International Red River Watershed Board

24th Annual

Progress Report

October 2023

INTERNATIONAL RED RIVER
WATERSHED BOARD

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Commissioners:

The International Red River Watershed Board is pleased to submit its Twenty Fourth Annual Progress Report to the International Joint Commission.

Respectfully submitted,

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Col. Eric Swenson

PREFACE

This report documents water quality trends and exceedances of objectives, effluent releases, and control measures for the Red River basin for the 2022 Water Year (October 01, 2021 through September 30, 2022). In addition, this report describes the activities of the International Red River Watershed Board during the reporting period October 01, 2022 to September 30, 2023 and identifies several current and future water quality and water quantity issues in the basin.

The units of measure presented in this report are those of the respective agencies contributing to this report.

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Appendices for International Red River Watershed Board's 2022 Annual Report

1. INTRODUCTION

In April 2000, the International Joint Commission (IJC) formally merged its International Red River Pollution Board and International Souris-Red Rivers Engineering Board consolidating the water quality and water quantity responsibilities of the former boards, to form the International Red River Board (IRRB). This consolidation formalized the already emerging cooperative efforts of the former boards toward an integrated approach to transboundary water issues in the basin. Further, in its November 2000 report *Living with the Red*, the IJC recommended that the governments assign certain flood-related tasks to the IJC for implementation by its IRRB. In June 2001, Canada and the United States formally approved a new expanded directive for the IRRB. A recently revised directive is included in Appendix A.

In April 2003, the IJC requested further discussion with the IRRWB on how to achieve a more ecosystem approach and a capacity to respond to the range of environmental and water-related challenges of the 21st century. In April 2004, the IJC adopted guiding principles aimed at broadening the partnership efforts of its international boards with other watershed entities for a more inclusive approach. The IJC refers to this effort as the International Watersheds Initiative. The various water management organizations in the Red River Basin appear receptive to the Initiative while at the same time recognizing the independent, impartial and objective role of the IJC and its boards in providing advice to governments. In June 2005, the IJC recommended that the governments of Canada and the United States confirm their support for the Initiative. The Red River basin was one of three pilot watersheds recommended by the IJC for implementation of the Initiative and for funding support.

In August 2021, the IJC elevated the IRRB to full Watershed Board status under the International Watersheds Initiative (IWI). This change included expanding the Board's roles and responsibilities in the Red River Basin, formally dropping the Poplar River from its mandate, and resulting in a name change to, 'International Red River Watershed Board (IRRWB)'. The Board returned to in-person meetings for the first time since Covid-19, and hosted its annual Board meeting in-person in Winnipeg in January 2023 in conjunction with the Red River Basin Commission conference. The Board has begun to align its work plan with the International Watersheds Initiative and the updated IJC Directive.

In October 2022, the governments of Canada and the United States approved four additional water quality objectives for the watershed as part of a broader nutrient management strategy. The approval was confirmation of eleven years of work by jurisdictions, the Board and its Water Quality Committee. Shortly thereafter, the Board began reporting on nutrient concentration objectives and load targets for nitrogen and phosphorus.

Another milestone was the efforts of the Indigenous Task Team with support of the Outreach and Engagement Committee to advance Phase I of a two-phase project on ways to increase collaboration. In 2021, the IJC appointed four Indigenous Members (two from Canada and two from the United States) to the Board, and all Indigenous members co-lead or participate in the Task Team. Finally, in November 2022, although not specifically a Board activity, the two Board Co-Chairs were invited by the governments of North Dakota and Manitoba to participate in the renewed Pembina River Task Team. The team convened its first meeting in January 2023.

The IRRWB is responsible for assisting the IJC in avoiding and resolving transboundary disputes regarding the waters and aquatic ecosystems of the Red River, its tributaries and aquifers. This is accomplished through the application of best available science and knowledge of the aquatic ecosystems of the basin and an awareness of the needs, expectations and capabilities of residents of the basin. The geographic scope of the Board's mandate is the Red River basin, excluding the Assiniboine and Souris Rivers. The Red River Basin is illustrated in Figure 1.

This report is the Twenty Fourth of the IRRWB annual progress report to the IJC.

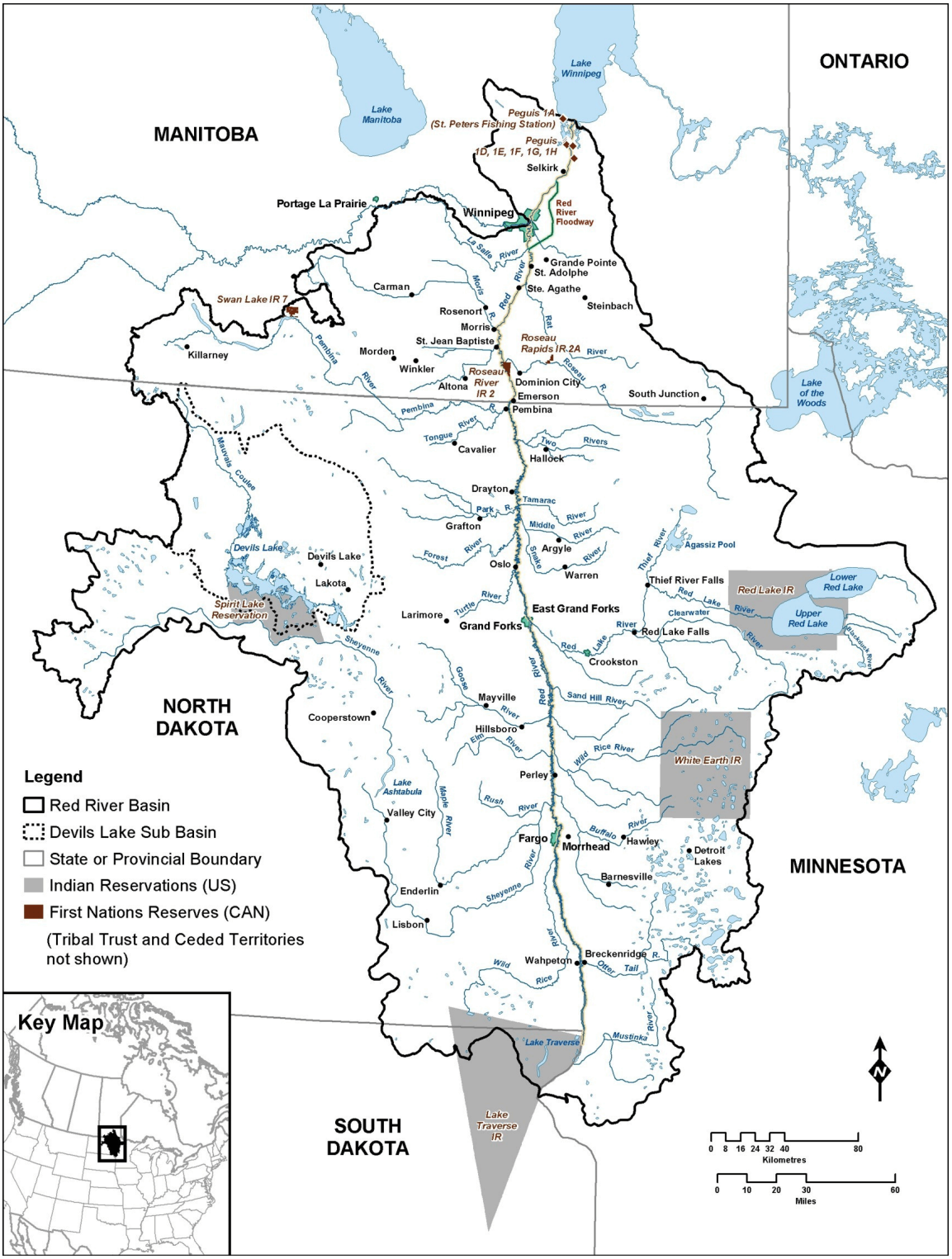

Figure 1. Red River and its Tributaries

2.0 BOARD MEMBERSHIP

Canadian Section

Patrick Cherneski, Canadian Chair,
Environment & Climate Change Canada

Melissa Hotain,
Director of Intergovernmental Affairs,
Sioux Valley Dakota Nation, MB

Dr. Annette Trimbee,
Métis President and Vice-chancellor
MacEwan University

Nicole Armstrong,
Manitoba Environment, Climate and Parks
WQC Co-lead

Mark Lee,
Manitoba Environment, Climate and Parks
COH Co-lead

Chris Propp,
Manitoba Infrastructure

Jason Vanrobaeys,
Agriculture and Agri-Food Canada

Dimple Roy,
International Institute
for Sustainable Development

Gavin van der Linde,
Public Member – Citizen of Basin

Malcolm Conly,
Environment & Climate Change Canada

Dr. Patricia Ramlal,
Fisheries & Oceans Canada; AEH co-lead

Girma Sahlu,
Canadian Secretary,
Environment & Climate Change Canada

United States Section

Colonel Eric Swenson, U.S. Chair,
U.S. Army Corps of Engineers

April E. Poitra-Walker,
Civil Engineering Consultant,
Member of the Turtle Mountain
Band of Chippewa Indians,
ITT Co-lead

Vacant, Minnesota Indigenous member

Theresa Haugen,
Minnesota Pollution Control Agency

Dave Glatt,
North Dakota Department of
Environmental Quality

Andrea Travnicek,
North Dakota Department of
Water Resources

Brian Caruso,
US Fish and Wildlife Service,
AEH Co-lead

Jason Gildea,
U. S. Environmental
Protection Agency

Brian Holmer
Red River Basin Commission,
O&EC Co-lead

Gregg Wiche,
U.S. Geological Survey

Nathan Kestner,
Minnesota Department of
Natural Resources

Rebecca Seal-Soileau,
U.S. Secretary, U.S. Army
Corps of Engineers

Cheyanne Carlin,
Action Officer, USACE

3.0 BOARD ACTIVITIES

The IRRWB held one virtual meeting on August 16-17, 2022; and one post-Covid in-person & hybrid meeting on January 19-20, 2023. The January meeting was held in conjunction with the Red River Basin Commission's (RRBC) Annual Conference. As in the past, IRRWB co-chairs provided a brief update about the IJC and activities of the IRRWB to conference attendees as part of board public engagement activities. IJC liaisons also presented an overview of the IJC and the Boundary Waters Treaty of 1909. Questions were submitted by the public in writing on forms provided by the Secretariat and handed to the Co-Chairs for reading. Approximately five comments were handed in with one providing contact information. There were questions about impacts of climate change in the Red River basin, nutrient management, and overall health of the aquatic ecosystem in the Red River including fisheries. The five Municipalities of Minnesota which included the cities of Breckenridge, Moorhead, Thief River Falls, Roseau and Warroad were also invited to attend the board meeting because of their interest in nutrient management in the Red River Basin.

Strategic Planning – In December 2022, the IRRWB met and discussed the implementation of the revised Directive that was issued to the Board by the IJC in August 2022. The following were discussed:

- The Foundation pieces - Boundary Waters Treaty101
- Where We Come From / What We've Accomplished
- IRRWB Strengths, Weaknesses, Opportunities, Threats
- Incorporation of Indigenous input and perspective
- Inclusion of existing work items that meet the new directive
- Identification of work items that are achievable with existing Board and Committee members, agency resources, time, and
- Identification of new work items needed to meet directive that are beyond current scope, engaged people, agency resources, financial means. E.g. climate change, new Water Quality Objectives for Nitrogen and Phosphorus.
- Discussion of priorities – what we need to accomplish in the next 3-5 years.
- Discussion of capacity and structure (do we have the correct Committee structure) for the priorities
- Make work Items SMART: Specific, Measurable, Achievable, Resourced, Time bound / Timely.

Other activities of the Board included:

- Development of an internal protocol for filling vacant co-chair and committee membership positions for its various committees.
- Conducting a cross-walk exercise between the existing work plan and revised Directive for the purpose of identifying responsibilities, gaps, what is included or not and to what extent, what needs to be added in the new work plan based on the 10 responsibility areas stated in the revised Directive.
- Addition of new nutrient objectives to the exiting bi-national water quality objectives – Board to discuss implementation.
- Inviting university students and professors to attend the Board meeting in January 2023 for a high level information session so students can see what projects they could work on. Furthermore, it is expected faculties could offer space to set-up lectures and presentations for high visibility.

Another significant activity of the Board was the work of Indigenous Task Team which resulted in an Indigenous Nations Roundtable that was held in Winnipeg, Manitoba from January 16-17, 2023. The purpose of the Indigenous Nations Roundtable was to provide an opportunity for First Nations, Red River Métis and Tribal Nations whose territories are located in the Red River Watershed Basin to come together to discuss their priorities related to the IRRWB, and the IJC and how traditional knowledge could be incorporated into future Board activities.

With the support from the Outreach and Engagement Committee, the Board made presentations on transboundary waters at the June 2023 Canadian Water Resources Association Annual Conference in Halifax, Nova Scotia.

Pembina River Task Team was revived again to start working on the ongoing flooding issue in the Pembina River Basin. Members of the Task Team were appointed by the Governor of North Dakota and Premier of Manitoba. The Co-Chairs of the International Red River Watershed Board are also invited to be part of the Task Team.

The Co-Chairs of the Board provided regular updates on basin issues and activities of the IRRWB at the fall 2022 and spring 2023 IJC Semi-Annual Appearances in Ottawa and Washington D.C., respectively.

The Aquatic Ecosystem Committee - Holds monthly phone calls except during the spring/summer field season. While generally the group's discussion centers on current work being done in the basin, linkages between ongoing programs, and how the various programs could collaborate to get a better picture of the entire basin with respect to the ecosystem, we are currently discussing the new direction as prescribed by the IJC. By far, the greatest benefit of this committee to the various agencies has been the opportunity it has provided to the members for the free exchange of information, ideas and plans for field work.

The Committee on Hydrology/Aquatic Ecosystem held a joint workshop on April 4, 2023. The joint, virtual, half-day workshop was initiated to find ways to join the interests of the two committees to be better able to answer questions regarding the instream flow needs assessment of the Red River. Data gaps were identified, especially with respect to bathymetry and the importance of focusing on species that cross the international border.

Red River Telemetry Studies - All telemetry data acquired in the frame of the Lake Winnipeg Basin Fish Movement Project were transferred to the new Fathom database provided by Innovasea, which will facilitate data-sharing between user groups.

Funding for the IWI proposal "Integrating fish passage considerations into cultural and ecological connectivity in the Red River watershed" was received in Fall of 2022. A graduate student started field work on the project in spring/summer of 2023. Specifically, the objectives are to: 1) monitor target species movements; (2) evaluate timing of movements; and (3) use these data to inform management decisions on future water management in the context of ecologically and culturally important species.

Red River Valley Water Supply Projects, and the Fargo-Moorhead Diversion Project in the Red River continue to be topics of interest to the Board and were discussed at the Board meetings in August 2022 and January 2023. Furthermore, the two meetings addressed water quality monitoring and compliance with the bi - national water quality objectives and established alert levels and IRRWB work plan priorities.

Indigenous engagement and collaboration - The IRRWB recognizes the importance of collaboration with Indigenous Peoples as the traditional owners and stewards of the land. The health of the river basin has a particular significance for the cultures, traditions, and well-being of Tribal Nations, First Nations and the Red River Métis. Indigenous peoples also have much to contribute to the sound stewardship of this shared watershed. An Indigenous Roundtable was held IRRWB Indigenous Task Team from January 16-17, 2023 in Winnipeg, Manitoba. The report from the Roundtable was shared with IRRWB and is expected to be part of the discussion during the Strategic Planning Workshop in Detroit Lakes, MN.

Implementation of the new nutrient objectives for Nitrogen and Phosphorus that have been approved by the Governments of Canada and the United States - The board is expected to start the discussion among its members on how to implement the new nutrient objectives.

Development of Terms of Reference for all the committees – Most of the committees currently do not have their terms of reference (TOR) completed. This is a priority item for the Board to ensure that all committees will have their approved TORs as soon as possible.

Strategic Planning Workshop to be held from August 28-30, 2023 – One of the outcomes would be aligning the work plan with updated directives from IJC; update work plan as quickly as we can with the acknowledgement that it is a significant undertaking.

Work plan – the board reviewed the highlights presented at the October 2022 IJC appearance and follow-up since with the expectation that there will be a workplan by the April 2023 IJC appearance. The board is currently focusing on a Strategic Planning Workshop to help facilitate the development of a workplan. The timely completion of the Strategic Planning workshop is expected to expedite the development of a new workplan based on the revised Directive that will meet the requirements of the IJC.

5. HYDROLOGIC CONDITIONS

Fall/Winter 2021/2022 - After severe drought conditions in summer 2021, drought conditions began to improve heading into fall 2021, especially after mid- to late-October rains. Soil moisture significantly improved and baseflows increased in tributaries and the mainstem. Rising baseflows combined with an increase in reservoir releases resulted in flows on the mainstem in the normal range throughout the fall and winter.

Manitoba's Hydrologic Forecasting Centre reported that, heading into freeze-up, soil moisture in the Red River basin was normal to below normal in southern Manitoba, and normal to above normal in the U.S. portion of the basin. The National Weather Service (NWS) Climate Prediction Center, through its soil moisture monitoring and modelling works, indicated above normal soil moisture for the U.S. portion of the Red River basin.

In January, the Canadian and United States Drought Monitors classified most of the basin still having some degree of dryness. With the exception of the southern most area, most of the US portion of the basin is classified as abnormally dry (D0). The Canadian basin was classified as abnormally dry to (D0) to exceptional drought (D4), with severity increasing towards the north. By April 2022, eastern North Dakota and western Minnesota were no longer in any drought condition.

Streamflow for the Red River and most of its tributaries was at normal levels, with the Sheyenne River even above normal (75th-90th percentile) and the Red Lake River below normal (10th-25th percentile) going into and during the 2021/2022 winter. Winter was characterized as colder than average, especially the month of February and higher than normal snowfall.

Figure 2 below shows the April precipitation for the basin. Most of the area received four to ten inches of precipitation, about 300 to 600 % of normal precipitation. The various storm events caused numerous peaks at many of the stream gages. This was especially evident in the upper portions of the basin, such as at Fargo.

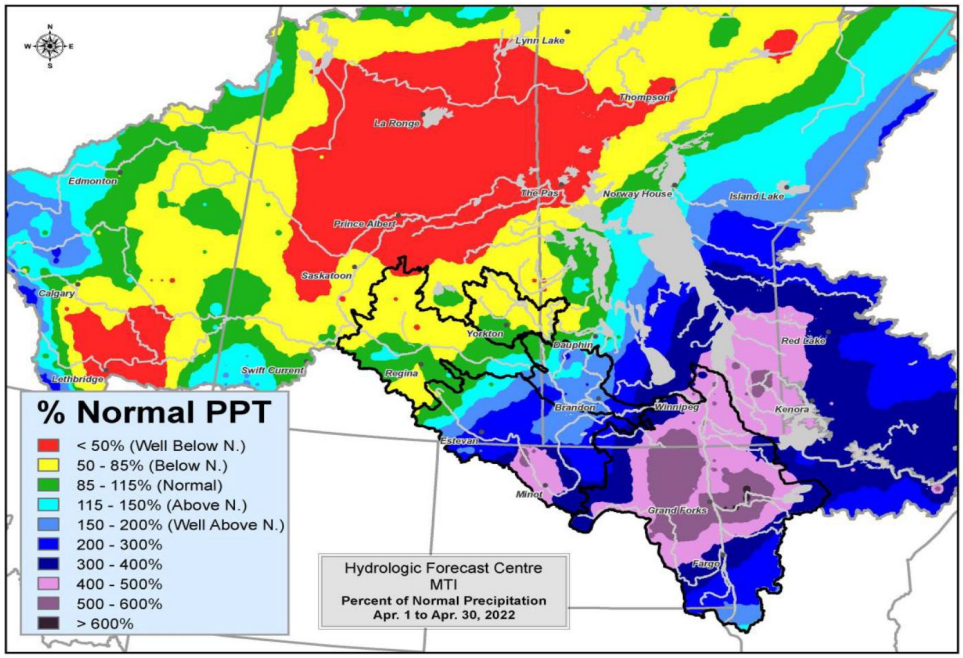

Figure 2. April Precipitation in the Red River Basin

The Red River Floodway was operated for two periods. The first operation period was relatively short (from April 8 to April 15) in response to moderate flooding from the spring melt. A series of subsequent snow and rainfall events caused major flooding along the Red River and the floodway was put back into operation from April 23 to June 16. The peak at James Ave. Station in Winnipeg was 19 ft (James Avenue datum) on April 30. Without floodway operation, the peak at James Avenue would have been 27.6 ft. In total, the floodway was operated for 61 days.

Summer 2022 - Summer precipitation in the Red River basin (Figure 3) ranged from below normal to above normal. With the exception of some isolated rain events, river levels on the mainstem Red River and its tributaries receded steadily from their peaks in May. The river flows reflected the generally drier conditions experienced in June and July (compared to April and May) and flows along the Red River mainstem were generally into the normal range by the end of summer and early fall.

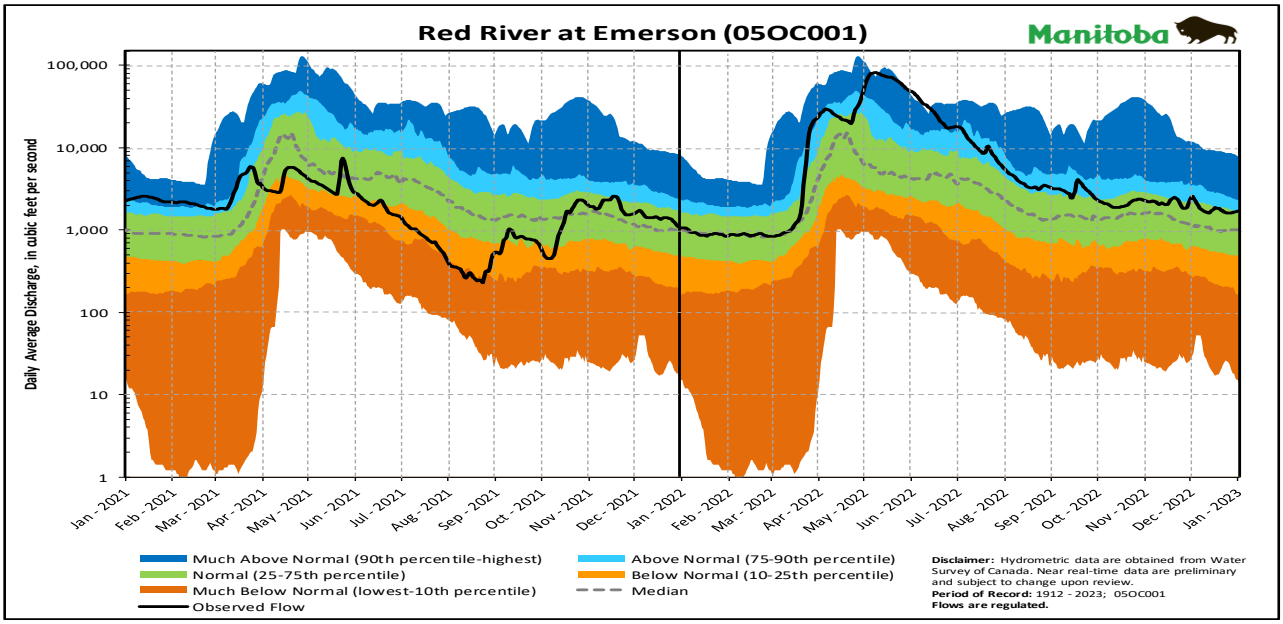

Figure 3. Average daily discharge in the Red River at Emerson for 2021 and 2022.

In the US portion of the Basin (Figure 4) according to the USGS, the January the outlook by the National Weather Service (NWS) showed a relatively low risk for significant (moderate or higher) spring flooding in the Red River and Devils Lake Basins, mostly due to fall (Sept-Nov) precipitation that was 1–4 inches below normal, depending on the location within the Basin. This lack of moisture resulted in soil moisture below normal heading into freeze-up, with severe drought conditions persisting across the lower Sheyenne and abnormally dry to moderate drought elsewhere in the Red River Basin. Streamflow conditions at the time of freeze-up were in the normal range for the Red River, but above normal for the Sheyenne, the Red Lake, and Goose Rivers. Early season snow cover contributed to a shallow frost layer in portions of the Basin; however, frost depths varied throughout the region. Snowfall at the time of this first flood outlook had also been much above normal for the entire region, with highest amounts in the Devils Lake and Sheyenne basins. The NWS gave the last official probabilistic flood outlook for Spring 2023 on March 23, at which time the 50% exceedance probability called for “moderate” to “major” flooding for the entire mainstem Red River as well as most of its tributaries (NWS Grand Forks Forecast Office and NWS North Central River Forecast Center,

2023b).

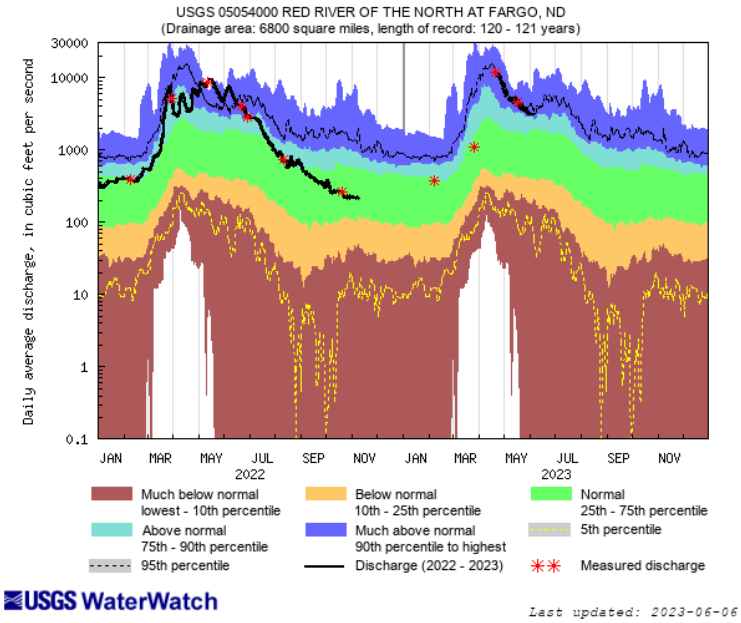

Figure 4: Streamflow at the Red River of the North at Fargo, ND January 1, 2022-June 5, 2023

The Devils Lake Basin (Figure 5) was subject to heavy snowfall in the 2022-2023 winter season, with an approximate snowpack of 24+ inches by April 4 that only diminished to around half of that by April 14, as per modeled snow depths from satellite imagery by the NWS. As this snowpack melted, it eventually caused a provisional rise of 1.10 ft in the Devils Lake level from April 14 to May 18, with a provisional peak of 50.71 ft on May 18 (U.S. Geological Survey, 2023). Pumping resumed out of the west-end outlet on May 15 and out of the east-end outlet on June 6 (North Dakota Department of Water Resources, 2023).

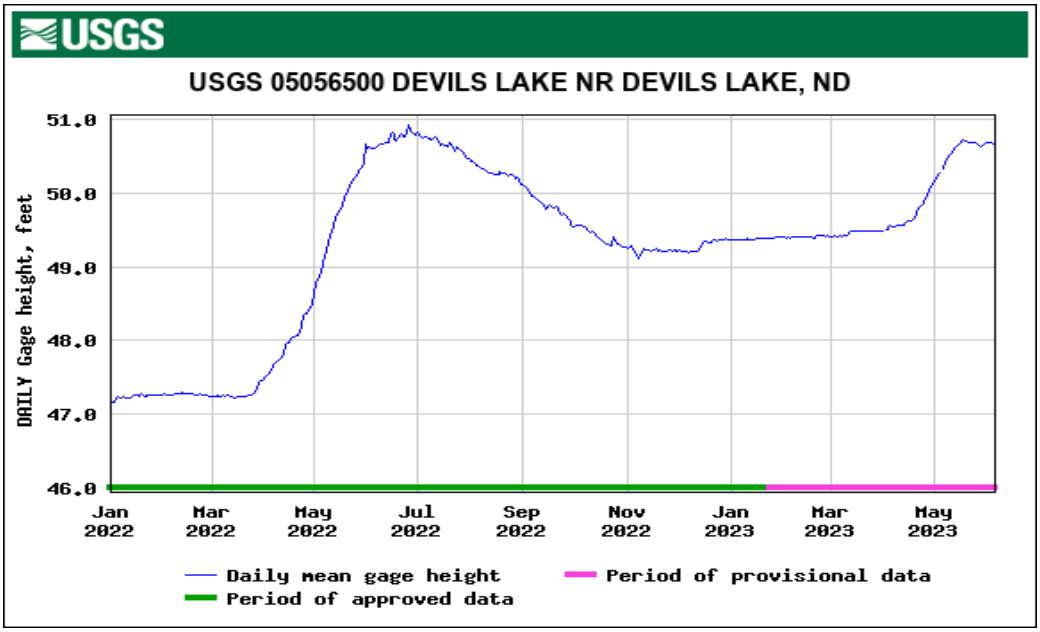

Figure 5. Devils Lake Water Elevations

6. WATER QUANTITY MONITORNIG

The Hydrology Committee monitors conditions in the basin and provides an overview of flow conditions and forecasts for board meetings, IJC semi-annual board appearances, the annual report and whenever else requested by the board or IJC. The reporting ensures the board and IJC are aware of the hydrologic conditions in the Basin.

Red River Low-Flow Frequency Study:

The Hydrology Committee received IWI funds to quantifying low flow frequencies to better understand potential low flow management criteria at the border. The result of the study will be a better understanding of the risks the Basin faces from various Red River drought scenarios and inform how a drought contingency plan or minimum flow criteria for the Red River could reduce these risks.

The water-balance model (WBM) has been calibrated and verified and the stochastically generated weather data has been derived. Future streamflows have been simulated and from these simulations, low-flow frequency curves have been derived for the Wahpeton, Halstad, Grand Forks and Emerson locations on the Red River. Results will be published in a USGS Scientific Investigation Report, planned for winter 2023-2024.

Red River Instream Flow Analysis

This work supports the board's desired outcome of assessing and recommending a process for the development and implementation of minimum flow management for the Red River at the International Boundary. Discussion paper presented to IRRWB at January 2019 Board meeting summarizing past work and future work required. Future work in the near term was to gather key data and improve and extend past modelling work to better understand the complexity of the Red River's aquatic ecosystem and make more informed low flow management decisions. The Hydrology Committee recommended that a complete homogeneous bathymetric survey would be fundamental to instream flow assessment and other work.

MTI completed bathymetry from near the border to just downstream on the Red River Floodway Inlet Control Structure in the summer and fall of 2022. Data includes 50 m of aerial LiDAR to cover the shoreline. USACE is planning to collect the US portion of the Red River in 2023. USACE also plans to merge the two surveys together.

7. WATER QUALITY MONITORING AT THE INTERNATIONAL BOUNDARY

Monitoring the water quality of the Red River at the Canada-US boundary is conducted by Environment & Climate Change Canada (ECCC). ECCC maintains a permanent water quality station on the Red River at Emerson, Manitoba. Monitoring of the Red River takes place twice monthly during the ice cover season, weekly during the open water season, and twice weekly during the spring freshet or other periods of flood. The water quality data for the 2021-2022 water year, included in this report, are based on instantaneous grab samples collected between October 1st, 2021 - September 30th, 2022.

These collected water quality data are used to determine compliance with the binational water quality objectives, nutrient objectives and targets, and alert levels at the international boundary. Detection of exceedances of the objectives and alert levels serves as a trigger mechanism for the Board to report to the IJC and for the IJC to report to governments and also may lead agencies to take appropriate action to prevent or to mitigate potential problems, and to minimize the potential for reoccurrence. Water quality characteristics at other locations throughout the basin are referenced elsewhere in this report to provide a more complete spatial representation of water quality and aquatic ecosystem conditions in the Red River basin (Appendix A-4).

There are five water quality objectives established by the governments of Canada and the United States, herein called binational water quality objectives, for the Red River at the International Boundary. These parameters are - Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Chloride (Cl), Sulphate (SO_4), and *Escherichia coli (E. coli)*. In addition, the IJC has established a number of alert levels for a suite of pesticides, metals and toxic substances, and has proposed objectives for two nutrient parameters. The IRRWB is responsible for monitoring and reporting on compliance with these objectives, proposed objectives, and alert levels.

7.1 Water Quality Objectives

The IJC recommended the establishment of water quality objectives for a limited number of variables at the International Boundary in April 1968, and the recommendation was approved by governments in May 1969. These variables with binational objectives included dissolved oxygen, total dissolved solids, chloride, sulphate, and fecal coliform bacteria. *E. coli* replaced fecal coliform as a water quality objective in October 2010. Several exceedances of binational water quality objectives were observed during the 2021-2022 water year, as summarized in Table 1. Additional detail on each parameter is provided.

Table 1 International Red River Board Water Quality Objectives
Summary of Exceedances Red River at the International Boundary
Oct 1, 2021 to Sept 30, 2022 Water Year

Parameter	Objective	Exceedances		
		Number (total # samples)	% samples exceeding	Maximum (Date)
Dissolved Oxygen	>5 mg/L	0 (53)	0%	5.95 ** (July 4th)
Total Dissolved Solids	500 mg/L	24 (52)	46%	1184 (Dec 13th)
Chloride	100 mg/L	3 (53)	6%	132 (Oct 20th)
Sulphate	250 mg/L	12 (53)	23%	572 (Jan 12th)
E. coli	<200 colonies /100 ml	0 (16)	0%	200 (April 5th)

***Minimum value for Dissolved Oxygen*

7.2 Water Quality Objectives and Targets for Phosphorus and Nitrogen

In May 2020, the IJC recommended the adoption of nutrient objectives and targets at the International Boundary, and in October 2022, the recommendation was approved by governments of Canada and the United States. The parameters total nitrogen and total phosphorus are each evaluated against ***concentration objectives*** as well as ***loading targets***. Nutrient concentrations and nutrient loads are reported in Table 2.

Table 2 Nutrient Concentrations and Loads, Red River at International Boundary

Parameter	Nutrient Concentration Objective	2022 Open Water Season Mean Concentration	Meets or Exceeds
Total Phosphorus	0.15 (mg/L)	0.40	Exceeds
Total Nitrogen	1.15 (mg/L)	2.49	Exceeds
Parameter	**Nutrient Load Target**	**2017-2021 Average Load**	**Meets or Exceeds**
Total Phosphorus	1400 (tonnes / year)	2366	Exceeds
Total Nitrogen	9,525 (tonnes / year)	11947	Exceeds

Water Quality Alert Levels

The former International Red River Pollution Board established alert levels for suites of pesticides, metals and toxic substances in 1986. For pesticides, the alert level is described as "not detectable in water", while specific metals have concentration values for alert levels (Appendix A-4).

Metals

A total of 53 water samples were collected and analyzed for metals and toxic substances during the reporting period (Appendix A-4). Four metals were detected in exceedance of alert levels. Cadmium, manganese and iron each had exceedance rates of 94-100%, with maximum values detected in April 2022. Iron and manganese are components in natural soils; however, the detection of higher levels of cadmium may indicate anthropogenic sources. Higher metals concentrations tend to correspond to higher flow and higher particulate matter events. The exceedance rates seen this water year are consistent with rates in recent years for these metals.

Zinc exceeded the alert level in one sample. The toxic substance arsenic also exceeded the alert level in one sample. Until recently, arsenic exceedances were rare, but a single arsenic exceedance has been observed in each of the last three water years.

Pesticides

Based on a total of up to 17 water samples, 11 pesticides and metabolites with alert levels (greater than detection concentration) were monitored during the 2021-2022 water year (Table B1). Three compounds (2,4-D, Atrazine, Metolachlor) were detected in 100% of the samples. The detection levels for all compounds were all below the Canadian Guidelines for the Protection of Aquatic Life. Given that the Red River basin is an agriculturally dominated region, the presence of pesticides is expected. The detection of banned pesticides (legacy contaminants) is not unusual given the slow bio-degradation rate of these chemicals. No legacy contaminants were detected during this reporting period.

Environment and Climate Change Canada recently enhanced the pesticide analyses to assess current use pesticide concentrations during open water conditions (May to October). The analysis have been expanded to include a broader range of pesticides. These include insecticides (neonicotinoids), herbicides (sulfonyl urea) and fungicide pesticides. In 2021-22, detections included 8 of 14 insecticides, 8 of 17 herbicides and 12 of 14 fungicides. The pesticides with the highest frequency of detection are summarized in Table B2 (Appendix A-4).

The IRRWB continues to closely monitor trends in these concentrations and their frequency of detection with the intention to update its assessment as new scientific information becomes available. The IRRWB recognizes that there is very little scientific information available to assess the implications of long-term exposure to low concentrations of pesticides and herbicides by aquatic organisms and humans.

8. WATER QUALITY AND BIOLOGICAL MONITORING PROGRAMS

Manitoba - During the 2021-2022 water year, Manitoba Environment and Climate continued its routine long-term monitoring of surface water quality within the Red River watershed. Sampling was conducted on a monthly frequency at three sites along the main stem of the Red River within Manitoba. These sites were located at Emerson, MB; upstream of the City of Winnipeg at the Floodway inlet control structure at St. Norbert, MB; and downstream of the City of Winnipeg at Selkirk, MB. Additionally, joint federal/provincial paired samples were collected at the Selkirk monitoring location for quality control/quality assurance purposes to ensure the long-term consistency of comparability between federal and provincial datasets. Water quality parameters measured included physical parameters, general chemistry, suspended sediment, bacteria, trace elements, nutrients, and agricultural chemicals. Benthic macroinvertebrates were also collected from the Red River at Emerson and Selkirk in September 2022.

As part of its regular Red River watershed monitoring, Manitoba Environment and Climate also conducted routine monitoring at nine sites on seven tributary streams to the Red River during the 2021-2022 water year. Tributary sites are typically monitored on a quarterly basis (October, December/January, April and July) throughout the water year. Tributary samples were analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, nutrients and agricultural chemicals. Long-term monitoring of tributary streams allows Manitoba Environment and Climate to identify potential sources of pollution to the Red River and develop management strategies that address existing and emerging water quality issues within the Red River watershed.

Biological Monitoring - Benthic macroinvertebrates were collected at two locations, Emerson, MB and Selkirk, MB, on the Red River in September 2022. At each location, one transect of five dredge grab samples were collected with a petit Ponar dredge. Starting at the east bank, samples were collected at five equidistant sample sites across the width of the river channel. Each Ponar dredge covered an area of 0.023 m^2. For each transect, 0.115 m^2 of sediment was collected. The dredge samples were washed through 500 µm Nitex nylon nets. River water was used to remove organisms and sediment from the nylon net into a 500 µm mesh sieve. Remaining sediment and all organisms were then placed in labelled 500 mL jars with 70 per cent ethyl alcohol preservative. Macroinvertebrates were subsequently identified to the lowest possible taxonomic level, typically genus and species, by ALS Environmental in Winnipeg, Manitoba. Data were screened for terrestrial species which were removed from the data subsequently reported.

Pollution Control - Three municipalities with populations greater than 1,000 discharge treated effluents directly to the Red River within Manitoba. The Town of Morris discharges for a short period of time each spring and fall, while the City of Winnipeg's South End and North End Water Pollution Control Centres and the Town of Selkirk discharge continuously. Upgrades are underway to the City of Winnipeg's South End and North End Water Pollution Control Centres including to add biological nutrient removal to meet 1 mg/L total phosphorus and 15 mg/L total nitrogen limits. In addition to the two major wastewater treatment facilities within the City of Winnipeg, discharges also occur from 76 combined sewer outfalls and 90 major land drainage outfalls. The City of Winnipeg reports annually on progress achieved regarding reductions in volumes of untreated effluent discharges originating from its municipal combined sewer system (https://winnipeg.ca/waterandwaste/sewage/annualResults/). Most

tributary streams also receive treated wastewater effluents from nearby communities.
During the reporting period, Manitoba was not notified of any intensive livestock operations proposing to locate near the international border on the North Dakota or Minnesota side. In Manitoba, no intensive livestock proposals were proposed near the international border between October 2021 and September 2022.

Pollution Abatement - Manitoba Water Quality Standards, Objectives, and Guidelines are applicable to streams within the Red River basin. Water uses protected in the Red River basin include domestic water supply source, protection of aquatic life, industrial uses, irrigation, livestock watering, and water-related recreation.

Treated municipal effluents discharged to the Red River and tributary streams in Manitoba are licensed under The Environment Act (Manitoba). Disinfection with ultraviolet light technology has been installed and is operational at the City of Winnipeg's South and North End Water Pollution Control Centres. In August 2004, the City of Winnipeg introduced a web-based system to inform the public whenever there is likely to be a sewer overflow into the Red or Assiniboine Rivers (http://winnipeg.ca/waterandwaste/sewage/overflow/previous24.stm). The City of Winnipeg also provides annual summaries of combined sewer overflows events, volumes and rainfall information (https://winnipeg.ca/waterandwaste/sewage/annualResults/default.stm).

Manitoba continues to work to understand sources of nutrients to Lake Winnipeg, to monitor the impacts of excess nutrients and to reduce nutrient loading to achieve a 50 per cent reduction in phosphorus in Lake Winnipeg. Manitoba has developed nutrient concentration objectives for Lake Winnipeg and nutrient loading targets for the main tributary rivers flowing into Lake Winnipeg. Concentration objectives and loading targets complement the proposed multi-national water quality objectives for total phosphorus and total nitrogen concentrations developed through the IRRWB. More information on the proposed objectives and targets is available at https://www.manitoba.ca/water/pubs/water/lakes-beaches-rivers/nutrient_targets_regulation_plain_language_summary_fall_2020.pdf.

In addition, Manitoba continues to implement a series of key water protection initiatives aimed at reducing nutrient loading to waterways including regulations restricting nutrient applications to land, requirements for advanced wastewater treatment to remove nutrients and improving surface water retention and management through integrated watershed management planning:

North Dakota - The North Dakota Department of Environmental Quality (NDDEQ) Watershed Management Program is responsible for tracking the ambient water quality conditions within the State of North Dakota. The NDDEQ maintains a monitoring network to evaluate trends, estimate loads and compare variations between sites in the Red River Watershed. The network coordinates with the US Geological Survey (USGS) and the North Dakota Department of Water Resources (DWR) water quality monitoring networks.

