LWF LAKE WINNIPEG FOUNDATION

LAKE WINNIPEG COMMUNITY-BASED MONITORING NETWORK

2019 Report

Assiniboine River near Virden; Photo: Paul Mutch

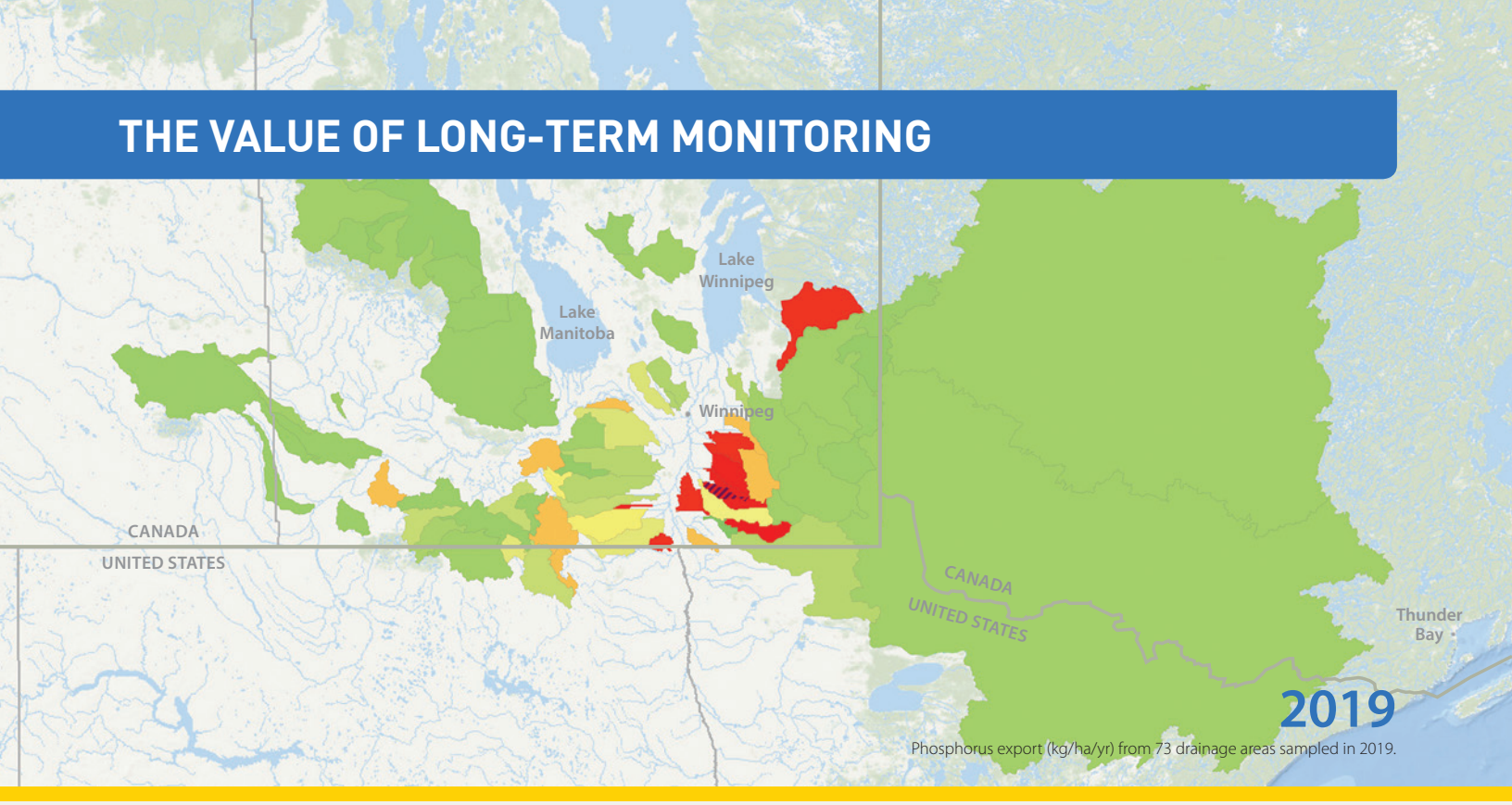
The Lake Winnipeg Community-Based Monitoring Network (LWCBMN), coordinated by the Lake Winnipeg Foundation (LWF), mobilizes citizens to collect water samples across Manitoba in order to measure phosphorus concentration.

