# 2017 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 2017.

Since the release of the Manitoba Drought Management Strategy in January 2016, a significant amount of work has been undertaken to implement the 12 action items included in the Strategy. As of the end of 2017, 33% of the action items have been completed or are ongoing, 50% have some progress made, and 17% have little to no progress.

High soil moisture and baseflows during the 2016 freeze-up and generally normal snowfall over the 2016/2017 winter season caused most of the major rivers and their tributaries to peak at above normal or much above normal flows during spring melt. Spring, particularly May, was very dry across agro-Manitoba; however, the subsoil generally had adequate moisture. The dry weather combined high water demand for crop spraying led to several municipal water system managers putting temporary conservation measures in place. By the end of August, the entire province, apart from a few isolated areas, was experiencing medium term (3-month) meteorological drought conditions. In northern Manitoba, large evacuations of several communities occurred due to wildfire activity.

Above normal precipitation in September across most of Manitoba replenished soil moisture and reduced fire activity. Despite below normal precipitation most crops saw above average yields; however, hay and pasture land conditions were reported as variable and many dugouts require adequate snowfall to fully refill in spring 2018. 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 2017. Long-term seasonal forecasts (February-March-April) are calling for below normal temperatures and normal precipitation.

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 and the long-term effects of climate change on water supply and demand for river basins.*** | **Some Progress.** Numerous smaller-scale and several large-scale water retention projects identified within the *Roseau River Watershed Distributed Retention Study* and the *Cooks Creek Watershed Distributed Retention Study*. |
| **(2)** | ***Establish drought committees to enable efficient information sharing and co-ordination of province-wide drought management efforts.*** | **Some Progress.** The Manitoba Drought Assessment Committee is established and actively meets a minimum two times per year. The Red River Basin Drought Assessment Group has been identified and will being meeting in 2018. The remaining Basin Drought Assessment Groups will be assembled in 2018. |
| **(3)** | ***Collaborate with Manitoba Emergency Measures Organization to enhance the Manitoba Emergency Plan to include specific guidance for drought-related emergencies.*** | **Some Progress.** Preliminary meetings have been held with the Emergency Measures Organization discussing development of a 'Drought Annex' to the Manitoba Emergency Plan. |
| **(4)** | ***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 are available on the Manitoba Drought Monitor website. Annual summary reports available from 2016 onwards. Continue to develop new improved maps and products into reports. |
| **(5)** | ***Determine drought preparedness levels for each river basin.*** | **Some Progress.** A pilot drought preparedness assessment will be completed in early 2018 for the Roseau River Basin. A preparedness assessment is ongoing in the Boyne-Morris watershed and will be completed in 2018/2019. Sustainable Development also provided support for Pembina Valley Water Co-op's Drought Management Study. Other basins studies to follow. |
| **(6)** | ***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. |

| | | |
|---|---|---|
| **(7)** | ***Establish a Manitoba Drought Monitor website with up to date drought information.*** | **Complete**<br>Manitoba Drought Monitor website went live in early 2016: www.gov.mb.ca/drought. Conditions reports and other drought information are available. Flow monitoring charts for 40+ rivers and lakes and other indicators are available through new online mapping tool. |
| **(8)** | ***Undertake research to develop drought forecasting tools for Manitoba.*** | **Little Progress.**<br>Research into this will be ongoing as opportunities and collaborations arise. Little progress has been made primarily due to constraints on time and resources. |
| **(9)** | ***Evaluate and enhance meteorological, hydrometric, soil moisture, groundwater and other networks used for drought monitoring and drought indicator computation.*** | **Some Progress.**<br>A review of the existing network has been completed. Methods to enhance the current network such as integrating new data from other departments and sources continue to be explored. |
| **(10)** | ***Participate in transboundary collaborations to better manage trans-boundary waters during drought.*** | **Ongoing.**<br>Manitoba currently has representatives on five transboundary committees or boards and is continually involved in transboundary drought-related management activities. |
| **(11)** | ***Implement and promote drought mitigation strategies to increase drought resiliency and reduce long-term drought impacts. Prepare information and awareness materials regarding drought, water supply management and water efficiency.*** | **Some Progress.**<br>Preparedness assessments make recommendations for viable drought mitigation measures based on sector-specific watershed vulnerabilities. Mitigation measures include a discussion on demand management and water efficiency.<br>Drought presentations were delivered to six organizations in 2017. |
| **(12)** | ***Periodically evaluate the Manitoba Drought Management Strategy to identify any gaps and update the strategy to incorporate new scientific methods and technologies.*** | **Ongoing.**<br>Every 5-10 years the Drought Management Strategy will be revisited to identify gaps and incorporate new scientific methods and technologies. Next update will be between 2021 and 2026. |

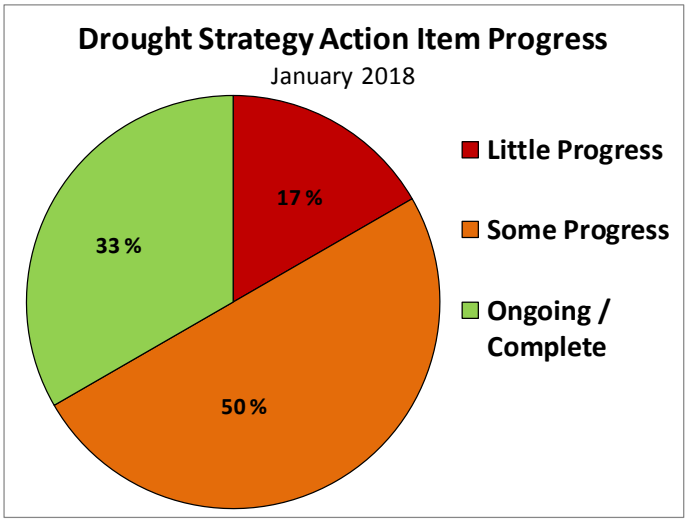


Figure 1: Progress in implementing actions in the Manitoba Drought Management Strategy.

## 2017 Conditions Summary

### *Antecedent conditions (Fall freeze-up 2016)*

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 by the Manitoba Hydrologic Forecasting Centre (Figure 2) showed that soil moisture conditions throughout most of Saskatchewan, southwestern Manitoba and most of northern Manitoba were above normal (115% – 150%) to well above normal (> 150%) at the time of freeze-up. Conditions were generally normal (85% – 115%) within central and eastern Manitoba and western Ontario. The American portion of the Red River Basin observed normal antecedent precipitation with a region of above normal conditions in the centre of the basin and a few pockets of below normal conditions (50% – 85%). Manitoba Agriculture's November soil moisture survey (Figure 3) indicated there were some drier regions (< 65% soil moisture content) in the Interlake, central and southwestern parts of the province. However, most of southern Manitoba was estimated to be at 85% to > 95% soil moisture content, indicating very wet conditions overall.

### *Winter 2016 / 2017 (December to March)*

During winter 2016/2017, baseflow conditions throughout the province were generally above normal, with many rivers and lakes at or near record high flows and levels for this time of year (Figure 4 and Figure 5). Overall, the normal to above normal soil moisture and baseflow conditions were cause for an optimistic outlook regarding spring water supply.

Total precipitation between November 1$^{st}$, 2016 and March 31$^{st}$, 2017 was generally normal (85% – 115% of normal) to above normal (115% – 150%) throughout most of Manitoba, with moderately dry conditions (60% – 85%) west of Lake Winnipegosis and severely dry conditions (40% – 60%) in the northeast portion of the province (Figure 6).

