# Big Lake Natural Area
# Management Plan Phase I
# Phase I Report

Prepared for:

**ALBERTA COMMUNITY DEVELOPMENT**
**PARKS AND PROTECTED AREAS DIVISION**
Lac La Biche, Alberta

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*In association with*:
**EDA Collaborative Inc.**
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**May 1, 2002**

**EE27024**

# EXECUTIVE SUMMARY

Recognizing the importance of the Big Lake Natural Area and its importance to biodiversity in Alberta, Alberta Community Development in partnership with the City of Edmonton, City of St. Albert and Sturgeon and Parkland Counties initiated a 3-Phase management planning process that will result in the Big Lake Natural Area Management Plan.

The purpose of Phase I was to prepare a comprehensive, scientifically defensible report that describes the management requirements for the Big Lake Natural Area. The scope of Phase I was to:

- Provide an updated inventory of relevant, available literature of the Big Lake Natural Area regarding: planning and legislative frameworks, birds, wildlife (mammals, amphibians/reptiles, fish), vegetation, hydrology and hydrogeology, and cultural resources;
- Identify information gaps and examine the quality of existing information;
- Provide a toolbox of measures and actions that can be implemented by landowners, municipalities and other partners; and
- Provide composite maps based on the relevant, available literature, identifying the capability of each resource (land districting; birds; wildlife; vegetation; hydrology; hydrogeology, and cultural resources) to adapt to various development pressures.

A further requirement of Phase I was to provide a proposed process for a public review of the Phase I report in Phase II. This proposal was submitted to the Technical Committee under separate cover in March 2002.

## Big Lake Natural Area and Phase I Study Area

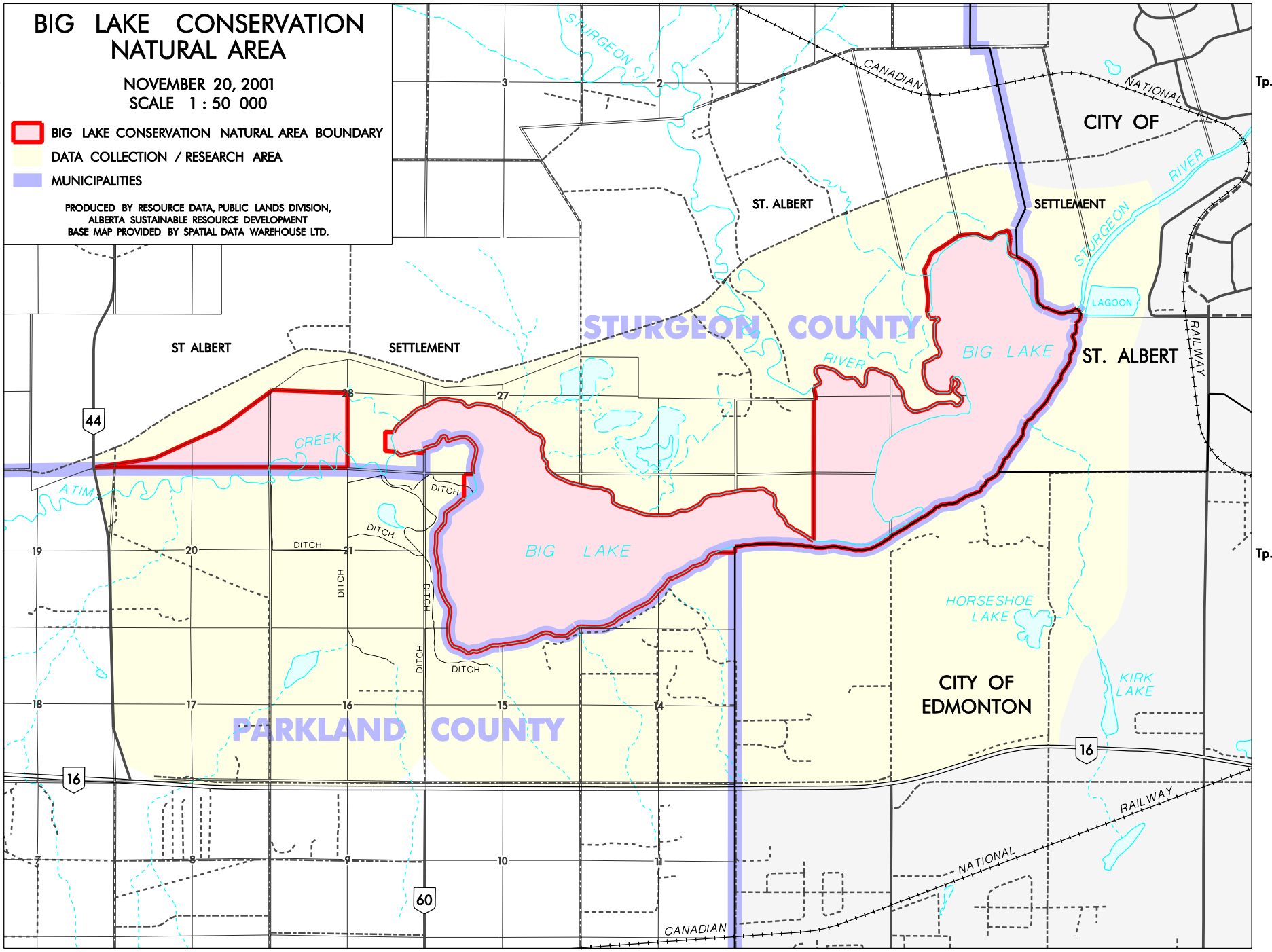
Big Lake Natural Area is located within Alberta's Central Parkland sub-region (AEP, 1994) adjacent to Edmonton, St. Albert, Parkland County, and Sturgeon County. Big Lake itself and a portion of a wetland are associated with the Big Lake Natural Area that covers an area of 11.2 $km^2$. For the purpose of Phase I, the study area extends from the Yellowhead Highway in Edmonton and Parkland County to Meadowview Drive on the north side of Big Lake in Sturgeon County, from the proposed Riel Drive Arterial in St. Albert and the easternmost boundary of the Transportation and Utility Corridor in Edmonton west to Highway #44 (Range Road 263A) in Parkland County (see map on following page).

# BIG LAKE CONSERVATION NATURAL AREA

NOVEMBER 20, 2001
SCALE 1 : 50 000

BIG LAKE CONSERVATION NATURAL AREA BOUNDARY
DATA COLLECTION / RESEARCH AREA
MUNICIPALITIES

PRODUCED BY RESOURCE DATA, PUBLIC LANDS DIVISION,
ALBERTA SUSTAINABLE RESOURCE DEVELOPMENT
BASE MAP PROVIDED BY SPATIAL DATA WAREHOUSE LTD.



## Methodology

A review of available information, including published and unpublished reports and maps from federal, provincial and municipal government agencies, university libraries, previous consultants' reports, and other private sector resources were conducted. When pertinent, interviews were conducted with experienced and knowledgeable people, from local organizations, concerning the birds of the Big Lake Natural Area.

The literature was first evaluated on the quality or accuracy of the data, including the age, the study design, and the laboratory result methods (if applicable). Next, specific information gaps were identified and recorded. Finally, the data attributes found in the study area were summarized.

In addition, the Legislative and Planning Framework section also reviewed available legislative and regulatory requirements and other background documents and guidelines pertaining to land use and planning in the Big Lake Study Area. This evaluation process aimed to define all land uses, districts, and policy areas; categorize documents into jurisdictional areas and define other relevant and current planning frameworks.

Following an initial review of the literature, a workshop was convened with the members of the Technical Committee, other members of their organizations who have knowledge of and interest in the various disciplines reviewed for this report, and consulting team members. The purpose of the workshop was to:

- Provide an overview of the information reviewed to date;
- Gather opinions on existing, and add to, the toolbox items;
- Gather additional information sources that should be reviewed in Phase I;
- Gather thoughts and comments on BLNA management; and
- Discuss mapping requirements.

A workshop summary was submitted to the Technical Committee under separate cover.

## Mapping

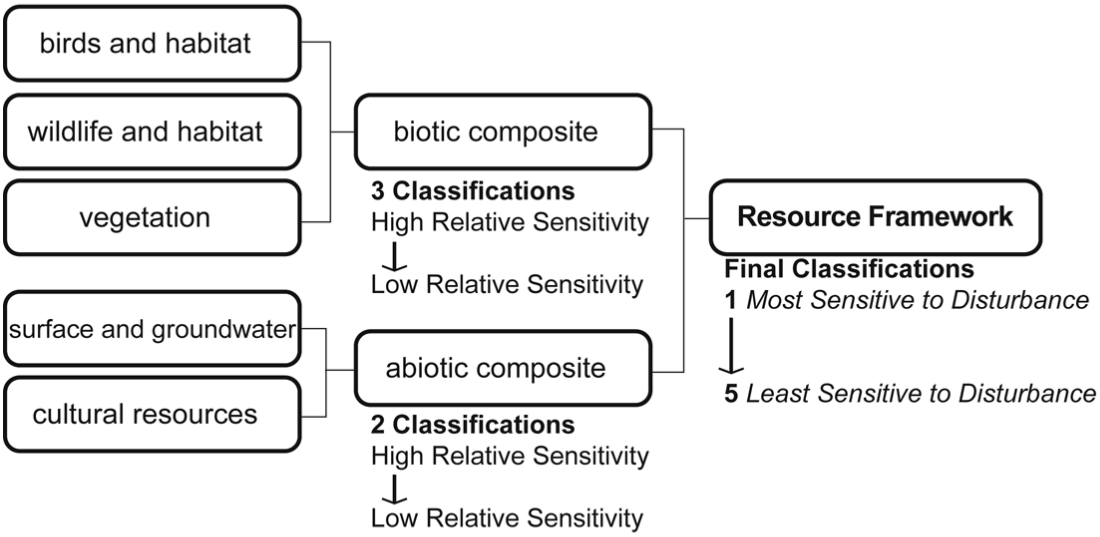
Five existing resource inventory maps were produced in support of the research provided by scientists in the various discipline areas. A Resource Framework Map helps to determine if there are areas, which are more sensitive to disturbances, based on the cumulative sensitivities of each of the respective disciplines.

From the five individual maps, each specific feature or element of the map was categorized in terms of its relative importance to the theme of the map by the discipline leads, with the exception of the *Birds and Habitat* maps; this process is described below. The criteria used by each specific discipline is based on the literature review, and the specific expertise of the scientists. The rankings applied include high, medium and low relative sensitivity to disturbance.

For example, ‘wet meadow’ on the vegetation map was considered of relative high sensitivity to disturbance.

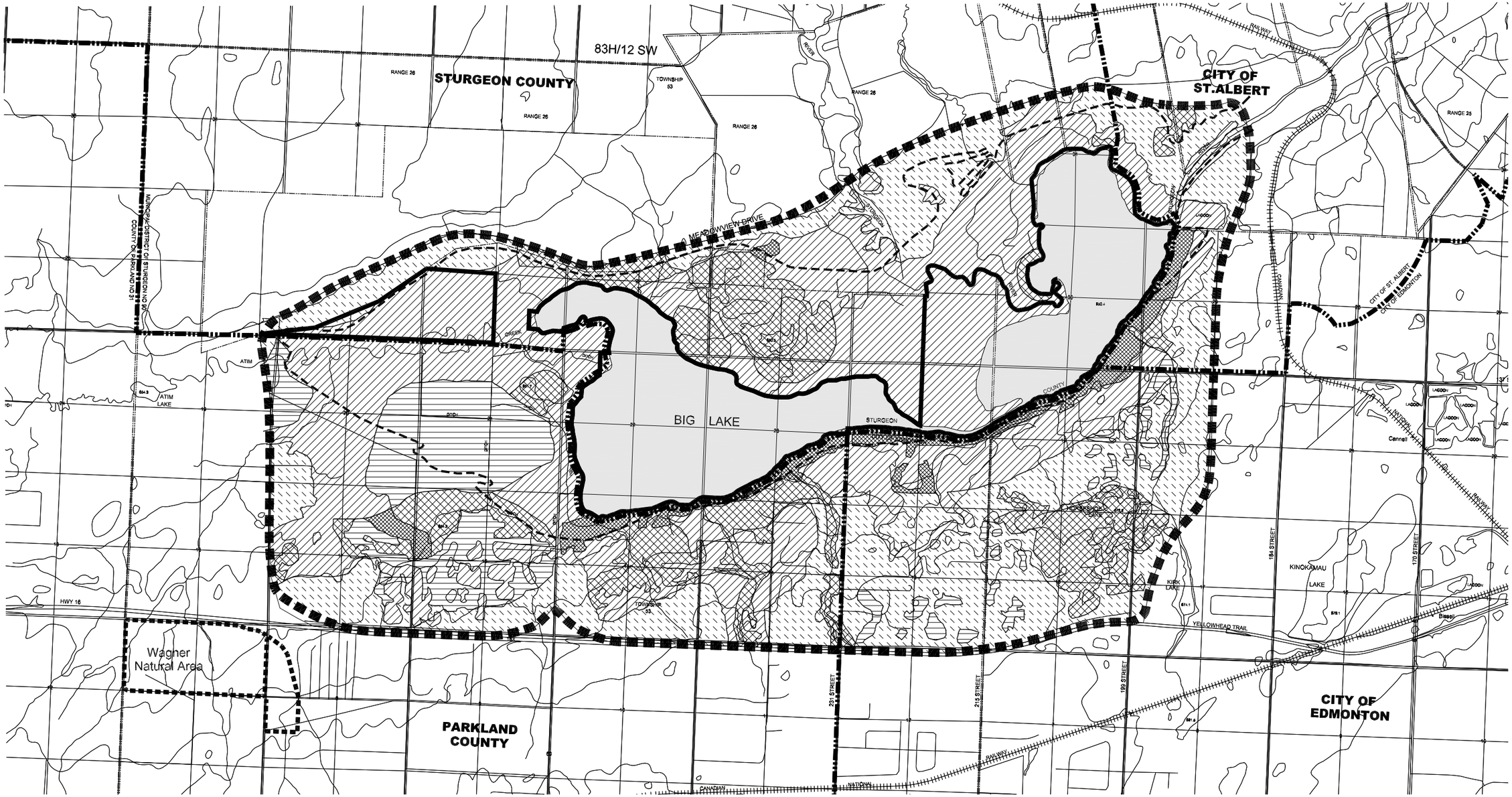
The *Birds and Habitat* map does not have definitive boundaries to each of the locations noted, with the exception of two spruce stands within the study boundary. Each area noted on this map is considered of high importance, with loosely defined boundaries.
Following the determination of a relative sensitivity to disturbance classification for each defined category on the individual maps, the maps were then manually overlaid to determine the cumulative importance of each of the five separate disciplines. Areas of relative high sensitivity to disturbance were combined and reorganized to show areas with a cumulative higher sensitivity. The five separate maps were overlaid as follows:

**Mapping Process**




Note: The number of ‘High Classifications’ represents a sum of ‘Areas of High Sensitivity to Disturbance’ on each of the Component Maps. For example, if the same area had a high rating on both the vegetation, the birds and habitat maps, this area would receive a higher relative classification on the biotic composite map.

The Resource Framework map illustrates (on next page) in a cumulative composite of individual maps, areas within the study area of a relatively higher or lower sensitivity to disturbance.

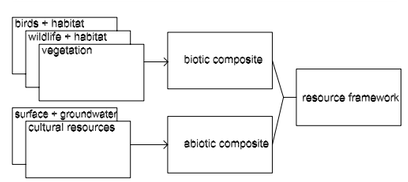


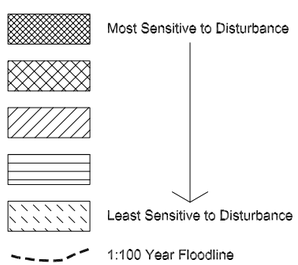

**Legend**

Data Collection / Research Area

Big Lake Natural Area Boundary

**Resource Composite Mapping Process**



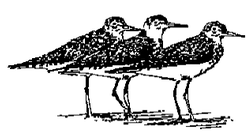


Airphoto (where applicable) provided by Alberta Environment, January 2002
Base information provided by Alberta Environment, January 2002

# resource framework

Alberta
COMMUNITY DEVELOPMENT

amec EDA



## BIG LAKE NATURAL AREA
*management plan*

March 2002

## Summary of Findings

*Legislative and Planning Framework*

As required by the *Municipal Government Act*, each of the municipalities adjacent to the Big Lake Natural Area (BLNA) have Municipal Development Plans and Land Use Bylaws that control the amount, location and types of development in the Big Lake Study Area. The municipalities also have area structure plans, inter-municipal development plans, area redevelopment plans and/or special recreation land use plans in place. For the most part, these plans recognize the BLNA as a significant natural resource that will tolerate, in close proximity, only specific land uses such as: recreation, agriculture, park reserves, and low-density residential housing.

A review was conducted of the various provincial and federal legislation and regulations that are applicable to the Big Lake Natural Area and include:

| Provincial Legislation | Federal Legislation |
|---|---|
| Environmental Protection and Enhancement Act | Canadian Environmental Assessment Act |
| Historical Resources Act | Fisheries Act |
| Municipal Government Act | Migratory Birds Convention Act |
| Public Lands Act | Navigable Waters Protection Act |
| Water Act | |
| Wildlife Act | |

In addition, a summary of non-statutory plans with specific emphasis on birds was also included for the following:

- Important Bird Areas Program
- Partners in Flight – Canada
- Prairie Canada Shorebird Conservation Plan
- The RAMSAR Convention
- Western Hemisphere Shorebird Reserve Network
- North American Colonial Waterbird Conservation Plan
- North American Waterfowl Management Plan
- North American Bird Conservation Initiative
- Convention on Biological Diversity

An effort was made to understand and illustrate the linkages between these programs and initiatives. It was found that while plan administrators cooperate as necessary, linkages between these plans are generally informal or unofficial.

*Birds*

The literature review found that birds at Big Lake have been studied since the 1930s and a relatively large amount of literature is available regarding birds at Big Lake. An analysis of the 235 species that have occurred at Big Lake and noted in the Annotated Big Lake Study Area Bird Checklist (based on the personal observations of local birders) is provided. The analysis breaks down the Checklist by breeding bird species, by the North American Bird Conservation Initiative categories, by family groupings, and by resident and migratory groups. The analysis shows that there is a great diversity of bird types breeding at Big Lake and that 60% of the birds are Neo-tropical Migrants (NTMs) which contributes to BLNA's relevance to NTM conservation initiatives such as Partners in Flight.

Risk status of the birds found in the BLNA shows that there are three species that are classified as "Threatened" and another three as "Special Concern" according to COSEWIC 2001 risk status system. The Alberta Fish and Wildlife 2001 risk status system shows that three species are "At Risk, one, "May be at Risk" and 33 species are "Sensitive."

This review also provided and the critical characteristics of Big Lake for birds including: year-to-year water fluctuations; shallow depth of the Lake; varied topography around the Lake; wide variety of vegetation types; springs which keep longer periods of open water on Big Lake; and relative lack of human disturbance.

A discussion is included about the possibility of using bird species and/or assemblages as biological indicators of BLNA's ecological health. Additional information is required to determine other wildlife/vegetation species that also may be used as indicators.

*Wildlife (Mammals, Amphibians/Reptiles and Fish)*

The literature review indicates that there is a wide variety of species found at BLNA and that the relative lack of forest cover stands does not provide the habitat required to support a significant number of larger mammals. Linkages between natural habitats via river and stream corridors are important in maintaining viable mammal populations.

The wildlife data is relatively sparse when compared to the amount of literature available for birds at BLNA. BLNA is poor fish habitat due to the inadequate flows and organic and physical pollution of the Sturgeon River that flows into Big Lake. A number of beaver dams also impair fish movement through the system.

*Vegetation*

Vegetation types are varied in the BLNA due to the varied topography that creates microclimates to support vegetation. Vegetation types include: willow, peat, upland vegation (poplar species), agricultural lands and submergent, floating and emergent lake vegetation. There is a possibility that rare plants exist in the BLNA due to its close proximity to the Wagner Natural Area to the southwest.

*Surface and Groundwater Resources*

The BLNA is part of the larger Sturgeon River watershed three sub basins including the Sturgeon River watershed, the Atim Creek watershed and the local Big Lake drainage basin. All three drain 3328 $km^2$ of land base and extends to the outlet at the North Saskatchewan River. Big Lake is typically shallow with variable water levels recorded from a low of 0.3m to a high of 4.1m.

Reductions of natural flows through water withdrawals are possible. At times human demand for available water in the basin exceeds supply and Alberta Environment has made recommendations to limit withdrawals. Overall, the data reviewed for the past 30 years has shown that groundwater withdrawals have not significantly impacted recharge to Big Lake. Increased development in the watershed, however, will increase runoff into Big Lake and may therefore compensate for any reductions in water levels experienced through withdrawals.

Big Lake is generally considered to have poor water quality due to its downstream position in the Sturgeon River watershed. Potential sources of pollutants include lead (due to hunting activity), hydrocarbons (due to oil and gas activity and airstrips), metals and hydrocarbons (from landfills), pesticides/fertilizers (due to residential and golf course maintenance), nitrates (due to outflows from upstream sewage lagoons). In addition, natural succession processes such as sedimentation and the build up of plant and animal matter on the bottom of the lake has resulted in an infilling of the lake over time.

*Outdoor Recreation, Tourism and Heritage Appreciation*

Generally there is a lack of recreational and tourism development in the Big Lake Study Area. This is due, in part, to inconvenient access and the limitations of the existing lands (flooding) and lake (shallow water depth) for traditional water-based activities. However, there is a high potential for passive recreational activities including walking/hiking, bird watching, nature photography, environmental education. The Big Lake Study Area may have high potential for archaeological resources and further evaluation is required to identify significant sites. Identification of specific cultural or heritage resources through this evaluation may provide the potential framework for an additional cultural theme development in the area.

**Toolbox**

The toolbox lists existing and possible measures and actions that can be implemented by landowners, municipalities and other partners. The tools are categorized into six main themes:

- Funding
- Conservation
- Research, Monitoring and Development
- Education
- Operational
- Legal

Existing tools are listed in the table first, followed by "opportunity" tools that are new toolbox ideas that could be used in the BLNA to achieve certain goals. Some tools were found in the literature that was reviewed. An excellent summary of conservation tools is contained in *Conserving Edmonton's Natural Areas – A Framework for Conservation Planning in an Urban Landscape* (February 2001). Other tools were brainstormed during the workshop and by the consulting team members. The discipline area (shown in columns) that the toolbox item may impact is indicated by "x".

**Concluding Remarks**

This literature review provided a foundation from which the management planning process may move forward. While the information reviewed and summarized in this report provides the beginning of a baseline of information, there is much opportunity for continued research, monitoring and evaluation of the biological health of the natural and cultural resources found in the BLNA. The steps required to obtain a broader picture of these resources should be evaluated and selected based on public, scientific and management needs.

Through this literature review, Alberta Community Development and the partnering municipalities have taken the first steps in better understanding the Big Lake Study Area and its potential to become a nationally-renowned nature reserve. A continued multi-jurisdictional cooperative effort between every level of government, NGOs and all other interested parties is required to ensure its conservation. With careful planning, in future, BLNA can become the symbol and the focus of coordinated environmental protection efforts that extend well beyond the immediate boundaries of the BLNA, and will serve as a biological indicator for the ecological 'state of health' of the region as a whole.

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## 1.0 INTRODUCTION

International conservation organizations such as the International Union for the Conservation of Nature (IUCN), World Conservation Monitoring Centre (WCMC), World Wide Fund for Nature (WWF) and conservation biologists (e.g., Noss and Cooperrider, 1994) agree that networks of representative protected areas constitute the most efficient and economic mechanism for perpetuating biological diversity. Canada is one of 168 signatory countries of the Convention on Biological Diversity – one of the key agreements adopted at the 1992 Earth Summit in Rio de Janeiro. To date, Canada has pledged $1.6 million to the Convention Trust Fund, and in 1995, completed the Canadian Biodiversity Strategy. The Strategy outlines the measures required to meet the obligations of the Convention and to enhance co-ordination of national efforts aimed at conservation of biodiversity and the sustainable use of biological resources (Convention on Biological Diversity Website, 2002; Environment Canada, 1995).

The newly-designated Big Lake Natural Area (BLNA) represents a small but significant cog in the global 'wheel' of biodiversity protection which, as an additional benefit, is capable of furnishing a variety of opportunities for natural history related appreciation, education/interpretation and recreation activities.

Recognizing the importance of BLNA and the need to anticipate and better manage development pressures on this Natural Area, Alberta Community Development and the municipal jurisdictions (City of Edmonton, City of St. Albert, Sturgeon and Parkland Countries) within which the BLNA falls, formed a partnership to prepare the BLNA Management Plan.

This is not the first regional planning approach undertaken for Big Lake. In 1987 the Edmonton Metropolitan Regional Planning Commission (EMRPC) prepared the *Big Lake Background Report*. The report was to culminate in a management plan that could be implemented by a number of federal, provincial, regional and local authorities, as well as local landowners and other private groups and individuals. The plan was to determine the capacity of the lake and shoreland to withstand change in land use. Since the regional planning commissions were dissolved, the four municipal jurisdictions surrounding Big Lake have developed individual municipal development plans (MDP), land use bylaws, and parks and transportation master plans.

This management planning process has three phases (see Terms of Reference in Appendix A).

The purpose of Phase I is to prepare a comprehensive, scientifically defensible report that describes the management requirements for the Big Lake Natural Area. The scope of Phase I is to:

- Provide an updated inventory of relevant, available literature of the Big Lake Natural Area,
- Identify information gaps and examine the quality of existing information,

- Provide a toolbox of measures and actions that can be implemented by landowners, municipalities and other partners, and
- Provide composite maps based on the relevant, available literature, identifying the capability of each resource (land districting; wildlife; vegetation; hydrology; and recreation, tourism, heritage) to adapt to various development pressures.

A further requirement of Phase I was to provide a proposed process for a public review of the Phase I report. This proposal was submitted to the Technical Committee under separate cover.

The structure of this report is as follows. Section 2.0 provides a description of the Big Lake Natural Area and the Big Lake Study Area used as geographic parameters for this report. Section 3.0 summarizes the methods used in the literature review and to compile the maps. Section 4.0 provides an overview of the municipal, provincial and federal planning and legislative framework within which the Big Lake Natural Area (BLNA) is managed. Section 5.0 gives the review and assessment of the literature available for each of the discipline areas examined including birds, wildlife (mammals, amphibians and reptiles, and fish), vegetation, surface and groundwater resources, and outdoor recreation heritage appreciation and tourism. Section 6.0 contains the toolbox of existing and possible measures and actions that can be implemented by individuals and organizations to achieve certain goals with respect to BLNA. Concluding statements are found in Section 7.0.

## 2.0 STUDY AREA

### 2.1 BIG LAKE NATURAL AREA

There are six natural regions in the province: Canadian Shield, Rocky Mountain, Grassland, Foothills, Parkland, and Boreal Forest (AEP, 1994). Big Lake Natural Area is located within Alberta's Central Parkland subregion (AEP, 1994) adjacent to Edmonton, St. Albert, Parkland County, and Sturgeon County. Within Alberta there is a network of parks and protected areas under the jurisdiction of Alberta Community Development, Parks and Protected Areas Division. Currently there are 6 classes of protected areas: Ecological Reserves, Wilderness Areas, Wildland Parks, Provincial Parks, Natural Areas, and Provincial Recreation Areas.

Big Lake Natural Area is designated a "Natural Area" under the *Wilderness Areas, Ecological Reserves and Natural Areas Act*. According to Alberta Community Development, the purpose of Natural Areas is to preserve and protect sites of local significance and provide opportunities for low impact recreation and appreciation of nature. Natural areas are typically small, however, larger sites may be included in this class. Facilities are typically minimal and consist of parking areas and trails. Some of the larger or more isolated sites may accommodate random or rustic camping. Big Lake itself and a portion of a wetland are associated with the Big Lake Natural Area that covers an area of 11.2 $km^2$.


ALBERTA
Big Lake
Natural Area
Edmonton
Calgary
north

# BIG LAKE CONSERVATION NATURAL AREA

NOVEMBER 20, 2001
SCALE 1 : 50 000

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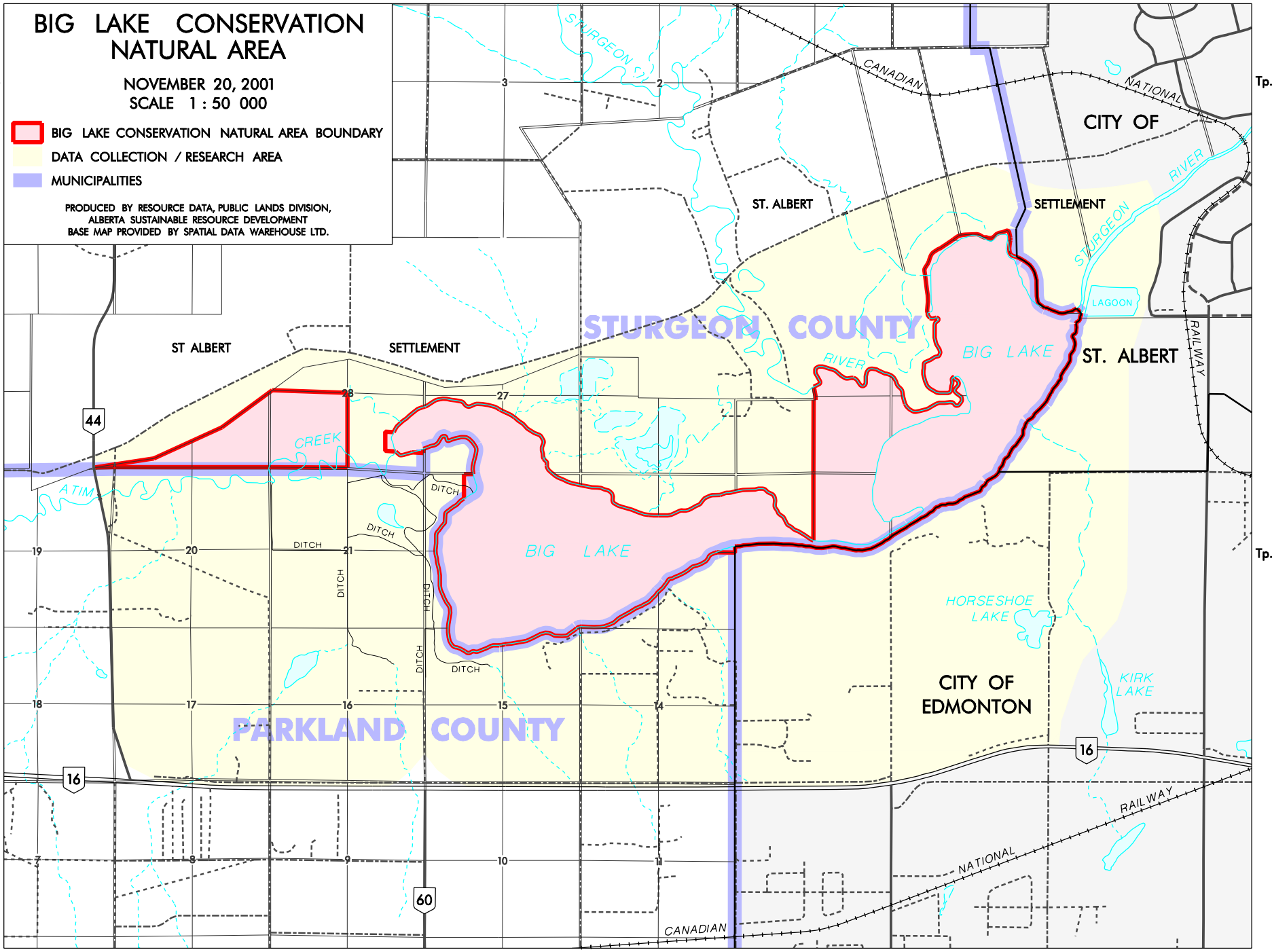

Some of the characteristics of the BLNA are as follows:

- Big Lake is a provincially significant Environmentally Sensitive (Infotech Services and Associates, 1989) and Environmentally Significant (AEP, 1997) Area. It was also recognized as a "Special Place" under Alberta's Special Places 2000 program and has been established as a provincial Natural Area under the auspices of the *Wilderness Areas, Ecological Reserves and Natural Areas Act*.

