Water Availability and Drought Conditions Report

March 2016

Executive Summary

- This Water Availability and Drought Conditions Report provides an update on drought conditions throughout Manitoba for the 2015/2016 winter season (November 2015 – March 2016).
- Soil moisture surveys conducted by Manitoba Agriculture indicated high soil moisture content at freeze-up for most of agro-Manitoba due to late summer and fall rains.
- Southwestern and central Manitoba, portions of the Interlake, and much of northern Manitoba received 40 to 85 per cent of average winter precipitation over the 2015/2016 winter season. This lack of snowfall caused some concerns for adequate replenishment of soil moisture, dugouts and water supply reservoirs.
- Precipitation over the short to medium term (one to three months) has been normal to above normal for the northwest and southeastern portions of Manitoba. However, large regions of the province have experienced moderately to extremely dry conditions such as the southwest, central, portions of the Interlake, and the northeastern parts of the province. Long-term (twelve months) precipitation amounts are generally normal to above normal throughout Manitoba, with some areas experiencing moderately dry conditions.
- March streamflow was normal or above normal for most major rivers across the province with the exception of the Churchill River Basin, which experienced extremely dry conditions.
- There are currently no major concerns over water supply as supplies are generally adequate across the province. Even with below normal snowpack, most water supply reservoirs in southern and western Manitoba are close to full supply levels, with the exception of the Elgin Reservoir which was intentionally de-watered in the fall of 2015. Manitoba Agriculture will begin reporting on dugout conditions at the beginning of May.
- Environment and Climate Change Canada's seasonal temperature forecast for April, May and June is projected to be above normal across southern Manitoba and normal for northern Manitoba. The seasonal precipitation forecast for April, May and June is projected to be normal.
- For more information on drought in Manitoba please visit the Manitoba Drought Monitor website: http://www.gov.mb.ca/drought.

Drought Indicators

Precipitation and streamflow drought indicators have been developed to assess drought conditions across Manitoba. Additionally, the Canadian Drought Monitor produces a blended drought indicator for Canada. These indicators describe the severity of dryness in a watershed.

Precipitation Indicators

Precipitation is assessed to determine the severity of meteorological dryness and is an indirect measurement of agricultural dryness. Three precipitation indicators are calculated to represent long term (twelve months), medium term (three months) and short term (one month) conditions. Precipitation indicators are summarized by basin in Table 1 and on Figure 1, Figure **2**, and Figure **3**. Long term and medium term indicators provide the most appropriate assessment of dryness as the short term indicator is influenced by significant rainfall events and spatial variability in rainfall, particularly during summer storms. Due to large distances between meteorological stations in northern Manitoba, the interpolated contours in this region are based on limited observations and should be interpreted with caution.

Over the short term (one month), large portions of Manitoba experienced normal or above normal conditions. Moderately dry conditions existed throughout much of northeastern Manitoba, with severely dry conditions centered over Norway House and Island Lake. Additionally, the area from the southwest corner of Manitoba northeast to Lake Manitoba experienced moderately to severely dry conditions throughout the month of March as well.

Over the medium term (three months), southern Manitoba experienced a range of conditions, from above normal along the eastern and western provincial border regions, to moderately dry conditions throughout much of the central and southwestern portions of the province. Isolated areas around Morden and Cypress River experienced severely dry conditions. During this three-month timeframe, most of northern Manitoba experienced moderately dry conditions, with severely dry conditions centered over Gillam and extremely dry conditions centered over Norway House.

Over the long term (twelve months), most of Manitoba experienced normal conditions. Portions of the Lake Manitoba basin extending south towards Brandon and Cypress River experienced moderately dry conditions. Additionally, some isolated areas centered over Lynn Lake and Churchill experienced moderately dry conditions as well.

Streamflow Indicators

The streamflow indicator is based on average monthly flows and is used to determine the severity of hydrological dryness in a watershed. The streamflow indicator is summarized by basin in Table 1 and on Figure 4.

The monthly streamflow indicator shows that March flows are normal or above normal for most major rivers across the province. Many of the rivers and tributaries in southern Manitoba experienced earlier than normal spring freshets during mid-March due to above average temperatures.

The Churchill River Basin experienced extremely dry conditions throughout the month of March. The Churchill River Diversion diverts water from the Churchill River through Southern Indian Lake into the Burntwood River, which then eventually joins the Nelson River at Split Lake. The moderately dry conditions observed at the Burntwood River at Thompson station are due to the lower than average flows being diverted through the Churchill River Diversion into the Burntwood River.

Canadian Drought Monitor

Agriculture and Agri-Food Canada monitors both the spatial extent and intensity of drought conditions across Canada. They produce monthly map products available through the Canadian Drought Monitor website including an interactive drought intensity map, which is based on precipitation, temperature, drought model index maps, and climate data as interpreted by federal, provincial and academic scientists. This map uses the same drought classification system as the larger North American Drought Monitor:

- D0 (Abnormally Dry) – represents an event that occurs once every 3-5 years;
- D1 (Moderate Drought) –5 to 10 year event;
- D2 (Severe Drought) –10 to 20 year event;
- D3 (Extreme Drought) –20 to 25 year event; and
- D4 (Exceptional Drought) –50+ year event.

Additionally, the map indicates the duration of drought as either short-term (S; less than 6 months) or long-term (L; more than 6 months).

The Canadian Drought Monitor March map dated March 31st (Figure 5) indicates that most of south-western and central Manitoba, the Interlake region, and portions of the northwest are experiencing abnormally dry (D0) conditions. Some isolated regions are experiencing moderate drought conditions (D1), specifically surrounding the town of Carman, and an area centered over the town of Virden and extending south to Melita and west into Saskatchewan.

Table 1: Drought Indicators by Major River Basin

Basin (in Manitoba)	Drought Indicators			
	Precipitation Indicators			Monthly Flow Indicators March 2016
	Percent of 1 Month Median March 2016	Percent of 3 Month Median January - March 2016	Percent of 12 Month Median February 2015 – March 2016	
Red River	Moderately dry in the western portion of the basin and normal to above normal conditions throughout the remainder of the basin.	Moderately dry to severely dry in the west and central portions of the basin and normal to above normal conditions in the east.	Generally normal to above normal, some moderately dry conditions surrounding Morden and towards the west	Above normal
Winnipeg River	Above normal	Above normal	Normal to above normal	Above normal
Assiniboine River-Souris River	Normal to above normal in the north-western portion of the basin, moderate in the eastern portion and severely dry conditions in the southwest corner	Normal to above normal in the north-western portion of the basin, moderately dry in the Souris River basin and moderately to severely dry conditions in the southeast corner	Normal to moderately dry	Above normal
Lake Manitoba	Generally normal or above normal except for moderately dry in the south portion and severely dry conditions surrounding McCreary	Generally normal or above normal except for moderately to severely dry conditions in the southwest portion of the basin	Normal to moderately dry	Above normal
Lake Winnipeg	Generally normal to above normal conditions	Generally normal to above normal, with moderately to severely dry conditions in the northern part of the basin and surrounding Fisher Branch	Normal to above normal except for moderately dry conditions surrounding Fisher Branch	Above normal
Saskatchewan River	Above normal	Normal	Normal	Normal
Nelson River	Generally normal, except for the south-eastern portion of the basin where conditions range from moderately dry to severely dry	Moderately dry to severely dry, with severely dry conditions surrounding Gillam and extremely dry conditions surrounding Norway House	Normal	Above normal, except for the Burntwood River near Thompson which shows moderately dry conditions
Hayes River	Moderately dry conditions, with severely dry conditions surrounding Island Lake	Moderately dry conditions, with normal conditions surrounding Island Lake	Normal	Normal
Churchill River	Generally normal to above normal except for moderately dry conditions within the eastern portion of the basin and surrounding Lynn Lake	Generally moderately dry with normal conditions within the western portion of the basin	Normal except for moderately dry conditions surrounding Lynn Lake and Churchill	Extremely dry
Seal River	Normal	Moderately dry	Normal	Above normal

