Parkland County
Environmental Conservation Master Plan

Phase 1 Background Technical Report

Phase 1 Report

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For: Parkland County

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Kilini Creek

Executive Summary

Parkland County's diverse landscape supports a wide variety of valued natural amenities and features. Well-connected networks of forests, lakes, wetlands, riparian areas, and other natural areas are important components of the rural, agricultural, and peri-urban landscapes that characterize Parkland County. These networks of green infrastructure support regional and local environmental processes and contribute to a high quality of life for residents. The values and benefits of natural areas demand wise stewardship in the face of growing development pressures. To meet Parkland County's goal of enhancing its role as "a respected steward of the environment", this Environmental Conservation Master Plan (ECMP) presents a portfolio of Environmentally Significant Areas (ESAs) within the County.

Environmentally Significant Areas (ESAs) have been defined in Alberta as places vital to the long-term maintenance of biological diversity, soil, water, or other natural processes at multiple scales (ATPR, 2013). The identification of ESAs can be used to prioritize environmental management toward areas that are under-protected or contain vulnerable resources, or resources that are have unique, rare, or irreplaceable qualities (Margules & Pressey, 2000). Identifying and mapping areas of outstanding biological and physical resources in the County can support informed decision making and wise land use planning to make Parkland County a more vibrant, healthy, and beautiful place to live and visit.

This Environmental Conservation Master Plan (ECMP) outlines the methodologies, theoretical underpinnings, and data sources used to map the relative environmental significance of landscape features in Parkland County. Generally, the process for identifying ESAs consisted of obtaining, formatting, and integrating a wide variety of County-wide spatial data sets within a consistent, repeatable mapping framework. The result of the exercise is an inventory and description of the 61 most important ESAs at the County-wide scale. Through extensive data analysis, ground-truth investigations, and stakeholder and public consultations, these 61 ESAs were deemed to have the greatest concentration of environmental values within Parkland County.

This study was based on similar methods and inventories previously undertaken by the province in 2009, and Parkland County in 2004. In contrast to these earlier studies, this ECMP incorporated updated spatial biophysical inventories at the County-wide scale, and additional criteria reflecting new research on environmental systems and landscape functions. For example, this study measured and mapped ecological connectivity and groundwater vulnerability metrics as components of the mapping exercise. Both the number and total area of ESAs identified in this report are greater than those identified by the previous studies and the delineated boundaries of the ESAs have been refined.

Identified ESAs were also classified into significance ratings, including international, national, provincial, regional, and local levels of significance. These classification ratings indicate the scale at which valued elements within identified ESAs are significant or rare. A large number of small "micro-site" ESAs are also present throughout the County, but are not described in detail by this report. Examples of "micro-site" ESAs include small wetlands, intermittent streams, and forest patches. Areas providing connectivity between ESAs may also qualify as micro-site ESAs. These small-scale features often play a key role in upholding ecological integrity at broader landscape scales, and are important to consider for sustainable landscape management. However, due to the sheer number of small scale micro-site features in Parkland County, these were not verified, mapped, and described in detail by this study .

It should also be emphasized that all of the land in Parkland County contributes to environmental quality in one way or another. For example, land use activities within the contributing watersheds of important lakes, rivers, or streams can impact these water bodies. Accordingly, this report also outlines recommended beneficial management practices (BMPs) for County-wide environmental conservation, including BMPs applicable to areas outside of identified ESAs.

The contents of this ECMP report are structured as follows:

- Chapter 1 provides an overview of environmental and cultural resources in Parkland County
- Chapter 2 outlines the methodology involved in determining ESA classification criteria, mapping and analysis
- Chapter 3 provides detailed summaries of the County's 61 identified ESAs
- Chapter 4 presents Beneficial Management Practices for environmental conservation in the County

The information and findings in this report are also intended to be integrated within the new Municipal Development Plan (MDP) currently being prepared by Parkland County, and within a planned future update to the Land Use Bylaw (LUB). This report also complements the Integrated Community Sustainability Plan (ICSP), the Alternative Land Use Services (ALUS), and lake management planning initiatives being undertaken by Parkland County.

The findings in this report should also be considered as baseline information, to be regularly updated as new findings, data sources, and social perceptions change and evolve over time.

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List of Acronymns

ABMI – Alberta Biodiversity Monitoring Institute

ACIMS – Alberta Conservation Information Management System

AESA – Aquatic Environmentally Significant Area

AESRD – Alberta Environment and Sustainable Resource Development

AGS – Alberta Geological Survey

ALUS – Alternative Land Use Services

ASP – Area Structure Plan

ATPR – Alberta Tourism, Parks, and Recreation

BGP – Base of Groundwater Protection

BMP – Best Management Practice

CNR – Canadian National Rail

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

DEM – Digital Elevation Model

EALT – Edmonton and Area Land Trust

ELC – Ecological Land Classification

ESA – Environmentally Significant Area

ER – Environmental Reserve

ERE – Environmental Reserve Easement

FWMIS – Fish and Wildlife Management Information System

GIS – Geographic Information Systems

HEMS – Hog Environmental Management Strategy

HRV – Historic Resource Value

ILM – Integrated Land Management

LU – Landscape Unit

MR – Municipal Reserve

NGO – Non-Governmental Organization

O2 – O2 Planning + Design Inc.

OHV – Off Highway Vehicle

PFRA – Prairie Farm Rehabilitation Administration

ROS – Recreation Opportunity Spectrum

RTFI – Recreation Tourism Features Inventory

SARA – Species at Risk Act

STReAM – Significant Tourism Recreation Areas Model

UNESCO – United Nations Educational, Scientific, and Cultural Organization

1. Overview of Environmental Resources

Well-connected networks of forests, lakes, wetlands, riparian areas, and other natural areas are important components of rural, agricultural, and peri-urban landscapes. These networks of green infrastructure support regional and local environmental processes while contributing to a high quality of life for residents. The values and benefits of natural areas demand wise stewardship in the face of growing development pressures. To meet these challenges, landowners and municipal governments are increasingly making efforts to incorporate, integrate, and restore well-connected networks of Environmentally Significant Areas within the landscape at multiple scales.

To meet Parkland County's goal of enhancing its role as "a respected steward of the environment", this Environmental Conservation Master Plan reflects a comprehensive portfolio of Environmentally Significant Areas (ESAs) within its boundaries. Identifying and mapping areas of outstanding biological and physical resources in the County can support informed decision making and wise land use planning to make Parkland County a more vibrant, healthy, and beautiful place to live and visit. The report also provides best management practices for County-wide environmental conservation.

ESAs have been defined in Alberta as places that are vital to the long-term maintenance of biological diversity, soil, water, or other natural processes at multiple scales, that can be used as a strategic conservation tool for land use planning and policy (Fiera Biological Consulting, 2009). They are commonly used to prioritize environmental management toward areas that are under-protected or contain vulnerable resources, or resources that are have unique, rare, or irreplaceable qualities (Margules & Pressey, 2000).

A coarse provincial-scale map and GIS database of ESAs in Alberta based on quarter-sections was recently updated on behalf of Alberta Tourism, Parks and Recreation (Fiera Biological Consulting, 2009). This provincial-scale study defined and mapped ESAs of international, national, and provincial significance using seven criteria, including:

- Areas that contain elements of conservation concern
- Areas that contain rare or unique landforms
- Areas that contain habitat for focal species
- Areas that contain important wildlife habitat
- Riparian areas
- Large natural areas
- Sites of recognized significance

The provincial-scale study functions as a useful screening tool to determine the general location of ESAs as well as their level of significance for land use planning. However, further analyses at finer scales are required to refine ESA boundaries, as well as to identify boundaries of regionally or locally significant ESAs for consideration. Unlike previous inventories of ESAs conducted for the County and the Province, a hallmark of this Environmental Conservation Master Plan for Parkland County is an emphasis on linkages between ESAs. Focusing on ESAs as a network as opposed to discrete entities helps to position the Environmental Conservation Master Plan as a tool for holistic County-wide land use planning.

As the first of three phases in the development of an Environmental Conservation Master Plan and Policy Updates for Parkland County, this report builds upon the province-level ESA mapping work by Fiera Biological Consulting (2009) and the ESA Inventory conducted for Parkland County by Westworth Associates Environmental Ltd. (2004). The overall goal of this first phase is to identify priority areas for conservation within the County based on inherent environmental significance and sensitivity, while also providing best-management practices aimed at conserving these areas.

This report incorporates information gleaned from interviews with Parkland County administrators and key stakeholders, as well as grey and peer-reviewed literature pertaining to ESA identification and mapping, to produce updated criteria for ESA designation in Parkland County. The findings presented in this report should be considered as a baseline, and should be regularly updated as new findings, data sources, and social perceptions change and evolve. The following sections of this report outline the background characteristics of the study area, establish updated criteria for ESA classification and identification, and provide detailed maps, information, and best management practices for each of the 61 identified ESAs within Parkland County.

1.1. Study Objectives

The primary goal of this first phase is to develop an Environmental Conservation Master Plan for Parkland County wherein priority areas for conservation are identified based on inherent environmental significance and sensitivity. Specifically, this report aims to carry out the following objectives:

- To prepare an Environmental Conservation Master Plan for Parkland County based on findings from previous Environmentally Significant Areas reports for the Province and County (Fiera Biological Consulting, 2009; Westworth Associates Environmental Ltd., 2004) while establishing new criteria, environmental standards, and best practices for County-wide environmental management
- To provide a series of maps identifying all Environmentally Significant Area (ESAs) for Parkland County, including those newly identified based on updated criteria
- To prioritize areas of "conservation concern" and "species at risk" in Parkland County, as well as conservation practices to preserve these areas and protect species housed within ESAs
- To establish beneficial management practices for Parkland County's environmental resources and valued environmental features

Purpose

The updated Environmental Conservation Master Plan (ECMP) 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 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 infom 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.

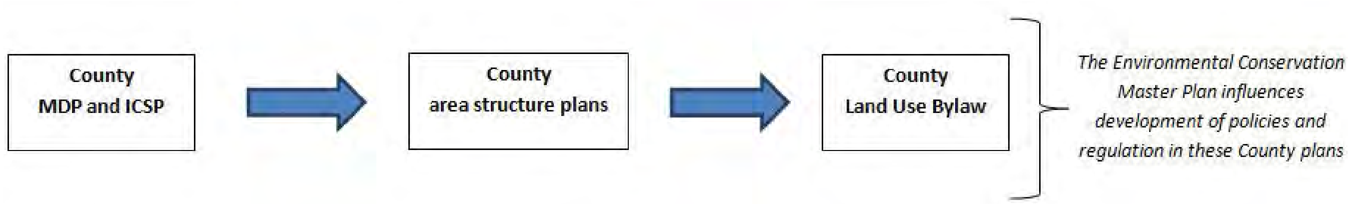


Figure 1. How the ECMP informs policy creation and evolution

1.2. Study Area Description

Parkland County is located in central Alberta west of the capital City of Edmonton. As of the 2011 census, the County population was 30,568 people (Statistics Canada, 2011). The County is home to a wide range of vegetation communities, fish and wildlife species, as well as several unique landforms and historic resources. This section outlines the characteristic regions and features that define the Parkland County study area.

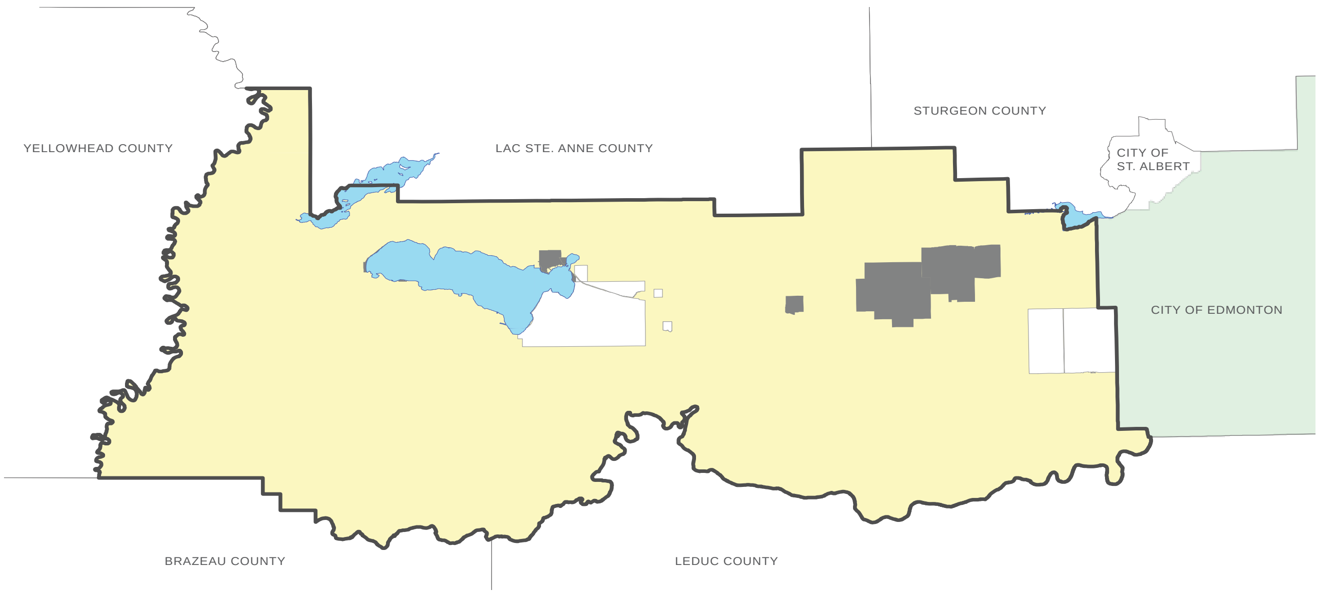


Figure 2. Parkland County and Surroundings

1.2.1. Natural Subregions

Natural ecoregions and subregions are landscape categories used to classify ecological units at a broad scale in Alberta. They are generally defined by landscape patterns delineated by soils, vegetation, climate, physiographic features, elevation and latitude.

Parkland County spans two ecoregions: the Aspen Parkland Ecoregion and the Boreal Transition Ecoregion. Within these ecoregions, Parkland County contains three natural sub-regions: Central Parkland, Dry Mixedwood, and Central Mixedwood (Map 1). Because Parkland County occupies a transition zone between Parkland and Boreal Ecoregions, the County is uniquely positioned in a zone of high species and habitat diversity. The following sections describe the typical features of each natural sub-region found in Parkland County.

1.2.1.1. Central Parkland

"The Central Parkland Natural Subregion occupies a broad, intensively cultivated and heavily populated area in central Alberta. It lies between the cold, snowy northern forests and the warm, dry southern prairies, sharing the climatic and vegetation characteristics of both" (Natural Regions Committee, 2006).

This subregion dominates the eastern portions of Parkland County, occupying 721 km^2 (26%) of the County (Map 1). Much of Parkland County's population is located within this subregion. Because some of the most productive agricultural land in the prairies occurs in the Central Parkland Subregion, much of this area in Parkland County remains under intense cultivation. Nationally however, the Central Parkland Subregion is one of the most threatened ecosystem types owing to extensive human settlement patterns throughout.

Hummocky uplands and undulating till plains are the dominant landforms in the Central Parkland Subregion. A mosaic of aspen and prairie vegetation occupies remnant native parkland areas, while grasslands are restricted to dryer sites. Black Chernozem soils usually occur within grasslands, and Dark Grey Chernozems and Luvisols usually occur in association with aspen forests. Balsam poplar or white spruce forests can be found in moist rich sites and poorly drained wetlands are often comprised of marshes, shrublands or fens.

The Central Parkland Subregion contains the northernmost breeding distribution for many warbler species, and includes productive and extensive waterfowl breeding habitat. A wide diversity of bird, mammal and aquatic species occur in the subregion. Provincially, three species have primary ranges within the Central Parkland: the Prairie vole, Franklin's ground squirrel, and the Piping Plover (Natural Regions Committee, 2006). The Piping Plover is considered Endangered according to Schedule 1 of the Species at Risk Act (SARA)[1] (Government of Canada, 2002).

1.2.1.2. Dry Mixedwood

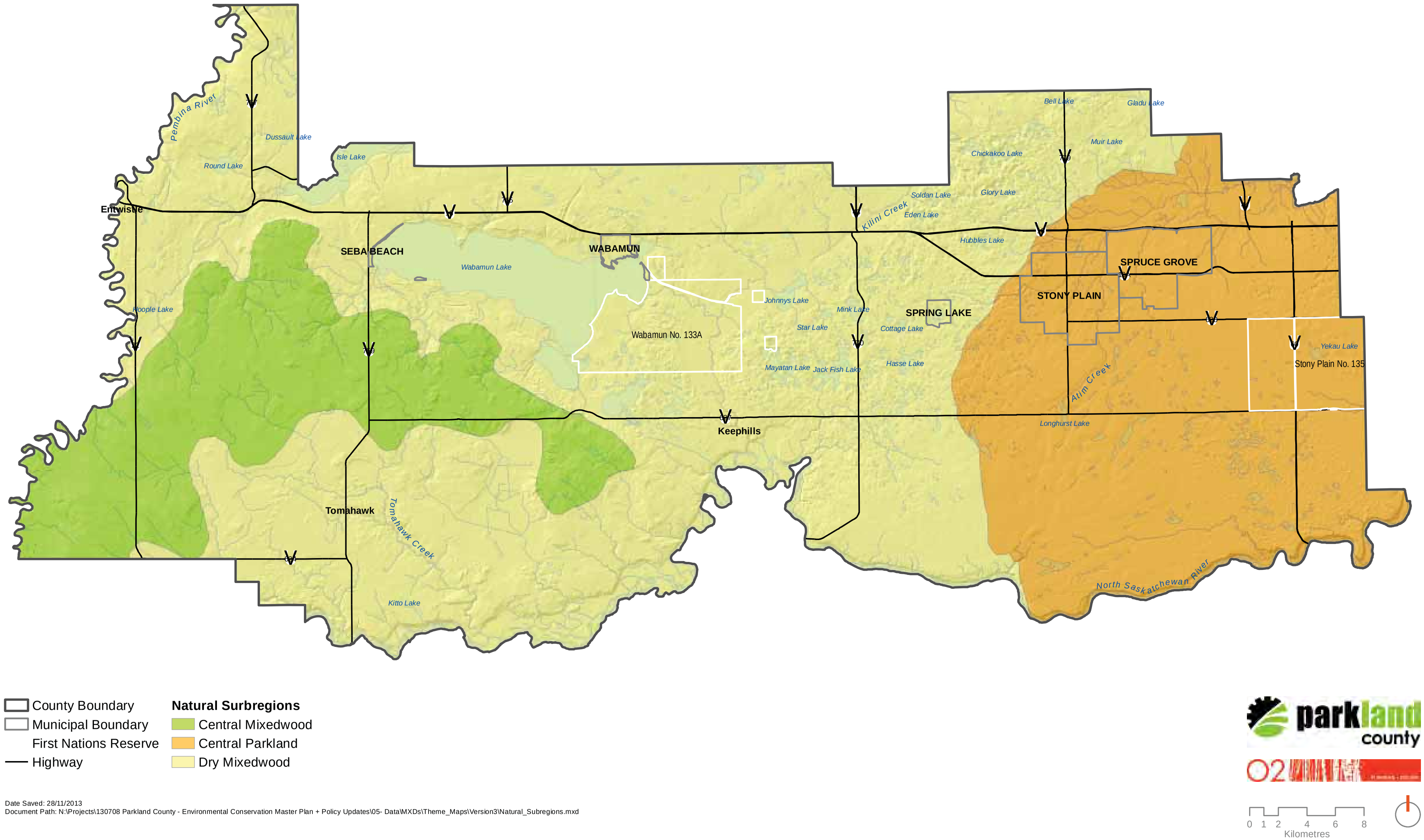
"Undulating plains, aspen-dominated forests and fens define the Dry Mixedwood Natural Subregion, the warmest boreal Natural Subregion." (Natural Regions Committee, 2006).

Occupying 1640 km^2, or almost 60% of the entire County, this subregion comprises the majority of Parkland County and is the second largest natural subregion in Alberta (Map 1). Much of the "lake country" in the central portions of Parkland County fall within this the Dry Mixedwood Subregion, and many subdivisions and cottages occur in these areas. The dominant land use is agriculture, with localized areas of fossil fuel extraction, residential and recreational developments (Westworth Associates Environmental Ltd., 2004).

Hummocky uplands and undulating till or lacustrine plains with scattered lakes are the dominant landforms in the Dry Mixedwood Subregion. Gray Luvisols are the prevailing soils on uplands, while Gleysols and Organic soils are typical in wetlands. This area is characterized by aspen forests on the uplands and fens in the lowlands, although other vegetation types occur in localized areas. Jack

1 While these species may exist within the a given subregion, there are have been no occurrences to date within Parkland County. Please see Table 1 for a complete list of SARA species in Parkland County

MAP 1: NATURAL SUBREGIONS OF PARKLAND COUNTY



Map 1. Natural Subregions of Parkland County

pine stands can be found on well-drained coarse textured soils, while balsam poplar or shrublands occur in moist sites and grasslands on steep slopes.

Aspen forests are home to a wide variety of upland songbird and mammal species. Most notably, the American beaver persists in this subregion, and is known to alter the landscape through its dam building activities (Westworth Associates Environmental Ltd., 2004). The lowland fens are commonly inhabited by bird species that may include the elusive Yellow Rail, a species of SARA Special Concern. The "lake country" is a species-rich area, home to birds of prey, moose and numerous water birds, including the Great Blue Heron which also has Special Concern status according to SARA2 (Government of Canada, 2002).

Central Parkland

1.2.1.3. Central Mixedwood

"The Central Mixedwood Natural Subregion includes vast expanses of upland forests and wetlands on level to gently undulating plains. Short, warm summers and long, cold winters define the Central Mixedwood Natural Subregion" (Natural Regions Committee, 2006).

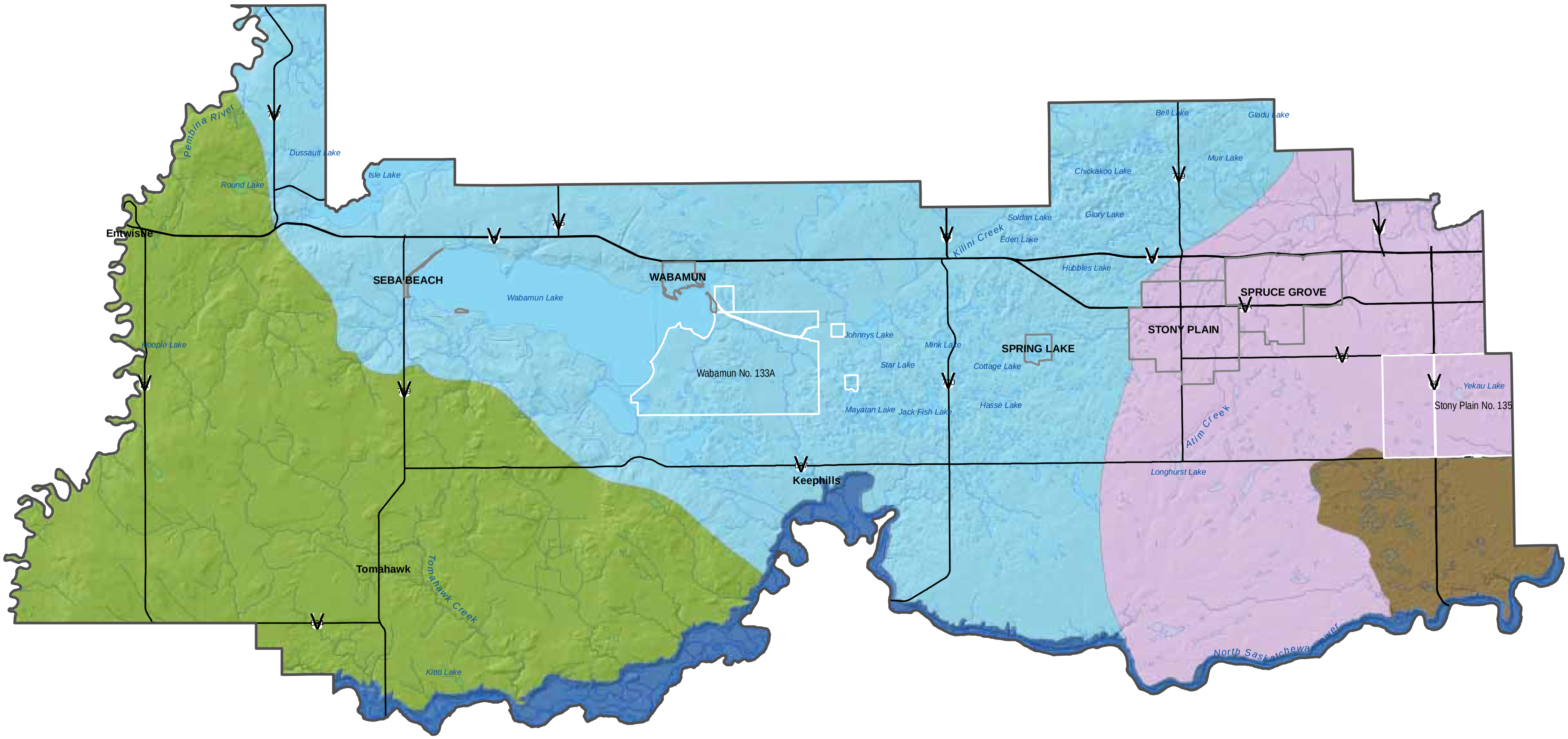
Dry Mixedwood

The Central Mixedwood Subregion is the largest natural subregion in Alberta. In Parkland County however, it occupies a limited area of only 393 km2 (14%) in the westernmost portions of the County. Human populations in this part of the County are sparse, and land use is dominated by working farms interspersed with provincial Crown lands (e.g., Jack Pine Provincial Grazing Reserve).

On upland areas, a mixture of aspen-dominated deciduous stands, aspen–white spruce stands, and white spruce-dominated stands are typical of till and lacustrine areas, with jack pine forests located on coarse soils. Balsam poplar occurs in mixed stands on moist sites. Wetlands can be wide-ranging and mainly consist of black spruce fens and bogs and peatlands. Luvisolic soils are typical of uplands and organic soils are dominant in wet, poorly drained areas (Westworth Associates Environmental Ltd., 2004).

Central Mixedwood

MAP 2: LANDSCAPE UNITS



County Boundary
Municipal Boundary
First Nations Reserve
Highway

Landscape Unit
- Central Lakes / Dry Mixedwood
- Devon Dunes
- Edmonton Plain Central Parkland
- North Saskatchewan River Valley
- Tomahawk Uplands Mixedwood

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Map 2. Landscape Units

1.2.2. Landscape Units

The "reference site" concept used to delineate Natural Subregions tends to reflect the relative boundaries of natural ecosystems that would dominate landscapes if left undisturbed by human activity (Natural Regions Committee, 2006). However, areas within a given Natural Subregion can often display characteristic, repeating differences in human activity and land use intensity. Consequently, environmental plans conducted at a finer scale than the provincial scale often benefit from further subdivision of Natural Subregions.

Landscape Units (LUs) provide a more refined framework for further subdividing Natural Subregions based on a combination of both natural factors and dominant land use factors. The central idea is that landscape patterns within an individual LU will tend to repeat themselves in similar form throughout, lending a cohesiveness to each individual LU that is not necessarily reflected by Natural Subregion divisions. Each LU represents a certain "landscape character" that "gives an area its visual and cultural image, and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique" (USDA Forest Service, 1994). Ultimately, delineation of LUs is a process informed by an expert understanding of the visual differential resulting from combinations of ecological and cultural factors, (Reiners & Thurston, 1996; USDA Forest Service, 1994). Examples of government-sponsored studies in Alberta applying the LU concept include the Southern Rockies Landscape Planning Pilot Study (O2, 1999), and several regional scenic resource assessments conducted in Alberta (O2, 2010; O2, 2011 b).

To delineate the LUs, an interdisciplinary staff team examined multiple data layers at multiple scales in a GIS environment, including the county orthophoto, topography, Natural Subregions, and LUs previously defined for the North Saskatchewan Region (O2, 2011 b). The staff team consisted of a GIS analyst, an environmental planner, a landscape ecologist, and a landscape architect. The team applied their collective expert judgement to determine and digitize LU boundaries representing logical breaks of repeating landscape patterns in Parkland County (Map 2). The defined LUs included:

- **Edmonton Plain Central Parkland:** This LU is characterized by gently rolling, extensively cultivated plains dominated by agricultural and urban land uses. Remnants of native aspen, grasslands, or wetlands occur in some areas.
- **North Saskatchewan River Valley:** The distinctive river valley system of the North Saskatchewan River is characterized by high scenic quality and unique landscape character, and was therefore considered as a separate LU.
- **Devon Dunes Central Parkland:** This gently rolling area is characterized primarily by sandy soils, wetlands and forest patches, interspersed with some limited agriculture as well as residential subdivisions
- **Central Lakes / Dry Mixedwood:** This area is characterized by lakes, wetlands, dry mixedwood forests, and agriculture. Coal mining is a major activity in portions of the LU, and country residential and cottage subdivisions are fairly common

- **Tomahawk Uplands Mixedwood:** This sparsely inhabited area consists of rolling hills with mixedwood forests of aspen and white spruce, along with cultivated hay and some crop production in the valleys and flat plateaus. Peatlands occur in low-lying areas, and forest and peat harvesting occur in many parts of this LU.

1.2.3. Geology and Landforms

Landform is defined as the morphology of the land surface resulting from the interaction of physical processes (e.g. flowing water, wind, glacial action, weathering) and crustal movements of the earth's surface (Whittow, 1984). Parkland County contains several interesting landform and geologic features that comprise a landscape characterized by moderately rolling, hilly topography interspersed with flat, level terrain. Glaciers have left remnant meltwater channels and a hummocky glaciolacustrine plain throughout much of the County. Exposed bedrock lining major watercourses, pre-glacial river valleys, and pitted deltas also characterize the landscape. Extensive coal veins, hummocky stagnation moraines, ice-thrust moraines, sand dunes, sand and gravel beds, and a regionally significant esker are located in Parkland County (Westworth Associates Environmental Ltd., 2004). Notably, the diverse topography is closely related to the perceived scenic quality of the region, and should be considered carefully in the land use planning process. *Map 9: Landforms and Slopes* illustrates the locations of key landforms identified, as well as important subsurface geological features found througout Parkland County.

Some of the key surficial geological features, including steep slopes in Parkland County, are shown on *Map 9: Landforms and Steep Slopes*, including the Devon Dunes, the Carvel Pitted Delta, and the Wabamun Meltwater Channel.

The **Devon Dunes** are the results of post-glacial winds blowing delta sands into parabolic, elongated dune shapes.

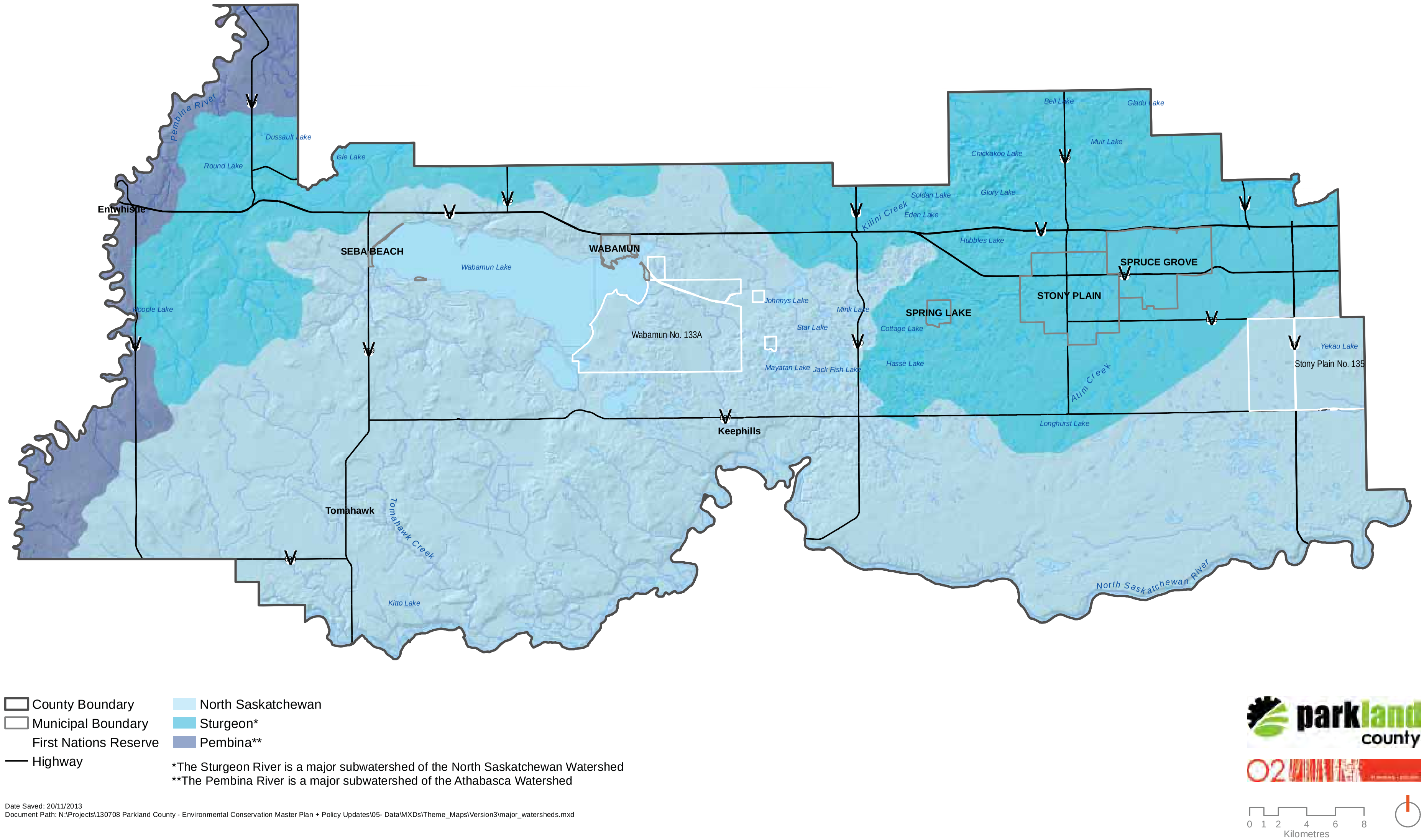
The **Carvel Pitted Delta** is an extensive hummocky, hilly area with numerous small kettle lakes and wetlands. They resulted from deltaic sediments being deposited on and around glacial ice. When the ice melted, the differential settling resulted in the hummocky or "pitted" topography. The Carvel Pitted Delta is a very unique geomorphological feature and is the only example in central Alberta.

The **Wabamun Meltwater Channel** was formed by waters flowing from a melting glacier, and runs through Wabamun Lake, Johnny's Lake, as well as the Kilini Creek corridor. Kilini Creek is in fact an "underfit" stream that runs through this much wider river valley channel, meandering back and forth between various nick points in the valley.

The **Smithfield Esker** is an additional minor glacial landform feature of interest. Eskers are sinuous ridges of sand and gravel that were deposited as sediments in a stream that flowed under a glacier.


Undulating topography of the Carvel Pitted Delta

MAP 3: MAJOR WATERSHEDS



Map 3. Major Watersheds

1.2.4. Watersheds and Aquatic Resources

Parkland County spans two major watersheds in Alberta and contains a variety of aquatic resources. The subsections below describe the main watersheds, subwatersheds, and aquatic resource features of Parkland County.

1.2.4.1. North Saskatchewan River Watershed

The North Saskatchewan Watershed drains over 80,000 km^2 of Alberta or 13% of Alberta's land mass. The watershed's headwaters are in Banff National Park and the river flows over 1,000 km to the Saskatchewan border. As part of the Nelson River Basin, water from the North Saskatchewan River eventually empties into Hudson Bay (NSWA, 2005). The majority of Parkland County's land (95%; about 2,600 km^2) occurs in the North Saskatchewan Watershed. Parkland County occurs in the "middle reaches" of the watershed, where several concerns have been identified due to agricultural, urban, and industrial land uses.

The North Saskatchewan River forms the southern boundary of Parkland County. The river channel averages about 120 m wide and 1.2 m deep in the area. The channel is sinuous with islands and bars and a pool and riffle sequence. It is partly entrenched and frequently confined in a valley. The North Saskatchewan River's flows are typical of a mountain headwater stream, with a strong snowmelt signature and peak flows during the summer. Peak summer follows have been reduced and minimum winter flows increased by water releases from the Brazeau and Bighorn Dams upstream (NSWA, 2005).

Water quality has been identified as a primary concern in the North Saskatchewan watershed (NSWA, 2012) (Goal 1 in the Integrated Watershed Management Plan states: "Water quality …is maintained or improved.") Water quality for the North Saskatchewan River within Parkland County is best represented by the Alberta River Water Quality Index monitoring records at Devon. Water quality at this station is typically "good" to "excellent" (90-100)[1]. In some years (e.g., 1998, 1999) nutrients have rated "fair". Many small tributaries to the North Saskatchewan River exhibit water quality issues. For example, Tomahawk Creek has very high faecal coliform counts and high particulate phosphorus, leading to "marginal" to "fair" water quality scores (Donahue, 2001).

1 http://environment.alberta.ca/01275.html. In addition, sub-indices for metals (22 variables monitored), nutrients (6 variables monitored), bacteria (2 variables monitored), and pesticides (17 variables monitored) are generally all "excellent" for the North Saskatchewan River at Devon.

Figure 3. Map of the North Saskatchewan River Watershed

Source: North Saskatchewan Watershed Alliance (2012)

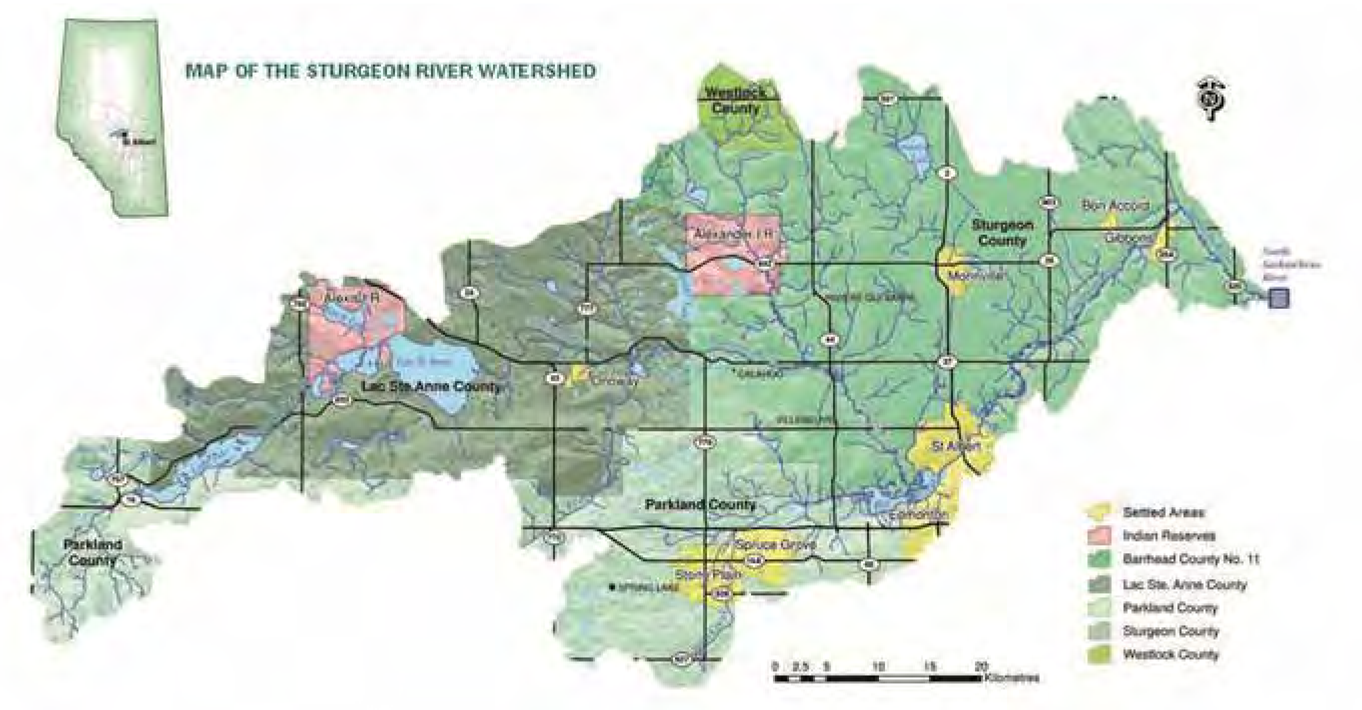


Figure 4. Map of the Sturgeon River Subwatershed

Source: City of St. Albert (2012)

1.2.4.2. Sturgeon River Subwatershed

The Sturgeon Subwatershed encompasses over 3,300 km^2 in total, and is shared between four counties, several urban municipalities and First Nations reserves (Figure 1). The Sturgeon River is a 259 km long river that meanders through the prairie. The river is named after the dinosaur-like fish that historically used to migrate through the river to feed, although it has vanished from the river now. The Cree knew the Sturgeon as mi-koo-oo-pow or “Red Willow River” (Ma, 2013).

About 30% of Parkland County’s land area (816 km^2) falls within the Sturgeon subwatershed (Map 3). The Sturgeon River’s headwaters begin near Hoople Lake in Parkland County between Highway 22 and the Jack Pine Provincial Grazing Reserve. The river flows northeast, passing through Isle Lake and entering Lac St. Anne County. Atim Creek and Kilini Creek are key tributaries to the Sturgeon River in the northern and eastern portions of Parkland County. Atim Creek flows into Big Lake, where it joins the main stem of the Sturgeon River. Kilini Creek joins the Sturgeon River near the Town of Onoway.

The health of the Sturgeon watershed has been assessed as “Fair” based on land use, water quantity, water quality, and biological indicators (City of St. Albert, 2012). No long-term water quality monitoring exists for the Sturgeon River; however, nitrogen and phosphorus have at times exceeded guidelines, and a subtle increase in nutrients and peaks in coliforms and nutrients have been observed near St. Albert.

1.2.4.3. Pembina River Watershed

A small portion on the west side of Parkland County is located in the Pembina River Subwatershed of the Athabasca Watershed. This area constitutes 144 km^2 within the county, or approximately 5% of the county’s land mass. The Athabasca River drains into the Peace-Athabasca Delta and is part of the Mackenzie River Basin, which drains into the Beaufort Sea in the Arctic.

1.2.4.4. Subwatersheds

The Water Survey of Canada’s “fundamental drainage areas” delineates five subwatersheds at an intermediate scale within the county, including:

- Upper North Saskatchewan – Wabamun (05DE)
- Upper North Saskatchewan – Strawberry (05DF)
- Sturgeon (O5EA)
- Central Pembina (07BB) (very small area within the County)
- Upper Pembina (07BA) (very small area within the County)

The large areas grouped under the Sturgeon and Upper North Saskatchewan drainage basins were of insufficient resolution to enable different areas to be compared with one another across the county with regards to hydrologic processes. Therefore, subwatersheds were further subdivided for this study using the Water Survey of Canada drainage basins, PFRA non-contributing area[12] boundaries, topography and hydrography, using a combination of ArcHydro drainage basin delineation and hand delineation of optimal drainage system boundaries by a Professional Engineer (member of APEGGA) specializing in water resources engineering. These boundaries were used as layers in some of the ESA modelling processed further described in this report.

Mishow Creek

Dussault Lake

Deer Lake Area wetlands

1.2.4.5. Other Creek Systems

Wabamun Creek provides an outlet for Wabamun Lake and tends to flow intermittently towards the North Saskatchewan River. Jackpine Creek, Shoal Lake Creek, and Mishow Creek are other small creeks that flow into the North Saskatchewan River. Many smaller ephemeral creeks flow only during spring snowmelt or during major rain events in the summer. Numerous small creeks, riparian areas, wetlands, and beaver ponds along creeks are also present in the County.

1.2.4.6. Lakes

Lakes of varying sizes and shapes occur in the County, particularly in the Central Lakes / Dry Mixedwood Landscape Unit. More information on available lake physical characteristics, water quality, fish and wildlife occurrences, and key management issues identified for key lakes in the County are summarized in the individual ESA fact sheets for each lake system.

1.2.4.7. Wetlands

Wetlands of various sizes and types occur throughout Parkland County. Many "prairie pothole" type wetlands (Stewart & Kantrud, 1971) occur in hummocky landscapes of the central and southeastern portions of the county. These include permanent, semi-permanent, and ephemeral lakes, ponds, marshes, and wet meadows characterized primarily by sedges (*Carex spp.*), bulrushes (*Scirpus spp.*) and cattails (*Typha spp.*). Wetlands adjacent to lakes, rivers, and streams (including oxbow wetlands and lacustrine wetlands) often contain willow (*Salix spp.*). Peatlands, including bogs and fens, occur in many locations throughout the county although they are concentrated in the western portions of the County in the Boreal Natural Subregions. Wetlands provide essential ecosystem services including water quality improvements, flood protection, groundwater recharge, carbon sequestration and climate regulation, while also supporting regional biodiversity. APPENDIX B presents a more in-depth look at the key functions and ecosystem services provided by wetlands.

1.2.4.8. Riparian Areas

Parkland County is characterized by many riparian areas flanking the edges of its rivers, streams, lakes, springs, ponds, and seeps. Like wetlands, riparian areas are hotspots for biodiversity, but also provide ecosystem services such as bank stability and erosion control, water quality improvement, flood mitigation, and aquifer recharge. As linear features in the landscape, riparian areas function as important movement corridors for wildlife. They also provide critical habitat for

1 Under normal circumstances (1:2 year events), non-contributing areas contribute no surface flow downstream (PFRA, 2008)

2

fish, and serve as significant recreational environments for people. APPENDIX B presents a more in-depth look at the key functions and ecosystem services provided by riparian areas.

1.2.5. Groundwater Resources

Groundwater is a significant water supply for most of the rural acreages and farmsteads in Parkland County. Groundwater occupies the saturated zones of underground soil and rock formations, where void spaces between soil grains or fractures are completely filled with water. Although groundwater is very common in most rock formations, some parts of the saturated zone contain more water than others. Intervals that can hold and convey large volumes of water are commonly referred to as aquifers. Generally, there are three different types of aquifers that can occur in Parkland County, including:

- Near surface sand and gravel deposits (sometimes referred to as "alluvial aquifers")
- Buried valley aquifers and/or inter-till sands and gravels
- Bedrock aquifers (sandstone, siltstone and/or fractured bedrock)

Map 10: Groundwater Resources highlights the locations of important surficial groundwater resource issues in Parkland County, including surficial sand and gravel aquifers and buried valley aquifers[3]. Sand and gravel aquifers are found in many parts of the County, but dominate the Devon Dunes area in the southeast of Parkland County in particular.

The Beverly Buried Valley occupies close to 374 km^2 in the county. This pre-glacial river valley was carved into the bedrock surface by erosion, and subsequently filled with glacial till, sands and gravels of the Empress Formation, and glacial Lake Edmonton deposits (Von Hauff, 2004). The valley runs from southwest to northwest across the county and underlies a large portion of the Town of Stony Plain and City of Spruce Grove. The valley ranges from approximately 6 to 9 km in width[4] and usually is less than 60 m deep, and on the surface generally corresponds with the topographic low visible on the surface extending from north of Stony Plain to Big Lake (Von Hauff, 2004).

The Onoway Buried Valley system occupies approximately 105 km^2 in the county. This buried bedrock valley is in the northwestern part of Parkland County, southeast of the Town of Entwistle. The buried valley is approximately 4 km wide with local relief less than 40 m. Sand and gravel deposits in the valley are expected to be less than 30 m thick.

3 Hotspots of groundwater use intensity as well available provincial and municipal models of the risk of groundwater contamination from activities at the surface are also incorporated on this map which represents the inherent risk that land use activities at the surface will affect groundwater resources.
4 Some hydrogeologists have expressed knowledge that the actual boundary of this formation is narrower than that mapped by HCL (1998); however Von Hauff (2004) is consistent with this information and future investigations would be necessary.


Atim Creek

Ecosystem Services

Ecosystems provide many conditions, functions, and processes that help sustain and fulfill human life (Bolund & Hunhammar, 1999; Daily, 1997; de Groot, et al., 2002; Tzoulas, et al., 2007; MEA, 2003). This recognition has given rise to the concept of Ecosystem Services (ES). ES include all of the direct and indirect benefits that people obtain from nature and natural processes. Some examples of ecosystem services include:

- Water storage and flood control
- Provision of water supplies
- Provision of genetic resources, raw materials, and food
- Pollination of crops and native vegetation
- Fulfilment of people's cultural, spiritual, recreational, and educational needs

An ecosystem services framework provides a way to communicate to a wide range of stakeholders that conservation is not just a matter of maintaining species and ecosystems for their inherent value, but is also a prudent strategy for sustaining many valuable services that support both the economy and human welfare. In contrast, a recent review of biodiversity monitoring programs noted that "many proposed and existing indicators do not connect clearly with human welfare and are unlikely to engage the interest of governments, businesses, and the public until they do so" (Balmford, et al., 2005). An ES framework recognizes the role of ecosystems in providing inputs for the production of economic goods, maintaining life-support systems over the long-term, and providing essential "green infrastruclture" that supports human activities in diverse ways (Heal, 2000).

The ECMP was crafted with an ES framework as its foundation. This document serves to foster a stonger, healthier, and more holistic relationship between Parkland County residents and their natural environment through analysis and recommendations designed to support the long-term viability of ecosystems and communities.

Black spruce and Larch trees at Wagner Natural Area

1.2.6. Vegetation

The unique location of Parkland County, at the intersection of two natural regions and three natural subregions, provides the potential for a wide diversity of habitat types and species. However, much of the vegetation in the region has been impacted by industrial, urban and agricultural development. This section describes the major native vegetation communities, as well as rare or unique plant species, that characterize Parkland County.

1.2.6.1. Forested Lands

There is a variety of forest communities within Parkland County whose presence depends on variations in slope, aspect, moisture regime, nutrients and soil type.

Deciduous and mixed-woods forests:

This forest type includes aspen and balsam poplar, with a varying abundance of white spruce.

- **Aspen** dominated stands occur on relatively flat and mesic sites with moderate nutrient regimes. They are considered the "pioneer" species and are often replaced by coniferous species like white spruce as these forests undergo succession. The understory is well-developed and diverse with many shrub and herbaceous species (Beckingham & Archibald, 1996).
- **Balsam poplar** becomes more prevalent in subhygric depressions or hygric riparian areas with rich nutrient regimes. These forests can be co-dominant with aspen and white spruce, and also have diverse shrub and herbaceous strata (Beckingham & Archibald, 1996).

Coniferous forests:

This forest type is dominated by jack pine, white spruce or black spruce; or a combination of each depending on the site conditions.

- **Jack pine** generally occurs on acidic, dry and nutrient poor sites with course soil. The presence of aspen, black spruce and white spruce may increase as moisture level across the site increases. Jack pine dominated forests are also characterized by a sparse shrub and lichen dominated understory that is characterized by bearberry, blueberry and reindeer lichen (Beckingham & Archibald, 1996).
- **White spruce** dominant stands are generally uncommon in Parkland County. This species generally occurs in co-dominant mixed-wood stands with diverse understories, or with jack pine as described above. Pure stands represent late successional stages of these communities and are rare in this region (Beckingham & Archibald, 1996).
- **Black spruce** tends to dominate poorly drained, nutrient-poor hygric sites, and jack pine will occur with black spruce in slightly drier sites. The sparse forest understory is characterized by Labrador tea and sphagnum mosses (Beckingham & Archibald, 1996).

1.2.6.2. Grassland

Native grassland communities are sparsely distributed throughout the county, but occur mostly on very dry, steep escarpments in river valleys that are not suitable habitat for trees. Grasslands are classified as such, if they have less than 20 to 30% shrub cover, have not been cleared or broken, and do not have an over story tree canopy (ASRD, 2013). Some native grassland may occur as unbroken pasture in various states of rangeland health. The communities of native grassland that may be remnant throughout the area may include species such as sand grass, needle and thread grass and June grass in drier areas; plains rough fescue and western wheatgrass in modal sites, and; fowl bluegrass and reed canary grass in wetter sites (ASRD, 2013). In general, the types of grassland depend on the moisture and nutrient regime (ASRD, 2012).

1.2.6.3. Shrubland

Shrubland communities occur throughout Parkland County and are also dependent on site moisture conditions. Willow and red-osier dogwood are common to riparian zones and areas of higher moisture regime. Species associated with drier, more exposed sites may include wild rose, snowberry, buckbrush, saskatoon, pincherry, and chokecherry (Westworth Associates Environmental Ltd., 2004). Shrublands may also be classified as such in areas of regenerating forests in cutblocks or seismic lines.

1.2.6.4. Wetlands

There is a diversity of wetlands types that occur in Parkland County that range from peat accumulating forested wetlands to mineral based, open water marsh wetlands. All are characterized by saturated hydric soils (Beckingham & Archibald, 1996).

Bogs and fens are the main categories of peatlands (saturated moss-derived organic soils) that occur in the region. Bogs tend to be more acidic and nutrient poor due to the lack of flowing groundwater. Fens receive nutrients from water sources flowing through and have a higher pH. Treed bogs and fens are commonly dominated by black spruce, with tamarack as a minor component. Shrubby bogs and fens have no trees and can be dominated by Labrador tea and other ericaceous shrubs. Bogs and fens can also occur as sedge-dominated peatlands with solely herbaceous plant cover (Westworth Associates Environmental Ltd., 2004).

Marshes develop on saturated mineral soils that are influenced by nutrient rich, standing or slow moving water. Reed grasses, cattails, rushes, sedges or aquatic grasses characterize these areas. Marshes in the province are generally classed by the Stewart and Kantrud system (1971), which defines marshes by water permanence, depth, and chemistry, and by land use. Any variations between wetland classes are reflected in differences in life form, cover interspersion, species composition, and species dominance (Stewart & Kantrud, 1971).

1.2.6.5. Rare Plants

Eighty-five species of rare plants have been recorded in Parkland County (ACIMS 2013). These include 26 species and two communities ranked in the S1 range, fifty-five species in the S2 range, seven of the S3's and two ranked SU (status unknown). The S-ranks, as established by the Alberta Biodiversity Monitoring Institute (ABMI), are a measure of rarity describing the conservation status for species in Alberta (Alberta Biodiversity Monitoring Institute, 2007). This database is only representative of those that have been recorded and does not preclude others from occurring in Parkland County. Table 5 of APPENDIX A outlines the species ranked either S1 or S2 that were used to determine areas of high environmental significance. There are a few vascular plants, but the majority are mosses, lichens, and liverworts. Many of the recorded rare species are found in peatlands, and other wetlands. The observations are mainly associated with Wagner Natural Area, North Saskatchewan River Valley, Wabamun Lake, Sturgeon River Headwaters, Devonian Botanical Gardens, and Clifford E. Lee Nature Sanctuary. The current distribution of rare species in part reflects the degree of sampling at various locations, sometimes in association with industrial developments as part of pre-disturbance biophysical assessments. The earliest records are from the 1920's and the current status of these individuals or populations is not known.

+
Campylium radical

Credit: Red Deer River Naturalists

+
Amerorcis rotundivolia var. linnaeta


Flocks of Canada Geese at Canada Geese ESA

1.2.7. Fish and Wildlife Resources

The unique location of Parkland County provides the potential for a wide diversity of habitat types and species; however, ecosystems in the region have been altered by industrial, urban and agricultural development. This section describes the major wildlife, and rare species, that have been observed in Parkland County.

1.2.7.1. Fish

Rivers and lakes in Parkland County provide habitat for many species of fish and minnows, providing excellent fisheries and recreation resources throughout the County (Westworth Associates Environmental Ltd., 2004). The North Saskatchewan and Pembina Rivers, and Wabamun Lake are important fish bearing water bodies in Parkland County, providing unique habitat for a wide range of fish species. Tributaries of both the North Saskatchewan and Pembina Rivers are important for spawning habitat, maintaining stream flow and maintaining water quality and quantity downstream (Westworth Associates Environmental Ltd., 2004).

The portion of the North Saskatchewan located in Parkland County is a transitional cold water to cool water habitat for fish, therefore, fish inhabiting this section of the river are a mix of cool and cold water species (i.e., northern pike, walleye, sauger, sturgeon, burbot, and suckers, goldeye). (Westworth Associates Environmental Ltd., 2004).

The Pembina River also contains a diversity of fish species (i.e., northern pike, walleye, rainbow trout, and goldeye) along with the southern-most populations of arctic grayling. Since arctic grayling populations have declined in Alberta over the past 20 to 30 years, the Pembina River is highly significant habitat conditions (Westworth Associates Environmental Ltd., 2004).

Steady populations of common sport fish species can be found in Wabamun Lake, Mink and Mayatan Lakes, Hasse, Mink, Muir, Spring, and East Pit Lakes (Westworth Associates Environmental Ltd., 2004). Northern pike, yellow perch, walleye, burbot, and white sucker are all found in Isle Lake, however the lake is subject to winterkill (Westworth Associates Environmental Ltd., 2004).

The County's close proximity to the City of Edmonton has resulted in overfishing and declines in most sport fish populations. A number of other non-sport fish have also experienced declines as a result of draining, improperly installed culverts, erosion, and stream modifications. Non-native fish may also be out-competing native fish for habitat and resources, resulting in a decline of populations (Westworth Associates Environmental Ltd., 2004).

Thirty-five species of fish have been recorded in Parkland County and observations were queried from the FWMIS 2013 database. This database is only representative of those that have been recorded and does not preclude others from occurring in Parkland County. According to the Status of Wildlife in Alberta, these include three exotic species, twenty-one secure species, one At Risk, one that May Be At Risk, two sensitive species and six whose status is undetermined (Table 1). The two sensitive species (i.e., sauger and redbelly dace) are particularly vulnerable to habitat degradation due to human activity.

Only the Lake Sturgeon is federally listed as endangered in Alberta, however, the Threespine stickleback is endangered in BC and was illegally introduced into Alberta. It has been observed at Eden and Hasse Lakes.

The bull trout is a coldwater species with relatively narrow biotic and abiotic tolerances (Rieman & McIntyre, 1995). Abundance and distribution of bull trout have declined over the last century – due to habitat degradation, competition with exotic trout and interbreeding with brook trout – and were not observed in the FWMIS database for Parkland County. Please see Table 6 of APPENDIX A for a full list of fish species observed in Parkland County. Some populations in Alberta have increased since the introduction of protective legislation in 1995 and the bull trout management and recovery plan (Westworth Associates Environmental Ltd., 2004).

1.2.7.2. Wildlife

A wide variety of ungulates, carnivores, fur-bearers, small mammals, waterfowl, shorebirds, songbirds, raptors, game birds, and a smaller number of amphibians and reptiles can be found in Parkland County. White-tailed deer are common throughout due to the interspersion of open and wooded habitats, while moose are abundant in areas of contiguous forest interspersed with wetlands. Mule deer and elk are less abundant (Westworth Associates Environmental Ltd., 2004). The coyote is the most abundant carnivore, followed by fewer populations of black bear, cougar, lynx and fox. Smaller carnivores include a variety of weasels, mink and marten that occur in a wide range of habitats.

Beaver and muskrat are ubiquitous throughout the region, occurring where forage exists close to wetlands that don't freeze through in the winter. Showshoe hare and red squirrel are abundant where forage and cover exist. Other small mammals include striped skunk, northern flying squirrel, porcupine, woodchuck, voles, mice, shrews, ground squirrel, gopher and American badger. A variety of bats have been observed where suitable habitat exists, including little and big brown bats, silver-haired bat, hoary bat, long-legged bat and northern long-eared bat (Westworth Associates Environmental Ltd., 2004).

Over 200 species of birds are known to inhabit Parkland County, including approximately twenty-five water bird species. High waterfowl breeding densities occur in the eastern portion of the county on the Stony Plain Moraine that is characterized by small lakes and knob and kettle terrain. The larger lakes are important staging areas for waterfowl, and colonial birds, as are the major rivers. There are also water birds that occupy more specific habitat like wet shrublands/grasslands, mudflats or peatlands (Westworth Associates Environmental Ltd., 2004).

Over 120 species of terrestrial birds occupy a variety of upland habitats depending on ecosite type. Forests, grasslands and wetlands are home to many sparrows, warblers and woodpeckers, as well as approximately twenty-two species of raptors. Game birds such as grouse, partridge and pheasant occupy woodlands, shrublands, grasslands and even agricultural areas (Westworth Associates Environmental Ltd., 2004).

Amphibians such as frogs, toads and salamanders occupy various wet habitats associated with woodlands, wetlands and riparian areas. The red-sided and plains garter snakes are the only reptiles observed in Parkland County, and depend on the availability of suitable hibernacula in close proximity to ponds, lakes, marshes and dugouts (Westworth Associates Environmental Ltd., 2004).

A number of species of special concern are known to occur or could potentially inhabit the County. A number of species are listed as Sensitive or At Risk in Alberta. SARA species observed or that have the potential to occur in Parkland County are summarized in Table 2. Specifically, there are many listed birds associated with peatlands and wetlands such as Horned grebe, Common nighthawk, Olive-sided flycatcher, Yellow rail, Rusty blackbird, and the Canada warbler. The status of the Short-eared owl is due to the dwindling number of native grasslands. There have been no recent observations of Northern leopard frog populations even though the previous species range covered a part of Parkland County. One observation of Grizzly bear was recorded in 2002 at Mumm Creek by Fish and Wildlife enforcement. The Peregrine falcon has been observed several times throughout the county, mostly nesting along the Pembina and North Saskatchewan Rivers (Westworth Associates Environmental Ltd., 2004).

Table 1. Species at Risk Act (SARA) species observed or potential to occur in Parkland County

Scientific Name	Common Name	Status	Habitat	Natural Sub-region
Lithobates pipiens	Northern Leopard Frog	Special Concern	wetlands and fish free streams	DM
Danaus plexippus	Monarch butterfly	Special Concern	milkweed meadows	CM, CP, DM
Asio flammeus	Short-eared Owl	Special Concern	native grasslands, prairie, fields	CM, CP, DM
Chordeiles minor	Common nighthawk	Threatened	open areas (clearings, bogs, lakeshores, disturbances)	CM, CP, DM
Contopus cooperi	Olive-sided flycatcher	Threatened	coniferous forested edges of wetlands and bogs	CM, CP, DM
Coturnicops noveboracensis	Yellow Rail	Special Concern	sedge dominated wetlands and peatlands	CM, CP, DM
Euphagus carolinus	Rusty Blackbird	Special Concern	boreal wooded peatlands	CM, CP, DM
Falco peregrinus anatum/ tundrius	Peregrine Falcon	Special Concern	cliffs, open areas, forested, urban	DM
Podiceps auritus	Horned Grebe	Special Concern	wetlands, lakeshores	CM, CP, DM
Wilsonia canadensis	Canada warbler	Threatened	boreal	CP, DM
Ursus Arctos (prairie population)	Grizzly bear	Extirpated	n/a	CM, CP, DM
Ursus Arctos (prairie population)	Grizzly bear	Extirpated	n/a	CM, CP, DM

DM – Dry Mixedwood; CM – Central Mixedwood; CP – Central Parkland

1.2.8. Protected Areas

Protected areas in Parkland County are largely associated with significant lakes, wetland areas, river systems, and natural areas within urban areas. They are owned and managed by the Province, the County, Municipalities, or Conservation organizations. Parkland County is home to several Provincial Parks, Natural Areas and Crown Lands, as well as the Jack Pine Provincial Grazing Reserve. Provincial Parks are distributed regularly across the County. Lois Hole Centennial Provincial Park, one of Alberta's newest Provincial Parks, is located in the northeast corner of the County, adjacent to Big Lake. Wabamun Lake Provincial Park is situated next to the Village of Wabamun, just south of Highway 16. The Pembina River Provincial Park is located at the western edge of the county along the steep slopes of the Pembina River Valley Gorge. Conservation organizations, including the Alberta Conservation Association, Alberta Fish and Game Association, Ducks Unlimited, the Edmonton and Area Land Trust, and the Nature Conservancy maintain a strong presence in the County; managing environmentally significant areas such as Glory Hills and the Clifford E. Lee Natural Sanctuary. *Map 12: Protected/Conservation Areas* illustrates the diversity and distribution of conservation areas, and areas of important ongoing ecological research, that exist throughout the County.

1.2.9. Cultural and Historic Features

Several areas within Parkland County have been recognized as containing potentially significant historic, archaeological, and paleontological resources. Each land parcel in the Alberta Listing of Historic Resources has been assigned an HRV ranging from 1 to 5[5]. The highest level of protection (HRV 1) is afforded to lands that have been designated under the Albert Historic Resources Act as Provincial Historic Resources. There are two historic resources in the County with designated values of 1. One is the Stony Plain School, which is significant due to its unique 1920s period architecture and its prominence in the development of Alberta's educational systems in the early part of the 20th century[6]. The second HRV 1 site in Parkland County is St. Aidan and St Hilda Angilcan Church located north of Wabamun Lake along Highway 16. This site is significant due to its unique architectural features and because it is a good example of early rural pioneer churches in Alberta[7] (The Alberta Register of Historic Places, 2013).

Thirty of the 296 archaeological sites identified in the County have been designated as HRV 4 sites, indicating the presence of an historic resource that may require avoidance (Alberta Historical Resources Act, 2013). HRV 4 sites in Parkland County are a combination of pre-contact campsites and stone tool artifacts, a Native animal kill site, settlement period homesteads, and an historic ferry crossing.

5 HRV1: Provincial Historic Resources, World Heritage Sites, and lands owned by Alberta Culture for historic resource protection and promotion purposes; HRV 2: designated under the Act as a Municipal or Registered Historic Resource; HRV 3: contains a significant historic resource that will likely require avoidance; HRV 4: contains a historic resource that may require avoidance; HRV 5: believed to contain a historic resource

6 Source: The Alberta Register of Historic Places https://hermis.alberta.ca/ARHP/Details.aspx?DeptID=1&ObjectID=4665-0572

7 Source: The Alberta Register of Historic Places https://hermis.alberta.ca/ARHP/Details.aspx?DeptID=1&ObjectID=4665-0046

The majority of potentially historic resources in the County have been severely disturbed by cultivation or other development activities over the past several decades. Intact sites are most likely found in areas where there is little to no agricultural activity, or where soil deposition processes have buried sites beneath typical cultivation zone depths (Westworth Associates Environmental Ltd., 2004). These conditions occur on large river flats prone to flooding, which explain the density of significant historic artifacts and remains discovered along the banks of the North Saskatchewan River. Some of these buried soils zones in the Edmonton Area have produced artifacts dating back to 7,000 years ago (Westworth Associates Environmental Ltd., 2004).

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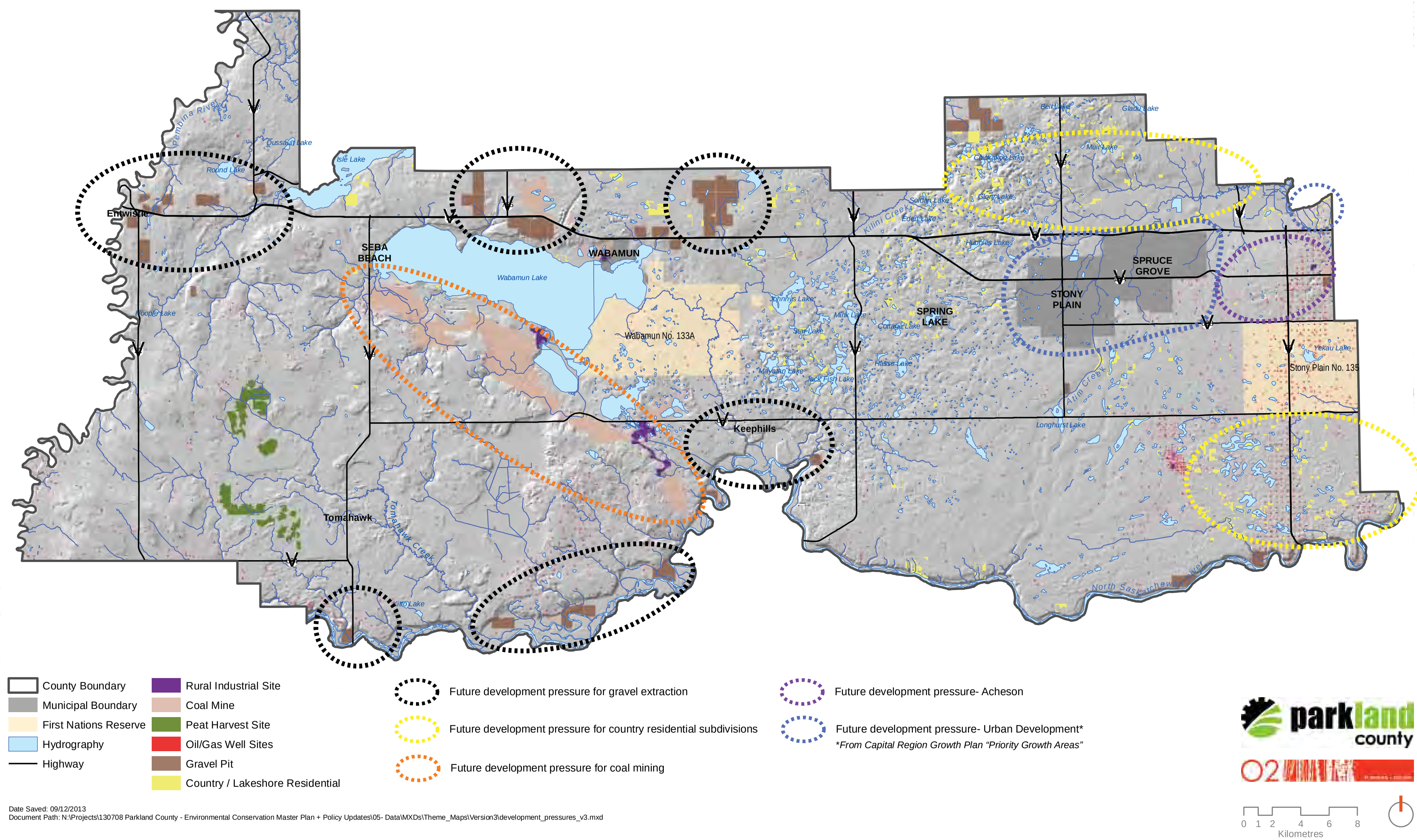
Wabamun Lake Provincial Park

MAP 4: DEVELOPMENT PRESSURES



Map 4. Development Pressures

1.2.10. Development Pressures

There are a variety of existing and future development pressures facing Parkland County. Population within the County proper is approximately 30,600 people, and has been growing steadily, with a 4.6% growth rate observed between 2006 and 2011 (Statistics Canada, 2011). According to recent population numbers approved by the Capital Region Board (2013), the County is projected to grow to 42,700 residents (low case scenario) to upwards of 50,000 (high case scenario) by 2044 (Capital Region Board, 2013).

In addition, urban municipalities embedded within Parkland County are experiencing extremely high growth rates, with population increases of 22% in the Town of Stony Plain and 34% in the City of Spruce Grove over 2006-2011. Population growth drives development pressures tied to the balance of land uses within the County. *Map 4: Development Pressures* highlights specific areas of the County targeted for certain key development pressures. The key development pressures identified within Parkland County include:

- The Acheson Industrial Area
- Country residential and lakeshore developments
- Sand and Gravel extraction
- Peat harvesting
- Coal mines and power plants (outside the jurisdiction of Parkland County)
- Oil and gas developments
- Large livestock operations

While many industry-specific management practices are touched upon in this section, Section 4 of this report provides a more in-depth discussion of best management practices for balancing conservation and development.

1.2.10.1. The Acheson Industrial Area

The Acheson Industrial Area is Parkland County's major commercial/industrial hub. The Area Structure Plan (ASP) area occupies 16 square miles (4,145 hectares or 10,240 acres) of land at the eastern edge of the County bordering the City of Edmonton. Its centre is the intersection of Highways 16A and 60. Substantial growth has occurred in recent years within the ASP area, especially north of the Canadian National Rail (CNR) line on both the east and west sides of Highway 60. The Northview Business Park on the west side of Highway 60 has a number of major industries occupying large parcels, including SMS Equipment, Suncor, Altalink, and Navistar (Parkland County, 2012). The majority of lands in the ASP area are districted for future industrial and commercial development. The availability of developable land, low industrial tax rates, and the Industrial Area's position within a major transportation network are among the advantages driving growth in Acheson.

While the majority of development in the Acheson Industrial Area has occurred north of Highway 16A in existing industrial parks, development phasing has now begun to move south of Highway16A. This expansion poses several potential conflicts with adjacent residential developments and environmentally significant areas.

The residential subdivision of Osborne Acres accounts for approximately 71.8 hectares (177.4 acres) of land in the ASP area. Osborne Acres consists of approximately 41 independently serviced country residential homes on lots ranging in size from 3.7 to 5 acres. Two Municipal Reserve parcels also exist within the subdivision. While a 200 m wide agricultural zone on the north, east, and south sides of Osborne Acres acts as a buffer between existing residential development and future industrial uses, pedestrian and traffic safety concerns may increase in the Osborne Acres area with increasing industrial development (Parkland County, 2012).

Also of concern relating to the expansion of the Acheson Industrial Area is the preservation of the Wagner Natural Area, located in the northwest corner of the ASP area (Parkland County, 2012). The Wagner Natural Area is a provincially significant ESA identified in this and previous reports, and constitutes a regionally and provincially significant natural area.

Expanding industrial land uses in the ASP area may compromise the ecological integrity and viability of the Wagner Natural Area if appropriate planning measures are not in place. Due to the natural area's extreme sensitivity to changes in water level, increased surface runoff resulting from industrial development south of Wagner has the potential to disrupt delicate hydrological regimes and sensitive plant communities within the natural area. Increasing the total volume of surface runoff should be avoided as much as possible, and any future developments located within the groundwater recharge zone or the natural surface drainage basin for the Wagner Natural Area must be diligent in maintaining historic surface and groundwater conditions (AECOM, 2011).

Figure 5. Acheson Industrial Area Structure Plan Boundary (Acheson Area Structure Plan, 1997)

The Acheson/Big Lake Area Master Drainage Plan

In 2011 Parkland County completed the Acheson/Big Lake Area Master Drainage Plan. The purpose of this Master Drainage Plan was to consider the cumulative effects of individual industrial and residential developments on the Area's stormwater management systems for prior to completion of this Master drainage Plan, individual developments were required to submit stormwater management studies that did not consider the cumulative effects they would have on the stormwater management systems. The Master Drainage Plan also created an overall stormwater management system for future developable lands in the area. As part of the Master Drainage Plan, a wetland inventory and classification study was completed for the entire Acheson/Big Lake Area.

Following completion of the Master drainage Plan, Parkland County applied to Alberta Environment Sustainable Resource Development (AESRD) for a Fenceline Approval under the Water Act for management of stormwater in the entire Acheson/Big Lake Area. On December 21, 2011 Parkland County received this Fenceline Approval. The Fenceline Approval requires developers to follow the criteria outlined in the Master Drainage Plan (such as discharge rates, quality requirements, isolation valve requirements, outfall and receiving body locations, etc.) and assists in ensuring construction of stormwater management facilities or improvements to the stormwater system are completed in a coordinated and organized fashion. The Fenceline Approval also outlines what wetland mitigation, operation and maintenance requirements are to be followed in the area. If developers propose any stormwater management systems that are in contravention with the Fenceline Approval, the developer is required to obtain support from Parkland County as well as an amendment Fenceline Approval from AESRD.

Existing documents such as the Water Act Fenceline Approval, the Acheson/Big Lake Area Master Drainage Plan, and the accompanying Acheson/Big Lake Area Wetland Inventory and Classification (AECOM, 2011), help to ensure that the area's stormwater is properly managed. These guiding documents attempt to minimize any impacts to the area's water systems, including the recharge zone underlying the Wagner Natural area, surrounding wetlands, and receiving water bodies.

1.2.10.2. Country Residential and Lakeshore Developments

Most of Parkland County's population lives in traditional country residential subdivisions concentrated in the northeast and southeast portions of the County near the City of Edmonton, Spruce Grove, and Stony Plain (Parkland County, 2010). Country residential developments are subdivisions of rural lands that create multiple residential lots. These lots are typically serviced with wells or cisterns and septic systems or by connection to communal water and sanitary services. Typically, country residential subdivisions have an average net residential density of less than 200 units per quarter section (CRB, 2009).

Demand for this type of residential subdivision, as a lifestyle, is expected to remain stable over the coming decade. However, the rising number of large lots with private onsite services is becoming increasingly unsustainable, particularly in regard to water supply, susceptibility to groundwater contamination from private sewage systems, and long-term road maintenance. While certain areas of the County may be able to support an increase in country residential development, smart growth principles resulting in more compact, serviced subdivisions should be explored in the interest of balancing growth, demand, and environmental integrity.

1.2.10.3. Sand and Gravel Extraction

Glacial deposits underlying much of Parkland County make it rich in aggregate resources. Owing the resource's importance in supporting the local and regional economy, aggregate extraction operations are widespread in Parkland County (Parkland County, 2010). Next to oil sands and coal, aggregate is the next largest extraction industry in Alberta. The expansion of roads and residential growth within the county will ensure the further development of aggregates required as construction material.

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Gravel Pit

Current operations exist along the north boundary of the county and some parcels along the North Saskatchewan River. Even though their land use is temporary, sand and gravel extraction sites in Parkland County should be strategically located away from sensitive adjoining land uses and environmentally significant areas. Future reclamation should also be carried out progressively, according to approved plans and regulatory requirements.

Any proposed pit larger than 5 ha is regulated by the Code of Practice for Pits under the Environmental Protection and Enhancement Act (EPEA), and Conservation and Reclamation Regulation (on private land), or by the Public Lands Act. If a pit is developed on public land, it is subject to the Water Act regulation as well as EPEA. The County was recently given the authority by the Alberta government to distribute and manage the permitting of pits.

1.2.10.4. Peat Harvesting

Peat harvesting occurs in a fairly localized area in the southwestern portion of the county. Peat harvesting is limited to areas where peatlands exist and compared to the other types of development pressures, may not be as concerning to environmentally significant areas. Current efforts should aim to maintain the integrity of existing sensitive areas and carefully consider the impacts of peat harvesting on adjacent lands. Applications for exploration and extraction of peat are reviewed under the Public Lands Administration Regulation (PLAR) and administered as a Surface Material Lease.

TransAlta Wabamun Power Plant

1.2.10.5. Coal Mines and Power Plants

The Transalta Wabamun power plant at the Whitewood coal mine was fully retired on March 31, 2010, whereby the mine ceased coal processing. Figure 5 shows forest loss related to coal mining at the Whitewood mine prior to decommissioning between 2000 and 2012[8]. Reclamation has advanced progressively since 1962 and more than 95 per cent of the lease area has been reclaimed to a state equivalent or better than its original land use. The reclaimed land can support agriculture, woodlands, wildlife habitat and recreation but most of the land has been reclaimed for agricultural purposes or wildlife habitat.

Although portions of the mine have been progressively reclaimed, the reclaimed areas will not be released to the crown until they are accessible, safe, no longer required for mine operations and certified as reclaimed by Alberta Environment. Currently, there are no known applications for further coal development in the county and pressures from this industry in the future are not expected.

1.2.10.6. Oil and Gas Development

The majority of oil and gas well site development is concentrated in the eastern portion, and dispersed throughout the remainder of the county. Compounded with the eastern oil and gas extraction, are country-residential expansions and the Acheson Industrial complex. This industry is expected to expand in the future; however, oil and gas development in Parkland County is conducted in association with an established consultation process. The safety and security of County residents, along with environmental impacts are elements of concern with each application for development.

8 Source: University of Maryland Global Forest Change analysis (Hansen, et al., 2013)

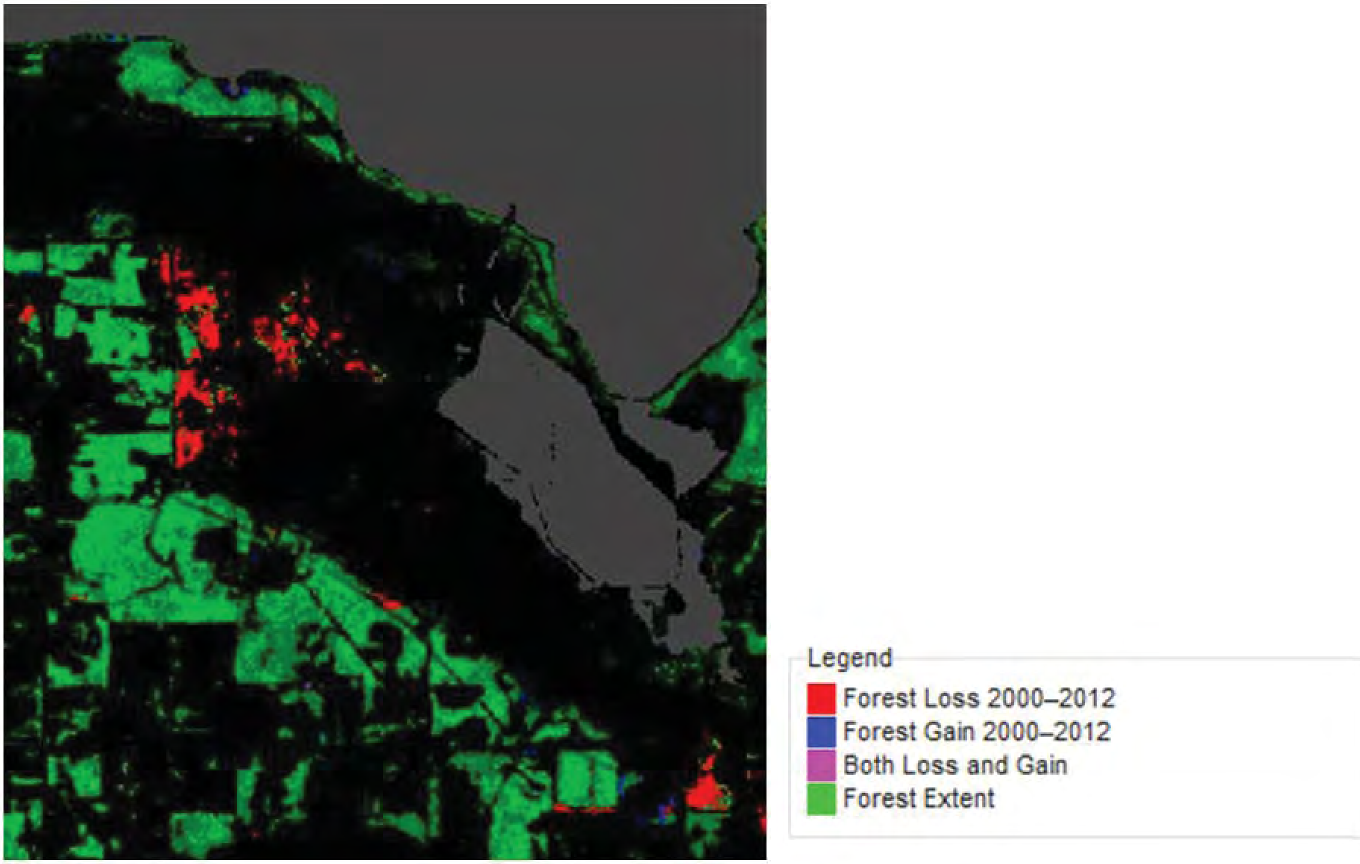


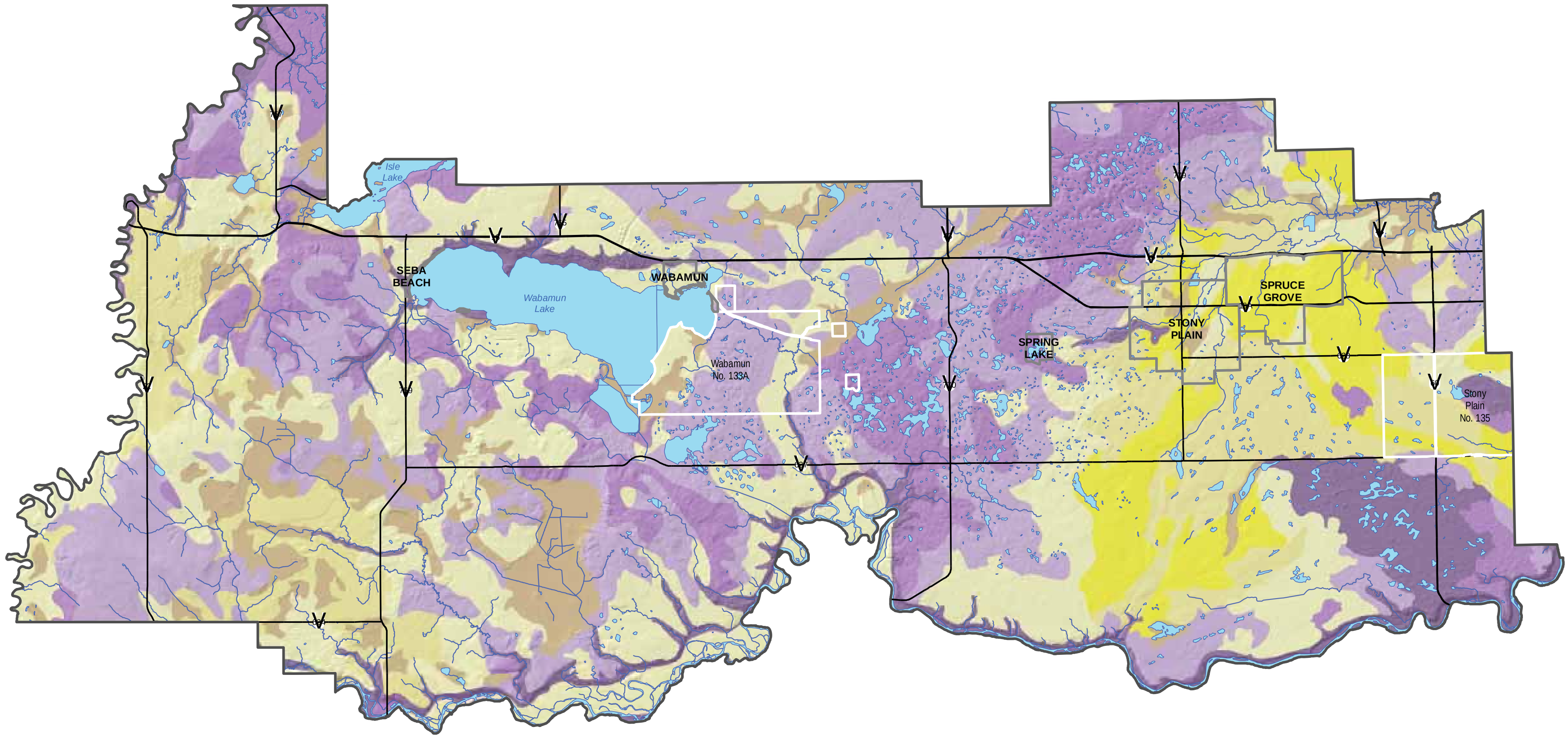
Figure 6. Coal mining related forest loss from 2000-2012 south of Wabamun Lake

1.2.10.7. Agriculture

Since some of the most productive agricultural land in the prairies occurs in the Central Parkland Subregion, much of this area in Parkland County remains under intense cultivation (Map 5). The dark Chernozem soils are highly suitable for cultivated crop production. The dominant land use in the Dry-Mixedwood Subregion is also agriculture due to the suitable soil types. The former Lake Edmonton basin is responsible for developing the best agricultural soils in the area. Areas that are dominated by wetlands or peatlands are less suitable for agricultural activities, but it is common for land owners to drain and cultivate through prairie pothole wetlands if they occur in a highly productive parcel of land.

