



# Environment and Climate Change Canada 2023 Agency Report

Mackenzie River Basin Board Meeting 78.  
December 2023.



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## **ECCC - Wood Buffalo National Park Action Plan**

Since 2019, Parks Canada and its federal, provincial, territorial and Indigenous partners have worked together to support the on-going implementation of the Action Plan. Each partner has specific responsibilities for action within their jurisdiction and authority, and with Indigenous governments, which have stewardship responsibilities for their traditional territories. Committees, working groups and task teams have been established to ensure collaboration in implementing and Strengthening Indigenous Partnerships, Environmental Flows and Hydrology, and Monitoring and Science themes. Updates on the Environmental Flows and Hydrology (EFH) actions and recent progress are highlighted below.

### **Water Control Structures**

- Two proposed water control structures are being designed to create a local water management approach in the Peace Athabasca Delta with an aim to restore ecological integrity and to support traditional Indigenous use in key areas of the Delta. Through the work of a multi-jurisdictional Task Team (involving government and Indigenous partners) and community engagement, a structured decision-making process that includes the consideration of Indigenous Knowledge alongside scientific information is being used to inform the design and operation of these water control structures. Fort Chipewyan community members have most recently provided input in early August. Community members will continue to have opportunities to participate, provide input and stay informed through their community representatives, as well as future engagement events in Fort Chipewyan, Fort Smith, and Fort Resolution.

### **Strategic Flow Release Protocol**

- A structured decision-making process which culminated in a decision sketch workshop in March 2023 was used to identify gaps in decision making, processes and considerations for the development of a Strategic Flow Release Protocol.
- The outcomes of the decision sketch workshop will inform the advancement of work of the Steering and Technical Committees for the collaborative development of the Strategic Flow Release Protocol.

### **Environmental Flows Framework Development**

- Co-development of an Environmental Flows framework for the PAD is progressing. The eflows framework will look at how water interacts with plants, animals and people and how water is shared within the PAD system. It is a tool to better understand the water levels and water flows needed for a healthy PAD ecosystem and for the people who rely upon it. This framework connects to water monitoring and management actions to support ecological and traditional use objectives.

Contact info:

ECCC Environmental Flows and Hydrology Secretariat: [efh-hde@ec.gc.ca](mailto:efh-hde@ec.gc.ca)

## **Water Quality Monitoring and Surveillance Report**

The Water Quality Monitoring and Surveillance (WQMS) Division of ECCC's Science and Technology Branch supports the Federal government's water quality-related obligations under various acts and agreements, e.g. Canada Water Act; Canadian Environmental Protection Act, 1999 (CEPA); Fisheries Act; International Boundary Waters Treaty Act; Federal/provincial/territorial agreements; Canada-United States water quality agreements; and, Federal Sustainable Development Strategy. Responsibilities include transboundary waters, waters on federal land, and waters of national importance. The WQMS Division's main activities consist of water sample collection, data analysis and interpretation, scientific advice, and reporting on results.

### **A risk-based adaptive management framework** (Contact: [gwyn.graham@ec.gc.ca](mailto:gwyn.graham@ec.gc.ca))

ECCC's Freshwater Quality Monitoring and Surveillance (FWQMS) program provides water quality monitoring in Canada through a risk-based adaptive management framework. Decisions on where and how to monitor watersheds are informed by this framework, helping to ensure relevant and objective programming. Risk is assessed at hydrologic basin, watershed, and sub-catchment scales and based on available information regarding the nature, probability, frequency, and severity of pressures to water quality and related aquatic ecosystem health threats to the watersheds. Through this framework, and ongoing collaboration with our provincial, territorial, other government and non-governmental partners, the federal government provides relevant, targeted, adaptable, and efficient water quality monitoring to ensure quality of service delivery and value for Canadians.

