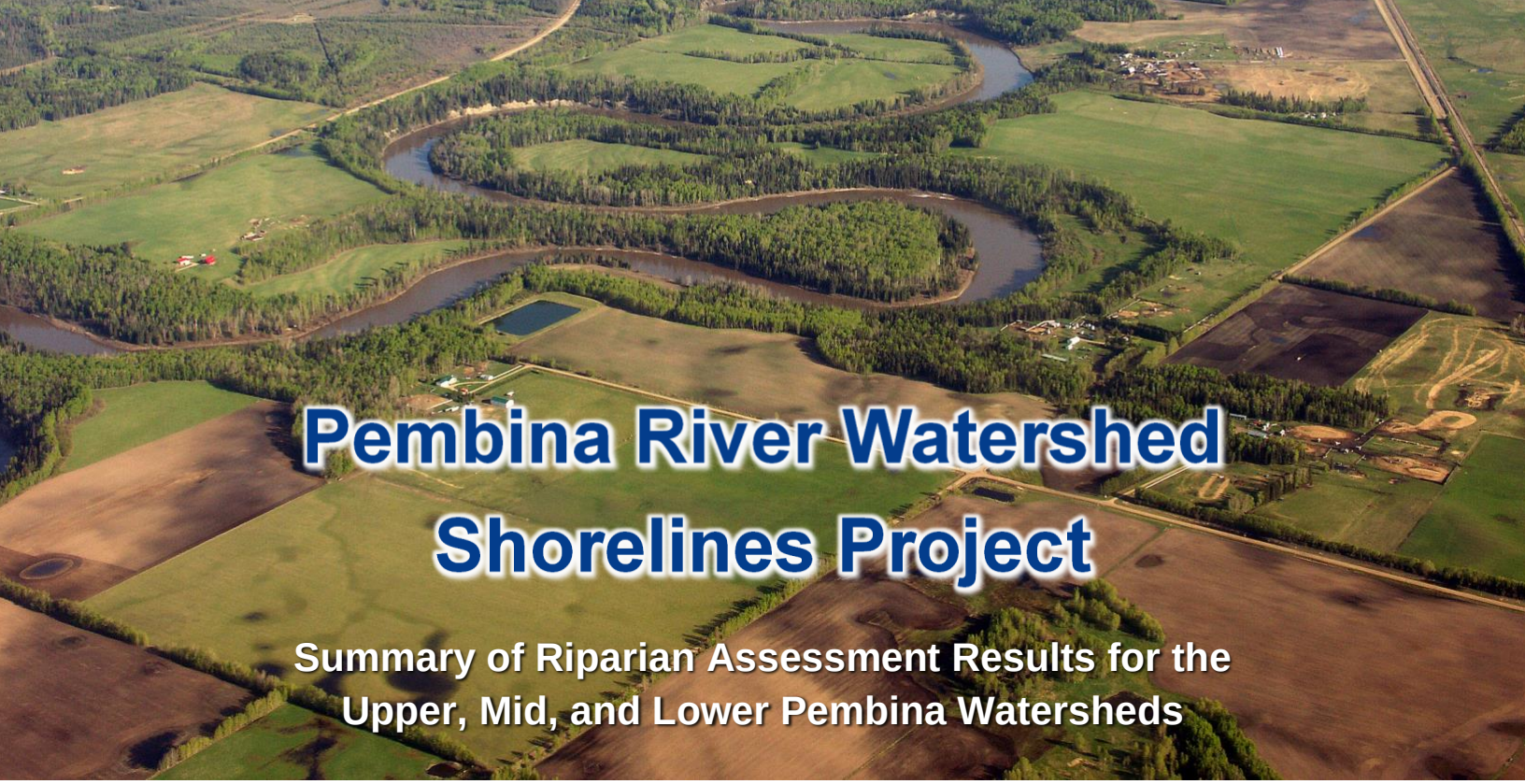


Pembina River Watershed Shorelines Project

Summary of Riparian Assessment Results for the Upper, Mid, and Lower Pembina Watersheds

Overview

Riparian habitats are found along the shorelines of all aquatic features, including lakes, streams, rivers, and wetlands. Riparian lands have substantial ecological, economic, and social value; for example, intact riparian habitats stabilize the banks of waterbodies and help modulate water velocities and high water events, thereby improving water quality and protecting surrounding lands from flooding. Intact riparian areas also play a vital role in the exchange of inorganic and organic material between terrestrial and aquatic ecosystems and regulate water temperature and the instream light environment, thereby ensuring suitable habitat for a range of aquatic species. Given the significant role that an intact riparian zone has on providing ecosystem services and supporting healthy and functional aquatic ecosystems, there is a need to effectively manage riparian areas. Thus, understanding the distribution of intact riparian habitat across the landscape and identifying areas where riparian intactness has been degraded is essential to improving conservation and management outcomes.

