

## Sub-Basins of the Athabasca Watershed

# The McLeod River Sub-basin

### Introduction

The Athabasca watershed can be broken down into ten smaller units (or sub-basins). This document focuses on the **McLeod sub-basin**.

### PART I – GENERAL DESCRIPTION

#### Sub-basin Description

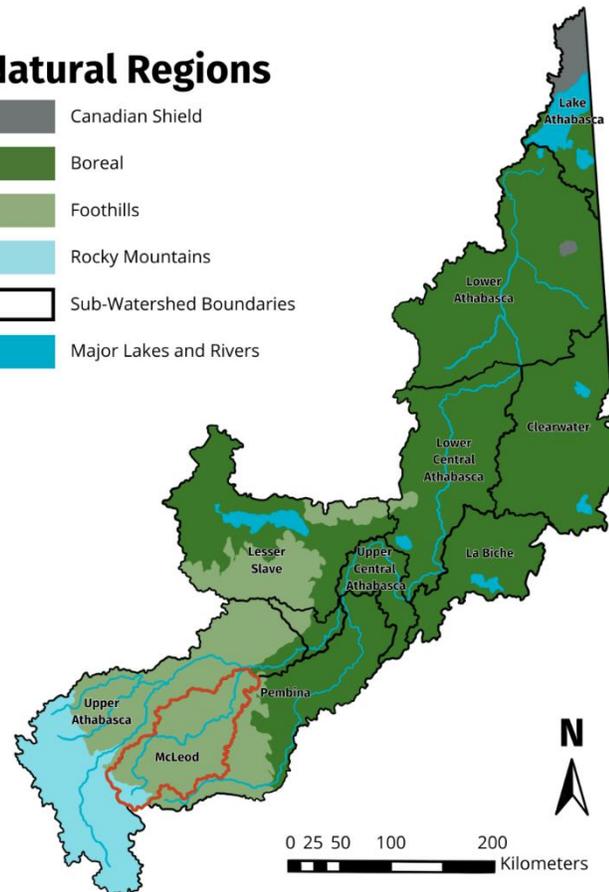
The lands that drain into the McLeod River make up the McLeod sub-basin, an area of 9,690 km<sup>2</sup> - 6.42% of the Athabasca watershed's total area. The McLeod sub-basin is divided into Upper and Lower portions.

The McLeod River is one of five major tributaries to the Athabasca River. It originates in the foothills of the Rockies just east of Jasper National Park. It then flows about 340 km through the Foothills before joining the Athabasca River just at the Town of Whitecourt. This river accounts for about 5% of the Athabasca River's mean annual discharge, with a flow of about 44.2 cubic metres per second (m<sup>3</sup>/s) and an annual volume of about 1,396,591,200 cubic metres per year (m<sup>3</sup>/y).

As it flows north towards Whitecourt, the McLeod River is fed by the meltwaters of the Cheviot and Tripoli Mountains at the junction where the Thorton and Cheviot Creeks meet at an elevation of around 1870 m and is additionally fed by the Harris, MacKenzie, and Prospect Creeks. As it flows through Yellowhead County towards Highway 16 it is joined by Whitehorse, Cadomin, Watson, Mercoal, Eunice, Deerlick, Wampus, Antler, Nice, and McCardell Creeks. Continuing to the east, the McLeod is joined by Gregg River at an elevation of around 1111 m just 22 km southeast of the Town of Hinton.

### Natural Regions

-  Canadian Shield
-  Boreal
-  Foothills
-  Rocky Mountains
-  Sub-Watershed Boundaries
-  Major Lakes and Rivers



Before the McLeod meets the Yellowhead Highway, it is joined by Anderson, Quigley, and McPherson Creeks. It then follows the highway for about 17 km before diverting south where it is joined by Erith River at an elevation of about 920 m where the McLeod is crossed by Highway 47. It is met by Sundance River on the southwest side of Edson, Moose Creek on the southeast side, and Ivory Creek and Edson River on the northeast side of the town at an elevation of around 840 m. The McLeod is then joined by Carrott Creek where the river is crossed by Highway 32 and then it follows along the border of Yellowhead and Woodlands County for 18 km before crossing over into Woodlands County. Just off of Highway 32, the McLeod is joined by Groat Creek at an elevation of about 729 m. Then the river passes through the Town of Whitecourt and finally empties into the Athabasca River at an elevation of about 689 m in the northern part of the town.

