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Photos by Ken Johnson

Clockwise from top left: Self haul for household water in Neskantaga First Nation, Ontario; Water point in Newtok, Alaska; and handwashing in a Native Alaskan home.

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Bagged sewage pick up in Greenland.

GREENLAND: IN THE SHADOW OF THE CORONAVIRUS

By Kare Hendriksen, Associate Professor, Department of Civil Engineering, Technical University of Denmar; and Ken Johnson, Planner and Engineer, EXP | Arctic

While Denmark is severely challenged by COVID-19, Greenland has successfully managed to maintain a low infection rate. A major accomplishment has been that the first wave of the infection was confined to the capital city of Nuuk, which has a good hospital and good water and sanitation system. However, outside of Nuuk, Greenland is challenged by the fact that 10 per cent of the population has no running water and must haul the water themselves, and a quarter must use honey buckets for human waste. So if the infection spreads outside Nuuk, it could quickly have severe consequences, not least because healthcare resources outside Nuuk are – at best – limited.

With only 56,000 inhabitants on the island, spread over 71 settlements, Greenland is a country that is geographically similar to Central Europe, but with a north-to-south distance equivalent to the distance between from Bergen, Norway to the north coast of Africa. For the health service, this poses some obvious logistical challenges.

With very limited healthcare resources available in the smaller communities, patients who need to be admitted to hospital are often medevaced to the nearest regional hospital. In most of the more serious illnesses or accidents, patients must be medevaced to Nuuk. This can take a day of travel from many parts of the country, and this medical travel is often hampered by weather.

Even with these limitations, the Greenlandic health system has generally succeeded in ensuring a good state of health in the country. However, COVID-19 has spread outside of Nuuk and the system is being taxed, and in the event of an infection boom, Greenland's six respirators will not go very far in meeting the need.

With Greenland's health system, prevention of the spread of infection is crucial. Denmark's non-proliferation strategy is based on keeping social distancing, hygiene, and frequent hand washing. However, in the households of Greenland's smaller communities, many people live in small houses where proper hygiene is a challenge. Ten per cent of the population does not have indoor plumbing and must obtain water by travelling to one of the "tap houses" in the community, and water use by these residents is less than 30 litres per person per day. Another 10 per cent have access to trucked water delivery, but this water supply is also limited.

In fact, because of water supply restrictions, there are 10 communities where the average daily water consumption is 10 to 15 litres per capita per day. In addition, there are three communities without any water supply, where the residents collect water from a steam in the summer and melt snow in the winter. In comparison, the water use in Denmark is 120 litres per capita per day.

Thinking that Greenland can only prevent the spread of COVID-19 for a significant part of the population through frequent hand washing is an illusion.

The fact that almost a fifth of Greenland's population doesn't have access to running water in the home is a product in part due to the Danish modernization of Greenland after the Second World War. In the post-war years, Denmark was under pressure from other countries to decolonize and modernize Greenland and open the country's economy. Greenland was poor, and because of the miserable housing conditions for most of the population, tuberculosis was so widespread that it caused one-third of all deaths.

Something had to be done and the challenge was great. In response, the Greenland Technical Organization (GTO) was established to coordinate the construction of housing and infrastructure in the coming decades. From a governance perspective, Greenland became a colony of Denmark-Norway in 1775 and it became an autonomous country within the Kingdom of Denmark in 1979, and now has widespread self-government.

Denmark also wanted to develop Greenland's economy so that it would become self-sustaining and, in the long run, profitable to the inhabitants. Therefore, efforts were made to streamline and develop cod fishing, which was seen as the future sustainable economic foundation, and it was the Danish plan to relocate the majority of the population to the open water villages on the southwest coast, where the ocean did not freeze during the winter.

Investments were made primarily in these fast-growing southwest coastal communities, and in most of these communities, residential blocks were built that required water supply and sewerage. In the following decades, water and sewerage networks were gradually expanded to include some of the other homes in these communities. However, much less infrastructure investment was made in the "outer districts" because the Danish Greenland administration wanted to motivate people to move to the larger communities.


Bagged sewage disposal in Greenland.

