

Exploring Water Management Challenges and Innovation in Ontario's Greenhouse Sector



Thank you to our sponsors









ONTARIO WATER CONSORTIUM







This project was undertaken with the financial support of Ce projet a été réalisé avec l'appui financier de



Agence de l'eau du Canada



Introduction

Ontario, Canada, is home to more than 60 percent of the greenhouses in Canada (Statistics Canada, 2022). Essex County, located in Southwestern Ontario, is home to the second highest concentration of greenhouses globally (TVO Today, 2023), concentrated within the Municipality of Leamington and the Town of Kingsville. These greenhouses grow more than 80 percent of Ontario's total greenhouse vegetable production, mainly compromising peppers, tomatoes, and cucumbers (Cooper, 2024). Since 2000, the greenhouse sector footprint has more than doubled and has expanded to multiple new watersheds (Stammler et al., 2023). As the concentration of these greenhouses continues to grow within the region, effective water management is becoming a pressing issue due to rising operational demands, regulatory requirements and environmental sustainability concerns.

The Union Water Supply System (UWSS) provides potable water to the Town of Kingsville, the Municipality of Learnington, a portion of the Town of Essex and a portion of the Municipality of Lakeshore (Ontario Clean Water Agency, 2024). UWSS has one treatment plant, servicing an estimated population of 67,041 (Ontario Clean Water Agency, 2024), along with the greenhouses within Essex County. Currently, greenhouses in Learnington and Kingsville use about half of the water supplied by Union Water (CBC, 2021). Greenhouses have found innovative solutions for water availability, using well water, building water ponds to house rainwater, and sometimes using their own developments that will take water out of the lake. However, there is still concern for water security and infrastructure with the continued growth of greenhouses and the increasing population relying on Union Water.

There is also increasing concern regarding the health of Lake Erie, which is facing a resurgence in algae blooms, threatening the lake's ecosystem and drinking water. Some experts believe that the greenhouse industry can be a major contributor to the input of nitrogen and phosphorous in the lakes, specifically from vegetable and cannabis greenhouses (Duong et al., 2024). Wastewater from greenhouses is known to contain high levels of phosphorous and nitrogen, and if not handled correctly can leak into nearby waterways, impacting downstream ecosystems (Maguire et al., 2018). Greenhouse stormwater retention ponds are also recognized as potential sources of nitrogen and phosphorous, despite their intended purpose of collecting rainwater from the expansive roofs (Varga et al., 2023). Uncertainty around the greenhouse wastewater is leading to increasing environmental concerns.

On March 27th, 2025, the Ontario Water Consortium, in collaboration with the Ontario Greenhouse Vegetable Growers (OGVG), University of Windsor Agriculture UWindsor (AgUWin) and Great Lakes Institute for Environmental Research (GLIER) hosted to day-long workshop, *"Exploring Water Management Challenges & Innovation in Ontario's Greenhouse Sector*". This event brought together a diverse group of stakeholders, including growers, researchers, industry leaders, water quality experts, policymakers, and community partners to explore and discuss innovative solutions to water management challenges. The event provided cutting-edge research and technological advancements in water management, allowed for engagement with experts on key issues affecting greenhouse water usage, and provided collaboration with peers to brainstorm strategies to deal with water management.



Assessing the current state of water management

Event participants conducted a comprehensive SWOT analysis of current water management practices, yielding key insights for strategic development.

Strengths

- Strong regional knowledge base
- High greenhouse density with important contributions to food security
- Controlled water usage
- Heightened efficiency of nutrient management (harvested on-site, reused/recycled)
- Adaptability and innovation driven by the moratorium
- Extensive industry expertise and diverse research initiatives in the region

Weaknesses

- Reliance on centralized potable water system and treatment
- Limited cross-sectoral communication and fragmented coordination among municipal, public and industry stakeholders
- Industry growth restrictions due to the moratorium
- Overregulation with limited compliance and enforcement mechanisms

