Manitoba
Conservation and Water Stewardship

WATER AVAILABILITY AND DROUGHT CONDITIONS REPORT

December 5, 2013

Synopsis/Overview

This Water Availability and Drought Conditions Report provides an update on meteorological and hydrologic conditions for Manitoba as of the end of November 2013.

Precipitation indicators show moderately to severely dry conditions prevailed in eastern and south-central Manitoba and the area around Churchill over the last three months. Otherwise, precipitation over the last three to twelve months has been normal or above normal for other regions of the province.

Overall, monthly stream flow indicators for November indicated flows were normal or above normal for almost all rivers across the province. Moderately dry hydrological conditions prevailed in the Bloodvein River above Bloodvein Bay.

The Manitoba Agriculture, Food and Rural Development fall 2013 soil moisture survey report indicates western Manitoba, particularly in the southwestern region, has above normal soil moisture conditions. In the interlake and southeast Manitoba, dry conditions persist with below normal soil moisture conditions.

Water supply reservoirs in southern and western Manitoba are at, or close to, full supply levels except the Goudney (Pilot Mound) Reservoir which is about 84 % full.

Outlook

Environment Canada's seasonal forecast for the next three months (December 2013 and January-February 2014) is for normal temperatures for the entire province. Normal precipitation is forecast for southern Manitoba and above normal for northern Manitoba (Attachment 4).

Indicators

Two types of indicators are assessed across Manitoba - precipitation and stream flow. The indicators describe the severity of dryness in a watershed.

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 the long term (twelve months), medium term (three months) and short term (one month). 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.

The stream flow indicator is used to determine the severity of hydrological dryness in a watershed.

Precipitation

Precipitation indicators are summarized by basin in Table 1 and on maps in Attachment 1.

Over the long term (twelve months), conditions were normal or above normal throughout the province with the exception of the areas near Pinawa, Gimli and Churchill, which experienced moderately dry conditions and the area near Norway House which experienced severely dry conditions.

Over the medium term (three months), moderately dry conditions prevailed in the areas around Morden, Carman, Winnipeg, Pinawa, Arborg, Berens River and Island Lakes. Severely dry conditions prevailed in the areas around Emerson, Gimli and Churchill.

Over the short term (one month), moderately dry conditions prevailed in the areas around Brandon and Winnipeg. Severely dry conditions prevailed in the areas around Morden, Carman, Portage la Prairie, Gimli, Roblin, and Swan River. Extremely dry conditions prevailed in the areas around Emerson, Melita, Dauphin and Churchill.

Stream Flows

Stream flow indicators are summarized by basin in Table 1 and on a map in Attachment 2. The monthly flow indicators for November indicated flows were normal or above normal for almost all rivers across the province. Moderately dry hydrological conditions prevailed in the Bloodvein River above Bloodvein Bay. During the winter (November to February), stream flow data are not available for the Boyne River near Carman, the Icelandic River near Riverton and Swan River near Minitonas.

Water Availability

Reservoir Conditions
Water supply reservoirs in southern and western Manitoba are full or close to full supply level (Attachment 3). The Goudney Reservoir near Pilot Mound is at 84 % of full supply level.

Fall 2013 Soil Moisture Survey
Manitoba Agriculture, Food and Rural Development fall 2013 soil moisture survey report indicates western Manitoba, particularly in southwestern region, has above normal soil moisture conditions. In the Interlake and southeast Manitoba, dry conditions persist with below normal soil moisture conditions (Attachment 5).

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'.

Potential Impacts
Eastern and south-central Manitoba have been experiencing dry conditions. Manitoba Agriculture, Food and Rural Development's fall 2013 soil moisture survey indicates dry conditions have resulted in below normal soil moisture in the Interlake and southeast regions of Manitoba. With Environment Canada's outlook for the next three months for normal temperature and normal precipitation for eastern and south-central Manitoba, dry conditions may persist or worsen.

Provincial water supply reservoirs should have sufficient water supplies for the balance of the year.

