2018 Water Availability and Drought Conditions Report

Manitoba
Sustainable Development

Executive Summary

This Annual Water Availability and Drought Conditions Report provides an update on the implementation of the Manitoba Drought Management Strategy and a summary of drought conditions and impacts throughout Manitoba during 2018.

Normal soil moisture with some pockets of dryness and below normal snowfall resulted in below normal runoff volumes in southern Manitoba during spring 2018. However, most rivers and tributaries peaked at normal or above normal flows due to a delayed spring melt, but receded quickly due to dry conditions. April and May were very dry across agro-Manitoba, and by the end of August, most of southern Manitoba was classified as moderate to severe drought by the Canadian Drought Monitor.

Normal to above normal precipitation in September and October helped to replenish soil moisture and reduce fire activity but made harvest challenging. Soil moisture conditions at freeze-up were reported as normal to below normal. However, streamflows, lake and reservoir levels and groundwater conditions were generally normal to above normal across the province at the end of 2018, with a few exceptions.

Agriculture, municipalities and the environment were all impacted due to the dry conditions throughout 2018. The primary impacts included on-farm water shortages, feed shortages, reduced crop yields, evacuations and health impacts (e.g. smoke inhalation, stress) due to wildland fires, difficulty accessing water supplies due to low levels in lakes and aquifers, and impacts to fisheries and forests.

For more information on drought in Manitoba, please visit the Manitoba Drought Monitor website at http://www.gov.mb.ca/drought.

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Implementation of Manitoba's Drought Management Strategy

In January 2016, Manitoba released its Drought Management Strategy. The Strategy can be found at the Manitoba Drought Monitor website (www.gov.mb.ca/drought). A number of action items are outlined in the strategy to increase Manitoba's resiliency to drought and minimize the impact of future droughts. Progress on the action items are reported yearly through the Annual Water Availability and Drought Conditions Report. The action items and their current status of implementation are outlined below in Table 1 and summarized on Figure 1.

Table 1: Current status of action items from the Manitoba Drought Management Strategy.

Action Items in Drought Strategy		Current Status
(1)	***Undertake studies related to water supply dams and reservoirs.***	**Some Progress.** An interdepartmental Working Group was formed to discuss current and future water supply and demand on the Assiniboine River. Staff from various departments attended meetings with water users in the Boyne River Basin to discuss challenges during 2018 and potential water supply enhancement options. Water retention projects were identified within the *Boyne-Morris River Surface Water Management Report* to support the ongoing integrated watershed management plan development in the watershed.
(2)	***Evaluate the long-term effects of climate change on water supply and demand for river basins.***	**Little Progress.** Little progress has been made to date. Research into this will be ongoing as opportunities and collaborations arise.
(3)	***Establish drought committees to enable efficient information sharing and co-ordination of province-wide drought management efforts.***	**Some Progress.** The Manitoba Drought Assessment Committee met monthly during summer 2018 due to drought conditions. Committee membership was recently evaluated and enhanced. An ad-hoc Boyne River Basin Drought Assessment Group was established and communicated weekly during the summer of 2018 due to lower than normal water levels in Stephenfield reservoir. Basin Drought Assessment Groups are being assembled for the Red River and the Assiniboine/Souris River.
(4)	***Collaborate with Manitoba Emergency Measures Organization to include guidance for drought-related emergencies in the Manitoba Emergency Plan.***	**Some Progress.** In fall 2018, Emergency Measures Organization initiated the planning process to develop a Drought Response Coordination Plan.
(5)	***Prepare regular Water Availability and Drought Conditions Reports that include drought indicators for each major river basin.***	**Ongoing.** Monthly conditions reports are published between March and October and annual summary reports are available from 2016 onwards. The monthly report format was streamlined in April 2018.
(6)	***Determine drought preparedness levels for each river basin.***	**Some Progress.** A pilot drought preparedness assessment will be completed in early 2019 for the Roseau River Basin. A drought preparedness assessment is ongoing for the Boyne-Morris watershed and will be completed in 2019/2020. Manitoba Sustainable Development provided support for Pembina Valley Water Co-op's drought

		planning initiatives. Other basin studies to follow in conjunction with the Integrated Watershed Planning Process.
(7)	***Implement a drought stage approach to monitor drought and determine the necessary response to drought in Manitoba.***	**Little Progress.** Drought stage monitoring requires an assessment of both drought conditions and basin preparedness levels. Improved progress on implementing a drought stage approach will happen as drought preparedness assessments are completed. Pembina Valley Water Co-op is adopting the drought stage approach for responding to drought conditions. Sustainable Development will continue to provide technical support to help them to determine a monitoring approach and trigger thresholds.
(8)	***Establish a Manitoba Drought Monitor website with up to date drought information.***	**Complete** The Manitoba Drought Monitor website went live in early 2016: www.gov.mb.ca/drought. Conditions reports and interactive drought indicator mapping are available on the site. New in 2018 is the addition of groundwater percentile plots to the online mapping tool.
(9)	***Undertake research to develop drought forecasting tools for Manitoba.***	**Little Progress.** Little progress has been made to date. Research into this will be ongoing as opportunities and collaborations arise.
(10)	***Evaluate and enhance meteorological, hydrometric, soil moisture, groundwater and other networks used for drought monitoring and drought indicator computation.***	**Ongoing.** Manitoba Agriculture continues to enhance the Manitoba Agriculture Weather Program monitoring network. Data from this program are now fully integrated into Manitoba's precipitation drought indicators. Manitoba Infrastructure continues to implement real-time reservoir and streamflow monitoring at additional locations.
(11)	***Participate in transboundary collaborations to better manage trans-boundary waters during drought.***	**Ongoing.** Manitoba currently has representatives on seven transboundary committees or boards and is involved in transboundary drought-related management activities.
(12)	***Implement and promote drought mitigation strategies to increase drought resiliency and reduce long-term drought impacts.***	**Some Progress.** Preparedness assessments make recommendations for viable drought mitigation measures based on identified watershed vulnerabilities. Manitoba Sustainable Development and Manitoba Infrastructure worked with several water providers to assess critical water level thresholds and ability to accommodate low flows on the Assiniboine River.
(13)	***Prepare information and awareness materials regarding drought, water supply management and water efficiency.***	**Some Progress.** Drought presentations were delivered internally, to water co-ops and other organizations and at several conferences and watershed planning meetings. Summary materials for water supply and demand on the Assiniboine River were prepared for public distribution.
(14)	***Evaluate the Manitoba Drought Management Strategy to identify gaps and incorporate new scientific methods and technologies.***	**Ongoing.** Every 5-10 years, the Manitoba Drought Management Strategy will be revisited to identify gaps and incorporate new scientific methods and technologies. Next update will be between 2021 and 2026.

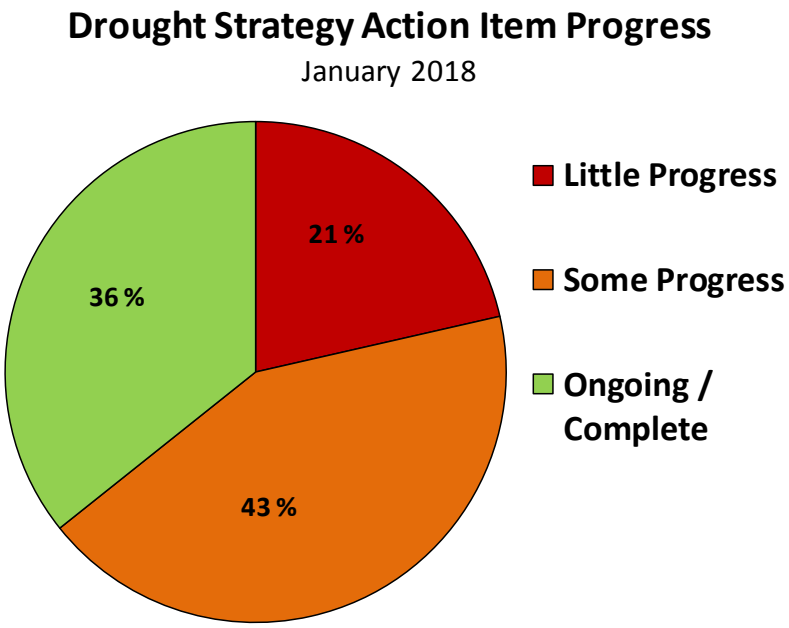

Figure 1: Progress on implementing actions in the Manitoba Drought Management Strategy.

2018 Conditions Summary

Antecedent conditions (Fall freeze-up 2017)

Conditions at freeze-up can play a significant role in determining the amount of available water supply the following spring. Two key variables characterizing moisture conditions at freeze-up include soil moisture content and baseflow.