Water Availability

Fall 2015 Soil Moisture

Manitoba Agriculture monitors soil moisture throughout agro-Manitoba, and publishes maps of the amount of soil moisture within the root zone just prior to freeze-up (early November; Figure 6).

Overall, the soil moisture survey indicated that most of the province was at 80 to 100 per cent of water holding capacity at the time of freeze-up. The survey results were confirmed by many local residents and producers. This high soil moisture at freeze-up contributed to spring flows by offsetting the lack of snowfall and above normal temperatures observed over the 2015/2016 winter season.

2015/2016 Winter Snowpack

The per cent of average precipitation from November 1st, 2015 to March 30th, 2016 shows lower than normal snowpack accumulation for much of Manitoba (Figure 7). Southwestern and central Manitoba, portions of the Interlake, and much of northern Manitoba received 40 to 85 per cent of average winter precipitation. This lack of snowfall did cause some concerns for adequate replenishment of soil moisture, dugouts and water supply reservoirs.

Reservoir Conditions

As of March 31st, 2016, most water supply reservoirs are close to or at full supply level, with the exception of the Minnewasta, Rapid City and Shellmouth Reservoirs. Minnewasta Reservoir and Rapid City Reservoir are at 84 % and 85 % of full supply volume, respectively. However, it should be noted that the last water level measurement available at Rapid City was from March 2nd, 2016, and the level has likely risen since the time of this last observation. As of March 31st, the spring melt in the upper Assiniboine River Basin has not yet commenced, and therefore inflows into the Shellmouth Reservoir are still low and primarily baseflow dominated. It is anticipated that the spring freshet will occur in April, and Shellmouth Reservoir conditions can be more accurately reported within the April Water Availability and Drought Conditions Report.

Additionally, Elgin Reservoir had been deliberately dewatered in the fall of 2015 for fish management purposes. Low snow accumulation over the winter in south-western Manitoba (Figure 7) resulted in a lack of runoff in the region to refill the reservoir to full supply level. Field staff have indicated there is a small amount of water in the reservoir, but equipment malfunction has prevented reporting of the supply status at the current time. Spring and summer rainfall will help to replenish the reservoir. However, full supply level may not be reached this year. The reservoir is used primarily for recreation and low levels should not cause any significant impacts.

On Farm Water Supply

Manitoba Agriculture reports on dugout conditions across Agri-Manitoba in their weekly Crop Reports. Crop Reports typically begin the last week of April or the first week of May. The last Crop Report of 2015 (Issue 24, published October 13th, 2015) summarized general dugout conditions heading into the winter season as adequate throughout the province, with the exception of the central region, as summarized in Table 2. Up to date on farm water supply conditions will be reported on in the April Water Availability and Drought Conditions Report.

Table 2: On Farm Water Supply (Dugout) Conditions in early October, 2015

Region	General Dugout Conditions
Eastern	Adequate
Interlake	Adequate
Southwest	Adequate
Central	60-100% capacity
Northwest	Adequate

Aquifers

Groundwater levels in major aquifers are generally good. 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. Most aquifers also store very large quantities of groundwater and can continue to provide water during extended periods of dry weather. Consequently, the major concern regarding groundwater and dry periods relates to water levels in shallow wells constructed in near surface sand aquifers. As the water table drops, there is less available drawdown in shallow wells and some wells may 'go dry', even during short-term drought conditions.

Future Weather

Environment and Climate Change's seasonal forecast for the next three months (April-May-June) projects temperatures to be above normal across southern Manitoba and normal throughout northern Manitoba (Figure 8). April-May-June precipitation is forecasted to be normal (Figure 9). The National Oceanic and Atmospheric Administration predict a transition from El Niño conditions to ENSO-neutral conditions during late spring or early summer of 2016.

Table 3: Reservoir Status (Southern and Western)

Water Supply Reservoir Levels and Storages								
Lake or Reservoir	**Community Supplied**	**Target Level (feet)**	**Latest Observed Level (feet)**	**Observed date**	**Supply Status (Recent - Target) (feet)**	**Storage at Target Level (acre-feet)**	**Storage at Observed Level (acre-feet)**	**Supply Status (observed storage/target storage) (%)**
Elgin	Elgin	1,532.00	Low **	**October 27, 2015**	N/A	520	N/A	N/A
Lake of the Prairies (Shellmouth)*	Brandon, Portage	1,402.50	1,387.86	April 1, 2016	-14.64	300,000	133,027	44%
Lake Wahtopanah (Rivers)	Rivers	1,536.00	1,536.54	April 1, 2016	0.54	24,500	25,716	105%
Minnewasta (Morden)	Morden	1,082.00	1,078.70	April 1, 2016	-3.30	3,150	2,632	84%
Stephenfield	Carman	972.00	972.43	April 1, 2016	0.43	3,810	4,014	105%
Turtlehead (Deloraine)	Deloraine	1,772.00	1,772.13	April 1, 2016	0.13	1,400	1,414	101%
Vermilion	Dauphin	1,274.00	1,274.29	April 1, 2016	0.29	2,600	2,667	103%
Goudney (Pilot Mound)		1,482.00	1,482.23	April 1, 2016	0.23	450	461	103%
Jackson Lake		1,174.00	1,173.90	April 1, 2016	-0.10	2,990	2,965	99%
Kenworth Dam		1,448.00	1,447.78	March 2, 2016	-0.22	600	584	97%
Killarney Lake		1,615.00	1,615.02	February 29, 2016	0.02	7,360	7,371	100%
Lake Irwin		1,178.00	1,177.99	**January 13, 2016**	-0.01	3,800	3,791	100%
Manitou (Mary Jane)		1,537.00	1,536.36	April 1, 2016	-0.64	1,150	1,092	95%
Rapid City		1,573.50	1,573.07	March 2, 2016	-0.43	200	170	85%
St. Malo		840.00	840.18	March 4, 2016	0.18	1,770	1,799	102%

* Summer target level and storage.

