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Demonstrating service excellence through the delivery of safe, reliable and cost-effective clean water.

Overcome the Challenges of Haloacetic Acids (HAAs), Since the Introduction of the Regulation in Ontario

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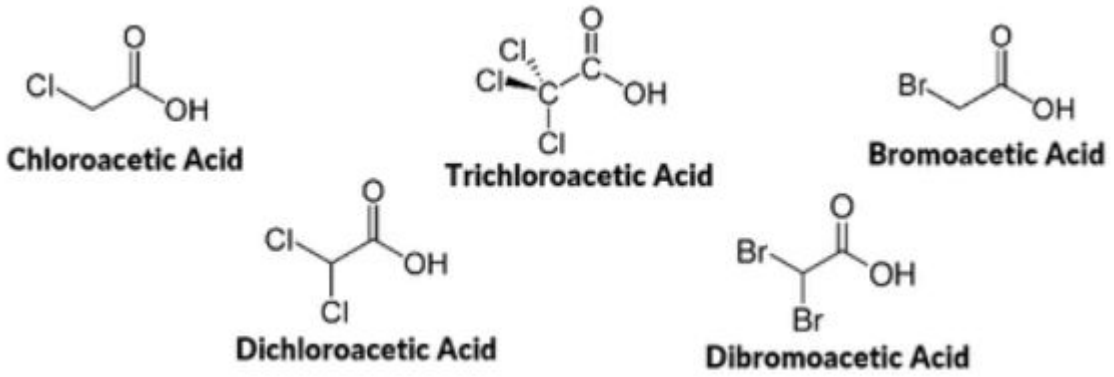
HAAs

- Haloacetic acids (HAAs) are disinfection by-products (DBPs) that can form when the chlorine reacts with naturally occurring organic matter in drinking water treatment and distribution.
- HAAs are the sum of monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid and dibromoacetic acid.



HAAs Regulation in Ontario

- Health Canada published the HAAs guideline in 2008
- Ontario drinking water systems have been required to take quarterly samples since 2017
- O.Reg. 170/03: The MAC of 80 µg/L is effective starting January 1st, 2020.
- Expressed as a locational running annual average (RAA) of quarterly samples.

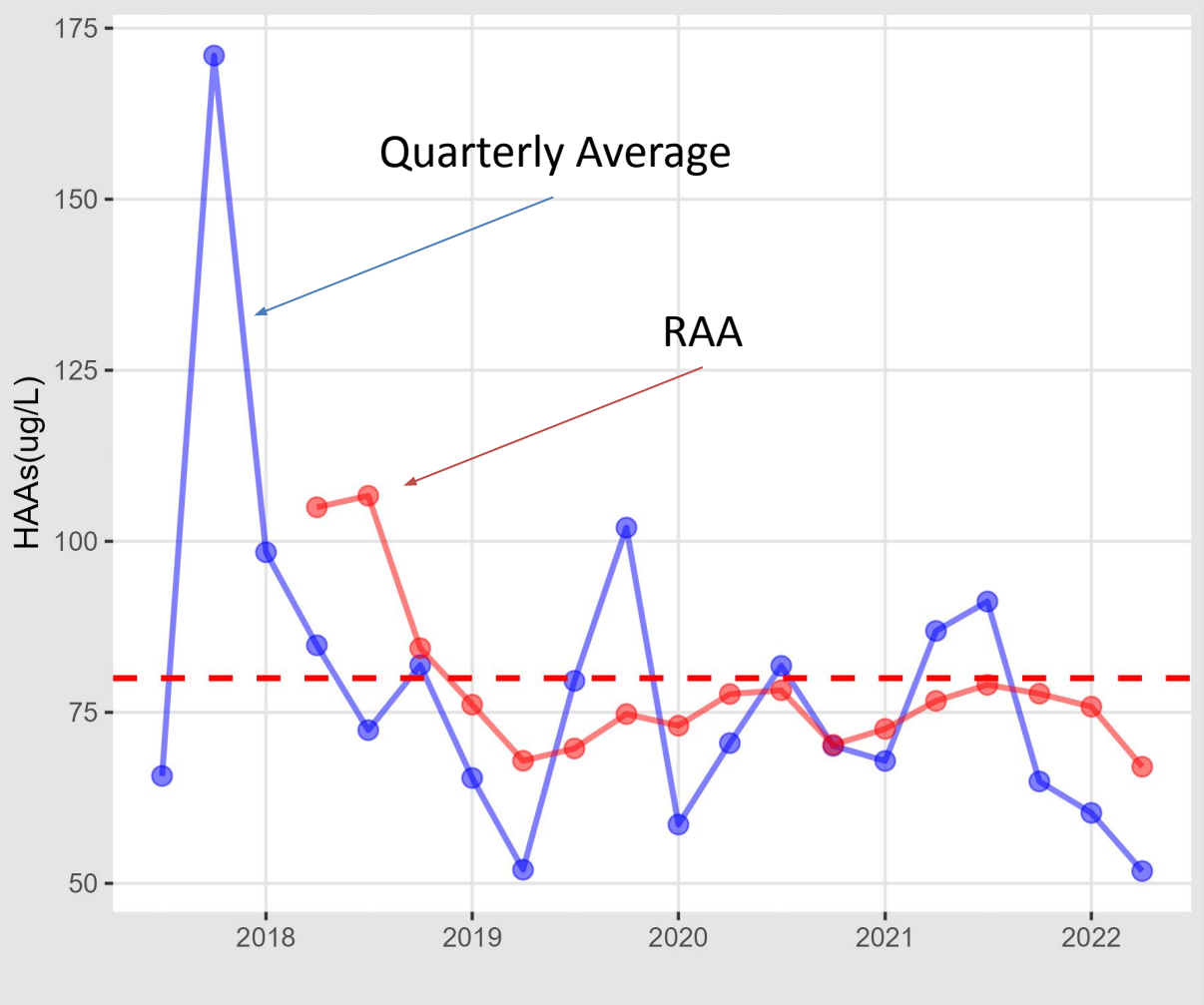
HAAs Regulation in Ontario

- Applicable to municipal residential (LMRS, SMRS) and non-municipal year-round residential drinking water systems (NMYRRS)

- Take at least one sample, for both THMs (tri-halomathanes) and HAAs, in each calendar quarter, from a location in their distribution system that is likely to have an elevated potential for the formation of these disinfection by-products.

- O.Reg. 170/03 defines that the calendar quarter begins on January 1, April 1, July 1 or October 1.

RAA vs Quarterly Average



- Water quality can vary due to seasonal changes, weather conditions, etc.
- RAA covers an extended period (4 quarters), smoothing out seasonal fluctuations, provides a more accurate representation of long-term exposure

HAAs results in DWSs across Ontario?