Table 1: Drought Indicators by Major River Basin (Attachments: 1, 2 and 6)

Basin (in Manitoba)	Drought Indicators			
	Monthly Precipitation Indicator (Percent of 1 month Median) November 2013	Monthly Precipitation Indicator (Percent of 3 month Median) (September - November 2013)	Monthly Precipitation Indicator (Percent of 12 month Median) (December 2012- November 2013)	Monthly Flow Percentile November 2013 (Lowest 10th -20th - 35th)
Red River	Moderately to extremely dry except normal conditions for Sprague	Moderately to severely dry except normal conditions for Sprague	Normal conditions	Normal conditions
Winnipeg River	Normal conditions	Moderately dry	Moderately dry	Normal conditions
Assiniboine River-Souris River	Moderately to extremely dry	Normal conditions	Normal conditions	Normal conditions
Lake Manitoba	Severely to extremely dry	Normal conditions	Normal conditions	Normal conditions
Lake Winnipeg	Normal conditions except moderately dry for Gimli	Moderately to severely dry	Normal conditions except moderately dry for Gimli	Normal conditions except moderately dry for the Bloodvein River above Bloodvein Bay
Saskatchewan River	Normal conditions	Normal conditions	Normal conditions	Normal conditions
Nelson River	Normal conditions	Normal conditions	Normal conditions except severely dry for Norway House	Normal conditions
Hayes River	Normal conditions	Moderately dry	Normal conditions	Normal conditions
Churchill River	Normal conditions except extremely dry for Churchill	Normal conditions except severely dry for Churchill	Normal conditions except moderately dry for Churchill	Normal conditions
Seal River	Normal conditions	Normal conditions	Normal conditions	Normal conditions

Acknowledgements

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

- Manitoba Infrastructure and Transportation: Flow information: http://www.gov.mb.ca/mit/floodinfo/floodoutlook/river_conditions.html
- Environment Canada: Flow and Lake information http://www.wateroffice.ec.gc.ca/index_e.html
- Fire Hazard: http://www.gov.mb.ca/conservation/fire/
- Environment Canada 3 month climatic outlook: http://weatheroffice.gc.ca/saisons/index_e.html
- Manitoba Agriculture, Food and Rural Development: http://www.gov.mb.ca/agriculture/crops/seasonal-reports/crop-report-archive/index.html
- Manitoba Conservation and Water Stewardship Fire Program

For further information, please contact: Abul Kashem, Surface Water Management Section, Manitoba Conservation and Water Stewardship, 204-945-6397/204-803-9431.

Definition of drought

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.*

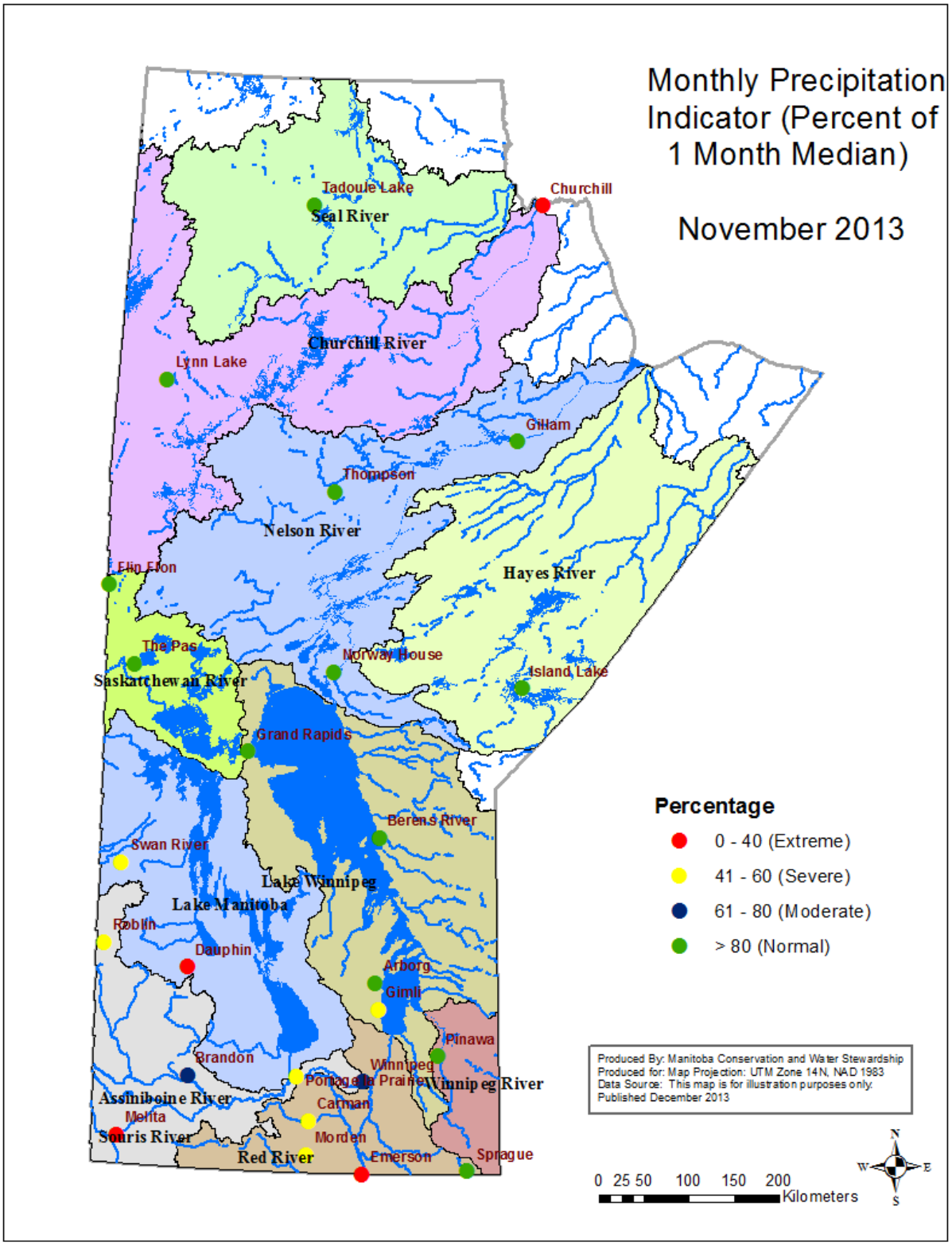
Hydrological Drought *is associated with the effect of low rainfall on water levels in rivers, reservoirs, lakes, and aquifers. Hydrological droughts are usually noticed some time after meteorological droughts. First, precipitation decreases and after some time, water levels in rivers and lakes drop. 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.*