### Brief Human History

The lands and watercourses that span the McLeod sub-basin have been used for thousands of years by Indigenous peoples and are central to many spiritual and cultural practices going back generations. The sub-basin spans portions of both Treaty 6 and Treaty 8 Territories, and includes several Métis communities. These regions were historically home to the Cree, Chipewyan, Stoney and other First Nations. The name “McLeod” may have come from Fort MacLeod in southern Alberta, named for Colonel James Macleod, the Commissioner of the North-West Mounted Police at the time the fort was built in 1874. This region’s early industry was almost entirely coal, with the Mercoal Mine instituted by the McLeod River Hard Coal Company in 1920. Today coal and forestry continue to be major industries in the McLeod, with three of Alberta’s ten coal mines found within the borders of this sub-basin. These three mines are the Gregg River Mine about 40 km south of Hinton, the Cheviot Mine another 20 km to the southeast, and finally the Coal Valley Mine on its eastern border. While the south-eastern tip of the Coal Valley Mine is in the Pembina sub-basin, the majority is within the McLeod River. Today, the McLeod sub-basin lays within the Counties of Yellowhead and Woodlands.



[www.facebook.com/coalvalleyminealberta](http://www.facebook.com/coalvalleyminealberta)

## PART 2 WHAT WE KNOW ABOUT ...

### Drinking Water

The McLeod sub-basin has a population of around 18,000 people. The bulk of residents are found in Whitecourt (pop. 9586), which receives its drinking water directly from the McLeod River, and Edson (pop. 8370), which receives its drinking water from several groundwater wells that all draw water from the Edson Channel and the Paskapoo Aquifer System. There are several smaller communities in the McLeod like Cadomin (pop. 54) that have a mix of groundwater systems or utilise truck fill stations provided by Yellowhead County.

