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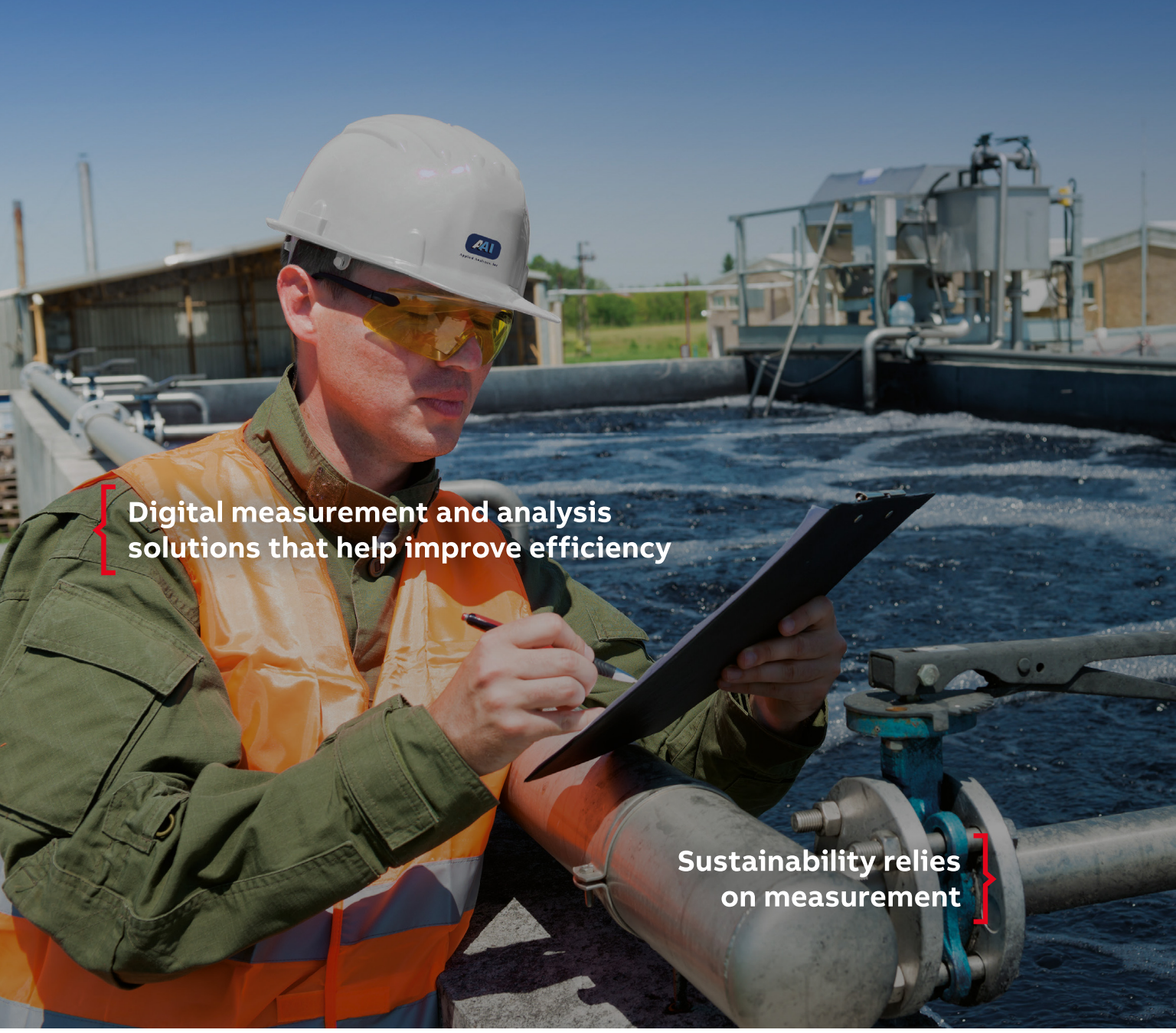

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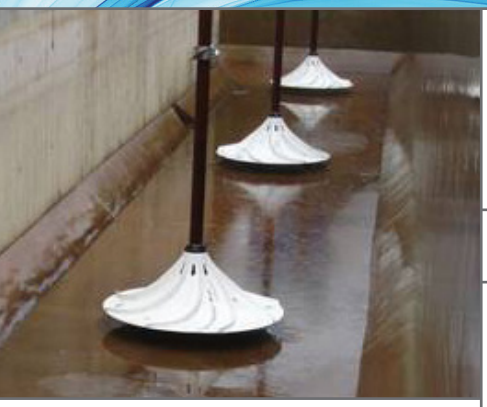

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Canada to welcome the global water treatment industry at ACE23 in Toronto

In 1985, I attended my first AWWA Conference and Expo (ACE) that was held in Washington D.C. While there, I had the honour of meeting Dr Abel Wolman, who at the time was one of the most respected waterworks engineers in the United States.

During his presentation at the opening general session, he said that people needed to relearn their horizons when dealing with developing nations. Dr Wolman felt that the biggest problem in providing drinking water and sanitation to developing countries stemmed from the fact that governments in these countries put these items at number seven or eight on their list of priorities. Their number one concern was poverty.

Thirty years later, in 2015, the world committed to United Nations Sustainable Development Goal 6 (SDG6) which promised that everyone would have safely managed water and sanitation by 2030. It set out the following objectives for joint action:

- Improve the management and quality of water resources, involving communities and including women and girls;
- Ensure that people have access to safe and affordable drinking water and adequate sanitation and hygiene;
- Protect and restore water-related ecosystems.

However, as it stands now, we are seriously off-track to meet this goal in the mere seven years remaining. It is estimated that by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, according to UN-Water.

The developed world is not immune to water issues either, which include drought, dropping aquifer levels, contaminants of emerging concern, and so on. According to a recent article by NPR, millions of Ukrainians have lost access to water services amid the war with Russia due to direct attacks on water treatment facilities, wastewater systems and the opening of the gates at a Russian-controlled hydropower facility on the Kakhovka Reservoir.

This is diverting water away from the storage site and making the future of water supplies in Ukraine even less certain. As a result, 70% of the population of Ukraine, who consume water from reservoirs on the Dnipro River, may be deprived of water, according to Ukraine's Ministry of Environmental Protection and Natural Resources.

So, the water industry has much to do, both here and abroad, and some 10,000 water industry professionals from 80 countries are expected to attend AWWA's ACE23, this June 11 – 15 in Toronto, Ontario.

According to the AWWA, ACE23's professional program was developed by industry experts to provide participants with the latest information on emerging topics and issues critical to water, as well as best practices for those looking to gain knowledge on a specific topic. The event will also showcase innovation and smart technologies in the 450-booth tradeshow.

The ACE23 professional program features 440 presenters addressing key issues such as, intelligent water, water quality and treatment, operator concerns, utility planning and management, utility risk and resilience, wastewater collection, treatment and resource recovery, water conservation and efficiency, water loss control, water reuse and source water protection. A full list of conference presentation topics can be seen at www.awwa.org/ace.

CANADA HOSTS THE WORLD

As co-hosts of ACE23 with the AWWA, the Ontario Water Works Association has prepared a technical stream designed for Canadian utilities at the event. This stream will include 14 sessions, containing three 30-minute presentations.

There will also be an opportunity for Canadian delegates to gather at the Canadian Water Forum, which is organized by the five Canadian sections of the AWWA. This evening of networking and refreshments takes place on June 12 at the Ballroom Social Club in downtown Toronto.

Exemplifying Canadian achievement and excellence at this international event, Dr Hayley Wickenheiser, four-time Canadian Olympic gold medalist and a member of the Hockey Hall of Fame, will deliver the keynote address during the Water Industry Luncheon on June 12. Dr Wickenheiser is considered to be one of the best female hockey players in the world, as well as a community leader, medical doctor, and businesswoman. Today, she is assistant general manager of the Toronto Maple Leafs, and will no doubt inspire the AWWA audience to give their best in everything they do.

ABOUT THE AWWA

The American Water Works Association (AWWA) was founded in 1881, at Engineers' Hall on the campus of Washington University in St. Louis, Missouri, by 22 men representing water utilities in Illinois, Indiana, Iowa, Kansas, Kentucky, and Tennessee.

They adopted a constitution that stated the purpose of the association as being "for the exchange of information pertaining to the management of water-works, for the mutual advancement of consumers and water companies, and for the purpose of securing economy and uniformity in the operations of water-works."

I think the founders would be proud that the association they created 142 years ago is still honouring their original goals, although perhaps at a scale and scope that they did not originally imagine.

ES&E Magazine is proud to be an exhibitor and media partner of the world-class ACE23 event this year. If you are attending the show, we encourage you to check out our advertisers that make ES&E Magazine possible, and stop by our booth (#2805) and say hello. ■

Steve Davey is the editor and publisher of ES&E Magazine. Please email any comments you may have to steve@esemag.com

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Made in USA

Toronto Western Hospital commissions massive wastewater energy transfer project

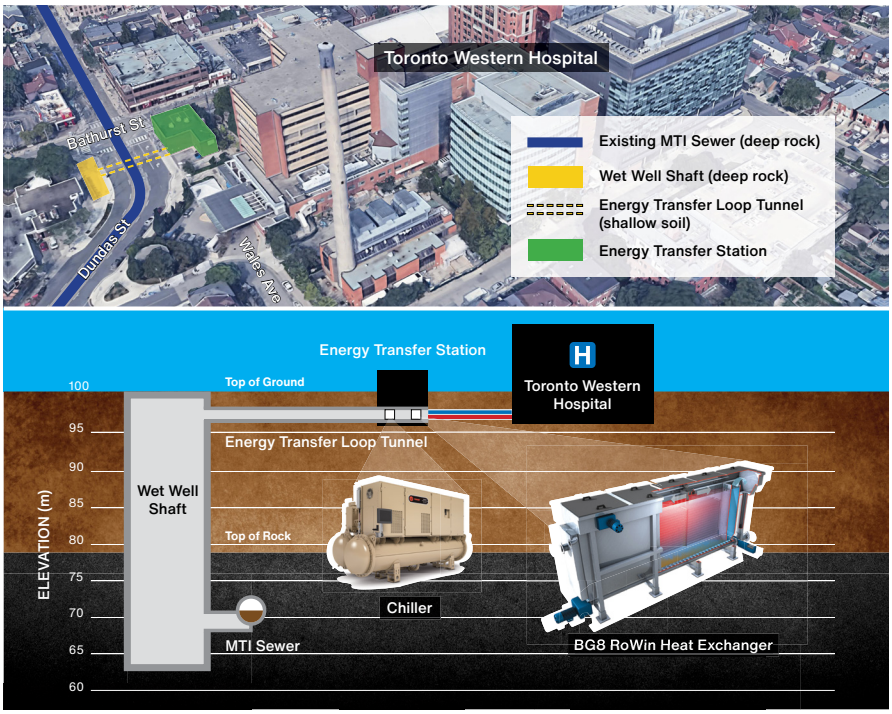
By **Mark Bruder** and **Emily Soscia**

Noventa Energy Partners, Bird Construction, R.V. Anderson Associates Limited, MCW Consultants Ltd., and other project partners on the design-build team are using the HUBER ThermWin® System to design/construct what is believed to be the world's largest raw wastewater energy transfer (WET™) system.

Located in the City of Toronto at the Toronto Western Hospital, this system will transfer energy to and from raw wastewater flowing through the deep rock mid-Toronto interceptor (MTI) sewer tunnel. The project includes the following components:

- Deep rock wet well shaft at the south-east corner of Bathurst Street and Dundas Street;
- Shallow soil energy transfer loop tunnel crossing underneath Dundas Street to the existing Scotiabank Building on the north-east corner of Bathurst Street and Dundas Street;
- Energy transfer station inside the existing Scotiabank Building.

Over the next 30 years, Noventa Energy Partners (Noventa) aims to supply 1.8 billion kilowatt-hours of energy, which is approximately 90% of Toronto Western Hospital's space heating and cooling requirements. This will save over 141 million kilowatt-hours of electricity, 130 million cubic metres of natural gas, 1.3 billion litres of cooling water, and will reduce CO_2 emissions by 250,000 tons.



Project overview. Credit: RVA

EXISTING INFRASTRUCTURE AND FLOWS

Toronto Water and the City of Toronto are both major stakeholders in the Toronto Western Hospital project. Noventa and Toronto Water entered into a "wastewater thermal energy agreement" to permit the transfer of energy to and from raw wastewater flowing through the MTI sewer. Per the agreement, the WET system must minimize the potential for adverse impacts on the proper management, operation, and maintenance of Toronto Water's sewage works. Impacts include, but are not limited to, the buildup of solids or gases, changes in hydraulic grade line, and limiting access to the MTI sewer for regular maintenance.

There are three major west-to-east running interceptor sewers in Toronto. These are the MTI sewer, the high-level interceptor sewer, and the low-level interceptor sewer. The MTI sewer and associated chambers were constructed in the mid-1970s. The MTI sewer conveys combined flow (dry and wet weather) and has a flow capacity estimated at 19,000 L/s. The MTI sewer is located entirely within the shale bedrock.

The proposed wet well shaft will be located in the same place as Toronto Water's existing Vortex Chamber 26 (VC26), which connects to the MTI sewer. VC26 conveys dry and wet weather flow from the Bathurst interconnecting sewer (BIS), which carries flow from a trunk sewer draining south along Bathurst Street.

Currently, when flow enters VC26, it drops into a hopper, travels through a pipe and sluice gate, and then spirals down a vortex drop towards the MTI sewer. The flow then travels through a horizontal connection tunnel (i.e., deaeration tunnel) and finally the flow enters the three-metre diameter MTI sewer.

Per Toronto Water, the BIS has a normal dry weather flow of 80 L/s and a peak wet weather flow of 250 L/s (330

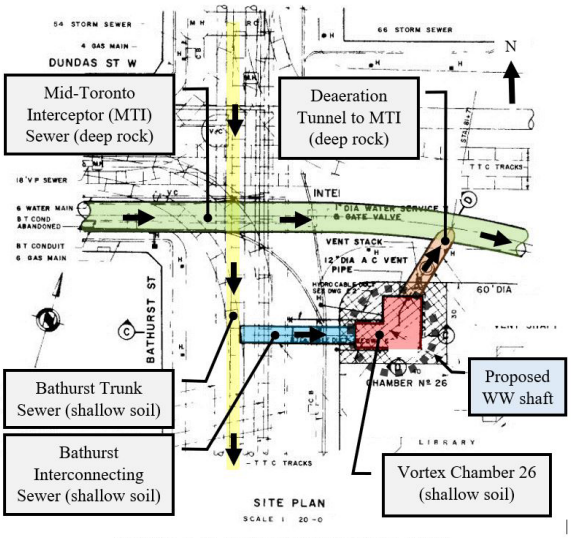


FIGURE 2: PLAN OF VC26 (SOURCE: RVA)

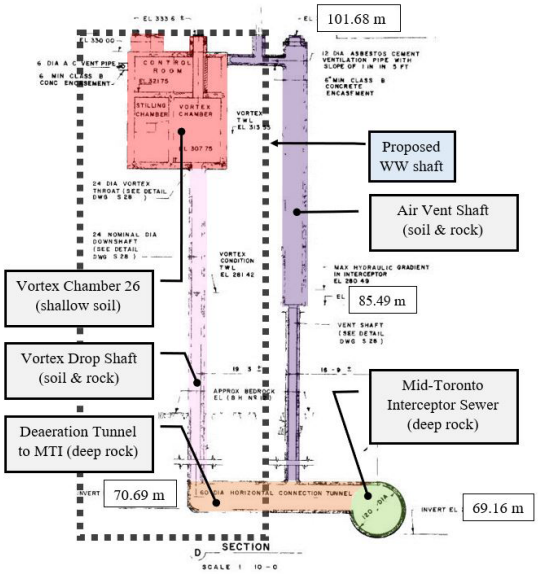


FIGURE 3: SECTION OF VC26 (SOURCE: RVA)

Plan of Vortex Chamber 26 (VC26). Credit: RVA

L/s total flow). Toronto Water also collected flow data of the MTI sewer, one kilometre upstream of VC26, for 2,121 days. Per this flow monitoring data, the average MTI sewer flow appears to be approximately 685 L/s.