It is not known how much the inadequate water supply and honey bucket toilets affect the state of health in Greenland, but there is no doubt that it is important influence. From the beginning of the 1990s when the increase of tuberculosis incidences was fully documented, there have been around 50 new cases per year. According to Statistics Greenland, 25 tuberculosis deaths have been recorded in the period from 2004 to 2013. Studies in other Arctic regions indicate that limited access to water and the use of honey bucket toilets play a significant role in community health.

In these Coronavirus times there is the potential danger of the spread of infection in Greenland running out of control and causing many deaths. Denmark should take the initiative and help to complete the establishment of water supply and wastewater management systems that are long overdue. This would correct the government's mistake made 75 years ago of trying to relocate communities for the benefit of the government and not for the people.

EEK, ALASKA GETS RUNNING WATER

Edited from an article by Anna Rose MacArthur

Eek is a Yup'ik village with a population of approximately 450 people of which 98 per cent are Native Alaskan (Yup'ik). Eek is located beside the Eeayarak River approximately 30 kilometres from the Bering Sea, and approximately 660 kilometres west of Anchorage.

Eek is mainly a boardwalk community, with only one dirt road connecting the airfield with the rest of town. It has a United States Post Office, a Yukon-Kuskokwim health clinic, and the Iqfijouaq Company store.

In 2019, the residents of Eek transitioned from individually hauling their water and sewer along the boardwalk system in the community to and from their homes to a piped system with faucets and flush toilets. Before having piped water, Eek residents could get treated water from the community watering point, paying a 25 cents for every 15 litres. Most homes also collected rainwater in summer and river ice in winter.

Formerly, a bathroom consisted of a basin and a toilet. The toilet was a honey bucket – a five-gallon bucket with a seat, lined with a trash bag. Having it near the door made taking it outside to dump easier. With the new system, there's a bathroom complete with a sink, shower, bath, and flushing toilet in every home.

When people don't have to haul every litre of the water they use to their house, they use more of it. Instead of everyone reusing the same basin of water to wash their hands, they can turn on a faucet and each person can wash in clean water. They can clean the house and wash dishes more often. They can also take showers and do laundry at home instead of at the community washeteria.

For Eek, a piped system was a huge step forward because in Alaska's Yukon-Kuskokwim Delta Region, 40 per cent of the homes do not have running water, except for nearby Bethel, Alaska, which has 1,700 residences.

The project in Eek began with working with the Alaska Native Tribal Health Consortium to identify funding for the project from a combination of federal and state money. The fundamental argument for the system was that when running water and sewer is introduced to a community, communicable disease infection rates drop. In one study of rural Alaskan communities, the construction of a piped sewer and water system resulted in a decline of 16 per cent in the number of clinic visits for respiratory infections, and declines of 20 per cent and 38 per cent, respectively, for skin and gastrointestinal infections. Families have also observed that, with running water, young children are not coughing as much and not getting sick as often. This is attributed to an increase in everyday handwashing and not reusing the water. Water quality is important, but so is water quantity.

Rural Alaskan homes without running water tend to use about five litres of water

Boardwalk system in Eek, Alaska for getting around the community.

Service connection installed to home in Eek, Alaska.

per person per day. The World Health Organization classifies this amount as a "very high" health concern. Meanwhile, the average American with running water uses over 500 litres of water per day. The largest use of American household water is for flushing toilets.

People growing up in Eek were taught by elders that water should be conserved. This contributed to the extraordinarily low water use. The transition to a piped water and sewer system has also required education to change the water use habits that have come down from the elders.

Many residents of Eek still prefer to brew coffee and tea with rainwater, saying that it tastes better than with the chlorinated water that comes out of the tap. This water preference may not change soon, but the availability of piped water and sewer has changed the public health picture in Eek and other communities in Alaska recently and for the far future.

Water and sewer piping to be installed in Eek, Alaska.

Aerial view of Eek, Alaska with sewage lagoons in the lower left.

NUNAVUT WATER SECURITY

Edited from a technical paper by Andrew Medeiros, Dalhousie University; Michael Bakaic, York University; and Sonia Wesche, University of Ottawa

Freshwater ecosystems are an essential part of the natural and built environments of the Arctic and provide clean drinking water for Arctic communities. This water supply relies on the unique Arctic terrain, with its shallow lakes, streams, and wetlands that are partially formed by the permafrost, which prevents water from soaking into the ground. Climate warming is melting the permafrost, which is drastically changing the nature of some Arctic lakes, streams, and wetlands. Along with these changes are emerging shifts in the beginning and end of the seasons, along with changes in the amount of precipitation, resulting in less snow and ice cover.