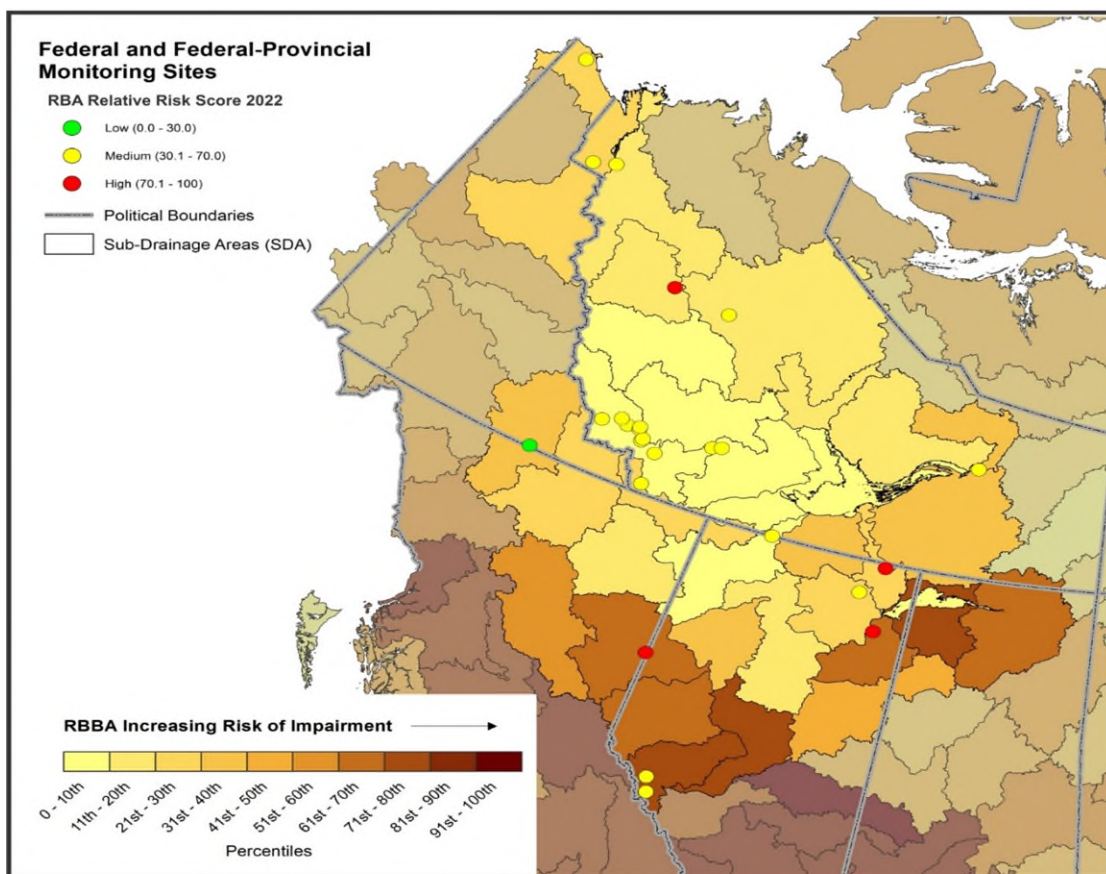
The FWQMS program framework includes three key components:

- (i) A regular review of ECCC's roles and responsibilities to ensure that our activities are consistent with our departmental mandate;
- (ii) A regular assessment of the level of risk for watersheds using three types of analyses:
  - risk-based site-specific analysis (described below; RBA) of all monitoring sites in ECCC's current monitoring network, based on chemical and biological measurements, upstream human activities at the watershed scale, the vulnerability of the aquatic ecosystem and other factors of relevance.
  - risk-based basin-level analysis (described below; RBBA) of all watersheds across Canada to identify pressures on water quality and aquatic health based on an array of point and non-point drivers and pressures. The analysis is based on the aggregation of multiple geospatial data layers.
  - statistical power analysis is applied to help assess the optimal sampling frequency for given water quality monitoring locations as a means of further informing on program efficiency and relevance.
- (iii) A Quality Management System that focuses on continuous program improvement through a Plan-Do-Check-Improve approach.

**Risk-based analysis** (RBA) is done at the monitoring station scale, to assess the likelihood, extent, and potential severity of impacts from human activities on water quality and the aquatic ecosystem. For each monitoring site, risks are scored between 0 and 10, weighted by risk group based on a list of 14 criteria (e.g., point sources, guideline exceedances, water uses, etc.) and aggregated to obtain an overall score

out of 100. The higher the score, the higher the potential risk to water quality is at the site (see Figure 1). ECCC has implemented a 5-year review cycle to ensure ongoing relevance .

**The risk-based basin analysis (RBBA)** is a spatial analysis tool used to quantify the relative risk to water quality from a range of 15 anthropogenic activities (primarily related to land use activities) across 1015 sub-sub-drainage areas to ensure national coverage. These include stressors such as point and non-point sources of pollution, a range of different types of land use activities, deposition of atmospheric contaminants, as well as climate factors such as temperature and precipitation. The RBBA tool aggregates these stressors and classifies basins on a relative risk scale (see Figure 1).



**Figure 1: Results of RBBA and RBA analyses for basins of interest to MRBB, 2022.**

**Open Data** (<https://open.canada.ca/data/>)

ECCC provides credible, scientifically sound information to support decision making. The public release of our water quality monitoring data supports the Government of Canada’s Directive on Open Government by providing access to water quality data to Canadians. Since January of 2017, national long-term water quality monitoring data are made available to the public on the Government of Canada’s Open Data portal, in both [English](#) and [French](#). The datasets include data for nutrients, metals,

major ions, and other physical-chemical variables from 2000 covering 22 basins across Canada. For the few monitoring sites located outside those basins, links are provided where the data are already available online or provided by partners. In addition, automated monitoring and surveillance water quality datasets (e.g., pesticides) are made available through Canada's Open Data Portal.

Other online water quality data sources from ECCC include:

[Acid Sensitive Lakes Study](#) and [Turkey Lakes Watershed Study](#),  
[Clean Air Regulatory Agenda Freshwater Inventory and Surveillance of Mercury](#),  
[Great Lakes Basin \(GLB\) Monitoring and Surveillance](#),  
[National Water Quality Pesticides Surveillance Data](#),  
[Canadian Aquatic Biomonitoring Network \(CABIN\)](#),  
[Canadian Environmental Sustainability Indicators \(CESI\)](#).