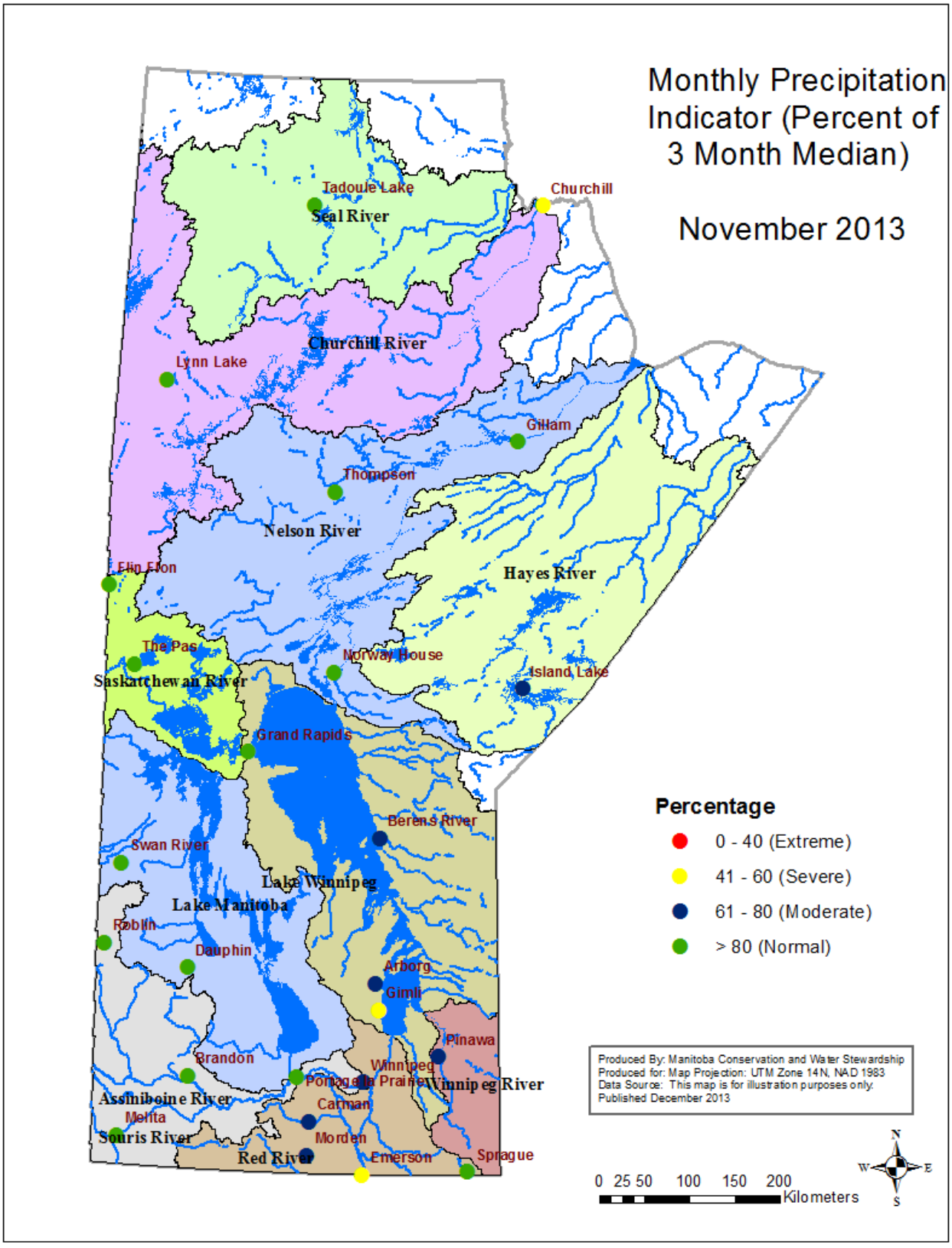
Rainfall also recharges groundwater aquifers through infiltration through the soil and run-off into streams and rivers. Once groundwater and surface waters are significantly impacted by lack of precipitation, a "hydrologic drought" occurs. Aquifer declines can range from a quick response (shallow sand)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