Antecedent precipitation analysis from the Manitoba Hydrologic Forecasting Centre (Figure 2) indicated that soil moisture conditions were generally normal (85 to 115 % of average) to below normal (50 to 85 %) throughout the province at the time of freeze-up. Manitoba Agriculture's fall moisture survey showed most of agro-Manitoba was experiencing adequate soil moisture with some isolated pockets of dryness (Figure 3). Dry conditions were located primarily along the Manitoba/Saskatchewan border. However, isolated regions of dry conditions also existed within the central, Interlake, and eastern regions.

As of December 31, 2017, baseflows on major rivers generally ranged between normal (25^{th} – 75^{th} percentile) to much above normal (>90^{th} percentile) (Figure 4, Figure 5). Exceptions include the Winnipeg River, with below normal streamflow (10^{th} – 25^{th} percentile) during December 2017. Groundwater levels in major aquifers were generally normal or above normal in fall 2017 (Figure 6).

Winter 2017 / 2018 (December to March)

Winter precipitation conditions between November 1, 2017 and March 31, 2018 were moderately dry (60 to 85 % of average) to severely dry (40 to 60 %) throughout agro-Manitoba, with small pockets of extremely dry conditions (< 40 %) (Figure 7). Precipitation conditions throughout northern Manitoba were generally in the normal to above normal (> 115 %) range, with drier conditions in the far north.

During winter 2017/2018, baseflow conditions throughout the province generally remained in the normal to much above normal range (Figure 4 and Figure 5).

Based on soil moisture conditions at freeze-up, baseflow conditions and winter snowfall, the Hydrologic Forecast Centre forecasted runoff potential to be below normal (50 to 85 % of average) across southern Manitoba and throughout the Red River and Assiniboine River basins. Other more northerly contributing watersheds, such as the Saskatchewan and Churchill River basins, were forecasted to have normal runoff.

Spring 2018 (March to May)

The primary spring runoff began later than normal in southern Manitoba. Many rivers and tributaries peaked in late April in the normal to above normal (75^{th} – 90^{th} percentile) range due to the late onset of the melt. However, some tributaries to the east of Lake Winnipeg (Winnipeg, Bloodvein, Whitemouth and Whiteshell Rivers) peaked at below normal flows, alongside Lake Manitoba and Lake Winnipeg, where below normal water levels were observed at the end of spring runoff. Due to the drier than normal conditions, many rivers and streams receded very quickly post-freshet. In northern Manitoba, most rivers peaked in the normal to above normal range.

Spring aquifer recharge was minimal in 2018. However, by the end of spring melt, groundwater levels in most monitored aquifers were generally in the normal to above normal range (Figure 6) due to the higher than normal levels during 2017. Exceptions include various locations throughout the Carbonate Aquifer (Anola, Steinbach, Poplarfield) and a sand and gravel aquifer near Steinbach where levels dropped into the below normal (10^{th} – 25^{th} percentile) to much below normal (< 10^{th} percentile) range by May 2018 and remained there most of the year.

Spring was very dry in southern Manitoba, whereby most of the province experienced moderately dry (60 to 85 % of median) to severely dry (40 to 60 %) precipitation conditions over this three-month period (Figure 8a). Regions within the Interlake and north of Lake Winnipeg experienced extremely dry conditions (< 40 %) during this time. April was an exceptionally dry month across agro-Manitoba, with the entire region receiving less than 40 % of median and some locations not receiving any rainfall at all. Dry precipitation conditions were also observed across most of northern Manitoba during this period, with May being the driest month for precipitation in the northern portion of the province.

Summer 2018 (June to September)

Precipitation in June was normal to above normal throughout much of the province. However the Interlake and portions of central and southeastern agro-Manitoba continued to experience moderately (60 to 85 % of median) to extremely dry (< 40 %) precipitation conditions. In July, the extent of dry conditions expanded across central and southwestern agro-Manitoba and the Canadian Drought Monitor classified most of this region as D1 (moderate drought; 5 to 10 year event) with a region of D2 (severe drought; 10 to 20 year event) in the northwest Interlake.

August rainfall brought some relief to the Interlake. However, the remainder of agro-Manitoba experienced precipitation conditions ranging from moderately to extremely dry in the east and central regions and severely to extremely dry in the southwest and northwest regions. The three month precipitation indicator for total precipitation during June-July-August (Figure 8b) showed most of southern Manitoba as moderately to severely dry. By the end of August, the Canadian Drought Monitor expanded the region of D1 and included additional pockets of D2 in central and eastern agro-Manitoba (Figure 9).

Throughout the summer, several rivers and lakes remained at below normal flows or levels throughout the entire season. These include the Icelandic River, Mossy River, Whitemud River, Boyne River, Whitemouth River, Bloodvein River, Winnipeg River, Lake Winnipeg, Lake Manitoba, and Round Lake. Groundwater levels in the Carbonate Aquifer and a sand and gravel aquifer near Steinbach remained below normal as well.

September and October brought normal to above normal precipitation to most of the province (Figure 8c), which helped to replenish soil moisture and reduce fire activity and risk.

Fall freeze-up 2018 (October to December)

The results of the 2018 fall soil moisture survey showed similar conditions to the 2017 fall survey. The surface was wet at most locations, except Moosehorn in the northwest Interlake. However, the full profile (0 – 120 cm) was at 80 - 100 % of water holding capacity throughout approximately two-thirds of agro-

Manitoba. Areas close to the Red River such as Kane, Dominion City and Steinbach observed drier conditions prior to freeze up, with soil moisture at 20 – 40 % of available water holding capacity.

Antecedent precipitation analysis from the Manitoba Hydrologic Forecasting Centre (Figure 11) indicated that soil moisture conditions across most of the province and contributing drainage area were classified as normal (85 % to 115 %) to below normal (50 % to 85 %) at the time of freeze-up.

As of January 1, 2019, baseflows and lake levels were generally within their normal ranges (25^{th} – 75^{th} percentile) (Figure 12). Exceptions include the Qu'Appelle River, Whitemouth River, Hayes River, Seal River and Lake Manitoba, which were classified as below normal (10^{th} – 25^{th} percentile) or much below normal (< 10^{th} percentile). Groundwater levels in major aquifers were generally good (Figure 6), except for a sand and gravel aquifer and the Carbonate Aquifer in the Steinbach area with record low or near record low levels.

Drought Impacts and Response

Wildland Fires

A total of 477 wildland fires burned 234,223 hectares in 2018. Comparing 2018 to historical wildland fire data, the total area burned equaled approximately 116 % of average based on 105 years of data (Figure 13). Most of the burned area was in the northeast (42 %) and eastern (41 %) regions of the province (Table 2).

Table 2: 2018 wildland fire activity (number of fires and total area burned) broken down by region.

Region	Northeast	Northwest	Western	Central	Eastern	Total
Total Fires	179	31	14	77	176	477
Total Area Burned (hectares)	99,108	515	12,068	26,030	96,502	**234,223**
Total Area Burned (per cent)	42	0.2	5	11	41	**-**

Due to the dry and windy conditions in late-April and early-May, wildland fires destroyed at least three houses in the Interlake and southeastern regions of Manitoba. The RM of Piney enacted a state of emergency due to an out of control wildfire near the community of Badger. During the remainder of May as dry conditions continued, wildland fires impacted a number of communities due to the proximity of the fires and related smoke. Little Grand Rapids First Nation, Pauingassi First Nation, Sapotaweyak Cree Nation, and Pelican Rapids were evacuated in May. A mandatory evacuation of all residents from Marcel Colomb First Nation and a voluntary evacuation of the community of Lynn Lake were completed at the end of June due to a nearby lightning caused fire. In addition to physical health impacts of wildland fires (e.g., smoke inhalation), evacuations can result in many mental health and psychosocial impacts as well.

Conditions were dry in July (southern Manitoba) and August (province wide), resulting in wildland fires burning approximately 55,000 to 65,000 hectares per month, primarily in the eastern and northeast regions. Closures in several provincial parks were put in place. However, no communities were

evacuated. Manitoba Public Health indicated that the worst air quality during August 2018 was due to smoke from fires in the Bissett region of southeast Manitoba. People with compromised health conditions were affected by the degraded air quality.

Agriculture

Impacts to producers due to dry conditions during the 2018 growing season were quite variable across agro-Manitoba and the effects on farmers is difficult to generalize. The text below summarizes the main impacts felt by producers in drier areas.

