



Wabamun Lake Subwatershed Land Use Plan Technical Report

October 09, 2015



**Wabamun Lake
Subwatershed Land Use Plan
Phase 1**

Technical Report



Prepared for:
Parkland County

Prepared by:
Stantec Consulting Ltd.

Project Number:
1161103580

October 9, 2015

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

October 9, 2015

Table of Contents

EXECUTIVE SUMMARY	V
ABBREVIATIONS	VII
UNITS AND CONVERSIONS	VII
GLOSSARY	VIII
1.0 INTRODUCTION	1
1.1 REPORT ORGANIZATION.....	5
2.0 DATA SOURCES AND METHODS	6
2.1 STAKEHOLDER ENGAGEMENT.....	6
2.2 FIRST NATION ENGAGEMENT	6
2.3 SCIENTIFIC INFORMATION	7
3.0 POLICIES AND REGULATIONS	7
3.1.1 Development Approvals and Management Jurisdiction.....	10
4.0 SUBWATERSHED OVERVIEW	16
4.1 INTRODUCTION.....	16
4.2 HISTORY	18
4.3 ABORIGINAL HISTORY AND TRADITIONAL USE	20
4.4 LAND	23
4.4.1 Land Use	23
4.4.2 Geology and Soils.....	47
4.5 WATER.....	53
4.5.1 Surface Water Quantity	53
4.5.2 Surface Water Quality.....	64
4.5.3 Groundwater.....	72
4.6 BIOLOGICAL COMMUNITIES	82
4.6.1 Aquatic Environment	82
4.6.2 Terrestrial Environment	87
4.6.3 Environmentally Significant Areas	101
4.6.4 Invasive Species.....	104
4.7 AIR.....	105
4.7.1 Relevance to Land Use Planning	106
4.8 CLIMATE CHANGE	106
4.8.1 Relevance to Land Use Planning	106
4.9 DEFINING HEALTH.....	107
5.0 KEY ISSUES	111
5.1 POLICY	111
5.2 BIOPHYSICAL.....	111

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

6.0	REFERENCES.....	113
6.1	LITERATURE CITED	113
6.2	PERSONAL COMMUNICATIONS	119
6.3	WEBSITES	119

LIST OF TABLES

Table 3-1	Legislation and Regulations Relevant to WLSLUP	7
Table 4-1	Wabamun Lake Subwatershed in Numbers	16
Table 4-2	Key Historical Events in the Wabamun Lake Subwatershed	18
Table 4-3	Village of Wabamun and Summer Villages Population Estimate	34
Table 4-4	Parkland County Population Estimate within the WLSLUP Area.....	35
Table 4-5	Wabamun Lake Subwatershed 2013 Crop Inventory	45
Table 4-6	Estimated Inflow and Outflow Volumes for Wabamun Lake, 2004- 2013	57
Table 4-7	Summary of Water Chemistry in Wabamun Lake	64
Table 4-8	Modelled Future Land Use Scenarios for Wabamun Lake	69
Table 4-9	Groundwater Diversion Categories and Maximum Annual Diversion	74
Table 4-10	Groundwater Well Use Categories and Maximum Annual Diversion Assumptions.....	76
Table 4-11	Groundwater Well Use Categories and Maximum Annual Diversion Assumptions.....	77
Table 4-12	Status of Sport Fish Species in Wabamun Lake	85
Table 4-13	Land Cover in the Wabamun Lake Subwatershed	89
Table 4-14	Wabamun Lake Riparian Health Assessment Results	92
Table 4-15	Wildlife Indicator Species for Common Habitat Types in the Watershed	100
Table 4-16	Environmentally Significant Areas within the Subwatershed.....	102
Table 4-17	Invasive Species of Management Concern.....	104
Table 4-18	Wabamun Lake Health Defined	108

LIST OF FIGURES

Figure 1-1	Wabamun Lake Subwatershed.....	2
Figure 1-2	Wabamun Lake Subwatershed Land Use Plan (WLSLUP) Development Process.....	4
Figure 3-1	Cross Section of Bank Location in Relation to Adjacent Water	11
Figure 3-2	Jurisdiction over Bed and Shore	12
Figure 4-1	Wabamun Lake Tributaries.....	17
Figure 4-2	Overall Land Use in the Wabamun Lake Subwatershed	24
Figure 4-3	Summer Village of Seba Beach Land Use	25
Figure 4-4	Summer Village of Point Alison Land Use	26
Figure 4-5	Summer Village of Kapasiwin Land Use	27
Figure 4-6	Summer Village of Betula Beach Land Use	28
Figure 4-7	Summer Village of Lakeview Land Use.....	29
Figure 4-8	Village of Wabamun Land Use.....	30

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Figure 4-9	Residential Development Municipalities and Subdivisions in the Wabamun Lake Subwatershed.....	32
Figure 4-10	Recreational Development in the Wabamun Lake Subwatershed.....	37
Figure 4-11	Highvale Mine Boundary and Pit Locations.....	39
Figure 4-12	Industrial Development within the Subwatershed	41
Figure 4-13	Linear Development within the Subwatershed	43
Figure 4-14	Crop Inventory in the Subwatershed	46
Figure 4-15	Wabamun Lake Subwatershed Topography	48
Figure 4-16	Wabamun Lake Subwatershed Slope Degree Overview	49
Figure 4-17	Surficial Geology in the Wabamun Lake Subwatershed	50
Figure 4-18	Soil Orders in the Wabamun Lake Subwatershed	51
Figure 4-19	Wabamun Lake Water Balance 1982-2001	55
Figure 4-20	Wabamun Lake Levels 1915 to 2012 as Deviation from Current Lake Management Level.....	56
Figure 4-21	Wabamun Lake Water Balance 2002-2014.....	58
Figure 4-22	Surface Water Licence Categories in the Subwatershed	59
Figure 4-23	Licensed Surface Water Diversion Locations.....	60
Figure 4-24	Annual Consumptive Surface Water Diversion Volumes by Licence Category	60
Figure 4-25	Wabamun Lake Floodplain.....	62
Figure 4-26	Wabamun Lake Phosphorus Inputs.....	66
Figure 4-27	Modelled Tributary and Contributing Area Flow-Weighted Total Phosphorus Concentrations.....	68
Figure 4-28	Wabamun Lake 2014 Monitoring Data for Bacteria	70
Figure 4-29	Groundwater Flow in a Watershed.....	73
Figure 4-30	Groundwater Licence Categories in the Subwatershed	75
Figure 4-31	Groundwater Well Use by Category	76
Figure 4-32	AWWID Well Records in Wabamun Lake Subwatershed.....	79
Figure 4-33	Licensed Groundwater Diversion Locations	80
Figure 4-34	Alberta Geological Survey DRASTIC Intrinsic Aquifer Vulnerability Index.....	81
Figure 4-35	Wabamun Lake Shoreline Habitat.....	83
Figure 4-36	Land Cover in the Wabamun Lake Subwatershed	90
Figure 4-37	Wetlands in the Wabamun Lake Subwatershed	93
Figure 4-38	Wabamun Lake Riparian Health Assessment	94
Figure 4-39	Riparian Health by Jurisdiction	95
Figure 4-40	Riparian Health Assessment Results for the Summer Villages	96
Figure 4-41	Riparian Health Assessment Results by Subdivision and Hamlets	97
Figure 4-42	Riparian Health Assessment Results in Environmental Reserves	98
Figure 4-43	Environmentally Significant Areas in the Wabamun Lake Subwatershed	103

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

LIST OF APPENDICES

APPENDIX A	ENGAGEMENT INPUT	A.1
A.1	Stakeholder Workshop	A.1
A.2	Public Open House	A.3
APPENDIX B	MUNICIPAL AND PROVINCIAL LEGISLATION.....	B.1
B.1	Municipal Authority and Jurisdiction	B.1
B.1.1	Municipal Government Act	B.1
B.1.2	Relationship of Municipal Planning to Provincial Authority	B.5
B.2	Municipal Bylaws	B.6
B.2.1	Parkland County - Municipal Development Plan Bylaw #37 (2007)	B.6
B.2.2	Parkland County - Land Use Bylaw #20-2009	B.12
B.2.3	Parkland County - Environmental Conservation Master Plan - 2014	B.21
B.2.4	Parkland County – Highvale End Land Use Area Structure Plan Bylaw #28-1997	B.30
B.2.5	Summer Village of Betula Beach Land Use Bylaw No. 03-02	B.34
B.2.6	Summer Village of Kapasiwin Land Use Bylaw #242 (2012)	B.35
B.2.7	Summer Village of Lakeview No. 153	B.36
B.2.8	Summer Village of Point Alison Land Use Bylaw # 10-157	B.39
B.2.9	Summer Village of Seba Beach Land Use Bylaw #2-2008	B.41
B.2.10	Village of Wabamun Land Use Bylaw# 02-2010	B.44
B.3	Provincial Jurisdiction	B.48
B.3.1	Alberta Land Stewardship Act.....	B.48
B.3.2	Agricultural Operation Practices Act	B.49
B.3.3	Public Lands Act	B.54

October 9, 2015

Executive Summary

The team sincerely thanks all partners for their contributions to and support of the development of this Technical Report and to the land use planning process, including the Wabamun Watershed Management Council, the Summer Villages, and the Village of Wabamun.

The Wabamun Lake subwatershed is located in Parkland County, approximately 60 km west of Edmonton. The subwatershed is part of the larger North Saskatchewan River watershed. With current and increasing economic growth and development in the subwatershed, Parkland County, in collaboration with its partners and stakeholders, has initiated a proactive planning process to manage this growth through the development of a subwatershed land use plan. The first step of the Wabamun Lake Subwatershed Land Use Plan (WLSLUP) process is this technical review and compilation of the relevant information available for the subwatershed.

The Wabamun Lake subwatershed is a mixture of both public and privately owned land located in the Dry Mixedwood and Central Mixedwood subregions of the Boreal Forest Natural Region. The subwatershed's landscape was originally a mosaic of forests and wetlands. A large portion of the subwatershed's vegetation has been modified or influenced by a number of man-made activities, including residential development, resource extraction, agriculture, power generation and distribution, transportation, and recreational use. In addition to Wabamun Lake, being one of the most heavily used recreational lakes in the province, Highway 16 and the Canadian National Railroad Main Line both run through the subwatershed.

Wabamun Lake is a well-buffered and productive lake. Lake levels have been controlled since 1913, resulting in a degree of artificiality to the water balance of the lake. The subwatershed as a whole likely acts as a groundwater recharge area.

All three levels of government (municipal, provincial and federal) have jurisdiction for approving development and enforcement related to various activities in the subwatershed. At the municipal level, there are seven municipalities each with jurisdiction over subdivision of land, land use and development within their respective municipal boundaries. Although all municipalities must follow a formal development process, the specific rules and regulations governing land use and development within this context are different for each municipality.

The Government of Alberta, through several Ministries and agencies, is responsible for development and activities that occur on the bed and shore of the lake, protecting wildlife and endangered species, protecting ground and surface water resources, air quality, agricultural practices, energy resource extraction, and provincial parks. The Federal Government governs the activities on the Paul Band Reserve, activities that may have an impact on fish habitat, navigation on the lake, public safety and railway regulations.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

In this subwatershed land use planning process, it is acknowledged that land use activities can have an effect on water, land and biological resources. When all effects within the area are taken into consideration, decisions on land use planning can contribute to a sustainable system that preserves the values important to its citizens and Albertans as a whole. This includes a healthy aquatic ecosystem, adequate water supply (both quality and quantity), healthy economic growth and sustainability, enhanced recreational opportunities and the aesthetics of the area. It is therefore important that stakeholders, Aboriginal peoples and the public are included in this land-use planning process to create awareness, identify key issues and provide opportunities for input into the development of a plan that strives for a meaningful balance of the interests of the residents of the area and all Albertans.

Initial input from stakeholders, the public and aboriginal communities, as well as available scientific information and regulatory and policy documents relevant to land use planning in the area for land, water, air and biological communities, were reviewed, summarized, and presented in this report. The following key issues for consideration in the development of the WLSLUP were identified:

- due to the number of jurisdictions, which have approval and regulatory authority for various activities, it may be difficult to have a holistic approach to managing the activities potentially affecting the long-term health of the lake and the subwatershed
- current land use planning does not effectively consider environmental conditions and integrate environmental features.
- concerns regarding the number of watercraft on the lake
- lack of knowledge by the general public related to activities that either harm or can help lake health, and the cumulative effects of those activities on the health of the lake
- lack of understanding of groundwater resource in the sub watershed

A number of goals for consideration in the development of the plan were also identified:

- maintain lake levels that support all uses of the lake, water quality and biological communities now and in the future
- maintain or improve current surface water quality
- maintain or improve current groundwater levels and quality
- maintain or improve current air quality
- improve wetland and riparian health
- protect shoreline habitat for waterfowl nesting and fish species from direct and sensory disturbance, including noise
- identify terrestrial wildlife indicator species and establish habitat needs
- improve fish population status
- control invasive species

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Abbreviations

ABMI	Alberta Biodiversity Monitoring Institute
AENV	Alberta Environment
AER	Alberta Energy Regulator
AOPA	<i>Agricultural Operation Practices Act</i>
ASCA	<i>Alberta Safety Codes Act</i>
ASP	Area Structure Plan
AUC	Alberta Utilities Commission
ESRD	Alberta Environment and Sustainable Resource Development
DFO	Fisheries and Oceans Canada
Golder	Golder Associates Ltd.
KCB	Klohn Crippen Berger Ltd.
LUB	Land Use Bylaw
MDP	Municipal Development Plan
MGA	<i>Municipal Government Act</i>
NRCB	Natural Resources Conservation Board
TransAlta	TransAlta Corporation or TransAlta Generation Partnership
WLSLUP	Wabamun Lake Subwatershed Land Use Plan
WSC	Water Survey of Canada
WWMC	Wabamun Watershed Management Council

Units and Conversions

°C	degree Celsius $*1.8 + 32 = ^\circ\text{F}$
dam ³	cubic decameter = 1,000 m ³ $*0.812 = \text{acre-feet}$
ha	hectare = 0.01 km ²
km	kilometer $*0.622 = \text{miles}$
km ²	square kilometer $*0.386 = \text{square miles}$
m	metre $* 3.28 = \text{feet}$

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

masl	meters above sea level
m ³	cubic meter = 0.001 dam ³ or 1,000 litres *35.31 = cubic feet
mg/L	milligrams per litre = parts per million or ppm

Glossary

Eutrophic	Refers to aquatic environments that have abundant nutrients and high productivity. In waterbodies such as lakes, ponds and slow-moving rivers, oxygen levels below the surface layer may be depleted. Opposite of oligotrophic.
Eutrophication	The natural and/or anthropogenic processes by which the nutrient content of natural waters is increased, generally resulting in an increase of biotic productivity and biomass.
Guidelines	Generic numerical concentrations or narrative statements that are recommended as upper limits to protect and maintain the specified uses of air, water, sediment, soil or wildlife. These values are not legally binding.
Hardness	The concentration of all metallic cat-ions, except those of the alkali metals, present in water. In general, hardness is a measure of the concentration of calcium and magnesium ions in water and is frequently expressed as mg/L calcium carbonate equivalent.
Linear Developments	Human development associated with seismic lines, pipelines, roadways, railways, and utility right-of-ways
Mesotrophic	Refers to aquatic environments with adequate nutrients and sufficient rates of productivity to sustain aquatic life (meso = "middle").
Natural Region	A region characterized by common geological, ecological, and climatological factors.
Nitrogen	A nutrient necessary for the growth and development of animals and plants. Typically, nitrogen is the limiting nutrient in terrestrial systems.
Phosphorus	A nutrient necessary for the growth and development of animals and plants, which is typically the limiting nutrient of aquatic systems.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Plankton	Assemblage of small drifting organisms suspended in the water column, including plants/algae (phytoplankton), animals (zooplankton) and bacteria (bacterioplankton).
Riparian	The transitional zone between upland and aquatic habitat. Riparian areas perform important ecological functions, contain a diverse assemblage of plant and animal species, provide essential habitat for wildlife and are influenced by seasonal water levels.
Subwatershed	A smaller watershed that feeds into a 'parent' watershed. The term subwatershed is used for WLSLUP because the Wabamun Lake and its watershed are part of the larger North Saskatchewan River watershed.
Water balance	The balance between water inputs and outputs in a waterbody or watershed.
Watershed	The area of land draining into a stream, lake, wetland or other waterbody. A watershed is often made up of a number of subwatersheds that contribute to its overall drainage.
Wetland	A wetland is land where the water table is at, near or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation. Wetlands include organic wetlands or "peatlands" and mineral wetlands or mineral soil areas that are influenced by excess water but produce little or no peat.

SOURCE: WWMC (2013)

October 9, 2015

1.0 INTRODUCTION

This is a living document, which will be updated periodically throughout the project as information and feedback is received from the stakeholders and partners.

Wabamun Lake is located within the North Saskatchewan River watershed and is the largest eutrophic lake in the Parkland County (**Figure 1-1**). The Wabamun Lake subwatershed faces varied pressures from coal mining, power generation plants, residential uses, oil and gas production, transportation (road & rail), agriculture and extensive recreational activities in and along its shores. Over the past decades the lake has been subjected to increased environmental stresses. The current health of the lake is rated as “fair” (WWMC 2013). Because of this, it has become important for both the County and its municipal neighbours to develop well thought out land use strategies to assist in maintaining or improving the health of Wabamun Lake.

With increasing economic growth and development in Parkland County and the Wabamun Lake subwatershed¹, there is a growing concern with maintaining the health of the subwatershed in anticipation of this growth. To proactively plan for and address these concerns, the County, in collaboration with partners and stakeholders, is leading the development of a subwatershed land use plan based on a foundation of historical and current scientific data, policy, and other documentation related to land use in the subwatershed.

Subwatershed planning acknowledges that land use activities can have an impact on water resources. Due to this interdependence, using a subwatershed as the planning boundary will help ensure impacts on water quality are considered when assessing the potential impacts of land use planning on the natural environment. When all impacts within that boundary are taken into consideration, decisions on land use planning can contribute to a sustainable system that preserves the values important to its citizens and Albertans as a whole. This includes a healthy aquatic ecosystem, adequate water supply (both quality and quantity), healthy economic growth and sustainability, enhanced recreational opportunities and the aesthetics of the subwatershed, while allowing for appropriate industrial and commercial resource uses.

The subwatershed area includes tributaries such as False Creek and Beaver Creek and drains via Wabamun Creek into the North Saskatchewan River. Land ownership is a mix of private and public (municipal, provincial, and Crown land) portions.

¹ The term **subwatershed** is used in the land use plan development because Wabamun Lake and its watershed are part of the larger North Saskatchewan River watershed.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015



Figure 1-1 Wabamun Lake Subwatershed

SOURCE: Created by Stantec Consulting Ltd.; subwatershed boundary created by Parkland County

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

There are three First Nations that have interest in the Wabamun Lake Area; Paul Band, Alexis Nakota Sioux Nation, and Enoch Cree Nation. Portions of the Paul First Nation Reserve are within the planning area. The Alexis Nakota Sioux Nation has interest in the planning area due to close relations to Paul Band through intermarriages and neighboring/sharing traditional Treaty lands. The Enoch Cree Nation has interest in the Wabamun Lake due to potential close family/tribal relations to both Alexis and Paul Band and they also share Traditional treaty areas. Metis Local 55 is also within this area, with interest in the Lake.

Over the past decades the lake has faced increased environmental stresses. The steps in the land use planning process are shown in **Figure 1-2**. This report is the result of the work completed in Phase 1.

The objective of the Wabamun Lake Subwatershed Land Use Plan (WLSLUP) process is to develop a plan that maintains a healthy lake, has the support of stakeholders, and acknowledges the need for present and future resource use. These activities are managed so that social, environmental, and economic values in the planning area are balanced from the perspective of the County, and the people living in and or having an interest in the planning area. As indicated by the diverse land uses within the subwatershed, any planning process requires the support of a wide range of partners and stakeholders, therefore the consultation process will be critical to the success of WLSLUP development.

Partner and stakeholder groups that have been identified for WLSLUP are:

- Alberta Environment and Sustainable Resource Development
- Alberta Lake Management Society
- Canadian National Railway
- Jackfish Lake Management Association
- Mayatan Lake Management Association
- Lakes of Parkland County
- North Saskatchewan Watershed Alliance
- TransAlta
- Summer Village of Betula Beach
- Summer Village of Kapasiwin
- Summer Village of Lakeview
- Summer Village of Point Alison
- Summer Village of Seba Beach
- Summer Village of Spring Lake
- Village of Wabamun
- Wabamun Watershed Management Council

October 9, 2015

Phase 1: WLSLUP Technical Review of Data

- compile historical and current scientific data and documentation;
- provides a scientific basis for the WSLUP.

Phase 2: WSLUP Development

- develop WLSLUP outlining the current health and land uses, future development, environmental issues and other pressures;
- list policies, procedures, regulations and recommendations needed to guide future development.

Phase 3: WLSLUP Implementation and Policy Development

- develop an Implementation Plan that details the procedures, actions, and timing;
- develop a Recommendations Report for proposed updates to the County's Environmental Conservation Master Plan as it relates to land use, the Land Use Bylaw and Municipal Development Plan.

Phase 4: WLSLUP Toolbox and Tool Development

- develop a flexible Lake Land Use Plan Toolbox that the County and its regional partners can implement when developing future lake land use plans

Figure 1-2 Wabamun Lake Subwatershed Land Use Plan (WLSLUP) Development Process

October 9, 2015

Aboriginal peoples have a long, close relationship with the land, and with their intimate understanding of the local environment, wildlife and aquatic ecosystems, they are able to contribute to land-use-planning in a unique way. Through the use of traditional knowledge, information on ecosystems and the impacts of human developments on plants and animals that use these habitats can be combined with contemporary science as a valuable contribution to the land planning process.

It is therefore important that Aboriginal peoples are included in this land-use planning process so that potential impacts to their constitutionally protected rights can be considered when land-use decisions are being made. This will enable the development of a subwatershed plan that strives for a meaningful balance that respects the rights of aboriginal communities with the interests of the residents and stakeholders within the subwatershed and all Albertans.

The principles for the development of WLSLUP account for the fact that land use activities can have an impact on water, land and biological resources. Whereas traditional land use planning was based on political or legal boundaries, this approach does not always address the relationships to natural systems. When all effects within the subwatershed are taken into consideration, decisions on land use planning can contribute to a sustainable system that preserves the values of a healthy aquatic ecosystem, adequate water supply (both quality and quantity), and recreational and aesthetic resources.

Available scientific information and documents relevant to land use planning within the Wabamun Lake subwatershed were reviewed and summarized, and presented in this report. This report provides summary of information on the current status of the watershed, how land use in the subwatershed has affected the health of the subwatershed over decades, and how effects have been managed. The information presented in this report will feed into the subsequent phases of the land use plan. The intended audience of this report is the stakeholders of the land use planning process and the general public. Therefore, non-technical language and terminology are used throughout the report, where possible.

1.1 REPORT ORGANIZATION

This report is organized as follows:

- **Data sources and methods** – outlines how this report was prepared and what information was used
- **Policies and regulations** – provides an overview of the regulatory and policy framework that is applicable to land use planning in the subwatershed
- **Subwatershed overview** – provides a high-level summary of scientific information relevant to land use planning for land, water, air and biological communities
- **Key issues** – outlines key issue themes that were identified during Phase 1 scientific information review and stakeholder and public consultation

October 9, 2015

2.0 DATA SOURCES AND METHODS

2.1 STAKEHOLDER ENGAGEMENT

A Stakeholder Workshop and a Public Open House for WLSLUP Phase 1 were held on November 12, 2014 in the Village of Wabamun Jubilee Hall. Information about the WLSLUP process and the status of the subwatershed was presented and discussed. Stakeholder representatives from relevant groups were invited to attend the Stakeholder Workshop, and the Public Open House was open to everyone. Both events were well attended: 14 attendees at the Stakeholder Workshop and 41 attendees at the Public Open House.

The objectives of the Phase 1 stakeholder engagement was to:

- advise the participants of the project and create awareness
- advise participants of the project process and opportunities for their input
- provide opportunity for participants to contribute their concerns, advice, and perspective for the project team's consideration
- establish a common understanding of the current status of the subwatershed
- identify key issues

Stakeholder Workshop and Public Open House feedback is provided in **Appendix A**. Relevant feedback from the engagement sessions was incorporated into this report and will be considered in the subsequent phases of the project.

2.2 FIRST NATION ENGAGEMENT

It is important that Aboriginal peoples are included in this land-use planning process so that potential impacts to their constitutionally protected rights can be considered when land-use decisions are being made. Initial engagement with the Paul, Alexis Nacota Sioux, and Enoch Cree Nations provided an opportunity to build a stronger relationship with Parkland County and started discussions on the WLSLUP, particularly Phase 1, which describes the current state of the watershed. Metis Local 55 also has interests in the WLSLUP area.

The First Nations are interested in what may affect them or their traditional ways of life. Initial discussions centered on the difference in land use within the Paul First Nation Reserve, the surrounding land use, and understanding the state of the lake with respect to First Nations interests. This led to discussions on ways to create a better understanding of what the First Nations considers important. The Alexis First Nation also suggested a Community meeting in the future to provide an opportunity for youth, elders, and other community members to come out and provide their concerns, feedback or discussion surrounding the plan. Parkland County provided Paul First Nation with specific mapping, aerial photos and shoreline photos.

October 9, 2015

Elders from the Alexis First nation also provided their valuable traditional knowledge of the watershed.

2.3 SCIENTIFIC INFORMATION

Documents related to the current policies and regulations, land use and status of water, land and air in the subwatershed were reviewed and summarized. All documents used to prepare this report are listed in **Section 6.0 References**. A large number of documents were recently summarized by Aquality Environmental Consultants in the State of the Watershed Report (WWMC 2013). This report leverages the WWMC (2013) report where appropriate, and any direct quotes are indicated with *italics*.

New and additional information available for the preparation of this report were:

- report on livestock operations on the subwatershed (Latham 2014)
- historical overview of lake level and water management issues (Hoyes 2014)
- various reports made available by TransAlta (Novak 2014, pers. comm.)
- unpublished fisheries information from Alberta Environment and Sustainable Resource Development (ESRD) (Mussel 2014, pers. comm.)
- paleolimnology report (Mussel 2014, pers. comm.; Hutchinson 2014)
- unpublished report on Wabamun Lake BATHUB Model (Trew 2014, pers. comm.; Tuininga unpublished)
- riparian health study results from the North Saskatchewan Watershed Alliance (North Saskatchewan Watershed Alliance 2014)

3.0 POLICIES AND REGULATIONS

WLSLUP will be developed within the current framework of federal, provincial and municipal legislation and policies. Legislation and policies relevant to watershed management in the sub-watershed are summarized in **Table 3-1**. See **Appendix B** for more information on provincial and municipal legislation.

Table 3-1 Legislation and Regulations Relevant to WLSLUP

Legislation/Policy and Implementing Government Organization	Description
Municipal	
Municipal Development Plan (MDP)	A bylaw adopted by municipal council as a Municipal Development Plan pursuant to the <i>Municipal Government Act</i> that sets the vision and strategic direction for future growth within the Municipality. It is the strategic "blue print" which outlines how the municipality will develop in the future.
Municipal Land Use Bylaws (LUB)	All municipalities are required pursuant to the <i>Municipal</i>

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Legislation/Policy and Implementing Government Organization	Description
	<i>Government Act (MGA)</i> to adopt a Land Use bylaw that divides the municipality into land use districts and establishes procedures for processing and deciding upon development applications. It sets out rules and regulates how each parcel of land can be used and developed and includes a land use district map. Land Use Bylaws may also stipulate rules regarding subdivision of parcels of land.
Municipal Area Structure Plans (ASP)	Adopted by municipal council as a bylaw pursuant to the <i>Municipal Government Act</i> that provides a framework for future development, circulation and servicing and of a defined area, in Parkland County's case usually a quarter section or larger, that has or is experiencing some form of development pressure.
Provincial	
Provincial Water Act – ESRD	Governs the diversion, allocation and use of water. Regulates and enforces actions that affect water and water use management, the aquatic environment, fish habitat protection practices and in-stream construction practices.
Provincial Environmental Protection and Enhancement Act – ESRD	Management of storm water, contaminated sites, storage tanks, landfill management practices, hazardous waste management practices and enforcement.
Provincial Land Stewardship Act – ESRD	This act supports the Land Use Framework, which is a comprehensive strategy to guide the management of public and private lands and natural resources in Alberta.
Provincial Agricultural Operations Practices Act – Natural Resources Conservation Board	Regulates and enforces on confined feedlot operation and environment standards for livestock operations.
Provincial Municipal Government Act – Municipal Affairs	Provides municipalities with authorities to regulate water on municipal lands, management of private land to control non-point sources, and authority to ensure that land use practices are compatible with the protection of aquatic environment.
Provincial Public Lands Act – ESRD	Regulates and enforces on activities that affect Crown-owned beds and shores of waterbodies and some Crown-owned uplands that may affect nearby waterbodies.
Provincial Safety Codes Act – Municipal Affairs	Regulates and enforces septic system management practices, including installation of septic field and other subsurface disposal systems.
Regional Health Authorities Act – Alberta Health	Has the mandate to promote and protect the health of the population in the region and may respond to concerns that may adversely affect surface and groundwater.
Provincial Wildlife Act – ESRD	Regulates and enforces on protection of wetland-dependent and wetland-associated wildlife, and endangered species (including plants).
Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act – ESRD and	Both Acts can be used to minimize the harmful effects of land use activities on water quality and aquatic resources in and adjacent to parks and other protected areas.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Legislation/Policy and Implementing Government Organization	Description
Community Development	
Provincial Wetlands Policy - ESRD	This policy will be used to protect wetlands and mitigate losses.
Natural Resources Conservation Board (NRCB)	The NRCB is an arms-length agency of the Government of Alberta. It was established in 1991 under the Natural Resources Conservation Board Act (NRCBA) to review proposed non-energy natural resource projects. In 2002 it was given additional responsibility for regulating Alberta's confined feeding operations under the <i>Agricultural Operation Practices Act</i> (AOPA).
Alberta Energy Regulator (AER)	The AER is authorized to make decisions on applications for energy development, monitoring for compliance assurance, decommissioning of developments, and all other aspects of energy resource activities (activities that must have an approval under one of the six provincial energy statutes). This authority extends to approvals under the public lands and environment statutes that relate to energy resource activities including coal mining.
Alberta Utilities Commission (AUC)	The AUC regulates the utilities sector, natural gas and electricity markets. AUC is responsible for regulating power plants and electrical infrastructure.
Federal	
Federal <i>Fisheries Act</i> – Department of Fisheries and Oceans Canada	Regulates and enforces on serious harm, alteration, disruption and destruction of fish habitat.
Federal <i>Canadian Environmental Protection Act</i> – Environment Canada	Aimed at pollution prevention and the protection of the environment and human health to contribute to sustainable development.
Federal <i>Environmental Assessment Act</i> – Canadian Environmental Assessment Agency	Requirement by federal departments, agencies and certain Crown corporations to conduct environmental assessments for proposed projects and activities before providing federal support to the project.
Federal <i>Water Act</i> – Environment Canada	Aimed to ensure that water issues of national significance are conserved, developed and managed.
Federal <i>Wildlife Act</i> –Environment Canada	Designed for the creation, management and protection of wildlife areas for wildlife research activities, or for conservation or interpretation of wildlife.
Federal <i>Navigation Protection Act</i> – Transport Canada	Aimed to protect the public right of navigation by prohibiting the building or placement of any "work" in, upon, over, under, through, or across a navigable water without the authorization of the Minister of Transport.
Federal <i>Species at Risk Act</i> – Environment Canada, Parks Canada, Department of Fisheries and Oceans Canada	Provides legal protection of wildlife species and the conservation of biological diversity.
Federal <i>Migratory Birds Convention Act</i> – Canadian Wildlife Service	Aimed to protect and conserve migratory birds, both as individuals and populations, as well as their nests.

October 9, 2015

Legislation/Policy and Implementing Government Organization	Description
---	-------------

SOURCES: WWMC 2013 , MGA and Alberta Municipal Affairs

3.1.1 Development Approvals and Management Jurisdiction

As indicated in **Table 3-1**, all three levels of government have jurisdiction over approving and enforcing various activities, which may affect the subwatershed. Given the various activities occurring within the WLSLUP and the numerous and disparate jurisdictions that have authority over these activities, holistic management of the lake and the activities in the watershed is challenging. With few exceptions, the lands of the bed and shore of permanent and naturally occurring bodies of water are public land. The bed and shore is composed of lands within a body of water. The boundary between the bed and shore and adjacent lands is typically identified by changes in vegetation or ground characteristics. The bed and shore is by definition land that is covered by water long enough to remove the vegetation, or land marked by a distinct margin in the vegetation or on the ground caused by water. **Figure 3-1** shows a general cross section of the bank in relation to water levels. This boundary may change over time as water levels fluctuate. A professional survey may be required to determine the boundary. **Figure 3-2**, delineates the general jurisdiction over lands surrounding the lake.

3.1.1.1 Municipal Government Jurisdiction

Municipalities have jurisdiction over subdivision of land, land use and development within their respective municipal boundaries. Municipalities have the authority to manage land use and development as directed by the *Municipal Government Act* (MGA) and ensure that structures are constructed and installed in compliance with the *Alberta Safety Codes Act* (ASCA).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

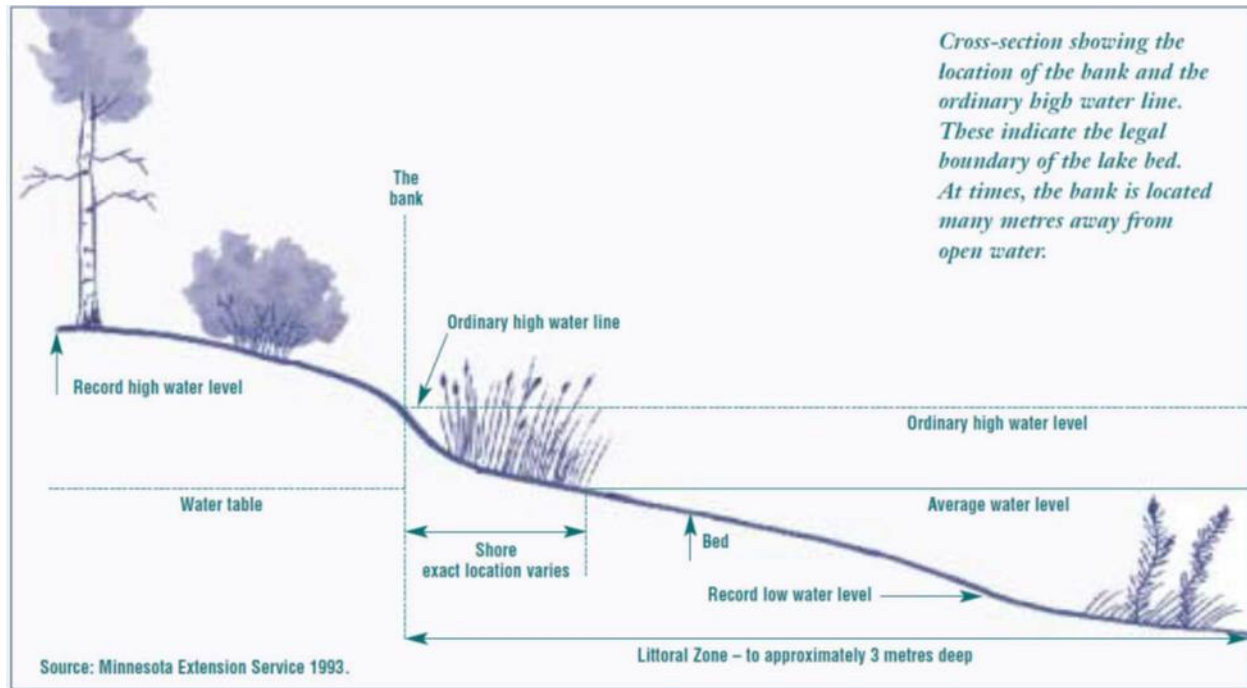


Figure 3-1 Cross Section of Bank Location in Relation to Adjacent Water

SOURCE: ACA (1999)

October 9, 2015



Figure 3-2 Jurisdiction over Bed and Shore

SOURCE: Modified from Bow River Project (2002)

The MGA requires all municipalities to adopt a Land Use Bylaw which regulates and controls the use and development of land and buildings within the municipality by dividing the municipality into land use districts and establishing regulations concerning permitted and discretionary uses within each district as well as prohibiting uses deemed inappropriate. The regulations may also speak to development setbacks from property lines, the number of structures allowed on a property, the size and height of buildings and requirements regarding site clearing, etc.

Although all municipalities must follow a formal development process outlined in the MGA, the specific rules and regulations governing land use and development within this context are different for each municipality. What is expected practice by one municipality may not necessarily be the case in another. For example, the Summer Villages, the Village of Wabamun

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

and Parkland County have their respective Land Use Bylaws that guide development differently within their jurisdictions. In addition, Parkland County has additional policies relevant to development which must also be followed. The MGA mandates that municipalities with a population over 3,500 must adopt a Municipal Development Plan (MDP). Parkland County therefore also has an MDP Bylaw in place which includes policies of relevance to the WLSLUP. The County also has additional environmental policy documents which are also applicable to the WLSLUP. Inconsistency of rules and regulations between the seven municipalities is a potential concern.

The following is a list of the relevant municipal policy and regulations guiding development within the subwatershed. These policies and regulation relevant to the WLSWLP are detailed in **Appendix B.**

Parkland County

- Municipal Development Plan Bylaw #37-2007
- Land Use Bylaw #20-2009
- Parkland County Environmental Conservation Master Plan – 2014
- Highvale End Land Use Area Structure Plan – Bylaw # 28-1997

Village of Wabamun

- Land Use Bylaw #07-2010

Summer Village of Kapasiwin

- Land Use Bylaw #242 (2012)

Summer Village of Point Alison

- Land Use Bylaw Bylaw No.10-157

Summer Village of Betula Beach

- Land Use Bylaw No. 03-02

Summer Village of Lakeview

- Land Use Bylaw No. 153

Summer Village of Seba Beach

- Land Use Bylaw No. 2-2008

Municipalities also are responsible for ensuring that structures are constructed in compliance with the ASCA. The ASCA governs permitting to ensure that structures are constructed and that plumbing, electrical installations are done in accordance with the Act. The ASCA also regulates the siting and operation of private septic systems to ensure that they function appropriately and do not contaminate ground water. Each municipality must issue safety codes permits prior to construction and retain licenced inspectors that ensure that appropriate inspections are undertaken, and construction and installation is undertaken per the requirements of the ASCA.

October 9, 2015

3.1.1.2 Provincial Government Jurisdiction

In addition to guiding the activities of the seven Municipalities in the subwatershed boundary, through the requirements of the MGA and ASCA, the Government of Alberta, and ESRD are responsible for all development and activities that occur within the bed and shore of the lake. This means activities that happen on, in and directly adjacent to the lake (see **Figure 3-1**). ESRD is also charged with protecting wildlife and endangered species, including plants. ESRD regulates and enforces actions that affect ground, surface water and water use, air quality and contaminated sites.

The Provincial Natural Resources Conservation Board (NRCB) has authority to approve and regulate confined livestock feeding operations and agricultural practices through the *Agriculture Operations Practices Act* (AOPA). Municipalities can indicate in their policy documents where their preference for siting confined feeding operations would be, but ultimately the decision lies with the NRCB. There are no confined feeding operations within the subwatershed boundary; however there are agricultural operations that do operate within the WLSLUP area.

Activities connected to energy related resource extraction, including TransAlta's coal mining activities, are the responsibility of the AER. Energy production, including TransAlta's power generation activities, falls under the authority and regulation of the AUC. Oil and gas activities occurring within the WLSLUP area are approved and regulated by the AER as well. Despite these activities occurring within their corporate boundaries municipalities have no jurisdiction over the approval and regulation of resource extraction or power infrastructure.

Wabamun Lake Provincial Park, located on Moonlight Bay at the northeast end of the lake, is managed and operated by Alberta Tourism, Parks and Recreation. It provides overnight camping, day use and group use facilities.

3.1.1.3 Federal Government Jurisdiction

Activities on Paul Band Reserve No. 133A are governed by the Government of Canada – Department of Aboriginal Affairs and Northern Development.

The Federal Department of Fisheries and Oceans (DFO) has authority over any activities that may have an impact on fish habitat. Transport Canada – Navigable Waters has jurisdiction over construction of piers, docks and other structures that may affect navigation on scheduled lakes. Wabamun is not identified as a scheduled lake, however, there is the ability to “opt-in” if added assurance is required that a particular construction project will not interfere with navigation.

Rail regulations in Canada are set by Transport Canada and the Canadian Transportation Agency. Canadian National Railway has jurisdiction over all activities within and adjacent to their rail right of way.

October 9, 2015

3.1.1.4 Enforcement

All three levels of government have jurisdiction over approval and regulation of specific activities within the WLSLUP and have the authority to enforce the activities that they regulate.

- Parkland County and the six other municipalities enforce Land Use Bylaws and regulation pertaining to development of land, land use types, how development occurs, and enforces building code regulations as delegated under the MGA and the ASCA. Municipalities are also responsible for policing within their boundaries. Each of the seven municipalities within the WLSLUP, contract policing to the RCMP and enforces its local bylaws and safety codes complaints.
- The Provincial Government manages and enforces land, natural resource and environmental regulations under various Acts including the *Environmental Protection and Enhancement Act*, *Water Act*, *Public Lands Act*, and *Parks Act*. This includes violations related to unapproved development or activities in the bed and shore of the lake and establishing the building code regulations that the municipality enforces.
- The Federal Government regulates uses on the lake (boat speeds, reckless boating) through the Ministry of Transportation (enforced by the RCMP), and enforces high level federal environment regulations such as the Federal Fisheries Act.

Enforcement of various inappropriate developments and other activities has been identified as a concern around the lake². Enforcement requires significant municipal resources. Municipal Bylaw enforcement is generally undertaken on a complaint basis and as a result, the inappropriate development or activity has already taken place. Enforcement of this nature usually involves issuing a stop order and outlining a strategy to remediate the infraction.

The RCMP are responsible for enforcement on the lake and surrounding land related to impaired driving/boating, operating watercraft without a licence, unsafe operation of a water craft etc. The municipal authorities are currently responsible for funding the RCMP to patrol the lake, and this has been inconsistent.

² Opinion expressed by public participants at the November 12, 2014 WLSLUP open house.

October 9, 2015

4.0 SUBWATERSHED OVERVIEW

4.1 INTRODUCTION

Wabamun Lake is the most studied lake in Alberta, and subsequently there is no shortage of information to summarize. This section provides a high-level summary of information that is key in understanding the top stressors and human influences in the subwatershed.

Wabamun Lake is a shallow headwater lake located in the North Saskatchewan River basin, approximately 60 km west of Edmonton. There are at least 35 small drainage courses that supply water to the lake, with the seven largest natural creeks contribute the majority of flow (Mitchell 1985, see **Figure 4-1**). The majority of the tributaries only flow during snow melt. Wabamun Lake is approximately 80 km² in area, with a gross subwatershed area of approximately 347 km² (see **Table 4-1**). The subwatershed is therefore relatively small compared to the size of the lake.

There is only one outlet from the lake. This outlet currently has a control structure (weir) set at 724.55 meters above sea level (masl). As a result, outflow is intermittent, and results in estimated lake residence time of 33 years (**Table 4-1**).

Table 4-1 Wabamun Lake Subwatershed in Numbers

Parameter	Description
location	Parkland County, Alberta, Canada
coordinates	53°31'47"N, 114°35'14"W
total subwatershed area	347 km ²
lake surface area (at weir crest)	80 km ² (average between 2004 and 2012)
maximum width	6.6 km
maximum length	19.2 km
mean depth	5.1 m
maximum depth	10.9 m
volume (at weir crest)	484,000 dam ³ (average between 2004 and 2012)
subwatershed:lake ratio	4.4:1
control structure (weir) elevation	724.55 meters above sea level (masl)
residence time (i.e., how long water stays in the lake)	>100 years (1980-1990 model), 33 years (current estimate)
outlet	Wabamun Creek (intermittent)
littoral zone	5 m depth, 31% of lake area
temperature stratification	Polymictic

SOURCES: Tuininga (unpubl), WWMC (2013), Casey (2011), Schindler (2004), Casey (2003), AENV (2002)

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

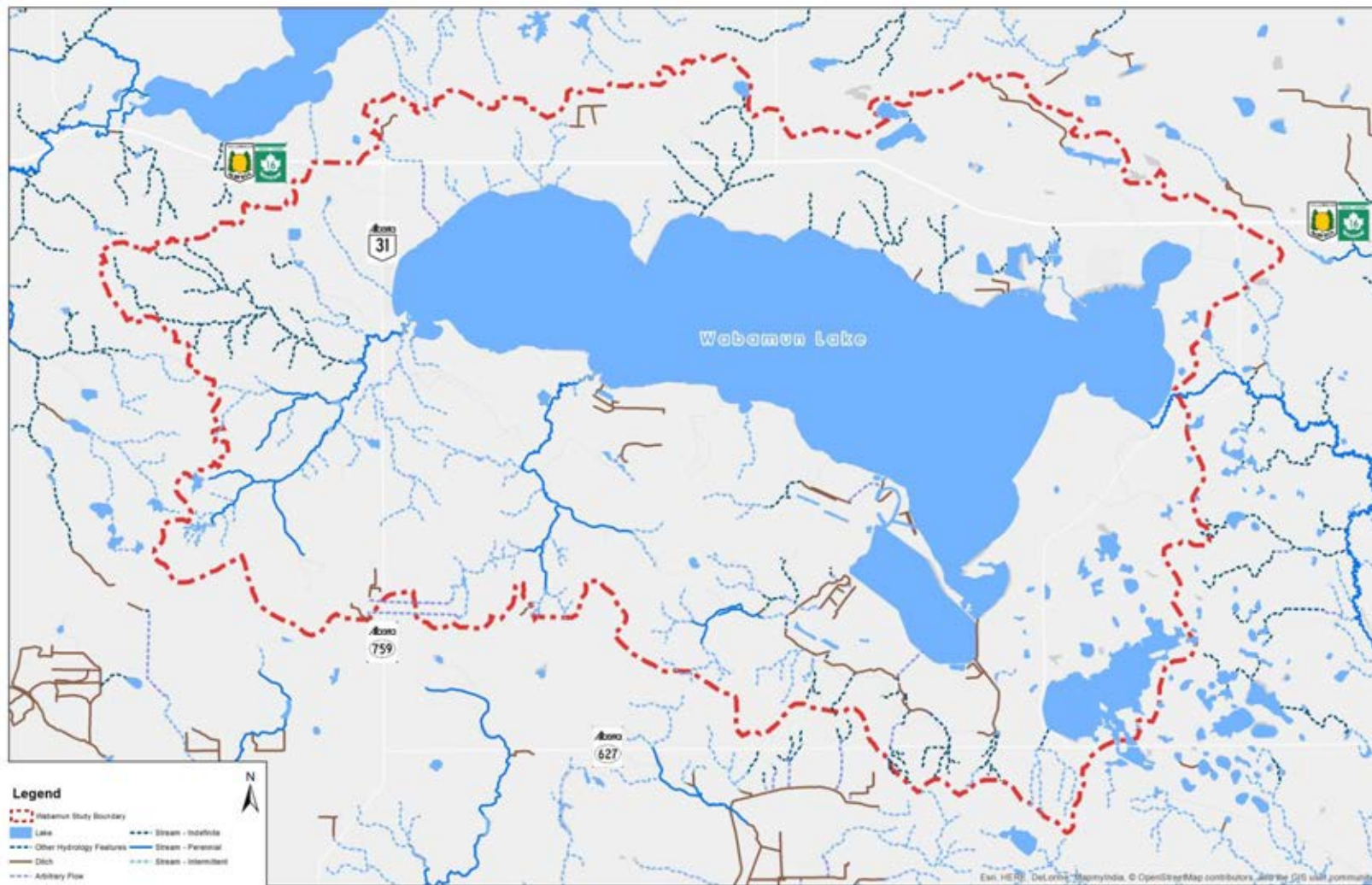


Figure 4-1 Wabamun Lake Tributaries

SOURCE: AltaLIS

NOTES: Perennial streams - the stream bed normally contains flowing water, except under drought conditions; intermittent streams - stream bed is often dry during certain times of the year due to climatic conditions and/or a limited area of drainage; indefinite streams - a perennial or intermittent stream whose channel cannot be clearly distinguished; arbitrary flow - arbitrary flow line from a digital elevation model is a system generated flow line required to connect real hydrography features.

October 9, 2015

4.2 HISTORY

Key events in the subwatershed's history are listed in **Table 4-2**. The history of Wabamun Lake was summarized in WWMC (2013) as follows:

The name Wabamun is derived from the Cree word meaning "mirror". Around the early 1800's the lake was referred to as White Whale Lake, due to the large lake whitefish caught in its waters. Later, around the turn of the century, the lake returned to its original Cree name of Wabamun Lake. By 1876, the Paul First Nations Band had separated from the Stoney Indian Nation, signed Treaty No. 6, and settled on the southeast shores of Wabamun Lake. As such, the watershed is an important traditional hunting and fishing ground for the Cree people (Mitchell and Prepas 1990).

People of European decent began settling around Wabamun Lake in the mid 1910's as part of the Canadian Governments agricultural settlement incentives. The Village of Wabamun itself was originally located on the Northwest corner of Moonlight Bay and with the arrival of the Grand Trunk Pacific Railway the community moved to its present location. The community of Wabamun was officially incorporated into a village in 1912 (Village of Wabamun 2010).