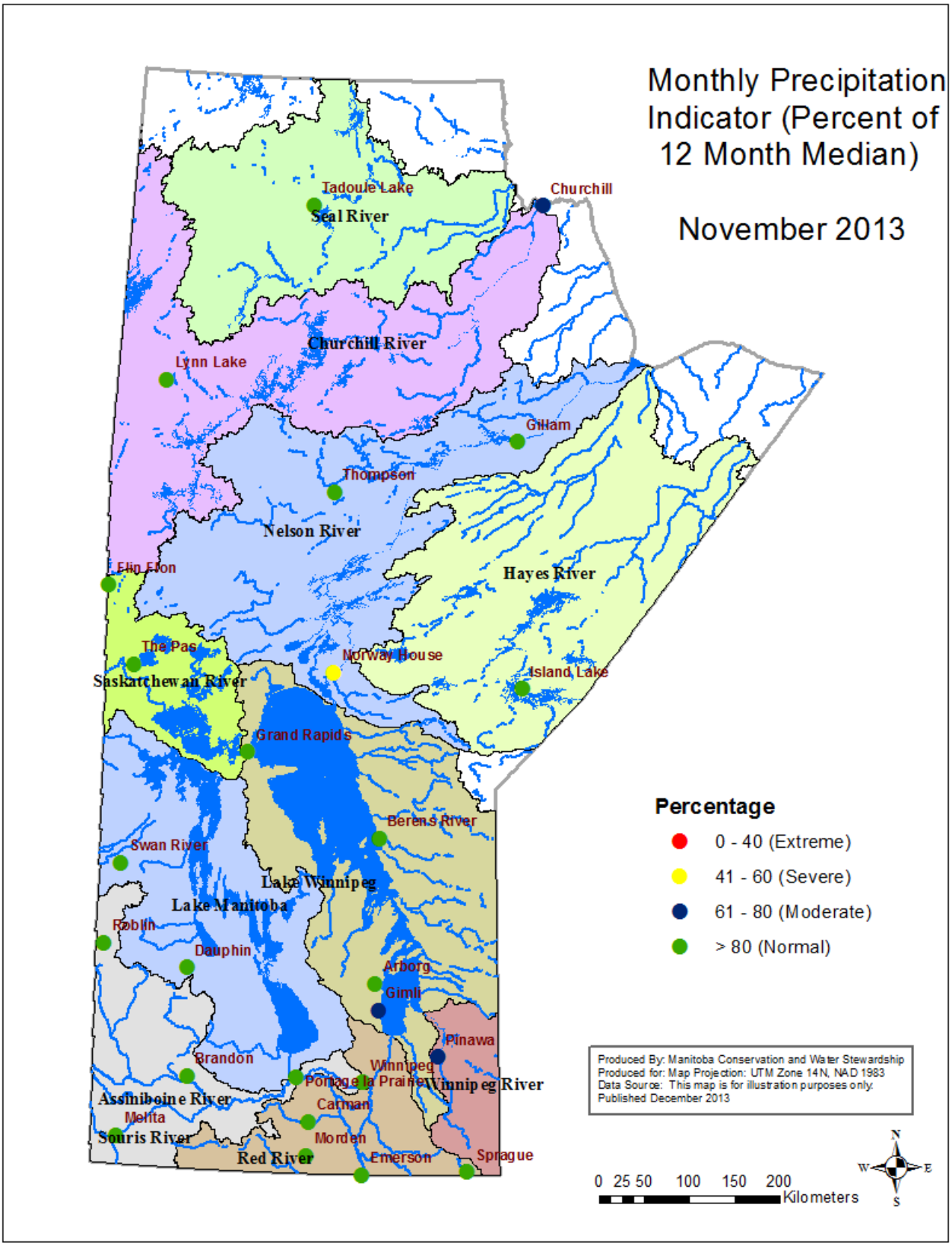
Socioeconomic Drought *occurs when the supply fails to meet the demand for an economic good(s) such as domestic water supplies, hay/forage, food grains, fish, and hydroelectric power, due to weather related water supply shortages from one or both of natural or managed water systems. At any time during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