Phosphorus is the nutrient responsible for blue-green algae blooms on Lake Winnipeg. Phosphorus comes from diverse sources across the watershed, including municipal wastewater and agricultural runoff.

With the help of watershed partners and citizen scientists, this long-term monitoring program is identifying phosphorus hotspots – localized areas that contribute higher amounts of phosphorus to waterways than other areas.

Targeting remedial action in hotspots will reduce the amount of phosphorus entering Manitoba's lakes and rivers, and improve the health of Lake Winnipeg.

THE VALUE OF LONG-TERM MONITORING



In 2019, LWCBMN once again identified localized phosphorus hotspots within the Lake Winnipeg watershed. In the Red River Valley, the location of these hotspots was similar to patterns observed in 2016 and 2017. The recurrence of these patterns over multiple years increases our confidence in the data generated by LWCBMN, helping to pinpoint areas that consistently contribute a high phosphorus load to Lake Winnipeg.

It's harder to draw conclusions based on a single year's data. Interannual climate variation – year-to-year changes in precipitation and temperature – affects the outcomes of environmental monitoring; for example, LWCBMN phosphorus exports were very different in 2017 (a wet year) and 2018 (a dry year). Each year's data give us a unique snapshot; taken on their own, neither tells the full story.

This is why long-term monitoring programs are important: they enable us to identify patterns and trends that persist over time despite interannual variation. Recurring hotspots in 2016, 2017 and 2019 point to meaningful trends in phosphorus loading and help us focus remediation efforts to improve Lake Winnipeg's water quality.

LWCBMN sampling activities increased in 2019, expanding into the Winnipeg River system – the second-largest phosphorus contributor to Lake Winnipeg (15 per cent of the annual phosphorus load). Unique partnerships enabled this expansion: Manitoba Hydro and Ontario Power Generation staff were trained and equipped to collect water samples at hydroelectric generating stations, and also provided flow data to enable calculation of phosphorus exports. Sampling efforts were also expanded into western Manitoba, with sites added in the Dauphin Lake, Souris River and Whitemud River watersheds.

Snow melts, floods and heavy rainfall events are responsible for most of the phosphorus that is flushed off the land and carried into our waterways. In 2019, partners and volunteers collected samples frequently during the spring runoff period and after large precipitation events, including the intense fall storms that flooded portions of the Red River Valley.

2019 BY THE NUMBERS

Number of samples:	2,039
Number of sites:	161
Number of flow-metered sites:	73
Citizen volunteers:	75
Watershed district partners:	10

Victoria Beach on Lake Winnipeg, 2019; Photo: Mikaela Mackenzie, *Winnipeg Free Press*

FOCUS ON PHOSPHORUS

Understanding the causes and controls of freshwater eutrophication

Eutrophication – the overfertilization of aquatic systems – results in excessive growth of algae, with economic, health and environmental implications. Lake Winnipeg, like many lakes across Canada and around the world, is experiencing increasingly severe algae blooms as a result of human actions and land-use change within the watershed.

In the 1960s, when algae blooms first plagued the Great Lakes, the government of Canada established the Experimental Lakes Area, a one-of-a-kind freshwater research facility in northwestern Ontario comprised of 58 small lakes and their surrounding watersheds. Created to answer questions about eutrophication, this unique natural laboratory conducts whole-ecosystem experiments which mimic real-world situations, making scientific conclusions more reliable than those based on small-scale lab studies.

