Create. Prove. Improve. Demonstrate.

Impact Report

SOUTHERN ONTARIO WATER CONSORTIUM

LE CONSORTIUM POUR L'EAU
DU SUD DE L'ONTARIO

Impact

In seven short years, the Southern Ontario Water Consortium (SOWC) has become a key force in cleantech innovation across the province. We've established crucial infrastructure, forged networks and funded collaborations that are making waves at home and internationally.

This report highlights our achievements and the successes of our three-year Advancing Water Technologies program. Together with our partners, we're creating, proving, improving and demonstrating water-tech excellence – right here in Ontario.

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Water is one of the most essential resources on the planet. But today, everything from aging infrastructure to extreme weather to urban growth are putting significant pressure on water and wastewater systems.

Ontario's water technology experts and innovators are tackling those challenges. However, getting great ideas off the ground isn't easy. It's a big jump to take a breakthrough from the lab bench to the marketplace.

A decade ago, several Ontario post-secondary institutions started thinking about ways to close that gap. They saw opportunities to work with companies, bringing innovations to market faster. In 2011, with the support of government funders and corporate partners, SOWC was born.

Since then, we've expanded our consortium to 10 world-class institutions representing more than 400 researchers, and an ever-growing network of companies large and small. We've built testing infrastructure for wastewater treatment technology and facilitated access to other real-world facilities.

With the launch of our Advancing Water Technologies (AWT) program in 2016, we created even more impact. With generous support from the Federal Economic Development Agency for Southern Ontario (FedDev Ontario), SOWC has invested more than $10 million in 60 industry-driven collaborations. By connecting small and medium-sized companies with university and college researchers, we've helped them overcome technical barriers and accelerate the commercialization of groundbreaking technologies that improve drinking water quality, treat sewage, manage stormwater and more.

Today, those products are helping municipalities and industry better manage water resources, cut operating costs, bolster conservation efforts and even generate revenue by recovering resources. As we wrapped up the AWT program in 2018, we also focused on how to drive adoption of these innovations, especially at the municipal level.

With funding from the Province of Ontario since July 2016, we have enhanced SOWC's role, supporting unique research, projects and events to promote job creation and investment. We have identified strategic opportunities and begun laying the foundation to create even more impact in the years ahead.

Thank you to all the funders, partners and collaborators who contributed to the successes showcased in this report. With your support, we've helped create a vibrant ecosystem of researchers, startups, major companies and municipalities that are bringing made-in-Ontario technology to the global marketplace. Together, we're creating a cleaner, greener province – and a cleaner, greener world.

$56 M

new sales projected by AWT companies by end of 2020

300+

jobs created or maintained by companies and post-secondary partners

More than

$17 M

leveraged investment by companies and partners

SOWC

Eight years of making waves

2011

2013

Joint events at University of Waterloo, Western University and University of Toronto to announce the creation of SOWC with support from the Government of Ontario and the Federal Economic Development Agency for Southern Ontario (FedDev Ontario)

2014

Ontario's Water Sector Strategy recognizes SOWC for its role in supporting innovative technologies

London and Guelph wastewater demonstration facilities commissioned

2015

Fleming College joins Consortium as a new member, adding the capacity of its Centre for Advancement of Water and Wastewater Technologies

Fleming College

MOU signed with Ontario Clean Water Agency to support technology demonstration

University of Waterloo · Western University · University of Toronto · Wilfrid Laurier University · McMaster University · Ryerson University · University of Guelph · University of Ontario Institute of Technology

2016

Prime Minister Trudeau announces new FedDev Ontario support for SOWC to create Advancing Water Technologies (AWT) program

SOWC's Net Zero Energy Wastewater Workshop builds momentum in this area

Queen's University joins Consortium as a new member

SOWC hosts Sustainable Infrastructure Roundtable with the federal Minister of Infrastructure and Communities and industry leaders to provide recommendations on water infrastructure funding

Call for proposals for large (>$100k) AWT projects launched

Provincial funding committed to enhance and expand SOWC activities

Moving Towards Smarter Water Workshop

2017

Ribbon cutting and announcement of Suez AWT project at Guelph wastewater pilot facility

Biosolids Expert Working Group created

SOWC hosts Inaugural Industry Engagement Days to connect HQPs and sector leaders

SOWC hosts Getting to Net Zero workshop to further accelerate this strategic area of strength

2018

Ontario Cleantech Strategy announced with renewed funding for SOWC as a Cleantech Accelerator

SOWC establishes Net Zero Energy Wastewater Municipal Working Group to help Ontario municipalities advance opportunities

Survey of Asset Management launched

GHG emissions calculator project initiated

AWT Technology Showcase Event brings together water sector leaders from industry, academia and all three levels of government

60 AWT projects completed

Create

Through our AWT program, SOWC is helping Ontario's water technology companies create new inventions, develop working prototypes and transform academic research into real-world applications.

Take the example of **Formarum**. The Toronto company teamed up with researcher Amy Bilton, who heads up the University of Toronto's Water and Energy Research Lab. Together, they've developed the most effective micro-turbine of its size in the world. The tiny device harnesses the flow of water through pipes, converting that mechanical energy into electricity.

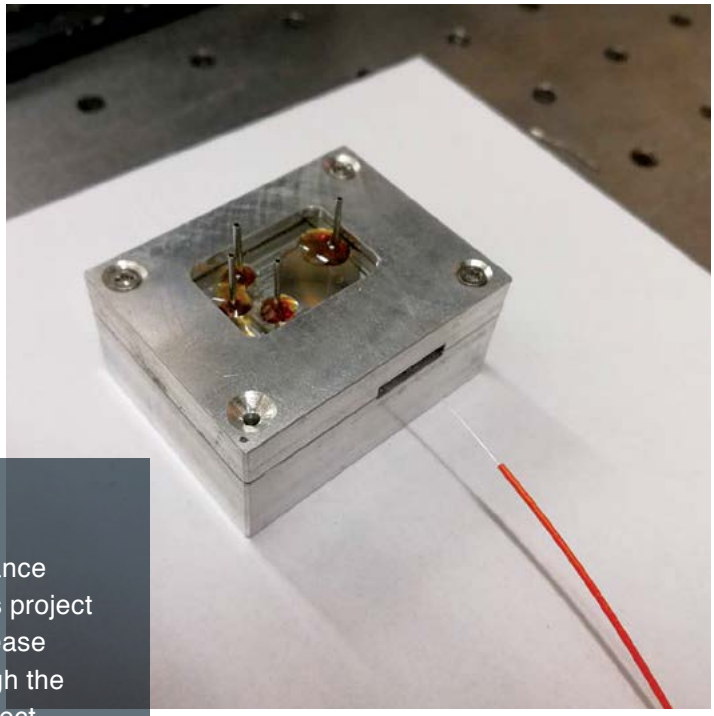
Their first application is a self-powered system for disinfecting swimming pools. Just add salt to the water, and electricity from the turbine breaks it into chlorine and sodium. Compared to conventional chlorinators, the Dive Smart Sanitizer reduces chlorine use up to 90 per cent, while cutting operating costs in half.

