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Measure

Partner with Xylem for a complete range of solutions & services to measure water.

WEFTEC 2024

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MEASURE

Optimizing Wastewater Treatment

Insights from Brockton AWRF's Sensor-Based Control System

Adrienne Stenz
Application Development Engineer

Brockton Advanced Water Reclamation Facility

MEASURE

Brockton uses 52 online sensors to optimize aeration control

Maintains stringent 3 mg/L TN effluent limit

John Downey leads sensor maintenance with best practices to ensure data accuracy and reliability

Optimizing with Ammonia-Based Aeration Control

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Overview of Brockton AWRF

14 MGD Advanced Wastewater Treatment Facility

MEASURE

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North Aeration Basins

MEASURE

xylem

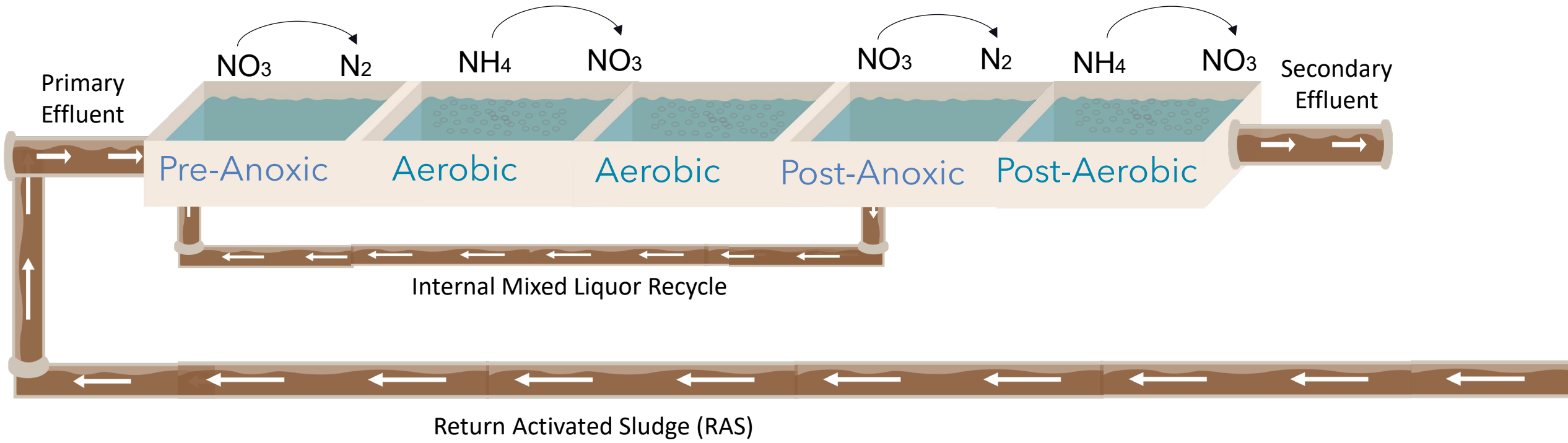
South Aeration Basins

MEASURE

xylem

Configuration of Each Aeration Train

MEASURE



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History of Ammonia-Based Aeration Control at Brockton

MEASURE

2016

Manufacturer Trial

- Head-to-head trial with three manufacturer's ion-selective ammonium sensors
- YSI decided in 2018