Of particular interest to MRBB, data for the following basins are published and regularly updated:

- [Lower Mackenzie River Basin Long-term Water Quality Monitoring Data - Canada's North - Environment and Climate Change Canada Data](#)
- [Peace - Athabasca River Basin Long-term Water Quality Monitoring Data - Environment and Climate Change Canada Data](#)
- [Canada-B.C. Water Quality Monitoring Program - Interactive Map \(arcgis.com\)](#)

In addition, the most recent data pertaining to the ongoing Oil Sands Monitoring Program are available online through both GoC Open Data ([Surface Water Quality, Oil Sands Region - Environment and Climate Change Canada Data](#)) and the Alberta Government's Oils Sands Environmental Data Viewer (<https://aws.kisters.net/OSM/applications/public.html?publicuser=Guest>) data web portals.

**Support to the MRBB** (Contact [Nancy.Glozier@ec.gc.ca](mailto:Nancy.Glozier@ec.gc.ca); [Kerry.Pippy@ec.gc.ca](mailto:Kerry.Pippy@ec.gc.ca); [Ayisha.Yeow@ec.gc.ca](mailto:Ayisha.Yeow@ec.gc.ca))

The Government of Canada remains committed to the Mackenzie River Basin Transboundary Waters Master Agreement and to continuing cooperation on water monitoring in the region and sharing data.

Environment and Climate Change Canada (ECCC) currently operates 28 stations throughout the Mackenzie Basin as part of the national long term water quality network. Table 1 includes information on these stations, some of which have been in operation since the 1960's. Planned sampling events for all sites total 152 per year, along with approximately 10% additional samples for Quality Assurance/Quality Control. In 2021, ECCC's water quality monitoring program returned to near normal sampling efforts after the suspension of monitoring during the COVID-19 pandemic, obtaining close to 90% of the planned sampling events in the MRBB between April 2021-March 2022. Samples are analyzed for a range of parameters including nutrients, metals, major ions, physicals and, at a subset of sites, bacteria and organics (pesticides and Polycyclic Aromatic Hydrocarbons (PAHs)).

**Table 1. ECCC Water Quality Monitoring Sites in the Mackenzie River Basin**

<b>Station</b>	<b>Ter/Prov</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Start Date of Long Term Monitoring</b>	<b>Status</b>	<b>Frequency (planned samples/yr)</b>
Great Bear R./Great Bear Lake	NT	65.1283	-123.5508	1969	Active	3
Liard River/Fort Liard	NT	60.2414	-123.4753	1998	Active	6
Liard River/Mouth	NT	61.7425	-121.2278	1960	Active	6
Lockhart River/Artillery Lake	NT	62.8889	-108.4658	1969	Active	3
Mackenzie R./Norman Wells	NT	65.2739	-126.8442	1960	Active	6
Mackenzie R./Strong Point	NT	61.8164	-120.7917	1992	Active	6
Mackenzie River/Arctic Red R.	NT	67.4558	-133.7531	1960	Active	6
Peel River/Ft. McPherson	NT	67.2589	-134.8886	1960	Active	4
Hay R./NWT-Alta. Boundary	NT	60.0036	-116.9719	1969	Active	4

Slave River/Fitzgerald	AB	59.8575	-111.5987	1960	Active	9
Flat River/Mouth	NT	61.5297	-125.4106	1972	Active	3
Flat River/Pk. Boundary	NT	61.4278	-126.6299	1988	Active	3
Prairie Creek/ New park Boundary	NT	61.5219	-124.7126	2010	Active	3
Prairie Creek/above Cadillac Mine	NT	61.5583	-124.8125	2003	Active	3
Prairie Creek/below Cadillac Mine	NT	61.5561	-124.8108	2003	Active	3
Prairie Creek/Mouth	NT	61.2844	-124.4456	1988	Active	3
Prairie Creek/Old Park Boundary	NT	61.3485	-124.4153	2001	Active	3
S.Nahanni R./Nahanni Butte	NT	61.0991	-123.5899	1988	Active	3
S.Nahanni R./Virginia Falls	NT	61.6361	-125.7969	1996	Active	3
Athabasca River at 27th Baseline	AB	58.1743	-111.3664	1989	Active	9

Athabasca River at Highway 16	AB	53.0417	-118.0872	1973	Active	4
Peace River at Peace Point	AB	59.1193	-112.4502	1967	Active	9
Athabasca River above Athabasca Falls	AB	52.6644	-117.8808	1972	Active	4
Liard River at Upper Crossing	YT	60.0477	-128.9018	1983	Active	12
Peace River above Alces River	BC	56.1260	-120.0600	1984	Active	12
Petitot River below Hwy 77	BC	59.98421	-122.92784	2012	Active	12
Murray River at the Mouth	BC	55.5526	-121.2035	2017	Active	6
Ogilvie River above Engineer Creek	YT	63.3581	-138.30556	2016	Active	12