Water Supplies

On-farm water supplies were a challenge during the 2018 growing season. In many areas of agro-Manitoba spring runoff was limited and inadequate to fill dugouts. By the end of July, low levels (dugouts less than one-third full) were occurring primarily in the eastern region and the Interlake, but levels were quickly falling across most of agro-Manitoba. Producers in the Interlake had already began hauling and pumping water. By the end of August, water was being pumped or hauled in parts of the Interlake, eastern, southwest and central regions, and/or livestock was being moved to pastures with water. Funding for producers was made available for water source development projects through Ag Action Manitoba – Assurance: Beneficial Management Practices.

Although September and October had normal to above normal precipitation, the rainfall was not enough to replenish dugouts and sloughs and levels remained low going into freeze-up. On-farm water supplies will require normal or above normal snowfall to be replenished for summer 2019.

Crop, Hay and Pasture

At the end of May, due to dry seedbed conditions, crop emergence was patchy in some regions. Hay and pasture were slow to grow and generally rated as fair to poor. Rain that did fall in late May was critical for germination and emergence and prevented widespread loses. By the end of July, areas with lighter textured soils had prematurely ripening crops and there were reports of moisture stress to corn and soybeans in some regions. Pasture regrowth was limited in dry areas and increased grasshopper activity was reported. First cut hay yields were classified as below to well below normal due to dry conditions. Producers in dry areas began looking for alternate feed sources to sustain their needs such as green feed, cutting of ditches and dried up sloughs or purchasing feed grains. Dry conditions persisted across much of agro-Manitoba throughout August and the aforementioned impacts continued to occur.

Harvest came early due to the hot and dry summer and yet was challenging due to wet conditions and below normal temperatures in September and early October. Crop yields varied significantly throughout agro-Manitoba due to the high variability of timely rains during the growing season. Many livestock producers with reduced winter feed supplies continued to look for alternate feed sources to sustain their needs while others downsized their herds due to the feed shortage. Some pastures were overgrazed during 2018, putting these producers in a tough position for spring 2019.

For additional information, please see Manitoba Agriculture's 2018 Crop Report Summary.

Municipal Water Supplies

Throughout 2018, there were no major concerns over reservoir water supplies. However, a few reservoirs such as Stephenfield Reservoir and Jackson Lake were closely monitored due to below normal levels.

Lower than normal levels on the Assiniboine River challenged numerous irrigators and water providers during 2018. Many had difficulties accessing the water using their current pump/intake configurations, likely due to the changes in geomorphology of the river over recent years.

There were some reports of groundwater impacts due to the dry conditions. The Manitoba Water Services Board worked with municipalities on water supply infrastructure projects to increase the resiliency of water supplies during future dry periods.

Environmental

Low spring runoff resulted in some negative impacts to some fishers and fisheries in the province. There were fish strandings at some Lake Winnipeg beaches that led to fish kills.

During 2018, urban forestry field crews noticed increased dieback, specifically with black ash trees. Dieback could be attributed to drought conditions, as trees become more susceptible to disease when they are water-stressed.

Acknowledgements

This report was prepared with information from the following departments and agencies, which are gratefully acknowledged:

- Manitoba Sustainable Development
- Manitoba Agriculture
- Manitoba Agricultural Services Corporation
- Manitoba Infrastructure
- Emergency Measures Organization
- Manitoba Municipal Relations
- Manitoba Health, Seniors and Active Living
- Manitoba Indigenous and Northern Relations
- Manitoba Hydro
- Agriculture and Agri-Food Canada
- National Drought Mitigation Center

For further information, please contact:

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Past reports are available on the Manitoba Drought Monitor website.

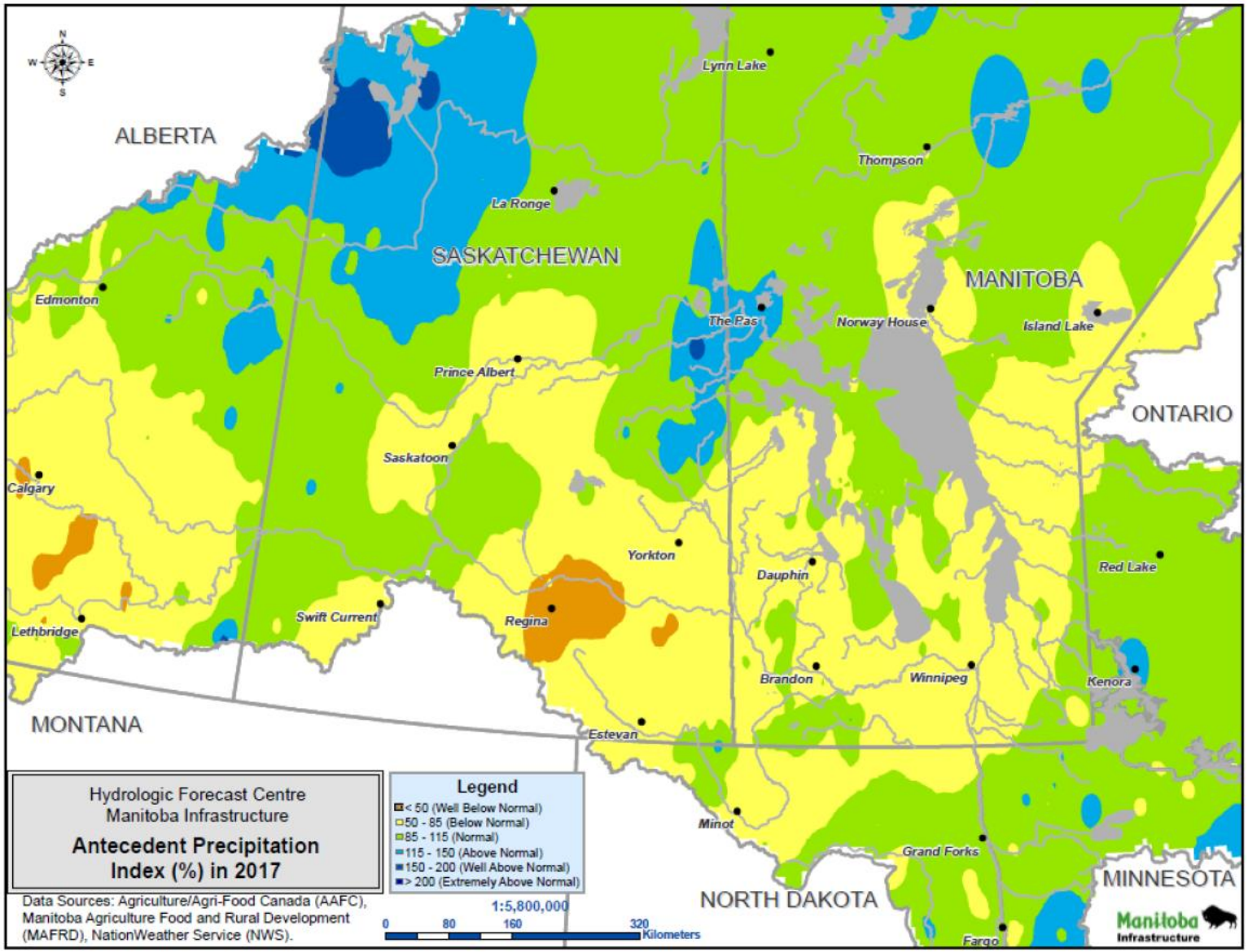

Figure 2: Manitoba Hydrologic Forecasting Centre's Antecedent Precipitation Index (API) for fall 2017.

