SIXTY-FIRST ANNUAL REPORT

TO THE

International Joint Commission

COVERING

Calendar Year 2019

International Souris River Board

INTERNATIONAL SOURIS
RIVER BOARD

CONSEIL INTERNATIONALE
DE LA RIVIERE SOURIS

October 2020

The International Joint Commission
Ottawa, Ontario and Washington, D.C.

Commissioners:

In accordance with the Directive of January 22, 2007 (replaces Directives of April 11, 2002 and May 31, 1959), we have enclosed the Sixty-First Annual Report covering calendar year 2019.

Respectively submitted,

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1.0 SUMMARY

1.1 2019 APPORTIONMENT

For the 2019 calendar year, the natural flow of the Souris River at the Sherwood Crossing was 73,930 cubic decametres (59,935 acre-feet), which represents 46 percent of the 1959-2019 long-term mean. North Dakota received 38,436 cubic decametres (31,160 acre-feet) or 52 percent of the natural flow.

Net depletions in Canada were 30,740 cubic decametres (24,921 acre-feet). Recorded runoff for the Souris River near Sherwood, North Dakota, was 38,436 cubic decametres (31,160 acre-feet), or about 29 percent of the 1931-2019 long-term mean.

The apportionment between Canada and the United States was discussed at the February 21, 2019 meeting of the International Souris River Board (Board). The Board reviewed the forecast for the spring 2019 hydrologic conditions and declared 2019 to be a non-flood year.

Based on the projected runoff volumes and per Annex B of the 1989 International Agreement, it was determined that Saskatchewan must pass 50 percent of the natural flow to North Dakota

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 10,317 cubic decametres (8,364 acre-feet), or 16 percent of the long-term mean since 1959. Recommendation No. 2 of the Interim Measures was met with a net gain in the North Dakota portion of the Long Creek basin of 2,012 cubic decametres (1,631 acre-feet).

Recorded runoff leaving the United States at Westhope, during the period of June 1 through October 31, was 92,900 cubic decametres (75,318 acre-feet). The flow was in compliance with the 0.566 cms (20 cfs) minimum flow requirement for the June 1 to October 31 period as specified in Recommendation No. 3(a) of the Interim Measures.

1.2 2019 WATER QUALITY OBJECTIVES

To determine the quality of water in the Souris River, samples at two border locations, Sherwood at the Saskatchewan/North Dakota border and Westhope at the North Dakota/Manitoba border, were compared to water quality objectives established by the ISRB. Of the 46 parameters with established water quality objectives nine exceed the established objective. These parameters are: phosphorus, sodium, sulfate, chloride, iron, dissolved oxygen, pH, total dissolved solids, and total suspended solids.

For the 2019 calendar year, both Sherwood and Westhope had total phosphorus concentrations that continue to exceed the objective in all samples, as they have done for most of the past twenty years. For the other eight parameters the two border sites showed differences in the timing and number of exceedances.

Of the eight samples taken at Sherwood in 2019, there were four exceedances of iron, three of sodium, and one each of pH and dissolved oxygen. Maximum values for these occurred over a number of months from ice cover until fall. Of the ten samples taken at Westhope, there were nine exceedances of sodium, four each of pH and total suspended solids, three of dissolved

oxygen, two of sulphate, and one of chloride. Maximum values for the Westhope exceedances all occurred in March, with the single exception of pH which occurred in September.

Considering trends of the median parameter values for the 2019 calendar year, the water quality of the Souris River had median values approximately the same as the median values over the past eight years for most of the 46 parameters. When compared to the median values of the historical record from 1991 to present, the median values in 2019 are lower except for three parameters: sulfate, arsenic, and chromium. Of these, only sulfate was above the water quality objective and only at Westhope. Arsenic (both sites) and chromium (Sherwood only) were well below water quality objectives and only slightly above the historical median.

Currently the ISRB's Aquatic Ecosystem Health Committee is undertaking two International Watershed Initiative Projects funded by the International Joint Commission. When completed, the Board's Aquatic Ecosystem Health Committee will use the information from the Continuous Dissolved Oxygen Study and the Water Quality Trends Analysis Study to provide insight on the exceedances observed in the basin and to assist with the review of the established water quality objectives.

2.0 INTRODUCTION

The International Souris River Board (Board) ensures compliance with water sharing in the Souris River basin, provides oversight for flood operations, maintains an ecosystem approach to transboundary water issues including related to water quality, and assists the International Joint Commission (IJC) in preventing and resolving transboundary disputes.

The 2019 annual report documents the activities of the International Souris River Board. The report contains a brief history of the Board that details the Board's membership, duties, and committees. Furthermore, the report summarizes hydrologic and water quality conditions, and water use within the basin related to the Board's mandate.

3.0 INTERNATIONAL SOURIS RIVER BOARD

3.1 SOURIS RIVER REFERENCE (1940)

In a letter on behalf of the Government of Canada dated 20 March 1959 and a letter on behalf of the Government of the United States of America dated 3 April 1959, the IJC was informed that the Interim Measures recommended in its report of 19 March 1958, in substitution for those recommended in the report dated 2 October 1940 in response to the Souris River Reference (1940), had been accepted by both Governments.

The Governments of the United States and Canada entered into an Agreement for Water Supply and Flood Control in the Souris River Basin on October 26, 1989.

Pursuant to this Agreement, the Interim Measures related to the sharing of the annual natural flow of the Souris River from Saskatchewan into North Dakota contained in paragraph 22(1) of the IJC's 1958 Report to the Governments were modified. In light of the modifications in 1989 and pursuant to a February 28, 1992 request from the Governments of the United States and Canada, the IJC on April 23, 1992 directed the International Souris River Board of Control to begin applying the "Interim Measures as Modified in 1992."

The measures were further modified by the Governments in December 2000. The "Interim Measures as Modified in 2000" are shown in Appendix C of this report.

3.2 INTERIM MEASURES AS MODIFIED IN 2000

In December 2000, the IJC directed the Board to implement the "Interim Measures as Modified in 2000" for the 2001 calendar year and each year thereafter. The 2000 Interim Measures were developed to provide greater clarification of the conditions that must prevail for the determination of the sharing of natural flow between Saskatchewan and North Dakota at the Sherwood Crossing.

In general, the Interim Measures provide that Saskatchewan shall have the right to divert, store, and use waters that originate in the Saskatchewan portion of the Souris River Basin, provided that the annual runoff of the river into North Dakota is not thereby reduced to less than half of the runoff that would have occurred in a state of nature; that North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the basin together with the waters that cross the boundary from Saskatchewan; and that Manitoba shall have the right to use the waters that originate in the Manitoba portion of the basin and, in addition, that North Dakota must provide to Manitoba, except during periods of severe drought, a regulated flow of at least 0.566 cms (20 cfs) during the months of June through October.

For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, as far as practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cms (4 cfs) when that level of flow would have occurred under the conditions of water-use development prevailing in the Saskatchewan portion of the drainage basin prior to the construction of Boundary Dam, Rafferty Dam, and Grant Devine Dam.

Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Grant Devine Reservoirs. During years when those conditions occur, the minimum flow to be passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Grant Devine Dam for flood control.

Except in flood years, flow releases to the United States should occur in the pattern that would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan, through the Board, that the release would not be of benefit to the State at that time.

The State of North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the Souris River Basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing, provided that any diversion, use, or storage of Long Creek water shall not diminish the annual runoff at the Eastern Crossing of Long Creek into Saskatchewan below the annual runoff of Long Creek at the Western Crossing into North Dakota.

In periods of severe drought, when it becomes impracticable for North Dakota to deliver the regulated flow of 0.566 cms (20 cfs), North Dakota's responsibility to Manitoba will be limited to providing such flows as the Board determines to be practicable and in accordance with the objective of making water available for human and livestock consumption as well as for household use.

3.3 BOARD OF CONTROL

In May 1959, the IJC officially approved and signed a Directive that created the International Souris River Board of Control. The Directive charged the Board with the responsibility of ensuring compliance with the Interim Measures as set out in 1958 and of submitting such reports as the IJC may require or as the Board, at its discretion, may desire to file.

3.4 AMALGAMATION OF THE INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD AND INTERNATIONAL SOURIS RIVER BOARD OF CONTROL

In 2000, the IJC directed the International Souris-Red Rivers Engineering Board to transfer responsibilities related to the Souris River to the International Souris River Board of Control. The IJC also changed the International Souris River Board of Control's name to the International Souris River Board.

3.5 AMALGAMATION OF THE INTERNATIONAL SOURIS RIVER BOARD AND SOURIS RIVER BI-LATERAL WATER QUALITY MONITORING GROUP

By letter dated January 22, 2007, the Board was officially notified by the IJC that the new Directive dated January 18, 2007, replaced the previous directive dated April 11, 2002. The new Directive sets out the duties of the Board as it moves toward a watershed approach in the Souris

River Basin and combined the duties of the Board and Souris River Bi-Lateral Water Quality Monitoring Group. It also increased the membership of the Board to twelve members.

The Board's duties were revised to include the following:

- Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River Basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the IJC about existing or potential transboundary issues.
- Oversee the implementation of compliance with the Interim Measures as Modified for Apportionment of the Souris River as described in Appendix A of the Directive.
- Assist the IJC in the review of a Joint Water Quality Monitoring Program.
- Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.
- Report on aquatic ecosystem health issues in the watershed and regularly inform the IJC on the state and implications of aquatic ecosystem health.
- Carry out such other studies or activities as the IJC may, from time to time, request.
- Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year.
- The Board shall submit an annual report covering all of its activities at least three weeks in advance of the IJC's fall semi-annual meeting, and the Board shall submit other reports as the IJC may request or the Board may feel appropriate in keeping with this Directive.
- The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year. The Board has agreed to hold the public meeting in the spring/summer and to advertise it.

In 2007, three committees were established to assist the Board in administering the requirements of its enhanced mandate. The Natural Flow Methods Committee was renamed as the Hydrology Committee and is charged with investigating procedures and questions on the approach and methods used to determine the natural flow of the Souris River. The Flow Forecasting Liaison Committee (FFLC) has the responsibility to ensure information sharing and coordination between the forecasting agencies in the basin. The Aquatic Ecosystem Health Committee (AEHC) has the responsibility to identify water quality and aquatic health concerns in the basin and to report on the water quality monitoring programs. In 2018 the Board established the Communications and Outreach Committee to undertake improved communications and outreach activities specific to the needs of the Board. Membership on these committees includes board members and contributors from other relevant agencies in the basin.

3.6 BOARD MEMBERS

At the end of 2019, the members of the Board were as follows:

Nicole Armstrong Member for Canada
Manitoba Agriculture and Resource Development (Co-Chair)
Winnipeg, Manitoba

Russell Boals — Member for Canada
Retired
Regina, Saskatchewan

John Fahlman — Member for Canada
Saskatchewan Water Security Agency
Moose Jaw, Saskatchewan

Mark Lee — Member for Canada
Manitoba Agriculture and Resource Development
Regina, Saskatchewan

John-Mark Davies — Member for Canada
Saskatchewan Water Security Agency
Saskatoon, Saskatchewan

Jeff Woodward — Member for Canada
Saskatchewan Water Security Agency
Regina, Saskatchewan

David Pattyson — Member for Canada
Agri-Environmental Group Plans
Tribune, Saskatchewan

Debbie McMechan — Member for Canada
Reeve of Two Borders
Two Borders, Manitoba

Joe Goodwill — Member for Canada
Deputy-Mayor of Souris
Souris, Manitoba

Garland Erbele — Member for the United States
North Dakota State Engineer (Co-Chair)
Bismarck, North Dakota

Frank Durbian — Member for the United States
U.S. Fish and Wildlife Service
Towner, North Dakota

Colonel Samuel Calkins — Member for the United States
U.S. Army Corps of Engineers
St. Paul, Minnesota

Gregg Wiche — Member for the United States

Retired
Bismarck, North Dakota

Scott Gangl — Member for the United States
North Dakota Game and Fish Department
Bismarck, North Dakota

Dave Glatt — Member for the United States
North Dakota Department of Health
Bismarck, North Dakota

Shelly Weppler — Member for the United States
Ward County Commissioner
Minot, North Dakota

Lorinda Haman — Member for the United States
North McHenry Soil Conservation District
Towner, North Dakota

David O'Connell — Member for the United States
Retired
Lansford, North Dakota

Secretaries

Girma Sahlu — Canada
Environment and Climate Change Canada
Regina, Saskatchewan

Chris Korkowski — United States
North Dakota State Water Commission
Bismarck, North Dakota

4.0 2019 ACTIVITIES OF THE BOARD

The Board held two face to face meetings and one public meeting in 2019. Discussions and decisions made are summarized in the following sections.

4.1 2019 SPRING MEETING

The Board held its annual spring meeting in Brandon, Manitoba on February 21, 2019.

The agenda for the Board's meeting included the following topics:

- Review of 2018 Hydrologic Conditions, Spring 2019 Hydrologic Forecast and Planned Operations
- Compliance of Souris River Flows to December 31, 2018
- Update from the Hydrology Committee
- Water Quantity Monitoring
- Water Appropriations in the Souris River Basin during 2018
- Update from the Flow Forecasting Liaison Committee (FFLC)
- Aquatic Invasive Species in Manitoba
- Update from the Aquatic Ecosystem Health Committee (AEHC)
- Compliance with Water Quality Objectives for 2018
- Water Quality Monitoring Plan
- Overview and Update on Tile Drainage in Manitoba
- ISRB Communications
- International Souris River Study Board Update (ISRSB)
- Update form the 1989 Agreement Core Committee
- Update on Water Management Projects
- International Watershed Initiative Projects
- Work Plan

Details of the 2019 spring meeting are provided under Appendix G.

4.2 2019 SUMMER MEETING

The Board held its annual summer meeting in Bottineau, North Dakota on June 26, 2019. The Board also hosted a public meeting on the evening of June 25, 2019 in partnership with the International Souris River Study Board.

The agenda for the Board's meeting included the following topics:

- Public Meeting Review
- Determination of Souris River Flows to May 31, 2019
- Update from the Hydrology Committee
- Review of 2019 Hydrologic Conditions and Operations, Summer Hydrologic Forecasts and Planned Operations
- Update from the Flow Forecasting Liaison Committee (FFLC)
- Aquatic Invasive Species in North Dakota

- Update from the Aquatic Ecosystem Health Committee (AEHC)
- Compliance with Water Quality Objectives for 2019
- Update on the Communications and Outreach Committee (COC)
- Update on Water Management Projects
- Internal Watershed Initiative Projects (IWI)
- International Souris River Study Board Update (ISRSB)

Details of the 2019 summer meeting are provided under Appendix G.

5.0 MONITORING

5.1 INSPECTIONS OF THE BASIN

During 2019, the staff of the Water Survey Division of Environment and Climate Change Canada (ECCC), Water Security Agency (WSA), North Dakota State Water Commission (NDSWC), the Manitoba Government and the United States Geological Survey (USGS) carried out frequent field inspections of the Souris River Basin.

5.2 GAUGING STATIONS

A list of the gauging stations operated in the Souris River basin is provided in Table 1. In addition, the USGS operated three miscellaneous streamflow measurement sites in the vicinity of the Eaton Irrigation Project near Towner, North Dakota. The station numbers and locations of the stations measuring streamflow, water level, and water quality are shown below in Tables 1, 2, and 3, respectively.

Table 1. Streamflow stations in the Souris River Basin

Index Number	Stream	Location	State or Province	Operated by
05NA003 (5113360)	Long Creek[1]	at Western Crossing	Saskatchewan	Environment and Climate Change Canada
05NA004	Long Creek	near Maxim	Saskatchewan	Saskatchewan Water Security Agency
05NA005	Gibson Creek	near Radville	Saskatchewan	Environment and Climate Change Canada
05NB001	Long Creek	near Estevan	Saskatchewan	Environment and Climate Change Canada
05NB011	Yellow Grass Ditch	near Yellow Grass	Saskatchewan	Environment and Climate Change Canada
05NB014	Jewel Creek	near Goodwater	Saskatchewan	Environment and Climate Change Canada
05NB018	Tatagwa Lake Drain	near Weyburn	Saskatchewan	Environment and Climate Change Canada
05NB021 (5113800)	Short Creek[1]	near Roche Percee	Saskatchewan	Environment and Climate Change Canada
05NB031	Souris River	near Bechard[2]	Saskatchewan	Saskatchewan Water Security Agency
05NB033	Moseley Creek	near Halbrite	Saskatchewan	Environment and Climate Change Canada
05NB034	Roughbark Creek	near Goodwater	Saskatchewan	Environment and Climate Change Canada
05NB035	Cooke Creek	near Goodwater	Saskatchewan	Environment and Climate Change Canada
05NB036	Souris River	below Rafferty Reservoir	Saskatchewan	Environment and Climate Change Canada
05NB038	Boundary Reservoir Diversion Canal	near Estevan	Saskatchewan	Environment and Climate Change Canada
05NB039	Tributary	near Outram	Saskatchewan	Environment and Climate Change Canada
05NB040	Souris River	near Ralph	Saskatchewan	Environment and Climate Change Canada
05NB041	Roughbark Creek	above Rafferty Reservoir	Saskatchewan	Environment and Climate Change Canada
05NC001	Moose Mountain Creek	below Moose Mountain Lake	Saskatchewan	Saskatchewan Water Security Agency
05ND010	Moose Mountain Creek	above Grant Devine Lake	Saskatchewan	Environment and Climate Change Canada
05ND011	Shepherd Creek	near Alameda	Saskatchewan	Environment and Climate Change Canada

Table 1. (Continued)

Index Number	Stream	Location	State or Province	Operated by
05ND013	Moose Mountain Creek	below Grant Devine Lake	Saskatchewan	Environment and Climate Change Canada
05NE003	Pipestone Creek	above Moose Mountain Reservoir	Saskatchewan	Environment and Climate Change Canada
05NF001	Souris River	at Melita	Manitoba	Environment and Climate Change Canada
05NF002	Antler River	near Melita	Manitoba	Environment and Climate Change Canada
05NF006	Lightning Creek	near Carnduff	Saskatchewan	Environment and Climate Change Canada
05NF007	Gainsborough Creek	near Lyleton	Manitoba	Environment and Climate Change Canada
05NF008	Graham Creek	near Melita	Manitoba	Environment and Climate Change Canada
05NF010	Antler River	near Wauchope	Saskatchewan	Environment and Climate Change Canada
05NG001	Souris River	at Wawanesa	Manitoba	Environment and Climate Change Canada
05NG003	Pipestone Creek	near Pipestone	Manitoba	Environment and Climate Change Canada
05NG007	Plum Creek	near Souris	Manitoba	Environment and Climate Change Canada
05NG012	Elgin Creek	near Souris	Manitoba	Environment and Climate Change Canada
05NG020	Medora Creek	near Napinka	Manitoba	Environment and Climate Change Canada
05NG021	Souris River	at Souris	Manitoba	Environment and Climate Change Canada
05NG024	Pipestone Creek	near Sask. Boundary	Manitoba	Environment and Climate Change Canada
5113520	Long Creek Tributary	near Crosby	North Dakota	United States Geological Survey
5113600 (05NB027)	Long Creek[1 3]	near Noonan	North Dakota	United States Geological Survey
5114000 (05ND007)	Souris River[1 3]	near Sherwood	North Dakota	United States Geological Survey
5116000	Souris River[3]	near Foxholm	North Dakota	United States Geological Survey
5116135	Tasker Coulee Tributary	near Kenaston	North Dakota	United States Geological Survey
5116500	Des Lacs River[3]	at Foxholm	North Dakota	United States Geological Survey
5117500	Souris River[3]	above Minot	North Dakota	United States Geological Survey
5119410	Bonnes Coulee	near Velva	North Dakota	United States Geological Survey
5120000	Souris River[3]	near Verendrye	North Dakota	United States Geological Survey
5120180	Wintering River Tributary	near Kongsberg	North Dakota	United States Geological Survey
5120500	Wintering River[3]	near Karlsruhe	North Dakota	United States Geological Survey
5122000	Souris River[3]	near Bantry	North Dakota	United States Geological Survey
5123300	Oak Creek Tributary	near Bottineau	North Dakota	United States Geological Survey
5123400	Willow Creek[3]	near Willow City	North Dakota	United States Geological Survey
5123510	Deep River[3]	near Upham	North Dakota	United States Geological Survey
5124000 (05NF012)	Souris River[1 3]	near Westhope	North Dakota	United States Geological Survey

Table 2. Water level stations in the Souris River Basin

Index Number	Stream	Location	State or Province	Operated by
5113750	East Branch Short Creek Reservoir	near Columbus	North Dakota	United States Geological Survey
5115500	Lake Darling	near Foxholm	North Dakota	United States Geological Survey
LGNN8	Souris River	at Logan	North Dakota	United States Army Corps of Engineers United States National Weather Service
SWRN8	Souris River	at Sawyer	North Dakota	United States Army Corps of Engineers United States National Weather Service
TOWN8	Souris River	at Towner	North Dakota	United States Army Corps of Engineers United States National Weather Service
VLVN8	Souris River	at Velva	North Dakota	United States Army Corps of Engineers United States National Weather Service
	Upper Souris Refuge	Dams 87 and 96	North Dakota	United States Fish and Wildlife Service
	Des Lacs Refuge	Units 1 - 8 inclusive	North Dakota	United States Fish and Wildlife Service
	J. Clark Salyer Refuge	Dams 320, 326, 332, 341, and 357	North Dakota	United States Fish and Wildlife Service
05NA006	Larsen Reservoir	near Radville	Saskatchewan	Environment and Climate Change Canada
05NB012	Boundary Reservoir	near Estevan	Saskatchewan	Saskatchewan Water Security Agency
05NB016	Roughbark Reservoir	near Weyburn	Saskatchewan	Environment and Climate Change Canada
05NB020	Nickle Lake	near Weyburn	Saskatchewan	Environment and Climate Change Canada
05NB032	Rafferty Reservoir	near Estevan	Saskatchewan	Environment and Climate Change Canada
05NC002	Moose Mountain Lake	near Corning	Saskatchewan	Environment and Climate Change Canada
05ND008	White Bear (Carlyle) Lake	near Carlyle	Saskatchewan	Saskatchewan Water Security Agency
05ND009	Kenosee Lake	near Carlyle	Saskatchewan	Saskatchewan Water Security Agency
05ND012	Grant Devine Lake	near Alameda	Saskatchewan	Environment and Climate Change Canada
05NE002	Moosomin Lake	near Moosomin	Saskatchewan	Environment and Climate Change Canada
05NF804	Metigoshe Lake	near Metigoshe	Manitoba	Manitoba Infrastructure
05NF805	Sharpe Lake	near Deloraine	Manitoba	Manitoba Infrastructure
05NG023	Whitewater Lake	near Boissevain	Manitoba	Environment and Climate Change Canada
05NG801	Plum Lake	above Deleau Dam	Manitoba	Manitoba Infrastructure
05NG803	Elgin Reservoir	near Elgin	Manitoba	Manitoba Infrastructure
05NG806	Souris River	above Hartney Dam	Manitoba	Manitoba Infrastructure
05NG807	Souris River	above Napinka Dam	Manitoba	Manitoba Infrastructure
05NG809	Plum Lake	near Findlay	Manitoba	Manitoba Infrastructure
05NG813	Oak Lake	at Oak Lake Resort	Manitoba	Manitoba Infrastructure
05NG814	Deloraine Reservoir	near Deloraine	Manitoba	Manitoba Infrastructure

Table 3. Water quality stations in the Souris River Basin

Index Number	Stream	Location	State or Province	Operated by
5114000 (05ND007)	Souris River[1 3]	near Sherwood	North Dakota	United States Geological Survey
5115500	Lake Darling	near Foxholm	North Dakota	United States Geological Survey
5116000	Souris River[3]	near Foxholm	North Dakota	United States Geological Survey
5116500 (380021)	Des Lacs River[3]	at Foxholm	North Dakota	United States Geological Survey and North Dakota Department of Health
5117500 (380161)	Souris River[3]	above Minot	North Dakota	United States Geological Survey and North Dakota Department of Health
5120000 (380095)	Souris River[3]	near Verendrye	North Dakota	United States Geological Survey and North Dakota Department of Health
5122000	Souris River[3]	near Bantry	North Dakota	United States Geological Survey
5123400	Willow Creek[3]	near Willow City	North Dakota	United States Geological Survey
5123510	Deep River[3]	near Upham	North Dakota	United States Geological Survey
	J. Clark Salyer Refuge	Pool 357	North Dakota	United States Fish and Wildlife Service
5124000 (05NF012)	Souris River[1 3]	near Westhope (QA)	North Dakota	United States Geological Survey Environment and Climate Change Canada
MB05NGS003	Souris River	near Treesbank (PR #530)	Manitoba	Manitoba Agriculture and Resource Development
MB05NGS004	Souris River	at Souris (PTH #22)	Manitoba	Manitoba Agriculture and Resource Development
MB05NFS024	Souris River	near Melita (PTH #3)	Manitoba	Manitoba Agriculture and Resource Development
MB05NGS079	Pipestone Creek	near Kola (PR #257)	Manitoba	Manitoba Agriculture and Resource Development
MB05NGS026	Pipestone Creek	at diversion (Mile Rd 150 W)	Manitoba	Manitoba Agriculture and Resource Development

1 International gauging station
2 Formerly published as Souris River below Lewvan
3 Operated jointly for hydrometric and water-quality monitoring

6.0 TRANSBOUNDARY WATER QUALITY OBJECTIVES AND MONITORING

To address the ISRB's mandate to maintain an awareness of existing and potential impacts to aquatic ecosystem health and report on those issues regularly, the Aquatic Ecosystem Health Committee (AEHC) was created after the amalgamation of the Bilateral Water Quality Monitoring Group with the ISRB in 2007. This committee provides expertise for the analysis of water quality and aquatic ecosystem data in support of the Board's mandate.