Formarum started selling their game-changing product across North America in May 2018, opening an office in Buffalo to tap into the lucrative U.S. market. Pool owners love Dive, rating it an impressive 9.3 out of 10. In 2019, the company plans to ramp up production to 2,500 units.

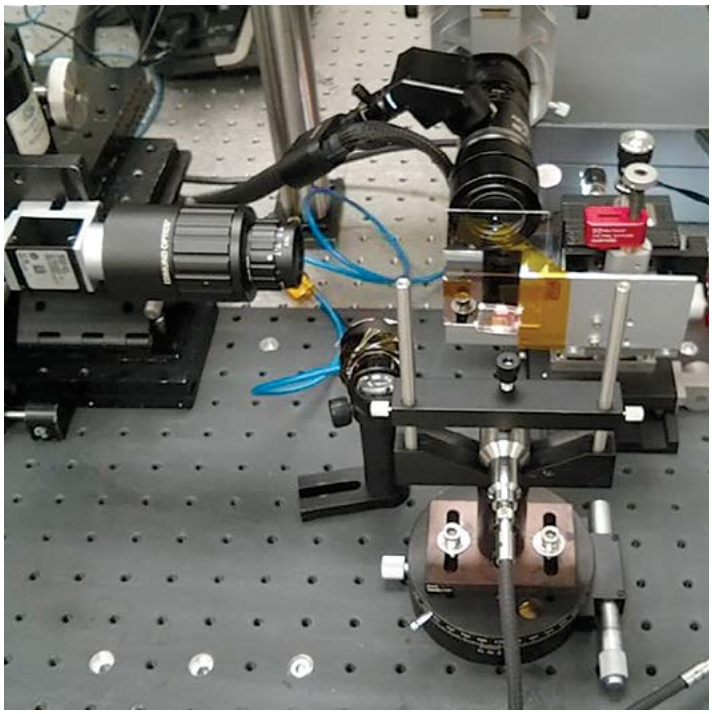
Now, through a second AWT project, the company is working with Bilton to harvest energy created by pressure reduction valves in municipal water networks. Using the same micro-turbine approach, the system will generate electricity from energy that currently goes to waste. The project will optimize the cost, efficiency and size of the mechanism and create a working demonstration, enabling Formarum to sign commercialization agreements.

Other AWT-funded companies are revolutionizing water-quality monitoring. In Hamilton, **Forsee Instruments** collaborated with McMaster engineering physics professor Chang-qing Xu to pioneer a first-of-its-kind device to detect even low levels of E. coli bacteria – right at the water source. After concentrating the bacteria through a ceramic membrane, Forsee uses a miniaturized microflow cytometry system to tag each E. coli cell with fluorescent antibodies. It then uses photonic sensors to count the number of glowing cells.

The system eliminates the need for expensive labs and technical expertise. And because it delivers results in less than an hour, it allows water system managers to take quick action to prevent water-borne disease outbreaks and save lives. The company is currently conducting field validations.



→ Forsee was able to advance several innovations in its project with McMaster and increase TRL by 3 levels. "Through the support of this AWT project, the prototyping, validation and field tests were accomplished in two years, which exceeds our initial expectation."



Meanwhile, Cambridge-based **Honeywell** is using sensors used in outer space to detect pollution here on Earth. Like Forsee Instruments, the company has developed a handheld device that can test water or wastewater samples in situ. In this case, the instrument fires a laser beam at a sample and then uses a spectrometer to analyze the light spectrum that is produced, revealing what contaminants lurk in the liquid. This approach makes it possible to perform continuous monitoring, test for multiple pollutants simultaneously and get speedy results.

To validate its performance, Honeywell worked with the University of Toronto's Elodie Passeport – the Canada Research Chair in Environmental Engineering and Stable Isotopes – and Toronto's Ashbridges Bay Wastewater Treatment Plant. Currently, they are focusing on detecting nitrates and phosphates: the nutrients that cause algae growth in lakes and rivers. However, the potential is much broader. In the future, Honeywell plans to expand the scope of the instrument to detect pesticides, pharmaceuticals, microplastics and more.

Integration of collection system, primary clarifier and fermenter for biosolids and wastewater quality management and control

Industry Lead
Trojan Technologies

Member Institution
Ryerson University

Research Lead
Elsayed Elbeshbishy

Design and optimization of a pico hydro turbine for inline water disinfection systems

Industry Lead
Formarum

Member Institution
University of Toronto

Research Lead
Amy Bilton

Development of a pico-turbine energy harvester for water networks

Industry Lead
Formarum

Member Institution
University of Toronto

Research Lead
Amy Bilton

Prototype development and field validation of an in-line E-coli analyzer for drinking water

Industry Lead
Forsee Instruments

Member Institution
McMaster University

Research Lead
Chang-qing Xu

Through the AWT project, CNEM was able to advance its TRL by 3 levels and identified more potential applications of their nano-membrane foam composite technology. The program enabled CNEM to access new talent, create another collaboration funded through NSERC, and accelerate its technology development.

