Halifax Water

Utility Partnerships – Halifax Water and Dalhousie University

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Water Quality Manager Halifax Water

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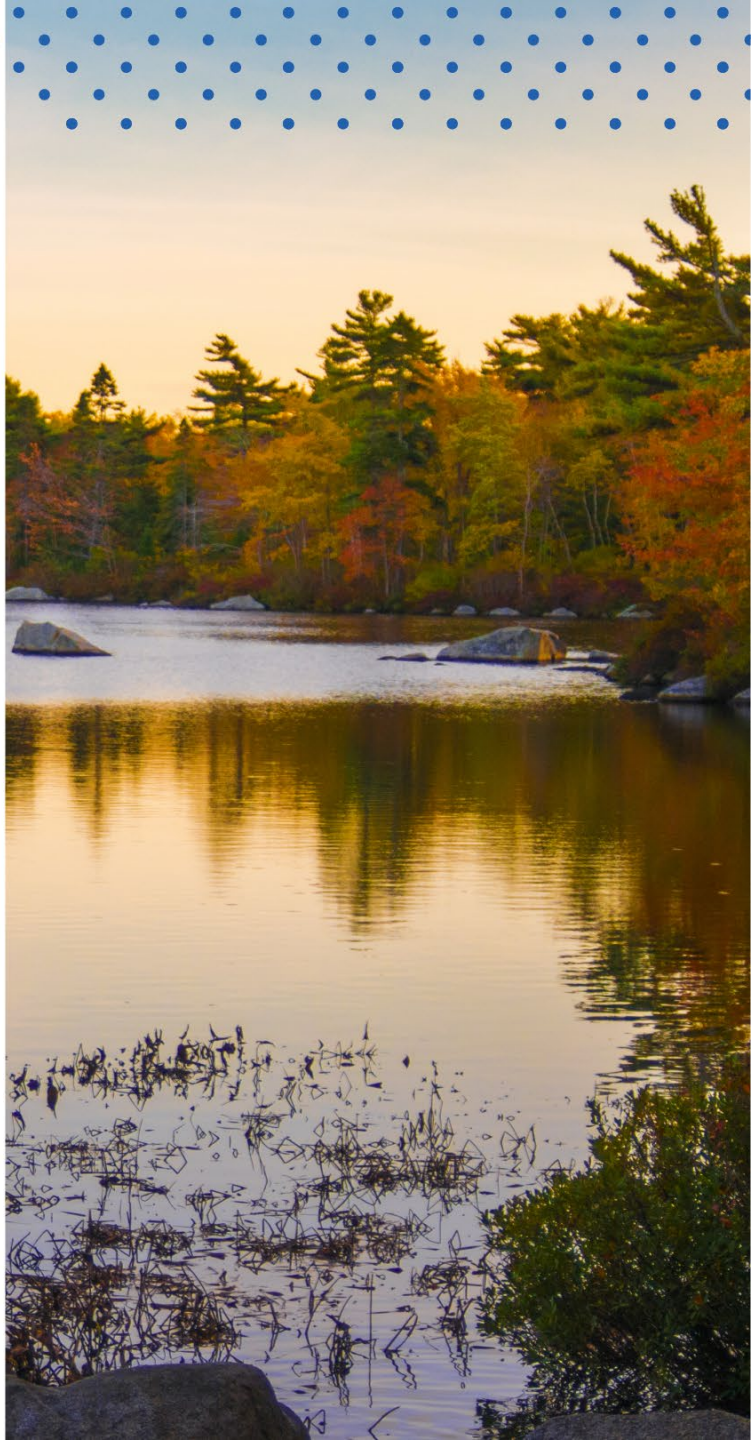
Dalhousie University

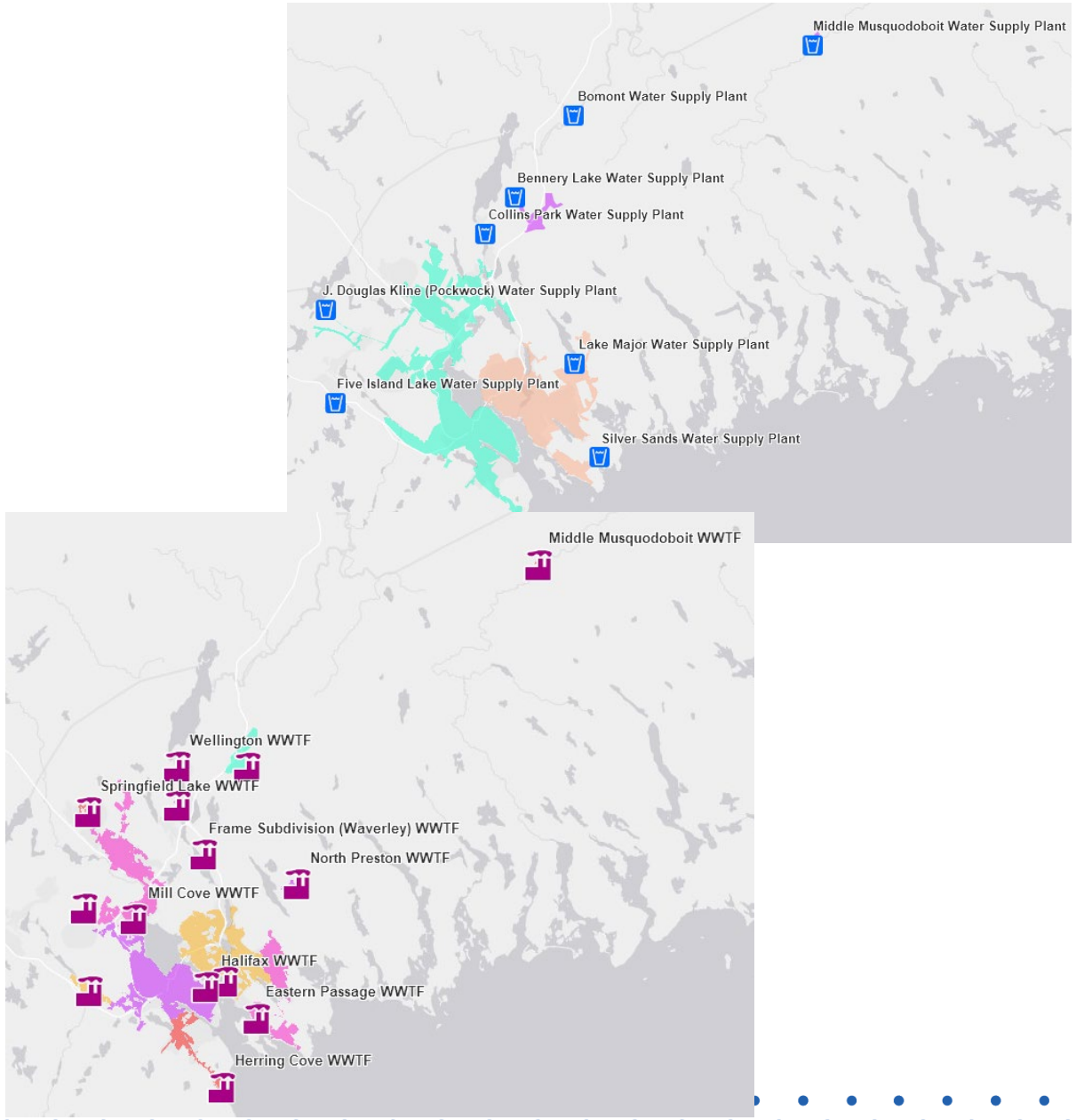
STRAIGHT from the SOURCE

November 2022



Halifax Water

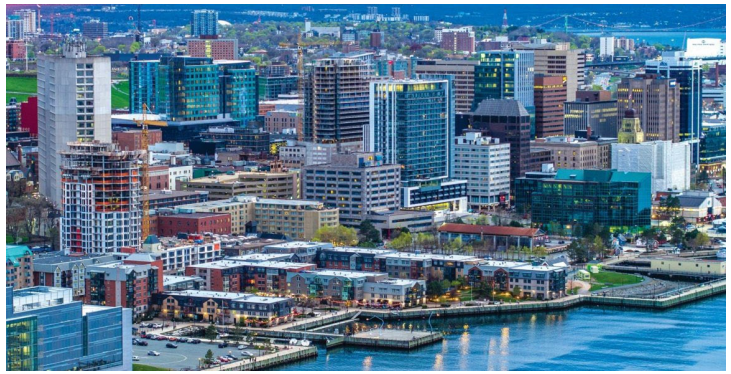
- Regulated drinking water, wastewater and stormwater utility
  - 1997 – Halifax Regional Municipality Amalgamation
  - 2007 – Wastewater and stormwater Services
- 85,000 service connection for approximately 350,000 people
- Approximately 500 employees
- Drinking Water:
  - Two large surface water plants
  - 6 small systems, combination of surface and groundwater plants
- Wastewater Treatment:
  - 7 large wastewater treatment facilities
  - 7 smaller community wastewater treatment plants



Centre for Water Resources Studies, Dalhousie University

Our Mission

The CWRS will apply the research resources of Dalhousie University in a manner that will address applied and emerging challenges in freshwater resources that exist or are anticipated in Mi'kma'ki and Atlantic Canada, with implications for the international community.