OVERVIEW OF THE WET SYSTEM

This project will transfer heat to and from raw wastewater flowing through the MTI sewer. The process does not require permanently adding or removing liquids/solids from the MTI sewer or other sewers in Toronto Water's sewage works. It is intended to be a closed loop that only temporarily redirects liquids/solids to facilitate the energy transfer process.

continued overleaf…

Noventa's current Toronto Western Hospital project aims to use a design flow from the MTI sewer of 522 L/s. For potential future expansion, the wet well (WW) shaft, energy transfer loop (ETL) tunnel, and energy transfer station (ETS) building are designed to convey upwards of 1,200 L/s.

Upstream of the WW shaft, within the deep rock, an opening will be made in the side of the MTI sewer. This opening will allow raw wastewater to be conveyed to the WW shaft via the MTI interception chamber. After screening the raw wastewater of solids, the wastewater will be collected in two cells at the base of the WW shaft and then pumped to the ETS building via forcemains.

Screened-solids will be lifted to the intermediate platform level and then dropped into the deaeration chamber where they will be resuspended prior to being conveyed back to the MTI sewer downstream. The intermediate platform will provide access to various mechanical equipment.

In the ETS building, HUBER RoWin® heat exchangers will transfer energy to and from the screened wastewater as required by the energy demand from Toronto Western Hospital. The screened wastewater will flow back to the WW shaft from the ETS building via a gravity return line. In the top portion of the WW shaft, a consolidation chamber will combine flow from the gravity return line and the BIS.

This combined flow will be conveyed back to the MTI sewer downstream of the WW shaft through a vortex drop structure, a deaeration chamber, and the existing deaeration tunnel. Finally, a flow control chamber with a sluice gate will be installed on the BIS to allow Toronto Water to regulate flows from the BIS into the MTI sewer, similar to the existing VC26.

CONVEYING SCREENED WASTEWATER

This project is being designed to convey upwards of 1,200 L/s of screened wastewater to and from the WW shaft and the ETS building. Submersible pumps will be installed at the base of the WW shaft, forcemains will be installed to lift the screened wastewater to the ETL tunnel, and a gravity return line will convey screened wastewater back to the WW shaft.

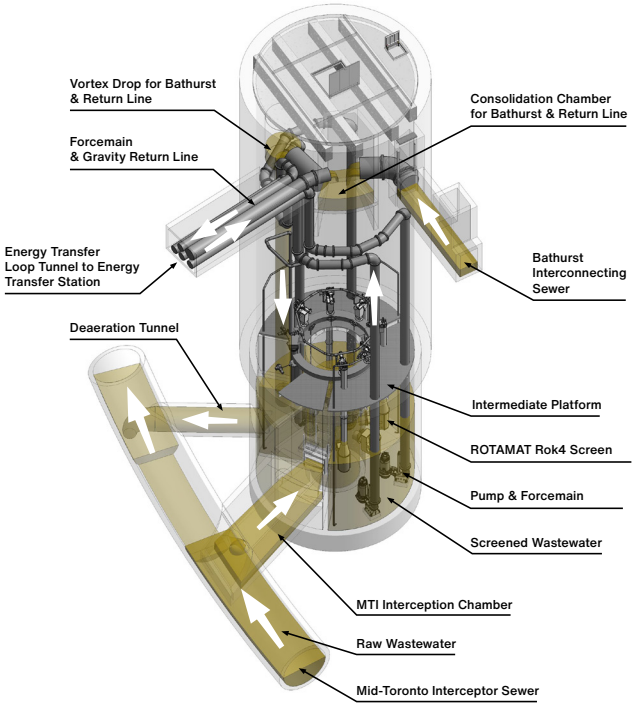
For the first phase, three identical pumps will be used, with each having a target flow rate of 300 L/s and a total dynamic head of 47 metres. Two pumps will be designated as duty and the third will be standby. Each will have a dedicated forcemain to convey screened wastewater to the ETS building.

The target flow rate in each forcemain is between 200 L/s and 300 L/s. This flow rate corresponds to a flow velocity of between 1.5 m/s and 2.5 m/s. The gravity return line will be sloped at 1.5% towards the WW shaft with a target flow velocity less than 3 m/s.

RETURNING SCREENED WASTEWATER AND SOLIDS

This project requires returning screened wastewater/solids to the MTI sewer through the WW shaft. Toronto Water/Noventa required that the design-build team satisfy the following design criteria:

- Consolidate the peak flow from the BIS (330 L/s) and the design gravity return line flow (1,200 L/s) inside the WW shaft for conveyance as a single flow, but be capable of conveying upwards of 1,840 L/s;
- Convey the BIS and gravity return line flow back to the MTI sewer. The reconnection design must have the same general functionality and flow capacity as VC26; and
- Return all solids that are handled by the RoK4 screens to the MTI sewer. Mitigate the accumulation of solids after they exit the RoK4 screen chute. Re-suspend the solids in screened wastewater prior to conveying everything back to the MTI sewer.



Isometric view of the wet well shaft and energy transfer loop tunnel. Credit: RVA

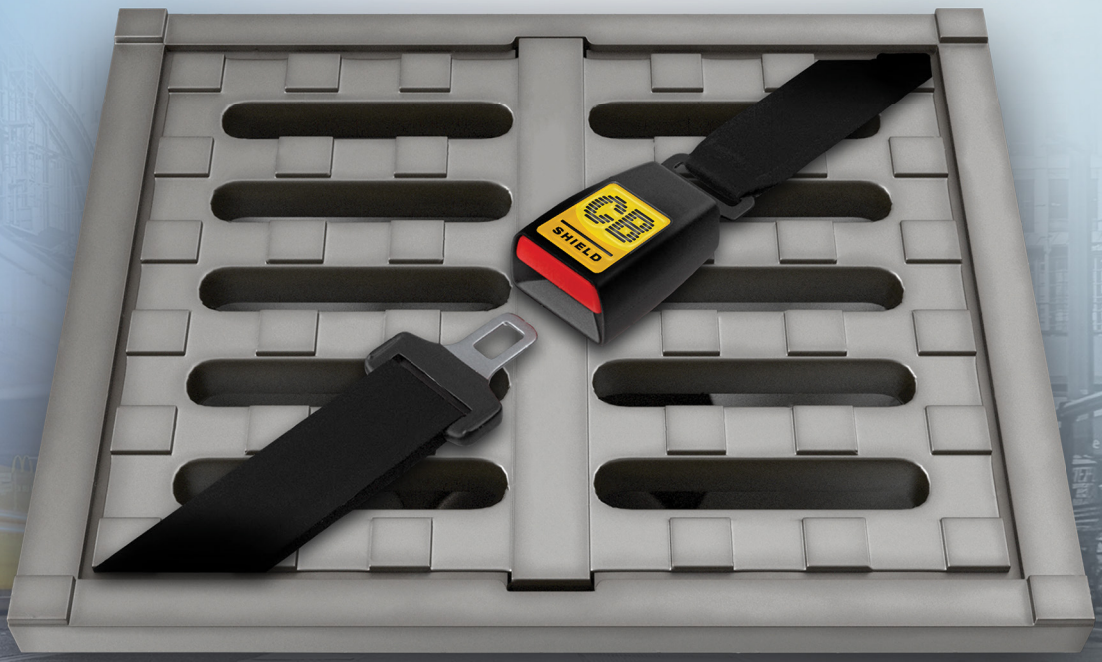
The RoK4 screens consist of a vertical screen basket and a shafted auger in a vertical tube. Raw wastewater flows into the screen basket, which has 6-mm perforations. Wastewater flows through the screen, and solids greater in size than the perforations remain in the basket.

Within the screen basket, the flights of the auger are equipped with a brush. As the solids are gradually elevated by the auger, they are dewatered by gravity drainage. Finally, solids are discharged through a vertical chute at the top of the RoK4 screens. A sloped trough with flushing water will return all solids to the MTI sewer where they will be re-suspended with screened wastewater.

The project's design and construction is progressing well, and the entire system is expected to be operational in early 2024. ■

Mark Bruder and Emily Soscia are with R.V. Anderson Associates Limited. For more information, email: mbruder@rvanderson.com

PROTECT THE DOWNSTREAM



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New study finds small, isolated wetlands adept at catching pollutants

By **ES&E Staff**

University of Waterloo researchers have determined that small, geographically-isolated wetlands make more efficient filters for nitrogen. Credit: IzzetNoyan, stock.adobe.com

University of Waterloo researchers have determined that small, geographically-isolated wetlands make more efficient filters for nitrogen. The new study is one of the first to utilize computer modelling and satellite data to quantify nutrient retention dynamics in wetlands.

Geographically-isolated wetlands are defined as wetlands that are completely surrounded by uplands, lack a persistent surface water connection to navigable streams, and may contain water for only part of the year.

"While the lack of apparent connection to surface waters increases their ability to be most effective as nutrient filters, it is this lack of connection that excludes them from the *Clean Water Act* and makes them most vulnerable to loss," the study says.

"Pollution is a particular concern in regions like southern Ontario, which has already lost more than 70% of its wetlands," says Dr. Nandita Basu, a professor at UWaterloo, Canada Research Chair in Global Water Sustainability and Ecohydrology, and study co-author.

In a 2022 study, UWaterloo estimated that filtration in southern Ontario's wetlands could provide $4.2 billion worth of sediment filtration and phosphorus removal every year. The wetlands not only act like sponges, but provide flooding protection. They retain excess nutrients from agricultural and urban runoff and protect downstream waters. What the study's authors call "transient hydrologic dynamics" can ultimately increase nitrogen retention by as much as 130%.

In particular, the anoxic conditions and high organic carbon content in wetlands promotes the removal of nitrogen through denitrification. "If pollutants aren't caught by small wetlands, then they'll run into our lakes, beaches and eventually impact our supply of drinking water and ability to use the beaches for recreation," Basu said in a statement.

According to the study, the researchers used 30 years of satellite imagery from across the U.S. to determine how 3,700 wetlands were filling up and draining as a function of seasons and climate. Then, they estimated how much nitrogen would be removed by these water bodies.

"Being disconnected can actually be better because they are catching the pollutants and retaining them as opposed to leaking them back to the stream waters," said Dr. Frederick Cheng, first author of the study and a postdoctoral fellow at Colorado State University.

The research team intends to apply these techniques to Canadian wetlands across the Great Lakes basin, as well as the prairie region in Western Canada. That work will be supported in part by a $6.8-million grant from Environment and Climate Change Canada. ■

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New water treatment plant commissioned for Chippewas of Nawash First Nation

By **Anna Comerton**

The Chippewas of Nawash Unceded First Nation is located in Neyaashiinigmiing (Cape Croker) in southern Ontario on Georgian Bay. The on-reserve population is approximately 830 and is projected to grow to approximately 1,400 by 2040.

This community has been on a boil water advisory since 2017. Its existing water treatment plant (WTP), originally commissioned in 1990, has had numerous challenges. As well, the water distribution system experiences extensive leakage. Approximately 60% – 70% of the drinking water is lost from the system. Only three of the 68 hydrants can provide the recommended flow for firefighting.

The Chippewas of Nawash engaged Associated Engineering (AE) in 2020 to complete the detailed design and provide construction administration and warranty support for water system upgrades.

These include a new WTP with a below ground reservoir, a 300-metre intake into Georgian Bay, a new access road and site services (e.g., hydro, phone, internet), and upgrades and expansion of the water distribution system.

The distribution system comprises 14.5 kilometres of new watermain and approximately 275 new or replaced water services. These water system improvements will eliminate the boil water advisory, address the extensive system losses, and meet present and future capacity demands. AE assisted the First Nation in securing the required capital funding from Indigenous Services Canada (ISC), a total of $61 million. To date, this is ISC's largest capital funding commitment for water system upgrades in Ontario.

Shortly after design started in January 2020, the COVID-19 pandemic struck, eliminating in-person meetings and limiting site access as the First Nation was closed to visitors. As such, the intent to have regular in-person design meetings, updates to chief and council, and community open houses had to be reconsidered.

To overcome this challenge, AE took advantage of 3D collaboration software. Revizto, a cloud-based integrated collaboration platform, allowed for virtual 3D walkthroughs for the client during design review meetings. These virtual tours also meant the AE team could visualize the water treatment plant, providing a better understanding of the design.

The WTP's conventional treatment process train was confirmed through a structured triple bottom line and risk evaluation process of several design concepts to identify the preferred alternative in collaboration with the client team and stakeholders.

The WTP's conventional treatment process train was confirmed through a structured triple bottom line and risk evaluation process of several design concepts.

Climate change impacts were also considered in the WTP design. For example, the selected treatment process is robust and able to manage variable water quality, which is expected to be more challenging due to heavier precipitation events, wind conditions, and higher temperatures.

Additionally, the design of the heating, ventilation and cooling systems considered more extreme annual temperature fluctuations and looked for opportunities for energy efficiency.

The new WTP intake into Georgian Bay is being installed via horizontal directional drilling, with the intake pipe exiting from the lake bed approximately 300 metres from shore. This eliminates the need for an open cut excavation to the shoreline and into the bay, and the associated site and environmental disruption.

Equipment was pre-selected and shop drawings pre-purchased for the packaged WTP treatment system and the two pre-fabricated booster pumping stations. This allowed for the vendor specific details to be available during the detailed design stage and reduced the impact of equipment lead time, particularly in consideration of pandemic-related supply chain issues.

Associated Engineering developed separate tender packages for the new water treatment plant and the distribution system upgrades, which were both awarded in the fall of 2021. Construction work under both contracts is expected to be substantially completed by August 2023 and the community's boil water advisory lifted. ■

Anna Comerton is with Associated Engineering. Email: comertona@ae.ca

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There is a strong confluence of factors around rising chemical costs: shortage of truck drivers; increased fuel prices; geo-political risk; rising energy costs; workforce shifts; congested railways; a lack of warehousing space; and, of course, inflation. In February, the Consumer Price Index rose 5.21% year over year. Credit: Zaie, stock.adobe.com

Water treatment chemical costs draining city coffers across Canada

By **David Nesseth**

In the Newfoundland City of Cornerbrook, the Mayor was stunned when he saw the 59% surge in the price of polyaluminum chloride coagulant during the recent tender for the city's water treatment plant's chemical supplies. In an effort to spread the word, he reached out to the local media and shared his astonishment with the community, who he knew would ultimately bear the cost.

On the other side of Canada, in Camrose, Alberta, the city manager is also facing the challenge of restocking their water treatment plant. He recently met with the former Minister of Municipal Affairs to explore possible interventions to cope with rising treatment chemical costs, but a response letter from the province did not appear promising. This year's budget is already set, with materials and supplies costs for the water system up by 51.3% and wastewater system supplies up by 62%.

In Toronto, Ontario, procuring polymers has also become an expensive issue for the city. In the summer of 2022, the city had to revise its contract with SNF Canada Limited, the supplier of water-soluble polyelectrolyte, or polymer, for biosolids dewatering at the city's Ashbridges Bay Treatment Plant. The rising costs of raw materials, coupled with persistent global supply chain issues, resulted in a massive $5.9-million increase.

"Chemicals critical to the proper operation of water and wastewater treatment facilities have seen significant price increases over the past two years," explains Frank Quarisa, director of wastewater treatment for the City of Toronto, who says many chemicals purchased by water and wastewater utilities rely on global supply chains. "This, in many cases, exceeds the inflationary pressures experienced in the global economy and has been exacerbated by a number of global events, including the war in Ukraine."

The pandemic hit hard and fast, causing chaos in supply chains and leaving the chemical industry reeling. Quarisa knows this all too well, as COVID-related shortages led to price hikes. But that was not all. Rising energy costs sent shockwaves throughout the manufacturing and transportation industries, piling onto already sky-high prices, and creating a perfect storm of price pressures.

It is a long list of factors that includes a shortage of truck drivers; increased fuel prices; geo-political risk; workforce shifts; congested railways; a lack of warehousing space; and, of course, inflation.

