Riparian Health Summary
Final Report

Lobstick River
Downstream of Chip Lake

Alberta Riparian Habitat Management Society
(Cows and Fish)

March 2016

Prepared for:

Stewardship Alliance for Conservation Agriculture
West Central Forage Association

Project Area:

Lobstick River
Downstream of Chip Lake to Pembina River Confluence

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Suggested report citation: *O'Shaughnessy,K. , Ross, C. 2016. Riparian Health Summary, Final Report, Lobstick River Downstream of Chip Lake. Alberta Riparian Habitat Management Society (Cows and Fish).*

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Acknowledgements

A key to the success of this project was the co-operation demonstrated by interested landowners in the Lobstick River - Downstream of Chip Lake project area (hereafter referred to as the *Lobstick River* project area). Thank you to everyone who allowed access to their land and supported this riparian inventory! A special thanks to the Stewardship Alliance for Conservation Agriculture (SACA), West Central Forage Association (WCFA) and their partners for their assistance in contacting landowners. We also thank Yellowhead County for providing air photos and mapping support for our field crews. This riparian health inventory summary report is part of the Lobstick River Stewardship Project initiated by the Stewardship Alliance for Conservation Agriculture and West Central Forage Association.

Funding for the Lobstick River riparian health inventory was provided by the Alberta Conservation Grant Eligible Fund grant received by SACA/WCFA. Additional support was provided by Yellowhead County, Cows and Fish members and supporters, and individual landowners and land managers.

We would like to acknowledge and thank ongoing support provided by Cows and Fish members and supporters: Producers and community groups, Alberta Beef Producers, Trout Unlimited Canada, Canadian Cattlemen's Association, Alberta Agriculture and Rural Development, Alberta Environment and Sustainable Resource Development, Fisheries and Oceans Canada, Agriculture and Agri-Food Canada and Alberta Conservation Association.

Disclaimer

- Any release of the information contained in this report, in whole or in part, to parties other than SACA/WCFA and participating landowners will not be the responsibility of Cows and Fish. Liabilities with the release of this report or use of the information beyond the original intent of the work will be the responsibility of the SACA/WCFA and participating landowners and land managers.

- All information in this report is a summary reflecting the overall state of riparian health expected to change as a result of landowner involvement in the Lobstick River project area. It does not share any specific information on individual landholdings assessed, based on Cows and Fish's commitment of confidentiality with the landowners who participated. Only general findings, reflecting the overall state of riparian health of the Lobstick River project area are presented in this report.

- The objective of completing these riparian health inventories is to provide a coarse filter review of the status of riparian function within the project area. The riparian health scores provide a general status of riparian health, not an absolute one. Riparian areas are dynamic and constantly changing. Because of this natural variability, the range of possible scores in each category is broad and one assessment is only an approximation of health. Repeat inventories, over a period of years at the same locations will provide a better picture of whether current management is maintaining, improving or negatively impacting riparian health.

- This report outlines the findings from the Lobstick River riparian health inventory initiative. Additional riparian health inventories and/or assessments are required in subsequent year(s) to better reflect riparian health conditions within a more representative proportion of the Lobstick River.

- The inventory and assessment of the functioning condition (health) of riparian habitat does not address any in-stream or water quality parameters associated with the Lobstick River project area.

EXECUTIVE SUMMARY

In 2014 and 2015, the Alberta Riparian Habitat Management Society (Cows and Fish) partnered with the Stewardship Alliance for Sustainable Agriculture (SACA) and West Central Forage Association (WCFA) to inventory riparian health along properties adjacent to the Lobstick River downstream of Chip Lake. This inventory is part of the Lobstick River Stewardship Project initiated by SACA/WCFA. This initiative is part of the SACA/WCFA's conservation programming and provides benchmarks of health for the selected properties along the Lobstick River. For the purposes of this report, the sites involved will be referred to as the "Lobstick River project area". Information obtained from the inventory of riparian health in the Lobstick River project area will inform and facilitate land management planning within the watershed, encouraging private landowners to understand and effectively manage riparian areas under their care. Riparian areas along the Lobstick River provide important fish and wildlife habitat, improve water quality and maintain water quantity on the landscape.

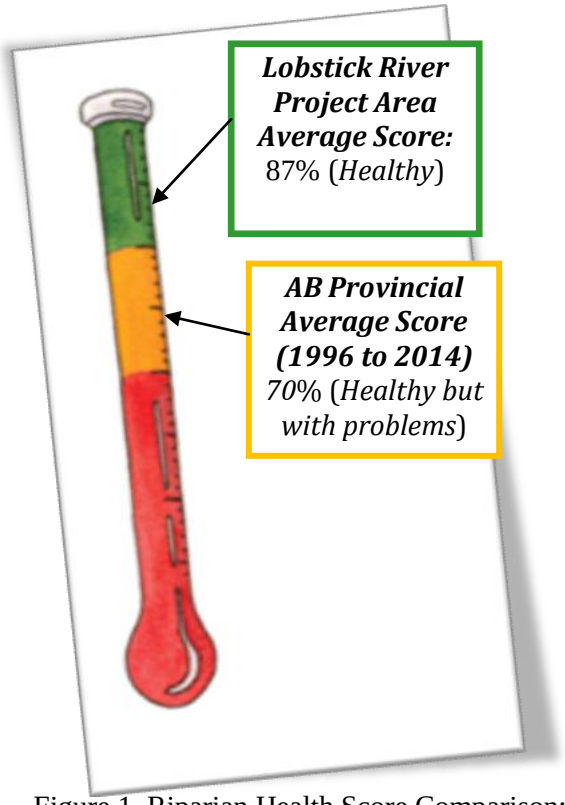

Figure 1. Riparian Health Score Comparison: Lobstick River Project Area and AB Provincial Average (1996 to 2014)

In September of 2014 and June of 2015, riparian health inventories were completed on ten sites within the Lobstick River project area. These sites represent approximately 6.7 km of river length and 16.7 ha of riparian area. Site selection was based on volunteer participation by landowners rather than randomized, representative sampling methods. Within the project area, four sites are on vacant crown land, two sites are on county land and four are on private land. Therefore, no land use, agriculture for the purposes of livestock grazing, and recreation are the primary land uses within the riparian areas inventoried.

Of the ten riparian sites inventoried/assessed, nine (90%) rate *healthy* and one (10%) rates *healthy but with problems.* No sites currently rate *unhealthy*. The average riparian health score for the project area is 87% (*healthy*), as shown in Figure 1, well above the Alberta provincial average[1].

Management recommendations for riparian areas are provided in Section 0 of this report and include maintaining and increasing the regeneration of tree/shrub communities; reducing browse utilization where it's manageable; monitoring and controlling disturbance-caused and invasive species; and maintaining minimal livestock and recreation access to mostly intact riverbanks.

This riparian health inventory was made possible by the support of the Alberta Conservation Association Grant Eligible Conservation Fund grant received by SACA/WCFA, Yellowhead County, Cows and Fish members and supporters, and individual landowners or land managers.

[1] Cows and Fish Riparian Health Inventory Data (1996 – 2014), based on 2,359 sites on 559 waterbodies in Alberta

1 BACKGROUND

1.1 *The Alberta Riparian Habitat Management Society - Cows and Fish*

Cows and Fish was formed in 1992 to foster a better understanding of how improvements in grazing management and other uses of riparian areas can enhance landscape health and productivity for the benefit of producers and others who use and value riparian areas. A key feature empowering Cows and Fish is the declaration of ownership of riparian issues in agricultural areas by cattle producers, other landowners and community groups.

1.2 *What Is A Riparian Area?*

Riparian areas are the portions of the landscape strongly influenced by water and are recognised by water-loving vegetation along rivers, streams, lakes, springs, ponds and seeps (Figure 2). Riparian areas can be described as the "green zones" around lakes and wetlands and bordering rivers and streams.

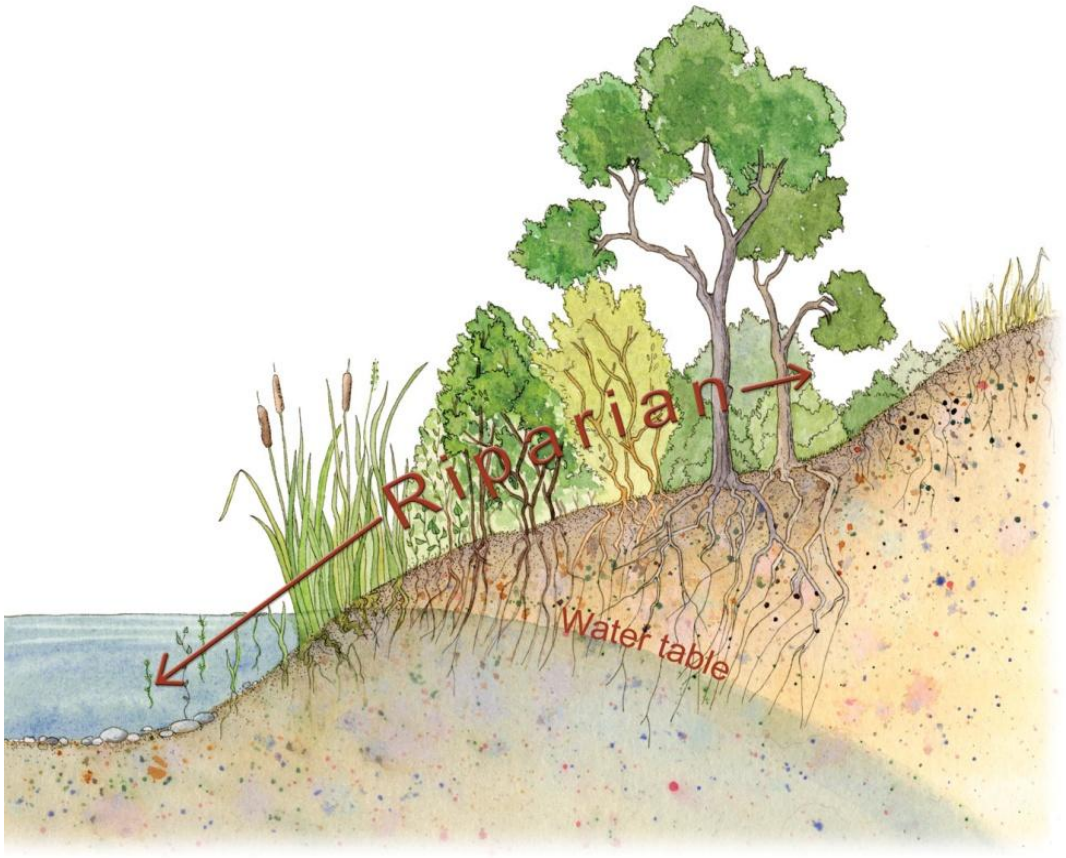

Figure 2. Diagrammatic Representation of a Riparian Area[2]

[2] Source: Fitch, L. and N. Ambrose 2003. Riparian Areas: A User's Guide to Health. Lethbridge, Alberta: Cows and Fish Program. ISBN No. 0-7785-2305-5.

1.3 *Why Are Healthy Riparian Areas Important?*

When in a properly functioning condition or *healthy* state, riparian areas sustain fish and wildlife populations, provide good water quality and stable water supplies, and support people on the landscape.

Important ecological functions performed by healthy riparian areas include trapping and storing sediment to maintain and build banks, recharging groundwater supplies, providing stable flows and flood protection, improving water quality by filtering runoff and reducing the amount of contaminants and nutrients reaching the water, and providing habitat for fish and wildlife, and shelter and forage for livestock. Maintaining healthy riparian areas is therefore important to the long-term sustainability of a healthy landscape.

1.4 *Why Assess Riparian Health?*

The intent of riparian health inventories is to provide a *state of the environment report* to the local community. Hopefully, this report will assist your community in making the best decisions on how to manage riparian range resources most effectively.

Combining this information with existing practical knowledge of rangeland resources will provide the best alternatives for sustaining healthy riparian areas within the Lobstick River project area. In general, this information helps landowners, land managers and local communities identify and effectively develop non-legislated or voluntary action plans to address specific riparian land use issues within local watersheds.

Assessing riparian health allows communities, landowners and professionals to:

- **Create awareness** amongst local landowners, land managers and their communities and build common understanding on riparian management issues in their watersheds.
- **Take action** by assisting local decision-makers develop strategies to find local solutions to address riparian land use issues.
- **Monitor progress** in improving, maintaining and protecting riparian health for agriculture operations and other properties and the watershed.
- **Identify environmental risk** and integrate into farm and ranch planning as well as planning for individual properties and watersheds.
- **Develop and maintain** range and riparian management plans for long-term productivity and ecological health.
- **Establish** benchmarks of riparian health from which change over time can be measured.

Working together on riparian management issues, including riparian health inventories, conveys a proactive message to the public. It shows that your community and the agricultural sector in general are taking steps to protect, maintain and improve the health of our landscapes and water supplies.

2 PROJECT DESCRIPTION

2.1 *Project Background*

The Lobstick River is located in west-central Alberta. It begins in the Lower Foothills natural sub-region near Niton Junction before entering Chip Lake. It then flows eastward past the community of Wildwood before joining the Pembina River near Evansburg/Entwhistle, which in turn flows into the Athabasca River. The Lobstick River downstream of Chip Lake is located within the Dry Mixedwood sub-region of the Boreal Forest natural region. The primary land use in the watershed is agriculture, along with recreation, acreage and sub-division development, and wildlife habitat.

Photo a: Lobstick River near Wildwood (2006). Cows and Fish, AERLLOB0013

In 2014 and 2015, Cows and Fish completed ten Riparian Health Inventories along the Lobstick River downsteam of Chip Lake. The work is spread over two years because the rapidly advancing fall and snow at the beginning of September of 2014 ended the field season early that year and work was postponed to the following year.

This project was initiated by the Stewardship Alliance for Conservation Agriculture (West Central Forage Association) and funded through the Alberta Conservation Association Grant Eligible Conservation Fund and Cows and Fish. Additional support was provided by Yellowhead County.

The following activities occurred in preparation for and during delivery of the project:

- Community members in the Lobstick River downstream of Chip Lake watershed were invited to attend an information meeting on June 9, 2014 at the Yellowhead County Wildwood office.
- Following this meeting, WCFA, Yellowhead County and Cows and Fish made phone calls to individuals to assess interest in participating in the riparian health inventory.
- Riparian Health Inventories were completed in September 2014 (2 sites) and June 2015 (8 sites).
- Data entry, analysis and reporting occurred between September 2014 and March 2015 as well as September 2015 and March 2016.

Landowners who participated in this project have each received detailed riparian health summary reports based on data that was collected on their lands in 2014 or 2015. This Lobstick River Project Area Summary Report does not contain site specific details in keeping with confidentiality agreements with these landowners. Instead, this report summarizes average riparian health conditions within the Lobstick River project area as a whole.

2.2 *Project Area and Site Selection*

The 2014-2015 Lobstick River project area, as shown in Figure 3, encompasses ten riparian sites with 6.7 km of channel length and a total area of approximately 16.7 ha (Figure 3. Lobstick River Project Area

).

Table 1. Lobstick River Project Area Description

Waterbody	# Landowners Contacted	# Landowners Participated	# Riparian Inventories	Stream Distance Inventoried (km)	Riparian Area Inventoried (ha)
Lobstick River	9	5	10	6.7	16.7

In Figure 3. Lobstick River Project Area

, the number of landowners contacted is different than the number of landowners who participatedin the project because this is a voluntary opportunity and three landowners were contacted but did not wish to participate and one gave permission to go onto his grazing lease but the access was limiting.

