ALBERTA WATER COUNCIL

NOVEMBER 2013

Riparian Land Conservation and Management Report and Recommendations

About the Alberta Water Council

The Alberta Water Council is a multi-stakeholder partnership that provides leadership, expertise and sector knowledge to engage and empower industry, non-government organizations, and governments to achieve the outcomes of the *Water for Life* strategy.

The Council regularly reviews implementation of the *Water for Life* strategy and champions the achievement of the strategy's goals. It also advises the Government of Alberta, stakeholders and the public on effective water management practices and solutions to water issues, as well as on priorities for water research.

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Executive Summary

Improved riparian land conservation and management in Alberta is needed. Healthy riparian lands are critically important landscape components, providing environmental, economic, cultural and recreational benefits. Ecological riparian functions, such as improved water quality, flood control, water storage, decreased erosion and the maintenance of terrestrial and aquatic biodiversity, have immeasurable value; the social and economic contributions of riparian lands are likewise considerable. Human activities have destroyed and degraded riparian lands and functions, although it is difficult to quantify the extent of this loss. As Alberta grows and land uses change, riparian lands will continue to be lost and degraded unless their high value is recognized and a concerted effort is made to better conserve and manage them. Improved management of riparian lands must be a priority. Costs and damages associated with recent flood events highlight the urgent need for improved riparian land management.

Given the importance of riparian lands to Albertans and concerns that riparian lands are being degraded with increasing growth pressures, the Council established the Riparian Land Conservation and Management Project Team to "enhance knowledge and provide recommendations for effective conservation and management of riparian lands in support of *Water for Life* goals." This report draws on a major consultant report, entitled "*Riparian Lands in Alberta — Current state, conservation tools, and management approaches*," as well as on the knowledge and experience from numerous Council sectors.

Improved riparian land management could be achieved most effectively through alignment and coordination with cumulative effects management, integrated resource management, regional planning and watershed planning. This approach blends well with research that suggests effective riparian land management includes managing riparian lands as components of a larger ecosystem. Progress on improvements to riparian land conservation and management should not be delayed by the timelines for planning and implementation of existing land use and watershed planning initiatives. Many of the steps towards effective and integrated riparian management identified in this report can be taken independently of these other initiatives while still maintaining alignment. This report includes timelines for implementation, and meeting these timelines may require resourceful solutions as well as significant stakeholder involvement.

Strong leadership is needed to ensure riparian management stays at the forefront of land and water planning. A provincial level vision and desired outcomes for riparian land conservation and management are needed, allowing for policies, strategies and initiatives at all scales to work towards a common outcome within a nested approach.

Along with setting the context for effective governance, the Council has identified gaps that hinder effective and coordinated riparian management. One key gap was the acceptance and use of a common definition. Various definitions for riparian lands are used by different sectors

for different purposes. Thus the Council has developed an ecological definition that clearly identifies riparian lands characteristics. Consistent and integrated methods to delineate and map riparian lands and assess their health and function should also be developed, and the Council stresses the need for a baseline "state of riparian lands" report.

Coordinated efforts to develop stronger, more effective partnerships among relevant jurisdictions and stakeholders should continue. Improvements can be achieved through a combination of education, use of riparian best or beneficial management practices, and support for stewardship efforts on public and private lands.

As cumulative pressures on the landscape lead to further riparian loss and degradation throughout Alberta, actions are needed to conserve and more sustainably manage riparian lands. The sustainability of Alberta's riparian lands and the durability of the *Water for Life* strategy will depend on adherence to principles of good governance, including effective public and stakeholder involvement, transparency and accountability in decision making, systematic performance monitoring and strong enforcement. With these factors in mind, the Council makes 13 recommendations to improve riparian conservation and management in Alberta:[1]

Recommendation 1: Identify a Lead

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within six months identify a lead who is accountable for the coordination and integration of riparian land conservation and management in the province, including implementation and annual public reporting on the progress of the remaining recommendations in this report. (*Section 5.1*)

Recommendation 2: Vision for Riparian Lands

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within one year and in consultation with stakeholders, establish a provincial riparian land conservation and management vision that recognizes the ecological, social and economic importance of riparian lands and their functions. (*Section 5.1*)

1 A summary table and figure further outlining the recommendations can be found in Section 4. The recommendations are not in order of priority.

Recommendation 3: Riparian Land Conservation Desired Outcomes

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within one year and in consultation with Alberta Agriculture and Rural Development, Alberta Municipal Affairs, Alberta Health, and other key Ministries and stakeholders, lead the development of desired provincial level riparian land conservation outcomes that are consistent with the provincial vision and that support integrated management. Alberta Environment and Sustainable Resource Development should also provide a framework for the development of aligned and more specific outcomes at multiple scales. *(Section 5.2)*

Recommendation 4: Integration with Other Initiatives

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within three years, and as frameworks and regional plans are developed, in consultation with stakeholders including other Ministries, ensure that the riparian land conservation and management vision and desired outcomes are integrated into regional land use planning, watershed management planning, and other relevant plans and frameworks including municipal planning as guided through the *Municipal Government Act*. *(Section 5.2)*

Recommendation 5: Cross-Ministry Legislative Review

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within three years undertake a cross-ministry review of legislation, regulation, policies and programs to ensure consistency and to facilitate removal of disincentives or barriers to conservation and management of riparian lands. *(Section 5.3)*

Recommendation 6: Incentive Tools

The Alberta Water Council recommends that the Government of Alberta within three years and in consultation with stakeholders, initiate and support the development of a suite of incentive tools, including conservation and stewardship tools, that are targeted toward the provincial outcomes for integrated riparian land conservation and management, with ongoing implementation and review. *(Section 5.3)*

Recommendation 7: Implementation and Enforcement

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within three years and in consultation with relevant Ministries, improve implementation and consistent enforcement of legislation and application of policy relevant to riparian lands, with ongoing review and continuous improvement. *(Section 5.4)*

Recommendation 8: Enhancing Municipal Support and Capacity

The Alberta Water Council recommends that the Government of Alberta within three years in consultation with Alberta Municipal Affairs and municipalities, improve riparian land conservation and management in municipalities by ensuring regulatory support and building capacity, with ongoing review. *(Section 5.4.1)*

Recommendation 9: Sharing Knowledge and Information

The Alberta Water Council recommends that the Government of Alberta within three years and in partnership with stakeholders, develop and implement an integrated province wide strategy to improve the sharing of knowledge and information regarding riparian lands. The strategy should increase sector and public understanding and stewardship of riparian lands functions, values, conservation and management, with ongoing implementation and review. (*Section 6.0*)

Recommendation 10: Methodologies to Delineate and Map

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within five years in partnership with stakeholders, lead the identification and adoption of accepted methodologies to delineate and map the extent of riparian lands in Alberta at multiple scales, and then map riparian lands as a coordinated ongoing activity. (*Section 7.1*)

Recommendation 11: Riparian Health and Function Assessment

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within one year and in partnership with stakeholders, lead the review, adoption and ongoing implementation of a provincial riparian health and function assessment framework that includes well accepted and currently practiced methods that are compatible at multiple scales. (*Section 7.2*)

Recommendation 12: Best or Beneficial Management Practices

The Alberta Water Council recommends that the Government of Alberta within two years and in partnership with stakeholders identify, adopt and support ongoing implementation of best or beneficial riparian management practices and approaches that align with nested outcomes. (*Section 8.0*)

Recommendation 13: Reporting on Progress

The Alberta Water Council recommends that the Government of Alberta within five years and in partnership with stakeholders, produce a publicly available "Alberta State of Riparian Lands Conservation and Management" progress report, and update and re-publish every five years thereafter. *(Section 9.0)*

1.0 Introduction

1.1 The Issue

Riparian lands are important components of functioning, healthy aquatic and terrestrial ecosystems. Considered among the most productive and valuable landscape types in terms of species richness and ecological function, they not only provide habitat for many wildlife species, they are integrally linked to aquatic ecosystem health. Riparian lands are valued because they can affect water quality and quantity, mitigate the impacts of floods and droughts, provide high levels of primary productivity, and enrich human quality of life. In addition to these ecological, cultural and social values, a strong business case can also be made for their reduction of flood impacts and cost savings in water treatment. However, riparian lands should not be viewed simply in utilitarian terms. They also hold significant historical, cultural and social value and have a particular place of importance to First Nations people.

The extent and health of riparian lands has declined in some areas of Alberta and across North America since these regions were settled. As Alberta's economy and population continue to grow, pressure on riparian lands will also increase, and effective management will be needed to protect these valuable lands. Thus, there is growing awareness in Alberta of the need to rethink and improve riparian land conservation and management.[2,3,4] Despite some good work and knowledge at the local level, Alberta lacks a province-wide assessment that identifies how much riparian land currently exists, what the state of riparian land is, and how much of this land has been lost or degraded. In general, the effects on ecological health and terrestrial and aquatic systems of multiple human uses and associated changes to riparian lands are poorly understood.

Effective conservation and management of riparian lands are essential to achieve goals of the *Water for Life* strategy. Riparian land conservation and management is complex because all levels of government as well as diverse stakeholders[5] on both public and private land

2 If you are viewing downtown Calgary's urban skyline, it is easy to forget this city is set in the middle of a prairie landscape along two rivers, with extensive development within riparian areas. Also missing from that urban view is the fact the city's steady expansion has consumed 80 – 90% of the prairie wetlands that once dotted the land in the area. For more information see: www.calgary.ca/CSPS/Parks/Documents/Planning-and-Operations/Natural-Areas-and-Wetlands/Calgarys_Wetlands_At_Work_for_You.pdf

3 The Institute of Wetlands and Waterfowl Research estimates that approximately 64% of the slough/marsh wetlands in the settled areas of Alberta no longer exist. For more information see: www.wetlandsalberta.ca/wetland-loss/

4 Cows and Fish. 2013. Riparian Areas: A User's Guide to Health. Available online at: www.cowsandfish.org/pdfs/ugfull.pdf

5 In this report, "stakeholder" refers to any party or entity that has a stake or interest in the project or process under discussion. A stakeholder may be an arm of government, a person, group or organization, a business, industry or sector. Stakeholders will be different for different issues.

have a role in managing and influencing outcomes on Alberta's riparian lands. Collaborative actions are required to ensure healthy, functioning riparian lands. Consistency and effort in defining and mapping riparian lands is an important step in understanding their extent. Additionally, a framework for assessing health and function and ensuring consistency in assessment methodologies is necessary to determine the "state of" riparian lands at multiple scales. Improvements are also needed to address inconsistencies in what is considered riparian land and riparian land management. Coordination and cooperation across sectors and scales to effectively integrate management solutions also need improvement. Finally, clear riparian outcomes are needed at the provincial scale to help guide provincial strategies and land use decisions, and provide overarching high level goals that will allow alignment and help develop outcomes at other scales. These provincial strategies and outcomes will also help land managers in management and conservation of riparian lands. Rethinking how we manage and measure riparian lands now will ensure that these valuable ecosystems continue to thrive and provide for future generations of Albertans.

1.2 The Project

The Alberta Water Council (AWC) is a multi-stakeholder partnership with members from governments, industry and non-government organizations. In October 2010, the Watershed Planning and Advisory Council (WPAC) sector brought forward a statement of opportunity on riparian land conservation and management for the Council to consider as a potential project.

The AWC agreed to undertake a project that would develop provincial level recommendations to improve the conservation and management of riparian lands at all scales. A working group was launched to further examine the project and develop terms of reference. The Riparian Land Conservation and Management Project Team was established in June 2011 to document and evaluate the current state of knowledge and develop recommendations for more effective conservation and management of riparian lands that meets the needs of sectors as well as the needs of watershed and land use planning initiatives. (A list of team members and the terms of reference appear in Appendix A).

This report describes how riparian land conservation and management can be improved in Alberta, and builds on existing and long-term efforts by many individuals and organizations. The report outlines specific challenges and needs for conservation and management of riparian lands and recommends integrated and holistic management solutions at all scales. Because many human activities and priorities affect riparian health, better alignment of desired provincial riparian outcomes among sectors will facilitate effective, long-term riparian land management.

The recommendations focus on:

- An ecological definition for riparian lands in Alberta based on scientific research.
- The development of a provincial vision and desired outcomes for the conservation and management of riparian land at multiple scales with supporting actions to fill knowledge and management needs.

2.0 Ecological Definition

The Council has developed an ecological definition of riparian lands that was supported by the sectors involved in this project. This science-based definition is necessary to inform and advance conservation and management outcomes. The need for a common definition arose because riparian lands are defined in various ways. The definitions often differ among sectors and are used for different purposes (e.g., academic and scientific use, legislation and regulation, land use planning, resource inventories and mapping). A clear and consistent understanding as to what characterizes riparian lands in an ecological context, including their geographic location and extent, provides a starting point from which stakeholders can begin to develop conservation and management outcomes.[6]

This ecological definition is intended to help provide consistency, align with research needs and ultimately inform decision makers, thus improving conservation and management of riparian lands. The definition is not intended to affect legal rights or preclude or predetermine any particular land use activities on riparian lands. As it is not a legal definition, it is not intended to approve, prescribe or imply management restrictions, particularly in relation to regulation.

The process for developing the ecological definition was iterative. Firstly, a comprehensive list of definitions were compiled. These existing definitions were then evaluated using a list of important core concepts, and the following ecological definition was created:

> **Riparian Lands — An Ecological Definition:** Riparian lands are transitional areas between upland[7] and aquatic ecosystems. They have variable width and extent above and below ground and perform various functions. These lands are influenced by and exert an influence on associated water bodies[8], including alluvial aquifers[9] and floodplains. Riparian lands usually have soil, biological, and other physical characteristics that reflect the influence of water and hydrological processes.

6 Other terms are defined in the glossary near the end of this report.

7 For the purpose of this definition, "upland" is considered to be the land that is at a higher elevation than the alluvial plain, stream terrace(s), or similar area associated with a water body.

8 A water body is any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands and aquifers (generally excludes irrigation works). Source: *Alberta Water Act*.

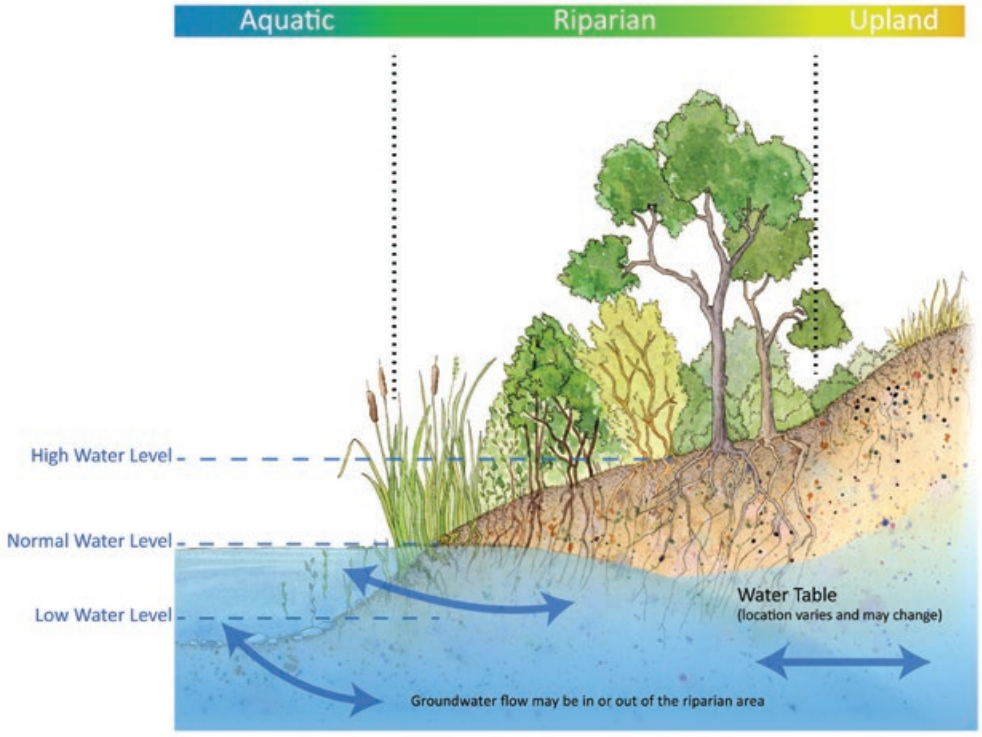
9 For the purpose of this definition, alluvial aquifers are defined as areas where groundwater is under the direct influence of surface water.

2.1 Ecology of Riparian Lands

Riparian services, functions and values flow directly from the vital and dynamic connections between water bodies, riparian zones and uplands. Riparian lands vary in width and depth above and below ground, where the riparian land on either side of the water body is not symmetrical. Groundwater may flow into or out of an associated surface water body, depending on conditions. The subsurface region where surface water and groundwater interact is known as the hyporheic zone; this is where biochemical processes and high levels of exchange occur, involving water, nutrients, other solutes and organisms.

Figure 1[10] illustrates the core concepts in the ecological definition of riparian lands.

