THE COMPLETE WATER MAGAZINE

# WATER CANADA Water Protectors

**Roles and Rights of Indigenous Canadians** 

Big Picture on Small Systems (page 10)

In Anishinaabe law, water is life (page 16)

P3s to Bridge the Gap (page 18)

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Full details and agenda are available on the website.







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THE COMPLETE WATER MAGAZINE











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### WATERCANADA

THE COMPLETE WATER MAGAZINE

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## A Profoundly Canadian Challenge

BY KATHERINE BALPATAKY

**IMAGINE A DAY** in the life of 12-yearold Makayla McWatch. After 10 years of growing up without access to clean drinking water, in a semi-remote community northwest of Sault Ste. Marie, her family turned on the tap and poured a glass of water they could drink for the first time in her memory. Makayla McWatch's story, as captured by CBC news, is one of many that we have been reading about lately in the mainstream media.

We know the appalling statistics: one third of First Nations communities have water systems that are at medium or high risk of producing unsafe water. As of Nov. 30, Health Canada reported 130 drinking water advisories in Indigenous communities across Canada. Thanks to the Globe and Mail, we also know that much of Indian and Northern Affairs' (INAC) capital budget goes to fixing poorly constructed water infrastructure. That is especially troubling, given that nearly all the funds that have been spent on new infrastructure and operating and maintenance (O&M) in Indigenous communities have come from the same ministry.

These challenges are not technical ones. Solutions exist. However, there's a need to re-examine how decisions on infrastructure spending are made and how those assets are sustained and more largely, how to overcome the broad jurisdictional barriers that have impeded progress for decades.

In this issue of Water Canada, we explore a variety of solutions that have proven successful in Indigenous and remote communities across Canada. On **page 10**, we examine the potential for on-site treatment solutions where a large centralized

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system doesn't make sense; **page 18** deconstructs the benefits of utilizing a P3 model to bridge the gap between the private sector and First Nations communities; **page 22** offers examples of jurisdictions where the co-governance model is working; and, on **page 36**, Kerry Black speaks to the need for enforceable drinking water regulations in First Nations to establish an equal playing field.

EDITOR

The theme of water and sanitation rights is also a focus, as emphasized by our cover. Professor Rob de Loë drove home the immediacy of this issue during a presentation in Ottawa. He said, "We are one Supreme Court decision away from a complete re-writing of the rules for water [and Indigenous Peoples] in this country [...] Right now, we talk about co-governance with Indigenous people-I wouldn't at all be surprised if one morning we woke up and realized that we actually have to determine what co-governance really is. It's a profoundly Canadian decision that we need to deal with."

I remain hopeful that we will get there. Given the current government's steadfast commitment to address Indigenous issues and the results from the most recent RBC Canadian Water Attitudes Study, suggesting that almost half of respondents are very concerned about the water conditions on First Nations Reserves, we are on the right path. The will may be there, but we need a new approach-one that gives Indigenous Canadians a seat at the table where decisions are made about how and where to involve the private sector. who will take responsibility for infrastructure assets, and what kind of support is needed.

#### Contact Katherine at 416-444-5842 ext. 116 or email katherine@watercanada.net



#### FEATURE CONTRIBUTORS



#### AIMÉE CRAFT

Aimée is an assistant professor of law at the University of Manitoba and director of research at the National Centre for Truth and Reconciliation. **PG 16** 



JEFF FRANK Jeff is a senior director at the Castlemain Group. PG 18



PAT KANE Pat is a Yellowknife-based photographer covering Canada's Far North. PG 22



JACINDA MACK Jacinda is the coordinator of First Nations Women Advocating Responsible Mining. PG 42

#### ABOUT THE COVER

Gwich'in community leader Tania Larsson stands on the shores of the Lutselk'e area, Northwest Territories. Larsson is the co-founder of Dene Nahjo, a group of young leaders who are working to advance social and environmental justice in the NWT by promoting traditional practices. Respecting and protecting the land, animals, and the water is part of the Dene way of life. The phrase Dene Nahjo means "doing things in a good way." The photo was taken by Pat Kane.

#### NEXT ISSUE: MAY/JUNE

- Water-energy nexus for drinking water
- Coastal climate change adaptation
- FloodNet

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#### The Water Brothers launch season 4

ALEX AND TYLER MIFFLIN (a.k.a. The Water Brothers) are at it again, having launched their fourth season of water episodes on March 3 through TV Ontario. The series of six episodes, airing Fridays at 7:00 p.m., explores how we can better protect water resources.

"One of the more interesting things that we did was to go underground and explore the sewers of Toronto," said Tyler. "It was gross. I smelled for three days. But it gave me a whole new level of respect for people who work in wastewater and water treatment."

"We also visited with Barry Orr from the City of London," said Alex. "Barry is a rock star in the water community, and he gave us a firsthand tour of some of the challenges that wastewater systems face across Canada."

In their first episode of the season, entitled Flying Rivers, the two brothers journey across the Amazon rainforest to show the effects of deforestation on the water cycle and meet with innovative farmers and Indigenous communities who are trying to protect forests while maintaining high productivity.

"We got to fly across the Amazon through the flying rivers with this guy who helped spearhead the project to measure how the water moves across the rainforest and how these flying rivers are being changed and transformed as the forest is destroyed," said Tyler. "Trees transpire 90–99 per cent of what they take into their roots. It gets evaporated back into the air. Across the Amazon you have hundreds of millions of trees and they are all transpiring a tremendous amount of water—so much in fact that it is more water than flows in the Amazon River itself. There are rivers of atmospheric water vapour."

Here's the rundown on season 4:

**March 3rd – Flying Rivers:** air adventure above the mighty Amazon.

**March 10th – The Big Leak:** investigating aging water networks underground.

March 17th – Ocean Spies: documenting illegal fishing near the South Pacific nation of Palau.

**March 24th – On Thin Ice:** exploring the Athabasca glacier in Alberta and Experimental Lakes Area (ELA) research centre in Northern Ontario.

**March 31th – Food, Less Water:** meeting farmers who employ innovative technologies to combat water waste.

**April 7th – The End of Sushi:** examining the impact that sushi has on the health of our oceans. wc



All Water Brothers' episodes are available for free streaming at **thewaterbrothers.ca** 

FRONT



## **One Hell of a Ditch**

THERE ARE FEW ENVIRONMENTS in Canada that are more susceptible to seasonal change in precipitation and surface water storage than Saskatchewan. Delivering upon its riskbased agricultural water management strategy, Saskatchewan's Water Security Agency (WSA) has issued the largest single agricultural drainage approval in the province's history. Located in the Gooseberry Lake Watershed, the Dry Lake Project is a single approval permit issued to 73 landowners of more than 7,000 hectares (18,000 acres) for an organized, managed drainage network. While large scale organized drainage projects have been built before, this project is unique as it includes all existing drainage works and some future drainage works.

"Nowhere else has a project of this magnitude ever been accomplished. This single project is equal to roughly one year of drainage approvals issued in southeast Saskatchewan, which is remarkable progress," said Scott Moe, the minister responsible for the WSA.

The province announced the terms of its new drainage regulations in 2015, with details on the approval process following. The new approach seeks to streamline approvals, while mitigating damage on water resources. Key changes include assessing the impact on flooding, water quality and habitat loss when approving drainage projects, and ensuring those impacts are addressed. The regulations also include some specific targets, such as zero tolerance for infilling, classification of wetlands, and aim for 10 per cent wetland restoration-many of which have some producers concerned about the bottom line impacts. All drainage activities in the province are subject to the new rules, including pre-1981 works, which are required to obtain an approval or be closed. The Dry Lake Project approval is part phased-in approach planned to bring the entire province into compliance within a decade. wc



#### CORRECTIONS

**Page 8, Jan/Feb 2017:** In the author's bio Alnoor Allidina is cited as the technical lead for the City of Toronto's Water Transmission System Optimization. It should say that Allidina is the associate director and practice lead of intelligent systems with IBI Group and technical lead on the project.

Page 30, Jan/Feb 2017: Water Canada erroneously tied Metro Vancouver's new Lions Gate Secondary Wastewater Treatment Plant with a wastewater project that is being undertaken by the Capital Regional District on Vancouver Island. To clarify, there is no connection between these two wastewater treatment infrastructure projects, which are being built by separate and autonomous regional governments in different parts of the province. The article quoted Jonathan Wilkinson, MP for North Vancouver and parliamentary secretary to the Minister of Environment and Climate Change, about the Capital Regional District without differentiating between both projects. Quotes from students that were included in the sidebar were also misrepresented.

# Online at WATERCANADA.NET



**COMMENT:** Four legal tools to protect First Nations right to water *bit.ly/RightsInCanada* 



**COMMENT:** Global Water Forum details the history, present, and future of United Nations Framework Convention on Climate Change and its policies blending climate change and water resource management.

bit.ly/Climate-Water



**NEWS:** First Nations will get \$24.7 million in federal funding to fight flooding and rising seas.

#### bit.ly/NorthernFlood





Canada's funding agencies need to catch up to foster the capacity of First Nations to manage their own water. BY JOHN MILLAR

FOR MORE THAN FOUR YEARS, Water First has delivered capacity building and training programs within First Nations communities to address critical water issues in Ontario. Boil water advisories in First Nations communities in Canada are widespread, and a third of First Nations communities in Ontario lack a certified water treatment plant operator. Yet, on more than one occasion, Water First has been the only Canadian charity, or one of just a few, present at national, provincial, and regional conferences related to First Nations water challenges. This is in stark contrast to other gatherings attended, with an emphasis on drinking water challenges abroad, where Canadian civil society has a rich and vibrant presence.