2020-2021

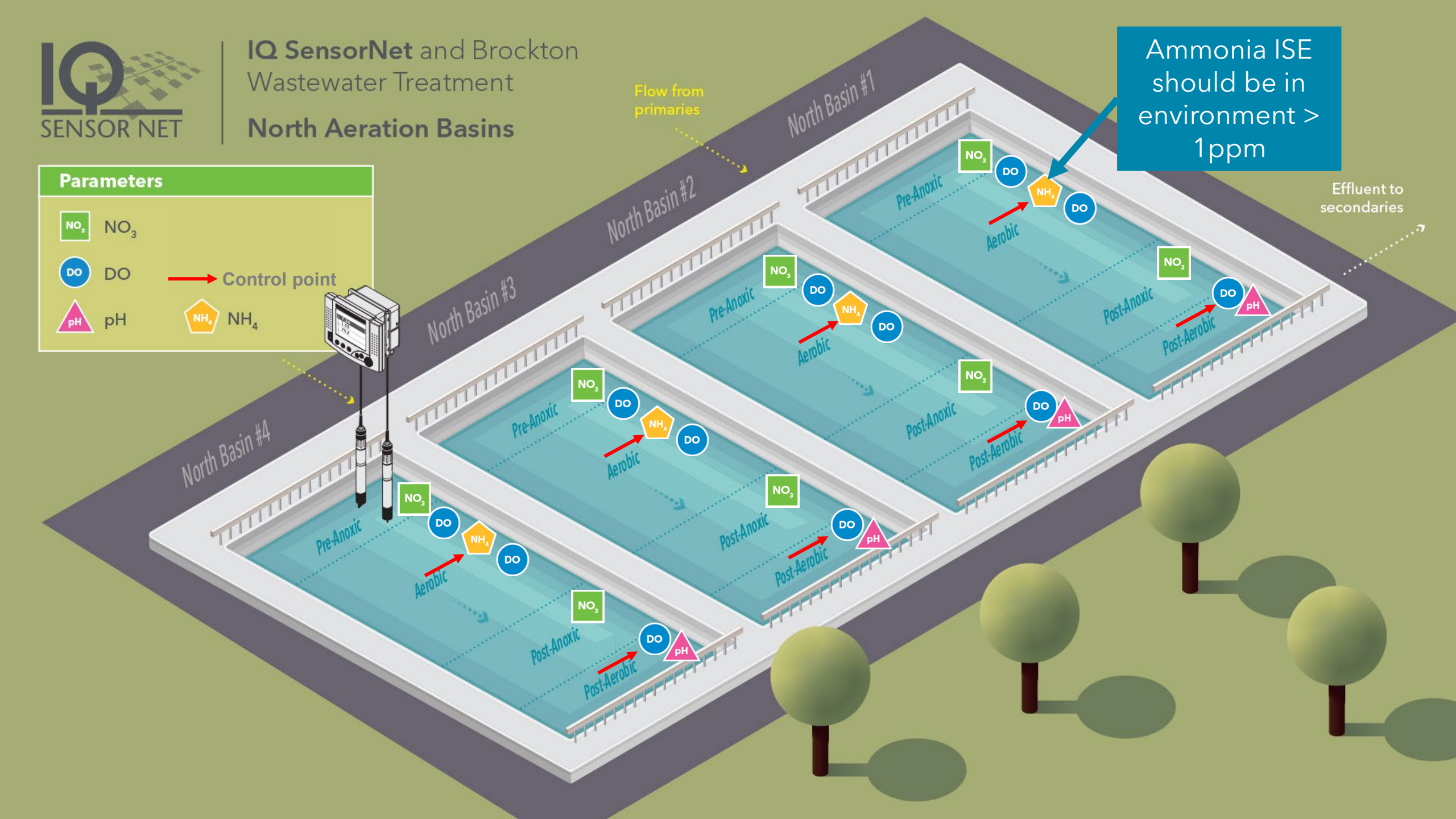
Installation of Upgrade Equipment

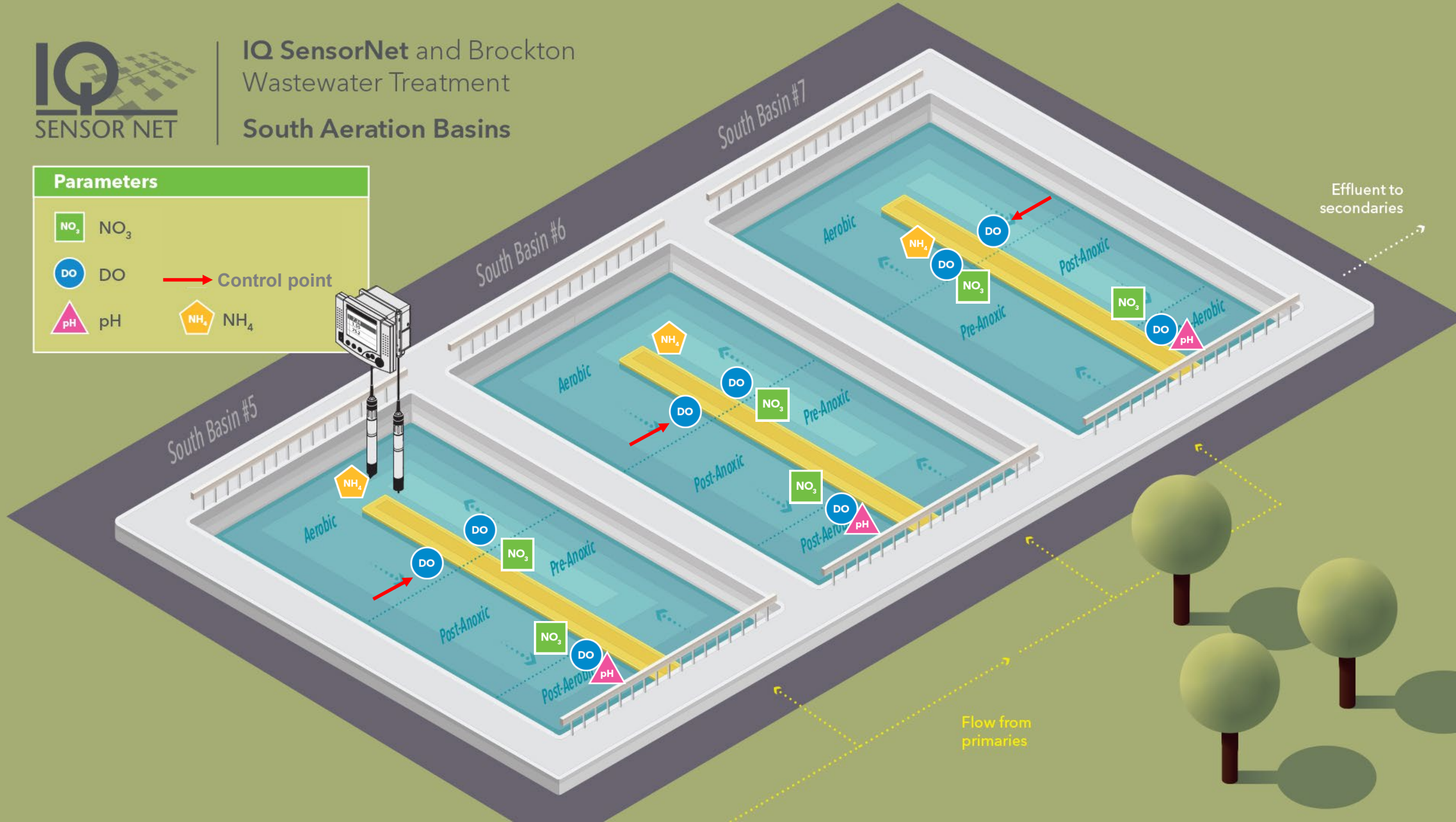
- Installation of new aeration equipment and online sensors
- North trains continued by the South

2021

Trials on Sensor Placement

- Evaluated ISE sensor placement in aerobic zone over 7-months to determine ideal location for process control


IQ SensorNet and Brockton Wastewater Treatment
North Aeration Basins
Parameters
NO3
DO
pH
NH4
Control point
Flow from primaries
North Basin #1
North Basin #2
North Basin #3
North Basin #4
Pre-Anoxic
Aerobic
Post-Anoxic
Post-Aerobic
Ammonia ISE should be in environment > 1ppm
Effluent to secondaries

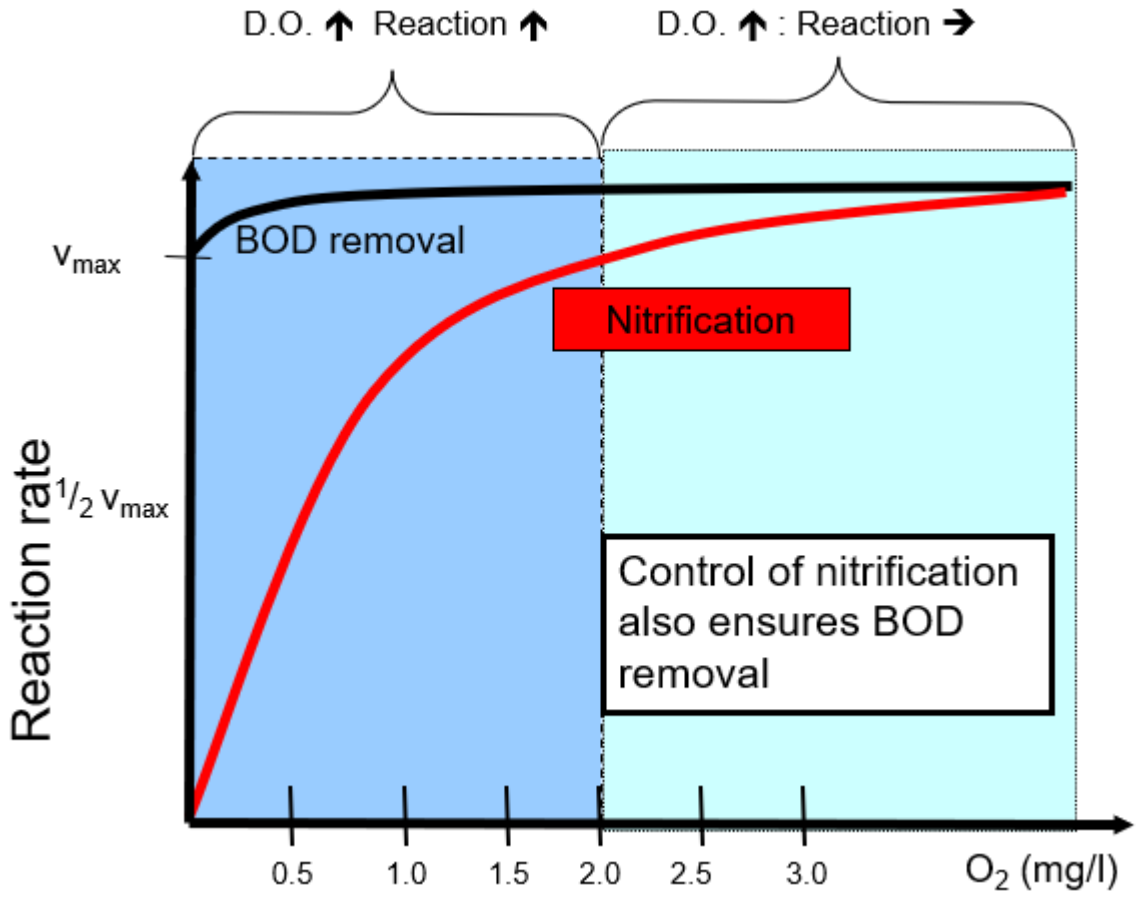

IQ SensorNet and Brockton Wastewater Treatment
South Aeration Basins
Parameters
NO3
DO
pH
NH4
Control point
South Basin #5
South Basin #6
South Basin #7
Aerobic
Pre-Anoxic
Post-Anoxic
Post-Aerobic
Effluent to secondaries
Flow from primaries

Why Ammonia-Based Aeration Control?