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Centre for Water Resources Studies, Dalhousie University

Our Team – www.waterstudies.ca

- The CWRS is led by 7 faculty members that train more than 75 graduate students and PDFs per year
- Collaboration is fostered between researchers and industry partners
- Trainees gain valuable knowledge and experience which advances the field and strengthens the partners' sectors

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Evolution of the Research Partnership

- Early 2000's
  - A passionate General Manager
  - A small utility with limited internal resources available for research
  - Dr. Gagnon, a new professor at Dalhousie University reached out and assisted with a small optimization project at a new treatment plant
- 2006 – Water Quality Master Plan V1– Process Optimization
  - Research execution led to long standing research partnership with Dalhousie University
  - Impacts of the research program were quickly realized which opened the door to further opportunities
- Today
  - Well established external research partnership for both water and wastewater treatment through NSERC Alliance Grant worth over $8M over 5 years

Summary of Halifax Water Research Initiatives

- NSERC Alliance Grant (Formerly Industrial Research Chair in Water Quality and Treatment)
  - Drinking water and wastewater research
  - On the fourth 5-year term
  - Multiple Partners
  - Current HW commitment is $1.48 M over 5 years, Entire program worth over $8M
- WRF participation
  - Tailored Collaboration
  - Participating Utility on various projects
- Participation in networks, programs and internship programs
- Defined external research projects
- Internal Research
  - Mainly distribution system water quality, short-term process optimization, and data collection to feed external research

Research Chair Drivers and Additional Benefits

- Initial driver was specific to process optimization to improve finished water quality
- Now drivers are much broader:
  - General execution of research plan with priority areas for Halifax Water drinking water and wastewater
  - Addresses regulatory issues, public health, cost effective solutions, sustainability, future- and climate adaptation for our systems
- Additional Benefits:
  - Tangential research and changing priorities
  - Access to advanced analytics and graduate students
  - Access to partners and other research opportunities
  - Access to HQP
  - Knowledge sharing
  - Forefront of industry knowledge, innovation
  - One Water
  - Leveraged funding

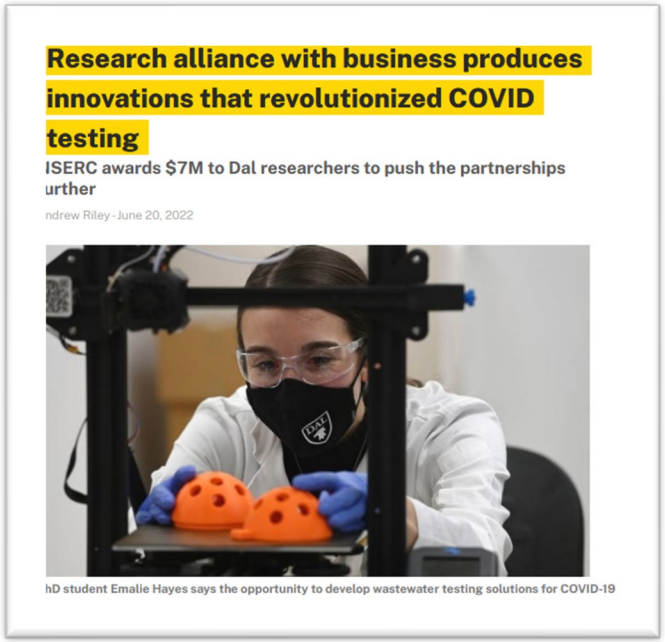
Researcher to Researcher

JOSEPH E. GOODWILL, COLUMN COORDINATOR

JENNIE RAND AND KEVIN BERGSCHNEIDER

The "Grahampire": The Broad Impacts of Excellence in Water Research

70 RESEARCHER TO RESEARCHER | JULY 2018 • 110:7 | JOURNAL AWWA



Research alliance with business produces innovations that revolutionized COVID testing

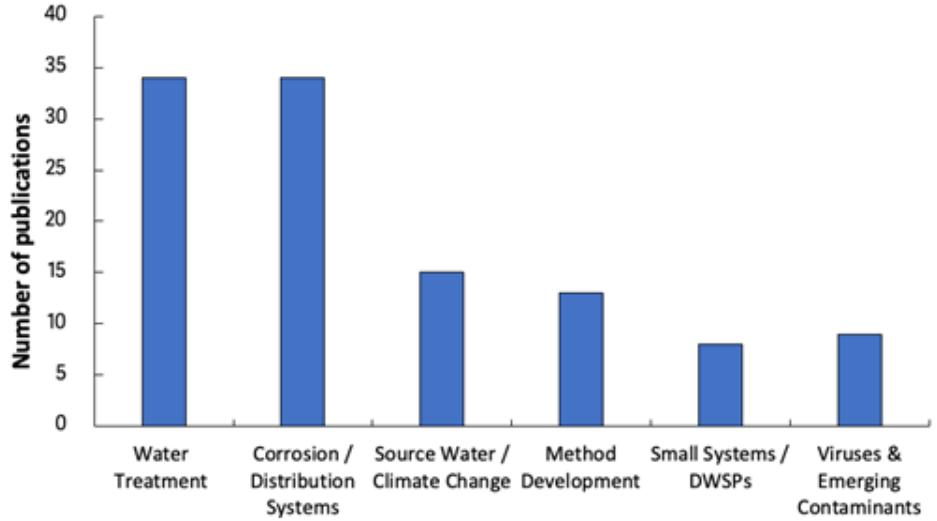
ISERC awards $7M to Dal researchers to push the partnerships urther

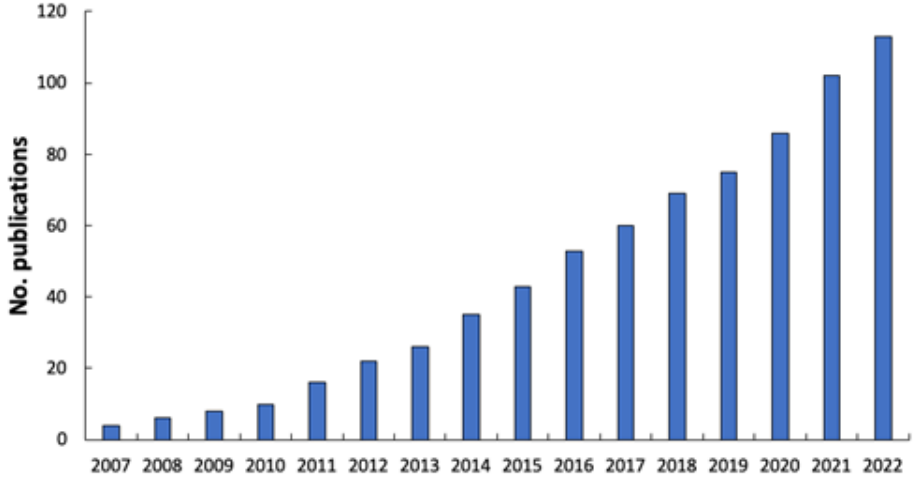
ndrew Riley - June 20, 2022

hD student Emalie Hayes says the opportunity to develop wastewater testing solutions for COVID-19

Academic Research Outcomes and HQP

	HQP since 2007	Current HQP in program
Post Doctoral Fellows	13	3
PhD	33	14
MASc	65	16
Co-op	104	4
Total	**215**	**37**





Case studies of research outcomes and impact

Case Study 1: Understanding Climate Change Effects on Drinking Water Treatment

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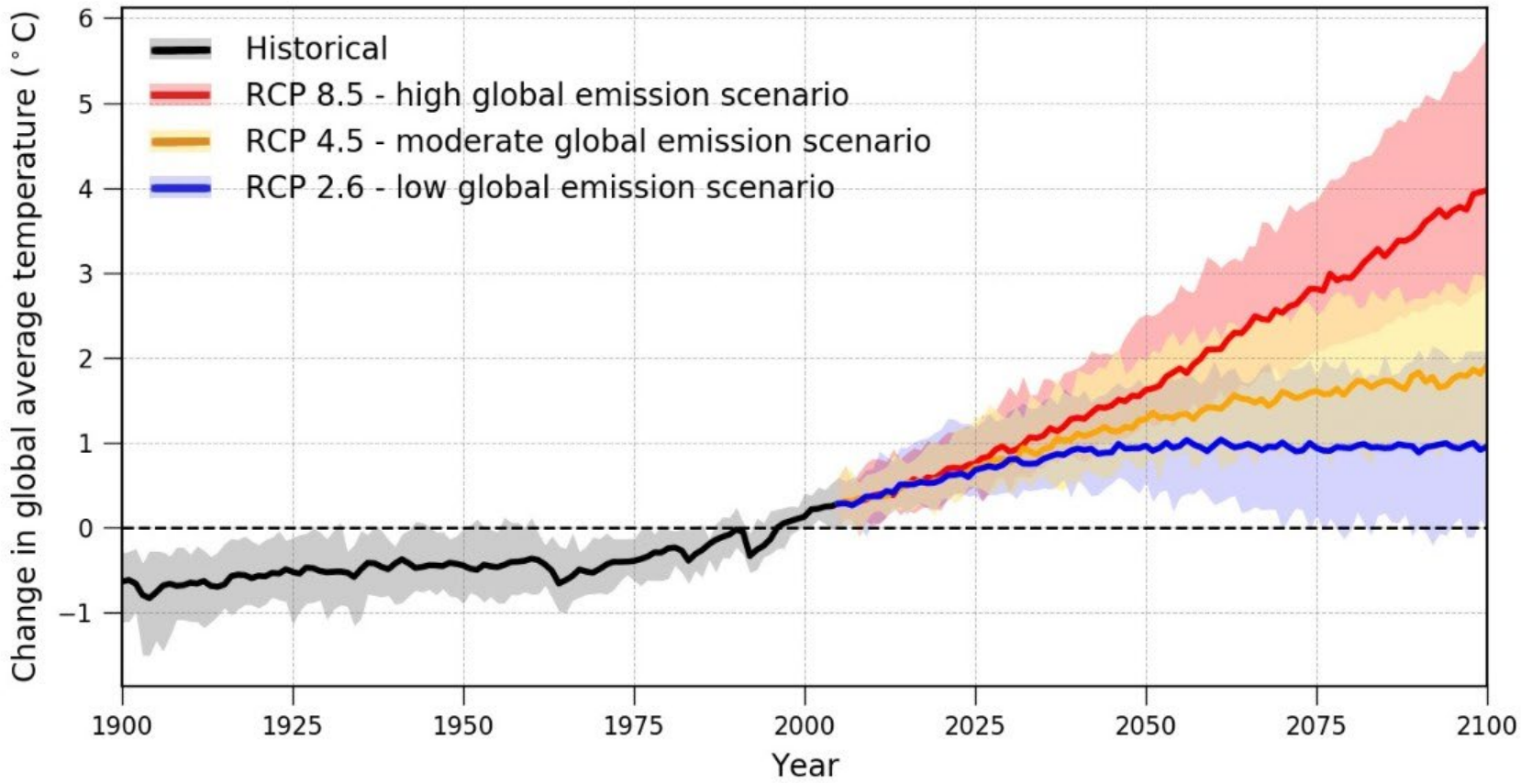
THE Water Research FOUNDATION