Opportunities

- Potential for on-site discharge treatment systems
- Expansion and coordination (government and research)
- Increased knowledge-sharing and understanding among and between industry, researchers, and other stakeholders to improve water treatment practices
- Exploration of new water sources (e.g., raw water)
- Public education and awareness campaigns on water management strategies
- Incentives for rainwater utilization and other innovative technologies and techniques

Threats

- Risk of excess nutrients, pathogens, herbicides, and pesticides, entering freshwater sources
- Political complexities no one-size-fits-all solution
- High costs associated with on-site water treatment
- Public perception challenges regarding greenhouse sector:
 - Residents' concerns over water rates and responsibility for treatment costs
 - o Concerns from Caldwell First Nation about water pollution



Considering innovative solutions and approaches

Event participants worked alongside peers from a diverse group of stakeholders to innovate solutions and approaches. Using their expertise, they came up with five areas to approach when envisioning solutions.





Envisioning an ideal future

In a collaborative effort to address current challenges and identify opportunities, event participants brainstormed and envisioned an ideal future defined by sustainability, innovation, and strategic partnerships. They emphasized closed-loop systems, resource recovery, improved coordination, and enhanced environmental stewardship. With collective effort and commitment, this future is well within reach.





Next Steps Forward

The interactive brainstorming and collaborative sessions concluded with event participants outlining key next steps to advance action-oriented solutions and innovation.

Step 2: Build and strengthen collaborative spaces

Integrate diverse perspectives and stakeholders into working groups or discussions to break down siloes and enhance multidimensional problem-solving.

Step 3: Recognize the complexity of BMPs

Invest in continuous research and development to innovate BMPs, recognize that no single BMP is universal and will require ongoing evaluation and communication.

Step 4: Challenge normalized discourses

Consider shifting the narrative from 'wastewater' to 'water reuse' to emphasize its value.

Consider reframing the conversation on 'bad actors', emphasizing communal, solutions-oriented approaches to water management.

Step 1: Maintain momentum

Explore opportunities for continued dialogue and action. Establish a dedicated working group with regular meetings to provide a structured platform for ongoing discussions.



Conclusion

The "Exploring Water Management Challenges and Innovations in Ontario's Greenhouse Sector" meeting provided valuable information, offering insights into water management in the greenhouse sector. The event helped to identify current strengths, weaknesses, opportunities and weaknesses of water management. Participants identified innovative solutions and approaches that could bring novel solutions to water management within the greenhouse sector.

Key thematic insights from this event underscored the importance of collaborative partners and sustained communication, leveraging research innovations, developing integrated industry resources, and recognizing the multi-faceted nature of best practices across public, industry and policy sectors.

Ultimately, realizing participants' visions of optimal water management hinges on enduring collaboration and communication from every stakeholder. For this successful event to truly mark the hopeful first stride toward this shared ideal of water management, unwavering commitment and continued engagement is not only proposed, but vital.



References

CBC. (2024, January 26). Rapid growth of Windsor-Essex greenhouses leads to fight over water access. CBC News. <u>www.cbc.ca/news/canada/windsor/water-capacity-kingsville-leamington-1.5888578</u>

Cooper, K. (2021, February 21). Food for Thought: Essex, Chatham-Kent leaders in greenhouse vegetable production. Chatham Daily News. <u>https://www.chathamdailynews.ca/opinion/columnists/food-for-thought-essex-chathamkent-leaders-in-greenhouse-vegetableproduction#:~:text=in%20our%20greenhouses.-,Essex%20County%2C%20mainly%20the %20Leamington%2DKingsville%20area%2C%20grows%20more,times%20the%20populat ion%20Canada%20does.</u>