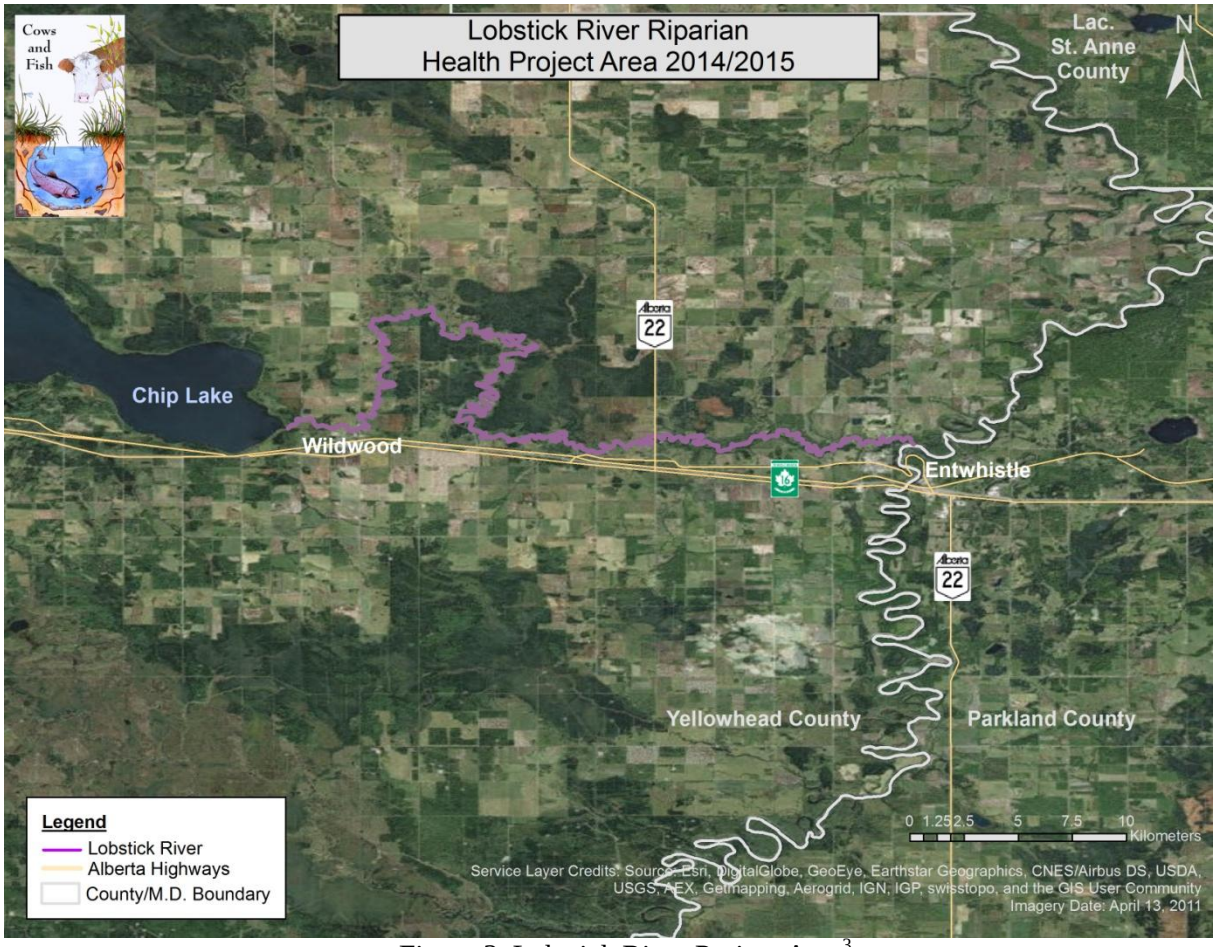

Figure 3. Lobstick River Project Area[3]

The Lobstick River project area was stratified using air photos (Google Earth) to find homogenous reaches based on valley, channel, vegetation, management and ownership characteristics. Every attempt was made to capture a representative sample within each reach, however it was difficult to find interested landowners to meet that goal. Therefore, site selection was done based on the willingness to participate on the part of private landowners or public land managers rather than a scientific, randomized selection of reaches. Riparian inventory sites, or polygons, were identified within each private or public landholding after one-on-one discussions with landowners and managers. Management practices, fence lines and topography constraints were taken into consideration when determining the upstream and downstream boundaries of the riparian health inventory sites.

[3] For confidentiality purposes, exact locations of the 2014-2015 RHIs are not shown on the above map. Purple highlighting is used to show the approximate extent of the project area, but it represents a greater stream length than was actually assessed.

Photo b: Riparian area along Lobstick River. *M. Laing, RHIP08LOB011*

3 RIPARIAN HEALTH INVENTORY METHODS

3.1 *Riparian Health Inventory*

Riparian health inventories provide comprehensive information about the diversity, structure and health of plant communities within the project area. The health inventory establishes an important baseline to compare to in the future, to keep track of whether riparian health is stable, improving or declining.

During a riparian health inventory, 79 health parameters are examined to provide comprehensive and detailed information on riparian function. For lotic large river systems such as the Lobstick River, an overall riparian health rating, as shown in
Table 2, is derived from eight vegetation and seven soil/hydrology parameters (i.e. key indicators of riparian function). A description of these parameters and how they are evaluated is given in Appendix D: Description Of Riparian Health Parameters For Large Rivers**.** By objectively examining each of these health parameters, we can determine where best to concentrate management efforts aimed at improving riparian health.

Table 2. Description of Riparian Health Ratings

Health Category	***Score Ranges***	***Description***
Healthy	*80-100%*	Little to no impairment to any riparian functions
Healthy but with problems	*60-79%*	Some impairment to riparian functions due to management or natural causes
Unhealthy	*<60%*	Severe impairment to riparian functions due to management or natural causes

3.2 *General Inventory Protocol*

Riparian health parameters are visually assessed by trained observers in the field. A health rating is derived from this field data using a computer software program (FileMaker Pro), in conjunction with field observations.

A hand-held eTrex20™ Global Positioning System (GPS) receiver is used to record the locations of the upstream and downstream ends of each site. For monitoring purposes, benchmark photographs looking upstream and downstream are taken at each end of all sites. Additional photographs are taken where warranted to document features of interest or concern (e.g. weed infestations, bank erosion, etc.). The lateral extent of the riparian area is subjectively determined in the field and mapped on an air photo[4] (1: 5,500 to 1: 9,000 scale).

On creeks and small rivers, both sides of the water body are inventoried as these generally have the same ownership and type of management. For large water bodies such as the Lobstick River, only one side is inventoried at a time because land ownership and management is typically different on either side of the river. Landmarks, such as fence lines, tributaries or other identifiable features, are

[4] Aerial photography was provided for the project by the Yellowhead County, Google Earth and Cows and Fish.

used, where possible, to delineate the ends of the site in order to facilitate monitoring the same section of stream in the future. Inventory sites encompass a minimum of two meander cycles. A complete meander cycle has equal inside and outside curvature.

3.3 *What Makes a Riparian Area "Healthy"*

Riparian areas are like a jigsaw puzzle; each individual piece or component of a riparian ecosystem is important to the successful function of the entire system. How the individual pieces function together affects the health of the riparian ecosystem including the stream, its watershed, and overall landscape health and productivity.

Healthy riparian areas have the following *pieces* intact and functioning properly:

- successful reproduction and establishment of seedling, sapling and mature trees and shrubs (if site has potential to grow them),
- lightly browsed trees and shrubs (by livestock or wildlife),
- floodplains and banks with abundant plant growth,
- banks with deep-rooted plant species (trees and shrubs),
- very few, if any, invasive weeds (e.g. Canada thistle),
- few disturbance-caused plant species (e.g. Kentucky bluegrass, dandelion),
- very little bare ground or altered banks,
- the ability to frequently (i.e. every few years) access a floodplain at least double the channel width,
- floodplain accessibility not restricted by berms or other human constructed embankments; and
- natural volume and timing of flows not controlled or altered by dam/weir structures and water removal or addition.

When riparian health degrades it usually means that one or more of the pieces has been impacted by natural or human-caused disturbances such as development, recreation, grazing, flooding or fire. As the rate and intensity of disturbance increases, the severity of health degradation can reach a point when the riparian area fails to perform its functions properly and becomes *unhealthy*. Riparian areas with moderate levels of impacts will typically fall within *the healthy but with problems* categor*y*, while those with very few or no impacts will normally be rated as *healthy*.

Note: Refer to Appendix A: Glossary of Terms ***for a Glossary of Terms used in this report***

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4 WHAT DID WE FIND?

4.1 Riparian Health Summary

Of the ten riparian sites inventoried in 2014/2015, nine sites (90%) rate *healthy* and one site (10%) rates *healthy but with problems* (Figure 4). No sites currently rate *unhealthy.* The average riparian health score for the project area is 87% (*healthy*). Refer to Appendix B: Lobstick River Project Area Riparian Health Score Sheet for details on the average riparian health for the project area by parameter as well as overall. Since we only inventoried a small proportion of the total length of the Lobstick River downstream of Chip Lake, this rating may not be representative of conditions for the greater Lobstick River system or the local watershed. It is also important to keep in mind that site selection for this project was not randomized, but instead relied on voluntary willingness to participate on the part of private landowners and managers taking the initiative to have us complete a riparian health inventory for them.

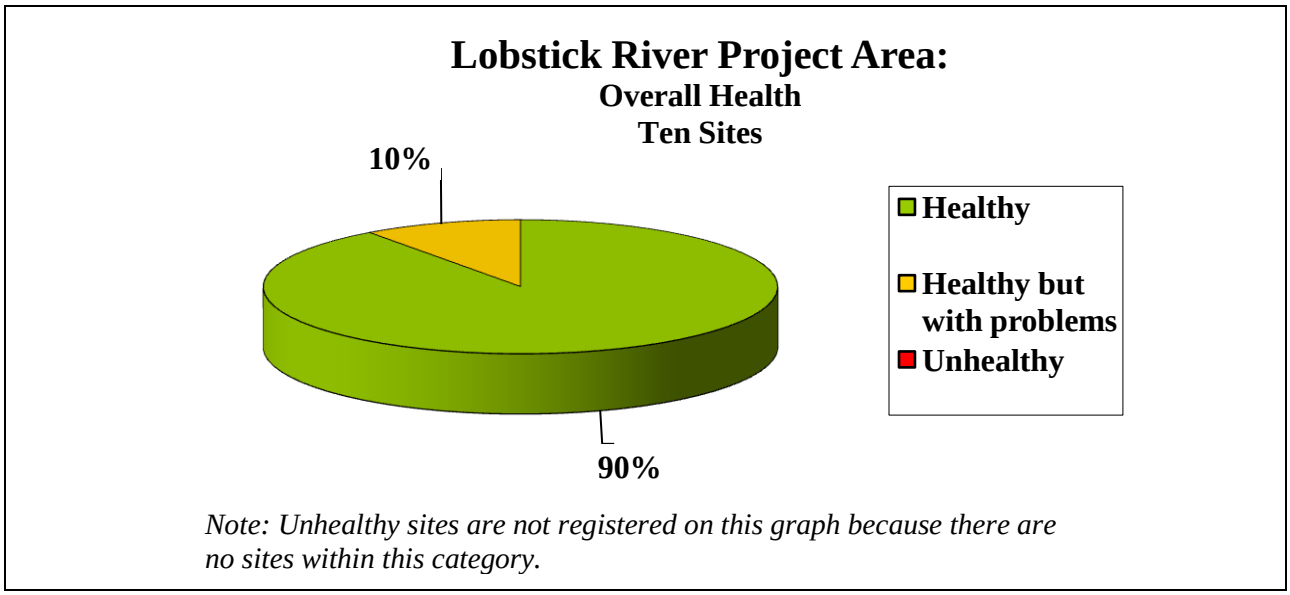


Figure 4. Lobstick River Project Area Riparian Health Score Results (based on ten sites)

Since riparian health inventory sites vary in size, the relative health of the project area based on the area assessed, compared to the number of sites assessed, may differ. For the ten sites evaluated in the Lobstick River project area, the average area-weighted riparian health rating is 86% (*healthy*), slightly lower than by number of sites. By area, approximately 14.6 ha of riparian habitat rates *healthy* and 2.2 ha is *healthy but with problems.* No area rates *unhealthy.*

Photos c – d (Page 13) provide examples of riparian sites along the Lobstick River.

Example of a riparian area along Lobstick River rated as *Healthy*

Photo c: The riparian area is well vegetated with a diversity of plant species and life forms. Structural alterations are minimal. *Photographer: K. England, RHIP01LOB003*

Example of a riparian area along Lobstick River rated as *Healthy but with Problems*

Photo d: This pasture area (left) within the riparian zone is lacking trees and shrubs but is still well vegetated with grasses. Closer to the river (right side of photo) the woody plant community potential is visible. *Photographer: M. Laing, RHIP04LOB009*

5 RIPARIAN HEALTH DISCUSSION

5.1 *Historic and Present Influences on Riparian Health*

The following discussion provides some insights on present and historical land use influences on riparian health conditions in the local watershed.

- **Grazing animals (including livestock and wildlife)** have primarily dominated land use in Alberta's riparian zones for hundreds of years. Prior to the introduction of cattle, bison provided the greatest seasonal grazing pressures on riparian areas within the project area. Currently, livestock grazing continues to be one of the land uses influencing riparian health along the Lobstick River and adjacent lands[5].

- **Beaver** have been building and modifying riparian areas for thousands of years. Beaver "manage" riparian areas with their extensive dams and through their harvest of trees and shrubs. Over long periods of time, productive, fertile stream and river valleys evolve under beaver management. Beaver dams can benefit landowners by storing water during periods of drought and by mitigating flood damage further downstream. Although beavers can cause problems by flooding roads and plugging culverts, various management tools such as pond levellers and culvert protectors now exist to mitigate these issues (for more information visit http://www.beaversolutions.com or www.cowsandfish.org/publications for the fact sheet An Overview of Beaver Management for Agricultural Producers - Decision Matrix Tool)**.** Additional information on the role of beaver with respect to riparian areas can be found in the fact sheet, *A Pond of Gold - Storing Water Naturally*, also available on the Cows and Fish website.

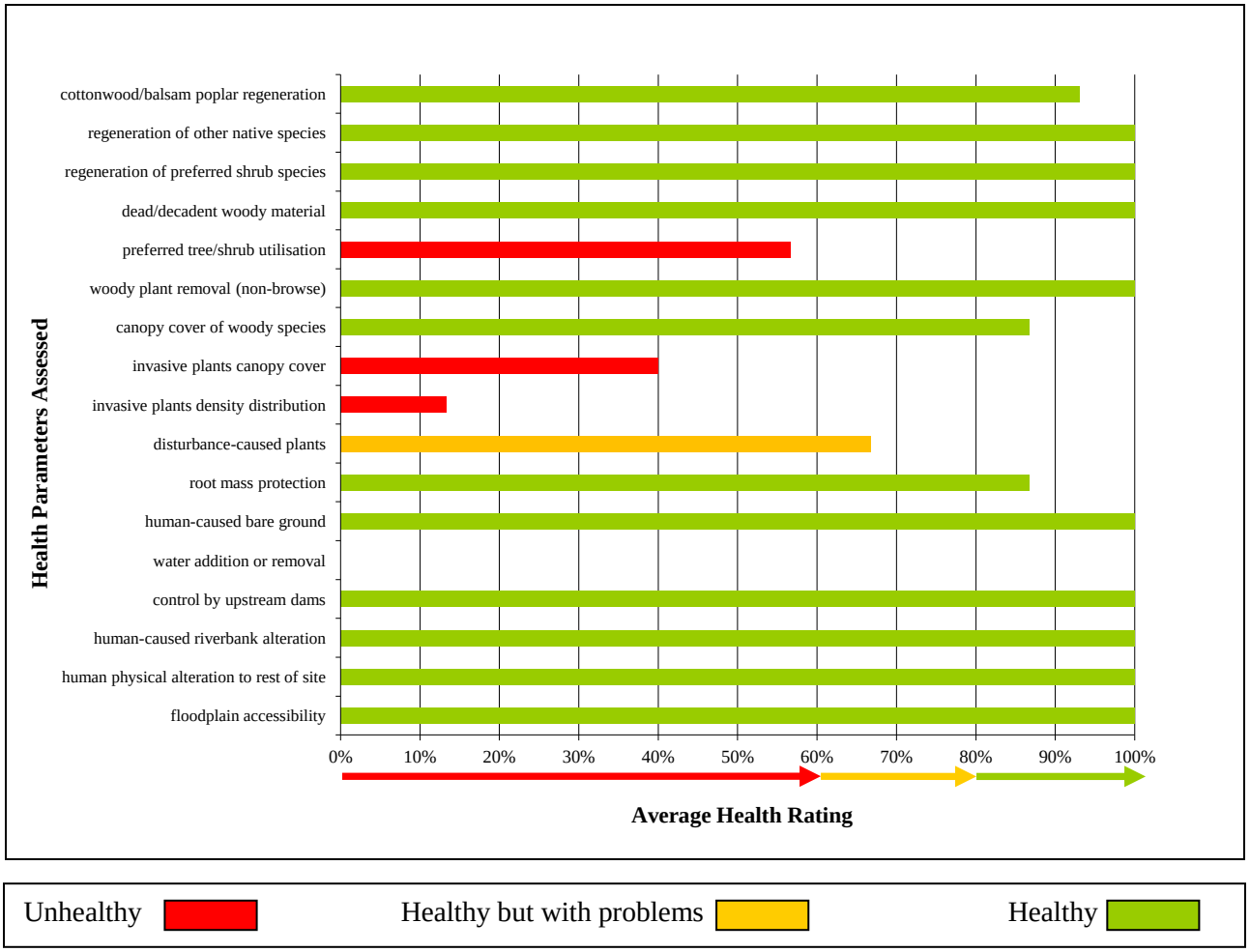
- **Availability and flow of water.** During our inventories (in September and June) it was observed that most sections of the river had abundant water and flow at this time of year. It is possible that there has been a change in current water available to the Lobstick River today due to land management changes (agricultural, residential, recreations and industrial, including roads) within the Lobstick River watershed over the past century. These impacts may have altered the natural dynamics of water flow and storage. The amount of water volume and flow that may be modified from addition or withdrawals could not be confirmed. However, the influence of any upstream dams or weirs on control of flood peak and timing is non-existent or minimal at best. Further studies of historic land management and current water manipulation may indicate the influence of changes on riparian health and stream dynamics.