** Reservoir was deliberately de-watered for fish management purposes in the fall of 2015.

Drought Definitions

Meteorological Drought is generally defined by comparing the rainfall in a particular place and at a particular time with the average rainfall for that place. Meteorological drought leads to a depletion of soil moisture and this almost always has an impact on agricultural production. Meteorological droughts only consider the reduction in rainfall amounts and do not take into account the effects of the lack of water on water reservoirs, human needs or on agriculture. A meteorological drought can occur without immediately impacting streamflow, groundwater, or human needs. If a meteorological drought continues, it will eventually begin to affect other water resources.

Agricultural Drought occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought depends not only on the amount of rainfall but also on the use of that water. Agricultural droughts are typically detected after meteorological drought but before a hydrological drought. If agricultural drought continues, plants will begin to protect themselves by reducing their water use, which can potentially reduce crop yields.

Hydrological Drought is associated with the effect of low rainfall on water levels in rivers, reservoirs, lakes, and aquifers. Hydrological droughts are usually noticed some time after meteorological droughts. First, precipitation decreases and after some time, water levels in rivers and lakes drop. Hydrological drought affects uses that depend on water levels. Changes in water levels affect ecosystems, hydroelectric power generation, and recreational, industrial and urban water use. A minor drought may affect small streams causing low streamflows or drying. A major drought could impact surface storage, lakes, and reservoirs thereby affecting water quality and causing municipal and agricultural water supply problems.

Rainfall also recharges groundwater aquifers through infiltration through the soil and run-off into streams and rivers. Once groundwater and surface waters are significantly impacted by lack of precipitation, a “hydrologic drought” occurs. Aquifer declines can range from a quick response (shallow sand) to impacts extending over multiple years. Impacts can include depletion of shallow depth wells, drying of farm dugouts, and changes to ground water quality.

Socioeconomic Drought occurs when the supply fails to meet the demand for an economic good(s) such as domestic water supplies, hay/forage, food grains, fish, and hydroelectric power, due to weather related water supply shortages from one or both of natural or managed water systems. At any time during meteorological, hydrological, or agricultural droughts, a socioeconomic drought can occur.

Acknowledgements

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

- Manitoba Infrastructure and Transportation - Reservoir level information: 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 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: http://www.gov.mb.ca/agriculture/crops/seasonal-reports/crop-report-archive/index.html
- Agriculture and Agri-Food Canada - Drought Watch: http://www.agr.gc.ca/drought

For further information, please contact:

Carly Delavau, P.Eng.
Water Supply and Drought Management Engineer
Surface Water Management Section, Water Science and Management Branch
Manitoba Sustainable Development
Box 14, 200 Saulteaux Crescent
Winnipeg, Manitoba R3J 3W3

Ph. (204) 806-4557, Fax (204) 945-7419
E-mail: Carly.Delavau@gov.mb.ca

Past reports are available at:
www.gov.mb.ca/drought

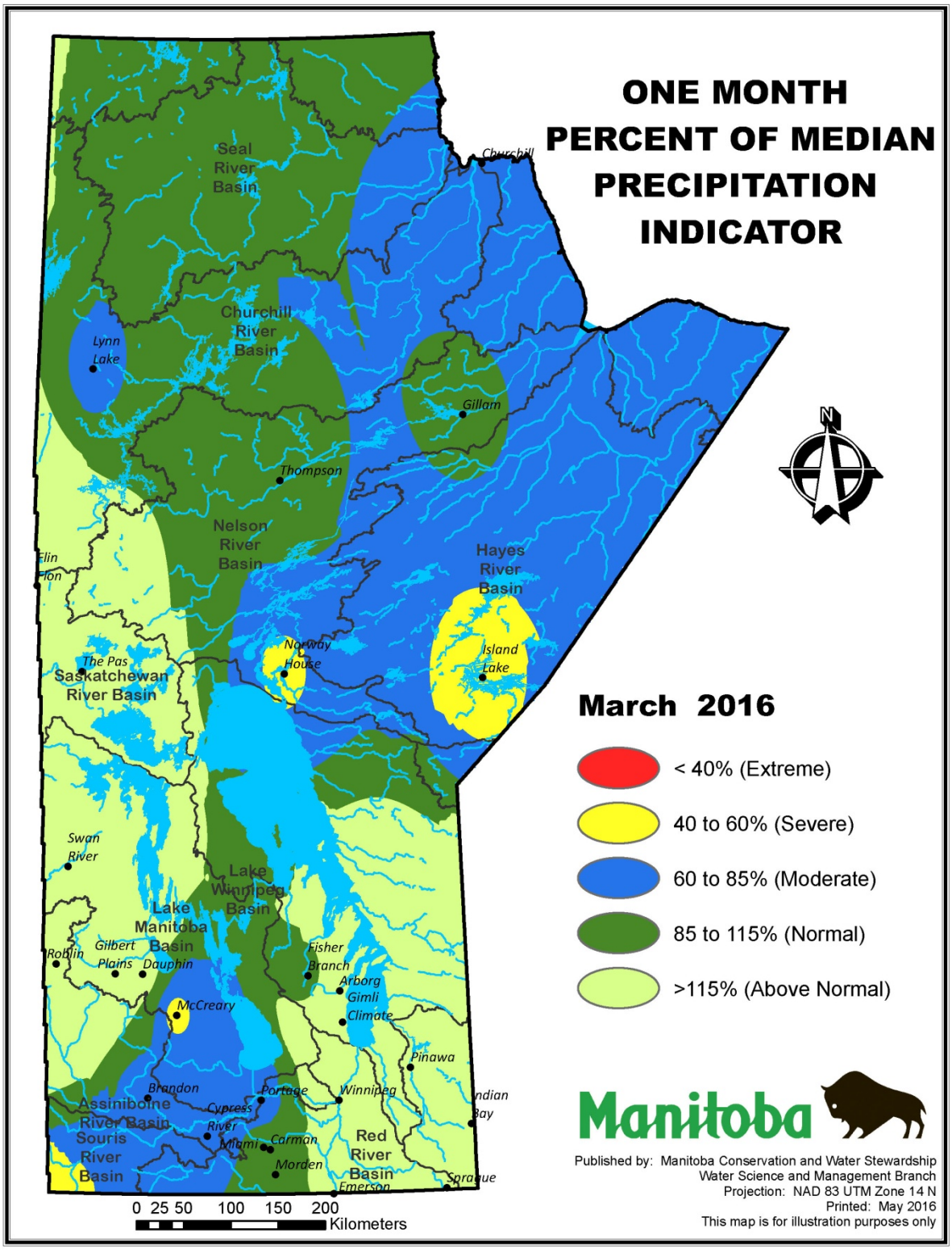

Figure 1: Precipitation Indicator (percent of one month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