**Status of PPWB and MRBB on Whirling Disease - Operational Impacts to Field and Laboratory Operations** (Contact: [Nancy.glozier@ec.gc.ca](mailto:Nancy.glozier@ec.gc.ca); [Elaine.Page@ec.gc.ca](mailto:Elaine.Page@ec.gc.ca))

While Whirling Disease has only been recently introduced and detected in Canada, it has been present in the USA for more than 20 years and follows a cycle of activity and relative dormancy. This parasite could eventually invade many prairie river systems leading into Lake Winnipeg, Hudson's Bay and potentially north through the Athabasca and Peace rivers. Whirling disease has no known human health effects and is an infectious disease of finfish caused by a parasite, *Myxobolus cerebralis*. There are no treatment options currently available, and containment and prevention are the focus for minimizing the spread of the parasite.

As of the most recently available Whirling Disease Risk Zone map many of the upper watersheds in the Eastern Slopes of the Rocky Mountains have had positive detections and are thus in the High Risk Red Zone in the risk zone map ([Whirling disease decontamination risk zone \[MAP\] - Open Government](#)

([alberta.ca](http://alberta.ca)) Many of these upper High Risk zones ultimately flow into the Bow, Oldman, Red Deer and North and South Saskatchewan rivers. Due to watershed connectivity, these downstream watersheds may be impacted although they have not been officially declared affected. Other watersheds in Alberta that may be implicated and are listed as at High to Moderate Risk (Yellow Zone) include the Athabasca and Peace rivers.

In response to this ongoing threat, ECCC has liaised and reviewed protocols with Alberta Environment and Parks to implement field and laboratory processes to mitigate spread of this parasite (for more information: <https://www.alberta.ca/whirling-disease.aspx>). In the field, personnel follow the decontamination protocol by using a combination of dedicated field equipment and sampling equipment, decontamination between sites and risk areas to mitigate the spread of the organism. For all samples from Alberta and the Alberta/Saskatchewan border, staff also are required to wipe down the interior of the shipping cooler and each individual sample bottle with a disinfecting wipe prior to shipping to the lab. ECCC labs have implemented a process whereby the instrument waste and any unused sample is collected and treated prior to disposal into municipal sewage. Currently, these modifications for field and laboratory processes have been applied to 6 of the 12 PPWB water quality monitoring sites (all sites on the AB/SK border) and for field processes associated with Oil Sands monitoring at 4 water quality sites and up to 50 CABIN (aquatic biomonitoring) sampling sites per year in the Lower Athabasca River watershed.

## **Water Quantity and Flow**

Environment Canada and Climate Change (ECCC) monitors water level and/or flow at 338 hydrometric stations in the Mackenzie River Basin (MRB) through its water collection and dissemination division, the Water Survey of Canada (WSC). Table 2 indicates the number of WSC stations in the MRB located in each province or territory. Figure 2 shows the locations of WSC monitoring stations in the MRB. The majority of these stations provide real-time data to the public through WSC’s real-time website. WSC operates these stations in support of provincial bilateral agreements, flood monitoring, power generation, climate studies and other scientific research.

Table 2. Active WSC hydrometric stations in the MRB by province and territory.

Province / Territory	Active WSC Hydrometric Stations
Alberta	175
British Columbia	46
Northwest Territories	93
Yukon	15
Saskatchewan	9
<b>Total</b>	<b>338</b>

