

Bring Back the Grayling!

2015 – 2040 Redwillow Watershed
Restoration Plan



Photo by AK Smith



EXECUTIVE SUMMARY

Located west of Grande Prairie, Alberta, the Redwillow Watershed includes the Redwillow and Beaverlodge rivers and many other tributaries, lakes and wetlands. This system, which flows out of British Columbia's Rocky Mountain foothills, flows into the Wapiti River which in turn flows northeast into the Peace River.

Over the years, the Redwillow Watershed has faced increasing pressures from growth and development. Today, these waters are used for drinking water, wastewater conveyance and a number of agriculture and industrial purposes. Local rivers and lakes are also valued for fishing and other recreational activities.

Associated with these uses are a number of issues that affect river and watershed health. Man-made structures such as weirs, culverts and crossings affect fish habitat connectivity. Shoreline grazing, cattle watering and motorized recreation impact the health of riparian shores. In the uplands, forest-clearing and wetland draining change how water flows across the landscape. Taken all together, these issues have a cumulative effect on the watershed, making it a complex matter to repair or restore river health and to bring back the grayling and other fish species that once thrived here. The challenge, then, is to balance the social, economic and environmental needs of those that live, work and play in this area, such that watershed health is restored and sustained through time.

Over the past decade or more, several organizations have been working to measure and improve conditions in the Redwillow Watershed, with varied success. Today, these organizations recognize the need for greater collaboration. Everyone in the watershed needs to be a part of the solution. Additionally, improving watershed health will require a multi-pronged approach and will take time. A restoration plan, developed by the Redwillow Watershed Restoration Team, will provide a roadmap for this work - showing who will do what and by when.

The goal of the Redwillow Watershed Restoration Plan is *to restore fish habitat in the Redwillow Watershed*. This goal will be achieved through a number of objectives and strategies as follows:

- **Objective A. Further degradation of the land and water is prevented by working with stakeholders including regulators, industry and the public.**
 - Strategy 1. Implement a watershed approach to integrating land and water management.
 - Strategy 2. Get stakeholder buy-in for the restoration plan.

- **Objective B. Healthy aquatic habitats (where degradation is minor and large scale declines of ecosystem function have not yet occurred) are maintained and protected.**
 - Strategy 3. Identify and protect key healthy aquatic habitats in the watershed.
- **Objective C. Degraded aquatic ecosystems are restored through the improvement of water quantity (flow), water quality and physical habitat where natural or human caused events have impaired capacity.**
 - Strategy 4. Improve water quantity (flow).
 - Strategy 5. Improve water quality.
 - Strategy 6. Restore and protect riparian areas including stream and river banks, floodplains, shorelines and wetland fringes.
- **Objective D. A healthy fish community is restored where fish habitat is connected, further loss to fish populations is prevented, biological diversity within the fish community is restored and a self-sustaining recreational fishery can be supported.**
 - Strategy 7. Remove impediments to restore river longitudinal connectivity where habitat is fragmented through anthropogenic disturbance (i.e. culverts, weirs) to allow fish species to access habitat throughout the Redwillow Watershed.
 - Strategy 8. Prevent further loss to existing fish populations.
 - Strategy 9. Restore biological diversity within the fish community.
 - Strategy 10. Ensure a self-sustaining recreational fishery can be supported.
- **Objective E. Land use managers and the public have knowledge of the fish resources and fish management issues in the watershed.**
 - Strategy 11. Develop an education and outreach plan that defines key messages, identifies audiences and selects the appropriate communication tools for each.
- **Objective F. As good stewards, fish, water and land resource users and others take the initiative to manage their activities and actions in a manner that will consider and protect fishery resources and the habitat upon which they depend.**
 - Strategy 12. Encourage and support individual and group stewardship initiatives.

Finally, a restoration plan will only be successful if it is implemented successfully. Hence, the plan will need to be resourced. Additionally, implementation progress, as well as physical improvement to the environment, should be measured and reported on over time.

List of Acronyms

ACA	Alberta Conservation Association
AER	Alberta Energy Regulator
AWES	Agroforestry and Woodlot Extension Society
BMP	Best or Beneficial Management Practices
DUC	Ducks Unlimited Canada
ESRD	Environment and Sustainable Resource Development
GOA	Government of Alberta
GPRAT	Grande Prairie Riparian Action Team
MPWA	Mighty Peace Watershed Alliance
RWRP	Redwillow Watershed Restoration Plan
WCWS	West County Watershed Society

Acknowledgements

This project is a collaborative effort between several partner organizations that make up the Redwillow Watershed Restoration Plan Team. This includes the Alberta Conservation Association, Alberta Environment and Sustainable Resource Development (Grande Prairie Fisheries Branch), Agroforestry and Woodlot Extension Society, Alberta Habitat Riparian Management Society (Cows and Fish), County of Grande Prairie (Agricultural Services Board), Mighty Peace Watershed Alliance, Town of Beaverlodge and the West County Watershed Society. Team members would like to thank their individual organizations for their financial and in-kind support of restoration work and plan development. The Team also acknowledges the financial support of Environment Canada through its Environmental Damages Fund.



This project was undertaken with the financial support of the Government of Canada.

Ce projet a été réalisé avec l'appui financier du gouvernement du Canada.



CONTENTS

EXECUTIVE SUMMARY	2
INTRODUCTION.....	8
THE WATERSHED	8
BACKGROUND	9
THE PLAN	12
UNDERSTANDING THE PAST	14
SETTLEMENT HISTORY	14
LAND USE HISTORY	15
UNDERSTANDING THE ISSUES.....	16
LOSS OF FISHERIES	16
UNHEALTHY SHORELINES	20
LOSS OF RIVER FLOW AND CONNECTIVITY	22
THE RESTORATION PLAN.....	24
PLAN GOAL	24
PLAN OBJECTIVES AND STRATEGIES	24
RESOURCING & IMPLEMENTING THE PLAN	32
MEASURING AND REPORTING ON IMPLEMENTATION SUCCESS	33
PERFORMANCE MEASURES AND REPORTING	33
PERIODIC REVIEW OF THE PLAN	33
RESOURCES FROM THE LITERATURE	34
OTHER RESOURCES.....	35
APPENDICES	36
APPENDIX 1 – REDWILLOW WATERSHED RESTORATION PLAN TEAM MEMBERS	36
APPENDIX 2. REDWILLOW WATERSHED RESTORATION PLAN	37

INTRODUCTION

THE WATERSHED

Located west of Grande Prairie, Alberta, the Redwillow River is a tributary of the Wapiti River which in turn flows northeast into the Peace River system. These waters then loop around to run northwest into the Mackenzie River and eventually enter the Beaufort Sea (Arctic Ocean).



Photo: S. Kitt

If you were to canoe the entire length of the Redwillow River, you would start just over the British Columbia (BC) border (at the southern tip of Highway #52). Here, the river starts as an outflow of Stony Lake, in the Rocky Mountain Foothills, at an elevation of 1,080 meters (3,540 ft). The river flows northeast between Lone Mountain and Squaw Mountain, receiving water from Rat Lake and other mountain creeks. South Redwillow River, a tributary, brings water from Quicksand Lake. Looking at this portion of the river with the help of satellite images¹, you can see the rugged terrain and heavy conifer forest, interspersed with forestry cutblocks, seismic lines and roads, oil and gas facilities and even cutbanks and old river channels no longer connected to the mainstem.

After draining Little Prairie Lakes, the Redwillow River continues east and receives water from Thunder Creek and Hiding Creek. It then meanders as it progresses east and north-east into the province of Alberta. Not far inside the Alberta border are the Redwillow Falls – a favourite place to recreate for many. As the river passes through Rio Grande, Sylvester and Elmworth, receiving water from Lattice and Diamond Dick Creek, the forest is left behind and the area turns into farmland. Below the Town of Beaverlodge, the river starts to turn south, receiving the waters of the Beaverlodge River (its largest tributary) just before it flows into the Wapiti River. Here, at an elevation of 575 meters (1,886 ft), the land again becomes more rugged and forested.

The Beaverlodge River takes a similar journey, originating from several small lakes and streams just over the BC border, before flowing east into Alberta farmland at Lymburn and dropping south past Hythe and Beaverlodge into the Redwillow River. A major tributary is Beavertail Creek, which in turn receive flows from Steeprock and Windsor creeks.

Rivers are affected by the area of land that drains into them. The total area of the Redwillow Watershed within Alberta is 211,529 ha. This watershed can be broken down further into two smaller sub-basins. The total area of the Redwillow River sub-basin within Alberta is 67,288 ha. The total area of the Beaverlodge River sub-basin in Alberta is 144,241 ha.

¹ To view online, go to <https://www.google.com/maps> and enter 'Redwillow River'. To get a feel for the terrain, turn on the satellite feature. To see photos of various sites along the river, turn on the 'Show imagery' function.

BACKGROUND

The Redwillow Watershed includes the Redwillow and Beaverlodge rivers and many other tributaries, lakes and wetlands in this drainage (Figure 1). Prior to European settlement, these rivers provided food and water to early subsistence hunters, and later to explorers and fur traders travelling through the area. As settlement occurred, the rivers also became a means to make a living through crop irrigation or livestock watering. As communities such as Beaverlodge and Hythe grew, so did the uses of the rivers which now became a source for drinking and process water and a conveyance for municipal and industrial wastewaters. Over time, these local rivers and lakes also became valued by the public for a variety of recreational activities.

