

MOOSE LAKE WATERSHED MANAGEMENT PLAN DRAFT



PREPARED FOR:
THE MOOSE LAKE *WATER FOR LIFE* COMMITTEE
BONNYVILLE, ALBERTA

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1.0 Table of Contents

1.0 Table of Contents.....	2
2.0 Executive Summary	3
3.0 Introduction	4
3.1 Background Information	4
3.2 Vision and Mandate of the Moose Lake Water for Life Committee	5
3.3 Scope of the Watershed Management Plan	5
3.4 Goals of the Watershed Management Plan	7
3.5 Watershed Management Plan Objectives.....	7
3.6 Authority	9
3.7 Public Consultation	9
3.8 Timelines and Schedule for Review.....	11
3.9 Concurrent Planning Initiatives	11
4.0 Site Description.....	11
5.0 Watershed Management Plan Implementation and Accountability.....	12
6.0 Watershed Issues and Their Resolution	13
6.1 Quality of the Drinking Water Source – Monitoring and Awareness	13
6.2 Algae Growth in Moose Lake	15
6.3 Quality of Seasonal Runoff Water Entering Moose Lake.....	16
6.4 Function of Private Sewage Systems	17
6.5 Increase Regulatory Support and Control of Contaminants (Sewage, Hazardous Chemicals and Nutrients) Entering the Lake.....	18
6.6 Decline in Fish Stocks.....	20
6.7 Riparian Areas and Environmental Reserves	21
6.8 Wetlands	23
6.9 Overall Recommendations.....	24
7.0 Conclusions	25
8.0 Glossary	26
9.0 Literature Cited	27
10.0 Appendix A: Approved Terms of Reference	28

2.0 Executive Summary

Residents and lake users have long been concerned about the environmental quality of Moose Lake. Past concerns have included algal blooms, weed growth, boating speed and noise, water quality, poor fishing, excessive crowds and excessive development. Many of these same concerns still exist today. The Moose Lake *Water for Life* Committee, along with Alberta Environment and several other stakeholders, have been working together since 2004 to create this Watershed Management Plan.

The goals of the Watershed Management Plan are as follows:

- A. Improve water quality in the Moose Lake Watershed to pre-development conditions.
- B. Improve wildlife and fish habitat and the overall aquatic environment, in conjunction with improving riparian health, wetland management, and overall Watershed health.
- C. Increase public awareness and engagement of land stewardship activities.
- D. Incorporation of the Watershed Management Plan recommendations into Town, Municipal District and Summer Village planning documents, encourage compliance with guidelines and Best Management Practices, and enforce legislated requirements found in these important documents.

Implementation of this plan and the recommendations contained herein will assist in future land use and management planning decisions within the Moose Lake Watershed and ultimately help to improve the health of the lake and its surrounding environment for all residents and users.

3.0 Introduction

3.1 Background Information

Members of the local community and recreational users of Moose Lake are concerned about low water levels, source water protection, frequent algal blooms, and environmental degradation resulting from increased development around the lakeshore. These concerns have led to the formation of the *Moose Lake Water for Life Committee*. The goals of the committee have been to 1) determine the causes of the decline in the environmental quality of the lake and its Watershed and 2) develop a Watershed Management Plan for the Moose Lake Watershed. The resulting plan discusses the current state of the knowledge of several issues identified through public consultation and also recommends specific actions for stakeholders to undertake to ensure the long term health of the water resources and the economic sustainability of the surrounding communities. These recommendations include the development of education and awareness programs, development of community based Watershed management tools, a review of enabling legislation to aid Watershed groups, and development of monitoring and performance measurements.

The Moose Lake Water for Life Committee is comprised of stakeholders and representatives from the M.D. of Bonnyville, Town of Bonnyville, Summer Villages of Bonnyville Beach and Pelican Narrows, and local community members. Technical assistance is provided by several project partners from regulatory agencies and non-government organizations including: Alberta Environment, Alberta Sustainable Development, Alberta Community Development (Provincial Parks), Ducks Unlimited Canada and Aquality Environmental Consulting Ltd.

Water is a resource that is managed for both quality and quantity. Conservation and management of water in Alberta is legislated under the provincial *Water Act* and other legislation. Sustainable management of water and the development of water management plans are guided by Alberta Environment and *The Framework for Water Management Planning* (AENV, 1999). Earlier planning activities focused on land development planning and subdivision of land (Provincial Planning, 1972; Runge, 1977; Alberta Municipal Affairs, 1985). The current planning approach is on a watershed scale and takes an integrated approach to resource management based on Watershed boundaries and not on jurisdictional boundaries. A watershed approach takes into account the influence of land use activities on water quality and quantity. A Watershed Management Plan is inclusive of all activities that potentially has an impact on the aquatic environment.

The first step in the Moose Lake planning process was to develop a comprehensive Terms of Reference to detail the goals and objectives of the new plan. The development of this plan was led by the Moose Lake Water for Life Committee and was guided by the *Framework for Water Management Planning* (Alberta Environment, 1999). Under the Terms of Reference for the Plan, technical sub-committees were formed to address the major issues of *i*) water quality and land use and *ii*) aquatic resources (fisheries, wildlife, riparian habitat and wetlands). These sub-committees were formed to conduct additional studies and gather information, coordinate with on-going regional studies, and provide recommendations and reports to the Moose Lake Watershed Management Committee.

The Terms of Reference was approved by Alberta Environment and the M. D. of Bonnyville in November 2004 (Appendix A). Following this approval, the Water for Life Committee completed

The State of the Watershed Environmental Inventory Report for Moose Lake in May of 2005 (AQUALITY, 2005a). The purpose of the State of the Environment Report was to document and summarize all available information on the Moose Lake Watershed, including land use. The report was structured to complement the Terms of Reference and to provide a basis from which the final Moose Lake Watershed Management Plan would draw its recommendations.