Aeration is the most energy-intensive process of wastewater treatment

- Most plants employ D.O. control with a setpoint of 2 mg/L

- Benefits compared to D.O. Control:
  - ✓ Energy Savings by reducing excess aeration
  - ✓ Maintains consistent nitrification
  - ✓ Ensures effluent limits are met
  - ✓ Improves total nitrogen nutrient removal



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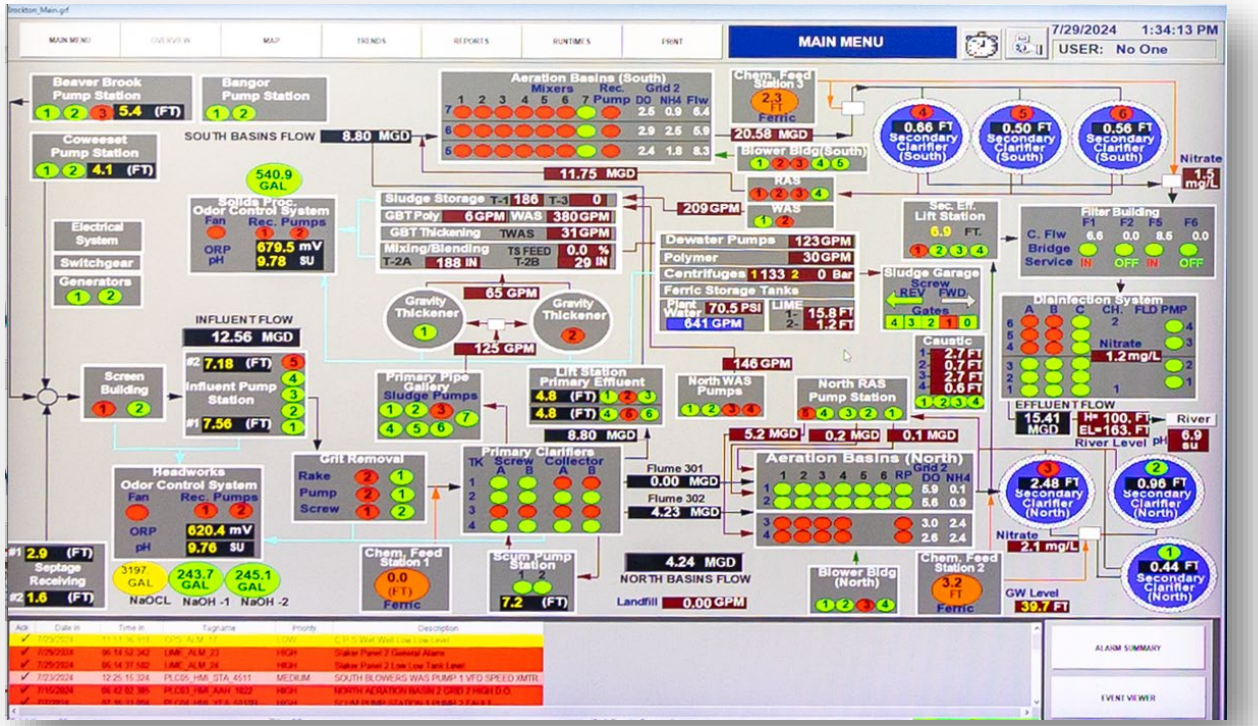
SCADA Data Analysis – Energy Efficiency Consumption

MEASURE

June 2024 Considerations:

- North Aeration Basin 1offline
- Primary clarifier 3 out of service
- SCADA drop-outs
  - 6/2 - 6/4
  - 6/7 – 6/10



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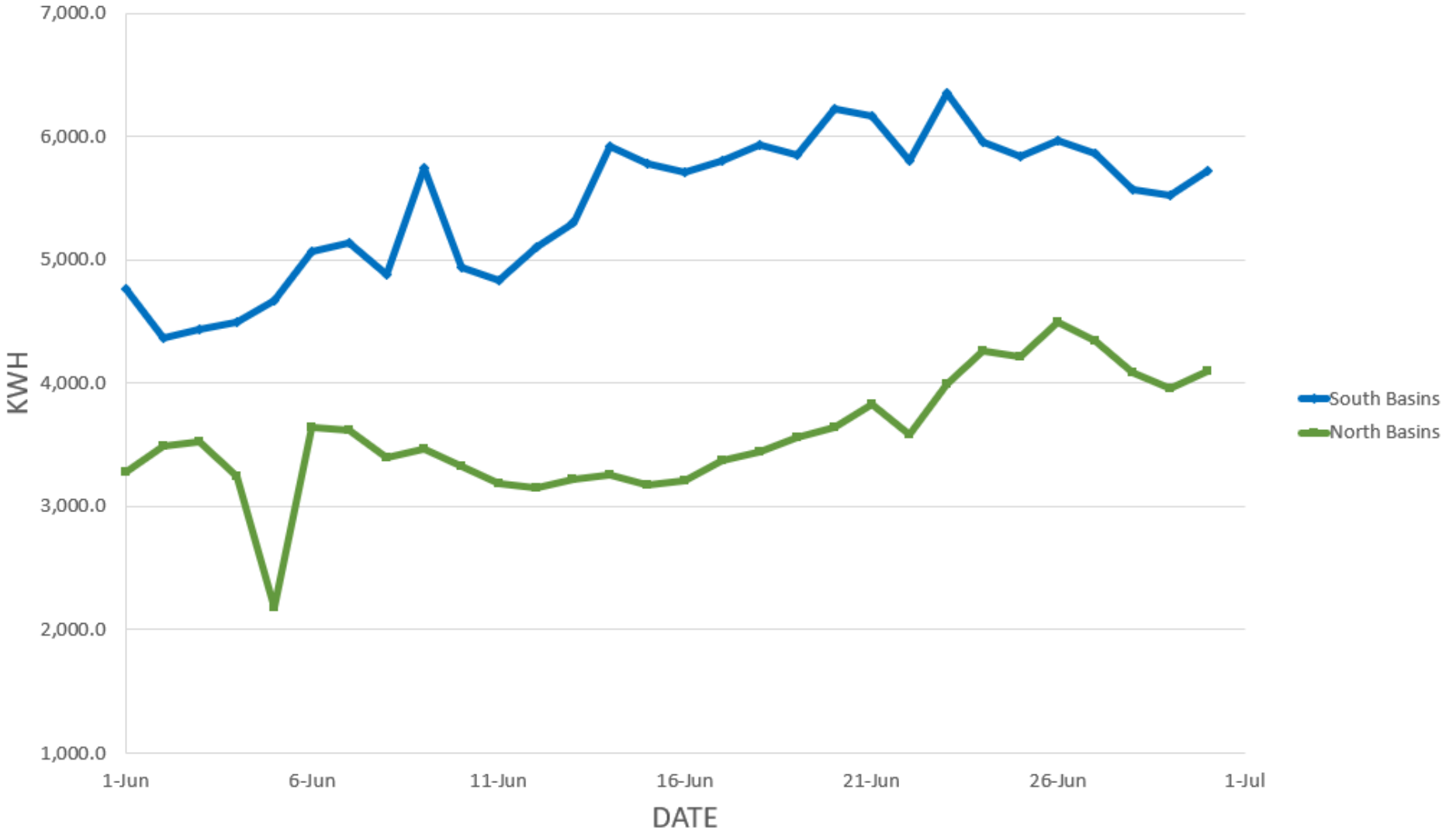
Brockton Blower kWh – Raw Data