Figure 1: Example of riparian land with water table from an ecological perspective



Provided by Cows and Fish, 2013[11].

10 Figures 1 is a visual representation of riparian lands but structure and species vary depending on location.

11 Figure 1 is credited to ©Cow and Fish (www.cowsandfish.org). Input on an existing illustration was provided to create this figure.

The width and vegetative composition of a riparian area also vary depending on soils, the slope of the land next to the water body, the type of water body, geographic location and its associated hydrologic properties (e.g., how much it floods or how variable the water level is). As Figure 1 shows, the water level of water bodies also fluctuates, depending on climate, water use, and overall inputs and outputs. The water table level changes through time as well, and this is reflected in changing water levels. Depending on the local stream geomorphology, riparian vegetation will also have varying degrees of interaction with subsurface water; areas with steep slopes have less interaction than areas with little change in topography from the water channel outward (Naiman et al 2005[12]). In addition, over longer periods of time (decades) the riparian width may change if water level changes persist.

Riparian lands, wetlands and floodplains all describe areas influenced by water; they often overlap and have important interactions with each other. In the case of streams and rivers with topographically unconstrained channel reaches, alluvial floodplains that host a diversity of types of riparian lands tend to develop. The flooding regime combined with geomorphological factors, soil and climate, results in a wide range of plant community types adapted to the many possible combinations of environmental conditions. As a result, many floodplains contain what are termed riparian wetlands (e.g., shrub or treed swamps along a river). For example, in the boreal plain, wetlands adjacent to small lakes and ponds are also defined as riparian lands because of their semi-terrestrial and transitional nature. Examples of riparian lands from various parts of Alberta are illustrated in Figure 2 and examples of some land uses adjacent to riparian lands in Alberta are shown in Figure 3. Although some of the illustrations show delineated riparian lands, the ability to delineate and map riparian lands varies in its complexity and depends on the water body, ecoregion and anthropogenic footprint.

12 Naiman, RJ, Décamps, H, McClain, ME. (2005). *Riparia — ecology, conservation, and management of streamside communities*. Elsevier Academic Press. Burlington, MA

Figure 2: Examples of riparian lands in Alberta[13]

Image 1: This photo shows the riparian area bordering Paradise Creek in the Alberta Foothills Natural Region.

Paradise Creek passes through extensive riparian wetlands in the upper part of the picture and borders an upland area in the right side of the picture. The inset photograph shows a ground-level photograph of Paradise Creek at the arrow location. The location was previously flooded by an old beaver dam that is still visible above the arrow (downstream).

The riparian land border in this photo is marked by both vegetation and ecosite changes that are visible on an air photo. There is also a pronounced landform change from dry upland ecosites to wet riparian ecosites that is formed by a steep water-carved bank that can easily be seen using a shaded bare earth representation derived from airborne LiDAR data. *Photo Credit: Hinton Wood Products*

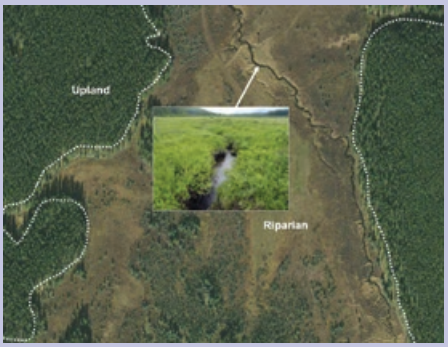


Image 2: Wildhay River and Pinto Creek riparian complex. Steep water-carved banks separate the riparian floodplain from adjacent uplands. These were identified using LiDAR as described above. The inset photograph shows an oblique air photo looking upstream along the Wildhay River (muddy water flow). Pinto Creek (clear water flow) is visible in the lower right corner of the photo. *Photo Credit: Hinton Wood Products*

13 The dashed lines in these examples of riparian lands show the boundary between upland and the riparian zone.

Image 3: Riparian land bordering potholes east of Red Deer. Approximate boundary sketched on using vegetation changes. Actual location may vary. *Photo Credit: Hinton Wood Products*

Image 4: Riparian land bordering potholes surrounded by grassland. This image is from an area southeast of Red Deer. Approximate border sketched on using vegetation changes as the guide. *Photo Credit: Hinton Wood Products*

Image 5: Riparian land along the Red Deer River and a wetland on the right side of the picture. Location is upstream a ways from Dinosaur Provincial Park. Approximate border sketched on using vegetation changes as the guide. *Photo Credit: Hinton Wood Products*

Figure 3: Examples of land uses adjacent to riparian lands in Alberta[14]

Image 6: Urban

Photo Credit: © Cows and Fish

Image 7: Suburban/Recreational

Photo Credit: © Cows and Fish

Image 8: Rural/Agriculture

Photo Credit: © Cows and Fish

Image 9: Transportation Infrastructure

Photo Credit: © Cows and Fish

2.2 Riparian Values and Functions

Riparian ecosystems are an important component of Alberta's landscape, providing diverse ecological, social and economic benefits for all Albertans. To better manage riparian lands, it is imperative to understand and appreciate the full scope of values and functions they offer, including their role in the water cycle.[15] Because riparian lands are a transition zone between terrestrial upland and aquatic components of the ecosystem, they reflect and accumulate inputs, impacts and changes that happen to both of these areas. For example, changes in hydrological patterns that are outside the range of natural variability can alter the composition of vegetation

14 Figure 3 photos are credited to Cows and Fish (www.cowsandfish.org)

15 For more information on the water cycle, see http://ga.water.usgs.gov/edu/downloads/watercycle/watercycle.pdf

in the riparian land. Similarly, changes in the upland, such as permanent cover that is modified to an urban environment, can affect recruitment of species into riparian lands, alter the timing and volume of water entering into riparian lands and, in general, alter energy and matter flow in biological, chemical and physical pathways. In addition, activities and practices on riparian lands themselves can alter these unique ecosystems.

Healthy, well-functioning riparian lands are more resilient when faced with environmental stresses and natural or human disturbances. Taking an integrated approach to ecosystem management enables us to recognize the cumulative effects of land uses and the inter-relationships between ecosystem types and components. Considering riparian lands as part of their surrounding ecosystem and not as separate, independent pieces of land is essential for effective long-term management.

The ecosystem services, functions, values and characteristics and the related environmental, social and economic benefits of healthy riparian lands are shown in Table 1. This list is not exhaustive but it does reflect how valuable riparian lands are and the array of services they provide.

Table 1: Ecological services, values and functions of healthy riparian lands

Service, Value or Function	Description	Primary Benefit Type: Ecological, Social, Economic
Biodiversity (includes fish and wildlife)	Riparian lands are extremely productive ecosystems, supporting diverse flora and fauna. Healthy riparian areas support fish, other aquatic life, wildlife and plant communities. Improvement of fish habitat can benefit the fisheries tourism industry.	Ecological Social Economic
Water Quality	Riparian lands can intercept sediments and other pollution and act as a medium for the biodegradation of plant nutrients and anthropogenic pollutants. This can contribute to improved water quality in receiving water bodies and translates into benefits to aquatic ecosystem health. However, the capacity of riparian lands to continually abate the effects of pollution moving from the upland areas to water bodies is finite. In the presence of particularly intensive land uses, a buffer may be needed between the ecologically defined riparian area and the particular land use. By improving water quality, functioning riparian lands can reduce the cost of drinking water treatment, provide high quality water for livestock watering and irrigation, reduce potential impacts on recreational fishing and swimming opportunities, provide an environment for a high level of biodiversity, maintain healthy aquatic ecosystems and reduce infilling of reservoirs.	Ecological Social Economic

Service, Value or Function	Description	Primary Benefit Type: Ecological, Social, Economic
Shoreline or Bank Stabilization, Channel Maintenance and Formation	Establishment and growth of perennial vegetation on riparian land helps to maintain the banks and shorelines, which reduces erosion and the amount of sediment transported in runoff and protects the aquatic ecosystem. Riparian lands influence channel migration, bank stability and channel depth, thus influencing location of the actual channel, erosion and erosion rates, flooding, deposition, transport of sediment or other material, and channel scouring. These influences can affect aquatic habitat, water quality, and other functions, values and benefits. Riparian lands maintain and support land values by stabilizing banks and moderating human and natural induced channel erosion and migration. In both urban and rural areas, loss of riparian lands as a result of erosion can reduce the existing function and value of intact lands, thus restricting the nature and extent of recreational activities, biodiversity and livestock (grazing) production.	Ecological Economic
Aquifer Recharge	Healthy riparian lands contribute to shallow and, sometimes, deep aquifer recharge, maintaining groundwater quantity. Healthy riparian lands also help maintain high groundwater quality.	Ecological Economic
Habitat	Riparian lands provide unique habitats for plants and other species. They also provide critical sheltering, rearing, feeding, and reproduction habitats for some species that are found nowhere else on the landscape.	Ecological Economic
Landscape Corridors	Riparian lands function as networks, connecting aspects of the landscape and linking water, fish, wildlife, plants and other natural ecosystem elements, including flows of energy and matter.	Ecological
Human Benefits	Riparian lands enrich the quality of human life through spiritual, aesthetic and traditional cultural connections to the natural environment. Many human activities have occurred and continue to occur on riparian lands, which offer valuable recreational, social and economic opportunities. Historic, archaeological and cultural sites (such as Aboriginal sites) can be found on riparian lands.	Social Economic
Agriculture	Riparian lands are highly productive with rich alluvial soils, microclimate growing sites, flat ground and good access to water. They provide a source of shelter, water and forage for livestock.	Ecological Social Economic

Service, Value or Function	Description	Primary Benefit Type: Ecological, Social, Economic
Timber	Riparian lands are highly productive with rich alluvial soils, microclimate growing sites and easy access for tree planting and timber harvesting.	Economic
Public, Commercial or Industrial Infrastructure	Healthy riparian lands reduce the need for stream bank stabilization and flood control structures. Damages to infrastructure due to flooding may also be reduced. Healthy riparian lands maintain or improve degraded water quality and can potentially reduce water treatment costs by improving water quality before it reaches water treatment systems.	Ecological Social Economic
Water Quantity — Flood Control and Drought Mitigation	Functioning riparian land helps to regulate base stream flows, ensuring that the minimum supply of water is consistent and reliable. Well maintained riparian lands can act as water reservoirs to reduce flood risk. Naturally vegetated riparian lands reduce the flow velocity of floodwaters. Protecting these lands can help reduce flood damage which is an economic benefit to citizens. Riparian lands also reduce the impacts of drought in low water years by acting as a water storage area.	Ecological Social Economic
Non-Commercial Products	Riparian lands provide opportunities to seek out non-commercial products such as berries, firewood, wild mushrooms, fish and other elements.	Social Economic

3.0 Methodology for Developing Recommendations

A report was commissioned for this project, entitled "*Riparian lands in Alberta — Current state, conservation tools, and management approaches.*" Prepared by Clare and Sass (2012) of Fiera Biological Consulting,[16] it is referred to as the "Fiera report." It was based on a literature review, an online survey and personal communication with experts in the field. More specifically the report:

- Summarized the existing information on the "current state" of riparian health and extent in each major Alberta watershed;
- Outlined the challenges and barriers associated with riparian management in Alberta, as articulated by key riparian land managers and decision makers in the province; and
- Reviewed information from across Alberta and other jurisdictions (with a focus on North America) to summarize existing and emerging scientific, social and economic approaches to riparian land assessment and management.

Although the scope of the Fiera work was limited by budget and time constraints, the research and the online survey results provided a solid foundation of knowledge that greatly helped in developing recommendations. Council sectors reviewed the Fiera report and provided feedback to ensure that no major issues or strategies had been overlooked.

16 Clare, S. and Sass, G. 2012. Riparian lands in Alberta: Current state, conservation tools, and management approaches. Report prepared for Riparian Land Conservation & Management Team, Alberta Water Council, Edmonton, Alberta. Fiera Biological Consulting Ltd. Report #1163. This report is available on the Council's website (Riparian Project Page) at: www.awchome.ca

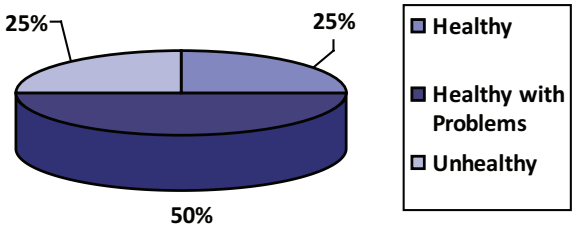
4.0 Introduction to Recommendations

The Council's recommendations are described in sections 5.0 through 9.0 and are summarized in Table 2 and Figure 5 in this section. There is a general sense of urgency around these recommendations due to the concern that riparian lands continue to be lost or degraded in many areas of the province, with associated impacts to aquatic ecosystem health. It was clear from sector feedback and the online survey that riparian lands are extremely important to Albertans and effective management and conservation were concerns for many participants. As a prelude to the recommendations, key observations from the project are described below.

Fiera reported that only a very small percentage of Alberta's riparian areas have been assessed. In general, assessments were concentrated in settled areas, often on a specific water body type (e.g., lakes), and assessment methods used were not always consistent or linked. Assessments to date have generally been sector-based (e.g., Environment and Sustainable Resource Development (ESRD) Public Lands business measures) or opportunity-based, drawing into question whether the conditions of riparian lands for the province as a whole are adequately represented.

Of those areas in Alberta where riparian health assessments have been conducted, a quarter of the riparian lands were considered "healthy" and fully functioning, half were "healthy with problems" and one-quarter were reported to be "unhealthy" (Clare and Sass, 2012), as depicted in Figure 4. Data on which this figure is based were collected between 1997 and 2012.

Figure 4: Summary of Available Riparian Health Data in Alberta



Data collected 1997 – 2012
Source: Clare and Sass, 2012

Again, this is a cautionary statement as too few riparian lands have been systematically sampled to assess the "state of" these lands on a provincial basis. Availability of information varies across the province; considerably less information on riparian health condition is available in the boreal portions of Alberta than in the south, although some local area and site information does

exist. In many parts of the province, riparian health conditions clearly show there is room for improvement.[17] Simply put, while data show that riparian health and function is a concern in portions of the province, it is difficult to determine the extent of the problem.

Moving from an assessment to a management context, the stakeholder survey conducted as part of the Fiera report identified themes related to the major barriers to successful riparian land management in Alberta. Some of the barriers or perceived barriers identified by survey respondents[18] were:

- *Jurisdictional fragmentation* — Confusion over roles and responsibilities across levels of government and between government departments creates uncertainty and inconsistent decision making for managing riparian lands. Many government agencies are managing aspects directly or indirectly related to riparian lands and may have overlapping or diverging responsibilities.
- *Insufficient public, scientific and technical knowledge* — There is a lack of general understanding and knowledge as well as a lack of scientific and technical information. Legislation and policy regarding riparian land conservation and management are also not clearly understood.
- *Insufficient or ambiguous regulation* — Existing policies and regulations are inadequate for improving riparian land conservation and management.
- *Economic constraints and lack of incentives* — Direct costs of implementing best or beneficial riparian management practices (BMPs) or forgone economic opportunities can result in high costs for riparian land conservation. Existing incentive programs often have limited scope and duration.
- *Lack of financial and human resources* — The lack of financial resources and personnel can impede the success of ongoing stewardship programs, as well as limit the collection and sharing of rigorous and scientifically robust information on the extent and condition of riparian lands.
- *Government priorities* — The conservation of riparian lands may not be a high enough priority for governments compared with other issues, such as economic growth.
- *Lack of government legitimacy and capture of government by industry* — There is a perception of inaction by governments to prioritize riparian land conservation above the interests of development.

17 Cows and Fish. 2013. Provincial Riparian Health Report. Online at: http://cowsandfish.org/publications/documents/ProvincialRiparianHealthOverviewFinalReport2008report035.pdf Accessed March 2013.

18 The survey results informed this report and recommendations, but the Council does not necessarily agree with all of the results.

- *Inappropriate or unrealistic planning and management scales* — The temporal and spatial scales at which land use planning and riparian land management are carried out often do not lead to changes on the ground.
- *Insufficient compliance and enforcement* — A lack of enforcement and compliance with existing laws and policy is a barrier to improved outcomes for riparian land management in the province.

Generally, the survey highlighted a need for increased consistency, coordination and accountability at all levels of government, along with responsible planning and enforcement to improve conservation and management of riparian lands.

Alberta is moving towards cumulative effects management of watersheds, including impacts to the air, land and biodiversity. This conceptual approach is the basis of the Land Use Framework and Regional Plans. The Cumulative Effects Management System (CEMS) emphasizes: realization of outcomes across space and time, understanding the effects of environmental pressures resulting from land uses, assessment of environmental risk, collaboration combined with shared responsibility and better integration of environmental, social and economic elements.[19] As well, the collaborative watershed management initiatives in Alberta's *Water for Life* strategy work to address landscape effects on water quality, quantity and aquatic ecosystems as a whole at multiple scales (i.e., watershed to local level).

