SASKATCHEWAN

Water Security Agency

# Water Supply Conditions and Outlook

## Based on Conditions as of October 1, 2023

Prepared by: Flow Forecasting & Operations Planning - Water Security Agency

## Overview

Precipitation received in September was generally well below normal across the province with most areas only receiving 20 to 40 per cent of normal accumulations. The exception was upper portions of the Churchill River Basin and the Hudson Bay area where accumulations were near normal.

Soil moisture conditions across the province are generally drier than normal for early October. Topsoil moisture shortages are most pronounced across the western and south-central portion of the grain belt where severe to extreme agricultural drought conditions are prevalent. Across most of the province, wetland areas are dry or at low levels and subsoil moisture deficits remain. Should dry conditions persist through the fall, low moisture conditions would reduce snowmelt runoff potential in spring 2024. This could result in some surface water supply concerns in 2024 unless the snowpack is above normal.

Fall operations are underway within the Qu'Appelle River Basin, including a temporary shutdown of flows between the Qu'Appelle River Dam and Buffalo Pound Lake to facilitate some in-channel construction work.

With the hot and dry weather experienced over the summer, water levels on the reservoirs in the Souris River Basin have been slowly declining; however, with the above normal runoff in the spring, all major lakes and reservoirs in the Souris River Basin remain at or above normal levels for this time of year. The release at Grant Devine Dam will be terminated in late fall or early winter while the release at Rafferty Dam will be increased in late fall to ensure the February 1 drawdown requirement for flood control is achieved.

Even with the dry summer and early fall, most lakes and major reservoirs across the province are at or near the normal levels for this time of year due to the runoff received this spring. The exception is Lake Diefenbaker and the Bigstick Basin where Harris and McDougald reservoirs are low.

Lake Diefenbaker water levels have generally been declining all summer and are currently the fifth lowest level on record. This water level is approximately 3 metres below median for this time of year. Currently, outflows from Lake Diefenbaker are being minimized due to the low water level. Winter outflows from Lake Diefenbaker at Gardiner Dam are expected to be amongst the lowest observed since the construction of the dam.

Most long-range forecasts are currently predicting near normal precipitation across the province for the next three months. These models are also predicting warmer than normal temperatures across the entire province for the same period.

Cover Photo: Ballantyne River above Ballantyne Bay, Sept. 27, 2023
Credit: Dylan McDonald, Water Security Agency

## Precipitation Summary

**Summary:**

- **Precipitation in September was variable and generally less than historical norms.**
- **Growing season precipitation for much of Saskatchewan was 60 to 80 per cent of normal.**
- **Only central areas of the province received near normal precipitation during the growing season.**

Figure 1 shows precipitation accumulations received in September, while Figure 2 illustrates how these amounts compare to the normal levels. These maps reveal variations in rainfall across the province during the month. Most of the province received below-normal precipitation, ranging from 40 to 60 per cent of normal. The exceptions were western portions of the Churchill River Basin, near Meadow Lake, the western portions of the Missouri and Old Wives Lake basins, and upper portions of the Swift Current Creek Basin, where near-normal accumulations were observed.

Figure 3 shows per cent of normal precipitation received throughout the growing season (April 1 to September 30). The figure indicates that most of Saskatchewan only received 60 to 80 per cent of normal precipitation during this period. The exception were western portions of the Churchill River Basin, including Cold Lake and Meadow Lake, and the area around Hudson Bay, where near-normal precipitation was observed.