- Big Lake was recently recognized as a globally significant Important Bird Area (IBA; Lane, 2000) and was officially dedicated as such on June 5, 2001. The IBA program is an international bird conservation initiative coordinated by Birdlife International.

- Big Lake was included in the province's "Wetlands for Tomorrow" program in recognition of its status as one of Alberta's "20 most important waterfowl habitat units" (Anon., 1986) by Ducks Unlimited (Canada) and Alberta's Fish and Wildlife Division. According to Lane (2000), under the North American Waterfowl Management Plan (NAWMP), Big Lake is also considered "a significant nesting and staging area for waterfowl".

- Under the Canada Land Inventory "waterfowl capability rating scheme", Big Lake was classified as 1S (i.e. the highest possible category) (CLI, 1970). Alberta Fish and Wildlife has rated Big Lake's waterfowl productivity/significance to wildlife index as "exceptional" (J. Folinsbee *in* Moore, 1992).

- A significant geomorphologic feature of Big Lake is the delta formed by the Sturgeon River where it enters the lake. This birdsfoot delta is one of only a handful, and considered the third-best example of its kind, within Alberta.

## 2.2 BIG LAKE STUDY AREA

For the purpose of Phase I, the study area will extend: from the Yellowhead Highway in Edmonton and Parkland County to Meadowview Drive on the north side of Big Lake in Sturgeon County, from the proposed Riel Drive Arterial in St. Albert and the easternmost boundary of the Transportation and Utility Corridor in Edmonton west to Highway #44 (Range Road 263A) in Parkland County (see map on previous page).

## 3.0 METHODOLOGY

A review of available information, including published and unpublished reports and maps from federal, provincial and municipal government agencies, university libraries, previous consultants' reports, and other private sector resources was conducted. This included literature and data files maintained by Alberta Environment (Alberta Sustainable Resource Development, the Alberta Energy and Natural Resources Fish and Wildlife Division, BSOD, the Alberta Natural Heritage Information Centre, and the Groundwater Database). When pertinent, interviews were

conducted with experienced and knowledgeable people, from local organizations, concerning the birds of the Big Lake Natural Area.

The literature was first evaluated on the quality or accuracy of the data, including the age, the study design, and the laboratory result methods (if applicable). Next, specific information gaps were identified and recorded. Finally, the data attributes found in the study area were summarized.

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- Provide an overview of the information reviewed to date;
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- Gather additional information sources that should be reviewed in Phase I;
- Gather thoughts and comments on BLNA management; and
- Discuss mapping requirements.

Comments from the workshop were submitted to the Technical Committee under separate cover.

## 3.1 MAPPING METHODOLOGY

### Mapping Methodology

Five existing resource inventory maps were produced in support of the research provided by scientists in the various discipline areas. The spatial information provided by each of the disciplines was manually transferred to the maps, depicting the following:

- Birds and habitat
- Wildlife and Habitat
- Vegetation
- Surface and Ground Water
- Cultural Resources

These maps were compiled from information gathered from a variety of resources as noted on the individual maps, by the individual discipline leads.

**Resource Framework Map**

The intent of the Resource Framework Map is to determine if there are areas, which are more sensitive to disturbances, based on the cumulative sensitivities of each of the respective disciplines. From the five individual maps, each specific feature or element of the map was categorized in terms of its relative importance to the theme of the map by the discipline leads, (with the exception of the *Birds and Habitat* maps; this process is described below). The criteria used by each specific discipline is based on the literature review, and the specific expertise of the scientists. Specific information on each of the disciplines can be found in the relevant sections of this report. The rankings applied include high, medium and low relative sensitivity to disturbance. For example, 'wet meadow' on the vegetation map was considered of relative high sensitivity to disturbance.

The *Birds and Habitat* map does not have definitive boundaries to each of the locations noted, with the exception of two spruce stands within the study boundary. Each area noted on this map is considered of high importance, with loosely defined boundaries.

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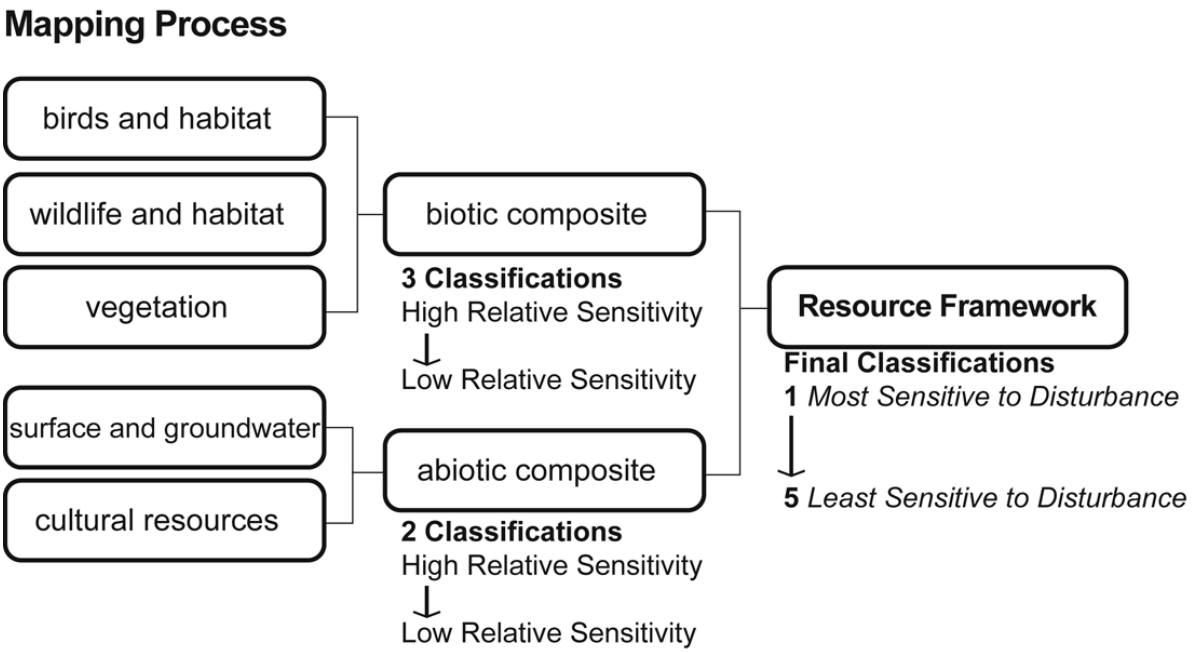
**Figure 1: Mapping Process**

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The Resource Framework map illustrates, in a cumulative composite of individual maps, areas within the study area of a relatively higher or lower sensitivity to disturbance.

All maps are contained in Appendix B.

# 4.0 LEGISLATIVE AND PLANNING FRAMEWORK

## 4.1 MUNICIPAL PLANNING FRAMEWORK

The land use districts and plan jurisdictions are shown on maps contained in Appendix B.

### 4.1.1 City of St. Albert

***City Plan St. Albert Municipal Development Plan (MDP) Bylaw 412000 (May 2000)***

In the MDP the future land use policy indicates that the area immediately surrounding Big Lake Natural Area within the Big Lake Study Area be kept or developed as an area for parks, open space, and schools. For St. Albert it was important to maintain the greenway linkages and trail system through the Big Lake Natural Area. The central focus of the parks system is Red Willow Park that runs along the Sturgeon River and incorporates 34 kilometres of walking trails linking many neighbourhoods. Policy 9.7 in the MDP discusses the Red Willow park corridor and states that the Land Use Bylaw shall protect and enhance the Red Willow park corridor, however, private development may occur in the Red Willow park corridor consistent with the *Red Willow Urban Park Master Plan* and the *Land Use Bylaw* (summarized below).

Section 10 of the MDP focuses on environmental management of natural areas and Policy 10.2 discusses how St. Albert should not only protect provincially and regionally significant areas, but also locally significant, sustainable areas except where the protection compromises other open space requirements. Policy 10.4 states that the City of St. Albert shall preserve and protect the Sturgeon River Valley Corridor in accordance with the *Red Willow Park Urban Park Master Plan*. In Section 14 on intermunicipal planning and regional cooperation, one of their objectives is to specifically address the desire for a regional parks corridor that connects to the Red Willow park system.

***City of St. Albert Land Use ByLaw 18/94 (February 1995)***

Within the City of St. Albert the Big Lake Study Area includes lands zoned as Direct Control (DC), Urban Reserve (UR) and Parkway Corridor (PC) districts. The Parkway Corridor District is to conserve and enhance the cultural, recreational and natural resources of the Sturgeon River Valley and to protect lands in the flood risk area from subdivision and development, which would disrupt normal hydrological action or increase the risk of damage from flooding. A key development regulation of the PC district is that development must not restrict continuous public access along the banks of the Sturgeon River. The land within the plan area is all privately owned property. Urban Reserve lands are to control land areas which are undeveloped or developed to low intensity and to ensure their orderly transformation to more intensive development. Direct Control lands are to enable Council to exercise control over the use and development of land or buildings within the area. There was no specific mention of setbacks or distance from Big Lake or adjacent water in the document. Permitted and discretionary land

uses for each of these land use districts are available for public review by contacting the municipality.

***Red Willow Urban Park Heritage Corridor Master Plan (July 1991)***

This Plan focuses on the Sturgeon River corridor and the shorelands of Big Lake within the corporate boundaries of the City of St. Albert, as well as River Lot 56.

The development of a major urban park along the shorelands of the Sturgeon River and Big Lake is a long-term objective for the City of St. Albert. The current ten-year urban park agreement with the Province of Alberta will provide the land base and structure of the park, and important initial facilities. The park objectives include restricting development to types compatible with the periodic conveyance of floodwaters, and to promote conservation and management of environmentally significant areas in the City. It is intended to create a continuous system of natural and developed parks along the banks of the Sturgeon River and Big Lake. In addition to the land that the City has already acquired, the park sets aside all land within the 1:100 year floodplain. Within the 1:100 year floodplain, park development and related land use must be compatible with periodic flooding without excessive damage and financial loss. While the plan states that conservation of wildlife habitat is achieved by maintaining shorelands and critical habitat in a natural state and in public ownership, and that the immediate river banks in the plan area be kept in a natural state providing habitat for waterfowl, muskrats and other animals, a buffer zone is not explicitly stated. The plan proposes to retain those shores of Big Lake within the City of St. Albert in a natural state. The northeast shore is proposed as a habitat improvement project.

***City of St. Albert Area Structure Plans***

While an area structure plan exists in St. Albert immediately adjacent to Big Lake, no major developments would be allowed to proceed until such time as an area structure plan General Report and bylaw are prepared and updated pursuant to the *Municipal Government Act*.

### 4.1.2 Sturgeon County

***Municipal Development Plan Bylaw 818/96 (February 1997)***

Environmentally significant areas in Sturgeon County were classified by the 1989 *Environmentally Sensitive Areas Study* and include important wetland and waterfowl areas, forest, wildlife, recreation and geological themes. The MDP states that the provincially and regionally significant areas are considered in the 1992 *Open Space Master Plan*.

The MDP also states that the shores of Big Lake continue to be preserved in their natural state through the continued application of the Agricultural-Nature Conservation District (see LUB below). Interpretative centres may be considered if approved by Alberta Environment.

### *Sturgeon County Land Use Bylaw No. 819/96 (October 2001)*

The Land Use Bylaw (LUB) protects these significant environmentally significant areas under the Agricultural-Natural Conservation land use district. The LUB states that no permanent structures will be permitted within the 1:100 year flood plain of Sturgeon County's major rivers (including the Sturgeon River), which flows into Big Lake. If development were proposed near the 1:100 year flood plain, the developer will be responsible for defining the precise boundary/contour of the flood plain. It is also stated that no permanent structures will be permitted within the 1:100 year flood plain of provincially and regionally significant lakes, including Big Lake. Restrictions are placed on those developments beside Big Lake that may reduce water quality, impede water flow, lead to soil erosion or shoreline damage, adversely affect the natural amenity, adversely affect recreational potential, restrict access to the water unless safety factors dictate otherwise, adversely impact the visual quality of the natural amenity, adversely affect fish and wildlife habitat, or result in excessive removal of tree cover and other vegetation (Policy 11.7). Permitted and discretionary land uses for each of these land use districts are available for public review by contacting the municipality.

### *Sturgeon Valley Area Structure Plan, Bylaw 882/99 (September 1999)*

While the area that is addressed by the Sturgeon Valley Area Structure Plan is outside the study area it also restricts permanent structures within the 1:100 year flood plain in the Sturgeon River Valley and therefore provides some consistent framework for habitat conservation in the River Valley corridor systems in the area.

### *Intermunicipal Development Plan (IMDP) – Sturgeon County and City of St. Albert (May 2001)*

The Big Lake Study Area is just outside of the plan area for the IMDP (the IMDP plan area stops just north of Meadowview Drive, north of Big Lake). The land that is located north of Meadowview Drive, east of Carrot Creek, and south of Villeneuve Road (just north of Big Lake) is proposed to be Urban Residential land. The land here slopes southward allowing residents to have excellent views of Big Lake. The area north of Meadowview Drive, west of Carrot Creek, south of Villeneuve Road, and east of Range Road 261 is slated to remain as extensive agricultural land, with an intermunicipal greenway located around Carrot Creek. It is stated in the IMDP that the Sturgeon River Valley Corridor is to be preserved and protected according to the *Red Willow Park Urban Master Plan* and the *Sturgeon Valley ASP Bylaw 882/99*.

### 4.1.3 City of Edmonton

***Plan Edmonton, Edmonton's Municipal Development Plan (MDP), Bylaw No. 11777 (August 1998)***

Edmonton is committed to working cooperatively with neighbouring municipalities to ensure effective use and development of the City's "fringe" lands (Policy 1.1.9). Plan Edmonton specifically recognizes Big Lake as a regional asset and provides for Edmonton's participation in the development of management principles and guidelines as part of the Special Places program. The City of Edmonton has a priority to preserve and enhance the river valley, natural areas and open spaces within the urban landscape, linking them together where possible. The MDP strategies support access and recreational use opportunities while still protecting the natural environment. The City would like to work with the Provincial Government to ensure that Crown interests in water bodies are addressed prior to development. The MDP also states that one of the City of Edmonton's priorities is to develop an integrated environmental protection strategy with neighbouring municipalities and the Province to improve air and river water quality, promote conservation, and ensure effective preservation and management of the City's green spaces.

***Edmonton Zoning Bylaw Number 12800 (June 14, 2001)***

The portions of the Big Lake Study Area contained within the City of Edmonton are zoned Agricultural Zone (AG), Highway Corridor Zone (CHY) and within the area covered under the Yellowhead Corridor Area Structure Plan are the designations of Rural Residential Zone (RR), Public Parks Zone (AP), and Industrial Business Zone (IB). While all these designations have restrictions on property frontage, there are no restrictions on setbacks from Big Lake or river valleys specifically. Permitted and discretionary land uses for each of these land use districts are available for public review by contacting the municipality.

*The Edmonton Zoning Bylaw (June 14, 2001) 12800* contains the *North Saskatchewan River Valley and Ravine System Protection Overlay*, which requires for all development permit applications a 7.5 metre development setback from the North Saskatchewan River valley and ravine system.

***Big Lake Area Structure Plan (August 1991)***

The plan area for the Big Lake Area Structure Plan is within the Big Lake Study Area. The ASP describes the proposed development concept for about 764 ha (1887 acres) of land situated in the northwest sector of the City of Edmonton and provides a framework within which City Council can evaluate future development. The plan proposes low density residential development. Recreational opportunities afforded by Big Lake are a major part of the development concepts.

The intent of the development concept was to develop six residential neighbourhoods, accommodating a total residential population of approximately 27,205 people and encompassing the majority of the land within the Big Lake Study Area. To date this area has little development due to the prohibitively high cost of locating utilities in the area. Furthermore, the City of Edmonton generally does not allow new Country Residential development within its boundaries.

The Big Lake ASP contains ravine and watercourse lands that fall within the boundaries of the *North Saskatchewan River Valley Area Redevelopment* Plan (NSRVARP) (summarized below). These lands are shown on the Big Lake ASP map as "Natural Conservation Areas." The delineation of the boundary of the ravine system within the Plan area, as outlined in the NSRVARP, is a generalized topographic approximation of the top-of-the-bank. The Natural Conservation Areas shown on the ASP map more closely reflect the limits of the ravine lands based upon site investigation, and thus do not completely coincide with the ravine boundary of the NSRVARP. The boundary of the Natural Conservation Areas will be refined at the Neighbourhood Structure Plan stage and the lands that lie within these areas will be acquired as Environmental Reserve at the subdivision stage (NSRVARP) (December 2000).

The Big Lake ASP integrates the goals of the Big Lake Background Report in that its goals were to "change the role of Big Lake…to an area that provides recreational opportunities related to its natural environment…and some residential use." The second goal is to "ensure that all future lake and land use change is directed toward those areas that can withstand change in use". This is accomplished through the designation of natural conservation areas, natural maintenance areas, and by proposing residential development at lower than typical densities.

***North Saskatchewan River Valley Area Redevelopment Plan (NSRVARP) Bylaw No. 7188 (1985)***

The NSRVARP was designed to "protect the North Saskatchewan River valley and ravine system as part of Edmonton's open space heritage and to establish the principles for future implementation plans and programs for parks development". By outlining policies and a plan of action the NSRVARP contributes to a part of the comprehensive River Valley and Ravine Management program. Portions of the Big Lake ASP are contained within the NSRVARP. Section 3.2.8 of the NSRVARP states "it is the policy of this plan that the City may acquire through subdivision, all lands lying below the geomorphic limit of the River Valley and Ravine systems as Environmental Reserve in accordance with the provisions of the Planning Act". Those environmentally sensitive lands will be dedicated as Environmental Reserve at the time of subdivision.

***Conserving Edmonton's Natural Areas – A Framework for Conservation Planning in an Urban Landscape (February 2001)***

This report was compiled in February 2001 by the City of Edmonton Community Services Department and the Alberta Environmental Network. The report was designed to be used as a tool to discuss future directions/policy changes with respect to the natural area planning and conservation process. Potential conservation sites were considered due to ecological factors such as size, potential linkages, biodiversity, and sustainability as well as external factors such as threats and opportunities presented by the development marketplace. Thirteen sites were identified in this document, and Big Lake was not one of them. The document stated that natural spaces are an important component of creating a good place to live within with City and that those communities in the northwest do not have a lot of natural areas and easy access to green space. Each of the groups involved in the process agreed that there was a need for land parcels that were large enough to be ecologically sustainable and were linked to other natural systems, that have inherent ecological value in terms of natural features, watershed value, and importance as habitat for native species of plants and animals. This document includes an extensive treatment and summary of conservation tools, many of which are included in the toolbox (Section 6.0) of this report. The reader is encouraged to also refer to this document for additional tools.

### 4.1.4 Parkland County

***Parkland County Municipal Development Plan (MDP) Bylaw #38-98 (September 1998)***

It is stated in the MDP that Parkland County desires to maintain and enhance environment quality throughout the municipality. The County believes that while development on certain lands might not be appropriate, they also feel that the goal of conservation does not necessarily preclude development.

In their Policies 7.13 pertaining to lakes, it states that Parkland County recognizes the importance of major lakes and their immediate shorelands as important open space and conservation features, including Big Lake. Policy 7.14 describes similar conditions to development as were described above in the sections on river valleys.

In sections of the MDP regarding intermunicipal cooperation with the City of Edmonton it states that the Big Lake Area Structure Plan (along with others) will guide the use and development of land and the maintenance and improvement of municipal infrastructure adjacent to Edmonton.

***Parkland County Land Use Bylaw 15-00***

The portion of Parkland County within the Big Lake Study Area includes Agricultural/Nature Conservation District (ANC), Country Residential Core District (CRC), and Country Residential Estate District (CRE). A Direct Control District (DC) also overlies all of these three areas within the Big Lake Natural Area Study Area, which is there "to enable and permit Council to regulate

and control the use, development and subdivision of land or buildings in any such manner as Council may by resolution consider necessary". Permitted and discretionary land uses for these land use districts are available for public review by contacting the municipality.

Parkland County developed residential housing adjacent to Big Lake, due to access to the regional trunk line for utilities. As Parkland County is not an urban municipality, the lot sizes adjacent to Big Lake are not forecasted to fall below half-acre lots, ensuring low density housing in the planning area.

***County of Parkland No. 31 – Big Lake Area Structure Plan (ASP) (July 1991)***

The objectives of the ASP are to provide rural residential development and other compatible land uses that do not detrimentally affect the provincially significant waterfowl breeding area associated with Big Lake. Extensive tracts of open space will be provided in the rural residential area to preserve the environmental quality and amenity of the area, including the wetland waterfowl breeding habitat area at the west end of Big Lake.

The south shoreline of Big Lake adjacent to the Plan area is designated as open space and is proposed to remain undisturbed as part of the environmentally sensitive areas and recreation system. In accordance with the policies of Alberta Environment, no structural development should be allowed within the 1:100 year floodplain or within 0.5 metres of the 1:100 year floodplain elevation. All of Big Lake and its associated floodplain are provincially recognized as important waterfowl breeding habitats and can only maintain that function with minimal disturbance from development. The Acheson Industrial Park to the south precludes a market desire for industrial development in this area but will continue to route heavy vehicle traffic adjacent the south and west boundary of the area.

A small commercial area will accommodate the demand for minor highway commercial and convenience servicing for area residents. An institutional area has been designated to meet the future demands for schools, community centres or religious institutions. Within the Big Lake Study Area there are residential, highway commercial, institutional, recreational, wetland conservation, environmentally sensitive lands, and roads, totalling 4,025 acres.

## 4.2 PROVINCIAL LEGISLATION

### 4.2.1 Environmental Protection and Enhancement Act S.A. c. E-12

- Comprehensive environmental legislation that regulates various areas of environmental considerations.

- The requirement for an environmental impact assessment report will depend on whether the proposed activity is for a mandatory, exempted, or other activity (Part 2). The Minister has the authority to require an environmental impact assessment report even if the

proposed activity is an exempt activity, or the Director has not ordered an environmental impact assessment report (s. 47).

- Specifically contemplates an inter-jurisdictional agreement respecting environmental assessment, whereby the Minister of Environmental Protection may, with respect to a proposed activity, enter into an agreement with the federal government or another provincial government to provide for a co-ordinated or joint environmental assessment process, or one where part or all of the environmental assessment performed by one government is adopted by the other government (s. 57).

- Requires an approval for certain activities designated by the regulations (s. 60).

- Prohibits the release of a substance into the environment in excess of the prescribed amount, concentration level or rate of release, or where none is prescribed, where the release may cause a significant adverse effect (ss. 108-109).

- A Director may designate an environment as a contaminated site if the Director is of the opinion that a substance that may cause, is causing or has caused a significant adverse effect is present. A site may be designated as a contaminated site even if a reclamation certificate has been granted (s.125).

- Even where an approval is not required, an operator who carries on an activity may need to conserve and reclaim specified land and obtain a reclamation certificate (s. 142).

- Penalties for offences include: for individuals, fines of up to $100,000 and imprisonment of up to 2 years; for corporations, fines up to $1,000,000 (ss. 227-228).

- A due diligence offence is prescribed, namely where an individual took all reasonable steps to prevent the commission of the offence (s. 229).

- A public official (including a municipal councillor, chief administrative officer or designated officer) can be liable for an offence of the municipality if he "knew or ought reasonably to have known of the circumstances that constituted the commission of the offence and had the influence or control to prevent its commission", whether or not the municipality has been prosecuted. However, the due diligence is offence is available (s. 223).

**Regulations under the Environmental Protection and Enhancement Act**

***Conservation and Reclamation Regulation* (A.R. 115/93)**

- Objective is to return specified land to equivalent land capability (s. 2).

- A municipality is not required to provide security for activities that would otherwise require security (s. 17.1).

***Environmental Assessment Regulation* (A.R. 112/93)**

- Contains requirements for environmental assessment process including requirements for screening process, preparation of terms of reference, publication of environmental impact assessment report.

***Environmental Assessment (Mandatory and Exempted Activities) Regulation* (A.R. 111/93)**

- Is listing of mandatory and exempted activities for which an environmental impact assessment (EIA) would be required.

- The Minister of the Environment has discretionary powers to require an EIA if he deems it is necessary.

***Wildlife Regulation* (A.R. 143/97)**

- Prohibits disturbance of the following (unless a permit has been issued):

- Nest and dens: of endangered animals throughout the year; certain migratory birds under the Migratory Birds Convention Act (Canada) throughout the year; and snake and bats from September 1 to April 30;

Beavers, wildlife in wildlife sanctuaries, and game birds in game bird sanctuaries (s. 96).

### 4.2.2 The Municipal Government Act M-26

The Municipal Government Act (MGA) provides power to municipalities to provide a range of mechanisms to implement municipal statutory plans. The Land Use Bylaw prescribes permitted and discretionary land uses, establishes site development standards and provides a mechanism for issuing development permits. Development permits are issued by the municipality pursuant to the Land Use Bylaw to permit development to occur.

Section 622 of the Act provides for the enactment of land use policies by Order-in-Council, and requires that all municipal statutory plans and planning actions are consistent with these land

use policies. These land use policies, adopted in 1996, are intended to "help municipalities to harmonize provincial and municipal policy initiatives at the local land-use planning level." Relevant goals of the land use policies are to:

- Encourage fairness, openness and equity in the planning process;
- Foster cooperation and coordination between neighbouring municipalities and between municipalities, and provincial government departments;
- Facilitate and promote land use patterns which coordinate the efficient development integration of land use, infrastructure, service and facility patterns and which provide an appropriate mix and balance of all land uses in an orderly, efficient, compatible, safe and economical manner;
- Maintain and enhance a healthy natural environment;
- Protect and utilize Alberta's water resources in a sustainable way; and
- Preserve, rehabilitate and re-use historical, archaeological and paleontology resources.

### 4.2.3 Public Lands Act R.S.A. 1980 c. P-40

- Vests in the Alberta Crown (with minor exceptions) the title to the beds and shores of all permanent and naturally occurring bodies of water, and all naturally occurring rivers, streams, watercourses and lakes (s. 3).
- Gives the Minister authority to impose conditions on dispositions of Crown land.
- Prohibits acts on public land that may injuriously affect watershed capacity, or the injury to the bed or shore of any river, stream, watercourse, lake or other body of water or land in the vicinity of that public land, except where the work is in accordance with the terms of a disposition or authorization (s. 54).

### 4.2.4 Water Act S.A. 1996 c. W-3.5

- The primary purpose of this Act is to provide protection and allocation of surface water and groundwater across Alberta. The Act is supported by three regulations and three codes of practice. The Act is used to issue single approvals for all water management activities that do not involve consumptive use of water. These activities usually involve a disturbance and/or alteration of the bed and banks of a water body.

### 4.2.5 Wildlife Act S.A. c. W-10

- Vests in the Alberta Crown property in all live wildlife, subject to narrow exceptions (s. 10).

- Gives the Minister the authority to make regulations including regulations respecting the protection and restoration of wildlife habitat, and the protection of endangered species (s. 103 u).

## 4.3 FEDERAL LEGISLATION

### 4.3.1 Canadian Environmental Assessment Act (CEAA) S.C. 1992, c. 37

Section 5 of CEAA requires an environmental assessment of a project that:

- is receiving any federal funding;
- the proponent is a federal authority,
- requires a federal authority to issue a license/approval/authorization/ or enabling action; or
- is on federal land.

Examples of projects that require a federal authorization include:

- Passage of fish (Fisheries Act s. 22(1)-(3))
- Harmful alteration, etc. of fish habitat or deposit of a deleterious substance in water frequented by fish (Fisheries Act ss. 32, 35-37)
- Construction of work in navigable waters (Navigable Waters Protection Act s. 5(1)(a))
- Certain physical activities impacting migratory birds within bird sanctuaries (Migratory Bird Sanctuary Regulations C.R.C. c. 1036)
- the killing of a migratory bird or the taking of a migratory bird or its nest (*Migratory Birds Regulations*, C.R.C. c. 1035 s. 28(1)).

### 4.3.2 Fisheries Act R.S. 1985, c.F-14, s.1.

- Prohibits carrying on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat. (s. 35)

- Prohibits the deposit of deleterious substance in water frequented by fish except where authorized by the federal Minister of Fisheries and Oceans or the federal cabinet (s. 34).

- The authority referred to above may include conditions respecting the supply of information (sampling, analysis, tests) and other requirements, such as plans, specifications and procedures (s. 36 and 37).

- Penalties for first offence include maximum fine of $1,000,000, and maximum imprisonment for three years. Further, an officer of a corporation who "directed, authorized, assented to, acquiesced in or participated in the commission of the offence" is liable for an offence committed by a corporation, even if the corporation has not been convicted of the offence (s. 78.2).

- Due diligence defence is available to both the person committing the offence, and a corporation's officer (S. 78.6).

### 4.3.3 Migratory Birds Convention Act, 1994 S.C. 1994, c. 22 and Regulations Respecting the Protection of Migratory Birds (C.R.C, c. 1035)

- Migratory birds include waterfowl, rails, cranes, shorebirds, pigeons, grebes, gulls, herons, loons and terns (see Schedule to the Act).

- The regulations prohibit possession of a migratory bird without a license, or disturbance of a nest of a migratory bird without a permit (s. 6).

### 4.3.4 Navigable Waters Protection Act R.S.C. 1985, c. N-22

- Prohibits the construction of a work in a navigable water except if approved by the Minister of Transport (s. 5), or the Minister determines that the work (other than a bridge, boom, dam or causeway) does not interfere substantially with navigation.

- Work includes bridges and pipes and the dumping of fill or excavation of materials from the bed of a navigable water (s. 3).

- Navigable water includes a canal and any other body of water created or altered as a result of construction of any work (s. 2).

## 4.4 NON-STATUTORY PLANS

### 4.4.1 Important Bird Areas Program (IBAP)

- Scope: International.

- Research that triggered IBAP was conducted in Europe in the mid-1980s. Publication of “Important Bird Areas of Europe” in 1989 is considered to mark the birth of the program.

- IBAP was started by the International Council for Bird Preservation which is now known as Birdlife International. The latter coordinates IBAP, with local partners, worldwide.