- **Agricultural activities in the uplands.** Cropland cultivation and tame pasture 'improvements' are primarily located in the uplands beyond the riparian area. Within the sites we visited, there is some but not allot of agricultural activity in the riparian zone. Despite this, there is an increased presence of disturbance-caused undesirable and invasive plants within the riparian area. It would appear that in most instances, these species have encroached from the surrounding landscape and have not been planted on the floodplain. Generally plant species such as Kentucky bluegrass (*Poa pratensis*), smooth brome *(Bromus inermis*) and Canada thistle (*Cirsium arvense*) are thought to reduce long-term productivity of riparian systems.

[5] Based on aerial photo interpretation and observations from Cows and Fish field crews.

5.2 *A Closer Look at the "Pieces"*

To better understand the overall health rating for the project area, it is helpful to take a closer look at which pieces of the riparian area are intact and functioning and which area not. Figure 5 provides an overview of the health ratings for each of the riparian health parameters that were assessed. The overall project area rates as *healthy* with an average score of 87%. There are impacts to riparian vegetation health some of which have resulted from long-term livestock grazing and/or encroachment of invasive and disturbance plant species into the riparian area.



Note: Water addition or removal does not register on this graph because data was not available to determine score therefore it is not collected (NC).

Figure 5. Breakdown of Riparian Health Parameter Ratings for the Lobstick River Project Area (based on ten sites)

Collectively, the vegetation parameters in the project area rate on average as *healthy but with problems* (76%). Riparian areas are well vegetated with a diversity of plant species. Refer to Appendix C: Riparian Plant Inventory Lobstick River for a list of all plants found in the Lobstick River project area. Detracting from the vegetative health of riparian areas is moderate utilization of preferred trees and shrubs, as well as a high proportion of disturbance-caused grasses and forbs and invasive species.

Soil/hydrology parameters in the project area, collectively rate on average as *healthy* (98%). Human-caused bare ground is limited in most areas and water is not confined to the channel during high flows. To our knowledge there are no major upstream dams in the watershed that are affecting the peak flow volume and timing which is critical for biological and physical processes to progress unhindered. Plants with sufficient root mass to protect banks from erosion are abundant in the majority of sites. All sites have minimal alterations to the riverbank and adjacent riparian area. The unknown factor related to hydrology of the Lobstick River is the amount of water that may be removed or added compared to what is needed for natural flows. This could not be confirmed prior to completion of this report so could not be factored into the health score.

5.3 *Riparian Plant Communities*

The vegetation health rating for a riparian area is influenced by the types of riparian plant communities present, and the health of both the woody and non-woody (herbaceous) plant components (refer to Sections 5.4 and 5.5).

Background Information on Riparian Plant Communities

Typically, a particular species of willow or other shrub will form the understory of a poplar, cottonwood or spruce community, within a riparian area. On smaller systems willows might be the dominant plant in the upper canopy with sedges and smaller shrubs forming the understory. These different combinations of plants occupying the same ecological niche are referred to as the *potential natural community*. The potential natural community is comprised of **habitat types** and **community types**. Habitat types have the potential to support 'climax plant communities' or, final state plant communities that are self-perpetuating and in dynamic equilibrium with their environment. Community types have the potential to support 'seral plant communities', or interim plant communities that are replaced by another community or species as succession progresses. Using this classification system, all the plant communities within the project area, were identified and classified.

Understanding the type of riparian plant communities a stream, river, lake, or wetland system has the potential to grow is important for a number of reasons. Firstly, it allows land managers to know if the desired plant communities are growing there already and if not, why not? How extensive should the plant communities be? Secondly, it provides insight into the feasibility of improving existing site conditions and recovering desired and healthier plant communities, if the desired plant community does not exist or is limited. Knowing how far existing plant communities are from the potential natural community of the riparian area allows managers to:

i. set realistic goals to either improve or maintain existing riparian health,
ii. understand how long recovery may take if improvement is needed, and
iii. obtain insight into what management strategies need to be implemented for improvement to occur or to maintain existing riparian health.

A well-known stockman, A.E. Cross, once stated, "Look after the grass, and the grass will look after you." If there is one thing a land manager, landowner or community can do to improve riparian health, it is to keep riparian plant communities healthy by using sustainable management strategies and land use practices.

Photo e. Riparian area along Lobstick River. *K. England, RHIP08LOB012*

Lobstick River Project Area Riparian Plant Communities

Shrub and herbaceous (non-woody) communities form a large portion of riparian communities found in the Lobstick River project area (Table 3). Approximately 64% of the project area is occupied by naturally occurring *habitat types*, while the remainder of the project area is occupied by seral or interim plant communities (*community types*) and two unclassified types.

A diverse woody plant community, including trees and shrubs, provides stability to the riverbank and shelter and forage for livestock and wildlife. Balsam poplar (*Populus balsamifera*) trees are particularly important indicators of riparian health on river systems in this region for deep binding root mass and wildlife habitat. The cover of balsam poplar community types throughout the project area is approximately 17%, highest of all tree types. Overall, native tree communities make up approximately 28% of the project area (of which 4% includes aspen (*Populus tremuloides*) and 4% is white spruce/low-bush cranberry (*Picea glauca/Viburnum edule*). An indicator of a healthy shrub understory is the presence of willows (*Salix* species) and red-osier dogwood (*Cornus stolonifera*), two highly palatable shrub species. Native shrub communities (primarily willow types) make up about 39% of the project area.

Native herbaceous species (e.g. sedges [*Carex* species] and reed canary grass [*Phalaris arundinacea*]) also exhibit deep binding root characteristics to help stabilise the riverbanks, although not to the same extent of shrubs and trees. Native herbaceous communities comprise about 41% of the project area. The dominant non-woody type is reed canary grass (Photo f) occupying 32% of the project area and having a present on nine out of 10 sites (90%). Although considered a native plant, reed canary grass can be an introduced plant community, [with a highly invasive nature] in the Parkland and Boreal Forest Natural Subregions[6]. The sites along the Lobstick included in this project area are relatively undisturbed and although livestock grazing and pasture are present in the watershed, the establishment of non-native disturbance-caused plant communities, primarily Kentucky bluegrass, in the riparian area is minimal and only represents approximately 1% of the project area. The retention of native riparian habitat has positive impacts on riparian health with high biodiversity, and abundance of trees and shrubs which promote bank stability, decrease erosion, and increase habitat structure and food sources for fish and wildlife.

[6] Thompson, W. and P. Hansen. 2003. Classification and Management of Riparian and Wetland Sites of Alberta's Parkland Natural Region and Dry Mixedwood Natural Subregion. Bitterroot Restoration, Inc. Prepared for the Alberta Riparian Habitat Management Society (Cows and Fish), Lethbridge, Alberta. 340 pp.

Table 3. Lobstick River Project Area Riparian Plant Communities

Plant Community[7]	*Classification**	*Area Occupied (ha)*	*Area Occupied (%)*
Tree Communities			
balsam poplar /red-osier dogwood	Community Type	2.7	16.1
white spruce/low-bush cranberry	Habitat Type	0.7	4.2
aspen/low-bush cranberry	Community Type	0.5	3.1
white birch	Community Type	0.4	2.3
balsam poplar	Community Type	0.2	1.3
aspen/red-osier dogwood	Habitat Type	0.1	0.7
	Tree Total	**4.7**	**27.9**
Shrub Communities			
yellow willow/ red-osier dogwood	Habitat Type	2.6	15.3
beaked willow	Community Type	1.2	6.9
beaked willow / red-osier dogwood	Habitat Type	0.5	2.9
beaked willow / awned sedge	Habitat Type	0.5	2.7
prickly rose	Community Type	0.3	2.1
sandbar willow	Community Type	0.2	1.1
river alder	Community Type	0.2	1.0
flat-leaved willow/ red-osier dogwood	Habitat Type	0.1	0.7
red-osier dogwood	Community Type	0.1	0.5
basket willow/ awned sedge	Habitat Type	0.04	0.3
unclassified wetland type		0.1	0.7
	Shrub Total	**5.7**	**38.7**
Herbaceous Communities			
reed canary grass	Habitat Type	5.3	31.5
unclassified wetland type		0.8	4.6
bluejoint (marsh reed grass)	Habitat Type	0.5	2.7
awned sedge	Habitat Type	0.2	0.9
Kentucky bluegrass	Community Type	0.2	0.9
common cattail	Habitat Type	0.1	0.4
	Herbaceous Total	**6.9**	**40.9%**

* "Unclassified" plant communities refer to those types that are not described in the 2012 ESRD range plant community guide[8] or by Thompson and Hansen 2003.

[7] The *Riparian Classification for the Parkland and Dry Mixedwood Natural Region* (Thompson and Hansen, July 2003) was used to classify the riparian plant communities along Lobstick River.

[8] Moisey, D., J. Young, D. Lawrence, C. Stone, M. Willoughby. 2012. *Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions of Alberta (7th Approximation).* Alberta Sustainable Resource Development, Public Lands and Forests. http://esrd.alberta.ca/lands-forests/grazing-range-management/documents/DryCentralMixedwoodRangePlantTypes-2012.pdf).

5.4 *Woody Plants - Trees and Shrubs: Presence, Reproduction and Health*

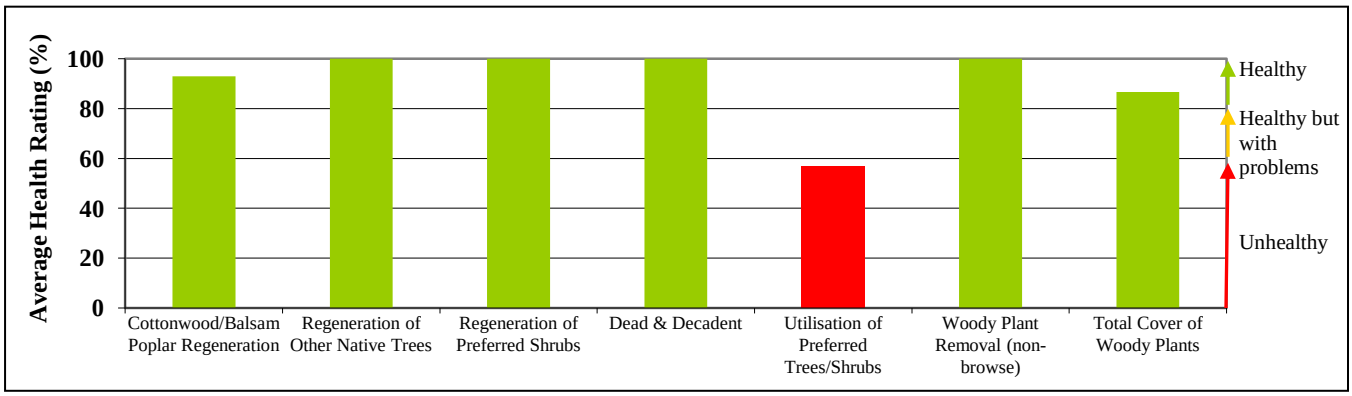


Figure 6. Lobstick River Project Area Woody Plant Parameters Health Ratings

Presence

Balsam poplar is a particularly important indicator of riparian health on river systems, as these trees provide stability to the riverbank. The presence of many different native tree and shrub species is often a good indicator of habitat structure and biodiversity. A diversity of plants provides low, medium, and tall habitat layers, benefiting wildlife and livestock. See Appendix C: Riparian Plant Inventory Lobstick Riverfor a list of all plant species observed.

- Balsam poplar covers approximately 19% (3.2 ha) of the riparian area and is present on all sites.
- In addition to balsam poplar, four other tree species and 33 shrub species were recorded within the Lobstick River project area. With the exception of one unknown shrub and two introduced shrubs (caragana [*Caragana arborescens*] and lilac [*Syringia* spp.]), these are all native tree and shrub species
- The combined canopy of trees and shrubs covers approximately 59% (9.9 ha) of the project area.
- Balsam poplar is the dominant tree in the project area. The other native trees are white birch (*Betula papyrifera*), aspen, white spruce, and lodgepole pine (*Pinus contorta*), all with less than 2% cover of the project area. White birch and aspen are also found on all sites, with white spruce on nine out of ten sites, and lodgepole pine on one site.
- Dominant shrubs (with ≥10% cover of the project area) are red-osier dogwood, and shining willow (*Salix lucida*). Other shrubs occupying 5-10% of the project area include river alder (*Aluns tenufolia*), prickly rose (*Rosa acicularis*), wild red raspberry (*Rubus ideaus*), buckbrush/snowberry (*Symphoricarpos occidentalis*), yellow willow (*Salix lutea*) and beaked willow (*Salix bebbiana*), listed in order of decreasing abundance.
- Eleven of the shrubs recorded are willow species and many others, such as saskatoon (*Amelanchier alnifolia),* are indicative of moist, nutrient rich habitats.

Reproduction

A good indicator of the ecological stability of a riparian reach is the presence of woody plants in all age classes, especially young as shown in Photo g. To maintain age class structure, at least 15% of

the balsam poplar cover should be established seedlings and saplings. Eight out of the ten sites inventoried (80%) exceeded this criterion (>15% cover). The other two sites (20%) have 5% to 15% cover from the younger age classes. For non-balsam poplar species and preferred shrubs, at least 5% cover should be from seedlings and saplings. Regeneration of other native trees and **preferred**[9] shrubs is occurring at all sites (Figure 6).

Health

Existing tree and shrub communities show normal amounts of dead and decadent branches in the upper canopy. This indicates there is sufficient moisture within the system, and that disease is not a problem in maintaining these communities.

In seven of ten sites (70%), preferred trees and shrubs are receiving *light* browse pressure (5% to 25% of the second year and older leaders are browsed) from livestock and/or wildlife. Woody plants can sustain low levels of use, but increased browsing can deplete root reserves and inhibit establishment and regeneration. The remaining three sites (30%) display signs of *moderate* browse pressure, which is characterised by *umbrella-shaped* or *flat-topped* plant growth forms.

Other removal of woody vegetation, related to activities not limited to human cutting, clearing or beaver use, is minimal, with all sites showing 0% to 5%) recent signs of this type of removal (Figure 6). The Lobstick River appears to be able to sustainably support beavers on the landscape and the existing forested cover should allow for beaver and riparian health to remain compatible into the future. Willows and balsam poplar readily sucker and re-grow following beaver use. As discussed in the Historical and Present Influences on Riparian Health section, beavers are a natural component of the Lobstick River watershed and can have beneficial ecological effects such as buffering flood impacts and raising the water table locally. By altering soil moisture conditions, beavers can also be an asset for restoration of degraded or altered riparian habitat.

How the Health of Trees and Shrubs Could Be Improved

- Reduce browse pressure on shrubs. Trees and shrubs considered preferred in terms of riparian health also tend to be those that are most palatable to livestock (e.g. red-osier dogwood). Woody plants are typically most susceptible to being browsed by livestock and wildlife in the fall and winter after grasses have matured, or in spring before grass growth begins.
- Provide rest from grazing and other disturbances to ensure seedling and sapling tree and shrub communities have time to establish and mature.
- Planting balsam poplar and other native tree and shrub species also has the potential to enhance and promote further regeneration of the woody plant community.
- Avoid any new clearing of trees and shrubs in the riparian area.

[9] Not all trees and shrubs are equally important, useful or desirable for maintaining ecological function. Only those that contribute most beneficially to riparian condition and stability are considered in evaluating establishment and regeneration. See Appendix C for further explanation and a list of excluded species.