Attachments

1. Precipitation Indicator (Percent of 1, 3 and 12 month median precipitation)




Monthly Precipitation Indicator (Percent of 3 Month Median)
November 2013
Tadoule Lake
Churchill
Seal River
Churchill River
Lynn Lake
Gillam
Thompson
Nelson River
Flin Flon
Hayes River
The Pas
Norway House
Island Lake
Saskatchewan River
Grand Rapids
Berens River
Swan River
Lake Winnipeg
Lake Manitoba
Roblin
Dauphin
Arborg
Gimli
Pinawa
Brandon
Winnipeg
Portage la Prairie
Winnipeg River
Assiniboine River
Carman
Melita
Souris River
Morden
Red River
Emerson
Sprague
Percentage
0 - 40 (Extreme)
41 - 60 (Severe)
61 - 80 (Moderate)
> 80 (Normal)
Produced By: Manitoba Conservation and Water Stewardship
Produced for: Map Projection: UTM Zone 14N, NAD 1983
Data Source: This map is for illustration purposes only.
Published December 2013
0 25 50 100 150 200
Kilometers
N
W
E
S


Monthly Precipitation Indicator (Percent of 12 Month Median)
November 2013
Iadoule Lake
Seal River
Churchill
Churchill River
Lynn Lake
Gillam
Thompson
Nelson River
Flin Flon
Hayes River
The Pas
Norway House
Island Lake
Saskatchewan River
Grand Rapids
Berens River
Swan River
Lake Winnipeg
Lake Manitoba
Roblin
Dauphin
Arborg
Gimli
Pinawa
Brandon
Winnipeg
Portage la Prairie
Winnipeg River
Assiniboine River
Carman
Melita
Souris River
Morden
Red River
Emerson
Sprague
Percentage
0 - 40 (Extreme)
41 - 60 (Severe)
61 - 80 (Moderate)
> 80 (Normal)
Produced By: Manitoba Conservation and Water Stewardship
Produced for: Map Projection: UTM Zone 14N, NAD 1983
Data Source: This map is for illustration purposes only.
Published December 2013
0 25 50 100 150 200
Kilometers
N
W
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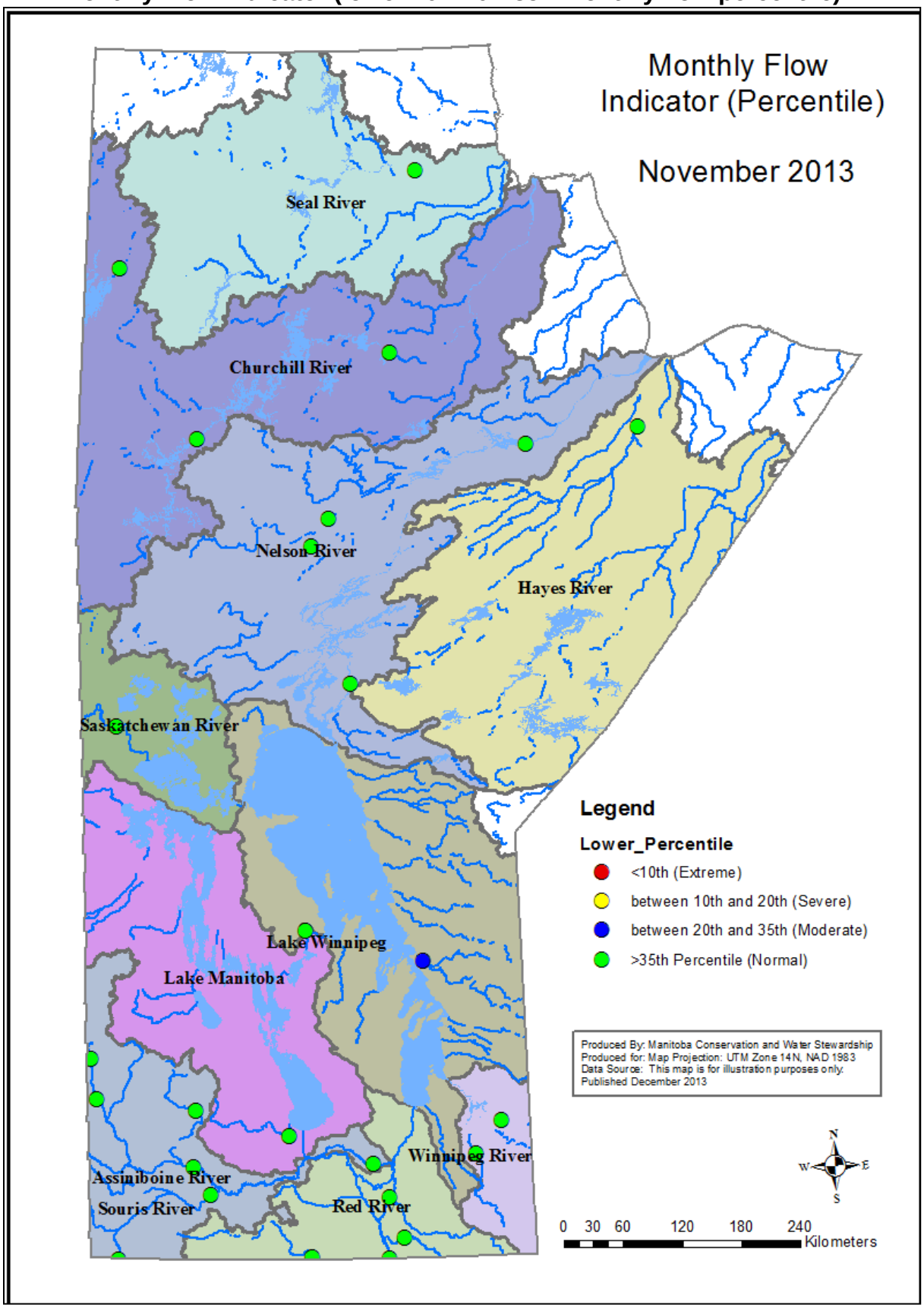
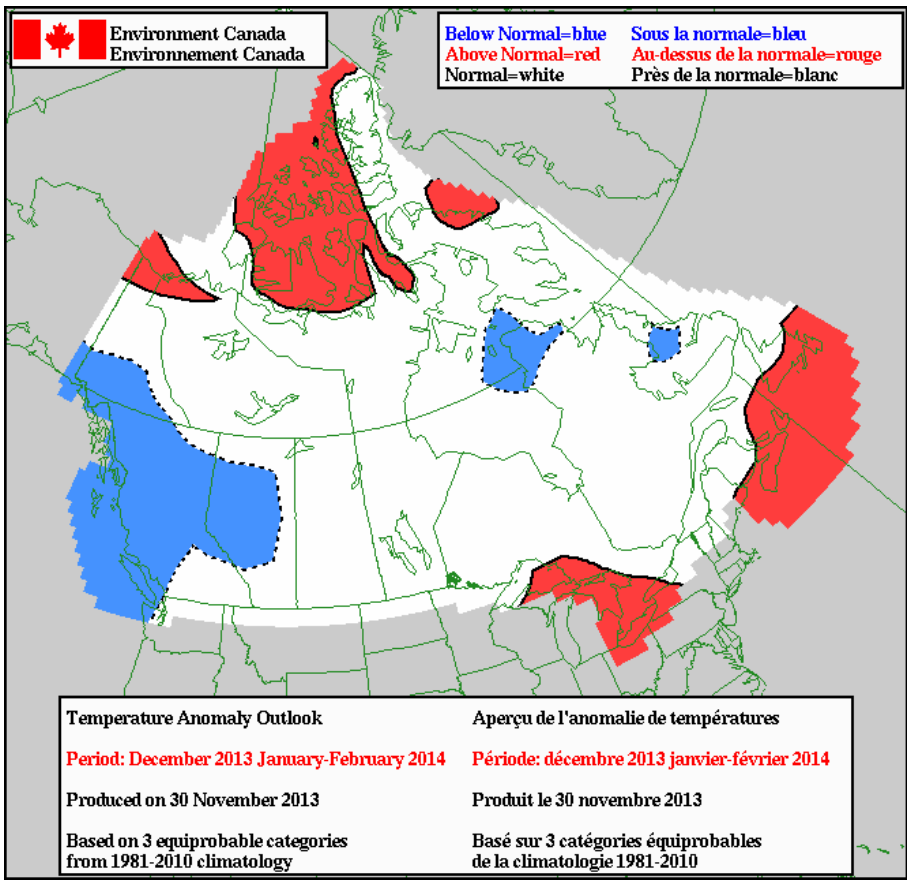
2. Monthly Flow Indicator (lower 10th-20th-35th monthly flow percentile)