Hazen

Lakes Becoming More Challenging to Treat Due to Climate and Anthropogenic Pressures



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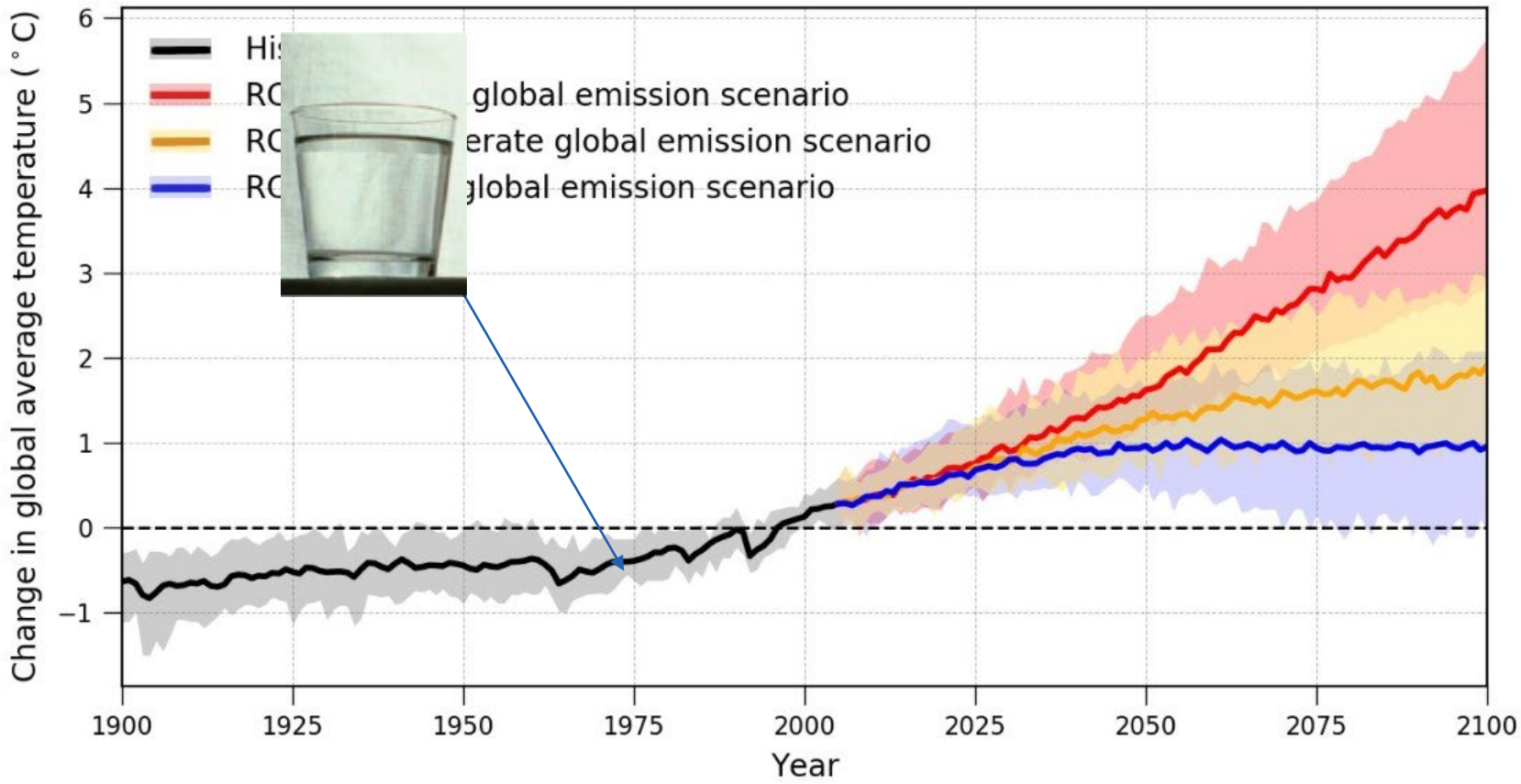

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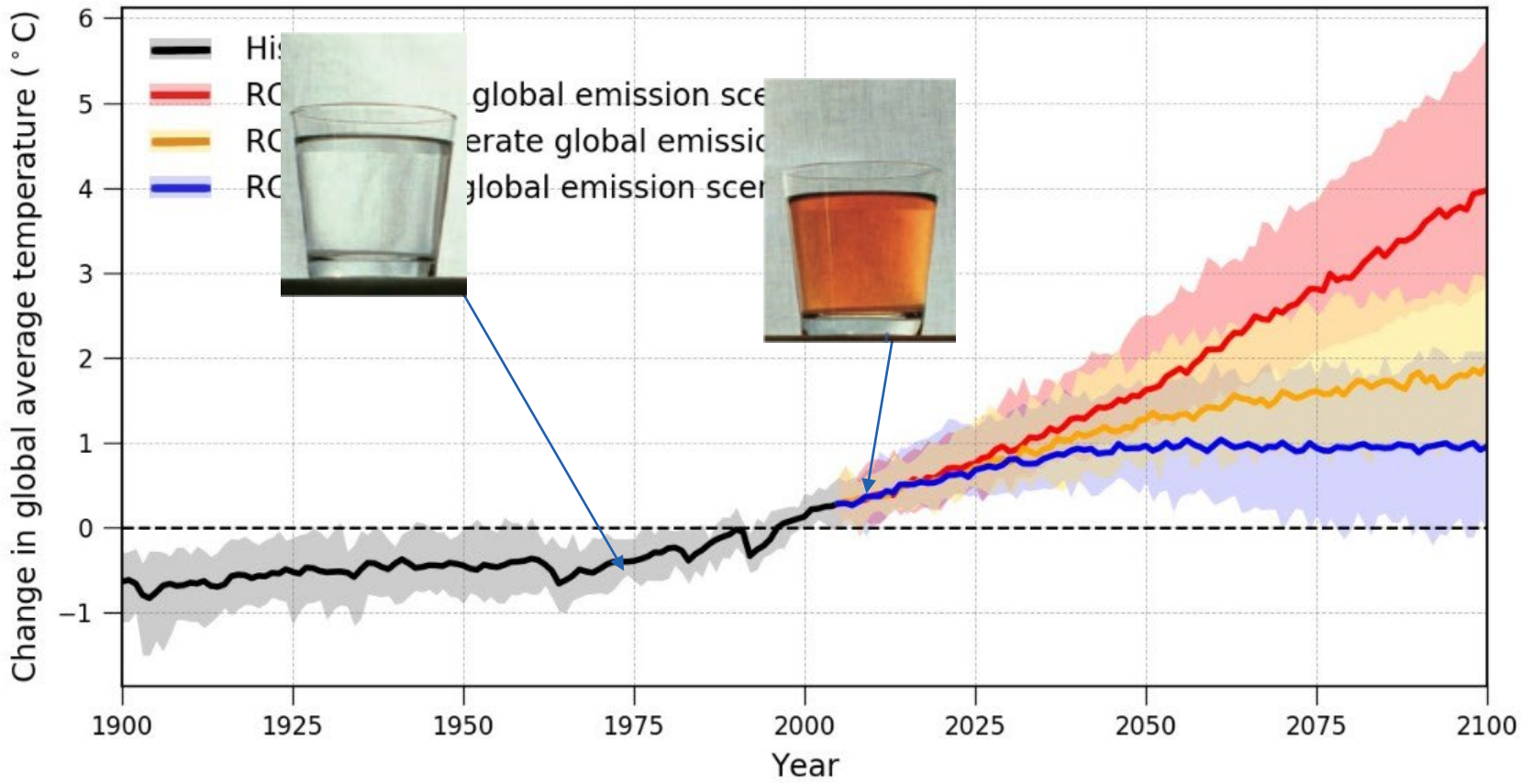

