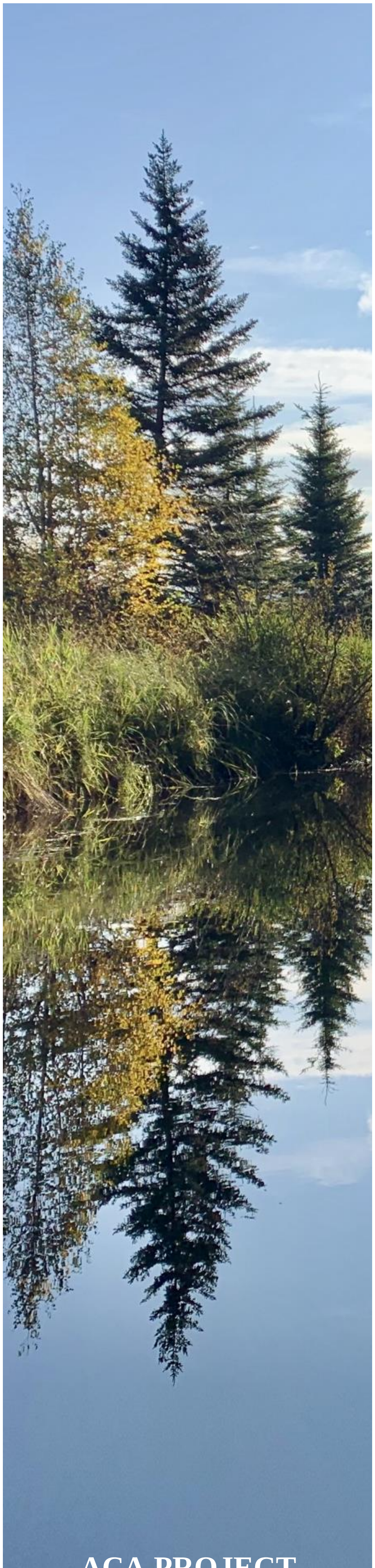

ACA PROJECT REPORT

# Comparison of 2009 and 2021 Riparian Health Assessments in the Beaverlodge River Watershed of Alberta Using Aerial Videography

Alberta Conservation Association

wildlife | fish | habitat

**Comparison of 2009 and 2021 Riparian Health Assessments in the Beaverlodge River Watershed of Alberta Using Aerial Videography**

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## EXECUTIVE SUMMARY

The Beaverlodge River watershed has been subject to human land use changes that have led to negative impacts on the ecological integrity and health of riparian areas. Alberta Conservation Association's Riparian Conservation Program (RCP) has classified the Beaverlodge River watershed as a priority watershed due to riparian degradation and the loss of Arctic grayling (*Thymallus arcticus*) from the system. In collaboration with several partners, the RCP team has been working in the watershed since 2004 to improve riparian health and fish habitat within the Beaverlodge River and three of its tributaries: Beavertail Creek, Windsor Creek, and Steeprock Creek.

This report explores the use of aerial videography as a landscape-level assessment tool; specifically, we used aerial videography to assess riparian health and changes to riparian health in a large portion of the Beaverlodge River watershed between 2009 and 2021. In 2021, the overall riparian health of the Beaverlodge River watershed was scored as 75.22% Good, 13.27% Fair, and 11.51% Poor. This is an increase of 12.78% of the riparian area scored as Good compared to the 2009 assessment. The results of aerial videography riparian health assessments help us evaluate the effectiveness of the RCP's actions since 2004 and guide future efforts of the program to improve riparian health in the Beaverlodge River watershed in Alberta.

**Key words:** aerial videography, riparian health, Beaverlodge River watershed, Beaverlodge River, Beavertail Creek, Windsor Creek, Steeprock Creek.

**ACKNOWLEDGEMENTS**

We would like to thank our corporate sponsors Ovintiv, TC Energy, and Cenovus Energy for their financial support of the helicopter flight in 2021. Thank you to John Hallett (ACA) and George Walker (Walker Environmental) for the 2009 data collection, scoring, and digitizing. Cows and Fish staff are to thank for earlier versions of the videography scorecard. Lastly, many thanks to ACA staff for assistance with the data analysis and report, including Erin VanderMarel for scoring assistance and contributions to the methods, John Hallett for videography advice and scoring assistance, Garret McKen for videography advice, Tyler Johns for GIS training, Jeff Forsyth and Scott Seward for reviews of an earlier draft, and Stefanie Fenson and Mandy Couve for reviews of the final draft.

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## 1.0 INTRODUCTION

Across Alberta, the ecological integrity of watercourses and riparian areas is increasingly impacted by human-caused disturbances such as agriculture, forestry, oil and gas, housing developments, and other land uses. Alberta Conservation Association (ACA)'s Riparian Conservation Program (RCP) identifies priority watersheds in Alberta to focus conservation efforts that enhance and improve riparian health and fish habitat. Priority watersheds chosen for the program are those that have experienced a decline in both riparian health and fish species abundance or extent.

In 2002, human-caused disturbances were documented in the riparian areas of the Beaverlodge River, Beavertail Creek, and Steeprock Creek in northwestern Alberta (Hallett 2003). Bankside livestock grazing and watering, vegetation removal for agriculture and ranching, and vehicle fording were the main disturbance types occurring in the watershed at that time (Hallett 2003) and continue to occur today. These areas of riparian degradation can have a detrimental impact on water quality and fish habitat throughout these watercourses.

Another primary concern in the Beaverlodge River watershed is the extirpation of Arctic grayling (*Thymallus arcticus*) from the system. Historically, the Beaverlodge River had a large spawning population of Arctic grayling (Lucko 1995). Arctic grayling have not been found in the system since 1994 (AECOM Canada Ltd. 2009), when two grayling were captured at the Beaverlodge weir (Lucko 1995). Electrofishing surveys conducted in the Beaverlodge River watershed in 2021 found species including longnose sucker (*Catostomus catostomus*), white sucker (*Catostomus commersonii*), lake chub (*Couesius plumbeus*), and northern pike (*Esox lucius*) (Matrix Solutions Inc. 2021, Wood Environment and Infrastructure Solutions 2021).

Since 2004, the Beaverlodge RCP team has worked with partners, including government, non-government conservation organizations, and the public, to restore and conserve riparian habitat. The team has installed livestock exclusion fencing and off-stream cattle watering systems, improved stream crossings, planted trees, staked willows, and conducted public outreach. The Beaverlodge RCP team has also monitored the health of riparian areas through time using on-the-ground riparian health assessments and inventories conducted by Cows and Fish and ACA staff, following the guidelines outlined in the *Riparian Health Assessment for Streams and Small Rivers - Field Workbook* (Fitch et al. 2009).

This report describes the use of aerial videography in the Beaverlodge River watershed in 2009 and 2021 as a planning tool to assess riparian health and integrity at a landscape level. Similar assessments have been completed in Alberta on both lakes and streams including the South Heart and West Prairie Rivers (Johns and Hallett 2009), Owl River (Johns and Cantin 2012), and Wabamun Lake (NSWA 2015). This tool is not a replacement for on-the-ground riparian health assessments; however, at a coarser scale, it allows a large land base to be assessed efficiently. We had three main objectives for this assessment: 1) quantify the current health of the riparian areas along the Beaverlodge River and three of its tributaries: Beavertail Creek, Windsor Creek, and Steeprock Creek using aerial videography; 2) compare the current riparian health to that in 2009 using similar methods; and 3) identify specific locations to focus future efforts of the Beaverlodge RCP.

## 2.0 STUDY AREA

For the purposes of this report, the watersheds discussed refer to the portions that are located in Alberta. The Redwillow watershed is in northwestern Alberta, west of Grande Prairie, in the Peace River drainage. The Redwillow watershed is 211,529 ha and can be broken down into two sub-basins: the Redwillow River watershed and the Beaverlodge River watershed (AECOM Canada Ltd. 2009, Redwillow Watershed Restoration Team 2015). The Beaverlodge River watershed sub-basin is 144,241 ha (Redwillow Watershed Restoration Team 2015) and is made up of the Beaverlodge River and its main tributaries: Beavertail Creek, Windsor Creek, and Steeprock Creek (Figure 1). The Beaverlodge River is supplied with water from its main tributary Beavertail Creek, which in turn is supplied with water from Windsor Creek and Steeprock Creek (Figure 1). The Beaverlodge River flows into the Redwillow River, just before the Redwillow's confluence with the Wapiti River (Figure 1).

From the confluence with the Redwillow River, for approximately the first 14 km upstream, the Beaverlodge River is characterized by large, forested valleys with steep banks. Continuing from here, the valleys become much shallower and contain many farms, ranches, and acreages. In 1981, a weir was placed on the Beaverlodge River near the town of Beaverlodge to divert water for municipal use (Carl et al. 1992). In 1984, a fish ladder was installed to facilitate fish passage, but the ladder presented a barrier to fish particularly in years with low flow and debris buildup (Redwillow Watershed Restoration Team 2015). The weir still exists today, but in 2018 a rock passage design was installed to better facilitate fish passage.

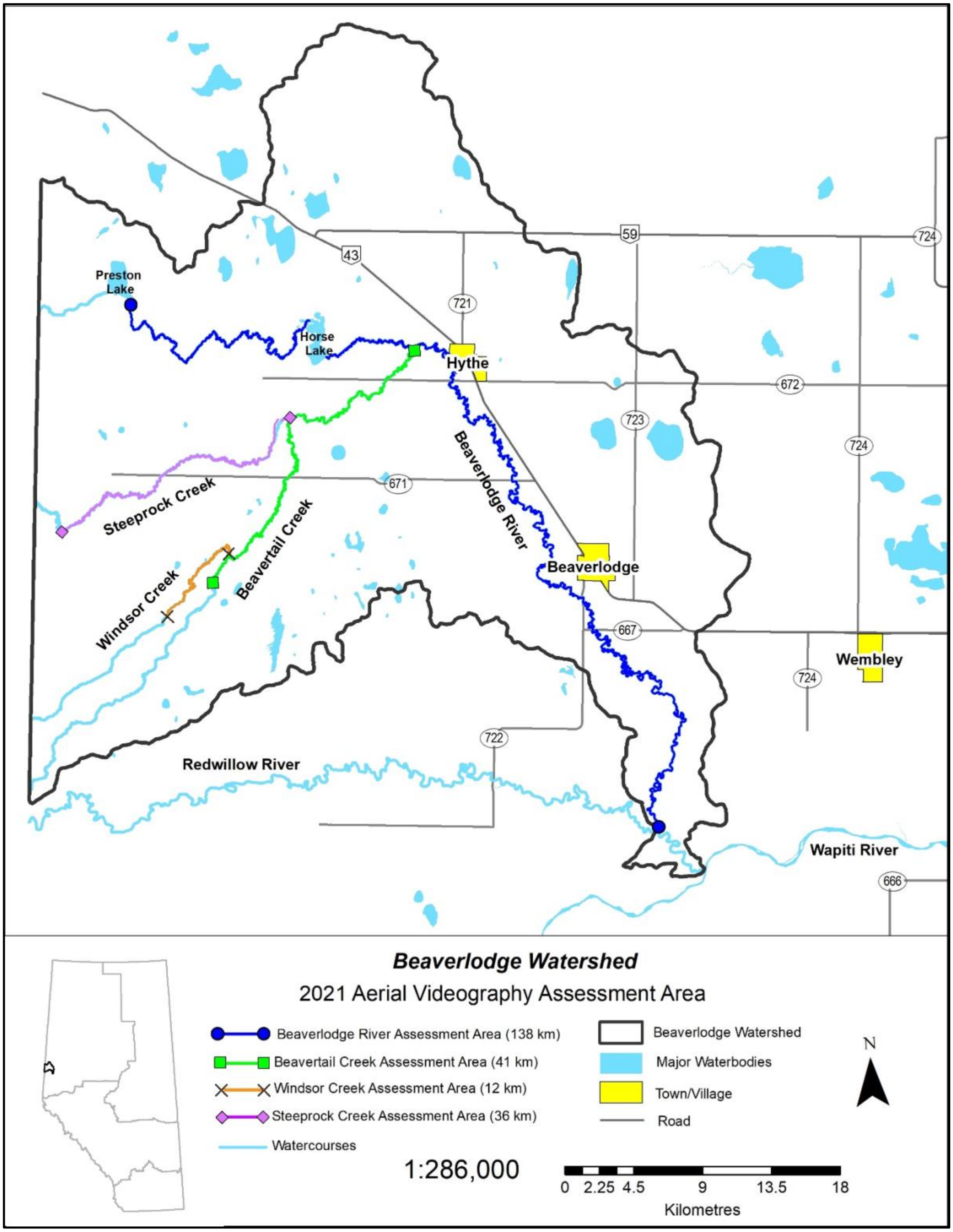



**Figure 1.** Map of Beaverlodge River watershed study area in Alberta with approximate flight distances for each watercourse.

## 3.0 MATERIALS AND METHODS

### 3.1 2009 data collection

On August 11, 2009, ACA staff and George Walker from Walker Environmental recorded a 2.5-hour helicopter flight using a chartered A-star helicopter (J. Hallett, pers. comm.). Specifics on the flight height, and speed are not known. The flight was recorded with a hand-held Sony TRV900 miniDV Camcorder connected to a Red Hen Systems VMS300 GPS unit, a device that embeds the geo-referenced aircraft position data to the video tape (J. Hallett, pers. comm.).

### 3.2 2009 video assessment scoring system

The video was processed using ACA's *Aerial Videography –2006 Lotic Riparian Assessment Scorecard* (ACA unpubl. report). John Hallett and George Walker completed the assessment.

### 3.3 2009 data analysis using ArcMap

MediaMapper computer software was used to develop an index file to display the flight path of the helicopter as a map (J. Hallett, pers. comm.). MediaMapper also saved a time code on the video tape to allow coordination between the video and still map. The index file was converted to a shapefile in ArcMap for further analysis (J. Hallett, pers. comm.).

### 3.4 2021 data collection

On September 14, 2021, Valley B Aviation was hired to fly approximately 227 km of stream in the Beaverlodge River watershed using a Robinson R44II helicopter. Approximately 138 km of Beaverlodge River, 41 km of Beavertail Creek, 12 km of Windsor Creek, and 36 km of Steeprock Creek were assessed (Figure 1). This assessment did not include Horse Lake or Preston Lake.

The helicopter flew approximately 50 m above ground level at a speed of approximately 60 knots. The videography was filmed with a Garmin Virb camera suction cupped to the window of the machine. Upon completion of the flight, the Garmin Virb camera footage was downloaded using a Garmin video editor program to produce a geo-referenced video two hours and four minutes in length. The GPX track stored in the camera was also downloaded and used to align data points.

### 3.5 2021 video assessment scoring system

The 2021 video was processed using the *2018 Aerial Videography – Lotic Riparian Management Area Health and Integrity Assessment Scorecard* (Appendix 1). For the assessment, the following definitions are used: "riparian area" is the lush transition zone between the watercourse and the upland that can vary in width along the watercourse and is characterized by a predictable change in dominant vegetation (Figure 2); "buffer area" is the land beyond (and including) the riparian area that has a fixed distance of approximately 30 m from the edge of the watercourse; and "riparian management area" is the total area composed of the buffer and riparian areas (Figure 2). It is possible that the buffer area is functionally equivalent to the riparian area if the riparian area fills the entire 30 m from the edge of the watercourse (Figure 2).