The CEMS framework attempts to take a more holistic approach to both land use and water and watershed management. Integrating riparian land management into CEMS and watershed planning would allow managers to understand how riparian lands fit within other ecosystem components, including wetlands, groundwater aquifers, rivers and lakes, forests and biodiversity. Ecosystem-based management respects the natural dynamics of systems and aims to maintain processes and ecological outcomes within the range of natural variability. By integrating effective riparian conservation and management strategies into these planning activities, the Council believes that increased consistency, coordination and accountability at the various scales would improve riparian land management and conservation.

19 For more information on Cumulative Effects Management, see https://landuse.alberta.ca/CumulativeEffects/CumulativeEffectsManagement/Pages/default.aspx

The WPACs' Watershed Management Plans and State of the Watershed reports reflect land and water planning at the watershed scale. However, there is lack of clarity about how riparian outcomes developed as part of watershed planning will be nested into other cumulative effects planning, including regional or municipal plans.[20]

Many successful riparian land programs and policies have been developed, but there has not been a broad scale provincial initiative to set and measure riparian outcomes that are formally supported by all stakeholders. Initiatives that take a provincial approach do not include all relevant stakeholders or they do not have the authority or mandate to determine such provincial outcomes for all stakeholders.

Provincial level desired outcomes will be critical in guiding outcome development at smaller scales and providing direction for management, and would assist in establishing riparian lands as important and valuable. Provincial level outcomes would also resolve the issue of inconsistency or lack of clear desired outcomes in riparian conservation and management throughout Alberta. This consistent, outcome-based approach to riparian land conservation and management requires a provincial framework that encourages the development of nested and scaled outcomes, commitment to stewardship and active collaboration by stakeholders on both private and public land.

Along with setting provincial desired outcomes, Alberta needs to maximize the effectiveness of existing tools, policy and legislation related to riparian land conservation and management. These must be reviewed and modified where necessary to ensure they support achieving provincial outcomes.

20 The Bow River Basin Council has taken steps to include riparian land outcomes in their Bow Basin Watershed Management Plan (2012) Report; a sample of these outcomes are:

- Existing riparian land including associated upland areas are kept intact or restored, ecologically functional, appreciated and valued.
- Core ecological functions of healthy riparian lands are maintained (e.g., water quality protection, water storage and flood conveyance, bank stability, biodiversity, soil health, etc.).
- Invasive plant species are reduced, especially in riparian lands adjacent to watercourses and water bodies.
- Enhanced knowledge and understanding of the:
  - importance of the composition, structure and health of the upland area to the health of riparian lands.
  - functions provided by riparian land and how to conserve and manage for those functions.

The full report is available at: http://brbc.ab.ca/index.php/resources/bbwmp

Finally, it is critical to move riparian land conservation and management forward and increase public awareness in the short and long-term. Action is needed to conserve and effectively manage riparian lands and their functions now, applied in conjunction with long-term strategies.

Table 2 and Figure 5 summarize the recommendations found later in this report.

Table 2: Summary of implementation process for recommendations[21]

Recommendation Key Outcome	Lead	Timeline
Recommendation 1: Identify a lead (*Section 5.1*)	ESRD	Six Months
Recommendation 2: Establish a vision (*Section 5.1*)	ESRD	One Year
Recommendation 3: Develop desired outcomes (*Section 5.2*)	ESRD in consultation with AARD, AH, AMA and stakeholders	One Year
Recommendation 4: Integrate the vision and desired outcomes into existing plans and frameworks (*Section 5.2*)	ESRD in consultation with stakeholders	Three Years
Recommendation 5: Review of legislation, regulation, policies and programs to remove barriers (*Section 5.3*)	ESRD in consultation with other ministries and stakeholders	Three Years
Recommendation 6: Initiate and support incentive tools (*Section 5.3*)	GoA	Three Years with ongoing implementation and review
Recommendation 7: Improve implementation and enforcement of legislation and policy (*Section 5.4*)	ESRD in consultation with relevant ministries	Three Years with ongoing review and continuous improvement
Recommendation 8: Ensure regulatory support and capacity building for municipalities (*Section 5.4.1*)	GoA in consultation with AMA and municipalities	Three Years with ongoing review
Recommendation 9: Strategy for improving and sharing knowledge and information (*Section 6.0*)	GoA in partnership with Stakeholders	Three Years with ongoing implementation and review
Recommendation 10: Identification and adoption of accepted methodologies to delineate and map the extent of riparian lands (*Section 7.1*)	ESRD in partnership with Stakeholders	Five Years with ongoing coordination
Recommendation 11: Review and adoption of a provincial riparian assessment health and function framework (*Section 7.2*)	ESRD in partnership with Stakeholders	One Year with ongoing implementation

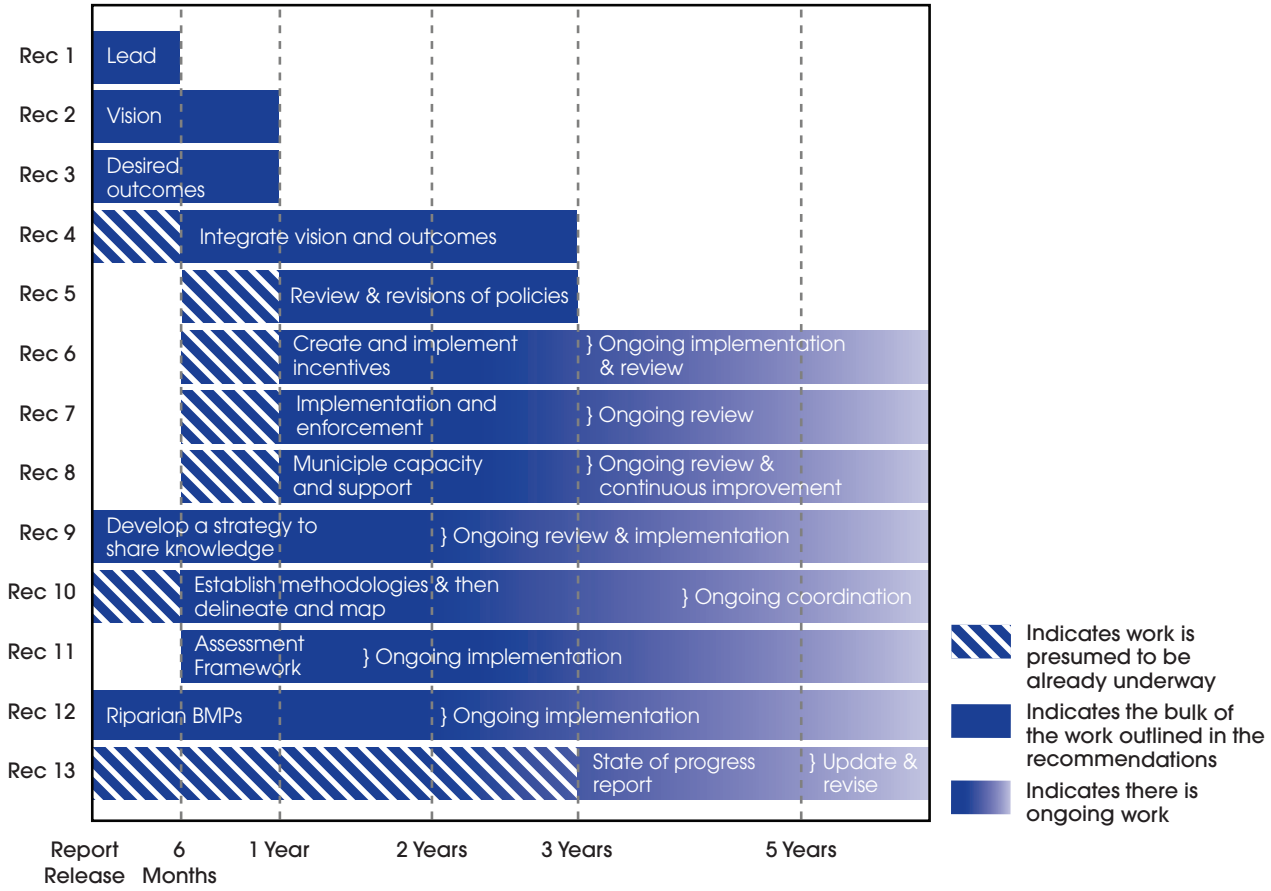
21 All timelines are to begin with the release of this report and are to be completed within the timeframe noted in the recommendations. Note that several of the recommendations require "ongoing" work.

Recommendation Key Outcome	Lead	Timeline
Recommendation 12: Identify, adopt and support best or beneficial riparian management practices and approaches (*Section 8.0*)	GoA in partnership with Stakeholders	Two Years
Recommendation 13: Produce a "state of" progress report (*Section 9.0*)	GoA in partnership with Stakeholders	Five Years, update and republish every Five Years

Note: ARD = Alberta Agriculture and Rural Development, AH = Alberta Health, AMA = Alberta Municipal Affairs, ESRD = Alberta Environment and Sustainable Resource Development, GoA = Government of Alberta

Although there is urgency to begin implementing the recommendations in this report, the timelines are charted on a relative, and not necessarily an absolute, basis.

Figure 5: Timelines for recommendation implementation



5.0 Provincial Strategy for Riparian Land Conservation and Management

The Council supports the need for the development of a provincial strategy that provides a consistent and targeted approach to improving riparian land conservation and management, and that an appropriate provincial-level lead should develop and coordinate such a strategy. A riparian strategy is not meant to be a standalone initiative, the recommendations in this report provide the key elements for a strategy that could feed into existing planning frameworks and provincial level initiatives. The lead should acknowledge the value of riparian lands and commit to improved management through a riparian vision for Alberta and the development of provincial level desired riparian outcomes. Such desired outcomes will help align and coordinate provincial policies with outcomes developed for specific watersheds and water bodies. A provincial strategy will facilitate the development of regional level strategies that consider ecological differences among regions as well as differences among land use impacts.

This proposal stems, in part, from survey results in the Fiera report, where respondents consistently identified jurisdictional fragmentation, lack of clarity around roles and responsibilities among various levels of government and stakeholders, and lack of an overall "lead" for riparian management as major challenges for effective riparian conservation and management. Survey respondents also noted the need for consistent decision making (geographically and at multiple scales) that is driven by scale-appropriate desired outcomes.

The provincial riparian strategy should align with the regional planning process, provincial cumulative effects frameworks and other land and water policies and watershed plans. However, strategy development and improved management should not be delayed while waiting for these plans and frameworks to be initiated or completed.

5.1 Leadership, Commitment and Vision

Understanding how management and land use choices affect riparian lands is key to their successful conservation and management and to maintain their ecological, social and economic values. Lack of such understanding or a lack of its application has often characterized management in the past, with negative consequences for riparian lands (i.e., loss of long-term ecological, social and economic values). The lead for riparian management and conservation must understand and consider the long-term implications

of land use choices and will direct initiatives at various scales and maintain momentum. ESRD, as the provincial water authority and lead for the *Water for Life* strategy and cumulative effects management, is a logical choice to either become or delegate[22] a lead to coordinate a provincial initiative for advancing riparian lands conservation and management.

Recommendation 1: Identify a Lead

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within six months identify a lead who is accountable for the coordination and integration of riparian land conservation and management in the province, including implementation and annual public reporting on the progress of the remaining recommendations in this report.

A strong lead is also needed to ensure riparian lands conservation and management is on the agenda of decision makers and land users. It is expected that the provincial lead would take on a coordination and facilitation role in partnership with other stakeholders, to ensure the recommendations in this report are implemented. Encouraging and facilitating strong partnerships with other government ministries such as Agriculture and Rural Development (ARD), Municipal Affairs (AMA), and Health (AH) as well as other stakeholders will be important. Annual reporting on implementation progress could occur through the AWC recommendation tracking process and could also involve a formal summary document. The lead is also accountable for the creation of a vision for riparian land conservation and management in Alberta.

Recommendation 2: Vision for Riparian Lands

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within one year and in consultation with stakeholders, establish a provincial riparian land conservation and management vision that recognizes the ecological, social and economic importance of riparian lands and their functions.

The vision statement should have a directive and an outcome, establishing what riparian lands are and the future we want for riparian lands in Alberta. The starting point for defining land use vision statements and objectives at any scale must be an acknowledgement that land and water resources are finite. Adoption of outcomes that stem from the vision statement should also

22 A delegated lead organization should be willing to accept this role and there must be some assurance that associated resources are part of the delegation process.

recognize that human impacts cannot expand indefinitely on a finite resource base with finite carrying capacity. The vision would help to align riparian priorities across stakeholder groups and provide direction and demonstrate commitment in the province.

Riparian lands should not be managed in isolation but rather as an integral part of the overall landscape and ecosystem. Important elements to consider in developing the vision are:

- Maintain ecological functions, which will help ensure that social and economic needs are met over the long-term.
- Riparian lands are interdependent and connected to associated uplands and water bodies, and all of these biological systems should be managed through a holistic and integrated approach.
- The vision will support the need to maintain or improve riparian function and health; for example: *Alberta's riparian lands are healthy and are managed to recognize and respect their ecological, social, and economic values, now and into the future.*

5.2 Development and Integration of Riparian Conservation and Management Outcomes

To ensure that the vision for riparian lands is achieved over the long-term, the Government of Alberta (GoA) should develop a set of desired riparian outcomes. These outcomes will help align provincial policies and guide the development of outcomes on smaller scales, such as for specific watersheds or water bodies. The provincial level desired outcomes must recognize the ecological, social and economic importance of riparian lands and their functions. Not all values and functions can be achieved in a particular location at the same time and long-term consequences of decisions need to be considered when setting outcomes. Full cost accounting for the value of riparian lands, the understanding that they are finite, and long-term planning and vision for their future have been absent from past initiatives. As well, because short-term economic gains are often more measurable, in many cases they have taken priority. For these reasons, opportunities to achieve multiple compatible outcomes for riparian lands have been missed. The desired outcomes should be established collaboratively with stakeholders, recognizing that this is a complex process and ecological health is linked to human and community health, prosperity and sustainability. Along with developing outcomes, a framework will assist with alignment of desired outcomes at other scales.

Recommendation 3: Riparian Land Conservation Desired Outcomes

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within one year and in consultation with Alberta Agriculture and Rural Development, Alberta Municipal Affairs, Alberta Health, and other key Ministries and stakeholders, lead the development of desired provincial level riparian land conservation outcomes that are consistent with the provincial vision and that support integrated management. Alberta Environment and Sustainable Resource Development should also provide a framework for the development of aligned and more specific outcomes at multiple scales.

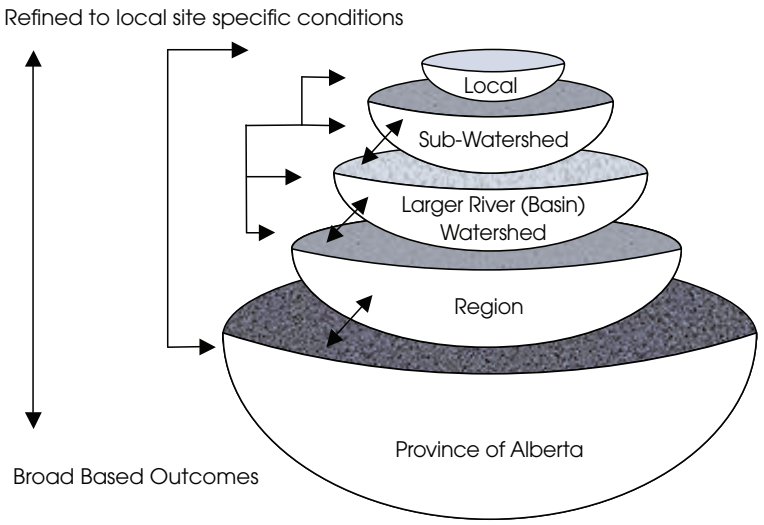
Provincial desired outcomes for riparian lands should align with the vision for the province and be appropriate at a provincial scale. These outcomes should also articulate the desired results and future conditions through the use of goals, objectives and targets. They should be broad enough that they can effectively guide the development, improvement and alignment of outcomes at other scales.

As described in the Fiera report, "nested" planning is integral to effective riparian conservation and management. Specifically, desired outcomes at the provincial scale would be used to help develop outcomes at regional, sub-regional, local and site-specific scales. Outcomes would get more precise the closer they get to the site-specific scale. This nested approach will help align and integrate outcomes among spatial scales and ensure that riparian conservation and management is achieved across Alberta. Figure 6 depicts the nested approach and the sidebar contains an example of nested outcomes. Additional examples of this approach appear in Appendix B.

Nested Outcomes: An example of nested outcomes is the United Nations Convention on Biodiversity initiative, which Canada signed in 1992. Alberta signed the Canadian Biodiversity Strategy in 1995. Alberta is committed to achieving a number of riparian related biodiversity targets, including significant reduction of natural habitat loss, degradation and fragmentation. This shows that Alberta is dedicated to protecting biodiversity and illustrates the nested approach from the global to provincial level.

