

SPECIAL FEATURE

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Time to build an ark? More flooding expected in the future

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As a winter without end finally gives way to warm spring temperatures, rivers choked with ice and swollen with runoff are causing floods in many parts of Canada.

At the beginning of May, parts of Alberta, Quebec, Ontario, British Columbia and, especially, New Brunswick were under water.

As soggy as the situation is now, many regions of Canada are likely to experience more flooding in the future, says Shawna Peddle, director of Partners for Action in the University of Waterloo's Faculty of Environment.

"There are many reasons," said Peddle.

"For example, changing weather patterns and an increase in the number of storm cell events. In addition, there is more and more development and paving-over of formerly empty ground, so there are fewer wetlands to absorb run-off."

On top of that, says Peddle, much of Canada's water infrastructure is old and out of date, and unable to handle the increased water volumes caused by up-stream development.

Although some regions of the U.S., such as the lower Mississippi River valley, and some countries, such as the Netherlands, are more often under water than Canada, flooding is still the number one cause of insurance and personal losses in this country.

"Most people remember such major floods as Winnipeg in 1950 and 1997, and Calgary in 2013, but they might not know that every province experiences flooding each year," said Peddle.

"Some of the floods take place in rural areas where relatively few people are affected, and those events might not make the news."

Although no city or region can

be made 100 per cent flood-proof, the risks of a good soaking can be reduced in a number of ways, says Peddle.

Examples include upgrading water-related infrastructure, updating building codes and encouraging closer inter-jurisdictional cooperation.

"Measures can be taken at all levels," she said. "Everybody has a role to play."

Another measure the country could take to keeping dry is to equip itself with up-to-date flood maps, says Tamsin Lyle, principal engineer at Ebbwater Consulting Inc. in Vancouver.

According to a report of the National Floodplain Mapping Assessment commissioned by Public Safety Canada, the country has mapped the geography of only 28,000 kilometres of waterways.

And although some provinces use once-in-100-years as the flood-risk standard, others use a more conservative once-in-500-years yardstick.

"The risks of flooding in many parts of Canada are growing because the country is growing and people and buildings are being added to vulnerable flood plains every year," said Lyle.

While there are certainly benefits to living in cities that happen to be located on flood plains, there are also costs, and we need to become more conscious of them and take them into account as we build our cities, she says.

"And when we're designing our solutions, we need to consider all of the potential natural disasters that could happen in the area, so that we don't inadvertently worsen the fall-out from another kind of catastrophe," Lyle said.

"We could, for example, put buildings on stilts, to keep them above water in the case of a flood.



GREENSEAS/SHUTTERSTOCK

Parts of New Brunswick are currently flooded this spring, impacting thousands of lives and businesses. Above, the flooding at the Lighthouse River Centre, in Hampton, N.B. Changing weather patterns, increased development and fewer wetlands to absorb run-off are creating more Canadian flooding events and strain on water and sewer infrastructure.

But those buildings could collapse if an earthquake struck."

Dave Murray, a principal and water resource engineer in the Victoria office of consulting engineers Kerr Wood Leidal Associates Ltd., says Canada should look abroad for ideas on flood mitigation.

"We need to study the Netherlands' Room for the River flood plain management program," Murray said.

Keeping their heads above water has been a preoccupation of the Dutch since people started settling on the marshy soil near the North Sea.

Two-third of the Netherlands is below sea level. And the rivers which flow through the country on their way to the ocean overflow regularly.

In 1993 and 1995, severe flooding resulted in mass evacuations and left thousands of acres of farmland under water.

As a result, the Dutch government developed a program that enabled the rivers to safely handle greater volumes of water than in the past.

This was a major shift in Dutch flood mitigation thinking.

Before the 1990's floods, the

Netherlands relied primarily on dikes and berms to keep flood waters at bay.

The Dutch program creates "room for the river" in a number of ways — increasing stream depth, storing water, relocating dikes, creating high water channels, and lowering into the river structures that disrupt water flow.

The program allows land lying along rivers to act as natural water sponges in the event of a flood.