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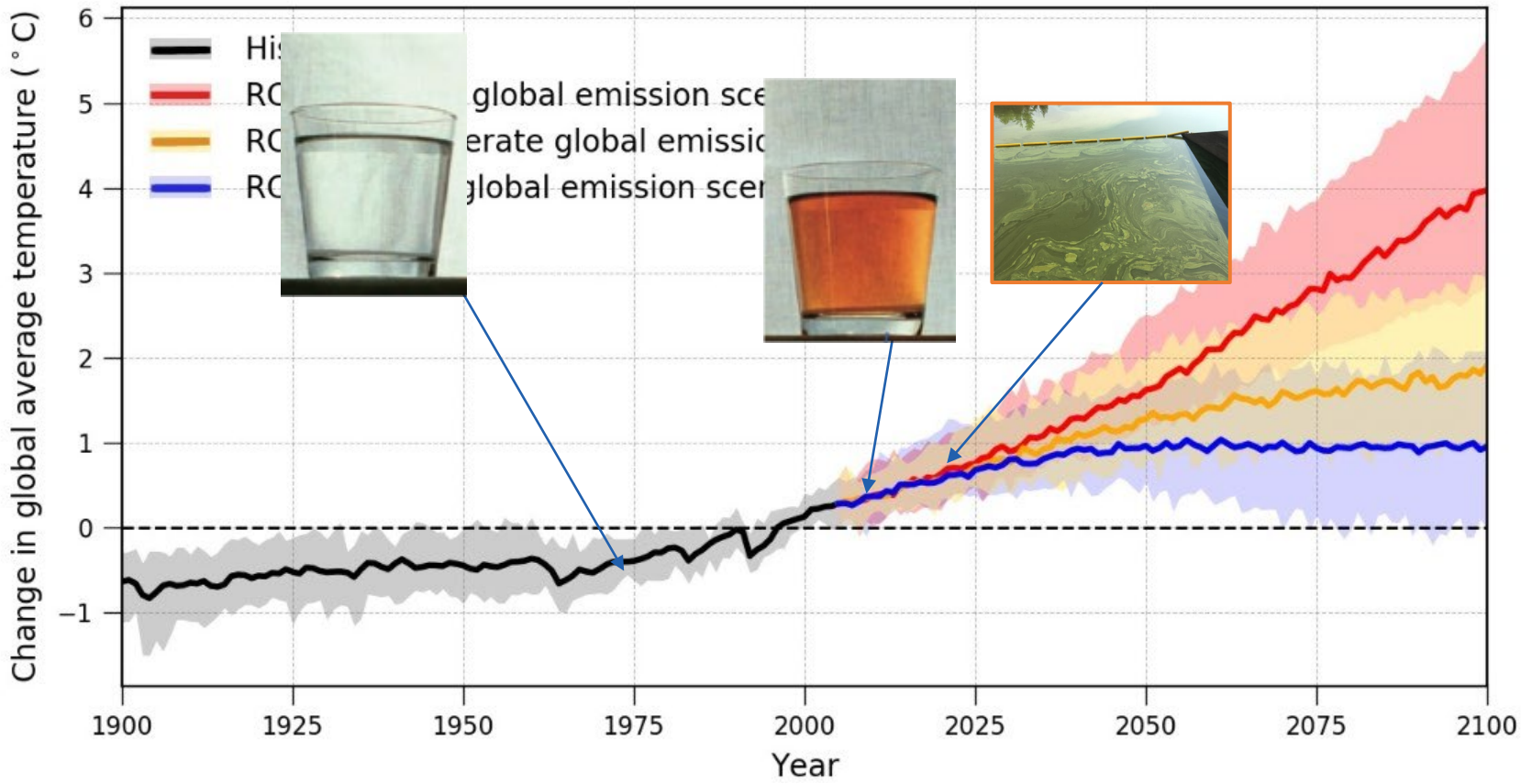

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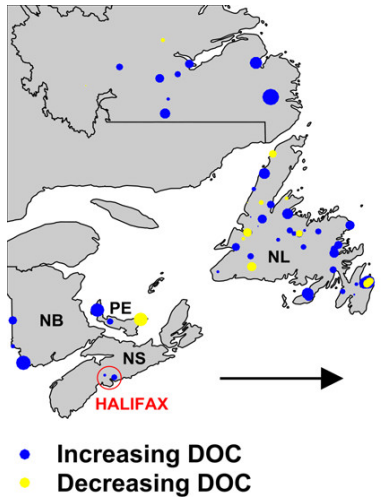
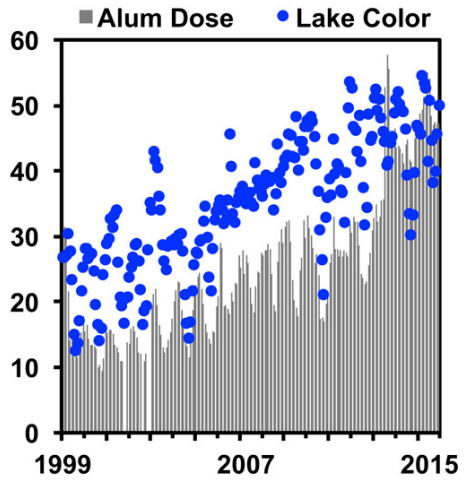
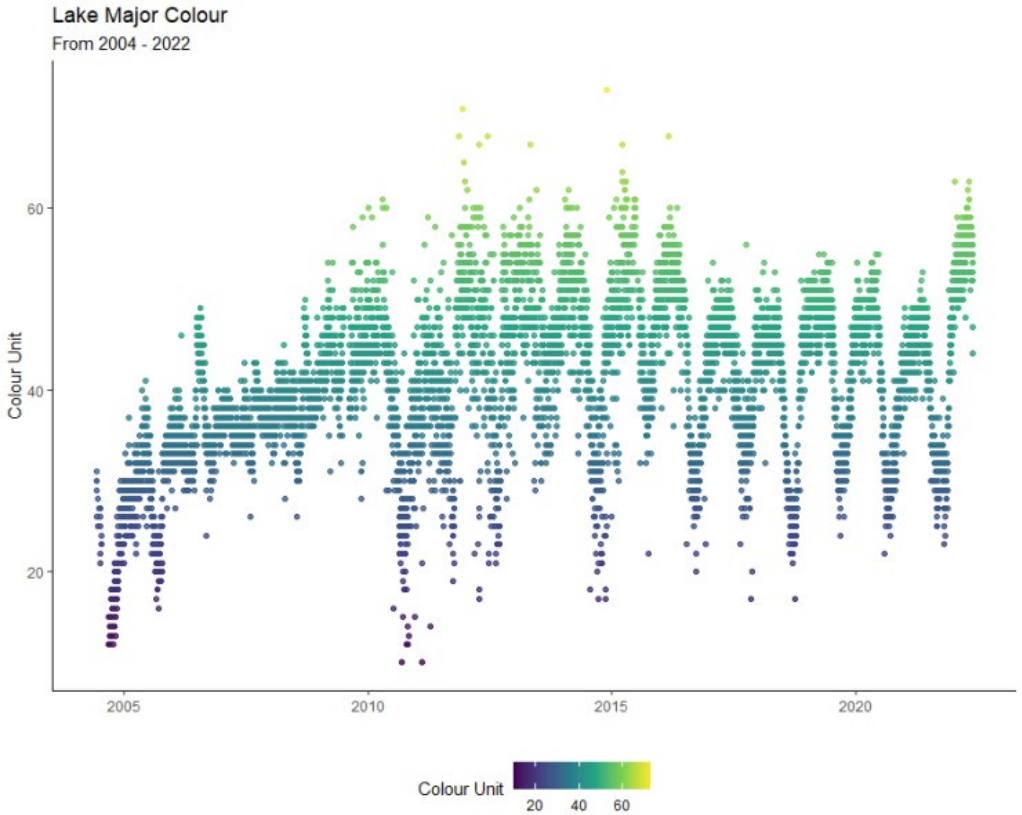
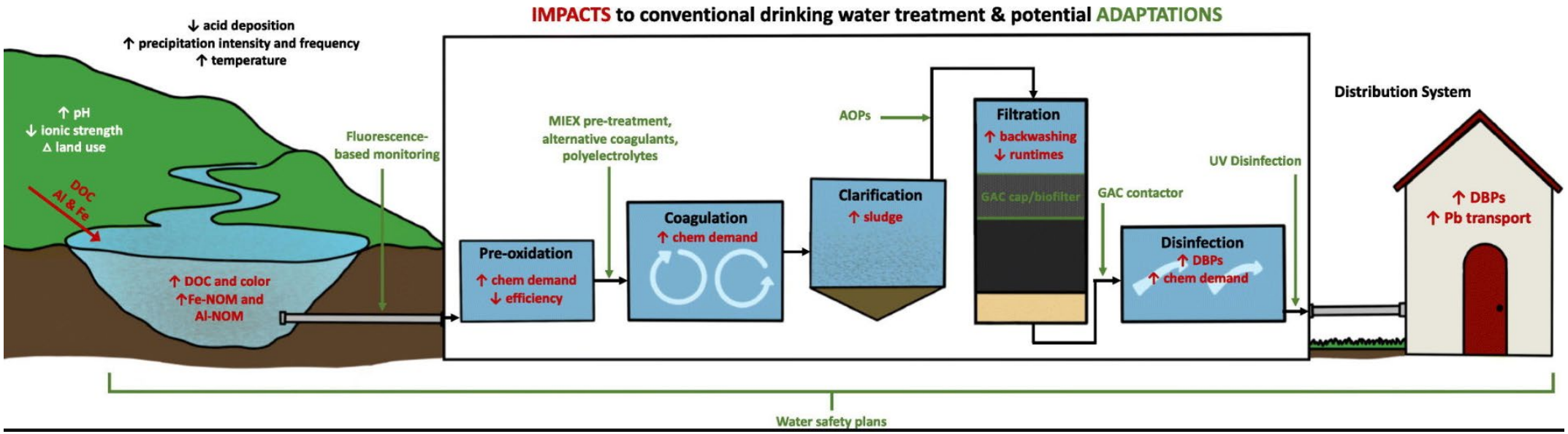