In the past, the Beaverlodge and Redwillow rivers were also prized for fishing. Both rivers functioned as spawning habitat for Arctic Grayling and other species valued for subsistence and recreational fisheries. However, during the last two decades, this population has disappeared – an indicator that the ecological health of the rivers may be impaired.

“The Beaverlodge River is not the river of my youth.”

Other uses of the rivers, such as withdrawals for drinking water and industry, livestock watering, wastewater conveyance, canoeing, swimming, bird watching, etc. are also no longer being met as well as they were in the past. This loss of social, economic and ecological benefits in turn affects the quality of life of those living, working and recreating in the Redwillow Watershed. As an upstream basin, this impairment also affects the health and ecology of the downstream Wapiti River system.

Like watersheds elsewhere in Alberta, the causes of this decline are many. Over the years, the Redwillow Watershed has faced increasing pressures from growth and development. Many of the activities detrimental to its health occur on the river itself or at the river’s edge. This includes the building of structures such as weirs, culverts and crossings that affect river flow and fragment fish habitat. It also includes activities like shoreline grazing and motorized recreation which can impair the health of riparian edge and its ability to filter sediments (from erosion) and pollutants (i.e. manure, fertilizers and pesticides) before they affect water quality.

Additionally, activities that affect surface water run-off in the uplands, such as forest-clearing and wetland draining, also affect river health (Figure 2). Combined, these land use activities have a cumulative effect on the health of the watershed, making it a complex matter to repair or restore river health and to bring back the grayling that once thrived here. The challenge, then, is to balance the social, economic and environmental needs of those who live, work and play in the Redwillow Watershed, such that land uses have less impact on the rivers and watershed health is restored and sustained through time.

Definitions

Watershed, basin or drainage: an area of land that contains a common set of streams and rivers that all drain into a single larger body of water such as a larger river, lake or an ocean.

Riparian: situated or taking place along or near the bank of a river or other waterbody.

Cumulative: gradually building up and becoming successively larger, stronger with each successive addition.

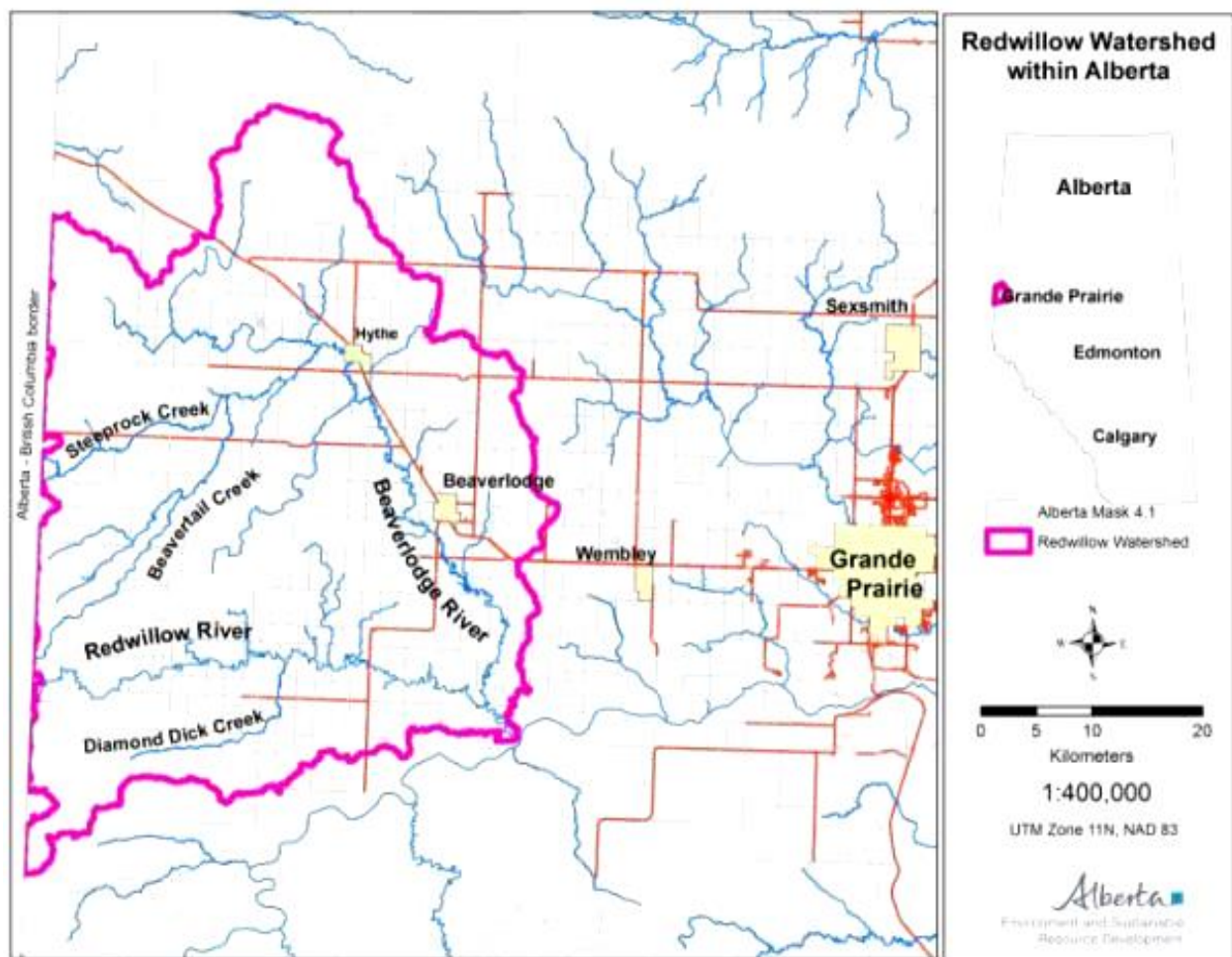


Figure 1. The Redwillow Watershed within Alberta showing the watershed boundary and major tributaries.

1949



1979



Photo. A. Norris

Figure 2. The top two air photographs show how the same parcel of land changed between 1949 and 1979. The bottom photograph reflects what the landscape throughout this area typically looks like today.

THE PLAN



Since the late 1950s, several agencies and organizations have carried out work in the Redwillow Watershed in order to understand and manage the water, fisheries and other related resources in this drainage. For example, fish surveys and water quality studies have been conducted, overgrazed or eroded riparian areas have been protected and restored, and information about the health of the watershed has been shared at events such as riparian tours and open houses.

Individually, and depending on the goal they are measured against, these activities have had varied success. Perhaps more importantly, they have increased awareness of the need for greater collaboration. Because everyone that lives in a watershed has an effect on it, everyone needs to be involved in its management. No one individual or organization can ensure the health of the Redwillow Watershed, but collectively, the people that live, work and recreate in this basin can restore it and keep it in good shape, now and for future generations.

Another realization is that there is no single short-term solution. Just managing wastewater releases or just restoring the riparian area won't be enough. The watershed faces a variety of pressures and a multi-pronged approach will be needed to address these cumulative effects. This approach must also be flexible, adapting as knowledge is acquired over time. In addition, just as this issue did not arrive overnight, it will take time to remedy the situation. Hence a plan, and the commitment to implement it, must be long term.

Recognizing this need for greater collaboration and a comprehensive watershed approach, the Redwillow Watershed Restoration Plan Team² formed in November 2013 with the purpose of working together collaboratively to develop and implement a Redwillow Watershed Restoration Plan (RWRP). This plan will build upon the previous work of all organizations involved in fisheries management, watershed management and stewardship in this area including the Agroforestry and Woodlot Extension Society (AWES), Alberta Conservation Association (ACA), Agricultural Services Board of the County of Grande Prairie, Alberta Riparian Habitat Management Society (Cows and Fish), Grande Prairie Fisheries Branch (Environment and Sustainable Resource Development), West County Watershed Society (WCWS) and others. The plan will also be inclusive as the participation and involvement of a broad range of stakeholders is both desired and critical. Together, the people who live, work and recreate in the watershed are the ones who can ensure that restoration efforts will lead to a Redwillow Watershed that is healthy and sustained, today and in the future.

*I hope someday
it can get back
to the state that
it was ...*

² For a list of Redwillow Watershed Restoration Plan Team members, see Appendix 1.

Who is the Agroforestry & Woodlot Extension Society?

The Agroforestry & Woodlot Extension Society (AWES) is a non-profit society that is a joint venture between government, industry, and conservation agencies. AWES evolved from the former Woodlot Extension Program (WEP) established in 2000. The objective was to provide extension services to landowners and to encourage the environmental stewardship and sustainable management of more than 3.6 million hectares of privately owned forested land in Alberta.

The similar mission of AWES is to increase the awareness of the economic, social, and environmental values of agroforestry and woodlots within the landscape. AWES promotes and encourages responsible stewardship and sustainable management of privately owned forested land in Alberta by providing project support and extension services to landowners, land stewards and others who influence land use practices in Alberta. Staff provide tree-planting services (i.e. seedling order, site assessment, site preparation, planting and evaluation) in a variety of settings throughout Alberta, with projects ranging from 1,000 to 80,000 seedlings. By implementing these services, AWES is improving the biodiversity, wildlife habitat, recreation and conservation of different regions throughout the province.

For more information, see <http://www.awes-ab.ca/>.

Who is Cows and Fish: Alberta Riparian Habitat Management Society?

The Alberta Riparian Habitat Management Society, also known as "**Cows and Fish**", is a non-profit society striving to foster a better understanding of how improvements in grazing and other management of riparian areas can enhance landscape health and productivity, for the benefit of landowners, agricultural producers, communities and others who use and value riparian areas.

