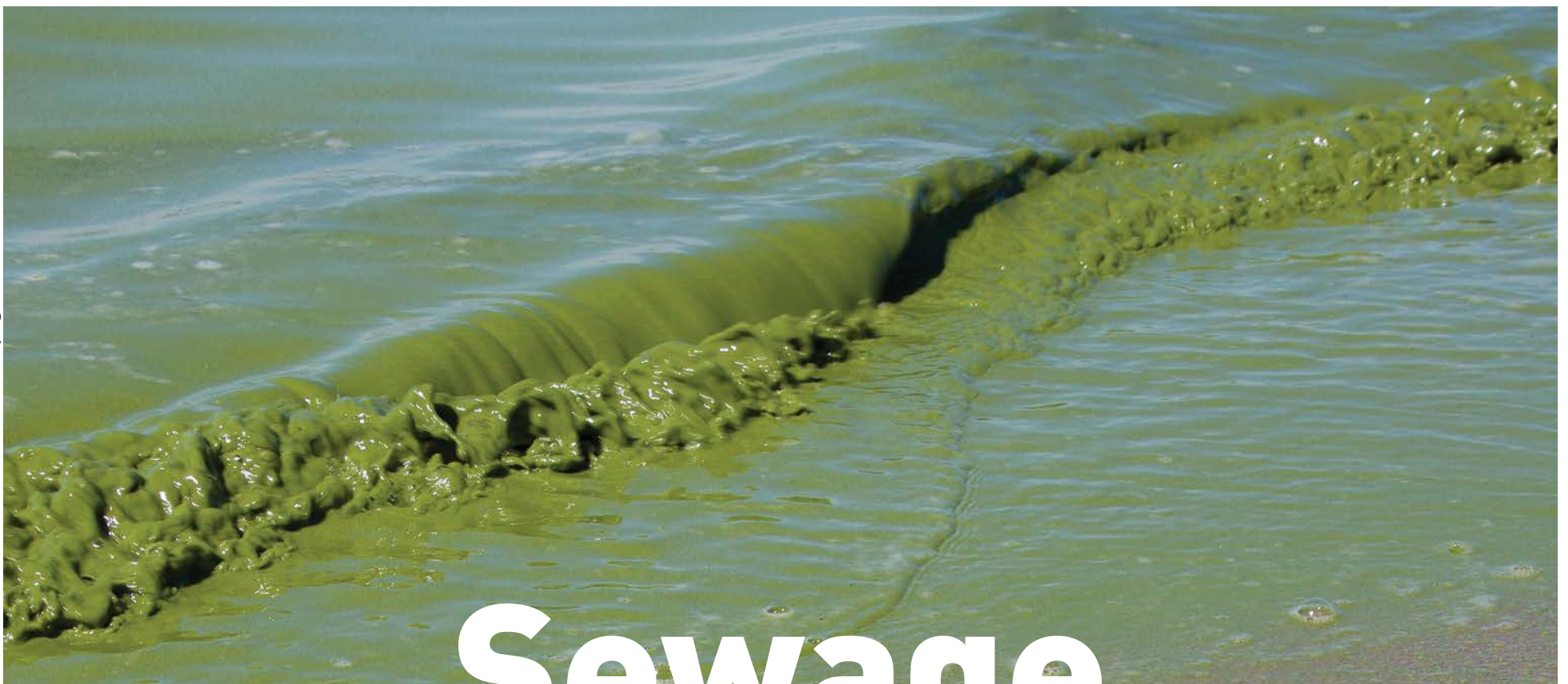

Victoria Beach on Lake Winnipeg, Summer 2017; PHOTO: JEOPE WOLFE

Sewage S.O.S.

Aging wastewater infrastructure is putting our lakes at risk

Out of sight, beneath the ground and behind the walls of industrial plants, a national crisis is growing.

Water and wastewater systems make up approximately 30 per cent of Canada's municipal infrastructure – and, across the nation, these systems are in serious trouble: crumbling due to age, chronically underfunded and increasingly inefficient.

The 2016 Canadian Infrastructure Report Card, led by the Federation of Canadian Municipalities (FCM), found 35 per cent of Canada's wastewater infrastructure is in fair to very poor condition. Equally alarming is the cost to repair or upgrade these systems: a whopping $19.9 billion, according to a separate FCM study conducted in 2007.