Source: Canadian Biodiversity Strategy, 1995, www.biodivcanada.ca/560ED58E-0A7A-43D8-8754-C7DD12761EFA/CBS_e.pdf

Figure 6: An example of a nested planning approach



This figure shows the path of influence that aids in achieving nested outcomes. Planning and outcomes within Alberta are intrinsically guided by federal and international influences.

The Council recommends that the riparian lead develop the desired provincial outcomes, in partnership with stakeholders. Examples of potential desired outcomes and the process to achieve them include:

- Riparian lands are recognized provincially as priority landscapes.
- The health and extent of riparian lands is known at provincial, regional and local scales through ongoing, targeted multi-agency monitoring and research to fill information gaps.
- The public and decision makers are better educated and more aware of matters related to stewardship, value and function of riparian lands.
- A measurable and more integrated and coordinated approach to riparian conservation and management is in place across sectors, ministries and jurisdictions (e.g., establishment of an annual forum on riparian conservation and management, internal government cross-ministry meetings that integrate riparian management, riparian leaders develop and implement a riparian engagement strategy, regional and watershed planning is supported and ongoing, and watershed management plans are required to include riparian outcomes).

- Riparian outcomes are integrated into comprehensive CEM and all levels of land use and watershed planning.
- Riparian health and function are improved across Alberta, with the understanding that natural disturbances are part of the overall ecosystem health and function of riparian lands.
- Improved and consistent riparian leadership at the provincial level along with supporting policy, regulation, and legislation should be applied at all scales to allow effective implementation of multi-scale outcomes (e.g., improving and consistently enforcing legislation, improving reclamation standards).
- Consistent and ecologically appropriate standards are identified and applied for riparian land users.
- Funding is allocated and targeted to meet riparian outcomes at all scales.
- The public is engaged, educated and empowered to develop and achieve outcomes at relevant scales.

Desired outcomes should be measurable, adaptable and continually improving through regular review of timelines and metrics to ensure that conservation and management efforts are maintaining or improving riparian lands in both extent and health throughout the province. Developing desired outcomes should be an integrated and collaborative process as part of a coordinated approach to riparian conservation and management across sectors and jurisdictions.

Recommendation 4: Integration with Other Initiatives

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within three years, and as frameworks and regional plans are developed, in consultation with stakeholders including other Ministries, ensure that the riparian land conservation and management vision and desired outcomes are integrated into regional land use planning, watershed management planning, and other relevant plans and frameworks including municipal planning as guided through the *Municipal Government Act*.

The ecological factors (e.g., natural disturbance) along with the social and economic factors associated with human use all play an important role in determining the needs of riparian lands when setting outcomes. Because riparian lands are components of larger ecosystems, any approaches to improve them should be holistic and ecosystem based, building on relevant, existing initiatives where possible. Outcomes should be aligned and integrated into existing provincial land, water and watershed planning frameworks where possible, but delays in provincial planning or frameworks should not delay actions to improve conservation and management of riparian lands.

5.3 Review and Revise Existing Policy and Tools

The results of sector feedback, the Fiera report, subsequent discussions and individual experience revealed perceived gaps in compliance assurance relevant to riparian lands as well as inconsistent use of tools and approaches to riparian management within government. Opportunities to improve integration between government and non-government organization (NGO) initiatives were also identified. The Council proposes that these gaps be addressed and that improved policy be accompanied by improved and consistent compliance and enforcement.[23]

Despite the gaps, various stakeholders have taken steps to improve conservation and management of riparian lands. Achievement boxes in the remainder of this document highlight some of these successes, showing that best outcomes are often achieved by applying several tools together rather than one tool alone. The achievement examples are sector-specific, site-specific or regional stories that illustrate opportunities to integrate policy and initiatives into broader, targeted strategy. There is no intent to suggest that all examples are relevant to all sectors in all places at all times.

The plans and policies highlighted in Achievements 1, 2 and 3 exemplify riparian conservation goals and promote sustainability of essential functions and connectivity between riparian lands and associated water bodies and uplands.

Achievement 1: Gravel aquifers can be highly lucrative sources of aggregate material. Unfortunately, there are gaps and inconsistencies in provincial policy on this issue, which results in extremely heavy pressure on some municipalities to allow mining of these aquifers and associated riparian lands. Land use planning and approval processes should consider the importance of riparian lands and their values. An example of this is the City of Edmonton Municipal Development Plan, which prohibits resource extraction under all but exceptional circumstances, "within the North Saskatchewan River Valley and Ravine System in order to preserve its ecological value..." The Municipal District of Peace also prohibits gravel extraction in, or within three metres (vertical) of the Grimshaw Gravels Aquifer, an important water supply source in the Peace River Region. These policies demonstrate progressive leadership under a system which otherwise does not protect these sensitive areas.

Sources: City of Edmonton, Municipal Development Plan. Online at: http://www.edmonton.ca/city_government/documents/MDP_Bylaw_15100.pdf. Accessed December 2012.

Municipal District of Peace, Grimshaw Gravels Aquifer Sand and Gravel Mining Procedures, Mackenzie Municipal Services Agency. Online at: www.mdpeace.com/getfile.asp?fn=2da9a731f6a084557212a0b00b8569da40b965e852d9ad4265810278186e930462361f. Accessed December 2012.

23 Riparian management must have buy in from non-regulated and private stakeholders with associated compliance and enforcement measures, so the management burden does not rest on regulated industries alone and greater success can be achieved.

Achievement 2: Great successes on the WPAC front are the watershed management plans that include riparian land objectives; e.g., the North Saskatchewan Watershed Alliance (NSWA) and Bow River Basin Council (BRBC). The NSWA, for example includes the following as part of its Integrated Watershed Management Plan: "evaluate instream flow needs for the protection of riparian zones, develop riparian objectives for the mainstem and priority water bodies, and maintain and restore riparian areas with the associated actions — complete an inventory and assess riparian condition, work with municipalities and stakeholders to develop riparian setback guidelines, and develop incentive programs for to enable and assist land owners to restore and maintain riparian areas on their land". As well, a few municipalities are following the lead of Wheatland County and Rocky View County and developing local riparian land inventories and management policies.

For more information, see NSWA at www.nswa.ab.ca, BRBC at www.brbc.ab.ca, Wheatland County at www.wheatlandcounty.ca, and Rocky View County at www.rockyview.ca.

Achievement 3: Foothills Stream Crossing Partnership (FSCP) is a voluntary group of stream crossing owners and government agencies working together to inspect stream crossings and develop collaborative restoration plans. Since inception in 2004 the FSCP has collected information on more than 3,000 crossings. This has led to millions of dollars in investment to restore hundreds of unsatisfactory crossings to improve ecological health and function.

Source: Foothills Stream Crossing Partnership. Online at: http://fscp.foothillsri.ca

An important component of any strategy to improve riparian land conservation and management is an understanding of how existing and proposed policies and tools work in conjunction with or in opposition to one another. Knowing where riparian land management fits within the current system and what policies and tools are available will help facilitate a consistent management approach at all scales.

Across Ministries and levels of government, legislation, regulation and policy related to riparian conservation and management could be better aligned and coordinated. The Fiera survey revealed differing views on whether new riparian policies are needed. Some individuals viewed existing policy and legislation as potentially insufficient or lacking enough clarity to allow for effective improvements in riparian land conservation and management. Improving coordination and alignment of the current system was considered the best path forward. Examples of federal and provincial legislation related to riparian lands can be found in Appendix C.

A comprehensive review and evaluation of existing policy[24] and its application and enforcement of riparian lands is needed to make sure the vision and desired outcomes align with these provincial land and water policies and planning frameworks. Aligning policy and providing clear direction will improve clarity and focus for riparian management at all scales. This review should identify any conflicting intentions as well as any barriers or disincentives[25] within existing policies at the various scales. To provide clear direction, revisions should remove disincentives to effective riparian management.

Recommendation 5: Cross-Ministry Legislative Review

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within three years undertake a cross-ministry review of legislation, regulation, policies and programs to ensure consistency and to facilitate removal of disincentives or barriers to conservation and management of riparian lands.

For this review, the riparian lead should gain the full participation of relevant government agencies at all levels as well as support from sectors. Any regional planning processes and provincial frameworks now being developed should also be part of the review to ensure consistency in implementation.

Current policy and regulations around riparian conservation and management often differ among levels of government and among industry sectors. These differences typically exist because it is difficult to create policy that fits all circumstances and applies across sectors. As well, policy and regulation created in the past were generally not linked to long-term outcomes, certainly not at the provincial scale. Developing provincial level desired outcomes followed by a review and alignment of the existing policy and planning frameworks is a good strategic approach.

The review process should recognize needs within different levels of government and within sectors to ensure that solutions are feasible and achievable for stakeholders. Several important aspects should be considered in this review process:

- The knowledge of the extent of riparian lands in Alberta is very limited due to a lack of systematic measurement of these lands.
- There is no established system for educating decision makers and the general public on the value of riparian land.

24 Policies in this context include guidelines, codes of practice, operating ground rules, and other similar documents.

25 In this report, "disincentives" refer to factors that may unintentionally encourage people to accept and adopt practices that prevent or discourage beneficial consequences, outcomes or actions.

- Although numerous policies could be applied to riparian management and conservation, some of these are not clear, necessary, consistent, applicable, implementable or applied equally, and may be counterproductive.
- There may be inconsistent oversight of the regulatory requirements and accountability for them.
- Capacity and consistent regulatory support may be lacking at various levels of government.
- Decisions may be made individually and in isolation rather than focusing on an integrated cumulative effects approach.

Once disincentives and barriers have been identified, the review process should look at potential incentives and evaluate their effectiveness for improved riparian management. The next step would be to integrate these incentives into riparian policy ensuring alignment and appropriateness for all levels of government.

Recommendation 6: Incentive Tools

The Alberta Water Council recommends that the Government of Alberta within three years and in consultation with stakeholders, initiate and support the development of a suite of incentive tools, including conservation and stewardship tools, that are targeted toward the provincial outcomes for integrated riparian land conservation and management, with ongoing implementation and review.

Although providing incentives for riparian conservation and better management can be an effective tool to achieve desired outcomes, there are some barriers to the development of incentive programs. There appears to be lack of clarity on what constitutes an incentive, as well as differing interests among stakeholders around incentives. Clearly defining what an incentive is and securing stakeholder agreement on it is essential. As well, the question of who benefits from maintaining healthy riparian lands and who pays for this public good has not been acted on or resolved. This is particularly problematic in areas where privately-owned riparian lands provide public benefits.

While the lead, in partnership with stakeholders, will identify opportunities for incentives, examples of potential opportunities are noted here:

- Support further pilot projects that evaluate transferable development rights (TDRs) and their potential role, identifying information gaps and opportunities for the use of TDRs in Alberta (e.g., pilot project on TDRs in the Beaverhills area[26]).
- Explore further opportunities to pilot offset initiatives throughout Alberta, as offsets are a potential tool that could be used to help achieve conservation outcomes on riparian lands.
- Support the development of tools that help identify and incent practice change to enhance ecosystem services related to riparian lands (e.g., GoA environmental reserve pilot for wetlands near Calgary[27]).
- Continue to support research into BMPs that lead to positive outcomes for riparian conservation and stewardship, and encourage practices that achieve positive outcomes (e.g., GoA Nutrient Beneficial Management Practices Evaluation Project 2007 to 2012[28]).
- Support pilot projects that demonstrate a market based approach to funding incentives for practice changes that support improved conservation and stewardship practices on riparian lands.
- Support research into natural disturbance emulation in riparian lands.

The *Alberta Land Stewardship Act* allows for the use of conservation tools such as offsets, and a voluntary conservation offset is being piloted in the South Saskatchewan region of Alberta. Conservation tools such as offsets that are funded by the industry or entity requiring the offset, can be used to create market based incentives for the adoption of BMPs. Incentives should be available for both public and private land and the GoA should evaluate how the various incentives function and how they might align with the provincial vision and desired outcomes for riparian land conservation and management.

26 For more information on the Beaver Hills Initiative see: www.beaverhills.ab.ca/contact/index.html

27 For more information on the GoA environmental reserve pilot for wetlands near Calgary see: http://environment.gov.ab.ca/info/posting.asp?assetid=8374&searchtype=asset&txtsearch=ecosystem

28 For more information on the Nutrient BMP Evaluation Project, see: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/epw11955

5.4 Improve Policy Implementation

As important as it is to review and revise current policies, regulations and programs for conservation and management of riparian lands, it is equally essential to ensure consistency in their application and enforcement. This is particularly relevant where current policies, regulations and programs could be used to improve riparian heath but are not being used effectively.

Implementing these aligned and integrated policies requires improved coordination within and between jurisdictions responsible for managing riparian lands. Ensuring and demonstrating transparency and inter-departmental alignment in goals and decisions at all levels of government regarding the management of riparian lands should be a priority.

Recommendation 7: Implementation and Enforcement

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within three years and in consultation with relevant Ministries, improve implementation and consistent enforcement of legislation and application of policy relevant to riparian lands, with ongoing review and continuous improvement.

Everyone who affects riparian lands is expected to comply with the laws and regulations pertaining to those lands.

Several important areas of focus for effective implementation and enforcement of legislation and policy related to riparian lands conservation and management should be considered:

- Integrate management of surface water and groundwater.
- Integrate policies and guidelines influencing riparian lands to reduce conflicts and increase efficiencies.
- Tie water and land use planning and decision making to science-based assessments and management frameworks to avoid arbitrary decisions that compromise ecological sustainability for short-term economic advantage.
- Define clear, consistent, enforceable and science based standards for determining land use setbacks from water bodies. Where existing uses do not match, new setback standards and BMPs should be considered.
- For all basins and sub basins, in-stream flow needs and water conservation objectives must be scientifically established and respected in land use and water management planning.
- To ensure that ecological limits are not exceeded, the criteria required to protect the ecological function of the riparian land should be defined (in conjunction with the

associated watershed within the context of CEM) before any land use affecting the water body and associated riparian land is approved.

- Within the context of the provincial outcomes, a mitigation hierarchy could be used as a tool to manage impacts on riparian lands. Avoidance must be the priority.
- The rate at which land disturbance projects are approved must align with capacity of government to manage impacts.
- Where inadequate reclamation standards are resulting in lost or degraded riparian function, current reclamation standards should be improved.[29]
- Assess environmental impacts and cumulative effects as part of resource extraction proposal review.
- Ensure that the burden of proof for an activity that may have adverse impacts rests with the proponent.[30]
- Maintain and strengthen open and democratic processes for land use planning and review.
- Ensure consistent and appropriate qualifications and related experience of planners and specialists who make or influence land use decisions.
- Ensure enforceable restrictions are placed on recreational activities, such as inappropriate use of all-terrain vehicles that can damage riparian lands.

Financial resource constraints are an important factor in any policy or program implementation. Government and other stakeholders must better understand resource needs and provide sufficient resources to parties responsible for riparian land conservation and management. The riparian lead will be responsible for resourcing strategies, but management and administration costs may not be captured in the current land management cost structure; thus, there are opportunities for improved cost and funding efficiencies. Full cost accounting should be used to confirm the environment is not being undervalued. Several examples of funding strategies were identified during sector discussions for this project (see Appendix D). Achievement 4 includes examples of successful integrated funding and incentive programs from other jurisdictions.

29 Reclamation standards have been improved for grasslands, cultivation and forests and the following fact sheet provides details: http://environment.alberta.ca/documents/2010-Reclamation-Criteria-Fact-Sheet.pdf. Many issues are the result of older standards or requirements (or lack thereof); the following ESRD site relating to reclamation provides additional information: http://srd.alberta.ca/LandsForests/IndustrialActivity/IndustrialDevelopmentReclamation/Default.aspx#

30 Burden of proof must be reasonable and not delay project application review times.

Achievement 4: Management of aggregate extraction in several European jurisdictions seeks to address the role of the resource in economic growth, while addressing both environmental impacts and increasing scarcity of the resource. Key initiatives to reduce aggregate extraction include aggregate taxes, waste taxes, targets for reduced extraction and waste, targets for increased use of alternative materials, and bonuses for beneficial practices. Goals of extraction taxes, ranging from approximately $1 to $4 CAD/tonne, are to offer both informative and incentive effects on aggregate users, fund research and education, fund policy initiatives, reduce demand for mined aggregates, improve environmental management, address environmental costs, reclaim abandoned pits and encourage use of recycled materials. The goals of waste taxes, ranging from approximately $45 to $80 CAD/tonne going to landfills are to minimize waste and encourage recycling. Of the total amount of aggregate produced in Denmark, less than three per cent is ultimately disposed of as waste in landfill. The Swedish National Roads Authority awards a bonus for use of crushed rock in road building, thereby reducing the demand for natural gravel, a vital and limited groundwater reservoir material.

Source: Pembina Institute, Rebalancing the Load. Online at: www.pubs.pembina.org/reports/Aggregatesfinal-web2.pdf. Accessed December 2012.