Their mission is to promote the improvement of riparian areas, their ecological processes and functions, through a collaborative partnership and voluntary, proactive community-based action that uses education and awareness about management options for producers, other landowners and their communities.

Staff are available to help landowners, communities and local stewardship groups:

- Understand riparian area functions and values
- Access technical advice and educational materials
- Examine and monitor the health of their riparian areas
- Evaluate and suggest management strategies

For more information, see <http://www.cowsandfish.org/about/about.html>.

UNDERSTANDING THE PAST

SETTLEMENT HISTORY

To understand how the Beaverlodge and Redwillow rivers have changed over time, it is important to look at the history of this area. The Redwillow Watershed has a long geological span that stretches back eons, as witnessed by discoveries of Hadrosaur prints and other dinosaur fossils found along the Redwillow River. At the time of the dinosaurs, this area was a lush, warm, landscape, vastly different from today.³

Did you know?

The mean annual temperature of the Beaverlodge area is 3°C (37°F) but temperatures can range from as warm as 36.7°C (98.1°F) to as cold as -47.8°C (-54°F). This area receives about 433 mm (17 in) of rain a year and has on average 102 frost free growing days.

More recently but prior to European settlement, this area was a mix of conifer and deciduous forest and northern prairies. At the beginning of the 20th century, ranchers and farmers began to settle in the Beaverlodge district, converting forests and native prairie into cultivated fields. With a typical climate of moderately warm summers and long growing days, the area was well-suited to agriculture.

As early as 1914, the Dominion Agricultural Research Station was established at Beaverlodge and the area became known for its high quality grain production. Soon after they arrived, local producers started looking for improved access to markets. This included trying to develop a route through the Rockies to the west coast via the Monkman Pass Trail - started in 1928 but never becoming a viable transportation route.⁴

With increasing farmers came the need for more services and centres to house them. Beaverlodge and Hythe both formed around 1910. Beaverlodge was incorporated as a village in 1929 and, with a population 2,365, as a town in 1956. Similarly, the population of Hythe (named after a town in England) grew into a village by 1929. Interestingly, Hythe was also known as the 'town of flowing wells' as it sits on a large aquifer. As more homesteaders moved in, many other small communities sprouted up with populations that waxed and waned over time. Elmworth had a post office by 1920. In 1927, a group of the Russian Mennonites settled at Lymburn.

³ To learn more about the geology and dinosaurs of this area, see the Palaeontological Society of the Peace at <https://www.gprc.ab.ca/community/pipestone/index.html>.

⁴ To learn more about the Monkman Trail, see <http://www.env.gov.bc.ca/bcparks/explore/parkpgs/monkman/downloads/MonkmanPassMemorialTrail-DrivingRoute.pdf>.

LAND USE HISTORY

Increased settlement by farmers in the latter half of the 20th century changed the landscape of the Beaverlodge area from primarily forest and native prairie to a landscape dominated by agriculture. Today, the Redwillow Watershed is predominately (83%) located in Alberta's White (Settled) Area and is largely privately-owned.



From a land use perspective, the majority of the Alberta portion of the Redwillow Watershed lays within the jurisdiction of the County of Grande Prairie.⁵ Development within the County is regulated by its Land Use Bylaw #2680. As can be seen by the County's LUB viewer map⁶, the majority of lands in the Redwillow Watershed, particularly those lands immediately adjacent to the Red Willow and Beaverlodge rivers, are zoned for agriculture. There are also a few small areas zoned for "country residential 5" (e.g. small businesses and acreage development) and "intensive recreation" (e.g. municipal parks and golf courses). On cultivated lands, crops include barley, wheat, canola and oats. Grazing lands are utilized primarily for cattle although there are a few bison and elk farms. Cargill Limited used to operate a large grain handling facility at Albright. However, this facility closed in 2010 with customers being re-directed to Rycroft.

Though not as large as the County of Grande Prairie, there are a number of smaller municipal governments with land use authority. The Town of Beaverlodge and the Village of Hythe manage development within their boundaries. Although not within the Redwillow Watershed, the City of Grande Prairie is Alberta's seventh largest city (population 55,032 in 2011) and one of Alberta's fastest growing communities. Its influence spreads beyond its borders as those that live or work there look outside the city for recreational opportunities or acreage homes.

The remaining portion (17%) of the Redwillow Watershed, which mostly includes the western headwaters, is located in the Green (Non-settled) Area. These lands are managed by the province largely for forestry operations although they are also more and more utilized for recreation. This is particularly true on the BC side where activities like camping, hiking, fossil and rock hunting, and more recently, geo-caching⁷ are being actively promoted around the Tumbler Ridge area. Underlying the surface of the Redwillow Watershed, this area is known as the 'Wapiti Formation', with a long history of coal, oil and gas and aggregate (gravel) mining.

⁵ However, note that under the *Alberta Land Stewardship Act*, this area will come under the Upper Peace Regional Land Use Plan, once it is completed.

⁶ For online County of Grande Prairie maps and land use zoning, see <http://www.countygp.ab.ca/EN/main/departments/planning-econ-dev/key-planning-documents/land-use-bylaw-maps.html> or <http://enterprise.countygp.ab.ca/public/default.aspx>.

⁷ For geo-caches in this area, see http://www.geocaching.com/geocache/GC15PN0_where-the-red-willow-falls.

UNDERSTANDING THE ISSUES

As mentioned, over the past 100 years, human settlement and activities such as clearing forests, draining wetlands, cultivating and fertilizing native prairie and adding livestock has altered the landscape in the Redwillow Watershed causing the degradation and fragmentation of fish habitat. Ecological functions (such as nutrient filtration, sediment capturing and erosion control) that take place in a healthy watershed have been impaired, affecting water quality and quantity, river flow, shoreline health, fisheries and other aspects of watershed health. In the following sections, we take a closer look at these issues as well as some of the past activities to address them.

LOSS OF FISHERIES

In the past, both the Beaverlodge and the Redwillow rivers were home to a variety of sport fish and non-sport fish species that supported a subsistence and recreational fishery. These rivers were also important as the spring spawning grounds for Arctic Grayling and other species from the Wapiti River.

“My family and I like the outdoors and would like more local areas to fish.”

As the landscape changed over time, this fishery declined, particularly in the Beaverlodge River. Land use and run-off, if not managed, can affect water quality, and this in turn can affect fish habitat and population health. In addition to the change in land use, river connectivity can affect fish populations. The weir at Beaverlodge was installed in 1981 in order to divert river water into the town’s reservoir. In 1982, fish, including grayling, were observed trying unsuccessfully to move upstream above the weir. The effects of other impediments including weirs, culverts and livestock crossings found throughout the basin are unknown.

The Beaverlodge River was sampled for fish from 1983-1987. Grayling were found all five years but numbers varied. In 1992-1993, the river was again sampled but no grayling were recorded. Today, grayling are no longer present in the Beaverlodge River and they may have disappeared from the Redwillow River.

Because of this decline, a number of fish management initiatives have been carried out since the early 1980s. After observing them in 1983, Fish and Wildlife staff captured and transported the trapped fish over the Beaverlodge weir. The following year, a fish ladder was installed, restoring fish habitat connectivity to some degree. While there are anecdotal reports that fish have used this ladder in the past, it can still pose a challenge to spawning fish in low flow years.

Fish of the Redwillow Watershed

- Arctic Grayling
- Brook Stickleback
- Bull Trout
- Burbot
- Flathead Chub
- Lake Chub
- largescale Sucker
- Longnose Dace
- Longnose Sucker
- Mountain Whitefish
- Northern Pike
- Pearl Dace
- Redside Shiner
- Slimy Sculpin
- Trout-perch
- Walleye
- White Sucker

In 2000, fisheries staff from Environment and Sustainable Resource Development (ESRD) and Alberta Conservation Association (ACA) identified the Beaverlodge River as a 'Priority Drainage' and continued to survey fish and aquatic health in this river. That year, ACA tagged 15 Arctic grayling in the Wapiti River and followed them using radio telemetry as they spawned upriver: all of the tagged fish bypassed the Beaverlodge River in favor of the Redwillow River for spawning.



In 2008, 25 sites were electro-fished throughout the Redwillow Watershed to determine fish community composition. This work showed that a shift in fish community has occurred in the Beaverlodge River. The low number or absence of sensitive species (e.g. grayling and bull trout) and the abundance of resilient species (e.g. white suckers and brook stickleback) are evidence of habitat degradation. In contrast, the Redwillow River does not show the same changes to its fish community. This aligns with the evidence that the Redwillow River Watershed has not experienced the same level of degradation from land use activities as the Beaverlodge River Watershed.

In 2008-09, ESRD commissioned a literature review of the Redwillow Watershed. The AECOM report *Redwillow Watershed: an Overview of the History and Present Status of Fish Populations and Fish Habitat and Recommendations for Restoration* provides a detailed synthesis of available information about the status of fish and the landscape within the Redwillow Watershed. Results of a historical survey to better understand baseline fisheries information was also included in this report. Much of this information was also shared with other fisheries managers and researchers at a grayling symposium in Grande Prairie in 2011.

In 2014, ESRD developed a number of Fish Management Objectives for the Redwillow Watershed to guide future management decisions and restoration efforts. These objectives have been adopted by the Redwillow Watershed Restoration Team and integrated into this restoration plan. Also in 2014, a public values survey conducted by the Team showed that 91% of survey respondents rated fisheries in the Redwillow Watershed as very important or important. Many of these respondents also indicated they would be willing to change behavior and carry out stewardship activities if it restored the grayling fishery in the future.