Much of this cost falls on the shoulders of Canadian municipalities. Cities and towns are struggling to balance competing spending priorities and fund massive capital projects at a time when transfer payments from other levels of government are being reduced, and revenue generation via civic taxation and/or user fees is limited. Meanwhile, construction costs continue to rise – and chronic delays are having a detrimental impact on the health of our beloved lakes and rivers.

For many, Canada's seemingly abundant fresh water is a source of pride. Yet according to the 2015 RBC Canadian Water Attitudes Study, the majority of Canadian citizens are woefully unaware of the condition of their sewage systems, water treatment plants or stormwater systems.

It's time to start paying attention.

Phosphorus is a nutrient needed by all living things. However, when excessive amounts of it are flushed into our waterways, phosphorus contributes to eutrophication, a process that produces the soupy, potentially toxic blue-green algae blooms that plague many Canadian lakes in the summer months.

Manitobans are all too familiar with the consequences of eutrophication. For decades, Lake Winnipeg has been under siege from phosphorus from a variety of upstream sources, including undertreated sewage from cities, towns, rural areas and Indigenous communities.

Algae blooms on the 10th largest freshwater lake in the world contaminate beaches, reduce water quality, and threaten the viability of lakeshore industries and communities. In 2013, the Global Nature Fund awarded Lake Winnipeg with the dubious distinction of "Threatened Lake of the Year."

Municipal wastewater treatment throughout Manitoba contributes approximately nine per cent of the total phosphorus input to Lake Winnipeg – or about 19 per cent of the load coming from within the province's borders. This is not only a significant contribution – it's also one that's relatively simple to address.

As Manitoba's largest municipality, Winnipeg can't ignore its own contribution.

Winnipeg's North End Water Pollution Control Centre (NEWPCC) was built in 1937 and is the largest – and oldest – of three city sewage plants. Today, it treats approximately 70 per cent of the wastewater produced by Winnipeg's 700,000-plus residents (approximately 195 million litres a day), removing bacteria and other contaminants from effluent that is then released into the Red River. Upgrades to the NEWPCC have been made periodically throughout its lifespan; still, according to the National Pollutant Release Inventory, reported annually to Environment and Climate Change Canada, it remains the fourth largest phosphorus polluter among all wastewater treatment facilities in Canada.

Winnipeg's wastewater plants are regulated under *The Manitoba Environment Act*. The NEWPCC's operating licence was first issued in 2003 and required the completion of plant upgrades by Dec. 31, 2014, to ensure that total phosphorus concentration in released effluent did not exceed 1 milligram per litre (mg/L) based on a 30-day rolling average.

Yet Winnipeg's sewage situation is mired in delays. The city has asked for, and received, extensions to its legislated deadline. Upgrades to remove algae-causing phosphorus have stalled due to squabbles about best practices and cost – now pegged at an estimated $1.4 billion. And all the while, phosphorus concentration in NEWPCC effluent is routinely above 1 mg/L – at times reported to be over five times higher than the licensed target.

Scientific research has made clear the connection between phosphorus loading and eutrophication. We now know that poorly managed civic wastewater systems can have significant ecological, economic and social consequences.

It's time to take the necessary steps to ensure that the water which flows down our drains and gets flushed down our toilets is not harming our rivers and lakes. The cost of inaction is simply too steep to ignore.

Following Winnipeg's water

Every day in Winnipeg, an interconnected network of pipes, sewers, valves, tanks and pumps moves, cleans and ultimately, releases treated wastewater – or effluent – into our city's rivers, which then flow downstream to Lake Winnipeg.

A nation of water wasters

As Canadians, we say we value water as a precious resource – but our consumption habits suggest otherwise.

Canada is the second-heaviest water user in the world, after the United States. In Manitoba, each of us uses an average of 174 litres per day. Every time we brush our teeth, flush our toilets or wash our clothes, we create wastewater – and all of it has to go somewhere.

Not clean enough

The City of Winnipeg operates three sewage treatment plants. All three facilities are expected to comply with the provincial licence limit for phosphorus concentration in released effluent of 1 milligram per litre (mg/L) based on a 30-day rolling average.