Conflicts with ESAs may occur where highly productive agricultural land is adjacent to or coincides with wetlands and riparian areas. For example, Whale Lake wetlands complex is a broad expanse of wetland/marsh habitat with some willow and upland forest habitat flanking its edges. The wetland is surrounded on all sides by agricultural land and the wetland edges have been affected by haying in several locations. Many of the ESAs associated with lakes or water ways are surrounded by intense agriculture, including Hubbles Lake, Isle Lake, Jackfish Lake, Wabamun Creek, and the North Saskatchewan River Valley. Productive soils are often adjacent to and associated with frequently inundated areas (i.e., wetlands and riparian areas), which constantly incurs development pressures on these valued ecosystem components.

MAP 5: AGRICULTURAL PRODUCTIVITY OF SOILS



County Boundary
Municipal Boundary
First Nations Reserve
Highway
Hydrography

Canada Land Inventory Soil Capability For Agriculture Classes
Class 1: No significant limitations for agriculture
Class 2: Moderate limitations
Class 3: Moderately severe limitations
Class 4: Severe limitations
Class 5: Very severe limitations
Class 6: Extremely severe limitations
Organic soils*

*Interpretive soil capability classification is not applied to organic soils due to insufficient information

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0 1 2 4 6 8
Kilometres

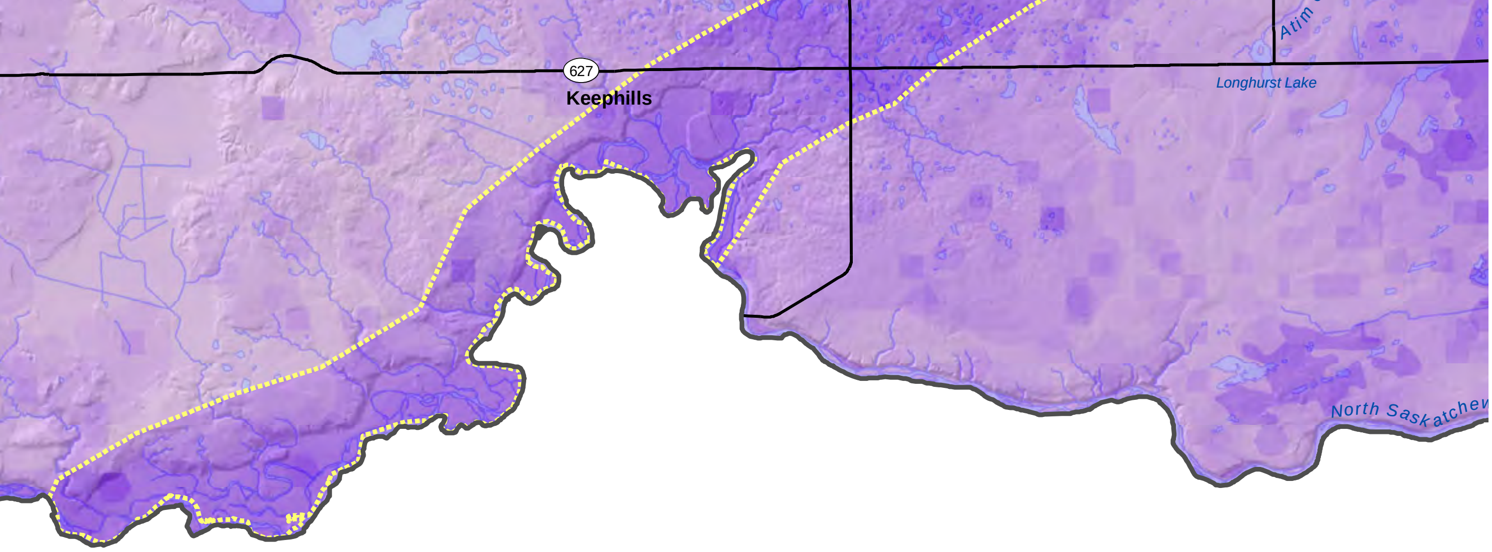
Map 5. Agricultural Productivity of Soils

1.3. Applicable Federal and Provincial Legislation

All jurisdictions, including Federal, Provincial, and Municipal entities, have some degree of authority over environmental resources in the County. Table 2 outlines legislation applicable environmental conservation and management concerns in Parkland County.

Table 2. Provincial and Federal Legislation Applicable to Environmental Management in Parkland County

Legislation/Policy	Description
Federal *Fisheries Act* - Fisheries and Oceans Canada(FOC) R.S.C. 1985 cF-14	Regulates and enforces policy to prevent harmful alteration, disruption, and/or destruction of fish habitat
Canada Water Act, R.S.C. 1985, c.C-11	Used to enable and regulate joint flood control and agricultural water use
Migratory Birds Convention Act 1994, 1994, c.22	Regulates activities that could harm migratory birds or thier nests, and prohibits dumping of certain materials that threatens to contaminate or destroy important migratory bird habitat
Federal Navigable Waters Protection Act - FOC R.S.C. 1985 c.N-22	Protects the public's right to navigation of Canadian waters by prohibiting construction on or across any navigable water without the authorization of the Minister of Fisheries and Oceans Canada
The *Species at Risk Act*, S.C. 2002, c.29	Prohibits harming or killing endangered species, as defined in the Act. Prohibts the destruction of critical habitat for species at risk.
Provincial Water Act, R.S.A. 2000, c.W-3	Governs the diversion, allocation, and use of water. Regulates and enforces actions that affect water use management, the aquatic environment, fish habitat, in-stream construction, and stormwater management
Provincial *Environmental Protection and Enhancement Act (EPEA)* R.S.A. 2000, c. E-12	Stipulates management of contaminated sites, storage tanks, landfill management practices, hazardous waste management practices, wastewater management, and enforcement
Provincial *Alberta Land Stewardship Act*, S.A 2009, c.A	Supports the implementation of the Land use Framework by designating seven land use regions. Establishes the Land Use Secretariat and gives authority to regional plans through the creation of Regional Advisory Councils that address cumulative effects of human and other activity.
Provincial *Municipal Government Act* R.S.A. 2000, c.M-26	Provides municipalities with authority to regulate and manage land use activities that may adversely impact the local environment
Provincial *Public Lands Act*, R.S.A. 2000, c.P-40	Regulates and enforces activities that affect Crown-owned beds and shores of water bodies and some Crown-owned uplands that may affect nearby water bodies
Wildlife Act, R.S.A. 2000 c.W-10	Regulates and enforces the protection of wildlife and endangered species, including plants
Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act - ASRD and Community Development	Both acts are used to minimize the potentially harmful effects of land use activities on environmental resources in and adjacent to parks and other protected areas
Provincial Wetlands Policy	Establishes a "No Net Loss" policy to protect wetlands and mitigate losses
Municipal Development Plans	Plan adopted by Council as guiding vision and framework for future development; pursuant to the *Municipal Government Act*
Area Structure Plans (Municipal)	Plans adopted by Council as a bylaw pursuant to the *Municipal Government Act*, that provide a framework for future subdivisions, development, and other land use practices within a specific area characterized by a certain land use or environmental feature, such as a lake
Land Use Bylaws (Municipal)	Divides the municipality into land use districts and established procedures for processing development applications. Sets forth rules dictating how land parcels can be used and developed, including zoning



2. Methodology

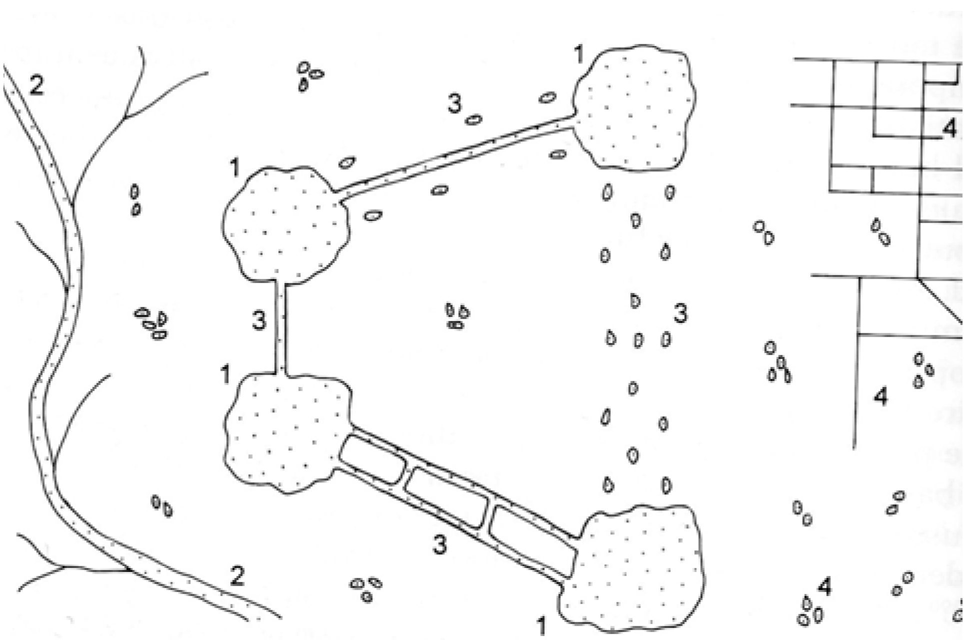
This section outlines the methodology used to identify Environmentally Significant Areas (ESAs) in Parkland County. ESAs are the priority areas for conservation as identified by the output of multiple ecological criteria analyzed in GIS models. Section 2.1.2 outlines the key criteria that went into these models to delineate ESAs at the county-wide scale. Sections 2.1.5 and 2.1.6 provide explanations of how final ESAs were ranked and prioritized within a hierarchy of environmental sensitivity and significance.

2.1. Landscape Ecology Principles

Over the past decade, ecological understanding of the `big picture' has emerged based on a foundation of general patterns and principles in landscape ecology. This big picture approach is founded on the idea that there are certain "indispensable patterns" in the landscape that, if protected, will conserve the majority of important ecological functions (Forman, 1995). These functions, in turn, strongly influence water quality, biodiversity, and other valued environmental components. While all or specific attributes of an ecosystem may not be protected by these measures, the most important assets will retain their integrity if the essential general patterns are maintained. This is the critical rationale behind identifying and prioritizing ESAs in Parkland County as a central component of the County's Environmental Conservation Master Plan. It is also the central concept driving analysis methods for ESA characterization and modelling.

Landscape ecologist Richard Forman of Harvard University (Forman, 1995) has demonstrated that the following Indispensable Landscape Patterns, if properly conserved, can ensure an ecologically viable landscape:

- **Large patches** of natural vegetation that provide the benefits of species richness, habitat for interior species, and natural hydrological processes that maintain water quantity, timing, and quality downstream.
- **Connectivity** between large patches in the form of wide corridors or clusters of smaller patches of natural vegetation. At least some of these corridors or clusters of patches should be large enough to provide interior habitat. Many of the "micro-site" ESAs in addition to the larger ESAs provide connectivity through the landscape.
- **Vegetated corridors** along major streams and rivers to provide for species movement, erosion control, water quality maintenance, and protection of fish habitat. In addition, headwater seepage areas and first order streams should receive protection in the form of near contiguous vegetative cover.
- **Stepping stones** of small natural vegetation patches through altered landscapes to provide for benefits such as habitat for rare species and species movement through the matrix. Many small micro-site ESAs (e.g., wetlands or forest patches) play this role in the landscape.



1= a few large patches of natural vegetation, 2= major stream or river corridor, 3= connectivity with corridors and stepping stones, 4=heterogeneous remnants of natural cover within the surrounding non-natural cover (Forman, 1995)

Figure 7. Indispensible Landscape Patterns

2.2. ESA Identification Process

Criteria for ESA identification and prioritization centre on the foundational patterns and principles of landscape ecology, and are bolstered by scale appropriate conservation targets and thresholds identified in peer-reviewed literature, technical reports, and other relevant publications. As such, systematically identifying ESAs based on ecological principles, recognized conservation values, and local expertise provides a high level of scientific rigor and objectivity in justifying their selection (Margules & Pressey, 2000). Drawing on this diverse knowledge base, well-defined criteria were established as quantifiable metrics of environmental significance aimed at meeting specified conservation objectives for Parkland County.

Advances in GIS technology have greatly improved the accuracy of quantifying and prioritizing environmental values across landscapes. ESA criteria, along with defined metrics of environmental sensitivity, were weighted according to relative importance and systematically overlain in a multi-criteria model aimed at identifying and classifying ESAs within Parkland County. By understanding where a particular landscape feature sits in this hierarchy of significance and vulnerability, more informed decisions can be made regarding the management of land uses in and around the ESA.

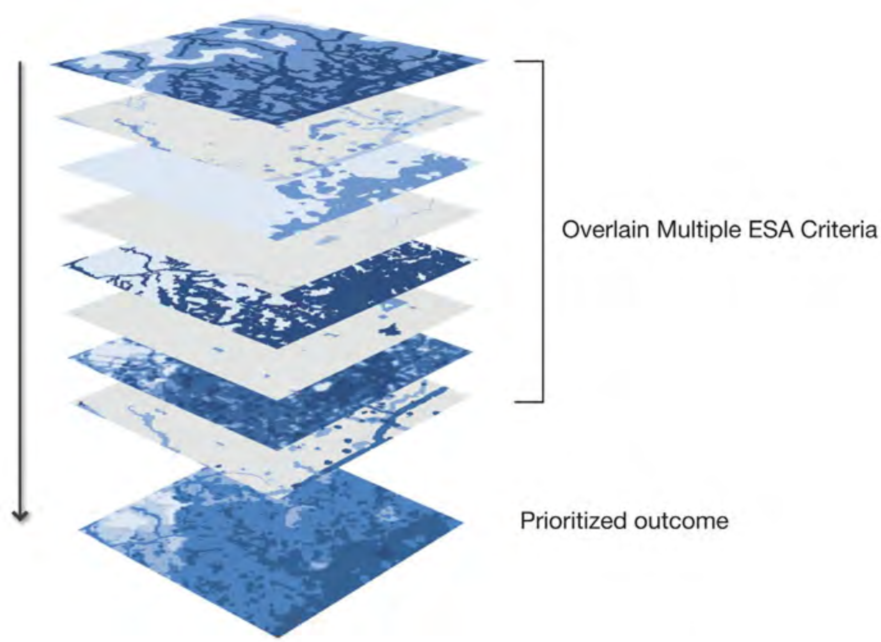


Figure 8. ESA Criteria Modelling Diagram

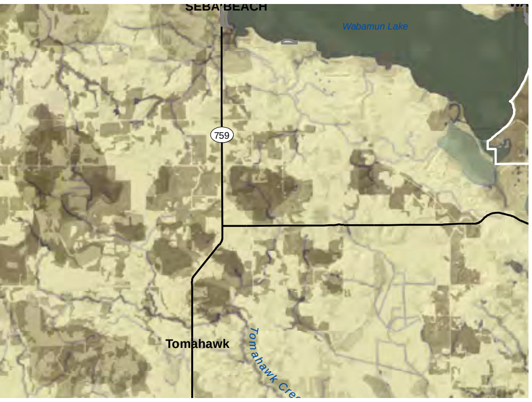
The following steps were taken in the process of identifying, classifying, and deciding how to manage ESAs:

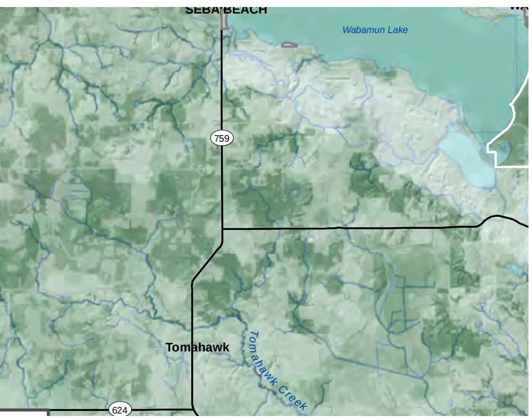
- Define ESA objectives
- Build criteria that meet specified objectives
- Acquire data that best represent established criteria
- Systematically weight and score criteria
- Conduct spatial modelling to determine the location, classification, and relative significance of ESAs
- Develop best management practices for ESA management

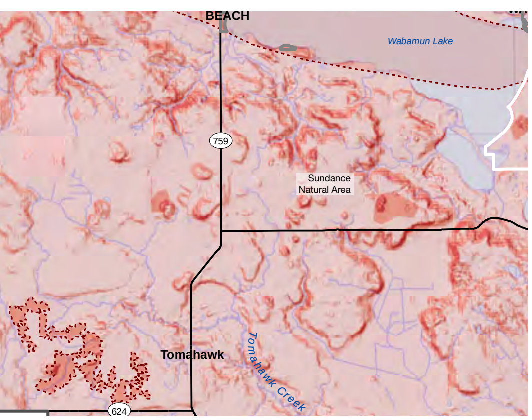
2.2.1. Objectives

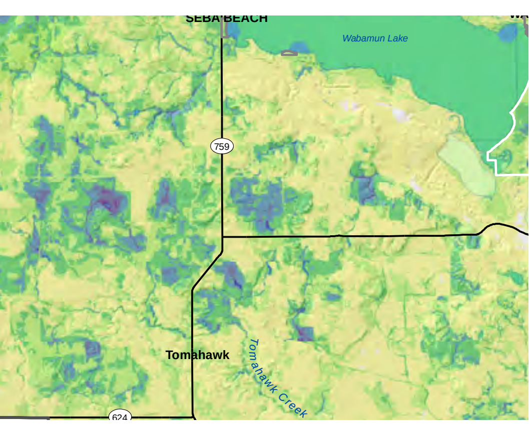
Conservation objectives were defined to encompass the full spectrum of significant features and elements that constitute an environmentally and culturally vibrant landscape specific to Parkland County. The foundation of this report is built upon the goal of identifying and protecting the following resources and landscape patterns:

- Areas housing species of conservation concern
- Rare or unique landforms
- Large intact patches of natural vegetation
- Nature corridors and connecting areas
- Riparian areas and lake shorelines
- Major river valley systems
- Wetlands
- Areas important for maintaining groundwater quality and quantity
- Areas important for maintaining surface water quality and quantity
- Areas of significant ecological research
- Areas of significant cultural, historic, or scenic value









2.2.2. Ecological Criteria

Objectives were translated into mappable criteria in the process of building a framework for ESA modelling. Building upon the criteria established by Fiera Biological Consulting (2009) for the Province of Alberta, and by Westworth Associates Ltd (2004) for Parkland County, ESA criteria were enhanced and new criteria were established for clearly identifying and classifying ESAs for Parkland County. An extensive literature review was conducted to develop scientifically defensible conservation based principles as ESA criteria for modelling. Spatial data sources representing each of the ESA criteria discussed above were obtained, reviewed, and assembled in geospatial formats. Table 7 of APPENDIX A provides a more detailed presentation of ESA criteria and associated data sources used in the ESA modelling process.

The following table (Table 2) lists ESA criteria, and the intrinsic landscape values they encompass, that were selected as indicators of environmental significance for Parkland County. In this case, landscape values refer to indicators of environmental quality such as biodiversity, landscape connectivity, water quality and quantity.

In essence, the following methodology establishes a systematic framework from which Parkland County managers can base land use decisions. By adopting this scientifically-backed, criteria based framework to identify the environmental significance of specific areas, delineate ESA boundaries, and compare different areas within the County, Parkland County administrators may harness the tools to generate effective and defensible land use policies and solutions.

It should be noted that many of the ESA criteria listed below are often interrelated and linked across the landscape. For example, consider the wetland criteria. Because wetlands serve as hotspots for rare and diverse species, but also contribute to maintaining regional water quality and quantity, potential wetland areas as a criterion for environmental significance may overlap with other criteria including species and habitats of conservation concern, landscape ecology measures, and surface and groundwater resources. When using the results of this report as an environmental planning tool, it is important to keep in mind the overlapping nature of ESA criteria in order to understand and manage landscapes from a more holistic point of view.

Table 3. ESA Criteria and Associated Landscape Values*

ESA Criteria Theme	GIS Layers	Landscape Values			
		Biodiversity	Connectivity	Water Quality	Water Quantity
Species and habitats of conservation concern	Rare plant species	x			
	Important fish habitat	x		x	x
	Important wildlife habitat	x	x		
	Important bird habitat	x	x		
	Riparian habitat	x	x	x	
Landscape Ecology Measures	Patch size	x	x	x	x
	Patch complexes	x	x	x	x
	Circuit connectivity	x	x	x	
	Major rivers valleys systems	x		x	x
Landforms and Steep Slopes	Rare or unique landforms	x			
	Steep slopes			x	x
Wetlands	Wetland ecosystems	x	x	x	x
	Peatland ecosystems	x	x	x	x
Surface water resources	Amount of water flowing into rivers (water yield)			x	x
	Surface water licenses volume per unit area			x	x
	Lake and river water quality			x	x
	Water erosion potential			x	x
	Rivers, lakes, and streams			x	x
	Lakeshore environments			x	x
Groundwater resources	Water wells per unit area			x	x
	Licensed groundwater volume per unit area			x	x
	Groundwater recharge areas			x	x
	Natural springs			x	x
	Buried valley aquifers			x	x
	Surficial sand and gravel aquifers			x	x
	Risk of groundwater contamination			x	x
Protected Areas and Research Areas	Provincial protected areas	x	x	x	x
	Municipal conservation areas	x	x	x	
	NGO owned and managed areas	x	x	x	x
	Areas of significant on-going ecological research	x		x	x

**Please see Tables 7 and 8 of APPENDIX A for a complete listing of ESA criteria, associated data sources, as well as weights and scoring*

2.2.2.1. Species and habitats of conservation concern[1]

Species

Species of conservation concern on an international, national, and provincial level require special management to ensure their long-term persistence in Parkland County and beyond. This criterion encompasses the following tracked occurrences of conservation concern for Parkland County:

- Species of International conservation concern: imperilled species and plant communities which have a global rank of G1 or G2 (Stein, et al., 2000), however none currently exist in Parkland County
- Species of National conservation concern: species listed or proposed for listing as "Endangered" or "Threatened" by the Committee on the Status for Endangered Wildlife in Canada (COSEWIC) and/or the Species At Risk Act (SARA) (COSEWIC, 2001)
- Species of Provincial conservation concern: species designated or proposed as "At Risk" under The General Status of Alberta Wild Species 2005 (Alberta Fish and Wildlife Division 2005), or as "Endangered" or "Threatened" under the Alberta Wildlife Act (Wildlife Act 2000)
- Species assigned a provincial rank of S1 or S2 by the Alberta Conservation Information Management System (ACIMS) (Alberta Tourism, Parks, and Recreation, 2013)
- Vegetation communities identified and tracked by ACIMS, regardless of their conservation rank

Following the method used by Fiera Biological Consulting (2009), only records from the ACIMS database that had precision values of "S" (elements known to occur within about 250 m of the given geographic coordinates) or "M" (elements known to occur within about 2.5 km of the given geographic coordinates) were retained. Over 30 wildlife species of concern occur within Parkland County, however only two are listed as "At Risk" in Alberta, therefore meriting designation as elements of Provincial conservation concern: the peregrine falcon and the trumpeter swan. The peregrine falcon is also considered threatened on the national level (COSEWIC, 2001), therefore constituting an element of national conservation concern. In addition, fifty-eight species of rare plants have also been recorded in Parkland County, several of which are tracked by ACIMS. The majority of these species exist in bogs and fens, lakes, ponds, and riparian areas and have been recorded in the Wagner Natural Area, North Saskatchewan River Valley, Wabamun Lake area, the Devonian Botanical Garden, the Clifford E. Lee Nature Sanctuary, and along the Pembina River (Westworth Associates Environmental Ltd., 2004).

This criterion also supports the protection of focal species—small groups of species whose distributions, abundances and habitat requirements encompass the needs of many other species (Noss, 1999). By managing for the habitat requirements of these umbrella species, it is assumed that the requirements of

1 Among other sources, point occurrence data from the Alberta Fish and Wildlife Management Information System (FWMIS) were used to map areas of important wildlife habitat. This data represents location-specific observations of wildlife within Parkland County. Therefore, observation points interpreted as important wildlife habitat may be confounded with areas of exceptional wildlife viewing. However, for the purposes of ESA identification, both are considered justification for environmental significance.

other species will also be met. Focal species in Parkland County include sensitive bird species such as the peregrine falcon, as well as sensitive fish species such as bull trout, sauger, and northern redbelly dace (Westworth Associates Environmental Ltd., 2004).

Habitats

Protecting important fish and wildlife habitat is central to conserving species of conservation concern and maintaining biodiversity. Areas that constitute important wildlife habitat or provide resources, often localized and ephemeral, that are essential to meeting the life requirements of certain species at specific times of the year, merit special conservation measures (Fiera Biological Consulting, 2009). The availability of critical habitats is a determining factor for the survival and reproduction of many species that depend on them. Examples of important wildlife habitat in Parkland County include wetlands, lakes, and riparian areas, as well large patches of natural habitat, migratory staging areas and corridors, and hibernacula (Westworth Associates Environmental Ltd., 2004; Fiera Biological Consulting, 2009). In particular, the Wagner Natural Area in Parkland County contains approximately one third of all of Alberta's plant species, including 300 species of flowering plants, and therefore merits designation as an ESA under this criterion (Westworth Associates Environmental Ltd., 2004).

This criterion encompasses the following landscape values:

- Biodiversity

2.2.2.2. Landforms and Steep Slopes

Landforms contribute to the diversity, function, and the aesthetic value of a regional landscape. Unique landforms in Parkland County include buried bedrock valleys, glacial landforms such as the Devon Dunes, the Carvel Pitted Delta, and the Smithfield Esker, as well as rare or unique ponds, lakes, and wetland types such as bogs and fens (Westworth Associates Environmental Ltd., 2004). Landforms included under this criterion are those considered rare in the province (e.g. Carvel Pitted Delta), or those considered to be an outstanding example of a given landform. Certain landforms, owing to their unique geomorphology, also have an inherently close relationship to water quality. Areas where groundwater aquifers are close to the surface and surface soils are permeable are susceptible to contamination. The Devon sand dune field in Parkland County is one such area prone to groundwater contamination (Westworth Associates Environmental Ltd., 2004). Unique landforms are often considered significant because they contain ecologically important habitat. For example, in Parkland County the Carvel Pitted Delta provides important wildlife habitat and is the only example of this type of glacial landform in central Alberta (Westworth Associates Environmental Ltd., 2004).

Steep slopes were also included in the criterion due to their ecological sensitivity and vulnerability to erosion.This criterion encompasses the following landscape values:

- Biodiversity
- Water Quality

2.2.2.3. Landscape Ecology Measures

This criterion is grounded in the central principles of landscape ecology, particularly Forman's "indispensable patterns" (Forman, 1995). These are critical patterns of habitat that, if protected, will conserve the majority of important ecological functions in a given landscape (Forman, 1995). For this study, patch size, patch complexes, and circuit connectivity among patches were analyzed and mapped in order to translate Forman's concept into quantifiable metrics of environmental significance.

Patch Size

Large patches of natural vegetation provide ecological services that cannot be duplicated by other elements (Dramstad & Olson, 1996). Large patches support higher biodiversity by providing microhabitat diversity, higher population sizes, a buffer against extinctions, and core habitat for animals with large home ranges (MacArthur & Wilson, 1967; Freemark & Merriam, 1986; Forman, 1995). In turn, biodiversity supports long-term ecosystem stability (Tilman, et al., 2006).

Because large patches of natural vegetation are the only structures in a landscape that protect a wide area of interconnected stream networks, patch size is also an important indicator of water quality (Trust for Public Land, 2004; Booth & Jackson, 1997). The size of a given patch is also connected to the carrying capacity of a landscape in terms of species diversity. Large patches can support focal species with more expansive home ranges, or area-sensitive birds with specific core area habitat and resource requirements (Crooks & Soule, 1999). For these reasons, the presence of intact natural habitat patches in Parkland County serves as an important criterion for ESA identification.

In this study, target patch sizes for environmental significance were informed by relevant findings from a review of recent peer-reviewed publications in landscape ecology. It is important to acknowledge that the amount of habitat necessary to maintain healthy wildlife populations varies according to many factors, such as taxonomic group, body size, resource requirements, and species dispersal patterns (Kennedy et al. 2003)[2]. Furthermore, little is known about threshold amounts of patch area required to maintain essential ecosystem functions, such as primary productivity, nutrient and hydrological cycling, or disturbance regimes (Forman, 1995).

However, trends in the literature point to certain thresholds for patch size that support key groups of focal species and ecosystem processes. One meta-analysis concluded that habitat patches of 55 ha (137.5 acres) appear to capture 75% of all species requirements surveyed in the review (Kennedy, et al., 2003). Likewise, minimum patch sizes required by mammals range from 1to10 ha for small mammals (Soulé, et al., 1992; Barbour & Litvaitis, 1993) and up to 220,000 ha for large bodied predators and wide-ranging mammals such as bears and cougars (Soulé, 1991; Mattson, 1990; Mace, et al., 1996; Beier, 1993). Patches >900 ha provide suitable habitat for large mammals such as bears (Mace et al., 1996; Mattson, 1990) and a wide range of area-sensitive bird species (Trine, 1998) Other studies have shown that wide-ranging predators, bull trout, and area- sensitive bird species require habitat patches greater than 500 ha for

2 Habitat patch size thresholds vary widely, even within the same taxonomic group and for the same species. This disparity demonstrates the vast range of habitat needs exhibited by different species across different ecosystems and that species response to habitat fragmentation is very complex (Kennedy, et al., 2003).

survival (Rieman & McIntyre, 1995; Trine, 1998). Patch sizes >500 ha were also used by Fiera (2009) in their provincial inventory of ESAs.

Accordingly, patches >500 ha were considered most significant in this study, owing to their ability to support wide-ranging focal species (Rieman & McIntyre, 1995; Trine, 1998), and were therefore assigned a score of 1. Patch sizes between 200 and 500 ha were assigned a score of 0.75. Patches ranging from 50 to 200 ha were afforded a mid-range of significance (score of 0.5) due to the large range of habitat requirements covered by this interval (Herkert, 1994; Trine, 1998; Fitzgerald, et al., 1999). Patches smaller than 50 ha were considered less significant; and were therefore assigned lower scores. Table 3 outlines scores assigned to each patch size interval, and the rationale used to justify each score class.

Patch size, as a quantifiable indicator of environmental significance, was derived from the compiled land cover data for Parkland County. Natural land cover was dissolved together, and the area of each patch calculated, and binned into discrete classes based on the finding from the literature cited above. Table 3 outlines the patch size intervals, scores, and rationale attributed to each interval used in the model

Table 4. Patch Size Scoring: Assumptions and Rationale

Patch Size	Score Assigned (0-1)	Rationale
>500 ha	1	Wide-ranging predators, bull trout, and area- sensitive bird species require habitat patches greater than 500 hectares for survival (Rieman and McIntyre, 1995; Trine, 1998). Patch sizes >500 hectares were also used by Fiera (2009) in their provincial inventory of ESAs. A few patches >500 ha do occur in the county.
200-500 ha	0.75	Contiguous blocks of >200 ha provide the greatest habitat potential for most grassland bird species and small mammals (USDA,1999)
50-200 ha	0.50	Many area-sensitive bird and mammal species require patches of suitable habitat of at least 55-150 ha (Herkert, 1994; Fitzgerald et al., 1999). Protecting habitat patches of >55 hectares captures the majority of species requirements (Kennedy, et al., 2003).
5-50 ha	0.25	Forest patches >40 ha and >5.5 ha are required to conserve >90% and >50% of insect-eating birds, respectively (Forman, et al., 1976).Several grassland bird species require minimum habitat patches of 10-50 ha (Fitzgerald et al., 1999).
2-5 ha	.10	Butterflies, seed-eating birds, and most invertebrate species require minimum patch areas of 2-5 ha (MacArthur & Wilson, 1967; Forman, et al., 1976)

This criterion encompasses the following landscape values:

- Biodiversity
- Connectivity
- Water Quality and Quantity

Patch Complexes

Natural patches may be in close proximity, but not directly touching one another. While they may be disconnected, they function as a single patch complex from the perspective of many ecological processes. By identifying the local patch complex that a particular polygon falls within, the relative value of that natural patch (as a portion of a larger complex) can be more readily determined.

The analysis begins with the creation of a 'friction raster' derived from the land cover shapefile.

- Natural cover types are assigned a 1, indicating that travel through these cover types is unrestricted
- Disturbed cover types are assigned a 3, indicating that travel through these cover types is impeded
- Developed cover types are assigned a 10, indicating that travel through these cover types is greatly restricted (but still possible)

All natural cover type polygons are then used as the 'source' for a cost-distance model. This model spreads outward from each source polygon, using the friction raster to calculate the accumulated 'cost' of movement away from the natural areas. A cost threshold of 50 cost-units is used to create a buffer around each polygon (aligned with the effective dispersal distance of many small birds and mammals), and any polygons with overlapping buffers are merged into the same patch complex. The total area of all natural patches within the identified complexes is calculated, scaled within 0 and 1, and assigned to each polygon in the complex.

This criterion encompasses the following landscape values:

- Biodiversity
- Connectivity

Circuit Connectivity

As an indicator of environmental significance, connectivity is strongly related to habitat fragmentation in a landscape. Together, natural habitat fragmentation and connectivity refer to the degree to which vegetation communities are broken apart into smaller isolated sections within a landscape. Connectivity amongst large patches of natural habitat ensures that wildlife and essential ecological processes can move freely across the landscape, thereby contributing to the overall health and functionality of the entire landscape (Lindenmayer & Fischer, 2006). Maintaining connectivity for broad-scale ecological processes like dispersal and gene flow is essential for conserving endangered species in fragmented landscapes. However, determining which habitats should be set aside to promote connectivity has been difficult because existing models cannot incorporate effects of multiple pathways linking populations (McRae & Beier, 2007). Many ways of predicting connectivity using landscape data have been developed (Tischendorf, 2000); (Tischendorf & Fahrig, 2000); (Moilanen & Nieminen, 2002); (Calabrese & Fagan, 2004). Common approaches range from the derivation of broad landscape pattern indices to individual-based movement simulations and analytic measures of network connectivity, such as graph theory and least-cost path models (Adriaensen, 2003).

Connectivity, as a quantifiable indicator of environmental significance, was derived from a circuit connectivity analysis of land cover data for Parkland County. This model identifies common 'pinch points' in the landscape that are likely to be required for movement between existing large patches of natural cover. Traditional connectivity analysis has focused on the 'least cost path' approach to identify expected animal movement pathways. The landscape is assessed with respect to the 'cost' of movement, and the least costly pathway between two specified points is identified. However, this technique makes a number of problematic assumptions, principally that the modeled animal has a set starting point and destination, and complete knowledge of the landscape it will cross along its path.

However, the irregular shape of many natural patches, and the extensive impacts of fragmenting human footprints weaken the predictive power of standard isolation-by-distance models. Recently, the circuit-resistance model has been introduced to the field of ecological connectivity modelling. This approach is commonly used in other disciplines to model the random flow of particles within a circuit with varying resistance to movement. This circuit-resistance approach is both more theoretically justified and more robust to spatial heterogeneity than Euclidean or least cost path-based distance measures (McRae & Beier, 2007).

Landscape connectivity may be described within this framework using a raster grid of modeled friction or resistance surfaces (defined using habitat suitability or occupancy modelling) which reflect the relative difficulty in crossing the landscape. This offers distinct advantages, evaluating the total contribution of all possible movement pathways through the landscape while making no assumptions about the intent or destination of animal movement.

Instead of identifying an 'optimal' pathway between two points, model results highlight the likelihood that any particular point on the landscape will be included in a path, over all possible pathways. This identifies areas which act as 'pinch points' to animal movement. These pinch points contain the greatest 'current flow' and are included in a large proportion of all possible pathways through the landscape. These areas deserve special consideration to ensure that access to and travel through these areas is maintained.

The analysis uses the same friction surface as used in the patch complex delineation, and assesses the frequency of travel through each 10 m pixel, using natural cover type patches as the target. Each natural cover polygon is selected in turn, and the least-cost path between it and all other natural patches in the area is calculated. The cumulative overlap of all these paths is a good indicator of the relative value of each pixel towards maintaining connectivity between existing natural patches. Each polygon is assigned the average value of the underlying connectivity raster, and then all values are scaled between 0 and 1.

This criterion encompasses the following landscape values:

- Biodiversity
- Connectivity
- Water Quality

Major River Valley Systems

In keeping with the principles underlying Forman's Indispensible Landscape Patterns (Forman, 1995), major river valley systems in Parkland County were included in the ESA model. Owning to their importance in providing connectivity across the landscape, erosion control, water quality maintenance, critical fish habitat, these areas are among the most important ecological features in any landscape system. In Parkland County, the Pembina and North Saskatchewan Rivers were mapped under this criterion.

This criterion encompasses the following landscape values:

- Biodiversity
- Connectivity
- Water Quality
- Water Quantity

Riparian Areas[3]

The Alberta Riparian Habitat Management Society (Cows and Fish) defines riparian areas as: "the portions of the landscape strongly influenced by water, and are recognized by hydrophytic (water-loving) vegetation along rivers, streams, lakes, springs, ponds and seeps" (Cows and Fish, 2002).

The importance of riparian areas far exceeds their relatively small area. Some of the most important functions provided by healthy, well vegetated riparian areas include bank stability and erosion control, water quality improvement, flood mitigation, fish habitat support, forage production, recreational opportunities, aquifer recharge, and aesthetic amenities. They also provide critical wildlife habitat and act as corridors facilitating landscape connectivity between large patches of natural habitat.

Many species of conservation concern in Parkland County thrive in these areas, including, for example, the great blue heron, golden eagle, and osprey, among other sensitive riparian species (Westworth Associates Environmental Ltd., 2004). Riparian areas along the North Saskatchewan River also provide important habitat for migrating waterfowl and other water birds. Therefore, riparian areas are an important criterion for ESA identification on a number of overlapping fronts. Riparian areas also provide important water quality improvements to the river system by removing nitrogen and other contaminants before they enter the aquatic system (Mayer, et al., 2007; Schlosser & Karr, 1981; Castelle, et al., 1994).

This criterion encompasses the following landscape values:

- Biodiversity
- Water Quality
- Water Quantity

3 Riparian areas are included in both Landscape Ecology and Surface Water Resources criteria

2.2.2.4. Wetlands

Wetlands are transitional environments between aquatic and terrestrial ecosystems. They consist of areas temporarily, seasonally or permanently covered by shallow water. Wetlands have characteristic wetland soils and are dominated by hydrophytic ("water-loving") vegetation (Stewart & Kantrud, 1971). Wetlands can be defined as: " Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment" (National Wetlands Working Group, 1988).

Wetlands of various sizes and types occur throughout Parkland County. Many "prairie pothole" type wetlands (Stewart & Kantrud, 1971) occur in hummocky landscapes of the central and southeastern portions of the county. These include permanent, semi-permanent, and ephemeral lakes, ponds, marshes, and wet meadows characterized primarily by sedges (Carex spp.), bulrushes (Scirpus spp.) and cattails (Typha spp.). Wetlands adjacent to lakes, rivers, and streams (including oxbow wetlands and lacustrine wetlands) often contain willow (Salix spp.). Peatlands, including bogs and fens, occur in many locations throughout the county although they are concentrated in the western portions of the in the Boreal Natural Subregion.

Many wetlands worldwide have been lost to drainage resulting from a multitude of human land uses. Remaining wetlands are therefore increasingly critical for maintaining biodiversity and providing essential ecosystem services such as flood reduction, groundwater recharge, climate regulation, and water quality. Wetlands also provide important scenic and recreational values.

In light of these critical attributes, potential[4] wetland cover is considered an important criterion for identifying and prioritizing ESAs.

This criterion encompasses the following landscape values:

- Biodiversity
- Water Quality
- Water Quantity

4 Due to inconsistencies in the available data, this criterion only reflects the "potential" for wetland cover. At this time, all areas mapped as potentially containing wetlands have not been ground-truthed for accuracy.

2.2.2.5. Surface Water Resources

The condition of surface water resources, including quantity and quality, typically reflects upland conditions in contributing watersheds. Therefore, key landscape ecology patterns such as large patches, riparian areas, and wetlands also represent the relative value of different parts of the landscape with respect to surface water resources. Factors such as water yield (as an indicator of the amount of water flowing into rivers), the number of surface water licenses within spatial hydrographic units (as a measure of ecosystem services to water users), erosion potential of the landscape, and readily available lake and river water quality data were also considered to determine the environmental significance of surface water bodies in Parkland County.

This criterion encompasses the following landscape values:

- Water Quality
- Water Quantity

2.2.2.6. Groundwater Resources

Safe and abundant groundwater resources are important considerations that should factor critically into determinations of environmental significance. Although groundwater is a complex, highly technical topic often fraught with uncertainty, activities on the surface can affect processes that contribute to high quality groundwater supplies over a range of time scales. Therefore, to adequately consider groundwater resources in this study, the locations of natural springs, buried valley aquifers, and surficial sand and gravel aquifers were assessed in conjunction with data on regional groundwater recharge rates, and available models on the susceptibility of groundwater resources to contamination from activities on the surface. In addition, as a measure of the importance of groundwater for human use (e.g., ecosystem services), water well drilling records, and the density of licensed groundwater volumes per unit area were also used to determine areas of high priority for groundwater resource protection.

This criterion encompasses the following landscape values:

- Water Quality
- Water Quantity

2.2.2.7. Protected Areas

This criterion reflects areas protected at either the Provincial level as Provincial Parks and Natural Areas, or at the Municipal level as conservation areas. At the Municipal level, data from Parkland County, as well as the City of Spruce Grove and Town of Stony Plain were aggregated together. Lands protected under conservation easements or otherwise owned and managed by local and regional land trusts such as the Edmonton and Area Land Trust (EALT) and the Alberta Conservation Association (ACA)[5] were also included under this criterion.

This criterion encompasses the following landscape values:

- Biodiversity
- Connectivity
- Water Quality
- Water Quantity

Areas of significant on-going research

Areas supporting significant on-going environmental research contribute to understanding and knowledge of ecological systems and processes. These areas may merit a higher priority for ESA designation so that research and related knowledge can continue to accumulate over time.

The Wagner Natural Area, the Devonian Gardens, and Wabamun Lake are among the key areas within the County where extensive scientific research has been conducted that is contributing to a body of ecological research within the county. The data and research generated through these research sites help to inform future ESA mapping and land use planning in Parkland County. Technical stakeholder consultations did not identify any additional areas of core scientific research that would merit consideration under this criterion[6].

This criterion encompasses the following landscape values:

- Water Quality
- Water Quantity
- Biodiversity

5 The following quarter sections were formerly owned and managed by the Alberta Conservation Association (ACA), but are currently owned and managed by Parkland County as Buck for Wildlife conservation properties: NE 19-53-03-W5, SE17-51-06-W5, NW 26-51-06-W5, SE 16-54-06-W5, NW 16-54-06-W5, NW 28-53-07-W5, SE 13-54-07-W5, SW 13-54-07-W5, NE 13-54-07-W5, NE 30-53-02-W5, SE 30-53-02-W5, NW 33-51-04-W5, and NE 16-51-05-W5 (Government of Alberta Fish and Wildlife Division, 1991).

6 Locations of site-specific monitoring activities (e.g., Government of Alberta GOWN monitoring wells, water quality monitoring locations) were not considered important enough in terms of providing pure applied or experimental research to be included in this category.

2.2.3. Mapping the Results

ESA criteria were weighted according to relative importance and systematically overlain in a multi-criteria model aimed at identifying and classifying ESAs within Parkland County. This section outlines the data acquisition and spatial modelling methods used to analyze ESA criteria.

2.2.3.1. Land Cover Compilation

As a single reliable and comprehensive land cover dataset does not exist for the county, O2 assembled one using the best possible datasets where available (excluding land cover classes with known inconsistencies), filling in gaps using lower quality data where necessary. The land cover is a function of the following datasets, in descending order of priority (where available, higher priority data takes precedence over lower priority data): the Alberta Biodiversity Monitoring Institute Human Footprint layer (ABMI_footprint), the Primary Land and Vegetation Inventory (PLVI), the Central Parkland Vegetation Inventory (with Anthropogenic features removed; CPVI) and the Alberta Biodiversity Monitoring Institute Land Cover layer (ABMI_landcover). Following the compilation of these datasets, the various land cover classes were crosswalked to a consistent set of land cover classes, used for subsequent analyses (Table 9 of APPENDIX A). High resolution aerial imagery was used to identify and resolve inconsistencies where the suggested land cover class obviously did not capture what was present on the ground (for example where human disturbance footprints had transformed areas which had been categorized as natural).

2.2.3.2. Hexagon Grid

To calculate a range of landscape criteria (i.e., fragmentation, the proportion of natural cover, and the summary of point and linear feature) a hexagonal grid schema was created which seamlessly covers the entire County.

2.2.3.3. Spatial Modelling

This section presents the approach applied in conducting a GIS-based analysis to identify and prioritize Environmentally Significant Areas within Parkland County. The analysis used a polygon overlay approach based on existing available data inputs representing criteria for significance. The focus of the analysis was to rank the overlaid data layers according to their respective strength as indicators of environmental significance and importance to County residents in order to assign each criterion an objective function score. Ecological targets and thresholds derived from peer-reviewed literature, as well as the results from the first public survey and open house, factored heavily into scoring determinations for the ESA criteria. The overall accuracy and scale appropriateness of data source were also considered by the GIS specialist, when assembling spatial data to represent ESA criteria (see Table 7 of APPENDIX A for a complete listing of all data sources).

By raising the score of an ESA criteria and environmental sensitivity layer, that criteria will contribute more towards the overall environmental significance score for a given area. By reducing a criteria weighting, more highly-weighted layers will tend to dominate. Higher weights make criteria more prominent, whereas lower weights lessen the priority given to certain criteria. Please see Tables 7 and 8 of APPENDIX A for a summarized list of ecological criteria, associated data, and scoring (Table 7) as well as the crieteria weightings (Table 8), used in ESA modelling.

Ecological target and thresholds used to derive upward ranges for ESA criteria tend to be highly specific to individual species and ecological processes and vary significantly according to spatial scale. In light of these limitations, threshold values and ranges presented below must be interpreted carefully. These range values have been tailored to the unique species, processes, and geographic settings of Parkland County to the greatest extent possible, however they are intended to serve as guidelines for conservation than idealized targets.

Theme Maps

Once the GIS data collection and processing were complete, the results for individual themes (e.g., Landscape Ecology, Surface Water Resources, etc.) were represented and mapped visually from low to high. Maps 6-12 below illustrate the results for each theme at the County-wide scale. Weightings were then applied to criteria themes to roll up results into an overall single county-wide map of environmental significance values, shown on Map 13.

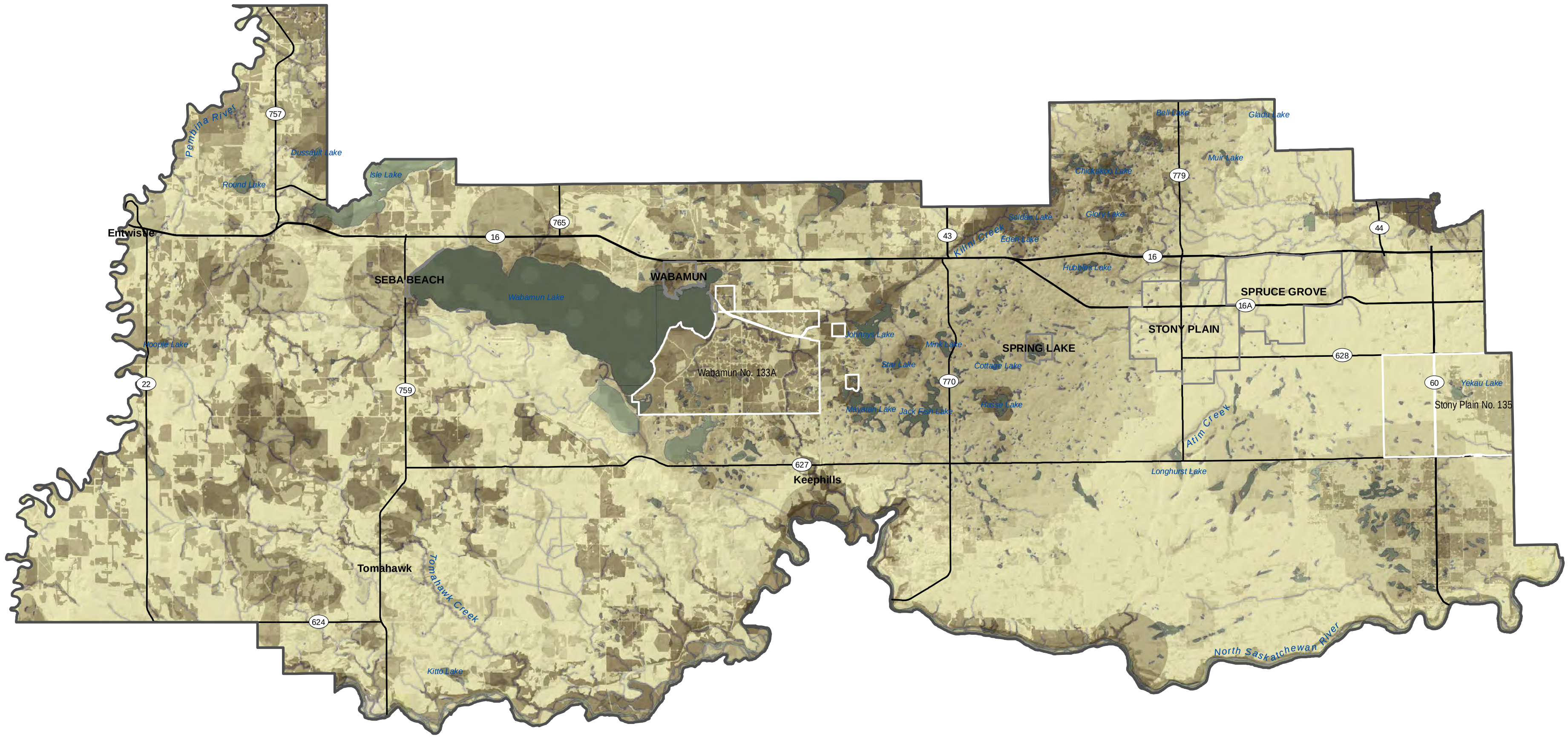
Selected weightings were based on the results of a public survey of perceptions of landscape environmental conservation priorities for Parkland County residents, combined with a technical/scientific review of individual GIS layers within criteria themes. Analysts considered the effects of data gaps, data format, and the resulting effects on model outcomes when selecting the weights to apply against individual criteria themes.

Environmentally Significant Areas of Parkland County

Once the overall map of environmental significance values was completed, a GIS analyst with landscape ecology expertise reviewed the data at the county-wide scale, as well as at a scale of approximately 1:20,000. Polygons representing contiguous areas of environmental significance distinctly visible at the county-wide scale were then digitized by hand by the analyst. Once digitized, these polygons were then classified as either internationally, nationally, regionally, or locally significant, based on the criteria identified in Table 5 and Figure 9. This hierarchy of ESAs was constructed to be consistent with the criteria established by the provincial ESA study completed by Fiera Biological Consulting (2009), while accommodating for new criteria appropriate to the scale of Parkland County and adaptable to be capable of incorporating new scientific information and data sources.

Designated ESAs were summarized by the Criteria Theme scores, in order to describe the nature of the valued elements that they contain. ESA boundaries were intersected with the individual theme layers, and an area-weighted average theme score was calculated for each ESA. These weighted-averages were then used to create a bar plot, showing the relative fraction of each theme found within each ESA.

MAP 6: SPECIES AND HABITATS OF CONSERVATION CONCERN



County Boundary
Municipal Boundary
First Nations Reserve
Highway

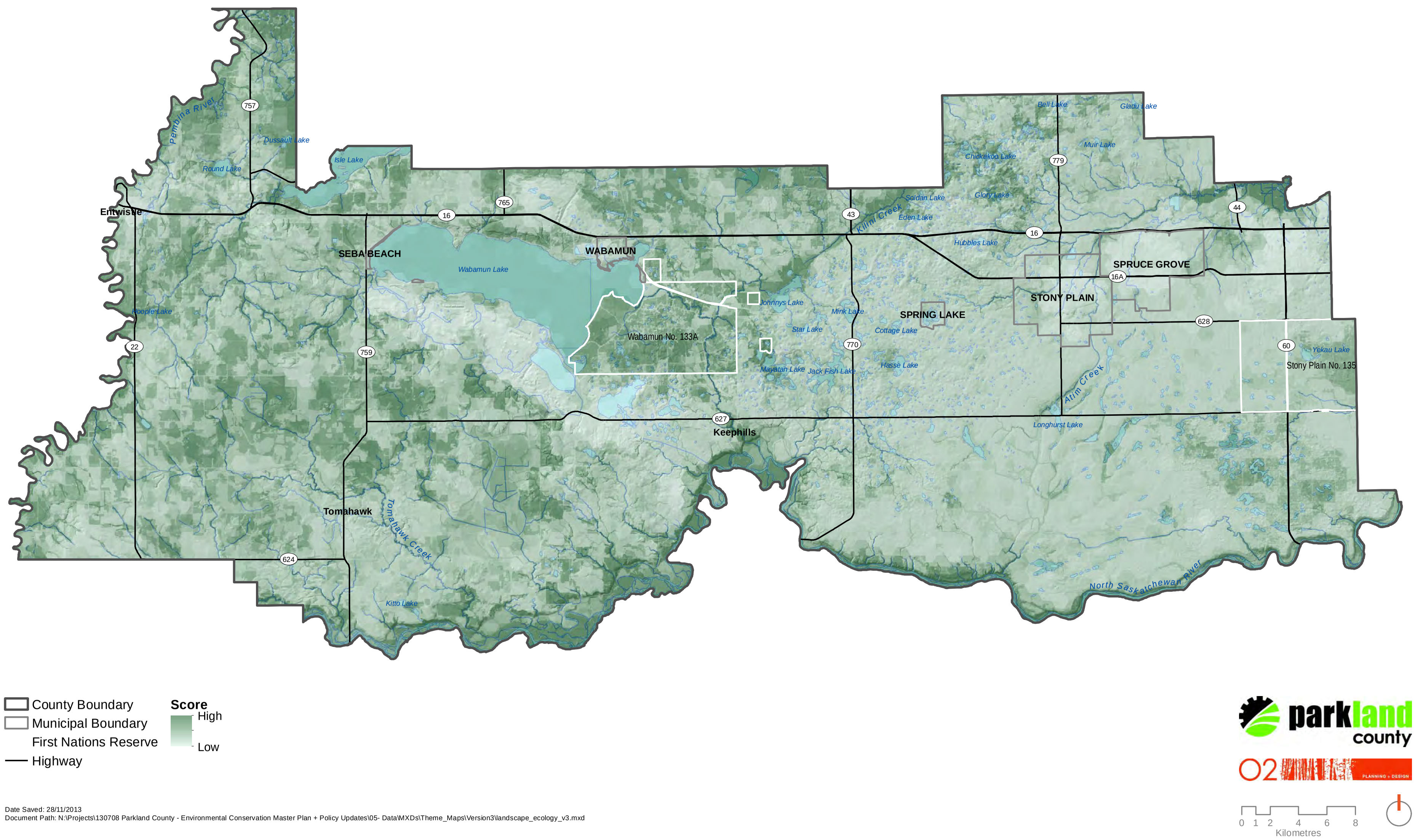
Score
High
Low

Date Saved: 28/11/2013
Document Path: N:\Projects\130708 Parkland County - Environmental Conservation Master Plan + Policy Updates\05- Data\MXDs\Theme_Maps\Version3\species_v3.mxd

0 1 2 4 6 8
Kilometres

Map 6. Species and Habitts of Conservation Concern

MAP 7: LANDSCAPE ECOLOGY MEASURES



Date Saved: 28/11/2013
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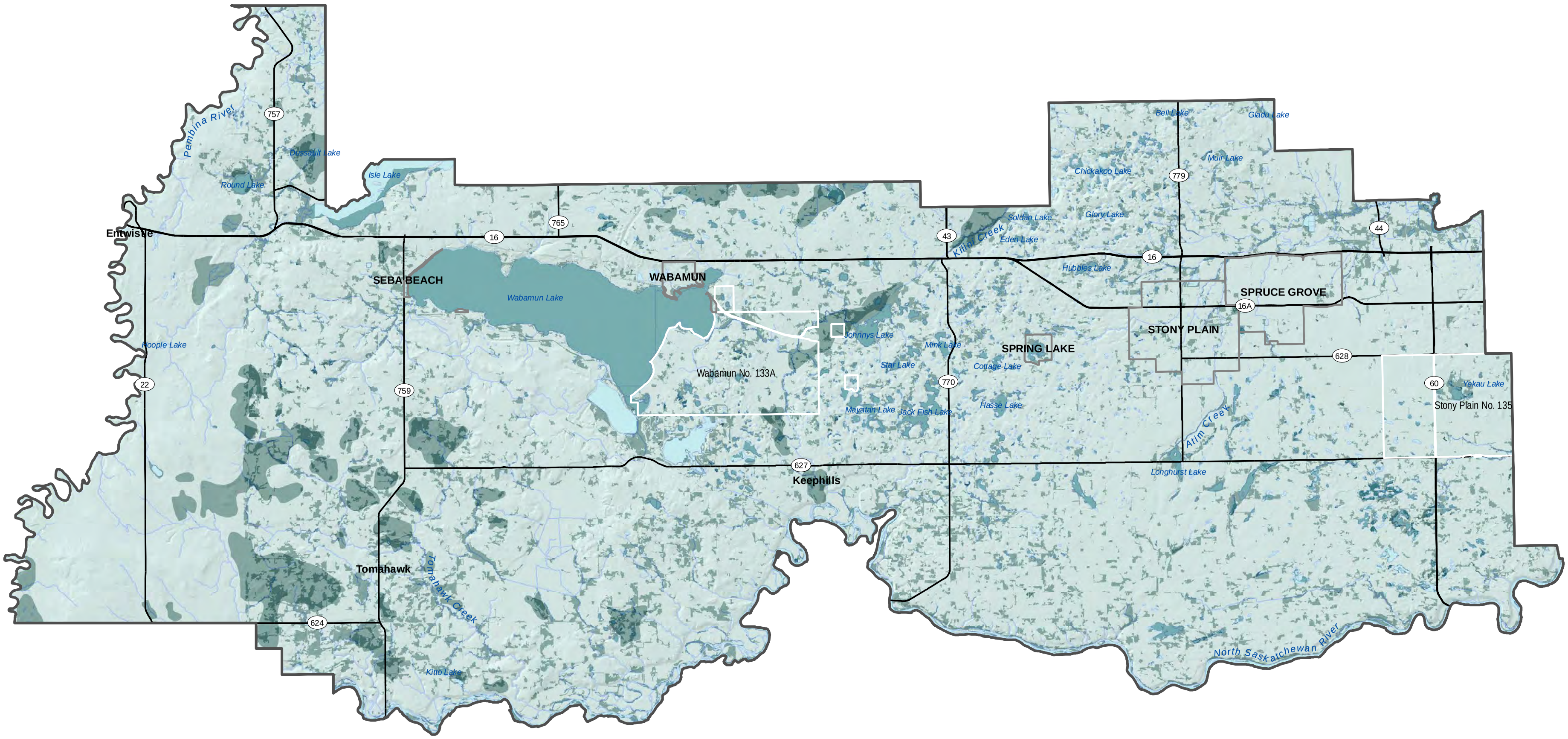
Map 7. Landscape Ecology Measures

MAP 8: WETLANDS



County Boundary
Municipal Boundary
First Nations Reserve
Highway

Score
Low
Moderate
High

Date Saved: 28/11/2013
Document Path: N:\Projects\130708 Parkland County - Environmental Conservation Master Plan + Policy Updates\05- Data\MXDs\Theme_Maps\Version3\wetlands_v3.mxd

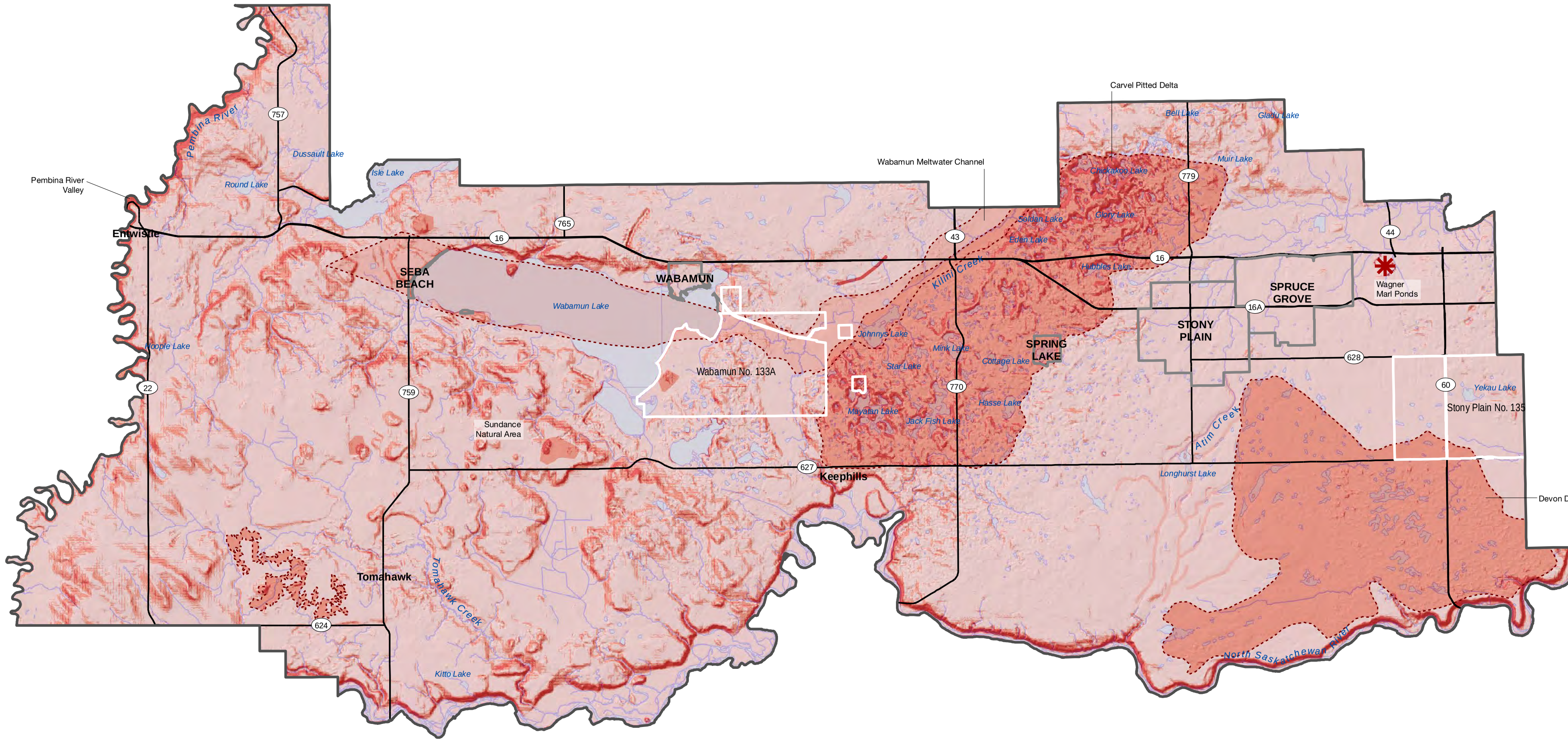
parkland county

O2 PLANNING + DESIGN

0 1 2 4 6 8
Kilometres

Map 8. Wetlands

MAP 9: LANDFORMS AND SLOPES



County Boundary
First Nations Reserve
Municipal Boundary
Highway

Score
High
Low

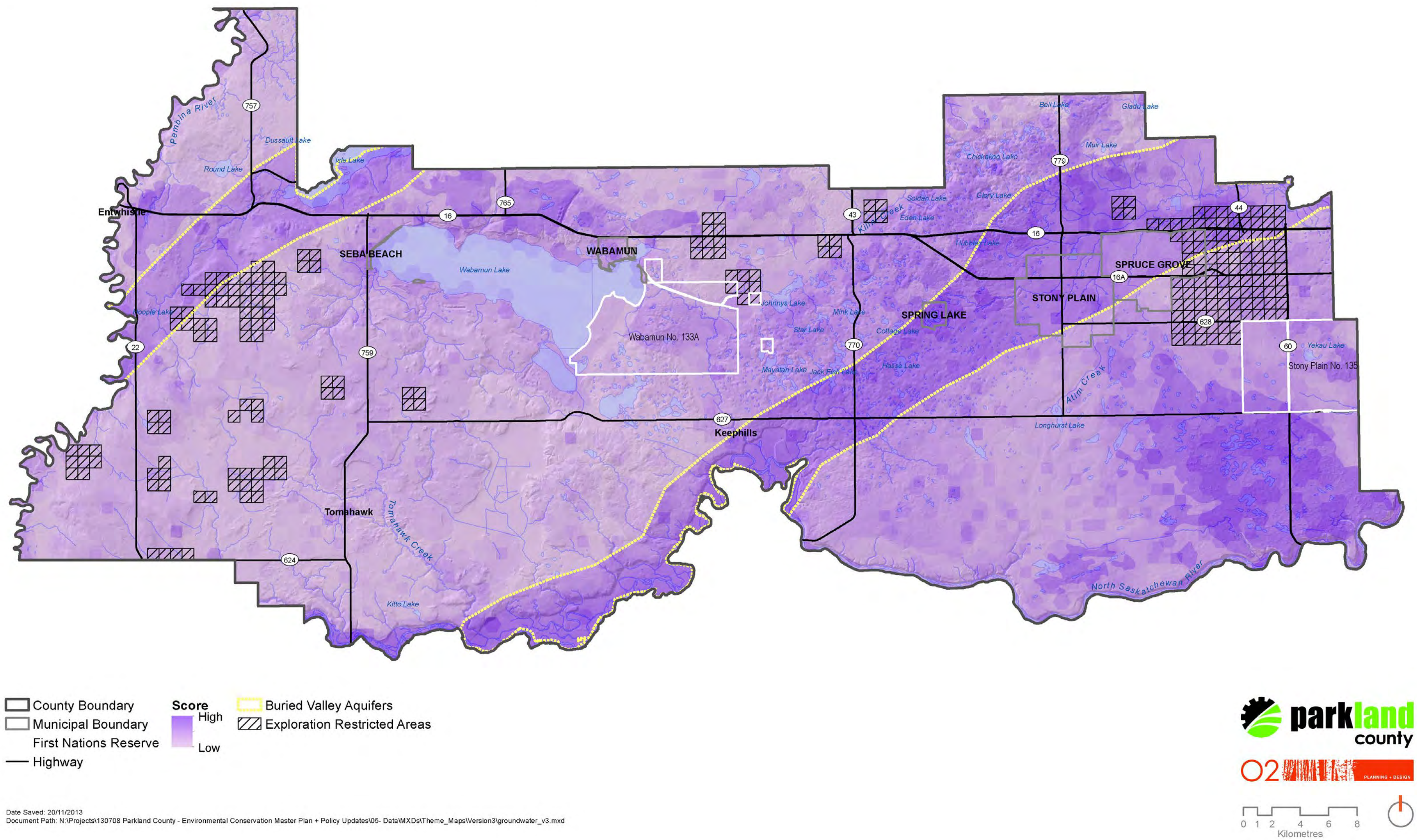
Priority Landforms
Minor Local Significance
Local Significance
Provincial Significance

0 1 2 4 6 8
Kilometres

Date Saved: 25/11/2013
Document Path: N:\Projects\130708 Parkland County - Environmental Conservation Master Plan + Policy Updates\05- Data\MXDs\Theme_Maps\Version3\landforms_v3.mxd

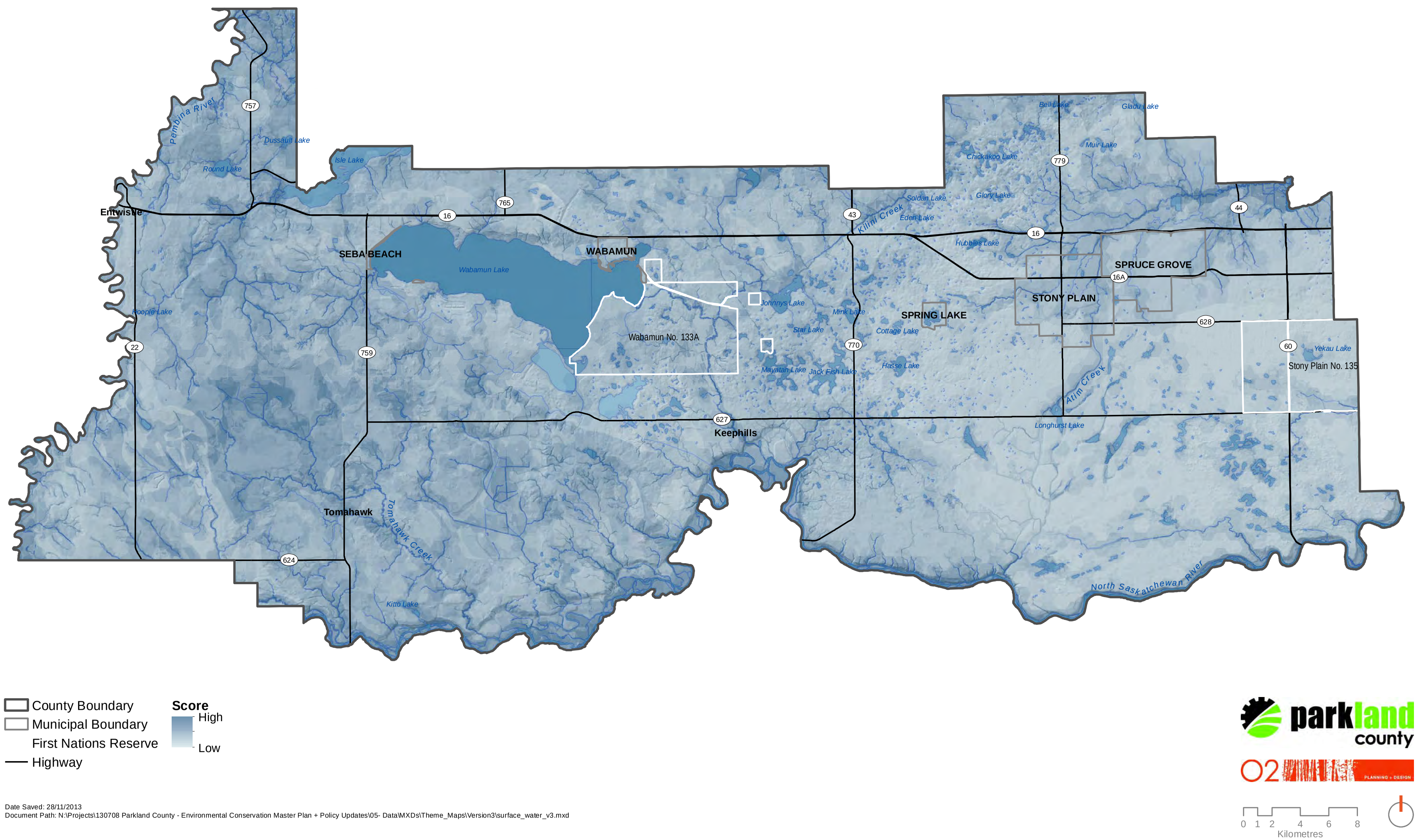
Map 9. Landforms and Slopes

MAP 10: GROUNDWATER RESOURCES



Map 10. Groundwater Resources

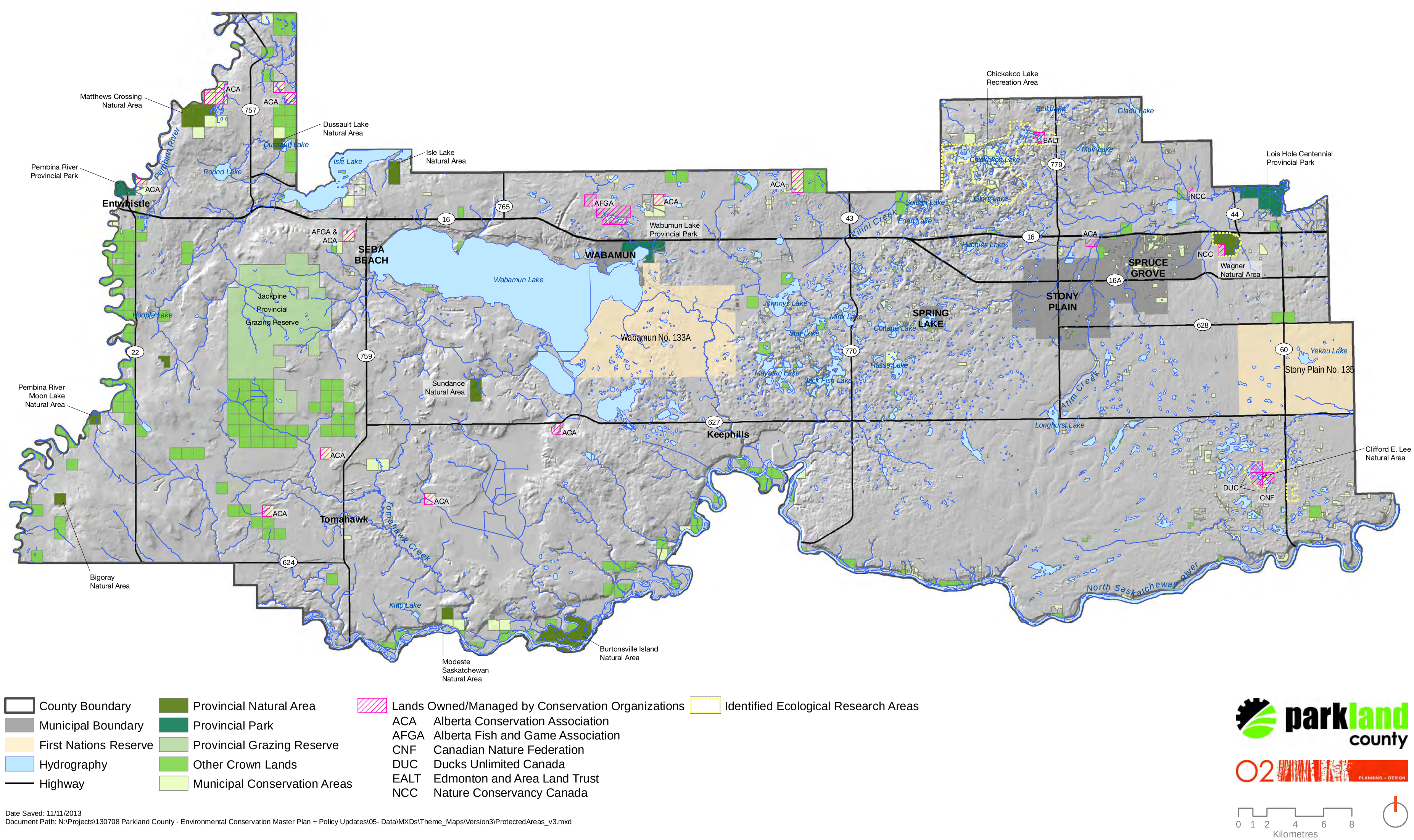
MAP 11: SURFACE WATER RESOURCES



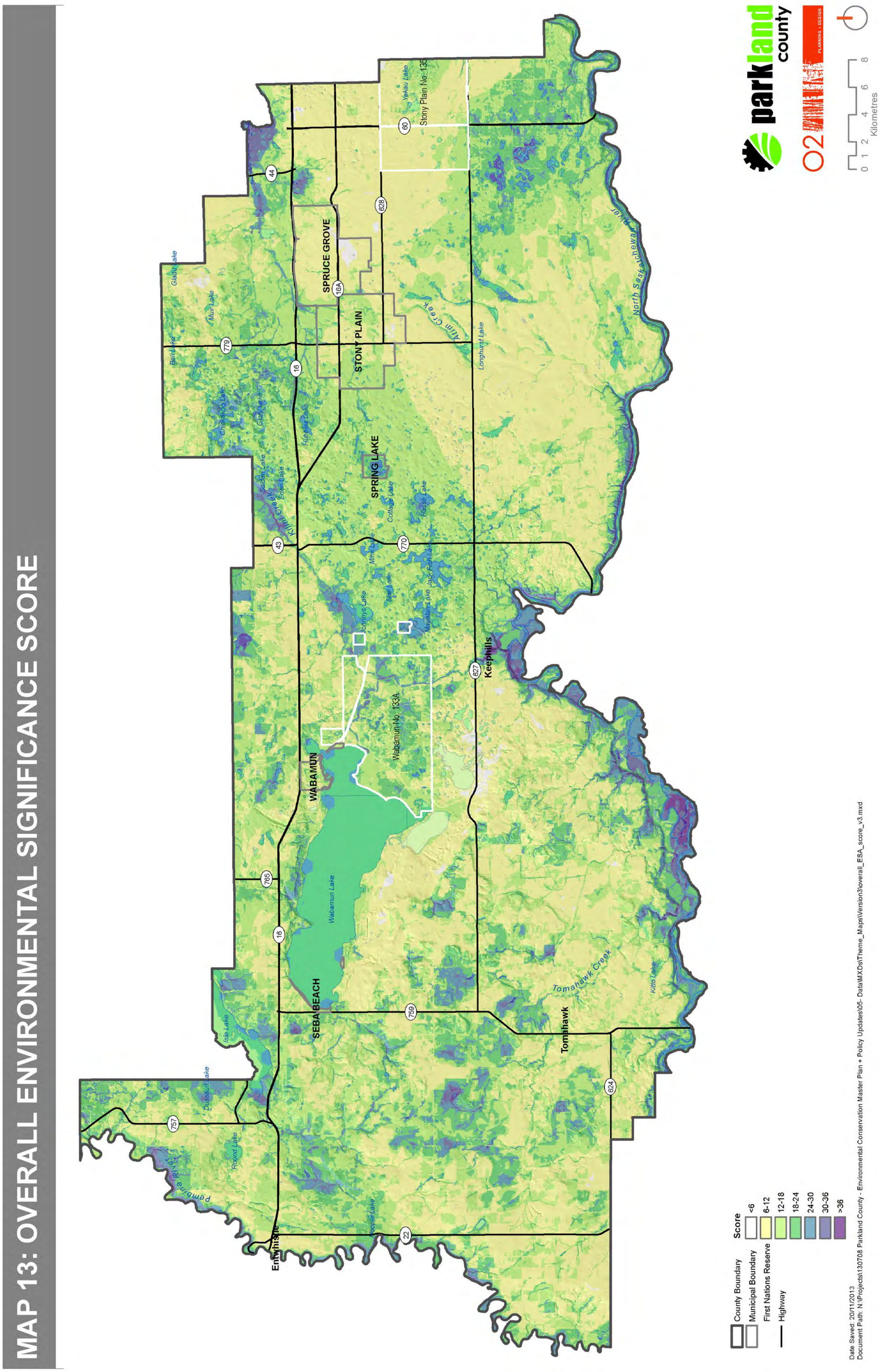
Date Saved: 28/11/2013
Document Path: N:\Projects\130708 Parkland County - Environmental Conservation Master Plan + Policy Updates\05- Data\MXDs\Theme_Maps\Version3\surface_water_v3.mxd

Map 11. Surface Water Resources

MAP 12: PROTECTED/CONSERVATION AREAS



Map 12. Protected/Conservation Areas



Map 13. Overall Environmental Significance Score

2.2.4. Determining Significance

Once modelling was completed, ESA boundaries were delineated and a rating of environmental sensitivity was established for each identified ESA. ESAs were then classified within a hierarchy of significance. **It is important to note that all lands in Parkland County have signficance, regardless of whether or not they fall within the boundaries of an ESA** (see *Perspectives on Hierarcy and Significance*, pg. 78)**.** Map 13 illustrates the gradient of significance across the County, with all areas exhibiting some degree of environmental value. However, for the purposes of prioritization in the planning process, ESAs were systematically evaluated for significance on a local, regional, provincial, national, and international level. Typically, sites of provincial, national, or international significance have clear criteria to facilitate their categorization (Figure 8).