- The Canadian IBAP began in 1996 and, in Canada, it is facilitated by Bird Studies Canada and the Canadian Nature Federation.

IBAP's three goals are:

- Identify a network of sites that conserve the natural diversity of Canadian bird species and are critical for the long-term viability of naturally-occurring bird populations.

- Determine the type of stewardship or protection required for each site, and ensure the conservation of sites through partnerships of local stakeholders who develop and implement appropriate on-the-ground conservation plans.

- Establish on-going local involvement in site protection and monitoring

Within Canada, IBAP is part of the developing Partners in Flight (PIF) conservation strategy

### 4.4.2 Partners in Flight – Canada

- PIF was launched in the USA in 1990 in response to an accumulation of scientific evidence that many Neotropical Migrants (landbirds) were in decline.

- From its initial focus on NTM birds it has broadened to include most landbirds and other species requiring terrestrial habitats.

- PIF – USA is facilitated/coordinated by the National Fish and Wildlife Foundation and the American Bird Conservancy.

- PIF's scope is hemispheric.

- PIF's central premise is that: the resources of public and private organizations in North and South America must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere.

- PIF's goal is to focus resources on the improvement of monitoring and inventory, research, management, and education problems involving birds and their habitats.

- PIF Canada began to be organized in 1995. The Canadian Wildlife Service and Bird Studies Canada play key coordination/facilitation roles in the Canadian program.

- PIF Canada's goal is to: enhance the conservation of Canada's landbirds through cooperation and communication among the many groups with an interest in Canadian birds and their habitats.

### 4.4.3 Prairie Canada Shorebird Conservation Plan (PCSCP)

- PCSCP (Gratto-Trevor et al., 2001) is a regional component of the Canadian Shorebird Conservation Plan (Hyslop et al., 2000), which was developed nationally to provide an overview of the status of shorebirds in Canada and to outline procedures for cooperative national and international shorebird conservation.

- PCSCP is both regional and hemispheric in its scope.

- The Canadian Wildlife Service is the lead organization / proponent / coordinator / facilitator of PCSCP.

- The goals are: to sustain and enhance the distribution, diversity and abundance of breeding and migrating populations of shorebirds throughout the Prairie Provinces.

- The US Shorebird Conservation Plan is that country's equivalent to the CSCP.

### 4.4.4 The RAMSAR Convention ("Ramsar")

- The Convention on Wetlands of International Importance (especially as waterfowl habitat) was drafted in Ramsar, Iran in 1971. It is now known as the "Ramsar Convention".

- It was signed by Canada in 1981 (Mexico in 1986, and the U.S. in 1987). Ramsar's scope is International.

- The International Union for the Conservation of Nature (IUCN; Gland, Switzerland) and the International Waterfowl and Wetlands Research Bureau (Slimbridge, England) supported the Convention's development and implementation.

- The Canadian Wildlife Service is responsible for implementation of "Ramsar" in Canada.

- Ramsar created an international mechanism for the protection of wetlands. Signatory countries demonstrate their commitment to the conservation, management and sustainable utilization of these environments, and their fauna and flora.

- Countries joining the Convention have an obligation to designate at least one wetland to be included in "The (Ramsar) List".

- The Peace-Athabasca Delta, Hay-Zama Lakes and Beaverhill Lakes are Albertan Ramsar sites.

### 4.4.5 Western Hemisphere Shorebird Reserve Network (WHSRN)

- WHSRN was started in 1985 and is now a division of the Wetlands for the Americas (WA) program.

- The Network offers support to local wetland conservation initiatives. It uses shorebirds as a symbol for uniting countries in a global effort to maintain the Earth's biodiversity.

- Its scope is international/hemispheric. (WHSRN is based in Manomet, MA, U.S.A.).

- The Canadian Wildlife Service is the principal agency in Canada involved with WHSRN activities.

- There are 4 categories of reserve: Hemispheric; International; Regional; and Endangered Species.

The Network works to achieve 5 main goals:

1. Identify and protect sites critical to the Western Hemisphere's migratory shorebirds.
2. Promote and support the development of strong conservation organizations and their efforts to protect shorebirds and shorebird habitats.
3. Build strong public support for wetlands and shorebird conservation through education and public awareness.
4. Develop and support international, national and local policies to help ensure the long-term protection and management of the hemisphere's migratory shorebirds and critical wetlands.
5. Compile, analyse and disseminate information on shorebird distribution, migration, habitat, and biology in the Western Hemisphere.

### 4.4.6 North American Colonial Waterbird Conservation Plan (NACWCP)

- Scope is continent-wide.

- Began in July 1998. Coordinated in the U.S. by the Biological Division of the U.S. Geological Survey.

- Purpose of NACCP: to advance the conservation of colonial-nesting waterbirds and their habitats.

- Goal of NACWCP: to develop a plan whose implementation will result in sustainable populations, distributions, and habitats of colonial-nesting waterbirds throughout North America, including breeding, migratory and wintering ranges.

- This plan is being developed in concert with other bird conservation planning efforts already underway.

- The coordinator of this plan in Canada will likely be the Canadian Wildlife Service.

### 4.4.7 North American Waterfowl Management Plan (NAWMP)

- Signed in 1986 by the Canadian Minister of the Environment and the U.S. Secretary of the Interior. Envisaged as a 15-year plan.

- The Plan is composed of: a set of Guiding Principals; a series of waterfowl population objectives (for a variety of species); and an identification of habitat conservation where it is required to achieve those objectives.

- The North American Wetlands Conservation Act – enacted by the U.S. Congress in 1989 – was designed to provide funding for wetlands conservation.

- For the mid-continent duck population the target was to restore populations to the levels that existed during the 1970s.

- Ducks Unlimited Canada is the agency that delivered the majority of Plan programs in Canada.

- Implementation has occurred primarily through regionally-defined joint ventures – that facilitate cooperation among public and private partners in conservation activities.

- In 1994, the Plan was updated and expanded to include Mexico.

- The Plan's scope is thus continent-wide.

- In 1998, the Plan was updated again in order to expand its vision. This update emphasizes a landscape context for conservation delivery, and collaboration with other conservation efforts, particularly migratory bird initiatives. Part of the 1998 updated vision for NAWMP calls for "Plan Partners to collaborate with other conservation efforts, particularly migratory bird initiatives, to reach out to other sectors and communities to forge broader alliances in a collective search for sustainable uses of landscapes."

- The Alberta Prairie Habitat Joint Venture (of NAWMP) is working to incorporate a multi-species (avian biodiversity) program into its current activities in the province.

### 4.4.8 North American Bird Conservation Initiative (NABCI)

- This initiative was launched in November 1998. Its creation was "facilitated and catalysed" by the Commission for Environmental Cooperation (CEC; that was established by NAFTA).

- It is continent-wide in scope, and is directed by a Tri-National (Canada/USA/Mexico) (steering) Committee. CEC is still the primary facilitator and coordinator of the Initiative.

- In Canada, Bird Studies Canada and the Canadian Wildlife Service (and many other NGOs and government agencies) will spearhead NABCI.

- NABCI's vision is to: achieve regionally-based, biologically-driven, landscape-orientated partnerships that deliver the full spectrum of bird conservation across the North American continent and that support simultaneous, on-the-ground delivery of conservation of all birds. As a result, North American bird populations will flourish, because they are valued by society, including all levels of government and private initiative.

- NABCI's goal is to: ensure the long-term health of populations of native North American birds by increasing the effectiveness of existing and new initiatives, enhancing coordination, and fostering greater cooperation among the nations and peoples of the continent.

- According to Gratto-Trevor et al. (2001), NABCI "seeks to facilitate the integration and coordination of four bird conservation initiatives i.e., NAWMP, PIF landbird conservation, NACWCP and the Canadian (and U.S.) Shorebird Conservation Plan.

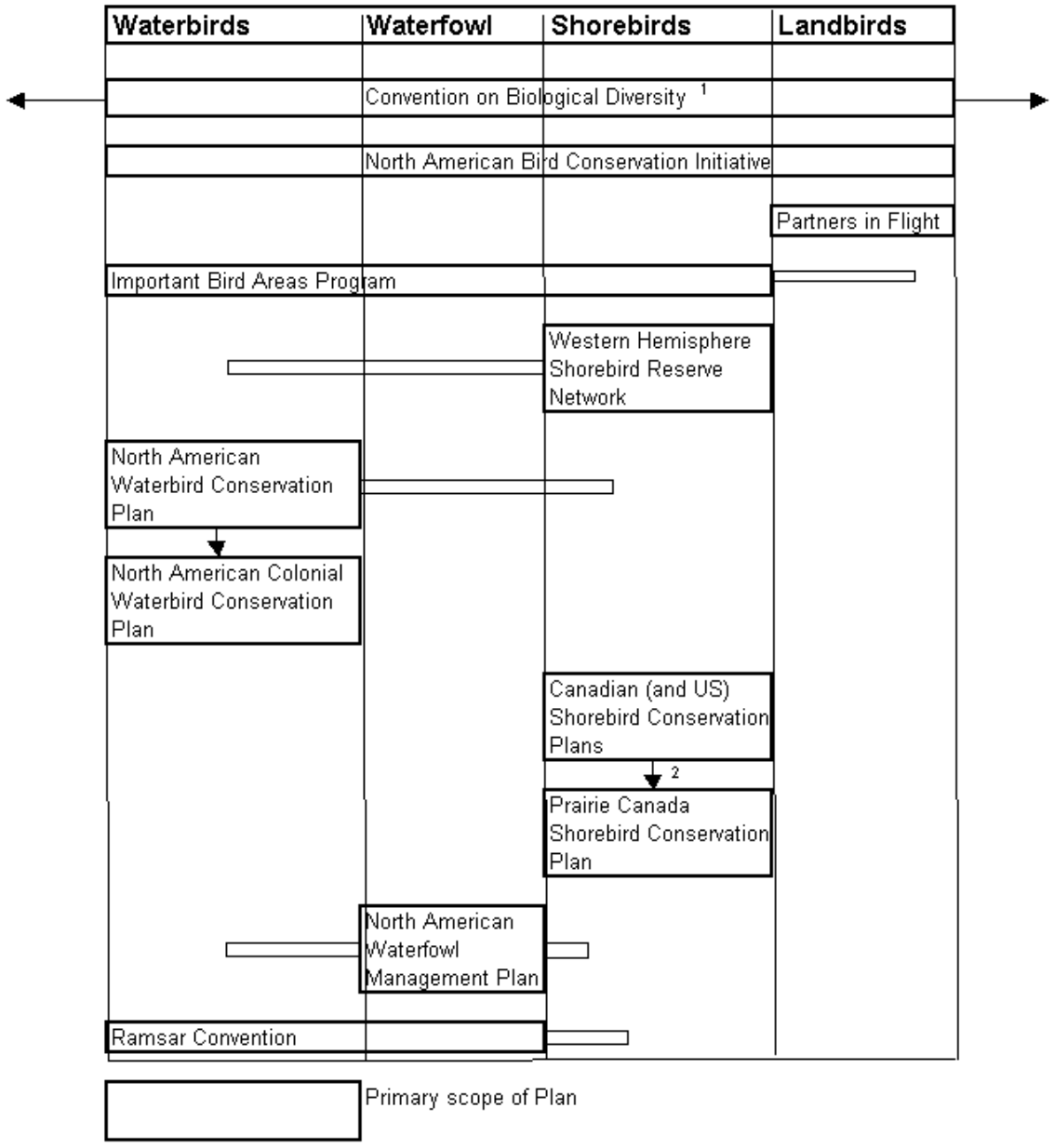
- The Prairie Landbird Conservation Plan is to be released this summer (this is the 4$^{th}$ of the NABCI plans, i.e., landbirds, shorebirds, waterbirds and waterfowl).

### 4.4.9 Convention on Biological Diversity

Canada is one of 168 signatory countries of the Convention on Biological Diversity – one of the key agreements adopted at the 1992 Earth Summit in Rio de Janeiro. To date, Canada has pledged $1.6 million to the Convention Trust Fund, and in 1995, completed the Canadian Biodiversity Strategy. The Strategy outlines the measures required to meet the obligations of the Convention and to enhance co-ordination of national efforts aimed at conservation of

biodiversity and the sustainable use of biological resources (Convention on Biological Diversity Website, 2002; Environment Canada, 1995).

**Figure 2: Primary (and Subsidiary) Scope of Bird and Bird Habitat Conservation Initiatives**




Plan administrators cooperate as necessary but linkages between plans are generally unofficial/informal.

[1] Convention on Biological Diversity (1992 "Rio Convention") encompasses all of Earth's biodiversity.

[2] Short arrows show plans (e.g., PCSCP) and the parent plans from which they derived.

# 5.0 LITERATURE EVALUATION

This section provides the results of the literature review for each discipline area [birds, wildlife (mammals, amphibians and reptiles and fish) vegetation, surface drainage, hydrogelogy and outdoor recreation]. The goals of this review were to assemble data, provide an analysis of the quality and quantity of the data, provide a summary of the existing conditions or characteristics of the BLNA study area and to identify data gaps appropriate to each respective discipline.

## 5.1 BIRDS

*"Birds are hugely popular and the public demands their conservation" (Moser et al., 1994).*

This quote was written by ornithologists from Britain, home to Europe's largest conservation organization, the Royal Society for the Protection of Birds (RSPB) which boasts a membership greater than one million. The sentiment may be equally applicable to BLNA, since to many people, birds are "what Big Lake is all about." Apart from insects, birds are the wild creatures most likely to be encountered by urban and rural Albertans. Birds are not only highly audible and visible, but also account for almost two-thirds of the province's regularly-occurring vertebrate species.

Being highly mobile organisms, birds are not restricted by political boundaries and, through their migrations, constitute Big Lake's ecological links to the Arctic, USA and Latin America. A number of current national and international bird (and wetland) conservation initiatives are relevant to the BLNA and its birdlife, and vice versa. These include (and were summarized in Section 4.0) the North American Waterfowl Management Plan (NAWMP, 1999), North American Bird Conservation Initiative (NABCI, 1999), Important Bird Areas Program (IBAP), North American Colonial Waterbird Conservation Plan (NACWCP, 2001), Partners in Flight (PIF), the Western Hemisphere Shorebird Reserve Network (WHSRN), the Prairie Canada Shorebird Conservation Plan (PCSCP; Gratto-Trevor et al., 2001) and the Ramsar Convention (Poston and Hyslop, 1987).

### 5.1.1 Review and Assessment of Available Information

Information regarding the birds of BLNA, encountered during this study is briefly described, in chronological order, below:

- According to Al Doberstein (pers. comm., 26 February, 2002), Dewey Soper conducted bird counts on Big Lake between 1933-1935, and published his results in a 1940 paper entitled: "Notes on bird sanctuaries and water conditions in the Prairie provinces". This reference has not been obtained and examined by the writer.

- R. G. Schmitke's description of three aerial surveys of Big Lake waterfowl he undertook for Alberta Fish and Wildlife on September 3, October 6, and October 21 of 1964 (which yielded total duck counts of 26,000, 1,000 and 8,000, respectively) are included in a

preliminary report to the ERPC (1965, p.4a). Schmitke concluded that Big Lake's importance as a waterfowl nesting area was "minor in comparison to (its) staging area importance."

- The afore-mentioned report also contains a letter dated March 2nd, 1965, from D.A. Boag (then an assistant professor at the University of Alberta) which lists 45 species of birds which breed at Big Lake, plus 23 additional species "seen regularly on migration". To the end of both lists is appended the phrase: (plus) "numerous flycatchers, warblers, sparrows, blackbirds" (ERPC, 1965, pp. 13a and 14a).

- In 1968, J.W. Guay – a Ph.D. student at the University of Alberta – completed his thesis on the breeding biology of Franklin's Gulls in the species' nesting colonies at Big Lake and Hay Lake. Guay (1968, pp.18), also lists 19 bird species he found nesting within or adjacent to the Big Lake colony. He estimated that in 1964, the latter colony comprised 500 pairs of adult gulls.

- Kemper and Doberstein (1977) refer to spring waterfowl surveys conducted at Big Lake by Renewable Resources Consulting Services Ltd. (1971) during which they tallied about 500 breeding pairs of dabbling ducks and 100 pairs of diving ducks. This report was not obtained by the writer.

- An Alberta Environment (1973) document containing "summary information" for Big Lake, mentions (p. 6) that in September, 1967 "an ecology study of the vegetation around Big Lake and its influence on waterfowl, mammals and insect species was undertaken by a graduate student at the University of Alberta." This unnamed student's field programme apparently included a "bird count" but unfortunately, the study itself has not been obtained.

- Kemper and Doberstein (1977) conducted "a number of aerial" bird (principally waterfowl) surveys (on behalf of the Canadian Wildlife Service) of Big (and Manawan) Lake from August 14 to November 16 of 1976. Concurrently they also undertook "ground checks" of various parts of Big Lake. Kemper and Doberstein regarded Big Lake as "an extremely important waterfowl production lake." They noted that the combined total of ducks, coots and grebes peaked in mid September (of 1976) and, like Renewable Resources (1971), recorded substantial numbers of coots on Big Lake. Kemper and Doberstein (1977) also mapped accumulated total populations of 'swans and geese', and 'ducks and coots and grebes' for the 16 surveys they conducted, and noted the occurrence of shorebirds, raptors, gulls and Great Blue Herons. Their report is based on as much (if not more) fieldwork as all the other Big Lake waterfowl surveys reviewed here combined.

- Moore (1992) cites a report by McFetridge and Glasgow (1979) involving "Migrating Wildlife Inventories on Lakes in the Edmonton Region" based upon 1978 fieldwork that apparently included Big Lake. However, this report could not be located.

- Alberta Fish and Wildlife staff surveyed Big Lake's waterbirds on June 14, 1982. Purdy et al. (1983) recorded totals of 655 Eared Grebes including one colony of 300+ birds at the western end of the lake; 600+ American Coots; 625+ Black Terns, and 2000+ Franklin's Gulls (Ibid., table 5). In their text however, Purdy et al. (1983, p. 19) state that "the west end also supports two Franklin's gull colonies (3000+ birds)." In addition to the birds already mentioned, these authors recorded 23 other species.

- For Ducks Unlimited Canada/Alberta Fish and Wildlife's "Wetlands for Tomorrow" cooperative conservation initiative, Calverley and Kosinski (1986) developed a "Preliminary Waterfowl Habitat Development Concept" for Big Lake. As part of this project they made one waterfowl count on May 2, 1986; compiled "scattered observations" of waterfowl broods (but no brood counts) in 1985; and undertook "fall staging observations" during 1985 and 1986. Calverley and Kosinski (1986, table 1, p. 8) compare the latter counts (from 8 different dates) with those done by Schmitke in 1964 (ERPC, 1965; see above). As one might anticipate, their report strongly emphasizes waterfowl, although a number of waterbird species are briefly described under the heading of "Other Wildlife" (Ibid., p. 4).

- Alberta Fish and Wildlife biologist John Folinsbee (pers. comm., 21 Feb., 2002) believes that bird surveys may also have been conducted on Big Lake during 1988/1989, but no evidence of such work could be located.

- As reported *in* Moore (1992), John Folinsbee undertook a waterborne bird survey of Big Lake on July 10, 1991. Of the 17 species he recorded, the following four boasted the highest totals: Eared Grebe (± 1,314); Franklin's Gull (± 1,714); Black Tern (± 290) and American Coot (± 1,961). Folinsbee calculated Big Lake's "significance to wildlife index" as "exceptional."

- Without specific attribution, a comment is included in the Edmonton Metropolitan Regional Planning Commission (EMRPC's) (Sept. 1987, p. 8) Big Lake Alternative Plans document that: "waterfowl counts at Big Lake conducted in 1964, 1976, 1985 and 1986 have shown a decrease in bird population numbers." However, given the major, week-to-week fluctuations in waterfowl numbers at Big Lake, especially during fall migration (Kemper and Doberstein, 1977), the validity of this statement is hard to assess.

- In 1992, the Federation of Alberta Naturalists (FAN) published the Atlas of Breeding Birds of Alberta (ABBA) (Semenchuk, 1992). For this atlas effort, breeding bird surveys were conducted within 10 km x 10 km UTM squares or 'blocks'. The western and eastern 'halves' of Big Lake lie within two adjacent atlas squares, namely: 12UUQ14 and 12UUQ24, respectively. Total observer effort within the two squares differed markedly. UQ24 (which includes the City of St. Albert) was relatively well-covered with a number of surveys being conducted by Alan Hingston (1987-1989) and Terry Thormin (1987). Minor (but significant) contributions were also made by other local birders such

as Hardy Pletz (raptors/owls). UQ14 on the other hand received scant attention until it was subjected to a surveying 'blitz' by various observers (so-called 'blockbusters') on May 15, 1991. The latter yielded a total of 83 bird species of which 64 were suspected or proven breeders. (Actual numbers of birds breeding in the Big Lake area are discussed in Section 5.1.2, below.) At the time of writing, a second, provincial breeding bird atlassing project (coordinated by FAN) is underway.

- Both the St. Albert Christmas Bird Count (CBC) and May Species Count were established in 1991 by Peter Demulder (who acts as data compiler for both). Since 2000, the St. Albert CBC has operated as an 'official' National Audubon Society count. The centre of the 15 mile (24.1 km) diameter count circle is located ca. 0.8 km southwest of St. Albert airport. This CBC is now a popular, local, annual event that regularly attracts from 120 to 164 participants, with up to 74 (in 2001) being in the field (P. Demulder, pers. comm., Feb. 19, 2002). Peter Demulder's compilation of 10 years of CBC records shows the number of species found annually ranges from 28-46, with the cumulative total being 64 species. The annual St. Albert May Species Count covers more-or-less the same area as the CBC circle. In May 2000 and May 2001, this count yielded species totals of 98 and 95, respectively (P. Demulder, pers. comm., Feb. 19, 2002), but the 10-year data set has not yet been compiled and analysed.

- In 1994, the Big Lake Environment Support Society (BLESS), based in St. Albert, published a bird check list for the "Big Lake and St. Albert Area," an area which coincides almost exactly with the present study area. This list, which comprises 214 species, was compiled by Peter Demulder. It is currently in the process of being updated by him, together with Alan Hingston and Dave Nadeau. These three, well-known, St. Albert birders kindly provided the writer with the bulk of the information used to compile the annotated bird checklist for Big Lake presented in Appendix C.

- According to Jack Park (pers. comm., March 14, 2002), provincial coordinator for the North American Breeding Bird Survey (BBS; cf. Robbins et al., 1986; Peterjohn, 1994), no BBS routes traverse the study area. The closest route lies to the northwest of Big Lake and circumscribes the Calahoo-Villeneuve area. (This route was operated for 30 years by Peter Demulder; he retired from it two years ago.)

- Since the mid-90s, Peter Demulder (and, on occasion, other St. Albert and Edmonton-based birders) has undertaken informal counts of waterfowl concentrations staging on Big Lake during the spring and fall migration periods. Efforts have concentrated, in particular, on tallying the numbers of Tundra Swans using the lake in fall. (P. Demulder, pers. comm., Feb. 19, 2002).

- As part of their "wildlife assessment" related to the Proposed (St. Albert) West Boundary Road environmental impact assessment study (IBI Group, 1996), Penner and Associates Ltd. (1996) conducted breeding bird surveys on ten plots (to the east and northeast of Big Lake's east basin) on June 12 and July 11, 1996. This work turned up

some interesting breeding records of locally rare species such as Sedge Wren and Virginia Rail. Penner and Associates Ltd.'s (1996, Appendix 1) breeding bird species totals for their June 12 and July 11 surveys were 69 and 80, respectively. They also list (Ibid., appendix 1) species found in UTM atlas squares UQ24 and UQ14 using FAN's "confirmed records database for breeding birds." However, Penner's species totals for St. Albert (96) and Big Lake (130) in their 'Appendix 1' are misleading since the species listed in the appropriate columns include non-breeders/transients such as Black-bellied Plover (which breeds in the Arctic). Penner and Associates Ltd.'s (1996, tables 2 and 3) report also contains useful information concerning vegetation communities/ecosystems (after Kipen Gibbs/Landscape Architects Ltd., 1991) in the Big Lake area, and "habitat associations" of Big Lake area birds.

- On 25 July, 2000 John Folinsbee and Peter Demulder conducted a waterborne survey of Big Lake's birdlife. It is interesting to compare their total counts for Eared Grebe (305), American Coot (321), Franklin's Gull (1) and Black Tern (58) to past tallies (see above) for these species.

- Big Lake and its birdlife receives minor mention in four other publications: Fisher and Acorn (1998) include Big Lake in their list of Alberta's top (80) birding sites; Spalding (1980, pp. 198-199) contains a description of the Big Lake area, especially its birds, written by Ludo Bogaert; Big Lake and its birdlife gets a rather cursory mention in Saley et al. (1995, pp. 28-29); and lastly, in Ducks Unlimited (Canada) / Alberta Fish and Wildlife's proposal for a Waterfowl Habitat Program (Anon., ?1986) which became the "Wetlands for Tomorrow" initiative, Big Lake's average annual production is conservatively estimated at 300 broods or about 1,500 ducks per year." Mention is also made that "as many as 26,000 staging ducks, geese and swans have been observed on Big Lake in a single day during fall migration." The presence of Sandhill Cranes and upland game birds is also noted (Ibid.).

- Finally, most of the key points in the above-listed sources of information were summarized recently by Lane (2000).

### 5.1.2 General Characteristics of the Study Area Birds

The broad character of the BLNA birds is broken down below using a series of tables and brief explanatory notes. This summary is based upon analysis of the Annotated Big Lake Study Area Bird Checklist prepared for this project (Appendix C). More details and/or, sources of information concerning individual species, including their risk status and population trends (when known), plus any other key facts pertinent to their conservation, are presented in Appendix C. A map of birds and bird habitat is contained in Appendix B.

A total of 235 species comprise the provisional, study area bird checklist (Appendix C). (One additional species i.e., Black-billed Cuckoo, believed to have occurred – but not confirmed – at Big Lake, is also included in Appendix C). Of these species, 181 (77%) are considered to be of

annual occurrence (i.e., "regular") while the remaining 54 (23%) are irregular (i.e., non-annual) in their occurrence. The relevant numbers of "breeding species" (known breeders, suspected breeders, or species thought to have formerly bred in the area) per category, are given below.

**Table 1: Big Lake Breeding Bird Species**

| Bird Grouping | Total No. of Bird Species | Number of "Breeders" | % of Total |
|---|---|---|---|
| Whole List | 235 | 129 | 54.9 |
| Species of Annual Occurrence | 181 | 117 | 64.6 |
| Species of Non-annual Occurrence | 54 | 11 | 20.4 |

Breaking down the checklist into the major groups of birds regarded as the four "pillars" of the North American Bird Conservation Initiative (NABCI) yields the following results:

**Table 2: Big Lake Bird Species in the Four Major (NABCI) Categories**

| Group of Birds | Whole List [Number (%)] | Species of Annual Occurrence [Number (%)] | Species of Non-annual Occurrence [Number (%)] |
|---|---|---|---|
| Waterfowl | 29 (12.3) | 24 (13.3) | 5 (9.3) |
| Waterbirds | 26 (11.1) | 21 (11.6) | 5 (9.3) |
| Shorebirds | 32 (13.6) | 21 (11.6) | 11 (20.4) |
| Landbirds | 148 (63) | 115 (63.5) | 33 (61) |
| Total | 235(100) | 181 (100) | 54 (100) |

Given the near-exclusive focus of available Big Lake bird literature upon waterfowl, it is worth noting that this group constitutes less than 1/6 of the study area's birds. The shorebird total indicates the potential of the BLNA as an important shorebird-viewing site. Sightings of many of the rarer shorebirds on the list took place at the former St. Albert sewage lagoons – mudflats exposed by water level drawdowns when these lagoons were operational proved highly attractive to shorebirds (A. Hingston, February 26, 2002). Landbirds, which comprise almost 2/3 of the Big Lake birds receive short shift in currently available ornithological literature. All 6 bird species non-native (as noted in Bird Checklist) to the Big Lake Study Area are landbirds.

The Big Lake bird species list can be further broken down into family groupings as shown in Table 3:

**Table 3: Big Lake Bird Family Groupings**

| Whole List (N=235) | | Bird Grouping (Families) | Native species of annual occurrence that breed (N=112) | |
|---|---|---|---|---|
| No. of Species | % of Total | | No. of Species | % of Total |
| 6 | 2.6 | Loons and Grebes | 5 | 4.5 |
| 20 | 8.5 | Other Waterbirds | 11 | 9.8 |
| 29 | 12.3 | Swans/Ducks/Geese | 16 | 14.3 |
| 14 | 6 | Raptors (diurnal) | 7 | 6.2 |
| 32 | 13.6 | Shorebirds | 10 | 8.9 |
| 8 | 3.4 | Owls | 2 | 1.8 |
| 7 | 3 | Woodpeckers | 6 | 5.35 |
| 7 | 3 | Flycatchers | 5 | 4.5 |
| 25 | 10.6 | Vireos &Wood-warblers | 8 | 7.1 |
| 6 | 2.6 | Swallows & Martins | 5 | 4.5 |
| 5 | 2.1 | Crows & Allies | 4 | 3.6 |
| 18 | 7.6 | Sparrows & Allies | 9 | 8 |
| 8 | 3.4 | Blackbirds & Orioles | 6 | 5.35 |
| 9 | 3.8 | Finches | 3 | 2.7 |
| 41 | 17.4 | Others | 15 | 13.4 |

This table underscores the heterogeneity/diversity of the study area's birdlife. Waterfowl form a very visible, abundant and (particularly, historically) economically important component of Big Lake's birds. However, this group only represents 14.3% of all native, annually-occurring bird species that breed in the Big Lake area. This point is worth emphasizing when considering the fact that there have been a number of proposals in the past to construct dykes and weirs at Big Lake, to enhance its suitability for waterfowl production (Surrendi, 1969, 1970, 1972; Calverley and Kosinski, 1986). Such habitat manipulations would undoubtedly have detrimental effects on a number of other bird species.

Finally, from a conservation perspective, it is worth breaking down the Big Lake checklist according to the basic migration strategies (or lack thereof) of its component species:

**Table 4: Resident and Migratory Resident Groups**

| Migration / Residence Category | Whole List (N=235) [Number (%)] | Annually Occurring Species (N=181) [Number (%)] | All Breeding Species (N=129) [Number (%)] |
|---|---|---|---|
| Residents | 27 (11.5) | 23 (12.6) | 22 (17) |
| Short-distance Migrants | 51 (21.7) | 35 (19.2) | 25 (19.4) |
| Neotropical Migrants | 144 (61.3) | 115 (63.2) | 81 (62.8) |
| Winter Visitors | 13 (5.5) | 9 (4.9) | 1 (0.8) |
| Total | 235 | 181 | 129 |

Reflecting the comparative severity and duration of study area winters, migrants account for 82.4% of its annually occurring birds. At this season however, its resident birdlife is augmented by a small number of winter visitors. Residents are defined as birds present throughout the year. Short-distance migrants are species which, winter within North America (usually either along its coasts, or in southern Canada and/or, the USA). Neotropical migrants (NTMs) are species that spend the bulk of their lives in the "New World" tropics but visit Canada (and/or, the USA) during our summer, in order to breed. Populations of many NTMs (especially forest-dependent species) are undergoing serious declines (Terborgh, 1989; Thomas, 1994). The fact that over 60% of Big Lake's birds comprises NTMs, highlights the relevance of international NTM conservation initiatives (such as Partners in Flight) to BLNA's managers. Winter visitors are defined as birds such as the snowy owl that only occur in the BLNA during the winter season.