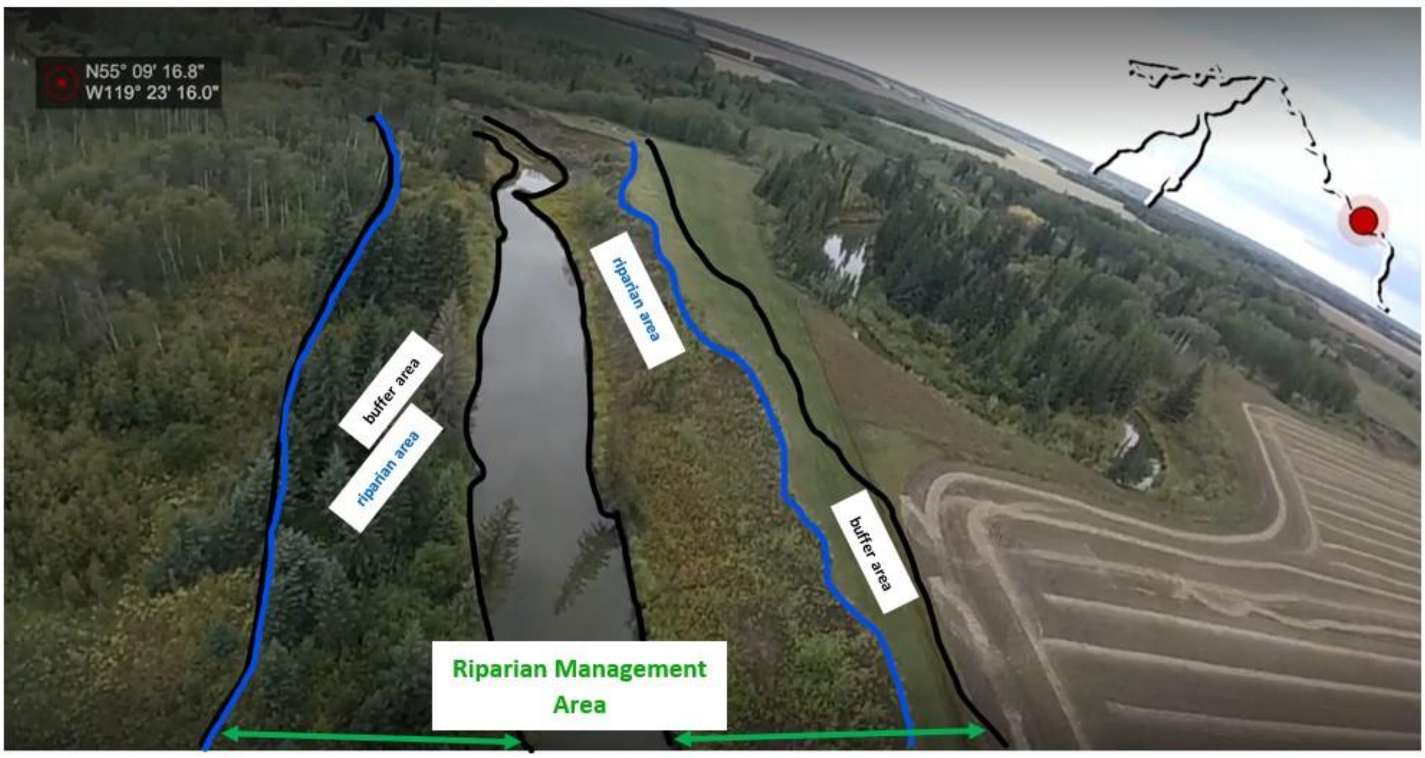



**Figure 2.** Schematic of riparian management area components.

The geo-referenced video was played and scored using an Excel scorecard (see example in Figure 3). At least two trained ACA staff members scored the video by holding their mouse cursor in the middle of the screen and assessing the video as it passed by the mouse cursor. The mouse cursor was used as the point of reference to mark the video time when changes in riparian score were observed. Each individual row in the Excel scorecard reflects these changes since a change in score of one question results in a new row entry. The right and left streambanks were assessed and scored independently. The streambank naming (left/right) was based on the convention of starting upstream and working downstream.

For riparian areas that have steep banks with no natural potential for vegetation (due to soil structure or other natural factors), vegetation cover was scored in the highest category because there was no evidence of human impacts (questions 1–3, Appendix 1). For this assessment, riparian areas impacted by human-caused disturbance (picture B, question 7, Appendix 1) are scored lower than those in a natural state (picture A, question 7, Appendix 1).

**Lotic Riparian Management Area Health & Integrity Assessment Scoresheet for the Beaverlodge River- LEFT Bank - 14 Sept 2021**

Based on the Alberta Conservation Association's March 2018 scorecard | Last edit to data: 01-Apr-22

Scores were a collaborative rating by Taylor Lund and and Erin Vandermarel

| Duration Hr:Min:Sec | Start | End | H&I Classification | 1. % Polygon Vegetated A(>90%=2) B(75%-90%=1) C(<75%=0) | 2. Woody spp. cover? A(>35%=2) B(15%-35%=1) C(<15%=0) | 3. Observable recruitment or persistance of woody species Y=2 N=0 | 4. % Polygon with visual signs of human/cattle -caused alteration of veg. A(<5%=4) B(5%-15%=2) C(>15%=0) | 5. % Polygon with visual signs of human/cattle-caused bare ground. A(<5%=4) B(5%-15%=2) C>15%=0 | 6. Bank Stability S(Stable=4) M(Moderately unstable=2) H(Highly unstable=0) | 7. Like Picture A=4 A&B=2 B=0 | 1$^0$ Land Use: Pasture, Hay, Crop, Natural, Road, etc. | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recorded Video | | | | | | | | | | | | |
| Beaverlodge River 14 Sept 2021 LEFT Bank | | | | | | | | | | | | |
| Use caution interpreting left and right banks as we are flying upstream. The river's LEFT bank is being viewed on the right side of the screen. | | | | | | | | | | | | |
| 0:01:24 | 0:00:00 | 0:01:24 | Good | a | b | y | a | a | m | a | natural | |
| 0:00:03 | 0:01:24 | 0:01:27 | Fair | a | b | y | b | a | m | ab | natural with trail | |
| 0:00:01 | 0:01:27 | 0:01:28 | Poor | c | c | n | c | c | m | b | trail to river | |
| 0:03:29 | 0:01:28 | 0:04:57 | Good | a | b | y | a | a | m | a | natural | |
| Break in video at 0:04:57 resumes again at 0:07:40 | | | | | | | | | | | | |
| 0:00:34 | 0:07:40 | 0:08:14 | Good | a | b | y | a | a | m | a | natural | |
| 0:00:07 | 0:08:14 | 0:08:21 | Fair | a | b | y | c | a | h | ab | natural with clearing above | large buffer |
| 0:01:53 | 0:08:21 | 0:10:14 | Good | a | b | y | a | a | m | a | natural | |
| 0:00:16 | 0:10:14 | 0:10:30 | Fair | a | b | y | b | b | s | ab | residential/natural | cabin |
| 0:02:58 | 0:10:30 | 0:13:28 | Good | a | b | y | a | a | m | a | natural | |
| Started decedent at 0:13:28, landed 14:01 to 14:30 | | | | | | | | | | | | |
| 0:00:09 | 0:14:30 | 0:14:39 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:01 | 0:14:39 | 0:14:40 | Poor | c | c | n | c | c | m | b | ford | |
| 0:00:17 | 0:14:40 | 0:14:57 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:03 | 0:14:57 | 0:15:00 | Poor | c | c | n | c | c | m | b | temp. bridge crossing | |
| 0:00:04 | 0:15:00 | 0:15:04 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:08 | 0:15:04 | 0:15:12 | Fair | a | c | y | b | b | s | b | quad trails and cleared veg | |
| 0:00:17 | 0:15:12 | 0:15:29 | Good | a | b | y | a | a | m | a | natural | |
| 0:00:02 | 0:15:29 | 0:15:31 | Poor | a | c | n | b | b | h | ab | slumping | |
| 0:00:05 | 0:15:31 | 0:15:36 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:10 | 0:15:36 | 0:15:46 | Fair | a | a | y | b | b | m | b | buffer, bare ground | |
| 0:01:04 | 0:15:46 | 0:16:50 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:03 | 0:16:50 | 0:16:53 | Fair | a | a | y | b | b | m | b | buffer, bare ground | |
| 0:00:30 | 0:16:53 | 0:17:23 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:17 | 0:17:23 | 0:17:40 | Good | a | a | y | b | a | s | ab | field above with buffer | |
| 0:00:04 | 0:17:40 | 0:17:44 | Poor | c | c | n | c | c | h | b | above | |
| 0:00:03 | 0:17:44 | 0:17:47 | Fair | b | a | y | c | b | m | ab | buffer | |
| 0:00:13 | 0:17:47 | 0:18:00 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:02 | 0:18:00 | 0:18:02 | Fair | a | c | n | b | a | m | ab | some buffer | |
| 0:01:05 | 0:18:02 | 0:19:07 | Good | a | a | y | a | a | s | a | natural | |
| 0:00:08 | 0:19:07 | 0:19:15 | Good | a | a | y | b | a | s | a | natural with field above | large buffer |

**Figure 3.** Sample of completed Excel scorecard for Beaverlodge River left bank in 2021.

### 3.6 2021 data analysis using ArcMap

A completed Excel scorecard was the product of the video assessment (Figure 3). We used ESRI ArcMap to display these assessment results on a map and to determine proportions for each score category. Three programs were open on the computer simultaneously while completing the ArcMap data analysis: 1) the geo-referenced flight video; 2) ESRI ArcMap displaying a shapefile of each watercourse, GPX track, and imagery; and 3) the completed Excel scorecard. To display the assessment results on a map, an arbitrary 40 m buffer was created in ArcMap using the Government of Alberta hydrology shapefile (BF_HYDRO_SLNET_ARC), which is a digitized polyline roughly following the middle of each watercourse.

After each watercourse shapefile was buffered, the new polygon was transformed into a polyline to create two outer boundary lines: one representing the left bank and one representing the right bank. The left and right polylines were analyzed separately in ArcMap. A combination of the GPX track and landmarks that matched between the video and the ArcMap imagery were used along with ArcMap's split tool to split each polyline into individual polyline segments according to individual rows recorded on the Excel scoresheets. Based on the calculated health score, each polyline segment was then assigned to a score category of Good, Fair, or Poor, and colour-coded.

### 3.7 Differences between 2009 and 2021 methods

Data analysis methods differed between 2009 and 2021. Specifically, when the 2009 data were digitized in ArcMap, the watercourse polygon was used instead of a buffered polyline. Without a buffer, a higher frequency of meanders in the stream are followed resulting in a longer length, preventing direct comparison of streambank lengths between 2009 and 2021. As a result, we could not perform spatial analyses on geographically specific locations. Nevertheless, we made an effective numerical comparison between the two years: the riparian health categories were summarized along the total length of each watercourse to determine proportions of the watercourse scored as Good, Fair, and Poor for each year. Using these proportions, each watercourse was compared between years to determine net changes.

Flight paths also differed slightly between 2009 and 2021. Maps in Appendices 2 and 3 display health scores for the entire flight of the watercourses in both years. Appendix 3a–3i maps can be used to visually compare different parts of the watercourses between years. It is important to note even though the entire flight was scored and mapped for each year, only the portions of the flight path that match between 2009 and 2021 can be proportionally compared. As a result, in the final stages of the ArcMap analysis, flight paths were clipped to include only the portions of the flight that matched between years to allow us to proceed with the numerical comparisons explained above.

# 4.0 RESULTS

## 4.1 2021 spatial results

In human-altered locations, riparian area width often determined the health score category (Appendices 2a–2i). A riparian management area comprised mostly of riparian area often resulted in a Good score, whereas a very narrow or entirely lacking riparian area often resulted in a Poor score. Generally, besides riparian area width, Good health scores were often attributed to natural areas or areas with exclusion fencing. In contrast, Poor health scores were often attributed to residences or crops directly adjacent to watercourses, as well as trails, fords, road crossings, and livestock activity on streambanks or directly in watercourses.

## 4.2 Spatial comparison of 2009 and 2021

### *4.2.1 Combined right and left streambanks*

Between 2009 and 2021, the proportion of river length categorized as Good increased for combined right and left streambanks on all watercourses, with Beaverlodge River increasing 12.17%, Beavertail Creek increasing 15.54%, Windsor Creek increasing 25.92%, and Steeprock Creek increasing 6.53% (Figure 4; Appendix 4). All watercourses showed a decrease in Fair and Poor category scores in 2021.

Combining all watercourses in the Beaverlodge River watershed, in 2009, riparian health was scored as 62.44% Good, 20.65% Fair, and 16.91% Poor; in 2021, riparian health was scored as 75.22% Good, 13.27% Fair, and 11.51% Poor. This is a 12.78% increase in riparian area scored as in Good health, a 7.38% decrease in area scored as Fair, and a 5.40% decrease in area scored as Poor.

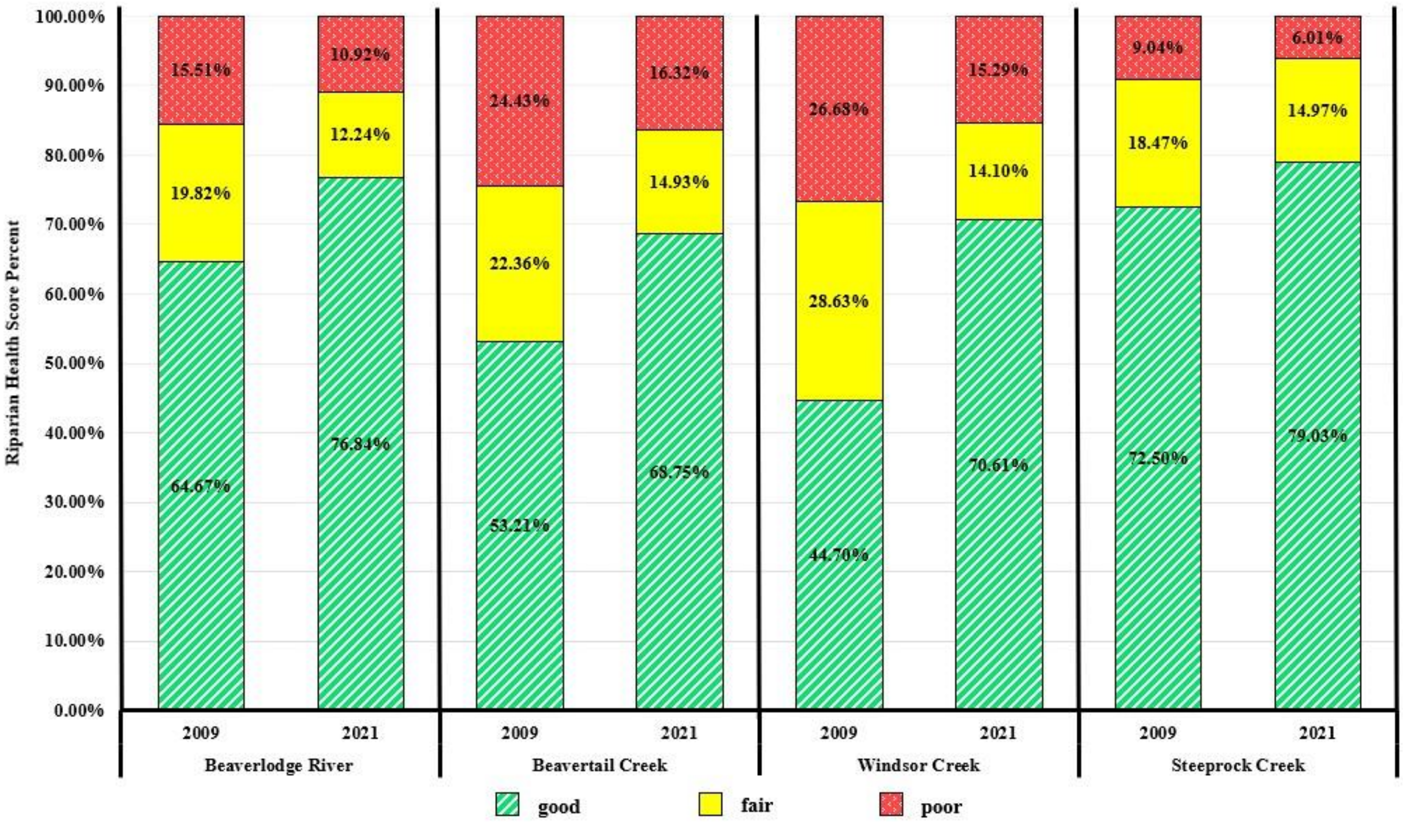



**Figure 4.** Results of combined aerial riparian health assessment scores for right and left streambank reaches in 2009 and 2021, showing proportion of total streambank that scored Good (green; diagonally striped), Fair (yellow; solid), and Poor (red; dotted).