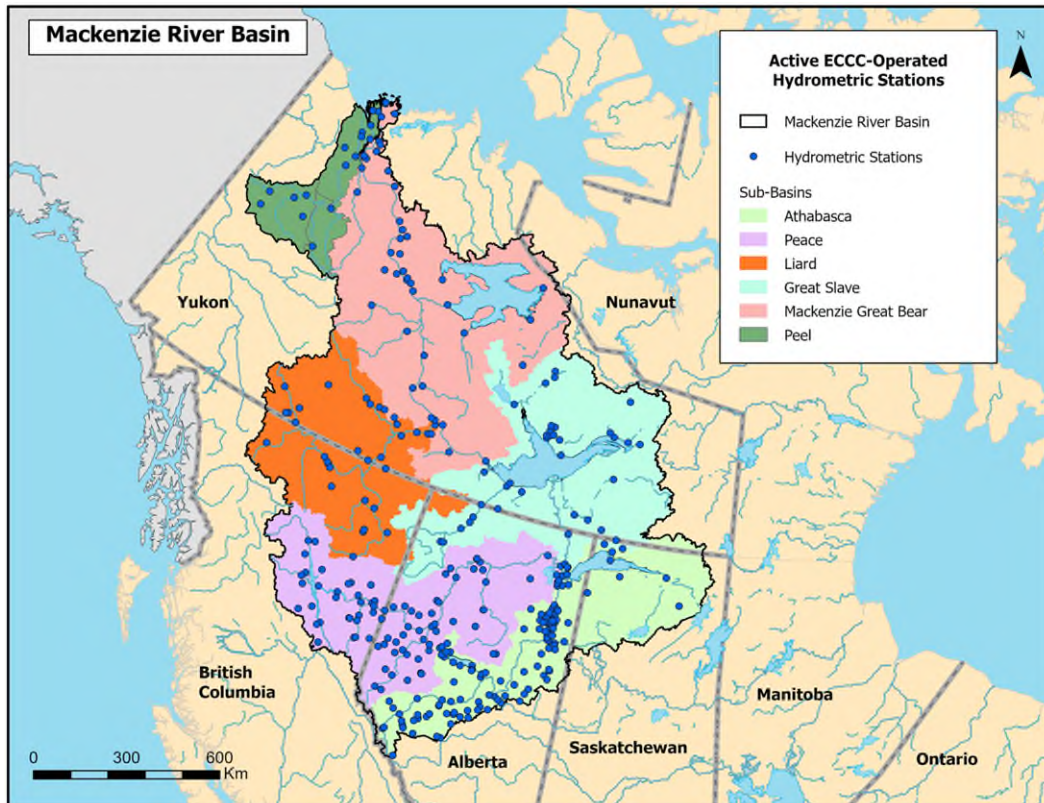


Figure 2. WSC hydrometric monitoring locations in the Mackenzie River Basin.

A summary of WSC monitoring operations in the Mackenzie River basin from provincial and territorial jurisdictions follow:

### SASKATCHEWAN

During the spring in northwestern Saskatchewan, precipitation was well below normal and flows were in the normal to low range.

Two stations were in the vicinity of fires but were unaffected. Fire activity was higher than the 5-year average across northern Saskatchewan in 2023.

In the fall of 2023, drought conditions were moderate to severe in the extreme northwestern Saskatchewan and abnormally dry across northern Saskatchewan.

### ALBERTA

In December 2022, low flow rates at Athabasca River below Fort McMurray (07DA001) fell below a threshold of 150 m<sup>3</sup>/s and this triggered an increased frequency of measurements. The thresholds are set out in the [Lower Athabasca region : surface water quantity management framework for the Lower Athabasca River](#) and can potentially limit oil sands water withdrawals. Increased frequency of measurements continued throughout the January to March 2023 ice period.

The Peace Athabasca Delta region (PAD), Fort McMurray and local surrounding areas experienced a relatively mild ice breakup with no significant events. Water levels were average, and minimal damage was incurred to infrastructure during ice breakup.

A high-water event occurred in the Edson/Whitecourt, Alberta areas from June 20-23, 2023. This event had significant impacts on the Pembina, McLeod and Athabasca River basins and their tributaries. Historic high measurements were recorded at various stations in the region, particularly high flows were noted on the Pembina and McLeod Rivers. Figure 3 depicts this high-water event at the Embarras River near Weald (07AF014) station. Additionally, a hydrometric station at Rat Creek near Cynthia (07BA002) was lost, and several other stations were submerged for up to 24 hours during the event. Measurements obtained during this event were used to update many discharge rating curves to better define the relationships under extreme high flow conditions.

One notable impact of this event was the stage rise of 3 meters over a span of 4 days at Fort McMurray. Furthermore, the second highest measurement on record was recorded at the Athabasca River below Fort McMurray (07DA001) station, highlighting the severity and magnitude of the high-water event.



Figure 3. Embarras River near Weald (07AF014) near peak flow.

The following is a list of notable work completed or planned at select hydrometric stations:

Wapiti River near Grande Prairie (07GE001):

- The station is located within a significant bridge construction project zone.
- Construction activities nearby have caused fluctuations in backwater, resulting in the suppression of discharge during the open water season.
- In July 2023, the station was permanently relocated to a new location at Magoo's Landing. This relocation was aimed at improving long-term data quality, likely by avoiding the disturbances caused by the nearby construction activities.

Lily Creek Near Slave Lake (07BG004):

- The station was relocated further upstream to enhance data collection quality.

Winagami Lake in Provincial Park (07BF006):

- The shelter at Winagami Lake in Provincial Park sustained damage in May 2022.
- A replacement shelter was set up during the fall of 2022 and became operational within the same year.

Stony Creek Near Tawatinaw (07BE004):

- A new shelter was put in place at Stony Creek Near Tawatinaw.

Atim Creek at Century Road (05EA012):

- The shelter at this location is scheduled to be replaced in the fall of 2023 due to its poor condition. The replacement aims to ensure the continued collection of accurate and reliable data for environmental and hydrological monitoring in the area.

Keg River at Highway No. 35 (07HF002):

- A new shelter was installed in 2023 at this location, as the old shelter was in poor condition.

Peace River at Peace River (07HA001):

- A temporary station was installed on the opposing bank in 2022.
- The temporary station has provided good water level data since its installation, requiring minimal maintenance.
- Discussions are ongoing about relocating the old station to the test site, aiming to improve the water level record and mitigate occupational health and safety concerns.