North blowers consumed

35%

less total kWh over the month of June



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Normalized Blower Data – Energy Efficiency per MGD

MEASURE

North basins consumed

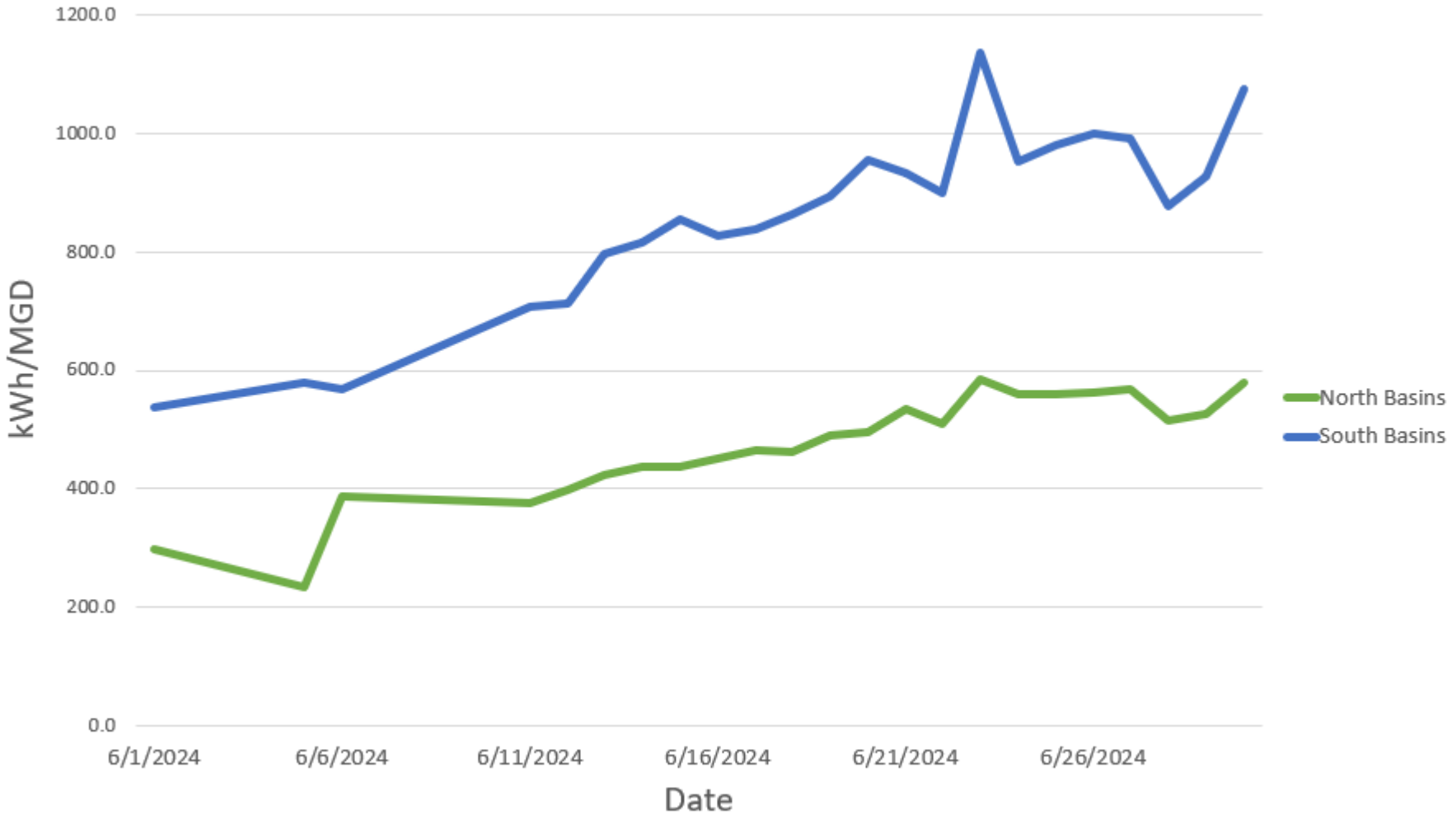
45%

less total kWh per MGD over the month of June 2024

Were

1.8x

more efficient



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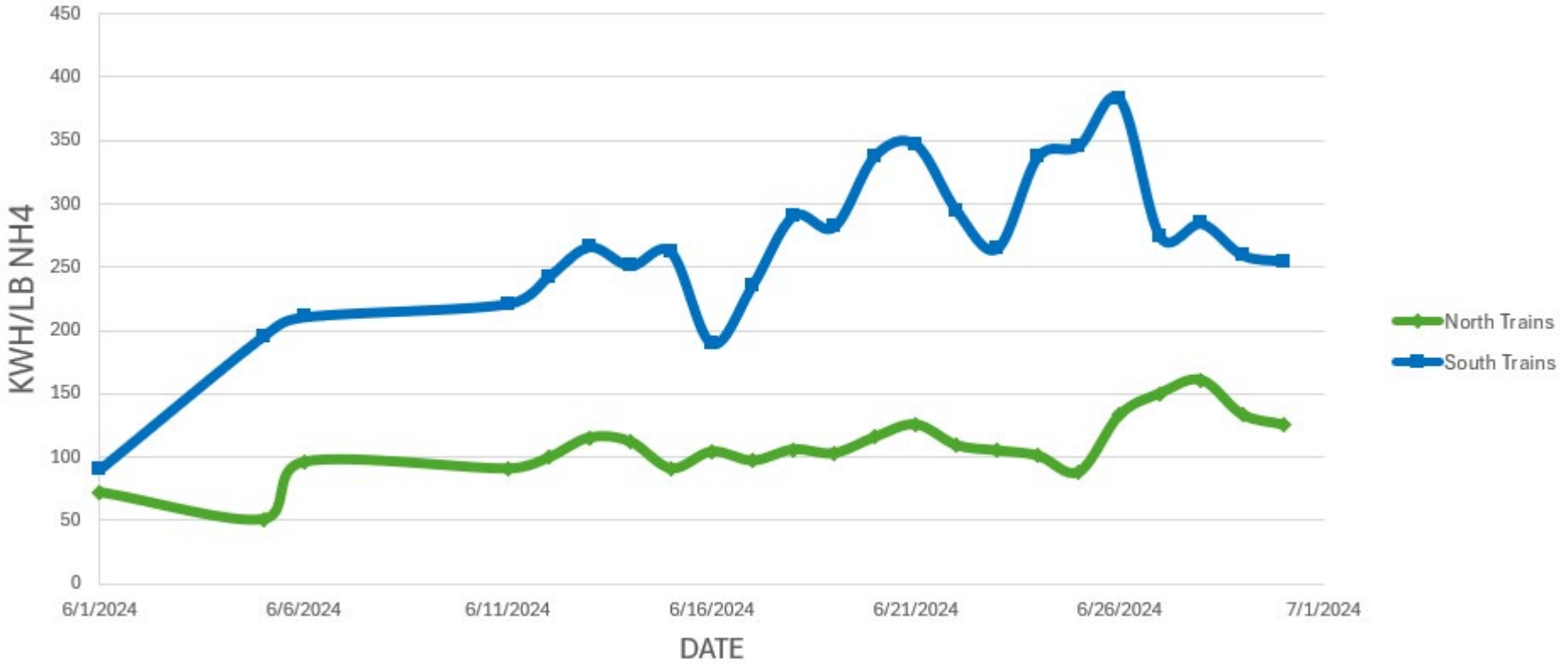
Energy per Ammonia Load Comparison