### *4.2.2 Separate right and left streambanks*

In 2009, Beaverlodge River, Beavertail Creek, and Steeprock Creek right bank scored better than the left bank, whereas Windsor Creek left bank scored better than the right bank (Figures 5 and 6; Appendix 4). In 2021, this held true for Beaverlodge River and Beavertail Creek; however, Windsor Creek's right bank scored better than the left bank and Steeprock's left bank scored better than the right bank (Figures 5 and 6; Appendix 4). Almost all watercourse's banks, regardless of being the right bank or the left bank, improved from 2009 to 2021 (Figures 5 and 6; Appendix 4). One exception was a net decrease of 0.65% in the proportion of creek length scored as Good for Steeprock Creek's right bank from 2009 to 2021 (Figure 5). This net decrease on the right bank was outweighed by a net increase on the left bank of 13.64% in the Good category (Figure 6). When combining both banks there was a net increase of 6.53% for Steeprock Creek (Figure 4).

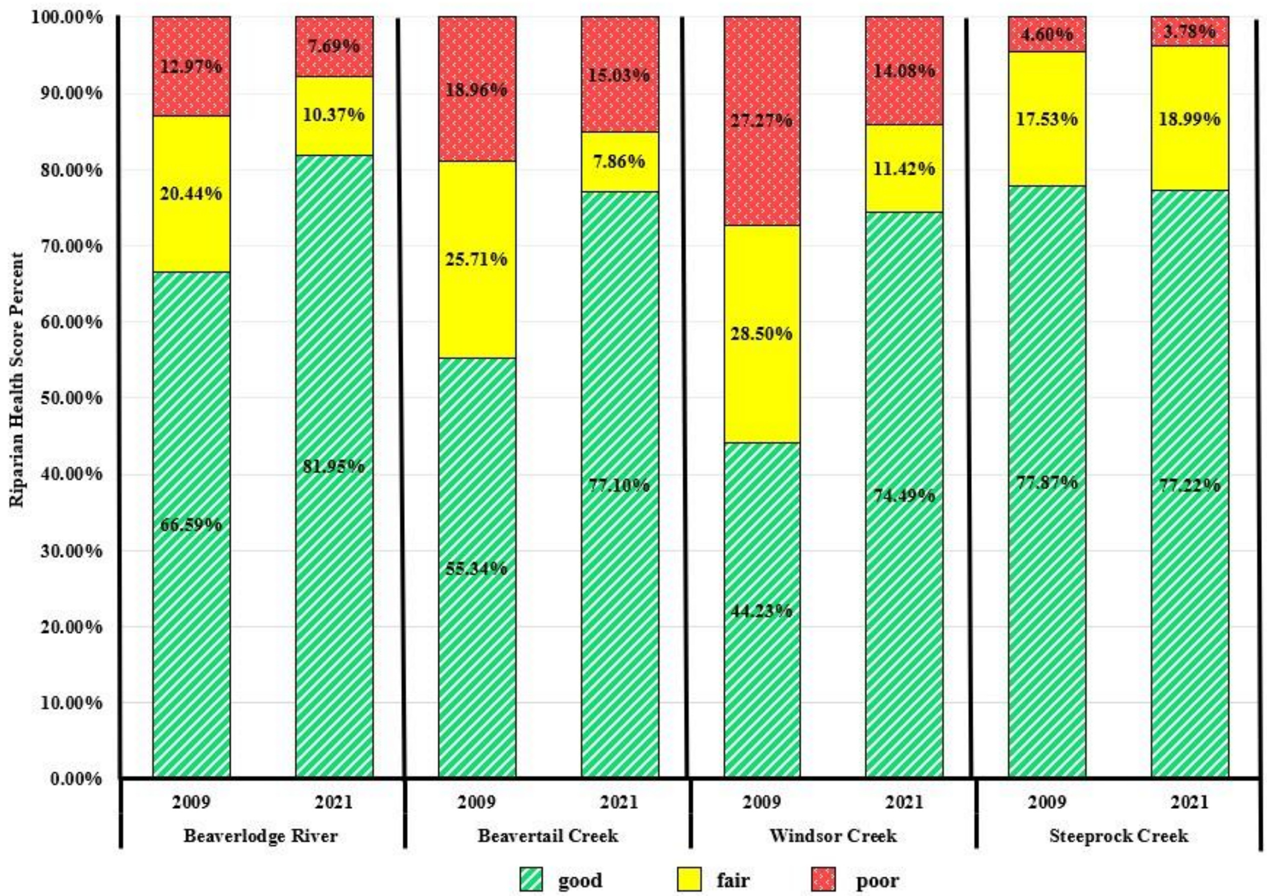



**Figure 5.** Results of aerial riparian health assessment scores for right streambank reaches in 2009 and 2021, showing proportion of total right streambank that scored Good (green; diagonally striped), Fair (yellow; solid), and Poor (red; dotted).

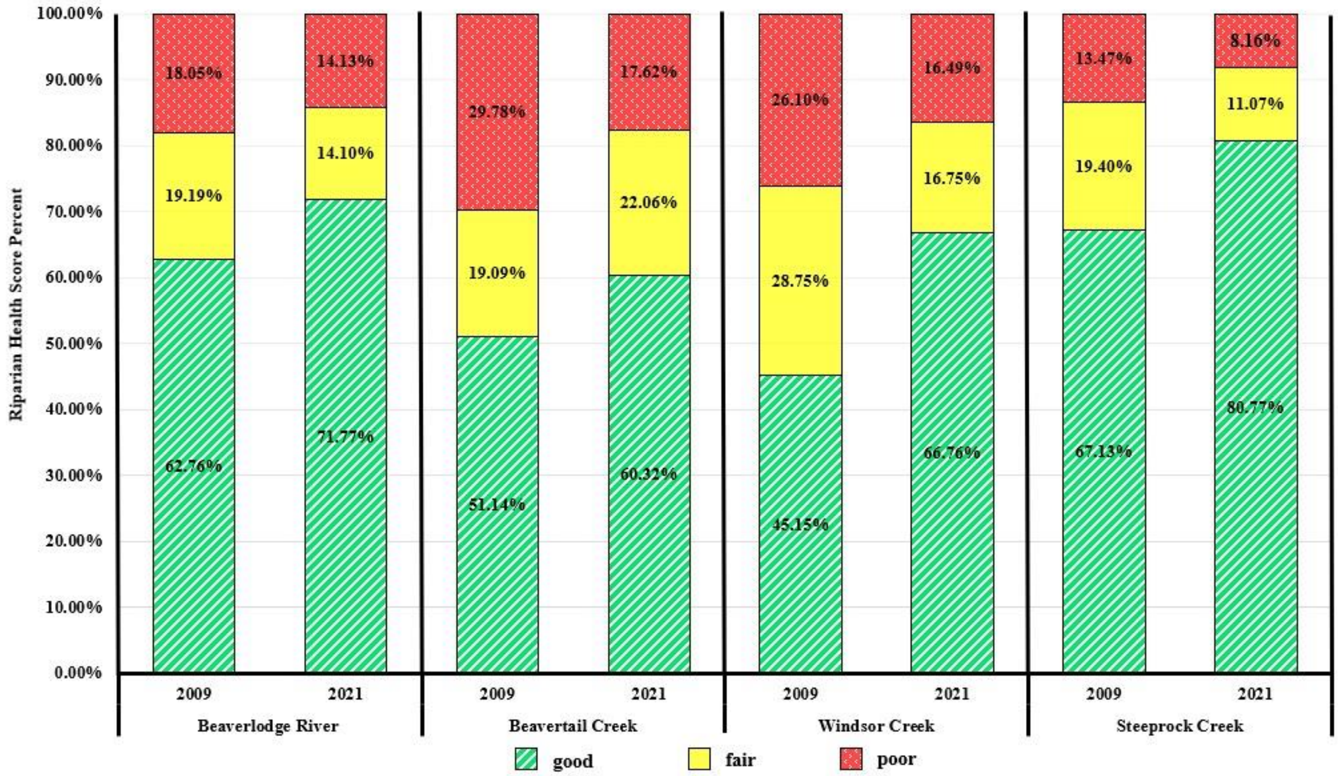



**Figure 6.** Results of aerial riparian health assessment scores for left streambank reaches in 2009 and 2021, showing proportion of total left streambank that scored Good (green; diagonally striped), Fair (yellow; solid), and Poor (red; dotted).

## 5.0 DISCUSSION

Aerial videography is a landscape-level riparian health assessment method that can be used to monitor the efficacy of riparian health initiatives to improve riparian health and help guide future efforts. We quantified the current health of the riparian areas within the Beaverlodge River and three of its tributaries and compared the current health scores to those in 2009 using similar methods. The overall riparian health of the Beaverlodge River watershed was scored as 75.22% Good, 13.27% Fair, and 11.51% Poor in 2021. This is an increase of 12.78% of the riparian area scored as Good compared to the 2009 assessment. Overall, there has been a positive increase in riparian health across the Beaverlodge River watershed.

Based on our 2021 riparian health scores, we determined specific locations with predominantly Poor scores to focus future RCP efforts in the Beaverlodge River watershed. These locations include Windsor Creek near the confluence with Beavertail Creek, Steeprock Creek near the confluence with Beavertail Creek, Beavertail Creek north and south of Highway 671, Beaverlodge River near the town of Hythe, and Beaverlodge River west of Horse Lake, as highlighted in Figures 7–11 with screen captures included from the geo-referenced video.


**Figure 7.** Windsor Creek near the confluence with Beavertail Creek (Appendix 2g) received Poor health scores with active livestock grazing on both streambanks.


**Figure 8.** Steeprock Creek near the confluence with Beavertail Creek (Appendix 2h) received Poor health scores with active livestock grazing on both streambanks.


**Figure 9.** Beavertail Creek received Poor health scores directly north and south of Highway 671 (Appendix 2e and 2f) due to heavily grazed pasture and bare ground.


**Figure 10.** Beaverlodge River received Poor health scores near the town of Hythe (Appendix 2c) due to slumping banks and lack of woody vegetation.


**Figure 11.** Beaverlodge River received Poor health scores west of Horse Lake (Appendix 2d) due to heavily grazed pasture and bare ground.

### 5.1 Recommendations

We have several recommendations for future videography assessments. Careful deliberation will be required to determine how score criteria should be applied to riparian areas naturally devoid of vegetation (e.g., steep, slumping riverbank) in the future, or if only assessing the human-altered riparian areas will provide a more accurate depiction of the current state and where future efforts could be focused. Generally, for the purposes of this assessment, riparian areas naturally devoid of vegetation were classified as Good in the absence of human-caused disturbances. It is largely impossible to mitigate the impact of naturally slumping or steep banks that may be devoid of vegetation due to soil structure or other natural factors. However, these areas naturally prone to erosion can cause increased siltation and reduced shading in streams, leading to reduced riparian health. We may not be able to manage for natural deficiencies such as tall, slumping banks, but they are still part of the riparian makeup of a watercourse and should be acknowledged in some way. One method could be to give less weight in the scorecard to a naturally disturbed area compared to areas with human-caused disturbance.

We also recommend changing the weight of scores for question 7 (see Appendix 1) to more evenly distribute the weights of each level of disturbance; weigh Picture A at 4 points, Combination of A and B at 2 points, Picture B at 0 points. Alternatively, question 7 could be removed entirely since the previous questions cover the content in question 7. Either of these recommendations will result in changing the total number of possible points that the riparian management area scores (Appendix 1). Additionally, when scoring the video, the fixed distance that makes up the buffer area (in the case of this assessment, 30 m) should be drawn onto the video screen from the edge of both banks to ensure that the whole riparian management area is being assessed.

In general, when conducting an aerial videography assessment for the first time using these assessment methods, record the video starting upstream and flying downstream so that the streambank naming convention intuitively matches the recorded video.

Lastly, when repeating an aerial videography assessment to compare to a previous assessment, ensure that the video is filmed in the same cardinal direction that was flown previously so videos can be viewed side-by-side and that flight path matches so there are no data gaps. Additionally, ensure data analysis methods (e.g., buffered polyline) are the same to allow spatial analysis queries rather than proportional comparisons.

## 6.0 LITERATURE CITED


AECOM Canada Ltd. 2009. Redwillow watershed: an overview of the history and present status of fish populations and fish habitat and recommendations for restoration. Report prepared for Alberta Sustainable Resource Development, Burnaby, British Columbia, Canada. 243 pp.

Alberta Conservation Association (ACA). Unpublished report. *Aerial Videography –2006 Lotic Riparian Assessment Scorecard*. 5 pp.

Carl, L. M., C. Walty, and D. M. Rimmer. 1992. Demography of spawning grayling (*Thymallus arcticus*) in the Beaverlodge River, Alberta. Hydrobiologia 243:237–247.

Fitch, L., B. W. Adams, and G. Hale. 2009. Riparian health assessment for streams and small rivers - Field workbook. Warwick Printers Co. Ltd., Lethbridge, Alberta. 96 pp.

Hallett, J. 2003. Summary of the 2002–2003 Beaverlodge riparian land use assessment. Alberta Conservation Association. Northwest Region, Alberta, Canada. 8 pp + App.

Johns T., and A. Cantin, 2012. Owl River riparian restoration and enhancement project. Technical report produced by Alberta Conservation Association, Sherwood Park, Alberta, Canada. 16pp + App.

Johns T., and J. Hallett. 2009. Aerial videography assessment for selected reaches of the South Heart and West Prairie Rivers, Alberta. Technical report produced by Alberta Conservation Association, Peace River, Alberta, Canada. 13 pp + App.

Lucko, B. 1995. Assessment of the Beaverlodge and Redwillow rivers spawning run spring, 1994. Report produced by Alberta Environmental Protection Fish and Wildlife Services, Peace River, Alberta, Canada, 18 pp.

Matrix Solutions Inc. 2021. Beaverlodge River watershed fish inventory. Retrieved 29-11-2022 from the Fish and Wildlife Management Information System, Alberta Environment and Parks.

North Saskatchewan Watershed Alliance (NSWA). 2015. Riparian health assessment of Wabamun Lake: An aerial assessment using an unmanned air vehicle. Report prepared for the Wabamun Watershed Management Council, Edmonton, Alberta, Canada. 22pp + App.

Redwillow Watershed Restoration Team. 2015. Bring back the grayling! 2015 – 2040 Redwillow Watershed restoration plan. Alberta, Canada. 35 pp + App.

Wood Environment and Infrastructure Solutions. 2021. Beaverlodge River watershed fish inventory. Retrieved 29-11-2022 from the Fish and Wildlife Management Information System, Alberta Environment and Parks.

## 7.0 APPENDICES

**Appendix 1.** 2021 Video assessment scoring system.

### AERIAL VIDEOGRAPHY – LOTIC RIPARIAN MANAGEMENT AREA HEALTH AND INTEGRITY ASSESSMENT SCORECARD March 2018

This scorecard is based on the riparian assessment models developed by Cows and Fish (Fitch *et al.* 2001 and Ambrose *et al. 2004*) and is adapted from aerial videography assessments completed on lentic systems[1] and described by Mills and Scrimgeour, 2004. This scorecard and definitions have been adjusted by Walker Environmental[2], in concert with the Alberta Conservation Association, to reflect changes made based on 6 years of scorecard use. The following are the current definitions of the assessment area polygon (called a reach), the current assessment questions used (with guidelines and scoring tips) to determine the riparian health and integrity of individual reaches of interest. Reaches surveyed and assessed in a watershed can then be summarized to illustrate the overall health and integrity of the entire system.

