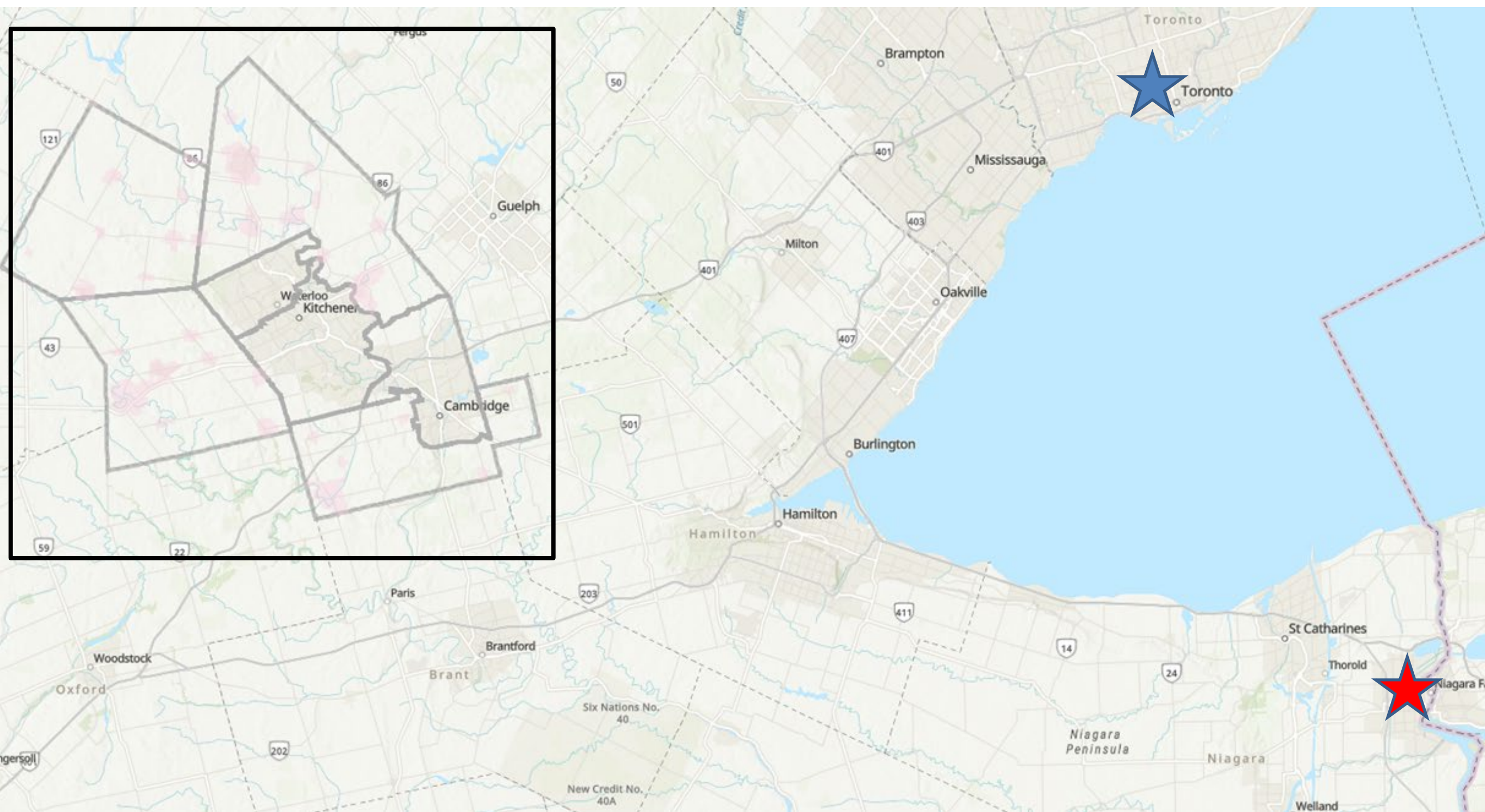


Mannheim WTP Optimization and Facility Plan

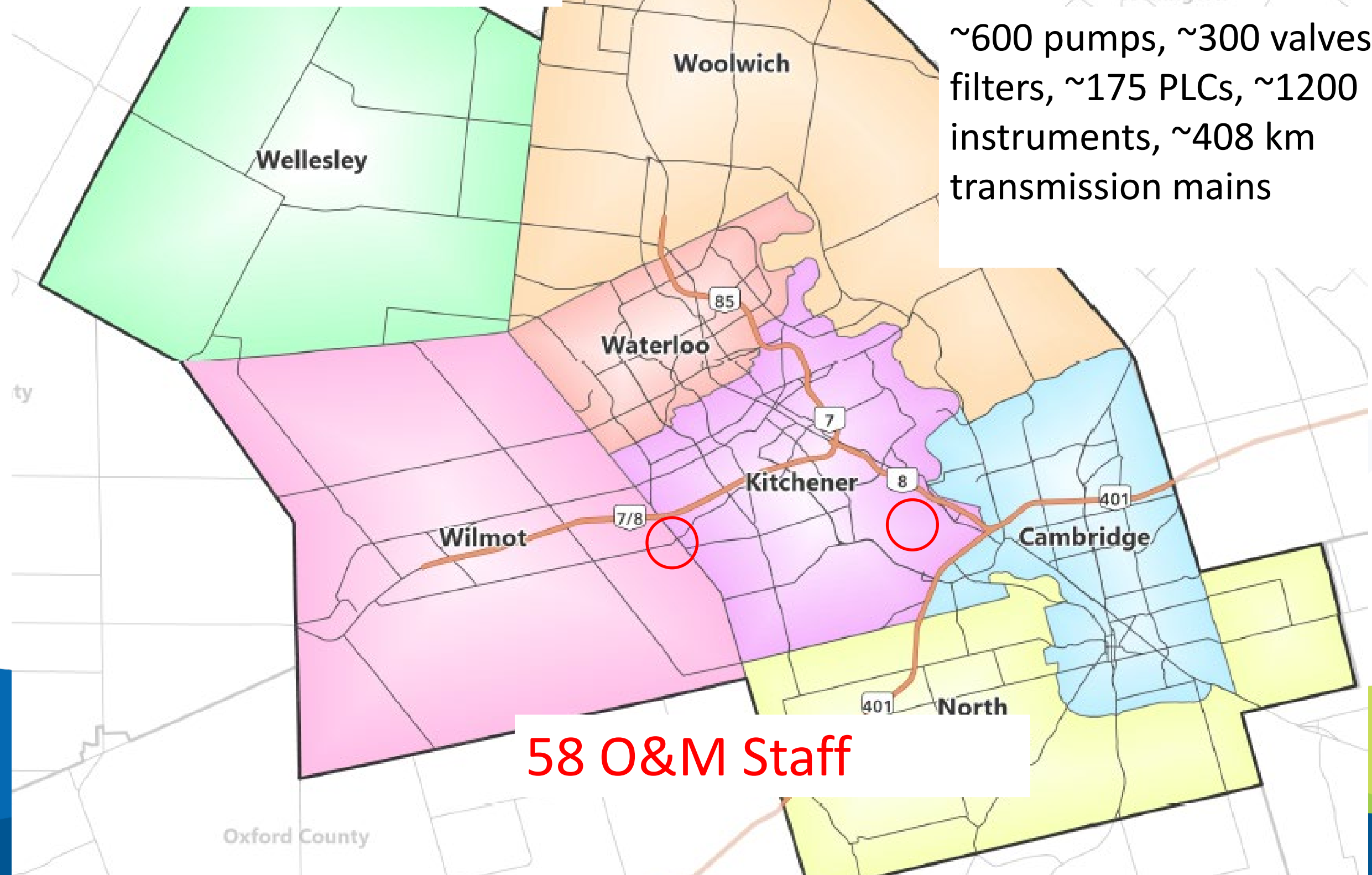


Region of Waterloo

Ayman Khedr, P.Eng
Nicole McLellan, PhD



106 Production Wells
34 Water Systems
10 pump stations
13 elevated tanks
1369 km²



~600 pumps, ~300 valves, ~50 filters, ~175 PLCs, ~1200 instruments, ~408 km transmission mains

58 O&M Staff

Mannheim Water Treatment Plant

- Commissioned in 1992; asset renewals
- Max **design** flow of 840 L/s; maximum **operational flow is ~600 to 650 L/s**
- 20 – 35 % of Region Water demand



Source: Google Maps

Project Overview

Why are we doing it?

Water Services – One of the fastest growing regions in Canada; we need to maximize our supply resources

O&M – Mannheim is the most operationally intensive plant in the Region

Asset Renewals – Aging infrastructure

Holistic Approach to evaluating the Treatment plant performance

Treatment Train

Hidden Valley Raw
Water Reservoirs

Mannheim Raw
Water Tanks