3.2 Vision and Mandate of the Moose Lake Water for Life Committee

Vision

To maintain a healthy and functioning Moose Lake Watershed and recognize the importance of living within the capacity of the natural environment as a means of ensuring sustainable environmental, economic and social values.

Mandate

We plan to achieve our vision by bringing together lake users, scientists, agricultural producers, government, industry, special interest groups and the general public. Through implementation of various management strategies, this group will strive to identify problems and implement corrective actions in order to restore and enhance Moose Lake and the Watershed area.

3.3 Scope of the Watershed Management Plan

The planning area is outlined in Figure 1. The plan addresses issues and concerns identified in the Terms of Reference such as:

- Land use practices that may affect the waters of Moose Lake.
- Algal growth in the lake.
- Quality of drinking water.
- Quality of seasonal run-off water entering Moose Lake.
- Malfunction of private sewage systems.
- Contaminants entering the lake.
- Decline in fish stocks.
- Disturbance of riparian areas and upland areas.
- Loss and degradation of wetlands and their functions in the Watershed.

3.4 Goals of the Watershed Management Plan

- a. Improve water quality in the Moose Lake Watershed to pre-development conditions by reducing nutrient and other pollutant loads into water bodies and improving riparian health throughout the Watershed.
- b. Improve wildlife and fish habitat and the overall aquatic environment, in conjunction with improving riparian health, providing wetland management, and protect Watershed health.
- c. Increase public awareness and engagement of land stewardship activities by providing information on the impacts of land use/development practices on water quality and wildlife habitat, and promoting best management practices that can minimize or compensate for those impacts.
- d. Incorporate our Watershed Management Plan recommendations into Town, Summer Village and Municipal District Land Use Bylaws, Municipal Development Plans and other planning documents, encourage compliance with guidelines and Best Management Practices, and enforce compliance with legislated requirements found in these important documents.

3.5 Watershed Management Plan Objectives

A Watershed Management Plan (WMP) is a place-based, comprehensive tool that Watershed groups, along with municipalities and other entities, can use to achieve their stewardship goals. An approved WMP is used by government and other resource decision makers as a reference when making decisions that impact water within that Watershed. This process has been formalized by the Government of Alberta in the *Framework for Water Management Planning (2001)* in a shared approach to Watershed planning. As the regulator, Alberta Environment is responsible for approving WMPs in Alberta.

Plans may either be approved by Cabinet, or by a regional director, depending on the needs within the plan. Alberta Environment will approve a WMP if the proponent adequately presents: (a) a summary of the issues considered, (b) a description of the area in which the WMP applies, (c) a summary of the information assembled as part of the planning process, (d) the relationship of the WMP to regional strategies or other planning initiatives (e) the recommended options and strategies to address the issues and (f) a list of performance monitoring requirements.

Our Watershed Management Plan objectives are:

a. Water Quality, Wetlands and Riparian Area Protection

Identify restoration targets by:

- Determining a baseline of pre-development (i.e. 1900) or historical water quality in lakes in the Watershed (Moose and Kehewin) using palaeolimnological techniques, to be used as future water quality targets.
- Establish sources of nutrients in all major water bodies in the Watershed. Rank and prioritize subcatchment areas of highest nutrient loading for remediation. Determine a performance indicator for performance monitoring.

- Identify and protect the areas of historic wetland and riparian habitat losses.
- Develop techniques and implementation plans to reduce nutrient loading and restore or reclaim damaged or lost riparian and wetland areas, for the restoration of their wildlife and fish habitats, buffers against flooding, filters of silt and nutrients, and other ecosystem functions.
- *Performance indicators:* report on historical water quality in Moose Lake, nutrient budget model.
- *Performance indicators:* a drained wetland inventory; a disturbed riparian habitat inventory; no further loss or disturbance of existing 2006 riparian and wetland habitats; development of a toolbox of riparian and wetland restoration techniques; an implementation plan for the progressive reduction of nutrient loading and restoration of lost/damaged wetlands and riparian areas in the Watershed; implementation of these.

b. Integration

- Identify the needs of the Municipality, Town and Summer Villages, and incorporate them into the Watershed Management Plan data gathering process so that our planning efforts will be integrated into the municipal planning process.
- All participants work with the Town, M.D., Summer Villages and Province to integrate this plan with their existing and future planning documents for private and Crown land.
- All participants ensure that implemented policies and land use practices (i) protect soils and vegetation in wetland and riparian areas, (ii) apply the “no net loss” of wetland and riparian area “values” for any activities or developments that have the potential to negatively impact existing or historic wetlands or riparian areas, and (iii) encourage best management practices for activities on upland areas that have potential to produce silt- or nutrient-laden runoff into flowing or standing waters of the Watershed.
- *Performance indicators:* a readily accessible bank of watershed-related resources for participants to consult; existing Provincial, Municipal and Summer Village Plans updated (Municipal Development Plan, Area Structure Plan, and Land Use Bylaws), and that the recommendations of this Plan are incorporated into future plans; wetland and riparian habitats are not disturbed or lost; and fewer upland areas contribute silt or nutrients to standing and flowing waters.

c. Public Education & Outreach

- Undertake public outreach and education using a comprehensive communication strategy to identify land stewardship practices that promote healthy and functional ecosystems, including wetlands, streams, and riparian areas.
- Ensure knowledge of and compliance with all regulations, guidelines and best management practices regarding management of shorelines, residential and agricultural lands, runoff, sewage, pesticides, herbicides and industrial chemicals.

- *Performance indicators:* Active websites, number of newsletters mailed, number of articles in local newspapers.

3.6 Authority

Human activities that affect the health of any watershed in Alberta are governed by a variety of Acts and Regulations (Table 1). The authority of these Acts and Regulations, when properly implemented and enforced, will support Moose Lake Watershed Management Plan goals.

3.7 Public Consultation

The development of a Watershed Management Plan must include public consultation to identify local issues, generate support and maintain constructive dialogue with stakeholders and residents within the Watershed. Watershed management is an adaptive process and must have broad support from the local communities to be successful.