Since it was developed, the Dutch have taken the Room for the River program to other countries, including the Philippines.

Damage from flooding doesn't have to be inevitable: experts

ALEXA TANNER & SCOTT MCKENZIE
SPECIAL TO THE JOC

For the past five years the message has been the same, Alberta, specifically Calgary, needs flood mitigation, and there is no time to spare in taking action before the Bow or Elbow Rivers spill their banks again.

After all, there were only eight years between Calgary's last two "100-year floods," the most recent of which resulted in \$6 billion in damages.

The increasing frequency and severity of flooding in Calgary is alarming. The city is built along two flood-prone river systems, and yet mitigation efforts are reactionary and piecemeal.

This is more than evident with flood events being reported across the country this spring, with hundreds of people ordered to evacuate in New Brunswick, Alberta and British Columbia. In New Brunswick, the flooding has been described as the worst in 80 years.

One way flood mitigation can be addressed is through system-wide regional planning that is shaped by public involvement within a transparent decision process. However, the complex nature of massive public works projects frequently results in inaction. Broader support is needed.

Recent research found that the public's perceptions about the risk of flooding are slowing Calgary's ability to take the steps

it should to lessen the damage from future floods.

What Alberta and the rest of Canada needs is a justifiable decision process backed by increasing awareness of the impacts of climate change.

People's perception of risk impacts their beliefs about flooding and their preferred methods to prevent floods.

For instance, after experiencing a flood event, people's concerns about repeating the experience diminish over time. This makes sense. The motivation to prevent future disasters directly after an event is high, but it decreases as time elapses.

Since personal memories and emotions from large-scale events come and go, many

studies have suggested that if we can change the underlying belief systems that drive people's actions, we would encourage proactive steps to prevent future flooding.

One way to do this is to strengthen people's awareness of the link between climate change and flood risk. Once the public recognizes that extreme weather, including flooding, is scientifically attributed to climate change, subsequent events reinforce this concern and a desire to take mitigation steps.

After the 2013 flooding in Calgary, a survey found people grasped the future risk of flooding in the short-term (five-year), but not for long-term (100-year).

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Maple Ridge sets North American record for sewer pipe bursting technology

JEAN SORENSEN
CORRESPONDENT

Trenchless technology took a major leap forward when a B.C. company and Fraser Valley municipality were recognized internationally for a record-breaking, pipe bursting project that converted a smaller 15-inch sewer line, undersized for a developing area, into a 34-inch line running through an environmentally-sensitive area.

"That kind of upsize had never been achieved in North America," said David O'Sullivan, owner of PW Trenchless Construction Inc., the project contractor, who upsized a 15-inch pipe to 28 inches on four sections but then upgraded the 15-inch line to 34 inches over three sections in the Maple Ridge area.

Technical literature on pipe bursting recommends only going up three sizes or a 33 per cent increase in size, which would have seen the 15-inch pipe replaced with 20-inch. In the 2017 installation, which has attraction attention in both Canada and the U.S., PW Trenchless was able upgrade nine sizes or 127 per cent.

The feat was recognized as one of the four most challenging projects by a member at the North American Society of Trenchless Technology (NASTT) 2018 No-Dig Show held in Palm Springs California in March. Sullivan attended with the City of Maple Ridge's Velimir Stetin, P.Eng., to present on the upsizing. The team carrying out the work consisted of PW Trenchless, City of Maple Ridge as contract administrator, TT Technologies as equipment supplier and ISCO Industries as the supplier of heavy-duty polyethylene pipe.

The challenge facing the city was a burgeoning population in the Albion area and the existing sewer line was operating at capacity; especially critical were 2,456 feet of 15-inch diameter PVC sanitary sewer.

The city's south slope interceptor sanitary sewer traversed the riverfront area of Kanaka Creek Regional Park, a Kanaka Creek and a greenbelt near the Fraser River. The two-kilometre stretch was also known to be in a high-water region. The conditions all combined to make open-cut trenching difficult and not the best solution.

Maple Ridge's Stetin said that if traditional open-cut was used on the project it would have not only cost the city more — an estimated 25 to 35 per cent saving — but disrupted eco-systems in the area.