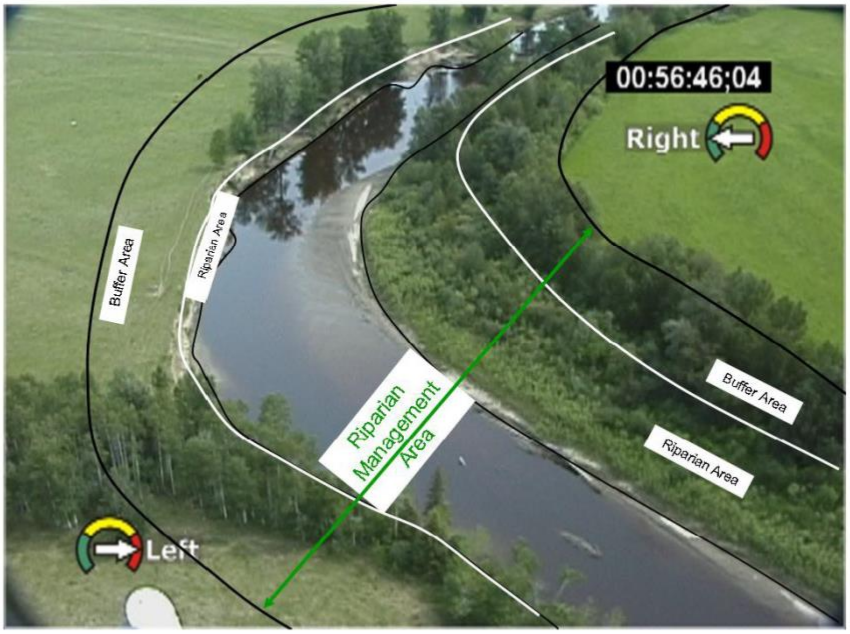
**Reach Assessment Area (polygon length and width):**

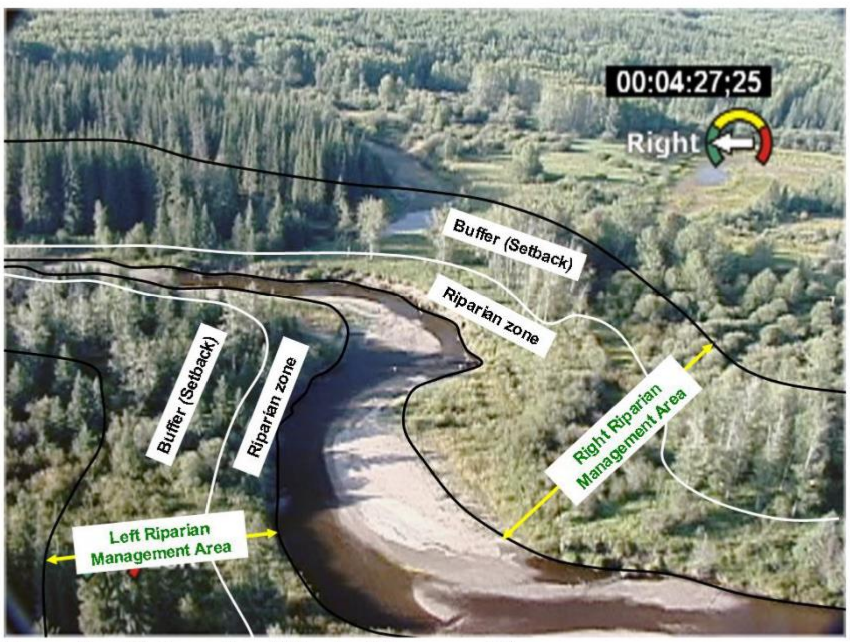
***Polygon Length:***

Polygons are separated or divided by changes in scores in one of the scorecard questions. A change in one of the scores may or may not result in a change of the polygons overall health score. The shortest a polygon can be is approximately the distance covered in one second of video (~ 20m). This allows for brief changes in riparian conditions such as bridges or pipeline crossings to be scored independently. There is no maximum polygon length. Video is usually recorded starting upstream and working (flying) downstream. Therefore, while viewing the video, the left and right banks match the scientific convention.

***Polygon Width*:**

The polygon width is the Riparian Management Area. This includes the riparian zone adjacent to a stream bank and a buffer (setback) area beyond the riparian area. See Figures 1 and 2. This buffer has an impact on the riparian area, and is useful to include in the assessment of **lotic** systems because often high stream banks have almost no riparian areas per se, but are affected by land use on top of the banks. Buffer areas can fulfill some of the riparian ecological functions when true riparian areas are missing or narrow. Most land management agencies recognize the ecological need for this buffer area. Because assessments are often vastly different on opposite stream banks, it is necessary to complete a scorecard for left and right banks independently. The results can then be summarized and displayed independently or combined to suit the characteristics of the stream.




Figures 1 and 2. Examples of Riparian Management Areas

## Assessment Process

> *General Assessment Scoring Tips:*
>
> 1) When reviewing the video, the changing oblique view often reveals shadows and relief. This helps to determine height and structure of ground features.
>
> 2) Rewinding and viewing a reach multiple times will increase assessment accuracy.

**Assessment Scorecard Questions (Completed independently for each bank):**

1. What % of the riparian management area is covered with vegetation?

    **More than 90%** (2 pts) **75% - 90%** (1 pt) **Less than 75%** (0 pts)

> *Scoring Tips:*
>
> 1) Vegetation cover includes all standing, rooted plants (live or dead). Do not include litter or downed wood.
>
> 2) Polygon area does not include area covered by water.
>
> 3) Bare soil, gravel roads, cattle trails, or artificial surfaces are considered unvegetated.
>
> (Taken from Fitch *et al.* 2001)

2. What % of the riparian management area is covered by woody plants like willow, birch, poplar or conifers?

    **More than 35%** (2 pts) **15% - 35%** (1 pt) **Less than 15%** (0 pts)

Note - In some cases riparian areas do not naturally have the potential for woody plants because of soil structure or chemistry and other natural factors, i.e., salinity and drainage. In some other cases woody plants do not meet this threshold because of site and successional reasons.

3. Is there observable evidence of woody species recruitment and replacement in the riparian management area?

    **Yes** (2 pts) **No** (0 pts)

> *Scoring Tips:*
>
> 1) Evidence of recruitment and replacement can include multiple age classes, seen as different sized individuals of a single species or the presence of a species highly prone to suckering (e.g. various willow sp.).

4. How much of the riparian management area shows visual signs of human/cattle-caused alteration of the vegetation community?

    **Less than 5%** (4 pts) **5% - 15%** (2 pts) **More than 15%** (0 pts)

Note – An unaltered vegetation community contains multiple structural layers with varied plant heights. Tall trees, tall and short shrubs, medium to short forbs and grasses plus short flowers and grasses should be present in an unaltered riparian area (Ambrose *et al.* 2004). Alterations to vegetation communities to be assessed include (but may not be limited to) a loss of one or more of the above noted vegetation layers, the partial or complete replacement of plant species, a reduction in species diversity and distribution as a result of various human activities (e.g. conversion of native vegetation to lawn grass, mowing, recreational traffic, excessive grazing, removal of woody vegetation, etc.).

> ***Scoring Tips:***
> 1) Tree cover often obscures observation of ground level conditions. A dense stand of trees may hide a heavily altered vegetation community below. It is often useful to note the conditions directly adjacent to the surrounding dense stand of trees.
> 2) Bare soil, gravel roads, cattle trails, or artificial surfaces are considered unvegetated.
> (Taken from Fitch *et al.* 2001)

5. How much of the riparian management area shows visual signs of human-caused bare ground and physical alterations?

**Less than 5%** (4 pts) **5% - 15%** (2 pts) **More than 15%** (0 pts)

Note – Bare ground and physical alterations that effect the functions of a riparian area can result from (but are not limited to) livestock trailing and rutting, hoof shearing, pugging/hummocking, road construction, rail bed deposits, OHV trails, timber hauling, building construction, channelization, stream diversions, etc. Consider all those activities that have resulted in cracking, slumping, shearing, compaction, removal or reconfiguration of stream banks and surrounding riparian management areas.

> ***Scoring Tips:***
> 1) Natural slides, slumps and eroding banks are not considered in this question (Fitch *et al.* 2001).
> 2) Do not count the same area for question 3 and 4 unless both the vegetation community and the physical structure of that area have been altered.

6. How would you categorize the overall vertical bank stability within the polygon?

**Highly stable** (4 pts) **Moderately stable** (2 pts) **Highly unstable** (0 pts)

Note – Vertical bank stability is highly influenced by slope, substrate type and presence of vegetation with binding root-mass. Cracking, slumping, sloughing and sliding are all indications of bank instability.

7. What picture does most of the riparian management area look like?

**Picture A** (4 pts) **Combination of A and B** (1 pt) **Picture B** (0 pts)



## Summary of Question Scores

**Total possible points = 22.**

If the reach score is **more than 17** it is likely the Riparian Management Area is **Good**.

If the reach score is **11 to 17** it is likely the Riparian Management Area is **Fair**.

If the reach score is **10 or less** it is likely the Riparian Management Area is **Poor**.

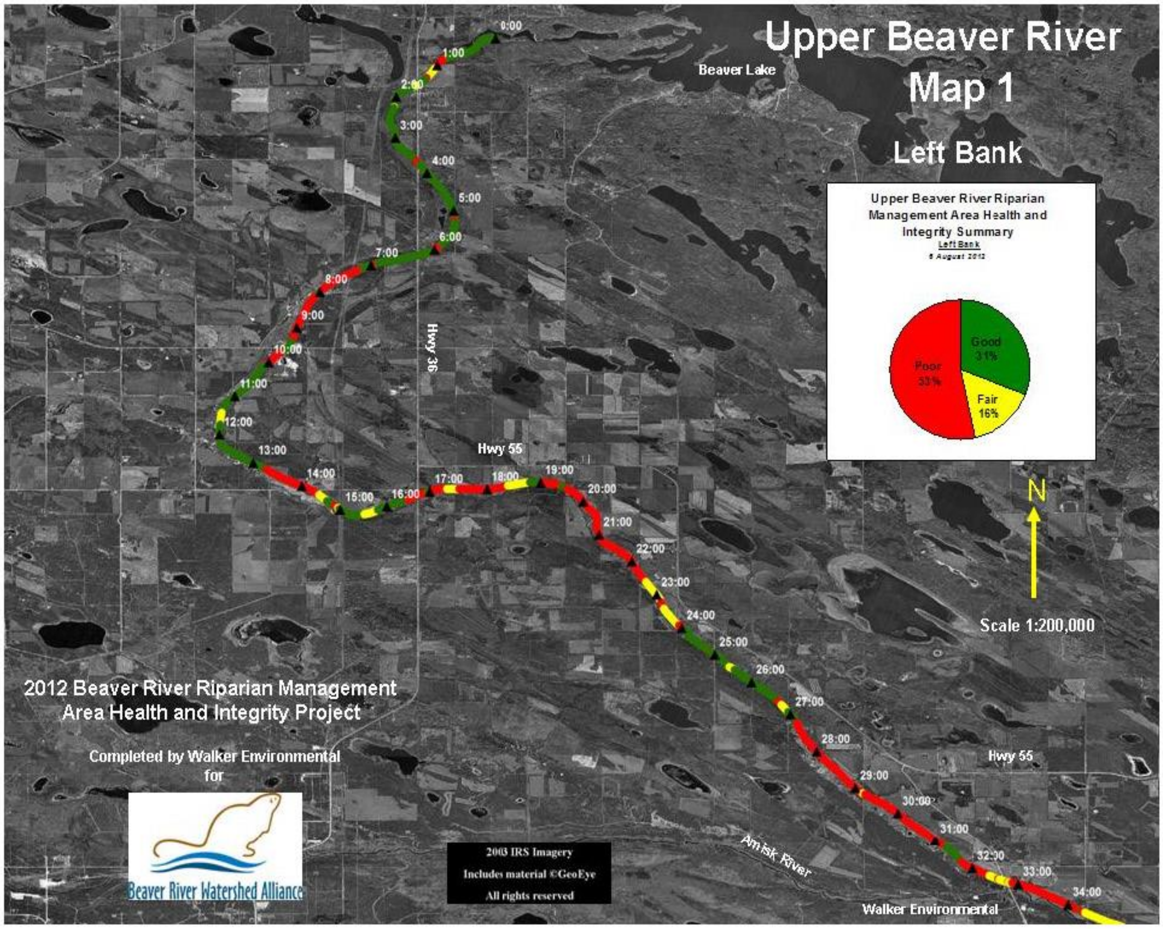



**Figure 3. Example of a Riparian Management Area results map.**

**Footnotes**

[1] **Aerial Videography and Riparian Management Area Health and Integrity Assessment Scorecard for Lakes** (August, 2003) developed by Blake Mills, Alberta Conservation Association and George Walker, Alberta Sustainable Resource Development, Fish & Wildlife Division.

[2] **Walker Environmental** (George Walker) is an independent consulting firm which continues to deliver Aerial Videography based Riparian Health and Integrity Assessments for Alberta lakes and rivers; work initially begun by the Alberta Conservation Association (Blake Mills, 2000 to 2006) and Alberta Sustainable Resource Development (George Walker, 2000 to 2006)

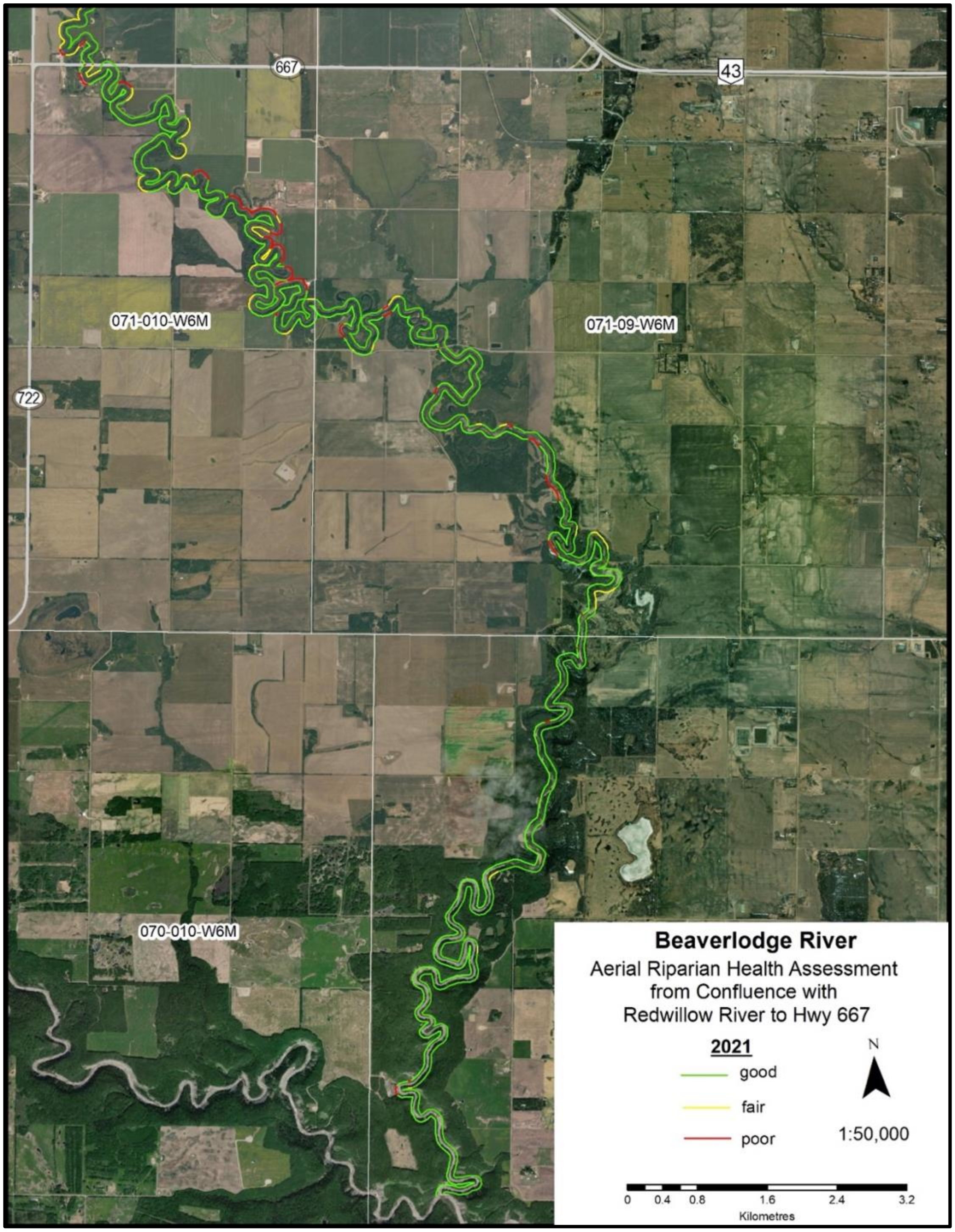
**References Cited**

**Ambrose, N., G. Ehlert, K. Spicer-Rawe. 2004.** Riparian health assessment for lakes, sloughs, and wetlands – field workbook. Modified from Fitch, L., B.W. Adams and G. Hale, 2001. Riparian health assessment for streams and small rivers – field workbook. Lethbridge, AB. Cows and Fish program. pp. 90.