6.1 OVERVIEW OF WATER QUALITY

The United States Geological Survey (USGS) and Environment and Climate Change Canada (ECCC) conducted monitoring at the two borders sites in 2019. Eight samples were collected at Sherwood between Saskatchewan and North Dakota and ten samples were collected at Westhope between North Dakota and Manitoba. Data from these sites were analyzed to determine compliance with established water quality objectives (WQO). A summary of data ranges and exceedances of WQOs is summarized in Appendix E.

Historically, exceedances of water quality objectives in the Souris River basin are related to high total dissolved solids (TDS), low dissolved oxygen levels, and high levels of nutrients, especially phosphorus. High TDS increases the hardness of water and can cause scale build up in pipes and filters. Low dissolved oxygen levels, or hypoxia, can result in the death of fish and other aquatic life, and can facilitate release of certain constituents from the sediment bed into the water column such as phosphate, iron, and manganese. High levels of certain nutrients can result in algal blooms. When large blooms decompose, dissolved oxygen is consumed, which can lead to low levels of oxygen in the water. High nutrient levels are also associated with the greater prevalence of cyanobacteria (blue-green algae), which under certain conditions can produce toxins harmful to humans and animals. As described below and summarized in Tables 4 and 6, a small number of parameters had exceedances during the 2019 sampling year.

The two monitoring sites show differences in the amount and timing of exceedances. To better understand better water quality patterns and trends within the entire basin, the ISRB accepted a grant to complete a trends analysis for key parameters, which is discussed further in Section 6.4

Sherwood Site:

Despite historical exceedances of TDS, there were no exceedances of the objective in 2019. Chloride and sulfate have had exceedances throughout their monitoring history; however, there were no samples with concentrations over the WQOs in 2019.

Table 4. Sherwood Water Quality Objective Exceedance Summary 2019.

Parameter	Exceedances	Months with Objective Exceedances	Maximum	Month of Maximum Value	WQO
Total Phosphorus	8	All	0.497 mg/L	Jul	0.1 mg/L
Iron	4	Feb, Apr, Jul, Oct	609 µg/L	Feb	300 µg/L
Sodium	3	Jul, Sep, Oct	219 mg/L	Oct	100 mg/L
Dissolved Oxygen	1	Feb	(min) 3.7 mg/L	Feb	≥ 5.0 mg/L
pH	1	Jul	8.6	Jul	6.5 - 8.5
8 Samples Taken					

Total Phosphorus

Total phosphorus exceeded the WQO for all samples in 2019. The highest concentration occurred in the summer when aquatic plant growth and decay is also at its highest, releasing nutrients into the system. However, concentrations were lower overall, bringing the median value down to 0.157 mg/L, closer to the 0.1 mg/L objective.

Iron

Exceedances of iron were observed in 50% of the samples. While 2011 to 2016 had very high concentrations of iron, three to four times the objective, concentrations in 2019 continued the downward pattern of lower values with a smaller range from minimum to maximum.

Sodium

Sodium values were consistent with previous years, with higher concentrations occurring in late summer and fall. The WQO was exceeded in 38% of the samples.

Dissolved Oxygen

Measured dissolved oxygen concentrations have historically not always met the dissolved oxygen objective. In some years this has led to winter hypoxia or anoxia (low to no oxygen in the water) and at times summer depletions, leading to fish kills. Since 2011, sample values have indicated that dissolved oxygen concentrations have remained at levels sufficient for protection of aquatic life. Only one sample was below the 5.0 mg/L objective in 2019. However, dissolved oxygen levels for the Souris River are known to have widely variable diurnal changes, especially during the summer. During periods of the day this can create conditions harmful to aquatic life, which are not captured by spot samples collected eight times per year. To increase our understanding of dissolved oxygen levels and fluctuations, the ISRB is conducting a study with funding from the International Watersheds Initiative to conduct continuous monitoring of dissolved oxygen levels, which is discussed further in Section 6.4

pH

Values for pH are typically consistent at Sherwood, and seldom exceed the WQO range. In 2019, pH exceeded the upper limit (8.5) once with a value of 8.6.

E. coli

E. coli bacteria have two WQOs, which are explained in detail in Section 6.2 along with explanations for the difference in *E. coli* units between Sherwood and Westhope. There were no exceedances of the single-sample WQO of 400 MPN/100 mL.

Table 5. Summary of Sherwood E. coli densities, 2019.

90 Day Period	90 Day Geomean (MPN/100 mL)	Number of Samples
May-Jul	57.18	3
Jun-Aug	41.23	2
Jul-Sep	61.64	2
WQO: 126 CFU/100 mL		

Westhope Site:

Parameters with exceedances in 2019 typically had higher concentrations than found in previous years. Hydrology and precipitation conditions in 2019 are considered be the most important factor that explains these increasing concentrations. Most of the highest concentrations occurred in the month of March and may be attributed to the very low runoff observed during snowmelt.

Table 6. Westhope Water Quality Objective Exceedance Summary, 2019.

Parameter	Exceedances	Months with Objective Exceedances	Maximum	Month of Maximum Value	WQO
Total Phosphorus	10	All	0.608 mg/L	Mar	0.1 mg/L
Sodium	9	Jan, Mar, May, Jun, Jul, Aug, Sep, Oct, Dec	409 mg/L	Mar	100 mg/L
pH	4	Jun, Jul, Aug, Sep	9.1	Sep	6.5 - 8.5
TSS	4	Apr, Jun, Aug, Oct	18 mg/L	Apr	10 mg/L
Dissolved Oxygen	3	Jan, Mar, Dec	(min) 0.06 mg/L	Mar	$\geq$ 5.0 mg/L
TDS	3	Jan, Mar, Dec	2577 mg/L	Mar	1000 mg/L
Sulphate	2	Jan, Mar	1060 mg/L	Mar	450 mg/L
Chloride	1	Mar	114 mg/L	Mar	100 mg/L
10 Samples Taken					

Total Phosphorus

Total phosphorus again exceeded the WQO for all samples in 2019. The highest concentration occurred following spring freshet, but overall concentrations were lower than in 2018. While 0.608 mg/L was the highest concentration sampled, the median values for all samples was 0.189 mg/L.

Sodium

Sodium exceedances of the WQO occurred in 90% of the samples in 2019 and occurred during nine of twelve months. The highest concentrations occurred under ice cover and right after spring freshet.

pH

The values for pH at this site are often higher than the objective, which may be attributed to soil types and eutrophic conditions of the river. Eutrophic conditions exist when nutrient levels are high resulting in high algae and aquatic plant growth. pH generally increases during periods of high net photosynthesis from algae and aquatic plants. About 40% of the samples had pH levels above the WQO of 8.5.

Total Dissolved Solids and Total Suspended Solids

While Total Dissolved Solids (TDS) often exceeds its objective, there were a limited number of exceedances in 2019. These exceedances occurred during ice cover and early snow melt. The maximum concentration of 2,577 mg/L, almost one and a half times the objective (1,000 mg/L), occurred in March. Total Suspended Solids (TSS) exceedances occur sporadically throughout the year.

Sulphate and Chloride

Historically, sulphate and chloride occasionally exceed their respective WQOs, and concentrations in 2019 were similar to previous years, with the highest concentrations occurring in March.

E. coli

Concentrations for *E. coli* bacteria were low at the Westhope site in 2019. The following table (Table 7) shows the results as compared to WQOs. One additional sample was collected at Westhope than at Sherwood, creating four rolling geomean periods. There were no exceedances of the single-sample WQO of 400 MPN/100 mL.

Table 7. Summary of Sherwood E. coli Analysis, 2019.

90 Day Period	90 Day Geomean (CFU/100 mL)	Number of Samples
May-Jul	2.8	3
Jun-Aug	5.1	3
Jul-Sep	7.7	3
Aug-Oct	17.6	3
WQO: 126 CFU/100 mL		

6.2 CHANGES TO POLLUTION SOURCES IN 2019

Development in the Saskatchewan/North Dakota region of the basin in connection with oil extraction from the Bakken Formation has the potential to increase areas that are susceptible to erosion.

Storm water can cause a variety of water quality impairments through increases in erosion and transport of pollutants from urban areas including heavy metals, nutrients, sediment, hydrocarbons and pesticides. However, runoff from non-point sources is considered to be the largest contributor to water quality impairments in the Souris River basin.

Nonpoint source pollution in the Souris River basin primarily consists of nutrients and sediment that are transported from the land surface of the watershed to the river by overland flow of water from precipitation or snowmelt. The Souris River basin typically experiences periodic short duration, and high intensity precipitation events during the spring and early summer months. Recently, the basin has also seen significant late summer/fall precipitation events. Snow can occur anytime between September and June in the basin, though the total amount of moisture in the snowpack can vary dramatically from year to year.

One way to reduce the amount of nonpoint source pollution that enters a waterway is to implement Best Management Practices (BMPs). BMPs are structures or processes such as runoff diversions, animal waste systems, stream buffers, wetland restoration, rotational grazing, nutrient management, and minimum tillage that can improve water quality while often providing other benefits such as carbon sequestration, habitat, etc. Both Canada and the United States have extensive cost share and technical guidance programs designed to help land managers and producers implement BMPs to reduce pollution. Numerous local watershed projects that implement BMPs to reduce surface water pollution and improve soil conservation can be found throughout Saskatchewan, Manitoba, and North Dakota. Examples of a few in the Souris Basin watershed include projects of the Upper Souris Watershed (www.uppersouriswatershed.ca/project.php) and the Lower Souris Watershed Committee (www.lowersouris.com) in Saskatchewan, and the Souris River Watershed District in Manitoba (www.tmca.ca and www.wsrcd.com).

Dams can have a substantial additive effect on phosphorus loading. Large reservoirs with hypolimnetic releases can contribute to higher phosphorus loads; however, reservoirs in the Lake Winnipeg basin have been shown to sequester large proportions of nutrients and decrease downstream nutrient loads. Nutrient concentrations at the border sites have historically been above the current objective.

Point source pollution is limited in the basin and may come from septic systems or from smaller cities that intermittently discharge from sewage lagoons. Government agencies in all three jurisdictions use permits or licenses to manage and limit the addition of pollution to the river from wastewater treatment lagoons.

Future changes to water quality and aquatic ecosystem health in the Souris are anticipated to occur due to changing agriculture practices, urban development, energy development, water appropriations that reduce flows, and reservoir operations.

6.3 CHANGES TO MONITORING

The current 2020 monitoring plan can be found in Appendix F.

There were no changes to *E. coli* monitoring, but there was a change to how *E. coli* data are compared to the WQOs. E. coli bacteria was added to the water quality objective list in 2018. The *E. coli* objective has two components: a geomean of 126 CFU/100 mL that addresses potential chronic conditions, and a single sample maximum of 400 CFU/100 mL, which serves as an alert indicator of more acute conditions. These objectives were originally derived as

contact recreational guidelines. Generally, because of inherent variability of bacterial numbers, a minimum of five samples collected within a defined period of time (typically 30 days) is desired when calculating a geomean. Due to the sampling schedule at Sherwood and Westhope and corresponding limited sample size collected each year, a seasonal geomean was used. The two national governments determined that a rolling 90-day geomean during the recreation season of May – October would be a better approach than a seasonal mean with a minimum of five samples.

Another change that occurred in 2018 is that the North Dakota Department of Environmental Quality's Lab, which analyzes the Sherwood samples, switched *E. coli* analysis methods from membrane filtration, which gave results in Colony Forming Units(CFU)/100 mL, to a Quanti-Tray, otherwise known as the multitube method, which gives results as Most Probable Number(MPN)/100 mL. The US Environmental Protection Agency (USEPA) has determined that, based on the research of Thomas and Woodward in *Estimation of Coliforms Density by the Membrane Filter and the Fermentation Tube Methods*, results from either technique can be considered comparable as long as the volume analyzed is equivalent. Going forward, the US will report *E. coli* as MPN/100 mL and Canada will continue to report in CFU/100 mL, with the understanding the different methods are directly comparable.

Dissolved Oxygen

In addition to the yearly sampling plan for dissolved oxygen, the International Watershed Initiative Grant for continuous dissolved oxygen monitoring was initiated in March 2019 with the deployment of three continuous water quality monitoring stations. While only preliminary data are available, the results are already improving our understanding of dissolved oxygen fluctuations in the Souris River. More information on the continuous monitoring program can be found in Section 6.4.

6.4 AQUATIC ECOSYSTEM HEALTH COMMITTEE

The Aquatic Ecosystem Health Committee (AEHC) has been working on providing a more recent, relevant, and reliable set of data to aid in decision making. The committee has initiated a number of projects that provide a foundation for a comprehensive review of the water quality objectives. In 2019, the AEHC is comprised of individuals with a variety of expertise and include:

US Co-Chair: Heather Husband, North Dakota Department of Environmental Quality

Canadian Co-Chair: Dorothy Lindeman, Environment and Climate Change Canada

Nicole Armstrong, Manitoba Agriculture and Resource Development

Ken Bottle, US Fish and Wildlife Service

John-Mark Davies, Saskatchewan Water Security Agency

Joel Galloway, US Geological Survey

Scott Gangl, North Dakota Game and Fish

Jim Noren, US Army Corps of Engineers

The AEHC communicated by conference calls and emails in 2019 to develop the International Watershed Initiative (IWI) grant proposal and to discuss changes to analysis method for the *E. coli* objective. Two committee meetings were held before the February and June ISRB meetings.

Continuous Dissolved Oxygen - IWI Grant

The ISRB was awarded an IWI grant to help understand the dynamics of diurnal and seasonal variations of dissolved oxygen and the possible correlations with flow. Continuous dissolved oxygen/temperature monitoring sensors were deployed by the USGS in March 2019 at three sites along the Souris River: at Sherwood, where the river crosses from Saskatchewan into North Dakota; above Minot, ND downstream of Lake Darling reservoir, part of a National Wildlife Refuge complex operated by the US Fish and Wildlife Service; and at Westhope, where the river crosses from North Dakota into Canada. The initial stage of the project includes activities for a two-and-a-half-year period. Following completion of requirements for the grant, consideration will be given to extending the project for another two-and-a-half years. Collected data are publicly available in real-time from the USGS NWIS website (https://waterdata.usgs.gov/nd/nwis/rt). Data on the website are preliminary but show significant potential to assist the ISRB to better understanding the factors that affect variation in dissolved oxygen concentrations, notably periods of low dissolved oxygen.

Trend Analysis - IWI Grant

This two-year project will address a critical knowledge gap on trends in water quality within the Souris River watershed. Trend analysis will be performed by the USGS with R-QWTREND (software developed by the USGS for water quality trend estimation) for 12 the 45 water quality parameters with ISRB water quality objectives. The project will describe flow-related variability and flow normalized concentration trends for sites throughout the basin. The project will produce an interactive story map to be hosted on the IJC's online map service. The proposal was accepted by the IJC in December of 2019 for work to begin in 2020.

7.0 WATER DEVELOPMENT ACTIVITIES IN 2019

7.1 NORTHWEST AREA WATER SUPPLY PROJECT

The Northwest Area Water Supply (NAWS) project was authorized by the Garrison Diversion Reformulation Act of 1986 and the Dakota Water Resources Act of 2000 under the Municipal, Rural, and Industrial (MR&I) Grant Program. NAWS is a water supply project designed to service a project area of 81,000 people using water from Lake Sakakawea supplied through a pipeline to the City of Minot.

In 1991, the state passed into law a bill creating the NAWS Advisory Committee, while giving the NDSWC the authority to construct, operate, and manage the project. Construction of NAWS began on April 5, 2002, with a main line and associated features being built between the City of Minot and Lake Sakakawea.

An Environmental Assessment (EA) was completed in 2001 and a Finding of No Significant Impact was issued in 2002. Construction of the pipeline between Minot and Lake Sakakawea began in April of 2002. In October of 2002, a legal challenge was filed by the Province of Manitoba, Canada to stop the construction of NAWS, claiming the EA conducted for the project was inadequate under the National Environmental Policy Act (NEPA). Manitoba's main concern was the potential for inter-basin transfer of invasive species. The District Court for the District of Columbia ruled in favor of Manitoba in 2005, remanding the project back to the Bureau of Reclamation (Reclamation) for further environmental review, specifically addressing likelihood of transfer of invasive species by the project and treatment technologies to prevent it. The Court also placed an injunction of the project limiting construction activities that may affect the treatment process used prior to crossing the continental divide.

An Environmental Impact Statement was completed in 2009. The State of Missouri, whose primary concern was depletions on the Missouri River system, had joined the lawsuit by this time. The District Court determined the EIS to be insufficient and remanded the case back to Reclamation for further environmental review, specifically to address impacts of the potential transfer of invasive species in Canada and impacts to the Missouri River system. A Supplemental Environmental Impact Statement was completed in 2015. Reclamation pursued comprehensive environmental assessments and investigations of the potential risks and consequences related to inter-basin water transfer as well as impacts to the Missouri River. The District Court ruled that the Bureau had fulfilled their NEPA obligations in 2017, denying Manitoba's motion for further environmental review and dismissing Missouri's complaint for a lack of standing in the case. The Court also vacated the injunction that had been on the project since 2005.

The 2017 ruling was appealed by Manitoba and Missouri. Manitoba's main interest for the appeal was to be included in the ongoing progression of the project. Manitoba dropped their appeal after the Reclamation agreed to set up an Adaptive Management Team that would be involved in the construction and operation of the Biota Water Treatment Plant, which would treat the Missouri River Basin water prior to it entering the Hudson Bay Basin. The Adaptive Management Team would also have a role in the development of emergency response measures, treatment monitoring, disruption contingency plans, and ongoing operation procedures. The memorandum of understanding, executed prior to Manitoba withdrawing their appeal, defined the role of the team and its composition. Missouri continued its appeal.

The United States Court of Appeals for the District of Columbia Circuit affirmed the District Court's August 2017 ruling in May of 2019. The August 1, 2019 deadline for Missouri to appeal the case to the Supreme Court came and passed with no action from Missouri, thus ending nearly 17 years of litigation on the project.

Meanwhile, design and construction progressed on the project. Two pipeline contracts for the potable water distribution system were bid. One was substantially complete at the end of 2019, and the other was under contract but wet conditions prevented work from beginning. Design was initiated on the two remaining pipeline contracts for the distribution system as well as for a

reservoir and pump station near Lansford. Design also continued on the project components necessary to move water from Lake Sakakawea to Minot, including intake modifications at the Snake Creek Pumping Plant, the Biota Water Treatment Plant at Max, and a reservoir and hydraulic control structure. A condition assessment of the existing 'raw' water pipeline was also initiated.

7.2 CANADIAN DAM SAFETY

WSA completed a new Probable Maximum Flood (PMF) study after the 2011 flood event. Results are detailed in "Final Report for Probable Maximum Flood, Rafferty and Alameda Dams," which was completed by HATCH in December of 2014. The study found that the PMF was the result of a rainfall-runoff event and was much larger than the previous PMF event used to size the reservoirs. Additional work was completed to rationalize a new Inflow Design Flood (IDF) using the CDA guidelines. This information was detailed in the report "Final Report for Alameda and Rafferty Dams IDF Study" completed by HATCH in August of 2016.

The IDF was defined as one-third of the difference between the 1:1000-year inflow event and the PMF for each reservoir. To route these IDF hydrographs through the reservoirs without exceeding the Maximum Allowable Flood Levels and outflow constraints, it was determined that Rafferty must be at or below 551.5 m (1809.4 ft), one meter above Full Supply Level (FSL), and Grant Devine must be at or below 561.0 m (1840.5 ft), equal to FSL. WSA refers to these levels as the Inflow Design Flood Service Level (IDFSL). WSA would need to maintain the reservoirs below these levels in June and July to mitigate the dam safety risk. Drawing down to IDFSL following a significant snowmelt runoff event may require the target flows at the Sherwood Crossing, which is outlined in the 1989 Agreement, to be exceeded.

Another issue is the 320 cms (11,301 cfs) outflow limitation at Grant Devine Dam due to the potential for high tailwater elevations threatening the integrity of the spillway. These high tailwater elevations are due to the limited capacity of a crossing through the downstream railway embankment.

WSA is developing Reservoir Operation Manuals to ensure that the dam safety risk is managed. These manuals would meet the requirements for Reservoir Regulation Manuals that were identified in the 1989 Agreement.

7.3 WATER APPROPRIATIONS

7.3.1 BACKGROUND

In 1995, the Board adopted a new method for reporting minor project diversions for the purpose of determining apportionment. The new method uses a common set of criteria and ensures that the same criteria are used in Saskatchewan and North Dakota. The method involves reviewing the project lists generated by the Natural Flow Methods Committee and adding newly constructed projects or subtracting cancelled projects each year. The projects that met the criteria in 1993 are used as the benchmark for all future reporting.

7.3.2 SASKATCHEWAN

In 1993 there were 137 minor projects in the Saskatchewan portion of the Souris River Basin that met the 1995 criteria. These projects had an annual diversion of 5,099 cubic decameters (4,134 acre-feet).

In 2019, water appropriation change decreased the total allocations by 340 cubic decameters (276 acre-feet).

7.3.3 NORTH DAKOTA

In 1993 there were 12 minor projects in the North Dakota portion of the Souris River basin upstream of Sherwood that met the 1995 criteria. The projects had an annual diversion of 1,257 cubic decametres (1,019 acre-feet). As of December 31, 2019, there were 22 minor projects (temporary permits) in the North Dakota portion of the Long and Short Creek basins. The annual diversions totaled 2,865 cubic decametres (2,323 acre-feet).

8.0 HYDROLOGIC CONDITIONS IN 2019

The 2019 spring runoff forecast was below the median on February 15, 2019, which was setup by the summer and fall of 2018. Drought conditions persisted in the summer and fall of 2018 for most of the basin. During the freeze up period of 2018, antecedent moisture conditions were normal to below normal in majority of the basin. The spring 2019 outlook had a risk of severe drought in Manitoba.

The total volume of flow past Long Creek at the western crossing, upstream of Boundary Reservoir, for the 2019 calendar year was 8,364 acre-feet (10,317 cubic decametres). This volume was approximately 34 percent of the long-term mean of 24,422 acre-feet (30,125 cubic decametres) over the past 61 years.

Table 8 provides the total annual inflow for Boundary, Rafferty, Grant Devine, and Darling Reservoirs for 2019, as well as the year-end elevations and change in elevation from January 1 to December 31, 2019. For reporting purposes, volumes were rounded to the nearest whole number and elevations were rounded to the nearest tenth for Table 8.

Table 8. 2019 dam statistics

Reservoir	Inflow cubic decametres (acre-feet)	End of Year Elevation meters (feet)	Elevation Change meters (feet)
Boundary	12,329 (9,995)	559.6 (1835.9)	-0.8 (-2.6)
Rafferty	8,046 (6,523)	549.2 (1801.8)	0 (-0.1)
Grant Devine	15,146 (12,279)	561.1 (1840.9)	0 (-0.1)
Lake Darling	38,736 (31,403)	486.5 (1596.1)	0 (-0.1)

On December 31, 2019, the estimated storage in the five major reservoirs in Saskatchewan (Boundary, Rafferty, Grant Devine, Nickle Lake, and Moose Mountain Lake) was 546,915 cubic

decametres (443,384 acre-feet) as compared to storage of 546,270 cubic decametres (442,861 acre-feet) on December 31, 2018. Figure 1 shows the storage contents of the major reservoirs in the Canadian portion of the Souris River Basin for 2018 and 2019.

Recorded runoff for 2019 for the Souris River near Sherwood was 38,436 cubic decametres (31,160 acre-feet), or about 29 percent of the 1931-2019 long-term mean.

The artificially drained areas of Yellow Grass Ditch and Tatagwa Lake contributed 2,484 cubic decametres (2,014 acre-feet) during 2019.

Figure 2 provides a schematic representation of recorded runoff above Sherwood, North Dakota.

Figure 4 illustrates the monthly releases from Boundary, Rafferty, Grant Devine, and Lake Darling reservoirs, which contribute to flows at the J. Clark Salyer National Wildlife Refuge.

The 2019 year-end storage in the J. Clark Salyer National Wildlife Refuge pools was 30,830 cubic decametres (38,029 acre-feet), or 9,608 cubic decametres (11,851 acre-feet) less than on December 31, 2018. The combined year-end storage in Lake Darling and the J. Clark Salyer Refuge pools was 166,716 cubic decametres (135,157 acre-feet), well above the 66,600 cubic decametres (54,000 acre-feet) severe drought criterion. Figure 3 shows the storage contents of the mainstem reservoirs in the United States.