Table 5. Definitions of Levels of Significance for ESAs

Adapted from Golder (2011) and Fiera Biological Consulting (2009)[7]

Rating	Definition	Criteria / Examples
International	Elements that are unique in the world or are of universal significance and value	•Globally Important Bird Areas (as designated by BirdLife International) •Elements ranked as globally rare (G1 or G2)* •RAMSAR Wetlands* •UNESCO World Heritage Sites* •Internationally recognized landforms*
National	Elements with limited distribution at the national level or which are the best or only representatives in Canada	•Occurrences of species / elements ranked as "endangered" or "threatened" by the Species at Risk Act (SARA) or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) •Nationally recognized landforms* •Designated Canadian Heritage Rivers* •National Parks*
Provincial	Elements which are limited in distribution at the provincial level that are the best examples of a given element or feature in Alberta	•Elements assigned a provincial rank of S1 or S2 by the Alberta Conservation Information Management System (ACIMS) •Large (e.g. >500ha), undisturbed patches of native habitat that have been disturbed in most other parts of the province. •Rare landforms or geological features which remain in a natural state and have been identified as provincially significant by ATPR
Regional	Elements of limited distribution at the regional level that are the best examples of an element or feature in the surrounding region	•Large undisturbed patches of natural vegetation •Production and staging areas for waterfowl and shorebirds •Habitats which support substantial populations of rare or uncommon plants and/or animals in the county •Landforms, landscapes or geological features which are uncommon or rare in the county •Areas which likely perform a significant function in maintaining regional hydrological functions (e.g., aquifer recharge, water quality, etc.)
Local	All ESA polygons identified in the county that do not meet the criteria in the above categories are designated as sites of local significance	•Elements valued for local environmental functions •Examples include small lakes or landforms such as glacial melt water channels that may not be readily visible from the ground but are important to maintaining local hydrological functions (e.g., aquifer recharge, water quality, etc.)
Microsite	Small-scale features which play a key role in upholding ecological integrity at larger landscape scales (not identified by this study)	•These are not identified at the scale of this study and require site-specific investigations including field work to confirm their location and function •Examples include small wetlands, lower order streams, small forest patches, etc.

**These elements do not occur in Parkland County*

7 International, national, and provincial significance ratings for ESAs followed the definitions, standards and framework used by Fiera Biological Consulting in their 2009 ESA inventory for the Province of Alberta (Fiera Biological Consulting, 2009), as well as those used by Golder Associates in their 2011 ESA inventory of Red Deer County (Golder, 2011). Regional and local significance ratings were applied to new ESAs based in part on the criteria established by Westworth Associates Environmental Ltd. (2004) for Parkland County, but also on new criteria rooted in landscape ecology principles as indicators of environmental significance.

However, others have noted that it is often more difficult to make consistent distinctions between local and regional levels of significance (Westworth Associates Environmental Ltd., 2004).

In general terms, sites that stand out in the range of environmental features found in a region are considered to be of regional or greater significance. However, it has often been a challenge to define clear, consistent, and objective criteria that can help distinguish between areas of local versus regional significance. For the purpose of this study, ESAs have been systematically classified within a hierarchy of significance from International to microsite significance[8]. These classifications are based on the following definitions (Table 4) and framework (Figure 8) that incorporate National and Provincial criteria, as well as key ecological targets as indicators of significance.

The following framework, or decision tree model, was formulated as a visual tool to aid in systematically classifying delineated ESAs into a significance hierarchy. This hierarchy will help to provide information upon which land use planners can base land use decisions.

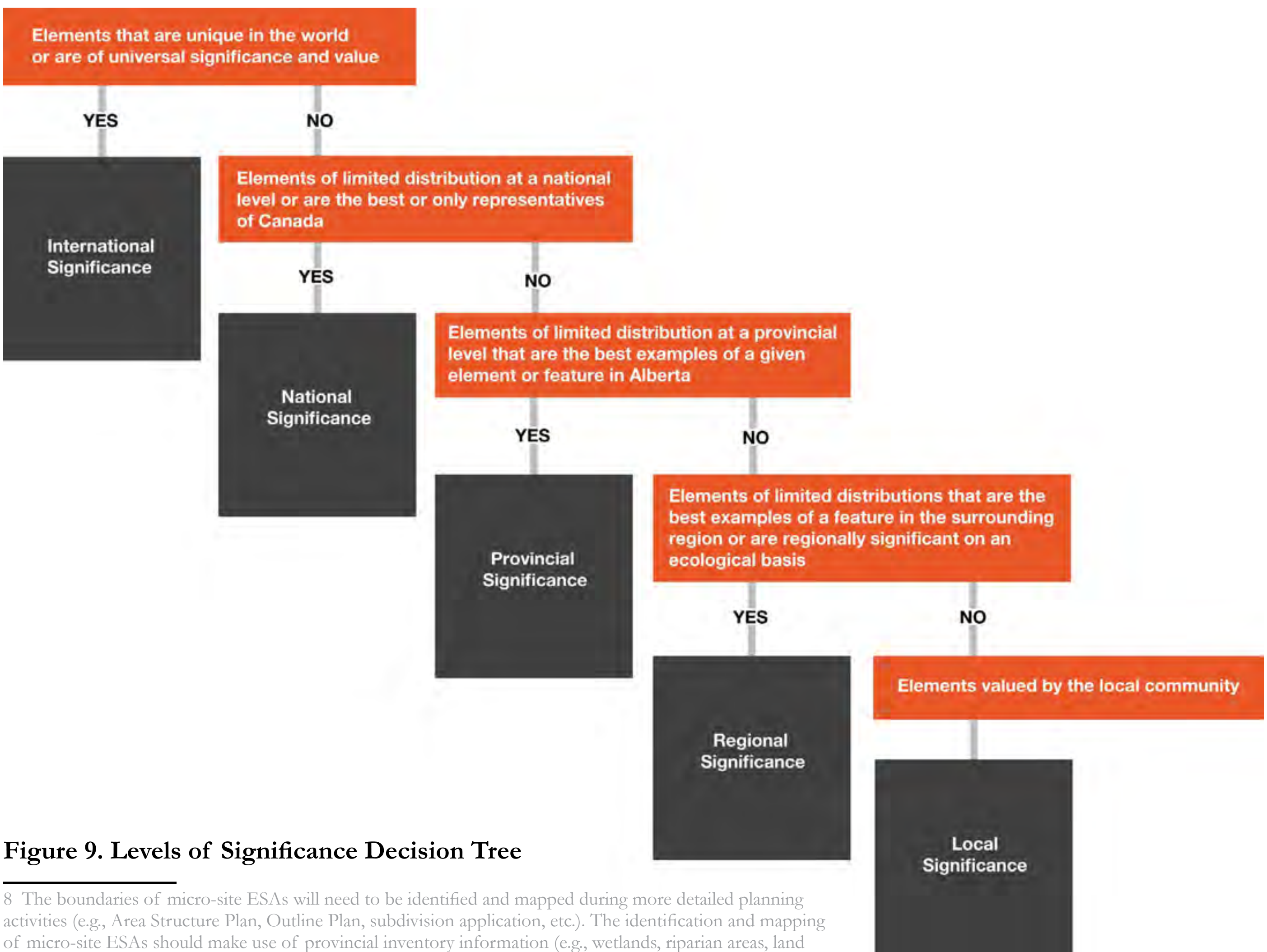


Figure 9. Levels of Significance Decision Tree

8 The boundaries of micro-site ESAs will need to be identified and mapped during more detailed planning activities (e.g., Area Structure Plan, Outline Plan, subdivision application, etc.). The identification and mapping of micro-site ESAs should make use of provincial inventory information (e.g., wetlands, riparian areas, land cover, FWMIS, etc.), as well as site-specific field work, and should be reported and mapped by qualified practitioners within a Biophysical Impact Assessment. Developers/landowners will be required to conduct these activities in advance of a development application, and, as far as possible, all ESAs, including micro-site ESAs, should be avoided by land development and resource extraction activities.

Perspectives on Hierarchy and Significance

A continuous map of environmental significance values clearly convey the message that **all parts of the landscape play a role in maintaining environmental quality**, despite the fact that some areas contain more environmental values than others. This message is highly consistent with our current understanding of landscape ecology, biology, and watershed science. The alternative of not displaying any significance values across wide swaths of the landscape implies that most areas do not play any role in meeting the definition of an ESA (e.g., places that are vital to the long-term maintenance of biological diversity, soil, water, or other natural processes at multiple scales). This is clearly not supported by science. Essentially, the whole is greater than the sum of the parts.

For example, a farmer's field can play a key role in wildlife connectivity across the landscape, despite the fact that it is not a natural area and may have low overall environmental significance in comparison to large patches of native forest. As another example, riparian areas along individual lower order streams are not as significant as the North Saskatchewan River Valley, but the cumulative effects of losing many small riparian areas are substantial and will considerably affect environmental quality including wildlife connectivity and water quality (Forman, 1995; Peterson, 2001; Dodds & Oakes, 2008). These issues of scale and significance also relate to the provincial definition of ESAs as "places that are vital to the long-term maintenance of biological diversity, soil, water, or other natural processes at multiple scales."

Clearly, although a hierarchy of significance can be a useful land use planning tool; all areas have the potential to maintain and enhance environmental values to varying degrees.

2.3. Environmental Sensitivity versus Significance

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. Areas considered to have "Very High" environmental sensitivity are often associated with landform-soil-vegetation units that are highly erodible, steep, permeable, or have unstable slopes and poor soil quality. Certain highly permeable formations that are susceptible to groundwater contamination from the surface can be highly sensitive as it is difficult to remediate groundwater once it has been polluted. Wetlands and riparian areas are also considered to be sensitive and highly valued due to relative difficulties in restoring them back to natural conditions once disturbed. Although significance and sensitivity are often correlated, this is not necessarily the case.

Ecological resilience can be broadly described as the capacity of an ecosystem to resist and recover from a perturbation or disturbance (Holling, 1973). Landscapes that have low ecological resiliency are typically sensitive systems characterized by a unique combination of vegetation, soils and hydrology. For example, peatlands have very high environmental sensitivity owing to their distinctive hydrology, organic soils and vegetation communities and the resulting difficulty in reclamation following anthropogenic activities. Current technological advances in peatland restoration have been moderately successful. However, little success has been demonstrated when the original peatland hydrology is altered, and full reclamation is required. Therefore, disturbances that significantly alter original topography, such as mining or borrow pits, require detailed reclamation planning that usually results in functioning, self-sustaining upland ecosystems and open water bodies. Ecological resilience can be achieved in reclaimed landscapes when reclamation involves high species diversity, a quality rooting zone and minimal sulfur and nitrogen deposition (Welham, 2013).

Metrics of vegetation, soil type, geology, slope, vulnerability to mining disturbance, and proximity to wetlands and riparian zones were analyzed to determine ratings of environmental sensitivity as secondary criteria for ESA identification. Threshold slope values for erosion potential were derived from a study of water erosion potential values for Alberta using the Water Erosion Prediction Project (WEPP) model (Jedrych & Martin, 2006).

1. **Very High:**

- Slopes >20% (included in WEPP model)
- Poor soil quality and/or sparse vegetation
- Underlain by highly permeable aquifers and groundwater recharge zones
- Large wetlands and riparian zones
- Very low resiliency to disturbance

2. **High:**

- Slopes 15-20% (included in WEPP model)
- Poor soil quality and/or sparse vegetation cover
- Underlain by permeable aquifers and groundwater recharge zones
- Wetlands and riparian zones
- Low resiliency to disturbance

3. **Moderate:**

- Slopes 10-15% (included in WEPP model)
- Moderate soil quality and/or moderate vegetation cover
- Moderate resiliency to disturbance

4. **Low:**

- Slopes 5-10% (included in WEPP model)
- Sites on relatively stable soils with vegetation cover

2.4. Public Consultation

Input from Parkland County staff members, technical stakeholders, and the public were a key component in the development of the ECMP. Consultation and communication activities were specifically designed to build support and understanding for the project, and to receive input to help identify ESAs.

Consultation Objectives

Four consultation objectives were identified for the development of the ECMP:

- Work with technical stakeholders to identify most recent data sources for ESA modelling and analysis
- Work with the public to identify environmental priorities and management issues within Parkland County
- Present and gather feedback on ESA analysis, mapping and priority areas of conservation concern
- Work with all participants to identify a preliminary list of best management practices for the conservation and protection of environmental areas

Phase One Consultation Activities

Five major consultation activities allowed stakeholders and residents to participate in the project to date, as summarized below. Newspaper advertisements, a project postcard, emails to the project mailing list and information posted to the website were used to notify residents of consultation events. Please see APPENDIX C, “What We Heard” summary, for a detailed record of public consultation, including information gleaned from participants.

- **Phone Interviews.** Phone interviews were conducted in September 2013 with over forty individual technical experts to ensure that the initial development of ESA modelling criteria was well informed and the best available data sources were being used. A standardized interview guide was used to conduct the interviews and record responses.
- **Public Online Survey.** An online survey was conducted through September and October 2013 to gain an understanding of the environmental priorities and environmental management issues of interest to the general public in Parkland County. Survey responses were used to inform the overall weights for ESA modelling criteria, and provided the project team with an understanding of environmental priorities for Parkland County residents.
- **Stakeholder Workshop.** A stakeholder workshop was held on December 4, 2013 to present and discuss the draft ESA inventory with project stakeholders. Over 50 stakeholders attended the event. Stakeholders were given the opportunity to review ESA analysis, and were asked for feedback on the draft modelling and mapping results as well as on industry-specific beneficial management practices (BMPs) for each theme of environmental significance. Input was directly incorporated into the ECMP, and will inform the development of municipal policies and tools in subsequent phases of the project.
- **Public Open House.** Public open houses were held on December 4, 2013 and December 5, 2013 to present and discuss the draft ESA inventory with County residents. Over 30 people attended the event. Residents were given the opportunity to review ESA analysis, speak with project team members, and provide feedback on the draft modelling and mapping results. Input was directly incorporated into the ECMP, and will inform the development of municipal policies and tools in subsequent phases of the project.
- **Web Mapping Tool.** An interactive web mapping tool was developed to allow stakeholders and residents the opportunity to virtually review ESA analyses, as well as to leave spatially referenced comments. This tool ensured that individuals who may not have been able to attend the workshop or the open house were still afforded an opportunity to participate in the project. Input was directly incorporated into the ECMP, and will inform the development of municipal policies and tools in subsequent phases of the project.

2.5. Field Reconnaissance

Results from the ESA modelling process were examined and ground-truthed for accuracy. Areas identified in the modelling process as hotspots of environmental significance were visited and documented to confirm the model results. On the ground, the results of the ESA model proved accurate and reliable. Each potential ESA was checked using a combination of recent aerial photos, driving public access roads, helicopter aerial surveys and other available information including local interpretive signage and posted advisories.

Field work was conducted from October 7th, 2013, to October 11th, 2013, and October 31st, 2013. In total, 20 additional ESAs were confirmed and added to the list of ESAs identified in the 2004 ESA inventory of Parkland County (Westworth Associates Environmental Ltd., 2004). In many cases, the boundaries of the 2004 ESAs were modified and expanded to encompass small but critical tributaries extending from the area, or to connect nearby adjacent patches. In this respect, the updated ESAs function more as interconnected networks of indispensible landscape patterns.

Large wetland within Smithfield/Amisk Acres ESA

3. Environmentally Significant Areas (ESA) Inventory

Summary

This section presents a detailed portrait of each Environmentally Significant Area identified in this study. ESA summaries have been classified by landscape unit in an effort categorize areas not only in terms of significant ecological features, but also by dominant landscape character. In the following pages, each ESA summary includes an overall description, level of significance, environmental sensitivity ratings, as well as recommended planning strategies to guide balanced development and conservation efforts.

3.1. ESAs Categorized by Landscape Unit (LU)

The following pages outline in detail, the findings of environmental significance specific to each ESA identified in the multi-criteria model. To enhance usability for planning purposes and simplify cross-referencing, ESAs have been grouped together Landscape Units (LUs) that make up distinct areas of Parkland County. The County contains dozens of environmentally significant areas, ranging in significance from microsite stream tributaries to a Globally Important Bird Area—Big Lake (BirdLife International, 2012). Map 14 shows the distribution and hierarchy of the 61 identified ESAs in Parkland County. The table below summarizes these ESAs by landscape unit.

Landscape Unit	Pages
Edmonton Plain Central Parkland	89-121
Central Lakes / Dry Mixedwood	123-247
Devon Dunes	249-272
North Saskatchewan River Valley	274-287
Tomahawk Uplands Mixedwood	289-349

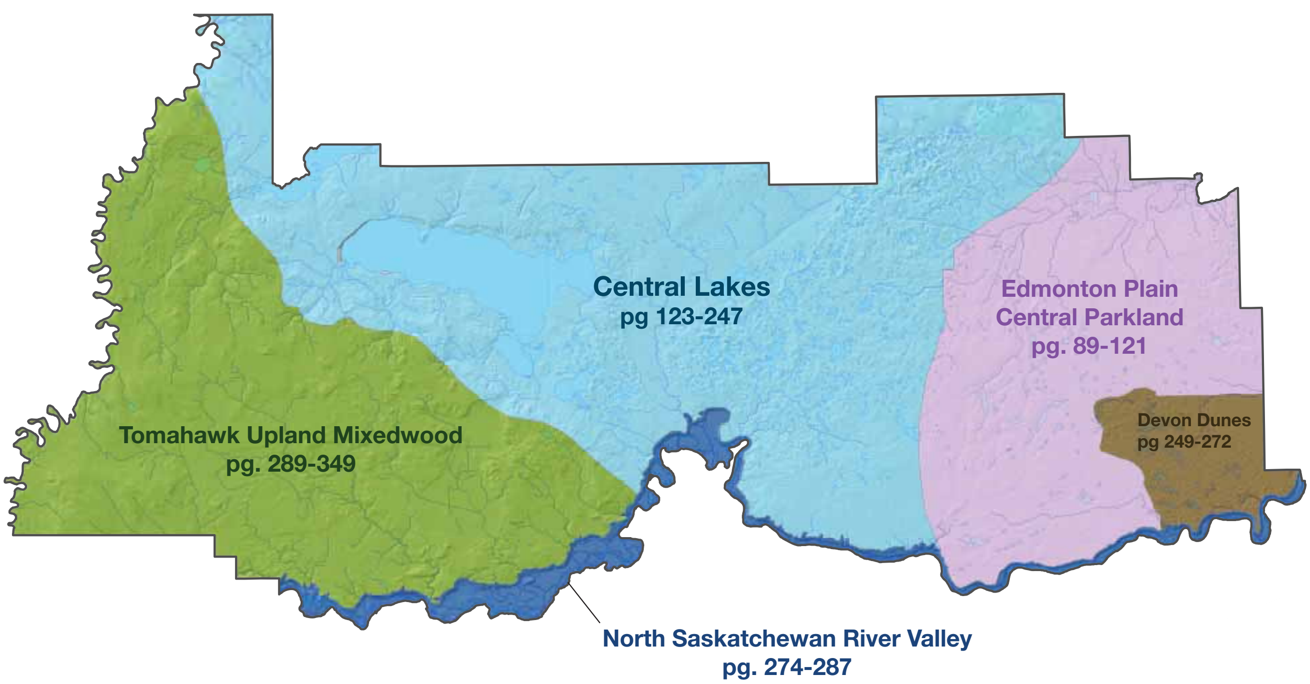
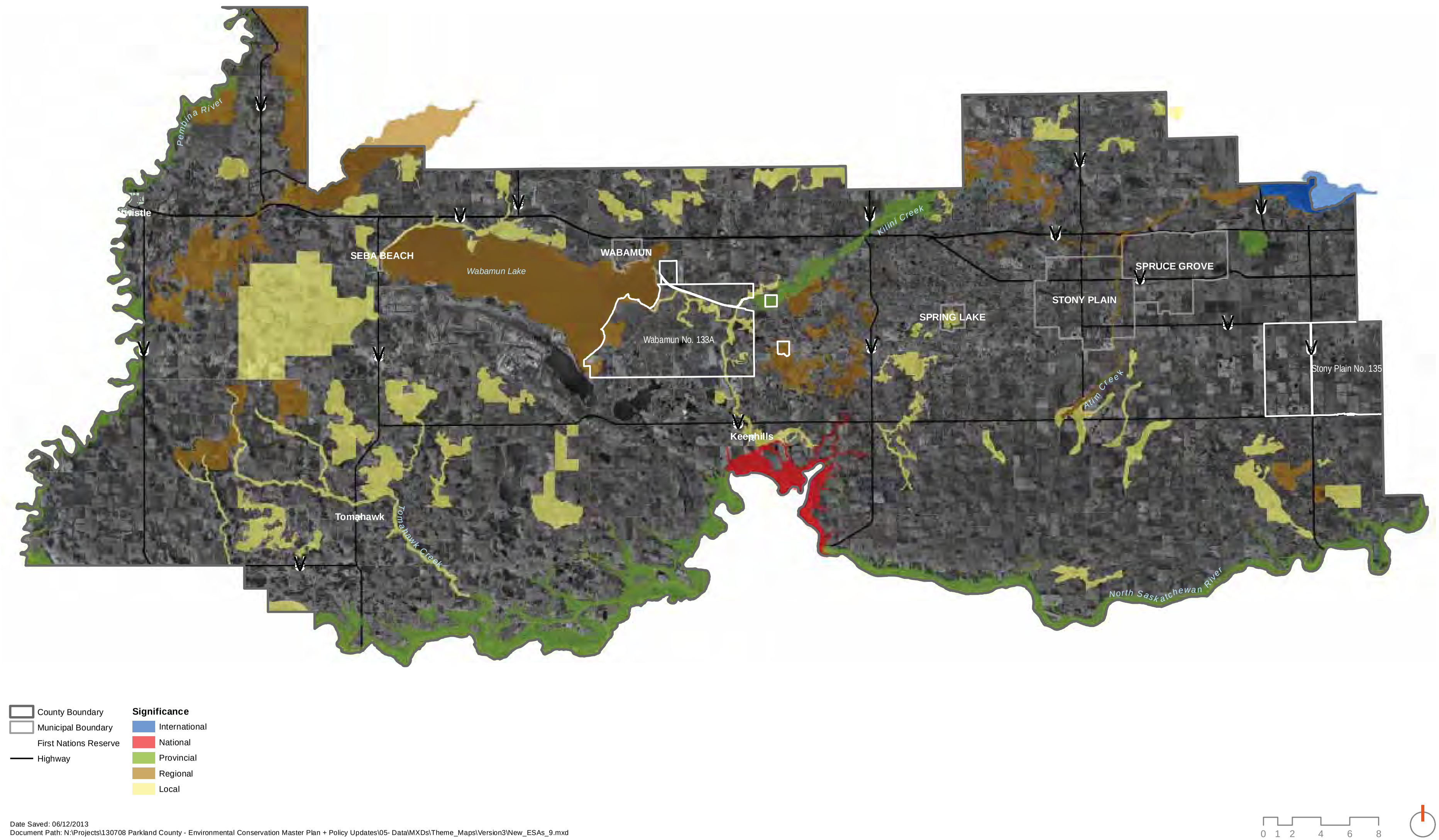


Figure 10. ESAs Categorized by Landscape Unit

MAP 14: ENVIRONMENTALLY SIGNIFICANT AREAS OF PARKLAND COUNTY (NEW 2013)



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Map 14. Environmentally Significant Areas of Parkland County

This section contains information on ESAs specific to each Landscape Unit (LU) in Parkland County, which can be found on the following pages of this document.

All ESAs are summariazed by a map and a fact sheet, which includes the following components:

- *ESA Name:* Short name that identifies the site
- *Site Location:* Short general description of the site's location in Parkland County
- *Area:* Total size of the ESA in hectares (ha), rounded to the nearest hectare
- *Land Status:* Existing land status e.g., private, crown provincial lands, provincial park, county land, etc.
- *Description:* General biophysical description of the ESA, including geography, vegetation, flora/fauna, water resources, land use, etc.
- *Significance Level:* Level of significance (local, regional, provincial, national, or international) and justification for classification within that level of significance
- *Thematic Bar Graphs:* A colour bar graph represents average scores within the ESA for the 7 different environmental themes; the relative length of each colour represents the average score for that theme
- *Environmental Sensitivity:* Level of environmental sensitivity (low, moderate, high, or very high), which represents susceptibility to surface disturbance and the inherent resiliency of the site
- *Key Features:* Bullet point summaries of the most important environmental resources in the ESA
- *Recommended Planning Strategies:* Description of potential impacts of current, proposed or potential land uses and suggested strategies that may be considered to assist in maintaining or improving existing environmental features of the site

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Wagner Natural Area

Edmonton Plain Central Parkland ESAs

The Edmonton Plain Central Parkland LU contains 7 identified ESAs, one of which is of international significance (Big Lake/Lois Hole ESA) due to its recognition as a Globally Important Bird Area (BirdLife International, 2012). This LU also contains one provincially significant ESA—the Wagner Natural Area and Surrounding Forest ESA—owing to the provincially rare plant species that occur there.

The Acheson Industrial Area is contained within the Edmonton Plain Central Parkland LU, and a portion of the western border is flanked by the City of Edmonton. These areas of intensive land use must be carefully considered when determining appropriate management approaches for ESAs.

This section presents a detailed portrait of each ESA in the Edmonton Plain Central Parkland LU, including a summary of recommended planning strategies specific to each ESA. For more information on best management practices for ESAs, please see Section 4: Beneficial Management Practices.

Big Lake/Lois Hole ESA

Big Lake/Lois Hole ESA

Site Location: Big Lake is located at the northeastern edge of Parkland County within the Sturgeon River basin.

Area: The ESA, including the lake and some surrounding area, encompasses 1,118 ha.

Description:

Big Lake is a large water body in the northeastern corner of the County that provides critical habitat for a diverse range of waterfowl and other wildlife. The ESA is comprised of the lake, as well as a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1].

Big Lake and the surrounding wetlands that comprise the Lois Hole Provincial Park collectively function as an important waterfowl moulting and staging site; with up to 26,000 staging waterfowl colonizing the site annually. As such, colonies of Franklin's gull, eared grebe, and black tern nest on the lake. The lake also supports large concentrations of great blue herons, gulls and terns in the non-breeding season.

The lake sits on the sands and gravels of the Empress Formation, an aquifer 30 m below its surface that was laid down by retreating glacial meltwaters. Big Lake is part of the 260 km long Sturgeon River that begins at Hoople Lake and flows east to the North Saskatchewan River. Atim Creek flows into Big Lake from the west and Carrot Creek from the north. At the delta, the lake narrows to 100 m. This is one of the three birdsfoot deltas that are found in Alberta. The lake is shallow, with depths varying between 0.3 to 4.1 m. Banks along the southern shore are steep, directing the lake's flood waters towards the west, north and east to feed surrounding marshlands during high water years.

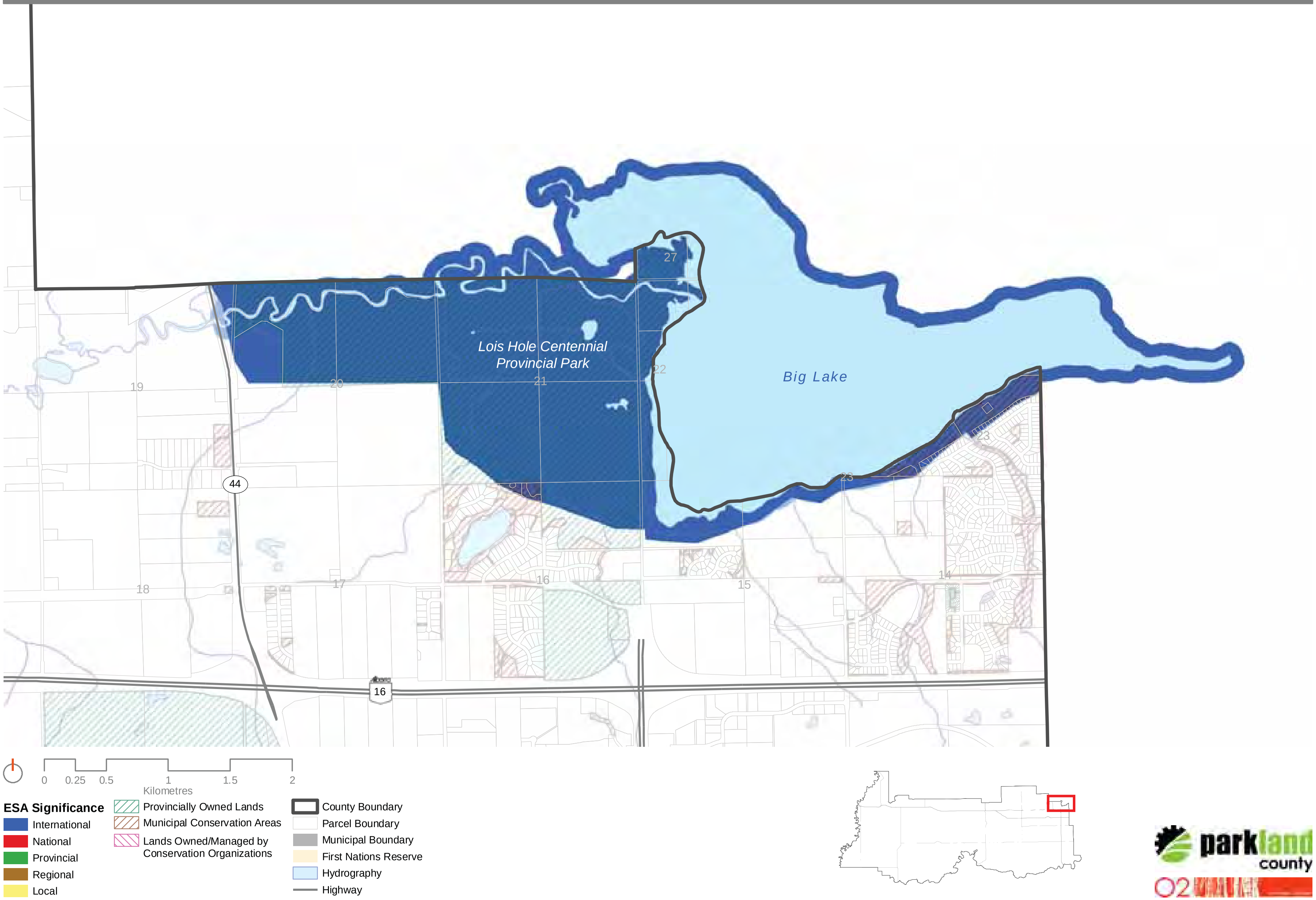
Old stands of white spruce grow on the northeast shore of the lake. A deciduous forest on the south shore contains highly diverse vegetation with unusual and rare plant species that include orchids and ferns. Archaeologists believe nomadic peoples used Big Lake as far back as 9,000 years. Specific archaeological sites have been recorded dating back 5,000 years. Stone tools and weapons found on the south and east sides of the lake attest to the importance of the lake to prehistoric people.

Big Lake is a dynamic wetland that provides critical habitat for waterfowl, and supports a diverse community of wildlife. The lake is relatively shallow, and contains wide expanses of emergent vegetation. The west end of Big Lake is characterized by an extensive low-lying area of grasses and sedges. Overall, over 200 bird species have been recorded in the vicinity of Big Lake. Stands of mature aspen, birch, and white spruce along the south shore of Big Lake are important for wildlife, including songbirds, woodpeckers, ungulates, furbearers, and canids. The surrounding area provides habitat for a number of wildlife species of concern, as well as rare plant species.

Big Lake has been designated as a "Conservation Natural Area" under the Province of Alberta's Special Places 2000 program, a "Globally Significant Bird Area" by Birdlife International, and recognized as a Wetland for Tomorrow by Ducks Unlimited. Big Lake acts as a natural reservoir, providing flood control for the City of St. Albert.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

BIG LAKE / LOIS HOLE ESA



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Big Lake/Lois Hole ESA

Environmental Sensitivity: High

- Presence of sensitive riparian areas

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Land Status:

- This area is designated as an Internationally Significant Bird Area
- A large proportion of the land component of the ESA is a provincial park
- Some county-owned lands and private lands also occur here

Key features:

- Recognized as one of the most important waterfowl habitat areas in Alberta
- Provides significant recreational, educational, and research opportunities due to its proximity to a major urban area (City of Edmonton)
- Provides habitat for a number of wildlife species of concern as well as rare plant species
- Hydrologically significant in its ability to maintain base flows in the Sturgeon River and provide flood protection for the City of St. Albert
- Functions as an important node for ecological connectivity- recognized as a Globally Significant Bird Area by Birdlife International

Recommended Planning Strategies:

- Maintaining an adequate buffer around the lake is important for upholding the hydrological integrity of the aquatic ecosystem.
- Agriculture, residential and industrial developments within Big Lake's watershed should be carefully managed to minimize the flow of contaminants and excessive nutrients into the lake

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Wagner Natural Area and Surrounding Forest ESA

Wagner Natural Area and Surrounding Forest ESA

> *This ESA functions as an important stepping stone and core habitat. It is one of the few remaining natural habitat areas between Edmonton and Stony Plain*

Site Location: Approximately 6.5 km west of Edmonton, and directly south of Highway 16 east of Atim Road (Range Road 270). The ESA includes Wagner Natural Area, as well as some surrounding adjacent areas that are not protected by the province.

Area: 392 ha

Description:

Located between Edmonton and Spruce Grove, the Wagner Natural Area represents a microcosm of boreal forest in the midst of agricultural fields and the nearby Acheson Industrial Area. The ESA includes the Wagner Provincial Natural Area, as well as surrounding forest areas just north of the neighborhood of Osborne Acres (the Fath Group property) and between the Natural Area and Spruce Grove.

The Wagner Natural Area is a diverse ecosystem consisting of calcareous fens and marl ponds, willow swamps, drier coniferous and deciduous forests and creeks. Distinct marl ponds exist with the Natural Area proper, while the surrounding forest areas to the SW and SE of the Wagner Natural Area also contain similar calcareous marl (Rostron, 2013). These varied habitat types account for a rich diversity of flora and fauna, including several provincially rare orchid species, carnivorous plants, and mosses. Rare plants that occur in the area include the following species: *Campylium radical*, *Desmatodon cernuus*, *Lecanora caesiorubella ssp. Saximontana*, *Lecanora hybocarpa*, *Eupatorium maculatum*, *Amblyodon dealbatus*, *Brachythecium acuminatum*, *Rhynchospora capillacea*, *Doellingeria umbellata var. pubens*, *Riccardia latifrons*, *Drepanocladus crassicostatus*, and *Malaxis paludosa* (ACIMS). Two newly discovered orchid species in Alberta (*Amerorcis rotundivolia var. linnaeta* and *Amerorcis rotundivolia var. immaculata)* also exist in the Natural Area (Rostron, 2013).

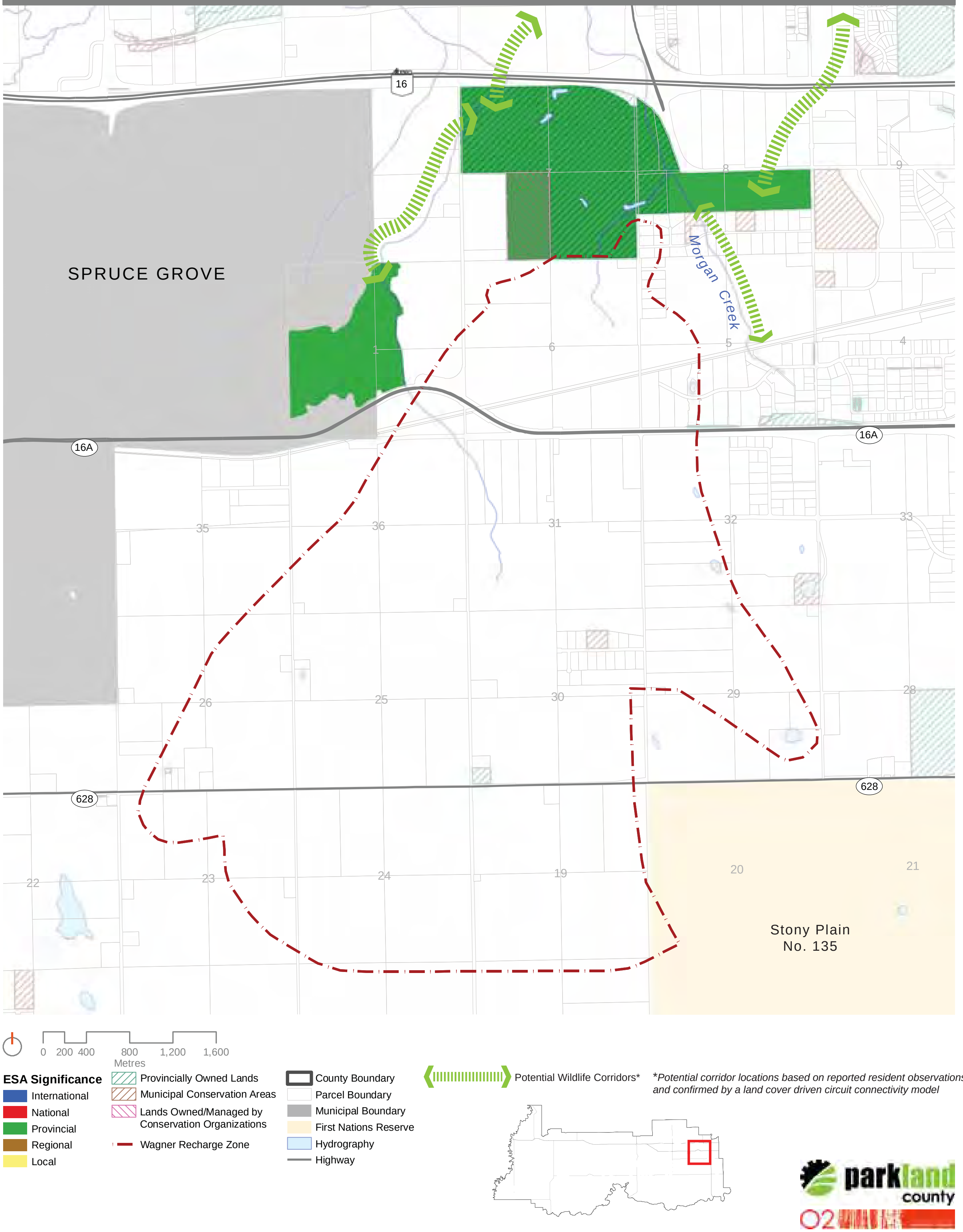
Insects, amphibians, and birds, as well as larger mammals such as white-tailed deer and moose also inhabit the area. Residents have reported numerous wildlife observations in the Wagner Natural Area and the adjacent areas, including the Osborne Acres neighbourhood. White tail deer and moose have been observed in particularly high numbers in the forested lands east and southeast of the Natural Area, along riparian areas in the fields located south of the Natural Area and Osborne Acres, and west of the Nature Conservancy property along Atim Road and Highway 16. Possible locally important wildlife corridors have also been reported along Spruce Valley Road north of Osborne Drive, Along Morgan Creek, and along the north and south boundaries of the Osborne Acres neighbourhood.

A Biological Resource Assessment conducted for the Fath Group property (SE 8-53-26-4) north of Osborne Acres cited numerous occurrences of sensitive wildlife and rare plant species. These include the bared owl and the pileated woodpecker, as well as several of the same provincially ranked S1 and S2 rare plant species recorded in the Wagner Provincial Natural Area. Similar to conditions found in the Natural Area proper, the diverse vegetation communities on the Fath Group property provide unique microhabitat conditions that support a high diversity of rare plants, including a number of rare plants, lichens, and mosses. Rare lichens were concentrated in the old-growth mixed-wood forest where species diversity was high, particularly for tree dwelling lichens. In addition, a significant population of an uncommon vascular plant species, Viola selkirkii, were found in the area (Fiera Biological Consulting, 2008).

The Wagner Natural Area is distinct in part due to the mineral springs that flow year round at a relatively constant temperature, creating a microclimate which support a rich diversity of flora and fauna that are unique to the area. These springs are fed by the Beverly Buried Valley aquifer underlying the Wagner Natural Area and surrounding lands to the northeast and southwest. The Natural Area is one of approximately ten peatlands found in Alberta in which boreal spring fens and the marl ponds are characteristic features (Parkland County, 2012).

The Wagner Natural Area Society has leased the Natural Area from the Province since 1983, serving as a volunteer steward and manager of the area (Wagner Natural Area, 2013). Since 1997, over 253 acres (102 ha) have been added to the originally designated Natural Area. The Nature Conservancy of Canada has been involved with these land acquisitions, and retains approximately 80 acres of land in SW 7-53-26-4.

WAGNER NATURAL AREA AND SURROUNDING FOREST ESA



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Wagner Natural Area and Surrounding Forest ESA

Wagner Natural Area Groundwater Recharge Zone:

The Wagner Natural Area groundwater recharge zone is located near the western edge of the Carvel Pitted Delta southeast of the Wagner Natural Area. The recharge zone occupies a linear area trending from the northwest of 24-052-27-W4 to the west half of 05-053-26-W4, and includes a portion in the southeast of the Natural Area. Groundwater discharge occurs along the flanks and bottom of the topographic low that reflects the location of the Beverly Buried Valley aquifer. Areas of groundwater discharge coincide with the locations of significant surface water features and mapped groundwater discharge areas, including Big Lake to the north, and Atim Creek.

The Wagner Natural Area ecosystem is dependent on a stable supply of high quality groundwater. Development in the Acheson Industrial area, which falls within the recharge area, is likely the greatest threat to the Natural Area, having the potential to affect the Wagner Natural Area groundwater flow system by introducing contaminants or changing recharge rates. Reduced recharge rates resulting from development in the groundwater recharge zone may lower groundwater levels in the Wagner Natural Area, and thereby affect the springs, which are known to be important to the ecosystem (Von Hauff, 2004). Most of the land area occupied by the recharge area is districted under the County's Land Use Bylaw as Agricultural General District. This zoning does not allow for intensive development, and therefore development in this area, as it is presently districted, should not have a significant impact on recharge rates (Von Hauff, 2004).

Existing documents such as the Water Act Fenceline Approval, the Acheson / Big Lake Area Master Drainage Plan, and the accompanying Acheson / Big Lake Area Wetland Inventory and Classification (AECOM, 2011); ensure that the area's stormwater is properly managed. The Fenceline Approval requires developers to follow the criteria outlined in the Master Drainage Plan (such as discharge rates, quality requirements, isolation valve requirements, outfall and receiving body locations, etc.) and assists in ensuring construction of stormwater management facilities or improvements to the stormwater system are completed in a coordinated and organized fashion. The Fenceline Approval also outlines what wetland mitigation, operation and maintenance requirements are to be followed in the Area. These guiding documents attempt to minimize any impacts to the area's water systems, including the recharge zone underlying the Wagner Natural area, surrounding wetlands, and receiving water bodies.

WAGNER NATURAL AREA AND SURROUNDING FOREST ESA

SIGNIFICANCE: Provincial

Elements assigned a provincial rank of S1 or S2 by the Alberta Conservation Information Management System (ACIMS)

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas

Wagner Natural Area and Surrounding Forest ESA

Environmental Sensitivity: Very High

- Located in an important groundwater recharge area, with a high water table
- Presence of fens and rare plant species sensitive to changes in environmental conditions
- Site ecology is vulnerable to changes in groundwater and surface water conditions; e.g reductions in groundwater recharge and/or surface water diversion or runoff resulting from nearby development
- Rare plant species sensitive to changes in environmental conditions
- Potential for groundwater and surface water pollution as a result of nearby development

Land Status:

- Wagner Natural Area is a designated Provincial Natural Area (crown land)
- Surrounding forest lands are held by either the Nature Conservancy of Canada or by private landowners (i.e. private land holdings)

Key features:

- Wagner Natural Area is a key stepping stone habitat area, functioning as one of the few remaining, predominantly intact natural habitat patches of significant size (core habitat area) between Stony Plain and Edmonton
- Significant ongoing use as an environmental research site
- Rare plant species and plant communities, including newly discovered orchid species in Alberta (*Amerorcis rotundivolia var. linnaeta* and *Amerorcis rotundivolia var. immaculata*) exist in the Natural Area (Ben Rostron, personal communication)
- Unique marl ponds (calcium rich) groundwater discharge environments have very limited distribution provincially
- The marl ponds are considered to be a provincially significant landform feature by the Alberta Geological Survey (AGS) and Alberta Tourism, Parks and Recreation (ATPR) (Proudfoot, 2013).
- The Natural Area's proximity to urban areas allows for high accessibility and opportunities for public use and appreciation.
- Provides habitat for a number of COSEWIC listed wildlife "species of concern", "sensitive" species, and species that "may be at risk"
- Functions as a significant habitat area for ungulate species (e.g. white tailed deer and moose)
- As part of the Big Lake drainage basin, the area contributes to maintaining a balanced hydrological and nutrient regime in Big Lake

Wagner Natural Area and Surrounding Forest ESA

Recommended Planning Strategies:

- Surrounding lands that are linked to the Natural Area and exhibit similar habitat types, as well as surrounding lands underlain by the recharge zone are not protected by the Provincial Natural Area. Nevertheless, these surrounding lands should be managed in concert with the protected Natural Area to ensure that the area is conserved as a dynamic system.
- To preserve the Wagner Natural Area over the long-term, the recharge area must be protected against further intensive industrial and residential development
- Certain portions of the recharge zone are less sensitive to changes than others. These areas include sections 24, 25 (TP 52, R27, W4), 31 (TP 52, R26, W4), and section 6 (TP 53, R 26, W4) (Von Hauff, 2004)
- Adjacent fen areas not protected by the province should be considered for acquisition by conservation organizations, the County, or the Province
- In the adjacent groundwater recharge zone, Parkland County will require that any development in this area apply Low Impact Development stormwater management techniques that mimic predevelopment hydrology. These techniques would strive to appropriately regulate infiltration, evapotranspiration, and runoff rates to prevent detrimental impacts to the fen. Such impacts can be described as reduced groundwater recharge, increased surface runoff, increased variability in water levels and water flow, and reduced water quality. To achieve this outcome, the following principles should be applied:
- Infiltration of stormwater should be promoted within the ESA's linked recharge zone if/when additional development occurs through the use of best practices and green technologies (AECOM, 2011)
- Soil investigations including the services of a professional hydrogeologist should be undertaken to determine infiltration capability of a proposed development site in the ESA's linked recharge zone (AECOM, 2011)
- Retention of existing wetlands – including very small temporary or ephemeral pothole wetlands in the groundwater recharge zone – is critical for ensuring groundwater inputs to the Wagner wetlands over the long term (it is estimated that over 98% of existing groundwater recharge in this area originates from wetlands). Therefore, existing wetlands will be retained as far as possible and stormwater management facilities will be designed to manage water quality sustainably while also enabling groundwater recharge to continue to occur in this area (AECOM, 2011).
- Onsite containment systems shall be used by all developments to minimize seepage of oil, gas and other materials into the groundwater. Containment systems shall allow for water infiltration, yet block oil, gas and other hazardous products from filtering into the groundwater system (Parkland County, 2012).
- Any future development in the Wagner Natural Area Recharge Zone shall not, during construction, operation or reclamation, remove water from the subsurface drainage system, or alter subsurface water drainage channels (Parkland County, 2012).

Wagner Natural Area and Surrounding Forest ESA

- Any future development in the Wagner Natural Area Recharge Zone shall be designed to reduce surface runoff and promote infiltration of clean groundwater. Developments in these areas shall consider maximizing landscaping, using permeable surface and paving materials, and other green technologies where applicable (Parkland County, 2012).
- Natural areas may be protected through Municipal Reserve or Environmental Reserve designation at the time of subdivision development. Existing municipal and environmental reserve parcels shall be maintained and continued to be used as separation buffers between incompatible land uses (Parkland County, 2012).
- Additional information on stormwater management considerations in the groundwater recharge zone for Wagner can be found in the Acheson/Big Lake Area Master Drainage Plan (Parkland County, 2012)
- All types of industrial, commercial and residential development shall be prohibited within the Wagner Natural Area (Parkland County, 2012)
- Consider the long-term conservation of an ecological buffer zone around Wagner Natural Area and its surrounding forest lands that accomodates appropriate land uses while protecting the ESA from the impacts of nearby development
- Existing habitat connectivity and linkages into and out of the Wagner Natural Area should, where possible, be protected and enhanced. Special care should be taken to protect and enhance linkages to nearby ESAs (e.g. Atim Creek ESA, Canada Geese ESA).
- Repair degraded riparian areas to restore connectivity between habitat patches
- Environmentally significant areas (Wagner Natural Area), kettle depressions, drainage courses, wetlands and recharge zones shall be identified at the Outline Plan stage for all future subdivision applications. Developers shall identify how the natural habitat, vegetation, soil and water (quantity and quality) of these areas will be protected and negative impacts minimized. Existing wetlands shall be identified and classified by a qualified aquatic biologist (Parkland County, 2012).

Wagner Natural Area and Surrounding Forest ESA

- The County shall investigate the potential to establish conservation easements to protect areas deemed to have environmental significance (Parkland County, 2012).
- Results of this Environmental Master Plan study does not preclude the potential for a more specific study focused on areas immediately south and west of the Wagner Natural Area, as noted in this fact sheet
- Trails and recreational use within the Natural Area should be managed through appropriate design (boardwalks, etc.) in order to maximize public appreciation while minimizing damage to the ecosystem
- Recreational uses (including trail corridors) may be considered as appropriate land use for areas connecting this ESA to Spruce Grove
- Where wetalnds with the recharge zone may need to be removed, developers should implement constructed wetlands as a means of capturing and filtering stormwater runoff. Constructed wetlands shall become a part of the overall stormwater discharge system.
- Parkland County should undertake additional science-based research to identifiy ecological/conservation buffers for the Wagner Natural Area as required by the Capital Region Board Growth Plan
- Parkland County, in partnership with Wagner Natural Area Society, the City of Spruce Grove, and other stakeholders, should continue to develop appropriate conservation and protection practices for the Natural Area

Atim Creek ESA

Atim Creek ESA

Site Location:

The headwaters of Atim Creek are located in NW 27 and section 34-51-W5M. The creek flows northeast into Big Lake.

Area: 204 ha

Description:

As part of one of the more significant drainage systems in Parkland County, Atim Creek drains 315 km^2 of land in the northeast portion of the County. The creek headwaters originate at Longhurst Lake, flow through portions of Stony Plain and Spruce Grove, and are joined by several tributaries downstream before eventually flowing into Big Lake. Atim Creek provides essential stormwater outlets for the communities of Stony Plain and Spruce Grove and is one of the main water sources feeding Big Lake.

Springs occur in many locations along the Atim Creek drainage which help to maintain winter flow along some sections of the creek. While stream flows vary widely from year to year, they are typically strongest in spring and early summer, becoming low to non-existent in the winter months.

Habitat along Atim Creek is variable in extent and cover, ranging from upland aspen/balsam poplar and white spruce forests in the headwaters to expansive marshlands of cattails, sedges, grasses, and willow at the confluence with Big Lake. Willow/grassland communities, mixedwood stands, and black spruce/bog habitats occur at other locations along the creek. Riparian habitat and adjacent woodlands along the creek and tributaries provide important habitat for wildlife and linkages between habitat blocks along the creek corridor. The creek is known to support populations of white suckers, brook stickleback, pearl dace, finescale dace, Iowa darter, fathead minnows, and possibly northern pike (Westworth Associates Environmental Ltd., 2004).

Atim Creek is connected to a Buck for Wildlife property that is characterized by grassland habitat interspersed with trees. While a relatively large area of forested and shrubby habitats occur along the creek just west of Stony Plain, portions of the creek are grazed. Where the creek enters and exits Longhurst Lake, the riparian zone and adjacent upland habitat are in robust condition, however some sections of Atim Creek have been extensively channelized and the riparian zone has been altered by vegetation clearing.

ATIM CREEK ESA

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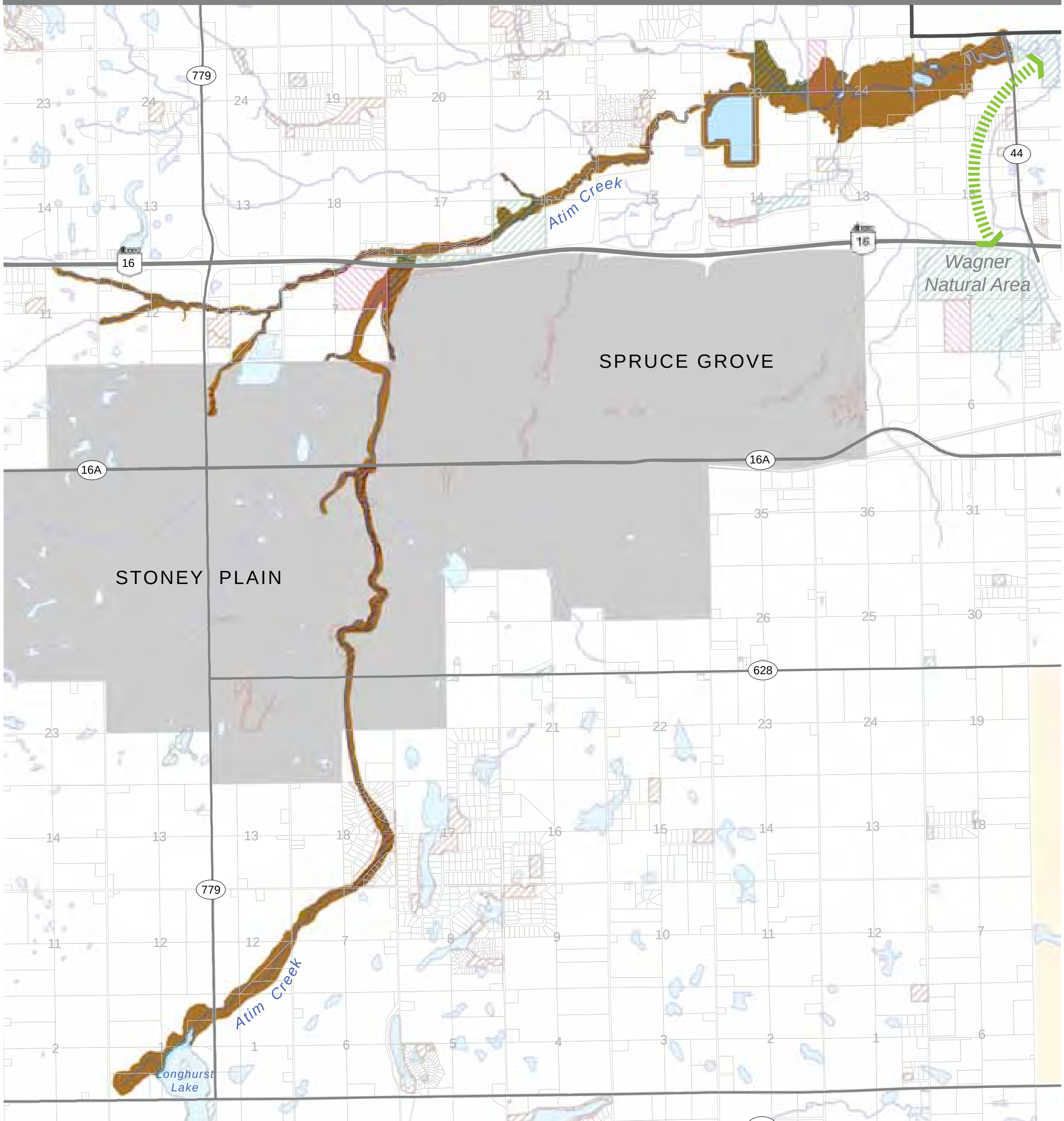

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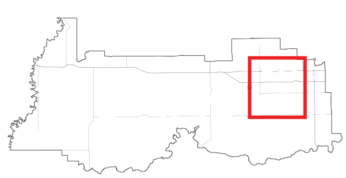
ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Atim Creek ESA

Environmental Sensitivity: Very High

- Moderate susceptibility to groundwater contamination
- Susceptible to drainage alteration, loss of riparian vegetation, erosion, and diminished water quality
- Relatively low water quality in the vicinity of Spruce Grove, continuing downstream

Land Status:

- Atim Creek crosses through both private and Crown lands

Key features:

- Important drainage system within Parkland County which is spring fed in some locations
- Important source of inflow into Big Lake
- Provides habitat for a variety of fish and wildlife
- Serves as an important movement corridor for wildlife, providing linkages between habitat patches along the creek eventually leading to Big Lake

Recommended Planning Strategies:

- Maintain riparian vegetation and enhance riparian buffers
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect creeks
- Cultivated areas around the upper reaches of the creek should adopt practices which minimize the impact to the creek
- Creek bed must be maintained to ensure spawning grounds remain intact. Access to riparian areas should be limited in order to minimize disturbances.
- Barriers to wildlife movement should be minimized

Big Lake Surrounding Area ESA

Big Lake Surrounding Area ESA

Site Location: The marshlands comprising the Big Lake Surrounding Area ESA flank the southwestern edge of Big Lake

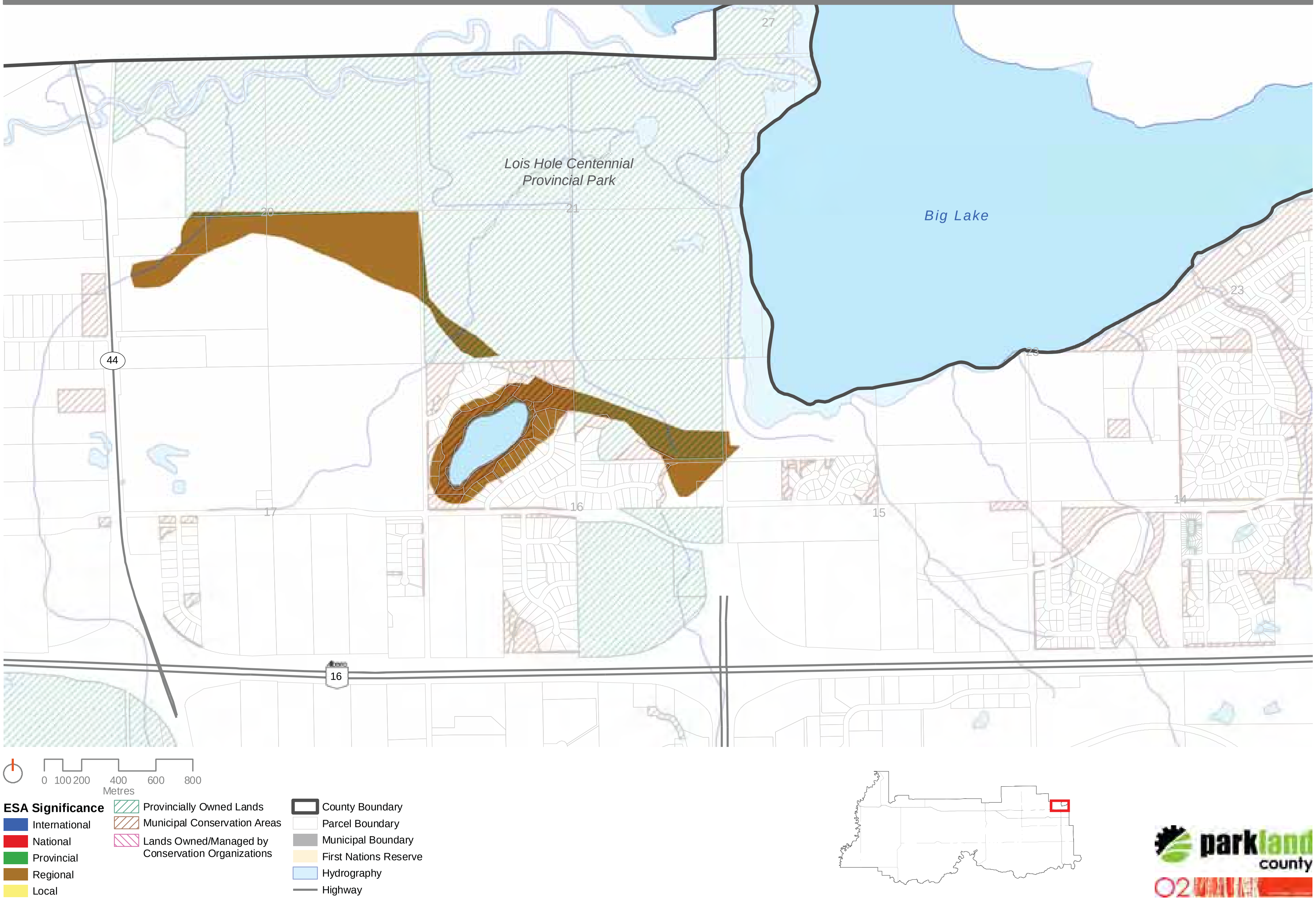
Area: 76 ha

Description:

The marshlands surrounding Big Lake's southern shoreline are an important component of the broader ecosystem, providing critical nesting habitat for birds and other wildlife.

Along the southern shore, the banks are steep, directing the lake's flood waters towards the west, north, and east to feed the surrounding marshlands during high water years. Old stands of white spruce grow on the northeast shore of the lake and a deciduous forest on the southern edge contains diverse vegetation with several rare plant species including orchids and ferns (BLESS 2013).

BIG LAKE SURROUNDING AREA ESA



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Big Lake Surrounding Area ESA

Environmental Sensitivity: Moderate

- Proximity to Big Lake

Land Status:

- Provincial Park and private land

Key features:

- Provides habitat for a number of wildlife species of concern, especially migratory birds
- Functions as riparian buffer for Big Lake, helping to maintain lake water quality

Recommended Planning Strategies:

- Maintaining riparian vegetation is important for upholding the hydrological integrity of the aquatic ecosystem
- Agricultural and industrial activities adjacent to the lake and its marshlands should be carefully monitored to avoid the flow of nutrients and contaminants into the lake

Longhurst Lake ESA

Longhurst Lake ESA

Site Location: Longhurst Lake is located west of the Highway 627 and 779 junctions, approximately 2.5 km south of Stony Plain

Area: 413 ha

Description:

Longhurst Lake is a shallow wetland located near the headwaters of Atim Creek. The ESA boundary includes the lake, several surrounding drainages and wetlands, and a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1].

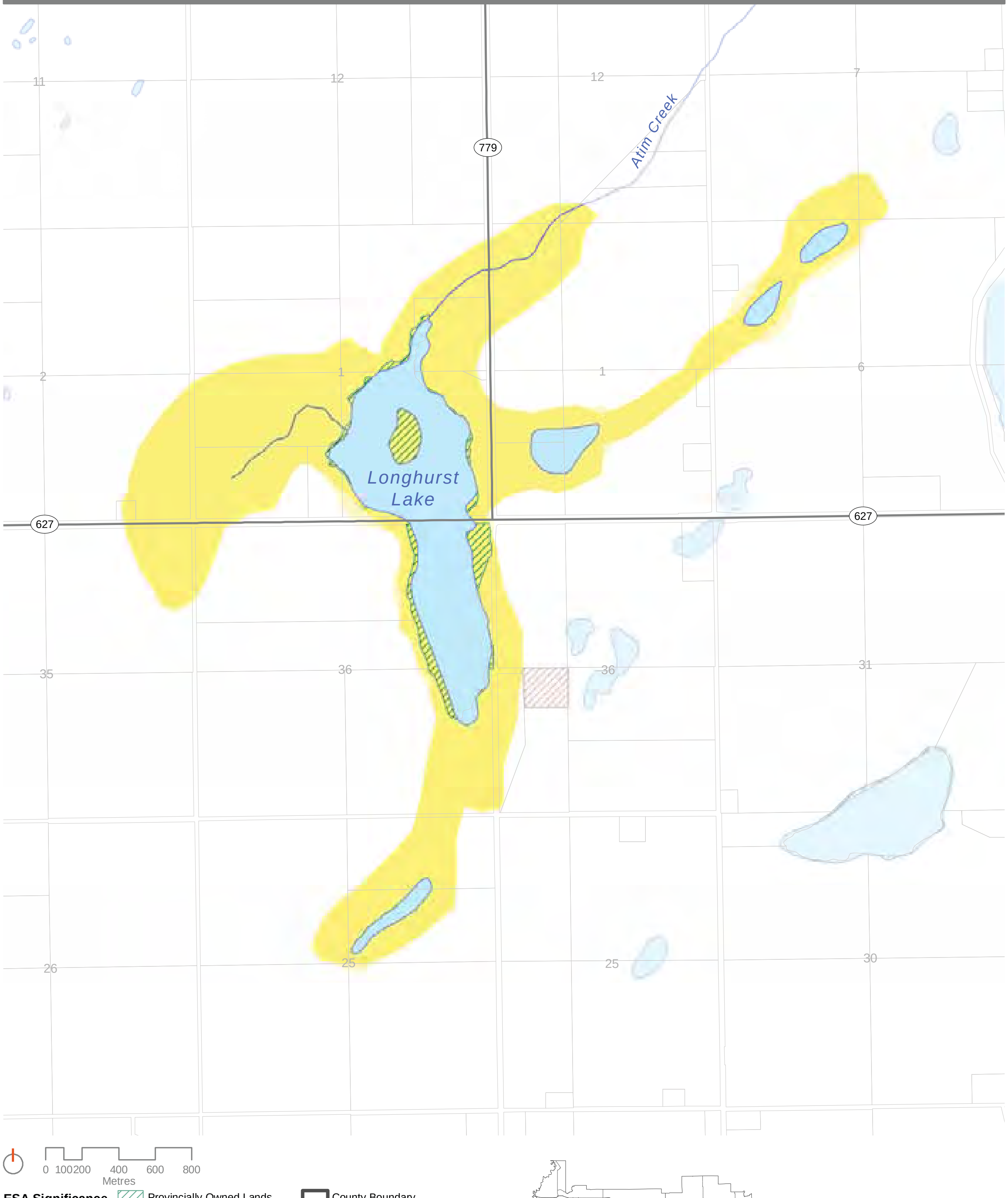
Longhurst Lake and the upper portions of Atim Creek developed in a series of glacial meltwater channels, which comprise a regional groundwater discharge area that help to stabilize the lake's water levels.

The vegetation communities adjacent to the lake are diverse. Cattail marshes, sedge fens, forested swamps, willows, shrubby fens, black spruce and larch forests, upland mixedwood forest and birch forests interspersed with white spruce comprise the primary vegetation communities surrounding the lake. Notably, the sedge fen communities include a number of marl ponds along the western edge of the lake. These features represent potentially important areas of groundwater discharge.

Owing to the diverse vegetation characterizing the lake environment, Longhurst Lake supports habitat for a wide range of aquatic and terrestrial birds. The lake is a local staging area for ducks, geese, and swans, and provides critical habitat for waterfowl production. In 1991, Ducks Unlimited installed a weir to control water levels and the lake was lowered to enhance waterfowl habitat on the lake. A colony of black terns has been recorded at the north end of the lake, as well as other sensitive bird species, including the American bittern and horned grebe (Westworth Associates Environmental Ltd., 2004). Shoreline habitats also function as important feeding and calving areas for moose and deer.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

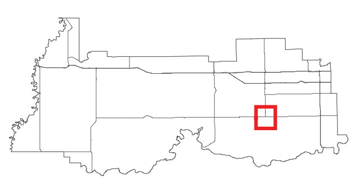
LONGHURST LAKE ESA



ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Longhurst Lake ESA

Environmental Sensitivity: High

- High susceptibility to groundwater contamination

Land Status:

- Private Lands

Key features:

- The meltwater channels in which Longhurst Lake is situated is a potentially important groundwater discharge area
- The black spruce-tamarack peatland that borders the north side of the lake is near the southern limit for this vegetation type in Alberta
- Longhurst Lake is located in a transition zone between the Boreal Mixedwood and Aspen Parkland natural subregions. As such, it supports a relatively high degree of biodiversity, including habitat for waterfowl and ungulates.

Recommended Planning Strategies:

- Highway development and adjacent land uses have adversely affected riparian habitat and lake water quality. Conserving shoreline and riparian vegetation, including those along Atim Creek are necessary to preserve the integrity of the lake.
- Fluctuating water levels have likely impacted vegetation communities that characterize the lake. Culverts passing under Highways 627 and 779 should be inspected regularly for obstructions, thereby ensuring that water level in all parts of the lake have the opportunity to equalize.
- Public access to the lake could be improved, allowing for enhanced recreational and educational opportunities

Mallard Park Wetlands ESA

Mallard Park Wetlands ESA

Site Location: The Mallard Park Wetlands are located approximately 3 km south of Spruce Grove along Range Road 214 south of Highway 627.

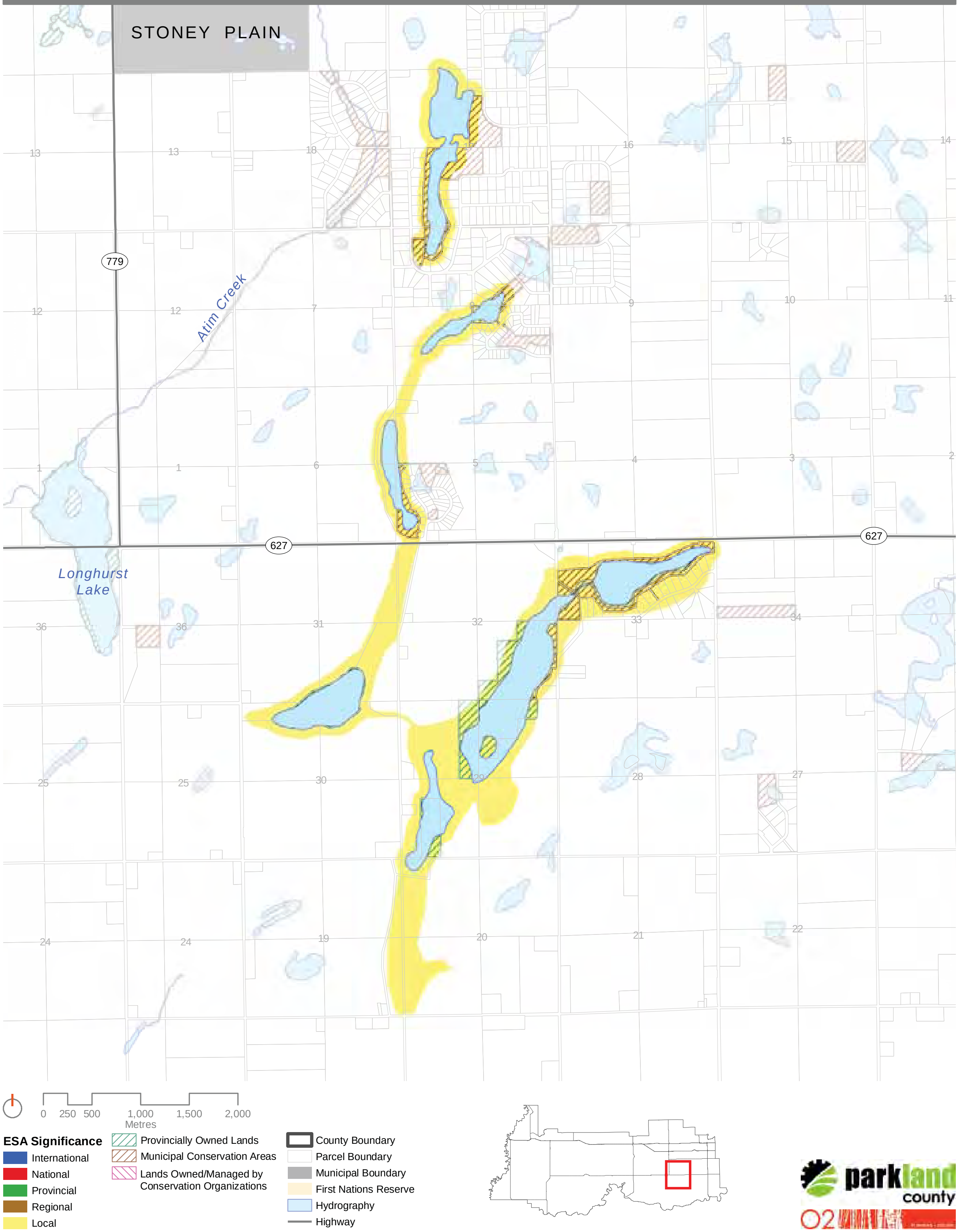
Area: 480 ha

Description:

The Mallard Park Wetlands is comprised of several shallow wetlands situated along a series of glacial meltwater channels. An emergent vegetation zone dominated by cattails characterizes the main lake, with willow shrubland interspersed in many sections. While the surrounding upland habitat is limited, aspen-balsam poplar communities and conifers are present in the area. Marshlands are located on the eastern side of the lake, and are characterized by cattails surrounding open water. A smaller lake, drainage, and shallow ponds are located to the west.

Agricultural lands surround most of the area, and grazing occurs along the eastern edge of the main lake. A rural subdivision is located along the southern portion of the lake marshlands. In the midst of these surrounding land uses, the Mallard Park Wetlands complex supports waterfowl production and staging, and provides habitat for a wide range of other wetland species.

MALLARD PARK WETLAND ESA



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Mallard Park Wetlands ESA

Environmental Sensitivity: Very High

- High susceptibility to groundwater contamination
- Water bodies may be sensitive to drainage or adjacent land use activities

Land Status:

- A combination of Crown lands, private land, and county owned land surround the main lake and drainage
- Private land surrounds the west Lake and drainage

Key features:

- Marshland habitat surrounding the lake and wetlands support waterfowl production and staging

Recommended Planning Strategies:

- Maintain and enhance shoreline buffers to conserve waterfowl habitat and safeguard groundwater quality
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect water bodies

Whale Lake Wetlands ESA

Whale Lake Wetlands ESA

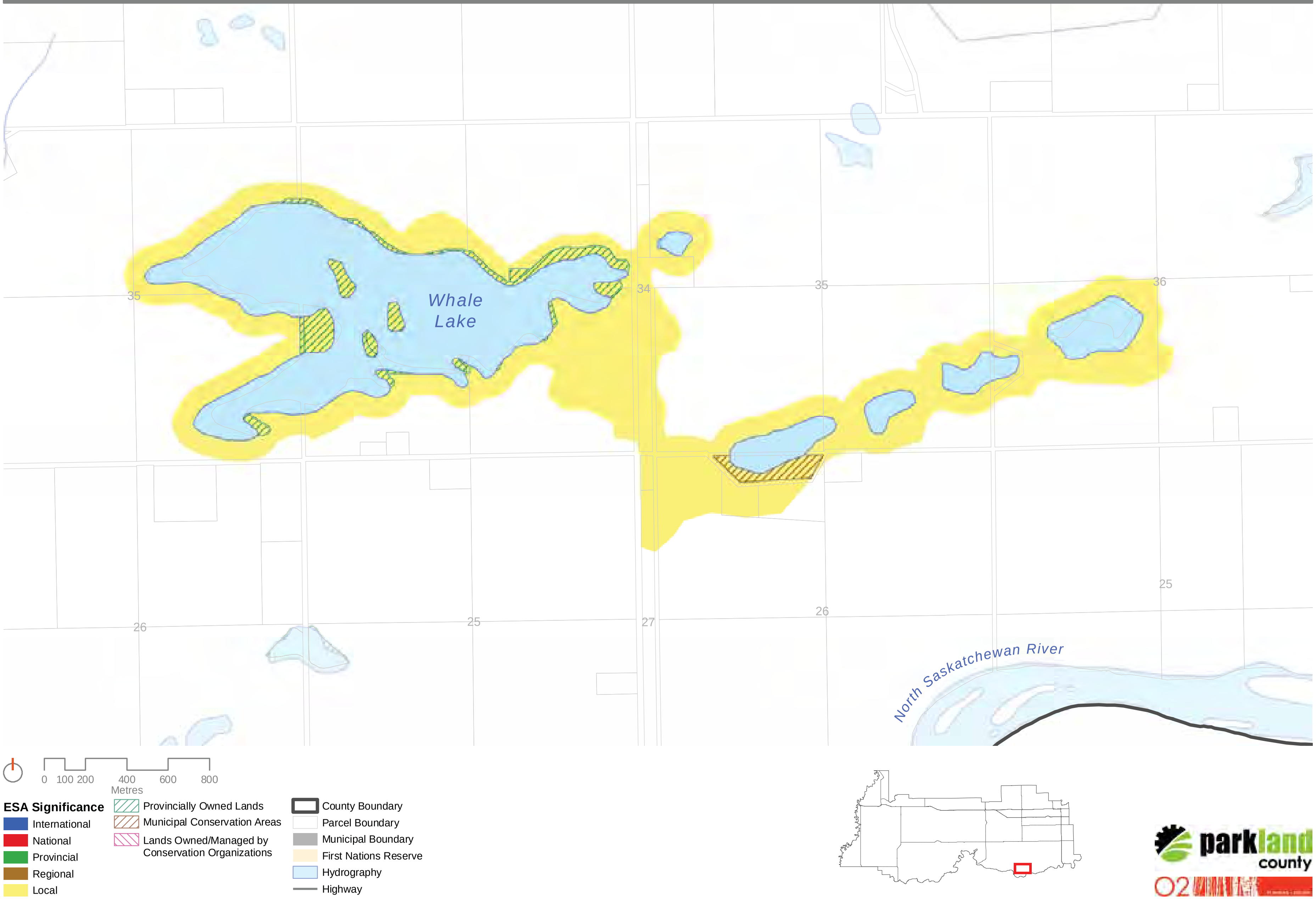
Site Location: The Whale Lake wetlands are located a few kilometers north of the North Saskatchewan River, just west of Highway 779.

Area: 287 ha

Description:

The Whale Lake wetlands complex is a broad expanse of wetland/marsh habitat with some willow and upland forest habitat flanking its edges. The wetland is surrounded on all sides by agricultural land and the wetland edges have been affected by haying in several locations. As an ephemeral lake/wetland, the area provides moderately productive habitat for waterfowl and other wetland/marsh species, especially given its location as an island of habitat surrounded by agriculture land use.

WHALE LAKE WETLANDS ESA



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Whale Lake Wetlands ESA

Environmental Sensitivity: Very High

- High susceptibility to groundwater contamination from surrounding land uses
- Observations of rare plants
- Sensitive water bodies present

Land Status:

- Private Lands

Key features:

- Provides habitat for waterfowl and other wetland/marsh species in an area of intensive agriculture

Recommended Planning Strategies:

- This lake is a Ducks Unlimited project that includes a water control structure
- Retain smaller wetlands in the area – including very small temporary or ephemeral pothole wetlands –to maintain hydrology of the lake's watershed
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect water bodies


Hubbles Lake

Central Lakes/Dry Mixedwood ESAs

As the largest landscape unit in the County, the Central Lakes / Dry Mixedwood LU contains 30 identified ESAs. This LU contains one provincially significant ESA – the Kilini Creek ESA – owing to the provincially rare plant species that occur along the creek corridor.

The majority of the recreational lakes in Parkland County occur in the Central Lakes / Dry Mixedwood LU. What is often referred to as the "lake country" in the County is underlain by the Carvel Pitted Delta – a broad glacial landform characterized by hills and kettle depressions in which the lakes formed. Country residential and lakeshore residential development in the lake country represent a significant development pressure in this LU. Gravel pits and coal mines, including the largest coal mine in Canada, are also operated within the LU, representing additional development pressures to surrounding ESAs.

This section presents a detailed portrait of each ESA in the Central Lakes / Dry Mixedwood LU, including a summary of management considerations specific to each ESA. For more information on best management practices for ESAs, please see Section 4: Best Management Practices.

Environmentally Significant Area (ESA)	Significance	Sensitivity	Page no.
Cottage Lake ESA	Provincial	Very High	124
Kilini Creek ESA	Provincial	Very High	128
Bunkerhill / Dussault Lake ESA	Regional	Moderate	132
Chickakoo Lake Complex ESA	Regional	Very High	136
Glory Hills ESA	Regional	Very High	140
Hubbles Lake ESA	Regional	Very High	144
Isle Lake ESA	Regional	High	148
Jackfish Lake / Star Lake ESA	Regional	High	154
Johnny's Lake / Mink Lake ESA	Regional	High	160
Mayatan Lake Complex	Regional	High	164
Wabamun Lake ESA	Regional	Low	168
Brightbank ESA	Local	Very High	172
Brookside ESA	Local	High	176
Canada Geese ESA	Local	Moderate	180
East Pit Lake ESA	Local	High	184
Fallis Slopes ESA	Local	Very High	188
Gladu Lake ESA	Local	Moderate	192
Hasse Lake ESA	Local	High	196
Isle Lake Natural Area ESA	Local	High	200
Isle Lake Surrounding Area ESA	Local	Moderate	204
Manly Corner ESA	Local	Low	208
Muir Lake ESA	Local	Low	212
Seba Beach / Junior Forest Ranger ESA	Local	Very High	216
Smithfield / Amisk Acres ESA	Local	Low	220
Soldan / Eden Lakes ESA	Local	Very High	224
Spring Lake ESA	Local	Very High	228
Unnamed Lake ESA	Local	Moderate	232
Wabamun Creek	Local	Very High	236
Westland Park ESA	Local	Very High	240
Wildlife Point ESA	Local	Very High	244

Cottage Lake ESA

Cottage Lake ESA

Site Location: Cottage Lakes are approximately 11 km west of Stony Plain

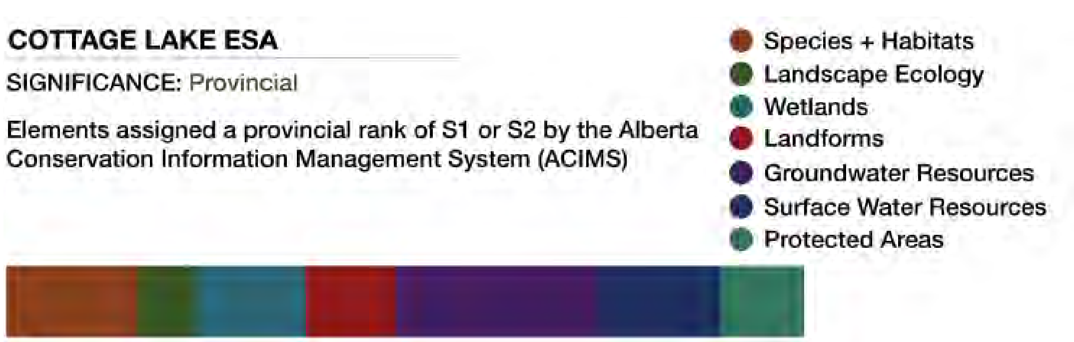
Area: 81 ha

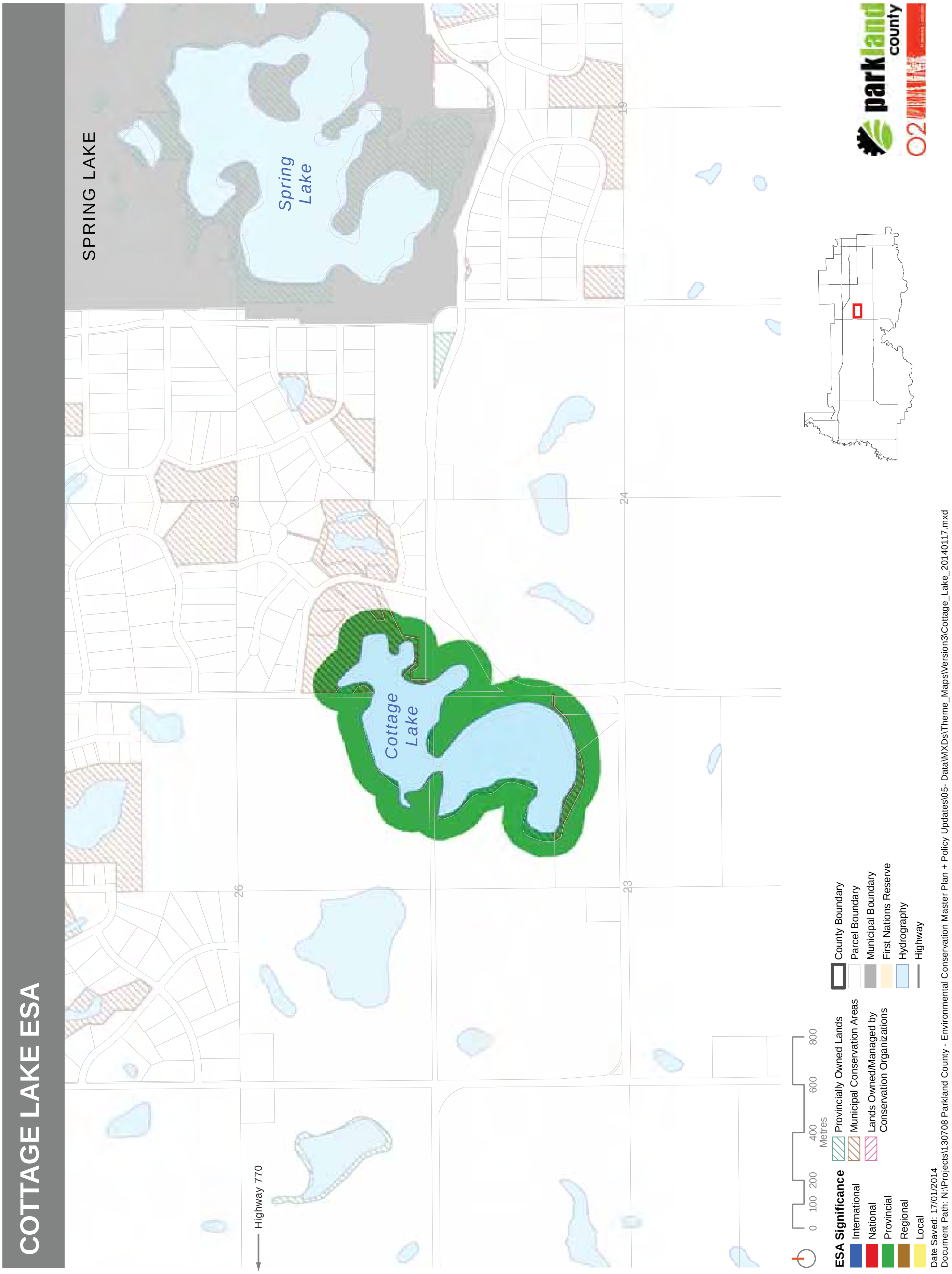
Description:

The Cottage Lake ESA includes the lake, as well as a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. Cottage Lake and Spring Lake share the same surficial drainage basin, and also display close relationships to local shallow groundwater systems. However, Cottage Lake has been ranked as provincially significant owing to the S1S2 provincially rare plant species that occur around the lake. This ranking is consistent with previous studies (Fiera Biological Consulting, 2009).