Water First proposes an education and training solution that addresses a key part of the problem—capacity. First Nations peoples are significantly underrepresented in the sciences, and water science is no exception. Widespread boil water advisories in First Nations communities are directly linked to this reality.

Experience has shown that building local capacity has the potential to generate significant cost savings for governments in the long run by helping to avoid replacing derelict water treatment plants. Local training offers sustainabilitywhen a project ends, the skills remain in the community, facilitating independent water resource management. Our programs experience very high levels of community uptake, and the political will to address this issue is currently strong. And yet, creativity to pursue water-focused capacity building programs through other objectives is necessary, because direct funding mechanisms related to our work, that charities can apply to, do not yet exist.

#### **Creative funding schemes**

Water First receives annual funding from the Natural Sciences and Engineering Research Council of Canada's Promoscience program; however, such funding opportunities are rare. We've analyzed the complex frameworks of leading non-profit granting agencies, met with their representatives, and concluded they do not have an avenue that facilitates First Nations water science training as an end unto itself.

To overcome these barriers, we brainstorm projects for which there are established funding avenues and we weave First Nations water science training into them. On the surface, the programs have nothing to do with First Nations water science capacity development; however, the byproducts do. For example, environmental rehabilitation and research projects such as fish habitat restoration, baseline water quality studies, or testing for mercury concentrations in fish can all be opportunities to pursue water science training with First Nations communities. The formal deliverables may be datasets and site restoration metrics, but if we hire and train locally to achieve project outcomes, we can deliver water science



training programs together with First Natons, nonetheless. We've now worked with 28 First Nations communities. Mnising, Keewaytinook Okimakanak, and the Union of Ontario Indians to create a scalable water management training

Experience has shown that building local capacity has the potential to generate significant cost savings for governments in the long run, by helping to avoid replacing derelict water treatment plants.

Private donors, foundations, and corporate sponsors have also supported our programs, yet few of these funding mechanisms have a mandate to scale up. As a result, we create a program, assemble the required resources, deliver that program, achieve decent results, and then shelve the program only to start all over from scratch.

#### Signs of change

Over the last six months, Water First has been working in partnership with the United Chiefs and Councils of Mnidoo and certification program for young adults in First Nations communities. Together, these groups propose to deliver an in-depth capacity building program in seven First Nations on Manitoulin Island, with the potential to expand to additional communities. At the time of writing, there's strong government interest in funding the pilot initiative.

Governments, donors, and other funding agencies have a long and successful history of influencing the activities of Canadian non-profits by providing direct funding for desired activities. Thanks to Prime Minister Trudeau's pledge to eliminate First Nations' boil water advisories within five years, there is more public awareness of the issue, and support for solving it, than ever before. Through this lens, there is a real opportunity to jumpstart Canadian civil society's engagement with First Nations' water challenges.

Canadian civil society has the capacity to deliver programs that lead to sustainable access to clean drinking water. If governments, other funding agencies, First Nations, and non-profilts work together to address capacity, Water First's work will one day be obsolete as First Nations gain the capacity to successfully and independently manage their water resources long into the future. wc



John Millar is the founder and executive director of Water First.



# **Big Picture on Small Systems**

Onsite treatment systems have incredible potential.

We just need to properly manage them.

**ONSITE WASTEWATER TREATMENT SYSTEMS** can provide permanent, affordable, and safe solutions for small communities. They can remove pollutants, including nitrogen and phosphorous, and often have a smaller energy footprint than conventional sewage plants. Onsite water systems keep water in the local watershed. They are scalable and can serve individual homes, commercial facilities, subdivisions, and entire communities. While onsite systems can provide many benefits, companies that offer these solutions often face pushback.

"The best solution for a small community is often an onsite or small communal system, but we constantly have to justify this," said Miles MacCormack, engineering design manager for RH2O North America. "We have more than 40 existing Environmental Compliance Approvals, but we have to educate the Ministry of the Environment and Climate Change (MOECC) about our technology with each new application." Despite the advantages of onsite systems in small communities, the sector has several nontechnical challenges to overcome.

#### Long and short

Onsite solutions are often considered interim measures that are meant to fill a need until a larger-scale conventional service is made available. This perception means that traditional solutions continue to take priority during design and procurement processes. When, in fact, onsite solutions have practical and sustainable potential as permanent solutions.

#### Line of duty

BY RICK ESSELMENT AND TRISH JOHNSON

Decentralized water and wastewater treatment shifts the responsibility of operation and maintenance to individuals, and thus, private ownership, so onsite servicing suffers from bureaucratic resistance. This is a substantial challenge, and it requires policy and regulations that enable collaboration between the government, owners, and service providers to verify and enforce compliance to protect the environment and public health.

MacCormack said that municipalities in Ontario are reluctant to take on management of distributed systems, mostly because it requires a Municipal Responsibility Agreement. "We manage wastewater treatment systems for a population equivalent to more than 15,000 with a staff of about seven people, so it is possible to efficiently and economically manage distributed systems. Our renewable one-year service agreement includes remote monitoring and control functionality to minimize operation risk for commercial clients, homeowners, and the MOECC."

#### **Pros who know**

There is an inertia stemming from a lack of professional knowledge in some of the large, conventional engineering firms about contemporary onsite solutions. While the tendency toward traditional solutions plays a role in project design specifications, consultants need to move toward small-scale projects with new knowledge, some creativity, and insight.

#### **Guidelines for management**

While most onsite systems are easy to operate and maintain, they are not always properly managed. For this reason, they do not always provide the required level of treatment, which poses risks for compliance and costs. To remedy this issue, Canada needs better life-cycle management policies and guidelines.

### Lessons from the United States

Since 1997, decentralized wastewater systems have been recognized as a permanent part of the national wastewater infrastructure in the United States. Onsite, distributed, and decentralized systems presently provide efficient solutions for 25 per cent of existing U.S. homes, serving 85 million people, and are planned for 33 per cent of all new development.

The U.S. Environmental Protection Agency (EPA) has created five conceptual management models, from the homeowner level up to Regional Management Entity (RME) Ownership that designate who and how these systems will be maintained in the long term. These models provide a guide that matches management controls to potential public health and water quality risks. The models ensure accountability and competent oversight, offering certification and education, inspection requirements, and the ability to use third-party managers.

There is potential in Canada to take cues from the U.S. EPA's management models and volunteer national guidelines to realize the benefits. Developing tools for better management of onsite systems will increase confidence in the systems among professionals. In turn, it will also allow small communities to realize the benefits. wc



Rick Esselment is past president of the Ontario Onsite Wastewater Association and is currently the government relations co-chair. Trish Johnson is the lead for WaterTAP's Better Best Practices Initiative.





Scientists continue fieldwork to settle on a remediation plan for the river system in Grassy Narrows. BY EVE KRAKOW

**THE ASUBPEESCHOSEEWAGONG NETUM ANISHINABEK** (Grassy Narrows) First Nation has been living with the effects of mercury poisoning for over a generation. While liability has not been established, it is known that between 1962 and 1970, the Reed Paper's chemical plant in Dryden dumped 10 tonnes of mercury into the Wabigoon-English River.

When high levels of mercury were discovered in the fish in 1970, the Ontario government closed the local commercial, tourism, and subsistence fisheries. This removed a primary income source for the Grassy Narrows people and an important part of their diet and their culture. But nothing was done to remedy the contamination.

Over the years, environmentalists, scientists, federal and provincial governments, and the First Nation community itself, have attracted attention for their actions, inactions, and calls for action to address contaminated areas. In 1984, an expert panel of federal and provincial scientists put forth a remediation plan. But the Ontario government did not act. Recently, the Grassy Narrows First Nation commissioned a team of mercury contamination experts to revisit the situation and recommend the best solutions to decontaminate the water.

The team asserts that the river can and should be cleaned up. They recommended a thorough investigation to find the source of what appears to be ongoing, low-level contamination and remediation of the river system using Enhanced Natural Recovery (ENR) and nitrate injection techniques.

#### Ongoing source

Dr. John Rudd is a former federal researcher that conducted the original three-year study of the Wabugoon-English river in the early 1980s. Rudd and his team have and continue to assert that the river can and should be cleaned up. Ultimately, he led the latest investigation for the Grassy Narrows community, and upon thorough inquiry as to the source of what appears to be ongoing, low-level contamination, recommended remediation of the river system using Enhanced Natural Recovery (ENR) and nitrate injection techniques.

In their findings, released May of 2016, Rudd and his colleagues reported that although, initially, the river seemed to be cleaning itself, recovery has stalled. They believe the upper lakes, Clay Lake and Ball Lake, could still be receiving mercury input from upstream [where the former Reed Plant sits], either from mercury trapped in sediments and eroded during times of high flow, or from leakage occurring at the site of the old plant.

"It's very common that former chloralkali plants continue to leak mercury at a much reduced, but still significant rate after they've been closed down. This can go on for decades," explained Rudd. In addition to his experience at

#### WATER RESOURCES



the Department of Fisheries and Oceans, and as chief scientist of the Experimental Lakes Area research station, Rudd has worked on two major industrial mercury remediation projects in the United States.

Earlier this year, the environmental organization Earthroots took soil samples in an area pointed out by a

One possibility is that there could be groundwater carrying mercury into the river at certain times of year.

former Dryden mill worker and found very high concentrations of mercury. Rudd said that while this dump could be the source, "there is often a lot of mercury under the concrete floors of buildings where chlor-alkali cells were formerly located." Either way, he said,

a complete investigation of the site is needed, so that any ongoing source of mercury can be shut off.