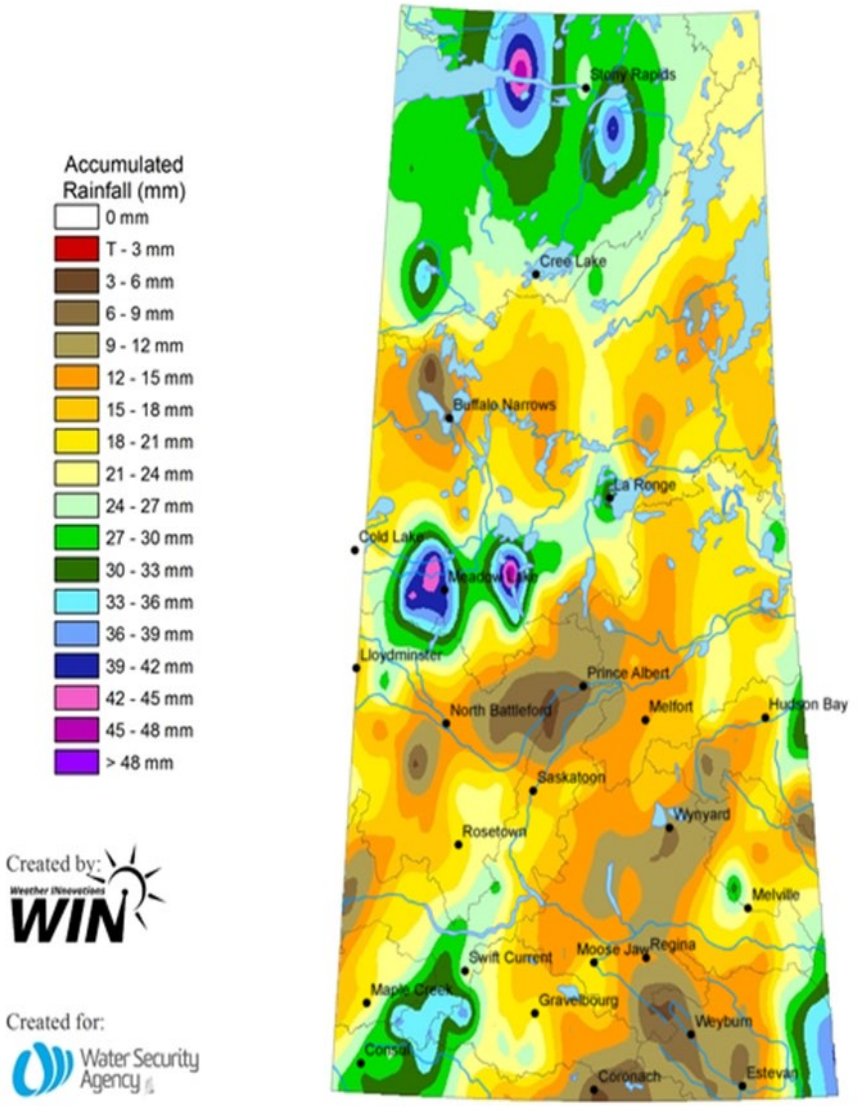


Figure 1: Accumulated Precipitation
September 1 to 30, 2023

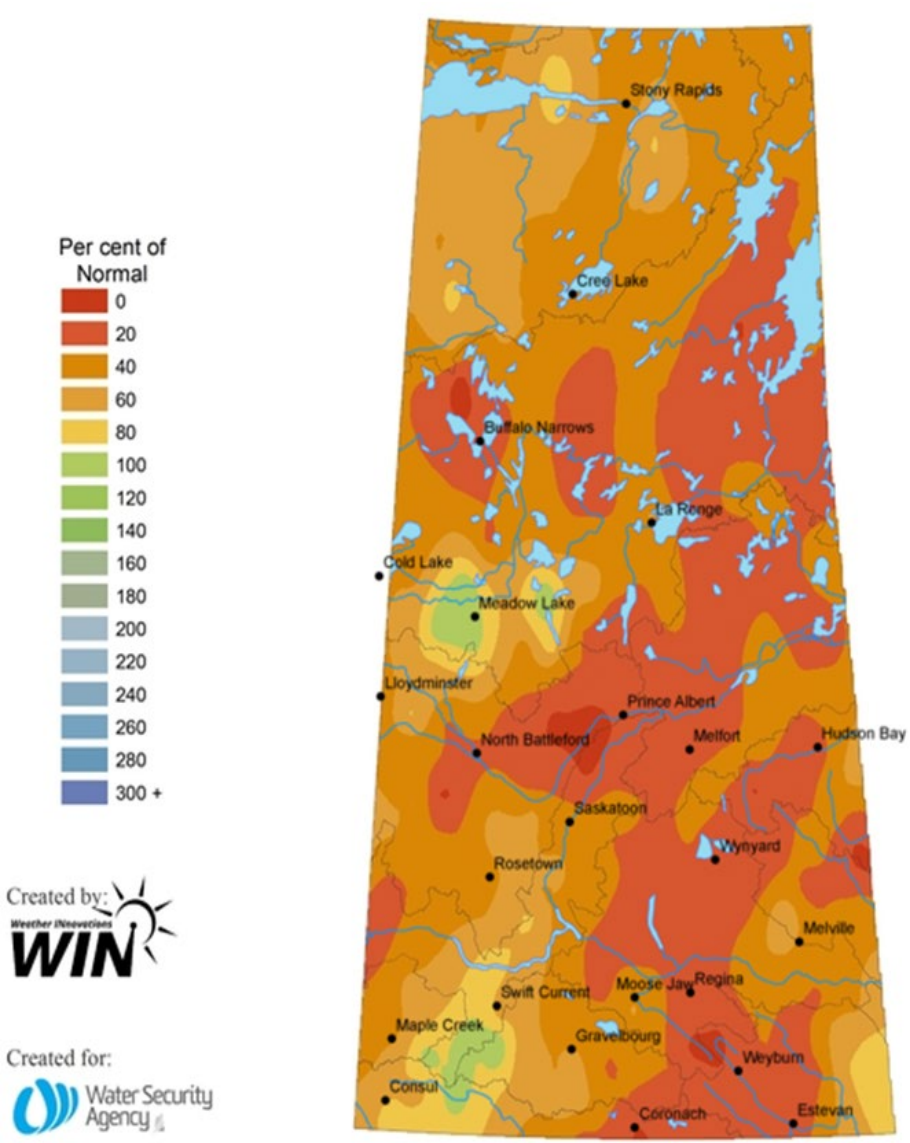


Figure 2: Per Cent of Normal Precipitation
September 1 to 30, 2023

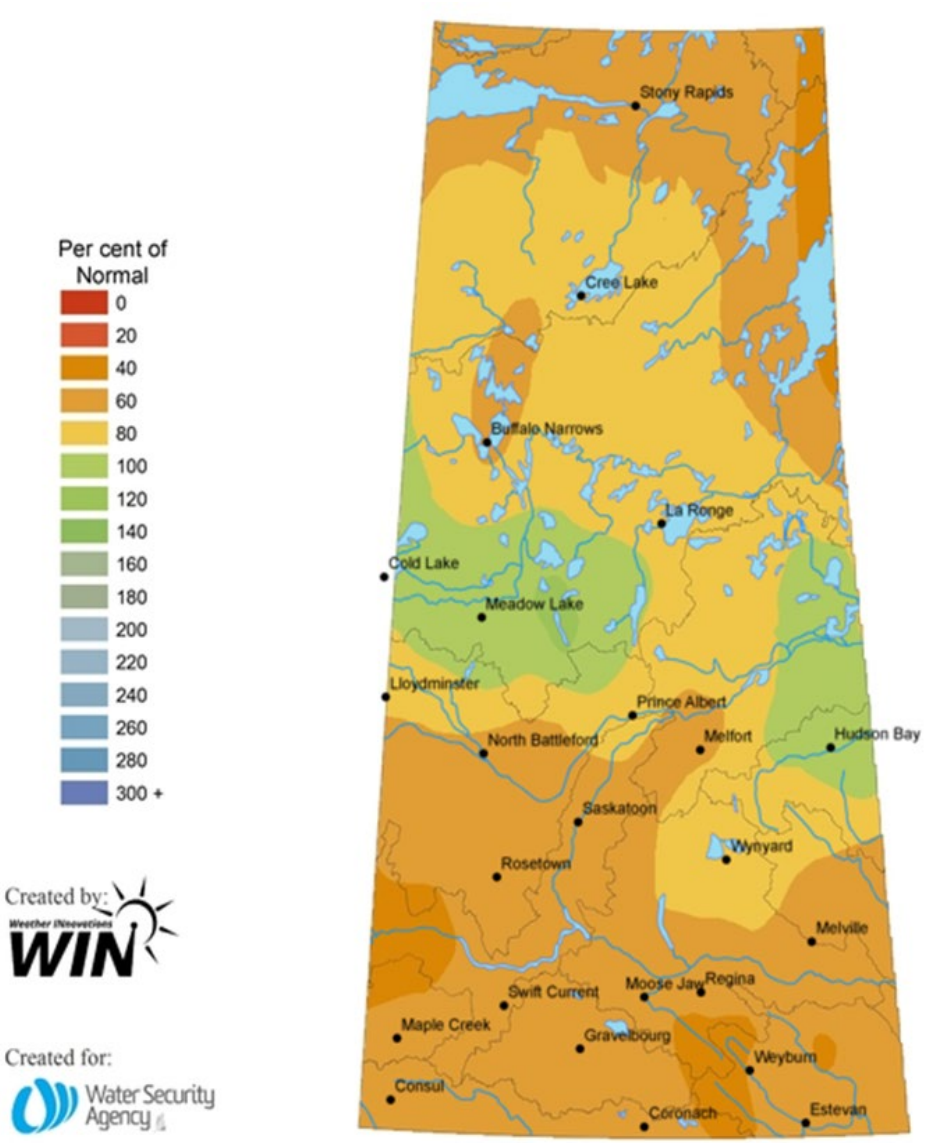


Figure 3: Per Cent of Normal Precipitation
April 1 to September 30, 2023

# Soil Moisture Conditions

**Summary:**

- **Topsoil moisture conditions are short to very short across much of the agricultural region.**
- **Evaluation of agricultural drought conditions suggests static conditions over southern Saskatchewan and deteriorating conditions over the north.**

Figure 4 shows the topsoil moisture conditions for croplands as of October 2, 2023. Topsoil moisture conditions are being reported as short across most of the agricultural regions of the province. Exceptions include northern regions spanning from Prince Albert to Hudson Bay, as well as pockets near Meadow Lake, North Battleford, Elbow, Regina, Indian Head, Estevan and Broadview, where topsoil conditions are reported as adequate.

The Canadian Drought Monitor assessment as of August 31 (depicted in Figure 5) indicates that exceptional agricultural drought is persisting over southern Alberta. Conditions have remained relatively unchanged across Saskatchewan other than northern Saskatchewan where conditions have deteriorated and now classified as experiencing moderate drought conditions.

Should dry conditions persist into freeze-up, low soil moisture may promote additional infiltration of meltwater in spring 2024 and reduce runoff yields.