The Moose Lake Water for Life Committee represents all relevant stakeholders in the Watershed as required under the *Framework for Water Management Planning*. First Nations and the County of St. Paul were not able to play an active role in the process, but requested regular updates from the committee.

The Moose Lake Water for Life Committee held a public meeting in the spring of 2003 to identify issues for the Terms of Reference. Information gathered at this meeting was included into a draft Moose Lake Watershed Management Plan Terms of Reference (ToR). This ToR was subsequently presented at a June 2003 public meeting. During this public meeting, other presentations from project partners including overview and background information about Moose Lake, were shared with an audience of 80 citizens. Comments on the draft Terms of Reference were incorporated into a final version, which was approved by Alberta Environment in November 2004.

In May of 2005, the Moose Lake Water for Life Committee facilitated a Watershed Management Plan Workshop with public officials and representatives to address any questions about the Water for Life Committee activities. In June 2005, the Committee held a one-day, public "Moose Lake Eco Day" to raise public awareness of the health of Moose Lake, discuss the Moose Lake Watershed Plan Terms of Reference and present the State of the Watershed Environmental Inventory Report.

Further public consultation is planned in 2006, when the draft Watershed Management Plan is expected to be completed.

Table 1: Legislation and policy involving water and watershed management.

Legislation/Policy	Description
Federal <i>Fisheries Act</i> - Department of Fisheries and Oceans Canada (DFO)	Regulates and enforces on harmful alteration, disruption and destruction of fish habitat in Section 35.
Provincial <i>Water Act</i> – Alberta Environment (AENV)	Governs the diversion, allocation and use of water. regulates and enforces actions that affect water and water use management, the aquatic environment, fish habitat protection practices, in-stream construction practices, storm water management.
Provincial <i>Environmental Protection and Enhancement Act (EPEA)</i> – AENV	Management of contaminated sites, storage tanks, landfill management practices, hazardous waste management practices and enforcement.
Provincial <i>Agricultural Operations Practices Act (AOPA)</i> – Natural Resources Conservation Board (NRCB)	Regulates and enforces on confined feedlot operation and environment standards for livestock operations.
Provincial <i>Municipal Government Act (MGA)</i> – Municipal Affairs	Provides municipalities with authorities to regulate water on municipal lands, management of private land to control non-point sources, and authority to ensure that land use practices are compatible with the protection of aquatic environment.
Provincial <i>Public Lands Act - Sustainable Resource Development (SRD)</i>	Regulates and enforces on activities that affect Crown-owned beds and shores of water bodies and some Crown-owned uplands that may affect nearby water bodies.
Provincial <i>Safety Codes Act</i> - Municipal Affairs	Regulates and enforces septic system management practices, including installation of septic field and other subsurface disposal systems.
<i>Regional Health Authorities Act</i> – Alberta Health	RHA have the mandate to promote and protect the health of the population in the region and may respond to concerns that may adversely affect surface and groundwater.
<i>Wildlife Act</i> - SRD	Regulates and enforces on protection of wetland-dependent and wetland-associated wildlife, and endangered species (including plants).
<i>Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act</i> – SRD and Community Development	Both Acts can be used to minimize the harmful effects of land use activities on water quality and aquatic resources in and adjacent to parks and other protected areas.
Provincial Wetlands Policy (expected September 2006)	This policy will be used to protect wetlands and mitigate losses through a No Net Loss policy.
Land Use Bylaws (Municipal)	The bylaw that divides the municipality into land use districts and establishes procedures for processing and deciding upon development applications. It sets out rules that affect how each parcel of land can be used and developed and includes a zoning map.
Area Structure Plans (Municipal)	Adopted by Council as a bylaw pursuant to the Municipal Government Act that provides a framework for future subdivisions, development, and other land use practices of an area, usually surrounding a lake.
Municipal Development Plans	The plan adopted by Council as a municipal development plan pursuant to the Municipal Government Act.

3.8 Timelines and Schedule for Review

2004	Work begins on the State of the Watershed Report
2005	May - the State of the Watershed Environmental Inventory Report for Moose Lake is complete May – Workshop with elected officials and representatives June – Host Moose Lake Eco Day to raise public awareness and present approved ToR and State of the Watershed Report
2006	May – Completion of draft Moose Lake Watershed Management Plan June -- Approval of the Plan by Alberta Environment
2007	Plan implementation, and 5-year incremental plan review

3.9 Concurrent Planning Initiatives

The Cold Lake - Beaver River planning area is part of the Cold Lake River Basin located in Alberta that drains to the outlet of Cold Lake. It also includes the Lower Beaver River Basin that drains to the Alberta / Saskatchewan border, including the Moose Lake Watershed. Currently, Alberta Environment, in partnership with the Cold Lake-Beaver River Basin Advisory Committee and the Lakeland Industry and Community Association (LICA), are working towards updating the 1985 Water Management Plan for the Cold Lake – Beaver River planning area. The study area focuses on the eastern portion of the Cold Lake – Beaver River Basin where industrial activity, municipal demands and land use activities are generally more concentrated, and where stakeholders have identified concerns with surface water and groundwater resources.

The updated plan will include recommendations under three main themes – water supply and demand, water quality (surface and groundwater), and a strategy for the protection of aquatic resources (AENV, 2006). An outcome of the revised plan will include a strategy to meet current and future water needs while living within the capacity of the basin. The plan will be used by Alberta Environment and its partners to make informed management decisions for water use and demand, protection of water quality and protection of aquatic resources in the Cold Lake – Beaver River Basin.

Integrating information from ongoing planning initiatives within the larger Cold Lake - Beaver River Watershed will harmonize both planning documents and create a collaborative environment. Linking the Moose Lake Watershed Management Plan to the larger planning initiative will also provide additional justification to carry out approved activities within this Watershed Management Plan. The Moose Lake Watershed is one of 8 sub-basins of the Cold Lake – Beaver River Basin.