Grant Walsom heads the Remediation and Risk Assessment Business Group at XCG Consulting and is vice-president of the Canadian Brownfields Network. He has over 20 years' experience in soil

> and groundwater remediation, mostly at industrial sites. Walsom agreed that if the river has not recovered on its own after all this time, there is likely

an ongoing, lowlevel contaminant source. "One possibility is that there could be groundwater carrying mercury into the river at certain times of yearwhether it's from the chlor-alkali plant site, a disposal site, or something else," said Walsom.

Nor was Walsom entirely surprised

by Earthroots' findings. "There were a lot of poor disposal practices in the 60s and 70s," he said. "It was very common for people to just dump waste or solvent in the gravel area behind the plant to kill the weeds, or to just dig a hole and bury it."

If, however, it turns out that the mercury is coming from sediments in the Wabigoon River between Dryden and Clay Lake, the situation will be trickier to address. Rudd said that if additional fieldwork reveals hot spots where mercury concentrations are particularly high, remediation solutions might include some very localized hydraulic dredging and/or armoured cappingcapping involves adding materials to cover contaminated sediment to prevent it from entering the water column.

#### **Cleaning up Clay Lake**

To deal with the mercury present in the lakes and rivers, Rudd and his team ranked a number of options according



to what would be most effective, least disruptive to the environment, and least costly. This led them to ENR and nitrate injection at Clay Lake.

It is important to understand that methyl mercury, the form of mercury found in fish, is produced from inorganic mercury, either in the sediments or in anoxic (low-oxygen) bottom waters of

If you could increase the clean sediment load to Clay Lake by a factor of two, mercury concentrations in the lake would be half.

lakes by bacteria that live there. The methyl mercury then moves up the food chain into the fish.

With ENR, the idea is to dilute the concentration of inorganic mercury in the sediments by adding clean sediments taken from another part of the river system. "If you could increase the clean sediment load to Clay Lake by a factor of two, mercury concentrations in the lake would be half, and so methylmercury production would be half," said Rudd.

The second method proposed is to inject nitrate into the lake bottom waters to prevent the bacteria from producing methyl mercury. "Lakes with anoxic bottom waters often have higher mercury concentrations in the fish," said Rudd. "We now know this is because [...]the methyl mercury is produced

> right in the water itself. When that water mixes into the rest of the lake, the methyl mercury is immediately available to the food chain and goes right into the fish." He added that nitrate

injection has been shown to cause a quick reduction in mercury levels.

The report team estimated it would cost \$6 million per year for ENR, which would need to be continued for seven to nine years; figures were not provided for nitrate injection.

Walsom thought the report and remediation solutions proposed were the least disruptive options. He also agreed with the proposal's adaptive management approach, i.e. start with one solution, monitor and assess how it goes, then adjust the program accordingly.

Judy Da Silva, who grew up in Grassy Narrows when the chemical plant was still operating, has been living with the effects of mercury poisoning all her life. These include loss of muscle co-ordination, vision loss, and slurred speech. A leading advocate for her community, Da Silva hopes the backing of professionals like Rudd will help move things forward. But she is wary. She fears the fieldwork will just lead to another report that will sit on another shelf.

### No remediation money promised

Last November, the Ontario government earmarked \$300,000 for her community to continue its studies. About \$80,000 has been received for work completed in the fall and for the next leg of fieldwork planned. So far, no money has been promised for actual remediation. "I feel like the government is stalling," said Da Silva.

However, in a statement released February 13, 2017, the Ontario government said it is "committed

#### WATER RESOURCES

to working with all partners [...] to creating and implementing a comprehensive remediation action plan for the English Wabigoon River." The statement was signed by David Zimmer, Minister of Indigenous Relations and Reconciliation, and Glen Murray, Minister of the Environment and Climate Change. The release also said that in light of new information that has come forward, "we are now conducting a full and rigorous mercury contamination assessment on the entire mill site."

Rudd and his team are going back to Grassy Narrows this summer to try and identify the source of the incoming mercury, whether it's from the plant or in the sediment. They will conduct further testing of ENR and nitrate injection to make sure these are the most appropriate remediation strategies for the area.

Rudd is optimistic. He plans to engage and mentor Grassy Narrows youth in the necessary fieldwork. "They will be involved in important parts of the scientific fieldwork, including the sampling of young walleye and northern pike."

"Our youth will benefit from being exposed to the science of the river system," agreed Da Silva. "The health of the river is the health of our people, the Anishinabek."

Even if all goes well, Rudd estimated it will take at least five years from the start of remediation before mercury concentrations start to drop. A study of Clay Lake in 1994 found mercury concentrations were 2.4 ppm in walleye and 1.5 ppm in northern pike. A level of 0.5 ppm would allow commercial and sport fisheries to resume, but "for a sustainable fishery, it needs to be around 0.2 ppm," said Rudd.

That is the ultimate goal for the Grassy Narrows people. "The food from the land is a part of who we are," said Da Silva. wc



Eve Krakow is a freelance writer based in Montreal.



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# Nibi onje biimaadiiziiwin

#### In Anishinaabe law, water is life. BY AIMÉE CRAFT

EVERY MORNING WHEN I WAKE UP in Winnipeg, I thank the spirit of the water and the people from whose territory I drink. I think of the people of Shoal Lake, whose lands have been providing safe and abundant drinking water to the city of Winnipeg for a century. Meanwhile, they boil their own drinking water and travel over dangerous water and ice from their community, which became an island when a canal was built to serve Winnipeg's drinking water needs. I think of the long underground journey of my drinking water, disconnected from its natural course over land, through a 150-kilometre aqueduct constructed for the sole purpose of sustaining the needs of a growing city. I also think of my relationship to water. As women, we are responsible for water, because we are the carriers of birth water. We acknowledge that the water flowing through our lands is the blood of Mother Earth (*ninge aakiin*). Our grandmothers collectively hold these water teachings.

#### Water is life.

Water is life. This phrase has been burning up social media, fueling resurgence

hear the phrase from many Indigenous people living on Turtle Island (North America). The story of Turtle Island tells us of our creation, or re-creation, and about the delicate balance of relationships between humans and other beings. It shows us that while water is the source of

Nibi onje biimaadiiziiwin is not a biological assertion. Of course we cannot survive without water and, yes, our bodies are made up of water. However, what it means is that water literally has a spirit to which we owe our lives.

campaigns, and voicing the anti-pipeline advocacy of Indigenous communities such as the Standing Rock Sioux. You'll life, it can also take away life, such as in the time of the great flood.

Anishinaabe and other Indigenous



(Anishinaabe law).

people have cared for water through Indigenous laws designed for its protection. In Anishinaabe inaakonigewin (our own legal system), we regard nibi (water) as a being with which we conduct a relationship. We do not control it, even though in some cases we try. Water is an independent legal actor. When we alter water, for example by adding chemicals to make it safer to drink, this changes our relationship with the water and makes many Elders feel unsafe. We also know that we cannot stop water's flow without consequences-and in Anishinaabe inaakonigewin, this is a breach of sacred and natural law. When we alter the flow of water, we must have good reasons and be prepared to make reparations to the water and other beings, including animals and plants. We do that through ceremonies for healing water and seasonal water ceremonies-and through our everyday actions. Each of us should be involved in supporting that process: Indigenous and non-Indigenous, women and men (as women's helpers), young and old. Our direction should come from the grandmothers.

Many water laws and teachings have been shared over the last few years by Elders from Anishinaabe nations in Treaty areas 1, 2, and 3 (Manitoba and northwestern Ontario). As part of research projects related to clean drinking water for First Nations, we have gathered on the land at sacred sites and teaching lodges. "When we fulfill our duties, it replenishes us... the spirits look after us," Elder Niizhoosake Copenace reminded us at one of these gatherings. The Elders have shared their knowledge with Indigenous and non-Indigenous participants, including students of law, arts, science, and engineering, to complement their technical skills and make them more effective professionals and community partners.

By raising awareness of our sacred relationship with water, we can encourage each other to have better environmental protection practices in our families and communities. And by understanding our relationships to other living beings, we work towards achieving our *mino-biimaadiiziiwin* (individual and collective well-being). Anishinaabe *nibi inaakonigewin* (our water law) is one important source of that well-being. wc

Aimée Craft was named director of research for the National Inquiry into Missing and Murdered Indigenous Women and Girls after working as an assistant professor of law at the University of Manitoba and director of research at the National Centre for Truth and Reconciliation.



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# **Private Equity**

#### Bridging the First Nations infrastructure gap using a P3 model. BY JEFF FRANK

**INDIGENOUS COMMUNITIES** across Canada face a deficit of on-reserve potable water, wastewater systems, water distribution, and wastewater collection infrastructure. They are also challenged by archaic procurement and financing models that drive up costs.

When you examine the numbers nationally, it would appear that the situation has progressively worsened. As of October 2016, there were 133 drinking water advisories in First Nation communities across Canada (not including B.C.); whereas, ten years earlier in March 2006, there were 54 fewer drinking water advisories across Canada (including B.C.).

In September 2005, the Commissioner

of the Environment and Sustainable Development released a report detailing on-reserve water treatment and that enforceable regulations for water and potable water treatment on reserve did not exist. They still don't. While training programs such as Train the Trainer and the Circuit Rider Training Program have proven to be effective in some regions, their positive impact does not offset poor design and performance criteria, or the under-funding of operation and maintenance programs.