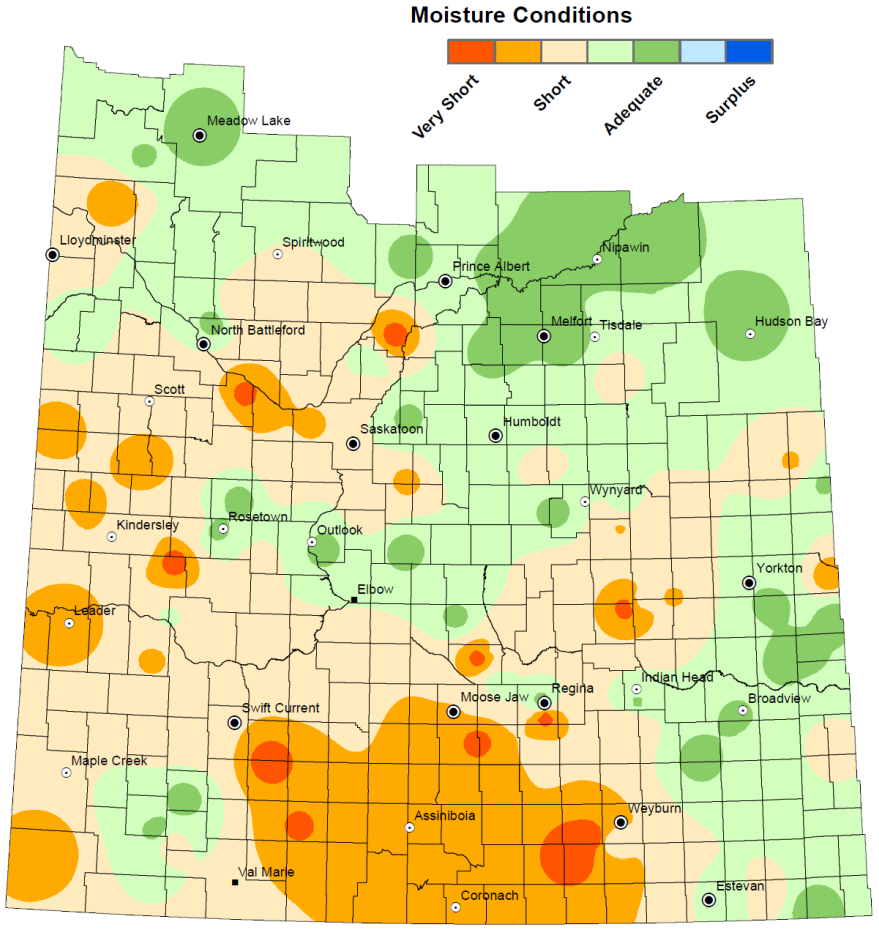


Figure 4: Cropland Topsoil Moisture Conditions as of October 2, 2023
(Map courtesy of Saskatchewan Ministry of Agriculture)

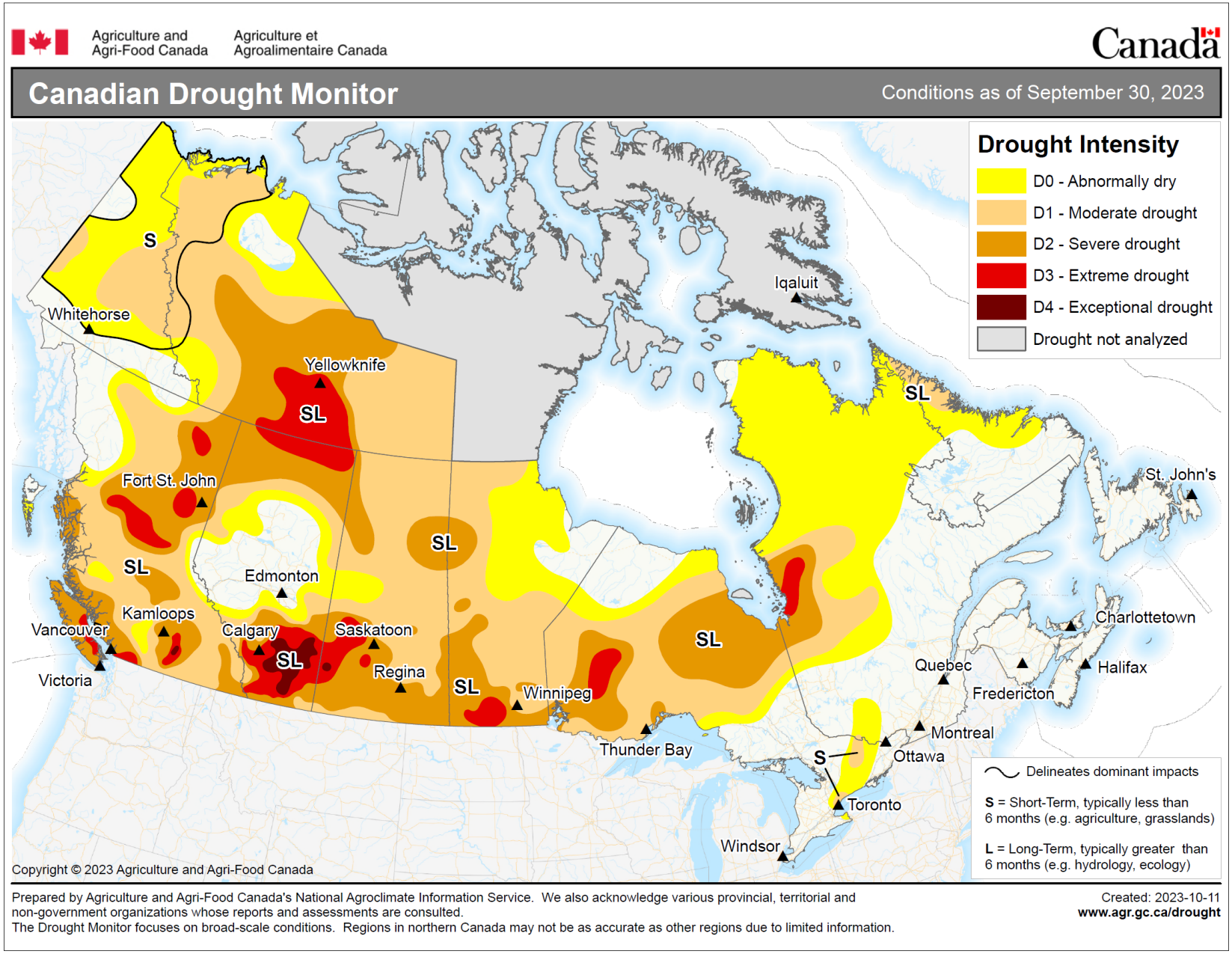


Figure 5: Canadian Drought Monitor – August 31, 2023
(Map courtesy of Agriculture and Agri-Food Canada)

# Long-Range Forecasts

**Summary:**

- **Seasonal forecasts indicate a likelihood of near-normal precipitation and above-average temperatures across the province through the fall and early winter.**

Most long-range forecasts are currently predicting near normal precipitation across the province from October 1 to December 31, 2023. These models are also forecasting warmer than normal temperatures (up to 2°C above average) across the entire province during this period. Figures 6 and 7 display multi-model ensemble maps for precipitation and temperature for this three-month period, representing the average results of seven seasonal weather forecasts, respectively. It is important to keep in mind that seasonal weather forecasts are statistically unreliable.

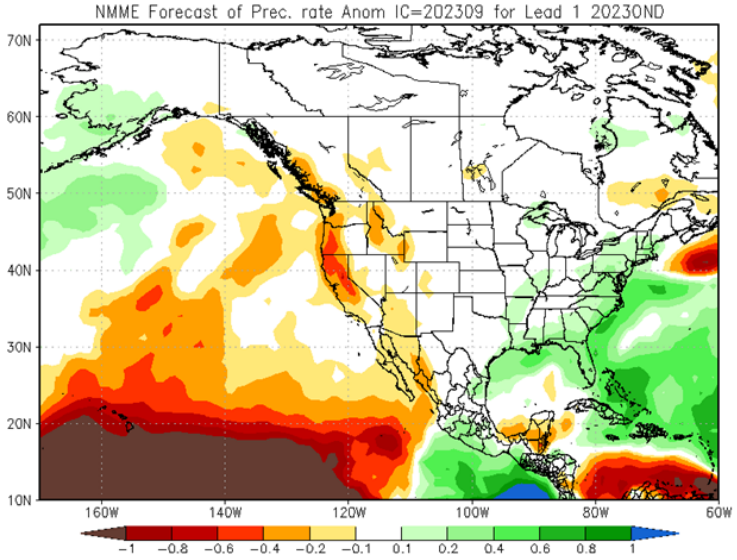


Figure 7: North American Multi-Model Ensemble Precipitation Anomaly Outlook for Oct 31 to Dec 31 (Map courtesy of the US National Weather Service)