4.0 Site Description

The Moose Lake Watershed is within the Boreal Transition Ecozone and is part of the Boreal Plain Ecozone of western Canada (Environment Canada, 1996). Mean annual temperature measured is 1.5°C, with a mean annual precipitation value of 432.9 mm. The Moose Lake Watershed covers about 40.8 km² and drains a gross area of 755 km² (excluding the lake). The main surface water inflow to Moose Lake is the Thinlake River which drains approximately 75%

of the entire catchment (Runge, 1977). Five intermittent streams drain the remaining 25% of the catchment. The outflow of Moose Lake is the Mooselake River, located in the same bay as the predominant inflow, which potentially increases the residence time of Moose Lake beyond the suggested 7.5 years (Mitchell & Prepas, 1990).

The water level of Moose Lake is controlled by a weir located on the Mooselake River. Water levels in Moose Lake have decreased by only approximately 1 metre since 1980 (Alberta Environment, 2004). Water withdrawal from Moose Lake for the Town of Bonnyville would equate to approximately 0.08m of depth annually if the entire allocation was extracted (Aquality, 2005a). There is a net input of groundwater to Moose Lake over the long-term but contributions on a monthly basis are relatively small (CLBR Technical Team, 2004a). Land within the Watershed is a mixture of both Crown and privately owned (Runge, 1977). Disturbance within the Watershed is predominantly categorized as agricultural and urban development. One of the most important sources of impact on the lake arises from urban and cottage development.

On the shores of Moose Lake, current population statistics indicate that in the M.D. of Bonnyville there are 8,399 people, in the Summer Village of Pelican Narrows there are 112 properties (35 units on 32 hectares) and in the Summer Village of Bonnyville Beach there are 74 properties (24 units on 13 hectares) (Alberta Municipal Affairs, 2004). For more detailed information refer to the *State of the Watershed Environmental Inventory Report for Moose Lake* (Aquality, 2005a).

5.0 Watershed Management Plan Implementation and Accountability

This management plan will not succeed until plan recommendations are implemented, and the plan will not be effective unless the tasks identified are performed and an accountability process is established and adhered to. For the purposes of this plan, Short Term Recommendations will be completed within three years of implementation of this plan, while Long Term Recommendations will likely take more than three years to complete. Improved coordination and partnership with provincial and municipal government departments will be realized through the implementation of this plan. Councils, planners and administration from the Town of Bonnyville, the M.D. of Bonnyville, the S.V.'s of Bonnyville Beach and Pelican Narrows, and the provincial government must publicly endorse, support, and enforce this plan in order to ensure its success.

Short Term Recommendations

- As a Watershed Stewardship Group partner under the Provincial Water Strategy, the Moose Lake Water for Life Committee could register as a non-profit society for additional funding opportunities.
- A partnership agreement (or partnering agreements) should be developed with provincial, federal and local government agencies and conservation groups to assist with the implementation of the Moose Lake Watershed Plan.
- There should be ongoing communication and collaboration with non-profit environmental groups, Lakeland Industry and Community Associations (LICA), community groups, landowners and agriculture producers to address the issues identified in the plan.
- The Moose Lake *Water for Life* Committee should participate on the Cold Lake-Beaver River Watershed Planning and Advisory Committee (WPAC), which has been proposed

under the Provincial Water Strategy.

Long Term Recommendations

- The Committee should provide an annual progress report on implementation of the Watershed Management Plan.
- A comprehensive review of the plan should be conducted at intervals of five years or as is reasonably appropriate.

Performance Measures

- Moose Lake *Water for Life* registered as non-profit society.
- Completion of annual reports and presentation of these reports to the respective councils involved.
- Minimum of one open house open to the public per year.
- Number of partnerships and collaborations with other resource agencies.
- Number of reviews and revisions completed.
- Moose Lake Committee representation on the Cold-Lake Beaver River WPAC.

6.0 Watershed Issues and Their Resolution

6.1 Quality of the Drinking Water Source – Monitoring and Awareness

Due to exceptionally dry climatic conditions over the past two decades, Moose Lake has become concentrated with salts. While most indicators of water fertility have not changed over the past 20 years (except for decreasing nitrate/nitrite concentrations), total nitrogen and phosphorus concentrations often surpass Canadian Council of Ministers of Environment (CCME) Surface Water Quality Guidelines for the Protection of Aquatic Life (PAL). Of the three bays on Moose Lake, Franchere Bay is the most fertile while Vezeau Bay near the Town of Bonnyville raw water intake, is the least fertile. A water quality study in the summer of 2003 found that Franchere Bay had high concentrations of the algal toxin microcystin. Oxygen concentrations there were often below CCME Guidelines at depths greater than 10m. This may indicate reduced flushing of lake water in Vezeau Bay as compared to other reaches of the lake.

A septic leachate survey was conducted on Moose Lake in the early 1990's and found that nutrient concentrations were within background conditions except for two sites near creeks that drain agricultural areas. Elevated nutrients and bacteria in that study could not be linked exclusively to leaking septic systems or to agricultural runoff.

Short Term Recommendations

- Develop a water quality monitoring program for Moose Lake to establish a nutrient budget for phosphorus. Restoration efforts will track how much phosphorus levels in the lake and inflows decrease over time.
- Establish a permanent working relationship with the Aspen Regional Health Authority to ensure routine bacteria sampling is undertaken at all public use sites throughout the open water season.
- A palaeolimnological study should be conducted which will provide a historical record of the changes Moose Lake has experienced. This information will provide a clearer appreciation of natural and man made changes in the water quality of Moose Lake, enabling the establishment of reasonable water quality and restoration goals.