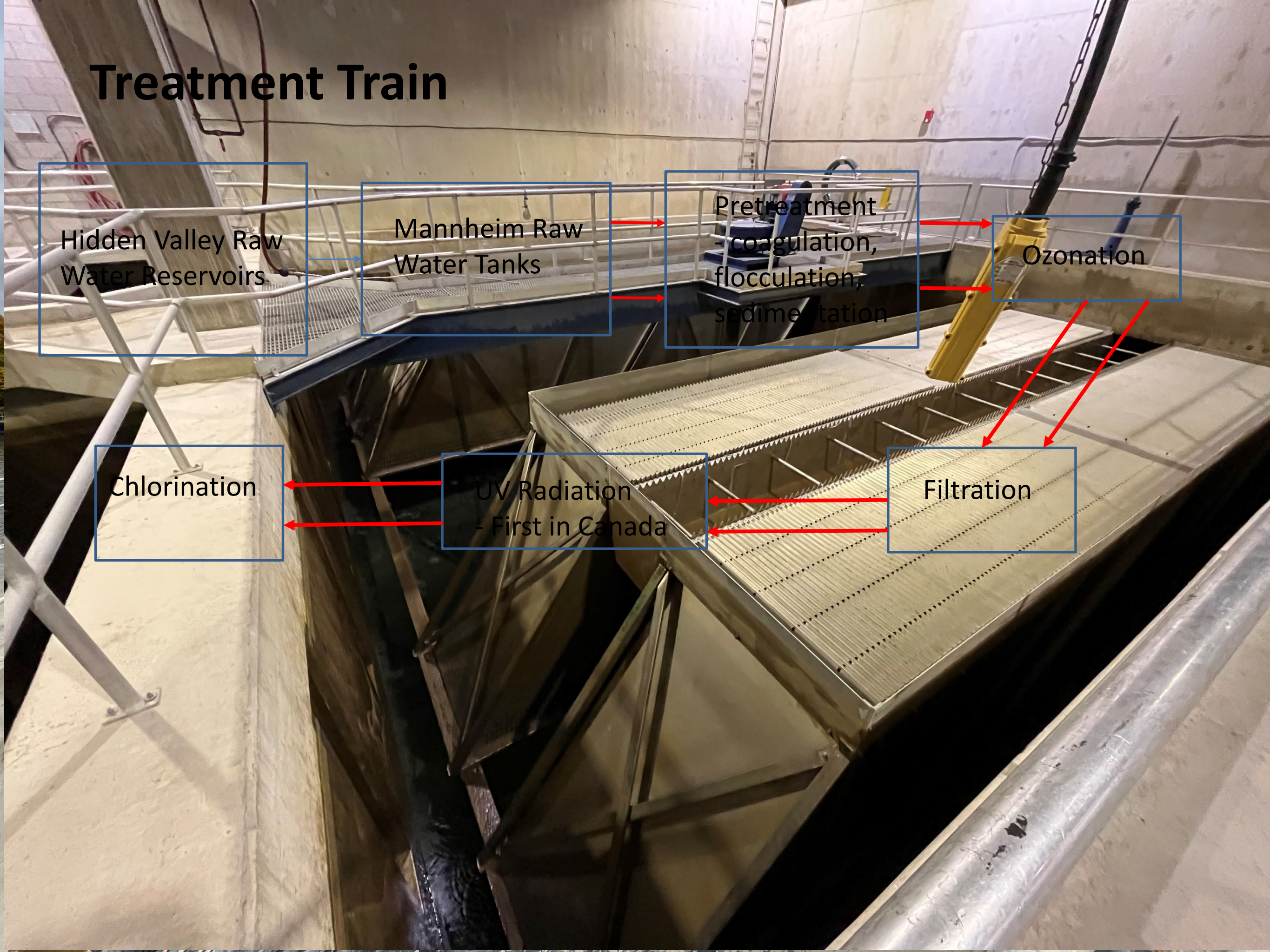
Pretreatment
- coagulation,
flocculation,
sedimentation

Ozonation

Chlorination

UV Radiation
- First in Canada

Filtration



Key Information

- Treatment process is robust
- Fully redundant – flow is split equally between two identical trains
- Treatment is flow paced; flow is controlled through butterfly valves
- Aging infrastructure
- pH control was implemented (H₂SO₄) – but discontinued

PROJECT SUMMARY

Project Goals

- Complete a comprehensive **Performance Evaluation to identify bottlenecks**
- Develop Quantitative and Qualitative key performance indicators (KPIs)
- Baseline current performance to track potential improvements over time
- Identify process upgrades and operational improvements prioritized based on impact to KPIs
 - Opportunities for automation
 - Short term / low capital upgrades projects
 - Long term / major capital projects
- Create a 10 year facility plan to implement aforementioned projects
- **GAIN OPERATOR BUY-IN****