Not everyone is a fisherman or concerned about fish. However, grayling make a great 'indicator' or 'keystone' species. If grayling are restored, we know the watershed is healthy, carrying out ecological functions like water filtration and supporting the biodiversity it once had. A healthy system can provide a variety of social, economic and environmental uses of the river. It's all connected!

Biodiversity in the Redwillow Watershed

Despite its name, Beaverlodge wasn't named after the beaver, but in fact for the many lodges built along the river by the Beaver Indians. Still, beavers and other furbearers played an important role throughout the Peace Watershed in the fur trade of the 1800s. Furbearer numbers have fluctuated over time in response to demand. To feed the trappers and traders, other flora and fauna, like moose, elk, fish, waterfowl, game birds, saskatoons, wild strawberries, etc. were also important. These country foods also kept the settlers alive their first few years until crops and gardens were planted and successfully harvested.

Despite the advent of game management laws and enforcement, many harvested species were negatively affected by the growing human population in the region. Elk and moose populations fluctuated over time. Caribou were pushed back from settled areas with only a small number of remnant herds remaining in the headwaters. Similarly, predators like wolf and bear have declined with settlement.

Today, along with Arctic Grayling and Bull Trout, other well-known species at risk in the Redwillow Watershed include Trumpeter Swans and Woodland Caribou. The management of Trumpeter Swans, decimated by overhunting and habitat change at the turn of the last century, is a good news story that has seen the downgrading of this species from threatened to sensitive. Unfortunately, the opposite has occurred with Woodland Caribou, which continue to decline precipitously and which are being considered for upgrading from threatened to endangered in Alberta.



Photo: S. Kitt

DECREASING WATER QUALITY

To understand the fisheries decline, land managers started looking at the quality of fish habitat. This included looking in the river – at water quality and water quantity (flow) – as well as what is entering the river from its shores.

Growth and development has affected water quality in the Beaverlodge and Redwillow rivers over time. Water quality is affected by both point (end of pipe) and non-point (diffuse) pollution. In the Redwillow Watershed, the biggest source of point source pollution is municipal wastewater releases. The Town of Beaverlodge, Village of Hythe and Horse Lake First Nation all discharge their treated sewage into the Beaverlodge River. For the most part, wastewater releases only have a short term effect on those waters immediately below the discharge point, before pollutants are diluted by the receiving waters. However, the cumulative impact of releases from all three communities is unknown.

Non-point pollution is likely a much bigger issue than point pollution in this watershed. The 2009 AECOM report summarized water quality data collected between 1977 and 2007. In April 2010, the ACA started doing sampling and this work has continued. In this year, ACA conducted additional water quality testing at 10 sites along the Beaverlodge River. In general, these rivers exceed guidelines for iron, phosphorus, and dissolved oxygen (DO) levels. ESRD is also doing water quality sampling in this watershed on a regular basis.

These findings are comparable to many other agricultural streams where run-off from the land brings nutrients such as manure and fertilizers, into the water. Unless the run-off is filtered by vegetation in a wetland or riparian area, it enters the river where concentrations can accumulate. Nutrients in turn contribute to increased plant growth. More plants consume more oxygen leading to lower DO levels, as well as more fluctuations in DO, making less oxygen available for other species like fish. Low DO also leads to the release of iron into the water column. Intuitively, water quality will be worse downstream of heavily impacted landscapes, or after large precipitation events that lead to greater surface run-off and erosion.

Fortunately, there are many ways to reduce non-point pollution including proper manure management, reducing inputs such as fertilizers and pesticides on the landscape, using shelterbelts to reduce erosion, and maintaining wetlands and riparian buffer zones that can filter contaminants from run-off before it enters a water body.

Wastewater Treatment

In 2006, the Town of Beaverlodge released its treated wastewater much as it had always done. This year, however, a ‘perfect storm’ of conditions including low flows and higher than normal temperatures led to high toxicity and a major fish kill event.

Learning from this situation, today, the Town has improved its wastewater release protocols and has also installed aeration and willow bed irrigation systems to prevent such events from happening again in the future.

UNHEALTHY SHORELINES

In the past and like many agricultural areas in Alberta and elsewhere, the shorelines of the Beaverlodge and Redwillow rivers and their tributaries were once heavily utilized for grazing and watering cattle and other livestock. Today, however, producers are recognizing that overgrazing and trampling the riparian area associated with a waterbody can have detrimental effects on water quality. As well, it can affect the health and well-being of livestock.

All water, including the bed and shore of any permanent waterbody belongs to the Crown. Hence, it is the responsibility of the Government of Alberta to ensure this resource is sustained for future generations. Starting in 1999, a number of conservation agencies started working with willing landowners and producers in the Redwillow Watershed, to look more closely at the health of riparian areas as they impact water quality in this watershed.

In 2002, staff of ESRD, ACA and the County of Grande Prairie flew along the mainstream of the Beaverlodge River, Steeprock and Beavertail Creeks and photographed the obvious agricultural and cultural impacts on the river. Concerned with the health of the Beaverlodge River, ACA initiated the Grande Prairie Riparian Action Team (GPRAT), bringing together several organizations to begin some riparian restoration work.

From 2004 – 2007, a number of projects were initiated to protect the riparian zone of the Beaverlodge River on private lands. Projects included riparian assessments, mapping and health inventories and reducing livestock access via streamside fencing and/or installing off-site watering systems such as dugouts or water wells.

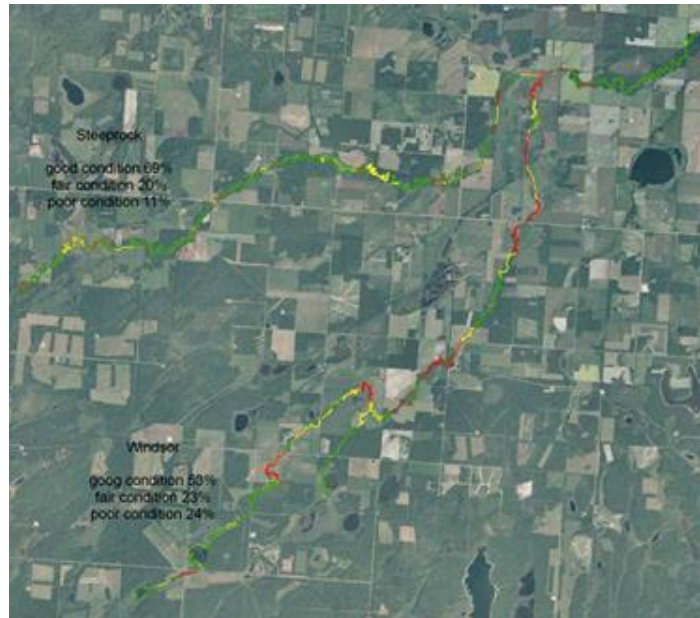
In 2008-2010, this work was formalized under the Riparian Reforestation and Wildlife Habitat Enhancement Project. Phase I started in 2008 as a partnership with County of Grande Prairie, Alberta Environmentally Sustainable Agriculture, Alberta Conservation Association (ACA) and the Woodlot Association of Alberta (WAA). In March and April, advertising programs in local papers in the area of the Town of Beaverlodge and Hythe were started to find interested landowners.



Photo: A. Norris

Five producers agreed to participate. All five locations underwent site assessment and mapping to determine if they were suitable. Then in May, a professional tree planting crew arrived and planted approximately 22,000 seedlings at the five sites. Fifty acres of degraded riparian areas on farmland were reforested with spruce, pine, poplar, dogwood and larch. All plantings with cattle were fenced to control their access to planted sites.

Seven landowners participated in 2009. After receiving the funding and mapping of the sites, 22,000 trees were ordered and planted on about fifty acres. The monitoring of tree survival and promoting of the project to the community continued in 2009. Similar activities were carried out in 2010. This project was recognized and promoted by a variety of newspaper articles, as well as being a finalist in the Alberta Emerald Awards in 2009 and 2010.



In 2009, Cows and Fish was invited as a partner to gather more detailed riparian health inventory data for each site. This information helped determine the baseline condition of the riparian area before the planting and/or management change (e.g. fence and/or watering system installed). Continued monitoring in the future will be used to track the success of the project in improving riparian health.

Also in 2009, the Beaverlodge River and Steeprock, Windsor and Beavertail creeks were analyzed for their riparian health. The area was flown and filmed out of a helicopter. With this information, health scores for the river banks were assigned by ACA. A good riparian area is characterized by lush vegetation (layers of grasses, shrubs and trees) and a stable river bank. A decline of vegetation and an increase of erosion and grazing results in a lower riparian health score. Information was summarized in area maps. As seen in the image above, good condition banks are coded green, the fair are yellow and the poor are red. An additional map, showing the landowners name and the areas re-forested in 2008 and 2009, was also developed.

While planting and fencing projects have been continued in recent years, ACA has also recognized the need for conserving riparian lands along the Beaverlodge River. Lands are protected either by purchase or by landowner agreements/conservation easements. A list of ACA conservation lands can be found at <http://www.albertadiscoverguide.com/search.cfm?mode=grid>.

LOSS OF RIVER FLOW AND CONNECTIVITY

Water quality management is confounded when water levels are low and discharge rates are unable to dilute pollutants or provide a ‘flushing flow’. River flows vary naturally from year to year depending on precipitation and timing of climatic events like spring snowpack melt, summer rains and winter snows. Most Albertans have witnessed events like floods and droughts.