At least 20 of the species on the Big Lake checklist can be considered irruptive, i.e., their numbers in any given region can vary dramatically from year to year, since populations are prone to large-scale movements in response to failure (particularly during winter,) or a localized super-abundance, of their normal food sources (cf. Koenig, 2001).

### 5.1.3 Risk Status of BLNA Bird Species

Those BLNA bird species included within the various risk categories (defined below) utilized by COSEWIC (2001) and Alberta Fish and Wildlife Division (2001) are listed in Tables 5 and 6, respectively.

**Table 5: COSEWIC 2001 Risk Status* for Bird Species Found at BLNA**

| Extinct | Extirpated | Endangered | Threatened | Special Concern |
|---|---|---|---|---|
| None | None | None | Peregrine Falcon (Anatum)<br>Sprague's Pipit<br>Loggerhead Shrike | Ferruginous Hawk<br>Short-eared Owl<br>Yellow Rail |

* **Extinct**: Species that no longer exists
**Extripated**: A species that no longer exists in the wild in Canada, but occurring elsewhere.
**Endangered**: A species facing imminent extirpation or extinction.
**Threatened**: A species that is likely to become endangered if limiting factors are not reversed.
**Special Concern**: A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

**Table 6: Alberta Fish and Wildlife 2001 Species Status* for Birds Found at BLNA**

| At Risk | May be at Risk | Sensitive |
|---|---|---|
| Ferruginous Hawk<br>Peregrine Falcon<br>Trumpeter Swan | Short-eared Owl | American Bittern<br>American White Pelican<br>Bald Eagle<br>Bay-breasted Warbler<br>Black-backed Woodpecker<br>Black-crowned Night-Heron<br>Black-necked Stilt<br>Black Tern<br>Black-throated Green Warbler<br>Bobolink<br>Canada Warbler<br>Cape May Warbler<br>Common Nighthawk<br>Forster's Tern<br>Golden Eagle<br>Great Blue Heron<br>Great Gray Owl<br>Horned Grebe<br>Loggerhead Shrike<br>Northern Goshawk<br>Osprey<br>Pied-billed Grebe<br>Pileated Woodpecker<br>Purple Martin<br>Sandhill Crane |

| At Risk | May be at Risk | Sensitive |
|---|---|---|
| | | Sedge Wren<br>Sharp-tailed Grouse<br>Sprague's Pipit<br>Swainson's Hawk<br>Upland Sandpiper<br>Western Grebe<br>Western Tanager<br>White-winged Scoter |

* **At Risk**: Any species known to be "at risk" after formal detailed status assessment and designation as "endangered" or "threatened" in Alberta.
**May be at Risk**: Any species that "may be at risk" of extinction or extirpated, and is therefore a candidate for detailed risk assessment.
**Sensitive**: Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

### 5.1.4 BLNA Study Area's Critical Characteristics (from an avian perspective)

- Big Lake's natural hydrological regime is distinguished by marked year-to-year and within-year variability, which manifests itself in large fluctuations in lake area and depth. This variability can result in wide zones of emergent vegetation (cattails, bulrushes) that form critical nesting habitat for colonial waterbirds such as Franklin's Gull. Big Lake's water level fluctuations are its main 'natural disturbance regime'.

- In average years, Big Lake's maximum depth barely exceeds 1.2 m (Alberta Environment, 1977). This precludes deep-diving ducks, but provides ideal feeding habitat for swans and dabbling ducks. It also means Big Lake experiences winter kill, which combined with Big Lake's lack of fish diversity (Northern Pike is its primary species) means that fish-eating birds (e.g., loons, osprey) are not prominent at the lake. Disturbance by anglers is also largely confined to the Sturgeon River downstream from its outflow point.

- The Big Lake area exhibits varied topography (EMRPC, 1987). Along the lake's southern margin are comparatively steep, north-facing slopes with up to 30.5 m local relief (above water level). By contrast, the lake's east, north and west slopes are gentle, and thus experience the most flooding/emergence depending on water levels. This affects mudflat/wet meadow distribution and hence the production of habitats favoured by shorebirds. The south shore "scarp" has its own micro-climate and supports a diverse assemblage of upland forest types. This topographic feature also serves to "funnel" migrating landbirds along the lake's southern shore.

- The Big Lake Study Area encompasses a wide variety of ecosystems/vegetation types including: sedge-willow marsh, areas of shallow and deep marsh, riparian ecosystems

including relict patches of spruce-Balsam Poplar forest along the Sturgeon River, stands of White Spruce, Black spruce "bog", and conifer-birch-poplar mixedwoods, Aspen stands, Tamarack "bogs", areas of grassland and open water environments (Russell and Spiers, 1983; Calverley and Kosinski, 1986; EMRPC, 1987; I.M.C. Consulting Group Inc., 1991; and Penner and Associates Ltd., 1996). This diversity of habitat types, set as it is in a highly anthropogenically-modified agricultural-urban landscape "matrix" acts as a magnet for wildlife.

- Horseshoe and Kirk Lakes are fed by springs (O'Leary et al., 1993). The possible presence of a spring may be the reason that the area of the eastern basin near the Sturgeon River outflow remains ice-free longest, and is one of the first ice-free areas on the lake. As such, it attracts the first waterfowl to arrive at the lake in spring and supports the last to leave before freeze-up.

- Big Lake is eutrophic, lacks a sport fishery and, particularly in the case of the west basin, has relatively poor access for humans. The latter combined with the lake's shallow depth, means that its birdlife is subject to lower levels of human disturbance from water-based recreational activities.

### 5.1.5 Birds as Potential Bioindicators of Big Lake's Ecological Integrity

The critical yardstick for measuring the long-term success or failure of any protected area's conservation action plan is the site's overall environmental 'state of health' or, more specifically, the degree to which its ecological integrity has been maintained. Angermeier and Karr (1994, p. 692) define biological (a.k.a. ecological or biotic) integrity as referring "to a system's wholeness, including presence of all appropriate elements and occurrence of all processes at appropriate rates." Biological integrity is a better reflection of ecosystem health than biological diversity (species richness) because the latter can be elevated by processes (e.g., forest fragmentation) that compromise integrity. Researching and monitoring the BLNA's ecological integrity is vital, so managers can: (1) establish its current ("baseline") integrity level (2) monitor changes in order to identify threats/problems; and (3) evaluate the effectiveness of BLNA's management plan.

Quantifying and monitoring ecological integrity involves the use of bio-(or ecological) indicators consisting of "diagnostic attributes or indicators" sensitive to a range of environmental stresses (Angermeier and Karr, 1994, p. 694). Types of bioindicators used thus far include species, populations, species assemblages (cf. Kremen, 1992) and (less frequently) ecological processes. The bioindicator approach and methodology is far more advanced/better developed for aquatic ecosystems than for their terrestrial counterparts (Ibid.; see also: Karr, 1991; Kerans and Karr, 1994; Adamus et al. ?2000; Teels and Adamus, 2001).

Birds have been proposed and/or, used as bioindicators by many researchers (U.S. EPA, 1995; O'Connell et at., 1998). In the past, several authors have commented on the difficulties of using birds in general – or the unsuitability of particular species – as bioindicators (Morrison, 1986;

Temple and Wiens, 1989; Strong, 1990). However, from their survey of relevant technical literature published in North America between 1990 and 2000, Adamus et al. (? 2000) concluded "these studies have clearly supported the utility of employing bird species composition – and wetland birds in particular – as an indicator of land cover alteration, habitat fragmentation, and other human influences at multiple scales." Kushlan (1993, p. 241) noted a number of instances where colonial waterbirds have proven valuable bioindicators of environmental contamination by toxins. Various workers have concluded that bird guilds (O'Connell et al., 2000) bird communities (O'Connell et al., 1998), bird communities and their habitat (Canterbury et al., 2000) or assemblages of species (e.g., woodpeckers: Angelstam and Mikusinski, 1994; Mikusinski and Angelstam, 1998; Mikusinski et al., 2001) are better to use as indicators of ecological integrity than individual species.

A number of the bird species that breed at Big Lake are potentially useful as bioindicators and as aids in the future development of an "ecosystem integrity report card" (cf. Harwell et al., 1999) for BLNA. Three of these: Franklin's Gull (Burger and Gochfeld, 1994), Black Tern (Dunn and Agro, 1995) and Eared Grebe (Cullen et al., 1999) are disturbance-sensitive, colonial-nesting waterbirds that require emergent vegetation and hence exhibit sensitivity to water levels. Yellow-headed Blackbird (Twedt and Crawford, 1995) constructs its nests in emergents over deeper water, and American Bittern - which is area demanding (nests in large reed-beds) and disturbance sensitive, would complement this trio as avian bioindicators of wetland integrity at Big Lake. Northern Harrier also nests at Big Lake, and its highest densities elsewhere are associated with "large tracts of undisturbed habitats" (MacWhirter and Bildstein, 1996). It feeds on small rodents and birds and thus decreased numbers of this raptor at Big Lake may reflect prey population stresses.

Use of Big Lake's woodpecker species assemblage (cf. Mikusinki et al., 2001) as a bioindicator should prove valuable in assessing, and tracking deterioration of, the integrity of the fragmented forests (especially along its southern flank) bordering the lake. In particular, the small population of Pileated Woodpeckers using the latter forest fragments should be monitored. This species is an area demanding/area sensitive habitat specialist. It requires large tracts of mature/old forest containing areas of sufficient diameter to 'host' its nest cavities. The latter are used by numerous other species including Boreal Owl and cavity-nesting ducks (e.g., Bufflehead; Common Goldeneye). As a result, Pileated Woodpecker is considered a keystone and umbrella species (Bull and Jackson, 1995; McClelland and McClelland, 1999; Savignac et al., 2000; Bonar, 2000).

A summary of these bird bioindicators is contained in Table 7 below.

**Table 7: Birds as Bioindicators**

| Birds | Bioindicators of….. |
|---|---|
| Eared grebe<br>Franklin's gull<br>Black Tern<br>Yellow-headed blackbird<br>American Bittern | Wetland integrity |
| Northern Harrier | Prey population stresses |
| Pileated Woodpecker | Forest integrity bordering southern portion of Big Lake |

The above-listed bird species should be used with other bioindicators especially aquatic invertebrates, that can be used to construct an Index of Biotic Integrity similar to that developed by Karr (1991; see also Kerans and Karr, 1994; Adamus et al., ?2000; and Teels and Adamus, 2001). There was not enough detail provided in the literature reviewed in the wildlife and vegetation sections of this report to provide a similar review of other bioindicators of ecological status.

### 5.1.6 Information Gaps

While birds are the BLNA's best-known group of organisms, closer inspection of this 'ornithological data base' reveals the presence of the following information gaps:

- Most BLNA-specific survey data relate to waterfowl.
- Most recent 'official' surveys of Big Lake have been one-day affairs, and the frequency of surveys has decreased markedly since the 1970s/80s.
- There has been a notable lack of consistency in the waterfowl / waterbird surveys conducted at Big Lake (e.g., with respect to survey dates, observer effort and methods).
- There have been no long-term monitoring programmes tracking, for example, population changes of individual species or changes in overall species assemblage composition, undertaken at Big Lake.

- With the exception of Franklin's Gull (Guay, 1968) there have been no detailed studies of the ecology or habitat requirements of Big Lake's bird species.

- There has been no long-term monitoring of changes in bird habitat quality and distribution within the BLNA.

- No up-to-date, demographic data sets (e.g., population numbers, variability, trends; productivity, survivorship, etc.) are available for any of Big Lake's bird species.

- Knowledge concerning which species breed within the BLNA, particularly its western 'half', remains incomplete.

- Most of the available information concerning Big Lake's birdlife is in unpublished Alberta Fish and Wildlife or Canadian Wildlife Service reports; consultants' reports, and the files/notebooks of ENGO's and individuals. Some relevant documents have been misplaced, and none of this body of literature has been published in readily-available publications such as peer-reviewed, scientific journals.

- One immediate goal of ecological integrity research at Big Lake should be to investigate why its Franklin's Gulls abandoned their colonies in 1999.

- Finally, the use of BLNA's odonate (dragonfly and damselfly) fauna as a bioindicator of wetland integrity, as has been done in southern Alberta (Hornung and Rice, 1999), should be pursued.

## 5.2 WILDLIFE

### 5.2.1 Mammals

Wildlife species commonly found in the Big Lake Study Area reflect existing land use and those species that have adapted to human activities. Wetlands and terrestrial vegetation in the area provide adequate food and cover to attract and support a variety of wildlife species and a broad diversity of species has been reported in the region historically. Habitat conditions in the study area are particularly favourable for muskrat, beaver, coyote and white-tailed deer (Penner and Associates Ltd. 1990; Alberta Environment 1977). Capture or sighting records of mammals within the Big Lake or St. Albert area exist for only a few species and are listed in Table 8 (Smith 1979; BSOD 2002).

**Table 8: Capture or Sighting Records of Mammals Within the Big Lake or St. Albert Area**

| Common Name | Scientific Name |
|---|---|
| Masked Shrew | *Sorex cinereus* |
| Arctic Shrew | *Sorex arcticus* |
| Little Brown Bat | *Myotis lucifugus* |
| Silver-haired Bat | *Lasionycteris noctivaganas* |
| Big Brown Bat | *Eptesicus fuscus* |
| Northern Long-eared Bat | *Myotis septentrionalis* |
| Snowshoe Hare | *Lepus americanus* |
| Northern Flying Squirrel | *Glaucomys sabrinus* |
| Northern Pocket Gopher | *Thomomys talpoides* |
| Beaver | *Castor canadensis* |
| Southern Red-backed Vole | *Clethrionomys gapperi* |
| Meadow Vole | *Microtus pennsylvanicus* |
| Muskrat | *Ondatra zibethicus* |
| Meadow Jumping Mouse | *Zapus hudsonius* |
| Coyote | *Canis latrans* |
| Short-tailed Weasel | *Mustela erminea* |
| Long-tailed Weasel | *Mustela frenata* |
| White-tailed Deer | *Odocoileus virginianus* |
| Moose | *Alces alces* |

Tables showing amphibians, reptile and mammal species potentially found in the vicinity of Big Lake are included in Appendix D. The status of these species is also listed in the tables. It should be noted that of the species recorded in the Big Lake Study area listed in Table 8, the long-tailed weasel is categorized as “may be at risk” according to Alberta Environment’s *The General Status of Alberta Wild Species 2000* (AEP 2000). Other species that potentially may be found in the Big Lake Study Area, that are classified as at risk, may be at risk or sensitive include: northern leopard frog (at risk); Canadian toad, northern long-eared bat, and long-tailed weasel (may be at risk); and red-sided garter snake, wandering garter snake, plains garter snake and Canada lynx (sensitive).

In urban landscapes natural habitat is generally limited and is important for maintaining local animal and plant species. Habitat potential is mapped for the Big Lake Study Area in Appendix B. Significant habitats for wildlife are those areas that are able to provide all the necessary life requisites for survival, including good quality food resources, cover from predators and extreme weather conditions, and core security areas used during breeding season and for the protection of young. In addition, animals are not able to survive long-term in genetically isolated populations that are found only in patches of suitable habitat.

The Sturgeon River shorelands represent an important natural corridor for wildlife and the Sturgeon River Valley has been identified as an environmentally sensitive area of regional

significance (Infotech Services 1989). The valley is physically linked upstream to the Red Willow Urban Park system in St. Albert and downstream to the North Saskatchewan River Valley system. However, development along the river valley likely impairs movement for larger mammals (Infrastructure Systems Ltd. 2001). Increasing urbanization, including expansion of the cities of St. Albert and Edmonton is decreasing the availability of wildlife habitat outside of the river valleys (Armin A. Preiksaitis & Associates Ltd. 1999).

The Sturgeon River Valley, side slopes, and ravines are a priority area for protection of wildlife and provide species such as moose and deer with food and cover (Armin A. Preiksaitis & Associates Ltd. 1999). Ravine vegetation includes mixed-wood forest dominated by aspen and poplar, as well as areas of grasslands and shrubs (Armin A. Preiksaitis & Associates Ltd. 1999). Wooded habitats throughout the study area provide a diversity of food and cover required for many species. Wetland ecosystems, which include poorly drained lands and open water are important for muskrat, beaver and mink. Big Lake is particularly important for muskrat (Alberta Environment 1977). Much of the remaining uplands consist of agricultural lands and country residential development, which provide limited wildlife habitat. Remnant aspen or balsam poplar stands can be found throughout the agricultural lands. However, few species would occupy these areas.

The larger tracts of forest appear to be important for over wintering deer (Penner and Associates Ltd. 1990). Aerial surveys conducted in 1993 by Alberta Fish and Wildlife found the highest number of deer were found on the east side of Big Lake (IBI Group 1996). But deer were observed in most wooded areas. Moose sign was found in 1996 within aspen cover along the eastern shore of Big Lake (IBI Group 1996). However, the study area is not expected to support a viable moose population.

Browse and pellet identification during a reconnaissance survey east of Big Lake determined potential movement corridors crossing 137 Ave heading northwest to southeast, and moving from natural area to natural area throughout the parcel between Levasseur Road and 137 Avenue and west to Big Lake (Infrastructure Systems Ltd. 2001). Observations identified high deer use and some moose use in the woodlot south of 137 Avenue, immediately southeast of the south limit of the proposed corridor for Ray Gibbon Drive. Animals cross 137 Avenue at that location and it may comprise part of a corridor stretching from Big Lake to Kinokamau Lake in Edmonton.

Other areas that have been identified as important to wildlife include Horseshoe Lake and Kirk Lake (Penner and Associates Ltd. 1990; Geowest Environmental Consultants Ltd. et al. 1993) Horseshoe Lake is the largest permanent wetland in the study area and is surrounded by emergent vegetation dominated by cattails, bulrushes, sedges and willows that are important for muskrat and beaver (Penner and Associates Ltd. 1990). The lake is part of the Horseshoe Lake Natural Area identified as a significant natural area near Edmonton (Geowest Environmental Consultants Ltd. et al. 1993). Kirk Lake is an open, deep-water lake with flooded trees along the shoreline that is also good for beaver and muskrat (Geowest Environmental Consultants Ltd. et al. 1993).

### 5.2.2 Amphibians and Reptiles

Amphibians have been surveyed along the eastern edge of the Big Lake study area (IBI Group 1996). This survey was conducted during reconnaissance investigations and the timing of the study was not specifically designed to detect amphibians. Minimal information is available on amphibian presence in the remainder of the study area. A list of species found in the BLNA and their risk status is included in Appendix D.

Reconnaissance investigations in 1996 detected wood frogs (Rana sylvatica) and boreal chorus frogs (Pseudacris maculata) in the vicinity of the Sturgeon River east of Big Lake (IBI Group 1996). Other species that have been recorded in the study area include the Canadian toad (Bufo hemiophrys), Western toad (Bufo boreas) (BSOD 2002). The northern leopard frog (Rana pipiens) and possibly the tiger salamander (Ambystoma tigrinum) potentially occur in the area. Suitable habitat for amphibians can be found along the shorelines of Big Lake and the Sturgeon River, in the cattail marsh south of the Riel Lagoon, as well as in other wetlands in the study area. Horseshoe Lake and Kirk Lake are maintained by freshwater springs, which are important for some sensitive amphibian species (Geowest Environmental Consultants Ltd. et al. 1993).

### 5.2.3 Fish

The Sturgeon River floodplain is predominantly marshy habitat and the river is considered fish bearing (Infrastructure Systems Ltd., 2001). However, the Sturgeon River in the vicinity of Big Lake is considered poor fish habitat because of inadequate flows and organic and physical pollution (Alberta Environment, 1977). Important areas include the inlet and outlet of the lake (Alberta Environment, 1977). Upstream of Big Lake is generally considered unsuitable habitat for game fish. The Sturgeon River itself contains a large number of beaver dams, which potentially impair fish movement through the system (Alberta Environment, 1977).

Big Lake provides seasonal habitat for some fish species (Penner and Associates Ltd. 1990). However, the fishery is rated as poor. Submergent vegetation in the lake provides abundant spawning and rearing habitat for northern pike, but the lake's shallow water depth limits overwintering capability (Penner and Associates Ltd., 1990). Northern pike also use the Sturgeon River and Atim Creek for spawning and rearing (IMC Consulting Group Inc., 1991). Other fish that may also be seasonally present include suckers and sticklebacks. Horseshoe Lake has the potential to support brook stickleback, fathead chub, and northern dace. Sticklebacks have been found in Kirk Lake (Penner and Associates Ltd., 1990). Riel Lagoon supports brook stickleback, fathead minnow, and three-spined stickleback (Spencer Environmental Management Services Ltd., 1999).

The Sturgeon River is incapable of sustaining significant populations of game fish and overwintering occurs in the North Saskatchewan River and larger area lakes (Alberta Environment, 1977). Studies conducted from 1969 to 1971 found white sucker and northern pike to be the most numerous in the Sturgeon River from the outlet of Big Lake to east of St.

Albert (Alberta Environment, 1977). From the Riviere Qui Barre confluence to Big Lake a large number of suckers and fewer pike were found (Alberta Environment, 1977).

### 5.2.4 Information Gaps

Minimal site-specific information is available on mammal species within the study area. The majority of species information is based on historical presence and distribution data. Wildlife evaluations that have been conducted in the area previously are based primarily on existing habitat and vegetation data. A reconnaissance survey was conducted east of Big Lake in 1996. The timing of this study was not designed to detect rare or sensitive species. No recent wildlife inventories have been conducted in the remainder of the study area. Additional studies are required to identify current species distribution and important habitats for mammals in the Big Lake Study Area.

Amphibians have been surveyed along the eastern edge of the Big Lake study area (IBI Group 1996). This survey was conducted during reconnaissance investigations and the timing of the study was not specifically designed to detect amphibians. Minimal information is available on amphibian presence in the remainder of the study area. Detailed investigations are required to detect rare amphibian species within the study area.

No specific field studies have been conducted to detect reptiles within the Big Lake Study Area, and no sightings have been recorded. Red-sided (Thamnophis sirtalis) and wandering garter snakes (Thamnophis elegans) may occur in this region (IBI Group 1996).

Fisheries investigations were conducted within the Sturgeon River in the vicinity of the Big Lake Study Area from 1969 to 1971, and updated in 1976 (Alberta Environment 1977). Data reported in recent assessments for the Big Lake Study Area relies primarily on these historic investigations in addition to more recent evaluations of aquatic habitat. Habitat assessments were conducted within the Sturgeon River downstream of Big Lake in the spring of 1996. Habitat information is also available for Big Lake. However, no specific studies to detect fish within the lake have been conducted. Detailed fisheries assessments are required to assess current aquatic habitat and fish distribution within the wetlands and tributaries located in the study area.

## 5.3 VEGETATION

### 5.3.1 Review of Vegetation in Big Lake Study Area

The study area of Big Lake is a wetland situated within the Central (Aspen) Parkland region (Edmonton Metropolitan Regional Planning Commission, 1987). The region surrounding the wetland is considered a transition between grasslands and aspen forest, as well as some northern boreal mixedwood forests (Penner and Associates Ltd., 1990). On the west side of the lake, a large peaty area can be found, covered with emergent vegetation such as cattails and bulrushes.

The vegetation has been extensively modified by man's agricultural and recreational activities (i.e. cropland, golf courses), as well as by the importation of some exotic species. This is most evident on the south side of the lake, along with a few agriculture areas and golf courses on the north side.

The south shore has somewhat different vegetation communities due to the steep north facing slopes. These north facing slopes of the south bank create conditions that are more cool and moist than in other areas. This results in a unique microclimate supporting significantly different vegetation species than commonly found in the rest of the study area. The study area, therefore, is characterized by a vast number of different plant communities and associations.

The quality of the data reviewed for this report is fair. There are some studies performed that are relatively complete in terms of methodology (aerial photo interpretation and field survey). Inventory studies were sometimes incomplete due to late season field-work (Russell and Spiers, 1983). However, verification of plant identification in the surveys was not listed or performed in most studies. Therefore the accuracy of this data is not known and subsequently the quality has to be taken into consideration.

One recent study performed by (Spencer Environmental Management Services Ltd., 1999), provides detail on the conservation status of certain habitats. However, the study area is only within St. Albert city limits as was found with other studies (Pedocan Land Evaluation Ltd, 1999) and therefore does not consider the whole Big Lake Natural Area.

***Plant Communities***

Some of the dominant and/or unique plant communities are briefly described in the following section. A listing of the plant species found at Big Lake is contained in Appendix E. The north and east side, the flat areas next to Atim Creek and on the west side of Big Lake are mostly willow communities (*Salix spp*.). The willows are a good example of a transition zone species; area between wet water areas and drier uplands. The transition zones on the south side of Big Lake are much narrower in width than on the north side (Edmonton Metropolitan Regional Planning Commission, 1987). The east end of the lake has a small transition zone, due to encroaching land development.

Aside from the transition zones the wetland vegetation also consists of floating and emergent vegetation such as duckweed, water plantain, as well as rushes and cattail.

The peaty areas located predominantly on the west side of the study area consist of willow species mixed with rushes and cattail. Some grasses and other woody vegetation such as black spruce, balsam poplar, tamarack and paper birch are commonly found in this area.

The upland vegetation is dominated by poplar species. Some communities include white spruce forest communities combined with trembling poplar and paper birch scattered throughout the

area. Black spruce mixed with balsam poplar can be found in the poorly-drained / moist areas. Understory is dense, especially in the drier areas. The understory typically consists of common shrubs such as snowberry, wild rose and red-osier dogwood.

Agricultural land in the uplands mainly consists of cereals and oilseeds, with some perennial pastures and hayfields. Most agricultural land is found on the south side of the study area.

The south side bank encarpment had a poplar/white spruce canopy that has currently resulted in a few mature white spruce stands, which are notable features along this rugged terrain. At the time of these studies it was indicated that there was little understory in the mixedwood forest (Edmonton Metropolitan Regional Planning Commission, 1987) and therefore this understory may no longer be present.

Due to the infilling process of the lake, change in vegetation may have occurred since some of these studies were performed. Infilling would have affected submergent, floating, and emergent vegetation. For example; extensive stretches of emergent vegetation were found on the north and east sides of the lake as well as a few islands of emergent vegetation were observed (EMRPC, 1987). Islands of emergent vegetation can greatly increase in size, decrease in size or even disappear depending on various interrelated environmental factors.

***Rare Plants***

Species that are at risk are well defined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and Alberta Natural Heritage Information Centre (ANHIC), which includes vascular and non-vascular plants. Some rare plants have been found around the Big Lake study area (Spotted Joe-pye weed). However, when these rare plant surveys were performed the study areas were not the same as the Big Lake Study Area and certain areas have not been investigated. Certain species are found outside the study area (Wagner Natural area), however the distance is close enough such that these species could be spreading/present in the Big Lake study area.

Rare plants are not always found each season. Climate, dormancy factors or even the timing of survey of certain rare plants can affect whether or not a rare plant emerges that season or is present at the time of survey. Therefore surveys may not have observed certain rare plants, despite their presence.

### *Other Related Studies*

A natural area sensitivity study has been performed within the St. Albert city limits. This study was performed recently (1999), but only incorporates the east bank of Big Lake (Spencer Environmental Management Services Ltd., 1999). Another similar study was performed focusing on ecological land classification of the Sturgeon River within St. Albert city limits (Pedocan Land Evaluation Ltd, 1999).

Environment Canada has composed a list of invasive plants and performed a national study (1993). The degree of invasiveness varies greatly throughout the country/region. Opinion based studies were performed on invasive plants to get an indication of the degree of invasiveness and potential for other invasive plants, and evaluate upland and wetland invasive species. However, no details were provided on the location of these studies in Alberta. Specifics on wetland invasive species in the Big Lake area were not found during the literature review. However, in an interview between Richard Thomas and Peter Demulder, it was indicated that operation at Big Lake.

The Great Plains organization has provided a range of literature on Multi-species Habitat Enhancement Techniques, discussing various ways to alter vegetation (and other natural factors) for the improvement of wildlife habitat and diversity of habitats (www.greatplains.org). The Great Plains Organization posted this document created by the North American Waterfowl Management Plan (NAWMP) for the purpose of knowledge sharing of different habitat enhancement techniques. The main purpose of this manual is to provide NAWMP planning and delivery staff with a guide to habitat enhancement techniques that may be applicable to the wide range of species associated with NAWMP landscape programs in Alberta.

The Great Plains Organization is an organization that cooperates with various organizations, agencies and jurisdictions to advance data activities and sustainable development within the Great Plains region. This region includes approximately 15 west and central US states including partnerships with British Columbia, Alberta, Saskatchewan and Manitoba governments and organizations.

### 5.3.2 Information Gaps

- Need recent plant and plant communities information collected for the entire Big Lake Study Area. The majority of information was collected from the east end of Big Lake, mostly within the city limits of St. Albert, extending north to Villeneuve Road, and south to Highway 16.

- Need to conduct rare plant surveys in all portions of the Big Lake Study Area.

- Need to conduct inventories of other non-vascular plants such as mosses and lichens. Certain lichens are good indicators of air water and soil pollution problems (Tyler, 1989) in the localized areas.

- Need an Alberta Wetland Inventory Standards survey and an Alberta Wetland Classification system to classify the wetland areas of the study area (Halsey and Vitt, 1996).

- Aerial photography or vegetation polygon maps should be prepared for the BLNA Study Area.

## 5.4 SURFACE DRAINAGE

Surface water quantity issues affecting the ecological integrity of BLNA essentially involve the components of the hydrologic water balance of Big Lake. The main water balance components are inflows, outflows, evaporation, withdrawals, and groundwater recharge or discharge. The principal effects of the water balance on the ecological integrity of BLNA involve (1) changes in lake water levels and (2) changes in the rate water passes through the lake (residence time). The latter effect is significant primarily for water quality and is discussed here only with respect to its dependence on water inflow and outflow quantities.

A map of surface and groundwater resources in the Big Lake Study Area is contained in Appendix B. The magnitude and timing of all hydrologic components are subject to natural variation, governed by seasonal and year to year variability in precipitation and temperature over the drainage basin. Variation is also caused by human development in the basin, via the following main activities:

- Changing land use, which alters runoff characteristics;
- Drainage course alterations such as installation of bridges and culverts, or channel improvements, which either restrict or improve discharge efficiency;
- Changing water use through withdrawals from streams, lakes and ponds, including increased evaporation losses from new or enlarged water bodies; and
- Changing the groundwater regime through withdrawals or dewatering to surface discharge.

The combination of natural climate variability and human development results in variation in the magnitude and timing of the hydrologic components of the Big Lake water balance, producing seasonal and annual water level changes in Big Lake.

The following discussion attempts to provide an overview of the surface water hydrology of Big Lake, along with an indication of the effects of human development within the context of the natural variability, as obtained from available data and reports.