While no catchall exists to correct all water infrastructure issues on reserve, there is an approach that could be applicable to 75 per cent of the water and wastewater systems in Indigenous communities. This approach would pair the knowledge, capacity, ingenuity, and expertise found in the private sector with Indigenous need. Currently, infrastructure on reserve tends to deteriorate at a faster rate than non-Indigenous communities, because on-reserve operation and maintenance (O&M) is underfunded. Often the community lacks adequate, consistent training or is unable to retain trained, qualified employees to operate the facility.

#### A role for the private sector

Connecting the private sector to a treatment system for its designed lifecycle, governed by the associated



performance criteria, would greatly reduce the number of drinking water advisories on reserve. Procurement processes—such as public-private partnerships (P3) and alternative the private sector is responsible for ongoing operation and maintenance of the asset, and payment is incentive based on contractual performance criteria. In basic terms, if the private sector does not

deliver the customer does not pay.

The private sector is financially motivated to build Indigenous capacity, expertise, and retention. Ensuring capacity

building, knowledge transfer, and ongoing technical support are at the forefront of design, construction, operation and maintenance plans—or they risk not meeting the requirements of performance-based contracts. Having the private sector and Indigenous communities work together for the lifecycle of treatment systems will not only help supply essential infrastructure, it will give First Nations essential marketbased skills to secure the (sustainable) future of their communities.

#### **Financial risk**

Financial risk serves to regulate private-sector activity in First Nations communities under this collaborative approach. It incentivizes appropriate design, financing, and construction methods and necessitates a sustainable and realistic O&M program.

With both models, building, knowledge transfer, and ongoing technical support are at the forefront of design, construction, operation and maintenance plans.

service delivery (ASD) models—create the necessary environment where delivery of the service becomes the most important outcome. With both models, Naysayers of ASDs and P3s in Indigenous infrastructure projects cite high development costs, insufficient project capital expenditure size, and unknown support from the federal government as common barriers. Though P3s will have higher development and transaction costs than a traditional design-build (DB) project, construction, operation, and maintenance costs can be much lower. As well, the retained risk for Indigenous communities in a P3 would be minimal compared to the DB model.

The integration of design, build, finance, operation, and maintenance into one contract encourages better up-front planning and integration. P3s generally have a longer procurement time, but that is more than made up for through a consequently well-planned construction phase. P3 procurement processes can shave years off the projected completion date of a project. Long construction phases have typically been one of the biggest issues with traditional procurement models used by Indigenous and Northern Affairs Canada (INAC).

#### Size up

While it is true that infrastructure projects that are \$30 million or less in size are less attractive to the private sector market, bundling projects is an option. Bundling similar projects provides buying power leverage to First Nations communities, shares the administration burden, and has the potential to be sufficient in size to attract the private sector market.

To date, one of the greatest impediments to implementing ASD models has been the bureaucratic ranks within INAC. Their existing procurement policies do not lend themselves to modernization and innovation, despite mandated policy and implementation edicts from the Treasury Board and Minister of Finance. As a minimum, a new O&M funding model is needed at INAC. The current model is not just a barrier to ASD models, it is a barrier to better outcomes for all infrastructure on reserve.

#### Shining examples

Although there are few examples in First Nation's where industry has played a long-term role in ensuring that performance criteria is maintained through the project lifecycle, there are a few shining examples. One of these is the Nanoose First Nation (NFN) Wastewater Treatment Plant project on Vancouver Island that was completed in 2006.

Prior to the construction of the new treatment plant, sewage treatment was by way of septic tanks and tile fields. The majority of the tile fields were in a stage of failure, and raw sewage flowed overland to the foreshore and polluted the intertidal area. The land was not suitable for ground disposal and there was no municipal or regional sewage system available to connect to. The only option available to NFN was to construct a sanitary sewage collection system and



a sewage treatment system with an ocean outfall. This idea was initially rejected by the Department of Fisheries and Oceans due to an objection by the Underwater Harvesters' Association. But the objection was overcome after a marine standards on the west coast of Canada. The sewage treatment process selected was a proprietary system supplied by ECOfluid Systems Inc., an Upflow Sludge Blanket Filtration (USBF). The plant was contracted as a Design-

(DBO)

The

Build-Operate

one of many ASD

model has proven

effective not just

in treatment, but

in its connecting

First Nations to

the private sector.

models available.

project,

ASD

The alternative service delivery model has proven effective not just in treatment, but in its connecting First Nations to the private sector.

environmental survey and mitigation plan was developed that satisfied all parties.

A sewage treatment plant was designed to deliver 10/10 effluent standard and has consistently delivered below that. The ocean outfall effluent attains one of the highest The treatment plant's O&M contractor was hired for the project lifecycle, and they have hired local band members and trained them under a certification program to provide the operation and maintenance of the system. In this case, the band petitioned INAC to pay the full cost of the O&M, instead of the standard 80 per cent of the formula based O&M costing allowance.

This example highlights the benefits of utilizing an ASD model to meet some of the strictest effluent criteria in Canada, while delivering the project on time and on budget, and further, delivering essential skills and capacity to a First Nations community. The NFN project and its funding model are a roadmap to delivering ASD models over conventional procurement for First Nations, and it shows that collaboration between the private sector and First Nations can provide clean water and prosperity. WC

Jeff Frank is the senior director at the Castlemain Group The Castlemain Group is a consultancy dedicated to providing negotiation, governance, policy, development, infrastructure, and communication advisory services to First Nations communities.



Lloyd Chicot, Chief of the Kakisa Dene First Nation, and his wife Anita take an evening boat ride in late September on Tathlina Lake, Northwest Territories. The Kakisa Dene First Nation resides within the Great Slave sub-basin, part of the Mackenzie River Basin. The Basin's water is a shining example of co-governance that was negotiated with First Nations at the table. A first suite of bilateral agreements with neighbouring jurisdictions, such as Alberta and B.C., have also been reached.

# Wayfinding

# Rethinking B.C.'s approach to freshwater through partnerships and shared decision-making. BY NATASHA OVERDUIN AND ROSIE SIMMS

**RECENT LEGAL SHIFTS** within certain provinces and territories in Canada are driving changes in how freshwater is governed. Within these modern arrangements, co-governance between non-Indigenous and Indigenous governments is widely supported as a critical condition of effective watershed governance.

Co-governance involves meaningful sharing of decision-making authority between Indigenous and non-Indigenous governments—as equal parties. Such an arrangement is essential to ensure that Indigenous rights are protected and that traditional knowledge shapes and informs decision-making processes.

In a recent electronic survey of nearly 500 water practitioners in B.C.,

conducted by the University of Victoria's POLIS Water Sustainability Project, 77 per cent of respondents agreed that co-governance with First Nations is a necessary requisite of effective watershed governance. Further reinforcing the need for new forms of shared decisionmaking, the Supreme Court of Canada has established that aboriginal rights and title can no longer be ignored and that First Nations must have an explicit role in decision-making in their traditional territories. Canada also recently adopted the United Nations Declaration on the Rights of Indigenous Peoples, which articulates the need for state governments to achieve the consent of Indigenous peoples in decisions affecting their territories.

A window of opportunity exists in B.C. for advancing watershed governance and shared decision-making for fresh water. In February 2016, British Columbia passed the Water Sustainability Act, legislation that provides more robust rules for ecological protection and enables new governance and planning tools. In parallel, numerous First Nations are exploring how to engage with other governments and organizations to advance freshwater protection in their territories. For example, on the coast and Vancouver Island, the interior, and north east regions of the province, a number of First Nations are articulating Indigenous laws for water and developing water strategies, declarations, and plans.

For meaningful shared decision-



making approaches to become a reality in B.C., the provincial government must commit to implementing the new *Water Sustainability Act* with robust supporting regulations. Developing these supporting regulations must include a deeper commitment to engage with First Nations in a more meaningful way. First Nations leaders have clearly articulated that the consultation undertaken for *WSA* development was inadequate, and this remains an ongoing concern.

Importantly, for governance approaches to be founded in Indigenous knowledge, laws, and values, First Nations may require space, capacity, and resources to develop water governance strategies, agreements, or other tools. The Centre for Indigenous Environmental Resources recently partnered with the First Nations Fisheries Council of B.C. to undertake a systematic review of Indigenousled freshwater planning initiatives and co-governance arrangements in B.C. and determine what capacity needs and gaps may exist. The results revealed a need for further technical, human, and financial support for First Nations to advance their freshwater interests, as well as a strong interest from Nations to continue leading watershed planning and governance initiatives in their territories.

As First Nations, watershed groups, and provincial and local government decision-makers across B.C. continue to develop collaborative watershed governance approaches, courageous leadership, political commitment, peer-to-peer learning, and adequate resources are needed to support these initiatives and ensure our most precious resource is protected now and into the future. wc



Rosie Simms is the water law and policy researcher at the University of Victoria's POLIS Water Sustainability Project. Natasha Overduin works jointly for the POLIS Project and the Centre for Indigenous Environmental Resources as a research associate.



# **Sound Service Fee**

Changing perceptions and the legitimacy of stormwater fees.

BY SARA JANE O'NEILL AND STEPHANIE CAIRNS

IN CANADA, stormwater user fees are gaining traction as a tool in municipal stormwater management programs, and for good reason. Local governments, the frontline guard of the urban stormwater challenge, are struggling to combat funding, flooding, and pollution. As status quo methods of financing stormwater through property taxes have proven to be inefficient, the user-pay method for municipal stormwater services has the potential to provide key benefits for local governments and our communities.