The West End Water Pollution Control Centre (WEWPCC) treats approximately 10 per cent of Winnipeg's wastewater. Facility upgrades were completed in 2010 and online WEWPCC compliance reports show phosphorus concentration in released effluent is well below the required limit.

Upgrades to the South End Water Pollution Control Centre (SEWPCC) are underway, with the City of Winnipeg projecting a completion date of 2021. This facility treats about 20 per cent of the city's wastewater.

The North End Water Pollution Control Centre (NEWPCC) is the largest of Winnipeg's plants, treating approximately 70 per cent of the city's wastewater. Planned upgrades to this facility have been repeatedly delayed.

Compliance reports show phosphorus concentration at both the SEWPCC and the NEWPCC are routinely above the 1 mg/L limit – over five times higher during some months.

The 101 on CSOs

In the city, snow melt and rainfall add pressure to our wastewater treatment systems. While some of this water is absorbed into the ground, the rest runs off streets into storm drains which connect to city sewer pipes.

Older Winnipeg neighbourhoods, approximately 30 per cent of the city, are serviced by combined sewers, a network of 1,037 km of pipe. These older systems collect both runoff and residential wastewater in the same pipe.

During drier weather, combined sewers transport water to a sewage treatment plant where it is cleaned before being released. However, these combined sewer systems were intentionally designed to overflow in wet conditions, releasing diluted, untreated sewage directly into rivers. Known as "combined sewer overflows," or CSOs, these discharge events protect homes from sewage backup.

Currently, CSOs happen in Winnipeg approximately 22 times per year at 79 separate discharge sites, a frequency that has been rising, and will likely continue to rise, due to increasingly extreme weather events.

5.0% **Winnipeg's sewage treatment plants contribute approximately five per cent of the total phosphorus load to Lake Winnipeg.**

0.26% **While CSOs capture our attention when they occur, they actually comprise only a tiny fraction of the total phosphorus load to Lake Winnipeg – just 0.26 per cent.**

Prioritizing action to restore Lake Winnipeg

No one wants sewage in their rivers. It's unpleasant, potentially dangerous, and contains phosphorus, the primary driver of algae blooms. But, getting past the ick factor, Winnipeggers need to consider the numbers.

Costs to upgrade Winnipeg's combined sewer system and the NEWPCC are both pegged at over $1 billion. Yet the two sources contribute very different phosphorus loads to Lake Winnipeg. CSOs comprise just 0.26 per cent of the total phosphorus load; Winnipeg's three sewage treatment plants contribute approximately five per cent.

With limited civic infrastructure funding, it makes sense to invest where we'll get the biggest bang for our buck. To protect Lake Winnipeg, that means upgrades to the NEWPCC must be our first priority.

Winnipeg's water-quality concerns date back decades – yet progress on removing phosphorus from civic wastewater has been painfully slow.

Flushing money down the potholes?

Marlo Campbell

Winnipeg decision-makers are in an unenviable position: facing down a ballooning infrastructure deficit while at the same time, challenged by limited funding sources.

A significant chunk of projected capital spending is earmarked for wastewater infrastructure, with the bulk of expenses designated for upgrades to Winnipeg's North End Water Pollution Control Centre, the largest of the city's sewage treatment plants. These much-needed improvements will enhance the facility's operational effectiveness and enable it to meet its provincial licence requirements. They have also been used to justify multiple increases to water and sewer rates over the past several years.

On the surface, this makes sense. Water and sewer rates are designed to fund all operational costs, as well as capital projects related to water and wastewater quality. This is the message shared with consumers on the Winnipeg Water and Waste Department's My Utility Bill website, which notes: "The revenue [from sewer charges] is used to collect, transport and treat sewage so that it meets environmental requirements before it is released to the Red and Assiniboine Rivers."

Dig a little deeper, however, and the City's fiscal response to its wastewater budget needs comes with a noteworthy caveat: Winnipeg isn't actually spending all the money raised through water and sewer rates on water and sewer services.

For years, the City has siphoned a portion of these revenues to pay for other projects, a process city council refers to as a dividend. This financial shell game has paid for road work and allowed property taxes to stay relatively low – but it also suggests that any attempt to blame the lack of substantial progress of wastewater upgrades on cost alone is somewhat disingenuous.