5.5 *Non-Woody Plants: Diversity and Health*

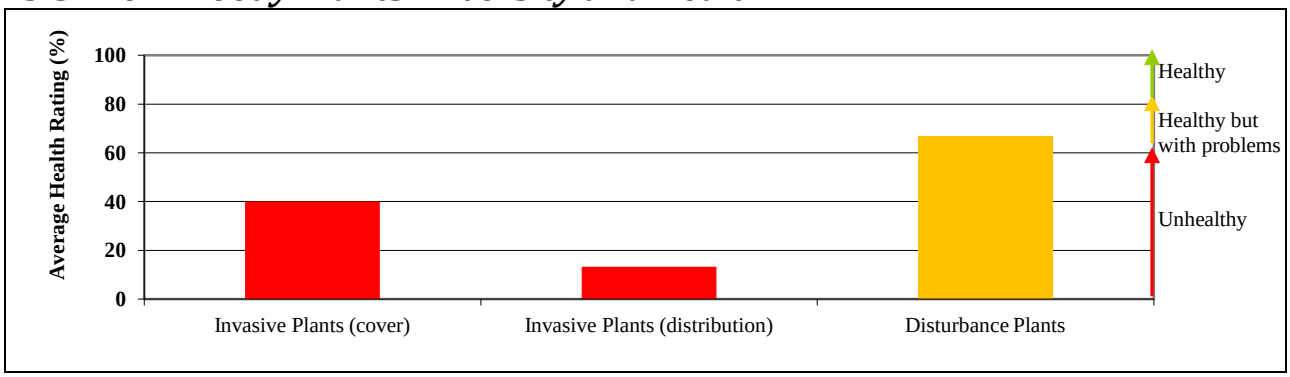


Figure 7. Lobstick River Project Area Invasive and Disturbance-Caused Plant Parameters Health Ratings

Diversity

Greater native plant species diversity lends to more robust and steady productivity over the long term and enhanced resilience to changes in the environment. An abundance of diversity in plant species occurs in the Lobstick River project area:

- 30 unique species of grasses and grass-like plants and 84 unique species of broad leafed plants (forbs) were recorded (Appendix C: Riparian Plant Inventory Lobstick River). Of these, 77% (88 species) are native plants. Having evolved in the area for thousands of years, native plant species are well adapted to local climatic fluctuations, soil conditions, pollinators, and predator or disease stresses.
- Four plants with poisonous properties were recorded in the project area: common horsetail (*Equisetum arvense*), red and white baneberry (*Actaea rubra*), common tansy (*Tanacetum vulgare*) and water hemlock (*Cicuta maculata*). These plants were only found in trace amounts and do **not** pose a management concern. However, avoiding early summer grazing of riparian areas with water hemlock should be considered as the risk can increase because other palatable forage has yet to emerge. With the exception of common tansy, which is invasive, the remaining three plants are native, naturally occurring components of the riparian habitat.

Health

Disturbance-caused undesirable herbaceous species and invasive species are prevalent throughout the Lobstick River project area (

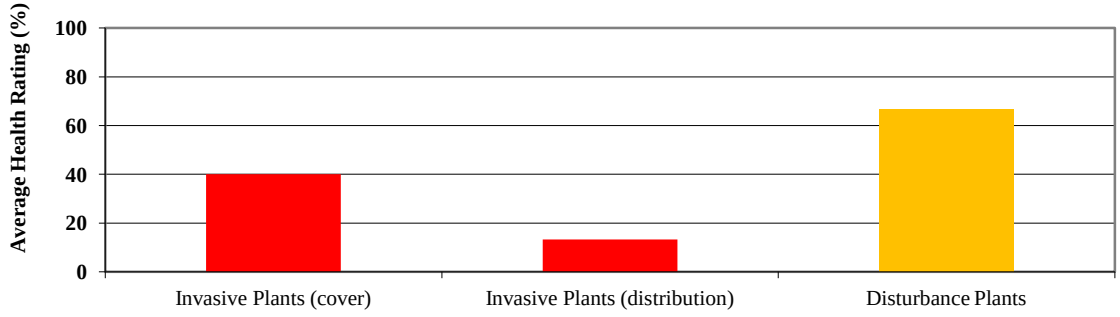


Figure **7**). Disturbance-caused plants are typically non-native grasses and forbs that aggressively displace native plants once the soil surface has been disturbed. Invasive plants are those that are listed by the *Weed Control Act of Alberta* as **prohibited noxious** or **noxious** weeds, as well as some

additional species identified by Cows and Fish to be invasive within riparian areas. They are non-native species that spread rapidly and are difficult to control. Disturbance and invasive plants typically do not have a deep, binding root mass and therefore do not provide bank, shore and soil protection as well as other native species.

- Three of ten sites have 25% to 50% of the riparian area covered in disturbance-caused undesirable herbaceous species, while the four sites have 5% to 25% cover of these species and three sites have less than 5% cover of disturbance-caused species. Combined, disturbance-caused species cover approximately 19% of the project area and can be indicative of long-term livestock grazing impacts or encroachment from adjacent agricultural land uses.
- Of the 15 disturbance-caused plant species present, the most prevalent are smooth brome (*Bromus inermis*) (14% cover of project area), Kentucky bluegrass (4% cover of project area), timothy (*Phleum pratense*) and quack grass (*Agropyron repens*)[10] with 3% and 2% cover of the project area respectively. Although these plants do provide forage for livestock, compared to native sedges and shrubs, they do not provide adequate amounts of deeply binding rootmass. Riverbanks with only disturbance-caused plant cover are therefore highly susceptible to erosion.
- **The prevalence of invasive plants is a concern.** Six ***noxious*** weed species were found: Canada thistle, perennial sow-thistle (*Sonchus arvensis)*, common tansy, ox-eye daisy (*Chrysthanemum leucanthemum*), smooth perennial sow-thistle (*Sonchus arvenis spp. uliginosus*) and tall buttercup (*Ranunculus acris*). Canada thistle occurs in all ten sites and has the highest overall canopy cover in the project area at 2%. Perennial sow thistle was found in eight sites and covers 0.4% of the project area. The distribution of Canada thistle ranges from a single patch plus a few sporadically occurring plants to a few patches plus several sporadically occurring plants. Most sites fall into the latter category. Tall buttercup was found in seven sites and covers 0.4% of the project area. Tufted vetch (Photo h), evaluated as an invasive species though not yet listed by the Alberta Weed Act, is found on 3 of the sites but covers 6.2% of the total area. Its distribution on two of those sites is a few patches plus several sporadically occurring individual plants, and on the other is a continuous occurrence of plants with a few gaps in the distribution. This is summarized in Table 4.

Table 4. Lobstick River Project Area Invasive Plant Summary

		Plant Status				
Lifeform	Species	Riparian Health	Regulated	Constancy*	Percent of Project Area	Density/ Distribution Class Range
Forb	Canada thistle	invasive	noxious	10/10 (100%)	1.6%	4 to 8
	tall buttercup	invasive	noxious	7/10 (70%)	0.4%	1 to 6
	perennial sow-thistle	invasive	noxious	8/10 (80%)	0.4%	1 to 8
	ox-eye daisy	invasive	noxious	2/10 (20%)	0.1%	3,8
	smooth perennial sow-thistle	invasive	noxious	2/10 (20%)	0.1%	4,8

[10] Kentucky bluegrass, smooth brome and timothy are tame or introduced species that have invaded many rangelands over the past decades. Opinions vary on how these grasses should be viewed in terms of contributing to riparian or pasture health but generally are thought to reduce long-term productivity. For the purpose of this assessment, points were subtracted for the presence of these non-native species.

	common tansy	invasive	noxious	1/10 (10%)	0.04%	4
	tufted vetch	invasive	not listed but on watch list	3/10 (30%)	6.2%	8,11
Shrub	common caragana	invasive	not listed	1/10 (10%)	0.7%	8

* Constancy is the number of times the species occurs divided by the total number of sites

Of note, caraway (*Carum carvi*) was found on four of the ten sites with a cover of 0.2% of the project area. This species is not listed as invasive by Cows and Fish or regulated by the Alberta Weed Act but is of interest as it seems to be expanding across the province.

How the Health of Non-Woody Plants Could Be Improved

- **Prevent an increase in disturbance-caused plants.** Complete elimination of disturbance-caused plants is not realistic. Instead, the best approach is to maintain the health of native plant communities and minimize new ground disturbance from vehicles, livestock or people.
- **Monitor and control invasive plants.** Landowners and managers are encouraged to work closely on this in collaboration with Yellowhead County and the Alberta Invasive Species Council (https://www.abinvasives.ca/) to review invasive plant identification and control measures. Minimizing ground disturbance will help reduce potential for weeds to spread. Each participating landowner has been provided with details on weed species abundance and distribution specific to their riparian site.
- **Determine stocking rates for riparian pastures, where applicable, based on plant communities.** Landowners are encouraged to refer to ESRD's Dry and Central Mixedwood Range Plant Community Guide to determine appropriate ecologically sustainable stocking rates for the riparian plant communities in their landholdings (http://esrd.alberta.ca/lands-forests/grazing-range-management/documents/DryCentralMixedwoodRangePlantTypes-2012.pdf). Riparian plant communities in the project area vary greatly in their forage productivity potential and/or suitability for cattle grazing.

Where Efforts Could Be Focused

Achieving the above goals requires ensuring plant communities have enough rest from grazing and other uses during the growing season to reduce the amount of bare ground and to allow native plants to out-compete disturbance-caused and invasive plants for nutrients and water. A combination of weed control measures and grazing strategies that consider distribution, timing and stocking rates will be required.

Vegetative health parameter photos

K. England, RHIP09LOB003

Photo f: Reed canary grass is present in almost all sites and has the highest cover of all grasses in the riparian project area. Reed canary grass has deep, binding roots and can help stabilise riverbanks; however, its competitive nature may suppress woody growth.

M. Laing, RHIP08LOB011

Photo g: Most of the balsam poplar in the riparian area is seedlings and saplings (foreground). Other native trees are also present (e.g. aspen and white spruce).

M. Laing, RHIP03LOB010

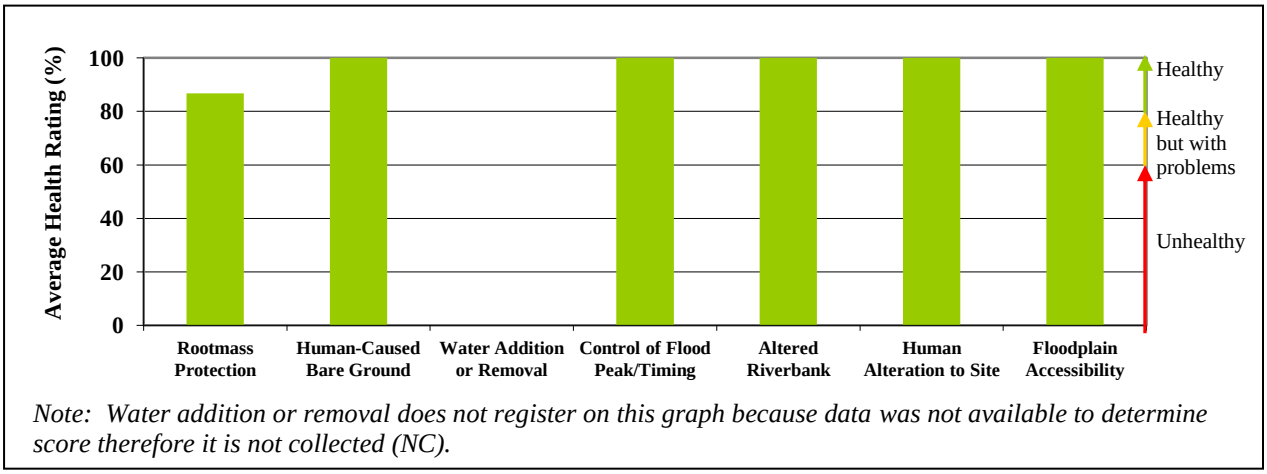
Photo h. Tufted vetch (or cow vetch), an invasive plant, is present on three sites. This invasive plant accounts for 6.2% of the vegetation cover in the project area.

www.albertawow.com/wildflowers/alberta_wildflowers

www.cerealcentral.ca/PDFs/a-field-guide-to-broadleaf-weeds

Tufted Vetch. The flower of tufted vetch is bluish-purple with all of the flowers crowded on one side of the stem. The plant is hairy, with climbing tendrils, and alternate leaves.

5.6 *Riverbanks and Floodplain Soil/Hydrology Health*



Note: Water addition or removal does not register on this graph because data was not available to determine score therefore it is not collected (NC).

Figure 8. Lobstick River Project Area Soil and Hydrology Parameters Health Ratings

Riverbank Stability and Root Mass Protection

Deeply rooted riverbank vegetation such as sedges, willows and balsam poplar helps maintain the integrity and structure of the bank by dissipating energy, resisting erosion and trapping sediment to build and restore banks. Healthy, well vegetated riparian areas slow the rate of erosion and balance erosion in one spot with bank increases through deposition elsewhere. If unstable banks are occasional, limited to a few outside meander bends, and the banks revegetate within a year, erosion rates are considered normal. Most of the bank length inventoried along the Lobstick River has excellent amounts of deep, binding root mass; however, there is increased risk of erosion where the deep binding rootmass is lacking.

- Riverbank rootmass protection is greater than 85% on seven of the ten sites, which is excellent.
- Two sites have 66-85% of the bank protected by vegetation with deep and binding roots which is good. One site has 35-65% deep binding rootmass protection which is fair.
- Often, where deep binding roots are lacking the tree and shrub community is reduced and a river the size of the Lobstick River needs those trees and shrubs for the best protection from erosion. However, except on the steepest outside banks, there is still some native grasses and sedges which offer some protection at the lower floodplain elevation.
- Some of the outside bends are naturally steep with active lateral cutting and therefore there is no vegetation along the bank; these are areas that do not have deep binding root mass. However, in most cases the tops of the banks remain well forested

K. EnglandRHIP10LOB006

Photo l: Unstable eroding banks (on left) need the deep binding roots of the trees along the top of the bank. Most sites have greater than 85% of their bank length with deep binding rootmass.

J. Melsted, RHIP05LOB014

Photo m: The channel is well defined and substrate diverse, where it is visible. In some places bed rock can be seen, and in other places it is too deep to see the channel bed.

Bare Ground

Bare ground is unprotected soil that is capable of being eroded by rain drops, overland flow or wind. Bare ground in riparian areas is often attributed to natural processes, such as sediment deposition from recent flood events. Bare ground can also result from activities like vehicle traffic, livestock hoof shear and trailing, recreational trails, timber harvest, and landscaping (Photo j). Areas of natural or human-caused bare ground are susceptible to weedy species encroachment.

- The total amount of bare ground in the project area is minimal (Figure 8), approximately 0.5%. Of this, approximately 32.5% is due to human causes, such as livestock trailing and trampling, and construction.
- Nine of the ten sites have trace amounts of bare soil. The remaining site did not have any bare ground.

K. England, RHIP01LOB013

Photo j: Bare ground from human activities such as trails is minimal in the project area but where they are present they pose a risk for erosion and establishment of disturbance and invasive plants.

J. Melsted, RHIP05LOB002

Photo k: Riprap is an example of a structural alteration to the bank and floodplain. This is not widespread in the project area but is present at some bridge crossings.

Alterations to the Riverbank and Floodplain

When a riverbank is physically altered erosion can increase, mobilizing channel and bank materials. This can degrade water quality and increase bank instability within the reach and downstream. A key function of riparian areas is to have abundant plants that filter and trap sediments. This builds a soil layer of moist, fine-textured material. Associated with this, roots and underground fauna create soil structure and macropores that allow water infiltration and storage. These types of soils are very susceptible to vehicle traffic, hoof action and compaction.

Riverbank alterations:

- Riverbanks were visible at all sites so the amount of bank length altered could be assessed.
- Alterations from human activities impact approximately 0.3% (0.02 km) of the length of riverbank.
- Of all ten sites, five have no alterations and the other five have less than 1% of the riverbank altered. Where the alterations are present, they are due to recreation (wooden stairs for access), grazing (trampling, trailing), bank stabilisation (riprap), and construction.

Floodplain alterations:

- All ten sites have less than 5% of the site (excluding riverbanks) physically altered by human causes. Of those, six have none and the other four have less than 1% of the area altered.
- Overall, about 0.2% (0.04 ha) of the project area has human caused alterations beyond the riverbank. Soil compaction, topographic change and roads from grazing, recreation and construction account for the alterations in localised areas. Otherwise the floodplain is intact.

Floodplain accessibility

Many of the most important riparian functions of a riparian ecosystem depend on the ability of the channel to access it's floodplain during high flows. Levees and other human constructed embankments such as road beds can restrict this access.

- Most of the sites we visited on the Lobstick River downstream of Chip Lake do not have any man-made berms, levees or embankments therefore floodplain accessibility is unrestricted and more than 85% of the floodplain is accessible to flood flows at these locations. One site directly downstream of a road does have a small portion of the floodplain access restricted by the bridge embankment and riprap but it is less than 15% o f the site.