Technology improvements have continued in the region with the installation of in-situ (submersible) sensors augmented with water temperature to improve the quality of data record.

In August 2023, a radar sensor was installed at Mackay River at Petro-Canada Bridge (07DB006), Figure 4.



Figure 4. Radar sensor at Mackay Rover at PetroCan Bridge (07DB006).

At the beginning of 2023, staff installed a Nupoint satellite camera at Clearwater River above Christina River (07CD005). These cameras provide a daily photo of the area, which not only assist with data computations but also provide a daily illustration of site conditions on a daily basis. This camera captured ice breakup in 2023.

Benchmark installations were conducted in Peace River, Slave Lake, Grande Prairie and High Level. New OTT water level installations were performed in Slave Lake, Peace River, Grande Prairie and High Level to improve data quality. Old Satlink 2 loggers were replaced as part of life cycle management in preparation of the end of CS1 viability as a transmission device.

The presence of forest fires and resulting smoke disrupted planned trips throughout the wildfire season. In particular, the Fort Chipewyan area (located in the PAD) faced flight limitations and cancellations. Despite these obstacles, proactive measures such as flight rescheduling and strategic plan adjustments were implemented. As a result, most monitoring sites were successfully visited and assessed within acceptable timeframes.

However, the northwestern regions of Alberta experienced challenges with compromised air quality due to the wildfires and reduced hotel availability due to regional evacuations, delaying field work. Monitoring equipment remained unaffected despite the threat of wildfires.

## **BRITISH COLUMBIA**

Two stations were destroyed by wildfire:

- Ominica River above Osilinka River (07EC002)
- Osilinka River near End Lake (07EC004)

Access to many stations was affected due to wildfires.

Three stations received water level sensor upgrades and one station received a logger upgrade as part of WSC's station modernization agreement with B.C. Ministry of Environment and Climate Change Strategy.

Much of the Mackenzie River basin region in British Columbia was at drought Level 4 (adverse impacts likely) and 5 (adverse impacts almost certain) from July through September. Figure 5 shows the drought map of BC during this period.

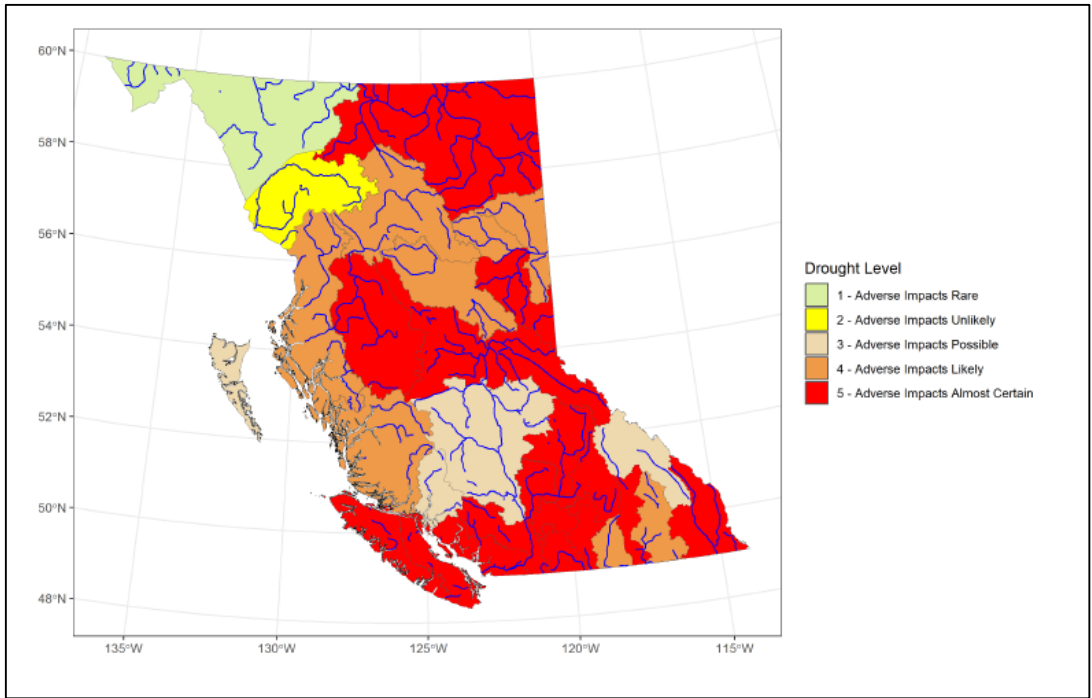


Figure 5. Drought map of BC, July to September 2023.

The hydrographs shown in Figure 6 reflect the overall lower-than-normal flows experienced in the basin this year.