The monitoring design includes 3 levels of sampling frequency. Level 1 sites are sampled 8 times per year (twice in April, once each in May, June, July, August, and October, and one time under ice), level 2 sites are sampled 6 times per year (April, May, June, August, and October and once under ice, and

level 3 sites are sampled 4 times per year (April, June, August, and October). There are 16 level 1 sites, 12 level 2 sites, and level 3 sites. Under the current design, the NDDEQ samples 5 level 1 sites, the Department of Water Resources samples 1 level 2 site, and the USGS samples all the rest.

Minnesota - There are 17 major tributaries to the Red River in Minnesota. The Minnesota Pollution Control Agency has developed Watershed Restoration and Protection Strategy (WRAPS) reports for each of these watersheds. Each WRAPS consists of monitoring, stressor identification, modeling, public participation/input and any associated TMDLs. The WRAPS and all associated Total Maximum Daily Load (TMDL) studies have been completed on all 17 watersheds, in the Red River Basin, as indicated below. This completes cycle 1 of the watershed approach for the Red River Basin.

The second cycle of monitoring has begun which will result in WRAPS Updates, as needed, for each watershed with any necessary TMDLs. Most of the watersheds in the Red River Basin are set to be sampled starting in 2023 through 2026 with a few that began in 2022 (Appendix A-4). For the summer of 2023 the MPCA is monitoring (fish, macroinvertebrate, and discrete water quality) the following watersheds in the Red River Basin Monitoring is expected to be completed by the end of September (monitoring is done for two years in each watershed):

- Red Lake River Watershed (1st year)
- Grand Marais Creek Watershed (1st year)
- Sand Hill River Watershed (2nd year)
- Thief River Watershed (2nd year)

9. INDIGENOUS ENGAGEMENT

The International Joint Commission (IJC) has instructed the International Red River Board Watershed Board to include Indigenous People in its membership and as such has appointed four new Indigenous members to join the Board in 2021. The addition is expected to provide a tradition knowledge perspective that would enrich the knowledge base for the protection of the ecology of the Red River Basin.

The Indigenous Task Team held its first Roundtable meeting from January 16-17, 2023 in Winnipeg, Manitoba. The purpose of the Indigenous Nations Roundtable was to provide an opportunity for First Nations, Red River Métis and Tribal Nations whose territories are located in the Red River Watershed Basin to come together to discuss their priorities related to the IRRWB, and the IJC more broadly.

The results of the Indigenous Nations Roundtable can inform opportunities for the IJC and the IRRWB to explore new models for partnership and collaboration with First Nations, Red River Métis, and Tribal Nations with rights in respect to the management of the Red River Watershed.

Opening Prayers were offered by Elders Norman Meade and Mary Maytwayashing. Elder Norman Meade welcomed participants to the homeland of the Red River Métis and offered a moment of silence, held in recognition of Joe Keeper, a Cree leader and advocate for water rights for decades. Opening Remarks were provided by Grand Chief Jerry Daniels of the Southern Chiefs' Organization. He acknowledged water as a living being with rights and ceremonial significance that need to be respected. Grand Chief Daniels also spoke to the need to ensure broad public understanding of the science behind water treatment. Grand Chief Daniels outlined three priorities:

- The need for high trans-boundary water quality protection standards;
- The need to implement adaptive measures to address climate change impacts, including flooding; and
- The need to determine how best to guarantee meaningful collaboration going forward.

Chief Gordon Bluesky, Brokenhead Ojibway Nation, Treaty 1, welcomed participants to the Territory, and spoke to the significance of water within the Territory. He acknowledged Elder Meade's reference to Shoal Lake 40, who cannot practice their traditional livelihoods in their traditional waters because of how Lake Winnipeg has been developed. The community's situation provides one example of why stronger water protections are needed. Chief Bluesky noted that since colonization Indigenous Peoples of Treaty 1 have faced water impacts. He acknowledged the International Joint Commission's efforts, but emphasized that more work is needed to acknowledge Treaty 1, and ensure meaningful solutions that make a difference, for the Nations immediately impacted by the US-Canada border, but also for those beyond since water continues to flow and travel elsewhere, for now and for future generations.

April Walker and Dr. Annette Trimbee, both Indigenous Board members, highlighted that they would like to hear how they can support the Board in taking a holistic approach to water management, centering the voices and differing experiences of Indigenous Peoples whose territory is located both upstream and downstream from the Red River Watershed.

Commissioner Henry Lickers spoke about Haudenosaunee cultural knowledge about water and how it aligns with what others have shared. He shared that as a biologist and as the first Indigenous IJC Commissioner, he is working as a commissioner under his personal and professional expertise. Commissioner Lickers provided an overview of the IJC, including its mandate, way of working, and recent work, including the international watersheds initiative, and work to collaborate with Indigenous Peoples. Commissioner Lickers emphasized that the IJC is still learning how to effectively communicate and work with Indigenous Peoples. He expressed an interest in hearing from participants about their priorities and ideas on how collaboration can best proceed.

10. INTERNATIONAL WATERSHEDS INITIATIVE (IWI)

In 2004, the IJC adopted guiding principles aimed at broadening the partnership efforts of its international boards with other watershed entities for a more inclusive approach. The IJC refers to this effort as the 'International Watersheds Initiative'. The aim of the Initiative is to enhance the capabilities of existing IJC international boards while at the same time, strengthening cooperation among the various local entities. Building this capability includes:

- employing a broader, systemic perspective of the watershed;
- expanding outreach and cooperation among organizations with local water-related interests and responsibilities;
- promoting the development of a common vision for the watershed;
- developing a better hydrologic understanding of the water-related resources; and
- creating the conditions for the resolution of specific watershed-related issues.

There are many government, non-government, academic, private; and other entities with resource management responsibilities and interests in the Red River basin. Many have expressed support for a watershed approach. The present IRRWB membership and Committee structures provide a linkage to key segments of this community with potential to expand the linkages as integrative approaches evolve.

In its June 2005 report to the governments of Canada and the United States[1], the IJC recommended that the governments confirm their support for the Initiative and that funds be made available commensurate with board work plans.

Currently, the IRRWB has six IWI projects underway with some to be completed in the near future.

- Aquatic Ecosystem Committee Telemetry Study (Funded 2016 extended sampling to battery life –to 2022).
- Drought Risk Analysis for the Red River Basin (Funded May 2020 - ongoing).
- Evaluation of Factors contributing to Sulfate Trends in the Red River Basin. (Funded late FY2021 Est Completion Late 2023).
- Supporting the IRRWB's Nutrient Management Strategy through Workshops and Technical Assistance in the Red River Basin (Accepted Feb 26, 2021- ongoing).
- Phase I - Building the foundations for Indigenous collaboration in the International Red River Basin (Funded Sept 2021).
- Integrating Fish Passage Considerations into Cultural and Ecological Connectivity (Funded Late Fall 2022)

The following are projects in development.

- Habitat Mapping
    - Complements AEC fish movement study and the Instream Flow Needs study (Completing in 2023)
- Review & Update Water Quality Objectives at the Border
- Phase II ITT Project – Continued from Phase I
- N-RFC CoCoRaHS Kits for Indigenous Collaboration
    - 2 IWI Phases: Purchasing; Distribution and Education
    - Collateral support from SWCD, N-FRC, Others
- Focus on Ecosystem Integrity: WQC - Assess nutrient metrics relative to biological measures –
    - Expand data set through monitoring (phytoplankton, periphyton, and others)

With the leadership of IJC liaisons, several other projects have been identified at the January 2023 Board meeting in Winnipeg as potential IWI projects.

Appendices
for
International Red River Watershed Board's
2022 Annual Report

Appendix A

Directive to the International Red River Watershed Board (2022)

DIRECTIVE TO THE
INTERNATIONAL RED RIVER WATERSHED (April 26, 2022)

History of Directive

Pursuant to the Boundary Waters Treaty of 1909, wherein Canada and the United States agree to certain provisions including regarding the maintenance of navigation, water levels, flows, and water quality of boundary waters, responsibilities have been conferred on the Commission under a 1948 Reference from the governments of Canada and the United States with respect to the use and apportionment of the waters along, across, or in the vicinity of the international boundary from the eastern boundary of the Milk River drainage basin on the west up to and including the drainage basin of the Red River on the east, and under the May 1969 authorization from the governments to establish continuous supervision over the quality of the waters crossing the boundary in the Red River and to recommend amendments or additions to the objectives when considered warranted by the International Joint Commission.

The directive from the International Joint Commission dated February 7th 2001 consolidated the functions of two former boards created pursuant to the above responsibilities, the International Red River Pollution Board and the International Souris-Red Rivers Engineering Board, into one board, known as the International Red River Board (IRRB). This Directive replaces the February 7th 2001 directive given that on [date] the International Joint Commission designated the IRRB an International Watershed Board, which shall now be named the International Red River Watershed Board (IRRWB), requiring it to operate pursuant to International Watershed Initiative principles and approaches.

Definitions

"Aquatic Ecosystem of the Red River Basin" means the structure, function and interacting components of water, land, air, and living organisms that relate to the Water Resources of the Red River Basin.

"Aquatic Ecosystem Integrity" means that the Aquatic Ecosystem of the Red River Basin can support and maintain a community of organisms that has species composition, diversity, functional organization, supporting processes, and rates of change comparable to those of natural habitats within the Red River Basin.

"Red River Basin" means the Red River excluding the Assiniboine and Souris Rivers.

"Water Resources of the Red River Basin" means the Red River and any order tributary to the Red River including deltas, tributaries of deltas, wetlands, and lakes which contribute water to the Red River, whether in liquid or frozen state and includes groundwater and aquifers.

Objective

The objective of the IRRWB is to support the Aquatic Ecosystem Integrity of the Red River Basin pursuant to this Directive.

Direction

The IRRWB operates under the authority of the Commission as set out in this Directive.

Commission's direction to the IRRWB is to achieve the Objective by assisting the Commission in preventing and resolving disputes relating to the Aquatic Ecosystem of the Red River Basin through implementation of its responsibilities under this Directive in accordance with the seven operating principles of an International Watershed Board (attached as Schedule A).

Responsibilities

To fulfil this Directive, the IRRWB shall:

1. Focus on all aspects of Aquatic Ecosystem Integrity which includes but is not limited to ground and surface water quality, quantity, levels, flows, and biological elements.
2. Maintain an awareness of current and emerging land use and development and socio-economic activities and conditions and the potential or existing impact of these activities and conditions on the Aquatic Ecosystem Integrity of the Red River Basin, including through maintaining an awareness of the activities of other governments (federal, provincial, state, municipal and/or Indigenous as relevant) and their agencies and institutions;
3. Provide a continuing and inclusive forum for the identification, discussion and resolution of relevant existing and emerging issues, science and traditional knowledge, and the sharing of information and best practices;
4. Develop an approach, maintain and report on the state of the Aquatic Ecosystem of the Red River Basin;
5. Recommend to the Commission objectives for Aquatic Ecosystem Integrity, including objectives related to the watershed and the component parts of the Red River Basin, and where objectives have been agreed to by governments of the Red River Basin:
    - Maintain continuing surveillance and perform inspections, evaluations and assessments, as necessary, to determine compliance with the objectives;
    - Encourage the responsible governments (federal, provincial, state, municipal and/or Indigenous as relevant), including their regulatory and enforcement agencies and the Commission to take steps to ensure that the objectives are met;
    - Review and update if necessary the objectives every five years or more frequently if circumstance so require;
    - Report yearly to the Commission on this provision, unless circumstances require more frequent reporting.
6. Encourage the responsible governments (federal, provincial, state, municipal and/or Indigenous as relevant) and their appropriate authorities, such as resource and emergency planning agencies, to develop and promote a culture of climate change adaptation and resilience, including flood, drought, and wildfire mitigation, management and preparedness and associated land management and conservation approaches.
7. Develop and promote a culture of climate change adaptation and resilience, including flood, drought, and wildfire mitigation, management and preparedness and associated land management and conservation approaches, and their effects on the Aquatic Ecosystem by:

- Monitoring and reporting on the adequacy of mitigation, management and preparedness activities, procedures, data and information collection networks, and warnings;
- Encouraging and facilitating adaptive management and the development, maintenance and sharing of collaborative and innovative data and information systems and forecasting and hydrodynamic techniques, mapping and models;
- Encouraging governments to develop improved procedures for emergency warnings and to improve communication of emergency forecasts;
- Interacting with all levels of government to help decision-makers become aware of these issues;
- Monitor potential effects of flood, drought, and wildfire mitigation, management and preparedness and associated land management and conservation approaches and other works in the Red River Basin, and encourage cooperative studies necessary to examine these effects;

8. Encourage governments to establish and maintain contingency plans, including early warning and coordination procedures, for appropriate reporting and action on emergency matters that may impact Aquatic Ecosystem Integrity including accidental discharges or spills, floods, droughts and wildfires and associated land management and conservation approaches.
9. Monitor and report on progress by relevant governments (federal, provincial, state, municipal and/or Indigenous as relevant) in implementing the IRRWB and Commission recommendations;
10. Involve the public in the work of the IRRWB, facilitate provision of timely, pertinent, and public-friendly (in terms of readability and accessibility) information and knowledge translation in the most appropriate manner including electronic information networks, and conduct an annual public meeting.

Accountability and Reporting

The IRRWB is accountable to the Commission and therefore shall:

1. Provide an annual report to the Commission on the state of the Red River Basin, progress made towards fulfillment of the Objective and the responsibilities set out in this Directive, plus other reports as the Commission may request or the IRRWB may feel appropriate in keeping with this Directive;
2. Provide a tri-annual assessment of progress to the Commission evaluating the effectiveness in achieving the Objective and any recommendations to improve effectiveness;
3. Ensure adequate opportunities are provided for the public to comment on the IRRWB's activities including on the adequacy of progress towards the Objective and effectiveness of fulfilment of this Directive;
4. Inform the Commission, in advance, of plans for any public meetings or public involvement in the IRRWB deliberations. The IRRWB shall report, in a timely manner, to the Commission on these meetings, including the representations made;
5. Provide the text of media releases and other public information materials to the Secretaries of the Commission for review and approval by the Commission's Public Information Officers, prior to their release;

6. Inform the Commission of any developments or cost impediments, actual or anticipated, which are likely to affect fulfilment of the IRRWB's responsibilities or attainment of the objective of this Directive, and provide the IRRWB's proposed plan to address fulfilment of its responsibilities under the circumstances.

Membership

1. The IRRWB shall have an equal number of members from each country.
2. The IRRWB shall be comprised of members representing a wide range, if not all interests in the Red River Basin to include, but not limited to, Indigenous, conservation, and municipal members.
3. The Commission shall normally appoint each member for a three-year term. Members may serve for more than one term.
4. Members shall act in their personal and professional capacity to uphold and achieve the objective and fulfil this Directive, and not as representatives of their countries, agencies, institutions or communities.
5. The Commission shall appoint one member from each country to serve as co-chairs of the IRRWB.
6. At the request of any member, the Commission may appoint an alternate member to act in the place of such member whenever the said member, for any reason, is not available to perform such duties as are required of the member. An alternate member may not act as a co-chair.
7. The co-chairs of the IRRWB shall be responsible for maintaining proper liaison between the IRRWB and the Commission, and among the IRRWB members. Chairs shall ensure that all members of the IRRWB are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the IRRWB, progress made, and any developments affecting such progress.
8. Each chair, after consulting the members of the IRRWB, may appoint a secretary. Under the general supervision of the chair(s), the secretary(ies) shall carry out such duties as are assigned by the chairs or as decided by the IRRWB.
9. The IRRWB may establish such committees and working groups as may be required to discharge its responsibilities effectively. All committees established by the IRRWB must be established in accordance with the terms of this Directive and operate according to Terms of Reference approved by the Commission. The Commission shall be kept informed of the duties and composition of any committee or working group.

Meetings, Management and Administration

1. The IRRWB shall conduct its work by consensus as per the Commission's Guidance on Board Consensus Document dated March 20, 2020.
2. In the event of any unresolved disagreement among the members of the IRRWB, the IRRWB shall refer the matter forthwith to the Commission for decision.
3. If, in the opinion of the IRRWB or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for timely and appropriate action shall be promptly communicated to the IRRWB.

4. Ordinarily, members of the IRRWB, committees, or working groups will make their own arrangements for reimbursement of necessary expenditures.
5. Reports, including annual reports, and correspondence of the IRRWB shall, normally, remain privileged and be available only to the Commission and to members of the IRRWB and its committees until their release has been authorized by the Commission.

Duration of Directive

1. This Directive continues until amended or discontinued by the Commission.
2. The Commission may amend this Directive and/or existing instructions or issue a new Directive and/or instructions to the IRRWB at any time.

Appendix B

Water Quality Monitoring at the International Boundary - ECCC

Water Quality Objectives and Water Quality Alert Levels

Water Quality Objectives

On October 1, 1964, the Governments of Canada and the United States submitted a reference to the IJC requesting an investigation of pollution in the waters crossing the International Boundary in the Red River pursuant to the provisions of Article IV of the Boundary Waters Treaty of 1909. Following receipt of the reference, the Commission established the International Red River Water Pollution Board on December 2, 1964, and appointed technical experts to the Board from both countries. The Commission provided detailed instructions to the Board in the form of a directive which asked that all relevant water quality information be examined, pollution sources identified and remedial measures determined. The International Red River Water Pollution Board conducted investigations from 1965 to 1966 and submitted a report to IJC in October 1967. The purpose of the water quality objectives and alert levels is to restore and maintain the chemical, physical, and biological integrity of the waters of the Red River. Five specific Binational water quality objectives were adopted for the Red River at the international boundary in 1969.

The IJC conducted public hearings on April 11, 1968 and reported to the Governments on their findings, recommendations and conclusions. The key recommendation was that WQOs, as defined in the IJC report, be accepted by Governments. In letters dated May 13 and 14, 1967, the Governments informed the Commission that the recommendations contained in the Commission's report to Governments were accepted and approved. The two Governments specifically authorized the Commission to establish continuous supervision over the quality of waters in the Red River crossing the International Boundary and to recommend amendments or additions to the objectives when warranted by the Commission. IJC recommended the establishment of WQOs for a limited number of variables at the boundary on April 11, 1968 and the recommendation was approved by governments on May 4, 1969. Shortly after, the Commission established the International Red River Pollution Board on June 10, 1969. Water quality objectives are used when necessary to secure government commitment to pollution abatement action. Compliance with the objectives is the primary means by which the International Red River Board identifies major water quality issues to the IJC.

The term “exceedance” is used to describe a situation where an objective is not met. A situation is classified as an exceedance if an individual instantaneous sample, obtained from the continuous auto- monitor, or through a grab sample, is equal to or greater than the corresponding water quality objective (except for dissolved oxygen, which must be observed to be equal to or less than the objective). The five specific parameters and corresponding objective are listed below.

E. coli	200 colonies/100 ml
Chloride	100 mg/L
Sulphate	250 mg/L
Total Dissolved Solids	500 mg/L
Dissolved Oxygen	5 mg/L

Water Quality Alert Levels

Water quality alert levels are used to complement water quality objectives. If exceeded, alert levels will trigger investigative action on the part of the IRRB or its representatives. The exceedance is addressed in terms of its magnitude, implications to water uses and possible resolutions. On the basis of alert level exceedances and subsequent investigations, the IRRB may advance proposals for additional objectives.

Water quality alert levels, for a wide range of parameters, in addition to the five specific parameters noted above, were developed by a working group in 1985. These alert levels were approved by the predecessor International Red River Pollution Board in January 1986.

ECCC Report - WATER QUALITY MONITORING AT THE INTERNATIONAL BOUNDARY

Monitoring the water quality of the Red River at the Canada-US boundary is conducted by Environment & Climate Change Canada (ECCC). ECCC maintains a permanent water quality station on the Red River at Emerson, Manitoba. Monitoring of the Red River takes place twice monthly during the ice cover season, weekly during the open water season, and twice weekly during the spring freshet or other periods of flood. The water quality data for the 2021-2022 water year, included in this report, are based on instantaneous grab samples collected between October 1st, 2021 - September 30th, 2022.

These collected water quality data are used to determine compliance with the binational water quality objectives, nutrient objectives and targets, and alert levels at the international boundary. Detection of exceedances of the objectives and alert levels serves as a trigger mechanism for the Board to report to the IJC and for the IJC to report to governments and also may lead agencies to take appropriate action to prevent or to mitigate potential problems, and to minimize the potential for reoccurrence.

Water quality characteristics at other locations throughout the basin are referenced elsewhere in this report to provide a more complete spatial representation of water quality and aquatic ecosystem conditions in the Red River basin.

Water quality monitoring on the Red River at the Canada-US boundary by Environment & Climate Change Canada.

Water Quality Objectives

The IJC recommended the establishment of water quality objectives for a limited number of variables at the International Boundary in April 1968, and the recommendation was approved by governments in May 1969. These variables with binational objectives included dissolved oxygen, total dissolved solids, chloride, sulphate, and fecal coliform bacteria. *E. coli* replaced fecal coliform as a water quality objective in October 2010.

Several exceedances of binational water quality objectives were observed during the 2021-2022 water year, as summarized in Table 1. Additional detail on each parameter is provided.

Table 1 International Red River Board Water Quality Objectives Summary of Exceedances Red River at the International Boundary Oct 1 2021 to Sept 30 2022 Water Year				
Parameter	**Objective**	**Exceedances**		
		Number (total # samples)	**% samples exceeding**	**Maximum (Date)**
Dissolved Oxygen	>5 mg/L	0 (53)	0%	5.95 ** (July 4th)
Total Dissolved Solids	500 mg/L	24 (52)	46%	1184 (Dec 13th)
Chloride	100 mg/L	3 (53)	6%	132 (Oct 20th)
Sulphate	250 mg/L	12 (53)	23%	572 (Jan 12th)
E. coli	<200 colonies /100 ml	0 (16)	0%	200 (April 5th)

***Minimum value for Dissolved Oxygen*

Dissolved Oxygen

Observed levels of *dissolved oxygen* did not fall below the objective of 5 mg/L during the 2021-2022 water year. The minimum observed value was 5.95 mg/L on July 4, 2022. Minimums often occur in summer, when discharge increases following significant rain events.

Total Dissolved Solids

Total Dissolved Solids (TDS) exceeded the objective of 500 mg/L in 46% of samples (Figure 4). Exceedances have been common over the last number of years: typically TDS values remain above the objective except where diluted by the higher flows of the spring freshet or other flooding. The highest observed value of TDS was 1184 mg/L on December 13th, 2021.

Chloride

The *chloride* objective (100 mg/L) was exceeded in 6% of samples during this reporting period. The maximum concentration was 132 mg/L on October 20th, 2021. In recent years, chloride has occasionally exceeded the objective at similarly low frequencies.

Sulphate

S*ulphate* exceeded the objective of 250 mg/L in 23% of samples during the 2021-2022 water year (Figure 5). Sulphate exceedances have been common over the last number of years: often exceeding the objective even more frequently than during this reporting period. The maximum value measured was 575 mg/L on January 12th, 2022.

E. coli

The bacteriological characteristics of the Red River are assessed on the basis of observed *Escherichia coli* bacteria. The presence of *E. coli* in water is an indicator of impacts via human and/or animal wastes. During the 2021-2022 water year, *E. coli* bacteria counts did not exceed the objective of 200 / 100 mL. However, the maximum concentration once exactly equalled the objective: 200 colonies / 100 mL were observed on April 5th, 2021.

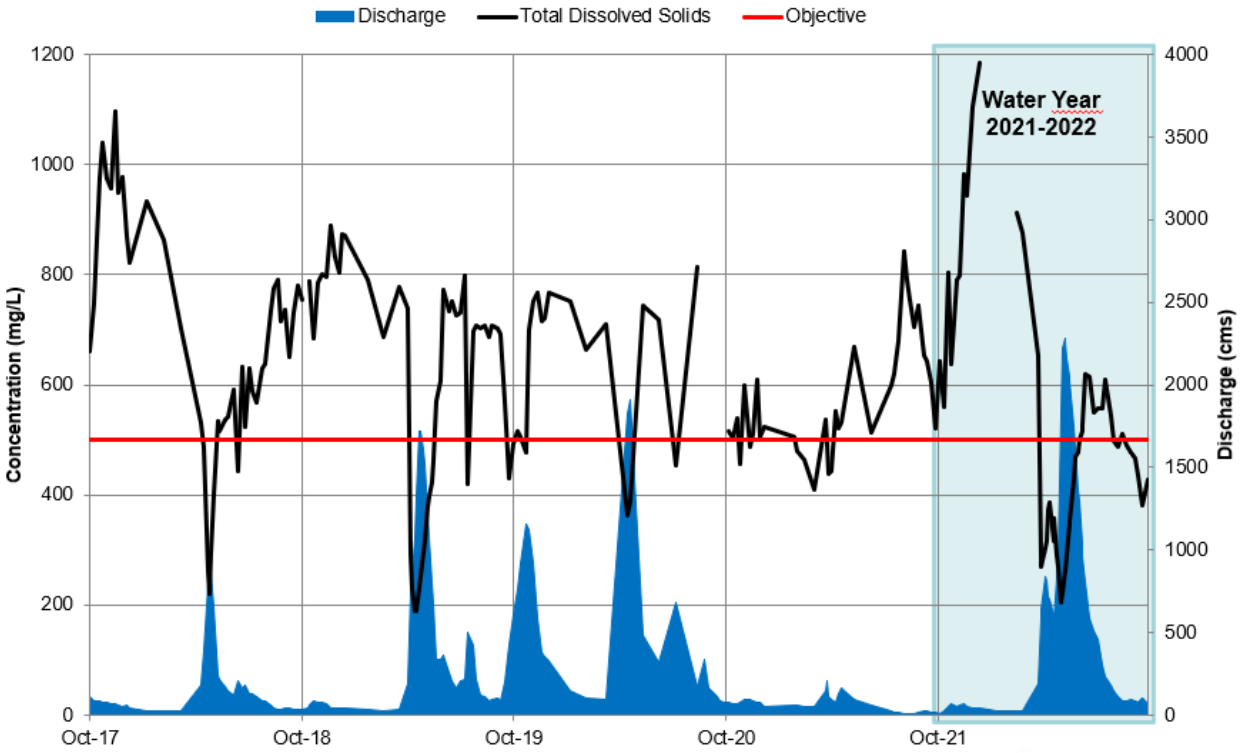

Figure 1: Total Dissolved Solids (TDS) - Red River at the International Boundary

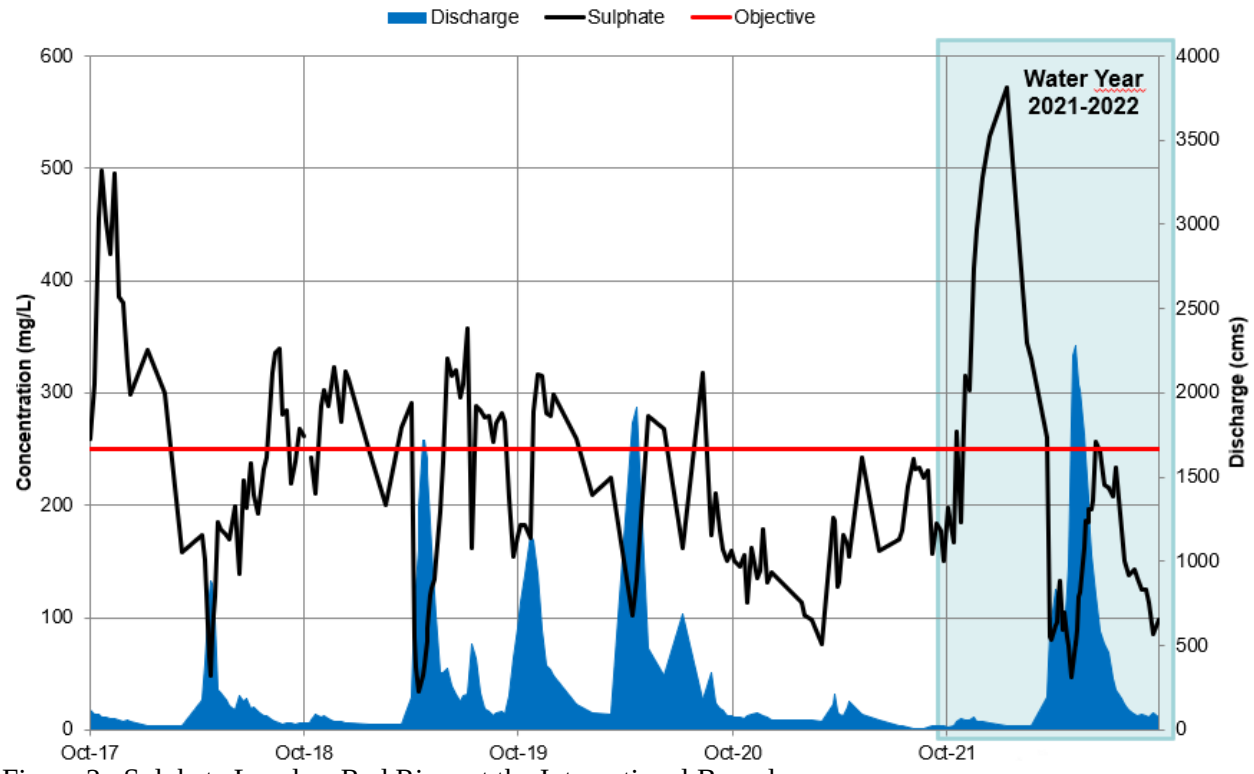

Figure 2: Sulphate Levels – Red River at the International Boundary

Water Quality Objectives and Targets for Phosphorus and Nitrogen

In May 2020, the IJC recommended the adoption of nutrient objectives and targets at the International Boundary, and in October 2022, the recommendation was approved by governments. The parameters total nitrogen and total phosphorus are each evaluated against ***concentration objectives*** as well as ***loading targets***. Nutrient concentrations and nutrient loads are reported in Table 2.

Table 2 Nutrient Concentrations and Loads, Red River at International Boundary

Parameter	Nutrient Concentration Objective	2022 Open Water Season Mean Concentration	Meets or Exceeds
Total Phosphorus	0.15 (mg/L)	0.40	Exceeds
Total Nitrogen	1.15 (mg/L)	2.49	Exceeds
Parameter	**Nutrient Load Target**	**2017-2021 Average Load**	**Meets or Exceeds**
Total Phosphorus	1400 (tonnes / year)	2366	Exceeds
Total Nitrogen	9,525 (tonnes / year)	11947	Exceeds

Nutrient Concentration Objectives

An open water season mean concentration is calculated as the average concentration in all samples collected between April 1st and October 30th in a given year. The open water season mean is compared against the concentration objective to determine compliance.

Total Phosphorus

The Apr-Oct mean total phosphorus concentration for the 2022 open water season was 0.40 mg/L, which exceeded the objective of 0.15 mg/L (Figure 3). Total phosphorus has consistently exceeded the concentration objective value for several decades.

Total Nitrogen

The Apr-Oct mean total nitrogen concentration for the 2022 open water season was 2.49 mg/L, which significantly exceeded the proposed objective of 1.15 mg/L (Figure 4). Total nitrogen has consistently exceeded the concentration objective value for several decades, but the magnitude of the 2022 exceedance is high compared to recent years.

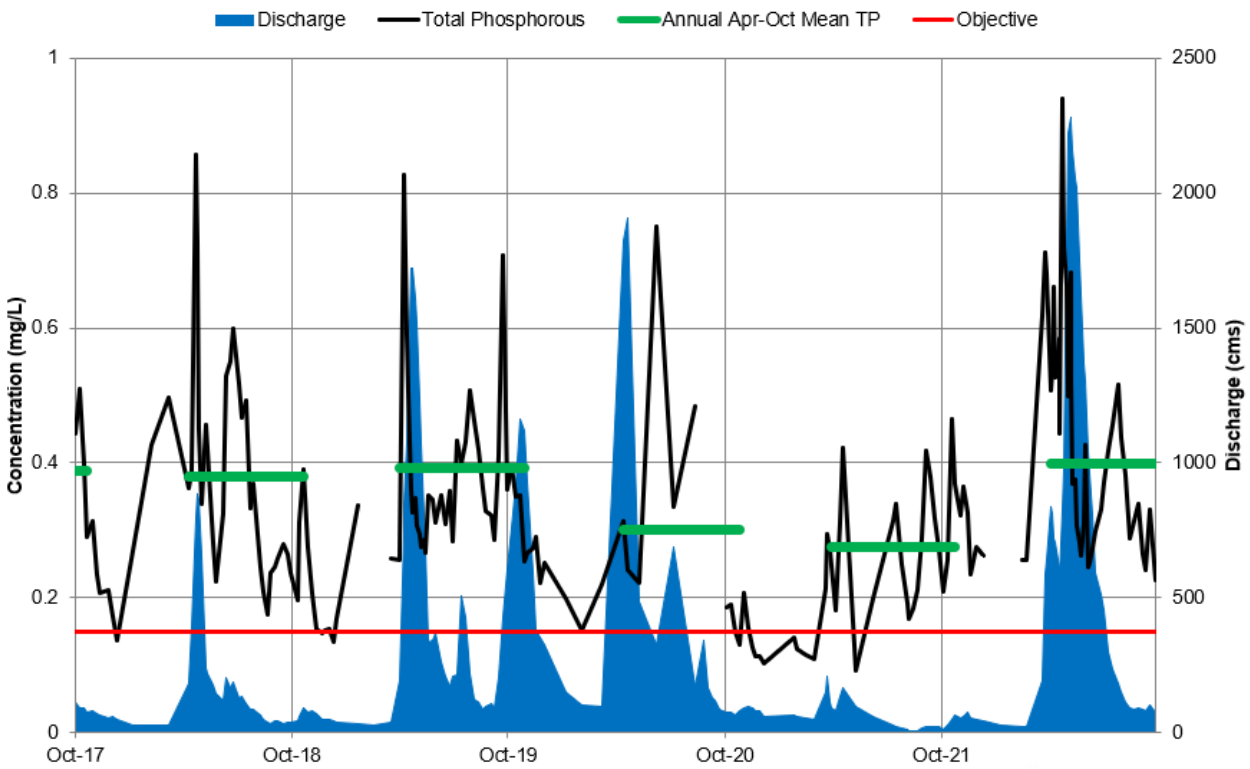

Figure 3: Total Phosphorus Concentrations – Red River at the International Boundary

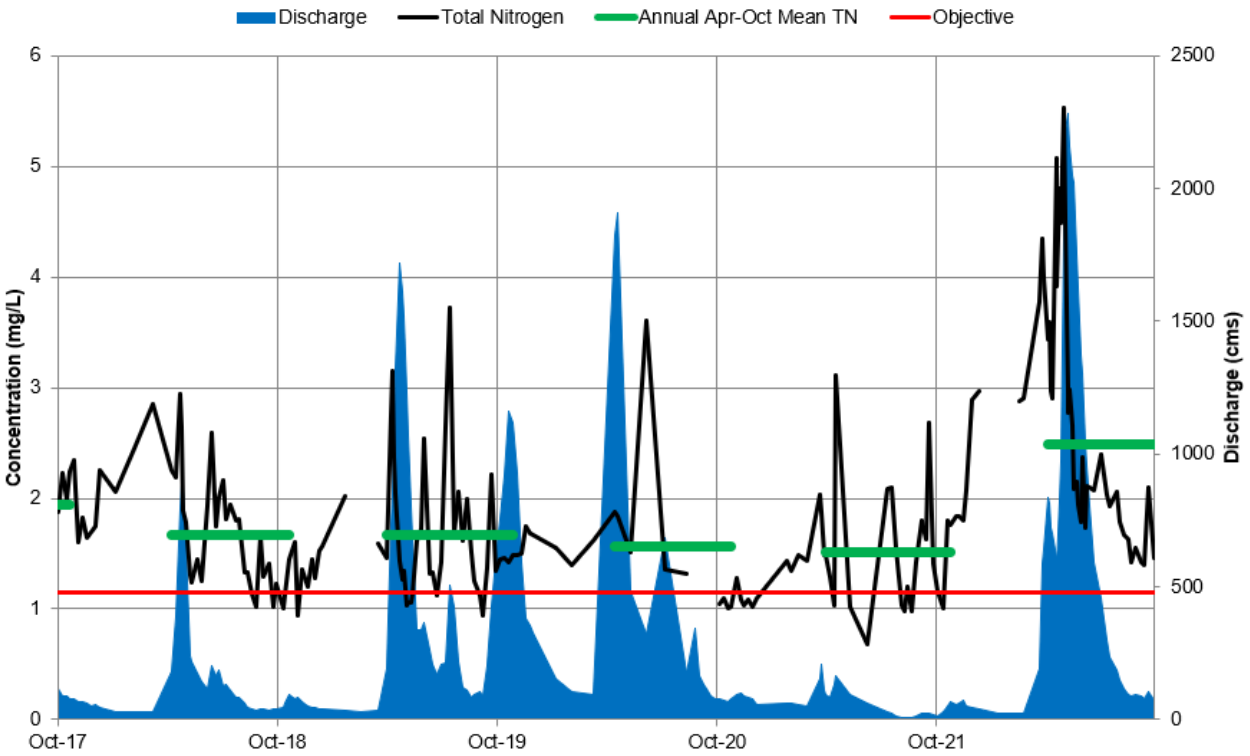

Figure 4: Total Nitrogen Concentrations – Red River at the International Boundary

Nutrient Loading Targets

Nutrient loads are calculated by calendar year based on concentrations and river flows. The nutrient loading target is applied to the five-year rolling average load to determine compliance.

Total Phosphorus

The total phosphorus load for the five-year period ending in 2021 was 2,366 tonnes per year, exceeding the loading target of 1,400 tonnes per year. Phosphorus loads have consistently exceeded the target for several decades.

Total Nitrogen

The total nitrogen load for the five-year period ending in 2021 was 11,947 tonnes per year, exceeding the loading target of 9,525 tonnes per year. Nitrogen loads have consistently exceeded the target for several decades.

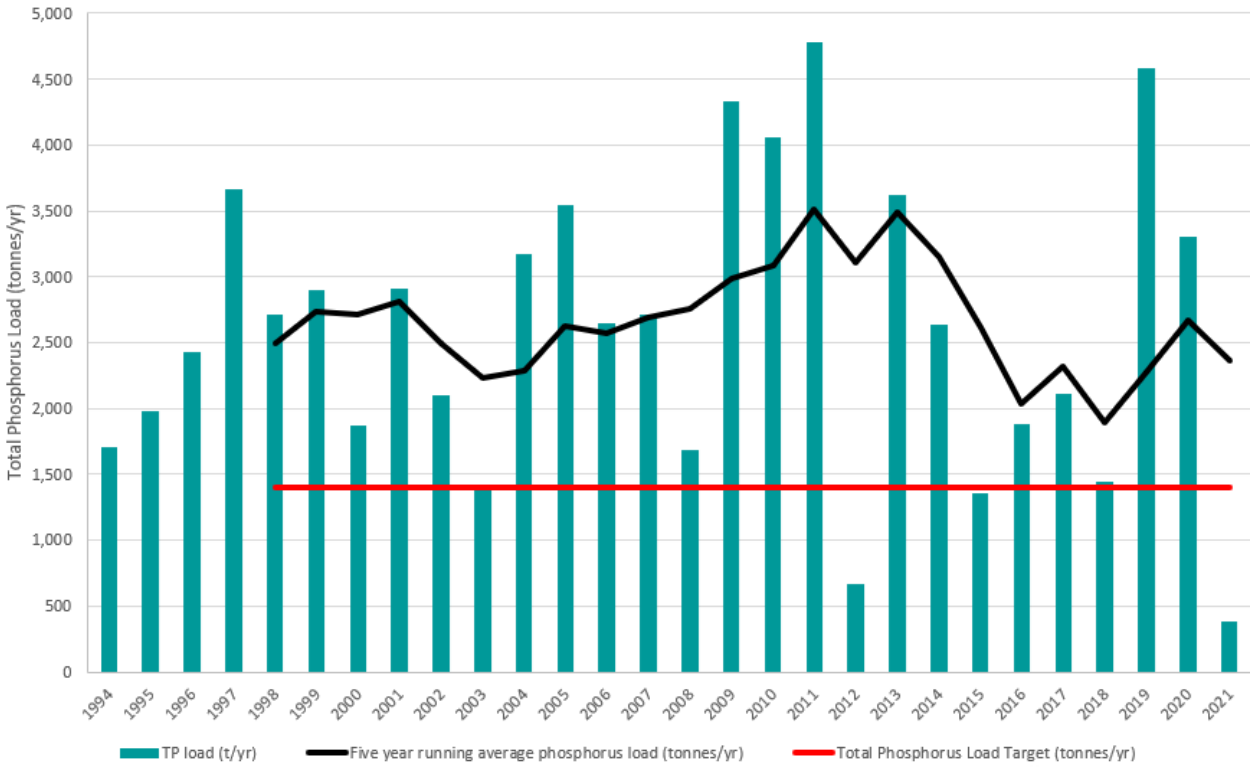

Figure 5: Total Phosphorus Loads – Red River at the International Boundary

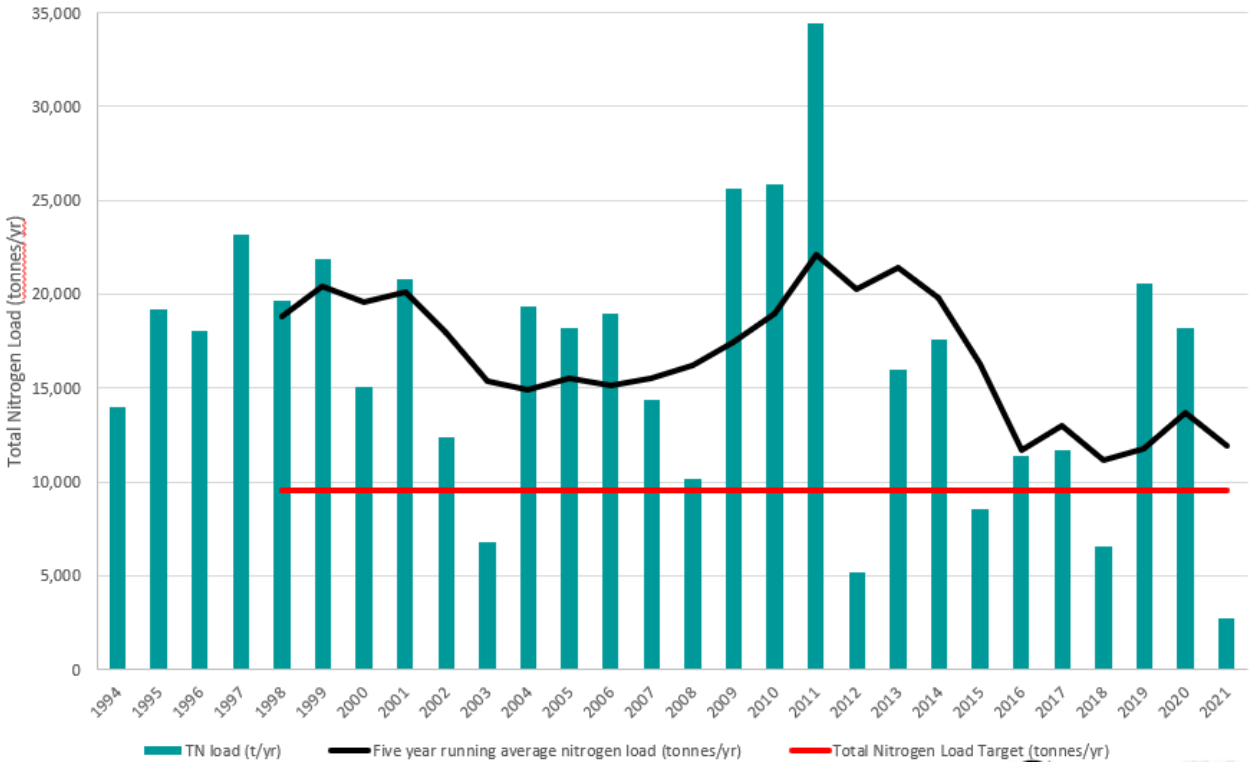

Figure 6: Total Nitrogen Loads – Red River at the International Boundary

APPENDIX B – Water Quality Alert Levels

The former International Red River Pollution Board established alert levels for suites of pesticides, metals and toxic substances in 1986. For pesticides, the alert level is described as "not detectable in water", while specific metals have concentration values for alert levels. The following table details the number of alerts detected by Environment & Climate Change Canada (Water Quality Monitoring and Surveillance Division) during the reporting period (Table B1).

