LOWER WINNIPEG RIVER BASIN DISCUSSION SHEET SERIES
Sheet #3

Hydrology:
River discharge and level

May 2021

Introduction

The lower Winnipeg River basin (LWRB) is located in the northwest section of the entire Winnipeg River basin (WRB), which spans parts of western Ontario and small parts of Manitoba and northern Minnesota, United States. The Discussion Sheet Series highlights research on ecological and socio-economic aspects of the basin to encourage discussion with experts, government departments, Indigenous groups, and stakeholders. The Discussion Sheet Series is based on available data collected in 2018 and 2019. Sheet 3 of 11 summarizes the hydrology (river discharge and level) in the LWRB.

Hydrology

The LWRB receives water directly from surface water runoff, streams, and tributaries from Manitoba and Ontario (see Figures 1 and 2 and Sheet 11: Maps). Most streamflow from Ontario is regulated by the Lake of the Woods Control Board. There are multiple Manitoba rivers that directly contribute water into the lower Winnipeg River, including the Whiteshell, Whitemouth, Lee, and Bird rivers, each flowing through various land covers, communities, and the Precambrian Shield.[1] There are six hydroelectric run-of-river generating stations along the LWRB—Pointe du Bois, Slave Falls, Seven Sisters, McArthur Falls, Great Falls, and Pine Falls—that together can generate 583 MW of electrical capacity, approximately 10% of the energy needs for the province (Manitoba Hydro, n.d.) (Figure 1).[2]

[1] For more information on landscape characteristics, refer to Sheet 2: Landscape Characteristics and Sheet 11: Maps.

[2] For more information on the river's hydroelectric industry, refer to Sheet 10: Industries and Economic Activity.

River Discharge

The mean annual discharge (± SD) (1987–2016) in the Winnipeg River at the Pine Falls Generating system is 1,008 ± 294 m^3/s,[3] typically peaking in June and July (Figure 3). Resulting from the poor and non-permeable soil characteristics of the Precambrian Shield (see Sheet 2: Landscape Characteristics), infiltration of precipitation within the Winnipeg River basin is relatively low, while many waterbodies in the basin help to attenuate surface runoff. Additionally, the river accounts for 49% of the mean monthly discharge of all rivers and streams entering Lake Winnipeg, despite its disproportionate contribution to the Lake Winnipeg basin contributing area (Environment Canada & Manitoba Water Stewardship, 2011).

Annual nutrient load to Lake Winnipeg from the Winnipeg River is highly attributed to discharge (Environment Canada & Manitoba Water Stewardship, 2011; see Sheet 4: Water Quality and Nutrient Loading). The median climate projection from an ensemble of simulations suggests an increase of 6.9% for mean annual precipitation and 3.3% for runoff into the Winnipeg River basin for the 2050s time period. This could have impacts on nutrient loading downstream; however, there is still uncertainty in climate projection variables, such as runoff (Manitoba Hydro, 2020; further described in Sheet 1: Climate and Climate Change).