#### **Dedicated revenue stream**

Many stormwater programs are struggling with budget allocations, because they must compete annually with the range of municipal programs funded by general revenue. In a user-fee system, all revenue is allocated back to the service for which the fees are charged, creating a dedicated stormwater revenue stream and allowing for strategic longterm planning.

#### Fair assignment of costs

municipalities charge Most for stormwater services through property taxes or as a portion of water utility bills, but these methods are not fair because there is no relationship between property value or water consumption and the volume of stormwater runoff generated by a site. High value properties could be paying for stormwater services they do not use while properties that consume very little water (e.g., parking lots), but generate a significant volume of runoff, could be being subsidized. A user-fee method charges each property owner based on the estimated amount of stormwater services used, creating an equitable assignment of cost and more closely following the polluter pays principle.

#### **Economic incentive**

When drinking water is priced by utilities based on consumption, people generally reduce their water usage in order to save money. The same can be true for stormwater. If property owners have the ability to reduce their user fees by reducing the volume of stormwater their site generates, an economic incentive is created that can encourage behavioural changes in private property stormwater management.

### Greater awareness and transparency

Experience has shown that charging specifically for stormwater sparks a conversation. Property owners learn what services the local government provides, exactly how much they are paying for these services, and how their property contributes stormwater to the municipal system. They can also gain a better understanding of the urban water cycle and how green infrastructure (trees, rain gardens, permeable pavement, green roofs, etc.) on their property can help restore that water cycle, reduce their fees, and benefit the whole community. Changing consumer habits, however, is never without challenges. Fortunately, in the case of stormwater user fee implementation, experiences in Canada and the U.S. are demonstrating that some of the main obstacles are common, and can be proactively addressed.

#### Public perception

User fees can be perceived as a new charge or tax when, in most cases, they actually represent a transfer of costs from one budget to another (i.e. from the general budget to a dedicated stormwater budget). Detailed information on how stormwater services are being funded today compared to how they will be funded under a userfee system, and how that will impact residents, are crucial to this discussion.

#### **User-fee design**

A stormwater user fee can be calculated using a number of methods, each having different levels of fairness, accuracy, and cost effectiveness. The method that's best for each individual community will depend on factors such as resources, capacity, political will, and community vision.

### Cost shifts between stakeholders

A user-fee method will redistribute costs such that those generating the most stormwater will pay the highest fees. In many cases, this will result in higher bills for some sectors, usually to non-residential property owners, which can cause concerns and resistance to the user fee. Many local governments have addressed this by phasing in the user fee over a period of time to allow property owners to budget for the costs. As well, when combined with a strong credit or discount program for adopting green infrastructure, non-residential property owners are encouraged to reduce the stormwater they generate and consequently their costs.

Stormwater user fees are one

part of a movement towards locally owned, innovative, and comprehensive stormwater programs that have great potential to create a more financially sustainable, less polluting, and more resilient stormwater management system for communities across Canada. WC



Sara Jane O'Neill is a senior research associate and Stephanie Cairns is the director of cities and communities at the Smart Prosperity Institute.



Read the full report, New Solutions for Sustainable Stormwater Management in Canada, at institute. smartprosperity.ca/stormwater



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# **Right Framing**

# Using the concept of water as a human right to motivate action on First Nations water. BY KATHERINE STARZYK

**PROGRESS TO PROVIDE** First Nations with adequate and secure water and wastewater services will be slow without a variety of approaches. Alongside other strategies, we must increase public support for resolving the issue. By changing the hearts and minds of non-Indigenous Canadians, politicians may feel more pressure and freedom to act more quickly.

Our collaborators and roundtable participants in Nisichawayasihk First Nation agreed that thinking of water as a human right might cause people to support more government action. To understand the power of thinking about water as a human right, we conducted several experiments with undergraduate students at the University of Manitoba and University of Winnipeg, as well as representative national community samples. Working with First Nation partners and a diverse group of academic

collaborators, we take a social-psychological approach to understand how to motivate people to support government action. Our study participants were

randomly divided into two groups: those exposed to the "water as a human right" frame, and those that were not. Next, we assessed their support for addressing water issues within First Nation communities. With a national sample of more than 600 Canadians, we told the "human rights" group that the term human rights refers to rights and freedoms that everyone in society is entitled to, and

### Ask yourself: Is water a human right?

are guaranteed under the law. Then, we asked them if the right to clean water should be guaranteed for all Canadians? Once this narrative was established, we briefly educated participants about the state of First Nations' water services.



Finally, participants rated their support for government action. The second group completed the same set of questions, but they were not introduced to the concept of water as a human right. The study showed that participants who considered the notion of water as a human right were more likely to support government action, believe access to water should be a human right, and expressed an interest in taking take advocacy-related action. Several additional studies replicated this basic finding.

These effects are statistically significant but small, likely because our study manipulations are subtle. For example, in one study, we primed water as a human right through a title that read, "Is water a human right?" and the following rhetorical question after a brief description of the issue, "Ask yourself: Is water a human right?" We believe that framing water as a human right holds promise for inciting social action and that our findings are relevant to those who work in fields that are advocating for improved sanitation and water access—so that First Nations can rightfully experience the same level of water services as other Canadian communities and cities. wc



Dr. Katherine Starzyk is a psychology professor at the University of Manitoba. She conducted this research with Dr. Danielle Gaucher, Dr. Jacquie

Vorauer, PhD students Katelin Neufeld and Matthew Quesnel, and research assistant and former honours student Aleah Fontaine of the universities of Manitoba and Winnipeg.



There are around 60 distinct Indigenous languages in Canada, falling into 10 separate language families. The 2015 Truth and Reconciliation Commission of Canada report calls on Canadians to recognize that "Aboriginal languages are a fundamental and valued element of Canadian culture and society, and there is an urgency to preserve them." Below is a sampling of Indigenous words for water.

#### Anishinaabe and Ojibwe: • *Nibi*

Blackfoot: • Aohkíí

Cree: • Nîpîy

#### inpiy

Dene:

• Deh (flowing water)

Hul'q'umi'num': • Qó

#### Inuktitut:

- *nilak* (freshwater ice, for drinking)
- *aniu* (snow used to make water)

#### Secwepemc and Nuxalk :

Kla. Tuu. Kwe.



#### The odds of finding a solution to First Nation water rights in Alberta.

BY CLAYTON LEONARD

THE GOVERNMENT OF ALBERTA has developed plans to manage looming water shortages in central and southern Alberta, but those plans risk leaving First Nations without reliable water supplies. At the heart of the issue is the unresolved legal question of First Nations' water rights.

#### Water and the Treaties

In 1876 and 1877, First Nations in central and southern Alberta entered into Treaties 6 and 7 with Canada. Reserve lands were set aside in fulfillment of a core term of the Treaties with the intention that each First Nations would settle permanently on these. It is self-evident that water supply is a necessity for economic development, housing, schooling, and other uses of reserve lands.

In the late 1800s water use was governed by the common law of water rights. The common law attached the right to use surface and groundwater to the ownership of land to ensure its productivity. Although the Treaties do not expressly mention water rights, the courts have held rights can be read into the Treaties if necessary (for example, to use and benefit from reserve lands).

#### **Unprecedented and uncertain**

To date, no Canadian case has addressed First Nation water rights. First Nations say that both the common law of water rights at the time of Treaty making and the intention underlying reserve lands in the Treaties support their right to use the

water resources on their lands. Alberta's position is that First Nations either never had water rights on their lands or that those rights have been taken away by federal legislation. Alberta's position relies

on the assumption that the Government of Canada either negotiated the Treaties without water rights—thereby undermining First Nations' ability to use or benefit from reserve lands—or that Canada took away First Nation water rights without their consent and without compensation. If Alberta is correct, it raises the specter of massive legal claims by First Nations against Canada for the loss of their water resources. This is the legal uncertainty that forms the context for today's dispute between First Nations and Alberta over water resources on reserve lands.

The absence of legal clarity has not hindered Alberta. In the water scarce central and southern regions of the

First Nations will get water only three out of every ten years with the water licenses being offered.

> province, a new regulation has been introduced that asserts that First Nations are required to get a water license from the province to use the water on their lands. If valid, the regulation will ensure that those new permit holders get the



lowest priority water licenses ever granted. Licenses under Alberta's Water Act are administered under the First in Time, First in Right (FITFIR) system. The seniority of licenses is based on the date each license was issued, and during periods of water shortages, senior licenses are entitled to all their water before junior licenses get any water. Nothing in this scheme accounts for the fact that First Nations were here prior to European settlement and used water on their lands well before the first water licenses were ever granted or the scheme was even in place.

#### Three out of Ten

The practical impact to First Nations is astonishing. According to Alberta's own water modelling studies, First Nations will get water only three out of every ten years with the water licenses being offered. As a condition to getting one of these effectively useless licenses, Alberta has also tried to cajole First Nations into signing an agreement which prevents them from pursuing their water rights through the courts.