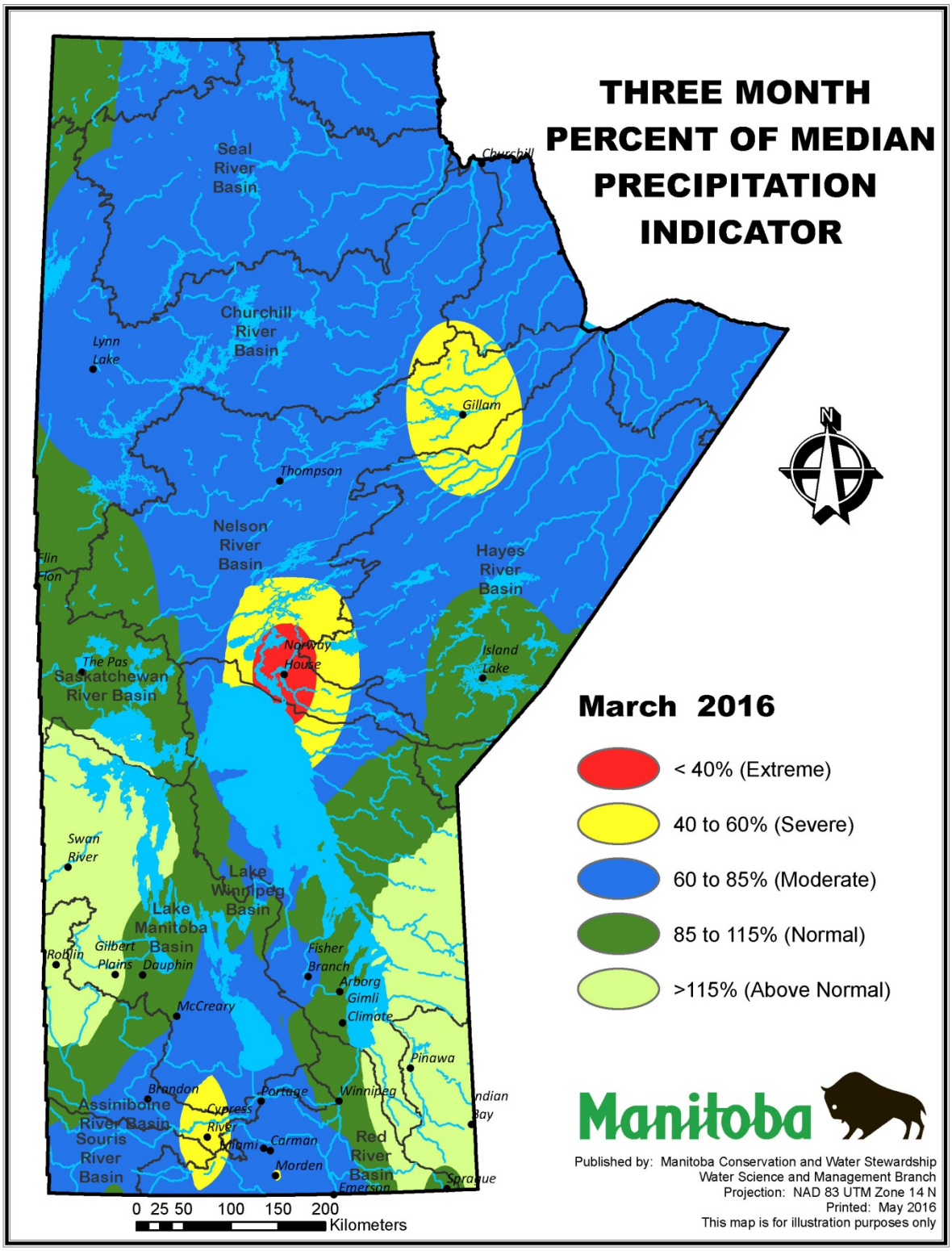

Figure 2: Precipitation Indicator (percent of three month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

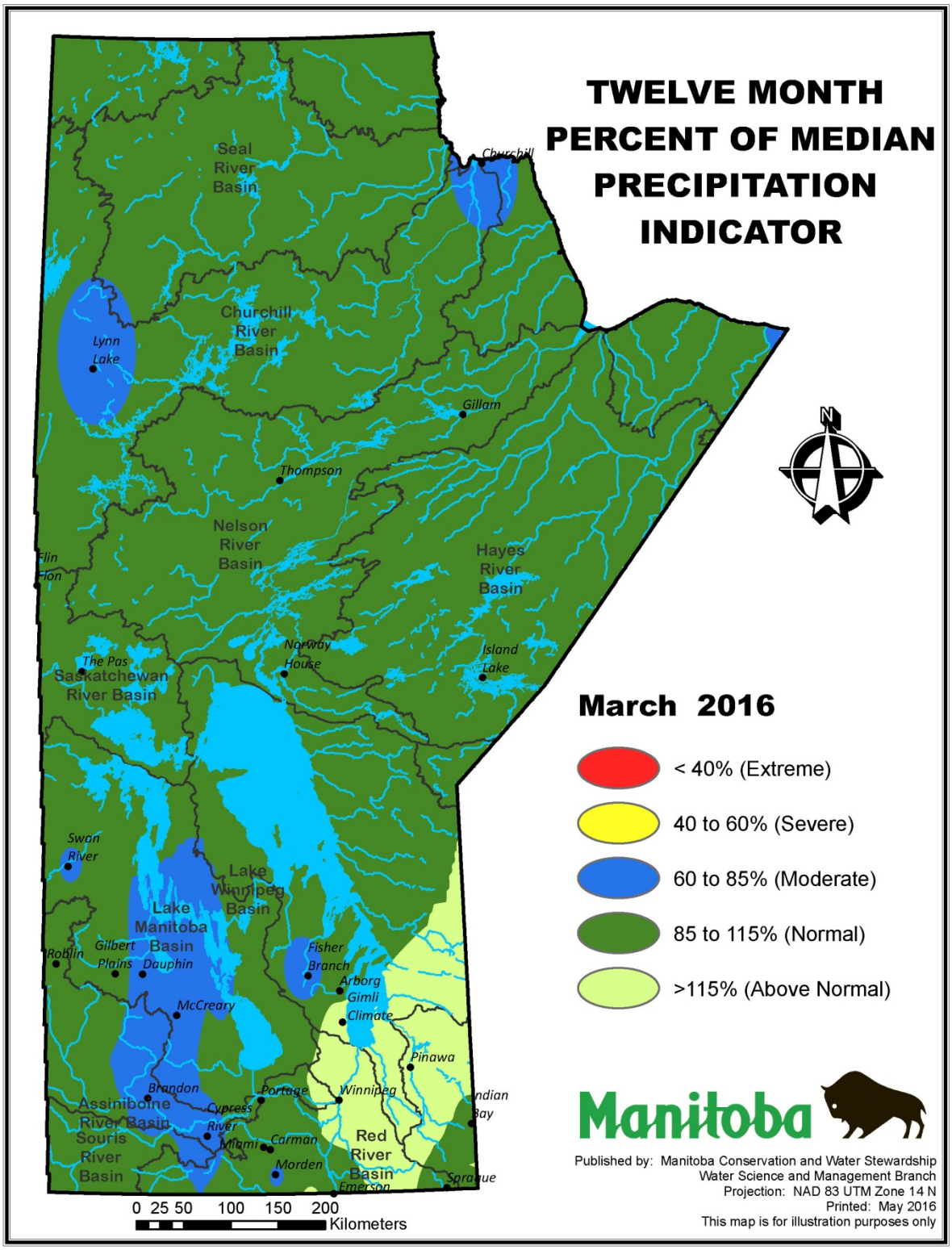

Figure 3: Precipitation Indicator (percent of twelve month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