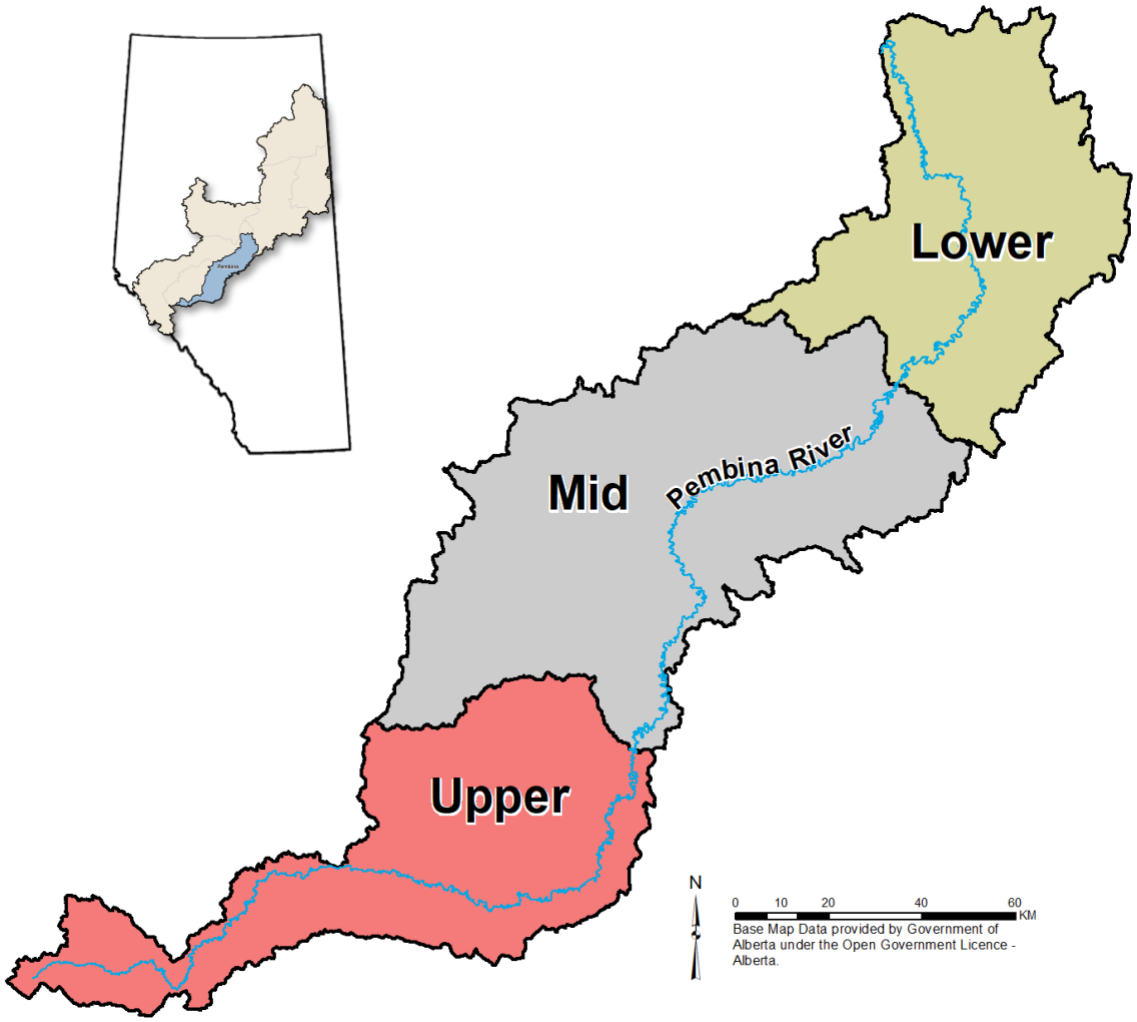
In an effort to better manage riparian habitats within the Pembina River watershed and contribute to the larger goal of improving flood and drought resiliency in the area, the Athabasca Watershed Council (AWC) retained Fiera Biological Consulting to conduct riparian assessments for the three HUC6 watersheds within the Pembina River watershed: the Upper, Mid, and Lower Pembina watersheds.

These GIS-based, large-scale assessments quantified intactness of riparian areas, assessed natural and anthropogenic pressure on riparian areas, and determined priority for riparian restoration and conservation for approximately 3,708 km of shoreline. Detailed methods and the results of these riparian assessments for each watershed have been summarized in separate reports, all of which are available on the AWC website. This summary provides a high-level overview of the methods and results presented in those reports.

Study Area

Covering an area of approximately 14,296 km^2, the Pembina River watershed is located in central Alberta, and has an extensive hydrological network that flows through the Boreal Forest, Foothills, Rocky Mountain and Parkland Natural Regions. The Pembina River watershed is composed of three smaller HUC6 watersheds: the Upper (4,140 km^2), Mid (6,220 km^2), and Lower (3,935 km^2). The Pembina River has its headwaters at the western extent of the watershed, and flows through all three subwatersheds.