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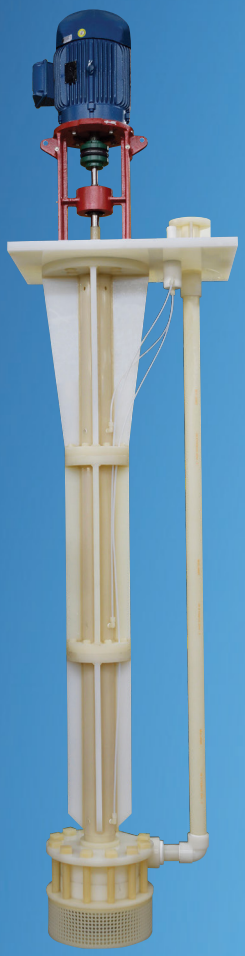

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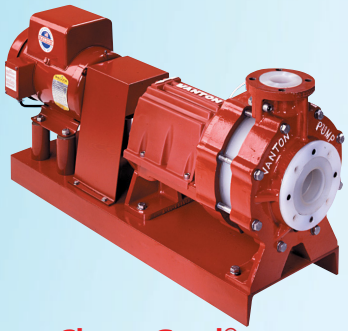

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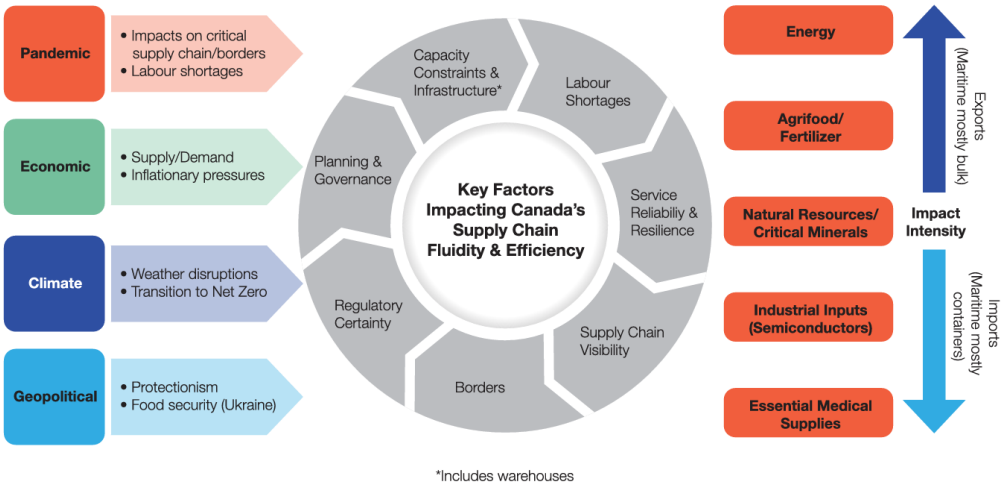

Key factors impacting Canada's supply chain fluidity and efficiency. Credit: Final Report on the National Supply Chain Task Force 2022.

In February of this year, the Consumer Price Index rose 5.2% year over year.

For Toronto Water, recent significant chemical increases have been for sodium hypochlorite, sodium bisulphite and, of course, polymers.

The tension over sodium hypochlorite's price and availability reached a high last year when the U.S. Environmental Protection Agency placed blame on manufacturing facility shutdowns and production limitations by some companies. "These market conditions have extended lead times for suppliers to purchase chlorine products from 14 to 21 days and at times these orders are only partially filled," EPA officials said in a May 2022 statement.

Notably, the EPA also warns that a proposed ban on asbestos diaphragms used to produce chlorine under the *Toxic Substances Control Act,* could impact approximately 30% of domestic chlorine production capacity.

In Salem, Ohio, the municipal Utilities Commission said that Jones Chemical raised its price four times in 2022 for its chlorine contract, going from the original bid of $550 per ton to the current price of $1,600 per ton: a 190% increase.

Back in Newfoundland, Mayor Jim Parsons of Corner Brook knows firsthand the struggle of dealing with skyrocketing chemical costs. When it came time to restock his water treatment plant with polyaluminum chloride coagulant, council documents show he was stunned to see that the contract jumped from almost $479,000 to over $763,000. The city agreed to a two-year deal with Kemira Water Solutions Canada Inc., for 550 tonnes at a unit price of $1.207 LMT.

Mayor Parsons is determined to tackle the challenge of rising costs head-on, with the city ramping up efforts to detect leaks throughout the system and reduce costs wherever possible. Officials are also exploring every avenue to cut down on consumption, which they say has been alarmingly high given Corner Brook's small population. In fact, it has soared to nearly twice the Canadian water use average of 427 litres per day in recent years.

> **"Many municipal governments are paying 40% to 60% more this year for polymers and chlorine products.**

For corrosion control, Corner Brook paid 40% more this year for 12,000 kilograms of zinc orthophosphate, at a unit price of $8.37 per kg. For soda ash, it paid 45% more to Quadra Chemicals over two years for 100 tonnes at a unit price of $1,460.

According to Quarisa, Toronto Water has been working closely with its suppliers to manage the impacts of rising chemical costs, as well as spikes in the cost of equipment and parts. This is a challenge, particularly if the items are imported from abroad, and are manufactured with stainless steel. Quarisa also says city staff are reviewing operational and maintenance practices as well as existing contracts to identify potential efficiencies and cost savings.

"The city also is in contact with other local municipalities to share market intelligence and anticipate any further market pressures," he says, noting that he is pleased with the 2023 Toronto Water rate increase being limited to 3%.

In Camrose, where the city is finalizing contracts for its new batch of water treatment chemicals, residents will be asked to pay an additional $6.84 per month this year for water and wastewater services. The municipality is currently in the process of a major wastewater treatment upgrade. By 2024, budget projections show that supply costs for the facility are expected to increase by 119%. ■

David Nesseth is a writer for ES&E Magazine. Email: editor@esemag.com

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Canada's new GHG reporting requirements take effect under two-year cycle

By **ES&E Staff**

Following consultation last summer, the federal government has considered stakeholder feedback and now enacted several key changes under the reporting requirements for its Greenhouse Gas Program.

Environment and Climate Change Canada (ECCC) will now cover two calendar years (2022-2023) for the greenhouse gas (GHG) reporting required from facilities that emit 10,000 tonnes or more of GHGs in carbon dioxide equivalent units per year.

ECCC also wants to publish emission totals by gas and by source category per facility. While some companies expressed issues over confidentiality, or revealing proprietary information, the department responded that concerns "will be addressed through maintaining the ability for facilities to request confidentiality."

Requests will need to include "sufficient and explicit justification," stated ECCC. "The intention is to increase transparency and support the use of the data in the National GHG Inventory as well as to publish more detailed facility data."

Additionally, there will no longer be an option for facilities to submit provincial reports in lieu of reporting federal expanded data. Allowing the provincial reports "led to incomplete and inconsistent data, as well as significant delays due to the required follow up with facilities," ECCC stated in its consultation response. Consistency in the data reported by facilities located across jurisdictions is important for comparability and a key goal of the program expansion, the department added.

Perhaps one of the most significant changes for most facilities will be updates to the quantification methods for calculating emissions, such as methane emissions from industrial wastewater. There is also an update to one of the methodologies prescribed for calculating CO_2 emissions from the combustion of natural gas.

For ammonia and hydrogen, as well as nitric acid production, there are changes to the reporting and quantification of emissions. The changes now

require reporting per nitric acid train. For ammonia and hydrogen, the current reporting requirements require facilities to deduct the appropriate values for recovered quantities of CO_2 from calculated gross emissions and report the amount for net emissions.

The government has moved toward reporting of both parameters so that the net emissions do not have to be calculated and reported by the facility, "as this has caused some confusion in the past," stated the consultation response. "Net emissions will instead be automatically calculated in the system using the other reported amounts."

ECCC has also updated global warming potential values used under the GHG reporting program to reflect updated values adopted for use under the United Nations Framework Convention on Climate Change's intergovernmental AR5 panel report.

This article is intended to be a preview of the legislation and not a replacement for the actual guidance from the government. For comprehensive data and all relevant information, please contact the organizations mentioned above.

Environment and Climate Change Canada will now cover two calendar years for the greenhouse gas reporting required from facilities that emit 10,000 tonnes or more of GHGs in carbon dioxide equivalent units per year. Credit: alpegor,stock.adobe.com

For more information, email: editor@esemag.com

Contaminated soil tracking system takes effect in Quebec

By **ES&E Staff**

Keeping tabs on project-site contaminated soil in Quebec is now mandatory under the Traces Quebec system. To comply with regulations and track all movements of the some 3 million metric tonnes of contaminated soil excavated in the province each year, businesses or project managers must create an account with Attestra to report through its web portal.

As of 2023, registration with Traces Quebec is mandatory for all stakeholders covered by the provincial regulation respecting the traceability of excavated contaminated soil. Fees per metric tonne for the custody of the soil are applicable under the regulation's fee structure. Fees of $2 per tonne now apply to any quantity of contaminated soil.

The program has been phased in since 2021 and gradually lowered the thresholds to trigger fees. Initially, Traces only charged projects that transported 5,000 metric tonnes from its land of origin. A year later that was lowered to 1,000 metric tonnes. The intent initially was to only target large-scale construction sites where "the risk of illegal management was high," stated Quebec Environment officials.

The on-site manager can use a tracking slip to enter the soil information into the Traces online system. Credit: Artinun, stock.adobe.com

The program is designed to discourage illegal dumping and counteract potential spills of contaminated soil.

The on-site manager can use a tracking slip to enter soil information into the Traces online system. The soil can then be weighed and transported to an authorized receiving location, treatment centre, burial or reclamation site, which will also file into the Traces system to accept the load. The soil's location is tracked through GPS monitoring to ensure proper transport. A final traceability report is then generated by the system.

"The method of management and the place of destination of excavated contaminated soil are mainly determined by its level of contamination," states the province's good practices guide. "As soon as soil is identified as contaminated and the contamination is quantified, its management must be prepared by choosing service providers for excavation, transport and reception."

Carriers of contaminated soil must be members of the Quebec Trucking Association or the National Association of Artisan Truckers Inc. Upon arrival, the potential contaminants and minimum and maximum concentrations of the load must also be recorded.

Article 16 of the Quebec regulation aims to create some separation between the party which owns the soil and the process of reporting and transporting the soil. Essentially, the regulation is creating accountability beyond a single party to avoid any fraudulent management or practice around the soil.

The new Quebec process is similar to the soil registry system developed in Ontario, spearheaded by the Resource Productivity and Recovery Authority. ■

This article is intended to be a preview of the legislation and not a replacement for the actual guidance from the government. For comprehensive data and all relevant information, please contact the organizations mentioned above.

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Peterborough WWTP developing a comprehensive optimization strategy

By **Daryl Stevenson**, **Mack Pardy**, **Alex Webb** and **John Devlin**

The City of Peterborough's wastewater treatment plant (WWTP) receives around 38 MLD, and serves a population of around 80,000. Primarily, it treats domestic wastewater, but in the summer months, there is an influx of cottage property septage brought to the plant's receiving station.

In conjunction with SENTRY Water Monitoring and Controls Inc. and Aquafy Water Technologies Inc., the city worked to understand the impact of high-strength side streams (centrate and septage) and influent monitoring.

After initial success, the teams collaborated to develop a comprehensive optimization strategy, using SENTRY's monitoring technology in conjunction with other technologies to make the Peterborough WWTP one of Ontario's leading facilities in efficient, high-quality treatment.

INITIAL FINDINGS AND DEPLOYMENT

The sensors monitoring the influent signal were able to quickly track the diurnal pattern for the facility, identifying off-peak versus on-peak organic strength. This gave the operations team detailed insight into their loading dynamics. It also helped identify optimal times to treat the centrate (during periods of low influent strength) with the goal of reducing strain on the aeration basins.

SENTRY identified an unexpected dilution event caused by the septage receiving flushing system. The SENTRY sensor quickly caught the event on the dashboard and alerted users of this change. The sensor was also able to quantify the dilution impact caused by spring snow melt and excess run-off diluting the organic content entering the facility.

During another event caused by an industrial discharger, the operations team noticed that the clarifier had turned completely blue. While the initial reaction was to ramp up aeration, the SENTRY signal indicated that the blue colouring was not impacting biological activity.

This meant that the colouring was not accompanied by what they assumed would be a potent load of biochemical oxygen demand (BOD) or toxicity. Staff could confidently operate the plant as normal, and save on both electricity and chemical costs. As well, they could focus operational efforts on priorities, instead of a prolonged campaign of sampling and treatment adjustments to address the blue colouring incident.

During an event caused by an industrial discharger, the clarifier turned completely blue. Data from the SENTRY sensor indicated that the blue colouring was in fact not impacting biological activity, thereby giving staff confidence and the knowledge to operate the plant as normal.

RESULTS AND VALUE

At the Peterborough WWTP, estimated yearly savings in the range of $100,000 to $160,000 are possible when the SENTRY data is used effectively to avoid upsets and fine tune operations based on changing influent conditions. The initial findings gave the city confidence in the SENTRY platform as one of the primary tools in its overall system optimization.

"I know the plant is protected because SENTRY's sensors have shown a clear picture of what is coming into our plant and helped us avoid costs and worry with certain conditions that don't affect treatment", says Daryl Stevenson, water and wastewater operations manager with the City of Peterborough, and a co-author of this article.

NEXT STEPS

Peterborough and SENTRY will use the sensor data to evaluate dissolved oxygen efficiency for potential aeration optimization improvements. This, coupled with their sampling data, will provide more insight into the SENTRY signal's relationship with traditional measures of organic matter, such as BOD, at this facility. This can provide additional information to guide operations control and effectiveness for the on-site team. ■

Daryl Stevenson is with the City of Peterborough, Mack Pardy and Alex Webb are with SENTRY Water Monitoring and Controls Inc., and John Devlin is with Aquafy Water Technologies Inc. For more information, email: mpardy@sentrywatertech.com, awebb@sentrywatertech.com, john.devlin@aquafy-wt.com

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MBBR used to reduce ammonia in poultry facility wastewater lagoon

By **Joseph Chaffee**

Whitewater Processing, an organic turkey processing plant has been a family-owned and operated facility since the 1930s. The future of this family-owned facility became questionable in the 1990s, when regulators challenged the outdated treatment system that had been treating the facility's wastewater.

The unlined lagoon plant had been approved in the 1970s, but there was concern about the effectiveness of the unlined lagoons. The facility had been processing between 6,000 and 8,000 turkeys each day, which resulted in roughly 550,000 litres per day of wastewater going to the lagoons.

Whitewater Processing reached out to earthTek, a wastewater treatment plant design and supply company, for guidance on improvements or replacement of the current plant, so that they could meet the more stringent current limits for discharge.

Initially, regulators suggested that the turkey processing plant hook up to the nearby municipal sewer system. However, the municipal treatment plant did not have the hydraulic or organic loading capacity to treat this wastewater. Normal strength wastewater contains a biological oxygen demand (BOD) of about 200 mg/l, while the turkey processing plant was producing BOD of about 800 mg/l, with elevated levels of fats, oils and grease (FOG).

While evaluating options on how to save the lagoon plant with a cost-effective treatment solution, Kevin Chaffee of earthTek found some research published by Karen Mancl, a researcher with the Ohio Agricultural Research and Development Center. He contacted her and described the situation and potential application to Mancl's previous work. Mancl decided to visit the plant to see if she could help come up with a solution.

The facility's MBBR process consisted of an insulated aboveground tank, with a 65% fill ratio of polyethylene, free-flowing MBBR media.

Mancl had recently completed a new study on an on-site bioreactor system that treated high-strength wastewater from a cheesemaking facility. "In that research, we showed that bioreactors could be used to treat wastewater with a high content of butterfat," Mancl said.

Whitewater Processing agreed to fund two years of lab studies using a bioreactor. "First, we demonstrated that it is, in fact, feasible to treat turkey processing wastewater with a sand/gravel bioreactor. The next phase was to optimize the design, so the bioreactor would be as small as possible, while producing as high-quality effluent as possible. The third phase was to operate the bioreactors in the lab for three years to make sure they would not clog, and to test new materials to pretreat the waste before it enters the bioreactor," stated Mancl.

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Upon completion of research, it was determined that Whitewater's wastewater would require a loading rate not to exceed 5.7 litres of wastewater per 0.1 square metre of bioreactor surface area per day. Unfortunately for Whitewater, this required a large footprint for the wastewater treatment plant. However, it also meant clean water, and that the processing plant could continue operations.

earthTek then designed and helped build an actual small footprint pilot plant adjacent to the facility to test the actual loading rate and mechanical design. This pilot plant was started up in the winter during very cold conditions. During initial testing, the incoming BOD had been measured at 830 mg/l, but effluent only had a BOD level of 3 mg/l.

The pilot plant operated for about a year or so and validated the treatment process and design media loading rate. The effluent quality was very good, so Whitewater Processing decided to move forward and build a full-scale wastewater treatment plant using the bioreactor technology.