Since the late 1940s, a number of man-made factors have affected water quantity (flow) in the Redwillow and Beaverlodge Rivers. River flows are affected by water withdrawals. There are a number of license-holders in the Redwillow Watershed. Ducks Unlimited Canada holds the largest volume of water under licence in the basin⁸. This water is used to stabilize a number of lake levels for the benefit of Trumpeter Swans and other waterfowl. Although this does not remove a large amount of water from the basin, it does affect the timing and strength of flows, and adds some evaporative loss.



1935 Flooding of the Beaverlodge River
(South Peace Regional Archives)

The Town of Beaverlodge also holds a water allocation licence. The Town can withdraw a volume of 690,760 cubic metres (m³). However, note that only 154,190 m³ (22%) is consumed or lost through leakage: the remainder is returned to the river as treated wastewater.

Although this restoration plan focuses on surface waters, it is important to know that the Redwillow Watershed also has extensive groundwater resources. In 1960, J. F. Jones, working for the Research Council of Alberta, wrote a comprehensive report on the groundwater resources of the Beaverlodge district. At that time, most landowners in the area got their water from groundwater wells, some capable of discharging up to 60 gallons per minute. The Town of Beaverlodge relied on groundwater at the time. By 1981, however, well water quality and quantity was poor and Beaverlodge converted to river water. Hythe continues to rely on groundwater. Groundwater is often linked to surface waters via recharge and discharge areas. Hence, groundwater flow can affect surface flow.

River flows can be impeded by both natural (e.g. beaver dams) and man-made (e.g. weirs, culverts, crossings) structures. As mentioned, the Town of Beaverlodge built a weir on the Beaverlodge River in 1981. Ducks Unlimited Canada has built a number of weirs at sites

⁸ As per the AECOM, 2009 report, Table 18 on page 64 (licences for both stabilization and wetlands).

throughout the watershed. Hanging culverts, cattle and equipment stream crossings, and other structures also impede river flows, particularly in dry, low-flow periods.

Landscape alterations, such as infilling wetlands, altering tributaries and making surfaces impervious to rain, can also affect flow rates. In the Redwillow Watershed, flow has not been well studied but if the goal is to restore grayling habitat, both water quality and water quantity requirements will need to be met. Hence flow may need to be restored by managing the amount and timing of withdrawals and releases, removing impediments and mitigating landscape alterations.

Who is the Alberta Conservation Association?

The vision of the Alberta Conservation Association (ACA) is an Alberta with an abundance and diversity of wildlife, fish and their habitats; where future generations continue to use, enjoy and value our rich outdoor heritage. Their mission is to conserve, protect and enhance fish and wildlife populations and their habitats for Albertans to enjoy, value and use.

Since its inception as a non-profit in 1997, ACA has directed hundreds of millions of dollars from fishing and hunting license sales and partnership contributions towards thousands of conservation efforts across Alberta, from studies on the largest species to the securement of vast tracts of precious habitat while providing Albertans with access to a myriad of sustainable outdoor recreation activities.

For more information, see <http://www.ab-conservation.com>.

Who is the West County Watershed Society?

The West County Watershed Society (WCWS), located in the Redwillow Watershed, was created by local members of the community concerned with the rapid degradation of local rivers and creeks. This non-profit organization was launched in 2010 to address the problems facing the Redwillow Watershed. Such problems include deterioration of riparian areas, water quality, and fish quantity in the Redwillow Watershed and its tributaries. In the past, have provided information seminars, help landowners obtain funds from various sources, assist in riparian health assessments, and monitor the health of the watershed. Going forward, WCWS is working to increase communication with landowners, grow a passion for stewardship in the community, create a common community goal that drives water conservation and return fish to local rivers.

For more information, see <https://www.facebook.com/west.county.watershed>.

THE RESTORATION PLAN

PLAN GOAL

In 2003, the Government of Alberta (GOA) released *Water for Life: Alberta's Strategy for Sustainability* to guide the management of Alberta's water resource. The *Water for Life* strategy has three goals, (1) Albertans are assured safe, secure drinking water; (2) Albertans are assured that the aquatic ecosystems are maintained and protected, and; (3) Water is managed effectively to support sustainable economic development. A key action for goal number two is the development of plans to improve the health of significantly impacted aquatic ecosystems.

The goal of this plan is **to restore fish habitat in the Redwillow River Watershed.**

Although this is a very specific goal, it is intended to use fish habitat as proxy – that is, if fish habitat is restored, other aspects of watershed health such as water quality, water quantity (flow) and riparian health must also be restored. If all of these elements of fish habitat are successfully restored, species like grayling and bull trout are likely to return to the Redwillow Watershed.

PLAN OBJECTIVES AND STRATEGIES

Within the GOA, the Fisheries Management Division of ESRD is responsible for the management of fish populations under the provincial *Wildlife Act*. The Division's goal, as outlined in the *Fish Conservation Strategy 2006-2010*, is *to manage Alberta's fish and wildlife resources and their habitats in a manner that ensures they are healthy and productive, capable of supporting sustainable populations for the benefit of future generations*. In the past, provincial fisheries management, like most wildlife conservation, focused on understanding populations in order to manage game harvest levels. With the recreational fishery mostly absent in the Redwillow Watershed, harvest limits are sadly, no longer an issue.

Today, local ESRD biologists recognize the need to restore habitat, and bring back the fishery, before they can again manage a sustainable harvest. Towards this end, they have identified six management objectives for the Redwillow Watershed. These objectives have been accepted by the RWRP Team and incorporated into this restoration plan. To achieve the plan goal and objectives, a number of strategies and actions have also been developed. These are provided in Appendix 2 and briefly described below.

Objective A. Further degradation of the land and water is prevented by working with stakeholders including regulators, industry and the public.

As we have learned about the issues facing the Redwillow Watershed, we have come to see that what we do on the land ultimately affects the water, which in turn affects the fish and other aspects of aquatic ecosystem health. Because we value this watershed and the social, economic and ecological goods and services it provides, we need to address these impacts by looking at the entire watershed and involving everyone that can influence outcomes.

Strategy 1. Implement a watershed approach to integrating land and water management.

Currently, there are several provincial and municipal departments and agencies with jurisdiction in the Redwillow Watershed. Additionally, there are a number of conservation and stewardship groups working to improve watershed conditions. In the past, several of these entities have come together to form partnerships and collaborations that in turn were successful in running well-coordinated projects or campaigns. Coordination and collaborations needs to continue!

“...to break something is easy but to fix it is more difficult.”

This plan encourages the RWRP Team to continue to be the coordinating body for restoration activities in this watershed. The Team can ensure an adaptive watershed approach is taken by overseeing the development, funding and implementation of the restoration plan. The Team also needs to recognize this will be a long-term plan and will require many resources to be successful.

Strategy 2. Get stakeholder buy-in for the plan.

The Team will not, however, be able to achieve the plan goal alone. To be successful, there must be support and buy-in for the plan from *all* stakeholders. The Team can start by providing opportunities for all stakeholders to be involved in plan development, implementation, monitoring and reporting. This includes landowners and the public; recreation, conservation and stewardship groups; local and provincial government departments with jurisdictional authority; agriculture and industry, etc.

Objective B. Healthy aquatic habitats (where degradation is minor and large scale declines of ecosystem function have not yet occurred) are maintained and protected.

Strategy 3. Identify and protect key healthy aquatic habitats.

While some stretches of the Redwillow and Beaverlodge rivers are impaired, there are also healthy areas. It is important to maintain these healthy areas and prevent any future degradation. This can be done by first identifying these sites, improving awareness of their importance, and understanding whose jurisdiction they fall into.

Where they exist, it is important to raise awareness of Crown rights under existing legislation for the water, bed and shore of any waterbody, as well as implications of the new wetland policy. Lands undergoing sub-division development also provide an opportunity for municipalities to apply tools under the *Municipal Governments Act* (MGA) such as conservation easements and environmental reserves for hazard lands or lands of environmental significance. Municipalities can also use bylaws to limit areas of random camping and off-highway vehicular use. Where healthy riparian lands are privately held, land trust agencies like ACA and Ducks Unlimited Canada (DUC) can work with landowners to put such lands under conservation easement.

Objective C. Degraded aquatic ecosystems are restored through the improvement of water quantity (flow), water quality and physical habitat where natural or human caused events have impaired capacity.

Strategy 4. Improve water quantity (flow).

The 2009 AECOM report suggested that the Beaverlodge River and Beavertail Creek might be highly-allocated in a low flow year however, actual water use compared to licensed volumes is unknown. Knowledge of actual water use and future demand compared to total surface water available is important information for successful watershed management. Hence licence-holders should be surveyed for actual water use data. They should also be encouraged to use Alberta's online Water Use Reporting System. Accurate information on naturalized flows, actual flows and water use in the watershed (volumes, locations, return flows, timing, future demand, etc.) could then be shared with water managers and other stakeholders in the basin.

Water Act managers would also benefit by having a better understanding of the effects of impoundments and releases on flow and availability of waters to meet current licence commitments in low flow years. A model of the watershed could be developed and used to run scenarios to determine the effect of DUC stabilization projects, timing of municipal drinking water withdrawals and wastewater releases, snowpack and groundwater contributions, etc. Once flows are better understood, the appropriate *Water Act* tools can be used to manage water

withdrawals sustainably. Water conservation objectives can be set in an approved water management plan to limit new licences. A water quantity management framework can be developed to manage existing licences in low flow years.