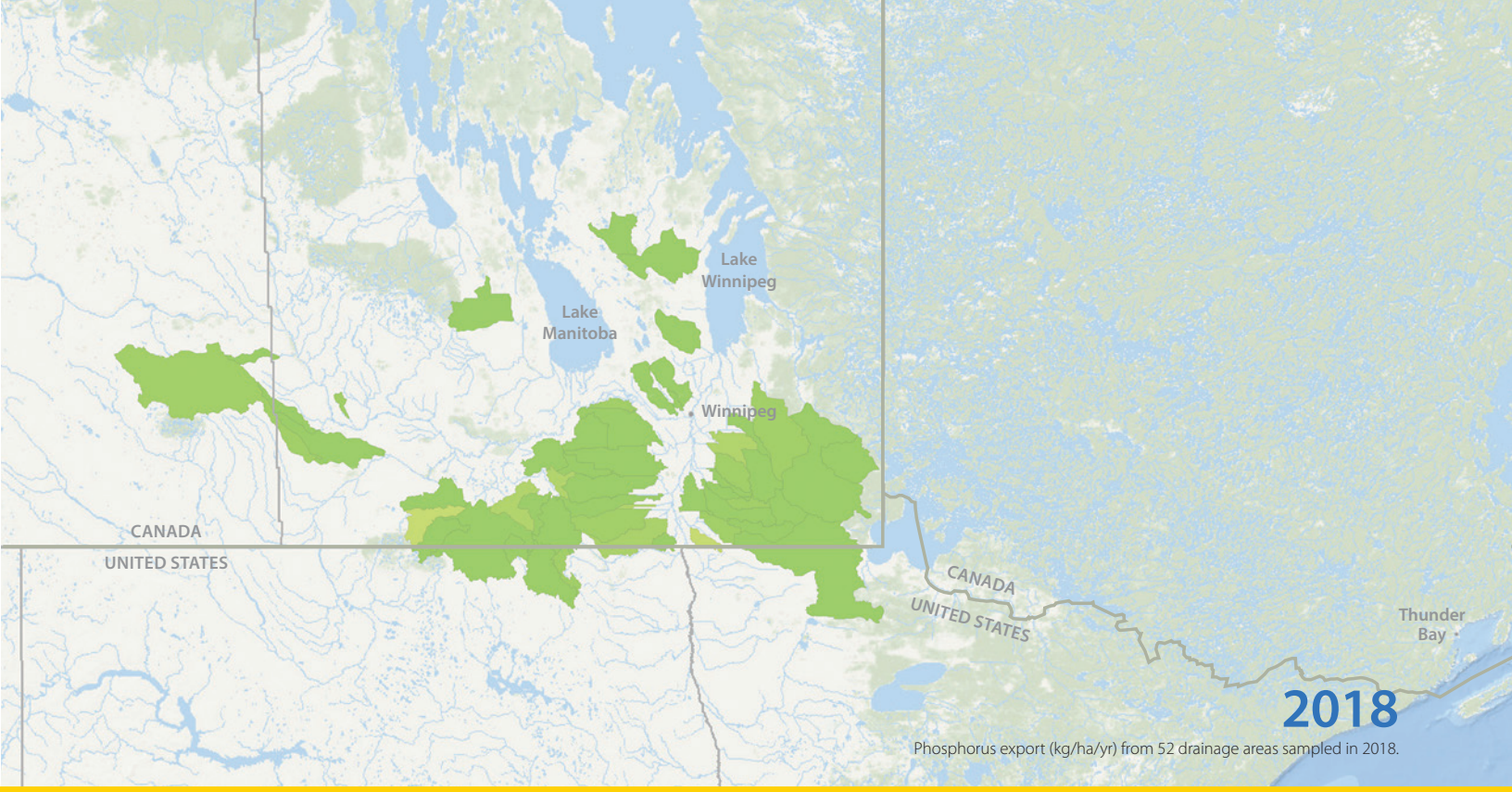
The first experiments tackled at the Experimental Lakes Area (now known as IISD-ELA) were designed to identify the cause of algae blooms on freshwater lakes. Several nutrients were put to the test.