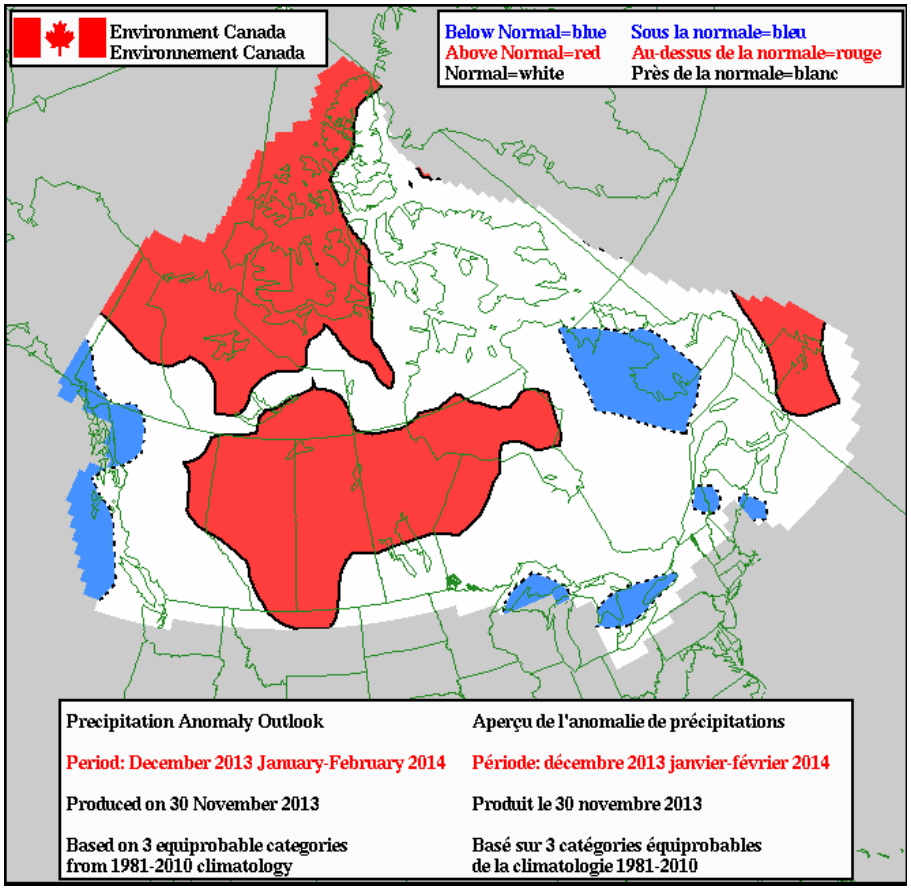


3. Water Supply Reservoir Status (Southern and Western)

	Water Supply Reservoir Levels and Storages							
	December 3, 2013							
Lake or Reservoir	**Community**	**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	1532.00	1531.54	October 7, 2013	-0.46	520	488	94%
Goudney (Pilot Mound)	Pilot Mound	1482.00	1480.93	December 3, 2013	-1.07	450	378	84%
Lake of the Prairies (Shellmouth)*	Brandon, Portage	1402.50	1399.44	December 3, 2013	-3.06	300,000	262,338	87%
Manitou (Mary Jane)	Manitou	1537.00	1535.87	December 3, 2013	-1.13	1,150	1,050	91%
Minnewasta (Morden)	Morden	1082.00	1080.42	December 3, 2013	-1.58	3,040	2,889	95%
Rapid City	Rapid City	1573.50	1573.94	October 8, 2013	0.44	200	231	115%
Lake Wahtopanah (Rivers)	Rivers	1536.00	1535.16	December 3, 2013	-0.84	24,500	23,576	96%
Stephenfield	Carman	972.00	971.56	December 3, 2013	-0.44	3,810	3,605	95%
Turtlehead (Deloraine)	Deloraine	1772.00	1771.55	December 3, 2013	-0.45	1,400	1,378	98%
Vermilion	Dauphin	1274.00	1273.94	December 2, 2013	-0.06	2,600	2,595	100%
* Summer Target level and storage.								

4. Environment Canada 3 Month Outlook





5. MAFRD Soil Moisture Survey Report Fall 2013

2013 Fall Soil Moisture Survey

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Background

During the last week of October 2013, a soil moisture survey was completed across Agro-Manitoba. Knowing the fall soil moisture status can be helpful for agronomic decisions such as crop selection, determining potential yield, and estimating fertilizer requirements. The amount of moisture within the root zone just prior to freeze-up provides a good indication of what can be expected in the spring. With snow cover and freezing temperatures, soil moisture content remains relatively stable throughout the winter. This is especially true in frozen moist soils whose pores become "sealed off" from further water infiltration.