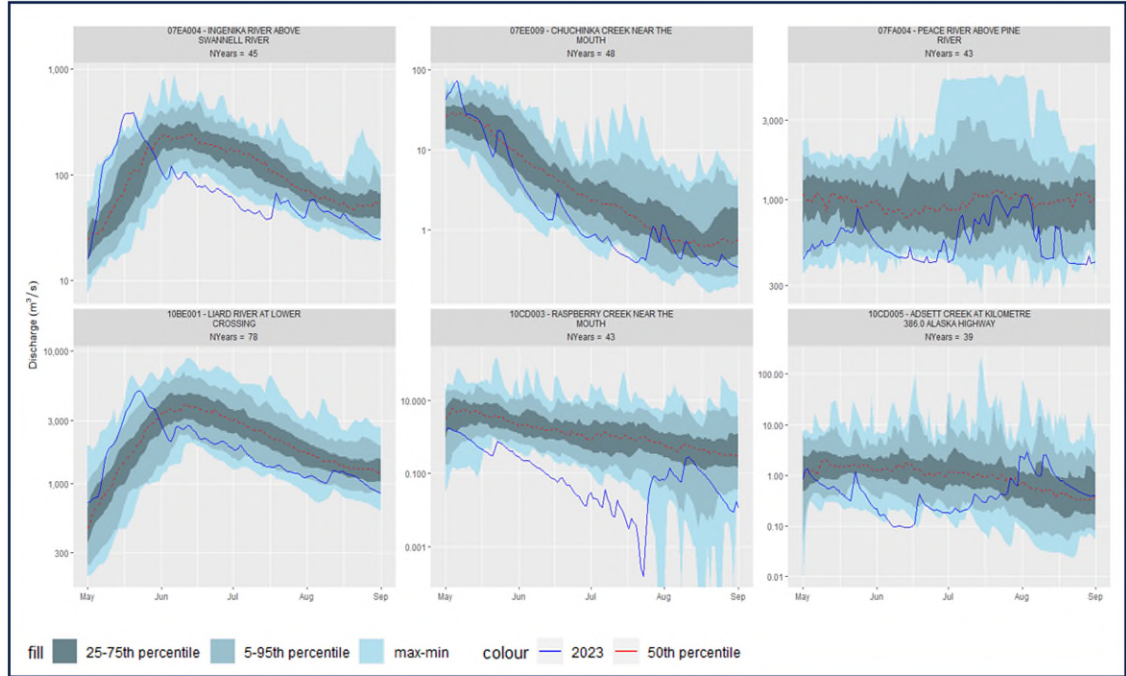


Figure 6. Hydrographs of select BC stations in the Mackenzie River basin showing below normal flows.

## YUKON

Access to certain areas of the Yukon were limited due to wildfire activity. Figure 7 presents select hydrographs from the region.

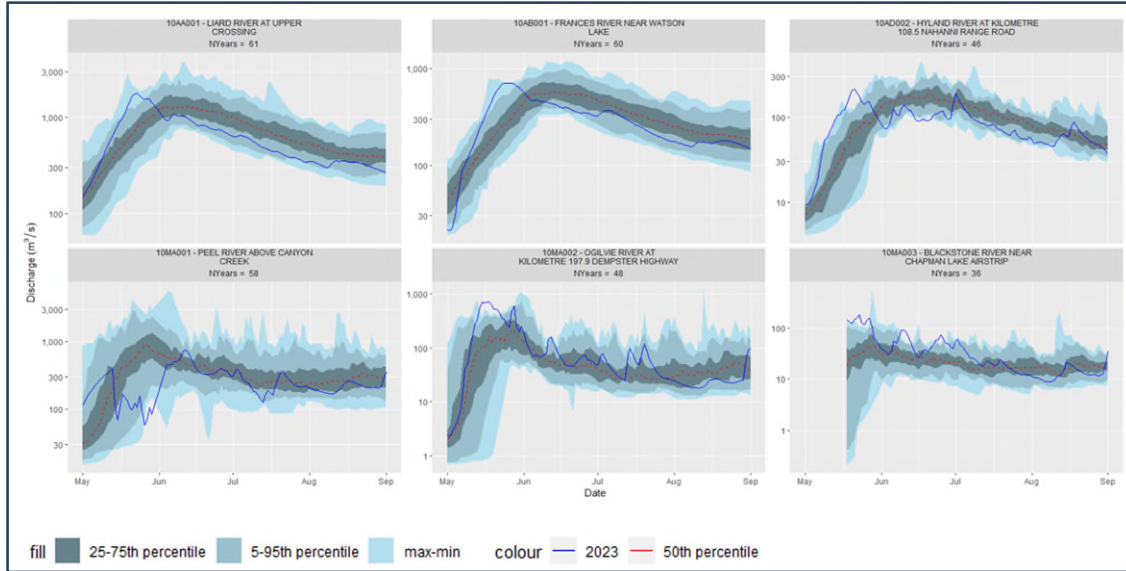


Figure 7. Hydrographs of select Yukon stations in the Mackenzie River basin.

## NORTHWEST TERRITORIES

No stations were lost to wildfire.

The Peel River at Fort McPherson flooded in May, causing significant damage to homes in the community of Eight Mile.

Wildfires caused road closures between the operating office and hydrometric stations. As a result, two scheduled field visits were cancelled for the following stations: Liard River at Fort Liard (10ED001), Blackstone River at Highway No. 7 (10ED007), Jean-Marie River at Highway No. 1 (10FB005) and Scotty Creek at Highway No. 7 (10ED009).