A 2012 Public Utilities Board report estimated that approximately 20 per cent of water and sewer utility revenue – almost $45 million per year – is not used for water and sewer services. Instead, it's redirected to the City's general revenue fund through several different mechanisms, dividends among them.

In 2015, city council approved amendments to the utility dividend policy, enabling the annual dividend payment to increase from eight per cent to 12 per cent of budgeted gross water and sewer sales.

Winnipeg's 2018 budget reports water service revenue at approximately $133.1 million, with a projected dividend of approximately $15.5 million. Wastewater service revenue for 2018 is expected to be approximately $197.7 million. The projected dividend from this revenue is approximately $22.7 million – up about $2 million from the previous year.

Costs related to upgrading Winnipeg's sewage treatment facilities have been used to justify rate increases, yet a portion of collected revenue is being redirected from its intended purpose.
PHOTO: MARLO CAMPBELL

Costs to upgrade Winnipeg's wastewater infrastructure are significant. If improvements to sewage facilities are, in fact, a priority, they need to be treated as such – and not just because construction costs continue to rise. Wastewater fees are collected for a specific, intended purpose. Using them instead to address budgetary shortfalls elsewhere is imprudent fiscal management.

Municipal wastewater management needs to be sustainable and resilient – and Winnipeg taxpayers deserve transparency and accountability.

Marlo Campbell is the Communications Director of the Lake Winnipeg Foundation.

March 31, 1988: *The Manitoba Environment Act* is passed, requiring all projects with potential environmental impacts – such as Winnipeg's North End Water Pollution Control Centre (NEWPCC) – to be provincially licenced. It will take government decision-makers over a decade to determine the specific terms and conditions to be included in those licences.

September, 2002: A major malfunction at the NEWPCC causes 427 million litres of untreated sewage to discharge into the Red River. This event reinforces the need for wastewater licencing and prompts the Province of Manitoba to convene a series of public hearings at which the City of Winnipeg outlines its plans to control nutrients at all three city sewage plants.
Estimated cost: $181 million

June, 2005: The Province issues licence 2684 to the City of Winnipeg for the NEWPCC, the city's largest sewage treatment plant. It requires upgrades be completed by Dec. 31, 2014, to ensure phosphorus (P) concentration in released effluent does not exceed 1 milligram per litre (mg/L) based on a 30-day rolling average. The City begins online compliance reporting for NEWPCC effluent.
Highest reported P concentration in effluent, December 2005: 3.7 mg/L*

November, 2012: A civic report recommends a three-year increase to water and sewer rates, citing costs related to sewage treatment improvements mandated by the Province. The *Winnipeg Free Press* reports NEWPCC upgrades required by licence 2684 will likely not be complete until 2019, according to city officials.
Estimated cost: $379 million
Highest P concentration in effluent, December 2012: 4.3 mg/L*

Dec. 30, 2014: One day before upgrades to the NEWPCC are required to have been completed, the Province grants the City's request for an extension on its licence. Upgrades are now required to be completed on or before Dec. 31, 2019.
Highest P concentration in effluent, December 2014: 5.2 mg/L*

February, 2015: A civic report notes the cost of upgrading the NEWPCC so that it can meet provincial phosphorus limits has risen.
Estimated cost: $569.37 million
Highest P concentration in effluent, December 2015: 4.5 mg/L*

The science of phosphorus and algae

Dr. Scott Higgins

Algae blooms can produce toxins harmful to humans and animals, affect drinking water supplies, cause low-oxygen 'dead zones' that result in fish kills, and have a number of other negative consequences.

Back in the 1950s, lakes across the globe began experiencing severe algae blooms. This led to an intense period of scientific investigation and debate to determine the importance of nutrients such as carbon, nitrogen and phosphorus in controlling algae. Given the significant potential costs of removing these elements from wastewater, the stakes were high. So high, in fact, that the Government of Canada designated 58 lakes and their watersheds in northern Ontario as the Experimental Lakes Area so that these questions could be examined using 'whole-lake' experiments. In one now-famous experiment, a plastic curtain was installed in the middle of an hourglass-shaped lake. Carbon and nitrogen were added to one side, while carbon, nitrogen and phosphorus were added to the other side. The side with the phosphorus experienced severe algae blooms; the other side did not.