Long Term Recommendations

- Groundwater mapping should be performed in order to determine critical recharge and discharge areas in the Watershed. Sensitive recharge areas could then be integrated into land use planning ensuring high risk activities are directed away from sensitive areas to reduce the possibility of groundwater contamination. The groundwater quality assessment that has been performed by the Cold Lake – Beaver River Technical Team in 2004 should be consulted in order to determine if any aquifers or groundwater discharge areas are currently contaminated and if there is potential for contaminant release into Moose Lake.

Performance Measures

- The design and subsequent implementation of a long term water quality monitoring program designed for source waters to measure TP, coliforms and other parameters of interest to source waters.
- Performance measurements for source water quality issues including algal growth, functioning of private sewage systems, and contaminants entering the lake will be integrated, optimizing the water quality monitoring program.
- The number of phone calls received at the local inquiry number regarding concerns about source water quality with a goal to decrease/eliminate calls.
- The Moose Lake Eco Days event is held and well attended.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for quality of the source of drinking water:

- *Water Act (AENV)*
- *Environmental Protection and Enhancement Act (AENV)*
- *Safety Codes Act (Municipal Affairs)*
- *Regional Health Authorities Act (Alberta Health)*

6.2 Algae Growth in Moose Lake

Moose Lake is a eutrophic (nutrient-rich) water body. Nutrients in the lake come from internal and external sources; excessive nutrients can lead to blue-green algal blooms and low oxygen concentrations. A recent water quality study found that nutrient levels varied between sample sites, leading to localized “hot spots” of algae blooms. This was the case in 2003 where recorded elevated nutrient levels in Franchere Bay led to a very high detection of microcystin, a potent toxin produced by a form of blue green algae. Since phosphorus constrains growth of most organisms in lakes, including algae, even a slight increase of phosphorus in a lake can promote algal blooms causing the water to turn green in the summer and impair recreational and other uses. To retain the existing water quality, or improve it, a number of activities are required to reduce algae growth by reducing nutrient inputs.

Long Term Recommendations

- Consider a sewage collection system for cottages around the lake to tap into the Town of Bonnyville treatment plant.
- Develop a nutrient budget for Moose Lake and all other major water bodies in the Watershed to identify and quantify the source of nutrient inputs from tributaries, sewage effluent and internal loadings.
- Explore the potential for large-scale restoration efforts. In many Alberta lakes, internal loading has been identified as the major source of phosphorus to the water column. At Pine Lake, a large-scale restoration using a hypolimnetic withdrawal technique was successfully used to remove phosphorus-rich deep water and has significantly decreased nutrient levels in the lake.

Performance Measures

- Identification and removal of point sources of phosphorus.
- Increasing secchi disk water transparency that leads to a decrease in algal bloom frequency or severity, based on water quality management, public education and remediation efforts.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for control of algal growth in the lake:

- *Water Act* (AENV)
- *Environmental Protection and Enhancement Act* (AENV)
- *Safety Codes Act* (Municipal Affairs)
- *Regional Health Authorities Act*
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.3 Quality of Seasonal Runoff Water Entering Moose Lake

Moose Lake receives runoff from nearby agricultural lands and local road systems which carries nutrients, organic matter, pesticides, metals and other compounds that can be detrimental to lake water quality. Runoff is highest in spring after snow melt and during high rain fall events.

Short Term Recommendations

- Change Land Use Bylaws to include riparian setbacks, minimum septic system standards, and storm water management plans for all developments near water bodies and other sensitive areas.
- Identify point sources of contamination within the Watershed that are problems and remediate them.
- Retain existing wetlands in the Watershed and manage them so that they remain functional. Only functional wetlands can provide valuable natural environmental services, such as water treatment of runoff water before water enters the lake, flood mitigation during high runoff events and water storage during drought conditions.
- Implement best management practices for agricultural fertilizer and pesticide use, cattle watering and manure management. Environmental Farm Planning (www.albertaefp.com) initiatives will be promoted by the Town and Municipality to local area producers by hosting and supporting public outreach and education sessions.

Long Term Recommendations

- Implement a storm water master plan for the Town and the M.D.
- Consider diversion or treat nutrient sources to Moose Lake with diversions or other treatment methods such as constructed wetlands, infiltration, decreasing impervious surfaces, or grit and oil separation.
- Implement and encourage best management practices for landowners to improve runoff quality including, guidelines for residential application of pesticides and fertilizers, waste management procedures, or bylaws discouraging vegetation removal from environmentally sensitive areas.
- Any new developments or roadways should have storm water best management practices in place to promote retention and/or infiltration.
- Track land cover and land use changes within the Watershed.

Performance Measures

- Identification and quantification of point sources of pollution in the Watershed.
- Improvements in water quality indicators as measured in the monitoring program.
- Increase in numbers of wetlands or no net loss of wetlands.

- Wetlands restored in areas that are critical to preserving the water quality in Moose Lake.
- Number of public outreach and education sessions held, and attendance numbers at these sessions.
- Number of successfully implemented Environmental Farm Plans.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for this issue:

- *Water Act* (AENV)
- *Fisheries Act* (DFO)
- *Agricultural Operations Practice Act* (AOPA)
- *Municipal Government Act* (MGA)
- *Safety Codes Act* (Municipal Affairs)
- *Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act*
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.4 Function of Private Sewage Systems

The residential subdivisions around the lake are not on a regional sewage disposal system. Individual lots have private sewage disposal systems, which can vary from holding tank systems to in-ground tile systems. It is important to ensure that these systems are not leaching into the lake and elevating nutrient levels or creating health hazards for water users. Nutrients contributed by septic systems are in a biologically available form that is immediately available for use by algae and plants.

Caffeine sampling in Moose Lake was performed in 2004 and 2005 by AQUALITY Environmental Consulting Ltd. (2005b). Caffeine was not detected at appreciable levels in either year, which suggests one of four things: (i) there is currently no raw human sewage entering the tested inflows, (ii) caffeine had naturally degraded below detection limits, (iii) detection limits were not sensitive enough to detect diluted caffeine levels; or (iv) caffeine was not present in the sewage (i.e. sewage had been partially treated). Even though current detection levels are in the order of 20 parts per billion, possible caffeine concentrations at these locations may be diluted beyond the detection levels of our current analytical method.