KEY FINDINGS

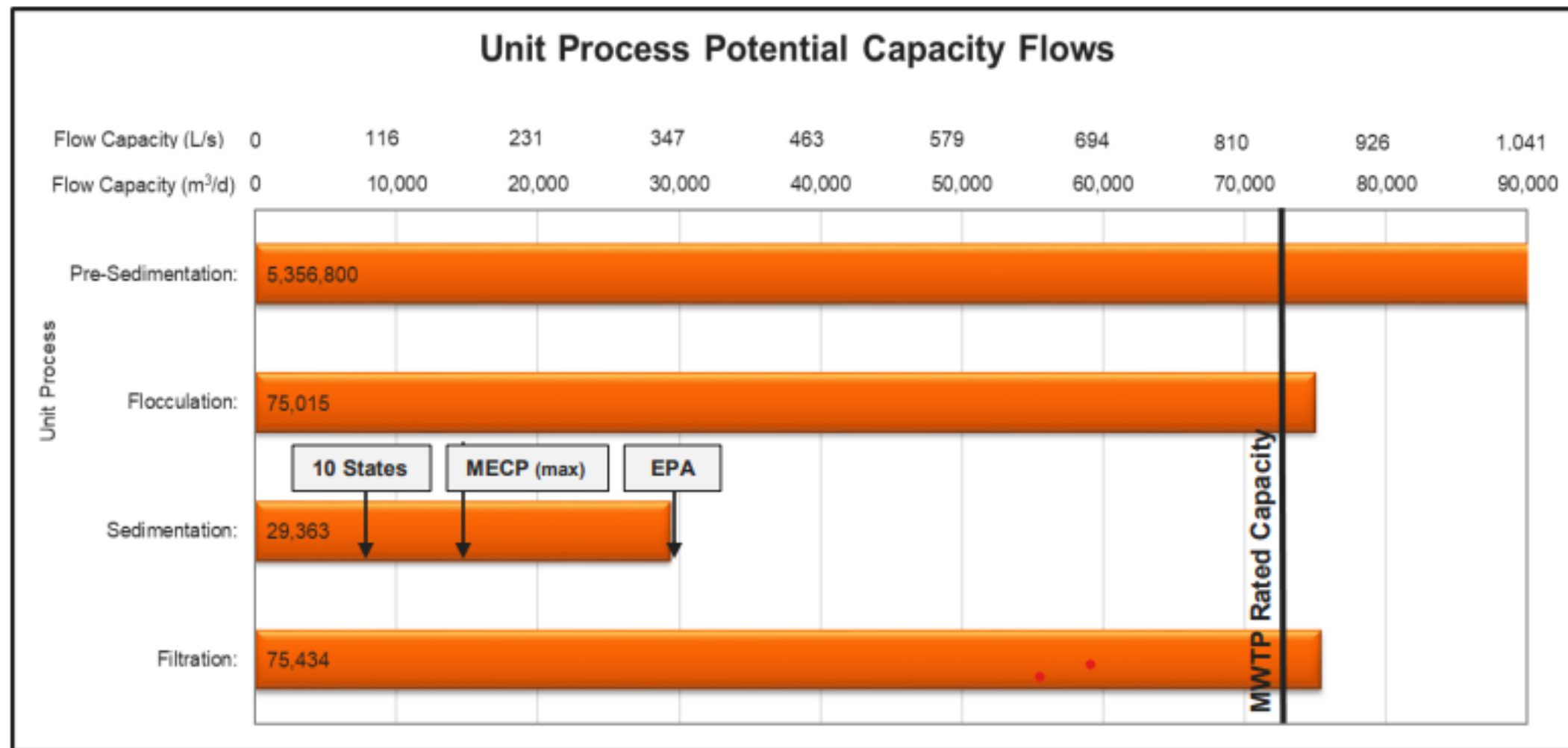
Bottlenecks/ Opportunities

1. Sedimentation basins are significantly undersized
2. Blender flow control is critical for Mannheim Operations
3. Reviewing potential for pH control (peak shaving)

1. Sedimentation Basin Sizing

Sedimentation Basins Undersized

Sedimentation is a key performance limiting factor for Mannheim WTP.