The evidence was clear: reductions in phosphorus were crucially needed.

Jurisdictions across the world responded by banning phosphates from laundry detergents and implementing phosphorus removal at wastewater treatment plants.

Another experiment at the Experimental Lakes Area has been ongoing since 1969 and is the longest-running controlled study on algae blooms in the world. This experiment is investigating how reducing the amount of nitrogen entering a lake affects algae blooms. Initially, both nitrogen and phosphorus were added to the lake. Then, over a series of years, nitrogen loading was reduced, and eventually stopped completely. Since 1990, only phosphorus has been added. The results, published in December 2017 in Springer's *Ecosystems* journal, indicate that total reduction of nitrogen did very little to reduce the size of algae blooms.

From a management perspective, this result is important. Reducing nutrient loading to lakes is costly, but nitrogen removal is much more costly than phosphorus removal, and the benefit of nitrogen removal in reducing algae blooms is uncertain. The results of these large-scale experiments indicate that in order to reduce algae blooms like those on Lake Winnipeg, significant efforts to reduce phosphorus loading from cities and agricultural landscapes will be needed.

A now-famous experiment demonstrated the connection between phosphorus and algae blooms.
PHOTO: IISD EXPERIMENTAL LAKES AREA

Science has an important role to play when governments are implementing strategies to tackle algae blooms – especially while working with limited resources. IISD Experimental Lakes Area research highlights the need for immediate, aggressive action to reduce phosphorus loading to our lakes.

Scott Higgins is a research scientist at IISD Experimental Lakes Area. His areas of focus include algae ecology, climate change and the effects of invasive species on freshwater ecosystems. Visit iisd.org/ela to learn more.

June, 2016: A civic report notes the projected completion date of December 2019 will not be achieved and the estimated cost of upgrades to the NEWPCC has risen again.
Estimated cost: $794.61 million
Highest P concentration in effluent, December 2016: 4.1 mg/L*

December 2017: A civic report notes a new conceptual design for the NEWPCC upgrades has pushed the budget so high, the project's schedule could be delayed as a result.
Estimated cost: $1.4 billion
Highest P concentration in effluent, December 2017: 4.4 mg/L*
Estimated completion date: Unknown

Compliance reports for Winnipeg's sewage treatment plants can be found online at winnipeg.ca/waterandwaste/sewage/license.stm.

*30-day rolling average

Cleaner water starts at home.

Across Manitoba, communities are implementing innovative wastewater solutions in response to local challenges.
Here are just a few examples.

Wetlands offer innovative low-cost approach to rural wastewater management

Fifty kilometres south of Winnipeg sits the growing community of St-Pierre-Jolys – a village known for its picturesque parks and annual Frog Follies Festival.

In 2012, this vibrant community was faced with a challenge: its existing lagoon system couldn't handle any more wastewater inputs. Provincial licencing requires any new or expanding wastewater facilities to meet a strict outflow requirement of 1 milligram per litre of total phosphorus. St-Pierre-Jolys started exploring options for the required upgrades.

Working with Native Plant Solutions (NPS), a local environmental consulting group, the village considered building new facilities and installing passive filtration systems. Then NPS brought an interesting new idea to the table: create a wetland and use it as a third lagoon cell to treat all community wastewater in a natural way. This would be the first municipal lagoon of its kind in Manitoba.

St-Pierre-Jolys has always been interested in green projects. When Chief Administrative Officer Janine Wiebe looked at the numbers, she was convinced. "It was the most economical way of doing it, it was an innovative approach and it will accommodate us for 20 to 25 years," she says. "If we need to upgrade our wastewater treatment again in 20 years, we just need to expand the existing wetland cell, which will be very affordable."

The new wetland system was built in summer 2017 by WPS Engineering and uses phyto-remediation, a process through which cattails do the filtration work.

NPS Senior Wetland Specialist Lisette Ross explains: "Cattails are especially hungry for nutrients [like phosphorus] in order to grow. The water enters this wetland cell and, throughout the summer, the plants uptake the phosphorus. In the fall, the phosphorus moves down into the roots and then the plants use that energy to grow in the spring."

It will take a year or two for the cattails to mature; however, by 2019, it's expected that the wetland solution will enable St-Pierre-Jolys to not only meet, but exceed, provincial phosphorus limits.