Ontario Dataset

Drinking Water Quality and Enforcement

Have your say

Rate this dataset
Provide feedback

Additional Information

Creator: Environment, Conservation and Parks

Contact Form: https://www.ontario.ca/feedback/contact-us?id=26985&nid=72714

Keywords:

Ontario has a comprehensive set of measures and regulations to help ensure the safety of drinking water. The following dataset contains information about the drinking water systems, laboratories and facilities the Ministry of the Environment, Conservation and Parks is responsible for monitoring to ensure compliance with Ontario's drinking water laws. The dataset includes information about: * the number and type of registered systems and laboratories * drinking water quality test results * adverse water quality incidents * activities to support reduced lead in drinking water * enforcement activities related to inspections * orders and convictions * system operator certification

▼ Made available by the Government of Ontario

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https://www.ontario.ca/data/drinking-water-quality-and-enforcement

Dataset

Data and Resources

2015-16 English dataset ZIP	Explore
2014-15 English dataset ZIP	Explore
2016-17 English dataset ZIP	Explore
2017-18 English dataset ZIP	Explore
2018-19 English dataset ZIP	Explore
Metadata Record English guide PDF	Explore
2015-16 French dataset ZIP	Explore
2014-15 French dataset ZIP	Explore
2016-17 French dataset ZIP	Explore
2017-18 French dataset ZIP	Explore

Drinking water quality test results from April 2017 to March 2022

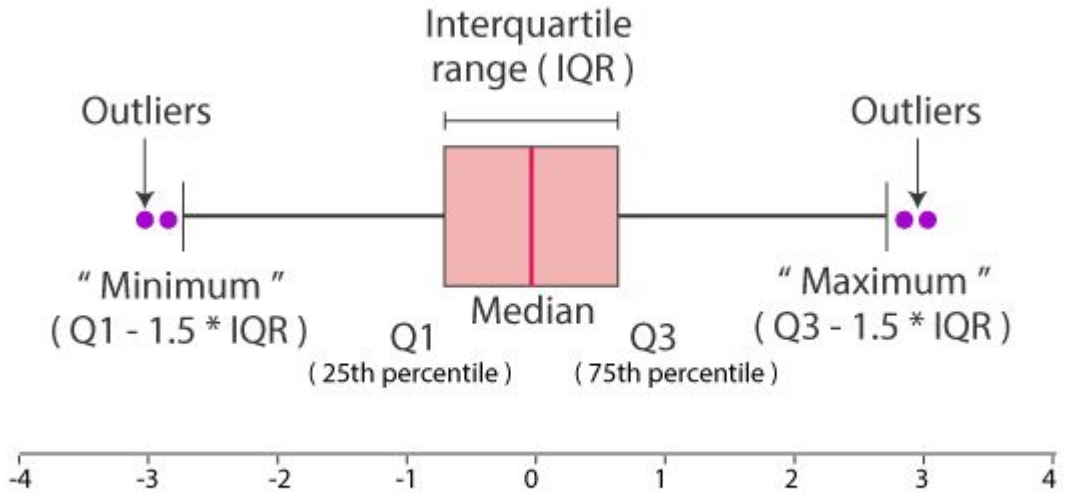
Dataset

Name	Type	Compressed size
AWQI Data 2021-22 EN.xlsx	Microsoft Excel Worksheet	378 KB
AWQI Data Summary 2021-22 EN.xlsx	Microsoft Excel Worksheet	18 KB
Certification 2021-22 EN.xlsx	Microsoft Excel Worksheet	18 KB
Certification Disciplinary Action 2021-22 ...	Microsoft Excel Worksheet	19 KB
Convictions 2021-22 EN.xlsx	Microsoft Excel Worksheet	20 KB
DWS Inspections 2021-22 EN.xlsx	Microsoft Excel Worksheet	93 KB
DWS Orders 2021-22 EN.xlsx	Microsoft Excel Worksheet	22 KB
Laboratory Inspections - 2021-22 EN.xlsx	Microsoft Excel Worksheet	22 KB
Laboratory Orders 2021-22 EN.xlsx	Microsoft Excel Worksheet	19 KB
Lead Control Strategy 2021-22 EN.xlsx	Microsoft Excel Worksheet	20 KB
MRS Inspection Rating Water Quality 202...	Microsoft Excel Worksheet	65 KB
Registered DWS and Laboratories 2021-...	Microsoft Excel Worksheet	18 KB
Test Results 2021-22 EN.xlsx	Microsoft Excel Worksheet	47,288 KB
Test Results Microcystin 2021-22 EN.xlsx	Microsoft Excel Worksheet	350 KB
Test Results Summary 2021-22 EN.xlsx	Microsoft Excel Worksheet	19 KB

Number of DWS Involved

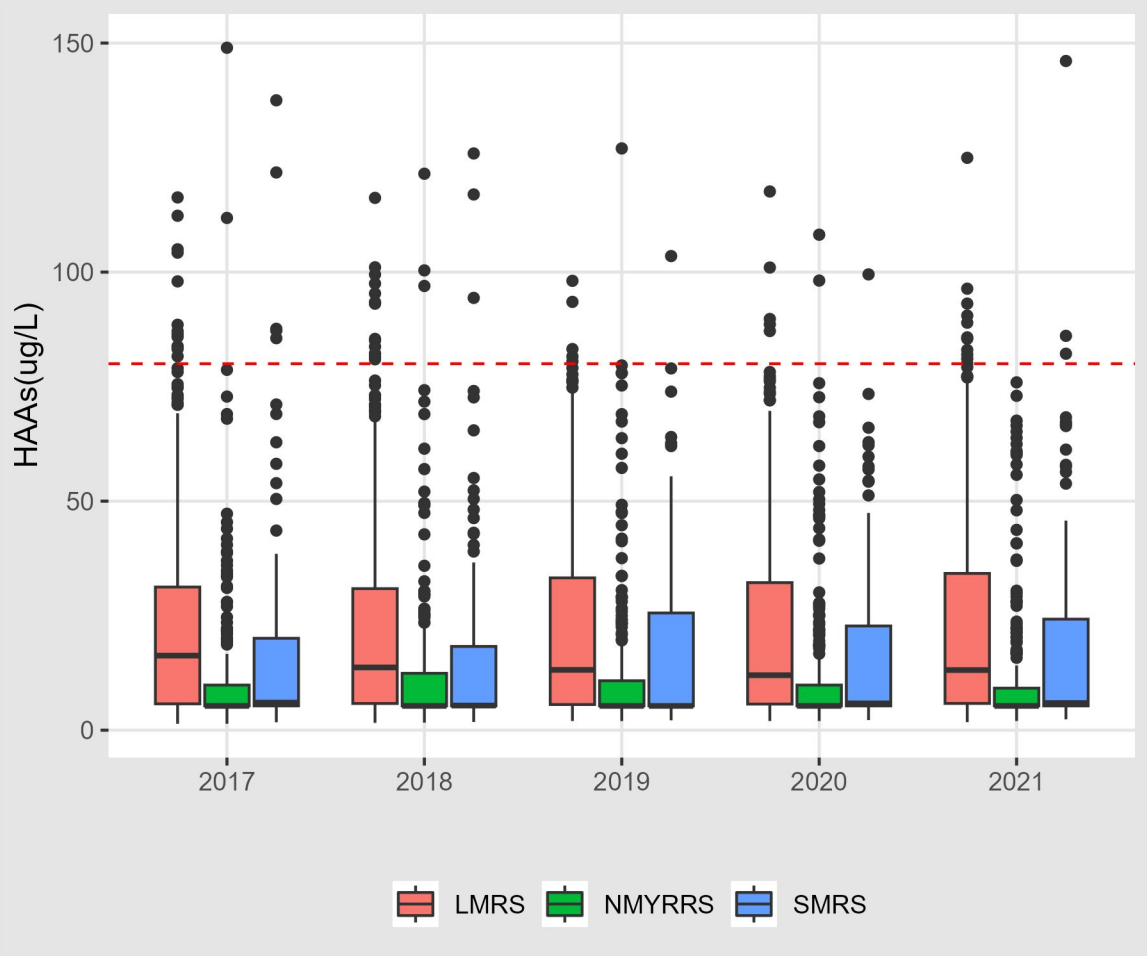
	2017	2018	2019	2020	2021
LMRS	485	493	497	495	494
NMYRRS	217	250	248	249	263
SMRS	120	120	108	107	110
Total	822	863	853	851	867