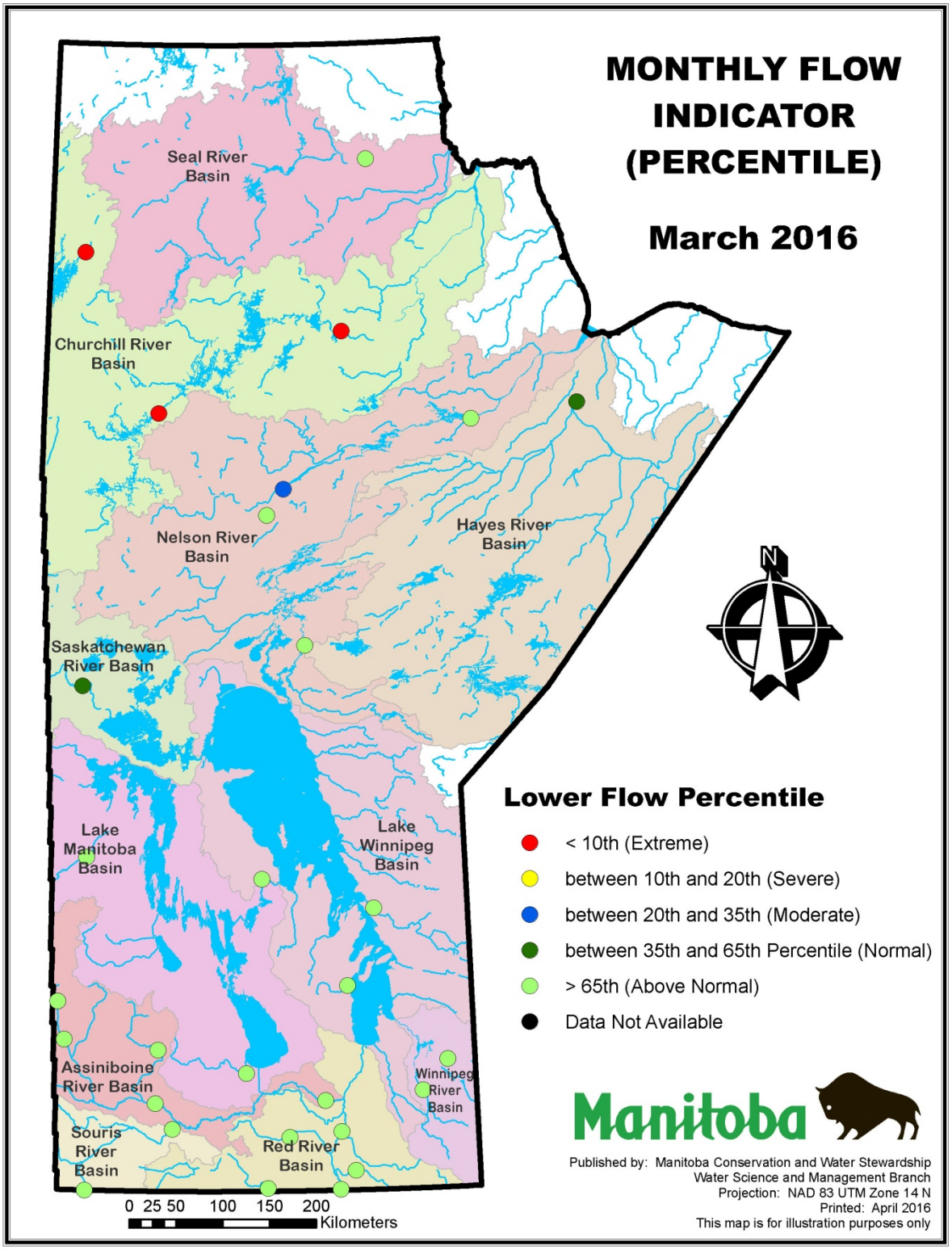

Figure 4: Monthly flow indicator for March, 2016.