Arctic ecosystems are influenced a lot by the changes in the seasons, which control the water these ecosystems need. Watersheds in the Arctic historically received relatively small amounts of run-off during the dry summers because of the small amount of rain in the Arctic desert environment. Most streams flow only during the short spring thaw season, as a result of with the spring snow and ice melt. Therefore, the amount of winter snowfall is critical for re-filling and sustaining Arctic lakes and ponds.

Thaw in active layer which eventually caused an entire lake to drain in the Northwest Territories.

Late melting snow is critical for both the aquatic and terrestrial environments. If regions experience particularly dry conditions, especially due to lower amounts of snow, a significant loss of moisture by evaporation can occur. It has been seen that some high Arctic lakes are now are completely drying up during the summer season for the first time in thousands of years.

The health and sustainability of aquatic systems depend on the ground conditions, which are in turn influenced by the permafrost conditions. The depth of the soil's active layer, which develops annually with the thawing of the permafrost, controls the amount of space in the soil in which subsurface water can flow and move into drainage systems. In other words, a deeper active layer means less surface water in an area.

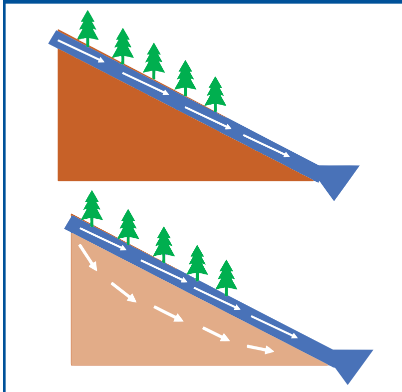
The permafrost layer is the most influential part of the Arctic water cycle. Increased air temperatures are causing higher soil temperatures that melt the areas of discontinuous permafrost. These are areas where there are patches or areas where the permafrost is not at the same depth from the surface due to different conditions at the surface, such as areas of shade or areas where the sun's heat can more easily warm the soil. The southern edge of permanent permafrost is also moving further north, which is resulting in increased vegetation as the depth of the active layer increases. This reduces surface water flow as more water can seep into the increasing active layer, which can hold more water. The increasing active layer means that a larger portion of the surface water and surface runoff is entering the soil, potentially causing landslides as the flowing water in the ground destabilizes sloped areas.

Some small lakes, and most Arctic ponds, exist only because the permafrost separates them from the seasonal sub-surface water system. Climate projections indicate that a gradual increase in the depth and spread of the seasonal active layer will result in the disappearance of Arctic wetlands. It has been observed that permafrost thaw is also a factor in the complete drainage of Arctic lakes and ponds. It's expected that these lake and pond systems that are created by permafrost will have an increasing influence on permafrost degradation as their water levels decrease. This will happen more and more as temperatures increase and the permafrost thaws. Basically, when water and permafrost interact, water ultimately wins.

Reductions in water levels in lakes and the amount of water flowing in rivers will ultimately affect the drinking water available to communities in the Arctic because most communities get their water from surface water systems. Across Nunavut, all the communities use surface water supplies, and in the Northwest Territories, all but one community (Wrigley) uses a surface water supply. Associated with the decrease in amount of water available to communities is a potential change in water quality, and this concern influences the perceptions of community residents about their environment, and the way they use water resources in their daily lives. Residents of many Arctic communities commonly drink untreated water directly from a variety of natural sources, including lakes, streams, and rivers in summer, and from lake ice, icebergs, snow, and multi-year sea ice in the winter.

For Arctic communities, increasing populations, limited and aging infrastructure, limited technical and financial capacity, and the high costs of constructing and maintaining water infrastructure are making communities more likely to have inadequate water supplies in a warming future. Environmental change means water quantity and quality issues will be among the most important concerns as the Arctic warms. The combined results of increased evaporation of freshwater supplies, decreasing water quality due to permafrost melting, increased development, and contamination left behind by development activity, such as mines, and other activities will have a serious impact on many aspects of northern life. Indigenous peoples over the centuries have demonstrated a capacity to adapt to changing conditions. However, the accumulated and increasing pressures on freshwater resources challenge the efforts being made to improve community sustainability.