A novel Raman-based sensor for cost-effective monitoring of nitrate and phosphate in water

Industry Lead
Honeywell / ComDev International

Member Institution
University of Toronto

Research Lead
Elodie Passeport

Water disinfection by metallic alloy foam in a continuous flow-through bed

Industry Lead
CNEM Corporation

Member Institution
University of Guelph

Research Lead
Emily Yi Wai Chiang & Rafael M. Santos

Development and validation of a complete greywater treatment system for multi-residential and commercial applications

Industry Lead
Interpump Supply

Member Institution
Fleming College

Research Lead
Brent Wooton

Development of an integrated toolkit for predicting influent quality of wastewater treatment plants

Industry Lead
Hydromantis Environmental Software Solutions

Member Institution
McMaster University

Research Lead
Zoe Li

Electrochemical treatment and recovery of industrial wastewater: developing electrode materials, electrochemical process, and application

Industry Lead
PW Custom Fabrications

Member Institution
McMaster University

Research Lead
Charles-François de Lannoy

The AWT program has accelerated PW Custom Fabrications' time to market by maintaining the engagement of a critical potential first customer and by opening up access to PhD level research and development talent. The institutional access to expertise and leadership in wastewater treatment, and the access to analytical equipment, would not have been possible without AWT.

Dynamic simulator for energy and process optimization in wastewater utilities

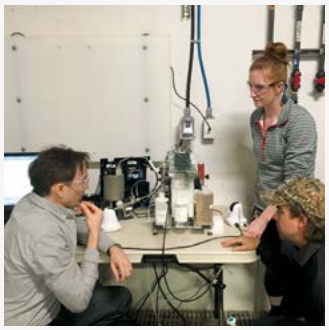
Industry Lead
Hydromantis Environmental Software Solutions

Member Institution
Western University / University of Toronto

Research Lead
Martha Dagnew / Prasanth Nair

"I think it is a great program that allows industries to tap into the research areas of universities while preparing young graduates for the workforce."

Rajeev Goel, President & CEO, Hydromantis



A.U.G. Signals found the experience with the AWT program "very rewarding for both technology development and commercial partnerships." A.U.G. Signals established new relationships with technology companies and researchers. Raising its TRL by 4 levels over the course of this project, A.U.G. Signals has opened up access to new markets not only in Canada but also in China and Europe, including establishing a new presence in Greece.

Development and validation of a prototype nutrient analyzer for continuous water sample analysis and real-time response to water quality variations

Industry Lead
A.U.G. Signals

Member Institution
Ryerson University

Research Lead
Christopher Wellen

Design and construction of portable detectors using fluorescent-based aptasensors for detection of priority contaminants in water

Industry Lead
Environmental Bio-Detection Products Inc. (EBPI)

Member Institution
University of Waterloo

Research Lead
Simarjeet Saini

In-situ SPE concentration and toxicity assessment system to monitor source water quality, evaluate treatment technologies, and improve water quality

Industry Lead
Environmental Bio-Detection Products Inc. (EBPI)

Member Institution
University of Toronto

Research Lead
Ronald Hofmann / Robert Andrews

Developing a rapid, in-situ, and real-time E. coli detection platform using magnetic bio-inks

Industry Lead
EcoliSense

Member Institution
McMaster University

Research Lead
Ishwar K. Puri & Fei Geng

Development of a novel hydrant based urban water distribution monitoring system

Industry Lead
Pattern Discovery Technologies Inc.

Member Institution
University of Waterloo

Research Lead
Sriram Narasimhan

The AWT program has created new interest in advancing pattern recognition intelligence & 'smart' hydrants and "has enhanced the visibility of what we do in this area and our competitiveness in securing additional grants."

Sriram Narasimhan, University of Waterloo

Validation of a real-time integrated microfluidics and high-frequency microwave sensing pathogen detection device

Industry Lead
QuantWave Technologies Inc.

Member Institution
Fleming College

Research Lead
Brent Wootton

Work on the optimization of their detection system has brought QuantWave's products closer to commercialization, and the company has focused in on potential new customers. As a result of its project, a new provisional patent was applied for and a new team member was brought on board to prepare for full commercial launch.

"The AWT program has provided a platform for the industrial innovators and academic researchers to develop innovative and commercialized technologies. The program provided excellent access for small to medium scale demonstration of novel technologies in association with academic researchers."

Hailin Wang, Partner, ETO Solutions Corp

Development of a handheld, real-time water quality testing device for pathogen detection in drinking water applications

Industry Lead
Nanolytix

Member Institution
Fleming College

Research Lead
Brent Wooton

Development and application of DNA-aptamer-based technology to detect cryptosporidium parvum oocysts in drinking water resources

Industry Lead
CREM

Member Institution
University of Waterloo

Research Lead
Juewen Liu

Demonstration of aerobic granular sludge formation in continuous-flow granulation systems

Industry Lead
ETO Solutions Corp

Member Institution
Ryerson University

Research Lead
Steven Liss

Development and validation of a model for automated process control of thermophilic pre-treatment systems for anaerobic digestion

Industry Lead
inCTRL Solutions Inc.

Member Institution
McMaster University

Research Lead
Younggy Kim

"SOWC has established itself as an extremely valuable partner in the water sector. It has brought together stakeholders in unique ways, including establishing a Biosolids Expert Working Group and creating a GHG emissions calculator for wastewater treatment. They are constantly thinking ahead about what the sector needs, not just to develop technologies but to adopt innovative approaches."

Ted Mao, Chief Technology Officer
Trojan Technologies

Prove

AWT funding is helping companies prove their technology works: trying new ideas on a pilot scale, testing new applications of existing technology and validating products for commercial markets.

→ "The AWT program has been an important contributor to help advance EKS business objectives in respect to both the EKS oil sands dewatering technology and to advance development of the EKS-Wastewater Treatment technology. EKS has derived good value from AWT funding in advancing technology development and in establishing significant relationships with both Western University and the University of Guelph."

Ed Hanna, VP Research and Development, EKS

Two AWT projects helped **Greyter Water Systems** move the company's residential greywater reuse solution to market and advance its multi-unit and commercial buildings reuse solutions. The company partnered with experts at Fleming College's Centre for Advancement of Water and Wastewater Technologies (CAWT) to optimize the residential product and prepare for the rigorous process of NSF certification, required in many water stressed jurisdictions. South of the border, the award winning Greyter HOME solution has been featured in concept homes of some of America's biggest residential production builders.