Flows leaving J. Clark Salyer National Wildlife Refuge enter Manitoba and were recorded at the Westhope gage. Recorded runoff for the year for the Souris River at Westhope was 266,570 cubic decametres (216,109 acre-feet) or some 6,349 cubic decametres (5,147 acre-feet) less than the volume that entered North Dakota at the Sherwood Crossing. The minimum flow for the period was 0.1 cms (3.62 cfs), which occurred on January 26th. The peak discharge for the period January 1 to December 31, 2019 was 24.66 cms (871 cfs), which occurred on April 18th.

9.0 SUMMARY OF FLOWS AND DIVERSIONS

9.1 SOURIS RIVER NEAR SHERWOOD

The natural runoff near Sherwood for 2019 was 73,930 cubic decametres (59,935 acre-feet). Net depletions in Canada were 30,740 cubic decametres (24,921 acre-feet). The volume of water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins was 2,484 cubic decametres (2,014 acre-feet). The total volume of water released from Boundary, Rafferty, and Grant Devine reservoirs in Canada in 2019 was 16,564 cubic decametres (13,428 acre-feet), representing 43 percent of the recorded flow at Sherwood, or 22.4 percent of the computed natural runoff at Sherwood.

The summary of the natural flow computations is provided in Appendix A. Saskatchewan was in surplus by 13,620 cubic decametres (11,042 acre-feet) as of December 31, 2019. Accordingly, Saskatchewan complied with sharing of the annual natural flow volume at the Sherwood Crossing provision specified in Recommendation No. 1(a) of the Interim Measures.

The flow of the Souris River at Sherwood was more than 0.113 cms (4 cfs) for the entire year. Accordingly, Saskatchewan complied with the 0.113 cms (4 cfs) provision specified in Recommendation No. 1 of the Interim Measures.

9.2 LONG CREEK AND SHORT CREEK

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 10,317 cubic decametres (8,364 acre-feet), or 34 percent of the long-term mean since 1959.

The increase in runoff on Long Creek between the Western and Eastern Crossings was 2,012 cubic decametres (1,631 acre-feet).

Short Creek, which rises in North Dakota, contributed 4,217 cubic decametres (3,419 acre-feet) to the runoff recorded at Souris River above Sherwood.

Recommendation No. 2 of the Interim Measures was met.

9.3 SOURIS RIVER NEAR WESTHOPE

Recorded flow near Westhope during the period of June 1 through October 31, 2019 was 92,900 cubic decametres (75,318 acre-feet). Figure 5 illustrates the recorded flows at Westhope and at Wawanesa near the mouth of the Souris River in Manitoba.

According to the USGS, flows recorded at the Souris River near Westhope gage through the December 31, 2019 calendar year were 266,570 cubic decametres (216,109 acre-feet).

The flow at Westhope was in compliance with the 0.566 cms (20 cfs) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures.

10.0 WORKPLAN SUMMARY FOR 2019

An updated workplan with input from the Board's committees was reviewed by the Board during its June 2019 meeting (Appendix H). The workplan is built around the 2007 directive and included key items such as overseeing implementation and compliance of the apportionment measures, the oversight function for flood operations, reporting on the joint water quality monitoring program, providing public involvement opportunities, and maintaining an awareness of proposed and existing developments.

Figure 1. Month end contents of reservoirs in Canada for the years 2018 and 2019.

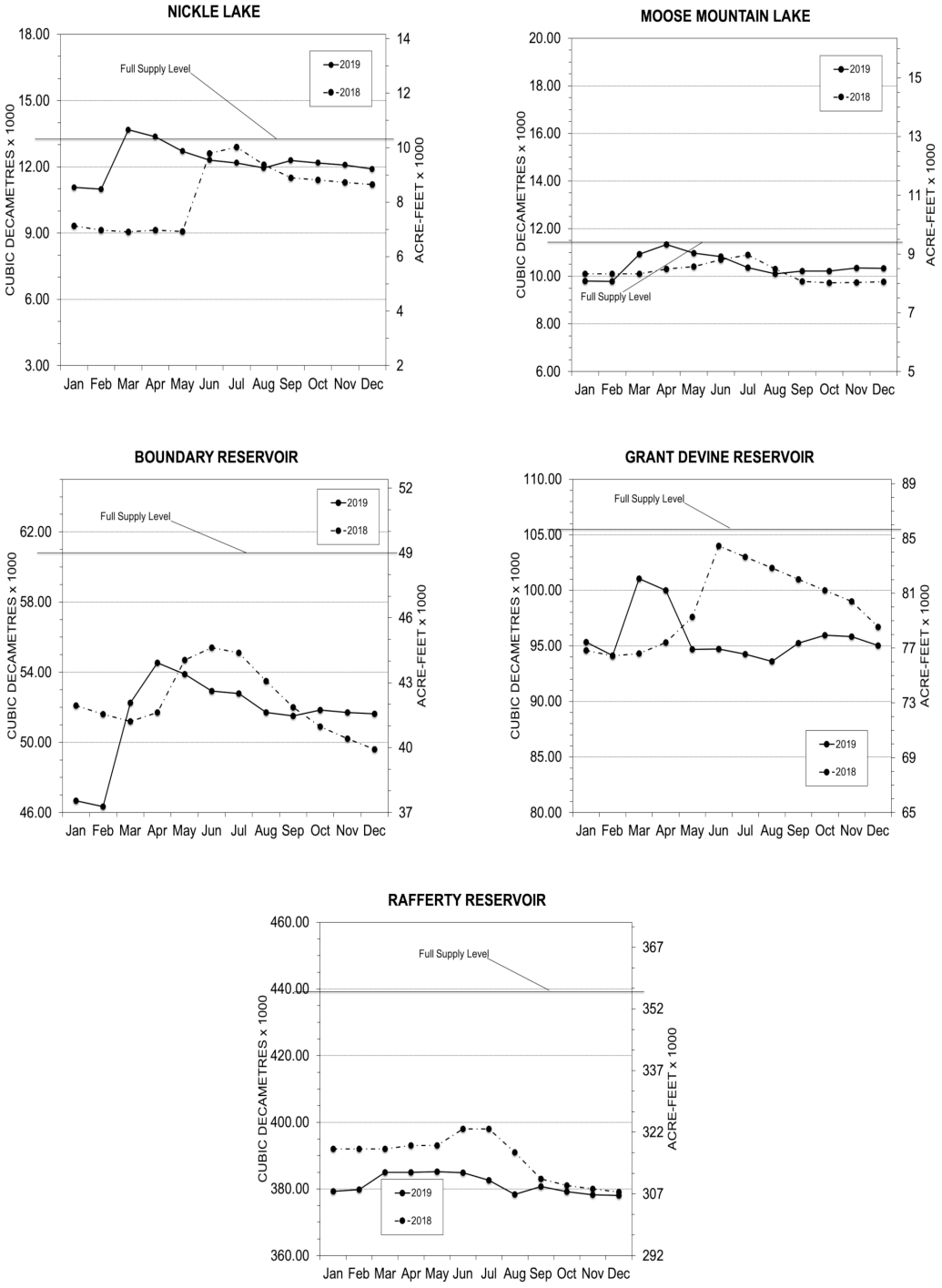


Figure 2. Schematic representation of 2019 flows in the Souris River Basin above Sherwood, North Dakota, U.S.A.

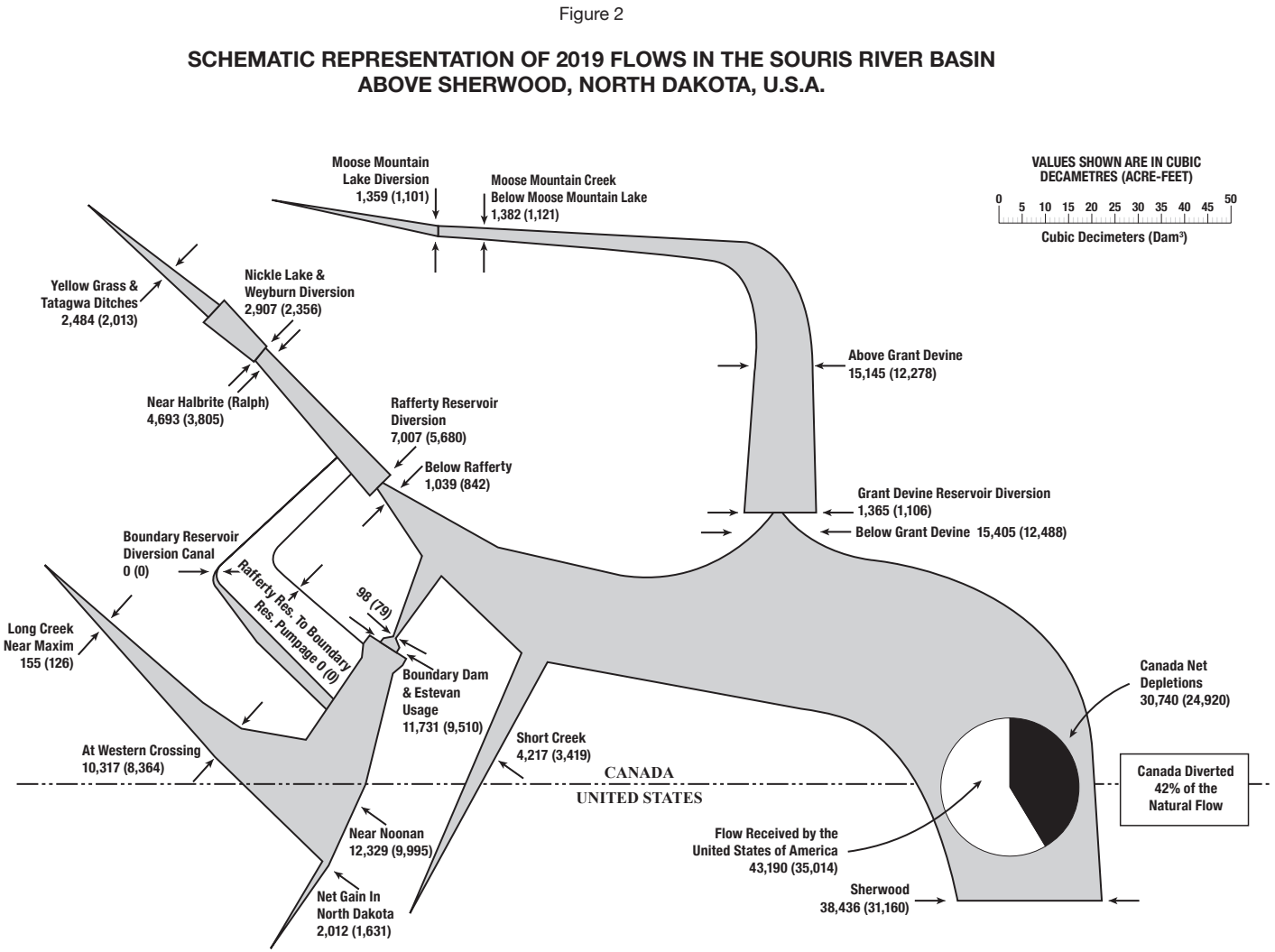


Figure 3. Month end contents of reservoirs in U.S.A. for the years 2018 and 2019.

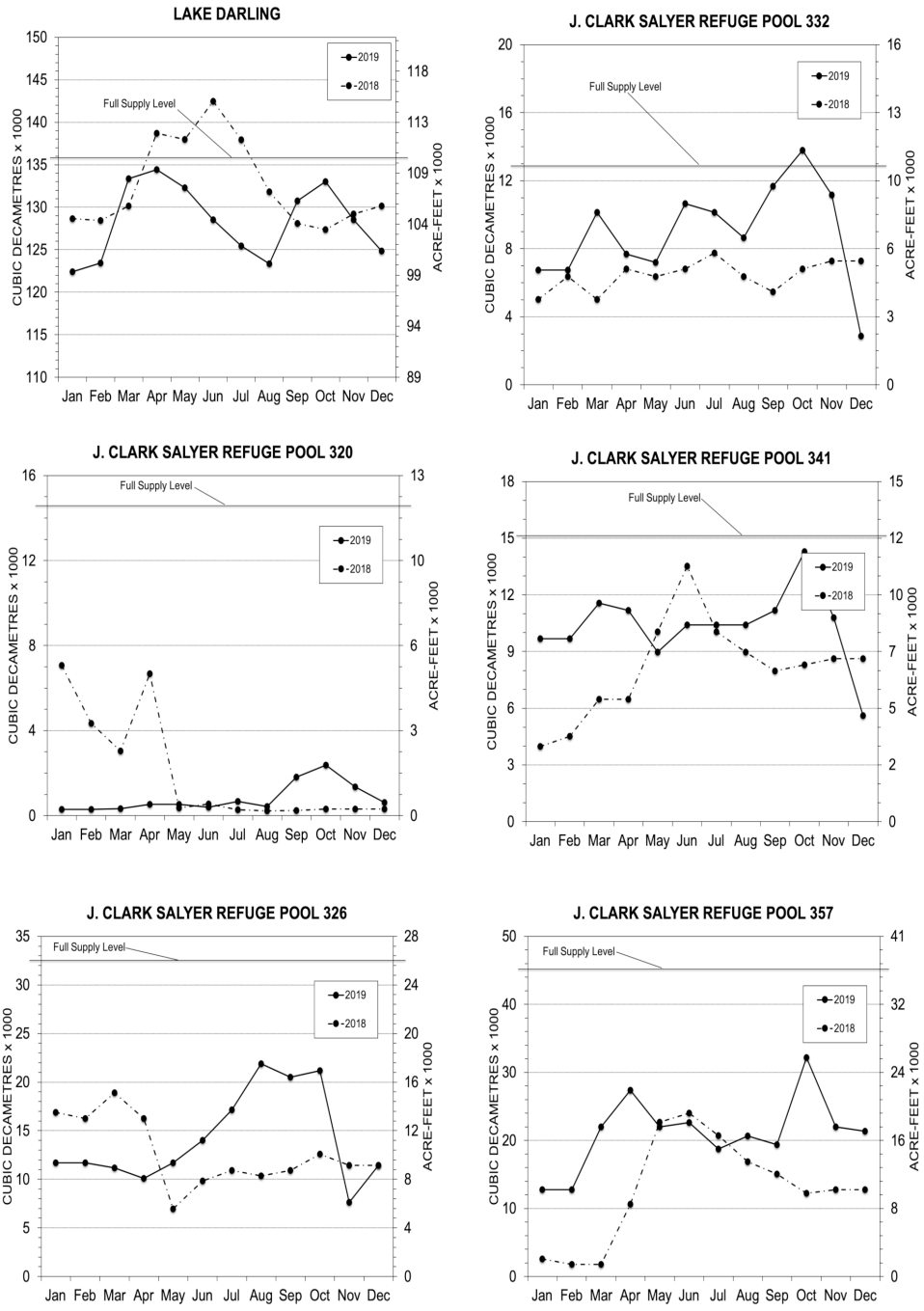


Figure 4. Monthly reservoir releases for the year 2019.

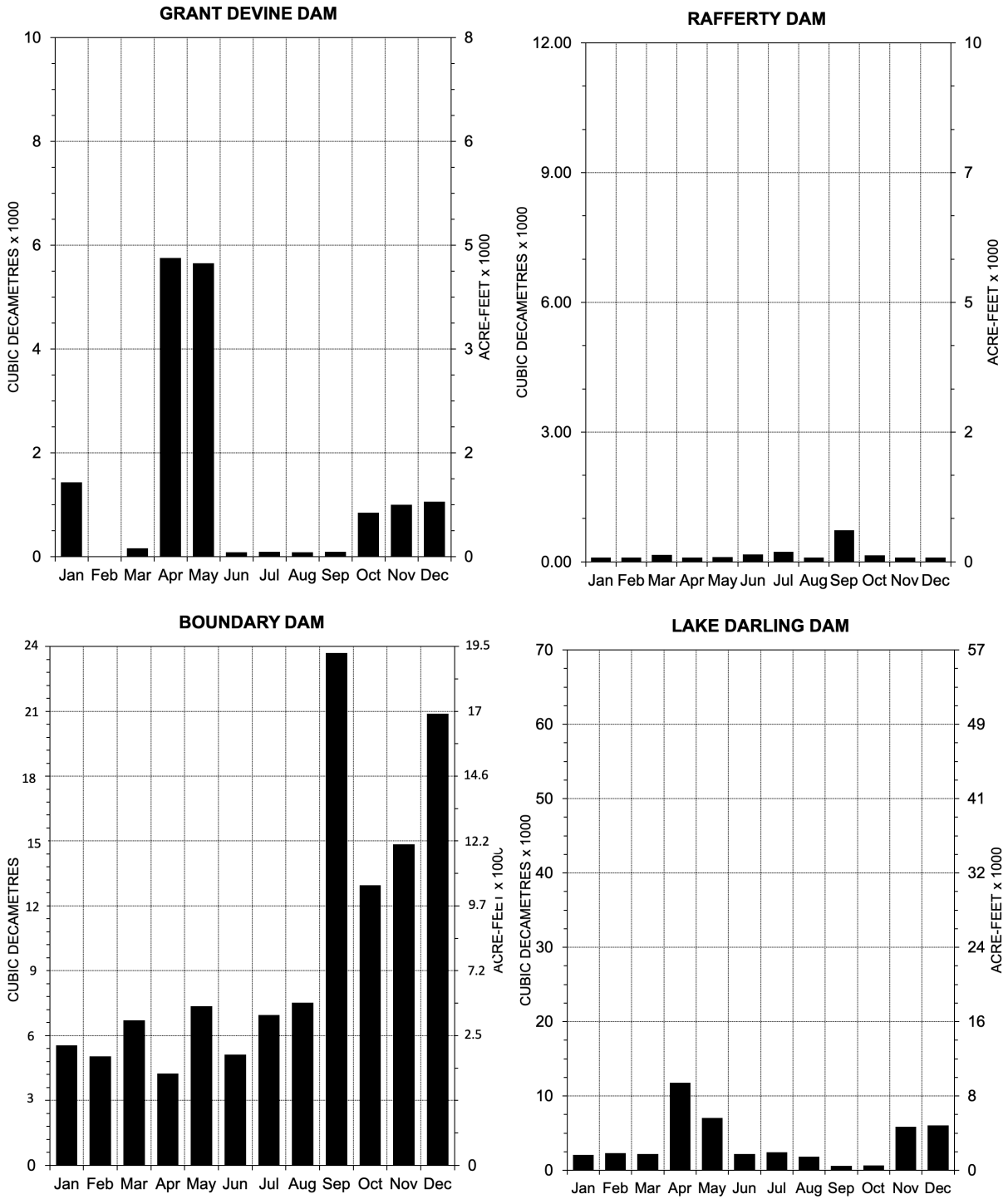
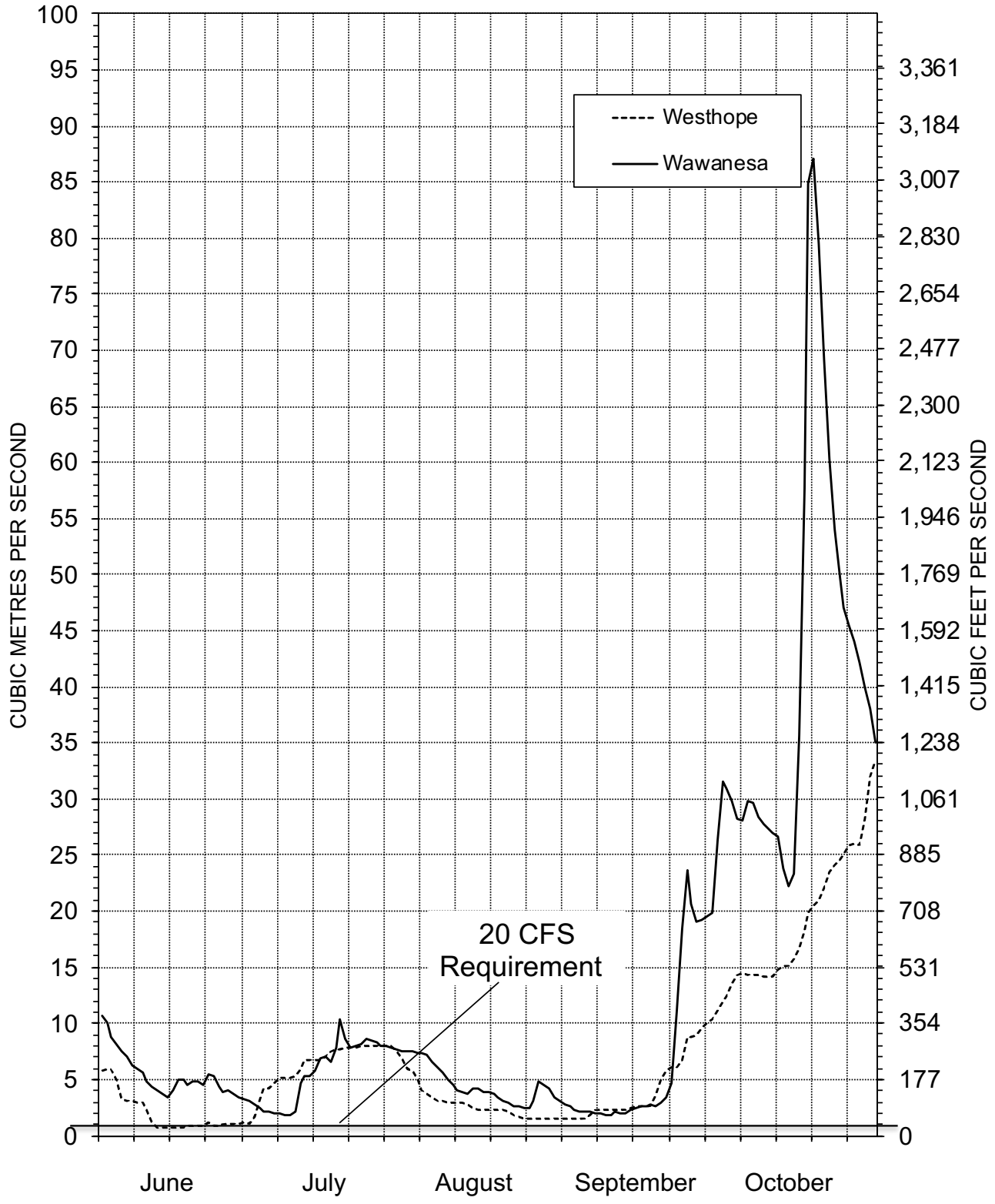
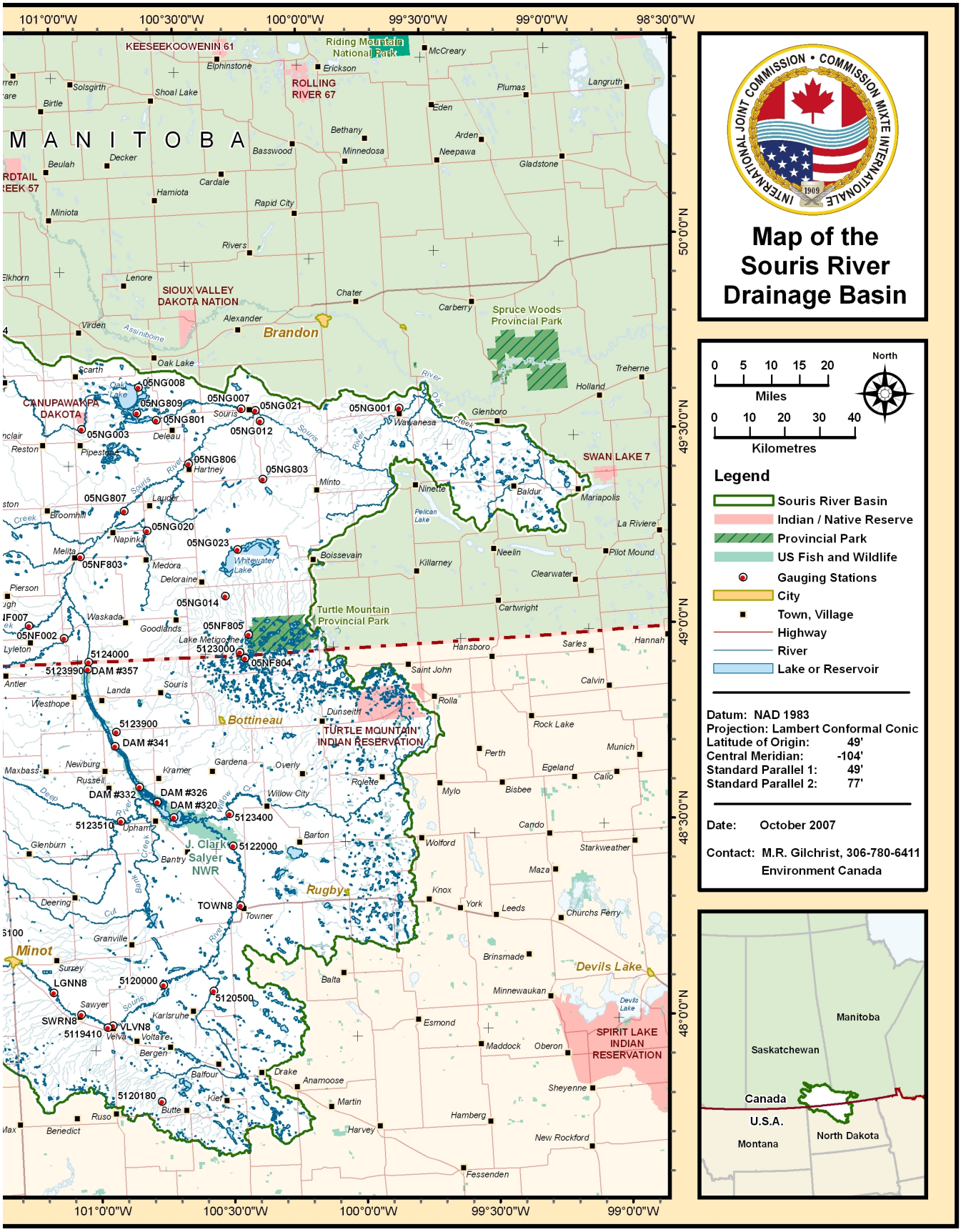


Figure 5. Souris River near Westhope and Wawanesa from June 1st to October 31st, 2019.