TransAlta, originally Calgary Power Company, built the company's first thermal generating plant, Wabamun Power Generating Station at Wabamun Lake in 1956, with adjacent coal reserves in excess of 50 million tons. Mining operations were started in 1962 at the Whitewood mine and in 1970 at the Highvale mine. TransAlta is the largest employer in Parkland County and the surrounding area.

Table 4-2 Key Historical Events in the Wabamun Lake Subwatershed

Year	Description
1876	Wabamun No. 133A Indian reserve, home of the Paul First Nation, established on the eastern shore of Lake Wabamun
1882 to 1912	Several complaints from farmers and property owners about flooding and high water levels
1910	First coal mines start underground operations
1911	Grand Trunk Pacific Railway completed from Edmonton through to Jasper
1912	Village of Wabamun incorporated on present site
1913	Outlet control structure built on Wabamun Creek near natural outlet as a response to complaints about flooding
1913	Formed the Village of Wabamun Beach
1913	Formed the Summer Village of Lakeview
1915	Recording of lake elevation begins
1918	Municipal District of Inga No. 520 established

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Year	Description
1918	Name of the Village of Wabamun Beach changed to the Village of Kapasiwin
1920	Formed the Summer Village of Seba Beach
1927	Weir established to control lake level at ~723.49 masl
1932	Numerous concerns expressed about low water levels in the lake
1932	Complaints about weed growth at east end of the lake
1933	New outlet control weir and channel constructed at present location
1942	The Municipal Districts of Spruce Grove No. 519, Inga No. 520 and Tomahawk No. 521 were merged into one new municipal district to be known as the Municipal District of Stony Plain No. 520
1943	Weir rebuilt after complaints about low lake levels
1945	The Municipal District of Stony Plain No. 520 was renumbered as the Municipal District of Stony Plain No. 84. Numbers were changed for all municipal districts throughout the province.
1948	Surface coal mining begins
1950	Lands withdrawn from the Municipal District of Stony Plain No. 84 and erected as the Summer Village of Point Alison
1956	Trans Alta Lake Wabamun Power Generating Station Unit 1 operational
1959 to 1963	Numerous complaints about low water levels and weed growth
1960	Steel weir installed at 724.95 masl
1961	Trans Alta Lake Wabamun Power Generating Station Units 2 & 3 operational
1962	Trans Alta Whitewood Mine operational
1966	Trans Alta Lake Wabamun Power Generating Station Unit 4 operational
1969	Parts of Improvement Districts No. 77 and No. 78 and the Stony Plain School Division No. 23 were amalgamated to form a county to be known as the County of Stony Plain No. 31. No information is available to explain the change from Municipal District of Stony Plain No. 84 to County of Stony Plain No. 31.
1969	The name was changed from the County of Stony Plain No. 31 to the County of Parkland No. 31.
1970	Trans Alta Highvale Mine operational
1970	Trans Alta Sundance Power Generating Station operational
1971	Canadian waterweed (<i>Elodea canadensis</i>) becomes dominant and nuisance aquatic plant in eastern area of the lake
1972	Alberta Environment commences a lake management study for Wabamun Lake
1973	Outage at Sundance power plant results in large fish kill due to 'cold shock'
1974	Diversion of process water from Lake Wabamun halted, sourced from the North Saskatchewan River instead
1975	Sundance effluent diverted to large cooling pond near lake formed by berming Goosequill Bay
1977	Canadian waterweed (<i>Elodea canadensis</i>) population subsides
1983	Trans Alta Keephills Power Generating Station Operational

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Year	Description
1988	Outlet controlled by roadbed at 725 masl
1989	Alberta Environment begins investigation of appropriate elevation for control structure
1989	Trans Alta Genesee Power Generating Station operational (outside of the subwatershed)
1990	Earthen/concrete weir established at 724.55 masl
1993	The Village of Kapasiwin is formed into the Summer Village of Kapasiwin
1995	The name was changed from the County of Parkland No. 31 to Parkland County
1997	Diversion and treatment of North Saskatchewan River water begins with completion of the Water Treatment Plant
2001	Second Water Treatment Plant becomes operational – combined capacity of 23 million m ³ per year
2002	Large fish kill near Wabamun Power Station inlet screens
2002	Unit 3 of Lake Wabamun Generating Station retired
2003	Commercial fishing licences suspended
2004	Unit 1 and 2 of Lake Wabamun Generating Station retired
2005	CN derailment on August 3 releases 712,500 litres of Bunker 'C' oil and 88,000 L of Pole Treating Oil into Wabamun Lake
2006	Wabamun Watershed Management Council formed
2007	Second Water Treatment Plant closed
2007	TransAlta's water deficit in the lake from 1992-2002 compensated
2008	Year-round zero catch limit for all sport fishing
2010	Last unit (Unit 4) of Wabamun Generating Station retired on August 11
2010	Whitewood Mine retired and reclamation begun
2013	State of Watershed Report released

SOURCE: Hoyes (2014), Schindler (2004), Mitchell and Prepas (1990) and Alberta Municipal Affairs

4.3 ABORIGINAL HISTORY AND TRADITIONAL USE

This report is a “living document” that will be updated as information and feedback is received from Aboriginal Nations and Partners as the WLSLUP is developed. This document should not be relied upon as a finished product but as an introduction to the challenges, unique perspective and history held by First Nations in the Wabamun Lake subwatershed area. The knowledge collected from those involved is a brief insight, and current developments of the document are subject to change and/or enhancement as we continue to have ongoing talks with First Nations. Parkland County is committed to introduce traditional history, information and will take into account traditional interests where possible both in the land use plan. Parkland County assumes no responsibility for oral history errors or omissions in this document, due to the format of the conversations.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

This section is based on the history of the Paul First Nation as provided on the Paul First Nation website and through initial conversations with the Paul Band and the Elders of Alexis Nakota Sioux Nation. It will be updated as new information is received from these communities.

Wabamun is a Cree word meaning mirror. In Sioux the lake is called "Nemenya" also meaning mirror. The lake was so clear at one time it was like a mirror. Wabamun Lake and Jack Knife Springs and water are considered sacred. Lac St Anne, Wabamun and Lake Isle are connected through an underground stream. Whatever affects one lake, affects the other lakes too.

Historically, the people travelled over a vast territory from the Hudson Bay to the Rocky Mountains, along the foothills to Montana USA. Allied with the Cree, the Nakoda, acquiring modern tools and goods from the Hudson Bay Company, trekked westward taking part in the fur trade, settling mainly in the Foothills, and the two other groups of Stoney, one of whom became Paul First Nation (Paul First Nation website).

The culture of the people is nature based and holistically intertwined to ensure adequate conditions for future generations. The world view of the people is to protect nature, and honour all things animate and inanimate. This is the first and foremost priority in the sacred duty owed to creation, passed on from generation to generation using ancient practices for countless millennium (Paul First Nation website).

First Nations people, the "people of the earth" view nature as an intricate web whereby everything is sacred and spiritual, each needing the other to survive and thrive. It is our hope that the evolution of man, in time and space, in particular industrial and economic development retains and fosters this world view so that all of creation will be afforded due respect in all areas of activity (Paul First Nation website).

Rocks collected along the shoreline of Wabamun Lake for ceremonial sweats are important to the Paul Band. Lake water is used for its energy and healing qualities. The Alexis First Nation once had a commercial fishing station in Moon Lake Bay and several small lodges near the golf course southwest towards the lake. The health of the animals based on what they eat and drink also has impacts on us as it affects our food source.

The CN derailment at Wabamun Lake has affected the health of the fish and ducks for the people of Paul First Nation. History shows that these were sustenance for many people from the community. The health of the lake impacts traditional ways of life (medicinal herbs, fish, etc.) for First Nations, and Metis peoples. The last time community members swam in Wabamun Lake was in the 1960s around the time when the generating plants originated onto the lake. There are fears that the current environmental system being used is out of date and not addressing the changes on the current landscape.

"Berry Hill" located around the boarder of the Paul First Nation, is a sacred place where the Alexis Nakota Sioux Nation and the Paul Band Nation practice their traditional use. There was historically an abundance of blueberries but they have declined since the electrical plants have arrived on the lake. Neighbouring lakes are also drying up, and tree health is jeopardized. Leaves are dying quickly and strange fungus growth is appearing on the trees.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

October 9, 2015

4.4 LAND

4.4.1 Land Use

As indicated in **Table 4-2**, and illustrated in **Figures 4-2 to 4-8** the lands surrounding Wabamun Lake have seen significant development over the last 150 years. The area has been influenced by a number of man-made activities that have seen the conversion of the land base to residential, resource extraction, agriculture, and recreational uses over time. Development in the subwatershed also includes linear disturbances such as roads, railroad lines, power lines and pipelines. The following key features are present in the subwatershed:

- there are seven municipalities within the WLSLUP boundary
- the Paul Band Reserve No. 133A is located on the eastern shore of the Lake
- TransAlta has mining rights to a considerable portion of the land surrounding the lake: the Whitewood mine area is currently being reclaimed and the Highvale mine area is actively mined. TransAlta also operates two power generating plants within the area.
- Wabamun Lake Provincial Park is located on Moonlight Bay
- Canadian National Railway's main line runs through along the north shore of Wabamun Lake

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

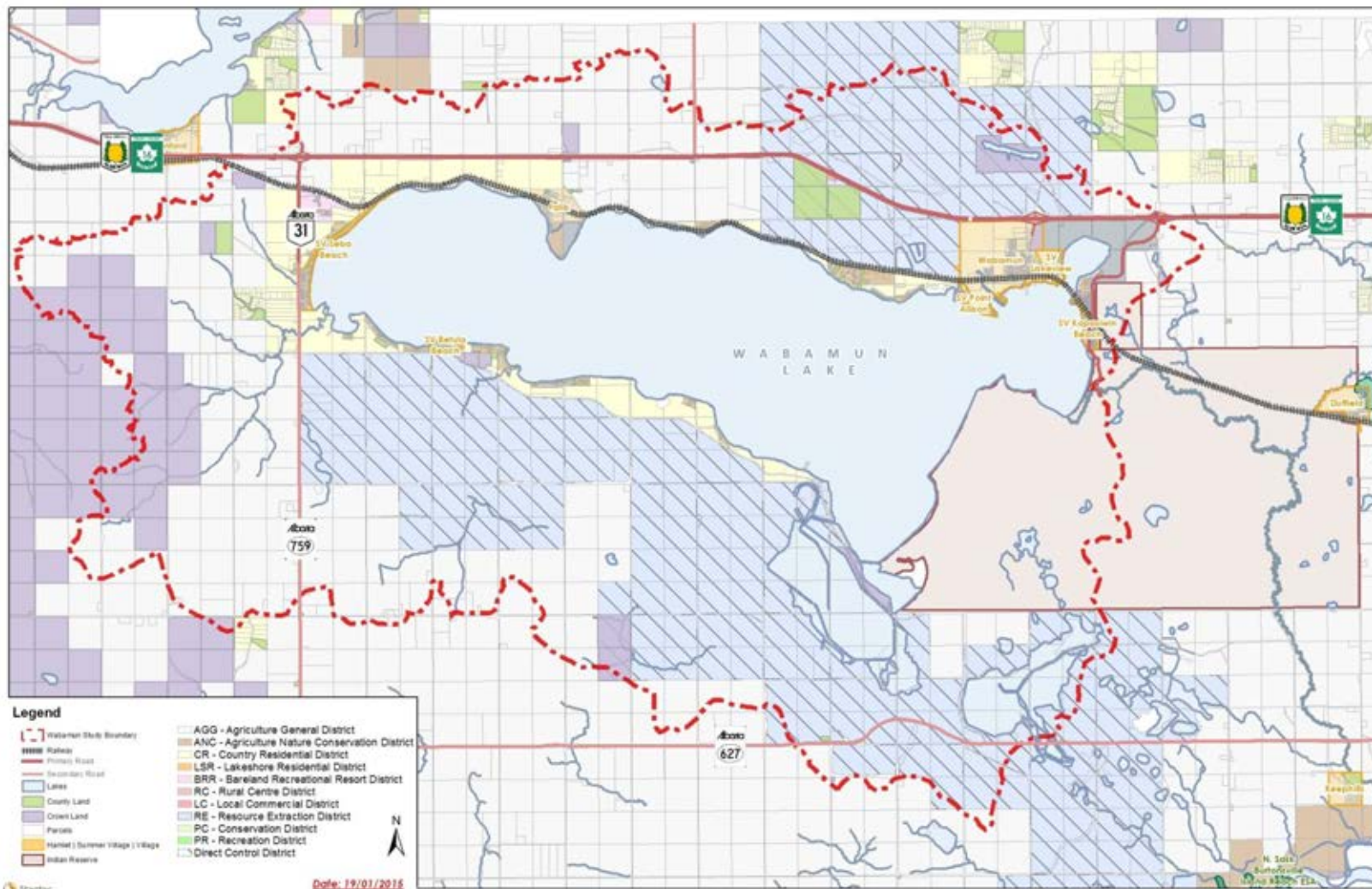


Figure 4-2 Overall Land Use in the Wabamun Lake Subwatershed

SOURCE: Data from Parkland County

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

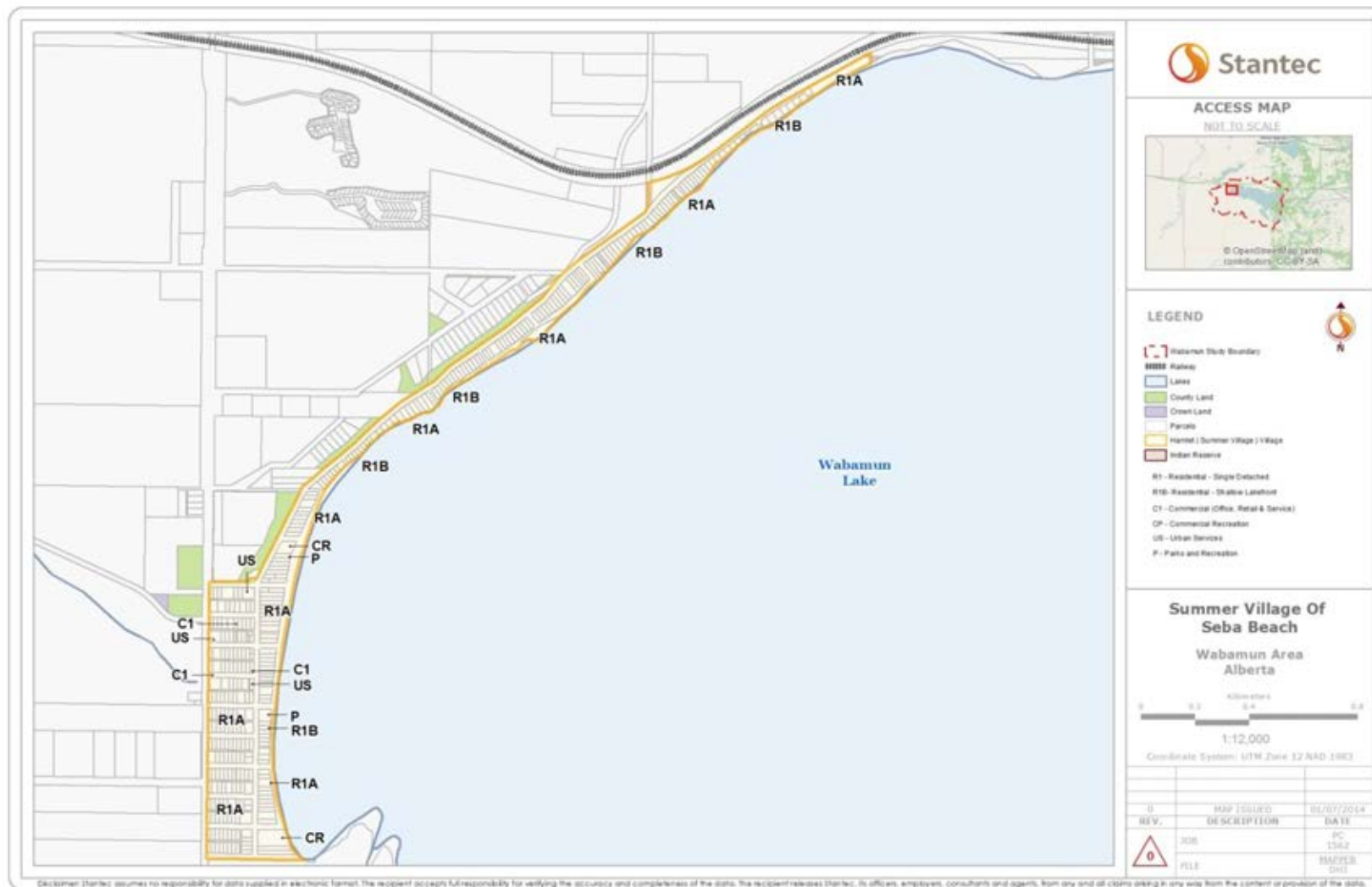


Figure 4-3 Summer Village of Seba Beach Land Use

SOURCE: Data created by Stantec Consulting Ltd.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015



Figure 4-4 Summer Village of Point Alison Land Use

SOURCE: Data created by Stantec Consulting Ltd.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015



Figure 4-5 Summer Village of Kapasiwin Land Use

SOURCE: Data created by Stantec Consulting Ltd.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015



Figure 4-6 Summer Village of Betula Beach Land Use

SOURCE: Data created by Stantec Consulting Ltd.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

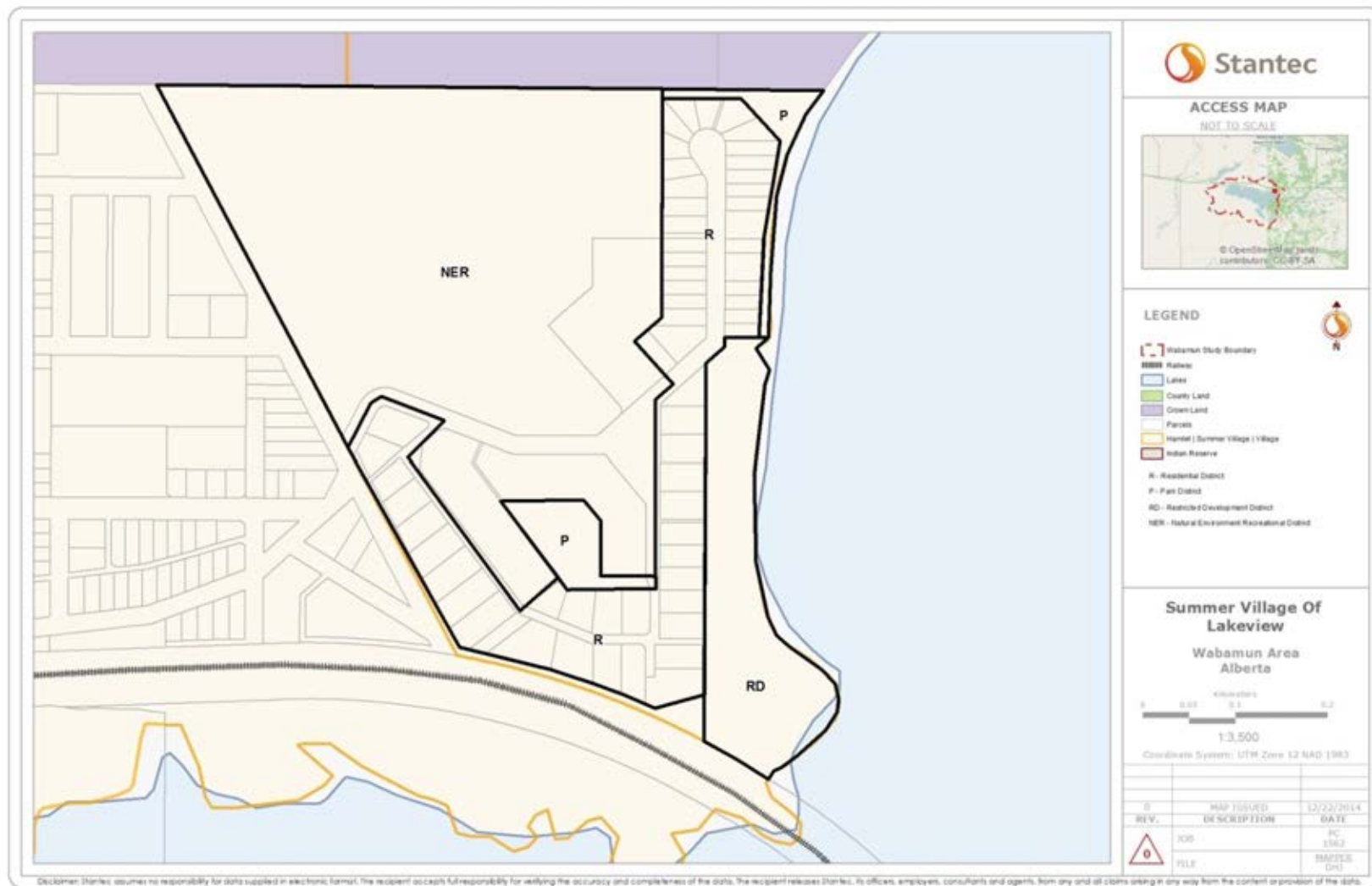


Figure 4-7 Summer Village of Lakeview Land Use

SOURCE: Data created by Stantec Consulting Ltd.

October 9, 2015



SOURCE: Data created by Stantec Consulting Ltd.

October 9, 2015

4.4.1.1 Residential Development

Formal settlement began with the establishment of the Wabamun No. 133A Indian (Paul Band) Reserve in 1876; though aboriginal peoples had been living in the area long before that. The incorporation of the Village of Wabamun and the establishment of other Summer Villages around the lake started in 1912. Residential subdivisions continued to be developed around the lake as the popularity of the lake for recreational pursuits increased.

Currently, there are seven incorporated municipalities within the WLSLUP boundary, see **Figure 4-9:**

- Summer Villages of
 - Kapasiwin
 - Point Alison
 - Betula Beach
 - Lakeview Beach
 - Seba Beach
- Village of Wabamun
- Parkland County

The County lands, within the WLSLUP plan area, include the Hamlet of Fallis as well as 26 residential subdivisions and numerous agricultural parcels with residences. The residential subdivisions adjacent to the lake, under the jurisdiction of Parkland County, include:

- | | |
|------------------------|------------------------|
| • Ascot Beach | • Rosewood Beach |
| • Beaver Bay Estates | • Sherwin Subdivision |
| • Coal Point | • Skyland Gardens, |
| • Freeman | • South Seba Beach |
| • Gardeners Cove | • South Woodland Acres |
| • Harbour Terrace | • Sundance Meadows |
| • Marine Drive Estates | • Sunshine Bay |
| • Mattwa Bay | • Tamarac Retreat |
| • McMahon Place | • Wabamun Beach |
| • Moulds Subdivision | • Waters Edge |
| • Philips Subdivision | • Whitewood Sands |
| • Prouse Park | • Willow Beach |
| • Rich's Point | • Woods Subdivision |
| • Rizzie Beach | |

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

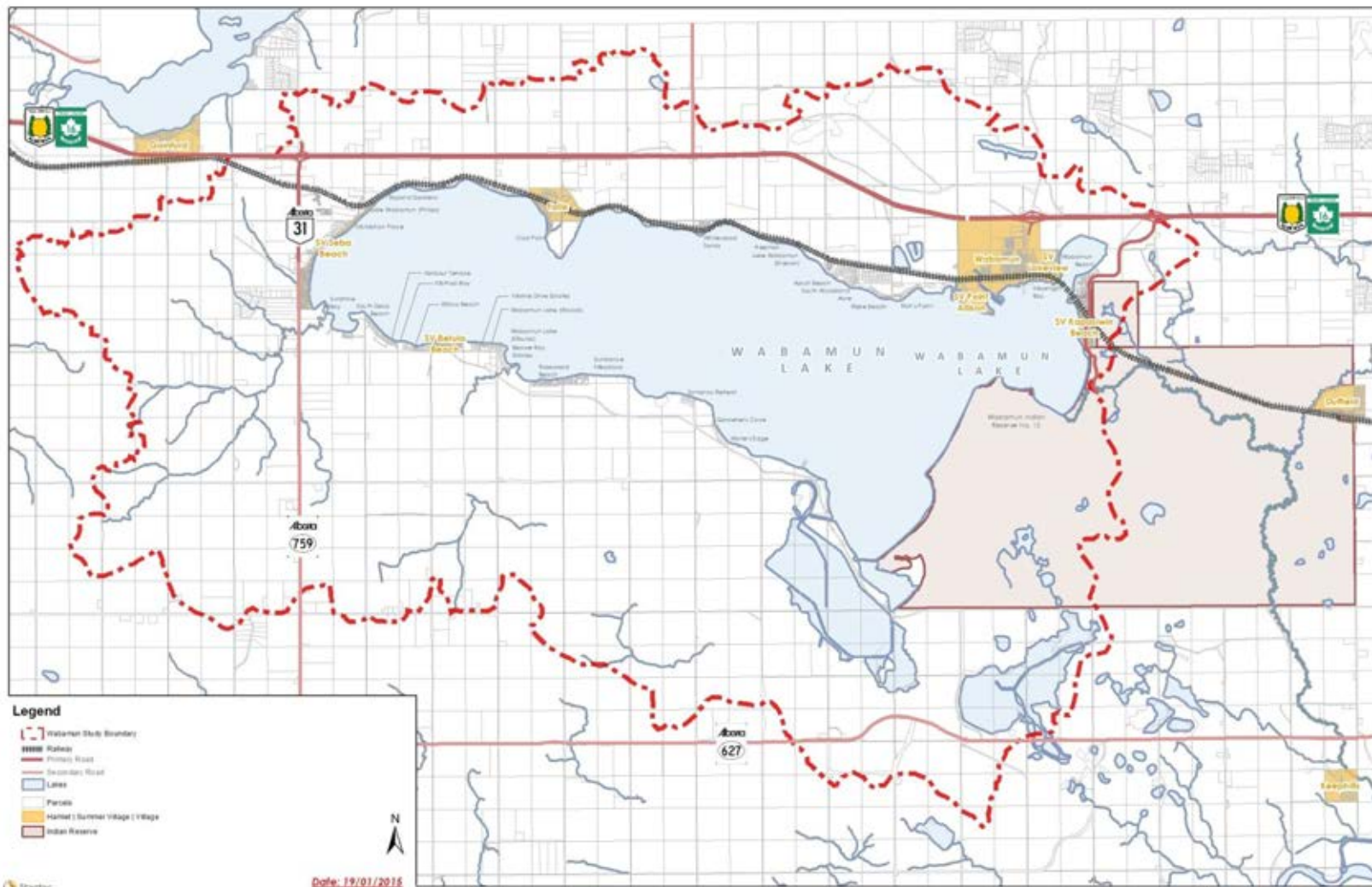


Figure 4-9 Residential Development Municipalities and Subdivisions in the Wabamun Lake Subwatershed

SOURCE: Data from Parkland County

October 9, 2015

4.4.1.2 Municipal Services

4.4.1.2.1 Solid Waste

Within the WLSLUP area, Parkland County operates two Waste Transfer Stations: the Kapasiwin Transfer Station - 3503 Twp Rd. 533A – North of Hwy 16, and the Seba Beach Transfer Station at 53128 Rge Rd. 61 just south of Hwy 16. Historically there were landfills at these two locations but they have subsequently been closed (Kapasiwin in 2002 and Seba Beach in 2008), reclaimed and replaced with Transfer Stations. There is also a small reclaimed landfill near Fallis on the eastern boundary of the cemetery located at SW-14-53-5-W5M.

4.4.1.2.2 Wastewater

Parkland County has recorded septic systems in the subwatershed since 2005 (Martin 2015, pers. comm.). These records are not exhaustive and do not include septic systems built prior to 2005. Data have been recorded for 48 quarter sections, with 47 quarter sections listed with no data. The septic system records include 47 septic tanks, 346 sewage holding tanks, and one treatment plant. Out of the 47 septic tanks, there were:

- 11 septic tanks with open discharge
- 24 septic tanks with treatment field
- nine septic tanks with treatment mound
- three septic tanks with unspecified treatment

Parkland County does not own or operate any wastewater lagoons in the WLSLUP area. The Village of Wabamun treats their wastewater through the use of a sanitary sewer system connected to a water treatment plant and treatment lagoons located 3.2 km north of Highway 16. Alberta Parks also has a lagoon for the Wabamun Lake Provincial Park.

The Summer Villages and residential subdivisions largely use septic pump out systems with the waste water hauled away by truck to the Entwistle lagoon operated by Parkland County.

4.4.1.2.3 Water

Potable water within the WLSLUP is supplied through either wells or water hauled in by truck and stored in on site cisterns. For surface water and groundwater use, see **Section 4.5.1** and **Section 4.5.3**.

4.4.1.3 Population

Determining a population for the WLSLUP area is problematic. Statistics Canada Census information cannot be refined to isolate only the population within the confines of the WLSLUP boundary. The Summer Villages and the Village of Wabamun have census numbers for their respective communities but these only reflect permanent residents and not seasonal residents, which in the case of Summer Villages is a significant percentage. Additionally, as noted above, Parkland County has 26 residential subdivisions within the Plan area. These subdivisions also have a permanent population and a seasonal population that uses their dwelling only during certain

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

times of the year (primarily during the summer months) as well; there are residences in the Plan area associated with agricultural uses. There are also two RV Parks within the Plan area, which would also have a seasonal resident population.

Alberta Municipal Affairs (2013) data for each of the Summer Villages and the Village of Wabamun includes population data, the number of residences and the number of occupied residences within each of the municipalities. From this, the calculations in **Table 4-3** below were made assuming all unoccupied dwellings would be occupied by the seasonal population at a similar resident per dwelling ratio as the permanent residents. It was established from these calculations that the total permanent population for the five Summer Villages and the Village of Wabamun is 864 and that the potential seasonal population increases by 435 for a combined permanent and seasonal population of 1,299.

Table 4-3 Village of Wabamun and Summer Villages Population Estimate

Municipality	Number of Residences	Number of Permanently Occupied Residences	Residents per Dwelling	Permanent Population (2013)	Estimated Seasonal Population	Estimated Total Population Permanent and Seasonal
Summer Village of Kapasiwin	45	7	2	14	40	54
Summer Village of Point Alison	25	2	5	10	28	38
Summer Village of Lakeview Beach	36	13	2	26	25	51
Summer Village of Seba Beach	338	66	2.17	143	274	417
Summer Village of Betula Beach	40	6	1.67	10	36	46
Village of Wabamun	295	265	2.49	661	32	693
Total	779	359	2.6¹	864	435	1299
SOURCE: Alberta Municipal Affairs 2013 NOTES: ¹ Average						

To calculate the permanent and seasonal Parkland County population within the WLSLUP, 2009 municipal census data for each subdivision was used as well as information regarding the number of farms within the watershed (WWMC 2013). It was assumed that all the farms had one occupied residence and that there is a dwelling on all residential lots within each subdivision, see **Table 4-4**.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-4 Parkland County Population Estimate within the WLSLUP Area

Subdivision or Hamlet	Number of developed Residential Lots	Residents per Dwelling ¹	Permanent Population (2009)	Estimated Seasonal Population	Estimated Total Population Permanent and Seasonal
Agricultural residences	63	2.6	158	0	158
Hamlet of Fallis	83	2.6	54	161.8	216
Ascot Beach	91	2.6	65	172	237
Beaver Bay Estates	10	2.6	0	26	26
Coal Point	54	2.6	0	140.4	140
Freeman	7	2.6	2	16.2	18
Gardeners Cove	12	2.6	4	27.2	31
Harbour Terrace	9	2.6	0	23.4	23
Lake Wabamun (Philips)	9	2.6	5	18.4	23
Lake Wabamun (Sherwin)	20	2.6	2	50	52
Lake Wabamun (Woods)	24	2.6	8	54.4	62
Marine Drive Estates	9	2.6	6	17.4	23
Mattwa Bay	8	2.6	3	17.8	21
McMahon Place	6	2.6	7	8.6	16
Prouse Park	14	2.6	6	30.4	36
Rich's Point	43	2.6	13	98.8	112
Rizzie Beach	32	2.6	3	80.2	83
Rosewood Beach	51	2.6	16	116.6	133
Skyland Gardens	20	2.6	14	38	52
South Seba Beach	85	2.6	25	196	221
South Woodland Acres	42	2.6	25	84.2	109
Sundance Meadows	48	2.6	8	116.8	125
Sunshine Bay	17	2.6	17	27.2	44
Tamarac Retreat	15	2.6	8	31	39
Wabamun Beach	12	2.6	5	26.2	31
Wabamun Lake (Moulds)	11	2.6	5	23.6	29
Waters Edge	7	2.6	5	13.2	18
Whitewood Sands	62	2.6	44	117.2	161
Willow Beach	7	2.6	4	14.2	18
Total	871	2.6	512	1747	2258

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Subdivision or Hamlet	Number of developed Residential Lots	Residents per Dwelling ¹	Permanent Population (2009)	Estimated Seasonal Population	Estimated Total Population Permanent and Seasonal
SOURCE: Alberta Municipal Affairs 2009					
NOTES:					
¹ Assumed the same as the average for the other municipalities.					

Based on this information, it is estimated that the total permanent population of Parkland County residents within the WLSLUP is 512 and that the potential seasonal population increases by 1,747 for a combined permanent and seasonal population of 2,258.

The total permanent population within the WLSLUP, given the assumptions stated, is estimated to be 1,376. The potential estimated seasonal population is 2,182. During the busy summer months, the population within the subwatershed could be as many as 3,557 people.

4.4.1.4 Recreational Development and Use

Wabamun Lake is one of the most heavily used lakes in the province (EDA 2013 and WWMC 2013). Recreational activities in and around the lake include: boating, swimming and fishing, bird and wildlife watching, camping and golfing. There are five sailing clubs which operate on the lake, two marinas and twelve boat launches. The popularity of Wabamun Lake is no surprise due to the lake's proximity to major urban centres within the Capital Region, such as Edmonton, Spruce Grove, Stony Plain, St Albert, Devon and Leduc, as well as the numerous residential acreages within Parkland and Leduc Counties, and the substantial residential and cottage development that exists around the lake. There are two full service campgrounds within the WLSLUP boundary. Wabamun Lake Provincial Park has 301 campsites, 110 which are electrified, available flush toilets and showers, playground areas, picnic shelters, a pier and boat launch. Kokanee Springs R.V. Resort has serviced 170 sites. In addition, there are 124 seasonal R.V. sites available at Pineridge Golf Course and 252 seasonal RV sites at Shadybrook Resort in Seba Beach. See **Figure 4-10** for these features.

There are a number of organizations that operate residential outdoor education camps including the Ernest Poole Scout Camp, Bissell Centre Moon Light Bay Camp, YWCA's Camp YoWoChAs, and Camp Oselia Children's Camp operated by the Ukrainian Catholic Eparchy of Edmonton. Each of these camps has residential dorm facilities, such as kitchens, washroom and shower facilities, and some also have additional campsite spaces.

There are two golf courses within the WLSLUP. The Paul Band operates the 18 hole Ironhead Golf and Country Club on reserve land and the 9 hole Pineridge Golf and RV Resort is located in Seba Beach.

October 9, 2015



SOURCE: Data digitized from WWMC 2013

October 9, 2015

Boating on Lake Wabamun is a very popular recreational activity. All manner of watercraft are in use on the lake, from canoes, kayaks, paddle boats and boards, to personal watercraft (SeaDoo's), motor boats, sail boats and windsurfers. Sailing is an especially popular activity on Lake Wabamun which is home to five Sailing clubs: The Wabamun Lake Sailing Club, the Edmonton Yacht Club, the Sunshine Bay Yacht Club, the Sinbad School of Sailing and the Alberta Offshore Sailing Association.

Concerns have been expressed over the number of boats on the lake, especially on long holiday weekends during the summer months. There are also concerns over wakes from motor powered watercraft impacting shorelines and nesting areas as well as general safety regarding speed and safe operation of watercraft on the lake.

Although counts of boats being launched have been undertaken at the various boat launches (as recently as 2013) currently, there is no data or estimates regarding the number of watercraft in use on the lake at any given time, especially during the busy summer holidays and whether the lake can support the number of watercraft in use during these peak times.

4.4.1.5 Industrial Development and Resource Extraction

Industrial activity within the subwatershed is considerable. Coal mining has occurred in the area as early as 1910 and strip mining for coal started in 1914 (WWMC 2013). Significant mining continues at TransAlta's Highvale Mine situated on the south shore of the Lake. In addition to the mining activity, TransAlta currently operates two power generation stations adjacent to the Lake; the Keephills and Sundance power plants. Oil and gas drilling have and continue to occur within the subwatershed. There have been 108 wells (both sour and non-sour) drilled in the WLSLUP area. Industrial and mining developments within the watershed currently occupy an area of 41.2 km², or 14.9% of the total land area (WWMC 2013).

The earliest mining activity originated on the north side of the Lake. When the original Wabamun Power Plant, constructed in 1956, was later converted to the easily accessible coal in 1963, the open pit mining activity began at the Whitewood Mine, north of Highway 16. When the Wabamun Power Plant ceased operations in 2010 and was dismantled the Whitewood Mine also closed. Final reclamation activities at the Whitewood Mine have been completed and TransAlta is currently waiting to receive a reclamation certificate from the Province. The reclaimed land will include 54.8 ha of wetlands, 194.2 ha of forests and 77.7 ha of end-pit lakes (WWMC 2013).

Extending along the entire length of the south shore of Wabamun Lake is TransAlta's Highvale Mine. The mine has been in operation since 1970 and provides feedstock to TransAlta's Sundance and Keephills Power Plants. The mine boundary is significant and extends beyond the WLSLUP boundary to the south, see **Figure 4-11**. Currently six pits are being actively mined directly adjacent to the lake. Reclamation activities have begun for Pits 03 through 07 with an estimated completion of reclamation activities scheduled between 2016 and 2029 (WWMC 2013).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

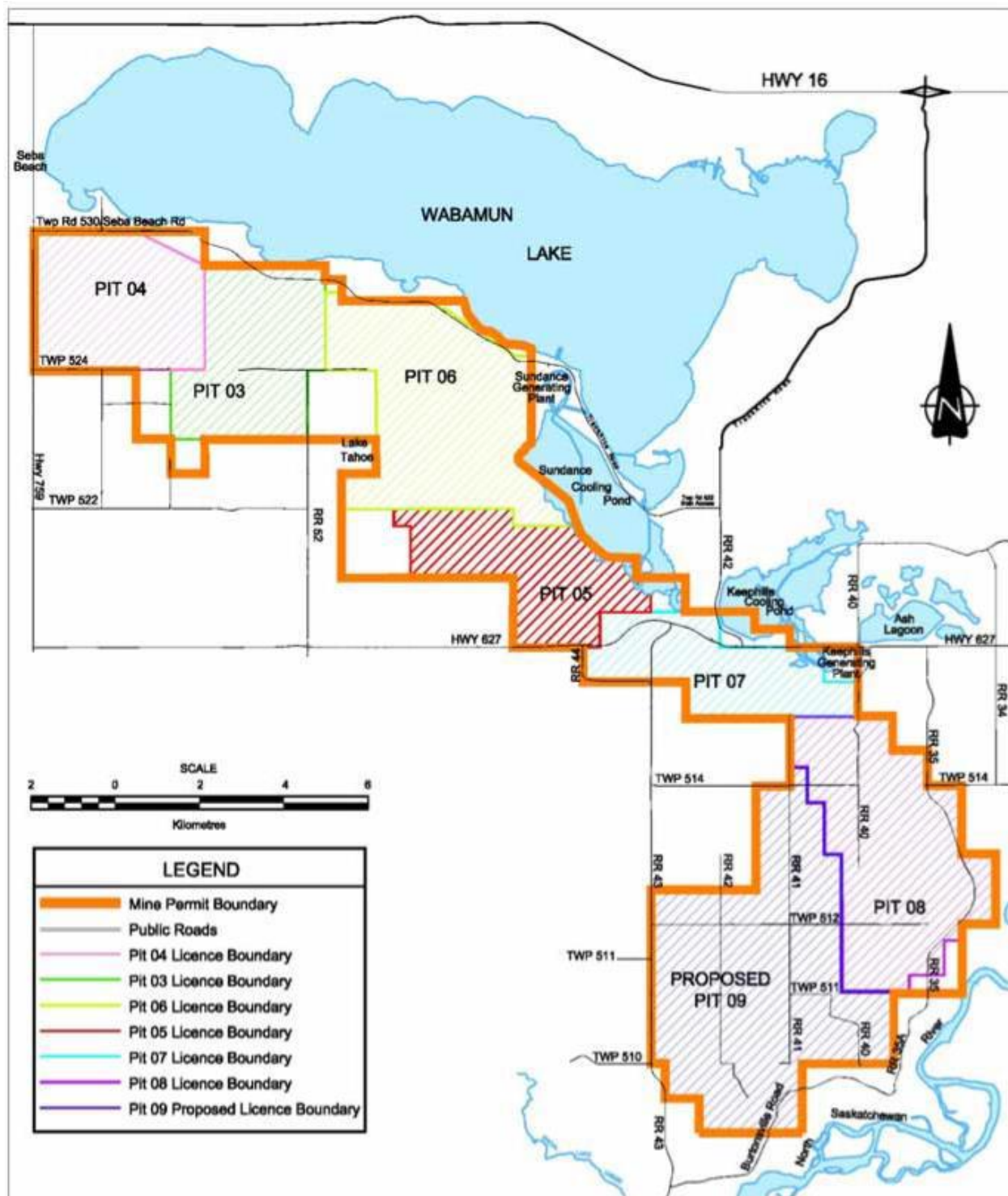


Figure 4-11 Highvale Mine Boundary and Pit Locations

SOURCE: WWMC 2013

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Reclamation plans for these pits will include 224.95 ha of wetlands, 443.3 ha of forest and 179.1 ha of open water in the form of end-pit lakes (WWMC 2013). TransAlta is currently applying to activate a new mine in Pit 09, located outside of the WLSLUP boundary, south of the Keephills cooling pond.

TransAlta's Sundance Power Plant is located on the south shore of the lake (see **Figure 4-12**). Constructed in 1970, it is currently the largest coal-fired power plant in western Canada (WWMC 2013). Though it initially used lake water for cooling, in 1975, a large cooling pond was subsequently constructed by closing off a portion Goosequill Bay in the southeast corner of the Lake. TransAlta diverts and treats water from the North Saskatchewan River for the operation of the Sundance Plant, then de-chlorinates it and cools it in the cooling pond before the water is released into Lake Wabamun.

TransAlta also operates the Keephills Power Plant located between Wabamun Lake and the North Saskatchewan River. Though the Plant itself is not located within the WLSLUP, a large portion of its cooling pond lay within the Plan area. Treated water from the North Saskatchewan River is used for cooling the Keephills Plant.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

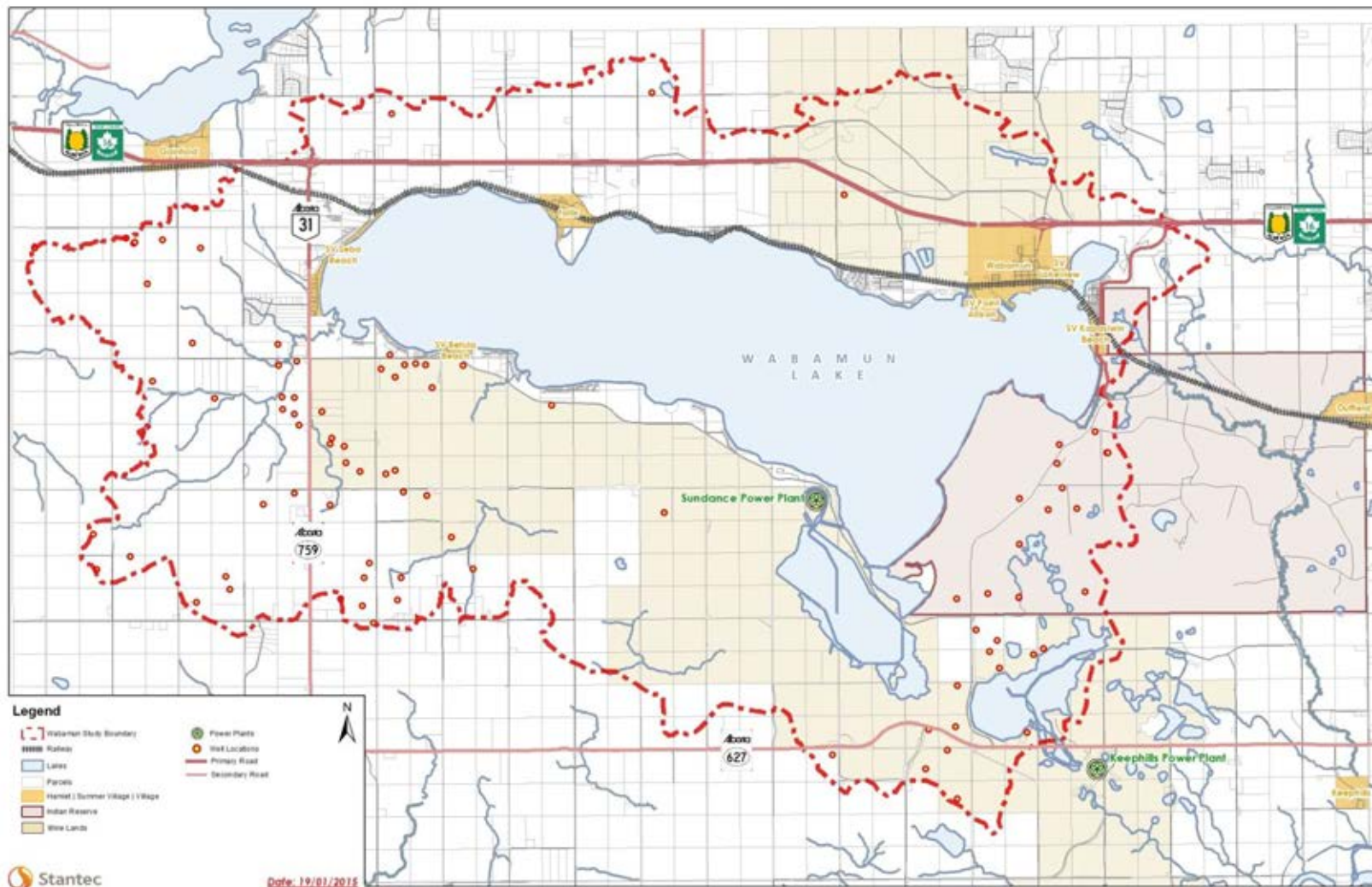


Figure 4-12 Industrial Development within the Subwatershed

SOURCE: Data from Parkland County

October 9, 2015

4.4.1.6 Linear Development

Linear development within the WLSLUP area includes the construction of roads, trails, railways, pipelines, seismic lines, transmission lines, and other man-made linear features, see **Figure 4-13**.

The most prominent of the linear features in the subwatershed is Highway 16, the Yellowhead Highway. This four-lane divided highway is major east-west vehicular transportation route for goods and services located north of Wabamun Lake. Additional highway corridors within the WLSLUP area include Hwy 31/759 and Hwy 627, as well as developed township and range roads throughout the area.

Another prominent linear feature is the Canadian National Railroad Main Line, which runs along the north shore of the Lake. Initially constructed in 1911 as the Grand Trunk Railway between Edmonton to Jasper, this line now functions as the primary "main" rail line for Canadian National Railroad traffic going to and from the west coast.