Short Term Recommendations

- Education and awareness programs and incentives aimed at enticing people to change their septic systems.
- Alberta Health and Wellness should partner with the Watershed group to create a long term strategy for sewage management including regular testing for sewage to identify and quantify sewage inputs into the lake.

Long Term Recommendations

- Set minimum standards and guidelines for any installation of new sewage disposal systems around the lake as an interim solution until a regional system can be implemented. Distribute this information to cottagers.

Performance Measures

- Develop and implement bylaws or regulations regarding minimum engineering standards for new and existing septic systems, changes to the Land Use Bylaws, Area Structure Plans, Municipal Development Plans and other planning documents.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for this issue:

- *Water Act* (AENV)
- *Environmental Protection and Enhancement Act* (AENV)
- *Municipal Government Act* (MGA)
- *Safety Codes Act* (Municipal Affairs)
- *Public Lands Act* (SRD)
- *Regional Health Authorities Act* (Alberta Health)
- *Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act* (ASRD and Community Development)
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.5 Increase Regulatory Support and Control of Contaminants (Sewage, Hazardous Chemicals and Nutrients) Entering the Lake

Agriculture is the main commercial activity within the Watershed. Winter feeding areas for livestock and intensive feedlot operations along creeks and slopes that drain to the lake can add significant nutrient loads to the lake. Industrial sites such as oil wells, storage yards and heavy truck operations could also contaminate water. There may also be contamination from malfunctioning septic systems contributing effluent into the lake from residential lake properties. Enforcement of regulations is required to ensure these sites are isolated from watercourses to prevent contamination. Should contamination occur, there must be accountability and a timely method of remediation.

Short Term Recommendations

- Implement a “Neighborhood Watch” program, where residents can anonymously report spills or other observed environmental violations to existing reporting phone numbers.

- Encourage Environmental Farm Planning (EFP) initiatives. Target implementation of 10 to 20 EFP's per year in the Watershed, through hosting, in-kind support and links to funding and assistance provided through the webpage and fact sheets.

Source protection planning should be undertaken for sources of drinking water in the Moose Lake Watershed. Source protection consists of three basic steps (CCME 2004):

1. Make an inventory of known and potential sources of contamination.
2. Determine the risk posed by these contaminants getting to, and through, the water system.
3. Implement measures to prevent, reduce or eliminate the threat(s).

Potential contaminants to sources of drinking water include chemicals or biological contaminants stored or produced as a result of activities in a Watershed. Once these potential contaminants are identified, the risk they pose to the waterworks can be assessed. Plans can then be developed to reduce or eliminate the risk of the contaminants entering the water system.

Long Term Recommendations

- Institute bylaws regarding both minimum engineering standards for septic systems, and waste handling and disposal.
- Increase bylaw enforcement presence and visibility.
- Institute administrative penalties, creative sentencing, fines and mandatory educational seminars for offenders.
- Emergency spill response plans should be in place under the authority of the Municipal District or other local governing body.
- Environmentally sensitive areas need to be identified as environmental reserves or provincially protected areas, to prevent any further development from occurring.
- Meet with local producers (Agriculture Service Board (ASB), Lakeland Agricultural Research Association (LARA), other groups) to identify issues and work together towards solutions around agricultural loadings.
- Source water protection.

Performance Measures

- Number of calls reporting confirmed incidents.
- Development and implementation of bylaws.
- Increase in number of bylaw enforcement officers employed by the Municipal District.
- Development of an enforcement system, and implementation of mandatory educational seminars for offenders.

- Development and implementation of an emergency spill response plan.
- Assignment of environmental reserves and provincially protected environmentally sensitive areas.
- Increased water quality.

Enabling Legislation and Policy

The following legislation and policies should be consulted when implementing recommendations for this issue:

- *Water Act (AENV)*
- *Environmental Protection and Enhancement Act (AENV)*
- *Municipal Government Act (MGA)*
- *Fisheries Act (DFO)*
- *Agricultural Operations Practice Act (AOPA)*
- *Safety Codes Act (Municipal Affairs)*
- *Public Lands Act (SRD)*
- *Regional Health Authorities Act*
- *Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act*
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.6 Decline in Fish Stocks

In addition to the use of catch limits and size limits to manage sport fishing, protection of fish habitat within the Watershed is extremely important. The loss of spawning and nursery habitat by removal of aquatic and riparian vegetation greatly contributes to the decline of fish stocks.

Short Term Recommendations

- Educate the public about the importance of maintaining aquatic and riparian vegetation using interpretive signs in the Watershed and factsheets which explain the link between fish stocks and habitat preservation.
- As suggested by Alberta Sustainable Resource Development (SRD, 2004), fisheries management plans need to be basin specific in order to maintain the productive capacity of the water body. Requirements of all fish species need to be quantified for survival and then for population increase.

Long Term Recommendations

- Determine a nutrient budget and Total Maximum Daily Load (TMDL) for Moose Lake. This will help control phosphorus and nitrogen levels, thereby reducing excessive plant

and algal growth and preserving oxygen levels in the water column. This will help provide more available habitat for fish populations.

- Stream surveys should be completed to determine if any other critical fish habitat areas exist in the Moose Lake tributaries.
- Identify critical fish habitat and ensure protection of contributing lands via conservation easements or other methods.