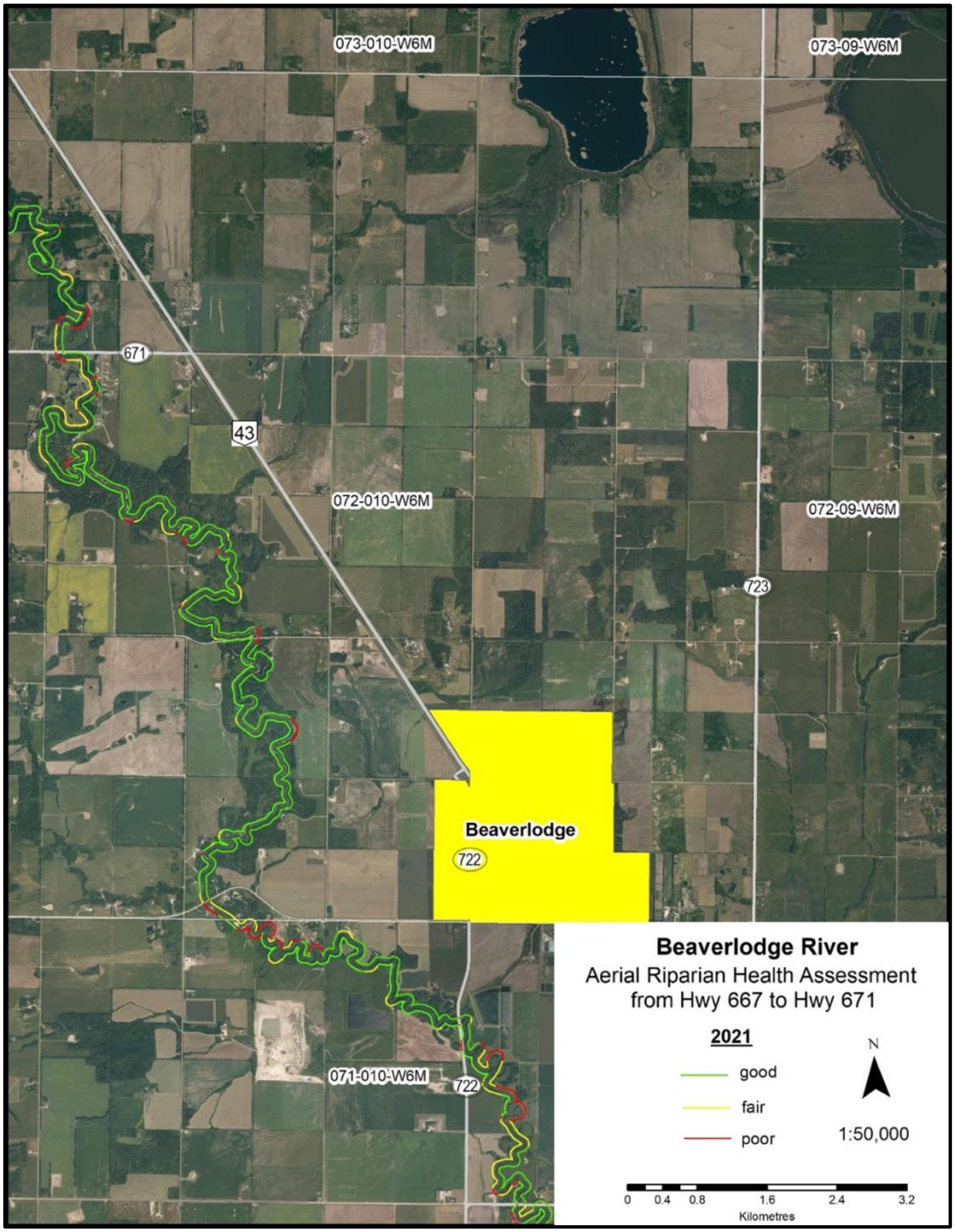
**Fitch, L., B. W. Adams, and G. Hale, Eds. 2001.** Riparian health assessment for streams and small rivers - field workbook. Lethbridge, AB: Cows and Fish program. 86 pages, adapted from Riparian and Wetland Research Program, School of Forestry. 2001. Lotic health assessments: Riparian health assessment for streams and small rivers (Survey) User Guide. University of Montana, Missoula, Montana, January 2001.

**Mills, B. and Scrimgeour, G. 2004.** The Effectiveness of Aerial Videography to Characterize Lakeshore Condition. Data Report (D-2003-XXX) produced by Alberta Conservation Association, Location, Alberta, Canada. 52 pp. + App.

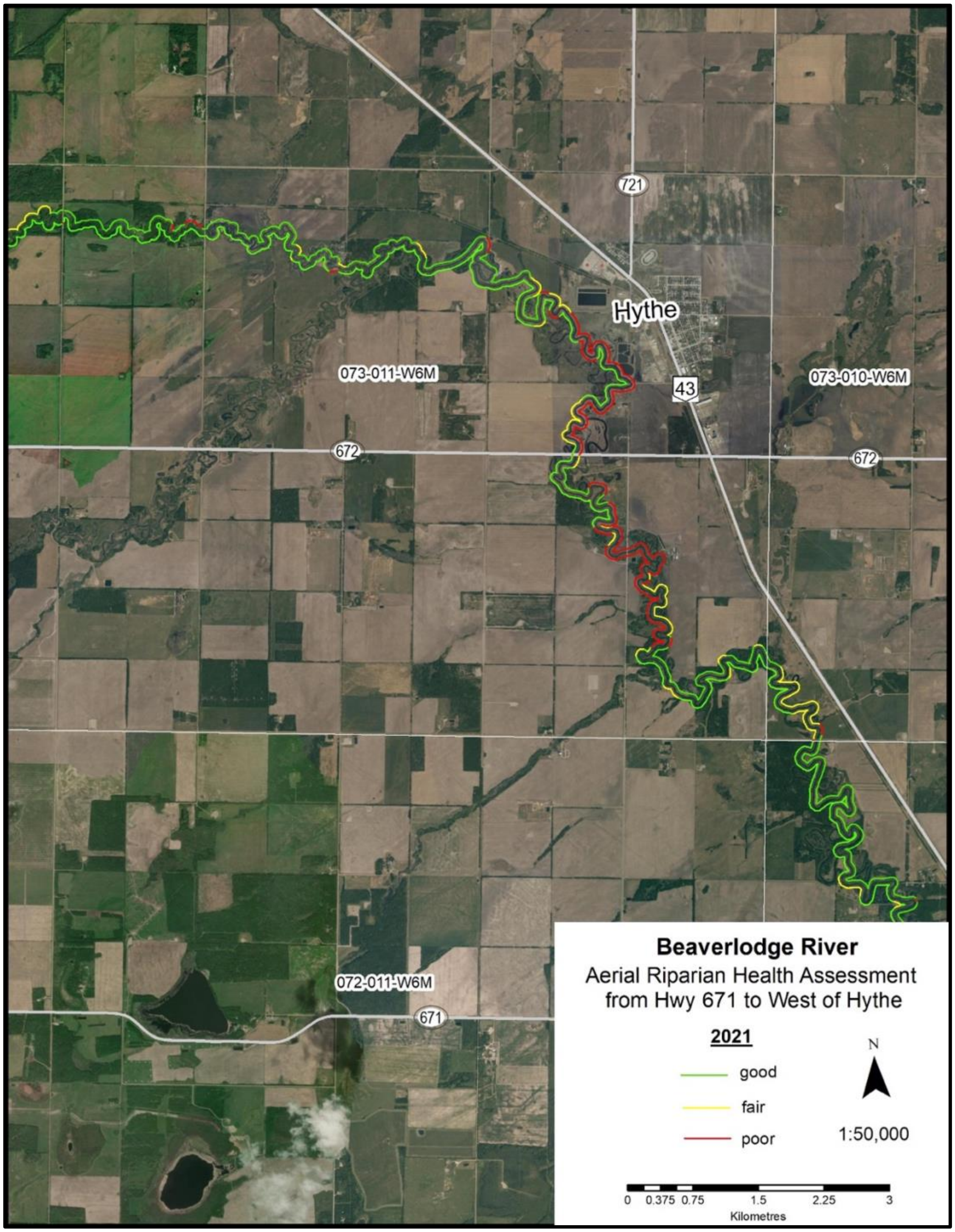
**Appendix 2.** Maps of watercourses in the Beaverlodge River watershed surveyed during aerial riparian health assessments in 2021.