Both January and February were unseasonably warm. During mid-February, the daily maximum temperature was above zero degrees Celsius for almost two weeks. This resulted in significant melting of the snowpack in some southern Manitoba basins, including the Red River Basin.

### *Spring 2017 (March to May)*

The primary spring runoff began in mid-March in southern Manitoba and early May in northern Manitoba. Across the province most of the major rivers and their tributaries peaked at above normal (75$^{th}$ – 90$^{th}$ percentile) to much above normal (>90$^{th}$ percentile) flows, partially due to high baseflows throughout the winter and into the spring (Figure 4 and Figure 5). Many northern rivers observed record high flows (ex. Churchill River).

Spring (March to May) was very dry in southern Manitoba (Figure 7a), and much of the region experienced moderately dry (60% – 85% of median) to severely dry (40% – 60% of median) precipitation

conditions over this three-month period. May was especially dry, and large areas of the central, eastern and Interlake regions of agro-Manitoba observed monthly precipitation amounts less than 40% of median. Dry topsoil conditions in lighter soils and low crop residue levels resulted in blowing and drifting soils in some areas, however the subsoil generally had adequate moisture. Precipitation in northern Manitoba was generally normal to above normal during the spring months, however some moderately dry conditions developed around Island Lake and Norway House.

### *Summer 2017 (June to September)*

Due to the dryness in May, Pembina Valley Water Co-op asked the public to conserve water in early June as the increased demand (primarily for crop spraying) temporarily exceeded the capacity of the Letellier plant to treat raw water supply from the Red River. The Langruth water treatment plant (RM of Westlake-Gladstone) and the Town of Niverville also implemented temporary water conservation measures in early June.

June precipitation was closer to normal than observations in the previous months, however large portions of agro-Manitoba continued to experience moderately to severely dry precipitation conditions. In July, the extent of dry conditions expanded across agro-Manitoba and across much of northern Manitoba. Producers reported hayland and pastures showed signs of moisture stress in dry regions. Dugout conditions in the southwest and northwest regions began to suffer. In North Dakota, 23 counties and the Standing Rock Sioux Tribe declared drought emergencies and drought assistance programs were activated to reduce the impacts to livestock.

By the end of August, all of Manitoba, apart from a few isolated areas, was experiencing meteorological drought (Figure 7b). The three-month (medium term) precipitation indicator for August showed that the total precipitation between June to August was 60% to 85% of median across Manitoba, with the exception of the regions surrounding Churchill and Indian Bay which saw normal precipitation amounts. Several regions in northwest and central agro-Manitoba observed severely dry conditions with rainfall totalling 40% to 60% of median during this period. Large evacuations of several northern communities occurred during August due to wildfire activity. More detail of these impacts is provided below.

September brought normal to above normal precipitation to most of the province (Figure 7c), which helped to replenish soil moisture and reduce fire activity and risk across the province. Although the summer months observed below average precipitation across most of agro-Manitoba, the yields were above average for many crops due to timely rains and high subsoil moisture content early in the growing season. Hay and pasture land conditions were reported to be variable.

### *2017 Wildfire Season*

A total of 543 wildfires burned 170,107 ha in 2017 (Table 2). Comparing 2017 to historical wildfire data, the total area burned equaled approximately 85% of average based on 102 years of data (Figure 8). Almost 90% of the total burn occurred during August 2017, primarily in the northeast portion of the province. Fire crews battled several major fires during the month of August. A wildfire northwest of Lynn Lake resulted in the closure of PR 394 and also impacted the community of Kinoosao, Saskatchewan.

The community of Poplar River had to be evacuated as a safety precaution due to a large and persistent wildfire that ignited the first week of August (approximately 4,600 ha in size). Fox Lake First Nation was temporarily evacuated as a safety precaution due to an encroaching wildfire (approximately 2,000 ha in size). A wildfire starting mid-August in the Island Lake region (approximately 23,000 ha in size) resulted in the evacuation of Wasagamack First Nation, St. Theresa Point and Garden Hill First Nation. Normal to above normal precipitation during September 2017 significantly reduced fire activity and risk across Manitoba.

Table 2: 2017 wildfire activity (number of fires and total area burned) broken down by region.

| Region | Northeast | Northwest | Western | Central | Eastern | Total |
|---|---|---|---|---|---|---|
| **Total Fires** | 336 | 100 | 5 | 22 | 80 | 543 |
| **Total Area Burned (hectares)** | 149,660 | 4,118 | 164 | 414 | 15,752 | **170,107** |

### *Fall freeze-up 2017 (October to December)*

Dugout conditions obtained from Crop Reports in early to mid-October 2017 indicated that on-farm water supplies generally require adequate snowfall to be replenished for summer 2018. This is in contrast to the previous few years where above normal precipitation generally kept on-farm supplies nearly full all year round.

Manitoba Agriculture's mapping of topsoil (0-30 cm) moisture conditions as of November 14th, 2017 showed most of agro-Manitoba was experiencing adequate to dry topsoil moisture (Figure 9). Dry conditions were located primarily in the southwest region and the municipalities surrounding Lake Manitoba; however, isolated regions of dry conditions also existed within the northwest, central and eastern districts. Antecedent precipitation analysis from the Manitoba Hydrologic Forecasting Centre (Figure 10) indicated that soil moisture conditions were drier than 2016 (Figure 2), with most of the province and contributing drainage area classified as normal (85% to 115%) to below normal (50% to 85%) at the time of freeze-up.

Most of the reservoirs monitored in real-time were close to (> 85%) or at full supply level going into freeze-up, except for Jackson Lake (74% of full supply level) and Stephenfield (78% of full supply level) which were slightly lower. The non-automated water supply reservoirs were last visited in September 2017. Based on these September water level measurements, five of the six reservoirs were close to (> 85%) full supply level, except for Lake Irwin, which was at 68% of full supply level.

As of December 31st, 2017, streamflow and lake levels generally ranged between normal (25th – 75th percentile) to much above normal (>90th percentile) (Figure 11). Exceptions included the Souris River, Round Lake and Weaver Lake, which were classified as below normal (10th – 25th percentile) or much below normal (<10th percentile). Groundwater levels in major aquifers were generally good (Figure 12). Water level responses to seasonal or yearly precipitation fluctuations in most aquifers lag considerably behind surface water responses, so even prolonged periods of below normal precipitation may not have a significant negative effect on groundwater levels.