First Nations have rejected Alberta's so-called solution and have taken steps to govern their own water use on their lands-other solutions are available, possible, and not without precedent. In B.C., provincial water legislation was amended to enable the province to enter into agreements with First Nations. The legislation establishes that the date of First Nation's water reservation is determined by the negotiation date, instead of being prescribed by the FITFIR provisions. Alberta conducted a review of its was legislation in the 1990s, during which it came to light that ranchers and farmers throughout the province had significant unlicensed historic water use on their lands, some of which pre-dated the creation of Alberta in 1905. Alberta amended the Water Act to allow ranchers and farmers to register their water use and get priority dates reflecting when their families first used water on their lands. A similar amendment could accommodate First Nations water use which pre-dates all others in the province. Both B.C.'s and Alberta's amendments demonstrate that it's possible to recognize and respect the reality that First Nations used water prior to anyone else, and that lands are set aside under constitutionally protected Treaties. Such an approach could also create the legal certainty that First Nations need for economic development and to ensure their communities thrive. Other far more reasonable and amicable solutions are possible—just the political good will towards First Nations seems to be lacking. wc



Clayton Leonard is a lawyer with JFK Law Corporation. A significant amount of his practice relates to water management and allocation,

Treaty and Aboriginal water rights and other water issues facing First Nations and other stakeholders. Clayton was named one of Canada's Leading Lawyers in The Canadian L'expert Legal Directory in Aboriginal Law and was recognized with the Harris Gillespie Field, Q.C. Prize in Environmental Law in 2002.

#### CONVEYANCE



An optical fiber cable is a cable containing one or more optical fibers that are used to carry light.





# DAYLIGHTING

# The future of water monitoring pipeline leaks through fiber optics.

#### BY JAMES SBROLLA

**IT HAS BEEN ESTIMATED** that around 13 per cent of the water that is withdrawn by Canadian municipal water suppliers is lost before it reaches final users. Water pipes buried under the ground can leak unnoticed for years. Not only is this lost water wasteful, but it can also cause disastrous sinkholes and water damage that cost municipalities millions of dollars. A group of engineers from Waterloo think that fiber optic technology is the solution.

"We started as a group of researchers that wanted to prove that the technology could work in the real world," said president & COO of AOMS Technologies, Amir Azhari. "Now we know that it works, our new mission is to have it installed in as many industries as possible."

After 11 years of R&D, the three researchers filed patents and built the company.

Although engineers have been exploring the use of fiber optics for distributed monitoring for about a decade, companies

#### CONVEYANCE



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like AOMS are advancing the breadth of its application. The technology is based on the seamless integration of highly pure and high-grade optical glass offered in the forms of rigid and flexible sensing cables. Once installed, fiber optics can sense multiple parameters such as pressure and temperature over long distances.

The sensing cables can be installed on or in the proximity of water pipes for continuous and real-time monitoring for early detection of abnormalities and mitigation of the risk of failure and potentially costly disasters. They are invulnerable to moisture, chemicals, and electromagnetic (signal) interference, therefore they are suitable for harsh environments where electronic sensors might fail. The technology can be used to monitor water pipes, wet wells and sumps, dams, chemical storing tanks, and wastewater treatment, as well as for structural health monitoring (SHM). Using advanced sensors, a threedimensional distribution of data (i.e., leakage, temperature, humidity, pressure, *et cetera*) can be drawn with resolutions down to a few centimeters.

"Having access to reliable data is the backbone of any strategic decision in all industries, particularly in oil and gas, freshwater, and groundwater quality management," said Azhari. "Fiber optic sensors can provide a three-dimensional map of reliable data from any harsh and hard-to-access physical domain which can assist the end-users to improve the efficiency and make informed decisions during operation." wc



James Sbrolla is a director of Actual Media and Water Canada.

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# **Priced to Save**

#### How does conservation pricing affect municipal water demand?

BY MICHAEL FORTIN, WAYNE GALLIHER, AND EMILY STAHL

THE CITY OF GUELPH has been a pioneer in the promotion of water conservation and efficiency in Canada. Motivated by limited supplies of local groundwater and the high cost of piping water from one of the Great Lakes, Guelph developed its first water conservation master plan in 1999. Earlier efforts to manage industrial demand resulted in the replacement of a what is known as a "declining block rate structure" with a uniform rate, thus eliminating low volumetric rates for large industrial water users. Since then, the uniform rate has remained in place. In the most recent update to its water efficiency strategy, the municipality reviewed alternative water conservation rate structures.

The purpose of a conservation rate

structure is to create an incentive to use less water by increasing the customer's cost of water. Conservation is one of

several basic rate setting principles, including: adequate cost recovery, to treat customers fairly, for its relatively simple and easy to understand, its relatively easy to

implement and administer, and to promote efficient water use.

The increasing-block rate structure is the most commonly used conservation rate structure in Canada. Here, the volumetric charge that increases in discrete steps, or blocks, as the volume of water consumed increases. For such a rate structure to work, the price

Five alternative rate strategies were evaluated with moderate to aggressive rate levels.

> differentials—especially for the third block—should be designed to give a strong incentive to the customer to decrease non-essential water use. The first block usually represents basic indoor household water needs, the second

#### LIQUID ASSETS

	Water use in each block (m3/month)			Price differential over the base rate		
	Residential	Multi-Res	ICI	Moderate	Aggressive	Very Aggressive
1st block	0 to 15	0 to 50	0 to 100	67% of the base rate		
2nd bock	15 to 22	50 to 800	100 to 5,400	base rate		
3rd block	>22	> 800	> 5,400	150%	200%	300%



captures average residential water use, and the third captures outdoor use.

In designing a water rate strategy, alternative structures can be combined. For example, an increasing block rate for residential customers and a uniform rate for non-residential customers.

#### Impact on demand

The impact of alternative rate structures on demand was estimated based on the condition that each rate structure would generate enough revenue to achieve the cost-recovery target. Achieving this objective by raising rates to target high water use period in summer means that the base price for water outside of the summer period be proportionately lower.

Five alternative rate strategies were evaluated with moderate to aggressive rate levels tested for each. The two figures above show the results of the evaluation of a strategy involving an increasing block rate for both residential and non-residential customers and the rate designs that were tested: The block rate structure was the most effective for reducing water demand, largely due to the price increase faced by a small number of large industrial, commercial, and institutional (ICI) customers. Given the diversity of such customers, it is very difficult to design this rate structure in a manner that assures the equitable treatment of such customers. Other rate structures that were tested had more modest impacts on demand with reductions ranging up to 1.4 per cent.

A qualitative rating of alternatives gave top rank to the existing uniform rate structure. Given this outcome and the low efficacy of all but the most aggressive conservation rate structures, a conservation rate structure was not adopted by the City of Guelph.

The main take away from this exercise was that, unless a municipality is willing to adopt a very aggressive conservation rate structure, the potential gains from such rates are modest at best, especially if other effective water conservation measures are already in place. wc



Mike Fortin is a consulting economist with M. Fortin Associates. Wayne Galliher and Emily Stahl are respectively acting plant manager and acting manager of technical services for the City of Guelph Water Services. Each stream has its own history, flavour, and voice, and yet it has the potential to form a larger whole," —Michael Blackstock

# Planet Reconciliation

Interweaving Indigenous knowledge and western science to make water-first decisions through Blue Ecology.

BY KIM STEPHENS, MICHAEL BLACKSTOCK, AND BOB SANDFORD

THE WARMING OF THE PLANET'S ATMOSPHERE is causing water to move more quickly and disruptively through the global water cycle. Flood, drought, fire, wind, and extreme cold events are becoming the norm. Instabilities in the water cycle are increasingly apparent. Impacts are magnified by human interventions. We have arrived at a fork in the road.

The situation calls for a whole-systems approach to managing the water balance distribution. The risks are too high, and the margins for error too small, to view water and watersheds only through narrow technical lenses. Adapting to changes in the water cycle and restoring the water balance starts with re-visiting our relationship with nature.

Over the generations, we have lost our way. Western science is not wrong; it is just not complete. It does not account for water as part of a living ecosystem.

The journey to a water-resilient

future starts with Western science acknowledging water for its central functional and spiritual roles in our world. Long recognized by UNESCO and the International Association of Hydrological Sciences, Blue Ecology is defined as the interweaving of western science and traditional First Nations teaching and local knowledge.

Blue Ecology has five guiding principles and aligns with the wholesystem, water balance approach— Spirit, Harmony, Respect, Unity and Balance. To make the right choices moving forward, we must understand how and where the rhythms of water are changing. Then we can apply ecosystembased understanding to adapt our practices to suit a changing climate.

#### Signs of change

Recently identified and potentially dangerous phenomena, such as atmospheric rivers, demand our full attention. An atmospheric river is a narrow corridor of concentrated water vapour aloft. These great rivers can be 400 kilometres across and thousands of kilometers long. The best known is the famous Pineapple Express, which periodically crosses the Pacific from Hawaii and unloads heavy rain when it hits the west coast of North America. When moderate in scale, atmospheric rivers bring badly needed water to dry states like California. When larger in scale, they can cause flooding of magnitudes not witnessed before.

The laws of physics provide a realitycheck: the warmer the global temperature becomes, the more water the atmosphere can carry. Until we stabilize the composition of the Earth's atmosphere, phenomena such as atmospheric rivers are likely to cause greater flooding and related economic damage widely forever making sustainability and adaptive resilience a moving target. The Blue Ecology water cycle and principles, designed by Michael D. Blackstock.



#### Hope for the future

There is hope for future generations. Success depends on embracing a waterfirst approach. Water is a core human interest upon which we can build collaborative cross-cultural climate change strategies. We need to build on that core interest now. Over the generations, we have lost our way. Western science is not wrong; it is just not complete. It does not account for water as part of a living ecosystem.