Changes to Flow Volume by Dewatering or Additions and Control of Flood Peak and Timing

Proper functioning of any riparian ecosystem depends up on the system supply of water. The degree to which this supply is artificially manipulated by removal or addition from/to the system is directly reflected in a reduction of riparian functions (e.g. wetland plant community maintenance, channel bank stability, wildlife habitat, and overall system primary productivity. Riparian ecosystems are also affected by human-constructed dams because they change the volume and timing of annual peak flows which are determined by the watershed water yield and variability of the local climate.

Removal or Addition of Water from/to the River System:

- The amount of removal or addition of water from/to the river system could not be confirmed. The degree of artificial manipulation to the water supply of the river system, through changes in water volume can affect riparian plant communities, bank stability, wildlife habitat and overall system primary production. There are numerous approvals for removal and use of the water from the Lobstick River and within the watershed[11], but the proportion of the annual flow impacted is unknown. Because the amount of water removed from, or added to, the river at this location has not been formally calculated, we could not confirm the degree of change to water volume. As a result, this parameter is not included in the score.

Control of Flood Peak and Timing by Upstream Dams:

- All ten sites rate *healthy* for this parameter because the Lobstick River watershed is not controlled by any "major" dams. This is based on some basic online research and conversations with local residents and partners including Alberta Environment and Parks (Personal Communication 2015)[12]. Also field observations limited to the riparian areas we inventoried and road access at bridge crossings downstream of Chip Lake did not show any dams or weirs. There may be smaller weirs upstream of the lake or on tributaries that do not register or are not registered with Alberta Environment and Parks but further information and ground truthing is needed to be certain.

How Health of Riverbanks and Floodplains Could Be Improved or Maintained

- ***Continue to minimise livestock and other human activities along the riverbank and within the active floodplain***. This will allow any structurally altered and damaged areas time to heal. Altered portions of the riverbank will recover naturally if given rest from disturbance. Promoting minimal disturbance will increase deep-rooted woody plants, which will help trap sediment to rebuild riverbanks, and protect against lateral cutting and erosion. Providing rest, especially during the sensitive portions of the growing season such as early spring, will also help promote natural recovery.
- ***Maintain and protect riparian buffers and minimize ground disturbance in the riverbank and floodplain from human activities (e.g. trails).*** To maintain riverbank integrity, water quality and riparian health, it is important to limit further ground disturbance to the bank and floodplain (including avoiding clearing of riparian plants). Where possible, riparian buffers should be maintained to continue to offer protection to the riparian area.

[11] Ahmad Asnaashari, Regional Hydrologist, Alberta Environment and Parks. Personal communication via email on March 10, 2016.

[12] Ahmad Asnaashari, Regional Hydrologist, Alberta Environment and Parks. Personal communication via email on March 2, 2016.

6 THE NEXT STEPS

6.1 *Community and Individual Action*

- ***Take stock of current and past conditions.*** The first step in addressing riparian management issues has been made; the collection of baseline information on riparian health and a review of historical land use practices have answered the question ***"Where are we now?"***

- ***Highlight and profile what is working on the landscape right now.*** The next step is to use this knowledge, along with the application of sound range and riparian management techniques, towards the restoration of riparian health. By working with landowners wanting to improve riparian health, practical examples of proper riparian management can be demonstrated to other landowners and communities. Landowners already managing healthy riparian areas in the area can be profiled, meaning their "good news" stories can be shared with others to speed up our knowledge of what works. As these sites yield results, the landowners of the Lobstick River project area will be closer to answering the question ***"Where do we want to go?"***

- ***Take control of the reins.*** Each landowner that participated in this riparian health inventory project has received a riparian health report for their landholding indicating what pieces of riparian health are intact and what pieces might be missing. Within these reports are some basic management principles specific to their riparian pastures, providing insight into the question ***"How do we get there?"***

- ***Continue riparian inventory work over the long-term.*** Monitor progress of community and individual effort to address riparian land use issues. With the application of sound range management principles on an individual and watershed basis, it is inevitable that the trend in riparian health will be positive over time. Long-term riparian monitoring and refinement in management will answer the question ***"Did we make it?"***

  - A single evaluation cannot define the absolute status of site health. To measure trend (improving, declining or staying the same) monitoring should continue to be pursued in subsequent years. Establishing demonstration and profile sites, or another overall riparian inventory can achieve this – every 3 to 5 years.

  - The field workbook ***Riparian Health Assessment for Streams and Small Rivers*** is available from Cows and Fish. This workbook explains how to conduct a rapid survey to quickly check the health status of your riparian area; but the parameters are slightly different than the ones we use for large rivers which are included as an appendix of this report. If you are interested in the ***Riparian Health Assessment for Large Rivers (Survey)*** details they are also available from Cows and Fish.

6.2 *Management Objectives*

Management objectives should:

- Establish new where needed and maintaining the existing healthy tree and shrub communities. If plantings were to be done, management of the reed canary grass would need to be part of the maintenance of the plantings until they are established enough to out compete it.

- Maintain the health and vigour of native trees and shrubs by keeping livestock browse utilization to a minimum (particularly during the spring and fall). Monitor browse from wildlife as well in riparian areas where livestock are not grazing.

- Maintain and monitor regeneration rates for native trees and shrubs and avoid new clearing of woody plants in the active riparian zone and adjacent steep slopes.

- Prevent a further increase in the abundance or distribution of disturbance-caused plants. It is unrealistic to completely remove these plants once they are well established in riparian areas; however, sound management practices can be effective in reducing the prevalence of disturbance-caused plants.

- Control and monitor invasive plants in collaboration with Yellowhead County.

- Minimize new ground disturbance from human activities. This will reduce potential for invasive or disturbance-caused plant infestations. It will also help prevent soil compaction and erosion in the active floodplain and riverbank.

- Monitor actively slumping and eroding banks and maintain and increase the cover of native deeply rooted riparian plants along the riverbank where they might be lacking.

- Allow for rest and recovery of trampled or otherwise altered portions of the riverbank and floodplain.

- Maintain an adequate riparian buffer along the riverbank and avoid new hayfield or tame pasture developments in the active floodplain.

- Work with land owners and managers to carefully manage livestock stocking rates to sustain productive, healthy riparian plant communities.

For more information on riparian management strategies and healthy refer to the Cows and Fish Caring for the Green Zone series: ***"Riparian Areas and Grazing Management"*** and "***Riparian Areas A User's Guide to Health"*** *publications (included with this report). Additional copies are available from Cows and Fish.*

6.3 *How to Contact Us*

The Cows and Fish emphasis is to help individuals, municipalities and local communities address riparian management issues on a watershed basis by increasing awareness and obtaining baseline riparian health information. This riparian health evaluation enables local communities and managers to identify and effectively develop plans to address specific land use issues, and/or celebrate successes. Working locally to develop common goals and objectives for entire watersheds is rewarding – it helps keep people invested in natural landscapes. Riparian management tools developed with the community allow people to improve landscape health, for their benefit and for others who use and enjoy these green zones.

To inquire about additional references for riparian health monitoring and management and for further information on any aspect of this report, please contact:

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Riparian Specialist – Edmonton
Tel: (780) 427-7940
Fax: (780) 422-9745
Email: koshaugh@cowsandfish.org

APPENDIX A: GLOSSARY OF TERMS

Alluvial – deposited by running water. Recent alluvial bars are an accumulation of sediments deposited by floodwater in the current season.

Bankfull channel width – width of a stream channel at the point where high water will begin to escape the channel during floods. This point may be determined by: the elevation at the top of depositional features like sand, silt or gravel bars; changes in bank material from coarse substrate within an active channel to deposited material of a smaller size; or exposed roots below an intact, vegetated soil layer indicating erosion.

Canopy cover – the ground area covered by vegetative growth. Different plant species can provide varying degrees of cover depending on their overall size and abundance. Total canopy cover can be greater than the area being studied due to overlap in plant structural layers.

Climax (plant) community – Refers to the final or steady state plant community which is self-perpetuating and in dynamic equilibrium with its environment. Also known as *Potential Natural Community.*

Community type – An aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. ***For the purposes of this document, a community type represents seral vegetation, and is never considered to be climax.***

Disturbance-caused undesirable herbaceous species – native or introduced non-woody plant species that are well adapted to disturbance or an environment of continual stress. This term *does not* include invasive plant species.

Floodplain – the land base alongside a stream that has the potential to be flooded during high water events.

Habitat type – the land area that supports, or has the potential to support, the same primary climax vegetation. It is based on the potential of the site to produce a specific plant community (plant association).

Hoof shear – pieces of bank broken off as a result of hoofed animals walking along the stream edge.

Human-caused bare ground – areas devoid of vegetation as a result of human activity. This can include vehicle roads, recreational trails and livestock trampling.

Invasive plant species – these are typically weed species classified as *noxious* or *restricted* by your municipal district or county and have the potential to infest riparian areas.

Lotic – this term means *flowing water* (i.e., streams and rivers).

Pointbar – areas along the stream edge where sediment has been naturally deposited by moving water. These typically occur on the inside portion of a channel bend. Also known as a *sandbar or alluvial bar*.

Polygon – term used to describe a riparian inventory site. On lotic systems, a polygon has an upstream and downstream end along a reach of a stream and an associated riparian width. The lateral extent (width) of the riparian area is subjectively determined in the field based on vegetation and terrain clues indicating the flood prone area.

Pugging and Hummocking – the depressions (pugging) and raised mounds of soil (hummocking) resulting from large animals walking through soft or moist soil.

Reach – section of a stream or river with similar physical and vegetative features and similar management influences.

Stream channel incisement – the degree of downward erosion within the channel bed.

Structural alteration – physical changes to the shape or contour of the riverbank caused by human influences. Some examples are livestock crossings, culverts and 'riprap'

Tree and shrub regeneration – the presence of seedlings and saplings, or the 'new growth'.

Woody plant species – simply refers to trees and shrubs. These plants serve different riparian functions than grasses and broad-leaf plants.

APPENDIX B: LOBSTICK RIVER PROJECT AREA RIPARIAN HEALTH SCORE SHEET

N = 10	AVERAGE		
RIPARIAN HEALTH PARAMETER	PROJECT AREA SCORE	MAXIMUM SCORE	
VEGETATION			
1. Cottonwood and Balsam Poplar Regeneration	5.6	6	
2. Regeneration of other Native Tree Species	3.0	3	
3. Regeneration of Preferred Shrub Species	6.0	6	
4. Decadent and Dead Woody Material	3.0	3	
5a. Utilisation of Preferred Trees and Shrubs	1.7	3	
5b. Live Woody Vegetation Removal by Other than Browsing	3.0	3	
6. Total Canopy Cover of Woody Species	2.6	3	
7a. Invasive Plant Species (Cover)	2.4	6	
7b. Invasive Plant Species (Density Distribution)	0.4	3	
8. Disturbance-Caused Undesirable Herbaceous Species	2.0	3	
Vegetation Rating	**29.7**	**39**	**76%**
SOIL/HYDROLOGY			
9. Riverbank Root Mass Protection[3]	5.2	6	
10. Human-Caused Bare Ground	6.0	6	
11. Removal or Addition of Water from/to River System	NC	NA	
12. Control of Flood Peak and Timing by Upstream Dam(s)	9.0	9	
13. Riverbank Human Structurally Altered	6.0	6	
14. Human Physical Alteration to Rest of the Site	6.0	6	
15. Floodplain Accessibility within the Site	6.0	6	
Soil/Hydrology Rating[1]	**38.2**	**39**	**98%**
OVERALL RATING[2]	**67.9**	**78**	**87%**

NC = Not Collected – data not available at this time

[1] The maximum soil/hydrology score averaged for the 9 sites assessed would normally be 48.0 points; however, since removal or addition of water was not collected, the maximum score for soil/hydrology is 39 points.

[2] The maximum overall score averaged for the 9 sites assessed would normally be 87.0 points; however, as one parameter was not assessed, the maximum overall score is 78.0 points.

	Healthy (80-100%) – Little or no impairment to riparian functions.
	Healthy but with Problems (60-79%) – Some impairment to riparian functions due to human or natural causes.
	Unhealthy (<60%) – Impairment to many riparian functions due to human or natural causes.

APPENDIX C: RIPARIAN PLANT INVENTORY LOBSTICK RIVER PROJECT AREA

This plant inventory list is based on the ten inventory sites completed in 2014-2015.

Life Form	Plant Status[1]	Area by Species		Percent Canopy Cover[2]				Percent of Project Area
		Acres	Hectares	Average	Min Range	Max Range	Constancy[3]	
TREES								
balsam poplar (Populus balsamifera)	native	7.7	3.2	18.9%	0.5%	40.0%	100.0%	18.9%
white birch (Betula papyrifera)	native	0.7	0.3	1.8%	0.5%	10.0%	100.0%	1.8%
aspen (Populus tremuloides)	native	0.6	0.2	1.4%	0.5%	3.0%	100.0%	1.4%
white spruce (Picea glauca)	native	0.5	0.2	1.3%	0.0%	10.0%	90.0%	1.23%
lodgepole pine (Pinus contorta)	native	0.01	0.003	0.5%	0.0%	0.5%	10.0%	0.02%
SHRUBS								
red-osier dogwood (Cornus stolonifera)	native	4.6	1.9	11.3%	0.5%	20.0%	100.0%	11.3%
shining willow (Salix lucida)	native	4.3	1.8	14.0%	0.0%	30.0%	50.0%	10.6%
river alder (Alnus tenuifolia)	native	3.8	1.6	14.1%	0.0%	30.0%	50.0%	9.3%
prickly rose (Rosa acicularis)	native	3.5	1.4	9.8%	0.0%	20.0%	90.0%	8.5%
wild red raspberry (Rubus idaeus)	native	2.8	1.2	7.4%	0.0%	10.0%	90.0%	6.9%
yellow willow (Salix lutea)	native	2.3	1.0	6.2%	0.0%	20.0%	90.0%	5.7%
beaked willow (Salix bebbiana)	native	2.1	0.9	5.2%	0.5%	10.0%	100.0%	5.2%
buckbrush/snowberry (Symphoricarpos occidentalis)	native	2.0	0.8	6.5%	0.0%	20.0%	90.0%	5.0%
Saskatoon (Amelanchier alnifolia)	native	1.2	0.5	3.0%	0.5%	10.0%	100.0%	3.0%
snowberry (Symphoricarpos albus)	native	1.0	0.4	9.2%	0.0%	10.0%	20.0%	2.4%
sandbar willow (Salix exigua)	native	0.6	0.2	3.7%	0.0%	10.0%	30.0%	1.4%
common wild rose (Rosa woodsii)	native	0.6	0.2	8.8%	0.0%	10.0%	20.0%	1.4%
bracted honeysuckle (Lonicera involucrata)	native	0.5	0.2	1.5%	0.0%	20.0%	80.0%	1.2%
Canada buffaloberry (Shepherdia canadensis)	native	0.4	0.2	1.3%	0.0%	3.0%	80.0%	0.9%
false mountain willow (Salix pseudomonticola)	native	0.3	0.1	2.1%	0.0%	3.0%	20.0%	0.8%
pussy willow (Salix discolor)	native	0.3	0.1	3.0%	0.0%	3.0%	10.0%	0.7%
common caragana (Caragana arborescens)	invasive, introduced	0.3	0.1	20.0%	0.0%	20.0%	10.0%	0.7%
dusky willow (Salix melanopsis)	native	0.2	0.1	1.4%	0.0%	3.0%	20.0%	0.5%
twining honeysuckle (Lonicera dioica)	native	0.2	0.1	1.1%	0.0%	10.0%	50.0%	0.5%
bunchberry (Cornus canadensis)	native	0.2	0.1	0.8%	0.0%	3.0%	60.0%	0.4%
low-bush cranberry (Viburnum edule)	native	0.1	0.1	0.5%	0.0%	0.5%	70.0%	0.3%