In the middle of Lake 226, a plastic curtain was installed. Carbon and nitrogen were added to one side of the lake, while carbon, nitrogen and phosphorus were added to the other side. Only the half which received phosphorus produced algae blooms. The answer was clear.

The Lake 226 experiment demonstrated the connection between phosphorus and algae blooms. This iconic picture has been described as the single most powerful image in the history of limnology. Photo: IISD Experimental Lakes Area, 1973

Another experiment, on Lake 227, is the world's longest-running controlled study on algae blooms – it began in 1969 and continues to this day. At first, researchers routinely dosed the lake with excessive amounts of both phosphorus and nitrogen. Over the years, the amount of nitrogen added was gradually decreased and, in 1990, researchers stopped adding it completely. Algae blooms continued to appear in Lake 227 with the same intensity because of the ongoing addition of phosphorus. Nitrogen reduction had no effect.

Our responses to urgent environmental challenges must be based on the best-available data, and decades of research at IISD-ELA have demonstrated that in order to control algae blooms, we must focus on phosphorus. With this scientific evidence as its foundation, LWCBMN is generating vital phosphorus data which can be used to inform solutions for Lake Winnipeg.



Phosphorus export (kg/ha/yr) from 52 drainage areas sampled in 2018.

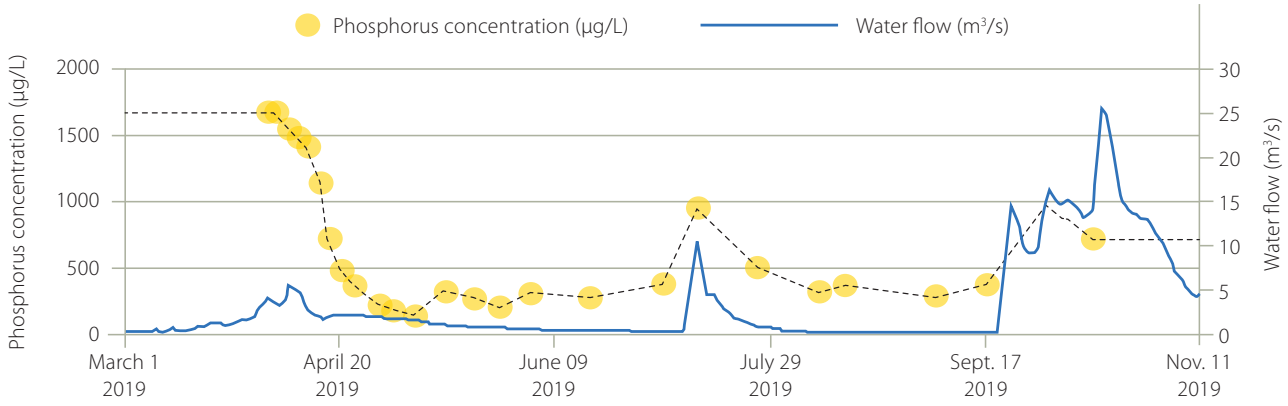
CLIMATE CHANGE AND THE FUTURE OF PHOSPHORUS LOADING

Though phosphorus hotspots in 2019 follow a similar spatial pattern to those observed in previous years, the seasonal timing of phosphorus loading was different. In 2019, at most sampling sites, the majority of phosphorus loading occurred during the fall rather than the spring.