AWT also helped **A.U.G. Signals** validate and finetune a photonic spectrometer that gives drinking water plant operators an early warning if THM levels get too high. This potential carcinogen, the byproduct of chlorination, must be kept within strict limits. A.U.G. collaborated with the University of Toronto's Ron Hofmann and water treatment operators in Smiths Falls. Together, they transformed a lab bench prototype into market-ready equipment.

Meanwhile, **SanEcoTec** has further developed AVIVE: a disinfection system that can replace chlorine as a secondary disinfectant within water networks and serve as a residual disinfectant in building-wide plumbing systems. Because it uses hydrogen peroxide, there's no risk of creating THMs, and it is less corrosive than chlorine. Not only that, AVIVE can control deadly Legionella bacteria.

AWT funding connected SanEcoTec with Queen's University researchers to prove the effectiveness and safety of their system.

AWT funding also helped several companies advance solutions for treating biosolids from municipal wastewater plants. For example, **Walker Environmental** worked with Fleming College's CAWT to integrate CleanB technology into their current treatment system.

CleanB uses sulphuric acid and sodium chlorite to reduce odours and destroy harmful pathogens in biosolids. Walker's N-VIRO system then uses an advanced alkaline stabilization process to treat those biosolids further, converting municipal waste into class A fertilizer that meets CFIA standards for registration. AWT-funded trials at Carleton Place Water Pollution Control Plant ensured the pre-treatment met provincial and federal regulations.

→ Walker Environmental established new partnerships with Fleming College and the Ontario Clean Water Agency to execute its AWT project, allowing it to gain the market knowledge and technical understanding needed to bring a unique municipal wastewater treatment technology to Ontario for the first time.

In Guelph, **Savron Solutions** has developed a unique smouldering combustion technology for treating biosolids that is much cheaper and more environmentally sustainable than incineration. Once the biosolids are ignited, all that's required to sustain the smouldering process is a steady flow of oxygen. Because it uses much less energy than incineration, this approach dramatically reduces greenhouse gas emissions. It also kills harmful pathogens and breaks down contaminants. AWT funding allowed Savron to work with experts at Western University to prove the effectiveness of smouldering at a pilot scale.

Meanwhile, **ElectroKinetic Solutions** undertook two AWT-supported projects. One focused on scaling up their electrokinetic dewatering technology for tailing ponds in the Athabasca oil sands. The system passes a current through the soup-like tailings, driving clay particles to the anode and water to the cathode, dramatically speeding up a process that currently takes decades.

In a second project, EKS worked with the University of Guelph's Bassim Abbassi to apply the same dewatering technology to municipal biosolids on a pilot scale. The novel approach promises significant economic and environmental benefits compared to conventional sludge dewatering.

"This is a great program and initiative that allows technology companies within the water sector to seamlessly gain access to partners and collaborators."

Saad Ulhaq, Environmental Toxicologist / Project Manager, WCI Environmental Solutions Inc. (now E M Fluids)

Advanced water treatment technology for enhanced oxygen delivery and aerobic processes in flowing waters

Industry Lead
WCI Environmental Solutions Inc. (now E M Fluids)

Member Institution
Ryerson University

Research Lead
Andrew Laursen & Vadim Bostan

This AWT project has resulted in new insight into the creation of the next generation of E M Fluids' technology, opened access to new markets within the water sector not previously considered by the company, and offered new opportunities for accelerated company growth. At least two patent applications are in the process of being submitted as a result of this project.

Demonstration of an online photonic sensor to guide treatment changes to minimize disinfection by-products in drinking water

Industry Lead
A.U.G. Signals

Member Institution
University of Toronto

Research Lead
Ronald Hofmann

The AWT program catalyzed a collaboration between the world-class Drinking Water Research group at the University of Toronto and A.U.G. Signals. This collaboration accelerated the technology through a 5 level increase in TRL and will enhance monitoring already in place in 19 First Nation communities.

"It has been an exceptional experience working with the SOWC and the partnering research institution. The access to resources has been very beneficial to the overall project and has helped the development of the technology greatly."

Aaron Kitagawa, Project Manager, IPEX

↓

A performance evaluation of the Vortex Force aeration device in wastewater applications

Industry Lead
IPEX

Member Institution
University of Guelph

Research Lead
Sheng Chang

SOWC provided critical facilitation to help bring the IPEX team together with Dr. Sheng Chang at the University of Guelph, and in exploring options for potential pilots. As a result of its AWT project, IPEX has accelerated the adoption of the Vortex Force aeration device in wastewater applications and established new relationships, including potential new customers.

Reducing populations of harmful bacteria by using a silver-stabilized hydrogen peroxide disinfectant as part of a drinking water treatment process

Industry Lead
SanEcoTec Ltd

Member Institution
Queen's University

Research Lead
Steven Liss

Pilot-scale testing of the ElectroKinetic Solutions-Wastewater Technology (EKS-WWT) for removal of solids from raw municipal wastewater

Industry Lead
Electrokinetic Solutions Inc.

Member Institution
University of Guelph

Research Lead
Bassim Abbassi

Assessment and field demonstration of silicate corrosion inhibitors for the reduction of lead release in drinking water distribution systems

Industry Lead
National Silicates Partnership

Member Institution
University of Waterloo

Research Lead
Peter Huck

Photocatalytic filter media for treatment of organics in water

Industry Lead
Line-X Coatings

Member Institution
Western University

Research Lead
Paul Charpentier

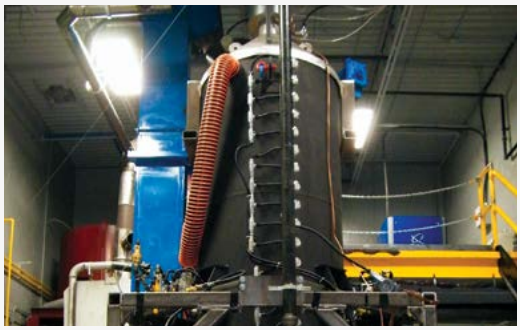
Development and optimization of an innovative ozone saturation system applicable to residential, commercial and industrial potable water treatment and "clean in place" applications

Industry Lead
Aclarus

Member Institution
Fleming College

Research Lead
Brent Wootton

This AWT project enabled new system improvements that were critical for system performance claims, functionality, and in preparation for third-party evaluation. This AWT project led to evaluation of the technology under Ontario Ministry of Environment, Conservation and Parks' Innovative Technology Verification (ITV) program, the first time that Fleming College has worked through this program.