There are a number of oil and gas pipelines within the WLSLUP area, including TransAlta's natural gas pipeline, which runs under Wabamun Lake, east of the Village of Wabamun to the Sundance Power Plant (WWMC 2013). In addition, there are numerous power transmission lines in the subwatershed that transport the electricity generated from the TransAlta power plants to all parts of Alberta.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

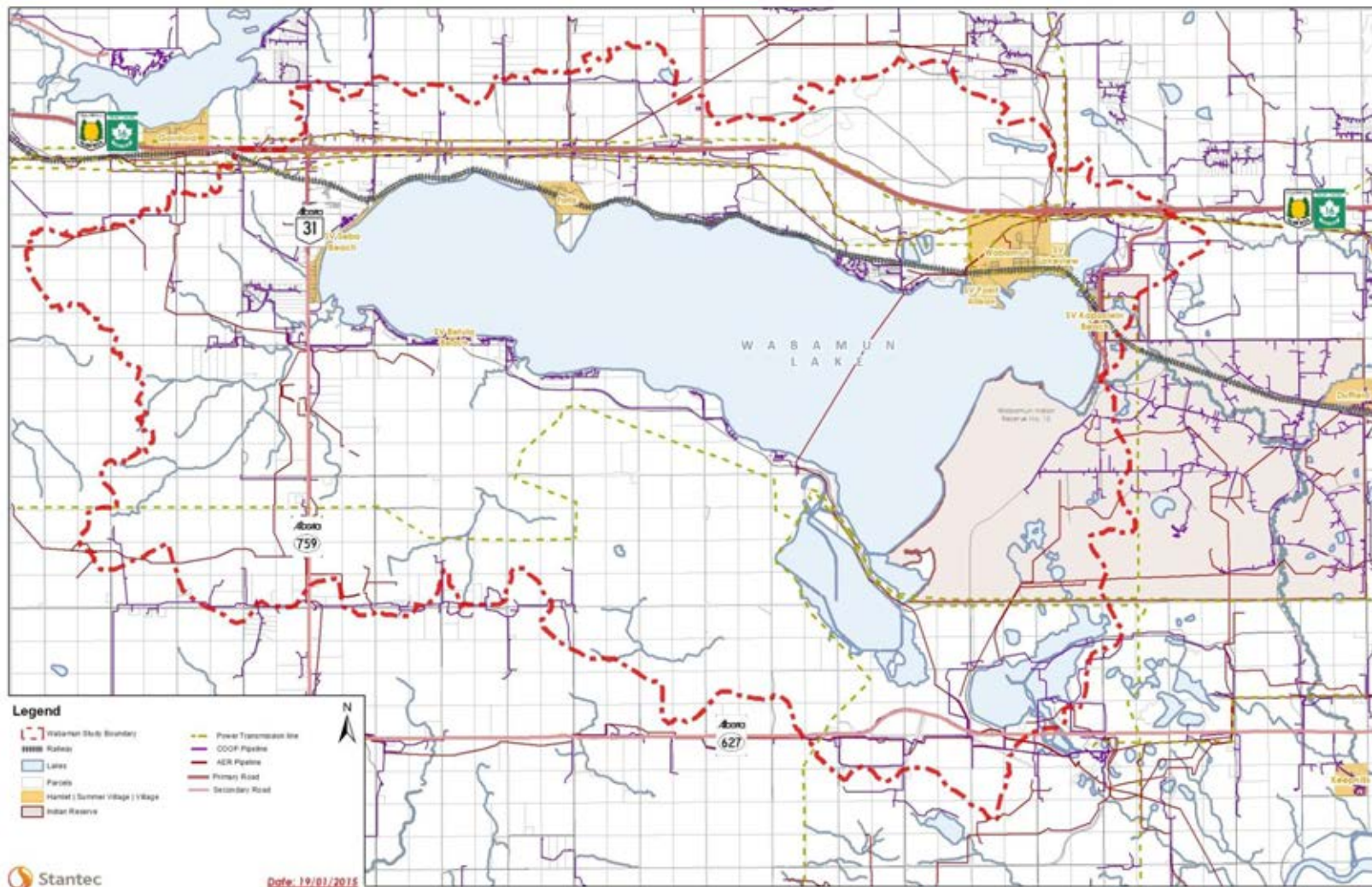


Figure 4-13 Linear Development within the Subwatershed

SOURCE: Data from Parkland County

October 9, 2015

4.4.1.7 Agriculture and Other Lands

4.4.1.7.1 Agriculture

Agriculture has been undertaken in the area since the first European settlers moved into the area in the early 1900s. In 2006 there was an estimated 63 farms in the subwatershed (Statistics Canada 2006), occupying a land base of 10,944 hectares (Latham 2014). Agricultural land is used mainly for pasture/forages (75%), canola (12%) and wheat (10%), with small areas of barley, oat, pea cultivation, see **Figure 4-14** and **Table 4-5** (AAFC 2013).

According to Latham (2014), the Wabamun Lake subwatershed contains an estimated 1513 cattle and calves (including buffalo) and 105 horses. No commercial hog, poultry or sheep operations were found in the subwatershed. Cattle manure production in the watershed is estimated to be 1,144 kg/ha. Latham (2014) concluded that there is likely minimal livestock-related nutrient contribution to the lake nutrient load.

4.4.1.7.2 Conservation Areas

TransAlta has identified two sites adjacent to the lake that they have or intend to donate to the Alberta Fish and Game Wildlife Trust Fund. These areas include a 19-ha portion of the shoreline between Point Allison and Rich's Point to assist in the protection of a western grebe colony and a 19-ha parcel of land on the south shore consisting of a range of ecological communities including, forests, wetlands and grassland meadows (WWMC 2013), see **Figure 4-14**.

4.4.1.7.3 Public Lands

Within the WLSLUP boundary, there are a number of lands that are public lands owned by the Crown. These include the Jackpine Grazing Reserve and Wabamun Lake Provincial Park as well parcels owned by Parkland County and the other municipalities, see **Figure 4-14**.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-5 Wabamun Lake Subwatershed 2013 Crop Inventory

Crop/Land Cover Type	Area (km ²)	% Total	% Agricultural
Pasture/Forages	66.7	19.2%	75.3%
Barley	2.3	0.7%	2.6%
Oats	0.5	0.2%	0.6%
Winter Wheat	0.05	0.01%	0.1%
Spring Wheat	8	2.4%	9.6%
Canola	10	3.0%	11.7%
Peas	0.2	0.05%	0.2%
Coniferous	4.2	1.2%	n/a
Broadleaf	76.6	22.1%	n/a
Mixedwood	0.6	0.2%	n/a
Shrub Land	25.3	7.3%	n/a
Wetland	19.1	5.5%	n/a
Grassland	0.6	0.2%	n/a
Water	93.4	26.9%	n/a
Exposed Barren Land	28.1	8.1%	n/a
Urban Developed	10.8	3.1%	n/a
Total	347	100%	100%

SOURCE: AAFC 2013

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

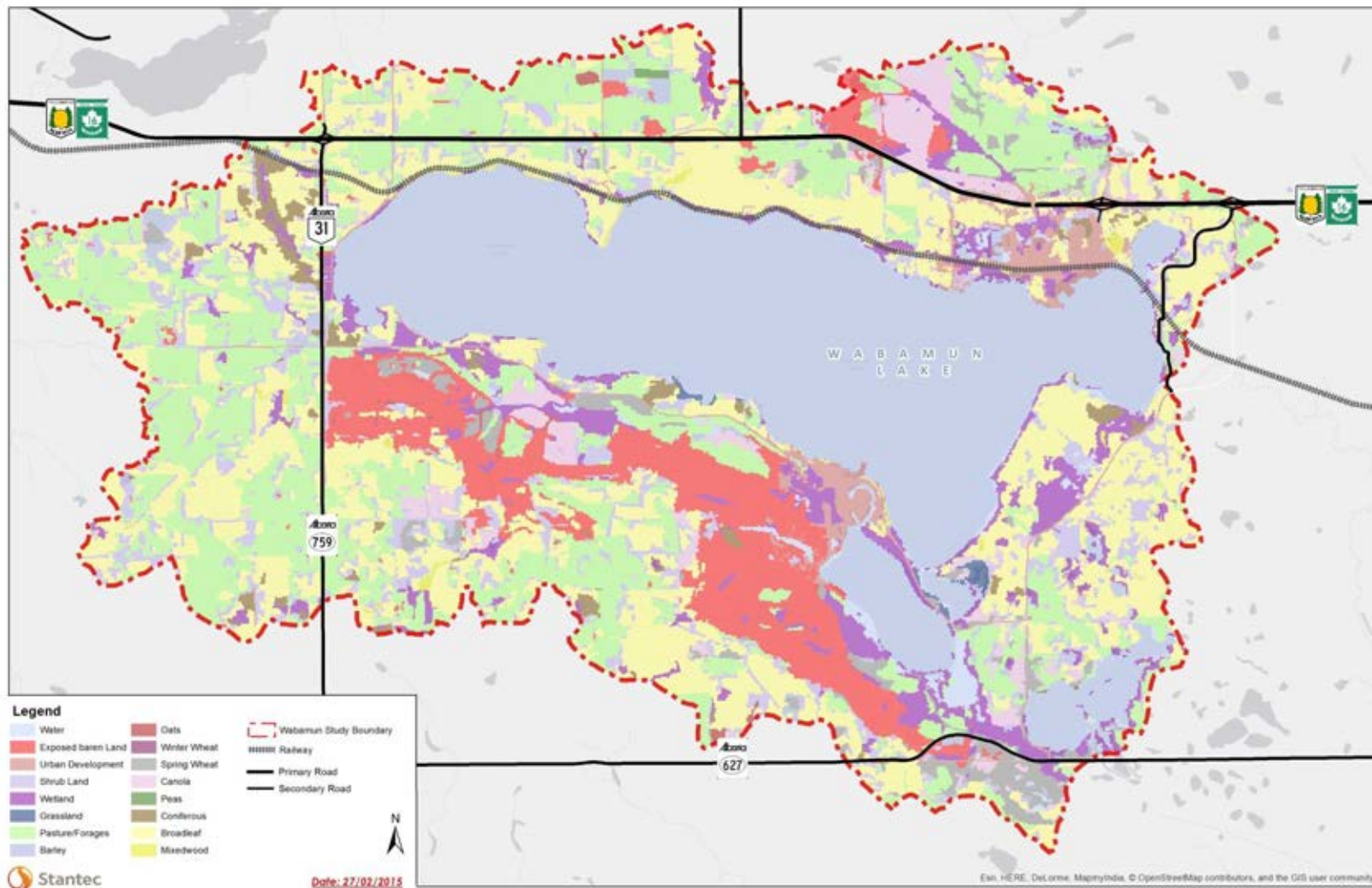


Figure 4-14 Crop Inventory in the Subwatershed

SOURCE: Data from AAFC 2013

October 9, 2015

4.4.2 Geology and Soils

The Wabamun Lake watershed is in the Aspen Parkland ecoregion, which is the transition zone between the grassland ecosystems to the south and the boreal forest ecosystem to the north. Within the watershed, there are Chernozemic soils (developed under grassland), Luvisolic soils (developed under forest) Regosolic soils (unstable), Solonetzic (high in salt) and Organic areas (wetlands).

The topography of the subwatershed is dominated by steep slopes (>15%) on the north shore of the lake, with several >20% slopes present (see **Figure 4-15** and **Figure 4-16**, Natural Resource Canada website, Parkland County 2014). Due to the steep slopes, this area has high potential for erosion (Parkland County 2014). WWMC (2013) summarized the geology and soils of Wabamun Lake subwatershed as follows (see **Figure 4-17** and **Figure 4-18**, Alberta Geological Survey 2013):

The underlying geology of a region is an important player in determining viable land use activities. For example, coal mining in the Wabamun Lake subwatershed is driven by the presence of coal seams originating from the lowermost Paskapoo formation or the uppermost cretaceous bedrock. The Paskapoo formation is formed from Tertiary Period deposits composed primarily of non-marine sedimentary rocks including primarily calcareous mudstone, siltstone and sandstone, with subordinate beds of limestone, tuff, and coal. In areas around the lake where coal seams reach the surface, black sands can be seen (Mitchell and Prepas 1990).

Surficial deposits to the south and west of the lake are mainly discontinuous glacial till less than two meters thick, or bedrock of the Paleocene age. Surface deposits along the north shore of the lake are mostly sandy lacustrine deposits less than two meters thick. Along the east shore of the lake one can find fine textured glaciolacustrine materials, with few or no stones. The bedrock along the north and west side of the lake is of the Cretaceous age (Andriashek et al. 1979).

Chernozemic soils are our best agricultural soils due to the interaction of plant roots and the type of mineral material that leads to the creation of a granular soil structure. This structure is very favourable for air and water movement in the soil and for plant growth. These soils also store a large amount of soil organic carbon (Soils of Canada website).

October 9, 2015



SOURCE: Natural Resource Canada website

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015



Figure 4-16 Wabamun Lake Subwatershed Slope Degree Overview

SOURCE: AltiLIS

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

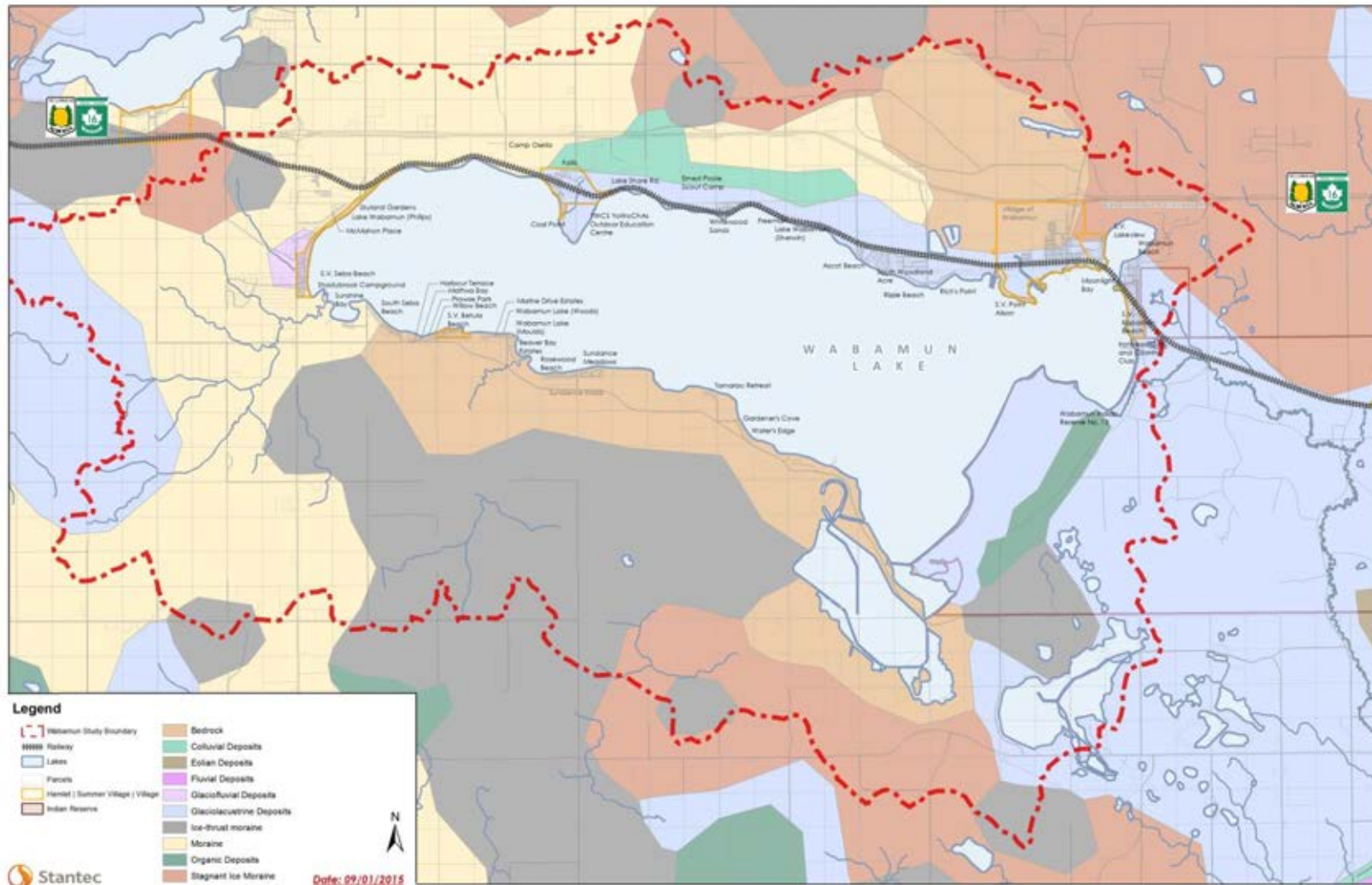


Figure 4-17 Surficial Geology in the Wabamun Lake Subwatershed

SOURCE: Alberta Geological Survey 2013

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

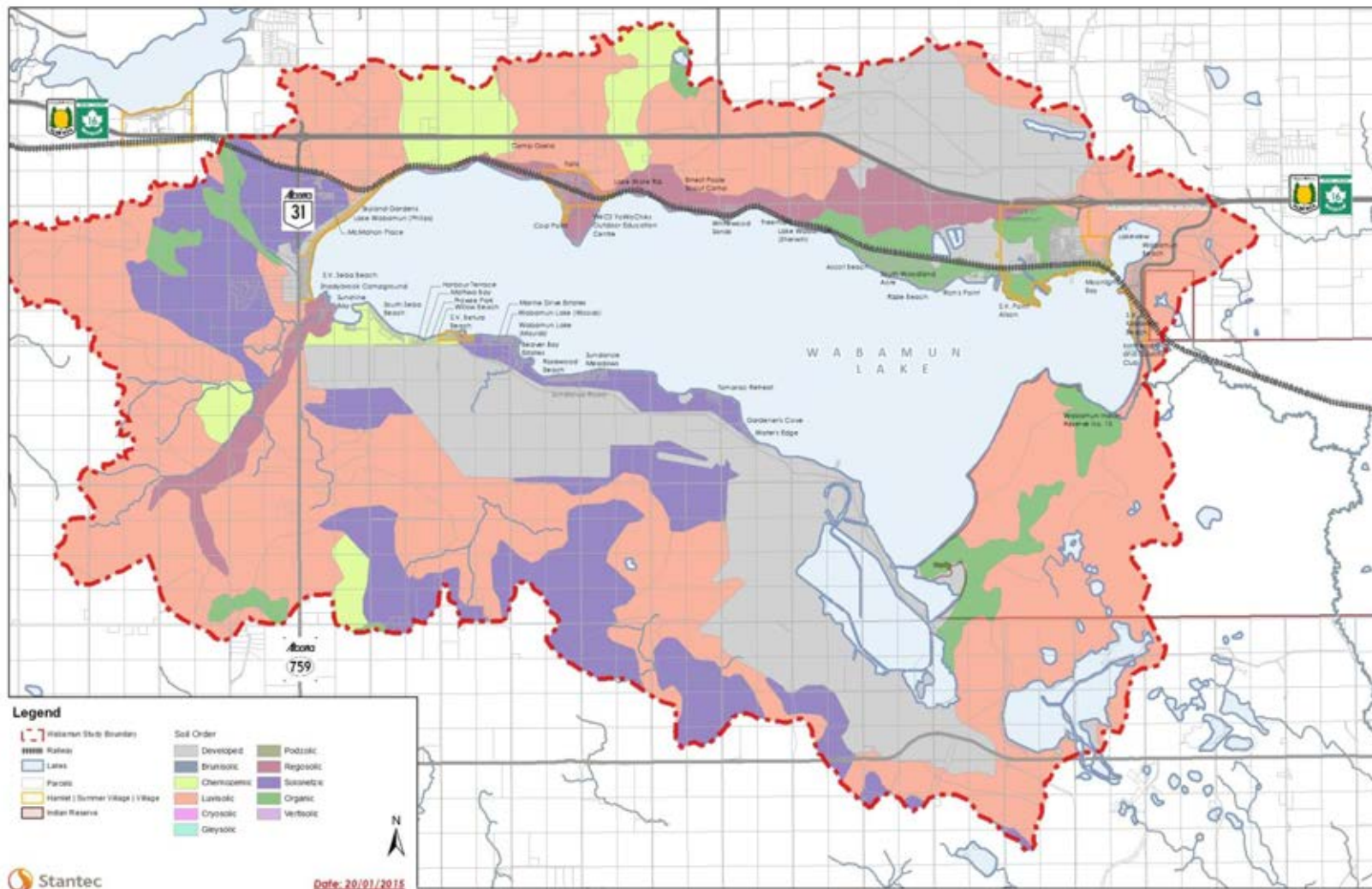


Figure 4-18 Soil Orders in the Wabamun Lake Subwatershed

SOURCE: Alberta Geological Survey 2013

October 9, 2015

The remaining forest cover in the subwatershed is located mainly on Luvisolic soils providing important habitat, watershed protection and aesthetics (Soils of Canada website). These soils normally have low organic matter, poor tilth and are generally deficient in nitrogen, phosphorus and sulphur. The lower horizons are slowly permeable to water and difficult for plant roots to grow into. Despite these limitations to agriculture production, appropriate fertilizer management, returning organic residues and manure to the soil, and forage cropping or improved pasture can lead to more productive soils for agricultural use (Pettapiece et al. 2010). These soils are also lost to country residential and urban expansion.

Regosolic soils result from instability and naturally occur on hillslopes that have high rates of water runoff and/or where slopes cause downslope movement of soil (Soils of Canada website).

Solonchic soils have high amounts of sodium that can arise from either the parent material the soil was formed from which was high in sodium, or sodium has been increased through deposition of salts from groundwater. When saline groundwater is found close to the surface, water is lost by uptake by plants or by evaporation, which increases the concentration of sodium left behind. This high level of sodium may also cause clay to clog the pores in lower parts of the soil, which progressively reduces its ability to transmit water. In cultivated fields, the upper soil levels are sometimes lost to erosion, and the clogged lower layers are then found at the soil surface. When this layer dries out it is very difficult to penetrate with tillage equipment and is difficult for root development. This is often referred to as hardpan (Soils of Canada website).

Organic areas form where water accumulates and saturates the soil from surface runoff and/or a high groundwater table located at or near the mineral soil surface, so that the soil is saturated with water for all or most of the year. These lands are generally not suitable for agriculture or other land uses unless they are drained. Many wetlands also serve as groundwater recharge areas (Soils of Canada website).

4.4.2.1 Relevance to Land Use Planning

The different soils in the Wabamun Lake Subwatershed with their different physical characteristics (see **Figure 4-17**) are relevant in the land use planning. Regosolic soils in the steep slopes (>15%) in the north shore of the lake are unstable and cannot be developed unless they are stabilized which is usually a very costly and uncertain venture. Slope erosion may potentially lead to loss of land surface, infrastructure and/or properties on these slopes with subsequent transport of fine sediments into the lake.

Chernozemic soils are our best agricultural soils and store large amounts of soil organic carbon. It has been estimated that 15 to 30% of the original soil carbon has been lost in these soils because of the conversion of native prairie to agriculture. Adoption of improved soil management can lead to increases in the amount of carbon storage by the soil (Pettapiece et al. 2010). Chernozemic soils are also lost due to non-agriculture developments such as country residential and urban expansion. Rich chernozemic soils should be preserved for farmland activity. These

October 9, 2015

soils formed over thousands of years and are very difficult to reclaim after their destruction (Alberta Geological Survey 2013).

Despite the limitations to agriculture production on Luvisolic soils, appropriate fertilizer management, returning organic residues and manure to the soil, and forage cropping or improved pasture can lead to more productive soils for agricultural use (Pettapiece et al. 2010). The forests on these soils provide important habitat, watershed protection and aesthetics. These soils are also lost to country residential and urban expansion.

Solonchic soils have high amounts of sodium that are detrimental to plant growth without intensive management such as ripping and treating the hard pan with lime and gypsum. Agriculture production can occur on these soils with this intensive management. From a soil productivity point of view, if a high water table or other constraints do not exist on these soils, they may be the best candidates for infrastructure development.

As organic areas form where water accumulates and saturates the soil, these lands are generally not suitable for agriculture or other land uses unless they are drained. Many wetlands also serve as groundwater recharge areas. These areas are also sensitive to shallow groundwater contamination.

4.5 WATER

4.5.1 Surface Water Quantity

Understanding the water balance in Wabamun Lake is essential for assessing the effect of human land and resource use on the lake health over time. Wabamun Lake levels have been controlled since 1913. This control results in a degree of artificiality to the water balance of the lake. The term water balance is used to describe the balance between water inputs and outputs in a waterbody or watershed. A water balance can characterize the net balance of the system (for example, a negative water balance means that a system is losing water) and the importance of individual inputs and outputs to the overall balance.

Water inputs into Wabamun Lake include:

- direct precipitation to the lake surface
- surface runoff (including tributary inflows³)
- TransAlta Water Treatment Plant treated water discharges
- groundwater inflows

Water outputs from Wabamun Lake include:

- evaporation from the lake's surface

³ There are at least 35 small drainage courses that supply water to the lake; seven largest natural creeks contribute the majority of flow (WWMC 2013). Total surface runoff has not been measured in the watershed (AENV 2002), and Tomahawk Creek at Tomahawk has been used as a proxy to estimate runoff yield from the catchment by AENV (2002) and KCB (2014).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- enhanced evaporation caused by TransAlta Wabamun Plant cooling water (ceased in 2010)
- groundwater outflows
- licenced consumptive surface water withdrawals
- outflow to Wabamun Creek

The Wabamun Lake water balance for 1982 to 2001 shows an overall decreasing trend in the lake volume (**Figure 4-19** and **Figure 4-20**; AENV 2002). This trend in lake volume was due to water diversions and use in the subwatershed. Between 1997 and 2007, TransAlta started water inputs to the lake from the Water Treatment Plant, effectively returning the lake volume to pre-early 1980s levels. TransAlta's 'water debt' to the lake was considered to be paid in 2007. Since 2007, TransAlta has managed the Water Treatment Plant discharges to produce enough water to offset the five-year forecasted average effect of TransAlta's activities in the subwatershed (KCB 2014).

Wabamun Lake water balance for 2004-2013 was calculated based on TransAlta's Annual Water Balance Report (KCB 2014), see **Table 4-6** and **Figure 4-21**. Key changes between the 1982-2001 and 2004-2013 periods are the increase in Water Treatment Plant water inputs to the lake and the cessation of enhanced evaporation, which resulted from the Wabamun Power Plant discharging warm cooling water to the lake, in 2010. The Wabamun Power Plant was decommissioned in 2010.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

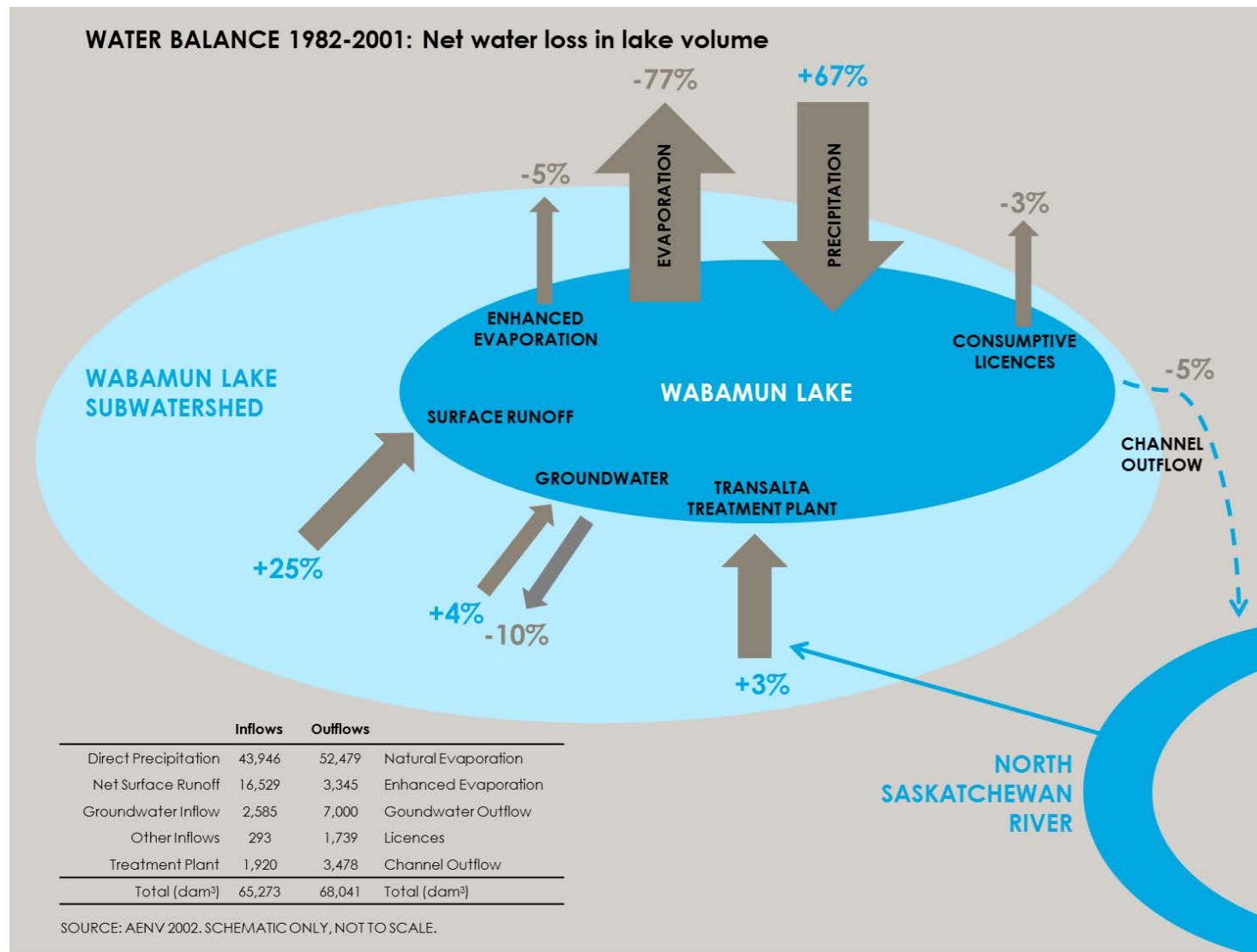


Figure 4-19 Wabamun Lake Water Balance 1982-2001

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

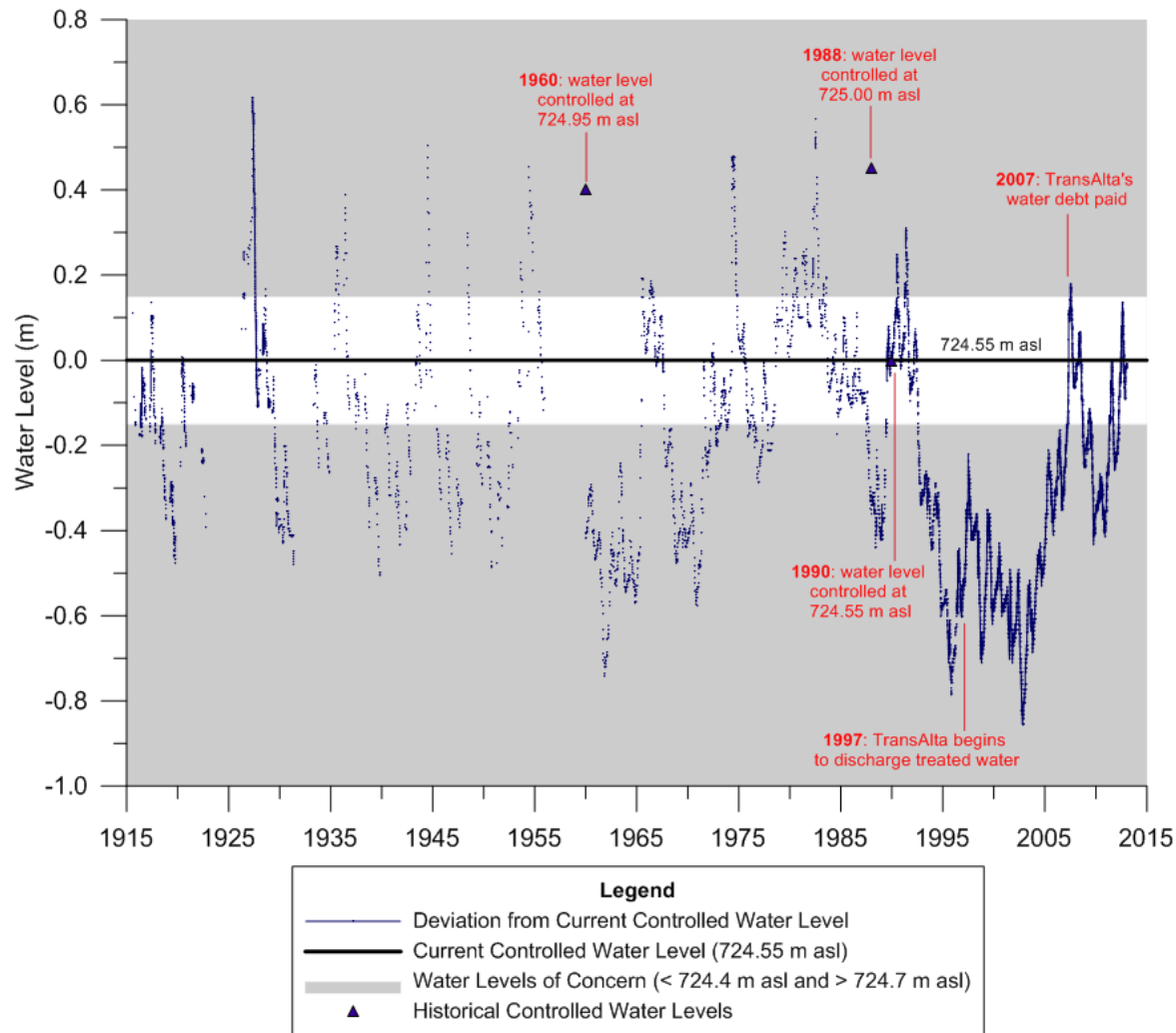


Figure 4-20 Wabamun Lake Levels 1915 to 2012 as Deviation from Current Lake Management Level

SOURCES: WSC (2014) for water level data, Hoyes (2014) for water levels of concern expressed by local property owners, Schindler (2004) for lake level management dates

NOTES: The TransAlta water treatment facility was commissioned in 1997, but did not deliver any substantial amount of water to the lake until 1999 (AENV 2002). The start date for release is shown in Figure 4-18. The water level drop in 2000 is assumed to be a result of drier conditions that year not offset by the amount of water discharged.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-6 Estimated Inflow and Outflow Volumes for Wabamun Lake, 2004-2013

Year	Inflows					Outflows					
	Direct Precipitation ¹	Net Surface Runoff ²	Ground-water Inflow	Treatment Plant ³	Sum of All Inflows	Natural Evapo-ration	Enhanced Evapo-ration ⁴	Ground-water Outflow	Licences	Channel Outflow	Sum of All Outflows
2004	40318	7986	2634	21803	72741	50400	2450	7000	2126	0	61976
2005	33342	13100	2782	20978	70203	51600	2508	7000	2095	0	63203
2006	46092	525	3128	20518	70264	52800	2566	7000	2060	0	64426
2007	52932	16008	2948	13265	85153	52000	2527	7000	2025	5996	69548
2008	32806	5377	3071	11554	52808	54800	2663	7000	1894	611	66968
2009	32678	5657	3080	11744	53159	52000	2092	7000	1999	0	63091
2010	42188	806	3039	10372	56404	50160	505	7000	1785	0	59450
2011	45587	16060	3052	10175	74874	56640	0	7000	1552	0	65192
2012	50391	21069	3052	10271	84784	50400	0	7000	1618	5883	64901
2013	39088	29809	2934	9840	81671	48800	0	7000	1626	22911	80337
Average											
2004-2013	41542	11640	2972	14052	70206	51960	1531	7000	1878	3540	65909
2004-2010	40051	7066	2955	15748	65819	51966	2187	7000	1998	944	64095
2011-2013	45022	22313	3013	10095	80443	51947	0	7000	1599	9598	70143
Percentage											
2004-2013	59%	17%	4%	20%	100%	79%	2%	11%	3%	5%	100%
2004-2010	61%	11%	4%	24%	100%	81%	3%	11%	3%	1%	100%
2011-2013	56%	28%	4%	13%	100%	74%	0%	10%	2%	14%	100%

SOURCE: All data from KCB 2014, except for groundwater outflows, which are from AENV 2002. Calculations are outlined below.

NOTES:

¹ Direct precipitation was calculated based on total precipitation in KCB (2014) multiplied by the lake surface area calculated using equation in AENV (2002) and Water Survey of Canada lake elevation data.

² Net surface runoff was calculated based on surface runoff depths from KCB (2014) multiplied by runoff contributing areas (estimated as 175 km²).

³ The water treatment facility was commissioned in 1997 but did not deliver any material amount of water to the lake until 1999 (AENV 2002).

⁴ Enhanced evaporation was caused by the Wabamun Plant cooling water discharges to the lake. These ceased when the plant was decommissioned in 2010.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

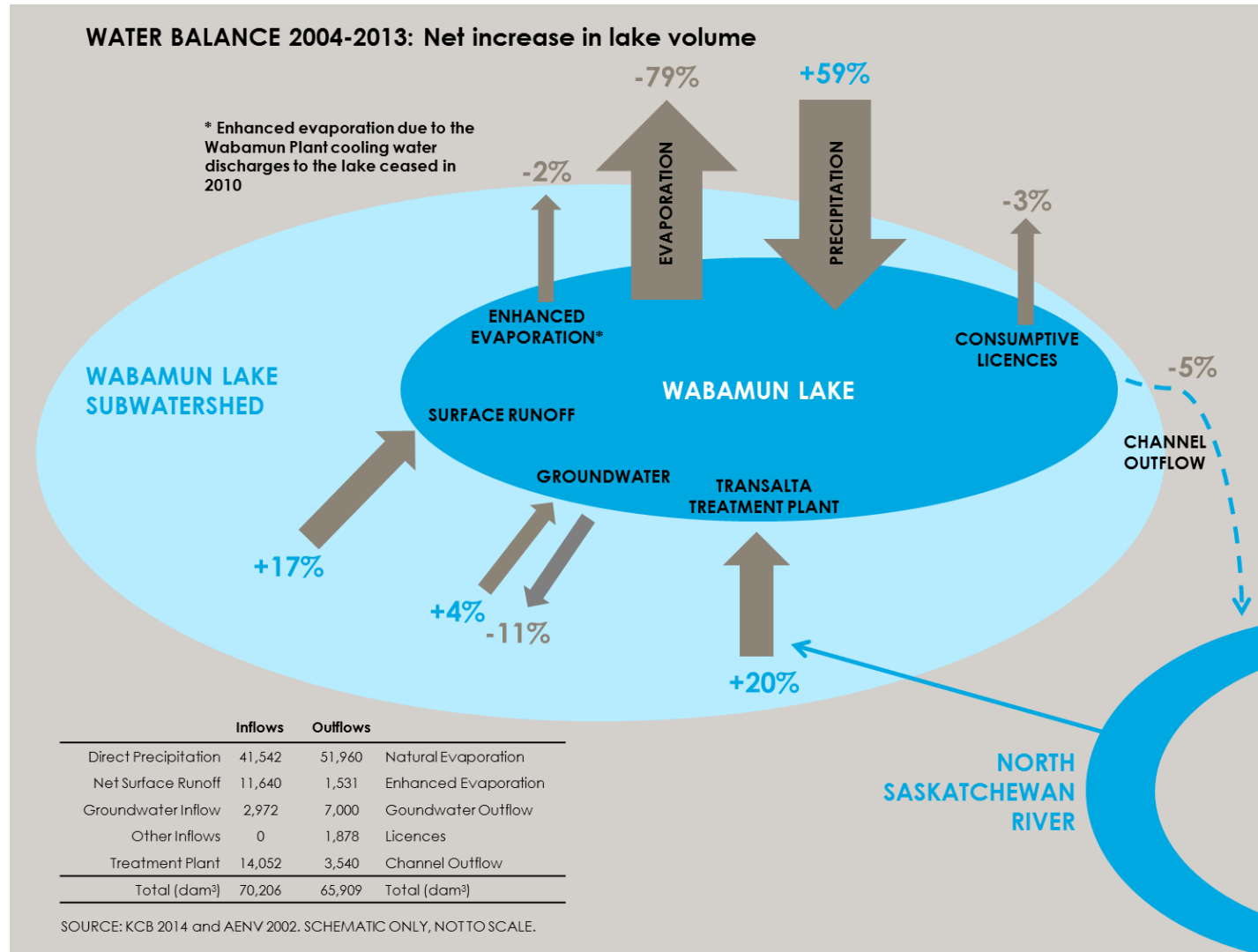


Figure 4-21 Wabamun Lake Water Balance 2002-2014

October 9, 2015

4.5.1.1 Licenced Surface Water Diversions

Water Act Approval Records returned for the subwatershed are summarized below. There are a total of 58 authorized surface water diversions within the Wabamun Lake subwatershed. However, the vast majority (52 licences or 89 percent) of the authorized diversions are for temporary construction, wetland augmentation, and utility crossings in aquatic areas. Most of these surface water diversions are in relation to the coal mining activity. The strip-mining technique necessitates aquatic areas in the mining footprint to be disturbed or drained to carry out the mining plan. As a result, there are several historical permits that were returned in the search related to mining activity and construction. There are six authorized surface water diversions in the basin for industrial, irrigation, and stock watering. For the distribution water use categories of the licences for the Wabamun Lake subwatershed, see **Figure 4-22**. For the location of the surface diversion authorizations, see **Figure 4-23**.

The volume diverted for industrial purposes is entirely related to the TransAlta Sundance Generating Station, which has held a surface water diversion licence since 1954 to divert, but with no consumptive use (i.e., 100% return flow) of a 234,361,552 m³ per year diversion for cooling water. A consumptive use surface water diversion is also held by TransAlta since 1967 for 1,850,223 m³ per year which makes up 99.37% of the consumptive use of surface water in the basin, see **Figure 4-24**. A total of three stock watering diversions are held for 11,676 m³ per year or 0.63% of the consumptive use. The diversion for irrigation is very small (10 m³ per year) and accounts for less than 0.1% of surface water use.

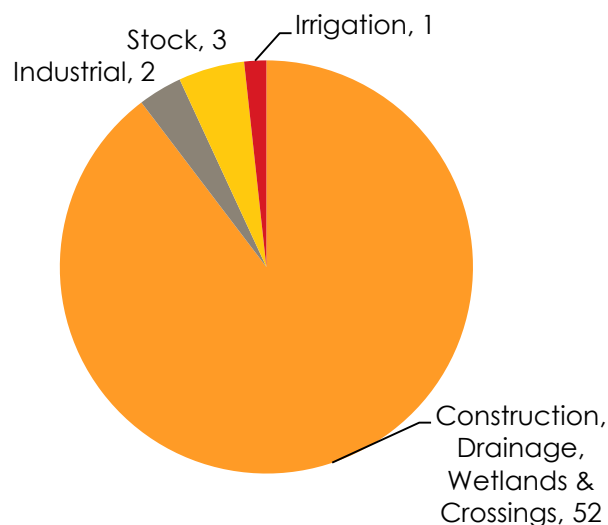


Figure 4-22 Surface Water Licence Categories in the Subwatershed

SOURCE: ESRD Authorization Viewer website

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015



Figure 4-23 Licensed Surface Water Diversion Locations

SOURCE: Screenshot from Alberta GeoDiscover Portal website. Blue dots indicate locations of water diversions.

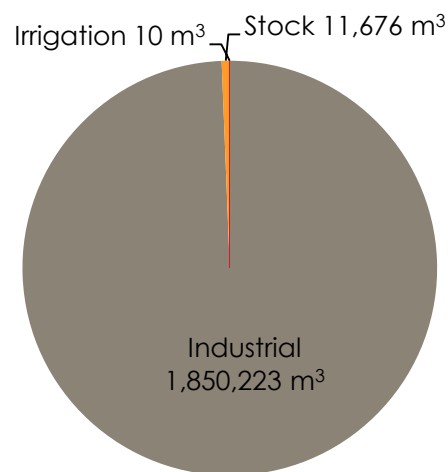


Figure 4-24 Annual Consumptive Surface Water Diversion Volumes by Licence Category

SOURCE: ESRD Authorization Viewer website

October 9, 2015

The largest volumetric diversion of water in the basin is returned to the natural environment within the basin. A continuous diversion of surface water is used for cooling with 100% return flow. The 52 diversion authorizations related to construction, aquatic utility crossings, and wetland disturbance are all temporary and do not divert water for consumptive use. Though water was diverted for these authorizations, they do not represent an ongoing or consumptive use that can alter the water balance in the basin significantly.

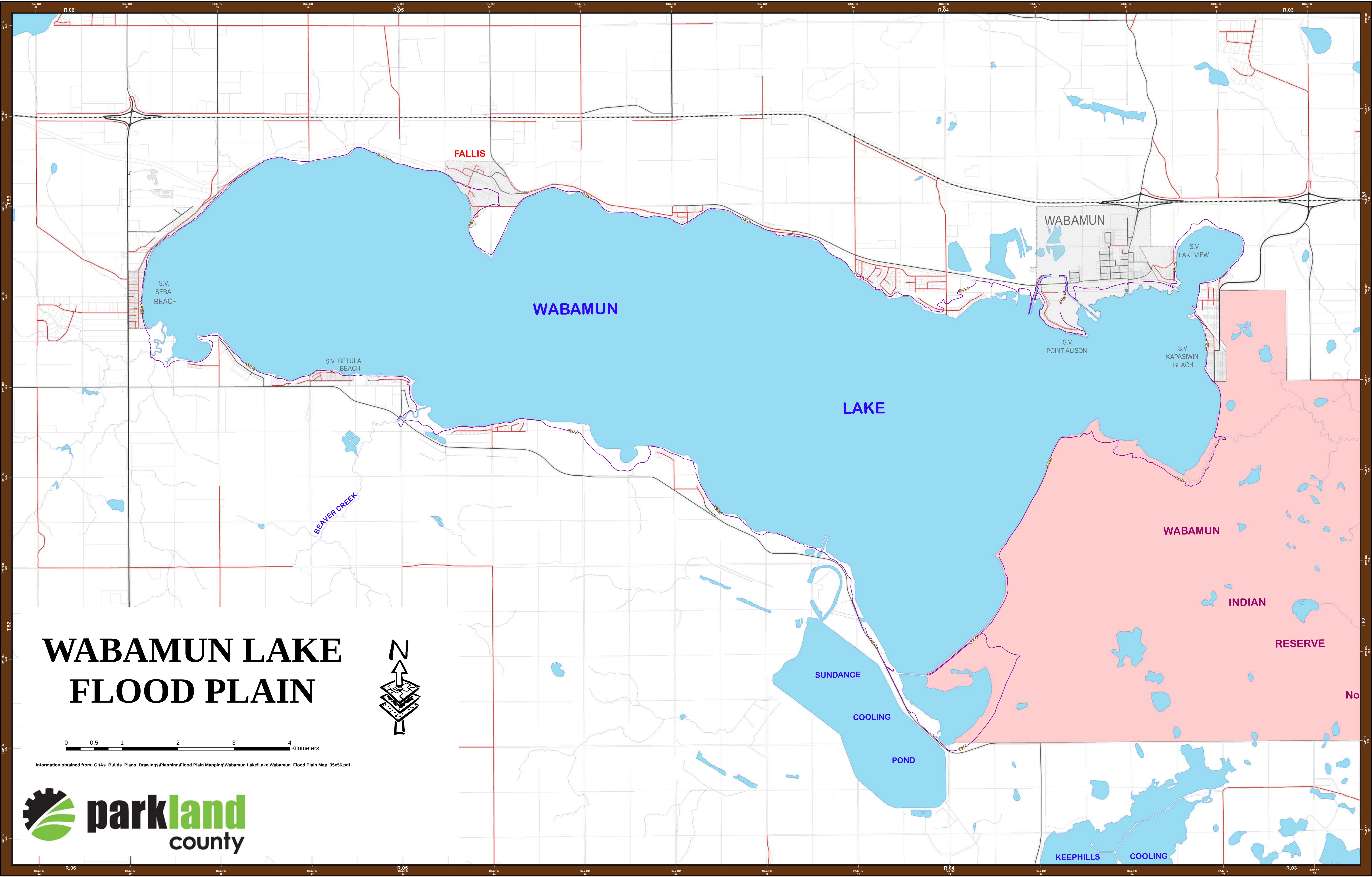
Diversion of surface water for purposes like irrigation also has a return flow component through groundwater recharge. Further, while difficult to estimate, groundwater diversion, particularly for irrigation and municipal uses may have a significant return flow component as well through discharging sewage treatment effluent, as well as domestic septic tank/weeping tile systems.

4.5.1.2 Floodplain

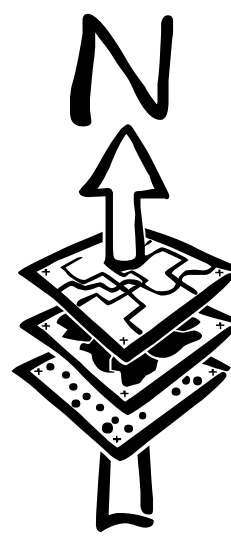
Wabamun Lake floodplain was delineated by Parkland County in 2015 (Martin 2015, pers. comm., **Figure 4-25**) based on a 1:100 year provincial floodplain map from 1980. This original 1980 map defined an elevation of 725.592 m asl as the Wabamun Lake 1:100 year floodplain extent. This elevation should be viewed in the context of the highest recorded water level in the lake by Water Survey of Canada in the last 100 year (725.168 m asl in May 1927), which is subsequently lower than the floodplain extent elevation. Additionally, the lake levels are controlled with a weir, so the floodplain extent is a theoretical lake water level extent.

4.5.1.3 Relevance to Land Use Planning

The relevance of the water balance to land use planning is that it gives an idea of what sort of variability that may be expected in the lake response to hydrological inputs. Variability in the water balance is driven largely by climate and modification of precipitation inputs via land use, vegetation and surficial geology in the watershed along with groundwater/surface water interaction. There is potential for the pattern of historical water balance variability to shift in magnitude and frequency as a function of climate change induced shifts in precipitation inputs, evapotranspiration rates and changes in vegetation. New developments with increased paved areas may reduce rainfall infiltration into porous soils and increase surficial runoff with additional fine sediments brought into the lake. All of these factors will affect the amount of potential runoff to the lake that may adversely affect lake health, in addition to any future developments within the watershed.



WABAMUN LAKE FLOOD PLAIN



0 0.5 1 2 3 4 Kilometers

Information obtained from: G:\As_Builds_Plans_Drawings\Planning\Flood Plain Mapping\Wabamun Lake\Lake Wabamun_Flood Plain Map_35x56.pdf



October 9, 2015

Blank page (back of 11 by 17 figure)

October 9, 2015

4.5.2 Surface Water Quality

Water chemistry data for Wabamun Lake have been collected intermittently for many years in different parts of the lake (west, central and east basins, and the Moonlight Bay). These data have been summarized in numerous reports, including most recently by Casey (2003), Schindler (2004), Emmerton (2011), Casey (2011), and WWMC (2013). For a summary of water quality of the lake, see **Table 4-7**.