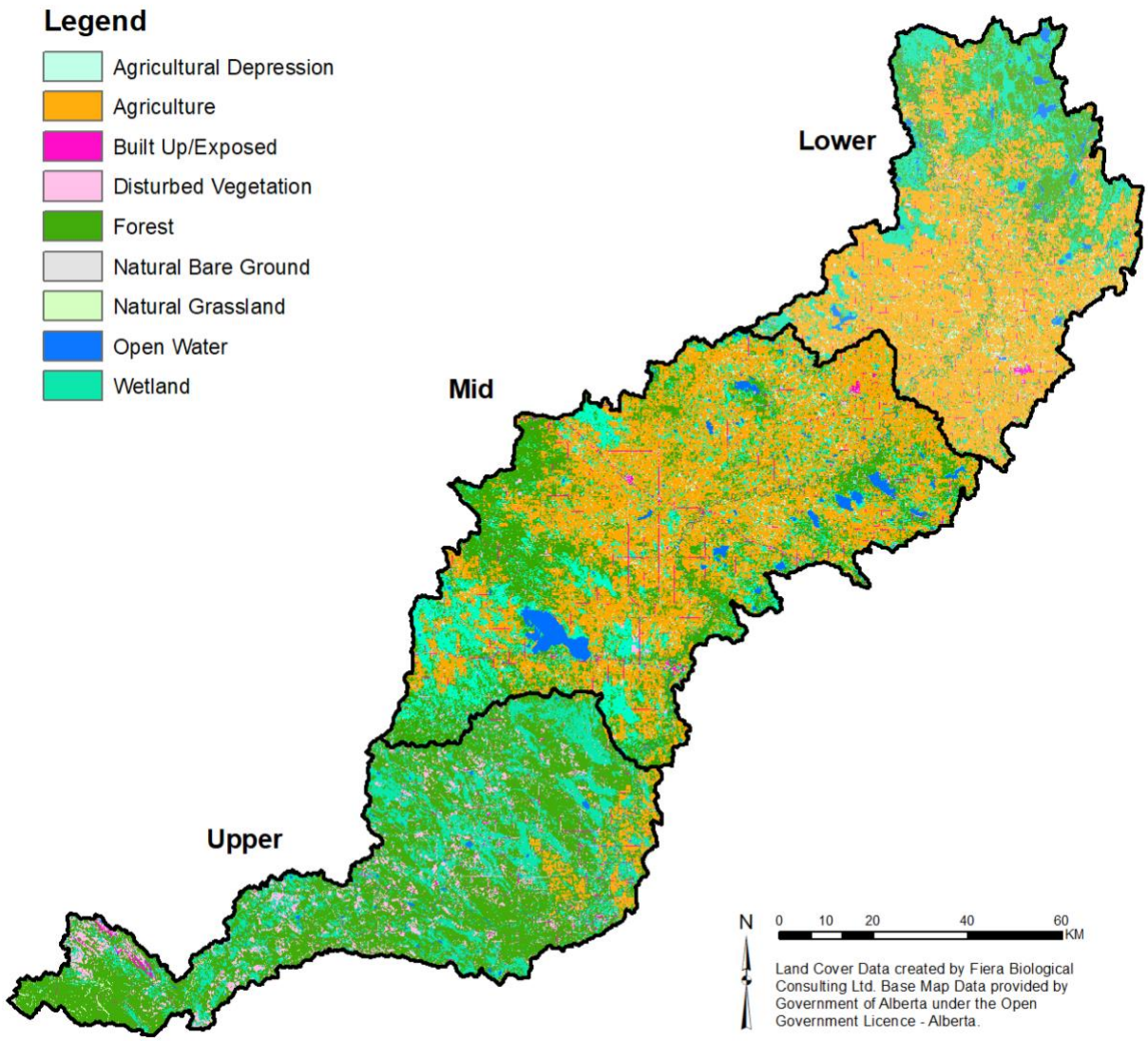
THE PEMBINA RIVER WATERSHED & THREE SUBWATERSHEDS



Land Cover

A land cover dataset was created for the Pembina River watershed using satellite data from 2017 and 2018. Land cover and land use in the Pembina River watershed transitions markedly between subwatersheds. The Upper Pembina is predominately covered by natural forest and wetland cover (82%) with some disturbed areas as a result of resource extraction (e.g., forestry, mining). The Mid Pembina is covered by a fairly even mix of natural forest and wetland cover (45%) and agricultural use (46%). The Lower Pembina is predominately covered by agricultural lands (54%) before transitioning back to forest and wetland cover (37%) at its northern extent. Open water accounts for roughly 2% of the land cover in the Pembina River watershed.

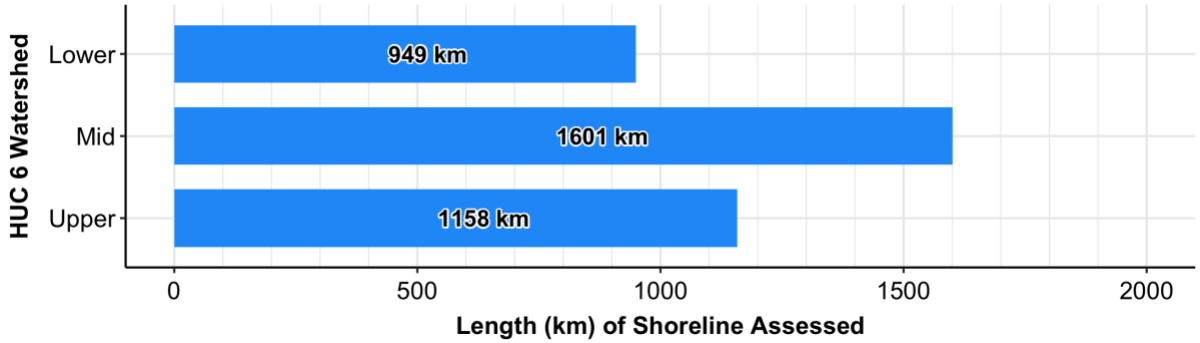
LAND COVER WITHIN THE PEMBINA RIVER WATERSHED