105°0'0"W
104°30'0"W
104°0'0"W
103°30'0"W
103°0'0"W
102°30'0"W
102°0'0"W
101°30'0"W
50°30'0"N
50°0'0"N
49°30'0"N
49°0'0"N
48°30'0"N
48°0'0"N
SASKATCHEWAN
MONTANA
NORTH DAKOTA
Regina
Weyburn
Estevan
Williston
Sidney
SAKIMAY I.R. 74
KAHKEWISTAHAW I.R. 72
COWESSESS I.R. 73
OCHAPOWACE I.R. 71
ASSINIBOINE I.R. 76
OCHAPOWACE I.R 71
PIAPOT I.R. 75
OCEAN MAN I.R. 69
PHEASANT RUMP NAKOTA BAND I.R. 68
WHITE BEAR I.R. 70
Moose Mountain Provincial Park
Kenosee Lake
Des Lacs NWR
Upper Souris NWR
Lostwood NWR
FORT PECK INDIAN RESERVATION
FORT BERTHOLD INDIAN RESERVATION
Lake Sakakawea
05NE003
05NE002
05NG02
05NB031
05NC002
05NC001
05ND009
05ND008
05NB011
05NF010
05NB018
05NB020
05NB040
05NB016
05NB033
05NA005
05NA006
05NB017
05NB041
05NB034
05NB014
05NB035
05ND010
05ND011
05ND012
05ND004
05NA004
05NF006
05NB039
05NB038
05NB036
05NB032
05NB001
05NB012
05NB021
05NA003
5113750
5113600
5113520
5114000
POOL D-1
POOL D-2
POOL D-3/3A
POOL D-4/4A
POOL D-5
POOL D-6
POOL D-7
POOL D-8
5116135
5115500
DAM87
DAM96
5116000
5116500
5117500


Map of the Souris River Drainage Basin
INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE
1909
North
0 5 10 15 20
Miles
0 10 20 30 40
Kilometres
Legend
Souris River Basin
Indian / Native Reserve
Provincial Park
US Fish and Wildlife
Gauging Stations
City
Town, Village
Highway
River
Lake or Reservoir
Datum: NAD 1983
Projection: Lambert Conformal Conic
Latitude of Origin: 49'
Central Meridian: -104'
Standard Parallel 1: 49'
Standard Parallel 2: 77'
Date: October 2007
Contact: M.R. Gilchrist, 306-780-6411
Environment Canada
Manitoba
Saskatchewan
Canada
U.S.A.
Montana
North Dakota
MANITOBA
KEESEEKOOWENIN 61
ROLLING RIVER 67
SIOUX VALLEY DAKOTA NATION
CANUPAWAKPA DAKOTA
SWAN LAKE 7
TURTLE MOUNTAIN INDIAN RESERVATION
SPIRIT LAKE INDIAN RESERVATION
Riding Mountain National Park
Spruce Woods Provincial Park
Turtle Mountain Provincial Park
J. Clark Salyer NWR
Brandon
Minot
Bottineau
Rugby
Devils Lake
101°0'0"W
100°30'0"W
100°0'0"W
99°30'0"W
99°0'0"W
98°30'0"W
50°0'0"N
49°30'0"N
49°0'0"N
48°30'0"N
48°0'0"N

APPENDIX A - Determination of Natural Flow of Souris River at International Boundary (Sherwood)

DETERMINATION OF NATURAL FLOW OF SOURIS RIVER AT INTERNATIONAL BOUNDARY (SHERWOOD)

All Quantities Reported In Cubic Decametres

FOR THE PERIOD: JANUARY 1 TO DECEMBER 31, 2019

LONG CREEK BASIN

LARSEN RESERVOIR				BOUNDARY RESERVOIR								
				INFLOW	OUTFLOW							
1	2	3	4	5 *	6	7	8	9	10	11	12 *	13
STORAGE CHANGE	EVAPORATION	DIVERSION	TOWN OF RADVILLE PUMPAGE	LONG CREEK AT EASTERN CROSSING	LONG CREEK NEAR ESTEVAN	ESTEVAN PIPELINE	DIVERSION CANAL	TOTAL (OUTFLOW)	DIVERSION	MINOR PROJECT DIVERSION	U.S.A. DIVERSION BETWEEN WESTERN & EASTERN CROSSING	**TOTAL DIVERSION LONG CREEK**
387	82	469 (1+2)	0	12329 / 0 PIPELINE	115	3266	0	3381 (6+7+8)	8948 (5-9)	1635	2506	13558 **(3+4+10+11+12)**

UPPER SOURIS RIVER BASIN - ABOVE ESTEVAN

NICKLE LAKE RESERVOIR					ROUGHBARK RESERVOIR			RAFFERTY RESERVOIR				
14	15	16	17	18	19	20	21	22	23	24	25	26
STORAGE CHANGE	EVAPORATION	CITY OF WEYBURN PUMPAGE	DIVERSION	CITY OF WEYBURN RETURN FLOW	STORAGE CHANGE	EVAPORATION	DIVERSION	INFLOW	OUTFLOW	DIVERSION	MINOR PROJECT DIVERSION	**TOTAL DIVERSION UPPER SOURIS RIVER**
800	1072	1968	3840 (14+15+16)	933	122	119	241 (19+20)	8046	1039 / 0 PIPELINE	7007 (22-23)	1080	11235 **(17-18+21+24+25)**

LOWER SOURIS RIVER--ESTEVAN TO SHERWOOD

27	28 *	29	30
CITY OF ESTEVAN NET PUMPAGE	SHORT CREEK DIVERSIONS IN U.S.A.	MINOR PROJECT DIVERSION	**TOTAL DIVERSION LOWER SOURIS RIVER**
2783	2248	2541	7572 **(27+28+29)**

MOOSE MOUNTAIN CREEK BASIN

MOOSE MOUNTAIN LAKE			ALAMEDA RESERVOIR				
31	32	33	34	35	36	37	38
STORAGE CHANGE	EVAPORATION	DIVERSION	STORAGE CHANGE	EVAPORATION	DIVERSION	MINOR PROJECT DIVERSIONS	**TOTAL DIVERSIONS MOOSE MOUNTAIN CREEK BASIN**
590	769	1359 (31+32)	-500	1865	1365 (34+35)	2889	5613 **(33+36+37)**

NON-CONTRIBUTORY BASINS

39	40	41
YELLOW GRASS DITCH	TATAGWA LAKE DRAIN	**TOTAL ADDITIONS**
2386	98	2484 (39+40)

SUMMARY OF NATURAL FLOW

42	43 *	44	45	46	47
TOTAL DIVERSION SOURIS RIVER BASIN	RECORDED FLOW AT SHERWOOD	NATURAL FLOW AT SHERWOOD	U..S.A. SHARE	FLOW RECEIVED BY U.S.A.	**SURPLUS (+) OR DEFICIT (-) TO U.S.A.**
37978 (13+26+30+38)	38436	73930 (42+43-41)	40% OF 44: 29570 / 50% OF 44	43190 (12+28+43)	(46-45) 40% SHARE: **13620** / (46-45) 50% SHARE

RECOMMENDATION - SECTION 2
ANNUAL FLOW OF LONG CREEK

48	49 *	50
RECORDED FLOW AT WESTERN CROSSING	RECORDED FLOW AT EASTERN CROSSING	**SURPLUS (+) OR DEFICIT (-) FROM U.S.A.**
10317	12329	**2012** (49-48)

*** DATA CONTRIBUTED BY U.S.G.S.**

APPENDIX B - Equivalents of Measure

EQUIVALENTS OF MEASUREMENTS

The following is a list of equivalents of measurement that have been agreed to for use in reports of the International Souris River Board.

1 centimetre equals 0.39370 inch
1 metre equals 3.2808 feet
1 kilometre equals 0.62137 mile

1 hectare equals 10 000 square metres
1 hectare equals 2.4710 acres
1 square kilometre equals 0.38610 square mile

1 cubic metre per second equals 35.315 cubic feet per second

The metric (SI) unit that replaces the British acre-foot unit is the cubic decametre (dam3), which is the volume contained in a cube 10 m x 10 m x 10 m or 1 000 cubic metres.

1 cubic decametre equals 0.81070 acre-feet
1 cubic metre per second flowing for 1 day equals 86.4 cubic decametres
1 cubic foot per second flowing for 1 day equals 1.9835 acre-feet

APPENDIX C - Interim Measures as Modified in 2000

INTERIM MEASURES AS MODIFIED IN 2000

APPENDIX A TO THE DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the International Souris River Board. For the purpose of these calculations, any reference to "annual" and "year" is intended to mean the period January 1 through December 31.

   For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metre per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River basin prior to construction of the Boundary Dam, Rafferty Dam, and Alameda Dam.

   Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the annual natural flow volume at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control in North Dakota and of evaporation as a result of the project.

   a. Saskatchewan will deliver a minimum of 50 percent of the annual natural flow volume at the Sherwood Crossing in every year except in those years when the conditions given in (i) or (ii) below apply. In those years, Saskatchewan will deliver a minimum of 40 percent of the annual natural flow volume at the Sherwood Crossing.

      i. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 486.095 metres (1594.8 feet); or

      ii. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 485.79 metres (1593.8 feet), and since the last occurrence of a Lake Darling June 1 elevation of greater than 486.095 metres (1594.8 feet) the elevation of Lake Darling has not been less than 485.79 metres (1593.8 feet) on June 1.

b. Notwithstanding the annual division of flows that is described in (a), in each year Saskatchewan will, so far as is practicable as determined by the Board, deliver to North Dakota prior to June 1, 50 percent of the first 50 000 cubic decametres (40,500 acre-feet) of natural flow which occurs during the period January 1 to May 31. The intent of this division of flow is to ensure that North Dakota receives 50 percent of the rate and volume of flow that would have occurred in a state of nature to try to meet existing senior water rights.

c. Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Projects' purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 485.79 metres (1593.8 feet) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 485.79 metres (1593.8 feet) on June 1. Releases will not be made by Saskatchewan Watershed Authority from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 486.095 metres (1594.8 feet) on June 1.

d. Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow.

e. A determination of the annual apportionment balance shall be made by the Board on or about October 1 of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31.

f. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the 0.113 cubic metre per second (4 cubic feet per second) minimum flow limit, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Watershed Authority, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.

2. Except as otherwise provided herein with respect to delivery of water to the Province of Manitoba, the State of North Dakota shall have the right to divert, store, and use the waters which originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing under Recommendation (1) above; provided, that any diversion, use, or storage of Long Creek water shall not diminish the annual flow at the eastern crossing of Long Creek into Saskatchewan below the annual flow of said Creek at the western crossing into North Dakota.

3. In addition to the waters of the Souris River basin which originate in the Province of Manitoba, that Province shall have the right, except during periods of severe drought, to receive for its own use and the State of North Dakota shall deliver from any available source during the months of June, July, August, September, and October of each year, six thousand and sixty-nine (6,069) acre-feet of water at the Westhope Crossing regulated so far as practicable at the rate of twenty (20) cubic feet per second except as set forth hereinafter: provided, that in delivering such water to Manitoba no account shall be taken of water crossing the boundary at a rate in excess of the said 20 cubic feet per second.

   In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use. It is understood that in the circumstances contemplated in this paragraph the State of North Dakota will give the earliest possible advice to the International Souris River Board of Control with respect to the onset of severe drought conditions.

4. In event of disagreement between the two sections of the International Souris River Board of Control, the matters in controversy shall be referred to the Commission for decision.

5. The interim measures for which provision is herein made shall remain in effect until the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the Reference of January 15, 1940, unless before that time these interim measures are qualified or modified by the Commission.

APPENDIX D - Board Directive from January 18, 2007

DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board was created by the International Joint Commission in April 2000 when it amalgamated the Souris River basin responsibilities previously assigned to the Commission in two separate references by the governments of Canada and the United States. The two references were the International Souris River Board of Control Reference (1959) and the Souris-Red River Engineering Board Reference (1948). The International Souris River Board's mandate changed further through an exchange of diplomatic notes on June 9, 2005 assigning water quality functions and the oversight for flood forecasting and operations as described in Section 4 below. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the International Souris River Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

The directive replaces the April 11, 2002 Directive to the International Souris River Board and sets out the mandate under which the Board will operate.

1. Pursuant to the Boundary Water Treaty of 1909 and related agreements, responsibilities have been conferred on the Commission to ensure compliance with apportionment measures for the waters of the Souris River, to investigate and report on water requirements and uses as they impact the transboundary waters of the Souris River basin, and to assist in the implementation and review of the Joint Water Quality Monitoring Program pursuant to the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

2. The apportionment measures derive from the approvals given by the governments of Canada and the United States, by letters of March 20, 1959 and April 3, 1959 respectively, to the recommendations made by the Commission in paragraph 22 of its report to the governments of March 19, 1958. Subsequently, with the signing of the Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin on October 26, 1989 (hereafter referred to as the 1989 Agreement), the Interim Measures for apportionment of the Souris River at the Saskatchewan-North Dakota boundary were revised as described in Annex B of the 1989 Agreement. By letters of measures as modified in the 1989 Agreement. By letters of December 20 and 22, 2000, the governments amended Annex B of the 1989 Agreement. The attached Appendix A is a consolidation of the apportionment measures against which the Commission is to monitor compliance.

3. By letters of January 12, 1948, the governments requested the Commission to undertake investigations of water requirements and uses arising out of existing dams and other works or projects in the mid-continent portion of the Canada-United States boundary, including the Souris River basin, and to make advisory recommendations.

4. By exchange of diplomatic notes between the governments of Canada and the United States dated January 14 and June 9, 2005, the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin was formally revised to

include a reference pursuant to Article IX of the Boundary Waters Treaty which assigned water quality responsibilities contained in the 1989 Agreement to the Commission. The Commission was requested to assist with the implementation and review of the Joint Water Quality Monitoring Program. On October 21, 2005 at the October 2005 Commission's meeting with governments, the U.S. State Department is of the opinion the Commission has the authority and has obtained the notification it needs from the U.S. State Department to proceed with carrying out the flood related responsibilities for the Souris River. On April 6, 2006 at the April 2006 Commission's meeting with the governments, the Department of Foreign Affairs and International Trade indicated that the Board should be assigned these responsibilities. It is recognized that Article X of the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin designated the entities responsible for operation and maintenance of the improvements mentioned in the 1989 Agreement and that the operations will be in accordance with the Operating Plan shown in Annex A of the 1989 Agreement. The Department of Army is the entity responsible for flood operations within the Canadian Province of Saskatchewan.

5. The Board's mandate is to support the Commission's initiative to explore and encourage the development of local and regional capacity with the objective of preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Souris River and its tributaries and aquifers. This would be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Souris River basin. The Board's mandate will be accomplished by performing the tasks identified in Clause 6 below.

6. The Board's duties shall be to:

    i. Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

    ii. Oversee the implementation of compliance with the Interim Measures As Modified For Apportionment of the Souris River as described in Appendix A of this document by:

        - Identifying an adequate hydro-climatic monitoring network to support the determination of natural flow and apportionment balance,

        - Encouraging the appropriate authorities to establish and maintain hydroclimatic monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of natural flow and apportionment balance,

- Informing the Commission, in a timely manner, of critical water supply or flow conditions in the basin,

- Encouraging appropriate authorities to take steps to ensure that apportionment measures are met, and

- Preparing an annual report and submitting it to the Commission.

iii. Assist the Commission in the review of a Joint Water Quality Monitoring Program (referred to hereafter as "the Program") by:

- Developing recommendations on the Program and the setting of water quality objectives,
- Exchanging data provided by the Program on a regular basis,
- Collating, interpreting, and analyzing the data provided by the Program,
- Reviewing the Program and the water quality objectives at least every five years and developing recommendations, as appropriate, to the Commission to improve the Program and the objectives, and
- Preparing an annual report containing:

  - A summary of the principal activities of the Board during the year with respect to the Program,
  - A summary of the principal activities affecting water quality in the Souris River Basin during the year,
  - A summary of the collated, interpreted, and analyzed data provided by the Program,
  - A summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary,
  - A section summarizing any definitive changes in the monitored parameters and the possible causes of such changes,
  - A section discussing the water quality objectives for the Souris River at the Saskatchewan/ North Dakota boundary and at the North Dakota/Manitoba boundary as established and revised pursuant to the 1989 Agreement,
  - A section summarizing other significant water quality changes and the possible causes of such changes, and
  - Recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under the 1989 Agreement.

iv. Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin by:

- Ensuring mechanisms are in place for coordination of data exchange, flood forecasts and communications related to flood conditions and operations;
- Determining whether the operations under the 1989 Agreement should proceed based on the Flood Operation of Non-Flood Operation of the Operating Plan, which is Annex A to the 1989 Agreement, using its criteria and informing designated agencies of this determination;
- Reporting to the Commission on any issues related to flood operations and management; and
- Providing the Commission and the designated entities under the 1989 Agreement recommendations on how flood operations and coordination activities could be improved.

v. Report on aquatic ecosystem health issues in the watershed, regularly informing the Commission on the state and implications of aquatic ecosystem health, and encourage the appropriative authorities to establish and maintain water quality and other monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of the health of the aquatic ecosystem.

vi. Carry out such other studies or activities as the Commission may, from time to time, request.

vii. Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year. The work plan shall be submitted annually to IJC for review.

7. The Board shall provide opportunities for the public to be involved in its work, including at least on public meeting in the basin each year.

8. The Board shall coordinate and collaborate with other agencies and institutions both within and outside the Souris River basin as may be needed or desirable, and facilitate the timely dissemination of pertinent information within the basin. The Board shall keep the Commission informed of these activities.

9. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Appointments may be renewed for additional terms. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint Canadian and United States co-chairs for the Board and will strive to appoint chairs with complementary expertise that encompasses a broad spectrum of basin issues.

10. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and amount the Board members.

11. The co-chairs shall ensure that members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

12. The co-chairs may appoint secretaries of the Board who, under the general supervision of the co-chairs, shall carry out such duties as are assigned by the co-chairs or the Board as a whole.

13. The Board may establish such committees and working groups as may be required to fulfill its responsibilities in a knowledgeable and effective manner. The Commission shall be kept informed of the duties and composition of any committee or working group.

14. Unless other arrangements are made with the Commission, members of the Board, committees, or working groups shall make their own arrangements for reimbursement of necessary expenditures for travel or other related expenses.

15. The Board shall inform the Commission in advance of plans for any meetings or other means of involving the public in Board deliberations, and shall report to the Commission, in a timely manner, on these and any other presentations or representations made to the Board.

16. The Board shall conduct its public outreach activities in accordance with the Commission's public information policies and shall maintain files in accordance with the Commission policy on segregation of documents.

17. Prior to their release, the Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers.

18. The Board shall submit an annual report covering all of its activities, including the annual report regarding the Program and the work plan, as described in Section 6 above, to the Commission, at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive. Reports shall be submitted in a format suitable for public release and electronic copies shall be provided to each of the Commission's section offices.

19. Reports, including annual reports, minutes and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by Commission. The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's website.

20. If, in the opinion of the Board 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 appropriate action.

21. The Board shall operate by consensus. In the event of any disagreement among the members of the Board which they are unable to resolve, the Board shall refer the matter forthwith to the Commission for decision.

22. The Commission may amend existing instructions or issue new instructions to the Board at any time.

Signed this 18th day of January, 2007

Elizabeth Bourget
Secretary
United States Section

Murray Clamen
Secretary
Canadian Section

APPENDIX E - Water Quality Data for Sherwood and Westhope

2019 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - SASKATCHEWAN/NORTH DAKOTA BOUNDARY
05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA[a] Median (max - min) #samples	HISTORIC DATA % detectable	HISTORIC DATA % exceedance	ANNUAL DATA 2019 Median (max - min) #samples	2019 DATA % detectable	2019 % exceedance
Biological Parameters								
Fecal Coliform	200/100 mL	#/100 mL	7 (1900 - <2) 204	60.8	4	NS		
E. coli [b]	126/100 mL 400/100 mL[b]	#/100 mL	140 (350 - <10) 28[b]	93[b]	0	97.5 (190 - 20) 4	100	0
Inorganic Parameters								
Ammonia (un-ionized as N)	-	mg/L	0.04 (3.3 – <0.01) 206	Calculated*	-	0.0195 (0.451 – 0.0195) 8	Calculated*	-
Chloride	100	mg/L	34.2 (220 – 4.0) 221	100	7.7	31.7 (69.9 – 19.7) 8	100	0
Fluoride	1.5	mg/L	0.20 (1.8 - <0.17) 221	93.7	0.5	0.15 (0.20 - 0.12) 8	100	0
NO_2 + NO_3 (as N) dissolved	1.0	mg/L	0.06 (1.4 - <0.02) 210	72.9	0.9	<0.03 (0.40 - <0.03) 8	12.5	0
Phosphorus (total P)	0.10	mg/L	0.22 (1.9 - 0.03) 222	100	88	0.16 (0.50 - 0.12) 8	100	100
Sodium	100	mg/L	128 (532 - 14) 220	100	64	91 (219 – 64.5) 8	100	37.5
Sulfate	450	mg/L	281 (1000 - 48) 221	100	12.7	296 (355- 284) 8	100	0
Arsenic (total)	50	µg/L	4 (28.3 -< 2) 213	95.8	0	4.6 (16.8 – 3.7) 8	100	0
Barium (total)[d]	1,000	µg/L	77.2 (148 – 14.7) 151[d]	100	0	51.1 (93.1 – 27.2) 8	100	0
Boron (total)	500	µg/L	181 (3500 - 40) 211	100	6.6	138.5 (308 - 99) 8	100	0
Beryllium (total)	100	µg/L	0.08 (43.5 - <0.01) 213	53.5	0	0.01 (0.01 - <0.01) 8	62.5	0
Cadmium (total)	27[c]	µg/L	0.06 (1.0 - <0.01) 213	57.7	0	<.03 (<0.03 - <0.03) 8	0	0
Chromium (total)	50	µg/L	0.50 (3.5 - <0.1) 212	67	0	0.65 (0.80 - <0.50) 8	87.5	0
Cobalt (total)	50	µg/L	0.79 (2.2 - <0.23) 213	77.9	0	0.45 (0.78 - 0.38) 8	100	0
Copper (total)	30[c]	µg/L	2.25 (18.6 - <0.8) 212	92	0	1.3 (1.6 - 1.1) 8	100	0
Iron (total)	300	µg/L	570 (5870 – <8) 212	99.53	75	302 (609 - 243) 8	100	50

NS = Not Sampled
[a] in historic dataset, values below detection limits (<) are included at ½ detection limit for median calculations; historic dataset is from 1991 - 2018 unless otherwise indicated
[b] E. coli has multi-value objective: rolling 90-day geomean and single sample max. Data range 2013-2019. See report for more details.
[c] value shown is based on hardness of 300 mg/L, actual objective is a hardness-based equation
[d] barium data set due to change in methods: 1999-2019
* un-ionized ammonia is calculated using temperature and pH, % detectable not applicable

2019 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - SASKATCHEWAN/NORTH DAKOTA BOUNDARY
05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA[a] Median (max - min) #samples	HISTORIC DATA % detectable	HISTORIC DATA % exceedance	ANNUAL DATA 2019 Median (max - min) #samples	2019 DATA % detectable	2019 %exceedance
Lead (total)	13[c]	µg/L	1.0 (4.54 - 0.09) 213[d]	81.7	0	0.18 (0.32-0.16) 8	100	0
Mercury	0.5 ug/g in fish flesh	µg/g	NS	NS	NS	NS	NS	
Molybdenum (total)	10	µg/L	3.0 (45.0 - 0.48) 213	97.2	4.7	2.56(3.24 – 2.15) 8	100	0
Nickel (total)	220[c]	µg/L	3.9 (11.0 – 1.7) 217	100	0	2.95 (3.60 – 2.20) 8	100	0
Selenium (total)	5[d]	µg/L	0.9 (14 - 0.21) 213[d]	97.7	0.5	0.35 (0.5 – 0.3) 8	100	0
Zinc (total)	30	µg/L	5.3 (110.0 - <2.0) 148	70	0.7	<2 (3.0 - <2) 8	25	0
Miscellaneous								
Total Dissolved Solids	1,000	mg/L	808 (1890 - 304) 103	Calculated*	25.2	763 (1000 - 653) 8	Calculated*	0
Total Suspended Solids	the lesser of 10 mg/L or 10% over ambient	mg/L	19 (256 - <1) 213	69.5	67.4	16 (30 – <15) 8[b]	50	***
pH (range)	8.5-6.5	standard units	8.2 (9.2 – 6.9) 252	100	13.9	8.3 (8.6 – 8.1) 8	100	14
Dissolved Oxygen (conc.)	>5.0	mg/L	8.6 (19.4 - 0.3) 214	100	12.5	9.1 (11.9 – 3.7) 8	100	13
Aesthetics		visual	NS			NS		
Oil and Grease		visual	NS			NS		

[a] in historic dataset, values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2018 unless otherwise indicated
[b] detection limit is greater than objective
[c] value shown is based on hardness of 300 mg/L, actual objective is a hardness-based equation
[d] detection limits were significantly lowered starting in 2004. Previous non-detects were above the lowest sampled value
* Calculated: parameter calculated from other measured values, % detectable not applicable

NS: not sampled

2019 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - SASKATCHEWAN/NORTH DAKOTA BOUNDARY
05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA[a] Median (max-min) # samples	HISTORIC DATA % detectable	HISTORIC DATA % exceedance	ANNUAL DATA 2019 Median (max-min) # samples	2019 DATA % detectable	2019 %exceedance
Organic Parameters								
Atrazine	2	µg/L	0.00365 (0.043 - <0.0019) 37	59.5	0	0.0256 (0.045 - 0.0098) 6	100	0
Bromoxynil	5	µg/L	37 samples/ND	0	0	<0.0002 (0.0126 – 0.0028) 6	33	0
Carbaryl	90	µg/L	37 samples/ND	0	0	6 samples/ND	0	0
a-Chlordane	0.0043	µg/L	NS	-	-	NS	-	-
g-Chlordane	0.0043	µg/L	NS	-	-	NS	-	-
DDT	0.001	µg/L	NS	-	-	NS	-	-
Dieldrin	0.0019	µg/L	NS	-	-	NS	-	-
Dicamba	In development	µg/L	37 samples/ND	0	0	6 samples/ND	0	0
Diclofop-methyl	In development	µg/L	NS	-	-	NS	-	-
Heptachlor	0.0038	µg/L	NS	-	-	NS	-	-
MCPA	0.20	µg/L	0.005 (0.024 - <0.0006)37	43.2	0	6 samples/1 value (0.0048)	17	0
Parathion	0.04	µg/L	37 samples/ND	0	0	ND	0	0
Phenols (total)	1.0	µg/L	(66-1)205[b]	61.3	-	(70-30) 8[b]	37.5	-
Picloram	0.05	µg/L	1 sample of 37 (0.58)	2.7	2.7	6 samples/ND	0	0
Polychlorinated biphenyl (PCB total)	0.001	µg/L	NS	-	-	NS	-	-
Triallate	0.57	µg/L	31 samples/ND	0	0	6 samples/ND	0	0
Trifluralin	0.10	µg/L	NS	-	-	NS	-	-
2,4-D	4.0	µg/L	0.011 (0.27 - < 0.0005) 37	81.1	0	0.024 (0.35 - 0.013) 6	67	0

[a] For Pesticides, historic data values below detection limits (<) are calculated at ½ detection limit; dataset is from 2013 - 2018 unless otherwise indicated. There are frequently multiple detection limits within the date range.