Table 4-7 Summary of Water Chemistry in Wabamun Lake

Category	Description	Trend
pH	alkaline (>7.5)	stable
Hardness	hard (>120 mg/l)	increasing
total dissolved solids	fresh (<500 mg/l)	increasing
phosphorus	total phosphorus has declined since the start of releases from the water treatment plant	declining
trophic status	mesotrophic/eutrophic	stable
Bacteria	fecal coliforms occasionally >200 CFU/ml at beaches (recreational guideline)	decreasing
Metals	have not caused detectable changes in aquatic ecosystem	not available
polycyclic aromatic hydrocarbons	do not represent a risk to human health, long-term effects in aquatic biota uncertain	not available
pesticides	very limited data available	not available
parasites (such as Cryptosporidium, Giardia)	no data available	not available

SOURCES: WWMC (2013), Casey (2011)

4.5.2.1 Routine Parameters

Wabamun Lake is a well-buffered, alkaline lake with pH consistently greater than 7.5. Buffering capacity, which is largely due to the carbonate rich deposits and soils in Alberta, protect lakes from the effects of acidification (Mitchell and Prepas 1990). The water is considered hard, with both calcium and magnesium present in comparable concentrations. However, over the past 30 years magnesium concentrations have steadily increased while calcium concentrations have slightly decreased (Casey 2003). Total ionic concentration in Wabamun Lake has also steadily increased over the past 30 years (Casey 2011), driven largely by increases in sulphate, chloride, sodium, and bicarbonate. The increases have been considered to be the result of evaporation and the addition of make-up water from the North Saskatchewan River.

October 9, 2015

4.5.2.2 Nutrients and Productivity

Phosphorus is the limiting nutrient in most lakes in Alberta, which means that algal and plant growth will often follow the availability of phosphorus (Mitchell and Prepas 1990, Emmerton 2011). Many lake watersheds in central Alberta are within an area of phosphorus-rich soils, and this phosphorus in soil can be deposited into a lake through runoff over land or from dust in precipitation. Because of the change in land use to non-Aboriginal agricultural, urban and industrial development, many lakes in Alberta have become more productive with associated water quality issues, such as algal blooms (Hutchinson 2014, Emmerton 2011).

Once phosphorus enters a lake, it generally remains there and recycles between the sediment and water column in a process called “internal loading”. Internal loading refers to the build-up of phosphorus in lake sediments, where phosphorus can be released to the water column and used by algae and plants. Wabamun Lake has ideal conditions for internal loading due to its shallow depth and repeated formation and mixing of summer thermal stratification (Schindler et al. 2004).

4.5.2.2.1 Historical Context

A recent paleolimnological⁴ study by Hutchinson (2014) indicates that Wabamun Lake is naturally eutrophic and that the lake productivity has not changed remarkably in the past 200 years. However, changes in paleolimnological indicators have occurred in the lake in response to watershed development since the 1950s. These changes include nutrient impacts, which could be associated with agriculture and shoreline development since the 1950s in the subwatershed, although the causality has not been established with data (Hutchinson 2014). Changes observed in some paleolimnological indicators suggested increased productivity, while others did not (Hutchinson 2014). Hutchinson (2014) concluded:

A large unknown for Wabamun Lake is if the observed trajectory of increased productivity in some sediment indicators before 1970 will continue in the absence of thermal water discharge and once diversion of river water is reduced. The most recent samples in the sediment core appear to indicate such a trend, but are not sufficient to be conclusive and have not been confirmed by measured data.

4.5.2.2.2 Current Condition

Currently, Wabamun Lake is considered a mesotrophic to mildly eutrophic lake based on algal biomass and total phosphorus concentrations, and this has been a consistent designation throughout the past 30 years (Casey 2011). Therefore, despite ongoing concern about anthropogenic eutrophication, at the present time eutrophication does not appear to be occurring within the lake (Schindler 2004). Phosphorus concentrations have decreased in Wabamun Lake since the beginning of treated water discharges, which are very low in

⁴ Paleolimnology is the study of past conditions of lakes based on sediment cores.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

phosphorus concentrations, from the Water Treatment Plant (Casey 2011). This “diluting effect” has only been observed in the east basin of the lake (Trew 2014, pers. comm.).

A BATHTUB eutrophication model has been developed for Wabamun Lake (Tuininga et al. 2015), which builds on previous phosphorus models for the lake (Emmerton 2011, Mitchell 1985). Based on this recent work, sources of phosphorus in Wabamun Lake were quantified (**Figure 4-26**) (Tuininga et al. 2015). Internal loading of phosphorus is an important part of the lake's phosphorus budget, forming 37% of phosphorus inputs.

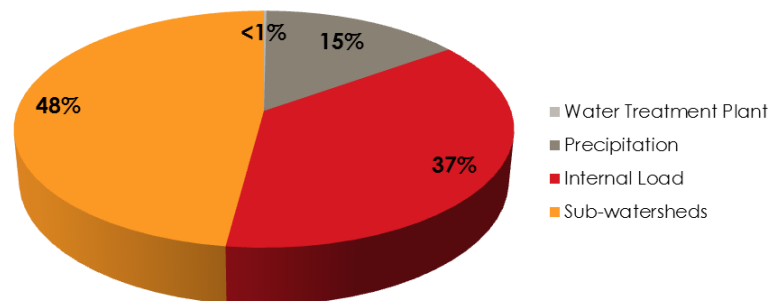


Figure 4-26 Wabamun Lake Phosphorus Inputs

SOURCE: Tuininga et al. (2015)

Seven primary streams in the watershed have some anthropogenic effects that are reflected in phosphorus concentrations based on data collected in the early 80s (Mitchell 1985) and in 2008 (Emmerton 2011). However, the concentrations are generally low compared to other, heavily agriculturalized streams in Central Alberta (Emmerton 2011). Modelled total phosphorus concentrations in tributaries and contributing areas (i.e., areas with direct or diffuse runoff to the lake) are shown in **Figure 4-27** (Tuininga et al. 2015). Generally, the local contributing areas and tributary watersheds with the most urban and agricultural development contribute the highest total phosphorus loading potential.

4.5.2.2.3 Future Condition

Several potential future land use scenarios were modelled by Tuininga et al. (2015) to illustrate the effect of land use on total phosphorus levels. These scenarios were:

- agricultural development scenario, where remaining forest and natural land cover in the subwatershed was converted to agricultural land over a 5-year period (excluding the Highvale mine area)
- restoration scenario, where agricultural land was converted to forest or natural land cover over a 5-year period (excluding the Highvale mine area)
- urban development scenario, where natural land cover was converted to urban developed land over a 5-year period (excluding the Highvale mine area)

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- mine reclamation scenario, where the Highvale mine area was converted equally to agricultural and forested land cover over a 5-year period

These hypothetical land use scenarios illustrate that while internal loading remains as the largest phosphorus source, land use changes in the subwatershed plays a major role in the future water quality of Wabamun Lake (**Table 4-8**, Tuininga et al. 2015). The agricultural, urban development and mine reclamation scenarios all result in a predicted increase in total phosphorus concentration in the lake, as well as an increase in the total load.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

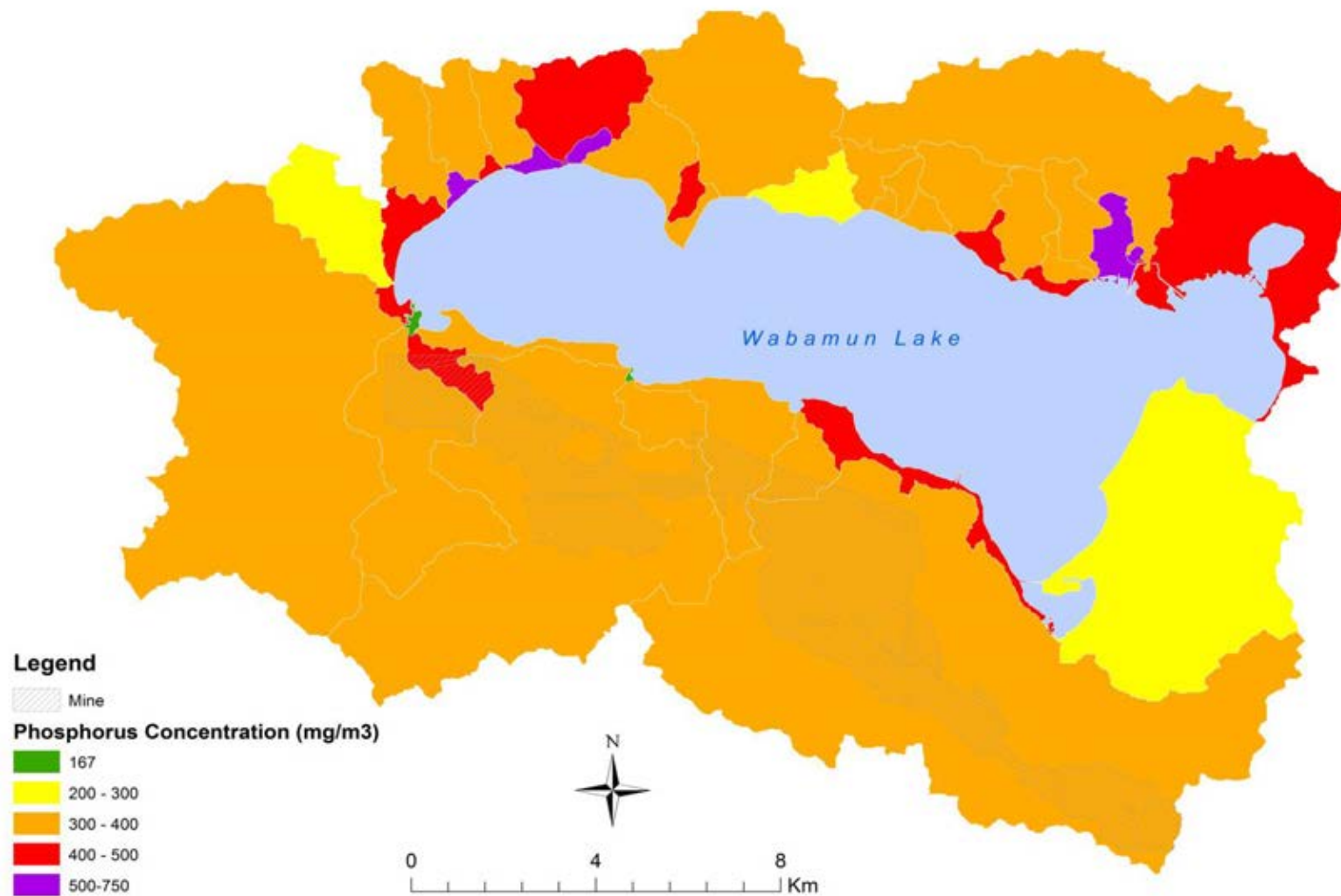


Figure 4-27 Modelled Tributary and Contributing Area Flow-Weighted Total Phosphorus Concentrations

SOURCE: Reproduced from Tuininga et al 2015

October 9, 2015

Table 4-8 Modelled Future Land Use Scenarios for Wabamun Lake

Scenario	Land Use Change Description	Change in Total P Load	% Change in Total P Load
Agricultural	Forest and natural land converted to agricultural land ¹	2072	16%
Restoration	Agricultural land converted to forest and natural land ¹	-1609	-13%
Urban Development	Natural land converted to urban developed land ¹	4038	32%
Mine Reclamation	Highvale mine area converted equally to agricultural and forested land	811	6%

SOURCES: Tuininga et al. (2015)
 NOTES:
 P = phosphorus
¹ Excludes the Highvale mine area

4.5.2.3 Other Parameters

Forms of bacteria⁵ that can cause human health concerns, fecal coliforms, are monitored at several beaches on Wabamun Lake. Sources of fecal coliforms include soil, plants, animal waste, sewage, manure runoff and pet waste. Monitoring data shows that fecal coliform levels have been in decline from 2002 to 2012 on Wabamun Lake (WWMC 2013). Alberta Health Services (2014) monitoring data at four beaches indicates that the Village of Wabamun beach fecal coliform levels are above medium and high concern levels for individual measurements and the annual mean, respectively (see **Figure 4-28**).

Several activities within the subwatershed can contribute to the presence of metals in the lake water. Some metals (arsenic, copper, zinc, mercury, selenium and antimony) are higher in Wabamun Lake sediments than in sediments in other lakes in the area (Anderson 2003 and Donahue et al 2006). However, metals have not caused detectable changes in the aquatic ecosystem (Schindler 2004). Metal concentrations in Wabamun Lake water generally meet water quality guidelines for the protection of aquatic life (Schindler 2004, WWMC 2013).

Polycyclic aromatic hydrocarbons (PAHs) occur in oil, coal, and tar deposits and are a by-product of fuel burning, and there are several sources of PAHs in the subwatershed, including power plant stack emissions and diesel-driven vehicles from traffic and coal hauling operations (TransAlta 2001, WWMC 2013). Another source of PAHs was the 2005 oil spill (see **Section 4.7.1.3** for additional information). Prior to the spill, PAH levels detected in Wabamun Lake sediments were considered not to represent a risk to human health; however, it was not certain if the PAH levels were affecting aquatic life (Schindler 2004). After the spill, there has not been an indication that the aquatic environment of Wabamun Lake was significantly affected, however long term monitoring will be needed to indicate if any long-term changes have occurred (Golder 2006).

⁵ The subset of the total coliform group that is more definitive as an indicator of fecal contamination. This group comprises the species *Escherichia coli* and, to a lesser degree, *Klebsiella* and *Enterobacter* species (Alberta Health and Wellness 2004).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

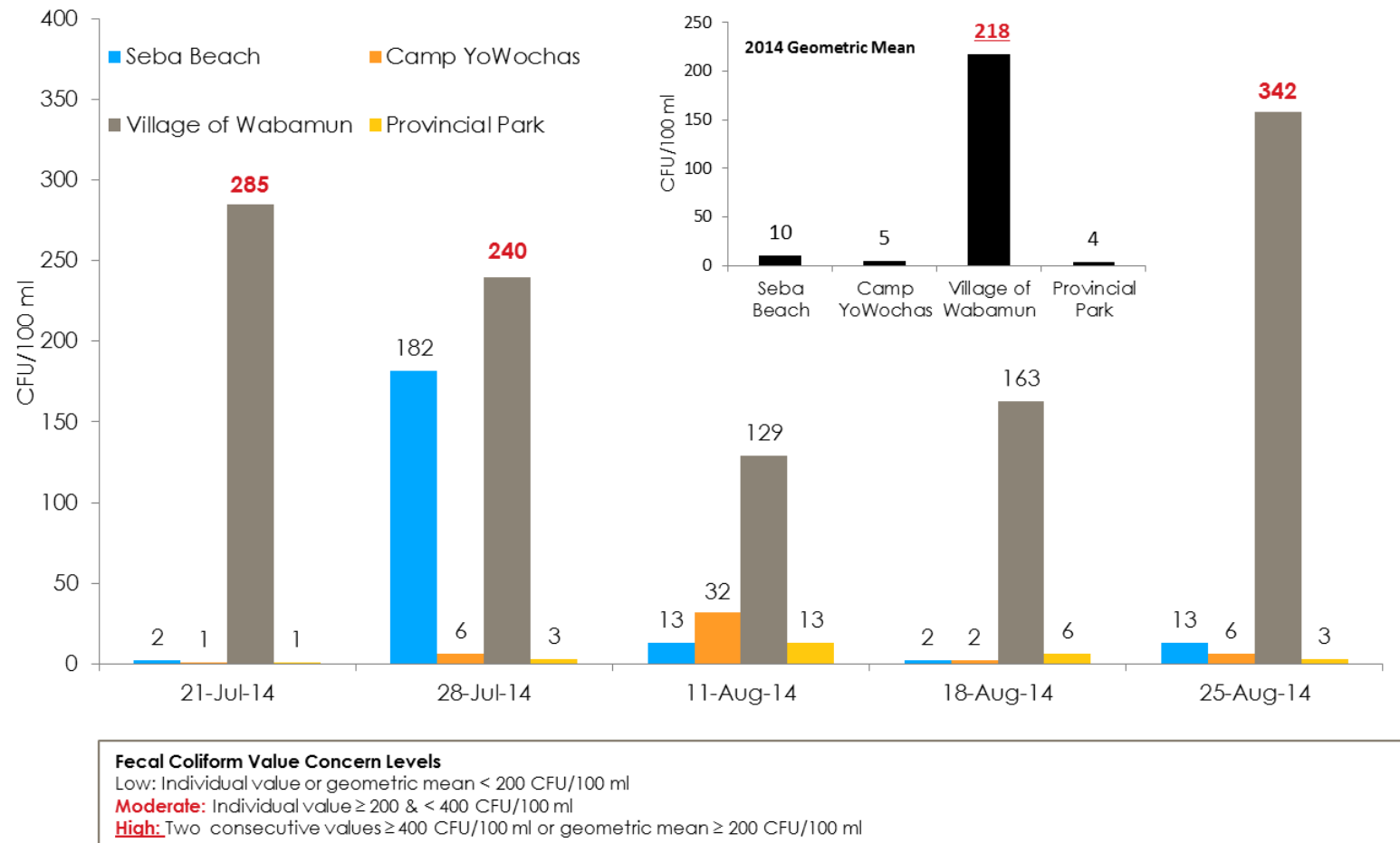


Figure 4-28 Wabamun Lake 2014 Monitoring Data for Bacteria

SOURCE: Alberta Health Services 2014

October 9, 2015

4.5.2.4 Relevance to Land Use Planning

Water quality is important to all life in, on and around Wabamun Lake. Land use can affect water quality through direct inputs (e.g., nutrients from fertilizer application and suspended solids from stormwater runoff) and indirect inputs (e.g., nutrient releases from soil as a result of clearing and water balance changes). Based on monitoring data, Wabamun Lake chemistry has changed over time as a result of land use changes in the subwatershed as follows:

- Land use changes in the subwatershed have resulted in a flux of nutrients from land to the lake and a slightly increased productivity of the lake since the 1950s (Hutchinson 2014). Changing land use from forests to agricultural land, residential areas, industrial sites and golf courses increase runoff of nutrients from the watershed (Schindler 2004). In addition, cottage development is a common source of nutrients: septic tanks that may leak, lawn fertilizers, pet excrement, and silt from construction (Schindler 2004). Eutrophication modelling by Tuininga et al. (2015) demonstrated that land use changes in the watershed have an effect on total phosphorus concentrations and loads, even though internal loading remains as the largest source of phosphorus in all modelled hypothetical land use scenarios.
- While natural surface waters contain some background levels of fecal coliform bacteria, these levels are usually less than 15-20 CFU/100 ml (Weiner 2008). The current levels on Wabamun Lake beaches exceed these natural background values can be due to human, livestock, pet and waterfowl sources (Emmertson 2008). Although fecal coliform bacteria are generally not harmful to humans themselves, the presence of fecal coliforms indicates the possible presence of disease-causing bacteria, viruses, and protozoan, all of which also live in human and animal digestive systems (Alberta Health Services 2014). The presence of fecal coliforms in water therefore acts as a determinant of risk of illness.
- Removal of a large footprint from the hydrologic cycle of the subwatershed and the compensating measure of pumping river water into the lake has resulted in increased total dissolved solids (i.e., salinity) in the last 30-40 years and changes in ion balance (Schindler 2004, Casey 2011). While sensitive species of plankton may begin to change as a result of changing ion balance, no short-term effects are expected on fisheries (Schindler 2004).
- Surface sediments in Wabamun Lake have higher concentrations of certain metals (including cadmium, copper and mercury) compared to other central Alberta lakes (Anderson 2003, Donahue et al 2006). This enrichment has been attributed to both local geochemistry and coal-related industry, especially near the now decommissioned Wabamun Power Plant ash lagoon outfall (Anderson 2003). The variety and concentration of PAHs are also higher in Wabamun Lake than other central Alberta lakes (Anderson 2003). The sources of PAHs are not certain, but can include coal mining and coal burning, leaching from coal seams in or near the lake, fossil fuel burning by motor boats, highway and rail traffic, and creosote-treated wood structures (piers, pilings and railway tracks) (Anderson 2003). The cumulative effect of all constituents in Wabamun Lake sediment was investigated through toxicity tests. While these tests indicated “*impairment of normal food chain structure and function*”, the result was same for reference lakes as well as Wabamun Lake (HydroQual 2003). Overall, detectable changes in the aquatic ecosystem have not been observed as a result of metals or PAHs (Schindler 2004).

October 9, 2015

4.5.3 Groundwater

Understanding of the groundwater resource quantity and quality in the subwatershed scale remains a data gap. This section summarizes currently available information. **Figure 4-29** shows the general flow of groundwater in a watershed.

Wabamun Lake recharges groundwater, with less groundwater inflows than outflows (AENV 2002). The subwatershed as a whole acts as a groundwater recharge area, with downward vertical hydraulic gradients in observation wells (TransAlta 2001, and references therein). The main source of groundwater recharge to the Quaternary sediments in the area is precipitation.

The region has four main hydrostratigraphic units (WorleyParsons 2013):

- surficial sediments (Quaternary and recent)
- bedrock above coal (Paskapoo Formation)
- Ardley coal zone (Scollard member)
- bedrock below coal (Scollard member)

The bedrock above coal unit can be further subdivided into (WorleyParsons 2013):

- upper bedrock (Unit 30)
- middle shale (unit 40)
- middle sandstone (Unit 60)
- lower shale (Unit 80)

Out of these, the middle sandstone of the bedrock above coal and the Ardley coal zone are the major aquifers in the Highvale mine area on the south shore of the lake (WorleyParsons 2013).

Based on data from the provincial Groundwater Observation Well Network, groundwater levels have slowly decreased over the past 20 years in all monitoring wells within the Parkland County (Parkland County 2013). This might indicate that the recharge rate of the County's aquifers is lower than the groundwater withdrawals (Parkland County 2013).

October 9, 2015

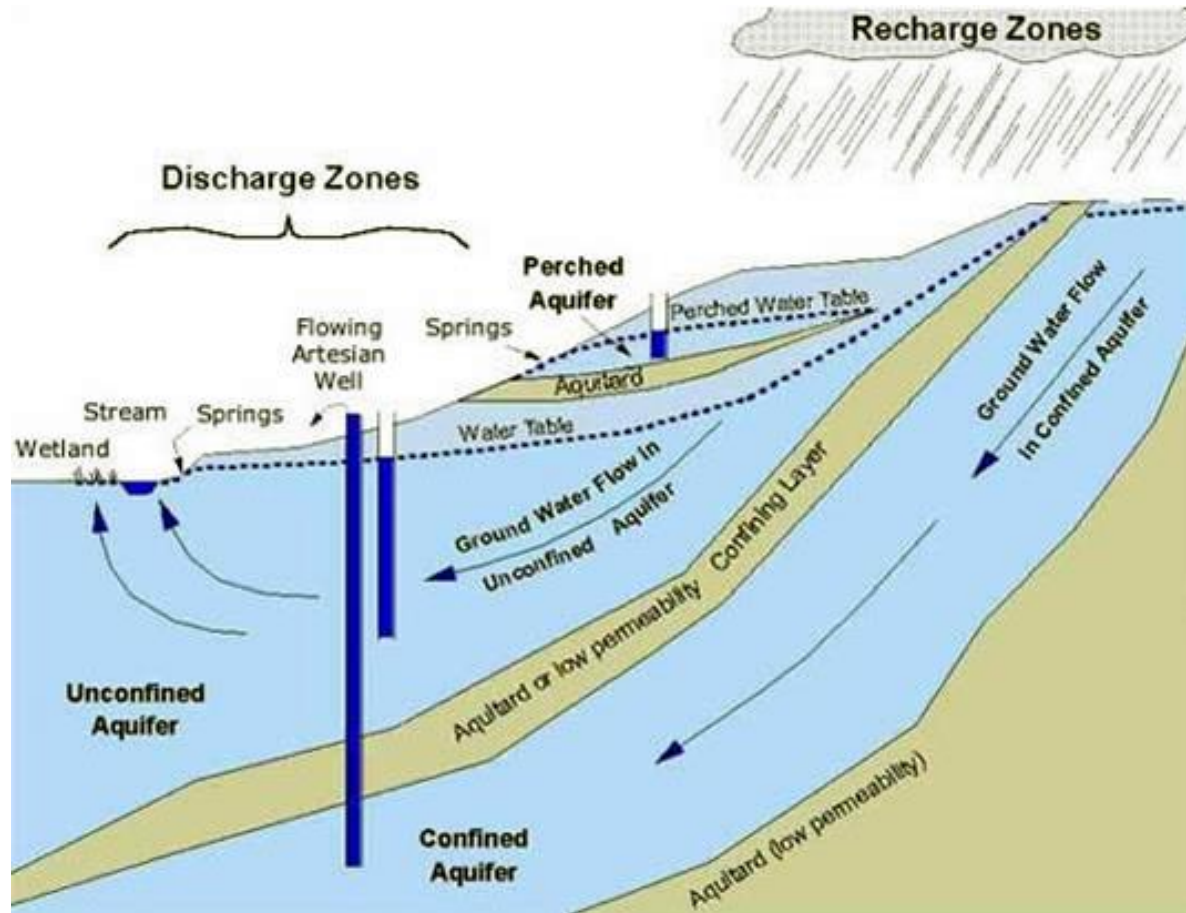


Figure 4-29 Groundwater Flow in a Watershed

SOURCE: ESRD website

4.5.3.1 Groundwater Use

Groundwater use falls into two distinct categories including licenced groundwater diversions and unlicenced groundwater diversion. Licenced groundwater diversions are recorded as a *Water Act* Approval, which generally are available through the ESRD Authorization Viewer (ESRD Authorization Viewer website). The Approval documents identify the water source (i.e., groundwater or surface water), licenced annual diversion volume, and the purpose for the diversion or use category. This information allows the licenced groundwater diversion volume to be estimated for the watershed. The DLS address of the groundwater diversion is noted, but not the exact location of the well. All sections within, or bordering the Wabamun Lake subwatershed boundary were queried using the ESRD Authorization Viewer website. The *Water Act* Approval Records returned from that search are summarized below. It should be noted that many of the *Water Act* Approvals returned are for interim or temporary construction, drainage activities. Further, there are many approvals related to the disruption of wetlands, utility crossings, drainage and temporary diversion within the fence line of the coal mine area south of Wabamun Lake.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

These approvals are not considered an ongoing water use and are not considered in the groundwater use estimates.

There are ten groundwater diversion licences in the Wabamun Lake subwatershed, though one is for construction and no consumptive use is associated with this groundwater diversion authorization (see **Table 4-9** and **Figure 4-30**). The Village of Wabamun is the subwatershed's largest single groundwater user diverting up to 210,000 m³ per year for municipal supply purposes. A licence to divert 7,000 m³ per year for a public park is also held by Alberta Tourism, Parks and Recreation. Four commercial licences with a total approved diversion of 2,380 m³ per year exist in the basin supplying water to two golf courses and two R.V. Parks to support their commercial operations. Three licences are held for stock watering totaling 5,955 m³ per year of groundwater diversion. In summary, diversion of 226,335 m³ of groundwater per year is licenced in the subwatershed.

The Authorization Viewer also returns Registered Water Users that have obtained a priority number to secure their water source under "First in Time First in Right" but do not require a diversion licence to divert up to 6,250 m³ per year for traditional agriculture purposes. The number of registered water diversions in the basin is very small (56 for both surface water and groundwater) relative to the overall number of groundwater wells (1781) in the basin. As such, the registered groundwater used is accounted for under the assumptions applied to the groundwater use estimated from the ESRD Albert Water Well Information Database (AWWID) website records. It should be noted that registered water users can have multiple DLS addresses associated with the priority number. However, duplicate registered users were removed to reflect the total number of distinct registered water users within the subwatershed.

Table 4-9 Groundwater Diversion Categories and Maximum Annual Diversion

Count of Well ID	AWWID Well Use Category	Max. Category Annual Diversion (m ³)
4	Commercial	3,380
1	Municipal	210,000
1	Recreation	7,000
3	Stock	5,955
1	Construction	0
Total Licenced Groundwater Diversion		226,335
SOURCE: ESRD Authorization Viewer		

October 9, 2015

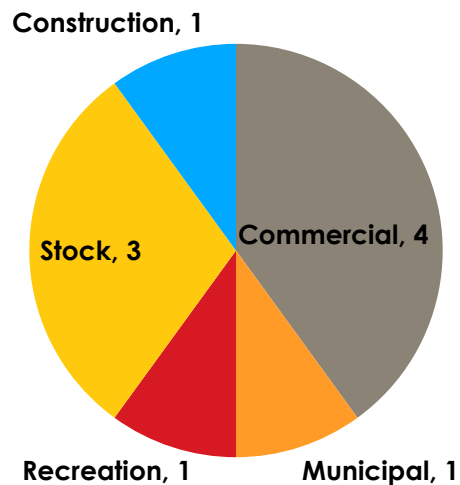


Figure 4-30 Groundwater Licence Categories in the Subwatershed

SOURCE: ESRD Authorization Viewer

The ESRD AWWID website also provides critical information on un-licensed and un-registered groundwater use. The information related to the groundwater wells in the subwatershed (including the licensed wells) is contained within this database. It should be noted that historically, the spatial information associated with each well record was based on a DLS address and the well position information defaults to the centroid of the DLS sub-unit provided. This may result in minor error in estimating groundwater use given the approximate location information associated with the well records. Each well record has a water use field allowing the quantity of groundwater diverted from each well to be estimated. Domestic, and wells used for potable and sanitary water systems for small businesses can divert up to 1,250 m³ per year without requiring a licence. As mentioned above, wells used for combined purposes of domestic supply and stock (traditional agriculture) can divert up to 6,250 m³ per year without a licence. Other water use categories such as investigation, observation, and monitoring are likely not used to divert significant volumes of water.

The overall groundwater use for both licensed groundwater diversion and un-licensed groundwater diversion is summarized below. For assumed maximum annual diversion quantity applied to the AWWID well records, see **Table 4-10**. For AWWID well use by categories, see **Figure 4-31**.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-10 Groundwater Well Use Categories and Maximum Annual Diversion Assumptions

Count of Well ID	AWWID Well Use Category	Assumed Max. Annual Diversion (m ³)	Max. Category Annual Diversion (m ³)
1243	Domestic	1,250	1,553,750
44	Domestic & Stock	6,250	275,000
1	Domestic & Industrial	1,250	1,250
44	Stock	6,250	275,000
121	Industrial	1,250	151,250
138	Investigation	0	0
3	Monitoring	0	0
16	Municipal	(deferred to GW Diversion Licences)	0
47	Observation	0	0
12	Other	0	0
57	Unknown	1,250	71,250
55	Dewatering	1,250	68,750
Total Groundwater Use Estimated from AWWID Well Records			2,396,250
SOURCE: ESRD AWWID website			

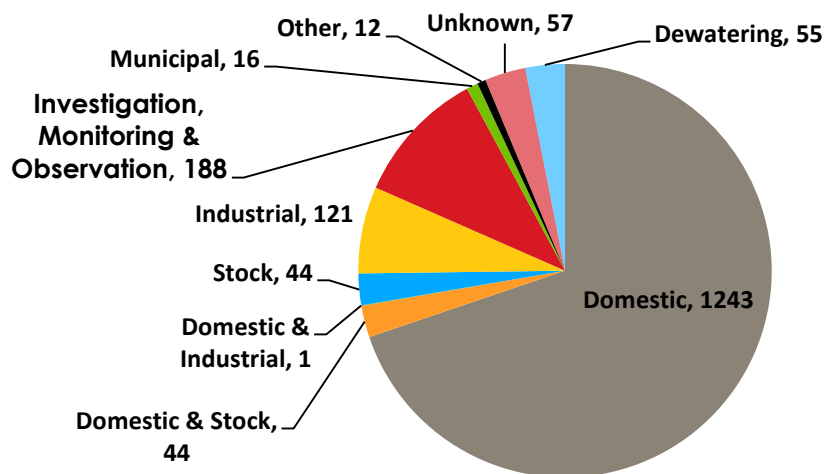


Figure 4-31 Groundwater Well Use by Category

SOURCE: ESRD AWWID website

October 9, 2015

The overall groundwater use in the Wabamun Lake subwatershed needs to consider both the licenced and un-licenced groundwater diversions within the subwatershed. While the Village of Wabamun is the largest groundwater user, the overall, cumulative groundwater diversion from un-licenced wells dominates the maximum annual diversion possible in the watershed. The licenced groundwater use is an order of magnitude less (226,335 m³/year) than the cumulative groundwater use from un-licence holder and unlicenced groundwater user, the diversion volume below represents the most conservative value based on the maximum allowable groundwater diversion volumes (see **Table 4-11**). Many AWWID records may be for un-used, abandoned, or decommissioned water wells. However, there is no reliable method using the data available to estimate operational versus non-operational wells. This analysis assumes 100 percent of the estimated groundwater diversions are consumptive with no return flow. However, in most cases, there would be some return flow associated with rural water users from septic systems and watering.

Table 4-11 Groundwater Well Use Categories and Maximum Annual Diversion Assumptions

Data Source	Maximum Annual Diversion Volume (m ³ /year)
Total Licenced Groundwater Diversion from ESRD Authorization Viewer	226,335
Total Groundwater Use Estimated from AWWID Well Records	2,396,250
Total Maximum Annual Groundwater Diversion	2,622,585

4.5.3.2 Groundwater Well Distribution

The groundwater use is highly correlated with the developed areas of the subwatershed, particularly near the shoreline of Wabamun Lake, where there are several recreational properties that use groundwater wells for potable water supply. There are several AWWID borehole records within the footprint of the coal mine assumed to be exploration boreholes and account for many of the wells in the Investigation, Monitoring & Observation category. Many of the records in the dewatering category likely related to mining activity as well. For the distribution of the water well records in the Wabamun Lake subwatershed, see **Figure 4-32**. For the location of the groundwater diversion authorizations, see **Figure 4-33**.

4.5.3.3 Groundwater Vulnerability

A number of different methods can be used to assess the vulnerability of groundwater to contamination from anthropogenic activities. Various mapping products with a groundwater vulnerability theme have been produced by ESRD (Aquifer Vulnerability Index and Groundwater Vulnerability Index) and the Alberta Energy Regulator's Alberta Geological Survey (DRASTIC Intrinsic Aquifer Vulnerability Index). **Figure 4-34** shows the DRASTIC Index for the Wabamun Lake Subwatershed as presented by the Alberta Geological Survey (Barker et al 2011).

October 9, 2015

The DRASTIC index is based on several geological and hydrogeological characteristics. The overall index rating is based on several hydrogeological variables related to the topography, geology, water table position, and recharge rates that determine the vulnerability of groundwater in a given area. The vulnerability index ranges from Extremely Low (in dark blue) to Medium (in orange). The medium vulnerability areas are typified by near surface water table, higher recharge rates and generally permeable unconsolidated and bedrock sediments. Lower vulnerability areas have lower recharge rates (often discharge areas) or deep water tables combined with low-permeability near-surface sediments.

4.5.3.4 Groundwater Quality

The regional groundwater in the Wabamun Lake subwatershed often exceeds the drinking water criteria for total dissolved solids, sodium, iron, and manganese (TransAlta 2001). Groundwater concentrations have also exceeded the irrigation criteria for total dissolved solids, manganese and boron, depending upon the crop type. Periodically, the groundwater exceeds the livestock watering criteria for boron. No data for pesticide levels in groundwater were available.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

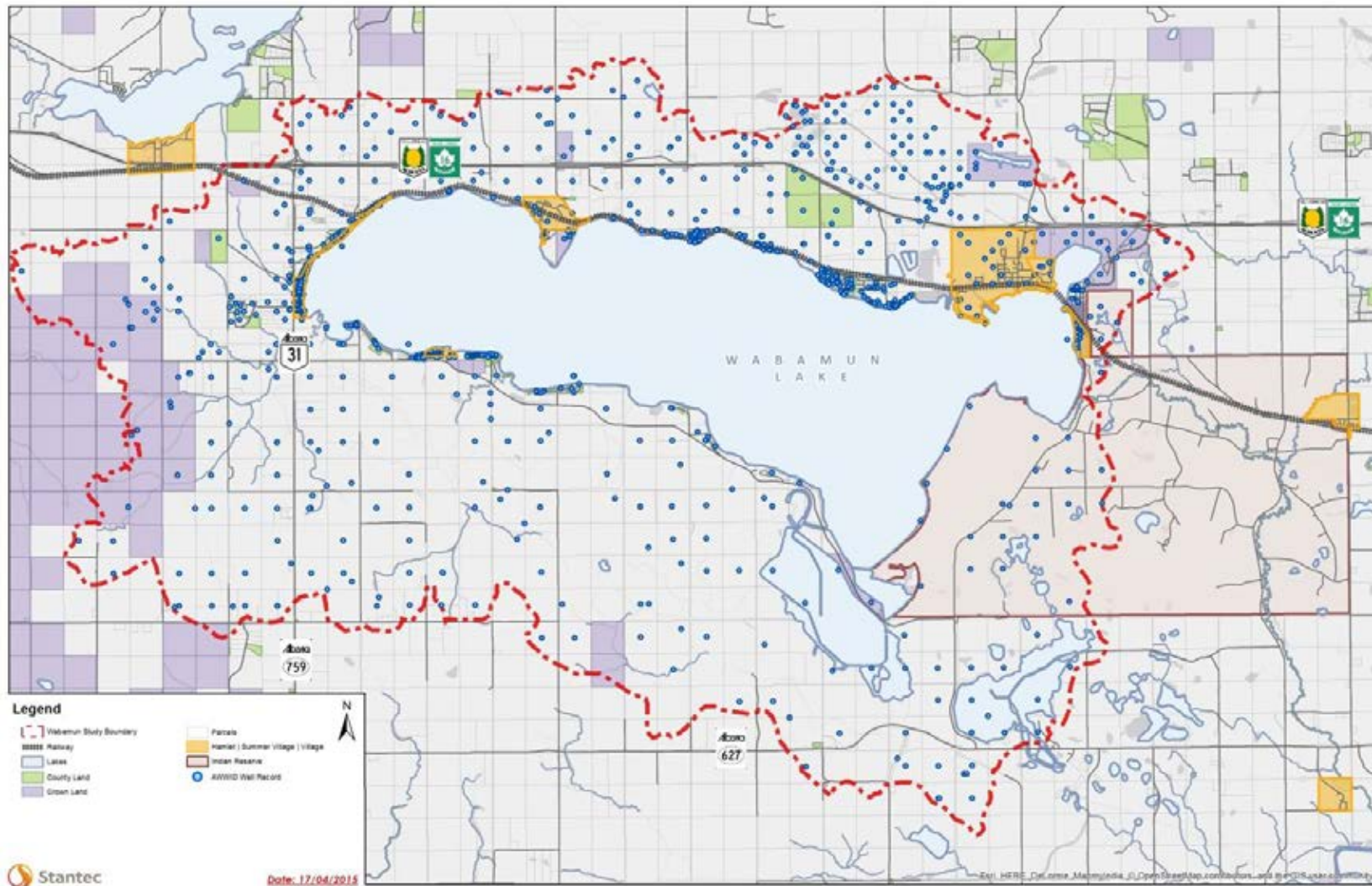


Figure 4-32 AWWID Well Records in Wabamun Lake Subwatershed

SOURCE: ESRD AWWID website

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

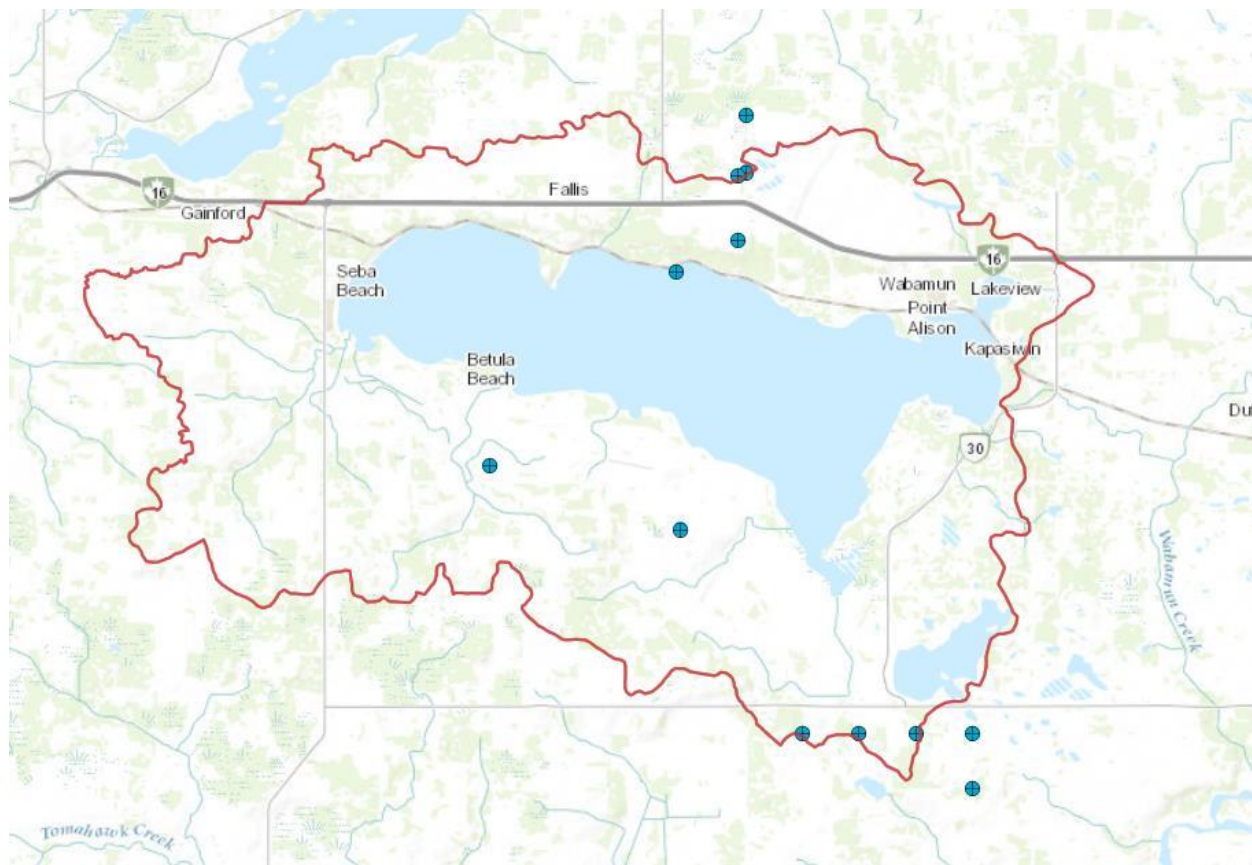


Figure 4-33 Licensed Groundwater Diversion Locations

SOURCE: Screenshot from ESRD GeoDiscover Portal website. Blue dots indicate groundwater diversion locations.

October 9, 2015

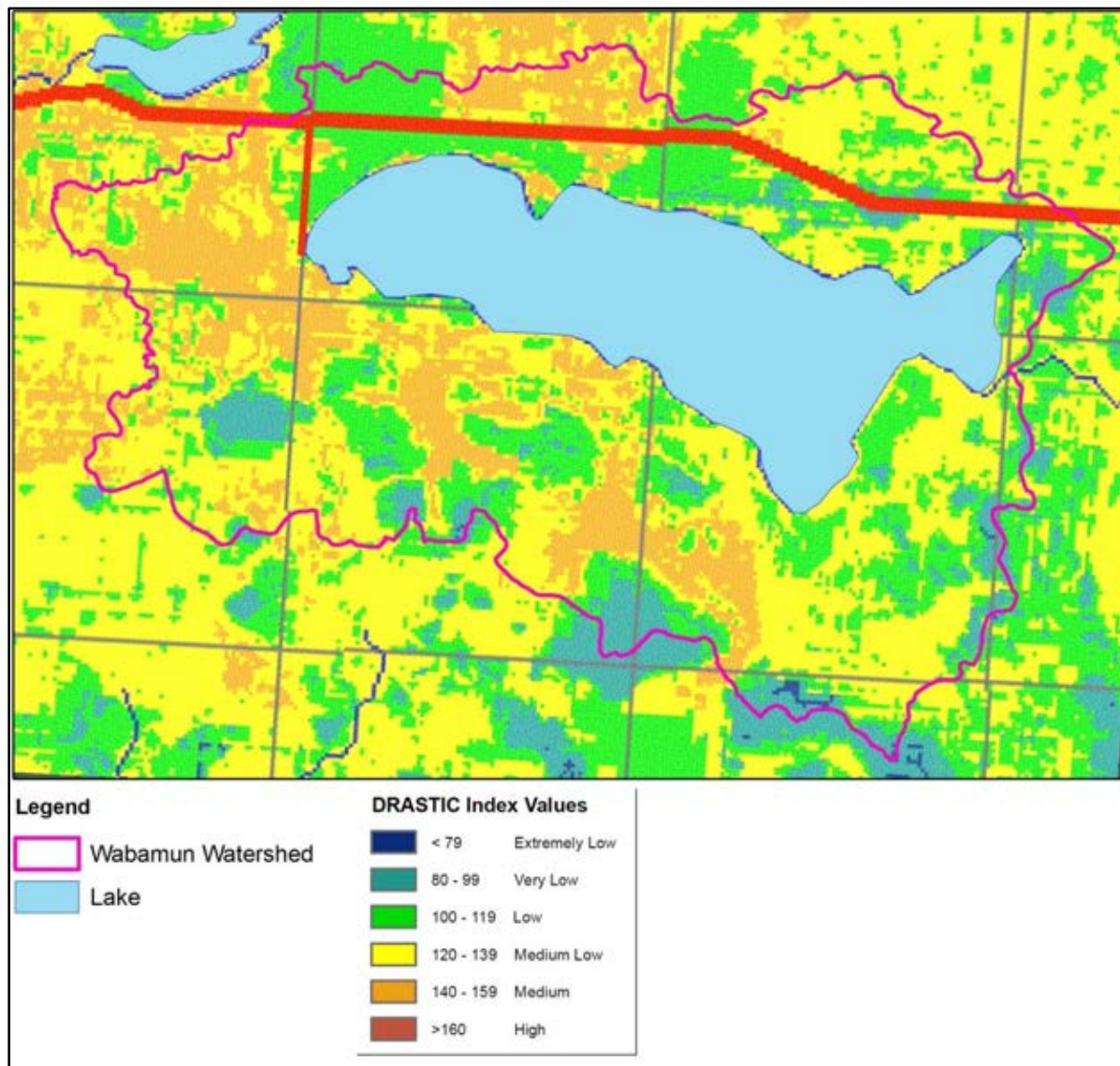


Figure 4-34 Alberta Geological Survey DRASTIC Intrinsic Aquifer Vulnerability Index

SOURCE: Barker et al 2011

4.5.3.5 Relevance to Land Use Planning

Groundwater quantity and quality are relevant for both Wabamun Lake health and for direct groundwater users (pumping wells). Groundwater is normally not visible, and therefore pollution pathways and processes are not readily perceived. The properties of the materials that overlie the groundwater are critical factors in determining the vulnerability of groundwater to pollution. Groundwater can also become contaminated by the creation of pathways, such as abandoned wells and leaking sewers, that short circuit the natural layers of protection. Pollution

October 9, 2015

can also occur in areas of groundwater recharge, with persistent and mobile pollutants representing the principal risks.

As well, excessive groundwater abstraction in relation to recharge can lead to the depletion of groundwater. Its replenishment can occur slowly, at rates varying between locations based on the properties of the materials overlying the groundwater recharge areas. New developments may add additional pressure on groundwater supply and potential for groundwater drawdown and contamination from onsite septic systems. Groundwater supported wetlands are potentially sensitive to groundwater level drawdown and need to be assessed on a case by case basis.

4.6 BIOLOGICAL COMMUNITIES

4.6.1 Aquatic Environment

The productive and shallow littoral zone extends to a depth of 5 m in Wabamun Lake and comprises approximately 31% of the lake area. The littoral zone is therefore found throughout extensive areas of the lake and indicates that Wabamun Lake should be a fairly productive aquatic ecosystem. Shoreline habitats for fish and waterfowl were identified as part of the Wabamun Lake Management Plan in the mid-1980s (see **Figure 4-35**).

4.6.1.1 Fish

Wabamun Lake has a sport fish community that includes northern pike (*Esox lucius*), lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and burbot (*Lota lota*). Several species of coarse and forage fish are present including white sucker (*Catostomus commersoni*), spottail shiner (*Notropis hudsonius*), brook stickleback (*Culaea inconstans*), and Iowa darter (*Etheostoma exile*). The status of the sport fish species populations is summarized in **Table 4-12**. In comparison to the overall Saskatchewan River watershed, there are relatively few fish species found in Wabamun Lake. Reasons for this are unknown, but may be related to lack of appropriate habitat and the intermittent connection with the North Saskatchewan River (i.e., outflow channel only flowing some years creating the connection between the North Saskatchewan River and the lake).