Metals

A total of 53 water samples were collected and analyzed for metals and toxic substances during the reporting period (Table B1). Four metals were detected in exceedance of alert levels. Cadmium, manganese and iron each had exceedance rates of 94-100%, with maximum values detected in April 2022. Iron and manganese are components in natural soils; however, the detection of higher levels of cadmium may indicate anthropogenic sources. Higher metals concentrations tend to correspond to higher flow and higher particulate matter events. The exceedance rates seen this water year are consistent with rates in recent years for these metals.

Zinc exceeded the alert level in one sample. The toxic substance arsenic also exceeded the alert level in one sample. Until recently, arsenic exceedances were rare, but a single arsenic exceedance has been observed in each of the last three water years.

Table B1 Exceedances of Alert Levels, Red River at International Boundary

October 1, 2021 to September 30, 2022

Parameter	Units	Alert Level	Number of Samples	Number of Exceedences %	Maximum Exceedence Value (Month)	Canadian Environmental Quality Guideline
Metals (total):						
Cadmium	µg/L	Detect	53	**53 (100%)**	1.59 (Apr)	0.37ug/L[1]
Chromium	µg/L	50	53	0	--	NG
Iron	µg/L	300	53	**50 (94%)**	17500 (Apr)	300 ug/l[1]
Manganese	µg/L	50	53	**50 (94%)**	1600 (Apr)	200 ug/L[2]
Selenium	µg/L	10	53	0	--	1 ug/l[1]
Zinc	µg/L	47	53	3 (6%)	100 (Apr)	30 ug/l[1]
Toxic Substances:						
Arsenic	µg/L	10	53	1 (2%)	12.2 (Apr)	5 ug/l[1]
Boron	µg/L	500	53	0	--	29 mg/l[1]
Total PCB	ng/L	Detect	--	--	--	NG
Pesticides:						
2,4-D	ng/L	Detect	17	**17 (100%)**	401 (Jul)	4000 ng/l[1]
Bromoxynil	ng/L	Detect	17	**5 (29%)**	8.07 (Sep)	5000 ng/l[1]
Clopyralid	ng/L	Detect	17	**7 (41%)**	80.8 (Oct)	NG[5]
Dicamba	ng/L	Detect	17	**12 (71%)**	873 (Jul)	10000 ng/l[1]
Imazamethabenz-methyl a	ng/L	Detect	17	**0**	--	NG
Imazamethabenz-methyl b	ng/L	Detect	0	--	--	NG
MCPA	ng/L	Detect	17	**16 (94%)**	149 (Jul)	2600 ng/l[1]
Mecoprop (MCPP)	ng/L	Detect	17	**12 (71%)**	19.9 (Oct)	NG
Picloram	ng/L	Detect	17	**2 (12%)**	72.2 (Nov)	29000 ng/l[1]
Aldrin	ng/L	Detect	0	--	--	NG
g-Benzenehexachloride	ng/L	Detect	17	0	--	10 ug/l[1]
Pentachloroanisole	ng/L	Detect	0	--	--	NG
Atrazine	ng/L	Detect	17	**17 (100%)**	1130 (Jul)	1800 ng/l[1]
Desethyl Atrazine	ng/L	Detect	17	**15 (88%)**	128 (Jul)	NG
Metolachlor	ng/L	Detect	17	**17 (100%)**	1600 (Jul)	7800 ng/l[1]
P,P-DDE	ng/L	Detect	17	0	--	NG
Alpha-Endosulfan	ng/L	Detect	17	0	--	3 ng/l[1,4]
Beta-Endosulfan	ng/L	Detect	17	0	--	3 ng/l[1,4]
Heptachlor Epoxide	ng/L	Detect	0	--	--	NG
Metribuzin	ng/L	Detect	17	**9 (53%)**	101 (Jul)	1000 ng/l[1]

Notes:

1. Canadian Water Quality Guidelines for the Protection of Aquatic Life (http://st-ts. ccme. ca/)
2. Canadian Water Quality Guidelines for the Protection of Agriculture (http://st-ts. ccme. ca/)
3. Guideline value corrected for minimum value for hardness (mg/L CaCO3) in the reporting period (http://st-ts. ccme. ca/?lang=en&factsheet=93)
4. Guideline value is for technical grade Endosulfan, which is a mixture of the two biologically active isomers (α and β)
5. NG = No guideline established

Pesticides

Based on a total of up to 17 water samples, 11 pesticides and metabolites with alert levels (greater than detection concentration) were monitored during the 2021-2022 water year (Table B1). Three compounds (2,4-D, Atrazine, Metolachlor) were detected in 100% of the samples. The detection levels for all compounds were all below the Canadian Guidelines for the Protection of Aquatic Life. Given that the Red River basin is an agriculturally dominated region, the presence of pesticides is expected. The detection of banned pesticides (legacy contaminants) is not unusual given the slow bio-degradation rate of these chemicals. No legacy contaminants were detected during this reporting period.

Environment and Climate Change Canada recently enhanced the pesticide analyses to assess current use pesticide concentrations during open water conditions (May to October). The analysis have been expanded to include a broader range of pesticides. These include insecticides (neonicotinoids), herbicides (sulfonyl urea) and fungicide pesticides. In 2021-22, detections included 8 of 14 insecticides, 8 of 17 herbicides and 12 of 14 fungicides. The pesticides with the highest frequency of detection are summarized in Table B2.

The IRRWB continues to closely monitor trends in these concentrations and their frequency of detection with the intention to update its assessment as new scientific information becomes available. The IRRWB recognizes that there is very little scientific information available to assess the implications of long-term exposure to low concentrations of pesticides and herbicides by aquatic organisms and humans.

Table B2 Detections of Current Use Pesticides, Red River at International Boundary					
October 1, 2021 to September 30, 2022 Water Year					
Parameter	**Units**	**Number of Samples**	**Detections (%)**	**Maximum Value (Month)**	**Canadian Environmental Quality Guideline[1]**
Fungicides					
Azoxystrobin	ng/L	12	92	68.1 (Aug)	NG[2]
Boscalid	ng/L	12	92	33.9 (Aug)	NG
Cyproconazole 1	ng/L	12	67	7.86 (Jul)	NG
Cyproconazole 2	ng/L	12	58	8.21 (Jul)	NG
Metconazole	ng/L	12	42	1.51 (Aug)	NG
Propiconazole	ng/L	12	100	58.6 (Jul)	NG
Pyraclostrobin	ng/L	12	67	1.08 (Mar)	NG
Pyrimethanil	ng/L	12	25	0.497 (Aug)	NG
Tebuconazole	ng/L	12	92	27.3 (Aug)	NG
Tetraconazole	ng/L	12	92	5.64 (Mar)	NG
Insecticides (Neonicotinoids)					
Acetamiprid	ng/L	12	50	0.394 (Nov)	NG
Chlorantraniliprole	ng/L	12	75	3.1 (Jul)	NG
Clothianidin	ng/L	12	92	37.5 (Mar)	NG
Dinotefuram	ng/L	12	42	1.47 (Nov)	NG
Imidacloprid	ng/L	12	92	14.9 (Jul)	2301
Thiamethoxam	ng/L	12	92	17.8 (Jul)	NG
Herbicides (Sulfonyl Ureas)					
Chlorsulfuron	ng/L	12	17	0.357 (Oct)	NG
Diuron	ng/L	12	92	8 (Oct)	NG
Flumetsulam	ng/L	12	92	46.2 (Jul)	NG
Fomesafen	ng/L	17	100	119 (Dec)	NG
Metsulfuron	ng/L	12	58	1.24 (Jul)	NG
Tribenuron	ng/L	12	42	6.29 (Jul)	NG
1. Canadian Water Quality Guidelines for the Protection of Aquatic Life (http://st-ts. ccme. ca/)					
2. NG = No guideline established					

APPENDIX C

Jurisdictional Monitoring in the Red River Basin in 2022

C-1 Manitoba

2023

MANITOBA STATUS REPORT

TO

THE INTERNATIONAL RED RIVER WATERSHED BOARD (IRRWB)

FOR THE

WATER YEAR OCTOBER 1, 2021 TO SEPTEMBER 30, 2022

1. Surface Water Quality Monitoring Program

During the 2021-2022 water year, Manitoba Environment and Climate continued its routine long-term monitoring of surface water quality within the Red River watershed. Sampling was conducted on a monthly frequency at three sites along the main stem of the Red River within Manitoba. These sites were located at Emerson, MB; upstream of the City of Winnipeg at the Floodway inlet control structure at St. Norbert, MB; and downstream of the City of Winnipeg at Selkirk, MB (Figure 1). Additionally, joint federal/provincial paired samples were collected at the Selkirk monitoring location for quality control/quality assurance purposes to ensure the long-term consistency of comparability between federal and provincial datasets. Water quality parameters measured included physical parameters, general chemistry, suspended sediment, bacteria, trace elements, nutrients, and agricultural chemicals. Long-term water quality parameters monitored by Manitoba Environment and Climate are shown in Table 1. Benthic macroinvertebrates were also collected from the Red River at Emerson and Selkirk in September 2022.

As part of its regular Red River watershed monitoring, Manitoba Environment and Climate also conducted routine monitoring at nine sites on seven tributary streams to the Red River (Figure 1) during the 2021-2022 water year. Tributary sites are typically monitored on a quarterly basis (October, December/January, April and July) throughout the water year. Tributary samples were analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, nutrients and agricultural chemicals. Long-term monitoring of tributary streams allows Manitoba Environment and Climate to identify potential sources of pollution to the Red River and develop management strategies that address existing and emerging water quality issues within the Red River watershed.

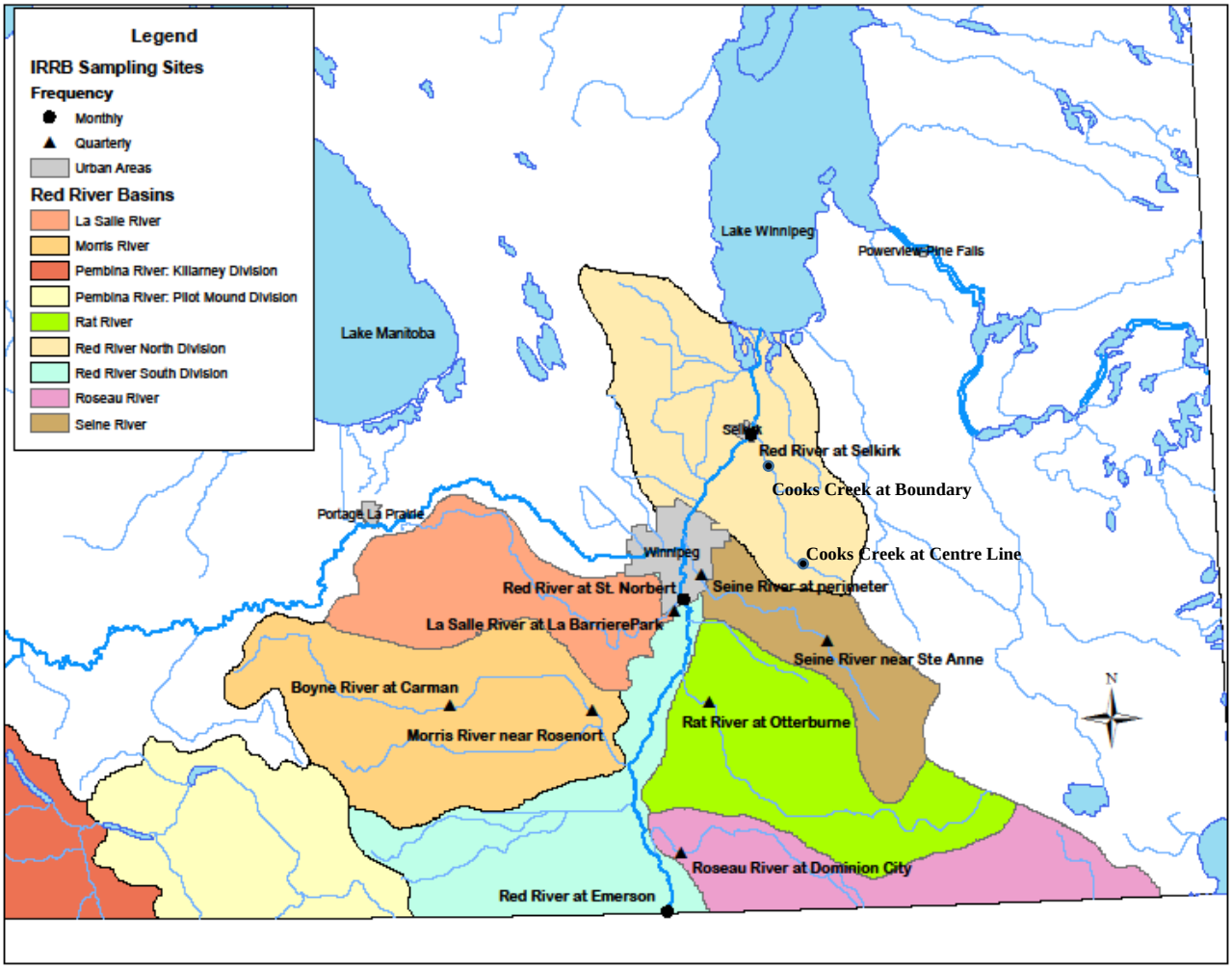

Figure 1. Location of water quality and benthic invertebrate sampling sites in the Red River watershed (Manitoba). Benthic invertebrates are collected once per year from the Red River at Emerson, MB and Selkirk, MB sites.

Table 1. Routine surface water quality monitoring parameters monitored by Manitoba Environment and Climate on the Red River and tributary sites within Manitoba, Canada.

Parameter	MDL [1]	Units
Physical		
Colour, True	5	CU
Turbidity	0.1	NTU
Temperature		°C
Total Suspended Solids	1	mg/L
Total Dissolved Solids	4	mg/L
Specific Conductivity	1	umhos/cm
Biological		
Escherichia coli (*E. coli*)	1	MPN/100 mL
Chemical		
General Chemistry		
pH	0.1	pH units
Hardness (as CaCO3)	0.2	mg/L
Dissolved Oxygen	0.1	mg/L
Biochemical Oxygen Demand	1	mg/L
Total Alkalinity (as CaCO3)	1	mg/L
Carbonate (CO3)	0.6	mg/L
Bicarbonate (HCO3)	1.2	mg/L
Hydroxide (OH)	0.34	mg/L
Chloride (Cl)	0.1	mg/L
Sulfate (SO4)	0.3	mg/L
Total Carbon	1	mg/L
Total Inorganic Carbon	0.5	mg/L
Total Organic Carbon	0.5	mg/L
Chlorophyll a	0.1	ug/L
Phaeophytin a	0.1	ug/L
Anion Sum	0.1	
Cation Sum	0.1	
Cation - Anion Balance	-100	
Nutrients		
Total Ammonia (as N)	0.01	mg/L
Total Nitrogen	0.2	mg/L
Total Kjeldahl Nitrogen	0.2	mg/L
Nitrate and Nitrite (as N)	0.005	mg/L
Nitrite (as N)	0.001	mg/L
Nitrate (as N)	0.005	mg/L
Total Phosphorus	0.003	mg/L
Total Dissolved Phosphorus	0.003	mg/L
Total Particulate Phosphorus	0.0042	mg/L
Total Inorganic Phosphorus	0.003	mg/L
Total Acid-Hydrolyzable Phosphorus	0.0042	mg/L
Total Reactive Phosphorus	0.003	mg/L

Parameter	MDL [1]	Units
Chemical - cont'd		
Total Metals		
Aluminum	3	ug/L
Antimony	0.1	ug/L
Arsenic	0.1	ug/L
Barium	0.1	ug/L
Beryllium	0.1	ug/L
Bismuth	0.05	ug/L
Boron	10	ug/L
Cadmium	0.005	ug/L
Calcium	50	ug/L
Cesium	0.01	ug/L
Chromium	0.1	ug/L
Chromium Hexavalent	0.5	ug/L
Cobalt	0.1	ug/L
Copper	0.5	ug/L
Iron	10	ug/L
Lead	0.05	ug/L
Lithium	1	ug/L
Magnesium	5	ug/L
Manganese	0.1	ug/L
Molybdenum	0.05	ug/L
Nickel	0.5	ug/L
Potassium	50	ug/L
Rubidium	0.2	ug/L
Selenium	0.05	ug/L
Silicon	100	ug/L
Silver	0.01	ug/L
Sodium	50	ug/L
Strontium	0.2	ug/L
Tellurium	0.2	ug/L
Thallium	0.01	ug/L
Thorium	0.1	ug/L
Tin	0.1	ug/L
Titanium	0.3	ug/L
Tungsten	0.1	ug/L
Uranium	0.01	ug/L
Vanadium	0.5	ug/L
Zinc (Zn)	3	ug/L
Zirconium	0.2	ug/L
Mercury	0.005	ug/L
Dissolved Metals		
Aluminum	1	ug/L

Parameter	MDL [1]	Units
Chemical - cont'd		
Pesticides		
Chlorothalonil	0.05	ug/L
Triclopyr	0.05	ug/L
AMPA	0.5	ug/L
Glyphosate	0.2	ug/L
Pentachlorophenol	0.02	ug/L
2,4-D	0.05	ug/L
2,4-DB	0.05	ug/L
2,4-DP	0.05	ug/L
Bromoxynil	0.02	ug/L
Dinoseb	0.05	ug/L
MCPA	0.025	ug/L
Mecoprop	0.05	ug/L
Picloram	0.2	ug/L
Dicamba	0.006	ug/L
Alachlor	0.1	ug/L
Atrazine	0.1	ug/L
Atrazine-desethyl	0.05	ug/L
Azinphos-methyl	0.1	ug/L
Carbofuran	0.2	ug/L
Chlorpyrifos	0.02	ug/L
Cyanazine	0.1	ug/L
Diazinon	0.03	ug/L
Diclofop-methyl	0.1	ug/L
Dimethoate	0.1	ug/L
Malathion	0.1	ug/L
Methyl Parathion	0.1	ug/L
Metribuzin	0.2	ug/L
Parathion	0.1	ug/L
Simazine	0.1	ug/L
Terbufos	0.1	ug/L
Triallate	0.1	ug/L
Trifluralin	0.03	ug/L
a-chlordane	0.008	ug/L
gamma-hexachlorocyclohexane	0.008	ug/L
g-chlordane	0.008	ug/L
Methoxychlor	0.008	ug/L
Carboxin	0.1	ug/L
Diuron	0.018	ug/L
Eptam	0.2	ug/L
Fenoxaprop	0.1	ug/L
Imazamethabenz-methyl	0.01	ug/L
Metsulfuron-methyl	0.01	ug/L
Propanil	0.2	ug/L
Propoxur	0.2	ug/L
Quizalofop	0.1	ug/L
Sethoxydim	0.1	ug/L
Thifensulfuron-methyl	0.01	ug/L
Tralkoxydim	0.1	ug/L
Benomyl	0.1	ug/L
Deltamethrin	0.04	ug/L
Tribenuron-methyl	0.01	ug/L
Ethalfluralin	0.02	ug/L
Bromacil	0.1	ug/L

[1]: Minimum detection limit of analytical method

1.1 Red River – Main Stem

During this reporting period, water quality in the Manitoba reach of the Red River main stem remained similar to previous years for most parameters monitored. In general, dissolved oxygen concentrations in the Red River were sufficient to support aquatic life and were within the historical range with a mean concentration of 8.39 mg/L upstream of the City of Winnipeg at St. Norbert and 8.42 mg/L downstream of the City of Winnipeg at Selkirk (Figure 2). The lowest dissolved oxygen concentrations observed during the current reporting period were 5.5 mg/L in July 2022 at St. Norbert, and 6.3 mg/L in June 2022 at Selkirk. All dissolved oxygen concentrations observed were above the 5.0 mg/L threshold required for the protection of aquatic life (Manitoba Water Quality Standards, Objectives, and Guidelines, 2011).

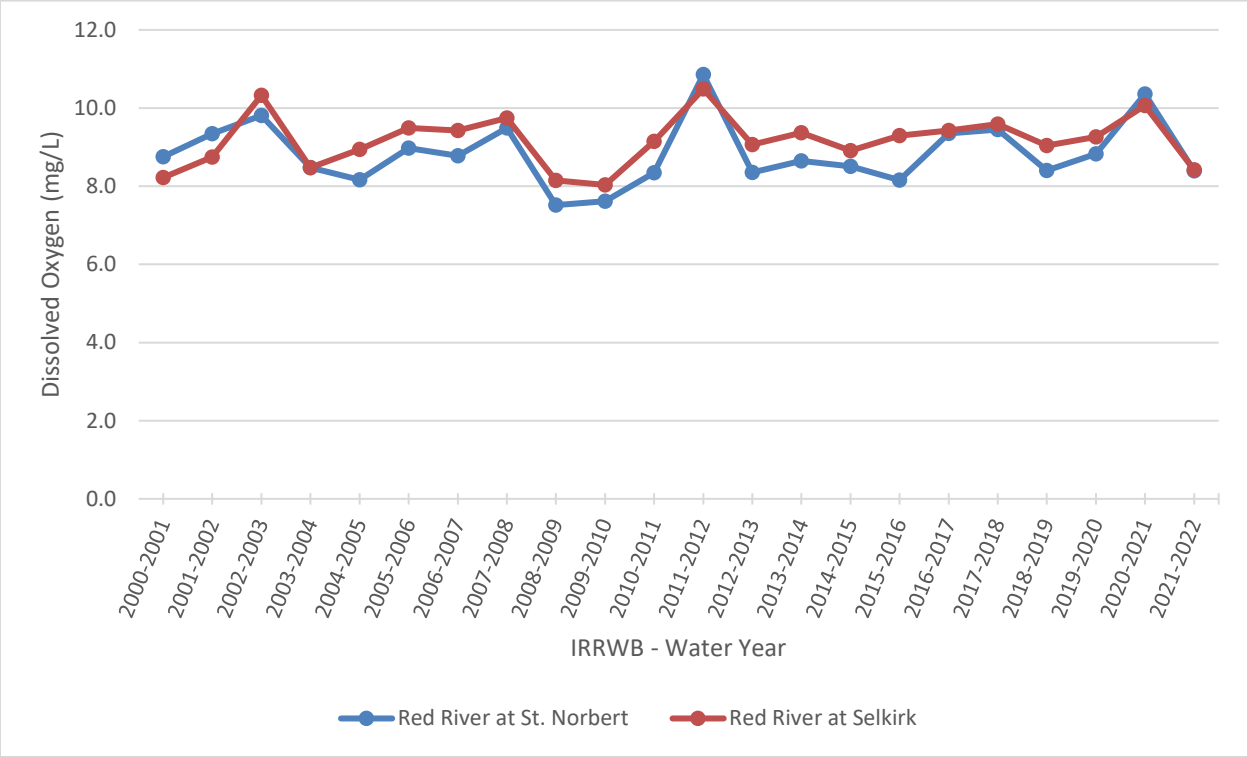

Figure 1: Mean annual (water year) dissolved oxygen (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

Densities of *Escherichia coli* (*E. coli*) bacteria downstream of the City of Winnipeg at Selkirk were substantially higher than previous reporting periods (Figure 3). The mean density downstream of the City of Winnipeg at Selkirk was 675 organisms per 100 mL, compared to 214 organisms per 100 mL during the previous reporting period. Ten of the 16 samples collected from this site had measured *E.coli* densities greater than the Manitoba recreational water quality objective of 200 organisms per 100 mL (Manitoba Water Quality Standards, Objectives, and Guidelines, 2011). Furthermore, of the 10 samples with observed exceedances of the recreational water quality objective, eight had measured densities above 770 organisms per 100 mL, or nearly four-times greater than the objective, while five had measured densities above 1,000 organisms per 100 mL. The maximum *E.coli* density observed at Selkirk was 1,990 organisms per 100 mL during the February 2022 sampling period, while the lowest measurement was observed in

September 2022 at 15 organisms per 100 mL. All ten of the samples with measured densities above the recreational guideline occurred in the period between December 2021 and June 2022 (11 total samples collected during this period). In contrast, all samples collected from the upstream reach of the Red River at St. Norbert were measured below the Manitoba recreational water quality objective, with a mean *E. coli* density of 34 organisms per 100 mL (Figure 3). The maximum *E. coli* density observed at St. Norbert was 179 organisms per 100 mL during the October 2021 sampling period, while the lowest measurement was observed in August 2022 at 2 organisms per 100 mL.

The cause of the large differences observed in *E.coli* bacteria densities between the upstream (St. Norbert) and downstream (Selkirk) sampling locations along the main stem Red River is unclear at this time. As was the case throughout much of the Red River watershed during the 2022 spring freshet period, Manitoba experienced extremely high water levels on the majority of watercourses in the southern and central portions of the Province. In particular, the 2022 spring freshet period resulted in the sixth-largest flooding event along the Red River since European settlement. Because of these high river water levels and high surface runoff volumes entering the City of Winnipeg's municipal sewage and drainage infrastructure, the City of Winnipeg experienced multiple combined-sewer-overflow events, which resulted in the discharge of untreated wastewater directly to the river. Additionally, during this same period, the City of Winnipeg's Water and Waste Department was forced to shut down the UV treatment facilities at both of its two largest wastewater treatment plants for intermittent durations to protect against damage to these UV treatment facilities. It is likely that these events contributed to the elevated *E.coli* densities observed at the downstream monitoring location in Selkirk. However, while the high water levels / combined-sewer-overflow events may potentially explain the elevated *E.coli* densities observed during the spring 2022 (March to June) period, they do not provide any meaningful insight into the potential causes of elevated densities observed at Selkirk during the December 2021 to February 2022 monitoring periods.

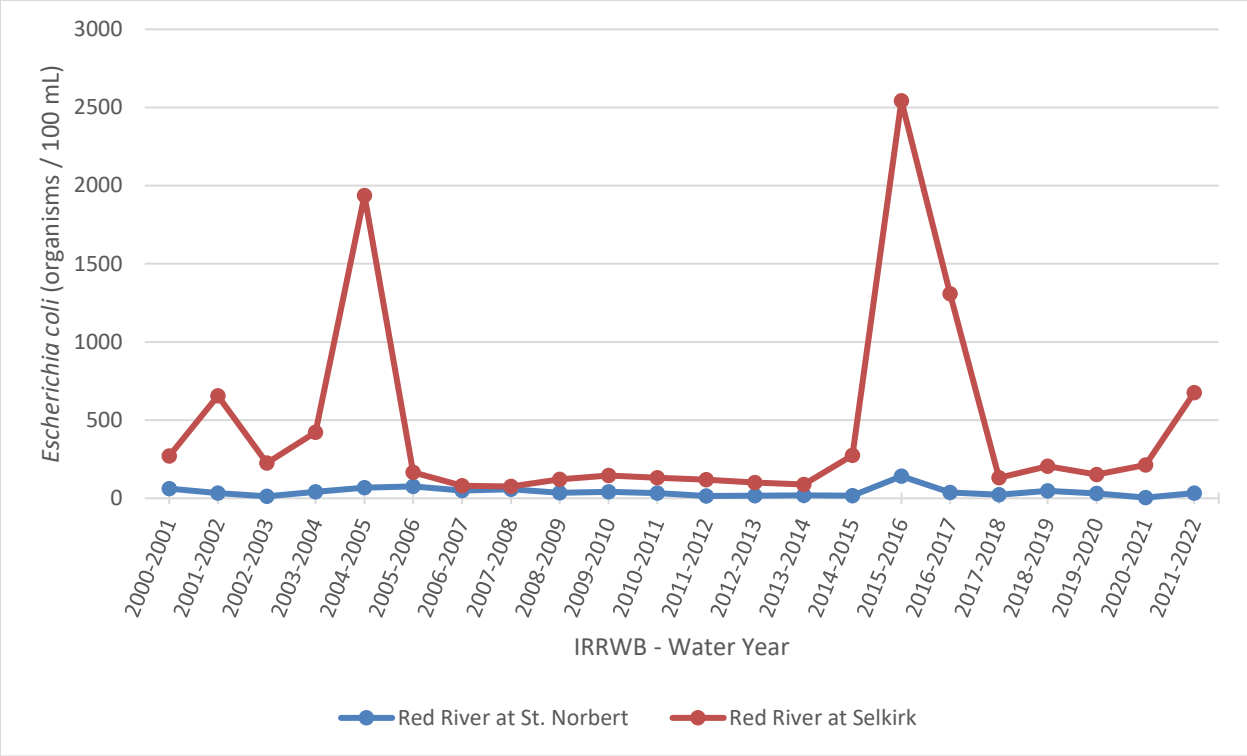

Figure 2: Mean annual (water year) *Escherichia coli* densities (organisms/100 mL) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

During the 2021-2022 water year, concentrations of total chloride, total sulphate and total dissolved solids were similar to previous reporting periods. The mean total chloride concentrations observed were 53.1 mg/L at St. Norbert and 47.3 mg/L at Selkirk (Figure 4). The highest measurements for total chloride were 115 mg/L at St. Norbert and 92.5 mg/L at Selkirk, both occurring during the October 2021 sampling period. Minimum total chloride concentrations occurred during the May 2022 sampling period at both locations, with 8.98 mg/L and 10.5 mg/L at St. Norbert and Selkirk, respectively. Mean total sulphate concentrations observed were 245.8 mg/L at St. Norbert and 215.0 mg/L at Selkirk (Figure 5). The highest concentration of total sulphate was 656 mg/L at St. Norbert and 515 mg/L at Selkirk, both occurring during the January 2022 sampling period. Minimum total sulphate concentrations occurred during April 2022 at both locations, with 61.7 mg/L and 50.8 mg/L at St. Norbert and Selkirk, respectively. Similar to total chloride and sulphate concentrations, total dissolved solids concentrations were very similar between the two Red River sites, as well as, between the previous water year for each of the respective sites (Figure 6). The mean total dissolved solids concentrations observed were 676 mg/L at St. Norbert and 621 mg/L at Selkirk. The highest measurements for total dissolved solids were 1,390 mg/L at St. Norbert and 1,190 mg/L at Selkirk, both occurring during the January 2022 sampling period. Minimum total dissolved solids concentrations occurred during the April 2022 at both locations, with 288 mg/L at St. Norbert and 267 mg/L at Selkirk.

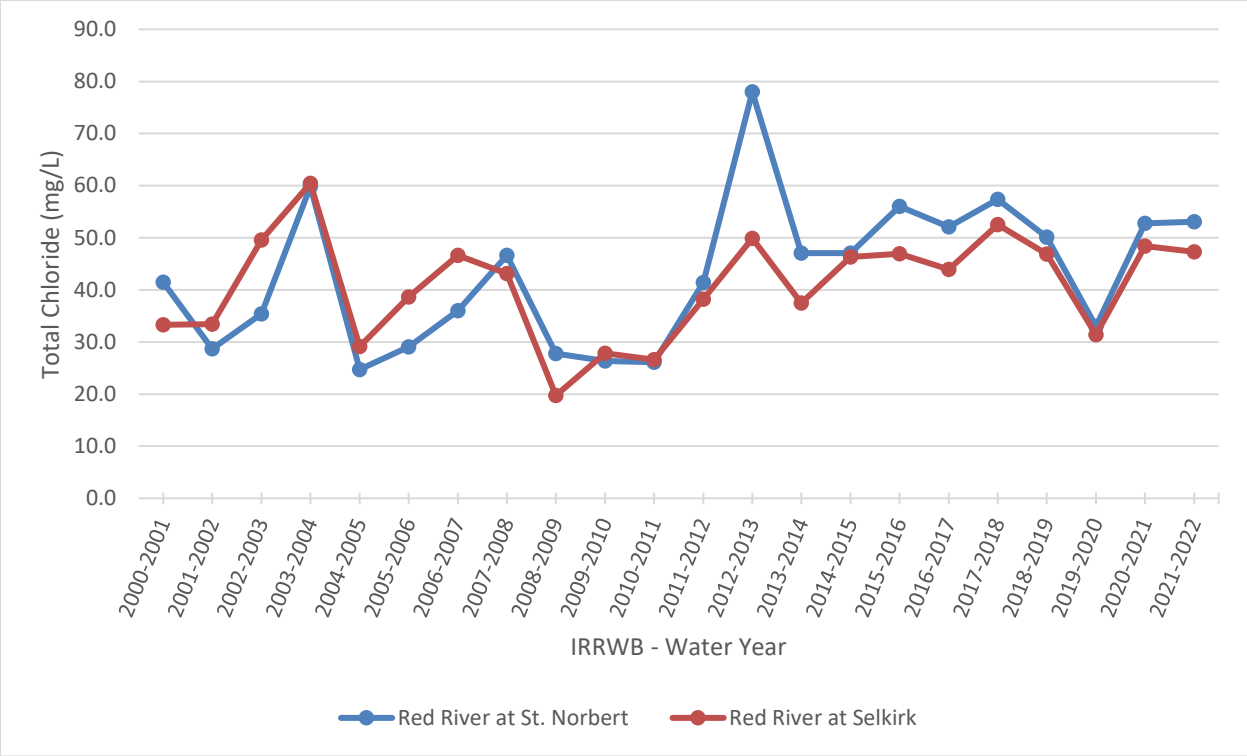

Figure 3: Mean annual (water year) total chloride (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

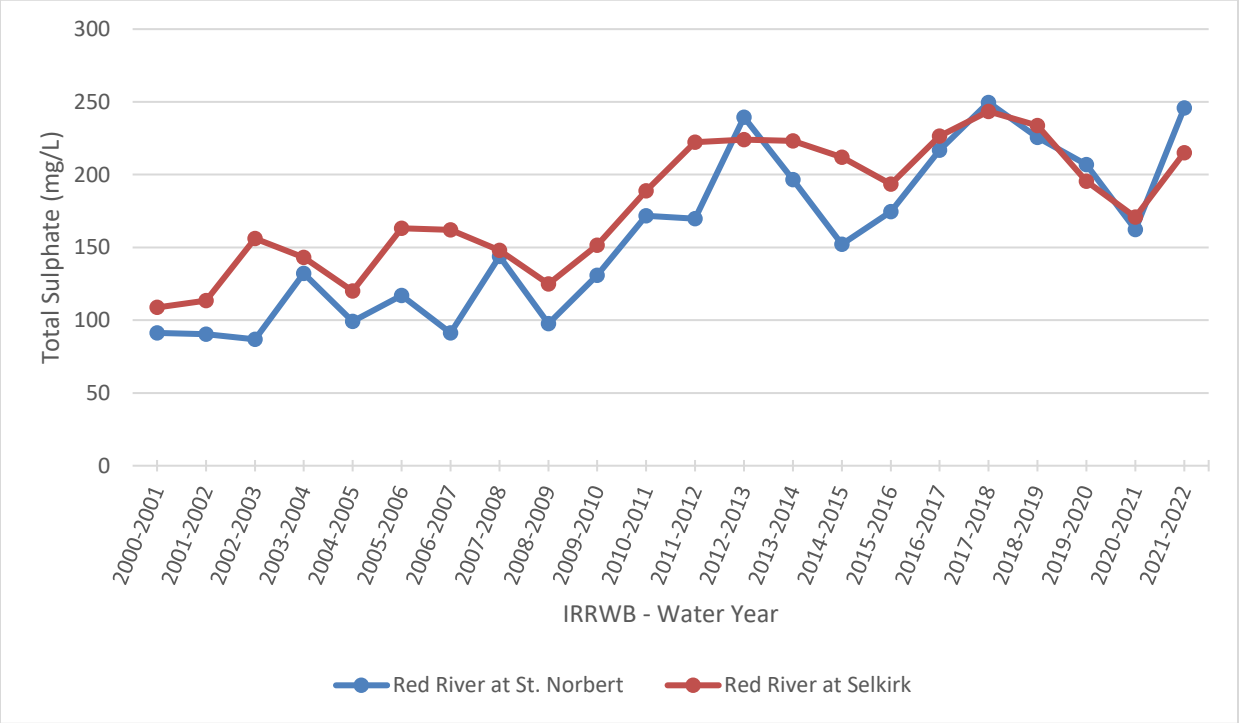

Figure 4: Mean annual (water year) total sulphate (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

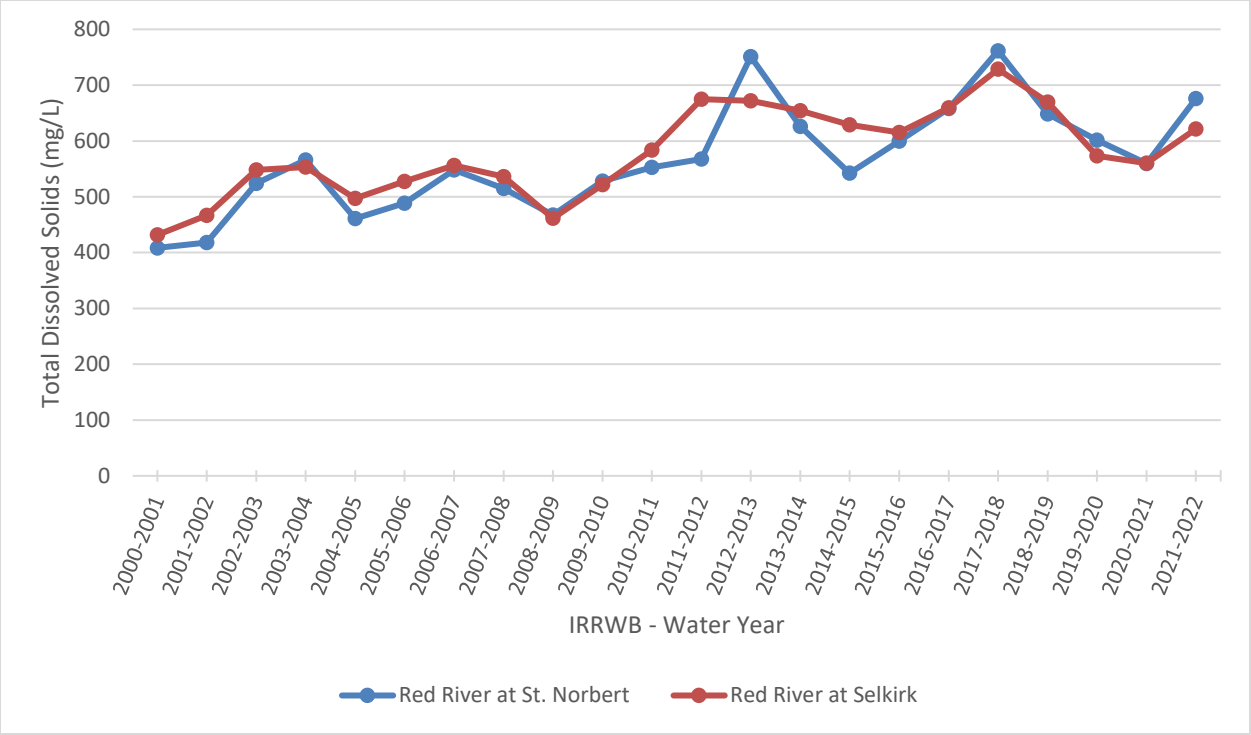

Figure 5: Mean annual (water year) total dissolved solids (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

Similar to previous years, total nutrient concentrations observed along Manitoba's Red River main stem monitoring sites were high during the 2021-2022 water year. Mean concentrations of total phosphorus at St. Norbert and Selkirk were 0.414 and 0.419 mg/L, respectively (Figure 7). Maximum concentrations of total phosphorus were observed in January 2022 at St. Norbert (0.887 mg/L) and April 2022 at Selkirk (0.759 mg/L). Minimum concentrations of total phosphorus observed at both main stem sites were also relatively high, with 0.128 and 0.221 mg/L measured at St. Norbert and Selkirk, respectively. Mean concentrations of total nitrogen at St. Norbert and Selkirk were 2.47 and 2.85 mg/L, respectively (Figure 8). Maximum concentrations of total nitrogen were observed in January 2022 at St. Norbert (3.59 mg/L) and February 2022 at Selkirk (5.23 mg/L). Minimum concentrations of total nitrogen observed were 1.16 mg/L and 1.45 mg/L at St. Norbert and Selkirk, respectively.

