# LAC LA BICHE
# WATERSHED MANAGEMENT PLAN
## APPENDICES

May 2021

**PREPARED FOR:**

Lac La Biche County
welcoming by nature.

**PREPARED BY:**

MUNICIPAL PLANNING SERVICES

CPP ENVIRONMENTAL

**TECHNICAL SUPPORT:**

Alberta Environment and Parks

**RECOMMENDED CITATION**

Lac La Biche Watershed Management Plan Steering Committee. 2021. *Lac La Biche Watershed Management Plan* (www.laclabichecounty.com).

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# APPENDIX A. IMPLEMENTATION PRIORITIES AND REPORTING

The purpose of this section is to prove a template for establishing implementation priorities and reporting. Upon adoption of the LLBWMP and establishment the Implementation Committee, the Committee will identify the categories outlined below. During annual reviews, this template can be used to evaluate progress and re-identify priorities for the next year.

**Categories:**

| TYPE | ROLES | TIMEFRAME | SUCCESS MEASURES | PRIORITY | STATUS |
|---|---|---|---|---|---|
| Policy<br>Technical<br>Community Action | Lead<br>Support | Short-term<br>Medium-term<br>Long-term | Performance Indicators (e.g., 100% Participation, etc.)<br>Milestone Indicators (One Project per Year, Task Completed, etc.) | Low<br>Medium<br>High | Not Initiated<br>Planning Stage<br>Some Progress<br>Progress on Track<br>Completed |

*Type*

Policy and regulatory guidance to control development and implement conservation and restoration strategies. Policy, statutory plans, and land use bylaws are how municipal governments implement watershed management planning to improve the health of the lake and watershed.

Technical refers technical actions on the part of experts and agencies to improve the state of knowledge and support stewardship activities. This may include studies, reports, guidelines, monitoring programs, etc.

Community Action refers to stewardship and outreach actions on the part of individuals and organizations to make changes. The volunteer actions of local residents, businesses, recreation, agriculture, and oil and gas operators, etc. are very important. Organizations and communities such as Healthy Waters Lac La Biche, municipalities, First Nations, Métis Settlements and other Indigenous communities/organizations, and agriculture and industry associations play a key role in promoting beneficial practices and providing information, education, and support.

*Roles*

Identification of organizations with primary and support roles in the implementation of the tasks. Roles are allocated into two types: Lead and Support.

Being a "Lead" means that this agency or group is best suited to track and organize resources to make progress on the recommendation. Achieving outcomes with Lead organization internal resources is not necessarily expected or required. A Lead agency needs to work with organizations or resources that can accomplish the identified outcomes. The abbreviations to be used in the recommendation tables are as follows:

| | |
|---|---|
| LLB | Lac La Biche County |
| HW | Healthy Waters Lac La Biche |
| GoA | Government of Alberta |

| | |
|---|---|
| MUN | Municipalities |
| NGO | Non-Governmental Organization |
| TS | Technical Specialist/Researcher |
| LA | Local Authorities |
| IN | Indigenous Communities (First Nations, Métis Settlements, other Indigenous organizations) |
| O | Operators (aggregate, forestry, farms, golf course, oil and gas, etc.) |

*Time frame*

The anticipated length of time to accomplish progress on each identified recommendation. Lead time is often needed for movement on a given recommendation.

*Success Indicators/Measures*

Metrics to assess the level of success of specific recommendations and actions. Two different kinds of indicators will be provided in the LLBWMP:

1. Performance indicators (e.g., rating systems, numeric levels, progress status, etc.)
2. Milestone indicators (e.g., specific event or achievement).

*Priority*

The purpose of this category is to establish priorities for each recommendation to help the Implementation Committee determine the focus of plan implementation each year.

*Status*

The current status of implementation for each recommendation should be tracked and reported during the annual update.

*Progress Update / Challenges*

The purpose of this section is to provide comments on the progress, document challenges, and outline reasons for re-identifying priority.

*Lessons Learned*

The purpose of this section is to provide comments on lessons learned during the implementation of the recommendation that may provide context and useful insight for implementation of other recommendations.

| **THE WATERSHED LANDS \|** Objective 1: Land Cover and Biodiversity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Increase land cover types that have lower nutrient release rates, trap nutrients and promote biodiversity. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 1.1 | **Low Intensity Development:** Encourage and facilitate low-intensity development to maximize the relative proportion of natural land cover by including regulations in municipal land use bylaws:<br>• Encourage the retention of existing tree stands.<br>• Require development permits for the clearing of vegetation (this does not include removal of dead vegetation).<br>• Limit the maximum percentage of developed lots that are non-permeable surfaces.<br>• Require landscaping plans to include minimum percentage of a developed lot as vegetative cover.<br>• Development that occurs near or within wetlands should be consistent with the Alberta Wetland Policy.<br>• Maintain and improve existing, identified riparian buffers within municipal land (ER and MR lands).<br>• Development which would damage or destroy permanent wetlands shall be discouraged within the watershed.<br>When a wetland is permanently affected within the watershed, the wetland replacement should occur within the watershed. | Policy | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 1: Land Cover and Biodiversity | | | | | | | | | |
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| 1.2 | **Growth Areas:** Where additional growth and higher density development is proposed, encourage the development to be located:<br>• In areas where municipal services can be provided;<br>• within hamlet growth areas, estate residential areas, or urban service areas as identified in the County's MDP. | Policy | | | | | | | |
| 1.3 | **Owl River Riparian Restoration:** Continue the Owl River riparian area restoration project that is currently underway. | Technical | | | | | | | |
| 1.4 | **High-priority Ecological Areas for Restoration and Protection:** Leverage current riparian restoration efforts on the Owl River by expanding the work to new areas along the Owl River and along other tributaries that discharge directly to Lac La Biche.<br>Identify new high-priority ecological areas for water quality, water quantity, and fish and wildlife habitat (e.g., important headwaters, critical riparian areas, drainages to the lake, critical spawning areas) to support decision-making regarding which areas to focus additional naturalization protection and restoration projects. | Technical | | | | | | | |
| 1.5 | **Wetland Restoration:** Collaborative work among Lac La Biche County, Indigenous communities, NGOs, and private landowners to identify damaged wetlands that could be restored, or sites appropriate for new wetland construction. Such sites could be used to retain water, sediment, and phosphorus prior to reaching the lake or one of its tributaries. Participate in the newly-established Wetland Replacement Program for funding. | Policy / Community Action | | | | | | | |

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| 1.6 | **Reforestation and Restoration:** Encourage the reforestation and restoration of wetlands and riparian areas on sites where the use that created the damage has been discontinued. | Policy / Community Action | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 2: Land Use and Phosphorus Management | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 2.1 | **Riparian Setback Matrix Model (RSMM):** Complete a review of the effectiveness of implementation of Riparian Setback Matrix Model, focusing on the practical application of the approach and examining potential enforcement approaches. | Technical / Policy | | | | | | | |
| 2.2 | **Stormwater Best Management Practices:** In residential areas, encourage the implementation of stormwater BMPs and low impact development (LID) practices in existing and new developments to reduce the export of phosphorus and other pollutants.* | Policy / Community Action | | | | | | | |
| 2.3 | **Septic Systems:** Encourage the removal of septic fields, in addition to upgrades to sewage/septic infrastructure of cottages and public use areas (where antiquated or ineffective) to improve the water quality of Lac La Biche. | Policy | | | | | | | |
| 2.4 | **Septic Maintenance Education:** Engage in public education of septic field maintenance and municipal inspection programs (voluntary or otherwise) to maximize septic field efficiency. | Policy / Community Action | | | | | | | |
| 2.5 | **Incentive Programs:** Consider the development of incentive programs for property owners near water bodies and watercourses that implement stormwater management BMPs, LID, restoration of riparian area vegetation, etc. | Policy / Community Action | | | | | | | |

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| 2.6 | Ranching and Hobby Farm Best Management Practices: Continue and encourage ranching and hobby farm BMPs including but not limited to:<br>• Reducing the intensity of grazing and trampling near riparian areas and the shorelines of watercourses (e.g., Owl River) and water bodies (e.g., Lac La Biche);<br>• Providing water alternatives away from watercourses (e.g., Owl River) and water bodies (e.g., Lac La Biche);<br>Manure management near riparian areas, watercourses (e.g., Owl River) and water bodies (e.g., Lac La Biche). | Policy / Community Action | | | | | | | |
| 2.7 | Agriculture Best Management Practices: Continue and encourage use of agriculture BMPs that promote soil health and responsible resource use including but not limited to:<br>• Conservation tillage programs to reduce the erodibility of soils and the subsequent potential for export via runoff.<br>• Precision agriculture approaches to avoid the export of excess nutrients off the land and into waterways by carefully controlling the application rate, timing, and placement of inorganic fertilizers or manure (e.g., encourage use of environmental farm plans).<br>• Consider the preservation of low-intensity agricultural areas as a form of preserving natural land cover.<br>4R nutrient management (right fertilizer source, right rate, right time, right place) | Policy / Community Action | | | | | | | |

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| 2.8 | **Low-Phosphorus Development Standards:** Incorporate low-phosphorus development standards in Land Use Bylaws, statutory plans and other bylaws such as:<br>• Bylaws to restrict fertilizers and pesticides usage<br>Include phosphorus as a parameter of consideration in municipal approvals (e.g., stormwater management approvals) | Policy / Community Action | | | | | | | |
| 2.9 | **Golf Course – Audubon Cooperative Sanctuary Program:** Pursue certification with the Audubon Cooperative Sanctuary Program for the Lac La Biche Golf and Country Club. | Policy | | | | | | | |
| 2.10 | **Industry Operations:** Implementation of the LLBWMP should include meaningful engagement with industry operators and the provincial government to identify potential voluntary actions and potential regulatory tools that can be used moving forward. | Policy | | | | | | | |
| 2.11 | **Industry Operations:** Encourage industry operators and Alberta and Environment and Parks to monitor the cumulative effects of industrial developments in the watershed. | Policy / Technical | | | | | | | |
| 2.12 | **Monitoring Cumulative Effects:** Implementation Committee to pursue partnerships with other organizations to identify opportunities to monitor cumulative effects of industrial developments on air quality, ground water quality, drinking water quality and biodiversity within the watershed. | Community Action / Technical | | | | | | | |

**Principles and practices for implementing LID practices can be found in the 2020 Alberta Clean Runoff Action Guide (Alberta Low Impact Development Partnership 2020)*

| **THE WATERSHED LANDS \|** Objective 3: Clean Runoff | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Encourage clean runoff practices and design to reduce the transport of nutrients and sediment to Lac La Biche. | | | | | | | | | |
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| 3.1 | **Oil Grit Separators:** Determine other locations around the lake and its main tributaries (e.g., Red Deer Brook) where oil grit separators would be beneficial. | Technical | | | | | | | |
| 3.2 | **Salt Usage:** Limit the use of salts on local shoreline roads and driveways to limit the increase in lake salinity via runoff where possible, while maintaining safety for people using the roads. | Policy | | | | | | | |
| 3.3 | **ECO Plans:** Consider adopting Alberta Transportation's Environmental Construction Operations Plan framework (**ECO plans**) for construction activities to ensure that contractors systematically identify and mitigate environmental impacts that may result from bridge or culvert replacement projects, as well as any project in or adjacent to environmentally sensitive areas. | Policy | | | | | | | |
| 3.4 | **Crossings:** When designing culvert or bridge capacity, design for larger flood events (e.g., 1:100 year flood or more), to take into account climate change and potential culvert damage that would add a significant amount of sediment to downstream environments. | Technical/Policy | | | | | | | |
| 3.5 | **Crossings:** Collaborate with Alberta Transportation to explore the feasibility of designing crossings to accommodate major flood events. | Technical/Policy | | | | | | | |
| 3.6 | **Emergency Management Plans:** Explore the feasibility of updating Emergency Management Plans to identify priority locations for installing oil booms to contain highway of rail spills to prevent leeching into water bodies or watercourses. | Policy | | | | | | | |

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| 3.7 | **Construction Activity Management:** Require construction activities to be carried out in such a manner that minimum suspended sediments are created (see ECO Plans above). | Policy | | | | | | | |
| 3.8 | **Lot Grading and Drainage:** Develop and implement Standard Design and Construction Guidelines for lot grading and drainage in new and previously developed areas. | Technical | | | | | | | |
| 3.9 | **Lot Grading and Drainage:** Require lot grading to be carried out in accordance with available Standard Guidelines for Design and Construction. Also, see ECO Plans above. | Policy | | | | | | | |
| 3.10 | **Source Control:** Direct stormwater in such a way that it does not run onto surfaces where pollutants can be picked up (pavement, exposed soil, etc.).<br>The following practices can be applied:<br>• Sweep pavement and roofs rather than washing;<br>• Control erosion by stabilizing exposed soils and banks with vegetation (riparian vegetation programs);<br>• Carry out landscaping in accordance with the Land Use Bylaw;<br>• Minimize the use of pesticides and fertilizers;<br>Ensure proper handling, disposal and recycling of toxic metals, organic compounds, oil, and grease. | Policy/Community Action | | | | | | | |

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| 3.11 | **Clean Runoff Awareness:** Improve awareness about the importance of clean runoff and improve information sharing practices regarding the consequences, implications, and mitigation measures that can be implemented. | Community Action | | | | | | | |
| 3.12 | **Stormwater Management Plan:** Continue to implement BMP recommendations from the County's Stormwater Management Plan (Genivar 2008). | Policy | | | | | | | |
| 3.13 | **Stormwater Management and LID:** Incorporate the principles of low impact development (LID) into stormwater management practices. | Policy | | | | | | | |
| 3.14 | **Encourage Lot-Level BMPs:** These BMPs (includes LID strategies) on individual lots reduce runoff volumes and/or treat stormwater onsite before it reaches the conveyance system. | Policy | | | | | | | |
| 3.15 | **Conveyance System BMPs:** Encourage the use of engineered temporary surface ponding in backyard, parking lots, and parking areas including bio-swales and linear drainage channels. | Policy/ Community Action | | | | | | | |
| 3.16 | **Conveyance System BMPs:** Transport runoff from developed areas through more natural means (e.g., grassed swales) to reduce peak stormwater discharge volumes. | Policy | | | | | | | |

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| 3.17 | **Environmentally Sensitive Areas - Development and Subdivision:**<br>New residential multi-lot subdivision and development should be designed to exclude environmentally sensitive areas.<br>Where environmentally sensitive areas are present, utilize the RSMM to determine the environmental and/or municipal reserves between subdivided lots and the environmentally sensitive areas.<br>Where environmentally sensitive areas are present, establish setbacks for development from the environmentally sensitive areas utilizing:<br>a. Recommendations from qualified professionals;<br>b. Government of Alberta's Stepping Back from the Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region; or<br>ESRD Recommended Guidelines for Setbacks chart (see Appendix E). | Policy | | | | | | | |
| 3.18 | **Environmentally Sensitive Areas - Development and Subdivision:**<br>When reviewing a proposed subdivision or development in or adjacent to environmentally sensitive areas, consider the increases to nutrient and sediment loading due to cumulative land cover change, not just due to the individual project itself. | Policy | | | | | | | |
| 3.19 | **Setbacks from Wetlands:** Require no-disturbance buffers around wetlands to protect function, improve storage and control runoff. | Policy | | | | | | | |

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| 3.20 | **Fertilizers and Pesticides:** For residential uses, prohibit cosmetic fertilizers and pesticides in or adjacent to environmentally sensitive areas (this does not apply to agricultural uses). | Policy | | | | | | | |
| 3.21 | **Groundwater Quality Data:** Compile existing groundwater quality data that is available, and partner with Alberta Health Services to map and monitor groundwater quality in the watershed. | Technical | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 4: Groundwater Quality | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve groundwater quantity and quality within the watershed to protect local drinking water and the water quality of Lac La Biche. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 4.1 | **Infiltration:** Implement on-lot infiltration systems and infiltration trenches for small basin areas only after evaluating the impact on groundwater. | Policy | | | | | | | |
| 4.2 | **Statutory Plans and Land Use Bylaws:** Groundwater Conservation: Incorporate water conservation guidance tools into municipal statutory plans and development requirements. | Policy | | | | | | | |
| 4.3 | **Wastewater Collection**: Support the extension of a regional wastewater system to lakeside communities including the Provincial Park campsites. Alternatively, investigate new local wastewater treatment technologies. | Policy | | | | | | | |
| 4.4 | **Wastewater System Inspections**: Promote regular inspections of both private and communal wastewater systems for integrity and leakage. Systems that fail are to be reported and repaired. | Policy | | | | | | | |
| 4.5 | **Wastewater Systems BMPs:** Encourage the adoption of wastewater (individual septic systems in particular) maintenance BMPs (e.g., septic sense workshops). | Community Action | | | | | | | |
| 4.6 | **Water Wells**: Encourage homeowners to adopt water conservation and well maintenance practices (e.g., Government of Alberta Working Well program). Encourage organizations and municipalities to provide information and to host workshops, etc. | Community Action | | | | | | | |
| 4.7 | **Industrial Groundwater Extraction**: Monitor permit applications and intervene where warranted on behalf of the watershed to maintain groundwater flows to the lake. | Policy/Community Action | | | | | | | |

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| 4.8 | **Peatlands and Recharge Areas:** Undertake a survey and inventory of peatlands and important recharge areas within the LLBWMP Area. | Technical | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 5: The Shoreline | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve the health and resilience of shoreline and near-shore areas. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 5.1 | **Riparian Vegetation:** Avoid and minimize, where possible, activities that involve the removal of riparian vegetation such as mowing, trimming, herbicide applications, cultivating, and land clearing. | Policy | | | | | | | |
| 5.2 | **Shoreline Monitoring:** Engage in ongoing shoreline monitoring programs to prevent the infestation of aquatic invasive species and riparian invasive species. | Policy | | | | | | | |
| 5.3 | **SHIM and Aquatic Habitat Index:** Incorporate SHIM Activity Risk Matrix and Aquatic Habitat Index for zones around Lac La Biche into municipal planning documents | Policy | | | | | | | |
| 5.4 | **Conservation:** Conservation programs and measures should be focused on portions of the shoreline that have high to very high habitat value, as well as the four zones of sensitivity. These areas may be either put in reserve or have significant development restrictions. | Policy/ Technical | | | | | | | |
| 5.5 | **SHIM:** Revisit SHIM ten years following the initial assessment to update the state of shoreline habitat and evaluate if restoration measures are increasing natural shoreline and habitat values. | Technical | | | | | | | |
| 5.6 | **Riparian Health Survey for Tributaries:** Consider developing a riparian health survey for major tributaries in the watershed to address a gap in riparian health knowledge in the watershed. | Technical | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 5: The Shoreline | | | | | | | | | |
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| 5.7 | **Landowner Stewardship:** Develop a landowner program to encourage shoreline protection and education as stewards. Partnerships could be formed with Cows and Fish and Alberta Conservation Association. This can target current landowners and developers to provide information and appropriate solutions to common concerns such as:<br>• *Public Lands Act* and who owns what part of the shoreline (provincial, the Crown or the landowner);<br>• Encouraging the use of shared docks and day use areas, instead of individual ones, and encouraging temporary/seasonal boat lifts and docks;<br>Eliminating the use of fertilizers and herbicides along the lakeshore properties. | Community Action | | | | | | | |
| 5.8 | **Littoral and Riparian Vegetation Education:** Provide educational tools and materials to watershed property owners and lake visitors about the importance of riparian and littoral vegetation. | Community Action | | | | | | | |
| 5.9 | **Natural Vegetation:** Encourage restoration and/or preservation of natural vegetation cover on shores instead of artificial armoring and modification of shorelines. | Policy | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 6: The Lake | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve knowledge about phosphorus and blue-green algae dynamics affecting the lake to reduce phosphorus loading, the intensity of algal blooms and support local fish populations. | | | | | | | | | |
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| 6.1 | **Lac La Biche Lake Water Quality Monitoring:** Continue monitoring Lac La Biche to contribute to long term data collection. Update trend analysis using recent data. | Technical | | | | | | | |
| 6.2 | **Lac La Biche Lake Water Quality Monitoring:** Incorporate other water quality measures (such as heavy metals, suspended sediment, salinity, etc.) into the Lac La Biche lake monitoring program and collaborate with AHS and AEP to share and evaluate the data. | Technical | | | | | | | |
| 6.3 | **Lac La Biche Lake Water Quality Monitoring:** Consider including invertebrate measurements in the Lac La Biche water quality monitoring program. | Technical | | | | | | | |
| 6.4 | **Red Deer Brook Water Quality Monitoring:** Maintain the annual surface water quality monitoring program for Red Deer Brook to monitor improvements from the upgraded wastewater treatment plant. | Technical | | | | | | | |
| 6.5 | **Tributary Water Quality Monitoring:** Expand the scope of the tributary (including Owl River) flow-based water quality monitoring evaluation and reporting program. | Technical | | | | | | | |
| 6.6 | **Nutrient Budget:** Prepare a nutrient budget including internal and external loading estimates, based on up-to-date information and tools including tributary flow-based water quality and Lac La Biche lake water quality. | Technical | | | | | | | |
| 6.7 | **Nutrient Reduction:** Develop a nutrient reduction model to determine what combination of activities will result in the most effective remediation with a relatively low level of risk. | Technical | | | | | | | |

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| 6.8 | **Algal Blooms:** Monitor the intensity and frequency of algal blooms. | Technical | | | | | | | |
| 6.9 | **Algal Blooms:** Undertake research to identify the interactions of the complex factors that contribute to algal blooms in Lac La Biche. | Technical | | | | | | | |
| 6.10 | **Public Beach Area:** Support the continuation of monitoring of public beach areas to support public health advisories pertaining to risks associated with blue-green algae. | Technical | | | | | | | |
| 6.11 | **Invasive Species:** With provincial partners, develop a response strategy and monitoring program to manage the occurrence of aquatic and riparian invasive species. | Technical | | | | | | | |
| 6.12 | **Invasive Species:** Provide information to lake users and residents on how to recognize aquatic invasive species to improve early detection and eradication. | Community Action | | | | | | | |
| 6.13 | **Fisheries and Cormorants:** Undertake monitoring of the fisheries, as well as cormorants and their co-nesting species. | Technical | | | | | | | |
| 6.14 | **Cormorant Research:** Continue research on cormorant management. | Technical | | | | | | | |