"It would have been very intrusive — we would have had to take out a whole forest," he said.

"It was really a pilot project as we were not sure we could do it. The city and the contractor both took a risk." The city had, in 2014, used trenchless pipe bursting to upgrade a smaller section of pipe in the region, moving it from 15 to 20 inches.

Stetin said the city has become a regular user of trenchless technology.

"We started in 2005," he said and since then the company has used not just pipe bursting to replace water and sewer lines but also directional drilling (under the main highway to replace a storm pipe) and sliplining (inserting one a liner into a pipe or culvert) and cured in place pipe (CIPP), placing a resin coated liner inside an existing line.

"We do as much as we can," said Stetin, and in some cases, such as major highways that cut through the municipality making it difficult to shut down access, going underground is the only solution.

O'Sullivan said that environmentally sensitive areas are just one application where trenchless technology is proving effective and more municipalities are turning to the tool-box of trenchless technolo-

gies for rehabilitating existing sewer, water, storm-sewer and culverts. Technologies include horizontal directional drilling, pipe bursting, sliplining, cast-in-place pipe, pipe ramming, mini-tunnelling through to large-scale tunnelling as was the case of Metro Vancouver's recent completion of a new water main under the Fraser River.

"It was really a pilot project as we were not sure we could do it. The city and the contractor both took a risk,"

Velimir Stetin
City of Maple Ridge

Yet, O'Sullivan estimates that only 15 per cent of the B.C. water and sewer pipe replacement work today in the Lower Mainland of B.C. is done by trenchless technology although it has the capacity to reduce costs by an estimated 25 per cent to 60 per cent. Municipalities such as Port Coquitlam, New Westminster and Maple Ridge are leading the way with regular technology use, he said, although other municipalities are undertaking smaller projects.

O'Sullivan said that communities are falling behind in their rehabilitation work and with the lower cost and ability to complete projects quicker, trenchless technology can help close that gap. He estimates the asset value of Lower Mainland sewer, water and storm pipes at approximately \$30 billion with a 100-year life and an estimated \$300 million a year should be carried out during an average year. However, municipalities are only replacing \$100 to \$60 million annually, he said.

But, over-all B.C. lags behind its neighbour Alberta. "Alberta is a lot more developed," said Stetin.

Both Alberta and Calgary have embraced trenchless technology with regular rehabilitation programs to upgrade their city infrastructure. CIPP is the majority of work undertaken for municipalities, said George Bontus, director of engineering, for Aegion Corporation, which supplies Insituform® CIPP for rehabilitating sanitary sewers, storm sewers, force mains and potable pressure pipelines throughout North America.

Even smaller municipalities on the Prairies have opted into CIPP realizing the cost-savings achieved over excavating and working in an open cut. "Some of the regional governments have banded together to reduce the cost (of the contractor mobilizing to the area)," he said.

In B.C., Victoria and District of Saanich have both used CIPP.

"Their lines are not that deep," he said, but the roads can be narrow causing traffic congestion over a longer period when using open cut is used for rehabbing pipe. With CIPP a whole block or more can be done in day, said Bontus.

CIPP technology is going beyond what was originally considered feasible in terms of life span, he said. "The first lining was used in 1971 in England and tested after 30 years and found performing better than predicted." The linings are given a 50-year life but even that is being predicted to extend to a 75 year life. The first CIPP was used in Canada was in 1976 in Winnipeg. B.C. followed 10 years later with the first CIPP project in Penticton.

"B.C. is behind the times," agrees director Bob Taylor of Mar-Tech Underground Services (located in the Fraser Valley) and specializes in trenchless technolo-

gies. CIPP work carried out in the Lower Mainland's 28 municipalities does not match what major cities like Edmonton does annually. The fragmentation of the municipal governments in B.C. can mean it is more difficult to gain universal acceptance whereas Edmonton and Calgary are major governing bodies in the region.

"Edmonton does two or three times the amount of CIPP that we see here alone," he said.