Cottage Lake is a small lake near Sundown Road, southwest of the Wild Rose Park subdivision. The lake contains a north and south basins connected by a narrow channel. A shallow emergent vegetation zone fringes the lakes and lacustrine fringe wetlands are found along the lakeshores. Public access to the lake remains very difficult. The lake contains slender naiad (*Najas flexilis*) on the lake bottom, which is an S2 ranked provincially rare species, as well as linear-leaved pondweed (*Potamogeton strictifolius*) within the lake. Healthy mature forests dominated by trembling aspen and balsam poplar surround the lake, including a heavily forested steep slope along the southwest corner of the lake between the lake and Range Road 21. The area provides habitat for a variety of mammals, birds, and amphibians including Canadian toad that has been observed in some of the wetlands between the north and south basins. There are three docks along the south shore of the lake that have been built by private landowners.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.




COTTAGE LAKE ESA
SPRING LAKE
Spring Lake
Cottage Lake
Highway 770
19
24
25
26
23
0 100 200 400 600 800
Metres
ESA Significance
International
National
Provincial
Regional
Local
Provincially Owned Lands
Municipal Conservation Areas
Lands Owned/Managed by Conservation Organizations
County Boundary
Parcel Boundary
Municipal Boundary
First Nations Reserve
Hydrography
Highway
parkland county
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Cottage Lake ESA

Environmental Sensitivity: Very High

- Rare plant species are present
- Lakeshore environments
- Regional groundwater models indicate high sensitivity to contamination

Land Status:

- Cottage Lake is surrounded primarily by privately owned lands, but County-owned lands occur along the northwest corner
- The large wetlands in between Spring Lake and Cottage Lake are surrounded by private lands
- The bed and shore of lakes and permanent wetlands in Alberta are provincial Crown lands

Key features:

- Two rare plant species are present
- Lake system is fed by groundwater

Recommended Planning Strategies:

- Property owners should follow good shoreline protection by maintaining/restoring a dense vegetated buffer around the lakes
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect water bodies
- Protecting the water balance and water quality of these lakes over the long term will require sustainable land use patterns and land management practices in surrounding areas of the County that do not affect the quality or quantity of surface water or groundwater
- The potential for landscape management practices and/or wetland loss in surrounding subdivisions within the watershed on the lake systems should be studied further and best practices for those acreage owners implemented. Subdivisions that may affect the watershed for these lakes include but are not necessarily limited to: Royal Park, Cottage Lake Heights, Arrowhead Estates, Wild Rose Park, Hillview Estates, Excelsior Park, Heatherlea, Lincolnshire Downs, Sundown Estates, Viewpoint Estates, Blueberry Hill Estates, and Spring Hills.


Kilini Creek ESA

Kilini Creek ESA

Site Location: Kilini Creek originates at Johnny's Lake and flows northeast approximately 8 km before reaching the Kilini Creek Natural Area northwest of Eden Lake.

Area: 1,242 ha

Description:

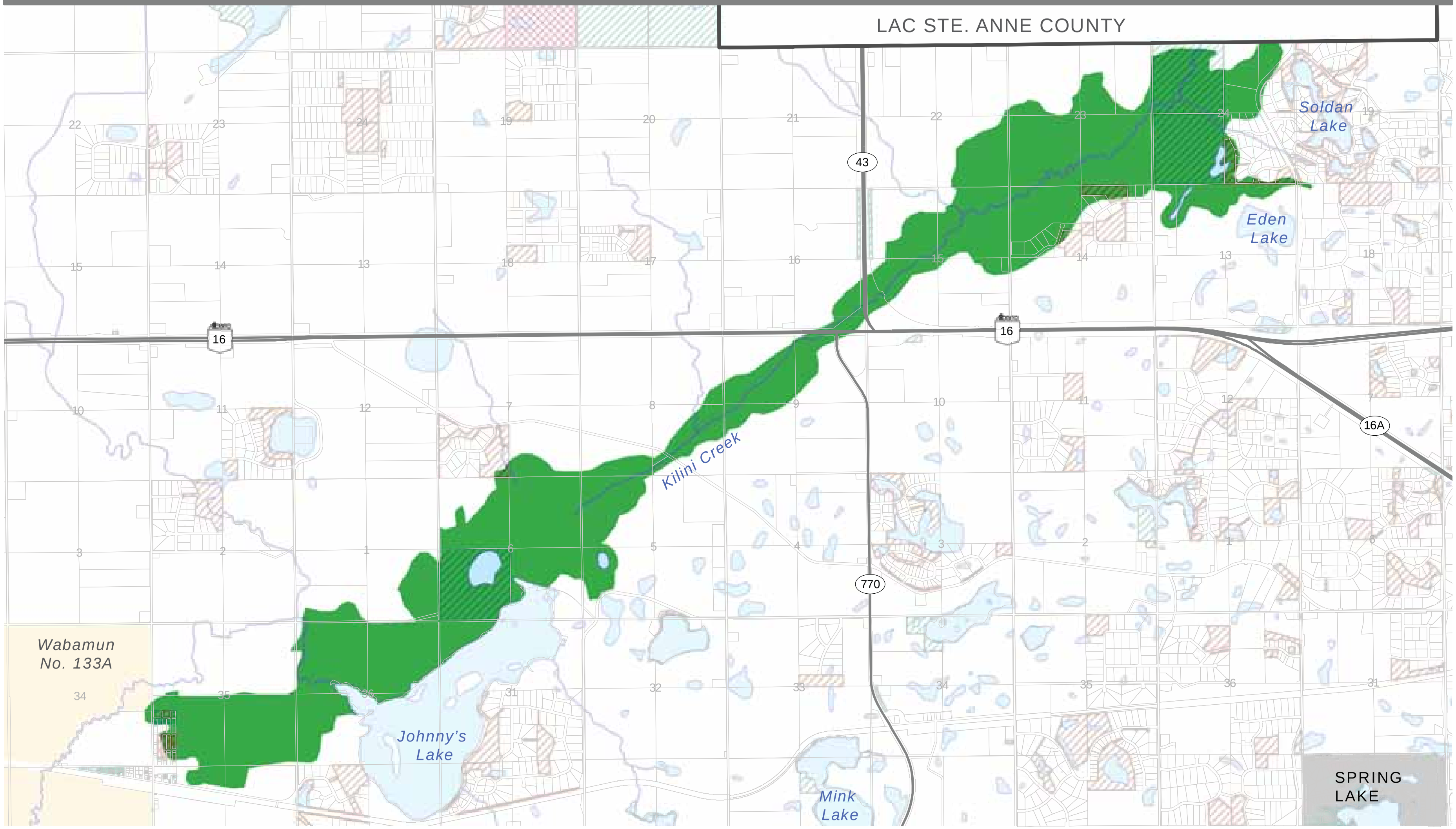
As part of the headwaters for the Sturgeon River, Kilini Creek flows northeast to its confluence with the Sturgeon River in Sturgeon County. The creek is situated in the Wabamun Meltwater Channel and runs through a variety of habitats including black spruce bog areas and aspen and white spruce uplands before it reaches the Kilini Creek Natural Area. A wide buffer of relatively undisturbed habitat flanks much of the west side of the creek, making it inaccessible in many areas.

The Kilini Creek Natural Area is comprised of diverse upland and lowland habitats. Upland areas contain aspen, balsam poplar, birch, and some white spruce and pine, while the lowland areas are characterized by peatlands, several small lakes, numerous ponds, marshes, and marl ponds. The peatland areas contain black spruce, pine, willow, and tamarack. The calciferous marl ponds found along the creek corridor date back thousands of years, and provide habitat for many provincially rare orchids, carnivorous plants, and a diversity of other rare plants species. Many of the plant species found at Kilini Natural Area, including rare species, are not found anywhere else except the Wagner Natural Area. Provincially rare plants confirmed to occur in the ESA include meesia moss, slender beak-rush, and a rare liverwort (*Riccardia latifrons*)[1].

Moose, deer, coyote, porcupine, muskrat, beaver, numerous bird species, as well as the occasional bear, lynx, and cougar have been observed in the area. The creek provides linkage between habitats along its course and functions as an important wildlife movement corridor. The creek may represent critical habitat for garter snakes, which move down into the creek area in the summertime. Leopard frogs, a COSEWIC listed species of concern, have also historically been found in the area.

1 Others have also reported other rare plants such as Cyperus-like sedge and White adder's mouth within the area (Westworth Associates Environmental Ltd., 2004), although these species were not confirmed in the 2013 data request to the ACIMS database by O2.

KILINI CREEK ESA



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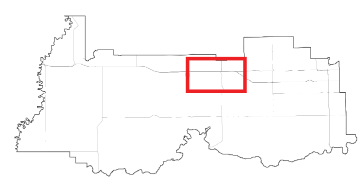
Kilometres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Kilini Creek ESA

Environmental Sensitivity: Very High

- Rare plants, peatlands, riparian areas

Land Status:

- Natural Area: provincial; private lands

Key features:

- Part of the headwaters for the Sturgeon River
- Leopard frog (COSEWIC listed species) and provincially rare plant species in the area
- Characterized by diverse upland and lowland habitats, including aspen/white spruce forests, peatlands, marshes, and marl ponds

Recommended Planning Strategies:

- Maintain extensive buffer area flanking the creek in order to minimize access and disturbance
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect creeks
- Cultivated areas surrounding the creek should adopt practices which minimize the impact to the creek
- Creek bed must be maintained to ensure spawning grounds remain intact. Access to riparian areas should be limited in order to minimize disturbances
- Barriers to wildlife movement should be minimized
- Limit development in surrounding areas in order to prevent surface and groundwater contamination while conserving important wildlife corridors in and out of the ESA
- Ecotourism and environmental education opportunities are available

Bunkerhill / Dussault Lake ESA

Bunkerhill / Dussault Lake ESA

Site Location: This ESA is located in most northwest corner of the County, north of Highway 16 and along Highway 757

Area: 2,210 ha

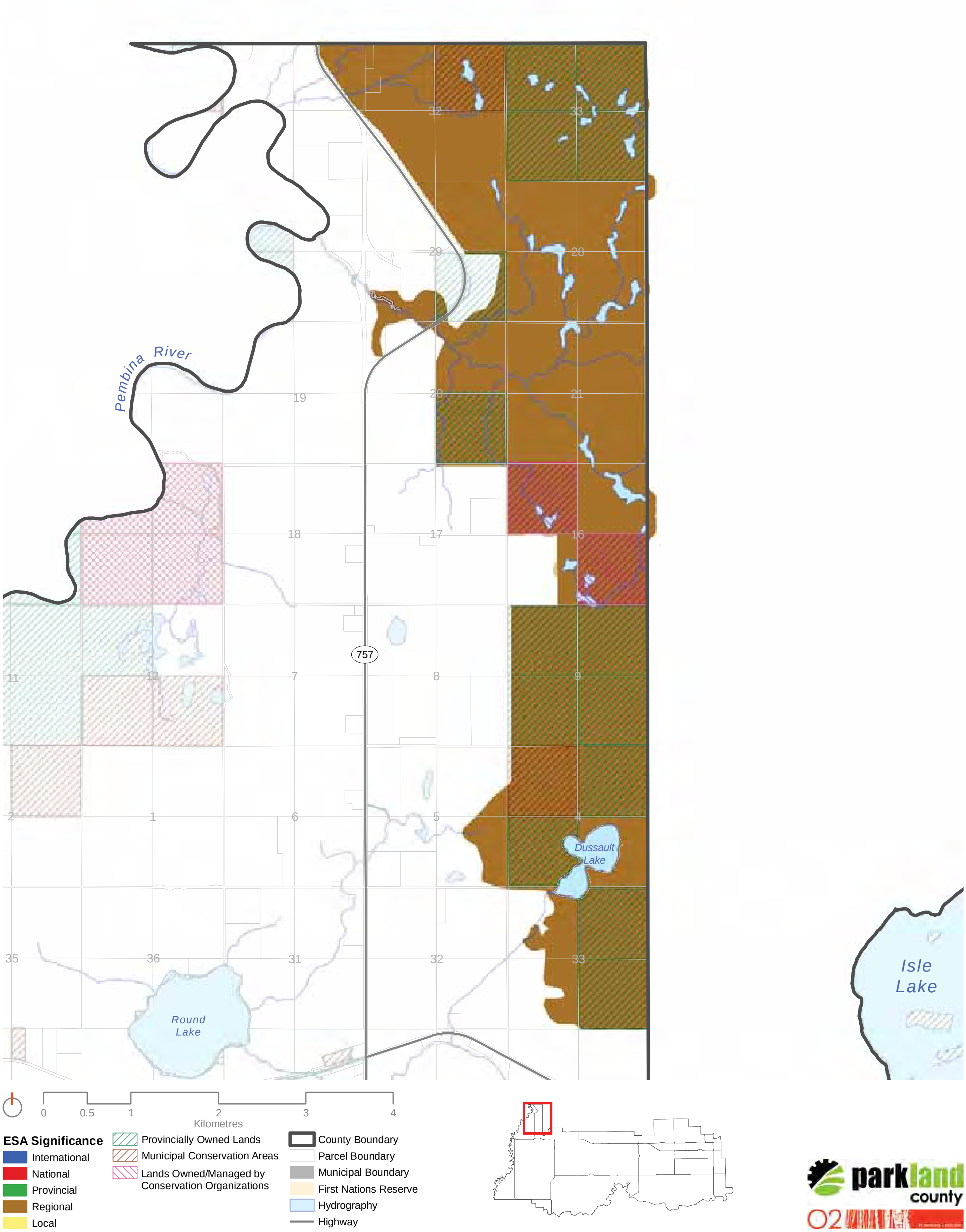
Description:

This area is characterized by diverse and relatively undisturbed native vegetation and is located on an extensive stagnation moraine and hummocky glacial-lacustrine deposit. Upland areas are dominated by a variety of forest types with a mixture of age classes including aspen, mixedwood and white spruce. The forest understory is diverse and contains species such as hazelnut, saskatoon, rose, and buffaloberry, along with a variety of forbs and grasses. Some jack pine can be found in drier areas.

Wetlands and riparian habitats can be found throughout this ESA in low-lying areas and where surface water has created drainage channels. Some wetland habitat has also been created through the construction of beaver dams. These lowland areas support large balsam polar, birch, red osier dogwood and lowbush cranberry. Peatlands can also be found in this area, and are dominated with willow, black spruce, and graminoid species. Bunkerhill is important wildlife habitat because of its large patch size and diverse vegetation communities. Moose and elk are abundant in Bunkerhill, as well as many species of songbirds and birds of prey.

Dussault Lake Natural Area is located in the southern portion of Bunkerhill and includes Dussault Lake and the surrounding vegetation communities. Forested peatlands and sedge dominated wetlands are the principal communities around the lake, although some uplands of aspen-balsam poplar forest are also present. Dussault Lake provides habitat for a variety of water birds.

BUNKERHILL DUSSAULT LAKE ESA



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Bunkerhill / Dussault Lake ESA

Environmental Sensitivity: Moderate

- This area is wet, with areas of organic soil, along with other areas of thin, highly erodible soils that make this area sensitive to disturbance.

Land Status:

- Several parcels of land are either unoccupied Crown or leased Crown lands
- Some parcels are privately owned

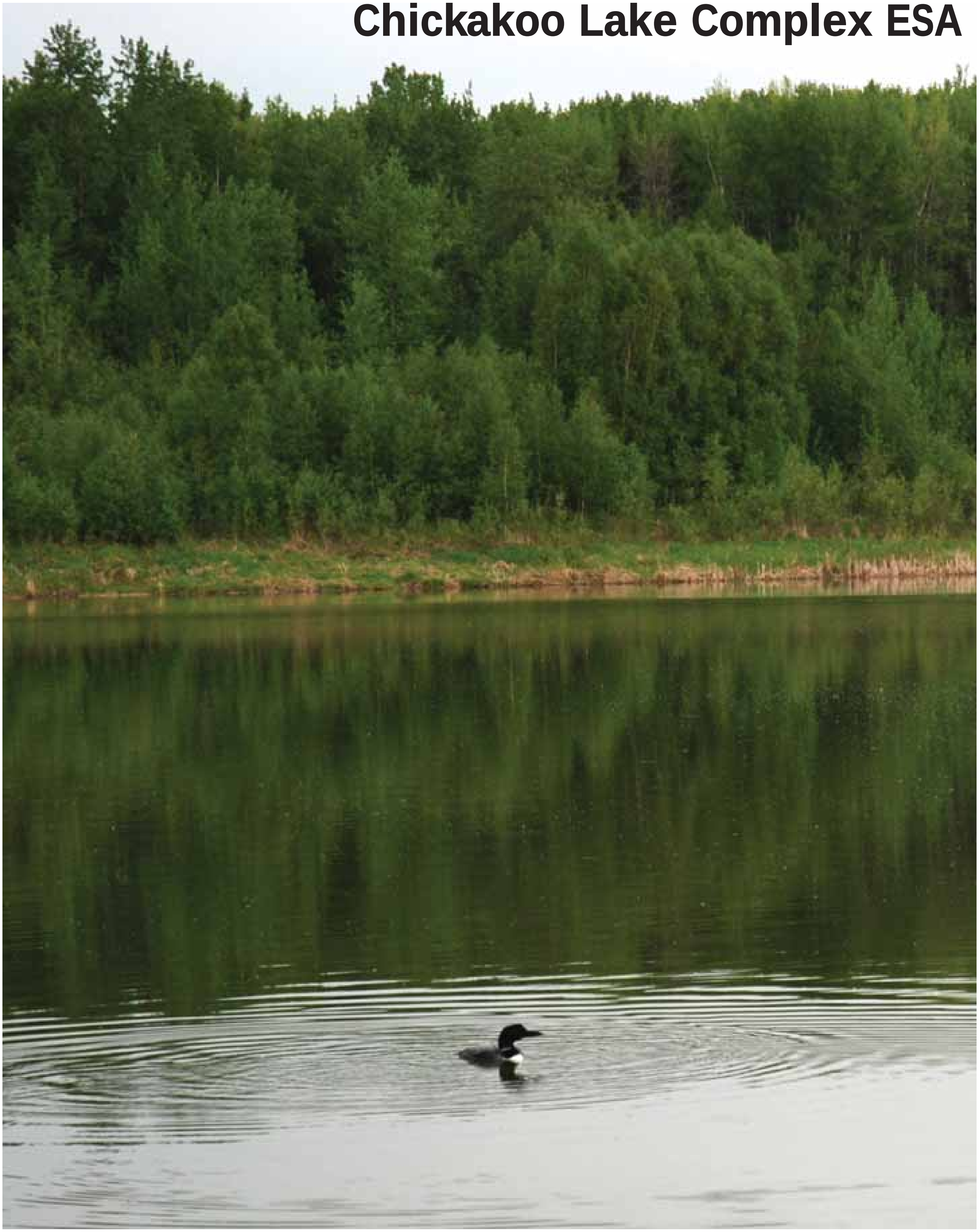
Key features:

- This area represents a large patch of highly diverse, relatively undisturbed habitat

Recommended Planning Strategies:

- Most of the area is classified as poor agricultural lands because of a combination of thin soil, knob and kettle topography, poorly drained peat soil, wetlands, and stones. The area is highly sensitive and has poor reclamation/ restoration capacity.
- Bunkerhill/Dussault Lake represents one of the last large, contiguous blocks of native habitat remaining within the County. The size of this parcel and its proximity to the Pembina River Valley and other natural areas to the east and southeast provide opportunity to support viable populations of most of the boreal wildlife species that currently exist in Parkland County. Conservation of some large, interconnected blocks of habitat is essential for biodiversity conservation in fragmented landscapes.
- Limit future access, and minimize the potential for future recreational vehicle use to ensure large patches remain relatively undisturbed

Chickakoo Lake Complex ESA



Chickakoo Lake Complex ESA

Site Location: This ESA is located north of Stony Plain off Highway 779, and is accessible by Township Road 534 or 540.

Area: 1,511 ha

Description:

The Chickakoo Lake Complex ESA is made up of a series of small lakes and ponds interspersed with undisturbed upland forest habitat. The ESA boundary includes a 100 m buffer[1] around all lakes in the complex, thereby capturing the important riparian areas that contribute to the ecological integrity of the ESA .

The lake complex is located within the Carvel Pitted Delta, with undulating to rolling topography similar to the Glory Hills ESA located nearby. Emergent wetland vegetation occupies the lake fringes, grading to willow and aspen / balsam poplar forest from the shore to the surrounding uplands. Pockets of birch and white spruce are also present. Some of the lakes are connected by intermittent or seasonal drainages.

Lakes in the area are typically situated in depressional areas without permanent inlets or outlets (i.e., lacking an integrated drainage system) and receive inflow from surrounding surface runoff and groundwater. Shallower depressions (wetlands) provide important waterfowl production habitat, and habitat for other water birds such as loons, grebes, terns, gulls, and shorebirds. Upland forests provide habitat for a diversity of bird species including woodpeckers, songbirds, forest owls, and hawks. Mammals such as ungulates, canids, furbearers and snowshoe hare occupy the uplands, while beaver and muskrat can be found inhabiting wetlands.

The Chickakoo Lake Recreational Area (CLRA) is a popular park within Parkland County. This area provides developed trails for walking, horseback riding, and cross-country skiing, as well as a local put-and-take trout fishery.

Some of the main lakes in this complex are described below:

Chickakoo Lake: This lake is approximately 26 ha with an average depth 4.7 m. Its drainage basin consists primarily of undisturbed forest. The lake is annually stocked with both rainbow and brook trout. This lake was evaluated in 1995 and determined to be eutrophic, with an average Secchi depth of 3 m.

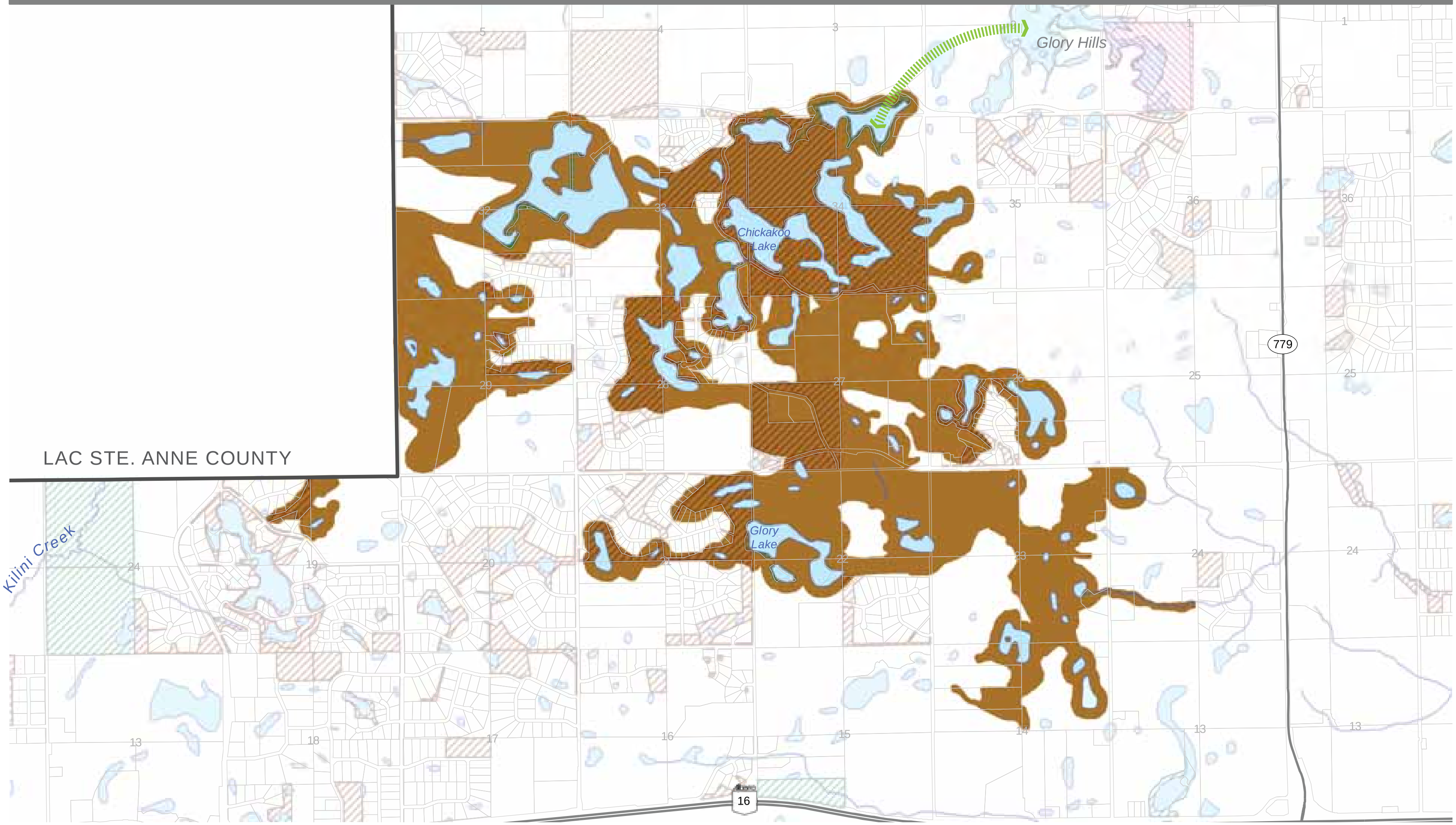
Kettle Lake: This lake is approximately 18 ha with an average depth 6.1 m. Most of the area surrounding the lake is undisturbed forest.

Little Mere Lake: This lake is approximately 11 ha with an average depth 4.7 m. The majority of the shoreline is comprised of undisturbed forest.

Windy Lake: This lake is approximately 6 ha with an average depth 5.1 m. The western shoreline consists of undisturbed forest, and the remainder of the lake is surrounded by agricultural lands.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

CHICKAKOO LAKE COMPLEX ESA



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Kilometres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway

Potential Wildlife Corridors*

**Potential corridor locations based on reported resident observations and confirmed by a land cover driven circuit connectivity model*

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Chickakoo Lake Complex ESA

North Lake: This lake is approximately 19 ha with an average depth 4.2 m. It is joined to Kettle and Little Mere Lakes by intermittent drainage channels. Much of the south shoreline has been cleared for agricultural uses and the southwest corner is contained within the CLRA.

Sauer Lake: This lake is approximately 10 ha with an average depth 4.2 m. It has a volume of 0.35 million m^3. The top layer of water remains clear due to the nature of the thermocline. Organic nutrients have been measured and this lake is considered to be mesotrophic, whereby phosphorus peaks in May after the spring turnover. Its drainage basin is about 49 ha, with no inlets or outlets, and is comprised mainly of undisturbed forest. All the land surrounding the lake is privately owned and includes a rural subdivision at the south end. Rainbow trout, brook stickleback, and redbelly dace naturally occur in Sauer Lake.

Cameron Lake: This lake is approximately 52 ha with some undisturbed shoreline surrounding it. The land to the north of the lake is relatively flat and the area to the south has more undulating topography.

Glory Lake: This lake has 3 basins with varying water depths and is inhabited by fish species such as Brook stickleback. The largest basin is approximately 9 ha. The land adjacent to the shoreline consists of undeveloped forest, with surrounding lands under private ownership (e.g., Glory Lake subdivision to the west).

Environmental Sensitivity: Very High

- High groundwater sensitivity and areas of sensitive soils

Land Status:

- Part of this ESA is a designated recreational park owned and maintained by Parkland County
- Many land parcels within the lake complex and surrounding habitats are privately owned

Key features:

- A highly diverse lake and wetland complex
- Intact patches of forested areas

Recommended Planning Strategies:

- Minimize clearing and fragmentation associated with rural residential and agricultural development to preserve the extent, connectivity, and quality of remaining habitat for wildlife
- Maintaining an appropriate setback around lakes and wetlands is essential to protecting aquatic resources
- Restrict recreational OHV use surrounding sensitive lakeshore environments
- Prohibit residential fertilizer use within the ESA boundary. Increase education and (where necessary) enforcement for non-compliance.
- Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the water basin. Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.

Glory Hills ESA

Glory Hills ESA

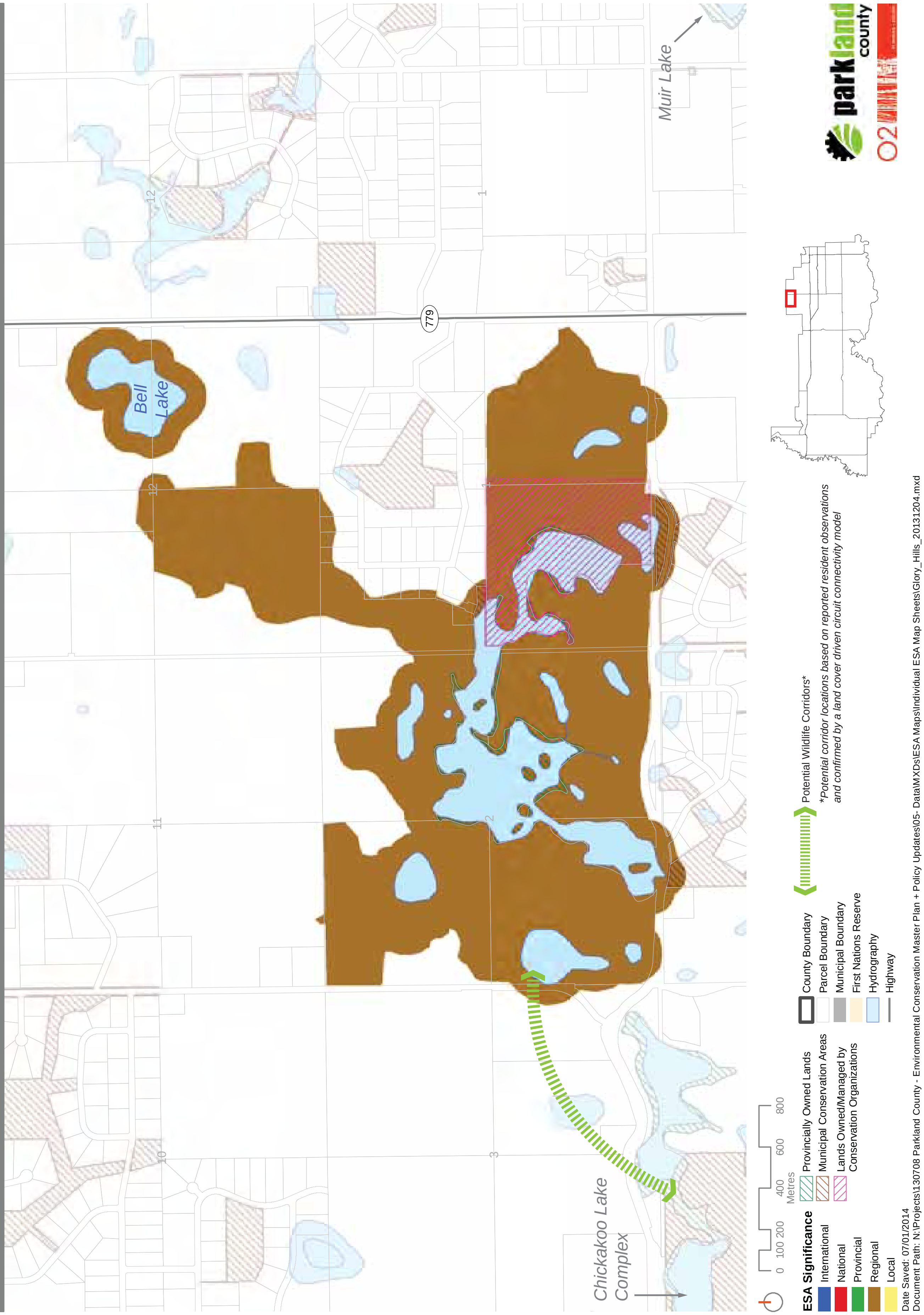
Site Location: The Glory Hills ESA is located northeast of the Chickakoo Lake Complex, just west of Highway 779

Area: 238 ha

Description:

The Glory Hills ESA, part of which is owned and managed by the Edmonton and Area Land Trust (EALT), is situated at the transition zone between the Boreal Forest and Aspen Parkland natural subregions. Due to its unique location between natural subregions, the area supports a diverse range of flora and fauna. The Glory Hills area is characterized by dense aspen forests, open grasslands, wetlands, and a lake. Moose, beaver, coyote, deer, ruffed grouse, and breeding loons, are known to inhabit the area. A great blue heron rookery was also recorded in the area. Wetlands within the Glory Hills are part of a chain of wetlands that help filter and protect the local water supply (EALT, 2010).

GLORY HILLS ESA



Glory Hills ESA

Environmental Sensitivity: High

- Moderate susceptibility to erosion
- High susceptibility for groundwater contamination

Land Status:

- EALT conservation lands and private lands

Key features:

- Large patch of relatively undisturbed natural vegetation
- Located at the transition zone between Boreal Forest and Aspen Parkland natural subregions
- Diverse habitat supports a wide range of plant and animal species
- A great blue heron rookery has been recorded in the area

Recommended Planning Strategies:

- Maintain vegetation cover on steep slopes to minimize erosion potential and maintain lake water quality
- Maintain riparian buffers to safeguard the integrity of lake and wetland habitats and enhance water quality
- Adjacent areas that are not conserved by the EALT should be considered for acquisition by the NGO, the County, or the Province

Hubbles Lake ESA

Hubbles Lake ESA

Site Location: Hubbles Lake is located just south of Highway 16 between Range Roads 13 and 14, a few kilometres west of Stony Plain.

Area: This ESA encompasses an area of approximately 88 ha. Hubbles Lake itself has a surface area of 37 ha, an average depth 7 m, with a maximum depth of over 30 m.

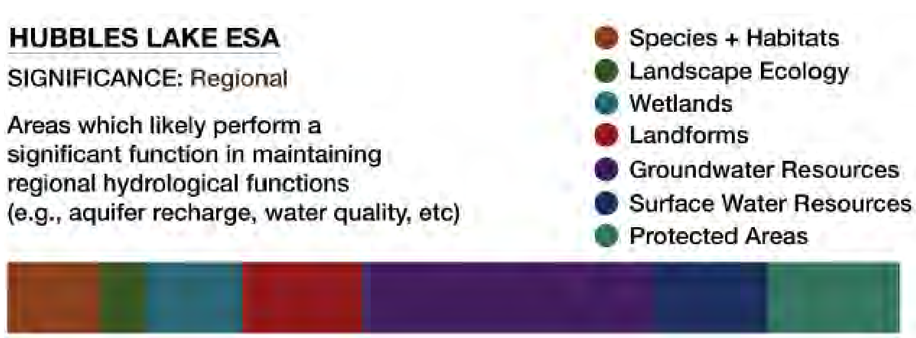
Description:

The Hubbles Lake ESA is comprised of the lake and a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. Hubbles Lake is a deep, clear, small lake situated in the Carvel pitted delta, with a volume of approximately 4.0 million m^3. The terrain is rolling to hilly in nature, and the lake is thus very sheltered by topography. There is no defined inlet or outlet, therefore ground water inflow likely contributes the most volume to the lake. The lake bottom is irregularly shaped with four deep holes, two holes being over 30 m deep. Emergent wetland vegetation surrounds much of the shoreline, while upland forest around the lake is primarily aspen and balsam poplar. The effective drainage basin is approximately 136 ha and a peatland is present at the southeast end of the lake. Permanent residences are located along 40% of the shoreline and commercially operated resorts are located in surrounding areas.

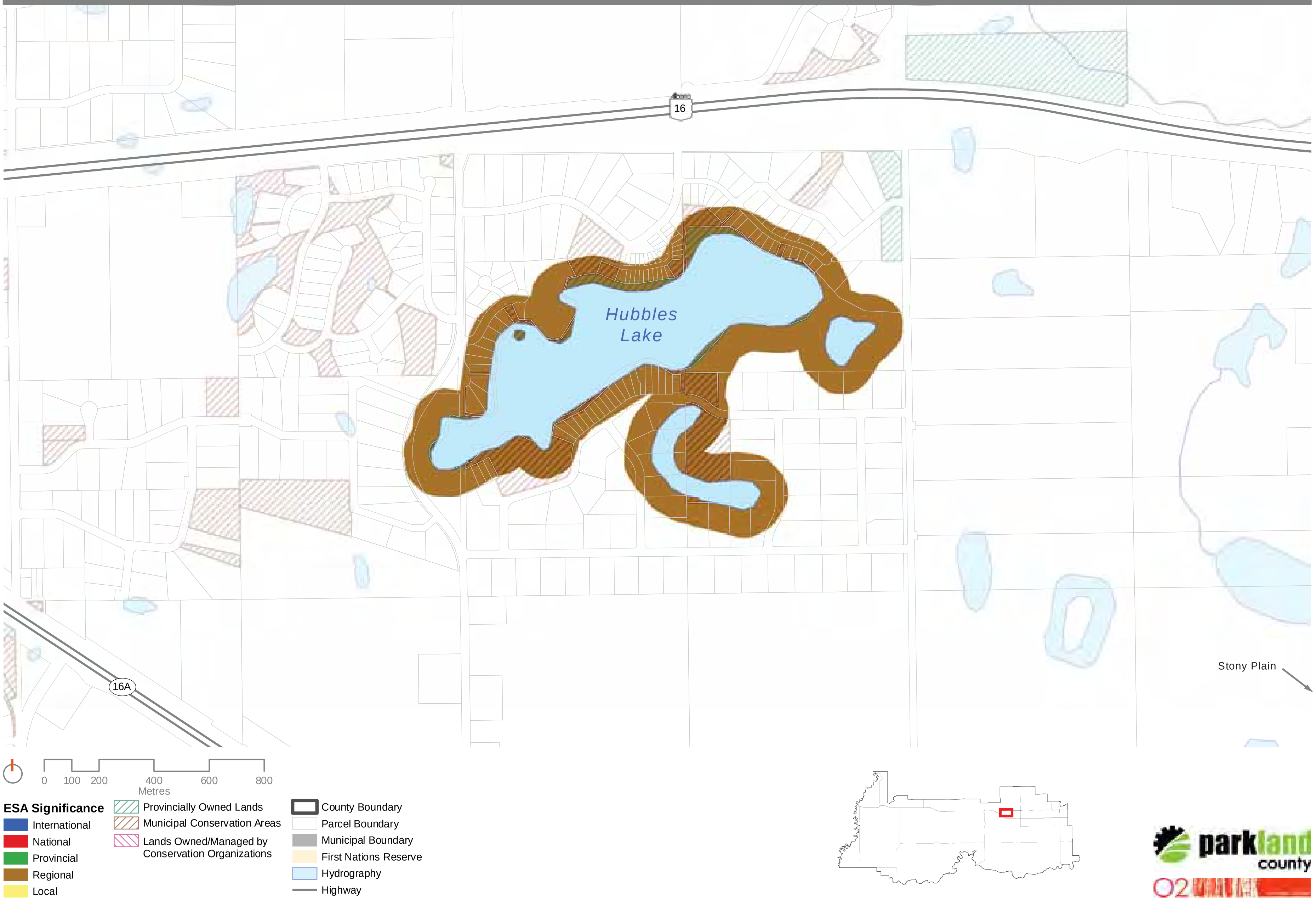
Due to the size and shape of the lake, it rarely mixes (turns over), resulting in unusual water quality characteristics and few algae. Hubbles Lake has been identified as mesotrophic, and the water tends to be very clear with Secchi depths of 5 m in mid-summer.

Although the lake supports a local sport fishery, it frequently winterkills, however; Northern pike and yellow perch are present. The clear water and depth make Hubbles Lake a popular destination for scuba divers. In an attempt to improve or create fish habitat, 2,000 old tires were chained together and sunk in the lake in 1967. The success of this venture has not yet been evaluated.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.



HUBBLES LAKE ESA



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Hubbles Lake ESA

Environmental Sensitivity: Very High

- Long residence time of water and low oxygen levels make the lake and associated groundwater highly sensitive

Land Status:

- The majority of the land surrounding the lake is privately owned
- The County owns a small piece of land at the southwest corner of the lake

Key features:

- This ESA represents a unique landscape feature containing a deep, spring-fed kettle lake

Recommended Planning Strategies:

- Much of the drainage basin has been cleared for agriculture and contains residential acreages. The areas adjacent to the shoreline have been developed for permanent residences and recreational resorts. Agricultural runoff and contaminant input from adjacent resorts/residences could eventually deteriorate the water in the lake, since the residence time for water is estimated to be about 100 years. For these reasons, further land clearing and residential development should be restricted in the area.
- Cabin owners need to follow good shoreline protection practices by maintaining a dense vegetated buffer around the lake
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect water bodies
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance
- 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*
- Undertake completion of a State of the Watershed Report and Lake Management Plan for Hubbles Lake


Isle Lake ESA

Isle Lake ESA

This ESA suffers from severe blue-green algal blooms and winter fish kill. "Land use is both the problem and solution".

-Dr. Michael Sullivan
Alberta Fish and Wildlife

Site Location: Isle Lake is located approximately 45 km west of Stony Plain, north of Highway 16. Parkland County shares this lake with Lac. St. Anne County.

Area: 2,644 ha

Description:

The Isle Lake ESA includes the lake and adjacent habitat flanking the southwest edge of the lake, as well as a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. Isle Lake is a narrow water body that is part of the Sturgeon River drainage system within the North Saskatchewan River Basin. The Sturgeon River headwaters drain a large portion of the area west of the lake. Isle Lake is approximately 2,300 ha with a volume of 95 million m^3. With a relatively shallow mean depth of 4.1 m, Isle Lake is particularly vulnerabie to contamination. A detailed description of the regional hydrology and water quality issues affecting Isle Lake can be found in the following pages of this fact sheet.

The area around Isle Lake exhibits undulating topography (knob and kettle terrain) and diverse vegetation communities. Upland forests are predominantly aspen and balsam poplar, with pockets of white spruce. There are wetlands near the lakeshore, and peatlands and shrubby swamps interspersed throughout the upland areas. In particular, there is a graminoid fen located near the inlet of the Sturgeon River. This diversity of habitats is important for ungulates, furbearers, songbirds, and raptors. The lake supports two colonies of western grebes and a large population of eared grebes. Isle Lake is an important staging and breeding area for waterfowl (i.e., bufflehead, goldeneye, lesser scaup, mallards), and other waterbirds like the Great Blue Heron. Osprey and bald eagle nests have been observed in the surrounding area. The characteristics of Isle Lake make it highly suitable for warmwater sportfish production, however the lake commonly experiences algal blooms and low oxygen levels sometimes cause fish kills (see *Nutrient Loading and Blue-green Algae* on the following pages).

The County maintains the Gainford Park Day Use Area and the Kokomoko Recreation Area. Cottage developments are prevalent in areas where stands of aspen/balsam poplar forest remain. The northwestern shore has mainly been cleared for agriculture, as well as large areas one mile south of the lake. Several exisitng and proposed large scale recreation and recreational vehicle areas in Parkland and Lac Ste. Anne County occupy areas adjecent to the Lake.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

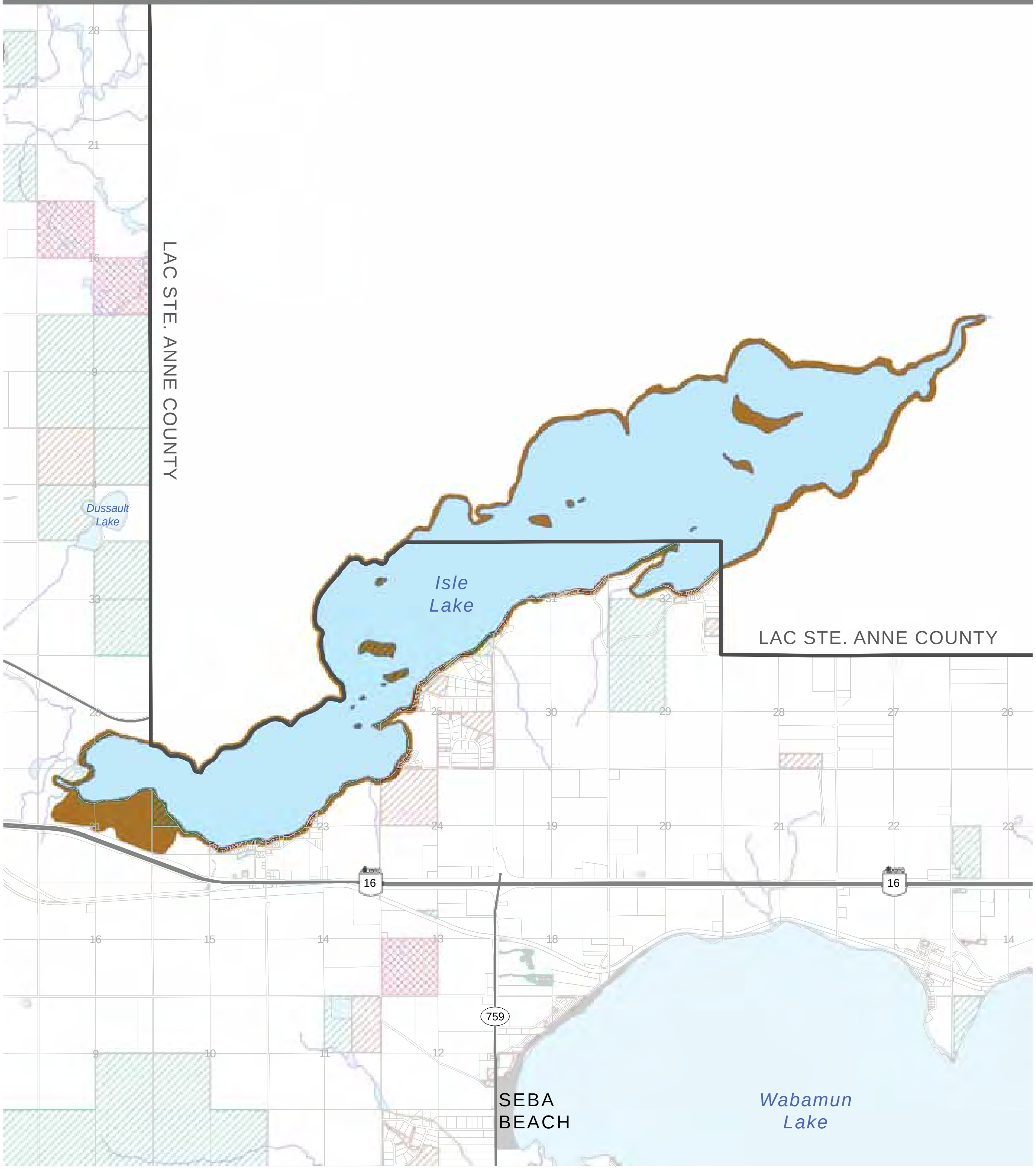
ISLE LAKE ESA

SIGNIFICANCE: Regional

Production and staging area for waterfowl and shorebirds

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas

ISLE LAKE ESA



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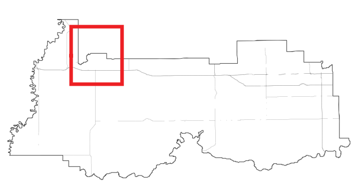
ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Isle Lake ESA

Regional Hydrology and Water Quality

As part of the Sturgeon River drainage system, Isle Lake receives inflow from six intermittent tributaries that discharge primarily in the spring or following precipitation events, and receives waters from an area of approximately 24,600 ha. Despite this high contributing area, groundwater provides an important contribution to the lake volume due to the unique geology underlying the area (Mitchell and Prepas, 1990).

Isle Lake is situated on top of a buried glacial valley, or thalweg, known as the Onoway Channel. The thalweg consists of permeable sand and gravel, making the area highly vulnerable to sub-surface groundwater contamination which can affect local aquifers and surface water bodies, such as Isle Lake. The Onoway Channel is inter-connected with Wabamun Lake by way of a glacial meltwater channel that underlies both the southern portion of Isle Lake, and the entirety of Wabamun Lake. HCL (1995) has assessed the southern shores of Isel Lake as having high potential for groundwater contamination.

The potential for groundwater contamination on the southern shores of Isle Lake has been assessed as high (HCL, 1998). Water enters Isle Lake from the Sturgeon River at the southwest. The mean residence time is approximately 9.5 years. Water from Isle Lake then flows back into the Sturgeon River from the northeast corner. From there, it travels northeast toward Lac. Ste. Anne. Therefore, water from Isle Lake has direct impacts on the receiving water quality of Lac. Ste. Anne. Given the interconnected nature of the underlying and surficial hydrology, the cumulative impacts of increasing residential and recreational development on Isle Lake can have cascading impacts on the entire regional ecosystem.

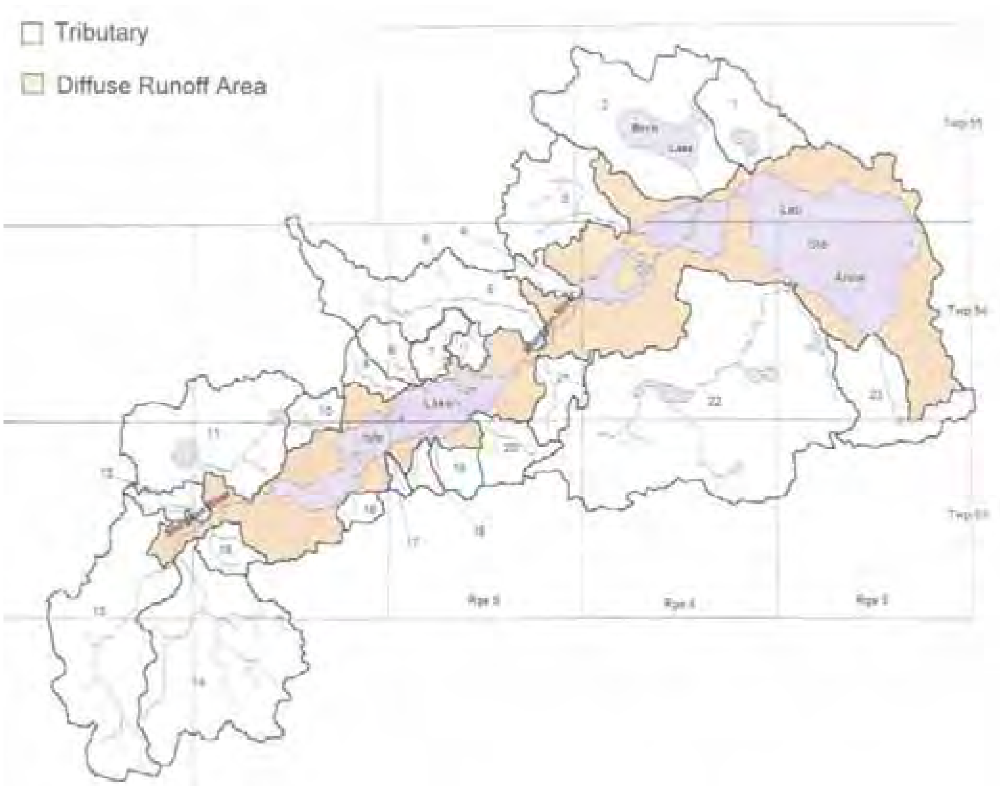

Figure 11. Isle Lake - Lac Ste Anne Basin (source: Mitchell, 1999)

Isle Lake ESA

Winter fish kill on Isle Lake
(photo credit: Bruce Edwards, Edmonton Journal)

Nutrient Loading and Blue-green Algae

Isle Lake, and many other shallow lakes in Alberta, are naturally high in nutrients. Even before Europeans settled the area, Isle Lake naturally supported blue-green algae blooms (otherwise known as cyanobacteria). However, recent nutrient concentrations (TP 165.4 mg/L) indicate that the lake has become hypereutrophic (AENV, 2014). Anthropogenic eutrophication from land use has made Isle Lake particularly susceptible to more frequent toxic blue-green algae blooms over the past several decades (Mitchell and Prepas, 1990).

The cumulative impacts of increasing residential and recreational development, and to a lesser extent agricultural and livestock activities, plus the removal of natural vegetation along shorelines have contributed to high nutrient loading and water quality degradation on Isle Lake. Excess nutrients fertilize the growth of algae blooms, which decompose and deplete dissolved oxygen levels in the lake. Low oxygen levels typically occur in the winter when the lake is covered with ice and cause fish to suffocate, resulting in massive fish-kills which have drastically reduced the overall fish population and species diversity in the lake over the past decade (Edmonton Journal, 2014). Low oxygen levels also result in unpleasant odours, thereby reducing the recreational appeal of the Lake.

Blue-green algae can also produce liver or nerve toxins that are dangerous to humans and animals who drink or swim in the water. The most common group of toxins produced and released by blue-green algae are called microcystins. These liver toxins can cause nausea, stomach cramps, vomiting, diarrhea, fever, headache, pains in muscles and joints, weakness and liver damage (AHS, 2012). Lakes with algal blooms are tested regularly for toxins and advisories are posted through AHS if the algae are found to be harmful to human health (AHS, 2012). For two consecutive years, AHS has posted a blue-green algae advisory for Isle Lake, which resulted in a new permanent sign with information about blue-green algae in 2013. If such an advisory is posted, it is critical that people, domestic animals, and livestock avoid exposure to lake waters.

Excess nutrients contributing to blue-green algae blooms also come from internal loading (amount of phosphorus released annually by lake bottom sediments). There is evidence in Alberta lakes that there is a correlation between internal phosphorus loading and the external phosphorus supply (Mitchell and Prepas, 1990). The internal supply is governed in part by the external supply from past years. It stands to reason then, that if the external supply can be reduced, internal loading would eventually decline. As the internal supply declines, the amount of algae produced declines, which in turn enhances the amount of oxygen at the bottom of the lake and depresses internal loading (Mitchell, 1999).

Isle Lake ESA

Land use, therefore, is ultimately both the problem and the solution. The phenomenon has been ongoing for decades, dating back to the 1920s. However, the problem has worsened over the last 15 years as residential and recreational development has intensified and agriculture has become more industrialized (ABMI, 2014). "Land use in the Isle Lake watershed (image source: ABMI, 2014)" illustrates the land use make-up within the 273 square kilometre watershed draining into Isle Lake. The majority of this region has been converted to rural residential areas and agriculture, with 52% of the land base currently covered by some form of human footprint (ABMI, 2014).

The phosphorous levels in the lake (both internal and external supplies) will continue to have a significant impact on lake water quality and human health unless serious consideration is given to beneficial management practices for recreational/residential and agricultural land uses. For example, more wetlands and riparian vegetation are needed to filter runoff entering the Lake, and education and enforcement are needed to increase public awareness of the relationship between individual actions and cumulative effects. In additon, efforts should be made to determine the sources and amounts of nutrients entering the Lake via inflow streams that drain from the watershed. Internal nutrient supply from lake bottom sediments should also be estimated in conjunction with determining a measured nutrient budget and annual loading limits for the Lake. These measures can be determined using emerging water quality modelling techniques (Trew, personal communication, 2014).

Please refer to the management considerations for this ESA, as well as the Benefical Management Practices specific to Lakeshore and Lakefront development (chapter 4 of this report) for more information on potential solutions.

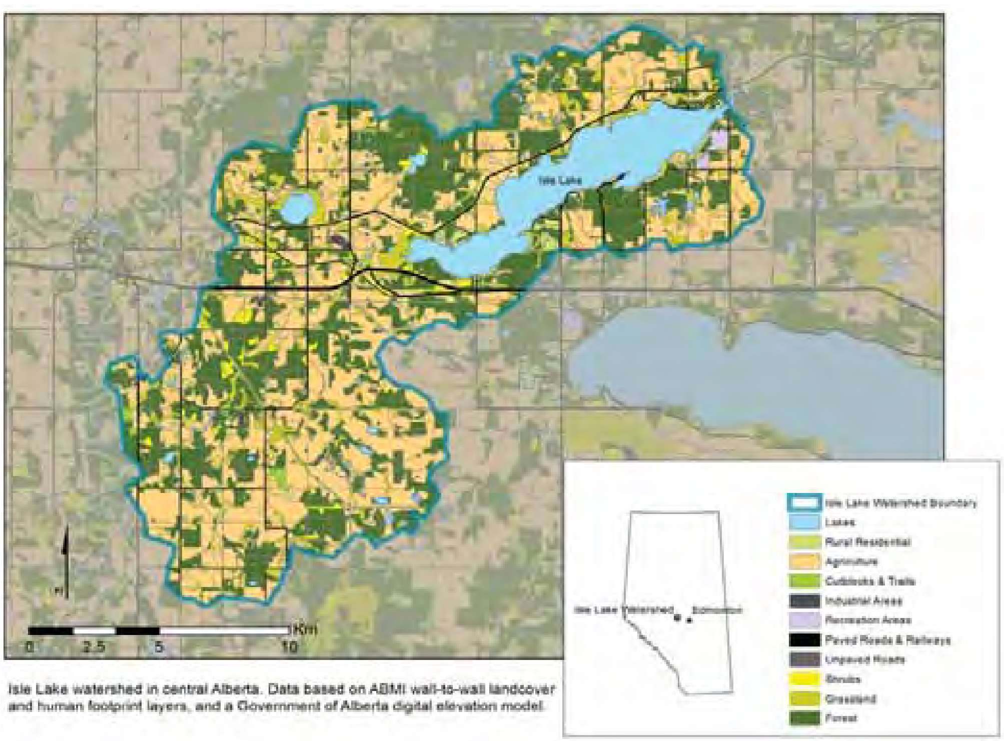

Figure 12. Land use in the Isle Lake watershed (image source: ABMI, 2014)

Isle Lake ESA

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

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 occurences

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 fitration of nutrient laden runoff from nearby source areas
- Protect the fen near the Isle Lake inlet from further disturbance
- Consider a hypolimnetic aeration system to optimize withdrawl of nutrient-rich water from lake bottom

Isle Lake ESA

- 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 it's 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).


Jackfish Lake/Star Lake Complex ESA

Jackfish Lake/Star Lake Complex ESA

Site Location: This ESA is a complex of lakes situated east of the Wabamun Indian Reserve and can be accessed south of Highway 16 off of Highway 770.

Area: 868.32 ha

Description:

The Jackfish/Star Lake Complex ESA is comprised of several small lakes and wetlands, as well as connecting habitat areas and a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1]. Some water bodies are surrounded by natural stands of aspen, poplar, and small pockets of spruce. Agriculture is the dominant surrounding land use.

Jackfish Lake: This 239 ha lake is situated in a depression typical of pitted delta and has an irregular shoreline with islands throughout. The water level is regulated by a fixed-crest weir, but on average has an 8.2 million m^3 capacity with a mean depth of 3.4 m. The contributing drainage basin is about 1,260 ha; however, groundwater inputs are still very important. Water quality analyses have determined that this lake is in good mesotrophic condition, but macrophyte growth still tends to be a concern. Residents have noted the uniquely high water quality of the lake complex. Protecting area water quality is of utmost concern to residents.

Small hills and hillocks occur near the lake, and several small intermittent lakes are found on the east and west sides. The south and west sides of the lake are partially forested and diverse wetlands are present at the southwest end. The lake is a staging/breeding area for waterfowl, and uplands are good for hiking and wildlife viewing (ungulates, songbirds). Islands within the lakes are noted to be significant habitat areas for geese and other bird species. A great blue heron colony occupies one of these islands in the northern portion of Jackfish Lake.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

JACKFISH LAKE / STAR LAKE COMPLEX ESA

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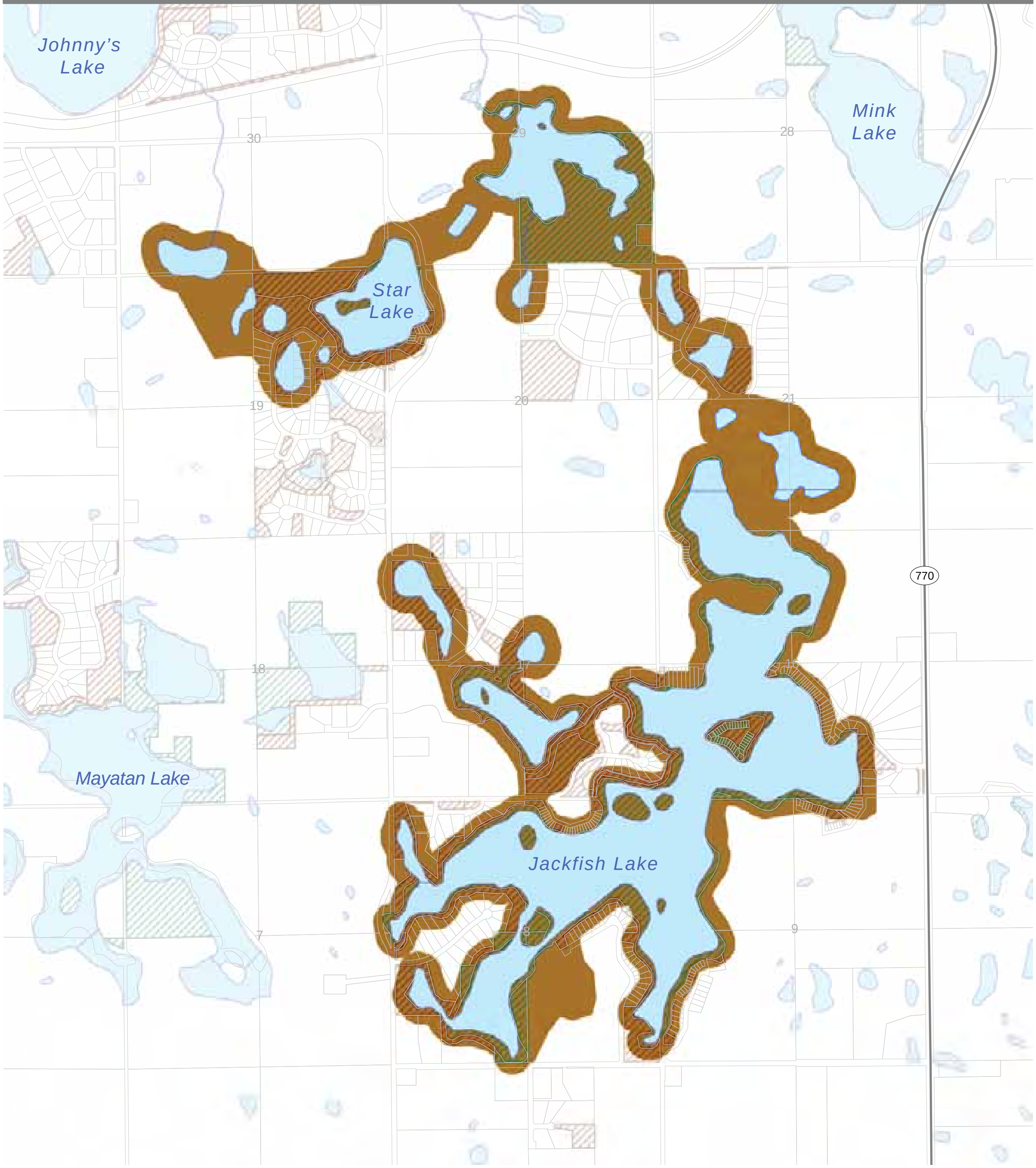

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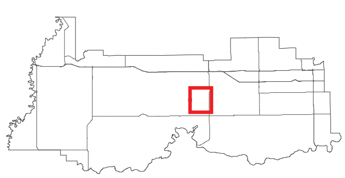
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Jackfish Lake/Star Lake Complex ESA

Many permanent residences and some cabins occur near the lake edge and on the island, but this lake is largely undeveloped compared to other lakes in the area. An area structure plan was presented to County council in November 2001 to ensure the sustainability of environmental and recreational resources around Jackfish Lake. The plan was amended and passed in April 2002 (Parkland County, 2013). The previous walleye fishery has collapsed in recent years.

Significant concerns facing the lake include continued pressures from residential and recreational development on the ESA, as well as increasing motorized boat use on the lake. Residential development and recreation pressures stress the lake environment, having the potential to significantly compromise the ecological integrity and hydrological function of the area if carrying capacities are exceeded.

Star Lake: Star Lake is approximately 15 ha and is a popular fishing spot for anglers. The lake is stocked with rainbow trout but there are burbot, whitefish pike and yellow perch that occur naturally. County supported facilities for fishermen are at the east end of the lake, with access off Township Road 524 and Range Road 25. The southwest side of the drainage basin has rural residential development, and the remainder of the area is a mosaic of agriculture and patches of upland forest.

Unnamed Wetlands: Part of this ESA complex is comprised of a variety of wetlands. Heavily forested, undulating topography limits development around these wetlands. Upland forests are mainly comprised of aspen and white spruce.

Environmental Sensitivity: High

- Due to high groundwater sensitivity
- Due to high surface water quality
- Due to the unique shape of the lake making it susceptible to water quality degradation

Land Status:

- The parcels around the lakes are mostly privately owned, with some parcels owned by Parkland County

Key features:

- The lake provides habitat and nesting for sensitive waterfowl species
- It is an important drainage area in the Sturgeon River system
- The lake complex has exceptionally high surface and groundwater quality

Jackfish Lake/Star Lake Complex ESA

Recommended Planning Strategies:

- Development applications within the ASP boundary should include a detailed biophysical inventory and environmental assessment
- Limit and enforce OHV (Off Highway Vehicle) use in and around the ESA in order to minimize erosion and sediment loading into the lake
- The Jackfish Lake ASP limits the boat launch facility to 23 parking stalls, overall limiting boat launch and use on the lake. Parkland County will continue to enforce the use of the boat launch area.
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect creeks and water bodies
- Fisheries restrictions are in place for Jackfish Lake through Fish and Wildlife division of AESRD; all walleye must be released and any northern pike / jackfish under 63 cm must be released to sustain the lake's breeding population
- The County-owned parking lot for the day-use area may be an excellent location for a Low Impact Development stormwater management initiative to filter runoff eminating from the parking lot. This effort would improve water quality while setting an example for good watershed stewardship for the community and visitors
- Limits to future subdivision development adjacent to the lakes should be considered to minimize impacts to surface and groundwater resources
- Boat speed limits fall under the purview of Transport Canada with the Federal Government responsible for enforcement.
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- Reduce pollution impacts from private sewage / wastewater systems through enforcement
- Prohibit clearing and sand dumping of riparian and shoreline areas in all lake ESA
- 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.
- Continue to enforce all policies in the Jackfish Lake Area Structure Plan

Jackfish Lake/Star Lake Complex ESA

- Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the lakes. Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.
- Undertake completion of a State of the Watershed Report and Lake Management Plan for Jackfish Lake

Johnny's Lake/Mink Lake Complex ESA

Johnny's Lake/Mink Lake Complex ESA

Site Location: A complex of water bodies situated just east of the Wabamun Indian Reserve and Wabamun Lake; can be accessed south of Highway 16 on Highway 770 and from Range Road 25/Township Road 524a.

Area: 469 ha

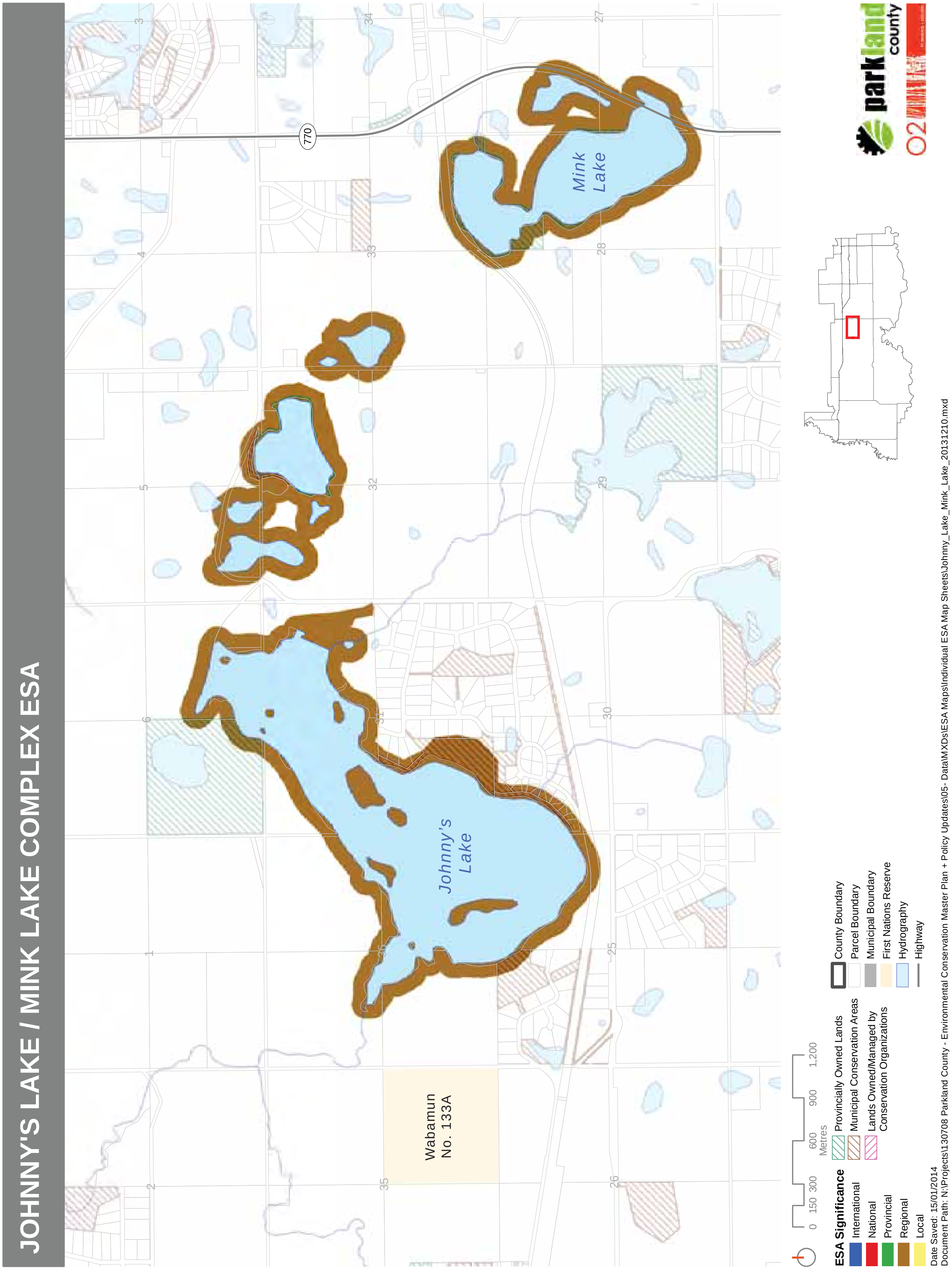
Description:

The Johnny's Lake/Mink Lake Complex ESA is comprised of the two lakes plus a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1]. This pair of lakes and associated wetlands is surrounded by natural stands of aspen, poplar, and small pockets of spruce. Agriculture is the dominant land use in the contributing areas. Several intermittent lakes are found in the south and northeast.

Johnny's Lake: This 207 ha lake is situated within a wide, flat glacial meltwater channel. Topography surrounding the lake is undulating to gently rolling, with a mosaic of wetlands and peatlands that make it unsuitable for residential development. Northern pike occasionally enter the lake from Mink Creek. However, the lake is subject to winterkill due to shallow water depths and is not suitable for stocking. The south and east side of the lake has subdivision developments of permanent residences.

Mink Lake: Mink Lake (approximately 50 ha) does not exhibit outflow or inflow drainages, and several small surrounding water bodies (sloughs) may become connected during high precipitation periods. Main surrounding land use is agriculture (cereal crops); although a commercial campground and associated facilities are situated on the south side of the lake. The area is heavily impacted with little surrounding natural habitat, although a wetland northeast of the lake is still intact. Northern pike and yellow perch are the only two sport fish species present, along with brook stickleback and Iowa darter.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.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ESA Significance
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Municipal Conservation Areas
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parkland county
O2

Johnny's Lake/Mink Lake Complex ESA

Environmental Sensitivity: High

- Due to moderately high groundwater sensitivity and lakeshore environments

Land Status:

- The parcels around the lakes are mostly privately owned, with some parcels owned by Parkland County

Key features:

- Water body complex of lakes and associated wetlands
- Important waterfowl habitat

Recommended Planning Strategies:

- Lands surrounding these lakes and wetlands have been extensively modified by agricultural development. Measures aimed at preserving remaining shoreline habitat and controlling agricultural runoff (e.g., vegetated buffers) would help to maintain ecological functions and recreational values.
- Limits to future subdivision development adjacent to the lakes should be considered to minimize impacts to surface and groundwater resources
- Boat speed limits fall under the purview of Transport Canada with the Federal Government responsible for enforcement.
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the lakes. Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.


Mayatan Lake Complex ESA

Mayatan Lake Complex ESA

Site Location: Approximately 68 km west of Edmonton and 3 km east of Wabamun Reserve No. 133

Area: 768 ha

Description:

The Mayatan Lake Complex ESA is comprised of Mayatan Lake, several surrounding smaller lakes and wetlands including lacustrine fringe wetlands, and the surrounding forested uplands. The ESA boundary also includes a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1].

Located within the Carvel Pitted Delta, the Mayatan Lake Complex ESA is characterized by hummocky terrain with kettle lakes and wetlands occupying low-lying areas. The area is relatively undeveloped and has a fairly intact riparian area, which is uncommon in Parkland County. Owing to its relative intactness, the lake complex displays moderately high connectivity and landscape ecology values illustrating its importance as part of a corridor and stepping stone for wildlife movement across the County. A collection of smaller lakes and wetlands function as important stepping stones, supporting the flow of ecological processes and elements across the landscape. Many of these features fall within the Mayatan Lake watershed outside of the ESA boundary. These features, while outside of the designated ESA boundary, play a key role in upholding the ecological integrity of the ESA at larger landscape scales.

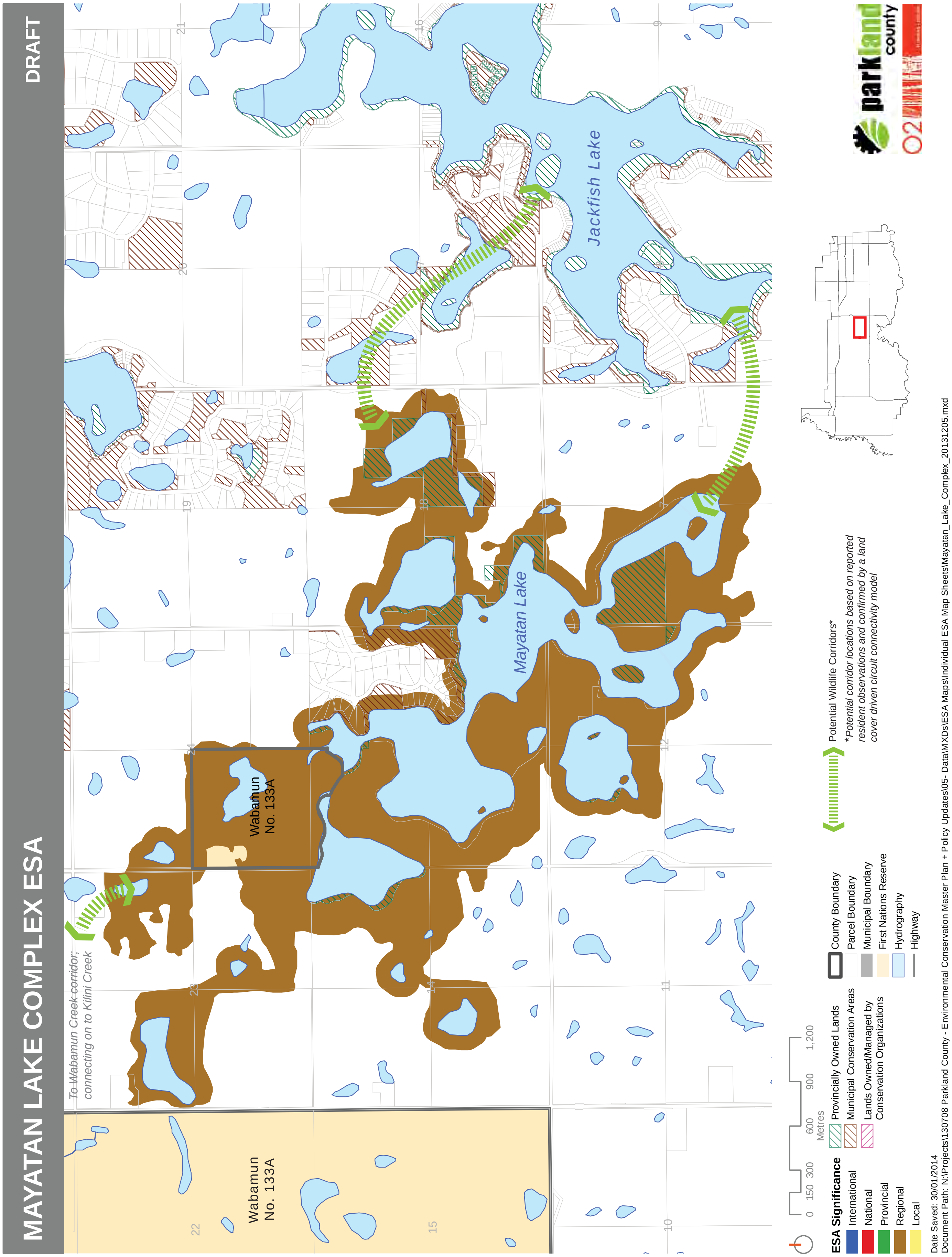
Mayatan Lake has a combined surface area of about 138 ha (1.38 km^2), and contains an eastern and western basin joined by a narrow channel. The western basin measures 27 metres deep. The depth of this basin is unusual among lakes in Parkland County, and contributes to the overall high water quality that characterizes the lake. In contrast, the eastern basin measures only 6.1 metres deep, and is therefore more sensitive to contaminants, temperature fluctuations, and nutrient loading. The lake has no outlet and falls in a non-contributing area[2] of the North Saskatchewan watershed. Water quality testing has been conducted over the past 3 years, as of the writing of this document. Testing indicates that Mayatan Lake is in relatively good condition, with nutrients and algae within the mesotrophic range (NSWA, 2012).The Lake is currently being studied by paleolimnologists to evaluate historical changes in water quality and chemistry in the lake over the past 150 years. As such, Mayatan Lake represents an important site for on-going ecological research and monitoring in the County.

The upland forests surrounding Mayatan Lake are dominated by trembling aspen, balsam poplar, white spruce, and several other species characteristic of the Dry Mixedwood Natural Subregion of the province. Emergent macrophytes in Mayatan Lake include greater bulrush, arrowhead, stonewort, northern watermilfoil, large-sheath pondweed and sago pondweed (NSWA, 2012).

Residents reported sightings of bear, cougars, osprey, great horned owl, and sora rail, as well as trumpeter swans using the lake. Great Blue Heron, common loon, hummingbird, ruffed grouse, evening grosbeaks, bald eagles, swans, and white pelicans have also been observed on and around the lake (NSWA, 2012). Fish species found within the lake include northern pike/jackfish, brook stickleback, and perch. In 2011, horsehair worms were found during the LakeWatch sampling program.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

2 Non-contributing areas do not contribute surface flow to creeks and streams for a median (1:2) annual runoff, but can become contributing areas by fill and spill processes during extremely wet periods


MAYATAN LAKE COMPLEX ESA
DRAFT
Jackfish Lake
Mayatan Lake
Wabamun No. 133A
Wabamun No. 133A
To Wabamun Creek corridor; connecting on to Kilini Creek
0 150 300 600 900 1,200
Metres
ESA Significance
International
National
Provincial
Regional
Local
Provincially Owned Lands
Municipal Conservation Areas
Lands Owned/Managed by Conservation Organizations
County Boundary
Parcel Boundary
Municipal Boundary
First Nations Reserve
Hydrography
Highway
Potential Wildlife Corridors*
*Potential corridor locations based on reported resident observations and confirmed by a land cover driven circuit connectivity model
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Mayatan Lake Complex ESA

Environmental Sensitivity: High

- The ESA is located in a groundwater recharge area, and vulnerability of groundwater to contamination from the surface is considered moderate to high (HCL, 1998)
- Lakeshore environments and wetlands are sensitive to disturbance
- Intact natural character of the lake/forest habitat complex compared to other lakes in central Alberta

Land Status:

- Mostly private land. Some crown provincial lands along southeastern shores
- A quarter section (SW 24-52-3 W5M) of the ESA is part of the Wabamun First Nations Reserve

Key features:

- Lake/forest habitat complex retaining a natural character which is relatively rare in this part of Alberta
- Provides important ecological connectivity within the habitat complex and the surrounding region

Recommended Planning Strategies:

- Agricultural activities in the surrounding contributing watershed can generate excess nutrients and bacteria from manure, crop fertilizers and pesticides that, in turn, lead to degraded water quality. Reduce additional nutrient loading into the lake from surrounding land uses in the watershed to prevent water quality deterioration (NSWA, 2012)
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation that filters runoff before it reaches the lake
- Enhance naturalized shoreline management and septic maintenance in surrounding rural acreages
- AltaLink transmission line right of way from Wabamun Lake to Jackfish Lake crosses Mayatan Lake. The new 908L Transmission Line was completed in 2013.
- Oil and gas well activity in the surrounding contributing watershed are potential risks of contamination
- Any future possible developments around the lake would need to consider how land use impacts local water quality and groundwater. Efforts should be made to prevent contaminants originating from surrounding developments from reaching the lake.
- Boat speed limits fall under the purview of Transport Canada with the Federal Government responsible for enforcement.
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, environmental assessment studies) for proposed developments within a 100 metre lake ESA zone. 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 lakes. Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.
- Refer to the Mayatan Lake State of the Watershed Report (2011)
- Support the Mayatan Lake Management Association in their completion of the Mayatan Lake Management Plan

Wabamun Lake ESA

Wabamun Lake ESA

Site Location: Wabamun Lake is situated south of Highway 16, east of Highway 31, and west of Highway 770. There are multiple access points including the town of Wabamun, Seba Beach, and Wabamun Lake Provincial Park.