"At the small pilot scale, it's very successful. Now we have proof. And this is only possible, I think, because of this funding from SOWC."

Amarjeet Bassi, Western University

Scale-up development of STARx systems (smouldering combustion) for the destruction of wastewater biosolids

Industry Lead
Savron Solutions

Member Institution
Western University

Research Lead
Jason Gerhard

This AWT project greatly accelerated the understanding needed to smoulder biosolids from municipal wastewater treatment plants, making a successful soil remediation technology viable in a completely new application. The project was a unique combination of scientific objectives and practical applications, which has helped attract top-level talent and supported students at all levels of study.

Phosphorous removal from wastewater secondary effluent by Uninterrupted Ion Exchange (UIX)

Industry Lead
Renix Inc.

Member Institution
Western University

Research Lead
Amarjeet Bassi

Renix's technology has been successfully applied to food and beverage and industrial wastewater. This AWT project allowed Renix to test its application to sewage treatment for the first time.

Pre-commercial small-scale testing program for ElectroKinetic Reclamation – Dewatering Technology (EKR-DT) of oil sands tailings

Industry Lead
ElectroKinetic Solutions

Member Institution
Western University

Research Lead
Julie Shang

Ultraviolet light photocatalysis for chemical-free tertiary organics treatment

Industry Lead
H2nanO

Member Institution
University of Waterloo

Research Lead
William Wong

Development and validation of an advanced wastewater treatment system for on-site residential septic treatment

Industry Lead
Blue Planet Environmental

Member Institution
Fleming College

Research Lead
Brent Wootton

Development, optimization and validation of an innovative onsite water reuse technology to treat greywater

Industry Lead
Greyter Water Systems

Member Institution
Fleming College

Research Lead
Brent Wootton

The AWT project and partnership with Fleming College enabled Greyter to meet the testing requirements to achieve NSF350 certification. This is a really important milestone towards realizing the full commercial potential of the Greyter HOME product as NSF certification is required in many US states. The Greyter HOME will be sold directly to large home builders in the US and Canada and the company expects to sell a few hundred systems by the end of the year.

Evaluation and assessment of an innovative integrated technology for the processing of municipal wastewater biosolids into a Class A fertilizer

Industry Lead
Walker Environmental

Member Institution
Fleming College

Research Lead
Brent Wootton

Evaluation and assessment of the ability of an advanced engineered wetland to treat glycol de-icing and anti-icing fluids from airport wastewater streams

Industry Lead
Stantec Consulting Limited

Member Institution
Fleming College

Research Lead
Brent Wootton

"Suez Water Technologies & Solutions is a well-established and connected global company with a long history in Ontario. There is no doubt that our partnership with SOWC has enhanced our investment in the province. The support through AWT ensured that our pilot installation and over $2 million company investment stayed here and has supported what we anticipate to be our first Ontario client for our Net Zero Wastewater solution."

Henk Koops, Global Technology Leader,
Suez Water Technologies & Solutions

Improve

AWT is helping Ontario companies make good products even better – whether it's optimizing their offerings, developing new features or creating the next generation of technology.

→ Through its AWT project, Civica Infrastructure has created the world's first asset management platform specifically designed for low impact development (LID) practices. Equipped with GIS-enabled mapping capabilities, the mobile-friendly tool lets inspectors keep track of their assets from their smartphones.

Vaughan-based **Civica Infrastructure** recognized that municipalities need robust tools to effectively manage their stormwater control assets, including low-impact developments (LIDs). Unobtrusively woven into the landscape in the form of rain gardens, grassy swales and more, LIDs help move stormwater runoff into the soil.

Through an AWT-funded collaboration with the University of Guelph's Ed McBean, Civica expanded SWMSoft – their proprietary software for tracking stormwater infrastructure – to include low impact development features. They also created a user-friendly mobile app for field inspections. The result is the world's first asset management platform specifically designed for LIDs. Thanks to Civica, municipalities can now easily to track the location and condition of LIDs, plan maintenance and forecast budgets.

Of course, LIDs aren't the only assets that municipalities maintain. Across North America, cities are dealing with aging water networks with leakage rates that typically range from 10 to 30 per cent. Mississauga's **Echologics** has developed technology to detect those leaks and assess the state of water pipes.

The company's EchoShore DX sensors, which sit inside the caps of fire hydrants, have proven their ability to detect leaks and pinpoint their location. However, Echologics saw potential to further refine this industry-leading innovation with the help of three AWT projects.

With experts at the University of Waterloo, they're using machine learning to refine algorithms, allowing the system to zero in on leaks with even greater accuracy. They're also working with a Queen's University researcher to define and isolate noise patterns caused by rust build-up. This "tuberculation" slows water and increases the risk of leaks.

Finally, a partnership with Fleming College is helping Echologics develop an automated way to measure the thickness of pipe walls – even though they're underground. Together, the three projects are creating better ways for municipalities to accurately assess the condition of water pipes, respond to leaks faster and develop strategic replacement plans.

→ Echologics experienced double-digit growth last year. The company undertook three separate AWT projects with researchers at different institutions to enhance system performance and productivity of both their leak detection and condition assessment systems. Results include increased TRL in all three projects, access to talent, potential sales and anticipation of a new patent application.

Toronto's **UV Pure Technologies** has been successfully selling their Crossfire UV disinfection system since 1990, with more than 18,000 units installed around the world. The next step for the company was expanding from residential, commercial and smaller public uses into large-scale industrial and municipal applications. To do that, they had to prove this new generation of Crossfire products could handle increased capacity and meet international standards.

The AWT program helped UV Pure work with Fleming College to develop and test new low-pressure UV lamps and the dosage algorithms required to ensure proper disinfection. A second project, conducted in collaboration with a Queen's University expert on materials and coatings, allowed the company to improve their self-cleaning wiper mechanism.