Performance Measures

- Development and implementation of a basin specific fisheries management plan for the Moose Lake Basin.
- Increase in amounts and health of aquatic and riparian vegetation.
- Increase in fish habitat.
- Improvement in dissolved oxygen concentrations in the lake, based on the findings of the water quality monitoring program.
- Increased fish populations.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for this issue:

- *Water Act* (AENV)
- *Municipal Government Act* (MGA)
- *Fisheries Act* (DFO)
- *Public Lands Act* (SRD)
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.7 Riparian Areas and Environmental Reserves

Functional riparian areas maintain stream banks and shorelines, reduce erosion and sedimentation, decrease water velocities, store water, recharge aquifers, filter nutrients and contaminants and increase biodiversity. Riparian areas provide water treatment, flood mitigation, wildlife and fish habitat, and other vital environmental services. Alberta Riparian Habitat Management Association estimates that 80% of Alberta's wildlife need riparian areas for some or all of their life cycle (ARHA, 2005). Many current land use and development practices result in the incremental loss and degradation of riparian and littoral habitat and thereby contribute to the decline in fish stocks in Moose Lake and surrounding water bodies.

Moose Lake has a significant amount of developed residential subdivisions along the shoreline. Most of these subdivisions have been registered with the inclusion of an Environmental Reserve (ER) separating the residential lots from the lake bed and shore. This reserve provides a natural

vegetated buffer to control and filter runoff water entering the lake. This buffer also preserves the natural aesthetics of the shoreline. Lack of ER conservation is a primary stressor on shoreline health. Some lake lot owners have encroached onto these reserves by cutting trees and clearing bed and shore vegetation. Shoreline areas must be left in their natural state as much as possible to provide a buffer to filter runoff water and provide habitat for wildlife. As of 2001, only 73% of riparian shoreline habitat around Moose Lake was classified as “healthy”.

Short Term Recommendations

- Require a buffer strip of 30-60m against lakes for new developments (except direct crossings and well planned trails), (SMRC, 2004) and require a comparable buffer setback for agricultural activities.
- Require a riparian setback of 30 meters against all intermittent and perennial streams in the Watershed (except for direct crossing and well planned trails) (SMRC, 2004).
- Enact bylaws restricting the clearing of vegetation on municipal ER lands.
- Install signs on walking paths and shoreline areas to educate tourists and property owners alike about the importance of environmental reserves, riparian vegetation and functional riparian areas. Circulate a newsletter regarding the same topic with utility bills, or during a municipally-led mass mail out to permanent and seasonal residents.
- Collaborate with a riparian group such as the Alberta Riparian Health Management Society (Cows and Fish) to establish riparian restoration demonstration sites in key areas within the Watershed.

Long Term Recommendations

- Establish the land surrounding Island Bay, which is an important waterfowl, fish and wildlife area, as a protected area or a provincial park.
- Place Protective Notation with conditions on critical wildlife areas.
- Consider the use of Conservation Easements on critical Municipal Reserve and Environmental Reserve parcels.

Performance Measures

- Municipal legislation in place for existing and future developments to protect and maintain riparian buffers and protect environmental reserves.
- Remediation and reclamation of existing impaired riparian areas.
- Improvement in riparian health as determined by riparian health surveys.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for this issue:

- *Water Act* (AENV)
- *Municipal Government Act* (MGA)
- *Fisheries Act* (DFO)
- *Public Lands Act* (SRD)
- *Wildlife Act* (SRD)
- *Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act*
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.8 Wetlands

Wetlands provide water treatment, flood mitigation, wildlife, source water protection and other vital services to people and the environment. The loss of these areas has a pronounced impact on the surrounding Watershed. The extent of historic wetland loss in the Watershed is unknown, and will not be known until the drained wetland inventory currently underway is completed. A drained wetland inventory is a key component for a complete land use inventory. By identifying areas of wetland loss, land management planners can implement management plans to address the fundamental elements of source water protection and Watershed function.

Short Term Recommendations

- Work with Ducks Unlimited Canada, Beaver River Naturalists Society and other stakeholders to enhance the wetlands component of the local Grade 5 curriculum.
- Develop a wetland policy in the Town of Bonnyville, the M.D. of Bonnyville and Summer Villages to provide guidance for development around wetlands.
- Add a strong wetland component to the Moose Lake Eco Days, educating attendees about the importance of wetlands and how they function. This information should also be included in any newsletters that would be mailed to area residents.
- Complete a drained wetland inventory and develop a plan with targets for restoration.
- Prevent or fully mitigate further wetland loss through a No Net Loss policy at the various levels of government.

Long Term Recommendations

- Restore lost critical wetland areas identified from the drained wetland inventory.
- Preserve the surface connectivity between streams and wetlands in order to maintain erosion protection and habitat for aquatic biota.

Performance Measures

- Organization of annual Moose Lake Eco Days, and public attendance numbers.

- No further loss of wetlands within the Watershed.
- Some wetlands reclaimed to functional wetland levels.
- Education and awareness program about the value of wetlands, through newsletters signage, or other programs.

Enabling Legislation and Policy

The following legislation and policy should be consulted when implementing recommendations for this issue:

- *Water Act* (AENV)
- *Municipal Government Act* (MGA)
- *Wildlife Act* (SRD)
- Government of Alberta Wetlands Policy (under development)
- *Provincial Parks Act & Wilderness Areas, Ecological Reserve and Natural Areas Act*
- Municipal District, Town and Summer Village Land Use Bylaws
- Area Structure Plan
- Municipal Development Plan

6.9 Overall Recommendations

To avoid duplication from the above sections, there are several short and long term recommendations that apply to many of the sections. They are:

- Develop a public outreach and education program with a comprehensive communication strategy focusing on the issues identified in the Moose Lake Watershed Management Plan. Newsletters, pamphlets, fact sheets, and a website may all be considered. A website (or perhaps a page hosted within the Alberta Stewardship Network Portal) and information fact sheet detailing the water quality monitoring program should be developed and distributed among stakeholders and the public. Subsequent water quality monitoring fact sheets could include results of the monitoring program on an annual basis. A Town and/or Municipal telephone inquiry line should be established for water quality information on Moose Lake. Some of the issues to be addressed include proper use of fertilizers on both residential and agricultural lands, water quality, environmental laws, environmental reserve laws, and Watershed Management Planning.
- An annual Moose Lake Eco Day to share and exchange information on water quality and the activities of the *Water for Life* Committee is an opportunity that should be explored. This could be done in conjunction with Alberta's Water Quality Awareness Day held each June.
- Continue regular stream water quality testing for indicator parameters (i.e. total phosphorus).