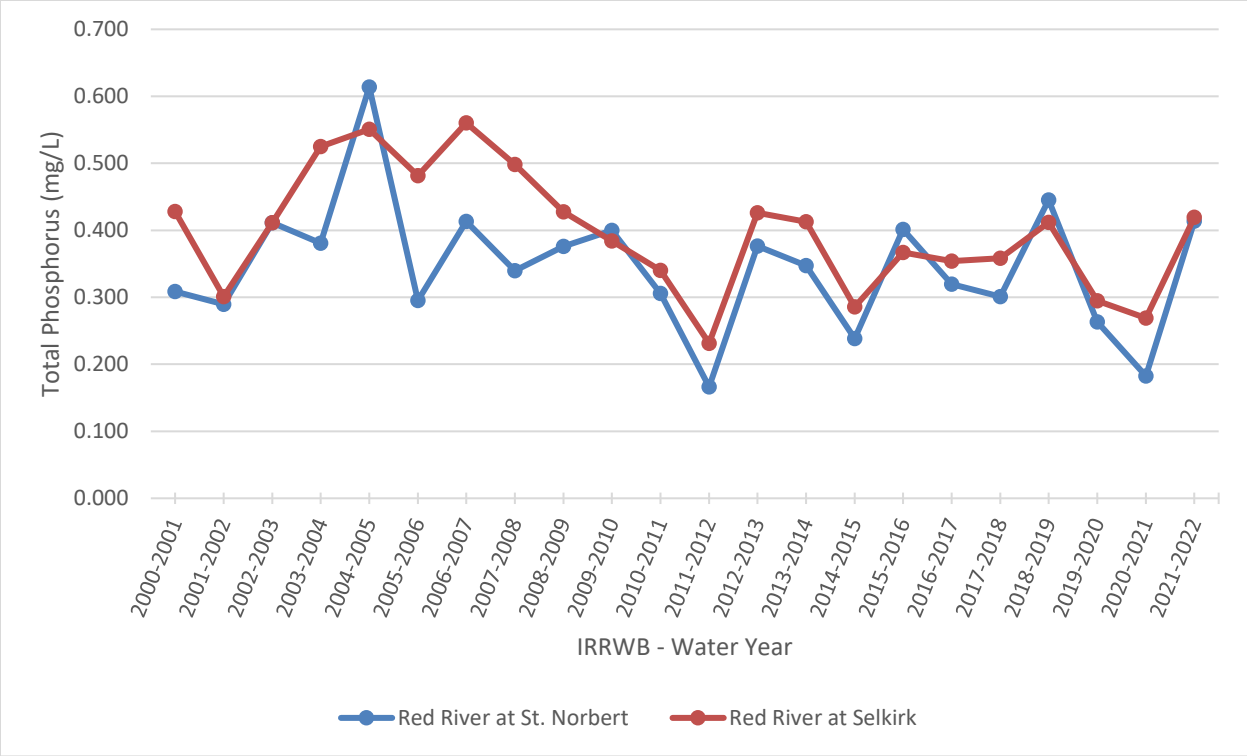

Figure 6: Mean annual (water year) total phosphorus (mg/L) for Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

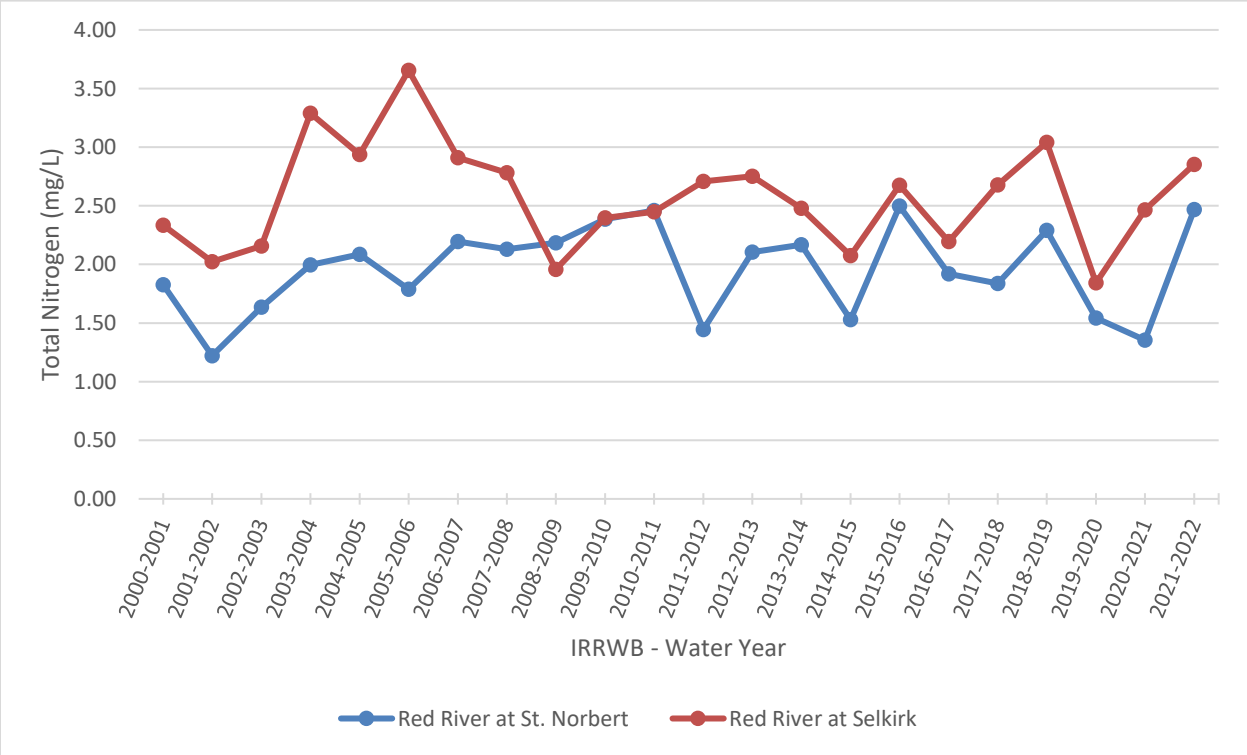

Figure 7: Mean annual (water year) total nitrogen (mg/L) for Red River at St. Norbert and Selkirk, MB from 2000 to 2022.

During this reporting period, 12 samples were analyzed for routine pesticide screening upstream of the City of Winnipeg on the Red River at St. Norbert. Of the 53 routinely monitored pesticides, nine were detected (17 per cent rate of detection) in the Red River at St. Norbert, which represents a modest increase from the previous reporting period (11 per cent rate of detection). Dicamba and 2,4-D were the most commonly detected pesticides with seven (58 per cent rate of detection) and eight (67 per cent rate of detection) detections, respectively. Atrazine, Glyphosate, AMPA and Pentachlorophenol were each detected on two occasions (17 per cent rate of detection) during the current reporting period, while Atrazine Desethyl, Bromoxynil and MCPA were each detected once (8 per cent rate of detection). Dicamba exceeded the irrigation guideline of 0.006 µg/L for all samples with detectable concentrations ranging from 0.0354 to 0.048 µg/L or nearly six to eight times greater than the irrigation guideline. None of the other pesticides detected upstream of Winnipeg exceeded water quality guidelines (where available) for drinking water, protection of aquatic life, irrigation, or livestock uses.

Twelve samples were also collected from downstream of the City of Winnipeg at Selkirk during the current reporting period and analyzed for pesticides. Similar to the upstream site, nine of the 53 routinely monitored pesticide species were detected (17 per cent detection rate) during the current reporting period. This represents a slight decrease in the overall number of pesticide species detected versus the 11 detected at this site in the previous reporting year. As with the upstream site, Dicamba and 2,4-D were the most commonly detected pesticides in the Red River at Selkirk, with six (50 per cent rate of detection) and seven detections (58 per cent rate of detection), respectively. Atrazine and Glyphosate were each detected twice (17 percent detection rate), while Atrazine Desethyl, MCPA, AMPA, Bromoxynil and Pentachlorophenol were each detected once (8 percent detection rate). Similar to the Red River at St. Norbert site, Dicamba exceeded the irrigation guideline (0.006 µg/L) for all samples with detections at Selkirk with concentrations ranging from 0.031 to 0.300 µg/L or nearly five to 50 times greater than the irrigation guideline. None of the other pesticides detected downstream of Winnipeg exceeded water quality guidelines (where available) for drinking water, protection of aquatic life, irrigation, or livestock uses.

1.2 Red River - Tributary Streams

During this reporting period, nine sampling sites on seven tributary rivers (Boyne, Rat, Roseau, Morris, La Salle, and Seine (two sites) rivers and Cooks Creek (two sites)) were each sampled four times, during October, December/January, April and July. In general, water quality parameters in these Red River tributaries remained comparable to previous years for most of the observations collected. However, several sites did experience some unusually low measurements throughout the water year. Interestingly, while mean dissolved oxygen concentrations among tributary sites were similar to previous reporting periods, ranging from 5.2 mg/L to 8.9 mg/L; several sites did experience incidences of very low dissolved oxygen concentrations. Of the thirty-six samples analyzed for dissolved oxygen among tributary sites, 10 samples (28 per cent) failed to meet the minimum water quality objective of 5 mg/L, compared to 22 per cent of samples (eight samples) failing to meet the objective in the previous reporting period. In particular, of the 10 samples that failed to meet the objective, eight samples were measured below 3.6 mg/L, while five of those samples had very low dissolved oxygen concentrations below 2 mg/L (Morris River, Boyne River, La Salle River, Seine River and Cooks Creek) during the winter sampling period

(December 2021 / January 2022). While it is not unusual to experience incidences of low dissolved oxygen concentrations at some of the tributary sites throughout the year, these are usually short-lived events, and levels sufficient to support aquatic life typically return relatively quickly, as was the case during the current reporting period.

The mean density of *E. coli* bacteria observed among all the Red River tributary sites during the current reporting period was 50 organisms per 100 mL, with a range of one to 416 organisms per 100 mL. Only two of the 48 samples collected from the Red River tributary sites failed to meet Manitoba's recreational water quality objective of 200 organisms per 100 mL during the current reporting period. The two samples with exceedances occurred during the April 2022 sampling period at the Rat River (236 organisms per 100 mL), and during the July 2022 sampling period at the Cooks Creek at Boundary site (387 organisms per 100 mL).

During the 2021-2022 water year, concentrations of total chloride, total sulphate and total dissolved solids were similar to previous reporting periods. The mean total chloride concentration observed among all tributary sites was 36.2 mg/L. The highest measurements for total chloride occurred at the La Salle River during the October 2021 and January 2022 sampling periods, with 180 mg/L and 306 mg/L, respectively. All other samples analyzed for total chloride among the tributary sites had concentrations below 82 mg/L. The mean total sulphate concentration for all tributary sites was 44.7 mg/L. The highest total sulphate concentrations observed were 365 mg/L at the Morris River and 175 mg/L at the La Salle River, both occurring during the January 2022 sampling period. All other total sulphate measurements were less than 100 mg/L. The mean total dissolved solids concentration was 390 mg/L for all the tributary sites monitored during the current water year. The highest measurements for total dissolved solids were 1,450 mg/L at the Morris River and 1,080 mg/L at the La Salle River, both occurring during the January 2022 sampling period.

Similar to the provincial main stem Red River monitoring sites, total nutrient concentrations observed at the tributary sites were relatively high during the 2021-2022 water year. The mean concentration of total phosphorus among all tributary sites was 0.436 mg/L, with a maximum concentration of 2.16 mg/L observed at the Morris River during the January 2022 monitoring period. Additionally, three other samples had measured total phosphorus concentrations above 1.0 mg/L, at the Rat River in April 2022 and at the furthest upstream Cooks Creek site in October and December 2021. Only five of the 48 samples analyzed for total phosphorus among the tributary sites during the 2021-2022 water year were observed below Manitoba's narrative water quality guideline of 0.05 mg/L. Total nitrogen concentrations observed among all tributary sites ranged between 0.53 mg/L and 10.2 mg/L, with a mean concentration of 1.99 mg/L. Similar to the previous reporting period, the highest total nitrogen concentration measured occurred during the December 2021 quarterly monitoring period at Cooks Creek.

2. Pollution Sources

Three municipalities with populations greater than 1,000 discharge treated effluents directly to the Red River within Manitoba. The Town of Morris discharges for a short period of time each spring and fall, while the City of Winnipeg's South End and North End Water Pollution Control Centres and the Town of Selkirk discharge continuously. Upgrades are underway to the

City of Winnipeg's South End and North End Water Pollution Control Centres including to add biological nutrient removal to meet 1 mg/L total phosphorus and 15 mg/L total nitrogen limits. In addition to the two major wastewater treatment facilities within the City of Winnipeg, discharges also occur from 76 combined sewer outfalls and 90 major land drainage outfalls. The City of Winnipeg reports annually on progress achieved regarding reductions in volumes of untreated effluent discharges originating from its municipal combined sewer system (https://winnipeg.ca/waterandwaste/sewage/annualResults/). Most tributary streams also receive treated wastewater effluents from nearby communities.

3. Notification Regarding Intensive Livestock Operations

During the reporting period, Manitoba was not notified of any intensive livestock operations proposing to locate near the international border on the North Dakota or Minnesota side. In Manitoba, no intensive livestock proposals were proposed near the international border between October 2021 and September 2022.

4. Pollution Abatement

Manitoba Water Quality Standards, Objectives, and Guidelines are applicable to streams within the Red River basin. Water uses protected in the Red River basin include domestic water supply source, protection of aquatic life, industrial uses, irrigation, livestock watering, and water-related recreation.

Treated municipal effluents discharged to the Red River and tributary streams in Manitoba are licensed under The Environment Act (Manitoba). Disinfection with ultraviolet light technology has been installed and is operational at the City of Winnipeg's South and North End Water Pollution Control Centres. In August 2004, the City of Winnipeg introduced a web-based system to inform the public whenever there is likely to be a sewer overflow into the Red or Assiniboine Rivers (http://winnipeg.ca/waterandwaste/sewage/overflow/previous24.stm). The City of Winnipeg also provides annual summaries of combined sewer overflows events, volumes and rainfall information (https://winnipeg.ca/waterandwaste/sewage/annualResults/default.stm).

Manitoba continues to work to understand sources of nutrients to Lake Winnipeg, to monitor the impacts of excess nutrients and to reduce nutrient loading to achieve a 50 per cent reduction in phosphorus in Lake Winnipeg. Manitoba has developed nutrient concentration objectives for Lake Winnipeg and nutrient loading targets for the main tributary rivers flowing into Lake Winnipeg. Concentration objectives and loading targets complement the proposed multi-national water quality objectives for total phosphorus and total nitrogen concentrations developed through the IRRWB. More information on the proposed objectives and targets is available at https://www.manitoba.ca/water/pubs/water/lakes-beaches-rivers/nutrient_targets_regulation_plain_language_summary_fall_2020.pdf.

In addition, Manitoba continues to implement a series of key water protection initiatives aimed at reducing nutrient loading to waterways including regulations restricting nutrient applications to land, requirements for advanced wastewater treatment to remove nutrients and improving surface water retention and management through integrated watershed management planning:

- Nutrient Management Regulation:
    - Manitoba is continuing to implement the Nutrient Management Regulation (https://www.gov.mb.ca/water/lakes-beaches-rivers/nutrient_management/index.html). The Nutrient Management Regulation addresses the application of nutrients to land from all sources, including livestock manure, inorganic fertilizer, cosmetic fertilizers, and biosolids/sludge.
    - Under the Nutrient Management Regulation, nutrients (regardless of the source) cannot be applied to land between November 10 and April 10.
- Wastewater Treatment:
    - The Manitoba Water Quality Standards, Objectives and Guidelines Regulation (https://www.gov.mb.ca/water/lakes-beaches-rivers/guidelines/index.html) includes province-wide standards for phosphorus in wastewater effluent (1 mg/L) and, where site-specific conditions warrant, nitrogen (15 mg/L). Under the province-wide nutrient standards, a 1 mg/L phosphorus limit applies to all new, expanding or modified wastewater treatment facilities. Small wastewater treatment facilities discharging more than 820 kilograms of phosphorus per year (serving less than 2,000 people or equivalent) have the option of implementing a demonstrated nutrient reduction strategy (for example, a constructed wetland, effluent irrigation, etc.) or the 1 mg/L phosphorus limit. Some facilities in Manitoba have received an extension for implementing the 1 mg/L phosphorus standard through an approved phosphorus compliance plan.
    - Compliance with the requirement to remove phosphorus to 1 mg/L is at 78 % for facilities across Manitoba for 2022. Compliance remains very similar to 2021 (79 %). Work is underway to improve further compliance. Work is also underway to accelerate improvements at the City of Winnipeg's North End Water Pollution Control Centre and the South End Water Pollution Control Centre, in response to failure to meet timelines outlined in their Environment Act licenses and The Water Protection Act.
- Watershed Districts and Integrated Watershed Management Planning:
    - Manitoba's Watershed Districts Program is a voluntary partnership between the province and local municipalities to protect, restore and manage water resources on a watershed basis. Watershed districts are also responsible for integrated Watershed Management Planning under The Water Protection Act. Manitoba's 14 watershed districts offer programs to reduce the impacts of flooding and drought,

improve land and water management practices, improve water quality, and protect drinking water. In particular, watershed districts in the Red River Basin (East Interlake, Northeast Red, Pembina Valley, Redboine, and Seine Rat Roseau) offer surface water retention, erosion control, and riparian management programs to reduce nutrient runoff and loading to Red River tributaries.

- In 2022/23, watershed districts supported operations and programming in water quality, surface water management, drinking water protection, water retention, soil conservation, wildlife habitat and public education programs promoting improvements to watershed health and resiliency. Watershed Districts established 710 cubic decametres of water storage capacity, installed 28.1 kilometres of riparian area fencing limiting more than 2200 head of cattle from waterways, sealed 108 abandoned wells, and hosted 55 demonstration and project tours with 5,300 participants.

- More information on the specific outcomes of watershed district programming is available in the annual report for the program - https://gov.mb.ca/sd/pubs/water/watershed/2021-22-cd-annual-report.pdf

- Work on integrated watershed management planning under The Water Protection Act continues in Manitoba. To date 24 first-generation watershed management plans have been completed. Planning continues for eight watersheds including four in the Red River basin, the Pembina, Boyne-Morris River, Plum-Marais, and Netley-Grassmere-Willow watersheds. Souris River, Shell River, Northwest Interlake and Lower Assiniboine River watershed management plans are also in development. Several of these planning processes are renewals of first generation plans: Souris River, Netley-Grassmere-Willow, and the Shell River watersheds.

- Integrated watershed management plans are compiled by local water planning authorities with input from government, Indigenous communities, non-government organizations and public. Plans are implemented, monitored and renewed regularly (every 10-15 years) by these water planning authorities. Designated under The Water Protection Act as water planning authorities, Manitoba's 14 watershed districts have been charged with the development of integrated watershed management plans guided by specifications in the Act. Manitoba provides financial, planning and technical assistance throughout the process. Integrated watershed management plans include an overview of current science and traditional knowledge of the watershed as well as actions to monitor, maintain, and improve watershed health (https://www.gov.mb.ca/sd/water/watershed/iwmp/index.html).

- Growing Outcomes in Watersheds (GROW):

  - Growing Outcomes in Watersheds (GROW) is a made-in-Manitoba approach that supports the delivery of ecological goods and services (EG&S) in Manitoba. Identified under the Water Pillar in Manitoba's Climate and Green Plan, GROW outcomes include reduced flooding, improved water quality, improved on-farm management of nutrients, enhanced resiliency to the impacts of climate change,

improved biodiversity, enhanced carbon storage, enhanced sustainable agricultural production, and improved biodiversity and habitat. GROW is delivered by Manitoba's watershed districts, as they are ideally positioned to support actions identified in their integrated watershed management plans that meet local and provincial priorities.

- More than $200 million dollars has been invested by the Manitoba Government in several trust funds (GROW Trust, GROW Wetlands Trust and the Conservation Trust) to support practices that will reduce flooding, improve water quality and nutrient management, and support the overall goals of the made-in-Manitoba Climate and Green Plan.

- In 2020-21, the first round of GROW funding from the Trusts was awarded with $5.6 M dedicated to GROW related activities delivered by watershed districts. Over the next three years, $5.5 M, $7.5 M and $7.5 M in GROW Trust funding was awarded to watershed districts to deliver local GROW programs in 2021, 2022, and 2023, respectively. Local GROW programs delivered by watershed districts in 2021-22 included riparian and erosion control, water retention, and livestock programming.

5. Biological Monitoring in the Red River Basin

5.1 Macroinvertebrates of the Red River in Manitoba

Benthic macroinvertebrates were collected at two locations, Emerson, MB and Selkirk, MB (Table 2), on the Red River in September 2022. At each location, one transect of five dredge grab samples were collected with a petit Ponar dredge. Starting at the east bank, samples were collected at five equidistant sample sites across the width of the river channel. Each Ponar dredge covered an area of 0.023 m^2. For each transect, 0.115 m^2 of sediment was collected. The dredge samples were washed through 500 µm Nitex nylon nets. River water was used to remove organisms and sediment from the nylon net into a 500 µm mesh sieve. Remaining sediment and all organisms were then placed in labelled 500 mL jars with 70 per cent ethyl alcohol preservative. Macroinvertebrates were subsequently identified to the lowest possible taxonomic level, typically genus and species, by ALS Environmental in Winnipeg, Manitoba. Data were screened for terrestrial species which were removed from the data subsequently reported.

Table 2. Geographic coordinates for the benthic macroinvertebrates sampling stations at Emerson and Selkirk on the Red River, Manitoba in September 2022.

Transect	Latitude	Longitude
Emerson	49°00'13.6"	97°13'16.2"
Selkirk	50°08'55.7"	96°51'24.8"

In 2022 at Emerson, 122 organisms were collected. To calculate organisms per square metre, the number of organisms at each transect was multiplied by a factor of 8.70, yielding 1,061 organisms per m^2 (Table 3). For the current reporting period at Emerson, the organisms in greatest abundance were from the Order Trichoptera (Family Hydropsychidae). The second most abundant type of organisms present were from the Order Diptera (Family Chironomidae). Overall, a significant increase in total organisms were observed for the current reporting period compared to the previous two periods, with 122 total organisms in 2022 versus 29 and 49 total organisms in 2021 and 2020, respectively. This increase in total organisms represents a gain of nearly 320 per cent in the current year compared to the previous water year. Additionally, it represents the first reporting period since 2019 without a large reduction in total organisms collected compared to the previous period. Similarly, the total number of taxa represented in the sampled population was also considerably greater during the current period, with 25 taxa represented, compared to 14 taxa in 2021 and 15 taxa in 2020. However, while the total number of organisms and taxa represented in the sampled population at Emerson was greater in 2022 compared to previous reporting periods, the overall composition of the population was similarly driven by very few taxa. In particular, two species of insect taxa from the Order Trichoptera (Hydropsyche sp. and Potamyia sp.) represented approximately 57 per cent of the individuals in the total population.

In the Red River at Selkirk, 190 organisms were collected. To calculate organisms per square metre, the number of organisms at each transect was multiplied by a factor of 8.70, yielding 1,653 organisms per m^2 (Table 4). For the 2021-2022 reporting period, the organisms of greatest abundance were from the Order Oligochaeta (Family Naididae). The second most abundant type of organisms present were from the Order Neotaenioglossa (Family Amnicolidae). In contrast to the trend observed at Emerson in 2022, the total number of benthic invertebrate organisms observed at Selkirk during the current water year decreased by approximately 42 per cent, compared to the total organisms collected in the previous water year (329 organisms in September 2021). However, similar to Emerson, the total number of taxa observed increased by approximately 83 per cent between 2021 and 2022 sampling periods, 12 taxa versus 22 taxa, respectively. Following successive years of decreases in total taxa observed within the population, the 2021-2022 water year represents the first increase in invertebrate species richness at Selkirk since the 2017-2018 reporting period.

Overall, in 2022, a greater number of total organisms of benthic macroinvertebrates were found in the Red River at Selkirk than at the Red River near Emerson. However, the Red River near Emerson had slightly more invertebrate taxa represented in the samples collected compared to the Selkirk monitoring location.

Table 3. Summary of benthic macroinvertebrates collected per transect and calculated total per metre squared in pooled Ponar © dredge samples from the Red River at Emerson, Manitoba in September 2022.

Class	Order	Family	Genus	Species	Number of organisms
ANNELIDA	OLIGOCHAETA	NAIDIDAE	unidentified	without hair setae	7
BIVALVIA			unidentified	damaged	1
BIVALVIA			unidentified	too young to ID	1
BIVALVIA	UNIONOIDA	UNIONIDAE	unidentified	too young to ID	4
GASTROPODA			unidentified	damaged	1
GASTROPODA	NEOTAENIOGLOSSA	AMNICOLIDAE	Amnicola	limosus	2
INSECTA	DIPTERA		unidentified pupa		2
INSECTA	DIPTERA	CERATOPOGONIDAE			3
INSECTA	DIPTERA	CHIRONOMIDAE	Axarus	sp.	9
INSECTA	DIPTERA	CHIRONOMIDAE	Labrundinia	sp.	1
INSECTA	DIPTERA	CHIRONOMIDAE	Polypedilum	sp.	3
INSECTA	DIPTERA	CHIRONOMIDAE	Tanytarsini	damaged	1
INSECTA	EPHEMEROPTERA	BAETIDAE	Baetis	sp.	3
INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Hexagenia	sp.	1
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	unidentifed nymph	damaged	1
INSECTA	EPHEMEROPTERA	LEPTOHYPHIDAE	Tricorythodes	sp.	1
INSECTA	EPHEMEROPTERA	PALINGENIIDAE	Pentagenia	vittegera	1
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	Brachycentrus	sp.	1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche	sp.	57
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Potamyia	flava	13
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	unidentified	damaged	1
INSECTA	TRICHOPTERA	HYDROPTILIDAE	Neotrichia	sp.	1
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Nectopsyche	sp.	2
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Oecetis	sp.	4
NEMATODA			unidentified		1
			Total number of organisms		**122**
			Total number per square meter		**1061**
			Total number of taxa		**25**

Table 4. Summary of benthic macroinvertebrates collected per transect and calculated total per metre squared in pooled Ponar © dredge samples from the Red River at Selkirk, Manitoba in September 2022.

Class	Order	Family	Genus	Species	Number of organisms
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Branchiura	sowerbyi	5
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Dero	sp.	6
ANNELIDA	OLIGOCHAETA	NAIDIDAE	unidentified	with hair setae	54
ANNELIDA	OLIGOCHAETA	NAIDIDAE	unidentified	without hair setae	55
BIVALVIA			unidentified	damaged	1
BIVALVIA	VENEROIDA	DREISSENIDAE	Dreissena	polymorpha	2
BIVALVIA	VENEROIDA	PISIIDAE	unidentified	Too young to ID	1
CRUSTACEA	OSTRACODA				3
GASTROPODA	NEOTAENIOGLOSSA	AMNICOLIDAE	Amnicola	limosus	21
GASTROPODA	NEOTAENIOGLOSSA	AMNICOLIDAE	Amnicola	sp.	11
GASTROPODA	PROSOBRANCHIA	VALVATIDAE	Valvata	sincera	2
INSECTA	DIPTERA	CERATOPOGONIDAE			1
INSECTA	DIPTERA	CHIRONOMIDAE	Ablabesmyia	sp.	1
INSECTA	DIPTERA	CHIRONOMIDAE	Polypedilum	sp.	2
INSECTA	DIPTERA	CHIRONOMIDAE	Procladius	sp.	7
INSECTA	DIPTERA	CHIRONOMIDAE	unidentified pupa		1
INSECTA	EPHEMEROPTERA	CAENIDAE	Caenis	sp.	2
INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Hexagenia	sp.	11
INSECTA	MEGALOPTERA	SIALIDAE	Sialis	sp.	1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche	sp.	1
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Oecetis	sp.	1
NEMATODA			unidentified		1
			Total number of organisms		**190**
			Total number per square meter		**1653**
			Total number of taxa		**22**

5.2 Benthic Invertebrate Indices: Simpsons Evenness, EPT taxa, and Bray-Curtis Dissimilarity Index.

Simpsons Diversity Index (D) (Krebs, 1994) places little weight on rare taxa and more weight on common species and is calculated.

$$D = 1 - \sum_{i=1}^{s} (p_i)^2$$

Where S total number of species in the community (richness), pi proportion of S made up of the i^{th} species. D ranges from zero to one, indicating a low to high level of diversity. Calculated Diversity scores for Emerson and Selkirk were 0.76 and 0.82 respectively.

Simpsons equitability or Evenness (E) indicates if taxa are evenly represented within a given sample. Evenness varies from a score of zero to one. A score of one represents a sample in which all the taxa are equally abundant (Smith and Wilson 1996). Evenness is calculated by

$$E_p = \frac{D}{D_{max}} = \frac{1}{\sum_{i=1}^{s} p_i^2} \times \frac{1}{S}$$

where:
E = evenness
pi = the proportion of the i^{th} taxon at the station
S = the total number of taxa at the station

Simpsons Evenness scores were 0.007 and 0.003 for the Red River at Emerson and Selkirk respectively. Relatively small numbers of individuals from many taxa influenced the Evenness score for both sites.

The EPT Index is named for three orders of aquatic insects that are common in the benthic macroinvertebrate community including pollution intolerant Ephemeroptera (mayflies) and Plecoptera (stoneflies), and generally pollution tolerant order Trichoptera (caddisflies). EPT taxa richness will decrease with decreasing water quality. The EPT score is the sum of the number of species from within these groups. The EPT score for Emerson was 12 and Selkirk was 4. No individuals from the pollution intolerant Order Plecoptera were found at either the Emerson or the Selkirk sites. Per cent EPT is the total number of EPT individuals divided by the total number of individuals in the sample. Per cent EPT was 70 per cent for Emerson and eight per cent for Selkirk. Overall, EPT individuals were substantially greater in numbers at Emerson than for Selkirk during the 2021-2022 water year.

The Bray-Curtis Index compares the community composition of two sites where the co-efficient reaches a maximum of one for two sites that are entirely different and a minimum score of zero for sites that possess identical composition (Legendre and Legendre, 1983). The calculated Bray-Curtis Dissimilarity Index was 0.89 indicating that community compositions were different between sites. In particular, while both sites had similar numbers of total individuals (122 and 190 at Emerson

and Selkirk, respectively) and diversity of taxonomic families represented at Emerson and Selkirk (25 and 22, respectively) during this reporting period compared to 2020-2021 water year, only 24 percent of taxonomic groups where identified at both locations. Overall, nine taxonomic groups were observed at both sites, while 16 groups and 13 groups were observed only at Emerson and Selkirk, respectively (Tables 3 and 4).
References:

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Legendre, L., and P. Legendre. 1983. Numerical ecology. Elsevier, Amsterdam.

Smith, B. and J**. Wilson. 1996. A consumer's guide to evenness indices.** - Oikos. 76: 70-82.

5.3 *E. coli* and Algal Bloom Monitoring in Lake Winnipeg

Manitoba monitored nineteen recreational beaches within the south basin of Lake Winnipeg for densities of *E. coli* during 2022 (Figure 9). Sampling began at the end of June and continued weekly until the beginning of September.

While some beaches occasionally exceeded Manitoba's recreational water quality guideline for fecal indicator bacteria in 2022, typically recreational water quality is excellent at Lake Winnipeg beaches. In 2022, there were eight incidents of Lake Winnipeg beaches showing elevated *E. coli* concentrations above the recreational water quality objective. Spruce Sands Beach was briefly closed following a sewage spill in close proximity to the beach and elevated *E. coli* concentrations in the swimming area. All beaches have a blue coloured "Clean Beaches" sign that provides information to bathers about *E. coli* and identifies precautions on how the bathing public can reduce risk of exposure to pathogens. For beaches that had *E. coli* densities above the guideline and that have a history of elevated densities, additional yellow coloured 'Beach Advisory' signs were posted. Results of DNA ribotyping from 2002 to 2006 indicated that approximately 34 per cent of *E. coli* from all samples could be attributed to shorebirds and geese, while less than five per cent of the samples could be attributed to human sources. Thirty seven per cent of the *E. coli* samples could not be matched to a particular animal source.

As part of the 2022 beach monitoring program, the department continued to monitor beaches on Lake Winnipeg for the presence of algal blooms. First level algal advisory signs are posted when the number of blue-green algal cells exceeds the Manitoba recreational water quality objective of 100,000 cells per mL. The advisory informs bathers that algal blooms have been observed at the beach and provides some additional advice regarding avoiding contact with the water when algal blooms are present. In 2022, there were three beaches on Lake Winnipeg posted with first level algal advisories. The second level algal toxin advisory is posted when the concentration of microcystin exceeds the Manitoba recreational water quality objective of 20 µg/L. The advisory indicates that drinking, swimming or other contact with the water is not recommended. In 2022, there were no beaches on Lake Winnipeg posted with second level algal advisory signs.

Figure 9. Map of beach monitoring locations on Lake Winnipeg as a part of the Clean Beaches Program.

5.4 Fisheries of the Red River in Manitoba

Biological Information

A total of 67 fish species have been recorded in the Manitoba portion of the Red River (Table 6). Presently, Bigmouth Buffalo (*Ictiobus cyprinellus)* and Chestnut Lamprey (*Ichthyomyzon castaneus*) are designated as Special Concern under *The Species at Risk Act.* In 2005 and 2017, Lake Sturgeon (*Acipenser fulvescens)* was recommended for listing as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A formal decision regarding Lake Sturgeon is expected within the next 2 years.

Known invasive species that have been introduced in the Manitoba portion of the Red River include the Common Carp (*Cyprinus carpio)*, White Bass (*Morone chrysops)*, Rainbow Smelt (*Osmerus mordax)* and Asian Carp Tapeworm (*Bothriocephalus acheilognathi)*. Other introductions into the Manitoba portion of the Red River include feral Goldfish (*Carassius auratus)*, Smallmouth Bass *(Micropterus dolomieu)* and Largemouth Bass *(Micropterus salmoides)*. Of these species, only Rainbow Smelt is listed formally as an Aquatic Invasive Species (AIS) in Manitoba. More significantly, Zebra Mussel (*Dreissena polymorpha*) veligers were detected in the Manitoba portion of the Red River for the first time in samples collected on June 9th, 2015 at Emerson and a second sampling location at Selkirk. Zebra Mussel veligers were subsequently found in the U.S.A. portion of the Red River. In early May 2015, adult Zebra Mussels were reported from a dock located in an offshoot of the Red River near Selkirk Park. This was the first detection of adult Zebra Mussels in the entirety of the Red River. Subsequently, Zebra Mussel veligers were found throughout the length of the Manitoba portion of the Red River and the channel region and the north basin of Lake Winnipeg. Zebra Mussel veligers were also found in Cedar Lake, Manitoba, a hydro-electric impoundment

located immediately upstream from Lake Winnipeg on the Saskatchewan River system. As of 2022, adult Zebra Mussels are found throughout Lake Winnipeg and the entire extent of the Nelson River. Zebra Mussels veligers have been detected at Assean Lake (which is proximate to the Nelson River near Split Lake) and most recently in Lake Manitoba.

Manitoba has continued its efforts to minimize the spread of Zebra Mussels from Lake Winnipeg, the Red River and the Nelson River to other water bodies by operating watercraft inspection stations, and continuing communication initiatives. Monitoring within Manitoba continues to determine the range and rate of spread of this species and other AIS. Manitoba operated five watercraft inspection stations in 2022, including a new placement at Wabowden, off the Nelson River system. Watercraft inspection station placement is determined primarily as a containment approach with units being situated between invaded and uninvaded waters.

Recreational Angling - Value

The Manitoba portion of the Red River is internationally known for the high quality of angling the fishery supports. Based on a 2010 Angler Survey, Manitobans and visitors to the province fished a total of 2 million days, of which 11% were spent on the Red River, and 8% on Lake Winnipeg, making these the most heavily fished water bodies in the province. It is estimated that anglers fishing the Red River and Lake Winnipeg contributed approximately $102M towards the overall economic value of angling in Manitoba (about $600M annually). A partial winter creel survey was conducted on Lake Winnipeg in winter 2018/19 and confirmed the continuing and rapid expansion of winter angling on the south basin of Lake Winnipeg during which an estimated 70,000 angler visits to the lake were reported. A subsequent winter creel survey was conducted in winter 2021/22 on Lake Winnipeg. However, data analysis is underway and results are not yet available.

The Red River fishery attracts non-residents to trophy Walleye and Channel Catfish angling opportunities. The diverse fish species composition appeals to residents of all ages. From an angling perspective, the fishery is managed to: 1) ensure sustainability of the recreational fishery for future generations, 2) encourage angler participation and development of the recreational fishing potential of the river, and 3) maximize economic returns to angling interests who rely on the fishery for their livelihood.

The majority of angling effort occurs between the floodway gate structure at St. Norbert and the north end of the south basin of Lake Winnipeg. Angling is especially concentrated from Lockport downstream to Netley Creek, within the City of Winnipeg and along the shore of the south basin. In 2021, Manitoba released its Recreational Angling Strategy which outlined a suite of angling regulations aimed at increasing opportunities to fish while enhancing protection of Manitoba's recreational fish populations. The Strategy includes lowering the limit of certain species, such as Walleye/Sauger and Northern Pike, and adding new size restrictions to protect large spawning fish, moving to species-specific seasons, and closing some sensitive areas to all fishing during spring. Particularly, the proposed Walleye/Sauger closed season will run from the first Monday in April to the second Friday in May. However, the Red River will be closed to all fishing activity for the same time period given it is home to important spawning grounds for walleye and is subject to high pressure from anglers. The Walleye/Sauger season on Lake Winnipeg is closed from the first Monday in April to the third Friday in May. This provides one additional week of protection on Lake Winnipeg. Manitoba's Fisheries Branch conducts spawn testing on Lake Winnipeg each spring. The 30-year

data set shows that walleye spawning on Lake Winnipeg continues later into the spring than it does within the tributaries due to cooler water temperatures in the lake as ice cover melts.

A commercial net fishery targeting primarily Walleye, Sauger and Lake Whitefish has operated on Lake Winnipeg since the late 1800s. The Lake Winnipeg fishery comprises more than 50% of the value of all of Manitoba's commercial fisheries and is valued at approximately $80M annually.

Table 5. Fish species of the Red River in Manitoba.

Common Name	Genus	Species	Presence	Common Name	Genus	Species	Presence
Banded Killifish	*Fundulus*	*diaphanus*	Rare	Largemouth Bass +	*Micropterus*	*salmoides*	Uncommon
Bigmouth Buffalo *	*Ictiobus*	*cyprinellus*	Common	Logperch	*Percina*	*caprodes*	Common
Bigmouth Shiner	*Notropis*	*Dorsalis*	Unknown	Longnose Dace	*Rhinichthys*	*cataractae*	Unknown
Black Bullhead	*Ameiurus*	*Melas*	Common	Longnose Sucker	*Catostomus*	*catostomus*	Common
Black Crappie	*Pomoxis*	*nigromaculatus*	Common	Mimic Shiner	*Notropis*	*volucellus*	Unknown
Blackchin Shiner	*Notropis*	*heterodon*	Unknown	Mooneye	*Hiodon*	*tergisus*	Rare
Blacknose Shiner	*Notropis*	*heterolepis*	Unknown	Ninespine Stickleback	*Pungitius*	*pungitius*	Common
Blackside Darter	*Percina*	*Maculate*	Unknown	Northern Pike	*Esox*	*lucius*	Common
Bluntnose Minnow	*Pimephales*	*Notatus*	Unknown	Pearl Dace	*Margariscus*	*margarita*	Unknown
Brassy Minnow	*Hybognathus*	*hankinsoni*	Unknown	Quillback	*Carpiodes*	*cyprinus*	Uncommon
Brook Stickleback	*Culaea*	*inconstans*	Common	Rainbow Smelt +	*Osmerus*	*mordax*	Uncommon
Brown Bullhead	*Ameiurus*	*nebulosus*	Common	River Darter	*Percina*	*shumardi*	Common
Burbot	*Lota*	*Lota*	Common	River Shiner	*Notropis*	*blennius*	Unknown
Central Mudminnow	*Umbra*	*Limi*	Common	Rock Bass	*Ambloplites*	*rupestris*	Common
Channel Catfish	*Ictalurus*	*punctatus*	Common	Rosyface Shiner	*Notropis*	*rubellus*	Unknown
Chestnut Lamprey *	*Ichthyomyzon*	*castaneus*	Unknown	Sand Shiner	*Notropis*	*stramineus*	Uncommon
Cisco	*Coregonus*	*Artedi*	Common	Sauger	*Sander*	*canadensis*	Common
Common Carp +	*Cyprinus*	*Carpio*	Common	Shorthead Redhorse	*Moxostoma*	*macrolepidotum*	Common
Common Shiner	*Luxilus*	*Cornutus*	Rare	Silver Chub	*Macrhybopsis*	*storeriana*	Common
Creek Chub	*Semotilus*	*atromaculatus*	Unknown	Silver Lamprey	*Ichthyomyzon*	*unicuspis*	Unknown
Emerald Shiner	*Notropis*	*atherinoides*	Abundant	Silver Redhorse	*Moxostoma*	*anisurum*	Common
Fathead Minnow	*Pimephales*	*Promelas*	Common	Smallmouth Bass +	*Micropterus*	*dolomieu*	Unknown
Flathead Chub	*Platygobio*	*Gracilis*	Unknown	Spotfin Shiner	*Cyprinella*	*spiloptera*	Unknown
Freshwater Drum	*Aplodinotus*	*grunniens*	Abundant	Spottail Shiner	*Notropis*	*hudsonius*	Common
Golden Redhorse	*Moxostoma*	*erythrurum*	Rare	Stonecat	*Noturus*	*flavus*	Unknown
Golden Shiner	*Notemigonus*	*crysoleucas*	Unknown	Tadpole Madtom	*Noturus*	*gyrinus*	Common
Goldeye	*Hiodon*	*Alosoides*	Common	Troutperch	*Percopsis*	*omiscomaycus*	Common
Goldfish +	*Carassius*	*Auratus*	Unknown	Walleye	*Sander*	*vitreus*	Common
Hornyhead Chub	*Nocomis*	*biguttatus*	Unknown	Western Blacknose Dace	*Rhinichthys*	*obtusus*	Unknown
Iowa Darter	*Etheostoma*	*Exile*	Common	White Bass +	*Morone*	*chrysops*	Common
Johnny Darter	*Etheostoma*	*Nigrum*	Common	White Crappie	*Pomoxis*	*annularis*	Unknown
Lake Chub	*Couesius*	*plumbeus*	Rare	White Sucker	*Catostomus*	*commersoni*	Common
Lake Whitefish	*Coregonus*	*clupeaformis*	Uncommon	Yellow Perch	*Perca*	*flavescens*	Common
Lake Sturgeon *	*Acipenser*	*fulvescens*	Rare				

Note: * = indicates species at risk, + = indicates introduced species

C-2 North Dakota

WATER QUALITY SURVEILLANCE PROGRAM
NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY

Ambient Water Quality Monitoring Program

The North Dakota Department of Environmental Quality (NDDEQ) Watershed Management Program is responsible for tracking the ambient water quality conditions within the State of North Dakota. The NDDEQ maintains a monitoring network to evaluate trends, estimate loads and compare variations between sites in the Red River Watershed. The network coordinates with the US Geological Survey (USGS) and the North Dakota Department of Water Resources (DWR) water quality monitoring networks.