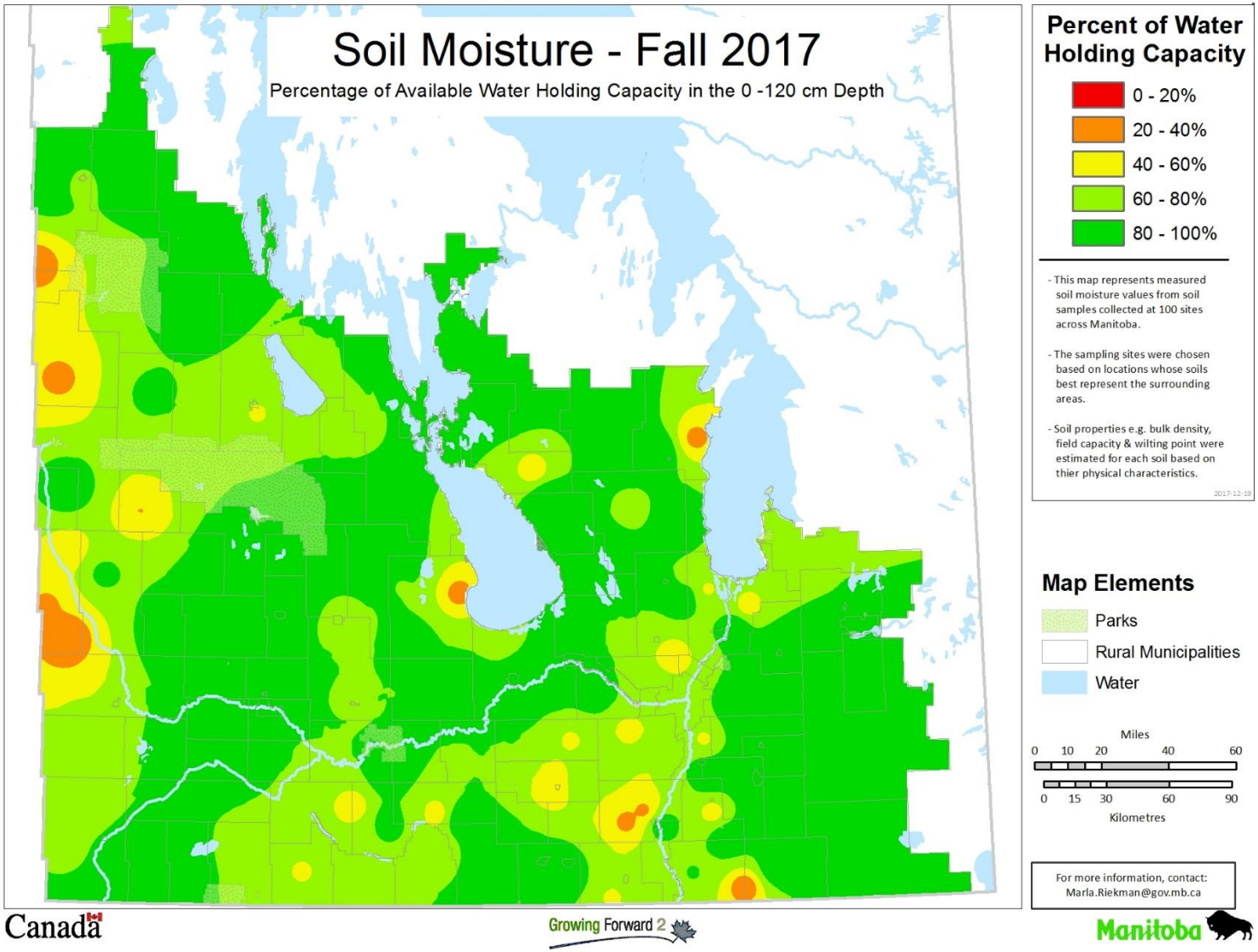

Figure 3: Manitoba Agriculture's fall 2017 soil moisture survey – percent of water holding capacity (0-120 cm depth).

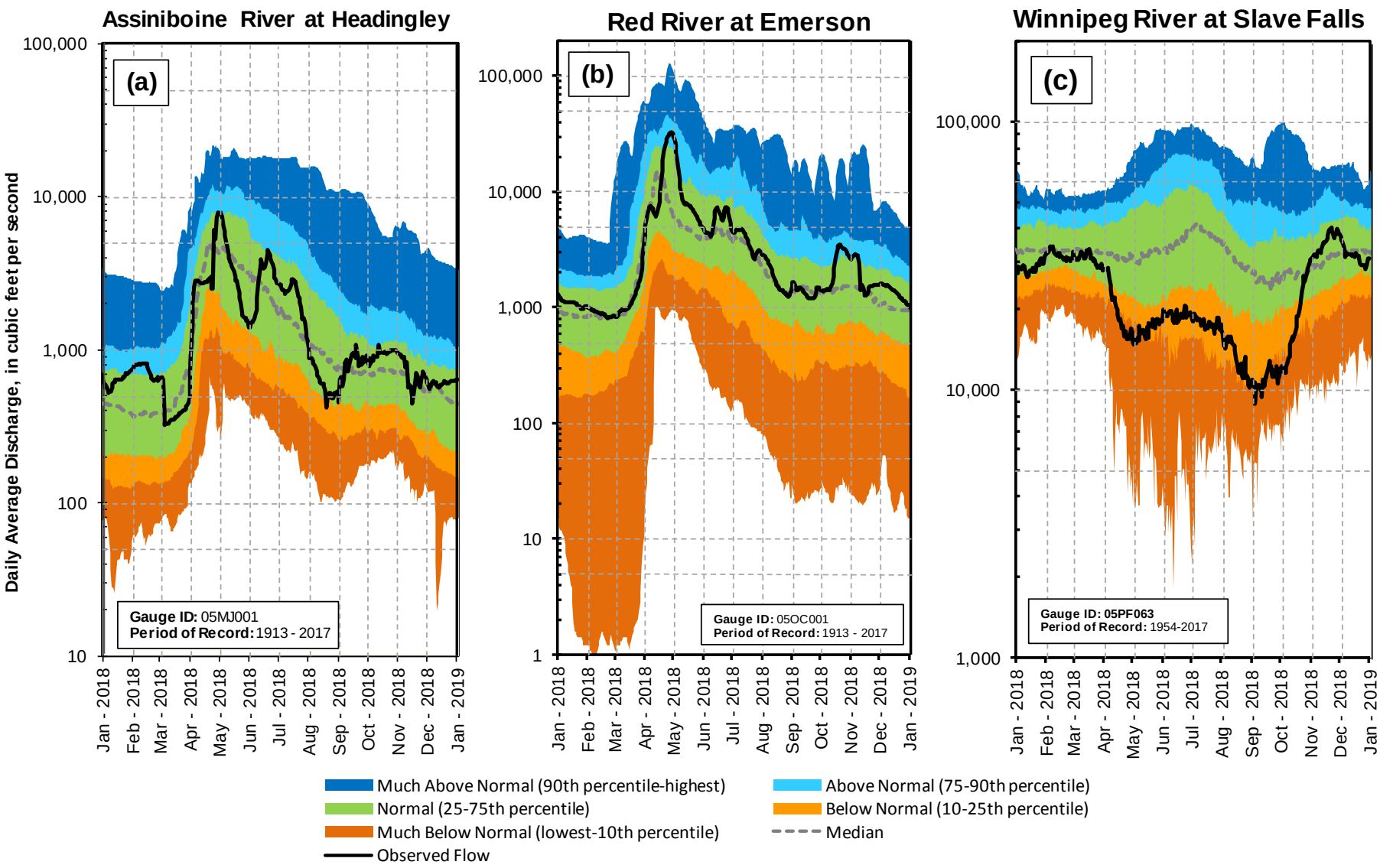

Figure 4: Daily streamflow percentile plots for the (a) Assiniboine, (b) Red, and (c) Winnipeg Rivers for 2018. Hydrometric data are obtained from Water Survey of Canada and Manitoba Hydro. Near real-time data are preliminary and subject to change upon review. All of the above gauges are classified as regulated.