MEASURE

North blowers consumed

60%

less kWh per lb of NH4 treated



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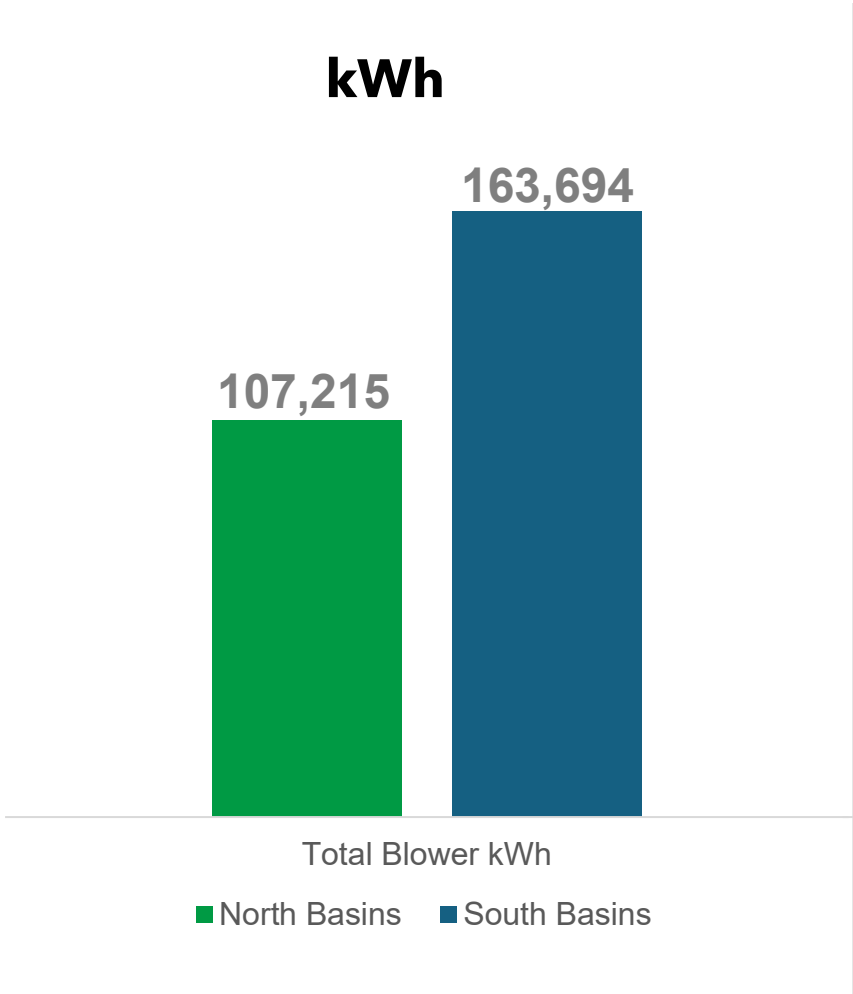
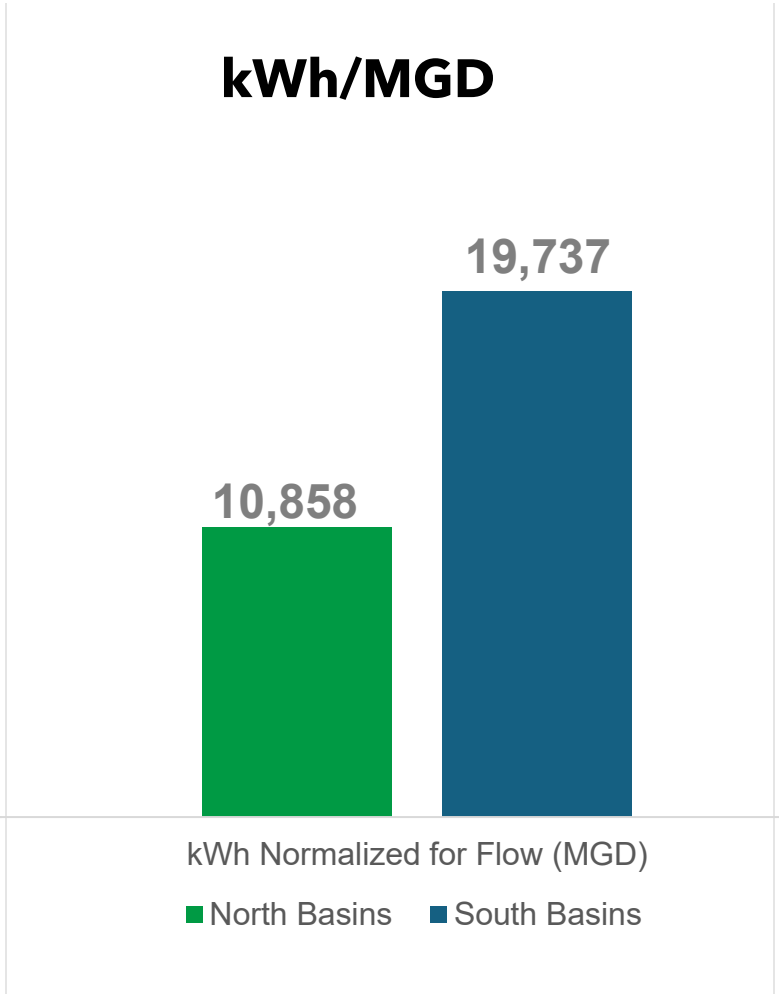
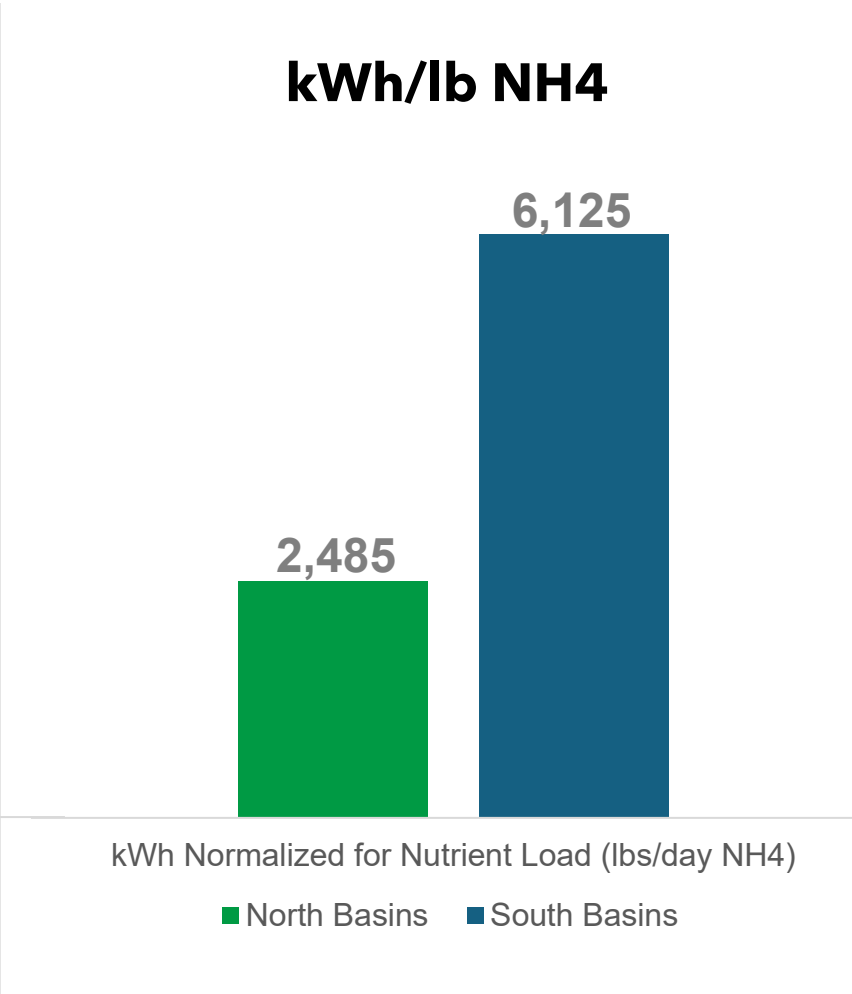
Blower Energy Comparison