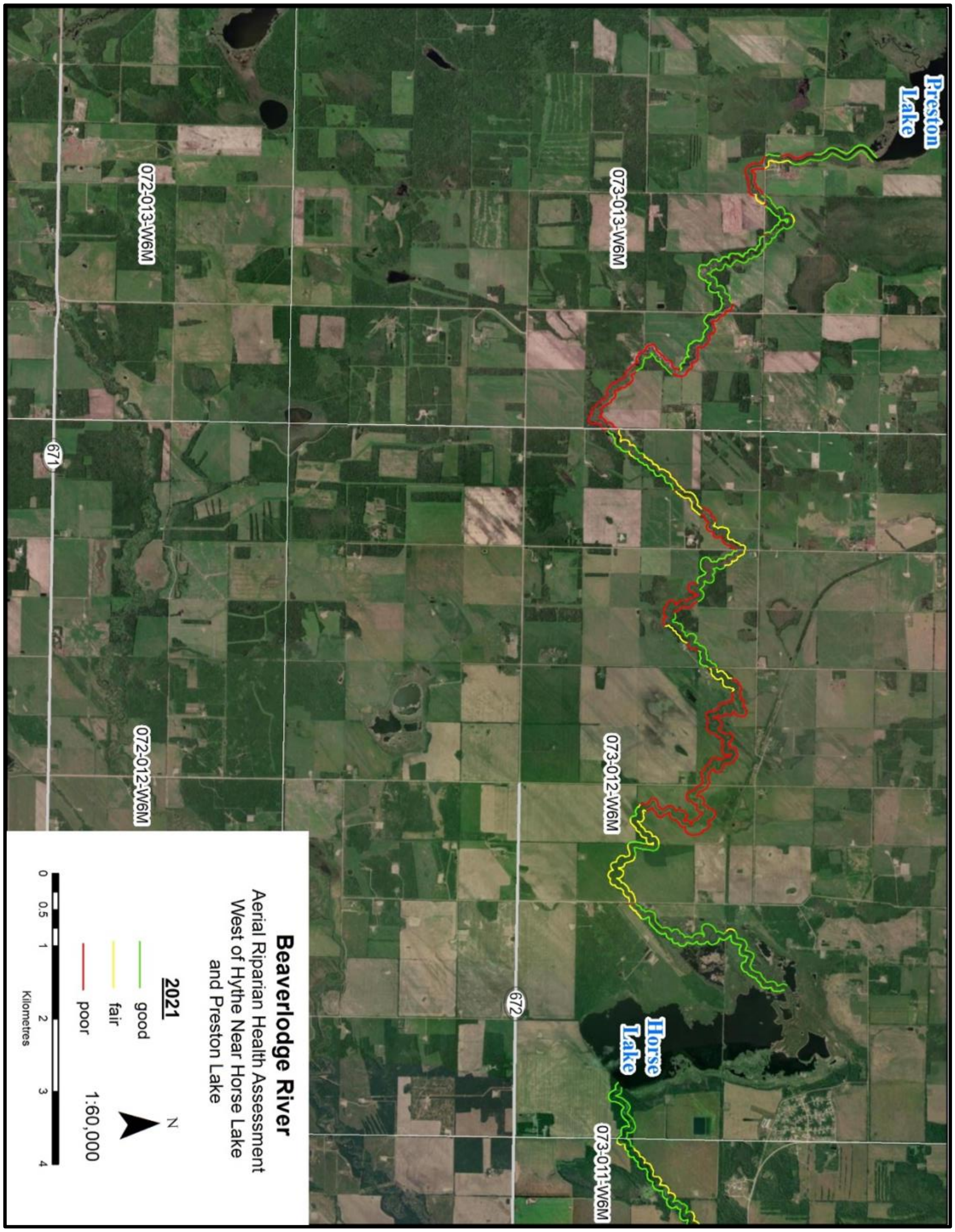

**Appendix 2a.** Beaverlodge River aerial riparian assessment for 2021 from confluence with Redwillow River to Hwy 667.



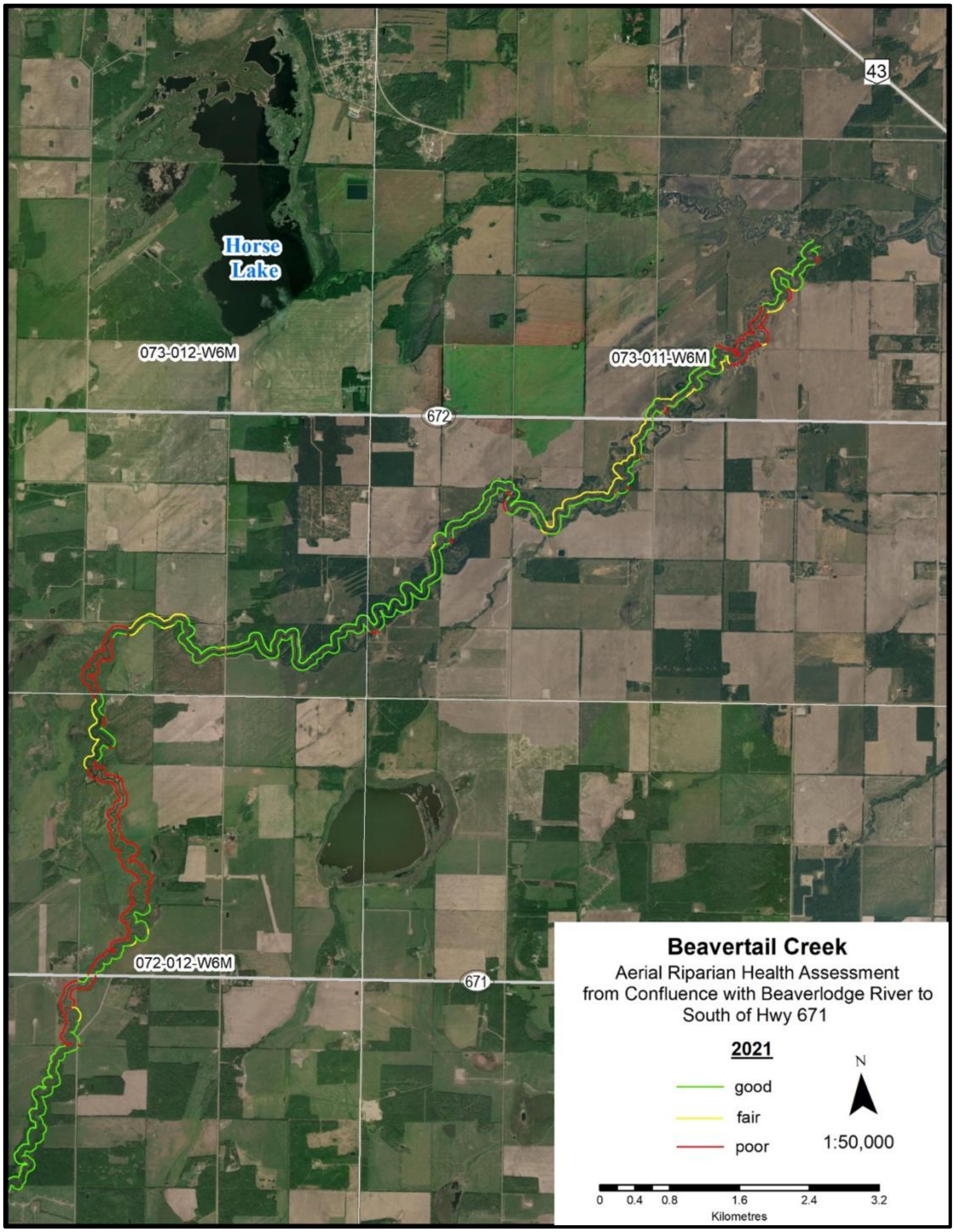

**Appendix 2b.** Beaverlodge River aerial riparian assessment for 2021 from Hwy 667 to Hwy 671.



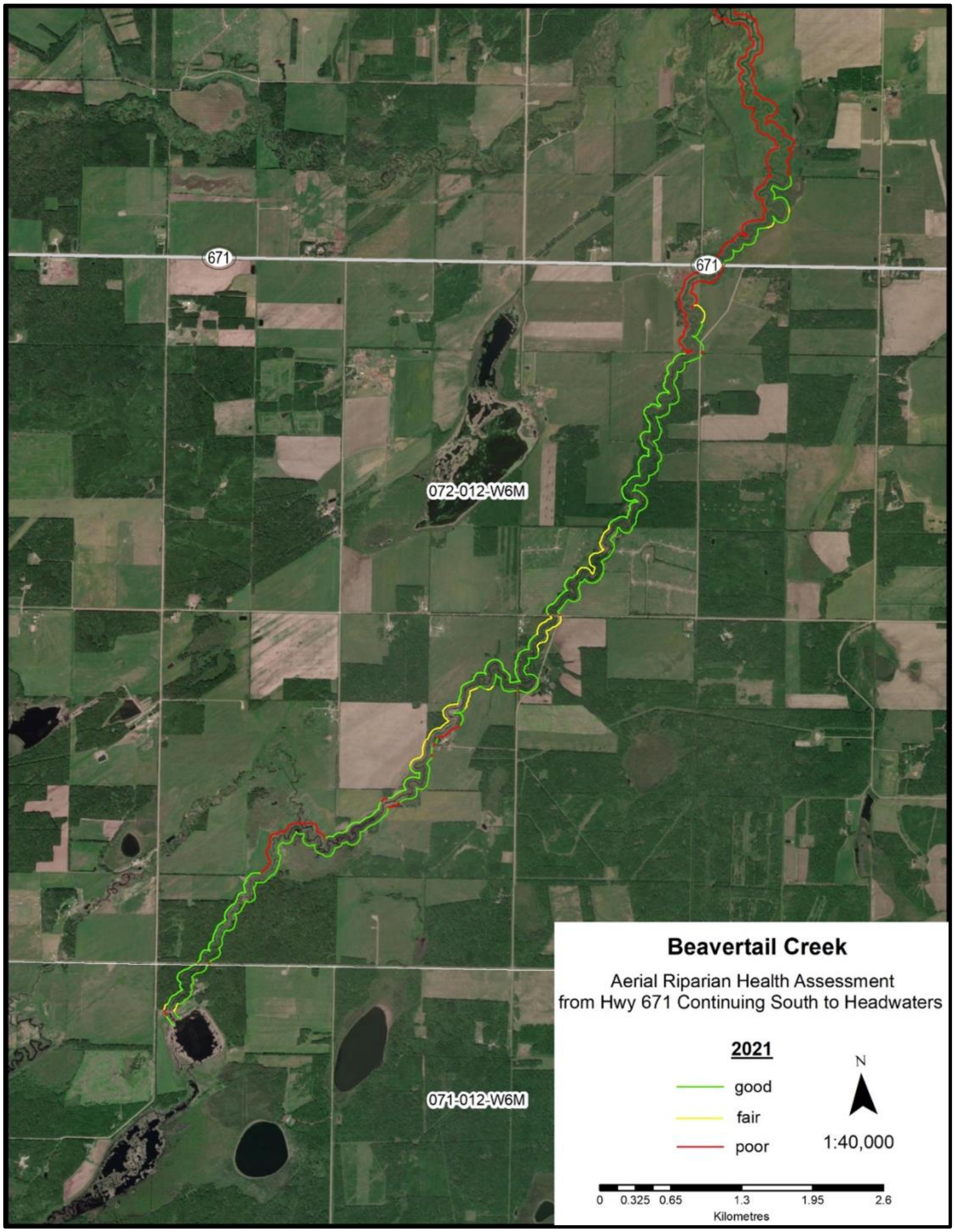

**Appendix 2c.** Beaverlodge River aerial riparian assessment for 2021 from Hwy 671 to west of Hythe.



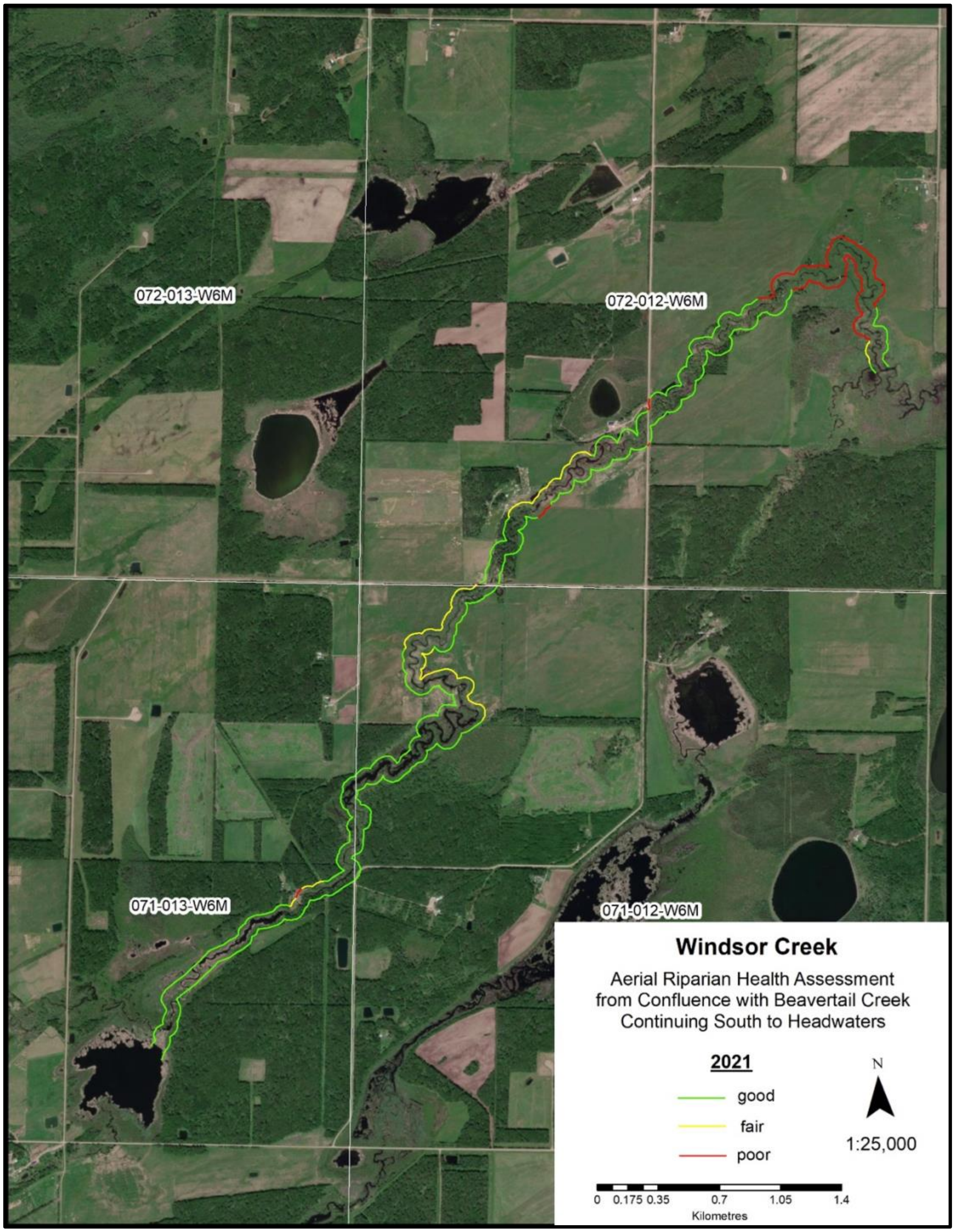

**Appendix 2d.** Beaverlodge River aerial riparian assessment for 2021 from west of Hythe near Horse Lake and Preston Lake.



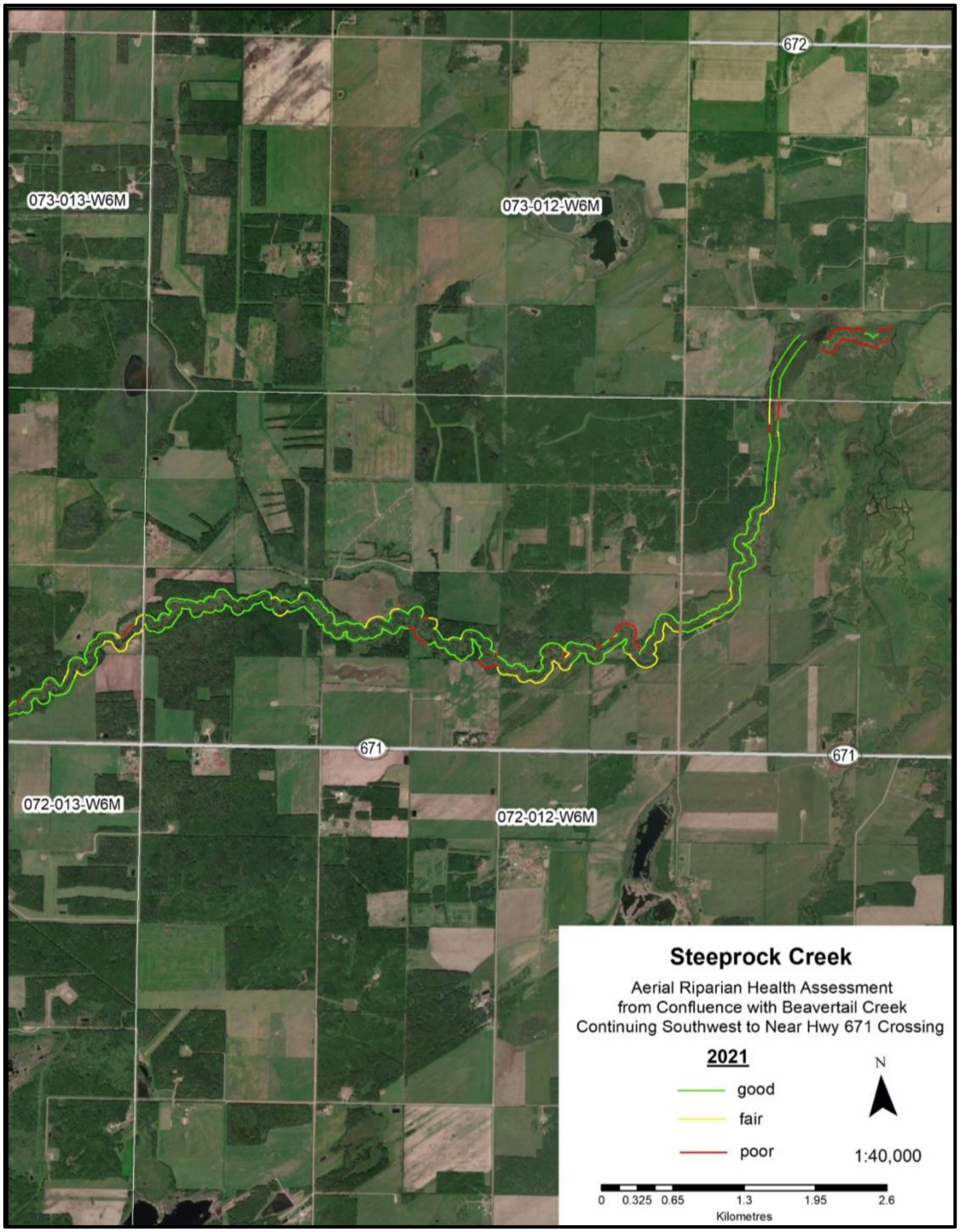

**Appendix 2e.** Beavertail Creek aerial riparian assessment for 2021 from confluence with Beaverlodge River to south of Hwy 671.



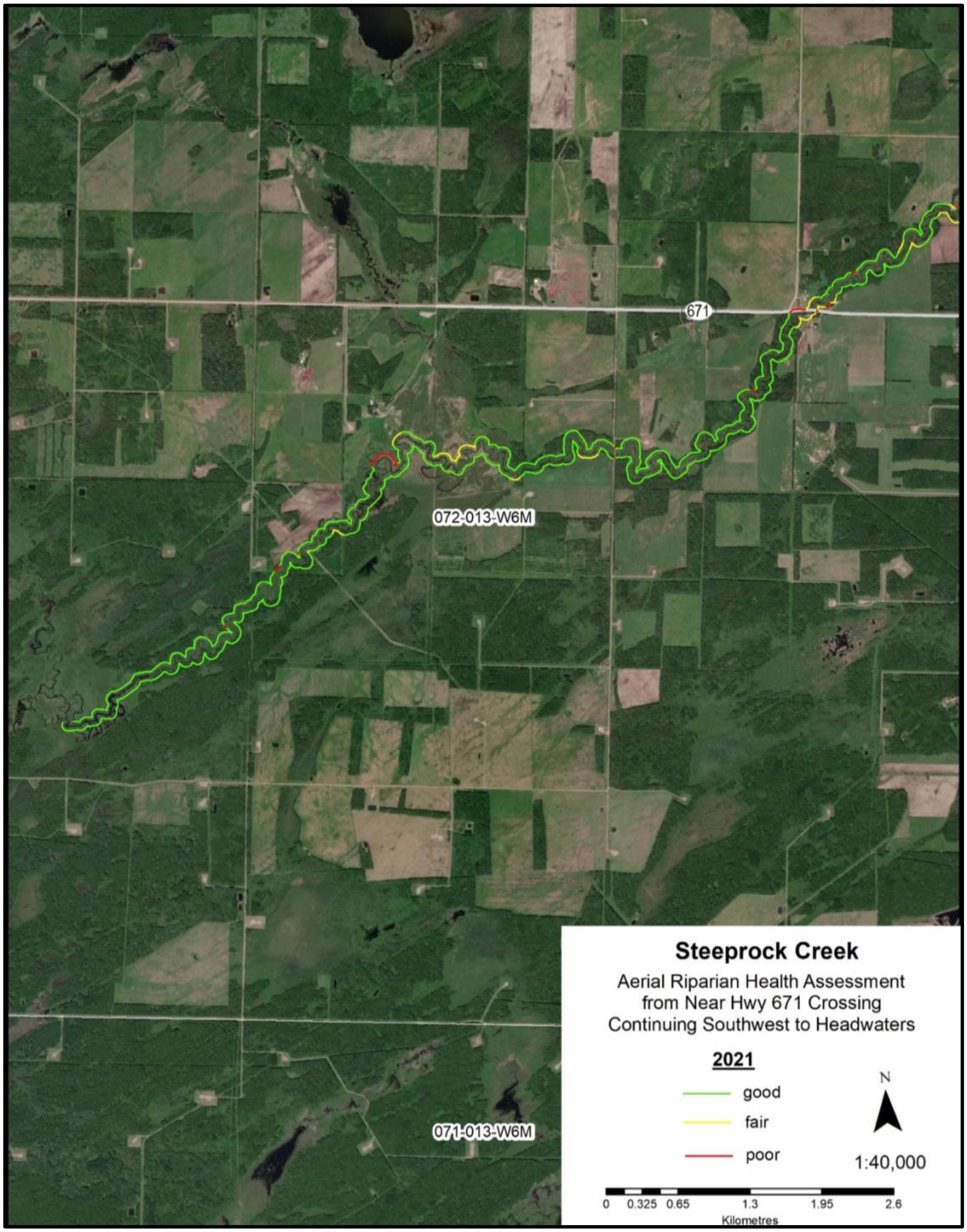

**Appendix 2f.** Beavertail Creek aerial riparian assessment for 2021 from Hwy 671 continuing south to headwaters.




**Appendix 2g.** Windsor Creek aerial riparian assessment for 2021 from confluence with Beavertail Creek continuing south to headwaters.