The monitoring design includes 3 levels of sampling frequency (Figure 1). Level 1 sites are sampled 8 times per year (Twice in April, once each in May, June, July, August, and October, and one time under ice), level 2 sites are sampled 6 times per year (April, May, June, August, and October and once under ice, and level 3 sites are sampled 4 times per year (April, June, August, and October). There are 16 level 1 sites, 12 level 2 sites, and level 3 sites. Under the current design, the NDDEQ samples 5 level 1 sites, the Department of Water Resources samples 1 level 2 site, and the USGS samples all the rest (Tables 1 through 3).

Field measurements are taken for temperature, dissolved oxygen, pH and specific conductance. Sampling and analysis consist of general chemistry, dissolved trace elements, and total and dissolved nutrients (Table 4). In addition, total organic carbon, dissolved organic carbon, total suspended solids, and E. coli bacteria are sampled and analyzed for at level 1 sites (Table 4). E. coli bacteria are only sampled during the recreation season (May-September). Additionally, the Red River at Fargo, the Red River at Grand Forks, and the Red River at Pembina are sampled for total suspended sediment. All chemical analysis except total suspended solids is performed by the NDDEQ's Laboratory Services Division. Total suspended solids analysis is conducted by the USGS Iowa Sediment Laboratory.

Table 1. Level 1 North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

USGS Site ID	NDDEQ Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051300	385055	Bois de Sioux River near Doran, MN	46.1522	-96.5789	1	NDDEQ
05051510	380083	Red River at Brushville, MN	46.3695	-96.6568	1	NDDEQ
05053000	380031	Wild Rice River near Abercrombie, ND	46.4680	-96.7837	1	USGS-GF
05054000	385414	Red River at Fargo, ND	46.8611	-96.7837	1	USGS-GF
05057000	380009	Sheyenne River near Cooperstown, ND	47.4328	-98.0276	1	NDDEQ
05058000	380153	Sheyenne River below Baldhill Dam, ND	47.0339	-98.0837	1	NDDEQ
05058700	385168	Sheyenne River at Lisbon, ND	46.4469	-97.6793	1	NDDEQ
05059000	385001	Sheyenne River near Kindred, ND	46.6316	-97.0006	1	USGS-GF
05060100	384155	Maple River below Mapleton, ND	46.9052	-97.0526	1	USGS-GF
05066500	380156	Goose River at Hillsboro, ND	47.4094	-97.0612	1	USGS-GF
05082500	384156	Red River at Grand Forks, ND	47.9275	-97.0281	1	USGS-GF
05083000	380037	Turtle River at Manvel, ND	48.0786	-97.1845	1	USGS-GF
05085000	380039	Forest River at Minto, ND	48.2858	-97.3681	1	USGS-GF
05090000	380157	Park River at Grafton, ND	48.4247	-97.4120	1	USGS-GF
05100000	380158	Pembina River at Neche, ND	48.9897	-97.5570	1	USGS-GF
05102490	384157	Red River at Pembina, ND	48.9769	-97.2376	1	USGS-GF

Table 2. Level 2 North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

USGS Site ID	NDDEQ Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051522	NA	Red River at Hickson, ND	46.6597	-96.7959	2	USGS-GF
05051600	385573	Wild Rice River near Rutland, ND	46.0222	-97.5115	2	USGS-GF
05054200	385040	Red River at Harwood, ND	46.9770	-96.8203	2	USGS-GF*
05055300	385505	Sheyenne R above DL Outlet nr Flora, ND	47.9078	-99.4162	2	SWC
05056000	385345	Sheyenne River near Warwick, ND	47.8056	-98.7162	2	USGS-GF
05057200	384126	Baldhill Creek near Dazey, ND	47.2292	-98.1248	2	USGS-GF
05059700	385351	Maple River near Enderlin, ND	46.6216	-97.5740	2	USGS-GF
05064500	NA	Red River at Halstad, MN	47.3519	-96.8437	2	USGS-GF
05065500	NA	Goose River nr Portland, ND	47.5389	-97.4556	2	USGS-GF
05082625	385370	Turtle River at State Park near Arvilla, ND	47.9319	-97.5145	2	USGS-GF
05084000	NA	Forest River near Fordville, ND	48.1972	-97.7306	2	USGS-GF
05092000	380004	Red River at Drayton, ND	48.5722	-97.1476	2	USGS-GF

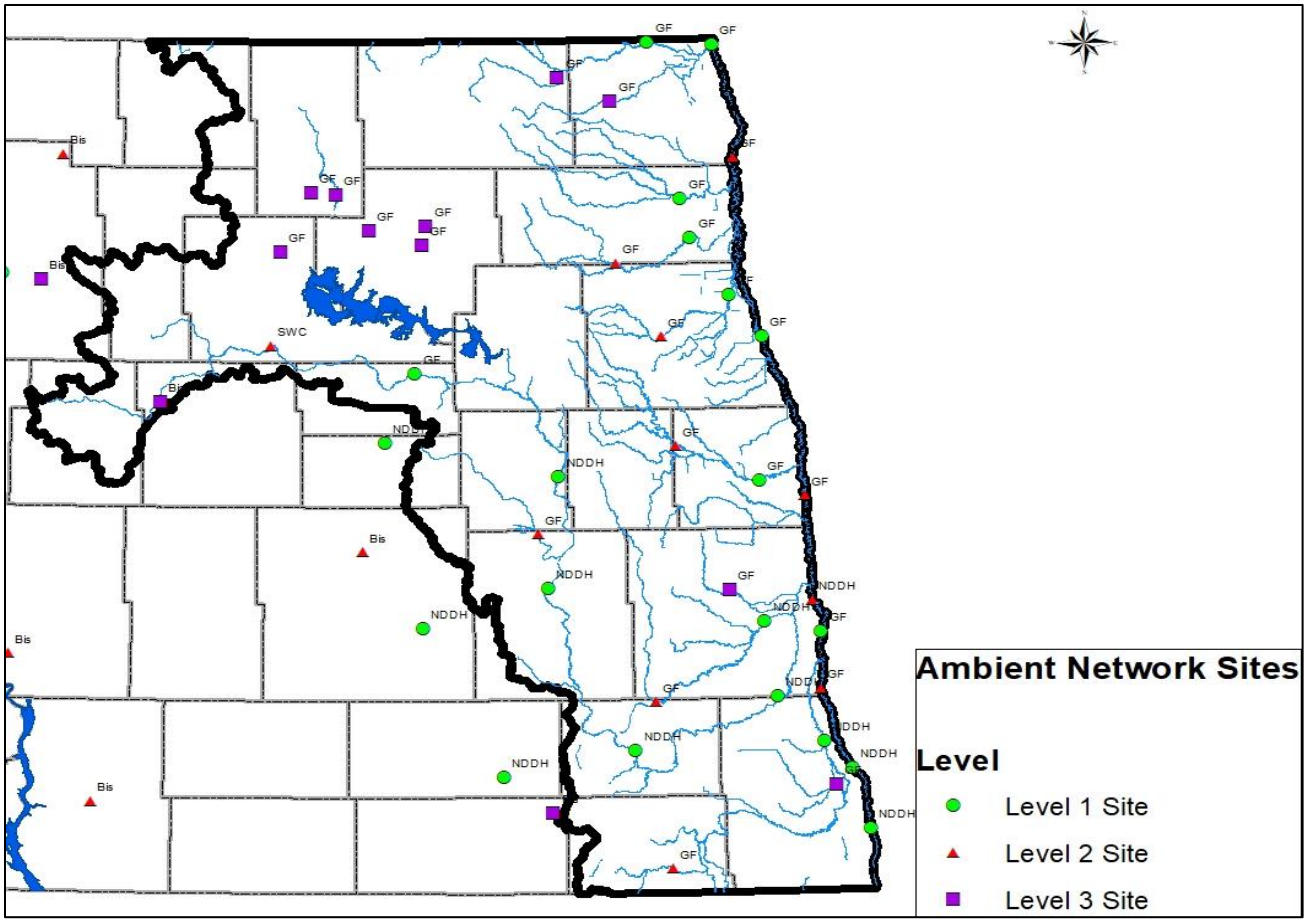

Figure 1. North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin

Table 3. Level 3 North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

USGS Site ID	NDDEQ Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05052500	385232	Antelope Creek at Dwight, ND	46.3113	-96.7345	3	USGS-GF
05054500	380135	Sheyenne River above Harvey, ND	47.7028	-99.9490	3	USGS-Bis
05056060	385089	Mauvais Coulee Trib #3 nr Cando, ND	48.4575	-99.2243	3	USGS-GF
05056100	380207	Mauvais Coulee nr Cando	48.4481	-99.1026	3	USGS-GF
05056200	385092	Edmore Coulee nr Edmore	48.3367	-98.6604	3	USGS-GF
05056215	385093	Edmore Coulee Trib nr Webster	48.2664	-98.6809	3	USGS-GF
05056239	385091	Starkweather Coulee nr Webster, ND	48.3206	-98.9407	3	USGS-GF
05056340	380213	Little Coulee nr Leeds, ND	48.2433	-99.3729	3	USGS-GF
05060500	385302	Rush River at Amenia, ND	47.0166	-97.2143	3	USGS-GF
05099400	385287	Little South Pembina near Walhalla, ND	48.8653	-98.0059	3	USGS-GF
05101000	381279	Tongue River at Akra, ND	48.7783	-97.7468	3	USGS-GF

Table 4. North Dakota Ambient Water Quality Monitoring Parameters

Field Measurements	Laboratory Analysis			
	General Chemistry	Trace Elements	Nutrients	Biological
Temperature	Sodium[1,2]	Aluminum[1,2]	Ammonia (Total) [2]	E. coli[3]
pH	Magnesium[1,2]	Antimony[1,2]	Nitrate-nitrite (Total) [2]	
Dissolved Oxygen	Potassium[1,2]	Arsenic[1,2]	Total Kjeldahl Nitrogen[2]	
Specific Conductance	Calcium[1,2]	Barium[1,2]	Total Nitrogen[2]	
	Manganese[1,2]	Beryllium[1,2]	Total Phosphorus[2]	
	Iron[1,2]	Boron[1,2]	Total Organic Carbon[3]	
	Chloride[1,2]	Cadmium[1,2]	Ammonia (Dissolved) [2]	
	Fluoride[1,2]	Chromium[1,2]	Nitrate-nitrite (Dissolved) [2]	
	Sulfate[1,2]	Copper[1,2]	Total Kjeldahl Nitrogen (Dissolved) [2]	
	Carbonate[2]	Lead[1,2]	Total Nitrogen (Dissolved) [2]	
	Bicarbonate[2]	Nickel[1,2]	Total Phosphorus (Dissolved) [2]	
	Hydroxide[2]	Silica[1,2]	Dissolved Organic Carbon[3]	
	Alkalinity[2]	Silver[1,2]		
	Hardness[2]	Selenium[1,2]		
	Total Dissolved Solids[3]	Thallium[1,2]		
	Total Suspended Solids[1]	Zinc[1,2]		

[1]Analyzed as dissolved.

[2]Sampled and analyzed at level 1, 2 and 3 sites.

[3]Sampled and analyzed at level 1 sites.

North Dakota Department of Agriculture Pesticide Monitoring Program

As a compliment to North Dakota's revised ambient water quality monitoring program, in 2019 the NDDEQ and the USGS cooperated with the North Dakota Department of Agriculture (NDDA) in a state pesticide monitoring program. The goals of the monitoring program were to: 1) determine the occurrence and concentration of pesticides in North Dakota rivers and streams; 2) identify trends in pesticide contamination to guide regulatory activities; 3) determine whether any pesticides may be present at concentrations that could adversely affect human health, aquatic life, or wildlife dependent on aquatic life; and 4) evaluate levels of certain neonicotinoid insecticides in North Dakota's rivers and streams.

Through this cooperative pesticide monitoring program, the NDDEQ and the USGS collected pesticide samples April through August and in October at all of the level 1 water quality monitoring sites in the state, while the NDDA provided sample analysis through a contract with

Montana State University's Agriculture Experiment Station Analytical Laboratory. A final report detailing the results of the monitoring program, including the results from samples collected in the Red River basin is available at:

https://www.ndda.nd.gov/sites/www/files/documents/files/2022%20Pesticide%20Surface%20Water%20Monitoring%20Report.pdf

WATER POLLUTION CONTROL

Pollution Abatement and Advisories

Point Source Control Program

The department regulates the release of wastewater and stormwater from point sources through permits issued by the North Dakota Pollution Discharge Elimination System program (NDPDES). Permitted municipal and industrial point source dischargers must meet technology or water quality based effluent limits. In addition, all major municipal and industrial permittees must monitor their discharge for whole effluent toxicity (WET) on a regular basis.

Toxic pollutants in wastewater discharges are regulated through the industrial pretreatment program which is administered by the NDPDES Program. The cities of Grand Forks, Fargo, and West Fargo all have approved pretreatment programs within the Red River basin in North Dakota. There are presently 151 facilities with a NDPDES Program permit in the Red River basin. Of these, there are 36 industrial wastewater permits and 115 domestic/municipal wastewater permits. Most of the domestic/municipal wastewater permits are for small lagoon systems which typically discharge 2-3 times a year for a period of a few days to a few weeks.

Stormwater

The NDPDES Program permits stormwater discharges from industrial sites, construction sites and larger municipalities or Municipal Separate Storm Sewer Systems (MS4s). The cities of Grand Forks, Fargo, West Fargo, Horace and their urbanized area continue to implement their MS4 permits within the Red River basin in North Dakota. There are approximately 311 stormwater permits for construction activity and 135 industrial stormwater permits in the Red River basin in North Dakota.

Animal Feeding Operations (AFOs)

The NDPDES Program regulates animal feeding operations (AFOs) in North Dakota. All large (>1000 animal units) confined animal feeding operations (CAFOs) are inspected annually. Medium and small AFOs are inspected on an as-needed basis. There are approximately 120 AFOs permitted by the NDDEQ in the Red River basin. Of these,25 designated as large CAFOs.

Nonpoint Source Pollution Management Program

The Division of Water Quality is responsible for administering the Clean Water Act Section 319 Nonpoint Source Pollution Management Program (NPS Program) in North Dakota. The NPS Program is administered with input from the North Dakota Nonpoint Source Pollution Task

Force (Task Force). The Task Force is comprised of representatives from state and federal natural resource agencies, commodity/producer groups and private wildlife/natural resource organizations.

Through the NPS Program, the department is currently supporting eight watershed projects in the Red River Basin that are focused on nonpoint source pollution mitigation. Additionally, there are two statewide watershed projects that provide technical/financial assistance in the Red River Basin. In most cases, these projects are addressing NPS pollution associated with agricultural activities. A map depicting the location of these projects is provided in Figure 2. Table 5 lists the best management practices (BMP) implemented with Section 319 funding through these projects. The following is a summary of the active watershed projects as of July 2023 in the Red River Basin.

- The Richland County Soil Conservation District (SCD) has been using Section 319 funding since 2011 to support the implementation of the Antelope Creek Watershed and Wild Rice Riparian Corridor project. The primary goal of the project is to restore the recreational uses of the impaired reaches of Antelope Creek and the Wild Rice River in Richland County. As a secondary goal, the project will protect and enhance aquatic life uses of Antelope Creek and the Wild Rice River through targeted implementation of BMPs within or immediately adjacent to the riparian corridor. These goals are being accomplished through one-on-one conservation planning; implementation of agricultural BMPs; septic system renovation; and public education. Through these efforts the project has reported declining E. coli bacteria concentrations in some reaches of the Wild Rice River. For one of these reaches, E. coli concentrations are consistently within state water quality standards limitation, indicating recreational uses have been fully restored.

- The Cass County SCD was awarded Section 319 funding for the Maple River Watershed project in 2014 and 2018. The long-term goal of the project is to restore the recreational uses of the Maple River in Cass County. As a secondary goal, the project is also promoting the implementation of best management practices (BMP) that improve soil health and reduce nutrient and sediment delivery to the Maple River. To achieve these goals, the project sponsors initiated a watershed-wide educational program and are also providing financial and technical assistance to implement BMPs. Emphasis is being placed on installing BMPs in priority cropland areas and along riparian corridors. Practices that may be installed include cross-fencing, off-site watering facilities, nutrient management, water wells, cover crops, riparian buffers, and grass waterways.
- The Wild Rice SCD has utilized Section 319 funding since 2010 to implement the Wild Rice River Restoration and Riparian project. The project is currently focusing on utilizing PTMApp to find priority areas for implementing BMP. The goal of the project is to improve aquatic life use in the Wild Rice River through focused project work in the sub-watersheds adjacent to the Wild Rice River including Shortfoot Creek and Crooked Creek. This is being accomplished by providing financial and technical assistance to agricultural producers to implement BMPs that reduce livestock impacts, restore riparian habitat, and improve the buffering capabilities of riparian areas and adjacent lands. Practices being promoted and installed include manure management, cross fencing, grazing management, no-till, cover crops, nutrient management, riparian easements,

grassed waterways, filter strips, and tree plantings. Because of these efforts, the project sponsors have reported declining trends in E. coli bacteria concentrations for one stream reach located in the Shortfoot Creek watershed.

- The Walsh County Three Rivers SCD was initially awarded Section 319 funding for the Homme Dam watershed project in 2014. That project area was expanded in 2018 to include the entire Park River watershed upstream of Grafton. Additional Section 319 funds were awarded in 2018 to support efforts in the expanded project area. The goal for the expanded project is to improve the recreational and aquatic life uses of the Park River and Homme Dam reservoir. E. coli bacteria, phosphorus and nitrogen are the primary NPS pollutants being addressed by the project. To achieve the long-term goal, technical and financial assistance is being provided to agricultural producers to implement BMPs that protect or enhance riparian areas as well as improve grazing and woodland management along the Park River and upstream and downstream from Homme Dam reservoir. Practices being promoted and implemented include fencing, off-site watering facilities, water wells, cover crops, grassed waterways, riparian tree plantings, grass buffers/filters, and windbreaks.

- The Grand Forks County SCD was awarded Section 319 funding in 2022 to pursue implementation work in the Turtle River/Larimore Dam Watershed following the successful English Coulee watershed project. The main goal for the project is to achieve an improving trend in the recreational and aquatic life uses of the Turtle River and mitigate nutrient and sediment loading in Larimore Dam. A secondary goal of the project is to educate the public on the relationship between healthy soils and water quality through education and BMP demonstrations. To accomplish these goals, the SCD is offering technical and financial assistance to producers for grazing management, fencing, tanks, pipeline, use exclusion, cover crops, and septic systems.

- The Griggs County SCD was awarded Section 319 funding for the Griggs County Sheyenne River Riparian Corridor project in 2019. The goal of the project is to achieve "fully supporting status" for the recreational uses of the Sheyenne River in Griggs County. As a secondary goal, the practices that will be promoted and implemented by the project will also benefit aquatic life use in the Sheyenne River. To meet the project goals, the SCD is providing technical and financial assistance to producers to improve livestock manure management as well as grazing and cropland management in the watershed. Emphasis is being placed on installing BMPs on priority cropland and grazing areas along the riparian corridors. Practices that may be installed include fencing, off-site watering facilities, nutrient management, wells, filter strips, tanks, grassed waterways, manure management systems, pipelines, and cover crops.

- The Ransom County SCD was awarded Section 319 funding for the Sheyenne River PTMApp project in 2021. The Ransom County SCD will provide financial and technical assistance for conservation planning and provide increased emphasis on NPS Pollution in their I/E program. The goals of this project are to 1) Reduce the sediment and nutrient inputs from farm fields and pasture/rangeland shown as major contributors by the PTMApp program, 2) Reduce the pathogen/nutrient inputs from 10 or more faulty septic

systems within close proximity to the Sheyenne River, and 3) Increase public awareness to the causes, effects and solutions to NPS pollution. Data collected as part of this project will be used for future TMDL development as the segment of the Sheyenne being addressed through this project has a high priority.

- The Sheyenne River Joint Board, in collaboration with BARR Engineering was awarded Section 319 funding for the Upper Sheyenne River Watershed Pilot project in 2022. The primary goal of the Upper Sheyenne River Watershed Pilot Project is to identify and implement channel stability measures in eighteen (18) select areas of high priority across the Upper Sheyenne River, from the headwaters in Sheridan County to Lake Ashtabula. Potential applicable measures to improve channel stability include changes to riparian vegetation, changes to grazing practices, replacement of road crossing culverts, and targeted bank stabilization measures. These measures will directly benefit in improving Sheyenne River water quality by reduction in sediment loading. Out of eighteen sites identified, the Joint Board selected seven (7) sites for the Project by working collaboratively with multiple stakeholders. Of these seven (7), two (2) will be funded through the 319 program.

Table 5. BMPs implemented with FY16-FY22 Section 319 funding in the active watershed project areas located in the Red River Basin, as of July 2023.

BMP Category/BMP Type	Amount Applied
Cropland	
Cover Crops	15,400 acres
Erosion Control	
Critical Area Plantings	5.0 acres
Grazing Manangement	
Livestock Fencing	37,088 linear feet
Pasture/Hayland Planting	1,233 acres
Pond	1 pond
Rural Water Hookup	1 hookups
Trough and Tanks	6 tanks
Wells (livestock watering only)	9 wells
Alternative Power Source (Livestock watering only)	5 sources
Livestock Manure Management Systems	
Full Containment Manure Management System	8 systems *
Miscellaneous Practices	
Septic System Renovations	97 systems
Well Decommissioning	43 wells
Riparian Area Management	
Riparian Easements (Cropland)	187 acres
Riparian Foerst Buffer	118 acres
Riparian Herbaceous Cover	415 acres
Strembank and Shoreline Stabilization	5,200 linear feet

**Systems implemented with Section 319 funds allocated to the statewide manure management programs administered by the ND Stockmen's Association and ND Department of Agriculture.*

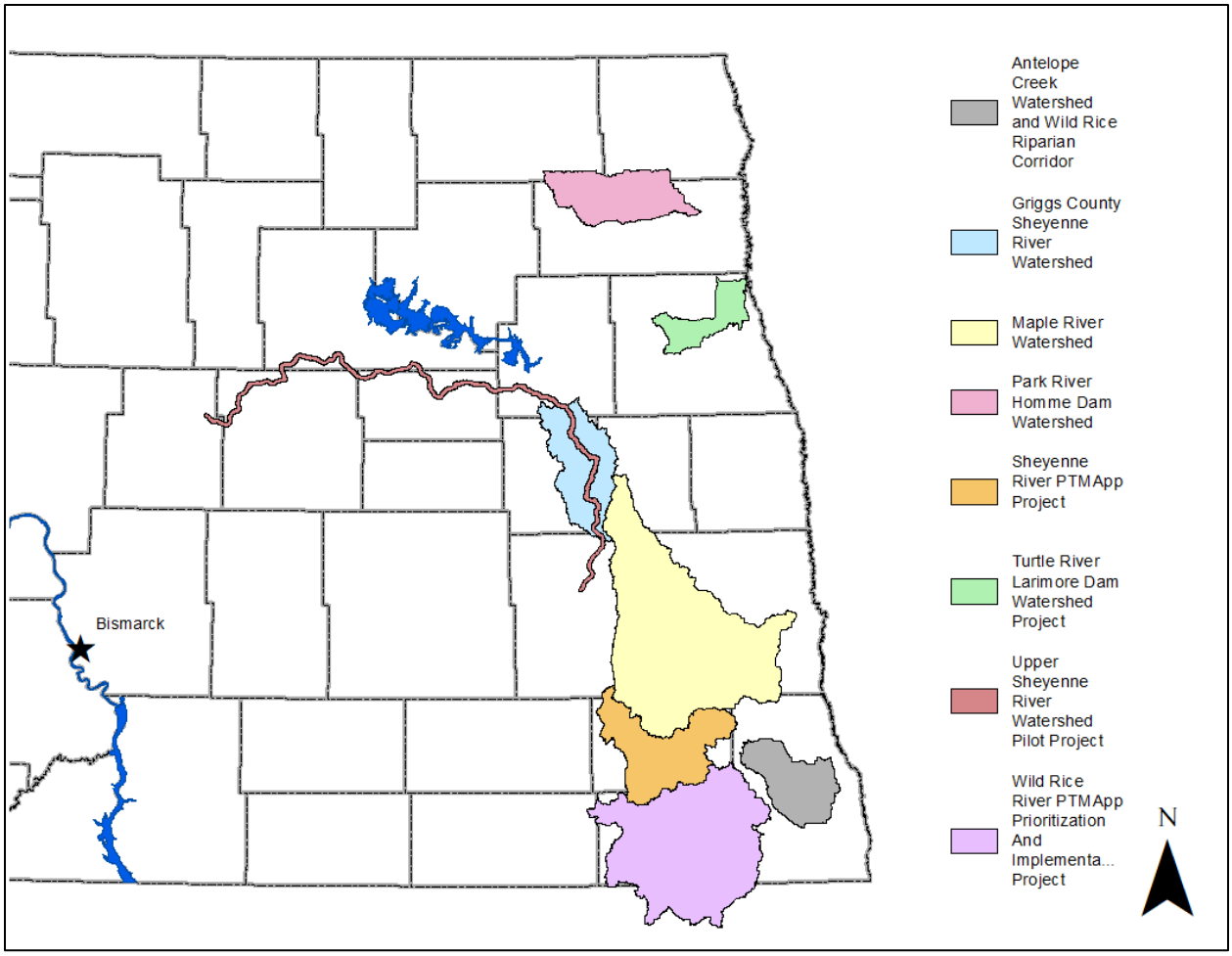

Figure 2. Active North Dakota Watershed Projects in the Red River Basin.

The statewide watershed projects that have supported work in the Red River Basin are:

- The ND Department of Agriculture has been awarded Section 319 funding since 2010 to support the Livestock Pollution Prevention Program (LP3). The goal of the program is to deliver a statewide program that will reduce water quality impairments associated with concentrated livestock feeding areas. This is being accomplished by providing planning assistance to livestock producers to design and install manure management systems. Some of the practices being installed include diversions, dikes, fencing, holding ponds, vegetative buffers, and settling basins. Since 2010 the LP3 has provided financial and technical assistance to implement seven full containment livestock manure management systems in the Red River Basin.

- Section 319 funds have been used by the Stockmen's Association since 2001 to support the ND Stockmen's Association Environmental Services Program. The program goal is to deliver a statewide program that addresses water quality impairments associated with concentrated livestock feeding areas. To meet this goal, financial and technical assistance

is provided to livestock producers to design and install full containment manure management systems. Assistance is also being provided to develop manure utilization plans for each feeding system. Practices that may be installed include diversions, dikes, fencing, holding ponds, vegetative buffers, and settling basins. To date, the Environmental Services Program has assisted with the implementation of one manure management system in the Red River Basin.

In addition to the watershed projects, the NPS Program also provides Section 319 financial support to several educational projects conducting outreach efforts in the Red River Basin. These educational projects are disseminating information on NPS pollution impacts as well as the solutions to those impacts. The target audiences for these educational events range from K-12 students to the public at large. However, given the extent of the agricultural industry in the state, agricultural producers are typically the primary target audience for most NPS Program educational efforts. Table 6 lists the specific educational projects currently active in the Red River Basin.

Table 6. Educational projects supported by the NPS Program in the Red River Basin

Section 319 Funded Education Project	Section 319 Funded Education Project
Statewide ECO ED Program	Envirothon Program
Ranchers Mentoring and Outreach Program	Red River Basin River Watch and River of Dreams Program.
Project WET/ND Water Education	Prairie Waters Education & Research Center
Soil Conservation and Watershed Leadership Academy	The Regional Environmental Education Series (TREES)
Nutrient Management Education & Support Program	

A third project category supported by the NPS Program includes projects that provide technical support to active NPS projects or address a specific priority resource concern. Collectively, these projects are identified as "support projects." The support projects are generally statewide or regional in scale. Four support projects are active in the Red River Basin. While the scope of the projects extends outside the Red River Basin, they have provided technical and/or financial support for BMP implementation in the basin. Active support projects are as follows:

- Pheasants Forever, Inc. was awarded Section 319 funding in 2017 and 2020 to implement the Precision Ag Business Planning Support Program. The goal of the program is to utilize precision ag business planning technology delivered through several Return-on-Investment Platforms to improve water quality and wildlife habitat while maximizing farm profits and minimizing risks for participating producers. This is being accomplished by providing technical assistance to producers to evaluate their fields and identify areas of low or negative profits. Using this information, project staff coordinate with local SCD and/or NRCS staff to assist producers in determining alternative uses for the revenue negative acres. The management objective for the targeted acres is to implement practices that will improve producer profits; eliminate unnecessary nutrient and/or pesticide inputs; protect the soil resource; and reduce potential water quality impacts. Typically, the management adjustments on the revenue negative acres include enrollment in the

Conservation Reserve Program or, for more short-term practices, planting annual cover crops, perennial forage crops or native grasses. Counties in the Red River Basin where the program is being implemented include Ransom, Sargent, Richland, and Barnes counties.

- The International Water Institute (IWI) was allocated Section 319 funding to support the development and management of the Prioritize, Target and Measure Application (PTMApp) for the Red River Valley in ND. The NRCS has also contributed significant funding for the development of the PTMApp in the state. The PTMApp provides the means to develop water quality geo-spatial data products at very fine scales. Using the web based PTMApp, these data can be used by local resource managers and landowners to establish watershed and field scale priorities; identify specific fields for BMP implementation; and estimate nutrient and sediment load reductions delivered to downstream lakes, reservoirs, rivers, and streams. The tool provides a readily available means to: 1) evaluate water quality benefits of different watershed improvement plans; 2) estimate the cost-effectiveness of potential practices for improving water quality; and 3) generate a report of "preferred" options to aid in developing watershed-based plans. Development of PTMApp has been completed for the Red River Basin in ND. The web address for the ND PTMApp is https://nd.ptmapp.iwinst.org/.

- The International Water Institute (IWI) was allocated Section 319 funding to support the need and potential success of a Pay-for-Progress (PfP) program in North Dakota. IWI will complete a review of PfP/outcomes/progress programs proposed or being used in other U.S. regions, develop a conceptual framework for the PfP. The IWI will solicit from a ND farmer-focus group, ND commodity groups, ND DEQ Staff, and the public, and 3 corporations with sustainability programs actively doing business in ND. A Pay-for-Progress report and recommendations for implementation will be submitted for use by the DEQ to deliver a functioning framework to deliver more cost-effective WQ improvements.

- The Ransom County SCD has received 319 funding since 2012 to assist with the engineering cost of Best Management Practices in 319 Watershed areas across the state through the NPS BMP Team. In addition to 319 funds, the NPS BMP Team also receives State Water Commission funds in support of this work.

Currently, the Nonpoint Source Pollution Management Program is in the process of awarding eight projects which received FY23 funding and soliciting applications for FY24 funding due November 1, 2023.

North Dakota's Nutrient Reduction Strategy for Surface Waters

Nutrients are essential components of aquatic ecosystems but when present in excess concentrations, they can result in water quality degradation. To address these concerns, the Department completed a reduction strategy in June of 2021. The strategy may be viewed at: https://deq.nd.gov/publications/WQ/3_WM/NutrientStrategy/FINAL_NDNutrientStrategy_June_2_2021.pdf

C-3 Minnesota

This information in this report is from July 1, 2022 to June 30, 2023

Watershed Restoration and Protection Strategy

There are 17 major tributaries to the Red River in Minnesota. The Minnesota Pollution Control Agency has developed Watershed Restoration and Protection Strategy (WRAPS) reports for each of these watersheds. Each WRAPS consists of monitoring, stressor identification, modeling, public participation/input and any associated TMDLs. The WRAPS and all associated Total Maximum Daily Load (TMDL) studies have been completed on all 17 watersheds, in the Red River Basin, as indicated below. This completes cycle 1 of the watershed approach for the Red River Basin.

The second cycle of monitoring has begun which will result in WRAPS Updates, as needed, for each watershed with any necessary TMDLs. Most of the watersheds in the Red River Basin are set to be sampled starting in 2023 through 2026 with a few that began in 2022. For the summer of 2023 the MPCA is monitoring (fish, macroinvertebrate, and discrete water quality) the following watersheds in the Red River Basin Monitoring is expected to be completed by the end of September (monitoring is done for two years in each watershed):

- Red Lake River Watershed (1st year)
- Grand Marais Creek Watershed (1st year)
- Sand Hill River Watershed (2nd year)
- Thief River Watershed (2nd year)

This next sampling cycle will create more recent monitoring data to inform the WRAPS and implementation work being done by local government partners.

Watershed Restoration and Protection Strategy reports:

Name	Status	Final WRAPS Approved
Bois De Sioux River	Complete & Approved	4/8/2020
Buffalo River	Complete & Approved	4/9/2016
Clearwater River	Complete & Approved	1/8/2021
Mustinka River	Complete & Approved	9/26/2016
Otter Tail River	Complete & Approved	10/14/2021
Red Lake River	Complete & Approved	11/20/2019
Red R. - Grand Marais Creek	Complete & Approved	4/11/2019
Red R. - Marsh River	Complete & Approved	6/24/2021
Red R. - Sandhill River	Complete & Approved	4/13/2017
Red R. - Tamarac River	Complete & Approved	3/21/2019
Roseau River	Complete & Approved	12/3/2020
Snake River (Red R. Basin)	Complete & Approved	12/3/2020
Thief River	Complete & Approved	3/18/2019
Two Rivers	Complete & Approved	6/10/2019
Upper Red River	Complete & Approved	12/22/2017
Upper/Lower Red Lake	Complete & Approved	5/21/2021
Wild Rice River	Complete & Approved	06/29/2022

Total Maximum Daily Load (TMDL)

TMDLs with completed WRAPS in the Red River Basin can be found at the following website, along with additional information: https://www.pca.state.mn.us/water/total-maximum-daily-load-tmdl-projects#approved-6123248a ;

National Pollutant Discharge Elimination System (NPDES)/State Discharge Elimination (SDS) wastewater permits and releases/bypasses

There were 10 individual National Pollutant Discharge Elimination System (NPDES)/State Discharge Elimination (SDS) permits issued of which 8 were for domestic wastewater treatment plants and 2 were for industrial facilities. There were also 48 general NPDES/SDS permits reissued of which 45 were to sand and gravel facilities, 1 to a municipal wastewater treatment pond system, 1 for a groundwater pumpout, and 2 to water treatment plants. There were 21 wastewater related incidents/releases of which two were noted as spills and the remaining 19 being releases or bypasses (all from municipal wastewater treatment plants).

Other

Five-Year Monitoring Program Red River Basin of Minnesota: The MPCA will be providing equipment (i.e., sondes) and technical support for the Red River Basin Flood Damage Reduction Work Group (FDRWG) five-year monitoring program. The primary water quality parameters will be total phosphorus, total suspended solids, orthophosphorus, and nitrate/nitrite nitrogen; flow monitoring data will also be collected at several of the sites which will enable load calculation. Earlier this year, the Minnesota Legislature appropriated $920k of Legislative-Citizen Commission on Minnesota Resources (LCCMR) funds to the FDRWG to assess the natural resource-related outcomes of 10-12 flood damage reduction projects in the Red River Basin. A Request For Proposals to identify a contractor to lead the implementation and monitoring of the program will be sent out in late July 2023. Monitoring is expected to begin in the spring of 2024.

Appendix D

Additional Activities in the Red River Basin

D-1 Devils Lake Sub-basin

Devils Lake Sub-Basin

The 2022 Devils Lake inflow (Figure 1) was one of the largest recorded in recent history, slightly less than the 2011 inflow. The high snow water equivalent and excessive precipitation during late spring resulted in the large inflow. Below normal precipitation prevailed in the watershed during the summer and early fall.

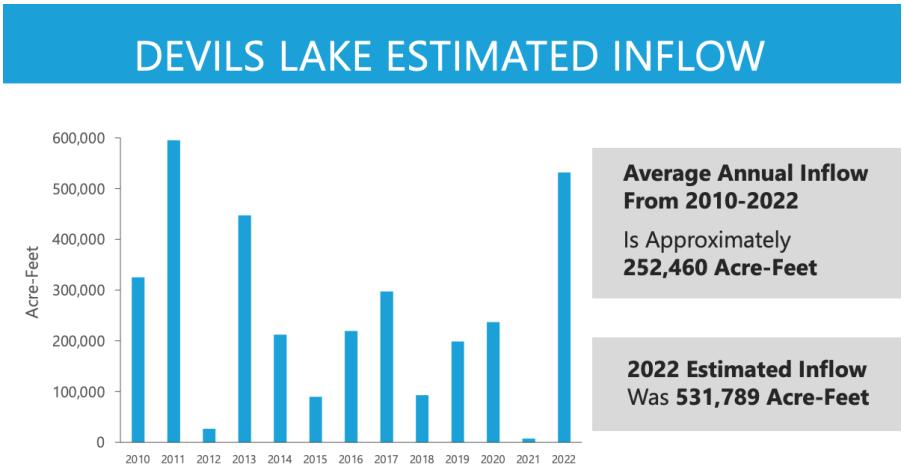

Figure 1. Annual Inflow to Devils Lake

The 2022 inflow caused a 3.8 feet increase to the water elevation of Devil Lake to 1450.9 feet (Figure 2). Evaporation and pumped discharge allowed the lake elevation to drop by about 1.7 feet by the fall of 2022. The 2023 spring runoff has caused the lake level to increase by approximately 1.5 ft to 1450.7 feet by the end of May 2023. This appears to be near the 2023 peak elevation, unless additional heavy precipitation occurs in the watershed.

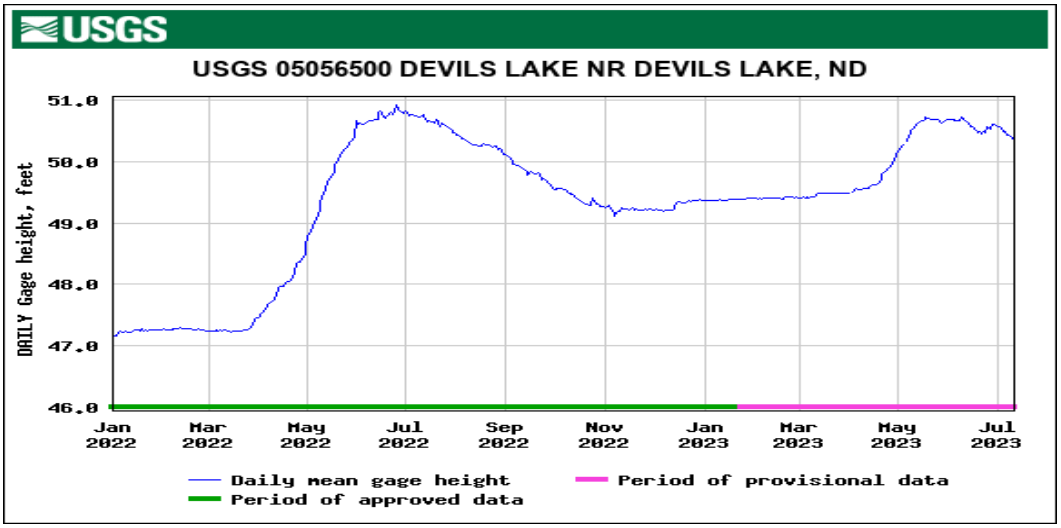

Figure 2. Devils Lake water stage: From Jan. 2022 through July 7, 2023 (Figure courtesy of USGS.)

The water elevation of Devils Lake has increased by more than 2 feet, in 1 year, several times in recent history. The figure (Figure 3) below shows the large increases in water elevation due to

the 2009 and 2011 runoff. The highest elevation in recent history was recorded in June 2011 at 1454.3 feet. The natural outlet is at an elevation of 1458.0 feet.

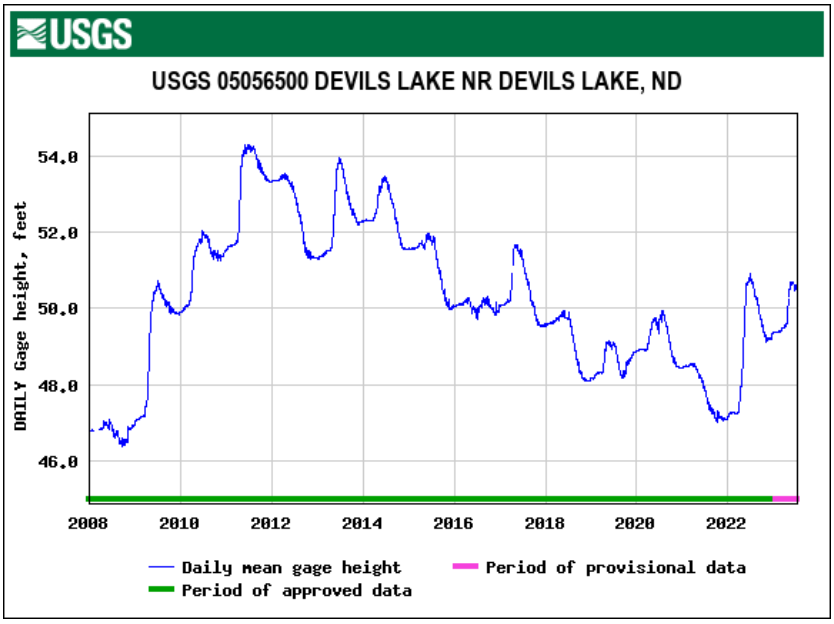

Figure 3. Devils Lake water stage: From 2008 through July 7, 2023. (Figure courtesy of USGS.)