Area: 8,905 ha

Description:

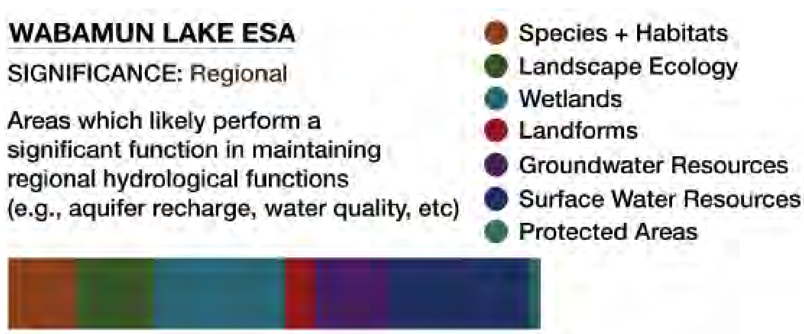
The Wabamun Lake ESA is comprised of the lake, several surrounding wetlands associated with the lake, and a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1]. Wabamun Lake, listed as White Lake on Palliser's map of 1865, is a large shallow lake, with a surface area of about 8,200 ha and a capacity of 513 million m^3. Despite the large drainage basin, groundwater is also an important source of water. The lake is situated in a wide glacial meltwater channel with a catchment area of 25,900 ha. Its long fetch along the prevailing wind, along with shallow depths results in periodic heavy wave action. The average depth is 6.3 m, reaching 11 m at the deepest western end, and has a mean residence time of over 100 years. Outflows are periodic through Wabamun Creek in times of high water. Natural beaches are present along much of the shoreline, but emergent vegetation restricts their use. The littoral zone (<5 m depth) includes 31% of lake bottom. Sandy areas are found at depths less than 2 m with soft clay or organic sediments over most of the lake bottom.

The water quality is moderate to good, and has been determined to be mesotrophic to mildly eutrophic. The lake experiences periodic blue-green algae blooms and has low dissolved oxygen in the winter. Lower water quality has been measured in Moonlight Bay.

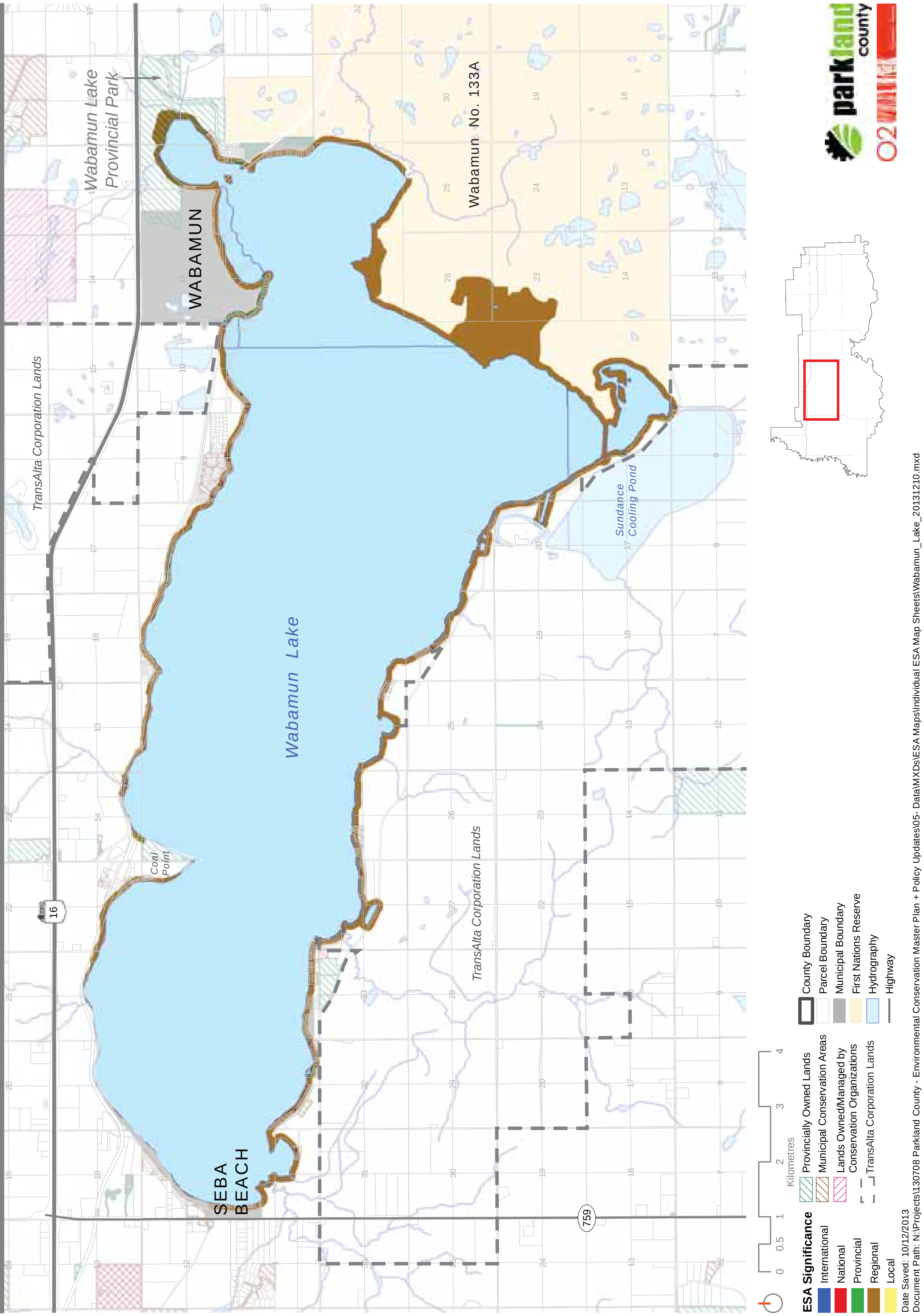
Main types of woody vegetation surrounding the lake include trembling aspen, balsam poplar, willow, white spruce, and paper birch. Wetlands containing sedges and cattails are also present along the lake fringe. Several gravel pit operations and coal mining also occurs near the lakeshore within the watershed. A combination of rolling moraine, parkland, mixedwood forest, bog and sandy pine areas adjacent to the lake supports many ungulates and birds. Bird species include common ravens, gray jays, great gray owls and barred owls, which are normally expected further to the north and west. Migrating, breeding and moulting water birds are common and include gulls, terns, rails, herons, loons, kingfishers, sandpipers, and even American white pelicans.

Large colonies of red-necked and western grebes nest on the lake and nesting of western grebes has also been observed west of the Village of Wabamun. The cooling ponds associated with the power plants at Wabamun, Sundance and Keephills provide year-round open water for hooded mergansers, bald eagles, and several thousand mallards. Ospreys nest on man-made structures (raptor platforms and power structures) in the area, and peregrine falcons nest at the three power plants. A significant number of Canadian toad records occur in the vicinity of Wabamun Lake, as do a selection of rare plant species. Common fish species found in Wabamun Lake are: lake whitefish, northern pike, yellow perch, white sucker, stickleback, spottail shiner, Iowa darter, and burbot. The lake is economically important for lake whitefish and northern pike fisheries.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.



WABAMUN LAKE ESA



Wabamun Lake ESA

Environmental Sensitivity: Moderate

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

Land Status:

- 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

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 set-backs 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.
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- 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

Brightbank ESA

Brightbank ESA

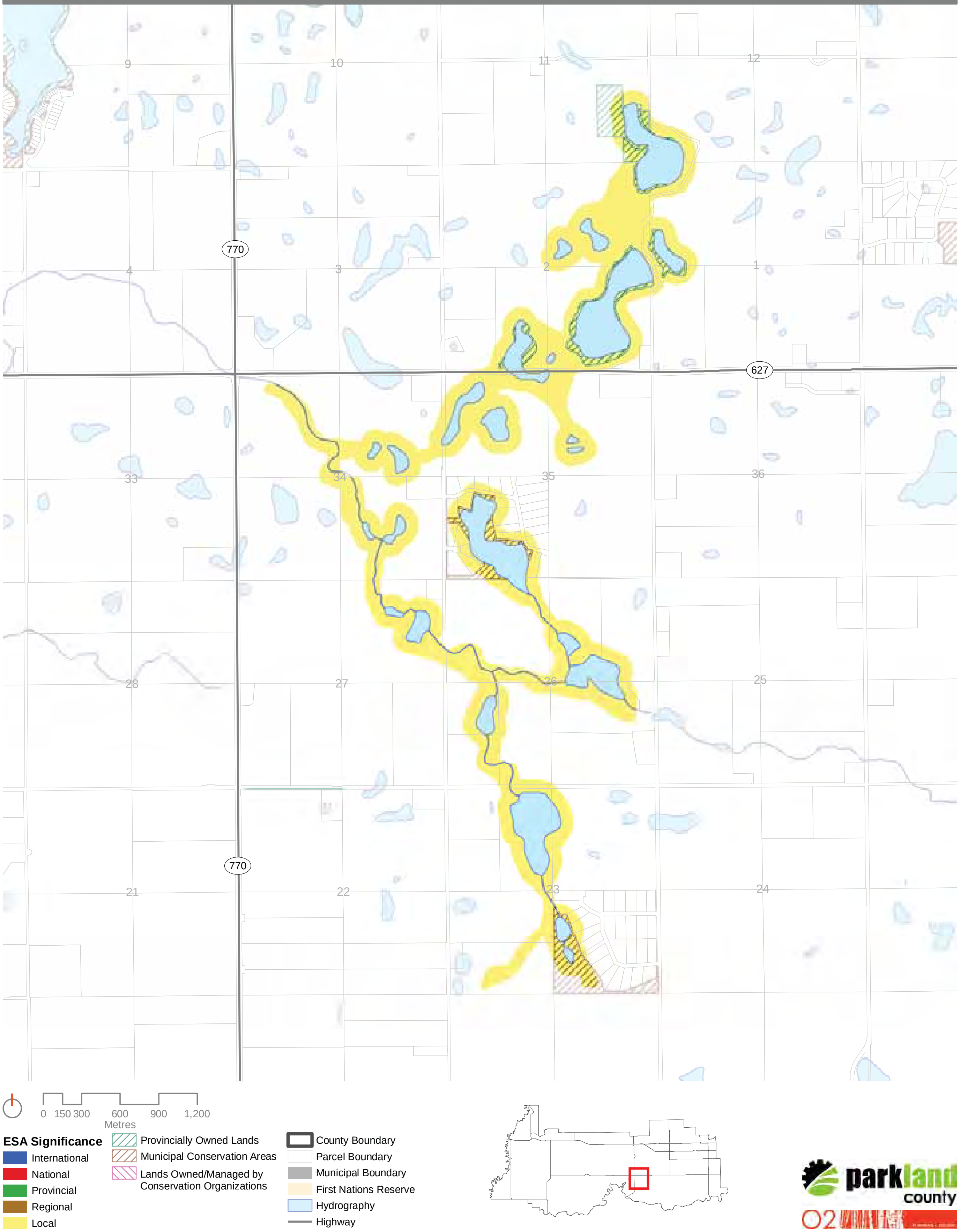
Site Location: Brightbank ESA is a chain of wetlands located east of Highway 770, crossing over Highway 627.

Area: 363 ha

Description:

Located near the community of Brightbank, the Brightbank ESA is a complex of Class 5 (permanent) wetlands and asociated open water zones. The surrounding landscape consists of aspen and white spruce forest interspersed with agricultural lands. As a complex of wetlands, the area as a whole functions as a patch complex, providing habitat connectivity across the broader landscape. The Brightbank wetlands also provide important habitat for ducks and other waterfowl, as well as a diversity of other wetland species.

BRIGHTBANK ESA



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Brightbank ESA

Environmental Sensitivity: High

- High susceptibility to groundwater contamination from surrounding land uses

Land Status:

- Private land

Key features:

- Contains several Class 5 (permanent) wetlands
- Provides connectivity among natural habitat patches
- Provides habitat for ducks and other wildlife

Recommended Planning Strategies:

- Maintain riparian buffers around all wetlands to safeguard water quality and enhance wildlife habitat

Brookside ESA

Brookside ESA

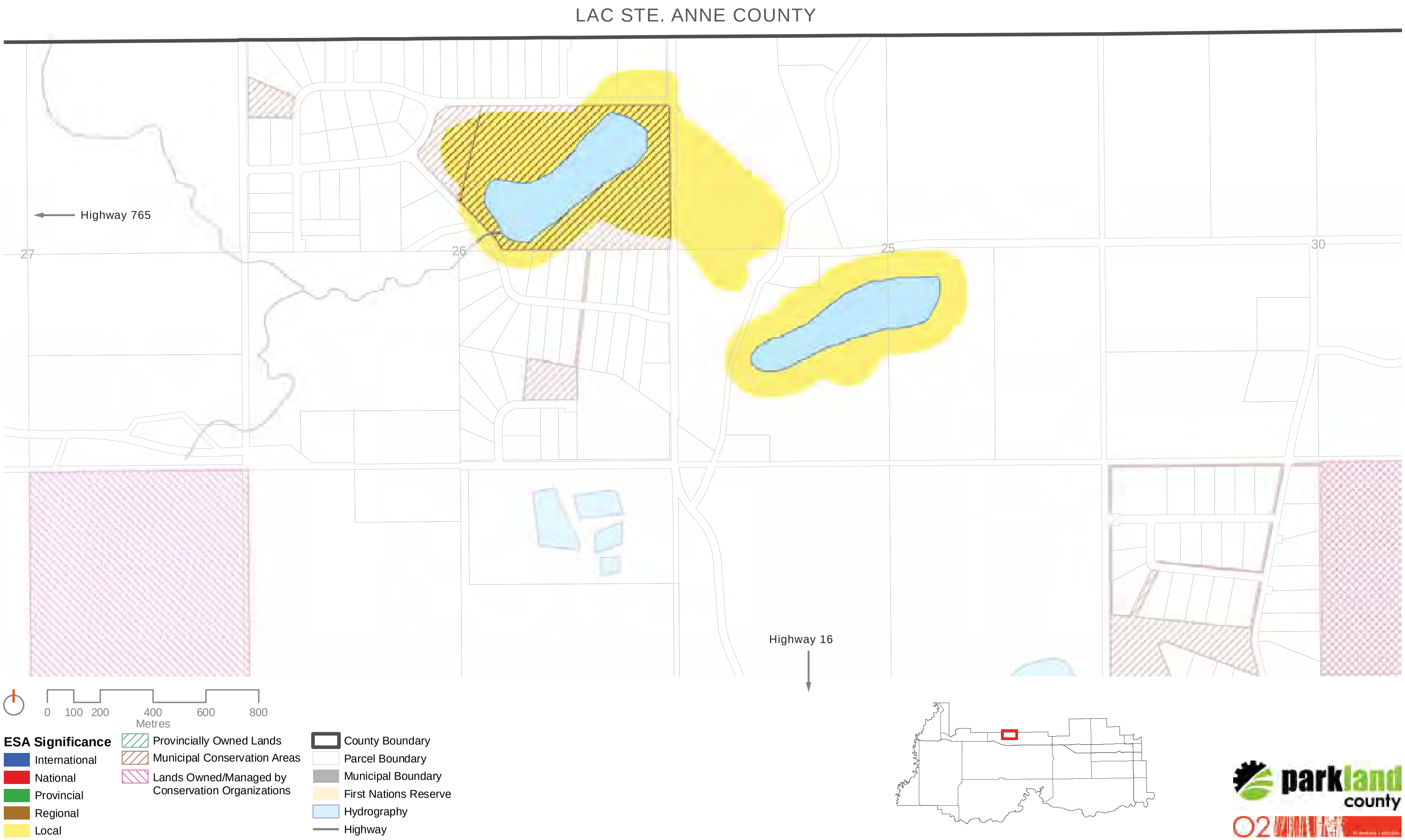
Site Location: Brookside ESA is located at the northern edge of the County north of the Village of Wabamun.

Area: 85 ha

Description:

The Brookside ESA is a large wetland located adjacent to the Brookside Estates subdivision. The wetland is part of a broad swath of relatively undisturbed forest habitat extending to the east and north of the subdivision. As such, the wetland and surrounding area provide important wildlife habitat and landscape connectivity, while also contributing to maintaining local water quality.

BROOKSIDE ESA



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Brookside ESA

Environmental Sensitivity: Low

- Some potential for groundwater contamination

Land Status:

- County land

Key features:

- Represents a large patch of relatively undisturbed forest
- Provides continuous habitat for wetland species and other wildlife

Recommended Planning Strategies:

- Maintain contiguous forest patch surrounding the wetland
- Continue to restrict encroachment from adjacent subdivision on wetland and surrounding riparian areas


Canada Geese ESA

Canada Geese ESA

Site Location: The Canada Geese ESA is located at the northern edge of the County, north of the Fallis slopes, and just west of Highway 765

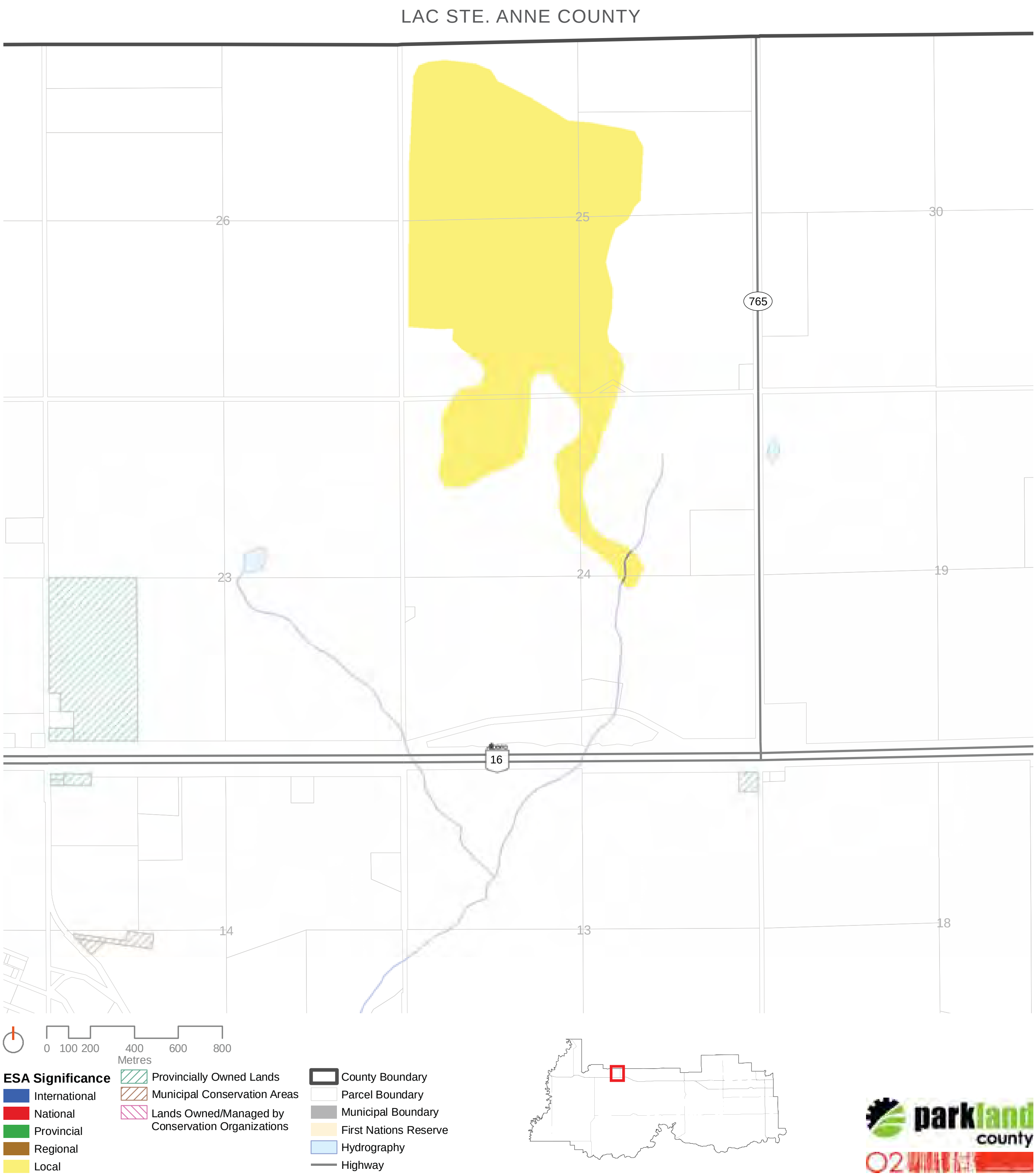
Area: 151 ha

Description:

Canada Geese ESA is a large wetland surrounded by relatively extensive forest habitat, making the wetland inaccessible in many areas. The ESA represents an important patch of natural habitat within the area.

Many Canada Geese were observed at the wetland, indicating the area's importance for birds and other wetland species.

CANADA GEESE ESA



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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


East Pit Lake ESA

East Pit Lake ESA

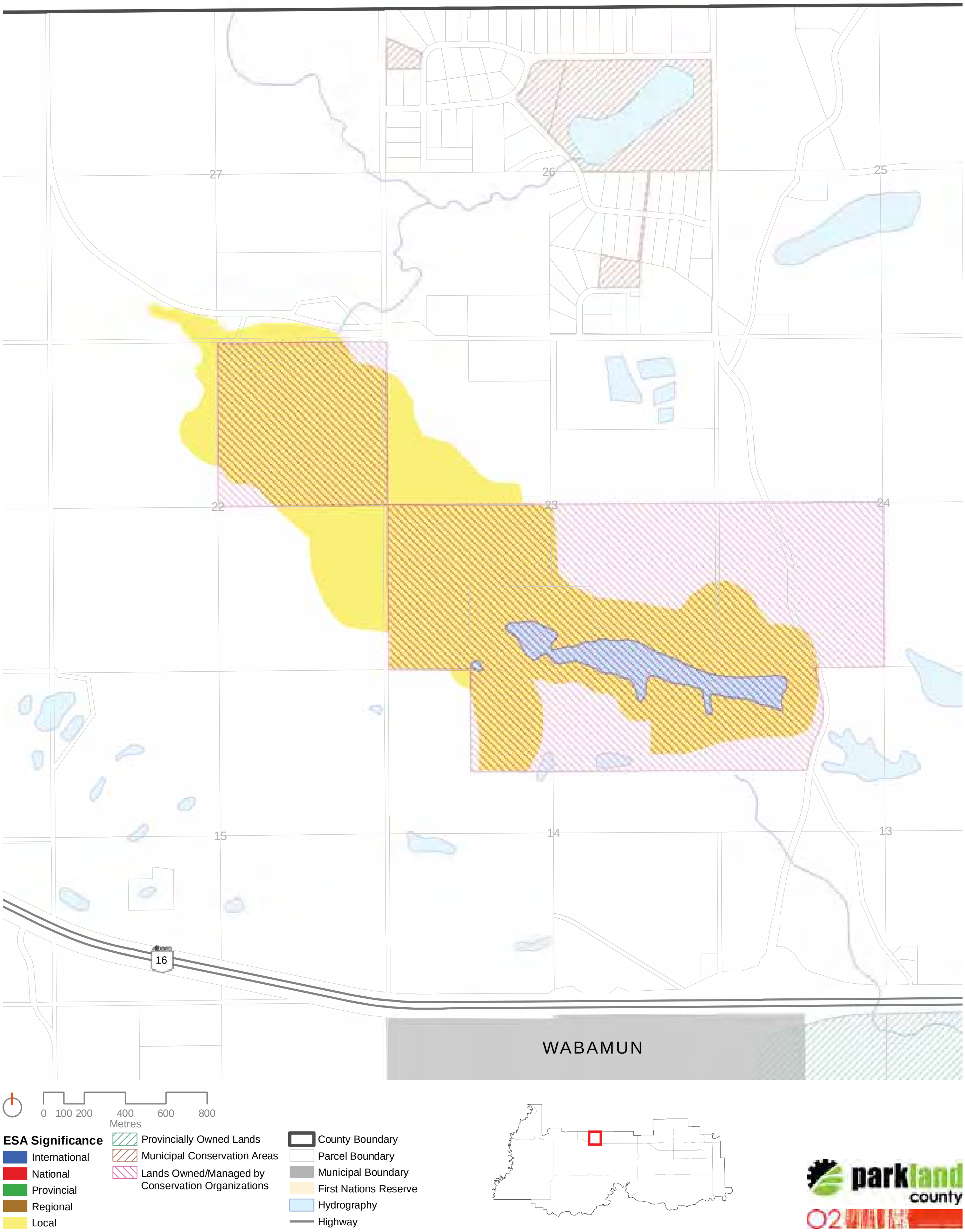
Site Location: Reclaimed mine land and adjacent habitat 1.6 km north of the Wabamun overpass on Highway 16, west of the Lac Ste. Anne Trail

Area: 279 ha

Description:

East Pit Lake is 1.2 km long and 0.2 km wide, and approximately 9 m deep. TransAlta reclaimed approximately 130 ha around the lake, which was a former open-pit coal mine. As is typical of pit lakes, the lake is quite deep and cold, and the shoreline is relatively steep with little emergent vegetation. The lake is stocked with trout and supports recreational fishing. Grasses and native species, including thousands of tree seedlings, were planted around the lake as part of the reclamation process to control erosion and re-establish locally common vegetation communities. Revegetation has continued through additional plantings in recent years. An abundance of wildlife including white-tailed deer, mule deer, moose, elk, ruffed grouse, ducks, geese, woodpeckers, and songbirds inhabit the reclaimed area. Public access is available for recreational activities such as fishing, nature observation, hiking, and cross-country skiing.

EAST PIT LAKE ESA



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East Pit Lake ESA

Environmental Sensitivity: High

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

Land Status:

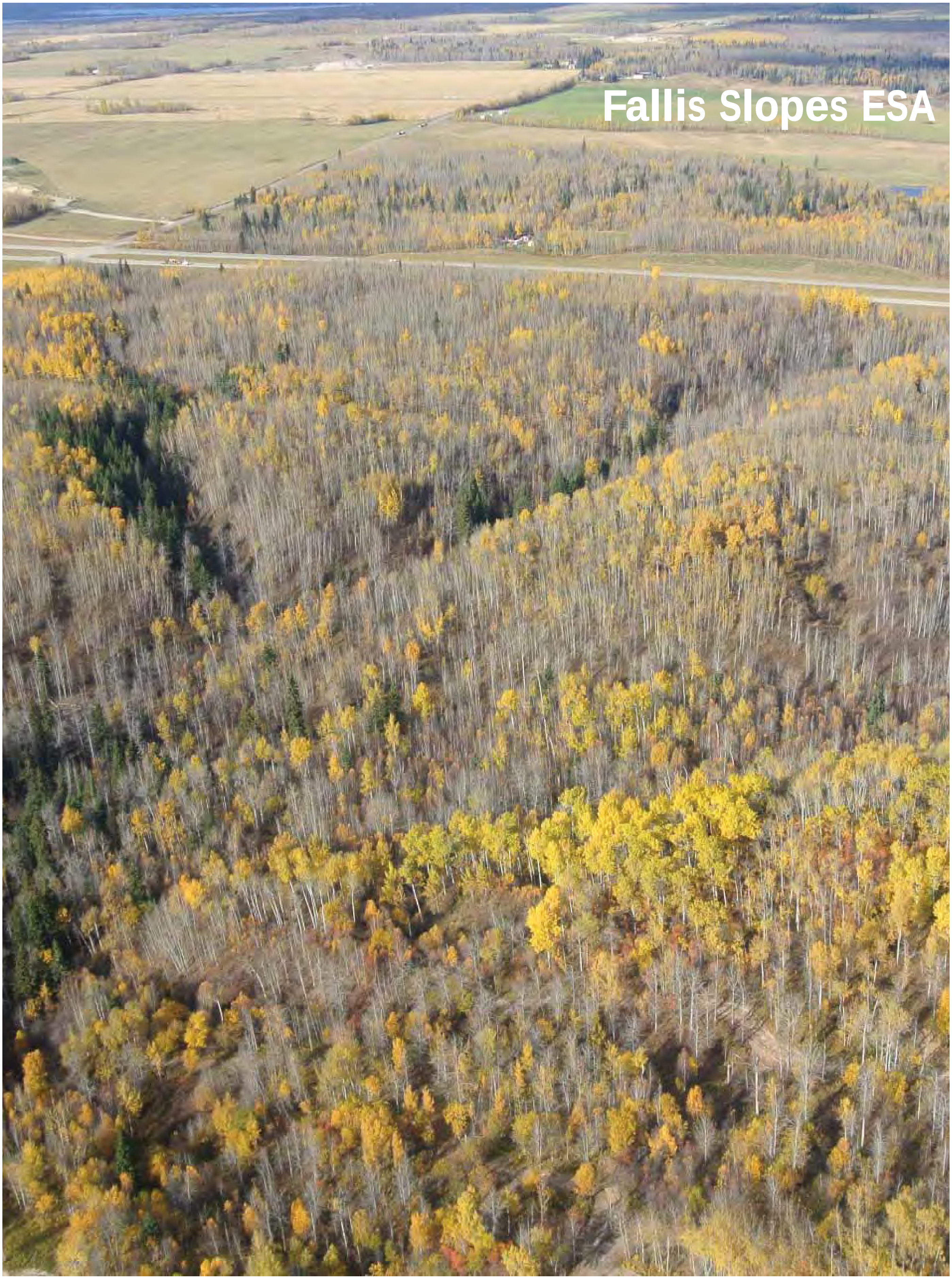
- This ESA is located on Crown Land parcels managed by the Alberta Fish and Game Association

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


Fallis Slopes ESA

Fallis Slopes ESA

Site Location:

North of Wabamun Lake, between the lake and Highway 1 / Yellowhead Highway

Area: 495 ha

Description:

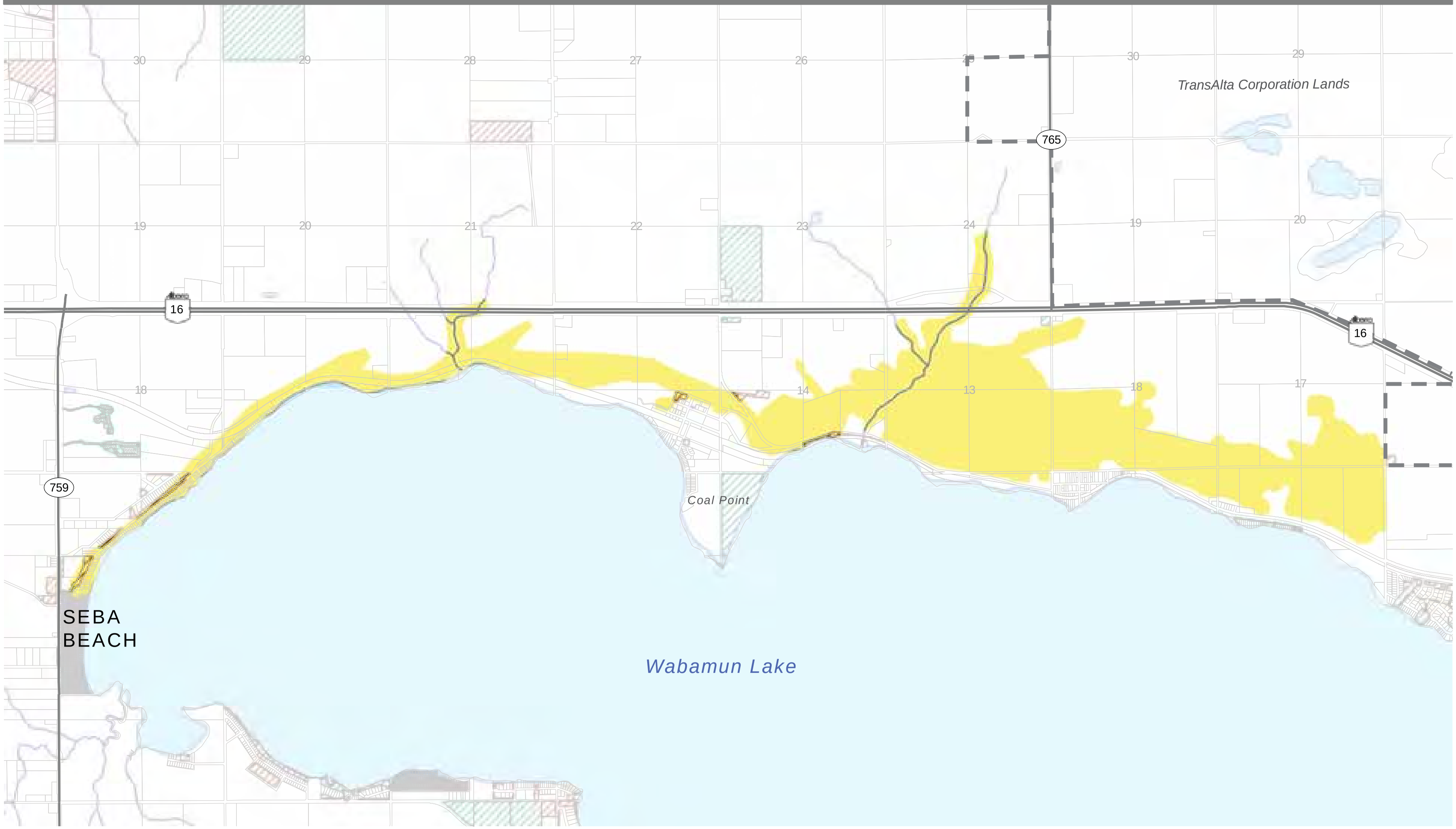
Steep (>15%) south-facing forested slopes occur throughout most of the area, with several steep slopes >20% present throughout. A large portion of the area is characterized by high potential for erosion.

The ESA is mostly forested and dominated by trembling aspen. Balsam poplar, paper birch, white spruce, and various shrubs and forbs occur as well. The area provides high ecological connectivity and wildlife habitat for a range of large mammals (deer, moose, black bear) and forest birds. Several intact forested riparian areas also occur throughout the ESA. High intact forest cover along the riparian areas and throughout the entire ESA helps protect the Wabamun Lake watershed.

In many parts of this ESA, high groundwater contamination risks are present due to the highly permeable surficial sediments.

Although few wetlands are found in the ESA, rare plant species have been observed in wetlands in the vicinity. Therefore, the small wetlands present within the ESA potentially provide rare plant habitat.

FALLIS SLOPES ESA



0 0.25 0.5 1 1.5 2
Kilometres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations
- TransAlta Corporation Lands

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway

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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


Gladu Lake Uplands ESA

Gladu Lake Uplands ESA

Site Location: Nine km north of Spruce Grove along Range Road 273; the majority of the lake is located to the west within Sturgeon County

Area: 113 ha

Description:

The Gladu Lake Uplands ESA includes Gladu Lake, surrounding forested habitat areas, and a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1]. Gladu Lake and its surrounding wetlands and forests are located in a relict glacial meltwater channel within the Buried Beverly Valley. The area is capped by Saskatchewan Sands and Gravels that were deposited by glacial thrusting from the vicinity of Villeneuve. This site represents one of a very few morainal uplands in the region, and the gravel cap makes the area unique.

The southwest portion of the lake is surrounded by trembling aspen-balsam poplar dominant forest, which is contiguous with a large expanse of forest land adjacent to the east side of the lake within Sturgeon County. The lake provides waterfowl production and staging habitat. Resident observations have indicated that the lake is situated along an important migratory path for these waterfowl, including swans. Surrounding forests provide important habitat for deer and moose, as well as songbirds and smaller mammals. The lake is extremely shallow with essentially no fisheries potential.

Resident observations indicate that groundwater within the ESA, along with overall water levels in Gladu lake, are extremely susceptible to variation. Residents have expressed concern over the downward trend in water loss resulting from conditions beyond normal drought patterns. Any proposed future development within the area will need to carefully assess existing drainage patterns, surface water levels, and hydrologic trends in the ESA's watershed.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

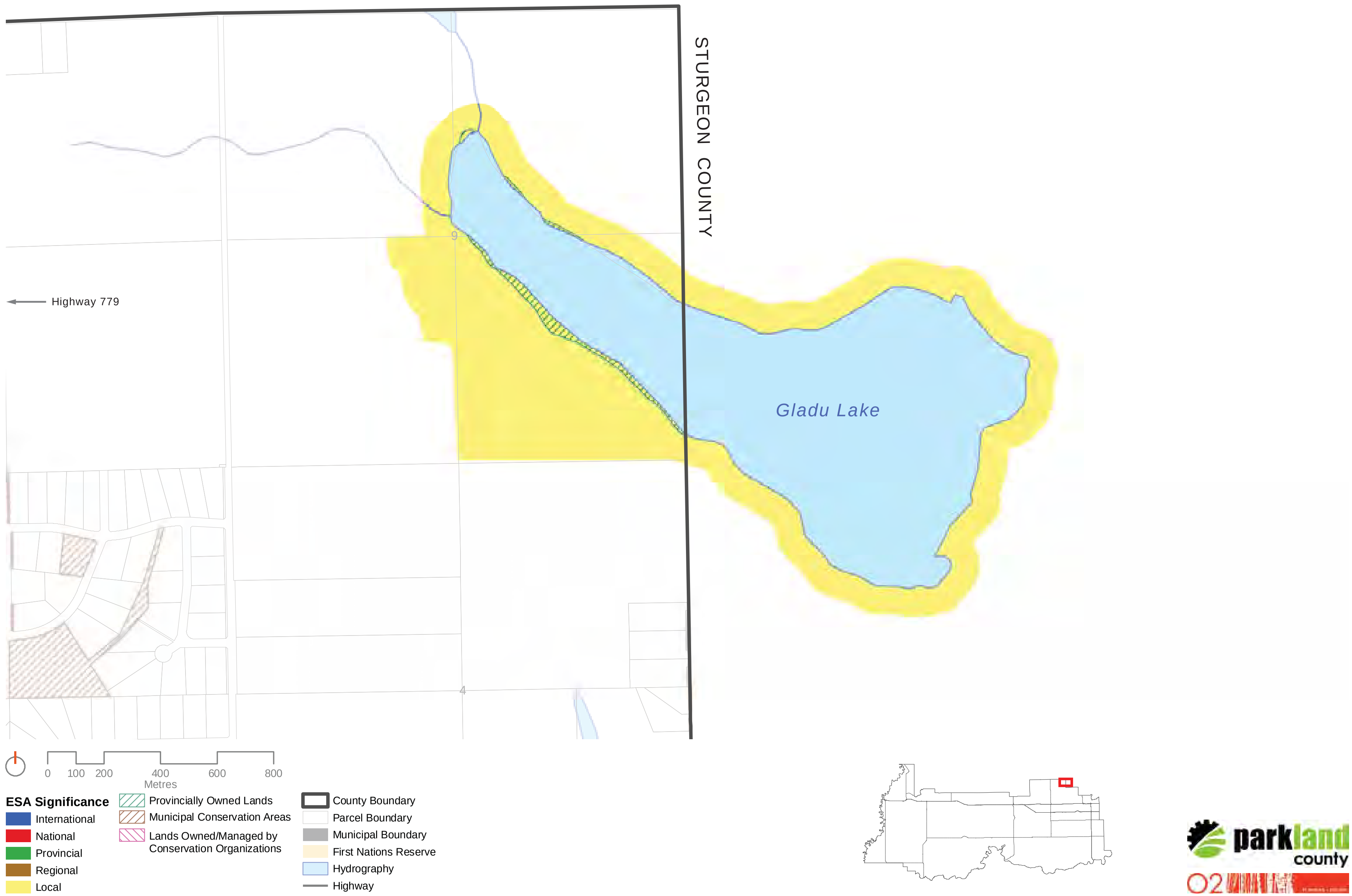
GLADU LAKE UPLANDS ESA

SIGNIFICANCE: Local

Elements valued for local environmental functions

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas

GLADU LAKE



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Gladu Lake Uplands ESA

Environmental Sensitivity: Moderate

- Moderate to high groundwater sensitivity due to surficial sands/gravels

Land Status:

- Private ownership of lands surrounding the lake; bed and shore of lake is publicly owned

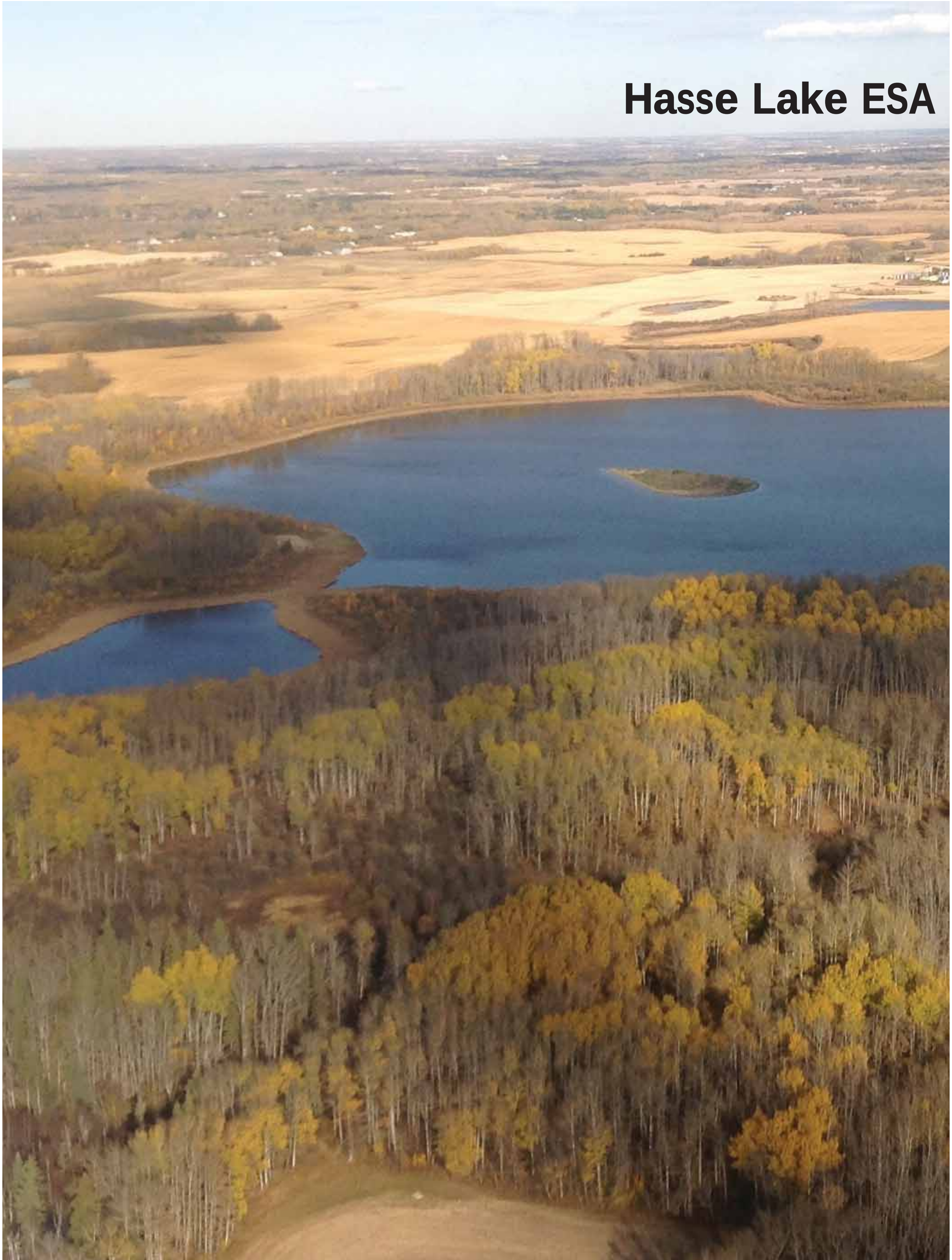
Key features:

- Morainal uplands with a unique gravel cap
- Lakeshore and forests surrounding Gladu Lake

Recommended Planning Strategies:

- Lakeshore environment should be adequately buffered from future development
- Lake water balance, drainage patterns, and hydrologic function of the lake system are susceptible to fluctuations resulting from various types of development, as well as natural drought conditions. Any new development should consider the cumulative impacts of development and drought conditions on the sensitive groundwater and surface water systems that characterize this ESA.

Hasse Lake ESA



Hasse Lake ESA

Site Location: 12 km southwest of Stony Plain along Township Rd. 524.

Area: 391 ha total; Hasse Lake is 81 ha

Description:

The Hasse Lake ESA includes that lake and a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1]. Hasse Lake is situated in the Carvel Pitted Delta, characterized by hummocky terrain with kettle lakes and wetlands in low-lying areas. Several large wetlands, lakes, and forest patches have been included within the mapped ESA boundaries, including a complex of forests, lakes and wetlands extending over 3 km to the west of Hasse Lake.

Hasse Lake has a mean depth of 3.5 m, and a volume of 3.3 million m^3. While the lake receives significant inputs from groundwater, water levels have slowly decreased over the years. Historically, Hasse Lake has been characterized by clear water relatively low in nutrients (Mitchell & Prepas, 1990).

The lake is situated above the Beverly Buried Valley Aquifer, and there is some indication that there is high sensitivity to groundwater contamination from the surface in the area.

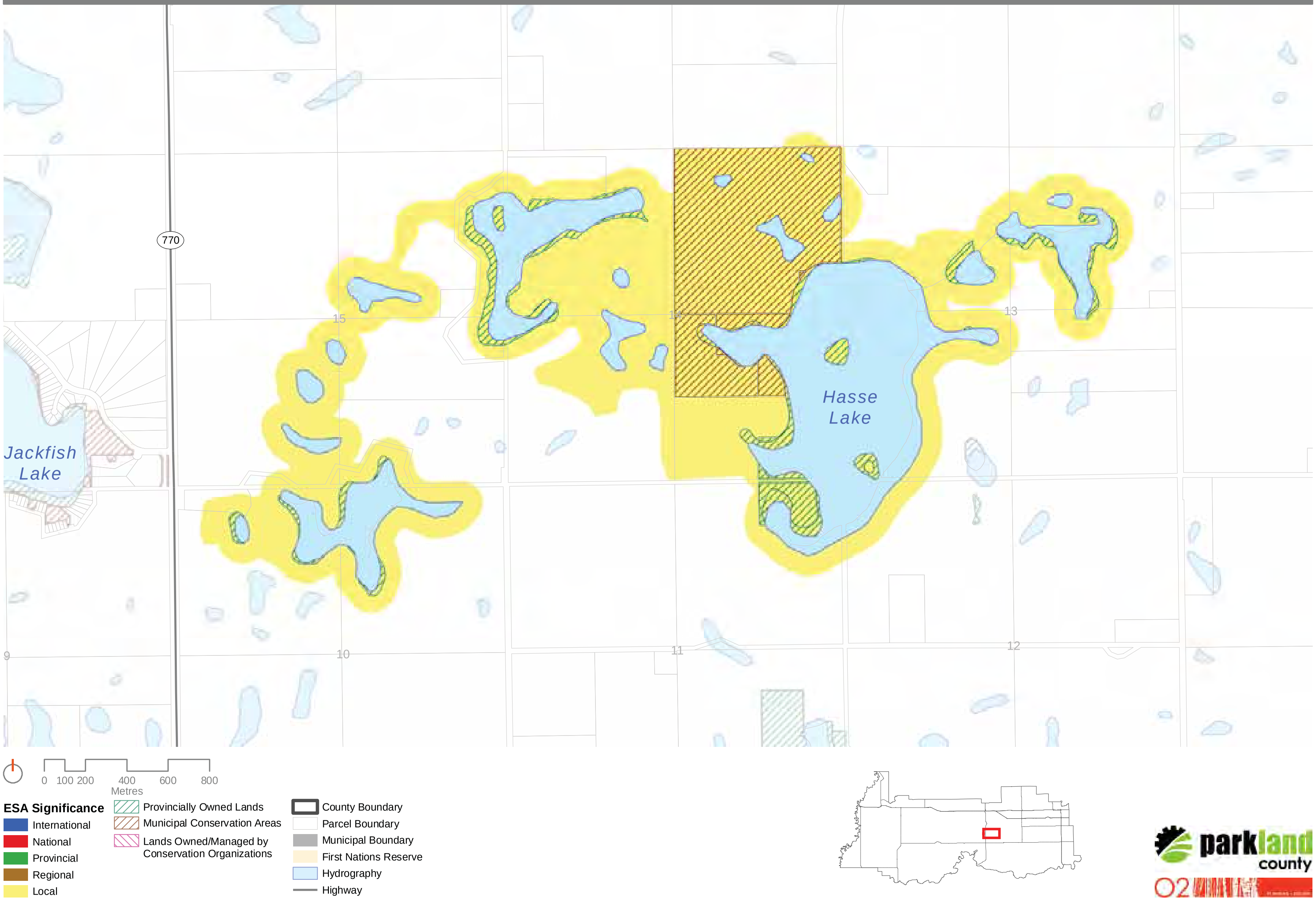
Upland forests are dominated by trembling aspen mixed with balsam poplar, with some interspersions of white spruce. Within Hasse Lake Park, some very old trembling aspen and balsam poplar trees are present.

Hasse Lake is an important staging area for waterfowl. Pelicans and great blue herons have been seen at the lake. Loons have been known to nest on the lake, and shorebirds use the lake in the fall. The smaller wetlands and lakes in the ESA also provide habitat for a variety of water birds. The forests in close proximity to water also provide good habitat for ungulates, furbearers (e.g., beaver), songbirds, woodpeckers, owls and hawks.

Native fish species in Hasse Lake include brook stickleback and fathead minnow. Three spine stickleback (a non-native species) has been introduced to the lake from British Columbia and a population survives in the lake, although they may compete with native species. Winter fish kills can occur in the lake due to freezing.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

HASSE LAKE ESA



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Hasse Lake ESA

Environmental Sensitivity: High

- High sensitivity to groundwater contamination from activities at the surface
- Lakeshore and wetland environments

Land Status:

- Majority of lands are privately owned
- Parkland County owns 69 ha of land on the NW side of the lake within the Hasse Lake Recreation Area
- The bed and shore of all lakes and permanent water bodies are considered crown provincial lands

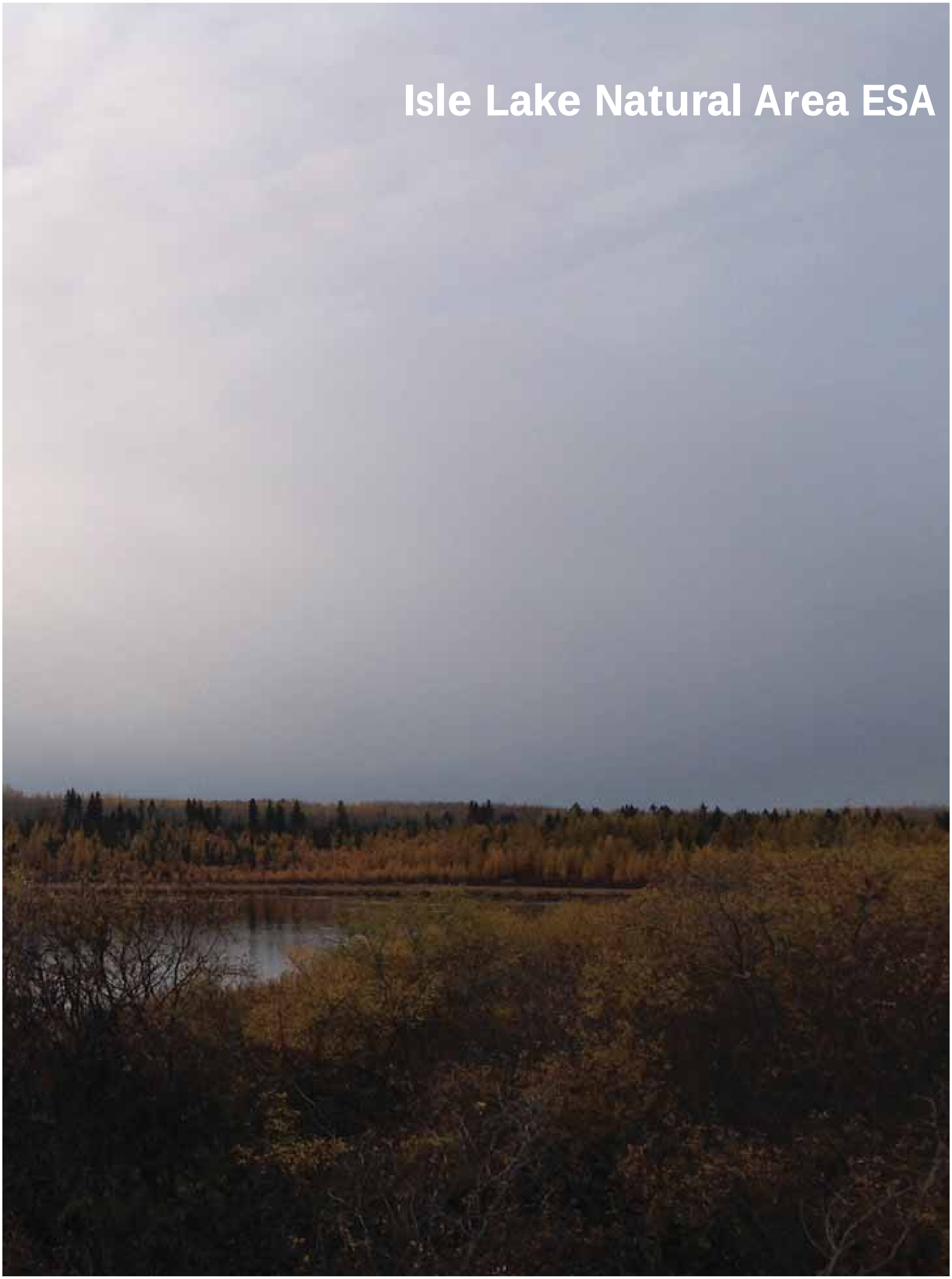
Key features:

- Contains several Class 5 wetlands
- Provides connectivity among natural habitat patches
- Provides habitat for ducks and other wildlife

Recommended Planning Strategies:

- Boating speeds fall under the purview of Transport Canada with the Federal Government responsible for enforcement.
- An ALUS-driven wetland restoration project has been successfully completed in agricultural lands just east of Hasse Lake. Similar projects should be undertaken in the area to promote connectivity for wildlife and support overall hydrologic function
- Treed buffer strips on the east and south edges of Hasse Lake and along some of the other wetlands and small lakes on the west side of the ESA are narrow and should targeted for future riparian restoration programs
- Monitoring of invasive species to ensure competition with native species is kept at bay
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- 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*.

Isle Lake Natural Area ESA



Isle Lake Natural Area ESA

Site Location: This natural area associated with Isle Lake is located on the southeast shore of Isle Lake, approximately 45 km northwest of Stony Plain.

Area: 225 ha

Description:

Isle Lake Natural Area and surrounding lands exhibit rolling topography (knob and kettle terrain) that slope toward the shore of Isle Lake. Several small drainage courses are cut throughout the forested areas. Poorly drained vegetation communities include mineral wetlands, peatlands, wet shrublands, and black spruce-tamarack forests. Mesic upland forests include aspen, balsam poplar, and white spruce. Most of the uplands have been impacted by forest fire and are in the early seral stages of succession. Contiguous forested areas are important for a diversity of wildlife including ungulates, furbearers, songbirds, and raptors.

Over the past several decades, nutrient laden runoff from surrounding agricultural land use has caused outbreaks of blue-green algae blooms in Isle Lake, leading to massive fish kills in the winter. Due to the Natural Area's proximity to Isle Lake, it's wetlands and riparian area play an important role in buffering the lake from surrounding land use by filtering runoff before it reaches the lake.

Environmental Sensitivity: High

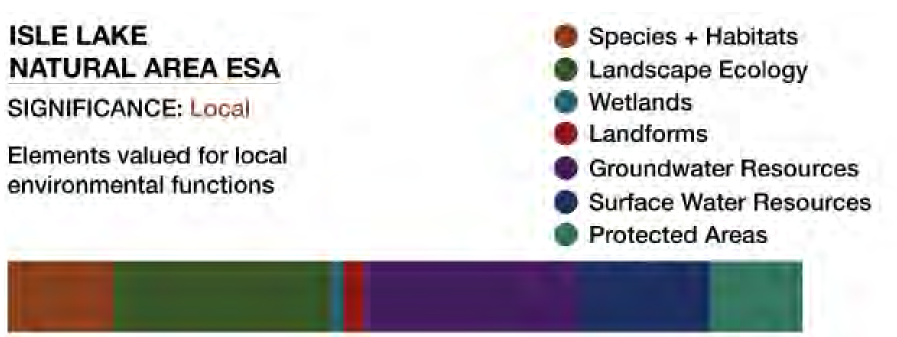
- Due to high groundwater sensitivity, with some sensitive soils and few occurrences of rare plants
- Due to proximity to Isle Lake, which suffers from nutrient loading

Land Status:

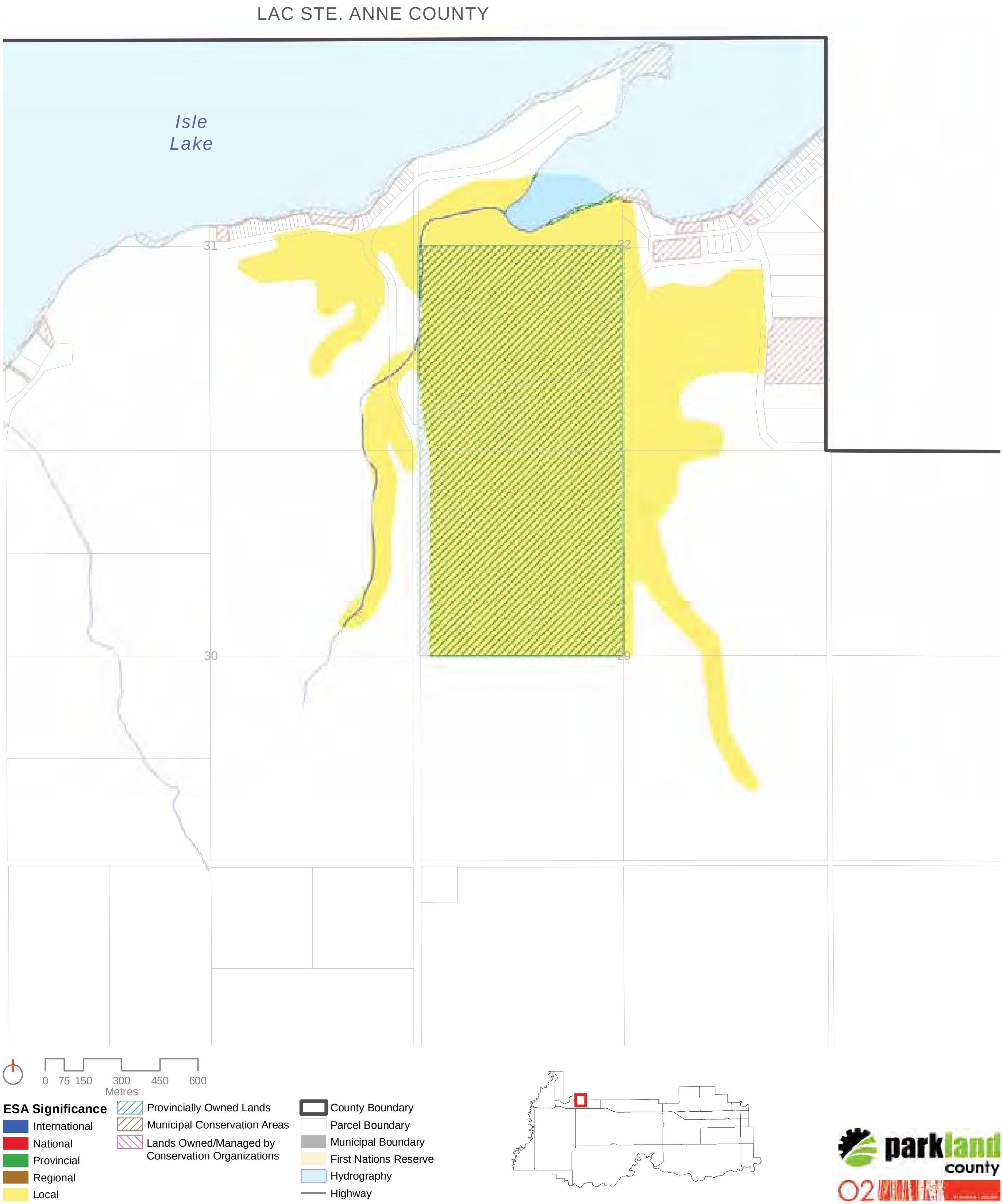
- Part of this ESA is Crown land designated as a Provincial Natural Area for recreation
- Some of the surrounding parcels are owned privately

Key features:

- Contiguous patch of diverse forest communities
- Valuable for wildlife and local environmental functions
- Plays a key role in buffering the Lake from surrounding land uses



ISLE LAKE NATURAL AREA ESA



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Isle Lake Natural Area ESA

Recommended Planning Strategies:

- This ESA is surrounded by forest habitat, resulting in a relatively large, contiguous habitat block for wildlife. Maintaining this large patch of habitat will assist in preserving the ecological value of this ESA.
- Agricultural operations in the vicinity of Lake Isle, in conjunction with the Sturgeon River Headwaters ESA, needs to focus on reducing the overall use on fertilizers to reduce phosphates levels travelling into Isle Lake
- Protect and enhance wetlands and riparian areas in and around the ESA to enhance fitration of nutrient laden runoff from nearby source areas
- Agricultural operators are encouraged to use best management practices such as ALUS (Alternative Land Use Services) program to protect creeks and rivers entering into Isle Lake
- Education programs to education recreational / residential land owners on Isle Lake to minimize the use of lawn fertilizers entering into the lake.
- 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. Development within the shoreline areas could be prevented and habitats could be restored.
- Human disturbances (i.e., personal watercraft, large boats) and surrounding developments contribute contaminants to the water body and disrupt the aquatic life.
- 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.
- Cabin owners need to follow good shoreline protection practices by maintaining and restoring a vegetated buffer along the lake
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- Reduce pollution impacts to Isle Lake from private sewage / wastewater systems through enforcement.
- Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, environmental assessment studies) for proposed developments within 100 meters of Isle 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 Isle Lake Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.

Isle Lake Surrounding Area ESA

Isle Lake Surrounding Area ESA

Site Location: This ESA is located north of Hwy 16 and west of Range Road 60 at the southernmost and eastern shore of Isle Lake.

Area: 293 ha

Description:

Similar to the Isle Lake Natural Area, this ESA and surrounding lands exhibit rolling topography with intermittent drainages. This area was designated as an ESA due to the relatively undisturbed patch of contiguous forest types that vary from poorly drained vegetation communities to mesic upland forests. Contiguous forested areas are important for a diversity of wildlife including ungulates, furbearers, songbirds, and raptors.

Over the past several decades, nutrient laden runoff from surrounding agricultural land use has caused outbreaks of blue-green algae blooms in Isle Lake, leading to massive fish kills in the winter. Like the Isle Lake Natural Area, this ESA's proximity to Isle Lake also plays an important role in buffering the lake from surrounding land use by filtering runoff before it reaches the lake. Wetlands and riparian areas in the Isle Lake Surrounding Area should be protected and enhanced in order to support ecological function of the entire lake ecosystem.

Environmental Sensitivity: Moderate

- Due to moderate levels of groundwater sensitivity
- Due to proximity to Isle Lake, which suffers from nutrient loading

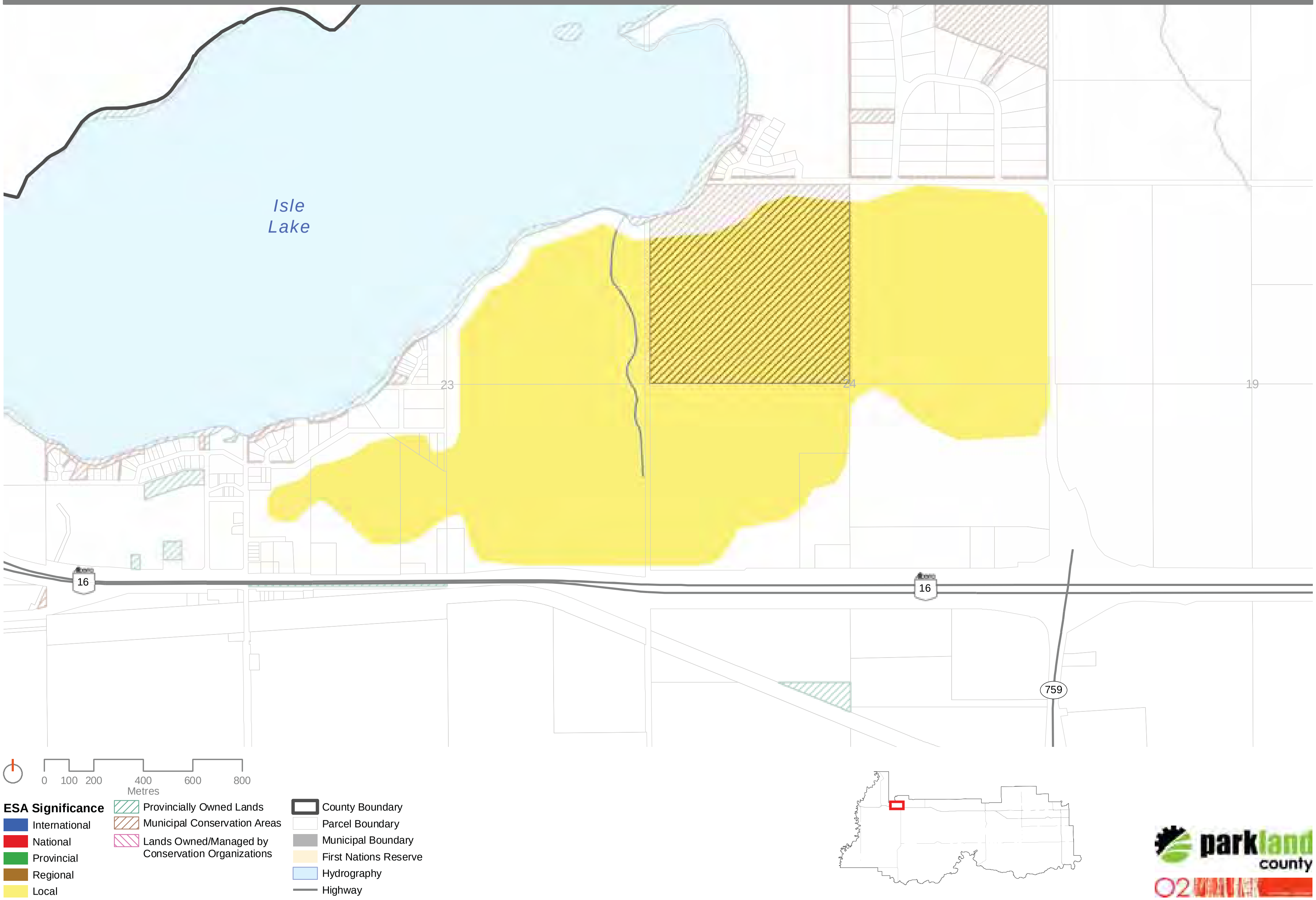
Land Status:

- Most of the parcels in this ESA are privately owned, and one parcel next to the Isle Cove development is County owned

Key features:

- Contiguous patch of diverse forest communities
- Valuable for wildlife and local environmental functions
- Plays a key role in buffering the Lake from surrounding land uses

ISLE LAKE SURROUNDING AREA ESA



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Isle Lake Surrounding Area ESA

Recommended Planning Strategies:

- This ESA is surrounded by forest habitat, resulting in a relatively large, contiguous habitat block for wildlife. Maintaining this large patch of habitat will assist in preserving the ecological value of this ESA.
- Agricultural operations in the vicinity of Lake Isle, in conjunction with the Sturgeon River Headwaters ESA, needs to focus on reducing the overall use on fertilizers to reduce phosphates levels travelling into Isle Lake
- Protect and enhance wetlands and riparian areas in and around the ESA to enhance fitration of nutrient laden runoff from nearby source areas
- Agricultural operators are encouraged to use best management practices such as ALUS (Alternative Land Use Services) program to protect creeks and rivers entering into Isle Lake
- Education programs to education recreational / residential land owners on Isle Lake to minimize the use of lawn fertilizers entering into the lake.
- 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. Development within the shoreline areas could be prevented and habitats could be restored.
- Human disturbances (i.e., personal watercraft, large boats) and surrounding developments contribute contaminants to the water body and disrupt the aquatic life
- 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.
- Cabin owners need to follow good shoreline protection practices by maintaining and restoring a vegetated buffer along the lake
- Prohibit residential fertilizer use in the ESA boundary area. Increase education and (where necessary) enforcement for non-compliance.
- Reduce pollution impacts to Isle Lake from private sewage / wastewater systems through enforcement.
- Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, environmental assessment studies) for proposed developments within 100 meters of Isle 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 Isle Lake Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act.*

Manly Corner ESA

Manly Corner ESA

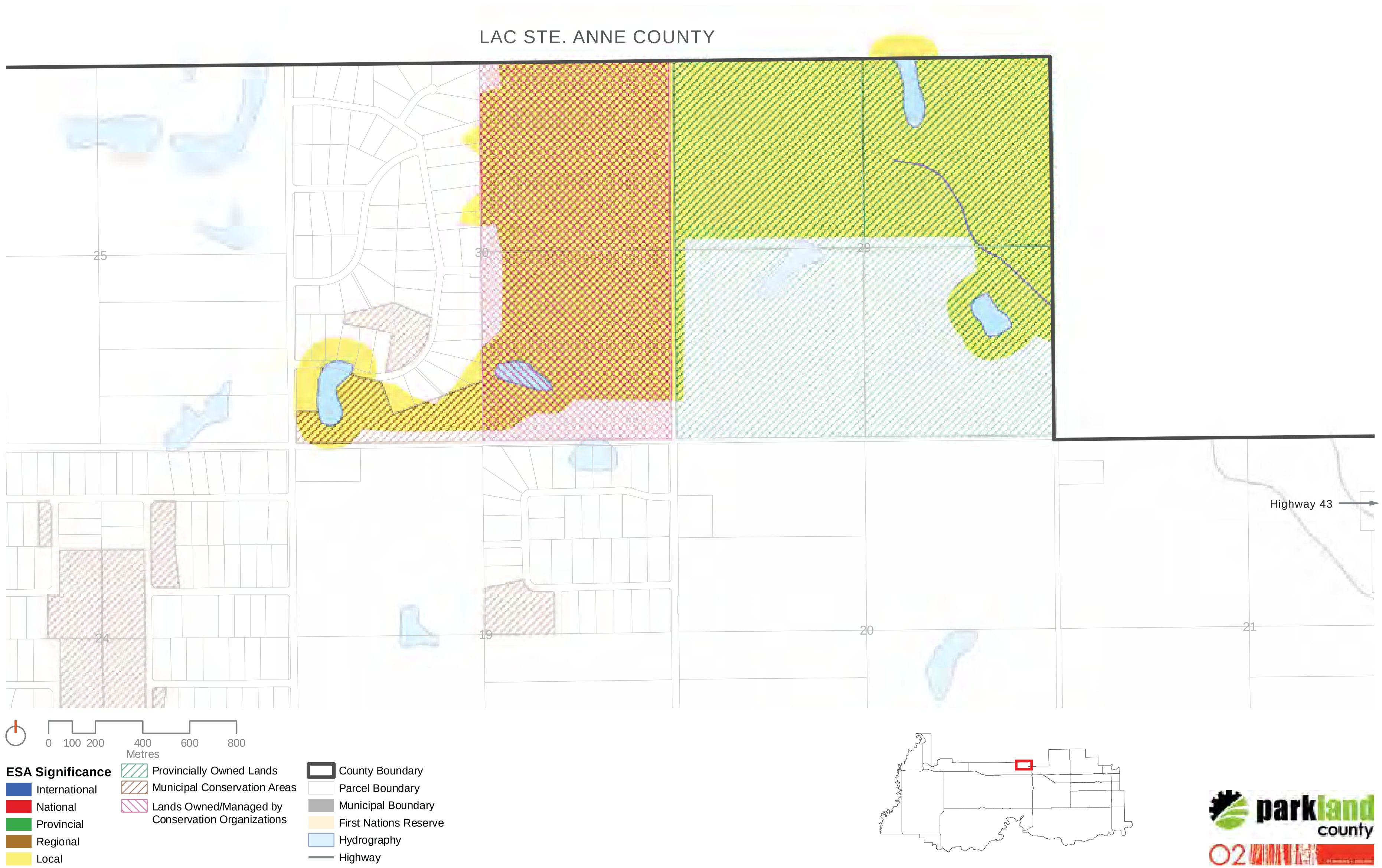
Site Location: This ESA is located north of Highway 16 between Range Road 24 and 25, at the north boundary of Parkland County.

Area: 271 ha

Description:

Manly Corner is located on a stagnation moraine with knob and kettle topography and contains diverse vegetation and wildlife. Upland habitats include mature aspen, aspen-balsam poplar, and white spruce forests. Poorly drained landscapes are characterized by shrubby swamps, and black spruce forests. A variety of ponds and marshes can be found in pothole depressions. The array of wildlife is typical of mature forests and includes moose, deer, beaver, coyote, snowshoe hare, red squirrel, and a variety of songbirds.

MANLY CORNER ESA



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Manly Corner ESA

Environmental Sensitivity: Low

- Some environmental sensitivity is due to groundwater resources and erodible soils

Land Status:

- The area is a combination of Crown Land and County Land

Key features:

- Diverse terrain and a mosaic of natural habitats
- A large contiguous patch of forested area

Recommended Planning Strategies:

- Manly Corner is an island of natural habitat in an area of high disturbance. Designation of the County owned lands to a Provincial Natural Area are recommended to afford more protection from surrounding development pressures.
- Protecting the connectivity between the Crown lands and County lands is important for surrounding wildlife and the maintenance of natural habitats

Muir Lake ESA

Muir Lake ESA

Site Location: Eight km NW of Spruce Grove, in the vicinity of Township Road 540 and Range Road 275

Area: 101 ha; lake area is approximately 32 ha

Description:

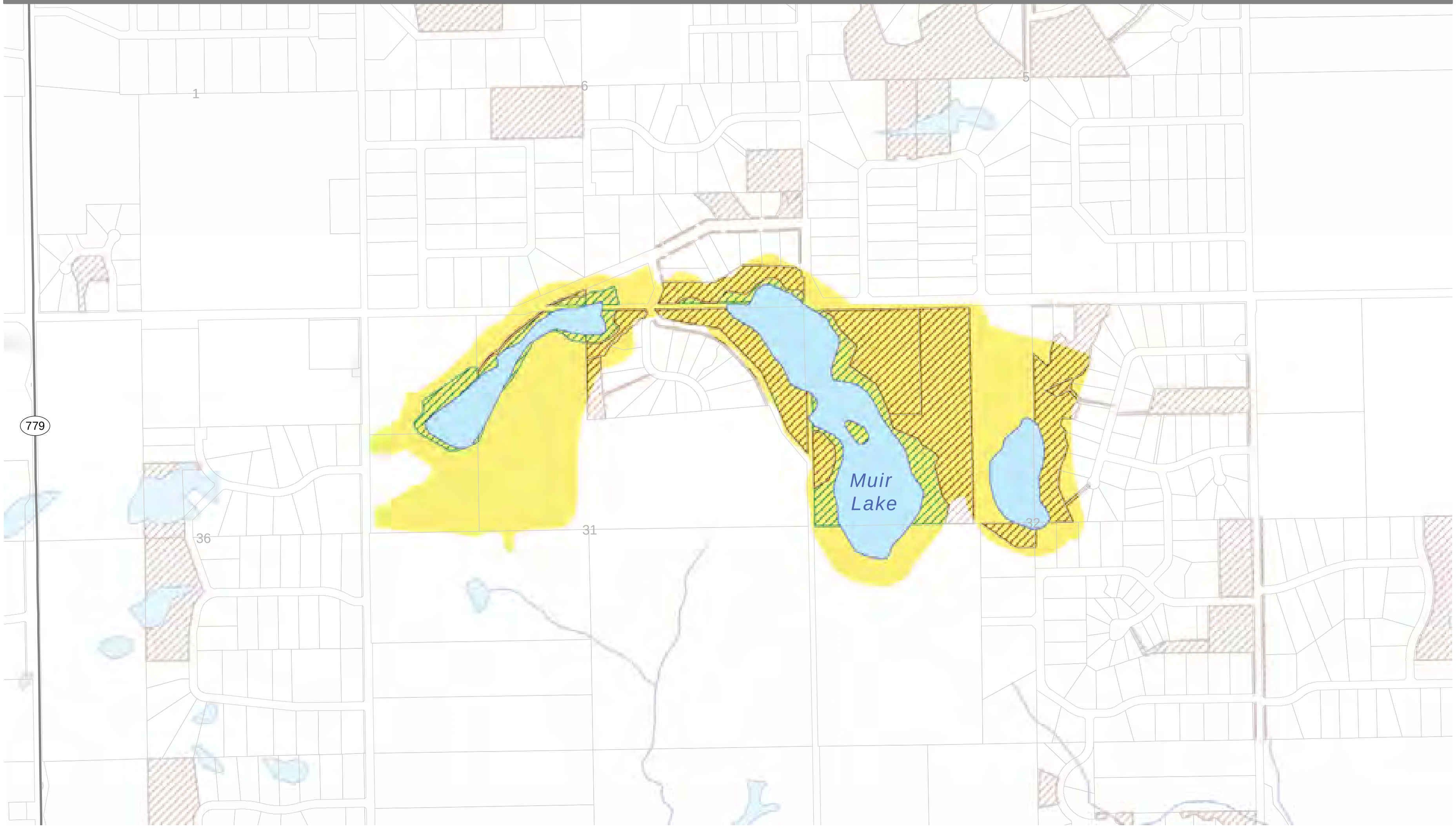
The Muir Lake ESA includes the lake, a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. surrounding forests and wetlands, as well as two smaller lake/wetland complexes located both east and west of Muir Lake.

A shallow emergent vegetation zone (cattails, rushes, and sedges) fringes most of the lakes/wetlands, and willows are common along the shorelines. Forests are characterized by mature balsam poplar and aspen poplar.

The lake/wetlands provide habitat for waterfowl, and forested uplands provide habitat for many birds and mammals. A trout fishery has been re-established at Muir Lake by several fishing clubs through the Muir Lake Project. The purpose of this project was to help people understand how a healthy trout fishery relies on a healthy habitat, and to encourage people to act as stewards of the environment. The lake is currently aerated by the Alberta Conservation Association in partnership with Parkland County during the winter months to prevent winter fish kills due to low dissolved oxygen. Parkland County maintains a day use area and nature trail along the eastern shore of the lake.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

MUIR LAKE ESA



ESA Significance

- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway

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Muir Lake ESA

Environmental Sensitivity: Moderate

- Sensitive lakeshore environments
- Surrounding land uses, such as agriculture and residential development, pose potential risk of contamination to groundwater resources in the watershed

Land Status:

- County-owned land on the east side; private lands on the south, west, and north shores

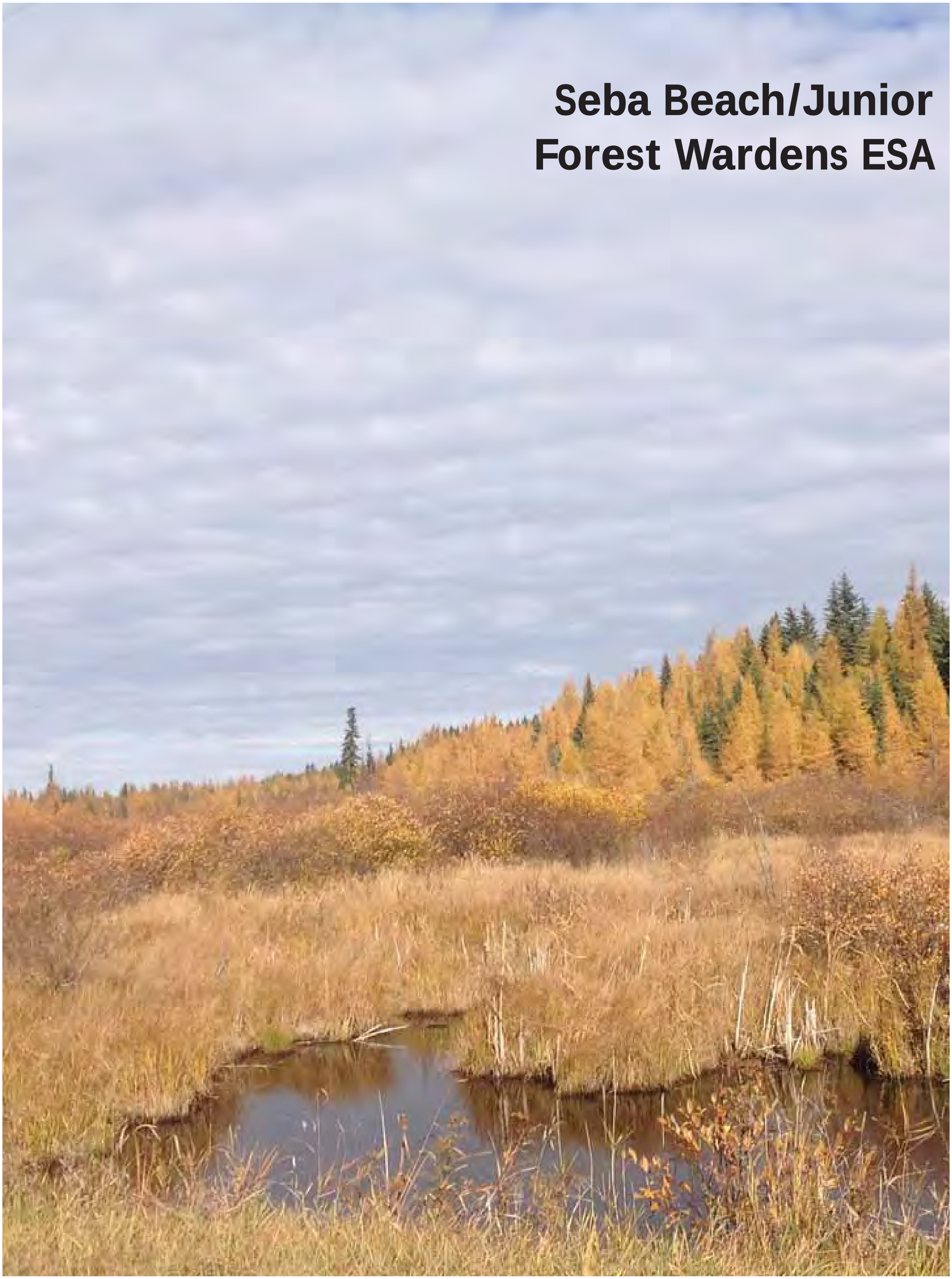
Key features:

- Trout fishery
- Lake is aerated during the winter

Recommended Planning Strategies:

- Maintain a healthy, well vegetated buffer around the lake
- Continue aerating the lake to maintain trout populations and recreational fishing opportunities
- Work in partnership with conservation and fish clubs to continue to provide stewardship in the area
- Prevent potential changes to lake hydrology due to increased development in surrounding watershed
- Boating speeds fall under the purview of Transport Canada with the Federal Government responsible for enforcement.
- Prohibit residential fertilizer use within the ESA boundary. Increase education and (where necessary) enforcement for non-compliance.
- 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*.