Method

Each sampling site was chosen based on the soil properties that best represent each area and the most common cropping system in the region. Soil samples were collected from 105 locations at five depths throughout the root zone: 0 to 6 inches, 6 to12 inches, 12 to 24 inches, 24 to 36 inches, and 36 to 48 inches. Samples were placed in sealed containers and subsequently weighed, oven dried, and re-weighed to determine their gravimetric moisture content.

Soil samples were classified based on their similarities to other well characterized soils in Manitoba according to Haluschak *et al* (2004). This enabled us to assign a bulk density, wilting point, field capacity, and available water holding capacity value to each depth from each sample location. From there, soil moisture by weight was converted to percent moisture by volume. Using percent moisture by volume, we were able to calculate and map the available water (Figure 1) and soil moisture as a percent of available water holding capacity (Figure 2). An inverse distance weighted (IDW) interpolation technique with minimal smoothing was used to retain the spatial variability of the results. The interpolation was performed between the actual values of the sample sites without accounting for soil variability between those locations.

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Results

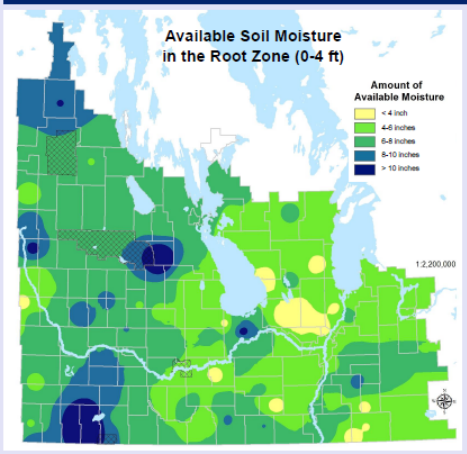

Figure 1: Available Soil Moisture in the Root Zone. Available moisture is the amount of water that a crop could potentially extract from the soil. As the water becomes depleted and is less readily available, the plant will have more difficulty accessing moisture. If the water becomes depleted, the crop will sustain permanent damage and the soil has reached the permanent wilting point. In a normal growing season, a wheat crop is expected to use between 10 and 13 inches of water while a corn crop would require between 16 and 20 inches of water. Therefore, it is important that precipitation arrives somewhat regularly throughout the growing season to avoid moisture deficits.

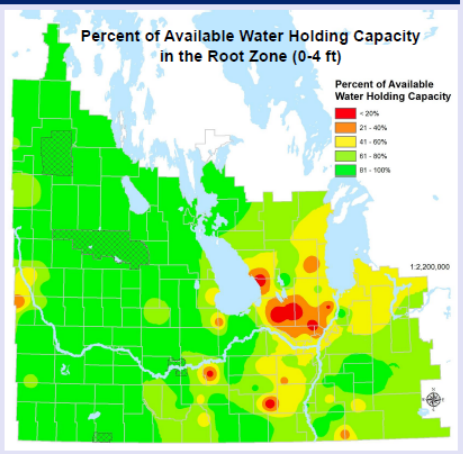

Figure 2: Percent of Available Water Holding Capacity in the Root Zone. Soil moisture expressed as percent of capacity shows the amount of available moisture in the soil as a percentage of the total available water holding capacity for the soil. Percent of available water holding capacity can be used to determine soil moisture on a relative scale to assess whether the soils are dry or wet. Soil with its moisture content at field capacity would have an available water holding capacity of 100% while soil at the wilting point would have a value of zero. For most crops, moisture stress can begin as the moisture content drops below 50-60%. The amount of water held at field capacity will vary greatly depending on the soil texture. Coarse sand at field capacity would have about 3 inches of available soil moisture, sandy loam would have about 7 inches, loam would have about 10 inches, clay loam would have about 11 inches, and clay could have over 12 inches.

Summary

In general, the western side of the province is consistently wet, having experienced high rainfall amounts over the growing season (especially in the southwest region). The interlake and southeast Manitoba received below average precipitation this summer, which is reflected in the fall soil moisture data. The western half of the province will be looking for normal rainfall amounts to support crop growth in the next growing season.

References

Haluschak, P., Griffiths, J. and Shaykewich, C. F. 2004. Available water holding capacities of Manitoba soil. Manitoba Soil Science Society Proceedings 2004: 224-232.

Acknowledgements

Many thanks to MAFRD staff who assisted with the soil sampling: Eric Cox, Nancy DeLong, Laura Grzenda, Jim Heshka, Mandy Lewick, Jewel Mazur, Peter Petrash, Clay Sawka, Mitchell Timmerman , Matthew Wiens and Brian Wilson.

The Manitoba Fall Soil Moisture Survey is an initiative of the Manitoba Ag-Weather Program.

6. Major River Basin