The figure below (Figure 4) shows the Devils Lake water elevation since about 1919. Historical evidence indicates that the water elevation had exceeded the elevation of the natural outlet many years prior to that time.

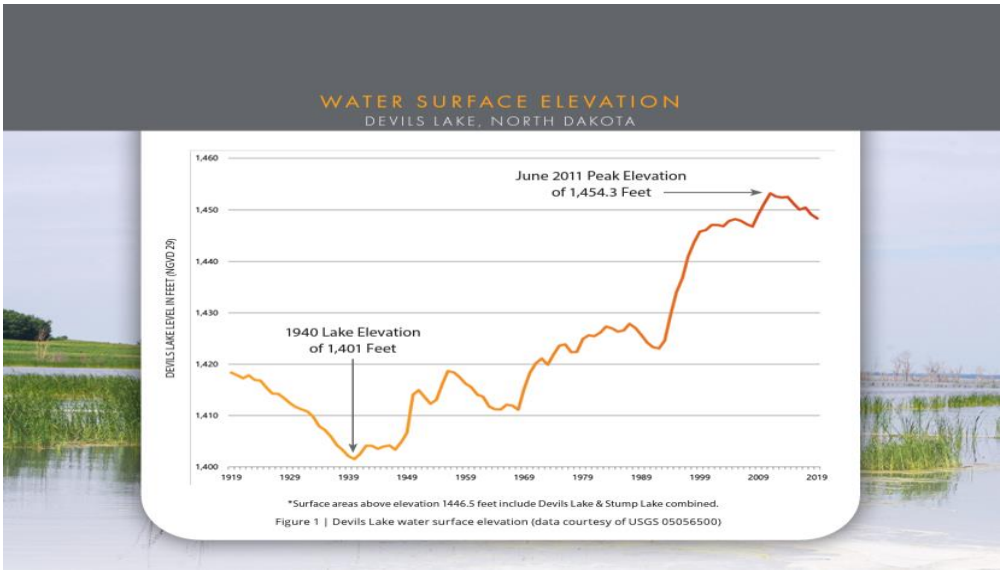

Figure 4. Devils Lake Historical Water Elevations (1929 datum)

The state of North Dakota owns and operates two outlets: West End and East End outlets. A summary of the annual outlet discharge is provided in the following graph. The West End outlet started the 2023 discharge on May 15, at 50 cfs. The discharge rate was increased to 175 cfs on May 17. The East End outlet started operation on June 6, at 200 cfs. The current discharge (as of

July 7, 2023) from the outlets total 400 cfs, with West End at 250 cfs and East End at 150 cfs.

A total of 4,844 acre-feet was discharged from the West End outlet during the month of May 2023 (Figure 5).

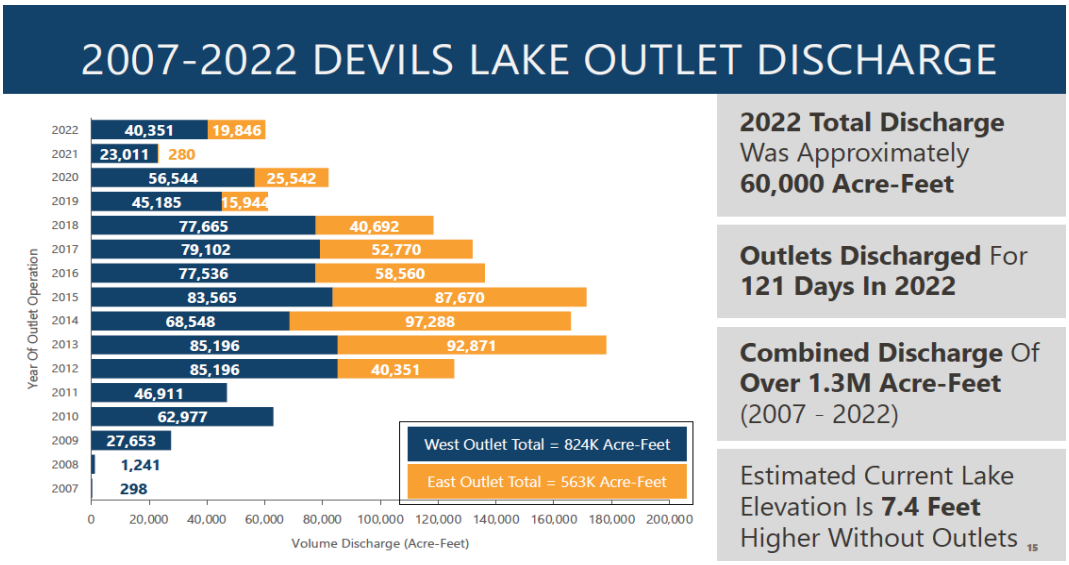

Figure 5. Summary of Outlet Discharge for Devils Lake

Water quantity and quality thresholds are in place for operating the outlets. The locations of the monitoring sites are shown in the following map (Figure 6).

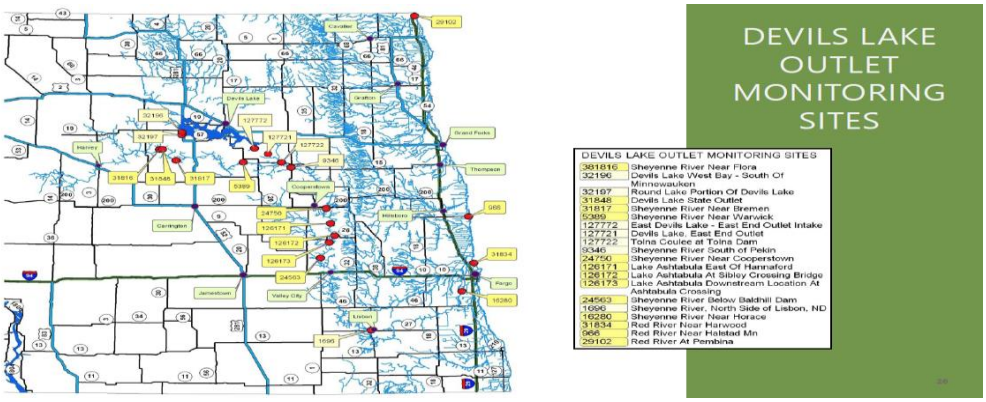

Figure 6. Location of Monitoring Sites

Outlet Monitoring Sites

The Devils Lake Outlets Management Advisory Committee met in Devils Lake on May 17, 2023. The Committee members stated that an emergency condition exists, and that pumping should continue at the maximum amount allowable.

Note: All elevations provided are based on the 1929 datum.
Stage + 1400 feet = Elevation in 1929 datum
Stage + 1401.33 feet = Elevation in 1988 datum

D-2 Red River Water Supply Projects

Red River Valley Water Supply Project (RRVWSP)

The Red River Valley Water Supply Project (RRVWSP) is a drought resiliency project and economic development initiative that will deliver Missouri River water to central and eastern North Dakota through a buried pipeline (Figure 7).

An emergency water supply will be delivered to communities and rural water systems during moderate to severe droughts. The water will also provide opportunities for industrial development, as a current lack of industrial water supply has driven industries to obtain water through less desirable means and/or relocation out of North Dakota.

Upon completion, the RRVWSP will benefit about half of North Dakota's population. Over 30 cities and water systems committed to help fund the development portion of the project. A capacity of about 159 cfs would be needed to service these interests. The current estimated cost of the project is $1.16 billion, for 165 cfs project capacity.

The project sponsor is the Garrison Diversion Conservancy District (District) while the local sponsor is the Lake Agassiz Water Authority (LAWA) for the project.

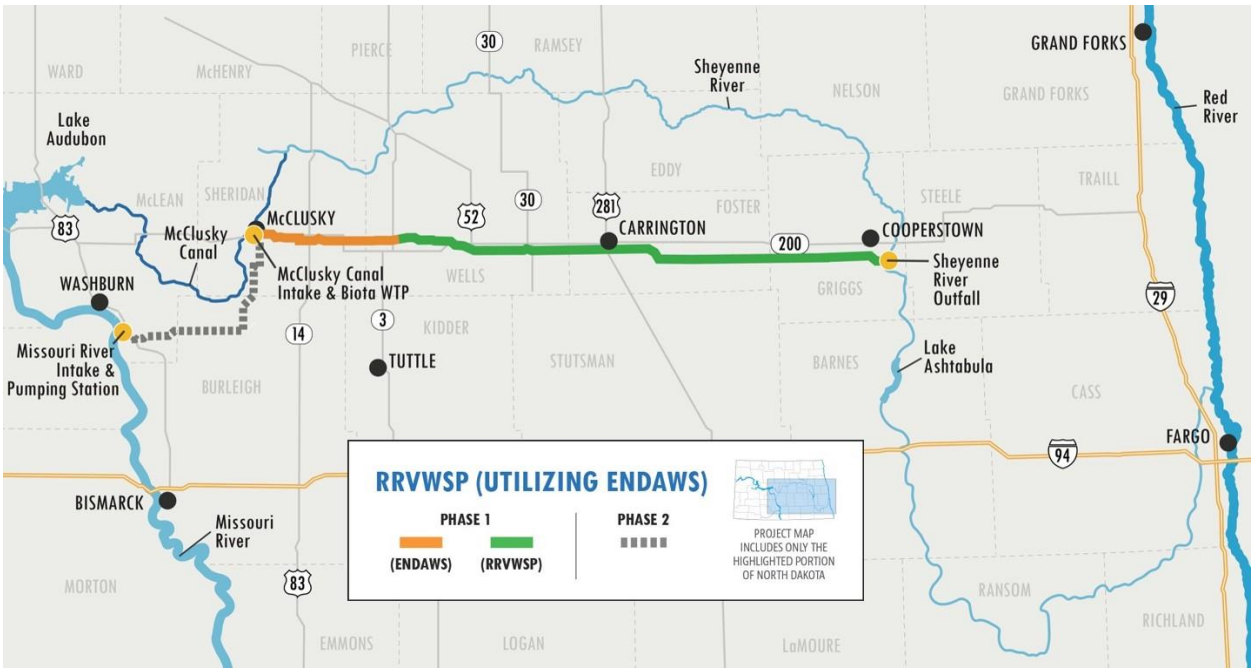

Figure 7. Red River Valley Water Supply Project

Design/Construction Status:

The following construction items are either substantially completed or underway.

- Contract 1 for the Missouri River intake pumping station wet well and site development is complete.
- Contract 2 for the Missouri River Intake, screens and tunnel is complete.
- Contract 5A, consisting of the installation of 1.25 miles of 72-inch transmission pipeline near Carrington, is complete.
- Contract 5B includes the construction of 9 miles of 72-inch pipeline and a trenchless crossing of the Canadian Pacific Railway in Foster County. Construction started in June 2022 and is expected to be completed by the end of 2023.
- Sheyenne River discharge structure and site development was completed in 2022.

Proposed Work in 2023-25 Biennium:

Senate bill 2020, the Department of Water Resources budget, approved up to $180 million for the RRVWSP for the 2023-25 biennium. The RRVWSP is proposing that the funds be used for construction of 27 miles of pipeline, complete the design of an additional 52 miles of pipeline, and begin preliminary design on additional project features such as the McClusky Canal intake and pumping station, biota water treatment plant and hydraulic break tanks.

D-3 US Army Corps of Engineers Flood Control Activities

U.S. Army Corps of Engineers Flood Control Activities

Introduction

The U.S. Army Corps of Engineers (Corps, USACE) St. Paul District has a long history of involvement in water resource issues in the Red River of the North Basin. The St. Paul District operates reservoirs for flood control, recreation, and environmental purposes.

The Corps works with other federal and state agencies, municipalities, local watershed districts, environmental groups, and local communities to address water resource problems and opportunities in the basin. The Corps also regulates work in navigable waters and other waters of the United States. The Omaha District is responsible for part of the Red River of the North Basin in North Dakota. The St. Paul District is responsible for other areas of the basin in North Dakota and Minnesota.

Currently, Corps activities in the basin include conducting flood risk management and ecosystem restoration studies, updates to USACE water control manuals constructing flood risk management and ecosystem restoration projects, and providing emergency assistance and disaster response.

Current Construction Projects

Fargo-Moorhead Metropolitan Area Flood Risk Management Project

Fargo, North Dakota; Moorhead, Minnesota

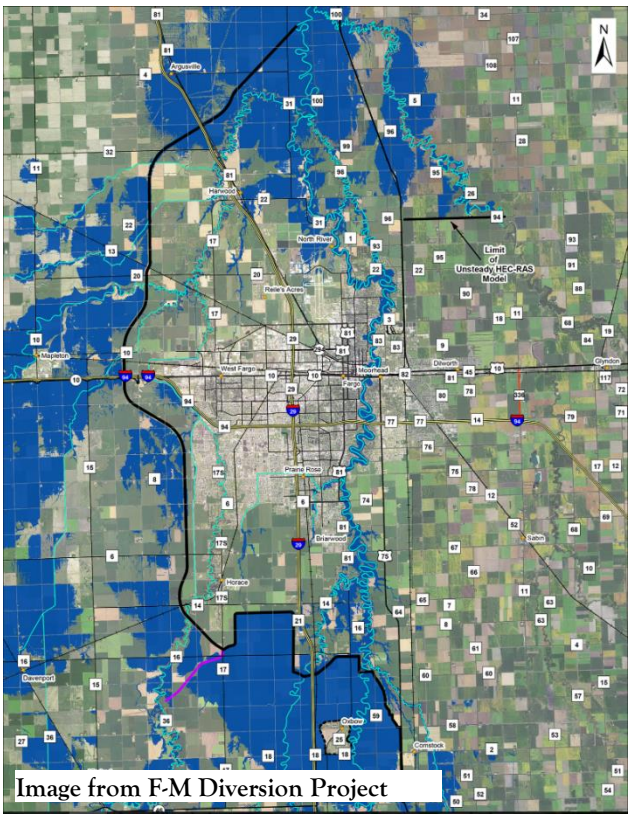

Image from F-M Diversion Project

The project was authorized in the Water Resources Reform and Development Act of 2014 and funded to begin construction in 2016. It includes building a 20,000 cubic feet per second diversion to the west of Fargo with upstream staging and storage. Once construction is complete, the diversion would operate for events larger than a 20-year flood event. The project will provide permanent flood risk management to a metropolitan area of nearly 260,000 people.

The project is being implemented using a split delivery plan. Under this plan, the local sponsor constructs the diversion channel using a public–private partnership (P3), and the Corps constructs the Southern Embankment or "dam" portion of the project. Federal construction began in spring 2017 and is ongoing for the Diversion Inlet Structure, Wild Rice River Structure, Red River Structure, I-29 Grade Raise, Drayton Dam Fish Passage Mitigation (see below) and Southern Embankment Reach SE-2A. Construction of the Southern Embankment Reach SE-1 and the Drain 27 Wetland Restoration are complete. The sponsors selected their P3 developer, Red River Valley Alliance, in June 2021 and construction of the diversion channel is began fall 2022. The Project is scheduled to be operational in time

for a Spring 2027 flood event. The federal work was funded to completion in the Infrastructure Investment and Jobs Act, Nov. 2021 (Public Law 117-58).

Drayton Dam Fish Passage Mitigation Project
Drayton, North Dakota

This aquatic ecosystem restoration project will provide fish passage and eliminate dangerous hydraulic conditions at Drayton Dam while maintaining the pool for water supply and bank stability. Construction plans involve removing and replacing the existing dam and creating an arched-rapid fishway, which creates rock riffles for fish movement. The project is included as mitigation for the Fargo-Moorhead Metropolitan Area Flood Risk Management Project. A construction contract was awarded in May 2022 and work is expected to be completed by fall 2024.

To date, much of the old low-head dam has been removed and the contractor is preparing to begin placing boulders for the arched-rapid fishway passage. In total, there will be 1,100 boulders placed this coming summer into fall with anticipated completion date at the end of September. The following spring the contractor will focus on riverbank vegetative establishment and is expected to be complete by fall 2024.


Image from USACE

Devils Lake Embankment Project
Devils Lake, North Dakota


Image from USACE

Devils Lake is a terminal lake in Devils Lake Basin, meaning water leaves the lake through evapotranspiration or when its elevation is high enough to overflow the basin's boundary. Because Devils Lake typically does not have a natural outlet, it is subject to extreme variations in lake levels depending on changes in climate.

As of June 7, 2022, the lake elevation is 1450.7 feet, down from its record elevation of 1454.30 feet in June 2011. The embankment construction is complete with a minimum elevation of 1466.00 feet. With all final components of the project complete, (construction and excavation) the project was transitioned to the city of Devils Lake, North Dakota, on July 17, 2018.). USACE is currently working to finalize all project documentation (Operation and maintenance manuals and project as-build drawing) with the city of Devils Lake. USACE continues to provide FEMA and State of North Dakota with project information in support of the National Flood Insurance Program with the project in place.

North Dakota Environmental Infrastructure Program (Section 594)

The Corps is authorized to assist communities and rural areas in North Dakota under this program. The Corps provides design and construction assistance for wastewater treatment and related facilities; combined sewer overflow; water supply, storage, treatment, and related facilities; environmental restoration; and surface water resource protection and development.

Section 594 of the Water Resources Development Act of 1999, Public Law 106–53, as amended, authorizes the following sanitary sewer systems where the work is performed by the non-federal sponsor.

City of Kindred Sanitary Sewer Service Improvement Project

During periods of wet conditions, heavy precipitation, and snowmelt events, the city of Kindred's wastewater collection system experiences substantial increases in wastewater flows, and at times exceeds the capacity of the city's main wastewater pump station, resulting in pumping of untreated wastewater out of the system and onto the ground. The city of Kindred (the non-federal sponsor) requested assistance from the Corps; this Section 594 project includes the design and rehabilitation of the existing stabilization ponds, the expansion of two new cells, the rehabilitation of the main lift station, and the replacement of the force mains to the stabilization ponds. In fiscal year 2019, the Section 594 program received $2,950,000 for this project. The project partnership agreement was signed in June 2019. In fiscal year 2020, the Section 594 program received an additional $1,250,000 for Phase 2 of the Kindred project. The Kindred Sanitary Sewer Service Improvement Project was physically completed in 2023 and the Corps continues to work with the city to close out the project financially.

City of Aneta Water and Sanitary Sewer Replacement Project

The city of Aneta's sanitary sewer and water infrastructure, originally installed around 1960, is aging and creating problems for the community. The city has been proactive with portions of their infrastructure, recently replacing their water tower, several fire hydrants and 3 blocks of emergency water main

replacement project. However, the sewer mains, a majority of the water mains and services have not been updated. The proposed project consists of replacing all of the above noted sanitary sewer and water mains. Also included in the scope of work is replacement of manholes, service lines, hydrants, valves, street repairs, curb and gutter, sidewalk and American with Disabilities Act ramp improvements. In fiscal year 2022, the city of Aneta received $4,887,500 for this project. The Corps anticipates executing a project partnership agreement with the city during fiscal year 23.

City of Cando Water and Sanitary Sewer Replacement Project

Approximately two-thirds of the city of Cando's sanitary sewer system is older vitrified clay pipe (VCP). The exact age of the pipe is unknown, but it is estimated that this pipe has been in the ground for 65 years or more. These clay sewer mains are at the end of their service life and are starting to deteriorate. The purpose of this project is to replace and rehabilitate the deteriorating sanitary sewer system and water mains throughout the city of Cando. This project will help prevent possible health and safety hazards by addressing system deficiencies and reducing the possibility of a sewer collapse and backup into homes and businesses. In fiscal year 2022, the city of Cando received $3,275,000 for this project. The Corps anticipates executing a project partnership agreement with the city during fiscal year 23.

City of Enderlin Drinking Water and Water Treatment Plant Improvement Project

The city of Enderlin's is currently working to identify what their environmental infrastructure funding will be put towards. They've hired a consultant to assist in this effort. In fiscal year 2022, the city of Enderlin received $3,800,000 for this project. Once the cities priorities are determined Corps will work with the community to execute a project partnership agreement for construction.

Current Studies

CAP 1135 – Lower Otter Tail River Restoration Project
Breckenridge, Minnesota

Under Continuing Authorities Project (CAP) Section1135 of the Water Resources Development Act of 1986, the Corps is authorized to study and implement ecosystem restoration projects at existing Corps projects. The Corps constructed a flood control project in the 1950s that straightened and enlarged a portion of the Lower Otter Tail River between Orwell Dam and the city of Breckenridge, Minnesota. This reach of the Lower Otter Tail River is characterized by unstable banks, excessive sediment loading, and degraded in-stream and riparian habitats.


Image from USACE

The St. Paul District and the Buffalo-Red River Watershed District (BRRWD) has completed the feasibility study on improving the environmental conditions of the Lower Otter Tail River while maintaining the originally authorized purpose of protecting adjacent lands from flood damages. Potential alternatives include constructing rock riffle structures to create diversified river pools and reconnecting river meanders that were cut off.

The Corps and the BRRWD plan to enter into a Project Partnership Agreement (PPA) with construction

beginning no earlier than 2024, subject to availability of federal and local funds. The maximum federal contribution is limited to $10 million.

CAP 14 – Sheldon Road Bridge

Sheldon, North Dakota

The purpose of the Continuing Authorities Program (CAP) 14 project is to evaluate alternatives and formulate a plan to stabilize the riverbank adjacent to Sheldon Road in order to protect the bridge from eroding into the Sheyenne River. The project is located where Sheldon Road crosses over the Sheyenne River approximately 4.75 miles south of Sheldon, North Dakota.

The bank of the Sheyenne River adjacent to the west side of the south abutment of the Sheldon Road Bridge, located on County Road 54, is being threatened by severe erosion. Surveys estimate that approximately 30 linear feet has eroded since 2006 and continues to erode today. The erosion is threatening the use of Sheldon Road Bridge. Without proper intervention, erosion could continue and potentially affect the integrity of both the bridge and the County Road 54 roadway.

Ransom County, the non-federal sponsor, submitted a request for assistance on February 12, 2018. The Corps worked closely with Ransom County on the federal interest determination which was approved July 13, 2020. Following the completion of the feasibility phase, the study report was approved June 2, 2021. A project partnership agreement between the Corps and Ransom County was executed March 22, 2023.

The design and implementation phase of the project will be cost shared at 65%federal and 35% non-federal and will utilize a design/build multiple award task order contract (MATOC). The Corps anticipates construction of the Sheldon Road Bridge CAP 14 project to begin during the 2024 construction season.

Tribal Partnership Program (TPP)

Red Lake River fish passage and the Zah Gheeng Marsh restoration

Red Lake River, Minnesota

The Tribal Partnership Program (TPP) will address the degradation of culturally significant habitat faced by the Red Lake Nation on their tribal lands along the Red Lake River and the Zah Gheeng Marsh. The study will assess and make recommendations related to fish passage through a low-head dam and wetland restoration opportunities along the Red Lake River. The Red Lake River is the only outlet to Lower Red Lake, which is completely within the boundaries of the Red Lake Nation in Red Lake, Minnesota. The Zah Gheeng Marsh is adjacent to the Red Lake River, immediately downstream of Lower Red Lake. The Red Lake River is a tributary to the Red River of the North.

The Zah Gheeng Marsh has not been functioning as it did before construction of the Red Lake Dam and channelization of the Red Lake River. Previous efforts to restore marsh function include construction of the low-head dam and inlet structures which pass flows into the marsh directly from Red Lake. The Red Lake Dam, channelization, low-head dam and inlet structures are USACE projects. The purpose of the feasibility study is to examine the hydrologic restoration of the Zah Gheeng Marsh as it relates to waterfowl and fur-bearing mammal habitat and a low-head dam on the Red Lake River in conjunction with wetland hydrology and fish passage.

A feasibility cost-share agreement between the Corps and the Red Lake Nation was signed on June 16, 2021. The study includes gathering information, formulating alternatives, analyzing costs, benefits and environmental impacts, and recommending a plan on how to address hydrologic

restoration and fish passage. Significant hydraulic modeling is currently underway. The Corps is drafting a feasibility study report with an integrated environmental assessment in coordination with the Red Lake Nation Tribal Council. In Summer 2024, a public meeting and review will be held. The final report is scheduled for winter 2024.

Sustainable Rivers Program (SRP)

Mud Lake, Wheaton, Minnesota

Under the Sustainable Rivers Project (SRP), the St. Paul District is evaluating the environmental effects of a drawdown, fall flooding, and minimum releases at Mud Lake via the White Rock Dam to provide shorebird and waterfowl habitat. Water releases would discharge into the Bois de Sioux River. The SRP is an Army Corps of Engineers and The Nature Conservancy partnership that focuses on modifying operations at Corps dams to enhance habitat conditions for the plants and animals that depend on downstream river flows.

In 2020 and 2021, scoping opportunities and constraints to modify discharges from Mud Lake occurred, including coordination with agency partners. During scoping there was general agreement from agencies that it would be possible to operate the dam in a way that would benefit both shorebirds and fisheries by identifying minimum flows and managing ramping rates. The Corps' EA has evaluated how operating the White Rock Dam to drawdown and flood Mud Lake will affect the hydrologic regime in the Bois de Sioux River and the organisms it supports, as well as other effects to the surrounding environment. The Corps has completed the draft environmental assessment to support this draw down request and it was released for public review/input in late spring 2023. The formal request for a deviation from MVD and a draw down is anticipated in the late summer of 2023. The water control manual update is considering including this type of draw down permanently.

Updates to Water Control Manuals at USACE Projects

In fiscal year 2023 the following USACE projects received funding to begin a Water Control Manual (WCM) updates.

- Lake Traverse (Reservation Dam)/Mud Lake (White Rock Dam)
    - The update is expected to take three years (at a minimum – assuming future appropriations)
    - In Feb of 2023 USACE conducted a public meeting to gain input from the public and stakeholder on the proposed update.
    - In May of 2023 USACE conducted an internal workshop to create building blocks for modeling based on the public and stakeholder input (delayed due to spring flooding)
    - In Jun-Aug of 2023 USACE modeled building blocks
    - In Sep of 2023 USACE will look at results of the building block runs and combine building blocks into alternatives for phase 2 modeling.

In fiscal year 2024 USACE the following USACE projects received funding for Water Control Manual updates.

- Lake Traverse (Reservation Dam)/Mud Lake (White Rock Dam)
    - Year 2 is funded.

    - Year 2 includes phase 2 modeling, results from phase 2 given to public and stakeholders for input on phase 3 modeling, phase 3 modeling and the draft decision document complete.
- Lake Ashtabula (Baldhill Dam)
    - Update is expected to take two years as it is assumed the manual is more u to date and it is assumed less phases of modeling will be required (at a minimum – assuming future appropriations).
    - Year 1 includes initial public/stakeholder meetings, phase 1 modeling, mid-point public/stakeholder meetings, phase 2 modeling.
- Red Lake (Red Lake Dam)
    - Update is expected to take three years (at a minimum – assuming funding)
    - Year 1 includes initial public/stakeholder meetings and phase 1 modeling.

Planning Assistance to States and Tribes (Section 22)

Long Term Flood Solutions Plan
North Dakota and Minnesota

The Corps is currently working on a Planning Assistance to States and Tribes (PAS) project for the Red River Basin Commission (RRBC). The project consists of developing a basin-wide, long term flood risk reduction plan for the Red River watershed within Minnesota and North Dakota. Specifically, the Corps is developing updated hydrologic and hydraulic models for the basin to assess the 1.0, 0.5, and 0.2%chance exceedance events and the possibility of flood risk reduction through potential upland storage impoundments for rarer flood events. Sensitivity to variations in precipitation and snow melt patterns will also be included. The Corps has updated existing hydraulic models and the sponsor will provide basin-wide hydrology models of the tributaries to be used in the storage analysis. The Corps will also incorporate climate variability to evaluate potential impacts on future flood magnitudes. The project has a 50/50 cost share with the RRBC, with a federal contribution of $325,000. The expected project completion is in 202.

Red River of the North Comprehensive Study/Downstream Storage Project
North Dakota and Minnesota

The Corps is currently working on a PAS project with RRBC to develop a distributed storage analysis for the portion of the basin downstream of Halstad, Minnesota. This project will complement the existing storage model upstream of Halstad. Additional hydrology models were developed by RRBC consultants to provide the basin detail required for the analysis. All required hydraulic models are complete and ready for use for the VTP (Virtual Thaw Progression) model runs. The Phase II report and appendices have been reviewed and are complete. This project has a 50/50 cost share with the RRBC, with a federal contribution of $312,500. The project is expected to be complete in 2024, and is a companion study to the Long Term Flood Solutions Plan PAS project.

Red River of the North Main Stem Bathymetric Study
North Dakota and Minnesota

The Corps and the North Dakota Department of Water Resources, with support from the RRBC, have executed a project partnership agreement to obtain bathymetric data for the Red River of the North main stem from White Rock Dam to the Canadian border. This project is being done under the Planning Assistance to States and Tribes (PAS) program. This will provide up-to-date channel geometry for the entire main stem river in the United States for 444 river miles. The Corps is working with the IJC in developing and coordinating additional phases to obtain the same data for the Canadian portion of the main stem and selected tributaries. This project has a 50/50 cost share with the North Dakota Department of Water Resources, with a USACE contribution of $75,000 for the first phase in the United States. Cost share funds for the sponsor's part of the work have been received.

Ongoing Programs
Silver Jackets

The Corps has worked with the U.S. National Weather Service, the U.S. Geological Survey, and others on the placement of soil moisture and temperature instrument packages around the basin to provide detailed hydrologic parameters to improve spring flood forecasts. In 2017, there was a project to update river gage datum to the current standard (NAVD 1988) and provide consistent elevations for the river stages across the basin that converted 34 river gages. This gage datum conversion project has received $150,000 of Bipartisan Infrastructure Law (BIL) funding in 2022 under the Flood Plain Management Services (FPMS) program to continue the effort, to be completed in 2023.

Emergency Operations

During flood events in the St Paul Districts area of responsibility, the St. Paul District provides emergency assistance in support of the locally-led flood response. The St. Paul District becomes part of a larger force made up of local, state, and federal responders as well as volunteers.

In 2023 the St. Paul District provided both technical and direct assistance in multiple communities due to spring flooding. The flood area manager and assistant area managers continue to better define roles and solidify relationships with communities in the affected basins to continually improve our support. The district's emergency management team is also prepared to provide water assistance due to drought.

In 2023, under PL84-99 authority, 5 communities requested USACE assistance post event for the rehabilitation of damaged levees from the 2022 Spring Flood event. As a result, the team completed 5 Project Information Reports (PIR) identifying recommended repairs and associated cost estimates. These reports will be submitted to MVD for review and approval in the summer of 2023.

D-4 USGS Water Resources Investigation and Activities

ADDITIONAL ACTIVITIES IN THE RED RIVER BASIN

USGS Water Resource Investigations and Activities

January-September 2023

The National Weather Service (NWS) Grand Forks Forecast Office held the first Spring Flood Outlook webinar of 2023 on January 26. The following description of Basin conditions is a summary from the briefing packet provided with the webinar (NWS Grand Forks Forecast Office and NWS North Central River Forecast Center, 2023a). The outlook showed a relatively low risk for significant (moderate or higher) spring flooding in the Red River and Devils Lake Basins, mostly due to fall (Sept-Nov) precipitation that was 1–4 inches below normal, depending on the location within the Basin. This lack of moisture resulted in soil moisture below normal heading into freeze-up, with severe drought conditions persisting across the lower Sheyenne and abnormally dry to moderate drought elsewhere in the Red River Basin. Streamflow conditions at the time of freeze-up were in the normal range for the Red River, but above normal for the Sheyenne, the Red Lake, and Goose Rivers. Early season snow cover contributed to a shallow frost layer in portions of the Basin; however, frost depths varied throughout the region. Snowfall at the time of this first flood outlook had also been much above normal for the entire region, with highest amounts in the Devils Lake and Sheyenne basins. The NWS gave the last official probabilistic flood outlook for Spring 2023 on March 23, at which time the 50% exceedance probability called for "moderate" to "major" flooding for the entire mainstem Red River as well as most of its tributaries (NWS Grand Forks Forecast Office and NWS North Central River Forecast Center, 2023b).

Prolonged freezing temperatures delayed any significant snow melt/runoff until mid-April—April was the 10th coldest April in 129 years of record (Akyüz, 2023). Although most of the mainstem Red River, as well as the Red Lake River, lower Sheyenne River, and most of the other tributaries to the Red reached "major" flood stage, no peak of record (POR) flows were recorded this spring (U.S. Geological Survey, 2023). Flooding conditions in the Red River Basin lasted approximately 3 weeks. In that time, staff out of the Grand Forks and Bismarck USGS field offices made 87 streamflow measurements, completed 10 streamgage repairs, and collected 46 water-quality samples in the Red River, Devils Lake, and Sheyenne River Basins.

Some provisional peaks for stations with at least 70 years of data are shown below. The Red Lake River at Crookston (120+ years of peak flow data) peak occurred when the stream was ice-affected and the peak has not been determined; therefore this streamgage is not included below despite the Red Lake River being a major tributary to the Red River.

05054000, Red River of the North at Fargo, ND

Provisional peak of 11,900 cfs at 29.76 ft on April 22, 2023; not a top 10 peak (U.S. Geological Survey, 2023).

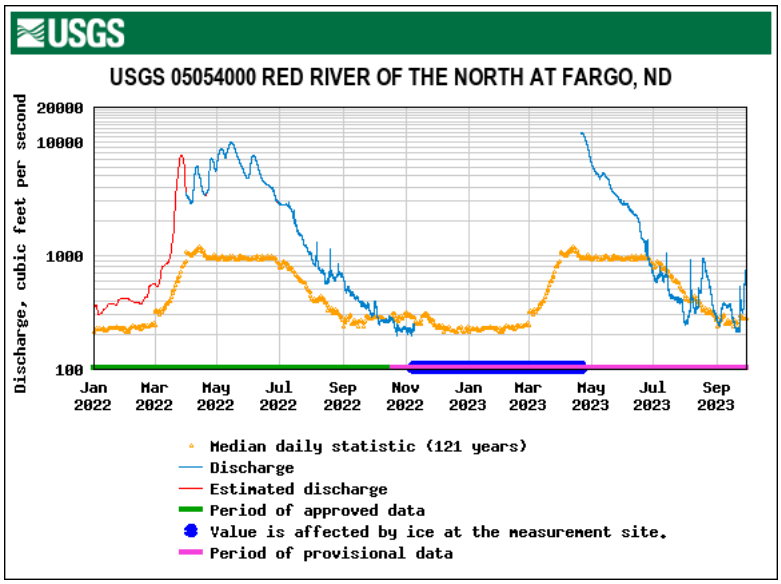

Figure 1: Streamflow at the Red River of the North at Fargo, ND January 1, 2022-Sept. 29, 2023 (nwis.waterdata.usgs.gov/nwis/uv/?ts_id=92349&format=img_stats&site_no=05054000&begin_date=20220101&end_date=20230929).

05082500, Red River of the North at Grand Forks, ND

Provisional peak of 43,100 cfs at 40.83 ft on April 24, 2023; not a top 10 peak (U.S. Geological Survey, 2023).

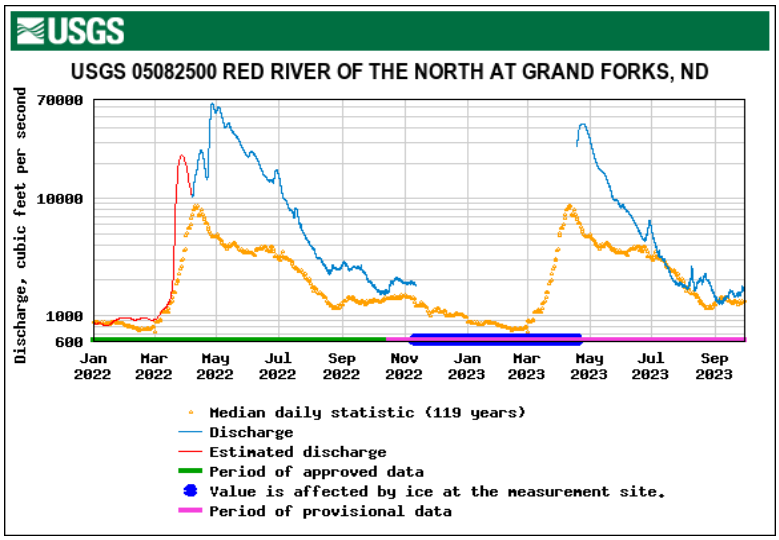

Figure 2: Streamflow at the Red River of the North at Grand Forks, ND January 1, 2022-Sept. 29, 2023 (nwis.waterdata.usgs.gov/nwis/uv/?ts_id=92537&format=img_stats&site_no=05082500&begin_date=20220101&end_date=20230929).

05059000, Sheyenne River nr Kindred, ND

Provisional peak of 3,160 cfs at 15.96 ft on May 16, 2023; not a top 10 peak (U.S. Geological Survey, 2023).

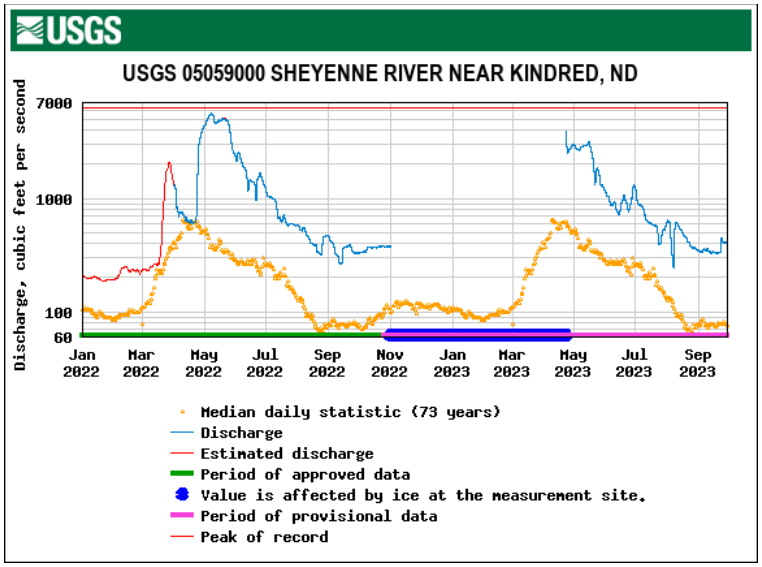

Figure 3: Streamflow at the Sheyenne River nr Kindred, ND January 1, 2022-Sept. 29, 2023 (nwis.waterdata.usgs.gov/nwis/uv/?ts_id=92479&format=img_stats&site_no=05059000&begin_date=20220101&end_date=20230929).

05100000, Pembina River at Neche, ND

Provisional peak of 6,250 cfs at 20.33 ft on April 29, 2023; 11th highest peak (U.S. Geological Survey, 2023).

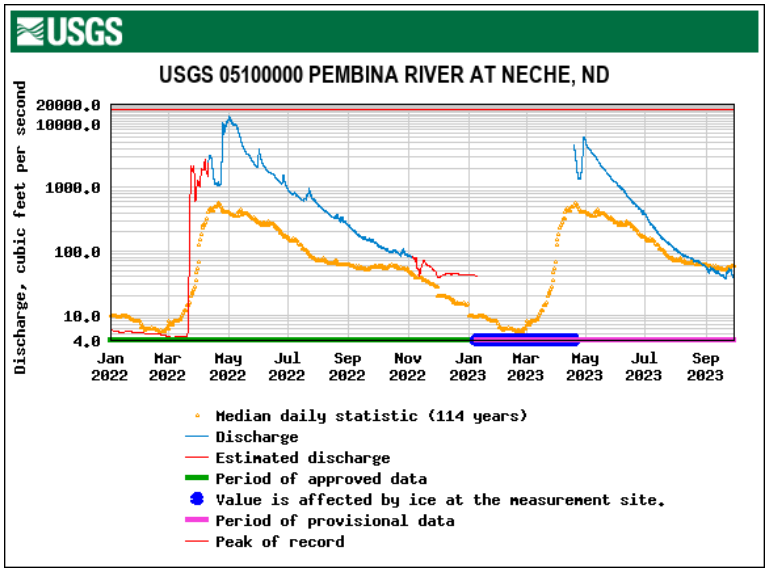

Figure 4: Streamflow at the Pembina River at Neche, ND January 1, 2022-Sept. 29, 2023 (nwis.waterdata.usgs.gov/nwis/uv/?ts_id=92577&format=img_stats&site_no=05100000&begin_date=20220101&end_date=20230929).

The Devils Lake Basin was subject to heavy snowfall in the 2022-2023 winter season, with an

approximate snowpack of 24+ inches by April 4 that only diminished to around half of that by April 14, as per modeled snow depths from satellite imagery by the NWS. As this snowpack melted, it eventually caused a provisional rise of 1.10 ft in the Devils Lake level from April 14 to May 18, with a provisional peak of 50.71 ft on May 18 (U.S. Geological Survey, 2023). Pumping resumed out of the west-end outlet on May 15 and out of the east-end outlet on June 6 (North Dakota Department of Water Resources, 2023). Pumping out of the east-end outlet ended Sept 15, while pumping out of the west-end outlet continued until Oct 24.