River Level

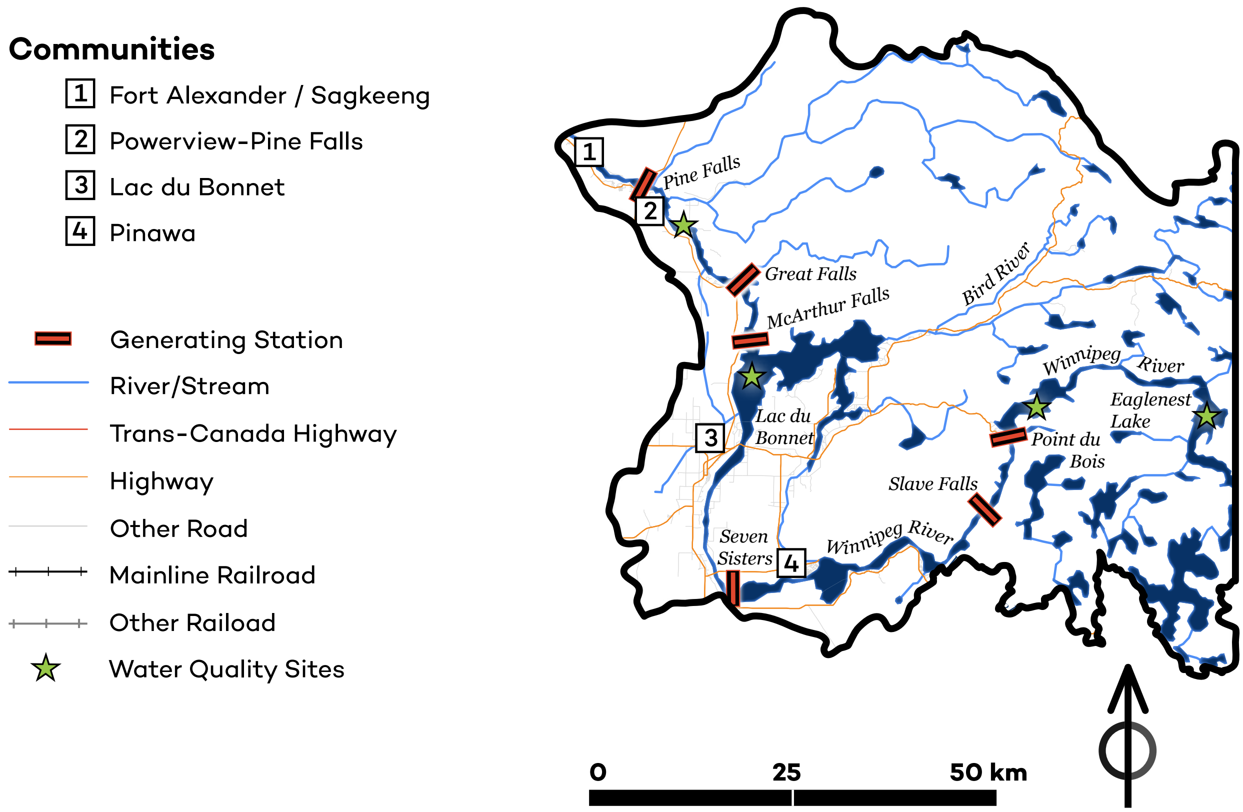
The water levels recorded at four hydrometric stations along the river remain relatively constant with low variability (Figures 4A–D). However, Nutimik Lake displays some seasonal trends. This site is not directly associated with a generating station and also receives inflow from the Whiteshell River. Run-of-the-river hydroelectric generating stations can cause an increase in surface area of the forebay compared to pre-existing conditions but have a negligible impact on discharge.

Any physical change to water level or flow may have an impact on water quality, ice cover, and terrestrial and aquatic habitat availability. Due to the connection between the generating stations and the aquatic ecosystem, the Coordinated Aquatic Monitoring Program (CAMP) was developed by Manitoba Hydro and the Province of Manitoba to monitor the health and integrity of aquatic ecosystems that are potentially influenced by hydroelectric generating stations (CAMP, 2017).

The Winnipeg River releases the greatest volume of water to Lake Winnipeg and contributes the second-largest nutrient load (Environment Canada & Manitoba Water Stewardship, 2011). River hydrology influences ecological, social, and economic conditions on the river and should be carefully considered for any future research or work.