### 5.4.1 Big Lake Watershed

Big Lake receives inflow from a total contributing area of 2188 $km^2$. That area does not include a number of non-contributing portions within the overall watershed. The Big Lake watershed can be divided into three basins – the Sturgeon River at the point of inflow to Big Lake, with a contributing area of 1744 $km^2$, Atim Creek with a contributing area of 354 $km^2$ and a local drainage with an estimated contributing area of 90 $km^2$ (Alberta Environment, 1994a). All three basins are part of the overall 3328 $km^2$ Sturgeon River watershed that extends to the outlet at the North Saskatchewan River.

***The Sturgeon River Basin***

Big Lake is an on-stream lake located on the Sturgeon River. Big Lake discharges to the downstream river, which flows through the City of St. Albert and ultimately discharges into the North Saskatchewan River. The overall Sturgeon River Basin has a relatively flat gradient, with many small undrained sloughs and wetlands and small to medium lakes which act to reduce and retard runoff. The Sturgeon River flows through a sequence of four major on-stream lakes: Isle Lake, Lac Ste. Anne, Matchayaw Lake, and finally Big Lake itself, all of which provide significant flow regulation. There are many beaver dams along the course of the river, which provide further attenuation of flows.

Where the Sturgeon River flows into Big Lake a birdsfoot delta has formed (Alberta Natural Heritage 2002). Birdsfoot deltas are characterized by a muddy plain that is incised by deep channels that may branch outwards and appear from the air to be shaped like a bird's claw. This is one of only three birdsfoot deltas found within Alberta.

Peak flows on the Sturgeon River at Big Lake tend to occur in April and are due to snowmelt. Snowmelt runoff can persist into May. Summer flows tend to be low; summer rainstorms generally produce low to moderate increases in flow. Zero or near zero flows are not unusual, and can occur in early spring before snowmelt, or in summer and fall during dry periods. Typical wet year (1982), average year (1985), dry year (1976) and very dry year (1984) hydrographs for the Sturgeon River near Villeneuve, upstream of Big Lake, are shown in Figures 1 through 4 in Appendix F.

### *Atim Creek*

The Atim Creek portion of the overall Sturgeon River watershed drains the area immediately to the west of Big Lake, and includes the Town of Stony Plain and the City of Spruce Grove. The Atim Creek Basin, like the Sturgeon River Basin, is characterized by a relatively flat gradient, with many small undrained sloughs, wetlands lakes and ponds which act to reduce and retard runoff. Over 30% of the basin is developed as country residential acreages. Culverts and bridges at road and driveway crossings tend to act as outlet restrictions for peak flows, enhancing the natural regulation of sloughs and wetlands, tending to reduce the magnitude of downstream flood peaks but tending to increase flood levels upstream. Atim Creek tends to overflow its banks for runoff events with a recurrence interval of 5 years or more (UMA, 2000). Typical hydrographs for Atim Creek near Spruce Grove, upstream of Big Lake, are shown in Figures 1 through 4, provided in Appendix F.

Groundwater recharge and discharge constitute significant components of the hydrologic regime of Atim Creek. The Town of Stony Plain is located in a groundwater discharge area and some dewatering is conducted by pumping to surface.

A recent water management plan study was conducted for the Atim Creek Basin by UMA for Parkland County, which recommended stormwater management guidelines and discharge rate controls, increasing the capacity of major road crossings on Atim Creek, and land use guidelines to regulate development within the Atim Creek 1:100 year flood zone (UMA, 2000).

### *Local Drainage*

Big Lake is located in a groundwater discharge area, and much of the local surface drainage around the lake, especially on the south and west sides, receives discharges from springs and seeps. This flow tends to persist even during dry periods when surface runoff typically diminishes. This drainage may therefore be important locally in maintaining wet habitat conditions around the extended shore zone of Big Lake and the immediately adjacent uplands. Examples are the Wagner Bog Natural Area located south of Highway 16 at SH 794, and the Kirk Lake and Horseshoe Lake areas located within the City of Edmonton, directly south of the east end of Big Lake (Geowest, 1993). Local surface drainage may infiltrate back to groundwater prior to reaching the water's edge of Big Lake.

## 5.4.2 Big Lake Inflows, Outflows and Water Levels

The two main sources of inflow to Big Lake are the Sturgeon River and Atim Creek, discussed above. The inflow from the Sturgeon River is by far the larger of the two, as shown in Figures 1 through 4 provided in Appendix F. The outflows for the corresponding years are also shown on the figures. Note that outflows for the very dry year of 1984 (Figure 4), exceeded the inflows, indicating that over-winter lake storage contributed to outflows.

Big Lake is shallow, with a typical summer depth of only 1.0 m to 1.2 m. Big Lake water levels rise in response to snowmelt runoff in spring. The magnitude of level rise on Big Lake is variable, depending on runoff volumes. For a 1:100 year runoff condition, the level rise is estimated to approach 3.7 m. The lowest recorded water levels correspond to a depth of about 0.3 m (various years); the highest levels to a depth of 4.1 m (1974). The lake bottom is at El. 649.6 m (Alberta Environment, 1977). Water levels have been observed on Big Lake on an intermittent basis since 1958. The observed data are shown on Figure 5. Caution should be used in interpreting Figure 5 because annual highs and lows may not have been observed.

The shore areas along the north and west sides of the lake are flat, and small increases in water level translate to large areas of inundation. At the lowest level, the lake surface area equals 240 ha, at the highest level, 2820 ha. Most of the inundation occurs along the north shore areas and westward along both sides of Atim Creek. It has been reported that the shoreline of the lake as visually defined by vegetation and surface conditions apparently does not correspond to a consistent contour level, but varies from El. 650 m to 654 m (Alberta Environment, 1977).

Average annual evaporation from the lake surface is estimated to be 666 mm, which exceeds the average annual precipitation of 460 mm by an amount of 206 mm (Alberta Environment, 1987).

### 5.4.3 Human Effects on Big Lake Hydrology

Human activities in the Big Lake watershed have the potential to either reduce the natural inflow or to increase it. Each effect is discussed separately below.

#### *Reductions in Natural Flows*

There are significant withdrawals of water throughout the Sturgeon Basin. Water is used for a variety of purposes including gravel washing, stock watering, irrigation, domestic supply and evaporation from constructed or augmented water bodies for waterfowl habitat or lake stabilization purposes. Based on 1991 data, only about 6% of the mean annual flow is licensed (County of Parkland, 1991; IMC, 1991). However, more than half the annual runoff is typically discharged by June, and withdrawals tend to occur during the dry low flow season. Withdrawals can therefore represent a significant proportion of available flows, and at times the water available is less than the demand. Alberta Environment has studied water supply and demand in the Sturgeon Basin and has developed recommendations to preserve the ecological integrity of the basin (Alberta Environment, 1994b). Those recommendations involve limiting withdrawals based on the estimated reliability of annual flows, and estimates of in-stream flow needs.

#### *Increase in Natural Flows*

With respect to actual or potential increases in flows due to development, no specific information was found. However, several documents indicate that developments in the watershed will typically require runoff controls, to keep peak flows from exceeding natural

magnitudes (County of Parkland, 1991; IMC, 1991). Development would nevertheless likely result in some increase in the seasonal or annual volume of surface runoff, although it is expected that there would be some compensating but smaller reduction in the volume of groundwater recharge.

***Discussion***

From a surface water perspective, the major concern would be reductions in inflow due to withdrawals. From that point of view, any increase in watershed runoff due to development could be considered beneficial, as it would tend to compensate for withdrawals.

Withdrawals will tend to have a larger impact during dry years, and thus make dry conditions relatively worse. Increased watershed runoff due to development will on the other hand tend to have a diminished effect during very wet years, as all portions of the watershed, whether developed or not, would then generate large amounts of runoff, resulting in flood conditions.

### 5.4.4 Surface Water Quality

Surface water quality in Big Lake is described in several reports (Stanley Associates 1976; Alberta Environment 1977; EMRPC 1987) with additional information regarding the Atim Creek sub-basin (Alberta Environment 1978). With the exception of the EMRPC (1987) these studies collected water samples and analyzed the data. The results showed that Big Lake is shallow, eutrophic and generally described as having poor water quality, largely due to its downstream position within the Sturgeon River Basin. Natural succession processes, such as sedimentation and the build-up of plant and animal matter on the bottom of the lake, have resulted in an infilling of the lake over time. These processes have been accelerated by upstream and local agricultural practices, outflow from upstream sewage lagoons and maintenance of local golf courses which have likely contributed fertilizers, nitrates and pesticides to surface water runoff and impacted the water quality of Big Lake. Insufficient information is available to evaluate the current impacts to groundwater quality from these sources in greater detail.

### 5.4.5 Implications for Big Lake Natural Area

Alberta Environment has studied water supply and demand in the Sturgeon Basin and has developed recommendations to preserve the ecological integrity of the basin (Alberta Environment, 1994b). Those recommendations involve limiting withdrawals based on the estimated reliability of annual flows, and estimates of in-stream flow needs. It is suggested that implementation of those recommendations, or some appropriate modification thereof, would do much toward preserving the ecological integrity of Big Lake and the BLNA.

Alberta Environment has previously suggested that Sturgeon River low flows could be significantly augmented (1.4 $m^3/s$ for 3 months) by providing 150 mm of regulated storage on Isle Lake and Lac Ste. Anne (Alberta Environment, 1977).

Development in the Big Lake watershed appears to be adequately regulated with respect to controlling stormwater runoff, based on review of a number of Area Structure Plans.

Recently a Big Lake Basin Study has been initiated by several municipalities located in the Big Lake drainage basin. The study is being managed by two regional committees (a Task Force and Technical Committee) with representation from Parkland County, Town of Stony Plain, City of Spruce Grove, County of Lac Ste. Anne, Sturgeon County, City of St. Albert, and three non-voting members from Alberta Environment (2) and Alberta Infrastructure.

The scope of this 12 month study is to:

- Examine the hydrology of the basin starting at the headwaters near Entwistle and ending at the Sturgeon River confluence with the North Saskatchewan River near Fort Saskatchewan.
- Building on the recent engineering analyses and the Sturgeon River Flood Plain mapping study of 1976, establish the current hydraulic condition of the major watercourses.
- Develop drainage solutions for the basin. These solutions would include but not be limited to; storage additions to the basin, channelization, land acquistion, and storm water management principles for each segment of the basin.

The findings of this study will be a critical future resource in the management of the BLNA.

## 5.5 HYDROGEOLOGY (GROUND WATER RESOURCES)

The hydrogeology of the Big Lake Natural Area is significant to the ecological integrity of the BLNA as impacts to groundwater quality or quantity may result in impacts to the surface water system. Groundwater withdrawals may result in lowering of the piezometric surface within aquifers and affect discharge rates into the surface water system. Groundwater quality may be affected by septic systems or industrial activities in the area. Published and available information was reviewed to establish the geological and hydrogeological framework for the BLNA. Available information regarding the potential sources of impacts to the ecological integrity of the BLNA was reviewed to identify areas where further information may be required, identify potential issues and possible strategies to address these issues.

### 5.5.1 Bedrock Geology

The bedrock geology has been mapped (Bibby 1974; Research Council of Alberta 1978) and is well defined in the area of Big Lake. The upper bedrock in the area of Big Lake is the Late Cretaceous Wapiti Formation, which is composed of non-marine sandstone, mudstone, shale, bentonite with some ironstone and scattered coal. Bedrock units dip gradually down to the southwest. The bedrock topography was determined (Farvolden 1963; Carlson 1967; Andriashek 1987) and used to identify preglacial channels eroded into the bedrock surface. The Beverly Channel trends approximately east west through Big Lake. The present day Sturgeon

River roughly follows the route of the Onoway Valley as it merges with the Beverly Valley at Big Lake. Numerous tributary channels are found adjoining these valleys.

### 5.5.2 Surficial Geology

The surficial geology has been mapped (Bayrock and Hughes 1962; Carlson 1967; Bayrock 1972; Kathol and McPherson 1975; Research Council of Alberta 1978) and is well defined in the area of Big Lake. Preglacial North Saskatchewan Sands and Gravels are found infilling the bedrock channels. These deposits are overlain by glacial till and, subsequently, glaciolacustrine Lake Edmonton deposits. Glacial till is composed of sand, silt, clay with pebbles and boulders. Glaciolacustrine deposits consist of rhythmically bedded and possibly varved sand, silt and clay. Pitted deltaic deposits of fine to medium grained sand were deposited at the margin of glacial Lake Edmonton and are located south of Big Lake. Minor pebble and till inclusions are found within the deltaic deposits. Glacial meltwater channels are found in the area of Kirk and Horseshoe Lakes.

Recent clay, silt, sand, peat, muck and marl are found on extensive low-lying land on the north and west sides of Big Lake. Some of these deposits are deltaic in origin brought into the lake by Atim Creek from the west and Sturgeon River to the north. Both of these waterways have gentle gradients and deposit fine sediment at their deltas and along the stream flood plains. Big Lake is shallow (see Hydrology section) and sediments deposited in the delta at the mouth of Sturgeon River have infilled much of the central portion of the historic lake.

### 5.5.3 Groundwater Aquifers

Regional hydrogeology studies have been completed in the area of Big Lake (Carlson 1967; Bibby 1974; Hydrogeological Consultants, 1998 and 2001). Groundwater aquifers are identified as the upper bedrock, preglacial Saskatchewan Sands and Gravels and glacial sands and gravels.

Groundwater yields were mapped on a regional scale for the surficial aquifers by Bibby (1974) and Research Council of Alberta (1978). Groundwater yields were mapped on a regional scale for both the surficial and upper bedrock aquifers within the Sturgeon River Basin in 1977 (Ground-Water Consultants Group) and for Parkland and Sturgeon Counties (Hydrogeological Consultants, 1998 and 2001). This information shows generally high yields expected from the surficial deposits and low yields are expected from the upper bedrock. The Research Council report also contains groundwater elevation contour maps for the surficial aquifer and a review of groundwater quality in the surficial aquifer. Water table elevations were reported in Williams (1990) for the City of Edmonton Big Lake ASP and found to be highly variable across the area. Regional groundwater quality is reviewed for both surficial and upper bedrock aquifers in the hydrogeological reports for Edmonton (Bibby, 1974) and Parkland and Sturgeon Counties (Hydrogeological Consultants, 1998 and 2001). Bibby (1974) also includes a review of upper bedrock groundwater quality.

Bibby (1974) identified that a hydraulic connection exists between the Sturgeon River and the buried valley sand and gravel deposits. There is no river in direct hydraulic connection with the Beverly Valley to the west of Big Lake, but this was identified as an area of flowing wells.

Both Horseshoe and Kirk Lakes are reportedly maintained by freshwater springs. Horseshoe Lake is interpreted as a perched water table and an area of local groundwater recharge (Penner and Associates, 1990). Groundwater discharge areas were determined within the City of Edmonton Big Lake ASP (Williams, 1990) and typically correspond to wetland areas (Russel and Spiers). Seeps or springs are reported but not documented in these reports. Water well data obtained from the Alberta Environment Groundwater Database shows that there are several flowing wells (possibly inadequately plugged seismic shotholes) located along the south edge of Big Lake.

In general, the areas of high water table are not well defined within the BLNA. Depressions and low-lying land, particularly to the north of the lake, are expected to have high water tables. Vegetation that has adapted to areas of high water table is expected to be sensitive to development. Development generally results in increased overland runoff and decreased infiltration and recharge to groundwater aquifers. The water table typically drops in response to the reduced recharge and vegetation zones may shift as a result.

### 5.5.4 Groundwater Users – Licensed and Domestic Withdrawals

Groundwater withdrawals may have an impact on groundwater levels. Area structure plans were reviewed for communities within the Big Lake study area to identify areas where groundwater withdrawals may be occurring. The area of Red Willow in St. Albert (UMA Engineering, 2001) currently has piped water supplies. It is not expected that groundwater users exist within this area. Water is also serviced within the City of Edmonton Big Lake ASP and only one active groundwater well was noted in 1991 (IMC Consulting Group). Within Parkland County any new multi-parcel subdivision developments are required to provide piped water or use temporary reservoirs for hauled water until a distribution line can be installed (County of Parkland, 1991). There are groundwater users in this area.

An inventory of the Alberta Environment groundwater database was made in 1987 (EMRPC) within the area of Big Lake. At that time 223 groundwater wells were identified in the area of Big Lake and approximately 189 were considered active. There are currently only a few licenses granted under the Water Act within the study area for several golf courses. The withdrawals from these wells are not expected to be substantial, but likely occur during drier periods. Details of the water licenses is available through AENV. The recharge area for groundwater aquifers within Big Lake is substantially larger than the current study area and an evaluation of groundwater withdrawals should be considered for a larger area than the current review. Industries that are outside the current study area, such as gravel excavations in Villeneuve, may impact groundwater levels within the Big Lake Natural Area. It is important to note, however, that no declining or increasing trends are evident in the Big Lake water level, as shown in

Appendix F. This would suggest that, overall, groundwater withdrawals in the area have not significantly impacted recharge to Big Lake over the last thirty years.

### 5.5.5 Septic System Users

Septic systems may impact shallow groundwater quality. Area structure plans were reviewed for communities within the Big Lake study area to identify areas containing individual septic systems. The area of Red Willow (UMA Engineering, 2001) currently provides sanitary services to the residents. It is not expected that individual septic systems are used within this area. Sanitary services are also provided within the City of Edmonton Big Lake ASP (IMC Consulting Group, 1991), however individual septic systems may exist within this area. Within Parkland County any new multi-parcel subdivision developments are required to develop a sanitary sewer line (County of Parkland, 1991). Lot owners will be permitted to use sumps and pumps that discharge to the ground surface as an alternative. Individual septic systems may be expected within this area.

The main chemical of concern associated with septic systems is nitrate. Bacteria, phosphorus and volatile organic compounds may also be associated with septic systems. In most cases these potential contaminants are diluted within a reasonable distance from the system and groundwater concentrations are below the standards established by Health Canada for drinking water quality. Chemistry reports were reviewed for shallow wells (less than 65 feet deep) within the Big Lake Study Area. Two wells were found to have nitrate concentrations that exceed the criteria in the Health Canada Guidelines for Drinking Water Quality (GCDWQ), all other wells had nitrate concentrations well below the GCDWQ criteria (Health Canada 2001). These exceedances may be the result of agricultural practices, a point source spill near the well or impact from a nearby septic system. There is insufficient information currently available to provide a more detailed evaluation of the risk of groundwater contamination from septic systems.

### 5.5.6 Industrial Sources

Several historical and current activities within the BLNA have potential to cause impacts to soil or water quality. Groundwater monitoring information is available for the old landfill site and spill records are available from the EUB for the petroleum industry leases, however, no other environmental impact documentation was discovered during the review. There is also potential for groundwater contamination from the infiltration of fertilizers, pesticides or herbicides applied to the land by agricultural practices or maintenance of the local golf courses. Discussion with the operators of these facilities or a Phase I investigation of the historical sites should be considered. These industries or activities are summarized in the table below.

**Table 9: Potential Pollutant Sources**

| Potential Sources | Possible Contaminant |
|---|---|
| Hunting | Lead |
| Petroleum Industry | Hydrocarbons |
| Landfill | Metals, hydrocarbons |
| Airstrip | Hydrocarbons |

### 5.5.7 Information Gaps

Groundwater withdrawals within the study area appear to be minimal and do not appear to be impacting mean water levels within Big Lake. Development within the Big Lake area is expected to impact the hydrological cycle and reduce infiltration to groundwater aquifers while increasing runoff. These changes are expected to impact the depth of the water table and consequently vegetation zones.

Insufficient information is available:

- To evaluate potential impacts to groundwater quality from septic systems, industrial or other activities within the study area; and

- Evaluate potential contaminant sources within the Big Lake Study Area to determine possible impacts to groundwater quality.

## 5.6 OUTDOOR RECREATION, HERITAGE APPRECIATION AND TOURISM

The existing resources inventory concerning the recreational, educational, tourism, and heritage attributes of the Big Lake Natural Area included discussions with municipal officials from the four jurisdictions, a review of statutory plans and environmental impact assessments for the area and discussions with NGO's that currently use the area. The greatest source of information was found in the *Big Lake Background Report: The Management Study* (EMRPC 1989). The current study also reviewed and assessed both the Local Committee background and recommendations for Special Place designation, and the composite maps generated by the legislative and planning framework, wildlife and habitat conservation, and surface drainage and groundwater resource categories to determine opportunities for cultural resources. A map of the cultural resources is contained in Appendix B.

### 5.6.1 Review of Recreation, Heritage Appreciation and Tourism in the Study Area

The identified cultural resources of the Big Lake Study Area are shown on the Cultural Resources map included in the appendix. As suggested, there is little recorded data on the area. In Parkland County there are farm structures that have been catalogued as part of the *Historic Sites Inventory* of Alberta Culture and Multiculturalism. These structures show the farming heritage of the area and some continue to be used today. While there are no provincially designated historic sites in this part of the County, there are 10 structures within the Study Area that have been part of a historic site inventory and are older than 50 years. The lands in the area are classified under the Canada Land Inventory (CLI) as having low, to moderately-low capability for recreation.

Existing recreational use is presently estimated as low, based on discussions with the Big Lake Environmental Support Society (BLESS), and winter site observations made at Big Lake. BLESS records suggest an annual use of approximately 900 people within its programs. This estimate accounts only for use of Big Lake for organized interpretive, educational or nature appreciation trips. Certainly, the lake has been perceived as unattractive to traditional water based activities (boating, swimming) although planning reports from the early 1970's attempted to position the lake as a major active recreational feature in the Edmonton region.

One of the primary factors precluding recreational use of Big Lake is access. Only informal trails exist in the immediate lake area, presumably created by local naturalists, hunters or ATV users exploring the area. The majority of these informal trails run southwest along the south shore of Big Lake from the existing viewing platform in St. Albert. A designated interpretive trail developed by the Rotary Club and Ducks Unlimited provides access from the north, off Meadowview Drive in Sturgeon County. This trail dead-ends at the northern lake edge.

Existing recreational uses, beyond the 1:100 year flood line but within the study area boundary, include six golf courses, the Pioneer Gun Club, Bar-B-Q Acres and informal trail use and viewing opportunities on the south edge of the lake. Most undeveloped lands in Parkland County, are currently zoned CR1 and CR2 (Country Residential). Future commercial recreational use will be limited by this zoning. Hunting, a traditional recreational use of the area, is probably declining given the increase in residential development surrounding the lake.

Future plans by St Albert for an expansion of Red Willow Park along the south shoreline and the development of a Waterfowl Interpretive Centre on the north shoreline immediately adjacent the community will present increased opportunities for recreation and tourism activities. A trail is also proposed to extend west from this interpretive centre, linking the Sturgeon River valley to the north into Sturgeon County.

Generally, the data available is non-site specific, and there is a lack of current information on cultural use in the area. Local ASP's from the surrounding Municipalities provide a loose framework for future development and land use, including cultural and recreational facilities.

### 5.6.2 Information Gaps

Recreation, heritage and tourism are not well documented for the area. Some information has been gathered from local individuals, such as those working with BLESS for example, but this too is an estimation. Specific gaps in current available data include;

- Lack of quantitative information on use by recreational users, educational programs, local interest groups and naturalists or birders;
- Little archaeological research or site specific surveys have been carried out on those areas identified as having a high potential as an archaeological resource;
- Lack of formal mapping of existing access points, trail heads, trails and other recreational facilities; and
- Without an overall development vision for the area, managing and planning for recreation/tourism in the area is difficult.

### 5.6.3 Summary

The lack of recreational and tourism development in the Big Lake Study Area is in part caused by inconvenient access and the limitations of the existing lands (flooding) and lake (water depth) for traditional water based activities. However, there is a high potential for passive recreational activities including walking/hiking, bird watching, nature photography, environmental education. In terms of cultural and heritage resources, the lands in the Big Lake Study Area (illustrated in Appendix B) may have a high potential for archaeological resources (EMRPC, 1989). These areas should be further evaluated prior to the development of the surrounding lands. Identification of specific cultural or heritage resources through this evaluation may provide the potential framework for an additional cultural theme development in the area.

## 6.0 TOOLBOX

The toolbox lists existing and possible measures and actions that can be implemented by landowners, municipalities and other partners. The tools are categorized into six main themes:

- Funding
- Conservation
- Research, Monitoring and Development
- Education
- Operational
- Legal

Existing tools are listed in the table first, followed by "opportunity" tools which are new toolbox ideas that could be used in the BLNA to achieve certain goals. Some tools were found in the literature that was reviewed. An excellent summary of conservation tools is contained in *Conserving Edmonton's Natural Areas – A Framework for Conservation Planning in an Urban Landscape* (February 2001). Other tools were brainstormed during the workshop and by the consulting team members. The discipline area (shown in columns) that the toolbox item may impact is indicated by "x".

## Funding Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Tool*:** Potential funding parternerships with organizations such as: North American Bird Conservation Initiative (NABCI) , and Partners in Flight, DU, Nature Conservacy, etc. | | **X** | | | **X** | |
| ***Tool:*** Alberta Environment - Water Monitoring Division; existing student labour programs. | | | | | **X** | |
| ***Tool:*** Solicit grants and seed money from all levels of government including Alberta Recreation, Parks and Wildlife funding. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Seek sponsorship and management partnerships with individuals, groups, and organizations. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Place a lot/development levy on public and private development for a natural site conservation fund. | **X** | | | | **X** | **X** |
| ***Opportunity:*** Establish a Big Lake Natural Area scholarship fund at post-secondary educational institutions. | | **X** | **X** | **X** | **X** | |
| ***Opportunity:*** Conservation fund that would be capitalized through public and private sources for the acquisition of significant natural areas that cannot be preserved through other means. | | **X** | **X** | **X** | **X** | **X** |

## Conservation Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Tool:*** Municipal Environmental Impact Assessments for any proposed development which would adversely affect any natural area. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Tool:*** Investigate appropriateness of Multi-species Habitat Enhancement Techniques. Literature available through the Great Plains organization (www.greatplains.org). | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Establish cooperative program or links with established organizations such as Britain's Royal Society for the Protection of Birds (RSPB) who are world leaders in the design and management of suburban/urban bird reserves, analogous to BLNA. | | **X** | **X** | **X** | **X** | |
| ***Opportunity:*** Establish a cooperative program with Ducks Unlimited (DU) who owns land on the north shore on the east basin of Big Lake, the area with the best potential for shorebird habitat creation (scrapes). | | **X** | **X** | **X** | **X** | |
| ***Opportunity:*** Establish links with the North American Bird Conservation Initiative (NABCI) and Partners in Flight. | | **X** | **X** | **X** | **X** | |

## Conservation Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Opportunity:*** Ensure that natural areas are linked to avoid islands of isolation. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Use viewpoints, boardwalks, surfaced trails to define access points to minimize impacts on critical habitat but still allow for recreation education and tourism opportunities. | | **X** | **X** | **X** | **X** | **X** |

## Research, Monitoring and Development Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Tool:*** The Federation of Alberta Naturalists is in the process of organizing the second Alberta Breeding Bird Atlas effort. Ensure maximum coverage of the Big Lake ecosystem is included in this new document. | | **X** | **X** | **X** | **X** | |
| ***Tool:*** Access graduate research programs at the University of Alberta. | | **X** | **X** | **X** | **X** | |
| ***Opportunity:*** Partner with BLESS, Edmonton Bird Club and wildlife agencies to fulfill research needs. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Access Alberta Native Plant Council for information gathering guidelines. | | | | **X** | | |
| ***Opportunity:*** Use Canadian Wetland Classification System for wetland classification. | | | | **X** | | |
| ***Opportunity:*** Work with ACA to set up a permanent RANA (Researching Amphibian Numbers in Alberta) site for amphibian monitoring. | | | **X** | | | |

## Education Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Opportunity:*** Establish public stewardship and incentive programs based on existing templates such as a "save an acre" program. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Conduct workshops with local schools, churches, recreational groups, and other organizations. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Partner with Friends of Environmental Education Society of Alberta (FEESA) and the Edmonton Bird Club to create education opportunities. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Alberta Department of Learning – virtual field-trips for schools. | **X** | **X** | **X** | **X** | **X** | **X** |

## Operational Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Opportunity:*** Senior government level policy development and enforcement like conservation authorities in Ontario: "Big Lake Conservation Authority". | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Need the administrative framework set up to allow for the coordination of linking municipalities and stakeholders together. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** The framework would acquire, manage, maintain, and interpret the site once conserved. | | | | | | |
| ***Opportunity:*** Patrol and enforcement by empowered offices. Three part compliance model comprises: education, prevention and enforcement. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Development of off-site interpretive/educational experiences through web-based virtual sites to: reduce on-site pressure; build a support constituency-province, nation and worldwide for continued protection. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Active resource management through manipulation of factors such as water levels, successional processes, or species re-introduction. | | **X** | **X** | **X** | **X** | |

## Legal Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Tool:*** Sale to and designation by the provincial government as a provincial park, wildlands park, recreation area, ecological reserve, natural area, wilderness area of wildlife sanctuary. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Tool:*** Municipal reserve required by municipality. | **X** | | | | | |
| ***Tool:*** Environmental Reserve required by municipality. | **X** | | | | | |
| ***Tool:*** Natural Area land use designation under Land Use Bylaw of municipality and other exercising of municipal authority involving down zoning to regulate land use. | **X** | | | | | |
| ***Tool*****:** Conservation easement instead of environmental or municipal reserve. | **X** | | | | | |
| ***Tool:*** Formal transfer of development potential (transfer of development rights) by municipality to developer from one parcel to another. | **X** | | | | | |
| ***Tool:*** Bareland condominium (unit owners own a common interest in a portion of parcel). | **X** | | | | | |
| ***Tool:*** Bonusing (municipality approving authority provides added subdivision or development potential, for example, density, in return for protecting an area). | **X** | | | | | |
| ***Tool:*** Municipal taxation (could be used to lower or exempt taxes where landowners help realize natural area municipal policy). | **X** | | | | | |

## Legal Tools

| | | Wildlife and Habitat Conservation | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Land Use Planning** | **Birds** | **Wildlife** | **Vegetation** | **Surface Drainage and Groundwater** | **Outdoor Recreation, Heritage Appreciation, and Tourism** |
| ***Tool:*** Gift or sale to and establishment by the federal government as a national park, park reserve, national historic site, migratory bird sanctuary or national wildlife area. | **X** | | | | | |
| ***Tool:*** Lease, gift or sale to an Environmental Non-Governmental Organization (ENGO). | **X** | | | | | |
| ***Tool:*** Lease or Gift to Municipality. | **X** | | | | | |
| ***Tool:*** Voluntary action by owner to refrain from or limit development. | **X** | | | | | |
| ***Tool:*** Common-law easement from owner regarding neighbouring land. | **X** | | | | | |
| ***Tool:*** Restrictive covenant regarding neighbouring land. (1) | **X** | | | | | |
| ***Opportunity:*** Include conservation goals in municipality's general bylaw making. | **X** | | | | | |
| ***Opportunity:*** Tie into framework for Water Management Planning. Link planning and policy development and other environmental and waterfowl management plans. | **X** | **X** | **X** | **X** | **X** | **X** |
| ***Opportunity:*** Determine what designations will work best by reviewing all. | **X** | **X** | **X** | **X** | **X** | **X** |

## 7.0 CLOSURE

This literature review provided a foundation from which the management planning process may move forward. While the information reviewed and summarized in this report provides the beginning of a baseline of information, there is much opportunity for continued research, monitoring and evaluation of the biological health of the natural and cultural resources found in the BLNA. The steps required to obtain a broader picture of these resources should be evaluated and selected based on public, scientific and management needs.