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| Improve knowledge about phosphorus and blue-green algae dynamics affecting the lake to reduce phosphorus loading, the intensity of algal blooms and support local fish populations. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 6.15 | **Source Water Protection Planning:** When reviewing the Lac La Biche County Drinking Water Safety Plan, utilize the Alberta Water Council's Guide to Source Water Protection Planning as a tool and guide during the review process. | Policy | | | | | | | |
| 6.16 | **Source Water Protection Planning:** Research and explore the feasibility of a Source Water Protection (SWP) Plan. Considerations for the Plan may include:<br>• Identification of protection zones;<br>• Surface water protection;<br>Groundwater protection. | Policy / Technical | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 7: Working Together | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve regional collaboration, partnerships and organizational effectiveness to promote collaboration action for a healthy watershed, healthy lake and healthy community. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 7.1 | **Implementation Committee:** Establish an external committee of Lac La Biche County to oversee administration of the LLBWMP including implementation, monitoring progress, annual updates, updating the plan, etc. The Committee should have representation from County Council and Administration, Healthy Waters Lac La Biche, local and regional non-governmental organizations, Indigenous communities, industry operators, and other organizations that were represented on the Steering Committee that prepared this LLBWMP. | .Policy / Community Action | | | | | | | |
| 7.2 | **Establish Roles, Time Frames, Success Indicators/Measures for WMP Recommendations:**<br>Establish the Roles, Time Frames, and Success Indicators/Measures, and Priorities using the template in Appendix A (to be completed by the Implementation Committee).<br>As part of this process and as the recommendations in the WMP are implemented:<br>• Identify areas where Success Indicators/Measures have already been identified and where they do not exist;<br>Develop and clarify specific Success Indicators/Measures where they have not been identified. | Policy/ Community Action | | | | | | | |
| 7.3 | **Regional Plans and Strategies:** Encourage the consideration of the Lac La Biche watershed and incorporation of the recommendations in this LLBWMP when regional plans and sub-regional plans are prepared and/or revised. | Policy | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 7: Working Together | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve regional collaboration, partnerships and organizational effectiveness to promote collaboration action for a healthy watershed, healthy lake and healthy community. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 7.4 | **Regional Plans and Strategies:** Work towards alignment with the Athabasca Integrated Watershed Management Plan (IWMP). | Policy | | | | | | | |
| 7.5 | **Municipal Development Plans**: Incorporate the environmental protection policies of the LLBWMP. | Policy | | | | | | | |
| 7.6 | **First Nations and Métis Settlements:** Continue discussion and relationship building with the First Nations and Métis Settlements to develop a deeper understanding of traditional ecological knowledge systems within the watershed. | Policy / Community Action | | | | | | | |
| 7.7 | **Source Water Protection Planning:** When establishing the priorities of the LLBWMP recommendations and actions and implementing the recommendations, utilize the Alberta Water Council's *Guide to Source Water Protection Planning* as a guide, where appropriate. | Policy / Technical | | | | | | | |
| 7.8 | **Industry Operators and Stakeholders:** Share the LLBWP with industry operators and stakeholders (forestry, gravel, oil and gas, etc.) | Community Action | | | | | | | |
| 7.9 | **Industry Operators and Stakeholders:** Engage with industry operators at time of application (renewal, new construction, etc.) and that industry operators consider the LLBWMP at time of application in the design/planning of renewal and new developments. | Community Action | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 7: Working Together | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve regional collaboration, partnerships and organizational effectiveness to promote collaboration action for a healthy watershed, healthy lake and healthy community. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 7.10 | **Mapping:** Prepare mapping to assist with the implementation of recommendations in the LLBWMP:<br>• Sub-watersheds of the Lac La Biche watershed;<br>• Inventory of wetlands within the Lac La Biche watershed;<br>• Dispositions and protective notations on Crown Land;<br>• Serviced/un-serviced areas (water, wastewater);<br>• Location of aggregate development;<br>• Location of peat operations;<br>• Environmentally Significant Areas (ESAs);<br>• Wildlife Biodiversity Zones;<br>Environmentally sensitive areas. | Technical | | | | | | | |
| 7.11 | **Research Opportunities and Priorities:** Establish a multi-disciplinary working group/sub-committee to:<br>• Identify research opportunities and priorities;<br>Discuss issues and information that can be shared. | Technical | | | | | | | |
| 7.12 | **LLBWP Updates:** At minimum, revisit the LLBWMP every ten years to accommodate the changing condition of the lake, success of current recommendations, new scientific knowledge, new legislation, and new stakeholder and organizational assets and interests. | Policy | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 7: Working Together | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve regional collaboration, partnerships and organizational effectiveness to promote collaboration action for a healthy watershed, healthy lake and healthy community. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 7.13 | LLBWMP Annual Updates:<br>• Provide an update on the implementation progress and the actions completed (See template in Appendix A);<br>• Review and update priorities (See template in Appendix A);<br>Provide the public with the update (see Communications and Engagement Plan recommendation below). | Policy | | | | | | | |
| 7.14 | Assess Organizational Assets: Investigate organizational options to increase effectiveness, staff resources, financing, risk management, and accountability in undertaking watershed and lake management tasks, including coordination of scientific inquiry, action by municipalities, and community action. | Policy | | | | | | | |
| 7.15 | Incentives to Promote Voluntary Action: Develop non-monetary and monetary incentive programs to promote voluntary action for individuals, municipalities, and organizations | Community Action | | | | | | | |

| **THE WATERSHED LANDS \|** Objective 7: Working Together | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Improve regional collaboration, partnerships and organizational effectiveness to promote collaboration action for a healthy watershed, healthy lake and healthy community. | | | | | | | | | |
| # | RECOMMENDATION | TYPE | ROLES | TIME FRAME | SUCCESS INDICATOR / MEASURE | PRIORITY | STATUS | PROGRESS UPDATE / CHALLENGES | LESSONS LEARNED |
| 7.16 | **Communication and Engagement Plan:** Establish a communications and engagement plan for disseminating and reporting LLBWMP progress to and amongst stakeholders and the public. Important considerations include but are not limited to:<br>• Current status of implementation of recommendations;<br>• Actions local residents can take to implement the LLBWMP;<br>• Providing clarity that actions to improve water quality can be gradual and long-term;<br>Monitoring, restoration, and protection programs and activities undertaken in the watershed by the County, Government of Alberta, stakeholders, Indigenous communities, Healthy Waters, Cows and Fish, Alternative Land Use Services (ALUS), Alberta Lake Management Society (ALMS), and other relevant organizations. | Community Action | | | | | | | |
| 7.17 | **Monitoring Plan:** Develop a monitoring plan for environmental trends including lake and tributary water quality and for plan performance including fulfillment of success measures. Identify resources and funding to conduct the monitoring program. | Technical | | | | | | | |

# APPENDIX B. SUMMARY OF THE SCIENCE

PREPARED BY:

CPP ENVIRONMENTAL

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## LIST OF FIGURES



## LIST OF TABLES

# 1. PREFACE

The Summary of the Science has been assembled as a foundation to the development of the Lac La Biche Watershed Management Plan (the LLBWMP). It is intended to update the 2009 Watershed Management Plan and provide current updates and benchmarks to many of the environmental indicators relevant to Lac La Biche and its watershed. General watershed planning implications are also identified related to the various topics. These will provide background to many of the specific recommendations forthcoming in the Plan, as well as planning policies and tools available. The intent of this document is to summarize the current scientific knowledge regarding the environmental concerns associated with Lac La Biche and to highlight where further research or remedial efforts are needed. CPP has reviewed the scientific information available for the writing of the Summary of the Science. Indigenous studies, knowledge transfer and consultation with First Nations or Métis Settlements have not been completed and are not included within the Summary of Science.

The document is organized into three main sections, which outline the state of knowledge at different spatial scales:

(i) the Lac La Biche watershed (Section 3: “Watershed Lands”),
(ii) the lake’s streams and shorelines (Section 4: “The Shoreline”), and
(iii) Lac La Biche itself (Section 5: “Lac La Biche”).

# 2. BACKGROUND

## 2.1 CHARACTERISTICS OF LAC LA BICHE

Lac La Biche is the 7th largest permanent waterbody in Alberta. It is situated in the Boreal Mixedwood Ecoregion of northeastern Alberta. It has numerous bays and rocky offshore islands, as well as wide areas of shallow littoral habitat characterized by extensive submerged and emergent vegetation. The watershed of Lac La Biche (4,040 $km^2$) is 16 times larger than the lake (234 $km^2$) (**Table 1**), which is about average for a lake in Alberta. The lake provides important habitat for many fish species and colonial and migratory water birds and aquatic mammals. Areas surrounding the lake include coniferous and mixed forests, wetlands (marshes, bogs, and fens), rivers and streams. The lake is valued for its sandy beaches, forested parks, lakeshores and is recognized as a biologically significant area for bird life. Development around the lakeshore is relatively low compared to total lakeshore area. Sir Winston Churchill Provincial Park encompasses the major islands located on the lake: Long Island, Big Island, Current Island, Birch Island, Fox Island, Pelican Island, High Island and two unnamed islands. The lake is comprised of two basins (East and West) separated by a peninsula and 2 large islands. The eastern basin has a maximum depth of 12.2 m, while the western basin has a gradual bottom slope with a maximum depth of 21.3 m. The East basin is structurally more complex compared to the West basin, with several smaller sub-basins, numerous islands, sand and gravel spits, and a causeway connecting Big Island (Sir Winston Churchill Provincial park) to the mainland. The main inflow into Lac La Biche is the Owl River, which in turn receives flow from tributaries such as Logan, Clyde and Piche Rivers, and Gull Creek all entering the East basin from the north. At the south of the East basin, two small creeks enter the lake (Red Deer Brook and one unnamed). Plamondon Creek is the main inflow into the West basin. The only outflow from the lake is the La Biche River located on the northwest shore of the West Basin. In the 20th century, the forests of the southern and western parts of the lake's watershed have been gradually cleared largely for agriculture. Lac La Biche is a source of water for agriculture, forestry, oil and gas, recreation/tourism, and domestic and municipal users.

***Table 1. Physical properties of Lac la Biche and its watershed***

| Physical Property | Value |
|---|---|
| Lake Surface Area | 234 $km^2$ |
| Lake Water Volume | 1,960,000 $m^3$ |
| Maximum Depth | 21.3 m |
| Mean Depth | 8.4 m |
| Shoreline Length | 167 km |
| Mean Annual Lake Evaporation | 702 mm |
| Mean Annual Precipitation | 524 mm |
| Mean Annual Inflow | 3,160,000 $m^3$ |
| Mean Residence Time | 7-30 years |
| Watershed Land Drainage Area | 4,040 $km^2$ |
| Watershed to Lake Area Ratio | 17:1 |

## 2.2 P FORMS, CYCLE AND SOURCES

In most temperate lakes, the nutrient that is in shortest supply, and is therefore limiting to biological productivity, is Phosphorus (P). Once P exists in enough quantities, growth of phytoplankton can proceed until limited by another factor (e.g., light, nitrogen, or wind). Excessive quantities of P can promote problematic overgrowth of cyanobacteria, also known as blue-green algae blooms. Cyanobacteria blooms can sometimes produce dangerous toxins, negatively impacting water quality and causing problems for human and ecological health. While many central Alberta lakes, including Lac La Biche, are naturally productive, increased human development and land cover changes within watersheds over the past century

appear to have increased the rates of P input into waterbodies and accelerated eutrophication rates. Thus, quantifying P inputs into waterbodies is an important first step towards controlling eutrophication to help prevent future water quality issues.

P compounds enter the lake in different forms and compositions, depending on their origin (**Figure 1**). Once in a water body, P undergoes complex chemical and biological reactions which result in it entering the water column. There are two main forms of P: dissolved (soluble) and particulate (as a component of organic and particulate matter). The primary dissolved form of P (orthophosphate, or $PO_4^{3-}$) is readily available for phytoplankton and plant uptake. In response to varying environmental conditions, particulate P can change from one chemical form to another (a process known as P cycling). For example, microbial decomposition of organic matter can turn organic particulate P into its dissolved form. Other chemical and physical changes in the water column and the lake sediments can also convert P in soil mineral particles to dissolved P.

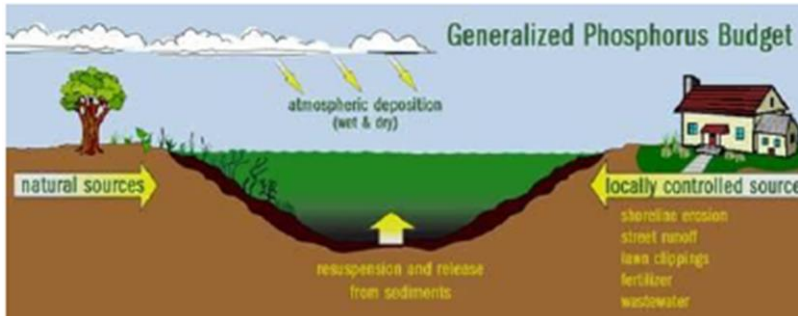


***Figure 1. Origins of phosphorus entering the lake***

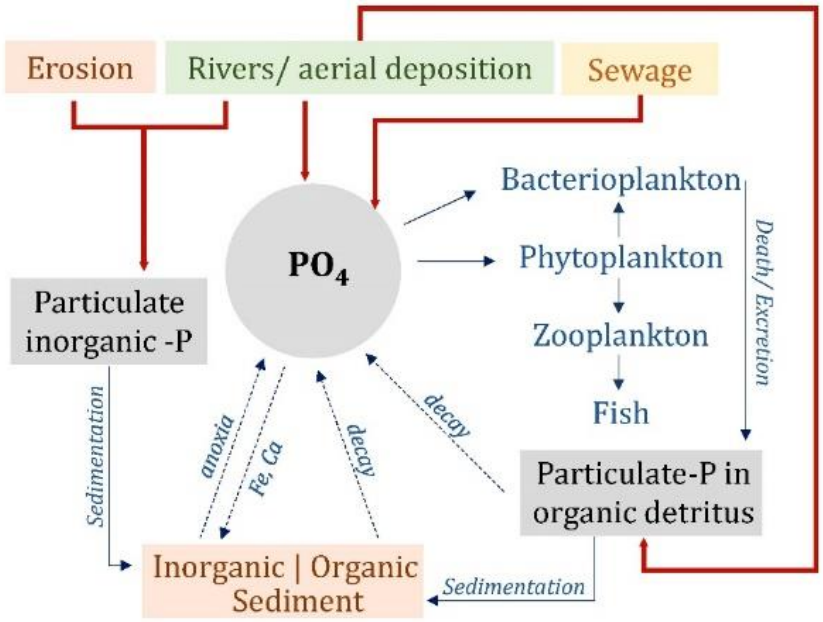


***Figure 2. A simplified P cycle in lakes.***
*Red lines = external loading. Dotted blue lines= internal loading. Solid blue lines = internal recycling.*

**Figure 2** shows a simplified P cycle in lakes. Phytoplankton and bacteria assimilate dissolved inorganic P and transform P into particulate organic P as it becomes part of their tissues. As plants and animals die or excrete, the organic P sinks to the bottom,

where bacterial decomposition turns it back to inorganic P, which ultimately returns to the water column and becomes again available for uptake.

Due to the changes in P forms, the term Total P (TP) is used to determine the total amount of P present in the water body, regardless of its chemical identity (dissolved and particulate). However, this term does not inform about the availability of P for plant or phytoplankton uptake – a concept named "bioavailability". The relative proportion of dissolved vs particulate P that enters to a water body will therefore influence algal growth in the short-term. Both total and dissolved forms of phosphorus are important in the medium to long-term. Particulate forms of P typically enter the lake via wind transport, atmospheric deposition or through erosive processes and subsequent sediment transport. Orthophosphate (i.e., dissolved) forms are generally produced by natural processes. Point sources (e.g., effluents from treatment plants or untreated water), and nonpoint or diffuse sources (e.g., runoff from agricultural sites and application of some lawn fertilizers) largely contribute to the input of dissolved P forms.

**Principles for Phosphorus Management**

1) keep P out of the lake since it is very hard to remove once it is in the lake and it will repeatedly re-cycle in the lake

2) especially avoid bio-available sources for short-term reductions in algae; however, total phosphorus is an important consideration for lake management in the long-term.

3) recognize the long-term state of the lake and its natural range of variability

Point-source and sewage contribution might seem proportionally small when compared to the contribution of other sources to the total amount of P entering the lake, yet most of the P supplied by these sources correspond to the more readily bioavailable fraction, and as such are critically important. Additionally, the specific P contributions from each of these sources may vary among seasons and years according to factors such as wind and precipitation patterns or land cover activities (e.g., whether a field is in fallow or being actively tilled and fertilized).

## 2.3 WHAT IS A RIPARIAN AREA?

A riparian area is defined as the strip of moisture-loving vegetation growing along the edge of a natural waterbody (**Figure 3**). The exact boundary is often difficult to determine because of a zone of transitions between the water body and the upland vegetation (Government of Canada 2020). Riparian areas serve many ecological functions: maintain ecological balance, protect water quality, provide habitat to wildlife and aquatic species, etc. Functions of the different components of riparian areas are as follows (refer to **Figure 4):**

**A.** Natural riparian vegetation usually has deep roots. The deep root mass helps maintain the bank or shoreline structure by holding the soil together. This vegetation provides a barrier to the erosive power of the water. By reducing

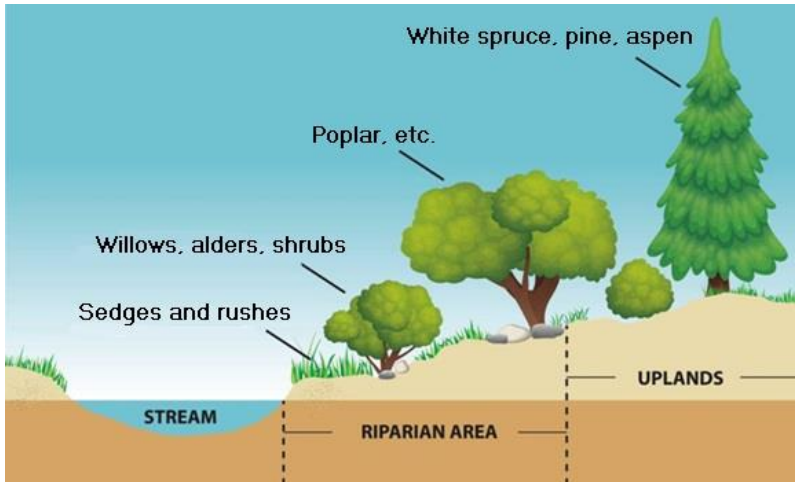


*Figure 3. Cross section of a waterbody, riparian, and upland (Image from Project Watershed 2018).*

erosion, less sediment is transported to the water body. Reducing sediment helps keep fish spawning areas clear, reduces nutrients, and makes water treatment easier.

**B.** Riparian vegetation can also help reduce the amount of sediment and nutrients that are transported in runoff. The vegetation physically traps sediment in surface flow and uses the nutrients in the shallow sub-surface flow.

**C.** Some riparian vegetation is a source of large woody debris. When floating or beached in a water body, debris provides shelter for fish and habitat for aquatic insects. In flowing water, the debris also traps sediment and helps create structure (pools, riffles and runs) in the stream. Pools, riffles, and runs are important components of a stream's ability to maintain aquatic life.

**D.** Riparian vegetation provides shade. Shade helps regulate stream temperatures by controlling the amount of sunlight that reaches the stream. Most fish species prefer the cooler temperature of shaded streams. Shady areas also provide refuge areas for fish. Less algae grows in shaded streams because reduced sunlight limits photosynthesis.

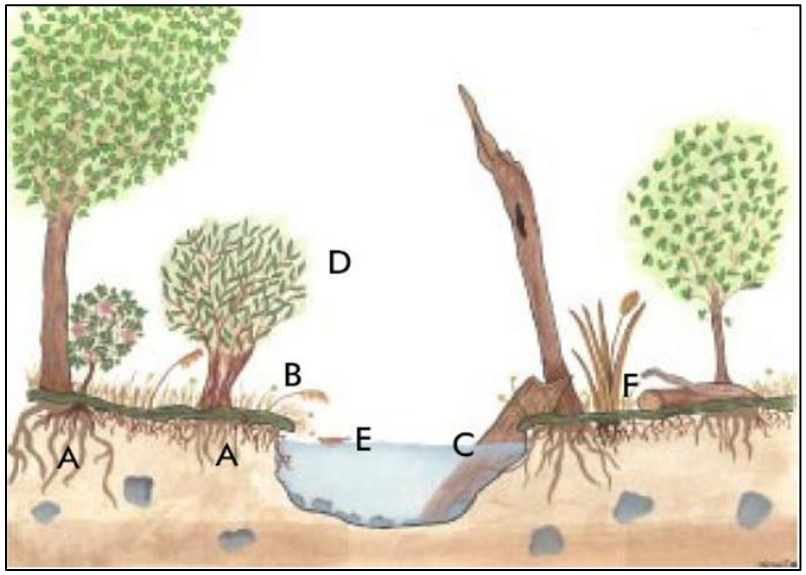


***Figure 4. Basic functions of riparian areas (Image from Government of Canada 2020)***

**E.** Riparian vegetation is a source of small organic debris, which may include leaves, twigs, and terrestrial insects. This debris is an important food source for many aquatic organisms.

**F.** Riparian vegetation helps reduce stream velocity during high flow events. This helps to slow down the natural erosion of the stream bed. Rapid erosion of the stream bed results in a lowering of the local groundwater table. Once the groundwater table is lowered, it is very difficult for water-loving plants to re-establish.

## 2.4 WILDLIFE AND BIODIVERSITY

With a range of landscapes and habitats, a variety of wildlife are documented within the Lac La Biche watershed area. Other than the obvious species, like overwintering raptors, songbirds, and waterfowl, moose, deer, coyote, fox, and rabbit, a variety of provincial, and some federal, sensitive species are also documented. Federal and provincially listed species are as follows:

- Woodland/Boreal Caribou (*Ranifer tarandus caribou)*
- Olive-Sided Flycatcher (*Contopus cooperi)*
- Western Grebe (*Aechmophorus occidentalis)*
- Sora (*Porzana Carolina)*
- Sedge Wren (*Cistothorus platensis)*
- Black Tern (*Chlidonias niger)*
- Canada Warbler (*Wilsonia canadensis)*
- Great Blue Heron (*Ardea Herodias)*
- Canadian Toad (*Anaxyrus hemiophrys)*
- Canada Lynx (*Lynx canadensis)*
- Fisher (*Martes pennanti)*
- Horned Grebe (*Podiceps auratus)*
- Bay Breasted Warbler (*Dendroica castanea)*
- Cape May Warbler (*Dendroica tigrine)*
- Common Nighthawk (*Chordeiles minor)*
- Alder Flycatcher (*Empidonax alnorum)*
- American Bittern (*Botaurus lentiginosus)*
- Barred Owl (*Strix varia)*
- Common Yellowthroat (*Geothlypis trichas)*
- Western Toad (*Anaxyrus boreas)*
- American White Pelican (*Pelecanus erythrorhynchos)*
- Trumpeter Swan (*Cygnus buccinator)*

Lac La Biche Lake is designated as a Provincial Game Bird Sanctuary (light green on **Figure 5**) under the *Wildlife Act*. The sanctuary is designated to protect waterfowl and their nesting locations. Hunting game birds or migratory game birds w ithin the sanctuary is required to be authorized. There are many known nesting and migratory stops for many waterfowl on the lake's islands and riparian areas. Migratory birds and their nests are protected under the *Migratory Bird Convention Act*. Colonial nesting sites (shown as orange rings in **Figure 5**), which have a 1000-meter development buffer, are found on an unnamed lake (WBID 333712) and an island on Heart Lake and Lac La Biche for Great Blue Herons and American White Pelicans. These sites are known nesting locations and are frequented every year. Waterbodies known to be nesting and migratory stop locations for Trumpeter Swan (yellow circle), which have a 500-meter buffer, are found on two unnamed lakes (WBID 333628 and 333562) and on a section of the Gold River (3.2 km upstream of unnamed lake WBID 333415). There are two ranges for Boreal Caribou found within the Lac La Biche watershed. The Cold Lake subunit of the Cold Lake Caribou Range (teal polygon on **Figure 5**) and the Wiau subunit of the East Side Athabasca Caribou Range (light green polygon on **Figure 5**) are within the watershed. Each range is separate by the Clyde River. The Key Wildlife Biodiversity Zone (purple on **Figure 5**) follows the Owl River upstream to approximately its confluence point with the Logan and Clyde Rivers. This key wildlife area is important for the viability and productivity of wildlife populations. Wildlife utilize this zone for winter migrations due to the abundance of food and landscape diversity offering a sustainable diet.