## Acknowledgements

This report was prepared with information from the following sources, which are gratefully acknowledged:

- Manitoba Infrastructure - Reservoir level information and antecedent precipitation mapping: *http://www.gov.mb.ca/mit/floodinfo/floodoutlook/river_conditions.html*
- Environment and Climate Change Canada - Flow and lake level information: *http://www.wateroffice.ec.gc.ca/index_e.html*
- Manitoba Sustainable Development's Fire Program: *http://www.gov.mb.ca/conservation/fire/*
- Environment and Climate Change Canada three month climatic outlook: *http://weatheroffice.gc.ca/saisons/index_e.html*
- Manitoba Agriculture Crop Reports and soil moisture mapping: *http://www.gov.mb.ca/agriculture/crops/seasonal-reports/crop-report-archive/index.html*
- AAFC Drought Watch (including the Canadian Drought Monitor): *http://www.agr.gc.ca/drought*
- United States Drought Monitor: *droughtmonitor.unl.edu/*
- National Oceanic and Atmospheric Administration: ENSO: Recent Evolution, Current Status and Predictions: *http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf*

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**Past reports are available on the Manitoba Drought Monitor website.**

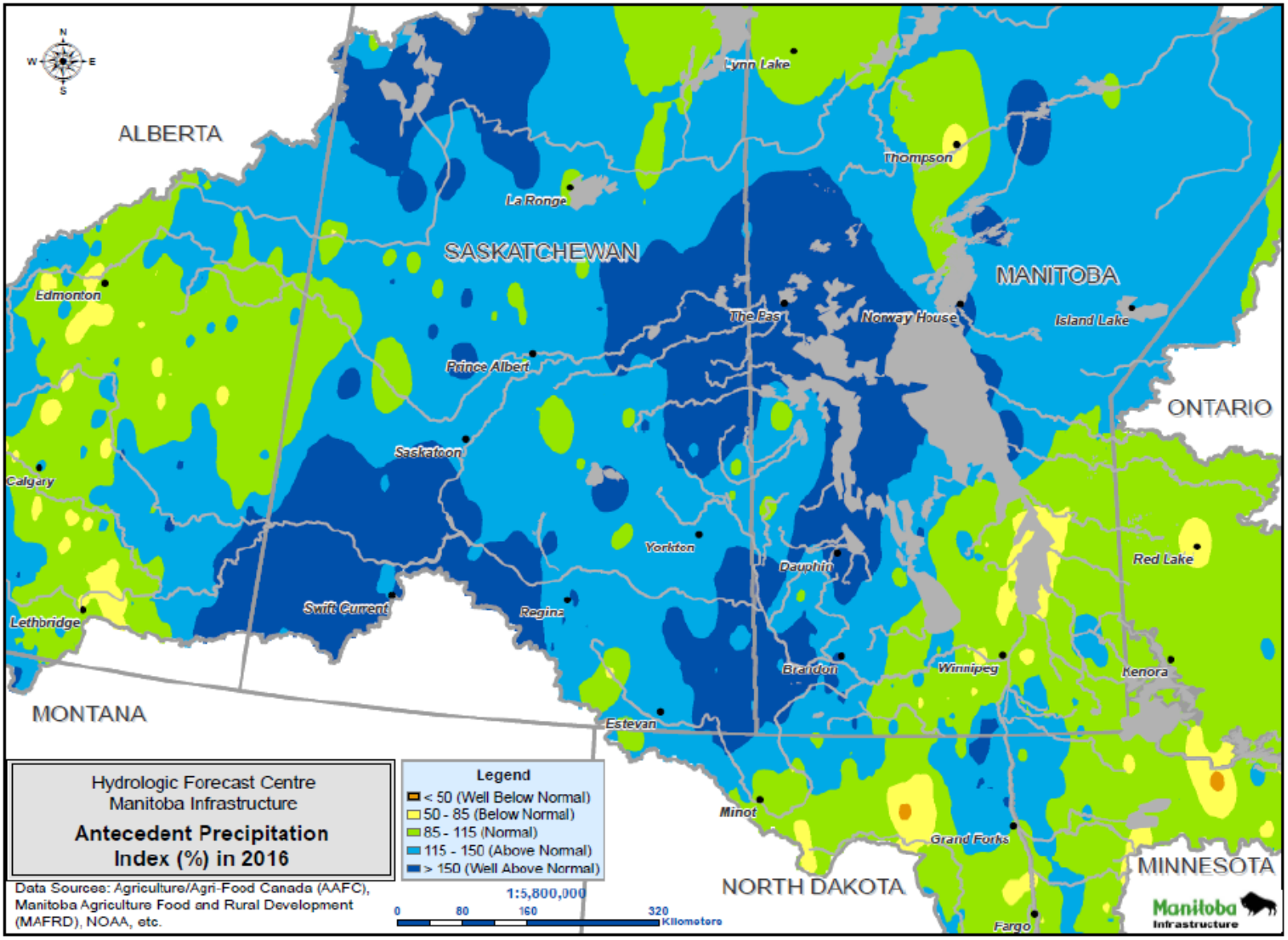


Figure 2: Manitoba Hydrologic Forecasting Centre's Antecedent Precipitation Index (API) for fall 2016.

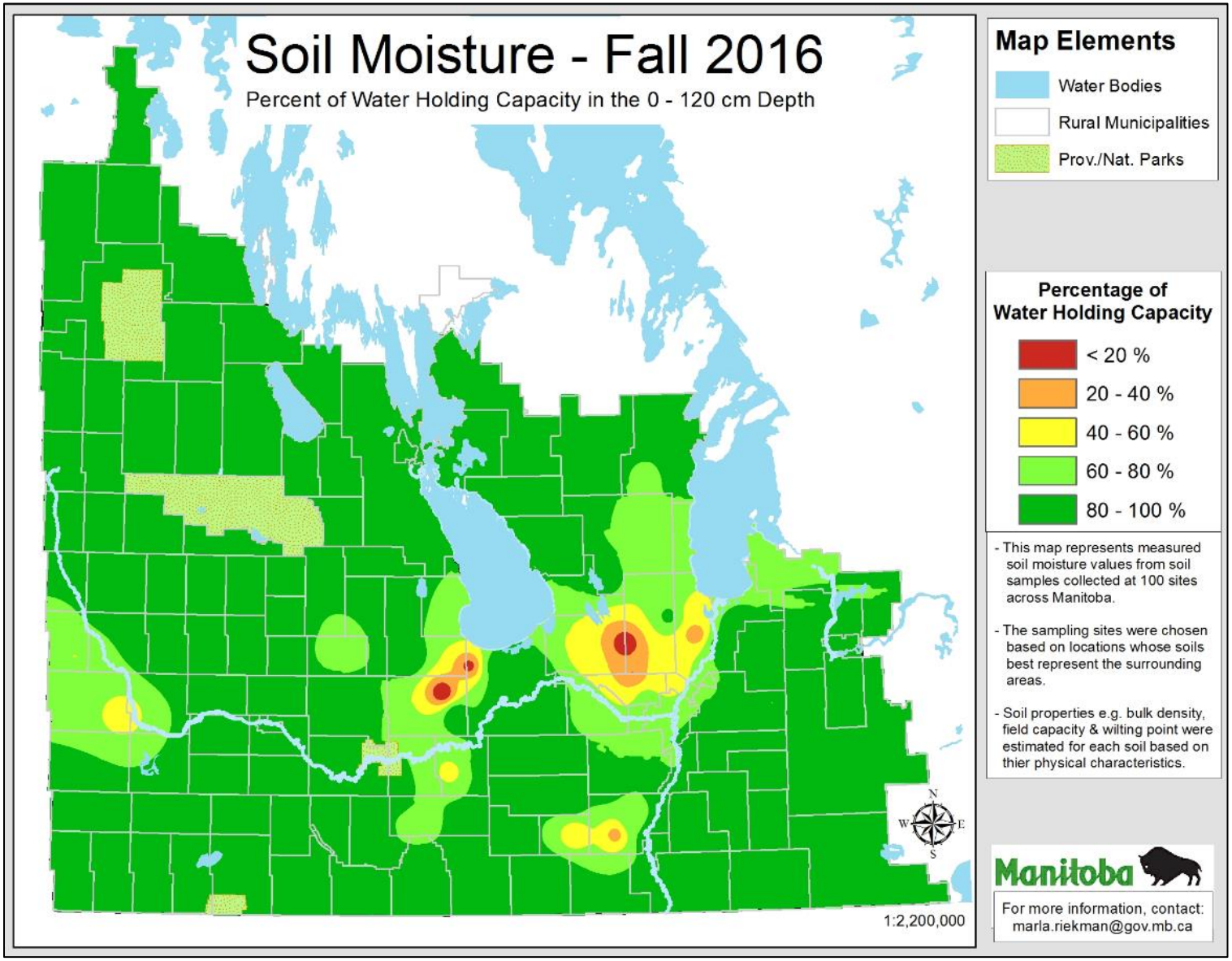


Figure 3: Manitoba Agriculture's fall 2016 soil moisture survey – percent of water holding capacity (0-120 cm depth).