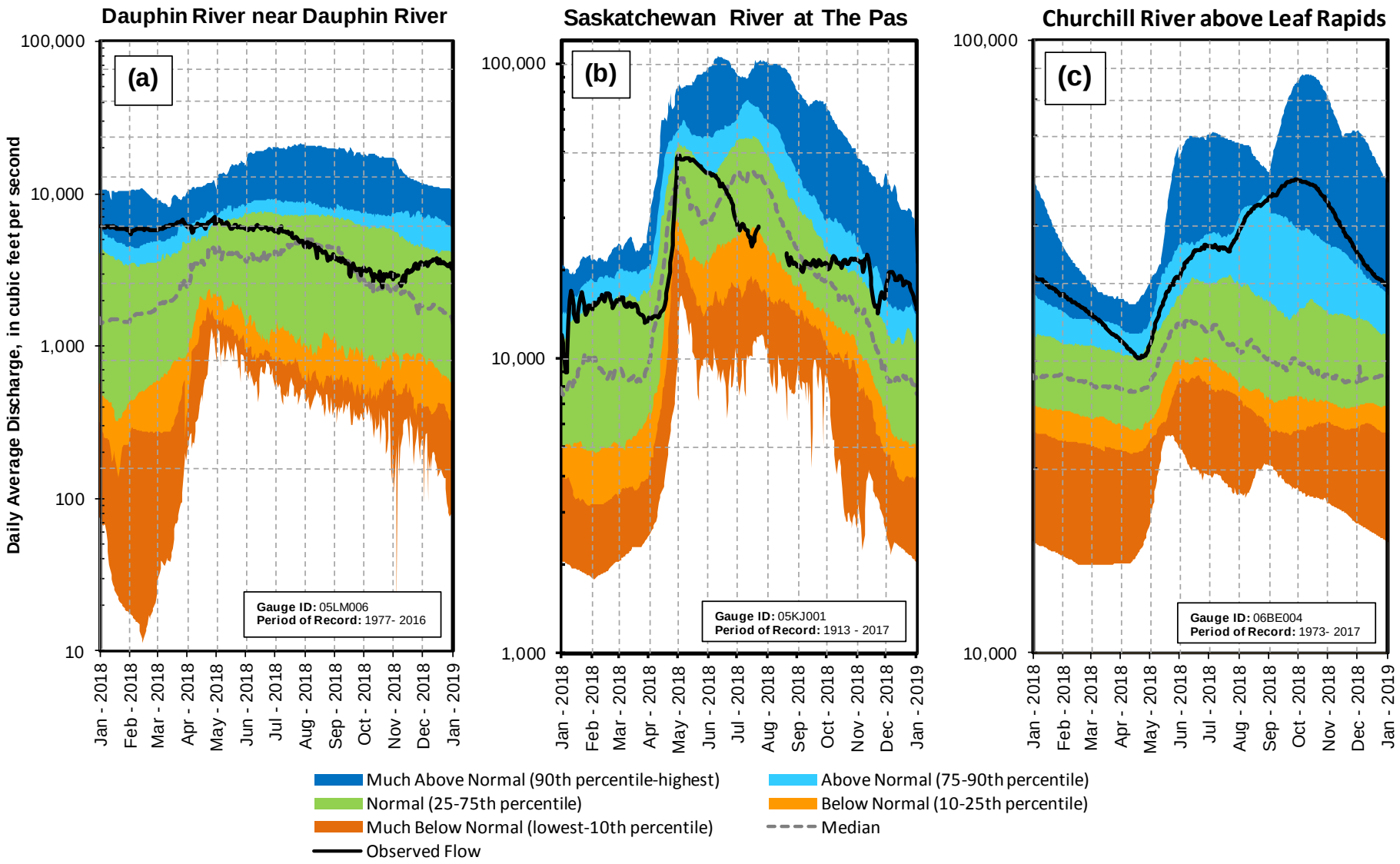

Figure 5: Daily streamflow percentile plots for the (a) Dauphin, (b) Saskatchewan, and (c) Churchill Rivers for 2018. Hydrometric data are obtained from Water Survey of Canada. Near real-time data are preliminary and subject to change upon review. All of the above gauges are classified as regulated.

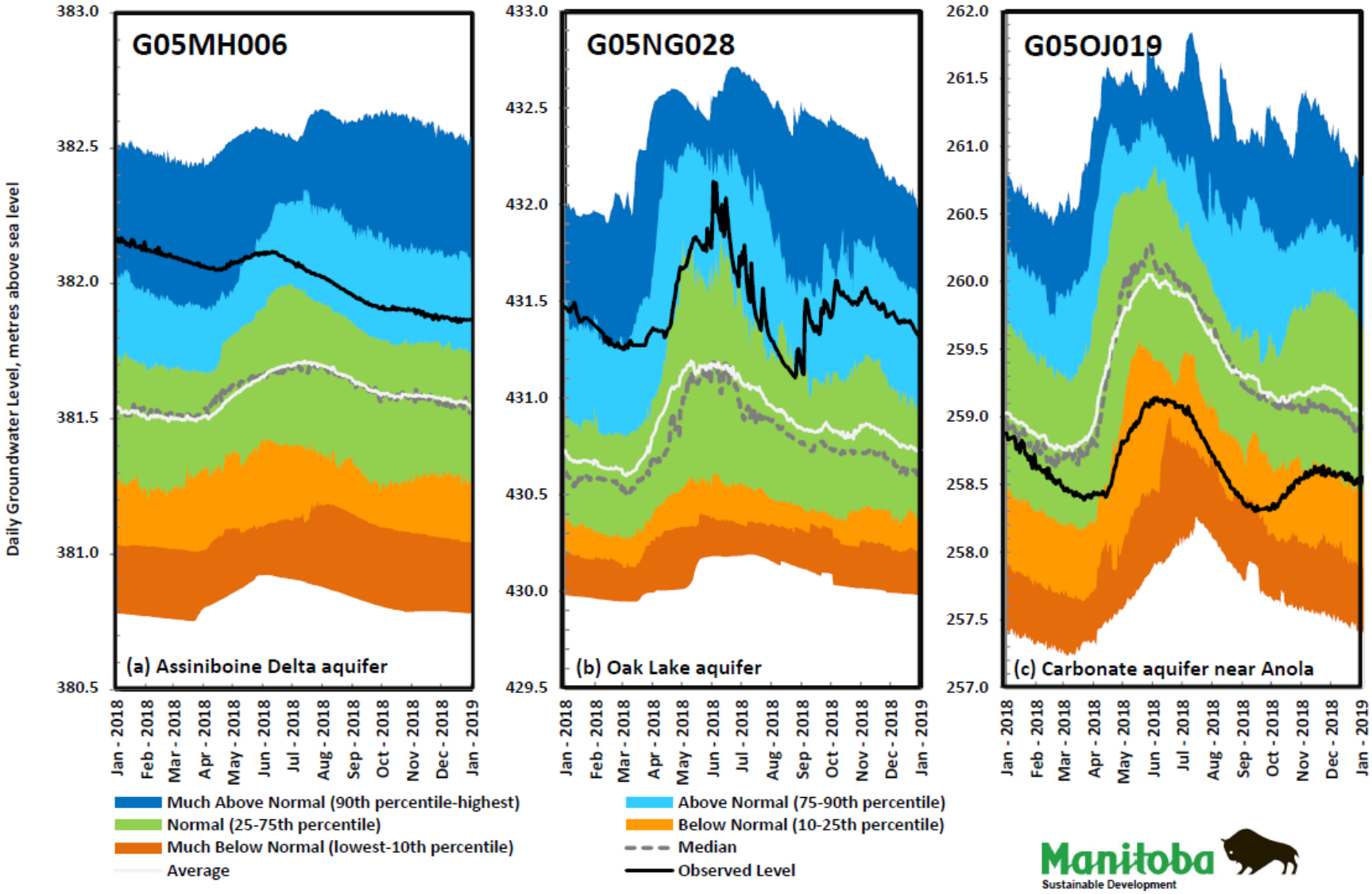

Figure 6: Groundwater hydrographs for (a) the Assiniboine Delta aquifer, (b) the Oak Lake aquifer, and (c) the Carbonate aquifer near Anola for 2018. Data provided by the Groundwater Management Section of Manitoba Sustainable Development.