7.0 Conclusions

Throughout this Management Plan, there is one recommendation that appears in almost every section, and that is public outreach and education. This is a vital element to the success of this Watershed Management Plan, and should be one of the recommendations that receives primary attention. Once the Moose Lake *Water for Life* Committee is recognized by the Province as the group responsible for implementing this management plan, the committee can continue to develop newsletters, fact sheets, interpretive sites, Eco Days and other outreach activities which will aid in educating the public about the issues currently facing their Watershed. This will be crucial in generating public support for the Watershed Management Plan, and in helping to successfully carry out the recommendations and seeing a measurable improvement in the health of the Watershed.

The Town of Bonnyville, M.D. of Bonnyville and Summer Villages should review their existing planning documents and by-laws to incorporate the Recommendations contained within this Watershed Management Plan. An Intermunicipal Development Plan should be considered to solidify the partnership between the four municipalities and incorporate the planning goals of the Water for Life Committee. Tools such as Conservation Easements, Environmental Reserve Easements and Protective Notations should be used to protect critical riparian and wetland habitat areas. Dedications, purchasing or land trades may also be considered to acquire critical habitat land.

Although unpleasant, appropriate enforcement measures must be available and must be used against those individuals who choose to ignore environmental protection tools such as education and awareness programs, incentive programs, guidelines, Best Management Practices, and formal prohibitions. Thoughtful and creative use of all of these tools will bring about and sustain many improvements in the water quality and the health of lake, stream, wetland, and riparian areas throughout the Moose Lake Watershed as a result of this Watershed Management Plan. Creative sentencing can prove to be a powerful tool in changing attitudes and awareness.

8.0 Glossary

Buffer – A vegetation strip maintained along a stream or lake to mitigate the impacts of actions on adjacent lands.

Eutrophic – nutrient-rich, or high in nutrients. Usually applies to phosphorus concentrations in fresh water.

Intermittent Flow - Flows that occur only at certain times of the year only when groundwater levels are high. Typically applies to streams that may only run for a short period of time during spring runoff, or following large rain events.

Riparian Area - Of, pertaining to, situated or dwelling on the margin of a river or other water body. Also applies to areas adjacent to water bodies where sufficient soil moisture from the water body supports the growth of moisture-loving vegetation.

Riparian Vegetation - Vegetation growing on or near the banks of a stream or other water body that is more dependent on water than vegetation that is found further away.

Runoff - Natural drainage of water away from an area. Precipitation that flows overland before entering a defined stream channel.

Total Maximum Daily Load (TMDL) - Specifies the amount a pollutant needs to be reduced to meet water quality standards, allocates pollutant load reductions among pollutant sources in a Watershed, and provides the basis for restoring a water body through point source and non-point source controls. It is calculated by summing the natural background loads, point source loads and non-point source loads. (Holdren *et al*, 2001).

WaterBodies - Locations where water flows or is present year round or intermittently. They include lakes, wetlands, creeks and sloughs.

Wetland – An area of land that shows a presence of shallow water or flooded soils (or saturated) for part of the growing season, has organisms adapted to this wet environment, and has soil indicators of this flooding, such as hydric soils.

9.0 Literature Cited

Alberta Environment, 1999. Framework for Water Management Planning. Alberta Environment, Edmonton, Alberta. ISBN No. 0-7785-1738-1

Alberta Environment, 2006. Cold Lake – Beaver River Management Plan website.
<http://www3.gov.ab.ca/env/water/Management/clbr/index.cfm>

Alberta Municipal Affairs, 1985. Moose Lake Area Structure Plan. Prepared for: M.D. of Bonnyville No. 87. 14 pp.

Alberta Riparian Habitat Management Society, 2006. Cows and Fish website.
<http://www.cowsandfish.org/riparian.html>

Aquality, 2005a. Moose Lake State of the Watershed Environmental Inventory Report for Moose Lake: Summary of Current Information. Prepared for: The Moose Lake *Water for Life* Committee, Bonnyville Alberta. Prepared by Aquality Environmental Consulting Ltd., Edmonton, Alberta.

Aquality, 2005b. Results of caffeine testing in Moose Lake, August 2004. Prepared for: The Moose Lake *Water for Life* Committee, Bonnyville Alberta. Prepared by Aquality Environmental Consulting Ltd., Edmonton, Alberta.

Canadian Council of Ministers of the Environment, 1999. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg.

Holdren, C., W. Jones, and J. Taggart, 2001. Managing Lakes and Reservoirs. N. Am. Lake Manage. Soc. And Terrene Inst., in coop. with Off. Water Assess. Watershed Prot. Div. U.S. Environmental Protection Agency, Madison, WI.

Provincial Planning, 1972. Interim Planning Report: Moose Lake Development Policy Plan. Provincial Planning Branch. 33 pp.

Reid Crowther, 2000. Town of Bonnyville Water Quality Study Final Report. Prepared for: Town of Bonnyville. Prepared by: Reid Crowther & Partners Ltd. October 17, 2000. Project No. 4371101.

Runge, R, 1977. Moose Lake Management Study. Regional Planning Section, Planning Branch, Planning Services Division, Alberta Municipal Affairs. 73 pp.

Storm water Manager's Resource Center, 2004. Aquatic Buffers Fact Sheet: Buffer Zones.
http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool3_Buffers/BufferZones.htm

Water for Life Committee, 2004. Moose Lake Watershed Management Plan, Terms of Reference. Prepared by Municipalities of the Summer Village of Pelican Narrows, Summer Village of Bonnyville Beach, Town of Bonnyville and The Municipal District of Bonnyville No. 87. 18pp.

10.0 Appendix A: Approved Terms of Reference