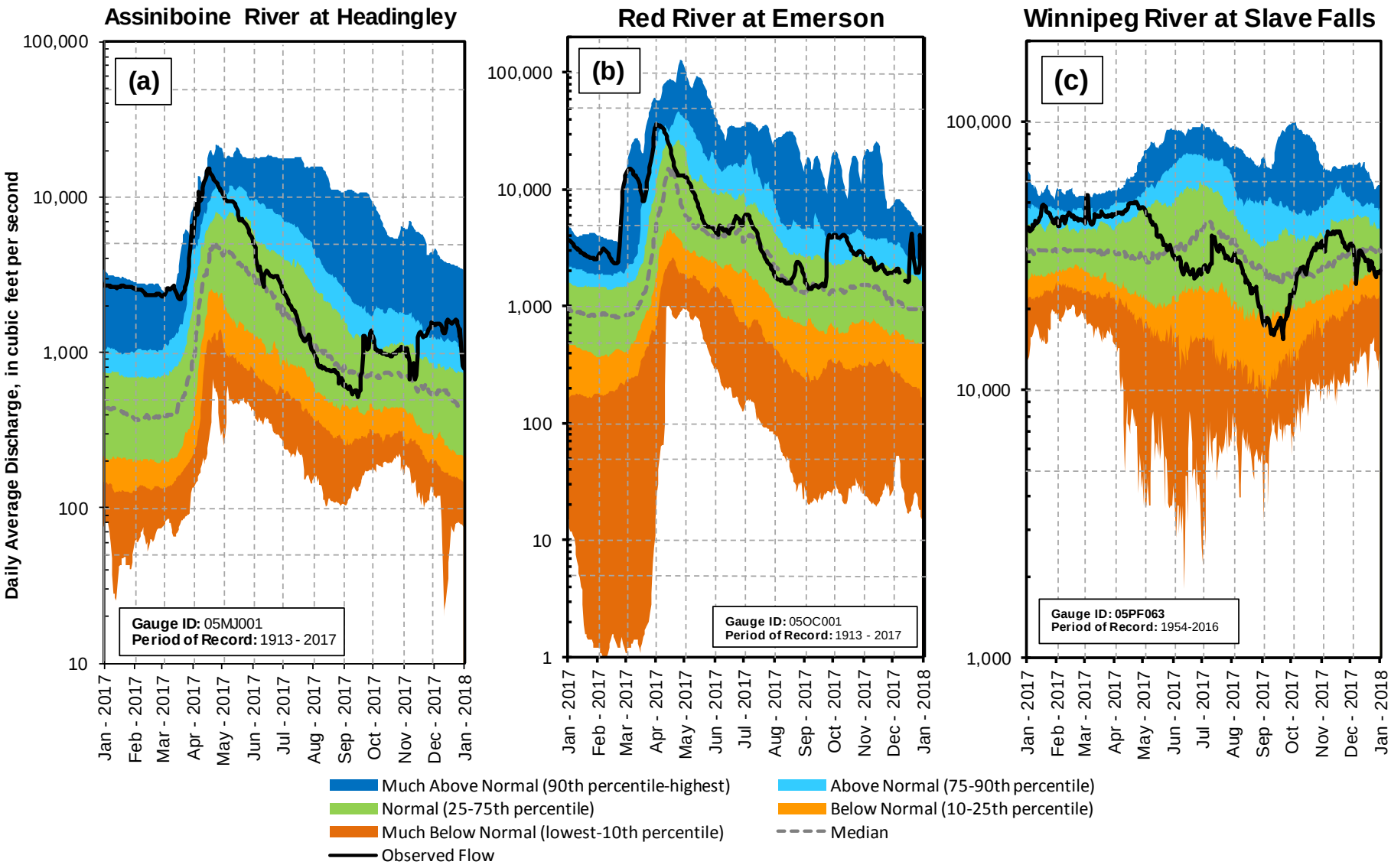


Figure 4: Daily streamflow percentile plots for the (a) Assiniboine, (b) Red, and (c) Winnipeg Rivers for 2017. Hydrometric data are obtained from Water Survey of Canada. Near real-time data are preliminary and subject to change upon review. All of the above gauges are classified as regulated.



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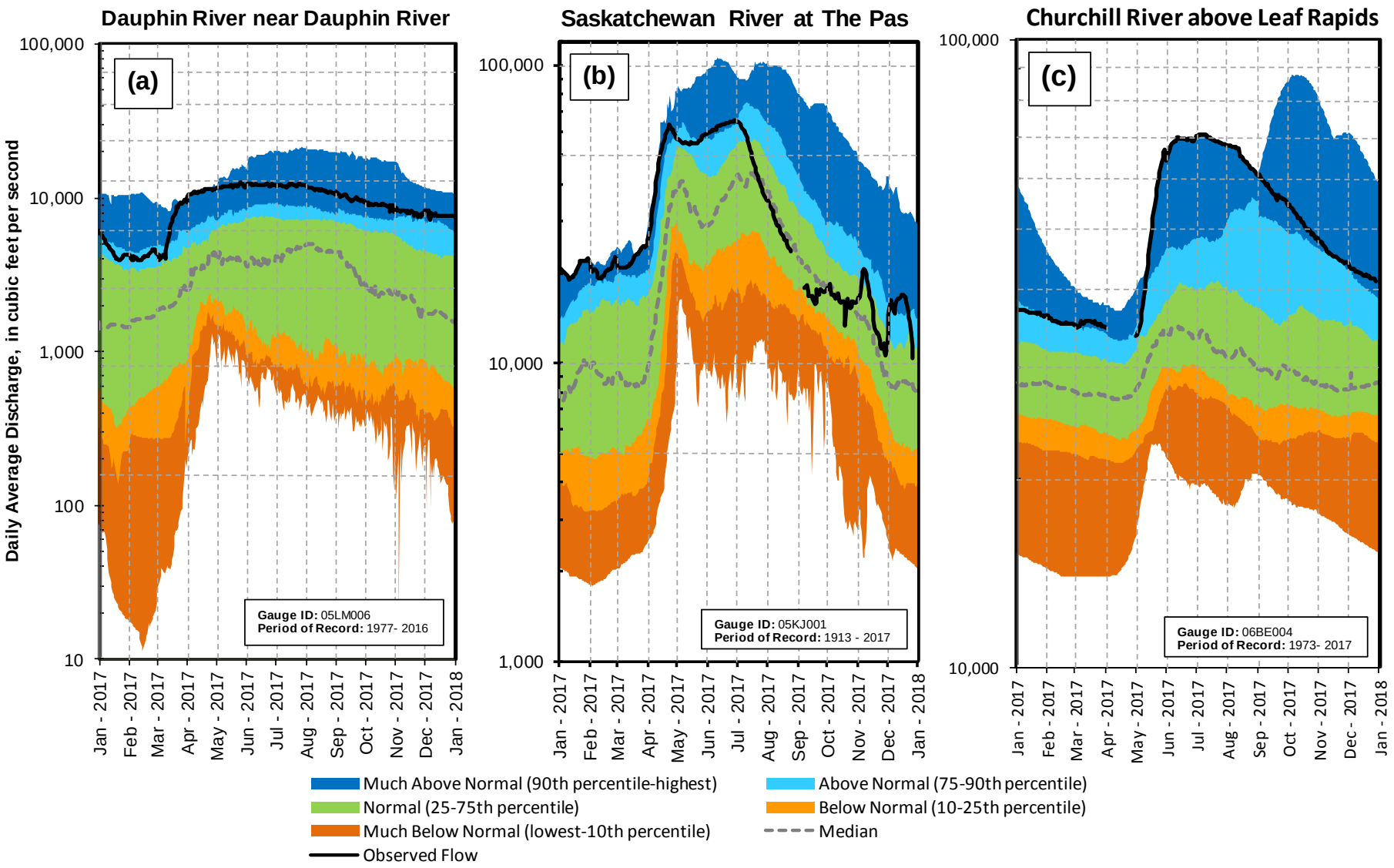