October 9, 2015

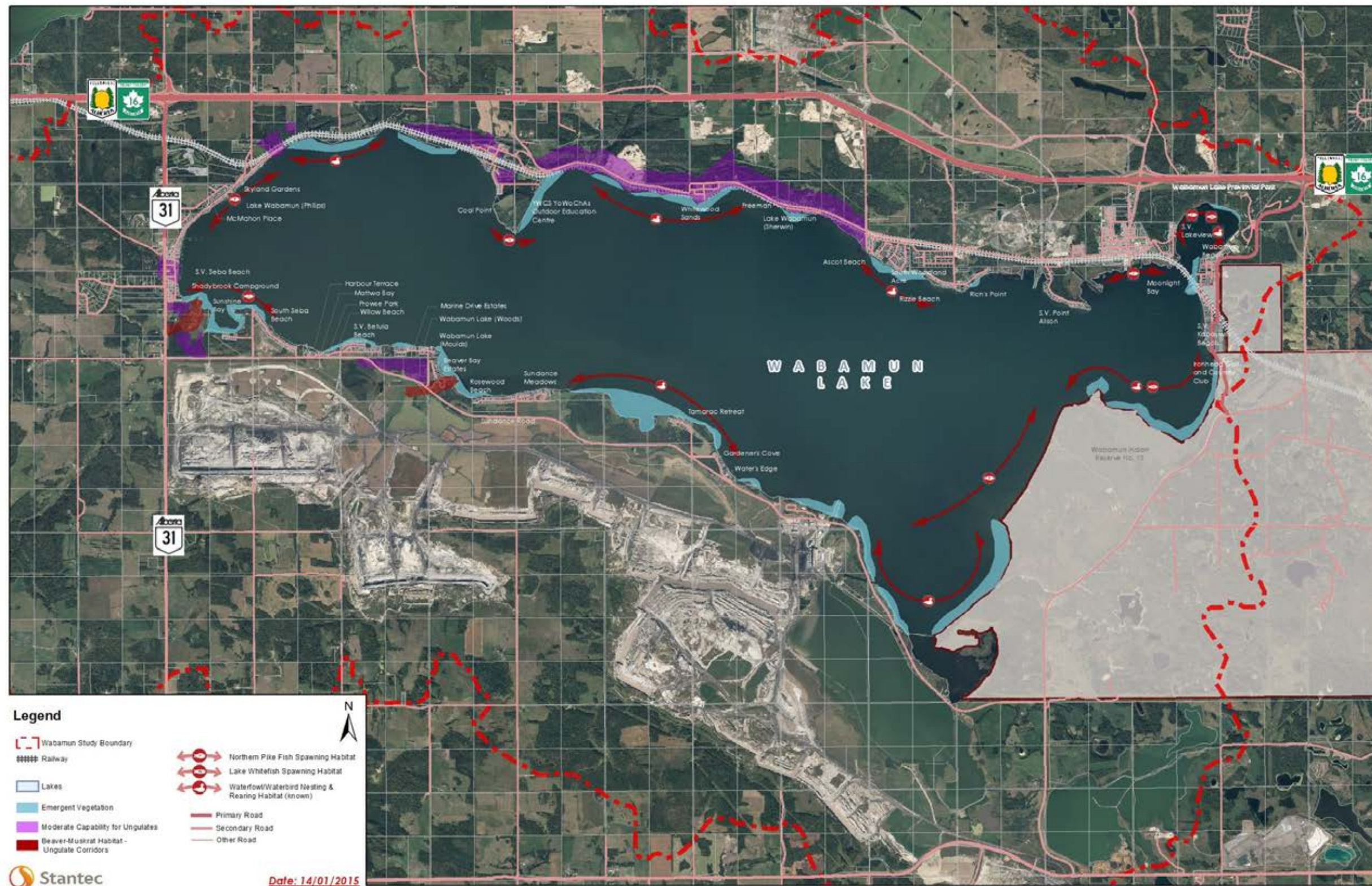


Figure 4-35 Wabamun Lake Shoreline Habitat

SOURCE: Originally from MMWC 1985, reproduced by EDA 2013

October 9, 2015

Blank page (back of 11 by 17 figure)

October 9, 2015

Table 4-12 Status of Sport Fish Species in Wabamun Lake

Species Name	Current Population Status
northern pike (<i>Esox lucius</i>)	Used to have an over-exploited population, with not enough fish reach reproductive age and size. It appears that the recovery time since 2008 zero catch limit regulation has allowed a rebound in northern pike numbers and sizes.
lake whitefish (<i>Coregonus clupeaformis</i>)	Fluctuates between very successful and unsuccessful reproduction; cycles of overpopulation and collapse; over-exploited. Even though the harvest has been completely restricted on the lake since 2008, the lake whitefish population has not yet shown signs of recovery. The lake whitefish population continued to decline in 2013 both in terms of overall density and numbers of larger, older fish.
walleye (<i>Sander vitreus</i>)	Small population, which is restocked by ESRD. The walleye re-introduction program appears to be an initial success in 2013, with excellent representation from the fry and fingerling stockings in 2011 and 2012 and confirmed natural reproduction by the transplanted adults.
yellow perch (<i>Perca flavescens</i>)	Have not reached large enough size to support recreational or commercial fishery. However, the species may become a more popular target for anglers in the future because of recent increase in abundance.
burbot (<i>Lota lota</i>)	Unknown
SOURCES: WWMC (2013), Schindler (2004), ESRD (unpublished a, b)	

Stabilization of the lake levels has likely adversely affected fish spawning and nursery habitats in Wabamun Lake by altering fish habitat (Schindler 2004). In addition, important shoreline fish habitat has been lost due to conversion to beaches and lawns. Historically, there were commercial, recreational and native fisheries in the lake targeting northern pike and lake whitefish. Fishing pressure affected all sport fish species in the lake, and most populations have showed signs of over-exploitation in the past. In an attempt to allow recovery of fish populations, the commercial fishery was closed in 2003 and the recreational fishery was closed in 2008 to a year-round zero catch limit (i.e., catch and release) (WWMC 2013).

Despite the health benefits that are associated with eating fish, in some locations in Alberta, fish can be exposed to mercury and other contaminants that when consumed in high amount, can affect human health. Currently, Wabamun Lake has a fish consumption advisory in place for northern pike that recommends maximum serving sizes per week for women (3 servings), children between 1-4 (1 serving), children between 5-11 (0.5 serving) and adults (no limit) (ESRD 2014b). One serving size is ½ cup of fish. Northern pike tissue mercury concentrations have been reported to be similar to those of other lakes in the region (WWMC 2013).

4.6.1.2 Benthic Invertebrates

Benthic invertebrates are organisms that live on the bottom sediments of streams and lakes. Only a few benthic invertebrate surveys have been completed. A recent paleolimnological study suggests that since the late 1700s, the species assemblages of Chironomids or midges, which are

October 9, 2015

types of benthic invertebrate species, have not changed (Hutchinson 2014). Chironomid species that can tolerate eutrophic conditions and low or no dissolved oxygen conditions decreased temporarily in the 1970s and 1980s, but returned to historical levels in the 2000s. The lake is naturally rich in species that can tolerate low or no dissolved oxygen, indicating adaptation to naturally eutrophic conditions (Hutchinson 2014).

4.6.1.3 2005 Oil Spill

In August 2005, 46 Canadian National Railway cars derailed 7.5 km west of the Village of Wabamun. This resulted in the release of 712,500 litres of Bunker 'C' oil and 88,000 litres of Pole-Treating Oil. It is estimated that 149,000 litres of Bunker 'C' oil and only trace amounts of Pole-Treating Oil entered Wabamun Lake (Golder 2006). The effect of the spill was summarized in WWMC (2013) as follows:

Overall, results of the weight of evidence framework indicate that effects of the oil were negligible in the open-water portion of the lake, including both near shore and offshore areas. Fish populations showed initial exposure to PAHs, but two months later no PAHs were detected in fish tissues. There was some indication of contamination to sediments to the near shore areas of the spill (Golder 2006). Overall the initial spill did not appear to significantly impact the aquatic environment of Wabamun Lake, however long term monitoring will indicate if any long-term changes have occurred.

The oil spill that occurred in 2005 proved to be problematic for western grebes on Wabamun Lake. As a result of the oil spill, 368 birds were killed, which was about 76% of the 2005 colony population. Almost all of the birds that were killed during the spill were adults; surprisingly the population rebounded in the following year to approximately 1,000 individuals (Yanch 2006).

Results from a recent paleolimnological study suggest that the oil spill left little, if any, traces in the sediment record (Hutchinson 2014).

4.6.1.4 Relevance to Land Use Planning

Fish are an important component of ecosystem health and provide opportunities for recreation and human consumption. Fish communities can be affected by a variety of water and land related activities including but not limited to fishing pressure, shoreline modification, water withdrawals, and terrestrial sediment and nutrient inputs. Fish communities in Wabamun Lake have been affected in the past from the following activities:

- Large increases in fishing effort are believed to have started in the mid-19th century and commercial fishing has occurred since 1915 (Schindler 2004). Overexploitation from commercial and recreational fishing has led to unsustainable natural populations of northern pike, walleye, and lake whitefish (Schindler 2004, WWMC 2013 and references therein).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- Thermal stress and cold shock occur in fish as a result of relatively rapid water temperature changes (Environment Canada 2014). Fish kills have occurred in Wabamun Lake as a result of power plant effluent prior to the decommissioning of the Wabamun Plant, (Schindler 2004 and references therein, WWMC 2013).
- Modification of shoreline habitat from residential and industrial development has removed habitat important for various fish life stages (e.g., spawning), reducing fish populations (Schindler 2004 and references therein).

Benthic invertebrates are most commonly used for biological monitoring. They are used to assess biological lake health based on information about their preferred habitat and tolerance to certain types of pollutants. The presence or absence of specific species, species richness, abundance and community structure can provide information about water and sediment quality and overall ecosystem health. Benthic invertebrates can integrate the effects of short and long-term environmental variables. Land use can affect benthic invertebrates through direct inputs of nutrients and toxicants (e.g., metals, pesticides and hydrocarbons), sedimentation and habitat alteration. Based on the limited monitoring data for Wabamun Lake, benthic invertebrate communities have changed little over time as a result of land use changes, as follows:

- The main species generally found in lakes consisting of soft fine substrate bottoms, such as Wabamun Lake, include Diptera - Chironomidae (midges) and Oligochaeta (aquatic worms).
- Based on the water quality, land use changes have resulted in a flux of nutrients and a slightly increased productivity of the lake (Hutchinson 2014) providing for eutrophic conditions. Chironomids and aquatic worms, which are abundant in Wabamun Lake, can tolerate these eutrophic conditions. The land use changes over the years have not appeared to have changed the species assemblages of chironomids to any great extent.
- Localized effects from, for example, the Canadian National Railway spill, left very little traces of oil in the sediments and did not appear to significantly impact the aquatic environment. Once the oil is no longer present, the benthic invertebrate community will generally recover fairly quickly.

4.6.2 Terrestrial Environment

4.6.2.1 Vegetation

The subwatershed's landscape was originally a mosaic of forests and wetlands (Schindler 2004); however, a large portion of the subwatershed's vegetation has been modified from its natural state. The subwatershed is located in the Dry Mixedwood and Central Mixedwood subregions of the Boreal Forest Natural Region (WWMC 2013). WWMC (2013) summarized the characteristics of the subregions as follows:

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- **Dry Mixedwood:** *Aspen forests are dominant with mixed understories of rose, low-bush cranberry; beaked hazelnut and Canada buffaloberry are typical on uplands. Treed shrubby or sedge-dominated fens are the most common wetland communities and occupy about 15% of the Natural Subregion. Jack pine stands with lichen understories are found on dry, well- to rapidly-drained glaciofluvial and eolian deposits in the Subregion (Natural Regions Committee 2006).*
- **Central Mixedwood:** *Grasslands are very rare in the Central Mixedwood Subregion, and are only found in patches of jack pine or black spruce forests on dry, coarse, well drained soils. In upland regions, forest types include aspen, aspen-white spruce, white spruce and jack pine. Of these, the aspen dominant and aspen-white spruce co-dominant are the most common forested communities. In these stands the understory vegetation is typically comprised of the following plants: low bush cranberry, rose, green alder, Canada buffaloberry, hairy wild rye, bunchberry, wild sarsaparilla, and dewberry.*

Land cover data for the subwatershed are shown in **Table 4-13** and **Figure 4-36** (ABMI website).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-13 Land Cover in the Wabamun Lake Subwatershed

Land Cover Type	Area km ²	Percent %
Water	97.6	28%
Exposed Land	34.8	10%
Developed	32.2	9%
Shrubland	9.0	3%
Grassland	19.2	6%
Agriculture	77.5	22%
Coniferous Forest	3.9	1%
Broadleaf Forest	71.7	21%
Mixed Forest	1.0	0.3%
Total	346.8	100%

SOURCE: ABMI website (dataset 2010 version 1.0)

NOTES:

- Water – includes lakes, lagoons, rivers, canals and artificial water bodies. Shallow open water is included in this category, unless there is more than 20% vegetation cover, in which case it belongs to the relevant vegetated class.
- Exposed Land - Bare soil (barren, non-agricultural), river sediments and cut banks, pond or lake sediments, reservoir margins, beaches, landings, recently burned areas, mudflat sediments, surface mining, or other non-vegetated (less than 6% trees, or less than 20% shrub/herb) surfaces.
- Developed - Urban and built-up areas (including industrial sites), impervious artificial surfaces (e.g. airport runways), railways and roads. Acreages and farmsteads are included in this class. Oil and gas well pads are included in this class if connected to a road and not abandoned or under reclamation. Urban terrain under development is included in this class, even if the land is exposed. Urban green areas are excluded from this class if larger than 2 ha and if they have less than 2 buildings per hectare.
- Shrubland - At least 20% ground cover which is at least one-third shrub, with no or little presence of trees (<10% crown closure). Examples of plants belonging to this class are alder, willow, juniper, and sagebrush. Shrubby fens and other non-treed woody wetlands, usually associated with floodplains and the shores of lakes and streams, belong to this class. Includes cutblocks where trees are still < 2m height, and recently burned forest areas.
- Grassland - Predominantly native grasses and other herbaceous vegetation with a minimum of 20% ground cover; may include some shrub cover (but less than a third of the vegetated area) or a few trees (but the tree cover cannot exceed 10%). Land used for range or native unimproved pasture (e.g., rough fescue) is included in this class. Alpine meadows fall into this class. Marshes and other non-woody wetlands with at least 20% vegetation cover (sedges, cattails, or moss) belong to this class. Note: A forestry cutblock harvested more than a year ago containing seedlings with less than 10% cover, belongs to this class. If the cutblock had no successful regeneration and is covered by more than 20% shrubs, it would belong to the 'Shrubland' class.
- Agriculture - Annually cultivated cropland, tame pastures (fields planted or sown with non-native grasses/legumes where livestock is directly grazing on them), forage crops (same as tame pasture, but instead cut for hay) and woody perennial crops (fruit orchards and vineyards). Includes annual field crops, vegetables, summer fallow, orchards and vineyards. Bare agricultural soil (i.e., tilled) belongs to this class.
- Coniferous forest - Treed areas with at least a 10% crown closure of trees, where coniferous trees (spruce, pine, fir, larch) are 75% or more of the crown closure. Providing crown closure is more than 10% and dominated by conifers, young plantations or regenerating cutblocks, and treed wetlands (e.g. black spruce bogs and fens) are included in this class providing mean tree height exceeds 2 m.
- Broadleaf forest - Treed areas with at least a 10% crown closure of trees, where broadleaf trees (trembling aspen, balsam poplar and white birch) are 75% or more of the crown closure. Providing crown closure is more than 10% and dominated by broadleaf trees, young plantations or regenerating cutblocks, and treed swamps along floodplains or wetlands are included in this class providing mean tree height exceeds 2 m.
- Mixed forest - Treed areas with at least a 10% crown closure of trees, where neither coniferous nor broadleaf trees account for 75% or more of crown closure.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

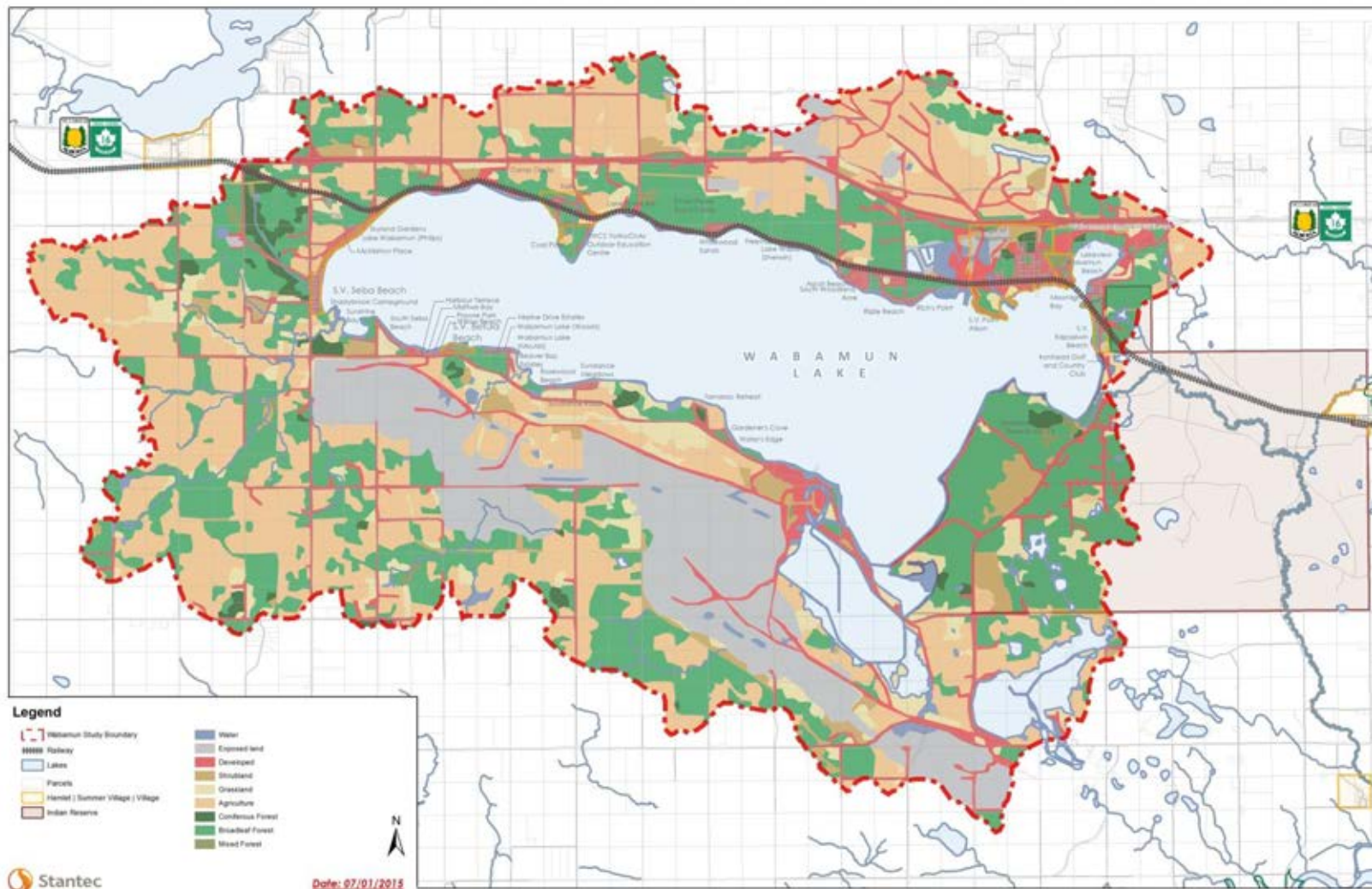


Figure 4-36 Land Cover in the Wabamun Lake Subwatershed

SOURCE: ABMI website

October 9, 2015

4.6.2.2 Wetlands

The extent of wetlands, including marsh, bog, fen, swamp and open water, in the subwatershed is shown in **Figure 4-37** (ESRD 2013). Open water covers 92.2 km², marshes 30.1 km², fens 7.4 km², bogs 1.6 km², and swamps 0.4 km². The state of wetlands in the subwatershed was summarized in WWMC (2013) as follows:

Loss of wetlands has undoubtedly occurred within the Wabamun Lake watershed due to the high industrial and agricultural activity; however, there is no form of historical data that the current wetland cover can be compared to.

4.6.2.3 Riparian Areas

The North Saskatchewan Watershed Alliance completed an aerial riparian health assessment in 2014 (North Saskatchewan Watershed Alliance 2015). The majority of the lake riparian area was rated healthy (57%, 38 km) (see **Table 4-14** and **Figure 4-38**). Healthy areas were located primarily on the south and eastern shores adjacent to the Paul Band First Nation, with small lengths scattered along the remaining shore line. Natural emergent, submersed aquatic and shoreline terrestrial vegetation was generally intact in these areas.

Areas rated highly impaired were the next most common, equaling 34% of the total shoreline (23 km). Short lengths of highly impaired areas are scattered along the north and south shores. The majority of the western shore was rated highly impaired. Almost all natural vegetation in these areas has been removed. Shorelines are mowed to the water line or close and many areas are bare soil and some areas are armored, including artificially added rocks, concrete and verandas. The highly affected riparian areas are generally residential developments that have expansive lawns with species compositions that appear to be dominated by turf grass.

Areas rated moderately impaired occupy 9% of the shoreline (6 km) and are scattered largely along the north shore, with a smaller amount on the west end of the south shore and north end of the eastern shore. Information on the condition in these areas is limited, but they appear to consist of patches of retained tree and shrub cover and mowed grass, but with a strip of unmodified grasses and rushes immediately adjacent to the shoreline.

Figure 4-39 summarizes the results of the riparian health assessment by jurisdiction. The "other" column is land that is controlled by the County but not included in a subdivision or a hamlet. **Figure 4-40** shows the riparian health assessment results for each of the Summer Villages on Wabamun Lake. **Figure 4-41** shows the comparison of riparian health assessment results by subdivision and hamlets around the lake. **Figure 4-42** shows the riparian management area health assessment results in Environmental Reserves on Wabamun Lake as compared to non-Environmental Reserve land in the same developed regions.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-14 Wabamun Lake Riparian Health Assessment Results

Health Rating	Shoreline Length	
	km	%
Healthy	38	56.9
Moderately Impaired	6	9.0
Highly Impaired	23	34.1
Total	67	100

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

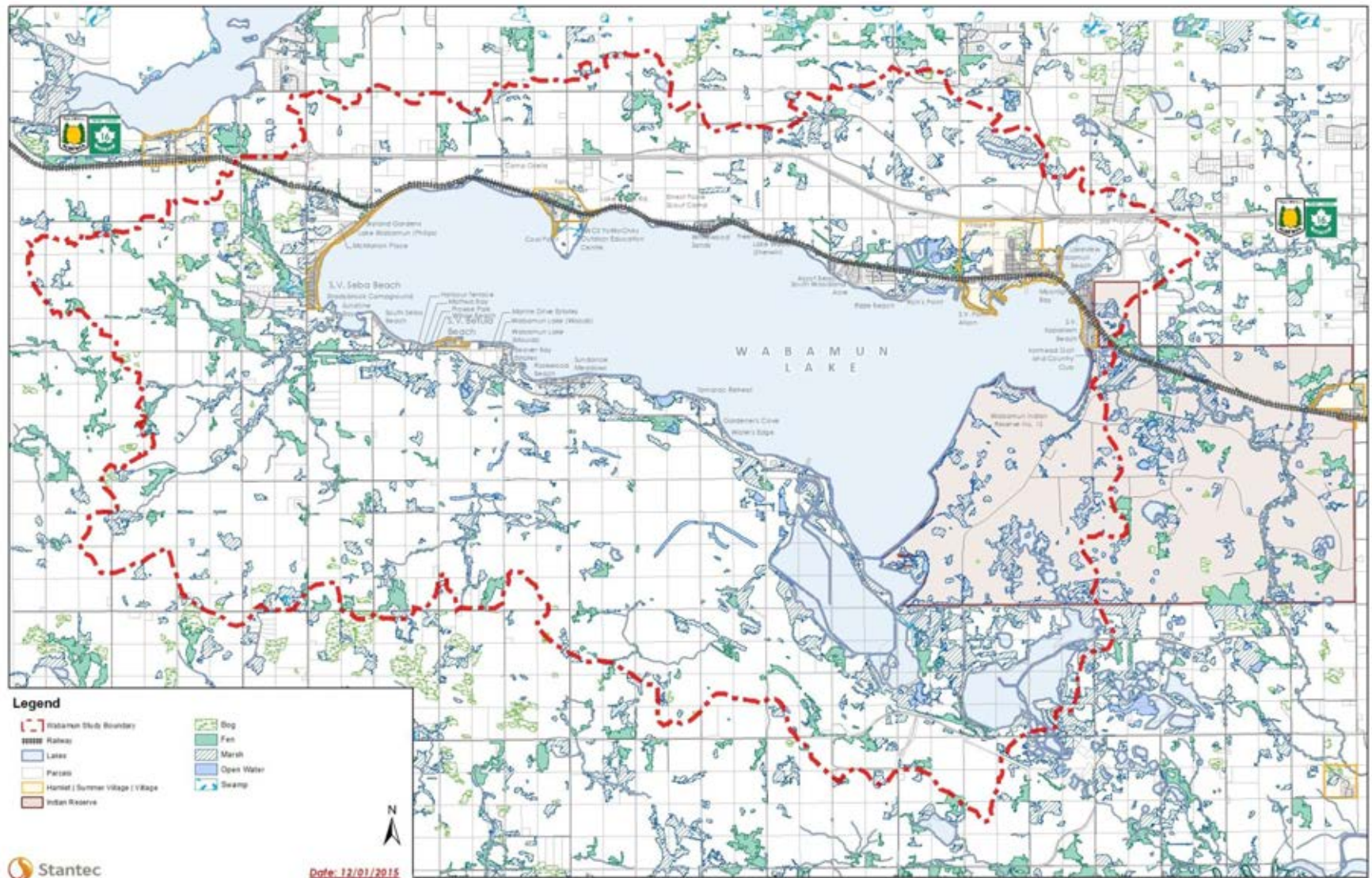


Figure 4-37 Wetlands in the Wabamun Lake Subwatershed

SOURCE: ESRD 2013

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

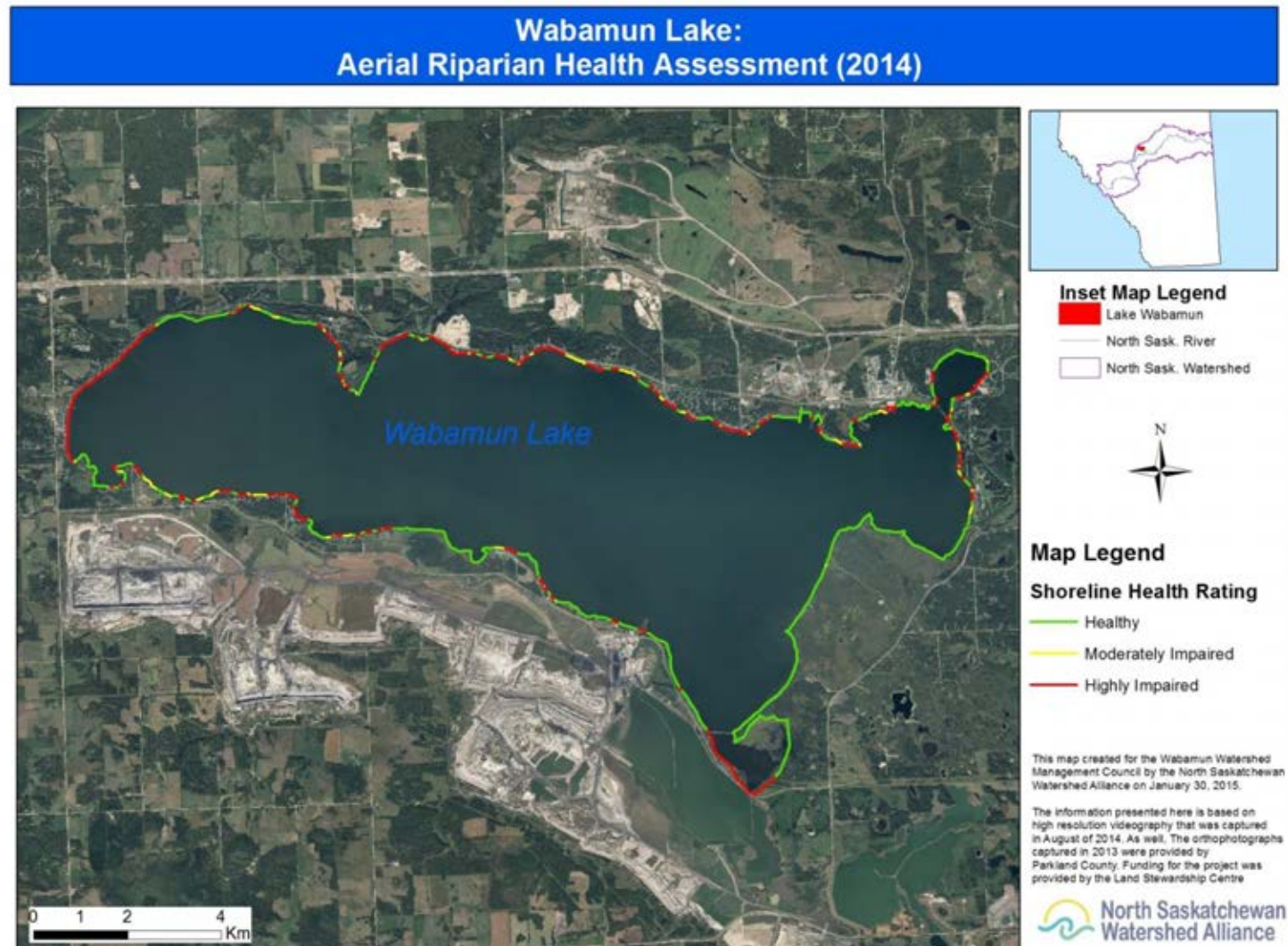


Figure 4-38 Wabamun Lake Riparian Health Assessment

SOURCE: North Saskatchewan Watershed Alliance (2015)

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

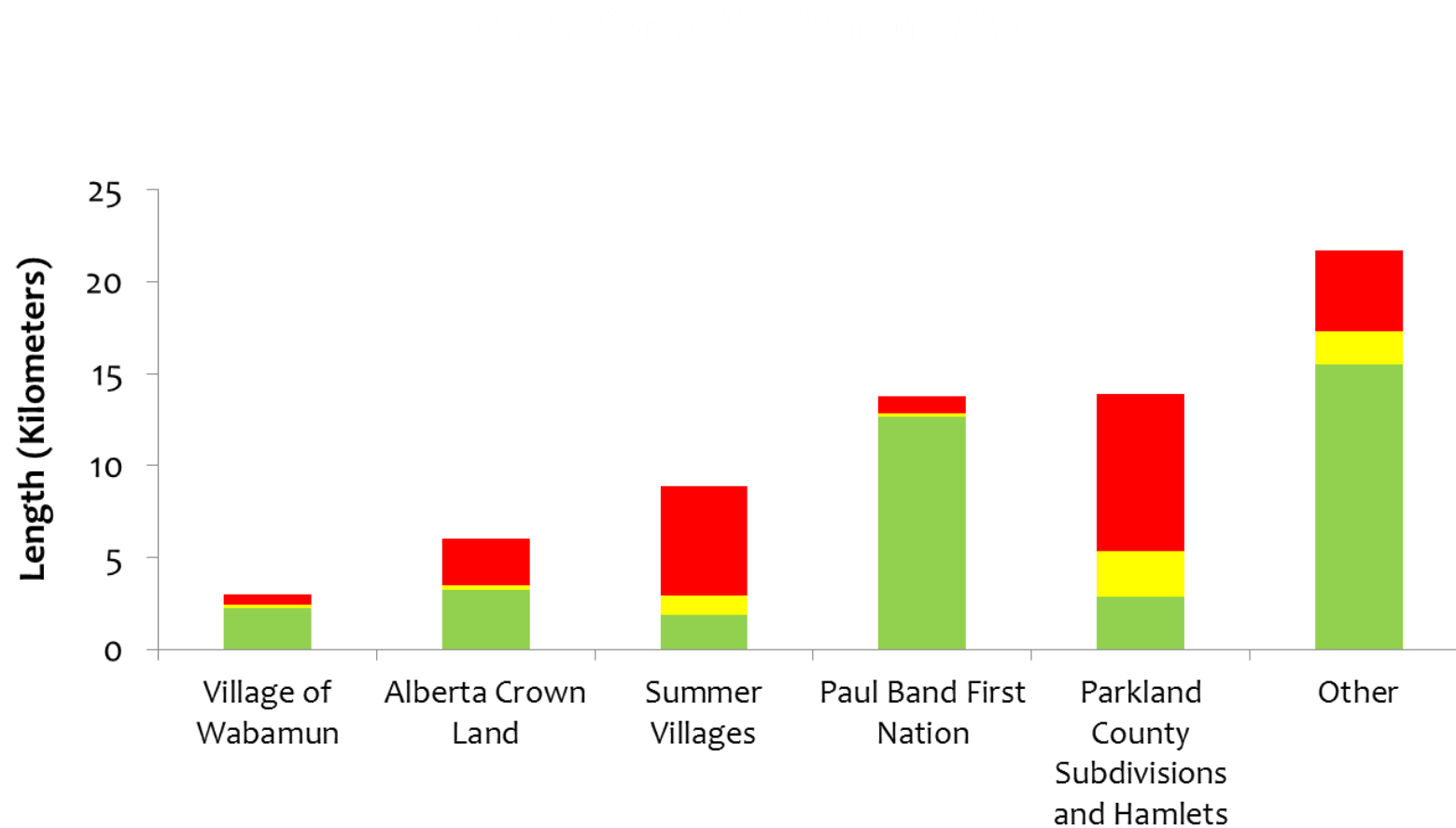


Figure 4-39 Riparian Health by Jurisdiction

SOURCE: North Saskatchewan Watershed Alliance 2015.

NOTES: Green – Healthy, Yellow – Moderately Impaired, Red – Highly Impaired. "Other" lands refers to land that is controlled by the County but is not included in a subdivision or a hamlet.

October 9, 2015

Summer Villages of Wabamun Lake

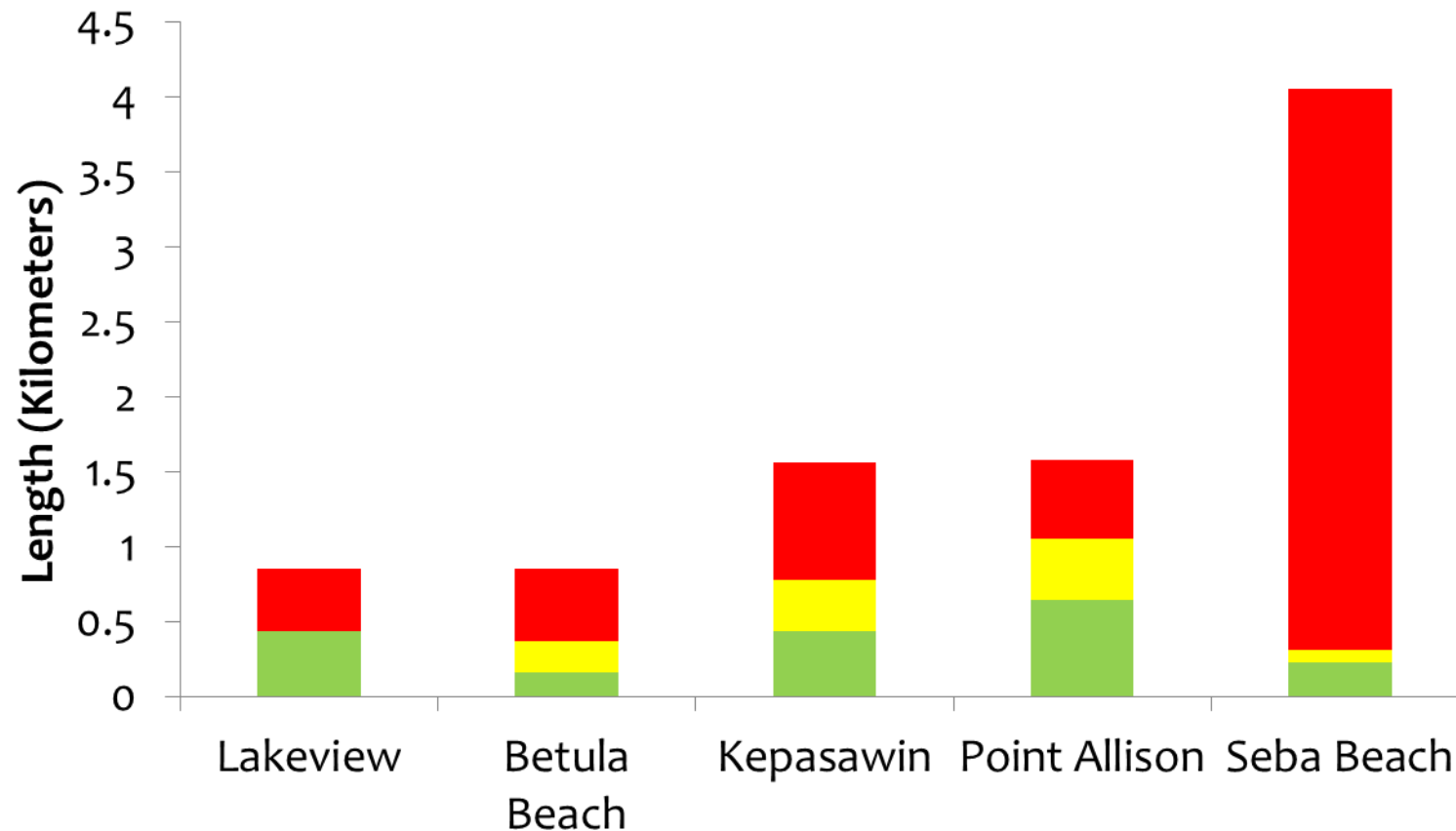


Figure 4-40 Riparian Health Assessment Results for the Summer Villages

SOURCE: North Saskatchewan Watershed Alliance 2015

NOTES: Green – Healthy, Yellow – Moderately Impaired, Red – Highly Impaired

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

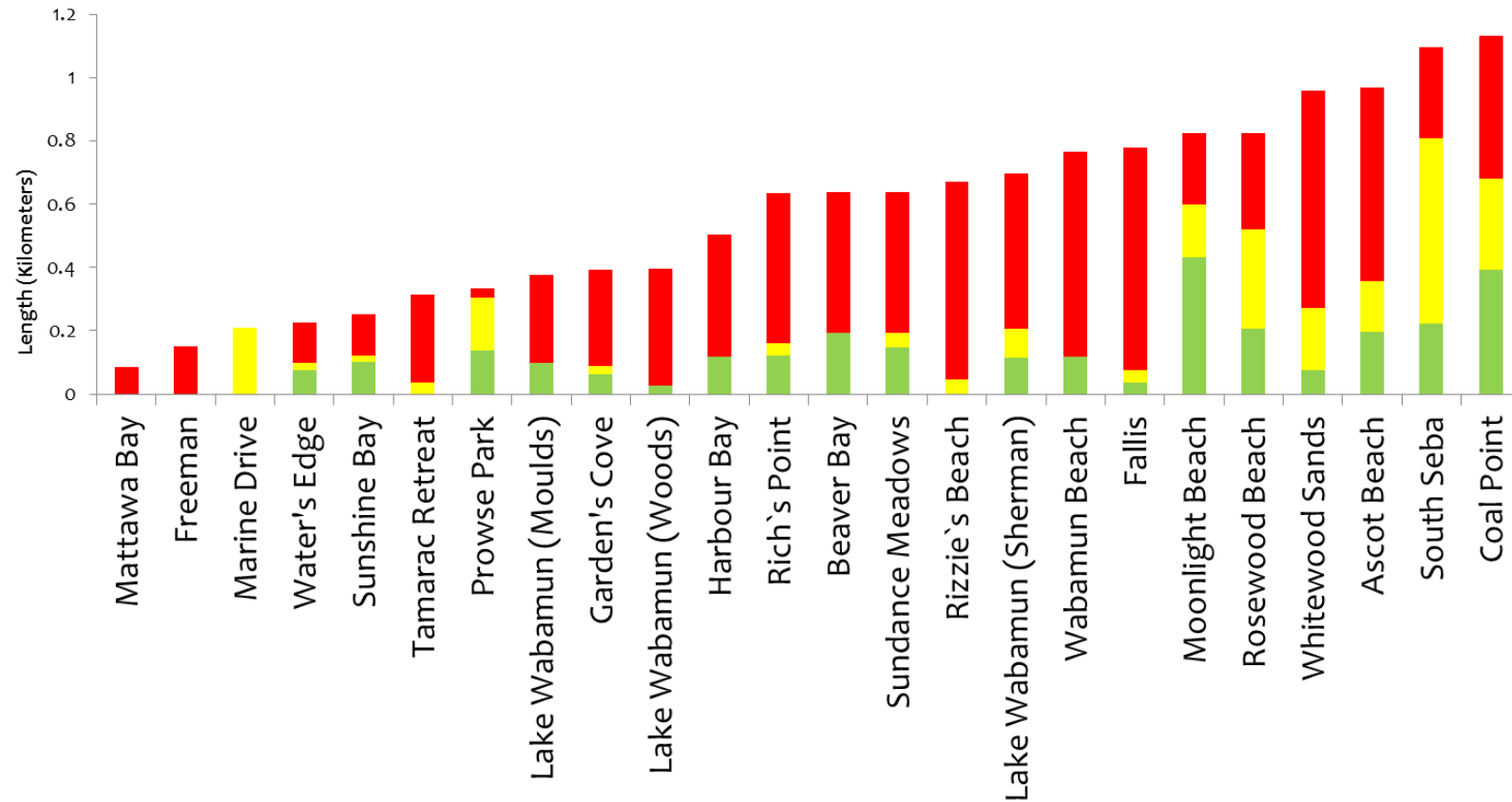


Figure 4-41 Riparian Health Assessment Results by Subdivision and Hamlets

SOURCE: North Saskatchewan Watershed Alliance 2015

NOTES: Green – Healthy, Yellow – Moderately Impaired, Red – Highly Impaired

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

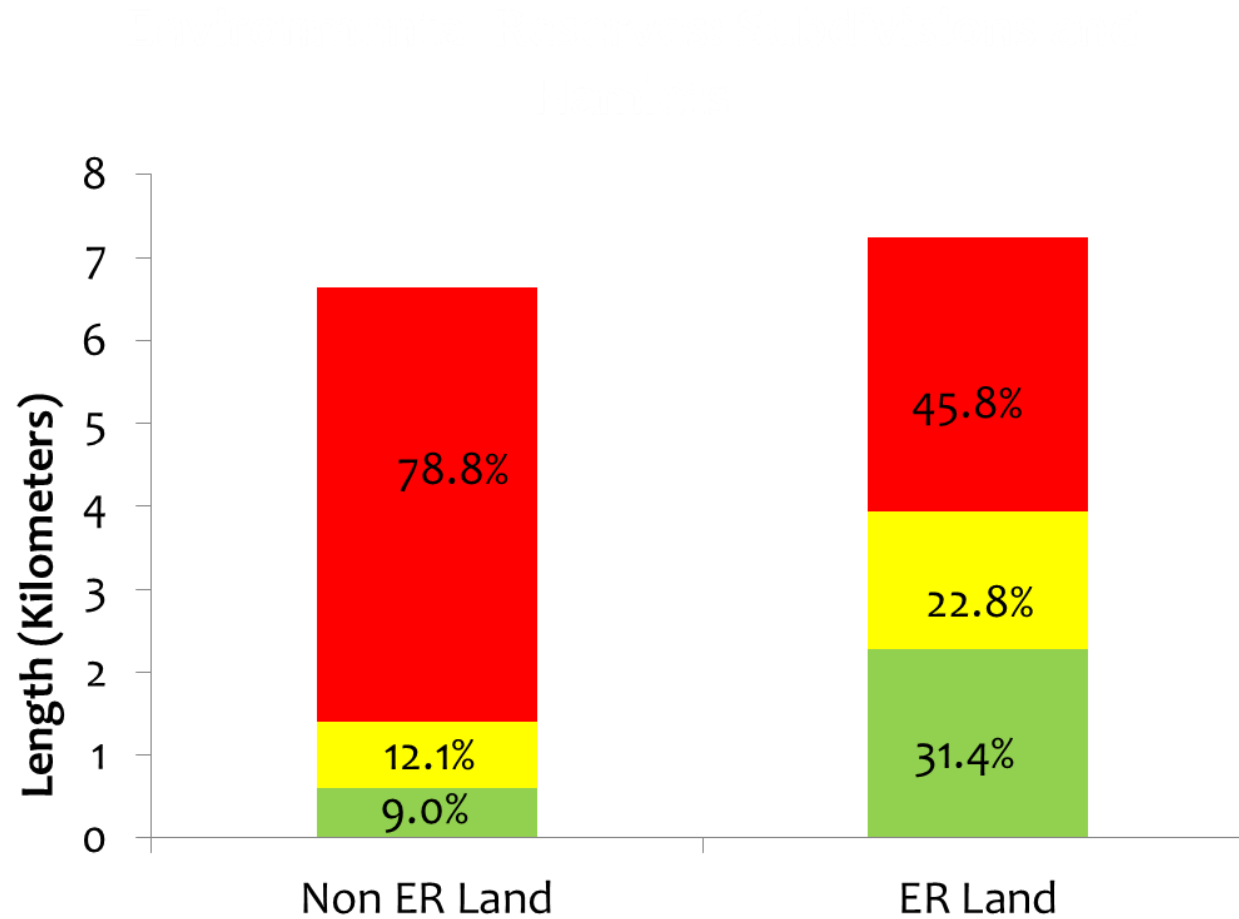


Figure 4-42 Riparian Health Assessment Results in Environmental Reserves

SOURCE: North Saskatchewan Watershed Alliance 2015

NOTES: Green – Healthy, Yellow – Moderately Impaired, Red – Highly Impaired

October 9, 2015October 9, 2015

4.6.2.4 Wildlife

The lake and surrounding shoreline habitat has been extensively modified. For some bird species, specifically ducks and other waterbirds that prefer to nest in shoreline emergent vegetation, this has resulted in an overall reduction of suitable nesting habitat (Mitchell and Prepas 1990).

The bird community of the subwatershed is fairly diverse and varies seasonally, as is typical for many areas in Alberta (Golder 1997). In the spring and summer, the subwatershed offers breeding and brood rearing habitat for a number of waterfowl (17 species; TGP 2011), gull, shorebird, and raptor species. In the winter, species include owls, woodpeckers, grouse, and passerines.

Because TransAlta's Sundance and Keephills cooling ponds stay ice-free during winter, several species that would otherwise not overwinter in the region stay in the subwatershed. Species that have been observed include loons, grebes, cormorants, herons, waterfowl (ducks, geese, swans, and mergansers), coots, kingfishers, and shorebirds (Golder 1997). Of the 27 waterfowl species recorded in Christmas Bird Counts from 1977 to 2013 (Audubon 2015), mallard and Canada goose are the most common species. The wintering birds forage primarily on stubble fields in the area but in deep-snow conditions, the birds will find forage in farmers' silage pits, straw stacks and feed lots (TransAlta 2001). A number of raptor species also overwinter in the subwatershed, and it is possible that these species are attracted to the area because of the abundance of waterfowl prey (Golder 1997 and references therein).

A TGP (2011) mammal study focused on ungulates in the subwatershed. White-tailed deer and moose abundance and density appear stable between 2005 and 2010; whereas, mule deer numbers have increased over the same period. Based on these results, TGP (2011) concluded that ungulates appear to prefer natural habitat such as deciduous, coniferous, and mixedwood forest stands. Coyote, red fox, and porcupine have been incidentally report in the subwatershed (TGP 2011).

Three of four amphibian species expected to occur in the Wabamun Lake subwatershed were recorded by TGP (2011). Boreal chorus frog followed by wood frog is the most abundant amphibian species and are found in cattail wetlands, wooded wetlands, reclaimed wetlands, and settling ponds. Western toad is less common and is found in black spruce woodlands, bogs, and fens; these habitat types are not abundant in the subwatershed. Based on habitat availability and range, Canadian toad could potentially occur in the subwatershed but have not been recorded.

Wabamun Lake subwatershed is potentially home to several wildlife species that are federally listed under the *Species at Risk Act* (WWMC 2013):

- three threatened species: common nighthawk, olive-sided flycatcher, peregrine falcon
- five species of special concern: western grebe, yellow rail, short-eared owl, rusty blackbird, and monarch butterfly

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

The presence or habitat for most of these federally listed species in the subwatershed has not been determined. However, peregrine falcon has nested successfully in nest boxes on the stacks of at least two generating plants between 2005 and 2010 (TGP 2011). Furthermore, a western grebe nesting colony exists on the north shore of the lake; this colony has been reported to be vulnerable to human disturbance (Parkland County 2014).

Individual wildlife species can serve as indicators of certain broad habitats and, subsequently, act as representatives of other wildlife species that use similar habitats. The availability of habitat for key indicator species can provide context for the need for habitat conservation within land use planning. **Table 4-15** outlines proposed indicator species for the broad habitat types in Parkland County (Basso 1994).

Table 4-15 Wildlife Indicator Species for Common Habitat Types in the Watershed

Habitat Type	Species Name
wetland	mallard duck (<i>Anas platyrhynchos</i>)
treed riparian	mink (<i>Mustela vison</i>)
coniferous forest	marten (<i>Martes americana</i>)
deciduous forest	hairy woodpecker (<i>Picoides villosus</i>)
shrub and deciduous-dominated forest	moose (<i>Alces alces</i>)
general upland	white-tailed deer (<i>Odocoileus virginianus</i>)

SOURCE: Basso (1994)

4.6.2.5 Relevance to Land Use Planning

Wetlands, vegetation and wildlife are important components of complex food chains and are economically important for timber harvesting, sport hunting, and wildlife viewing. Land use planning in the Wabamun Lake subwatershed has had a major impact on vegetation and in turn wildlife communities. A large portion of the native mixedwood forest has been eliminated or fragmented due to development for residential use, resource extraction, agriculture, and recreational use. Linear disturbances such as roads, railways, pipelines, seismic lines, and transmission lines have also fragmented the native mixedwood forest. Fragmentation reduces habitat availability for forest interior species and creates more edge habitat where habitat generalists are more competitive for both vegetation and wildlife (Fahrig 2003).