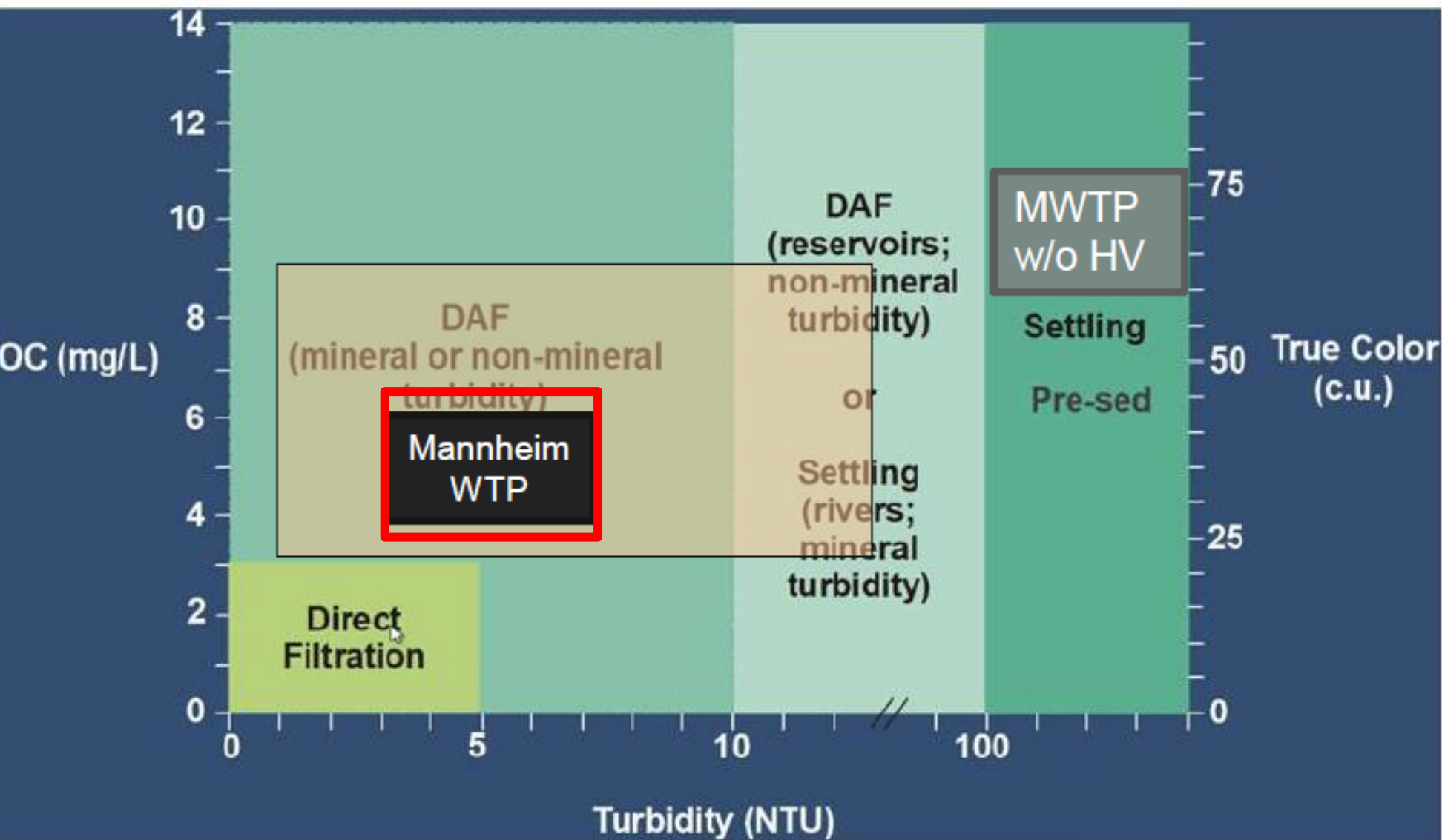


RECOMMENDED PLATE SETTLER SOR VALUES

Source	SOR (m/h)	Capacity (m ³ /d)	Capacity (L/s)	Notes
10-State Standards	2.4	7,206	86	
MECP	2.5 - 5.0	15,012	180	(5 applied)
EPA	9.78	29,363	352	



Pre-Treatment



- **Black box:** Average; **Orange box:** Range
- **Grey box:** MWTP without Hidden Valley

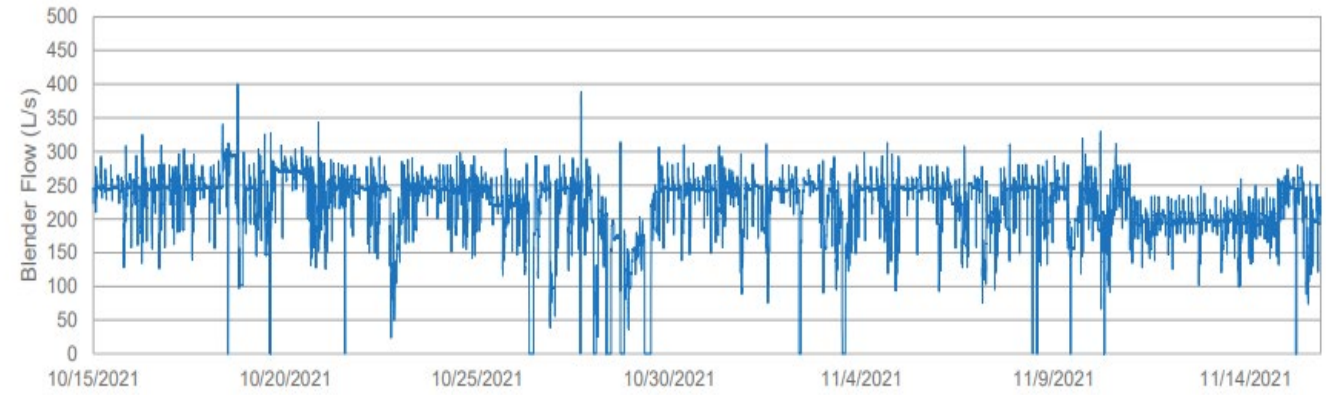
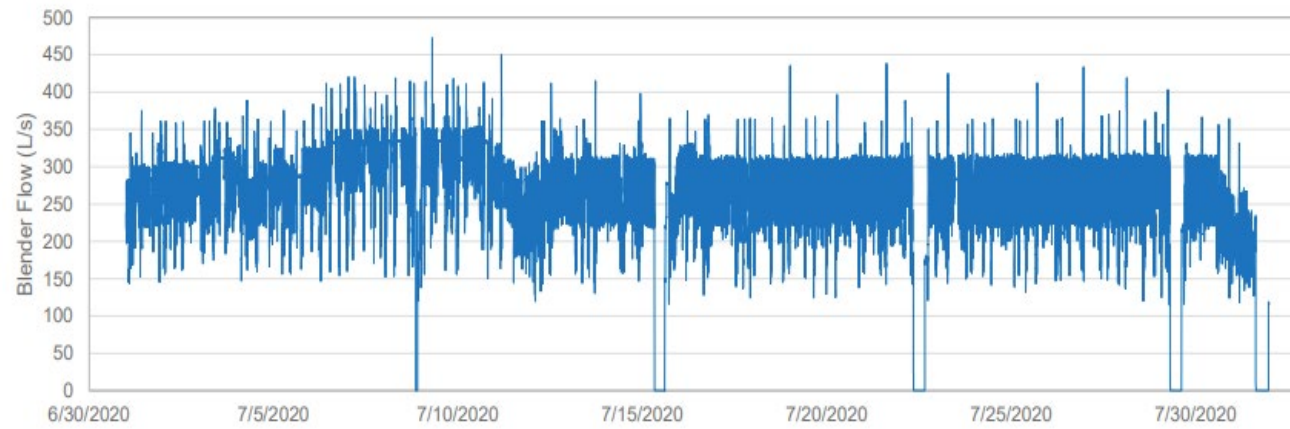
- DAF is recommended for relatively high quality waters with average river turbidity <10NTU, or <100NTU from settled reservoirs
- No upper limit of TOC or colour for DAF processes
- Ballasted flocculation is recommended for water with highly variable water quality and maximum non-mineral turbidity >200NTU