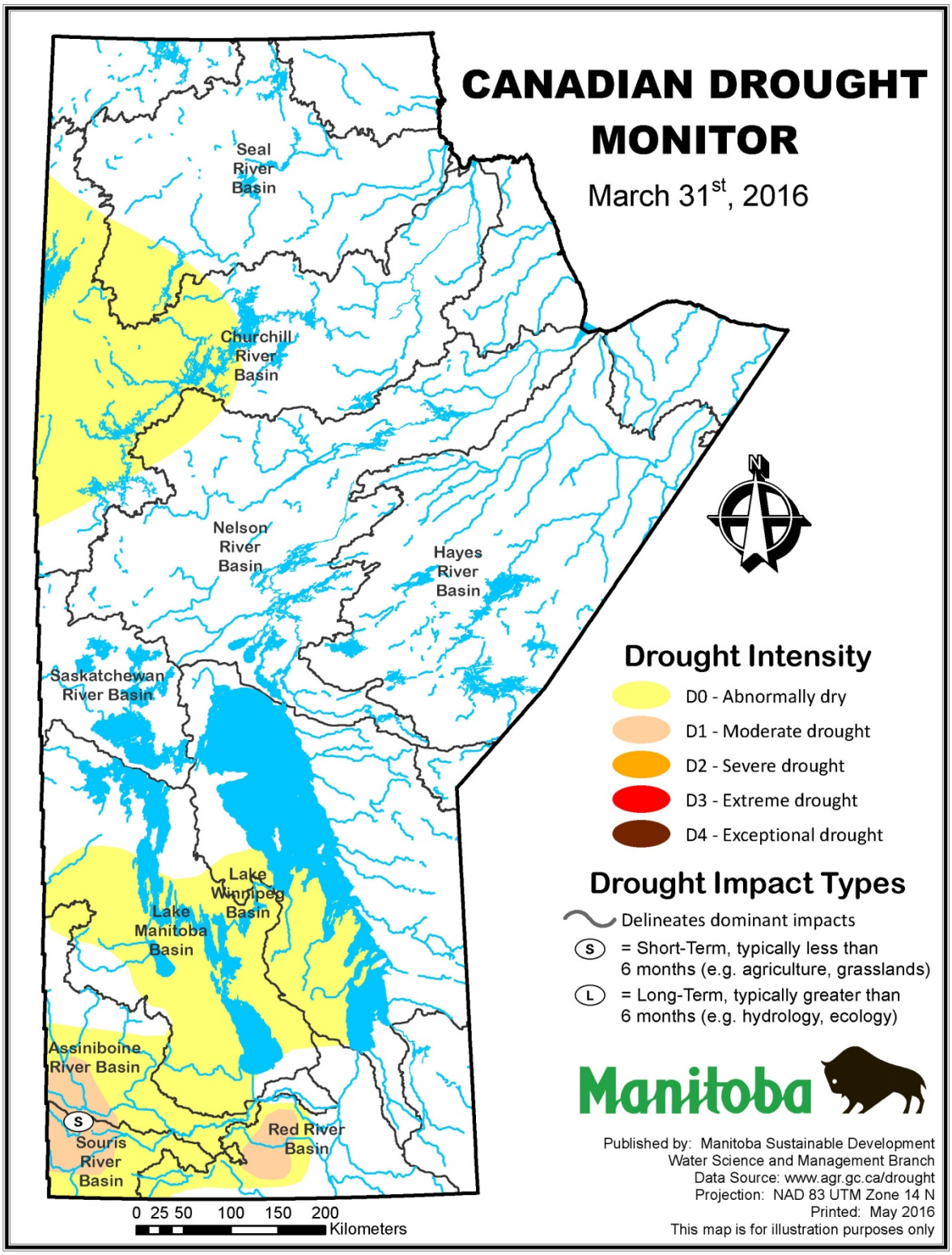

Figure 5: Agriculture and Agri-Food Canada's Canadian Drought Monitor mapping of short-term (S) and long-term (L) drought conditions as of March 31st, 2016.

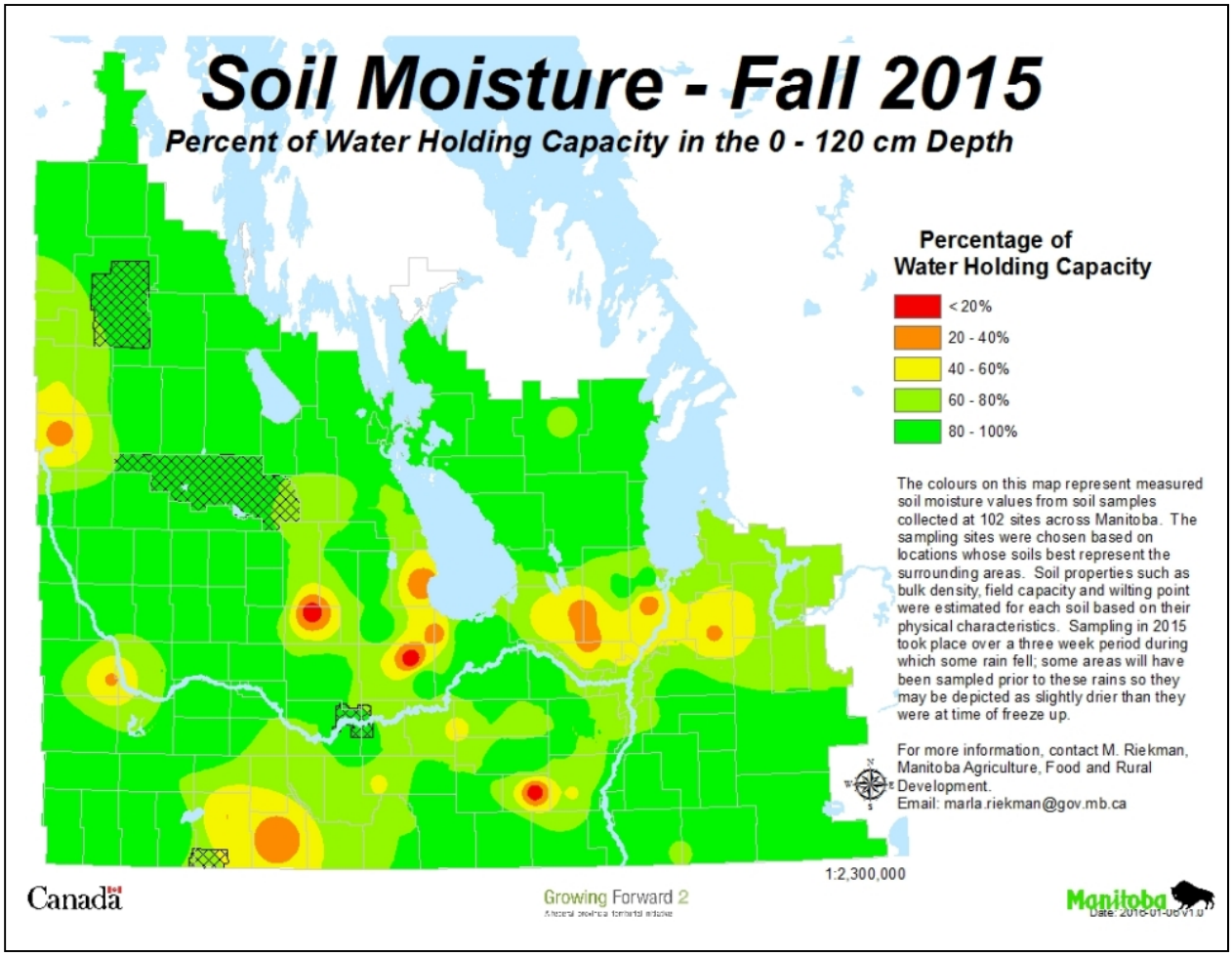

Figure 6: Manitoba Agriculture's fall 2015 soil moisture survey –per cent of water holding capacity (0 – 120 cm depth).