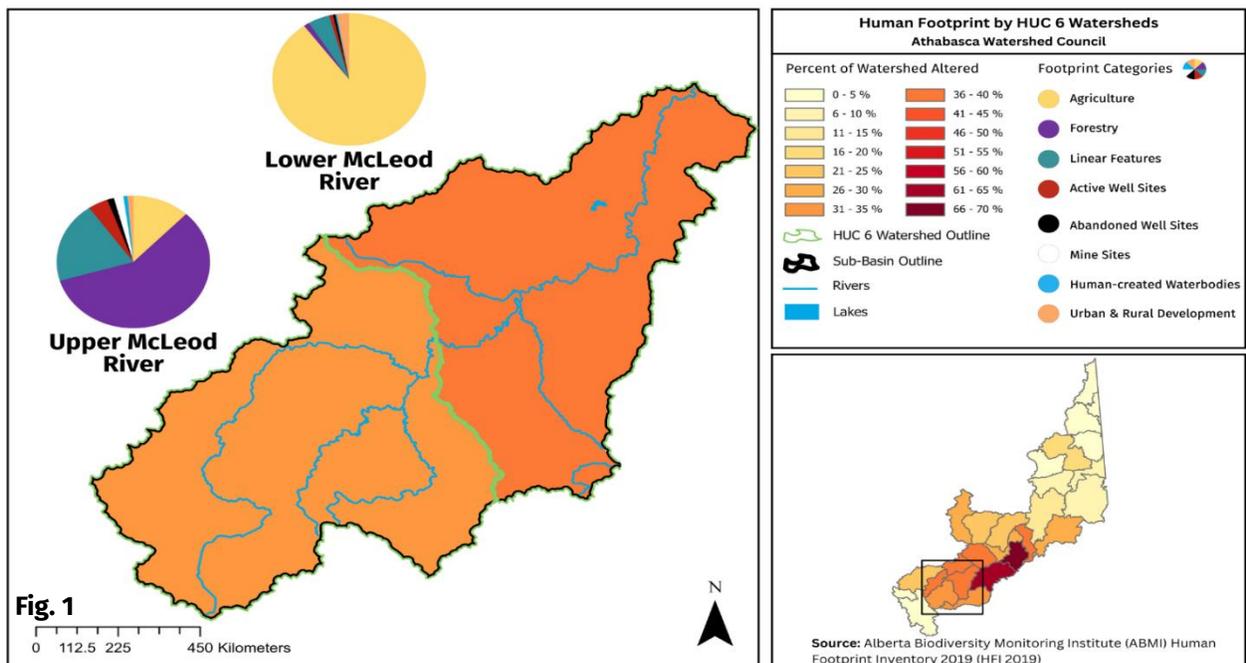
## Community Resiliency

The AWC vision is a healthy Athabasca watershed that supports resilient communities. Communities that are resilient are knowledgeable about what climate variability and climate change might look like in their area. They are also proactive in protecting their source drinking water and in mitigating risk from fires, floods, droughts and other climatic events. The lower McLeod sub-basin is rated by the Government of Alberta's [Watershed Resiliency and Restoration program](#) as a high priority for water quality, drought and flood mitigation. The upper McLeod is rated high priority for water quality, with less concern for droughts and floods. The province has completed [Flood Hazard mapping](#) along the lower McLeod River as part of the Woodlands County-Whitecourt flood mapping initiative.

## Water Quality

Water quality in the McLeod River is affected by both point and non-point sources of pollution. Major point sources in the McLeod are largely municipal wastewater discharge points. Edson is the largest community along the McLeod that discharges treated wastewater into the river. The Peers and Pinedale Wastewater Systems in the Lower McLeod sub-basin also discharge into the McLeod River via Beaver River and an Unnamed Creek, respectively.

Non-point source pollution comes from diffuse run-off and varies depending on upland cover and land use. There are multiple land uses in this sub-basin, starting with coal mining and logging in the upper sub-basin (which is largely public lands), with a transition to agriculture in the lower sub-basin (predominately private lands), as well as oil and gas, recreation and tourism activities throughout. In the eastern portion of the basin (the lower McLeod), there is a higher percentage of lands converted for agricultural purposes. Compared to other sub-basins, the McLeod has one of the larger human footprints in the Athabasca watershed.



**Fig. 1 Human Footprint by HUC 6 Watersheds (McLeod sub-basin)** A localised human footprint map of the McLeod sub-basin (tertiary watersheds 07AF and 07AG) showing the percentage of watershed altered by human activity.

## Instream Flow Needs and Reliable Supplies

The McLeod River has a mean annual discharge of about 44.2 m<sup>3</sup>/s. Instream flow needs (IFN) include the quantity of water (usually as a measure of river flow, or discharge) needed by fish and other biodiversity, and for functions like scouring and maintaining river channels. Although there is currently no legislated amount set aside for IFN in the McLeod (via use of a Water Conservation Objective under the *Water Act*), the area does fall under the advisory [Surface Water Allocation Directive](#) which can include requirements on water allocation licences to protect IFN.