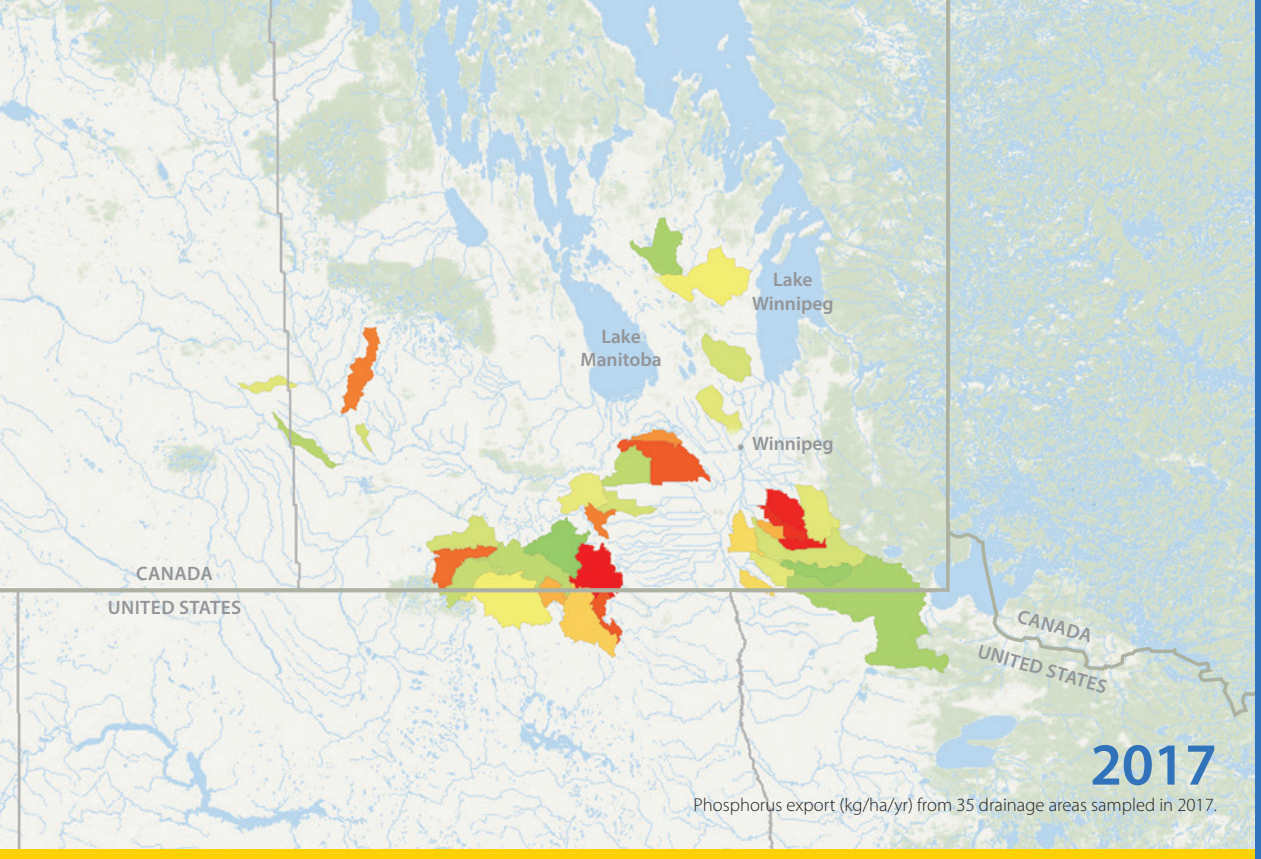
Fall storms and flooding on the eastern side of the Red River Valley and in the Winnipeg River system resulted in high phosphorus exports, including an export of 2.29 kg/ha/y from the lower Joubert Creek. This is one of the greatest phosphorus exports ever reported by any monitoring program in Manitoba.

A new phosphorus hotspot was also identified in the lower Winnipeg River, upstream of the Pine Falls Generating Station. Again, high fall water flow was responsible for this high phosphorus export. However, with only one year of data so far, ongoing monitoring is required to learn more.