Water quantity is also affected by demand. Demand can be reduced by promoting water conservation, efficiency and productivity. Agriculture, industry and municipalities can reduce water use by using tools such as incentives, metering, bylaws, best management practices (BMPs) or other tools as appropriate. Conserved water can then be left in the river to meet instream flow needs or it can be used to meet new growth and development without having to issue new allocations.

Finally, flows can be improved if the ability of the landscape to capture, store and slowly release water (i.e. acting like a sponge) is also improved. A variety of tools including education, incentives, compliance and enforcement can be used to limit illegal ditching, channel straightening, wetland drainage, etc. Implementing BMPs can also increase storage capacity by increasing the number of ephemeral wetlands on the landscape. Other grant and funding sources are also available to assist with implementation of management changes.

Strategy 5. Improve water quality.

To improve understanding of the state of water quality in the basin, a water quality monitoring and reporting system should be developed. Data could then be mapped with other data layers in an atlas to correlate water quality hot spots related to land uses (e.g. manure and fertilizer maps).

Non-point source pollution needs to be reduced in degraded areas along the Beaverlodge River. Stewardship groups and conservation agencies should continue to work with local and provincial agriculture groups to promote Environmental Farm Planning and BMPs to limit pollutants in surface run-off. Similarly, BMPs can be promoted to acreage owners, recreational groups, industry and transportation.

While the Town of Beaverlodge has made a number of improvements to its wastewater treatment process, the cumulative effects of releases from Beaverlodge, Hythe and Horse Lake are unknown but should be examined, and perhaps, coordinated to lessen their collective impact on the river. These communities can also look within their own boundaries to ensure stormwater, impervious surfaces, and floodplain activities are not affecting the river.

Strategy 6. Restore and protect riparian areas including stream and river banks, floodplains, shorelines and wetland fringes.

Because of its critical role in capturing surface pollutants before they run off into the water, affecting water quality and fish habitat, riparian health must become a priority in the Redwillow Watershed and any alteration, disruption and destruction must be stopped.

Re-establishing riparian health, particularly along the more-heavily utilized Beaverlodge River, will require a three-step process that first includes identifying sites needing work by inventorying, monitoring, assessing and reporting on riparian health. Second, landowners and land managers need the knowledge and tools to make behaviour changes. This can be provided by promoting BMP demo sites (e.g. streamside fencing, offsite watering, erosion control, etc.), leading tours and carrying out other outreach activities to agricultural and other communities (urban, acreage, municipal) affecting riparian areas.

Finally, labour and supplies might make the difference between a project occurring, or not. Where they are able, conservation groups can provide funds, supplies, labour and technical support to willing landowners to install fencing, off-site watering, beneficial plantings, etc. to restore degraded areas.



Photo: A. Norris

Objective D. A healthy fish community is restored where fish habitat is connected, further loss to fish populations is prevented, biological diversity within the fish community is restored and a self-sustaining recreational fishery can be supported.

Strategy 7. Remove impediments to restore river longitudinal connectivity where habitat is fragmented through anthropogenic disturbance (i.e. culverts, weirs) to allow fish species to access habitat throughout the Redwillow Watershed.

After the fish ladder was installed at Beaverlodge in the 1980s, grayling were observed using it to move upriver to spawn. In recent years, however, no grayling have been observed at the weir. Designed in the 1980s, the current weir may not be optimal. Additionally, issues with water quality and low flow may be affecting its use. An improved design could increase its effectiveness for grayling and other fish species.

Similarly, it is unknown if DUC weirs and other impediments (hanging culverts, cattle crossings, ghost streams, drained wetlands⁹, etc.) scattered throughout the Redwillow Watershed are affecting fish passage. This should be looked at and mitigated where required.

Strategy 8. Prevent further loss to existing fish populations.

Fish populations and fish harvest are managed by ESRD under the authority of Alberta's *Wildlife Act* and its associated regulations. ESRD uses a variety of tools to regulate and enforce fish harvest as appropriate to achieve individual species' plan goals and objectives. For example, zero harvest rule prevent at risk species such as grayling and bull trout from being harvested. Catch and release and bag limits are additional tools that can be used to manage fisheries.

Strategy 9. Restore biological diversity within the fish community.

As previously mentioned, a shift in fish community might reflect environmental changes to a river. This shift has been seen in the Beaverlodge River. Further monitoring can be done to see if this change has occurred or is occurring in the Redwillow River. Future monitoring can tell us if conditions are improving over time as the restoration plan is implemented.

Strategy 10. Ensure a self-sustaining recreational fishery can be supported.

The ultimate goal of this plan is to restore fish habitat to a state where Arctic Grayling can return to spawn in the Beaverlodge and Redwillow rivers. Given where we are at today, this will take large scale change with the involvement and participation of many to address the complex issues affecting this watershed. However, fisheries managers can get started on achieving this goal by first gaining a better understanding of the needs of grayling and other fish populations in the Redwillow Watershed.

For example, they can conduct an instream flow needs (IFN) assessment to determine if flows are adequate or if mitigation is required. They can also monitor winter dissolved oxygen, substrate conditions and other parameters affecting fish habitat. Finally, it is important to improve our understanding of current grayling spawning habitat including what barriers currently exist for fish moving upstream from the Wapiti to the Redwillow and Beaverlodge rivers.

⁹ Ducks Unlimited Canada is developing a wetland inventory for Canada. To view the online map of wetlands inventoried to date including those of the Redwillow watershed, see <http://maps.ducks.ca/cwi/>.

Objective E. Land use managers and the public have knowledge of the fish resources and fish management issues in the watershed.

Strategy 11. Develop an education and outreach plan that defines key messages, identifies audiences and selects the appropriate communications tool for each.

At a recent workshop, RWRP Team members all agreed that education and outreach is the underpinning of restoration plan implementation success. Stakeholders, who live, work or recreate in the watershed need to understand the impact of their activities. They also need to know how they can change their behaviour to mitigate these impacts.

A method used by many watershed groups to convey information about what is going on in a basin is ‘state of’ report that includes a number of indicators of watershed health. Fisheries, aquatic and other indicator information can be used to inform stakeholders and to justify why behavior change is needed. As a smaller sub-basin of the Peace, the RWRP Team might consider working with the Mighty Peace Watershed Alliance to determine if their state of indicators are appropriate for the Redwillow watershed.

Since 1999, a variety of education and outreach activities have been conducted by several organizations for a variety of audiences in the Redwillow Watershed. Going forward, a good place to start is to develop an education and outreach plan. This plan would identify key messages so that all audiences understand the linkage between land use activities, water quality and quantity, and fish health. A plan can also help identify the many audiences that can be found in the Redwillow Watershed. And finally, a plan can help identify the appropriate communications tools for the right audiences. For example, underwater wildlife cameras and YouTube videos might be the best tools to engage students. Demonstration sites might be the best tool for engaging landowners. A list of potential audiences, topics of interest and communication tools is provided as a starting point below:

Potential Audiences	Potential Topics of Interest	Potential Communication Tools
• Acreage Owners • Agricultural Producers • Councillors • Decision-makers • Industry • Public • Recreationists • Researchers • Stewardship Groups Youth	• Beavers: their role in the watershed • Ecology of the watershed • Research being conducted • Resources available • Restoring watershed health • Riparian management • State of the watershed • Value of water • Wastewater management • Water allocation system • Water quantity and quality • Water use • Water conservation • Wetlands	• Billboards • Demonstration sites • Fish cams • Newsletters • News media articles • Open houses • Presentations • Printed materials • Riparian tours • Shoreline clean-ups • Signage • Social media • Symposiums, workshops • Trade booths and displays

Objective F. As good stewards, fish, water and land resource users and others take the initiative to manage their activities and actions in a manner that will consider and protect fishery resources and the habitat upon which they depend.

Strategy 12. Encourage and support individual and group stewardship initiatives.

To change behaviour, the Team can recognize and encourage landowners on private land and industry on crown land to be good stewards that protect and restore riparian areas and maintain water quality and supply. Team member organizations should support stewardship initiatives wherever capacity allows. This includes industry stewardship as well as land and water stewardship.



Photo: S. Kitt

What is the Agricultural Services Board (County of Grande Prairie)?

The Agricultural Services department of the County of Grande Prairie is directed by an Agricultural Service Board. Together, their vision is to preserve the areas' agricultural heritage while promoting a vibrant agricultural future based on innovation, cooperation, leadership and environmental stewardship. Under the Board's direction, department staff work to increase awareness of agricultural issues within the County of Grande Prairie, including the Weed Control Act, the Soil Conservation Act, the Agricultural Pest Act and assist with disease control under the Animal Health Act. The department also delivers an Environmental Agriculture extension program to promote watershed health.

For more information, see www.countygp.ab.ca.

RESOURCING & IMPLEMENTING THE PLAN

As long as there is a demand for the water, soils, forest products and energy resources to be found in the Redwillow Watershed, growth and development will continue to affect the ecological health of this area. The degree of that impact will be determined by the willingness of stakeholders in the area to get involved in supporting this restoration plan. Support is more than just tacit agreement. It also must come with the commitment for financial and in-kind resources required to see actions carried out and behavior changes implemented, sometimes at an economic cost.

Fortunately, several agencies and individuals have already shown their moral and financial commitment to restoration of the Redwillow Watershed by investing in the large number of activities already carried out to date. By promoting the plan and reaching out to even more stakeholders, the RWRP Team can continue to ensure the resources needed for implementation are found.

Even with adequate resources, implementation of the plan will be challenging. Many actions are required and many of these actions will require long-term commitment before improvements are seen. However, again, if all stakeholders are engaged, and if everyone does their part, success will occur over time.