Anderson et al. (2017) *Environmental Science & Technology* 2017 *51* (3), 1414-1422 DOI: 10.1021/acs.est.6b04889

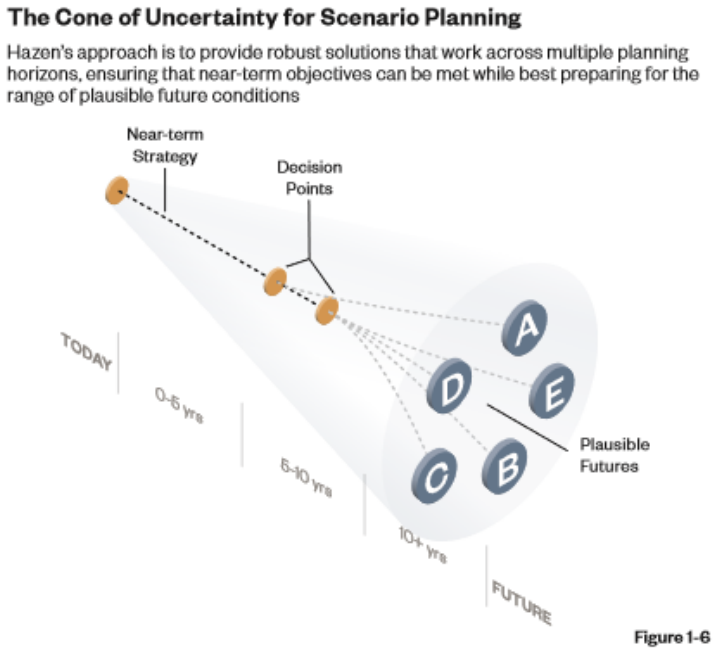
Impacts and Adaptations to Treatment



Anderson et al. (2022) *Science of the Total Environment* Accepted October 20, 2022. DOI: 10.1016/j.scitotenv.2022.159699

WRF 4920- Decision Support Tool for Utilities in the Face of Rapidly Changing Water Quality

- Team
  - PI: Hazen and Sawyer
  - Utilities: Halifax Water, Tampa Bay, New York City, Mohawk Valley, Brick Township
- Goals
  - Options for managing changing source water quality in the near term and long term
  - Development of a decision support framework

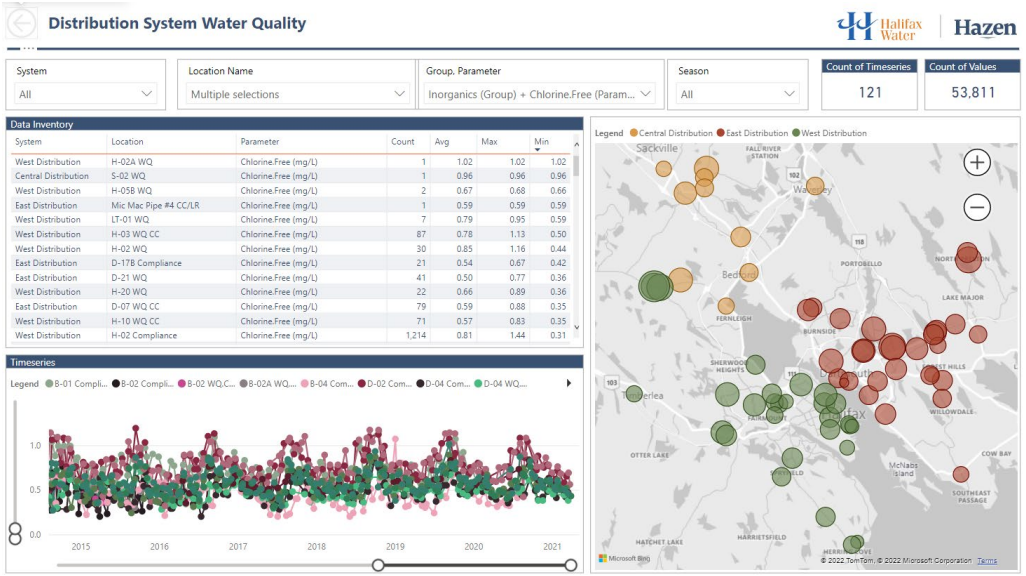


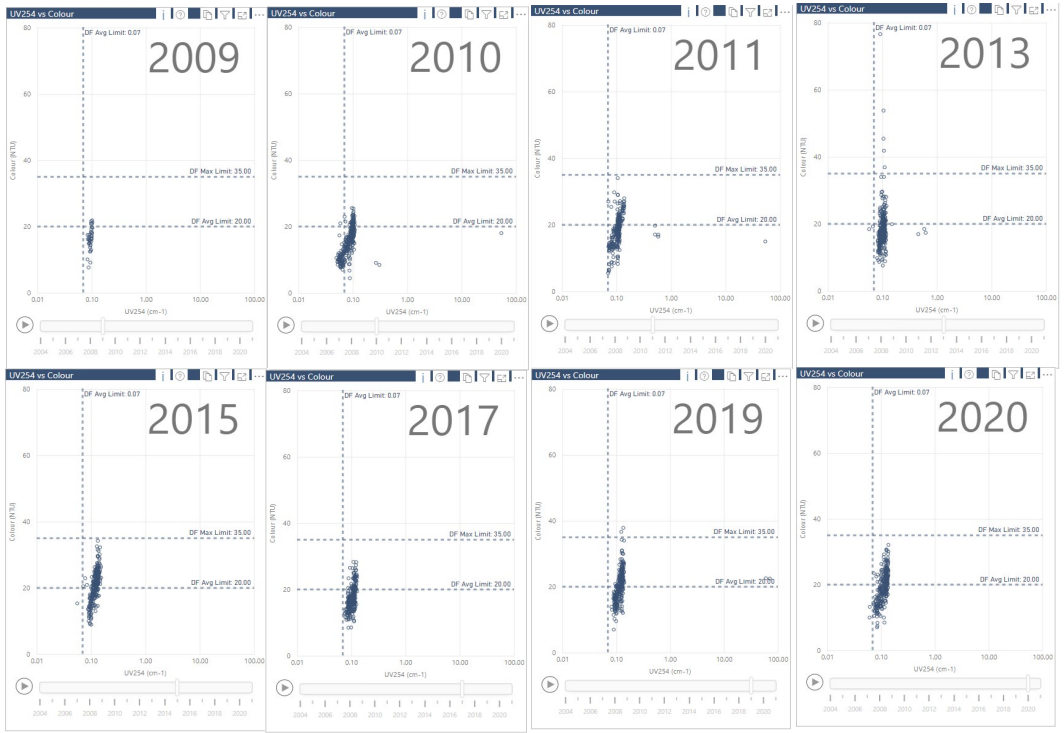
https://www.waterrf.org/research/projects/decision-support-framework-drinking-water-treatment-plants-experiencing-lake

WRF 4920- Decision Support Tool for Utilities in the Face of Rapidly Changing Water Quality

Impacts:

- Data Analytics
  - better response and planning
- Capital Spending $$$$$
  - Climate adaptation and future proofing





CWRS Impact: Monitoring SARS-CoV-2 in Wastewater

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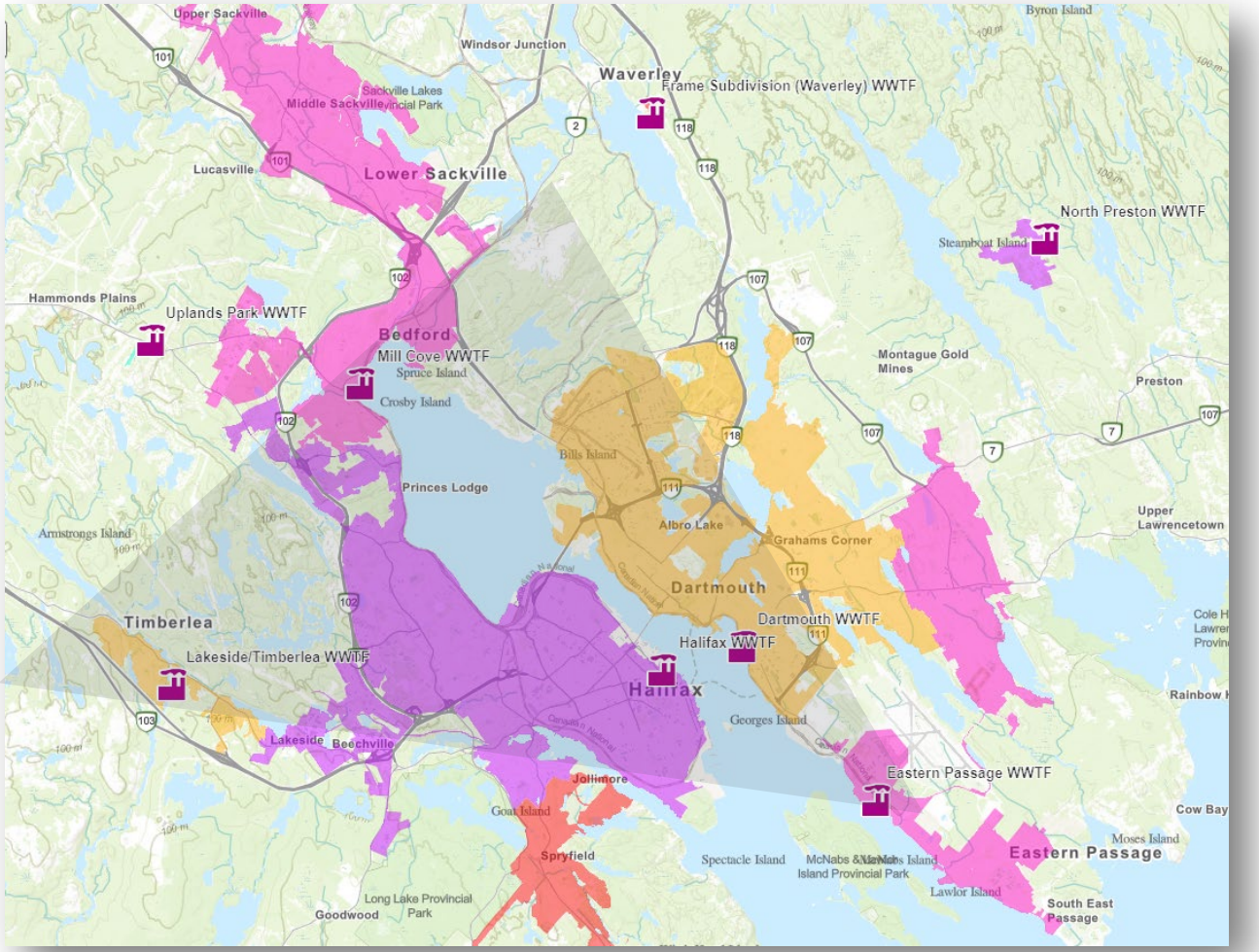
LUMINULTRA®
microbial monitoring