The turkey processing plant produced 550,000 litres per day of wastewater, with BOD of about 800 mg/l, and elevated levels of fats, oils and grease.

The plant operated very well over several years, and kept Whitewater well within limits. It wasn't until years later, when more stringent ammonia limits were mandated, that another cause for concern was created.

Generally, the system worked well with very low BOD and TSS concentrations, but the lower ammonia limits started causing problems in the winter when colder temperatures arrived. The bioreactor beds were open to the elements and, over time, the temperatures in the beds dropped, especially during long cold spells.

During the summer months, ammonia was reduced by nitrification in the aerobic packed bed filter, but during cold weather the nitrification process slows down as the nitrifying bacteria become less active.

So, Whitewater Processing reached out again to earthTek to evaluate options for more consistent year-round ammonia reduction. During review of the available options, it was determined that a moving bed biofilm reactor (MBBR)

process could be installed after the bioreactor process to reduce the ammonia to acceptable levels.

This would provide more consistent and cost-effective ammonia reduction, even with the lower water temperatures. earthTek provided a design and modelled the design using BioWin wastewater treatment plant modelling software. The modelling results reported that the proposed system would reduce ammonia levels well below the permitted values while also keeping BOD and TSS levels well below the permit limits.

The MBBR treatment process consists of a 342,000-litre insulated and glass-lined aboveground steel tank installed downstream of the bioreactor and upstream of the plant's UV disinfection process. This tank was designed with a 65% fill ratio of polyethylene, free-flowing MBBR media.

MBBR media is neutrally buoyant and is mixed by a coarse bubble diffused air supply. Air is supplied by two 30 HP positive displacement blowers with one blower being active and the other as standby. The blowers alternate weekly and are controlled by variable frequency drives (VFD), which allows the operator to vary the air flow to the tank as needed.

Air travels from the blowers through stainless-steel piping into the tank, where it is diffused by stainless steel, coarse bubble diffusers mounted near the floor of the tank. Stainless-steel outlet screens and influent check valves were installed to prevent any media from leaving the tank.

Water collected from the bioreactor enters an existing plant pump station that feeds the plant effluent to the MBBR tank. From the MBBR tank, the effluent travels to the UV disinfection. The MBBR tank can be bypassed using valves and bypass piping if needed.

While testing for ammonia during the first full winter of operation, test results regularly came back as non-detect, while requiring little maintenance or operational control of the MBBR process.

Whitewater Processing continues to operate the MBBR system year-round with minimal air required during the summer due to the excellent ammonia reduction, and is currently in compliance with all effluent discharge limits. The efforts of all those involved have helped to keep this family-operated plant in business for current and future generations. ■

Joseph Chaffee is with earthTek. Email: joe@packageplants.com

Correction Notice

In the February 2023 issue of ES&E Magazine, there was an error in the email address for the author of *"Understanding the impacts of FOGs on wastewater systems"* (p12). The correct email address is d.mandoza@kurita-water.com.

Free chlorine and why it matters for adequate disinfection

By **Jean Hendrickson**

For over a century, chlorine has been used to provide clean and safe drinking water. In correct doses, it can kill a wide range of pathogens, while remaining safe for people and animals to consume. Dosage is key, as too little chlorine will not have the disinfecting power required to eliminate the most critical pathogens. Too much can cause water to taste and/or smell unappealing, or worse, have long-term negative impacts.

This is why measuring chlorine levels in drinking water before it leaves the water treatment plant (WTP) is important. But measuring chlorine is not a simple matter of saying, "I have X parts per million in my water." After all, once chlorine enters water, it begins to change, and when it interacts with pathogens and other matter, it changes again.

As such, operators and water quality managers need to know at any given moment the levels of free, combined, and total chlorine in their system. Understanding these metrics and their role is the foundation of providing clean and safe drinking water.

HOW CHLORINE WORKS

In water, chlorine breaks down into smaller chemicals such as hypochlorite ion and hypochlorous acid. It is these substances that kill bacteria, viruses, and other microorganisms. They do this by either collapsing proteins in bacterial cells, or damaging the outer membrane of viruses and similar pathogens.

Not every pathogen is equally vulnerable to chlorine, however. Protozoa such as *Giardia lamblia* and *Cryptosporidium* are chlorine-resistant. Thankfully, such pathogens are large and can be easily removed by filtration.

Free chlorine is the amount that is available to combine or oxidize contaminants in water. The greater the amount of free chlorine, the greater the disinfection potential. In a drinking water system, the amount of free chlorine should generally be kept between 2 ppm and 4 ppm.

When free chlorine levels rise above 4 ppm, the water may take on a strong "swimming pool" smell or taste, which can lead to upset customers. However, too little chlorine means there may not be enough chlorine available to disinfect pathogens, especially for those customers who are farthest downstream from the plant.

When hypochlorite ions and hypochlorous acid interact with contaminants, they form new compounds, which are no longer available for disinfection. The amount of combined chlorine tells operators how many pathogens or other contaminants have been using chlorine, which helps to understand how dirty the water is, or was.

Of course, not all combined chlorine chemicals are inert. When chlorine combines with nitrogen, it can form chloramines. These compounds do have some disinfection power, but they are not likely present in high enough quantities to be considered in disinfection potential. That is unless operators deliberately added ammonia to the system with the intent of forming chloramines.

Other types of combined chlorine include disinfection byproducts (DBPs), such as trihalomethane and haloacetic acid. These substances occur when chlorine reacts with natural organic matter in the water. DBPs can be harmful to human health and are regulated. Operators should be testing for DBPs separately from other types of combined chlorine.

Total chlorine is the amount of both combined chlorine and free chlorine. It is the easiest to measure and can be done with simple test strips.

Out of the three measurements, free chlorine is the most critical figure to have. Operators do not need to worry about having all three figures, as being able to measure free and total chlorine gives a reasonable estimate of the amount of combined chlorine in the system.

HOW TO MEASURE CHLORINE

There are many ways to measure free and total chlorine in a WTP. Operators can pull a sample and use either

test strips or hand analyzers. However, these consume a lot of operator time and can have questionable accuracy.

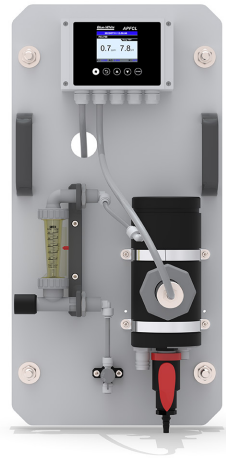
Blue-White's water analyzers can measure chlorine simply and accurately. The APFCL Online Chlorine + pH Analyzer measures free chlorine, pH, and temperature. The APH2O Multi Parameter Online Analyzer measures free chlorine, pH, temperature, and ultra-low turbidity.

Both analyzers can help operators maintain the balance of having enough free chlorine in the water distribution system to battle dangerous pathogens, but not so much that it ruins the taste and smell of the water. They continuously test the water for chlorine levels and can alert operators when free chlorine drops below a pre-set threshold.

It is important to consider water quality analyzers that use electrodes rather than membranes. Membranes tend to absorb impurities during operation, which can build up and cause fouling. Electrode-based analyzers do not suffer this setback and can be more easily cleaned.

Blue-White's analyzers have a unique Bare-Gold electrode technology for residual chlorine measurement. It eliminates membrane and electrode solution replenishment commonly associated with conventional sensors. The flat bubble pH electrode is designed to reduce fouling potential.

Blue-White's water analyzers are shipped board-mounted with handles included for easy installation and quick startup. The TS10 Display is an LCD colour industrial capacitive touch screen. Each analyzer has built-in 4GB of RAM/1 million data records. ■



Water quality analyzers, such as the APFCL Online Chlorine + pH Analyzer, that can be installed inline or on a side stream save time and provide greater accuracy than pulling samples to test for chlorine.

Jean Hendrickson is with Blue-White. For more information, visit: www.blue-white.com

Hamilton tackles invasive species to keep stormwater flowing

By **Amanda Wong** and **Dave Alberton**

The City of Hamilton, Ontario, is intersected by the Niagara Escarpment, producing hundreds of kilometres of natural watercourses. Hamilton Water manages roughly 148 km of these watercourses that flow into Lake Ontario and Lake Erie.

To mitigate the impacts of development on natural watercourses, the city has approximately 130 stormwater management facilities (SWMFs) that detain runoff and release water at a pace that tries to mimic the undisturbed natural forested landscape. These include wet ponds, wetlands, dry ponds, and low impact development (LID) end-of-pipe systems.

SWMFs in newly developed subdivisions help protect watercourses by reducing flooding and erosion. They also improve water quality by allowing sediment and pollutants to settle at the bottom of the pond before flowing into creeks. Keeping these facilities unobstructed to do their job is paramount to maintaining safe water management for both people and the environment.

In 2020, Hamilton Water documented that approximately 60 of its SWMFs were being infested by Phragmites, or European Common Reed *(Phragmites australis)*, a very invasive perennial grass. Phragmites can grow to five metres tall and can have very dense stands of 200 stems per square metre.

All this growth can clog inlet and outlet drainage channels and out-compete the more favorable native plant species that were planted in the facility. Sediment also gets trapped in these stands, which then reduces the water capacity of the pond, increasing the potential for flooding during a rainstorm.

Don Young, water distribution and wastewater collection superintendent for Hamilton Water, said, "stormwater ponds can provide ideal conditions for this invasive species as Phragmites is often the first species to colonize exposed soils, preferring disturbed lands, and being very opportunistic in their spread."

The City of Hamilton is not alone in dealing with the invasion of Phragmites. This is a province-wide problem that the Ontario government is working hard to address.

Originally from Eurasia, Phragmites were brought over to be sold as ornamental grasses. They spread voraciously with several modes of reproduction, including the dispersal of seeds, through rhizomes in the roots, and through fragments of roots that break off from the plant.

The plant produces thousands of seeds annually that can be transported by wind, drop into waterways and flow downstream, attach to animals, or even get stuck onto vehicles or machinery that then spread it to other locations. Its roots and rhizomes actively secrete toxins into the soil, impeding or even killing the growth of neighbouring plant species.

Article co-author Amanda Wong retrieves a goldfish from a stormwater pond. Goldfish are non-native species that can reproduce rapidly and are bottom feeders. As a result, they stir up sediment in stormwater management facilities, causing water quality issues.

Phragmites rhizomes can grow several metres horizontally every year, and any fragments of the stolons (or ground runners) can produce new plants, meaning that cutting the plant down does not stop it from growing, and may even encourage new growth. Stolons are so hardy that studies have shown that after a prescribed burn with fire, rhizomes still spread and sometimes even faster. The most effective solution to rid Hamilton's SWMFs of this invasive species is through herbicide spraying.

THE START OF A FOUR-YEAR ERADICATION PROGRAM

In August 2020, the city treated 53 SWMFs by rolling and spraying with the herbicide WeatherMax (glyphosate). The practice of rolling effectively flattens the plant before spray-

ing, which was thought to increase the effectiveness of the herbicide application. This also gave the benefit of clearly seeing the extent of the infestation.

The herbicide used is the first choice of the Ontario Invasive Plant Council (OIPC) and the Ministry of Natural Resources and Forestry (MNRF) for use in sensitive natural environments.

However, glyphosate is not able to be used on plants that are over water, so the water in SWMFs needed to be pumped out before the application, which was costly and time consuming. After waiting approximately 35 days after spraying, to allow the herbicide to work and reach the roots, the dead Phragmites stands were removed.

"The 2020 treatment was effective, as re-growth in the following year was significantly reduced in most of the locations," said Young. "We estimate that in some stands, we achieved 100% eradication and averaged higher than 50% die-off overall."

continued overleaf…

A dense stand of invasive Phragmites in April 2020 in Stoney Creek prior to treatment.

EVOLVING BEST PRACTICES ACCELERATED ERADICATION

In 2021, the city eliminated rolling after a review of a newly issued best management practice document put out by the OIPC (2020), which indicated that rolling and breaking the stalks was not beneficial. Rolling breaks the live plant stems, preventing the intact stalk's photosynthetic flow paths from carrying the pesticide's active ingredients from the top of the plants into the roots. This kills the roots as well as the stalks.

Leaving the stands intact also prevented dying and brittle stalks from breaking off, washing downstream and clogging drains if a heavy summer rainfall were to occur during the days between spraying and removal.

Also in 2021, a new herbicide, Habitat Aqua (imazapyr), was approved in Canada for use over water, so pumping of water prior to spraying was no longer necessary. The City also streamlined the removal process by not removing the stands that were less dense or more importantly, not causing an issue of displacing permanent pool volume for flood mitigation.

"The new approach maintains best management practices and significantly reduces the cost of Phragmites management. Density and height were considerably reduced after the new treatment practices in 2021," said Young.

Glyphosate was still used on a total of 65 terrestrial sites, covering 32,000 m² and the Habitat Aqua was used on 40 sites covering 38,222 m².

Young added: "We have tracked all our spraying with ArcGIS Field Maps and have mapped each stand with density and height estimates; this enables us to assess the results of our treatment practices with real quantitative data every year."

In addition to Phragmites, the city also targets other invasive or noxious plant species, including Japanese knotweed, poison ivy and wild parsnip.

The Hamilton stormwater team is also working on another invasive species that is causing problems in Hamilton's SWMFs: goldfish. "We can't say for sure how they got into our stormwater catchment facilities, but it is likely that people freed their pet goldfish into the ponds, not knowing the consequences of non-native fish on the local environment," said Young.

After a second treatment with Habitat Aqua, regrowth in year three is minimal, and flow has returned. The creek bank is already being naturally restored.

As a generalist species, goldfish can tolerate a wide range of habitat conditions, meaning they can out-compete native species for resources, as well as eat their eggs or young. Goldfish reproduce rapidly and are bottom feeders, so they stir up sediment causing water quality issues.

This is the opposite goal of a stormwater management pond, which is designed to reduce turbidity and release cleaner water into the downstream watercourses.

A study conducted by Lake Simcoe Region Conservation Authority on stormwater pond performance found that ponds that have goldfish are more likely to have an increase in phosphorus levels. This can lead to an increase in algae growth, which can choke up pipes, inlets and outlets, requiring crews to perform more extensive maintenance.

Young said: "once goldfish are in a pond, they will continue to grow and reproduce to the limits of the pond, so when the DFO approached us to do a joint project on early detection of invasive species, we were all in."

The Department of Fisheries and Oceans (DFO) is comparing environmental DNA (eDNA) sequencing with traditional but more labour-intensive methods of fish sampling. As organisms shed DNA into their environments, eDNA analysis can provide clues about species presence without disrupting the environment.

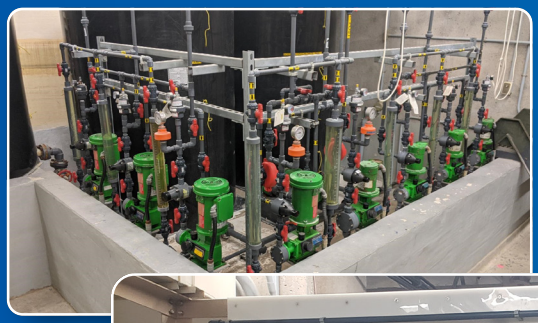
As stormwater ponds are small bodies of water, they are easier to sample than large natural lakes. This means Hamilton's goldfish problem is an opportunity for the DFO.

"It's a win for both of us," said Young. "DFO is collecting all the fish and taking them to their labs for research and analysis, and Hamilton's stormwater ponds are being restored to their original function as water quality and quantity treatment facilities." ■

Amanda Wong and Dave Alberton are with Hamilton Water. Email: amanda.wong@hamilton.ca, dave.alberton@hamilton.ca

THE DICE

THE EVOLUTION OF THE CHEMICAL METERING SYSTEM



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Determining the effectiveness of ultrasound to control algae in wastewater treatment lagoons

By **Dennis J. Gregor**

Wastewater treatment lagoons provide an ideal environment for blue-green algae growth as they have high nitrogen and phosphorous concentrations, are relatively shallow, have a small surface area that limits wave action, are designed to have a controlled residence time, and are generally warmer and ice-free for longer periods than natural ponds.

Most lagoons, however, have aeration systems to ensure circulation and oxygenation. The turbulence caused by the aeration systems may reduce algae growth, especially blue-green algae, because these algae optimize growth by controlling their buoyancy with the gas vesicles within their cell wall.