The final step was ensuring the scaled-up model met the stringent specifications required for global sales. To do that, Fleming's Centre for Advancement of Water and Wastewater Technologies worked with an engineering firm to validate the enhanced Crossfire system to EPA and NWRI standards. As a result, municipalities and companies around the world now have access to a highly effective and environmentally friendly alternative to chlorination.

Electrodialysis in wastewater treatment applications

Industry Lead
Suez Water Technologies and Solutions

Member Institution
McMaster University

Research Lead
Younggy Kim

Applying machine learning classifiers to acoustic leak detection data

Industry Lead
Echologics, a Division of Mueller Canada Ltd.

Member Institution
University of Waterloo

Research Lead
Alex Wong & Kumaraswamy Ponnambalam

Integrating soil properties into wave propagation model for acoustic condition assessment of water-filled metal pipes

Industry Lead
Echologics, a Division of Mueller Canada Ltd.

Member Institution
Queen's University

Research Lead
Ian D. Moore

Development of a machine based acoustic device for municipal pipeline condition assessments

Industry Lead
Echologics, a Division of Mueller Canada Ltd.

Member Institution
Fleming College

Research Lead
Brent Wootton

Peel Region and the Credit Valley Conservation Authority are now field-testing the optimized inspection tool, and two municipal clients have purchased and deployed the beta version. As these early adopters provide feedback, Civica will continue to fine-tune its system before they launch into full-scale commercialization.

Optimized inspection and asset management solution for low impact development practices

Industry Lead
Civica Infrastructure Inc.

Member Institution
University of Guelph

Research Lead
Ed McBean

Design and validation of third generation UV water purification systems for enhanced treatment of drinking water, reuse and wastewater

Industry Lead
UV Pure Technologies

Member Institution
Fleming College / Queen's University

Research Lead
Brent Wootton / Hans-Peter Loock

Application of high-density DNA sequence analysis to improve onsite wastewater treatment processes

Industry Lead
Waterloo Biofilter Systems

Member Institution
McMaster University

Research Lead
Herb Schellhorn

Optimizing aeration to improve the nutrient-and organics-reducing performance of a BioCord™ fixed-film technology

Industry Lead
Bishop Water Technologies

Member Institution
Western University

Research Lead
Martha Dagnew

Development of new tests and applications for detecting bacteria in water based on TECTA-PDS

Industry Lead
Pathogen Detection System (PDS)

Member Institution
Queen's University

Research Lead
Stephen Brown & Steven Liss

The activities in PDS' AWT project significantly impacted the company's technology development and market potential. A new Enterococcus test will provide a completely new, marketable product and validating the technology for municipal wastewater opens up an entirely new application and market.

Integrated Watershed Telemetry System: Enhanced hydrologic data collection, logging and communication for watershed-scale monitoring

Industry Lead
Solinst Canada Ltd.

Member Institution
University of Waterloo

Research Lead
David Rudolph

Enabling recovery and reuse of nutrients with residential septic systems

Industry Lead
Waterloo Biofilter Systems

Member Institution
University of Guelph

Research Lead
Susan Glasauer

"I have been involved in a number of projects supported by different funding programs and the AWT program was one of the most successful in enabling industry-driven research leading to direct commercial benefit to the company and economic benefit to Ontario. The model of collaboration between the university and industry is excellent and the roles of the respective institutions were clear and well defined. The training of HQPs was excellent, providing them with valuable industry research experience."

Siva Sarathy, Senior Research Scientist, Trojan Technologies

Pathogen and micropollutant control for water reuse using advanced ultraviolet-based technologies

Industry Lead
Trojan Technologies

Member Institution
Western University

Research Lead
Ajay Ray

Improved high frequency water quality data collection: reliable real-time fault detection and data analysis

Industry Lead
Primodal Systems Inc.

Member Institution
McMaster University

Research Lead
Emil Sekerinski

Real-time microbial monitoring system for drinking water quality

Industry Lead
Genemis Laboratories Inc.

Member Institution
University of Waterloo

Research Lead
William Anderson

According to Genemis, its AWT project "has improved our company's reputation as an innovator in field water testing technologies and opened partnership opportunities that would not have been available without this project". The company has signed a partnership with one of the largest dental equipment companies in the world, and has generated interest from major water treatment companies.

"Each of the post-secondary institutions that are partners in SOWC possess unique expertise and capacity in water. But SOWC's singular focus on water technologies, connections across the water sector, and meaningful engagement of companies is something that none of us could offer on our own."

Bernard Duncker, Associate Vice-President, Interdisciplinary Research, University of Waterloo

Demonstrate

Before investing in new technology, buyers need to be confident it works. By helping Ontario companies demonstrate their products under real-world conditions, AWT provides the evidence required.

MANTECH, a Guelph company, developed a tool to measure the natural organic matter that can create taste, colour and odour problems in drinking water and produce harmful disinfection byproducts. Their nanotechnology-based PeCOD analyzer is more sensitive than existing methods and gives operators results in a matter of minutes.

An AWT-funded collaboration with University of Toronto expert Robert Andrews helped MANTECH work out the kinks and improve the sensitivity of their analyzer. It also allowed them to pilot the device at Peterborough's water treatment plant, demonstrating that it can help plant operators save money and deliver safe, high-quality drinking water. The PeCOD is utilized at multiple municipalities in Canada and the USA.

AWT projects have also helped several companies bring innovative wastewater treatment solutions to market.