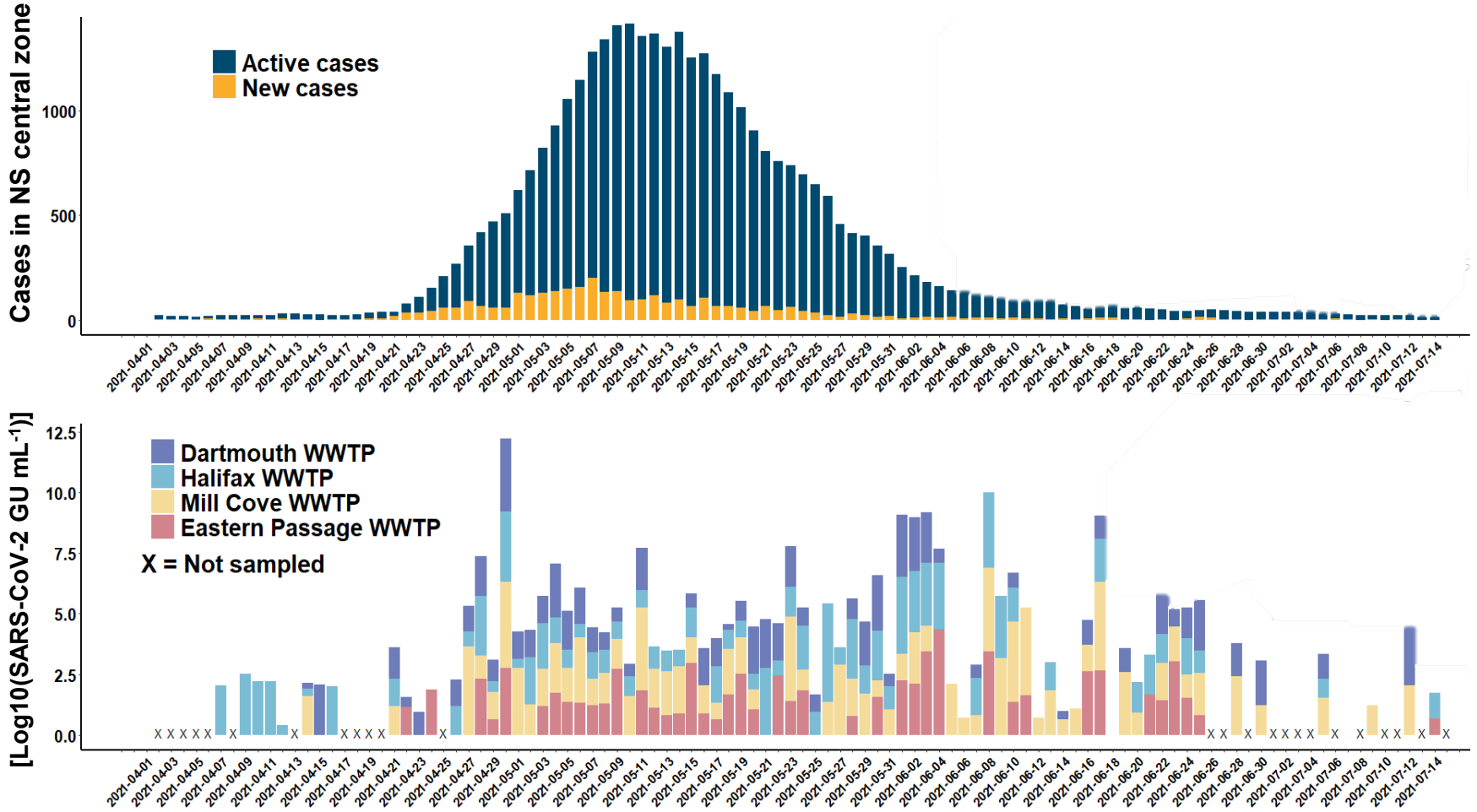
researchNS

Developing a Method to Detect SARS-CoV-2 from Wastewater



Guardado, A. L. P. et al. (2020). Development and optimization of a new method for direct extraction of SARS-CoV-2 RNA from municipal wastewater using magnetic beads. https://doi.org/10.1101/2020.12.04.20237230

Developing a Method to Detect SARS-CoV-2 from Wastewater



Developing a Method to Detect SARS-CoV-2 from Wastewater

- PhD student research that led to a patent for a rapid COVID-19 wastewater test that is now sold globally by HACH
- Shown to detect COVID-19 trends up to 7-days before clinical case reporting
- Permits localized mass-screening through non-invasive measures

Lead in Drinking Water

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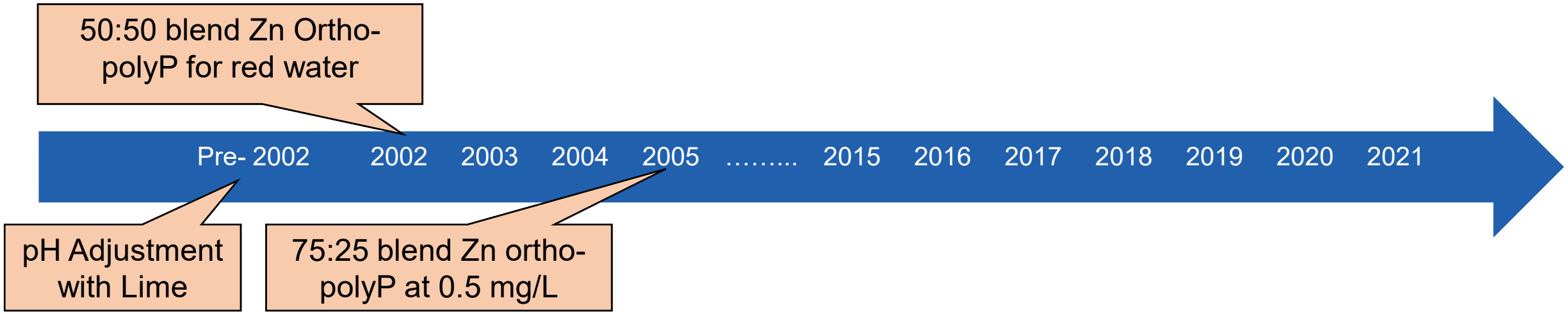
MITACS

Corrosion Control Timeline



Corrosion Control Timeline

50:50 blend Zn Ortho-polyP for red water

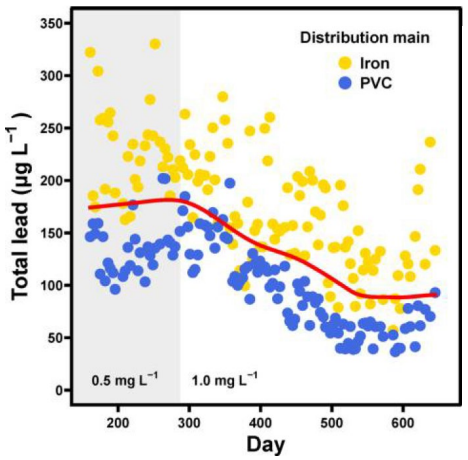
Switched to $ZnPO_4$ at 0.5 mg/L

Pre- 2002 | 2002 | 2003 | 2004 | 2005 | ..... | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