Figure 5: Daily streamflow percentile plots for the (a) Dauphin, (b) Saskatchewan, and (c) Churchill Rivers for 2017. Hydrometric data are obtained from Water Survey of Canada. Near real-time data are preliminary and subject to change upon review. All of the above gauges are classified as regulated.



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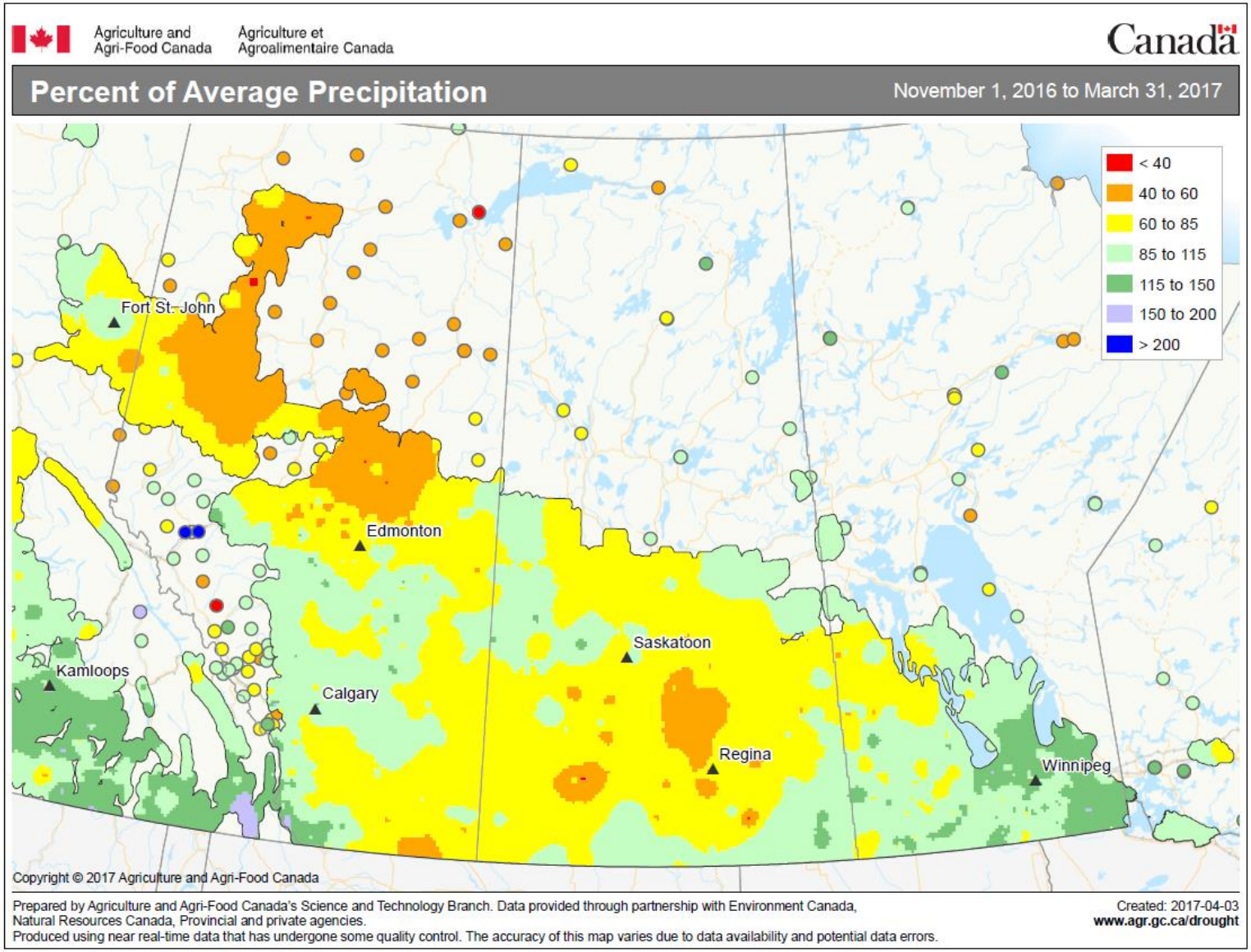


Figure 6: Agriculture and Agri-Food Canada's winter season (November 1st, 2016 – March 31st, 2017) percent of average precipitation.