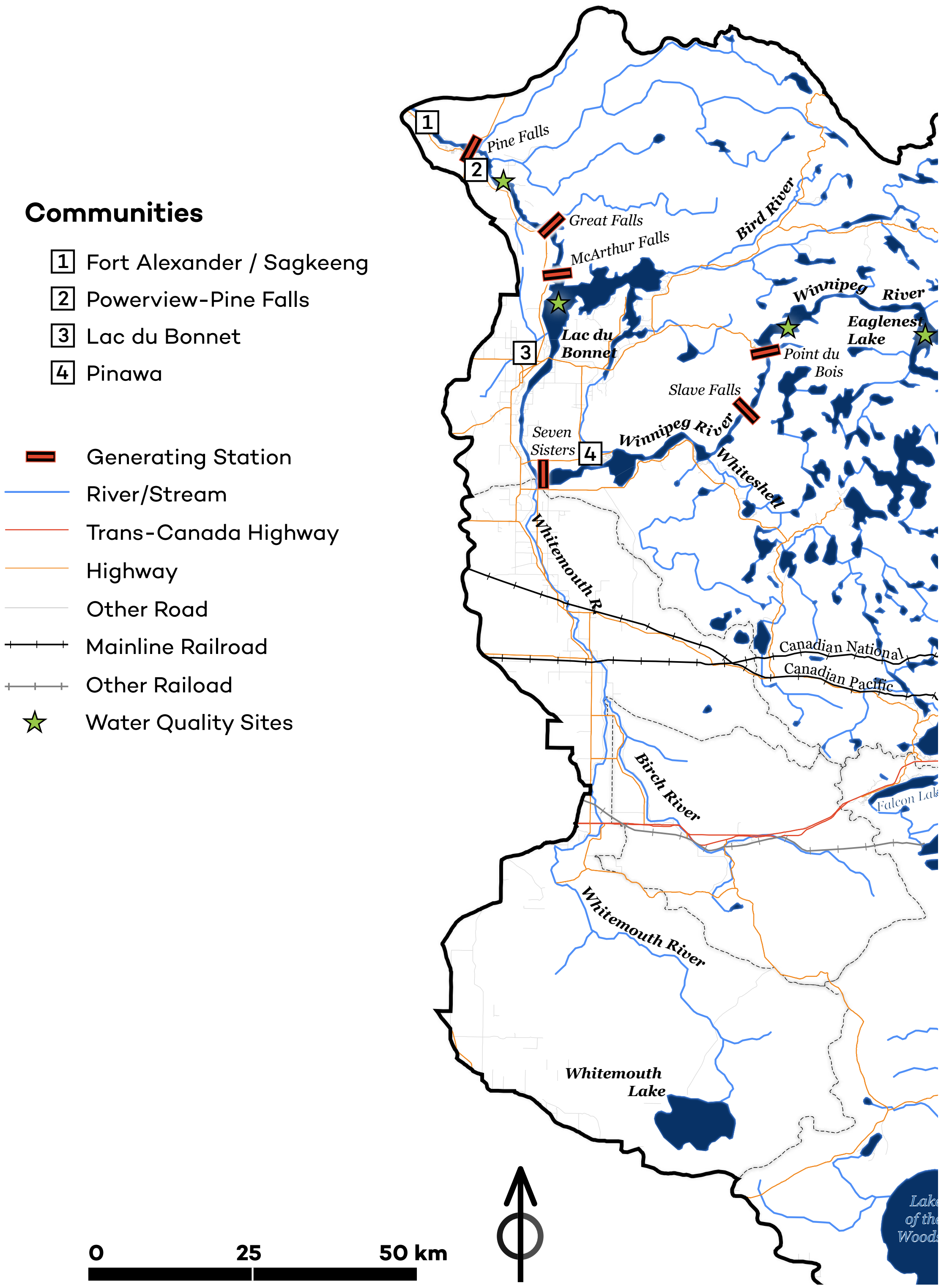
[3] Mean annual discharge calculated from annual mean flows from 1987 to 2016 (Source: Environment and Climate Change Canada, 2018). Discharge data is also available from McArthur Falls, Slave Falls, and Pointe du Bois, but it is not discussed further herein.