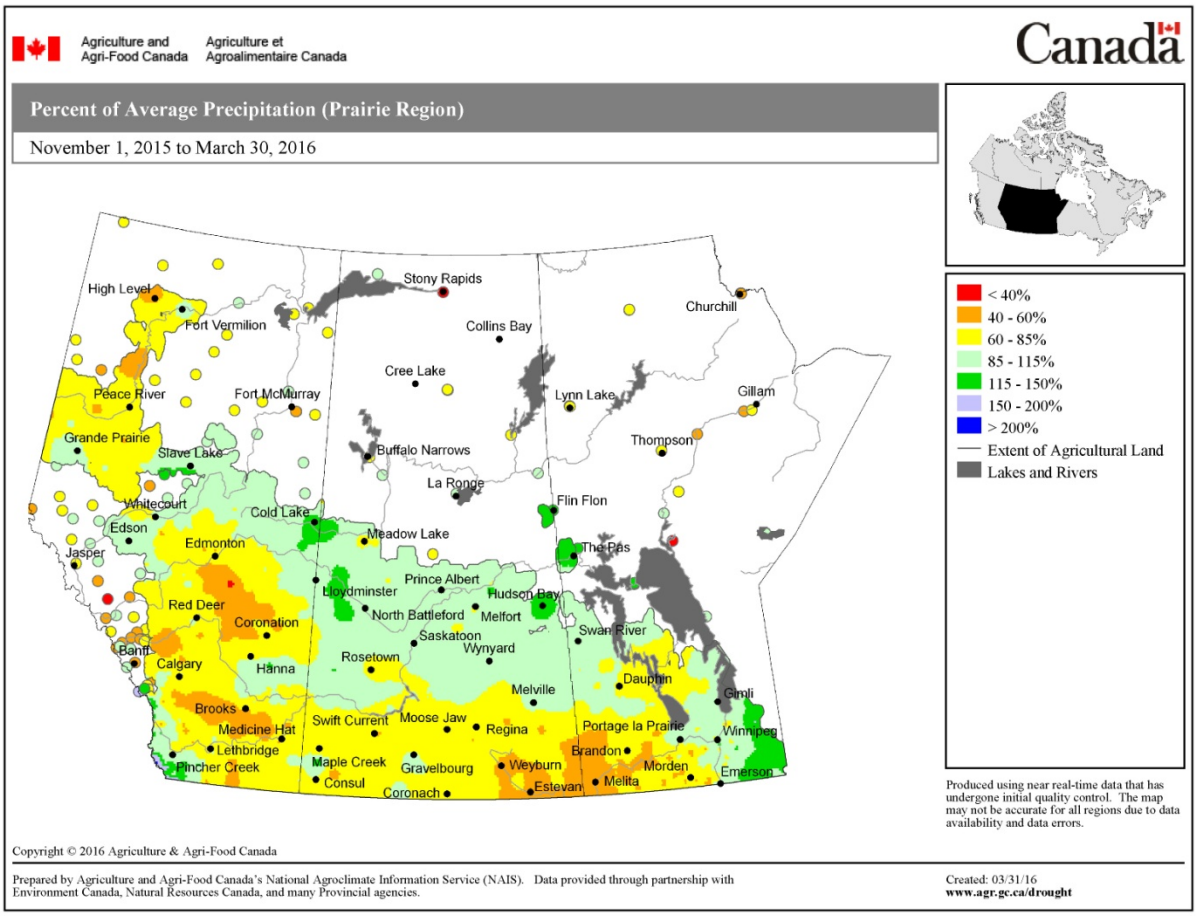

Figure 7: Agriculture and Agri-Food Canada's winter season (November 1st, 2015 – March 30th, 2016) percent of average precipitation.

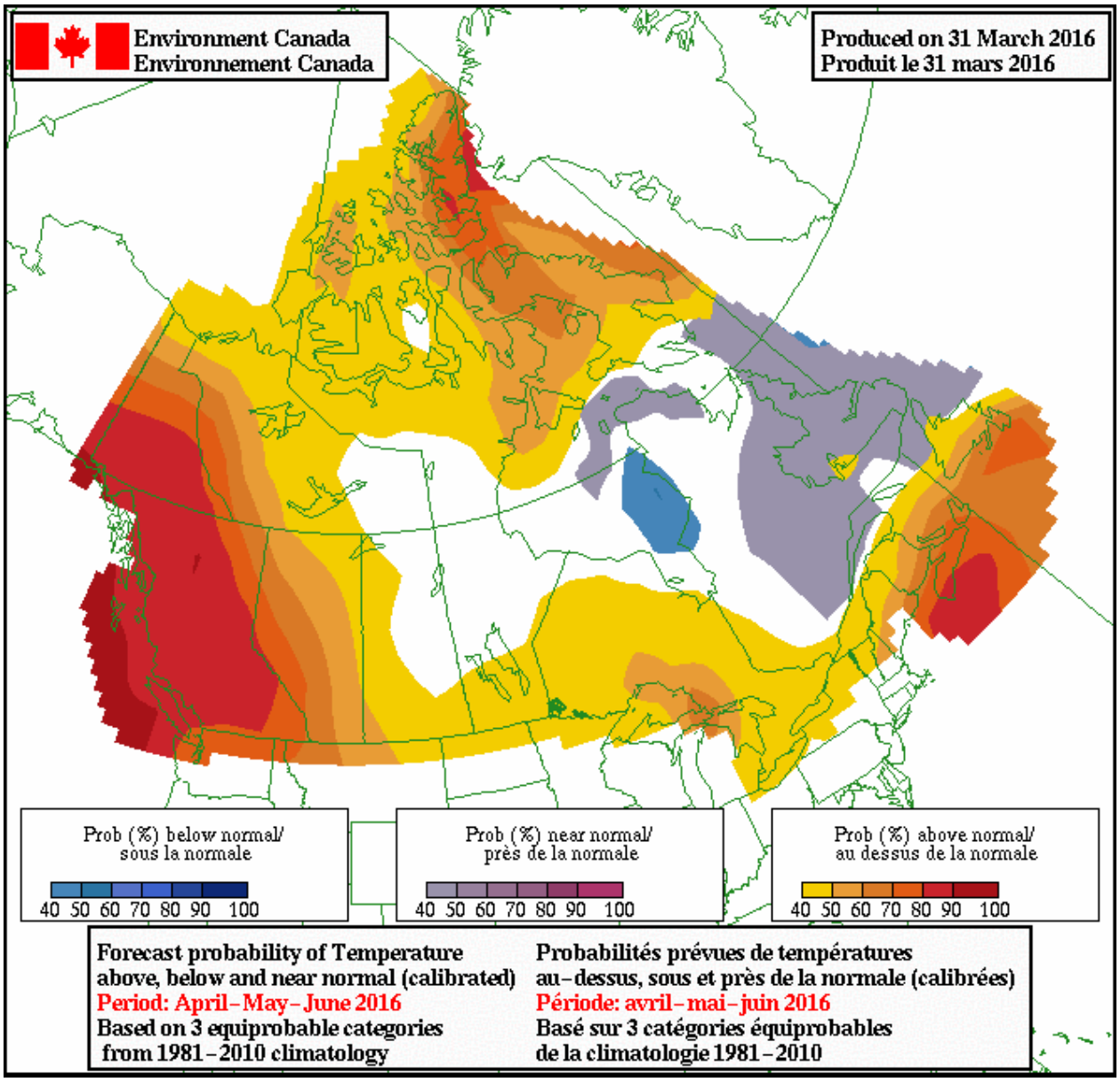

Figure 8: Environment and Climate Change Canada Seasonal (3 month) temperature outlook for April, May and June.