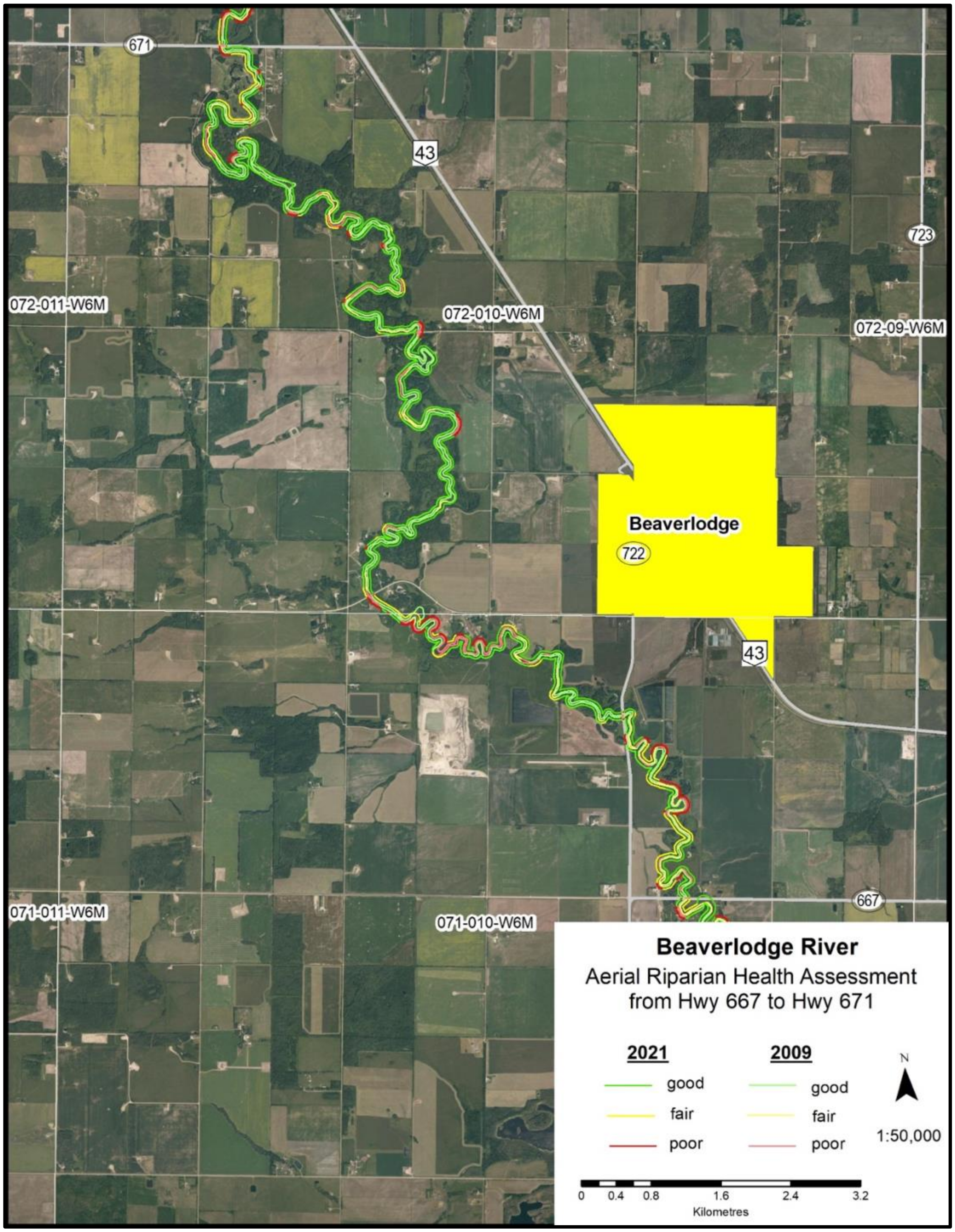

**Appendix 2h.** Steeprock Creek aerial riparian assessment for 2021 from confluence with Beavertail Creek continuing southwest to near Hwy 671 crossing.



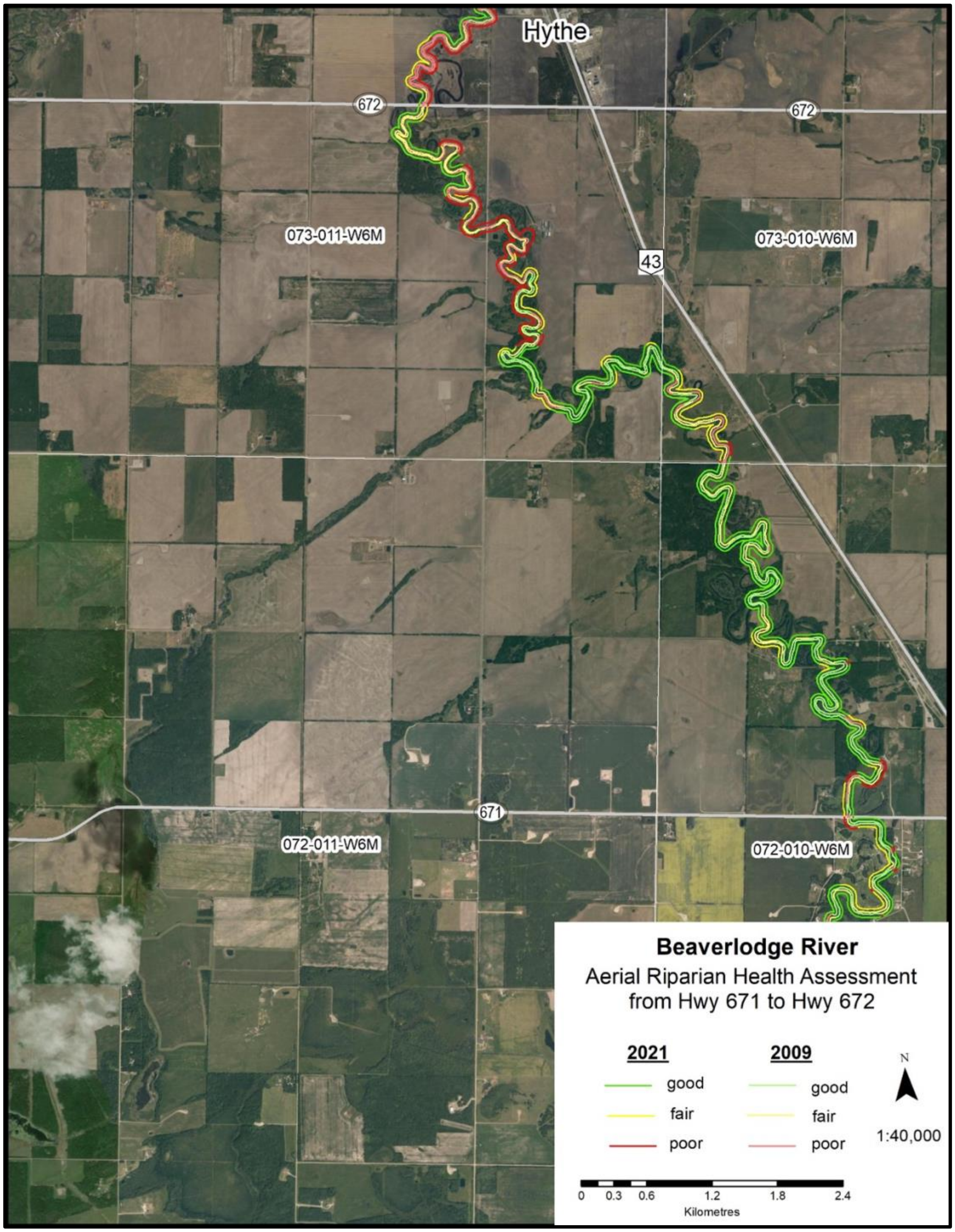

**Appendix 2i.** Steeprock Creek aerial riparian assessment for 2021 from near Hwy 671 crossing continuing southwest to headwaters.

**Appendix 3.** Maps of watercourses in the Beaverlodge River watershed surveyed during aerial riparian health assessments in 2009 and 2021. The 2021 scores are presented in brighter colours (i.e., the outermost lines) and are buffered around the watercourses, whereas 2009 scores are presented in fainter colours and are in the watercourse itself (i.e., the innermost lines).

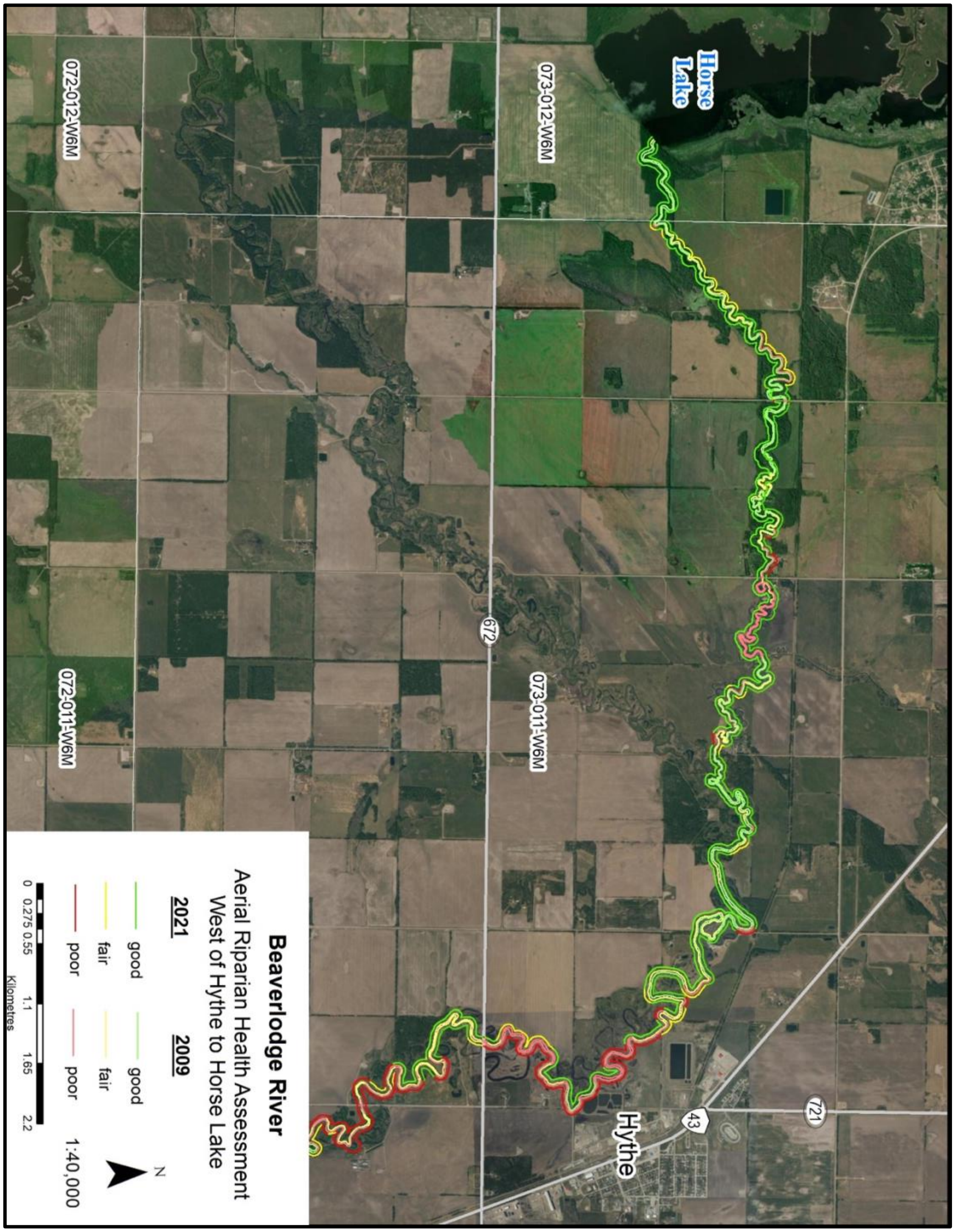

**Appendix 3a.** Beaverlodge River aerial riparian assessment for 2009 and 2021 from confluence with Redwillow River to Hwy 667.