Figure 1. Map of the LWRB, highlighting the generating stations



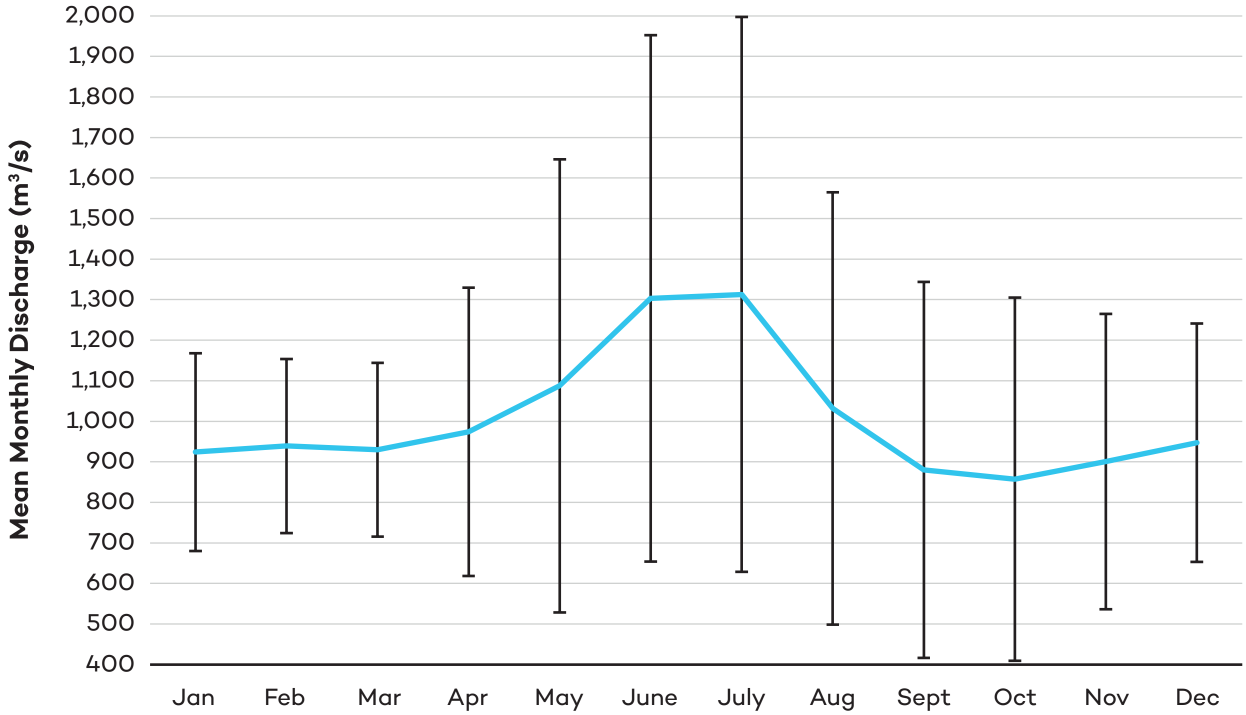
Source: Government of Manitoba, n.d.

Figure 2. Context and community map of the Manitoba portion of the Winnipeg River basin