Indigenous societies believe that water is a living entity. It is the sacred centre from which all other activities radiate. The Blue Ecology frame provides a holistic cultural context to enhance Western science's knowledge of the water cycle for the benefit of hydrologists and water managers. What we are essentially talking about is reconciliation—going back to the headwaters of where we got our relationships with water and with one another wrong, and then starting back down the river of time. Only this time, the journey is made together, with a full understanding of the importance of embracing a water-first approach to planning human interventions in the environment. WC



Kim Stephens is the executive director, Partnership for Water Sustainability in BC. His responsibilities include the Water Sustainability Action Plan for BC. Michael Blackstock is an independent scholar, professional forester and chartered mediator of European and Gitxsan descent. Bob Sandford is the EPCOR chair for Water and Climate Security at the United Nations University Institute for Water, Environment and Health.



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RULES & REGS



# **Renew/Re-Act**

First Nations drinking water in the absence of meaningful regulation and legislation. BY KERRY BLACK

AS OF NOVEMBER 30, 2016, there were 130 drinking water advisories (DWAs) in 85 communities across Canada, not including British Columbia. For British Columbia, as of January 31, 2017 there were 21 DWAs in effect in 19 First Nation communities. Nearly 75 per cent of these DWAs (not including B.C.) have been in place for over a year—the majority of which are in Ontario. Since October 2015, there has been little change in the number of total advisories, from 139 in October 2015 to 130 in November 2016.

It remains to be seen how legislation and regulations will be enacted around First Nations drinking water. On November 1, 2013, the *Safe Drinking Water for First Nations Act* came into force, after consideration in the Senate as Bill S-11 then Bill S-8. The Act enables the government to develop enforceable federal regulations to ensure access to safe, clean, and reliable drinking water, the effective treatment of wastewater, and the protection of drinking water sources on First Nation lands. It has garnered widespread criticism from First Nations across Canada based on the lack of committed resources to implement the regulations once developed, and lack of meaningful engagement and consultation with First Nations throughout the Act's development.

In an era where the federal government has signaled a renewed relationship with Indigenous peoples, the Prime Minister has committed to conduct a review of any legislation unilaterally imposed on Indigenous peoples by the previous government. Prime Minister Trudeau stated that where "measures are found to be in conflict with your rights, where they are inconsistent with the principles of good governance, or where they simply make no public policy sense, we will rescind them." At the 2015 Special Chiefs Assembly, the Assembly of First Nations (AFN) called for a repeal of the *Safe Drinking Water for First Nations Act.* 

The concern is not necessarily with the development of regulations and how this can be done respecting the United Nations Declaration of Rights Indigenous Peoples and the Truth and Reconciliation Commission's Calls to Action. The concern is with the implementation and imposition of regulations in the absence of adequate resources. The Safe Drinking Water for First Nations Act, as a Senate bill, was passed with no commitment of the funding required for its implementation. This is one of the main reasons First Nations object to the Act. It calls into question liability, and absolving the government's responsibility, it leaves

unanswered questions as to how First Nations will be responsible and able to meet the regulations in the absence of sustained and sufficient funding.

Many have criticized the Act for developing regulations on paper that cannot be met in reality. The government has now committed to review all legislation, creating an opportunity to work together with First Nations to draft appropriate legislation. Legislation and regulation alone, however, are not enough. Substantial funding must be provided to First Nations to adequately address chronic underfunding over past years, and to ensure sufficient funding for continued operation and maintenance of drinking water treatment plants. The 2016 federal budget included significant investments in water and wastewater for First Nations, including \$1.8 billion over five years for infrastructure, operations and management and to end long term boil water advisories in five years. Yet this is still well below what is required to build, operate, and maintain new or upgraded treatment facilities.

In the simplest terms, any legislation developed for First Nations must be developed with and by First Nations. This is consistent with the UN Declaration on the Right of Indigenous Peoples. It is important to remember the urgency of the matter. While legislation and regulation are debated and politicized at the national level, First Nations across the country are being denied access to safe drinking water. There is a pressing need to address the quality of First Nations drinking water. This must remain a priority throughout the development of regulation and legislation. wc



Kerry Black, is a senior policy advisor at the Assembly of First Nations.



#### **APPOINTED**



The Centre for Alternative Wastewater Treatment (CAWT) has welcomed Jeremy Kraemer, Ph.D., P.Eng. as director of the CAWT. Kraemer joined CAWT from a global

infrastructure engineering and operations firm, where he most recently managed the design delivery for a \$125 million nutrient removal wastewater treatment plant upgrade.



Anastasia

Lintner

Dr. Anastasia Lintner has joined the Canadian Environmental Law Association (CELA) to lead the organization's Healthy Great Lakes program. Lintner will

work part-time as CELA Special Projects Counsel while continuing her work with Lintner Law. The Healthy Great Lakes program will work to increase the national and binational capacity to protect and restore the waters of the Great Lakes and St. Lawrence River Basin.



Black

Joining the Assembly of First Nations as their senior policy advisor is Kerry E. Black, M.A.Sc. Black has long been an advocate for best practices in Indigenous

communities for the delivery of water and wastewater infrastructure, speaking on financing models and project implementation. While serving the Assembly of First Nations, she will also be completing her Ph.D with Dr. Edward McBean, at the University of Guelph. Her thesis is focused on enhanced Indigenous participation and decision-making through bottom-up participatory approaches.

Black told WC, "I'm thrilled at the opportunity to work directly on the issues I am most passionate about including advocating for sustainable water and wastewater drinking treatment for First Nations, improved decision-making power for First Nations on housing, water and infrastructures, and promoting increased First Nations control. I hope to continue to shed light on the importance of Indigenous culture,

history, and knowledge in environmental decision-making, and the urgent need to address drinking water in Indigenous communities in Canada."

Black is the author of this month's Rules & Regs column on page 36.



#### Patricia Dennison has joined Hammond Manufacturing Company Limited as their data/ comm product manager for Ontario. Dennison

Patricia Dennison

will be responsible for developing new business opportunities and growing the demand for Hammond's racks, cabinets, and accessories within Ontario. "I am ecstatic to have been chosen to represent Hammond's data/ comm division in Ontario," said Dennison. "I look forward to working with the team at Hammond and I am especially excited about the opportunity to offer and support a quality Canadian made product.



Helen Jowett has been acclaimed to a second oneyear term as chair of the Grand River Conservation Authority (GRCA), and

Jeremy Schmidt has

moved from Carleton

University to take up a

new position as assistant

professor and lecturer

on Human Geography

reporting to the Board

Helen Jowett

Chris White has also been acclaimed to a second oneyear term as vice-chair. Both Jowett and White expressed their gratitude to their fellow board members and GRCA staff for their dedication and contributions in

the stewardship of the natural resources

within the Grand River watershed.



Schmidt

at Durham University. There, he will continue his work on Canadian water issues, especially land and energy challenges in Alberta. He will also continue his work with international networks on issues of water justice.



Aysha Muzaffai of Directors. Muzaffar will assist in managing, coordinating, planning, and providing support to the board and various committees on projects that will further the goals, mission, and the strategic direction of the association. "Over the past several years the association has seen positive growth in providing relevant programs and services to its members. The addition of Aysha will ensure that members' interests are continued to be well represented," said Shelley Peters, CWQA president.

#### RETIRED



After completion of his first three-year term as president and CEO of the Ontario Clean Water Agency (OCWA), Rob Andrews announced that he would retire from the

OCWA and the Ontario public service. On his retirement, Andrews said, "It has been a privilege to lead the Agency and I leave confident in your combined talents, dedication and commitment to the values we stand for."

John Bergsma, acting chair of OCWA's Board of Directors said, "It has been a great pleasure working closely with Rob over the past three years as he has implemented the Board's vision for the future of the Agency. Under his leadership, OCWA became more clientfocused and expanded its services to become a 'total water solutions provider'-ready to manage all of our clients' water and wastewater issues. On behalf of the Board, I would like to thank Rob for his support and leadership and offer our warmest wishes for much future happiness and success."

#### AWARDED

H20 Innovation's Frédéric Dugré named global water leader: Frédéric Dugré, president and CEO of H2O Innovation, was nominated as part of Water & Wastewater International (W&WI) Top 25 Water Leaders.

Each year, the W&WI Top 25 showcases leadership talent-whether it's founding and growing a company from scratch or adapting a well-established corporation to whether economic and market changes.

Dugré was given the 14th position on the list and the only one awarded to a Canadian. W&WI stated that H20 Innovation's revenue increases, Dugré's strong passion for water treatment, and his ability to continuously find new ways to elevate H2O Innovation were the hallmarks of a true water player, worthy of recognition throughout the industry.

In 2000, four years after completing a Bachelor degree in Mechanical Engineering at Laval University, Dugré founded H20 Innovation with the goal of taking part in the consolidation of the water treatment industry. In 2016, H20 Innovation won two awards for their work in implementing cleantech systems in water, the Water Technology Company of the Year award at the 2016 Global Water Awards and a National Award of Merit from the Design-Build Institute of America.

More news items can be found at watercanada.net/ topics/news

#### **IN MEMORIUM**

One of Canada's leading researchers on freshwater resources and conservation from Brock University has passed away. Dr. **Steven Renzetti** passed away Friday Feb. 3 four months after being diagnosed with cancer at the age of 57. A professor of economics whose research made him an internationallyrenowned thought leader on freshwater resources and conservation, Renzetti was known on his own campus as a reassuring friend and confidant who made an indelible impression on colleagues and students.

Having joined Brock as a lecturer in the Department of Economics in 1988, his accomplishments include creating Brock's Environmental Sustainability Research Centre; establishing the Water Economics, Policy and Governance Network (WEPGN); and authoring several books and numerous articles. Renzetti was also very dedicated to providing advice on numerous editorial boards, government commissions and panels, including National Roundtable on the Environment and Economy's Expert Advisory Committee on Water Sustainability and most recently on the Science Advisory Committee to the International Joint Commission's Great Lakes Water Ouality Board.