The link between food security and water security is clear, and access to sustainable and clean freshwater resources has not received the attention it critically requires. Freshwater management policy and planning are currently limited in Nunavut, and future development pressures and climate warming will only make it more likely that the ability of northern residents to have easy access to clean freshwater will be endangered. Conclusions about the sustainability of future water resources differ somewhat from study to study because of inaccuracies in the climate models. However, it is important that plans for managing and adapting to changes in freshwater resources be developed and applied so that Arctic communities will have the quality and quantity of water necessary for the communities to flourish in the future.



Changing ground flow in the Arctic with thaw in the active layer – seasonal flow penetrates much further into the ground creating unstable ground conditions and opportunity for much greater flows to occur

USING SATELLITES
TO HELP ASSESS WATER QUALITY IN THE NORTHWEST TERRITORIES

By Bing Yue, John Bennett and Michael Henschel, Centre for Cold Oceans Resources Engineering (C-CORE)

In 2012, the Centre for Cold Oceans Resources Engineering (C-CORE) at Memorial University started monitoring water temperature and the amount of sediment in rivers in the Northwest Territories (NWT) from space. With support from the Canadian Space Agency, C-CORE collected and analyzed satellite pictures and made measurements in the rivers to help understand the river ecosystems. The monitoring program relied on both space-based technology and residents to track and confirm the assessments.

Over the past several decades, resource development in the upstream portion of the Slave River and Mackenzie River watersheds has increased. Human activity in agriculture, pulp and paper manufacturing, and energy development (oil, gas, and coal) have been identified by northerners as concerns in environmental change. To address these concerns, C-CORE work has focused on continuous monitoring of northern river systems. Water temperature, one of the key indicators of the health of the river system, changes the natural cycle of evaporation, as well as the oxygen in the water, which affects the aquatic life.

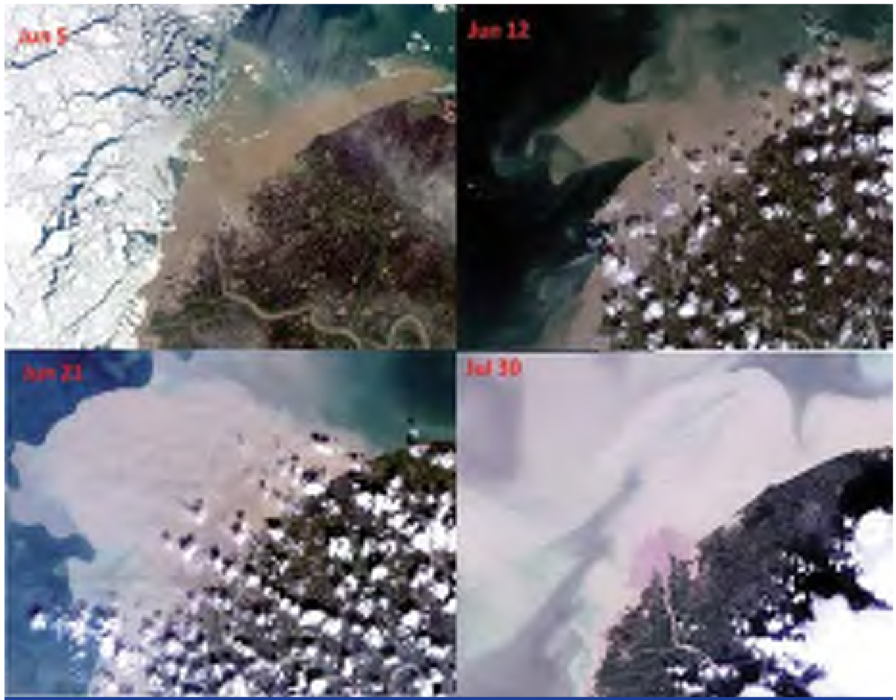
The amount of sediment in the water also affects the nutrients in the water, the penetration of light into the water, and the pollutants within the river system. While the sediment in the water can enhance the productivity of a river delta, large increases in sediment in the rivers can block channels normally used by fish. The use of space-based imaging satellites supports the continuous monitoring of the rivers, which may be used to evaluate the impacts of industry on the river systems.