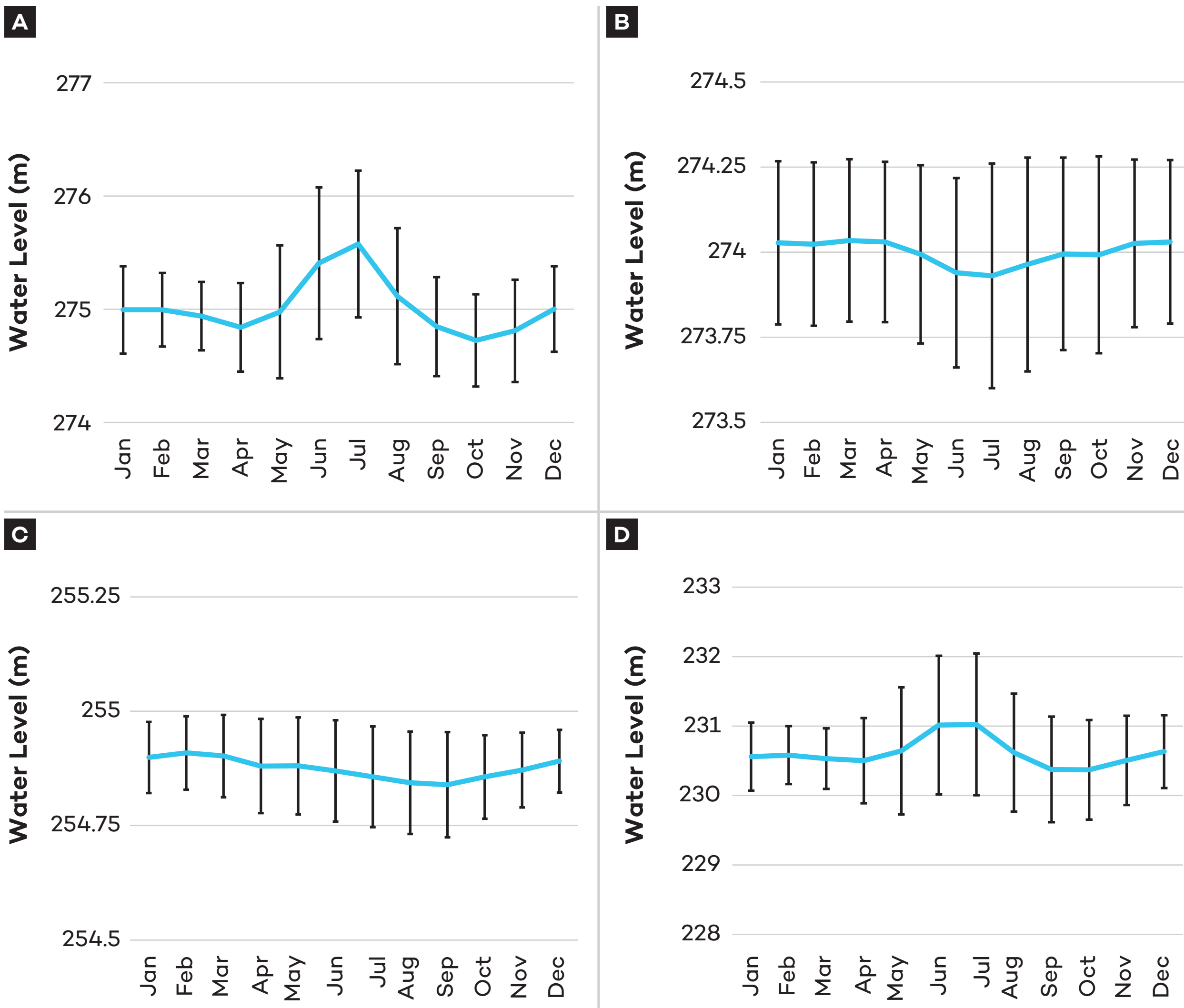
Source: Government of Manitoba, n.d.

Figure 3. Mean monthly discharge (m3/s) (± SD) at Pine Falls (05PF069, N=359, 1987–2016) into Lake Winnipeg



Source: Environment and Climate Change Canada, 2018.

Figure 4. Mean monthly water level (m) (± SD) at Nutimik (A) (05PF070, N=211, 1999-2016), Seven Sisters (B) (05PF057, N=444, 1978-2016), Lac du Bonnet post McArthur (C)[4] (05PF062, N=656, 1956-2016), and Great Falls (D)[5] (05PF048, N=407, 1982-2016)[6]



Source: Environment and Climate Change Canada, 2018.

[4] Note: Water level data that pre-dates the McArthur Generating Station development (1955) was removed.

[5] Note: Years of drawn down for refurbishment of Great Falls were removed until completion in December 1981 (personal communication, Brian Giesbrecht, December 2020).

[6] Note: Each figure has a different y-axis for water level due to large differences between sites and to display potential seasonal variability.

References

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