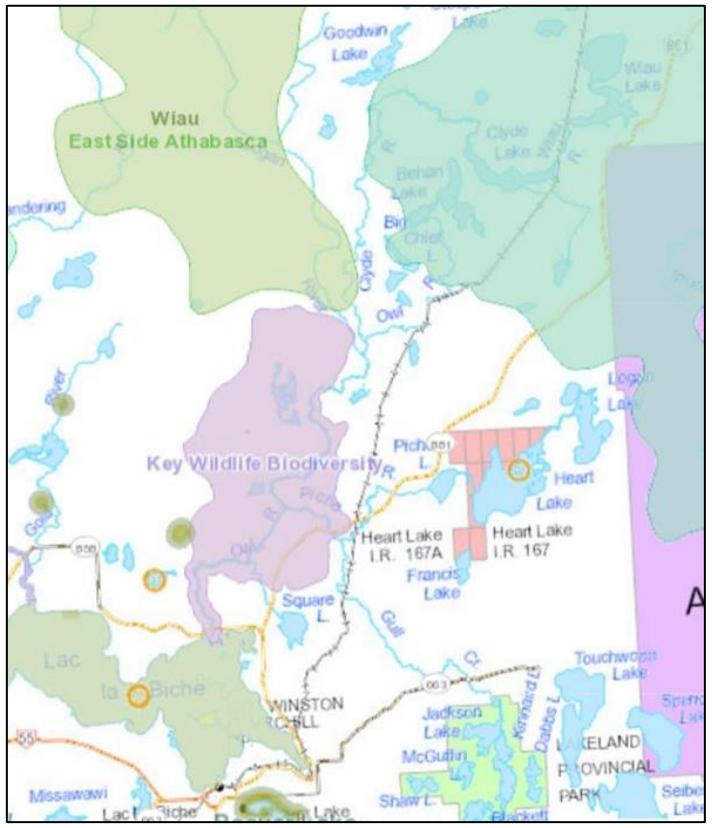


***Figure 5. Biodiversity zones within the Lac La Biche watershed (FWMIS 2020).***

Lac La Biche Lake is part of IBA Canada (Important Bird Areas). IBA Canada is a Canadian co-partner in BirdLife International, a global alliance of non-governmental organization dedicated to the conservation of birds, their habitat, and biodiversity. An IBA are discrete sites that support specific groups of birds: threatened birds, large groups of birds, and birds restricted by range or by habitat. Lac La Biche Lake was deemed an IBA in 1996 based off its habitat biodiversity for waterfowl and colonial nesting history. IBA Canada is working on a IBA Conservation Plan.

## 2.5 LITERATURE

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# 3. WATERSHED LANDS

## 3.1 INDUSTRY, LAND COVER, AND NUTRIENT LOADING TO THE LAKE

The main industry drivers in the Lac La Biche watershed are oil and gas, aggregate, forestry, agriculture, and tourism. Each industry type poses its own challenges for watershed management and planning. On a large scale, the watershed is relatively undisturbed, however, at a smaller scale, disturbance to the land has been on the rise in the last 10 years. Changes in land cover can reflect the type of landscape changes as a direct result of industry's stamp on the land.

The quantity and quality of water in Lac La Biche are influenced by the natural hydrologic functioning of the landscape, altered hydrology, and the land cover composition of the watershed. As described in Devito et al. (2012), the natural hydrologic context of the Boreal Plain consists of: 1) a climate with a water deficit (sub-humid) and pronounced annual (seasonal) and decadal (inter-annual) cycles of water availability interacting with 2) a deep, heterogeneous geologic landscape, composed of fine-textured, coarse-textured, or veneer type glacial deposits, which can store large volumes of water but varies greatly in storage and transmission properties. Runoff from developed areas occurs mainly during spring snowmelt and following rainfall events, and can contain large quantities of nutrients from fertilizers, manure, and loosened soil particles which will ultimately enter Lac La Biche. Unlike point source pollution from industrial sites or sewage treatment plants (where the source of pollution is easily identified), sources of pollution resulting from runoff, precipitation or atmospheric deposition are difficult to identify and control due to the multiple sources of pollution and the large transport capacity. These sources of pollution are called non-point (or diffuse) and are mainly influenced by the type of land cover (e.g., agricultural activities, urban areas, or natural vegetation cover) and the human activities in the watershed (e.g., pesticides and nutrients from lawns and gardens).

While the direct impact of urban settlements on lake water quality is challenging to quantify, some proportion of the external nutrient loading into Lac La Biche can be attributed to human presence. Human-generated land cover changes and use increase nutrient loading in two main ways:

1. Increasing the nutrient availability in the watershed

- Nutrient additions related to lawn fertilizers and agricultural operations
- Release of some proportion of sewage and pollutants produced from cottages, campgrounds, and day-use areas

2. Facilitating the introduction of nutrients into the lake
    - Removing natural vegetation and riparian buffers, which act as filters for nutrients and other pollutants
    - Increasing the percentage of hard surfaces, which decreases infiltration, increases the overland flow, and entrains pollutants
    - Land disturbances that release sediment containing P

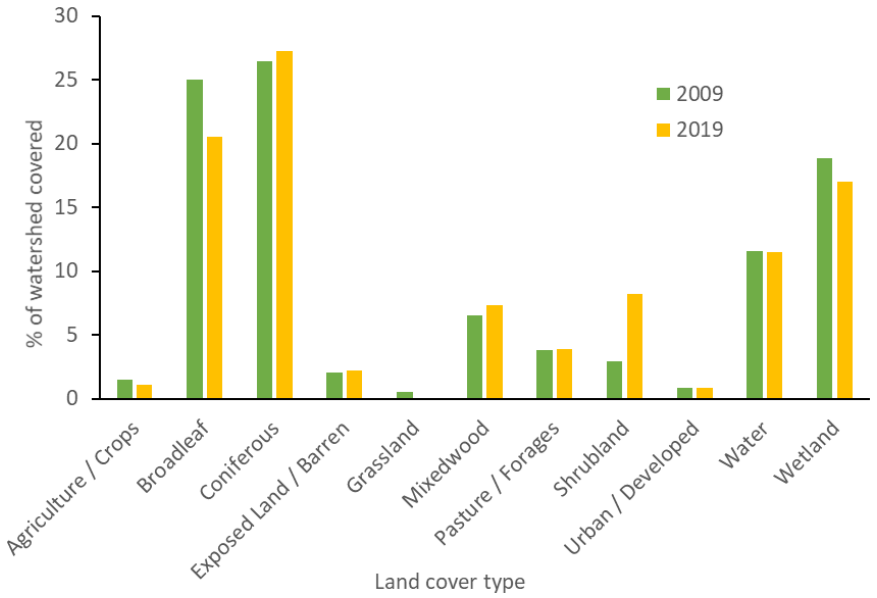


*Figure 6. Land cover in the Lac La Biche watershed in 2009 and 2019*

**Figures 6, 7, and 8** show land cover changes in the Lac La Biche watershed over time, using the Annual Crop Inventory by Agriculture and Agri-Food Canada (AAFC). This dataset was used since it had the most up to date information and the land cover categories were broken down into meaningful categories. It is important to note, however, that due to improvements in land cover classification methodology over time, some land cover types may have been misclassified over time. For example, some wetland areas may have been misclassified as coniferous forests and shrublands which is why these cover types have appeared to change over time. That said, this data teaches us a few things:

- The Lac La Biche watershed, on average, is relatively undisturbed. Less than 10% of the watershed is disturbed as crops, pasture, or developed land. However, some portions of the watershed (sub-watersheds) are highly altered. As **Figures 7 and 8** show, the southern part of the Lac La Biche watershed has been cleared, largely for pasture and crops. A study from the University of Alberta published in 2003 showed that 6 sub-watersheds that were specifically selected to have a range of land-use change ranged from 0 to 43% (Schindler et al. 2003; **Figure 6**).
- Land cover appears to change slowly at the watershed scale – it is relatively unchanged from 2009 to 2019. At the local scale, changes have likely been rapid in certain areas (e.g., new subdivisions, gravel pits, industrial sites, etc.). It is important for the health of the watershed and the lake that such new developments are properly set back from environmentally sensitive areas and that construction and site management methods use the latest beneficial management practices (BMPs). Several tools can be used to assist with minimizing the environmental impact of such activities moving forward (see Plan Implications section below)

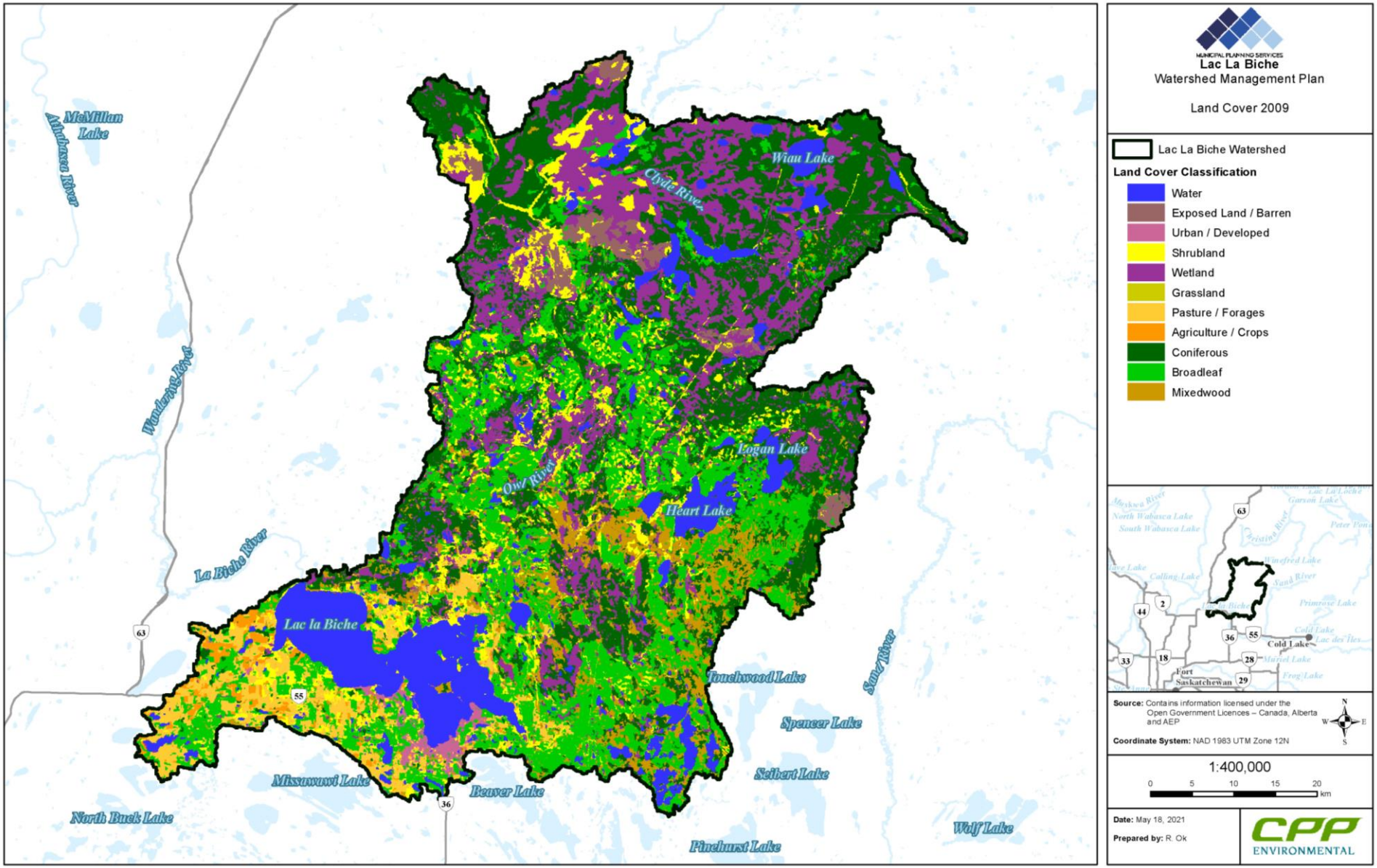


*Figure 7. 2009 Land Cover*

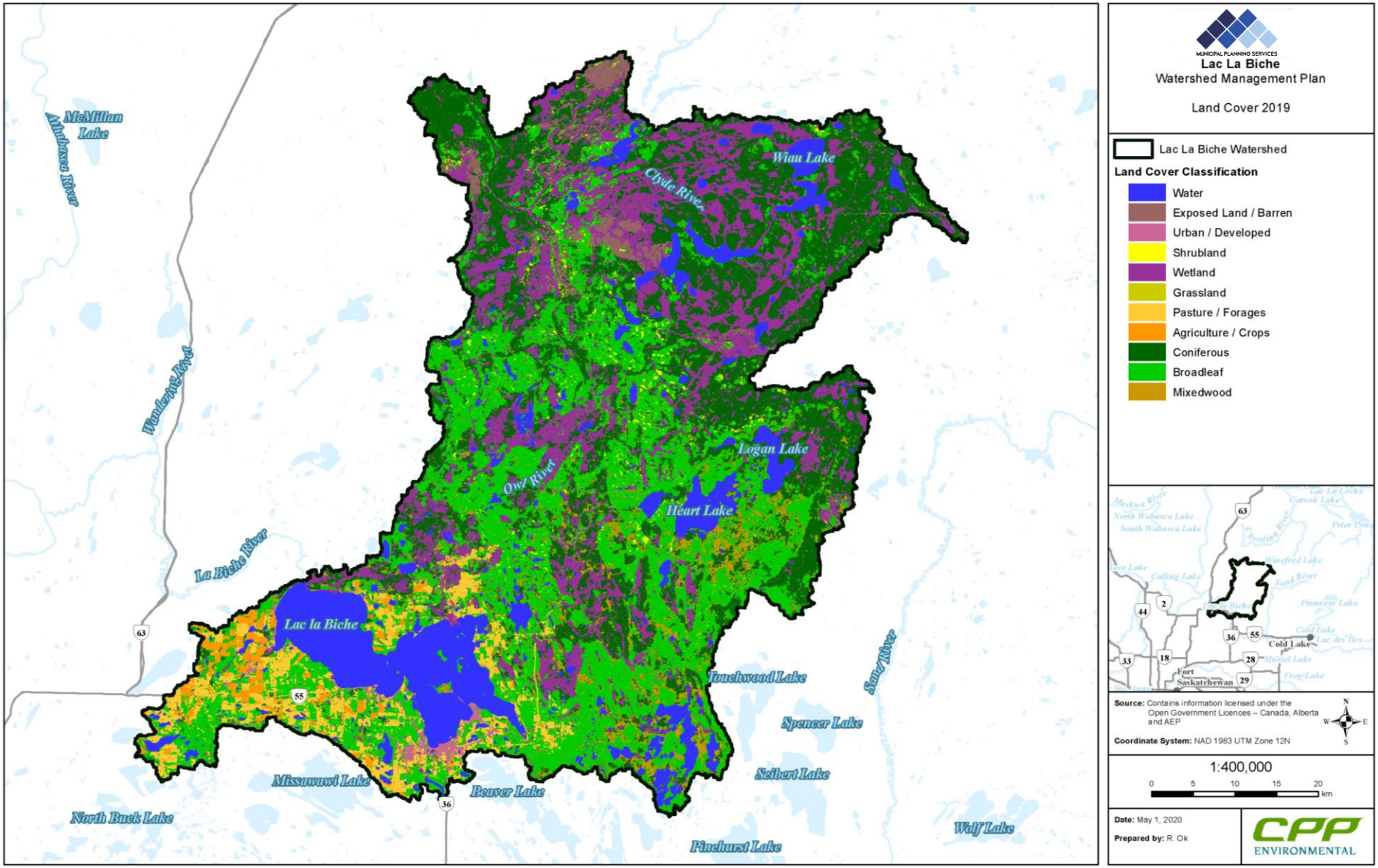


*Figure 8. 2019 Land Cover*

Nutrients – notably P and N – enter Lac La Biche directly through many inflowing streams and drainage ditches, as well as directly from the shoreline. Nutrient loading rates vary among streams, depending on the nutrient concentration and the stream's discharge rate. Given that it supplies most of the water to the lake, the main source of P to the lake is the Owl River. In 2003, it was estimated that, on average, the Owl River supplied 43% to 68% of the total annual P load from the watershed and the atmosphere, followed by direct deposition through precipitation (12-21%), and Red Deer Brook (11-20%; Schindler et al. 2004). However, P from Red Deer Brook was in a more bioavailable form than in the Owl River, supporting the immediate priority of Red Deer Brook P management. Also, P load from the Owl River is higher primarily due to much higher stream flow. P concentrations were 10+ times higher in Red Deer Brook, although flow was much lower. These high concentrations occurred primarily during summer when the potential for algal bloom formation is greatest. These results led to a significant project – the upgrading of the wastewater treatment plant (see Wastewater Treatment Plant Upgrade below).

Based on a study from the University of Alberta published in 2004, the losses of P from sub-catchments most dominated by agricultural lands were generally higher than forested lands (**Figure 9a**). Neufeld (2005) documented that P inputs per unit area from pastures and cropland were approximately double the areal inputs from forested catchments in the area. Indeed, the two watersheds most developed (Plamondon and Mission) generally had higher P export than the other four (**Figure 9b**). That said, the Cadieux and Goldie sub-watersheds had relatively higher P export values, suggesting that there is more to the story than we currently know. Despite this variability, the positive relationship between land use / land cover and nutrient export is generally agreed upon in the scientific community.

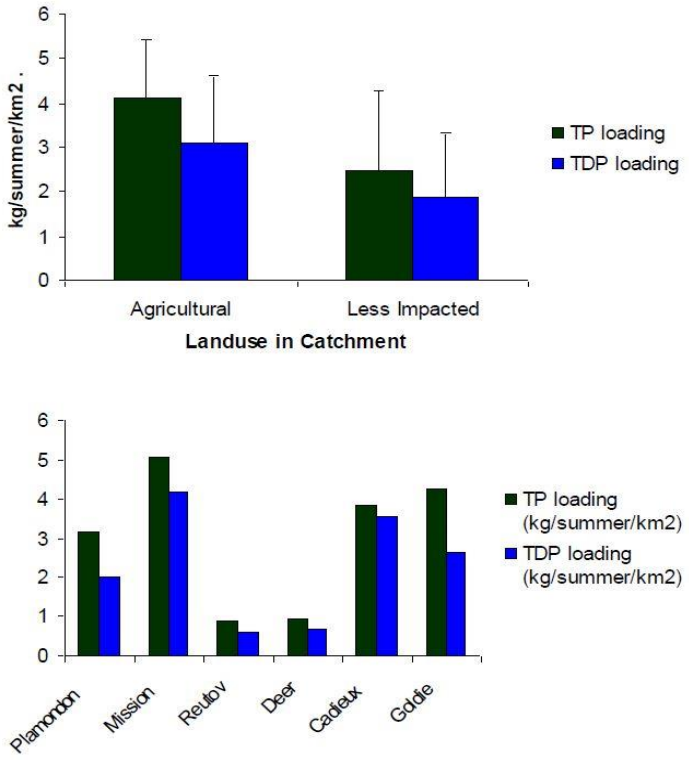


***Figure 9. (a) Nutrient inputs from cleared land within the Lac La Biche catchment. (b) Developed sub-catchments within the immediate catchment of the lake (Schindler et al. 2004)***

## 3.2 LEARNING FROM EXPERIENCE: WATERSHED IMPROVEMENT INITIATIVES

### 3.2.1 Wastewater Treatment Plant Upgrades: BNR Process

In 2013, Lac La Biche County upgraded its Wastewater Treatment Plan (WWTP) to include the Biological Nutrient Removal (BNR) process, which allows N and P to be removed from treated effluent from Lac La Biche and Plamondon sewage treatment plants, prior to discharge into Red Deer Brook (RDB) and then Lac La Biche. Lac La Biche County commissioned numerous water quality studies prior to the construction of the WWTP with the BNR process (Alberta Environment 2000,

Aquality Environmental 2006, Aquality Environmental 2011, Aquality Environmental 2013). These studies collected valuable monitoring data and showed that the efficacy of Field Lake to treat P and N had decreased over time, further supporting decisions to build the new WWTP.

The addition of the BNR process had a positive effect on nutrient concentrations in Red Deer Brook and nutrient loading to Lac La Biche (Stantec 2017). Total ammonia, N, and P were significantly lower following commissioning of the WWTP, as compared to pre-construction. *E. coli* concentrations also declined dramatically. Nitrate is the only form of nutrient that increases in concentration post BNR; however, it was suggested that nitrification is occurring as ammonia and nitrite move downstream. Orthophosphates (presence in the water can indicate the amount of P that is available for algae and plant growth) were reported higher downstream in the RDB than in treated effluent, suggesting other sources may be entering the RDB. With the findings of nutrient loading from various compounds downstream of the WWTP discharge, further investigation is required. Stantec (2017) recommended sampling all locations once per year in the late summer/early fall to capture low flow conditions when the effect of the WWTP would be greatest, which the County has been doing. Ongoing surface water quality monitoring is important to document long-term effects that this BNR system has on the RDB, its wetland complexes and Lac La Biche.

### 3.2.2 Owl River Riparian Restoration

Riparian vegetation immediately adjacent to Lac La Biche and its inflowing streams are thought to naturally mitigate the rates at which runoff-borne nutrients directly enter the water. Ongoing development has led to the degradation of these natural buffers, resulting in minimal filtration or removal of excess nutrients before they reach the water. Increased land disturbance and the loss of riparian areas increase the rates at which both diffuse and point-source nutrient inputs enter the lake. This has other consequences for water quality such as an increase in suspended materials due to increased shoreline erosion.