- Duong, D., O'Rourke, C., Sharma, S., Stamcoff, B., & Wills, C. (2024). Glasshouse Geospatial Group: Mapping Your Growth. ArcGIS. Retrieved April 7, 2025, from https://storymaps.arcgis.com/stories/e65ca1cbade14c3daea1b727f1b484e2
- Maguire, T. J., Wellen, C., Stammler, K. L., & Mundle, S. O. C. (2018). Increased nutrient concentrations in Lake Erie tributaries influenced by greenhouse agriculture. *Science of the Total Environment*, 633, 433–440. <u>https://doi.org/10.1016/j.scitotenv.2018.03.188</u>
- McGrath, J. M. (2023, February 3). *Ontario's greenhouse industry is experiencing growing pains*. Tvo Today. <u>https://www.tvo.org/article/ontarios-greenhouse-industry-is-</u>experiencing-growing-pains
- Ontario Clean Water Agency. (2024). Drinking Water Systems Regulation O. Reg. 170/03 Drinking Water Systems Regulations ANNUAL REPORT Drinking Water System Number: 210000853 Drinking Water System Name: Union Water Supply System Drinking Water System Owner: Drinking Water System Category.
- Stammler, K., Weinz, A., & Grgicak-Mannion, A. (n.d.). Expanding greenhouse sector in Essex County, ON and downstream water quality degradation Kingsville Leamington Nutrient Project 2012-2022. <u>https://doi.org/10.13140/RG.2.2.32209.92009</u>
- Varga, E., Reid, T., Mundle, S. O. C., & Weisener, C. G. (2023). Investigating chemical and microbial functional indicators of nutrient retention capacity in greenhouse stormwater retention ponds in southwestern Ontario, Canada. *Science of the Total Environment*, 855. <u>https://doi.org/10.1016/j.scitotenv.2022.158894</u>



Appendix 1: Agenda

- 8:30 AM Registration and Refreshments
- 9:00 AM Welcome
 - Tom Schnekenburger, University of Windsor / Rahim Kanji, Ontario Water Consortium

Opening Remarks: Richard Pellerin, Sco-Terra

Speaker: Rob Petro, Ontario Greenhouse Vegetable Growers

Interactive Session

Speaker: Tom Schnekenburger, University of Windsor

Interactive Session

- **10:40 AM** Coffee Break and Networking
- **11:00 AM** Catalyst Speaker Discussion: Current Water Management Practices, Challenges and Potential for the Future
 - Robert Sharon, Matt Korpan, Derek Davy, and Liana Major

Interactive Session

12:15 PM Lunch Break

- 1:15 PM Catalyst Speaker Discussion: Emerging Research and Success Stories in Water Practices
 Dr. Fadi Al-Daoud, Dr. Chris Weisener, Dr. George Arhonditsis, and Dr. Catherine
 - DI. Fadi Al-Daoud, DI. Chris weisener, DI. Georg Febria

Interactive Session

- **2:45 PM** Coffee Break and Networking
- **3:05 PM** Next Steps and Closing Remarks
- **3:30 PM** Networking
- 4:00 PM Safe Journey Home



Appendix 2: Speakers

Session: Current Water Management Practices, Challenges and Potential for the Future

Commercial greenhouse production and centre for horticultural innovation Matt Korpan (Nature Fresh Farms)

• Driving innovation in the greenhouse sector through advanced technology, new crops, genetics, tissue culture, and food science.

Econse water purification systems

Derek Davey (Econse)

• Providing sustainable wastewater solutions to minimize water pollution, enabling industry growth while safeguarding the environment.

Greenhouse solutions

Lianna Major (Veolia)

• Championing waste reduction, renewable energy, clean water solutions, and lower greenhouse gas emissions.

Municipal perspective on water management in greenhouses

Robert Sharon (Municipality of Learnington)

• Overseeing the treatment, allocation, and delivery of potable water to greenhouses, as well as managing stormwater impacts and greenhouse wastewater/nutrient discharge.



Session: Emerging Research and Success Stories in Water Practices

Controlled environment agriculture

Dr. Fadi Al-Daoud (OMAFA)

• Greenhouse water management, including recirculation, filtration, disinfection, and recycled nutrient solutions

Informed sustainable water management for growers

Dr. Chris Weisener (GLIER)

• Informed, sustainable water management strategies by developing targeted BMPs for improved pond management and practical chemical and bioindicators.

Data-driven tools to better understand and solve real-world environmental problems Dr. George Arhonditsis (University of Toronto)

• Integrating regional assessment with watershed planning and field-level implementation through basin, watershed, and farm-level modelling.