Totals for North vs South Aeration Trains

MEASURE







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Effluent Quality – June 2024

Parameter	Average Concentration (mg/L)
NO3	1.02
NH3	0.08
TN	2.82

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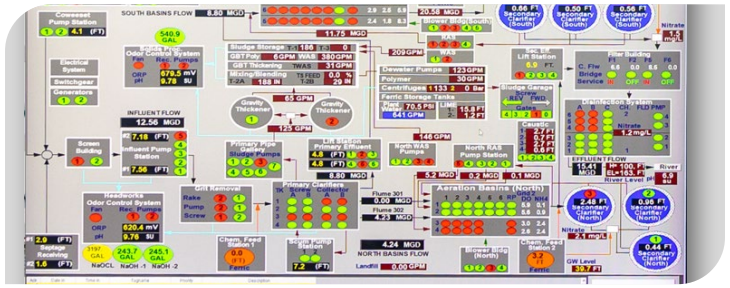
Key Takeaways from Brockton AWRF

Reliable Compliance

- Reduced energy consumption with improved nitrogen removal performance

Proven Maintenance Strategies

- Effective sensor maintenance practices by John Downey ensure accurate, reliable data



Data-Driven Decisions

- Continuous data from 52 sensors across plant supports ongoing process optimization

Optimized Efficiency with Ammonia-Based Aeration Control

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Thank you!

Contact Info:

Brockton Application Note:

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Treat

Partner with Xylem for full lifecycle expertise, services & aftermarket support to treat water for residential, municipal, industrial, & commercial applications.

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TREAT

Let It Flow: An Update on Water Funding in the Bipartisan Infrastructure Law

Radhika Fox

October 7, 2024

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Thank you

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Optimize

Partner with Xylem for digital expertise, services & support to optimize water operations & infrastructure.

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Let's Solve Water

Pump Station Evolution

Boost Efficiency with Data-Driven Management

Challenges of today require a modern approach

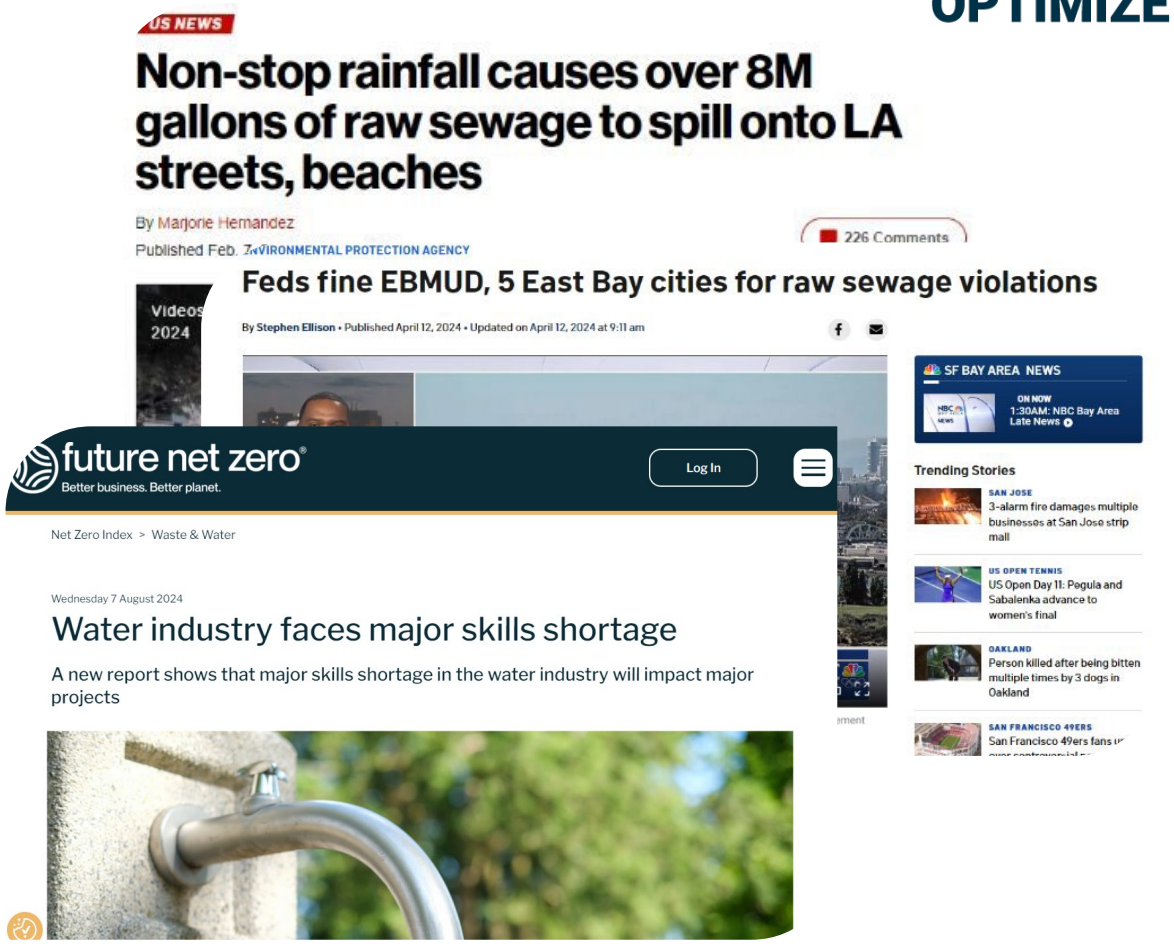
OPTIMIZE

Infrastructure under stress

- Population growth across many utility areas
- Changing weather patterns and severity
- Urban creep and hardened surfaces
- Underfunded infrastructure
- More stringent regulation
- Keeping IT-Infrastructure secure