- Fiscal year. E.g. 2017 represents April 1, 2017 – March 31, 2018.
- Calculated the RAA of HAAs for the last quarter of each fiscal year for each DWS (i.e., all 4 quarters are involved in the calculation).

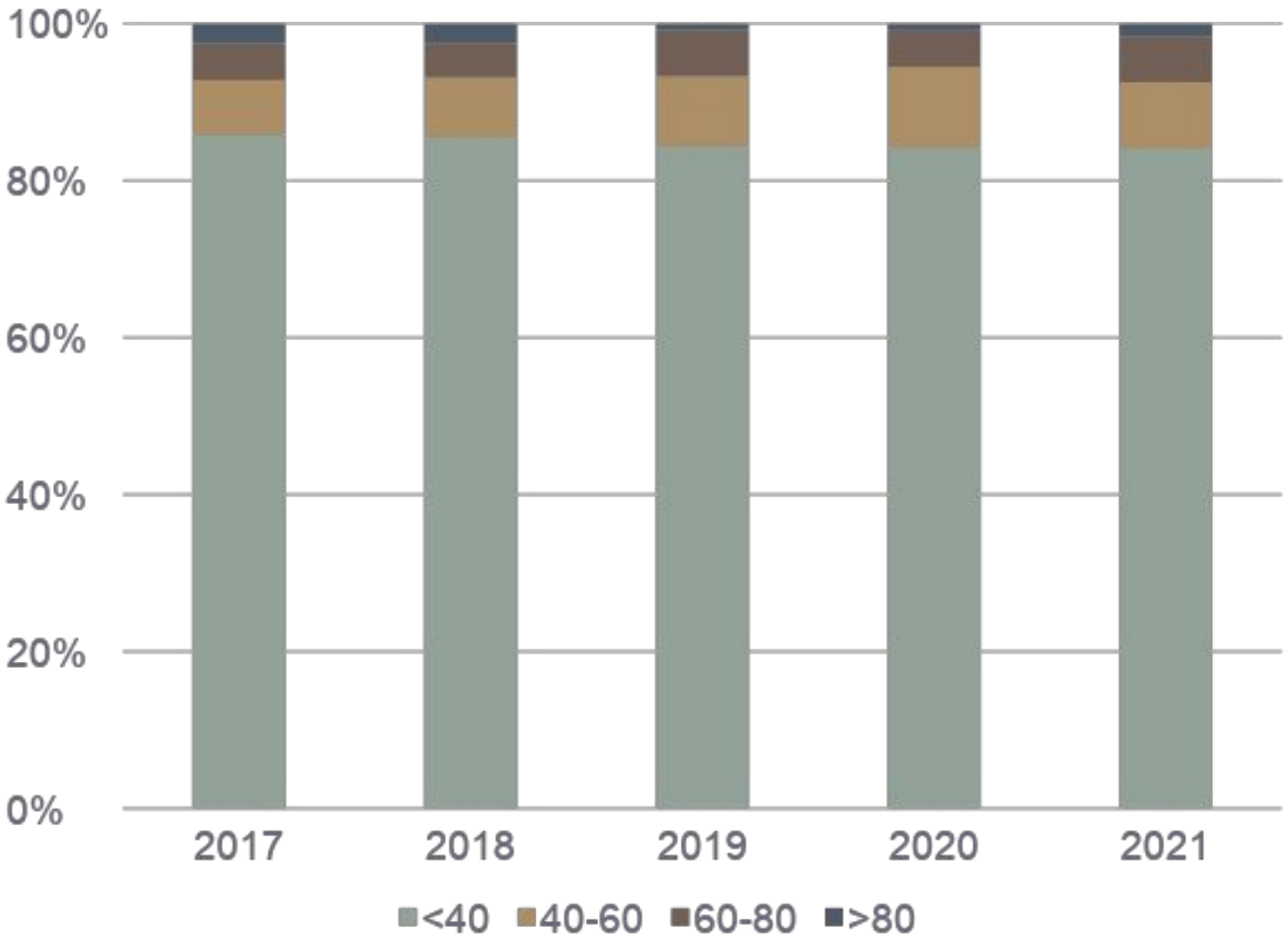


Different parts of boxplot

Boxplot



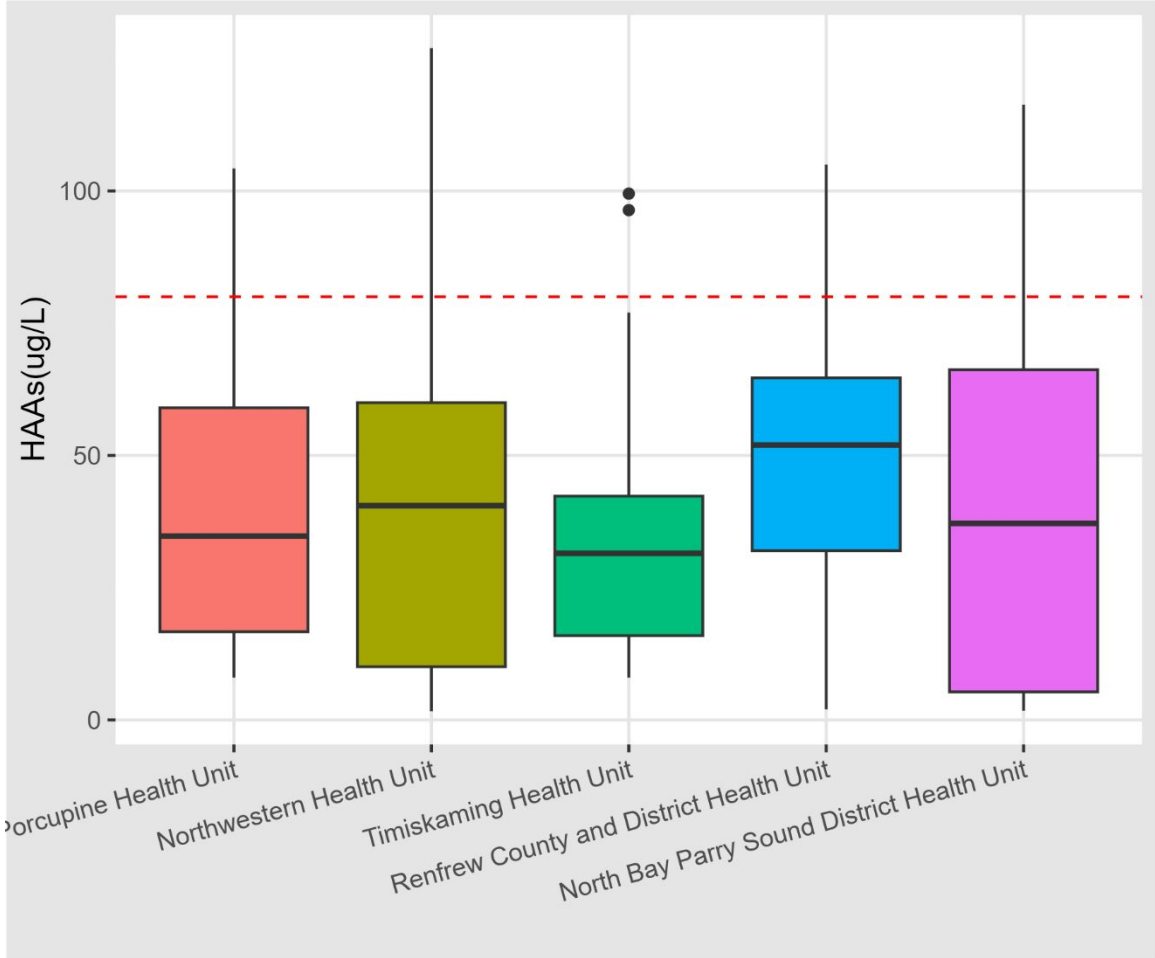