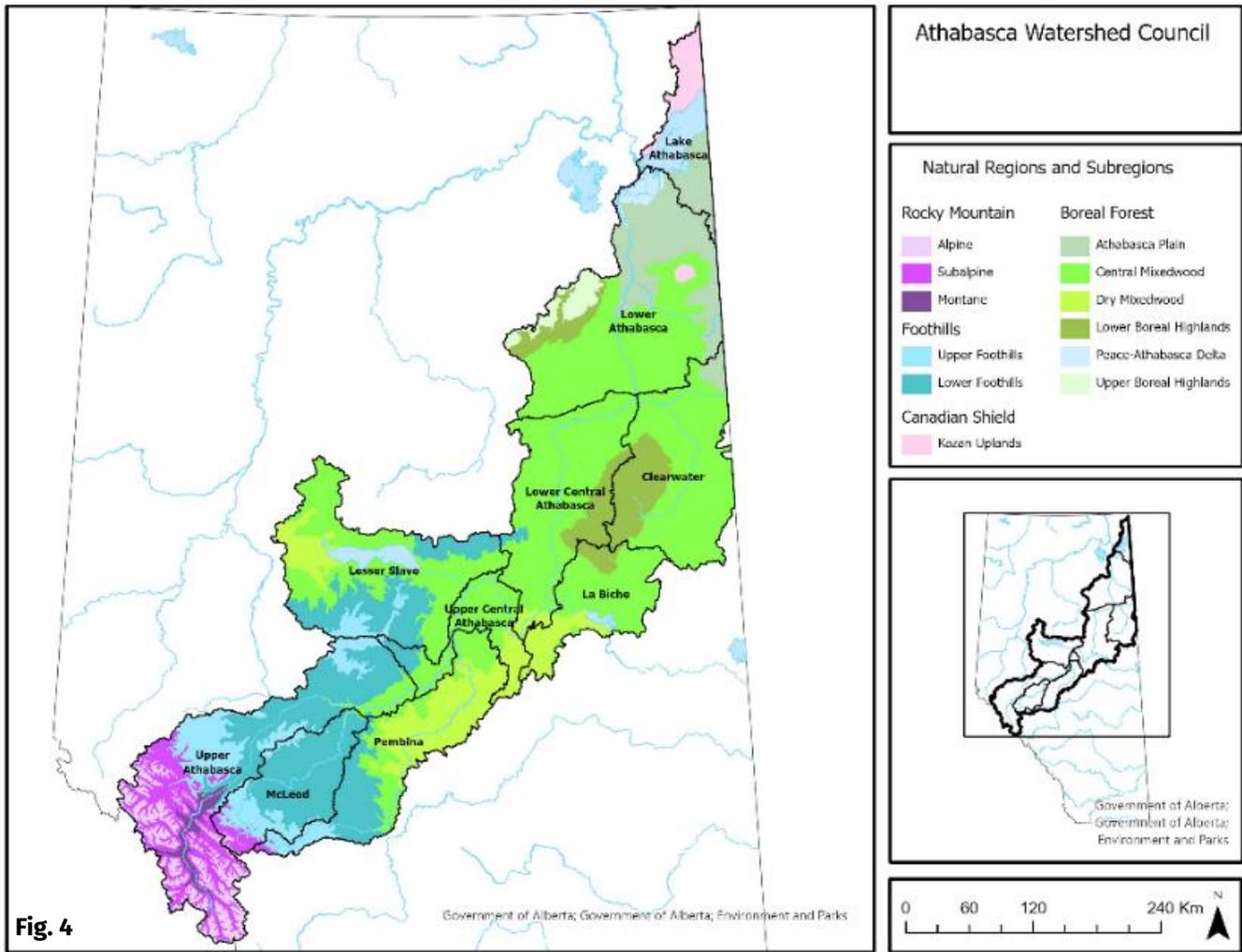
According to the [Alberta Water Tool](#) (using the AEPA Desktop Method; downloaded Dec. 13, 2023), the McLeod sub-basin has a sustainable withdrawal limit of 13.9% of its discharge. It currently has allocations of 1.33%. Hence it appears IFN is currently being met, with room for additional allocations. However, these amounts are based on desktop calculations and have not been ground truthed. Note also that licenced allocation amounts may not reflect actual water withdrawals and/or consumption. The oil and gas sector holds the majority of allocations, largely from both surface and groundwater term licences. Other allocations are for ‘other’ (e.g., lake stabilization), municipal, agriculture, commercial and power sectors.

## Biodiversity

To the west, the McLeod Sub-Basin begins at the Rocky Mountains, but moving east, quickly shifts into the Foothills, characterised by Lodgepole Pine, White Spruce, and Aspen dominating the upland canopy, Black Spruce and Larch in the lowland. Labrador Tea and Low Bush Cranberry are characteristic of the underbrush. At the cessation of the basin, there is a brief change to Boreal Forest where the McLeod meets the junction of the Athabasca and Pembina Sub-Basins. (For detailed descriptions of these regions, see [Natural Regions & Subregions of Alberta](#).)