Workforce challenges

- Average age of utility workers in the US is over 50, which is higher than the national average
- Staffing levels are not increasing as quickly as challenges faced
- Many utilities are operate using outdated practices



Challenges can be tackled by working smarter; digital solutions are a fundamental to achieving this

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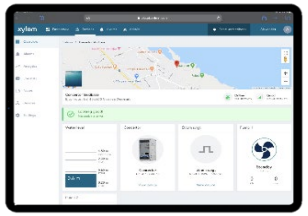
Overview of digital system

Digital system stack

Enterprise management
Xylem Vue powered by GoAigua



Pump station systems
Xylem Avensor

Station Control
MultiSmart Powered by Nexicon®

Machines
Flygt Concertor®

OPTIMIZE

Optimization at each level
System optimization and resilience at each level. Each part deliver rich data for the next level

Supplier agnostic
Use one or all parts in the system stack. Each system can easily be integrated

Pre-Integrated
Pre-integration and system responsibility when using multiple parts of the stack

Design Principles

xylem

Machines – Flygt Concertor

OPTIMIZE

The World's First Pump with Fully Integrated Intelligence

- Clog-free pumping with no emergency call outs
- Energy consumption reduced by 70%
- No extra investment in enlarged cabinet
- Possibility to reduce inventory
- Clean sumps and reduced cleaning and servicing costs

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Station Control - MultiSmart Powered by Nexicon®

OPTIMIZE

Pre-programmed modular controller developed by wastewater experts

- Modular & flexible design fitting todays needs while being expandable for the future
- Ease of use delivered through pre-programmed application expertise
- Efficiency features such as Energy Minimizer to support your sustainability goals
- Prepared for current and future cybersecurity regulations

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Pump station systems – Xylem Avensor

OPTIMIZE

Unique simplicity in achieving data and insights for water assets

- Powerful Insights out of the box with anomaly detection for common issues in wastewater pumping
- Easy and quick to set up and use with low integration costs
- Connects to Xylem and non-Xylem equipment
- Alarms and alarm management
- Systems monitored 24/7 for peace of mind
- Robust cybersecurity protection and compliance

xylem

Pump station systems – Avensor Remote Inspection

OPTIMIZE

Remote Visual Inspections to free up time

Dome cameras

Power Meter

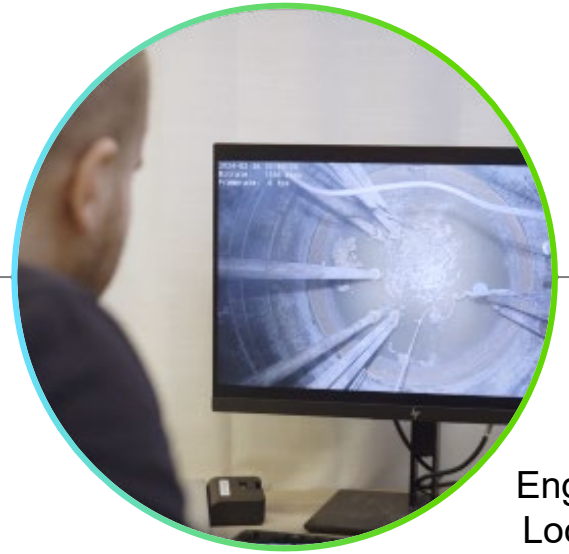
Hardware kit installed at pump stations

Level sensors

Modem

Engineer receives alerts and station insights

Travel to sites only when necessary



Engineer can inspect remotely. Look and listen for anomalies.

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Xylem Vue powered by GoAigua Architecture

Platform & Data Integration

Operation Intelligence

SERVICE OPERATIONS CENTER | BI CONNECTORS | DASHBOARDS & REPORTING

Modular Applications

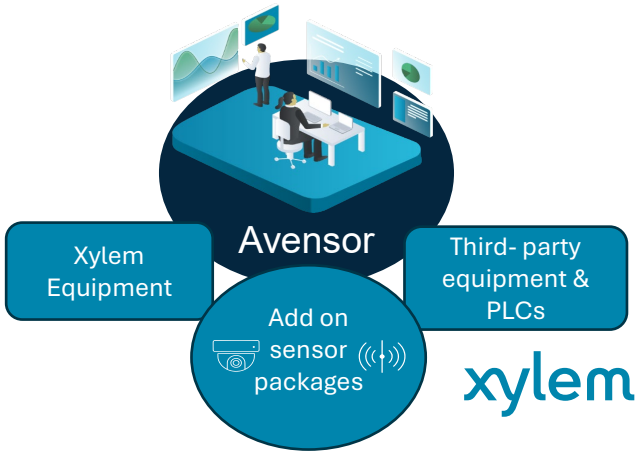
- UNIFIED NETWORK MANAGEMENT
- LEAK DETECTION
- BIOLOGICAL MONITORING
- SSO) / CSO PREDICTION & PREVENTION
- METER DATA ANALYTICS
- CLOG MONITORING
- UNIFIED PLANT MANAGEMENT
- REAL-TIME WHAT-IF SCENARIOS
- PLANT REAL-TIME DECISION SUPPORT