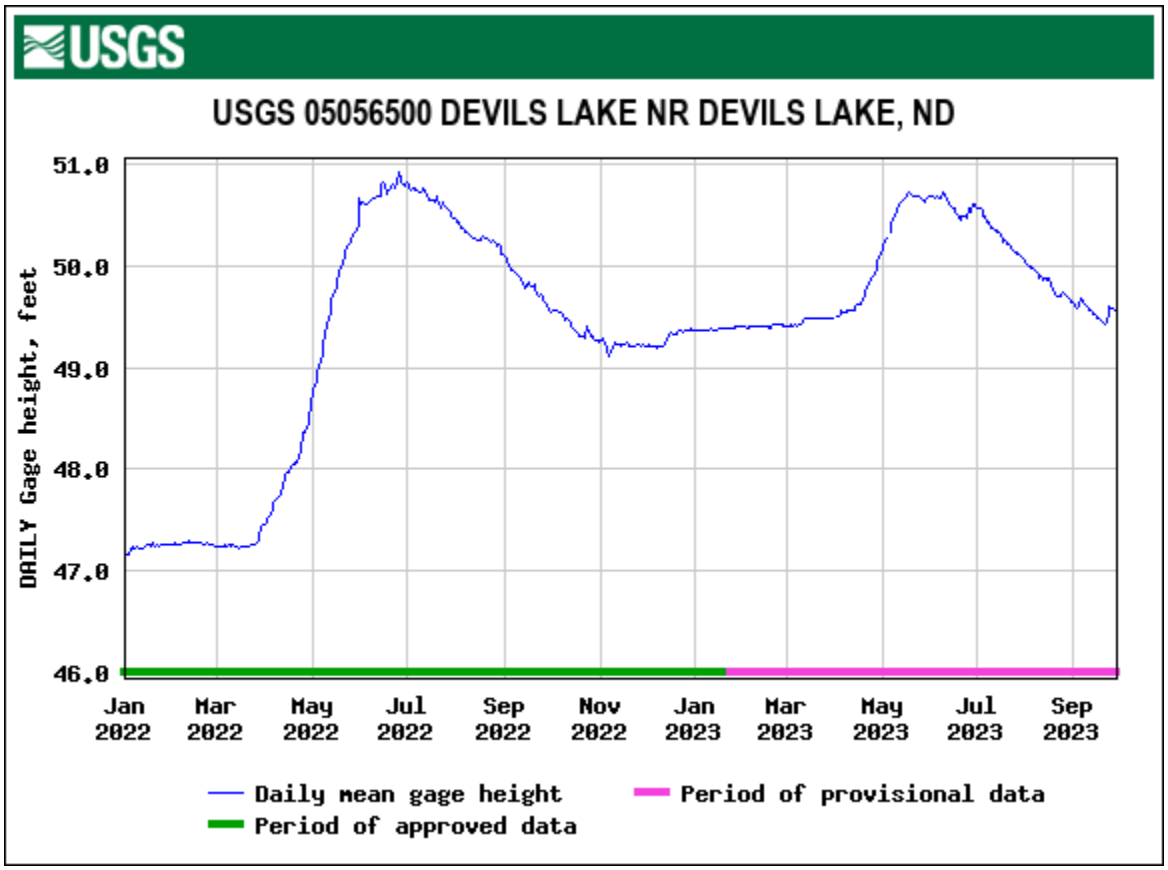

Figure 5: Devils Lake Gage Height January 1, 2022–September 28, 2023 (nwis.waterdata.usgs.gov/nwis/dv/?ts_id=234803&format=img_default&site_no=05056500&set_arithscale_y=on&begin_date=20220101&end_date=20230928).

Fargo-Moorhead Diversion Monitoring

A monitoring program began in October 2019 in the Fargo-Moorhead area to detect any changes from the construction and operation of the various aspects of the Fargo-Moorhead Diversion project. The program is meant to provide consistent sampling methods and critical site locations to detect trends in water quality and to estimate constituent loads (mass per time) for understanding of how water-quality constituents are transported and how that could change throughout the project. Continuous, real-time monitoring upstream and downstream of the project also provides information on changes in water-quality that might happened on a shorter timescale such as from rainfall-runoff events, spills, and channel disturbances. The current program is designed for sampling before, during and after construction of the Diversion and consists of:

- 10 Sampling Locations
    - Red River at Halstad, Georgetown, Harwood, Fargo, and Hickson.
    - Sheyenne River at Kindred and Harwood
    - Wild Rice River at Abercrombie and St. Benedict
    - Maple River below Mapleton.
- 8 scheduled samples per year - January, April (2 samples), May, June, July, August, October.
- Increased sampling during flood conditions.
- 3 continuous water-quality monitors for (water temperature, specific conductance, pH, dissolved oxygen, and turbidity).
    - Red River at Georgetown, Fargo, and Hickson
- All sites operated for continuous discharge, excluding Red River at Harwood.

Data collection for the first phase, pre-construction, is complete and a USGS Scientific Investigations Report will be published after September 2023 to describe the methods and data analysis of the monitoring during the pre-construction phase of the Fargo-Moorhead Diversion project. The second phase of data collection, during construction, began fall 2022 and will continue through fall 2027.

Red River Low-flow Study

The Red River is susceptible to periods of dry conditions that have the potential to adversely impact ecological conditions and water supply. To understand the potential for drought conditions along the Red River, the USGS began a study in May 2020 to develop a water-balance model (WBM) of the Red River Basin upstream of Emerson and stochastic hydrometeorological data to derive a set of synthetic streamflows that would be used to statistically characterize the potential for periods of extreme low flows over the next 50 years. The WBM has been calibrated and verified and the stochastically generated weather data has been derived. Using the calibrated WBM and 100 50-year traces of stochastic weather data, future streamflows have been simulated. From the future streamflow simulations, low-flow frequency curves have been derived for Wahpeton, Halstad, Grand Forks and Emerson. Results will be published in a USGS Scientific Investigation Report, planned for winter 2023-2024.

Red River Sulfate Study

The Red River sulfate study is a follow up to the Red River trend analysis and is dependent upon output from the Red River low-flow study. This project was set up to develop trend attribution models for the Red River at Emerson and the Red River at Selkirk. Two categories of explanatory variables will be evaluated for this project: natural or hydroclimatic variables and anthropogenic variables. Natural/hydroclimatic variables will be considered first and then anthropogenic sources. Based on the large and consistent increases in sulfate occurring about the same time as the onset of the wetter conditions in the basin, we expect that the natural/hydroclimatic variables such as shallow groundwater flow or runoff from saturated soil will explain a large component of the trends. Output from the Red River low-flow water balance model (WBM) that represent the components of runoff will be used for natural/hydroclimatic variables. Output from the Red River low-flow model has recently become available so work will soon begin on the trend attribution model for the Red River at Emerson. An additional piece planned for this project is to extend the Red River low-flow WBM from Emerson to Selkirk. Once the low-flow WBM is extended, a trend attribution model for Selkirk will be developed. Results will be published in a USGS Scientific Investigation Report, planned for spring 2024.

Akyüz, A., 2023, North Dakota monthly climate summary—April 2023: North Dakota monthly climate summary, v. 17, no. 4, 6 p., accessed June 13, 2023, at https://www.ndsu.edu/fileadmin/ndsco/ndsco/summary/2023/apr23.pdf.

North Dakota Department of Water Resources, 2023, North Dakota Department of Water Resources, accessed June 13, 2023, at https://www.facebook.com/NDWaterResources.

NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2023a, Red River and Devils Lake Basins—2023 spring flood outlook—January 26, 2023: National Weather Service, 2 p., accessed June 13, 2023, at https://www.weather.gov/fgf/currentfloodoutlook.

NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2023b, Red River and Devils Lake Basins—2023 spring flood outlook—March 23, 2023: National Weather Service, 2 p., accessed June 13, 2023, at https://www.weather.gov/fgf/currentfloodoutlook.

U.S. Geological Survey, 2023, U.S. Geological Survey water data for the nation, accessed June 13, 2023, at National Water Information System—Web Interface at https://doi.org/ 10.5066/ F7P55KJN.

Appendix E

Committee and Task Team Reports

E-1 Water Quality Committee

July 2023 Water Quality Committee Report to the IRRWB

The Water Quality Committee currently consists of the following members:

Nicole Armstrong, Manitoba Environment, Climate and Parks (co-chair)
Theresa Haugen, Minnesota Pollution Control Agency (co-chair)
Ted Preister, Red River Basin Commission
Rochelle Nustad, U.S. Geological Survey
Iris Griffin, Environment and Climate Change Canada
Jason Vanrobaeys, Agriculture and Agri-Foods Canada
Elise Watchorn, Environment and Climate Change Canada
Keith Weston, Red River Retention Authority
Jason Gildea, US Environmental Protection Agency
Holiday Wirick, US Environmental Protection Agency
Dan Rheault, Manitoba Environment, Climate and Parks
James Noren, US Army Corps of Engineers

Much of the work of the committee continues to focus on the board's nutrient management strategy including an IWI project on wastewater optimization (see details below) and discussions regarding a second workshop on cold-climate agricultural best management practices. The committee (through Environment and Climate Change Canada) is now reporting regularly on compliance with the approved nutrient objectives and targets.

The committee has also been tasked with preparing a "white paper" on the interbasin transfer projects proposed in North Dakota (Eastern North Dakota Alternate Water Supply Project and Red River Valley Water Supply Project) and that work is ongoing.

Finally, the committee recognizes the need to review and update the water quality objectives for the Red River at the US/Canada border and has prepared a draft IWI proposal for submission to the IJC in 2023. To support the objectives review, an IWI project is underway to evaluate factors contributing to trends in sulfate, chloride and total dissolved solids in the Red River Basin (see details below).

International Watersheds Initiative – USGS Sulfate, Chloride and TDS Project

The USGS is undertaking a project titled "Evaluation of factors contributing to trends in sulfate, chloride and total dissolved solids in the Red River Basin: Statistical models" with IWI funding. Work is now underway through the USGS. When complete, the project will provide critical information on the factors contributing to trends in concentrations of sulfate, chloride and total dissolved solids, and inform water quality objective review for these three parameters.

The Red River sulfate study is a follow up to the Red River trend analysis and is dependent upon output from the Red River low-flow study. This project was set up to develop trend attribution models for the Red River at Emerson and the Red River at Selkirk. Two categories of explanatory variables will be evaluated for this project: natural or hydroclimatic variables and anthropogenic variables. Natural/hydroclimatic variables will be considered first and then anthropogenic sources. Based on the large and consistent increases in sulfate occurring about the same time as the onset of the wetter conditions in the basin, we expect that the natural/hydroclimatic variables such as shallow groundwater flow or runoff from saturated soil will explain a large component of the trends. Output from the Red River low-flow water balance model (WBM) that represent the components of runoff will be used for natural/hydroclimatic variables. Output from the Red River low-flow model has recently become available so work will soon begin on the trend attribution model for the Red River at Emerson. An additional piece planned for this project is to extend the

Red River low-flow WBM from Emerson to Selkirk. Once the low-flow WBM is extended, a trend attribution model for Selkirk will be developed. Results will be published in a USGS Scientific Investigation Report, planned for spring 2024.

International Watersheds Initiative – Wastewater Optimization Project

The Red River Basin Commission with support from the Environmental Protection Agency (EPA) and others has completed a project titled "Supporting Wastewater Utility Nutrient Voluntary Performance Improvement Through Training and Technical Assistance in the Red River Basin". The project was approved for funding in March 2021 and is now complete. A final report summarizing workshop results, identifying a list of best practices. Two additional addenda are expected over the next six months highlighting performance improvements at specific facilities. The full report is now available at https://www.redriverbasincommission.org/_files/ugd/4a0263_beb46e9bc76c4631a6372f67877fcce8.pdf The addenda will be added to the same file location as they are completed.

E-2 Aquatic Ecosystem Committee

Aquatic Ecosystem Committee-IRRWB
June 2023

Canadian Co-Chair: Patricia Ramlal, Fisheries & Oceans Canada
US Co-Chair: Brian Caruso, US Fish and Wildlife Service

As of June 2023 committee members are:
Todd Caspers (ND)
Lee Gutowsky (CAN)
Amanda Hillman-Roberts (MN)
Benjamin Holen (ND)
Geoff Klein (MB)
Nicholas Kludt (MN)
Jeff Long (MB)
Doug Watkinson (CAN)
Brett Hultgren (USACE) Observer

The Aquatic Ecosystem Committee (AEC) holds monthly phone calls except during the spring/summer field season. While generally the group's discussion centers on current work being done in the basin, linkages between ongoing programs, and how the various programs could collaborate to get a better picture of the entire basin with respect to the ecosystem, we are currently discussing the new direction as prescribed by the IJC. The AEC is planning on developing a draft Terms of Reference based on the recently revised Directive from the IJC to the International Red River Watershed Board, the outcome of the Indigenous collaboration workshop and further guidance from the IJC. We have been given to understand that a template will be provided to the committee co-chairs so that these terms are consistent with all other boards. By far, the greatest benefit of this committee to the various agencies has been the opportunity it has provided to the members for the free exchange of information, ideas and plans for field work.

Committee on Hydrology/Aquatic Ecosystem Workshop, April 4, 2023

This joint, virtual, half-day workshop was initiated to find ways to join the interests of the two committees to be better able to answer questions regarding the instream flow needs assessment of the Red River. Data gaps were identified, especially with respect to bathymetry and the importance of focusing on species that cross the international border. Further discussion is needed between the two committees to develop joint International Watershed Initiative (IWI) proposals. This will occur following the strategic planning session discussions to be held in late August 2023.

Red River Telemetry Studies
Through the International Red River Watershed Board (IRRWB), the AEC submitted a second project proposal in 2019 to the IWI for funding from IJC to extend funding for another three years. The collected data on habitat use and fish movement are valuable input information for Instream Flow Needs (IFN) predictions of the Committee on Hydrology (CoH) of the IRRWB and provide detailed information on fish movement, spawning sites and timing, and overwintering areas. Additionally, we have increased our understanding of the population structure and movement of fish in the Red River between the US and Canada.

The Lake Winnipeg Fish Movement Project continued in its 7th year. Forty-two Walleye were tagged in the fall of 2022 near Riverton, some of whom may be Red River spawners bringing the total number of tagged fish up to 950, representing eight species.

Images of surgical tagging and release of fish.

The receiver downloads in Lake Winnipeg (~220) were delayed due to a colder than average spring and delay in the melt on Lake Winnipeg. Receiver downloads in the Red River were delayed until flows dropped below 300 cms, and downloading in Winnipeg River were delayed until October.

New data related to a VEMCO Positioning System (VPS) have been submitted detailing fine scale movements of all tagged species.

All telemetry data acquired in the frame of the Lake Winnipeg Basin Fish Movement Project were transferred to the new Fathom database provided by Innovasea, which will facilitate data-sharing between user groups.

In early 2022 the AEC submitted a proposal “Integrating fish passage considerations into cultural and ecological connectivity in the Red River watershed” to the IWI. The project was funded in the

autumn of 2022. Dr. Mark Pegg of the University of Nebraska will be responsible for the administration of the funds through the U.S. Fish and Wildlife Service. A graduate student began field work on the project in 2023. This work will dovetail into the existing telemetry network within the Red River-Lake Winnipeg watershed to answer newly emerging questions. Specifically the objectives are to: 1) monitor target species movements; (2) evaluate timing of movements; and (3) use these data to inform management decisions on future water management in the context of ecologically and culturally important species.

These photos are of the Drayton Dam breach; this is the final structure that needed to be modified for fish passage on the mainstem Red River in the U.S. The contractor should be re-starting on construction later in June 2023.

The committee continually reviews and updates their work plan, most recently done in April 2023, with the goal to further update following full Board strategic planning sessions in late August 2023. The plan includes:

Aquatic Invasive Species - As previously discussed we will consider jurisdictional issues with AIS management, how science feeds into jurisdiction, and xenocarps as one of the major concerns in the Red River Basin. The current plan being considered would be to have a virtual workshop to: 1) understand risk potential of these carps moving into the system; (2) understand what mitigation tools may be possible / available; (3) discuss response tools that may be available and (4) determine if the AEC committee needs an AIS sub-committee or if this is a project that does not need a that level of governance.

Habitat Evaluation - The CoH proposed doing work on the Red River in this area, to which the AEC provided some suggestions. This work complements the fish movement study and the IFN study by the COH. We suggested the additional surveys of some of the tributaries, with ADCP if depths are deep enough, or with alternate survey equipment appropriate to the depths being surveyed. The proposed work is to be completed in 2023 and the AEC will work with the CoH in the development of future ways to merge the understanding of hydrology to the ongoing biological studies. The two groups met in April to discuss past work and future plans.

Placeholders in the work plan:

Roseau River Restoration: This project will rehabilitate and reconnect the historic river channel and re-establish the natural dimension, pattern and profile of the channel. Restoration of the stream to

the historic meandering channel will provide better aquatic habitat diversity (pools and riffles) than the current ditch. There are 2 mussel species of special concern and 18 species of fish that will benefit from the restoration.

- *Possible roles for the AEC include public outreach and evaluating relationships to climate change, but the AEC needs further discussion as to precisely what we can do within the IJC directive.*

Assessing species distribution abundance. Currently ND and MN do this on a periodic basis. MB and Canada do not. MN does this assessment once every five years timed with the descending limb of the spring hydrograph; they also use trap nets in the tributaries once every seven years. Due to the pandemic some of the surveys were delayed. Longitudinal surveys conducted in MB with a boat electro-fisher provide information on species distribution and abundance and discover introduced species, but do not sample Channel Catfish effectively (target species in the MN surveys). The AEC put a placeholder in the work plan.

E-3 Hydrology Committee

Monitoring

The Hydrology Committee monitors conditions in the basin and provides an overview of flow conditions and forecasts for board meetings, IJC semi-annual board appearances, the annual report and whenever else requested by the board or IJC. The reporting ensures the board and IJC are aware of the hydrologic conditions in the Basin.

Red River Low-Flow Frequency Study:

The Hydrology Committee received IWI funds to quantifying low flow frequencies to better understand potential low flow management criteria at the border. The result of the study will be a better understanding of the risks the Basin faces from various Red River drought scenarios and inform how a drought contingency plan or minimum flow criteria for the Red River could reduce these risks.

The water-balance model (WBM) has been calibrated and verified and the stochastically generated weather data has been derived. Future streamflows have been simulated and from these simulations, low-flow frequency curves have been derived for the Wahpeton, Halstad, Grand Forks and Emerson locations on the Red River. Results will be published in a USGS Scientific Investigation Report, planned for winter 2023-2024.

Red River Instream Flow Analysis

This work supports the board's desired outcome of assessing and recommending a process for the development and implementation of minimum flow management for the Red River at the International Boundary. Discussion paper presented to IRRWB at January 2019 Board meeting summarizing past work and future work required. Future work in the near term was to gather key data and improve and extend past modelling work to better understand the complexity of the Red River's aquatic ecosystem and make more informed low flow management decisions. The Hydrology Committee recommended that a complete homogeneous bathymetric survey would be fundamental to instream flow assessment and other work.

MTI completed bathymetry from near the border to just downstream on the Red River Floodway Inlet Control Structure in the summer and fall of 2022. Data includes 50 m of aerial LiDAR to cover the shoreline. USACE is planning to collect the US portion of the Red River in 2023. USACE also plans to merge the two surveys together.

Fall/Winter 2021/2022

After severe drought conditions in summer 2021, drought conditions began to improve heading into fall 2021, especially after mid- to late-October rains. Soil moisture significantly improved and baseflows increased in tributaries and the mainstem. Rising baseflows combined with an increase in reservoir releases resulted in flows on the mainstem in the normal range throughout the fall and winter.

Manitoba's Hydrologic Forecasting Centre reported that, heading into freeze-up, soil moisture in the Red River basin was normal to below normal in southern Manitoba, and normal to above

normal in the U.S. portion of the basin. The National Weather Service (NWS) Climate Prediction Center, through its soil moisture monitoring and modelling works, indicated above normal soil moisture for the U.S. portion of the Red River basin.
In January, the Canadian and United States Drought Monitors classified most of the basin still having some degree of dryness. With the exception of the southern most area, most of the US portion of the basin is classified as abnormally dry (D0). The Canadian basin was classified as abnormally dry to (D0) to exceptional drought (D4), with severity increasing towards the north. By April 2022, eastern North Dakota and western Minnesota were no longer in any drought condition.

Streamflow for the Red River and most of its tributaries was at normal levels, with the Sheyenne River even above normal (75^{th}-90^{th} percentile) and the Red Lake River below normal (10^{th}-25^{th} percentile) going into and during the 2021/2022 winter. Winter was characterized as colder than average, especially the month of February and higher than normal snowfall.

As precipitation increased through winter, nearly the entire Red River basin received above normal to well above normal precipitation. Late snowfalls resulted in flood forecasts progressively increasing the risk of flooding across the basin. Some areas in the U.S. portion of the Red River basin received up to 200 % of normal precipitation. At the end of February, the Fargo NWS station had recorded a record number of blizzards at 11 blizzards, surpassing the 1996-1997 winter by one blizzard. The threat of moderate and even major flooding increased with each subsequent flood outlook and the outlook on March 10 noted that five out of the seven factors recognized by the NWS to contribute to a high risk of a significant flooding event occurring, had been met. The only two factors left were the two most unpredictable ones, thaw cycle and spring precipitation. The March flood outlook released by Manitoba's Hydrologic Forecasting Centre indicated that the risk of major flooding was high for the Red River main stem.

Heading into freeze-up in 2021, soil moisture in the Red River basin was normal to below normal in southern Manitoba, and normal to above normal in the U.S. portion of the basin. As precipitation increased through winter, nearly the entire Red River basin received above normal to well above normal precipitation. Late snowfalls resulted in flood forecasts progressively increasing the risk of flooding across the basin. Some areas in the U.S. portion of the Red River basin received up to 200 % of normal precipitation. At the end of February, the Fargo NWS station had recorded a record number of blizzards at 11 blizzards, surpassing the 1996-1997 winter by one blizzard. The threat of moderate and even major flooding increased with each subsequent flood outlook and the outlook on March 10 noted that five out of the seven factors recognized by the National Weather Service (NWS) that contribute to a high risk of a significant flooding event occurring had been met. The March flood outlook released by Manitoba's Hydrologic Forecasting Centre indicated that the risk of major flooding was high for the Red River mainstem.

A warm period from March 15 to 24 allowed for river ice to break up and initial spring runoff peaks to occur. Due to the warming period only lasting nine days, and with little-to-no precipitation during this time, a significant runoff event was prevented from occurring during this initial March rise. After rising shortly into the above normal flow (75^{th} – 90^{th} percentile), and in isolated cases even into the much above normal flow (>90^{th} percentile) in late March, river levels along the mainstem Red River and its tributaries fell back into the normal range (25^{th} – 75^{th} percentile) by early April.

April 2022 was an extremely cold month, tied for the 8th coldest April on record at the Fargo-Moorhead NWS climate site. Additionally, several large precipitation events occurred in the basin in April 2022. The heaviest precipitation totals from these storms were in the central and northern portions of the Red River basin in the U.S. and Manitoba. Spring 2022 was the second wettest spring on record for Winnipeg. Through April and May, Manitoba received 12 major precipitation systems, six of which were Colorado Low systems. All this combined to create a second, much more significant flooding event on the mainstem Red River and all of its tributaries through late April and May.

The figure (Figure 1) below shows the April precipitation for the basin. Most of the area received four to ten inches of precipitation, about 300 to 600 % of normal precipitation. The various storm events caused numerous peaks at many of the stream gages. This was especially evident in the upper portions of the basin, such as at Fargo.

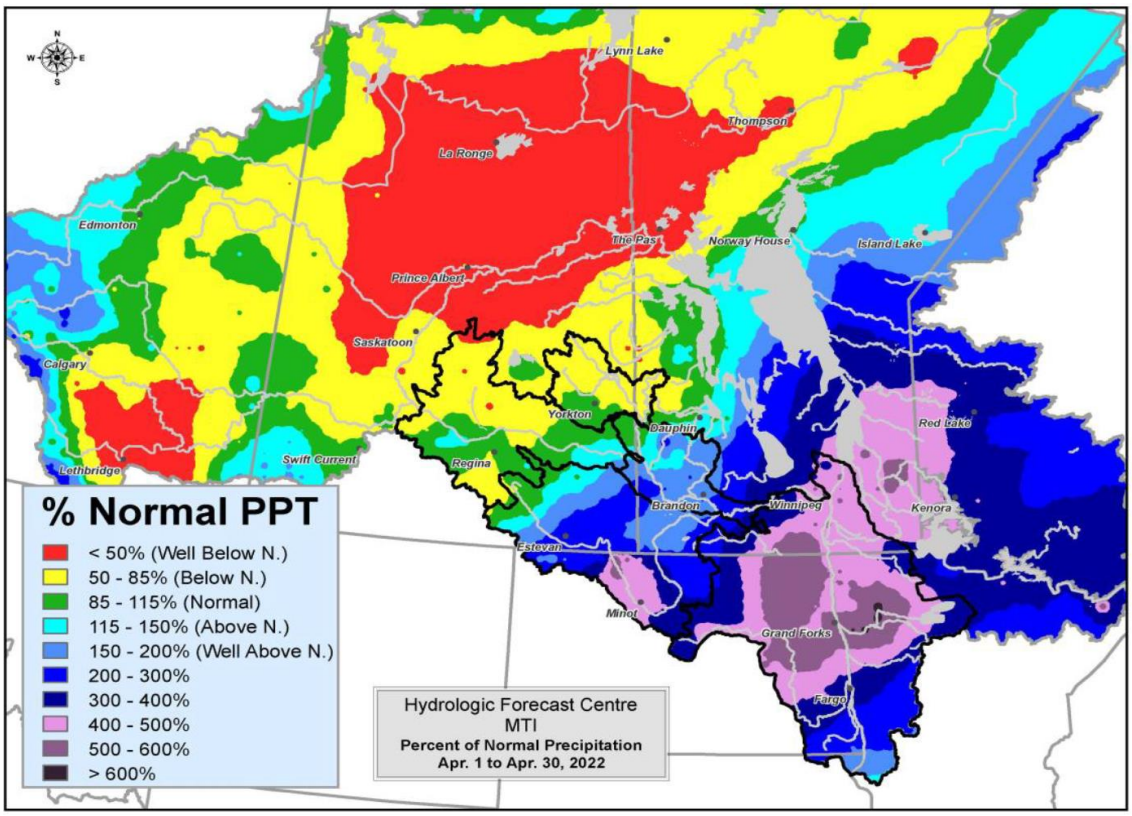

Figure 1. April Precipitation in the Red River Basin

Data from the U.S. Geological Survey (USGS) indicates that the 2022 peak stage at Fargo was 26.49 feet (ft) on May 14, at a peak flow of about 9,830 cubic feet per second (cfs). The 2022 peak flow was the 26th highest peak recorded out of 120 years of peak flow record at Fargo. Data shows a 2022 peak stage of 46.07 ft at Grand Forks on April 26. The 64,800 cfs peak flow also occurred on April 26 and was the 10th highest peak flow recorded at Grand Forks, out of 140 years of peak flow record. The peak at Emerson was 81,600 cfs (2310 cms) on May 8th, corresponding approximately to a 30-year event. The peak flow at the Red River Floodway inlet occurred on May 13th at 85,000 cfs (2,406 cms) which was the 4th highest peak in the period of record.

The Red River Floodway was operated for two periods. The first operation period was relatively short (from April 8 to April 15) in response to moderate flooding from the spring melt. A series of subsequent snow and rainfall events caused major flooding along the Red River and the floodway was put back into operation from April 23 to June 16. The peak at James Ave. Station in Winnipeg was 19 ft (James Avenue datum) on April 30. Without floodway operation, the peak at James Avenue would have been 27.6 ft. In total, the floodway was operated for 61 days.

Summer 2022

Summer precipitation in the Red River basin ranged from below normal to above normal. With the exception of some isolated rain events, river levels on the mainstem Red River and its tributaries receded steadily from their peaks in May. The river flows reflected the generally drier conditions experienced in June and July (compared to April and May) and flows along the Red River mainstem were generally into the normal range by the end of summer and early fall (Figure 2).

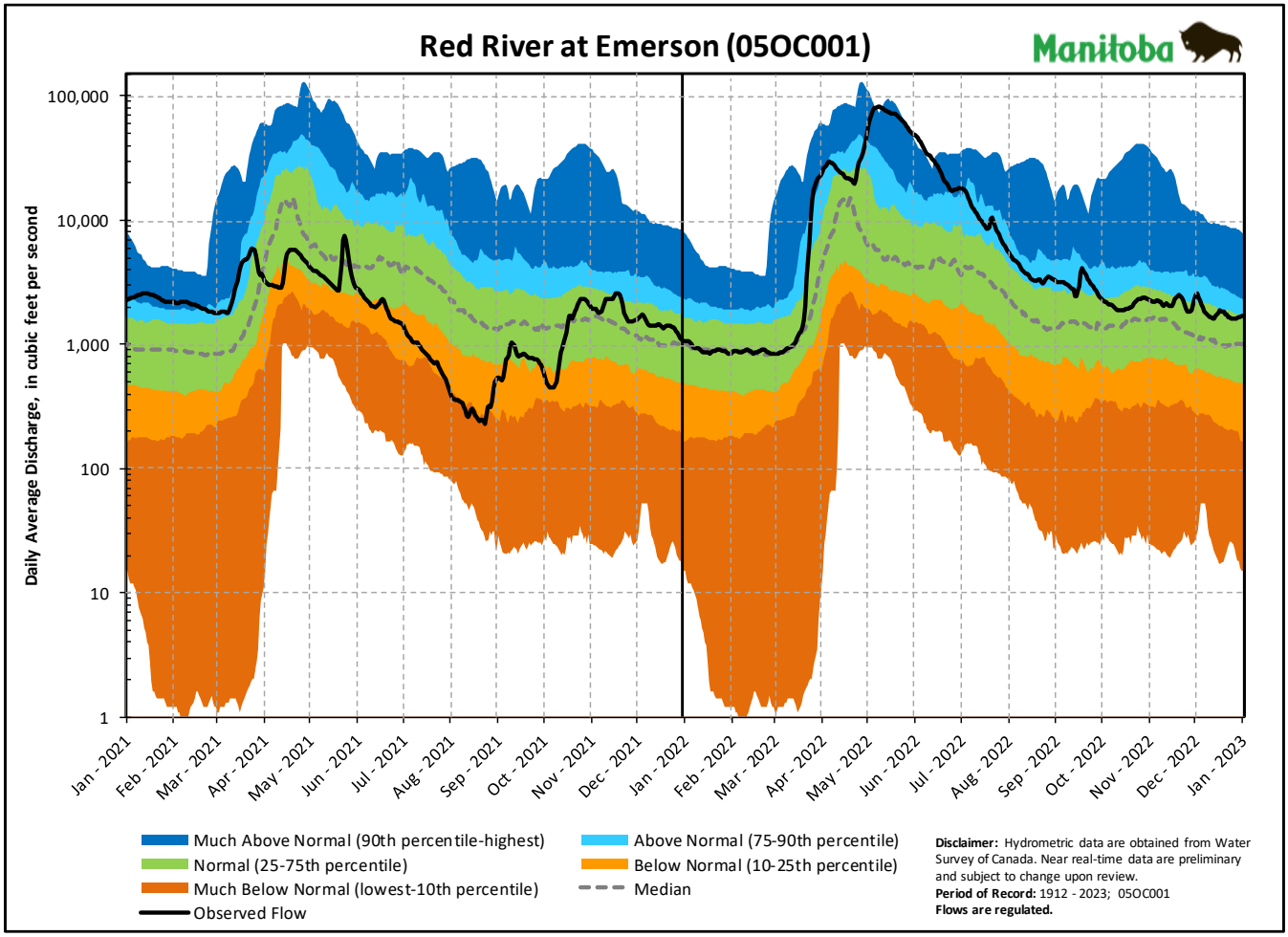

Figure 2. Average daily discharge in the Red River at Emerson for 2021 and 2022.

E-4 Department of Fisheries and Oceans

International Red River Watershed Board
Agency Report - Fisheries & Oceans Canada
June 2023

Fisheries & Oceans Canada (DFO) has a continuing role in the Red River Basin. The International Red River Watershed Board comprises of members of the Aquatic Ecosystems Committee (Dr. Patricia Ramlal (co-chair), Doug Watkinson, and Dr. Lee Gutowsky) and the Hydrology Committee (Dr. Haitham Ghamry). Changes in the Department have lead to the formation of the Ontario and Prairies Region, which is mainly focused on freshwater issues. It is currently unclear when this region will be operationally separated from the Arctic Region.

DFO participates in collaborative efforts on Lake Winnipeg and the Red River Basin including the following:

- Signed Memorandum of Understanding (MOU) with the Province of Manitoba to work together on the Fisheries Advisory Committee.

- Participant in the Environment and Climate Change Canada-Manitoba MOU; member of the steering committee; member of the science subsidiary agreement committee.

Species at Risk

- Analysing the movement of Lake Sturgeon and Bigmouth Buffalo, and Channel Catfish (host of the threatened Mapleleaf mussel): This work is planned to continue until 2025 and may be extended further. The fieldwork of the 2022 field season was successfully conducted. All receivers in the Red, Assiniboine, and Winnipeg rivers as well as in Lake Winnipeg have been visited, data downloaded, and batteries replaced.
- DFO provides in-kind support as required to assist with receiver placement, downloads and analysis of date from the Assiniboine and Red rivers.

Aquatic Invasive Species

- DFO is conducting environmental DNA work on Dreissenid mussels in the Lake Winnipeg basin.
- DFO is developing eRNA methods to support eDNA activities.

High-Resolution Climate Change Projections in Support of Aquatic Ecosystem Management in the Lake Winnipeg Basin (LWB)

- Proposals will be submitted in the 2023-24 fiscal year to support this work.

Fisheries

- Fish Movement Studies: Three fish movement studies are currently conducted: (1) the Lake Winnipeg Basin Fish Movement Study including Lake Winnipeg, the Red River, the Lower Assiniboine River, and the Winnipeg River with Bigmouth Buffalo, Burbot, Channel Catfish, Common Carp, Freshwater Drum, Lake Sturgeon, Walleye, and Lake Whitefish as study species. This is a collaborative effort with State and Provincial agencies; (2) the Upper Assiniboine River Study in collaboration with the Province of Manitoba; and (3) Dauphin River drainage Lake Whitefish movement study, where detection data are provided to the Manitoba Transportation and Infrastructure Department via North South Consultants to augment receiver work. These studies are used to provide science advice to answer Instream Flow Needs, Species at Risk, Aquatic Invasive Species, and stock protection / management questions. This study is part of a larger six-year project entitled "Effects of nutrients and aquatic invasive species on the local fish community in the Lake Winnipeg Basin" analyzing fish movement and habitat use in the Lake Winnipeg basin in relation to Aquatic Invasive Species and other environmental stressors (e.g., climate change, nutrient loads, Instream Flow Needs). In the spring of 2022, 42 Walleye were tagged near Riverton, MB as part of a bioenergetics study.

- In collaboration with the University of Manitoba: In 2022, DFO collected water and tissue samples from Bigmouth Buffalo in Manitoba to support Gen-Fish's eDNA and transcriptional work. GEN-FISH (https://gen-fish.ca/) works to determine the location and abundance of Canada's 200+ freshwater fish species, and measure how they are performing in the face of increasing stressors.

- Offshore Juvenile Fish Survey: DFO is leading the Lake Winnipeg Pelagic Fish Trawls. This monitoring program has been in place since 2002, and is processing the fish samples from the R.V. *Namao.* The 2022 spring, summer and fall survey samples are about 80% processed.

- The Living Lab project between AAFC, ECCC, and DFO is studying the impact of different land use practices on the soil health and nutrient run-off and its subsequent effect on the fish assemblage. A first fish survey was successfully conducted in the summer of 2020. A third fish survey was completed during the summer of 2022.

- A collaborative project (University of Nebraska, DFO, MDNR) led by Dr. Mark Pegg from the University of Nebraska was supported by the IJC International Watersheds Initiative through the IRRWB AEC subcommittee to conduct a telemetry study addressing fish passage and species conservation questions. Work on this project is described in the Aquatic Ecosystem Committee report and is currently underway.

DFO participates in the ongoing collaborative efforts on development of an Instream Flow Needs (IFN) recommendation to help inform low flow decision making/policy in the USA-Canada trans-boundary waters of the Red River Basin including the following:
Estimating preliminary results on the impact of low flows on the aquatic habitat availability and IFN for various key fishes in the Red River in the trans-boundary area near Emerson, Manitoba.

Investigating the likelihood and duration of low flow periods on the Red River and how often the Red River Water Supply would potentially operate.

Reviewing water use upstream in Manitoba to determine if water use worsened ecosystem health conditions during extreme low flows.

Carrying out drought-risk analysis of stochastically generated streamflow for the Red River Basin to understand the potential for drought conditions along the Red River.

Collaborative USA-Canada transboundary data collection of Bathymetric Surveys to help inform the IFN and AEC studies on the Red River are being coordinated. The bathymetric work is being done on the Red River south of the Canadian border, about 444 river miles in the USA (the length of the Bois de Sioux and Red River main stem from White Rock Dam to the Canadian border) down to Lake Winnipeg.

E-5 Environment and Climate Change Canada

ECCC Agency Report to the IRRWB, August 2023

Update to the International Red River Watershed Board on Environment and Climate Change Canada's Freshwater Activities

KEY DEPARTMENTAL UPDATES (August 2023)

Mandate and Priorities related to Freshwater

Recognizing a clean and safe freshwater supply is essential to the well-being of Canadians, the health and sustainability of the environment, and to the economy, the Government of Canada committed to the creation of a Canada Water Agency and a strengthened Freshwater Action Plan. Once fully established, the Canada Water Agency will advance the modernization of the *Canada Water Act* to reflect Canada's freshwater reality, including climate change and Indigenous rights.

Budget 2023 announced significant investment in fresh water in Canada, including:

- $650M over ten years, starting in 2023-24, to support monitoring, assessment, and restoration work in the Great Lakes, Lake Winnipeg, Lake of the Woods, St. Lawrence River, Fraser River, Saint John River, Mackenzie River, and Lake Simcoe t (Note that this amount includes the $420M announced by the Prime Minister for the Great Lakes, part of a renewed joint commitment to preserving and restoring these critical waters, building on 50 years of Canada-US collaboration).
- $22.6 million over three years, starting in 2023-24, to support better coordination of efforts to protect fresh water across Canada.
- $85.1 million over five years, starting in 2023-24, and $21 million ongoing thereafter to support the creation of a Canada Water Agency.

Through Budget 2023, Canada also committed to the involvement of Indigenous Peoples in the implementation of the Freshwater Action Plan, through greater engagement, and seeking Indigenous advisory expertise, especially from women who are the traditional "water carriers" in Indigenous communities.

Canada Water Agency

- The Canada Water Agency was established as Branch within Environment and Climate Change Canada (ECCC) in June 2023. By the end of 2023, the government will introduce legislation that will fully establish the Canada Water Agency as a standalone Agency.
- The CWA will advance freshwater protection and management in Canada by providing leadership for federal action on water and facilitating effective federal collaboration, and improving coordination and collaboration with provinces, territories, and Indigenous Peoples to proactively address national, and regional transboundary, freshwater challenges and opportunities.

- Headquartered in Winnipeg, the Agency will be regionally responsive, including advancing delivery of Freshwater Ecosystems Initiatives in Lake Winnipeg, Lake of the Woods, Great Lakes, and other waterbodies of national significance across the country.

PROGRAM UPDATES
Lake Winnipeg Basin Program

Grants and Contribution Funding

- In 2022/23, the Lake Winnipeg Basin Program invested $1.6 Million in 25 partner-led projects to accelerate nutrient reduction, advance collaborative governance, and enhance Indigenous engagement and leadership in freshwater management. Since 2017, Canada has invested over $10 million dollars in stakeholder led action. The next call for proposals is anticipated in winter/spring 2023/2024.

Ongoing Collaborative Arrangements with other Government Departments

ECCC support is ongoing for:

- Canada-Manitoba MOU Respecting Lake Winnipeg and its Basin (2021-2026) – Collaborative efforts through the MOU are coordinated through the Canada-Manitoba MOU Steering Committee
- A Science Subsidiary Arrangement to the MOU is being developed to identify priorities for science activities and help coordinate comprehensive reporting, monitoring, research, and communication activities, maximize synergies, and avoid duplication.
- Indigenous engagement is a priority for the Canada-Manitoba MOU Steering Committee, with an engagement session was held March 2023 with several Indigenous organizations to help inform future approaches and opportunities that s inclusion of Indigenous peoples and knowledge in the committee's work.

Lake Winnipeg Science Plan

- The LWBP Science Plan includes four priority areas:
  o reporting on progress towards restoring a healthy Lake Winnipeg
  o monitoring to assess status and track changes
  o research on nutrient sources and transport pathways to the lake
  o research on lake ecosystem components to achieve a sustainable nutrient balance
- In 2022/23, Environment and Climate Change Canada (ECCC) collected nutrient concentration and load data during spring runoff and summer rainfall events at five sites in Lake Winnipeg Basin. These sites were decommissioned in fall 2022 with a total of 80 site-years of data collected. The data set includes extremes of flood and drought and a range of fertilizer and manure management practices. Initial analyses show that hydrological drivers have a greater influence on downstream nutrient loading than fertilizer management, but poorly timed or excessive nutrient applications can result in increased off target transport. Management of ditch vegetation may provide an opportunity to reduce downstream losses.
- Collaborative research on potential of variable rates of manure and phosphorus fertilizer to reduce nutrient losses in runoff is continuing in 2023/2024. The first stage of this research is to determine drivers of soil phosphorus distribution in the landscape. Phosphorus hotspots in hydrologically active areas could then be prescribed a lower rate of fertilizer application.
- The development of binational Bayesian SPAtially Referenced Regressions on Watershed

attributes (SPARROW) model for the Red-Assiniboine River Basin is ongoing.