Life Form	Plant Status[1]	Area by Species		Percent Canopy Cover[2]				Percent of Project Area
		Acres	Hectares	Average	Min Range	Max Range	Constancy[3]	
SHRUBS								
choke cherry (Prunus virginiana)	native	0.1	0.05	0.7%	0.0%	3.0%	60.0%	0.3%
basket willow (Salix petiolaris)	native	0.1	0.04	0.5%	0.0%	0.5%	70.0%	0.3%
northern gooseberry (Ribes oxyacanthoides)	native	0.1	0.04	0.5%	0.0%	0.5%	60.0%	0.2%
flat-leaved willow (Salix planifolia)	native	0.1	0.03	0.8%	0.0%	3.0%	50.0%	0.2%
wild red currant (Ribes triste)	native	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
Scouler's willow (Salix scouleriana)	native	0.05	0.02	0.5%	0.0%	0.5%	10.0%	0.1%
willow (Salix spp.)	unknown, not unique	0.05	0.02	0.5%	0.0%	0.5%	10.0%	0.1%
twinflower (Linnaea borealis)	native	0.03	0.01	0.5%	0.0%	0.5%	30.0%	0.1%
round-leaved hawthorn (Crataegus rotundifolia)	native	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
dewberry (Rubus pubescens)	native	0.03	0.01	0.5%	0.0%	0.5%	30.0%	0.1%
hoary willow (Salix candida)	native	0.02	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
lilac (Syringa spp.)	introduced	0.01	0.003	0.5%	0.0%	0.5%	10.0%	0.02%
GRASSES AND GRASS-LIKES								
reed canary grass (Phalaris arundinacea)	native	14.0	5.7	34.2%	10.0%	60.0%	100.0%	34.2%
marsh reed grass (Calamagrostis canadensis)	native	7.2	3.0	21.9%	0.0%	50.0%	70.0%	17.7%
smooth brome (Bromus inermis)	disturbance, introduced	5.9	2.4	14.9%	0.0%	30.0%	90.0%	14.4%
Kentucky bluegrass (Poa pratensis)	disturbance, introduced	1.6	0.7	4.7%	0.0%	20.0%	90.0%	4.0%
awned sedge (Carex atherodes)	native	1.6	0.7	4.1%	0.0%	20.0%	90.0%	4.0%
timothy (Phleum pratense)	disturbance, introduced	1.2	0.5	4.2%	0.0%	10.0%	40.0%	2.9%
quack grass (Agropyron repens)	disturbance, introduced	1.0	0.4	6.6%	0.0%	10.0%	20.0%	2.4%
small-fruited bulrush (Scirpus microcarpus)	native	0.6	0.3	1.9%	0.0%	10.0%	80.0%	1.6%
tufted hair grass (Deschampsia cespitosa)	native	0.5	0.2	1.5%	0.0%	10.0%	70.0%	1.2%
common great bulrush (Scirpus validus)	native	0.1	0.1	0.5%	0.0%	0.5%	40.0%	0.3%
beaked sedge (Carex utriculata)	native	0.1	0.1	0.6%	0.0%	3.0%	50.0%	0.3%
fowl bluegrass (Poa palustris)	native	0.1	0.05	0.5%	0.0%	0.5%	40.0%	0.3%
common tall manna grass (Glyceria grandis)	native	0.1	0.05	0.5%	0.0%	0.5%	60.0%	0.3%
short-awn meadow-foxtail (Alopecurus aequalis)	native	0.1	0.04	0.5%	0.0%	0.5%	60.0%	0.3%
water sedge (Carex aquatilis)	native	0.1	0.04	0.5%	0.0%	0.5%	30.0%	0.3%
creeping spike-rush (Eleocharis palustris)	native	0.1	0.04	0.5%	0.0%	0.5%	50.0%	0.2%
northern manna grass (Glyceria borealis)	native	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
needle spike-rush (Eleocharis acicularis)	native	0.1	0.03	0.5%	0.0%	0.5%	20.0%	0.2%

Life Form	Plant Status[1]	Area by Species		Percent Canopy Cover[2]				Percent of Project Area
		Acres	Hectares	Average	Min Range	Max Range	Constancy[3]	
GRASSES AND GRASS-LIKES								
sweet grass (Hierochloe odorata)	native	0.1	0.02	0.5%	0.0%	0.5%	20.0%	0.1%
redtop (Agrostis stolonifera)	introduced	0.1	0.02	0.5%	0.0%	0.5%	20.0%	0.1%
narrow reed grass (Calamagrostis stricta)	native	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
slough grass (Beckmannia syzigachne)	native	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
red fescue (Festuca rubra)	native or introduced	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
rush (Juncus spp.)	unknown, not unique	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
purple oat grass (Schizachne purpurascens)	native	0.02	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
creeping meadow foxtail (Alopecurus arundinaceus)	introduced	0.02	0.01	0.5%	0.0%	0.5%	10.0%	0.04%
Bebb's sedge (Carex bebbii)	native	0.02	0.01	0.5%	0.0%	0.5%	10.0%	0.04%
brownish sedge (Carex brunnescens)	native	0.01	0.003	0.5%	0.0%	0.5%	10.0%	0.02%
short sedge (Carex curta)	native	0.01	0.003	0.5%	0.0%	0.5%	10.0%	0.02%
turned sedge (Carex retrorsa)	native	0.01	0.002	0.5%	0.0%	0.5%	10.0%	0.01%
hay sedge (Carex siccata)	native	0.01	0.002	0.5%	0.0%	0.5%	10.0%	0.01%
FORBS								
tufted vetch (Vicia cracca)	invasive, introduced	2.5	1.0	15.8%	0.0%	20.0%	30.0%	6.2%
swamp horsetail (Equisetum fluviatile)	native	1.0	0.4	6.6%	0.0%	10.0%	20.0%	2.3%
common horsetail (Equisetum arvense)	native, poisonous	0.7	0.3	2.1%	0.0%	10.0%	90.0%	1.8%
cow parsnip (Heracleum lanatum)	native	0.7	0.3	2.3%	0.0%	10.0%	80.0%	1.7%
Canada thistle (Cirsium arvense)	invasive, introduced	0.7	0.3	1.6%	0.5%	10.0%	100.0%	1.6%
common cattail (Typha latifolia)	native	0.7	0.3	2.2%	0.0%	10.0%	80.0%	1.6%
common nettle (Urtica dioica)	native	0.6	0.3	2.0%	0.0%	10.0%	80.0%	1.5%
Canada anemone (Anemone canadensis)	native	0.5	0.2	1.7%	0.0%	3.0%	90.0%	1.3%
white clover (Trifolium repens)	disturbance, introduced	0.4	0.2	1.3%	0.0%	3.0%	50.0%	0.9%
meadow horsetail (Equisetum pratense)	native	0.3	0.1	3.0%	0.0%	3.0%	20.0%	0.8%
Canada goldenrod (Solidago canadensis)	native	0.3	0.1	1.8%	0.0%	3.0%	50.0%	0.8%
red clover (Trifolium pratense)	disturbance, introduced	0.3	0.1	0.9%	0.0%	3.0%	70.0%	0.7%
common dandelion (Taraxacum officinale)	disturbance, introduced	0.3	0.1	0.7%	0.5%	3.0%	100.0%	0.7%
marsh hedge-nettle (Stachys palustris)	native	0.3	0.1	0.7%	0.0%	3.0%	80.0%	0.6%
woodland horsetail (Equisetum sylvaticum)	native	0.2	0.1	2.8%	0.0%	20.0%	40.0%	0.6%
alsike clover (Trifolium hybridum)	disturbance, introduced	0.2	0.1	1.1%	0.0%	3.0%	60.0%	0.6%
veiny meadow rue (Thalictrum venulosum)	native	0.2	0.1	0.6%	0.5%	3.0%	100.0%	0.6%

Life Form	Plant Status[1]	Area by Species		Percent Canopy Cover[2]				Percent of Project Area
		Acres	Hectares	Average	Min Range	Max Range	Constancy[3]	
FORBS								
star-flowered Solomon's-seal (Smilacina stellata)	native	0.2	0.1	0.5%	0.0%	0.5%	90.0%	0.5%
tall lungwort (Mertensia paniculata)	native	0.2	0.1	0.8%	0.0%	3.0%	70.0%	0.5%
common plantain (Plantago major)	disturbance, introduced	0.2	0.1	0.5%	0.0%	0.5%	90.0%	0.4%
common yarrow (Achillea millefolium)	native	0.2	0.1	0.5%	0.0%	0.5%	80.0%	0.4%
wild vetch (Vicia americana)	native	0.2	0.1	0.5%	0.0%	0.5%	80.0%	0.4%
tall buttercup (Ranunculus acris)	invasive, introduced	0.2	0.1	0.5%	0.0%	0.5%	70.0%	0.4%
wild strawberry (Fragaria virginiana)	disturbance, native	0.2	0.1	0.5%	0.0%	0.5%	90.0%	0.4%
northern bedstraw (Galium boreale)	native	0.2	0.1	0.5%	0.0%	0.5%	90.0%	0.4%
perennial sow-thistle (Sonchus arvensis)	invasive, introduced	0.2	0.1	0.5%	0.0%	0.5%	80.0%	0.4%
narrow-leaved dock (Rumex triangulivalvis)	native	0.2	0.1	0.5%	0.0%	0.5%	80.0%	0.4%
Macoun's buttercup (Ranunculus macounii)	native	0.1	0.1	0.5%	0.0%	0.5%	80.0%	0.3%
Philadelphia fleabane (Erigeron philadelphicus)	native	0.1	0.1	0.5%	0.0%	0.5%	70.0%	0.3%
water-hemlock (Cicuta maculata)	native, poisonous	0.1	0.04	0.5%	0.0%	0.5%	50.0%	0.3%
caraway (Carum carvi)	introduced	0.1	0.04	0.5%	0.0%	0.5%	40.0%	0.2%
cream-colored vetchling (Lathyrus ochroleucus)	native	0.1	0.04	0.5%	0.0%	0.5%	40.0%	0.2%
purple-stemmed aster (Aster puniceus)	native	0.1	0.04	0.5%	0.0%	0.5%	30.0%	0.2%
hemp-nettle (Galeopsis tetrahit)	disturbance, introduced	0.1	0.04	0.5%	0.0%	0.5%	30.0%	0.2%
common scouring-rush (Equisetum hyemale)	native	0.1	0.04	0.5%	0.0%	0.5%	50.0%	0.2%
alfalfa (Medicago sativa)	introduced	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
common fireweed (Epilobium angustifolium)	native	0.1	0.03	0.5%	0.0%	0.5%	60.0%	0.2%
wild mint (Mentha arvensis)	native	0.1	0.03	0.5%	0.0%	0.5%	60.0%	0.2%
arum-leaved arrowhead (Sagittaria cuneata)	native	0.1	0.03	0.5%	0.0%	0.5%	60.0%	0.2%
sweet-scented bedstraw (Galium triflorum)	native	0.1	0.03	0.5%	0.0%	0.5%	20.0%	0.2%
American brooklime (Veronica americana)	native	0.1	0.03	0.5%	0.0%	0.5%	40.0%	0.2%
giant bur-reed (Sparganium eurycarpum)	native	0.1	0.03	0.5%	0.0%	0.5%	50.0%	0.2%
wormseed mustard (Erysimum cheiranthoides)	disturbance, introduced	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
large-leaved yellow avens (Geum macrophyllum)	native	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
palmate-leaved coltsfoot (Petasites palmatus)	native	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
heart-leaved Alexanders (Zizia aptera)	native	0.1	0.03	0.9%	0.0%	3.0%	30.0%	0.2%
water parsnip (Sium suave)	native	0.1	0.03	0.5%	0.0%	0.5%	30.0%	0.2%
many-flowered yarrow (Achillea sibirica)	native	0.1	0.03	0.5%	0.0%	0.5%	50.0%	0.2%
purple avens (Geum rivale)	native	0.1	0.02	0.5%	0.0%	0.5%	20.0%	0.1%

Life Form	Plant Status[1]	Area by Species		Percent Canopy Cover[2]				Percent of Project Area
		Acres	Hectares	Average	Min Range	Max Range	Constancy[3]	
FORBS								
wild sarsaparilla (Aralia nudicaulis)	native	0.1	0.02	0.5%	0.0%	0.5%	20.0%	0.1%
water smartweed (Polygonum coccineum)	native	0.1	0.02	0.5%	0.0%	0.5%	30.0%	0.1%
western Canada violet (Viola canadensis)	native	0.1	0.02	0.5%	0.0%	0.5%	20.0%	0.1%
celery-leaved buttercup (Ranunculus sceleratus)	native	0.1	0.02	0.5%	0.0%	0.5%	40.0%	0.1%
water smartweed (Polygonum amphibium)	native	0.1	0.02	0.5%	0.0%	0.5%	50.0%	0.1%
biennial sagewort (Artemisia biennis)	native	0.05	0.02	0.5%	0.0%	0.5%	30.0%	0.1%
fairybells (Disporum trachycarpum)	native	0.05	0.02	0.5%	0.0%	0.5%	10.0%	0.1%
leafy arnica (Arnica chamissonis)	native	0.05	0.02	0.5%	0.0%	0.5%	10.0%	0.1%
wild licorice (Glycyrrhiza lepidota)	native	0.05	0.02	0.5%	0.0%	0.5%	10.0%	0.1%
tufted loosestrife (Lysimachia thyrsiflora)	native	0.05	0.02	0.5%	0.0%	0.5%	40.0%	0.1%
agrimony (Agrimonia striata)	native	0.03	0.01	3.0%	0.0%	3.0%	10.0%	0.1%
ox-eye daisy (Chrysanthemum leucanthemum syn. Leucanthemum vulgare)	invasive, introduced	0.03	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
smooth perennial sow-thistle (Sonchus arvensis ssp. uliginosus)	invasive, introduced	0.03	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
mustard (Brassica spp.)	introduced	0.03	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
flixweed; tansy mustard (Descurainia sophia)	disturbance, introduced	0.03	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
western wood lily (Lilium philadelphicum)	native	0.03	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
yellow sweet-clover (Melilotus officinalis)	disturbance, introduced	0.03	0.01	0.5%	0.0%	0.5%	20.0%	0.1%
red and white baneberry (Actaea rubra)	native, poisonous	0.03	0.01	0.5%	0.0%	0.5%	40.0%	0.1%
stinkweed (Thlaspi arvense)	disturbance, introduced	0.03	0.01	0.5%	0.0%	0.5%	30.0%	0.1%
low goldenrod (Solidago missouriensis)	native	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
western dock (Rumex occidentalis)	native	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
late goldenrod (Solidago gigantea)	native	0.03	0.01	0.5%	0.0%	0.5%	10.0%	0.1%
graceful cinquefoil (Potentilla gracilis)	native	0.02	0.01	0.5%	0.0%	0.5%	10.0%	0.04%
common tansy (Tanacetum vulgare)	invasive, introduced, poisonous	0.02	0.01	0.5%	0.0%	0.5%	10.0%	0.04%
sweet flag (Acorus americanus)	native	0.01	0.01	0.5%	0.0%	0.5%	10.0%	0.03%
showy aster (Aster conspicuus)	native	0.01	0.01	0.5%	0.0%	0.5%	10.0%	0.03%
western water-horehound (Lycopus asper)	native	0.01	0.01	0.5%	0.0%	0.5%	10.0%	0.03%
seaside buttercup (Ranunculus cymbalaria)	native	0.01	0.01	0.5%	0.0%	0.5%	10.0%	0.03%
marsh yellow cress (Rorippa palustris)	native	0.01	0.01	0.5%	0.0%	0.5%	10.0%	0.03%

Life Form	Plant Status[1]	Area by Species		Percent Canopy Cover[2]				Percent of Project Area
		Acres	Hectares	Average	Min Range	Max Range	Constancy[3]	
FORBS								
bog violet (Viola nephrophylla)	native	0.01	0.01	0.5%	0.0%	0.5%	10.0%	0.03%
common pink wintergreen (Pyrola asarifolia)	native	0.01	0.01	0.5%	0.0%	0.5%	20.0%	0.03%
smooth aster (Aster laevis)	native	0.01	0.003	0.5%	0.0%	0.5%	10.0%	0.02%
forb (Forb)	unknown, not unique	0.01	0.003	0.5%	0.0%	0.5%	10.0%	0.02%
harebell (Campanula rotundifolia)	native	0.01	0.002	0.5%	0.0%	0.5%	10.0%	0.01%
common red paintbrush (Castilleja miniata)	native	0.01	0.002	0.5%	0.0%	0.5%	10.0%	0.01%
long-stalked chickweed (Stellaria longipes)	native	0.01	0.002	0.5%	0.0%	0.5%	10.0%	0.01%

[1] Plant status is designated by Cows and Fish in association with Alberta Environment and Parks, Alberta Agriculture and Forestry, and the Alberta Weed Control Act. '*unknown*' = plant not identified to species so plant status unknown.

[2] Based on visual estimates of the amount of ground the canopy of the plant covers. The percent cover values presented are the mid-values for the following ranges: 0.5=less than 1%; 3.0=1%-5%; 10.0=5%-15%; 20.0=15%-25%; 30.0=25%-35%; 40.0=35%-45%; 50.0=45%-55%; 60.0=55%-65%; 70.0=65%-75%; 80.0=75%-85%; 90.0=85%-95%; 97.5=greater than 95%; — = not observed.

[3] Constancy is the number of times the species occurs divided by the total number of sites.