Sector feedback and subsequent discussions highlighted a need for improved and consistent enforcement of provincial legislation and municipal bylaws relevant to riparian lands. In these situations, improved policy must be accompanied by consistent enforcement of related regulations and bylaws. Achievement 5 describes an example of regulators and landowners placing high value on riparian lands.

Achievement 5: In Iceland, regulation of gravel mining is comprehensive, with high levels of compliance. Enforcement is carried out on a regular basis to ensure that standards are met. Gravel mining occurs primarily on barren land, generally rocky areas and highlands, thereby conserving agricultural and riparian lands and water resources. In Iceland farmers place very high value on soil and water, and very seldom allow mining activities on their lands, despite potential for short-term economic benefit.

Source: Iceland; Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining. Land Restoration Training Programme. Online at: www.unulrt.is/static/fellows/document/musah-ja.pdf. Accessed December 2012.

5.4.1 Municipal Initiatives

Alberta has delegated the authority for regulating and controlling land use on private lands to municipal governments, with some exceptions. The part of the *Municipal Government Act* (*MGA*) that deals with land use planning and bylaw development[31] provides opportunities for regulation and control of development within municipal boundaries. The *MGA* also gives a municipality the "direction, control and management" of all water bodies within the municipality, subject to provincial and federal laws.[32] More information on provincial and federal legislation can be found in Appendix C.

Discussions, sector feedback and the Fiera stakeholder survey indicated that the role and jurisdictional responsibilities of municipal governments regarding the conservation and management of riparian lands are not clearly defined. Municipalities do have legislative authority under the *MGA* to manage riparian land use and associated human activities that may affect the health and welfare of all or part of the municipality.[33] However, there is an urgent need for the *MGA* to be updated to ensure municipal accountability for improved riparian conservation and management.

If a person wants to subdivide or develop land within a municipality, he or she must apply for approval. At the time of subdivision or development, a municipality may require that certain lands be dedicated to the municipality as environmental reserve[34] to protect development from hazards such as flooding and subsidence, to protect water bodies from pollution and to provide public access to beds and shores of water bodies. The process is challenging because some municipalities do not have capacity, including the necessary information, knowledge, tools and financial resources to make such decisions. There are also concerns that increased development pressures can have an undue negative effect on land use policy and planning as well as an overwhelming effect on municipalities without the capacity to respond to these pressures.

31 *Municipal Government Act*. RSA 2000, Chapter M26 Part 17, section 640. Online at: www.qp.alberta.ca/documents/Acts/m26.pdf

32 *Municipal Government Act*. RSA 2000, Chapter M26. Section 60. Online at: www.qp.alberta.ca/documents/Acts/m26.pdf

33 *Municipal Government Act*. RSA 2000, Chapter M26, Section 7. Online at: www.qp.alberta.ca/documents/Acts/m26.pdf

34 For a complete overview of an Environmental Reserve see: *Municipal Government Act*. RSA 2000, Chapter M26, section 664. Online at: www.qp.alberta.ca/documents/Acts/m26.pdf

Recommendation 8: Enhancing Municipal Support and Capacity

The Alberta Water Council recommends that the Government of Alberta within three years, in consultation with Alberta Municipal Affairs and municipalities, improve riparian land conservation and management in municipalities by ensuring regulatory support and building capacity, with ongoing review.

Examples of municipal tools that could be used or enhanced for riparian land conservation and management include:

- Improve municipal capacity for land use decision making where needed.[35]
- Strengthen conservation and land use planning requirements under the *MGA*.

To effectively implement policy, stakeholders (including implementers) need the proper knowledge and awareness to improve riparian lands conservation and management. They also need an effective system to share knowledge and a transparent, inclusive process for decision making. Other examples to improve implementation of policy include improvements to monitoring, communications, transparency and public participation in land and water use decision making processes at the municipal level. Seeking support and buy-in is an essential component to successful implementation.

Achievement 6 describes Mountain View County's riparian fencing initiative.

Achievement 6: Mountain View County established a policy to identify Environmentally Significant lands, including riparian land, archeological sites and undisturbed native rangeland. As follow up, they incorporated the following policy into their subdivision process: if you are approved for a subdivision of non-riparian land on a quarter section that contains a portion of riparian land then a condition of subdivision would include fencing of the riparian land to control cattle entering those lands. The Agriculture Service Board provided financial support to assist in the fencing projects.

For more information, see: http://mountainviewcounty.com.

35 For example: Summer villages and small municipalities are included within the municipal context as needing resources and capacity. They do not have Municipal Development Plans and often do not have any planning expertise or personnel to assess development options.

6.0 Improve the Sharing of Riparian Knowledge

Key to implementing many of the approaches outlined in this report is improving coordination of knowledge sharing and clarifying roles for knowledge dissemination at the various scales. The Fiera report survey results highlighted that the public has only a limited understanding of riparian lands and function and concern over the lack of shared scientific knowledge for better decision making at the planning and regulatory levels. The Fiera report also noted that many stakeholders, including some municipalities, are not aware of all policy and legislation available to better manage riparian lands. Thus there appears to be a need to increase understanding and knowledge, to share educational opportunities and experiences, and to foster a stewardship ethic[36] regarding riparian land conservation and management in Alberta, which could be accomplished through an integrated provincial strategy. Recommendation 9 would not preclude the integration of existing successful strategies.

Recommendation 9: Sharing Knowledge and Information

The Alberta Water Council recommends that the Government of Alberta within three years and in partnership with stakeholders, develop and implement an integrated province wide strategy to improve the sharing of knowledge and information regarding riparian lands. The strategy should increase sector and public understanding and stewardship of riparian lands functions, values, conservation and management, with ongoing implementation and review.

This strategy would identify current roles in education and define future roles and opportunities at the provincial, regional and local levels, including GoA departments and agencies, WPACs, stewardship groups, environmental NGOs and individual AWC sectors, and could entail a knowledge partnership. The creation of a knowledge partnership referred to in Recommendation 9 might include: Alberta Land Institute (University of Alberta), Alberta Land Use Knowledge Network, WPACs, Alberta Conservation Association, Cows and Fish, Ducks Unlimited, and others. The information collected through the knowledge partnership could be housed in a publicly accessible database with the information categorized by regional planning area and by watershed. This would align well with watershed and regional plans to inform decision making around policy and management.

36 For the purposes of this report "stewardship ethic" refers to principles of conserving ecological value and function for present and future generations.

Several approaches for knowledge sharing and development could be used to improve riparian management and conservation in Alberta:

- Inform Albertans about riparian lands, why they are important and how activities within and surrounding them can affect our lives both positively and negatively. Fully inform Albertans of risks, costs, values and benefits associated with both protecting and losing riparian lands.
- Educate decision makers regarding the value of water, riparian lands, conservation and stewardship, and compare these values to the costs of failure to conserve.
- Improve awareness and respect for connectivity between riparian lands and associated ecosystems.
- Engage landowners to gain buy-in and interest for programs and projects that improve riparian conservation and management.
- Improve awareness of ownership of beds and shores and what is meant by the terms "water body", "in-stream flow needs" and "healthy aquatic ecosystems."
- Improve understanding of environmental reserves and their roles.
- Raise awareness that groundwater and surface water are one interconnected water resource.
- Provide more training for assessment of riparian health and extent.
- Provide reliable information on who is accountable and responsible for riparian land conservation and management.
- Improve awareness of traditional knowledge related to riparian lands and their management.
- Improve access to comprehensive groundwater data.
- Improve documentation of extent and severity of cumulative land use disturbances.
- Improve public access to cumulative effects data.
- Increase knowledge and understanding of compatible and incompatible land uses.
- Increase knowledge and understanding of ecological goods and services.
- Increase knowledge and understanding of restoration versus reclamation, what constitutes effective repair and what does not, and what damages cannot be repaired at all.

Several organizations, including ARD, Cows and Fish (Achievement 7) and the Rangeland Resource Management Group in ESRD are already building capacity by doing some of this work. Where possible, Recommendation 9 should build on work already underway to avoid duplication of effort.

Achievement 7: Education and awareness are about sensitizing people to an issue or topic, as well as increasing their knowledge and understanding. In parts of Alberta, the understanding of the value, importance and role of riparian areas has changed, due largely to the work by Cows and Fish. What began as a concerted effort between the beef cattle sector, cold-water fish conservation and numerous agricultural and conservation departments and organizations, has led to a substantial change in how most agencies, organizations, and many livestock producers approach riparian areas and their management.

Cows and Fish is a voluntary stewardship organization focused on improving appreciation and awareness of riparian areas and their management. Cows and Fish was established in 1992, long before the term riparian was known by most people or organizations, but they have tirelessly delivered education and outreach, each year reaching 5,000 or more people as part of 150 – 250 presentations, workshops and hands-on field days. They have been instrumental in promoting locally-led, community driven stewardship efforts focused on riparian health, encouraging other partners to bring their expertise and resources together to work collaboratively. As part of this work, they helped develop ground-based riparian health assessment and inventory methods, methods now widely used across Alberta and many other provinces. They have assessed over 2,200 riparian sites in Alberta, offering landowners, land managers and communities benchmark data as well as identifying areas for improvement.

For more information, see: www.cowsandfish.org

The success of improved riparian land management depends on revised policies, regulation and programs, as well as on improved stewardship of both private and public lands. Achievement 8 describes work done by Hinton Wood Products and demonstrates good stewardship by industry. A focus on the stewardship ethic in addition to recognition of incentives is a good first step in developing long-term sustainable actions to improve riparian land management.

Achievement 8: Hinton Wood Products has installed three operational trials of alternatives to clear-cutting to better conserve riparian floodplain forest dominated by white spruce. The trials are single-tree/small clump selection, strip shelterwood and group shelterwood. All maintain permanent forest cover and approximate complex natural disturbance processes associated with floodplain forests. The oldest trial was harvested in 1990. Hinton Wood Products is incorporating the promising results of the trials into a new ecosystem-based riparian management strategy being developed for their one-million-hectare Forest Management Area in west-central Alberta.

For more information, see: www.westfraser.com/company/locations/hinton-wood-products.

7.0 Consistent Approach to Mapping and Riparian Health Assessment

Comprehensive and defensible data on the extent and health of riparian lands, reflecting the ecological differences across the province will better inform land use planning and adaptive management. One of the challenges in assessing riparian extent and health using existing data sets is that they lack transferability and uniformity because they were created for different purposes and applications.

This section provides context and describes some of the needs and challenges around riparian assessment in Alberta.

7.1 Methods to Delineate the Extent of Riparian Lands

According to the Riparian Land Conservation and Management Phase 1 Final Report, the definition for delineating riparian lands is "*to define the area adjoining water bodies where land and water are directly interacting or influencing each other above the ground and below the surface.*"[37] The ability to properly delineate this area is challenging and varied due to the lack of consistent definition of what comprises riparian lands, which led to the Council developing a consistent ecological definition.

Challenges in delineating the extent of riparian lands include the lack of a standardized mapping method to define riparian extent, lack of expertise in what constitutes riparian lands, and lack of a consistent definition of what is riparian land. The diversity of riparian lands further complicates efforts to measure extent, as it is challenging to create tools that can be used across diverse regions with different physical characteristics. Delineation now occurs at the site level and not at the watershed scale, where site specific mapping cannot be done with existing spatial analysis tools. New methods are being tested that allow high-level GIS mapping of riparian lands, and these may provide options for improved delineation. Consistent standards and methods for collecting information on the extent of riparian lands are needed for all sectors across the province. The resulting inventory would enhance understanding of the extent of riparian lands and aid in developing effective management strategies.

37 *Riparian Land Conservation and Management Project: Phase One Final Report*. 2007. Prepared by Alberta Environment for Riparian Land Conservation and Management Project Members. Page 4.

Recommendation 10: Methodologies to Delineate and Map

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within five years in partnership with stakeholders, lead the identification and adoption of accepted methodologies to delineate and map the extent of riparian lands in Alberta at multiple scales, and then map riparian lands as a coordinated ongoing activity.

The review, development and definition of accepted riparian delineation methods can be used at the provincial and regional scales. Delineation and mapping first involve resolving and standardizing an assessment methodology; this work should proceed quickly and be completed within one year. Mapping at the provincial scale may take a number of years. The methodologies may already be in use within GoA or other agencies but would need to be formally identified and adopted. Part of this task would involve cataloguing existing methodologies, their use and outcomes. The work to map Alberta's riparian lands is expected to be an ongoing task, and some work is already underway (e.g., Alberta Wetlands Inventory, Wet Areas Mapping, Grassland Vegetation Inventory). Existing methodologies and mapping information, where appropriate and valid, should be considered and incorporated to address Recommendation 10. By reviewing and applying available geomatic databases and graphic outputs, provincial mapping could be completed as a desktop exercise, depending on scale and purpose. However, mapping completed by GIS methods and technologies will require validation by field work (i.e., ground-truthing).

This information is to be used to inform and help achieve provincial level outcomes and to provide more effective support for provincial and regional outcomes as part of the provincial management frameworks and ongoing GoA business needs. In addition, information transfer and access to the data will be an important component for the success of the outcomes. Ensuring that the information is usable and accessible to planners and implementers at all scales will be essential. It is also important that the information remain as current as possible. The City of Calgary's map project described in Achievement 9 provides some insight into the application of this tool to support riparian land management. Achievement 10 illustrates use of mapping to protect sensitive areas in Red Deer County.

Achievement 9: The City of Calgary (the City) has developed strategies that promote the conservation and environmental protection of key resources, including riparian areas. To date, various policies, initiatives, and projects to preserve, enhance, or rehabilitate riparian areas have been implemented by the City. However, additional mapping, planning and information tools are required to support riparian area management and ongoing policy development. As a result, the City retained O2 Planning + Design Inc. in 2011 to undertake a riparian mapping project. The geographic scope of the project is focused primarily on riparian areas adjacent to major rivers and streams, including the Bow River, Elbow River, Nose Creek and West Nose Creek. The project included mapping and modelling of riparian area location and extent. A variable-width spatial model was constructed to provide the best estimate of riparian area extent. Multiple City sources were incorporated into a GIS database that produced maps showing location and function of riparian areas, riparian restoration projects, infrastructure located in riparian areas, and relevant policy and regulatory elements. The ultimate goal of the project is to develop maps that will incorporate additional data based on stakeholder consultations representing riparian protection opportunities.

For more information, see: www.calgary.ca

Achievement 10: The Red Deer County Environmentally Significant Areas Inventory identifies the location and extent of environmentally significant areas within the county. This mapping supports protection of riparian lands, floodplains, alluvial aquifers and hyporheic zones.

Source: Red Deer County Municipal Development Plan and Environmentally Significant Areas Inventory. Online at: https://reddeercounty.civicweb.net/Documents/DocumentList.aspx?ID=10676

Understanding the current (and potentially historic) extent of riparian lands will help to: determine the amount of riparian land in the province, identify outcomes for the conservation and management of these areas, and direct and guide management and use of these lands by better understanding their extent, location and context within other landscape components.

Urgency for this work is demonstrated by the increasing competing uses and demands on riparian lands; it is the intensity of these uses that make riparian lands vulnerable. Land use decisions with long-term and far reaching impacts should be made with an understanding of the broader consequences and cumulative impacts of competing pressures on these sensitive lands. Examples of mapping riparian lands are shown in Figure 7.

Figure 7: Examples of riparian land mapping

Riparian Map Upper Wildhay 100,000ha

Photo Credit: Hinton Wood Products

Riparian Map Orthophoto

Photo Credit: Hinton Wood Products

7.2 Methods for Riparian Health Assessment

Healthy riparian lands can help deliver a full range of ecological goods and services — clean water, flood protection, pollutant filtering, biodiversity, and other elements. Because riparian functions can be impaired due to natural and human causes, recognizing the dynamic nature of these areas in planning, management and monitoring is important. For example, after a flood event riparian lands may be impaired. However, floods are essential to maintain long-term riparian function because, among other things, they scour channels, clean sediments from fish spawning gravel, and add coarse woody debris to the riparian system. Assessment efforts also need to incorporate or account for land use variability, and plan for overall, long-term health and function.

The Fiera report defined riparian health as "*the ability of an ecosystem to perform a number of key ecological functions.*" There are many ways to evaluate and define what we mean by riparian health, although a basic method, championed by Cows and Fish, is widely used and accepted in Alberta.[38]

Riparian health assessments define baseline conditions or outline areas where health has changed, including where it has been degraded and should be restored. Riparian health assessment data has been collected mostly at the local watershed and site level and may not always be publicly available. Some sectors require provincial scale information to inform decision-making efforts, and sampling at finer scales may not provide the type of information required unless it is structured to be representative. A lack of systematic data gathering for riparian health information has limited our ability to quantify riparian health at some scales. In addition, lack of comprehensive data limits our ability to understand connectivity of riparian lands. Although the health assessment methods themselves would not necessarily require

38 Cows and Fish. 2013. Online at: www.cowsandfish.org/riparian/health.html. Accessed March 2013.

assessment of connectivity, understanding overall connectivity of riparian lands would better fit within an ecosystem and cumulative impact approach to management.