[b] For Phenols, detection limits are highly variable making normalizing the data almost impossible. Minimum and maximum are for values detected, which may fall below detection limits on previous dates. They are for illustrative purposes only to show a range of detectable values. For example, 2019 data show a maximum of 70 ug/L and a min of 30 ug/L, but the five non-detects had values of <80. Also note in this case detection limit is well above the water quality objective.

NS: Not Sampled ND: Not Detected – detection limits not available from data source

2019 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY
US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA[a] Median (max - min) #samples	HISTORIC DATA % detectable	HISTORIC DATA % exceedance	ANNUAL DATA 2019 Median (max - min) #samples	2019 DATA % detectable	2019 % exceedance
Biological Parameters								
Fecal Coliform	200/100 mL	#/100 ml	7 (1900 - <2) 219	60.7	4.1	18.5 (140 - <2) 10	60	0
E. coli [b] single sample	126/100 mL 400/100 mL[b]	#/100 ml	5 (2800 - <2) 86[b]	59.3[b]	3.5	5 (38 - <2) 10	50	0
Inorganic Parameters								
Ammonia (un-ionized as N)	-	mg/L	0.005 (0.425 – 0.0) 215	Calculated*	-	0.006 (0.031 – 0.000) 10	Calculated*	-
Chloride	100	mg/L	34.9 (297 - 6.2) 222	100	4.5	31 (114 - 21) 10	100	20
Fluoride	1.5	mg/L	0.19 (0.87 - <0.01) 221	99.5	0	0.15 (0.32 - 0.11) 10	100	0
NO_2 + NO_3 (as N) dissolved	1.0	mg/L	<0.01 (1.11 - <0.01) 221	52.9	0.5	0.028 (0.089 - <0.01) 10	70	30
Phosphorus (total P)	0.10	mg/L	0.307 (4.52 - 0.091) 220	100	99.1	0.189 (0.608 - 0.137) 10	100	100
Sodium	100	mg/L	154 (1040 - 19) 222	100	80.6	126 (409 - 67) 10	100	90
Sulfate	450	mg/L	306 (3490 - 38) 222	100	23	311 (1060 - 171) 10	100	20
Metals								
Arsenic (total)	50	µg/L	4.8 (33.4 - 0.6) 203	100	0	5.5 (8.3 – 2.5) 10	100	0
Barium (total)	1,000	µg/L	87.2 (631.0 - 32.3) 221	97.7	0	67.6 (239.0 – 39.4) 10	100	0
Boron (total)	500	µg/L	198 (2080 - 41) 189	99.5	2.6	154 (302 - 92) 10	100	0
Beryllium (total) [d]	100	µg/L	0.017 (0.177 - <0.001) 125 [d]	99.2 [d]	0 [d]	0.008 (0.014 - 0.003) 10	100	0
Cadmium (total) [d]	27[c]	µg/L	0.026 (0.220 - 0.006) 125 [d]	100 [d]	0 [d]	0.016 (0.114 - 0.007) 10	100	0
Chromium (total) [d]	50	µg/L	0.33 (5.05 - 0.07) 125 [d]	100 [d]	0 [d]	0.22 (0.34 - 0.11) 10	100	0
Cobalt (total) [d]	50	µg/L	0.56 (4.97 - 0.17) 125 [d]	100 [d]	0 [d]	0.357 (0.79 - 0.25) 10	100	0
Copper (total)	30[c]	µg/L	1.79 (21.00 - 0.32) 221	94.6	0	1.25 (1.99 - 0.54) 10	100	0
Iron (total)	300	µg/L	351 (14,500 - 14) 206	100	61.2	300 (1260 - 175) 10	100	50

[a] in historic dataset, values below detection limits (<) are included at ½ detection limit for median calculations; dataset is from 1991 - 2018 unless otherwise indicated
[b] E. coli has multi-value objective: rolling 90-day geomean and single sample max. Data range is 2008-2019. See report for more details
[c] based on hardness of 300 mg/L, actual objective is a hardness-based equation
[d] historic data calculated from 2003 – 2018 due to major analytical method changes
*un-ionized ammonia is calculated using temperature and pH. % detectable not applicable

2019 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY
US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA[a] Median (max - min) #samples	HISTORIC DATA % detectable	HISTORIC DATA % exceedance	ANNUAL DATA 2019 Median (max - min) #samples	2019 DATA % detectable	2019 %exceedance
Lead (total) [b]	13[c]	µg/L	0.31 (5.17 - 0.03) 125 [b]	100 [b]	0 [b]	0.17 (0.32-0.06) 10	100	0
Mercury	0.5 ug/g in fish flesh	µg/g	NS	NS	NS	NS	NS	
Molybdenum (total)	10	µg/L	2.28 (35.2 - 0.50) 206	99	2.4	1.74 (3.53 - 0.80)	100	0
Nickel (total)	220[c]	µg/L	3.17 (24.7 - <2.0) 221	93.7	0	2.56 (6.08 - 1.94) 10	100	0
Selenium (total)	5	µg/L	0.36 (1.81 - <0.05) 203	98.0	0	0. 28 (0.58 - 0.21) 10	100	0
Zinc (total) [b]	30	µg/L	2.20 (26.80 - 0.30) 125 [b]	100 [b]	0 [b]	1.4 (1.8 - 0.8) 10	100	0
Physicals								
Total Dissolved Solids	1,000	mg/L	842 (4107 - 149) 220	calculated	30	748 (2577 - 462) 10	calculated	30
Total Suspended Solids	the lesser of 10 mg/L or 10% over ambient	mg/L	13.4 (158 - <1) 221	99.6	63	8.5 (18 – 5) 10	100	40
pH (range)	8.5-6.5	standard units	8.4 (10.0 – 7.1) 231	100	39.4	8.3 (9.1 - 7.4) 10	100	40
Dissolved Oxygen (conc.)	>5.0	mg/L	8.41 (23.57 - 0.00) 230	100	19.6	8.6 (10.9 – 0.1) 10	100	30
Aesthetics		visual	NS			NS		
Oil and Grease		visual	NS			NS		

[a] in historic dataset, values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2018 unless otherwise indicated
[b] historic data calculated from 2003 – 2018 due to detection limit changes (however, no exceedances in detectable values before 2003)
[c] value shown is based on hardness of 300 mg/L, actual objective is a hardness-based equation
* Calculated: parameter calculated from other measured values, % detectable not applicable

NS: Not Sampled

2019 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY
US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA[a] Median (max-min) # samples	HISTORIC DATA % detectable	HISTORIC DATA % exceedance	ANNUAL DATA 2019 Median (max-min) # samples	2019 DATA % detectable	2019 %exceedance
Organic Parameters								
Atrazine	2	µg/L	0.0187 (0.0464 - <0.0019) 83	71.1	0	0.0734 (0.1820 - 0.0138) 6	100	0
Bromoxynil	5	µg/L	0.0057 (0.2020 - <0.0002) 109	29.4	0	0.0012 (0.0100 - <0.0002) 6	66.7	0
Carbaryl	90	µg/L	NS			NS		
alpha-Chlordane	0.0043	µg/L	<0.0001 (<0.0001 - <0.0001) 106	0	0	(< DL 0.0005) 6	0	0
gamma-Chlordane	0.0043	µg/L	<0.0001 (0.0020 - <0.0001) 106	1.0	0	(< DL 0.0004) 6	0	0
DDT	0.001	µg/L	<0.0004 (0.0027 - <0.0004) 106	1.0	1	(< DL 0.0018) 6	0	0
Dieldrin	0.0019	µg/L	<0.0003 (0.0003 - <0.0003) 106	1.0	0	(< DL 0.0013) 6	0	0
Dicamba	In development	µg/L	0.0087 (0.1800 - <0.0004) 109	46.8	-	0.0582 (0.1020 - < 0.0004) 6	83.3	-
Diclofop-methyl	In development	µg/L	<0.0423 (<0.0074-<0.0074) 106	0	-	(< DL 0.0116) 6	0	-
Heptachlor	0.0038	µg/L	<0.0001(<0.0001 -<0.0001) 89	0	0	NS	NS	
MCPA	0.20	µg/L	0.0150 (0.3150 - <0.0002) 109	56.3	1.9	0.0122 (0.0206 - 0.0024) 6	100	0
Parathion	0.04	µg/L	<0.0155 (<0.0155 - <0.0155) 33	0	0	NS	NS	
Phenols (total)	1.0	µg/L	NS			NS	NS	
Picloram	0.05	µg/L	0.0250 (0.1700 - <0.0006) 109	37.6	11.0	0.0656 (0.1730 - 0.0101) 6	100	50
Polychlorinated biphenyl (PCB total)	0.001	µg/L	<0.0002 (<0.0002-<0.0002) 43	0	0	NS	NS	
Triallate	0.57	µg/L	<0.0022 (0.0800 - <0.0022) 107	5.6	0	(< DL 0.0044) 6	0	0
Trifluralin	0.10	µg/L	<0.0050 (<0.0084 - <0.0026) 107	0	0	(< DL 0.0026) 6	0	0
2,4-D	4.0	µg/L	0.0460 (0.9160 - < 0.0005) 109	78.9	0	0.0798 (0.1280 - 0.0542) 6	100	0

[a] For Pesticides, historic data values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2018 unless otherwise indicated. There are frequently multiple detection limits within the date range. The maximum for parameters with only one detection over the period of record (DDT, Dieldrin, Gamma Chlordane) is given as the value of the single detection, although detection limits higher than that value may have occurred. The median is given as the median of all detection limits.

NS: Not Sampled

APPENDIX F - Water Quality Monitoring Plan for Sherwood and Westhope

Collection of discrete samples will continue according to the established plan in 2020 (Tables F1 and F2). In addition, the collection of continuous dissolved oxygen and temperature data will proceed according to the IWI grant at both Sherwood and Westhope sites, along with the third site in Minot, ND.

At time of writing this report it is known that the sampling plan at Westhope in 2020 will be reduced due to the SARS-CoV-2 virus and corresponding management actions undertaken to reduce the spread of related covid-19 infections.

Table F1. Sherwood Monitoring Plan for 2020. Sampling, at Sherwood to be conducted by the USGS, pesticide analysis to be done by the North Dakota Department of Agriculture.

Season	No. of Site Visits	No. of Samples per Year				
		Dissolved Oxygen*	Major Ions	Nutrients	Trace Elements	Pesticides
1 (Mar - Jun)	4	4	4	4	4	Conducted by North Dakota Department of Ag
2 (Jul - Oct)	3	3	3	3	3	
3 (Nov - Feb)	1	1	1	1	1	
TOTAL	8	8	8	8	8	

*These are discrete grab samples. The continuous monitoring sondes will also collect dissolved oxygen data at this site.

Table F2. Westhope Monitoring Plan for 2020. Sampling at Westhope to be conducted by ECCC.

Season	No. of Site Visits	No. of Samples per Year				
		Dissolved Oxygen*	Major Ions	Nutrients	Trace Elements	Pesticides
1 (Mar - Jun)	3	3	3	3	3	3
2 (Jul - Oct)	4	4	4	4	4	4
3 (Nov - Feb)	1	1	1	1	1	1
TOTAL	8	8	8	8	8	8

*These are discrete grab samples. The continuous monitoring sondes will also collect dissolved oxygen data at this site.

APPENDIX G - Detailed Activities of the Board in 2019

G1.0 2019 ACTIVITIES OF THE BOARD

Since the presentation of the Sixtieth Annual Report (2018) to the IJC, the Board has held two face-to-face meetings and one public meeting. The discussions and decisions made are summarized in the following sections.

G1.1 2019 Spring Meeting

The Board held its annual spring meeting in Minot, North Dakota on February 21, 2019. Board members in attendance:

Garland Erbele, Nicole Armstrong, Frank Durbian, Russell Boals. Mark Lee, Dave Pattyson, Gregg Wiche, Debbie McMechan, Lorinda Haman, Jeff Woodward.

Board members in attendance via conference call:

John Fahlman, John-Mark Davies, Scott Gangl, Ken Bottle and Brian Caruso.

The agenda for the Board's meeting included the following topics:

- Review of 2018 Hydrologic Conditions, Spring 2019 Hydrologic Forecast and Planned Operations
- Compliance of Souris River Flows to December 31, 2018
- Update from the Hydrology Committee
- Water Quantity Monitoring
- Water Appropriations in the Souris River Basin during 2018
- Update from the Flow Forecasting Liaison Committee (FFLC)
- Aquatic Invasive Species in Manitoba
- Update from the Aquatic Ecosystem Health Committee (AEHC)
- Compliance with Water Quality Objectives for 2018
- Water Quality Monitoring Plan
- Overview and Update on Tile Drainage in Manitoba
- ISRB Communications
- International Souris River Study Board Update (ISRSB)
- Update form the 1989 Agreement Core Committee
- Update on Water Management Projects
- International Watershed Initiative Projects
- Work Plan

G1.1.1 Review of 2018 Hydrologic Conditions, Spring 2019 Hydrologic Forecast and Planned Operations

G1.1.1a Saskatchewan, Canada

WSA initiated the drawdown at Grant Devine Dam on November 2, 2018 at the rate of 0.84 m^3/s (30 cfs) to bring the reservoirs down to its February 1st Normal Drawdown Level (NDL) over the winter months. Grant Devine Lake was 0.52 m above its NDL at that time. The NDL was achieved on January 18, 2019 and the outflow was terminated at that time. No outflow was required at Rafferty as levels were below the February 1st NDL at freeze-up. Jeff W. also showed precipitation maps that indicated the April 1 to October 31, 2018 precipitation was near to slightly above normal across the basin. The September 3rd to November 1, 2018 precipitation was near normal. According to the National Oceanic Atmospheric Administration (NOAA) Modelled Snow Water Equivalent (SWE), snow ranges from trace amounts in the east to 10 cm (4 in) in the west corner.

WSA also presented the forecast and operating plans for Rafferty, Grant Devine and Boundary Reservoirs. According to the February 15, 2019 spring runoff forecast, below normal runoff is expected across the basin; therefore, non-flood operations will apply. There is no need for additional drawdown. Apportionment will be based on a 50/50 split as the natural flow at Sherwood is expected to be less than 50,000 dam^3.

WSA stated, based on current conditions, the reservoirs in Canada are not expected to fill in spring 2019. If Boundary fills, the excess will be diverted to Rafferty. No drawdown is required from Rafferty. If filled, the excess will be released at a controlled rate. No drawdown is required from Grant Devine, as well. Fill and release at a controlled rate if there is excess. If surcharged, plan to return to Full Supply Level (FSL) by June 1st. Releases from Grant Devine will be used for any apportionment requirements.

G1.1.1b North Dakota, United States of America

The United States Geological Survey (USGS), presented a summary of 2018 flow conditions for the US portion of the basin. According to Steve R.'s report, the total volume of flow past the Long Creek at the Noonan gage through December 31, 2018 calendar year was 5,670 acre-ft (6,994 dam^3). This volume is about 36% of the median flow for the last 59 years. The peak discharge for the reporting period January 1 to December 31, 2018 is 307 ft^3/s (8.69 m^3/s) on April 22, which ranks 41st in 59 years of record.

The total volume of flow past the Souris River near Sherwood gage through December 31, 2018 calendar year was 26,500 acre-ft (32,688 dam^3). The total flow is 50% of the median flow for the last 88 years. The peak discharge for the period January 1 to December 31 was about 542 ft^3/s (15.3 m^3/s).

Flow recorded at the Souris River near the Westhope gage through the December 31, 2018 calendar year was 36,920 acre-feet (45,541 dam^3). The calendar year's total flow is about 31% of the median flow for the last 88 years. The peak discharge for the period January 1 to December 31, 2018 was 416 ft^3/s (11.8 m^3/s) on July 9, which ranks 65th in 88 years of record.

It was noted that the US Government shutdown for five weeks did not affect the USGS's ability to maintain their stream gaging network and meet the obligations to make flow measurements during that time.

The United States Fish and Wildlife Service (USFWS) presented a summary of refuge operations and flows for 2018. The total provisional inflow measured at Sherwood for the first five months of the year was 10,498 acre-ft (108,982 dam^3). This was only 13% of the historic January-May inflow, which was 82,559 acre-ft (101,837 dam^3) for the period 1938 through 2018. Total Upper Souris Refuge pool volume increased an estimated 7,532 acre-ft (9,291 dam^3) during the first five months. The total provisional outflow measured at Foxholm on the south end of the Upper Souris Refuge for the first five months of 2018 was 2,515 acre-ft (3,102 dam^3). This was only 4% of the historic record for the January-May outflow, which was 70,636 acre-ft (87,130 dam^3) for the period 1938-2018. Lake Darling elevation increased 0.86 ft (0.26 m) from 1595.76 ft (486.39 m) on January 1st to 1596.12 ft (486.50 m) on May 31, 2018. The lake elevation on June 1st 2018 was 1596.22 ft (486.53 m).

Total yearly provisional flow at Sherwood was 26,705 acre-ft (32,941 dam^3). This was 23% of the historic average annual inflow (based on calendar year), which is 117,014 acre-ft (144,337 dam^3) for the period of record from 1938-2018. Total yearly provisional outflow measured at the Souris River near Foxholm on the south end of the Refuge was 12,638 acre-ft (15,589 dam^3). This was 11% of the historic average annual outflow which is 119,659 acre-ft (147,488 dam^3) for the period of 1938-2018. Total outflow was 7,983 acre-ft (9,847 dam^3) less than total measured inflow. On December 31, 2018, Lake Darling was at an elevation of 1596.01 ft (486.46 m).
At the J. Clark Salyer National Wildlife Refuge, the total provisional flow measured from the Souris River to the Refuge from January 1 through May 31 was 17,722 acre-ft (21,860 dam^3). This was only 17% of the historic January-May inflow, which was 106,999 acre-ft (131,983 dam^3) for the period of 1938-2018. Total Pool volume on May 31 was 37,603 acre-ft (46,383 dam^3). This was 12,806 acre-ft (15,796 dam^3) above the January 1st volume. Approximately 4,459 acre-ft (5,500 dam^3) was passed to Manitoba during the five-month period.

Total outflow measured at Westhope for the 2018 calendar year was 36,651 acre-ft (45,209 dam^3). Total inflow at Bantry was estimated to be 17,315 ac-ft (21,358 dam^3) more than the total measured outflow on the Souris at Westhope. Outflow during the June 1 to October 31 period was 30,614 ac-ft (37,762 dam^3), or 24,545 ac-ft (30,276 dam^3) above the 6,069 ac-ft (7,486 dam^3) required minimum.

The average daily flow at the Westhope gage fell below the minimum 20 ft^3/s (0.57 m^3/s) threshold several times from August 25th through September 6th. The lowest was 18.5 cfs (0.52 m^3/s) often represented only a few measurements during the total 24-hour period with a majority of the measurements equal to or greater than 20 cfs. These low flow measurements were likely due to a combination of relatively low calculated flow and wind fetch. Frank D. mentioned that the USFWS will aim to maintain a 25 cfs flow at Westhope in order to prevent dropping below a 20 cfs reading at the gage.

USFWS also provide summaries of Refuge operations for 2018 and the proposed plans for 2019, along with monthly lake elevations for Lake Darling including pool elevations for the various impoundments in the Wildlife Refuge. No major operational changes are expected in the wildlife refuge 2019.

G1.1.1c Manitoba, Canada

Manitoba Sustainable Development (MSD) presented a summary of the hydrologic conditions for the Souris River in Manitoba. With drier conditions in the fall 2018 and below normal snowfall, below normal runoff was expected in Manitoba. The spring melt started in early to mid-April. Flood peaks were well below normal and corresponded to 1-in-5 year low flow events, indicating that these peaks have been exceeded in 80% of years on record. The Souris River at Wawanesa peaked at 23.7 m^3/s (840 ft^3/s) on April 21st, which is considered to be a 1-in-4-year low flow event; or exceeded in 75% of years on record.

MSD stated that the antecedent moisture conditions at the 2018 freeze-up were normal to below normal for much of the basin including Manitoba's portion of the Souris River Basin. Snow accumulation in the Manitoba portion of the basin has been below normal to date. Flows entering Manitoba from releases from the J. Clark Salyer Wildlife Refuge have been approximately 0.3 m^3/s (10 ft^3/s) over the winter. The current flow at Wawanesa gauge is approximately 0.42 m^3/s (15 ft^3/s). The flow is within the "normal range" for this time of year. The Manitoba portion of the Souris River Basin is currently categorized as either abnormally dry or moderate drought by the Canadian Drought Monitor.

MSD mentioned the risk of severe flooding in Manitoba along the Souris River and its tributaries is lower than normal in the Spring of 2019. The Manitoba Hydrologic Forecasting and Coordination Branch will release their first 2019 conditions report at the end of February. The National Weather Service's probabilistic forecast at the North Dakota – Manitoba border (Westhope, ND) shows the probability of spring flooding in 2019 is lower than the historical average. With drier conditions, drought water supply conditions in the Manitoba portion of the Souris River Basin will be monitored closely during the spring melt. For more information go to the Manitoba Drought Monitor website at:
http://www.gov.mb.ca/sd/water/drought_contions/index.html

G1.1.2 Compliance of Souris River Flows to December 31, 2018

Environment and Climate Change Canada (ECCC) presented the results of the natural flow computations for the period ending December 31, 2018. The total diversion in the Souris Rivers basin was 26,150 dam^3 (21,200 acre-ft). Recorded flow at Sherwood was 32,731 dam^3 (26,535 acre-ft). The natural flow computed at Sherwood was 55,422 dam^3 (44,931 acre-ft). According to these computations, the US share at 40% was 22,170 dam^3 (17,973 acre-ft). The flow received by the US was 35,364 dam^3 (28,670 acre-ft), which constitutes a surplus delivery of 13,194 dam^3 (10,696 acre-ft). The annual flow requirement/apportionment at Long Creek station has also been met with a surplus of 1,946 dam^3 (1,578 acre-ft).
A motion was made to accept the natural flow computations made by ECCC, the motion was carried.

G1.1.3 Update from the Hydrology Committee

The Hydrology Committee discussed the Apportionment Procedures Manual (APM) for the Souris River. It was noted that the APM was put on hold to wait for the Plan of Study to

conclude. This decision was made because the current APM highlights questions and issues that needed to be addressed by the Plan of Study. The decision to place the APM on hold was to provide the Plan of Study time to investigate and evaluate those concerns in order to address them for the APM.