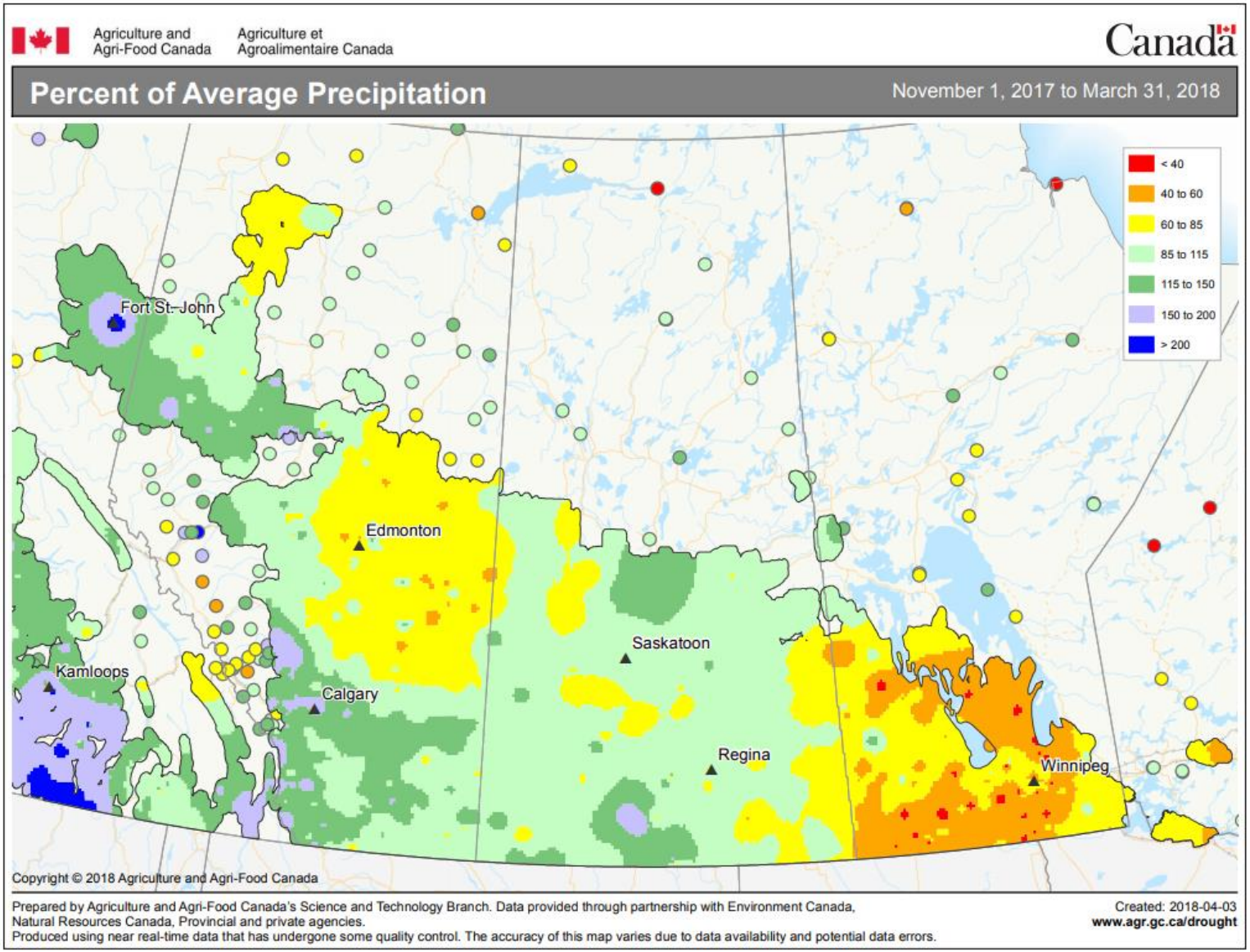

Figure 7: Agriculture and Agri-Food Canada's winter season (November 1, 2017 – March 31, 2018) percent of average precipitation.

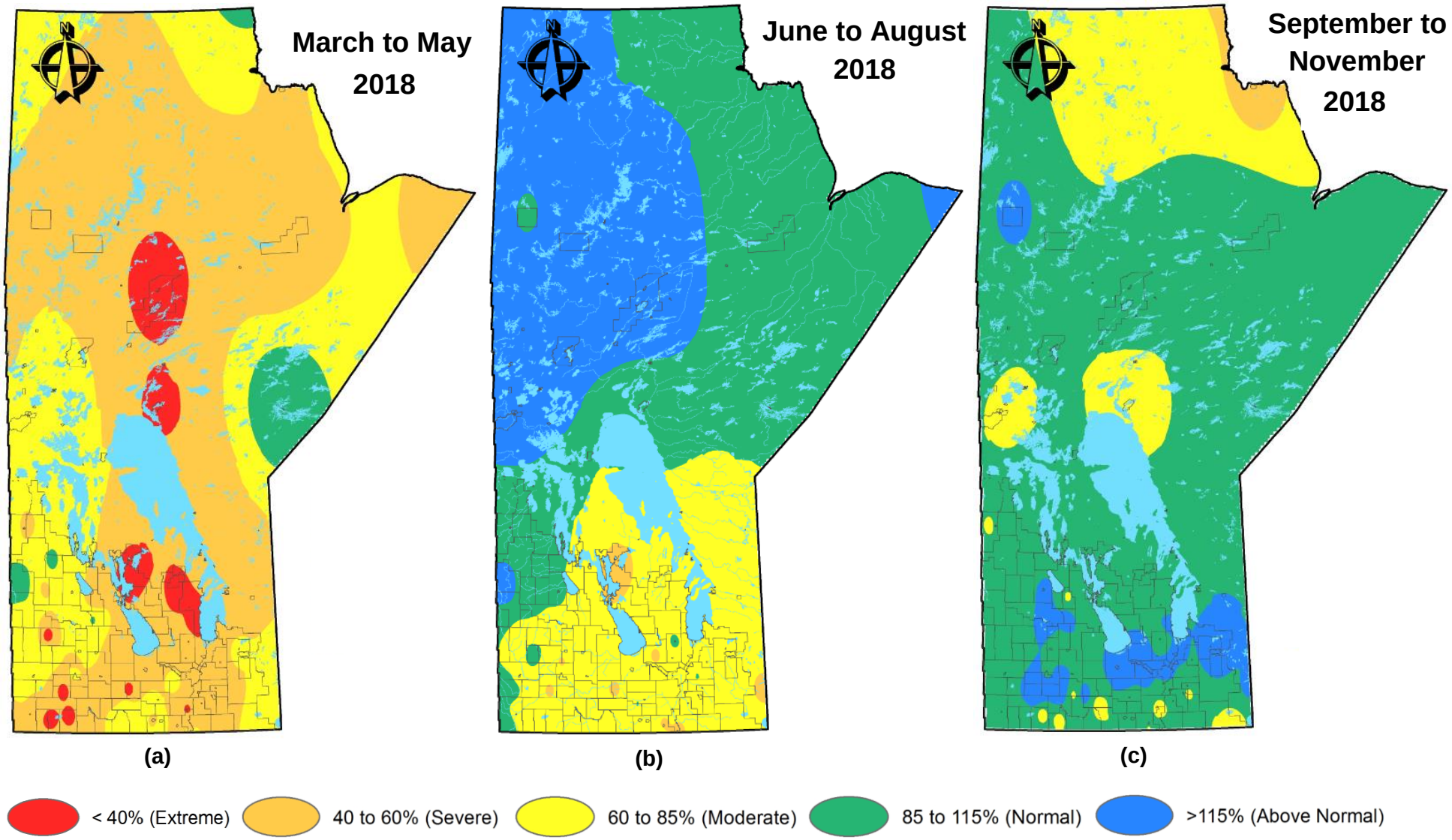

Figure 8: Three month (medium term) percent of median precipitation indicator for (a) March to May, (b) June to August, and (c) September to November 2018. Municipal boundaries are displayed.