From 2011-2017, the Alberta Conservation Association (ACA) conducted a project to restore riparian habitat along the Owl River, which is upstream of Lac La Biche. This was in association with the Government of Alberta's Lac La Biche walleye restoration program to increase the quality of walleye spawning habitat in the Owl River, which has been identified as the primary spawning habitat for walleye in the area. As a result of the project, riparian health in project areas were improved substantially, particularly where livestock exclusion fencing was installed in 2012 (**Figures 10, 11 & 12**). The main finding from the study is to reduce grazing opportunity by livestock within the riparian area. Wildlife-friendly livestock fences were installed along sections of the Owl River with the cooperation of leaseholders and landowners. On private land, the ACA

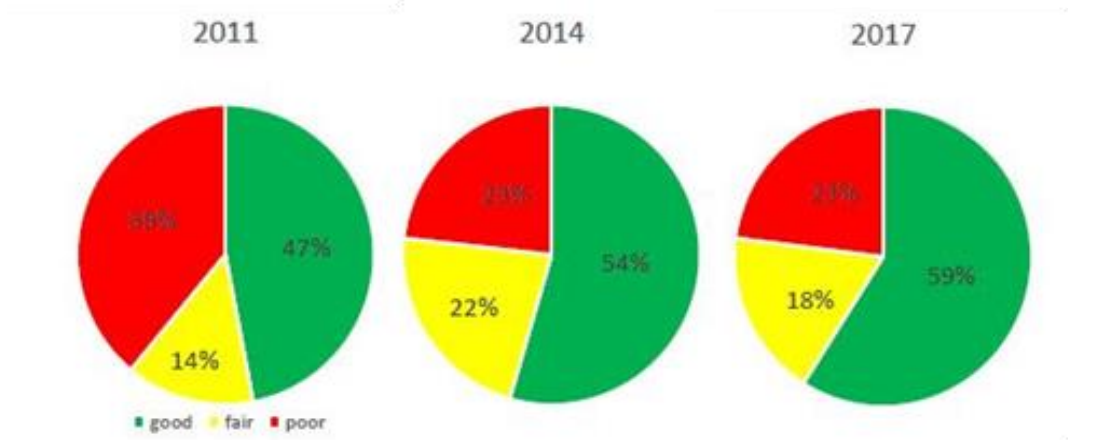


*Figure 10. Riparian health improvements in the Owl River from 2011 to 2017 (Fenson 2018)*

negotiated with landowners for the purchase of a long-term lease (15+ years) of 50 m of riparian buffers on each side of the river, with fence maintenance assigned to the landowner. On grazing leases, the ACA worked with the Alberta Public Lands and their leaseholders to negotiate the establishment of fences, with long term maintenance assigned to the leasee. The ACA successfully excluded grazing from 8 km of riparian areas in eight quarter sections under a grazing lease along the Owl River. Before moving forward with further grazing lease withdrawal negotiations, the local Alberta Public Lands staff requested that the ACA and AEP work together to develop a protective notion (PNT) application and implementation for the area that have already been withdrawn through this project. Cows and Fish were tasked to conduct on the ground assessments in 2018-19 since 2017 flooding occurred rendering the ACA unable to conduct field work. No published data was available from Cows and Fish for this project.

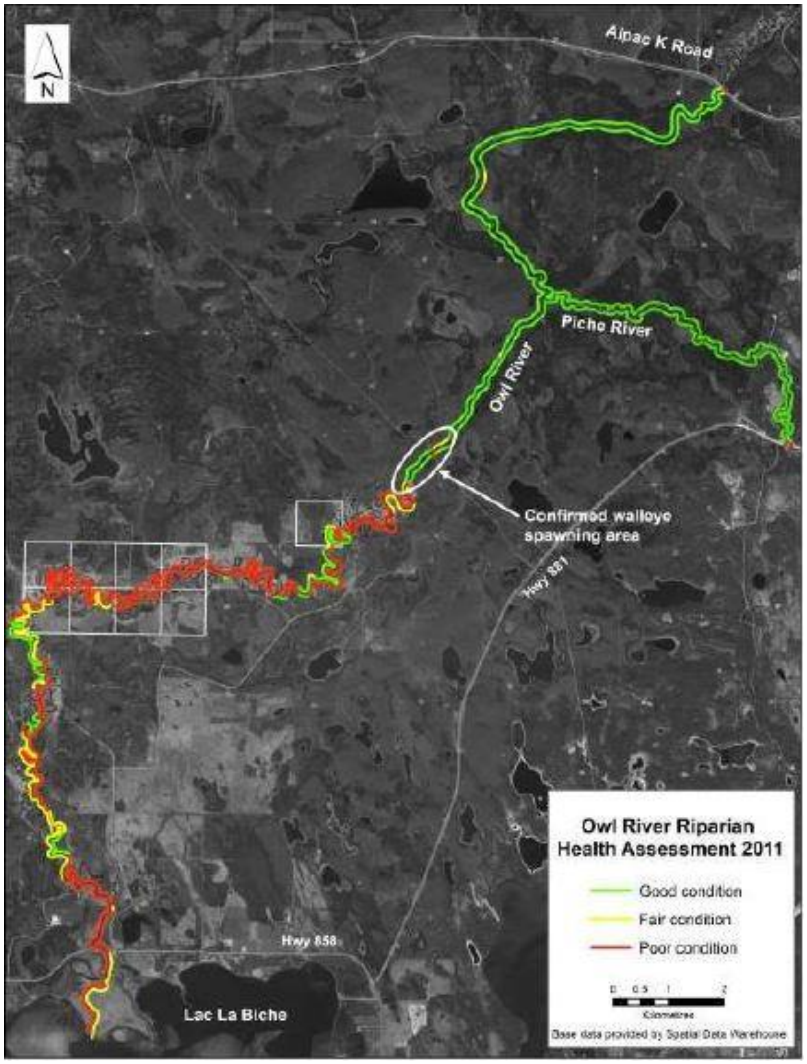


*Figure 11. Conditions of riparian area shown (8 quarter sections) along a section of the Owl River in 2011 (Fenson et al. 2018)*

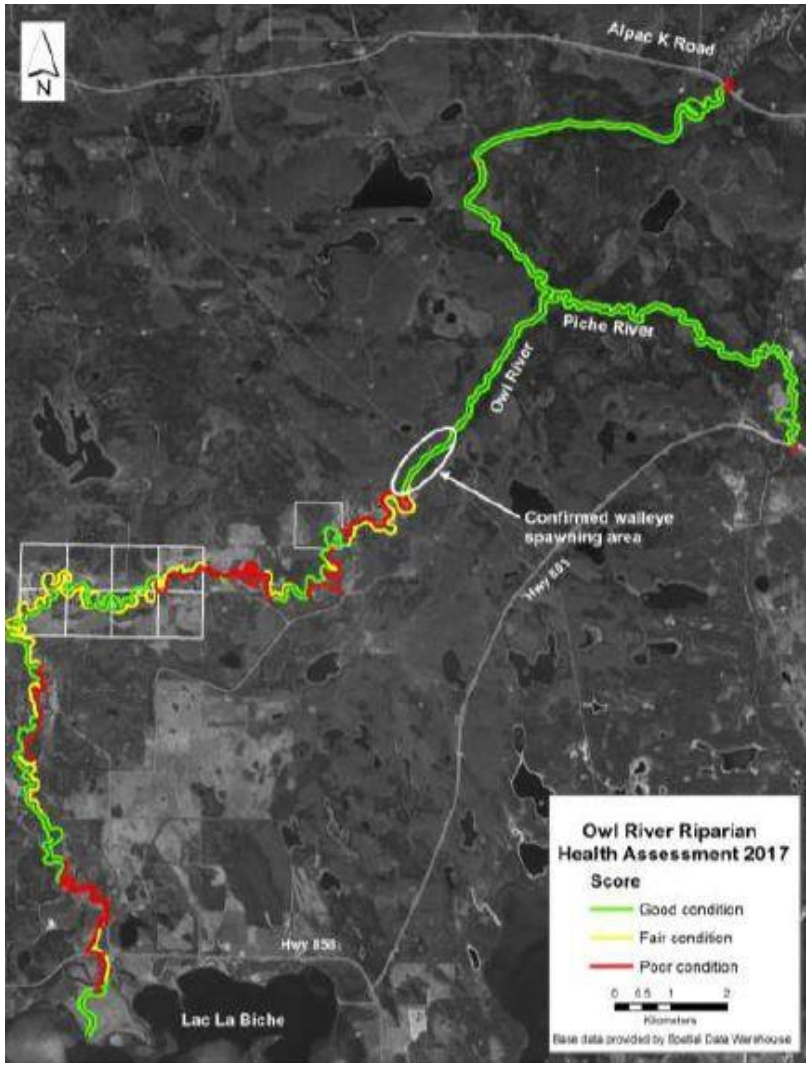


*Figure 12. Conditions of riparian area shown (8 quarter sections) along a section of the Owl River in 2017 (Fenson et al. 2018)*

## 3.3 TRIBUTARIES TO LAC LA BICHE

A tributary is a watercourse flowing into a larger waterbody or watercourse. Lac La Biche has 22 tributaries as per Alberta's Fish and Wildlife Management Internet Tool (FWMIS). **Figure 13** depicts the tributaries flowing into Lac La Biche and **Table 2** lists the waterbody identification (WBID) given from FWMIS, the name of the tributary, and a description of the tributary.

## 3.4 ENVIRONMENTAL FARM PLANS

The Government of Alberta founded the Alberta Environmental Farm Plan (EFP) program in 2003. The Agriculture Research and Extension Council of Alberta (ARECA) has been operating the program since 2013. To date, Alberta EFP has had 14,000 inquiries from Alberta producers of whom approximately 9,000 have completed an EFP. This represents 24% of registered Alberta farms. Since 2009, just under 2 million acres of agriculture land has been added under EFPs. Some industry groups who have incorporated EFPs into membership requirements and assessment tools are Potato Growers of Alberta and Egg Producers of Alberta.

The EFP is a voluntary, whole farm, self assessment tool that helps producers identify their environmental risks within their operations and develops plans to mitigate identified risks. The program is designed to put the onus of land and environmental stewardship on the producer to encourage due diligence in protecting water, air, and soil quality for a sustainable production of crops and livestock and to leaving a healthy and productive farm for the next generation. The EFP will identify improvements that can be made and to areas where the producer is doing well. It is in the producer's best interest to address the identified risks to increase operational efficiency while reducing farm costs. With the completion of an EFP, a certificate is awarded, and the producer is eligible for some funding under the Canadian Agriculture Partnership. Having an EFP demonstrates to the public, government, lenders and/or investors that operations are managing for environmental risks.

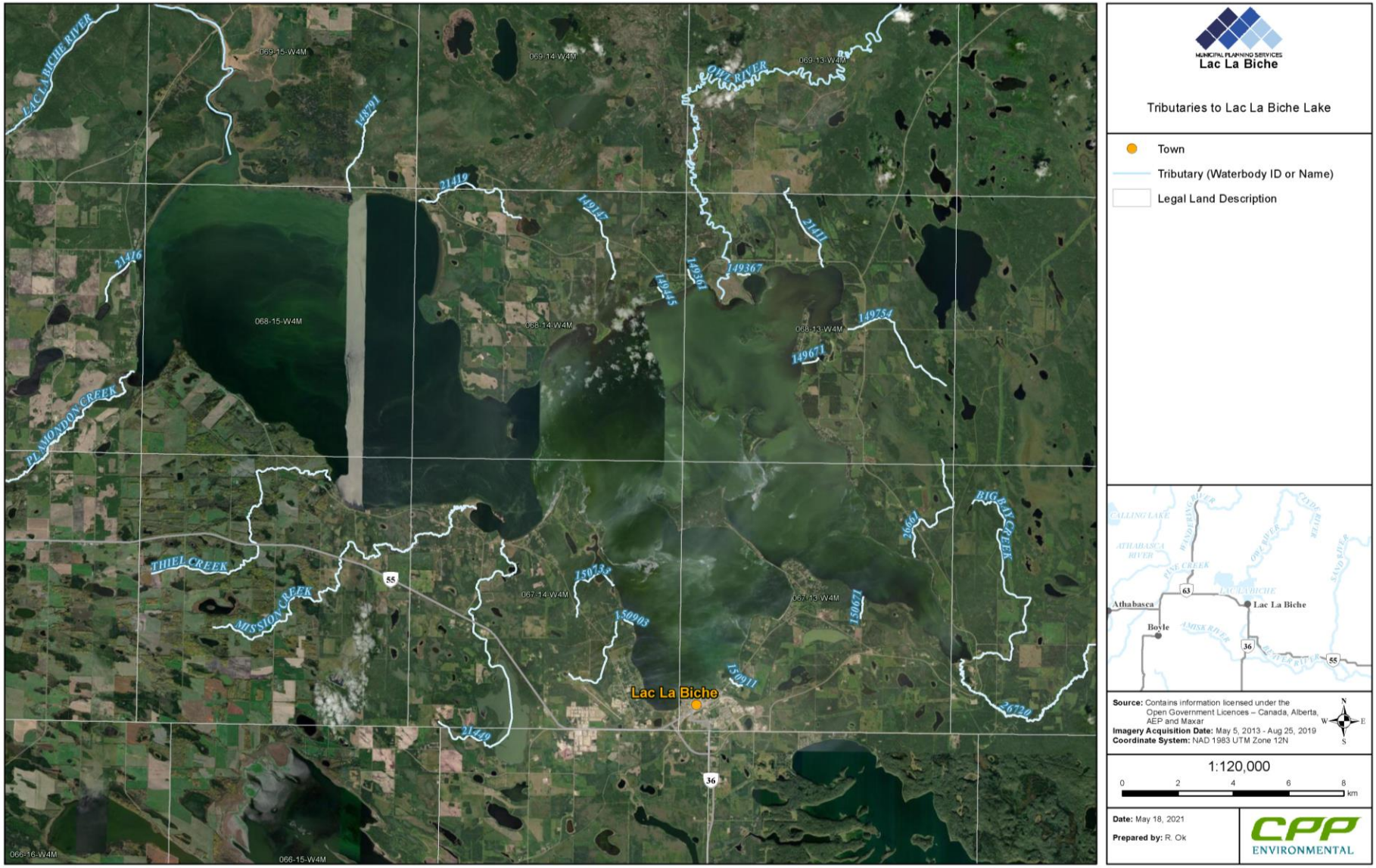


*Figure 13. Mapped tributaries into Lac La Biche*

*Table 2: Tributaries entering Lac La Biche (AEP FWMIS 2020)*

| WBID | Name | Description of Tributary | WBID | Name | Description of Tributary |
|---|---|---|---|---|---|
| 1351 | Plamondon Creek | Confluence of Horse Creek Horse Creek and Plamondon Creek approximately 600 meters upstream from confluence with Lac La Biche lake. Deemed "Special Waters" by AEP. | 26720 | Unnamed | Creek with multiple arms. Deemed "Special Waters" by AEP. |
| 21416 | Unnamed | Drainage for two unnamed small permanent lakes. | 150671 | Unnamed | Drainage for one unnamed small permanent lake. |
| 148791 | Unnamed | Drainage for two unnamed small permanent lakes. | 150671 | Unnamed | Drainage from Lac La Biche Trout Pond. |
| 21419 | Unnamed | Drainage for Skukun Lake and a small permanent lake. | 150911 | Unnamed | Locally known as Red Deer Brook. Creek connects multiple unnamed small permanent lakes and Field Lake. Deemed "Special Waters" by AEP |
| 149147 | Unnamed | Drainage for Lagoon Lake. | 150903 | Unnamed | Creek. |
| 149445 | Unnamed | Drainage for one unnamed small permanent lake. | 150733 | Unnamed | Drainage from McGrane Lagoon and a small unnamed permanent lake. |
| 149361 | Unnamed | Drainage for one unnamed small permanent lake. | 21449 | Unnamed | Drainage from Antoine Lake and multiple unnamed small permanent lakes. Deemed "Special Waters" by AEP. |
| 149367 | Unnamed | Drainage from Owl River riparian area. | 21413 | Mission Creek | Creek with multiple arms. Deemed "Special Waters" by AEP. |
| 21411 | Unnamed | Creek. | 21414 | Thiel Creek | Creek with multiple arms. Deemed "Special Waters" by AEP. |
| 149754 | Unnamed | Creek with one arm. | 26661 | Unnamed | Creek with two arms. |
| 149671 | Unnamed | Drainage from Savouye Lake and unnamed small permanent lake. | 21410 | BigBay Creek | Confluence with multiple creeks draining multiple unnamed small permanent lakes. |

## 3.5 PLAN IMPLICATIONS

1. Literature from the Lac La Biche watershed is consistent with the broader scientific community's assertion that there is a relationship between land cover\use and nutrient export, with natural lands exporting the lowest amount of nutrients. Therefore, we recommend maintaining or improving the coverage and ecological condition of natural land cover (e.g., forests, grasslands, and wetlands).
    - Focus could be on encouraging and facilitating low-intensity development to maximize the relative proportion of natural land cover.
    - In residential areas, BMPs and implementation of Low Impact Development (LID) practices (stormwater section) in existing and new developments will be very important to reduce P export. Principles and practices for implementing LID practices at Lac la Biche are detailed in the Alberta Clean Runoff Action Guide (ALIDP 2016). Incorporating low-P development standards in Land cover Bylaws and statutory plans will be very important to achieve compliance on the part of individual landowners and developers.

- The identification of high-priority ecological areas for water quality, water quantity, and fish and wildlife habitat (e.g., important headwaters, critical riparian areas, drainages to the lake, critical spawning areas) could be accomplished to support decision-making regarding which areas to focus on for naturalization protection/restoration.
- Review of development applications could consider the increases to nutrient and sediment loading due to cumulative land cover change, not just due to the individual project itself. Perhaps consider this for high-priority ecological areas as per above.

2. Riparian areas leading up to and including walleye spawning habitat in the Owl River have already been identified as prime importance. Furthermore, of all the tributaries, the Owl River is the most important to the hydrology and water quality of Lac La Biche. Building off the tremendous success of the Owl River riparian restoration project, riparian restoration along the Owl River should be a top priority moving forward.
3. Further to the above point, given the tremendous importance of the Owl River and its tributaries, consider the implementation of a water quality monitoring program.
4. Significant functions of wetlands are their ability to trap and retain nutrients and provide necessary habitat for countless species. Furthermore, keeping wetlands on the landscape will allow water retention on the landscape, which will prevent downstream flooding and damage to infrastructure such as culvers and bridges. To increase these functions in the Lac La Biche watershed, wetlands should be conserved and restored. Thus, a list of candidate wetlands for restoration within the watershed should be developed and will streamline watershed improvement efforts under the Alberta Wetland Policy. Also, riparian buffers around wetlands are required to protect function.
5. In agricultural lands, continue and encourage use of BMPs that promote soil health and responsible resource use (e.g., conservation tillage, keeping cattle out of waterbodies, etc.). Conservation tillage programs can reduce the erodibility of soils and the subsequent potential for export via runoff. Similarly, precision agriculture approaches can be taken to avoid the export of excess nutrients off the land and into waterways by carefully controlling the application rate, timing, and placement of inorganic fertilizers or manure (i.e., encourage use of environmental farm plans). BMPs specific to ranching include reducing the intensity of grazing and trampling near riparian areas and providing water alternatives away from streams and lakes. Cattle activity in riparian areas causes soil compaction and disturbance, which prevents the effective recovery of riparian vegetation communities. Lastly, consider the preservation of low-intensity agricultural areas as a form of preserving natural land cover. Consider focussing these efforts along Lac La Biche and all tributaries that discharge directly to it (see **Figure 13**), and along the Owl River and its major tributaries. Production and implementation of Environmental Farm Plans should be encouraged, particularly where manure and nutrient management are required.
6. Improvement in septic field management. In the long-term, removal of septic fields, in addition to upgrades to sewage/septic infrastructure of cottages and public use areas (where antiquated or ineffective) should be encouraged to improve the water quality of Lac La Biche. In the interim, public education of septic field maintenance and municipal inspection programs (voluntary or otherwise) may maximize septic field efficacy. Although sewage inputs to the lake are a relatively small source of P, reducing seepage into the lake will have benefits to water quality since the P forms present in sewage are highly bioavailable for algal and plant uptake (i.e., dissolved forms of P).
7. Consider prohibitions on cosmetic fertilizers and pesticides in or adjacent to environmentally-sensitive areas.

8. Maintain the annual surface water quality monitoring program for Red Deer Brook to continue to document improvements from the upgraded WWTP.
9. Nutrient loading estimates have been generated for the tributaries that discharge into Lac La Biche. However, this information is dated (2003). Nutrient loading estimates should be updated with new information from the County and combined with internal loading estimates to complete a water and nutrient budget for Lac La Biche.
10. Encourage farm owners in the area to become apart of the EFP program to ensure farms are ecologically sustainable and limit deleterious substances from entering waterbodies.

## 3.6 LITERATURE


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# 4. THE SHORELINE

## 4.1 SENSITIVE HABITAT INVENTORY MAPPING

Sensitive Habitat Inventory Mapping (SHIM) is a method for characterizing the physical and biological features of a lake's foreshore so that ecologically sensitive areas and critical habitat can be identified and protected from shoreline development. The SHIM project for Lac La Biche was initiated in 2016 by Living Lakes Canada and the Stewards of Lac La Biche Watershed (in partnership with Lac La Biche County) to respond to community concerns over the health of the lake and in response to the 2009 Watershed Management Plan. The SHIM approach has proven successful in a variety of lakes in British Columbia when incorporated into local and regional land cover planning to develop appropriate mitigations measures and minimized impacts to sensitive features. This was the first application of the SHIM method outside of British Columbia. The project consisted of three main components: Foreshore Inventory and Mapping (the collection of information), Aquatic Habitat Index and Activity Risk Table (determined ecological habitat value and risk of proposed development activities), and Shoreline Management Guidelines (recommends management practices and mitigation measures to avoid and minimize adverse environmental effects).

### 4.1.1 Foreshore Inventory and Mapping

The foreshore inventory summarizes the physical and biological features along 167 km of Lac La Biche shoreline. The physical features evaluated are based on two broad categories: natural and disturbed shorelines. The shorelines are categorized by shore type and land cover, and shoreline modifications. The shoreline segments ranged from 100% natural to 100% disturbed depending on the adjacent land cover and level of impact.

Approximately 85% of Lac La Biche's shoreline was assessed as natural (**Figure 14**). The islands within the lake are designated as protected area

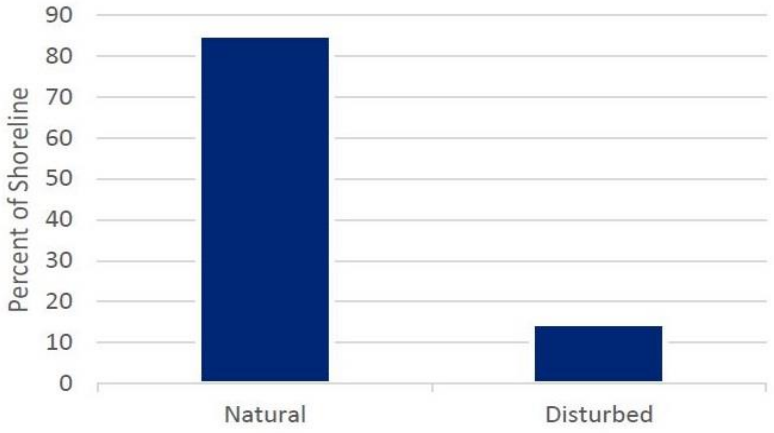


***Figure 14. Percent of natural and disturbed shoreline on Lac La Biche***

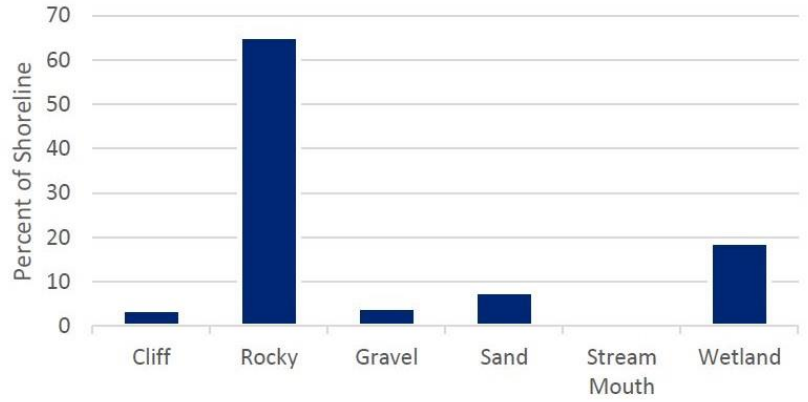


***Figure 15. Percent of shoreline occupied by various shore types on Lac La Biche***

for colonial water bird species during nesting season and remain natural. The dominant shore type was rocky (65%), followed by wetlands (19%), sand (8%), gravel (4%), cliff (4%), and stream mouth (<1%) (**Figure 15**). Sand shore types were located adjacent to residential developments, while rocky shores were scattered throughout the lake and wetlands were concentrated along the north shore of both basins (**Figures 16 and 17**). The largest wetland was along the floodplain of the La Biche River fen area (northwestern basin).