Researchers have demonstrated the effectiveness of ultrasound to control cyanobacteria. A frequent concern with the use of ultrasound is that the ultrasonic vibration could result in cell lysing (i.e., breaking of the cell wall) that could release the microcystin toxins stored within the blue-green algae cell. However, based on demonstrations elsewhere, ultrasound does not result in cavitation (formation of bubbles in the water), and consequently, does not lyse the blue-green algae cells.

The application of ultrasonics to control blue-green and green algae in wastewater lagoons was studied at two locations in Ontario.

Left: *Samples of raw water from cell 4, Essex Northeast Lagoons on March 16, 2021 prior to installation of ultrasound.* ***Right:*** *Samples from the effluent from cell 4 on May 4, 2021.*

TOWN OF SUNDRIDGE

The town of Sundridge, located approximately 50 km north of Huntsville, has two wastewater lagoons. The main, active lagoon is aerated with a series of fine bubble diffusers extending across it. In addition, the lagoon is subdivided into three sections by two impermeable geomembrane flow diversion baffles with limited openings, or windows, for a maximum flow of 0.020 m/sec between each cell.

There was a concern that these impermeable flow diversion baffles might interrupt the ultrasonic signal, or reduce the effectiveness of the ultrasound that was placed in the middle of the lagoon, approximately midway between the two baffles.

These lagoons are regulated under an Environmental Compliance Approval (ECA) issued by the Ontario Ministry of the Environment, Conservation and Parks (MECP). Frequent exceedances of the ECA total suspended solids (TSS) limits were a concern, with algae blooms being the main cause of these exceedances.

Algae also affects the efficiency of the underground Submerged Attached Growth Reactor (SAGR) system that is installed downstream of the lagoon to control ammonia concentrations in the wastewater.

Wastewater system operators sought a cost-effective solution that would control or eliminate the algae blooms, would allow the system to meet its ECA TSS effluent limits, and directly benefit the SAGR operation. Water samples collected on July 14, 2020 confirmed that the algae in the lagoon were predominantly the green algae Chlorophyceae *(Chlamydomonas sp.)* and Cyanophyceae *(Pseudanabaena sp.)*.

Both types of algae are now controlled by ultrasound, using a solar powered SonicSolutions (now Water IQ) Dual Band (DB)® ultrasonic unit, which was installed on August 18, 2020 in the main treatment lagoon.

TOWN OF ESSEX

MECP sets effluent limits under an ECA for the spring discharge from the Town of Essex's four wastewater lagoons. They provide treatment prior to effluent discharge during spring freshet into the Puce Drain. Extremely poor water quality in Cell 4 of the lagoons led to a decision to test the effectiveness of ultrason-

ics to control algal blooms in the lagoon.

A lagoon water sample collected on March 16, 2021, and analyzed by ALS Environmental Laboratories, demonstrated that algae in the lagoon were dominated by Chlorophyceae *(Chlamydomonas sp.),* Chlorophyceae *(Unidentified)* and Cyanophyceae *(Aphanothece sp.).* The MECP agreed to an extension of the discharge window to May 15, 2021, to allow time for the ultrasound, installed on March 31, 2021, to control algae in the lagoon.

ULTRASOUND TECHNOLOGY AND HOW IT WORKS

The SonicSolutions ultrasound is a patented ultrasonic and biofilm control device that has four ultrasound sources (piezos), and uses two bandwidths with over 2,000 ultrasonic frequencies. This allows it to cover 360 degrees with a radial range of 400 metres, or an area of 50 hectares (ha), for the control of blue-green algae. It has a range of 150 metres (7 ha) for the control of green and diatom algae, and a range of 60 metres (1.1 ha) for aerobic bacteria.

The surface area of the Sundridge lagoon is approximately 3.5 ha, while Cell 4 in Essex is approximately 6 ha. Accordingly, all blue-green, green and diatom algae theoretically will be treated throughout the treatment lagoon, along with aerobic bacteria within a portion of each lagoon.

The treatment of aerobic bacteria is important for ultrasonic applications in wastewater lagoons because it minimizes the colonization of the transducer heads. This would impair the unit's effectiveness and require frequent cleaning.

As a result, the ultrasound units were able to operate for the entire period of the demonstration (two months at Sundridge and five months at Essex), without maintenance of the in-water units. As there was no AC power supply directly available at either location, both sites were DC powered (24 V) systems with 200 W solar panels and two 12 V Group 27 Absorbed Glass Mat (AGM) batteries.

A Morningstar Corporation ProStar 15-amp, 12/24 V solar charge controller was used to manage the solar panels and protect the batteries. The DC power source located onshore provided power to the ultrasound head via a submerged 150 m cable.

The SonicSolutions system has been tested extensively in CanDetec's facility and has a peak pulsed power demand of less than 3 amps at 24 V. At this low power output, it has no visible vibration effect, even in small water containers (60 L) and does not induce cavitation. While controlling a large number of algae species, ultrasound does not control weeds and filamentous forms of algae that look more like vegetation due to their structure.

With respect to blue-green algae, the absence of cavitation does not lyse (break apart) the cell wall. Lysing potentially releases the toxins produced within

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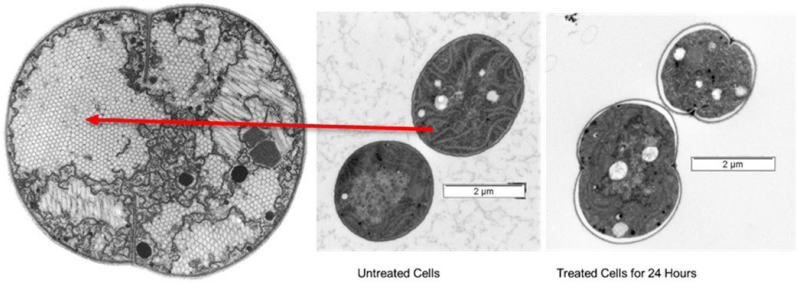

Transverse section of a dividing cell of the bacterium (Microcystis sp.) showing hexagonal stacking of the cylindrical gas vesicles at x31,500 magnification (Walsby, 1994) and transmission electron microscopy images of ultrasonic damage to vesicles showing loss of gas to outer cell wall which is permeable to the internal gas after 24 hours of exposure (Huang and Zimba, 2020).

the cell. Rather, ultrasound stops the growth and reproduction of the algae by disrupting the integrity of the internal gas vesicles. The disruption of these vesicles results in the loss of the ability of the algae to control its movements in the water column.

Vertical movement of the cells is necessary to permit access to sunlight and food sources. This loss of buoyancy causes the algae to sink out of the photic zone, resulting in a loss of light within approximately three to four days, with overall decay of the algae population occurring over a period of several weeks.

Other forms of algae, such as green algae, are also affected by ultrasound. Through the disruption of the internal cell fluid, green algae will die off in three to four weeks due to their inability to grow and reproduce. As noted above, the effective range for green algae is more restrictive, at a radius of about 150 metres.

Anaerobic bacteria are not directly affected by the ultrasound, but their growth and colonization is minimized.

SAMPLING AND ANALYTICAL ANALYSIS

Water samples were taken periodically at both Sundridge and Essex's lagoons throughout the demonstration projects to document algae populations and effectiveness of the ultrasound. All samples were collected for the enumeration of cyanobacteria and commonly for phytoplankton and microcystin. Samples were preserved (if appropriate) and shipped refrigerated to ALS Environmental Laboratories in Winnipeg for analysis.

The analysis of total microcystin using the Enzyme-Linked Immunosorbent Assay (ELISA) with a detection limit of 0.10 for MECP or 0.20 µg/L for ALS, never exceeded the detection limit on a total of 11 samples. The MECP further noted, based on their analysis of a sample from Cell 4 final effluent collected on May 4, 2021 at Essex that: *"No algal mat, cyano bloom or algae bloom [was] (sic) found…"* and *"The sample contained extremely deteriorated material. There were numerous bacterial cells and debris observed in the sample. The sample also contained numerous extremely small algal cells which were not identifiable due to poor condition…."*

RESULTS

The results for all sampling events for both Sundridge and Essex Cell 4 are summarized in Figure 1. The Sundridge figure demonstrates the reduction in cell counts of the microcystis *Cyanophyceae* and Total Cyanobacteria, which is comprised mostly of *Cyanophyceae.*

The direct effect of the ultrasound resulted in the reduction of the Total Cyanobacterial cell count by more than 1,300 times (from 2.09 million on August 18 to 1,600 by October 28, 2020). Most of this reduction was achieved in the first 30 days of operation (from 2.09 million on August 18 to 4,420 by September 21, 2020, or a reduction of almost 500 times).

Aphanizomenon *(Cyanophyceae)*, which was not present in the July sample, doubled between start-up in August and the first sample on September 21. Thereafter, Aphanizomenon was significantly controlled, with cell counts declining from 2,440 cells/ml in September to 300 cells/ml and 0 cells/ml on October 6 and 28, respectively. It is

not surprising to see some species increase after the installation of the ultrasound, likely as a result of the loss of competition for nutrients and light from the originally dominant algae in the water column.

Although it was expected that the overall benefits of the ultrasound would be limited by the impermeable membranes that ran across the Sundridge lagoon, this turned out not to be the case. The ultrasound signal could be detected at strength around the entire lagoon, including near the outlet structure.

The ability of the ultrasound signal to pass through the membranes is likely due to the fact that they are thin, stretched, and directly contacted by water on both sides. This allows the signal to propagate through the membrane. This means that a single ultrasound unit is capable of treating this lagoon, and others that may have similar membranes.

The Essex Cell 4, dominated by the single species Aphanothece *(Cyanophyceae sp.)*, was reduced from over 14 million cells/ml to 9.4 million cells/ml, 14 days after the ultrasound was installed, and to 3.1 million cells/ml in the 34 days following installation.

The ultrasonic treatment did not result in measurable microcystin toxins in the effluent after four weeks of treatment. The MECP provincial officer overseeing the site, stated in email correspondence on August 18, 2021, after reviewing data from the May 2021 discharge *"…that the ultrasound treatment was effective in preventing a bloom to form downstream in the river. Based on these positive results from the spring discharge, we support the use of the ultrasound treatment in the lagoons on a permanent basis."*

In addition to the control of blue-green algae, ultrasound will reduce the total suspended solids concentration and the pH in wastewater effluent. The low base cost of the ultrasound technology, combined with low power requirements that can be readily accommodated through on-site solar systems, and minimal maintenance requirements, makes SonicSolutions ultrasonics an excellent choice to effectively manage wastewater lagoons and other water resources that are impacted by blue-green and green algae blooms. ■

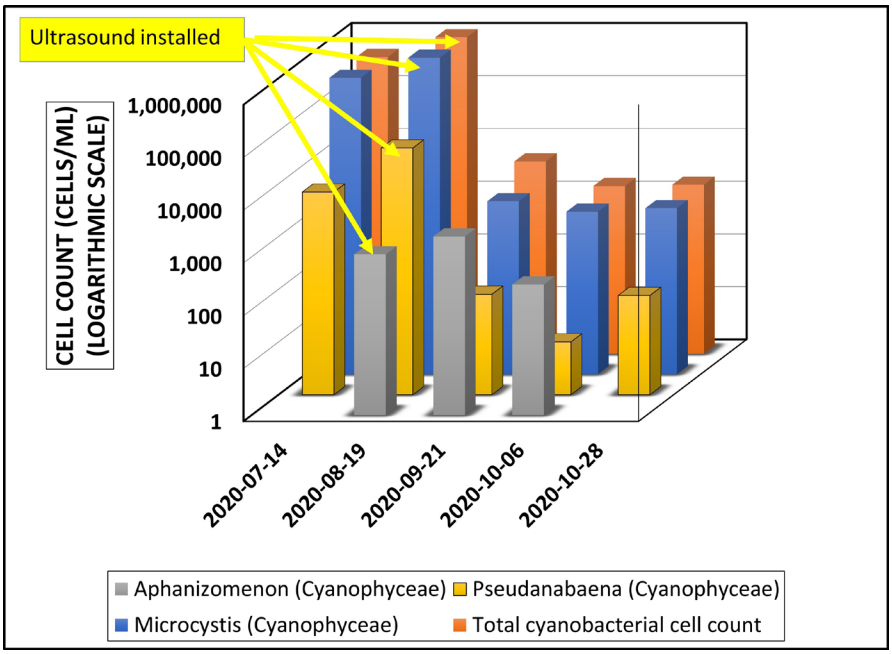

Figure 1. Cell counts of algal species and total cyanobacteria in Sundridge wastewater lagoon in the summer of 2020 with ultra-sound treatment commencing on August 19, 2020 and Total Cyanobacteria count for Essex Cell 4 with ultra-sound treatment commencing on March 31, 2021. A single species, Aphanothece (Cyanophyceae) predominated (>98%) in this cell throughout the demonstration and thus only the Total Cyanobacteria count is shown

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References are available upon request.

The author wishes to acknowledge the support and assistance of staff of the Ontario Clean Water Agency at both Essex and Sundridge, as well as the support of reviewers who assisted with scientific terminology and improved the reading of this report.

DOE invests $18M to research cleantech mineral extraction from wastewater

By **ES&E Staff**

Extracting minerals from wastewater could potentially recover significant quantities of the lithium needed for battery technologies. Credit: SobrevolandPatagonia, stock.adobe.com

The U.S. Department of Energy (DOE) is investing $18 million into research focused on the beneficial reuse of wastewater, as well as the extraction of recoverable critical minerals from wastewater or produced water, including rare earth elements essential to clean energy.

The wastewater projects would be associated with oil and natural gas development or coal-based thermal electric power generation facilities, primarily coal combustion residuals waste streams, the DOE stated.

Extracting minerals from wastewater could potentially recover significant quantities of the lithium needed for battery technologies, according to the U.S. Office of Fossil Energy and Carbon Management. Minerals are also expected to be recovered for use in the manufacturing of solar panels, wind turbines, and hydrogen fuel cells.

Officials with the fossil energy office say that project wastewater disposal is the leading water management practice in the country, with oil and gas sites across the nation expected to produce more than 60 million barrels of wastewater per day by 2030.

Brad Crabtree, assistant secretary of Fossil Energy and Carbon Management, said in the announcement that the government hopes to make the massive amounts of project-related wastewater generated each year a valuable resource, and create a safer approach for the environment in the process.

"Clean water is essential for the health and economic prosperity of our communities, but while demand from the energy sector for this vital resource has grown, aquifers in arid and semi-arid regions of the country have become depleted by drought conditions made worse by a warming climate," stated Crabtree.

Managing wastewater safely and effectively could mean irrigation for non-edible crops, hydrogen generation, and aquifer recharge and recovery, said the DOE. But it also means avoiding common practices such as injecting produced water underground into saltwater disposal wells, potentially over-pressurizing geological formations and, in some cases, causing minor seismicity.

Waste streams associated with thermal electric power plant sites, such as coal and fly ash ponds and other coal combustion residuals waste streams, can also result in contamination of soil, surface water, and groundwater with heavy metals and other pollutants.

Funded projects can also address the development of infrastructure to efficiently transport and treat wastewater to reduce environmental impacts related to trucking and seismic events. The DOE expects to make nine awards between $1.5 million and $3.2 million, each with a minimum of a 20% cost-sharing from the awardees. ■

For more information, email: editor@esemag.com

New water monitoring method improves flocculation and minimizes mixing energy

By **ES&E Staff**

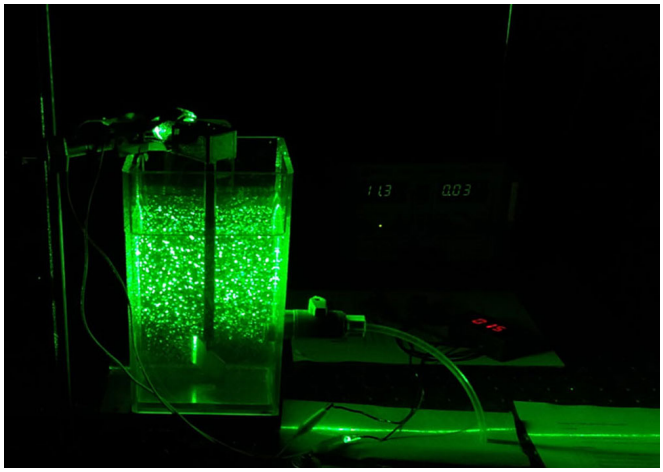
Engineering researchers at Texas A&M University have developed a first-of-its-kind water monitoring technique that improves flocculation and minimizes the energy used for mixing.