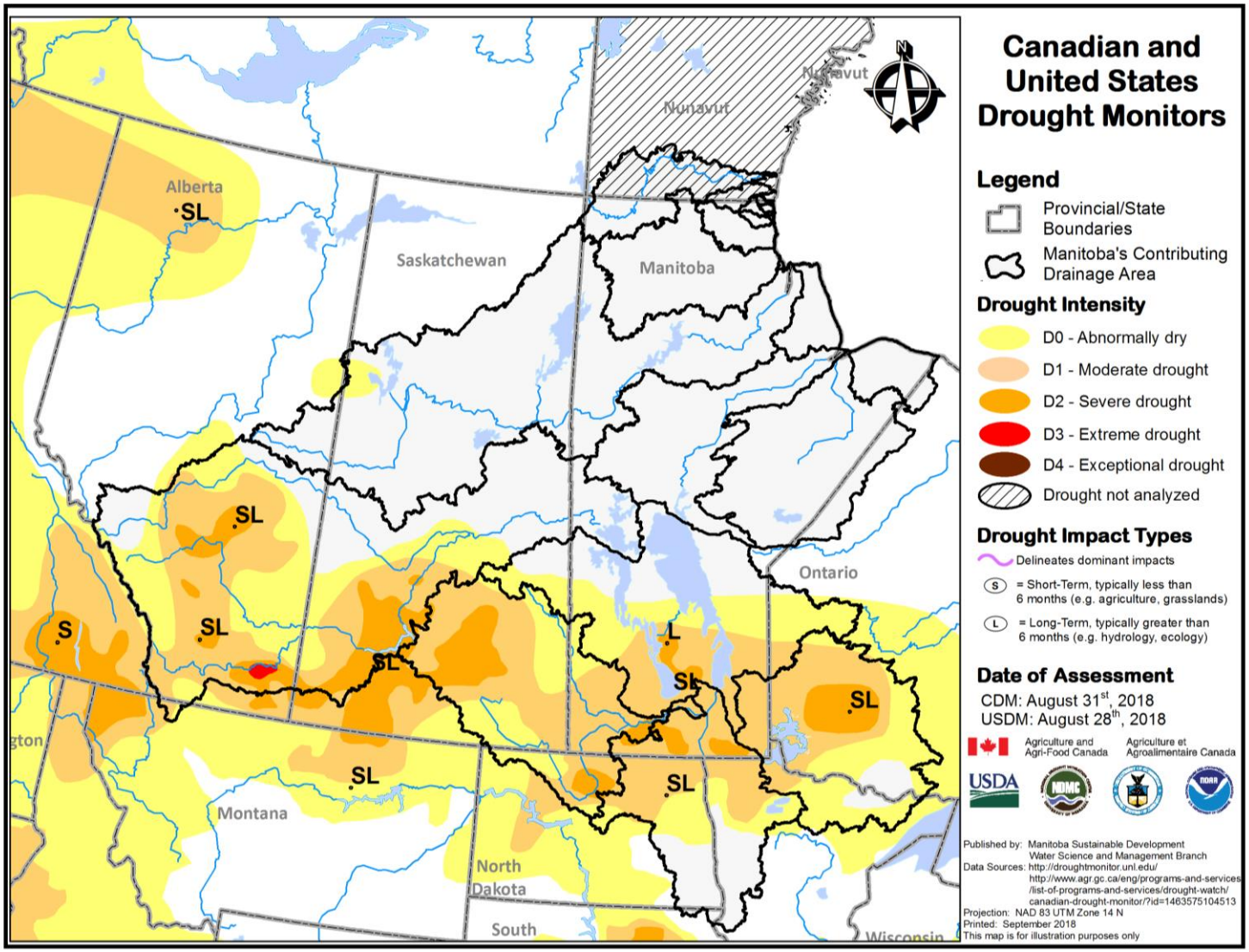

Figure 9: Canadian and United States Drought Monitors' classification of short-term (S) and long-term (L) drought conditions assessed as of August 31, 2018.

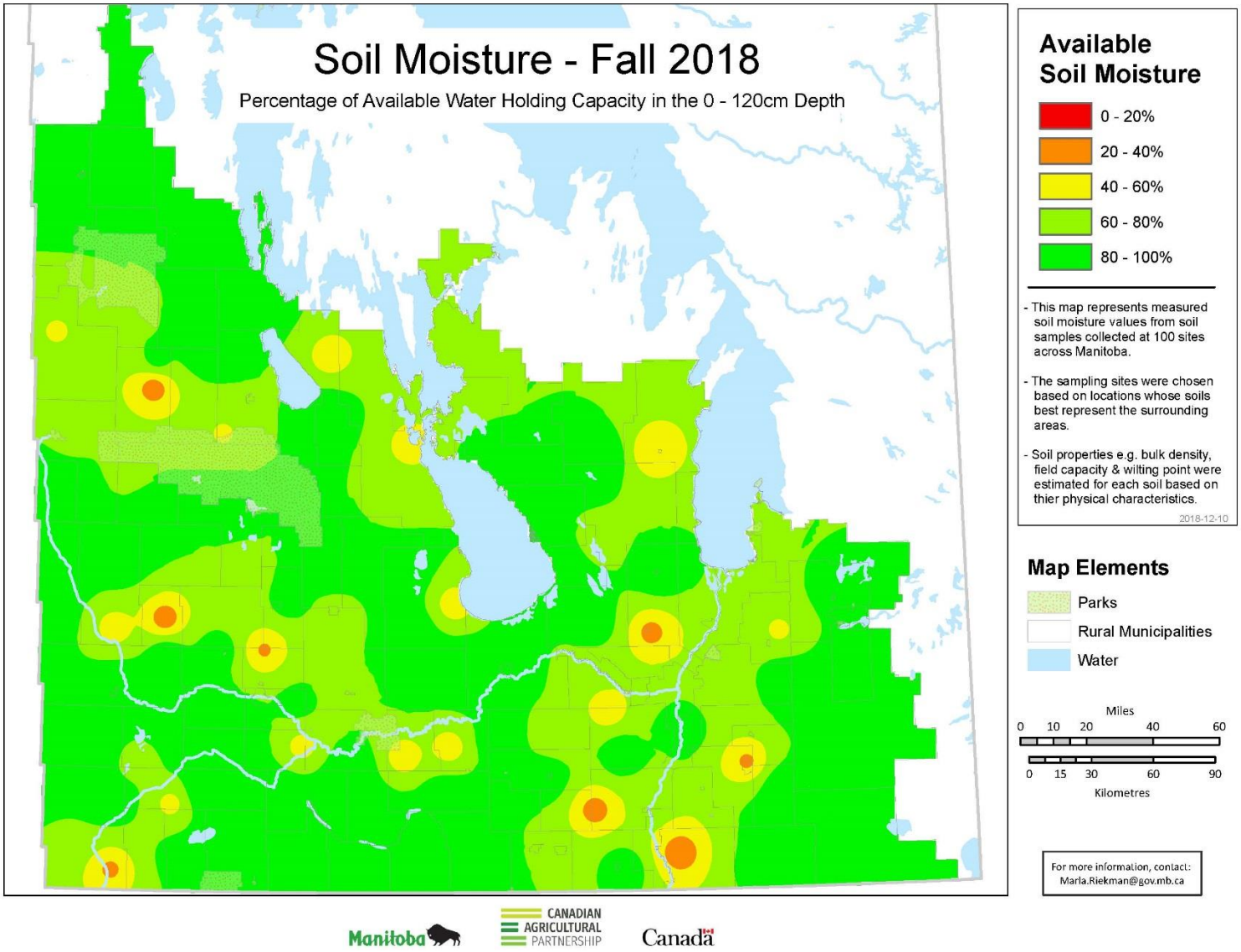

Figure 10: Manitoba Agriculture's fall 2018 soil moisture survey – percent of water holding capacity (0-120 cm depth).

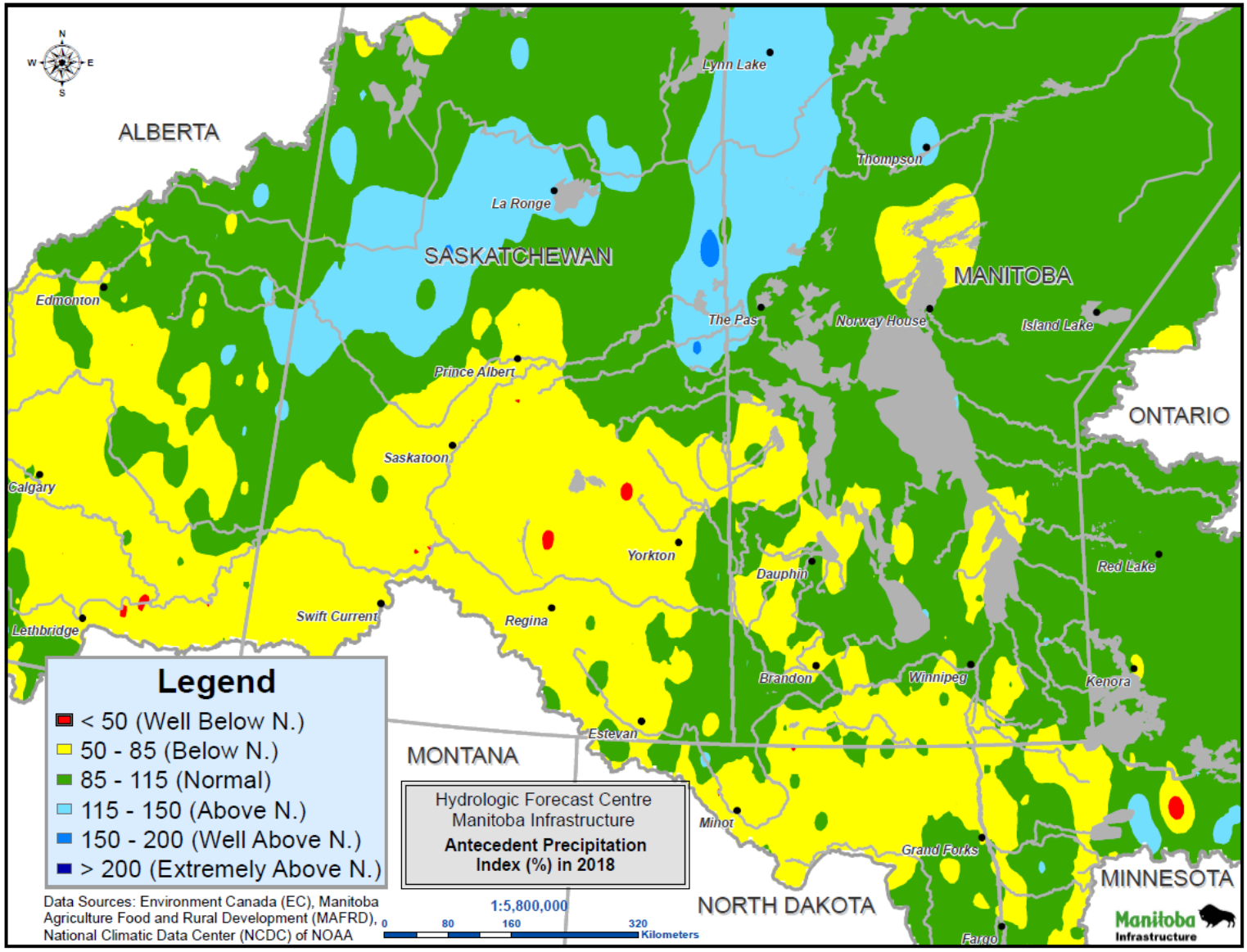

Figure 11: Manitoba Hydrologic Forecast Centre's Antecedent Precipitation Index (API) for the fall of 2018.