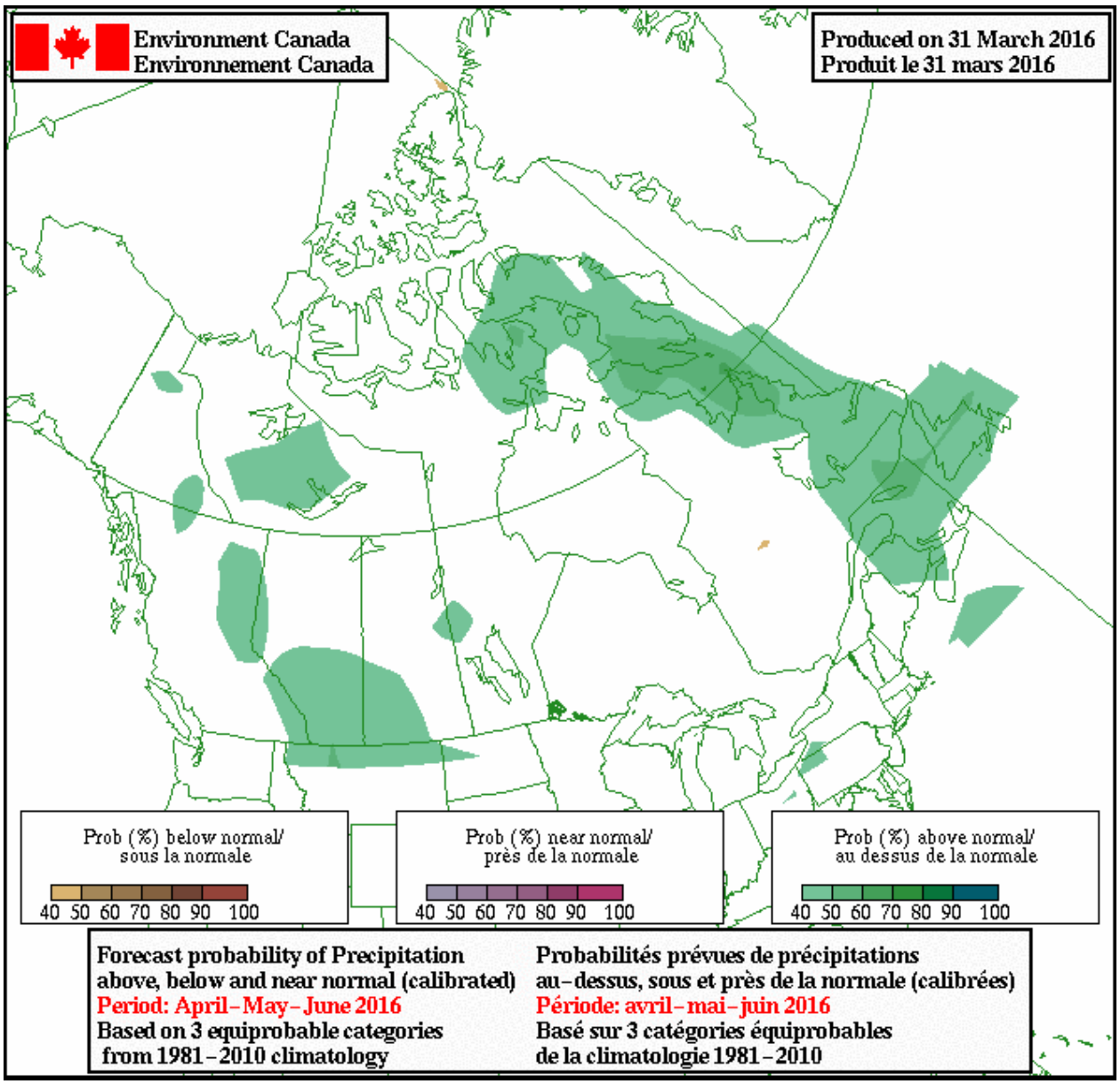

Figure 9: Environment and Climate Change Canada Seasonal (3 month) precipitation outlook for April, May and June.

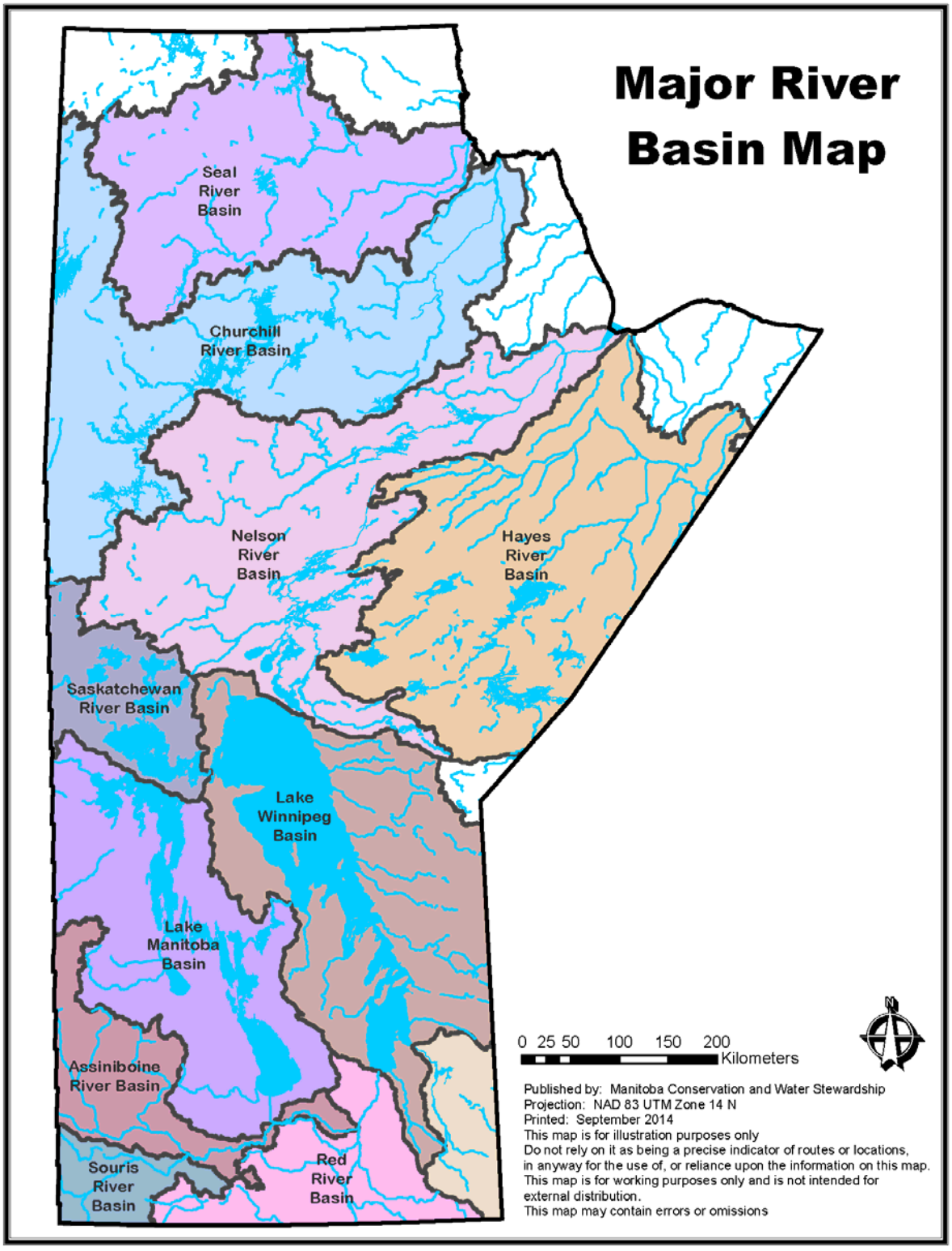

Figure 10: Major Manitoba river basins.