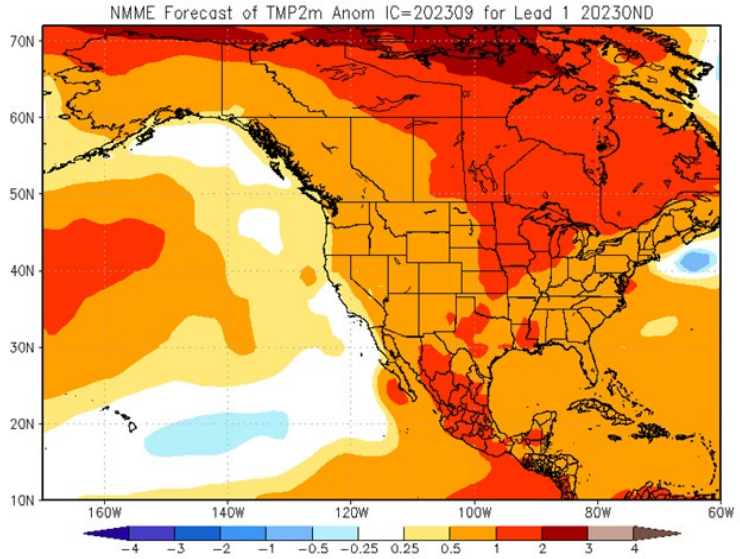


Figure 6: North American Multi-Model Ensemble Temperature Anomaly Outlook for Oct 1 to Dec 31 (Map courtesy of the US National Weather Service)

## Detailed Water Supply Conditions

Table 1 provides a summary of the current levels and storages of the major water supply lakes and reservoirs in Saskatchewan. Figures 9 to 11 show how current reservoir levels compare to the historical average. These figures show that nearly all reservoirs in the south were near or above historical average levels on October 1, except for Lake Diefenbaker. While Lake Diefenbaker is well below normal levels, it is 83 per cent full and meeting the needs of most users. In the Bigstick Lake Watershed near Maple Creek, the levels of Harris and McDougald reservoirs remain low due to normal irrigation water use and minimal inflow throughout the spring and summer months.

Table 1: Conditions at Major Water Supply Reservoirs as of October 1, 2023

| Reservoir | Date of Observation | Elevation (m) | Full Supply Level (m) | Departure from Full Supply (m) | Current Storage ($dam^3$) | Current Per cent Full | Lower Quartile Elevation (m) | Median Elevation (m) | Upper Quartile Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| Altawan | October 1, | 898.18 | 899.71 | -1.53 | 4,120 | 62% | 893.82 | 896.67 | 898.20 |
| Avonlea | October 1, | 596.98 | 597.90 | -0.92 | 6,770 | 76% | 596.52 | 597.06 | 597.69 |
| Boundary | October 1, | 560.03 | 560.83 | -0.80 | 56,200 | 93% | 558.51 | 560.17 | 560.44 |
| Buffalo Pound | October 1, | 509.50 | 509.47 | 0.03 | 94,900 | 101% | 509.25 | 509.40 | 509.46 |
| Cookson | October 1, | 752.35 | 753.00 | -0.65 | 36,300 | 89% | 750.87 | 751.87 | 752.32 |
| Cypress | October 1, | 974.81 | 975.97 | -1.16 | 100,000 | 79% | 971.42 | 973.07 | 974.48 |
| Diefenbaker | October 1, | 552.72 | 556.87 | -4.15 | 7,800,000 | 83% | 554.89 | 556.14 | 556.62 |
| Downie | September | 876.88 | 878.89 | -2.01 | 7,510 | 61% | N/A | N/A | N/A |
| Eastend | October 1, | 917.61 | 918.06 | -0.45 | 1,950 | 77% | 915.69 | 916.64 | 917.19 |
| Grant Devine | October 1, | 561.25 | 562.00 | -0.75 | 97,100 | 92% | 560.93 | 561.06 | 561.45 |
| Highfield | October 1, | 721.80 | 722.99 | -1.19 | 9,190 | 62% | N/A | N/A | N/A |
| Huff | October 1, | 815.53 | 815.72 | -0.19 | 3,840 | 89% | 813.32 | 813.90 | 814.52 |
| Junction | October 1, | 754.96 | 757.28 | -2.32 | 5,040 | 39% | N/A | N/A | N/A |
| Newton | October 1, | 802.55 | 803.28 | -0.73 | 8,530 | 69% | 800.78 | 801.55 | 802.17 |
| Nickle | October 1, | 562.48 | 563.00 | -0.52 | 11,100 | 84% | 562.42 | 562.71 | 562.98 |
| Rafferty | October 1, | 549.91 | 550.50 | -0.59 | 412,000 | 94% | 547.91 | 549.12 | 549.75 |
| Reid/Duncairn | October 1, | 806.54 | 807.72 | -1.18 | 87,000 | 83% | N/A | N/A | N/A |
| Thompson/Lafleche | October 1, | 714.25 | 714.76 | -0.51 | 32,800 | 88% | N/A | N/A | N/A |

N/A – Insufficient historical data available to compute statistics.

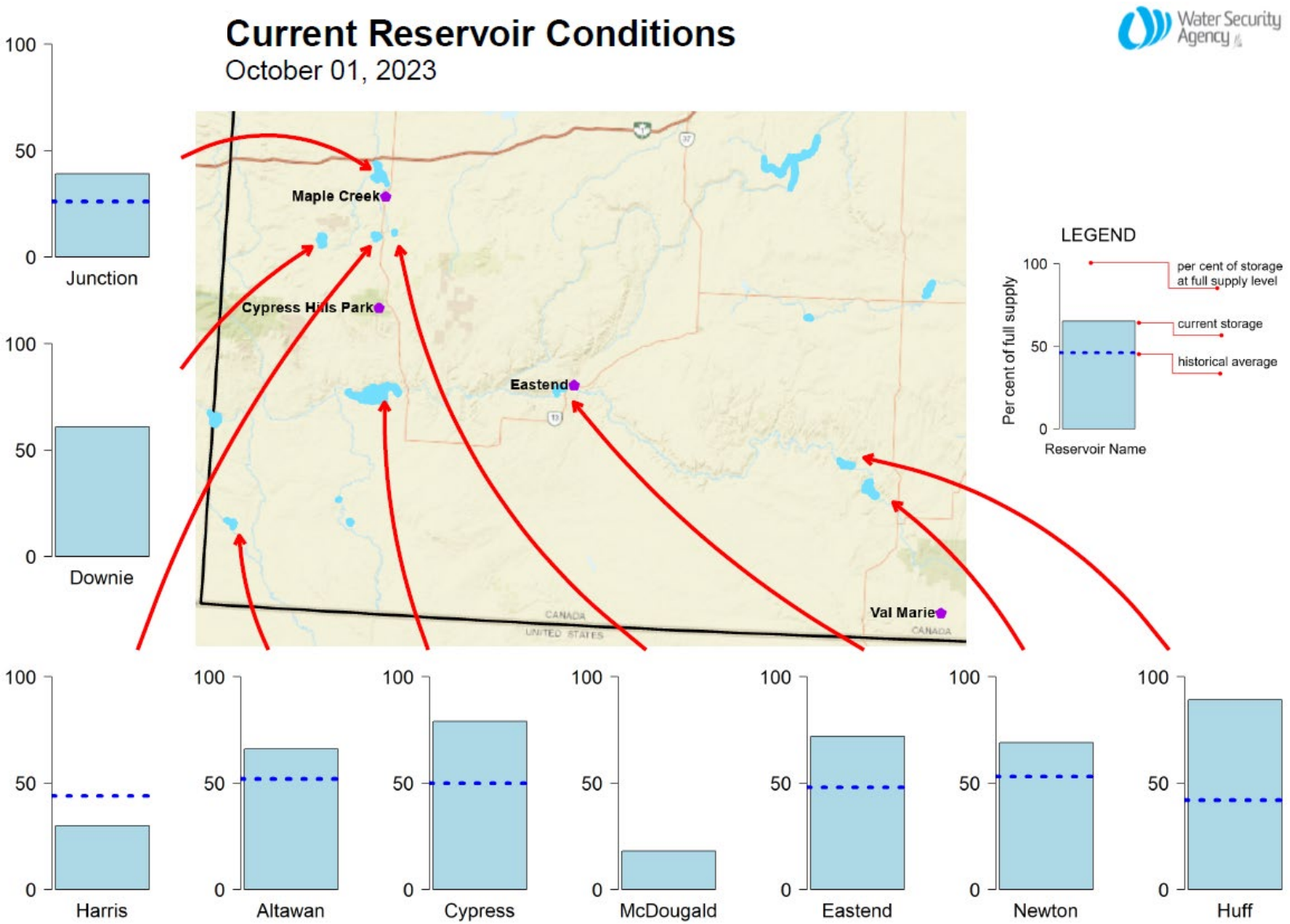


Figure 8: Current Conditions as of October 1 for Reservoirs in Southwest Saskatchewan