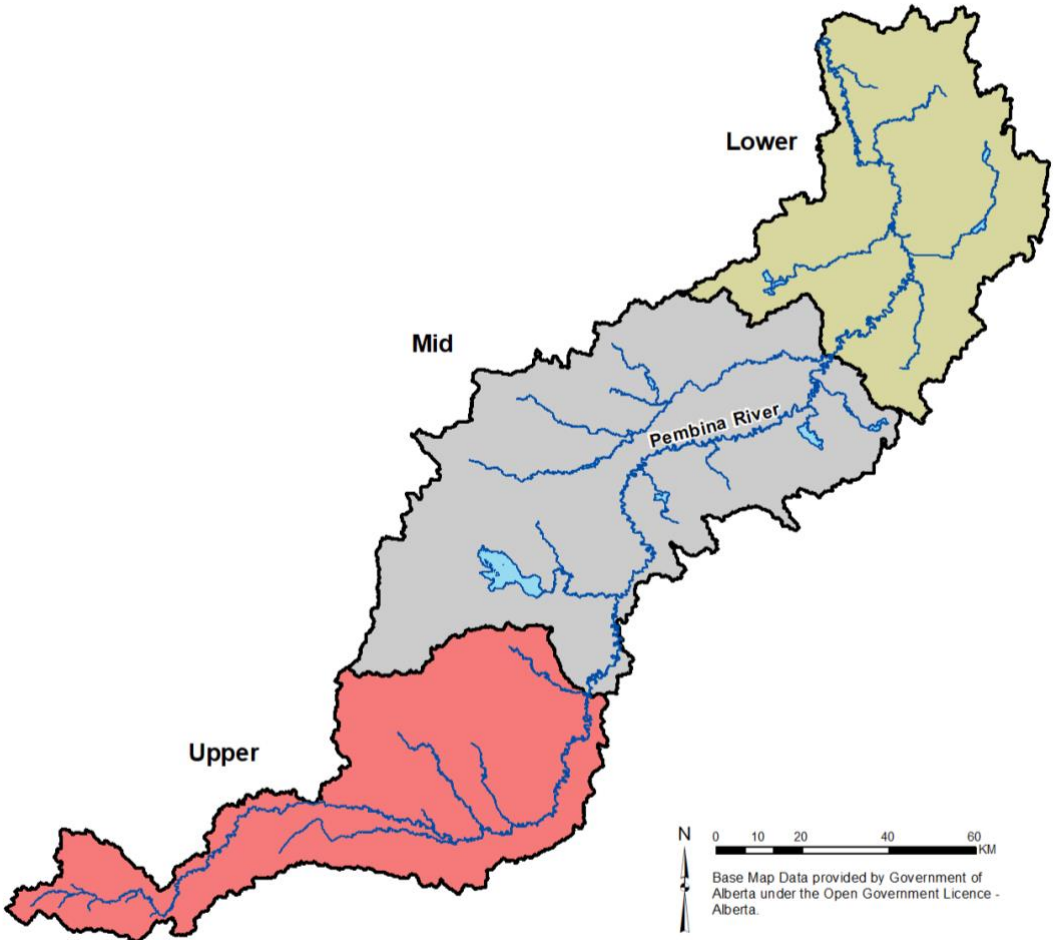


Length of Shoreline Assessed

In total, 3,708 km of shoreline was assessed in the Pembina River watershed, which included 28 creeks, streams, and rivers, and 11 lakes. The greatest length of shoreline was assessed in the Mid Pembina watershed.