The unprecedented wet fall conditions in 2019 highlight changing weather patterns on Manitoba's Prairies. Short-lived, intense storms are expected to become more frequent as a result of climate change. Coupled with spring snowmelt, this is likely to increase phosphorus loading in southern Manitoba.

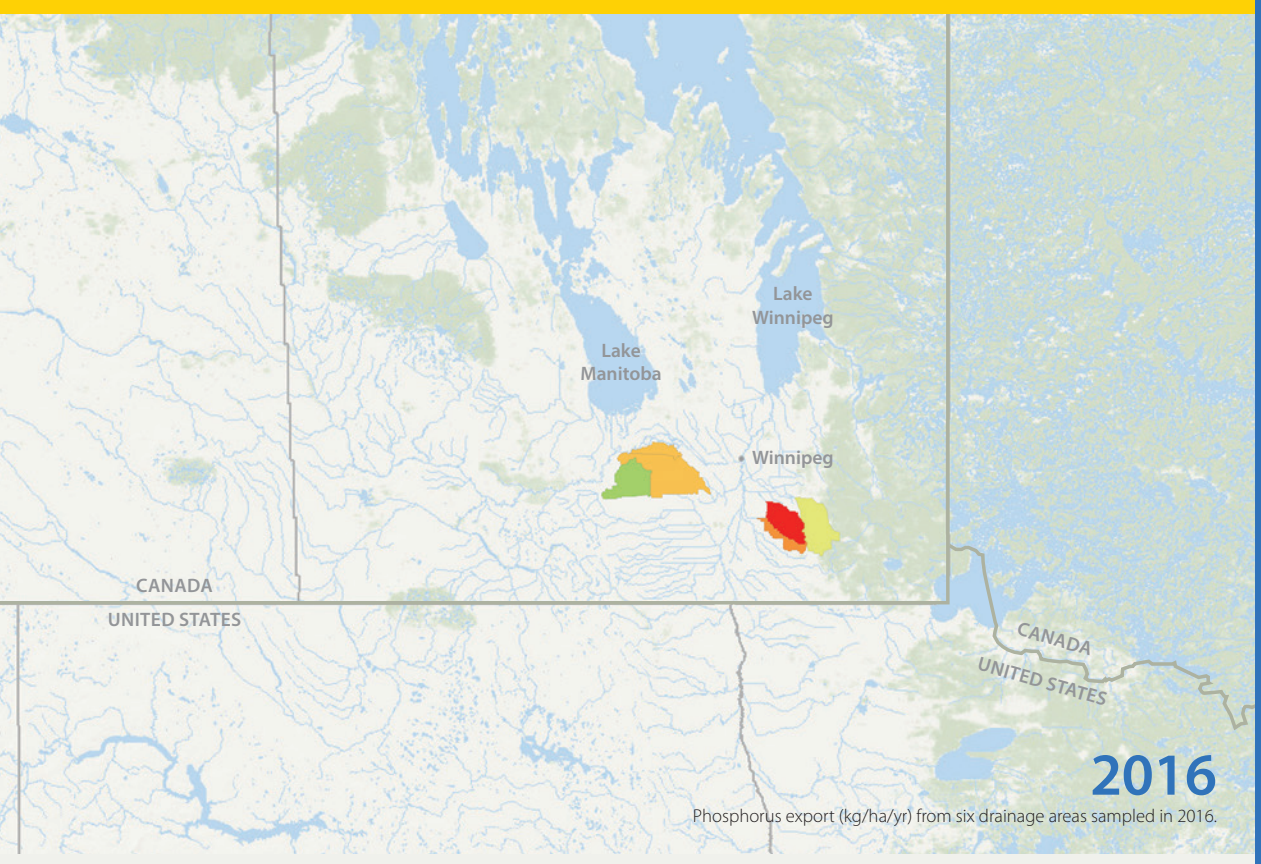


Water flow and phosphorus concentration for the lower Joubert Creek near St-Pierre-Jolys. In 2019, 70 per cent of the phosphorus load and 73 per cent of the water load occurred during the fall (Sept. 22 to Nov. 11).