- For most DWSs, the HAAs are well below ½ of the MAC (40 µg/L)
- The median of LMRS appears to be the highest (~20 µg/L)



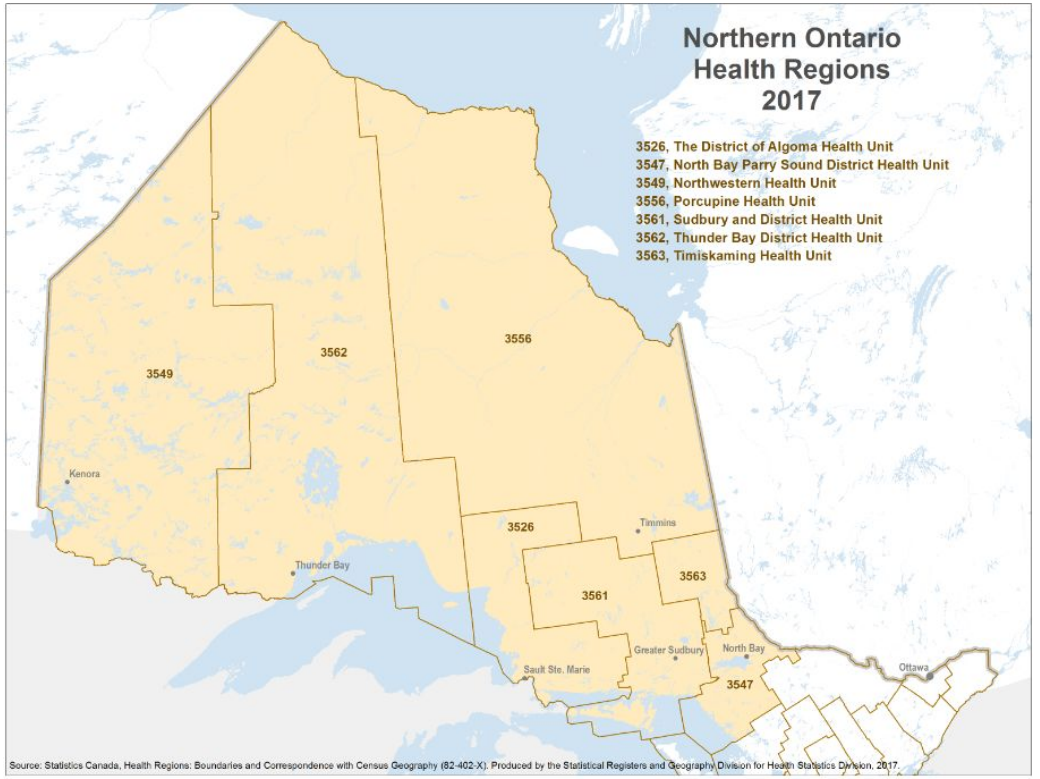
>75% of MAC

Year	<40	40-60	60-80	>80
2017	86%	7%	5%	3%
2018	90%	8%	5%	2%
2019	88%	9%	6%	1%
2020	87%	11%	5%	1%
2021	89%	9%	6%	2%