While initial construction costs are similar to those of more conventional wastewater facilities, the real savings are in the maintenance costs. Conventional facilities require periodic chemical applications which, over 25 years, would add up to almost $1 million. With the wetland, the only maintenance required is periodic water testing.

Native Plant Solutions' Luke Hemphill seeds St-Pierre-Jolys' innovative new wetland cell. PHOTO: NATIVE PLANT SOLUTIONS

NPS is now having conversations with other Manitoba communities looking to use wetland cells to upgrade their wastewater treatment facilities.

"This is a low-maintenance, environmentally sustainable approach to managing phosphorus," Ross says.

"These towns are game-changers – recognizing opportunities and doing business differently."

Urban housing developments get a natural upgrade

Though sometimes forgotten in discussions about civic wastewater, rainfall does have an effect on local water quality. Whether that effect is positive or negative depends on how we choose to manage it.

Before 2003, all new large housing developments in Winnipeg managed street and yard runoff by creating stormwater retention basins (SRBs), large ponds that collected storm water and then slowly released it into nearby creeks or rivers. While these SRBs managed flooding in the neighbourhoods, the water quality in these basins was largely ignored; ponds were surrounded by "rip rap" (loose stone and rock) and manicured grass, and the water quickly became consumed with algae.

The naturalized stormwater retention pond in Winnipeg's Royalwood Phase II development. PHOTO: CHRIS PENNER

Winnipeg urban-design firm Scatliff + Miller + Murray (S+M+M) knew there was a better way. In 2003, S+M+M collaborated with a team of engineers and ecologists to design and install the city's first naturalized stormwater retention pond (NSRP).

Located in Royalwood Phase II, a neighbourhood just off Bishop Grandin Boulevard, the water-retention system mimics the role of a wetland in an urban setting. Runoff from the surrounding landscape collects in the pond and is naturally cleansed by plants which hold the excess phosphorus. Once the water is released from the ponds into urban waterways, it has a whopping 80 times less algae than its retention-basin cousins – which means less algae-causing phosphorus is making its way to Lake Winnipeg.

Chris Penner is an ecologist with S+M+M. "The plants in the NSRPs create a visually appealing and natural look," he says, "but the main difference is that, when you create these ponds, you are importing wetland functionality."

Since the success of the first NSRP, S+M+M has installed dozens of similar systems in new neighbourhoods. Ranging in size from two to 20 acres, the NSRPs are constructed before the houses are built to ensure the system is operational when residents move in.

In addition to their aesthetic value and ecological function, NSRPs also offer a financial benefit.

"The cost of construction of the NSRPs is 10 to 20 per cent less than the old SRBs – and, after the first two years, the maintenance costs are virtually zero," Penner says. This is an obvious advantage over older SRBs which require ongoing investments in lawn cutting and fertilization, as well as periodic (and expensive) rip rap replacement.

S+M+M has worked with both local developers and the City of Winnipeg to make naturalized stormwater management the norm in all new housing developments. It's also begun exploring how NSRPs and other green infrastructure can be used in smaller municipalities.

"This is one of the real-life things we can do to make a measurable difference," Penner says. "The science is in. These ponds are good for our environment."

Made-in-Manitoba technology solves northern wastewater challenges

Looking ahead – and to the south – led Winnipeg wastewater technology company Nexom to develop an innovative approach to wastewater treatment.

"Back in the early 2000s, we saw ammonia regulations come into play in the U.S. and knew those regulations would hit western Canada soon," says Martin Hildebrand, Nexom's president, "but there were no working technologies that could adapt to cold temperatures."

Nexom's idea: submerged attached-growth reactors, or SAGR for short.

Ammonia is toxic if released into water at high levels, killing fish and impacting aquatic food chains. The SAGR system uses beneficial bacteria to reduce ammonia levels in wastewater: water flows from a sewage lagoon into the SAGR's aerated, coarse-gravel beds, where bacteria bind ammonia with oxygen, a process known as nitrification. Nitrification usually slows down in extreme cold, but SAGR was designed with an insulation layer and a patented process that grows extra beneficial bacteria while the water is warm so that, even in the coldest of winter temperatures, it can still effectively break down all the ammonia.