Unless sampling methods address these gaps and needs it is difficult to evaluate the status of riparian health at larger scales to identify trends or connections. Improved provincial level standards (or application of standardized methods) for measuring and assessing riparian health are needed and riparian health evaluations must recognize the diverse needs at both large and small scales.

Recommendation 11: Riparian Health and Function Assessment

The Alberta Water Council recommends that Alberta Environment and Sustainable Resource Development within one year and in partnership with stakeholders, lead the review, adoption and ongoing implementation of a provincial riparian health and function assessment framework that includes well accepted and currently practiced methods that are compatible at multiple scales.

Health assessments will help inform conservation and management of local sites and be used to address management and conservation at larger scales; this includes informing planning and CEMS approaches to allow for adaptive management and continuous improvement. In addition, riparian health assessment identifies areas that have lost function, and this tool can be used to educate and inform decision makers about the consequences of past, present and future management and land use decisions. Understanding current riparian health can and should be used to educate and motivate landowners, land users, managers and stakeholders to maintain or improve riparian lands and promote the functions that provide a diversity of ecological goods and services. Understanding what functions are lost or impaired and where health has been degraded can guide implementation of better management strategies for land and water use.

The recommended assessment framework should be adaptive and should consider the geographic and hydrological differences across the province to give managers and planners the appropriate data to evaluate and drive their management plans. The framework is needed to outline how to approach implementation. This should include standards and methods for collecting information for both field-based and remotely sensed assessments (where and if valid). Standardized information should ensure comparability of data (so that data at one scale can be related to data at another scale), show where those relationships are meaningful, and relate to the health and function of riparian lands. This will in turn create reliable and consistent information that can be used to monitor and manage riparian lands across the province.

A provincial assessment framework that utilizes and builds on current riparian health assessment data in Alberta is appropriate across ministries that are responsible for riparian lands management. The provincial assessment framework should align with existing initiatives such as Alberta's CEMS, and should be developed with the input of stakeholders to maximize value, effectiveness, coordination and collaboration.

It is difficult to quantify and assess riparian health at some scales, particularly those not based on local site (ground level) information. At some scales, it may be difficult to set criteria or objectives to measure riparian health. Regardless of scale, it is essential to recognize that assessment of health (function) should be the focus of the parameters or characteristics considered, and that a suite of characteristics is required to give a reasonable picture of the health or condition of the riparian land. In addition, when evaluating riparian health at multiple scales, relationships between characteristics or features examined at these scales should be established to provide meaningful nested assessments. Examining health at multiple scales, using an established set of nested and compatible criteria, will result in better understanding of the health of riparian areas at local, watershed and provincial scales, and will yield more meaningful and simplified reporting. Providing opportunities for shared and consistent reporting will be beneficial as well.

Health assessments can be done at multiple scales, from very broad remote sensing of regions to on-the-ground local site health assessment. Assessments done at a high level scale, such as remote sensing, may be best suited for broad scale and longer-term planning. Assessments at smaller scales are suitable for determining actual riparian health conditions at specific sites, which can then be used to encourage and guide management change, or to support and learn from existing healthy riparian land management. Health assessments done at a finer scale can be amalgamated into coarser scales, summarizing local watershed, basin, regional and provincial data, to complement and confirm work done at other scales. Work done at finer scales will likely capture more detailed and specific information that cannot be readily assessed at larger scales. Some sectors may also prioritize which assessments should be done and when, such as those based on sensitivity, intensity of use, potential for improvement or recovery, and value (ecological, social or economic). At a site level, as well as at larger scales, riparian lands are influenced by natural disturbances and are naturally dynamic ecosystems; this dynamic nature should be acknowledged in developing riparian health assessment outcomes.

A science-based approach to obtaining statistically meaningful, compatible data for comparison over time, as well as a framework for ensuring consistency across regions may enable us to better understand and improve riparian health and function. However, there is a need to recognize the wealth of existing information on riparian health, including information collected on private land or as part of proprietary situations. This data collection will presumably continue and will contribute to our understanding and management of riparian lands in Alberta. Recognizing the value of such data, as well as the management and educational initiatives that are often associated with gathering riparian health information will add immediate and long-term value and increase the combined impact of both activities. Valuable information often results from voluntary stewardship efforts that should be further encouraged.

The status of riparian health in the province is based on available data. Lands that are healthy, but show signs of problems, could become unhealthy if improper management or more intensive land or water uses occur. Conversely, riparian lands that are unhealthy or healthy with problems, frequently will improve with changes in management or land and water use. Natural disturbance may cause the loss of additional functions in some time scales, and needs to be factored into management decisions. Natural disturbances also offer the opportunity for recovery and can enhance diversity of function and ecosystem complexity; thus, integrated, holistic and cumulative effects management needs to plan or account for natural disturbances and any additional impacts due to human disturbance. Improving the ecological function of riparian lands will ensure the long-term provision of ecological goods and services so they are available for Albertans in the future.

The Council is of the view that the Alberta Riparian Habitat Management Society (Cows and Fish) — Riparian Health Assessment and Inventory is the preferred tool among practitioners for site-specific examination for riparian land health assessments, as it is scientifically accepted by many agencies and used widely throughout North America.

Other considerations for implementing riparian health assessments include:

- Identify a core set of criteria for assessing riparian health, with modifications for sector specific needs and multiple scales, while recognizing that the intent of the methods is to determine overall health and function, not individual values or functions. If modifications are made to accommodate for multiple scales, criteria need to be aligned so they overlap and are complementary.
- Establish baseline status at various scales (such as provincial, watershed and sub-watershed scale for lakes, wetlands, large rivers, streams and small rivers), which should help prioritize efforts, motivate change and monitor the effectiveness of initiatives. This might include a combination of systematic sampling to fill in knowledge gaps. Targeted or directed sampling such as at local scales could help monitor project effectiveness, identify management changes required, better understand management in general, or identify land uses that would result in healthy riparian areas.
- Implement substantial scientific monitoring and assessment programs to underpin effective water and riparian land management frameworks.

Any methodology developed should be tested to align with existing methods that can be used at different scales. This would help to identify the inter-relationships of the different methods and their purpose relative to the others. Wherever possible, data from these assessments should be available to the public so that it helps to inform land use planning at the various scales, supports and motivates improved management, and acknowledges success of efforts made. Data required for planning will differ from data required for individual site restoration or management, and publicly available data should recognize these different intended uses.

8.0 Best or Beneficial Riparian Management Practices

The management of riparian lands should be based on the best available science and closely tied to supporting ecological function. Best or beneficial management depends on recognizing and appreciating the ecological goods and services provided by riparian lands and on understanding the consequences of the loss of those goods and services when function is impaired as a result of management or land use decisions. BMPs for riparian lands need to be first identified for the various sectors and land and water uses; such BMPs should be evaluated for their ability to maintain or improve the ecological functions of riparian lands.

Recommendation 12: Best or Beneficial Management Practices

The Alberta Water Council recommends that the Government of Alberta within two years and in partnership with stakeholders identify, adopt and support ongoing implementation of best or beneficial riparian management practices and approaches that align with nested outcomes.

The development and identification of riparian BMPs should be related to land use activities. The first step would be to understand the existing riparian BMPs from various sources. One strategy would be to assess and evaluate the effectiveness of current BMPs towards achieving desired outcomes and how they contribute to the health and function of riparian lands in general. Long-term viability, resiliency, adaptability and practicality of BMPs should also be considered, if they are to contribute to improved riparian health over the long-term.

A GoA approach should ensure cross-ministry participation that builds on existing riparian work such as that of the former Sustainable Resource Development Riparian Management Committee. In addition, some GoA ministries are already working with industry and producer groups (see Achievements 11 and 12). For example, ARD does a biennial survey as part of its business measures on the adoption of environmental stewardship practices. Partnerships could be used effectively to further BMPs in the province; an example is the Beaverlodge Riparian Conservation Project led by the Alberta Conservation Association with partners from GoA, counties, industry and a watershed group (see Achievement 13).

Another example is fish movement through a culvert on Prairie Creek, driven by industry and described in Achievement 14. As well the Alberta Beef Producers work to conserve and enhance riparian lands (Achievement 15).

Achievement 11: Some of the GoA initiatives that support riparian land conservation and management:

- Riparian Health Assessments — Completion of 2,097 Riparian Health assessments for Lentic, Lotic and Large Rivers on Public Lands throughout Alberta.
- Enhanced Approvals Process (EAP) — Setbacks are built into the EAP which are based on wetland classification. In addition to standard setbacks, there are setbacks associated with the presence of amphibians within the associated wetlands. The more stringent setback always applies.
- ESRD Water Course crossing protocol — Based on and modified from the Foothills Stream Crossing Program. A crossing inspection protocol assessing fish passage and sedimentation risk and used by ESRD for all activities.
- ESRD-Stepping Back from the Water: A Beneficial Management Guide for New Development Near Water Bodies in Alberta's Settled Region — A handbook that provides a scientifically defensible method for determining setback distances for new development adjacent to water bodies. It also summarizes existing policies and guidelines for reducing risks and impacts associated with development near water bodies, as well as suggesting ways for maintaining healthy riparian areas.
- ARD and Federal Government Program, Growing Forward 1 and 2 — Funding for best management practices for riparian health.
- ARD funding to Cows and Fish and Municipalities to support education and extension for improving riparian health and riparian health assessments.

For more information, see: http://alberta.ca.

Achievement 12: ARD and partners carried out a six-year (2006 to 2012) scientific evaluation of BMPs in two watersheds: Whelp Creek near Lacombe in central Alberta, and Indianfarm Creek near Pincher Creek in southern Alberta. In addition, there were two field sites in the Lower Little Bow River and Battersea Drain watersheds east of Picture Butte in southern Alberta. The selected sites were used to evaluate before and after BMP implementation through the monitoring of surface water quality and quantity, soil nutrient status, riparian health, and rangeland health. The results of this study will provide science-based information on selected BMPs. The field work has been completed and the final report is being prepared and will be available in early 2014.

Source: Nutrient Beneficial Management Practices Evaluation Project, 2007 – 2012. Online at: www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/epw11955. Accessed March 2013.

Achievement 13: The Beaverlodge Riparian Conservation project is led by Alberta Conservation Association and involves partners from Alberta Agriculture and Rural Development, ConocoPhillips, County of Grande Prairie, Penn West Energy, Royal Bank of Canada and West County Watershed Group. It focuses on riparian habitat degradation along the Beaverlodge River and two of its tributaries, Beavertail and Steeprock creeks. A variety of projects including streambank fencing, alternative livestock watering systems and tree planting have been completed. The initiative has resulted in incremental changes within the watershed with regard to riparian conservation efforts and influencing how landowners make land use decisions.

Source: Beaverlodge Riparian Conservation (2012). Online at: www.ab-conservation.com/go/default/index.cfm/programs/program-reports/2011-2012/fish/beaverlodge-riparian-conservation/. Accessed March 2013.

Achievement 14: A large culvert on Prairie Creek under the Ram River Gas Plant's access road was built in the 1960s. The creek has scoured out the area downstream of the culvert, creating a drop from the end of the culvert into the creek. Husky and ESRD were concerned that the drop would prevent fish from migrating upstream.

Working with environmental consultants (Tera Environmental), ESRD and the Federal Department of Fisheries & Oceans, Husky's plan was to capture fish downstream of the culvert, radio tag them and then monitor their use of the culvert. The crew caught, tagged and released 109 fish, mostly brook trout, but also brown trout, burbot and mountain whitefish. The crew then set up four monitoring stations around the culvert (upstream, at the entrance and exit and downstream) to monitor fish movement between late August and late December 2012. A project like this has not been completed before on such a large culvert.

During the monitoring, the tagged fish registered close to 3,000 times, but most significantly, monitoring showed 12 fish passing through the culvert a total of 21 times. The report concluded that the culvert was not a barrier to adult brook and brown trout during the fall spawning and winter migration seasons. The regulatory agencies supported the study's conclusions and agreed there is no need for additional remediation at this time. However, the creek will eventually need remediation again; when that need arises, a fishway could be designed to allow spawning and migrating fish access to the culvert.

Source: Husky Energy. 2013.

Achievement 15: Alberta Beef Producers (ABP) recognized the importance of environmental stewardship and was the first agricultural commodity group to present an award for it in Alberta. Since 1991, ABP has chosen a deserving beef producer as the annual recipient of the Environmental Stewardship Award. With the large area of Alberta which is well suited for beef production and the desire of beef producers to preserve and enhance these lands, the award was a great way to showcase good performance. A large number of past winners and nominees use several techniques to help protect riparian lands. These may include off stream watering systems, rotational grazing, tree plantings, hard crossings, stream bank restoration and exclusion fencing to name a few. The desire of producers to work with nature to enhance these riparian lands, provide clean water and healthy pastures not only benefits the cattle, but the producers and the rest of Alberta. ABP and beef producers in this province are dedicated to sustaining the pristine environment in which they live and work for future generations.
For more information, see: www.albertabeef.org.

Government and stakeholders have numerous opportunities to further support riparian BMPs by working with all groups or agencies to:

- Promote education as part of conservation and watershed stewardship efforts and land use application procedures.
- Incorporate BMPs into the earliest stages of land use planning, as damage prevention is more cost-effective and timely than remediation.
- Strongly encourage industries to adopt BMPs and effective implementation tools.
- Reward behavioral improvement and technological innovation.
- Respect and support citizen conservation initiatives through programs, funding, in-kind and technical support, and policy improvement.
- Identify and support human uses of riparian lands that integrate social and economic needs with respect for healthy riparian lands.
- Improve support for WPAC initiatives concerning riparian conservation and management BMPs.

The GoA should support BMPs by working with all groups and agencies and by promoting education and understanding of riparian functions and values as part of land and water use activities. All levels of government should promote BMPs as a positive way of doing business, and ensure that implementation of BMPs will be an integral component of any land or water use project.

Achievement 16 illustrates an example of BMPs in British Columbia. Achievement 17 from the irrigation sector highlights how water use and flow can be managed to benefit cottonwoods, an important riparian species. Achievement 18 notes the work done by a volunteer watershed stewardship group emphasizing the importance and role of local conservation and stewardship groups. Achievement 19 explains the use of log jams in creating fish habitat.

Achievement 16: An aggregate operation can lower the groundwater table if excavation occurs at a depth below the average high table. In British Columbia, this situation rarely occurs because most aggregate operating permits prohibit excavation within one metre of the high groundwater table. The Aggregate Operators Best Management Practices Handbook for British Columbia provides technical information, guidance and best management practice options to sand and gravel pit and rock quarry operators for many aspects of planning, operating and reclaiming aggregate operations in that province. It states that aggregate operations should conduct their business in such a manner as to not leave permanent damages or limit post-extraction land uses. Sites where no development will occur should be returned to their natural state with an equal or enhanced ability to grow trees or other forms of vegetation.

Source: Aggregate Operators Best Management Practices Handbook for British Columbia. Ministry of Energy, Mines and Natural Gas Online at: www.em.gov.bc.ca/Mining/Aggregate/BMP/Pages/default.aspx. Accessed December 2012.

Achievement 17: Cottonwoods (*Populus* sp) are a keystone species in riparian areas particularly along southern Alberta rivers. Spring floods which get over the banks provide an opportunity for successful recruitment. Damming sometimes eliminates these time-sensitive events but work to return natural flood patterns that allow seedling recruitment was made possible in 2010 and 2011 with a planned controlled increase in the release of water from the St. Mary, Waterton and Oldman Reservoirs. A controlled release that simulates a flood event and then slowed water recession rates (less than 4cm per day) enabled successful seedling establishment. The plan was implemented in collaboration with ESRD, which controls flows from major water structures; University of Lethbridge which provided the science and direction as to timing and amount of water released; ARD, which played an advisory role and encouraged wide participation; and the irrigation districts on the Oldman River system that accepted the increased risk to their operations and managed their storage and diversions to make this possible.

Source: Alberta Irrigation Products Association. Online at: www.aipa.ca/files/39831323385799930am-RoodAIPA2011ImplementingEnvironmentalFlowsfinal.pdf

Achievement 18: Cochrane Branches and Banks is a volunteer watershed stewardship group that works on riparian land restoration and management. Over 30,000 trees have been planted within the town: the Big Hill Creek, Jumping Pound Creek and the Bow River, as well as in Caroline Goodfrey Park and the Robinson wetland. The group annually raises funds for trees and volunteers plant them along eroded stream and riverbanks, while others clean up garbage around the water bodies, remove invasive weeds, and protect poplars from beavers.

For more information, see: www.cochrane-environment.org/branches-and-banks.

Achievement 19: Log jams are natural features on larger waterways that maintain key ecological functions, including creation of fish habitat. They also divert water flows and cause channel migration that can threaten roads and stream crossings. In summer 2011 a flood changed the channel of the Gregg River and the new flow eroded boulder rip-rap protecting a road abutment to a bridge owned by Hinton Wood Products (HWP).