LENGTH & LOCATION OF SHORELINES ASSESSED IN THE PEMBINA RIVER WATERSHED



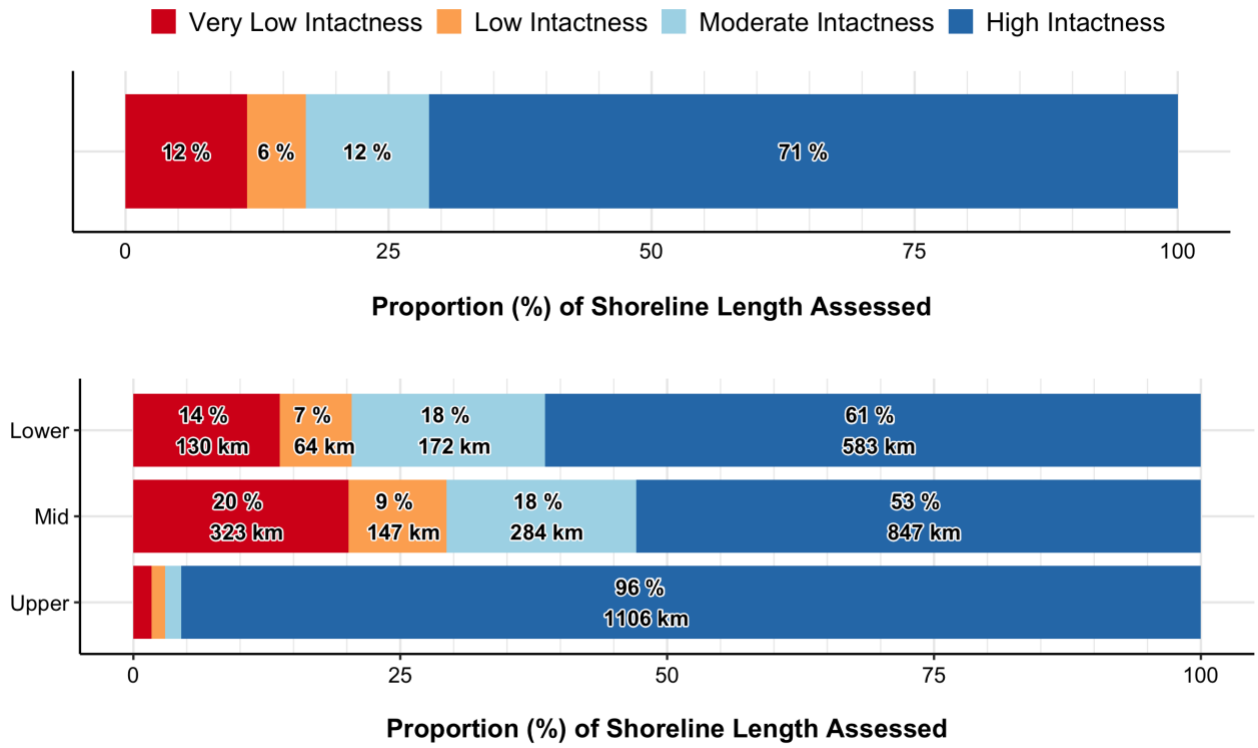


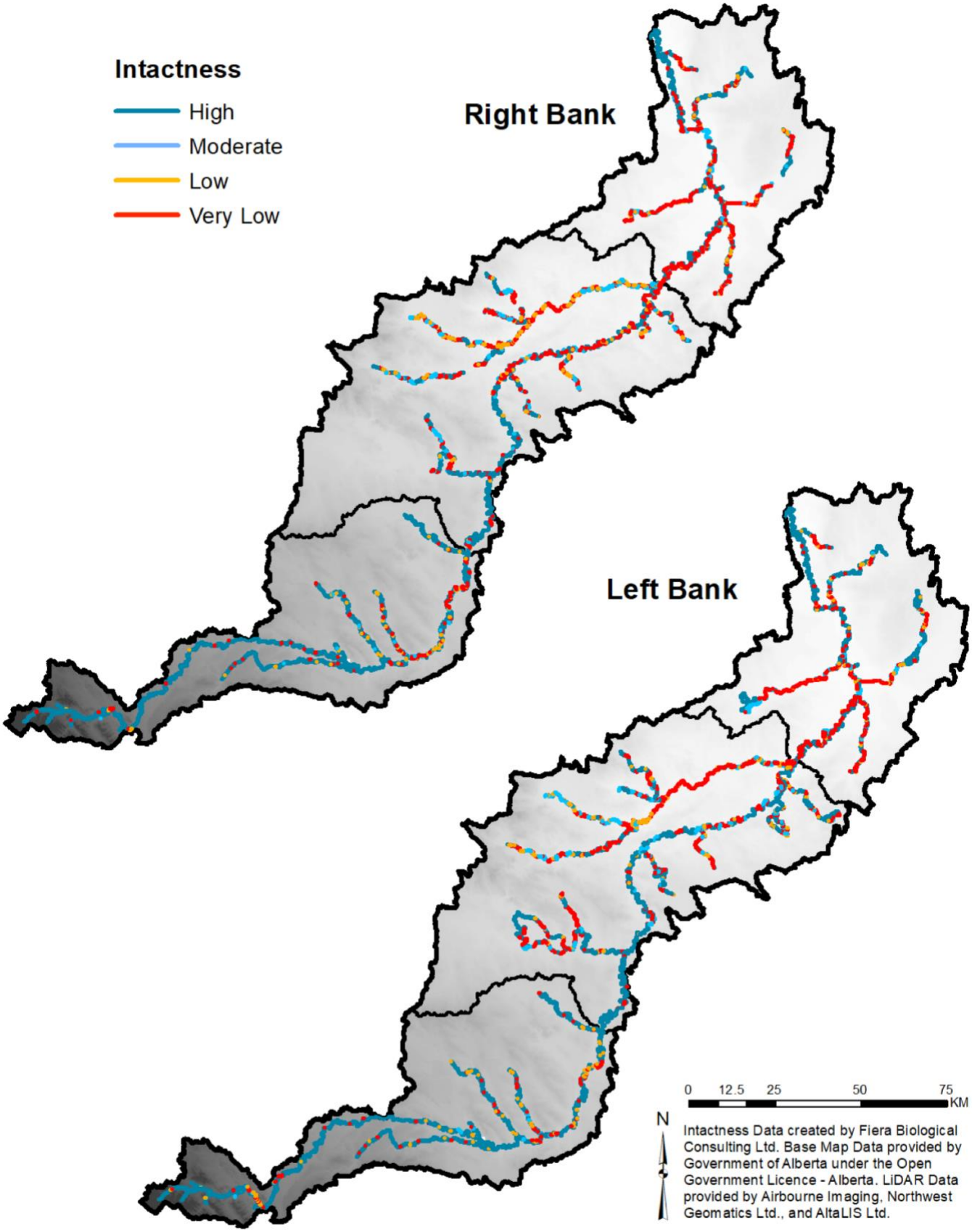
Riparian Intactness

Riparian intactness was assessed along the shorelines of interest using a desktop-based assessment tool that utilized the land cover data. Intactness was assessed within riparian management areas (RMAs) that had a variable length, as determined by major breaks in the proportion of vegetation cover along the shoreline, and a fixed 50 m buffer that extended perpendicular to the shoreline. Within each RMA, intactness was assessed based on the type and extent of vegetation and human disturbance present. A completely intact riparian area is a location that is entirely free from human disturbance, and a loss of intactness occurs as a result of habitat fragmentation or degradation that is caused by human activities. For all watercourses, intactness was assessed and mapped separately for the left and right banks, which allows for spatial targeting of areas for management action.