Not only can trenchless systems be faster (a block or more a day), but the technology bypasses many of the problems associated with traditional open-cut, such as lessening shoring needs for deeper excavations, trucking soil off site (which can be contaminated) and then trucking fill back, re-routing traffic, and repaving streets. There are also the other utilities underground that can be impacted.

"You would be surprised what is under the asphalt and you are either disrupting it or you have to work around it," Taylor said.

While some of the lag is accredited to a preference of traditional construction methods, Taylor said some of the reluctance also lies with the fact that some

municipalities, such as Vancouver, have their own construction crews. "They do so much in-house," he said, while trenchless relies upon contractors with specialized equipment.

O'Sullivan said another hurdle for trenchless has been the way that municipalities post contracts for work. If municipalities post a contract which outlines an open-cut process, then, it excludes trenchless contractors from bidding.

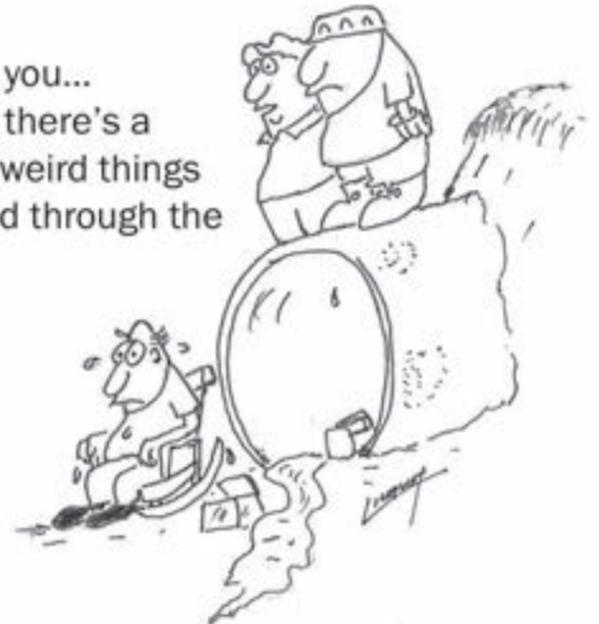
Instead, he said, posting a request for proposal would allow trenchless contractors to propose different technologies that might meet the contract objective. Municipalities, he said, would also be able to compare the financial, environmental and associated costs — such as road life — of a project.

"Every time you dig a road up or a trench in the asphalt of a road and patch it — even if it is done perfectly — you are shortening the life of the asphalt by 15 per cent," he said.

"Now if Fortis or Telus goes in at some point and also digs up the road, then you have just lost 30 per cent of the life of your asset."

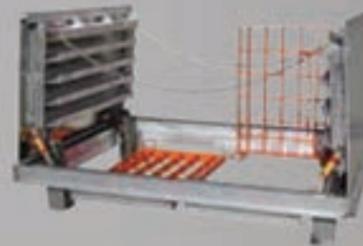
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Winnipeg facing billions in upgrade costs to wastewater treatment systems

JEAN SORENSEN
CORRESPONDENT

The City of Winnipeg is facing almost \$3 billion in needed upgrades and expansions of its wastewater treatment and city collection system as it attempts to deal with end-of-life equipment needs and also meet new provincial standards for emptying wastewater into public water bodies.

"I think mostly it is the provincial regulations which have changed and that is causing us to change how we operate," said city counsellor Brian Mayes, who chairs the environment committee responsible for city's water and waste department.

"But, it is not all the result of regulation, as the North End treatment plant has some equipment that is reaching end-of-life and a couple of hundreds of million dollars of upgrades are needed."

The upgrade cost at the city's North End Wastewater Pollution Control Centre (NEWPCC), which handles 70 per cent of the city's wastewater, is estimated is now at \$1.4 billion, while upgrading the city's storm sewer system is pegged at \$1.3 billion as well. The city is in the midst of an upgrade of its south end wastewater treatment plant at cost of \$335 million.

Duane Griffin, branch head of Winnipeg's water planning and project delivery, said fortunately the city has an extended timeline to accommodate the vast sewer collection system upgrade and it can parcel out the work to meet new regulations.