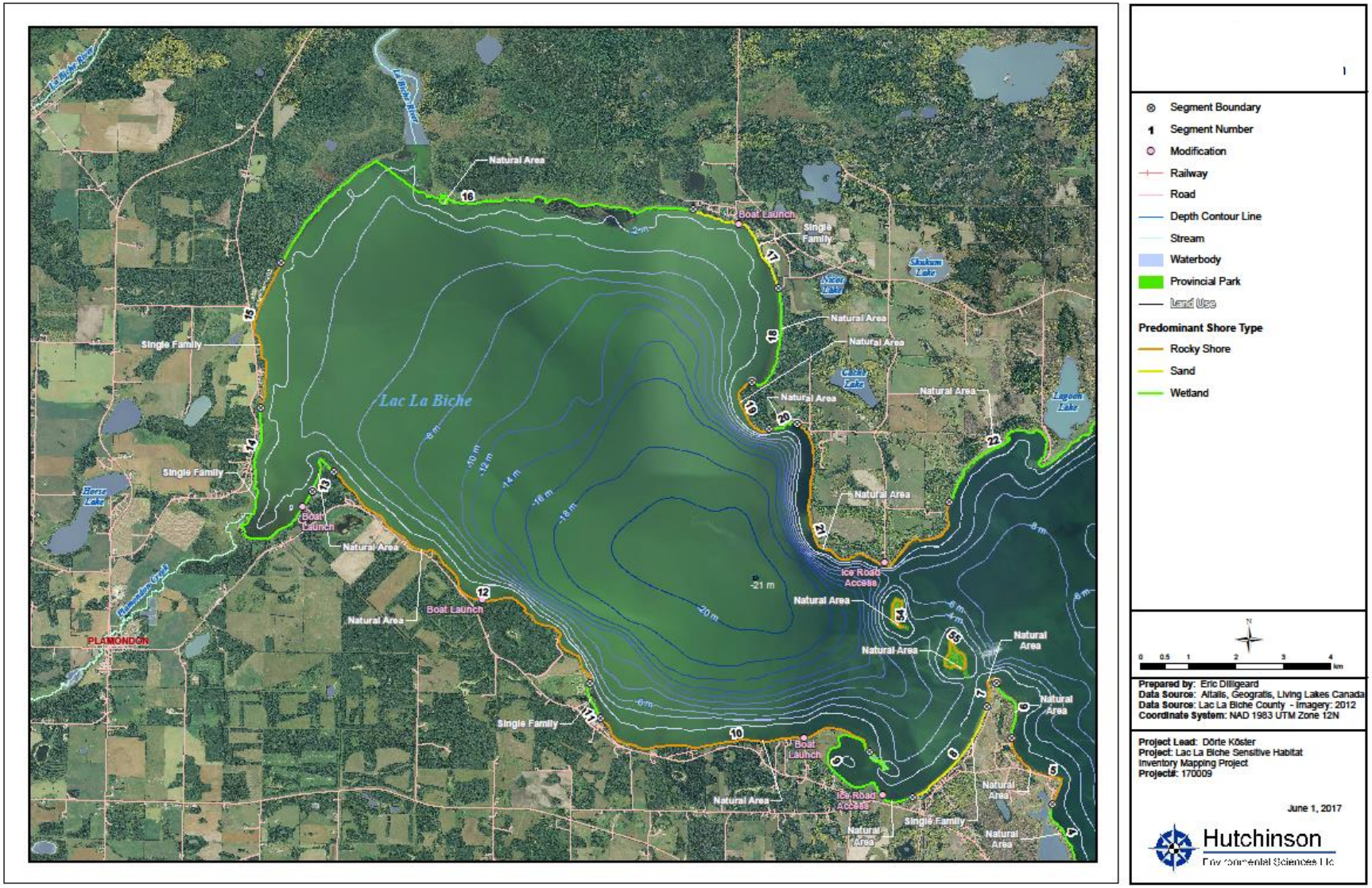


*Figure 16. Physical features of Lac la Biche – West Basin*

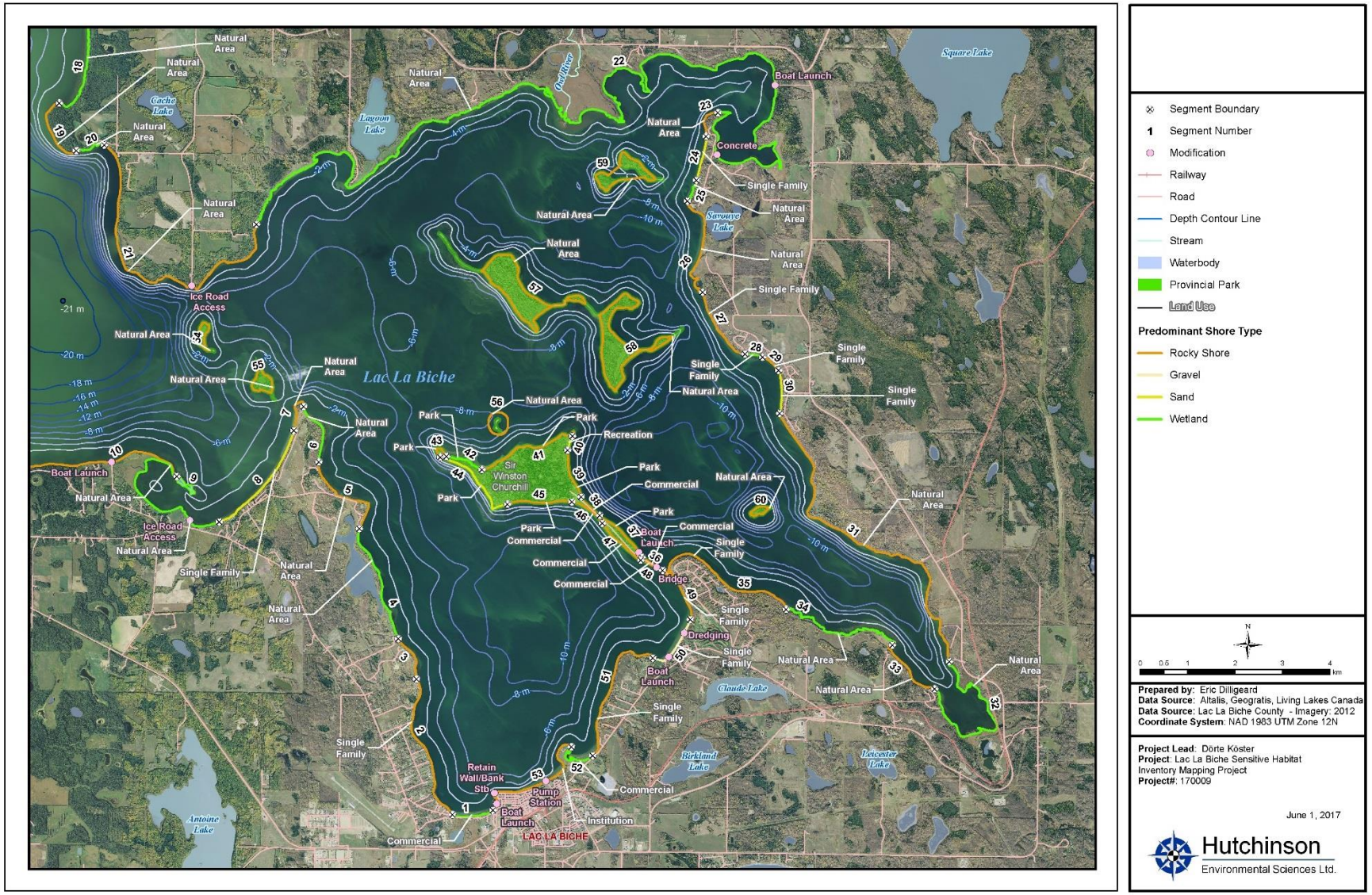


*Figure 17. Physical features of Lac la Biche – East Basin*

The most abundant land cover directly adjacent to the shoreline was natural areas, which occupied 65% of the shoreline, followed by commercial (12%), single family (12%), and natural park (11%). The remaining land covers were < 1% for agriculture, recreation and industrial (**Figure 18**). Commercial land cover is relatively high due to the presence of roads, most of which constitute the causeway to Sir Winston Churchill Provincial Park. Most single-family homes were associated with Mystic, Mission, McGrane, Lac La Biche West, Golden Sands subdivisions, as well as the hamlet of Lac La Biche.

Modified shorelines were most abundant along the southern shoreline of the eastern basin near the hamlet of Lac La Biche and adjacent to other areas of high-density development. These modifications included smaller developments such as residential docks and boat houses, while larger modifications included eight public boat launches, two ice road accesses, a large retaining wall and an area of dredging. More specifically, there were 229 docks, 248 boat lifts, 39 private boat launches, 50 retaining walls, 10 marine railways, 11 mooring buoys and 1 pump station observed along the shoreline. Heavily modified shorelines were observed adjacent to single-family residential development, like a 1.5 km retaining wall comprised of wood, stone, and concrete. Other notable modifications to the shoreline were riparian, wetland and submerged vegetation removal, as well as the addition of substrate for boat launches and beaches for recreation.

In the riparian area (from the high-water mark inland 30 m), vegetation was classified as broadleaf forest (45%), mixed forest (39%), natural wetland (5%), shrubs (5%), landscaped (4%) herbs/grasses (2%) or exposed soil (<0.1%) (**Figure 19**). Wetland vegetation was most evident in the southeastern embayment. Shrubs were most abundant around High Island, Black Fox Island, and Fox Island. Landscaped vegetation was found near developed areas, and broadleaf and mixed forests were

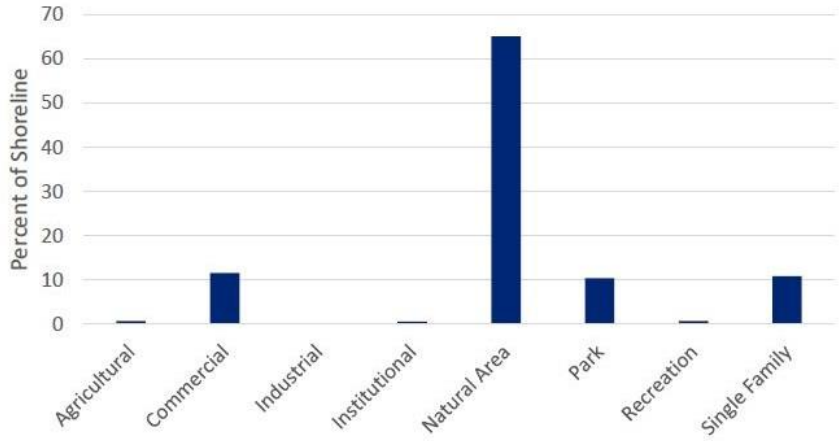


*Figure 18. Percent of shoreline occupied by various shore land uses on Lac La Biche*

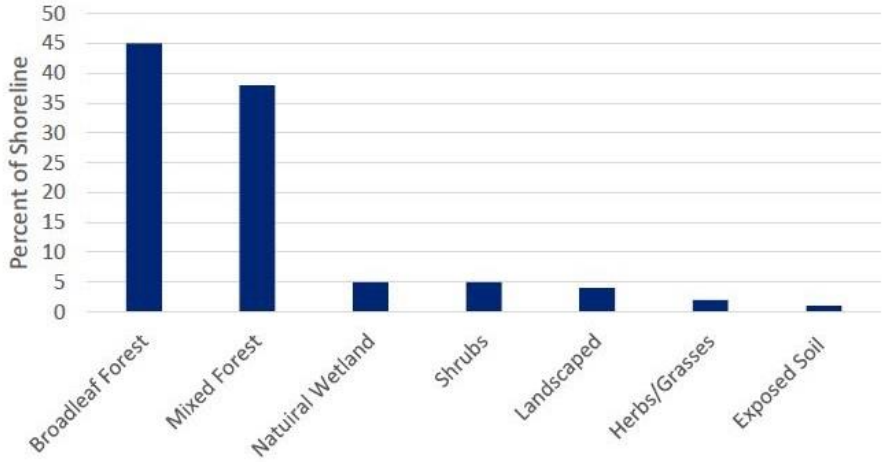


*Figure 19. Types of riparian vegetation observed in the B1 zone on Lac La Biche*

scattered around the lake. Rocky shorelines (the predominant shore type) generally had overhanging vegetation and shrubs or emergent grasses and herbs beginning at the high-water mark and extending inland 1-3 m, while larger trees and shrubs dominated beyond.

The littoral zone (i.e., near-shore areas within the water) performs a wide range of ecologically important functions, including nutrient and contaminant sequestration, shoreline stabilization, buffering water flows, and supporting rich biodiversity. The littoral zone is characterized by submerged and emergent aquatic vegetation and is a key environmental feature in a lake that provides cover habitat for fish and a food source for wildlife and birds. Submerged vegetation was abundant, covering 70% of the littoral environment. Coverage was highest (>80%) along the north shore of the western basin adjacent to the floodplain of the La Biche River and throughout the eastern basin's shoreline. Emergent vegetation was less abundant than submerged vegetation, occupying 18% of the shoreline, varying due to rocky and sandy substrate; however, abundant coverage (>90%) was found adjacent to wetlands. In general, emergent vegetation cover was related to the extent of shoreline development, and substrate type (introduced or natural).

### 4.1.2 Aquatic Habitat Index and Activity Risk Table

An Aquatic Habitat Index (AHI) is a tool to assess habitat value and environmental sensitivity of a shoreline. Biophysical habitat parameters were selected to represent overall ecological shoreline health and categorized by their condition. Each parameter was weighed based on its significance or contribution to the health of the aquatic habitat. Shorelines with Very High and High habitat values are a good indication of environmentally sensitive areas and are classified as Zones of Sensitivity (ZOS). Most of the shoreline was classified with having high habitat value (40%), followed by very high habitat value (30%), moderate habitat value (28%), and low habitat value (<2%) located adjacent to the Hamlet of Lac La Biche (**Figures 20, 21, and 22**). There were four identified ZOS along the shoreline of Lac La Biche: Plamondon Wetland, La Biche River Fen, Spawning Shoal, and Bird Sanctuary (**Figure 23**). Boat launches had the greatest shoreline modification impact (60%), followed by docks (35%), retaining walls (5%) and groynes (<1%).

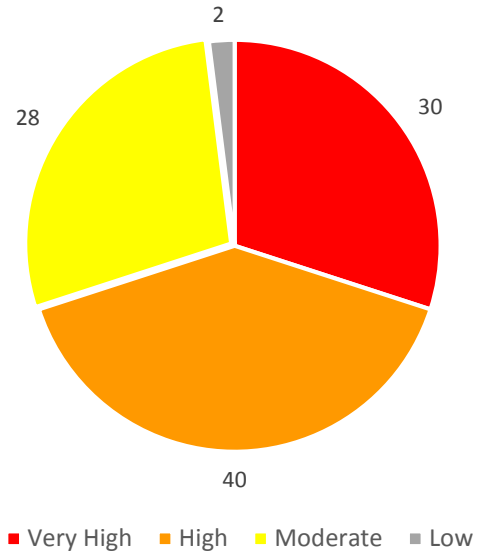


*Figure 20. Aquatic Habitat Index Values represented by percentage for the Lac La Biche shoreline*