Coagulant chemicals are typically added to purify drinking water, remove turbidity and microscopic pathogens. They form large clumps called flocs that can easily be filtered out. The new method simultaneously monitors the size and shape of floc clumps and the mixing intensity in a single step, in real time, allowing for more accurate measurements, and the ability to successfully remove contaminants by growing large enough clumps with less energy expended.

"All previous research did this in two steps," explained Dr. Kuang-An Chang, professor in the Zachry Department of Civil and Environmental Engineering at Texas A&M, in an announcement from the university. "In the old approach, first, artificial particles of known characteristics would be added to monitor mixing. Then, a second experiment would be done with "identical' settings and the actual clumps would be monitored," he added.

Mixing is one of the most energy-intensive processes during water and wastewater purification, said Chang. The new technique non-intrusively monitors the mixing to precisely control it. Chang noted that it is crucial to properly mix the water and chemicals so the pathogens properly clump. If mixing is low, clumps won't form. If mixing is too intense, clumps will form but quickly break apart. The new technique also allows researchers to quantify heterogeneities within the reactor, and potentially optimize it to create flocs of desired characteristics.

"We essentially halved the workload and improved precision because there are always statistical differences any time you do two experiments," said Chang. ■



Researchers used a green laser on a jar filled with water to show how the water moves and the contaminants clump together. Credit: Dr. Kuang-An Chang, Texas A&M

For more information, email: editor@esemag.com

Permafrost data recording helps with Arctic wastewater lagoon repairs

By **Renata Klassen**, **Elan Chalmers** and **Ken Johnson**

Continuous recording of temperature data is a method of monitoring the operational performance of sewage lagoons constructed on permafrost in the Canadian Arctic. Factors that impact the performance of these lagoons include the condition of the permafrost prior to construction and after the structure is built, and changes in the permafrost that result from warming caused by the contained sewage.

Furthermore, drainage around the lagoons, as well as subsurface water around and below them, impact asset performance. Both flowing and standing water contribute to melting of permafrost.

A study was completed by EXP for the Government of Nunavut on the Kugluktuk sewage lagoon, which has historically been plagued by leakage and a malfunctioning liner. The study involved installing temperature monitoring equipment into berms and data collection, as part of a 2021 field program.

The Kugluktuk lagoon is a rectangular engineered pond, lined with 60 mil (1.52 mm) thick high-density polyethylene-

Geotechnical drilling program on the lagoon perimeter.

plastic. It is approximately 240 by 200 metres in size, with compacted granular earth berms, and was designed to store 125,000 cubic metres of sewage for a 12-month period.

The treatment process allows this facultative lagoon to passively function over the period of warmer and sunny Arctic summers and discharge into an adjacent wetland for supplementary treatment in the fall. The lagoon was constructed on top of a natural drainage course that crossed the area.

The goal of the 2021 field program was to collect data that could be used to assess the geotechnical elements of the lagoon and develop a plan to improve issues with it.

The lagoon was commissioned in 2009, and several issues started occurring in the first year of its use, which became obvious over time. These issues included: a floating liner that formed "islands" (also referred to in the industry as "whales"), which started forming after construction in 2009; lagoon leakage under one of the berms in 2010; and significant subsidence of the earth berms progressing over time. In one location the berm subsided over 40 centimetres.

Four holes were drilled around the top of the lagoon and polyvinyl chloride tubes were installed in the holes. Wires with electronic thermometers at

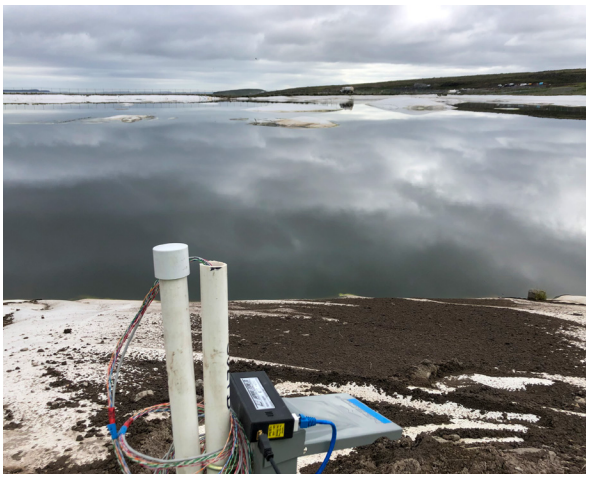
several places along the wires (thermistor strings) were put into these tubes and connected to equipment in protective cases.

This system continuously recorded the temperature of the earth around the tubes. A multimeter, which recorded details such as voltage, current and resistance, was also connected to the thermistor strings to do spot-check readings at various times and spots.

Water levels in the holes were measured at several locations along the berm with a water level meter. This information was added to information on the temperature distribution in the earth berms on the north and west sides of the lagoon. The ground temperature measurements revealed similar temperatures between the holes, suggesting that the ground below the berms was frozen and the base of the berms was freezing back.

Upon completion of the 2021 field program, a decision was made to leave a data logger connected to a thermistor string on site for further data collection. In March 2022, data from the data logger, which had been recording since August 2021, was downloaded. The recorded temperatures confirmed that the ground was frozen to at least four metres below the base of the berm in this location.

Temperature data recorded in 2021 and during the follow-up in 2022 provided valuable information about the possible causes of the poor performance of the sewage lagoon structure in Kugluktuk.



Left: *Recording temperatures in one of the holes on the lagoon's perimeter. The blue thermistor cable is connected to a data logger housed in a protective casing.*

Right: *PVC tubing with a thermistor cable connected to a data logger recording temperatures in a drill hole on the lagoon perimeter.*

Recorded temperatures indicated that permafrost was freezing back into several of the berms. However, one of the berms measured while on site in July 2021 was not freezing back, which could indicate unfrozen ground within the permafrost. Data from the field investigation has been used to develop several remedial options for the lagoon. These include relining in combination with a drainage collection system below the lagoon, and a vertical barrier to cut off surface and subsurface drainage from entering the lagoon.

Continuing data collection will provide information for fine tuning these options before starting to prepare the detailed design of remedial work on the lagoon. ■

Renata Klassen and Ken Johnson are with EXP. Elan Chalmers is with the Government of Nunavut. For more information, email: renata.klassen@exp.com, ken.johnson@exp.com, echalmers@gov.nu.ca

Overcoming difficulties with pumping primary sludge

Operators at a wastewater treatment plant were faced with pumping primary sludge with a solid content of between 4.5% – 9.5%. The circumstances for pumping this product were severe, making handling and treatment difficult.

The required capacity for the pump is 5 m^3/hr and the geodetic height is approximately 18 metres. The pump could not be positioned near the fluid inlet, leaving a longer suction line.

The solid content of the sludge varies depending upon the incoming effluent, and solid content affects the viscosity. At 4.5% solids, the laminar viscosity of the fluid is 0.78 – 2.71 Pa·s (average high level of 747 – 2,593 cSt). At 9.5% solids, the laminar viscosity is 6.42 – 22.3 Pa·s (average high level of 5,894 – 20,350 cSt).

Previously, an eccentric screw positive displacement pump was applied to transfer the sludge at the plant, but it experienced several problems. One of them was due to severe suction conditions caused by the sludge thickness.

Operators found it impossible to control the flow, as the increase in solid content has the effect of raising the viscosity. This in turn caused a drop in pump capacity. Higher pump speed would resolve the problem, but as solid content then decreased, the lower viscosity increased the flow. Thus, the pump did not maintain a constant relationship between flow and speed.

A Verderflex VF65 hose pump installation.

Another problem occurred regularly when a partial blockage in the suction line would cause the pump to run dry for short periods, resulting in a burned stator. In addition, the abrasive solids in the product caused high wear. This resulted in pump, stator, and rotor lifespan being significantly below expectations.

Following a site visit, specialist engineers from Verder identified the key requirements to fix the issues the plant had faced. These included positive displacement pumps with good suction characteristics and the capability to run dry. Subsequently two Verderflex peristaltic hose pump VF65s were installed.

According to Verder, these pumps can handle sludges of varying thickness and viscosity due to high quality hosing. The high suction capability generated by the hose is matched by its ability to handle abrasive solids without adverse wear and tear.

After installing the Verderflex VF65 hose pumps, maintenance costs at the plant dropped significantly, and pump performance is completely controllable. The peristaltic pump has been used for over 4,000 hours and it is still running well. ■

Verderflex peristaltic/hose pumps are distributed by York Fluid Controls Ltd. For more information, email: sales@yorkfluid.com

Ontario's Whitesand First Nation secures long-sought funding for biomass plant

By **ES&E Staff**

After lobbying for the project since 1992, the Whitesand First Nation in northwestern Ontario has finally secured $35 million in federal funding for its long-awaited biomass cogeneration facility.

Whitesand is a community of about 400 people. It is an Ojibwa First Nation with a land base of about 250 hectares. The Armstrong Settlement is their main community. Officials say their Sagatay Co-Generation Limited Partnership's 6.5-megawatt biomass facility will displace millions of litres in diesel consumption and improve local air quality once connected to the local micro-grid.

Their hope is that the facility will ultimately provide heat and power for three communities about 250 km northeast of Thunder Bay by using locally-sourced wood waste.

"I am proud of the vision and determination of Sagatay Co-Generation LP to stay focused on completing this project which will reduce the use of diesel fuel for heat and energy," announced Indigenous Services Minister Patty Hajdu.

Once operational, the biomass plant is expected to provide heat and power for three communities as well as a new wood pellet plant and a fully electric wood merchandising yard. Credit: Whitesand First Nation

Once operational, in about three years, the biomass plant is also expected to provide heat and power to a new wood pellet plant and a fully electric wood merchandising yard, said local officials.

In a statement, Whitesand First Nation Chief Allan Gustafson acknowledged the long and difficult road to securing federal funding for the project.

"Whitesand's vision of energy independence and economic growth began in 1992 when we proposed a biomass cogeneration facility," Gustafson noted. "Although that proposal was not accepted, and despite the many barriers we have faced through the years, we did not give up and today our vision of a sustainable future through the use of our local forest is at hand," the chief added.

David Mackett of the Sagatay Co-Generation Limited Partnership responded to the funding announcement by noting that the project is confirmation of Canada's commitment to low-carbon programs and support can lead to substantial economic growth and employment in the community, as well as greenhouse gas reductions.

Funding is provided under Natural Resources Canada's Smart Renewables and Electrification Pathways (SREPs) program. The department previously provided $4.1 million in funding for the project's pre-development work from the Clean Energy for Rural and Remote Communities. ■

For more information, email: editor@esemag.com

B.C. towns upgrade WWTPs to protect aquatic life

By **ES&E Staff**

As British Columbia's Ahousaht First Nation celebrates the completion of their new wastewater treatment plant, the province's Maliview Wastewater Treatment Plant three-phase upgrade project on Salt Spring Island has received new funding.

For Ahousaht First Nation located on the west coast of Vancouver Island, the new plant replaces the old septic tank treatment and lift station, as well as the old outfall pipe, which did not meet regulatory standards due to its location in a shellfish habitat sensitive to sewage contamination.

The new plant will provide adequate wastewater collection, secondary treatment with disinfection, and marine disposal, while meeting both the federal wastewater systems effluent regulations and the B.C. municipal wastewater regulation.

The British Columbia communities of Maliview and Ahousaht First Nation. Credit: David Stanley, Wikimedia Commons

This larger infrastructure will have the capacity to support future population growth in the community, which is only accessible by ferry or plane, and support seafood safety by protecting local marine ecosystems, stated an announcement from Indigenous Services Canada.

"As an oceanic people, our marine ecosystem and aquatic food systems are integral and interconnected to our way of life," announced Ahousaht Chief John Rampanen, in a statement. "The improvements offered through this updated wastewater treatment facility will not only sustain our efforts to enhance and protect our environment, it will also greatly improve our quality of life," he added.

Ahousaht's new wastewater system is designed to accommodate 1,300 people, nearly double its current population.

For Salt Spring Island, the new $1.98 million in funding will go towards the supply and delivery of packaged moving bed biofilm reactors for the Maliview Wastewater Treatment Plant, which has consistently struggled to meet regulatory requirements.

During the summer of 2019, Environment and Climate Change Canada officers inspected the Maliview WWTP and collected effluent samples for toxicity testing. The samples failed both rainbow trout lethality analyses and contained approximately 1.5 times more ammonia than allowable. It was these issues that led to the creation of the three-phase upgrade plan.

In phase one of Maliview's upgrades, local officials identified several actions to improve service, such as increasing the frequency of waste sludge hauling to reduce solids retention time. This move improved the organic removal efficiency of the rotating biological contactor.

Additionally, the plant increased the fats, oils and grease removal frequency, removed some biomass from the first stage of the contactor, and fixed the short-circuiting of the return activated sludge from the primary clarifier to the secondary clarifier.

Detailed design work is currently underway for Maliview to refine cost estimates and inform next steps, including a decision to proceed with a borrowing bylaw and begin construction in 2023. Maliview's WWTP was built in the late 1970s and discharges treated effluent into Trincomali Channel. ■

For more information, email: editor@esemag.com

Water group warns of arsenic buildup in water pit after lithium mine closes

By **ES&E Staff**

Despite a greenlight from the federal government's recent assessment, controversy is still following the James Bay Lithium Mine Project in Quebec over feared watershed contamination and the loss of wetlands.

Galaxy Lithium Inc.'s open pit mine would have an estimated mine life of 15 to 20 years, and produce on average 5,480 tonnes of ore per day, said federal officials. But, nearby First Nations and environmental protection groups have ongoing concerns about its impact on the watershed, particularly in terms of arsenic.

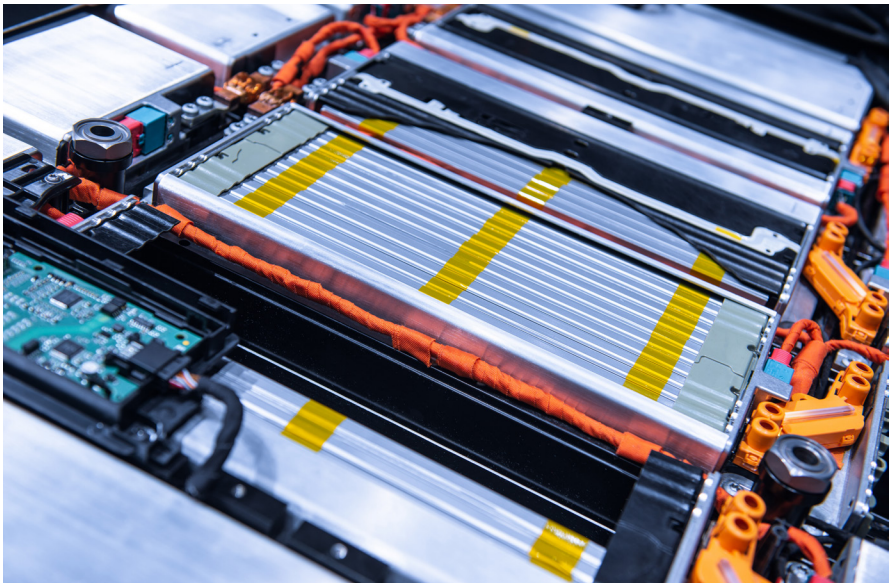
Critical Elements Corp. and Nemaska Lithium are also among the new crop of companies looking to extract lithium in the James Bay region, raising even louder environmental concerns from neighboring First Nations as Northern Quebec quickly becomes a lithium hub.

In Galaxy's 2021 environmental impact assessment for its lithium project, the company states that arsenic concentrations are generally expected to be in line with 0.2 mg/L federal guidelines. However, they could exceed that value as precipitation decreases during the summer months around year eight of the project, when arsenic treatment "may be required." Additionally, arsenic levels could spike during backfilling in the post-rehabilitation phase.

"The quality of the pit lake water could deteriorate since part of the water from precipitations will be exposed to the rock walls," states Galaxy's assessment by WSP.

A Quebec-based non-profit water protection organization, Eau Secours, says it has concerns about Galaxy's rehabilitation plan, which it claims fails when it comes to concrete measures to restore the water quality to its original level. Eau Secours says Galaxy "relies on water balance assumptions and dilution factors that are not demonstrated in any thorough modeling."