Through this literature review, Alberta Community Development and the partnering municipalities have taken the first steps in better understanding the Big Lake Study Area and its potential to become a nationally-renowned nature reserve. A continued multi-jurisdictional cooperative effort between every level of government, NGOs and all other interested parties is required to ensure its conservation. With careful planning, in future, BLNA can become the symbol and the focus of coordinated environmental protection efforts that extend well beyond the immediate boundaries of the BLNA, and will serve as a biological indicator for the ecological 'state of health' of the region as a whole.

# APPENDIX A

# TERMS OF REFERENCE

# Terms Of Reference for Planning Consultant
# For
# Big Lake Natural Area

## May 1, 2002

# TERMS OF REFERENCE FOR A PLANNING CONSULTANT FOR BIG LAKE NATURAL AREA

## 1. INTRODUCTION

Big Lake Natural Area includes the lake and a portion of a wetland complex in the Central Parkland adjacent to the cities of Edmonton and St. Albert and the counties of Parkland and Sturgeon. Although relatively small (11.19 $km^2$), the natural area is significant because of its proximity to a large population that appreciates the area for its abundant and diverse bird populations and educational value. Supporting a large nesting colony of Franklin's gull, migrating flocks of tundra swans and a diversity of nesting and migrating waterfowl and shorebirds, Big Lake was recently recognized as a Globally Significant Important Bird Area.

Natural landscapes of ecological significance consisting of both wetlands and uplands extend well beyond the boundaries of the Natural Area. These lands are owned by a variety of interests. Land use activities in the upstream watershed, particularly those that may have an effect on surface or groundwater can influence the long-term ecological integrity of Big Lake.

## 2. Project Description

### Phase I: Data Collection and Review

**Goal**: To produce a comprehensive, scientifically defensible report describing the management requirements for Big Lake Natural Area.

The report, to be prepared by a consultant, will be an information document that can be supported by stakeholders and used by the province and the four municipalities to integrate management for Big Lake Natural Area with surrounding lands.

### Phase II: Public Review

**Goal**: To undertake a process for public review of the Phase I document and provide opportunity for the expression of all interests.

The detailed program for public review will be developed at the conclusion of Phase I.

### Phase III: Management Plan

**Goal**: To produce an agreed upon management plan with an overall implementation strategy.

Phases I and II will provide the context for the preparation of a management plan for Big Lake Natural Area that can be integrated with the management of surrounding lands.

**Phase IV: Implementation**

**Goal**: To implement the management plan through provincial plans, local plans and bylaws, and other initiatives or partnerships.

It is expected that numerous detailed initiatives for implementation will be identified, flowing from the collected data, the public input and the overall implementation strategy of the management plan. These initiatives could potentially involve the province, municipalities, landowners and other interest groups or stakeholders.

The first three phases will prepare municipal decision-makers to implement recommendations within the context of Municipal Development Plans, Area Structure Plans, Land Use By-laws and other instruments. Any drafting of plans or changes to existing plans will be a municipal responsibility.

## 3. SCOPE OF PHASE I

### a. Study Area

For the purpose of Phase I, the study area will extend: from the Yellowhead Highway in Edmonton and Parkland County to Meadowview Drive on the north side of Big Lake in Sturgeon County, from the proposed Riel Drive Arterial in St Albert and the easternmost boundary of the Transportation and Utility Corridor in Edmonton west to Highway #44 (Range Road 263A) in Parkland County. (See attached Map)

### b. Data Sources

Data will be compiled from a literature review as well as consultation with local experts.

### c. Legislative and Planning Framework

- In order to develop an effective framework for natural ecosystem management, develop a description of the municipal, provincial and federal regulatory planning and institutional arrangements that will apply to the development of a management plan for Big Lake.

- Identify the Statutory and non-statutory plans (existing or proposed) that are relevant to Big Lake (e.g., North American Waterfowl Management Plan, North American Colonial Waterbird Conservation Plan, transportation functional plans, environmental protection plans, Provincial Planning Guidelines, MDP's, Area Structure Plans, Land Use By-laws, etc.). Organize this information into a coherent framework that is accessible to all stakeholders and interest groups.

- Provide an assessment of the wetland functions and values of Big Lake (hydrological, water quality, habitat, science/information, aesthetics, recreational and production).

**d. Wildlife and Habitat Conservation**

Big Lake Natural Area and surrounding lands are ecologically significant for a variety of wetland and upland species of wildlife and vegetation. Depending upon the location and type of use, development surrounding Big Lake can reduce the value of this habitat for wildlife. Activities within the Natural Area can similarly impact its ecological value.

- The study will compile existing inventories and map areas in terms of their habitat significance for different species and communities.

- The study will review existing literature with regard to habitat effectiveness with particular emphasis on proximity to various types of activities and developments. The sensitivity of indicator species to human intrusion should be stressed and appropriate use and development guidelines proposed.

- A literature review should be done to determine appropriate buffer zone sizes and distances.

- A literature review should be completed on bird species found at Big Lake and a species list of birds included. Information on any special conservation status/issues associated with the birds should be provided.

- Assess the existing knowledge and gaps in this knowledge of the bird species and habitat classes identified with respect to: ongoing and completed bird monitoring, research and conservation programs in the area; existing public education programs; key sites used by breeding birds (locations identified on map), species present, history and numbers; population goals and changes for each species; summary of most significant species and the times and habitat functions used by these species (nesting, loafing etc.).

- Organize the list of birds at Big Lake into a habitat management framework that integrates with the planning framework advocated by the North American Bird Conservation Initiative.

- Develop a conservation needs assessment for the habitat classes and individual species or communities of special concern at Big Lake. Address conservation needs of individual species, Habitat protection and conservation needs, and population needs. Address threats to key habitats and key species and sites that should be addressed in the management plan (disturbance, predators, changes to depth of water, etc.) and provide details on research needs and potential communication and education needs for the area.

- A literature review should be completed for all other wildlife and plantsfound in and around the Big Lake Natural Area (fish, mammals, amphibians,

reptiles, plants etc.) and any special conservation status/issues associated with the species should be provided.

- Provide an inventory and description of the goals and objectives of the important North American, Canadian and Alberta migratory bird conservation initiatives related to the North American Bird Conservation Initiative and describe their relevance to Big Lake. Some of these plans or organizations may include: North American Waterfowl Management Plan, North American Colonial Waterbird Conservation Plan, Canadian Shorebird Conservation Plan or North American Bird Conservation Initiative. Organize this information into a planning framework suitable for developing a management plan for Big Lake Natural area.

- Provide an inventory and description of invasive or non-native species.

**e. Land use**

- A number of Area Structure Plans and other land use instruments are in place for the municipalities. These plans will be provided to the consultant in digital format.

- The study will compile a composite map of existing Area Structure Plans and other land use controls at a scale suitable for public display. Recommend a 1:20,000 or 1:15,000 scale. The map will be accompanied by an overview that will clearly convey to the public and enhance understanding of what the various designations mean.

- Lands within the study area are owned by a variety of interests. The study will compile from sources provided by the municipalities a composite map of land ownership suitable for public display.

- The province will provide a composite satellite image at the same scale to provide the public with a visual overview of existing development.

- Provide a summary of current issues in the Big Lake watershed that have potential to affect and present challenges to the implementation of a management plan and identify those issues that should be considered in a public consultation strategy. (e.g., land use planning, transportation planning, existing property rights, habitat requirements, public access/use).

**f. Surface Drainage and Groundwater**

Rural residential subdivisions, urban development in Spruce Grove, industrial activities and agriculture within the study area and immediately upstream have the potential to

effect the quality and quantity of both surface and groundwater that are an integral component of the ecological process of Big Lake.

- The study will review existing literature and studies with regard to both surface drainage and groundwater with particular emphasis on existing and potential impacts on the ecological integrity of Big Lake. Appropriate guidelines to mitigate negative impacts should be proposed.

**g. Outdoor Recreation, Heritage Appreciation and Tourism**

- The Special Places Local Committee provided background and recommendations on a number of recreational, educational and tourism aspects related to the designation of Big Lake Natural Area. Many of these activities are not confined to the Natural Area. Within the context of the Local Committee recommendations the consultant will examine the various recreational, educational and tourism activities in terms of their relationship to surrounding lands. Proposals will be made on how these linkages could be strengthened including complementary activities and developments. This information will be synthesised in a form suitable for public review.

- Provide a summary of potential for partnerships and/or linkages with organizations that have an interest in water/wildlife management at Big Lake that would find a management plan to be mutually beneficial (e.g. Big Lake Basin Task Force, urban development interests, tourism organizations, non profit organizations).

- Provide details on potential communication and education needs for the area.

**h. Toolbox**

- Based on the above compiled information and sources, develop a toolbox of measures and actions that can be implemented by landowners, municipalities and other partners. This would include a variety of tools: educational; planning; land use; habitat preservation; water management; etc.

## 4. Meetings

The draft report of the consultant will be critically reviewed by the Technical Committee for its accuracy, comprehensiveness and adequacy in meeting the Terms of Reference. Scientific experts will be asked to comment on the scientific content of the Terms of Reference. The consultant will then organize meetings and present their findings to representatives of the four municipalities and the province.

The Technical Committee believes it is desirable to have a political Review Committee, comprised of representatives of the four municipalities to: provide feedback to the Technical Committee; liaise with and brief other members of their respective Councils; and make a recommendation to the Councils when appropriate.

**5. Public Review Proposal – Phase II**

The consultant will develop and present, to the Technical Committee, a separate proposal that provides the public the opportunity to review and comment on the work of Phase I. The proposal will include such steps as necessary to provide information to the public, opportunities for input as well as feedback at the draft and final stages of document preparation.

## PHASE II

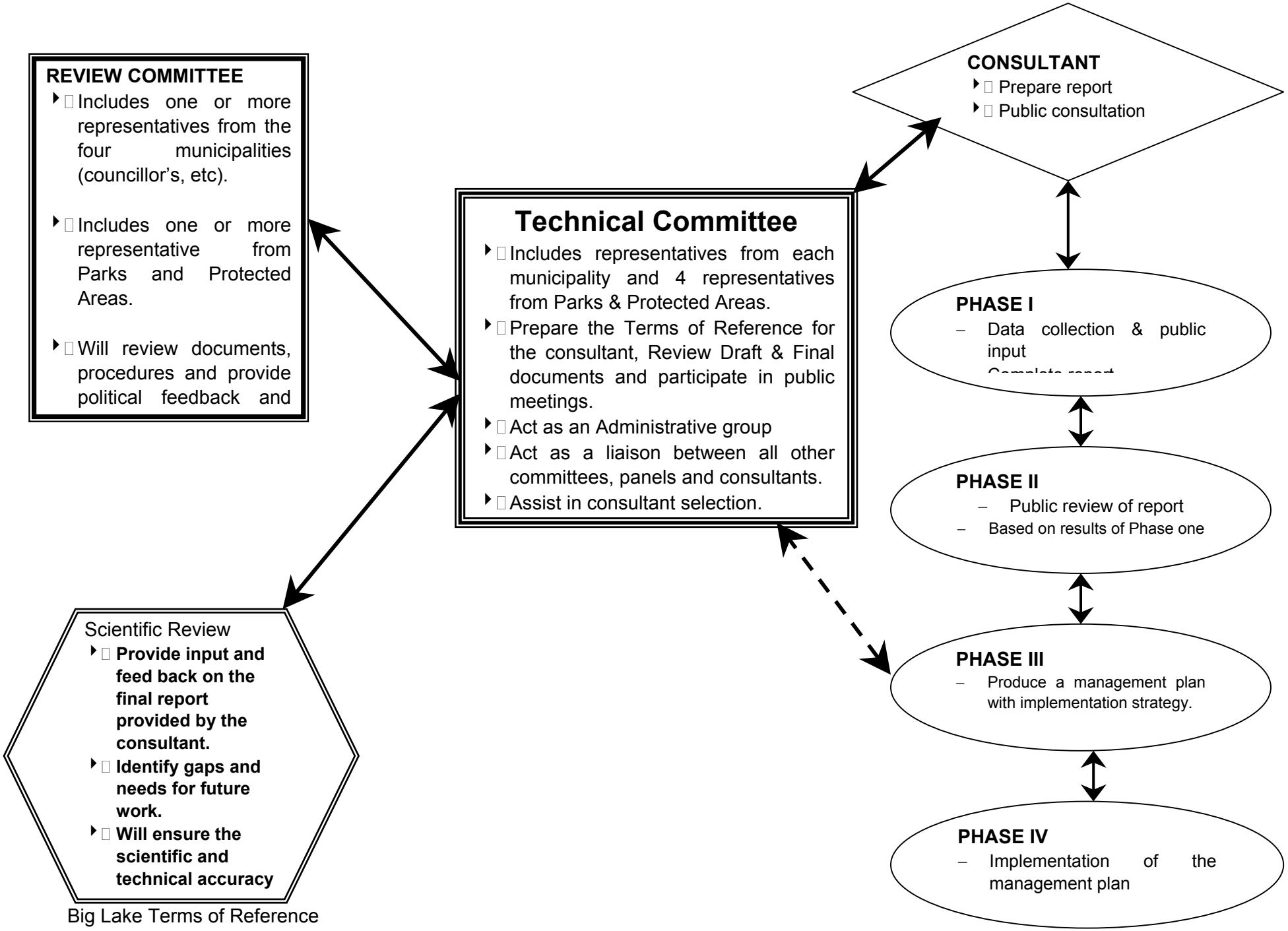
**Public review**

**PHASE III**

**Management plan preparation and completion**

**PHASE IV**

**Implementation**


REVIEW COMMITTEE
Includes one or more representatives from the four municipalities (councillor's, etc).
Includes one or more representative from Parks and Protected Areas.
Will review documents, procedures and provide political feedback and
Technical Committee
Includes representatives from each municipality and 4 representatives from Parks & Protected Areas.
Prepare the Terms of Reference for the consultant, Review Draft & Final documents and participate in public meetings.
Act as an Administrative group
Act as a liaison between all other committees, panels and consultants.
Assist in consultant selection.
CONSULTANT
Prepare report
Public consultation
PHASE I
– Data collection & public input
PHASE II
– Public review of report
– Based on results of Phase one
PHASE III
– Produce a management plan with implementation strategy.
PHASE IV
– Implementation of the management plan
Scientific Review
Provide input and feed back on the final report provided by the consultant.
Identify gaps and needs for future work.
Will ensure the scientific and technical accuracy

# APPENDIX B

# MAPS

# APPENDIX C

## Annotated Bird Checklist of the Big Lake Study Area and Bird Families Comprising the Big Lake Checklist by the NABCI Categories

# ANNOTATED BIRD CHECKLIST OF BIG LAKE STUDY AREA

This checklist is believed to include all (235) bird species that currently occur, or are known to have occurred, within the Big Lake Study Area. The occurrence of two other species – marked thus: [ ], i.e., Black-billed Cuckoo and Fenugionous Hawk – is considered hypothetical, and both were excluded from the checklist 'statistics' presented in Section 5.1.2.

**Format**:
The amount of information available per species with respect to its occurrence in the study area varies greatly but, to a greater or lesser degree, each species outline given below corresponds to the following basic format:

1. Occurrence: annual or non–annual;
2. Breeding Status; any pertinent information regarding:
3. Seasonal Abundance;
4. Favoured locations/specific, preferred sites; and
5. Conservation Information – this includes :
    - a) Migratory Status i.e., whether species is Resident, a Winter Visitor, an Obligate Neotropical Migrant (NTM–0; i.e., all, or a majority, of the species' population winters in the New World tropics), or a Facultative Neotropical Migrant (NTM–F; i.e., a minority of the species' population winters in the New World Tropics). Those species not labelled as any of the previous categories are short–distance migrants.
    - b) Whether species is introduced (i.e., non-native);
    - c) Whether species is irruptive (*cf*. Koenig, 2001);
    - d) Special nesting and/or habitat requirements;
    - e) Threats – e.g., species sensitive to human–caused disturbance; and
    - f) Risk status and/or, population trends.

**Sources of Information:**
The taxonomic order and nomenclature used in this checklist follows that of "The Check-List of North American Birds" (Seventh Edition: AOU, 1998) and its Forty-first (AOU,1997) and Forty-second (AOU, 2000) Supplements. By far the preeminent source of information used to compile this checklist has been the bird records of Peter Demulder, Alan Hingston and Dave Nadeau (to all of whom, the author extends his sincere gratitude). Where specific attribution is warranted, these observers' initials are used to identify their individual sightings or comments. Seasonal abundance notes are largely based on Alan Hingston's personal, provisional Big Lake bird checklist. Abundance terms used are relative and subjective/non-quantitative.

***Big Lake Birds:*** Specific literature used included Kemper and Doberstein (1977); D.A. Boag *in* ERPC (1965); L. Bogaert *in* Spalding (1980); Guay (1968); Calverley and Kosinski (1986); Penner and Associates Ltd. (1996) and BLESS (1994). Ealey and MacNicholl (1991) was helpful for tracking down papers on rarity occurrences at Big Lake (e.g., Bulmer and Bulmer, 1976).

Breeding bird information was taken from the above sources, Semenchuk (1992) and Alberta Breeding Bird Atlas project data sheets for atlas squares UQ14 and UQ24. Useful sources of habitat and nesting requirement information include: Ehrlich et al. (1988); Semenchuk (1992);

Pinel et al. (1993); Penner and Associates Ltd. (1996); Saxena et al. (1996); Alberta Environment (2000); The Birds of North America series (e.g., MacWhirter and Bildstein, 1996) and, concerning shorebirds, Gratto-Trevor et al. (2001). Various other bird guides for Alberta, Canada and North America were also consulted.

Additional conservation information was derived from the above sources, plus Thomas (1994) and Thomas and Klauke (2001). Risk status and population trends were taken from COSEWIC (2001); Gratto-Trevor et al. (2001); Downes et al. (2000); Dunn et al. (2000); Rodriguez (2002); various species-specific publications (e.g., Peterjohn and Sauer, 1997); North American Birds magazine (and its precursors), and Alberta Fish and Wildlife Division (2001). References of special interest are cited for certain species.

## SPECIES ACCOUNTS

- **LOONS (Gaviidae)**

**Common Loon:** Annual; non-breeder; uncommon in both spring and fall migration. Favours larger lakes and Riel Lagoon. Often nests on islands or Beaver lodges. Sensitive to disturbance and environmental contamination (e.g., Leahy, 1998). Declining.

- **GREBES (Podicipedidae)**

**Pied-billed Grebe:** Annual; breeds; uncommon. NTM-F. Undergoing significant, wide-scale, long-term decline (Rodriguez, 2002).

**Horned Grebe:** Annual; breeds; fairly common. Declining throughout range in Alberta.

**Red-necked Grebe:** Annual; breeds; common.

**Eared Grebe:** Annual; breeds; common. NTM-F. Colonial nester; 300+ pairs in colony on north shore of West Basin in 1999. Sensitive to disturbance and water level changes.

**Western Grebe:** Annual; probable breeder; common on Big Lake. NTM-F; Colonial nester; sensitive to disturbance.

- **PELICANS (Pelecanidae)**

**American White Pelican:** Non-annual; non-breeder; rare visitor to Big Lake. NTM-F. Colonial nester. Sensitive to disturbance. Increasing.

- **CORMORANTS (Phalacrocoracidae)**

**Double-crested Cormorant:** Annual; non-breeder (though listed as a breeding species by Penner and Associates Ltd., 1996); uncommon spring and fall visitor to Riel Lagoon. NTM-F. Colonial nester. Sensitive to disturbance. Increasing.

- **HERONS (Ardeidae)**

**American Bittern:** Annual; presumed breeder; uncommon (though difficult to detect when not "booming"). NTM-F. Favours large beds of cattails and bulrushes at Big Lake. Area-demanding. Sensitive to disturbance. Declining due to habitat loss.

**Great Blue Heron:** Annual; non-breeder within study area, but small (8-10 bird) intermittent colony in Sturgeon River Valley east of St. Albert (DN); common. NTM-F. Sometimes roosts in reed islands at east end of East Basin. Colonial nester. Sensitive to disturbance. Size and number of colonies declining in Alberta (AFWD, 2001).

**Great Egret:** Non-annual; non-breeder; rare (extralimital) visitor to Alberta. NTM-F. One study area record. Colonial nester. Sensitive to disturbance.

**Snowy Egret:** Non-annual; non-breeder; rare (extralimital) visitor to Alberta. NTM-F. One study area record. Colonial nester. Sensitive to disturbance.

**Black-crowned Night-Heron:** Annual; probable breeder; fairly common; favours marsh to south of Riel Lagoon, and roosts in reed islands at east end of East Basin. NTM-F. Colonial nester. Sensitive to disturbance. Habitat specialist. Alberta population believed to be increasing; but significant long-term declines across Canada (Dunn et al., 2000).

- **GEESE, SWANS & DUCKS (Anatidae)**

**Greater White-fronted Goose:** Annual; non-breeder; uncommon, most often seen/heard passing overhead. Big Lake lies on the western edge of this species' main migration corridor through Alberta.

**Snow Goose:** Non-annual; non-breeder; rare/casual visitor. Big Lake lies well west of this species' primary migration path through the province.

**Canada Goose:** Annual; breeder; common. Increasing.

**Trumpeter Swan:** Annual; non-breeder; rare, small numbers occur in fall (but was fairly common in 1997 [DN]). Usually found along Sturgeon River at or near its outflow. Sensitive to disturbance. Population increasing but still considered "at risk" in Alberta.

**Tundra Swan:** Annual; non-breeder; occurs on Big Lake in large numbers during both spring and fall migration (e.g., maximum one-day counts of 18,000 -20,000 recorded in fall of 1999).

**Wood Duck:** Non-annual; non-breeder; one record for study area. Cavity nester.

**Gadwall:** Annual; breeder; common. NTM-F.

**Eurasian Wigeon:** Non-annual; non-breeder; casual visitor to Big Lake during spring migration. One of earliest waterfowl migrants in spring.

**American Wigeon:** Annual; breeder; common. NTM-F.

**Mallard:** Annual; breeder; common. Populations not as robust as those of most other dabbling ducks.

**Blue-winged Teal:** Annual; breeder; common. NTM-O.

**Cinnamon Teal:** Annual; breeder; uncommon, but Big Lake area population appears to be increasing. NTM-O.

**Northern Shoveler:** Annual; breeder; common. NTM-F.

**Northern Pintail:** Annual; breeder; common. Can occur in large numbers in both spring and fall migration; single-day counts of 10,000 have been recorded, especially in "Pintail Bay" (East Basin). NTM-F. North American population described as "struggling" (Miller and Duncan, 1999).

**Green-winged Teal:** Annual; breeder; common. NTM-F.

**Canvasback:** Annual; breeder; fairly common in summer, common during fall migration. Most often reported from Riel Lagoon. Decreasing.

**Redhead:** Annual; breeder; fairly common in summer, higher numbers during fall migration. NTM-F.

**Ring-necked Duck:** Annual; probable breeder; uncommon, favours smaller lakes within study area. NTM-F.

**Greater Scaup:** Annual; non-breeder; uncommon spring and fall migrant but most often seen in early spring. Riel Lagoon is the best location. Declining (Austin et al., 2000).

**Lesser Scaup:** Annual; breeder; common. NTM-F. Undergoing widespread decline, but cause(s) uncertain (Austin et al., 2000).

**Surf Scoter:** Non-annual; non-breeder; rare/casual visitor during migration periods. Declining. Riel Lagoon is best location.

**White-winged Scoter:** Annual; non-breeder? (Penner and Associates Ltd., [1996] list it as a Big Lake breeder); rare. Favours Riel Lagoon. Undergoing long-term decline.

**Long-tailed Duck:** Non-annual; non-breeder; casual visitor to Big Lake (Riel Lagoon is best site) during fall migration period.

**Bufflehead:** Annual; breeder; fairly common, numbers boosted by fall migrants. Cavity nester.

**Common Goldeneye:** Annual; breeder; common. Cavity nester.

**Barrow's Goldeneye:** Non-annual; non-breeder; rare visitor during migration periods. ? Increasing in northeast Alberta. Cavity nester.

**Hooded Merganser:** Annual; non-breeder; rare. Usually seen in late summer/fall on the Sturgeon River. Cavity nester. Increasing ? in northeast Alberta.

**Common Merganser:** Annual; non-breeder; rare, small flocks visit Riel Lagoon in spring and fall migration. Cavity nester.

**Red-breasted Merganser:** Annual; non-breeder; odd birds visit Riel Lagoon during both migration periods.

**Ruddy Duck:** Annual; breeder; fairly common. NTM-F.

- **HAWKS & EAGLES (Accipitridae)**

**Osprey:** Annual; non-breeder; rare visitor - usually seen passing overhead. Nests well to the west of Big Lake area (Kemper and Doberstein, 1977, fig.15). NTM-O. Sensitive to disturbance and environmental contaminants. Decreasing.

**Bald Eagle:** Annual; non-breeder; uncommon in spring and fall (although good numbers sometimes seen at east end of East Basin when lake icing over); rare in summer. Sensitive to disturbance.

**Northern Harrier:** Annual; breeder; uncommon. Most often seen during late summer/fall passage. NTM-F. Decreasing ?.

**Cooper's Hawk:** Annual; probable breeder; uncommon. NTM-F. Sensitive to disturbance; area-demanding.

**Northern Goshawk:** Annual; probable breeder; uncommon. Resident. Sensitive to disturbance. Area-demanding; requires large tracts of intact mature/old-growth forests. Declining due to on-going loss of habitat.

**Swainson's Hawk:** Annual; breeder; fairly common. NTM-O. Sensitive to disturbance. Vulnerable to pesticides (e.g., large numbers poisoned recently in Argentina). Significant declines in prairie populations over last decade.

**Red-tailed Hawk:** Annual; breeder; common. NTM-F. Has benefited from forest clearance/fragmentation. Harlan's morph has been seen over study area during fall.

**[Ferruginous Hawk]:** One reported in UQ14 atlas square on 15 May, 1991, but authenticity of sighting questioned by local birders. Species of Special Concern (COSEWIC, 2001). Declining.

**Rough-legged Hawk:** Annual; non-breeder; fairly common to uncommon fall and winter visitor, also seen regularly in spring. Irruptive.

**Golden Eagle:** Non-annual; non-breeder; rare/casual migrant usually seen passing overhead. One record by Kemper and Doberstein (1977) in fall of 1976. Sensitive to disturbance.

- **FALCONS (Falconidae)**

**American Kestrel:** Annual; rare breeder (Penner and Associates Ltd., 1996); uncommon in study area as a whole. NTM-F. Cavity nester. Decreasing.

**Merlin**: Annual; breeder; uncommon. Resident.

**Gyrfalcon:** Non-annual; non-breeder; rare fall and winter visitor.

**Peregrine Falcon:** Annual; non-breeder; rare. NTM-O. Pair nesting at Inland Cement, and passage birds, visit Big Lake area to hunt. Sensitive to disturbance. Threatened (COSEWIC, 2001).

- **GROUSE & ALLIES (Phasianidae)**

**Chukar:** Non-annual; non-breeder; only one record (? of a recently released bird). Introduced. Extirpated in study area.

**Gray Partridge:** Annual; breeder; uncommon (on occasion, fairly common). Resident. Introduced. ?Declining.

**Ring-necked Pheasant:** Annual; suspected breeder; uncommon. Resident. Introduced. ?Declining.

**Ruffed Grouse:** Annual?; presumed breeder, but status unclear; uncommon to rare. Local population declining due to habitat loss. Resident.

**Sharp-tailed Grouse:** Non-annual;? Non-breeder (probable former breeder); rare (but 20 recorded on 1998 CBC). Resident. Has undergone a wide-scale significant, long-term population decline over last two decades.

- **RAILS & COOTS (Rallidae)**

**Yellow Rail:** Non-Annual; non-breeder (possible former intermittent breeder); casual. Has occurred in area of north shore interpretive trail when latter flooded. Species of special concern (COSEWIC, 2001). Declining.

**Virginia Rail:** Non-annual; intermittent breeder (recorded as breeding by Penner and Associates Ltd., 1996); rare to casual (depending on water levels). NTM-F.

**Sora:** Annual; breeder; fairly common to common. NTM-F.

**American Coot:** Annual; breeder; common. NTM-F. Central Alberta populations appear to be increasing.

- **CRANES (Gruidae)**

**Sandhill Crane:** Annual; non-breeder; fairly common migrant in both spring and fall. Good numbers often seen/heard passing overhead in mid May. Flocks sometimes spend night on north shore, sedge marsh/grassy areas. NTM-F. Sensitive to disturbance. Decreasing.

- **PLOVERS (Charadriidae)**

**Black-bellied Plover:** Annual; non-breeder; uncommon spring and fall migrant. Like most Big Lake shorebird species, abundance depends on water levels/availability of suitable foraging habitat (e.g., mudflats). NTM-O. Decreasing in Canada (Gratto-Trevor et al., 2001).

**American Golden-Plover:** Annual; non-breeder; uncommon spring and fall migrant. NTM-O. Some significant declines, species of high concern.

**Semipalmated Plover:** Annual; non-breeder; uncommon spring and fall migrant, best numbers usually in mid-May. NTM-O.

**Killdeer:** Annual; breeder; common. NTM-F. Has undergone significant, wide-scale declines in Canada and U.S.A. over last 20 years.

- **AVOCETS & STILTS (Recurvirostridae)**

**Black-necked Stilt:** Non-annual; non-breeder; one spring record from north shore interpretive trail area. NTM-F. Over last 15+ years has expanded its breeding range into southern Alberta, and population still appears to be on increase.

**American Avocet:** Annual; breeder; uncommon (abundance dependent on lake levels). NTM-F. Decreasing in Canada.

- **SANDPIPERS & ALLIES (Scolopacidae)**

**Greater Yellowlegs:** Annual; non-breeder; uncommon spring and fall passage visitor. NTM-O. Usually found along Sturgeon River and edges of Riel Lagoon. (DN).

**Lesser Yellowlegs:** Annual; suspected breeder; fairly common. NTM-O. Has declined significantly over last 30 years.

**Solitary Sandpiper:** Annual; non-breeder (possible former breeder?); locally fairly common to uncommon. NTM-O. Decreasing in Canada.

**Willet:** Annual; breeder; rare to uncommon. NTM-O. Decreasing in Canada.

**Spotted Sandpiper:** Annual; breeder; fairly common. NTM-O.

**Upland Sandpiper:** Non-annual; non-breeder; casual visitor. NTM-O. Prairie populations have declined due to habitat loss.