McLeod Sub-basin Total Area: 9690 (km <sup>2</sup> )			
Natural Region	Natural Sub Region	Area (km <sup>2</sup> )	Area (%)
Rocky Mountain	Total	836	8.6 %
	Alpine	113	1.2 %
	Subalpine	723	7.4 %
Foothills	Total	8,780	90.6 %
	Upper Foothills	2,206	22.8 %
	Lower Foothills	6,574	67.8 %
Boreal	Total	723	7.5 %
	Central Mixedwood	723	7.5 %

The majority of the McLeod sub-basin landcover is coniferous forests (about 40%), as well as mixedwood regions (about 30%), with cropland and grassland/shrub making up a relatively small portion of the basin (about 10%). The remaining landcover is taken up by developed areas, wetlands, and deciduous forest. The McLeod is home to many Alberta Indicator species, such as Arctic Grayling, Athabasca Rainbow Trout, Bull Trout, Burbot, Northern Pike and Walleye. The sensitivity of fish habitats along the McLeod River and its tributaries is rated high. native populations of Athabasca Rainbow Trout are restricted to the area of the Upper Athabasca and headwater streams, which includes the Upper McLeod River.



**Fig. 4**

**Fig. 4 Map of the Natural Sub-Regions in the Athabasca Watershed.** The McLeod sub-basin is located in the southwestern portion of the watershed and includes subregions upper and lower foothills, as well as alpine and subalpine mountainous areas.

# McLeod Sub-Basin Species Highlight



Bull Trout photographed by Jeremy Stewart

## Fun Fact!

The Bull Trout owes its name to its large head and pronounced upper jaw that are often used to distinguish it from similar species like the Dolly Varden.

## Bull Trout

### *Salvelinus confluentus*

#### Family: Salmonidae

Description	Bull trout are small brown fish, with white bands on the leading edges of their fins.
Distribution & Habitat	Bull trout exhibit both migratory and non-migratory tendencies. They prefer habitats with large gravel/cobble substrates, high elevations, and cold temperatures no warmer than 18°C, with an ideal range between 12°C-15°C. They are found in the upper McLeod headwaters but are not common in the Lower McLeod as it is dominated by finer sediments. This species is highly limited by temperature and can be isolated to portions/tributaries of the McLeod during the summer when temperatures rise.
Conservation Status	As of 2023 the Government of Canada has classified bull trout a species of <i>Special Concern</i> and they are considered <i>Threatened</i> under Alberta's <i>Wildlife Act</i> . Angling restrictions exist for the McLeod River, however disturbed habitat, sedimentation and water quality continue to affect the health of this species.
What's Being Done?	<p>Several organizations and partnerships are collaborating to conserve and restore trout habitat in the McLeod sub-basin. For example, in 2017 Trout Unlimited Canada, with West Fraser Mills (Hinton Wood Products) worked to restore the functionality of Quigley Creek by replacing obsolete culverts to allow the water to run freely and reduce barriers to native fish. Similarly, MacKenzie Creek is a tributary of the McLeod River and important spawning habitat for Bull Trout. It has been closed to fishing for the last 20 years to maintain populations. From 2019 – 2022 Freshwater Conservation Canada (formerly Trout Unlimited Canada) partnered with Alberta Environment and Parks, the Alberta Off Highway Vehicle Association, and West Fraser to restore and re-align many Off Highway Vehicle trails that cut through the MacKenzie Creek. They also installed bridges to deter off-road vehicles from crossing through the water, thereby reducing the risks to water quality and fish habitats.</p> <p>For more information on the status of Bull Trout populations and habitat in the McLeod River, please see the <a href="#">Alberta Conservation Association's Native Trout Inventory (2021-2022)</a> and <a href="#">ABOUT   Freshwater Canada</a></p>