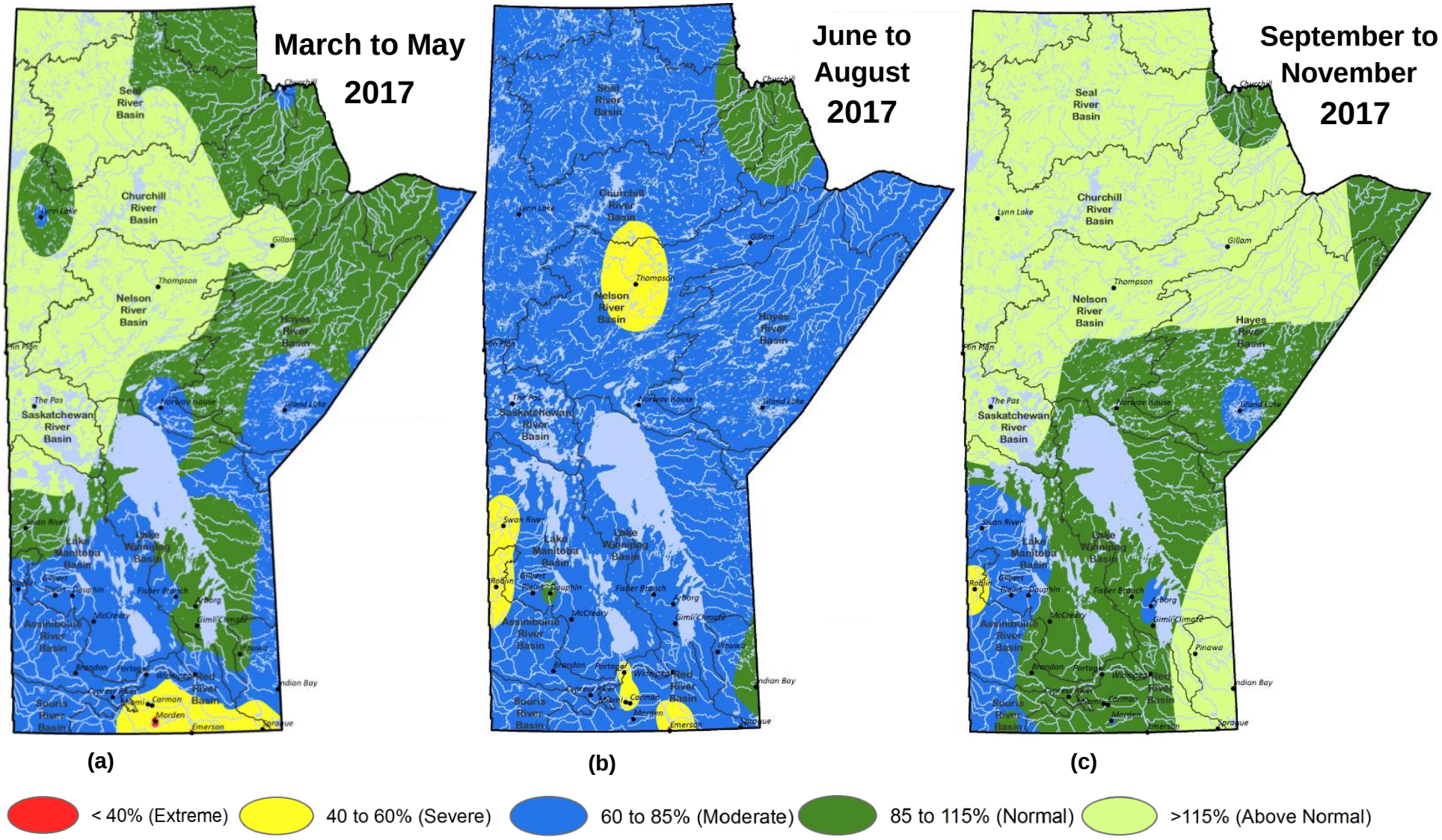


Figure 7: Three month (medium term) percent of median precipitation indicator for (a) March to May, (b) June to August, and (c) September to November 2017.

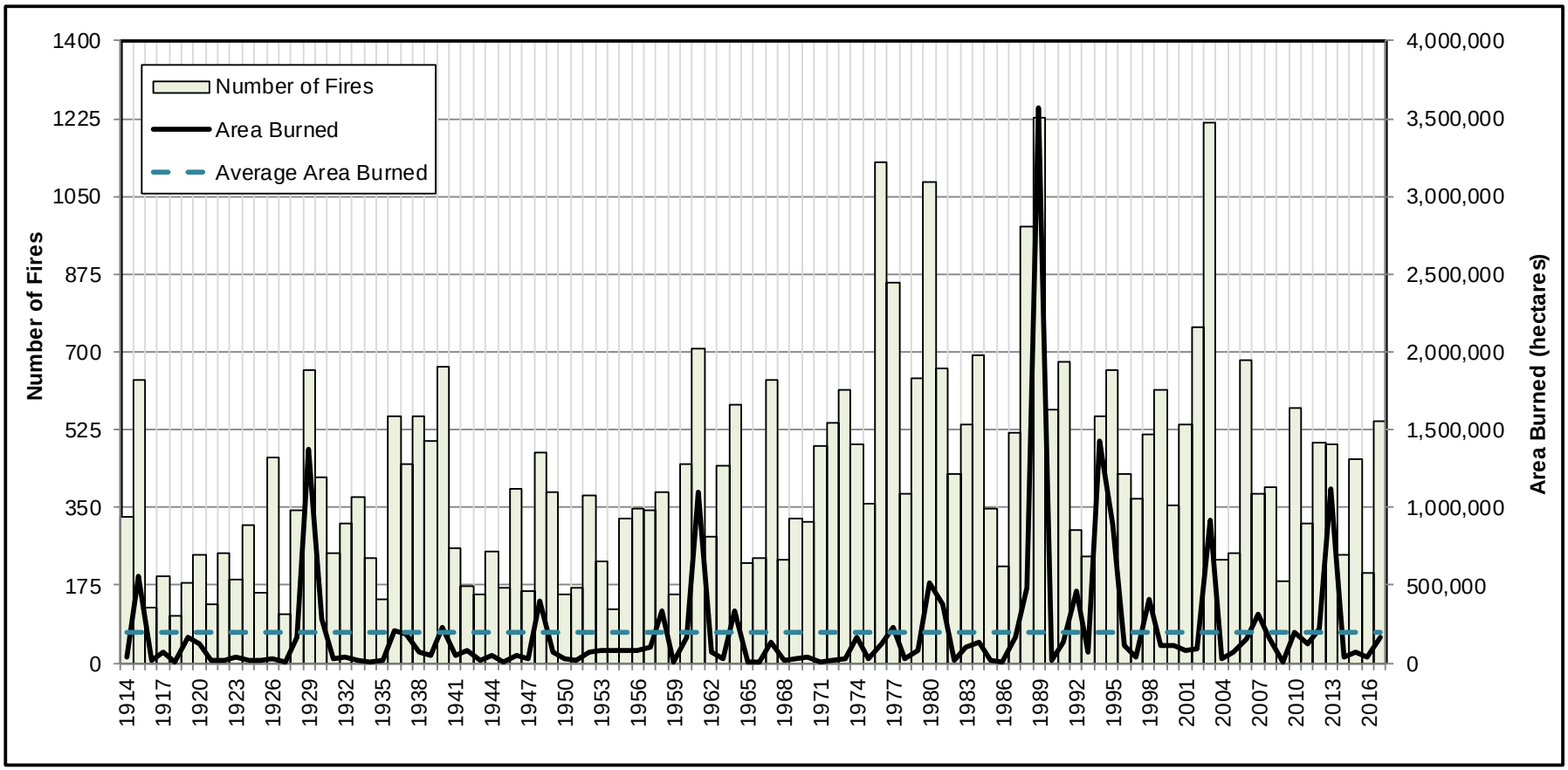


Figure 8: Manitoba Fire Program historical wildfire data from 1914 to 2017.