**Hudsonian Godwit:** Non-annual; non-breeder; casual visitor. NTM-O. Declining.

**Marbled Godwit:** Annual; possible breeder; uncommon. NTM-F.

**Ruddy Turnstone:** Non-annual; non-breeder; casual visitor. NTM-O.

**Red Knot:** Non-annual; non-breeder; rare to casual visitor. NTM-O.

**Sanderling:** Annual; non-breeder; rare to uncommon visitor. NTM-F. Decreasing in Canada.

**Least Sandpiper:** Annual; non-breeder; uncommon migrant, primarily in spring. NTM-F.

**White-rumped Sandpiper:** Non-annual; non-breeder; uncommon spring migrant. NTM-O.

**Baird's Sandpiper:** Annual; non-breeder; uncommon migrant, mainly during spring. NTM-O.

**Pectoral Sandpiper:** Annual; non-breeder; uncommon. Found in small numbers along river banks. NTM-O.

**Dunlin:** Non-annual; non-breeder; rare spring or late fall migrant.

**Stilt Sandpiper:** Non-annual; non-breeder; rare spring and fall migrant. NTM-O. May be declining.

**Buff-breasted Sandpiper:** Non-annual; non-breeder; rare to casual spring or fall migrant. NTM-O. Declining in Canada.

**Ruff:** Non-annual; non breeder. One spring record (May 6-9) in 1976, at former sewage lagoons (Bulmer and Bulmer, 1976). Eurasian species, casual visitor to Alberta. Paleotropical migrant.

**Short-billed Dowitcher:** Annual; non-breeder; rare migrant, recorded mostly in spring. NTM-O. Declining ? due to fragmentation of Boreal.

**Long-billed Dowitcher:** Annual; non-breeder; rare in spring, uncommon in fall migration. Found mainly along outflow channel of Sturgeon River. NTM-F.

**Common Snipe:** Annual; breeder; fairly common. Abundant suitable nesting habitat. NTM-F.

**Wilson's Phalarope:** Annual; breeder; fairly common. NTM-O. Decreasing in Canada.

**Red-necked Phalarope:** Annual; non-breeder; uncommon migrant - occurs primarily in spring. NTM-O. Decreasing in Canada.

**Red Phalarope:** Non-annual; non-breeder; casual, late-fall visitor. NTM-O.

- **GULLS, TERNS & JAEGERS (Laridae)**

**Franklin's Gull:** Annual; former breeder; common. NTM-O. Colonial nester. In 1964, 500 pairs were nesting in two colonies at western end of West Basin (Guay, 1968). By 1986, three West Basin nesting colonies contained a total of "several thousand" pairs (Calverley and Kosinski, 1986). Last nested in 1998. Sensitive to disturbance and fluctuations in water levels. Declining.

**Bonaparte's Gull:** Annual; possible former breeder (Boag *in*: ERPC, 1965). Good numbers (fairly common) during spring and fall migration, uncommon in summer. Fall flocks migrate along Sturgeon River Valley. NTM-F. Colonial nester.

**Ring-billed Gull:** Annual; non-breeder (*con*. Penner and Associates Ltd., 1996); common. NTM-F. Colonial nester. Sensitive to disturbance. Populations increasing in Alberta?

**California Gull:** Annual; non-breeder (*con*. Penner and Associates Ltd., 1996); fairly common during spring and fall migration periods, uncommon in summer. Colonial nester. Sensitive to disturbance.

**Herring Gull:** Annual; non-breeder; small numbers pass through in spring and fall. NTM-F. Colonial nester. Sensitive to disturbance.

**Common Tern:** Annual; non-breeder; fairly common. NTM-O. Colonial nester. Sensitive to disturbance.

**Forster's Tern:** Annual; intermittent breeder; fairly common. NTM-F. Colonial nester. Sensitive to disturbance.

**Black Tern:** Annual; breeder; common. Up to 300+ pairs have bred on Big Lake in past. Uses bulrush 'islands' for nesting; colony locations vary according to water level. NTM-O. Colonial nester. Sensitive to disturbance. Undergoing serious long-term declines across Canada, particularly in Aspen Parklands (Peterjohn and Sauer, 1994, fig.3).

- **DOVES (Columbidae)**

**Rock Dove:** Annual; breeder; common. Resident. Introduced.

**Mourning Dove:** Non-annual?; non-breeder; rare visitor to Big Lake area. NTM-F.

- **CUCKOOS (Cuculidae)**

**[Black-billed Cuckoo]:** Non-annual; non-breeder; suspected, but not proven, to have occurred within study area. One recorded north of Calahoo in 1987 during significant irruption of this species in response to a large Forest Tent Caterpillar outbreak. (J. Park, pers. comm., March 14, 2002). NTM-O.

- **OWLS (Strigidae)**

**Great Horned Owl:** Annual; breeder, uncommon. Resident. Nesting usually commences by end of January. Declining across Canada.

**Snowy Owl:** Non-annual; non-breeder; casual winter visitor. Irruptive. Cavity nester.

**Great Gray Owl:** Non-annual; non-breeder; rare winter visitor. One has over-wintered in "The Spruce Lot" (DN). Irruptive.

**Short-eared Owl:** Non-annual; intermittent breeder; rare to fairly common (in irruption years). Up to 30 or 40 birds have over-wintered on north shore in exceptional years (A. Doberstein, pers. comm., February 26, 2002). Primarily a fall/winter visitor but has occurred in all seasons. NTM-F. Species of Special Concern (COSEWIC, 2001). Declining across breeding range in North America.

**Long-eared Owl:** Non-annual; former breeder; casual summer/fall visitor.

**Boreal Owl:** Non-annual; former breeder; casual visitor; former resident and fall migrant (L. Bogaert *in* Spalding, 1980). Cavity nester. Old-growth forest dependent. Range contracting in response to forest loss/fragmentation.

**Northern Saw-whet Owl:** Annual; breeder; rare. Resident. Cavity nester. Declining in region due to forest clearance.

- **NIGHTJARS (Caprimulgidae)**

**Common Nighthawk:** Annual; former breeder; rare. NTM-O. Is undergoing a significant, long-term decline across Prairie Provinces.

**HUMMINGBIRDS (Trochilidae)**

**Ruby-throated Hummingbird:** Annual; presumed breeder; rare. NTM-O.

- **KINGFISHERS (Alcedinidae)**

**Belted Kingfisher:** Non-annual; possible former breeder; rare to casual visitor. Tends to occur along Sturgeon River downstream of Big Lake. NTM-F. Undergoing significant, long-term decline in North America. Nests in holes in river banks.

- **WOODPECKERS (Picidae)**

**Yellow-bellied Sapsucker:** Annual; breeder; uncommon. NTM-F. Cavity nester. Possible keystone species.

**Downy Woodpecker:** Annual; breeder; common. Resident. Cavity nester.

**Hairy Woodpecker:** Annual; breeder; common. Resident. Cavity nester. Area sensitive; mature/old-growth forest dependent.

**Three-toed Woodpecker:** Annual; intermittent breeder; rare. Resident. Irruptive. Cavity nester. Old-growth dependent.

**Black-backed Woodpecker:** Annual; non-breeder (?former breeder); rare. Habitat specialist (early, post-fire, forest successional stage). Irruptive. Resident. Cavity nester.

**Northern Flicker:** Annual; breeder; fairly common to common. Some birds are resident. Cavity nester. Undergoing gradual, long-term decline across Canada.

**Pileated Woodpecker:** Annual; breeder; fairly common. Resident. Cavity nester. Keystone species. Area-demanding, forest-interior/old-growth forest specialist. Declining locally due to forest destruction/fragmentation.

- **FLYCATCHERS (Tyrannidae)**

**Olive-sided Flycatcher:** Annual; non-breeder; rare migrant through study area. NTM-O. Undergoing significant, long-term decline.

**Western Wood-Pewee:** Annual; breeder; fairly common to common. NTM-O. During last decade has been declining in Canada.

**Alder Flycatcher:** Annual; breeder; fairly common. NTM-O. Favours lakeshore and riparian shrub thickets.

**Least Flycatcher:** Annual; breeder; common. NTM-O. Some population declines in Canada over last decade.

**Eastern Phoebe:** Annual; breeder; fairly common within localized distribution. NTM-F.

**Say's Phoebe:** Annual; non-breeder; uncommon migrant through Big Lake area. NTM-O.

**Eastern Kingbird:** Annual; breeder; common to fairly common. NTM-O. Some declines in Canada over last decade.

- **SHRIKES (Laniidae)**

**Northern Shrike:** Annual; non-breeder; uncommon winter visitor, rare spring and fall migrant.

**Loggerhead Shrike:** Non-annual; non-breeder; casual spring/summer visitor. Threatened (COSEWIC, 2001) in Prairie Provinces. NTM-F.

- **VIREOS (Vireonidae)**

**Blue-headed Vireo:** Annual; non-breeder; rare spring and uncommon fall migrant. NTM-O. Old-growth coniferous forest dependent.

**Warbling Vireo:** Annual; breeder; fairly common. NTM-O.

**Philadelphia Vireo:** Annual; non-breeder; rare migrant. NTM-O. Has suffered large losses of wintering habitat. Declining?

**Red-eyed Vireo:** Annual; breeder; fairly common. NTM-O. Area sensitive.

- **JAYS, CROWS & ALLIES**

**Gray Jay:** Annual; former breeder?; rare winter visitor (? from Wagner Bog area). Former resident? Declines across Canada in last decade.

**Blue Jay:** Annual; breeder; common. Adaptable, appears to have benefited from forest fragmentation/clearance. Resident. Increasing?

**Black-billed Magpie:** Annual; breeder; common. Resident. Has benefited from urbanization and forest clearance/fragmentation. Increasing.

**American Crow:** Annual; breeder; common. Another beneficiary of forest fragmentation. Increasing. A few individuals usually over-winter in St. Albert.

**Common Raven:** Annual; localized breeder; common. Resident. Increasing.

- **LARKS (Alaudidae)**

**Horned Lark:** Annual; non-breeder; uncommon spring and fall migrant. NTM-F. Has declined in Canada over last decade.

- **SWALLOWS (Hirundinidae)**

**Purple Martin:** Annual; intermittent breeder; uncommon spring and fall migrant, rare summer resident. A few occupied martin houses along Meadowview Drive. NTM-O. Cavity nester. Declining in study area.

**Tree Swallow:** Annual; breeder; common - makes use of the many nest boxes in area. NTM-O. Cavity nester.

**Northern Rough-winged Swallow:** Non-annual; non-breeder; casual visitor. NTM-O.

**Bank Swallow:** Annual; breeder; fairly common. Most nest downstream of Big Lake along Sturgeon River. Colonial nester. NTM-O. Declining in Canada over last decade.

**Cliff Swallow:** Annual; breeder; fairly common. Most breed outside study area (Cunningham Bridge/Starkey Bridge). NTM-O. Colonial nester.

**Barn Swallow:** Annual; breeder; fairly common. NTM-O. Some declines in Canada over past two decades.

- **CHICKADEES (Paridae)**

**Black-capped Chickadee:** Annual; breeder; common. Resident. Cavity nester.

**Mountain Chickadee:** Non-annual; non-breeder; accidental. One-record (March, 1957?). Cavity nester. Resident .

**Boreal Chickadee:** Annual; breeder; (e.g., in "The Spruce Lot"); fairly common. Resident. Cavity nester. Has undergone significant declines across Canada over last three decades. Old-growth spruce forest-dependent.

- **NUTHATCHES (Sittidae)**

**Red-breasted Nuthatch:** Annual; possible breeder; fairly common. Resident. Irruptive. Cavity nester. Old-growth dependent.

**White-breasted Nuthatch:** Annual; breeder; common to fairly common. Resident. Cavity nester.

- **CREEPERS (Certhiidae)**

**Brown Creeper:** Annual; non-breeder?; uncommon. A few over-winter, but bulk of population migratory. Cavity nester. Area sensitive; forest-interior species; old-growth dependent.

- **WRENS (Troglodytidae)**

**House Wren:** Annual; breeder; common. NTM-F. Cavity nester.

**Sedge Wren:** Non-annual; intermittent breeder; rare to casual. NTM-F. Occur/breeds when water levels suitable. Reported as breeding by Penner and Associates Ltd. in 1996. Loss of habitat is a problem in Alberta.

**Marsh Wren:** Annual; breeder; common in summer. NTM-F. Lots of suitable habitat around Big Lake.

- **KINGLETS (Regulidae)**

**Golden-crowned Kinglet:** Annual; non-breeder?; uncommon spring and fall migrant (a few may over-winter). Old-growth dependent.

**Ruby-crowned Kinglet:** Annual; breeder; fairly common summer resident. NTM-F.

- **BLUEBIRDS & THRUSHES (Turdidae)**

**Mountain Bluebird:** Annual; non-breeder; uncommon migrant in study area. Cavity nester. Increasing due to nest box programs.

**Townsend's Solitaire:** Annual; non-breeder; rare spring and uncommon fall migrant. NTM-F.

**Gray-cheeked Thrush:** Non-annual; non-breeder; casual migrant through study area; few records. NTM-O. Undergoing long-term, significant decline in Canada.

**Swainson's Thrush:** Annual; non-breeder; uncommon spring and fall migrant. NTM-O. Forest-interior specialist.

**Hermit Thrush:** Annual; non-breeder; uncommon spring and fall migrant. NTM-O. Forest-interior specialist.

**American Robin:** Annual; breeder; common. NTM-F. A few sometimes over-winter.

**Varied Thrush:** Non-annual; non-breeder; casual visitor to study area.

- **MOCKINGBIRDS & THRASHERS (Mimidae)**

**Gray Catbird:** Annual; breeder; uncommon. NTM-O. Nests along Sturgeon River both upstream and downstream of East Basin.

**Brown Thrasher:** Non-annual; non-breeder; casual summer visitor. Some Canadian populations have undergone significant, long-term declines.

- **STARLINGS (Sturnidae)**

**European Starling:** Annual; breeder; common. Resident. Introduced. Cavity nester. Out-competes many native bird species for nest-holes.

- **PIPITS (Motacillidae)**

**American Pipit:** Annual; non-breeder; rare spring and fall-migrant in small flocks. NTM-F.

**Sprague's Pipit:** Non-annual; non-breeder; casual spring/summer visitor. Threatened COSEWIC, 2000). "Dramatic population declines documented in recent decades" (AFWD, 2001).

- **WAXWINGS (Bombycillidae)**

**Bohemian Waxwing:** Annual; non-breeder; common winter visitor. Some stay quite late into the spring. Irruptive.

**Cedar Waxwing:** Annual; breeder; common. NTM-F. Some years, a few are recorded on the St. Albert Christmas Bird Count.

- **WOOD-WARBLERS (Parulidae)**

**Tennessee Warbler:** Annual; possible breeder?; uncommon spring migrant, common fall migrant. NTM-O. Spruce Budworm specialist. Irruptive. Declining.

**Orange-crowned Warbler:** Annual; non-breeder; rare to uncommon spring migrant, fairly common fall migrant. NTM-F.

**Nashville Warbler:** Non-annual; non-breeder; casual visitor. Two records for study area (DN).

**Yellow Warbler:** Annual; breeder; common in summer. NTM-O.

**Magnolia Warbler:** Annual; non-breeder; uncommon fall migrant. NTM-O. Decreasing.

**Cape May Warbler:** Annual; non-breeder; rare fall migrant. NTM-O. Spruce Budworm specialist. Dependent on coniferous old-growth forest. Declining.

**Yellow-rumped Warbler:** Annual; breeder; fairly common in summer, most numerous fall warbler. NTM-F.

**Black-throated Green Warbler:** Annual; non-breeder; uncommon migrant in both spring and fall. NTM-O. Old-growth dependent. Decreasing.

**Palm Warbler:** Annual; non-breeder; uncommon fall migrant. NTM-O.

**Bay-breasted Warbler:** Non-annual; non-breeder; rare to casual fall migrant. NTM-O. Spruce Budworm specialist. Old-growth dependent. "Declining over parts of North American range" (AFWD, 2001).

**Blackpoll Warbler:** Annual; non-breeder; rare spring migrant and uncommon fall migrant. NTM-O. Has declined in Canada over last two decades.

**Black-and-White Warbler:** Annual; non-breeder; rare fall migrant. NTM-O. Area sensitive. Decreasing?

**American Redstart:** Annual; possible breeder; rare spring migrant, uncommon fall migrant. NTM-O. Area sensitive. Decreasing?

**Ovenbird:** Annual; non-breeder; rare fall migrant. NTM-O. Forest-interior specialist; area sensitive. Decreasing?

**Northern Waterthrush:** Annual; possible breeder?; rare spring and fall migrant. NTM-O.

**Connecticut Warbler:** Non-annual; non-breeder; rare/casual fall migrant. NTM-O. Has undergone a significant decline in Canada over the last three decades.

**Mourning Warbler:** Annual; possible breeder (breeds in River Lot No. 56 Natural Area); rare spring and fall migrant. NTM-O. Area sensitive. Decreasing.

**Common Yellowthroat:** Annual; breeder; uncommon to fairly common summer visitor; fairly common in fall migration. NTM-O. Some populations have declined significantly over last 30 years.

**Wilson's Warbler:** Annual; non-breeder; rare spring migrant, uncommon to fairly common fall migrant. NTM-O.

**Canada Warbler:** Annual; non-breeder; rare fall migrant. NTM-O.

**Yellow-breasted Chat:** Non-annual; non-breeding; accidental visitor (one record). NTM-O. ?Declining in Alberta.

- **TANAGERS (Thraupidae)**

**Western Tanager:** Annual; possible breeder?; uncommon to rare spring and fall migrant. NTM-O. Old-growth dependent. Declining in parts of North American range.

- **SPARROWS & ALLIES (Emberizidae)**

**American Tree Sparrow:** Annual; non-breeder; uncommon spring and fall migrant. A few birds sometimes over-winter.

**Chipping Sparrow:** Annual; breeder; common summer visitor, fairly common fall migrant. NTM-F. Has declined in Canada over last two decades.

**Clay-colored Sparrow:** Annual; breeder; common in summer and fall. NTM-O. Declining in Canada.

**Vesper Sparrow:** Non-annual; possible breeder (e.g., Penner and Associates Ltd., 1996); uncommon spring and fall migrant. NTM-F. Expanding its range in response to forest clearance/fragmentation.

**Savannah Sparrow:** Annual; breeder; common in summer and fall. NTM-F.

**Le Conte's Sparrow:** Annual; breeder; rare migrant, uncommon in summer.

**Nelson's Sharp-tailed Sparrow:** Non-annual; intermittent breeder; rare visitor when water levels suitable. Decreasing?.

**Fox Sparrow:** Annual; non-breeder; rare migrant, more often seen in fall.

**Song Sparrow:** Annual; breeder; common in summer and fall. Has declined in Canada over last decade.

**Lincoln's Sparrow:** Annual; breeder; fairly common in summer and fall. NTM-O.

**Swamp Sparrow:** Annual; breeder; rare to uncommon in summer and fall. Breeds in wetlands such as one located to south of Riel Lagoon.

**White-throated Sparrow:** Annual; breeder; common in summer and fall. Declining in northern portion of range.

**Harris's Sparrow:** Non-annual; non breeder; rare migrant more often seen in fall. Declining.

**White-crowned Sparrow:** Annual; non-breeder; rare spring migrant, uncommon during fall migration. NTM-F.

**Dark-eyed Junco:** Annual; probable breeder (e.g., in "The Spruce Lot"); uncommon in spring, fairly common in summer and fall. Small numbers regularly over-winter.

**Lapland Longspur:** Annual; non-breeder; uncommon spring and rare fall migrant.

**Snow Bunting:** Annual; non-breeder; fairly common winter visitor, uncommon during spring and fall migration.

- **GROSBEAKS & ALLIES (Cardinalidae)**

**Rose-breasted Grosbeak:** Annual; possible breeder in study area (believed to breed in River Lot No. 56 Natural Area); uncommon in summer and fall. NTM-O. Area sensitive. Some populations declining.

- **BLACKBIRDS, ORIOLES & ALLIES (Icteridae)**

**Bobolink:** Non-annual; non-breeder; casual visitor. Undergoing significant declines over last two decades in Canada. Alberta population in severe decline due to habitat loss.

**Red-winged Blackbird:** Annual; breeder; common. NTM-F. Has declined in Canada over last two decades.

**Western Meadowlark:** Non-annual; non-breeder; rare visitor to study area. NTM-F. Population in province expanding northward and westward in response to forest clearance (Pinel et al., 1993).

**Yellow-headed Blackbird:** Annual; breeder; common. NTM-F. Nests in loose colonies in emergents over deeper water than Red-wingeds. Numbers, 'colony' locations and nesting success very dependent upon water level conditions.

**Rusty Blackbird:** Annual; non-breeder; rare spring and uncommon fall migrant. This species has undergone a precipitous decline (of ca. 90%) over the past three decades (Greenberg and Droege, 1999) whose causes are uncertain.

**Brewer's Blackbird:** Annual; breeder; common. NTM-F. Breeds along Meadowview Drive (DN). North American populations have undergone significant long-term declines.

**Common Grackle:** Annual; breeder; fairly common to common. Returns in mid April (AH). Some populations have declined significantly over last three decades.

**Brown-headed Cowbird:** Annual; breeder; common. NTM-F. Brood parasite. Population and range have expanded dramatically as a result of forest clearance/fragmentation and ubiquity of cattle-raising operations.

**Baltimore Oriole:** Annual; breeder; fairly common. NTM-O. Declining due to loss of wintering habitat and forest clearance on breeding grounds.

- **FINCHES (Fringillidae)**

**Pine Grosbeak:** Annual; non-breeder; common winter visitor, rare in spring and fall. Irruptive.

**Purple Finch:** Annual; breeder; fairly common. Irruptive. Breeds in "The Spruce Lot" (DN). Has undergone significant, long-term declines in Canada (over last three decades).

**Red Crossbill:** Non-annual; non-breeder; rare visitor to study area. Irruptive. Resident in Alberta.

**White-winged Crossbill:** Annual; ?non-breeder; fairly common to rare in winter, uncommon during spring and fall. Irruptive. Resident in Alberta.

**Common Redpoll:** Annual; non-breeder; uncommon to common winter visitor. Irruptive.

**Hoary Redpoll:** Annual; non-breeder; rare winter visitor. Irruptive.

**Pine Siskin:** Annual; ?non-breeder; fairly common in early summer and fall, uncommon in winter. Irruptive. During last decade has declined in Canada.

**American Goldfinch:** Annual; breeder; fairly common in summer and early fall.

**Evening Grosbeak:** Annual; non-breeder; fairly common to uncommon winter visitor. Irruptive. Spruce Budworm predator. Has declined in Canada during each of last three decades.

- **OLD WORLD SPARROWS (Passeridae)**

**House Sparrow:** Annual; breeder; common. Tied to human habitations. Resident. Introduced. Opportunistic cavity nester.

**BIRD FAMILIES COMPRISING THE BIG LAKE CHECKLIST BY THE NABCI CATEGORIES**

| **WATERBIRDS** | **LANDBIRDS** |
|---|---|
| Loons | Hawks and Eagles |
| Grebes | Falcons |
| Pelicans | Grouse and Allies |
| Cormorants | Doves |
| Herons | Cuckoos |
| Rails and Coots | Owls |
| Cranes | Nightjars |
| Gulls, Terns and Jaegers | Hummingbirds |
| | Kingfishers |
| **WATERFOWL** | Woodpeckers |
| Geese, Swans and Ducks | Flycatchers |
| | Shrikes |
| **SHOREBIRDS** | Vireos |
| Plovers | Jays, Crows and Allies |
| Avocets and Stilts | Larks |
| Sandpipers and Allies | Swallows and Martins |
| | Chickadees |
| | Nuthatches |
| | Creepers |
| | Wrens |
| | Kinglets |
| | Bluebirds and Thrushes |
| | Mockingbirds and Thrushers |
| | Starlings |
| | Pipits |
| | Waxwings |
| | Wood-warblers |
| | Tanagers |
| | Sparrows and Allies |
| | Grosbeaks and Allies |
| | Blackbirds, Orioles and Allies |
| | Finches |
| | Old World Sparrows |

## APPENDIX D

## WILDLIFE DATA

**SOURCES:**

Alberta Sustainable Resource Development (ASRD). 2000. The General Status of Alberta Wild Species. Edmonton, AB: Natural Resources Service, Wildlife Management Division 46p.

Alberta Natural History Heritage Information Centre (ANHIC). 2000. *Alberta Tracking List – Vertebrate*s. Alberta Sustainable Resource Development, Edmonton, Alberta.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2001. *Canadian Species at Risk.* Ottawa, Ont. 18pp.

**AMPHIBIAN AND REPTILE SPECIES POTENTIALLY FOUND IN THE VICINITY OF BIG LAKE**

| Reptiles and Amphibians | Scientific Name | Occurrence | Habitat Association | COSEWIC * Updated 2001 | AEP 2000 [1] | ANHIC [2] Provincial Updated 2000 | ANHIC [2] Global Updated 2000 |
|---|---|---|---|---|---|---|---|
| Canadian Toad | *Bufo hemiophrys* | Recorded near Big Lake | Marshes, bogs, wetlands | | May be at Risk | S4, apparently secure | G4, apparently secure |
| Western Toad | *Bufo boreas* | Recorded near Big Lake | Ponds, streams, lakes | | Sensitive | S4, apparently secure | G5, T5, secure, subspecies only |
| Boreal Chorus Frog | *Pseudacris maculata* | Recorded near Big Lake | Ponds, streams, lakes, marshes, bogs, wetlands | | Secure | | |
| Northern Leopard Frog | *Rana pipiens* | Unknown | Ponds, streams, marshes, wetlands | Special Concern | At Risk | S2, S3, few occurrences | G5, secure |
| Wood Frog | *Rana sylvatica* | Recorded near Big Lake | Marshes, bogs, wetlands | | Secure | | |
| Tiger Salamander | *Ambystoma tigrinum* | Unknown | Small lakes, ponds, dugouts | | Secure | S4, apparently secure | G5, secure |
| Red-sided Garter Snake | *Thamnophis sirtalis* | Unknown | Marshes, bogs, wetlands, forest, and farmland | | Sensitive | S3, rare or restricted range | G5, secure |
| Wandering Garter Snake | *Thamnophis elegans* | Unknown | Near streams, lakes, ponds, marshes or ditches | | Sensitive | S3, S4, rare or restricted range, apparently secure | G5, secure |
| Plains Garter Snake | *Thamnophis radix* | Unknown | Near ponds, lakes, streams, marshes, and dugouts | | Sensitive | S4, apparently secure | G5, secure |

**MAMMAL SPECIES POTENTIALLY FOUND IN THE VICINITY OF BIG LAKE**

| Mammal Species | Scientific Name | Occurrence | Habitat Association | COSEWIC * Updated 2001 | AEP 2000 [1] | ANHIC [2] Provincial Updated 2000 | ANHIC [2] Global Updated 2000 |
|---|---|---|---|---|---|---|---|
| Arctic Shrew | *Sorex arcticus* | Recorded near Big Lake | Muskeg, dried sloughs, stream edges | | Secure | | |
| Common Water Shrew | *Sorex palustris* | Unknown | Muskeg, dried sloughs stream and lake edges | | Secure | | |
| Dusky Shrew | *Sorex monticolus* | Unknown | Muskeg, sedge meadows | | Secure | | |
| Masked Shrew | *Sorex cinereus* | Recorded near Big Lake | Forest, shrubland | | Secure | | |
| Pygmy Shrew | *Sorex hoyi* | Unknown | Most habitat types | | Secure | S3, rare or restricted range | G5, secure |
| Big Brown Bat | *Eptesicus fuscus* | Recorded near Big Lake | Open forest | | Secure | S4, S5, apparently secure | G5, secure |
| Silver-haired Bat | *Lasionycteris noctivagans* | Recorded near Big Lake | Open forest | | Secure | S3B, rare or breeding range is restricted | G5, secure |
| Hoary Bat | *Lasiurus cinereus* | Unknown | Open grassy areas in coniferous and deciduous forest | | Secure | S2B, few occurrences or breeding records in few locations | G5, secure |
| Little Brown Bat | *Myotis lucifugus* | Recorded near Big Lake | Most habitat types | | Secure | S5, secure | G5, secure |
| Northern Long-eared Bat | *Myotis septentrionalis* | Unknown | Forested areas associated with water bodies | | May be at Risk | S2, S3, few occurrences | G4, apparently secure |
| White-tailed Jackrabbit | *Lepus townsendii* | Unknown | Open woodlands, grassland | | Secure | | |
| Snowshoe Hare | *Lepus americanus* | Recorded near Big Lake | Coniferous and deciduous forest, dense shrubland | | Secure | | |

| Mammal Species | Scientific Name | Occurrence | Habitat Association | COSEWIC * Updated 2001 | AEP 2000 [1] | ANHIC [2] Provincial Updated 2000 | ANHIC [2] Global Updated 2000 |
|---|---|---|---|---|---|---|---|
| Northern Flying Squirrel | *Glaucomys sabrinus* | Recorded near Big Lake | Mature coniferous and mixed forest | | Secure | | |
| Red Squirrel | *Tamiasciurus hudsonicus* | Unknown | Coniferous and mixed forest | | Secure | | |
| Franklin's Ground Squirrel | *Spermophilus franklinii* | Unknown | | | | | |
| Thirteen-lined Ground Squirrel | *Spermophilus tridecemlineatus* | Unknown | Brushy edges of tallgrass prairie | | Undetermined | | |
| Richardson's Ground Squirrel | *Spermophilus richardsonii* | Unknown | Prairie grassland, meadows, pastures | | Secure | S5, secure | G5, secure |
| Woodchuck | *Marmota monax* | Unknown | Grassy fields adjacent to woodland | | Secure | | |
| Least Chipmunk | *Tamias minimus* | Unknown | Open coniferous and aspen forest | | Secure | | |
| Northern Pocket Gopher | *Thomomys talpoides* | Recorded near Big Lake | Dry grassland areas | | Secure | | |
| American Beaver | *Castor canadensis* | Recorded near Big Lake | Ponds and streams adjacent to woodland | | Secure | | |
| Northern Bog Lemming | *Synaptomys borealis* | Unknown | Bogs, spruce forest | | Secure | | |
| Common Muskrat | *Ondatra zibethicus* | Recorded near Big Lake | Sloughs, lakes, marshes, streams | | Secure | | |
| Meadow Vole | *Microtis pennsylvanicus* | Recorded near Big Lake | Marshes, stream edges, deciduous forest, dense herbaceous shrub | | Secure | | |
| Western Heather Vole | *Phenacomys intermedius* | Unknown | Coniferous forest | | Secure | | |
| Southern Red-backed Vole | *Clethrionomys gapperi* | Recorded near Big Lake | Muskeg, coniferous and aspen forest | | Secure | | |
| Deer Mouse | *Peromyscus maniculatus* | Unknown | Grassland, forest, shrubland | | Secure | | |

| Mammal Species | Scientific Name | Occurrence | Habitat Association | COSEWIC * Updated 2001 | AEP 2000 [1] | ANHIC [2] Provincial Updated 2000 | ANHIC [2] Global Updated 2000 |
|---|---|---|---|---|---|---|---|
| Meadow Jumping Mouse | *Zapus hudsonius* | Recorded near Big Lake | Marsh, shrubland, dense forest | | Secure | | |
| Western Jumping Mouse | *Zapus princeps* | Unknown | Tall grass near streams | | Secure | | |
| Common Porcupine | *Erethizon dorsatum* | Unknown | Open forest | | Secure | | |
| Red Fox | *Vulpes vulpes* | Unknown | Open forest | | Secure | | |
| Coyote | *Canis latrans* | Recorded near Big Lake | Forest, grassland, shrubland | | Secure | | |
| Black Bear | *Ursus americanus* | Unknown | Mixed and deciduous forest | Not at Risk | Secure | | |
| American Badger | *Taxidea taxus* | Unknown | Open grassland and parkland, avoids forested areas | Not at Risk | Sensitive | S4, apparently secure | G5, secure |
| American Mink | *Mustela vison* | Unknown | Streams, ponds | | Secure | | |
| Long-tailed Weasel | *Mustela frenata* | Recorded near Big Lake | Open forest, grassland and agricultural areas | Not at Risk | May be at Risk | | |
| Least Weasel | *Mustela nivalis* | Unknown | Marshes, coniferous forest | | Secure | | |
| Short-tailed Weasel | *Mustela erminea* | Recorded near Big Lake | Coniferous and mixed forest, stream edges | | Secure | | |
| Striped Skunk | *Mephitis mephitis* | Unknown | Stream edges, open forest, shrublands | | Secure | | |
| Canada Lynx | *Lynx canadensis* | Unknown | Coniferous forest | Not at Risk | Sensitive | | |
| Moose | *Alces alces* | Recorded near Big Lake | Coniferous and deciduous forest, shrubland, muskeg, stream edges | | Secure | | |
| White-tailed Deer | *Odocoileus virginianus* | Recorded near Big Lake | Open forest, shrubland, stream edges | | Secure | | |
| Mule Deer | *Odocoileus hemionus* | Unknown | Immature forest, stream edges | | Secure | | |