- Researchers updated critical sources areas and main tributary nutrient loadings in the Red River Basin (RRB) and assessed a suite of BMP scenarios with the updated Red River Basin Soil and Water Assessment Tool (SWAT) model. The Assiniboine River Basin (ARB) SWAT model was recalibrated and validation of the model based on extended climate data (1988-2017) and observed flow and water quality data at monitoring stations is complete.
- Researchers assessed the impact of climate change on flow, sediment, and nutrient loadings from the Red and Assiniboine River Basin to the Lake of Winnipeg based on the calibrated RRB and ARB SWAT models with seven long-term GCM climate change scenarios (1950-2100).
- Researchers evaluated long-term nutrient (Total Phosphorus, Total Nitrogen) and suspended solids (TSS) concentrations, loads, and yields in the Canadian portion of the Lake Winnipeg Basin.
- Sediment cores were collected for analysis of phosphorus and its fractions as a nutrient source along a gradient of nutrient-producing activities, such as agricultural and sewage effluent (this data is being analyzed).
- Remotely sensed algal bloom products continue to be delivered by ECCC's EOLakewatch through a near-real-time web portal, weekly email bulletins, and annual summary reports. The bloom of 2022 peaked at a spatial extent of 10,700 km2(43% of lake area) with a maximum severity observed on August 25. The 2023 bloom began in the North Basin around July 23rd and as of August 13thhas reached a spatial extent of 10,345km 2, tracking above the long term median for the time of year. Field campaigns were conducted in August 2023 to validate satellite bloom retrievals and contribute to new bloom community composition algorithm development. Work is ongoing to complete a large-scale validation of retrievals using historical provincial monitoring data and investigate nutrient loading responses, in order to update the analysis being carried out by Binding et al. (2018) which covered the period 2002-2011.
- Remotely sensed Secchi disk depth retrievals have been validated and used to report on long term changes in water clarity on Lake Winnipeg since 1998. Results capture a marked increase in water clarity since 2012 (manuscript in prep).
- A high-resolution 3D hydrodynamic-ecological model (AEM3D) for the lake is under development. The year-round simulation of hydrodynamics is complete and ECCC has started to conduct multi-year modelling with the ecological modelling integrated. The inputs from different sources including monitoring data, outputs from watershed model, data-driven models, and remote sensing tools are gathered to drive the model. The calibration and validation of tempo-spatial variability of ice, dissolved oxygen (DO), nutrients (e.g., Total Phosphorus, Total Nitrogen), total suspended solid (TSS), and chlorophyll a is ongoing.

Water Quality Monitoring

- International long-term monitoring is ongoing at 4 sites (Red River at Emerson, Pembina River at Windygates, Souris River at Westhope, North Dakota and at Sherwood, North Dakota)
- Red River Emerson Automated Station
    - Continuously monitored, hourly water quality data is now available for public access on the federal open data portal: https://data-donnees.ec.gc.ca/data/substances/monitor/automated-fresh-water-quality-monitoring-and-surveillance-data. Data files for the Red River are those with station

ID MA05OC0001.
    - The portal has been updated with Red River data from 2018-2021. Historic data dating back to 1971 is also available.
- Lake Winnipeg Nearshore Monitoring
  o Two water quality monitoring surveys were successfully completed in spring and summer 2023 with a fall survey planned. Surveys visited the north and south basin, and Netley-Libau Marsh.
  o The backlog of biological samples has been analyzed by contract laboratories; data interpretation is underway.
- Lake Winnipeg Eastern Tributary Monitoring
  o Monitoring of four rivers (Manigotagan, Bloodvein, Pigeon, and Berens) was conducted between 2017-2023.
- Ongoing collaborations on Lake Winnipeg-related work include:
  o Manitoba Environment, Climate and Parks (Morison) – ECCC partnered with Manitoba to carry out under-ice winter water quality sampling. Helicopter surveys in the North & South Basin were carried out in Feb/March 2023.
  o ECCC-led research (Binding) – WQMS conducts ground truthing of remotely sensed harmful algal blooms.
  o ECCC-led research (Zastepa) – Toxin and taxonomic samples are collected by WQMS when cyanobacterial blooms are encountered.
  o Manitoba Environment and Climate (Morison) – samples for cyanobacterial cell count and microcystin analysis collected when blooms encountered.
  o University of Manitoba (Goldsborough) and Red River Basin Commission – Netley-Libau Marsh channel measurements and incidental biological samples provided to inform wetland restoration plans.
  o Lake Winnipeg Foundation / Lake Winnipeg Research Consortium (Stainton) – WQMS has provided in-kind support in the form of a decommissioned nutrient autoanalyzer. LWF is investigating whether this device can be rehabilitated / repurposed for installation aboard the MV Namao, which would allow for real time continuous nutrient monitoring during cruises of Lake Winnipeg.

National Hydrological Services (NHS)

ECCC is mandated to monitor and provide advice on domestic and international transboundary water levels and flows in Canada's inland waters, as well as on federal lands. The NHS delivers on this mandate through two sub-activities: *National Hydrometric Program* and *Inter-jurisdictional Water Management.*

National Hydrometric Program (NHP)

- Working in partnership with provincial governments, NHP collects, analyzes, interprets and disseminates (in real time) hydrometric (i.e., water quantity) monitoring data and services.
  o 88 active and 65 discontinued (archival) hydrometric stations within the Canadian portion of the Red River Watershed.
  o 56 active and 51 discontinued (archival) hydrometric stations in the Canadian portion of the Souris River Watershed.
  o 26 active and 47 discontinued (archival) hydrometric stations in the Canadian portion of the Rainy-Lake of the Woods Watershed.

Flood Hazard Identification and Mapping Program (FHIMP)

- In 2021, the Government of Canada initiated the new Flood Hazard Identification and Mapping Program (FHIMP) to help Canadians better plan and prepare for future flood events. FHIMP was recently extended as part of the National Adaptation Strategy. FHIMP is a joint initiative between Natural Resources Canada (NRCan), Environment and Climate Change Canada, and Public Safety Canada, to work with provinces and territories to complete flood maps for higher-risk areas in Canada.
- The FHIMP aims to help Canadians better plan and prepare for future floods, to complete flood hazard maps of higher risk areas in Canada and make this flood hazard information accessible. The program will provide flood data and maps to support flood prevention, mitigation, response, and planning activities for communities in Canada at higher risk of flooding.
- ECCC is an integral partner in the FHIMP; it provides high-quality data, science, and engineering support and guidance to the provinces and territories, NRCan, and Public Safety Canada to ensure that flood maps are scientifically valid and provide robust information for decision-makers.

Inter-jurisdictional Water Management

ECCC's domestic and international board-related activities include:

Prairie Province Water Board (PPWB)

- The mandate of the PPWB is to ensure that transboundary waters in the Prairie region are protected and equitably shared as per the Master Agreement on Apportionment. The Board serves as a forum for cooperative water management.
- The PPWB is completing a final review of a new 'Schedule F' on groundwater that, once approved, will become part of the Master Agreement on Apportionment (MAA). Schedule F is a comprehensive framework for the collaborative management of transboundary aquifers and groundwater. Risk Informed Management will be used as a guiding approach to structure and clarify the way the Parties will work together to achieve the objectives of Schedule F.
- The Board is a significant supporting partner of a University of Regina Climate Change Adaptation Project investigating the governance and management practices of selected river basins in Canada and Latin America. The PPWB is one of many national and international partners.

International Joint Commission

- Through the Water Quality Monitoring and Surveillance Program and the National Hydrometric Service (NHS), ECCC provides technical and secretariat support to domestic and international water management boards to assist the Government of Canada in meeting its mandated obligations under the Department of Environment Act, International Boundary Waters Treaty Act and water quality and quantity monitoring agreements.
- Through a MOU with the International Joint Commission (IJC), the NHS works in conjunction with US agencies to provide ongoing coordination and advice for water management and apportionment, and during major flood and drought events. The NHS also provides hydrological and hydraulics engineering expertise to assess environmental impacts and cumulative effects of proposed projects under the Canadian Impact Assessment Act and

manages licensing for activities that may alter the flow of rivers flowing into the United States in accordance with the International River Improvement Act. Additionally, the NHS also participates on non-IJC Boards and Committees such as the International Lake of the Woods Control Board (ILWCB) and houses the secretariat of the domestic Lake of the Woods Control Board.

- ECCC continues to provide engineering and technical support to the many IJC water boards and committees across the entire international border. In the Hudson Bay and Mississippi Drainage Basin this includes from west to east: the Accredited Officers of the St. Mary-Milk Rivers, the International Souris River Board; the International Red River Watershed Board; and the International Rainy-Lake of the Woods Watershed Board. In the spring of 2022, drought conditions in the southern Prairie region persisted and there were concerns with low flows in the Poplar, Souris and Red River watersheds.

<u>International Red River Watershed Board (IRRWB)</u>

- Phase one of a project entitled, "Building the foundations for Indigenous Collaboration in the International Red River Basin" has been completed with guidance provided through the Indigenous Task Team. Findings and recommendations, informed by the Indigenous Nations Roundtable held in January were presented to the Board in May 2023. The Task Team is now planning for future phases/next steps including the implementation of recommendations coming out of Phase 1.
- A strategic planning session is being planned for August 2023 as a follow-up to the Directive issued by the IJC to the Board in May 2022 and to inform the future work/governance of the board.
- The IRRWB, including ECCC staff, attended the IJC spring appearance in Washington and provided an update on its work and a plan for updating its 3-year workplan.
- A major milestone in 2022 was the approval by Canada and the United States of four new water quality objectives for nitrogen and phosphorus. Development of the objectives was completed by the IRRWB Water Quality Committee over a period of approximately 9 years with the Board recommending the adoption of these objectives to the IJC in 2019.
- The Pembina River Task Team (PRTT) was formally re-initiated in November 2022. It had been inactive since the beginning of COVID-19. The reactivated team held its first meeting in North Dakota in early January 2023. As in the past, the Governor of North Dakota and the Premier of Manitoba play the lead role, including the appointment of Task Team members. The IRRWB Co-Chairs have been invited to participate in the Task Team.

<u>International Souris River Board (ISRB)</u>

- Discussions are still ongoing to finalize the restructuring of the ISRB following a revised Directive by the IJC. Currently, 11 out of 14 Board members have been identified by the IJC. The populating of Committees supporting the work of the Board has begun. The first meeting of the new Board was held February 28, 2023 in Estevan, Saskatchewan. The annual summer meeting of the Board was held was held June 27, 2023 in Minot, North Dakota.

E-6 Lower Pembina Task Team

The IRRWB, at its January 2008 meeting, established the Lower Pembina Task Team (LPTT). The mandate of this Task Team was to develop a science-based solution(s) to mitigate flooding in the lower Pembina River Basin (Figure 1). A significant milestone for the IRRB was the completion of the LPTT Report. The LPTT has overseen the completion of a three- phased International Watersheds Initiatives (IWI) study report entitled, "Simulation of Flood Scenarios on the Lower Pembina River Flood Plains with the Telemac 2D Hydrodynamic Model". All three phases of the study were conducted by the National Research Council (NRC). Based on the results of the modelling effort, the LPTT developed a document titled, "An exploratory analysis of mitigation measures for the lower Pembina River basin". These LPTT reports from the three phases were then presented to the Board and subsequently accepted by the IJC. The reports, the model and animations have also been made public.

One of the recommendations provided by the IJC to Governments was to establish a Task Team to work towards a binational solution to help manage the flooding issues in the Pembina Basin. Based on this recommendation, the Governor of ND and the Premier of Manitoba have each assigned 5 members and have created the Pembina River Task Team. IRRB Co-chairs have also been included as members of the Task Team in addition to the 10 Task Team members. The committee was active from 2013 to 2015 and Committee meetings were facilitated by the Red River Basin Commission. The committee was working on recommendations to provide to the Governor and Premier but, the work has halted when the court case surrounding Pembina River flooding went to trial in the Federal Court of Canada.

Two additional phases of the Telemac 2D were completed to support the committee work. The additional modelling provided additional scenarios key to the committees work and to investigate culvert configurations for the potential raising of Hwy 18 near Neche, ND.

The National Hydraulics Centre has developed a Pembina Interactive Visualization Tool in 2016/2017 to assist in viewing flood inundation areas for various scenarios modeled with the Telemac 2D model for the Lower Pembina River area. Various scenarios are shown and can be compared using a split screen visualization. The tool is available at: http: //pyla.canadacentral.cloudapp.azure.com:8080/Border Dike Lawsuit

After the judge ruled that the Canadian Federal Court did not have jurisdiction to hear the lawsuit, an application for leave to appeal was submitted to the Supreme Court of Canada in August 2017. The applicants are requesting to appeal the Canadian Federal Court and the Canadian Federal Court of Appeal concerning the determination that the Federal Courts do not have any jurisdiction to hear the issues concerning the border dike located near the Lower Pembina River. In December 2017, the Supreme Court of Canada dismissed the leave application for appeal of the Federal judge decision concerning whether the border dike lawsuit could be heard in Federal court.

Pembina River Basin Task Team

In June 2017, the Red River Basin Commission sent letters to North Dakota and Manitoba, requesting if there was interest in re-engaging the Pembina River Basin Task Team. Both responded favourably and scheduled a meeting to re-establish the work of the committee. Meetings were held in June 2019 in Gretna, MB, and in November 2019 in Pembina, ND. The Red River Basin Commission facilitated the meetings. A summary of the history of the issues along the border, previous studies completed to

analyze the problems and potential solutions, and the progress from the previous task team were presented.

Additional meetings of the Task Team were anticipated but were delayed because of the border closure due to COVID-19. It was felt that the discussion was at a critical stage, where face-to-face communication was essential. If the borders are able to open, it is expected that discussion for the next meeting will get underway. Because of the delay, an update to the membership may also be needed.

After the subsidence of the extensive spring flooding in 2022, both ND and MB executive offices sought to re-energize the discussion. The RRBC was able to confirm interest from both the Pembina County Commission and the Pembina Water Board to have representation on the Task Team. It is anticipated that appointments by the Premier and Governor can be completed in time for a meeting in the late fall of 2022.

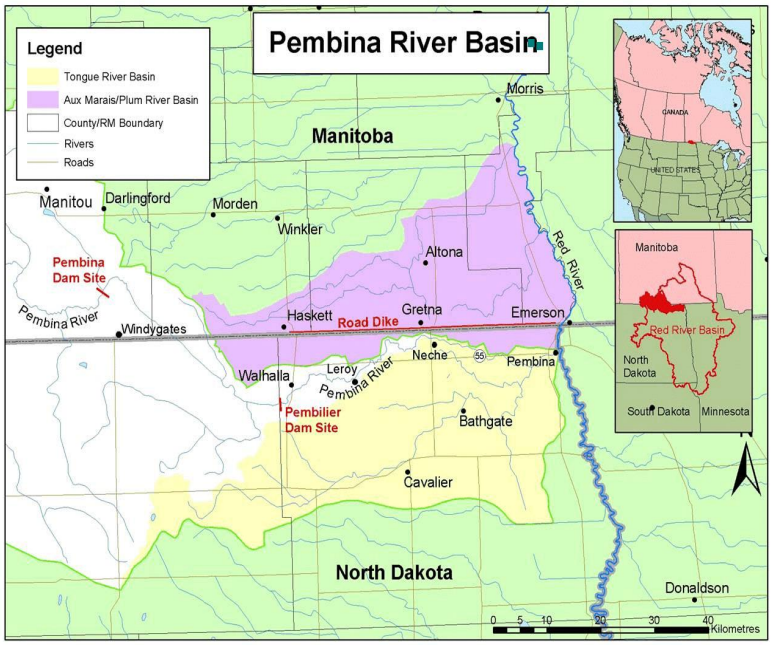

Figure 1. Pembina River Basin. The yellow and white areas comprise the Pembina River Basin.

The current Pembina River Task Team (reconstituted in late 2022) does not report to the IRRWB. It was created by and reports to Govts (ND and MB). The current chair is Red River Basin Commission (Ted Priester). So too was the previous iteration, the pre-Covid one that did a draft report. The Task team reconvened officially in late 2022 (includes IRRWB Co-Chairs) and met early January 2023.

Prior to both these iterations, there was an even earlier one – the Lower Pembina River Flood Task Force was created by the IRREB to do a hydrologic study/modeling of flooding in the Pembina watershed for the Board. Most if not all of the IRRB COH members were on the team. The IRRB gave the results to the IJC. IJC passed them on to govts. Ultimately, this led to the creation of the above-mentioned Pembina River Task Team.

E-7 Indigenous Task Team

The IRRWB recognizes the importance of collaboration with Indigenous peoples as the traditional owners and stewards of the land. The health of the river basin has a particular significance for the cultures, traditions, and well-being of Tribal Nations, First Nations and the Red River Métis. Indigenous peoples also have much to contribute to the sound stewardship of this shared watershed.

The Indigenous Collaboration Project was initiated in 2021 and is intended to build and strengthen relations with Tribal Nations, First Nations, the Red River Métis and institutions and communities in the Red River Basin. This includes examining ways that the IRRWB can better work with Indigenous partners in the future. The project draws inspiration from other IJC boards including the International Rainy-Lake of the Woods Watershed Board and the Souris River Study Board who have actively engaged Indigenous nations in their work.

To support this initiative, an Indigenous Collaboration Task Team with representation from both Canada and the U.S. was appointed by the IRRWB at the August 2021 Board Meeting to provide oversight and leadership on Indigenous engagement and collaboration including the implementation of the Indigenous Collaboration Project. An Indigenous Working Group was also formed to assist with building relationships and leveraging networks to support planning efforts for working sessions/workshops with Indigenous Nations/communities.

The Indigenous Task Team held its first Roundtable meeting on January 16-17, 2023 in Winnipeg, Manitoba. Key findings and recommendations were presented to the Board. Four of the thirteen recommendations were approved by the Board at its meeting held on August 31, 2023 in Detroit Lakes, Minnesota. The remaining nine recommendations will be discussed by the board to make decisions. The Final report that was submitted to the IRRWB from the task Team is shown below.

Indigenous Nations Roundtable
International Red River Watershed Board (IRRWB)
of the International Joint Commission (IJC)
January 16 and 17, 2023
Winnipeg, Manitoba

Prepared by:
Celeste McKay Consulting Inc.

Introduction

The International Joint Commission (the IJC) has been tasked with responsibilities under the Boundary Waters Treaty. Recognizing that Indigenous Peoples are inherent rights-holders, the IJC is seeking to involve Indigenous Peoples in a more respectful, fulsome way.

Established in April 2000, the International Red River Watershed Board (the IRRWB) is a relatively new structure within the IJC that has the mandate to help resolve transboundary disputes regarding the waters and aquatic ecosystem of the Red River, its tributaries, and aquifers.

The purpose of the Indigenous Nations Roundtable was to provide an opportunity for First Nations, Red River Métis and Tribal Nations whose territories are located in the Red River Watershed Basin to come together to discuss their priorities related to the IRRWB, and the IJC more broadly.

The results of the Indigenous Nations Roundtable can inform opportunities for the IJC and the IRRWB to explore new models for partnership and collaboration with First Nations, Red River Métis, and Tribal Nations with rights in respect to the management of the Red River Watershed.

Roundtable Meeting Summary

This Roundtable brought together 38 participants, including representatives of Indigenous Nations from both sides of the Canada-United States border who traditional territory is located within the Red River Watershed, including participants from the Southern Chiefs' Organization, the Manitoba Métis Federation – the National Government of the Red River Métis as well as Tribal Nations. A Commissioner from the IJC and members of the IRRWB were also present.

A **Dawn Pipe Ceremony** was performed by Arion Poitra offsite.

Opening Prayers were offered by Elders Norman Meade and Mary Maytwayashing. Elder Norman Meade welcomed participants to the homeland of the Red River Métis and offered a moment of silence, held in recognition of Joe Keeper, a Cree leader and advocate for water rights for decades.

Opening Remarks were provided by Grand Chief Jerry Daniels of the Southern Chiefs' Organization. He acknowledged water as a living being with rights and ceremonial significance that need to be respected. Grand Chief Daniels also spoke to the need to ensure broad public understanding of the science behind water treatment. Grand Chief Daniels outlined three priorities:

- The need for high trans-boundary water quality protection standards;
- The need to implement adaptive measures to address climate change impacts, including flooding; and
- The need to determine how best to guarantee meaningful collaboration going forward.

Chief Gordon Bluesky, Brokenhead Ojibway Nation, Treaty 1, welcomed participants to the Territory, and spoke to the significance of water within the Territory. He acknowledged Elder Meade's reference to Shoal Lake 40, who cannot practice their traditional livelihoods in their traditional waters because of how Lake Winnipeg has been developed. The community's situation provides one example of why stronger water protections are needed. Chief Bluesky noted that since colonization Indigenous Peoples of Treaty 1 have faced water impacts. He acknowledged the International Joint Commission's efforts, but emphasized that more work is needed to acknowledge Treaty 1, and ensure meaningful solutions that make a difference, for the Nations immediately impacted by the US-Canada border, but also for those beyond since water continues to flow and travel elsewhere, for now and for future generations.

Introductory Remarks by IRRWB Board Members Annette Trimbee and April Walker

April Walker and Dr. Annette Trimbee, new Board members appointed in April 2021, noted their recent appointment as Indigenous representatives. Introductions were made and both shared their commitment to working with the Board, as well as their interest in understanding current needs and priorities of Indigenous Nations. They highlighted that they would like to hear how they can support the Board in taking a holistic approach to water management, centering the voices and differing experiences of Indigenous Peoples whose territory is located both upstream and downstream from the Red River Watershed.

Overview of the IRRWB and the IJC by Henry Lickers, Haudenosaunee, IJC Commissioner

Commissioner Henry Lickers spoke about Haudenosaunee cultural knowledge about water and how it aligns with what others have shared. He shared that as a biologist and as the first Indigenous IJC Commissioner, he is working as a Commissioner under his personal and professional expertise.

Commissioner Lickers provided an overview of the IJC, including its mandate, way of working, and recent work, including the international watersheds initiative, and work to collaborate with Indigenous Peoples. Commissioner Lickers emphasized that the IJC is still learning how to effectively communicate and work with Indigenous Peoples. He expressed an interest in hearing from participants about their priorities and ideas on how collaboration can best proceed.

In follow-up to Commissioner Lickers' presentation there was a discussion period where the following views were shared:

- In response to a question for clarification on how the IJC ensures consultation is not just a box-checking exercise, Commissions Lickers noted that Commissioners are appointed by the Prime Minister of Canada or the US President. They are well-placed to push for response to concerns raised by Indigenous Peoples.

- In response to a question about the IJC's role in addressing longstanding difficulties for traditional land users to engage in land-based activities because of harassment and impacts from private land-owners, including agricultural run-off leading to algae blooms, Commissioner Lickers acknowledged the frustration. He further noted that the current Commissioners are passionate about water and need to keep the pressure on for action.

- In response to a question about whether there has been any push to give the IJC more "teeth", Commissioner Lickers noted that more support is needed from the public. He noted the impact of past research groups established across the Great Lakes that have contributed to current water quality agreements, and the need for similar organizing and collaboration to create change.

- In response to a question about youth involvement with the IJC's work, Commissioner Lickers emphasized the importance of sharing knowledge with youth and spoke to his plans to be a teacher when he retires from the IJC.

Roundtable Discussion: What relationships do the First Nations, the Red River Métis, and the Tribal Nations want to establish with the IRRWB? And the IJC?

Participants discussed the need for:

- Meaningful engagement and early consultation, as well as recognition of traditional laws, territories, sovereignty, hereditary responsibilities, and Treaty rights.

- Enforcement against people who are destroying the waters.

Noting that the IJC is a Canada-US exclusive relationship that subtly attaches Indigenous relations, participants expressed that the Board must make greater efforts to recognize Indigenous Peoples' laws and knowledge. Participants also discussed the importance of avoiding pan-Indigeneity approaches to collaboration.

The MMF clarified that they would prefer the IJC not to appear to advocate on their behalf. It is important that there be due recognition of the MMF as the official voice for any Red River Métis concerns.

Roundtable Discussion: What have been the barriers to past involvement with the IRRWB and the IJC? How can these barriers be removed?

Participants discussed challenges, alongside some solutions or approaches to these challenges. This included, for example: how colonized views could be addressed by bringing in traditional knowledge and centering Indigenous Peoples' voices and expertise; how barriers to cross-cultural communication could be addressed by using two-way knowledge sharing; how lack of youth involvement could be addressed by creating opportunities for youth.

The need to work across many jurisdictions was also emphasized as a key challenge, and one that particularly impacted on enforceability when ensuring action to address Indigenous concerns. Participants also noted that the current approach to water management by working across provincial boundaries was ineffective, and that water basin boundaries offered a better approach for watershed management.

Panel of Experts from the Tribal Nations, the Red River Métis, and the First Nations

Experts shared priorities and concerns of the First Nations, the Red River Métis and the Tribal Nations in respect to the protection and management of the Red River Watershed Basin.

Richard Monette, Turtle Mountain Band Chippewa Indians, spoke about the competing legal systems in the US that determine how water is allocated: prior appropriation and riparian systems. The former allocates water based on proximity of those who own land next to the water in question, and the latter is based on a first-use basis. Both systems fail to consider larger dynamics of shared use, and different states prioritize different systems. He emphasized the need to determine a balance between collective entities and the individual people who use or rely on a water system, while navigating different cultures of water use.

Connor Staub and Riley Bartel, the Manitoba Métis Federation, provided an overview of the Red River and the Red River Métis and their ongoing relationship to the environment. They shared the following Red River Métis priorities areas as follows:

- Capacity support to engage Red River Métis Citizens;
- Involvement in the IRRB's ongoing work; and
- Flood and drought mitigation.

The MMF shared further details on ongoing work to support intergenerational knowledge transfer, including identifying Elders and Knowledge Keepers who are able to work with youth out on the land during activities such as blueberry surveys and water sampling. The water testing work is still a pilot project, and there is interest in building Red River Métis water testing databases to ensure community data ownership and access.

Later in the day, Chief Gordon Bluesky spoke about the history of Treaty 1 and the long struggle to ensure community members can exercise their Treaty rights, including long struggles regarding water rights and sovereignty. He also spoke about his people's long history with the waters of Treaty 1, including predating the Treaty. Now, most of the Territory has been turned into farmland and municipalities, all changes made without Indigenous input, and all impacting on the ability to maintain the lands and waters and continue practicing traditional livelihoods. Chief Bluesky emphasized the importance of a role for Treaty 1 in working with the IJC to strategize and come up with solutions, but also asked for understanding as his community, and many others, work to simultaneously address other pressing issues such as housing, substance use, and suicide.

Participants discussed the restrictions and challenges to upholding Indigenous Peoples' water rights given current legal regimes in Canada and the US, at the federal and at the state/province level. Further, participants noted the historic role of the IJC in failing to uphold the rights of Indigenous Peoples on both sides of the border, and the need for a firm commitment to address Indigenous Peoples' concerns.

Participants considered different strategies for promoting Indigenous Peoples' voices and rights in the context of international, trans-boundary water issues, including:

- Promoting consultation and consent requirements;
- Referencing historic Treaty promises; and
- Referencing the *UN Declaration on the Rights of Indigenous Peoples*, which underscores the rights of Indigenous Peoples to their traditional territories, as opposed to defining Indigenous Peoples' interests based solely on the areas to which they have been displaced.

Roundtable Discussion: What elements are necessary to make partnership with the IRRWB and the IJC effective on a long-term basis?

Participants discussed the need for respect and equity – to develop concepts and tools in a meaningful way and ensure the Board is listening to all parties, especially Indigenous groups and traditional knowledge holders. Indigenous knowledge and spirituality should be centered, not side-lined, and Indigenous Peoples should be involved in all aspects of work and research carried out on their land (e.g., data collection, data analysis, and communication). Of particular importance, work should be done to effectively communicate any findings back to communities to ensure accessibility of research findings, for example, through partnerships with Indigenous communicators.

The need for more representation of Indigenous women on Watershed Boards, as well as intergenerational representation from Indigenous Nations was also underscored in discussion. In terms of encouraging youth involvement, participants noted the need to create opportunities for youth through capacity building and improved access to education. Participants also flagged the need for increased funding to support access to international opportunities and grants.

Participants emphasized the importance of moving away from consultation toward meaningful inclusion in decision-making, and for engagement with Indigenous Peoples, to understand the unique and overlapping priorities within and across communities.

Participants also discussed the need to ensure the Board's gatherings are culturally appropriate, safe spaces, including by allocating adequate time for ceremony and discussion.

Closing Remarks – April Walker

April Walker expressed hope for a future of Indigenous people working with the IJC, of the creation of an Indigenous Peoples board that includes Elders and youth, as well as the guidance of women to ensure the work proceeds in right direction for water protection. She thanked all participants for sharing their perspectives during the rich discussion that took place.

Closing Prayers by Elders Meade and Maytwayashing from the Territory.
Conclusion

Support for Indigenous Peoples' approaches to water management is needed.

Water is important to everything in life and connected to many rights issues. Water also carries unique spiritual significance for many Indigenous Peoples. Indigenous water knowledge, as well as

Indigenous Peoples' relationships to water have not historically been reflected in Canadian or US water governance, and instead have actively been harmed and suppressed.

The IJC itself has been an instrument of implementing colonial law and policy. Moving forward, the IRRWB will seek to work with the IJC, and being accountable for taking a new approach that respects the rights and knowledge of Indigenous Peoples.

Respect for Indigenous ways of knowing must include recognition of the importance of intergenerational knowledge transfer and support for youth involvement; an approach to water management based on river basins and the free movement of water across colonial borders; and measures to ensure research and data collection give back directly to communities instead of replicating extractive colonial dynamics.

Indigenous Peoples have specific responsibilities as well as rights when it comes to water that also need to be recognized and respected. For example, the role of women as water protectors must be upheld.

This Roundtable is a first step in a new relationship based on mutual respect and partnership that must continue to be pursued.

Appendix I: Agenda

JANUARY 16, 2023 (afternoon session)

DAY 1

6:00 am	**Dawn Ceremony** from a Tribal Nation (remotely – Nation TBC)
1:00 pm	**Opening Prayers** by Elders from the territory, Mary Maytwayashing and Norman Meade
1:15 pm	**Opening Remarks** Southern Chiefs Organization Grand Chief Daniels, Treaty 1 Chief Gord Bluesky
1:45 pm	**Introductory Remarks** by IRRWB board members Annette Trimbee and April Walker To set out the purpose of the workshop to participants, as well as an overview of the meeting and any necessary housekeeping tasks.
2:00 pm	**Overview of the IRRWB and the IJC** by Henry Lickers, Haudenosaunee, Commissioner, International Joint Commission
2:30 pm	**Question and Answer Period**
2:45 pm	Nutrition Break
3:00 pm	**Roundtable Discussion** **Key Questions:** What relationship to First Nations, the Red River Métis and Tribal Nations want to establish with the IRRWB? And the IJC. What have been the barriers to past involvement with the IRRWB and the IJC? How can these barriers be removed?
4:00 pm	**Summary of the day**
4:20 pm	**Closing Prayers** **Adjournment**

JANUARY 17, 2023 (morning session)

DAY 2

8:30 am	**Opening Prayer**
8:45 am	**Panel of Experts from the Tribal Nations, the Red River Métis and the First Nations:** Chief Gord Bluesky (Brokenhead Ojibway Nation), Richard Monette TBC (Turtle Mountain Band of Chippewa) and Connor Staub and Riley Bartel (Red River Métis)
10:00 am	**Question and Answer Period with Keynote Speakers**
10:30 am	Health Break
10:45 am	**Roundtable Discussion**
	Key Questions:
	What elements are necessary to make partnership with the IRRWB and the IJC effective on a long-term basis? Consider procedural and structural changes.
11:50 am	**Closing Prayers** by Elders from the Territory
12:00 pm	Adjournment
12:10 pm	**Meet and Greet with IJC Commissioners and International Red River Watershed Board Members**
	The Meet and Greet will take place in the Broadway Room, Fort Gary Hotel.

Appendix II: Participant List

IJC Representatives
Commissioner Henry Lickers
Melissa Hotain, IRRWB Member
Anette Trimbee, IRRWB Member
April Walker, IRRWB Member

SCO Delegates
Elder Mary Maytwayashing
Elder David Scott
Grand Chief Jerry Daniels
Chief Gordon Bluesky
Morgan Brighnose
Kenneth Courchene
Daniel Gladu
Cobina Hardisty
Rebecca Sinclair

MMF Delegates
Elder Norman Meade
Riley Bartel
Phoenix Combe
Eli Desuatels
Christian Goulet
Maddy Perry
Jenny Petrynko
Connor Staub

Tribal Delegates
Will Bement
Stacy Blue
Ryan Brown
Deb Dirlam
Monica Hedstrom
Chris Holm
Charlene Miller
Christa Monette
Richard Monette
Mary Morin
Al Pemberton
Arion Poitra
Brandy Toft
Jessica Tolifson
Joshua Tweeton

Amanda Wold

Facilitator
Celeste McKay

Appendix-E8 Outreach and Engagement Committee

Outreach and Engagement Committee input to the 2022 International Red River Watershed Report Annual Report

Respectfully submitted in April 2023

Members of the Outreach and Engagement Committee consisted of Ute Holweger, Environment and Climate Change Canada (Canadian co-chair), Ted Preister, Red River Basin Commission, Dimple Roy, International Institute for Sustainable Development, Gavin van der Linde, Red River Basin Commission, Rebecca Seal-Soileau, US Army Corps of Engineers and Girma Sahlu, Environment and Climate Change Canada. The Committee would like to thank Mary Scherling (US Co-chair), whose term on the board ended in 2022, for her leadership and support that she provided to the committee over the years.

The committee met several times throughout the year to advance its priorities and workplan activities. The committee has discussed the need for increased collaboration/coordination with the other committees of the board and need for developing an outreach strategy that can enable a more proactive and targeted approach for outreach and engagement.

The key priority of the Outreach and engagement Committee in 2022 continued to be ongoing support for the Indigenous Task Team in advancing Indigenous collaboration through the *Building the foundations for Indigenous collaboration in the International Red River Basin initiative* that is being funded by the IJC's International Watershed Initiative. Environment and Climate Change Canada also provided funding for this work in 2022. Through this work, the following accomplishments have been achieved:

- Indigenous Task Team (including Terms of Reference developed) and Indigenous Working Group established to provide oversight and guidance
- Two contractors (project administrator and facilitator) secured to support engagement process
- Supporting documents for engagement process were developed

The IRRWB brochure was updated in 2022 with English and French versions of the brochure posted on the IJC IRRWB Website https://ijc.org/en/rrb/international-red-river-board-brochure.

The committee provided input and guidance to a News Release published in November 2022 regarding Canada and US' approval of nutrient objectives for the Red River. See: The International Red River Watershed Board to monitor key nutrients to help reduce the impact of harmful blooms in the Red River basin | International Joint Commission (ijc.org)

Some of the committee members also participated in a Communications Workshop held in conjunction with the IJC's Fall Appearances.

No summer tour was held in August 2022 as the board meeting was held virtually due to COVID restrictions.

Appendix F

Contingency Plan Contact List

Notification List
For D.O. Depletions, Non-toxic, Oil, and Toxic Spills

United States:

Minnesota Pollution Control Agency – Detroit Lakes, MN

Theresa Haugen- (218) 856-0730 (office) State Duty officer
(218) 846-0719 Fax
1-800-422-0798 (24-hr) State Duty officer

Minnesota Department of Natural Resources – Bemidji, MN (Fisheries)

Marilyn Danks - (651) 259-5087 (office – primary contact Central Office St. Paul)
Henry Drewes - (218) 308 -2633 (office – secondary contact Bemidji office)
1-800- 422-0798 (24-hr National Response Center)

North Dakota Health Department – Bismarck, ND

David Glatt - (701) 328-5210 (office)
Aaron Larsen - (701) 328 -5214 (office)
(701) 328-5200 fax
1-800-472-2121 (24-hr in-state-ask for REACT Officer)
(701) 328-9921 (24-hr out-of-state - ask for REACT Officer)

Environmental Protection Agency – Denver, CO

Jason Gildea - (303) 312-6670 office
-(303) 312 -8637 (office-alternate contact)
-(303) 312-7206 fax
1-800-424- 8802 (24-hr National Response Center)

Canada:

Manitoba Environment, Climate and Parks – Winnipeg, MB

Spills - (204) 944-4888 (24-hr telephone service emergency number)

Exceedance - Nicole Armstrong – nicole.armstrong@gov.mb.ca

Environment and Climate Change Canada – Winnipeg, MB

Ute Holweger - (204) 983 – 9832 (office)
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Patrick Cherneski - (306) 564-4450 (office)
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Environment and Climate Change Canada – Regina, SK

Girma Sahlu - (306) 564 – 4457(office)

Appendix G

Committee Membership List

HYDROLOGY COMMITTEE, AQUATIC ECOSYSTEM COMMITTEE, WATER QUALITY COMMITTEE, INDIGENOUS TASK TEAM, AND OUTREACH & ENGAGEMENT COMMITTEE MEMBERSHIP LIST

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Bruce Davison	National Hydrological Services Environment and Climate Change Canada	11 Innovation Blvd Saskatoon, Saskatchewan S7N 3H5	(306) 975-5788	bruce.davison@canada.ca
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International Red River Watershed Board
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International Red River Watershed Board
Outreach and Engagement Committee Membership:

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International Red River Watershed Board
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International Red River Watershed Board
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Membership:

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Appendix H

INTERNATIONAL RED RIVER WATERSHED BOARD (IRRWB)

DESIGNATION LETTER AUGUST 4, 2021

International Joint Commission
Canada and United States

Commission mixte internationale
Canada et États-Unis

August 4, 2021

Mr. Patrick Cherneski
Canadian Co-Chair
International Red River Board
patrick.cherneski@canada.ca

Col. Karl Jansen
US Co-Chair
International Red River Board
Karl.D.Jansen@usace.army.mil

Dear Mr. Cherneski and Col. Jansen,

IJC Commissioners would like to congratulate you and the Board for all of your efforts over the past decade in carrying out exceptional binational work as a pilot watershed board under the International Watersheds Initiative (IWI). As of today, we can formally recognize the International Red River Board (IRRB) as a watershed board and will refer to you henceforth as the International Red River Watershed Board (IRRWB).

We sincerely thank you for your continued patience over the years as the IJC and governments deliberated on the issue.

Along with this designation comes also the need to update the board name and its directive. Attached to this letter please find a revised directive to reflect the new designation as well as the Commission's decision of October 2015 removing reporting responsibilities for the Poplar and Big Muddy Rivers.

Should you wish to make recommendations for additional changes to the directive please forward these to us for Commission consideration. Please feel free to contact liaisons and IJC staff should you have any questions or concerns.

Once again, we thank you for your continued patience in this effort and for your commitment to healthy shared waters along the US-Canadian boundary. Congratulations!

Sincerely,

Pierre Béland
Chair, Canadian Section

Jane Corwin
Chair, U.S. Section

Enclosure: IRRWB Directive, August 4, 2021

cc: Michael Flores, Director, Office of Canadian Affairs, U.S. Department of State
Evelyne Coulombe, Executive Director, U.S. Transboundary Affairs, Global Affairs Canada

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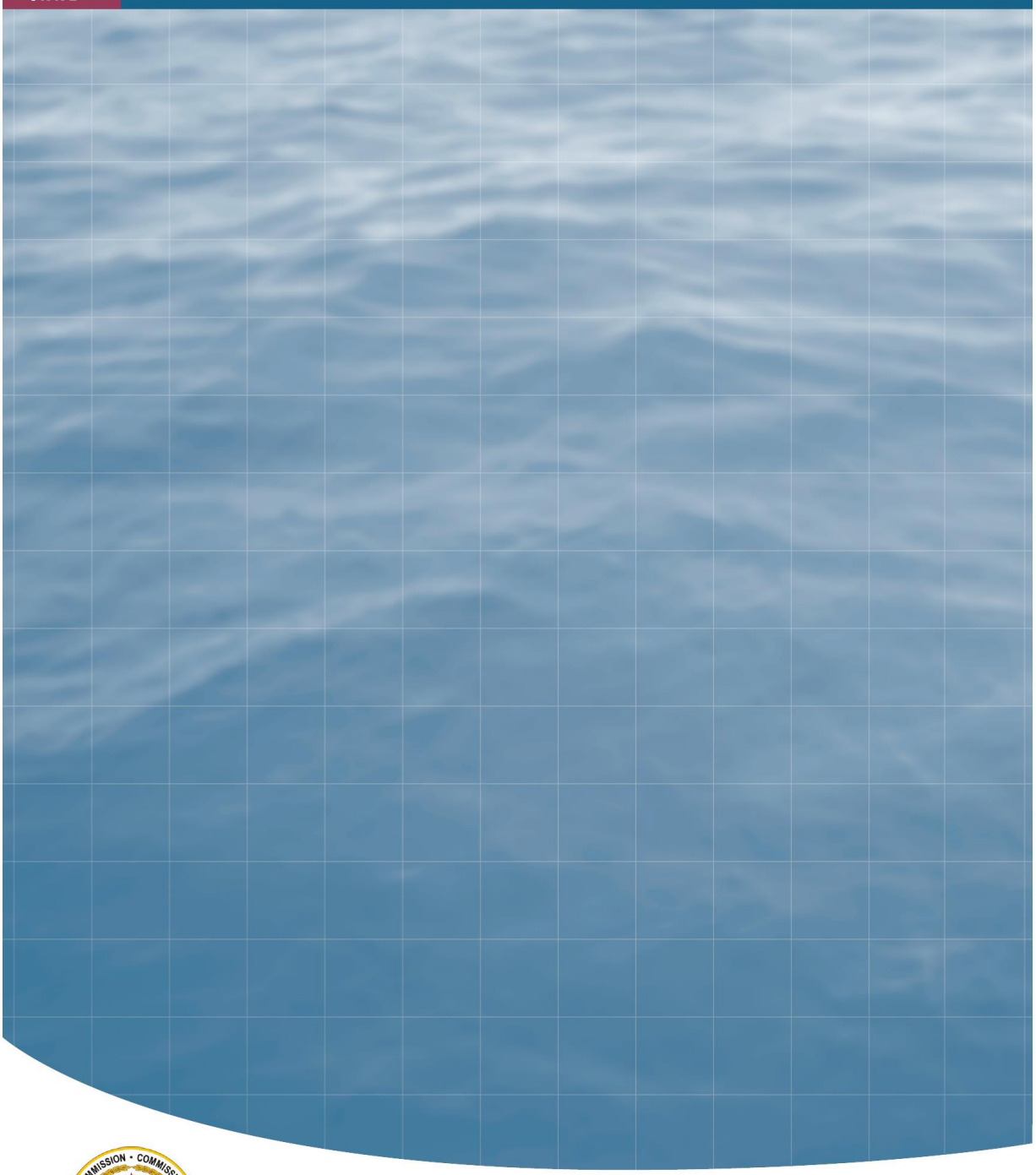
IRRB

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