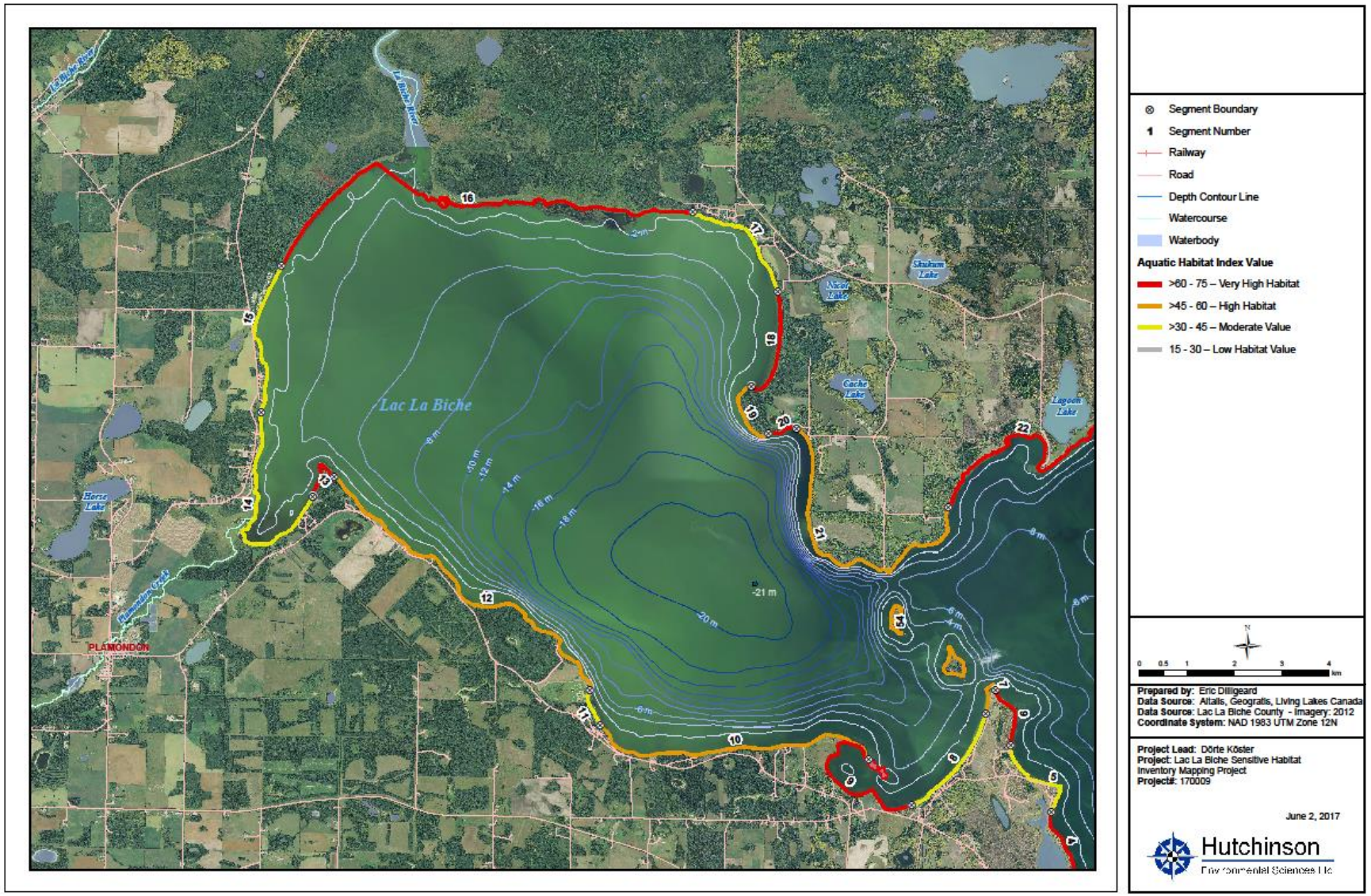


*Figure 21. Aquatic habitat index – West Basin*

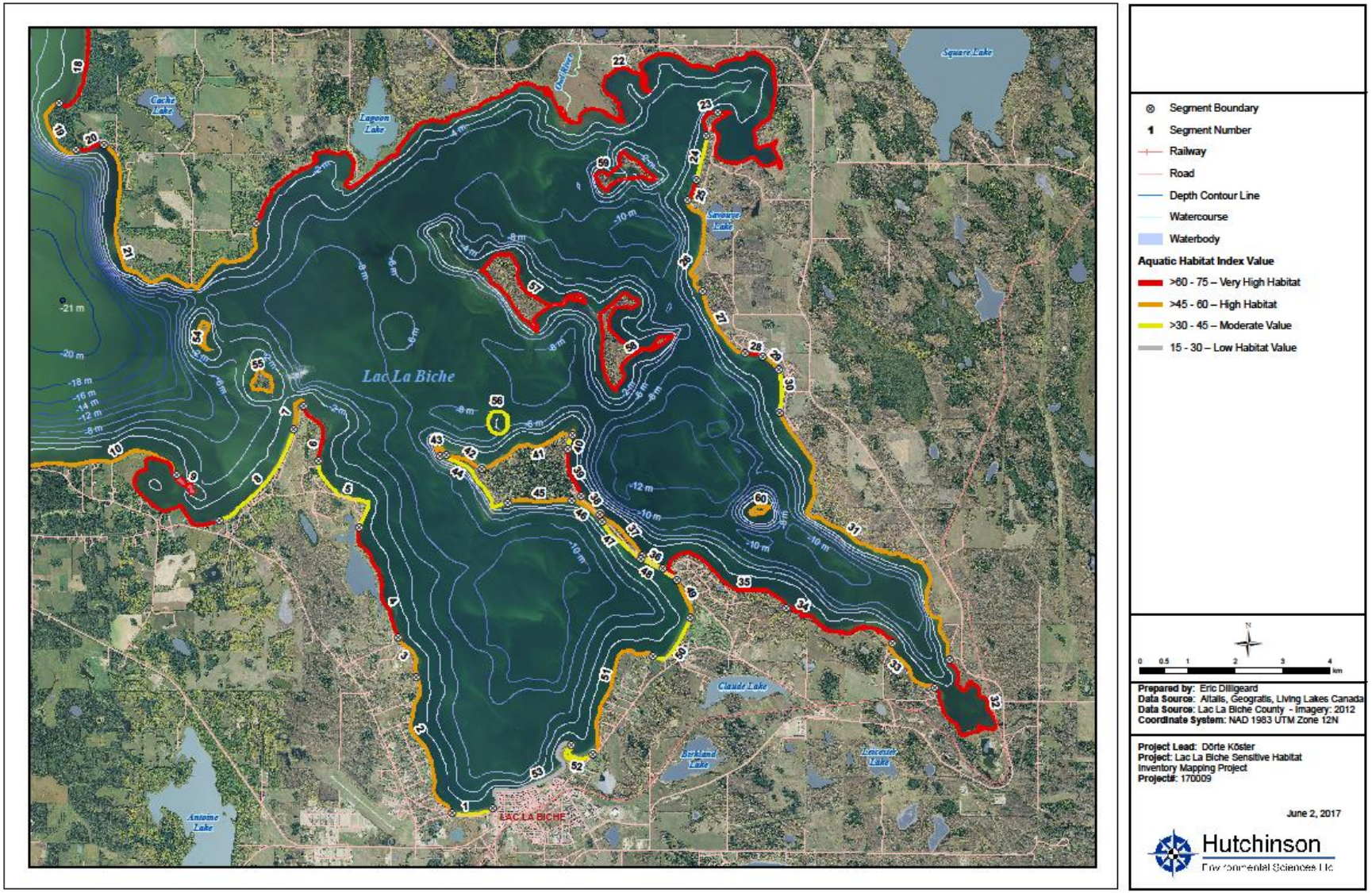


*Figure 22. Aquatic habitat index – East Basin*

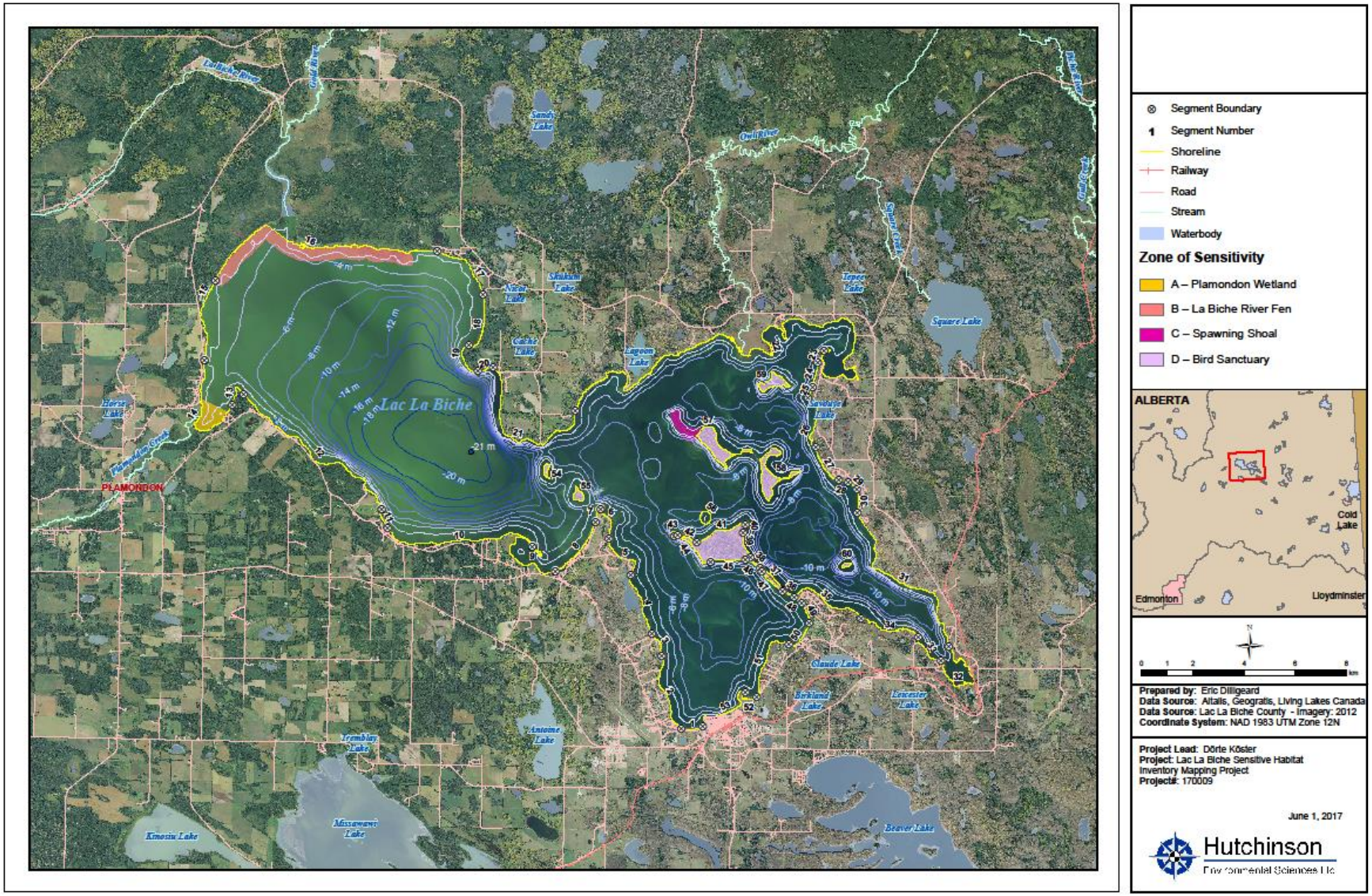


*Figure 23. Zones of sensitivity along Lac la Biche*

The Activity Risk Matrix (ARM) contains a list of common development activities that could occur in the foreshore of Lac La Biche (**Table 3**). Each activity is based on its anticipated environmental impacts and the value of ecological habitat found in each segment. The AHI and Activity Risk Table provide a planning tool, but individual features and functions need to be considered based on social, economic, and environmental factors, as well as any provincial, federal, and municipal regulations.

Living Lakes Canada proposes a decision-making flowchart, according to the above activity risk, to enable users to scope project requirements in accordance with activity risk. This flowchart does not follow current regulatory processes in Alberta, thus further evaluation and discussion is required regarding its application.

***Table 7. Activity Risk Matrix relating development activities with AHI Categories and ZOS to determine the activity risk as high (H), medium (M) or low (L). Adapted from Hutchinson 2017***

| Activity | Shore Zone Category and Activity Risk | | | | Modifier |
|---|---|---|---|---|---|
| | Red | Orange | Yellow | Grey | Zone of Sensitivity |
| Aquatic vegetation removal | H | H | H | M | H |
| Beach creation above HWM | H | H | M | M | H |
| Beach creation below HWM | H | H | H | H | H |
| Boat house below HWM | H | H | H | M | H |
| Boat launch upgrade | H | H | H | H | H |
| Boat lift - Temporary | M | M | L | L | H |
| Docks | Refer to Department of Fisheries and Oceans (DFO)Guideline for docks | | | | |
| Dredging | H | H | H | H | H |
| Dredging – Maintenance/ previously approved | H | H | H | H | H |
| Elevated boardwalk below HWM | H | M | M | M | H |
| Erosion protection (hard engineered) | H | H | H | M | H |
| Erosion protection (soft engineered) | H | M | L | L | H |
| Foreshore sediment disturbance and removal of lakebed substrates | H | H | M | M | H |
| Infill | H | H | H | H | H |
| New boat launch | H | H | H | H | H |
| Over water piled structure (house, building) | H | H | M | M | H |
| Public beach maintenance | M | L | L | L | H |
| Septic application | Refer to residential permitting requirements | | | | |
| Installation of treated effluent discharge pipe | H | H | M | M | H |
| Upland vegetation removal | H | M | M | M | H |
| Waterline drilled | H | M | L | L | H |
| Waterline trenching | H | H | H | M | H |

## 4.2 LEARNING FROM EXPERIENCE: WATERSHED IMPROVEMENT INITIATIVES

### 4.2.1 Riparian Setback Matrix Model

Lac La Biche County implemented the Riparian Setback Matrix Model (RSMM) in 2010. As part of the development application process, a developer is responsible for the use of the RSMM where developmental activities are proposed to occur near lakes, streams, rivers, and wetlands. The RSMM is used to determine the appropriate allocation of Environmental Reserve/Riparian Development Setback (ER/RDS) to prevent deleterious substances from entering the water body from developmental activities. Although the program has been very successful at the planning stage, the main challenge Lac La Biche County has encountered with the implementation of this policy is the confirmation that the ER/RDS has been implemented and respected at the time of construction. Another challenge is that it can be difficult to measure all of the parameters that are used to determine the setback.

### 4.2.2 Stormwater Management

Depending on the type of land cover, stormwater may contain a significant quantity of toxic metals, salts, nutrients, oil and grease, bacterial and other contaminants. There are a variety of Best Management Practices (BMPs) to aid in the removal of contaminants from stormwater. The existing stormwater system in the Hamlet of Lac La Biche has eleven outfalls that drain into Lac La Biche. In 2008, the County commissioned a stormwater management plan that recommended improving the quality of stormwater prior to discharge into the lake by incorporating a hydrodynamic separation as part of the stormwater management system (Genivar 2008). Six oil grit


*Figure 24. Locations of General Oil Grit Separators (OGS) within the Hamlet of Lac La Biche (from Lac La Biche County)*

separators (OGS) were installed on existing outfalls to date, with remaining outfalls to be replaced in the future (**Figure 24**). Existing channels that feed the old outfall structures are typically rehabilitated and/or replaced to accompany the installation of the OGS.

## 4.3 PLAN IMPLICATIONS AND RECOMMENDATIONS

1. Complete a review of the effectiveness of implementation of RSMM, focussing on the practical application of the approach and examining potential enforcement approaches, if any.
2. SHIM:
    - SHIM has created an Activity Risk Matrix to be used in conjunction with Aquatic Habitat Index for zones around Lac La Biche. Discussion needs to occur to determine how to incorporate this Matrix into municipal planning frameworks.
    - Other than what the County can do, conservation programs and measures should be focused on portions of the shoreline that have high to very high habitat value, as well as the four zones of sensitivity.
    - Revisit SHIM ten years following the initial assessment to update the state of shoreline habitat, and if restoration measures are increasing natural shoreline and habitat values.
3. Develop a landowner program to encourage shoreline protection and education as stewards. Partnerships could be formed with Cows and Fish and Alberta Conservation Association. This can target current landowners and developers to provide information and appropriate solutions to common concerns such as:
    - Public Lands Act and who owns what part of the shoreline. Provincial, the Crown or the landowner.
    - Encouraging the use of shared docks and day use areas, instead of individual ones, and encouraging temporary/seasonal boat lifts and docks.
    - Eliminating the use of fertilizers and herbicides along the lakeshore properties.
4. Consider a riparian health survey for major tributaries in the watershed to address a gap in riparian health knowledge in the watershed.
5. Inasmuch as possible, the County to limit the use of salts on shoreline roads and driveways to limit the increase in lake salinity via runoff.
6. Inasmuch as possible, the County to limit the use of fertilizers and pesticides near environmentally sensitive areas.
7. Determine other locations around the lake and its main tributaries (e.g., Red Deer Brook) where oil grit separators would be beneficial.
8. For County projects, consider adopting Alberta Transportation's Environmental Construction Operations Plan framework (ECO plans) for construction activities to ensure that contractors systematically identify and mitigate environmental impacts that may result from their activities.
9. Avoiding where possible activities that involve the removal of riparian vegetation such as mowing, trimming, herbicide applications, cultivating, and land clearing. Maintaining natural vegetation cover on shores is preferred to artificial armoring and modification of shorelines.

10. Educating watershed property owners and lake visitors about the importance of littoral vegetation. The current perception of many is that most aquatic plants are all "weeds" and are a nuisance to lake users. However, educating the public on the ecological value of aquatic vegetation is important for the maintenance and improvement of these areas.

11. BMP recommendations from the County's Stormwater Management Plan (Genivar 2008) should continue to be implemented:

    - Source Control: Directed stormwater in such a way that it does not run onto surfaces where pollutants can be picked up (pavement, exposed soil, etc.). Create awareness and a sense of ownership so that the consequences, implications, and mitigation measures are understood.

        - ✓ Sweeping pavement and roofs rather than washing.
        - ✓ Controlling erosion by stabilizing exposed soils and banks with vegetation (riparian vegetation programs).
        - ✓ Carrying out landscaping in accordance with the Municipal Development Plan.
        - ✓ Minimizing the use of pesticides and fertilizers.
        - ✓ Ensuring proper handling, disposal and recycling of toxic metals, organic compounds, oil, and grease
        - ✓ Carry out construction activities in such a manner that minimum suspended sediments are created (see ECO Plans above)

    - Lot-Level BMPs: These practices reduce runoff volumes and/or treat stormwater before it reached the conveyance system.

        - ✓ Carrying out lot grading in accordance with available Standard Guidelines for Design and Construction
        - ✓ Implementing on-lot infiltration systems and infiltration trenches for small basin areas only after evaluating the impact on groundwater
        - ✓ Creating temporal surface ponding in backyard, parking lots, and parking areas. Consider bio-swales.

    - Conveyance System BMPs: Transport runoff from developed areas through more natural means (e.g., grassed swales) to reduce peak stormwater discharge volumes. It is recommended to carry out the stormwater conveyance system BMPs in accordance with the Stormwater Management Guidelines for the Province of Alberta.

    - Other BMPs include incorporating the principles of Low Impact Development (LID) design. The principle is based on creating a hydrologically functional landscape that mimics the natural hydrological regime.

## 4.4 LITERATURE

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# 5. LAC LA BICHE

## 5.1 WATER QUALITY

Lac La Biche is highly "eutrophic", meaning it contains high nutrient concentrations that produce large quantities of algae. This is due to a combination of factors, including high P inputs from both human and natural sources, very long water residence time and efficient internal recycling of P. Schindler et al (2003) noted that on an annual basis, 32% of the P that enters the lake is deposited within the lake, while only 17.5% of it leaves via the outflow, representing a net gain in P. Because of the large area and relatively shallow depth of the lake, it doesn't take much wind energy to prevent or break-down thermal stratification of the water column. Thus, the water column stratifies and mixes repeatedly throughout the summer (i.e., it is polymictic). Stratification in summer is weak, i.e., when warmer water occurs, short periods of stratification can occur. Even during these short episodes, near bottom oxygen concentrations decrease and nutrient concentrations increase. During mixing events, nutrients that have accumulated in deeper waters are brought to the surface, available to be consumed by algae during summer. This results in near-surface waters repeatedly resupplied with nutrients during the summer. In this way, polymictic conditions (i.e., weak stratification) are optimal for promoting algae growth.

The morphology of the west basin permits periodic stratification throughout the warmer months like other lakes in the region. In contrast, the shallower east basin only becomes weakly stratified, if at all. **Table 4** summarizes water quality data from the last 10 years to historical water quality data. A trend analysis on water quality data from the east basin of Lac La Biche using data from 1983 to 2004 has showed no statistically significant change in water level, total P, or algal biomass (chlorophyll-*a*). However, there has been a significant decrease in water transparency (Casey 2011), meaning that the water became cloudier historically. Also notable is that total dissolved solids (i.e., the amount of salts in the water) increased, but the trend was not quite statistically significant. This may have implications regarding the use of road salts and minimizing stormwater runoff directly into the lake.

*Table 8. Water parameters comparing historical data to the last 10 years, showing results from 2010, 2015, and 2019.*

| Water Parameter | Year Sampled | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Historical (2006-2009) | | 2010 | | 2015 | | 2019 | |
| | East | West | East | West | East | West | East | West |
| Secchi Depth Average (m) | 2.25 | 2.75 | 1.6 | 1.5 | 2.1 | 1.2 | 2.2 | 2.47 |
| Total Nitrogen (mg/L) | 0.95 | 1.08 | 0.9 | 1.0 | 1.25 | 1.8 | 3.15 | 3.12 |
| Total Phosphorus (mg/L) | 0.11 | 0.09 | 0.12 | 0.08 | 0.24 | 0.09 | 0.19 | 0.199 |
| N/P ratio | 8.64 | 12.0 | 7.5 | 12.5 | 5.2 | 20 | 16.6 | 15.7 |
| Specific Conductivity (µS/cm) | 272 | 290 | 278 | 284 | 243 | 243 | 255 | 255 |

Resident knowledge and a paleo-environmental study have confirmed that algal blooms have intensified over the past 200 years (Schindler et al. 2008). Most variables examined in this study began to change in consistent ways in the early 20$^{th}$ century, during the period when land clearing in the watershed began, the results of increased influx of European settlers. Increased annual fluxes of inorganic matter indicates that erosion in the watershed of the lake has increased, likely due to the conversion of forested lands to agricultural, industrial, and urban uses, and associated road and stream crossing development. Eutrophication particularly accelerated in the east basin after about 1950, and after 1970 in the west basin. Annual P sedimentation increased at an exponential rate to present time, with the most rapid increases in the early 2000s. The declining N to P ratio over time in the west basin (see **Table 4** above) indicates that nutrient conditions have become increasingly favorable for N-fixing cyanobacteria, a species that are commonly associated with nuisance blooms of algae. Results from the paleo-environmental study of Lac La Biche determined that the lake was eutrophic before European settlement but has undergone additional cultural eutrophication in the past 40-60 years.

Both the East and West basins of the lake exhibit the necessary factors that promote algae growth. These factors include a stable water column, warm water temperatures, high epilimnetic nutrient concentrations, low N to P ratios, high pH, low available $CO_2$ concentrations, and reduced grazing by large zooplankton. Lac La Biche has a long long-recorded history of algal and cyanobacteria blooms dating back to the 1920s (Chipeniuk 1975). Cyanobacteria and algal blooms can sometimes produce microcystins which are toxic when ingested. In enough concentrations, microcystins can pose a serious threat to human and animal health. Besides favorable environmental conditions, the success and proliferation of cyanobacteria in Lac La Biche may be partly attributable to certain aspects of their biology. These include fast reproductive rates, lower light requirements relative to other phytoplankton, decreased palatability to some grazing zooplankton, buoyancy-promoting gas vesicles in certain species, N-fixing capability of certain species, and the ability of certain species to extract P from the sediments directly. Cyanobacteria can become over-buoyant, causing them to concentrate near the surface of the water, which tends to occur when calm conditions follow windy periods. Surface accumulations may intensify when waves concentrate the bacteria in bays or along shoreline and beaches. While cyanobacteria-ecosystem dynamics are not yet fully understood in Lac La Biche, ecological perturbations observed in other eutrophic lakes may indicate some of the potential

impacts that cyanobacteria blooms have on Lac La Biche biota. For example, the increased turbidity of lake water during and following cyanobacteria blooms decreases light penetration into the water, which suppresses the growth of rooted aquatic vegetation. The capacity of the vegetation to uptake P from the sediments and retain it in biomass is reduced, resulting in more nutrients available for internal loading and feeding cyanobacteria blooms. The highest concentrations were typically reported in the eastern basin due to westerly winds.

## 5.2 INVASIVE SPECIES

Aquatic invasive species pose a multitude of threats; they can alter existing aquatic ecosystem functions; impair water treatment and industrial infrastructure; potentially harm human health; and affect ecological tourism and fisheries, recreational watercraft, and waterfront properties. Lac La Biche Watershed and Lac La Biche have no reported sightings of aquatic invasive species as of 2019. However, waterbodies like Lac La Biche are under constant threat from the unintentional introduction of invasive species. These organisms, whether they are plants, fish, or invertebrates, can cause significant damage to the lake's ecosystem. Other areas in Alberta have already seen the effects of waterbody-choking plants such as Eurasian Watermilfoil or Flowering Rush and fish such as Prussian Carp, while species such as zebra and quagga mussels have caused immense devastation elsewhere in Canada. The potential introduction of these species can be the result of improper care of boats and other recreational items and by the inter-lake transfer of water equipment. Extreme care must be taken with water vessels and equipment (boats, canoes, fishing gear, waders etc.) to ensure removal of any plants, animals and/or mud. The *Clean, Drain, Dry* program has been introduced as a means of protecting lakes from these invasive species. The Government of Alberta and a handful of not-for-profits organizations have been actively monitoring various lake in Alberta. Mandatory watercraft inspection stations have been present along major highways coming into Alberta from the east, west and south since 2013.

Some of the species of concern are:

1. Zebra mussels (*Dreissnea polymorpha*) and quagga mussels (*Dresissnea bugensis*) were introduced to North America via ballast water from Eurasia and have severely disrupted aquatic ecosystems in the Great Lakes Region and elsewhere. These organisms attach to hard surfaces (e.g., boat hulls, propellers, docks, and any in water infrastructure) in very high densities and their veliger's (larvae) are readily transported in bait containers, live wells, waders, and mud. Thus, boats are the primary form of zebra and quagga mussel introduction to new waterbodies. In addition to disrupting aquatic food webs, zebra and quagga mussels pose a considerable nuisance to recreation and impediment to infrastructure; once colonies have established, they are extremely difficult to eradicate. Zebra and quagga mussels have not been detected in Lac La Biche as of 2019, but have been confirmed in Montana, USA and Lake Winnipeg, Manitoba as of 2017. Early detection and actions are necessary to prevent infestation and potentially irreversible consequences. Alberta Environment and Parks has been conducting monitoring from 2014-2018 (2019 data may not be available yet).
2. Eurasian Watermilfoil (*Myriophyllum spicatum*), listed as a Prohibited Noxious Weed in Alberta, is a rooted aquatic plant that can be highly disruptive to lake ecosystems. It is an unpalatable food source for native waterfowl and fish, and its rapid growth and ability to grow from stem fragments allow it to out-compete native aquatic vegetation. The plant grows close to the water surface and can restrict swimming and boating access, as well as block water outlets. Eurasian Watermilfoil fragments are easily spread between waterbodies via boats,

trailers, anchors, and propellers. Lakes in British Columbia, Ontario and Quebec have already become infested. The plant has not been found in Alberta yet, early detection and a proactive boat maintenance program will be critical to prevent a serious lake-wide threat in Lac La Biche.

3. Flowering Rush (*Butomus umbellatus*), also listed as a Prohibited Noxious Weed in Alberta, is an aquatic plant that can severely disrupt wetland, river, and lake ecosystems. It resembles a large sedge or bulrush but has showy pink flowers and can grow in both emergent and submerged forms. The plant has an extensive root system and – in addition to producing seeds – can reproduce vegetatively from root fragments if they are broken. These root fragments can travel long distances in water and create dense colonies where they establish, crowding out and displacing native aquatic vegetation. Flowering Rush can interfere with boat propellers and its large, dense stands can restrict waterbody access for a variety of lake users. Flowering Rush was sold commercially as an ornamental garden plant in the 1990s but has established in Lake Isle, Lac St. Anne and in Parkland County along the Sturgeon River. This plant has not yet been observed in Lac La Biche, though prevention of a Flowering Rush infestation will require early detection and proper control techniques if any plants establish in the waterbody.
4. Prussian Carp (*Carassius gibelio*) are relatives of common goldfish and pose a serious threat to Alberta freshwater ecosystems. These fish are extremely hardy, able to survive in conditions of very poor water quality which would be intolerable for other fish species. Additionally, Prussian carp can reproduce asexually and effectively create clones of themselves, contributing to rapid population increases. The source of Prussian carp introduction into Alberta's aquatic ecosystems is unclear, though the impacts on aquatic ecosystems of these fish are well-documented. Prussian carp outcompete native fish species for food and habitat resources and can cause fundamental changes in the aquatic invertebrate communities, possibly leading to trophic collapses. There are established populations in the Oldman, Red Deer, Bow and South Saskatchewan watersheds, but no fish have been reported in Lac La Biche as of 2019. Eradication of Prussian carp is very difficult once they are established in a waterbody; hence, education efforts and prevention of introduction into Lac La Biche are paramount.
5. Whirling Disease is caused by *Myxobolus cerebralis,* a microscopic parasite that affects salmonid fish (e.g., trout and whitefish species) through a complex lifecycle involving both the fish (definitive host) and an aquatic worm (*Tubifex*; intermittent host). The severity of whirling disease depends largely on the area and size of salmonid host. Young fish are more vulnerable, with mortality rates reaching up to 90%. Precautions have been implemented since 2017 to help stop the spread of whirling disease from watershed to watershed and is declared in the Bow, North Saskatchewan, Oldman, and the Red Deer watersheds. Fish movement is the primary source of transmission; however, it may also spread through the movement of contaminated mud or water on equipment used for both recreational and industrial activities. As of February 2019, some of the Lac La Biche Watershed (west of Highway 63) has a high to moderate risk for whirling disease. Focus should be on stopping the spread (decontaminating all equipment that comes in contact with the water body before entering a different water body) of the parasite on the landscape to mitigate its impacts on waterbodies.