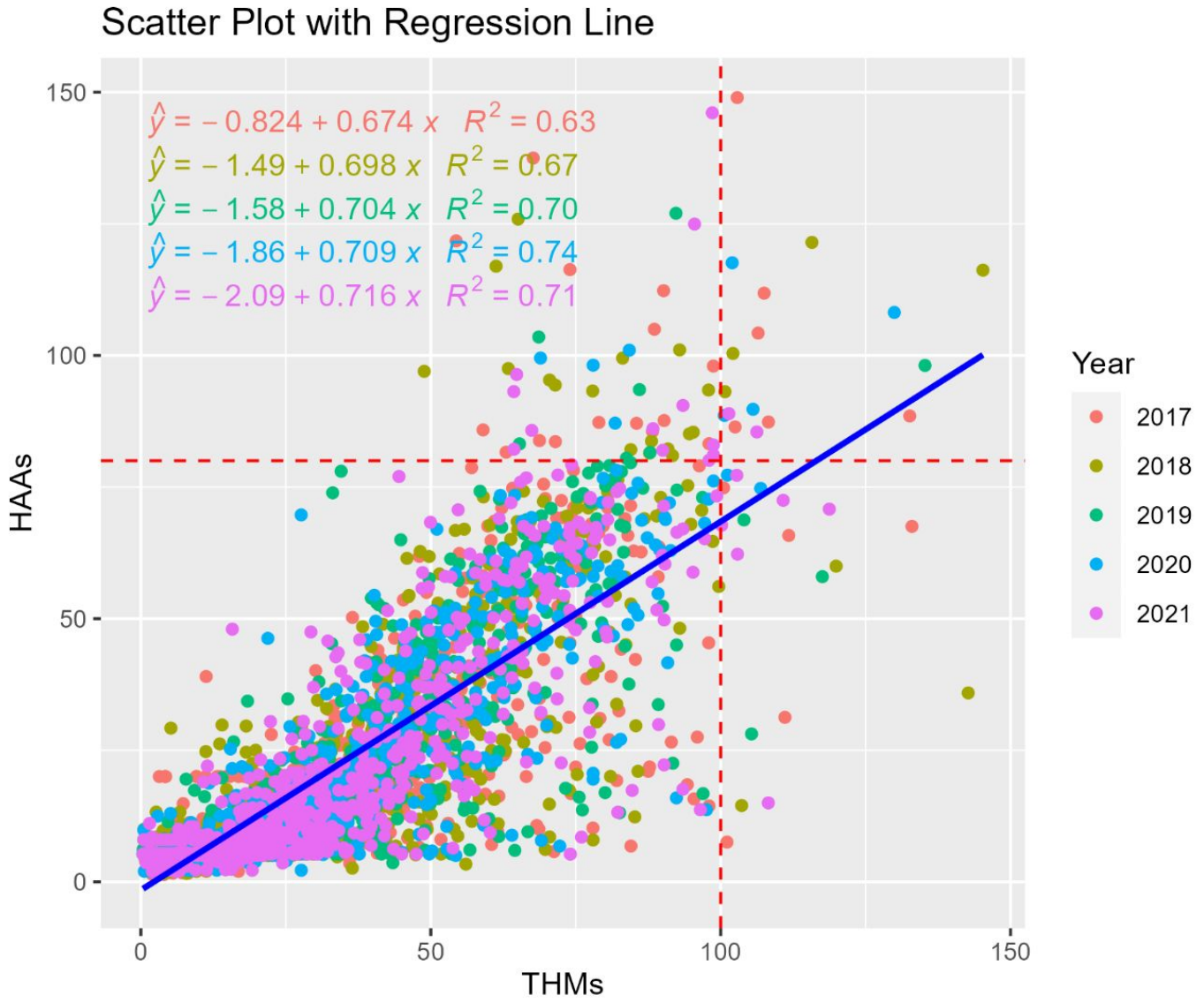
Top 5 PHUs



- Top 5 PHU based on the median values



HAAs vs. THMs

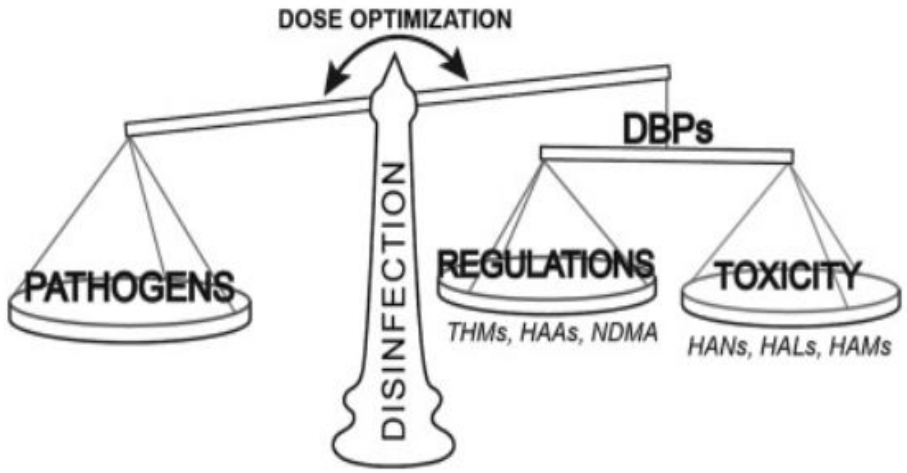


- 5 outliers removed (THMs >350 µg/L and HAAs <50 µg/L

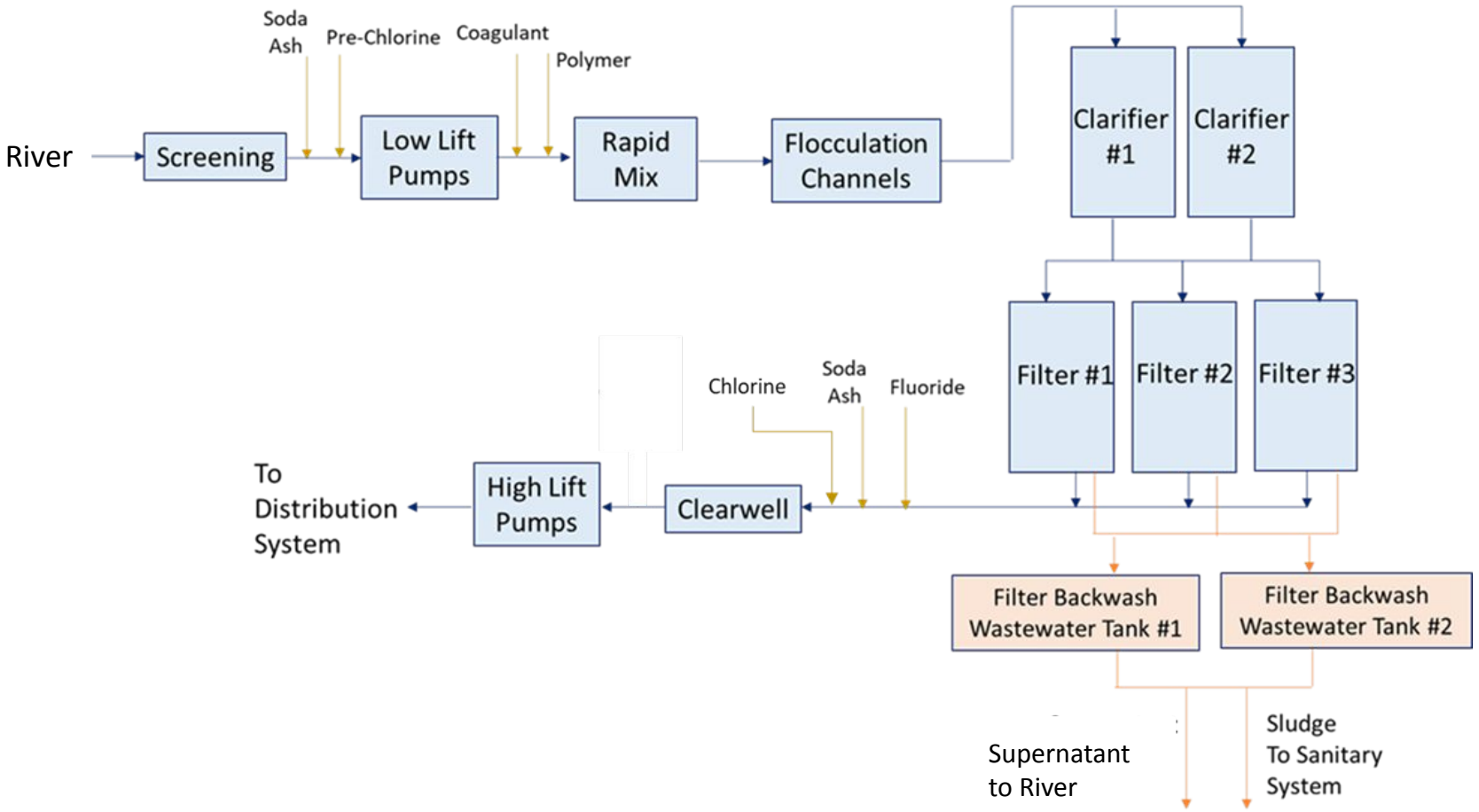
Case Studies

Optimization Approach

- Data analysis to fully understanding of the problem and identify optimization opportunities.
- This could be a design-related issue or an operational issue
- Effective communication with the parties involved is the key to find the feasible short-term and long-term solutions: OCWA internal, MECP, Municipality, Consulting Firms, and the Public.