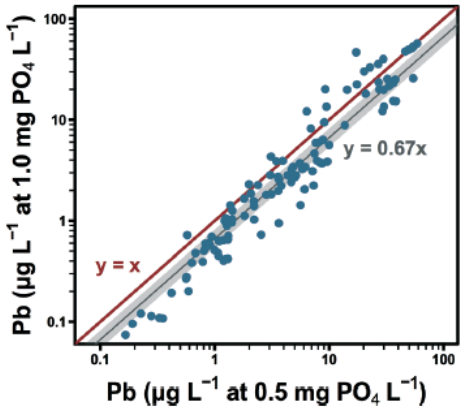
pH Adjustment with Lime

75:25 blend Zn ortho-polyP at 0.5 mg/L

Increased $ZnPO_4$ to1 mg/L



Trueman et al., 2016 ES&T



Trueman et al., 2018 ES:WR&T

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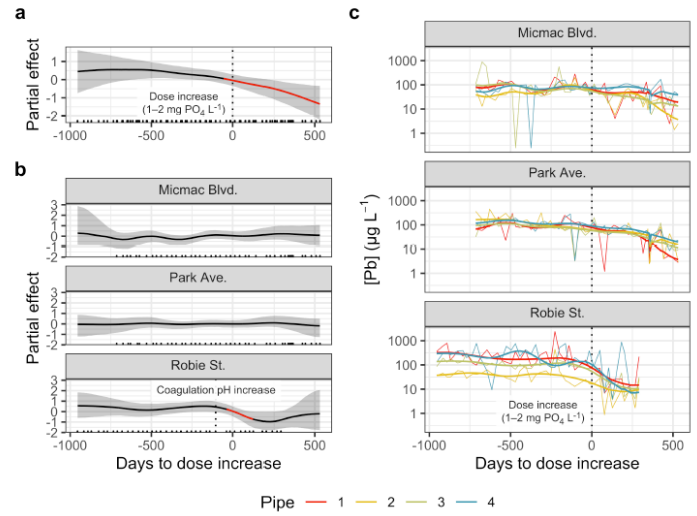


50:50 blend Zn Ortho-polyP for red water

Switched to $ZnPO_4$ at 0.5 mg/L

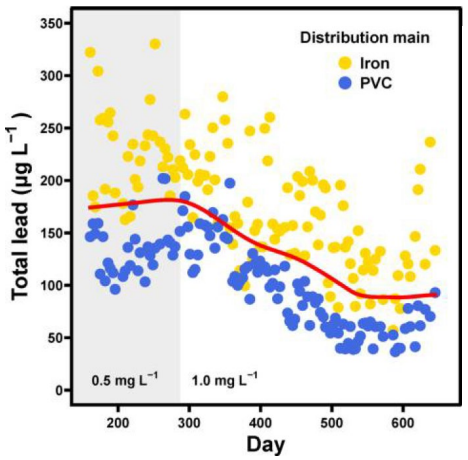
Increased $ZnPO_4$ to 2 mg/L

Pre- 2002 | 2002 | 2003 | 2004 | 2005 | ..... | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

pH Adjustment with Lime

75:25 blend Zn ortho-polyP at 0.5 mg/L

Increased $ZnPO_4$ to1 mg/L



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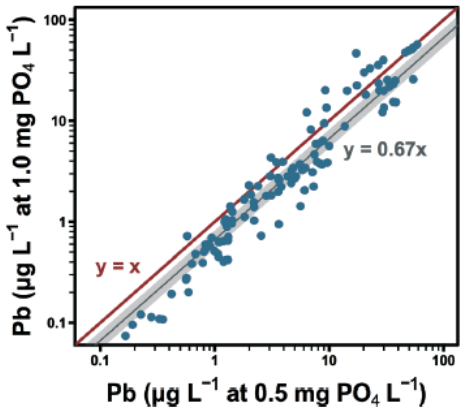

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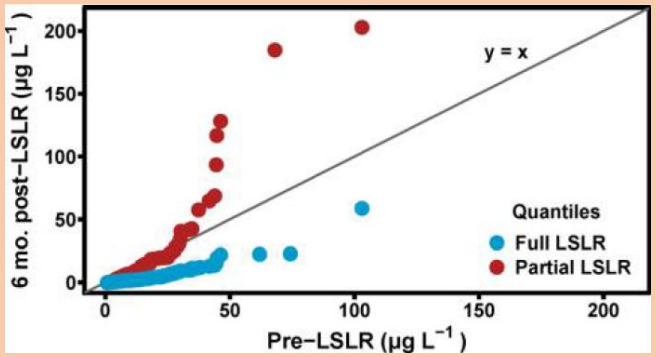
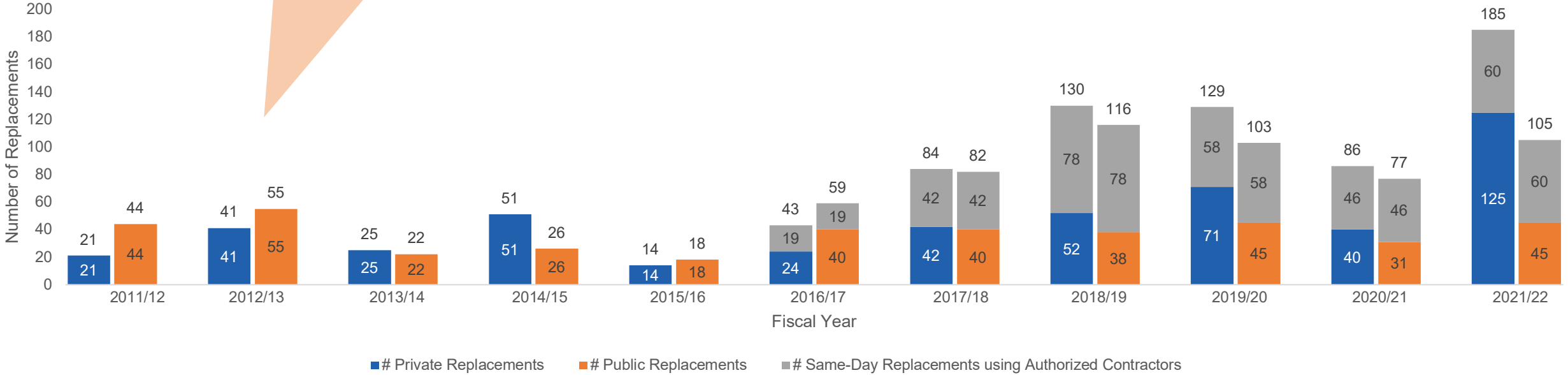
Evolution of Lead Service Line Replacement



Trueman et al., 2016b



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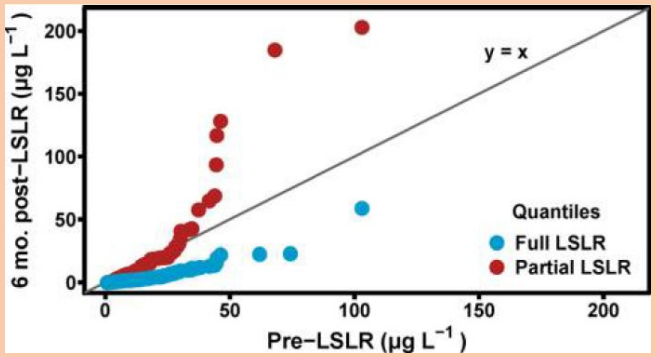
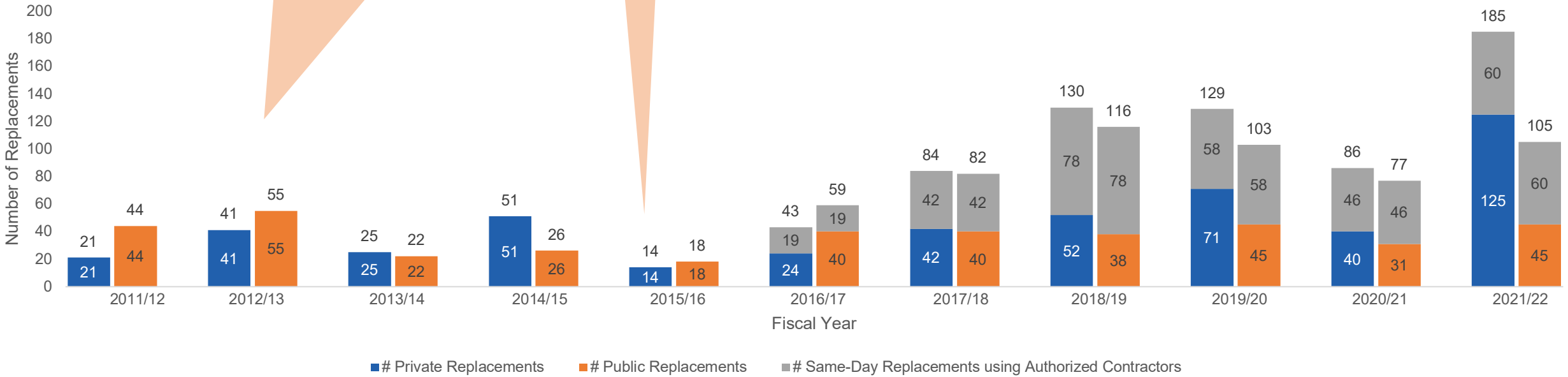