"It was such a privilege to work with him," said fellow researcher and friend **Ryan** 



**Plummer**. "Steven's commitment to scholarly excellence was unwavering. He embodied what it means to truly be an academic internationally recognized for his expertise in water resource economics, dedicated to the enterprise of higher education, and devoted to service in Niagara and the Canadian water community. Brilliant, ever approachable, humble and generous, the impacts of his contributions will continue to shape Brock University and the field of water resources in Canada and beyond."

Renzetti earned an undergraduate degree in economics and environmental studies from the University of Toronto and his Masters and Ph.D at the University of British Columbia. He leaves behind his brother David and his sisters Cathy and Elizabeth, his mother Mildred, his wife Diane Dupont and children Alexandra and Nicholas.



As part of the University of Waterloo Water Institute's WaterTalks lecture series, professor Dr. **Alex Mayer** of the civil and environmental engineering department at Michigan presented a talk on Developing the Great Lakes' Blue Economy: Water productivity, water depletion, and virtual water trade in the Great Lakes basin. By combining water use and availability data, evaluating consumptive flows, and the flow of imports and exports, Mayer's research shows that on average, the current economy does not create significant impacts on surface waters of the Great Lakes. Yet, there is risk that unregulated large water uses can create environmental flow impacts if they are

### **Developing the Great Lakes' Blue Economy** Waterloo, ON

developed in the wrong locations.

Although Mayer's research only considered American data, he expressed an interest to examine similar datasets in Canada. Professor **Rob de Loë**, who was in the audience, noted some of the limitation to availability of data in Canada and the potential to compare them with data from the U.S.

#### Climate Extremes: National Collaboration on Floods and Droughts Ottawa, ON

Canada's leading flood and drought experts gathered in Ottawa on Jan. 27 to discuss the impacts of climate change extremes and the affect this has on our water resources. Hosted by the Canadian Water Resources Association (CWRA), the Climate Extremes roundtable featured representatives from academia, government, and NGOs in Canada speaking on a broad range of topics from policy and finance to forecasting and security.

Morning sessions featured Dr. **Paulin Coulibaly**, scientific director of FloodNet and McMaster University professor discussing Flood Forecasting and Warning Systems Across Canada; **Ryan Hunt**,



director, Strategic Policy Division, Public Safety Canada, on Disaster Financial Assistance Arrangement (DFAA) and the National Disaster Mitigation Program; Floodplain Mapping Guidelines and Research Projects in Support of Flood Mitigation from **Michelle Poirier**, Natural Resources Canada; and Perspectives on Drought from **Paul Legam**, Mississippi Valley Conservation Authority, Dr. **Brian T. Gray**, Agriculture and Agri-Food Canada, Science and Technology Branch, and **Robert Haller** from the Canadian Water and Wastewater Association

The CWRA convened the roundtable in response to recent extreme weather

events in Canada that have impacted people, the environment, and the economy. These events spurred a need for a greater understanding of flood events and for greater collaboration nationally, according to the CWRA.

"[The] volatility of Canada's weather and increased severity of flood and drought impacts is an identifiable symptom of the changing climate in Canada," said CWRA's president, **Dave Murray**. "What is missing, however, is recognition that a national approach to managing our water, a crucial factor in climate change adaptation, is the foundation for Canada's economic future."



#### Top100 Projects Key Players and Owners Dinner Toronto, ON

Three hundred senior executives from across Canada and around the world joined ReNew Canada in celebrating the 2017 Top100 Projects at this year's Key Players and Owners Dinner. The event was held February 21 at The Carlu in Toronto to recognize more than \$186.4 billion worth of public sector infrastructure under development in Canada, up from \$161.3 billion in 2016. Canada's top six water projects totalling \$3.4 billion of infrastructure spending were part of this list. The new parliamentary secretary for the Minister of Infrastructure and Communities **Marc Miller**, the MP for Ville-Marie—Le Sud-Ouest—Île-des-Sœurs (Montreal) spoke about federal investments and infrastructure and the work already being done thanks to those investments. Ontario's Minister of Infrastructure **Bob Chiarelli** stressed the need to work with the private sector to provide direction on the future of infrastructure. **Michael Cautillo**, president and CEO of the Windsor-Detroit Bridge Authority delivered the closing keynote.

ReNew Canada has produced the Top100 Projects report for the past eleven years. The listing of Canada's 100 biggest projects (ranked by project value) is an industry touchstone—a look at how some of our mega-projects are funded and which firms are working on them. A project remains on this list until it's completed, which means some will continue to rank for a few years or stick around for decades. *For more information visit top100projects.ca* 

#### **PEOPLE & EVENTS**

### Ribbon Cutting for New Wastewater Research and Development Project,

#### Guelph, ON

On January 27, the Southern Ontario Water Consortium (SOWC) in partnership with GE Water & Process Technologies, City of Guelph, University of Guelph, the province of Ontario, and the federal government hosted a ribbon cutting ceremony for a new wastewater/resource recovery project. The new project, housed in a wastewater research and of resource recovery facility at the Guelph Wastewater Treatment Plant, has three primary process goals:

- Generate clean water from wastewater for purposes of reuse;
- Harvest biogas from the processing of biosolids; and
- Collect pathogen-free fertilizer.



The pilot is the first large-scale project to receive funding under the SOWC's Advancing Water Technologies (AWT) program, which supports collaborative, industry-led technology development projects. "This first large AWT project epitomizes what SOWC is all about," said Brenda Lucas, executive director of SOWC. "We are connecting the needs of industry with Ontario's academic expertise and enabling real-world testing in unique facilities to help bring innovative technologies to market."

Representing the partnerships were Lloyd Longfield, MP for Guelph; Liz Sandals, MP for Guelph; Cam **Guthrie**, mayor of the City of Guelph; **Glenn Vicevic**, executive of product management at GE Water & Process Technologies; **John Livernois**, associate VP of Research Services at the University of Guelph; and **Brenda Lucas**, executive director of the SOWC.

"The project speaks to the shared role of governments, academia, and the private sector to strengthen our economy, while working to preserve our national resources," said Longfield. "The environment and the economy go hand-in-hand on this project." Longfield further described the facility as evidence of the successful investment of up to \$12 million dollars in SOWC through FedDev's Investing in Commercialization Partnerships.

Vicevic noted that the energy content of wastewater is two-to-four times the amount of energy that is required to treat wastewater in conventional systems; therefore, the kinds of research systems being conducted at the new Guelph project will be effective in a cap and trade market.





If we have entered the era of water wars, Indigenous women won't back down. By JACINDA MACK



THESE ARE OUR WORDS FOR WATER. As an Indigenous woman, I am culturally, physically, spiritually, and mentally connected to water in ways that I am only now beginning to fully understand. Born from the ancient Nuxalk and Secwepemc Indigenous peoples, living in modern day British Columbia, Canada, I think about water a lot.

In 2014, the tragic and catastrophic tailings dam fail at Imperial Metals' Mount Polley Mine released over 25 billion litres of mine waste into the clean and salmonbearing waters of my motherland. Ground waste rock and process water containing heavy metals and toxic chemicals scoured nine kilometres of mountainside into Yuct Ne Senximetkwe, the birthing waters of life-sustaining salmon of the mighty Fraser River.

Quesnel Lake is the last leg of the salmon's journey and was the last clean water the fish could swim into and spawn. The Fraser River has been polluted and on the endangered list for years. Now, it is a disaster zone that both Mount Polley and the B.C. government continue to deny.

Two years after the worst environmental

disaster in Canada, the provincial government of British Columbia has permitted Mount Polley back to full time operations, without a single fine, leaving the waste intact. It is business as usual, despite government reports recommending otherwise. These are dangerous precedents for future disasters, predicted to happen twice every decade in the Mount Polley Panel report.

Now, Mount Polley's proposed longterm water management plan includes dumping into already damaged lakes and to groundwater as its treatment plan to meet B.C. water quality guidelines. I have been told that "the solution to pollution is dilution." I wholeheartedly disagree. So do many others.

In December 2016, First Nations Women Advocating Responsible Mining, a B.C.-based coalition dedicated to reforming unsafe mining practices, organized a letter campaign to raise awareness and take action. My partner Chris and auntie Teena joined me, doorto-door, to discuss the plan. There was no free, prior, and informed consent to this mining project, emphasized by 205 signatures demanding fully treated water at the end of pipe.

Our petition was further supported by organizations across B.C., Alaska, Canada, and the United States. We are all downstream and are connected by the water we drink, use, and pollute. We will soon find out if Prime Minister Trudeau's words that, "governments grant permits, but communities grant permission" will be factored into the decision.

My indigenous teachings say that protecting water is traditionally a woman's role. Women and water are life givers. Young women receive names bearing the word water, and are taught important water ceremonies. As clean water is becoming scarce, and treated as a bottomless well for industry to use, abuse, and pollute, our women are standing up and our men are standing beside us—to protect the sacred.

I look to my indigenous relatives near the proposed Site C Hydro Dam in Northern B.C., and south, to pipeline opposition at Standing Rock, North Dakota. Have we entered the era of water wars? Speaking truth to power has never been an easy or conflict-free experience. We stand where our ancestors stood, where our children and grandchildren will stand. Clean water will be protected. We are fighting for our very survival, and yours. wc

Jacinda Mack is the coordinator of First Nations Women Advocating Responsible Mining, as well as a grassroots advocate, mother, and auntie, committed to protecting clean water. For more information visit, fnwarm.com.

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