Lobstick River Riparian Plant Composition Summary

Species Tally Summary		% Native Species
Total # of species =	151	81%
Total # of TREE species =	5	100%
Total # of SHRUB species =	32	94%
Total # of GRASS / GRASS LIKE species =	30	80%
Total # of FORB species =	84	76%

Total # of ***native plants*** =	123
Total # of ***restricted*** plants =	0
Total # of ***invasive*** plants =	8
Total # of *disturbance* plants =	15
Total # of plants with *poisonous* properties =	4

APPENDIX D: DESCRIPTION OF RIPARIAN HEALTH PARAMETERS FOR LARGE RIVERS

The riparian health score is based on 15 basic parameters pertaining to riparian health. This appendix addresses the guidelines and stipulations followed when each parameter was answered during the assessment. Keep in mind that these parameters are meant to encompass the broad range of ecological diversity that lake and wetland systems have the potential to express. The interpretations are not completely specific to any one type of stream system, yet still capture the essential factors of riparian health and function.

Many different factors must be considered when answering any one of these parameters. It is quite possible that every scenario that could be encountered when conducting assessments is not covered here. Personal judgment based on sound riparian knowledge and good visual estimations are critical tools necessary for answering these questions consistently.

This description of riparian health parameters is based on the Alberta Lotic Wetland Health Assessment for Large River Systems (Survey) User Manual (Cows and Fish, current as of May 27, 2015). The complete user manual can be found at:
http://cowsandfish.org/riparian/documents/ALBRiverSurveyManual_001.pdf.

LARGE RIVER RIPARIAN HEALTH PARAMETERS

Some factors on the evaluation will not apply on all sites. For example, sites without potential for woody species are not rated on factors concerning trees and shrubs. Vegetative site potential can be determined by using a key to site type. On severely disturbed sites, vegetation potential can be difficult to determine. On other sites, clues to potential may be sought on nearby sites with similar landscape position.

Most of the factors in this evaluation are based on ocular estimations. Such estimation may be difficult on large, brushy sites where visibility is limited, but extreme precision is not necessary. While the rating categories are broad, evaluators do need to calibrate their eye with practice. It is important to remember that a health rating is not an absolute value. The factor breakout groupings and point weighting in the evaluation are somewhat subjective and are not grounded in quantitative science so much as in the collective experience of an array of riparian scientists, range professionals and land managers.

Each factor below will be rated according to conditions observed on the sites. The evaluator will estimate the scoring category and enter the value on the score sheet. It is important to **remember that a health rating is not an absolute value**. Each factor is rated according to conditions observed on the site at the time of evaluation.

1. Cottonwood and Balsam Poplar Regeneration. This item is assessed differently on either side of the Red Deer River valley. For areas south of and including the Red Deer River Valley, do not count asexual regeneration from root sprouts. In this southern area of the province, count only reproduction from seed. This is because these trees are primarily riverine species that pioneer on recent alluvium from seed, and root sprouts do not serve well to maintain populations. In areas north of the Red Deer River Valley (and some areas farther south in higher precipitation zones, such as the foothills west of Highway 2) count any mode of reproduction for this group of trees, because in these cooler/moister zones cottonwoods and balsam poplar populations are not dependent on seed deposited on riverine alluvium. (***NOTE:*** In this item do not include the species *Populus tremuloides* [aspen], which is included in the next item below.)

Reproduction success can be determined by estimating the established seedling and sapling cover expressed as percentage of the overall cover of the species on the site. (***NOTE:*** For this item, include plants taller than 30 cm (1 ft) in height, but less than 12.5 cm (5 in) in dbh [diameter at breast height: 1.35 m (4.5 ft)]). If no potential for cottonwood or balsam poplar exists on the polygon (such as when it is on the outside of a long meander curve where depositional material is not expected, or there are no such trees on similar site positions nearby) replace both Actual Score and Possible Score with NA. Count plants installed by human planting, if these are successfully established. To be successfully established the new plants need to have at least one complete growing season on the site. Most newly established plants do not survive the first growing season.

NOTE: *Use judgement and caution in counting occasional seedlings in precarious positions where they have little potential for survival due to natural physical jeopardy (e.g., at water's edge along outside curve).*

Scoring:
6 = More than 15% of the cottonwood and/or balsam poplar cover is established seedlings and/or saplings.
4 = 5% to 15% of the cottonwood and/or balsam poplar cover is established seedlings and/or saplings.
2 = Up to 5% of the cottonwood and/or balsam poplar cover is established seedlings and/or saplings.
0= None of the cottonwood and/or balsam poplar cover is established seedlings or saplings.

2. Regeneration of Other Native Tree Species. As succession progresses on a riparian site, the pioneer trees and shrub communities are replaced by later seral communities (if river dynamics allow enough time). If the site is not de-watered or otherwise disturbed, this progression is often to communities dominated by other native tree species. Depending upon dynamics of the system (how fast the channel migrates laterally), the potential may exist for equilibrium at different locations along the river between younger (those dominated by young trees and willows) communities and older communities with aging cottonwoods/poplars and later seral species such as *Populus tremuloides* (aspen), *Picea glauca* (white spruce), *Acer negundo* (Manitoba maple), and *Fraxinus pennsylvanica* (green ash). ***NOTE:*** Seedlings and saplings of these species include individuals which are less than 7.5 cm (3 in) in dbh. In situations where all plant communities are in an early successional stage and where no later successional species are yet expected (such as a young point bar or a newly formed island), replace both Actual Score and Possible Score with NA.

The health of a population can be based on current regeneration success without having to determine the exact potential distribution between cottonwoods/poplars and the other tree species on a site. This regeneration success can be determined from the seedling and sapling canopy cover

expressed as a percentage of the overall cover of the group of tree species on the site other than cottonwoods/poplars. Count plants installed by human planting, if these are successfully established. To be successfully established the new plants need to have at least one complete growing season on the site. Most newly established plants do not survive the first growing season.

Scoring:
3 = More than 5% of the other (non-cottonwood/balsam poplar) tree cover is seedlings and/or saplings.
2 = 1% to 5% of the other (non-cottonwood/balsam poplar) tree cover is seedlings and/or saplings.
1 = Less than 1% of the other (non-cottonwood/balsam poplar) tree cover is seedlings and/or saplings.
0 = Seedlings and saplings of trees species other than cottonwoods/balsam poplars or absent.

3. Regeneration of Preferred Shrub Species. Another indicator of a river system's ecological stability and, therefore, health is the presence of enough shrub regeneration to maintain the lifeform population along the river over the long term. Ecological stability is used in the broad sense that over the reach as a whole there is an equilibrium of community composition and structure.

The following species are excluded from the evaluation (those not listed are considered preferred):

- *Artemisia cana* (silver sagebrush), including subsp. *cana* and *viscidula*;
- *Artemisia frigida* (fringed sagewort);
- *Caragana* species [caragana]
- *Crataegus* species (hawthorn);
- *Elaeagnus angustifolia* (Russian olive);
- *Elaeagnus commutata* [silverberry/wolf willow];
- *Potentilla fruticosa* [shrubby cinquefoil];
- *Rhamnus catharticus* [European/common buckthorn]
- *Rosa* species (rose);
- *Sarcobatus vermiculatus* (greasewood);
- *Symphoricarpos* species [buckbrush/snowberry];
- *Tamarix* species (salt cedar); and
- non-native species.

These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-intense grazing pressure; ***AND*** for which there is rarely any problem in maintaining presence on site. Examples of the latter include *Artemisia cana* (silver sagebrush) and *Sarcobatus vermiculatus* (greasewood). Both are considered climax species in many riparian situations and rarely have any problem maintaining a presence on a site. Only under extreme long-term grazing pressures will these species be eliminated from a site. *Elaeagnus angustifolia* (Russian olive), *Caragana* species (caragana), *Rhamnus catharticus* [European/common buckthorn], and *Tamarix* species [salt cedar] are considered especially aggressive, undesirable exotic plants.

The main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (e.g., *Salix* species [willows], *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. ***FOR EXAMPLE:*** A polygon may have *Symphoricarpos occidentalis* (buckbrush/snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix*

exigua (sandbar willow) present, but represented only by older mature individuals. We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the buckbrush/snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of buckbrush/snowberry).

For shrubs in general, seedlings and saplings can be distinguished from mature plants as follows. For those species having a mature height generally over 1.8 m (6.0 ft), seedlings and saplings are those individuals less than 1.8 m (6.0 ft) tall. For species normally not exceeding 1.8 m (6.0 ft), seedlings and saplings are those individuals less than 0.45 m (1.5 ft) tall or which lack reproductive structures and the relative stature to suggest maturity. Count plants installed by human planting, if these are successfully established. Establishment success can be assumed for plants surviving at least one full year after planting. (***NOTE:*** Evaluators should take care also not to confuse short stature resulting from intense browsing with that due to young plants.)

Scoring: (*If the site has no potential for shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA. If the evaluator is not fairly certain potential exists for preferred shrubs, then enter NC and explain in the comment field below.*)
6 = More than 5% of the preferred shrub species cover is seedlings and/or saplings.
4 = 1% to 5% of the preferred shrub species cover is seedlings and/or saplings.
2 = Less than 1% of the preferred shrub species cover is seedlings and/or saplings.
0 = None of the preferred shrub species cover is seedlings or saplings.

4. Standing Decadent and Dead Woody Material. The amount of decadent and dead woody material on a site can be an indicator of the overall health of a riparian area. Large amounts of decadent and dead woody material may indicate a reduced flow of water through the stream (de-watering) due to either human or natural causes. De-watering of a site, if severe enough, may change the site vegetation potential from riparian species to upland species. In addition, decadent and dead woody material may indicate severe stress from over browsing. Finally, large amounts of decadent and dead woody material may indicate climatic impacts, disease and insect damage. For instance, severe winters may cause extreme die back of trees and shrubs, and cyclic insect infestations may kill individuals in a stand. In all these cases, a high percentage of dead and decadent woody material reflects degraded vegetative health, which can lead to reduced streambank integrity, channel incisement, and excessive lateral cutting, besides reducing production and other wildlife values.

The most common usage of the term ***decadent*** may be for over mature trees past their prime and which may be dying, but we use the term in a broader sense. We count decadent plants, both trees and shrubs, as those with 30% or more dead wood in the upper canopy. In this item, scores are based on the percentage of total woody canopy cover which is decadent or dead, not on how much of the total polygon canopy cover consists of dead and decadent woody material. Only decadent and dead standing material is included, not that which is lying on the ground. The observer is to ignore (not count) decadence in poplars or cottonwoods which are decadent ***due to old age*** (rough and furrowed bark extends substantially up into the crowns of the trees) (species: *Populus deltoides* [plains cottonwood], *P. angustifolia* [narrow-leaf cottonwood], and *P. balsamifera* [balsam poplar]), because cottonwoods/poplars are early seral species and naturally die off in the absence of disturbance to yield the site to later seral species. The observer is to consider (count) decadence in these species if apparently caused by de-watering, browse stress, climatic influences, or parasitic infestation (insects/disease). The observer should comment on conflicting or confounding indicators, and/or if the cause of decadence is simply unknown (*but not due to old age*).

Scoring:
3 = Less than 5% of the total canopy cover of woody species is decadent and/or dead.
2 = 5% to 25% of the total canopy cover of woody species is decadent and/or dead.
1 = 25% to 50% of the total canopy cover of woody species is decadent and/or dead.
0 = More than 50% of the total canopy cover of woody species is decadent and/or dead.

5a. Browse Utilization of Available Preferred Trees and Shrubs. (*Skip this item if the site lacks trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh, or all woody plants have already been removed.*) Livestock and/or wildlife browse many riparian woody species. Excessive browsing can eliminate these important plants from the community and result in their replacement by undesirable invaders. With excessive browsing, the plant loses vigour, is prevented from flowering, or is killed. Utilization in small amounts is normal and not a health concern, but concern increases with greater browse intensity. Nine shrub genera or species (e.g., *Elaeagnus angustifolia* [Russian olive], *Symphoricarpos* species [buckbrush/snowberry], *Rosa* species [rose], *Crataegus* species [hawthorn], *Elaeagnus commutata* [silverberry/wolf willow], *Potentilla fruticosa* [shrubby cinquefoil], *Caragana* species [caragana], *Rhamnus catharticus* [European/common buckthorn], and *Tamarix* species [salt cedar]) are excluded from the evaluation of utilization. These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-intense grazing pressure; ***AND*** for which there is rarely any problem in maintaining presence on site. *Elaeagnus angustifolia* (Russian olive), *Caragana* species (caragana), *Rhamnus catharticus* [European/common buckthorn], and *Tamarix* species [salt cedar] are considered especially aggressive, undesirable exotic plants.

As discussed above, the main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (e.g., *Salix* species [willows], *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. ***FOR EXAMPLE:*** A polygon may have *Symphoricarpos occidentalis* (buckbrush/ snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix exigua* (sandbar willow) present, but represented only by older mature individuals. We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the buckbrush/snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of buckbrush/snowberry).

Consider as available all tree and shrub plants to which animals may gain access and that they can reach. For tree species, this means mostly just seedling and sapling age classes. When estimating degree of utilization, count browsed second year and older leaders on representative plants of woody species normally browsed by ungulates. Do not count current year's use, because this would not accurately reflect actual use when more browsing can occur later in the season. Browsing of second year or older material affects the overall health of the plant and continual high use will affect the ability of the plant to maintain itself on the site. Determine percentage by comparing the number of leaders browsed or utilised with the total number of leaders available (those within animal reach) on a representative sample (at least three plants) of each tree and shrub species present. Do not count utilization on dead plants, unless it is clear that death resulted from over-grazing. ***NOTE:*** If a shrub is entirely mushroom/umbrella shaped by long term intense browse or rubbing, count utilization of it as heavy.

Scoring: (*Consider all shrubs within animal reach and seedlings and saplings of tree species. If the site has no woody vegetation [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.*)
3 = None (0% to 5% of available second year and older leaders of preferred species are browsed).
2 = Light (5% to 25% of available second year and older leaders of preferred species are browsed).
1 = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).
0 = Heavy (More than 50% of available second year and older leaders of preferred species are browsed).

5b. Live Woody Vegetation Removal by Other Than Browsing. Excessive cutting or removing parts of plants or whole plants by agents other than browsing animals (e.g., human clearing, cutting, beaver activity, etc.) can result in many of the same negative effects to the community that are caused by excessive browsing. However, other effects from this kind of removal are direct and immediate, including reduction of physical community structure and wildlife habitat values. ***Do not include natural phenomena such as natural fire, insect infestation, etc. in this evaluation.***

Removal of woody vegetation may occur at once (a logging operation), or it may be cumulative over time (annual firewood cutting or beaver activity). This question is not so much to assess long term incremental harvest, as it is to assess the extent that the stand is lacking vegetation that would otherwise be there today. Give credit for re-growth. Consider how much the removal of a tree many years ago may have now been mitigated with young replacements.

Three non-native species or genera are excluded from consideration because these are aggressive, invasive exotic plants that should be removed. They are *Elaeagnus angustifolia* (Russian olive), *Rhamnus cathartica* (European/common buckthorn), and *Tamarix* species (salt cedar).

Determine the extent to which woody vegetation (trees and shrubs) is lacking due to being physically removed (i.e., cut, mowed, trimmed, logged, cut by beaver, or otherwise cut from their growing position). The actual timeframe is not as important as the actual ecological effect. Time to recover from this kind of damage can vary widely with site characteristics. What we really need to measure is the extent ***today*** of any damage remaining to the vegetation structure as a result of the woody removal. We expect that the woody community will recover over time (re-grow), just as an eroding bank will heal with re-growing root mass. This question simply asks how much woody material is still missing from what should be there? --as judged by indications, such as stumps and other clues to what was removed. The amount of time since removal doesn't really matter, if re-growth has been allowed to progress. If 20 years after logging, the site has a stand of sapling spruce trees, then it should get partial re-growth credit, but not full credit, because the trees still lack most of their potential habitat and ecological value. (***NOTE:*** In general, the more recent the removal, the more entirely it should be fully counted; and conversely, the older the removal, the more likely it is to have been mitigated by re-growth.)

This question is really looking at volume (three dimensions) and not canopy cover (two dimensions). For example, if an old growth spruce tree is removed, a number of new seedlings/saplings may become established and could soon achieve the same canopy cover as the old tree had. However, the value of the old tree to wildlife and overall habitat values is far greater than that of the seedling/saplings. It will take a very long time before the seedlings/saplings can grow to replace all the lost habitat values that were provided by the tall old tree. On the other hand, shrubs, such as willows, grow faster and may replace the volume of removed plants in a much shorter time. Answer this question by estimating the percent of woody material that is missing

from the site due to having been removed by human action. Select a range category from the choices given that best represents the percent of missing woody material.