October 9, 2015October 9, 2015

Wetlands provide a diverse array of services, including flood attenuation, water storage, sediment trapping and nutrient removal, and are some of the most productive communities (Alberta Environment 2006). Although effects to wetlands in the watershed cannot be quantified, effects have likely occurred as a result of changes in land use, including loss and reduced function. Reducing wetland loss and effects to wetland function are key goals of the Alberta Wetland Policy (Government of Alberta 2014) and further loss in the watershed should be carefully evaluated and avoided if possible. Altered semi-permanently and permanently flooded wetlands should also be targeted for protection and possible restoration. This could improve wildlife habitat and for wetlands hydrologically connected to Wabamun Lake, contribute to nutrient removal from surface runoff.

As with wetlands, riparian areas are important for nutrient uptake, sediment trapping and wildlife habitat. Large segments of the shoreline are still rated healthy and have intact natural vegetation. However, riparian health has been reduced for a considerable length of shoreline with 34% highly impaired. High impairment appears to be associated primarily with lake residences and could be improved with small adjustments in land management. Providing a shoreline buffer of natural or unmaintained vegetation would improve shoreline health and provide greater wildlife habitat. Targeting an increase in health of highly impaired areas to moderately impaired is recommended. As outlined by the North Saskatchewan Watershed Alliance (2015), *"one modern 'best management practice' is to establish Environmental Reserve between new developments and waterbodies, as required by the Municipal Government Act"*. Parkland County uses environmental easements on land titles as another 'best management practice'.

Land use planning directly affecting Wabamun Lake levels and its thermal regime has implications for vegetation and wildlife. Water level control has stabilized natural fluctuations in Wabamun Lake, thus reducing opportunities for regeneration of flood- and drought-dependent vegetation and associated wildlife. Output from thermal generating plants into Wabamun Lake creates open water habitat in winter. Waterfowl that would normally migrate south for winter may stage in these open water areas because of the accessibility of food resources such as vegetation and invertebrates in wetland areas or waste grain in the upland areas (TGP 2011). Disturbance from human activities is a concern to Wabamun Lake's western grebe nesting colony (Waterbird Parkland County 2014). Ivey (2004) reported declines in western grebe nesting colonies in California due to human disturbance. Low floating nests are susceptible to destruction by boat wakes and wave action. Colony disturbances can lead to nest abandonment and increased egg predation.

4.6.3 Environmentally Significant Areas

Environmentally Significant Areas (ESAs) were recently mapped for the Parkland County (Parkland County 2014). ESAs were defined *"places vital to the long-term maintenance of biological diversity, soil, water, or other natural processes at multiple scales"*. For the ESAs identified within the Wabamun Lake subwatershed, see **Table 4-16** and **Figure 4-43** (Parkland County 2014). For more details on the ESAs, see **Appendix B, Section B.2.3**.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-16 Environmentally Significant Areas within the Subwatershed

Name	Significance ¹	Sensitivity ²	Area km ²
Canada Geese ESA ³	local	moderate	1.5 ³
East Pit Lake ESA	local	high	2.8
Fallis Slopes ESA	local	very high	5.0
Isle Lake Surrounding Area ESA ³	local	moderate	26.4 ³
Jackpine Grazing Reserve ESA	local	moderate	55.1
Seba Beach/Jr Forest Ranger ESA	local	very high	2.1
Shoal Upland Habitat ESA ³	local	moderate	10.5 ³
Sundance Natural Area and Surrounding Areas ESA	local	high	4.9
Wabamun Creek ESA	local	very high	4.0
Wabamun Lake ESA	regional	low	89.1
Wildlife Point ESA	local	very high	0.5
SOURCE: Parkland County 2014 NOTES: ¹ Definition for regional significance: elements of limited distribution at the regional level that are the best examples of an element or feature in the surrounding region. Definition for local significance: All ESA polygons identified in the county that do not meet the criteria in international, national, provincial or regional categories were designated as sites of local significance. See p. 76 of Parkland County (2014). ² Environmental sensitivity refers to the susceptibility of a site to surface disturbance and its inherent resiliency or ability to be restored back to functioning pre-disturbance ecological condition. This is in contrast to significance, which refers to the overall importance of an area regardless of sensitivity/resilience. ³ ESA is located partially within the Wabamun Lake Subwatershed.			

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015October 9, 2015

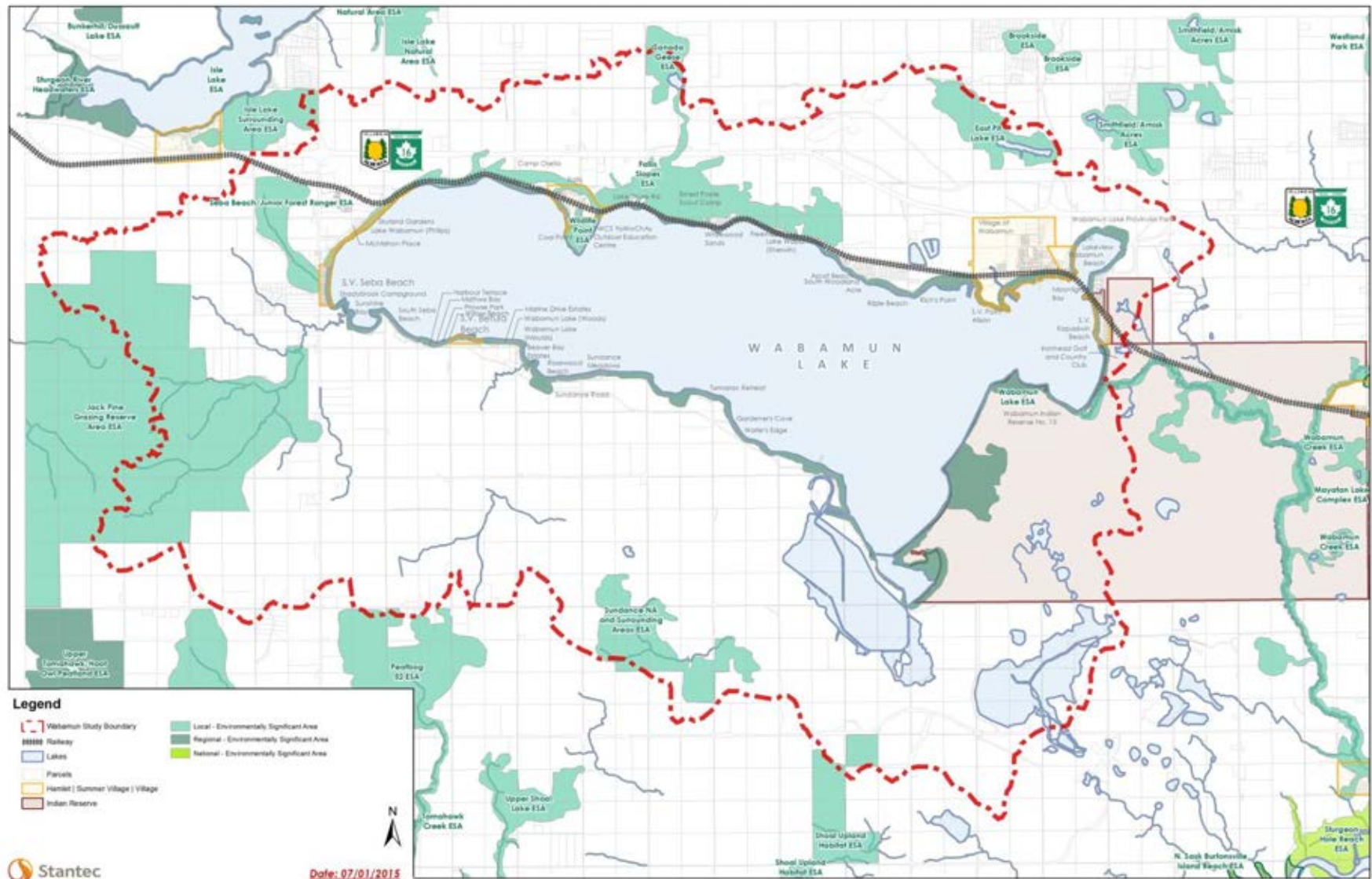


Figure 4-43 Environmentally Significant Areas in the Wabamun Lake Subwatershed

SOURCE: Parkland County 2014

4.6.3.1 Relevance to Land Use Planning

ESAs within the subwatershed represent relatively undisturbed areas or areas with unique environmental features. Conservation of these areas needs to be considered when developing the WLSLUP.

4.6.4 Invasive Species

WWMC (2013) summarized information on invasive species as follows:

Invasive species are species that are considered non-native which have been introduced intentionally or unintentionally from other countries and pose a threat to native ecosystems and biodiversity. These species can often reproduce very rapidly as they have no natural predators in their new environment. Because of their highly competitive nature, invasive species can be very difficult to remove once they have become establish[ed] in a particular area.

Table 4-17 provides a list of invasive species of management concern in the subwatershed. Other invasive species present in the subwatershed include Himalayan balsam (*Impatiens glandulifera*), flowering rush (*Butomus umbellatus*), common tansy (*Tanacetum vulgare*), and scentless chamomile (*Tripleurospermum perforatum*) (WWMC 2013).

Table 4-17 Invasive Species of Management Concern

Species Name	Status and Concerns
eurasian water milfoil (<i>Myriophyllum spicatum</i>)	An aquatic plant that has been detected and confirmed at four locations in Alberta. Forms large floating mats that block light and get tangled in boat propellers. At this time there is no evidence that Eurasian water milfoil is present in Wabamun Lake.
purple loosestrife (<i>Lythrum salicaria</i>)	This plant is highly invasive and occupies semi-aquatic habitats. Purple Loosestrife does occur within the Wabamun Lake subwatershed. As a result, Parkland County has taken the initiative to control known infestations of this species around Wabamun Lake.
rock snot (didymo) (<i>Didymosphenia geminata</i>)	A fast-growing diatom, which forms thick mats that reduce the quality of spawning habitat and abundance of food sources for fish. There is no record of rock snot observations in Wabamun Lake.
zebra and quagga mussels (<i>Dreissena polymorpha</i> and <i>Dreissena rostriformis bugensis</i>)	These mussels have caused ecological damage and taxpayer expenses in Ontario and Minnesota. There are currently no documented cases of zebra or quagga mussels in Alberta. Two boats that had zebra mussels were intercepted at separate occasions at vehicle inspection stations in 2014 (CBC 2014).
SOURCE: WWMC (2013)	

October 9, 2015

4.6.4.1 Relevance to Land Use Planning

Invasive species have the potential to outcompete native species and alter habitat for existing biological communities (Gurevitch and Padilla 2004). Recreational and industrial activities can introduce invasive species via transport from other regions. Once invasive species have established in an area the economic cost can be significantly higher than the cost to prevent the introduction (Marbek 2010).

4.7 AIR

The Wabamun Lake subwatershed is located within the West Central Airshed Management Zone. One of the airshed's monitoring stations, Meadows, is located within the subwatershed. Based on recent monitoring reports, air quality at the Meadows air quality monitoring station at the west end of Wabamun Lake was judged to be "good", with no exceedances of ambient air quality objectives for nitrogen dioxide or sulphur dioxide (TransAlta 2014, 2013). Sulphur dioxide generally originates from industrial stack emissions, whereas nitrogen dioxide and particulate matter have several origins, including vehicle traffic, agricultural activities and stack emissions (TransAlta 2001). Stack emissions from high power plant stacks tend to diffuse to the ground at downwind distances of greater than 5 km (TransAlta 2001). Prevailing wind direction in the subwatershed is from the northwest to southeast (TransAlta 2014).

Particulate matter and ozone are not monitored in the subwatershed, but data for both of these parameters are available for Genesee station, which is located southeast from the subwatershed. Ozone concentrations did not exceed air quality objectives in 2012 or 2013 (TransAlta 2014, 2013). Fine particulate matter concentrations were generally low between 2010-2013, with occasional peaks due to sources unrelated to activity in the subwatershed (e.g., forest fires) (TransAlta 2014, 2013). Residents of the south shore of the lake occasionally notice dust blowing from the Highvale mine, when winds are from the southeast (WWMC 2013 and references therein).

At the time when the four coal-fired power plants, Wabamun, Keephills, Sundance and Genesee (located outside of the subwatershed), were operational, 74% of all CO₂ emissions and 65% of airborne mercury emissions from industrial sources in Alberta originated from the four power plants (Schindler 2004). The Wabamun Plant has since been decommissioned.

TransAlta (2001 and references therein) summarized findings related to observed air quality effects in vegetation in the subwatershed as follows:

Lichens, mosses and a shrub (red osier dogwood) have significantly elevated levels of heavy metals downwind of the ash disposal pit east of the Sundance plant (Case et al. 1987). The lichens in these areas were less vigorous and had symptoms of stunted growth, loss of pigmentation and dead tissue. As well, lichen and moss diversity were reduced at sites near the Sundance plant, especially in the vicinity east of the ash disposal area. This

disposal area was capped in 1994 and the surrounding lands flooded as part of the cooling pond expansion.

Moss bags were used as collectors of heavy metals in the Wabamun Lake area over a four-year period to determine the impact of emissions from the four coal-burning power plants (Goodarzi 1997). Elevated levels of heavy metals were found downwind, particularly at locations within 15 to 20 km of most power plants. Loading of heavy metals was calculated to be very low compared to the background levels in the soil.

4.7.1 Relevance to Land Use Planning

In general, land use and resulting air emissions issues and are not localized to an area the size of the subwatershed because of the long distances that airborne emissions can travel. While air quality in the subwatershed remains good (TransAlta 2014, 2013), land use, especially coal mining and power plants, in the subwatershed have affected vegetation (TransAlta 2001 and references therein) and resulted in dust concerns on the south shore (WWMC 2013). Air emissions at their current levels have not been observed to affect lake health or resulted in human health concerns.

4.8 CLIMATE CHANGE

Over the past 100 years Alberta's mean temperature has increased by an estimated 1.4°C, with most of the increase occurring since 1970, and precipitation has declined in central Alberta by 5%. Within the same timeframe, precipitation has increased in northern Alberta by up to 20% (Shank and Nixon 2014 and references therein).

Paleolimnological data record in Wabamun Lake is too variable to determine if the increased temperature over the last 100 years has affected lake productivity (Hutchinson 2014). However, research in other lakes suggests that climate change since the Little Ice Age has had little effect on prairie lake water quality compared to that associated with land use changes (Hutchinson 2014 and references therein).

Averaging across 24 General Circulation Models (GCMs) for Alberta suggests that the mean annual temperature may rise by up to 4.2 °C by the end of the century with a potential increase of 9.4% for mean annual precipitation (Schneider 2013). However, this increase is for winter precipitation and an overall decline in summer precipitation is predicted. Associated with warming temperatures is increased evapo-transpiration of moisture from soil and vegetation.

4.8.1 Relevance to Land Use Planning

Wabamun Lake's water balance is strongly affected by precipitation and evaporation, which account for the majority of water inputs and outputs to the lake. Therefore, a change in precipitation and evaporation due to climate change could alter the water budget of the lake.

October 9, 2015

While a weir can be used to manage high water levels in the lake that could be caused by climate change, low water levels could be more challenging to manage. TransAlta's current discharges from the Water Treatment Plant will not be continued once the Highvale mine pits are reclaimed and water in the pit lakes is of suitable quality to be released to the lake. It is uncertain how TransAlta's activities in the subwatershed will affect the water balance of the lake in the timeframe of climate change projections.

4.9 DEFINING HEALTH

The key goal of the WLSLUP is to support a healthy lake, and the scientific information can be used to quantify different aspects of lake health. The WLSLUP uses the following two general definitions of aquatic ecosystem health, which incorporate societal values in the definitions:

1. *A healthy ecosystem is sustainable and resilient to stress, maintaining its ecological structure and function over time similar to the natural (undisturbed) ecosystems of the region, with the ability to recover from disturbance, while continuing to meet social needs and expectations (Stantec 2005).*
2. *Healthy environments imply normal aquatic communities, and normal physical and chemical environments. The practical definitions of "normal" are typically based on reference conditions, which are spatially and temporally variable, and depend on the type of aquatic environment (river, lake, or wetland) (Jacques Whitford 2005).*

For specifics related to defining health or "normal" state for Wabamun Lake while continuing to meet social needs and expectations, see **Table 4-18**.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Table 4-18 Wabamun Lake Health Defined

Ecosystem Component	Healthy or "Normal" Condition
Surface Water Level	Wabamun Lake levels have been artificially controlled since 1913. Because of developed properties along the lake shore, the current level of 724.55 m above sea level should be considered the long-term management target.
Surface Water Quality	Wabamun Lake is a naturally eutrophic lake with stable levels of primary productivity since the 1700s (Hutchinson 2014), and should remain at mesotrophic to eutrophic productivity level. Summer bloom-forming phytoplankton are common in the lake (Hutchinson 2014), and their modern abundance should remain within historical range. Water in the lake should be generally clear and blue-green algae blooms are rare (Schindler 2004). It is recommended that a phosphorus target concentration be identified for the lake for maintaining productivity at current level or lower; but this is outside of the scope of this report. Bacteria (fecal coliform) levels should be low or near zero. Sediment metal and PAH levels should be similar to other central Alberta lakes.
Groundwater Level	Groundwater levels in the Wabamun Lake area depend on lake water levels, precipitation, and groundwater use (pumping of active wells). AENV (2002) modelled natural groundwater flow into and out of Wabamun Lake indicating that the lake loses water to groundwater recharge. Partial studies conducted in the southern part of the Wabamun Lake area (TransAlta 2001) indicate that downward vertical gradients in observation wells dominate with a few exceptions. Based on data from the provincial Groundwater Observation Well Network, groundwater levels have slowly decreased over the past 20 years in all monitoring wells within the Parkland County (Parkland County 2013). From all the above, establishing safe groundwater levels to maintain the health of Wabamun Lake is difficult. Groundwater levels depend on climatic parameters and natural cycles in groundwater levels have to be expected. Targeted periodical groundwater level monitoring in the Wabamun Lake area and comparison to climatic parameters would help establishing a seasonal/annual baseline.
Groundwater Quality	The regional groundwater in the Wabamun Lake subwatershed often exceeds the drinking water criteria for total dissolved solids, sodium, iron, and manganese (TransAlta 2001), which are typically observed to have elevated natural background concentrations in Alberta. The historical baseline values for groundwater should be considered as "normal" for the long-term management of the Wabamun Lake subwatershed.
Soils	A normal condition for soils in the subwatershed entails no contamination of soils and shallow groundwater, and without erosion caused by construction or clearing activities.
Air Quality	The existing good air quality in the subwatershed should be maintained and local air quality (including dust) issues are addressed.
Aquatic biota	Wabamun Lake has been utilized as a commercial and recreational fishery since the 19 th century, and the

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Ecosystem Component	Healthy or "Normal" Condition
	lake is an important traditional fishing ground for the Paul First Nation. Several fish species have historically been found in Wabamun Lake, but historical data regarding fish population abundance generally focus on harvest reports for targeted species while abundance estimates of other species are limited. Management objectives for fisheries in Wabamun Lake will determine population targets; however, historical and current fish communities should form a baseline for fish species diversity. The ability of fish populations to sustain themselves through natural reproduction will depend on the availability of habitat including spawning grounds, rearing areas, surface water quality, and food resources. If population or harvest targets are identified, the availability of shoreline habitat may require reassessment, with the potential requirement for restoration programs. For any given fish management objective, the availability of suitable habitat for all life stages is critical to supporting fish populations. Benthic invertebrates are used to assess biological lake health since they can integrate the effects of short and long-term environmental variables. Based on the limited monitoring data for Wabamun Lake, benthic invertebrate communities have changed little over time as a result of land use changes. The flux of nutrients into the lake providing for eutrophic conditions has provided suitable conditions for the dominance of chironomids in the lake. As a "normal" condition, Wabamun Lake should have similar benthic invertebrate community and abundance compared to other lakes with similar productivity in central Alberta
Vegetation	About 40% of the Wabamun watershed has been altered and native vegetation removed. Some of this area is expected to be re-vegetated following closure of portions of the Highvale mine. Further unplanned loss of native vegetation cover, particularly along Wabamun Lake tributaries, could affect lake water quality and wildlife habitat. Targets for vegetation conservation should be considered, but these are outside of the scope of this report.
Wetlands	Past effects to wetland abundance and function are difficult to determine as a historical assessment of wetland conditions is not available. Given the alteration of the watershed and general vegetation condition, wetland loss is expected to have occurred and wetlands in agricultural and non-native grasslands likely have altered vegetation structure and function. In keeping with the Alberta Wetland Policy (Government of Alberta 2014), further wetland loss and alteration should be limited in the subwatershed. Wetlands provide important wildlife habitat, have a distinct plant composition and can help improve water quality of downstream waters.
Riparian Areas	Riparian health has been reduced for a considerable length of shoreline with 34% highly impaired and 9% moderately impaired. High impairment appears to be associated primarily with lake residences and could be improved with small adjustments in land management. Providing a shoreline buffer of natural or unmaintained vegetation would improve shoreline health and provide greater wildlife habitat. Targeting an increase in health of highly impaired areas to moderately impaired is recommended.
Wildlife	Wabamun Lake's wildlife community has adapted to habitat fragmentation, artificially controlled water levels, and a thermal water regime in winter modified by output from thermal generating plants. Wildlife

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Ecosystem Component	Healthy or "Normal" Condition
	data is lacking prior to habitat fragmentation, water level control and thermal electrical generation, although water-dependent species would normally be absent from the lake in winter due to frozen conditions. In fact, a total of 27 waterfowl species has been recorded at Wabamun Lake in winter from 1977 to 2013 (Audubon 2015). In contrast, 17 waterfowl species have been recorded during the 2005 and 2010 summer breeding seasons (TGP 2011). Waterfowl reproductive success is unknown, but is highly dependent on the quality of feeding and nesting habitat in uplands and wetlands. In addition, human or predator disturbance can negatively impact reproductive success. Ungulate and amphibian populations appear stable. These factors make it difficult to establish a "normal" wildlife status that would support a healthy lake.
Invasive Species	Several invasive plant species (all of these are terrestrial and wetland species) have been documented in the Wabamun subwatershed. Three species are designated prohibited noxious and two noxious in Alberta (Government of Alberta 2010). There are currently no aquatic invasive species documented in Wabamun Lake, which should remain a management goal for a healthy aquatic ecosystem. Invasive species pose a threat to native ecosystems and biodiversity and can be very difficult to remove or control once established.
Climate Change	A healthy or "normal" environment definition must also consider climate variability in time. Typically a climate "normal" is defined by the World Meteorological Organization (WMO) as occurring over a 30-year period, with 1981-2010 being the most recent. These normals also incorporate longer-term patterns of climate change and thus should be considered in defining lake health, e.g., in the context of changing water balance in the future.

October 9, 2015

5.0 KEY ISSUES

Key issues and goals for the land use plan were identified through review of existing documents and stakeholder engagement.

5.1 POLICY

The following policy issues were identified:

- The number of jurisdictions, Federal, Provincial and Municipal which have approval and regulatory authority for various activities occurring within the subwatershed suggests that it may difficult to have a holistic approach to managing of the activities which could potentially affect the long-term health of the lake.
- The various development regulations outlined in the Land Use Bylaws of each of the seven municipalities within the WLSLUP means that there is currently not a consistent approach to managing land use and development within the WLSLUP.
- Current land use planning does not effectively consider cumulative environmental effects of development activities. Enforcement or lack of enforcement of land use, environmental and safety regulations at the Federal, Provincial and Municipal levels of government.
- Concern regarding the number of watercraft on the lake at any given time. Can the Lake support all of the watercraft that operate on the lake during peak usage periods? This speaks to the Carrying Capacity of the Lake. How many boats are too many boats?
- Lack of knowledge by the general public related to activities that either harm or can help lake health and cumulative effects of those activities on the health of the lake.

5.2 BIOPHYSICAL

The following issues were identified:

- Lack of understanding of groundwater resource in the subwatershed
- Lack of understanding among residents and visitors of how their actions affect the lake

The following goals were identified:

- Maintain lake levels that support all uses of the lake, water quality and biological communities now and in the future
- Maintain or improve current water quality
 - Even though eutrophication is not currently occurring in the lake, phosphorus management remains an important issue for land use planning.
 - It is uncertain how the cessation of water treatment plant discharges will affect the lake water quality. It is possible that nutrient inputs from the watershed may re-gain importance and affect Wabamun Lake water quality (Hutchinson 2014).
- Maintain or improve current groundwater levels
- Maintain or improve current groundwater quality
- Maintain or improve current air quality

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- Improve wetland and riparian health
- Protect shoreline habitat for waterfowl nesting and fish species from direct and sensory disturbance, including noise
- Identify terrestrial wildlife indicator species and establish habitat needs
- Improve fish population status
- Keep invasive species out of the subwatershed or manage invasive species if they are in the subwatershed

October 9, 2015

6.0 REFERENCES

6.1 LITERATURE CITED

- AAFC (Agriculture and Agri-food Canada). 2013. AAFC annual crop inventory. Accessed February 2015 at <http://open.canada.ca/data/en/dataset/ba2645d5-4458-414d-b196-6303ac06c1c9>
- ACA (Alberta Conservation Association). 1999. Caring for shoreline properties – changing the way we look at owning lakefront property in Alberta. Published by Alberta Conservation Association and Fisheries and Wildlife Management Division, Alberta Environmental Protection.
- AENV (Alberta Environment). 2006. A Review of Indicators of Wetland Health and Function in Alberta's Prairie, Aspen Parkland and Boreal Dry Mixedwood Regions. Prepared by: Wray, H.E. and S.E. Bayley. University of Alberta, Edmonton, Alberta.
- AENV (Alberta Environment). 2002. Wabamun Lake water balance 1982-2001. Alberta Environment, Environmental Assurance Environmental, Operations Division Hydrology Branch, Surface Water Section, Edmonton, Alberta.
- Anderson, A-M. 2003. A survey of metals and trace organic compounds in sediments from Wabamun Lake and other Alberta lakes. Prepared for Alberta Environment, Environmental Monitoring and Evaluation Branch. September 2003.
- Alberta Geological Survey. 2013. Surficial Geology of Alberta, 1:1,000,000 scale (GIS data, polygon features). Digital data 2013-0002. Prepared by MM Fenton, EJ Waters, SM Pawley, N Atkinson, DJ Utting and K Mckay. Accessed January 12, 2015 at http://www.ag.gov.ab.ca/publications/abstracts/DIG_2013_0002.html
- Alberta Health Authority. 2014. Environmental health – popular beaches: water testing results. Accessed February 2015 at http://www.calgaryhealthregion.ca/publichealth/envhealth/beach_sampling/beach_index.htm
- Alberta Health and Wellness. 2004. Environmental public health field manual for private, public and communal drinking water systems in Alberta. Second edition.
- Alberta Municipal Affairs. 2013. Municipal Census and Population Lists. http://www.municipalaffairs.alberta.ca/mc_official_populations.cfm
- Alberta Municipal Affairs. 2009. Municipal Census and Population Lists.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- Andriashek, L.D., M.M. Fenton and J.D. Root. 1979. Surficial geology Wabamun Lake, Alberta, NTS 83G. Alberta Resource Council, Edmonton.
- Audubon. 2015. Audubon Christmas Bird Count. Wabamun Lake Count: 1977-2013. Accessed 23 February 2015 at:
<http://netapp.audubon.org/CBCObservation/Historical/ResultsByCount.aspx>
- Barker, AA, Riddell, JTF, Slattery, SR, Andriashek, LD, Moktan, H, Wallace, S, Lyster, S, Jean, G, Huff, GF, Stewart, SA and Lemay, TG. 2011. Edmonton–Calgary Corridor groundwater atlas; Energy Resources Conservation Board, ERCB/AGS Information Series 140, 90 p.
- Basso, Anne Carol. 1994. A strategy for landscape planning in the County of Parkland, Alberta. A Practicum submitted in partial fulfillment of the requirements for the degree Master of Natural Resources Management. Natural Resources Institute, University of Manitoba, Winnipeg, Manitoba. 133pp.
- Bow River Project. 2002. Protecting riparian areas: creative approaches to subdivision development in the Bow River Basin. A guide for municipalities, developers and landowners.
- Case, JW, DL Dabbs and SE Alexander. 1987. Keephills Vegetation Biomonitoring Benchmark Study. Prepared for TransAlta Utilities Corp. Calgary, Alberta.
- Casey, R. 2011. Water Quality Conditions and Long-Term Trends in Alberta Lakes. Prepared for Water Policy Branch, Environmental Policy Division, Alberta Environment and Water. W1102. 446pp.
- Casey, R. 2003. Wabamun Lake Water Quality 1982 to 2001. Science and Standards, Alberta Environment. W0309. September 2003. 121pp.
- CBC. 2014. 2 boats with zebra mussels intercepted at Alberta border – province reminding boaters to clean watercraft before entering Alberta lakes in bid to stop invasive species. August 28, 2014.
- Donahue, WF, EW Allen, DW Schindler. 2006. Impacts of coal-fired power plants on trace metals and polycyclic aromatic hydrocarbons (PAHs) in lake sediments in central Alberta, Canada. *Journal of Paleolimnology* 35: 111-128.
- EDA (EDA Collaborative Inc.). 2013. Lake Wabamun Boat Launch Study. Prepared for Parkland County. Prepared by EDA Collaborative Inc. in association with RC Strategies and Shoreplan. May 2013.
- Emmertson, C. 2011. Wabamun Lake Phosphorus Budget during the 2008 Runoff and Open Water Season. Prepared for Alberta Environment.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- Emmerton, C. 2008. Wabamun bacteria study 2008 – summary. Prepared for Alberta Environment.
- Emmerton, C. 2008. Wabamun phosphorus budget during the 2008 runoff and open water season. Alberta Environment and Sustainable Resource Development, Edmonton, Alberta.
- ESRD. 2014. Recommended Fish Consumption Limits for Fish Species in Alberta Water Bodies. Accessed in October 2014 at mywildalberta.com.
- ESRD. 2013. Alberta Merged Wetland Inventory. Alberta Environment and Sustainable Resource Development, Government of Alberta, Edmonton, Alberta.
- ESRD. 2008. Digital Data 2008-0525 Wabamun Lake, Alberta - Bathymetry, Digital Elevation Model (Arc ascii grid format). Accessed March 2015 at http://www.ags.gov.ab.ca/publications/abstracts/DIG_2008_0525.html
- ESRD. Unpublished a. Survey of open water anglers at Wabamun Lake, Alberta 2013. Prepared by Adam Hope, Fisheries Technician.
- ESRD. Unpublished a. Survey of open water anglers at Wabamun Lake, Alberta 2013. Prepared by Adam Hope, Fisheries Technician.
- ESRD. Unpublished a. Wabamun Lake Fall Walleye Index Netting Survey, 2013. Prepared by Don Hildebrandt, Fisheries Technician.
- Fahrig, L. 2003. Effects of Habitat Fragmentation on Biodiversity. *Annual Review of Ecology, Evolution, and Systematics* 34:487-515.
- Goodarzi, F. 1997. The Impact of Anthropogenic Activities on the Wabamun Lake Area. Prepared for TransAlta Utilities Corp., Edmonton Power Limited and Geological Survey of Canada. Calgary, Alberta.
- Golder (Golder Associates Ltd). 2006. Summary Findings: Wabamun Lake Environmental Effects Monitoring. Prepared for Canadian Natural.
- Golder. 1997. A synthesis of historical information on the effects of the TransAlta Utilities Wabamun Lake Power Plant using a risk assessment approach. Prepared for TransAlta Utilities, March 1997. Project 962-2354. Golder Associates Ltd. Calgary, Alberta.
- Government of Alberta. 2014. *Alberta Wetland Policy*. Alberta Environment and Sustainable Resource Development. Edmonton, Alberta.
- Government of Alberta. 2010. Alberta Weed Control Act. Weed Control Regulations. Alberta Regulation 19/2010. Alberta Queen's Printer. Edmonton, Alberta.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Gurevitch, J. and D.K. Padilla. 2004. Are invasive species a major cause of extinctions. *Trends in Ecology and Evolution*. 19(9): 470-474.

Haekel, G. 2002. The law and the lake: navigating Alberta's regulatory framework. Prepared by Gerry Haekel, Shoreland Management Program Coordinator, Public Lands Division, Alberta Sustainable Resource Development. Edmonton, Alberta.

Hoyes, EG. 2014. Wabamun Lake historical overview – lake level and water management issues. Presentation to Wabamun Lake Advisory Council. September 17, 2014.

Hutchinson (Hutchinson Environmental Sciences Ltd.). 2014. North Saskatchewan Regional Plan: Lake Paleolimnology Survey. DRAFT for discussion. Prepared for Alberta Environmental and Sustainable Resource Development.

HydroQual (HydroQual Laboratories Ltd.). 2003. Toxicity assessment of Wabamun Lake sediments. Prepared for Alberta Environment, Central Region. September 15, 2003.

Ivey, G.L. 2004. Conservation Assessment and Management Plan for Breeding Western and Clark's Grebes in California.

Jacques Whitford. 2005. Scope of work for the initial assessment of aquatic ecosystem health in Alberta. Prepared for Alberta Environment. August 4, 2005.

Latham, J. 2014. Report on the impact of livestock operations on the watershed. Prepared for the Wabamun Watershed Management Council. January 2014.

KCB (Klohn Crippen Berger Ltd.). 2014. Lake Wabamun 2013 Annual Water Balance Report. Prepared for TransAlta Generation Partnership. June 26, 2014.

Marbek. 2010. Economic Value of Protecting the Great Lakes: Literature Review Report. Prepared for Ontario Ministry of the Environment, January 2010. Marbek in association with Informetrica, Dr. Steven Renzetti, Dr. Diane Dupont, and Dr. Jim Bruce. Ottawa, Ontario.

Mitchell, PA. 1985. Preservation of water quality in Lake Wabamun – Lake Wabamun eutrophication study. Prepared by Patricia Mitchell, Water Quality Control Branch, Pollution Control Division, Environmental Protection Services, Alberta Environment. April 1985.

Mitchell, PA and EE Prepas (eds.). 1990. Atlas of Alberta Lakes, University of Alberta Press. 690 pp.

MMWC (Marshall Macklin Monaghan Western Limited). 1985. Lake Wabamun Management Plan. Prepared for Lake Wabamun Management Plan Steering Committee. Prepared by Marshall Macklin Monaghan Western Limited with ICL – Interplan, a division of IEC Beak Consultants Ltd.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

- Natural Regions Committee. 2006. Natural regions and subregions of Alberta. Compiled by DJ Downing and WW Pettapiece. Government of Alberta, Edmonton, Alberta.
- North Saskatchewan Watershed Alliance (NSWA). 2005. North Saskatchewan Watershed Report 2005 – A Foundation for Collaborative Watershed Management. Prepared by Aquality Environmental Consulting Ltd., Edmonton, Alberta.
- North Saskatchewan Watershed Alliance. 2015. Riparian Health Assessment of Wabamun Lake – an aerial assessment using an unmanned aerial vehicle (UAV). DRAFT report.
- Parkland County. 2014. Environmental Conservation Master Plan: Phase 1 Background Technical Report. Prepared by O2 Planning + Design Inc. for Parkland County. October 2014.
- Parkland County. 2013. State of the Environment Report 2012. Prepared by Parkland County Sustainability Services. May 28, 2013. Parkland County, Alberta.
- Parkland County. 2011. Integrated community sustainability plan. Parkland County, Alberta.
- Parkland County. 2009. Land Use Bylaw #20-2009. Parkland County, Alberta.
- Parkland County. 2007. Municipal Development Plan Bylaw#37 (2007). Parkland County, Alberta.
- Parkland County, 2009 - Municipal Census, Parkland County, Alberta
- Pettapiece, W, J Robertson, and D Anderson. 2010. Cultivated grey luvisol soils of the prairie region. *Prairie Soils and Crops Journal* 3: 73-83.
- Schindler, DW. 2004. Wabamun Lake: A review of scientific studies and environmental impacts. Alberta Environment, Edmonton, Alberta. 44pp.
- Schneider, RR. 2013. Alberta's Natural Subregions Under a Changing Climate: Past, Present and Future. The Biodiversity Management and Climate Change Adaptation Project.
- Shank, CC and A Nixon. 2014. Climate change vulnerability of Alberta's biodiversity: A preliminary assessment. Biodiversity Management and Climate Change Adaptation project. Alberta Biodiversity Monitoring Institute, Edmonton, AB. 60 pp.
- Soil Classification Working Group. 1998. The Canadian system of Soil Classification (third edition). Agriculture and Agri-Food Canada Publication 1646, 187 pp.
- Stantec (Stantec Consulting Ltd.). 2005. Alberta Environment Water for Life – aquatic ecosystems: review of issues and monitoring techniques. Prepared for Alberta Environment. October 2005. 86 pp

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

TransAlta (TransAlta Generation Partnership). 2014. TransAlta Generation Partnership and Capital Power Corporation Ambient Air Monitoring Program – 2013 Annual Report. Prepared by TransAlta Generation Partnership, Capital Power Corporation in association with WBK & Associates Ltd. and Intrinsik Environmental Services Inc. for Alberta Environment and Sustainable Resource Development. Final. September 2014.

TransAlta (TransAlta Generation Partnership). 2013. TransAlta Generation Partnership and Capital Power Corporation Ambient Air Monitoring Program – 2012 Annual Report. Prepared by TransAlta Generation Partnership, Capital Power Corporation in association with WBK & Associates Ltd., Stantec Consulting Ltd., and Intrinsik Environmental Services Inc. for Alberta Environment and Sustainable Resource Development. Final. September 2013.

TransAlta (TransAlta Corporation). 2001. TransAlta Centennial Project Environmental Impact Assessment. July 2001.

TGP (TransAlta Generation Partnership). 2011. Wabamun-Genesee Area TGP Wildlife Monitoring Program – 2010 Annual Report. Prepared by TGP in association with Stantec Consulting Ltd for Alberta Environment in June 2011.

Tuininga, A., D.O. Trew, and M.E. Shain. 2015. Wabamun Lake: Eutrophication Modelling with BATHTUB. Prepared by Alberta Environment and Parks and the North Saskatchewan Watershed Alliance.

Village of Wabamun. 2010. Village of Wabamun municipal development plan bylaw no. 06-2010. Village of Wabamun, Wabamun, Alberta.

Weiner, ER. 2008. Applications of environmental aquatic chemistry – a practical guide. Second edition. Taylor & Francis Group, Boca Raton, Florida.

WSC (Water Survey of Canada). 2014. Hydrometric data Wabamun Lake at Wabamun (Station 05DE002).

WorleyParsons. 2013. 2012 Groundwater Monitoring Report: Highvale Mine – Ash Disposal Sites. Prepared for TransAlta Corporation. Edmonton, Alberta.

WWMC (Wabamun Watershed Management Council). 2013. Wabamun Lake State of the Watershed Report. Prepared by Aquality Environmental Consulting for the Wabamun Lake Watershed Management Council. Wabamun, Alberta. 97 pp.

Yanch, J. 2006. Status of the Western Grebe (*Aechmophorus occidentalis*) in Alberta. Alberta Sustainable Resource Development and Alberta Conservation Association, Edmonton Alberta.

October 9, 2015

6.2 PERSONAL COMMUNICATIONS

Martin, D. 2015. Planner, Parkland County. Email. October 9, 2015.

Mussell, D. 2014. Planner, Resource Integration Branch, Alberta Environment and Sustainable Resource Development. Edmonton, Alberta. Email. October 30, 2014.

Mussell, D. 2014. Planner, Resource Integration Branch, Alberta Environment and Sustainable Resource Development. Edmonton, Alberta. Email. November 27, 2014.

Novak, B. 2014. EH&S Manager, TransAlta Corporation. Duffield, Alberta. Meeting. October 28, 2014.

Trew, D. 2014. Executive Director, North Saskatchewan Watershed Alliance. Edmonton, Alberta. 2014. Telephone conversation. November 10, 2014.

Sonnleitner, Tony. 2014. Development Officer for the Summer Villages of Seba Beach, Lakeview, Betula Beach and Kapasiwin, Telephone conversation. November 7, 2014

6.3 WEBSITES

ABMI (Alberta Biodiversity Monitoring Institute). Alberta wall-to-wall land cover map (vegetation) 2010 version 1.0. Accessed on January 7, 2015 at <http://www.abmi.ca/abmi/rawdata/rawdataselection.jsp>

Alberta GeoDiscover Portal. Accessed March 2015 at <http://geodiscover.alberta.ca/Viewer/?Viewer=GDA>.

ESRD (Alberta Environment and Sustainable Resource Development). *Environmental Protection and Enhancement Act and Water Act* Authorization Viewer. Accessed in March 2015 at: <https://avw.alberta.ca/ApprovalViewer.aspx>

ESRD. Alberta Water Well Information Database (AWWID). Accessed in March 2015 at <http://groundwater.alberta.ca/WaterWells/d/>

ESRD. Groundwater. Accessed in April 2015 at <http://esrd.alberta.ca/water/programs-and-services/groundwater/>

Natural Resources Canada. National Topographic Database (NTDB), Canada. Accessed January 12, 2014 at <http://geogratis.gc.ca/geogratis/DownloadDirectory?lang=en>

Paul First Nation. Accessed November 6, 2014 at <http://www.paulfn.com/>.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

October 9, 2015

Soils of Canada. Accessed April 1, 2015 at <http://www.soilsofcanada.ca/>. Developed by Department of Soil Science, University of Saskatchewan.

Appendix A **ENGAGEMENT INPUT**

A.1 STAKEHOLDER WORKSHOP

Date: November 12, 2014

Number of Attendees: 14

Workshop Session Notes

- Plan needs to establish development control over sub watershed which will help to control and better manage the land use.
- Afraid of what will happen to Biodiversity now that there is no more Commercial Fishing in Alberta
- Public is apathetic towards the state of the lake, because they believe it is healthy. Public takes for granted.
- What are the limits and capacity of development on the lake?
- Restrictions need to be placed on the amount of lakeshore clearing that is being done for back lot owners.
- Large political influence towards enforcement of negative impacts on the lake.
- Land use has negative impacts on surface and subsurface water.
- These policies need to make sure development does not affect water quality.
- When Lake is higher it is healthier, support weir level where it is.
- Need to regulate pressure on boat launches and recreation use of the sub watershed.
- The more people move around the lake, the more potential there is for negative consequences.
- ESRD has no time to address our concerns on the shoreline being modified without a permit.
- Lake Management Plan needs to include how they plan to maintain lake health now and in the future. (i.e., TransAlta stops pumping)
- Need more studies of unanswered questions surrounding air, noise, groundwater, surface water quality.
- The area needs a quality water treatment plan, and plan needs to ensure rules are followed.
- Municipalities do not have the power to regulate or enforce boat launches.
- Development pressure and the lack of enforcement of existing policies are issues that need to be addressed more often.
- The plan needs to include aquatic species
- Parking is an issue, parking needs to help regulate public coming in.
- Developing reclaimed mine area as recreational area.
- Need to better understand groundwater, too much pressure from users.
- Province is too busy to enforce septic tanks/fields.
- There may be new gaps because of changes to federal legislation (i.e., fish habitat).
- There needs to be a better integration between municipal and provincial governments on developing an invasive species plan.
- Lots of land uses need to be better regulated
- Concerns over the effects of too many users on the lake.
- Levels on the lake are too difficult to maintain seasonally, or annually.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix A Engagement Input
October 9, 2015

- Maintain and improvements need to be done on riparian health.
- There are concerns of permitting issues for new development (i.e., large clearing north side of the lake).
- Fish population strategy is working.
- Some small communities cannot afford enforcement officers. We are in need of someone who can do both municipal and provincial jurisdictions.
- Need to change from septic to holding tank, and they need to be better maintained.
- Boat launches should be close to the provincial parks, power plants, and important habitats.
- Most municipalities have land use by laws in place.
- Set banks required to protect riparian areas (i.e. cows and fish).
- There should be documents that disclose regulation impacts on lakes.
- Look at Parkland Counties Boat Launch study.
- Consider the historical context (i.e. the pending paleolimnology report).
- Once residents have transformed from well to serviced water may show impacts to lake may be noticed.
- Trans Alta may stop pumping water earlier than 40 years.
- Need to maintain as close to possible historic lake levels with natural range of variability – Look at amending agreement between TransAlta and Env.
- ESRD is developing an invasive species plan. Counties need to be better integrated in plan.
- Education – needs to be backed by strong enforcement. Lots of buck passing currently
- Plan needs to establish Development Control Area over the whole basin vs. planning through individual proposals

Workshop Questions:

- How is the sub watershed basin defined?
- Is there a relationship between the input of pure water and the low levels of blue green algae?
- What is the status of the mercury levels?
- What are the most current groundwater level studies?
 - Groundwater observation well network
- Any fracking?
- Can look at any approvals to determine.
- Will wildlife be considered? (i.e., wildlife corridors, species at risk, etc.)
 - Yes, to the extent that the data exists and scale to scope of the project

A.2 PUBLIC OPEN HOUSE

Date: November 12, 2014

Number of Attendees: 41

Open House Notes

- Is the toolbox applicable to eutrophic lakes? (i.e. Lake Isle, Lac Ste. Anne)
- Need better restrictions on agriculture holding lands
- Enforcement needs to be increased
- Need to check boat launches for zebra mussels
- Wooden docks an issue, lots of wood debris
- Wabamun Boat launch study needs to be done
- Need old air photo maps to show comparisons of growth impacts (1950, 1960, 1970, 1980)
- Is there any other old/chronological data that can be shown?
- Speeds boats and SeaDoos going to too close and too fast near bird nesting and habitat area around the lake.
- There needs to be more environmentally respectful development
- Concerns over proposed development near Wabamun waterfront park (loss of reeds, biodiversity, and habitat)
- There is a lack of enforcement on lake
- Noise of motor boats and SeaDoos in the summer and skidoos in winter.
- Concerns over speeding SeaDoos heading up Beaver Creek
- The environmental policy is too sensitive to eco-stability on private property
- Policies need to favor environmental development and recreational use.

Open House Map Notes:

- This Creek should be non-motor access only
- In this bay there is extensive bird nesting. There are disturbed when speed boats of SeaDoos sweep at high speeds along short lines and into the bay. People should have to cut engines in bay as they approach their beach.
- We need to enforce laws with respect to altering the riparian areas in front of private property. People are still clearing land right to the shore and when reports, the response are not good enough. It's time to slap on some big fines and restoration orders
- Protect habitat by beaver creek inflow
- Any areas with an existing biophysical inventory?
- Mapping should indicating ESA's
- This area has been clear cut and bulldozed. No notices or information has been provided about it. What is going on?
- Keep boat launches
- Sailing club uses all parking at day use parking lot
- Nesting birds are harassed by wakes from motor boats.
- At boat launch, minimum is not being obeyed

Appendix B MUNICIPAL AND PROVINCIAL LEGISLATION

B.1 MUNICIPAL AUTHORITY AND JURISDICTION

The authority for municipal planning, subdivision and development control is established in Part 17 "Planning and Development" of the *Municipal Government Act* (MGA). The purpose of this Part allows municipalities to adopt plans, land use bylaws and make planning decisions to achieve the beneficial use of land without infringing on the rights of individuals except to the extent necessary for the greater public interest. In addition, the Subdivision and Development Regulation provides for the administration of subdivision applications, subdivision and development conditions, registration and endorsements of subdivision and setbacks for provincial appeals.

The legislative framework for regional and municipal planning includes policy, operations, and appeal components. Municipalities establish planning policy by adopting statutory plans and land use bylaws. Policies are put into operation by municipally appointed subdivision and development authorities which are responsible for receiving and deciding on subdivision and development permit applications. These administrative decisions may be appealed to the subdivision and development appeal board or, in certain instances, to the Municipal Government Board.

Statutory plans allow municipal councils to establish general development policies for all or part of the municipality. Legislation provides for four types of statutory plans:

1. Two or more municipalities may adopt an inter-municipal development plan in respect of land where a consensus on use and development is desired. Such a plan typically relates to the fringe area of urban and rural municipalities or to shared natural features such as lakes.
2. The municipal development plan establishes policies for land use in the entire municipality. Municipalities with a population of 3500 or more are required to adopt a municipal development plan. Municipalities with a population of less than 3500 are encouraged to do so.
3. Municipalities may adopt area structure plans to establish the general land use, transportation, and servicing framework for specific areas undergoing substantial new development.
4. Municipalities may adopt area redevelopment plans to outline proposals for addressing planning issues when rejuvenating existing developed areas.

B.1.1 Municipal Government Act

B.1.1.1 Land Use Bylaws

The land use bylaw is the means of regulating the use and development of parcels of land. The MGA defines "development" as an excavation or stockpile, construction, renovation or repairs to a building, a change in the use of land or intensity in the use of land.

All municipalities are required to adopt a land use bylaw. The land use bylaw divides the municipality into districts, prescribing permitted and/or discretionary uses for each district.

The bylaw establishes development standards within each district and provides for a system for issuing development permits.

The MGA requires all municipalities to establish a subdivision authority to exercise powers and duties on behalf of the municipality. The subdivision authority is responsible for receiving, processing, and deciding on subdivision applications in accordance with the MGA, and other current enactments and regulations. A subdivision authority may include any or all members of council, a designated officer, a municipal planning commission, or any other person or organization.