After the water levels receded, HWP needed a more permanent repair. The traditional fix is to install more rip-rap or divert the river channel back to its original location. These alternatives are costly to install and maintain, and they have long-term effects on fish habitat.

HWP worked with a consultant, ESRD, and Fisheries and Oceans Canada to develop an innovative solution. Large white spruce and balsam poplar trees growing in nearby riparian areas were tipped over with an excavator and the whole trees were moved to the project site. Workers removed dirt from the rootwads and clean trees were placed to overlap the channel and weave a log jam that could withstand future floods.

Fish response to the new log jam habitat was amazingly quick. Migrating mountain whitefish appeared in the pool under the first rootwad within 10 minutes and stayed there for the rest of the installation. Working with direct placement of clean trees onto clean gravel and cobbles totally eliminated sediment issues.

The log jam functioned well in a summer 2012 flood and accumulated more logs as the river moved them downstream. This wood recruitment will naturally replace the logs over time, maintaining the logjam and meeting the project objectives. In addition to the innovation to lessen installation impacts and create fish habitat, the total cost of the project was considerably less than alternatives.

For more information, see: www.westfraser.com/company/locations/hinton-wood-products.

9.0 Monitoring and Evaluation

An adaptive management approach should be used to ensure that the provincial level outcomes are being achieved and can integrate into existing planning frameworks that use this same approach. Evaluation and monitoring mechanisms should be developed to review progress, assess gaps and barriers to implementation and develop new management solutions.

A regular evaluation of progress toward achieving provincial level outcomes by stakeholders would be beneficial. This allows for improvements and adaptation of existing management strategies to incorporate new realities. Sufficient data will be required for the evaluation to be purposeful and effective; results of the evaluation must be implemented to provide the information needed to make better policy and program decisions. Knowledge and social science research will be important in monitoring and influencing future efforts. Riparian extent and health information will be an integral part of monitoring the effectiveness of riparian conservation and management efforts, and should be used to inform and guide planning and decision making at the various scales.

Recommendation 13: Reporting on Progress

The Alberta Water Council recommends that The Government of Alberta within five years and in partnership with stakeholders, produce a publicly available "Alberta State of Riparian Lands and their Conservation and Management" progress report, and update and re-publish every five years thereafter.

This progress report would review the current state of knowledge of riparian land extent and health, management, land use impacts and improvements using monitoring data. It should include results of evaluation of the recommendations in this report as well as any results from regular evaluation of scientific, policy, economic and social management related to riparian management.

10.0 Conclusions

Riparian lands are critically important pieces of our landscape, contributing to many aspects of ecosystem health and function, to our livelihoods and culture, and to recreational opportunities. The social and economic values of riparian lands are considerable, in addition to the immeasurable value of ecological functions we receive from healthy riparian lands. For these reasons, we must manage and conserve these lands to maintain their values and services. Riparian management is also a critical component of sound watershed management.

As the cumulative effects of riparian loss and degradation build across Alberta, it is urgent that we take action to conserve and more sustainably manage riparian lands now. The sustainability of Alberta's riparian lands and the durability of the *Water for Life* strategy will depend on adherence to principles of good governance, including effective public and stakeholder involvement, transparency and accountability in decision making, systematic performance monitoring, and strong enforcement. As part of an adaptive management approach, regular evaluation of the success of scientific, policy, economic, and social actions will facilitate continual improvement in the management of riparian lands.

The complexity and diversity of issues and challenges facing riparian lands requires that all sectors be engaged and committed to riparian conservation and management. Strong provincial direction and leadership are necessary to properly integrate a riparian land conservation and management approach into existing planning frameworks. No single agency or sector can manage riparian lands alone. Fortunately, opportunities for extensive collaboration exist in Alberta through interested and motivated stakeholders, organizations and individuals, as well as through many initiatives, including the *Water for Life* strategy. Seizing these opportunities to engage governments, industry sectors, watershed partners, landowners and others will speed the development of an effective riparian land conservation and management framework for the province. This improved connectivity of policy and planning at multiple scales, along with ecosystem and cumulative effects approaches of monitoring and assessing progress, will lead to better decisions in the management of riparian lands and, ultimately, improved aquatic ecosystem health in Alberta.

Acronyms and Abbreviations

AH	Alberta Health
ARD	Alberta Agriculture and Rural Development
AWC	Alberta Water Council
BMP	Best or Beneficial Management Practice
CEMS	Cumulative Effects Management System
ERCB	Energy Resources Conservation Board
ESRD	Alberta Environment and Sustainable Resource Development
GoA	Government of Alberta
MGA	Municipal Government Act
NGO	Non-Government Organization
NRCB	Natural Resources Conservation Board
TDR	Transferable Development Rights
WPAC	Watershed Planning and Advisory Council

Glossary

Alluvial Aquifers: For the purposes of this report, alluvial aquifers are defined as areas where groundwater is under the direct influence of surface water.

Anthropogenic Footprint: Anthropogenic means caused or produced by human activities.[39]

Aquatic Ecosystems: Those ecosystems occurring in or on water or its beds and shores, including biological organisms and communities. This includes the physical, chemical and biological characteristics of rivers, lakes and wetlands and the plants and animals associated with them.[40]

Beneficial Management Practices: Cost effective, practical methods that minimize environmental impacts.[41]

Best Management Practices: Those practices determined to be the most efficient, practical, and cost-effective measures identified to guide a particular activity or to address a particular problem.

Biochemical Process: Chemical processes occurring in living organisms.

Biodiversity: Refers to the variety of all animals, plants and microorganisms interacting in all types of environments found on the planet.[42]

Boreal: The boreal zone is the broad circumpolar vegetation zone of the high northern latitudes. Although mainly covered with trees, the boreal zone is more than just forest. It contains lakes, rivers and wetlands, as well as naturally treeless terrain such as alpine areas, heathlands in regions where the climate is influenced by the ocean, and grasslands in drier areas.[43]

39 Environment Canada. Online at: www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=B710AE51-1. Accessed September 2013.

40 Alberta Water Council. 2009. *Provincial Ecological Criteria for Healthy Aquatic Ecosystems* report Available at awchome.ca.

41 Alberta Agriculture and Rural Development. 2011. Online at www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/aesa5826. Accessed January 2013.

42 Alberta Environment and Sustainable Resource Development. 2013. Online at http://environment.alberta.ca/02221.html. Accessed March 2013.

43 Natural Resources Canada. Online at: http://cfs.nrcan.gc.ca/pages/255. Accessed September 2013.

Connectivity (ecological): Connections that allow the transfer of energy and materials.[44]

Conservation Offsets: Measurable compensatory actions that address the unavoidable ecological losses arising from development. Offsets are the third step in the mitigation hierarchy to address any residual development impacts, following avoidance and onsite mitigation.

Cumulative Effects: Changes caused by an action in combination with other past, present and future actions.

Cumulative Effects Management: Within the Cumulative Effects Management System, people and organizations use various tools and resources to work together to comprehensively manage activities that affect the environment, economy and society. It is an adaptive management system that follows a "plan-do-check-act" approach to setting, meeting and evaluating outcomes.

Delineation of Riparian Lands: To define the area adjoining water bodies where land and water are directly influencing each other above the ground and below the surface.[45]

Desired Outcomes: Articulation of the goals, objectives and targets.

Floodplain: An area that has been or may be covered by flood water.

Geomorphology: The study of the physical features of the surface of the earth and their relation to its geological structures.

Hydrology: The scientific study of the properties, distribution and effects of water as a liquid, solid, or gas on the earth's surface, in the soil and underlying rocks and the atmosphere.

Hyporheic Zone: For the purposes of this report, a hyporheic zone is an area where surface water and ground water mix.

Incentive: An incentive is something that motivates an individual to perform an action.

Jurisdictional Fragmentation: Confusion over roles and responsibilities across levels of government and between government departments that creates uncertainty and inconsistent decision making for managing riparian lands.[46]

44 Clare, S. and Sass, G. 2012. Riparian lands in Alberta: Current state, conservation tools, and management approaches. Report prepared for Riparian Land Conservation & Management Team, Alberta Water Council, Edmonton, Alberta. Fiera Biological Consulting Ltd. Report #1163.

45 *Riparian Land Conservation and Management Project: Phase One Final Report*. 2007. Prepared by Alberta Environment for Riparian Land Conservation and Management Project Members. Page 4.

46 Clare, S. and Sass, G. 2012. Riparian lands in Alberta: Current state, conservation tools, and management approaches. Report prepared for Riparian Land Conservation & Management Team, Alberta Water Council, Edmonton, Alberta. Fiera Biological Consulting Ltd. Report #1163.

Riparian Health: Considers the condition and related functions of riparian ecosystems; is the ability of an ecosystem to perform a number of key ecological functions.[47]

Riparian Health Inventories: An in-depth measurement of riparian health; a detailed inventory that thoroughly examines vegetation, soil parameters, and hydrology of the area. [48]

Riparian Lands: Riparian lands are transitional areas between upland and aquatic ecosystems. They have variable width and extent above and below ground and perform various functions. These lands are influenced by and exert an influence on associated water bodies, including alluvial aquifers and floodplains. Riparian lands usually have soil, biological, and other physical characteristics that reflect the influence of water and hydrological processes.

Solute: The substance that is dissolved in a solution.

Stakeholder: For the purposes of this report, "stakeholder" refers to any party or entity that has a stake or interest in the enterprise, project or process under discussion. A stakeholder may be an arm of government, a person, group or organization, a business, industry or sector, and stakeholders will be different for different issues.

Stewardship Ethic: Refers to principles of conserving ecological value and function for present and future generations.

Sustainability: Meets the needs of the present without compromising the ability of future generations to meet their own needs.

Topography: The arrangement of the natural and artificial physical features of an area.

Upland: For the purposes of this report, "upland" is considered to be the land that is at a higher elevation than the alluvial plain, stream terrace(s), or similar area associated with a water body.

Water Body: A water body is any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands and aquifers (generally excludes irrigation works).[49]

Wetland: Land saturated with water long enough to support formation of soils, vegetation and biological processes that are adapted to a wet environment.

47 Clare, S. and Sass, G. 2012. Riparian lands in Alberta: Current state, conservation tools, and management approaches. Report prepared for Riparian Land Conservation & Management Team, Alberta Water Council, Edmonton, Alberta. Fiera Biological Consulting Ltd. Report #1163.

48 Cows and Fish. 2013. Online at: www.cowsandfish.org/riparian/health.html. Accessed March 2013.

49 Government of Alberta. *Alberta Water Act.* RSA 2000, Chapter W-3, section 1(1)(ggg).

Appendix A: Team Members and Acknowledgements

Current Members	
Norine Ambrose	Alberta Riparian Habitat Management Society — Cows and Fish
Rick Bonar	Alberta Forest Products Association
Greg Bowie	Alberta Beef Producers
Jim Fujikawa	Natural Resources Conservation Board
Al Kemmere	Mountain View County
Tony Machacek	Taber Irrigation District
Sharon McKinnon	Crop Sector Working Group
Donna Mendelsohn	Alberta Environmental Network
Julienne Morissette	Ducks Unlimited Canada
Stephanie Neufeld	Alberta Lake Management Society
Norma Posada	City of Calgary
Karen Raven	Alberta Agriculture and Rural Development
Judy Stewart	Bow River Basin Council
Martin Shields	City of Brooks
Alternates and Past Members	
Bill Franz	Agriculture and Agri-Food Canada
Keith Murray	Alberta Forest Products Association
Rick Istead	Crop Sector Working Group
Tracy Young	Encana

AWC Project Managers: Alesha Hill, Meredith Walker

We acknowledge the above individuals for their time and commitment to this project. We also thank their member organizations for supporting their participation. Additionally, several sponsors provided funding to engage a consultant. Contributions were provided by:

- Alberta Agriculture and Rural Development
- Alberta Beef Producers
- Alberta Environment and Sustainable Resource Development
- Alberta Irrigation Projects Association
- Athabasca Watershed Council
- Beaver River Watershed Alliance
- Canadian Association of Petroleum Producers
- City of Calgary
- Crop Sector Working Group
- Ducks Unlimited Canada
- EPCOR
- Intensive Livestock Working Group
- Oldman Watershed Council

Riparian Land Conservation and Management Project Team Terms of Reference

Approved by the Alberta Water Council on: June 16, 2011. Timelines and Membership amended March 21, 2013.

CONTEXT:

- The Riparian Land Conservation and Management initiative originated from a statement of opportunity (SOO) brought forward to the Council by the Watershed Planning and Advisory Councils (WPAC) sector. The Council identified this initiative as a potential Council project at the October 2010 board meeting and established a Working Group to further define the scope of a potential project.
- Riparian lands are among the most productive and valuable of all landscape types in terms of species richness and ecological function. Healthy riparian lands are also more resilient when faced with environmental stresses (such as climate). Despite this, pressure continues to grow for both the health and quantity of some riparian lands in Alberta. Recognizing the value of riparian lands, many organizations work to promote riparian land health and function and overall protection, but still face many challenges. There is an opportunity to improve riparian management in Alberta and the SOO proposed that the Council develop provincial level recommendations to improve the conservation and management of riparian lands at all scales.
- The Council uses a multi-stakeholder consensus based process to provide recommendations to advance the three goals of the *Water for Life* strategy. This project aligns with advancing the three goals and requires the Council's approach for effective cross-sector solutions.
- The project team will operate in a manner that is consistent with the rules, policies and procedures adopted by the Alberta Water Council, including the use of consensus to make decisions in a multi-stakeholder process.

STRATEGIC INTENT (GOAL):

The purpose of this initiative is to enhance knowledge and provide recommendations for effective conservation and management of riparian lands in support of *Water for Life* goals.

OBJECTIVES:

1. Develop a definition for riparian lands.
2. Document the current state of riparian lands, management, and stewardship in Alberta and the riparian management and stewardship "best practices" (policy, practices and procedures) of other jurisdictions.
3. Evaluate the current state of riparian lands, management, and stewardship against the needs of all relevant sectors and propose recommendations for improving riparian land conservation and management in Alberta.

KEY TASKS:

The project team will:

- Build a work plan and operate according to its timelines and tasks.
- Provide regular updates to the Council.
- Prepare a consensus definition of riparian land to facilitate a shared understanding of the definition and its intent by reviewing other working definitions and their application and/or intents and present that definition to Council for approval.
- Develop a glossary of terms related to the project team's work.
- Engage a qualified consultant to complete a literature review and sector discussions for the "state of" knowledge on:
  - riparian land health and function within Alberta from a broad overview perspective, such as an annotated bibliography at sub-basin level or higher (ie: state of watershed reports).
  - existing policy, practices and procedures of riparian land conservation and management implemented in Alberta and other jurisdictions, that include:
    - methodologies for delineating riparian lands
    - criteria for defining riparian health and function
    - tools for riparian land conservation and management taking into account social, ecological, and economic factors
- Work with the consultant to contribute relevant sector specific information and known data sources.
- Invite sectors to provide an overview of riparian lands in relation to their sector, specifically outlining management strategies, challenges or issues.
- Identify successes and gaps in riparian knowledge and management from Alberta and other jurisdictions.
- Using the consultant report and the sector information, make recommendations to the Council on:
  - a definition for riparian lands in Alberta.
  - priority actions to fill identified knowledge and management needs/gaps.

TIMELINES and DELIVERABLES:

- Present the results of the consultant's report on the "state of" knowledge..... June 2012
- Prepare and present for approval a definition for riparian lands..... October 2012
- Draft final report recommendations..... October 2012
- Final report recommendations..... October 2013

MEMBERSHIP:

Industry:

- Cropping
- Forest
- Irrigation
- Livestock
- Oil and Gas

Government:

- Large Urban
- Small Urban
- Rural
- Federal

Non-Governmental Organizations:

- Environmental NGO
- Fish Habitat Conservation
- Lake Environment Conservation
- Wetland Conservation
- Watershed Planning and Advisory Councils

Government of Alberta and Provincial Authorities:

- Alberta Agriculture and Rural Development
- Natural Resources Conservation Board

BUDGET:

The Working Group estimates a total budget of $ 139,900 to complete the project, broken down as follows:

Core Funding Costs (covered by Alberta Water Council):

Stakeholder support	$ 70,400
Hosting	$ 4,500
Communications support	$ 5,000

Project Funding Costs (covered by stakeholders):

Report on current state of riparian lands, management, and stewardship in Alberta and the riparian management and stewardship "best practices" (policy, practices and procedures) of other jurisdictions	$ 60,000

Appendix B: Examples of Nested Outcomes

This appendix shows hypothetical examples of the nested approach to desired outcomes. These examples are to be considered scenarios to help explain the concept of the nested approach and any numerical values are theoretical.

General Example:

Provincial	Riparian lands are, as a whole, healthy and functioning.
Regional	Riparian lands are maintained and restored in the North Saskatchewan River Watershed.
Sub-regional	Municipalities within the North Saskatchewan River Watershed develop riparian set-back guidelines.
Local	Incentive programs (financial and expertise) are developed that enable and assist landowners to retain riparian lands, restore damaged riparian land and replant riparian vegetation on their own land in XYZ Watershed.
Site-specific	Invasive species are removed along a 3 km stretch of ABC Creek and volunteers planted native shrubs and plants on 2.5 km2 of the riparian area at this site.