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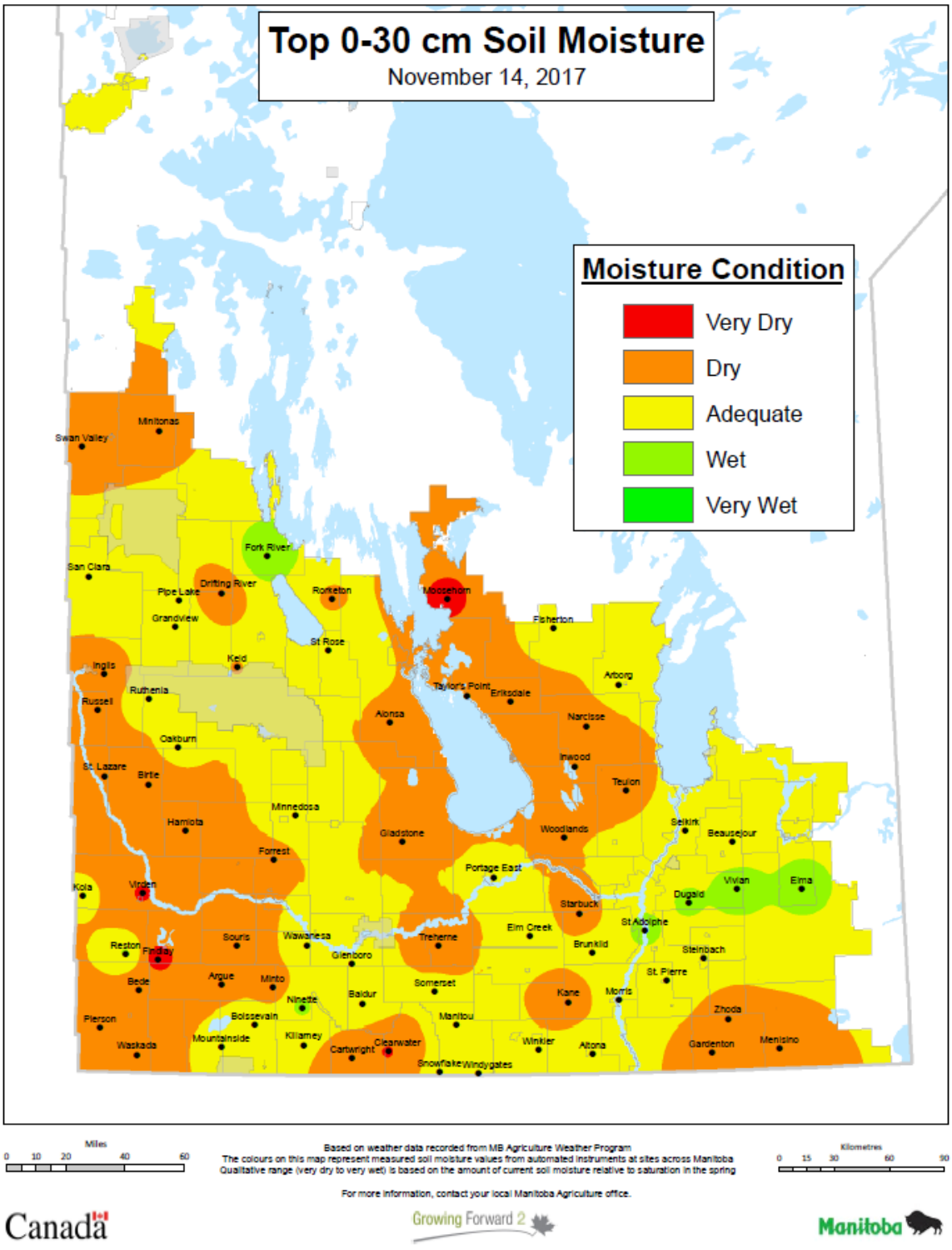


Figure 9: Manitoba Agriculture's fall 2017 soil moisture survey – average soil moisture (0 – 30 cm depth).



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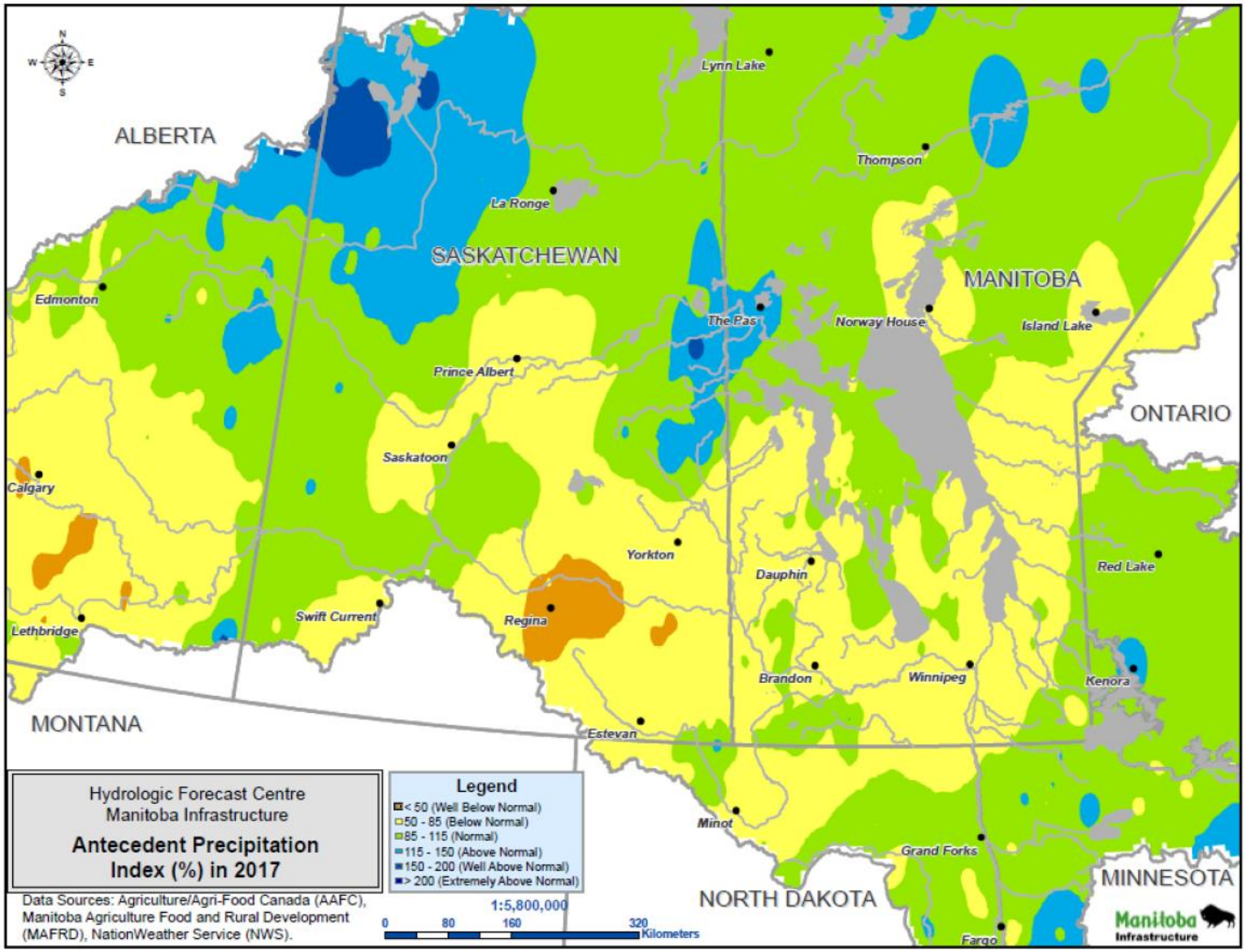


Figure 10: Manitoba Hydrologic Forecasting Centre's Antecedent Precipitation Index (API) for the fall of 2017.