In the Pembina River watershed 71% (3,092 km) of the shorelines assessed were classified as High Intactness, with approximately 18% (744 km) of the shoreline assessed as either Low or Very Low Intactness. When intactness is summarized by HUC6 watershed, the greatest proportion of shorelines classified as Low and Very Low intactness were located in the Mid Pembina watershed, with the overwhelming majority of the shorelines assessed in the Upper Pembina classified as High Intactness.

RIPARIAN INTACTNESS IN THE PEMBINA RIVER WATERSHED

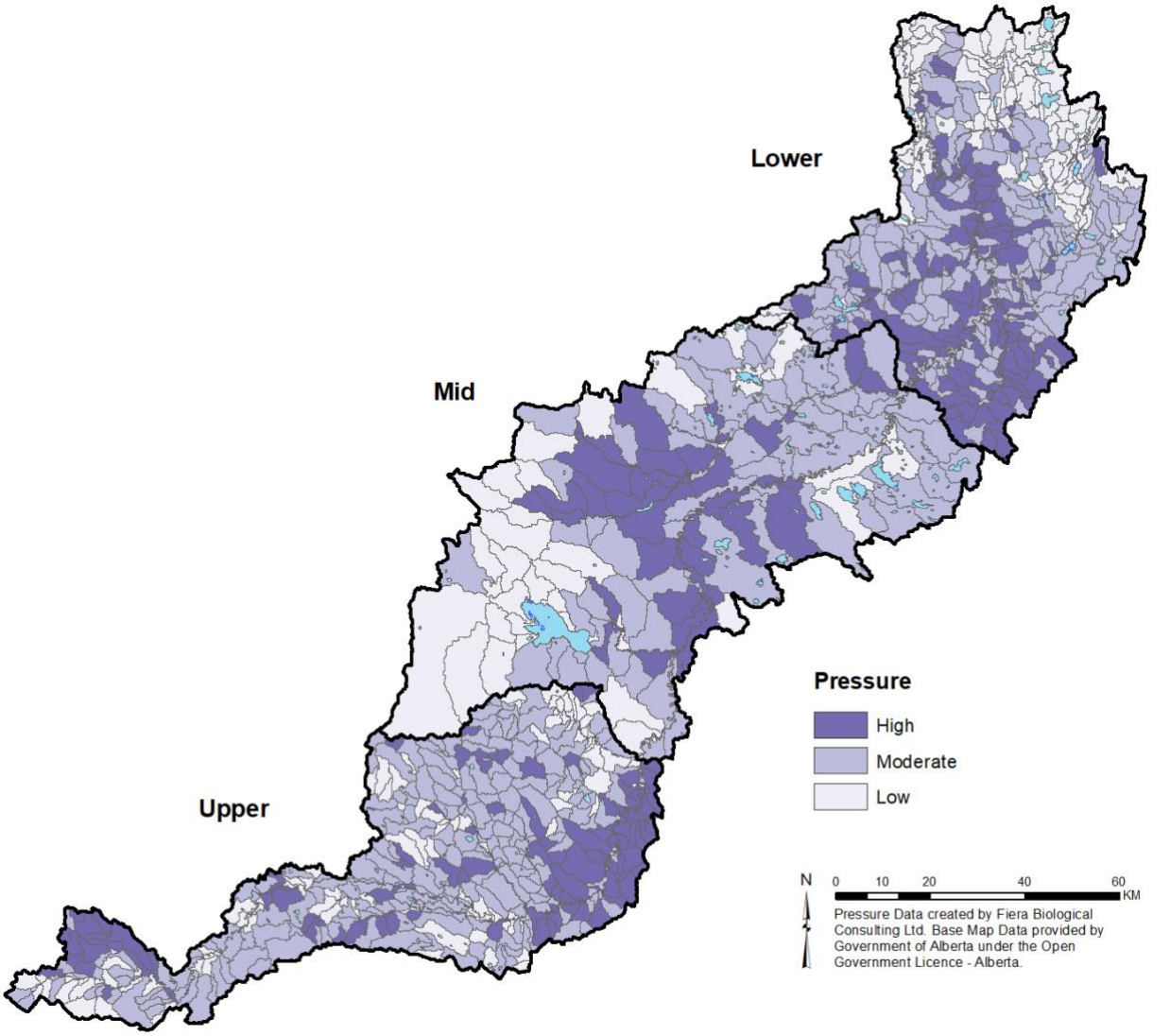



Intactness
High
Moderate
Low
Very Low
Right Bank
Left Bank
0 12.5 25 50 75
KM
N
Intactness Data created by Fiera Biological Consulting Ltd. Base Map Data provided by Government of Alberta under the Open Government Licence - Alberta. LiDAR Data provided by Airbourne Imaging, Northwest Geomatics Ltd., and AltaLIS Ltd.