Site Visits

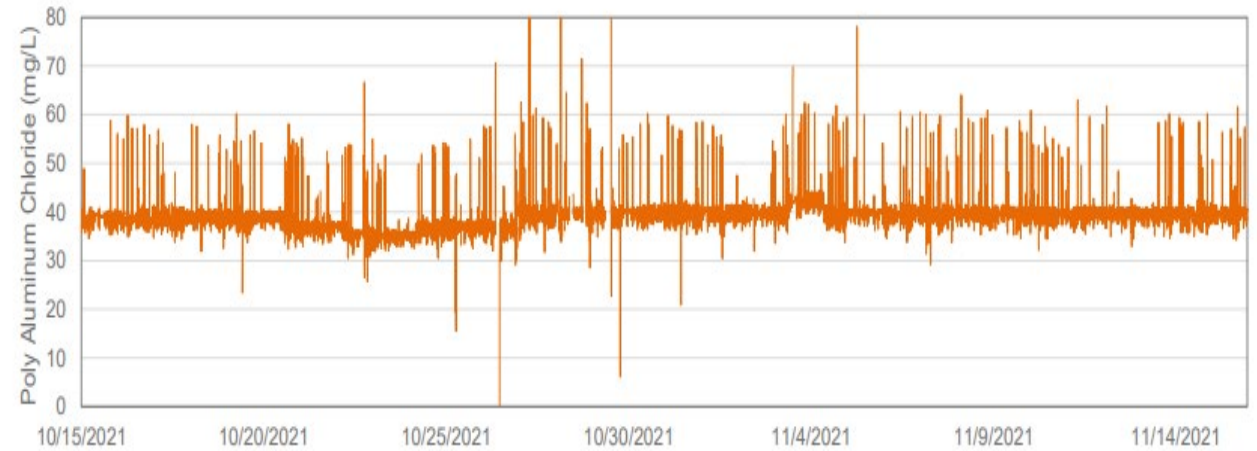
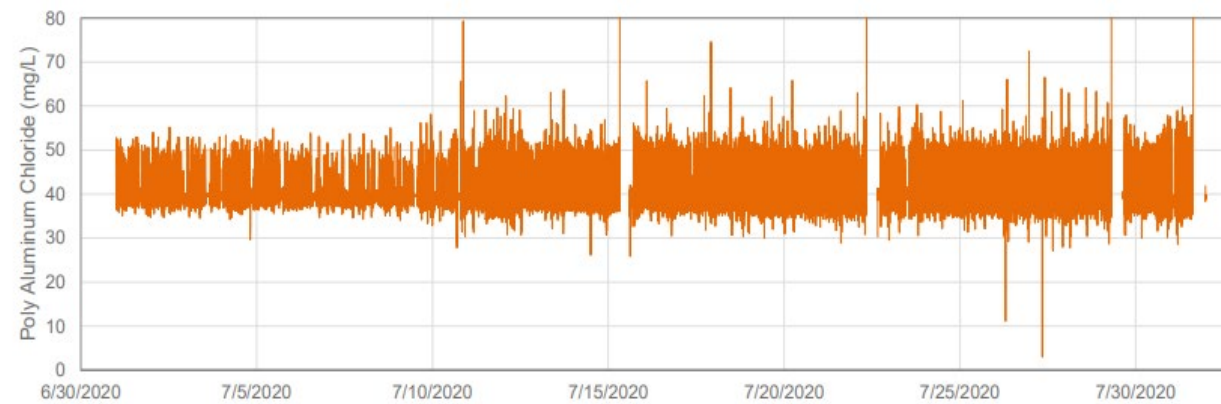
Parameter	Typical Range			
	Mannheim	Belleville	Brantford	Union
Temp (C)	0.5 to 25	0.5 to 32	3 to 29	4 to 24
Turbidity (NTU)	5 to 15	4 to 25	2 to 200	1 to 117
pH	7.8 to 8.5	7.4 to 8.8	7.4 to 8.5	7.25 to 8.23
DOC (mg/L)	5 to 7	4 to 7	4 to 6	2
Alkalinity (mg/L)	160 to 230	90 to 150	164 to 256	94
Hardness (mg/L)	210 to 315	115 to 145	293 to 411	106
Pre-treatment	Plate Settlers	DAF	Ballasted Flocculation and pH control	DAF and pH control

2.0 Blender Flow Control

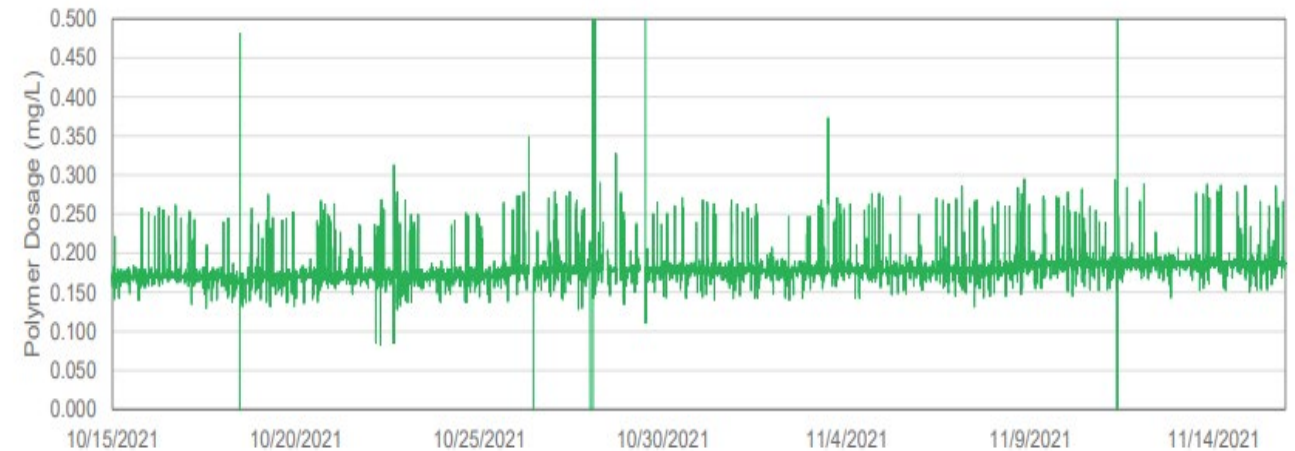
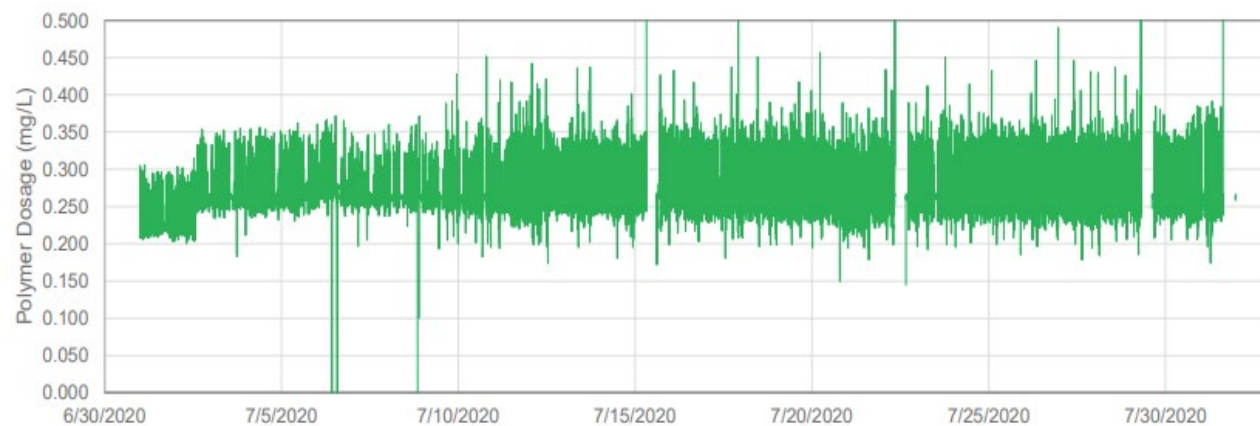
Blender #1 Flow – 31-Day Trend