## Ecosystem Health

### **Wetlands**

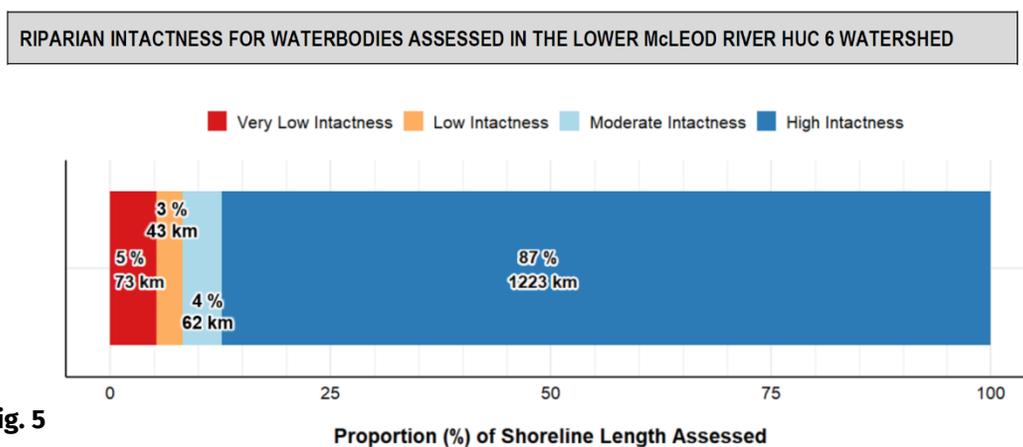
Wetlands are an important component of any watershed, providing services such as water storage, flood attenuation and groundwater recharge. Just about 11% of the McLeod Sub-Basin is made up of wetlands, predominately fens, open water, and swamps, with a small number of marshes and bogs. For more information about wetlands in Alberta (and other parts of Canada) please visit the Canadian Wetland Inventory (CWI) tool [Canadian Wetland Inventory | Climate Change Data and Resources](#).

Wetland Class	Wetland Area (km <sup>2</sup> )	% of McLeod sub-basin (9690 km <sup>2</sup> )
Fen	860	8.9
Open water	95	1.0
Swamp	92	0.9
Marsh	7.4	0.08
Bog	1.9	0.02
Total	1056.3	10.9

### **Riparian Areas**

Riparian areas are transitional buffers between terrestrial and aquatic environments along the margins of waterbodies, such as rivers, streams, and lakes. Like wetlands, riparian areas also provide many important functions, such as reducing the amount of sediment discharge into the water to help maintain water quality, providing habitat for wildlife, and slowing flood waters.

The AWC has completed a Riparian Assessment for the Lower McLeod River. The majority of shoreline was assessed as High Intactness, with the remaining shoreline found to be Moderate (4%), Low (3%), and Very Low (5%). For more information, see [riparian.info](#).



**Fig. 5 Riparian Intactness in the Lower McLeod River Watershed.** Taken from *Riparian Area Assessment for the Lower McLeod River Watershed Final Report*.

### **Major Lakes or Other Water/Ecological Features of Note**

The McLeod sub-basin has a number of lakes, natural areas, campgrounds and other recreational areas to explore! Some key sites include:

- Bear Lake Campground
- Fickle Lake Provincial Park
- Hard Luck Canyon
- Hornbeck Cross Country Skiing Public Land Recreational Area
- Jerry Vanderwell Memorial Park Campground
- Long Lake Campground
- McLeod River Provincial Recreational Area
- Minnow Lake Provincial Recreational Area
- Riverside Campground
- Shiningbank Lake Campground (with nearby Kathleen and Long Lakes)
- Sundance Provincial Park
- Whitecourt Lions Campgrounds
- Whitecourt Mountain Natural Area
- Wolf Lake West Provincial Recreational Area

### **Knowledge (Research and Monitoring)**

Alberta Environment monitors both flow and water quality in the McLeod sub-basin and this information supports the Upper Athabasca Surface Water Quality Monitoring Framework. Both government and non-government organizations have been involved in several decades of fish management in this sub-basin. Additionally, data on species biodiversity, wetlands and human footprint is available through the Alberta Biodiversity Monitoring Institute.

For the past five years, the AWC has collected benthic invertebrate data in the Upper McLeod, using the CABIN protocol as part of a larger East Slopes Biomonitoring Collaborative. Additionally, the AWC has completed several Athabasca State of the Watershed reports which include information on the McLeod sub-basin. To read these reports and to learn more check out the AWC's [State of the Watershed | Athabasca Watershed Council](#).