Seba Beach/Junior Forest Wardens ESA



Seba Beach / Junior Forest Wardens ESA

Site Location: Immediately west and northwest of the summer Village of Seba Beach.

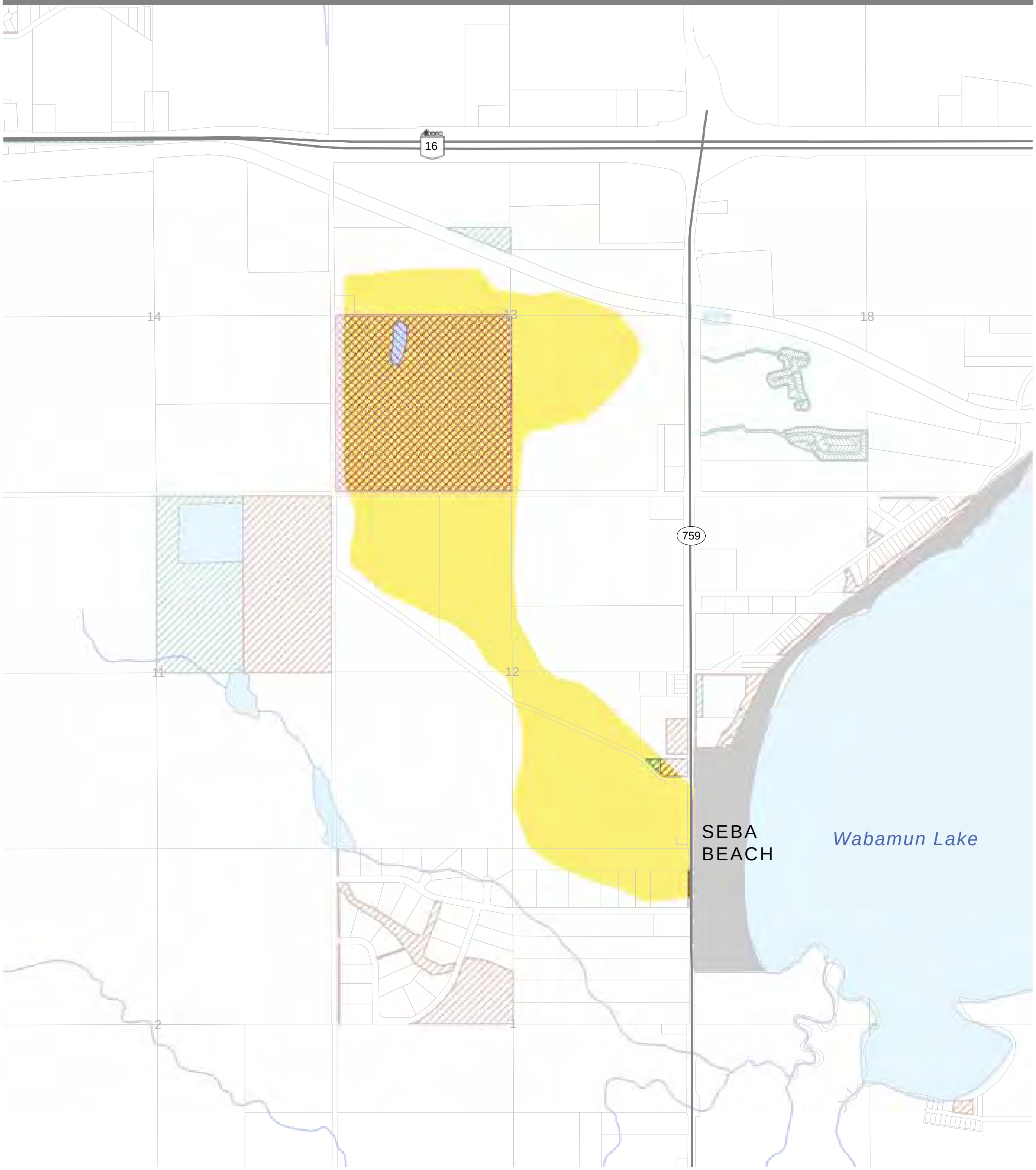
Area: 214 ha

Description:

This area contains a large pond in the northwest corner, and a riparian/wetland corridor that trends southwest towards the Summer Village of Seba Beach. The forests are primarily a mixture of white spruce, tamarack, trembling aspen, and balsam poplar, with some limited black spruce and peatlands in wet areas. The area provides a movement corridor and a large patch of habitat. There is strong evidence of beaver activity along the riparian corridor and good habitat for ungulates such as deer and moose is present.

The county-owned property was reforested by the Junior Forest Wardens, in conjunction with Parkland County and Weldwood Canada Ltd., who conducted forestry operations in this area in the past.

SEBA BEACH / JUNIOR FOREST RANGER ESA



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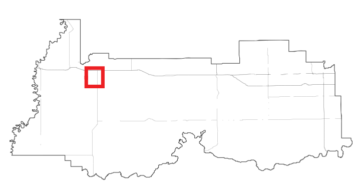
ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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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

Smithfield/Amisk Acres ESA

Smithfield/Amisk Acres ESA

Site Location: This ESA is located 27 km west of Stony Plain on Highway 16 to the Kapasiwin overpass, then 2.4 km north.

Area: 508 ha

Description:

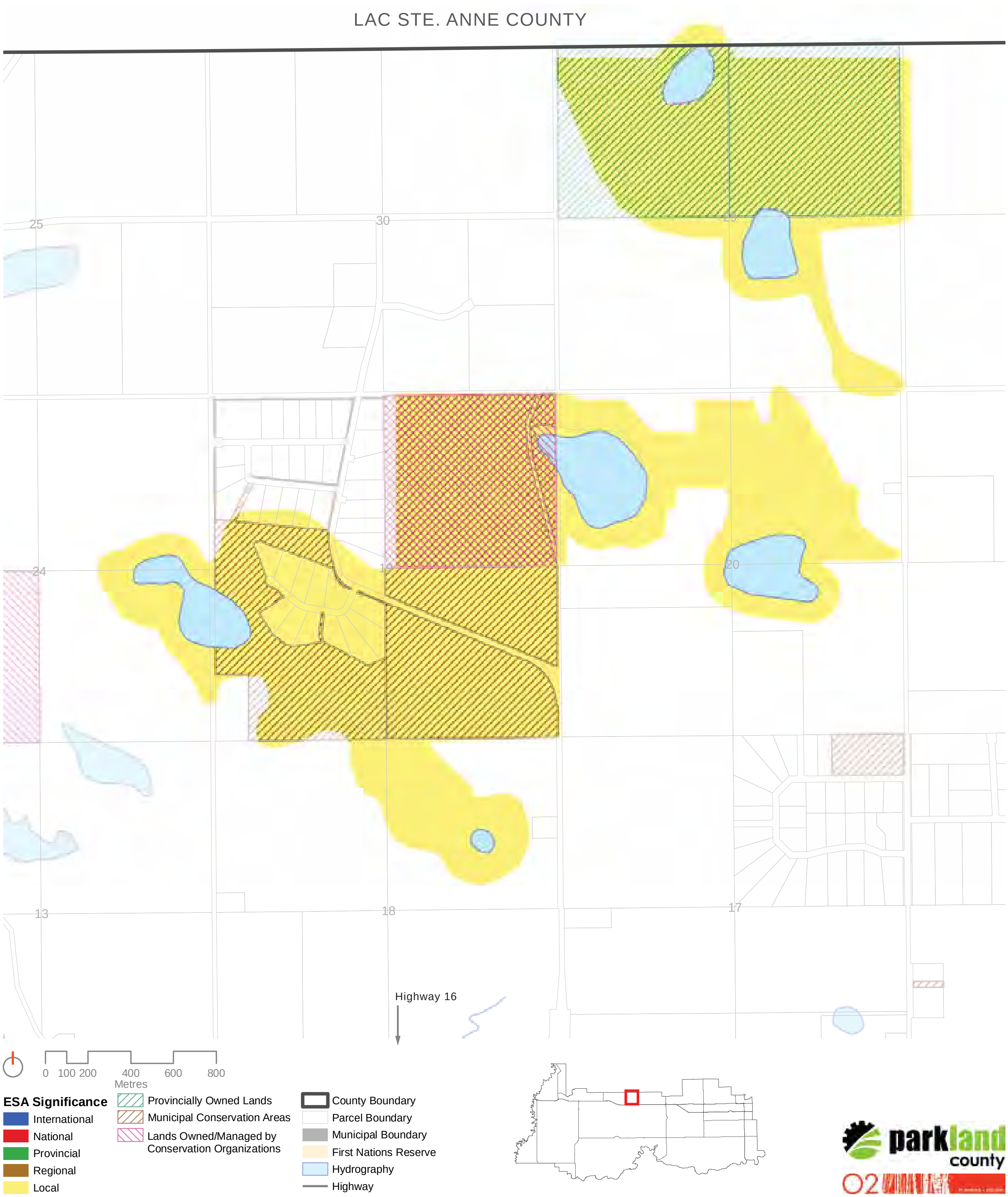
The Smithfield Area is comprised mainly of poorly drained lowlands and contains diverse wetland communities. Key features of the area include a small lake surrounded by fen, a wet meadow, shrublands, peatlands, aspen forest and stands of tamarack.

The Amisk Acres Buck for Wildlife area is a combination of a peatland (60%) and upland forest (40%) located in the west and southeast portions of the quarter. The upland forest is an open mixedwood stand of mature trembling aspen, balsam poplar and white spruce. Typical of a mature forest, the shrub layer is well-developed and dominated by rose, aspen saplings and white spruce seedlings. This peatland area consists of both a shrubby bog and treed bog containing black spruce and tamarack. An additional 12 ha peatland is located on the northeast side of the ESA.

This area has good overall wildlife habitat potential due to the diversity of wetlands, which are also important surface water reservoirs and groundwater recharge areas.

Smithfield/Amisk areas are connected by a forested quarter section to the northeast. This connection, in combination with other adjacent natural habitat to the south and east, creates a large patch of natural habitat. Important surrounding habitats include two small lakes, a drainage channel, upland forests and peatlands.

SMITHFIELD / AMISK ACRES ESA



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Smithfield/Amisk Acres ESA

Environmental Sensitivity: Low

- Some environmental sensitivity is due to groundwater conditions and the presence of bogs and wetlands.

Land Status:

- There is a combination of Crown Land, County land, and some privately owned parcels

Key features:

- A mosaic of different types of wetlands - including treed peatlands – and upland forests

Recommended Planning Strategies:

- Restricting development in surrounding natural habitats would increase the ecological value of the candidate Natural Area/Buck for Wildlife properties
- Future planning should serve to maintain connectivity between the designated Natural Area and Buck for Wildlife properties
- Bogs and wetlands are sensitive to changes in drainage patterns of surrounding lands, as well as direct disturbance. Care should be taken maintain drainage patterns in surrounding areas.

Soldan/Eden Lakes ESA

Soldan/Eden Lakes ESA

Site Location: 11 km NW of Stony Plain, in vicinity of Lake Eden Road and Township Rd. 534, immediately east of the Kilini Creek ESA

Area: 143 ha

Description:

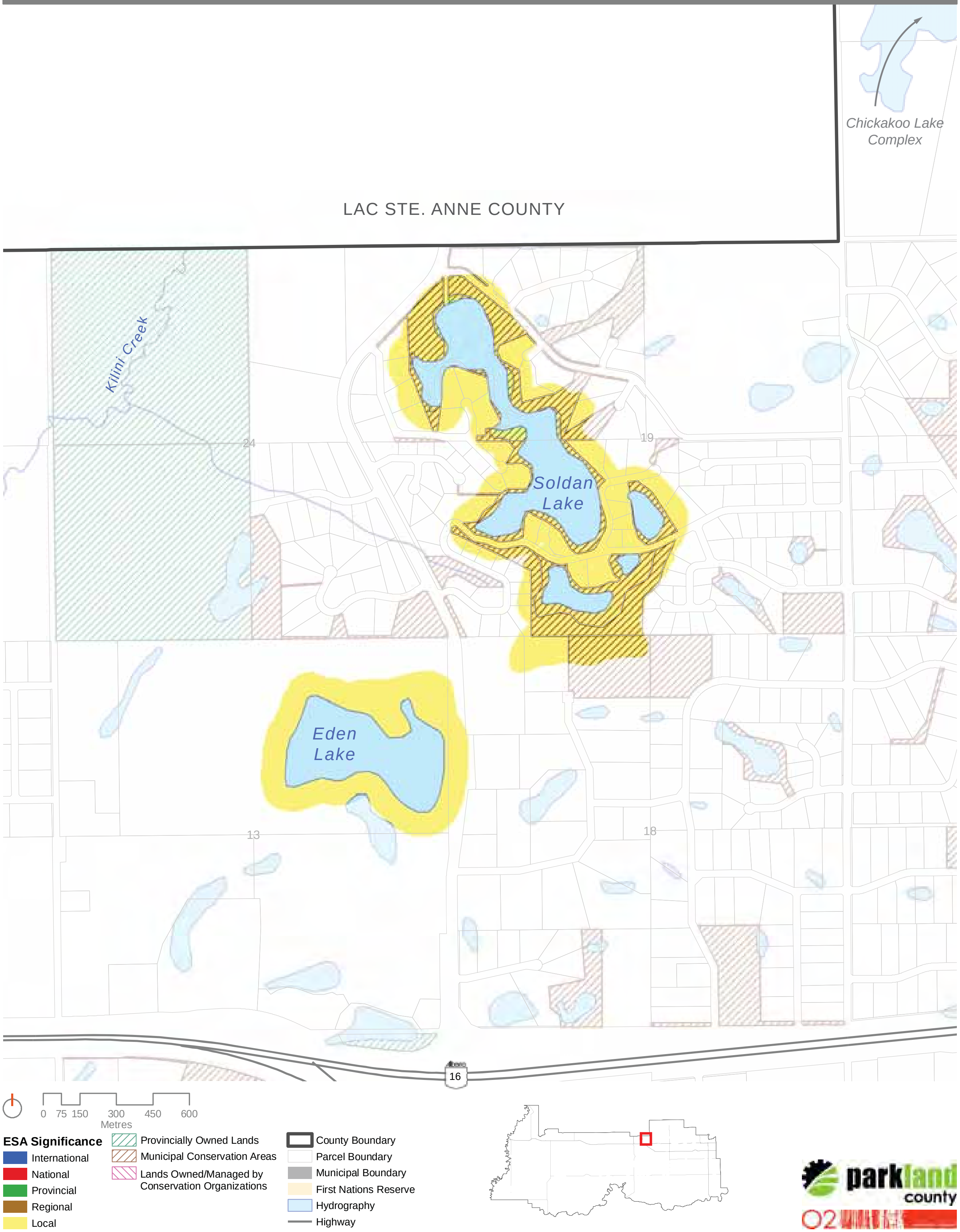
This ESA includes two separate areas: Soldan Lake occurs east of Lake Eden Road, and Lake Eden is located west of the road. Each area includes the respective lake and associated water bodies, as well as a 100 meter precautionary planning buffer around the lakes—a measure designed to promote careful planning and management of fragile riparian areas[1]. Rolling topography characteristic of the Carvel Pitted Delta is present throughout the area and all lakes and wetlands in the ESA occupy kettle pothole landscape positions.

Soldan Lake and several smaller surrounding lakes and wetlands occur within the Chateau Heights and Bridgewater subdivisions east of Lake Eden Road. Riparian lakeshore areas are mostly intact and include willow, various shrubs, balsam poplar, and trembling aspen. In some locations, roads bisect the riparian areas and several country residential acreage properties occur close to the lakeshore. Various mammals and bird species inhabit the area, and landscape connectivity for species movement to surrounding areas is considered to be moderate. Brook stickleback and Yellow perch are common fish species in Soldan Lake and surrounding lakes.

Lake Eden and surrounding riparian areas and forests occur west of Lake Eden Road. Lake Eden has a mean depth of 7 m and a very small drainage basin of 1.5 km^2. With no inlets or outlets, groundwater inputs are suspected to be a very important part of the water balance. Lake Eden has clear water and a mesotrophic nutrient status, and has very low salt content that is unusually low for the region. Sometimes fall algal blooms can occur in the lake, and winter dissolved oxygen can become depleted (Mitchell and Prepas 1990). Three spine stickleback are a common fish species in the lake, and historically the lake was stocked with rainbow trout to maintain a sport fishery. Several steep slopes occur surrounding the lake, particularly on the west side of Lake Eden, and on the southwest side of the lake where the former Lake Eden ski resort operated from the 1970s to the early 1990s. Public access to Lake Eden currently remains restricted. A mixture of abandoned summer homes, cabins, and other debris are strewn about the area. Clean up efforts have been undertaken by the landowner.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

SOLDAN / EDEN LAKES ESA



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Soldan/Eden Lakes ESA

Environmental Sensitivity: Very High

- Lakeshore environments
- Many observations of rare plants
- Some erodible soils present
- Regional groundwater models indicate high sensitivity to contamination

Land Status:

- Lands surrounding Eden Lake are entirely privately owned
- Lands surrounding Soldan Lake are a mixture of County-owned lands and private lands

Key features:

- Groundwater inputs an important component of the water balance
- Developed shorelines

Recommended Planning Strategies:

- Property owners should follow good shoreline protection by maintaining/ restoring a dense vegetated buffer around the lakes and minimizing the use of turf landscaping, fertilizers and pesticides
- Lands currently surrounding Lake Eden are districted as “Direct Control”. The landowner is currently in the process of developing an area structure plan for Lake Eden.

Spring Lake ESA

Spring Lake ESA

Site Location: Spring Lake is 9 km west of Stony Plain, while Cottage Lakes are approximately 11 km west of Stony Plain.

Area: 136 ha

Description:

The Spring Lake ESA includes that lake, as well as a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. Spring Lake and Cottage Lake share the same surficial drainage basin, and also display close relationships to local shallow groundwater systems.

Spring Lake is surrounded by the Village of Spring Lake and is outside the jurisdiction of Parkland County; however it can be influenced by land use activities in the County within the contributing surface watershed or by groundwater contamination in surrounding areas which are linked to this spring-fed lake. Key characteristics of Spring Lake include a surface area of 80 ha, a volume of 1.6 million m^3, a mean depth of 1.9 m (but with five holes greater than 6 m), a surrounding local watershed of approximately 12.5 km^2 (which includes the Cottage Lake basin), and no defined inlets or outlets. Its namesake reflects the fact that groundwater inputs are important to the lake's water balance. The water is usually clear and the lake is classified as mesotrophic with moderate levels of nutrients and algae overall. The lake is vulnerable to winter fish kills, and provides a limited sport fishery for perch and rainbow trout (Mitchell and Prepas 1990). Brook stickleback also are common in the lake, and northern pike have been observed. Beaver are common in the area, and the surrounding forests and wetlands provide habitat for a variety of mammals and birds. The Edmonton Beach Resort is located on the east side of the lake within the Village of Spring Lake.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

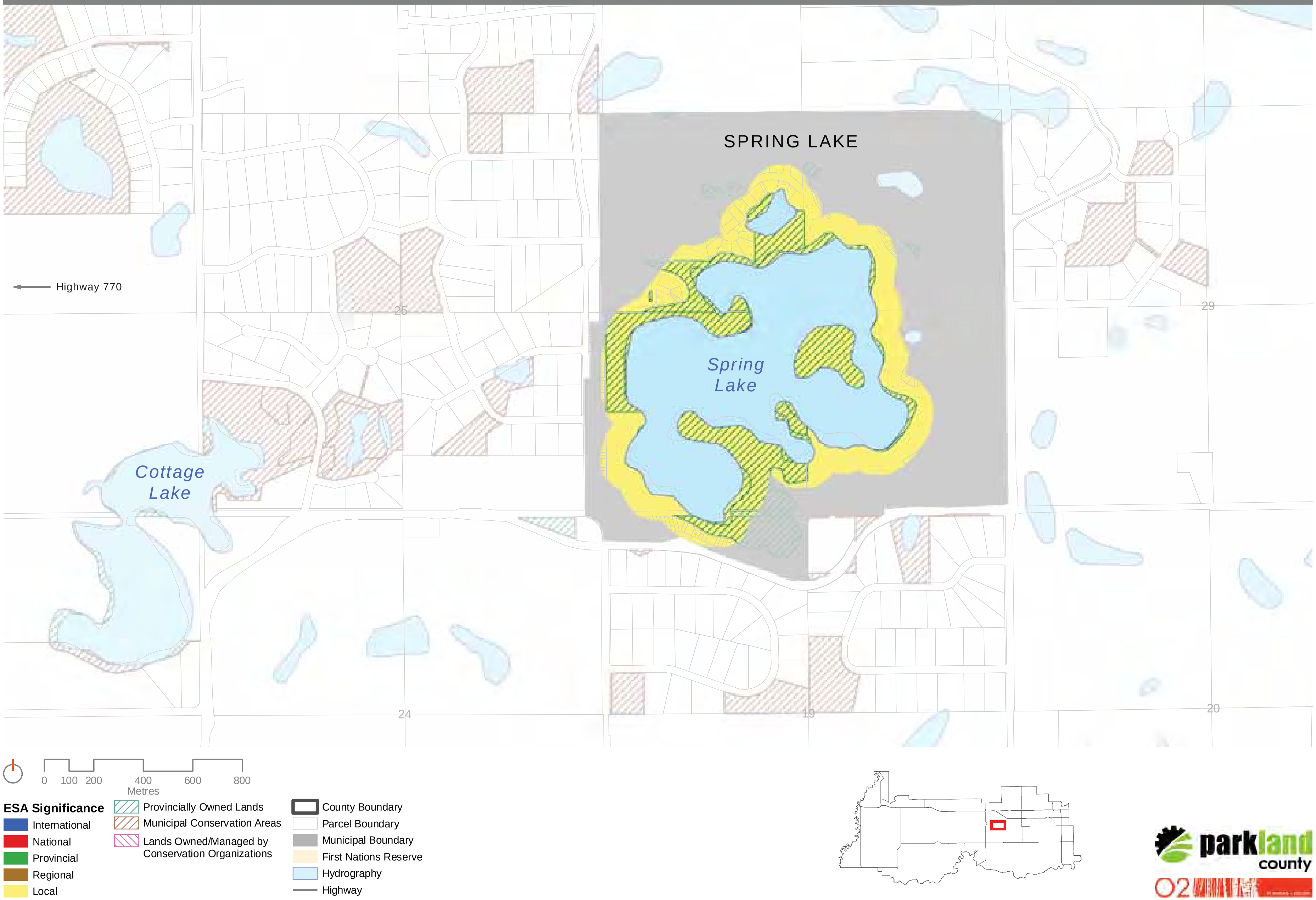
SPRING LAKES ESA

SIGNIFICANCE: Local

Elements valued for local environmental functions

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas

SPRING LAKE ESA



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Spring Lake ESA

Environmental Sensitivity: High

- Lakeshore environments
- Regional groundwater models indicate high sensitivity to contamination

Land Status:

- Spring Lake is surrounded by the Village of Spring Lake
- The large wetlands in between Spring Lake and Cottage Lake are surrounded by private lands
- The bed and shore of lakes and permanent wetlands in Alberta are provincial Crown lands

Key features:

- Lake system is fed by groundwater

Recommended Planning Strategies:

- Property owners should follow good shoreline protection by maintaining/restoring a dense vegetated buffer around the lakes
- Protecting the water balance and water quality of these lakes over the long term will require sustainable land use patterns and land management practices in surrounding areas of the County that do not affect the quality or quantity of surface water or groundwater
- The potential for landscape management practices and/or wetland loss in surrounding subdivisions within the watershed on the lake systems should be studied further and best practices for those acreage owners implemented. Subdivisions that may affect the watershed for these lakes include but are not necessarily limited to: Royal Park, Cottage Lake Heights, Arrowhead Estates, Wild Rose Park, Hillview Estates, Excelsior Park, Heatherlea, Lincolnshire Downs, Sundown Estates, Viewpoint Estates, Blueberry Hill Estates, and Spring Hills
- Boat speed limits fall under the purview of Transport Canada with the Federal Government responsible for enforcement


Unnamed Lake ESA

Unnamed Lake ESA

Site Location: Located south of Highway 627 approximately 3 km west of Stony Plain

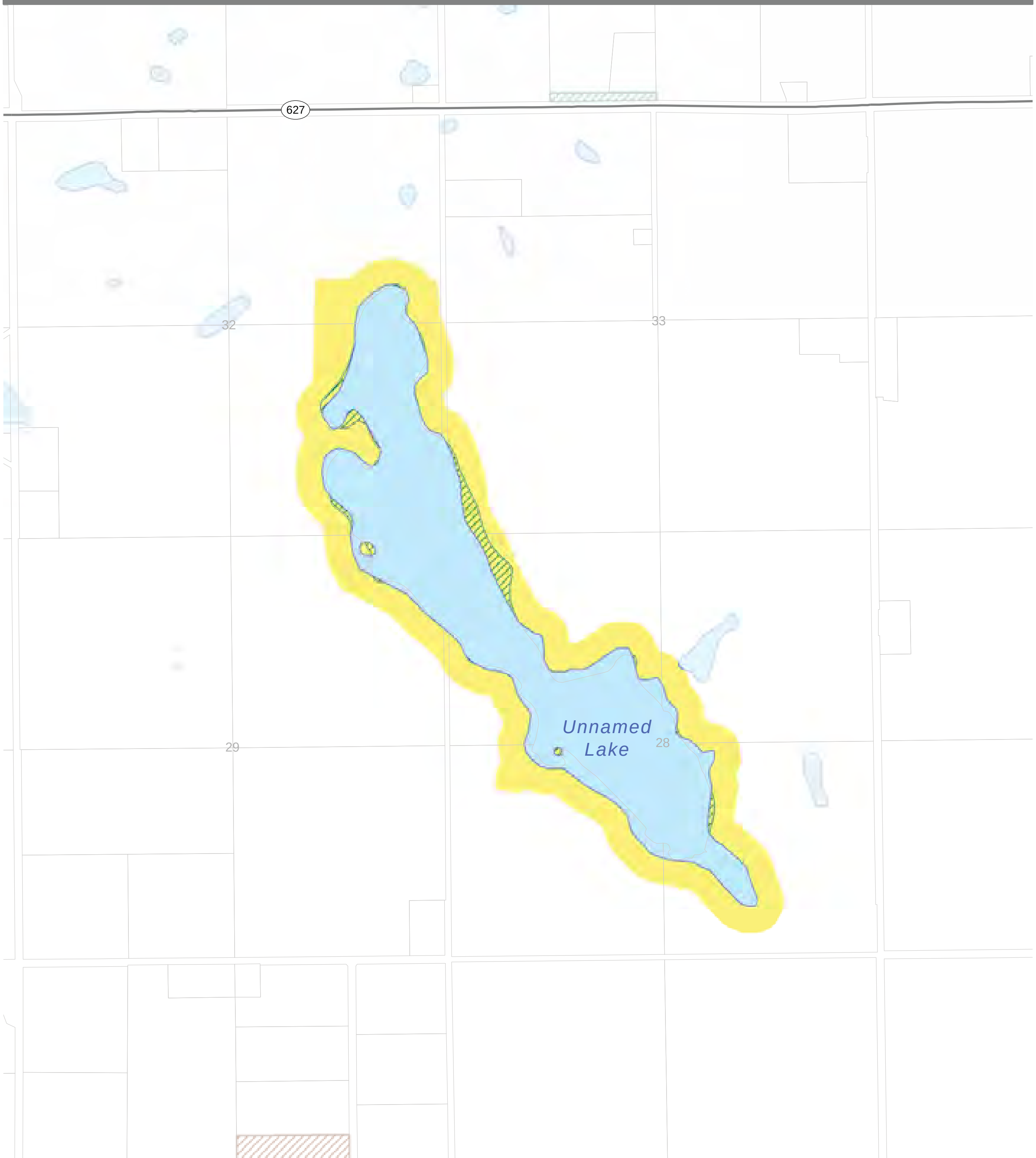
Area: 163 ha

Description:

The Unnamed Lake ESA includes the lake and a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. Unnamed Lake is a small, elongated lake surrounded by a fringe of upland deciduous forest. The edge is characterized by a well-developed emergent zone, as well as sedges and willow. The lake supports one or two eared grebe colonies totaling 120 adults, and likely provides habitat for a variety of other water-associated birds.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

UNNAMED LAKE ESA

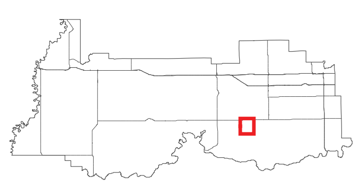


0 100 200 400 600 800
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Unnamed Lake ESA

Environmental Sensitivity: Moderate

- Risk of groundwater contamination

Land Status:

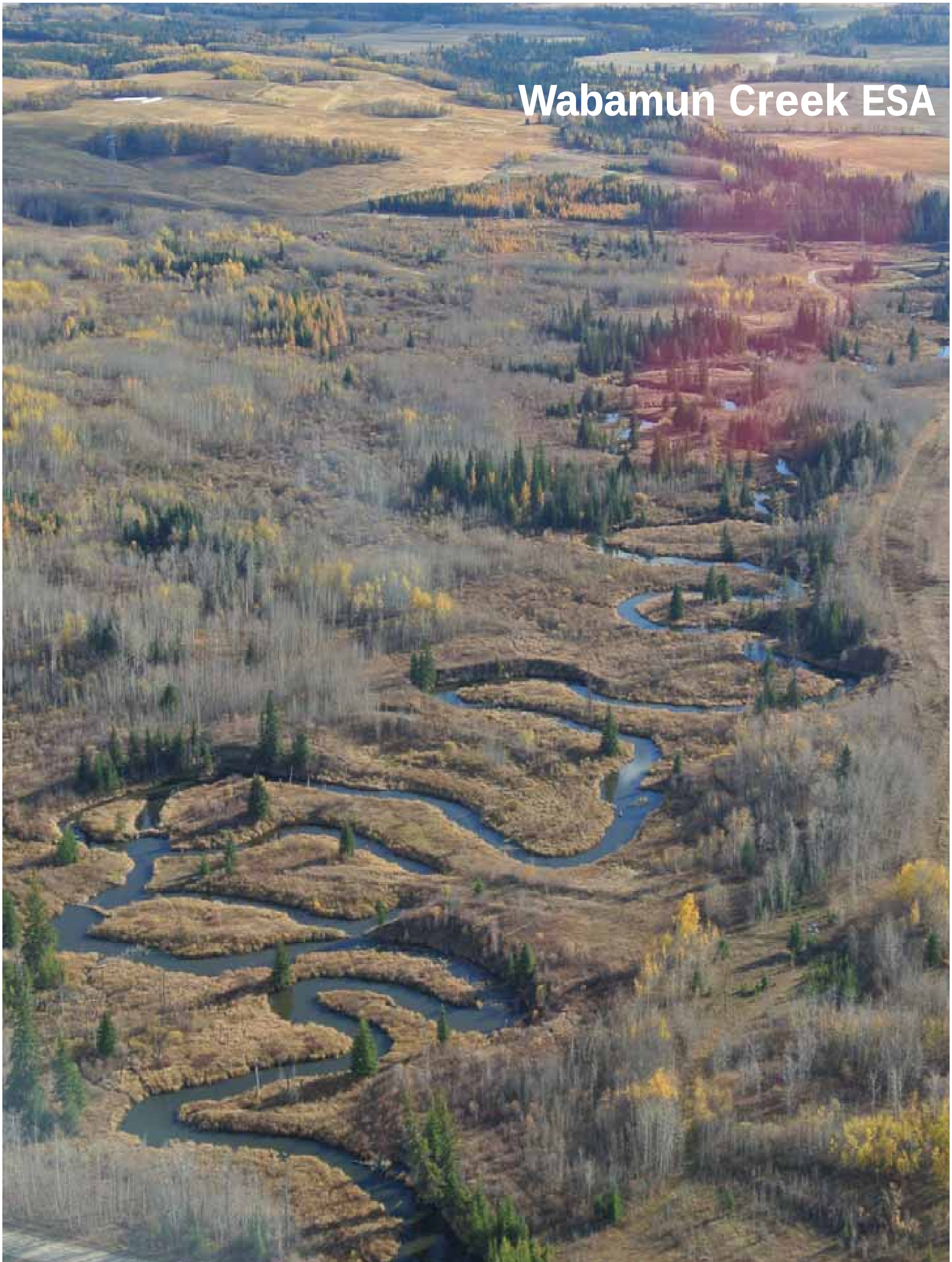
- Surrounded by Private Land

Key features:

- Breeding colonies of birds

Recommended Planning Strategies:

- Maintain remaining treed buffer around the lake, and buffer the lake from future developments


Wabamun Creek ESA

Wabamun Creek ESA

Site Location: Situated south of Highway 16, the creek flows out of the east side of Wabamun Lake, through the Wabamun Indian Reserve, along Range Road 33, across Highway 627, and enters the North Saskatchewan River at Section 25 52-3-W5M

Area: 399 ha

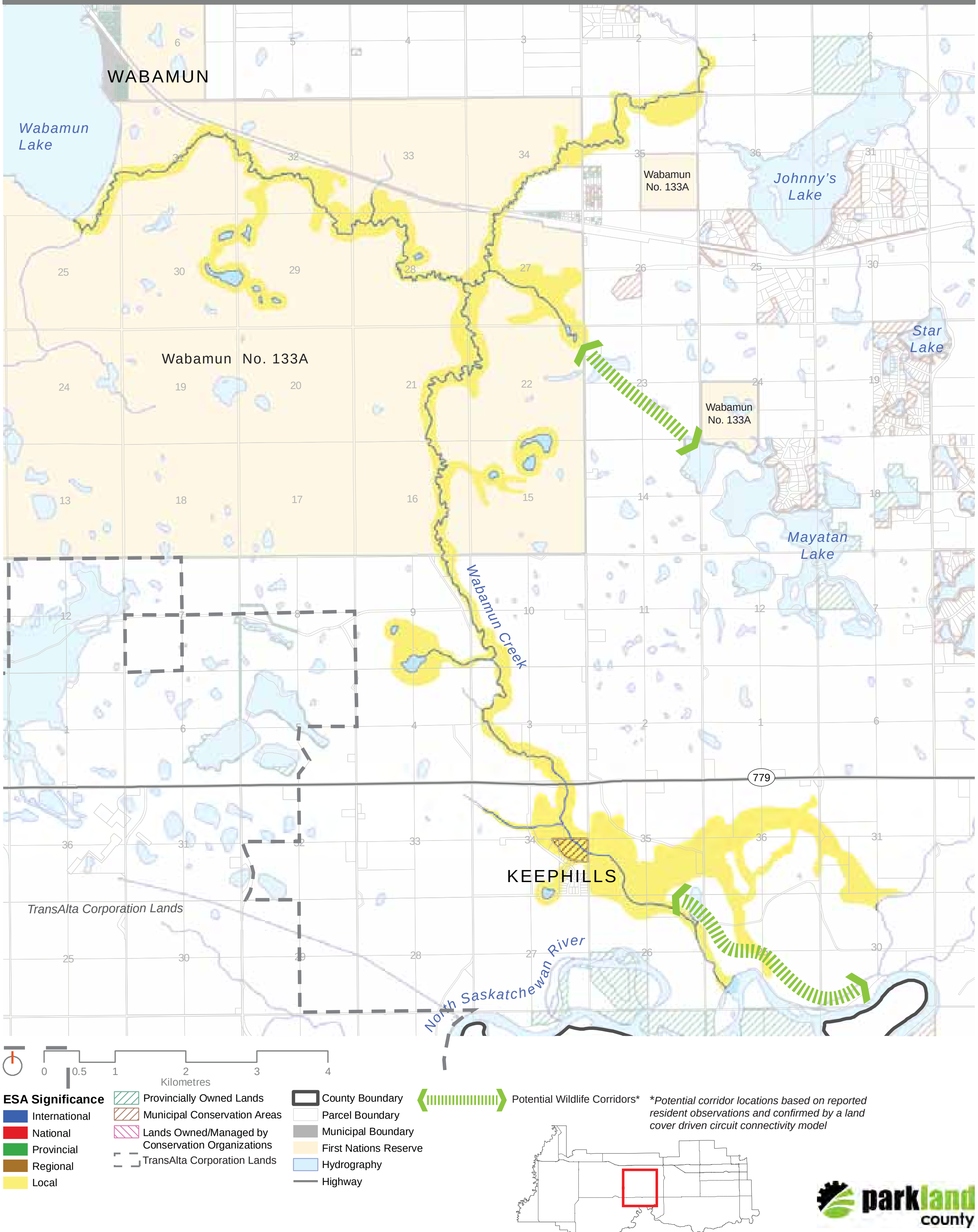
Description:

Wabamun Creek flows from Wabamun Lake, following a meltwater channel into the North Saskatchewan River. Wabamun Creek is fairly intact over major portions of the drainage into the North Saskatchewan River, and parts of the creek run through very steep ravines which protect the habitat from development. Vegetation communities along the creek include riparian shrubs, aspen/balsam forest, white spruce, and mixedwood. In the vicinity of the community of Keephills, fairly contiguous adjacent forest blocks are present and white spruce and jack pine dominate much of this area. Just east of Keephills, Wabamun Creek runs through a deep valley, and has some older stands of spruce and aspen/poplar, providing habitat for a diversity of birds. Lands east of the creek are used primarily for intensive agriculture; however, some large stands of spruce remain.

The area has barred owl, northern goshawk, and pileated woodpecker ("Sensitive" species) records; species typically found in larger older-aged forests. There are also a significant number of records of Canadian toads ("May Be At Risk") around the creek.

The creek provides linkage between the North Saskatchewan River valley and Wabamun Lake, and likely functions as a movement corridor for wildlife. Wabamun Creek is an important spawning area for lake sturgeon from North Saskatchewan River. It also provides habitat for suckers and forage fish, and possibly yellow perch and northern pike.

WABAMUN CREEK ESA



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Wabamun Creek ESA

Environmental Sensitivity: Very High

- High erosion risk
- 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

Westland Park ESA

Westland Park ESA

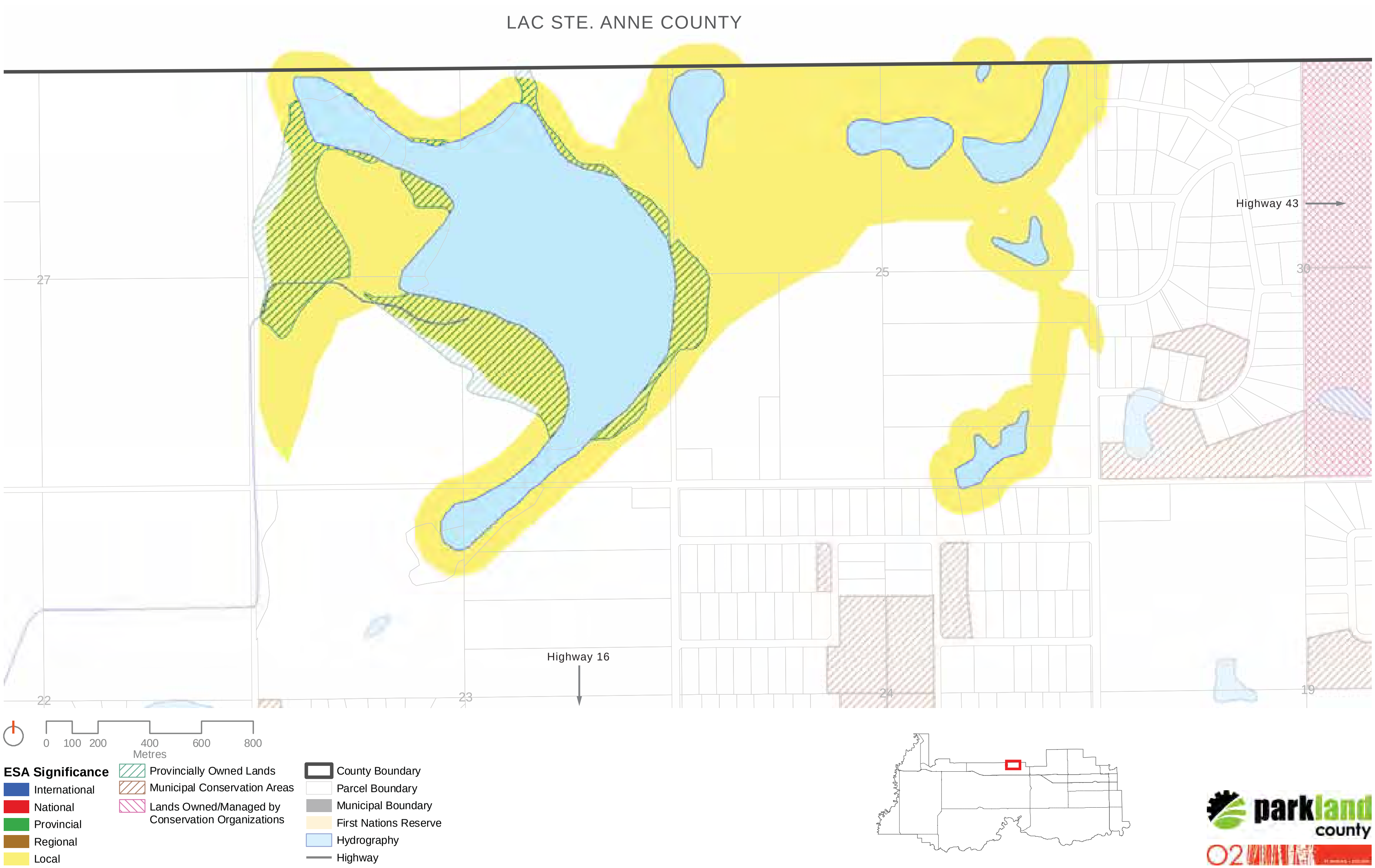
Site Location: North of Highway 16, West of Range Rd 32, East of Meso Rd.

Area: 358 ha

Description:

The Westland Park is an area identified for the presence of a very large wetland, as well as its contribution to regional connectivity, providing an important stepping stone across the northern extent of the county. It neighbours the Manly Corner ESA, and contains considerable wetland habitats, as well as forested areas, shrubs, disturbed areas, and exurban development. Its placement northeast of Lake Wabamun makes it an important refuge for wildlife during movement north and eastward. Groundwater risk models suggest this area is sensitive to groundwater contamination.

WESTLAND PARK ESA



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Westland Park ESA

Environmental Sensitivity: Very High

- Risk of groundwater contamination
- Sensitive riparian areas
- Potential for rare plant occurrences

Land Status:

- Private land

Key features:

- Important stepping stone for wildlife movement north and eastward
- Sensitive to groundwater contamination
- Encroaching development to the southeast

Recommended Planning Strategies:

- Development to the southeast should be carefully planned to ensure it does not disrupt wildlife movement patterns or impact groundwater
- Riparian areas should be maintained as refuge for rare plants and as corridors for wildlife movement

Wildlife Point ESA

Wildlife Point ESA

Site Location: South of Lake Shore Rd on the northern shore of Lake Wabamun

Area: 47 ha

Description:

Also known as “Coal Point”, this important jut of land reaches into Lake Wabamun from the north, nestled between the Lake Wabamun and Fallis Slopes ESAs. The area is known for its rich biodiversity, despite its location near extensive lake shore development. Mixedwood forest predominates, interspersed with wet areas. Its location makes it an important stop for wildlife crossing the lake from the south, as well as those travelling east-west along the northern shoreline.

WILDLIFE POINT ESA

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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.

Devonian Botanical Garden

Devon Dunes ESAs

The Devon Dunes LU contains 6 identified ESAs, two of which are regionally significant: the Clifford E. Lee Natural Area ESA and the Devonian Gardens ESA.

This LU is characterized sandy soils originating from glacial activity, as well as many small lakes and wetlands. Several of the lakes and wetlands in the area, especially those in the Deer Lake Area ESA, have been drained in recent years to reduce the impact of flooding on residential areas (Clarke, 2013). Drainage in the area has led to concerns over the potential impact to nearby sensitive wetland areas, such as the Clifford E. Lee Nature Sanctuary.

This section presents a detailed portrait of each ESA in the Devon Dunes LU, including a summary of recommended planning strategies specific to each ESA. For more information on best management practices for ESAs, please see Section 4 : Best Management Practices.

Clifford E. Lee Natural Area ESA

Clifford E. Lee Natural Area ESA

Site Location: This site is located southwest of Edmonton, with access from Highway 60, Woodbend Road and south onto Range Road 264.

Area: This ESA is comprised of the Nature Sanctuary, Natural Area, Municipal Park Reserve and surrounding wetlands and uplands. These areas combined equal 315 ha.

Description:

This ESA is comprised of the Clifford E. Lee Nature Sanctuary, Natural Area, Municipal Park Reserve and wetlands and uplands that are in the neighbouring areas. The ESA is situated on a large sandy lake bed, which was a result of a retreating glacier approximately 10,000 years ago. The sanctuary and surrounding area is a complex of mineral wetlands located in a meltwater channel, jack pine forests, open meadows, pothole wetlands skirted by willows, and some pockets of boreal forest and aspen parkland. Underground springs found within the sanctuary are an important local source of water.

The diverse landscape within this area provides key habitat for over 100 bird species, over 100 flowering plant species, and several mammals. Deer, moose, coyotes, beavers, muskrats, northern flying squirrel, snowshoe hare and black bears are among the mammals observed here. Wildflowers are also abundant, and include species like wild lily-of-the- valley, wintergreen, yellow lady's slipper, fringed gentians, and evening primrose.

The sanctuary was designated in the Special Places program in 1995. Lee Nature Sanctuary Society manages Clifford E. Lee Nature Sanctuary on behalf of Ducks Unlimited Canada. This area is visited by approximately 5,000 nature enthusiasts and school children per year. The boardwalk and established trail system make it a fascinating area for wildlife viewing.

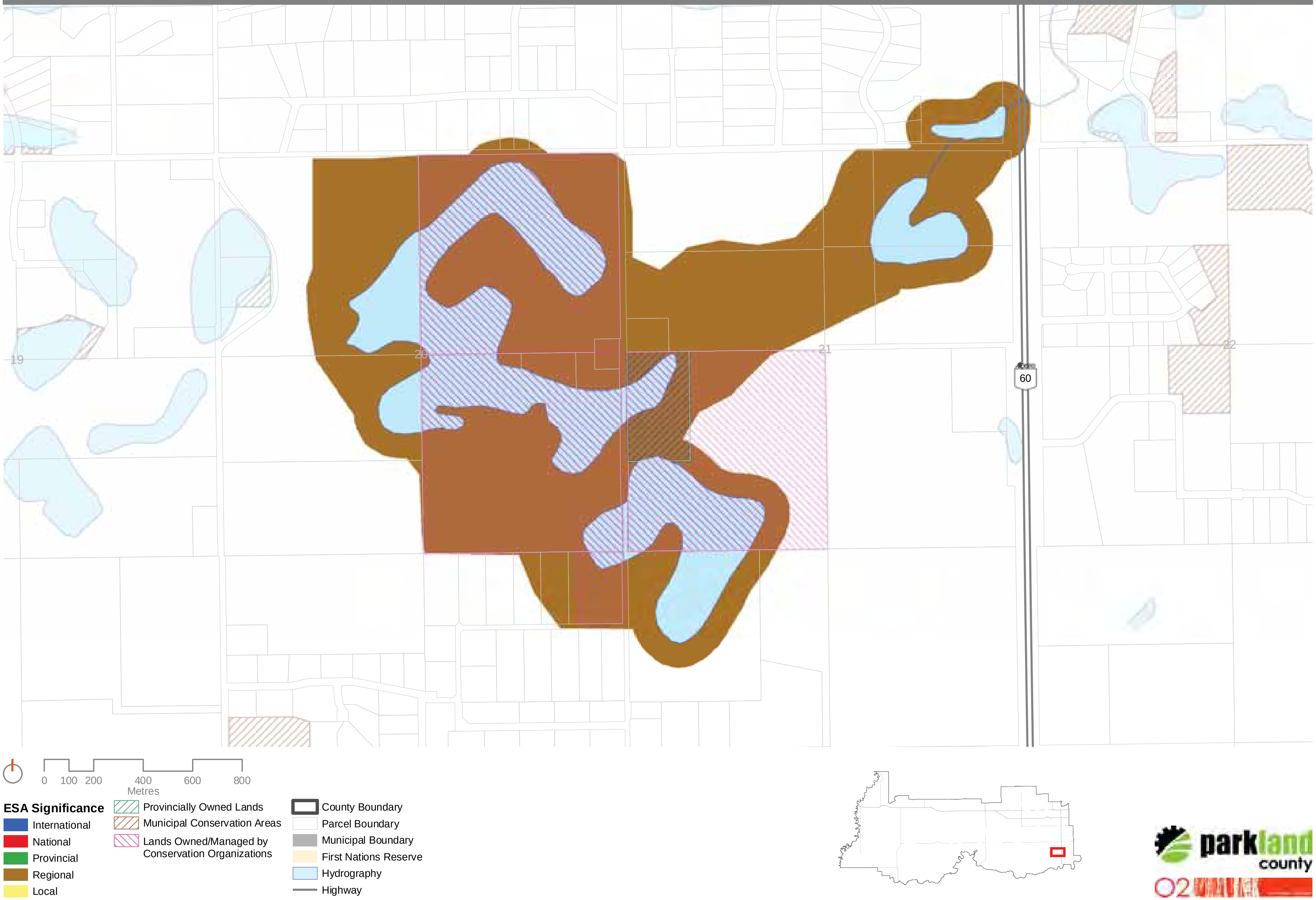
CLIFFORD E. LEE NATURE SANCTUARY ESA

SIGNIFICANCE: Regional

Habitats which support substantial populations of rare or uncommon plants and/or animals in the County

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas

CLIFFORD E. LEE NATURE SANCTUARY AND AREA ESA



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Clifford E. Lee Natural Area ESA

Environmental Sensitivity: Very High

- Due to heightened groundwater sensitivity

Land Status:

- This area has parcels with a variety of land statuses, including Sanctuary, Natural Area, Municipal Park Reserve – Conservation, and some are under private ownership.

Key features:

- Diverse complex of natural ecosystems including uplands and wetlands
- Highly visited due to its Special Places designation and wildlife viewing opportunities

Recommended Planning Strategies:

- Alteration of drainage in surrounding areas will impact the hydrology in this ESA. The outlet channel for the wetlands should be protected.
- There are risks of introducing agricultural runoff into wetlands from surrounding areas. An adequate upland buffer should be maintained around the wetlands to mitigate these risks.
- It will be important to protect the local ground water aquifer by maintaining native plant cover and limiting drainage from shallow ground water sources on the surrounding landscape
- Ensuring the water quality and quantity of the upstream water sources (Deer Park and Woodland Park) is important in sustaining the integrity of the wetlands in this natural area
- Eradication and/or aggressive control of weed species such as purple loosestrife are essential for the long-term viability of the sanctuary's wetlands and natural habitats

Devonian Botanical Garden ESA

Devonian Botanical Garden ESA

Site Location: The Devonian Botanical Garden is located 5 km north of Devon on Highway 60.

Area: 77 ha

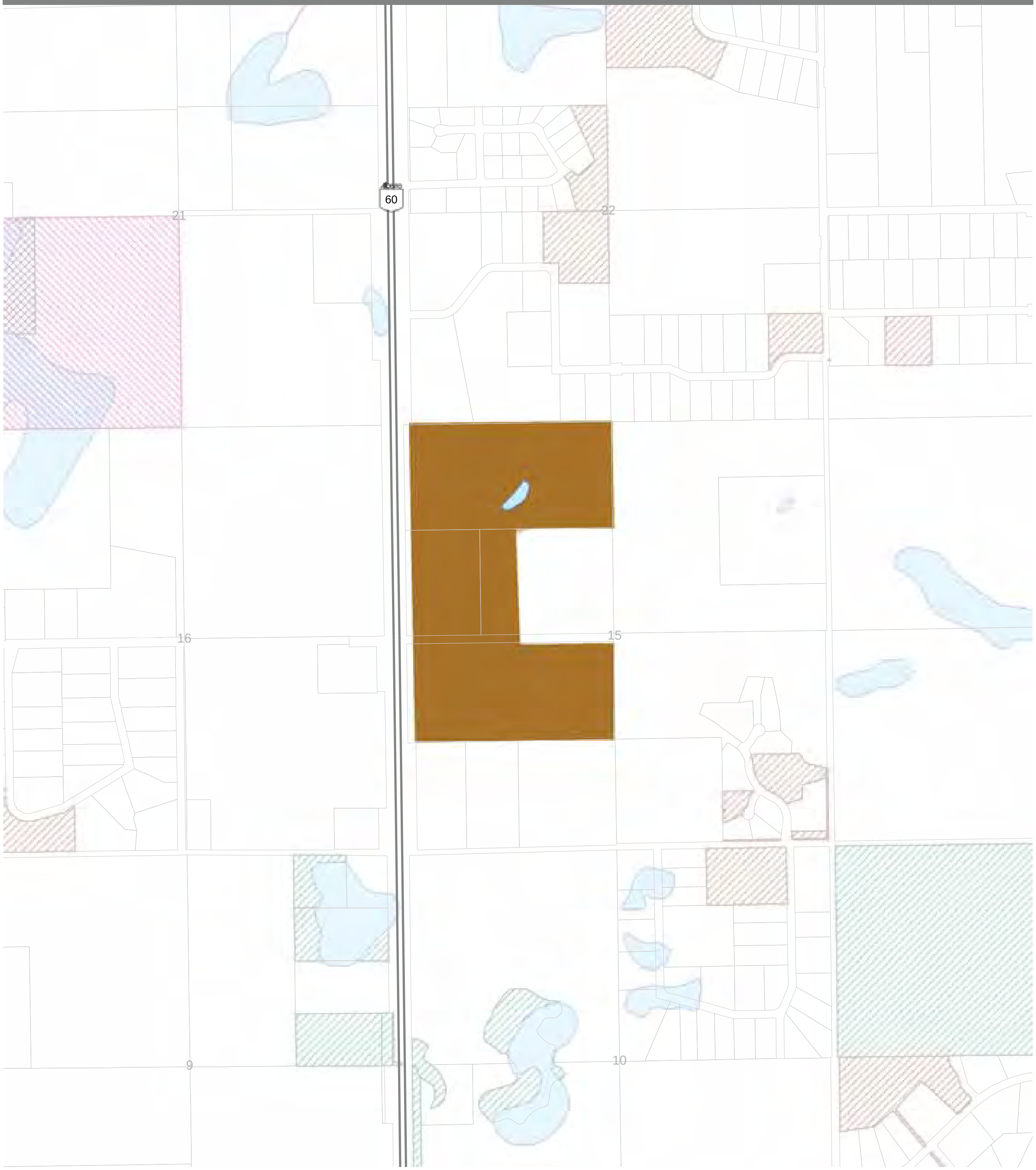
Description:

The Devonian Botanical Garden is located within the Devon Dunes that represent the former shore of glacial Lake Edmonton. Sandy soils and a high water table characterize this area, as well as a highly sensitive aquifer.

Native flora and fauna can be observed in the complex of manmade gardens and natural areas. The botanical garden is a regional educational centre for horticultural and environmental collections of living plants and fungi. It provides a live herbarium for native Alberta species and specimens of botanical, horticultural, historical, medicinal, and worldwide geographic significance. Multidisciplinary research is conducted for wetland ecology, biology of microfungi and mycorrhizas, horticulture and phenology.

Native plant communities in the area include treed, shrubby and graminoid fens; willow thickets; and balsam poplar and jack pine forests. The tamarack fen is found within a peatland and contains a unique species-rich understory. The balsam poplar community is in a moist area and is rich in herbaceous and woody plants, such as wild rose, low-bush cranberry, and bracted honeysuckle. The jack pine community occurs on well-drained, sandy ridges, and is characterized by jackpine with some white spruce regeneration in the understory. A series of trails in natural areas provides the public with opportunities to examine the sand dune ecology of the Garden. Natural areas of the Garden support high faunal diversity including numerous insects, mammals, and birds.

DEVONIAN BOTANICAL GARDEN ESA

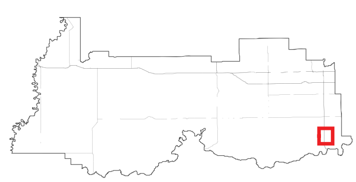


0 75 150 300 450 600
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Devonian Botanical Garden ESA

Environmental Sensitivity: Very High

- Due to a high incidence of rare plant occurrences and groundwater sensitivity

Land Status:

- Operated by the University of Alberta

Key features:

- Unique complex of manmade gardens and natural upland and wetland areas
- Educational facility that supports academic research
- Features collections of Alberta plant specimens

Recommended Planning Strategies:

- The ecological integrity and biodiversity of the site may be more susceptible to impacts due to its relatively small size and the intensity of surrounding residential development
- Maintaining connectivity with adjacent natural habitats may be beneficial in preserving ecological integrity and biodiversity


Deer Lake Area ESA

Deer Lake Area ESA

Site Location: This site is in the vicinity of Deer Lake Estates and other country residential subdivisions. It is also south and east of the Clifford E. Lee Nature Sanctuary.

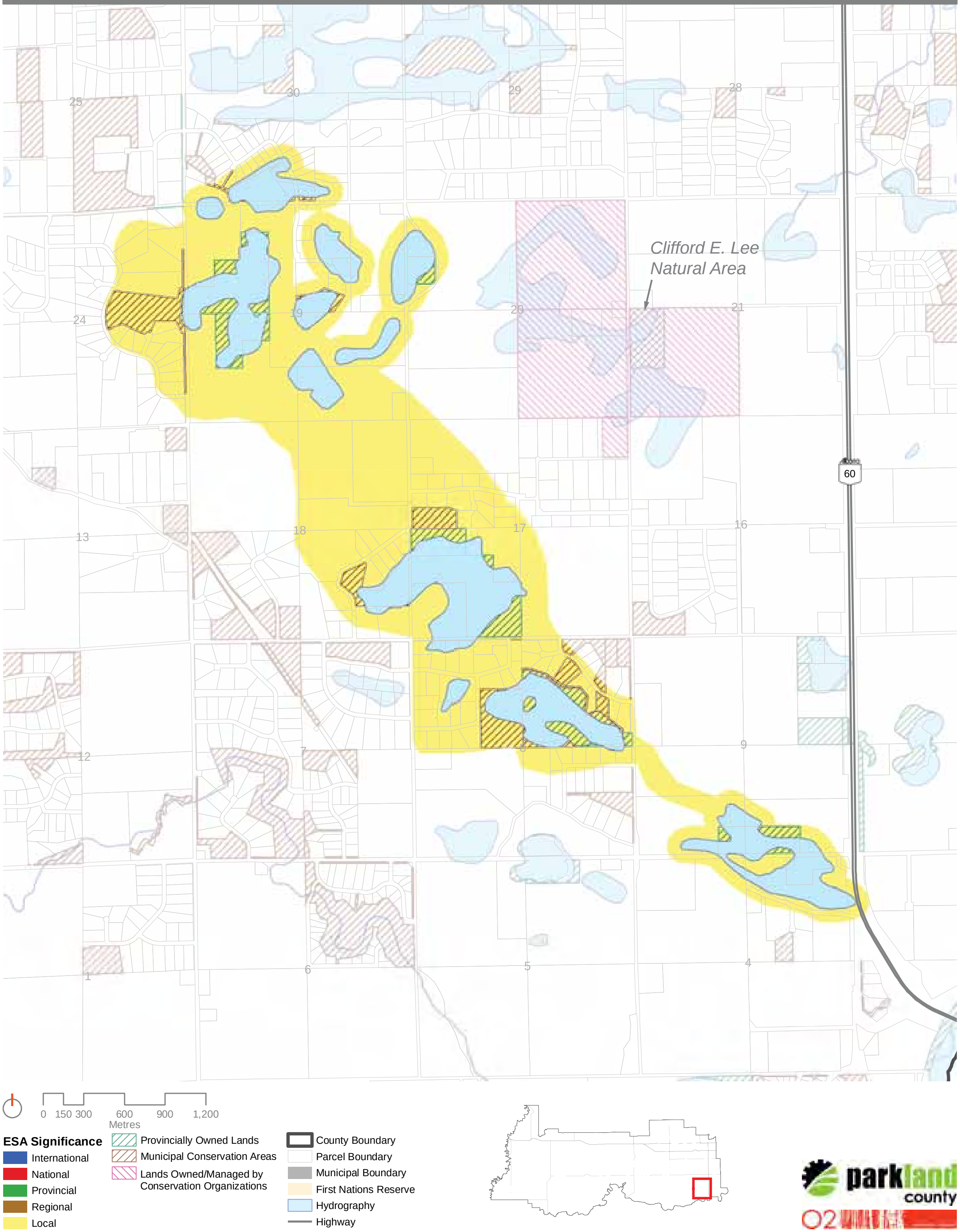
Area: 738 ha

Description:

The Deer Lake Area ESA includes a series of shallow lakes and wetlands surrounded by a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1] This large area features lakes and wetland areas with emergent shoreline vegetation, interspersed with upland forests such as pine, aspen, balsam, white spruce, and birch. These unique landscape features make it a productive area for a wide variety of flora and fauna, and functions as an important groundwater recharge area.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

DEER LAKE AREA ESA



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Deer Lake Area ESA

Environmental Sensitivity: High

- 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

Devon Dunes/Parkland Syndicate ESA

Devon Dunes/Parkland Syndicate ESA

Site Location: The Devon Dunes lie in the southeast corner of the county, directly east of Devonian Gardens.

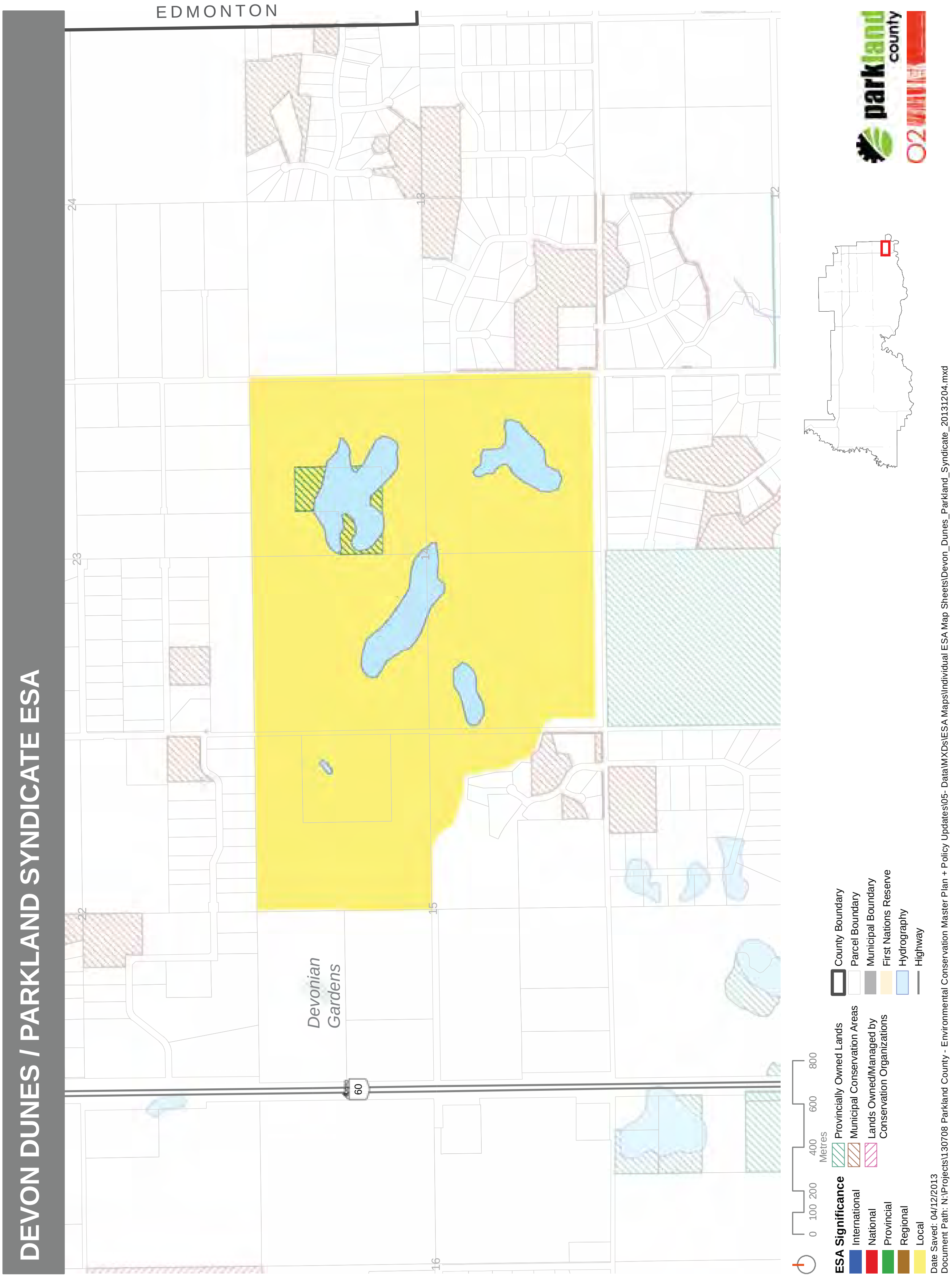
Area: 335 ha

Description:

During the latter part of the last glaciation, ice melted in rivers from the glaciers that covered the west part of the county. The meltwater created channels, deltas, and lakes on the east side of the county, draining into glacial Lake Edmonton. Fine and coarse materials were deposited from Carvel to Stony Plain and north of Devon. The former lake basin is responsible for developing the best agricultural soils in the area. Devon Dunes represent a field of sand dunes that were formed from the coarse deltaic sediments.

Post glacial winds blew these delta sands into unique landscape features, including parabolic and elongated dune shapes. Additional examples of these types of dunes can be found near Redwater and south of Peers, Alberta.

The groundwater aquifer is close to the surface in this location. The combination of this feature, and the highly permeable sandy soils, make the aquifer highly susceptible to contamination. This highly sensitive area of Parkland County is also subject to intensive development pressures and requires careful management.


DEVON DUNES / PARKLAND SYNDICATE ESA
EDMONTON
Devonian Gardens
60
24
23
22
18
12
15
16
0 100 200 400 600 800
Metres
ESA Significance
International
National
Provincial
Regional
Local
Provincially Owned Lands
Municipal Conservation Areas
Lands Owned/Managed by Conservation Organizations
County Boundary
Parcel Boundary
Municipal Boundary
First Nations Reserve
Hydrography
Highway
parkland county
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Devon Dunes/Parkland Syndicate ESA

Environmental Sensitivity: High

- Highly sensitive groundwater aquifer in the sand dune area
- The aquifer is shallow and the overlying sands are very permeable

Land Status:

- The majority of lands in this area are privately owned

Key features:

- Unique landscape and plant community features due to sand dune formations
- Sensitive and permeable soils make this area highly sensitive to intensive development
- Underlying aquifer is highly sensitive to contamination due to permeable soils

Recommended Planning Strategies:

- Due to the high soil permeability and close proximity to the aquifer, waste disposal, storm water run-off and grey water from country residential subdivisions should be carefully managed
- Spills of industrial or agricultural waste that could enter the aquifer are a significant concern in this area and specific mitigations for soluble contaminants should be considered
- Intensive residential development, which accesses groundwater resources for potable water, needs to be minimized. If not, alternative means to provide "hauled-in" water must be considered.


Spanish Oakes ESA

Spanish Oakes ESA

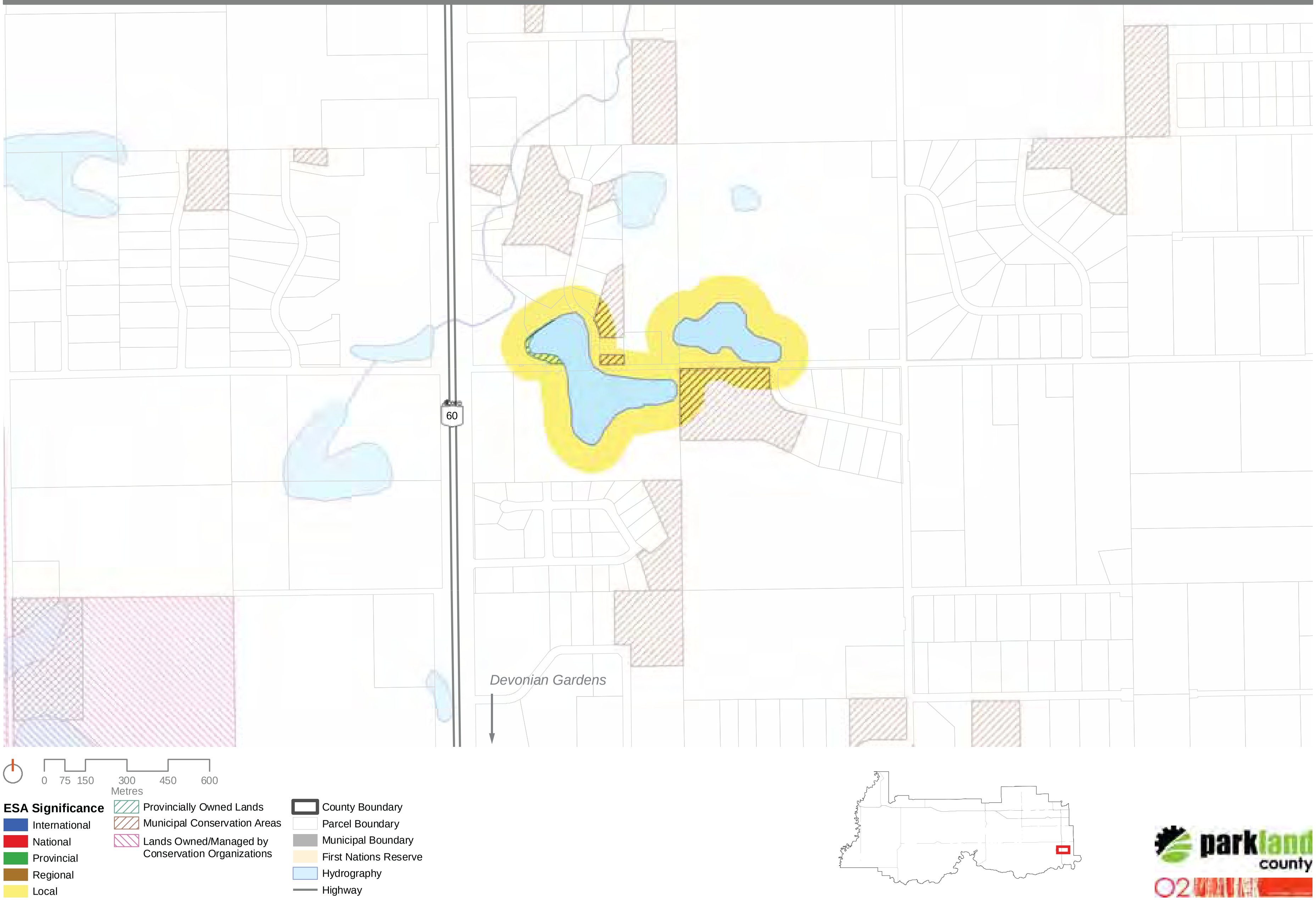
Site Location: This ESA can be found east of Highway 60 at Township Road 514.

Area: 46 ha

Description:

This ESA is a complex of permanent marsh wetlands found between a series of subdivision developments. Permanent wetlands within residential areas are important landscape features and provide valuable ecological goods and services. The functions and benefits these wetlands provide relate to water storage, nutrient removal, wildlife habitat, and public recognition.

SPANISH OAKES ESA



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Spanish Oakes ESA

Environmental Sensitivity: Very High

- Very high groundwater sensitivity
- Some lakeshore present (pond areas)

Land Status:

- The parcels in this ESA include a combination of privately owned land and County owned land
- It also includes portions of the Woodbend and Woodridge subdivisions

Key features:

- Class V permanent wetlands, responsible for recharging local groundwater supplies
- Habitat for waterfowl and other wildlife

Recommended Planning Strategies:

- These wetlands are under development pressure from surrounding subdivision developments. It will be important to ensure setbacks are established to preserve the ecological functions of these wetlands.
- Local residents should be aware of the effects and consequences of fertilizer and pesticide runoff on local wetlands
- Groundwater disturbances resulting from residential development should be minimized. These disturbances include private individual well drilling and potential contamination from onsite sanitary systems.

Woodland Park Wetlands Complex ESA

Woodland Park Wetlands Complex ESA

Site Location: 10 km northwest of the Town of Devon, west of Highway 60 and north of Township Rd. 514

Area: 363 ha

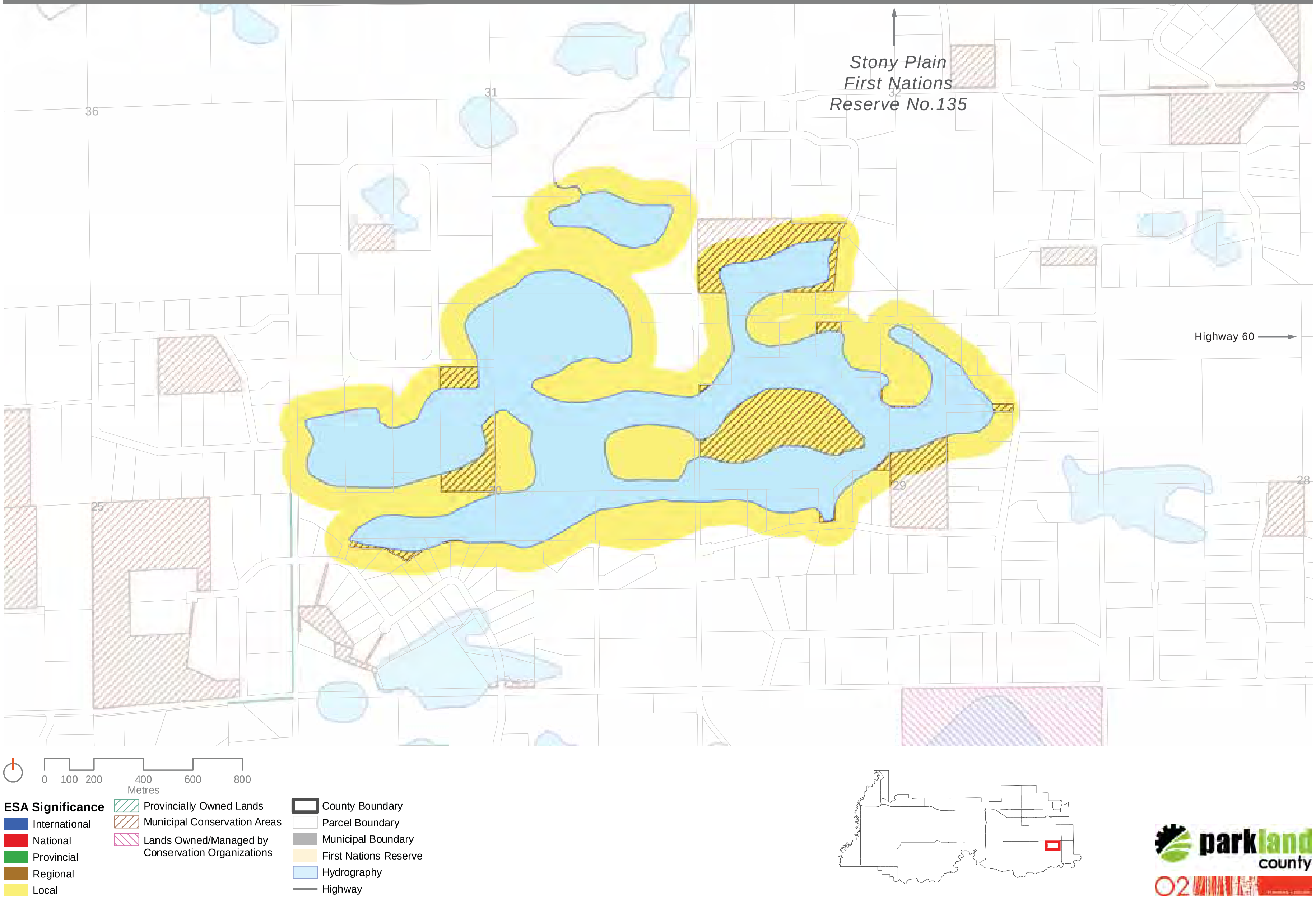
Description:

The Woodland Park Wetlands Complex ESA is comprised of several shallow lakes and wetlands buffered by a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1] . This large wetland complex is bounded by the Woodland Park subdivision. It is an area formerly established and maintained by the Buck For Wildlife program, with the cooperation and participation of the Devon Fish and Game Association and Parkland County.

The wetlands contain expansive emergent vegetation zones with cattails, rushes and sedges. Forests surrounding the wetlands include several large balsam poplar and trembling aspen stands. A large number and variety of duck species make use of the area for habitat.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

WOODLAND PARK WETLAND COMPLEX ESA



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Woodland Park Wetlands Complex ESA

Environmental Sensitivity: Very High

- High groundwater vulnerability identified in the area due to sandy soils
- Riparian and lakeshore habitats present

Land Status:

- Large amount of County-owned land for central wetland portions, many private lands along the edges of the wetland complex

Key features:

- Large wetland complex
- High groundwater vulnerability in area

Recommended Planning Strategies:

- Maintain a healthy, well vegetated buffer around the wetland complex
- OHV use appears to be common in the area and requires improved stewardship
- Potential groundwater contamination from properties within and adjacent to the wetlands
- Disturbances to the groundwater system, including residential development which utilizes private individual well drilling and onsite sewage systems, may result in groundwater contamination. These disturbances should be minimized.

North Saskatchewan River Valley ESAs

The North Saskatchewan River Valley has been classified into three separate ESAs by reach: the Burtonsville Island Reach (from the southwestern County boundary to south of Keephills), the central Sturgeon Hole Reach from south of Keephills to Highway 770, and the eastern reach from Highway 770 to the County's boundary with Edmonton. The North Saskatchewan is one of Canada's outstanding heritage rivers. This extensive river corridor provided a major east-west link across Canada, facilitating exploration, trade, and settlement for more than 100 years from the time explorers and fur traders first travelled through the area in 1807. The descriptive name is taken from the Cree term, kis-is-ska-tche-wan, meaning swift current.

The North Saskatchewan River valley supports a high diversity of plant communities, reflecting local variation in aspect, moisture regime, and slope position. Grassland-shrub and deciduous communities tend to characterize drier, warmer south-facing slopes. White spruce and conifer-dominated mixedwoods are typically associated with cool, moist north-facing slopes and adjacent ravines. Deciduous and mixedwood stands occur along much of the top of the bank.

The river valley is one of the most productive white-tail and mule deer corridors in Alberta. Within Parkland County, the valley is also important habitat for moose and elk. Larger carnivores including black bear, cougar, coyote, and marten use the river as a protected movement corridor. Many of the bluffs along the steep riverbanks are significant historic nesting and observation sites for the peregrine falcon and bald eagle. Songbird diversity is high in the river valley corridor due to the range of habitat types. Older-aged forested stands provide habitat to wood warblers, forest hawks, and owls. The river is also used as a staging area in spring and fall migration for waterfowl. The North Saskatchewan River provides significant wintering, spawning, and rearing habitat for a multitude of fish species, including: mountain whitefish, longnose dace, flathead chub, lake chub, fathead minnow, emerald shiner, longnose sucker, mountain sucker, trout-perch, Iowa darter, sauger, walleye, and spoonhead sculpin.

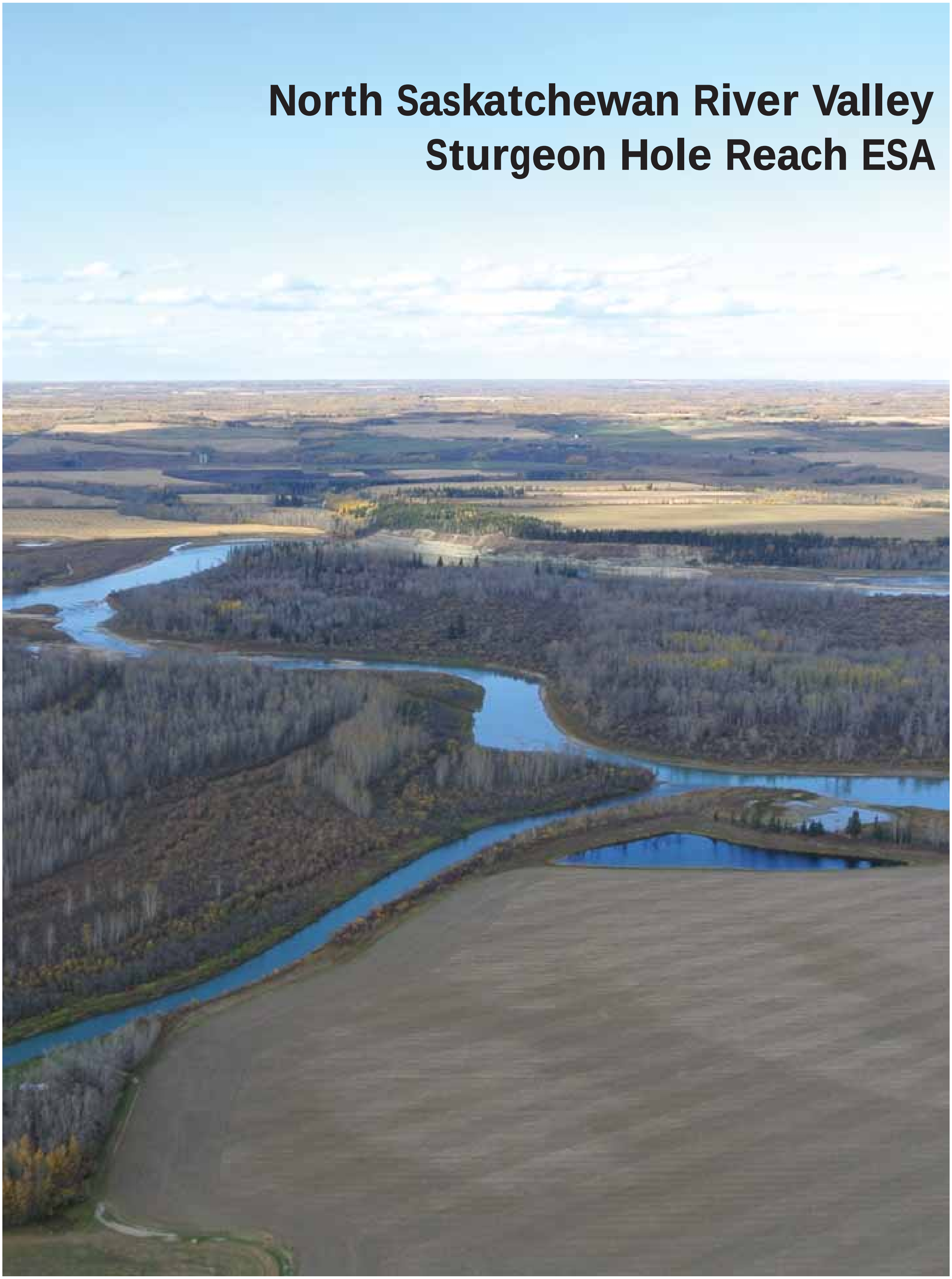
The eastern half of the North Saskatchewan River Valley was incised entirely during the postglacial period, whereas the western half from Tomahawk to Keephills follows the Beverly Buried Valley. The morphology of the valley is relatively narrow (less than 1.6 km wide), with steeply inclined walls approaching 60 m in height. Exposed geological sections provide opportunities to view or study the province's geological history (e.g., bedrock formations or interesting geological features such as palaeosols and buried volcanic ash layers).