"Three-hundred and five hectares of destroyed natural environments and a pit that will fill with arsenic-contaminated water over 120 years and then flow into nearby rivers, these are examples of the price to pay for a so-called green transition," Eau Secours announced in a statement translated from French.



Canada recently announced that lithium is considered one of six critical minerals in a strategy tied to the clean technology sector, due to its use in electric vehicles and many phone and computer batteries. Credit: Sergii, stock.adobe.com

Eau Secour also asserts that federal conditions placed on the lithium project should have taken into consideration the "legislative shortcomings" of federal mining effluent regulations, particularly in terms of arsenic and its potential for contamination well beyond the closure of the mine.

"Remember that the pit will fill with water over 120 – 160 years, and that it will reappear in the neighboring waterways about 50 years after the mine closes," Eau Secours announced in a statement.

Canada recently announced that lithium is considered one of six critical minerals in a strategy tied to the clean technology sector, due to its use in electric vehicles and many phone and computer batteries.

Mining experts say the James Bay region may have one of the world's largest deposits of spodumene, a fairly rare pyroxene composed of lithium, aluminum and silica. The lithium project will be accompanied by a water treatment plant, pond, and tailings storage areas, according to the minister's decision statement.

Under the project's conditions, monitoring must be in place for suspended particulate matter, and concentrations of lithium, fluoride, silver, arsenic, cadmium, chromium, lead, nickel, iron, zinc, mercury and copper.

The impact assessment states that some 305 hectares of wetlands would likely be lost due to the lithium project. The proponent proposes additional measures, such as requiring the creation of new wetlands for an area equivalent to at least 75% of the wetland area losses. A provincial assessment for the project is still ongoing. ■

For more information, email: editor@esemag.com

Methane emissions from wastewater treatment may be nearly double previous estimates

By **ES&E Staff**

After measuring and analyzing emissions from 63 U.S. municipal wastewater treatment plants, two new studies by researchers at Princeton University show that the process used to quantify methane emissions may be substantially underestimating the extent of the methane released.

Researchers at Princeton's Andlinger Center for Energy and the Environment suggest that guidelines developed by the Intergovernmental Panel on Climate Change (IPCC) are based on limited measurements at a relatively small number of wastewater treatment plants. When the researchers used the Princeton Atmospheric Chemistry Experiment (PACE) Mobile Laboratory to estimate methane emissions, they were nearly double the estimates derived from the IPCC method.

Using open-path portable gas sensors with near-infrared (IR) and mid-IR lasers as light sources, the PACE tests yielded methane estimates 1.9 times greater than emissions estimates that used existing IPCC and U.S. Environmental Protection Agency guidelines. The results could mean that current guidelines underestimate methane emissions equivalent to 5.3 million metric tons of carbon dioxide, according to the new studies.

Mark Zondlo, professor of civil and environmental engineering and associated faculty at the Andlinger Center for Energy and the Environment, said that the waste sector is one of the largest anthropogenic sources of methane in the world.

"As cities continue to urbanize and develop net-zero plans, they can't ignore the liquid wastewater treatment sector," Zondlo said in an announcement from the university.

Researchers determined that wastewater treatment plants with inefficient anaerobic digesters had among the biggest methane leaks due to issues such as pressure buildups.
Credit: Dana.S., stock.adobe.com

Daniel Moore, first author of the direct measurement study, and a graduate student in civil and environmental engineering, suggested that the IPCC guidelines assume a "certain level of efficiency in these wastewater treatment systems that may not exist on a plant-to-plant basis." Moore pointed to leaks and inefficient equipment that may go undetected at wastewater treatment plants, yet could lead to significant greenhouse gas emissions.

Professor of Civil and Environmental Engineering, Zhiyong Jason Ren, said his team of researchers, in a second study, utilized machine learning methods to analyze published literature data from methane monitoring studies of various wastewater collection and treatment processes around the globe.

"Not many people have studied the methane emissions associated with wastewater infrastructure, even though we know that it's a hotspot for methane production," Ren said in an announcement from the university. "We were able to show, using two different approaches, that methane emissions are a much bigger issue for the wastewater sector than previously thought," Ren added.

Cuihong Song, first author of the study and a postdoctoral researcher in civil and environmental engineering at Princeton, said the research determined that treatment plants equipped with inefficient anaerobic digesters were among the biggest methane leakers due to issues such as pressure buildups. The research showed that these plants emitted more than triple the methane released by plants without digesters.

"If the digester is not gas-tight, you can end up with high methane emissions," Song said.

The study notes that wastewater treatment plants equipped with anaerobic digesters account for less than 10% of all treatment plants in the U.S. However, most of these plants are large facilities, and they treat around 55% of the wastewater in the country.

While the researchers say that estimations of methane emissions may be skewed, Ren added that the methane produced from processes like anaerobic digestion also serves as a valuable energy source, and by "identifying and mitigating fugitive methane emissions, we would see double benefits" through recovery.

Along with anaerobic digesters, researchers found that methane emissions from sewer systems contribute significantly to nationwide methane emissions. However, current guidelines largely do not account for fugitive methane emissions from sewers. The researchers said that it is important to account for these in future greenhouse gas inventories.

While the researchers say that estimations of methane emissions may be skewed, they also noted that the methane produced from processes like anaerobic digestion serve as a valuable energy source through recovery. Credit: Bumper DeJesus, Princeton University

The researchers are now working with partners to build an inventory and methodology that would allow managers to easily monitor their methane emissions.

For more information, email: editor@esemag.com

The government of Quebec hopes is temporary moratorium on the agricultural use of U.S. biosolids will ensure that the organic residues used to fertilize crops are safe for the environment and public health. Credit: Wolfgang Jargstorff, stock.adobe.com

Quebec bans US biosolids imports until it develops PFAS protections

By **ES&E Staff**

As a "sign of caution," Quebec has issued a temporary moratorium on biosolids imports from the U.S., as it works to establish control mechanisms and thresholds for per – and polyfluoroalkyl substances (PFAS).

The "transitional measure" for the agricultural use of residual fertilizing materials appears as an addendum in the update of Quebec's Guide to the recycling of fertilizing residual materials published by the Ministry of the Environment, the Fight against Climate Change, Wildlife and Parks.

"The temporary moratorium on the agricultural use of U.S. biosolids announced today is a sign of caution," announced Environment Minister Benoit Charette. "It allows us to ensure that the organic residues used to fertilize crops are safe for the environment and public health, until a threshold is established to confirm the quality of imported materials," he added.

Late last year, the Order of Chemists of Quebec (OCQ), the Order of Agronomists of Québec (OAQ) and the Order of Veterinary Physicians of Quebec issued a joint warning over the use of U.S. biosolids. PFAS was noted as an emerging contaminant of concern, and the groups highlighted the risk around imports from Maine where high levels of PFAS contamination have been discovered in soil, milk, grass and manure.

Last spring, the Maine legislature banned the use of all products that contain wastewater biosolids due to concerns about PFAS contamination. "Chemists and biochemists are experts in chemical substances and their various interactions," announced OCQ President Michel Alsayegh in a statement. "Several of them are hard at work characterizing sewage sludge in an exhaustive manner and developing decontamination and recovery solutions in accordance with our mission to protect the public," he added.

The groups also advised against using compost augmented by biosolids or any other byproduct.

In his statement, Charette called the agricultural spreading of nutrient-rich, organic materials resulting from the treatment of sewage in a wastewater treatment facility, "a responsible, sustainable and advantageous management solution from an agronomic and environmental perspective," and an effective alternative to landfilling in the face of climate change. He noted that Quebec is currently working on establishing an acceptable PFAS threshold.

The addendum notes that in the case of biosolids already stored on site, it will be necessary to obtain written confirmation from the generator certifying that no PFAS are contained. The new moratorium also applies to composite waste material generated from paper deinking processes. ■

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Assessing, remediating and performance monitoring abandoned mine sites in the Northwest Territories

By **Reid Smith** and **Arlen Foster**

The Northwest Territories has a long history of mining activity that has resulted in a number of abandoned mine sites with varying levels of environmental liabilities. These sites present a range of risks to the environment and public health and safety, and can represent substantial financial liabilities for governments.

The Bullmoose Area mine sites remediation and monitoring project encompasses the assessment, remediation, and performance monitoring at seven abandoned mine sites (Ruth, Bullmoose, Beaulieu, Spectrum, Chipp, Storm, and Joon) located between 70 and 90 kilometres east of Yellowknife.

These sites were active between 1939 and 1988, with various ownership and activities ranging from open-pit mining to exploratory drilling. Once abandoned, several environmental concerns arose from the materials and debris left behind. These include hazardous and non-hazardous debris, underground mine openings and trenches, petroleum hydrocarbon and/or metal impacted soil and sediment, tailings and waste rock. Due to the insolvency of previous operators, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) inherited the mine sites.

Stantec was contracted to conduct an expert peer review of the human health and ecological risk assessments (HHERAs) for several of the Bullmoose Area mine sites on behalf of Public Services and Procurement Canada.

As a result of this review, the HHERAs were redeveloped for four of the Bullmoose Area mine sites: Bullmoose, Ruth, Spectrum and Beaulieu. The objective was to determine whether on-site concentrations of metals posed unacceptable risks to human and/or ecological receptors, derive ecological site-specific target levels (Eco-SSTLs), and provide recommendations for future work.

An aquatic assessment field team prepares the boat and field equipment for slinging by helicopter to the next lake involved in the monitoring program.

These results were used to aid in the development of an updated remedial action plan (RAP) and cost estimate for all the Bullmoose Area mine sites. Additional engineering studies/designs and tender package development to support the remediation program and necessary permits (water licence, land use permit, quarry authorization, etc.) and community engagement activities were also completed, followed by a two-year construction period and long-term monitoring.

The Bullmoose project provides a valuable case study for currently operating mines that are actively managing environmental liabilities. These include:

- Successful treatment of petroleum hydrocarbon impacted soils by landfarming during the short summer season.
- Use of dominant geochemical dynamics in natural wetlands for attenuating mine portal seepage with elevated metals.
- Vegetation techniques in difficult substrates with a short growing season.
- Capping impacted soils in place for closure.
- Development of baseline geotechnical and other performance data for tailings storage facilities.

SUSTAINABLE DEVELOPMENT AND MINIMIZED ENVIRONMENTAL IMPACTS

While returning the impacted sites to a stable, safe condition for future land use is the overarching objective of the project, sustainable remediation and monitoring methods have been incorporated into the project.

Sustainable approaches were first considered in the development of a RAP, which included a coupled remediation and risk management approach. These included the development of site-specific risk-based criteria and considered

human and ecological health risks, limited unnecessary disturbance associated with heavy equipment use during excavation or soil capping construction activities at low-risk areas, and requiring less physical maintenance and inspection.

The RAP also recommended further evaluation of a natural wetland, with potential to provide long-term contaminant attenuation, rather than pursuit of contaminant removal by excavation or construction of costly engineered wetland features.

Substantial reductions in greenhouse gas emissions were also achieved, as construction activities were completed one year ahead of schedule. This removed the need for another year of construction and operation of a winter ice road. Sustainable methods during performance monitoring efforts have included the design and implementation of automated monitoring instrument stations, with telemetry capabilities allowing for reduced maintenance and fewer trips to the site.

AQUATIC EFFECTS MONITORING PROGRAM (AEMP)

Following completion of remediation activities, an AEMP was designed to assess if fish species in Bullmoose Lake were abundant, healthy and suitable for human consumption. This was due to suspected impacts to the lake from mining activities throughout the Bullmoose Area mine operations. The AEMP would also be used to monitor for positive changes in surface water and lake sediment chemistry and overall fish health as a result of remediation work.

The AEMP used a control-impact study design, to assess fish health and abundance within the Bullmoose Lake compared to a reference area. Two sentinel, or "target" fish species, which are culturally important to the local communities, were selected for monitoring fish health and three species were selected for monitoring fish tissue based on the species present in Bullmoose Lake.

The fish tissue study targeted fish from different trophic levels (e.g., piscivorous or planktivorous species) to assess metal accumulation within the aquatic food web. The approach, methodology and fish health metrics applied were consistent with those for existing mines subject to the *Metal and Diamond Mining Effluent Regulations* (MDMER).

Fish health field dissection of a Northern Pike.

Lake sediment sampling as part of the Aquatic Effects Monitoring Program.

Results indicated that concentrations of contaminants in water and sediment within Bullmoose Lake and the reference lake were generally below Canadian Water Quality Guidelines for Protection of Aquatic Life and Canadian Sediment Quality Guidelines Probable Effects Levels. Comparisons in abundance of targeted fish, fish health and tissue chemistry between Bullmoose Lake and the reference lake did not identify differences due to suspected effects of historical mining.

Findings to date provide valuable insight into the likely extent of aquatic effects in Bullmoose Lake, considering the site's lengthy history of mining activities, and disturbances to the terrestrial and lake environments during the remediation program.

The Bullmoose AEMP provides a case study, methodology and recommendations, that may be used to assess effects of abandoned mines sites with varying levels of environmental liabilities on aquatic receiving environments for comparable sites across Canada, in particular for northern regions. The study design of the AEMP incorporated the findings of environmental site assessments, risk assessments and site-specific monitoring to assess fish community health and establish a baseline. This can potentially be used in the future to monitor potential changes over time, following remediation of the site and to inform local Indigenous communities and stakeholders.

IMPLEMENTING EROSION AND SEDIMENT CONTROL AND RUNOFF CONTROL

Working in remote areas with limitations for site access has provided unique project constraints. Specifically, the fly-in only Bullmoose mine sites have restrictions on the size/weight of construction equipment, number of available personnel, and available construction materials. These include full size excavators, large rip-rap materials, concrete, etc.

To address these challenges and pursue long-term, low maintenance solutions, different stabilization techniques were piloted on slopes prone to erosion and weathering to compare effectiveness after a growing season. The ultimate outcome for exposed slopes prone to erosion would be to have vegetative stability established for long-term erosion protection. Suitable rock protection material is difficult and costly to source at the mine sites. However, a short growing season and low availability of organic soils leads to difficulty in establishing vegetative cover.

The trials included the use of different biodegradable erosion control blankets (ECBs), a variety of native seed mixes and mulches, biodegradable coir logs, live-staking and small berms. In 2020, areas of the Bullmoose mine experiencing minor erosion and poor re-vegetation were divided into sections and stabilized with different trial methods. These included coir matting, jute matting and seeding with mulch. Areas with more significant erosion were stabilized

continued overleaf…

using minor grading works to repair rilling and gully erosion areas. Flow breaks of coir logs were placed across the slope.

A large area of erosion at a former access road was repaired with a temporary stabilization method using filter fabric and the largest substrate available on site. Plans for permanent stabilization of this erosion area have been prepared. These include an engineered articulated concrete block product that is light enough to be flown in and installed with small equipment and manual labour.

Overall, as indicated by site monitoring to date, the treated areas are stabilizing satisfactorily and vegetative cover for erosion control is considered achievable on site within shorter timelines than expected. The results of these pilots have been incorporated into designs for other site areas, such as landfill cover upgrades. Previously, the erosion control objectives would have been pursued using borrow excavation and coarse material production methods with much higher costs and levels of disturbance.

NATURAL WETLAND MECHANICS AND ATTENUATION CAPACITY

During the frost-free months, a slow steady amount of water seeps from the capped entrance of the Bullmoose Mine. It flows into a wetland area, before migrating east to Bullmoose Lake, or south to Bullmoose Creek, which also flows into Bullmoose Lake.

Contaminants of concern (COCs) in this seepage water are iron, manganese and arsenic. The wetland is a natural feature, which formed following the 1988 mine closure activities when overlying waste rock was used to backfill the underground mine workings and portal entry.

During the environmental site assessments and remedial design phase, it was suspected that the wetland may have the ability to sequester COCs from the portal seepage prior to discharge into Bullmoose Lake. However, annual and seasonal mass loading rates were uncertain. Therefore, the long-term reductive capacity as a natural treatment system without engineered controls remained a critical question.

Remedial options that were considered included a range of passive and active approaches for portal seepage treatment, as well as small-scale augmentation techniques for the natural wetland and/or excavation of the entire wetland/impacted sediments and construction of an engineered wetland. Due to a lack of available site data at the time, and the high cost of select options (e.g., active water treatment unit, construction/ maintenance of engineered wetland), it was recommended that remediation of other project components move forward. Continued monitoring and assessment was to be completed at the portal seepage and wetland area, in order to determine next steps.