Trueman et al., 2016b

Develop Business Plan around 5 pillars of NDWAC Approach



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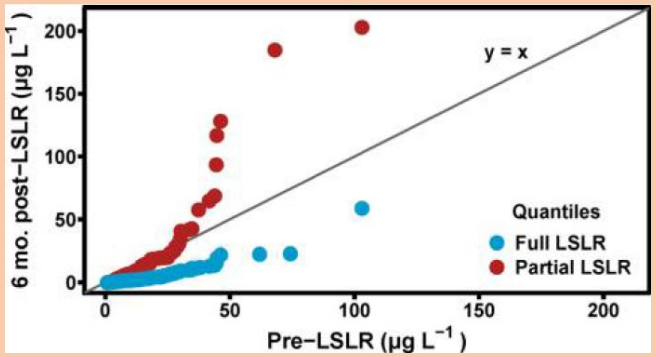
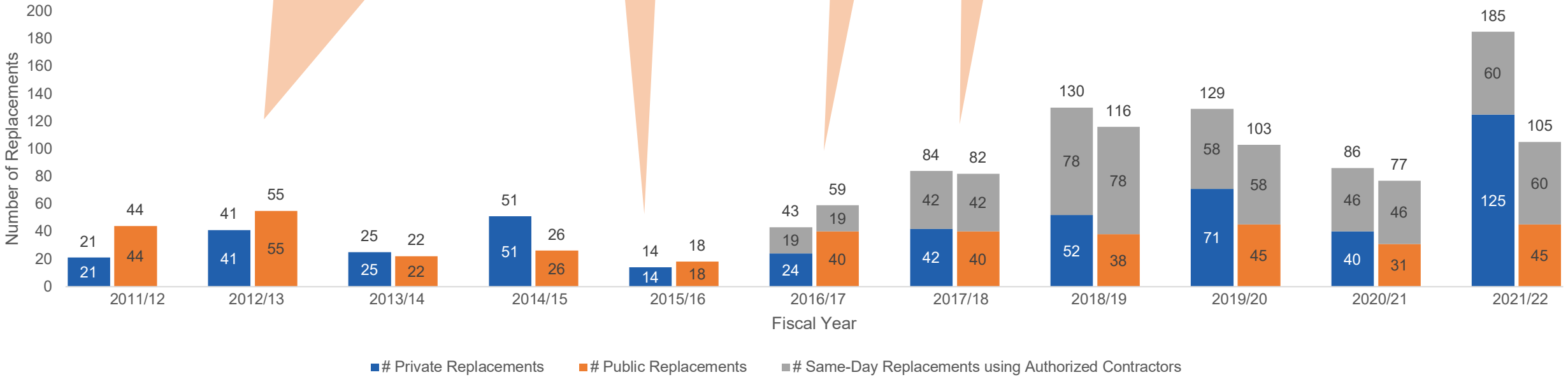


Trueman et al., 2016b

Develop Business Plan around 5 pillars of NDWAC Approach

Implement Authorized Contractors

Implement 25% Rebate Program



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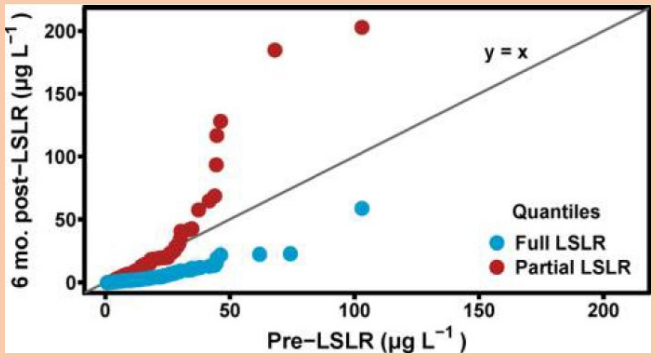


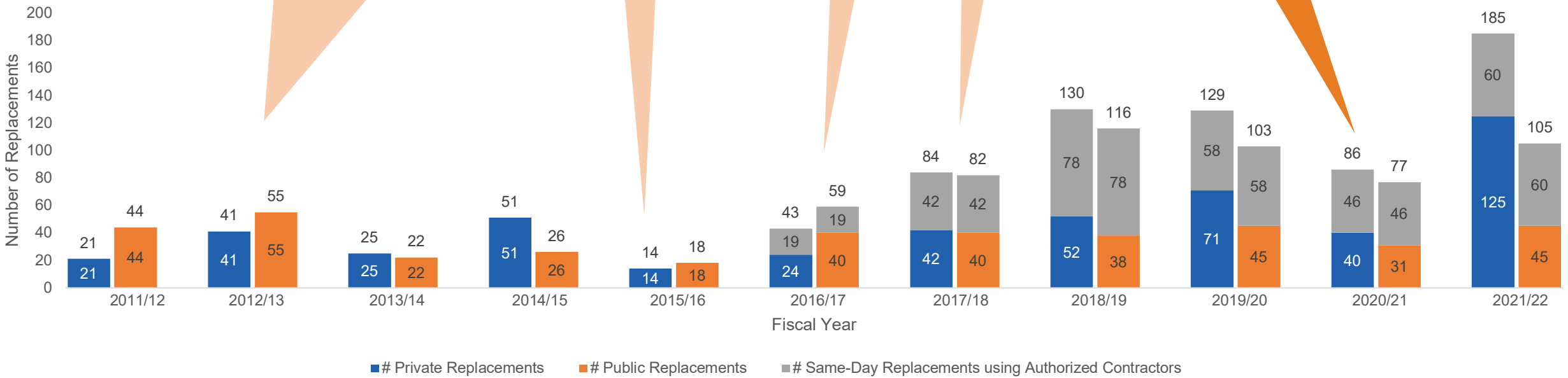
Trueman et al., 2016b

Develop Business Plan around 5 pillars of NDWAC Approach

Implement Authorized Contractors

Implement 25% Rebate Program

Submit Application for "Get the Lead Out" replacement from the main to the meter



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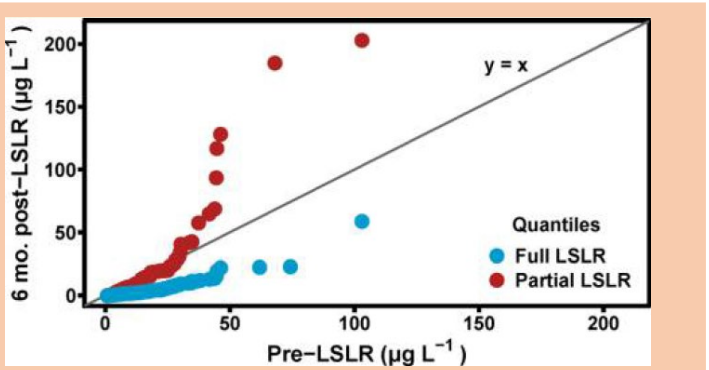
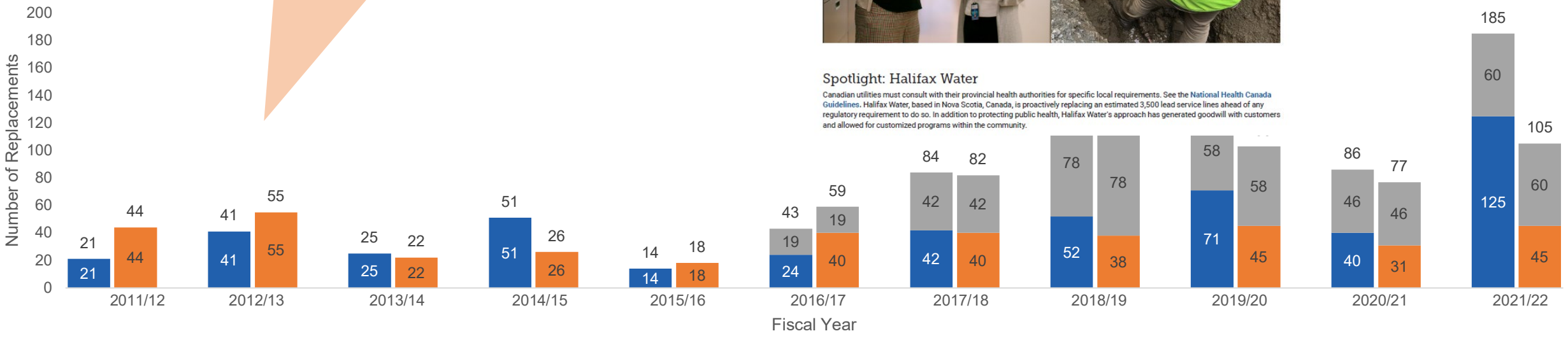


Trueman et al., 2016b

Year 1: Get the Lead Out from the main to the meter



Summary and Lessons Learned

- Halifax Water has had a well-established research partnership with the Centre for Water Resources Studies at Dalhousie University since 2007.
  - Program targets priority areas, integrates students into facilities.
  - Program has evolved over time and has flexibility to adapt
  - NSERC Alliance – One Water approach
- Original drivers were research outcome based, needed an answer to a specific problem.
- Now the partnership provides specific research outcomes but also so much more:
  - access to resources (human and analytical),
  - training
  - networking and relationship building
  - well established relationships and trust lead to further opportunities

Contact Info

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Evolution of Research Chair and Outcomes

- Term 1 – 2007
  - Led to construction of the pilot plant at JDK. Owned and maintained by HW and operated by Dalhousie University
  - Major outcomes: Coagulation evaluation, corrosion control (pipe loops)
  - Partners: Halifax Water
- Term 2 – 2012
  - Major outcomes: Corrosion control, flocculation hydraulics, reduction in DBPs: biofiltration
  - Partners: Halifax Water, CBCL, LuminUltra, CBRM
- Term 3 – 2017
  - Major outcomes: Lake Recovery, Corrosion control, JDK interim optimization
  - Partners: Halifax Water CBCL, LuminUltra, CBRM, Mantech, Moncton, AGAT Labs, Aquisense
- Term 4 – 2022
  - Wastewater research added into the Chair, funding change from NSERC IRC to NSERC Alliance grant
  - “Partnership for Innovation in Climate Change Adaptation in Water and Wastewater Treatment”
  - Partners: Halifax Water CBCL, LuminUltra, CBRM, Mantech, Moncton, AGAT Labs, Aquisense