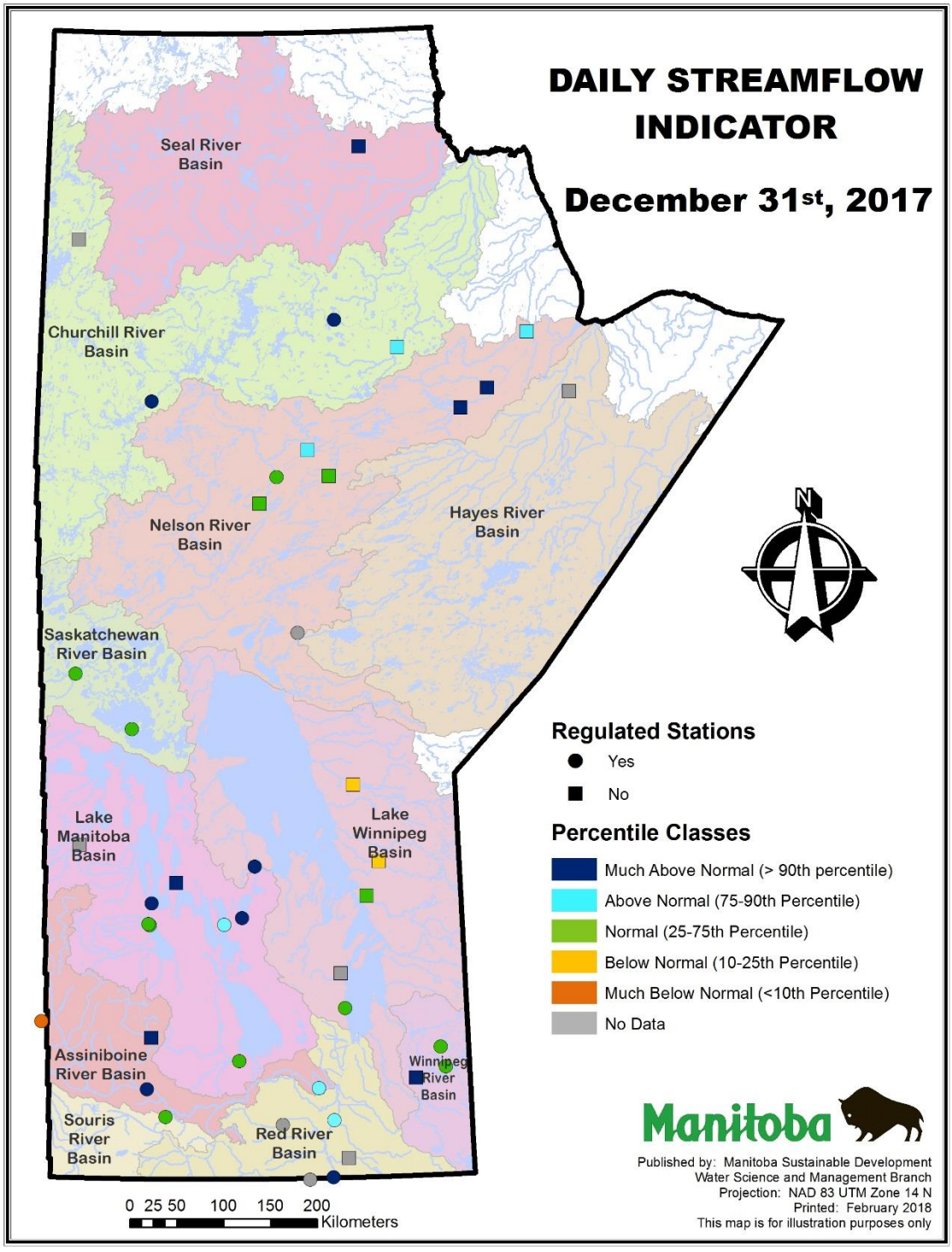


Figure 11: Daily streamflow indicator for December 31st, 2017. Real-time daily streamflow and water levels are compared to historical values for the specified day.

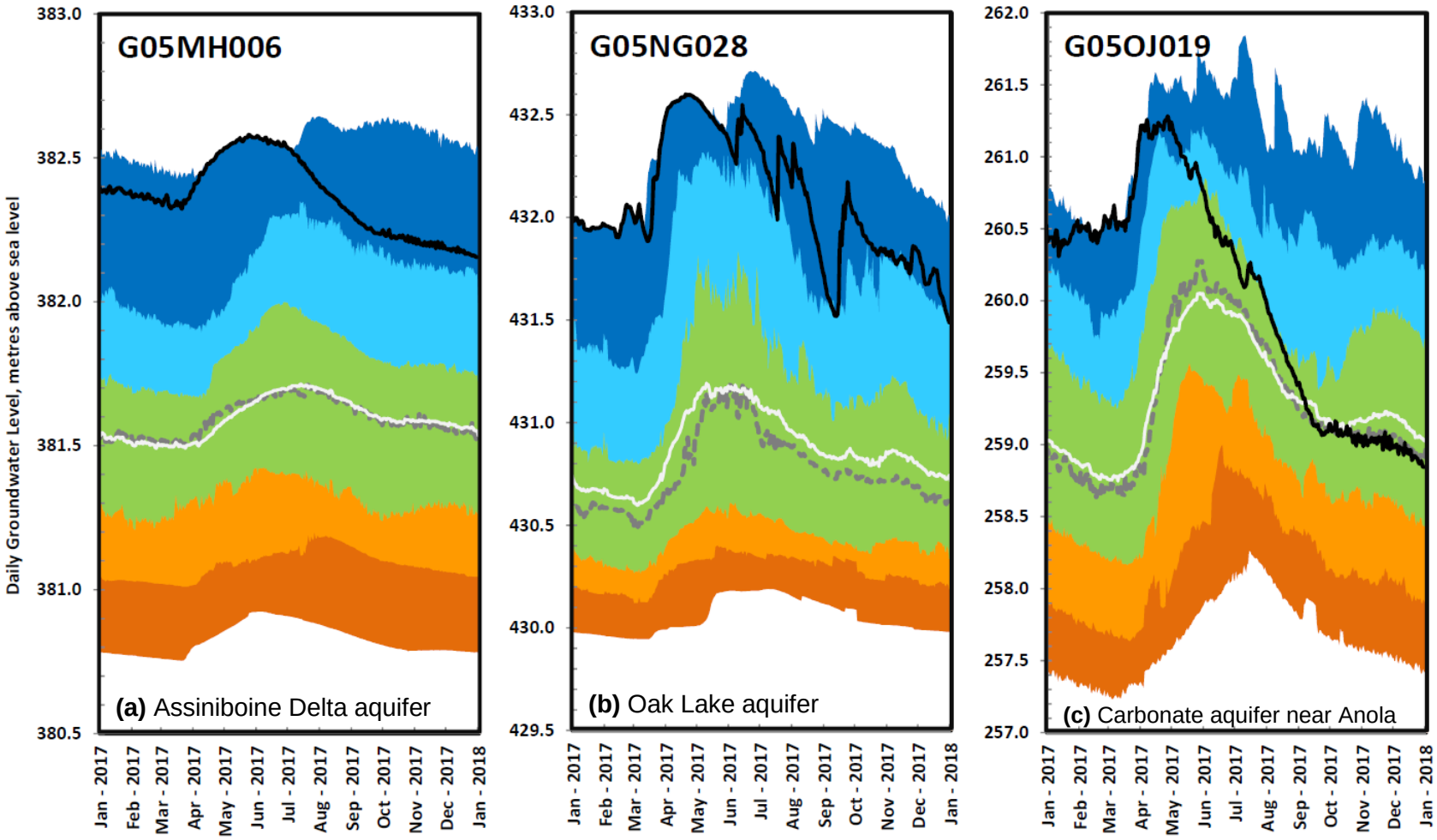


Figure 12: Groundwater hydrographs for (a) the Assiniboine Delta aquifer, (b) the Oak Lake aquifer, and (c) the Carbonate aquifer near Anola for 2017.