## 5.3 FISH AND FISH HABITAT

To understand the overall biological health of Lac La Biche, it is important to consider the fish community. According to the AEP Fish and Wildlife Management Information System (FWMIS) database, which provides information on recorded historical fish and wildlife occurrences across the

province, fish species historically captured in Lac La Biche include burbot (*Lota lota*), cisco/tulibee (*Coregonus artedi*), lake whitefish (*Coregonus clupeaformis*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), white sucker (*Catostomus commersonii*) and yellow perch (*Perca flavescens*). The lake supports both indigenous and recreational fisheries for burbot, walleye, northern pike, yellow perch, and lake whitefish. The lake has had commercial fishing historically, which had led to overharvesting, but was closed in the province in 2014. There have been walleye stocking programs implemented since the 1980s, the most recent being from 2006 to 2011 (tied to a walleye restoration program; see McGregor 2014). The most recent walleye management efforts have incorporated cormorant management since it is known that the walleye and cormorant populations are tied (McGregor et al. 2015). The recovery of the walleye in the lake is currently in a monitoring phase with no new stocking occurring.

Fall Index Netting (FIN) was conducted by AEP Fisheries Biologists in 2013, 2016 and 2018 (AEP 2019). FIN is a standardized index netting method used by AEP to monitor walleye and northern pike abundance in Alberta lakes by determining catch rates (*i.e.*, number of fishes captured per net night). In addition, the sizes and ages of fish are also recorded to determine if potential overharvest (*e.g.*, too few fish living to old age) or habitat (*e.g.*, poor spawning success) problems exist. AEP Fisheries Biologists combine this information with data on water quality, lake access, watershed development, and habitat threats to determine a Fish Sustainability Index (FSI) that are compared to risk thresholds (**Table 5**). More information regarding this program can be found at https://www.alberta.ca/fall-index-netting.aspx.

***Table 9. 2018 Alberta fish sustainability index risk thresholds for walleye and northern pike (adapted from AEP, 2019)***

| Mature Walleye/ ½ net | Mature Pike/ ½ net | Risk to Sustainability |
|---|---|---|
| >14.5 | >10.9 | Very Low |
| 10.2 - 14.5 | 7.7 - 10.9 | Low |
| 7.3 -10.1 | 5.5 - 7.6 | Moderate |
| 2.9 – 7.2 | 2.2 – 5.4 | High |
| <2.9 | <2.2 | Very High |

FIN was most recently conducted in Lac La Biche from September 17$^{th}$ to 21$^{st}$, 2018. Thirty-two ½ length nets captured 175 cisco, 33 lake whitefish, 92 northern pike, 394 walleye, and 195 yellow perch. Mean catch rates of mature and immature walleye were 9.6/ ½ net-night and 2.4/ ½ net, respectively, and corresponding to an FSI score of moderate risk to sustainability for adult walleye. The 2018 length distribution of walleye shows abundant yet inconsistent recruitment into the fishery, and very abundant large adult-sized fish. The mean catch rate of mature northern pike was 2.8/net-night, indicating an FSI score of high risk to sustainability (**Table 5**). The length distribution of northern pike showed a low recruitment and weak abundance of moderate-sized northern pike and a good representation of larger fish.

From 2013 to 2018, the walleye population in Lac La Biche has inclined from high risk to moderate risk, while the northern pike population has varied from low risk to high risk. Walleye populations in Lac La Biche currently meet the status and criteria for a Sustainable Harvest fishery, and recommendations have been made to change the recreational management regulation to allow for the harvest of one walleye between the length of 50 to 55 cm. The northern pike population does not currently meet the status and criteria for the objective of a sustainable harvest fishery and strict conservation-based management (*i.e.*, catch and release regulations) has been recommended to promote recovery and ensure the long-term sustainability of the Lac La Biche northern pike fishery. Although no FSI has been completed for lake whitefish, the current adult population has been estimated to be at moderate risk and a catch limit of 3 with no size restriction regulation has been recommended to support the population.

In summer, increasing water temperatures reduce the amount of oxygen a lake can hold and can also promote algal blooms. Lakes experiencing blooms can suffer drastic fluctuations in dissolved oxygen, with peaks occurring mid-day along with highest photosynthetic rates and depletion at night as plants and algae respire (Wetzel 1983). When these blooms die, decomposition of the algae further reduces oxygen levels in the water. While deeper lakes may contain enough DO for fish survival, shallow eutrophic lakes can suffer episodic summer fish kills which may deplete fish populations over time. Lack of rainfall, which typically contributes oxygenated water to a lake, is another factor which can lead to summerkill conditions (Banks and Herrera 1977).

In winter, insufficient surface inflow, as well as thick snow and ice cover, can reduce the amount of oxygen that is incorporated into a lake (Babin and Prepas 1985; Barica and Mathias 1979). Due to snow and ice cover and lower temperatures, the amount of oxygen produced within the lake through photosynthesis is also reduced. Oxygen is further reduced by decomposition of organic material (*e.g.,* algae and plants) below the ice, leading to anoxic (oxygen-lacking) conditions which suffocate fish that are unable to migrate to more oxygenated waters. Other substances, including hydrogen sulfide, ammonia, methane and carbon dioxide, may accumulate during anoxic periods and can reach levels toxic to fish, further exacerbating the lethal effects of low oxygen (Alabaster and Knowles 1979; Greenbank 1945; Schwalme 1995). Winterkill conditions are generally more frequent and severe in shallower and more productive lakes, which contain greater relative amounts of dead organic matter and offer fewer opportunities for fish refuge. While smaller fish kill events can occur in some shallow bays occasionally, large events have not been observed. Fish kills can be a common occurrence in Alberta lakes (especially shallow, highly productive lakes), and are typically caused by low levels of oxygen, which can occur in both summer and winter (Schwalme 1995).

## 5.4 PLAN IMPLICATIONS AND RECOMMENDATIONS

1. Consider achievable management goals. For example, to maintain the natural functioning of an aquatic ecosystem adapted to nutrient-rich conditions, an appropriate management target could be to maintain a water quality level amenable for recreational use with a minimal occurrence of algae blooms. Site-specific water quality objectives could be defined under this goal. Management actions would work towards these objectives.
2. Continue monitoring Lac La Biche yearly to contribute to long term data collection. Update trend analysis, using recent data.

3. Flow-based water quality sampling of tributaries and re-calculation of external nutrient loading. Use this information, as well as internal loading estimates, to create a water and nutrient balance of the lake. Accurate and up-to-date water quality data for Lac La Biche is essential for updating the P budget and the development of an effective lake- and watershed-scale water quality model.
4. Lac La Biche is naturally nutrient-rich, with P loading into the water column from the watershed and lake sediments. Thus, actions should be proposed and evaluated to reduce both external and internal nutrient loading into Lac La Biche, though the allocation of efforts between these sources may be unequal due to technical, financial, and feasibility considerations. Development of a nutrient reduction model may be an effective approach to determine what combination of activities will result in the most effective remediation with a relatively low level of risk. Note that whatever nutrient-reduction strategies employed, there will be a lag time between implementation of nutrient control measures and water quality improvements. Thus, stakeholder expectations should be for gradual, long-term improvements.
5. Cyanobacteria blooms are not solely the result of increased nutrient availability, but instead are likely driven by several additional factors such as increased water stability (both turbulence and thermodynamically), changing climate conditions, increased light availability, and higher water temperatures. Further research is necessary to identify the interactions of these and other factors and to determine the mechanisms responsible for cyanobacteria bloom dynamics. For example, analysis of long-term water quality and phytoplankton community data may reveal the physical or chemical drivers behind seasonal phytoplankton community shifts favoring cyanobacteria dominance (see recent work by Dr. Rolf Vinebrooke, University of Alberta).
6. Robust fish populations are important to both the ecology of Lac La Biche and the sustainability of recreational and indigenous fisheries. Additional studies of how fish populations interact with cyanobacterial blooms in Lac La Biche may be worthwhile, although this relationship is fairly well established in the literature.
7. Monitoring and proactive efforts to prevent the infestation of aquatic and riparian invasive species. Educating lake users and residents on how to recognize aquatic invasive species is critical for early detection and eradication.
8. McGregor (2014) recommended a holistic approach to long-term monitoring of Lac La Biche, including annual monitoring of the fisheries, as well as cormorants and their co-nesting species. She also recommends cormorant management to continue for an indefinite amount of time as the abundant yellow perch population provides a large forage base to support successful breeding of large populations of waterbirds.

## 5.5 LITERATURE

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# APPENDIX C. LEGISLATION, PLANS, POLICIES AND GUIDES

The following section outlines enabling legislation as well as policies, plans, guides, and initiatives that are most relevant to the LLBWMP. There may be other policies, plans, guides, and initiatives that may be relevant to the LLBWMP but are not necessarily idenified in this list.

## 1.1 ENABLING LEGISLATION

### 1.1.1 Federal

*Fisheries Act*

The *Fisheries Act* provides for the proper management and control of fisheries, the conservation and protection of fish, the protection of fish habitat and pollution prevention. The *Fisheries Act* is the main federal law governing fisheries in Canada. It has protected fish and fish habitat and regulated seacoast and inland fisheries since 1868.

In 2019, strengthened fish and fish habitat protection provisions under the modernized *Fisheries Act*, as well as regulations that support these provisions, officially came into force. These changes include:

- Protection for all fish and fish habitats;
- Restoring the previous prohibition against the "Harmful Alteration, Disruption or Destruction of fish habitat (HADD); and,
- Restoring a prohibition against causing "the death of fish by means other than fishing".

*Migratory Birds Convention Act*

Canada seasonally hosts approximately 450 species of native birds, the majority of which are protected under the *Migratory Birds Convention Act* (MBCA) and are collectively referred to as "migratory birds." The purpose of this Act is to implement the Convention by protecting and conserving migratory birds — as populations and individual birds — and their nests.

The MBCA was passed in 1917, and updated in 1994 and 2005, to implement the Migratory Birds Convention, a treaty signed with the United States in 1916. As a result, the Canadian federal government has the authority to pass and enforce regulations to protect those species of birds that are included in the Convention.

The *Fisheries Act* is federal legislation that provides for the **management and control of fisheries, conservation and protection of fish and fish habitat**.

The *Migratory Birds Convention Act* is federal legislation that **protects and conserves migratory birds and their nests.**

### 1.1.2 Provincial

*Alberta Land Stewardship Act*

In 2009 the province adopted the *Alberta Land Stewardship Act (ALSA)*. The ALSA enables several of the strategies identified in the LUF to be carried out by establishing:

- Seven regions that cover the entire province for the purpose of establishing a regional plan;
- The position of the Stewardship Commissioner to oversee the development and implementation of regional plans;
- The scope of regional plans and the process for their preparation and adoption;
- Provisions for the establishment of tools for conservation and stewardship on public and private lands; and
- A process for compliance and enforcement of regional plans.

*Alberta Land Use Framework*

In 2008 the province adopted a policy statement titled the *Land Use Framework* (LUF). The LUF sets out an approach to manage public and private lands and natural resources to achieve Alberta's long-term economic, environmental and social goals. The LUF identifies seven strategies to achieve these goals:

- Develop seven regional land-use plans based on seven new land-use regions.
- Create a Land-use Secretariat to oversee implementation of the LUF and establish a Regional Advisory Council for each region;
- Cumulative effects management will be used at the regional level to manage the impacts of development on land, water and air;
- Develop a strategy for conservation and stewardship on private and public lands;
- Promote efficient use of land to reduce the footprint of human activities on Alberta's landscape;
- Establish an information, monitoring and knowledge system to contribute to continuous improvement of land-use planning and decision making; and
- Include Indigenous Peoples in land-use planning.

*Public Lands Act*

The *Public Lands Act* establishes the role of the Alberta government in managing public land. It sets out mechanisms by which rights in public land may be transferred by lease or sale. It provides for and defines the powers of the Minister and the Lieutenant Governor in Council with respect to establishing regulations to govern use and allocation of public land. The *Act* and its regulations also control public land use through the establishment of public land use zones, recreation areas and trails. The *Act*

The *Alberta Land Stewardship Act (ALSA)* divides the province into **seven regions based on major watershed basins** and establishes the **legal framework for regional plans.**

The *Alberta Land Use Framework (LUF)* sets out an approach to manage public and private lands and natural resources to **achieve Alberta's long-term economic, environmental, and social goals. It also provides guidance for the development of the regional plans.**

provides for appropriate use and management of public land and for the classification of the public land base in Alberta.

The *Act* establishes that the title to the beds and shores of all permanent and naturally occurring bodies of water, rivers, streams, watercourses and lakes is vested in the Crown in right of Alberta.

### *Municipal Government Act*

The *Municipal Government Act (MGA)* is the legislative framework in which all municipalities and municipal entities across the Province of Alberta operate. Among other things, the *MGA* mandates that municipalities "foster the well-being of the environment" and enables municipalities to regulate and control impacts of land use and development on the local environment. The *MGA* also establishes requirements for municipal statutory plans to conform to the applicable regional land-use plan.

### *Alberta Wetland Policy*

The Alberta Wetland Policy was released in 2013. The goal of the Alberta Wetland Policy is to maintain wetland areas in Alberta such that the ecological, social, and economic benefits that wetlands provide are maintained, thereby helping to ensure that Albertans have healthy watersheds that provide safe and secure drinking water supplies, healthy aquatic ecosystems, and reliable, quality water supplies for a sustainable economy. In recognition of the high rates of wetland loss in some watersheds, this policy also encourages Albertans to be proactive in increasing wetland area.

### *Environmental Protection and Enhancement Act*

The *Environmental Protection and Enhancement Act* is the primary act in Alberta through which regulatory requirements for air, water, land, and biodiversity are managed. This *Act* supports and promotes the protection, enhancement and wise use of the environment by designating proposed activities for which an approval or registration is required.

### *Water Act*

The *Water Act* is provincial legislation that supports and promotes the conservation and management of water in Alberta. Through the *Water Act*, the Government of Alberta has committed to protecting existing good standing water rights and water resources for future generations. It recognizes the need for shared responsibility among all Albertans to ensure continued and viable economic growth and prosperity in Alberta.

### *Water for Life: Alberta's Strategy for Sustainability*

*Water for Life* is a strategic action plan set by the Alberta Government in 2003. The province released the action plan as a guide for the government and its partners to follow. *Water for Life* acknowledges

The MGA mandates that municipalities **"foster the well-being of the environment"** and enables municipalities to regulate and control impacts of land use and development on the local environment.

the population increase and economic growth that Alberta has seen over the past years, which has impacted Albertans' changing water needs. The strategy has three main goals:

- Safe, secure drinking water supply;
- Healthy aquatic ecosystems; and
- Reliable, quality water supplies for a sustainable economy.

*Alberta Fisheries Act*

The Alberta *Fisheries Act* controls licences for fishing, the transportation of fish, fish stocking and the handling, marketing, processing, storage, preservation, sale and disposition of fish. It also prohibits the possession, importation and sale of prescribed invasive organisms without approval, and provides unique protections for fish that allow action to be taken to prevent the spread of ecological threats to fish, including fish parasites, diseases and genetic contamination of fish.

*Private Sewage Disposal Regulation*

The Private Sewage Disposal Systems Regulation 229/97 establishes certification requirements for private sewage equipment, adopts the Alberta Private Sewage Systems Standard of Practice 2015, and specifies the types of systems for which this Regulation applies.

## 1.2 PLANS AND POLICIES

### 1.2.1 Provincial

The following section outlines major provincial plans and guides that have authority within the Lac La Biche watershed region. Error! Reference source not found. and Error! Reference source not found. on the next page illustrate the plan areas for the plans outlined below.

*Lower Athabasca Regional Plan*

The Lower Athabasca Regional Plan (LARP) is the first of seven regional plans for the province of Alberta, as provided for in the *ALSA*. The LARP is a long-term regional plan that seeks to plan for "robust growth, vibrant communities, responsible resource development and a healthy environment within the region." The *MGA* aims to ensure that all statutory plans align with the policies of the LARP.

*Athabasca Integrated Watershed Management Plan*

The Athabasca Watershed Council (AWC) is currently developing and implementing an integrated watershed management plan to ensure the Athabasca River Watershed remains healthy and resilient, within its range of natural variability, for current and future generations.

The Lac La Biche Watershed is located within the plan area of the **Lower Athabasca Regional Plan (LARP).**

The AWC is a registered not-for-profit organization formed in 2009. The AWC works with academia, industry, environmental and stewardship groups, various levels of government, communities, citizens, and Indigenous Peoples to provide information about the Athabasca River Watershed.

### *Cold Lake Sub-Regional Planning Area (Caribou Sub-Regional Task Force)*

In 2019, the province created three caribou sub-regional task forces that will advise government on land-use planning at a local scale, including caribou recovery actions. Sub-regional plans will be built on a foundation of science and socio-economic assessments, which help us to understand how sub-regional plans work within local and regional economies. The LLBWMP is within the Cold Lake Sub-Regional Planning Area.

### *Lakeland Sub-Regional Integrated Resource Plan*

Integrated Resource Plans (IRPs) are high level resource management plans that identify resource potentials and development opportunities, as well as provide guidance for decision-makers, industry and the public in a particular region. The preparation of the Lakeland Sub-regional Integrated Resource Plan was prompted in the mid-1980s following policy direction regarding recreational land uses.

### *Lac La Biche Fisheries Restoration Program*

The Lac La Biche Fisheries Restoration Program was initiated in 2005 because important fish species such as walleye, pike, and whitefish experienced population decline and previous efforts to recover the populations were unsuccessful. The program includes management actions targeting commercial and recreational fisheries reductions, walleye stocking, Double-crested cormorant control, protection of critical fish areas, and monitoring.

### *Forest Management Plans*

The details of where, when and how trees on Crown land in Alberta are harvested and managed for sustainability are contained in Forest Management Plans which are required under the *Forest Act* and approved by the Government of Alberta, with input from public and other stakeholders.

Forest Management Plans prepared by industry, also referred to as detailed forest management plans, are a requirement of Forest Management Agreements negotiated between the Government of Alberta and forest companies. Forest Management Agreements provide companies with rights to harvest and reforest trees on Crown land and ensure activities are carried out in a sustainable manner.

Part of the Lac La Biche watershed is located within the Al-Pac Forest Management Agreement (FMA 9100029) Area. The FMA area is located in northeastern Alberta and falls predominately within Central Mixedwood, Upper and Lower Boreal Highlands, and Athabasca Plain natural sub-regions. Al-Pac and other forestry operators in the FMA area must adhere to the Al-Pac Forest Management Plan.

The Lac La Biche Watershed is located within the plan areas of the **Cold Lake Sub-Regional Planning Area and the Lakeland Sub-Regional Integrated Resource Plan.**

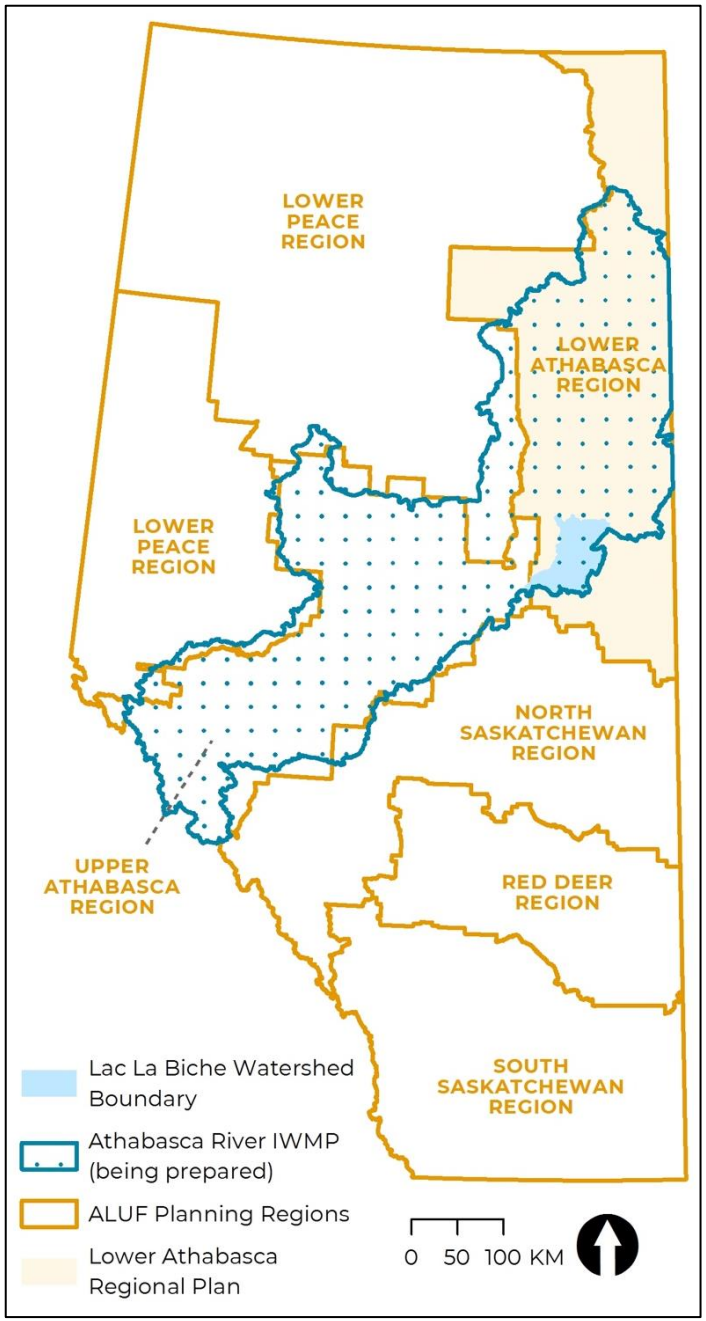


*Figure C1. ALUF Planning Regions, Regional Plans and Integrated Watershed Management Plans (IWMP)*

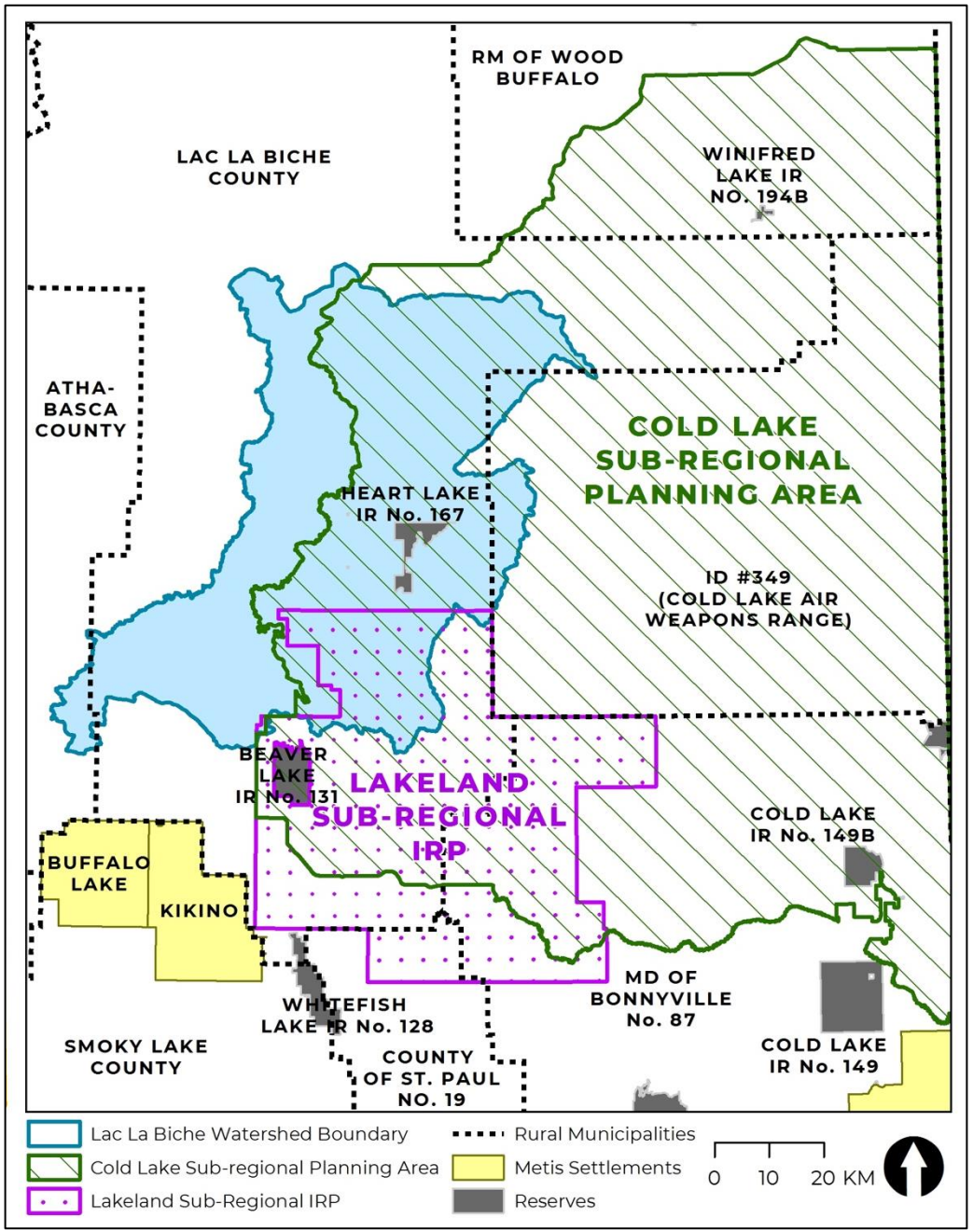


*Figure C2. Sub-Regional Planning Areas and Sub-Regional Integrated Resource Plans (IRPs)*

### 1.2.2 Municipal

*Lac La Biche County Strategic Plan*

The Lac La Biche County Strategic Plan is a plan achieving a vision for the County by 2024. It identifies strategic goals for desired outcomes in areas such as economic development, recreation and culture, social wellness, tourism, and the environment.