B.1.1.2 Subdivision Control

Ordinarily, a person wishing to create one or more lots from a parcel of land must obtain subdivision approval from the municipal subdivision authority. Conditions may be attached to a subdivision approval requiring the applicant to:

5. Provide land as environmental reserve
6. Provide up to 30 percent of the land, less any land taken for environmental reserve or environmental reserve easement, for roads and public utilities.
7. Provide up to 10 percent of the land or money in place of land, less any land taken for environmental reserve or environmental reserve easement, for municipal and/or school reserves. Additional reserves may be required by the Subdivision and Development Regulation.
8. Enter into a development agreement to construct or pay for the construction of roads, walkways, public utilities, or off-street parking necessary to serve the development.
9. Pay an off-site levy for the capital cost of water, sanitary sewer, or drainage facilities. An off-site levy may be collected only once in respect of a parcel.

B.1.1.3 Development Authority

The MGA requires all municipalities to establish a development authority to exercise powers and duties on behalf of the municipality. The development authority is responsible for receiving, processing, and deciding on development permit applications. A development authority may include one or more of: a designated officer, a municipal planning commission, or any other person or organization. Most municipalities assign decision-making and administrative responsibilities to staff. In many municipalities, decisions involving discretionary authority are referred to a municipal planning commission.

B.1.1.4 Development Control

The land use bylaw requires development permits for most developments. Conditions may be attached to a development permit requiring the applicant to:

1. Enter into a development agreement to construct or pay for the construction of roads, walkways, public utilities, or off-street parking necessary to serve the development.
2. Pay an off-site levy for the capital cost of water, sanitary sewer, or drainage facilities. An off-site levy may be collected only once in respect of a parcel.
3. Comply with provisions specified in the ALSA regional plan and land use bylaw.

B.1.1.5 Appeal Boards

Municipalities are required to establish a subdivision and development appeal board to hear appeals from the decision of the subdivision or development authority. Municipal employees, persons who carry out subdivision or development duties or who are members of the municipal planning commission, may not be appointed to the appeal board. In certain situations identified in the MGA, subdivision appeals must be made to the Municipal Government Board. Planning and development bulletins contained in the Municipal Resource Handbook address specific situations in detail. Subdivision and development appeal board decisions and Municipal Government Board planning decisions may in turn be appealed to the Court of Appeal but only on a question of law or jurisdiction.

B.1.1.6 Obtaining Subdivision and Development Approval

All development must comply with the ALSA regional plans, the MGA, the Subdivision and Development Regulation, and the land use bylaw. Most development will require a development permit. In some cases, statutory plans and land use bylaws must be amended, or subdivision applications approved, before a development permit can be issued.

Statutory Plan and Land Use Bylaw Amendments

If a development proposal cannot be approved because it does not conform to the land use bylaw, a proponent may apply to the municipal council to amend the bylaw. If a statutory plan amendment is also required to accompany the land use bylaw amendment, municipalities generally will coordinate these amendments where required. A staff report and recommendation are usually prepared and forwarded to council. Notice must be given of an application for both a statutory plan and a land use bylaw amendment and council must hold a public hearing before giving second reading.

Council's decision on proposed amendments to the land use bylaw or statutory plans is final. There is no legislated time frame within which council must consider applications for amendment. Ordinarily, the minimum time is that required for at least two meetings of council, during which period notice must be given and the public hearing held. Depending on the

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

complexity of the amendment, additional time may be necessary to prepare more extensive staff reports and review.

Subdivision Application

If a development proposal requires land to be subdivided, a subdivision application must be submitted to the municipal subdivision authority. The proposed subdivision must conform to any statutory plan, land use bylaw, the MGA, and Subdivision and Development Regulation. Under section 6 of the Subdivision and Development Regulation, a subdivision authority must decide on an application within 60 days. An applicant may consider a failure to make a decision within this 60-day period a "deemed refusal." The subdivision authority may refuse an application, approve it, or approve it with conditions. The written decision of the subdivision authority must include reasons for its decision under Subdivision and Development Regulation.

Subdivision Appeals

The subdivision authority's decision or deemed refusal may be appealed to the subdivision and development appeal board. An appeal may be launched by the applicant, a provincial government department that was referred the application originally, council of the municipality (if the municipality is not the subdivision authority), or school authority (for matters related to municipal reserve and school reserve). Notice of the appeal must be filed with the subdivision and development appeal board within 14 days of receipt of the notice of the decision or the deemed refusal. If the notice was mailed, the MGA allows 5 days for the notice to be received. This means the appeal period extends to 19 days if the notice is mailed. If, based on the legislation, the application is determined to involve a provincial interest; the appeal must be to the Municipal Government Board. The subdivision and development appeal board must hold a hearing within 30 days and give a written decision with the reasons for the decision within 15 days of concluding the hearing.

The Municipal Government Board must hold a hearing within 60 days and give a written decision with reasons for the decision within 15 days of concluding the hearing. Regardless of which board makes the decision, it can be further appealed to the Court of Appeal on a question of law or jurisdiction.

Development Permit Application

After any required subdivision has been approved or statutory plan or land use bylaw amendments passed, a developer may apply for a development permit. An application for a permitted use that complies with the standards for a district must be approved, with or without conditions. Applications for discretionary uses or applications for permitted uses that do not meet all the standards set out for a district may be approved, conditionally approved, or refused. Applications for uses that are neither permitted nor discretionary within a district must be refused.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

The development authority must make a decision on a development permit within 40 days, unless the applicant and development authority agree to extend the time, and notify affected persons of the decision in accordance with the land use bylaw. An applicant may consider a failure to make a decision within this period a "deemed refusal."

Development Permit Appeals

An appeal may be launched by the applicant or by other affected persons by filing a notice of appeal with the subdivision and development appeal board within 14 days of receiving notice of the decision or of the deemed refusal. If mailed, the Interpretation Act deems the notice delivered after 7 days have lapsed, bringing the appeal period to 21 days. Where the use is permitted under the land use bylaw, decisions may be appealed only if the appellant believes the provisions of the bylaw were relaxed, varied, or misinterpreted. The subdivision and development appeal board must hold a hearing within 30 days of receiving the notice of appeal and must give a written decision within 15 days of the conclusion of the hearing. The board's decision may be further appealed to the Court of Appeal on a question of law or jurisdiction.

B.1.2 Relationship of Municipal Planning to Provincial Authority

While there is no provincial review or approval of municipal plans or bylaws the Province has set parameters around municipal planning authority. The relationship between the municipal planning and development authority and provincial authority comes under the following four main headings.

B.1.2.1 Exemptions

Under section 14 of the Interpretation Act, the MGA is not binding on Her Majesty. Thus, where the province is undertaking development, it is not required to obtain subdivision or development approvals although, in fact, it often does. Where the province has leased or transferred title to another party, however, that party must comply with the requirements of the MGA. The federal government and federal government agencies are also exempt. Under section 618 of the MGA, subdivision or development for roads, wells, or batteries, pipelines, and designated Crown lands are exempt from the provincial regulations and municipal bylaws under Part 17 of the MGA. The Planning Exemption Regulation exempts other developments such as hydro transmission and electric distribution lines and irrigation works undertaken by an irrigation district from the planning provisions. The MGA also exempts confined feeding operations and manure storage facilities as defined under the Agricultural Operations Practices Act.

B.1.2.2 Limitations

Various sections of the MGA and the Subdivision and Development Regulation establish rules or set limits on municipal planning authority. Examples include:

- Limitations on the content of off-site levy bylaws and development agreements

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- Limitations on land dedication for roads, municipal and school reserves
- Requirements to make decisions on subdivision and development permit applications within the time specified in the MGA.
- Requirements to notify the public of applications to amend statutory plans and bylaws, subdivision applications and development permit decisions.
- Subdivision processing requirements and setbacks and standards for subdivision and development contained in the Subdivision and Development Regulation.

B.1.2.3 Consistency

The MGA establishes that a licence, permit, approval, or authorization granted by the Natural Resources Conservation Board, Alberta Energy Regulator or Energy and Utilities Board prevails over any statutory plan, land use bylaw, subdivision decision, or development decision by a subdivision authority, development authority, subdivision and development appeal board or the Municipal Government Board.

The MGA also establishes that a condition of a provincial licence, permit, approval, or authorization prevails over any condition of a development permit that conflicts with it and provides for the establishment of land use policies and requires that municipal statutory plans, land use bylaws, and planning decisions be consistent with these policies. The Provincial Land Use Policies were approved by the Lieutenant Governor in Council on November 6, 1996.

The MGA also provides for the establishment of Edmonton International Airport vicinity protection area regulations. These regulations operate notwithstanding any statutory plan, land use bylaw or other regulations and are binding on a subdivision authority, development authority, subdivision and development appeal board, and the Municipal Government Board. A municipality must amend its statutory plans and land use bylaw to conform with the regulation.

B.2 MUNICIPAL BYLAWS

B.2.1 Parkland County - Municipal Development Plan Bylaw #37 (2007)

Parkland County's Municipal Development Plan (MDP) provides "policy direction for managing new growth while maintaining the viability of the County's agriculture industry and ensuring the sustainability of its rural communities and maintenance of its rural character." The MDP provides direction to move towards its vision of being a "sustainable community that provides an enhanced quality of life by balancing conservation of its natural environment with economic prosperity and lifestyle choices."

The applicable policies are as follows:

- Guiding Principles

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- 1. Support Environmental Sustainability – The County supports communities that are designed to minimize air, water, and soil pollution, reduce resource consumption and waste, and to protect natural systems that support life.
 - o Environmental sustainability, and, in particular, protecting natural areas is important to many County residents for managing future growth and for maintaining a high quality of life.
- New Best Practice Initiatives
 - 5. Encouraging Brownfield development which involves redeveloping, expanding, or reusing a property which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. The *decommissioning* of the Wabamun power plant site provides opportunity for Brownfield development in Parkland County.
 - 6. Encouraging the recycling and re-use of water by promoting, for example, the use of improved private sewage disposal systems wherein sewage is treated to produce *grey water* that can be used for irrigation purposes.
- Area Structure Plans
 - 14. The 1997 Highvale End Land Use Area Structure Plan that extends along the south side of Wabamun Lake and encompasses the Sundance and Keephills Power Plants as well as related cooling ponds and open pit mines. This Area Structure Plan provides a land use plan and policy structure for future development of the reclaimed mining lands in particular.
- **Agricultural Lands**
 - Goal
 - o To protect and enhance the County's valuable agricultural land resource, the agri-based economy and the rural lifestyle, while still accommodating appropriate non-agricultural land uses.
 - Objectives
 - o Promote agricultural practices that are sustainable and environmentally responsible.
 - o Conserve agricultural lands for agricultural and related uses.
 - o Encourage the growth and expansion of value added agricultural or industrial agricultural uses such as food processing facilities.
 - o Minimize land use conflicts between Confined Feeding Operations and rural residential and other forms of development.
 - o Provide direction for the evaluation of Confined Feeding Operations.
 - General Policies
 - o 2.1 To preserve the integrity of productive agricultural areas and the conservation of agricultural land, all land within Parkland County is deemed to be agricultural unless:
 - The land has a non-agricultural district designation in the Land Use Bylaw
 - The Land Use Concept Map indicates the predominate use of the land may not be agricultural in nature, or,
 - The land has significant environmental sensitivities or value such that the County deems the land should not be agricultural

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

While the use of agricultural land will be primarily for agricultural purposes, the use of agricultural land by non-agricultural uses may be allowed but only in accordance with the provisions of this Plan.

- o 2.2 Agricultural operations will be encouraged to be:
 - Consistent with the sustainable use of agricultural lands on which they are operating, and,
 - Practiced in a manner compatible with surrounding land uses and the environment.
- o 2.14 Value added agricultural industrial uses will be encouraged to utilize waste streams from industry or confined feeding operations in order to reduce the use of fossil fuels and minimize environmental impacts.
- o 2.15 CFO and manure storage facilities for which an approval or a registration is required pursuant to the Agricultural Operations Practices Act are not regulated by this Plan but by the Agricultural Operations Practices Act and associated regulations.
- o 2.16 Notwithstanding the jurisdiction and authority of the Natural Resources Conservation Board (NRCB) through the Agricultural Operations Practices Act (AOPA), the County, will through this Municipal Development Plan guide the location of confined feeding operations by the use of a confined feeding operation overlay map (Map 4). According to the Act, the NRCB shall have regard to the direction as provided for in the Municipal Development Plan, however, it is not bound by it. Accordingly, the County has produced a map providing direction to this authority. The map is based on specified criteria, which provides setbacks from CFO's to various types of land uses and natural features. The following setbacks have been used in determining areas where the County desires to prohibit CFO development.
 - All land within 3.2 km (2.0 miles) of a corporate boundary of a City, Town, Village or Summer Village;
 - All lands within 3.2 km (2.0 miles) of lands districted, and including those lands districted as CRC, CRE, CRR, CRH, RC, MHR and Cluster Country Residential Districts as referenced in the Land Use Bylaw;
 - All lands within 1.6 km (1.0 mile) of the municipal boundaries of Lac St. Anne County, Brazeau County, Leduc County, Yellowhead County and First Nations Reserves;
 - All lands within 0.8 km (0.5 miles) of land districted as ANC – Agricultural/Nature Conservation District as referenced in the Land Use Bylaw;
 - All lands within 0.8 km (0.5 miles) of named or numbered lakes;
 - All land within 0.8 km (0.5 miles) of named rivers and creeks;
 - In areas in which CFO's are precluded by the provisions of an approved Area Structure Plan or other statutory Plan.
- o 2.18 In directing and approving sites for land uses that are incompatible with a confined feeding operation, Parkland County will refer to NRCB for applicable MDS.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- **Residential Development**

- Objectives
 - o Mitigate conflicts with agricultural uses.
 - o Ensure that country residential development conforms to environmental and public health guidelines and regulations.
- General Policies
 - o 3.1 Multi-parcel residential subdivisions shall comply with the provisions of an applicable Area Structure Plan (Map 3) or an Outline Plan for the entire ¼ section will be required. The Outline Plan will include:
 - The location, dimension and boundaries of the ¼ section to be subdivided;
 - The portions thereof which the applicant proposes to register and all subsequent stages;
 - The location, area and proposed dimensions of all parcels, roads and points of access to all the proposed parcels;
 - Contour information, related to a geodetic datum at an interval of 2 metres is to be superimposed over the plan;
 - The location, dimensions, numbers and other designations shall be noted in respect to highways, secondary roads, public roadways, and rights-of-way or easements (including pipelines, well sites, power transmission and distribution lines and railway lines) on record in Land Titles which exist on or adjacent to the lands subject of the plan;
 - The location of all existing buildings or structures on or immediately adjacent to the lands;
 - The location, siting and plotting of natural and man-made physical features such as sloughs and/or other bodies of water, rivers, creeks and intermittent streams, muskeg or swamp, organic areas, subsidence information on valley banks, top of bank, wooded areas, man-made water bodies, major drainage ditches, gravel and/or clay deposits, and land under cultivation;
 - Proposed methods of handling surface drainage through preliminary storm water management;
 - Proposed methods of on-site servicing for potable water and sewage; and,
 - The location, dimensions and areas of all proposed municipal and environmental reserve parcels, public open spaces and public utility lots.
 - o 3.2 Notwithstanding Policy 3.1 and pursuant to Policy 6.2, an Outline Plan prepared in support of a Multi-parcel residential subdivision shall include a Biophysical Assessment for a site proposed for a Multi-parcel subdivision or major development if all or part of the site is located within areas defined as environmentally significant in the Environmental Conservation Plan, or if the site contains natural features such as sloughs or extensive tree cover.
 - o 3.20 Bareland Recreational resort subdivisions shall comply with the following criteria:
 - The proposed development is located adjacent to a lake or other similar waterbody, and/or other amenity feature to the satisfaction of Parkland County.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- o 3.22 Bareland Recreational Resort subdivisions may be serviced by privately owned communal piped water and sanitary sewer services that comply with the requirements of Policy 10.25, or the applicant shall demonstrate to the satisfaction of Parkland County the applicability of alternative servicing strategies.
- **Industrial and Commercial Development**
 - General Policies
 - o 5.12 Pursuant to Policy 5.11 and in cooperation with Trans Alta, the marketing strategy shall consider an approach for attracting heavy and medium industrial development to Trans Alta's reclaimed lands located north and south of Wabamun Lake. In particular, the strategy will consider attracting such industry to the Whitewood mine located along the north side of Highway 16. The reclaimed mine site provides an opportunity for a new Brownfield, eco-industrial type of heavy industrial park.
 - o 5.14 Resource extraction development proposals may be discouraged in close proximity to hamlets, predominately residential areas or in areas which are known to possess historical resources and/or unique environmental features that would be disturbed or destroyed by resource extraction.
- **Environmental Management**
 - Goals
 - o The County supports communities that are designed to minimize air, water, and soil pollution, reduce resource consumption and waste, and protect natural systems that support life.

The County supports protecting environmentally significant areas and, in particular, it supports maintaining the environmental integrity of the County's rivers, streams and lakes.

- Objectives
 - o Protect environmentally significant areas as identified by the Environmental Conservation Plan from inappropriate development.
 - o Reduce the impact of development on the natural environment to the extent possible.
 - o Apply Environmental Reserve and other provisions to protect environmentally significant areas.
 - o Protect water quality and quantity through effective subdivision design.
 - o Require a Biophysical Assessment as part of the development process.
 - o Promote public awareness regarding the impact of development on the environment.
- Policies
 - o 6.1 Lands deemed to be environmentally significant shall be protected using a variety of legislative and voluntary techniques such as Environmental Reserve dedication or the placement of Conservation Easements with particular emphasis on protecting the environmental integrity of the County's rivers, streams and lakes.
 - o 6.2 A Biophysical Assessment will be required for a site proposed for a Multi-parcel subdivision or a major development if all or part of the site is located within areas

- defined as environmentally significant in the Environmental Conservation Plan (see Map 5), and may be required within 0.8 km of areas defined as environmentally significant in the Environmental Conservation Plan, or if the site contains natural features such as sloughs or extensive tree cover. The biophysical assessment shall identify and evaluate the environmental significance and sensitivity of existing vegetation, wetlands, other water features, wildlife habitat and unique physical features, and shall recommend appropriate measures for protecting significant features.
- o 6.3 Environmentally significant areas shall be identified in an Outline Plan and the level of protection to be determined at the time of subdivision
 - o 6.4 Environmentally significant features, setbacks and hazard lands that meet the environmental reserve provisions of the Municipal Government Act shall be dedicated as Environmental Reserve at the time of subdivision, and subsequently managed by the municipality.
 - o 6.6 A property line setback from the top of the bank of a river or stream and/or the high water mark of a lake shall be applied. The appropriate setback distance shall be recommended by a qualified professional engineer acceptable to Parkland County
 - o 6.7 Where slopes are 15% or greater, the property line setback distance shall be set in accordance with the recommendations of a qualified professional engineer acceptable to Parkland County.
 - o 6.8 A Conservation Easement may be considered by landowners as a way of preserving significant natural features and areas that do not qualify as Environmental Reserve under the Municipal Government Act. The use and control of these features and areas shall be clearly stated in the easement agreement.
 - o 6.12 To protect the quality and quantity of surface and groundwater, Alberta Environmental Protection's Interim Guidelines for Evaluation of Groundwater Supply for Unserved Residential Subdivisions shall be applied to all applications for subdivision as well as groundwater evaluation and licensing requirements of the Water Act.
 - o 6.13 Subdivision and development proposals that involve hazard lands as defined by the Municipal Government Act shall be preceded by a geotechnical assessment conducted by a qualified professional engineer that demonstrates to the satisfaction of the County that slopes are stable, flood hazard areas are defined, safe building elevations exist and the potential for near surface groundwater, flood damage or erosion to existing or new developments is mitigated.
 - o 6.14 No permanent structures shall be permitted within the 1:100 year flood plain of any river, stream or lake shore. As well, unless proper flood proofing techniques are applied, permanent structures as not allowed within 0.5 meters vertical distance from the 1:100 year flood elevation, except for Lake Wabumun where the vertical distance has been increase to 1.0 metre. A certificate from a qualified professional engineer or architect will be required by the County to confirm that the development has been properly flood proofed.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- o 6.17 Section 3(1) of Public Lands Act – Chapter P-40 defines public lands as:
 - all permanent and naturally occurring bodies of water, and
 - all naturally occurring rivers, streams, watercourses and lakes,

Enforcement on Public lands is the responsibility of the Minister of Sustainable Resource Development

- **Municipal Reserve**

- Policies
 - o 7.2 For new country residential subdivisions located along lakeshores, the North Saskatchewan River Valley and the Pembina River Valley, Municipal Reserve shall be required to be linked with Environmental Reserve parcels to enhance public access and enjoyment of the water feature.
 - o 7.4 Municipal Reserve may be required to protect environmentally significant and valuable natural features as identified by a biophysical assessment prepared in support of an Outline Plan.
 - o 7.5 Municipal Reserve lands in Multi-parcel country or cluster residential subdivision shall be located to provide recreation/open space benefit to the residents and/or, where feasible, to allow for the development of a continuous linked recreation/open space or trail system.

- **Transportation and Utilities**

- Objectives
 - o Manage stormwater in a manner that sustains the quality and quantity of water being released into the County's water features.
- Policies
 - o 10.17 The County encourages alternative water conservation measures such as rain water collection and re-use of grey water to encourage greater sustainability and a more environmentally responsible community.
 - o 10.26 The enhancement of existing wetlands to serve as a constructed wetland storm water retention facility shall be supported.
 - o 10.29 Communication towers shall be located in a manner that minimizes the impact on the natural environmental and residential communities while recognizing the unique locational requirement for siting communication towers.

B.2.2 Parkland County - Land Use Bylaw #20-2009

Parkland County's Land Use Bylaw facilitates "the orderly, economical and beneficial development and use of land and buildings" by establishing "regulations for the use of land and buildings in Parkland County. It regulates the type, location and intensity of land use and buildings, and also outlines the process for rezoning land and applying for permits to develop property."

The applicable policies are as follows:



WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

• Part 2 – Land Use Districts

- Section 3 – Establishment of Land Use Districts
 - o 3.2 Overlay and District Boundaries
 - 1. The boundaries on the Land Use District Maps shall be interpreted as follows:
 - (c) where a boundary is shown as approximately following the edge or shorelines of any river, lake, creek or other water body, it follows the edge or shoreline. In the event of a change in the location of said edge or shoreline, it moves with same.
- Section 4 – Agricultural
 - o 4.1 AGG – Agricultural General District
 - 5. Other Development Regulations
 - (b) Dugouts shall not be located within 30.0 m (98.5 ft.) of any public road, or as approved by the Development Authority, and shall not encroach upon, or affect, any watercourse or drainage easement, and shall meet the minimum setback requirements of the applicable district
 - (e) Pursuant to the MDP, a biophysical assessment shall be required for a site proposed for a multi-parcel subdivision or a major development if all or part of the site is located within areas defined as environmentally significant in the *Environmental Conservation Plan*, and may be required within 0.8 km of areas defined as environmentally significant in the *Environmental Conservation Plan*, or if the site contains natural features such as sloughs or extensive tree cover.
 - (i) The biophysical assessment shall identify and evaluate the environmental significance and sensitivity of existing vegetation, wetlands, other water features, wildlife habitat and unique physical features, and shall recommend appropriate measures for protecting significant features.
 - o 4.2 ANC – Agriculture/Nature Conservation District
 - 5. Other Development Regulations
 - Same as in AGG
- Section 5 – Residential
 - o 5.1. CR - Country Residential District
 - 1. Purpose
 - To provide for traditional multi-parcel country residential subdivision/development identified in a statutory plan for that use and related uses, including minor agricultural pursuits. Subdivision and development may be serviced by private on-site systems.
 - 2. Uses

PERMITTED	DISCRETIONARY
	Animal Health Care Services
	Apiary
Bed and Breakfast Home	
	Boarding House

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

PERMITTED	DISCRETIONARY
	Cemetery
	Community Recreation Services
	Day Care Services
Demolition	
	Dugouts
	Dwelling, Duplex
Dwelling, Single Detached	
	Educational Services
Extensive Agricultural Development	
Extensive Livestock Development	
	Garden Suite
	Government Services
	Group Care Facility
	Group Home, Limited
	Group Home, Major
Home Based Business Level 1	
	Home Based Business Level 2
	Home Based Business Level 3
Home Day Care	
	Horticultural Use
	Indoor Participant Recreation Services
	Kennel
	Manufactured Home, Single Wide
	Medical Treatment Services
	Natural Resource Extraction/ Processing
	Natural Science Exhibit
	Outdoor Participant Recreation Services
Park	
	Professional, Business, Financial and Office Support Services
	Recreational Vehicle Storage
	Religious Assembly
	Riding Arena
	Secondary Suite

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

PERMITTED	DISCRETIONARY
	Shipping Container (maximum 1)
Show Home	
	Small Animal Breeding/Boarding
	Telecommunication Tower
	Tourist Campground, Destination
	Tourist Campground, Enroute
	Utility Services – Major Infrastructure
Utility Services - Minor Infrastructure	
Wind Energy Converter System (WECS) – Minor (1 System)	
	Wind Energy Converter System (WECS) – Minor (2 Systems)

- Subdivision
 - a) Parcel Area Requirement (for purposes of new parcel creation only)
 - o (i) Extensive agriculture and extensive livestock shall have a minimum parcel area of 16.2 ha (40.0 ac), more or less. The minimum parcel frontage shall be 399.9 m (1312.0 ft), more or less.
 - o (ii) Manufactured home, single wide and single detached dwelling shall have a minimum parcel area of 0.8 ha (2.0 ac) of contiguous developable land and a maximum parcel area of 4.1 ha (10.0 ac) for a single parcel or multi-parcel residential subdivision, unless greater area is required to include shelterbelts, buildings or other improvements related to the residential component of a farmstead. Minimum parcel width at the parcel front shall be 30.0 m (98.5 ft) excepting that it may be 20.1 m (66.0 ft) fronting onto an internal cul-de-sac.
 - o (iii) The maximum width:depth ratio for a residential parcel shall be 1:4.
 - b) Parcel Density Requirement (for purposes of new parcel creation only)
 - o (i) Extensive agriculture and extensive livestock shall have a maximum of two (2) 32.4 ha (80 ac) parcels or a maximum of four (4) 16.2 ha (40 ac) parcels, more or less, from a quarter section.
 - o (ii) Manufactured home and single detached dwelling for single parcel residential subdivision shall have a maximum of three (3) single residential parcels from an un-subdivided quarter section or a maximum of one (1) single residential parcel from an existing 32.4 ha (80 ac) parcel, more or less but not less than 28.3 ha (70 ac) unless significant physical features dictate otherwise at the discretion of the Subdivision Authority.
 - o (iii) For all other Permitted and Discretionary Uses, including multi-parcel residential subdivision, the parcel density requirement shall be determined by the Subdivision Authority.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- 4. Development
 - c) Setbacks for Principal Buildings
 - o (i) A minimum setback of 7.6 m (25.0 ft) shall be provided from the property line of an adjacent internal subdivision road.
 - o (ii) A minimum setback of 23.0 m (75.5 ft) shall be provided from the property line of an adjacent municipal road right-of-way.
 - o (iii) A minimum setback of 45.7 m (150.0 ft) shall be provided from the property line of an adjacent arterial road right-of-way.
 - o (iv) A minimum setback shall be provided as determined by Alberta Transportation for parcels adjacent to a highway.
 - o (v) A minimum setback of 6.1 m (20.0 ft) shall be provided from the side edge of the parcel, not adjacent to any roadway.
 - o (vi) A minimum setback of 6.1 m (20.0 ft) shall be provided from the rear edge of the parcel, not adjacent to any roadway.
 - d) Setbacks for Accessory Buildings
 - o (i) A minimum setback of 7.6 m (25.0 ft) shall be provided from the property line of an adjacent internal subdivision road.
 - o (ii) A minimum setback of 13.1 m (43.0 ft) shall be provided from the property line of an adjacent municipal road right-of-way.
 - o (iii) A minimum setback of 45.7 m (150.0 ft) shall be provided from the property line of an adjacent arterial road right-of-way.
 - o (iv) A minimum setback shall be provided as determined by Alberta Transportation for parcels adjacent to a highway.
- 5. Other Development Regulations
 - c) Pursuant to the MDP, a biophysical assessment shall be required for a site proposed for a multi-parcel subdivision or a major development if all or part of the site is located within areas defined as environmentally significant in the Environmental Conservation Plan, and may be required within 0.8 km of areas defined as environmentally significant in the Environmental Conservation Plan, or if the site contains natural features such as sloughs or extensive tree cover.
 - (i) The biophysical assessment shall identify and evaluate the environmental significance and sensitivity of existing vegetation, wetlands, other water features, wildlife habitat and unique physical features, and shall recommend appropriate measures for protecting significant features.
 - d) Permitted and Discretionary Uses are subject to the appropriate
- o 5.6 LSR – Lakeshore Residential District
 - 1. Purpose

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- To provide for development and redevelopment of smaller, pre-existing parcels along the lakeshore of Wabamun Lake, Jackfish Lake and Isle Lake. The district is intended to not allow for new subdivisions
- 2. Uses

PERMITTED	DISCRETIONARY
	Bed and Breakfast Home
	Community Recreation Services
Demolition	
Dwelling, Single Detached	
Home Based Business Level 1	
	Manufactured Home, Single Wide
Park	
	Secondary Suite
	Show Home
	Tourist Campground, Destination
	Tourist Campground, Enroute
Utility Services – Minor Infrastructure	
	Wind Energy Converter System (WECS) – Minor (1 System)

- 3. Subdivision
 - This district is intended for smaller, pre-existing parcels and no re-subdivision of existing parcels shall be determined
- 4. Development
 - b) Minimum side yard setback shall be:
 - o (ii) 6.1 m (20.0 ft.) for those parcels where the side yard is adjacent to municipal reserve, environmental reserve, lake shore, or internal subdivision road.
 - c) Minimum rear yard setback shall be:
 - o (i) 6.1 m (20.0 ft.) for the principal dwelling and accessory buildings adjacent to municipal reserve, environmental reserve or lake shore.
- Section 7 – Industrial
 - 7.5 RE – Resource Extraction District
 - o 1. Purpose
 - To permit agricultural production and related farming activities while permitting uses associated with the large scale exploration, extraction, processing and reclamation of coal resources located in the vicinity of Wabamun Lake and falling within a mine permit area designated by the Alberta Energy and Utility Board.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

o 2. Uses

PERMITTED	DISCRETIONARY
Apiary	
Aquaculture	
Auctioneering Services	
	Bed and Breakfast Home
	Bulk Fuel Depot
Demolition	
	Dwelling, Single Detached
Extensive Agriculture Development	
Extensive Livestock Development	
	Farm Vacation Home
	Garden Suite
	General Industrial Manufacturing/Processing
	Home Based Business Level 2
	Home Based Business Level 3
	Horticultural Use
	Indoor Participant Recreation Services
	Industrial Storage and Warehousing
Kennel	
	Manufactured Home, Single Wide
Natural Resource Extraction/Processing	
	Outdoor Participant Recreation Services
Security Suite	
Small Animal Breeding and or Boarding Services	
Telecommunication Tower	

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

PERMITTED	DISCRETIONARY
	Utility Services – Major Infrastructure
Utility Services – Minor Infrastructure	
Wind Energy Converter System (WECS) – Minor (1 System)	
	Wind Energy Converter System (WECS) - Minor (2 Systems)
	Work Camp

- Section 8 – Parks and Services
 - 8.1 PC – Conservation District
 - o 1. Purpose
 - To provide for the preservation of environmentally sensitive and significant areas and lands having significant natural capability for conservation, passive recreation and education.
 - 8.2 PR – Recreation District
 - o 1. Purpose
 - To permit the development of a variety of parks and public and private recreation facilities intended for passive and active outdoor recreation activities including buildings for community recreation and accessory uses to activities like golf courses.
- Section 9 – Direct Control
 - 9.3 Highvale End Land Use Direct Control District Regulations (DC Area 2)
 - 3. The intent of these regulations is to allow Council the flexibility and control necessary to plan and regulate all aspects of the development of the region relative to the requirements of the requirements of the Highvale End Land Use Area Structure Plan, as may be amended from time to time.
 - 4. The purpose of the Area Structure Plan is to provide a set of goals and policies that allow Parkland County and TransAlta Utilities to establish an acceptable pattern of land use, transportation and service infrastructure, natural spaces and restored land quality for the area subsequent to the reclamation of the land base after the completion of the open pit coal mining and completion of power generation at the Highvale and Sundance Plants.
 - 5. At the time of the adoption of these regulations, the underlying land use district of the Land Use Bylaw shall apply. As such, the underlying district for the defined areas shall be RE – Resource Extraction.
- Section 10 – Overlays
 - 10.2 Lake Wabamun Floodplain

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- o The purpose of this Overlay is to provide for the safe and efficient use of lands within the defined Lake Wabamun Flood Plain Area, within Parkland County, through the regulation of future land use and subdivision.
 - o 1. Application
 - This Overlay applies to those lands identified within the Lake Wabamun Flood Plain Area, which is defined as the 1:100 year Flood Plain (725.17 m ASL) elevation plus 1.0 m (3.7 ft), which will be verified at the time of subdivision or development through a topographical survey conducted by a professional land surveyor.
 - o 2. Only the following uses shall be considered on a discretionary basis within the Lake Wabamun Overlay:
 - Private open space;
 - Environmental reserve or natural areas;
 - Existing uses, buildings and structures provided such uses, buildings and structures were approved by the County prior to the passing of this Bylaw;
 - Extensive agriculture;
 - Forestry;
 - Public utilities;
 - Passive outdoor recreation;
 - Golf course with environmental protection plan excluding a clubhouse; and
 - Dwelling, single-detached and accessory building, provided such uses, buildings and structures are located 1.0 m (3.3 ft.) above the 1:100 year Flood Plain and mitigating measures are taken to the satisfaction of the Development Authority.
- **Part 3 – Development Regulations**
 - Section 11 – General Regulations
 - o 11.3 Development on/or Adjacent to Hazard Lands
 - 1. No development shall be permitted within the 1:100 year Flood Plain of the North Saskatchewan and Pembina Rivers, Atim Creek, Big Lake or other water body or natural feature, unless in strict compliance with Section 10.2, Section 10.3, and this Section of the Bylaw.
 - 3. A development permit application may be subject to a Slope Stability Assessment, Biophysical Assessment as per the Municipal Development Plan, Environmental Risk Assessment or Environmental Impact Assessment, at the discretion of the Development Authority, that reviews the suitability of the resulting development to the subject site and considers the effect of the resulting development on the stability of the slope, including potential mitigation measures for the site and proposed structure(s).
 - 4. When considering a development permit application involving land in or near Environmentally Sensitive Area, as defined by the Municipal Development Plan,

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

the Development Authority may refer the application to federal or provincial departments and other relevant environmental agencies for comments prior to reaching a decision.

- 6. Buildings setbacks from hazard lands shall be as follows:
 - A minimum of 30.0 m (98.5 ft.);
 - A minimum of 50.0 m (164.0 ft.), in industrial land use districts;
 - A lesser distance specified in a geotechnical analysis required pursuant to Subsection 11.3.2; or
 - A lesser distance that in the discretion of the Development Authority, is considered acceptable, from the top of bank, as determined pursuant to Subsection 11.3.2, or any other escarpment or steep slope where the grade exceeds 30%.
- Section 14 – Parking and Loading
 - o 14.1 General Parking and Loading Requirements
 - 3. Grades and drainage shall dispose of surface water. In no case shall grades be established that would permit surface drainage to cross any sidewalk or site boundary without the approval of the Development Authority.

Complementary to the Land Use Bylaw are a series of Land Use District Maps. These maps detail the current and future land uses within Parkland County. In particular, 3 of these maps apply to the Wabamun Lake Subwatershed area: Map's 2, 5 and 6.

Map 2 deals with the area around the Summer Village of Seba Beach and the western shore of Lake Wabamun. In this area, the Map prescribes three types of uses: Country Residential District (CR), Lakeshore Residential District (LSR), and Bareland Recreational Resort District (BRR). In this area, the majority of the land use is designated as CR.

Map 5 deals with the remainder of the shores of Lake Wabamun. Lands directly adjacent to the lake's north shore are designated as Rural Central District (RC), Agricultural Nature Conservation District (ANC), Recreation District (PR), Country Residential District (CR), and a portion of DC (Area 3) –Whitewood. The east shore of the lake is shown to be designated as either Lakeshore Residential District (LSR), PR, or the Wabamun Indian Reserve No. 133 A. The Map shows the lands along the south shore of the lake as being designated for LSR, CR, or DC (Area 2) – Highvale End.

Map 6 concerns itself primarily with the cooling ponds south of Lake Wabamun. Around these pools, the map designates the land use as DC (Area 2) Highvale End and DC (Area 4) Keephills.

B.2.3 Parkland County - Environmental Conservation Master Plan - 2014

The updated Environmental Conservation Master Plan (ECMP; Parkland County 2014) is a critical tool to assist the County in updating its Municipal Development Plan (MDP). Findings from the Environmental Conservation Master Plan will directly guide the development of the environmental section, principles and goals for the new Community Sustainability Development Plan (CSDP), which will contain the updated MDP. As a statutory plan, the CSDP will be one of

the key means to implement specific findings from the ECMP. The ECMP will also be used to inform the development of new Area Structure Plans, as well as updates to existing plans. Findings will also be used to guide the County's update to the Land Use Bylaw. The ECMP will also inform future policies and regulations developed for these statutory plans. Used in conjunction with each other, these plans represent a suite of holistic planning tools to guide environmental management in Parkland County for current and future generations. The following sections provide information on the ESAs that are of relevance to the WLSLUP (text extracted from Parkland County 2014).

B.2.3.1 Isle Lake ESA

Environmental Sensitivity: Very High

- Due to shallow depth of lake and nutrient runoff from surrounding land uses, it is vulnerable to nutrient loading, blue-green algal blooms with associated toxins, and fish kills
- Due to interconnectivity of regional hydrology network and high groundwater sensitivity (permeability of thalweg soils overlaying the aquifer, making it vulnerable to contamination)
- Due to a few rare plant occurrences

Land Status:

- Both Private and Crown land parcels surround the lake within this ESA

Key features:

- The lake provides habitat and nesting for sensitive waterfowl species
- It is an important drainage area in the Sturgeon River system

Recommended Planning Strategies:

- Identify the nutrient sources and quantify the nutrients entering the Lake via inflow streams that drain from the watershed using water quality modelling techniques
- Estimate internal nutrient supply from lake bottom sediments
- Determine a measured nutrient budget and annual loading limits for the Lake using water quality modelling
- Monitor the trophic state of the Lake bi-annually
- Agricultural operations in the vicinity of Isle Lake, in conjunction with the
- Sturgeon River Headwaters ESA, needs to focus on reducing fertilizer use to reduce nutrient runoff to Isle Lake
- Encourage agricultural operators to use best management practices such as ALUS (Alternative Land Use Services) program to protect creeks and rivers entering into Isle Lake
- Where possible, relocate livestock wintering and feeding areas in close proximity or upstream of Isle Lake and tributaries
- Encourage home owners through education and incentives to install pumpouts and holding tanks in order to reduce pollution impacts from private sewage systems
- Upgrade sewage treatment to minimize pollution impacts from wastewater systems
- Protect and enhance wetlands and riparian areas surrounding the lake to buffer and enhance filtration of nutrient laden runoff from nearby source areas

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- Protect the fen near the Isle Lake inlet from further disturbance
- Consider a hypolimnetic aeration system to optimize withdrawal of nutrient rich water from lake bottom
- Provide educational materials to the public to increase awareness of the relationship between lake water quality and land use
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- Native habitat in areas surrounding the lake (on both north and south shores) is being lost to developmental pressures. Increasing development also alters the drainage patterns and contributing areas to the lake. Further development could be limited or prevented in these areas.
- Shoreline habitat is being lost or altered, which reduces the ability of the lake to function ecologically. Prevent or minimize development within the shoreline areas to restore habitats.
- Western and eared grebe nesting colonies are vulnerable to human disturbance.
- Adequate buffering of the lakeshore environment from future developments would be beneficial to the integrity of the lake.
- Encourage cabin owners to follow good shoreline protection practices by maintaining and restoring a vegetated buffer along the lake
- Human disturbances (i.e., personal watercraft, large boats) and surrounding developments contribute contaminants to the water body and disrupt the aquatic life.
- Boat speed limits fall under the purview of Transport Canada with the Federal Government responsible for enforcement.
- Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, environmental assessment studies) for proposed developments within 100 meters of the lake. Negative environmental assessments would require significant development alterations or would be disallowed from future development.
- Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the lake. Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.
- In an effort to address net cumulative effects around the lake, a new Inter-municipal Plan, as described in section 631 of the Municipal Government Act, should be drafted to coordinate strategic development around the entire Lake and its drainage basins.
- Undertake completion of a State of the Watershed Report and Lake Management Plan for Isle Lake
- Encourage stakeholders to participate in the watershed stewardship group and the development of a watershed management plan (e.g. Alberta Lake Management Society, 2013).

B.2.3.2 Wabamun Lake ESA

Environmental Sensitivity: Moderate

- Due to some groundwater sensitivity, with few occurrences of rare plants

Land Status:



WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- Crown Land surrounds small portions of the lake. The Village of Wabamun is located on the north side and the Summer Village of Seba Beach is on the west end. The Wabamun Indian Reserve borders the east side of the lake, while TransAlta Utilities Company owns most of the land along the south shore, and Coal Point has a YWCA camp. Most of the north side has privately owned lakeside lots, including permanent residences and seasonal cabins.

Key features:

- Large lake system with significant wildlife and fish habitat, and recreational values
- Key features:

Recommended Planning Strategies:

- Concerns have been expressed that operation of coal-fired power plants adjacent to the lake and discharge of cooling water have significantly altered the ecology of Wabamun Lake. Negotiate with TransAlta to develop mitigation practices.
- A western grebe nesting colony along the north shore of lake is vulnerable to human disturbance. Adequate development setbacks from the lakeshore environment would be beneficial to the ecological integrity of the lake.
- Peregrine falcon nesting sites are also vulnerable to disturbance. Development set-backs should be considered in these areas as well.
- Historical overfishing on the lake is a concern. As of fall 2013, all fishing in Lake Wabamun was catch and release only; management of recreational and commercial fisheries is the responsibility of the Fish and Wildlife Division, Alberta Environment and Sustainable Resource Development. A walleye reintroduction program has been recommended with complete restriction to breeding and rearing areas (Schindler, 2004).
- Encourage cabin owners to follow good shoreline protection practices by maintaining a vegetated buffer along the lake.
- Residents should be aware of the effects and consequences of modifying shorelines and pulling weedbeds (Schindler, 2004) and how to manage nuisance plants.
- Land uses around the lake should be managed from an ecological perspective
- It has been recommended to allow water levels in the lake to naturally fluctuate and not artificially alter them using the weir (Schindler, 2004).
- The industrial lands in the contributing watershed should be reclaimed to locally common habitats as soon as they are no longer required for operations (Schindler, 2004)
- Concern has been expressed about degrading water quality in the lake due to surrounding cottage development, agriculture, the 2005 CN Rail oil spill and adjacent industrial development. CN Rail train derailed on the shores of Wabamun Lake on August 3, 2005, spilling more than 700,000 L of a variety of fuel oils and pole treating oils into the lake. It has been recommended to provide more stringent guidelines for fertilizer use, development, thermal pollution and waste disposal to improve water quality, and develop a monitoring program to evaluate water nutrients and other contaminants (i.e., metals and coliforms) (Schindler, 2004).
- Boat speed limits fall under the purview of Transport Canada with the Federal Government responsible for enforcement.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for noncompliance.
- Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the lake. Examples include The Water Act, and The Environmental Protection and Enhancement Act.
- Refer to the Wabamun Lake State of the Watershed report (2013)
- Undertake completion of a Lake Management Plan for Wabamun Lake

B.2.3.3 Canada Geese ESA

Environmental Sensitivity: Very High

- High erosion risk
- High risk of groundwater contamination

Land Status:

- Private land

Key features

- Large wetland surrounded by extensive forest habitat

Recommended Planning Strategies:

- Maintain the natural character of the area
- Ensure connectivity with neighbouring natural patches
- Ensure disturbances occur away from erodible areas
- Prevent groundwater contamination

B.2.3.4 East Pit Lake ESA

Environmental Sensitivity: High

- High groundwater sensitivity
- Observations of rare plants
- Peatlands present in the ESA
- Riparian areas present

Land Status:

- This ESA is located on Crown Land parcels managed by the Alberta Fish and Game Association

Key features:

- Reclaimed waterbody and surrounding uplands that support a variety of wildlife and recreational uses

Recommended Planning Strategies:

- Limiting fragmentation by restricting linear feature development and maintaining large patches of native vegetation are important for conserving wildlife corridors and ungulate wintering habitat

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

B.2.3.5 Fallis Slopes ESA

Environmental Sensitivity: Very High

- Steep slopes >15% occur in many locations throughout; steep slopes >20% occur in several locations
- High potential for erosion as well as high groundwater contamination risks for coarse sediments

Land Status:

- Private land

Key features:

- Steep slopes, large connected forest patch in close proximity to Wabamun Lake

Recommended Planning Strategies:

- There are concerns over allowing future gravel pits in the ESA
- If future gravel pits are approved, these should apply appropriate erosion and sediment control practices, best practices, progressive reclamation, and landscape ecology principles in their plans and designs
- Prohibit clear cutting on slopes to minimize risk of erosion and sediment loading in Wabamun Lake

B.2.3.6 Seba Beach / Junior Forest Wardens ESA

Environmental Sensitivity: High

- High groundwater sensitivity
- Many observations of rare plants
- Riparian areas present

Land Status:

- One quarter section is owned by Parkland County. The rest is privately owned.

Key features:

- Movement corridor connecting surrounding areas
- Good habitat for ungulates

Recommended Planning Strategies:

- Recreational activities including hunting and OHV use appear to be popular in the area. Minimize access point into the area in order to minimize land disturbance by OHV use
- A mobile home park is located directly east of the area. Prevent potential for expansion west into the ESA

B.2.3.7 Wabamun Creek ESA

Environmental Sensitivity: Very High

- High erosion risk



WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- High risk of groundwater contamination
- Sensitive riparian areas

Land Status:

- Almost half the length of the creek is contained in the Wabamun Lake Indian Reserve. The remaining section is private land, except for a portion entering the North Saskatchewan River Valley.

Key features:

- Intact riparian areas
- Important spawning area for lake sturgeon
- Important wildlife corridor

Recommended Planning Strategies:

- Agricultural activities must be managed to avoid impacts to remaining sensitive riparian areas
- Gravel pits should be either avoided or carefully managed at the junction of Wabamun Creek and the North Saskatchewan River in order to protect critical habitat areas
- Creek bed must be maintained to ensure spawning grounds remain intact.
- Access to riparian areas should be limited in order to minimize disturbances
- Wildlife movement corridors between Wabamun Lake and the North Saskatchewan River valley

B.2.3.8 Wildlife Point ESA

Environmental Sensitivity: Very High

- Very high erosion risk
- Risk of groundwater contamination
- Presence of rare plants

Land Status:

- Private and Crown Land

Key features:

- Natural area, surrounded by lake shore development

Recommended Planning Strategies:

- Management of this area will require collaboration with property owners along the lake shore, to ensure that wildlife movement along the northern shore is maintained.
- Access from the northeast and northwest into the Fallis Slopes ESA should be maintained.

B.2.3.9 Deer Lake Area ESA

Environmental Sensitivity: High



WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- Due to high groundwater sensitivity

Land Status:

- Private land

Key features:

- Unique complex of lakes and wetlands interspersed with upland forests

Recommended Planning Strategies:

- Development pressures that result in the drainage or alteration of drainage patterns, and drought conditions have reduced the extent of wetland habitats.
- Also, the development of rural subdivisions has resulted in fragmentation of the surrounding upland habitat
- It would be beneficial to limit further rural development around lakes and maintain setbacks around existing water bodies
- Further development should aim to maintain or restore natural drainage patterns in the Deer Park drainage system (between Mallard Park wetlands and Deer Lakes wetlands) as it supplies surface water to the Deer Lakes system

B.2.3.10 Jack Pine Grazing Reserve ESA

Environmental Sensitivity: Moderate

- Potential erosion risks
- Potential for groundwater contamination

Land Status:

- Provincial – Grazing Reserve administered by the Public Lands Alberta Sustainable Resource Development; Private – adjacent lands

Key features:

- Large grazing area provides connection through the central axis of the county
- The reserve provides habitat to a wide variety of species
- Relatively undisturbed drainage and surrounding upland habitat are located on the northeast side of the reserve

Recommended Planning Strategies:

- Forested areas are highly fragmented, and movement between these patches should be ensured
- Heavy grazing has impacted the wildlife value of the open space in the reserve
- Current and future oil and gas developments
- Recreational uses (off-highway vehicles) should be managed appropriately

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

B.2.3.11 Shoal Uplands Habitat ESA

Environmental Sensitivity: Moderate

- Erosion risk
- Some potential for groundwater contamination

Land Status:

- Private land

Key features:

- Connecting habitat between the North Saskatchewan River valley and Lake Wabamun
- Ice-thrust blocks and moraine landforms

Recommended Planning Strategies:

- Grazing practices should be designed to maintain wildlife connectivity between the river valley and the lakes to the north
- Drainages should remain undisturbed wherever possible

B.2.3.12 Sundance Natural Area and Surrounding Areas ESA

Environmental Sensitivity: High

- Erosion risk
- Some potential for groundwater contamination
- Riparian areas

Land Status:

- Provincial Natural Area – Recreation, and several surrounding lands owned by
- AltaLink and other landowners

Key features:

- Channeled creek with erodible banks
- Abundant wildlife
- Snowmobile trails

Recommended Planning Strategies:

- The area serves as an important stepping stone connection between the southwest with similar areas to the south east. The areas immediately north west of the Sundance Natural Area are highly disturbed by open-pit mining, and travel through these areas is heavily restricted. For this reason, maintaining stepping stones of habitat between the ESA and larger patches of natural habitat in the southern portion of the County is critical to conserving overall landscape connectivity and regional biodiversity.