*** National Status (COSEWIC 2001)**

| | |
|---|---|
| **Endangered** | A species facing imminent extirpation or extinction. |
| **Threatened** | A species likely to become endangered if limiting factors are not reversed. |
| **Special Concern** | A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. |
| **Not at Risk** | A species that has been evaluated and found to be not at risk. |
| **Data Deficient** | A species for which there is insufficient scientific information to support status designation. |

**[1] Provincial Status (Alberta Environment 2000)**

| | |
|---|---|
| **At Risk** | Previously Red (1996), any species known to be 'At Risk' after formal detailed status assessment and designation as 'Endangered' or 'Threatened' in Alberta. |
| **May be At Risk** | Previously Blue (1996), any species that 'May be At Risk' of extinction or extirpation, and is therefore a candidate for detailed risk assessment. |
| **Sensitive** | Previously Yellow (1996), any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk. |
| **Secure** | Previously Green (1996), a species that is not 'At Risk', 'May be At Risk', or 'Sensitive'. |
| **Undetermined** | Previously Status Underdetermined (1996), any species for which insufficient information, knowledge or data is available to reliably evaluate its general status. |
| **Not Assessed** | Any species that has not been examined. |
| **Exotic/Alien** | Any species that has been introduced as a result of human activities. |

**[2] Alberta Natural Heritage Information Centre (ANHIC 2000)**

| **S=Alberta, G=Global** | |
|---|---|
| **S1/G1** | 5 or fewer occurrences or only a few remaining individuals, may be especially vulnerable to extirpation because of some factor of its biology. |
| **S2/G2** | 6-20 or fewer occurrences or with many individuals in fewer locations, may be especially vulnerable to extirpation because of some factor of its biology. |
| **S3/G3** | 21-100 occurrences, may be rare and local throughout it's range, or in a restricted range (may be abundant in some locations), may be susceptible to extirpation because of large scale disturbances. |
| **S4/G4** | Typically > 100 occurrences, apparently secure. |
| **S5/G5** | Typically > 100 occurrences, demonstrably secure. |
| **A** | Accidental or casual in the province, includes species recorded very infrequently, commonly far outside their usual range. |
| **B** | A rank modifier indicating breeding status for a migratory species. |
| **N** | A rank modifier indicating non-breeding status for a migratory species. |
| **Q** | Taxonomic problems involved, more information is needed. |
| **T** | Rank for subspecific taxon (subspecies or variety). |
| **_?** | Rank is questionable. |

## APPENDIX E

## VEGETATION DATA

Tables represent compilation of data from the following sources of information:

- Alberta Environment (2002)
- COSEWIC (2001)
- EMRPC (1987)
- IMC Consulting Group Inc. (1991)
- Kippen Gibbs Landscape Architects Ltd. (1991)
- Pedocan Land Evaluation Ltd. (1999)
- Penner & Associates Ltd. (1990)
- Russell & Spiers (1983?)
- Spencer Environmental Management Services Ltd. (1999)

**WOODY VEGETATION**

| Common Name | Scientific Name | Comments |
|---|---|---|
| Balsam Poplar | *Populus balsamifera* | |
| Beaked Hazelnut | *Corylus cornuta* | |
| Black Spruce | *Picea mariana* | |
| Bracted Honeysuckle | *Lonicera involucrate* | |
| Buckrush | *Symphoricarpos occidentalis* | |
| Bunchberry | **Cornus canadensis** | |
| Canadian Buffaloberry | *Shepherdia canadensis* | |
| Choke Cherry | *Prunus virginiana* | |
| Currant | *Ribes species* | |
| Mountain Cranberry | *Vaccinium vitis idea* | |
| Northern Gooseberry | *Ribes oxyacanthoides* | |
| Paper Birch | *Betula papyrifera* | |
| Pin Cherry | *Prunus pensylvanica* | |
| Pussy Willow | *Salix discolor* | |
| Red Osier Dogwood | *Cornus stolonifera* | Key species for Moose – winter browse |
| River Alder | **Alnus tenuifolia** | |
| Saskatoon | *Amelanchier alnifolia* | |
| Silver Berry | *Elaeagnus commutata* | |
| Small Bog Cranberry | *Oxycoccus microcarpus* | |
| Snowberry | *Symphoricarpos albus* | |
| Tamarack | *Larix laricina* | |
| Trembling Aspen | *Populus tremuloides* | |
| White Spruce | *Picea glauca* | |
| Wild Black Currant | *Ribes hudsonianum* | |
| Wild Rose | *Rosa woodsii* | |
| Willow | *Salix species* | |

**FORBS/SUBMERGENT VEGETATION**

| Common Name | Scientific Name |
|---|---|
| Aster | Aster species |
| Arrow Head | *Sagittaria cuneata* |
| Arrow-leaved Coltsfoot | *Petasites sagittatus* |
| Baltic Rush | *Juncus balticus* |
| Beggarticks | *Bidens cernua* |
| Big Sheath Pondweed | *Potamogeton vaginatus* |
| Cattail | *Typha latifolia* |
| Common Bladderwort | *Utricularia vulgaris* |
| Common Pink Wintergreen | *Pyrola asarifolia* |
| Coontail | *Ceratophyllum demersum* |
| Dewberry | *Rubus pubescens* |
| False Melic | *Schizachne purpurascens* |
| Ferns | *Dryopteris* species |
| Frie's Pondweed | *Potamogeton friesii* |
| Fringed Gentian | *Gentianella crinata* |
| Hardstem Bulrush | *Scirpus acutus* |
| Horned Pondweed | *Zannichellia palustris* |
| Leafy Pondweed | *Potamogeton foliosus* |
| Lesser Wintergreen | *Pyrola minor* |
| Lily-of-the-Valley | *Maianthemum canadense* |
| Little Duckweed | *Lemma minor* |
| Marsh Cinquefoil | *Potentilla palustris* |
| Marsh Marigold | *Caltha palustris* |
| Naked Mitrewort | *Mitella nuda* |
| Northern Bedstraw | *Galium boreale* |
| Northern Bog Bedstraw | *Galium labradoricum* |
| One-flowered Wintergreen | *Moneses uniflora* |
| Palmate-leaved Coltsfoot | *Petasites palmatus* |
| Purple Clematis | *Clematis verticellaris* |
| Ragwort | *Senecio congestus* |
| Reeds | |
| Richardson's Pondweed | *Potamogeton richardsonii* |
| River Bulrush | *Scirpus fluviatile* |
| Sago Pondweed | *Potamogeton pectinatus* |
| Sedges | *Carex species; C. aquatilis, C. aherodes, C. rostrata* |
| Small Bedstraw | *Galium trifidum* |
| Softstem Bulrush | *Scirpus validus* |
| Spike Rush | *Eleocharis species* |
| Star Duckweed | *Lemma trisulca* |
| Starflowered Solomon's Seal | *Smilacina stellata* |
| Starwort | *Callitriche* species |
| Stemless Raspberry | *Rubus acaulis* |
| Sweet Cicely | *Osmorhiza longistylis* |
| Sweet Flag | *Acorus calamus* |

| Common Name | Scientific Name |
|---|---|
| Sweet scented Bedstraw | *Galium triflorum* |
| Tall Lungwort | *Mertensia paniculata* |
| Twin Flower | *Linnaea borealis* |
| Twisted Stalk | *Streptopus amplexifolius* |

**GRASSES**

| Common Name | Scientific Name |
|---|---|
| Alkali Grass | *Puccinellia nuttalliana* |
| Awnless Brome | *Bromus inermis* |
| Bearded Wheatgrass | *Agropyron subsecundum* |
| Bog Muhly | *Muhlenbergia glomerata* |
| Drooping Wood Grass | *Cinna latifolia* |
| Fowl Manna Grass | *Glyceria striata* |
| Foxtail Barley | *Hordeum jubatum* |
| Fringed Brome | *Bromus ciliatus* |
| June Grass | *Koeleria macrantha* |
| Kentucky Bluegrass | *Poa pratense* |
| Marsh Reed Grass | *Calamagrostis canadensis* |
| Needle grasses | *Stipa* species |
| Northern Reed Grass | *Calamagrostis inexpansa* |
| Reed Canary Grass | *Phalaris arundicnacea* |
| Rough Fescue | *Festuca scabrella* |
| Slender Wheatgrass | *Agropyron trachycaulum* |
| Slough Grass | *Beckmannia syzigachne* |
| Tall Manna Grass | *Glyceria grandis* |
| Water Foxtail | *Alopecurus aequalis* |

**WEEDS**

| Common Name | Scientific Name |
|---|---|
| Canada Thistle | *Cirsium arvense* |
| Common Bladderwort | *Utricularia vulgaris* |
| Common Nettle | *Urtica gracilis* |
| Dandelion | *Taraxum officinale* |
| Giant Burreed | *Sparganium eurycarpum* |
| Goosefoot | *Chenopodium* species |
| Horsetail species | *Equisetum* species – *E. fluviatile, pratense* |
| Marestail | *Hippuris vulgaris* |
| Perennial Sowthistle | *Sonchus arvense* |
| Buttercup species | *Ranunculus* species |
| Smartweed | *Polygonum* species |
| Western Dock | *Rumex occidentalis* |

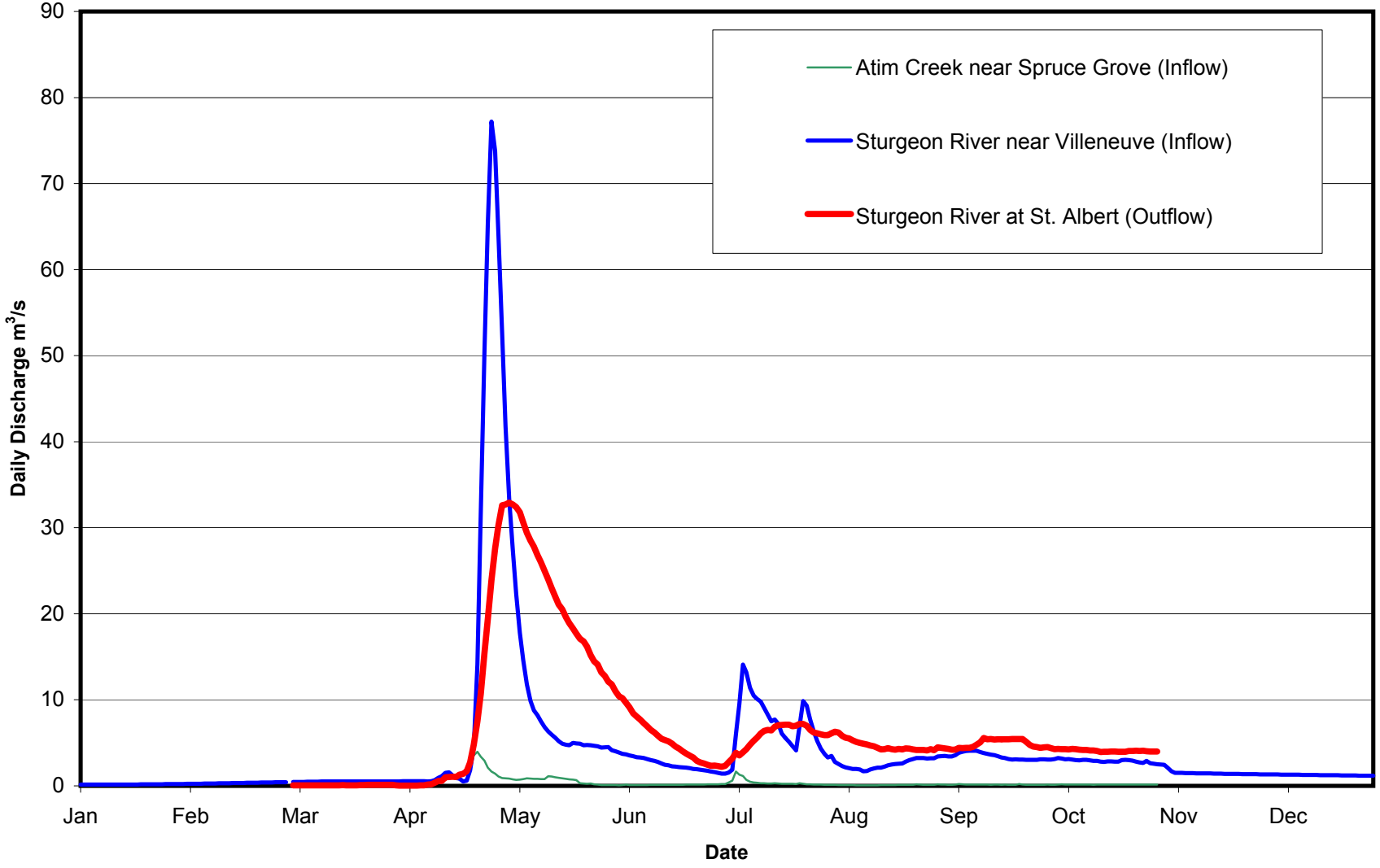
**RARE PLANTS**

| Common Name | Scientific Name | Location Found |
|---|---|---|
| Brachythecium plumosum | *Brachythecium plumosum* | Wagner natural area |
| Campylium polyganum | *Campylium polyganum* | Wagner natural area |
| Campylium radicale | *Campylium radicale* | Wagner natural area |
| Black Woodscript Lichen | *Xylographa parallela* | Wagner natural area |
| Bog Adder's Mouth | *Malaxis paludosa* | Wagner natural area |
| Brown Moss | *Drepanocladus crassicostatus* | |
| Common Naiad | *Naja flexilis* | |
| Flat-topped white aster | Aster umbellatus | Wagner natural |
| Floating-leaf Pondweed | *Potamogeton natans* | Grandin Park pond |
| Lecanora hybocarpa | Lecanora hybocarpa | Wagner natural |
| Lecidea aeruginosa | *Trapeliopsis flexuosa* | |
| Narrow-leaved Chain-teeth Moss | *Desmatodon cernuus* | Wagner natural area |
| Slender Beak Rush | *Rhynchospora capillacea* | Wagner natural area |
| Slender Spike Rush | *Eleocharis tenuis* | Wagner natural area |
| Spotted Joe-pye weed | *Eupatorium maculatum* | |
| Trapeliopsis flexuosa | *Trapeliopsis flexuosa* | |

# APPENDIX F

# HYDROLOGY AND HYDROGEOLOGY DATA

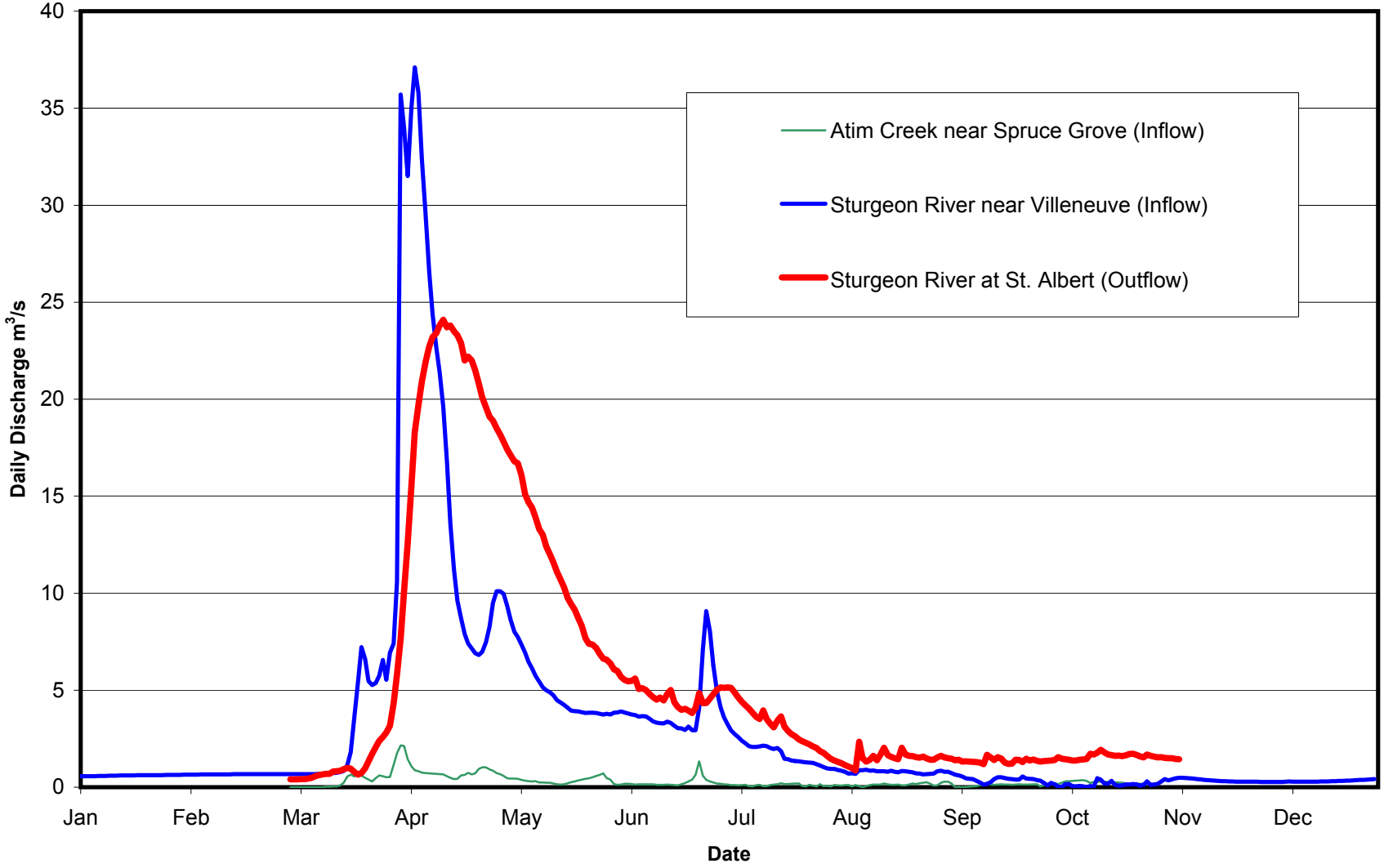
## Big Lake Inflows and Outflow
## Wet Conditions (1982)




SOURCE: AENV 2002
P:\PROJECT\EE\2704\Hydat Analysis\Figures to send.xls\1982

**Figure 1**

## Big Lake Inflows and Outflow
## Average Conditions (1985)




SOURCE: AENV 2002
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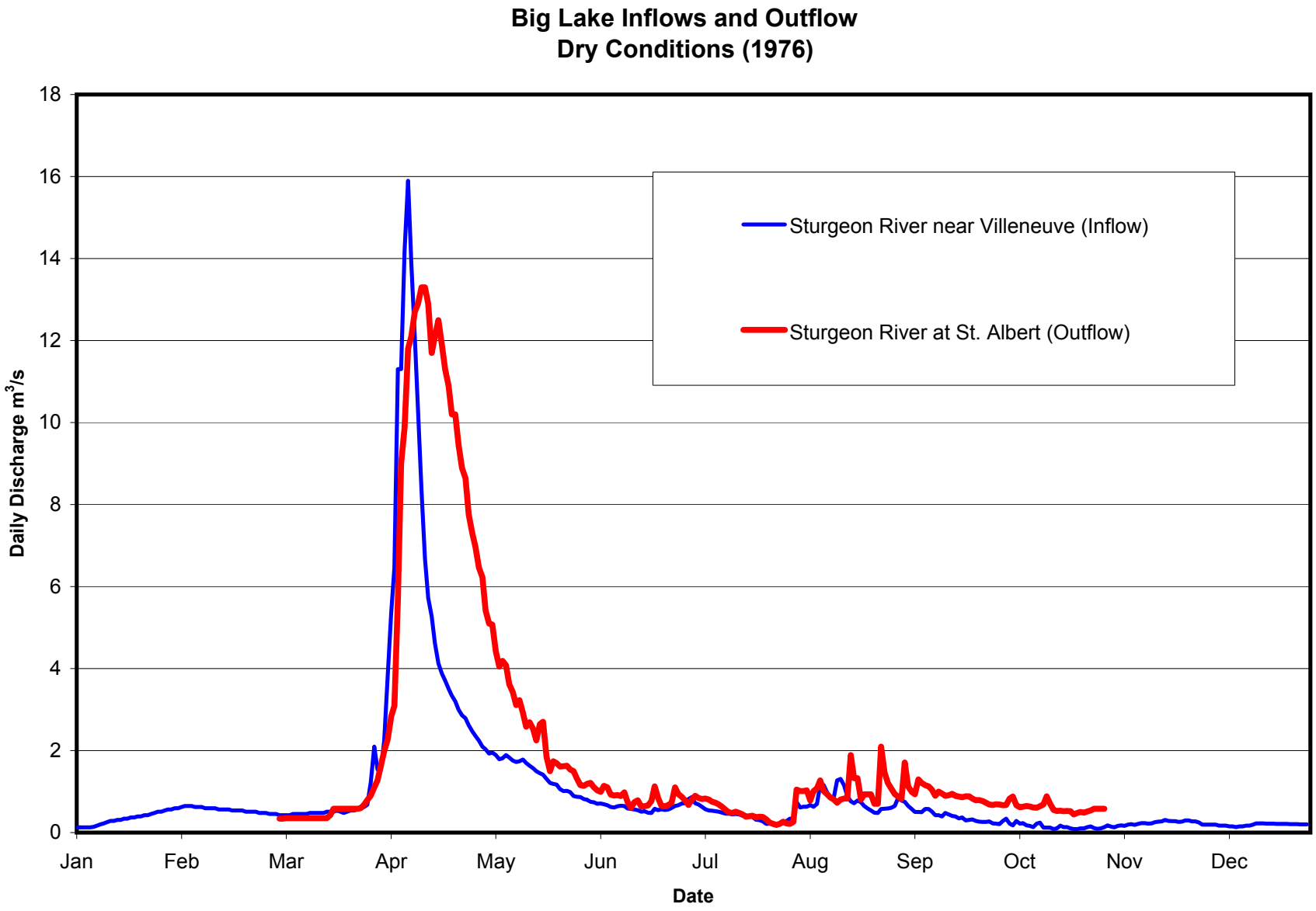
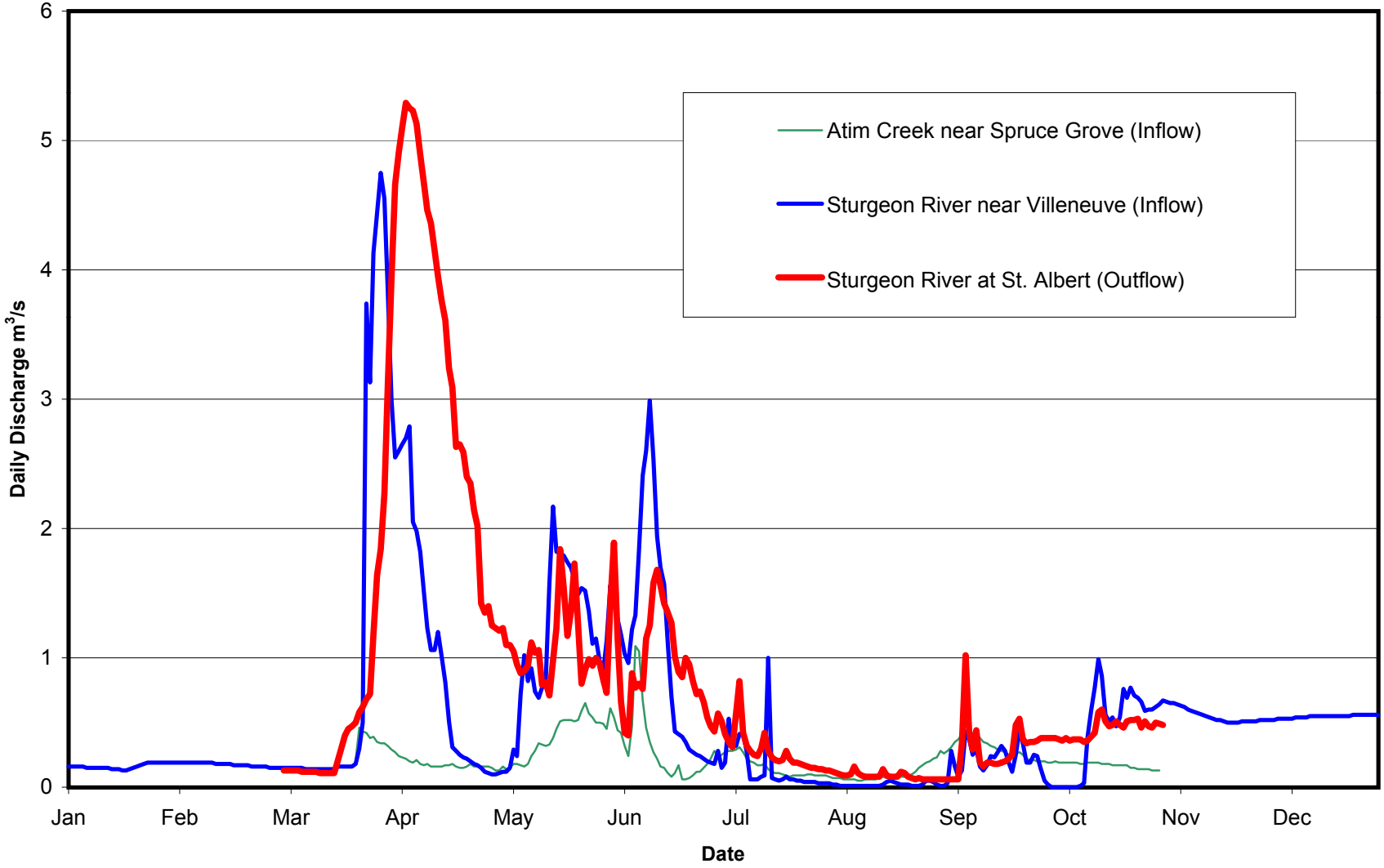
**Figure 2**




SOURCE: AENV 2002
P:\PROJECT\EE\2704\Hydat Analysis\Figures to send.xls\1976

**Figure 3**

## Big Lake Inflows and Outflow
## Very Dry Conditions (1984)




SOURCE: AENV 2002
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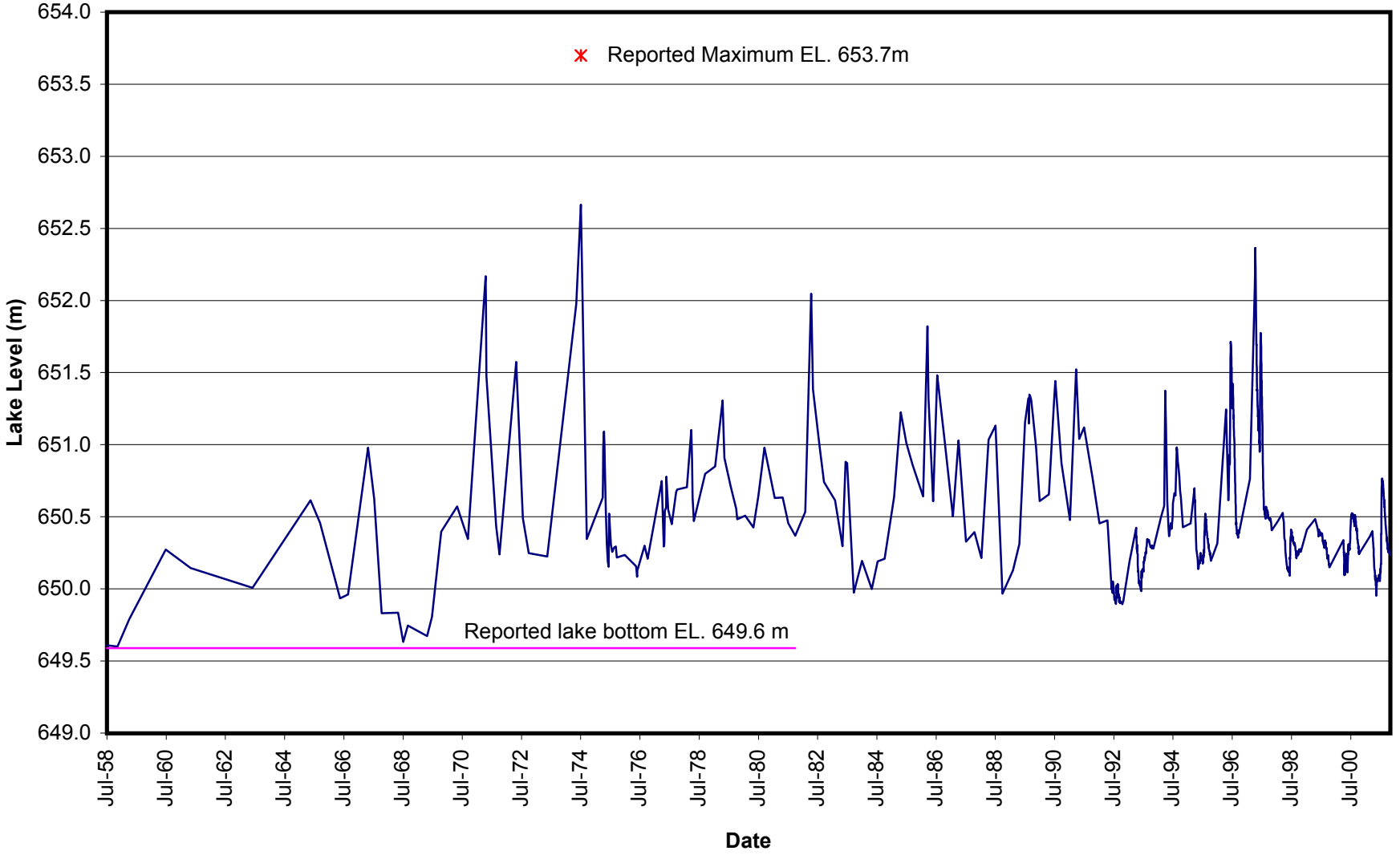
**Figure 4**

## Big Lake near St. Albert (1958-2001)




P:\PROJECT\EE\27024\Hydat Analysis\
05ea902 level plot

**Figure 5**

# APPENDIX G

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