2017

Phosphorus export (kg/ha/yr) from 35 drainage areas sampled in 2017.



2016

Phosphorus export (kg/ha/yr) from six drainage areas sampled in 2016.

LWCBMN data online

LWF is committed to sharing LWCBMN data in an open, accessible way. In addition to annual network-level reports, regional reports featuring site-specific data are generated after each field season, and are available on our website: lakewinnipegfoundation.org.

LWCBMN data are also available on LakeWinnipegDataStream.ca. This open-access, online portal for water-quality data features searchable maps and other data visualization tools.

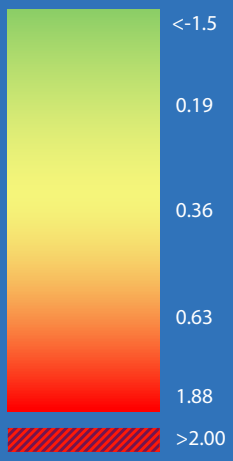
DEFINITIONS

Phosphorus concentration: the amount of phosphorus in a defined volume of water, measured in micrograms per litre (µg/L)

Water flow: the rate at which water flows past a sampling site, measured in cubic metres per second (m^3/s)

Phosphorus load: the total amount, in tonnes, of phosphorus flowing past a sampling site in a field season, calculated by multiplying phosphorus concentration by water flow

Phosphorus export: the amount of phosphorus exported from each hectare of land in a year (kg/ha/y), calculated by dividing the phosphorus load by the drainage area



Water load: the total volume of water flowing past a sampling site in a field season, measured in cubic kilometres (km^3)

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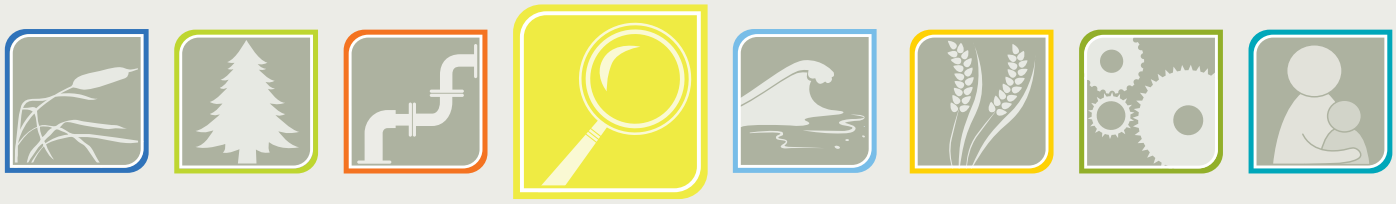
THE WINNIPEG FOUNDATION For Good. Forever.

LWCBMN is a collaborative initiative delivered in partnership with Manitoba's watershed districts, LWF's science advisors, volunteer citizen scientists and the Centre for Earth Observation Science, University of Manitoba.

MONITORING OUR WATERWAYS

To reduce phosphorus loading, we need to know how, when and from where phosphorus is reaching Lake Winnipeg. The Lake Winnipeg Community-Based Monitoring Network (LWCBMN) is a long-term phosphorus monitoring program that engages citizen volunteers to collect water samples across Manitoba using scientific protocols. Because citizen scientists live, work or commute near their sampling sites, they can sample frequently in response to weather events and water conditions, generating critical data to inform research and policy.



The Lake Winnipeg Foundation (LWF) advocates for change and coordinates action to improve the health of Lake Winnipeg. LWF's flagship initiative, the Lake Winnipeg Health Plan, is a set of eight evidence-based actions to reduce phosphorus loading. By addressing the root causes of potentially harmful algae blooms, the plan provides a blueprint for cost-effective decision-making and long-term, adaptive freshwater management.