A performance monitoring program was designed for evaluating the natural wetland that included surface water flow and chemistry, sediment chemistry and vegetation tissue chemistry. A detailed review of monitoring data indicated that the wetland continues to effectively remove COCs via filtration through wetland vegetation and sedimentation onto wetland sediments. There is also likely support by chemical oxidation and adsorption reactions.

> **Long term sequestration of COCs in wetland sediment occurs via chemical reduction and metal precipitation reactions.**

Long term sequestration of COCs in wetland sediment occurs via chemical reduction and metal precipitation reactions. Plant tissue samples collected from the wetland indicate that vegetation does not hyperaccumulate, or bioconcentrate, trace elements from the portal discharge.

The natural wetland vegetation contributes to the overall removal and retention of metals within the wetland by promoting ideal settling conditions across the wetland, attenuating discharge velocities and promoting sedimentation. Particulates, such as iron oxide precipitates, are filtered as water passes through wetland vegetation.

Vegetation root systems also help to stabilize the sediment. This decreases the potential for resuspension of settled particles. Decomposition of the wetland vegetation provides a continuous source of organic matter to the wetland substrate, facilitating reducing conditions and increasing sequestration capacity for COCs within the deeper underlying sediments.

ASSESSMENT, CLASSIFICATION AND REMOTE MONITORING ARRAY INSTALLATION

There are two separate inactive tailings areas at the Bullmoose mine site: the Beta Lake Dam and Skeeter Lake Dam. These dams are currently in the active closure state, as minor improvements to them are underway.

The Beta and Skeeter Lake Dams are earth embankments approximately five to six metres high that provide containment for small tailings areas about 5 and 20 hectares in size, respectively. Limited information was available regarding the embankment construction materials, although it was assumed that the majority of the structures are comprised of waste rock from historical mining activities.

A list of deficiencies and non-conformances that did not meet the Canadian Dam Association standards were noted. As a result, additional studies were completed, including dam break analyses and dam classification, and evaluation of options for autonomous remote monitoring.

InSAR monitoring, in combination with GNSS and piezometer monitoring, was identified as the preferred option. A detailed instrumentation design was developed, and installations were completed in 2022. This allows for ongoing data collection and monitoring.

Overall, the Bullmoose Area mine sites project is a great example of how sustainability and reducing environmental impacts can extend beyond just soil remediation. ■

Reid Smith and Arlen Foster are with Stantec. For more information, email: reid.smith@stantec.com, or arlen.foster@stantec.com

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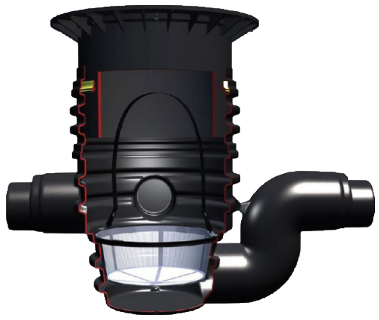

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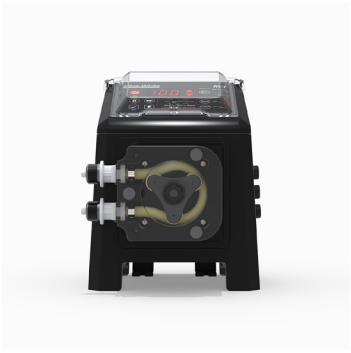

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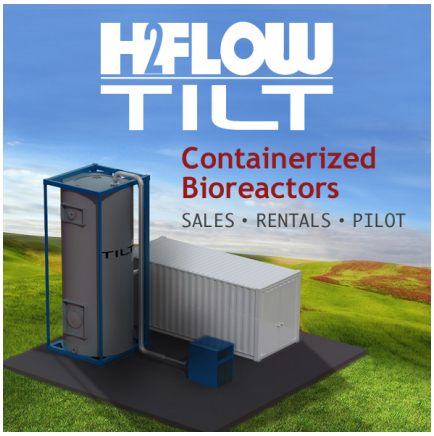

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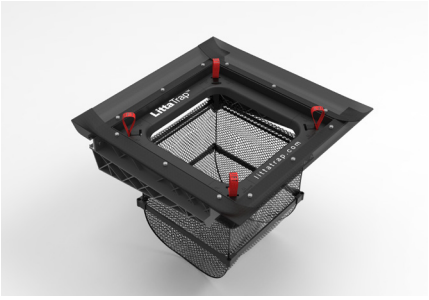

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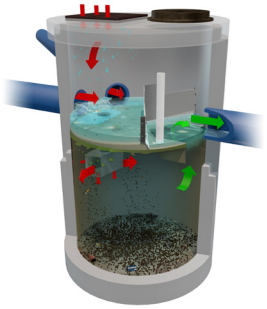

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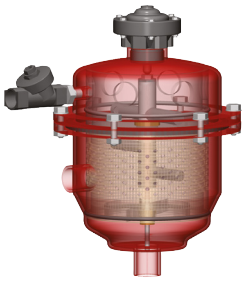

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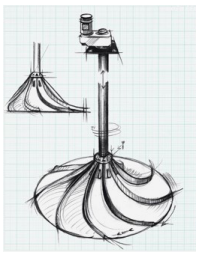

HYPERBOLOID MIXERS

Invent Environment is the manufacturer of hyperboloid mixers which have revolutionized anoxic and swing zone mixing. Invent provides low-shear, efficient mixers with no submerged motors or gear boxes for easy access for maintenance. They have now released the Hyperclassic Mixer Evo 7 which has increased the number of motion fins and adjusted the geometry of the mixer to maximize mixer efficiency, reducing operation costs even further.

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The benefits of upgrading to modern grinder pump technology

By **Mackenzie May**

We live in a world where the popularity of environmentally-friendly low-flow appliances and "flushable" products has exploded. This has wreaked havoc on sewage systems everywhere. The combination of less water and increased solids content has led to significant clogging challenges, particularly in pumps.

As the wastewater stream changes, the pump industry must react and adapt to provide reliable solutions to the market. The grinder pump market is a great example of where manufacturers have adapted their offerings and technologies to support changing needs.

Contractors took less than an hour to complete the installation of this replacement pump. The upgrade unit was designed to seamlessly integrate into an alternate manufacturer's station.

IMPROVED HYDRAULICS AND PUMP TECHNOLOGY

Progressive cavity or centrifugal pumping technologies are used for grinders, and both offer unique hydraulic performance. With a progressive cavity grinder, pumping is performed by a specially shaped, stainless-steel rotor that turns within a multi-lobed rubber stator. The friction developed between the two components develops the pressure used to transport fluid.

Centrifugal grinder pumps use a vortex impeller to create pressure and flow. As the impeller rotates, it creates a vortex in the pump casing that carries the slurry outward from the volute chamber to the piping system.

Progressive cavity grinders can pump with a narrow flow range at high head pressures, up to 46 litres per minute and 46 metres of head. This is particularly important in pressure sewer applications, where wastewater may have to be pumped for long lateral distances, or over hilly terrain. With that said, progressive cavity pumps are not self-limiting with respect to pressure. As the system volume increases, flow remains stable, but pressure will continue to increase. Each pump has a maximum allowable pressure achievable, called the shut-off head.

With progressive cavity pumps, if the system pressure exceeds the shut-off head pressure for the pump, it will continue to try to overcome back pressure until something breaks down. The breakdown could be as simple as a tripped thermal sensor, or as serious as a broken line or damaged pump.

A shortcoming of progressive cavity pumps is their tendency for wear. For example, the stator component, which operates by way of friction, experiences continuous wear. This is further accelerated during operations with high pres-

sure, long run times, or the addition of grainy particulates in the waste stream, such as sand and dirt. Since the pump stator of a progressive cavity grinder is one of the more expensive components to replace, repair or premature failure can be very costly.

An alternative technology available in the marketplace is a centrifugal grinder pump. These were sufficient in some applications, because they could offer four times the flow as their progressive cavity counterpart. However, they were limited to a maximum of 30 metres of head pressure.

They also provided some system simplification, as centrifugal pumps operate at a larger range of flows, which are dictated by the system pressure (head). Contrary to progressive cavity units, a centrifugal pump can operate at shut-off head limits safely. They will essentially idle there until the system pressure stabilizes, before returning to pumping as normal. Without "high wear items" like the progressive cavity units, there will also be an improved mean time between service calls.

Both progressive cavity and centrifugal grinder technologies have been, and continue to be, highly utilized in the market with minimal changes. As a result of understanding the hydraulic benefits of the progressive cavity units and the reliability of centrifugal pumps, a modernized solution was developed to optimize pump performance and hydraulics – this being the dual-stage centrifugal grinder.

By sacrificing some flow, the addition of a second-stage impeller allows double the head pressure. The result of this innovation is a centrifugal grinder pump that can operate at 60 metres of head pressure. Also, in low pressure situations, it can pump 140 litres per minute. Thus, a dual-stage centrifugal grinder can provide a diverse range of hydraulics combined with reliable pump technology.

IMPROVED SOLIDS HANDLING AND CUTTING CAPABILITIES

Radial cutting mechanisms were originally designed in the early 1970s as a method of solids reduction in grinder pumps. A radial grinder features an angled spinning blade inside a sharp shredder ring with several channels around the radius. As solids enter the pump, the blade paired with the sharp channels in the shredder ring cuts down items as they pass through.

Since solids begin entering the pump as they are being cut, radial grinders are susceptible to clogging, or jamming, if the pump stops running. Radial cutters are ideal for larger horsepower grinders, which have the high torque required to overcome solids when the pump restarts.

Axial cutting mechanisms were engineered to combat the evolving waste stream and are the solution for low horsepower grinder pumps. An axial

continued overleaf…

cutting mechanism features a cutter plate that is mounted to the bottom of the pump with a blade spinning beneath it. Think of the cutter plate as a cheese grater with a spinning blade attached to it. As a solid moves along the blade and cutting plate, it is nibbled into small pieces until completely reduced.

This prevents large materials from entering the pump without first being ground into small pieces, and reduces the risk of oversized or challenging items stretching across and clogging the cutter.

By offering different cutter styles depending on the pump size and application, the reliability of pumps can be improved. This results in less clogging or back-ups, and reduces maintenance costs, service costs and downtime.

SERVICE AND MAINTENANCE

Grinder pumps are often used in residential applications, where the end user is a homeowner who is typically not a pump expert. When a pump goes down, homeowners typically notice it during off-hours. After-hours service calls are an inconvenience for everyone involved and they are more expensive due to overtime labour rates. Calls are often only attended by a single technician.

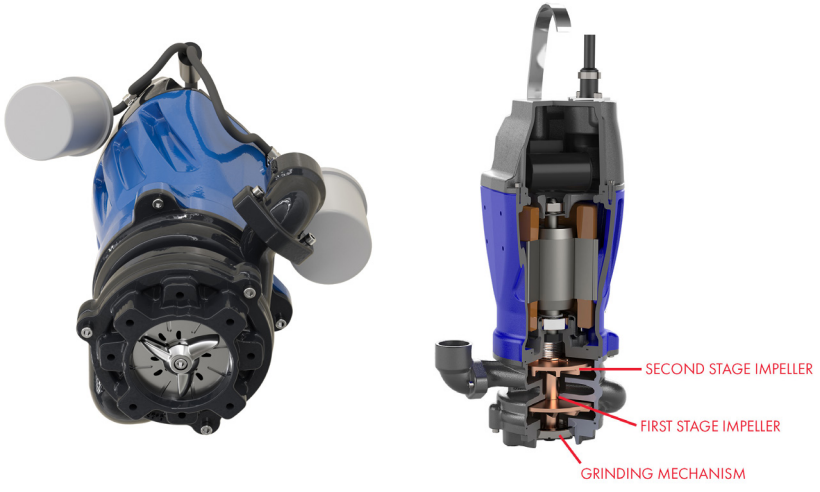
As a result, serviceability and maintenance on a grinder pump should be made as simple as possible. A lightweight pump makes both installation and service calls easier for the technician. By simplifying the pump hardware, manufacturers can minimize the tools that are required for service.

Power cords can be an added hassle when trying to service a pump. If a pump must be removed from the field for service, a technician typically would need to disconnect the cord from the control panel or junction box, and remove it through the conduit and complete the service. Then, to re-install the pump, they must feed the cord back through the conduit to the control panel. This is a process that is further complicated in explosion-proof installations, where the conduit must be sealed with epoxy. A plug-and-play cord allows disconnection at the pump itself, meaning the pump can be removed and serviced without having to remove the cord.

Another possible failure mode on a grinder pump is the capacitor. Traditionally, internal capacitors are in the oil-filled motor housing, where replacing a capacitor would also mean replacing the oil and mechanical seal. A grinder pump where the internal capacitors are located above the oil chamber, provides the ability to remove the motor cap and replace the capacitors without draining the oil.

When pump manufacturers design their products, the ability to easily upgrade and replace their own equipment in the future is top of mind. Aftermarket sales are arguably the biggest area for sales potential, so many companies are developing packages suitable for upgrading competitive installations to their products and solutions. This competition provides great benefit to contractors and end users, because a key product focus on these upgrade units is ease of installation and serviceability. ■

Mackenzie May is with Crane Pumps and Systems. For more information, email: mmay@cranepumps.com



A dual-stage centrifugal grinder is equipped with two impellers. These hydraulics allow for a maximum head of 200 feet with flows up to 30 gallons per minute.

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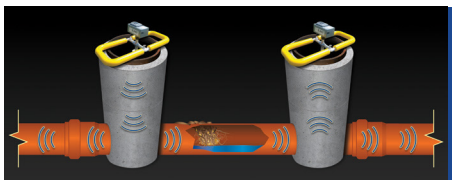

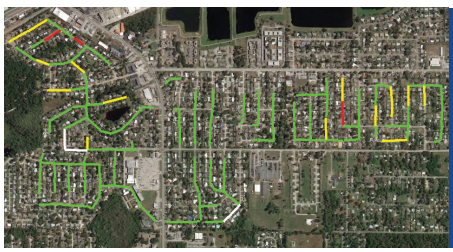

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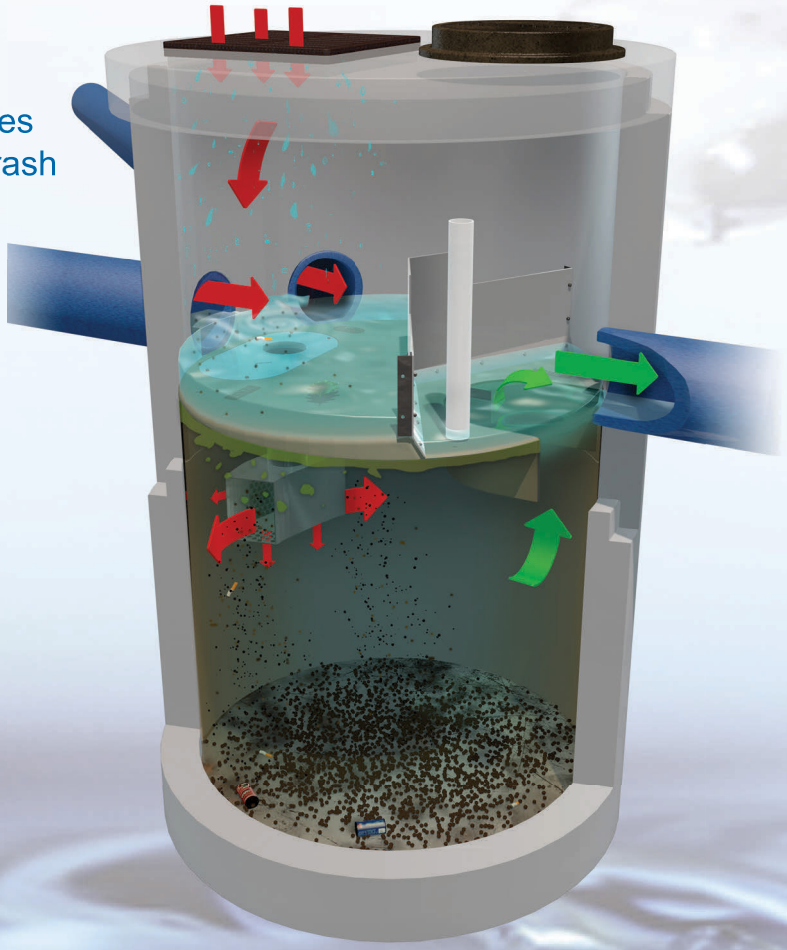

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