Water surface temperature and the amount of sediment in the river can be estimated using satellite images. Old and new data is available from the satellite systems of NASA and the European Space Agency. Information from space is the most useful when it is accessible to people, and therefore the C-CORE created Internet tools to provide these water measurements that were collected. The tool is available for free at https://www.looknorthservices.com/watermonitoring.

The water surface temperatures retrieved using LANDSAT satellite images on the Slave River is presented in the figures below. The satellite temperature estimates were confirmed with water temperature readings at seven different locations.

The LANDSAT images presented in remaining figure were collected in the open water season of 2011 in the Slave River Delta region. From the image analysis, it is notable that the water colour variation in the open water areas on the images is related to the amount of sediment in the water. Linear models between the amount of sediment in the water and water reflectance values were shown to have a direct mathematical relation in the C-CORE study.

The mathematical models from the C-CORE study are available for free to the public through the Internet. C-CORE provides archived and real-time water surface temperature and information on the amount of sediment in the water. The Internet portal also provides the ability to select temperature data using an interactive timeline tool. As well, historical trends at selected locations on the river can also be presented in an image.



Satellite image of the Slave River Delta near Fort Resolute showing river sediment on various dates of a year


Thermal satellite image of Slave River identifying a water temperature in the river of approximately 14° C.


Thermal satellite image of Slave River identifying a water temperature in the river of approximately 19° C.

Wood stave piping in Dawson City Yukon, circa 1970

HISTORY OF FREEZE PROTECTED WATER SYSTEMS IN THE CANADIAN ARCTIC

By Ken Johnson, Planner and Engineer, EXP | Arctic

The use of piped water distribution systems in the Canadian Arctic is a century-old practice that began with an installation in Dawson City, Yukon in 1905. The Dawson City system was very rudimentary, but the fundamental practices of freeze protection by heating the water and bleeding the water were used. Heating was accomplished by running a parallel steam pipe system beside the water system, which continuously provided a heat source for the wood-stave pipe. The bleeding was done with a constant discharge of the water system into the adjacent Yukon River.

The next significant piped water distribution system in the Arctic was constructed for the mining community of Yellowknife in 1950. In the 45 years since the Dawson City system was built, considerable improvements were made in freeze protection practices. The Yellowknife water system employed a circulating water system, with provision for heating. A 200-millimetre (mm) iron header fed the system from an intake pumphouse, and the flow was divided into 150 mm branching water lines, with a 100 mm water line that returns to the main line to provide recirculation flow. Each house had a 12 mm service connection that looped from the 150 mm lateral returning to the 100 mm return lateral. The return line connection had a small hole to generate continuous circulation. All pipelines were buried with a minimum soil cover of 1.5 metres, as a freeze protection measure, and the pipes were also insulated using local moss.

The establishment of the new town of Inuvik in 1960 – to replace the flood-prone community of Aklavik – had a similar type freeze protected system as that used in Yellowknife. However, because of the thaw-sensitive permafrost, a decision was made to install the system in an above-ground linear box system that became known as a “utilidor”. The piping was asbestos cement, and the system was a recirculating one, with heat supplied by connecting to the high-pressure district-heating system that was located in the same utilidor “box” as the water and sewer piping.

Iqaluit’s original water system copied the system in Inuvik, with an above-ground utilidor using asbestos cement piping. This system also used water tempering, water recirculation, and water bleeding to protect the system from freezing. The construction of the Astro Complex in Iqaluit was the first major development needing a water supply. Astro Hill Complex was connected to the water distribution system with an above-ground utilidor that originated from the water treatment plant at Lake Geraldine.

Substantial residential growth occurred in Iqaluit in the 1970s, and the Territorial Government decided to extend the piped water system. This growth initiated the introduction of buried service lines, which provided the benefit of avoiding the exposure to the extreme cold at the ground surface. The new buried service installed to service the residential growth also introduced improvements in pipe and manhole materials. All the "modern" provisions incorporated into the design of water systems in the Canadian Arctic were in place at the end of the 1970s. These modern materials included buried high-density, urethane-insulated polyethylene piping, which was installed as a looped system with water reheating and recirculation.

In the mid 1980s, another substantial expansion of the piped water system in Iqaluit was installed. This expansion saw the introduction of the metal "access vault" as a replacement for concrete manholes. These structures provided better separation between servicing systems and the were easier to install. The commissioning was also less challenging because the access vaults could be tested before shipment from the factory in the south.