Who is the Mighty Peace Watershed Alliance?

The Mighty Peace Watershed Alliance (MPWA) was formed in 2011 and has been designated by the Government of Alberta as the official Watershed Planning and Advisory Council for the Peace/Slave River Basin under Alberta's *Water for Life* Strategy. Their vision is *the Peace is a healthy, sustainable watershed that supports our social, environmental and economic objectives*.

The MPWA is a multi-sector, not-for-profit society committed to planning for an ecologically healthy watershed while ensuring environmental, economic and social sustainability. They are a group of active stakeholders and communities that use consensus, adaptive management and innovation to understand and promote living within the watershed. The Board will report on the state of the watershed, lead watershed planning activities, promote best management practices and develop educational programs. As the Redwillow Watershed is a sub-basin within the larger Peace River Watershed, the MPWA is taking a leadership role in creating a restoration plan for this area.

For more information, see <http://www.mightypeacewatershedalliance.org>.

MEASURING AND REPORTING ON IMPLEMENTATION SUCCESS

PERFORMANCE MEASURES AND REPORTING

The ultimate goal of this plan is to see healthy fish habitat restored in the Redwillow Watershed in the hopes that native fish assemblages will be restored, including Arctic Grayling. However, this is a long term goal. The Team should also have a number of performance measures to determine if the plan is progressing in the interim. Performance monitoring will help the RWRP Team track a diverse range of partner organizations and actions. It will also help the Team when they need to report to funding agencies and partner organizations on funding and plan implementation success.

Two types of indicators are needed:

1. **Implementation Indicators** – The focus here is on seeing that plan actions are completed within the specified time. Performance measures here might include checking that a report is complete, a number of presentations have been given, a demonstration site has been built or a number of BMPs have been implemented. Another measure here might be the number of actions completed compared to the total number of actions (26) in the plan.
2. **Environmental Indicators** – once completed, actions in the plan should lead to physical improvements in the environment. Environmental indicators might include an improvement in a riparian health assessment, a change in phosphorus or dissolved oxygen levels, a change in fish community, etc.

In a recent public values survey, 80% of respondents said they would like to continue to be engaged in restoration plan development and implementation via surveys, open houses and presentations. Residents of the watershed can also be kept informed of plan progress by receiving annual reports. Performance measures should be determined before the first annual report is prepared.

PERIODIC REVIEW OF THE PLAN

The Redwillow Watershed Restoration Plan will become dated over time and made need adjusting as knowledge of the watershed is improved. To maintain its relevance, the document itself should be reviewed from time to time to ensure its contents and links to resources are up-to-date.

RESOURCES FROM THE LITERATURE

AECOM. 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, Grande Prairie. 243 pp.

Alberta Environment. 2008. Indicators for Assessing Environmental Performance of Watersheds in Southern Alberta. 69pp.

Alberta Sustainable Resource Development. 2005. Status of the Arctic grayling (*Thymallus arcticus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 57, Edmonton, AB. 41 pp.

Government of Alberta. 2006. Fish Conservation Strategy for Alberta 2006-2010. Alberta Resource Development. ISBN 0-7785-4826-0.

Government of Alberta. 2008. Water for Life; A Renewal. Alberta Environment. ISBN 978-0-7785-7670-9.

Hvenegaard, P.J., 2001. Wapiti River Watershed Study. Draft Progress Report, 2000-2001. A Fisheries Management Enhancement Project, Northern Boreal Region, Alberta Conservation Association, Peace River, AB. March 2001.

Johnson, C.F. and A. Meinke, 2009. Changes to Fish Populations, Water Quality and Quantity, and Land Use in the Redwillow and Beaverlodge Rivers: a Historical Perspective Based on Interviews from Local Residents. Draft Report Prepared by the Fish and Wildlife Division, Smoky Region, Alberta Sustainable Resource Development. Grande Prairie, AB. March 2009.

Johnson, C.F. and J. Burgess, 2009. Status of the Fish Community and Sport Fish Populations in the Redwillow and Beaverlodge Rivers. Draft Report Prepared by the Fish and Wildlife Division, Smoky Region, Alberta Sustainable Resource Development. Grande Prairie, AB. March 2009.

Johnson C.F. and Wilcox K. 2012. An overview of the status of Arctic Grayling, Walleye, Bull Trout, and Goldeye, and associated anthropogenic risk in Alberta's Peace River watershed as of 2012. Alberta Sustainable Resource Development, Fisheries Management Branch

Jones, J.F. 1960. Groundwater Geology Beaverlodge District, Alberta. Research Council of Alberta, Edmonton, Alberta.

Karr J.R. 1981. Assessment of Biotic Integrity Using Fish Communities. *Fisheries*, 6:6, 21-27.

Norris, A. P. 2004. Cumulative Effects Thresholds for Arctic Grayling in the Wapiti River Watershed (Thesis). University of Alberta, Edmonton, AB.

Seip, Dale and Elena Jones. 2011. Population Status of Threatened Caribou Herds in the Central Rockies Ecoregion of British Columbia. BC Ministry of Environment, Prince George, BC.

Tchir, J., A. Wildeman and P. Hvenegaard. 2003. Wapiti Watershed Study Final Report 2002. Northern Boreal Region, Alberta Conservation Association, Sherwood Park and Lethbridge, Alberta. 29 pp. + App.

OTHER RESOURCES

Alberta Water Council Water Conservation, Efficiency and Productivity Project
<http://www.albertawatercouncil.ca/Projects/CompletedProjects/WaterCEP/tabid/115/Default.aspx>

Alberta Water Use Reporting System <http://esrd.alberta.ca/water/reports-data/water-use-reporting-system/default.aspx>

City of Grande Prairie http://en.wikipedia.org/wiki/Grande_Prairie

Framework for Water Management Planning <http://esrd.alberta.ca/water/programs-and-services/surface-water-quality-program/documents/FrameworkWaterManagementPlanning.pdf>

Michigan Tech News: Can we bring back the Grayling?
<http://www.mtu.edu/news/stories/2011/august/can-bring-grayling-back-michigan.html>

Michigan Department of Natural Resources: Michigan Grayling only a memory.
http://www.michigan.gov/dnr/0,4570,7-153-10364_18958-53612--,00.html

Redwillow River Wikipedia page http://en.wikipedia.org/wiki/Redwillow_River

South Peace Regional Archives <http://southpeacearchives.org/>

Southwest Montana Arctic Grayling Reintroduction
http://fwp.mt.gov/news/publicNotices/environmentalAssessments/restorationAndRehab/pn_0124.html

Wikipedia: Redwillow River http://en.wikipedia.org/wiki/Redwillow_River

APPENDICES

APPENDIX 1 – REDWILLOW WATERSHED RESTORATION PLAN TEAM MEMBERS

Name	Organization	Website
Jill Henry	Agricultural Service Board, County of Grande Prairie	http://www.countygp.ab.ca/EN/main/departments/agriculture.html
Ed Kolodychuk	Alberta Conservation Association	http://www.ab-conservation.com/
Adrian Meinke	Environment & Sustainable Resource Development	http://esrd.alberta.ca/
Cathy Newhook	West County Watershed Society	https://www.facebook.com/west.county.watershed
Adam Norris	Mighty Peace Watershed Alliance	http://www.mightypeacewatershedalliance.org
Kerri O'Shaughnessy	Cows and Fish – Alberta Riparian Habitat Management Society	http://www.cowsandfish.org
Jeff Renton	Agroforestry and Woodlot Extension Association	www.awes-ab.ca
Pat Schulz	Town of Beaverlodge	http://www.beaverlodge.ca/
Lenore Stone	Alberta Conservation Association	http://www.ab-conservation.com/

APPENDIX 2. REDWILLOW WATERSHED RESTORATION PLAN

Restoration Plan Goal: to restore fish habitat in the Redwillow Watershed.					Short = 5 yrs, Medium = 10 yrs, Long = 25 yrs	
OBJECTIVES	STRATEGIES	ACTIONS	Steps	Lead	Other partners	Time-frame
A. Further degradation of the land and water is prevented by working with stakeholders including regulators, industry and the public.	1. Implement a watershed approach to integrating land and water management.	1.1 Develop a single agency to coordinate a Redwillow Watershed restoration plan.	1.1.1 Formalize the Redwillow Watershed Restoration Team by approving team operating principles.			Done.
		1.2 Adaptively manage the Redwillow Watershed as a single hydrologic planning unit.	1.2.1 Develop, implement, monitor and report on a 25 year restoration plan.			Long
		1.3 Fund plan implementation.	1.3.1 Develop a budget and seek appropriate funding and support.			Long
	2. Get stakeholder buy-in for the Redwillow watershed restoration plan.	2.1 Provide opportunities for all stakeholders to be involved in plan development, implementation, monitoring and reporting.	2.1.1 Regularly engage the public including local residents, students, non-profit groups, recreational groups, etc.			Long
			2.1.2 Regularly engage jurisdictions who can influence or are affected by the plan including Federal, transboundary, Provincial, First Nations and Municipal governments.			
			2.1.3 Regularly engage agriculture and industry (oil and gas, agriculture, forestry, aggregate mining, etc.),			
B. Healthy aquatic habitats (where degradation is minor and large scale declines of ecosystem function have not yet occurred) are maintained and protected.	3. Identify and protect key healthy aquatic habitats.	3.1 Identify potential conservation areas and acquire or seek landowner agreements or conservation easements as opportunities arise.	3.1.1 Inventory potential healthy sites along the Beaverlodge and Redwillow rivers.			Done.
			3.1.2 Work with landowners and other land trusts to acquire priority conservation properties as opportunities arise.			Long
		3.2 Manage random camping and recreation to reduce impacts on healthy riparian areas.	3.2.1 Assess regional recreational needs and if required, develop an infrastructure plan to address issues and/or use MGA tools such as bylaws, reserves, etc to protect aquatic areas.			Medium