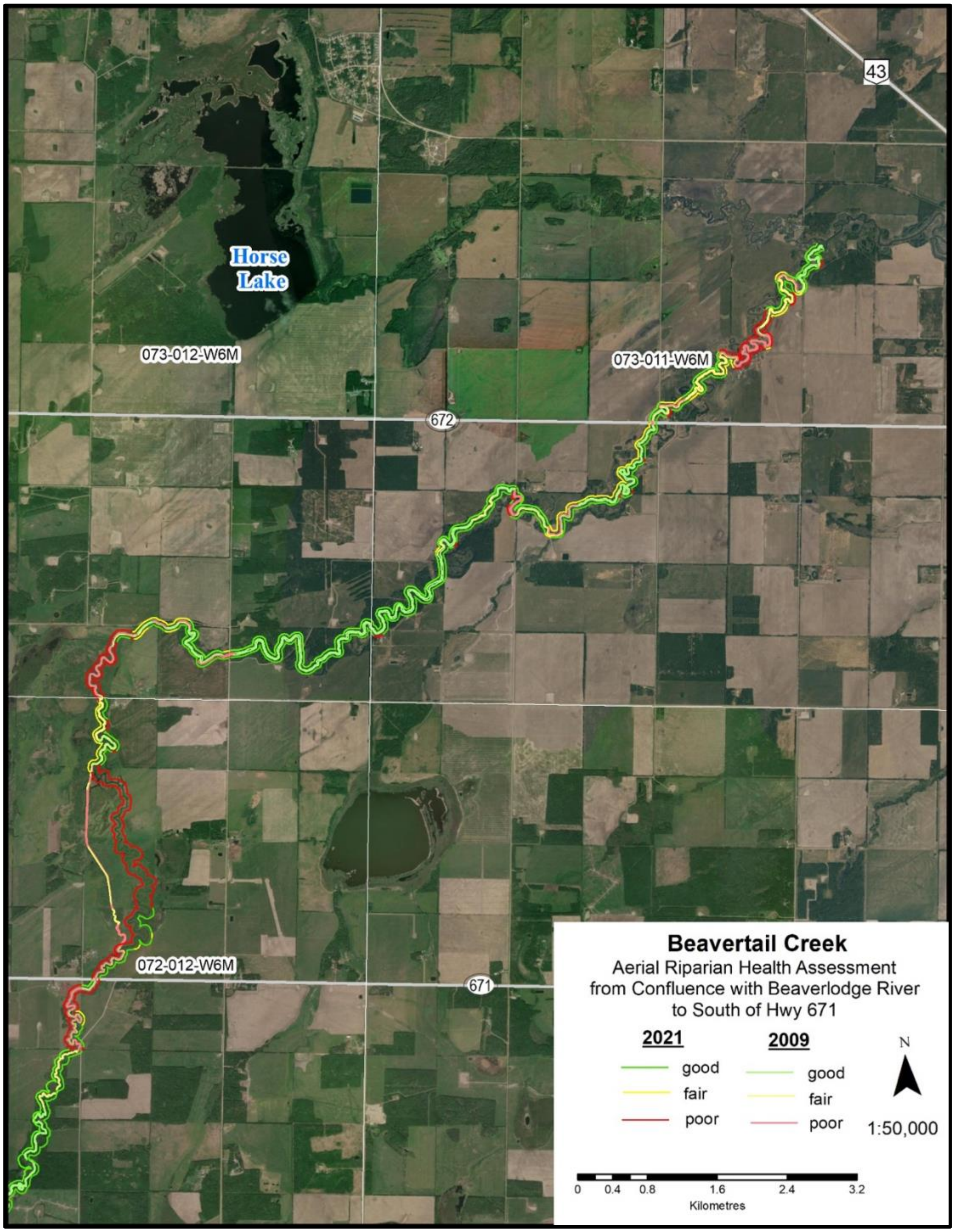

**Appendix 3b.** Beaverlodge River aerial riparian assessment from 2009 to 2021 from Hwy 667 to Hwy 671.



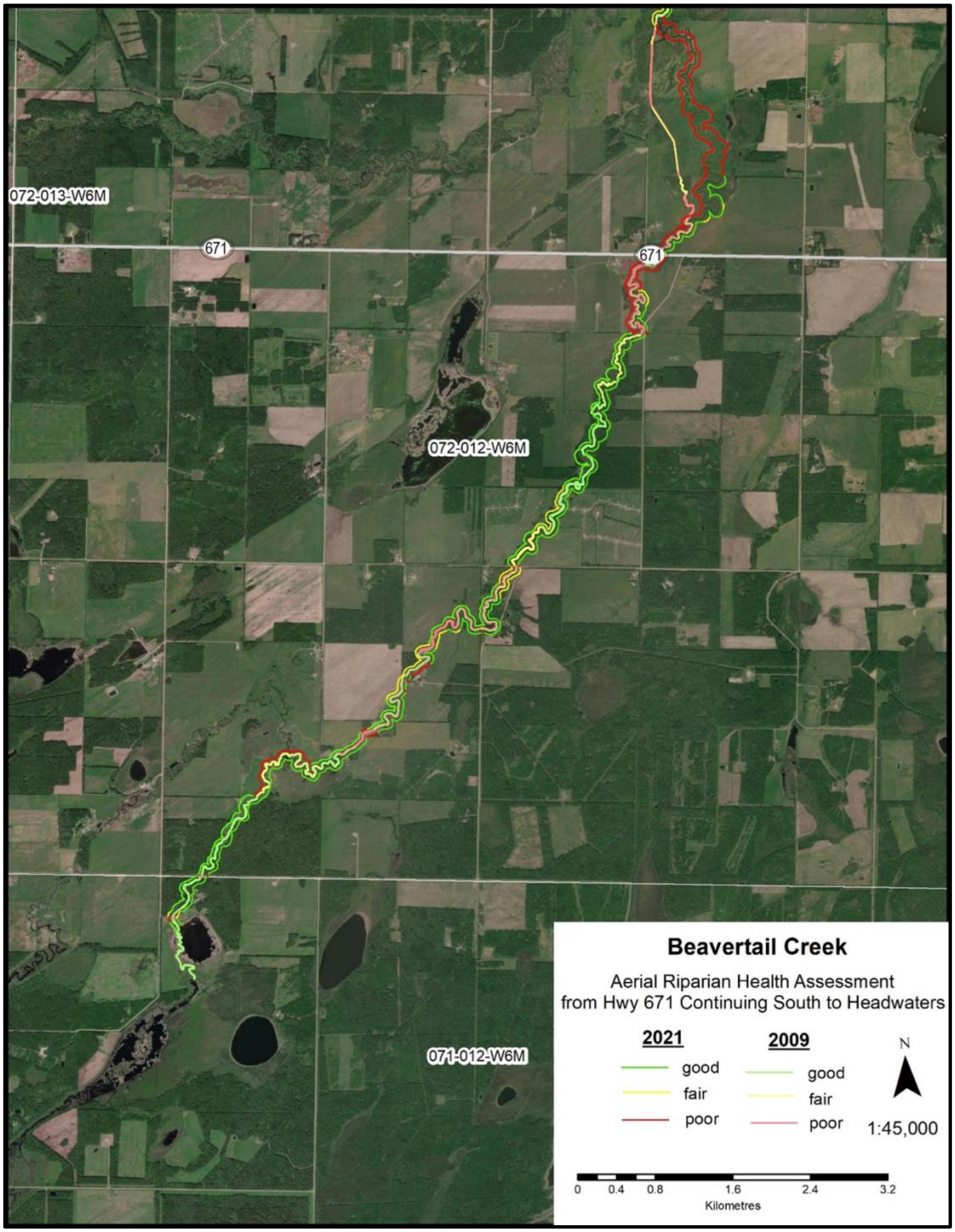

**Appendix 3c.** Beaverlodge River aerial riparian assessment for 2009 and 2021 from Hwy 671 to Hwy 672.



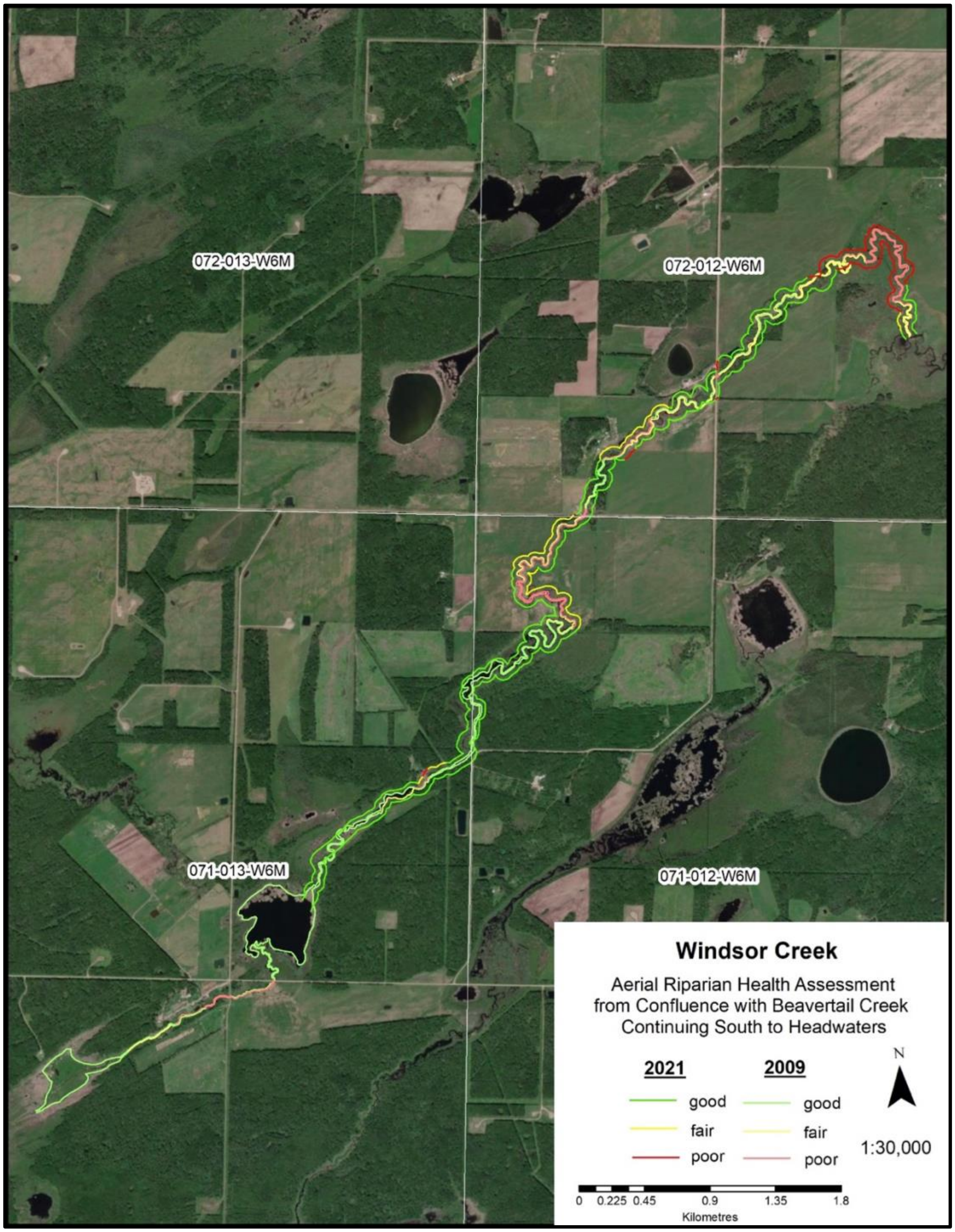

**Appendix 3d.** Beaverlodge River aerial riparian assessment for 2009 and 2021 west of Hythe near Horse Lake.




**Appendix 3e.** Beavertail Creek aerial riparian assessment for 2009 and 2021 from confluence with Beaverlodge River to south of Hwy 671**.**

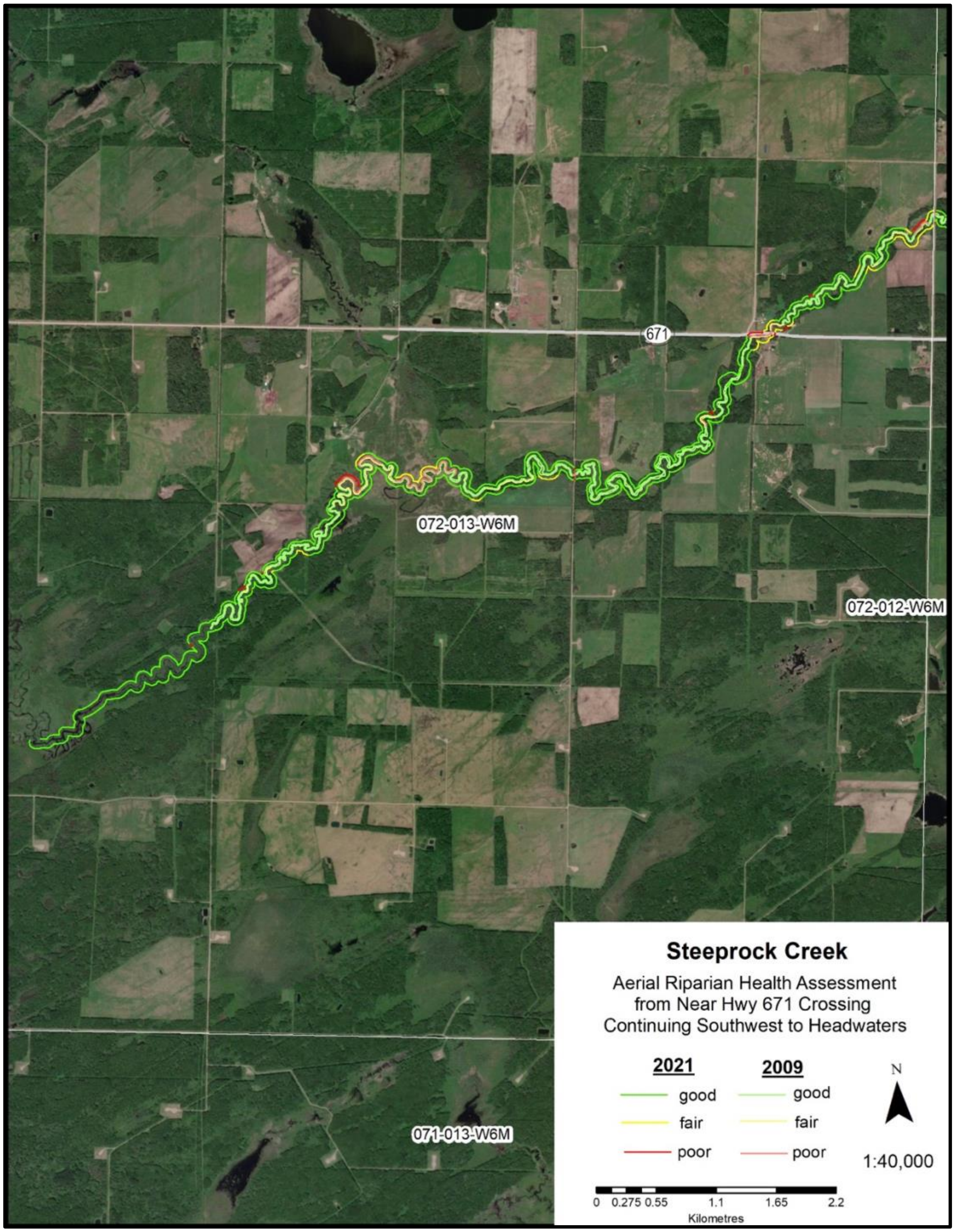



**Appendix 3f.** Beavertail Creek aerial riparian assessment for 2009 and 2021 from Hwy 671 continuing south to headwaters.




**Appendix 3g.** Windsor Creek aerial riparian assessment for 2009 and 2021 from confluence with Beavertail Creek continuing south to headwaters.


**Appendix 3h.** Steeprock Creek aerial riparian assessment for 2009 and 2021 from confluence with Beavertail Creek continuing southwest to near Hwy 671 crossing**.**




**Appendix 3i.** Steeprock Creek aerial riparian assessment for 2009 and 2021 from near 671 crossing continuing southwest to headwaters.

**Appendix 4.** Riparian health score category proportions for combined (A) and separate right and left streambank reaches (B) for 2009 versus 2021 for three tributaries and the Beaverlodge River in the Beaverlodge River watershed.

**A.**

| Waterbody Name | Score Category | Proportion in 2009 | Proportion in 2021 | Difference in Proportion from 2009 to 2021 |
|---|---|---|---|---|
| **Beaverlodge River** | good | 0.646724179 | 0.768432863 | 0.121709 |
| | fair | 0.198183915 | 0.122380119 | -0.075804 |
| | poor | 0.155091906 | 0.109187018 | -0.045905 |
| **Beavertail Creek** | good | 0.532122 | 0.687494 | 0.155372 |
| | fair | 0.223564 | 0.149292 | -0.074272 |
| | poor | 0.244314 | 0.163214 | -0.081100 |
| **Windsor Creek** | good | 0.446958 | 0.706124 | 0.259166 |
| | fair | 0.286276 | 0.140967 | -0.145309 |
| | poor | 0.266766 | 0.152909 | -0.113857 |
| **Steeprock Creek** | good | 0.724954577 | 0.79026479 | 0.065310 |
| | fair | 0.184654014 | 0.149681524 | -0.034972 |
| | poor | 0.090391409 | 0.060053686 | -0.030338 |

**B.**

**Beaverlodge River**

| Year | Score Category | Right Proportion | Left Proportion | Proportion for Combined Banks (Right and Left) |
|---|---|---|---|---|
| 2009 | good | 0.665883 | 0.627571 | 0.646724 |
| | fair | 0.204448 | 0.191922 | 0.198184 |
| | poor | 0.129670 | 0.180507 | 0.155092 |
| 2021 | good | 0.819454 | 0.717716 | 0.768433 |
| | fair | 0.103677 | 0.140971 | 0.122380 |
| | poor | 0.076868 | 0.141312 | 0.109187 |

**Beavertail Creek**

| Year | Score Category | Right Proportion | Left Proportion | Proportion for Combined Banks (Right and Left) |
|---|---|---|---|---|
| 2009 | good | 0.553363 | 0.511389 | 0.532122 |
| | fair | 0.257076 | 0.190852 | 0.223564 |
| | poor | 0.189561 | 0.297758 | 0.244314 |
| 2021 | good | 0.771040 | 0.603244 | 0.687494 |
| | fair | 0.078614 | 0.220566 | 0.149292 |
| | poor | 0.150346 | 0.176190 | 0.163214 |

**Windsor Creek**

| Year | Score Category | Right Proportion | Left Proportion | Proportion for Combined Banks (Right and Left) |
|---|---|---|---|---|
| 2009 | good | 0.442308 | 0.451532 | 0.446958 |
| | fair | 0.285035 | 0.287496 | 0.286276 |
| | poor | 0.272657 | 0.260972 | 0.266766 |
| 2021 | good | 0.744943 | 0.667598 | 0.706124 |
| | fair | 0.114229 | 0.167503 | 0.140967 |
| | poor | 0.140828 | 0.164899 | 0.152909 |

**Steeprock Creek**

| Year | Score Category | Right Proportion | Left Proportion | Proportion for Combined Banks (Right and Left) |
|---|---|---|---|---|
| 2009 | good | 0.778702 | 0.671262 | 0.724955 |
| | fair | 0.175265 | 0.194033 | 0.184654 |
| | poor | 0.046033 | 0.134705 | 0.090391 |
| 2021 | good | 0.772220 | 0.807735 | 0.790265 |
| | fair | 0.189950 | 0.110696 | 0.149682 |
| | poor | 0.037830 | 0.081569 | 0.060054 |

Alberta Conservation Association

wildlife | fish | habitat