In the 1990s, the system layouts for recirculation, even for pipe sections that could not easily be looped, were standardized with water pipes looping back on themselves in some cases. The modest increase in cost for the "double piping" of the recirculation loop was offset by benefits such as the ability to reverse the flow in the return line when additional flow is required to fight a fire, and providing a back up system water supply by using the return line as a supply line in the event that the main line fails. The watermains were also deep enough that the seasonal temperature variations that the system was subjected to were small.

Since 1990, the nuts and bolts of the water systems the Arctic systems have been aging, so replacement work has been underway. Part of this work has been the installation of a reliable and accurate flow measurement and monitoring, which has become considerably cheaper. While good quality flow measurement/monitoring equipment was available pre -1990, it was extremely expensive and, as a result, was not commonly used in Arctic water systems. In water systems that rely on flow or recirculating flow to provide freeze protection, flow monitoring is critical. The ability to install alarms that warn of loss of flow, or to start standby pumping in event of a loss of flow, have both improved system reliability and simplified the lives of operations staff.

The second major technological advancement has come with improvements in communications technology. Earlier systems may have relied on something as simple as a passerby noticing that the red beacon on the outside of a panel or building was on. Telephone, cell phone, satellite, and/or internet-based communications systems now provide both continuous

Buried High Density Polyethene (HDPE) water and sewer pipes, with recirculation line, between steel access vaults in Rankin Inlet, Nunavut.

equipment monitoring and alarm triggering in the event of abnormal conditions in heating or circulating freeze protection systems. Modern electronics have also allowed for optimization in the control systems (for example, operating the systems closer to zero degrees Celsius, which saves on energy for reheating).

The number of communities with piped water systems has not expanded a great deal, however a handful of communities have received "core" community water systems that service just the larger water users in the centre of the community such as schools. These systems were developed without any plans for expansion because of the high capital cost of buried systems compared to trucked systems. Another factor is ground movement resulting from permafrost changes, which is very hard on buried pipelines and shortens the life of the systems. As the impacts of climate change unfold, factors such as ground movement are only becoming worse.

Burned out neighbourhood in Fort McMurray after wildfire.

FORT MCMURRAY WILDFIRE EMERGENCY RESPONSE

Edited from an article by Stephen Weninger, Stantec

In May 2016, a wildfire swept into Fort McMurray, Alberta, destroying 2,000 homes and prompting the largest fire evacuation in Canadian history. The community of 88,000 remained evacuated for a month, during which time the fire melted the water and sewer connections, flooded the basements of the burned-out homes, and filled the sewers with debris. The Fort McMurray biological wastewater treatment plant also failed, and smoke damaged the filters on electrical equipment in lift stations, and ash, gravel, and debris from the fire threatened to plug the wastewater and storm sewers. The assessment, repair, and return to service of the community's infrastructure required a herculean effort under very demanding circumstances by personnel in operations, emergency management, construction, and engineering.

Normal inflow and infiltration in the sewer system, plus damaged water service lines in the burned areas, allowed water to flow freely into the sewer system. The average daily flow before the fire was approximately 25 million litres per day. During the time the community was evacuated, the flow only dropped to approximately 15 million litres per day, even though the community was completely empty except for fire fighters, emergency responders, and a few critical support personnel. Making matters worse, that 15 million litres per day was clear water which means that the organic material needed to "feed" the wastewater treatment plant was zero. In fact, the wastewater flowing into the wastewater treatment plant was so clear that it met the approved levels required for water leaving the plant after treatment.

The clear water and reduced flow were caused by water flowing unimpeded into the basements of burned-out houses and then right into the sanitary sewer. Operators couldn't isolate household water services and distribution lines to shut them off because the drawings that recorded the original construction of the water supply system were not accurate enough to locate the valves to turn off the flow. This high flow of clear water, combined with the lack of the nutrient-rich organic matter normally entering the wastewater treatment plant, was devastating to the biological process normally taking place in the plant. Although the wastewater finally leaving the plant continued to meet the levels of total suspended solids, ammonia, and biochemical oxygen demand that the plant had approval to discharge, the mass of bacteria or biomass needed to treat the wastewater in the plant was dying off quickly. Although the plant biomass wasn't fed for a month, the water exiting the wastewater treatment plant never exceeded the levels of contaminants it was licensed to release. In the first few weeks after the fire, the water coming into the treatment plant in fact was as clean as the water leaving the treatment plant was required to be because there were no toilets contributing to the water entering the plant.