Through the evaluation process, it has been determined that the Sturgeon Hole Reach is of National significance, while the other reaches are of Provincial significance. Riparian areas of major rivers and their contributing tributaries are very highly sensitive and valuable habitats. The major features of each ESA in the North Saskatchewan River Valley are presented in Table 9 and described in detail below.

Environmentally Significant Area (ESA)	Significance	Sensitivity	Page no.
North Saskatchewan River Valley Sturgeon Hole Reach ESA	National	Very High	276
North Saskatchewan River Valley Burtonsville Island Reach ESA	Provincial	Very High	280
North Saskatchewan River Valley Highway 770 to Edmonton Reach ESA	Provincial	Very High	284


North Saskatchewan River Valley

North Saskatchewan River Valley Sturgeon Hole Reach ESA



North Saskatchewan River Valley Sturgeon Hole Reach ESA

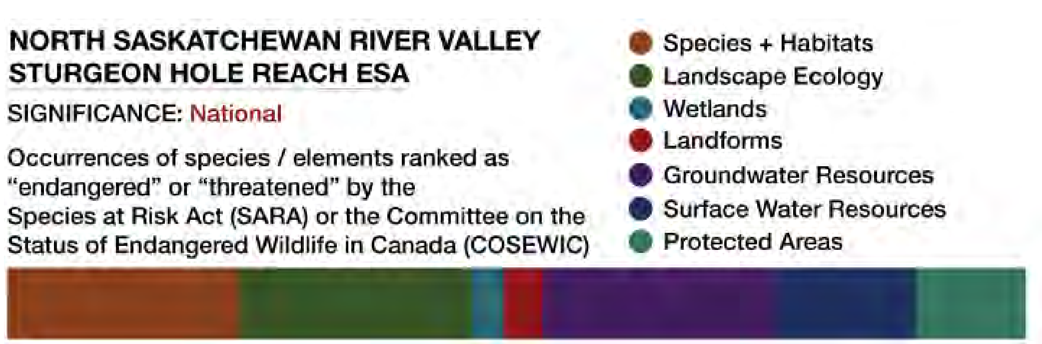
Site Location: This ESA is around the confluence of Wabamun Creek and the North Saskatchewan River, and downstream to approximately the Highway 770 river crossing. The south side of the river channel is within Leduc County.

Area: 1,622 ha

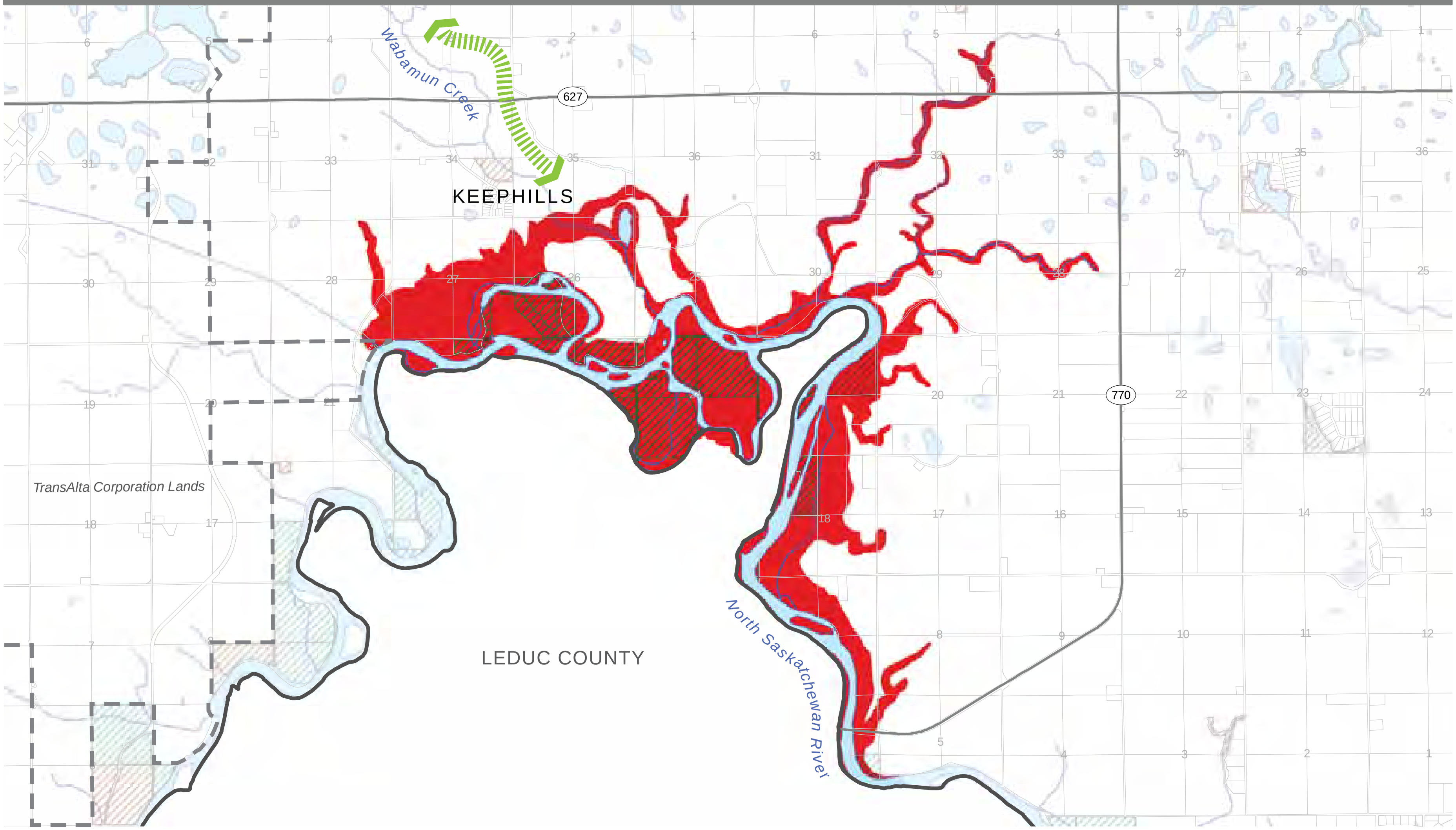
Description:

The ESA incorporates the river valley system south of the Hamlet of Keephills as well as adjacent ravine systems that extend outwards from the river valley. This area provides the only sturgeon hole that occurs along the North Saskatchewan River within Parkland County, and is considered a “Class A” water body for fish by the province due to presence of the sturgeon spawning habitat . Backwaters in the area provide low flow velocities and depositional areas suitable for rearing of a number of fish species, including COSEWIC listed endangered lake sturgeon.

The section of river in this particular ESA is located in a transitional area whereby upstream, the channel is unconfined, meandering, with multiple side channels, oxbows, islands, and bars. Downstream, the river is confined and sinuous, with a narrow flood plain. The varied landscape features include deep scour pools, deep runs, side channels, shoals, and bars. Notable wildlife seen in this area include sawhet owls, red sided garter snakes, blue herons, pileated woodpeckers and a wide variety of plant species. Landscape connectivity across the areas is considered to be high. Other potential species observed in the area include merlins, kestrels, ladyslipper flowers, and both tundra and trumpeter swans.



NORTH SASKATCHEWAN RIVER VALLEY STURGEON HOLE REACH ESA



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Kilometres

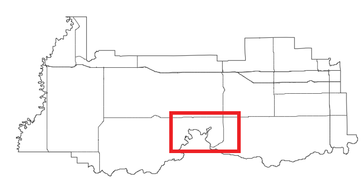
ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations
- TransAlta Corporation Lands

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway

Potential Wildlife Corridors*

*Potential corridor locations based on reported resident observations and confirmed by a land cover driven circuit connectivity model



parkland county

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North Saskatchewan River Valley Sturgeon Hole Reach ESA

Environmental Sensitivity: Very High

- Moderately erodible soils
- High groundwater sensitivity
- Observations of rare plants
- Presence of sensitive riparian areas

Land Status:

- All areas surrounding major rivers are owned by the Crown, and several parcels in the central portion of the ESA are provincial Crown lands
- However, large portions of the river valley area away from the river as well as adjacent ravine systems are privately owned

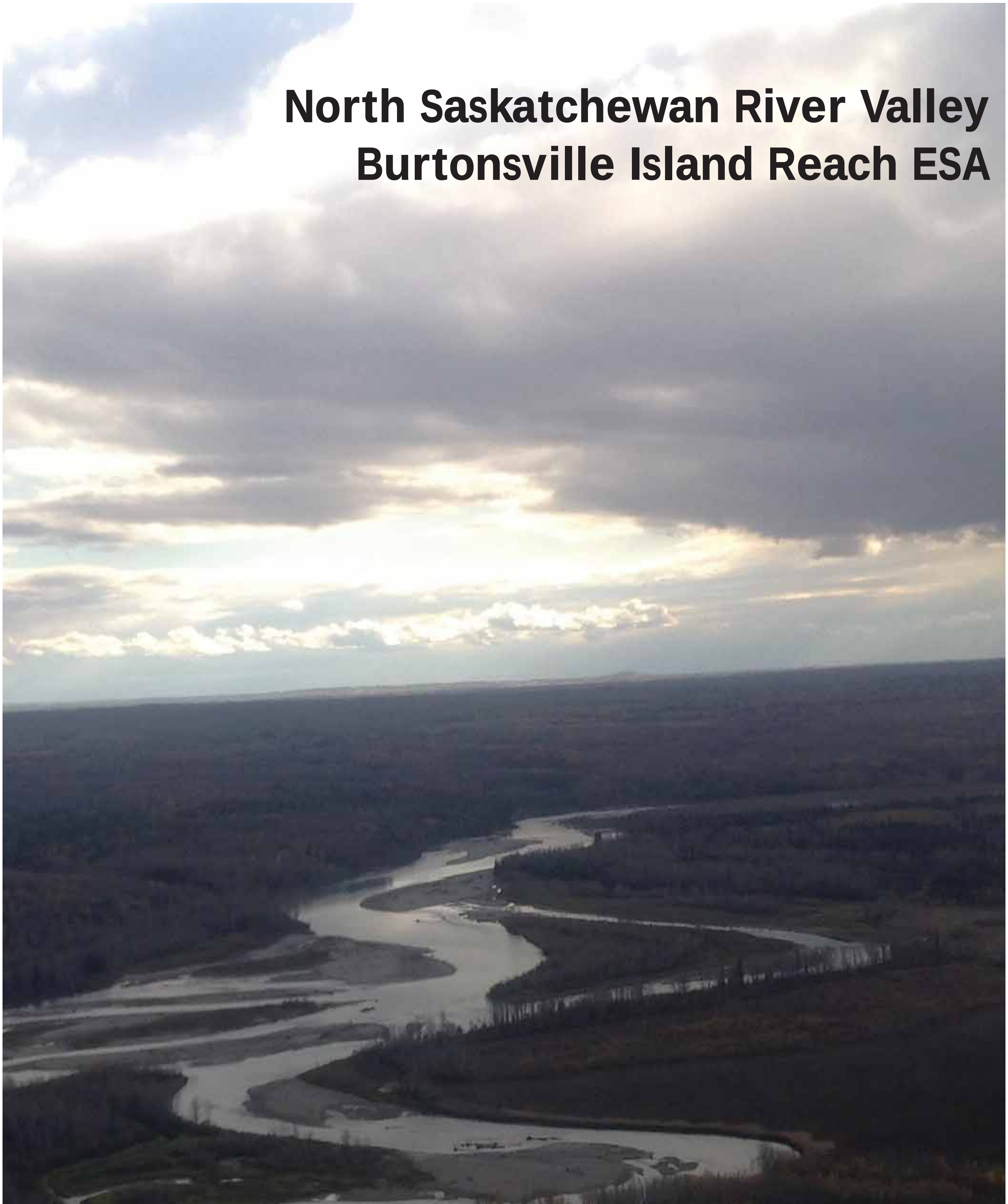
Key features:

- Highly diverse section of the river valley that is suitable for lake sturgeon spawning and rearing

Recommended Planning Strategies:

- Caution should be exercised with approving gravel operations, livestock grazing, and use of ATVs and dirt bikes. Maintaining buffer zones of natural vegetation would help to prevent erosion, and sustain the river valley as a wildlife corridor.
- There is a high concentration of existing gravel pits immediately upstream from the area. Gravel pit operators should be made aware of the status of this ESA and best management practices should be implemented by new and existing operators to address the assets and vulnerabilities of this ESA
- Maintaining buffer zones around historical peregrine falcon nest sites may be important for future recovery of this threatened species
- No in-stream activities or developments should be permitted in this area

North Saskatchewan River Valley Burtonsville Island Reach ESA



North Saskatchewan River Valley Burtonsville Island Reach ESA

Site Location: This ESA is located in the North Saskatchewan River Valley near Burtonsville Road.

Area: 6,388 ha

Description:

The Burtonsville Island Natural Area encompasses a large island and several smaller islands in the North Saskatchewan River. The Island and adjacent areas contain a mosaic of riverine and upland vegetation communities. These include riparian shrubland, deciduous riparian forest, and mature white spruce forest. The Island has been used since 1958 by the University of Alberta and the Edmonton Public School system to conduct educational programs.

Many species of birds inhabit this area due to the diversity of community types. Older forest dependent species like the pileated woodpecker, yellow-bellied sapsucker, and Tennessee warbler, as well as secondary cavity nesters like the house wren and black-capped and boreal chickadees, are found in the mature forests. Songbirds such as the cedar waxwing, white-breasted nuthatch, least flycatcher, northern oriole, and song sparrow are common, and birds of prey (red-tailed hawk and bald eagle) have been observed. The river banks provide habitat for spotted and solitary sandpipers, and belted kingfishers nest in the steep banks. Three species of amphibians (boreal chorus frog, wood frog, and western toad) have also been observed in this ESA. Waterfowl (e.g., mallard, bufflehead, common goldeneye) can be observed on the river edge and within associated ponds. The river valley is a key wildlife corridor and is important for black bear, coyote, cougar, elk, moose, and deer. Muskrat, beaver, snowshoe hare, and red squirrel can also be found inhabiting this ESA.

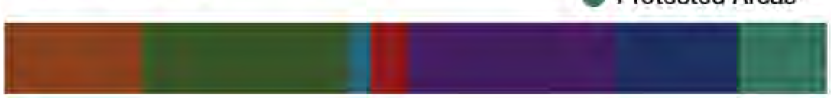
Homesteads were established in the late 1800s when loggers moved upstream in search of timber. The D.R. Fraser Lumber Company was founded at the Goose Encampment located in the Burtonsville district. The Grand Trunk Railway was established through Duffield in 1910, and a Post Office was erected in Burtonsville in 1912. The island was designated a natural area with the Wildlife 1987 centenary in the 1950s. There are anecdotal reports that trumpeter swan could potentially use this area.

NORTH SASKATCHEWAN RIVER VALLEY BURTONSVILLE ISLAND REACH ESA

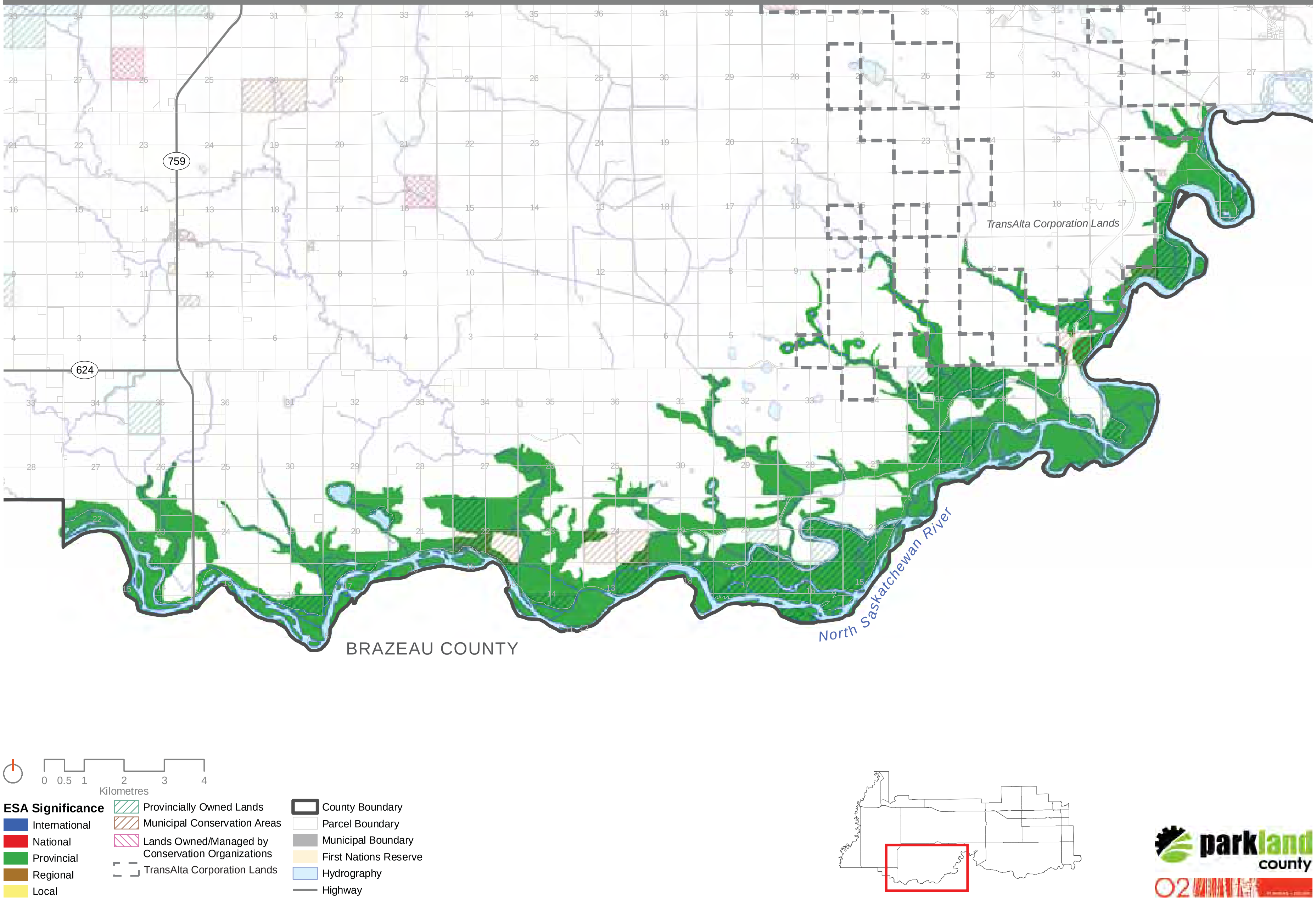
SIGNIFICANCE: Provincial

Large undisturbed patches of natural vegetation that have been disturbed in most other parts of the province

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas



NORTH SASKATCHEWAN RIVER VALLEY BURTONSVILLE ISLAND REACH ESA



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North Saskatchewan River Valley Burtonsville Island Reach ESA

Environmental Sensitivity: Very High

- Some erodible soils along the river valley escarpments
- High groundwater sensitivity
- Observations of rare plants
- Presence of riparian areas

Land Status:

- All areas surrounding major rivers are owned by the Crown
- The Burtonsville Island Natural Area and the Modeste Saskatchewan Natural Area occur in the ESA

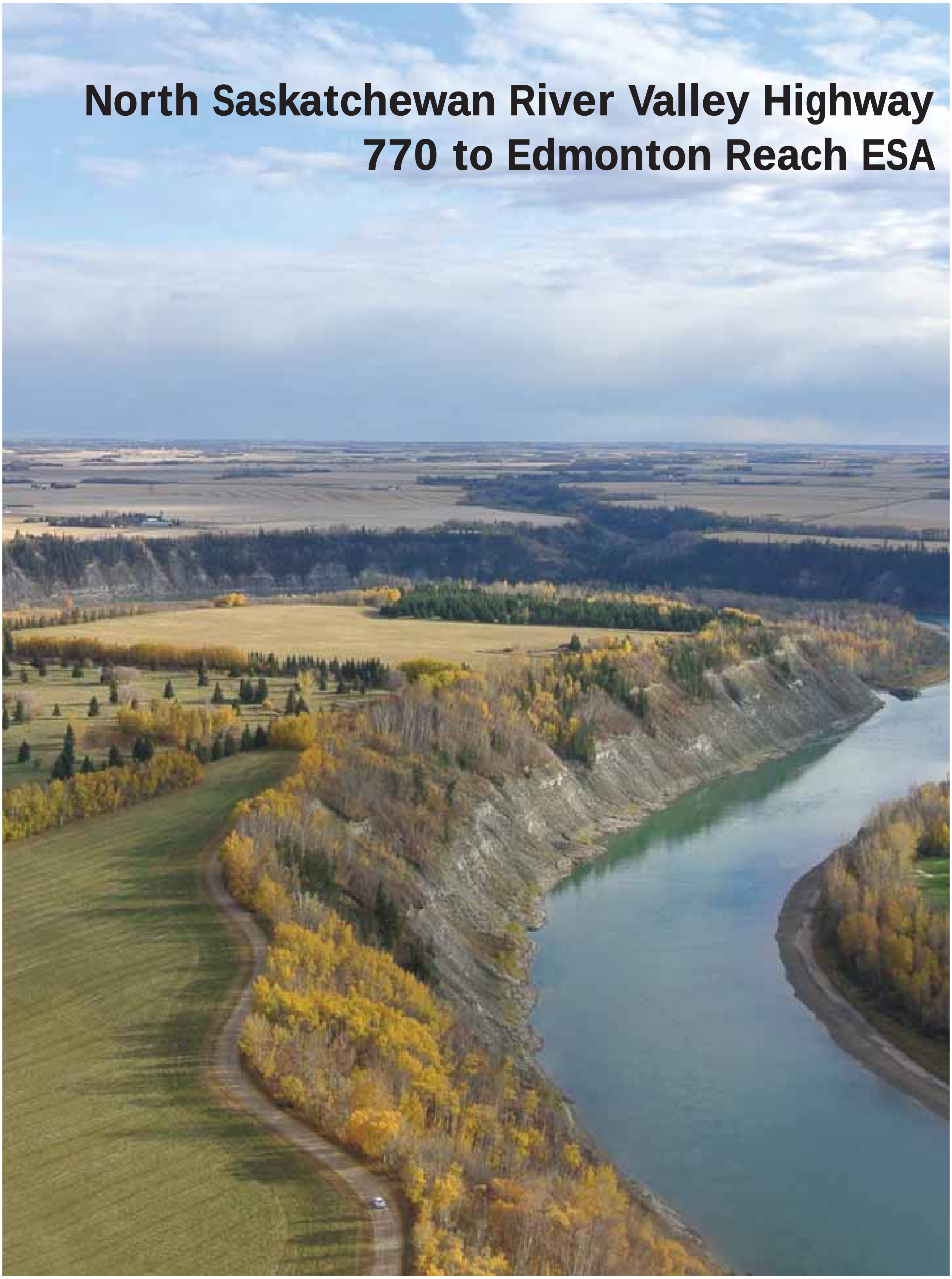
Key features:

- Highly diverse area of the North Saskatchewan River Valley that is valued for hydrological function and wildlife habitat

Recommended Planning Strategies:

- Activities currently having an adverse effect on the significant ecological and historical features associated with the North Saskatchewan River valley include gravel extraction, livestock grazing, and use of OHVs and dirt bikes. Maintaining buffer zones of natural vegetation would help to prevent erosion, and sustain the river valley as a wildlife corridor.
- Maintaining buffer zones around historical peregrine falcon nest sites may be important for future recovery of this threatened species
- The island has received minimal impact, other than some logging in the 1940's and 50's. However, the area is a well-known outdoor education destination, and disturbance mitigation is required. The Island would benefit from the development of a management plan.

North Saskatchewan River Valley Highway 770 to Edmonton Reach ESA



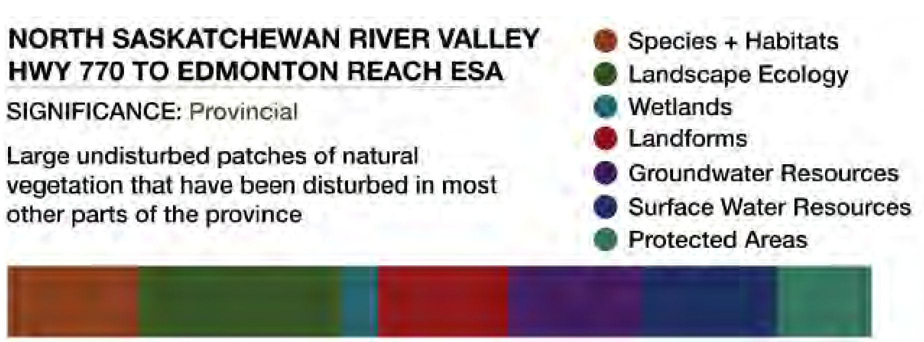
North Saskatchewan River Valley Highway 770 to Edmonton Reach ESA

Site Location: This portion of the North Saskatchewan River Valley is located between Highway 770 and eastward to Edmonton. Leduc County and the Town of Devon are located on the south side of the river channel.

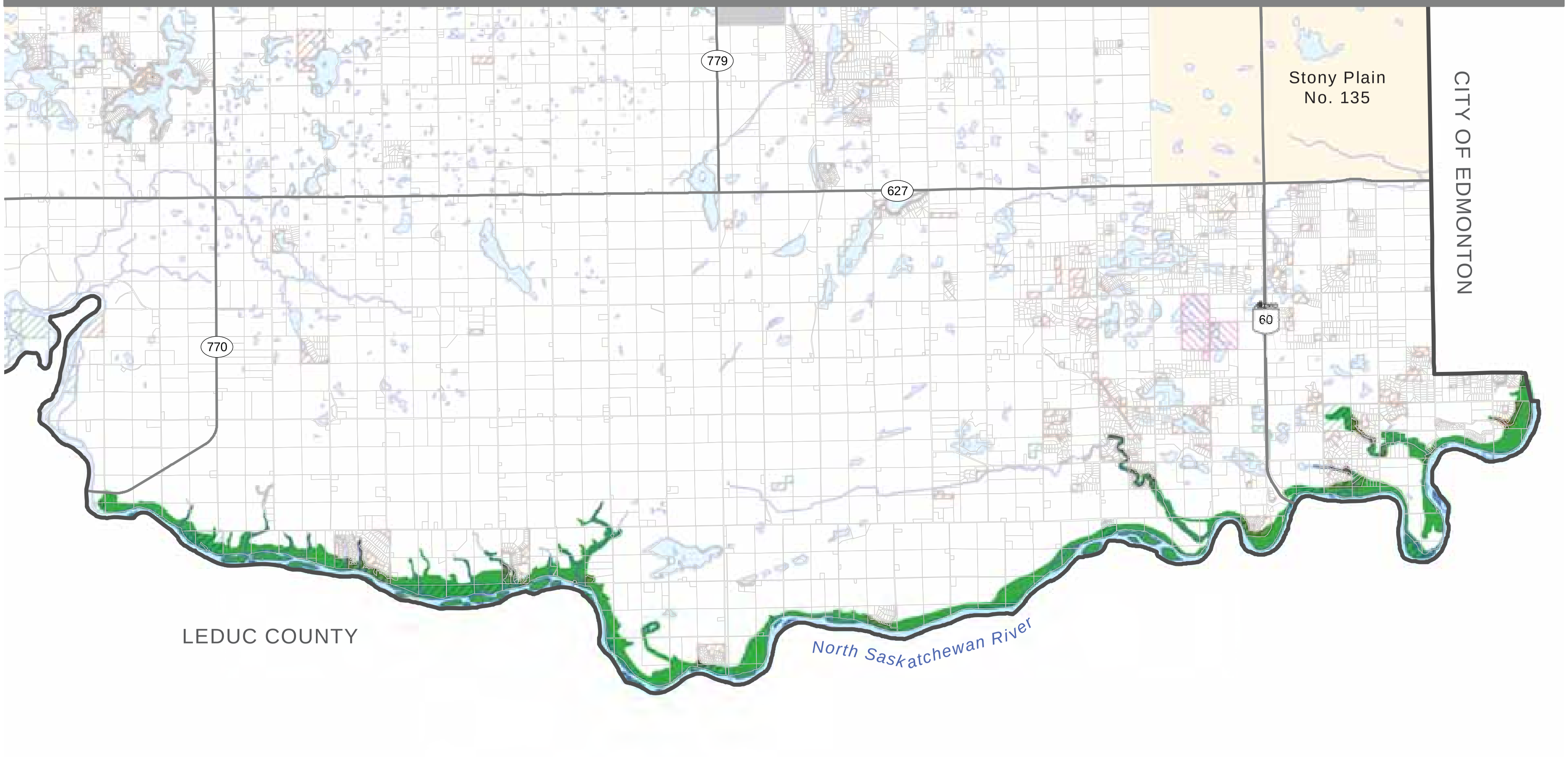
Area: 3,244 ha

Description:

This reach of the North Saskatchewan River has fewer contributing tributaries along the channel length and was encised entirely during the postglacial period. Several ravine systems are included within the ESA. Grassland-shrub and deciduous communities tend to characterize drier, warmer south-facing slopes. White spruce and conifer-dominated mixedwoods are typically associated with cool, moist north-facing slopes and adjacent ravines. Deciduous and mixedwood stands occur along much of the top of the bank. This variety of habitats makes it particularly valuable for raptors, songbirds, smaller mammals and large ungulates. The lands adjacent to this reach are very suitable for agriculture and residential development and are perhaps under more development pressure than its western counterparts.



NORTH SASKATCHEWAN RIVER VALLEY HIGHWAY 770 TO EDMONTON REACH ESA

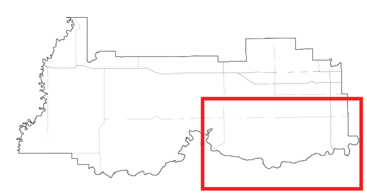


0 0.5 1 2 3 4
Kilometres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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North Saskatchewan River Valley Highway 770 to Edmonton Reach ESA

Environmental Sensitivity: Very High

- Erodible soils present
- High groundwater sensitivity
- Rare plant observations
- Riparian areas present

Land Status:

- All areas surrounding major rivers are owned by the Crown

Key features:

- Highly diverse area of the North Saskatchewan River Valley that is valued for hydrological function and wildlife habitat

Recommended Planning Strategies:

- This reach of the North Saskatchewan River contains the water intake for the Town of Devon
- Activities currently having an adverse effect on the significant ecological and historical features associated with the North Saskatchewan River valley include gravel extraction, agriculture, and use of ATVs and dirt bikes. Maintaining buffer zones of natural vegetation would help to prevent erosion, and sustain the river valley as a wildlife corridor
- Maintaining buffer zones around historical peregrine falcon nest sites may be important for future recovery of this threatened species
- No in stream activities or developments should be permitted in this sensitive area


Round Lake

Tomahawk Uplands Mixedwood ESAs

The Tomahawk Uplands Mixedwood LU contains a variety of land cover, ranging from bogs, fens and peatlands, to mixedwood forests, wetlands and important riparian areas surrounding streams, lakes and rivers. Agriculture, grazing and peatland harvesting activities occur throughout the area, which have resulted in changes to drainage patterns and have the potential to reduce or impede wildlife movement throughout the region. The diversity of land ownership requires collaborative management activities to balance economic development with environmental stewardship. A thorough inventory of the area for rare plants and habitats may better inform management of this area, as there are many locations which have the potential to contain rare features, but the extensive disturbances to drainage patterns and natural cover make the actual presence of these features uncertain.

Environmentally Significant Area (ESA)	Significance	Sensitivity	Page no.
Pembina River Valley ESA	Provincial	Very High	290
Matthews Crossing ESA	Regional	Moderate	294
Sturgeon River Headwaters ESA	Regional	Moderate	298
Upper Tomahawk / Hoot Owl Peatlands ESA	Regional	High	302
Jackpine Grazing Reserve ESA	Local	Moderate	306
Larch Bog ESA	Local	Very High	310
Mishow Creek ESA	Local	High	314
Peatbog 52 ESA	Local	Very High	318
Peatland Fragments ESA	Local	Moderate	322
Round Lake ESA	Local	Low	326
Shoal Upland Habitat ESA	Local	Moderate	330
Southwest of Tower Acres ESA	Local	High	334
Sundance Natural Area and Surrounding Areas ESA	Local	High	338
Tomahawk Creek ESA	Local	High	342
Upper Shoal Lake ESA	Local	High	346

Pembina River Valley ESA

Pembina River Valley ESA

Site Location: The Pembina River flows along the west boundary of the County. Pembina Provincial Park can be accessed 2 km northwest of Entwistle on Highway 16A or 3 km northeast of Evansburg.

Area: 3048 ha

Description:

The Pembina River Valley flows through Central and Dry Mixedwood Forest ecoregions and enters the Athabasca River 130 km north of Edmonton. The Pembina River enters the Onoway Buried Valley in Township 51, where no notable banks are present along the river. North of Township 51, it runs through a post-glacial valley with a deeply incised gorge. The cliffs of the Pembina River Gorge are as high as 60 m, created by meltwater from the last glacial epoch. The Pembina River within the provincial park has cut through the brown sandstone bedrock of the Paskapoo Formation, providing important scenic views of these geological formations.

The river valley contains a variety of habitats, including meadows, old channels, lodgepole pine, white spruce, aspen, pine-black spruce woodlands, willow-dwarf birch shrubs, beaver ponds, and springs. These habitats provide some critical wildlife zones for moose, deer, furbearers, songbirds, marshbirds, and waterfowl. Mature forest stands provide nesting sites for Cooper's hawk, northern goshawk, osprey, and bald eagle. The valley is a travel corridor for ungulates and furbearing animals. Bluffs along the river are historical nesting sites for peregrine falcons which have been observed nesting in the area.

The river is an important sport fishery site, with a diversity of fish species (northern pike, walleye, rainbow trout, and goldeye). The river supports the most southerly stocks of Arctic grayling, as well as coarse fish including white sucker.

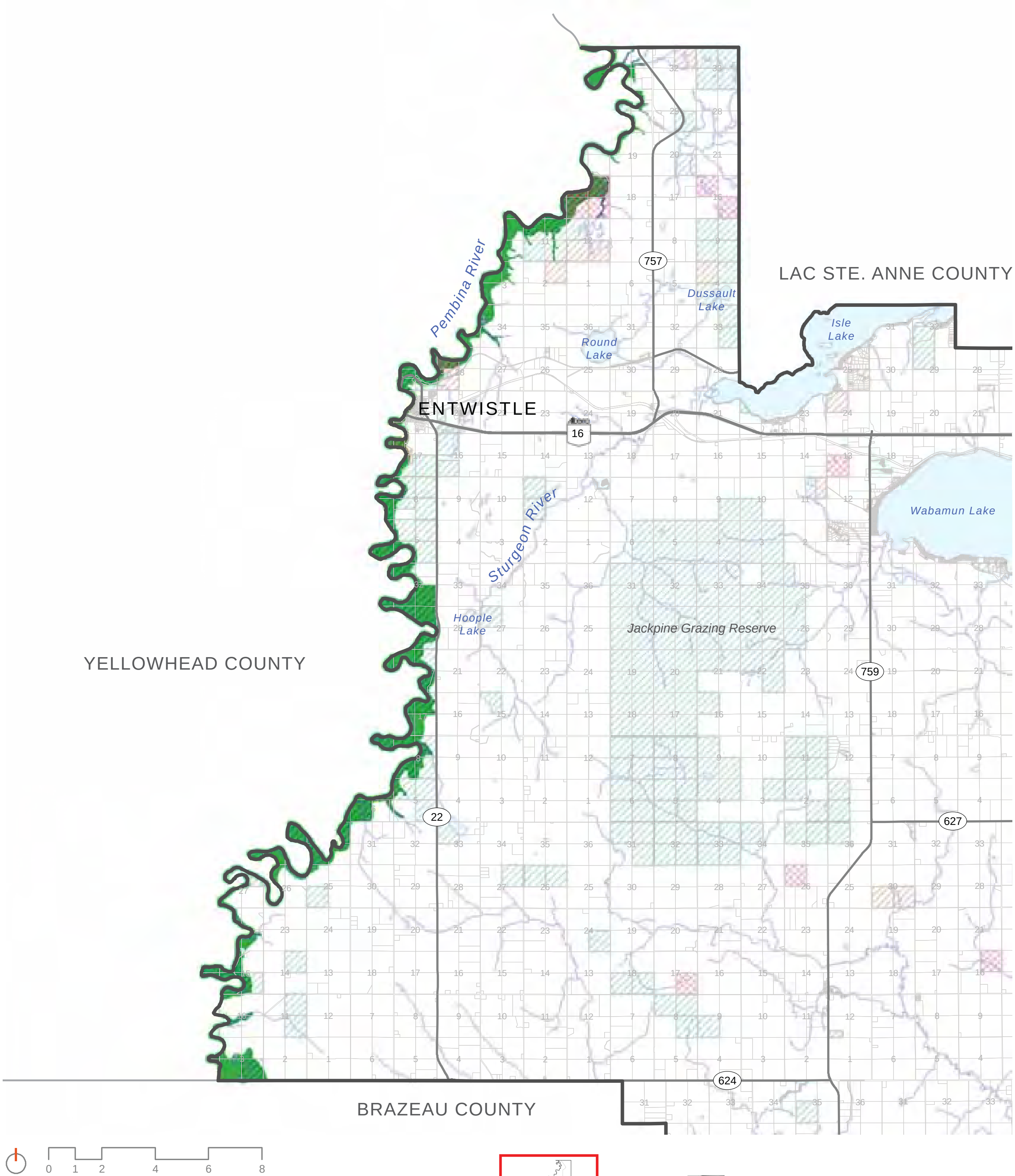
PEMBINA RIVER VALLEY ESA

SIGNIFICANCE: Provincial

Rare landforms or geological features which remain in a natural state and have been identified as provincially significant by Alberta Tourism, Parks, and Recreation (ATPR)

- Species + Habitats
- Landscape Ecology
- Wetlands
- Landforms
- Groundwater Resources
- Surface Water Resources
- Protected Areas

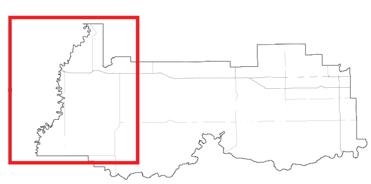
PEMBINA RIVER VALLEY ESA



ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Pembina River Valley ESA

Environmental Sensitivity: Very High

- Very High erosion potential
- High potential for groundwater contamination
- Presence of rare plants

Land Status:

- Crown Land, Provincial Park, mostly surrounded by private land; Buck for Wildlife Property owned by Parkland County

Key features:

- Steep river gorge
- Key wildlife corridor
- Peregrine falcon nesting sites
- Sport fisheries

Recommended Planning Strategies:

- The river valley corridor serves as an important wildlife corridor, and recreational activities along the river must be managed to maintain its natural functioning while minimizing human impact
- Disturbances to the land should avoid steep slopes and known nesting locations

Matthews Crossing ESA

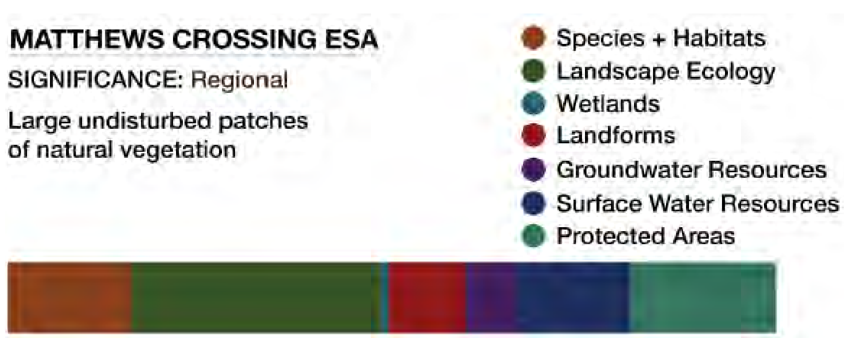
Matthews Crossing ESA

Site Location: Located in the northwest corner of Parkland County, west of Highway 757 and adjacent to the Pembina River.

Area: 704 ha

Description:

The Matthews Crossing Area is characterized by older forests of white spruce, balsam poplar, and trembling aspen that occur along the lower section towards the river. The terrain is rolling and there are steep banks down to the Pembina River. Wetlands are present in some of the depressions, and open aspen forests are associated with upland areas. Wildlife is abundant and the area is known for its high bird diversity, particularly in the older white spruce stands. It is an important part of the Pembina River corridor for ungulates and carnivores. Matthews Crossing is used for hunting, hiking, camping, and dirt biking. Matthew's Crossing also has historical value, as settlers forded the Pembina River here in the 1800's.



MATTHEWS CROSSING ESA

0 150 300 600 900 1,200
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway

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parkland county
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Matthews Crossing ESA

Environmental Sensitivity: Moderate

- Some erosion risk
- Riparian areas
- Potential for groundwater contamination
- Potential presence of rare plants

Land Status:

- Provincial Natural Area: Recreation

Key features:

- Steep banks
- Wildlife corridor for ungulates and carnivores
- Recreational use

Recommended Planning Strategies:

- Maintaining recreational opportunities while preventing degradation of important wildlife connectivity through the region is of utmost concern
- Identify and conserve nearby patches of natural habitat, wildlife corridors, and other "microsite" ESAs outside of the ESA boundary in order to enhance the overall connectivity and ecological integrity of the broader area


Sturgeon River Headwaters ESA

Sturgeon River Headwaters ESA

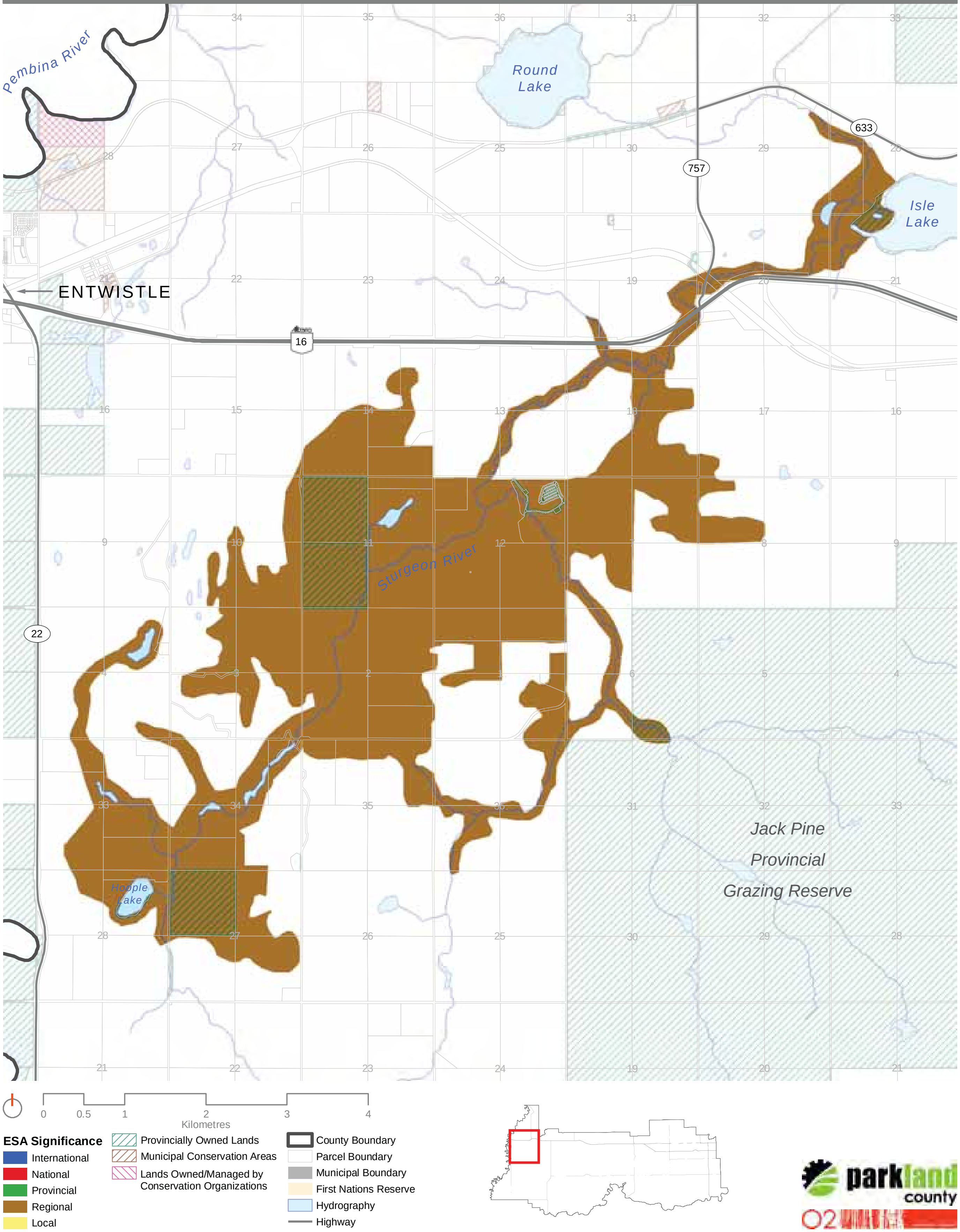
Site Location:
Northwest of Jack Pine Grazing Reserve, watercourses drain northeast to Isle Lake.

Area: 2,417 ha

Description:

The upper headwaters of the Sturgeon River drain a large area southwest and west of Isle Lake, before entering the lake. The headwaters are comprised of a network of wetland and riparian areas that may be important to the maintaining flows within the Sturgeon River. Bogs (treed and open), riparian and upland areas occur along portions of the drainage. A wetland marsh characterizes the confluence of drainages with Isle Lake. Much of the surrounding landscape is heavily fragmented by agriculture, although drainages are intact within portions of the headwaters area.

STURGEON RIVER HEADWATERS ESA



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Sturgeon River Headwaters ESA

Environmental Sensitivity: Moderate

- Presence of rare plants
- Potential for erosion risk
- Potential for groundwater contamination

Land Status:

- Predominantly private land, with some Crown land parcels

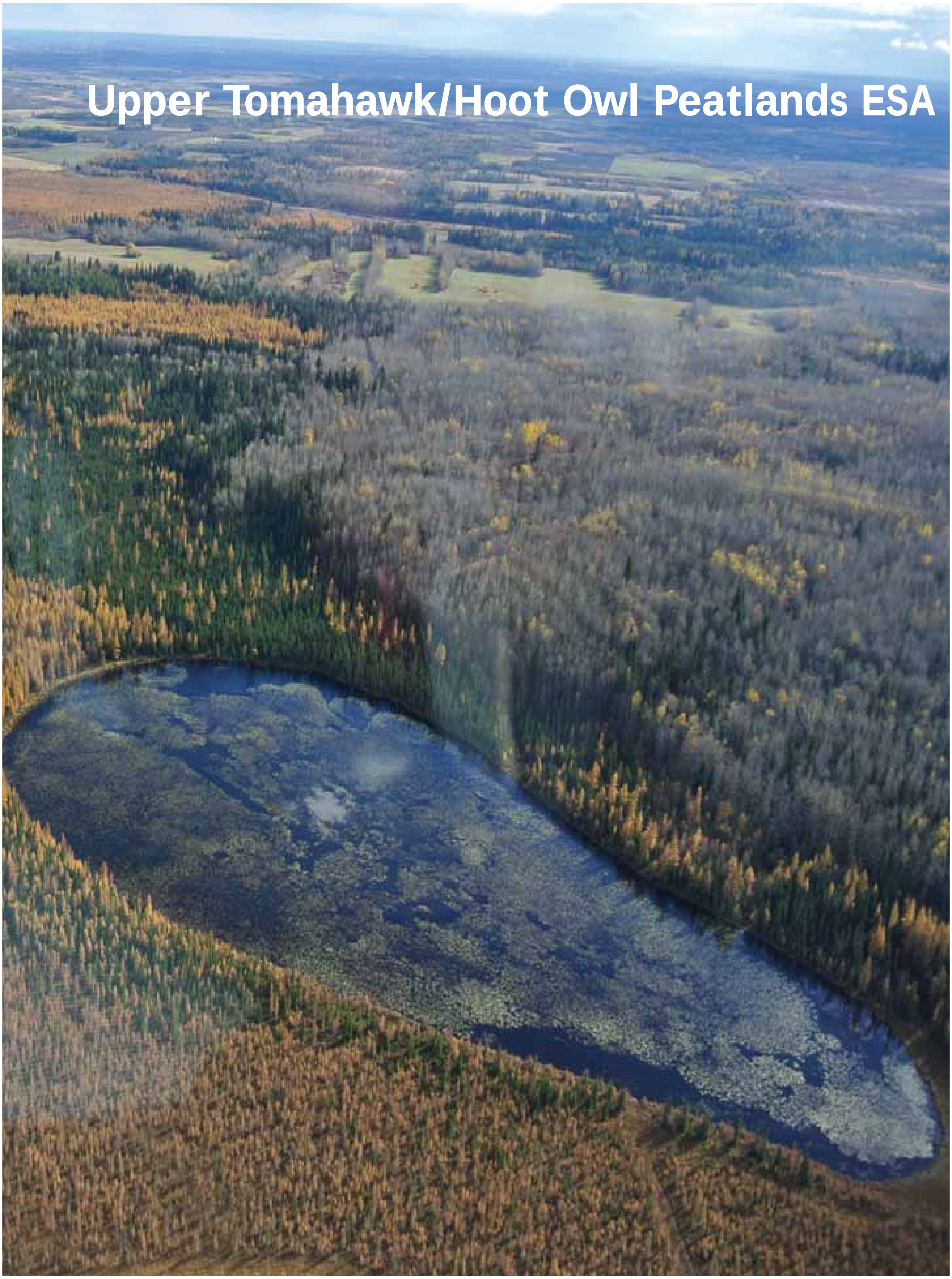
Key features:

- Headwaters of the Sturgeon River
- Sensitive wet areas
- Intact drainages threatened by agricultural practices

Recommended Planning Strategies:

- Agricultural operators encouraged to use best management practices such as ALUS (Alternative Land Use Services) program to protect creeks and rivers entering into Isle Lake
- Agricultural operations in the vicinity of Isle Lake, in conjunction with the Sturgeon River Headwaters ESA, needs to focus on reducing the overall use on fertilizers to reduce phosphates levels travelling into Isle Lake
- Agricultural activities on private lands should be encouraged to adopt low impact activities
- Further development of the area should avoid highly erodible steep slopes and wet areas that would require further drainage or land cover conversion
- Limit vehicular access to ESA, which has historically led to habitat destruction in certain areas
- Resource extraction activities should be limited and given special consideration in order to safeguard ecological integrity

Upper Tomahawk/Hoot Owl Peatlands ESA



Upper Tomahawk/Hoot Owl Peatlands ESA

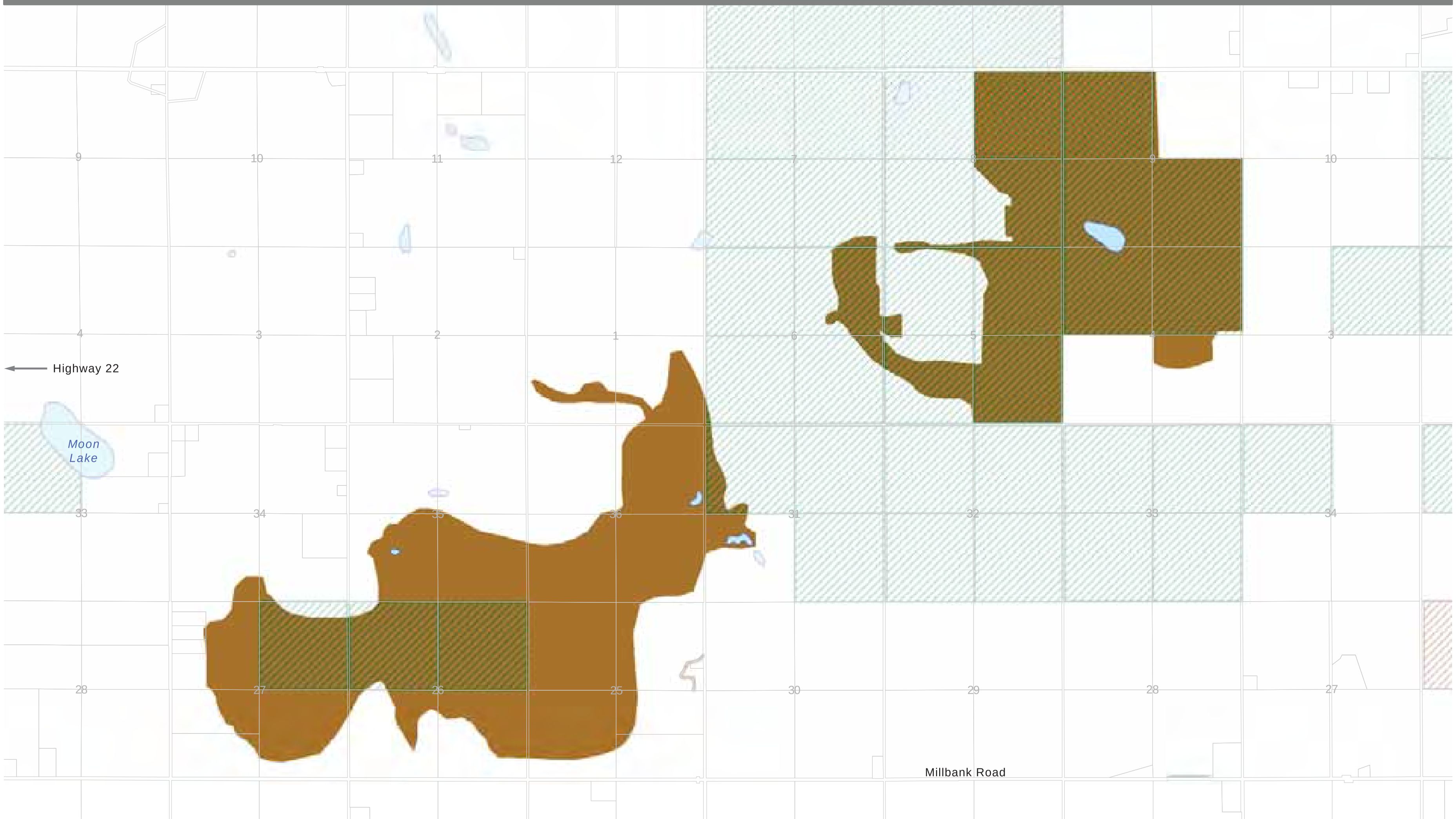
Site Location: The peat bogs located south of Jackpine Grazing Reserve are accessible west off of Highway 31 on Township Road 522 or Township Road 514 or Highway 624.

Area: 1,202 ha

Description:

Bog areas are characterized by a mixture of treed and open peatlands and forested uplands. Treed peatlands support a mix of black spruce, tamarack and/or jack pine. Willow, bog birch, cotton grass, cloudberry, Labrador tea, sedge, moss and lichens are common in the area. Open peatland areas are predominantly sedge with bog birch and willow around the edges. Upland areas support aspen, balsam poplar, white spruce and occasionally jack pine, as well as grasses with scattered shrubs and forbs at some locations. The Upper Tomahawk Creek Peatland is home to a variety of diverse habitats and landscape features.

UPPER TOMAHAWK / HOOT OWL PEATLAND ESA



0 250 500 1,000 1,500 2,000
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway

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parkland county

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Upper Tomahawk/Hoot Owl Peatlands ESA

Environmental Sensitivity: High

- Presence of rare plants
- Presence of sensitive riparian areas

Land Status:

- Private and crown land

Key features:

- Bog and open peatlands
- Upland areas
- Biodiverse peatland

Recommended Planning Strategies:

- Peat harvest will reduce the extent of natural peatland areas
- Clearing and draining of peatland areas are required to harvest the peat; drainage lowers the water table and may affect surrounding ecosystems
- Peatland regeneration will not likely replace the pre-harvest habitat types/ ecosystems

Jack Pine Grazing Reserve ESA

Jack Pine Grazing Reserve ESA

Site Location: The Jack Pine Provincial Grazing Reserve is located 4.5 km south of Highway 16 at Gainford

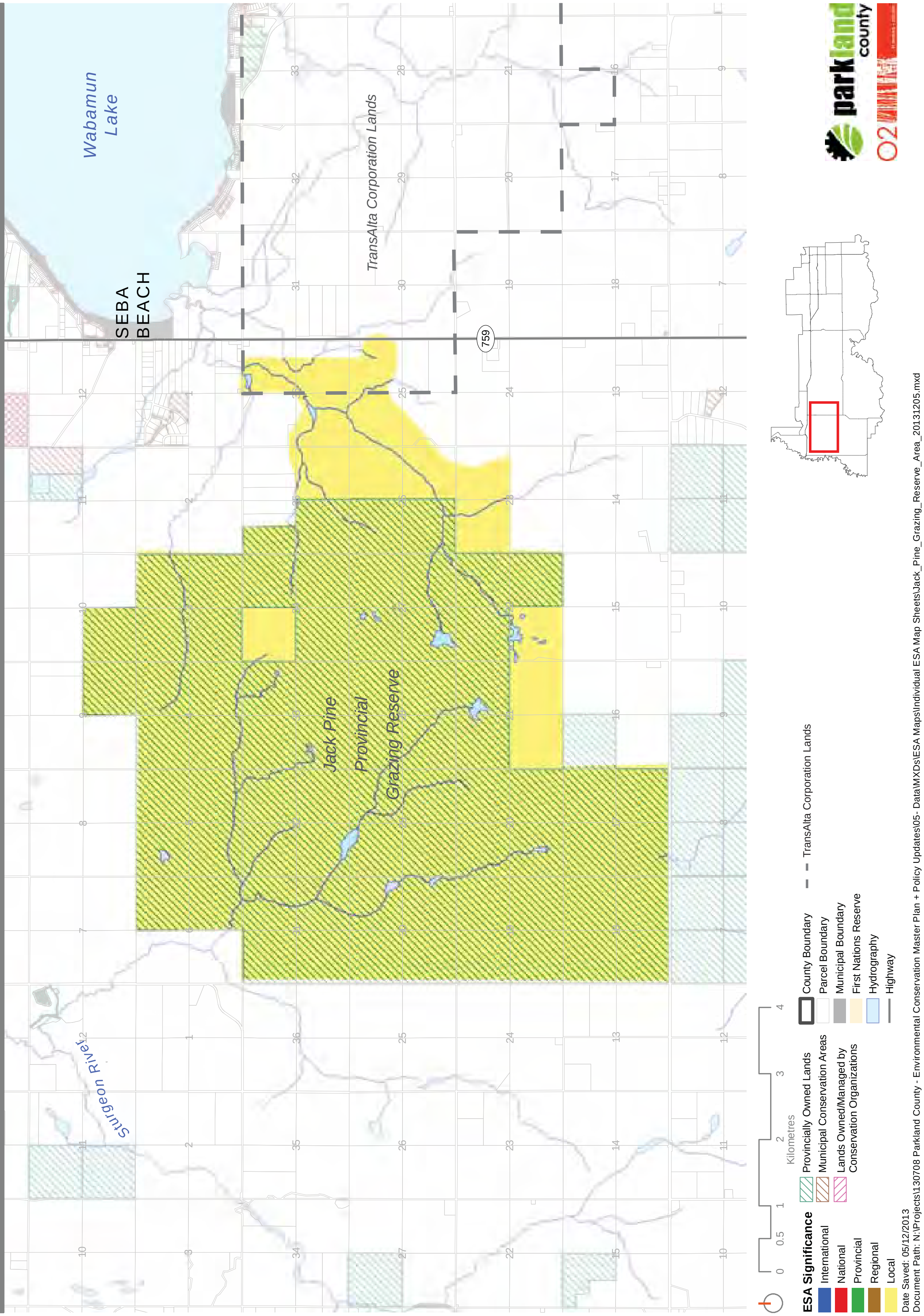
Area: 5,509 ha

Description:

The reserve is located within the moist Mixedwood subregion with luvisolic soils being the dominant soil type on the upland areas. Forest cover consists of aspen with scattered balsam poplar, white spruce, and jack pine, as well as willow in select areas. Forest habitat is highly fragmented, as over 50% of the reserve has been developed into tame pasture and considerable oil and gas development has occurred within the reserve. Peatlands are also present on the reserve and several creeks drain the area. A relatively undisturbed drainage and surrounding upland habitat are located on the northeast side of the reserve and are included as part of the overall area. Wet areas surrounding the reserve are unfenced and ungrazed. Peat moss harvesting operations are located around the periphery of the reserve.

Although forested habitat within the grazing reserve has been heavily fragmented by conversion to improved pasture, the reserve continues to provide habitat for a wide diversity of forest and open country species. A sharp-tailed grouse lek was reported in the reserve in the past (BSOD 1988). A variety of recreational activities including hunting, camping, and snowmobiling are allowed on the reserve with permission.

JACK PINE GRAZING RESERVE AREA ESA



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

Larch Bog ESA

Larch Bog ESA

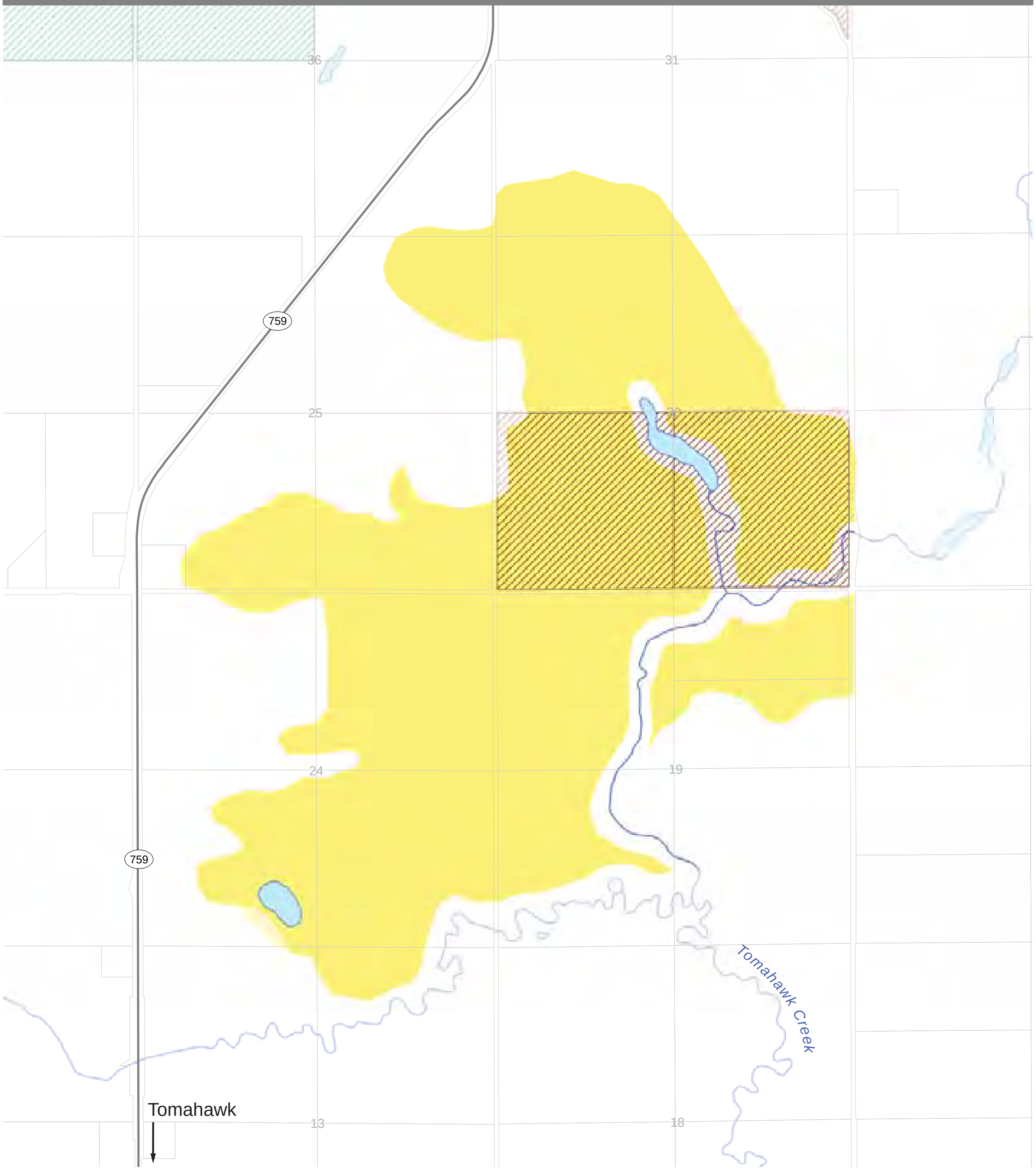
Site Location: This site is adjacent to Tomahawk Creek and southwest of the junction of Highways 759 and 627

Area: 572 ha

Description:

This area represents a peatland complex with a mosaic of peatland types. It has remained largely undisturbed due to the unsuitability of the soils for agriculture and rural residential development. This area is relatively flat, with graminoid, shrubby and treed fens. Fens are peat accumulating wetlands that are fed by flowing groundwater. They tend to be higher in nutrients and less acidic than bogs, which receive water only from precipitation. Fens tend to have a high incidence of rare species observations, and are sensitive to contamination and disruption of water flow. Rare birds such as the olive-sided flycatcher, rusty blackbird and the yellow rail are known to inhabit these types of peatlands. Fens require a particular water chemistry to maintain healthy and functioning. This ESA has surface drainages in the vicinity (Tomahawk Creek and tributaries), and is surrounded primarily by agricultural development. There may be a high risk of water impoundment due to the adjacent roads and contamination due to the surrounding agriculture.

LARCH BOG ESA

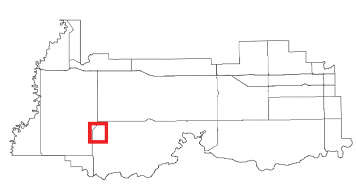


0 100 200 400 600 800
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Larch Bog ESA

Environmental Sensitivity: Very High

- High potential for groundwater contamination
- Presence of rare plants
- Presence of sensitive riparian areas

Land Status:

- Private land

Key features:

- An undisturbed patch of different fen types
- Habitat potential for several types of rare species

Recommended Planning Strategies:

- Further road development in this area should be carefully considered or be constructed to maintain water flow within this ESA
- Land owners in the adjacent areas should be aware of the effects of agricultural run-off on sensitive peatlands, and consider limiting the use of pesticides and fertilizers
- The County should consider limiting further development within this ESA
- There has been some seismic development within this ESA. Further development should consider low impact seismic techniques

Mishow Creek ESA

Mishow Creek ESA

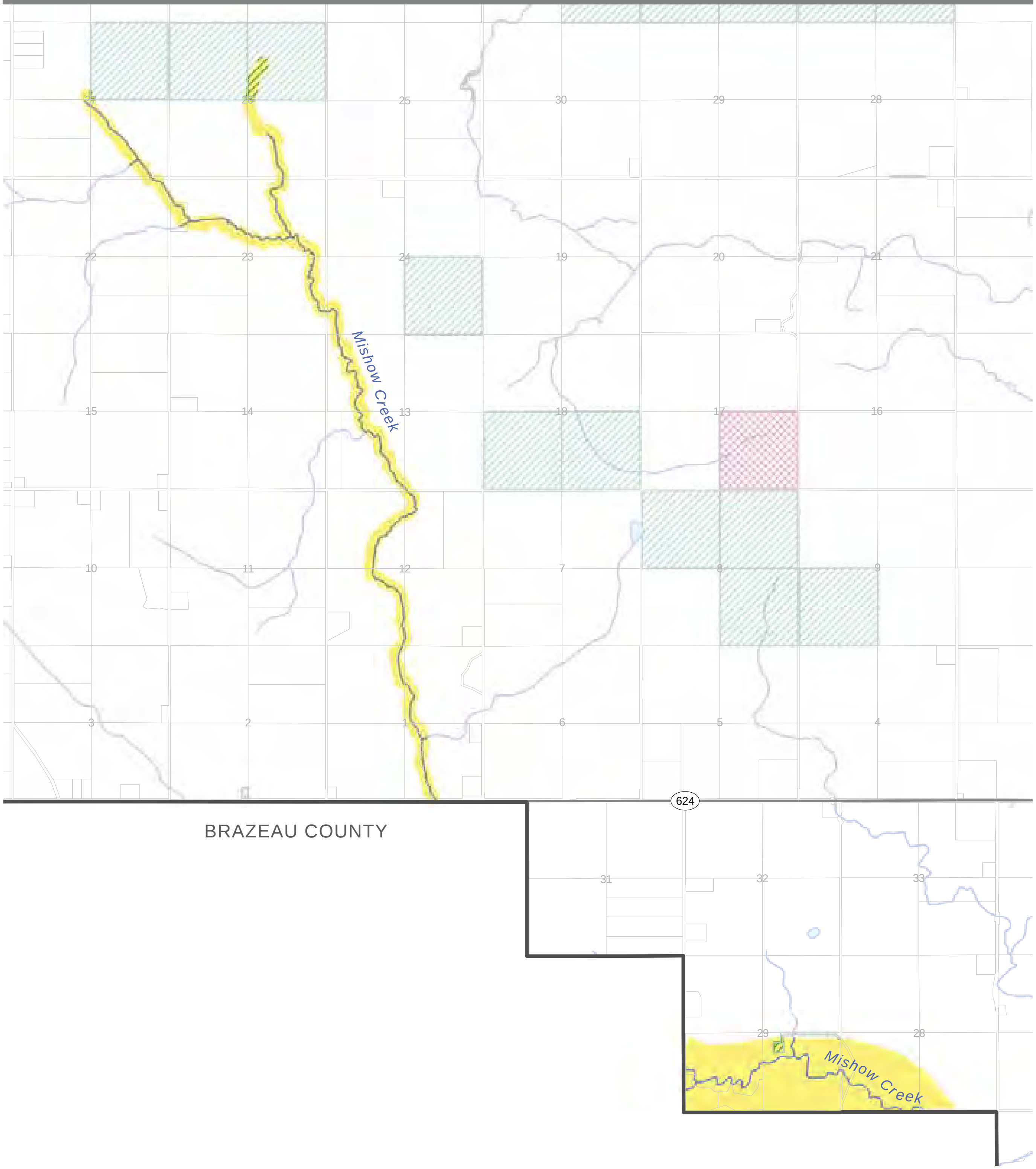
Site Location: Mishow Creek is located in the southwest corner of Parkland County; accessed along Range Road 71 and Township Road 514

Area: 348 ha

Description:

Mishow Creek flows into the North Saskatchewan River at the southwest corner of the County. The creek flows through some largely cultivated areas, but the lower reach is relatively undisturbed, flowing through a fairly steep ravine that is well-buffered with adjacent forest. The ravine is characterized by white spruce and mixedwoods on north-facing slopes and mature balsam poplar on terraces. Small bogs also occur in the area. Mishow Creek is important for ungulates (deer and moose), woodpeckers, songbirds, and smaller mammals, including marten.

MISHOW CREEK ESA

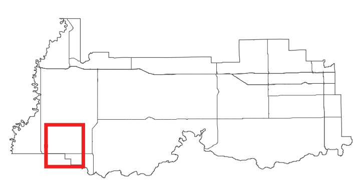


0 250 500 1,000 1,500 2,000
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Mishow Creek ESA

Environmental Sensitivity: High

- High erosion risk
- Presence of sensitive riparian areas

Land Status:

- Mostly Private, some Crown

Key features:

- Forested ravine with easily eroded slopes
- Important wildlife corridor

Recommended Planning Strategies:

- Cultivated areas around the upper reaches of the creek should adopt practices which minimize impacts to the creek
(e.g., riparian buffers of natural perennial vegetation, cattle fencing)
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation and protect creeks
- Barriers to wildlife movement should be minimized

Peatbog 52 ESA

Peatbog 52 ESA

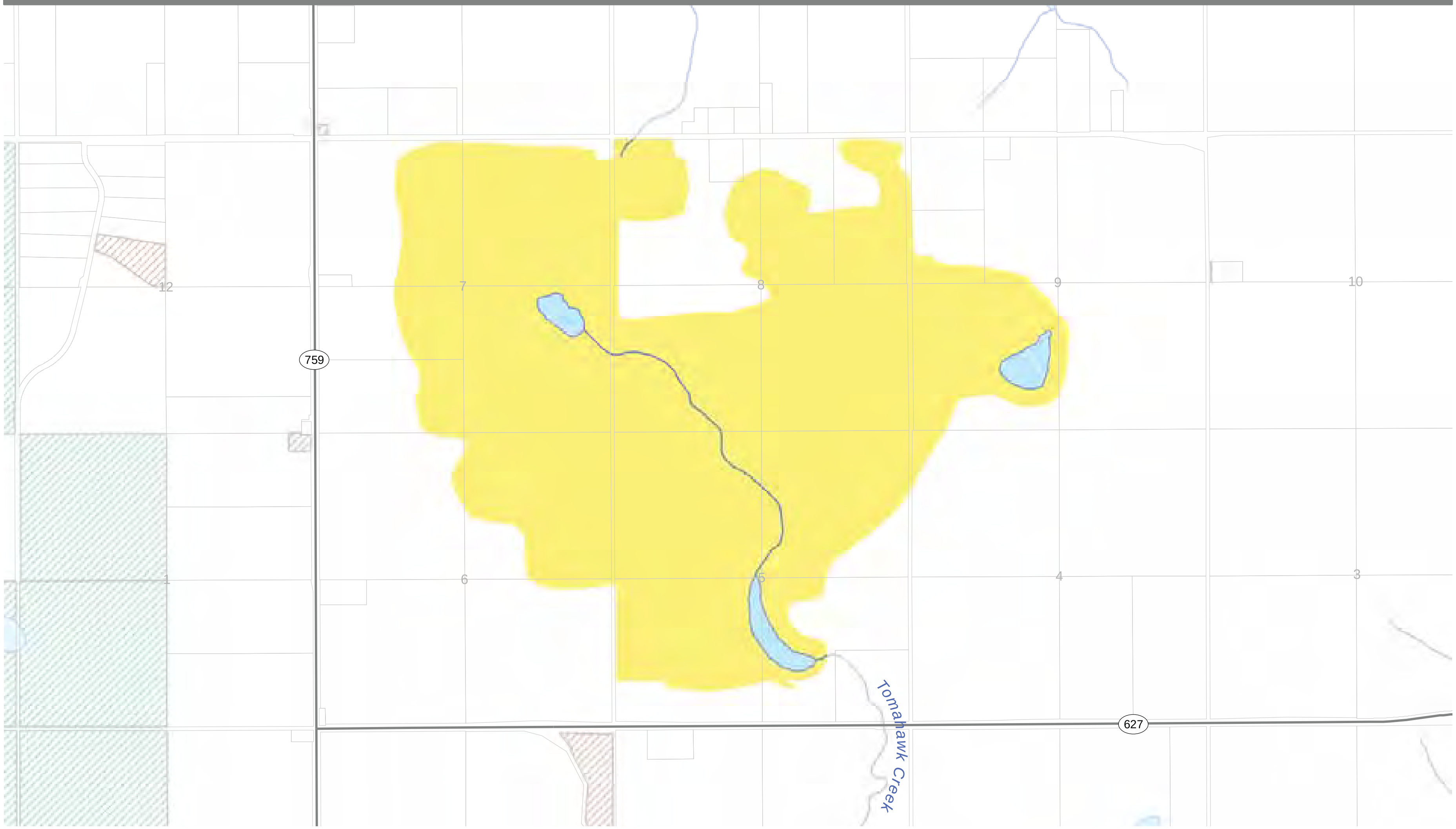
Site Location:
Located east of Highway 759, approximately 8.5 km north of Tomahawk.

Area: 678 ha

Description:

This area is characterized by a relatively extensive and undisturbed peatland within a landscape heavily fragmented by agricultural activity. The bog area is characterized by a mix of treed and open peatland. Treed peatland typically supports a mix of black spruce and tamarack/larch. Willow, bog birch, cotton grass, cloudberry, Labrador tea, sedge, mosses and lichens are other species common in treed bog areas. Open peatlands are generally sedge dominated with bog birch and willow around the edges. Drainage within the bog has not been notably disturbed/altered. Some treed upland is present in the area, and supports aspen, balsam poplar, and white spruce.

PEATBOG 52 ESA

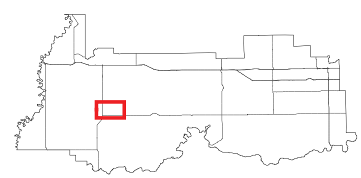


ESA Significance

- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Peatbog 52 ESA

Environmental Sensitivity: Very High

- Presence of rare plants
- Presence of sensitive peatlands
- Presence of sensitive riparian areas
- Potential for groundwater contamination

Land Status:

- Private land

Key features:

- Undisturbed peatland
- Agricultural matrix surrounding remaining natural areas

Recommended Planning Strategies:

- Undisturbed peatland should be maintained and the drainage of the area left unmodified
- Agricultural practices in the surrounding areas should be guided by principles which minimize impact to the natural areas they surround
- Barriers to wildlife movement should be minimized

Peatland Fragments ESA

Peatland Fragments ESA

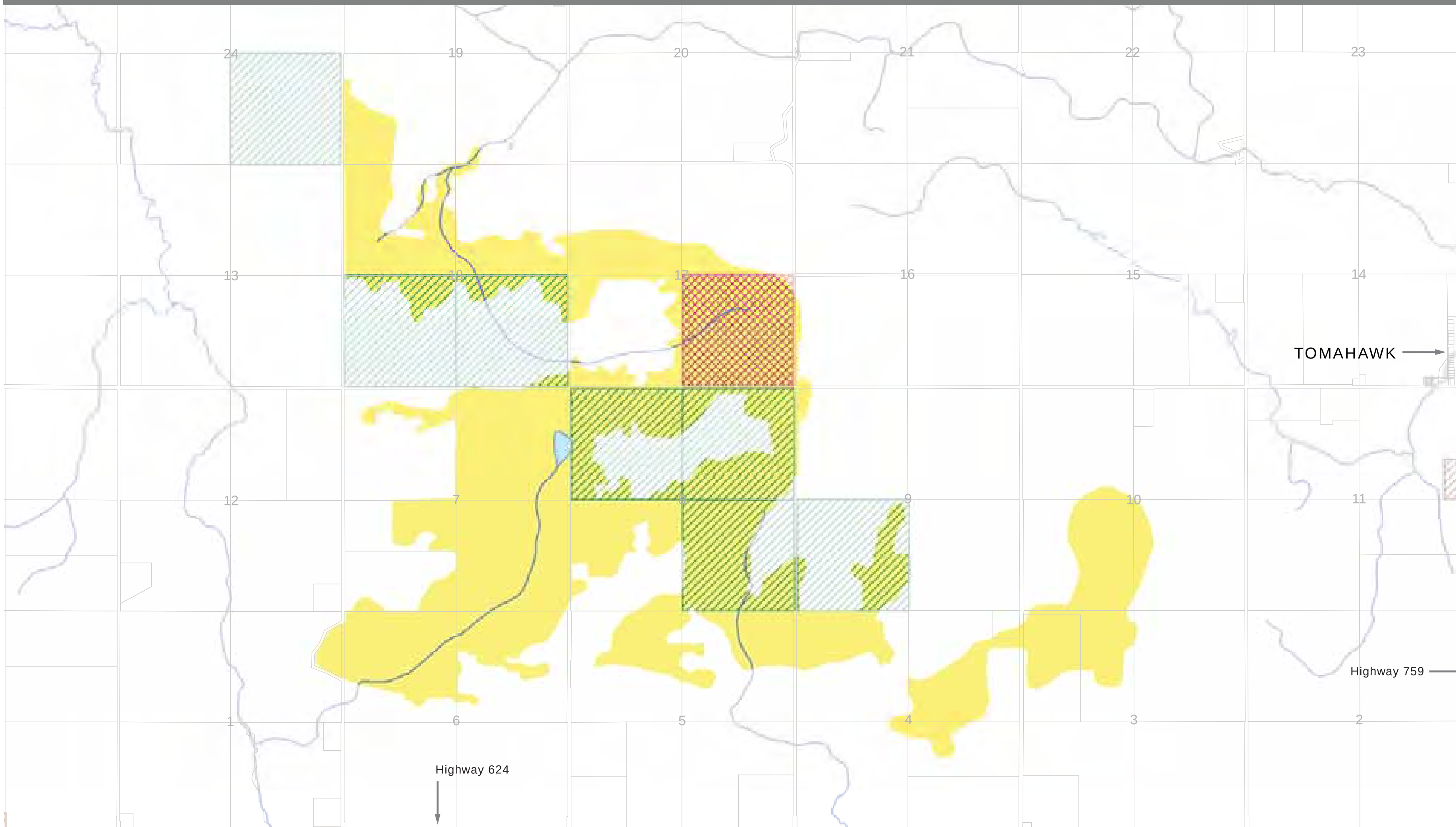
Site Location: Located east of Range Rd 70, north of Township Rd 510, approximately 3.5 km west of Tomahawk

Area: 862 ha

Description:

This ESA is a fragmented assortment of upland areas and peatlands, where predominantly treed fens are interspersed with mineral soils. Peatland harvesting activities have left regular patterning across much of the area. The ESA is ordered by creeks to the north and west, the area serves as a stepping stone to wildlife movement northwards from the North Saskatchewan River valley.