Despite the above activities, data gaps still exist, and further work is needed to better understand pollutant run-off rates, sources /tributary loading of pollutants to the main stem, risks to source drinking water and the future impacts of climate change and cumulative effects in this region.

### **Partnerships & Other Initiatives in the Pembina Sub-basin**

Today, there are several agencies working on water and related issues in the McLeod sub-basin. For more information on their activities, check out their websites:

- [Alberta Conservation Association](#)
- [Alberta Environment and Protected Areas](#)
- [Alberta Off Highway Vehicle Association](#)
- [Highway 2 Conservation](#)
- [Northern Fly Fishers \(Trout Unlimited Canada\)](#)

## IN CONCLUSION

The McLeod River sub-basin is an important sub-basin of the larger Athabasca watershed. It has a relatively larger human footprint than other Athabasca sub-basins and is subject to some pressures. Continued research, monitoring, and collaboration between interested partners is required to ensure this watershed retains its resiliency, today and for future generations.

## References and Resources

### Literature

- Alberta Environment. 2021. Surface Water Allocation Directive. Alberta Environment and Parks, Government of Alberta.
- Alberta Parks. 2015. Natural Regions and Subregions of Alberta. A Framework for Alberta's Parks. Alberta Tourism, Parks and Recreation. Edmonton, Alberta. 72pp.
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- Fiera (Fiera Biological Consulting Ltd). 2013. State of the Watershed Report - Phase 3: Water Quantity and Basic Water Quality in the Athabasca Watershed. Report prepared for the Athabasca Watershed Council. Fiera Biological Consulting Report #1234.
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- Fiera Biological Consulting Ltd. 2024. Riparian Area Assessment for the Lower McLeod River Watershed. Fiera Biological Consulting Report #2328. Prepared for the Athabasca Watershed Council, Athabasca, Alberta. Pp. 53.
- Ingram, R., Munir, T.M., and Xu, B. 2021. Regional wetland status and sensitivity to disturbances near Fox Creek, Alberta; Geological Survey of Canada, Open File 8812, 66 p. <https://doi.org/10.4095/328584>
- Redmond, L.E. 2021. Water quality in the McLeod River as an indicator for mining impacts and reclamation success (2005 to 2016). Government of Alberta, Ministry of Environment and Parks. ISBN 978-1-4601-4982-9. Available at: <http://open.alberta.ca/>
- Spence, Z., C. Judd, and M. Rodtka. 2023. Upper McLeod River trout inventory, 2021–2022. ACA Project Report: Final, produced by Alberta Conservation Association, Sherwood Park, Alberta, Canada. 21 pp + App.

### Web Links

[Alberta topographic map, elevation, terrain](#)

[Alberta Water Tool \(alberta-watertool.com\)](#)

[All Alberta RV Parks and Campgrounds \(allstays.com\)](#)

[Athabasca Watershed Sub-Basins | Athabasca Watershed Council \(awc-wpac.ca\)](#)

[Bringing Back Bull Trout - Trout Unlimited Canada \(tucanada.org\)](#)

[Canadian Wetland Inventory | Climate Change Data and Resources](#)

[Consultant Report 6 - Hydrology \(alberta.ca\)](#)

[Flood Hazard mapping](#)

[GeoDiscover Alberta](#)

[Location of the McLeod River headwaters \(Alberta, Canada\). The five... | Download Scientific Diagram \(researchgate.net\)](#)

[McLeod River - McLeod River Provincial Recreation Area | Alberta Parks](#)

[Reconnecting Quigley Creek - Trout Unlimited Canada \(tucanada.org\)](#)

[Reports - ALMS](#)

[Riparian Management Resources Webpage – AWES | Agroforestry and Woodlot Extension Society of Alberta \(awes-ab.ca\)](#)

[Topographical Heterogeneity \(AKA: Rough and Loose\) - Trout Unlimited Canada \(tucanada.org\)](#)

[Upper McLeod River Trout Inventory, 2021-2022 - ACA](#)