Scoring: (*If the site has no trees or shrubs **AND** no cut plants or stumps of any trees or shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.*)
3 = None (0% to 5% of live woody vegetation expected on the site is lacking due to cutting).
2 = Light (5% to 25% of live woody vegetation expected on the site is lacking due to cutting).
1 = Moderate (25% to 50% of live woody vegetation expected on the site is lacking due to cutting).
0= Heavy (More than 50% of live woody vegetation expected on the site is lacking due to cutting).

6. Total Canopy Cover of Woody Species. Woody species play a critical role in riverbank integrity. Natural riverbanks are protected by large bank rock (e.g., boulders and cobbles) and by woody vegetation. On floodplains comprised primarily of fine textured materials—which are typical of many western rivers—riverbanks are protected only by the woody vegetation. In these cases, it is critically important to manage for healthy woody vegetation. Woody vegetation also traps sediment, helps to reduce velocity of flood waters, protects the soil from extreme temperatures, and provides wildlife habitat. ***NOTE:*** Unlike other items dealing with woody plants, this item focuses on how much of the total polygon is covered by woody plants.

Scoring:
3 = More than 50% of the total area is occupied by all woody species.
2 = 25% to 50% of the total area is occupied by all woody species.
1 = 5% to 25% of the total area is occupied by all woody species.
0= Less than 5% of the total area is occupied by all woody species.

7. Invasive Plant Species (Weeds). Invasive plants (weeds) are alien species whose introduction does or is likely to cause economic or environmental harm. Whether the disturbance that allowed their establishment is natural or human-caused, weed presence indicates a degrading ecosystem. While some of these species may contribute to some riparian functions, their negative impacts reduce overall site health. This item assesses the degree and extent to which the site is infested by invasive plants. The severity of the problem is a function of the density/distribution (pattern of occurrence), as well as canopy cover (abundance) of the weeds. In determining the health score, all invasive plant species are considered collectively, not individually. A weed list should be used that is standard for the locality and that indicates which species are being considered (i.e., *Invasive Weed and Disturbance-caused Undesirable Plant List* [Cows and Fish 2002]). Space is provided on the form for recording weed species counted. Include both woody and herbaceous invasive plant species. ***Leave no listed species field blank, however;*** enter 0 to indicate absence of a value. (A blank field means the observer forgot to collect the data; a value means the observer looked.)

The site's health rating on this item combines two factors: weed density/distribution class and total canopy cover. A perfect score of 6 out of 6 points can only be achieved if the site is weed free. A score of 4 out of the 6 points means the weed problem is just beginning (i.e., very few weeds and small total canopy cover [less than 1%]). A moderate weed problem gets 2 out of 6 points. It has a moderately dense weed plant distribution (a class between 4 and 7) and moderate total weed canopy cover (between 1% and 15%). A site scores 0 points if the density/distribution is in class 8 or higher, or if the total weed canopy cover is 15% or more.

7a. Total Canopy Cover of Invasive Plant Species (Weeds). The evaluator must evaluate the total percentage of the polygon area that is covered by the combined canopy of all plants of all species of invasive plants. Determine which rating applies in the scoring scale below. For field determination

of vegetative cover related questions (questions D2 to D14) include **all rooted plant material** (live or dead). Do not include fallen wood or other plant litter. Do not consider the polygon area covered by water (such as between emergent plants).

Scoring:
6 = No invasive plant species (weeds) on the site.
4 = Invasive plants present with total canopy cover less than 1% of the polygon/site area.
2 = Invasive plants present with total canopy cover between 1% and 15% of the polygon/site area.
0 = Invasive plants present with total canopy cover more than 15% of the polygon/site area.

7b. Density Distribution of Invasive Plant Species (Weeds). The evaluator must pick a category of pattern and extent of invasive plant distribution from the chart below (Figure 2) that best fits what is observed on the polygon, while realizing that the real situation may be only roughly approximated at best by any of these diagrams. Choose the category that most closely matches the view of the polygon/site.

Scoring:
3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with density/distribution in categories 1, 2, or 3.
1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
0 = Invasive plants present with density/distribution in categories 8, or higher.

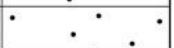
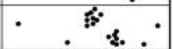
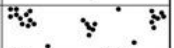
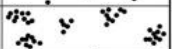
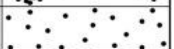
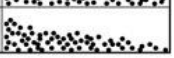
CLASS	DESCRIPTION OF ABUNDANCE	DISTRIBUTION PATTERN
0	No invasive plants on the polygon	
1	Rare occurrence	
2	A few sporadically occurring individual plants	
3	A single patch	
4	A single patch plus a few sporadically occurring plants	
5	Several sporadically occurring plants	
6	A single patch plus several sporadically occurring plants	
7	A few patches	
8	A few patches plus several sporadically occurring plants	
9	Several well spaced patches	
10	Continuous uniform occurrence of well spaced plants	
11	Continuous occurrence of plants with a few gaps in the distribution	
12	Continuous dense occurrence of plants	
13	Continuous occurrence of plants associated with a wetter or drier zone within the polygon.	

Figure 1. Invasive plant species class guidelines (figure adapted from Adams and others [2003])

NOTE: Prior to the 2001 season, the health score for weed infestation was assessed from a single numerical value that does not represent weed canopy cover, but instead represents the fraction of the polygon area on which weeds had a well established population of individuals (i.e., the area infested).

8. Disturbance-Increaser Undesirable Herbaceous Species. A large cover of disturbance-increaser undesirable herbaceous species, native or exotic, indicates displacement from the potential natural community (PNC) and a reduction in riparian health. These species generally are less productive, have shallow roots, and poorly perform most riparian functions. They usually result from some disturbance, which removes more desirable species. Invasive plant species considered in the previous item are not reconsidered here. As in the previous item, the evaluator should state the list of species considered. A partial list of undesirable herbaceous species appropriate for use in Alberta follows. A list should be used that is standard for the locality and that indicates which species are being considered (i.e., *Invasive Weed and Disturbance-caused Undesirable Plant List* [Cows and Fish 2001]). The evaluator should list any additional species included.

Antennaria species (pussy-toes)	*Hordeum jubatum* (foxtail barley)	*Potentilla anserina* (silverweed)
Brassicaceae (mustards)	*Plantago* species (plantains)	*Taraxacum* species (dandelion)
Bromus inermis (awnless brome)	*Poa pratensis* (Kentucky bluegrass)	*Trifolium* species (clovers)
Fragaria species (strawberries)	_____	_____

For field determination of vegetative cover related questions (questions D2 to D14) include **all rooted plant material** (live or dead). Do not include fallen wood or other plant litter. Do not consider the polygon area covered by water (such as between emergent plants).

Scoring:
3 = Less than 5% of the reach covered by undesirable herbaceous species.
2 = 5% to 25% of the reach covered by undesirable herbaceous species.
1 = 25% to 50% of the reach covered by undesirable herbaceous species.
0= More than 50% of the reach covered by undesirable herbaceous species.

9. Riverbank Root Mass Protection. Vegetation along river banks performs the primary physical functions of stabilizing the soil with a binding root mass and of filtering sediments from overland flow. Few studies have documented depth and extent of root systems of plant species found in wetlands, however flow energies commonly experienced by rivers are effectively resisted only by the deep and extensive roots provided by tree and shrub species. Natural rivers typically move dynamically across their valley bottom. The vegetation roots serve to slow this lateral movement to a rate that allows normal floodplain ecosystem function, such as development of mid and later seral vegetation communities for habitat values. For this reason there needs to be good root mass protection well back from the immediate toe of the current bank position.

In situations where you are assessing a high, cut bank (usually on an outside bend), the top may be upland, but the bottom is riparian. Do not assess the area that is non-riparian. In cases of tall, nearly vertical cut banks, assess the bottom portion that comes in contact with floodwaters. Omit from consideration those areas where the bank is comprised of bedrock, since these neither provide binding root mass, nor erode at a rate that is normally a concern. In assessing root mass protection along a river, consider a band that extends back approximately 15 m (50 ft) from the bank top. (This is a rule of thumb for guidance that requires only estimated measurements.) The bank top is that point where the upper bank levels off to the relatively flat surface of a floodplain or terrace. This question is most critically assessed along straight reaches and outside curves, therefore do not get too concerned with trying to find the exact location of the bank top along inside curve point bar positions. ***NOTE:*** *Rip-rap does not substitute for, act as, nor preclude the need for deep, binding root mass.*

Scoring:
6 = More than 85% of the riverbank has a deep, binding root mass.
4 = 65% to 85% of the riverbank has a deep, binding root mass.
2 = 35% to 65% of the riverbank has a deep, binding root mass.
0= Less than 35% of the riverbank has a deep, binding root mass.

10. Human-Caused Bare Ground. Bare ground is soil not covered by plants, litter or duff, downed wood, or rocks larger than 6 cm (2.5 in). Hardened, impervious surfaces (e.g., asphalt, concrete, etc.) are not bare ground—these do not erode nor allow weeds sites to invade. Bare ground caused by human activity indicates a deterioration of riparian health. Sediment deposits and other natural bare ground are excluded as normal or probably beyond immediate management control. Human land uses causing bare ground include livestock grazing, recreation, roads, and industrial activities. The evaluator should consider the causes of all bare ground observed and estimate the fraction that is human-caused.

River channels that go dry during the growing season can create problems for polygon delineation. On most rivers, the area of the channel bottom is excluded from the polygon. (***NOTE:*** *The whole channel width extends from right bankfull stage to left bankfull stage; however we need to include the lower banks in all polygons, therefore consider for exclusion ONLY the relatively flat and lowest area of the channel—the bottom.*) This allows data to be collected on the riparian area while excluding the aquatic zone, or open water, of the river. The aquatic zone is the area covered by water and lacking persistent emergent vegetation. Persistent emergent vegetation consists of perennial wetland species that normally remain standing at least until the beginning of next growing season, e.g., *Typha* species (cattails), *Scirpus* species (bulrushes), *Carex* species (sedges), and other perennial graminoids.

In many systems, large portions of the channel bottom may become exposed due to seasonal irrigation use, hydroelectric generation, and natural seasonal changes such as are found in many prairie ecosystems. In these cases, especially along prairie rivers, the channel bottom may have varying amounts of herbaceous vegetation, and the channel area is ***included*** in the polygon as area to be inventoried. Typically, these are the pooled channel river type that has scour pools scattered along the length, interspersed with reaches of grass, bulrush, or sedge-covered channel bottom. If over half (>50%) the channel bottom area has a canopy cover of persistent vegetation cover (perennial species), taken over the entire length of the polygon as a whole, then the entire channel qualifies for inclusion within the inventoried polygon area. If you are in doubt whether to include the channel bottom in the polygon, then leave it out, but be sure to indicate this in the comment section. This is important so that future assessments of the polygon will be looking at the same area of land.

Scoring:
6 = Less than 1% of the polygon/site is human-caused bare ground.
4 = 1% to 5% of the polygon/site is human-caused bare ground.
2 = 5% to 15% of the polygon/site is human-caused bare ground.
0= More than 15% of the polygon/site is human-caused bare ground.

NOTE: **Questions 11 and 12 below generally must be answered in the office using maps and other data.**

11. Removal or Addition of Water from/to the River System. Proper functioning of any riparian ecosystem depends, by definition, upon the system supply of water. The degree to which this lifeblood is artificially manipulated by removal or addition from/to the system is directly reflected in a reduction of riparian functions (e.g., wetland plant community maintenance, channel bank stability, wildlife habitat, overall system primary production). The extent of this alteration of the system can be estimated by determining the fraction of the average river flow, which is removed or added during the critical growing season each year. This determination can be based upon gauging station records as they relate to historic flow records established before construction of diversions. This question only deals with water volume changes. The question of dams controlling the timing of peak runoff is taken care of in the next question.

Scoring:
9 = Less than 10% of average river flow volume during the critical growing season is changed.
6 = 10% to 25% of average river flow volume during the critical growing season is changed.
3 = 25% to 50% of average river flow volume during the critical growing season is changed.
0 = More than 50% of average river flow volume during the critical growing season is changed.

12. Control of Flood Peak and Timing by Upstream Dam(s). Natural riverine ecosystems adapt to, and depend upon, the volume and timing of annual peak flows, which are determined by the watershed water yield and variability of the local climate. Humans have installed dams on many rivers for agricultural and industrial purposes and to mitigate the damages caused by the natural flooding to human development on the floodplain. The dams affect the functional health of the natural system. In this context, the health of the river system relates directly to the fraction of the watershed which remains undammed. Thus, this item includes all tributaries which flow into the river upstream of the reach being assessed.

Scoring:
9 = Less than 10% of the watershed upstream of the reach is controlled by dams.
6 = 10% to 25% of the watershed upstream of the reach is controlled by dams.
3 = 25% to 50% of the watershed upstream of the reach is controlled by dams.
0 = More than 50% of the watershed upstream of the reach is controlled by dams.

13. Riverbanks Structurally Altered by Human Activity. Altered riverbanks are those having impaired structural integrity (strength or stability) due to human causes. These banks are more susceptible to cracking and/or slumping. Count as riverbank alteration such damage as livestock or wildlife hoof shear and concentrated trampling, vehicle or ATV tracks, and any other areas of human-caused disruption of bank integrity, including rip-rap or use of fill. The basic criterion is any disturbance to bank structure that increases erosion potential or bank profile shape change. One large exception is lateral bank cutting caused by stream flow, even if thought to result from upstream human manipulation of the flow. The intent of this item is to assess only direct, on-site mechanical or structural damage to the banks. Each bank is considered separately, so total bank length for this item is approximately twice the reach length of channel in the polygon (more if the river is braided). ***NOTE:*** Constructed riverbanks (especially those with rip-rap) may be stabilised at the immediate location, but are likely to disrupt normal flow dynamics and cause erosion of banks downstream. In assessing structural alteration, consider a band along the river bank approximately 4 m (13 ft) wide back from the bank toe. As with deep, binding root mass, this question is most critically assessed along straight reaches and outside curves, therefore do not get hung up trying to find the exact location of the bank top along inside curve point bar positions.

Scoring:
6 = Less than 5% of the bank length has been structurally altered by human activity.
4 = 5% to 15% of the bank length has been structurally altered by human activity.
2 = 15% to 35% of the bank length has been structurally altered by human activity.
0 = More than 35% of the bank length has been structurally altered by human activity.

14. Human Physical Alteration to the Rest of the Polygon/Site. Within the remainder of the polygon area, outside the streambank area that was addressed in the previous question, estimate the amount of area that has been physically altered by human causes. The purpose of this question is to evaluate physical change to the soil, hydrology, etc. as it affects the ability of the natural system to function normally. Changes in soil structure will alter infiltration of water, increase soil compaction, and change the amount of sediment contributed to the water body. Every human activity in or around a natural site can alter that site. This question seeks to assess the accumulated effects of all human-caused change. Count such things as:

- **Soil Compaction.** This kind of alteration includes livestock-caused hummocking and pugging, recreational trails that obviously have compacted the soil, vehicle and machine tracks and ruts in soft soil, etc.
- **Plowing/Tilling.** This is disruption of the soil surface for cultivation purposes.
- **Results of Hydrologic Change.** Include in this category any area that is physically affected by removal or addition of water for human purpose, although cause may be occurring upstream off-site. The physical effects to look for are erosion due to reduced or increased water, bared soil surface that had water cover removed, or flooded area that normally supports a drier vegetation type.
- **Human Impervious Surface.** This includes roofs, hardened surfaces like walkways and roads, boat launches, etc.
- **Topographic Change.** This is the deliberate alteration of terrain and/or drainage pattern for human purposes. It may be for aesthetic (landscaping) or other reasons, including such structures as water diversions ditches and canals.

Scoring:
6 = Less than 5% of the polygon/site is altered by human causes.
4 = 5% to 15% of the polygon/site is altered by human causes.
2 = 15% to 25% of the polygon/site is altered by human causes.
0 = More than 25% of the polygon/site is altered by human causes.

15. Floodplain Accessibility within the Site. Many of the most important functions of a riparian ecosystem depend upon the ability of the channel to access its floodplain during high flows. This access is restricted by levees and other human constructed embankments, such as roadbeds. Evaluators should determine what fraction of the historic 100 year floodplain within the polygon remains unrestricted by such embankments. This can usually be determined by comparing the area within the embankments (as shown on the latest photos or maps available).

Scoring:
6 = More than 85% of the floodplain is accessible to flood flows.
4 = 65% to 85% of the floodplain is accessible to flood flows.
2 = 35% to 65% of the floodplain is accessible to flood flows.
0 = Less than 35% of the floodplain is accessible to flood flows.