Pressure on Riparian System Function

In addition to assessing riparian intactness, pressure on riparian system function was evaluated to identify riparian areas that may be functionally impaired due to surrounding land use activities. Because surface water flows across the landscape and eventually through riparian areas into surface water bodies, this analysis evaluates landscape conditions that may increase riparian habitat resilience, or conversely, impact the ecological or hydrological function of riparian areas. Pressure on riparian system function was assessed at a local "catchment" scale, and was calculated based on a variety of metrics including, the amount of natural cover, terrain characteristics, and type, extent, and intensity of human disturbance. Catchments were then categorized as Low, Moderate, or High Pressure, with catchments with more natural cover having higher resilience, and thus, lower pressure, and catchments with a greater proportion of high intensity land uses having higher pressure.

AREAS OF HIGH, MODERATE & LOW PRESSURE WITHIN THE PEMBINA RIVER WATERSHED

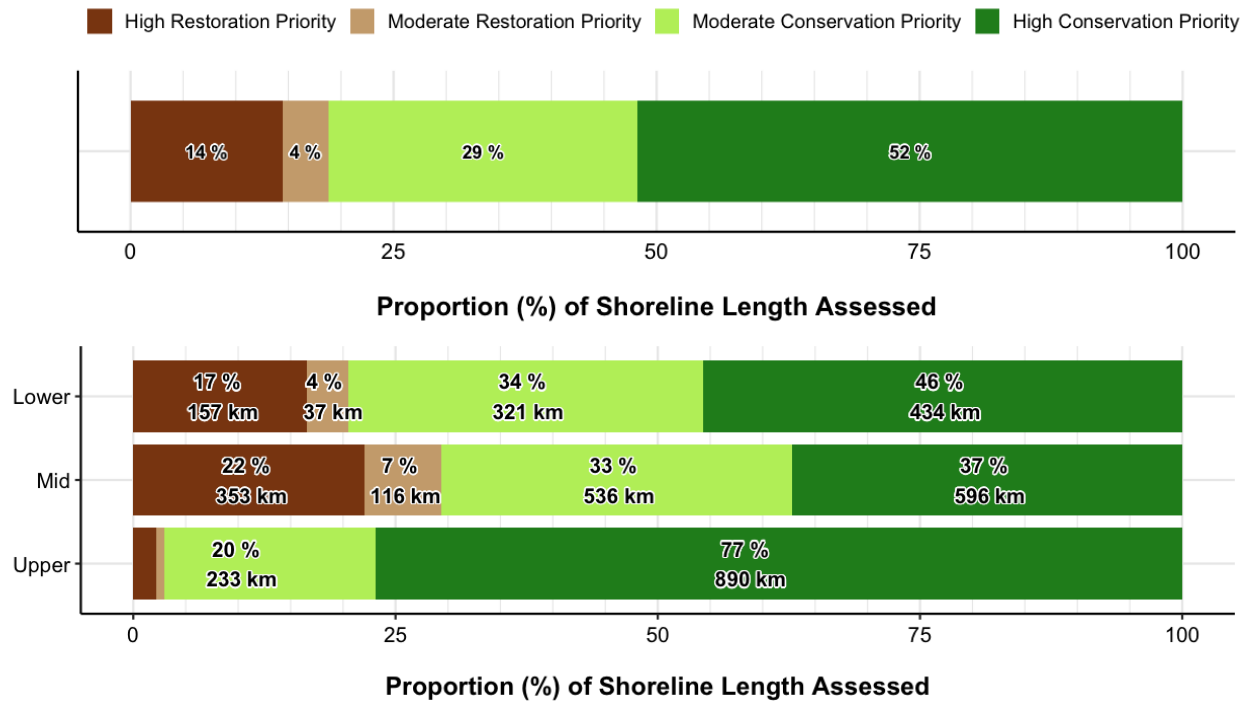


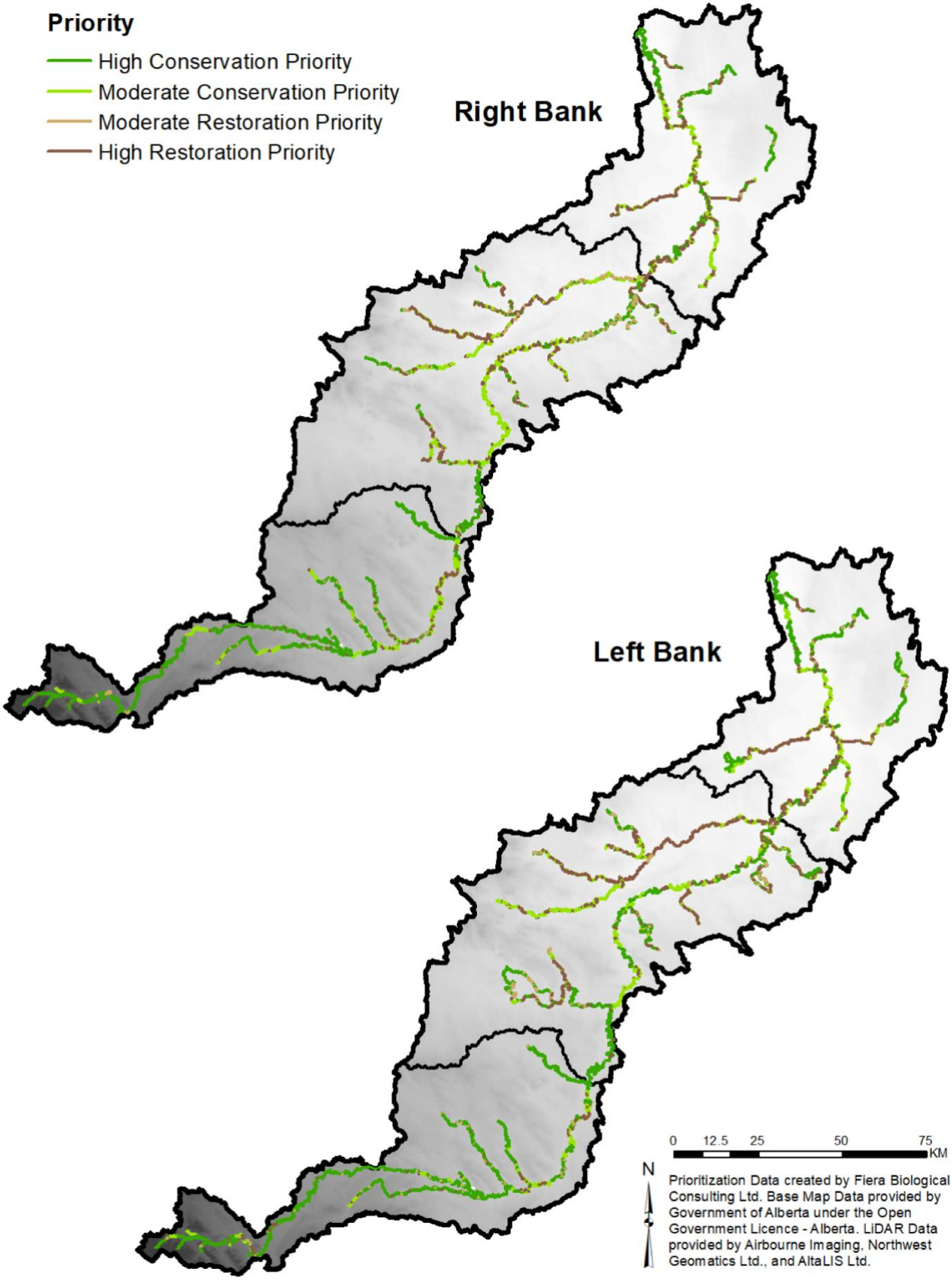
Conservation & Restoration Priority

While riparian intactness and catchment pressure scores on their own provide land managers with important information about riparian condition, combining these scores together to create a prioritization matrix that identifies high priority areas for both conservation and restoration allows land managers to more precisely target areas for management. For this assessment, riparian management areas that are in good condition are targets for conservation, with areas classified as either Low or Very Low intactness being identified as targets for restoration. Within each of the conservation or restoration categories, High or Moderate priority is determined based on the pressure score of the surrounding catchment.

In the Pembina River watershed 52% (1,920 km) of the shorelines assessed were classified as High Conservation Priority, with approximately 18% (698 km) of the shoreline assessed as either Moderate or High Restoration Priority. When prioritization is summarized by HUC6 watershed, the greatest proportion of shorelines categorized as High Restoration Priority were located in the Mid Pembina, with the majority of the shorelines categorized as High Conservation Priority located in the Upper Pembina watershed.

CONSERVATION & RESTORATION PRIORITY IN THE PEMBINA RIVER WATERSHED




Priority
High Conservation Priority
Moderate Conservation Priority
Moderate Restoration Priority
High Restoration Priority
Right Bank
Left Bank