G1.1.4 Water Quantity Monitoring

ECCC reported that the water monitoring network for 2019 would remain the same as 2018. The only plans were to move a stand-alone weather station at Handsworth to Moose Mountain Lake Hydrometric Station, but the decision was to have it remain in Handsworth for now.

USGS reported that there were no expected changes to the stream gaging network in the U.S. in 2019. The USGS raised concerns related to the aging gage infrastructure and the stress caused by the 2011 flood. Repairs to gauging stations that were damaged during the 2011 flood were to be completed in the summer of 2019. Construction on the new gage on the Broadway Bridge in Minot, ND, were to be completed in the summer of 2019.

G1.1.4 Water Appropriations in the Souris River Basin During 2018

WSA reported that there was one Approval to Operate cancelled in 2018, with a combined allocation of 23 cubic decameters (18.6 acre-feet) within the effective drainage area of the basin. There were nine Approvals to Operate that were issued in 2018, within the effective drainage area, with a total allocation of 28 cubic decameters (22.7 acre-feet). Two approvals decreased in the amount allocated in 2018. There was no change in the Saskatchewan portion of Long Creek, the lower Souris River, and Moose Mountain Creek.

NDSWC reported the following temporary water permits issued in North Dakota, for a total of 3,177.9 cubic decameters (2,576.3 acre-feet):

- 29 permits for 2,495 ac-ft (3,077.6 dam^3) from isolated sources,
- 5 permits for 11.3 ac-ft (13.9 dam^3) from streams, and
- 2 permits for 70 ac-ft (86.3 dam^3) from streams with 90% non-consumptive use.

G1.1.5. Update from the Flow Forecasting Liaison Committee (FFLC)

The FFLC reported on recent activities which consisted of coordination on a February 1st and February 15th spring outlook. The FFLC reported that the spring outlook of dry weather did not warrant additional conference calls and the FFLC planned to continue to coordinate forecasts on the first and fifteenth of each month until runoff commences. Based on the forecast (less than 1:10-year event) flows at the Sherwood crossing were determined to be less than 50,000 dam^3 (40,535 acre-feet). Therefore, the apportionment for 2019 was a 50/50 split between Canada and the United States.

A motion to declare 2019 a non-flood year and that the apportionment to be 50/50 split between Canada and United States was carried.

G1.1.5. Aquatic Invasive Species in Manitoba

Manitoba Sustainable Development (MSD) started by providing a brief overview of Aquatic Invasive Species (AIS) and Zebra Mussel in Manitoba. Candace P. also talked about the legislative review, prevention programs, monitoring, early detection and response, control and management, and AIS concerns for Manitoba. Some facts about AIS:

- Not native to Manitoba,
- Require an aquatic habitat,
- Could be introduced either intentionally or accidentally,
- Have competitive advantage over native species,
- Cause ecological, social, economic, and human health impacts, and
- Can be introduced and transported by various pathways.
- The number one transport of ANS is by watercraft.

A sample of zebra mussels was passed around for attendees to see what they actually look like. At early stage, zebra mussels are too small to be detected/seen with naked eyes. Zebra mussels are prohibited in Manitoba, dead or alive. Zebra mussels are successful because there are no native predators or diseases to control their population. Furthermore, female zebra mussels produce up to one million eggs per year, which significantly increases their survival rate. MSD also showed a timeline map that displayed the invasion of Zebra and Quagga mussels and their distribution / density across the US to May 2015. To date, the highest concentration of Zebra mussels is found in the eastern portion of the Unites States. Further explained the impacts of AIS which included:

- Increased maintenance costs for power generating stations, water treatment plants, water delivery infrastructure and communities,
- Damage to native fisheries,
- Change in aquatic ecosystem,
- Decreased tourism and recreational income,
- Decrease in waterfront property values and increased taxes,
- Long-lasting /generational impacts; and
- Reduced recreational potential of beaches.

MSD provided an overview of the AIS Unit's Program with the following components:

Legislation –
This includes both federal and provincial regulations. Federally, Manitoba was delegated with fisheries management responsibilities similar to other inland provinces. Manitoba was also delegated under the federal AIS Regulation (2015) - the Fisheries Act. The Fisheries Act prohibits importation, possession, transportation and release of zebra mussels, quagga mussels and invasive carp in Canada.

Provincially, AIS regulation is under the Water Protection Act of Manitoba. AIS are listed in Schedule A which includes over 80 fish species, 24 invertebrates, 21 plants and 2 algae. The

Law requires to clean, drain, dry, dispose and decontaminate if necessary. Furthermore, it is a legal requirement to stop watercrafts at inspection stations. In addition, the Water Protection Act includes water-related equipment, aircraft, ORVs, water garden and aquarium trade and bait harvesters and dealers.

Prevention –
The objective is to prevent and slow the spread of AIS from invaded water bodies within Manitoba to non-invaded water bodies. Prevention includes educating the public, demonstrating to how to clean, drain, and dry watercraft and equipment properly; conduct watercraft inspections; and perform decontaminations. There are strategic highway "pinch-points" to intercept traffic coming from invaded water bodies and high-volume boat launches. Candace P. also provided a summary of the 2018 watercraft inspection program at six different locations in the province. On a regional and national basis, there is an Interprovincial – Territorial Agreement coordinated in defence against AIS. Internationally, the engagement includes the IJC and IRRB.

Monitoring –
The goal is to understand the profile of AIS in Manitoba water bodies. The focus is on Zebra mussels that will target veliger and settled life stages. Candace P. noted 78 water bodies were sampled (un-invaded and higher risk) with the help of a range of agencies. Zebra mussels were found in the north basin of Lake Winnipeg.

Early Detection/Containment –
Suspect adult Zebra mussels were found in Singush Lake. As a result, initiated a containment plan in 2017 that will now be entering its third consecutive year. The lake has been closed to day-use boaters; locals are allowed but their watercraft are restricted to only Singush Lake. No additional Zebra mussels have been discovered, and the lake will open again if none are found this year.

Management and Control –
MSD mentioned there is an Inter-departmental Committee that examines pesticide registration options for Manitoba. There is also an Inter-governmental Committee working towards engaging Health Canada's Pest Management Regulatory Agency (PMRA) on possible management options for Zebra mussels. PMRA approves the control options.

G1.1.6. Update from the Aquatic Ecosystem Health Committee (AEHC)

North Dakota Department of Environmental Quality (NDDEQ) and ECCC reported on the activities of AEHC in 2018. The Committee had its conference call on January 17 to discuss data and the path forward for the next report. However, the work was suspended for development of an IWI project proposal for dissolved oxygen (DO) monitoring. The project will install continuous DO/temperature monitoring sensors at three sites along the Souris/Mouse River. These sites (Sherwood, Minot, and Westhope) will be co-located with USGS gaging stations to provide discharge information for later analysis. The sites were selected to represent water leaving Saskatchewan, water modified by Lake Darling, and water entering Manitoba. The purpose of the project is to analyze DO data for diurnal and seasonal variations and to determine possible correlations to flow.

AEHC completed its first draft of IWI proposal on April 6; and had subsequent meetings to discuss the water quality index results, water quality objectives, reporting changes, and ECCC's work on the Westhope data, historic to present. Furthermore, the Committee also discussed the AEHC portion of the draft ISRB work plan, current terms of reference, and DO monitoring IWI proposal. It was also determined that the Water Quality portion of the Annual Report would be distributed to the entire AEHC for comments and edits before sending to the ISRB secretary. Discussion continued on how to proceed with the Water Quality Objectives review. After receiving final comments, AEHC submitted the IWI proposal to IJC on October 31st.
On December 3rd, IJC recommended the proposal for funding, with a few minor modifications. These were mostly regarding improved communication efforts between the ISRB and the IJC for progress reports and ways to get information regarding the project out to the public.

During December, a large portion of the AEHC was also recruited to assist the ISRSB Resource Agency Advisory Group (RAAG) with the development of performance indicators for water quality that will go into the model to create alternatives for the POS. While the process slowed during the US government shutdown, the group is committed to having a product by the May 2020 deadline. While a full water quality trends analysis of the entire basin will not be possible given the time constraint, data has been compiled on a limited number of parameters for Sherwood, Minot, and Westhope sites and will be run through the USGS's QWTrend model to look for possible relationships between the parameter concentration and flow, season, and time. Calls on this effort are occurring every two weeks. NDDEQ further stated, while it was recognized that there was not sufficient time or resources to develop basin-wide trend analysis by the deadline of the ISRSB Study, it was determined to be a necessary step in the process of looking at water quality objectives as well as general analysis of water quality in the basin by the AEHC. To support this effort, the AEHC will be submitting another grant proposal during the next IWI cycle.

The group also discussed exceedances, specifically Atrazine which was detected in 2018.

G1.1.7 Compliance with Water Quality Objectives for 2018

NDDEQ presented a summary of the water quality monitoring program for the Sherwood site; and ECCC presented the data for the Westhope site:

The USGS collected eight regular water quality samples from the Souris River near Sherwood in 2018. However, one of the samples was lost in transit to the lab, so seven samples are used in the calculations. In addition, a joint sampling event with ECCC occurred at the Sherwood site in September.

NDDEQ stated it was interesting to note that a large portion of the parameters had their lowest concentrations for the April 25 samples and the highest concentrations for the September or October samples. Also, many of those below with exceedances to Water Quality Objectives had lower minimum and maximum values than last year and pervious years, but higher median values. Only six parameters overall exceeded Water Quality Objectives in 2018.

Sherwood-USGS/ND Department of Health (NDDOH)

- ***Total Phosphorus*** exceeded the Water Quality Objective of 0.10 mg/L for all samples in 2018. The Total Phosphorus concentrations at Sherwood ranged from 0.130 mg/L on January 4 to 0.390 mg/L on September 5.

- ***Sodium*** exceeded the Water Quality Objective of 100 mg/L for 6 of 7 samples in 2018. The concentrations ranged from 59.7 mg/L on April 25 to 254 mg/L on October 2.

- ***Sulfate*** exceeded the Water Quality Objective of 450 mg/L on 2 occasions in 2018. The minimum concentration was 160 mg/L on April 25 and the maximum concentration was 556 mg/L on September 5.

- ***Total Dissolved Solids*** exceeded the Water Quality Objective of 1000 mg/L on 2 occasions in 2018. The highest concentration was 1260 mg/L on September 5, and the lowest concentration was 380 mg/L on April 25.

- ***Total Iron*** exceeded the Water Quality Objective of 300 µg/L in 6 of 7 samples in 2018. Concentrations ranged from a minimum of 168 µg/L on January 4 to a maximum of 2120 µg/L on June 12.

- ***pH*** exceeded the upper Water Quality Objective of 8.5 pH units twice in 2018, but only just over the objective. Maximum values of 8.6 occurred on September 5 and October 2. The minimum value of 7.60 occurred April 25.

- ***Dissolved Oxygen*** concentrations were above the minimum 5 mg/L Water Quality Objective in all samples.

- ***E-coli*** values for 2018 ranged from less than 97 CFU/100 mL on September 5 to 230 CFU/100 mL on May 15. There were no exceedances of the single-sample objective of 400 CFU/100 mL. The geomean for April to September (5 months) was 168.46 CFU/100 mL, which is slightly above the seasonal geomean objective of 126 CFU/100 mL.

- ***Organics***

  - Pesticide samples were collected six times by the ND Department of Agriculture on the Souris River at Sherwood May through October 2018. Atrazine was detected in all samples, but with reportable values in only four of six samples. The concentrations ranged in value from 0.0079 µg/L to 0.043 µg/L. 2,4-D was also detected in all samples, with reportable values in five of the six samples. Concentrations ranged from 0.009 µg/L to 0.27 µg/L. Bromoxynil and MCPA, detected in some samples (see Table 1). All detections were well below Water Quality Objectives.

- Other pesticide detections, for parameters without Water Quality Objectives, were also noted. A few just had detections, but not at concentrations that were above reportable limits. These included the list below, with parenthesis to indicate their uses:
    - Diuron (unwanted vegetation, non-crops, forage crops)
    - Fluroxypyr (multi-use herbicide)
    - Imazethapyr (soybeans)
    - Propiconazole (fungicide)
    - Saflufenacil (soybeans and corn)
    - Pyrasulfotole (cereal crops)
  - These pesticides were detected at reportable values, though still well below any concentration of concern:
    - Bentazon – six detections, used for beans and peas with specific instructions to not apply directly to water or wetlands.
    - Tebuconazole – four detections, used as a fungicide
    - Tebuthiuron – five detections, used on non-cropland, right of ways, industrial sites, and to kill woody vegetation
  - In addition to the Atrazine mentioned above, several of the metabolites of Atrazine were also detected. It is important to monitor these as they can persist for longer in the water. These included Deethyl Atrazine, Deisopropyl Atrazine, and Hydroxy Atrazine.

<u>Westhope –ECCC</u>

ECCC collected eight (8) regular water quality samples from the Souris River near Westhope in 2018. As well, a joint sampling event with the USGS occurred at the Sherwood site in September.

- ***Total Phosphorus*** exceeded the Water Quality Objective of 0.10 mg/L for all samples in 2018. The Total Phosphorus values at Westhope ranged from 1.070 mg/L on April 10 to 0.251 mg/L on June 8.
- ***Sodium*** exceeded the Water Quality Objective of 100 mg/L for all samples in 2018. The results ranged from 115 mg/L on June 8 to 693 mg/L on February 20.

- ***Sulphate*** exceeded the Water Quality Objective of 450 mg/L on 4 occasions in 2018. The minimum value was 326 mg/L on April 12 and the maximum concentration was 1880 mg/L on February 20.

- ***Total Dissolved Solids*** exceeded the Water Quality Objective of 1000 mg/L four times in 2018. The highest value, 3638 mg/L occurred on January 10, and the lowest value was 783 mg/L on July 5.

- ***Total Iron*** exceeded the Water Quality Objective of 300 µg/L in all 8 samples in 2018. Concentrations ranged from a minimum of 620 mg/L on May 1 to a maximum of 5490 µg/L on January 10.

- ***pH*** exceeded the upper Water Quality Objective of 8.5 pH units three times in 2018. The maximum value of 9.06 occurred on September 5. The minimum value of 7.60 occurred twice, on January 10 and April 10. There were no exceedances of the lower objective of pH 6.5.

- ***Dissolved Oxygen*** concentrations were below the minimum 5 mg/L Water Quality Objective in two samples, January 10 and February 20, 2018.

- ***Fecal coliform*** values for 2018 ranged from less than 2 on April 10, to 190 on September 5. The objective of 200 colonies/100 mL in one sample was not exceeded.

- ***E-coli*** values for 2018 ranged from less than 2 on April 10 to 140 colonies/100 mL on September 5. There were no exceedances of the single-sample objective of 400 colonies /100 mL. The geomean for April to September (5 months) was 19.99 colonies/100 mL. This was well below the geomean objective of 126.

- ***Chloride*** exceeded the Water Quality Objective of 100 mg/L twice in 2018, on January 10 and February 20. The maximum value of 163 mg/L occurred on February 20th, and the minimum of 30.1 mg/L on June 8.

- ***Total Boron*** exceeded the Water Quality Objective of 0.50 mg/L once in 2018, with a maximum value of 532 µg/L on February 20. The minimum value of 146 occurred on May 1.

- ***Organics***

    - Pesticide samples were collected on the Souris River at Westhope in the April through September sampling events for 2018. 2,4-D and Atrazine were detected in all samples. Bromoxynil, Dicamba, MCPA, and Picloram were detected in some samples.
    - No pesticide variables exceeded their objectives.

The AEHC was actioned with putting together a package of information regarding Atrazine and a request to conduct more water quality monitoring for neonicotinoids.

G1.1.8 Water Quality Monitoring Plan

NDDEQ noted that there are no major anticipated changes to the Water Quality Monitoring Plan for 2019 except that three more stations will be added. ECCC added that the Water Quality Monitoring for the Westhope site will remain the same and also mentioned that they dispatched two Hobo Meters, monitoring DO and temperature, one at the Westhope site and one 10 km North of the Sherwood site.

G1.1.9 Overview and Update on Tile Drainage in Manitoba

Manitoba Agriculture provided an update on tile drainage in Manitoba. The purpose of tile drainage is to remove excess water from the soil profile. This is accomplished by placing perforated pipes in the ground, typically 24 inches to 36 inches deep. A tile drainage system typically includes a number of smaller diameter lateral pipes that empty into a larger main pipe. The water in the pipes flows by gravity to the edge of an agricultural field where it is released via gravity or lift station to the surface drainage system (ditch or municipal drain). Manitoba Agriculture further explained what tile drainage accomplishes, what it entails; and how it is installed and operated.

MSD provided a brief overview of the Water Rights Act and Tile Drainage in Manitoba. ***The Water Rights Act states that no person shall control water or construct, establish or maintain any water control works unless he or she has a valid and subsisting licence to do so.*** The Water Rights Act is administered by MSD. Water control works are defined as any dyke, dam, surface or sub-surface drain, improved natural waterway, canal, tunnel, bridge, culvert, borehole or contrivance for carrying or conducting water, that temporarily or permanently alters or may alter the volume or direction of flow, the level or location of water. MSD noted that any of these activities triggers the requirement of a Water Rights Licence to construct control works. MSD further explained the licencing process for tile drainage projects in Manitoba. Currently, there are proposed changes to the Legislation dealing with tile drainage.

The Board then had a discussion on the implications and regulation of tile drainage determining that it is a topic requiring more attention.

G1.1.10 ISRB Communication

Russell Boals provided the final draft of the Terms of Reference (ToR) of the Communication Committee. The ToR specifies roles and responsibilities, accountability and authority, membership, frequency of meetings and duration of mandate of the Communication Committee. The current members are:

- Russell Boals
- David Pattyson – Upper Souris Watershed Association
- Wanda McFadyen – Assiniboine River Basin Initiative
- Debbie McMechan – Reeve, Manitoba
- Shelly Weppler – Ward County Commissioner
- Darin Schepp – North Dakota State Water Commission

The Co-chairs, one from the United States and one from Canada, will be selected by the members and serve for a two-year term. The Committee will exist as an on-going basis until its ToR are modified or replaced by the ISRB.

Mark Gabriel mentioned the plan for the Communication Committee to develop a Communications Infographic with possible IWI funding and asked if that was still desired and, if so, where the Committee was in the timeline for that. Russell Boals answered that it was still intended for the Committee to apply for funding and produce an infographic; however, at this moment the focus has been in producing fact sheets for the Study Board.

Ken Bottle expressed his desire to seek help from the Communication Committee in the preparation of an IWI project proposal by the COH. The Communication Committee will package the COH proposal for submission to the IJC for funding. The Communication Committee will actively participate in the development of the new IJC website, as well.
Two actions occurred at the meeting for the ISRB Communication Committee. The first was for the Secretaries to distribute finalized Communication Committee terms of reference to the board and the second was to package the COH IWI proposal for submission.

G1.1.11 International Souris River Study Board Update (ISRSB)

G1.1.11a Update from Study Managers, Co-chairs, and Board Members

Jeff Woodward and Rebecca Seal-Soileau presented the study purpose and objectives; and the status of the POS. The ISRSB is composed of 8 members with 4 members each from Canada and the United States. In addition, the ISRSB also has a Public Advisory Group (PAG), as well as the RAAG, Independent Review Group (IRG), and Climate Advisory Group (CAG). There are provisions for Observer status and Independent Parties, as well. Jeff W. explained what has been completed to date:

- ISRSB Work Plan updated and submitted to IJC in October, 2018 and briefed at appearances in Ottawa,
- IJC staff have worked closely with ISRSB members and PAG to provide up to date information regarding ISRSB activities,
- Held Forecasting Meeting in July 2018,
- H&H Face to Face meeting in November 2018,
- WSA Letter of Contract for Consultants for LIDAR Surveys,
- Meteorological Network (HydroMet) assessment completed, and
- H&H modeling well underway.

Public Engagement - The ISRSB held its public meetings on February 20, 2018 in Minot, ND, June 25, 2018 in Estevan, SK, and February 19, 2019 in Brandon, MB. Webinars and workshops held by the PAG and RAAG are as shown below:

<u>PAG/RAAG Webinars:</u>

- January 28, 2019 – Study Update, Information and planning for March Workshops

- March 4, 2019 – Study update with alternatives background briefing and input on useable data formats

PAG/RAAG Workshops:

- June 25, 2018, Estevan – Kick off meeting and introduction to study, initial input on impacts of water levels and flows.
- March 18-20, 2019 Minot, ND – Evaluate performance indicators developed from questionnaire and RAAG input, provide input to alternatives.
- July 22-24, 2019 – View initial results

Rebecca S. mentioned there were 15 public participants at the Brandon meeting. Approximately 10 questions and comments were received. A number of mitigation measures were discussed during the public meeting including the effectiveness of the reservoirs and if any changes that may arise from the new plan will be monitored for reservoir efficiency as well. Jeff W. mentioned that it may be pertinent to do a review of the reference for the Board and the initial environmental assessments to see if, and make sure, items of interest are being addressed. The first steps most likely would be to reassess the 1989 Agreement to fully understand what was envisioned at the time. The ISRSB was planning on seeking guidance from the ISRB on this matter.

Russell Boals noted that when the Canadian Reservoirs were constructed, because they were affecting the flows of an international stream in Canada, there was a requirement for them to be licensed under the *International Rivers Improvement Act*. This license has a number of conditions in regards to follow ups on the mitigation measures. Water quality monitoring included in the Bi-lateral water quality monitoring of the Agreement is directly related to that requirement.

Girma Sahlu mentioned that the Board has a copy of the International Rivers Improvement License if it is required.

Indigenous Engagement – Study Board is working with PAG and IJC to contact First Nations, Metis and Tribes who may have interest in aspects of Work Plan. In the US, the Study Board is working with North Dakota Indian Affairs Commission staff to seek guidance on Tribal interest and consultation process. Another meeting to discuss Indigenous Engagement is being scheduled in March. Gregg Wiche mentioned there are five tribes in North Dakota that will be engaged for their input. Wayne Jenkinson stated on the Canadian side, a consultant was hired to work with the IJC. Three meetings were held with the Cowessess, Swan Lake, and Carry-the-Kettle First Nations. More engagement is expected in the summer.

Advisory Groups - The ISRSB currently has three advisory groups and an Independent Review Group. The PAG is active and growing. The PAG co-chairs held media interviews in Canada and the US to promote questionnaire. The RAAG was established to act as conduit for input on interests to the study. The RAAG solicited feedback from agencies through request for information to be used in models to evaluate alternatives. The CAG will be established soon. Currently, the CAG is in the process of developing draft Terms of Reference (ToR) and

soliciting membership recommendations. CAG will help identify future climate states such as precipitation, temperature, and evaporation that will be used to estimate future hydrologic conditions.

Work Plan – The final work plan was delivered to the IJC in October. Improvements to the work plan was made based on comments received online from the Internal Review Group, and from the ISRSB public meetings in Minot and Estevan. Operating Rules Review (OR1) ISRB comments were received and incorporated. The majority of group tasks on Hydrology/Hydraulics and the Plan Formulation tasks (PF1-PF4) are all underway.

Next Steps – Continue with planned activities to engage Canadian First Nations/Metis and US tribes. Hold a PAG & RAAG workshop in Minot, March 18-20, 2019. Bi-monthly Hydrology and Hydraulics calls will continue to discuss technical issues and resolve any modelling issues. There will be a Plan Formulation/Alternatives Development Workshop in Saskatoon, in May 2019. Adjustments to the Work Plan will be made based on Public Input, Independent Review and Government Shutdown -- Evaluating potential need for time and budget extension. The Study Board will continue its engagement with the public.

G1.1.11b Update from the 1989 Agreement Core Committee

Jeff Woodward provided a status report on the work of the Core Committee (review of the Operating Principles of the Reservoirs, contained in Annex A). Comments that were received from the Board have been incorporated. The next step is to finish the plain language review and have it approved by the Board. Some discussion is needed at the Study Board and Souris Board level concerning the necessary steps for the language approval. The next determined steps include the finalization of the review by the Study Board and submission to the ISRB for comments. Liz Nelson is in charge of the Annex A revisions at this time, and is expected to have the report ready for discussion at the June 2019 Board meeting.

An action was given for the United States Army Corps of Engineers (USACE) to provide a status report and give an update on the revisions to Annex A of the 1989 Agreement prior to the June 2019 meeting.

G1.1.12 Update on Water Management Projects

G1.1.12a Update on the Northwest Area Water Supply (NAWS)

NDSWC reported that there were no major changes from the last update except forward progress on the planning and construction stages and intake modifications at the source (Lake Sakakawea).

G1.1.12b Update on the Northwest Area Water Supply (NAWS)

WSA provided an update on the revised Probable Maximum Flood (PMF) and its implications on the development of reservoir operating plans for Rafferty and Grant Devine Dams. The 2011 flood in the Souris River Basin resulted from summer rainfall events that followed already wet

conditions from spring freshet and generally wet conditions in 2010. The 2011 flood was different than the 1986 PMF design flood. WSA pointed out that the dominant runoff is in the spring from snowmelt with a few years of relatively minor summer flow. The 2011 flood resulted from summer rains and as a result caused the WSA to re-visit the design and operating principles of both Rafferty and Grant Devine reservoirs. The original principles were based on hydrological analysis from 1988 and dealt mainly with spring runoff from winter snow accumulation. This was the basis for the "Annex A Operating Plan for Rafferty, Alameda [now Grant Devine], Boundary and Lake Darling" of the 1989 Souris River Agreement between Canada and the United States.