B.2.4 Parkland County – Highvale End Land Use Area Structure Plan Bylaw #28-1997

Parkland County's Highvale End Land Use Area Structure Plan (ASP) is intended to "provide a set of goals and policies that will allow Parkland County and TransAlta Utilities to establish a rational acceptable pattern of land use, transportation and service infrastructure, natural spaces and restored land quality for the area defined as the Highvale Mine located to the south of Lake Wabamun in Parkland County."

The applicable policies are as follows;

- 1.4 Policies
 - 1.4.1 Types of Land Use:
 - o Agricultural Mixed Use District (AMU)

This land use would extend from south of the Sundance Shore Line Road to link to the same district to the south of the study area (See Policy dealing with development control)

- o Country Residential District (CR)

This land use would apply as currently applied across the lake shore up to the Sundance Shore Line Road. (See policy dealing with development control)

- o Direct Control (DC)

Two Direct Control Districts shall be established one centered on the Sundance Thermal Plant (the residential complex built to house employees for this plant), and the other around the Keephills Thermal Plant. The primary purpose of these Direct Control Districts is to:

- o Allow for the possible development of new commercial enterprise of other industries within the areas utilizing the existing infrastructure systems available, and
- o Allow for a more concentrated development (cottage or recreation activities), that will utilize the existing infrastructure systems available. (See Policy dealing with development control)
- o Agriculture/Nature Conservation District (ANC)

This land use would apply to the Provincial Natural Conservation Area (E ½ Section 11 Twp 52 Rg 5 W5M), the Wabamun Lake Natural Area (pt N1/2 Section 33-52-5-W5M), and the Wildlife and Habitat regeneration areas such as those around the decommissioned Sundance Cooling Pond, the area east of Range Road 42 and north of Secondary Highway 627, and/or End Cut lakes in order to:

- o Protect the natural features of the topography, vegetation and wildlife in the area;

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- o Provide wildlife and habitat corridors from Wabamun Lake shore line to the hinterland; and
 - o To protect existing undisturbed and newly constituted drainage channels and water ways.
- 1.4.2 Recreation and New Recreation Opportunities
 - The policies related to recreation opportunities shall be determined in relation to:
 - The shore line of Lake Wabamun;
 - The End Cut Lakes;
 - Along both natural and reclaimed stream beds or drainage systems, and
 - Any re-established waterfowl and wildlife areas around re-established ponds (i.e. Goose Quill Bay).
 - While these areas have been designated as either Country Residential District, Agricultural/Natural Conservation District, and/or Agricultural Mixed Use District for now, the potential for new recreation opportunities exists.
 - The following criteria shall apply when assessing potential applications:
 - o Ownership of the land – this would determine responsibility for any built structures located on the lake shore of the End Cut Lakes and access roads;
 - o Geological stability of the shore line from both erosion and from potential subsidence and slumping;
 - o The requirement to provide information and assurance that a potable water supply and proper sewage disposal methods can be provided without polluting the End Cut Lakes or Wabamun Lake, and
 - o That services (telephone, power), can be economically extended to service the area.
 - The expansion of water and sewer services from a central water treatment plant and to an established sewage lagoon might also be considered provided that they meet the engineering and geotechnical criteria established for this area.
 - Natural gas services require the same assessment before being permitted in any area.
- 1.4.3 Development on Reclaimed Mine Areas.
 - The process established new land uses and development on reclaimed mine lands must occur in a manner to protect the interests of all parties – future land holders, miner operator, and responsible government jurisdictions. Future development needs to be selected for and adopted to the risks and limitations related to ground subsidence, ground and surface water, contaminants, and soil conditions of the post mine landscape. The following policies are designed to minimize potential conflicts and problems in the transition to new land uses:
 - 1) Development Approaches – when the existing or future owners of reclaimed mine lands wish to make improvements involving the structures of infrastructure (roads, utilities, sewage disposal systems, etc.) an additional requirement to normal development/building permitting process would be required to ensure

- appropriateness of improvements and to limit liability with respect to the effects of mining. Additional submissions would be required for:
- Geotechnical study for structures and infrastructure,
 - The evaluation of the suitability for the development of intensive livestock operations shall be reviewed as a discretionary land use where details of ground water, manure management, and surface drainage information must be provided as part of the application,
 - The provision of potable water supply and sewerage disposal systems for residential development which meets Parkland County standards.
- 1.4.5 Reconstituted Streams and Creeks
- o All of the natural surface drainage of the pre-mine drainage basins is to be returned to Wabamun Lake via reconstructed drainage courses and existing streams that have natural characteristics and support a diversity of plant communities and wildlife.
 - o The channels of drainage courses should exhibit the natural sinuosity, channel profile and cross-section and valley shape which is naturally stable and regionally prevalent.
 - o The rate of surface runoff should be roughly equivalent to the pre-mine landscape. Drainage courses should incorporate water bodies, and wetlands which slow down and even out the release of surface drainage into Wabamun Lake. Wetlands serve valuable ecological functions including the filtering of impurities and the creation of habitat diversity.
 - o Where possible:
 - Drainage courses which rely on licenced drainage and drop structures should be redesigned using the above principles;
 - Economically feasible road crossings of natural drainage features should be designed to facilitate the movement of wildlife along the drainage course, and
 - The terrain immediately beside the new drainage course should be designed to discourage agricultural activity and encourage colonization by natural plant and animal communities
 - o Natural Streams that still exist after mining should be afforded the same protection as reconstituted streams.
- 1.4.6 Ecological Conservation Areas (ECA)
- o Landscape corridors along drainage courses and water bodies are to be designated as Ecological Conservation Areas and managed to promote natural ecosystem re-establishment and conservation. Designated ECA's will have special controls and development criteria designed to promote natural and partially assisted re-establishment:
 - Terrain which discourages other economic activities;
 - Re-vegetation with natural vegetation communities, and
 - Development and use restrictions which gives young plant communities time to establish
 - o ECA's should be established:
 - Along existing undisturbed and reconstituted streams and creek banks;

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- Around End Cut Lakes;
 - Around wetlands that are to be retained, and
 - Around portions of the Wabamun Lake shoreline.
 - Landscape corridors need to be of sufficient width to permit cover establishment for wildlife movement corridors. A guideline setback is recommended of 50-150 meters from the shoreline of a water body or center of a drainage course.
 - Because to majority of the land is currently under a single owner (TransAlta Utilities), changes in ownership rights may be more easily implemented. Although it is recognized that Environmental Reserves or Environmental Reserve Easements may only be claimed by the County at the time of subdivision, it is hoped TransAlta Utilities would voluntarily undertake to establish the limits of environmental reserve, either by caveat or through manipulation of the topography in the area where environmental reserve might be best suited.
- 1.4.7 Sundance Provincial Natural Area, and the Wabamun Lake Natural Area
 - o The natural areas (E1/2-S11-52-5-W5_ and N1/2-S33-52-5-W5M) designated by the Province as a natural areas should be maintained in perpetuity as an ecological reserve and natural area. Management of the Provincial Natural Area and the Wabamun Lake Natural Area, should be reviewed periodically by the County in conjunction with Alberta Environmental Protection and local interest groups. Management objectives need to be established for conservation and low impact use of these sites.
 - 1.4.8 Waterfowl Habitat
 - o Land use and cooling pond reclamation in the eastern half of the Area Structure Plan Study area needs to support the habitat conditions for waterfowl use identified in the Canada Land Inventory. Policies include:
 - Supportive land-use districting (e.g. ANC – Agriculture/Nature Conservation District), and
 - Design of remnant cooling ponds for productive waterfowl habitat as a prime land use objective.
 - 1.4.12 Intensive Livestock Development
 - o Within the Agricultural Mixed Use District within the Area Structure Plan area, all proposed livestock developments shall be considered as Discretionary Uses. No intensive livestock development shall be approved unless detailed information is provided that will ensure availability of an adequate water supplies and that there is a capability to properly manage effluent runoff and manure waste.
 - 1.4.13 Links to the Lake Wabamun Management Plan
 - o The area north of the Sundance Shore Line Road and the Wabamun Lake shore falls under this Management Plan. Reference should be made to this document and to the Land Use Bylaw for any new development within this area.
 - 1.4.15 Obligation of Parties
 - o There is an obligation for TransAlta Utilities, under the conditions of the approval to mine, to fulfill specific requirements regarding re-establishment of roads, survey lands,

- habitat, and the method of disposing of reclaimed and/or surplus land within the mine and to keep the public informed of the reclamation process.
- o The Area Structure Plan and supporting documents do not affect any prior agreements, or create any agreements between Parkland County and TransAlta Utilities Corporation.

B.2.5 Summer Village of Betula Beach Land Use Bylaw No. 03-02

The Summer Village of Betula Beach Land Use Bylaw No. 03-02 provides for "the orderly, economical and beneficial development of land and buildings within the Summer Village of Betula Beach using the regulating powers provided for in the Municipal Government Act." Relevant policies are as follows:

- Section 33 DEVELOPMENT ON LANDS CONTAINING A HIGH WATER TABLE
 - (1) Residential development of any development generating sewage effluent shall not occur on lands containing a high water table unless and until satisfactory arrangements are made to provide adequate fill or trenching so as to lower the water table to a suitable level. In this respect the Development Officer may require testing to confirm that the water table has been suitably lowered.
 - (2) the Development Officer may refer to Alberta Environmental Protection for their comments prior to issuing a development permit for filling or trenching or for assistance in assessing any water table results.
- Section 35 SEWAGE DISPOSAL
 - (5) On Parcel Sewage Collection system:
 - o No privy shall be constructed closer than
 - (iv) 20.0m (66.0 ft) from any body of water, including the lake
- Section 38 DEVELOPMENT ON HAZARDOUS LANDS
 - (3) The Development Officer may consult with Alberta Energy and Natural Resources to assist in determining high water marks, floodplain area, banks and the like of the lake or its tributaries.
- Section 43 R – RESIDENTIAL DISTRICT
 - (5) (e) Notwithstanding any other provisions in this Bylaw, the Development Officer shall ensure that accessory buildings and uses do not jeopardize the lake environmentally or aesthetically and in this respect may require that any accessory use or building meet more stringent requirements than those cited within this district
 - (6) Basements: Basements shall not be allowed where high water tables would in all likelihood cause flooding to occur.
- Section 44 P – PARK AND RECREATION DISTRICT
 - (1) The General Purpose of this District is to provide land for recreational development
 - (2) Permitted Uses
 - o Recreational Use
 - o Public park
 - o Accessory building

- Discretionary Uses
 - Public building or use
 - Caretaker's residence
- (3) Development Regulations: All regulations shall be at the discretion of the Development Officer. The design, siting, landscaping, screening and buffering shall minimize and compensate for any objectionable aspects or potential incompatibilities with development in abutting districts.

B.2.6 Summer Village of Kapasiwin Land Use Bylaw #242 (2012)

The Summer Village of Kapasiwin Land Use Bylaw #242 (2012) identifies the land uses in the Summer Village. Relevant Policies include:

- Section 11 CONDITIONS OF DEVELOPMENT PERMIT
 - 7. Environmentally Sensitive Lands, any development on lands, which are designated or deemed by the Development Officer to be environmentally sensitive, shall be discouraged or carefully controlled.
 - a) When reviewing an application for development on environmentally sensitive lands, the Development Officer shall consider the following:
 - i) The impact of the proposed development on the subject and surrounding area and Lake
 - ii) The soil types and conditions of the area surrounding the subject property
 - iii) Any information on the past history of the subject property and surrounding area from a geo-technical perspective and
 - iv) Comments and recommendations from the Ministry of Environment and Sustainable Resource Development.
 - b) As part of the Development Permit application, the Development Officer may require a geo-technical study, prepared by a qualified geo-technical engineer, addressing the proposed development. The geo-technical study shall establish building setbacks from property lines based on land characteristics of the subject property.
 - c) The Development Officer may require the following as conditions of approval for a Development Permit application on land which is considered environmentally sensitive:
 - i) that measures be taken to ensure that infiltration into area slopes, the subject property and adjacent lands are minimized , and
 - ii) that measures be taken to reduce impact on environmental sensitive lands, and
 - iii) the registration of a restrictive covenant relating to conditions to protect the environmentally sensitive land against the certificate of title for the subject property related to the approved development.
- Section 24 DEVELOPMENT BELOW THE 725.42M (above sea level) CONTOUR

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- All new development below the 725.42 metre above sea level contour shall be constructed at the risk of the owner who shall be responsible for any loss or damage that may occur to their development.
- Schedule A
 - 1. Regulations for the R.1 Residential District
 - o 1.6 Sanitation
 - (b) All principal buildings and accessory buildings which contain toilet facilities or produce waste water of any type shall be connected to sewage systems consisting of a holding tank in turn connected to disposal fields or a mound. All holding tanks shall have a pump out capability.
 - (d) The regulations of the Alberta Department of Labor, Plumbing Inspection Branch, shall govern the installation of holding tanks and septic systems, the operation of existing septic tanks and the location of disposal fields.
 - (e) No earth closets or privies are permitted and the Development Officer on reasonable notice to an owner may require a privy or earth closet without pump out tank to be removed.
 - 2. Regulations for the R.2 - Residential District (Shallow lakefront lots)
 - o 2.3.3 All principal buildings and accessory buildings which contain toilet facilities or produce waste water of any type shall be connected to holding tanks only. All holding tanks shall have a pump out capability. No holding tank shall be constructed in a front yard in this District. No disposal fields, mounds or other types of waste water disposal systems shall be permitted in this District.
 - 3. Regulations for NER - Natural Environmental Recreational District
 - o 3.1 Permitted Uses
 - (a) Natural reserve
 - (b) Historical sites registered or classified under the Alberta Historical Resources Act.
 - Lands and Property, the use and development of which is or may be subject to superior legislation including Lands and Property held by the Government of Canada in Right of Her Majesty, a Development Permit is not required for any use in this District which is consistent with those uses, activities and operations prescribed in the appropriate superior legislation.
 - (c) Recreation facilities that are already developed or are yet to be developed by the Summer Village of Kapasiwin.
 - o 3.4 Sanitation - As for R1 Residential District.

B.2.7 Summer Village of Lakeview No. 153

The Summer Village of Lakeview Land Use Bylaw No. 153 and accompanying Districting Map identifies land use provisions to direct development. Relevant policies are as follows:

- Section 11 APPLICATION FOR DEVELOPMENT PERMIT
 - 1. Every application for development shall



WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- o (d) include lot plans in duplicate at a scale satisfactory to the Development Officer, showing any or all of the following:
 - (ix) The location of all natural tree areas and how they will be affected by the proposed development.
- SECTION 23 POLLUTION CONTROL
 - In any district, no storage or activity may be undertaken which, in the opinion of the Development Officer, constitutes a danger or annoyance to persons on the lot, on public property, or on any other lots, by reason of the generation of noise, vibration, dust and other particulate matter, smoke, odour, toxic and noxious matter, traffic, radiation hazards, fires and explosive hazards, heat, humidity and glare, refuse matter, waste or waterborne waste, and water or steam.
- SECTION 28 LOT GRADING
- In all cases, lot grades shall be established with regard to preventing drainage from one lot to the next except where drainage conforms to an acceptable local or subdivision drainage plan. Proposed grading shall not alter natural drainage patterns without the prior written approval of the affected neighbours and the local council.
- SECTION 31 SEWAGE DISPOSAL
 - (5) On-Parcel Sewage collection system:
 - o (a) No sewage collection system shall be constructed closer than:
 - (iv) 10.0 m (30.0 ft.) from any water source;
- SECTION 33 ACCESSORY USES
 - (1) Lakeshore Accessory Use:
 - o (a) Prior to the issuance of a development permit for a lakeshore accessory use, the Development Officer may require a lot plan giving information as to exact location in relation to property lines, architectural appearance, construction, materials, standards and access.
 - o (b) Any lakeshore accessory use which lies only partially within the Summer Village and therefore extends beyond the corporate boundaries of the Summer Village of Lakeview, shall require a development permit for that portion within said corporate boundary.
- SECTION 34 ENVIRONMENTALLY SENSITIVE LANDS
 - (1) Development on lands which are designated or deemed by the Development Officer to be environmentally sensitive shall be discouraged.
 - (2) When reviewing an application for development on environmentally sensitive lands, the Development Officer shall consider the following:
 - o (a) the impact of the proposed development on the subject and surrounding area;
 - o (b) the soil types and conditions of the area surrounding the subject property;
 - o (c) any information on the past history of the subject property and surrounding area from a geotechnical perspective; and
 - o (d) comments and recommendations from Alberta Environmental Protection.
 - (3) As part of the development permit application, the Development Officer may require a geotechnical study, prepared by a qualified geotechnical engineer, addressing the

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- proposed development. The geotechnical study will establish building setbacks from property lines based upon land characteristics of the subject property.
- (4) The Development Officer may require the following as a condition of approval for a development permit application on land which is considered environmentally sensitive:
 - o (a) that measures be taken to ensure that infiltration into area slopes, the subject property, and adjacent lands are minimized, and
 - o (b) the registration of a restrictive covenant against the certificate of title for the subject property related to the approved development.
 - SECTION 37 FLOOD PRONE LANDS/STEEP SLOPES
 - (1) Development on land which may be subject to flooding shall be discouraged, especially on lands which are within the 1:100 year flood plain, as determined by Alberta Environmental Protection and the Summer Village of Lakeview.
 - (2) Residential development on lands which have been designated as a flood area is prohibited. New development shall not be permitted unless the proposed development is directly related to a recreational or lake use, such as picnic tables, boat docks, launch ramps, etc.
 - (3) Where applicable, new development shall not be allowed unless it complies with Canada Mortgage and Housing Corporation standards for flood-proofing of buildings.
 - (4) Development in areas with a potential to be flooded may have, at the discretion of the development Officer, a restrictive covenant related to the approved development registered against the certificate of title for the subject property.
 - (5) Development on lands which have a gross slope in excess of 15% shall be accompanied by a site plan designed and approved by a professional engineer.
 - SECTION 43 YARDS AND SETBACKS (ALL DISTRICTS)
 - The following minimum yards and setbacks are required:
 - o Front Yard:
 - 8.0 m (26.2 ft.)
 - On lakefront lots the minimum lakefront yard setback shall be 10.0 m (32.8 ft.) but in no case shall it be below the 725.42 m (2,380 ft) contour.
 - SECTION 47 REC - RECREATIONAL
 - (1) This district is generally intended to provide for the development of public areas that can be used for lake related recreation.
 - (2)
 - o Permitted Uses
 - None
 - o Discretionary Uses
 - Boat houses
 - Natural areas
 - Picnic grounds
 - Recreational uses
 - SECTION 48 P - PARK DISTRICT
 - o Permitted Uses

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- None
 - o Discretionary Uses
 - Public parks and recreation areas with any necessary buildings
- SECTION 49 NER - NATURAL ENVIRONMENT RECREATIONAL DISTRICT
 - (2)
 - o Permitted Uses
 - None
 - o Discretionary Uses
 - Natural reserve
 - Historical sites registered or classified under the Alberta Historical Resources Act

B.2.8 Summer Village of Point Alison Land Use Bylaw # 10-157

The purpose of the Land Use Bylaw of the Summer Village of Point Alison (Bylaw No.10-157) is “to prohibit or regulate and control the use and development of land and buildings within the municipality to achieve the orderly and economic development of land. Relevant policies include:

- 3.4 PERMISSION FOR DEVELOPMENT
 - (1) An application for a development permit shall be made to the Development Authority in writing, in the form required by the Development Authority, and shall be accompanied by:
 - (3) The Development Authority may also require with an application for a development permit information prepared by a Professional Engineer describing the potential of a subject site being flooded from any rise in the elevation of Lake Wabamun, the elevation of the water table at various points on the subject lot, the potential subsidence or erosion of a subject site, and the ground compaction of a subject site, and further information describing the mitigative measures necessary to eliminate the defined flood, subsidence, erosion hazard or to resolve any ground compaction concerns.
 - (13) The Development Authority may require, as a condition of issuing a development permit, that sanitary sewage from the proposed development be disposed of by being first stored in a holding tank, and then being pumped out into and transported by truck to another location, rather than by any form or system that would result in the placement of sanitary sewage or any material or liquid either under or on the ground.
- 1.7 OBJECTS PROHIBITED OR RESTRICTED IN YARDS
- No person shall keep or permit in any part of any yard in any Residential District:
 - (6) any development or storage or activity which, in the sole opinion of the Development Authority, is or may be or may become offensive, objectionable, or a nuisance by reason of the generation of noise, vibration, dust or other particulate matter, smoke, odour, toxic or noxious matter, radiation, fire or explosion hazards, heat, humidity, glare, refuse, waste (either in air, in water or on land), water, or steam or any other substance or energy or any of them.
- 1.12 FLOOD SUSCEPTIBLE LANDS

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- (1) Notwithstanding any other provision of this Bylaw to the contrary, no development of dwellings or of accessory buildings to dwellings other than fences, patios and similar buildings may be allowed on lands which, in the opinion of the Development Authority, may be subject to a flood hazard during a 1:100 year flood event or as a result of a 1:100 year high water elevation of any water body, including, but not limited to, Lake Wabamun.
- (2) For the purposes of this Bylaw, the 1:100 year high water elevation of Lake Wabamun shall be 725.42 m (2380 ft.), asl.
- (3) The Development Authority shall require that no dwellings within the municipality be constructed such that their ground floors are below the elevation of 726.42 m (2383.25 ft.) (providing 1.0 m (3.28 ft.) of freeboard above the flood elevation noted in Subsection (2) above), and, further, that a minimum of 2.0 m (6.6 ft.) of the ground adjacent to all dwellings be at a minimum elevation of the same 726.42 m (2383.25 ft.).
- (4) Development on lands which are, in the sole opinion of the Development Authority, suspected to be in an area of high water table shall be prohibited from having basements.
- 1.13 OFF-STREET VEHICULAR PARKING
- When any new development is proposed, off-street vehicular parking stalls or garage spaces shall be provided in accordance with the following:
 - (2) Surfacing and Drainage (a) All parking stalls or garage spaces:
 - o (b) Each parking stall shall be so graded and drained as to dispose of all storm water runoff to the municipal roadway or lake shore, or to retain the storm water on site. Drainage shall only be allowed to enter the roadway if approved by the Development Authority.
- 1.15 ACCESSORY BUILDINGS
- (2) No accessory building other than a fence, pool, deck, or patio shall be located:
 - o (c) in any rear yard unless, in the sole opinion of the Development Authority, the accessory building is located so as to not affect the view of Lake Wabamun from an adjacent lot

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

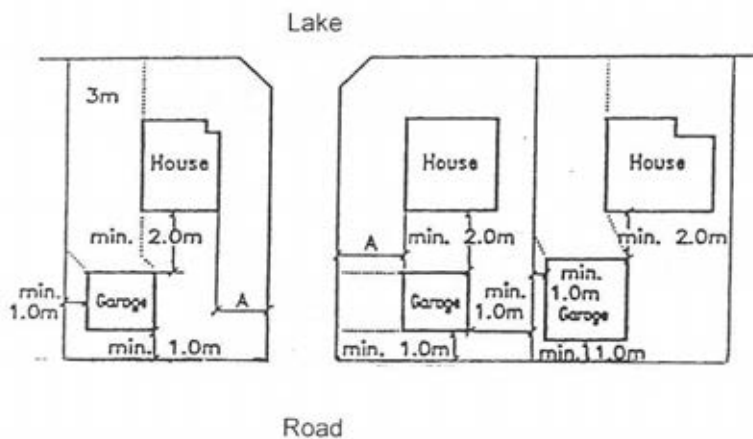
Appendix B Municipal and Provincial Legislation
October 9, 2015

B.2.9 Summer Village of Seba Beach Land Use Bylaw #2-2008

The relevant policies for the Summer Village of Seba Beach Land Use Bylaw #2-2008 are as follows:

- Section 23 Building Regulations
 - Figure 2: Siting of Accessory Buildings

LANELESS SUBDIVISION



A – No Closer than Principal Dwelling

- 8) Fences in Lakefront Yards
 - o Notwithstanding any other provision of this Bylaw to the contrary, no fence or other structure other than a boathouse shall be located within 7.62 m (25.ft.) of a property line which is a shoreline.
- Section 28 Flood Prone Lands
 - (1) Development on land which may be subject to flooding shall be discouraged, especially on lands which are with the 1:100 year flood plan, as determined by Alberta Environmental Protection and the Summer Village of Seba Beach.
 - (2) Residential development on lands which have been identified as a flood area by the Development Authority shall be prohibited.
 - (3) In flood areas, new development shall not be allowed unless the proposed development is directly related to a recreational or lake use, such as picnic tables, boat docks, launch ramps, etc.
 - (4) Development in areas with a potential to be flooded may have, at the discretion of the Development Officer, a restrictive covenant related to the approved development wherein the landowner waives any rights to compensation for damages, registered against the certificate of title for the subject property.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- (5) Development on lands which have a gross slope in excess of 15% shall be accompanied by a site plan designed and approved by a professional engineer.
- Section 29 Environmentally Sensitive Lands
 - (1) Development on lands which are designated or deemed by the Development Officer to be environmentally sensitive by reason of slopes, flood-susceptibility, or treed areas shall be discouraged.
 - (2) When reviewing an application for development on the environmentally sensitive lands described in Subsection (1) above, the Development Officer shall consider the following:
 - o (a) the impact of the proposed development on the subject and surrounding area;
 - o (b) the soil types and conditions of the area surrounding the subject property;
 - o (c) any information on the past history of the subject property and surrounding area from a geotechnical perspective; and
 - o (d) comments and recommendations from relevant Provincial departments and private agencies.
 - (3) As part of the development permit application, the Development Officer may require a geotechnical study or hydrogeological study, prepared by a qualified engineer, addressing the proposed development, the extent of any flood susceptible areas, and the stability of any slopes. The study will establish, among other things, flood-susceptible areas, flood-proofing elevations, slope stability enhancement techniques (including the means to ensure slope stability during the construction process and during occupancy afterwards), and building setbacks from property lines based upon land characteristics of the subject parcel.
 - (4) The Development Officer may require the following as a condition of approval for a development permit application on land which is considered environmentally sensitive:
 - o (a) that the measures recommended in the geotechnical or hydrogeological study be taken to ensure that development not occur in such a manner as to be either flood-susceptible or subject to erosion or subsidence hazard, and
 - o (b) the registration of a restrictive covenant against the certificate of title for the subject property related to implementation of the recommendations of the geotechnical or hydrogeological study during development and afterward.
- Section 37 R1A – Residential – Single Detached (Class A)
 - (7) Minimum Parcel Area No new parcel for a dwelling shall be created which has an area less than:
 - o (a) If not served by either a sewage collection system or a water distribution system, a minimum of 1,858.0 m² (20,000 ft.²) of developable land.
 - o (b) If served by a water distribution system but not a sewage collection system, a minimum of 1393.5 m² (15,000 ft.²) of developable land.
 - o (c) If served by a sewage collection system but not a water distribution system, a minimum of 929.0 m² (10,000 ft.²) of developable land.
 - o (d) If served by both a sewage collection system and a water distribution system, a minimum of 696.5 m² (7500 ft.²).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- (9) Minimum Lakefront Yard Setback
 - o The minimum lakefront yard setback shall be at the discretion of the Development Officer who shall have concern for development or potential development on adjacent parcels, but in no case shall a lakefront yard setback be less than 7.5 m (25.0 ft.).
- Section 38 R1B – Residential – Detached Family (Shallow Lakefront Parcels)
 - (1) General Purpose of District
 - o This district is generally intended to provide regulations in an area where existing lots are smaller. It is not intended to apply this District to new development areas, but only to apply it to existing small lot areas.
 - (2) Permitted Uses Discretionary Uses
 - o • Minor home occupation
 - o • Modular home
 - o • Single detached dwelling
 - o • Buildings and uses accessory to permitted uses
 - Discretionary Uses
 - o • Day care facility
 - o • Major home occupation
 - o • Park and playground
 - o • Public use
 - o • Buildings and uses accessory to discretionary uses
 - (3) Parcel Coverage
 - o Parcel coverage of all buildings shall not exceed 55% of the total parcel area.
 - (4) Minimum Floor Area (not including attached garage) for single detached dwellings and modular homes
 - o Shall be no less than 55.7 m² (600.0 ft.²).
 - (5) Maximum Height
 - o The height of all structures shall not exceed 9.0 m (29.5 ft.) and is subject to the provisions of this Bylaw.
 - o In consideration of any relaxation or variance of this regulation, the Development Authority shall take careful note of the heights of surrounding development, and shall ensure that any development exceeding this regulation is not higher than existing development in an area.
 - (6) Minimum Parcel Area No new parcel for a dwelling shall be created which has an area less than:
 - o (a) If not served by either a sewage collection system or a water distribution system, a minimum of 1,858.0 m² (20,000 ft.²) of developable land.
 - o (b) If served by a water distribution system but not a sewage collection system, a minimum of 1393.5 m² (15,000 ft.²) of developable land.
 - o (c) If served by a sewage collection system but not a water distribution system, a minimum of 929.0 m² (10,000 ft.²) of developable land.
 - o (d) If served by both a sewage collection system and a water distribution system, a minimum of 696.5 m² (7500 ft.²).

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- (7) Minimum Front Yard Setback
 - o Shall be at the discretion of the Development Officer who shall have concern for development or potential development on adjacent parcels, but in no case shall a front yard setback be less than 7.0 m (22.9 ft.).
- (8) Minimum Lakefront Yard Setback
 - o The minimum lakefront yard setback shall be at the discretion of the Development Officer who shall have concern for development or potential development on adjacent parcels, but in no case shall a lakefront yard setback be less than 7.5 m (25.0 ft.).
- (9) Minimum Side Yard Setback
 - o (a) Side yards shall total at least 20% of the parcel width with each side yard being at least 1.5 m (4.9 ft.) and 2.3 m (7.5 ft.) for buildings 7.6 m (24.9 ft.) or more in height.
 - o (b) Notwithstanding the above, where a parcel has vehicular access from the front only, one side yard setback must be a minimum of at least 3.2 m (10.5 ft.) except where an attached garage or carport is provided.
- (10) Minimum Rear Yard Setback
 - o A rear yard setback shall be provided of not less than 1.5 m (5.0 ft.).
- (11) Guest houses
 - o Guest houses shall be as provided under Section 23 (1).
- (12) Garages and Accessory Buildings
 - o Garages and accessory buildings shall be as provided under Section 23 (2).

B.2.10 Village of Wabamun Land Use Bylaw# 02-2010

The Village of Wabamun's Land Use Bylaw intends to "divide the municipality into districts, prescribe and regulates the use(s) for each district, establish the Development Authority, establish a method for making decisions on development permit applications and issuing development permits, prescribe the manner in which notice is to be given of the issuance of a development permit, implement the policies of the statutory plans of the Village of Wabamun, establish supplementary regulations government certain specific land uses; and establish the procedures for making amendments."

The applicable policies are as follows:

- 2.4 Permission for Development
 - (1) An application for a development permit shall be made to the Development Authority in writing on the application form provided, and shall:
 - o (3) The Development Authority may also require with an application for a development permit information prepared by a Professional Engineer describing the potential of a subject site being flooded from a 1:100 year flood event, the potential subsidence or erosion of a subject site, and the ground compaction of a subject site, and further information describing the mitigative measures necessary to eliminate the

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- defined flood, subsidence, erosion hazard or to resolve any ground compaction concerns.
- o (4) The Development Authority may also require a biophysical assessment to assess the impact of a proposed development on the environment or any phase of the environmental site assessment to determine the possible contamination of a subject site and the mitigative measures necessary to eliminate such contamination.
- 7.7 C2 – Lakefront Commercial
 - o (1) General Purpose of District
 - This District is generally intended to provide from mixed office, retail and personal service outlets, particularly as related to the tourism industry and associated aquatic sporting.
 - o (2) Permitted Uses
 - Bakeries
 - Business offices
 - Clinics
 - Eating and drinking establishments (not drive in restaurants)
 - Hotels
 - Laundromats/drycleaners
 - Personal service shops
 - Retail stores
 - Buildings and uses accessory to permitted uses
 - Discretionary Uses
 - Aquatic equipment servicing, sales and repair
 - Commercial schools
 - Day care facilities
 - Dwellings attached to commercial uses
 - Indoor amusement facilities
 - Marinas
 - Motels or motor hotels
 - Parking facilities
 - Public uses
 - Utilities
 - Buildings and uses accessory to discretionary uses
 - Other uses which in the opinion of the Development Authority are similar to the above mentioned permitted and discretionary uses.
 - o (3) Parcel Coverage
 - No maximum, provided that adequate provision is made for parking, loading and garbage facilities.
 - o (4) Minimum Floor Area
 - Floor area for a commercial building shall be no less than 93 m² (1,000 ft.²).
 - o (5) Minimum Parcel Dimensions
 - A parcel shall be no less than 185.0 m² (1,991.4 ft.²) in area, 6.0 m (19.7 ft.) in width, or 30.0 m (98.4 ft.) in depth.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

- o (6) Front and Rear Yard Requirements
 - No minimum requirement.
- o (7) Minimum Side Yard
 - None required, except where abutting a residential district there shall be a side yard no less than 1.5 m (4.9 ft.) or 40% of the building height, whichever greater.
- o (8) Maximum Height
 - Building height shall not exceed 9.0 m (29.5 ft.) or two storeys (whichever is less).
- o (9) Parking
 - (a) Parking facilities may be located up to 100 m (328 ft.) off-site.
 - (b) On-site parking should be located at the side or rear of buildings
 - (c) Notwithstanding the location of parking, the main doors of any new commercial building shall front onto the street.
- o (10) Building Design
 - (a) Manufactured, or portable buildings shall not be permitted in this district.
 - (b) Where mixed commercial/residential structures are permitted the residence shall be located on the upper floor and have a separate entry at the ground floor from any commercial uses.
- o (11) The regulations for dwelling units shall be indicated for apartments in the Residential (R3) District.
- 7.12 OS – Open Space
 - o (1) General Purpose of District
 - This district is intended to preserve natural areas in perpetuity, particularly environmental reserve areas adjacent to Lake Wabamun, as well as additional areas designated for environmental protection.
 - o (2) Permitted Uses
 - Natural open spaces
 - Non-motorized outdoor recreation facilities
 - Trails
 - Discretionary Uses
 - Utilities
 - o (3) Development Regulations
 - (a) At the sole discretion of the Development Authority, an environmental review or biophysical site assessment may be required prior to a development permit being issued for new development.
 - (b) The removal of vegetation or disturbance of soil or natural ground is not allowed.
 - (c) The Development Authority may refer development permit applications involving land with existing or potential recreation, wildlife scenic or environmental value to Alberta Sustainable Resource Development for its review and recommendation.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

By way of a council amendment, Map 2 – Future Land Use Plan was added to the Land Use Bylaw. This map details the location and extent of current and proposed land uses within the Village of Wabamun's boundaries.

In terms of Wabamun Lake, the map lists the following intended uses for directly along the lakeshore community lands, pedestrian-oriented commercial and residential.

B.3 PROVINCIAL JURISDICTION

Many developments will require provincial approval prior to construction. The following are some examples:

- Development adjacent to provincial highways requires a development permit from Alberta Transportation.
- Certain developments identified in the *Environmental Protection and Enhancement Act* require an environmental impact assessment.
- Major projects identified in the Natural Resources Conservation Act require the approval of the Natural Resources Conservation Board.
- Energy and utility related projects require the approval of the Alberta Energy Regulator or the Alberta Utilities Board respectively.

Parkland County has several existing plans and policies that affect the Wabamun Lake subwatershed. These include the Integrated Community Sustainability Plan, Parkland County Land Use Bylaws, and the Parkland County Municipal Development Plan. These, along with the bylaws implemented by the various summer villages along the lake, help direct land use activities and development within the subwatershed.

An Integrated Community Sustainability Plan was adopted by Parkland County on August 23, 2011 (Parkland County 2011). This plan aims to increase the County's sustainability performance in four key areas: environment, economy, governance and social/cultural life. One of the goals of this plan is to protect the County's water resources from degradation due to increasing intensive human activity. In order to achieve this goal the County will aim to reduce water consumption and reduce the amount of contaminants in wastewater. Parkland County will also look for ways to minimize the destruction of waterways, wetlands and riparian areas.

B.3.1 Alberta Land Stewardship Act

The Purpose of the *Alberta Land Stewardship Act* (ALSA) is to provide a means by which government of Alberta can give direction and provide leadership in identifying the objectives of the province, including economic, environmental and social objectives and a means to plan for the future, recognizing needs of current and future Albertans. It provides for coordination of decisions by decision-makers concerning land, , human settlement, natural resources and the environment and creates legislation and policy that enable sustainable development by taking into account and responding to cumulative effects of development ALSA also supports/requires local land-use decision-makers and the provincial government to coordinate their planning and decision-making. The authority for regional plans is established in ALSA. Municipal planning decisions must conform to regional plans that are approved under the Act.

ALSA establishes the legal basis for the development of regional plans in Alberta. Regional plans under ALSA are intended to integrate provincial policies at the regional level and provide a

clear context for land use decision-making by municipalities, provincial departments, boards, and agencies.

Municipal decisions, those of the subdivision authority, development authority, municipal planning commission, and subdivision and development appeal board, align with regional plans' policies and outcomes. ALSA requires municipalities to review existing statutory plans, municipal development plans, area structure plans, land-use bylaws, policies and procedures and make any amendments to comply with the regional plans.

B.3.2 Agricultural Operation Practices Act

The *Agricultural Operation Practices Act* (AOPA) sets manure management standards for all operations in Alberta who handle manure. The Act defines siting and construction standards for manure storage and collection facilities, addresses the application of manure to agricultural land and ensures environmental protection through an approval process which involves directly affected neighbours and municipalities. Nuisances such as odour, dust, noise and smoke resulting from agriculture activities are also dealt with in the Act. The Act also outlines penalties and fines that apply to contraventions of the Act.

A confined feeding operation (CFO) is defined as a fenced or enclosed land or buildings where livestock are confined for the purposes of growing, sustaining, finishing or breeding by means other than grazing, and any other building or structure directly related to that purpose. Backgrounding operations that meet the threshold animal numbers in the regulation are also considered to be CFOs. CFOs do not include residences, grazing livestock operations, livestock seasonal feeding and bedding sites, equestrian stables, auction markets, race tracks or exhibition grounds.

The Natural Resources Conservation Board (NRCB) administers AOPA and its regulations. NRCB approval officers process applications and issue permits, while NRCB inspectors follow up on complaints and compliance related issues.

Municipal governments are invited to provide input on all AOPA applications within their municipal boundaries and to develop land-use provisions within their municipal development plans that identify where new and expanding CFOs would not be compatible with current or future land uses.

B.3.2.1 Existing and Expanding CFOS

All CFOs, manure storage facilities and manure collection areas that existed prior to January 1, 2002 are deemed to have a permit under AOPA.

Existing CFOs do not have to upgrade facilities to meet AOPA standards unless the facility is posing a risk to the environment or an inappropriate disturbance, as determined by the NRCB.

An approval, registration or authorization is required by an existing CFO if expansion is to take place.

When an existing CFO expands, only the new or expanded portions of the facility that collect or store manure must meet the standards in the regulations. The rest of the existing operation will be evaluated with respect to environmental risk. If there is a risk to the environment, the operator will be required to address the risk.

B.3.2.2 Siting Requirements

Minimum Distance Separation (MDS)

The MDS is a setback established between a CFO facility and the neighbouring residences that are in existence at the time the application is submitted. Its purpose is to minimize the impact of odour. Each operation has its own MDS that is determined by various characteristics or factors of the operation as follows:

Livestock Siting Unit (LSU) is the basis for determining the MDS. The LSU is a method for comparing the odour potential of livestock facilities based on the type of livestock, manure production and manure handling system.

Odour Objective is based on the municipal land zoning of neighbouring residences. There are four categories that determine the odour objective used in the MDS calculation for that residence.

- Category 1 – residences on land zoned for agricultural purposes (e.g., farmstead, acreage residences),
- Category 2 – residences on land zoned for nonagricultural purposes (e.g., country residential, rural commercial businesses),
- Category 3 – residences on land zoned for high use recreational or commercial purposes,
- Category 4 – residences on land zoned for large-scale country residential, rural hamlet, village, town or city.

The MDS is determined for each category ranging from the least separation for a Category 1 residence to the greatest separation for a Category 4 residence. The MDS will always be at least 150 metres unless:

- The owner of the residence waives the requirements in writing,
- The owner or operator of the CFO owns or controls the residence, or
- An existing CFO is upgrading its operation and is not increasing the volume of manure produced.

A number of factors can be considered by the NRCB to reduce the MDS. These are:

Technology Factor is the effect a manure storage or handling system will have on reducing the odour nuisance level.

Dispersion Factor allows for a variance to the MDS, based on unique climatic and topographic influences at the site that can influence odour dispersion and can include:

- Topography. The effect of topographical features, such as hills and valleys, on air dispersion.
- Screening. The effect of natural or constructed screening, such as windbreaks, trees, fences or screens, on air dispersion from the manure storage facility.
- Microclimate. Meteorological data may show a significant alteration in odour intensity or frequency in relation to neighbouring land use. Some of these factors include temperature, humidity, predominant wind direction and intensity.

Expansion Factor is only applicable to operations that are increasing the size of the facility to store more manure or to accommodate more livestock.

B.3.2.3 Affected Parties

An “affected party” must be notified when an application for an approval or registration for a CFO is received by the NRCB. Affected parties include:

- The applicant.
- A person who resides on or owns land that is within the greater of 0.8 kilometres or the MDS of a registration-sized operation.
- A person or municipality that is entitled, under the Water Act, to divert water from the river, stream or canal within 16 kilometres downstream, as measured along the water course, if any part of the CFO facility is located or is to be located within 100 metres of the bank of a river, stream or canal.
- A person or municipality who resides on or owns land that is within the following distances from the boundary of a parcel of land on which an approval-sized CFO is located or is to be located.

B.3.2.4 Directly Affected Parties

Only directly affected parties may request the Board to hold a review of the approval officer’s decision on a permit. A directly affected party is a neighbour, organization or member of the public that:

- submitted a statement of concern regarding an application, including reasons why the party should be considered directly affected for the application, and
- has been determined by the NRCB to be directly affected.

B.3.2.5 Land Base and Manure Handling Requirements

New or expanding CFOs applying for permits must show they have access to enough land to accommodate manure application based on soil nitrate-nitrogen limits. Operations need to

develop either a nutrient management plan or a manure handling plan if they do not comply with the land base requirements. **Nutrient Management Plans** - An approved nutrient management plan is required if a person plans to exceed the soil nitrate-nitrogen or salinity limits set out in the regulations when applying manure. The NRCB can approve a nutrient management plan for applying manure in excess of the limits if the NRCB is satisfied that implementing the nutrient management plan will provide equal or greater protection to the soil and water.

Manure Handling Plans - A person applying for a CFO permit can submit a manure handling plan to the NRCB to reduce or eliminate the need to meet the manure storage and application requirements under AOPA. For example, an operator may submit a manure handling plan where an agreement is in place with others who will be accepting the manure from the operation. Manure production and transfer records must be kept in these situations.

B.3.2.6 Manure Storage and Collection Areas

AOPA includes standards for the construction of solid and liquid manure storage facilities and manure collection areas. .

It does not include facilities at an equestrian stable, an auction market, a racetrack or exhibition grounds.

If 500 tonnes or more of manure are stored for more than seven months in a calendar year on the same spot, a permit must be obtained from the NRCB for a manure storage facility.

B.3.2.7 Setbacks

Common Body of Water - Manure storage facilities or manure collection areas must be constructed at least 30 metres from a common body of water. This does not apply if the owner or operator demonstrates to the NRCB, prior to construction, that either:

- The natural drainage from the facility or area is away from the common body of water, or
- A berm or other secondary protection for the common body of water constructed by the owner or operator protects the common body of water from contamination.

Flooded Areas - A manure storage facility or manure collection area must not be in an area that floods.

- The 1:25 year maximum flood level at a manure storage facility or manure collection area must not be less than one metre below any part of the facility where run-on can come into contact with the stored manure.
- If the 1:25 year maximum flood level cannot be determined, the manure storage facility or manure collection area must be not less than one metre below any part of the facility where run-on from the highest known flood level can come into contact with the stored manure.

Natural Water and Wells - Manure storage facilities and manure collection areas must be constructed at least 100 metres away from a spring or water well. This does not apply if the owner or operator:

- Demonstrates to the NRCB, prior to construction, that an aquifer from which the spring rises, or into which the water well is drilled, is not likely to be contaminated by the facility, and
- Implements a groundwater monitoring program if required by the NRCB.

B.3.2.8 Groundwater Resource Protection

AOPA addresses groundwater resource protection for all manure storage facilities and manure collection areas (for both solid and liquid manure). These structures must have either a protective layer or liner that lies below the bottom of the facility and above the uppermost groundwater resource of the site and also meets regulatory requirements.

Manure Storage Volumes - The owner or operator of a CFO must size and construct manure storages to accommodate nine consecutive months of manure production, or fewer consecutive months if the NRCB approves a manure handling plan submitted by the owner or operator. This storage requirement does not apply to an owner or operator of a CFO who stores solid manure in accordance with short-term storage manure criteria.

Surface Water Control Systems - To minimize run-on flowing through and runoff leaving a manure storage facility or manure collection area, surface water control systems are required. These systems must not significantly alter regular water flow, must not affect or alter a non-flowing water body and must not be located on a fish-bearing water body.

Short-term solid manure storage sites must be located at least:

- 150 metres from a residence or occupied building that the producer does not own
- 100 metres from a spring or water well
- 1 metre above the water table
- 1 metre above the 1-in-25 year maximum flood level or 1 metre above the highest known flood level if the 1-in-25 year flood level is not known.

B.3.2.9 Seasonal Feeding and Bedding (Wintering) Sites and Livestock Corrals

Seasonal feeding and bedding sites (wintering sites) and livestock corrals are not required to obtain a permit but must be sited and managed to protect surface water bodies. A seasonal feeding and bedding site or livestock corral must be located at least 30 metres away from a common body of water. If this cannot be achieved, the operator must either design the site to divert runoff away from the common body of water or move the manure to an appropriate location away from the common body of water prior to a runoff event.

B.3.2.10 Manure Application

AOPA includes regulations for spreading manure for all agricultural operations in Alberta. They include requirements for manure incorporation, soil nitrogen and salinity limits, setback distances, record keeping and soil testing.

Manure Incorporation Requirements

Manure must be incorporated within 48 hours when applied to cultivated land except when applied to forages or direct-seeded crops, frozen or snow-covered land (other requirements apply) or unless an operation has a permit that specifies additional requirements.

Setbacks for Manure Application

Setback distances are required to reduce nuisance impacts on neighbors and to minimize the risk of manure leaving the land on which it is applied and entering a common body of water. Manure must be applied at least: 150 metres away from a residence or other occupied building if the manure is not incorporated.

- 30 metres away from a water well
- 10 metres away from a common body of water if subsurface injection is used
- 30 metres away from a common body of water if manure is surface-applied and incorporated within 48 hours of application, except when applied on forage, direct-seeded crops, frozen or snow-covered land.

If the land slopes towards a common body of water, a person who applies manure on forage, direct-seeded crops, or frozen or snow-covered land must meet the setbacks for manure application based on the average slope of the terrain.

Spreading manure on snow-covered or frozen ground is prohibited by the Agricultural Operation Practices Act unless specifically authorized on a case by case basis by the NRCB.

Manure Application Limits

The regulation sets soil nitrate-nitrogen and salinity limits for manure application. These limits can only be exceeded if a producer has a nutrient management plan that has been approved by the NRCB.

B.3.3 Public Lands Act

The title to the beds and shores of all permanent and naturally occurring bodies of water, and all naturally occurring rivers, streams, watercourses and lakes is vested in the Crown in right of Alberta unless a Land Title specifically grants ownership to the title holder

The Lieutenant Governor in Council may authorize the Minister to purchase land or sell, lease or set aside public land for public purposes and set related terms and conditions.

WABAMUN LAKE SUBWATERSHED LAND USE PLAN PHASE 1

Appendix B Municipal and Provincial Legislation
October 9, 2015

A person who occupies public land and is not the holder of a disposition authorizing the person to do so, or is not otherwise authorized to do so under the Act or the regulations, is deemed to be a trespasser and any improvements created by the person are the property of the Crown. Where a person unlawfully occupies public land they may be ordered to vacate the public land.

The holder of a disposition shall not conduct any act that injures or destroys, or that is likely to injure or destroy, the surface of the public land unless authorization to so in a disposition.

No one shall cause or permit the accumulation of waste material, debris, refuse or garbage on public land, cause damage to public land, injuriously affect watershed capacity, results in injury to the bed or shore of any river, stream, watercourse, lake or other body of water or land in the vicinity of that public land, or the creation of any condition on public land which is likely to result in soil erosion.

B.3.3.1 Regulations

The Lieutenant Governor in Council may make regulations:

- declaring any area of land to be a public land use zone; permitting, prohibiting, regulating or controlling activities on and uses of land in public land use zones;
- declaring any area of land to be a public land recreation area or public land recreation trail;
- governing the use of public land recreation areas or public land recreation trails and prohibiting, regulating or controlling activities in them;

The Lieutenant Governor in Council may make regulations prescribing the terms and conditions on which grazing lessees may conduct range improvement projects on the land contained in their grazing leases.