Urban Example:

Provincial	Riparian lands adjacent to Alberta's water bodies will be healthy, functioning and contribute to overall healthy aquatic ecosystems.
Regional	Riparian lands in the ABC basin will be healthy, functioning and contribute to overall healthy aquatic ecosystems.
Watershed	Based on scientific assessment, incompatible development within the established riparian land in the XYZ watershed will be discouraged. Where development has occurred within the riparian land, programs will be established to restore as much of the shore environment to a healthy and functioning status.
Municipal development plan	No new development or buildings will be permitted within the established riparian land of No Name water body, as identified on the XYZ Municipal Development Plan.
Municipal environmental reserve bylaw provision	No person may operate a motorized vehicle in an environmental reserve parcel. Notwithstanding the above, emergency vehicles and municipal maintenance vehicles may, from time to time, have access to lands in environmental reserve parcels.
ERCB (now the Alberta Energy Regulator)	Oil and gas wells will be directed 100 metres from the beds and shores of water bodies within the XYZW Region.
ARD and NRCB	Confined feeding operation buildings and structures will be constructed XXX metres from the beds and shores of water bodies in XYZW Region.
ESRD	No timber harvesting is permitted within 100 metres from the beds and shores of large water bodies in XYZW Region.

Public Education Example:

Provincial	Albertans will understand the important functions of riparian lands.
Regional	Riparian lands are inventoried, mapped and assessed for health within XYZ Region and education programs are offered to help people understand their importance.
Watershed	Education projects and programs will be put in place to ensure all stakeholders understand the important functions of riparian lands.
Municipal	Riparian land policy and related land use bylaw provisions will help citizens understand their importance.
Watershed Stewardship Groups	Riparian land health assessment will be done annually through volunteer pilot projects.

Appendix C: Sample of Federal and Provincial Legislation Affecting Riparian Lands

Federal Legislation	Purpose or Highlights
The Fisheries Act (Canada), R.S.C. 1985 c.F-14.	The prohibition against causing serious harm to fish that are part of or that support a commercial, recreational or Aboriginal fishery. Recently amended.
Canada Shipping Act, 2001, 2001, c.26	Regulates all aspects of recreational boating. Minister of Transport is responsible for administration of the Act.
Migratory Birds Convention Act 1994, 1994, c.22	Regulates activities that could harm migratory birds or their nests, and prohibits deposits of certain materials that might be harmful in water frequented by migratory birds. Recently amended.
The Navigable Waters Protection Act, R.S.C. 1985 c.N-22	Regulates activities that may interfere with navigation on navigable waters. Recently amended.
The Species at Risk Act, S.C. 2002, c.29	Prohibits the destruction of critical habitat for species at risk. Provides stewardship opportunities of critical habitat. Prohibits killing, harming or harassing endangered species as defined.
The Canadian Ecological Gifts Program, Environment Canada	A federal program to ensure that conservation easements can be registered on private lands with tax benefits accruing to the landowner registrant.

Provincial Legislation	Purpose or Highlights
Agricultural Operations Practices Act, RSA 2000, c A-7	Defines an agricultural operation broadly. Regulates and controls confined feeding operations and manure handling.
Alberta Land Stewardship Act, S.A. 2009, c. A-26.8	Provides legislation to support the Alberta Land Use Framework. Enables the creation of regional plans based on major watershed boundaries. Only one regional plan currently exists: LARP. Provides new tools such as conservation directives and offset schemes.
Environmental Protection and Enhancement Act, R.S.A. 2000, c. E-12.	Regulates municipal water, wastewater and storm drainage systems, groundwater wells, private wastewater systems, waste management, pesticides, etc. Provides for conservation easements. See also: Pesticide Sales, Handling, Use and Application Regulation, Alta. Reg. 24/1997 *Environmental Protection and Enhancement Act* — Code of Practice for Pesticides
Fisheries (Alberta) Act, R.S.A. 2000, c.F-16.	Enables Alberta to administer federal fisheries legislation in Alberta waters.
Line Fence Act, R.S.A. 2000, c.L-13.	Provides for regulation and control of fences that block public access on trails, and a mechanism to resolve disputes and collect the costs of maintenance and repair of fences erected between adjoining livestock producers.

Provincial Legislation	Purpose or Highlights
Land Titles Act, R.S.A. 2000, c.L-4.	Provides for boundary changes when the "natural boundary" changes through erosion or accretion of lands when the title to lands is a "natural boundary". Public lands are excluded from titles. See *Law of Property Act*, R.S.A. 2000, c.L-7 that clarifies exclusion of public lands from title.
Law of Property Act, R.S.A. 2000, c.L-7.	Provides that owners of land own the sand and gravel, clay and marl as surface rights: see section 56 – 58.
Municipal Government Act, R.S.A. 2000, c.M-26	Provides for municipal bylaw passing powers, (Part 1) municipal "direction, control and management of natural water bodies, (section 60), and Planning and Development of all private and municipal lands within municipal boundaries. (Part 17). The *MGA* provides enabling legislation for all municipal corporations. Also see the Safety Codes Act, R.S.A 2000, c. S-1., which appends the Plumbing Code Regulation AR 119/2007 and the Alberta Building Code Regulation AR 111/2007. The Subdivision and Development Regulation, AR 43/2002 also affects development of private lands adjacent to the ROW. Also see municipal statutory plans, the Land Use Bylaw, and other municipal bylaws that prohibit, regulate or control activities.
Alberta Public Health Act, Nuisance and General Sanitation Regulation 243/2003, Section 2	(1) No person shall create, commit or maintain a nuisance. (2) ... a person who creates, commits or maintains (a) any premises in a condition that (b) any street, pool, ditch, gutter, watercourse.... (c) any well, spring or other water supply... in condition that (f) any work, trade or business so situated that is or might become injurious or dangerous to the public health ... is deemed to have created, committed or maintained a nuisance.
Public Lands Act, R.S.A.	Regulates the use and development of all provincial public lands, including the beds and shores of all permanent and naturally occurring water bodies in Alberta, as surface rights this does not include ownership of water body's beds and shores.
Surveys Act, R.S.A. 2000, c.S-26.	The "ordinary high water mark" or legal bank establishes the delineation of bed and shore of permanent and naturally occurring water bodies owned by the Province. The legal bank is established by surveyors pursuant to the Act. Defines bed and shore for purpose of determining natural boundary.

Provincial Legislation	Purpose or Highlights
Water Act, R.S.A. 2000, c.W-3.	Section 3: "The property in and the right to the diversion and use of all water in the Province is vested in Her Majesty in right of Alberta except as provided for in the regulations." Diversion and use of water is regulated, and water management planning is a component of the legislation. Disturbance of water bodies (such as draining and filling) is an activity under the Act that requires an approval. See section 96 with respect to flood risk areas and the authority the province has to work with municipalities to regulate and control land use on designated flood risk areas. *Water for Life*: Alberta's Strategy for Sustainability is a Policy document and is not part of the *Water Act* legislative scheme. However, see the Framework for Water Management Planning that is a statutory requirement under the *Water Act* and the Strategy for the Protection of the Aquatic Environment embedded in that framework as Section 5.0. Both are available online: http://environment.gov.ab.ca/info/library/6367.pdf
Weed Control Act, R.S.A. 2000, c.W-5.	Municipalities are the delegated authority to pass local bylaws to control restricted noxious and, noxious weeds on municipal lands and on certain public lands such as highway corridors. Recently amended.
Wildlife Act, R.S.A. 2000 c.W-10.	Prohibits unauthorized activity on specified public or private land that could harm a nest or den of identified wildlife. Migratory birds identified for purpose of legislation.

Note: This table was adopted from a similar chart prepared by Aquality Environmental Consulting Ltd. based on information collected from many sources and provided by Judy Stewart when preparing the "Interim Wetland Policy Implementation Plan" for Strathmore, Alberta. This information was further updated for work on *Buffalo Lake Shoreland Management Plan Implementation Plan* and updated in March 2013.

Appendix D: Sector Discussion Results

The Council project team undertook sector engagement once the Fiera report was completed to gather feedback and ensure that no major issues or strategies were missing. The sector engagement also yielded perspectives not covered by the report and responses from stakeholders that did not agree with the Fiera report, resulting in a more complete account of the state of riparian lands conservation and management. Key items of information from the stakeholder engagement are noted below; they are the opinions from the various sectors and do not necessarily reflect the views of the Alberta Water Council.

Outcomes

The sector discussions resulted in several suggestions on what the desired outcomes for improved riparian land management could include, such as:

- Coordination and collaboration between private individuals, community-based groups and public agencies is required for work conducted or planned regarding the conservation and management of riparian lands. Leadership is needed.
- Improved riparian health and function across Alberta.
- A more Integrated and coordinated approach to riparian conservation and management across sectors and jurisdictions.
- Improved education of the public and decision makers.
- Comprehensive cumulative impact management.
- Clearly defined conservation and management roles and responsibilities.
- Monitoring and research to fill information gaps.
- Buy in from all sectors through improved public participation.
- Improved accountability, fairness and equity with respect to land use planning.
- Improved enforcement of legislation.
- Improved reclamation standards.
- Consistent application of the Precautionary Principle.

Barriers

The sector discussions identified several examples of barriers:

- The scale and compatibility of databases regarding currently available or planned riparian health and extent assessment information is problematic and limiting for potential users interested in this information. Suggestions include a publicly available database or library or at least outputs from a database that are available to all. Everyone needs to be using the same information.
- Policy wordings that may allow provisions to be ignored or circumvented.
- Policy wordings that may allow counterproductive interpretations.
- Provisions that may reward counterproductive decisions or actions.
- Provisions that may create or foster conflict of interest on the part of decision makers.
- Inadequate oversight and accountability of proponent self-regulation.
- Restrictions to public participation in planning and decision making processes.
- Lack of capacity and accountability of municipal governments.
- Excessive "discretionary" powers of decision makers.
- Address the disparity in municipal capacity relating to riparian land management.
- There is a perception that the affected/"directly affected"[50] criterion limits public participation.

Incentives

The sector discussions suggested the following opportunities for incentives:

- Study offsets, conservation easements and TDRs as alternatives to existing methods of compensation, identifying information gaps and opportunities for their use in Alberta.
- Study the use of transferable development rights and their potential role, identifying information gaps and opportunities for the use of TDRs in Alberta.
- Support land trusts and their work (e.g., through the land trust grant program).

50 An example of directly affected can be found in the Alberta Environmental Appeals Board decision: Appeal No. 10-038-043-ID1; in the matter of an appeal filed by the Alberta Wilderness Association, Trout Unlimited Canada, Water Matters Society of Alberta, Cheryl Bradley, Lorne Fitch, and Walter Hohloch with respect to Water Act License Amendment No. 00071066-00-01 issued to the Eastern Irrigation District by the Director, Southern Region, Environmental Management, Alberta Environment. The groups and individuals, with the exception of Walter Holoch, were deemed to be not directly affected by the decision. The result was that their substantive issues were never heard by the board. Only Walter Hohloch was deemed directly affected. This appeal can be found online at: www.eab.gov.ab.ca/search.htm

- Provide further incentives to private landowners who undertake formal conservation projects (e.g., landowners who sign an agreement). Private landowners are often reluctant to sign perpetual conservation agreements but are more receptive to termed agreements (typically 5 to 30 years). Policy and funding making this type of agreement easier would make riparian conservation more feasible.
- Further develop conservation offsets with the understanding that impacts should not be "offset" elsewhere. There should be areas identified as "no impact allowed" and implementation of offset programs will be key to how the system functions.
- Support further pilot projects that evaluate transferable development rights and their potential role, identifying information gaps and opportunities for the use of TDRs in Alberta.
- Explore further opportunities to pilot offset initiatives throughout Alberta.
- Support the development of tools that help identify and incent practice change to enhance ecosystem services related to riparian lands.
- Continue to support research into BMPs that lead to positive outcomes for riparian conservation and stewardship. Ensure we incent practices that achieve positive outcomes.
- Support pilot projects that demonstrate a market based approach to funding incentives for practice changes that support improved conservation and stewardship practices on riparian lands.

Implementation and Enforcement

The sector discussions identified several key areas of focus for effective implementation and enforcement of riparian lands conservation and management legislation and policy:

- Integrate management of surface water and groundwater.
- Tie water and land use planning and decision making to science based assessments and management frameworks to avoid arbitrary decisions that compromise ecological sustainability for short-term local, political or economic advantage.
- Assess environmental impacts and cumulative effects as part of resource extraction proposal review.
- Place burden of proof that an action is not harmful onto those proposing the action.
- Provide a more open and democratic process for review and approval of land and water disturbances.
- Revise interpretation of "directly affected" to respect reality and environmental protection.
- Level the playing field between industries, preventing some from operating at lower standards.
- Level the playing field between municipalities, preventing some from operating at lower standards.

- Raise the bar for qualifications of specialists and planners who influence municipal land use decisions.
- Concerns related to the implementation phase of riparian lands conservation and management recommendations such as setting or recommending timeframes, prioritization and risk-based assessment, strategic planning and specific objectives, targeted funding and resources were identified.

Resources

Some key elements for funding strategies were suggested through the sector discussions:

- Government must frame economic activity within an ecological framework, attaching costs of lost ecological goods and services to industrial development.
- If the environment is a "free good" it will be undervalued and overexploited, and society as a whole will bear the cost.
- Independent decisions lacking consideration of cumulative impacts to landscapes, watersheds and airsheds are no longer affordable.
- Collect sufficient financial security to ensure completion of conservation and reclamation activities.
- Collect sufficient royalties or levies on all resource extraction to cover responsible governance, including cumulative impact assessment and management, integrated planning, educated decision making, comprehensive monitoring and strong enforcement.
- Ensure that funds generated by fees for resource extraction are directed toward improved management.
- Cost recovery for interveners is consistent with the environmental principle of polluter pays, and is necessary for effective and meaningful public participation.
- Recognize international data on billions of dollars/year costs of restoring degraded riparian lands, as we do not want to follow the same path and have to reverse centuries of mismanagement.
- Address conflicting incentives for land management affecting riparian management and conservation and increase the ability to target funding to specific areas versus on a first come first served basis.

Stewardship Effort

Several examples of information needs to enhance riparian stewardship efforts were identified by the sector discussions:

- An increased awareness and understanding of riparian lands (e.g., function, biodiversity issues, health, state), by the general public and the stakeholder sectors, including political decision makers, is required. There is a need for increased emphasis on communication and education regarding riparian lands between stakeholders and the public.
- Improve awareness of ownership of bed and shore.
- Improve awareness and respect for connectivity between riparian lands and associated ecosystems.
- Raise awareness that groundwater and surface water are one water resource.
- Compile comprehensive groundwater data.
- Educate decision makers regarding the value of water, riparian lands, conservation and stewardship, versus costs of failure to conserve.
- Understand what is considered a water body.
- Improve understanding of environmental reserves and their role.
- Educate Albertans as to what riparian land is, why it is important and how activities within the riparian area and surrounding lands can affect our lives both positively and negatively.
- Increase knowledge and understanding of compatible and incompatible land uses.
- Increase knowledge and understanding of ecological goods and services.
- Increase knowledge and understanding of restoration versus reclamation, what constitutes effective repair and what does not, what damages cannot be repaired at all, etc.
- Improve documentation of extent and severity of cumulative land use disturbances.
- Improve public access to cumulative impact data.
- Provide more training for assessment of riparian health and extent.
- Fully inform Albertans of risks, costs, values and benefits associated with either protecting or sacrificing riparian lands.
- Define and respect in-stream flow needs and protected water to support healthy aquatic ecosystems. Provide reliable information on who is accountable and responsible.
- Riparian lands conservation and management efforts need to be considered within the concept of an ecosystem and integrated into established ongoing and planned initiatives; examples include the Land Use Framework, wetlands policy, watersheds management planning, forest and vegetation inventories (i.e., biophysical/anthropogenic/land use), wet areas mapping.
- Emphasize that riparian lands, adjacent lands and setback lands require management. Strategies for management need to recognize the natural occurring (versus man made) disturbance in riparian and upland areas and focus on retaining the functions of riparian lands.

Best or Beneficial Riparian Management Practices

The sector discussions identified several opportunities for government and stakeholders to further promote BMPs by working with all relevant groups or agencies to:

- Promote education as part of land use application procedures.
- Incorporate best management practices into earliest stages of land use planning, as damage prevention is more cost-effective and timely than remediation.
- Strongly encourage industries to adopt BMPs and effective implementation tools.
- Reward behavioral improvement and technological innovation.
- Respect and support citizen conservation initiatives through programs, funding, in-kind and technical support, and policy improvement.
- Identify and support human uses of riparian lands that integrate social and economic needs with respect for healthy riparian lands.
- Improve support for WPAC initiatives concerning riparian conservation and management BMPs.

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