Side 1 Coagulant Dose – 31-day Trend

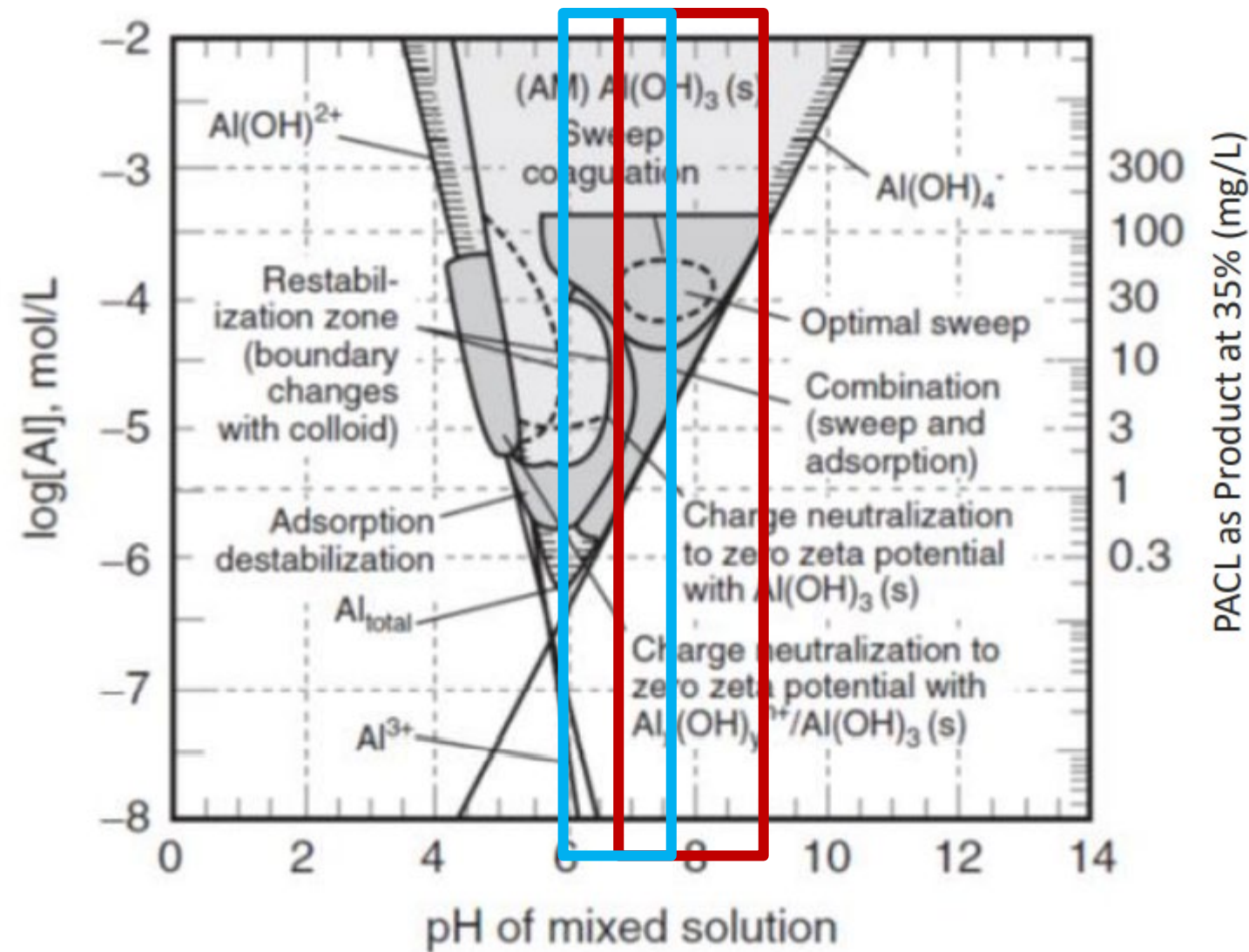


Side 1 Polymer Dose – 31-day Trend



3.0 pH control

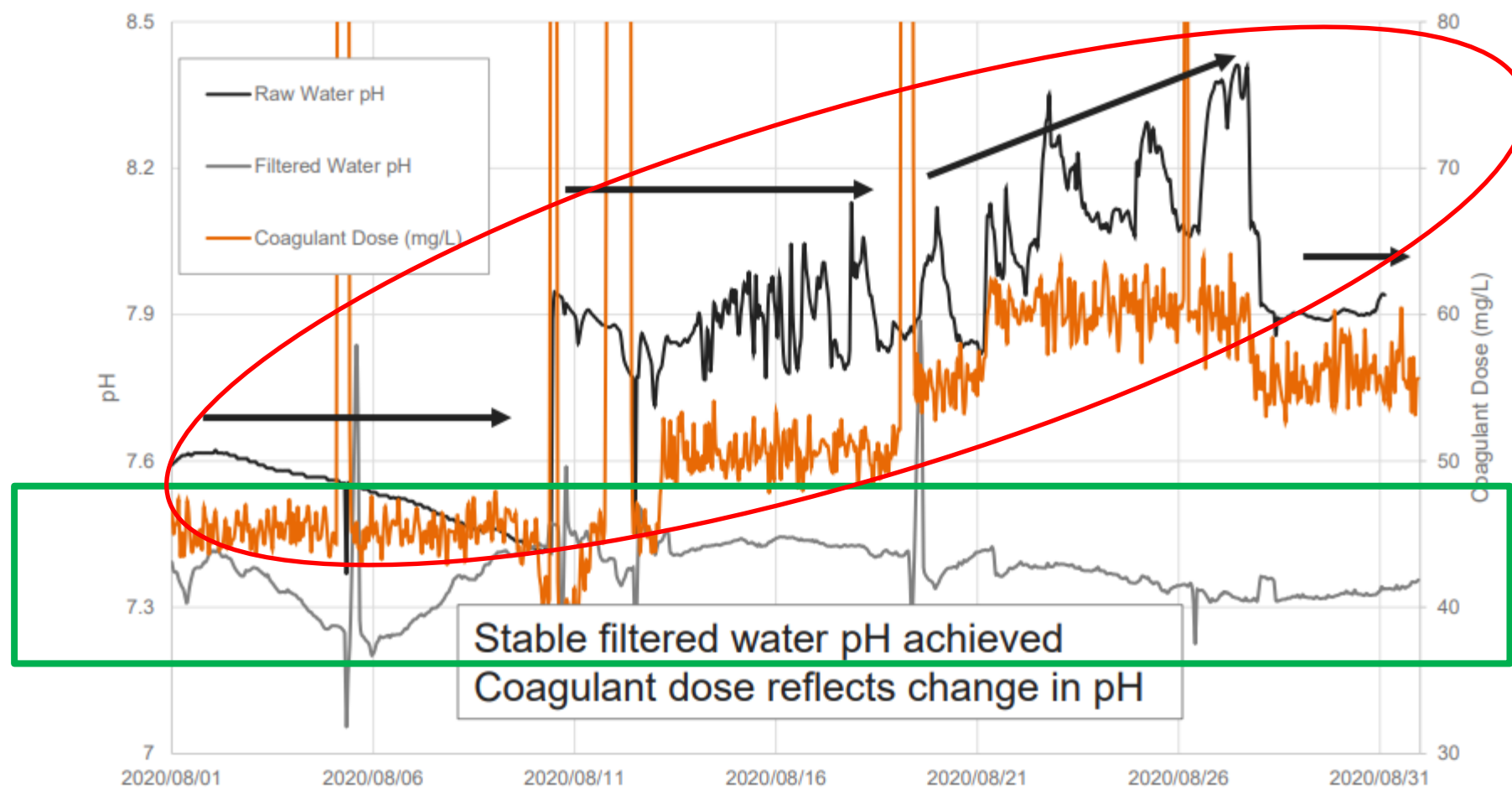
Coagulation is pH Dependent



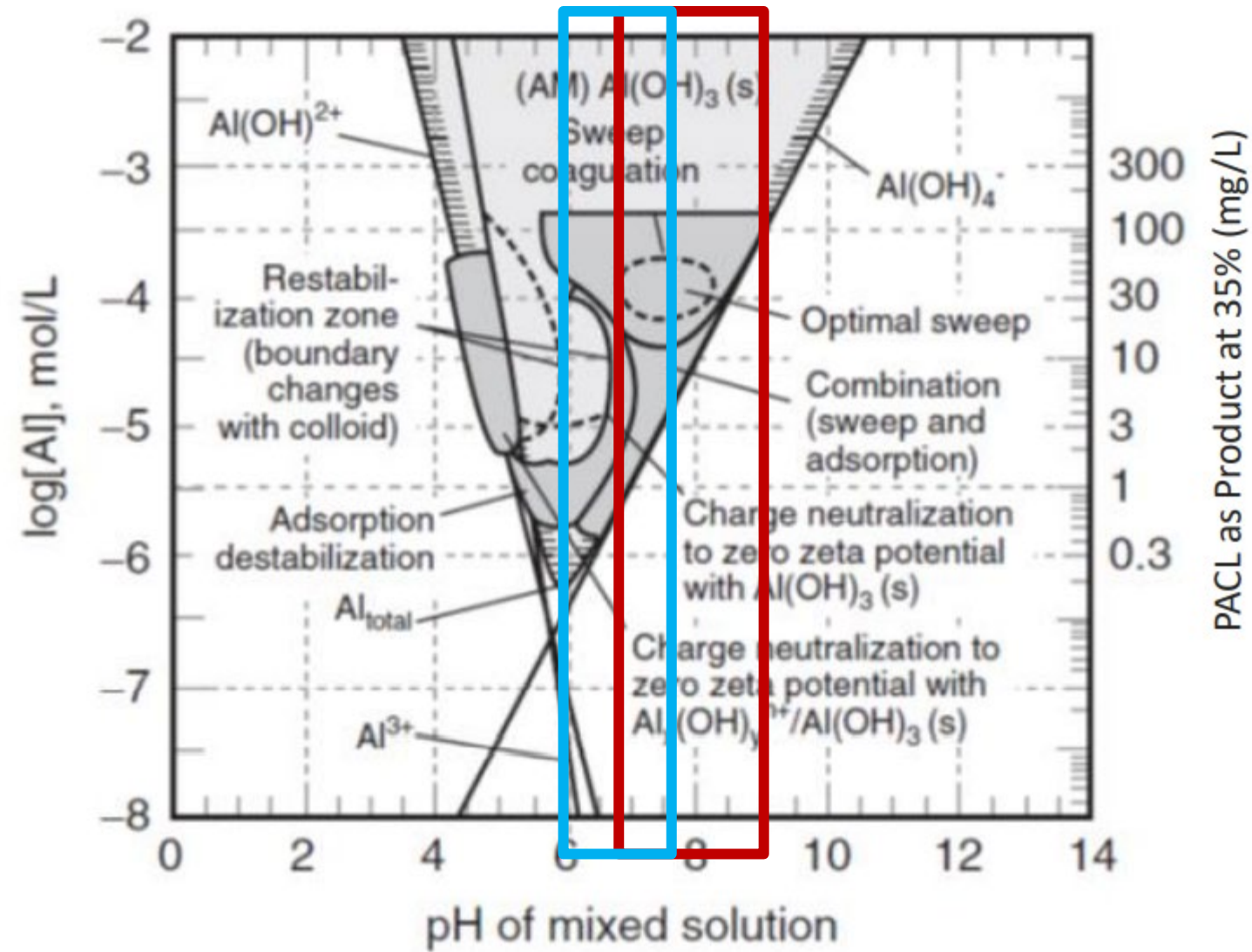
Inherent pH control

Chemical Dosing for pH Control

Evidence that coagulant dose is being used to provide pH control



ph Shaving

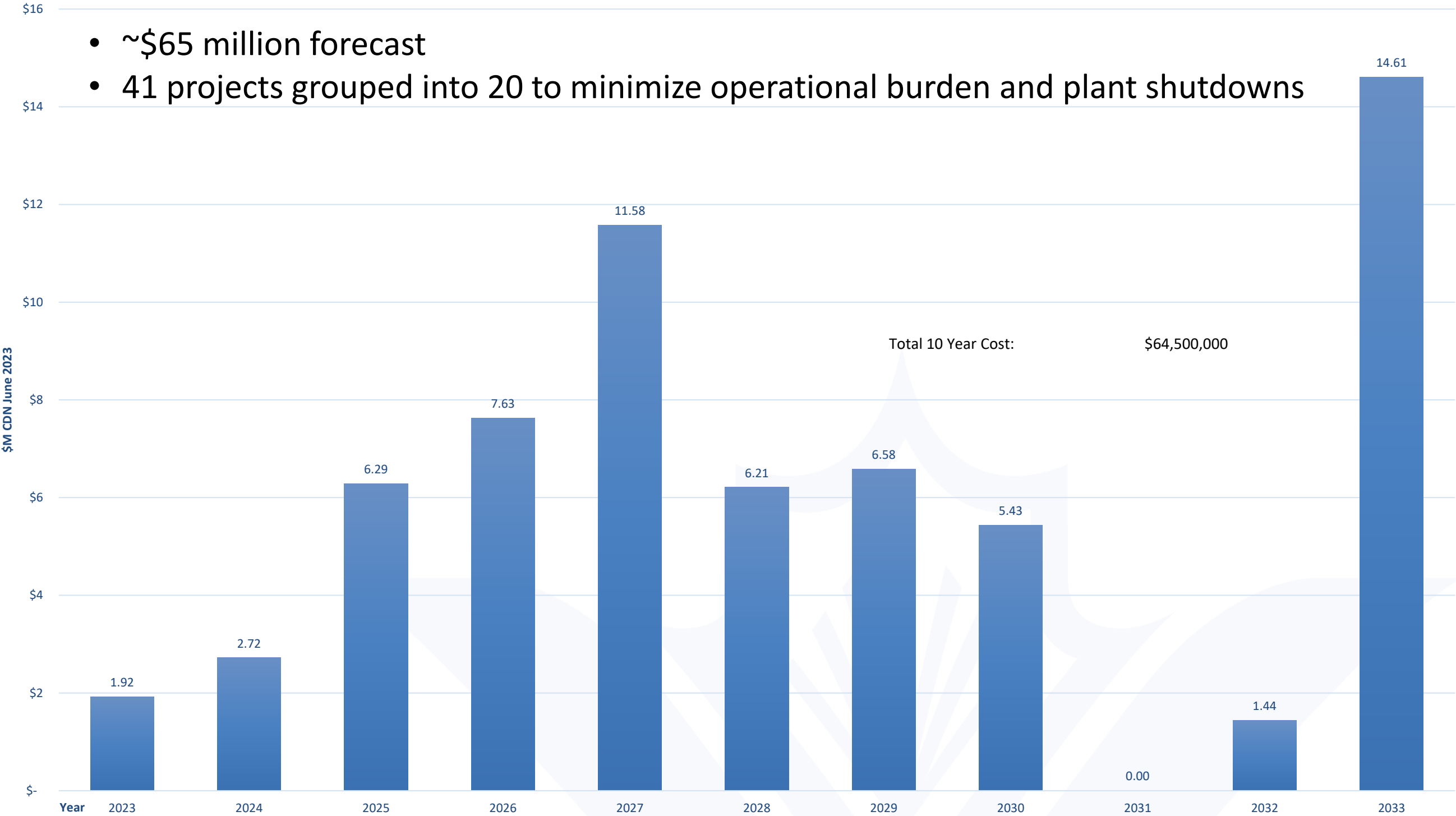


NEXT STEPS & LESSONS LEARNED