Review of PMF – Hatch 2014 – WSA explained the review of the PMF (Hatch 2014) for Rafferty and Grant Devine dams. For Rafferty, the PMF 1988 design was 800 m^3/s, and the PMF 2014 revised design was 1,380 m^3/s. Similarly, the PMF 1988 design for Grant Devine Dam was 1,189 m^3/s, and the PMF 2014 revised design was 1,760 m^3/s. The first issue is the new PMFs are larger than the original designs.

Inflow Design Flows (IDF) – Hatch 2016 – WSA pointed out both Rafferty and Grant Devine were classified as high consequence dams, allowing the design flow to be one-third between 1:1000 year-flood and the PMF. The IDFs would be 833 m^3/s for Rafferty and 862 m^3/s for Grant Devine. The second issue is the new PMF and IDFs are summer events and not spring snowmelt events. To pass the IDF, reservoirs need to be drawn down enough by June 1st, considering the allowable flows out of the reservoirs. The constraints are that the Rafferty spillway is undersized and can only pass 495 m^3/s at Maximum Allowable Flood Level (MAFL). Furthermore, flows out of the Grant Devine Reservoir are restricted to 300 m^3/s by a downstream railway embankment. The proposed solution is to drawdown the reservoirs to Inflow Design Flow Service Levels to create storage to pass the summer IDF.

WSA also mentioned the changes to the operating principles to account for a significant summer rain event. The impact on the basin has become part of the Souris River POS and will be studied as part of the investigation of alternatives. The POS being undertaken by the IJC is designed to improve the agreement between Canada and the United States and the cooperative operations of the reservoirs in the Souris Basin.

Path Forward – WSA stated the POS will look at the implications of the proposed new operating plans as one of the modelled alternatives. This should allow an assessment of the impact to the basin and an analysis of the implications to the agreement. A special note is that Annex A is specific to the spring operations only, so it may require modification. The WSA will complete Reservoir Operating Plans that will be jointly reviewed by the US and Canada. The intended course of investigation is for the POS to analyze how the system could be operated to better manage the re-occurrence of a summer flood. This will result in modifications to the operating plan which will be documented in a reservoir operating manual that is required as part of the 1989 Agreement. Nicole Armstrong mentioned that Manitoba is part of the Adaptive Management Team, which has not convened yet, and could provide additional input to the revised Operating Plans.

G1.1.12c Other Planned Developments

Garland Erbele mentioned the proposed Red River Valley Water Supply Project (RRVWS) in the Red River Basin that brings water to eastern North Dakota from Lake Sakakawea. The project is going through its early design stages. Garrison Diversion Conservation District (GDCD) is the lead agency. Manitoba has expressed concerns about the potential transfer of non-native biota from the Missouri River Basin to the Hudson Bay Basin, similar issues to the NAWS Project.

G1.1.13 International Watershed Initiative Projects

Wayne Jenkinson mentioned the DO issue is still outstanding. The AEHC is assisting the Study Board regarding water quality in the Souris River Basin. Some water quality work was done for the Red and Assiniboine River basin (SPARROW Model) five years ago. The IJC website training is coming up. The IJC semi-annual meeting has been delayed, and commissioners have not been named yet both in Canada and the United States. No dates have been set yet. Wayne J. also talked about the IJC Climate Change Framework that was introduced at the Board meeting in Estevan and how climate change could affect the Board to deliver its mandate. Both the St. Croix and Rainy – Lake of the Woods watershed boards have gone through the process of incorporating the Climate Change Framework. The Souris Board could wait until the POS is complete. The work by the Rainy – Lake of the Woods Board might be useful to the Souris Board. The engagement of First Nations was noted. Furthermore, the IRRB and ISRB could exchange and share information. There were questions regarding the status of ISRB becoming an 'IWI Board" and implications of the POS work on the mandate of ISRB.

G1.1.14 Work Plan

The latest version of the work plan for 2019 was distributed to the Board. Not a lot of changes were made since the last version. The work plan is based on five expected results as shown below:

1. Oversee the implementation of compliance with the 2000 Interim Measures for Apportionment of the Souris River as modified,

2. Perform an oversight function for flood protection,

3. Assist the IJC with the Joint Water Quality Monitoring Program and report on aquatic ecosystem health issues in the watershed,

4. Provide opportunities for the public to be involved in the work of the Board, and

5. Maintain an awareness of existing and proposed developments and carry out other studies or activities the IJC may request.

The Board will revisit the work plan in 2020.

G1.2 2019 Summer Meeting

The Board held its annual summer meeting in Bottineau, North Dakota on June 26, 2019. Board Members in attendance:

Garland Erbele, Nicole Armstrong, Frank Durbian, Mark Lee, Dave Pattyson, Gregg Wiche, Debbie McMechan, Lorinda Haman, Jeff Woodward, John Fahlman, Scott Gangl, Ken Bottle, Shelly Weppler, Col. Samuel Calkins, Joe Goodwill, Bruce Davison.

Board members attending via conference call included:

Russel Boals

The agenda for the Board's meeting included the following topics:

- Public Meeting Review
- Determination of Souris River Flows to May 31, 2019
- Update from the Hydrology Committee
- Review of 2019 Hydrologic Conditions and Operations, Summer Hydrologic Forecasts and Planned Operations
- Update from the Flow Forecasting Liaison Committee (FFLC)
- Aquatic Invasive Species in North Dakota
- Update from the Aquatic Ecosystem Health Committee (AEHC)
- Compliance with Water Quality Objectives for 2019
- Update on the Communications and Outreach Committee (COC)
- Update on Water Management Projects
- Internal Watershed Initiative Projects (IWI)
- International Souris River Study Board Update (ISRSB)

G1.2.1 Public Meeting Review

Garland Erbele noted that the ISRB held a joint meeting with the ISRSB, facilitated by the Public Advisory Group, the night previous. There were a number of good presentations explaining the respective groups involvement in the Souris Basin. Most of the public's questions and concerns revolved around the technical aspects including the computer models. There was also a discussion over the management of the river system that was educational for everyone.

G1.2.2 Determination of Souris River Flows to May 31, 2019

ECCC presented the results of the natural flow computations. ECCC outlined their results of natural flows for the period ending May 31, 2019. The total diversion in the Souris Rivers basin was 31,378 dam^3 (25,449 acre-ft). Recorded flow at Sherwood was 29,234 dam^3 (23,710 acre-ft). The natural flow computed at Sherwood was 58,665 dam^3 (47,549 acre-ft). According to the computations, the US share at 40% was 23,470 dam^3 (19,035 acre-ft). The flow received by the U.S. was 32,173 dam^3 (26,093 acre-ft), which constitutes a surplus delivery of 8,703 dam^3 (7,058

acre-ft). The annual flow requirement/apportionment at Long Creek station was met with a surplus of 2,194 dam^3 (1,779 acre-ft).

ECCC also presented on their roles and responsibilities for the Souris River Apportionment. Using a network of 20 stream flow stations for estimating inflows and outflows to the reservoirs, 7 water level stations to estimate the change in storage, and 2 meteorological stations for estimating evaporation; the ECCC determines apportionment volumes using the standard procedures developed and approved by the ISRB in support of the 1959 Interim Measures. Data for Municipal and Minor project usage, and stream flow data is also provided by ECCC partners including the Water Security Agency (WSA), the United States Geological Survey (USGS) and Saskatchewan cities. The data is entered in the Natural Flow Spreadsheet, which is used to determine the natural flow and apportionment values. ECCC provides apportionment reports on May 31, August 31 and December 31. Interim natural flow calculations are used, when required, to guide the management of reservoir operations.

ECCC, in collaboration with the USGS, WSA and municipalities, is in the process of identifying methodologies to improve apportionment reporting. A transition from the spreadsheet to processing using a standard computer language is being considered, as well as using average water usages.

The Board discussed investigating the natural flow computations to determine if the dates and frequency of calculation was still applicable.

Action: The Hydrology Committee is to investigate the Natural Flow reporting dates and make recommendations for adapting them to provide more guidance based on existing basin conditions for quicker responses to apportionment needs.

Motion: John Fahlman motioned to accept the natural flow computations made by ECCC. Gregg Wiche seconded. Carried.

G1.2.3 Update from the Hydrology Committee

Ken Bottle mentioned that the Hydrology Committee held a meeting the night prior, before the public meeting. The Terms of Reference (TOR) for the Hydrology Committee was last reviewed in 2009. A review of the TOR is currently on hold, awaiting any potential changes brought about by the Plan of Study. The Hydrology Committee is considering adding a work task for the addition of supplemental language "to help coordinate and support the other ISRB committees in their tasks" in their TOR. The Hydrology Committee would also like to add a task of coordinating with the Study Board for the addition of the Apportionment Procedures to the POS. Ken Bottle noted that he has been the US Co-Chair for the previous four years and recommended that Darin Schepp be appointed the new US Co-Chair for the Hydrology Committee. It was anticipated that there will be membership changes on both the US and Canadian membership of the Hydrology Committee prior to the next ISRB meeting.

The Apportionment Procedures Manual (APM) for the Souris River is currently on hold until the Plan of Study (POS) is complete. Clarification on the status of the APM was suggested noting

the importance of having the toolset of the APM defined during the interim while the Study Board is still active. Ken Bottle noted that the APM could be modified based on the findings of the Study Board. It was also added that the recent work on the APM provides a description of the current steps being performed for determination of natural flow and apportionment. The APM also documents potential areas for improvement in the procedures that would require considerable investigation and hydrologic engineering.

Nicole Armstrong asked for a clarification regarding the Hydrology Committee's request concerning the addition of the APM to their workplan. Ken Bottle mentioned that the Committee was unaware of the procedure necessary to coordinate with the Study Board to have an apportionment component added to their technical work. Bruce Davidson responded that the IJC requested the Study Board add apportionment to the work being completed; the revised Workplan added a sub-task focusing on how the study contributes to apportionment. Bruce D. noted that it will be helpful for the Study Board to consult with the Hydrology Committee to ensure that the requirements are being met.

Action: The Hydrology Committee and Outreach and Communications Committee coordinate and determine the necessity of generating a Souris Basin Hydrology Infographic and generate an IWI Proposal if deemed necessary.

Motion: Mark Lee motioned to appoint Darin Schepp as the US Co-Chair for the Hydrology Committee. Frank Durbian seconded. Carried.

G1.2.4 Review of 2019 Hydrologic Conditions, Operations, and Hydrologic Forecasts

G1.2.4a Saskatchewan, Canada

WSA gave a presentation that included the review of the 2018-19 hydrological conditions, observed runoff, spring 2019 forecast evaluation, current conditions and the operating plans of the reservoirs in Saskatchewan for the remainder of 2019.

In 2018, fall moisture conditions in the basin were near normal at freeze-up, though subsurface deficits remained and wetland storages were low. According to the WSA manual point snow surveys in March 2019, the snowpack was near to slightly above normal in the basin.

Winter Drawdown – WSA initiated the drawdown at Grant Devine Dam on November 2, 2018 at the rate of 0.84 m^3/s (30 cfs) to bring the reservoirs down to their February 1st Normal Drawdown Level (NDL) over the winter months. Grant Devine Lake was 0.52 m above its NDL at that time. The NDL was achieved on January 18, 2019 and the outflow was terminated. No outflow was required at Rafferty as levels were below the February 1st NDL at freeze-up.
Spring Runoff Summary – A forecast was issued on February 15 with below normal runoff expected across the basin, signaling non-flood operations. There was no need for additional drawdown.

Runoff generally began early in the basin on the 15th of March, 2019. All inflows to Boundary, Rafferty and Grant Devine Dams were stored, and the Boundary to Rafferty Diversion works

were not used. None of the Canadian Reservoirs reached their full supply level. Given non-flood operations, and based on Sherwood natural flows, which were expected to be less than 50,000 dam^3, the apportionment was assessed to be a 50/50 split. Grant Devine Reservoir made a release of about 11,200 dam^3 (9,084 acre-ft) from April 1 to May 20 to provide 50 percent of apportionable flow to North Dakota prior to June 1.

As mentioned previously, the volume of natural flow at the Sherwood Crossing by May 31 ended up being above the 50,000 dam^3 (40,552 acre-ft) threshold, shifting the apportionment into a 60/40 split. This caused Saskatchewan to have delivered a surplus of approximately 2,535 dam^3 (2,056 acre-ft). The surplus was reported to be 8,703 dam^3 (7,058 acre-ft) under agenda item 5.

WSA reported that current precipitation maps indicated the April 5 to June 3, 2019 precipitation was well below normal across the basin, ranging from 60 to 80 percent of average.

2019 Reservoir Operation Plans – Jeff Woodward stated that based on the current dry conditions and the reservoirs in Canada being below Full Supply Level (FSL), summer releases due to rainfall runoff are unlikely. It is also unlikely that a drawdown operation to reach NDL ahead of February 1, 2020 will be necessary; Rafferty is already below NDL, and evaporation will likely take Grant Devine Reservoir below NDL. Any additional releases in 2019 will likely be related to meeting apportionment or water user requests.

G1.2.4b North Dakota, United States of America

The USGS presented a summary of 2018 flow conditions for the US portion of the basin. The total volume of flow past the Long Creek at the Noonan gage through May 31, 2019 calendar year was 7,900 acre-ft (9,7414 dam^3). This volume is about 53 percent of the median flow for the last 60 years. The peak discharge for the reporting period January 1 to May 31, 2019 is 470 ft^3/s (13.31 m^3/s) on March 25, which ranks 34th in 60 years of record.

The total volume of flow past the Souris River near Sherwood gage through May 31, 2019 calendar year was 23,700 acre-ft (29,222 dam^3). The total flow is 47 percent of the median flow for the last 89 years. The peak discharge for the period January 1 to May 31, 2019 was about 717 ft^3/s (20.31 m^3/s) on March 25, which ranks 57th in 89 years of record.

Flow recorded at the Souris River near the Westhope gage, through May 31, 2019 calendar year was 69,300 acre-ft (85,447 dam^3). The calendar year's total flow is about 60 percent of the median flow for the last 90 years. The peak discharge for the period January 1 to May 31, 2019 was 803 ft^3/s (22.74 m^3/s) on April 18, which ranks 52th in 90 years of record.

The USGS reported that they will be installing a new gaging station on the Broadway Bridge in Minot, ND, sometime in the next few months. This gage will be operated as a "real-time" gage, meaning instantaneous discharge readings will be available via the USGS website.

The United States National Weather Service (NWS) reported that the current conditions are dry in the ND portion of the basin. NWS forecast outlooks suggest that the conditions will not be changing in the near future.

The USFWS presented a summary of refuge operations and flows to May 31, 2019. The total provisional inflow measured at Sherwood for the first five months of the year was 23,733 acre-ft (29,263 dam^3). This was only 29 percent of the historic January-May inflow, which was 81,842 acre-ft (100,911 dam^3) for the period 1938 through 2019.

Total Upper Souris Refuge pool volume increased an estimated 8,310 acre-ft (10,246 dam^3) during the first five months. The total provisional outflow measured at Foxholm on the south end of the Upper Souris Refuge for the first five months of 2019 was 17,851 acre-ft (22,010 dam^3). This was only 26 percent of the historic record for the January-May outflow, which was 69,992 acre-ft (86,300 dam^3) for the period 1938-2019. Lake Darling elevation increased 0.786 ft (0.24 m) from 1596.05 ft (486.48 m) on January 1 to 1596.83 ft (486.71 m) on May 31. The lake elevation on June 1st 2019 was 1596.83 ft (486.71 m).

The total provisional flow measured from the Souris River to the J. Clark Salyer National Wildlife Refuge (NWR) from January 1 through May 31 was 52,435 acre-ft (64,652 dam^3). This was 49 percent of the historic January-May inflow, which was 106,334 acre-ft (131,110 dam^3) for the period of 1938-2019. Total Pool volume on May 31 was 40,737 acre-ft (50,229 dam^3). This was 7,954 acre-ft (9,807 dam^3) above the January 1 volume of 32,783 acre-ft (40,421 dam^3). Approximately 68,555 acre-ft (84,528 dam^3) was passed to Manitoba during the five-month period.

Lake Darling operations for the remainder of 2019 are planned to maintain an approximately 25 ft^3/s (0.71 m^3/s) release to sustain a "live flow" downstream and to accommodate water management needs at J. Clark Salyer NWR. A continued drop in reservoir elevation is expected throughout the summer because of extremely dry local conditions and zero inflows to the lake. J. Clark Salyer NWR operations for the remainder of 2019 include adjusting pool levels to maximize wildlife habitat quality and availability. Adjustments will be made to compensate for inflow conditions while meeting the 20 ft^3/s (0.57 m^3/s) required flow into Canada.

G1.2.4c Manitoba, Canada

Manitoba Sustainable Development (MSD) presented a summary of the hydrologic conditions for the Souris River in Manitoba. Antecedent moisture conditions were normal to below normal in Manitoba's portion of the basin. Snow accumulation had been below normal until later in the winter. February snow accumulation in North Dakota significantly raised the forecasted flood peaks. Flow entering Manitoba were maintained at approximately 0.3 m^3/s (10.6 ft^3/s) throughout the winter. A favorable drawn out snowmelt dissipated the risk for flooding on the main stem of the Souris River. The Souris River at Wawanesa peaked at 55.5 m^3/s (1,960 ft^3/s) on March 31st, which is considered to be a 1-in-2-year flow event, very close to the median for flood peaks on record.

The river steadily receded after the spring peak and over the last week has had consistent flow at the lower end of normal from recent rains. The Souris River at Wawanesa has a current flow of approximately 4.0 m^3/s (141 ft^3/s).

The Canadian Drought Monitor had classified the Manitoba portion of the basin as a moderate (D1) drought at the end of May, similar to conditions last year. There has been below normal to normal precipitation over the growing season, and May/June rains have been welcomed to the area with a desire for more. Manitoba Agriculture recently reported that farm water supplies are currently adequate but will need recharging to last the grazing season.

G1.2.5 Flow Forecasting Liaison Committee (FFLC) Update

Laura Diamond provided an update on the activities of the FFLC.

With the relatively complaisant spring for 2019, the FFLC has had minimal formal activity. Keeping with the terms of the Canada-US Agreement on Water Supply and Flood Control in the Souris River Basin, four forecasts were produced by the FFLC thus far in 2019 (February 1, February 15, March 1 and March 15). The runoff was underway by April 1, so no further forecasts were performed at that time, but a report was circulated to the group via email over concerns of the apportionment not being met. Those concerns led to a flow measurement being taken at Sherwood, in coordination with the WSA, ECCC and USGS, facilitated through the FFLC, to determine a better estimate of the flow volume that had already passed the gage through the observed period. The WSA used the estimation to determine necessary releases from Grant Devine Dam in order to eliminate the possible apportionment deficit. June 1 was the preferred date to make up that deficit by the partners on the North Dakota side.

Updates on WSA's operational plans are communicated through the FFLC via email. If Basin conditions make it necessary for the Committee to become more active, the FFLC will respond as defined by the FFLC Communications Plan.

There have been no changes to the FFLC membership since what was presented at the February meeting. The FFLC also does not have any scheduled tasks in their workplan due to their involvement with the POS.

G1.2.6 Aquatic Invasive Species in North Dakota

Jessica Howell of the North Dakota Game and Fish Department (NDGF) provided an overview of North Dakota's Aquatic Nuisance Species Program (ANS).

In 2018, there were no new ANS detected or established. NDGF focused on maintaining the desirable elements of their existing ANS program while revising their public outreach and overall management plan. They performed a record number of boater surveys and sampled 180 bodies of water for ANS.

The Aquatic Invasive Species Committee began an update to the State ANS Management Plan in 2017. The update went through two rounds of edits and was approved by the Committee in November of 2018 and signed by North Dakota Governor Burgum in December of the same year. The Committee keeps active by hosting two meetings annually and contributes efforts on a national scale while keeping up to date with research by attending regional and national conferences.

Education and outreach are large components of ND's effort towards the prevention of the spread of ANS. Advertisements and public notices through printed and digital media have been found to be a large factor in the determent of ANS transmission. The NDGF also performed 1,167 boater interactions to assess the public knowledge of ANS and to ensure that the information is getting released. Other prevention and control efforts consist of permitting weed harvesters, inspecting and certifying bait importers, equipment permitting, training and inspecting at fishing tournaments and constructing carp berms.

NDGF ANS Sampling and Monitoring program for 2018, in addition to the earlier mentioned 180 ND waterbodies sampled, consisted of 27 waterbodies; the USFWS fish hatcheries sampled specifically for early detection of Zebra mussels. The Bureau of Reclamation sampled four waterbodies and the USACE sampled 12 locations on Lake Sakakawea and on the Missouri River for Zebra mussels as well. Priority monthly sampling from May through September was performed in Lake Audubon, Lake Sakakawea, Lake Oahe and Lake Patterson as well. There is continual seasonal monthly monitoring of the Red River of the North Zebra mussel population at Fargo, Grand Forks and Drayton Dam to determine peak veliger densities.

In June of 2019, Zebra mussels were found and confirmed established in Lake Ashtabula on the Sheyenne River. Stakeholders and the public were notified, and future efforts will include additional sampling and securing fish hatchery production.

Two Silver carp were captured below LaMoure Dam on the James River, one male and one female. Based on their physical condition and estimated population, it was determined that there was a failed reproductive event and it is hoped that they will die off.

G1.2.7 Update from the Aquatic Ecosystem Health Committee (AEHC)

G1.2.7a Report on activities of the AEHC including USGS analyses update for ISRSB Performance Indicators

Heather Husband reported on the activities of AEHC in 2019.

The Committee had a conference call on January 17, 2018 to discuss data and the path forward for the next report. However, the work was suspended for development of the dissolved oxygen (DO) monitoring IWI project.

The DO monitoring proposal was submitted to the IJC last October and was approved for funding in December. The purpose of the project is to analyze DO data for diurnal and seasonal variations and to determine possible correlations to flow.

Continuous DO/temperature monitoring sensors were installed at three sites along the Souris/Mouse River; Sherwood, Minot and Westhope, ND. These sites were co-located with USGS gaging stations to provide discharge information for later analysis. These sites were selected to represent water leaving Saskatchewan, water modified by Lake Darling, and water entering Manitoba.

Joel Galloway (USGS) presented the first month and a half of provisional data that has been collected by the monitors. It was noted that even in the short amount of time, patterns are already beginning to emerge and there was a period of low flow that influenced the DO during that time. The real-time data is available at the USGS gage station sites.

Heather Husband then reported that, beginning in December, the AEHC assisted the ISRSB Resource Agency Advisory Group (RAAG) with the development of performance indicators for water quality that will go into the model to create alternatives for the POS. Data was compiled on a limited number of parameters for the Sherwood, Minot, and Westhope sites and was analyzed by the USGS's QWTrend model to look for possible relationships between the parameter concentration and flow, season, and time. Thirteen potential correlations were reduced to 5 or 6 through this process.

The work involving the RAAG has led the AEHC to determine that a basin wide trend analysis of water quality over time will be necessary to provide a deeper look into what is actually happening in the Basin. The AEHC is in the process of submitting an IWI Grant to facilitate this study and it is expected to be sent in the fall.

Work is still progressing on a Water Quality Index, but IWI proposals have taken priority.

G1.2.7b Report on changes to the current water quality monitoring plan

There were no changes.

G1.2.8 Compliance with Water Quality Objectives for 2019

G1.2.8a Report on data concerns and proposed changes to the AEHC section of the Annual Report

Heather Husband presented a summary of the water quality monitoring program for the Sherwood and Westhope sites:

The USGS collected eight regular water quality samples from the Souris River near Sherwood in 2018. However, one of the samples was lost in transit to the lab, so seven samples are used in the calculations. In addition, a joint sampling event with ECCC occurred at the Sherwood site in September.

Heather Husband stated it was interesting to note that a large portion of the parameters had their lowest concentrations for the April 25 samples and the highest concentrations for the September or October samples. Also, many of those below with exceedances to WQOs had lower minimum and maximum values than last year and pervious years, but higher median values. Only six parameters overall exceeded WQOs in 2018.

<u>Sherwood-USGS/ND Department of Environmental Quality (NDDOEQ)</u>

- ***Total Phosphorus*** exceeded the WQO of 0.10 mg/L for all samples in 2018. The Total Phosphorus concentrations at Sherwood ranged from 0.130 mg/L on January 4 to 0.390 mg/L on September 5.

- ***Sodium*** exceeded the WQO of 100 mg/L for 6 of 7 samples in 2018. The concentrations ranged from 59.7 mg/L on April 25 to 254 mg/L on October 2.

- ***Sulfate*** exceeded the WQO of 450 mg/L on 2 occasions in 2018. The minimum concentration was 160 mg/L on April 25 and the maximum concentration was 556 mg/L on September 5.

- ***Total Dissolved Solids*** exceeded the WQO of 1000 mg/L on 2 occasions in 2018. The highest concentration was 1260 mg/L on September 5, and the lowest concentration was 380 mg/L on April 25.