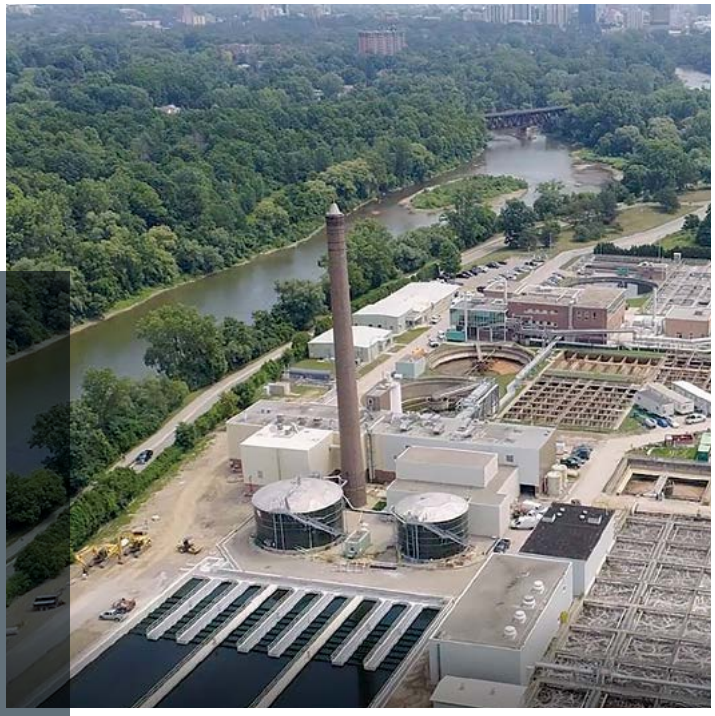
In Renfrew, **Bishop Water Technologies** has pioneered a simple, effective, low-cost way to increase the performance of wastewater lagoons and conventional activated sludge systems – without increasing their footprint.

Bishop's modular BioCord Reactor consists of densely packed loops of polymer that create a surface for sewage-eating microorganisms, while a fine bubble diffuser gives those bugs the oxygen they need. By installing one (or many) units into their system, operators can achieve 90 per cent reductions in ammonia, 50 per cent reductions in nitrogen and 80 per cent reductions in biochemical oxygen demand.

An initial AWT partnership Western University's George Nakhla proved it works even in sub-zero conditions. A follow-up AWT project with fellow Western researcher Martha Dagnew demonstrated the oxygen transfer efficiency minimizes energy costs. As a result, Bishop is now piloting their BioCord Reactor in Sylvan Lake, Alberta.

For small communities and remote sites that need a simple approach to wastewater treatment, Vaughan's **H2Flow Equipment** has the answer. Their TILT-MBBR system offers complete treatment conveniently packaged in a shipping container. A continuous rotating filter belt provides primary treatment, a modified moving bed bioreactor takes care of secondary treatment, while UF filtration provides the final polishing.

H2Flow was able to optimize TILT-MBBR operation and design parameters in a pilot installation thanks to an AWT-funded collaboration with Fleming College. The result is a robust solution that strikes the right balance between effluent quality, energy efficiency, transportability and ease of use.



→ SOWC London and Guelph pilot facilities enable real-world demonstration of wastewater technologies. The London facility is located at the Greenway Water Pollution Control Plant (pictured).

AWT helped **Suez Water Technologies & Solutions** commercialize new products. The company teamed up with researchers from McMaster University and the University of Guelph to test "energy-neutral" wastewater treatment that reduces electricity use, generates renewable energy and produces clean water and fertilizer.

By incorporating biological hydrolysis into the anaerobic digestion process, Suez ensures more organic waste gets digested and creates more biogas. Meanwhile, their ZeeLung MABR biofilm technology promotes the growth of microorganisms that feed on nutrients – a nitrogen-removal system four times more efficient than conventional aeration. The AWT project allowed SUEZ to demonstrate the performance and efficiency of these innovations under real-world conditions at a London wastewater treatment plant.

In a second AWT project, the company worked with a McMaster researcher to show how electrochemical membrane technology can remove nutrients from wastewater, speeding up treatment time and substantially reducing costs.

The pilot enabled Suez to double the energy efficiency of its Zeelung membrane by reusing air in the system to deliver oxygen to the microorganisms. This also reduces overall complexity and cost for the product. The full-scale demonstration allowed the company to validate the technology and the energy benefits, test further enhancements, and realize a faster time to market.

Validation and full-scale demonstration of the Biological Hydrolysis Anaerobic Digestion (BH-AD) and ZeeLung MABR technologies for energy neutral wastewater treatment

Industry Lead
SUEZ Water Technologies and Solutions

Member Institution
University of Guelph / McMaster University

Research Lead
Sheng Chang / Younggy Kim

Pilot installation to optimize performance of the TILT-MBBR ultrafiltration system for the treatment of municipal wastewater

Industry Lead
H2FLow Equipment Inc.

Member Institution
Fleming College

Research Lead
Brent Wootton

Full scale BioCord demonstration project for cold temperature ammonia removal in a wastewater treatment lagoon

Industry Lead
Bishop Water Technologies

Member Institution
Western University

Research Lead
George Nakhla

"This project has greatly assisted the commercial readiness of our technology. Implementing a real-world system allowed us to understand the challenges of wastewater treatment in lagoon systems and address the issues that come with a full scale installation and improve our technology."

Kevin Bossy, CEO,
Bishop Water Technologies

The AWT program has provided Greenfield Global access to highly qualified academic researchers and an opportunity to connect with a variety of stakeholders in Ontario's municipal wastewater industry. Access to HQPs and state-of-the-art laboratories is critical for its technology validation and optimization, and with the continued help of SOWC, Greenfield Global strongly believes that it will "be able to secure a host municipal site to further validate and showcase our innovative Canadian anaerobic digestion technology".

Optimization and evaluation of thermal hydrolysis for full-scale anaerobic digestion

Industry Lead
Greenfield Global Inc.

Member Institution
Ryerson University

Research Lead
Elsayed Elbeshbishy

Development of an oxidative organic monitoring tool for source and treated drinking waters

Industry Lead
MANTECH

Member Institution
University of Toronto

Research Lead
Robert Andrews

Validation and optimization of a pilot-scale proprietary Forward Osmosis process for industrial wastewater treatment, recovery and reuse

Industry Lead
Forward Water Technologies

Member Institution
University of Toronto

Research Lead
Vladimiros Papangelakis

Development and full-scale validation of a commercial greywater reuse technology

Industry Lead
Greyter Water Systems

Member Institution
Fleming College

Research Lead
Brent Wootton

Validation of RESOLVE airborne aquifer imaging technology for enhanced source-water management and protection

Industry Lead
CGG Canada Services Ltd.

Member Institution
University of Guelph

Research Lead
Beth Parker

Development, optimization and validation of an innovative integrated anaerobic thermophilic digester for the treatment of organic waste and septage

Industry Lead
SusGlobal Energy Corp.