Ecosystem approach to addressing water challenges

Dr. Catherine Febria (University of Windsor)

• Fostering local partnerships for science-based research and capacity building on farms and waterways, co-creating sustainable water solutions through diverse knowledge systems.



Attendees L	ist: 87	Attendees
-------------	---------	-----------

First Name	Last Name	Organization
Nasser Mohieddin	Abukhdeir	University of Waterloo
Fadi	Al-Daoud	Ontario Ministry of Agriculture, Food and Agribusiness
Ainsley	Archer	Agriculture and Agri-Food Canada (AAFC)
George	Arhonditsis	University of Toronto
Emma	Arnew	Essex Region Conservation Authority
Kevin	Baines	OMAFA
Annyse	Balkwill	Luminus Group
Shannon	Belleau	Municipality of Learnington
Kevin	Bossy	Bishop Water
Isaac	Braun	Nature Fresh Farm
Matthew	Child	International Joint Commission
Chelsea	Crundwell	University of Windsor
Derek	Davy	Econse Water Technologies
George	Dekker	Mucci Farms
Michael	Del Ciancio	DC Farms
Glen	Dsouza	Western University
Catherine	Febria	University of Windsor
Craig	Fowler	OMAFA
Riddhi	Gadre	
Michael	Helps	Lambton Area Water Supply System
Sara	Hemmati	McMaster University
Zachary	Hilbert	GLIER
Jane	Но	Ontario Clean Water Agency
Craig	Hotchkies	Enereau Systems Group Inc.
James	Hotchkies	Enereau Systems Group Inc.
Stephen	Hrastovec	TriSon Farms International Inc.
Rob	Hyde	Canada Water Agency
Dave	Jubenville	Ontario Clean Water Agency
Rahim	Kanji	Ontario Water
Younggy	Kim	McMaster University
Tony	Kobilnyk	Bishop Water
Matt	Korpan	SEF Horticultural Innovation
Amanda	Lim	Nature Fresh Farm
Lianna	Major	Veolia Water Technologies & Solutions
Ted	Mao	MWTechnologies Inc.
Matt	Marchand	Ontario Greenhouse Vegetable Growers
Asbah	Masood	OMAFA
Kevin	McKague	Ontario Ministry of Agriculture, Food and Agribusiness
Mike	McKay	University of Windsor
Paul	Morris	LLC BG Biologics
Sarah	Nasri	Ontario Greenhouse Vegetable Growers



R	Nicol	Lambton College
Robert	Nyman	Ontario Water
Sandali	Panagoda	McMaster University
Robert	Petro	Ontario Greenhouse Vegetable Growers
Kumaraswamy	Ponnambalam	University of Waterloo
Nicole	Roberge	University of Windsor
Kathryn	Russell	Greenhouse Floriculture Specialist
Tom	Schnekenburger	University of Windsor
Rajesh	Seth	University of Windsor
Robert	Sharon	Municipality of Learnington
Natalia	Shiu	McMaster University
Nidhan	Singh	Fanshawe
Patrick	Spezowka	Ministry of the Environment and Climate Change
katie	stammler	Essex Region Conservation Authority
Wendy	Stark	Invest WindsorEssex
Robin	Trepanier	Ontario Clean Water Agency
Kerry	Tuyen	Ontario Clean Water Agency
Poornima	Unnikrishnan	University of Waterloo
Chris	Uszynski	ONYXEngineering Ltd
Chris	Weisener	University of Windsor
Yuanyan	Zi	University of Windsor
Trever	Pitcher	University of Windsor
Shreni	Parikh	University of Windsor
Sydney	Thompson	University of Windsor
Farhan	Khan	University of Windsor
Pawel	Suszycki	University of Windsor
Masoud	Akhshik	St. Clair College
Rahul	Banerjee	University of Windsor
Layan	Barakat	University of Windsor
Mark	Reimer	Great Lakes Greenhouses, Inc.
Sandy	Aljaleelah	
Amish	Nepal	University of Windsor
Matt	McIntosh	
Jeanine	West	Flowers Canada Ontario
Ann	Huber	The Soil Resource Group
Erika	Borrelli	University of Windsor
Julian	Ware	Independent Robotics