Restoration Plan Goal: to restore fish habitat in the Redwillow Watershed.					Short = 5 yrs, Medium = 10 yrs, Long = 25 yrs	
OBJECTIVES	STRATEGIES	ACTIONS	Steps	Lead	Other partners	Time-frame
C. Degraded aquatic ecosystems are restored through the improvement of water quantity (flow), water quality and physical habitat where natural or human caused events have impaired capacity.	4. Improve water quantity (flow).	4.1 Improve knowledge of actual water use and future demand compared to total surface water available.	4.1.1 Survey licence holders on actual water use versus allocation and promote Alberta's Water Use Reporting System.			Short
			4.1.2 Share a report/ presentation with stakeholders on naturalized flows, actual flows and water use in the watershed (volumes, locations, return flows, timing, future demand, etc.)			Short
		4.2 Improve <i>Water Act</i> managers understanding of the impact of impoundments and releases on flow and availability of waters to meet current licence commitments in low flow years.	4.2.1 Develop a model of the watershed and run scenarios to determine the effect of DUC stabilization projects, timing of municipal drinking water withdrawals and wastewater releases, snowpack and groundwater contributions, etc.			Short
		4.3. Use the appropriate <i>Water Act</i> tools to manage water withdrawals sustainably, particularly on the Beaverlodge River and Beavertail Creek in low flow years.	4.3.1 Set water conservation objectives in an approved water management plan to limit new licences. Develop a water quantity management framework to manage existing licences in low flow years.			Short
		4.4 Promote water conservation, efficiency and productivity (see AWC water conservation sector plans).	4.4.1 Work with agriculture, industry and municipalities to reduce water use via incentives, metering, bylaws, BMPs or other tools as appropriate.			Ongoing
		4.5 Increase the ability of the landscape to store and slowly release water.	4.5.1 Use education, compliance and enforcement to limit illegal ditching, channel straightening, wetland drainage, etc.			Ongoing

Restoration Plan Goal: to restore fish habitat in the Redwillow Watershed.					Short = 5 yrs, Medium = 10 yrs, Long = 25 yrs	
OBJECTIVES	STRATEGIES	ACTIONS	Steps	Lead	Other partners	Time-frame
<i>C. Degraded aquatic ecosystems are restored continued...</i>	5. Improve water quality.	5.1 Improve understanding of the state of water quality in the basin.	5.1.1 Implement regular water quality monitoring and reporting.			Annual
			5.1.2. Develop an atlas showing water quality hot spots related to land uses (e.g. manure and fertilizer maps).			Short
		5.2 Mitigate point and non-point source pollution from wastewater releases, surface runoff, soil erosion, etc.	5.2.1 Work with local and provincial agriculture groups to promote EFPs/ BMPS for surface run-off, manure mgmt, etc.			Ongoing
			5.2.2 Promote the Green Acreages Guide to acreage owners.			Ongoing
			5.2.3 Work with motorized recreational groups to mitigate impacts via designated trails, signage, bylaws, etc.			Ongoing
			5.2.4 Work with industry and transportation to implement BMPs to limit point and non-point source pollution (e.g. forest harvest setbacks, stream crossings, erosion control, etc.).			Medium
		5.3 Work with municipalities to identify and mitigate point and non-point pollution.	5.3.1 Share with other municipalities the results of the Beaverlodge willow-bed aeration project.			Short
			5.3.2 Look at the timing, cumulative effects and options to mitigate the impact of wastewater releases from Beaverlodge, Hythe and Horse Lake.			Medium
			5.3.3 Implement urban BMPs to limit non-point source pollution (e.g. stormwater mgmt, pervious surfaces)			Long
		5.4 If required, take a cumulative effects approach to improving water quality.	5.4.1 Develop a surface water quality management framework with targets, triggers, limits, etc. to limit total daily loading on the Beaverlodge River.			Long

Restoration Plan Goal: to restore fish habitat in the Redwillow Watershed.					Short = 5 yrs, Medium = 10 yrs, Long = 25 yrs	
OBJECTIVES	STRATEGIES	ACTIONS	Steps	Lead	Other partners	Time-frame
<i>C. Degraded aquatic ecosystems are restored continued...</i>	6. Restore and protect riparian areas including stream and river banks, floodplains, shorelines and wetland fringes.	6.1 Stop the alteration, disruption and destruction of riparian habitat.	6.1.1 Establish a periodic riparian health inventory, monitoring, assessment and reporting process. Communicate results.			Medium
			6.1.2 Develop a longer term plan for riparian restoration projects and secure funding (note AWES Riparian Planting Protocol research in 2014-16).			Medium
			6.1.3 Continue to develop and promote BMP demo sites (streamside fencing, offsite watering, erosion control, etc.), lead tours and carry out other outreach activities to the agricultural community.			Ongoing
		6.2 Restore and enhance riparian areas and in-stream habitat.	6.2.1 Continue to provide funds, supplies, labour and technical support and other incentives to willing landowners to install fencing, off-site watering, beneficial plantings, etc.			Ongoing
			6.2.2 Study the impact of and mitigate the effects of industry, forestry and recreation on riparian areas.			Long

Restoration Plan Goal: to restore fish habitat in the Redwillow Watershed.					Short = 5 yrs, Medium = 10 yrs, Long = 25 yrs	
OBJECTIVES	STRATEGIES	ACTIONS	Steps	Lead	Other partners	Time-frame
D. A healthy fish community is restored where fish habitat is connected, further loss to fish populations is prevented, biological diversity within the fish community is restored and a self-sustaining recreational fishery can be supported.	7. Remove impediments to restore river longitudinal connectivity where habitat is fragmented through anthropogenic disturbance (i.e. culverts, weirs) to allow fish species to access habitat throughout the Redwillow Watershed.	7.1 Mitigate weirs by removing and/or adding fish ladders.	7.1.1 Mitigate Town of Beaverlodge weir and fish ladder structures by upgrading the design/effectiveness.			Short
			7.1.2 Investigate an alternative municipal water source off-river.			Long
			7.1.3 Evaluate the impact of other weirs on fish passage and mitigate if required.			Short
		7.2 Inventory, and if needed, mitigate other impediments to connectivity (hanging culverts, cattle crossings, etc.)	7.2.1 Inventory rivers for impediments, prioritize restoration and work with responsible jurisdictions in a downstream to upstream direction.			Long
		7.3 Inventory and if needed, mitigate 'ghost streams' and lost wetlands interrupting habitat connectivity.	7.3.1 Inventory ghost streams and lost wetlands, prioritize and restore.			Long
			7.3.2 Raise awareness of the new provincial wetland policy.			Short
	8. Prevent further loss to existing fish populations.	8.1 Continue to regulate and enforce fish harvest as appropriate to achieve plan goals and objectives.	8.1. 1 Use education, compliance and enforcement to support zero harvest limits on grayling and bull trout.			Long
			8.2.1 Promote other harvest mgmt tools such as catch and release.			Long
	9. Restore fish biological diversity.	9.1 Complete an Index of Biotic Integrity (IBI) and continue to monitor fish biodiversity.	9.1.1 Continue to sample populations on a regular basis.			Medium
	10. Ensure a self-sustaining recreational fishery can be supported.	10.1 Develop a better understanding of the state of grayling and other fish populations and their habitat requirements.	10.1.1 Conduct a desktop IFN assessment and work with Water Quantity managers to improve flows where required.			Short
			10.1.2 Monitor winter dissolved oxygen, substrate conditions and other parameters affecting fish habitat.			Long

Restoration Plan Goal: to restore fish habitat in the Redwillow Watershed.					Short = 5 yrs, Medium = 10 yrs, Long = 25 yrs	
OBJECTIVES	STRATEGIES	ACTIONS	Steps	Lead	Other partners	Time-frame
			10.1.3 Improve understanding of current grayling spawning habitat and the barriers to passage from the Wapiti entering the Redwillow or Beaverlodge.			Medium
E. Land use managers and the public have knowledge of the fish resources and fish management issues in the watershed.	11. Develop an education and outreach plan that defines key messages, identifies audiences and selects the appropriate communications tool for each.	11.1 Disseminate fisheries, aquatic and other indicator information to inform the public as to the <i>state of</i> the Redwillow Watershed.	11.1.1 Work with the MPWA to determine if their state of indicators are appropriate for the Redwillow watershed and tie into their reporting system.			Medium
F. As good stewards, fish, water and land resource users and others take the initiative to manage their activities in a manner that considers and protects fishery resources and their habitat.	12. Encourage and support individual and group stewardship initiatives.	12.1 Recognize and encourage landowners on private land and industry on crown land to be good stewards that protect and restore riparian areas and maintain water quality and supply.	12.1.1 Develop a stewardship awards and/or recognition program.			Short
			12.1.2 Develop an online mapping tool of stewardship activities. (see www.dawsoncreek.ca/static/watershed_map/)			
		12.2 Assist watershed stewardship/conservation groups where possible.	12.2.1 Provide technical support as capacity allows.			Ongoing
			12.2.2 Help groups access ASN and other stewardship grants.			