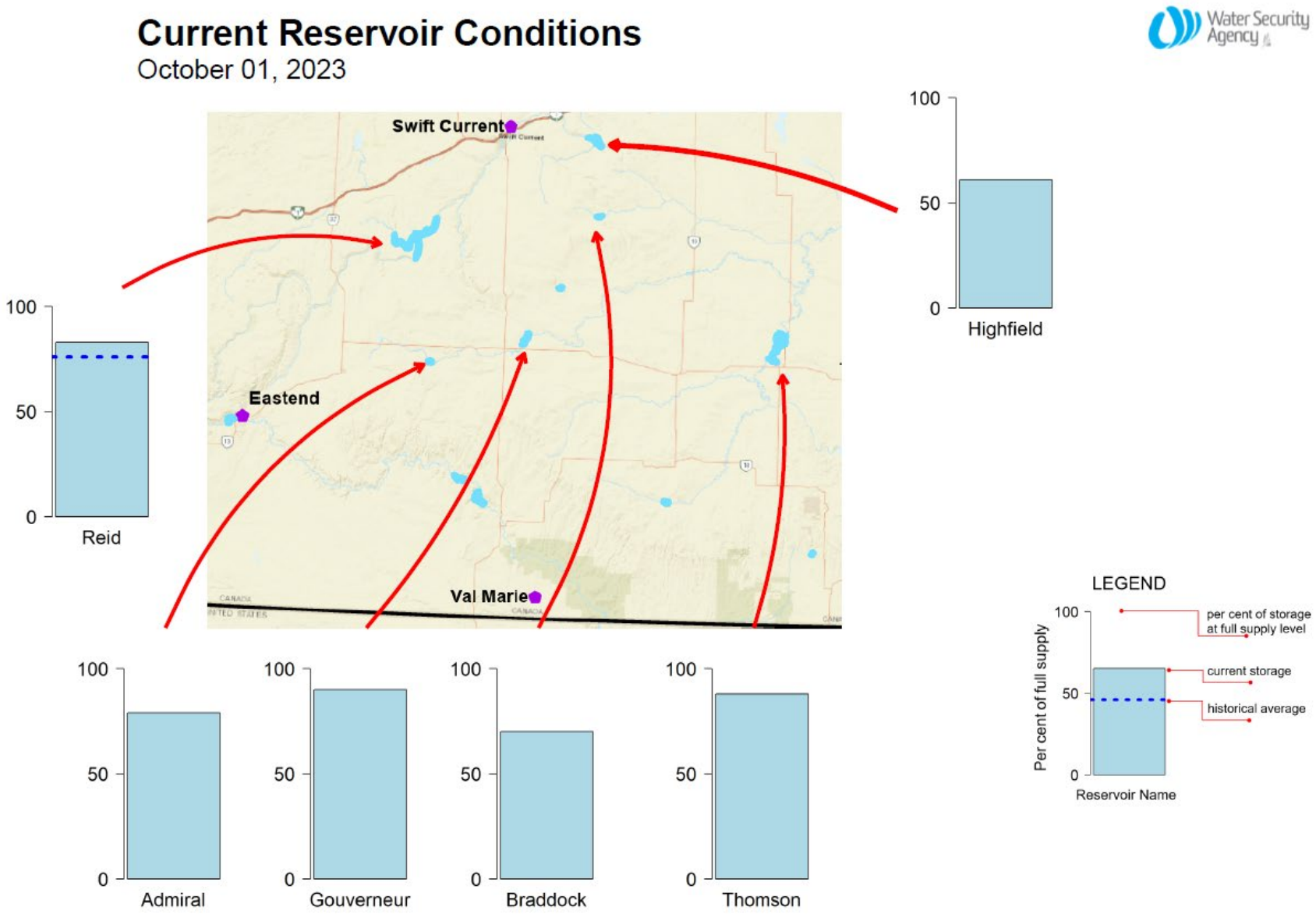


Figure 9: Current Conditions as of October 1 for Reservoirs in South Central Saskatchewan

# Current Reservoir Conditions

October 01, 2023

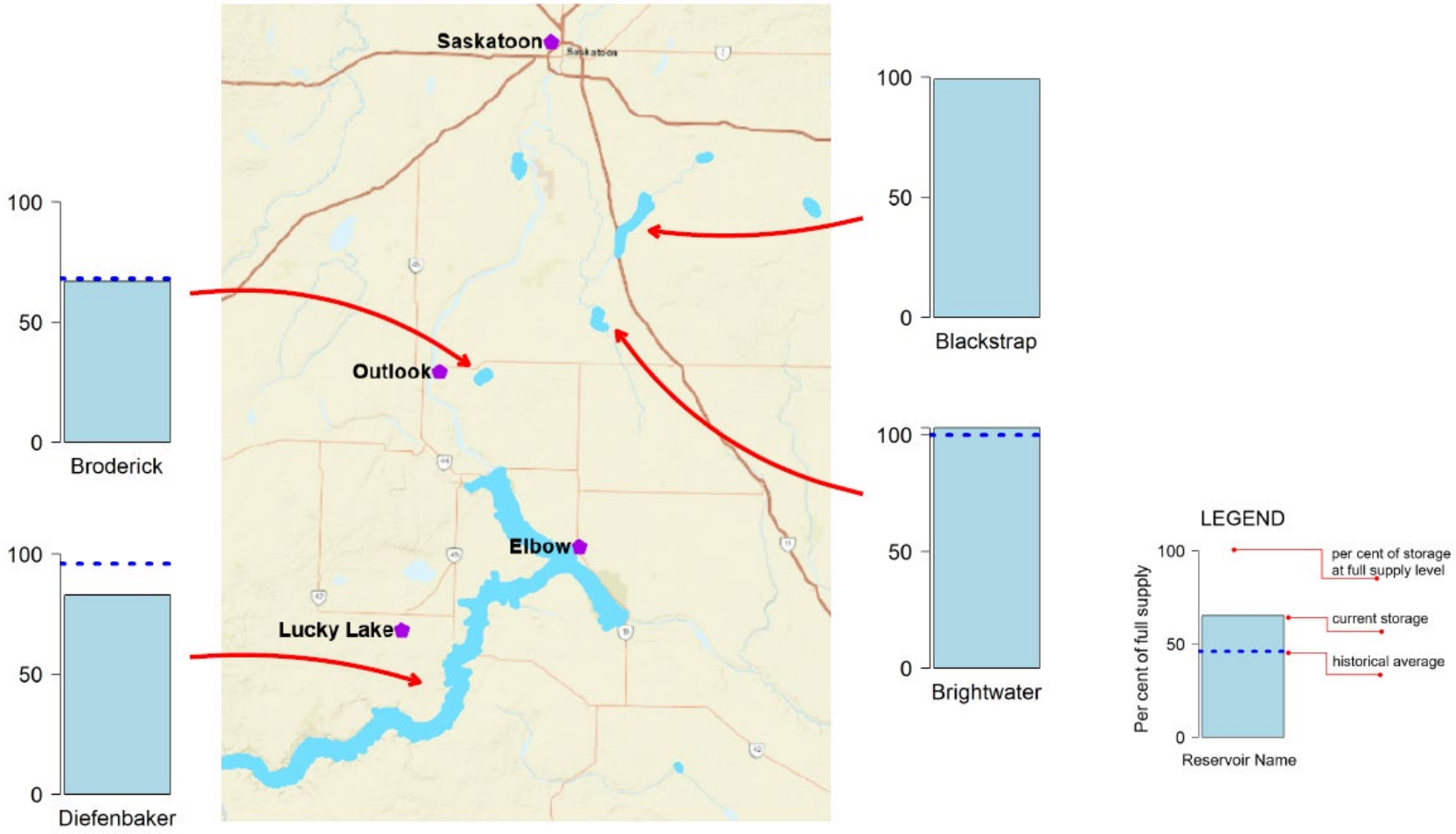


Figure 10: Current Conditions as of October 1 for the Reservoirs in Central Saskatchewan