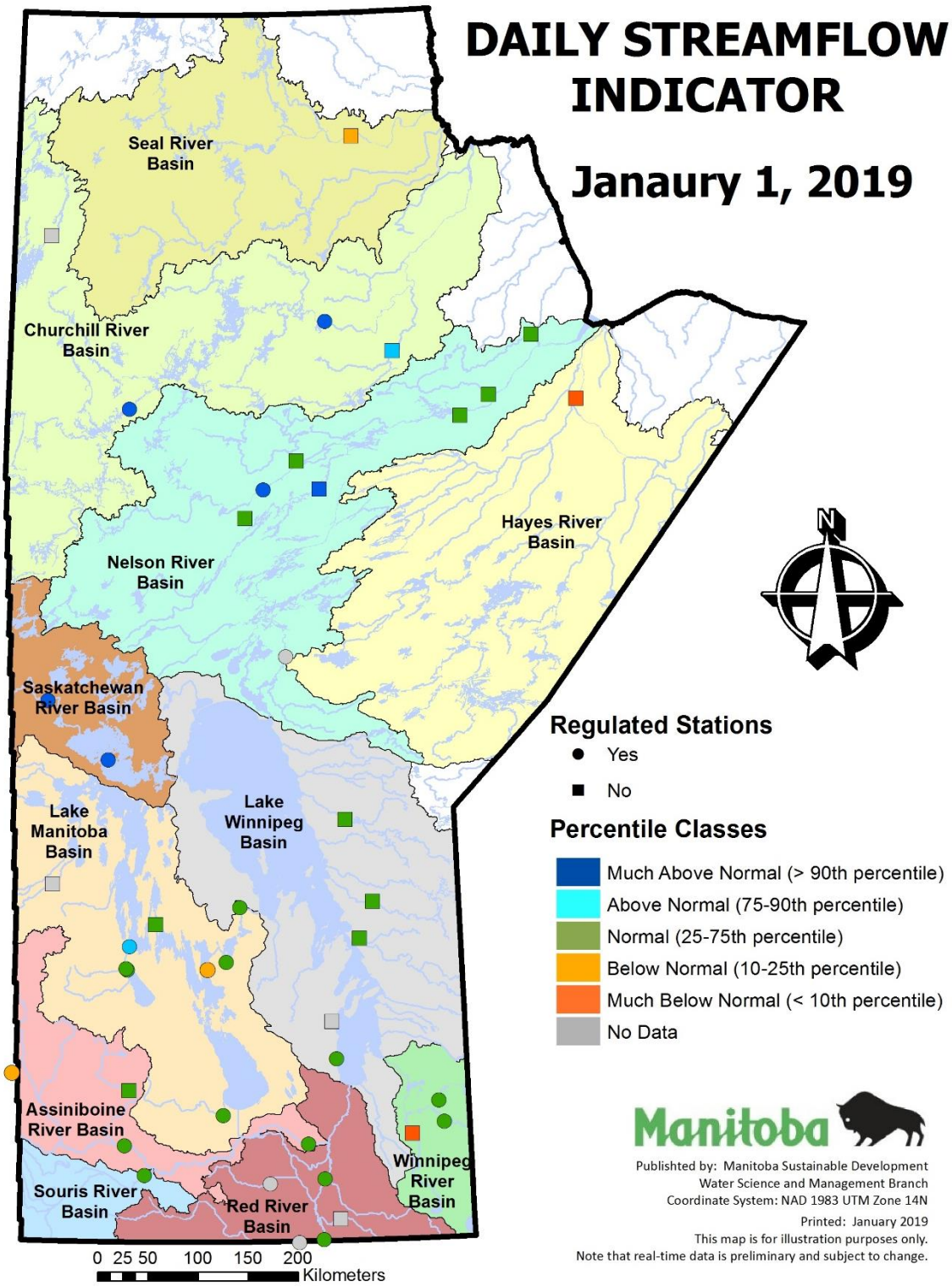

Figure 12: Daily streamflow indicator for January 1, 2019. Real-time daily streamflow and water levels are compared to historical values for the specified day.

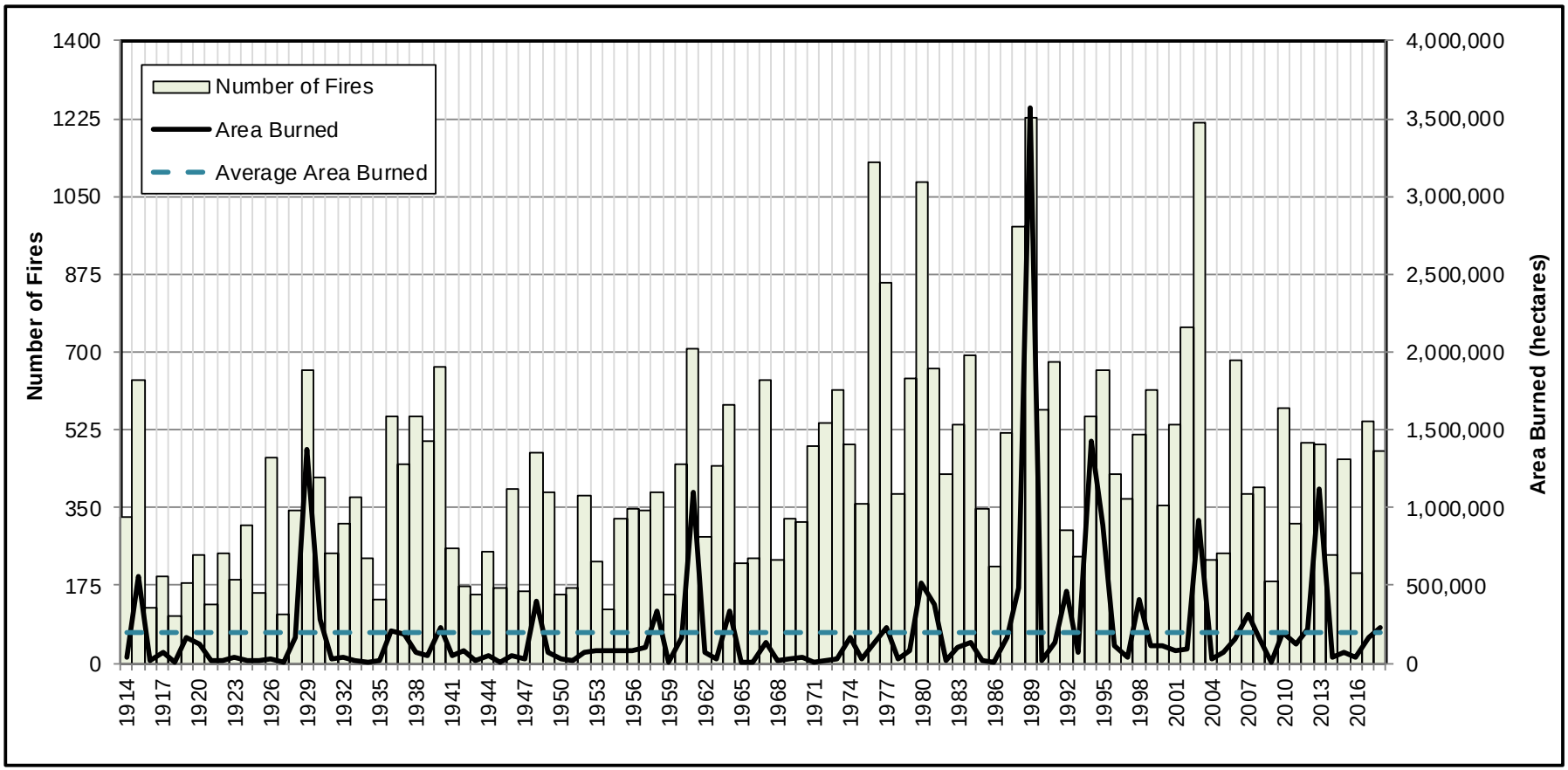

Figure 13: Manitoba Fire Program historical wildfire data from 1914 to 2018.