- ***Total Iron*** exceeded the WQO of 300 µg/L in 6 of 7 samples in 2018. Concentrations ranged from a minimum of 168 µg/L on January 4 to a maximum of 2120 µg/L on June 12.

- ***pH*** exceeded the upper WQO of 8.5 pH units twice in 2018, but only just over the objective. Maximum values of 8.6 occurred on September 5 and October 2. The minimum value of 7.60 occurred April 25.

- ***Dissolved Oxygen*** concentrations were above the minimum 5 mg/L WQO in all samples.

- ***E-coli*** values for 2018 ranged from less than 97 colony forming units/100 mL on September 5 to 230 colony forming units/100 mL on May 15. There were no exceedances of the single-sample objective of 400 colonies /100 mL. The geomean for April to September (5 months) was 168.46 CFU/100 mL, which is slightly above the seasonal geomean objective of 126 CFU/100 mL.

- ***Organics***

- Pesticide samples were collected six times by the ND Department of Agriculture on the Souris River at Sherwood May through October 2018. Atrazine was detected in all samples, but with reportable values in only four of six samples. The concentrations ranged in value from 0.0079 µg/L to 0.043 µg/L. 2,4-D was also detected in all samples, with reportable values in five of the six samples. Concentrations ranged from 0.009 µg/L to 0.27 µg/L. Bromoxynil and MCPA, detected in some samples (see Table 1). All detections were well below WQOs.

- Other pesticide detections, for parameters without WQOs, were also noted. A few just had detections, but not at concentrations that were above reportable limits. These included the list below, with parenthesis to indicate their uses:

- Diuron (unwanted vegetation, non-crops, forage crops)
- Fluroxypyr (multi use herbicide)
- Imazethapyr (soybeans)
- Propiconazole (fungicide)
- Saflufenacil (soybeans and corn)
- Pyrasulfotole (cereal crops)

- These pesticides were detected at reportable values, though still well below any concentration of concern:
  - Bentazon – six detections, used for beans and peas with specific instructions to not apply directly to water or wetlands.
  - Tebuconazole – four detections, used as a fungicide
- Tebuthiuron – five detections, used on non-cropland, right of ways, industrial sites, and to kill woody vegetation
  - In addition to the Atrazine mentioned above, several of the metabolites of Atrazine were also detected. It is important to monitor these as they can persist for longer in the water. These included Deethyl Atrazine, Deisopropyl Atrazine, and Hydroxy Atrazine.
  - No neonicotinoids were detected at this site

<u>Westhope –ECCC</u>

ECCC collected eight (8) regular water quality samples from the Souris River near Westhope in 2018. In addtion, a joint sampling event with the USGS occurred at the Sherwood site in September.

- ***Total Phosphorus*** exceeded the WQO of 0.10 mg/L for all samples in 2018. The Total Phosphorus values at Westhope ranged from 1.070 mg/L on April 10 to 0.251 mg/L on June 8.
- ***Sodium*** exceeded the WQO of 100 mg/L for all samples in 2018. The results ranged from 115 mg/L on June 8 to 693 mg/L on February 20.
- ***Sulphate*** exceeded the WQO of 450 mg/L on 4 occasions in 2018. The minimum value was 326 mg/L on April 12 and the maximum concentration was 1880 mg/L on February 20.

- ***Total Dissolved Solids*** exceeded the WQO of 1000 mg/L four times in 2018. The highest value, 3638 mg/L occurred on January 10, and the lowest value was 783 mg/L on July 5.

- ***Total Iron*** exceeded the WQO of 300 µg/L in all 8 samples in 2018. Concentrations ranged from a minimum of 620 mg/L on May 1 to a maximum of 5490 µg/L on January 10.

- ***pH*** exceeded the upper WQO of 8.5 pH units three times in 2018. The maximum value of 9.06 occurred on September 5. The minimum value of 7.60 occurred twice, on January 10 and April 10. There were no exceedances of the lower objective of pH 6.5.

- ***Dissolved Oxygen*** concentrations were below the minimum 5 mg/L WQO in two samples, January 10 and February 20, 2018.

- ***Fecal coliform*** values for 2018 ranged from less than 2 on April 10, to 190 on September 5. The WQO of 200 colonies/100 mL in one sample was not exceeded.

- ***E-coli*** values for 2018 ranged from less than 2 on April 10 to 140 colonies per 100 mL on September 5. There were no exceedances of the single-sample objective of 400 colonies/100 mL. The geomean for April to September (5 months) was 19.99. This was well below the geomean objective of 126.

- ***Chloride*** exceeded the WQO of 100 mg/L twice in 2018, on January 10 and February 20. The maximum value of 163 mg/L occurred on February 20th, and the minimum of 30.1 on June 8.

- ***Total Boron*** exceeded the WQO of 0.50 mg/L once in 2018, with a maximum value of 532 µg/L on February 20. The minimum value of 146 occurred on May 1.

- ***Organics***
  - Pesticide samples were collected on the Souris River at Westhope in the April through September sampling events for 2018. 2,4-D and Atrazine were detected in all samples. Bromoxynil, Dicamba, MCPA, and Picloram were detected in some samples.
  - No pesticide variables exceeded their objectives.
  - Neonicotinoid testing will begin in 2019 with 13 different strains being tested

G1.2.8b Report Atrazine information

As of 2014, Atrazine was the second most widely used herbicide in the US, with 76 million pounds applied each year. The most commonly detected pesticide was Atrazine in the 2014-16 ND Department of Agriculture pesticides report.

Atrazine is widely used for the control of broadleaf and grassy weeds in corn, sorghum, rangeland, sugarcane, macadamia orchards, pineapple, turf grass, asparagus, grass crops and roses. Corn sorghum and certain other plants are not susceptible; they absorb and metabolize Atrazine without its toxic effects.

Atrazine degrades slowly and has a half-life of two or more years. Breakdown is negligible in neutral or somewhat alkaline waters. Atrazine is moderately long-lived in temperate climate soils. It persists for up to a full season under average field conditions and even longer under some circumstances.

Atrazine continues to be found in a high percentage of samples, explainable by large-scale use and chemical properties. Use has also likely increased due to an increase in glyphosate resistant weeds. On the USGS Pesticide National Synthesis Project estimated annual agricultural pesticide use map for 2016, the estimated use of Atrazine in the US portion of the Souris Basin was less than 3.14 pounds per square mile.

Atrazine was banned in the European Union (EU) in 2004 due to health concerns and persistent contamination of groundwater. It was considered to be a Priority A chemical for potential groundwater contamination by the US Environmental Protection Agency (EPA) and was ranked highest of 83 pesticides in the Agriculture Canada priority scheme for potential groundwater contaminants.

Atrazine does not appear to bioaccumulate to any great degree in the food chain. Health effects of Atrazine may include endocrine-disruption, manifesting as demasculinization and hermaphrodism in frogs, and possible effects on human growth and reproduction. There is little information about the potential for any link between Atrazine and Cancer.

The current WQO for Atrazine in the Souris River is 2 µg/L. Atrazine has been detectable in 64 percent of samples at the Sherwood site and in 69 percent of samples at the Westhope site up to 2018. No exceedances of the WQO have been detected in historic or recent water quality sampling.

G1.2.8c Report on Neonicotinoid information

Neonicotinoids are neuro-active insecticides chemically similar to nicotine. Imidacloprid is the most widely used insecticide in the world. The second most common neonicotinoid in the Souris River basin is clothianidin.

Compared to organophosphate and carbamate insecticides, neonicotinoids cause less toxicity in birds and mammals than insects. Some breakdown products are also toxic to insects.

Neonicotinoids are highly water-soluble, persistent in the environment and systemic (the pesticides migrate into all parts of the treated plant).

Neonicotinoid use has been linked in a range of studies to adverse ecological effects that include bee deaths and loss of birds due to a reduction in insect populations. In 2013 the EU and a few non-EU countries restricted the use of certain neonicotinoids, and in 2018 the EU banned the three main neonicotinoids; Clothianidin, Imidacloprid and Thiamethoxam, for all outdoor uses. Several states in the US have also restricted the usage of neonicotinoids out of concern for pollinators and bees.

On the USGS Pesticide National Synthesis Project estimated annual agricultural pesticide use map for 2016, there was no estimated use of Imidacloprid in the Souris Basin. The ND Department of Agriculture pesticide monitoring program began analyzing for Imidacloprid in 2008 and 2009. Clothianidin was added in 2013 and since 2013, Clothianidin, Imidacloprid and Thiamethoxam have been regular analytes in the monitoring program.

Compared to Atrazine and 2,4-D, neonicotinoids were not frequently detected, only once in the last five years. Any detections were at very low levels. The EPA has recently lowered the aquatic life benchmark for all neonicotinoids because of recent research on Clothianidin and Imidacloprid. Clothianidin changed from 1.1ppb to 0.05ppb and Imidacloprid changed from 1.05ppb to 0.01ppb.

The Sherwood site began including Neonicotinoids as analytes in sampling for the 2019 sampling year. The Westhope site will begin monitoring for 13 neonicotinoids also in the 2019 sampling year.

G1.2.9 Update on the Communications and Outreach Committee (COC)

Russell Boals reported that the Committee membership has not yet been formalized as most of the proposed members are active with the POS, Public Advisory Group (PAG) and RAAG. The formalization is expected to occur once those activities are concluded.

The IJC website has updated, creating micro-sites for each river board. Russell Boals and the Co-Secretaries have participated in training on how to maintain the Souris Board micro-site in July and have access to the micro-site. If any of the Board or Committee members go to the site and see areas that need to be updated or information that needs to be added, pass those requests to the Co-Secretaries.

The Committee has also been participating directly with the POS in the creation of communication items such as a fact sheet on the understanding of the Agreement and a number of fact sheets related to the Souris Board. They also have been involved in the creation of public announcements and notifications.

The COC has been discussing the infographics for the Hydrology Committee and is coordinating with the POS in order to build upon the effort that has already been made. The COC plans to

work with the IJC's communications section for the development of the infographics. The final product could be generated through the Study Board or an IWI Proposal.

G1.2.10 Update on Water Management Projects

G1.2.10a Update on Northwest Area Water Supply Project (NAWS)

NDSWC reported that the DC Appellate ruled in North Dakota's favor on May 3, 2019.

An internal 30 percent design review of the Biota Water Treatment Plant Design was held in March and a Value Engineering Workshop was held in June. The project should be ready to bid early next year.

Work is currently underway for constructing a new primary treatment building in Minot, ND to replace the aging softening basins, chemical storage and the feed systems. A new lab and IT facilities are also currently being constructed.

Other components of the project are in various stages; distribution pipeline construction is progressing and the design for the Snake Creek Pumping Plant modifications has begun. Nicole Armstrong added that Manitoba was included in the Adaptive Management Team for the NAWS Project moving forward. The first meeting for that team is scheduled to occur late August or early September of this year.

G1.2.10b United States and Canadian Dam Safety Work

Jeff Woodward provided a review of the completed Hatch Engineering Study that revised the Probable Maximum Flood (PMF) and its implications on the development of reservoir operating plans for Rafferty and Grant Devine Dams. The 2011 flood resulted from summer rains and as a result caused the WSA to re-visit the PMF design of both Rafferty and Grant Devine spillways. The end result was the production of draft Operating Plans that shift the emphasis from winter to summer events, which cause some potential deviations from the Agreement.

Communications were then initiated with the US in order to find a path forward, which is complicated by the POS. The approach is to use the POS to investigate alternatives that may handle the summer rainfall events, but there is still a need for the individual dam operators to discuss dam safety. The Operating Plans cannot be finalized without having discussions with the US, and dam safety has become a topic of interest.

Michael Bart (USACE) reports that the USACE has been in discussions with the WSA on the topic of dam safety for more than a couple of years. There is an unusual agency situation with the operation and project funding for Lake Darling between the USFWS and the USACE. The USACE recently began researching, analyzing and modeling an updated inflow design flood (IDF) and PMF for Lake Darling. The target date to have some preliminary results is early 2020. It was noted that Lake Darling was only designed to pass 70 percent of the PMF and not its entirety, because the incremental damage past that point is already at its maximum.

The potential deviations from the Agreement caused by the draft Operating Plans are in preliminary discussions, and the potential ramifications are yet to be determined. The Board will be involved when solutions are developed and the implications the findings of the Hatch Engineering studies have for Lake Darling.

Col. Samuel Calkins notes that this is one situation where the role of the IJC is critical in having established communications and coordination between the committees instead of having to take on an issue like this between newly formed groups. He asked if all of the right people are being involved with this issue or if there are any others that should be considered.

Michael Bart responded that discussions have been initiated between the IJC, USACE, the USFWS and others to determine who the right people are that need to be involved and that, through the course of this continuing discussion, the proper individuals will be identified. The issue is a legal and technical one.

Col. Samuel Calkins asked if the technology and methods used to derive the PMF and design flows have changed in the past 30 years or if the 2011 flood was so unexpected that it wasn't considered by the engineers when they were doing the calculations in 1989.

Michael Bart answered that 2011 was one data point, but there was also a significant rain event in 2014 in Manitoba. These events have warranted consideration and if site specific IDF's are more appropriate for Lake Darling, as it was for the Canadian Dams.

Jeff Woodward added that the procedures used to derive the PMF and design flows have changed with time and with the additional data collected, since when the original PMF was derived, have significantly increased the PMF. There is also a different approach to the risk management of the reservoirs that needs to be considered. The actual design flows didn't change that drastically, but they did highlight shortcomings in the designs.

Garland Erbele noted that the ND State Water Commission is currently re-evaluating the PMF for the State of North Dakota, which may provide some fresh data points for the topic. This study had its kickoff meeting in May and has a timeline of 2 years.

Garland Erbele then asked if the design standards between Canada and the United States are similar or if there are differences.

Michael Bart answered that it is unknown at this point and there could be issues.

G1.2.10c Other planned developments

WSA mentioned that Nickle Lake had water supply issues the year prior and since then has been resolved.

The City of Estevan is planning on changing its water supply from Boundary Reservoir to Rafferty Reservoir. It is a better supply in both quality and quantity.

The Canadian Federal Government's desire to phase out Coal Power Production by 2030 will have an effect on both Boundary and Rafferty Reservoirs, but the results of an ongoing carbon sequestration project may offset the phasing out of these plants by the 2030 deadline. In 2021 and 2024, Sask Power will be decommissioning two of its power plants; however, this action will not have any significant changes to water allocation.

Dan Jonasson provided a quick update on the Enhanced Mouse River Flood Protection Project. The first three phases in Minot, ND, are making progress, Phase II and III should be completed this fall. Phase I is projected to be completed next year. Work is continuing on advancing the design of other phases.

ND Legislature allocated $82.5 million in the next biennium to keep the project moving forward throughout the basin. In Burlington, ND, there is a bridge replacement project underway and bids are expected by the fall for the flood protection portion.

G1.2.11 International Watershed Initiative Projects (IWI)

Mark Gabriel reported that the IWI three-year Dissolved Oxygen monitoring project started last May. The aim of the project is to determine how flow effects DO levels in the river.

There is a second project in the process of being submitted to the IWI that is proposing to study water quality trends over time in a larger scale across the basin. There is a similar study currently underway for the International Red River Board. This proposal will most likely be submitted in the fall.

The Board is encouraged to submit more IWI proposals.

Re-appointments of Board members is also necessary and with the new IJC Commissioners this is now possible. Board members may be asked to submit updated biographies and other information for the process.

Wayne Jenkinson mentioned that the dates between October 21 through to the 26 have been scheduled for the Semi-Annual Meeting in Ottawa, CA.

The IWI Project Report is due in 2020. Opinions of the Boards on how the IWI project is going, successes and challenges, will be necessary for the report. The Co-chairs will be contacted to provide information.

Randi Morri is leaving the IJC.

Canadian liaisons for the IJC will be changing for the boards.
Wayne Jenkinson also mentioned that when the ISRSB has completed its tasks there will be a number of items that will be handed off to the ISRB. While it is important that the Board continue on with the work done by the ISRSB, emphasis is placed on continuing the engagement

with indigenous communities including First Nations, Metis and Tribes and keeping them involved with the work of the Board.

Mark Gabriel suggested that a sub-committee focused on Indigenous Engagement may be a successful path forward in retaining the ISRSB's work on establishing those communications.

G1.2.12 International Souris River Study Board (ISRSB)

G1.2.12a Update from the 1989 Agreement Core Committee

Rebecca Seal-Soileau provided a refresher to the Board about Annex A and B that provide the outline for how the reservoirs are to be operated for both flood and drought conditions. Over time it has been determined that some of the language in the Annexes is outdated and confusing. Meetings of the Core Committee has been delayed due to personnel changes and basin conditions in some area. Ken Bottle is taking over the group from Liz Nelson. The Committee plans to meet in the next month to review the latest round of revisions in order to be able to present a draft to the Board in November.

John Fahlman added that considerations had been made to update the language of the Annexes prior to the beginning of the Plan of Study. It was found that some of the language contained too much ambiguity and determined that work needed to be done on the document while some of the original witnesses to its creation were still present to maintain the original intent of the document.

Action: The Core Committee is to present the latest draft of Annex A to the Board prior to the next meeting**.**

G1.2.12b International Souris River Study Board (ISRSB) Progress Update

Michael Bart and Al Pietroniro provided a presentation on the Souris River Plan of Study. The primary study objectives are to review the operating rules in the 1989 Agreement, including Annex A and B, build a model of the reservoir system, and model alternatives with considerations towards input from stakeholders; PAG, RAAG and the Study Board.
The study team is taking a phased approach to the alternative modeling. Currently the Study Board is in Phase 3 of the 5.

- Phase 1 – Stakeholder engagement and brainstorming flow scenarios
- Phase 2 – Single variable screening (HEC-ResSim)
- Phase 3 – Sensitivity analyses of fundamental variables (HEC-ResSim, Stochastic)
- Phase 4 – Creating/refining alternatives (HEC-ResSim, Stochastic)
- Phase 5 – Detailed evaluation (HEC-ResSim, Stochastic, Climate Change, HEC-RAS)

A model of the river beginning at the Canadian Reservoirs and ending at Westhope, ND was developed using HEC-Reservoir System Simulation (HEC-ResSim). The operating rules from the 1989 Agreement for the Canadian reservoirs were established, and any other real-world operations or constraints, then applied to the entire period of record from 1930 to 2017. The

modeling includes Grant Devine Lake, Boundary Reservoir, Rafferty Reservoir, the Boundary-Rafferty diversion and pipeline, Lake Darling, the Eaton Irrigation Project and J. Clark Salyer National Wildlife Refuge.

The model outputs included daily reservoir elevation time series and daily flow time series at control points. *R* scripts are then used to score those model outputs using Performance Indicators (PIs).

The ISRSB then held various forms of public engagement in Manitoba, Saskatchewan and North Dakota: Meetings and engagement with Tribes, First Nations and Metis; public meetings in February and June of 2018, and February and June of 2019; PAG/RAAG webinars in January and March of 2019; PAG/RAAG workshops in June 2018, March, April and a future one in July of 2019. There was also a public questionnaire sent out.

The PAG/RAAG workshops gathered input on the PIs and Flow Alternatives to investigate various scenarios. Those alternatives were ranked and a selection criterion was offered. Some of the Stakeholders' concerns included a desire for flexibility and adaptive management in reservoir operations, improved communications between operators and the general public, continued engagement between decision makers and stakeholders, continued engagement with Tribes, First Nations and Metis, water quality, the impacts of Climate Change, and the impacts of artificial drainage.

Evaluation tools were developed in close coordination with the RAAG using input from the PAG. The tools were established on the relationship between river flow or reservoir elevation and its categorical impacts to people or the environment. The resulting PIs that were developed are based on eight study themes: Flood Control, Water Supply, Agriculture, Environmental, Erosion, Recreation, Cultural, and Water Quality.

There are an additional 13 subjects to the 21 river reaches that received the standardized methodology for assessment using PIs. Attempts were made to make them as quantitative as possible, but the data is limited for some of the themes that needs to be considered in their use to evaluate alternatives. It was also noted that additional input and considerations will most likely be provided as the study moves forward. The alternative evaluation is presented as a normalized PI value on a baseline, indicating a positive or negative effect on different areas of concern based on that individual alternative.

The ISRSB has asked the Board to consider what legacy models and outcomes from the project will be carried forward by the ISRB (e.g.: forecasting, modeling, First Nations engagement, etc.). Tools that have been developed that can be used for future studies include: reconstructed hydrology dataset, stochastic hydrology dataset, climate changed hydrology dataset, PIs, HEC-ResSim model, MESH model and HEC-RAS model. Additional reports that may be of use are a forecasting review and an artificial drainage review.

The Study Board also gave the ISRB some post study considerations to deliberate:

- First Nation engagement after the Study

- Will the forecasting review task activities impact the FFLC
- Does the dam safety analysis impact the Study Board's work
- How will the water quality review impact the AEHC
- What will the ISRB receive from the Study Board as an outcome of the Climate Change analysis
- Will there be data monitoring programs to fill in data gaps for future analysis
- Will modeling tools become long-term resources for the ISRB
- How will adaptive management recommendations impact the ISRB's activities (and do they)
- What is the schedule for involvement for the ISRB in the review process

The Study will soon be entering Phase 4 and will have a strong indication of what the recommendations will be. It is necessary for the ISRB to be involved in the review process prior to the Study Board entering Phase 5. It is expected that the end of Phase 4 will occur towards the end of 2019.

The Study Board recommended that the ISRB hold a meeting in November of 2019 to discuss the post study considerations mentioned above, and the indications provided by Phase 4, so that they may provide input to the Study Board prior to entering Phase 5.

Commissioner Jane Corwin mentioned how critical it is for the Board to be as engaged as possible with the study. Any recommendations that are implemented that may have impact on an entity or individual will result in them coming back to the Board with questions and concerns regarding why those decisions were made. The more considerations made by the Board towards all of the interests of the basin during this development phase will greatly reduce the potential of any stakeholders being left out of the process and concerns that their best interests were not being met.

Action: The ISRB to hold a Board Joint Meeting November 13-14, 2019, in Regina, SK**.**

APPENDIX H - Work Plan

International Souris River Board
Work Plan 2019

Result 1: Oversee the implementation of compliance with the 2000 Interim Measures for Apportionment of the Souris River as modified

Goals	Lead	Activities
Compliance with the Interim Measures as Modified.	Canadian and US monitoring agencies Board Members	Monitor and approve apportionment for the Souris River basin in accordance with 2000 Interim Measures as Modified.
	Hydrology Committee	Develop a simple procedures manual for the computation of natural flows and the determination of apportionment. Develop a supplemental document containing the details and history of the Hydrology Committee and the development of the apportionment determinations.

Result 2: Perform an oversight function for flood operation

Goals	Lead	Activities
Effective and cooperative flow forecasting and flood operations.	Flow Forecasting Liaison Committee	Facilitate information sharing for flow forecasting and approve official forecasted runoff in the Souris River basin for flood/non-flood decision. Maintain a watch on low flow conditions during 2019.

Result 3: Assist the Commission with the Joint Water Quality Monitoring Program and report on aquatic ecosystem health issues in the watershed

Goals	Lead	Activities
Oversee a Joint Water Quality Monitoring Program	Aquatic Ecosystem Health Committee	Complete a review of the joint water quality monitoring program with a focus on reporting and recommend adjustments to the program (ongoing).
Identify aquatic ecosystem health issues in the watershed	Aquatic Ecosystem Health Committee	Implement an IWI project for an investigation of dissolved oxygen concentrations in the Souris River including the placement of continuous dissolved oxygen/temperature sensors at Sherwood. Identify ecosystem health related information to add to the annual report (for example, aquatic nuisance species). Develop a proposal for reviewing and updating water quality objectives at the Saskatchewan/North Dakota and North Dakota/Manitoba borders starting with an assessment of trends in water quality.

Result 4: Provide opportunities for the public to be involved in the work of the board

Goals	Lead	Activities
Increase awareness of the Board, its role, and communicate issues and successes with the public.	Canadian and US Co-secretaries, Canadian and US Chairs	Host one annual public meeting in the basin to present an overview of the Board's role and activities and to consult with the public and stakeholders in the basin. Attend and report on Board activities to IJC at its semi-annual meetings in April and October, as required. Communicate on-going apportionment and critical conditions to the IJC and the public, as required.
	Communications and Outreach Committee	Develop a communication strategy for the ISRB. Prepare plain language fact sheets and infographics to promote and increase awareness of the role and responsibilities of the Board. Support the Board with organizing the 2019 annual public meeting. Review and update of the Board's information hosted on the IJC's web on a regular frequency (once every two months).

Result 5: Maintain an awareness of existing and proposed developments, and carry out other studies or activities the Commission may request

Goals	Lead	Activities
Prevent and resolve transboundary concerns in the basin	Board Members	Report on existing and proposed developments, conditions, activities, and issues in the basin at the board's semi-annual meetings.
	Canadian and US Co-chairs and co-secretaries Board Members (especially those co-appointed to the International Souris River Study Board)	Share information regarding the implementation of the Plan of Study with the ISRB board members and facilitate collaboration between the two boards
Effective and cooperative management of the Board functions	Canadian and US co-secretaries	Prepare meeting Minutes within three weeks of the meeting. Prepare an annual report for 2018 by October 2019