In 2012, Canada implemented the *Wastewater Systems Effluent Regulations*, requiring communities to meet more stringent ammonia limits. Nexom's forward thinking was about to pay off.

Based on demonstrated success in other locations, a SAGR system was installed in 2013 in Misipawistik Cree Nation (MCN), which sits on the western shoreline of Lake Winnipeg's north basin. In addition to the new federal requirements, a growing population was putting strain on the community's existing wastewater plant. Upgrades were needed.

MCN Councillor William Ferland was part of the team that brought in the SAGR technology. "We considered digging another lagoon, but this made more sense," he says.

MCN came up with a creative solution for the system's insulation layer. Instead of ordering in peat moss, it used wood chips from local crews clearing nearby hydro lines. This saved money and made use of debris that would have had to be shipped away.

In addition to its efficacy in cold weather, SAGR is simple to operate and very low maintenance – a significant advantage for small communities with small budgets and limited staffing. An add-on to the system uses a chemical called alum to remove algae-causing phosphorus from released wastewater. This enables communities to meet both phosphorus limits and ammonia limits.

Since seeing the success in MCN, Nexom has gone on to install more than 10 of its made-in-Manitoba SAGR systems throughout the province, and dozens more across the northern U.S. and Canada. Coun. Ferland says that between the phosphorus and ammonia treatments, the water coming out of MCN is cleaner than the water coming in.

MCN's wastewater treatment plant operator Clarence Cook closes a valve used to expel condensation collected in the SAGR's aeration system over winter. PHOTO: LLOYD VASQUEZ, NEXOM

"It's a great combination of being environmentally friendly and economically viable," he says. "We are located right by Lake Winnipeg. We have over 100 commercial fishers and we have to ensure healthy water."

Doing right by our lakes

Dr. Alexis Kanu

Infrastructure spending is always a top priority in Canadian elections. Potholes and underpasses, health-care centres and stadiums – all loom large as we head to the ballot box. But it may well be that the infrastructure we think least about has the greatest impact on our quality of life – and our pocket books – over the long term.

Wastewater infrastructure delivers the water used in our homes and industries directly into the lakes and rivers we use for recreation. Toilet water ultimately becomes lake water – all that stands between the two is our wastewater treatment system. Whether we choose to take note or not, we rely on this infrastructure to ensure that the lake water we enjoy on our vacations is clean and safe.

It's time to make a dedicated investment in our wastewater assets. A myriad of innovative solutions is at hand and science points clearly to the best path forward: addressing phosphorus in wastewater treatment plant effluent must be a top civic priority. We can no longer afford cost increases due to delays and we can no longer ignore the impacts of inaction – the glaring problem of Lake Winnipeg's algae blooms confronts us every summer.

In 2016, the federal government announced a $2 billion Clean Water and Wastewater Fund (CWWF), for projects with a strong plan in place that could be immediately implemented. In Manitoba, 25 communities accessed CWWF funding for wastewater improvement projects, while others are tapping into additional federal funding pots. In August 2016, Selkirk and Gimli each received matching federal and provincial funding to upgrade their facilities – commitments which came with an explicit nod to the beneficial impacts these improvements will have on Lake Winnipeg's water quality.

The City of Winnipeg, directly upstream of ailing Lake Winnipeg, must follow suit.

Civic leaders must ensure that the North End Water Pollution Control Centre meets the phosphorus limit of 1 milligram per litre by the license deadline of Dec. 31, 2019.

With robust evidence to guide us and funding opportunities within reach, we cannot allow Lake Winnipeg to remain a victim of political inaction and costly delays.

All levels of government acknowledge this lake's great value: the 10th largest freshwater lake in the world, a precious national resource, an economic driver for Manitoba and a natural playground right in Winnipeg's own backyard.

It's time to put our money where our mouth is. It's time to invest in immediate, aggressive phosphorus reduction – the proven solution for Lake Winnipeg.

Alexis Kanu is the Executive Director of the Lake Winnipeg Foundation.

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lakewinnipegfoundation.org

With information from:
CBC; City of Winnipeg; Environment and Climate Change Canada; Government of Manitoba; Organization for Economic Co-operation; Polaris Water Project; Statistics Canada; The Winnipeg Free Press