# Current Reservoir Conditions

October 01, 2023

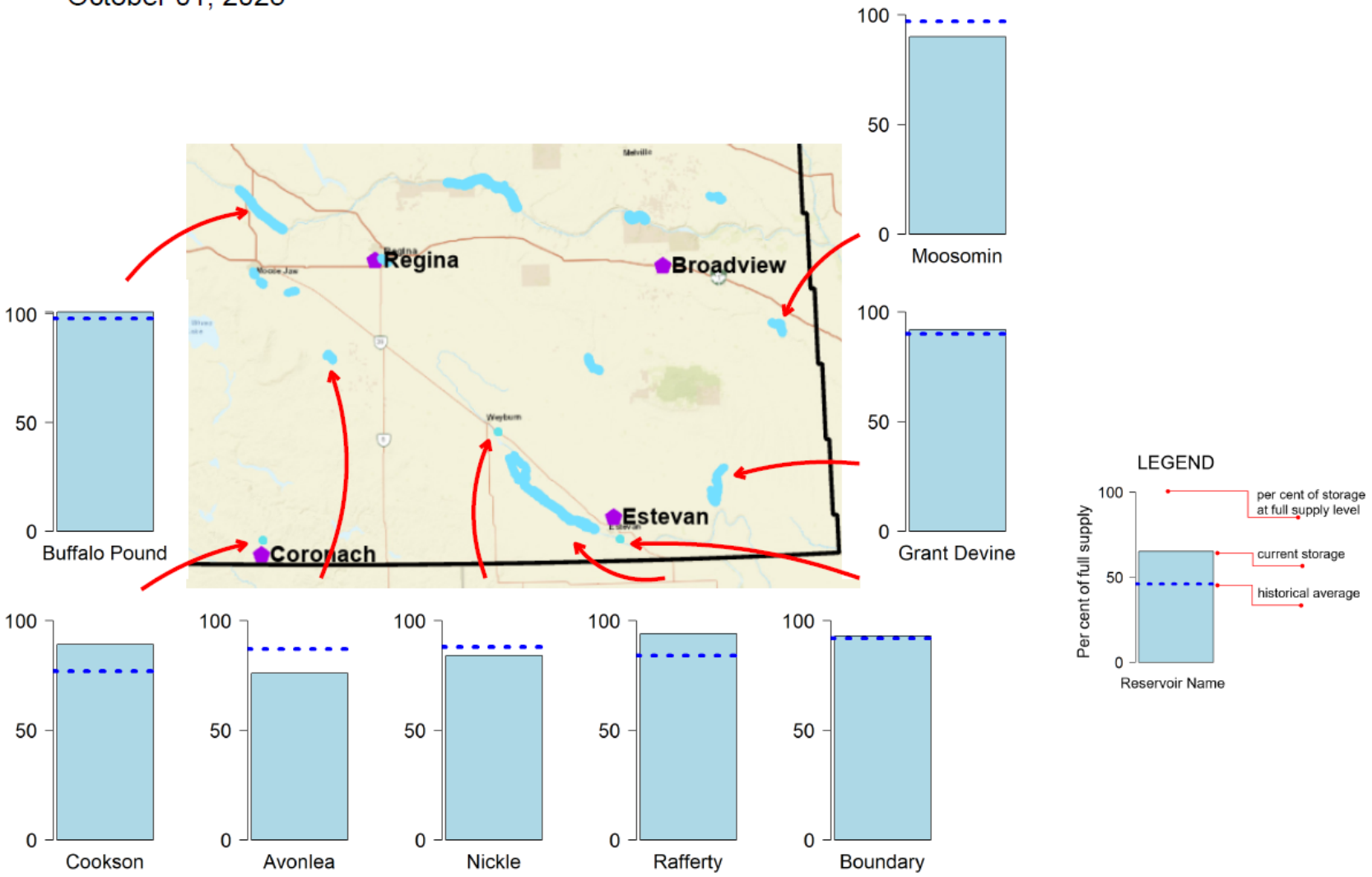





Figure 11: Current Conditions as of October 1 for Reservoirs in Southeast Saskatchewan

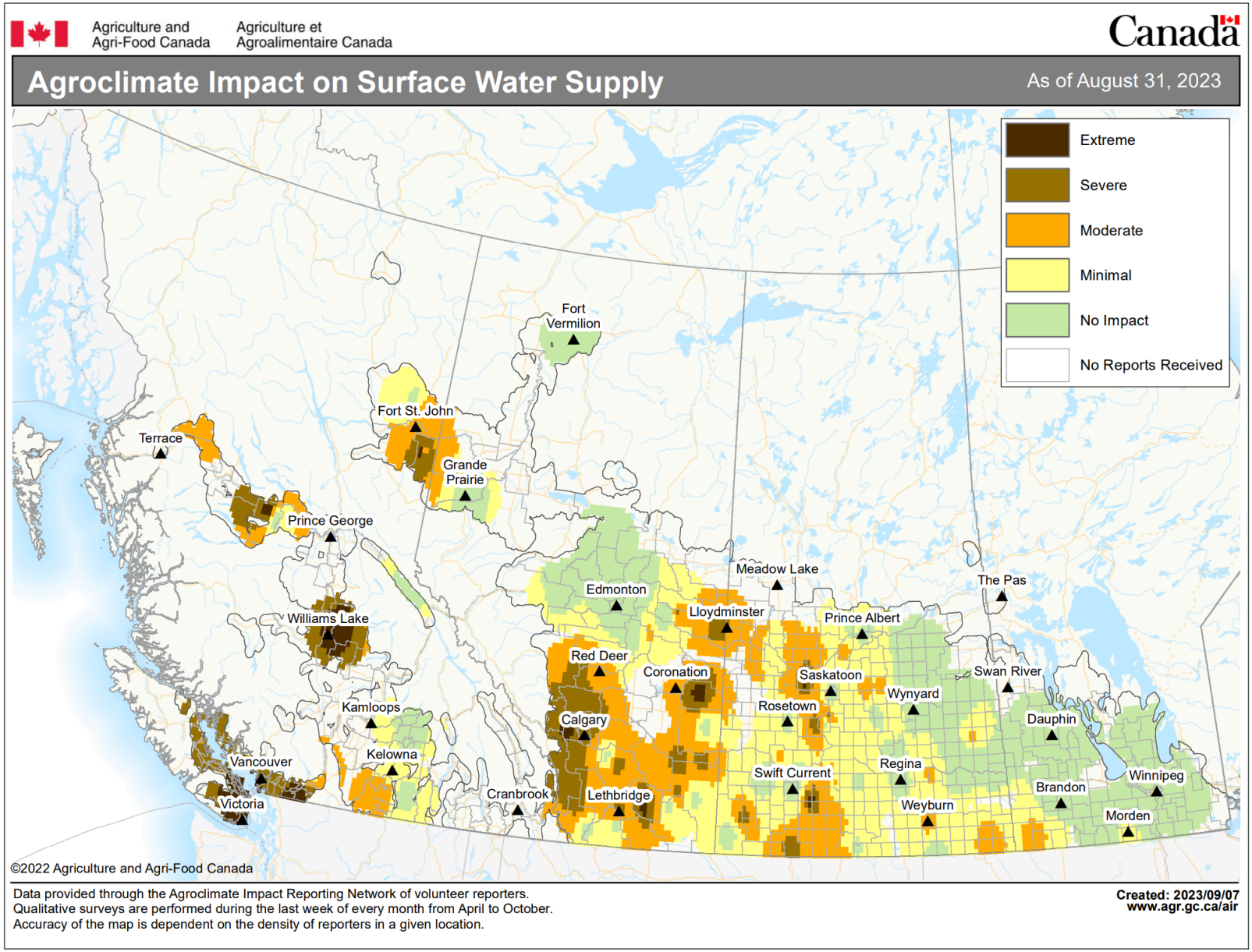


Figure 12: On-farm Surface Water Supply Conditions as of August 31, 2023
(Map courtesy of Agriculture and Agri-Food Canada)