"We have 27 years," he said. However, Winnipeg is moving forward on its master plan (due for completion in 2019) which involves remedies such as sewer separation. The city is also spending close to \$30 million annually upgrading the lines in city areas.

The North End plant is a different story. Mayes said: "The North End plant is the biggest hot potato — it will be the largest capital expenditure in the history of city of



CITY OF WINNIPEG

Upgrades to Winnipeg's North End Wastewater Pollution Control Centre are estimated at \$1.4 billion.

Winnipeg." It is a project that has been under discussion for the past decade and equipment at the facility is reaching end of life in 2019.

"We are clearly not going to make that," he said as city approval has been given to the concept of upgrading the plant but no actual plan.

Funding remains a problem. "We have set aside \$795 million," said Mayes. "We will be seeking help from both levels of government (provincial and federal)."

There are two other challenges facing the rebuilt, said Mayes. He said the council needs to decide how to go forward on the proposal to upgrade the NEWPCC (doing the end of life replacement only or a complete upgrade). He also wants to see a decision made before the October fall elections which could mean a council change with different priorities. Once a decision is made on how to proceed, Mayes said he expects his committee will approach federal and provincial governments for financial support.

"Later this summer we need to make a decision," he said.

A portion of the NEWPCC rebuild has already started. Jackie Veilleux, the city's project manager for sewage treatment projects, said the upgrade of the North End plant would require more power to facilitate enhanced nutrient extraction. As a result, the city has commissioned a new \$50 million power plant. In February, Black M. McDonald, a construction company that specializes in high voltage construction projects, was awarded the contract as the preferred proponent to design build the power plant upgrade project. The agreed contract was for \$35 million for the two year project.

The upgrade to meet provincial licence requirements will see the NEWPCC remove more nitrogen and phosphate from wastewater material and halt it from entering waterways where it can provide unwanted plant or algae growth. The city has provided an indicative design concept of what it wants in a plant but the contract, when it is let, will be design-build.

Veilleux said the upgrade envisioned by the city would use the Ostara Nutrient Recovery Tech-

nologies system to recover phosphates and turn it into a saleable pelletized fertilizer. She said the city also wants to integrate a thermal hydraulic digester system that will allow end-product sludge material to have reduced pathogens and be usable ground cover on flower beds.

"Almost 80 per cent of the process is going to be brand new," Veilleux said, adding that while end-of-life equipment is being replaced, the ancillary equipment also needs upgrading.

"We are budgeting for a new screening and grit system," she said, adding that once the new equipment is installed there will be more stringent screening required.

Also, a new pump station and greater intake feed required. The plant will also provide for wet weather flow — that short rush of water that occurs annually when winter snow in the city thaws. Unless the city can release water, the system will be overwhelmed, she said.

She said several reports on how the project could proceed and

where it stands financially have been filed with the city's finance committee. One of the considerations is building the project in phases. "That is under review," she said.

While consideration is given to the NEWPCC rebuild, she said her department still has much to keep it busy.

"We have another \$335 million project under construction," she said.

The South End sewage treatment plant, which handles 20 per cent of the city's wastewater, is currently undergoing a major expansion and upgrade. In addition to the odour control stack and the thermal oxidizer unit, a new bio-filter system is being added. Concentrated foul air sources from a new sludge thickening system and new sludge fermenters will be sent to the facility's bio-filter for treatment.

Bio filtration is a biological process that converts odour-causing compounds into non-odorous gases and salts. The biofilter system will be housed in a concrete enclosure. The \$180 million contract for the work went to Morriston, Ont.-based NAC Constructors, the lowest bidder on a job which will prepare the concrete foundations for buildings and infrastructure for equipment to be installed.

A smaller third plant, which takes only 10 per cent of the city's wastewater, has already undergone an upgrade.

The longer upgrade facing the city centres on its combined sewers, which make up approximately 31 per cent of the city's system and are in the older city sections. Normally, water run-off from heavy melts or rain and sewage go through the treatment plants prior to release into public waterways. However, during peak run-off periods which overwhelm the treatment plants' ability, untreated material is discharged into public water bodies.

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