*Intermunicipal Development Plans*

An Intermunicipal Development Plan (IDP) is a statutory plan adopted as a bylaw by two or more municipalities. It is enabled by the *MGA* and provides a framework for land use planning between municipalities, leading to enhanced regional cooperation and collaboration.

Currently, there are no approved IDPs in the LLBWMP area.

*Municipal Development Plans*

Municipal Development Plans (MDPs) are required statutory plans adopted by a municipality. They are enacted through bylaw, as enabled by the MGA.

In accordance with the *Municipal Government Act*, the MDP must address:

- Future land use;
- Proposals for future development;
- Co-ordination with adjacent municipalities;
- Transportation;
- Municipal services and facilities;
- School and municipal reserves;
- Protection of agricultural operations;
- Land uses adjacent to sour gas facilities.

In addition, the *MGA* allows the MDP to address:

- Coordination of physical, social, and economic development;
- Environmental matters;
- Conservation matters;
- Development constraints;
- Economic development;
- Financing and programming of municipal infrastructure;
- Financial resources.

There are **no approved Intermunicipal Development Plans** for the lands in the Lac La Biche watershed.

The **Lac La Biche County's and Athabasca County's Municipal Development Plans** apply to the lands in the Lac La Biche watershed.

Currently, lands within the Lac La Biche watershed are subject to the policies of one of two MDPs:

- Lac La Biche County Municipal Development Plan (Bylaw 13-020); and
- Athabasca County Municipal Development Plan (Bylaw 003-2019).

### *Area Structure Plan*

An Area Structure Plan (ASP) is a statutory plan that may be adopted by a municipality. It is enacted through bylaw, as enabled by the *MGA*. A municipality may adopt an ASP for the purpose of providing a framework for subsequent subdivision and development of a specific area of land. An ASP must describe the:

- Sequence of development proposed for the area;
- Land uses proposed for the area, either generally or with respect to specific part of the area;
- Density of population proposed for the area either generally or with respect to specific parts of the area; and
- General location of major transportation routes and public utilities;

and may contain any other matters the Council considers necessary.

There are seventeen Lac La Biche County ASPs that affect lands within the watershed:

- Amity Beach ASP (Bylaw 16-016)
- Diamond Ridge ASP (Bylaw 09-035)
- East Lac La Biche ASP (Bylaw 10-023)
- Estates of Arborfield ASP (Bylaw 16-015)
- Hamlet of Beaver Lake ASP (Adopted in 1993 as part of ID of Little Divide No. 18)
- Hamlet of Plamondon ASP (Bylaw 17-015)
- Highway 36 ASP (Bylaw 17/006)
- South Lac La Biche Major Area Structure Plan (Bylaw 17-006)
- Lac La Biche West ASP (Bylaw 17-009)
- Lac La Biche West ASP (Ministerial Order 426/91)
- Lagoon Lake ASP (Bylaw 09-003)
- Lakeview Estates ASP (Bylaw 07-016)
- Moonlight Cove Island View Bay ASP (Bylaw 05-015)
- North Beach Subdivision (Bylaw 03-003)
- Richard Estates ASP (Bylaw 14-028)
- Sentinel East Industrial Park ASP (Bylaw 11-009)
- SW 5-67-13-W4M ASP (Bylaw 04-007)

There are currently **seventeen Area Structure Plans** that apply to lands within the Lac La Biche watershed.

### *Land Use Bylaw*

A Land Use Bylaw (LUB) is a required regulatory land use document for Alberta municipalities that implements the policy direction set forth in a municipality's Municipal Development Plan. An LUB regulates and controls the use and development of land and buildings within a municipality.

Currently, there are two LUBs that regulate lands within the Lac La Biche watershed:

- Lac La Biche County Land Use Bylaw (Bylaw 17-004); and
- Athabasca County Land Use Bylaw (Bylaw 004-2019).

### *Outline Plans and Concept Plans*

An Outline Plan is a detailed planning document that guides the development and conceptual layout for a specific area. It is not adopted as a statutory plan; however, it may be located within an area covered by an existing statutory plan (e.g. ASP), and the preparation of an outline plan may be a policy of an existing MDP or ASP.

An Outline Plan provides a high level of detail as to how the land will be subdivided, serviced and developed. There are two Outline Plans that affect lands within the watershed. These Outline Plans have been adopted by Lac La Biche County, and include:

- Lot 18, Block 2, Plan 1026167 Outline Plan (Bylaw 12-018)
- Mystic Beach Outline Plan (Section 9-68-13W4, Section 16-68-13W4)
- Wheating Estates Concept Plan (NE-31-067-16W4M)

### *Lac La Biche County Riparian Setback Matrix Model (RSMM)*

Lac La Biche County uses the Riparian Setback Matrix Model (RSMM) for the determination of Environmental Reserve or Riparian Development Setback allocation at time of subdivision.

Aquality Environmental Consulting Ltd. developed the RSMM to help delineate development or environmental reserve and easement setbacks for riparian areas. The RSMM incorporates such features as vegetation type and abundance, bank slope and height, groundwater influence, and various soil characteristics to determine the most appropriate setback distance. It can also be adapted to the intended role of the setback; setback distances can be increased to improve removal of nutrient pollutants or maintenance of wildlife corridors are key, or reduced if the intended function is to increase bank or shoreline stability and integrity (Aquality Enviromental Consulting Ltd.)

Lac La Biche County uses the **Riparian Setback Matrix Model (RSMM)** for determining environmental reserves allocation for subdi

*Lac La Biche County Recreation and Parks Master Plan*

The Lac La Biche County Recreation and Parks Master Plan is a comprehensive plan to guide future investment in public recreation and leisure services in Lac La Biche County over the next 10 years. The plan has not yet been adopted.

*Hamlet of Lac La Biche Stormwater Master Plan*

The Stormwater Management Master Plan for the Hamlet of Lac La Biche is the framework for addressing issues related to the stormwater generated in the Hamlet and surrounding areas which lies within the Hamlet of Lac La Biche watershed. A mixture of storm sewer systems, drainage channels and/or overland flow, wet ponds, wetlands, outfalls, and existing lakes have been incorporated in the hydrologic and hydraulics analysis in this study.

*Lac La Biche Transportation Master Plan*

The primary objective of the Transportation Master Plan is to develop short-term, medium range and long-term transportation system improvements to accommodate existing and future developments and to assist the County in developing budgets and priorities for local roadway network.

*Other Lac La Biche County Initiatives*

In addition to the plans outlined above, the County has undertaken the following:

- BNR Removal Plant (refer to Section 2.5)
- Installation of grit oil separators
- Public Washrooms Program
- Low Impact Development (swales) on municipal land
- Environmental Reserve Bylaw

## 1.3 INDIGENOUS COMMUNITIES

The lands within the Lac La Biche watershed are the ancestral and traditional lands of many First Nations and Métis Peoples, including Beaver Lake Cree Nation, Chipewyan Prairie First Nation, Cold Lake First Nation, Fort McMurray First Nation No. 468, Heart Lake First Nation, Kehewin Cree Nation, Saddle Lake Cree Nation, Whitefish (Goodfish) Lake First Nation, Métis Settlements, Buffalo Lake Métis Settlement. Elizabeth Métis Settlement, Fishing Lake Métis Settlement, Kikino Métis Settlement and many others.

Within the Lac La Biche watershed, is the Heart Lake First Nation Indian Reserve (IR) #167 and #167A. IR #167 and 167A is controlled by Heart Lake First Nation, a First Nations band government and

Heart Lake IR #167 and 167A are located within the Lac La Biche watershed.

The lands in the Lac La Biche watershed region **are the ancestral and traditional lands of many First Nations and Métis Peoples.**

signatory to Treaty 6. Historically the Heart Lake First Nation hunted, trapped and fished extensively within their traditional lands to satisfy a range of subsistence, livelihood, nutritional, social, cultural, spiritual and other needs. The Heart Lake First Nation is now looking to take advantage of opportunities that are arising through resource development in order to provide a meaningful life for the Heart Lake community members (Heart Lake First Nation, 2015).

## 1.4 GUIDES, ORGANIZATIONS AND OTHER INITIATIVES

*Guide to Watershed Management Planning in Alberta*

The *Guide to Watershed Management Planning in Alberta* guides local communities and Water for Life partnerships through the steps of developing and implementing a watershed management plan for their respective watershed, encouraging active participation from the public, partners, and stakeholders along the way.

This guide outlines the iterative process of adaptive management from planning through to implementation and evaluation. It is intended to guide the partnership through a coordinated process of continually identifying and addressing priority issues and opportunities within the watershed.

*Healthy Waters Lac La Biche*

The Healthy Waters Lac La Biche, formed in 2019, is comprised of community stakeholders committed to implementing the monitoring, outreach and stewardship recommendations of the 2009 (and the new 2020) LLBWMP. Healthy Waters works on grassroots stewardship activities including:

- Sensitive Habitat Inventory Mapping (2016)
- Public awareness and education;
- Installation of updated signage at public access points regarding the lake's Provincial Waterfowl Sanctuary and Important Bird Area status;
- Importance of the riparian zone to watershed health.

*Alberta Lake Management Society: Workbook for Developing Lake Watershed Management Plans*

The Alberta Lake Management Society (ALMS) was formed in 1991 and became the first Canadian Chapter of the North American Lake Management Society in 1992. ALMS and its members are active in providing a link to individuals, local communities, educational institutions, governments and industry across Alberta who are interested in lake and watershed management.

The ***Guide to Watershed Management Planning in Alberta*** **and the** ***ALMS Workbook for Developing Lake Watershed Management Plans*** provide guidance for the preparation and implementation of WMPs.

**Healthy Waters Lac La Biche** formed in 2019.

ALMS undertakes the collection of data and information to increase the knowledge of lake functions and management options, and disseminates information and experiences of all aspects of lake management in Alberta.

In September 2013, ALMS developed the *Workbook for Developing Lake Watershed Management Plans in Alberta* as a guide for preparing watershed management plans and as decision support tool and procedural guide for citizens interested in protecting and managing their lake.

### *Alberta Summer Villages Association: Lake Stewardship Guide*

In 2006, the Association of Summer Villages of Alberta (ASVA) prepared the *Lake Stewardship Reference Guide*. The Guide provides Summer Village councillors and administrators with general information, issue identification, legal, reference materials, and suggestions for effective stewardship of lake environments. It celebrates and shares success stories of active lake stewardship projects and suggests policies that can be utilized by Summer Village councils to achieve lake stewardship goals and objectives.

### *Alberta Water Council: Recommendations to Improve Lake Watershed Management Planning in Alberta*

The Alberta Water Council (AWC) is a multi-stakeholder partnership with members from governments, industry and nongovernment organizations. In July 2017, the AWC prepared *Recommendations to Improve Lake Watershed Management Planning Alberta*. The report includes recommendations for a coordinated approach to lake watershed management in Alberta. When implemented, these recommendations are intended to support the Government of Alberta's development of a provincial lake policy, foster greater provincial coordination of the stakeholders involved and contribute to improved lake watershed management.

### *Alberta Water Council: Source Water Protection Planning Guide and Companion Document*

In 2018, the Government of Alberta asked the Alberta Water Council (AWC) to form a multi-sector project team to document existing source water protection (SWP) approaches and provide guidance for protecting sources of drinking water in Alberta. *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning* provides advice on how to safeguard drinking water sources by developing a SWP plan. The guide is intended to support municipalities, Indigenous communities, drinking water providers, or others interested in undertaking this voluntary, collaborative process. The companion document *Protecting Sources of Drinking Water in Alberta* summarizes the key findings of the project and is supporting document for the Guide.

Alberta Water Council's *Recommendations to Improve Lake Watershed Management Planning in Alberta* **provides recommendations for a coordinated approach to lake watershed management in Alberta.**

The *Source Water Protection Planning Guide and Companion*, also prepared by AWC, **provides guidance for protection sources of drinking water in Alberta.**

*Other Organizations and Initiatives*

Other organizations and their initiatives relevant to the LLBWMP include:

- Local and regional non-governmental organizations (Alberta Conservation Association, Cows and Fish, Community Futures, Lac La Biche Birding Society, LARA, LICA, etc.)
- Education institutions (Portage College)
- Lac La Biche Golf & Country Club
- Recreational associations
- Homeowners associations (such as Golden Sands Landowners Association, etc.)

# APPENDIX D. COMMUNITY ENGAGEMENT

A key consideration of the plan preparation was engagement with municipalities, the public, local community groups, Indigenous communities, NGOs, government agencies, and other key partners to provide opportunities to learn about the LLBWMP and provide feedback.

The goals for the public engagement program were to:

1. Promote effective and innovative communication between the County, Steering Committee, Plan Advisors, stakeholders, partners, local communities, and the public.
2. Facilitate awareness and education about the watershed and the LLBWMP.
3. Provide opportunities for the public to learn and provide feedback on the preparation of the LLBWMP.
4. Prepare an accessible WMP that is valued and accepted by the public, communities, and stakeholders.
5. Foster an engaged public that will participate in the implementation of the LLBWP.

## 1.1 STEERING COMMITTEE

The first step in the community engagement program was the establishment of a diverse Steering Committee to oversee and provide direction for the preparation of the LLBWMP. Several organizations, Indigenous communities, government agencies and stakeholders were contacted in November/December 2019 to provide information about the project and opportunities to get involved with the Steering Committee:

### Municipalities

- Lac La Biche County
- Athabasca County
- Improvement District #349 (Cold Lake Air Weapons Range)

### Government Agencies

- Alberta Environment & Parks

### Agriculture & Natural Resources

- Agricultural Service Board
- Natural Resource Industries: Al-Pac, CNRL, Cenovus Energy Inc.

### Indigenous Communities

- Beaver Lake Cree Nation

**Due to the COVID-19 pandemic,** the engagement program was primarily conducted through online means.

- Buffalo Lake Métis Settlement
- Chipewyan Prairie First Nation
- Cold Lake First Nation
- Elizabeth Métis Settlement
- Fishing Lake Métis Settlement
- Fort McMurray First Nation No. 468
- Heart Lake First Nation
- Kehewin Cree Nation
- Kikino Métis Settlement
- Saddle Lake Cree Nation
- Whitefish (Goodfish) Lake First Nation

### Local/Regional NGOs & Educational Institutions

- Alberta Lake Management Society (ALMS)
- Athabasca Watershed Council (AWC)
- Community Futures
- Cows and Fish
- Lac La Biche Birding Society
- Healthy Waters Lac La Biche
- Lakeland Agricultural Research Association (LARA)
- Lakeland Industry & Community Association (LICA)
- Portage College

### Local Associations, Organizations & Businesses

- Lac La Biche Golf & Country Club
- Resident/Homeowners Associations (Golden Sands Landowners Association)
- Recreational Associations

*Information Session December 10, 2019*

An Information Session was held for the local community groups, Indigenous communities, NGOs, government agencies, industry stakeholders and other partners that expressed interest in participating in the preparation of the plan. At the Information Session, background information was provided about the project and opportunities to participate on the Steering Committee.

Following the Information Session, the Steering Committee was assembled, consisting of individuals interested in guiding the preparation of the plan. The list of Steering Committee members is included in the Acknowledgments section of the LLBWMP.

**The preparation of the updated LLBWMP was guided by a Steering Committee**, with representation from Lac La Biche County Council and Administration, Alberta Environment and Parks, local and regional non-governmental organizations, Indigenous communities, local organizations, and the forestry and oil and gas industries.

## 1.2 COMMUNTY ENGAGEMENT PROGRAM

The Community Engagement Program for the preparation of the LLBWMP included various communication, information sharing, and feedback gathering methods. Due to the limitations on in-person activities, the Community Engagement Program focuses on an online presence with supporting physical engagement tools.

### *Lac La Biche County Website*

In July 2020, a dedicated webpage was developed on the Lac La Biche County provide background information about the project and house future engagement materials.

### *Information Materials*

Various information materials were utilized to provide updates on the progress of the LLBMWP:

- Social media posts, e-newsletters, media releases:
    - In January 2021, an announcement was released to provide background information about the LLWMP project.
    - In April 2021, an announcement was released to provide information about the release of the draft LLBWMP to the public and the online open house.
- Newsletter mail-outs:
    - In March 2021, a newsletter was mailed to County residents to provide information about the release of the draft LLBWMP to the public and the online open house.

### *Online Surveys – January and April 2021*

Surveys were utilized to obtain feedback from the public:

- In January 2021, a Survey #1 was released to gauge interest in the project.
- In April 2021, Survey #2 was released in advance the online open house to gather feedback on the draft LLBWMP.

### *Online Open House April 22, 2021*

An online open house was held electronically on April 22, 2021 to provide information about the draft LLBWMP and gather feedback from the public. Attendees participated in a question and answer period and provided excellent questions and comments regarding the LLBWMP.

### *What We Heard Report*

A What We Heard Report was prepared to summarize the feedback received regarding the LLBWMP and to identify required revisions to the LLBWMP. See the What We Heard Report for more details.

The draft LLBWMP was well received by the Steering Committee, Lac La Biche County and the public.

# APPENDIX E. ESRD GUIDELINES

## Sustainable Resource Development Recommended Guidelines for Minimum Environmental Reserve/Easement Widths

In reference to Section 664 of the *Municipal Government Act*, the following are recommended where a boundary to a proposed subdivision is a water body or watercourse.

**Table 1. Standard recommended minimum widths for Environmental Reserves or Environmental Reserve Easements based on type of water feature.**

| Water Feature | Minimum ER Width[2] | Notes |
|---|---|---|
| Reservoirs & Regulated Lakes | 30 m from right of way or easement boundary | A regulated lake is a lake where water levels are established to a predetermined elevation and actively managed through use of a licensing requirement (e.g. to pump water into the water body). |
| Lake (natural & controlled) | 30 m from natural boundary | On controlled lakes, 30 m from sill elevation of licensed control structure. |
| Swamp/wetland[1] | Variable, include wet meadow zone | Wet meadow zone can be extensive in some situations, and in these instances the ER should be wide enough to preserve ecological function. |
| Large River (≥ 15m width) | 30+ m | See additional requirements for hazardous lands. |
| Small River/Large Steam (6-15 m) | 15 m | See additional requirements for hazardous lands. |
| Medium Stream (3 - 6 m) | 10 m | See additional requirements for hazardous lands. |
| Small Stream (≤ 3 m) | 6 m | See additional requirements for hazardous lands. |
| Ephemeral watercourse (no defined channel) | 0 m | Use bylaw to regulate tree cutting within a defined distance from feature to maintain riparian vegetation and drainage. |
| Braided Stream | 10 m from outside boundary of active floodway | |

[1] Sustainable Resource Development views the term "swamp" to mean any area with hydrological conditions of sufficient duration to have developed saturated soils and hydrophytic vegetation (i.e. wetlands or peatlands).
[2] In addition to the recommended ER width for the water feature itself, associated landscape features may require the ER width to be modified to factor in additional inherent hazards to development.

For lands described in section 664(1)(b) of the *Municipal Government Act* (unsuitable for development because they are subject to flooding, have high risk of erosion, or have existing topographical or geo-technical constraints) the following are recommended.

**Table 2. Additional factors that may necessitate an increase in the width of an Environmental Reserve or Environmental Reserve Easement.**

| Hazardous Lands | ER Modifier | Notes |
|---|---|---|
| Floodplain | • The width of the 1:100 year flood line or 30m from the natural boundary of a watercourse or lake, whichever is less.<br>• The width of meander belt for watercourses that tend to meander or entire floodplain if it is highly constrained within a confined valley. | • Residential development within a floodplain is discouraged.<br>• Development within flood fringe area should only be considered if flood proofing undertaken to reduce risk of flood damage. Flood risk mapping or delineation of the 1:100 year flood line generally defines the extent of expected flood occurrence (see Alberta Environment policy and guidelines).<br>• The width of a meander belt is determined by multiplying bankfull width by 20 for each reach, and is split equally on either side of creek along axis of meander belt. |
| Erosion prone areas | Provide for a toe erosion allowance. | Consider highly erosive soils and annual recession rates. |
| Gully, ravine, coulee, or valley escarpments | Provide for a stable slope allowance. Apply construction and building setbacks from this line. | Boundary of stable slope allowance measured from top of crest of plateau (terrace), valley slope or tableland. |
| Steep Slopes (>15%) | 3X escarpment height or as recommended by a geotechnical report on slope stability, rate of erosion, etc. | |