0 12.5 25 50 75
KM
N
Prioritization Data created by Fiera Biological Consulting Ltd. Base Map Data provided by Government of Alberta under the Open Government Licence - Alberta. LiDAR Data provided by Airbourne Imaging, Northwest Geomatics Ltd., and AltaLIS Ltd.

Opportunities

Foundational to any conservation planning exercise is the collection and generation of scientific information that can be used as the basis for the development and implementation of an evidence-based adaptive management framework. Through the commissioning of these studies, the AWC and its stakeholders have an important foundation of scientific evidence upon which to build a systematic and adaptive framework for riparian habitat management in the Pembina River watershed. Specifically, this data provides a critical baseline that can be used to track change through time, and it also includes important information that stakeholders can use to inform discussions about management targets and actions.

The results from this study can also be used to target shorelines for restoration or conservation, or identify areas where a field-based assessment of riparian condition may be required to address specific management questions.

Conclusion

The overall goal of this project was to quantify and characterize the intactness of riparian management areas in the Pembina River watershed, and to further assess pressure on riparian system function by evaluating land use and land cover within local catchments immediately adjacent to the waterbodies included in this study. The results of this work provide the AWC and its stakeholders with an overview of the status of riparian areas within the watershed, and further provides a foundation of scientific evidence upon which to build a systematic and adaptive framework for riparian habitat management.

More detailed information about the riparian assessments that have been completed in the Upper, Mid, and Lower Pembina River can be found on the following reports, which are available on the Athabasca Watershed Council's website:

Fiera Biological Consulting Ltd. 2020. Upper Pembina Watershed Riparian Area Assessment. Fiera Biological Consulting Report #2012c. Prepared for the Athabasca Watershed Council, Athabasca, Alberta. Pp. 74.

Fiera Biological Consulting Ltd. 2020. Mid-Pembina Watershed Riparian Area Assessment. Fiera Biological Consulting Report #2012. Prepared for the Athabasca Watershed Council, Athabasca, Alberta. Pp. 80.

Fiera Biological Consulting Ltd. 2021. Lower Pembina Watershed Riparian Area Assessment. Fiera Biological Consulting Report #2012b. Prepared for the Athabasca Watershed Council, Athabasca, Alberta. Pp. 76.