Member Institution
Fleming College

Research Lead
Brent Wootton

As a result of its AWT project, SusGlobal was able to raise its technology's TRL to 8 and attract new investment. It has been able to demonstrate a more effective configuration of anaerobic digesters when compared against the conventional paradigm, allowing it to capture the attention of new markets.

AWT Showcase 2018

Bringing agents of innovation together

UV water purifiers. Microbiological sensors. Sludge fermenters. Since 2016, SOWC's Advancing Water Technologies program has accelerated the development of a wide range of groundbreaking technologies right here in Ontario.

To celebrate those successes, an AWT Showcase was hosted on September 20th in Mississauga by SOWC with Ontario Clean Water Agency. The one-day event kicked off with lively breakfast conversations among 170 representatives from water tech companies, researchers and municipalities. Down the hall, staff from companies were setting up displays of their technologies in a mini-tradeshow.

"We really wanted to create an opportunity for industry innovators to meet each other, to meet potential academic collaborators and, critically, to show all this innovation off to Ontario municipalities," SOWC executive director Brenda Lucas said in her opening remarks.

Municipalities: Key agents of innovation

Strategic partnerships with municipalities was a theme that came up frequently in panel discussions, workshops and hallway conversations. For Civica Infrastructure, getting feedback from city stormwater managers will help them optimize their asset inventory software. For Environmental Bio-detection Products, it's about getting access to municipal water samples for field trials once their algae-bloom sensors have been proven in the lab.

Many companies also identified the important role municipalities play in piloting new technology. Bishop Water Technologies had developed a system that enhances the growth and efficiency of microorganisms involved in wastewater treatment. However, they needed a municipality to test it.

Enter AWT. Through the program, Bishop Water Technologies connected with the Township of Southgate, which agreed to try out the company's BioCord System.

For Southgate, it was an opportunity to explore a solution to the challenges they faced removing ammonia from their wastewater treatment lagoon in the winter. For Bishop Water Technologies, it provided critical data to optimize their product, validated its year-round capabilities and helped them make inroads with other municipalities.

Identifying barriers, brainstorming solutions

The day also focused on overcoming some of the barriers technology providers face in securing municipal partnerships. Whether it's navigating a city's strict procurement policies, addressing a culture of risk aversion or simply getting the attention of busy project managers, getting innovative solutions into the hands of municipalities often presents challenges.

In response, company execs and municipal representatives brainstormed solutions in smaller groups, packing sheets of flipchart paper with ideas. In one session, Greg Robles from Walker Environmental shared how they worked with the town of Carleton Place to pilot their technology, which converts biosolids into Class A fertilizer. In another workshop, senior engineer Emily Zegers from Toronto Water offered advice on how best to engage with cities.

Showcasing success

Between sessions, participants visited the tradeshow booths to learn more about the AWT-funded companies. Staff from Echologics explained how their acoustic sensors can help cities avoid costly water main blowouts. Researchers and municipal leaders crowded around Greyter Home System's wastewater recycler, eager to hear how it can slash residential water consumption by up to 30 per cent. MANTECH demonstrated how their portable water-quality analyzer can offer municipal leaders a fast and reliable alternative to sending samples to labs for testing. IPEX demonstrated how their Vortex Force aerator reduces odours from sewers.

Altogether, 35 companies showcased their technologies. While the range of what was on display was broad, they all shared a few things in common. For starters, they're advancing innovative solutions – helping municipalities better manage water resources, cut operating costs, bolster conservation efforts and more. They also offered clear evidence of the impact of the AWT program.

For ElectroKinetic Solutions (EKS), the funding paid for test space at the Guelph wastewater treatment plant. The direct feed of raw sewage allowed EKS to refine their electrochemical approach to removing suspended solids. For H2nanO Incorporated – whose advanced oxidation process uses nanomaterial to break down organics in industrial wastewater – funding made it possible to train new engineers.

Strengthening connections

As valuable as the facilitated workshops and discussions were, plenty of magic happened in between formal sessions and during the networking event that followed. City officials, university researchers and tech company executives made introductions, discussed current projects and laid the groundwork for future collaborations.

"It's really quite amazing to have all of you in one place," Lucas told participants in her closing remarks. "It's really important to recognize the wealth of innovation and expertise and knowledge and potential in this room."

It's potential that SOWC is proud to have helped foster – and will continue to foster in the coming years. While the future of AWT is still taking shape, Lucas made one thing clear: "We're not stopping here," she said.

Building on success

For the past seven years, our role has been to open the taps of water-tech innovation in this province. And we have — by giving Ontario researchers and companies the funding, opportunities and connections they need to bring novel solutions to market.

But we are far from finished. Today's big water challenges continue to demand big ideas. At the same time, we need to address barriers to adoption, paving the way for municipalities and other end-users to embrace new technologies.

We've proved the SOWC model works, creating jobs and commercializing groundbreaking, made-in-Ontario products. Looking ahead, we will be seeking funding to establish the next phase of the AWT program and leverage our successes to date.

With the ongoing support of our partners, we'll continue to advance innovative technologies that drive economic growth in Ontario and help steward the water we all rely on.

Who We Are

Brenda Lucas
Executive Director

Rahim Kanji
Manager, Industry Partnerships

Robert Nyman
Project Coordinator

Aishi Salimi
Research Financial Analyst
(University of Waterloo)

Nancy Sej
Research Project Accountant
(University of Waterloo)

Anna Ziolecki
Manager, Research Partnerships
(until November, 2018)

Southern Ontario Water Consortium
Research Advancement Centre 1
200 University Avenue West
Waterloo, Ontario N2L 3G1

sowc.ca

Creative: **forgoodintent**.com Writing: **cadmiumred**.ca

Post-Secondary Members

University of Waterloo, Wilfrid Laurier University, Queen's University, University of Toronto, University of Ontario Institute of Technology, McMaster University, Western University, Fleming College, Ryerson University, University of Guelph

Funding Partners

Ontario

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Canada

SOUTHERN ONTARIO WATER CONSORTIUM

LE CONSORTIUM POUR L'EAU
DU SUD DE L'ONTARIO