As the four-day time period when Fort McMurray's residents would be coming back to the community approached, it was critically necessary to prepare for this as the wastewater treatment plant would have to handle a rapid increase in wastewater while still fulfilling the legal requirements the plant had to meet.

The expectation of 88,000 people returning to their homes in a short period of time created an urgency and a realization by the plant operators, consultants, and regulators that the return to normal operations would not be easy to achieve. To kickstart the recovery process, two loads of thickened biomass were delivered from the wastewater treatment plant in Red Deer, Alberta, a seven-hour drive away. The first delivery happened a week before the residents returned in order to re-establish biological activity in the treatment plant and confirm the plant's effectiveness. The second delivery was on the day before the first residents arrived home so that it would boost biological activity in the plant in time for the increase in wastewater flowing into the plant.

Throughout all the challenges encountered at the plant, which included the community evacuation, the heavy increase in water passing through the plant, and the residents returning to their homes, the facility was always in compliance with the regulations it is required to meet. Inspections and coordinated repairs were also completed on 13 sewage lift stations and another two wastewater treatment plants in the vicinity of Fort McMurray.

The observations made during the recovery of the various wastewater systems may be of value for future emergency planning. Firstly, the diesel generators that were used to back up lift station operations remained in service all during the emergency. Natural gas generators went out of service because the gas distribution system either failed or was shut down. It is preferable that a service (such as electricity) not be used to provide another service (such as natural gas).

Secondly, trees growing close to a facility pose a great danger as flames in these trees can easily leap onto the roofs. There was only limited fire damage to some of the Fort McMurray facility buildings. However, at some of the facilities, where trees had been allowed to grow really close to the buildings, the flames had no trouble spreading onto the roofs.

The Fort McMurray wildfire event was a catastrophic experience for the community, though the coordinated efforts of all levels of government and the resources which were available to them, provided the support necessary to respond to the emergency.

NTWWA PRESIDENT'S REPORT
ALAN HARRIS

Greetings! How have you all been?

I hope you are staying healthy and safe. I know that during this time you are being bombarded with news about COVID-19 and it's hard to escape. It is everywhere, and it's hard to take your mind off it.

I want to thank all of you for helping to flatten the curve by properly social distancing and being mindful of your own health and others' around you. If you're involved as an essential worker, as I know many of you are, thank you for what you are doing.

Thanks to everyone who joined us in Iqaluit last year for our annual NTWWA Conference, Tradeshow, AGM and Operators' Workshop. We had a good conference, with 94 people in attendance and good participation in the Operators' Workshop. Most who completed evaluations gave it a high rating, and the presentations and information shared, along with networking opportunities, were great. We had a small vendor turnout, but a big thank you to the organizations that did participate.

Thanks to Kurt Stogrin for putting together the Operators Workshop Lab course material and Mike Korpan for presenting it. There were good exercises in testing procedures and proper use of testing equipment. The reason for Water Licence Inspections and sampling requirements was talked about along with differences between some of our communities' raw water sources. Information was provided on Nunavut's move forward on operator training and certification, a positive step forward for the region. Tours arranged in Iqaluit seemed to be enjoyed by all who joined in. We had a look behind the scenes of the Iqaluit Aquatic Centre and the Nunavut Brewing Company. Both are great tours with some interesting information.

Unfortunately, due to the ongoing virus threat and continued travel restrictions, the NTWWA was forced to cancel this year's annual event. Our current board, with the support of the members at the recent virtual AGM, will remain in their board positions until elections can be held next year. Thanks to Rob Osbourne once again, who has been re-appointed as executive director, and to our administrator Pearl Benyk. My thanks to Ken Johnson for continuing to put this journal together. This is currently about our only means of sharing good northern water and waste information. I also want to thank the Government of the Northwest Territories and the Government of Nunavut for their continued support.

The NTWWA is hoping to hold the 2021 event in Yellowknife, where the 2020 event had originally been planned. I hope to see many of you there.

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