# Major River Systems

## Summary:

- **Despite low inflow and being at the fifth lowest level for late September, the storage at Lake Diefenbaker is still 83 per cent of its capacity. Alberta has met their 2023 water sharing commitments thus far. Limited overwinter releases from Gardiner Dam may affect water levels at Cumberland Lake.**
- **Most lakes in the Qu'Appelle River System are operating near typical fall levels with fall operations underway.**
- **The Quill lakes have experienced a slight decrease from their peak in June but remain above typical summer levels. Levels are expected to recede a bit further before freeze-up.**
- **Despite a hot and dry summer, major Souris River Basin reservoirs are at or above normal levels. Adjustments to Grant Devine and Rafferty dam releases are planned to meet drawdown requirements by February 1.**
- **Most irrigation needs were well met in the Southwest in 2023 and international water sharing commitments have been met. All reservoirs, other than Harris and McDougald are at or above typical levels for September.**
- **Despite the wetter conditions, flows on the Churchill River generally remain below normal. Lac La Ronge remains near the midpoint of its operating range.**

## Saskatchewan River System

With limited precipitation over the headwaters in September, inflows to Lake Diefenbaker have not improved and remain well below normal.

Since June, Lake Diefenbaker has generally been experiencing a decline in water levels and is currently at 552.72 m. This is the fifth-lowest lake level for this time of year and the lowest level since 2001.

Throughout the summer, the releases at Gardiner Dam have been generally held near 70 $m^3/s$, and this release rate is expected to be maintained for the month of October. With low levels at Lake Diefenbaker and an expectation of well below normal inflows to the reservoir over the upcoming winter, winter outflows at Lake Diefenbaker are expected to be near record lows, 100-110 $m^3/s$, and similar to what was last experienced in the winter of 1984-85.

With increasing concerns about the low flow conditions, the Prairie Provinces Water Board has moved from quarterly to monthly computations and reporting on the apportionment of flows for 2023 on the South Saskatchewan River. At the end of September, the delivery, through the South Saskatchewan River at the Saskatchewan Border was 58 per cent of the natural flow (we are entitled to 50% on an annual basis). Officials in Alberta are closely managing the South Saskatchewan River System and we remain confident that they will meet their apportionment obligations in 2023.

In early and mid-September, rainfall events over the North Saskatchewan River's headwaters resulted in some improved flows on that system However, due to minimal outflow from Gardiner Dam, which is only approximately 25 per cent of the total flows in the North Saskatchewan River, the flow patterns in the Saskatchewan River is currently emulating that of the North Saskatchewan River.

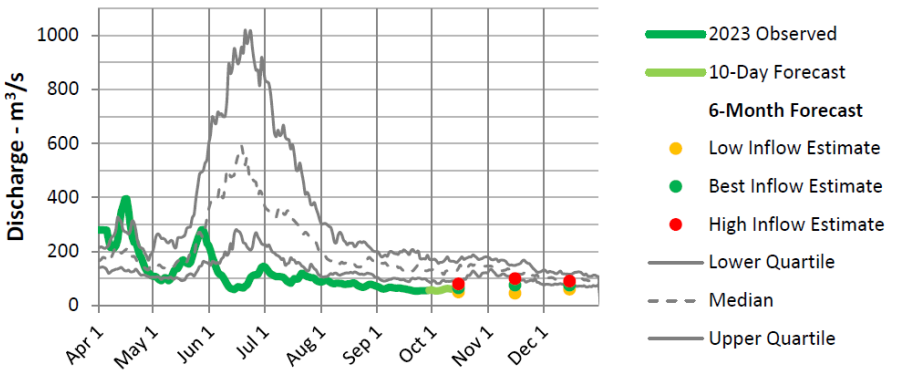


Figure 13: Lake Diefenbaker Observed and Forecasted Inflows

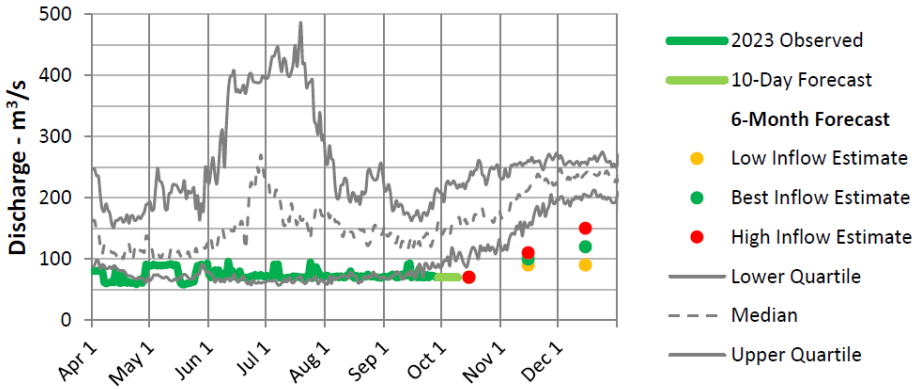


Figure 14: Lake Diefenbaker Observed and Forecasted Outflows

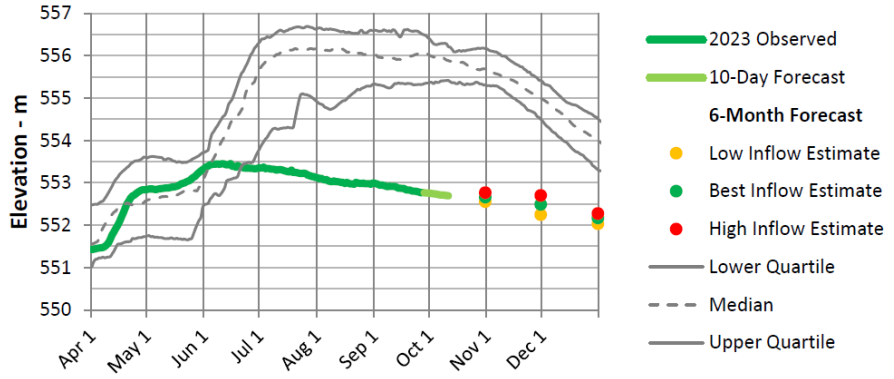


Figure 15: Lake Diefenbaker Observed and Forecasted Elevations

## Qu'Appelle River

All the lakes in the Qu'Appelle system are near typical fall levels at the beginning of October.

The outflow from the Qu'Appelle River Dam was terminated on September 29 to facilitate some in-channel construction work within the Upper Qu'Appelle Conveyance and on Ridge Creek. The expectation is that flows will be resumed on or near October 11, but that will depend on the completion of the work.

Fall operations within the system began on September 28 when the first set of stoplogs were removed from the Crooked Lake control structure. Additional operations are planned for Crooked Lake on October 12 and 24, during which, all remaining stoplogs will be removed from the operable bays.

A stoplog removal operation took place at the Echo Lake structure on October 3. Additional operations may take place there on October 17 and 26. Following the October 3 operation, the Echo Lake control structure had 11 stoplogs remaining in each operable bay. This is similar to the configurations that were maintained throughout the winter of 2021. If conditions remain dry within the basin, the remaining two operations at Echo Lake may be canceled

to retain additional water within Pasqua and Echo lakes through the winter, reducing the risk of lower than desired levels in summer 2024.

An outflow of 2 $m^3/s$ is expected at the Qu'Appelle River Dam through the winter. We also expect to maintain an outflow of 0.5 $m^3/s$ at Buffalo Pound Lake Dam through the winter months. An outflow from the Craven Control Structure that is a little higher than recent years will likely be required through the winter months to bring Last Mountain Lake down to the upper end of its operating range ahead of spring 2024.

## Quill Lakes

The Quill lakes are at an elevation of about 519.58 m. The lakes have dropped by approximately 0.32 m after peaking in early June. The current elevation is about 4 cm lower than what was observed in early October 2022. With near average temperatures and rainfall, the lakes are expected to recede a further 6 to 8 cm prior to freeze-up.