Liard River at Fort Liard (10ED001) experienced missing data when the water level sensor could not be serviced due to wildfires.

The entire Norman Wells Field Area was not visited between June and July due to the lack of aircraft availability and the August trip was cancelled due to wildfires. A visit was successfully undertaken in September.

Station visits were cancelled at Buffalo River at Highway No. 5 (07PA001) and Hay River near Alberta/NWT Boundary (07OB008) due to wildfire road closures, the May evacuation of Hay River and the August evacuation of Hay River and Yellowknife. Data collected at Buffalo River at Highway No. 5

(07PA001) is likely unusable for the year because of the inability to access the site to resolve gauge pool issues.

The Fort Smith/Hay River area (South Slave) hydrometric network was impacted by wildfires and not operated from August to late September. Visits to stations for the remainder of the season will be assessed based on weather, aircraft and staff availability.

WSC produced and issued Mackenzie River flood forecasts three times per week from the open water period (typically mid-May) until the onset of freeze up (typically end of October) to assist with the navigation of barges on the Mackenzie delta.

Flows in much of the basin ranged from below-normal to historic lows. Select hydrographs in the region shown in Figure 8 generally reflect the low flows experienced in the basin this year.

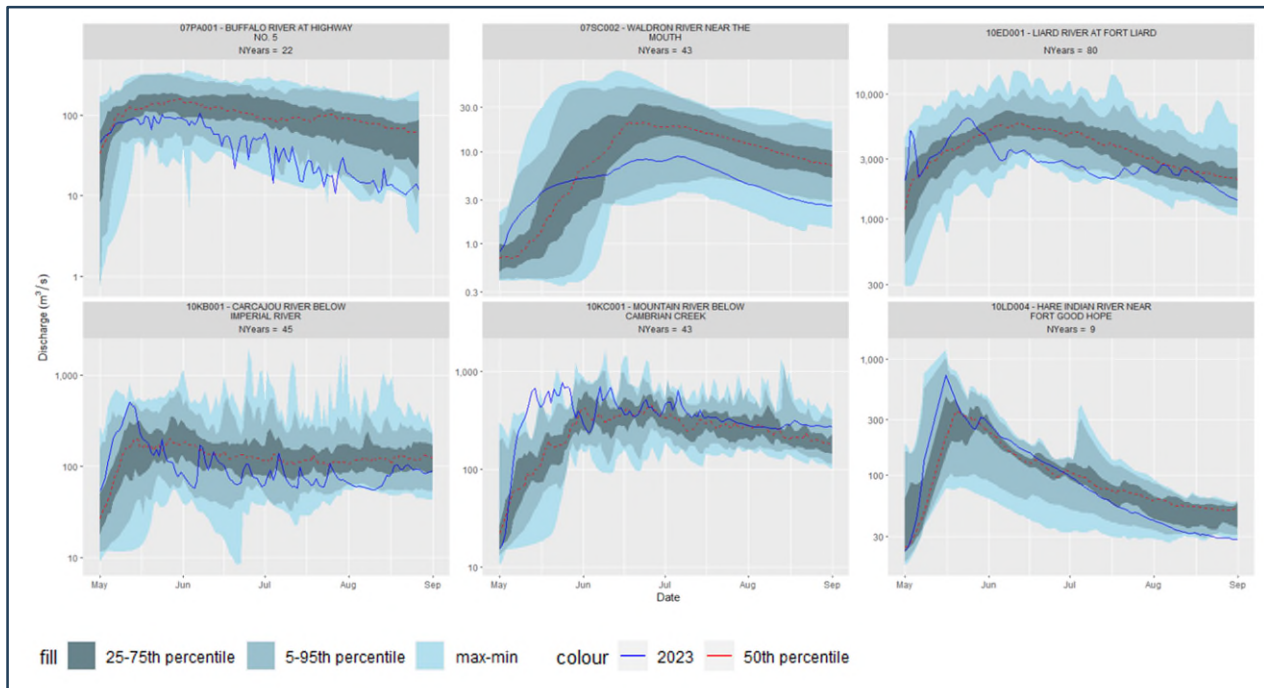


Figure 8. Hydrographs of select stations in NWT in the Mackenzie River basin showing primarily below-normal flows.

#### WEBSITE AND CONTACT INFORMATION:

Access to real-time Water Survey of Canada flow and water level data can be found at: [https://wateroffice.ec.gc.ca/mainmenu/real\\_time\\_data\\_index\\_e.html](https://wateroffice.ec.gc.ca/mainmenu/real_time_data_index_e.html)

Access to historical Water Survey of Canada flow and water level data can be found at: [https://wateroffice.ec.gc.ca/mainmenu/historical\\_data\\_index\\_e.html](https://wateroffice.ec.gc.ca/mainmenu/historical_data_index_e.html)

For further information please contact:

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National Hydrological Services / Water Survey of Canada