PEATLAND FRAGMENTS ESA

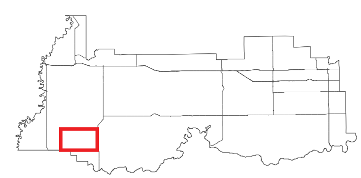


0 200 400 800 1,200 1,600
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Peatland Fragments ESA

Environmental Sensitivity: Moderate

- Presence of rare plants
- Presence of sensitive peatlands

Land Status:

- Private land

Key features:

- Remnant peat bogs shaped by peatland harvesting patterns
- Rare plants

Recommended Planning Strategies:

- Remaining undisturbed treed fens in the area should be maintained and further changes to the drainage of the area minimized
- Agricultural practices in the surrounding areas should be guided by principles which minimize impact to the remaining natural areas
- Further harvesting should attempt to mimic natural patterning
- Unrestricted wildlife movement through these areas should be encouraged


Round Lake ESA

Round Lake ESA

Site Location: Located west of Isle Lake, Southeast of Matthew's Crossing

Area: 252 ha

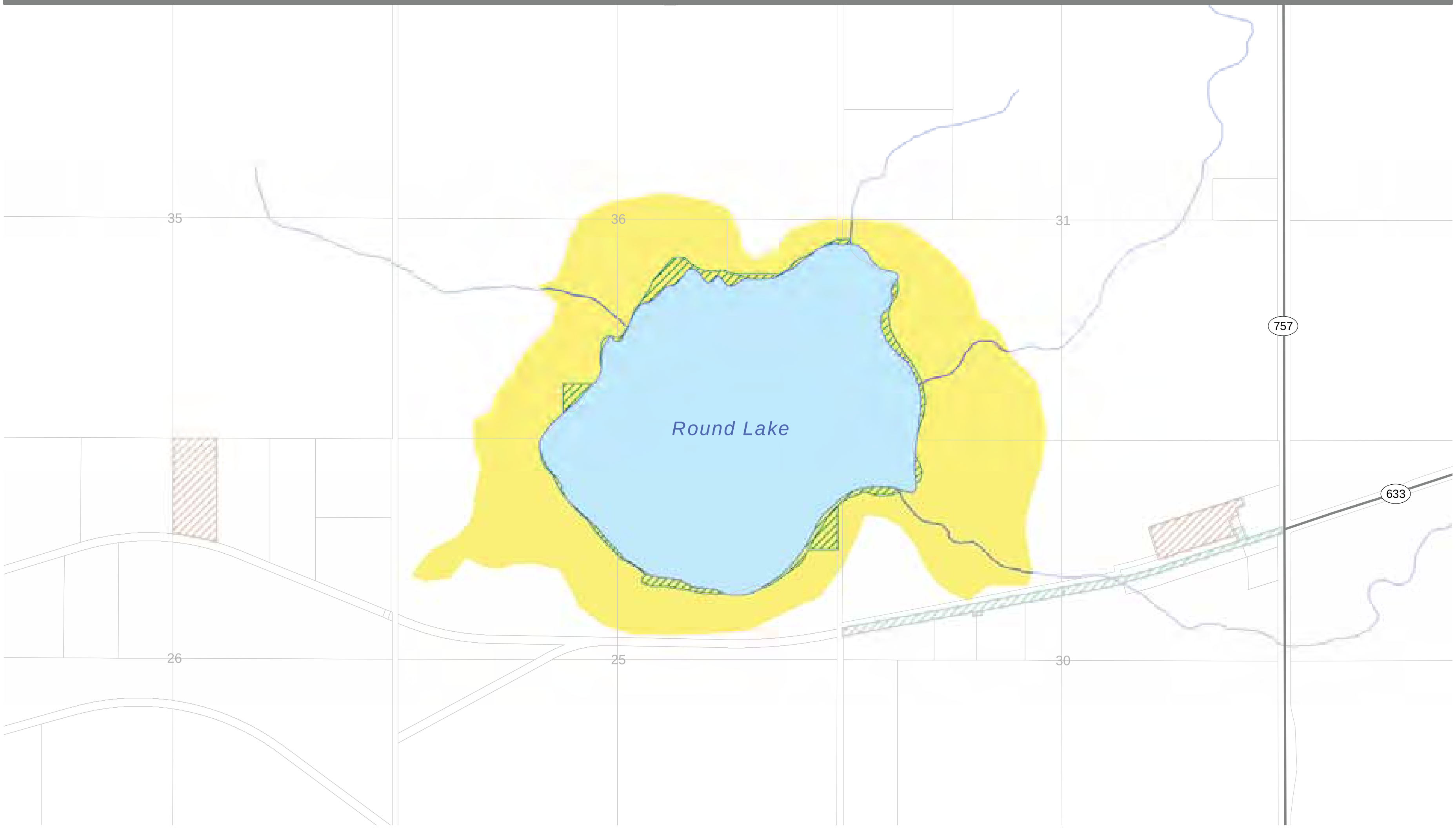
Description:

The Round Lake ESA includes the lake itself as well as a 100 meter precautionary planning buffer around the lake—a measure designed to promote careful planning and management of fragile riparian areas[1]. Round Lake lies in a circular natural area and is surrounded by marsh where fairly steep slopes rise from all sides. Other small marshes are nearby. The willow pockets along the water's edge provide good habitat for yellow warbler, common yellowthroat, and both clay-colored and song sparrows. The surrounding forested areas of aspen, white spruce, black spruce, and tamarack provide habitat for a variety of wildlife. There is good waterfowl breeding habitat present, and deer and moose frequent the area.

No residential development is evident on the lake shore; however the community of Magnolia and farmsteads occur nearby. Some land around the lake has been cleared for agriculture; although there appears to be an adequate buffer around most of the lake, likely due to the flood potential of the low-lying lands.

1 All lake ESAs in the County include a 100 m buffer from the shoreline. This buffered area is not to be interpreted as a development restriction zone, but rather, a precautionary planning zone in which development must be met with extreme care for the conservation of riparian environments.

ROUND LAKE ESA



0 100 200 400 600 800
Metres

ESA Significance
International
National
Provincial
Regional
Local

Provincially Owned Lands
Municipal Conservation Areas
Lands Owned/Managed by Conservation Organizations

County Boundary
Parcel Boundary
Municipal Boundary
First Nations Reserve
Hydrography
Highway

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Round Lake ESA

Environmental Sensitivity: Low

- Some riparian areas
- Some potential for groundwater contamination

Land Status:

- Private land

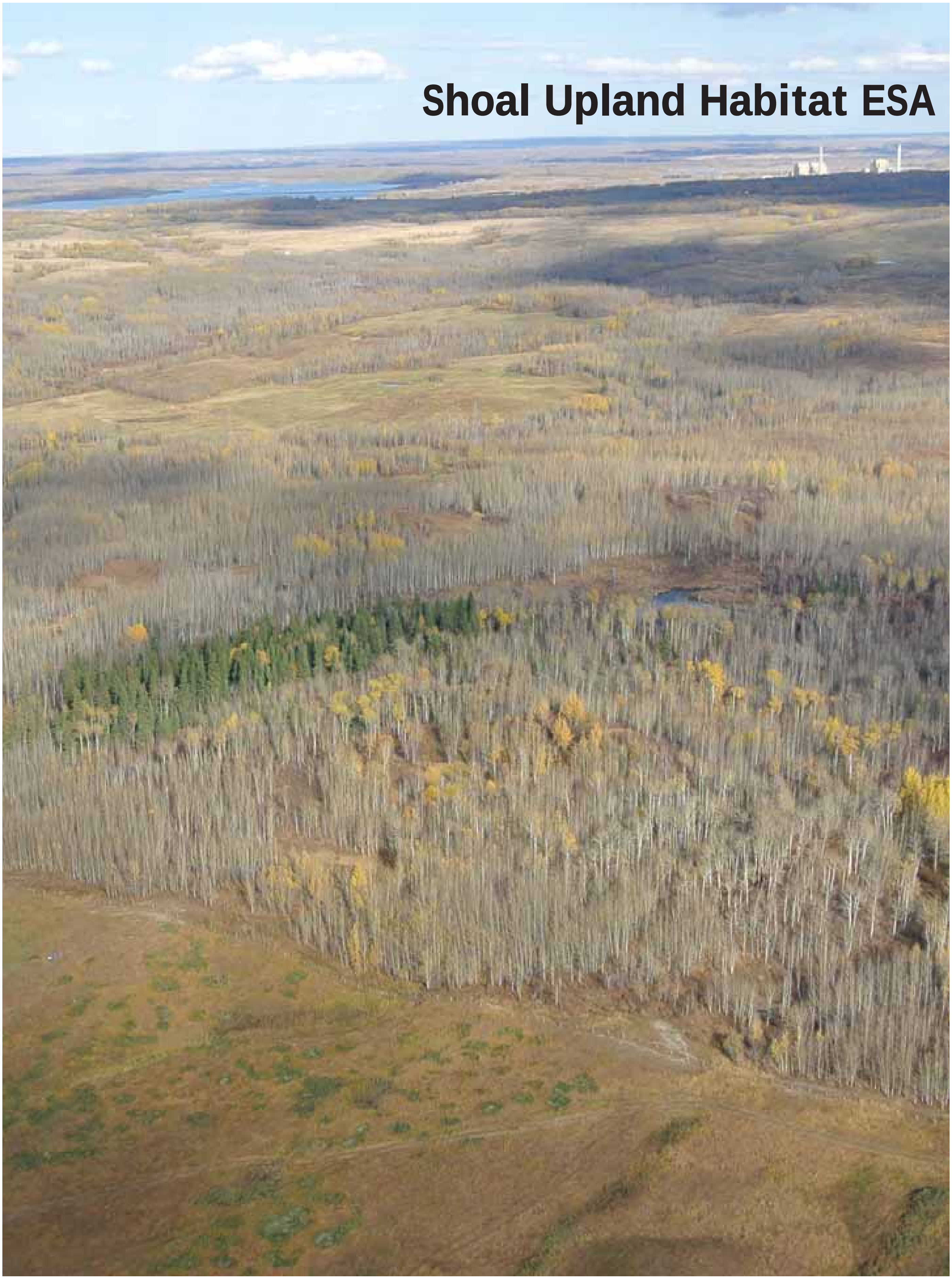
Key features:

- Lake shore is free of development
- Stepping stone for movement north and westward

Recommended Planning Strategies:

- Natural buffers around Round Lake should be maintained
- Shoreline habitat and water quality of Round Lake may be adversely affected by livestock grazing
- Nesting opportunities for common goldeneye and bufflehead could be enhanced by erecting nesting boxes

Shoal Upland Habitat ESA



Shoal Uplands Habitat ESA

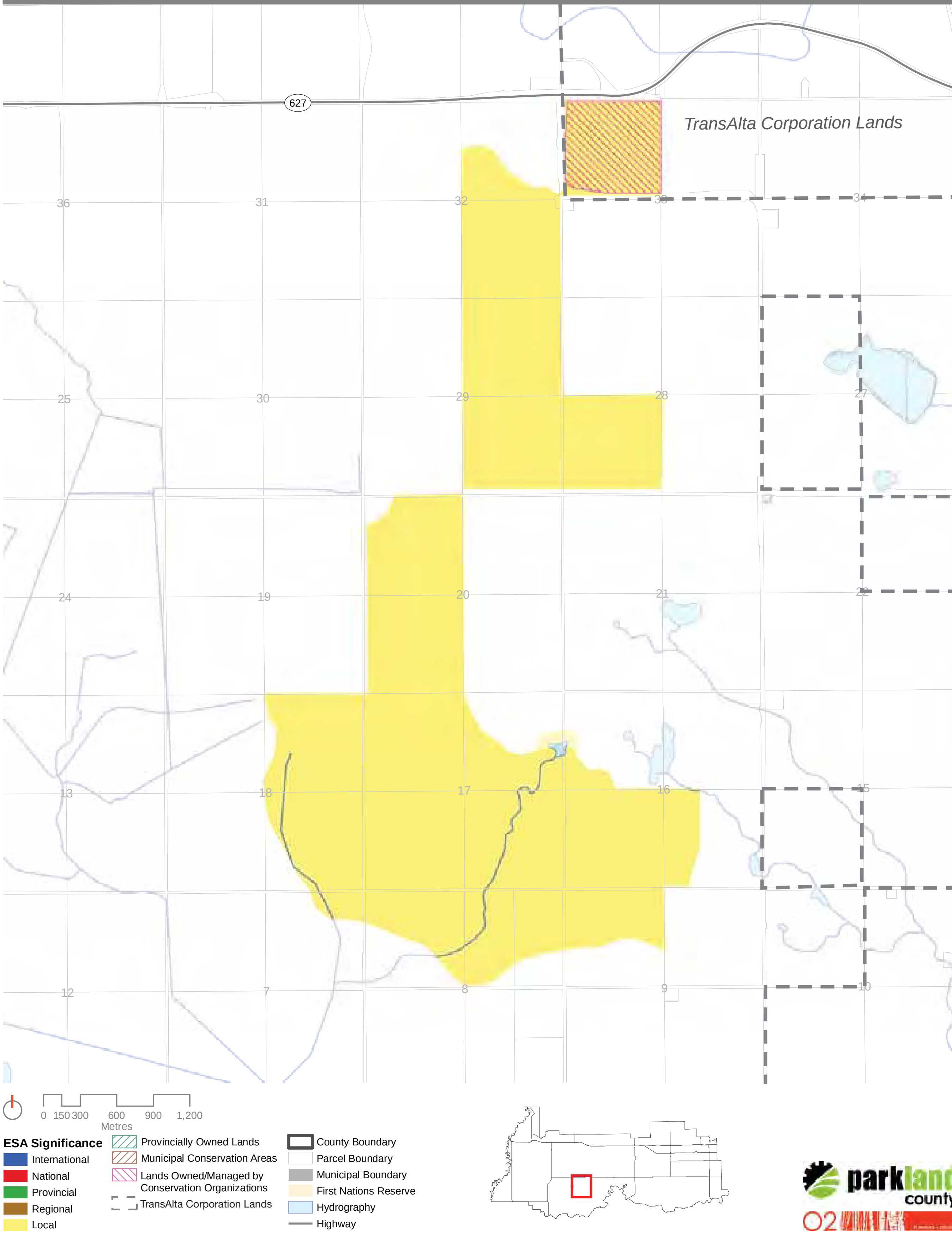
Site Location: Along the east border of historic Shoal Lake

Area: 1,052 ha

Description:

The Shoal Uplands provide a connecting region of relatively undisturbed habitat between the North Saskatchewan River valley and Lake Wabamun. Characteristic vegetation includes aspen, aspen-balsam poplar, aspen-shrub, and deciduous shrub communities. Several drainages pass through the site. The area likely supports a variety of wildlife, although grazing practices impact habitat value over portions of the site. Shoal Upland has several examples of ice-thrust blocks and stagnation moraine landforms.

SHOAL UPLAND HABITAT ESA



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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

Southwest of Tower Acres ESA

Southwest of Tower Acres ESA

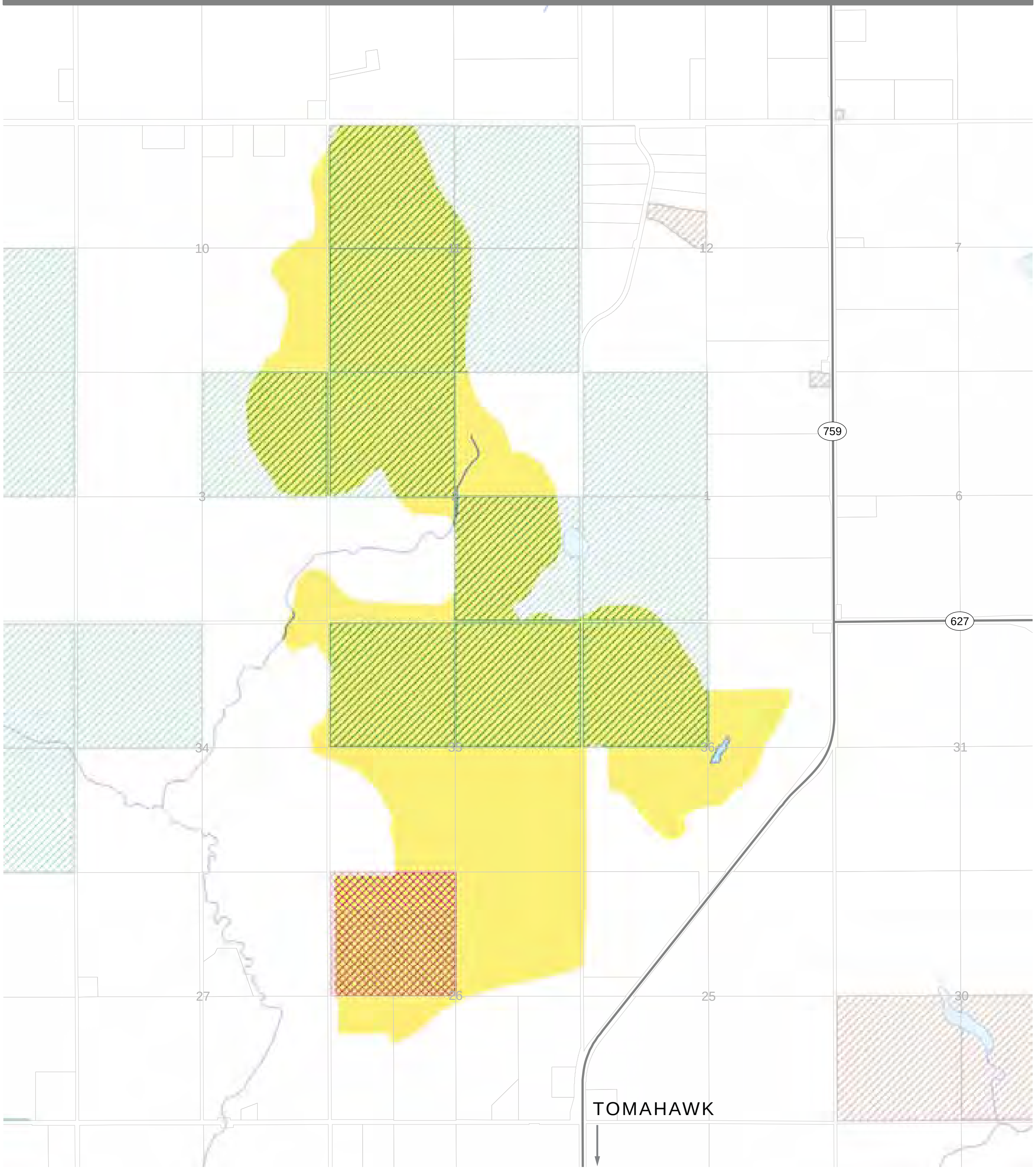
Site Location: This ESA is located to the west of the junction of Highways 759 and 627 and to the east of Tomahawk Creek, SW of the “Tower Acres” subdivision

Area: 870 ha

Description:

This area contains a complex of peat accumulating wetlands and upland habitats. The uplands are fairly undisturbed with a few residences and some deforested areas. The peatlands are largely undisturbed due to the unsuitability of the soils for agriculture and rural residential development. Linear disturbances are present due to seismic exploration / land surveys. This area is relatively flat, with graminoid, shrubby and treed fens, and treed bogs. Fens are peat accumulating wetlands that are fed mostly by flowing groundwater. They tend to be higher in nutrients and less acidic than bogs, which receive water only from precipitation. Fens and bogs have a high potential for rare species observations, and are sensitive to the impacts of contamination and disruption of water flow. Rare birds such as the olive-sided flycatcher, rusty blackbird and the yellow rail are known to inhabit these types of peatlands.

SOUTHWEST OF TOWER ACRES ESA

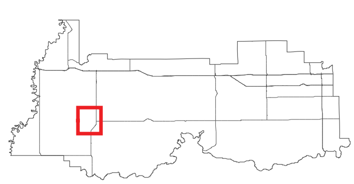


0 150 300 600 900 1,200
Metres

ESA Significance
- International
- National
- Provincial
- Regional
- Local

- Provincially Owned Lands
- Municipal Conservation Areas
- Lands Owned/Managed by Conservation Organizations

- County Boundary
- Parcel Boundary
- Municipal Boundary
- First Nations Reserve
- Hydrography
- Highway



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Southwest of Tower Acres ESA

Environmental Sensitivity: High

- High potential for groundwater contamination
- Potential presence of rare plants

Land Status:

- Mostly Crown lands, one county-owned quater section, some private lands

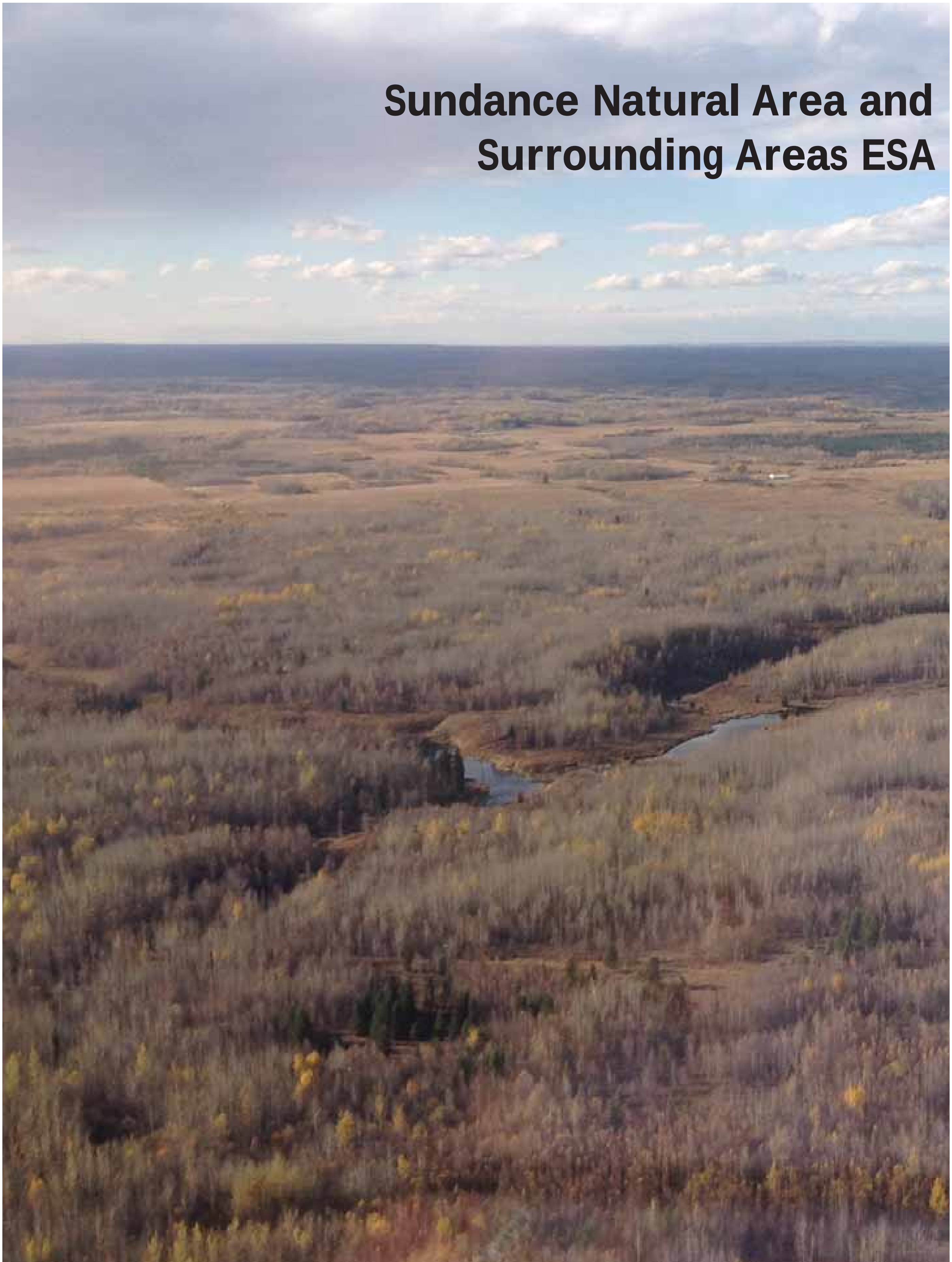
Key features:

- An undisturbed patch of different fen types
- Habitat potential for several types of rare species

Recommended Planning Strategies:

- Further road and linear development in this area should be carefully considered or be constructed to maintain water flow within this ESA. There has been some seismic development within this ESA. Further development should consider low impact seismic techniques.
- Land owners in the adjacent areas should be aware of the effects of agricultural run-off on sensitive peatlands, and consider limiting the use of pesticides and fertilizers
- The County should consider limiting further development within this ESA and maintaining contiguous habitats in adjacent areas. Reclaiming the peat harvesting operation to the west of this ESA would serve to broaden this patch of native vegetation and create additional habitat for boreal species.

Sundance Natural Area and Surrounding Areas ESA



Sundance Natural Area and Surrounding Areas ESA

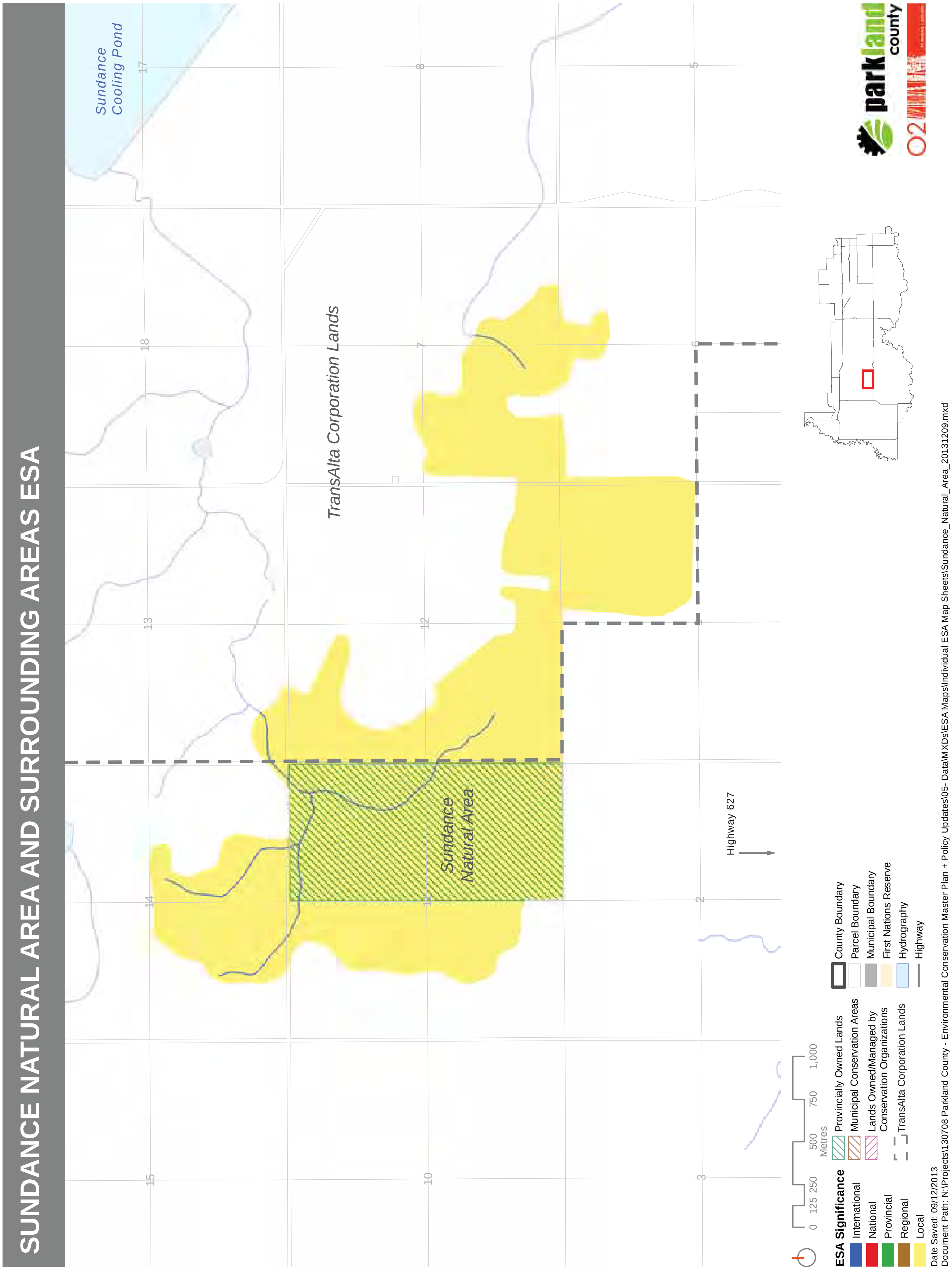
Site Location: Sundance Natural Area is located 1.6 km north of Highway 627 and 0.8 km west of Range Rd. 52

Area: 487 ha

Description:

This area features rolling terrain, with a creek running through the north and east sides. The area is mainly open, with fire-related successional aspen forest containing scattered balsam poplar, white spruce, and pine. The understory is dense with shrubs and herbs. A balsam poplar forest with dense willow and alder understory is present along with a drainage slough. Riparian areas along the creek channels are characterized by balsam poplar, birch, and white spruce. The area has abundant wildlife and is used for hunting and snowmobiling.

SUNDANCE NATURAL AREA AND SURROUNDING AREAS ESA



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.


Tomahawk Creek ESA

Tomahawk Creek ESA

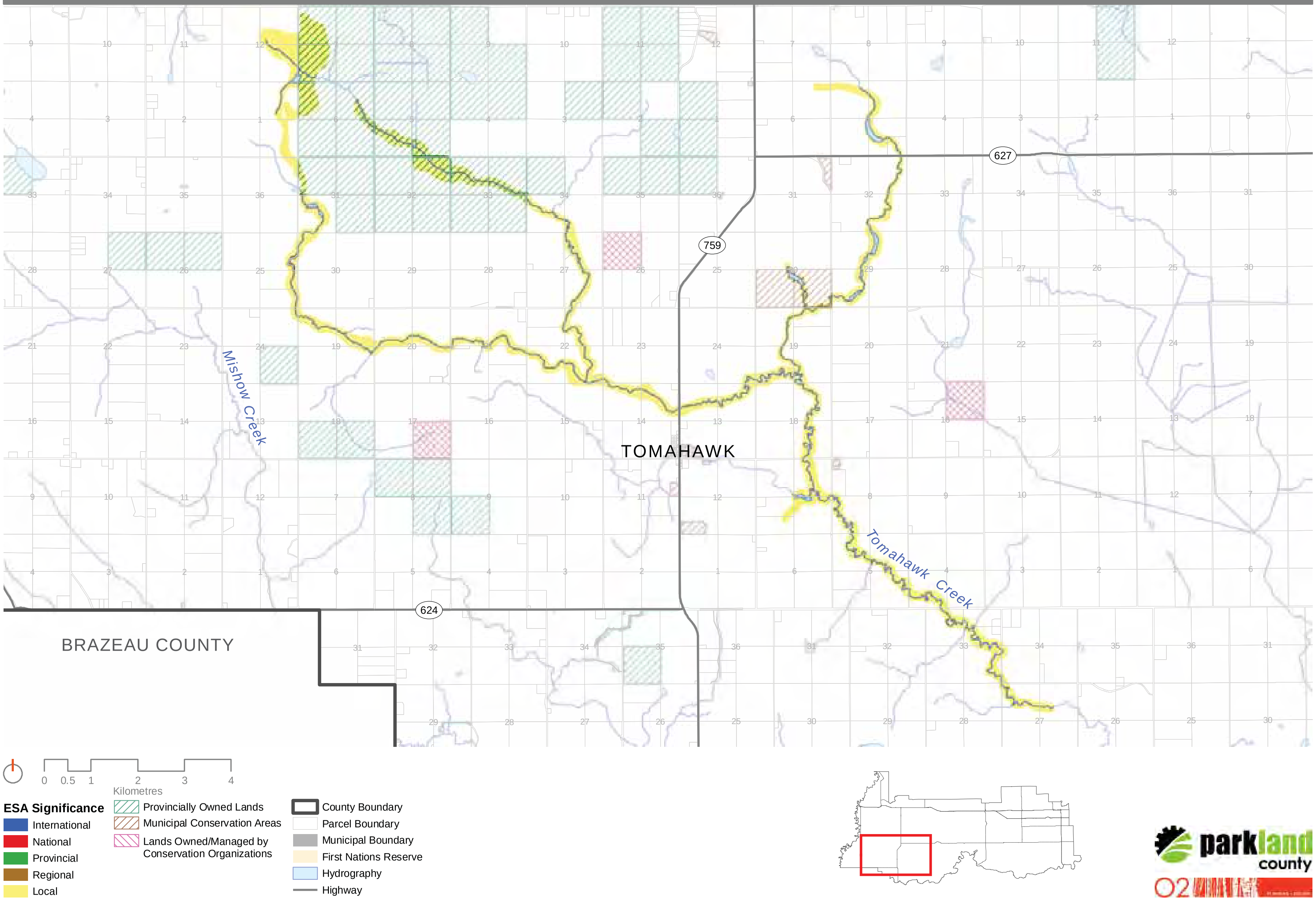
Site Location: Situated south of Highway 16, in the vicinity of the Hamlet of Tomahawk, the creek flows southeast into the North Saskatchewan River

Area: 1,231 ha

Description:

The Tomahawk Creek drains the Sun Gro sphagnum peat operation and enters the North Saskatchewan River just west of Burtonsville Island Natural Area. Upper parts of the creek have been channelized to facilitate peatland draining, and portions have been impacted by livestock grazing. The lower creek is natural and is deeply incised and heavily wooded. White spruce is present on the northeast slopes with aspen/balsam poplar being present on adjacent uplands. The creek serves as an important connecting corridor between the North Saskatchewan River and the natural areas in the northwest of the County.

TOMAHAWK CREEK ESA



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Tomahawk Creek ESA

Environmental Sensitivity: High

- Potential for groundwater contamination
- Presence of sensitive riparian areas
- Some erosion risk

Land Status:

- Private land

Key features:

- Peat harvest activities
- Lower creek remains natural

Recommended Planning Strategies:

- Peat harvest activities should be managed to ensure that draining and channelization do not impact the natural functioning of the riparian areas
- Landowners to maintain an adequate buffer from the creek to protect sensitive riparian areas
- Tomahawk lagoon discharge requires monitoring of potential impacts

Upper Shoal Lake Creek ESA

Upper Shoal Lake Creek ESA

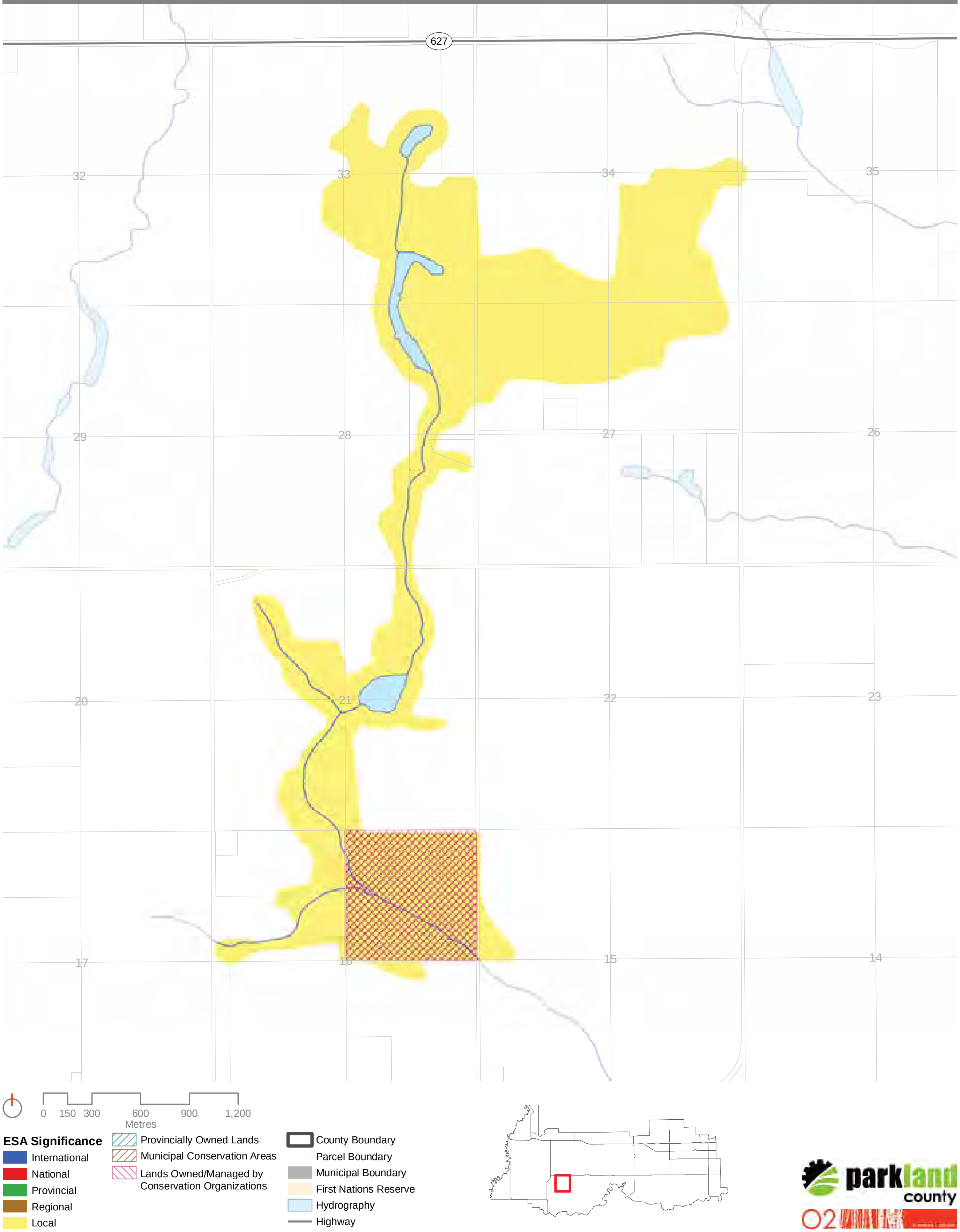
Site Location: South of Township Rd 520, West of Range Rd 52 and East of Range Rd 54

Area: 451 ha

Description:

This mixedwood area around the headwaters of Shoal Lake Creek forms an important stepping stone between Tomahawk Creek and the Shoal Uplands to the east. The ESA is valued for its contribution to regional biodiversity, connectivity and watershed values. Agricultural land use dominates the surrounding areas bordering the ESA. To the east, forest cover becomes scarce, making this an important shelter for wildlife movement.

UPPER SHOAL LAKE ESA



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Upper Shoal Lake Creek ESA

Environmental Sensitivity: High

- Presence of sensitive riparian areas
- Some erosion risk
- Potential for groundwater contamination

Land Status:

- Primarily private lands, one quarter section of municipal lands

Key features:

- Stepping stone for wildlife movement
- Local connection between neighbouring natural areas

Recommended Planning Strategies:

- Coordination between various land-owners will ensure that wildlife movement in and out of this area is unimpeded
- Impacts to water resources can be reduced by ensuring healthy riparian buffers of native perennial vegetation along permanent and non-permanent watercourses
- Retention and/or restoration of forest cover will help to encourage usage of the area by wildlife

3.2.6 Microsite ESAs

It is worth noting that there are many more micro-scale environmentally significant areas in the County beyond the ones presented in the previous sections. These include any small-scale environmental features that play a role in upholding ecological integrity at broader landscape scales. Identifying these areas would require site-specific investigations including field work completed by a qualified biologist, environmental specialist, or hydrologist, to confirm their location and function. It is recommended that this analysis be part of a biophysical assessment procedure undertaken as part of future development application procedures.

Some examples of micro-site ESAs could include:

- Smaller wetlands not flagged as an ESA by the preceding analysis
- Lower order streams and associated riparian areas (e.g., Dog Creek that runs through Spruce Grove)
- Small forest patches (e.g., within the Westbrook Crescents subdivision)

Small stream north of Stony Plain

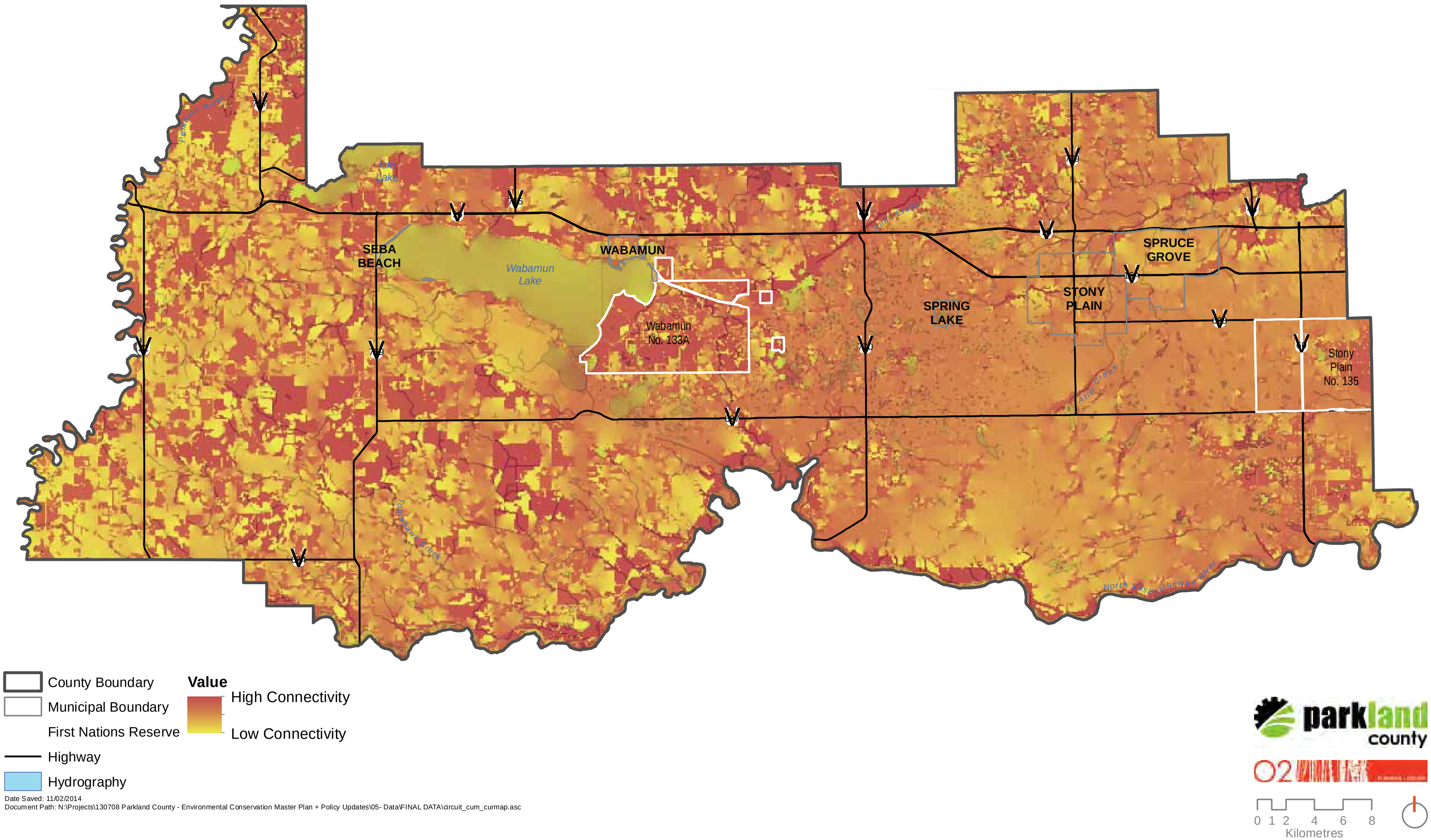
3.2. Connectivity Discussion

While the county contains extensive existing developments, the landscape still allows for movement between the remaining natural cover. The circuit connectivity analysis for the County reveals that much of the area has the potential for wildlife movement, with 17% of the landscape showing a high expected likelihood of wildlife movement (connectivity values in the upper half of the range exhibited in the County). ESAs defined in this study contain 45% of these areas, with the remaining areas of high connectivity value falling outside the identified ESAs. Maintaining connectivity in Parkland County will therefore require a twofold approach, managing both the condition and functioning of the designated ESAs, while bolstering and retaining the permeability of the landscape between ESAs.

It is important to stress that the model results are simply an estimate of the permeability of the landscape, and not directly tied to wildlife movement observations within the county. Actual wildlife may well be observed in 'low connectivity' areas, this analysis should be seen as a rough assessment at the county scale, and may well benefit from more refined local analysis. In particular, movement between designated ESAs is expected to be commonplace, as ESAs are identified only for those areas which have a wide variety of valued landscape elements. Areas of high connectivity which lack other elements may not be identified as an 'ESA' per se, but still play an important role in maintaining the environmental functioning of the broader landscape. Best management practices should be adopted across the entire county, to ensure that connectivity is maintained and improved where ever possible. This may involve removing barriers to movement across agricultural fields, minimizing noise and light pollution around developed areas, and placing crossing structures across new road developments.

In fact, one such crossing structure is currently slated for construction just outside of the County. The Hawk Ridge 215 Street Wildlife Passage is set to be constructed across Winterburn Road NW to two large natural habitat areas existing on either side of the road.

MAP 15: CIRCUIT CONNECTIVITY



Map 15. Circuit Connectivity

Aspen stand

4. Beneficial Management Practices

Beneficial Management Practices are common-sense operating principles that are simple and economical to implement. During consultations over the course of project delivery, stakeholders also strongly felt that BMPs should also be about creating a vision and policy intent to address future issues, which is reflected in the content below.

Resources are rarely adequate to deliver education and technical assistance to "everyone." Therefore, defining target audiences who most need to adopt BMPs is an approach to make the best use of these limited resources.

The following document contains a list of BMPs for each theme of environmental significance in Parkland County. General BMPs have been identified, along with specific categories for the following industries:

- Agriculture
- Oil and Gas
- Industrial Development (e.g., Acheson area)
- Coal Mining
- Aggregate Mining
- Peat Harvesting
- Country Residential Development
- Recreation

4.1. Species, Habitats and Landscape Ecology

Key Objectives

- Maintain "indispensable landscape patterns" including large patches of native vegetation, regional corridors, well-vegetated riparian areas, and connectivity through the landscape (Forman, 1995)
- Avoid areas containing sensitive wildlife or plant species and wetlands
- Protect critical wildlife habitat
- Provide incentives and education and outreach to landowners
- Conduct field inventories of significant habitats, listed species' presence and sign, snake hibernacula, rare plants, etc. prior to development

4.1.1. General BMPs

Habitat Management (Terrestrial and Aquatic)

- Include habitat and species protection in the guiding principles of the new Municipal Development Plan
- Undertake pre-project planning and consultation with County staff to avoid environmentally sensitive areas
- Consider cumulative effects and timing in development and operations
- Maintain connectivity of habitat where possible
- Replace or restore lost habitat
- Restore connectivity by reclaiming disturbances
- Provide conservation offsets to reduce impacts to sensitive landscapes
- Retain a qualified environmental specialist to analyze, inspect, and monitor relevant pre-development, construction, operation, and reclamation activities

Vegetation Management

- Conduct pre-disturbance and biophysical impact assessments
- Engage in pre-project planning to identify specific risks and mitigation measures
- Weed inspections and control (consult Invasive Species Council of Alberta)

4.1.2. Selected Industry Specific BMPs

Industry	BMP
Agriculture (From Beneficial Management Practices Environmental Manual for Crop Producers in Alberta)	**On Cropped Land** Convert marginally productive lands for annual crops to long-term forage production Provide incentives for non-cropped areas Add perennial or annual forages to crop rotations, and manage perennial forage stands for longer life Use a flushing bar when haying Delay haying near wetlands until at least July 1, and whenever possible delay until mid-July Plant fall-seeded crops Reduce or eliminate tillage and/or try to eliminate fall tillage to provide cover and food during winter Use strip cropping rather than conventional fallow Use integrated pest management **On Non-Cropped Land** Retain existing natural areas Enhance the habitat values of treed areas by adding productive trees and leaving dead trees Avoid over-grazing of pasture land and delay spring grazing near wet areas Enhance habitat value in idle areas by planting a variety of grasses, legumes and shrubs, and adding nesting boxes Maintain the edges between habitat types Store reject bales carefully to avoid deer eating crops in corridors
Oil and Gas	Develop site designs which avoid impacting intact native vegetation communities and wetlands (i.e. use existing ROWs, access roads and disturbances) Implement Low Impact Seismic (LIS) techniques for cut lines Use low impact installation methods for pipelines to minimize disturbance Progressively reclaim wellsites by revegetating areas that are not in use following construction Use low impact techniques for constructing temporary access roads and block access to recreational users Consider leveraging the Orphan Wells Program for contaminated sites and low production wells
Industrial Lot Development	If possible, redevelop brownfield (old underused industrial areas) and greyfield (old underused commercial areas) rather than expanding development into natural areas and/or farmland

Coal Mining / Aggregate Mining	Consider establishing an “upper limit” to industrial development around Wabamun Lake Implement progressive reclamation concurrent to ongoing development to reestablish functioning ecosystems as fast as possible Mine reclamation should include ponds, natural wetlands, and upland forests Implement water management strategies by treating stormwater on-site prior to release to the surrounding environment Salvage and stockpile topsoil (and subsoil) for replacement on reclaimed areas The Area Structure Plan near the Highvale Mine site near Lake Wabamun should be redone and more progressive reclamation of this mine site is needed
Peat Harvesting	Restore areas with native species after harvesting Prioritize previously degraded peatlands for harvesting Avoid deforestation when identifying harvest areas Use extraction techniques that will enable rehabilitation (maintaining hydrological regime and establishing a functioning acrotelm) Implement rehabilitation to a functioning ecosystem immediately after peat extraction, and implement mitigation techniques during operations: minimize impact to surrounding areas (water/dust management) minimize the spilling of fuel or other wastes stockpile peat to minimize decomposition
Country Residential Development	Design the site to retain trees and green space Use buffers and corridors to link and protect sensitive habitats Maintain natural/native vegetation that contributes to wildlife corridors Use natural landscaping techniques Salvage at least 20 cm of topsoil Stockpile natural soils Reduce soil compaction Use local native plants, trees and shrub Redevelop brownfield and greyfield sites rather than expanding into natural areas Create narrow roads with infiltration swales Cluster development in areas close to existing infrastructure Create a County regional development cluster, considering that much of the public feels that the balance of development does not necessarily have to mean much smaller acreages
Lakeshore/Lakefront Development	Prohibit clearing and sand dumping in riparian and shoreline areas in all lake ESA.in order to maintain critical nesting and wildlife habitat Prohibit the removal of riparian lakeshore vegetation with improved enforcement on environmental and municipal reserve lots. This measure will ensure that critical habitat areas are maintained and enhanced

Recreation	Avoid creating disturbances (e.g. snowmobile access) to wintering ungulate populations Use established trails/linear disturbances for off-roading Continue to restrict and enforce OHV use in environmental reserve lots and other conservation lands

4.2. Wetlands

The bed and shore of permanent wetlands are Crown lands, even if surrounded by private lands

Key Objectives:

- Sustain and conserve wetlands
- Provide wetland compensation when impacts are unavoidable
- Restore wetlands

4.2.1. General BMPs (All Industries)

Wetland Protection and Conservation Tools

- All industries including the agricultural sector and governments should aim to avoid impacting wetlands
- Maintain and restore wetland riparian buffers as large as possible and ensure they contain healthy, natural vegetation
- Ensure that land use practices adjacent to wetlands minimize runoff of nutrients, pesticides, sediment, pathogens, and other contaminants

Compensation Considerations

- Where impacts on wetlands are unavoidable, ensure mitigation or compensation occurs
- Locate compensation wetlands as close to the original wetland as possible, and within the same sub-watershed or landscape unit
- Create new wetlands that provide comparable functions to the original wetland (consider size, shape, riparian buffer, function assessments, etc.)
- Create a wetland mitigation bank and market to enhance the availability of wetland offset credits

Wetland Restoration

- All drained wetlands and drained lakes should be managed for wetland values and ideally restored towards its pre-disturbance condition (e.g., Low Water Lake)
- Targeted wetland restoration should occur above and beyond those wetlands being constructed for compensation for recent impacts in light of the historical losses over the last 150 years

Education

- Develop education strategies targeting loss/drainage of wetlands in agricultural and urban contexts
- Educate all audiences on economic and social benefits of wetlands, including how wetlands can enhance development, as opposed to being at their expense
- Identify, involve, document, and mobilize support for wetland conservation among multiple sectors of society — waterfowl hunters, conservationists, landowners, recreationists, etc.
- Address potential recreational impacts on wetlands in areas of intensive recreational activity with indirect measures (signage, education, diversion of OHV users to areas with no wetlands) and direct measures (e.g., access control, boardwalk siting, design, facilities, surveillance)

4.2.2. Selected Industry Specific BMPs for Wetlands

Industry	BMP
Agriculture	Review the ALUS program for stewardship projects related to wetlands such as exclusion fencing Share costs of exclusion fencing to lessen burden on producers
Oil and Gas	Ensure appropriate setbacks (e.g., ideally 100 m) of facilities from wetlands
Industrial Lot Development	Turn liabilities into assets (e.g., stormwater ponds and constructed engineered wetlands as amenities)
Coal Mining / Aggregate Mining	Reclaim Elmdale/Whitewood Mine Mine reclamation should include as many naturalized wetlands as possible as part of the end land uses to emulate pre-disturbance habitats
Peat Mining	Conduct groundwater and hydrology surveys prior to peat harvesting Use only wood structures for roads through wetlands (corduroy)
Country Residential Development	Establish minimum setbacks from all wetlands Parkland County to develop a Riparian Setback Matrix model to establish a scientific basis to tailor minimum setbacks to specific conditions
Lakeshore/Lakefront Development	Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, biophysical impact assessments, etc.) for proposed developments within 100 metres of lakes and wetlands. Negative environmental assessments would require significant development alterations or would be disallowed from future development. Protect and enhance wetlands and riparian areas surrounding lakes to enhance fitration of runoff from nearby source areas
Recreation	Use boardwalks to prevent trampling of sensitive wetland vegetation Continue to restrict and enforce OHV use in environmental reserve lots and other sensitive conservation lands, such as wetlands

4.3. Landforms and Steep Slopes

Key objectives:

- Minimize land and soil disturbances
- Avoid development on steep slopes
- Conserve significant landforms

4.3.1. General BMPs (All Industries)

Steep Slopes and Significant Landforms

- Avoid locating infrastructure on or adjacent to steep slopes or significant landform features
- Erosion and sediment control plans should be prepared and implemented by professionals if traversing steep slopes is unavoidable
- Develop municipal bylaws according to slope degree (typically >15%)
- Maintain vegetation cover on slopes
- Establish setbacks for steep slopes

Soil Conservation

- Coordinate pre-project planning regarding the selection of sites and site designs
- Employ two- and three-lift techniques for soil stockpiling during construction
- Use wood fibre as a driving surface for roads
- Ensure that a qualified soil specialist provides monitoring and inspection of construction, operation and reclamation activities

4.3.2. Selected Industry-Specific BMPs

Industry	BMP
Agriculture (From Beneficial Management Practices Environmental Manual for Crop Producers in Alberta)	Manage livestock access to areas with steep erosion- prone slopes with a variety of tools, including temporary or permanent fencing and alternative livestock watering systems (e.g., solar, cattle nose pump, etc.)
Oil and Gas	Minimize land and soil disturbances with innovative pipeline construction equipment and techniques where possible
Recreation	Address recreational impacts on steep slopes with indirect measures (signage, education) and direct measures (e.g., access control, boardwalk siting, design, facilities, surveillance) Continue to restrict and enforce OHV use in environmental reserve lots and areas with steep sloes that are vulnerable to erosion.

4.4. Groundwater and Surface Water Resources

Key Objectives

- Conserve water
- Protect against water contamination
- Manage all lands with watershed values in mind
- Examine a suite of initiatives including incentives, payments for ecosystem services, innovative tax shifting, leveraging easements, regulation, etc.
- Create consistent, science-based policy beyond case-by-case basis

4.4.1. General BMPs

Surface Water Protection

- Avoid developing areas of ecological infrastructure providing important watershed functions (floodplains, wetlands, riparian areas, alluvial aquifers, steep slopes, identified Environmentally Significant Areas [ESAs], etc.)
- All industries, including agriculture, and governments should aim to avoid development or resource extraction in or directly adjacent to local variable-width riparian areas and associated steep slopes
- Reconnect severed linkages in the riparian network where possible
- Where riparian impacts are completely unavoidable, investigate potential compensation elsewhere in the same sub-watershed

- Collaborate with other landowners and surrounding jurisdictions to address shared issues
- Maintain and restore riparian buffers as large as possible that contain healthy natural vegetation
- Reduce the occurrence of invasive plants and weeds in riparian areas
- Limit loss of riparian areas due to hard engineering infrastructure (rip rap, gabions) and channelization by avoiding placement of infrastructure in vulnerable areas and using “soft” bioengineering techniques as an alternative
- Refer to the County’s Riparian Setback Matrix model tool[1] to reduce the potential impact to lakes, rivers, and streams in the process of development

Groundwater Protection

- Municipal overlay zones for sensitive groundwater areas are required and tools to deny applications for development in those areas should be developed
- Completions of water wells across multiple discrete aquifer intervals is not to occur in order to eliminate the risk of induced connections between otherwise isolated intervals (AESRD)
- Spills of harmful or toxic substances must be contained and cleaned up as quickly as possible, and contaminated soil removed from the area, to protect shallow groundwater resources.
- Storage of fuels and chemicals should be done in dedicated and secured areas to ensure isolation of the substances from the groundwater environment and containment of any spills. Secondary containment should be employed for particularly toxic or harmful substances.
- Adequate wellhead protection areas should be established using a risk-based approach for water wells situated in developed areas to ensure that groundwater quality is sufficiently protected. Monitoring of water quality should be conducted regularly for constituents that may be related to nearby activities (e.g., volatile hydrocarbons for gas stations or fuel storage areas).
- Areas identified as being at higher-risk based on vulnerability and sensitivity mapping should have some form of groundwater monitoring established (either new wells or existing wells) to assess groundwater conditions (quality and/or quantity).
- Certain development activities (e.g., waste storage or management areas) should be restricted from key recharge areas, particularly those readily connected to nearby waterbodies. Adequate buffer zones should be established otherwise using a risk-based approach.
- Well owners should be made aware that management of private wells is their responsibility (AESRD Working Well program (http://environment.alberta.ca/01317.html).

1 To be developed by Parkland County as part of Phase 3 of the ECMP

- The public should be informed as to the potential impacts of human activities on groundwater resources such as through the AESRD Working Well program (e.g., http://environment.alberta.ca/01317.html; http://fracfocus.ca, etc.)
- In sensitive/higher risk areas where developments are proposed, industrial and/or municipal insurance bonds or other financial instruments should be examined to create more awareness of the potential for groundwater contamination as well as to ensure appropriate financing and responsibility for remediation if damage is caused

Education

- Develop an education strategy specifically to target riparian areas in agricultural areas, using lessons learned from surveys on producer knowledge of riparian areas and functions (Cows and Fish, 2002)
- Educate all audiences on the economic and social benefits of conserving riparian areas, including how riparian areas can enhance development, as opposed to being at the expense of development
- Educate, inform and engage the community and users of these areas to assist in improving riparian health and developing riparian management strategies
- Promote community action events that tackle riparian issues and give the public the opportunity to directly improve riparian health (e.g., weed pulls, clean-up days, etc.)
- Develop community monitoring programs that involve local user groups and residents (Cows and Fish, 2012)
- Provide appropriate training for municipal staff to understand wetland and riparian goals during application review processes
- Communicate with all stakeholders during the development of planning documents and seek early and regular input into the process
- Ongoing targeted education of public officials, civil servants, the development community, and the public is required to ensure proper understanding, support, and technical knowledge

4.4.2. Industry-Specific BMPs for Water Resources

Industry	BMP
Agriculture	*Manure Management Practices:* Adequate risk-based buffer distances should be established and maintained between manure management systems and nearby water wells Routine soil testing should be conducted to ensure that over-fertilizing of soils used for crop development is not occurring (i.e., N and P) Proper setback distances from water bodies should be established to ensure against unintended impacts (i.e., eutrophication) *Other Farming Practices:* Conserve and restore wetlands and riparian areas, including incentives for landowners who may be forgoing some income in order to achieve this Application of pesticides or manure on the land surface should be minimized/optimized to protect shallow groundwater resources. Monitoring of groundwater quality around large livestock operations near aquatic or human receptors should include assessment of key pharmaceuticals, and key pathogens (e.g., E. coli O157:H7) Apply conservation tillage (no till and reduced till) to conserve soil organic matter and moisture, leading to better management of "green water" and reduced need for irrigation (Shotyk 2012) Plan small-scale water storage (e.g., dugouts) to capture extra water during wet seasons or wet years, for use during dry seasons or years Feedlots, dairy producers, and other stock-intensive industries should refer to best practices related to water conservation and efficiency in the Environmental Manual for Dairy Producers in Alberta (AM + AARD, 2003) and the Environmental Manual for Feedlot Producers in Alberta (ACFA + AARD, 2002) Agricultural producers and rural landowners should strive to participate in Parkland County's Alternative Land Use Services (ALUS) project to help sustain agriculture, wildlife, and natural spaces while supporting the local economy Carefully manage livestock access to riparian areas with a variety of tools, including rotational grazing, time controlled grazing (avoid moist conditions), appropriate stocking rates, temporary or permanent fencing, and alternative livestock watering systems (e.g., solar, cattle nose pump) Restore riparian areas to native cover; if this is unfeasible, convert crops to perennial hay cover or agroforestry operations as appropriate which are preferable to annual crops If cropping in riparian areas does occur, ensure annual crop stubble is left near or in the riparian zone during fall, winter and spring, or that fall cereals are used as an alternative Consider wetland retention ponds for farmland with tile drainage systems, because riparian buffers will be ineffective for nutrient retention, particularly if pipes bypass the riparian zone and discharge directly into streams Management and cultivation of croplands should be done in a manner to encourage groundwater recharge and reduce or eliminate soil salinization issues.

Oil and Gas	Minimize land and soil disturbances with innovative pipeline construction equipment and techniques where possible Apply technologies and processes for improving water conservation, efficiency, and productivity (e.g., water reuse and recycling, improved process efficiency, reduced water losses, etc.) Avoid using surface water and potable groundwater for industrial uses, particularly in areas vulnerable to local water scarcity Use saline groundwater for pressure maintenance purposes where available in sufficient quantities, with appropriate subsurface re-injection back to the source once it has been used Reuse municipal wastewater for industrial applications where feasible and beneficial Treat and reuse produced water that would otherwise be disposed of by injection Provide for increased monitoring and sampling of local surface water and groundwater in areas that may be impacted by industrial activity to identify concerns Groundwater risk assessments should be conducted on major fields and/or development areas employing hydraulic fracturing technology or recovering oil and gas via conventional means This includes the risk of gas migration and production fluid releases to groundwater intervals above the Base of Groundwater Protection or BGP (AER) Risk assessments should be conducted in advance of any hydraulic fracturing (HF) operations near existing or abandoned production wells open across the same interval (and within the radius of pressure influence), as well as any other interval that may be affected by HF operations Each risk assessment should conclusively demonstrate that the HF operations will not create a risk to groundwater above the BGP (AER). Sound wellbore construction practices, sourcing alternatives to fresh water where appropriate (e.g., avoiding potable water sources), and recycling water for reuse should be employed as much as practical to safeguard the quality and quantity of surface and groundwater resources (CAPP) A proper communication strategy should be developed to inform area residents of activities and monitoring efforts to ensure protection of groundwater above the BGP (AER) This communication strategy should include the disclosure of fracture fluid additives and the use of fluids with the least environmental risks (CAPP) Pipeline routing should be done to avoid sensitive groundwater areas such as near-surface sand and gravel deposits, near surface buried channels, and large outwash deposits either connected to waterbodies or used by local residents as a water supply. If unavoidable, proper setback distances from receptors should be established to protect against adverse impacts in the event of a pipeline rupture. Hydrocarbon storage and processing facilities should not be developed in sensitive recharge areas.
Industrial Development	Convert riparian areas that are developed as industrial or commercial uses to open spaces if and when such opportunities arise during redevelopment and/or brownfields remediation Utilize Low Impact Development stormwater management technologies that aim to emulate pre-development hydrology including infiltration, etc. using a combination of planning and design techniques including: Minimize impervious areas and maximize open spaces Provide bioswales and grassed swales Provide rain gardens and infiltration trenches Green roofs Pervious pavement Stormwater ponds as well as constructed wetlands and engineered natural wetlands Re-use stored stormwater for irrigation from stormwater ponds
Coal Mining	Use retention ponds to minimize water quality concerns from mine runoff or industrial process water Reduce water usage at facilities through improved process efficiencies Address the significant water quality issues related to dewatering using new technologies, processes, and land management practices

Aggregate Mining	Advocate/ encourage improved water recycling in aggregate washing Better define regulations and enforcement for Class II (<5 ha) sand/gravel pits within County jurisdiction (Class I are >5 ha) Avoid the development of new sand and gravel mines in extremely vulnerable or sensitive areas (e.g., hyporheic exchange areas adjacent to rivers) Avoid wet gravel extraction/dewatering processes as far as possible In cases where dry pit extraction is not possible, detailed hydraulic and hydrological studies will be required by the proponents in extracting gravel from areas that are not dry pits For maintaining groundwater levels in vicinity of aggregate mines, a recharge pond may be constructed so groundwater is not drawn down affecting downstream areas Accelerate appropriate reclamation of existing sand and gravel mines Develop and implement detailed sediment control measures, spill handling procedures, and equipment maintenance regimes for existing sand and gravel mines Adequate risk-based setback distances and mitigation measures should be established for aggregate mines located in deposits connected to waterbodies, to ensure against negative impacts to baseflow contributions and water quality Completed mines should be properly reclaimed to re-establish groundwater flow and quality conditions that existed prior to development Completed mine pits should be assessed for their usefulness as future artificial recharge areas or water storage areas
Peat Harvesting	Restore to a functional wetland over time after harvesting Re-wet the land slowly Apply optimal seed cover ratio for seed bed during reclamation Do not mine below the HC3 soil horizon (~0.9 m)
Regional Water / Wastewater Systems	Detect and correct potential sewage leaks/spills from regional wastewater pipeline transfer to Edmonton

Country Residential Development	*Water Conservation* Restrict outdoor watering during dry seasons or years, increasing the use of bylaws and enforcement if necessary Use native, xeric, low-maintenance plants for landscaping to help reduce outdoor watering requirements (use incentives, Land Use Bylaw revisions, etc.) Conserve topsoil (e.g., minimum 300 mm of topsoil for all landscaped areas) Install low flow water fixtures and toilets Consider small-scale rainwater harvesting Consider stormwater reuse Consider grey water reuse and water recycling Conduct water-use audits Reduce leaks from aging infrastructure and replace / fix leaky water mains *Watershed Management, Stormwater Management, and Flooding* Develop setbacks for shoreline development Improved erosion and sediment control planning and design Reduce salt from water softeners sent out in septic tanks around lakes Encourage shoreline residents to respect shoreline habitats to protect water quality and habitat (e.g., see resources provided by Nature Alberta Living By Water program including On the Living Edge: Your Guide to Waterfront Living http://naturealberta.ca/programs/living-by-water/) Reduce road salting (e.g., Big Lake residential communities) Do not develop in flood-prone areas (note that "flood prone areas" may be much greater than the 1:100 year design flood identified in older provincial floodplain maps and should be based on the best available data) Construct stormwater management systems that mimic predevelopment hydrology Follow Low Impact Development (LID) design standards and construction procedures. In addition to stormwater ponds to minimize peak flow discharge rates, LID includes decentralized networks of source control stormwater management facilities (e.g., rain gardens, bioswales, green roofs, pervious pavement, etc.) Consider minimum densities for greenfield development, and identify priority areas for redevelopment and rezoning Development layouts should reduce large lot acreages in favour of smaller lots and larger areas for Environmental Reserve and green spaces New residential areas should be developed with stormwater management systems that encourage recharge (e.g., leaky stormwater collection ponds or established flood areas) Permeable hard surfaces should be used where possible to facilitate infiltration to the subsurface and reduce issues with stormwater runoff Strongly discourage use of residential fertilizers or pesticides Residences established in areas where groundwater discharges to nearby water bodies should refrain from using pesticides on their lawns and gardens to mitigate risks of water body contamination *Groundwater* Residences located in areas with highly permeable sediments (e.g., river gravels) should not establish septic leach field systems. A secured system or communal process of waste management should be deployed. Residences located in areas with high groundwater tables should not include basement developments, and/or should complete extensive mitigation measures to ensure proper drainage The working well program should continue to be promoted/extended to additional landowners Where development relies on groundwater for supplies, aquifers should have specific indicators and targets developed for both water quantity and quality Restrict ground-sourced heat pumps to closed loop systems in areas with high scores for groundwater resources

Lakeshore / Lakefront Development	Prohibit residential fertilizer use within the ESA boundary of all lake ESAs. Increase education and (where necessary) enforcement for non-compliance. Reduce pollution impacts on river and lake ESAs from private sewage / wastewater systems through enforcement Prohibit clearing and sand dumping in riparian and shoreline areas of all lake ESAs Prohibit the removal of riparian lakeshore vegetation with improved enforcement on environmental and municipal reserve lots Parkland County to develop a Riparian Setback Matrix model to establish a scientific basis for determining future Environmental Reserve (ER) lands Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, biophysical impact assessments) for proposed developments within 100 metres of lakes and lake ESAs. Negative environmental assessments would require significant development alterations or would be disallowed from future development Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation that protects lakes and other water bodies Prepare lake use plans for several County lakes including Wabamun, Isle Lake, Mayatan, Jackfish Lake, and Hubbles Lake. Lake use plans to identify appropriate land uses along all lake areas, and guide future Area Structure Plan development Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the water basin. Examples include The Water Act, and The Environmental Protection and Enhancement Act Protect and enhance wetlands and riparian areas surrounding lakes to enhance fitration of runoff from nearby source areas
Recreation	Address summer and winter recreational impacts on riparian areas with both indirect measures (signage, education) and direct measures (e.g., access control, trail siting and design, facilities, bylaws, surveillance) Siting of latrines in campgrounds and other established recreational areas should avoid highly permeable sediments, particularly those that might be connected to nearby surface waterbodies Toilet facilities at recreation sites should ideally be 100 m away from any stream or body of water and must be maintained according to best practices Vulnerable and sensitive areas where OHV activity may adversely impact groundwater recharge and quality conditions should be identified, communicated to the public, and managed accordingly (including the establishment of no-access areas) Campground water wells should have a sufficient depth of installation, well completion process, and wellhead protection area to safeguard against any impacts Continue to restrict and enforce OHV use in environmental reserve lots and other sensitive conservation lands prone to erosion

4.5. Protected Areas / Conservation Areas

Key Objectives

- Ensure high value, representative ecosystem types are included within protected area systems
- Meet evolving and diverse visitor experience needs within parks and protected areas
- Ensure provincial, municipal, and non-government initiatives for parks and conservation areas complement one another
- Integrate parks with surrounding public lands, communities, and watersheds

4.5.1. General BMPs

- Establish new parks/conservation areas in locations of high environmental value as suitable opportunities arise through planning processes at multiple scales
- Consider partnering with land conservation organizations to fund land acquisitions and coordinate connected landscapes for parks/conservation areas
- Involve community partners in developing, maintaining, and sustaining parks
- Develop and deliver interpretive parks programs in partnership with Aboriginal communities
- Develop comprehensive zoning strategies within parks to minimize environmental impacts and maximize a diversity of recreational opportunity typologies in suitable areas
- Leave adequate natural vegetated buffers between protected areas and proposed developments
- Retain natural vegetation along boundaries adjacent to protected areas, and replace lost vegetation with appropriate native plant species
- Avoid or minimize lighting adjacent to protected areas
- Install interpretive signage between developments and protected areas
- Continue to restrict and enforce OHV use in environmental reserve lots and other sensitive protected areas and conservation lands

4.6. Recreation

Key Objectives:

- Meet evolving and diverse visitor experience needs for recreation and tourism across a wide range of landscapes within the County, while ensuring that recreational uses do not adversely affect the local and regional environment

4.6.1. General BMPs

- Provide an appropriate mix of recreational facilities that meet current and future needs for recreational opportunities while minimizing risks to environmental values
- Prohibit motorized recreation in incompatible areas to minimize environmental impacts and impacts on nature-based recreation experiences
- Divert higher-risk activities (e.g., ATV use) away from environmentally sensitive locations by designating and promoting specific nodes at more resilient locations which still contain suitable features for high quality user experiences
- Use indirect recreation management strategies to influence visitor behavior in recreation areas, including signage, education, media releases, bottom-up stewardship initiatives, etc.
- Restore areas damaged by recreational usage (e.g., ATVs, horse trails, etc.)
- Install and/or upgrade bridges and other water crossing structures on recreational trails to minimize bank erosion and riparian damage
- Use direct recreation management strategies to influence visitor behavior in recreation areas, including:
- Implement control strategies to limit access to environmentally sensitive areas (e.g., cross ditches, earthen berms, felled timber, gates, etc.)
- Trail design criteria to avoid higher risk areas (e.g., steep grades, wet soils, soils with high clay or silt, riparian areas, etc.)
- Install or upgrade bridges, boardwalks, and water crossings on designated trails to cross streams, riparian areas, and wetlands
- Limit the total number of people permitted to camp overnight at specific locations
- Construct and maintain boat launch facilities properly in a manner that provides access while reducing bank erosion and disturbance
- Develop recreation activity bylaws to control inappropriate recreational uses in environmentally sensitive areas
- Ensure sufficient resources for surveillance and enforcement

4.7. Lakeshore and Lakefront Development

Key Objectives:

- Ensure that the ecological integrity of the County's lake environments, and the ecosystem services they provide, are conserved for current and future generations
- Ensure that lakeshore and lakefront development is planned and managed from a cumulative effects perspective, with awareness of sensitive environmental features, resources, and processes
- Ensure that the ecological carrying capacities of the County's lakes are not exceeded

4.7.1. General BMPs

- Determine the sources and amounts of nutrients entering lakes 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 lakes using water quality modelling
- Sample and monitor the trophic state of lakes annually
- 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 of all lake ESAs. Increase education and (where necessary) enforcement for non-compliance.
- Reduce pollution impacts from private sewage / wastewater systems through enforcement
- Provide grants to home owners to install pumpouts and holding tanks
- Upgrade sewage treatment in the vicinity of lakes
- Prohibit clearing and sand dumping in riparian and shoreline areas of all lake ESAs
- Prohibit the removal of riparian lakeshore vegetation with improved enforcement on environmental and municipal reserve lots
- Require additional environmental assessments (i.e. use of Riparian Setback Matrix model, biophysical impact assessments, etc.) for proposed developments within 100 metres of lakes and lake ESAs. Negative environmental assessments would require significant development alterations or would be disallowed from future development.
- Parkland County to develop a Riparian Setback Matrix model to establish a scientific basis for determining future Environmental Reserve (ER) lands
- Prepare lake use plans for several County lakes including Wabamun, Isle Lake, Mayatan, Jackfish Lake, and Hubbles Lake. Lake use plans to

identify appropriate land uses along all lake areas, and guide future Area Structure Plan development

- Implement all Alberta Environment and Sustainable Resource guidelines for waste and stormwater management to eliminate direct runoff into the water basin. Examples include *The Water Act*, and *The Environmental Protection and Enhancement Act*.
- Land owners and agricultural operators are encouraged to take advantage of County best management practice programs such as ALUS (Alternative Land Use Services) to enhance riparian vegetation that protects lakes and other water bodies
- Maximum boating speeds (12 km/hr on most lakes in the County— see individual fact sheets for details) should be enforced to minimize disturbance to the lake environment and other recreational users
- Protect and enhance wetlands and riparian areas surrounding lakes to enhance fitration of runoff from nearby source areas
- Refer to existing State of the Watershed Reports for Wabamun Lake (2013) and Mayatan Lake (2013) and undertake the completion of these reports for other county lakes
- Undertake completion of Lake Management Plans for lakes with Parkland County, with full understanding and incorporation of Integrated Watershed Mangement

4.8. Overall BMPs for Land Use and Environmentally Significant Areas

Key Objectives:

- Avoid developing areas of ecological infrastructure (areas with wetlands, riparian areas, alluvial aquifers, steep slopes, floodplains, native vegetation, ESAs, etc.)
- Apply integrated land management (ILM) principles. ILM is a way of thinking that reduces the footprint of human land use and associated natural resources. It encompasses sharing footprints across industries, reclaiming or re-using footprints, and coordinating developments to minimize new footprints[2]. Although focused on public lands the approach can also be used on private lands.
- Manage land with respect for the past, and as an investment in the future
- Encourage all landowners and land users to cultivate an ethic of "ownership"
- Education and outreach of residents, property owners, and specific industry groups is critical

2 http://www.srd.alberta.ca/LandsForests/IntegratedLandManagement/ILMToolbox.aspx

- Consider price values of ecosystem services
- Conduct Biophysical Impact Assessments to explore areas surrounding ESAs subject to development pressure for a complete inventory of microsite ESAs at a finer resolution. These specific areas should in turn be addressed through planning tools such as an Area Structure Plan.

4.8.1. General BMPs

Education

- Emphasize social, economic and environmental benefits of responsible land management
- Conduct education and outreach before disturbances occur, this will allow landowners and developers to feel like they are part of the process, rather than create confrontation
- Educate County residents about requirements for designated Environmental Reserve, especially around lakeshores
- Education is required around the meaning of policies and bylaws
- Conduct open houses or public meetings in cooperation with Lake Management Associations
- Provide environmental education about issues in Parkland County through the schools
- Improved signage of environmentally significant lands
- Fact sheets and presentations for targeted user groups (e.g., lakeshore residents, OHV users)
- Searchable databases or interactive mapping platforms
- Collaborative data gathering programs
- Use language and level of detail that is easy for people to understand
- Conduct education and outreach before disturbances occur

Development Approvals / Cumulative Effects Management

- Evaluate development through a triple bottom line[3] framework
- Emphasize the economic benefits of ESAs
- Coordinate area-wide reviews of key environmental systems
- Identify and map priority areas for more specific cumulative targets
- Require restoration, reclamation, or enhanced mitigation for projects
- Develop conservation offset systems
- Focus other required restoration and reclamation efforts on areas with the greatest positive cumulative impacts
- Develop municipal bylaws, plans and policies for ESAs

3 Triple Bottom Line is a framework that incorporates three dimensions of performance: social, environmental and financial..

- Develop and apply additional tools such as conservation easements, tax benefits, market-based instruments under the Land Stewardship Act, etc. to promote environmental conservation of key areas
- Develop restoration programs for private landowners including financial incentives and grants, technical support, and advice (e.g., Alternative Land Use Services program underway in the County, also see the Government of Manitoba's Wetland Restoration Incentive Program as another example)
- Conduct data gathering to determine whether BMPs are working or not

Compliance and Enforcement

- Reward exemplary behavior, report on violations
- Include an environmental checklist as a condition of development approval, and provide information about environmental rules, policies and best practices at the time of approval
- Create tax incentives to encourage private stewardship
- Translate policies into bylaws to ensure enforceable consequences
- Target education and outreach materials in coordination with compliance and enforcement activities (e.g. outline requirements and penalties for non-compliance, distribute additional outreach materials to offenders, etc.)
- Consider linking property tax evaluations to effective land management practices to provide more financial incentives to landowners (e.g. reduce property taxes if effective land stewardship has been implemented)
- Consider publishing the environmental track records of businesses to reward those doing a good job
- Consider additional financial penalties (taxes) for non-compliant residents and businesses

Industry	BMP
Agriculture	*Investigate Payments for Ecosystem Services Programs* in Key Areas. Some existing programs including the County-led Alternative Land Use Services (ALUS) and Alberta Agriculture and Rural Development (AARD) offer grant programs to help with funding for fencing animals out of riparian areas. Red Deer County's "Off the Creek" Program is another good example *Conservation tillage* No Till and Reduced Till practices conserve land and water resources, soil organic matter and moisture. The result is not only watershed benefits and less erosion, but in some cases (depending on climate and soil type) it may also provide improved yields and better nutrient management. Retention of nitrogen and phosphorus, the two most relevant nutrients as regards water quality, are promoted by conservation tillage, via incorporation in humus and adsorption onto soil mineral particles (Shotyk 2012) Agricultural riparian buffers. Conserve as large a riparian area as possible, and convert crops to perennial hay cover or agroforestry operations within riparian areas as appropriate. Manage Livestock Access to Riparian Areas (see previous chapters) Conserve/Restore wetlands (see previous chapters) Integrated Pest Management to reduce reliance on pesticides Beneficial Management Practices for all Producers: Inform and educate stakeholders about BMPs to reduce agricultural runoff and associated contaminants, with particular focus in priority areas. Refer to provincial "Beneficial Management Practices" reports, including: Environmental Manual for Dairy Producers in Alberta (AM + AARD, 2003) Environmental Manual for Feedlot Producers in Alberta (ACFA + AARD, 2002) Environmental Manual for Livestock Producers in Alberta (AARD 2010)

Oil and Gas	Implement adequate erosion and sediment control measures Ensure sufficient emergency response training and equipment available for mobilization (e.g., through Western Canada Spill Services) Conduct integrated study of older pipeline river crossings and highlight areas at high risk requiring upgrades Reclaim disturbances as soon as possible (minimize amount of time with open trench during pipelining operations, rapid reseeding of disturbed land around drilling, well and pipeline construction sites, etc.) Apply Integrated Land Management (ILM) principles (parallel existing footprints and corridors, avoid all sensitive areas, coordinate footprints with forestry cut blocks, consider recreational access issues and controls, etc.) Minimize stream crossings Cross streams with Horizontal Directional Drills to minimize riparian and in-stream disturbance Restore riparian areas Locate block valves strategically to minimize potential spill volumes into water bodies Comprehensive detection and correction of oil spill leaks Conserve wetland hydrology Adequate management of water intake and discharge locations for hydrostatic testing Minimize water use Safely manage production of saline produced water Continue to evolve approaches to adopt "cutting edge" research, technologies, and methods Review and implement all BMPs as described in documents produced by the Canadian Association of Petroleum Producers (CAPP)

*Current country residential policies for Parkland County stipulate that parcel sizes must not exceed a maximum of 4 hectares (10 acres), and that each parcel must be able to accommodate onsite sewage disposal and water services. Conversely, maximum lot densities for cluster country residential subdivisions must not exceed 1.85 lots per hectare (0.75 lots per acre), and the subdivisions must be serviced by piped municipal water and sewer systems (Parkland County, 2010)

Country Residential Development	*Clustered Country Residential Development* Rural lands that have been subdivided to create multiple residential lots that are connected to communal services, and designed to group or "cluster the residential uses together on smaller lots in order to maximize the retention of open space" (CRB, 2009)*. Apply conservation easements Retain connectivity through riparian areas and wetlands and use easements as conditions of development to maintain landscape connectivity Encourage Use of Transfer of Development Credits Further explore TDC programs that allow development potential to be transferred from areas where a community would like more conservation to areas where they would like more development. A TDC program for Red Deer County has been previously investigated (Miistakis Institute, 2006). *Encourage Land Stewardship and Green Acreages* Distribute and encourage green practices on acreages with the "Green Acreages" guide *Septic Management and Sludge Management* An ongoing education and outreach program is required to ensure country residential property owners are aware of issues with sewage disposal in the watershed and proper maintenance practices. Face to face meetings as well as mail-outs are recommended if resources are available. A template for an information brochure is available from the Regional District of Nanaimo (http://www.rdn.bc.ca/cms/wpattachments/wpID1866atID2664.pdf) but should be adapted to address the unique characteristics of the watershed. Other Tools Develop and apply additional tools such as conservation easements, tax benefits, market-based instruments under the Land Stewardship Act, etc to promote conservation of key areas of watershed ecological infrastructure


Harvested Peatland


Riparian area in need of restoration, Sturgeon River

4.9. Opportunties for Restoration and Reclamation

The ESAs identified in this report are meant to reflect existing conditions. As such, they are an indication of "what is" today than of what "could be" in the future. There are many opportunities for landscape restoration and reclamation throughout Parkland County that could increase the areas of environmental significance in the future, and enhance the ecosystem services provided by natural areas. Restoring and reclaiming key areas within the County may also increase the connectivity and size of natural patches of habitat. For example, the East Pit Lake ESA used to be a coal strip mine but today is identified as a locally significant ESA. It may be beneficial to use the ECMP to identify potential restoration areas and plan future developments accordingly.

Developments that operate under Government of Alberta approvals, such as coal mines, pits, well sites and harvested peatlands, are required to be reclaimed to a land use similar to pre-development conditions once areas are no longer needed for operations. Most operators adhere to BMPs with regards to reclamation and these developments are expected to be reclaimed in the future. It can take a several years to restore forests, wetlands and peatlands back to pre-development conditions. For example, research has shown that natural vegetation and function in harvested peatlands can be restored within approximately 10 years if BMPs are followed. Reclaimed areas must meet the conditions outlined in the operating approval or current guidelines to obtain reclamation certification, and demonstrate they are on a trajectory towards a natural state, baseline conditions or the agreed upon land use.

Many riparian areas in the County today have been impacted by agricultural or residential development activities. It has been demonstrated that the cumulative impacts of riparian degradation along temporary, ephemeral streams are far greater than riparian degradation along major permanent streams and rivers. Riparian areas in the County appear to vary greatly in intactness and function. The western portion Tomahawk Creek and the upper headwaters of Atim Creek are obvious targets for restoration. Restoration efforts will assist with improving the ecological function of Atim Creek, along with Big Lake and the Sturgeon River downstream. As riparian areas often serve as vectors to ecological connectivity, it would be beneficial to restore functional riparian areas throughout the County, to potentially improve the significance ratings and the ecosystem services of existing natural areas.

Due to several key factors noted throughout this ECMP, wetlands are highly significant landscape features. Restored wetlands will improve the ecological function of the landscape and provide a multitude of ecological goods and services. All impacted or drained wetlands are potential opportunities for restoration, including: Low Lake/Shoal Lake, Deer Lake, Whale Lake, and areas surrounding Clifford E. Lee Nature Sanctuary. Similar to riparian areas, wetlands have the potential to improve the connectivity and significance ratings of existing areas.

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