## Souris River

With the hot and dry weather over the summer, reservoirs in the basin have been slowly declining; however, with the above normal runoff in the spring, all major lakes and reservoirs in the Souris River Basin remain at or above normal levels for this time of year. Releases from both Grant Devine and Rafferty dams were maintained near 0.6 $m^3/s$ and 1 $m^3/s$, respectively, for the past couple of months. Based on the current releases, the plan is to terminate flow from Grant Devine Dam in November once the reservoir is slightly below the normal drawdown level to ensure it remains below the prescribed drawdown prior to February 1. Planned maintenance work at the Woodlawn Weir downstream of Rafferty Dam is scheduled for later in October. For this work, the outflow at Rafferty Dam will be terminated for about ten days. Once that work is complete, the release at Rafferty Dam is expected to be increased to 2 $m^3/s$. This increase will ensure the reservoir reaches the February 1 drawdown requirement.

## Southwest

The water supply in reservoirs across the southwest is generally good for this time of year despite the dry summer.

In the Missouri River Basin, a small international apportionment deficit exists on Battle Creek, where natural flow is crossing the international border to gradually reduce the volume owed to the United States. It is expected that natural flows will eliminate this deficit in early October without the need for a release from Cypress Lake. On the Frenchman River, releases from Eastend Dam, West Val Marie Dam (Huff Lake) and Val Marie Dam (Newton Lake) have been increased to bring the reservoir elevations down to the desired winter operating levels. The targeted Frenchman River reservoirs drawdown completion date is November 1, after which, the outflows from the dams will be set to pass the Frenchman River inflow through the system all the way to the international border. The Lodge Creek Basin has had zero natural flow since early July 2023. On Swift Current Creek, the outflow from Duncairn Dam was reduced to conserve water in Reid Lake during the time period from now until freeze-up. Outflows from Duncairn Dam will be increased prior to freeze-up conditions to maintain a consistent flow of water to the City of Swift Current throughout the winter months.

In the Big Stick Lake Basin near Maple Creek, releases from reservoirs for the purpose of irrigation have concluded. Most sprinkler irrigation in the area is also complete.

In the Old Wives Lake Basin, requests for fall domestic and stock watering releases from reservoirs will be completed upon request from producers to replenish downstream water supplies prior to freeze-up.

## Churchill River

Accumulated rainfall throughout September was generally well below normal across much of the Churchill River Basin. This resulted in the tributary flows declining throughout the month. Most flows are now near or below the lower quartile levels for this time of the year. Flows on the mainstem also generally remain near well below normal levels.

Lac La Ronge is currently near the bottom end of its desired operating range. The lake is expected to remain within its operating range throughout the remainder of the fall. Outflows will be increased on October 11 to target a water level of 364.1 m for spring 2024.

Table 2 contains October 1 water levels for a cross section of Saskatchewan lakes.

Figure 16: Churchill River above Wintego Rapids - Sept. 28, 2023
(Courtesy of Environment and Climate Change Canada)

Table 2: Lake Level Summary

| Lake/Reservoir | October 1, Level (m) | Normal Summer Level (m) | Recorded Historical Peak Level | |
|---|---|---|---|---|
| | | | Level (m) | Year |
| Anglin | 515.37 | 515.35 | 515.99** | 2013 |
| Big Quill | 519.62 | 515.00 | 520.93** | 2017 |
| Boundary | 560.03 | 560.50 | 561.15 | 1979 |
| Buffalo Pound | 509.50 | 509.47 | 511.45 | 1974 |
| Candle | 494.04 | 494.40 | 495.25 | 1973 |
| Cookson | 752.35 | 752.50 | 753.35 | 1979 |
| Crooked | 451.54 | 451.65 | 454.40** | 2014 |
| Echo and Pasqua | 479.02 | 479.10 | 480.98 | 2011 |
| Fishing | 529.91 | 528.50 | 530.92 | 2011 |
| Good Spirit | 484.48 | 484.60 | 485.68** | 2010 |
| Grant Devine | 561.25 | 561.50 | 556.58** | 2011 |
| Jackfish | 529.19 | 529.40 | 530.00 | 1985 |
| Katepwa and Mission | 478.25 | 478.30 | 479.58 | 2011 |
| La Ronge | 364.21 | 364.30 | 364.98** | 2011 |
| Last Mountain | 490.05 | 490.20 | 492.09 | 1955 |
| Moose Mountain | 620.08 | 620.30 | 621.90 | 2011 |
| Rafferty | 549.91 | 550.50 | 554.05** | 2011 |
| Round | 441.82 | 442.4*** | 445.70** | 2014 |

**Occurred after spring runoff during summer precipitation event(s).
***With outlet structure operated. Without the outlet structure, the normal summer level is 441.3 m.

## Ongoing Water Supply Outlook

Up-to-date flows and lake levels are available at [wsask.ca.](wsask.ca)

WSA will issue Water Supply Conditions Reports monthly until November 2023.

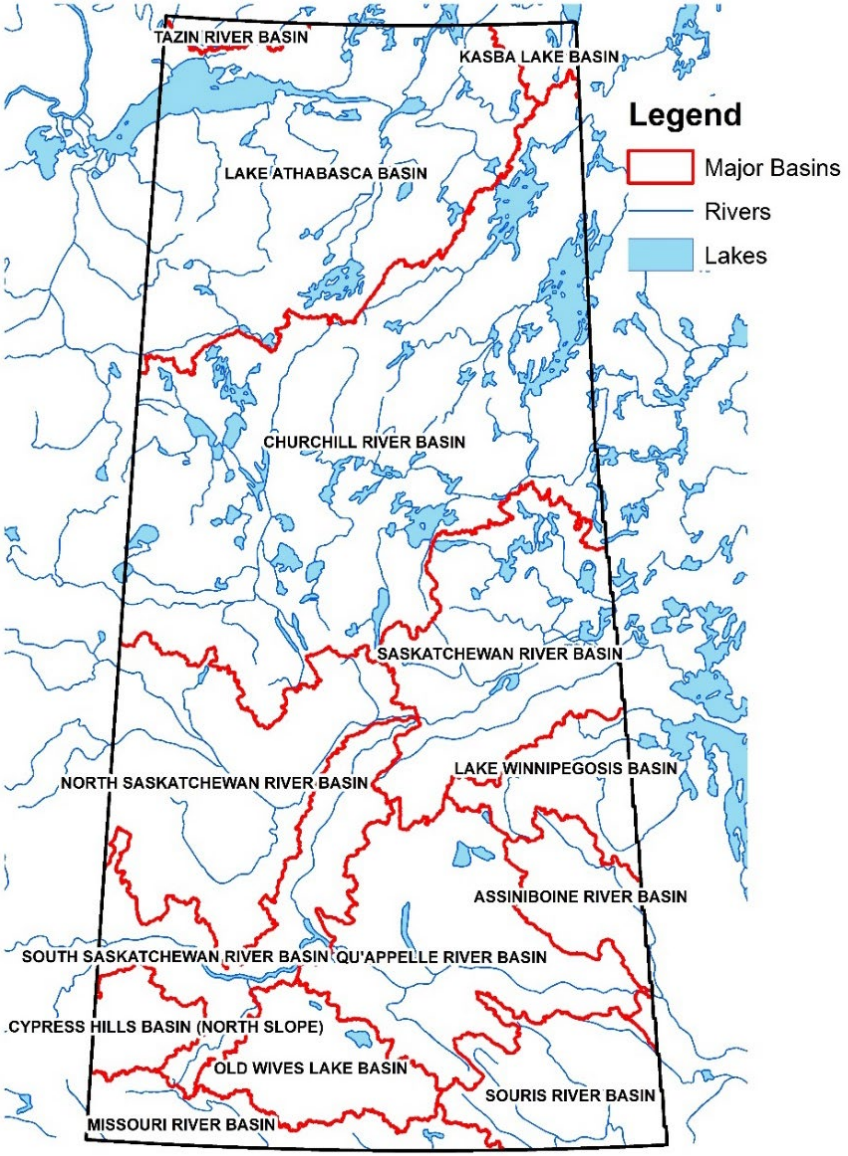


Figure 17: Major Drainage Basins