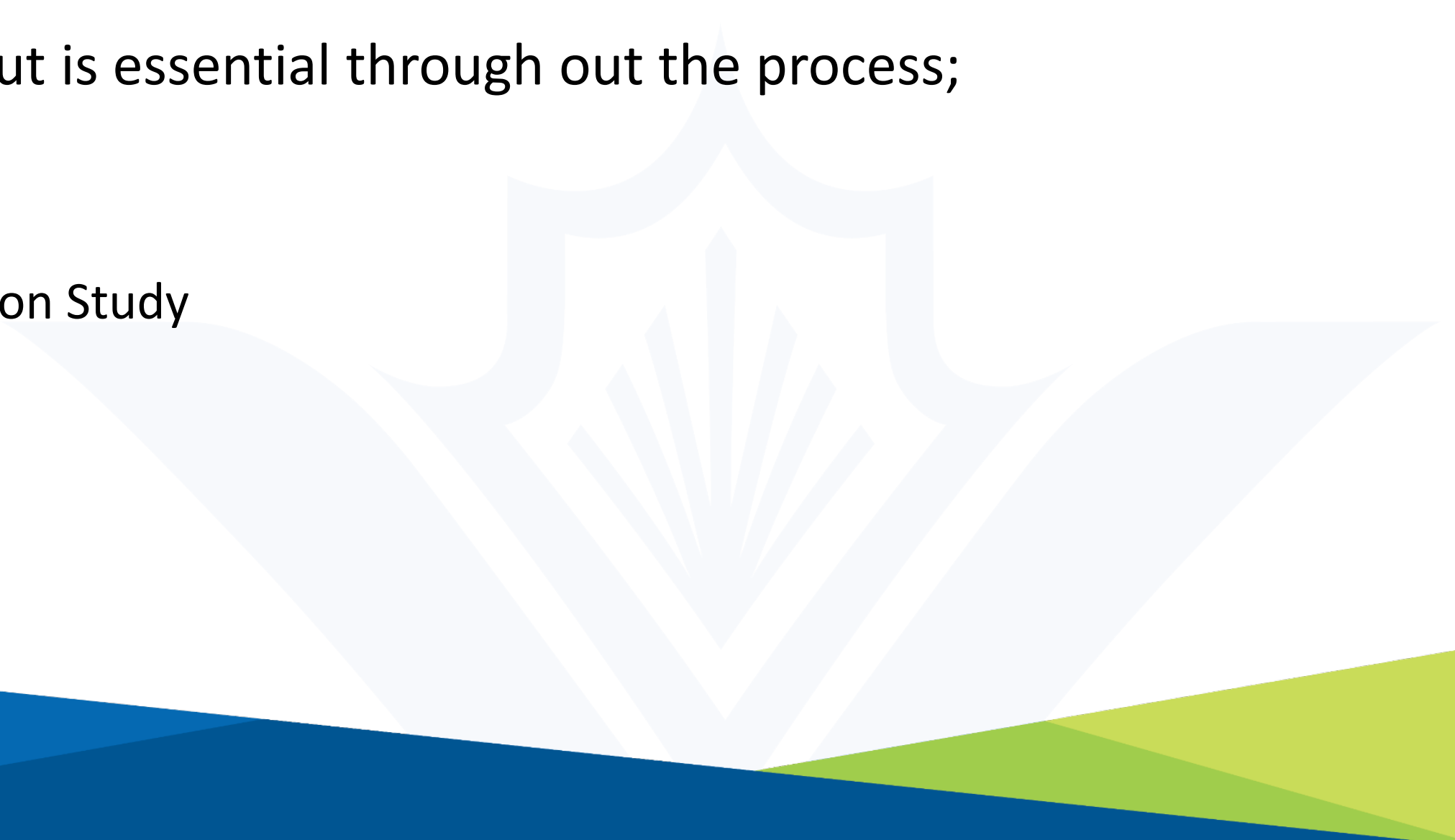
C2021-10 Mannheim 10-Year Facility Spending Plan

Expected Annual Expenditures (Millions \$CDN June 2023)

- ~\$65 million forecast
- 41 projects grouped into 20 to minimize operational burden and plant shutdowns

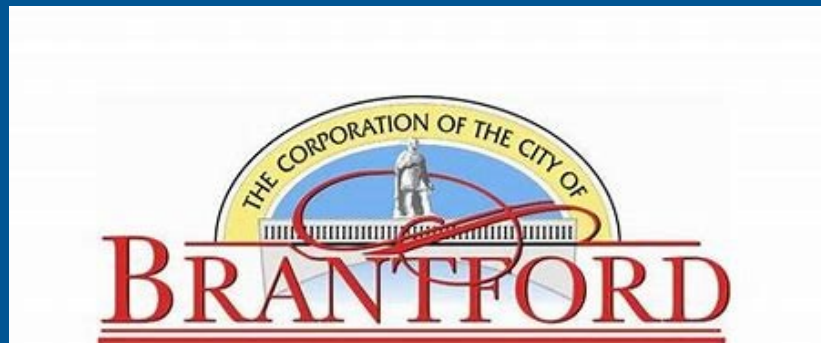


Lessons Learned

- Permitted/design flows may not accurately represent plant capacity
 - Change is hard!
 - Operator input is essential through out the process;
 - Site Visits
 - Workshops
 - Demonstration Study
- 
- A decorative background graphic featuring a large, light blue stylized sunburst or fan shape in the center. Below this, there are overlapping geometric shapes in shades of blue and green, creating a layered, abstract effect at the bottom of the slide.

Thank you!

- Nicole McLellan – Stantec
- Dennis Mutti – C3 Water
- Perry Decola – Belleville
- Duane Ayres – Brantford
- Rodney Bouchard – Union WTP



Stantec