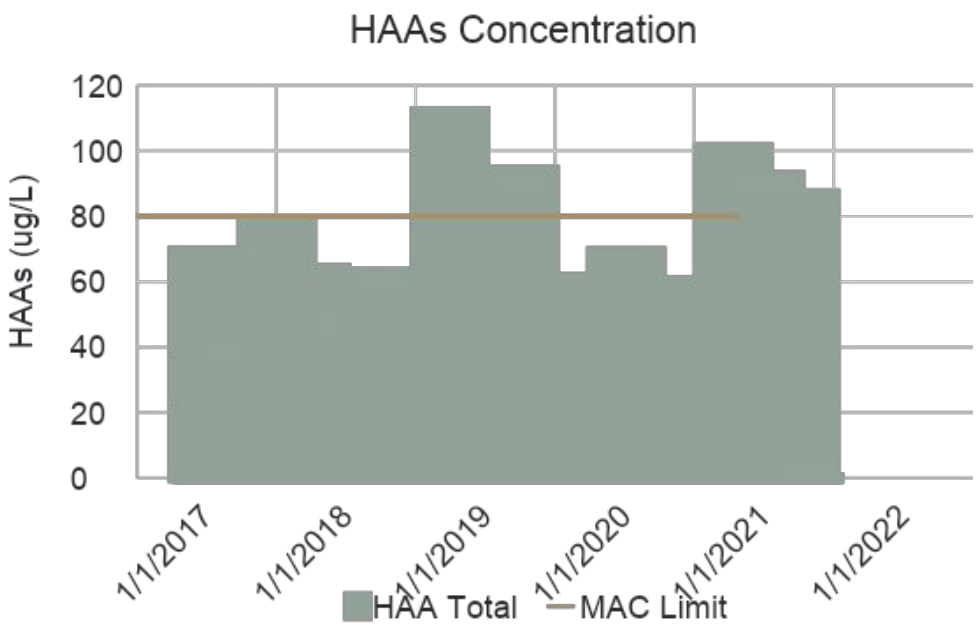


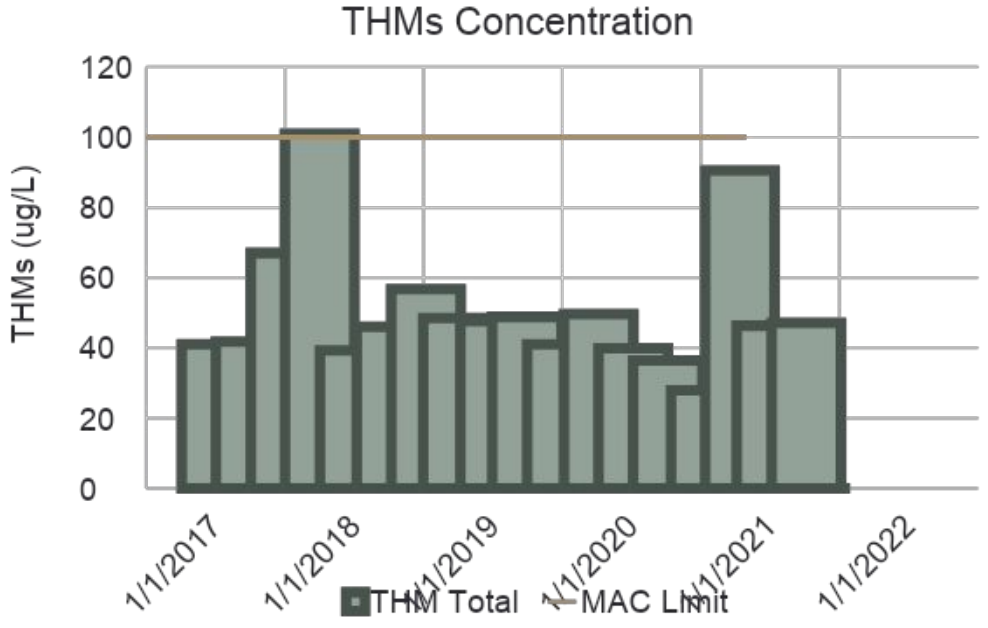
Case Studies #1 – Conventional System



- Source water is a river.
- TOC/DOC: 7 – 9 mg/L

Case Studies #1 – HAAs & THMs

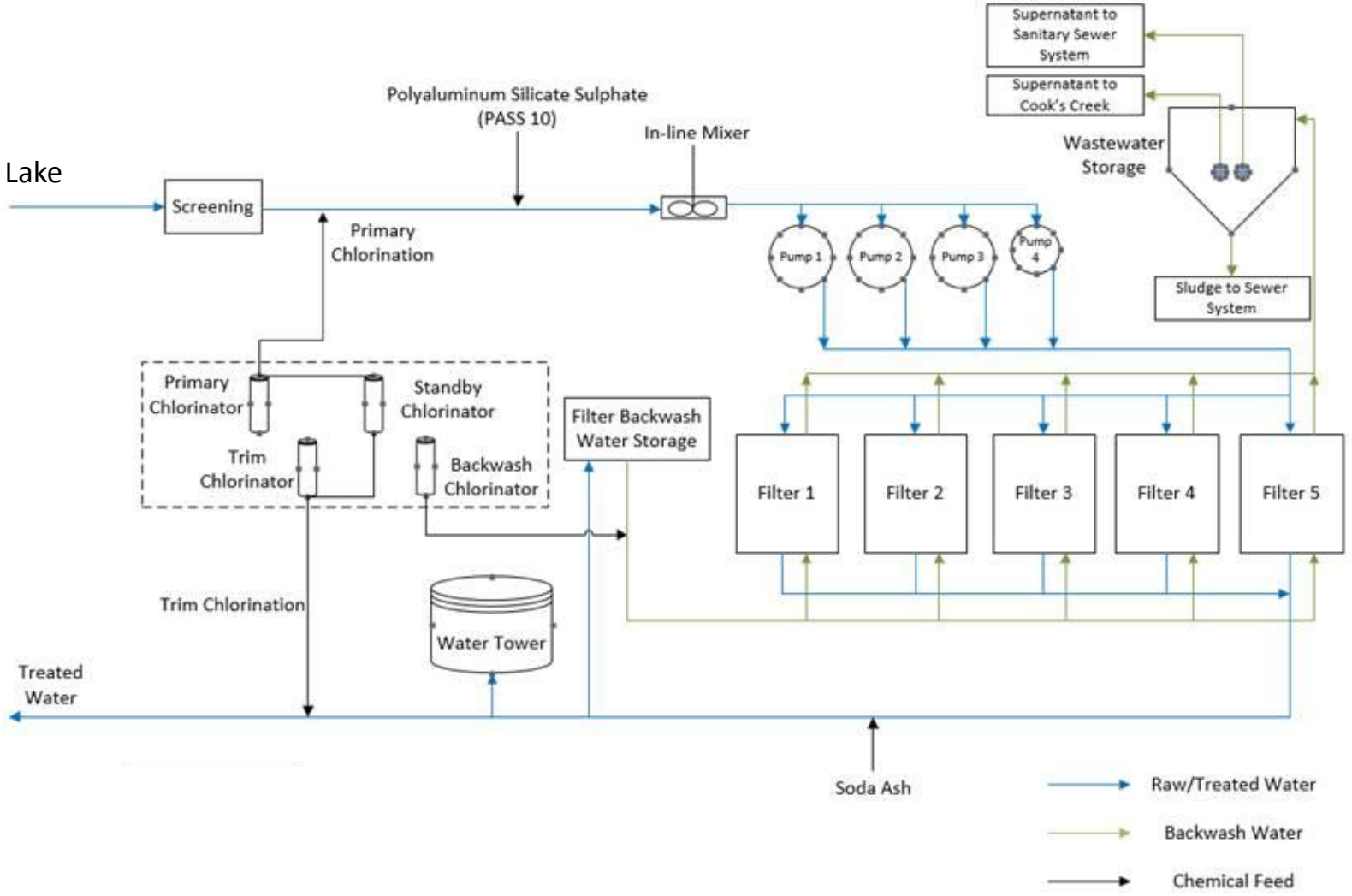




Case Studies #1 - Recommendations

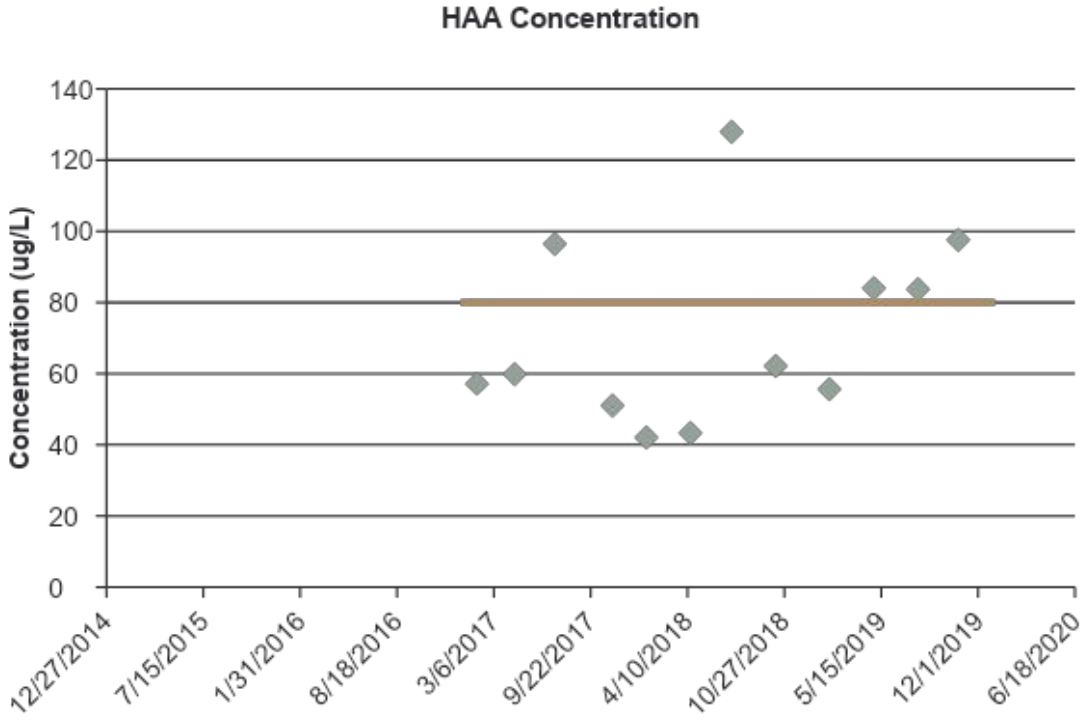
- Implement a water quality sampling program to troubleshoot the DBPs formation (TOC/DOC, UV254, THMs, HAAs)
- Evaluate treatment technologies
  - Enhance coagulation (jar tests to optimize the dosage)
  - GAC filters (or GAC cap to existing filters)
- Evaluate UV for primary disinfection.
- Evaluate chloramination as secondary disinfection
- Optimize chlorine dosage and dosing points

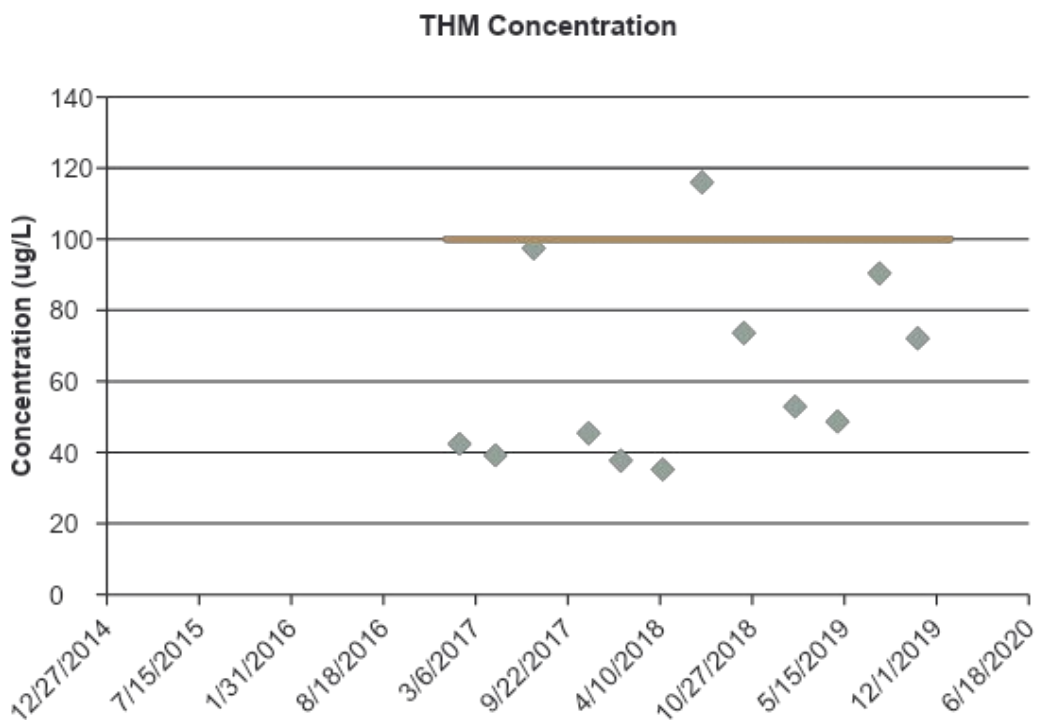
Case Studies #2



- Dual-media pressure filters – "direct filtration"
- MDWL requires chlorine CT to provide 1-log Giardia and 3-log viruses removal.

Case Studies #2 – HAAs & THMs

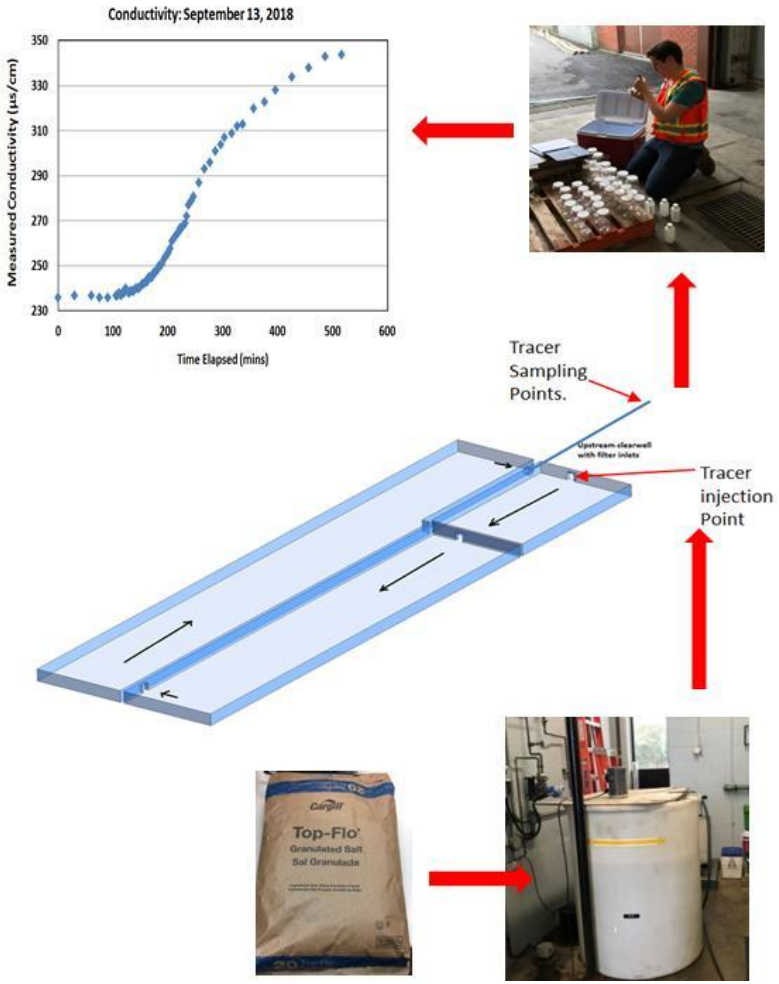




Case Studies #2 - Recommendations

- Implement a water quality sampling program to troubleshoot the DBPs formation (TOC/DOC, UV254, THMs, HAAs)
- Evaluate treatment technologies
  - Enhance coagulation
  - GAC filters (or GAC cap to existing filters)
- Evaluate UV for primary disinfection.
- Evaluate chloramination as secondary disinfection
- Optimize chlorine CT (direct filtration is only given 2.0-log credit for *Giardia* removal)

Case Studies #3 - Tracer Study



- Three tracer tests (at different operating conditions) were conducted by injecting food-grade salt at clearwell inlet and monitoring conductivity at outlet.
- Data analysis results:
  - Cell # 1: BF = 0.2 (> MECP Proposed 0.1)
  - Cells # 2-4: BF = 0.59 (>> than design BF 0.3).
  - The existing clearwells have sufficient retention time to meet CT requirement
  - Can lower the chlorine dosage.

Case Studies #4 – Operational Solution

MECP inspector and review engineer raised concern on the Worst case CT calculation for a clearwell:

- The Municipality's CT calculations did not include fire flow, considering that the fire pumps are rarely used.
- However, MECP inspector requires that fire flow should be considered as the worst-case condition.

- Look into the worst-case scenario, is it too conservative?

- To address the concern, review the operation and SCADA data
  - Frequency of fire pumps running in the past 5 years
  - Max flow rate when fire pumps are running
  - Current low chlorine alarm setpoints

- Discuss with MECP the possibility of treating fire flow separately as an emergency condition.
  - Prepare an emergency plan for fire pump operation: with boiling water advisory to water users

- Optimize plant operation to increase CT during a fire event:
  - Maintain the clearwell water level as high as possible during routine operation (Increase “low” level set point)
  - Maintain chlorine residual in the clearwell on the higher end of the typical range

Summary

- For most DWSs (>86%), the HAAs are well below ½ of the MAC (40 µg/L)
- Approximately 7% of Ontario DWSs are impacted by the introduction of the HAAs regulation since Jan. 2020 (>75% of the MAC or above).
- Potential solutions to overcome the challenge:
  - Additional treatment process for organics removal
  - Optimize the enhanced coagulation process
  - UV for primary disinfection
  - Optimization of the chlorination process
- Effective communication with internal teams, the client and the ministry is the key in dealing with challenging CT issues
- Sufficient data is critical for decision-making.