Unified Smart Water Engine

TIMESERIES STORE | ASSET INFORMATION

AMI/AMR | SENSORS | SCADA, PLCs & IoT Sensors | Distributed DBs | GIS, CMMS

Over 120 protocols/systems supported



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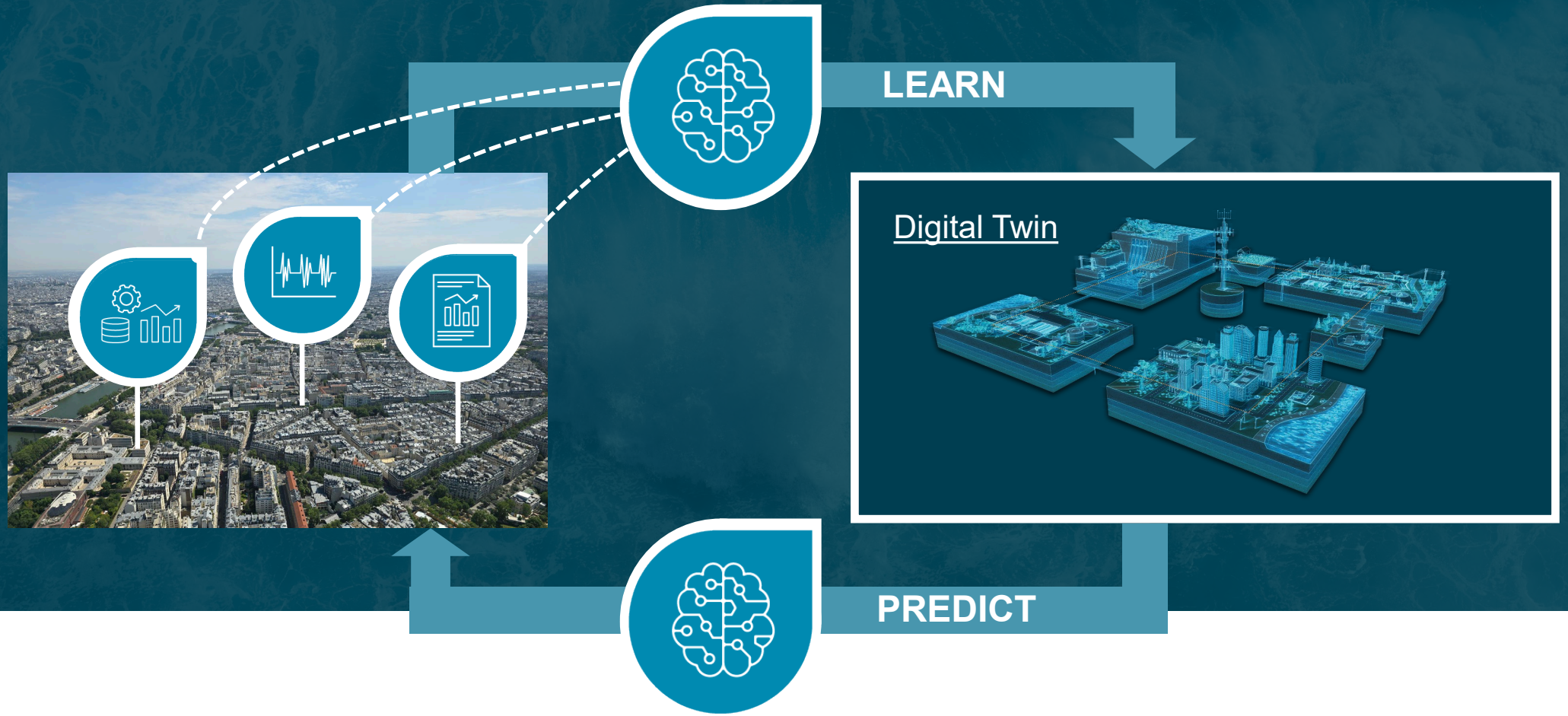
Sewer Digital Twin

OPTIMIZE

« A digital twin is a virtual representation of a physical asset, process or system that then can be leveraged to predict performance under changing conditions and inform recommendations. »



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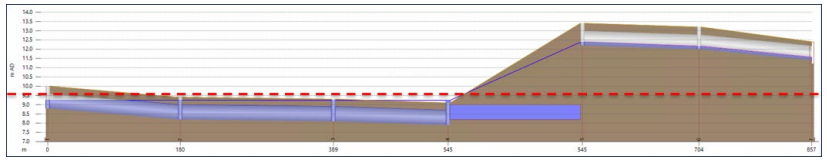
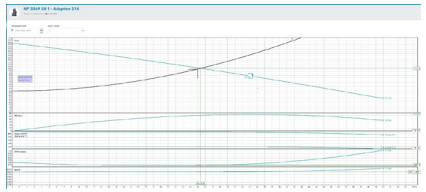
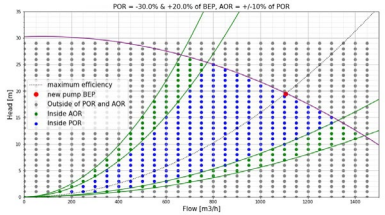
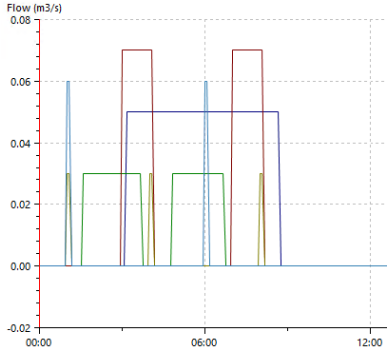
Optimising dry weather flows to works

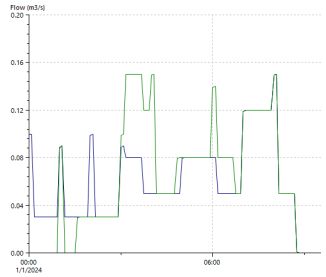
OPTIMIZE

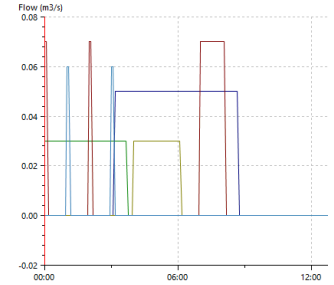












Offline assessment

- Consider pump station curves
- Use hydraulics to determine min/max levels
- Agree on max parameters

Develop optimization

- Consider pump and station combinations and impact
- Assess typical volumes per day
- Devise likely pump station combinations

Deploy optimizer to platform

- Ensure data presence
- Link optimiser to sources
- Outputs recommendations

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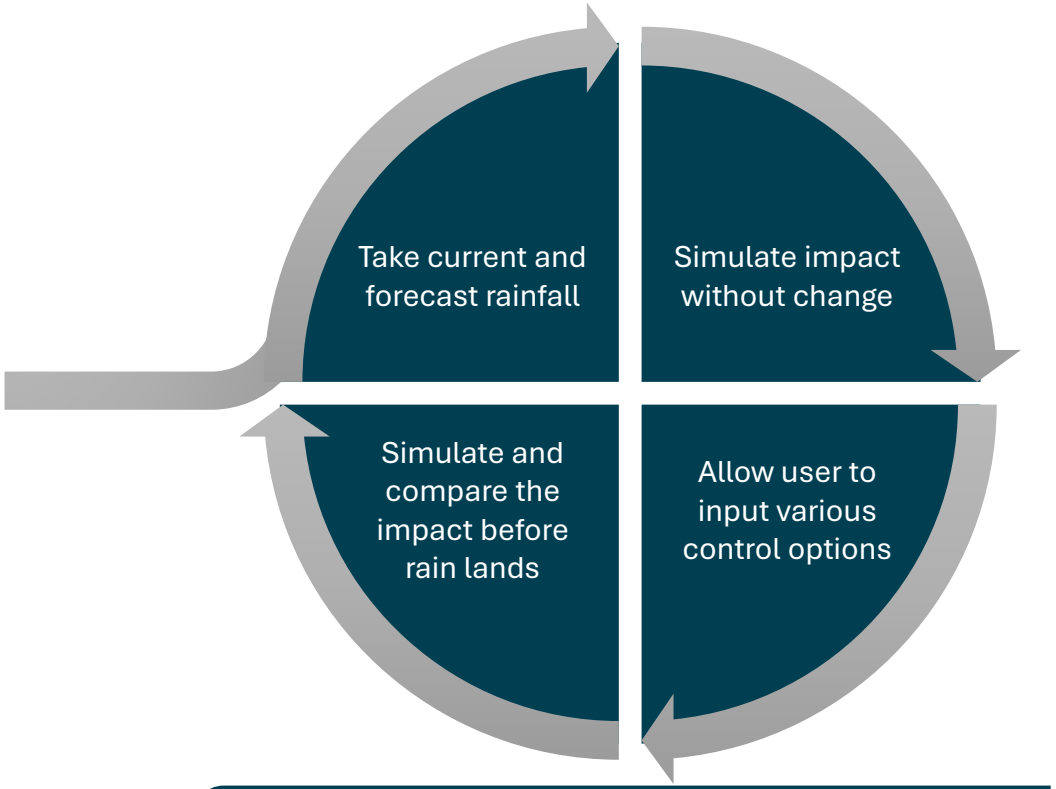
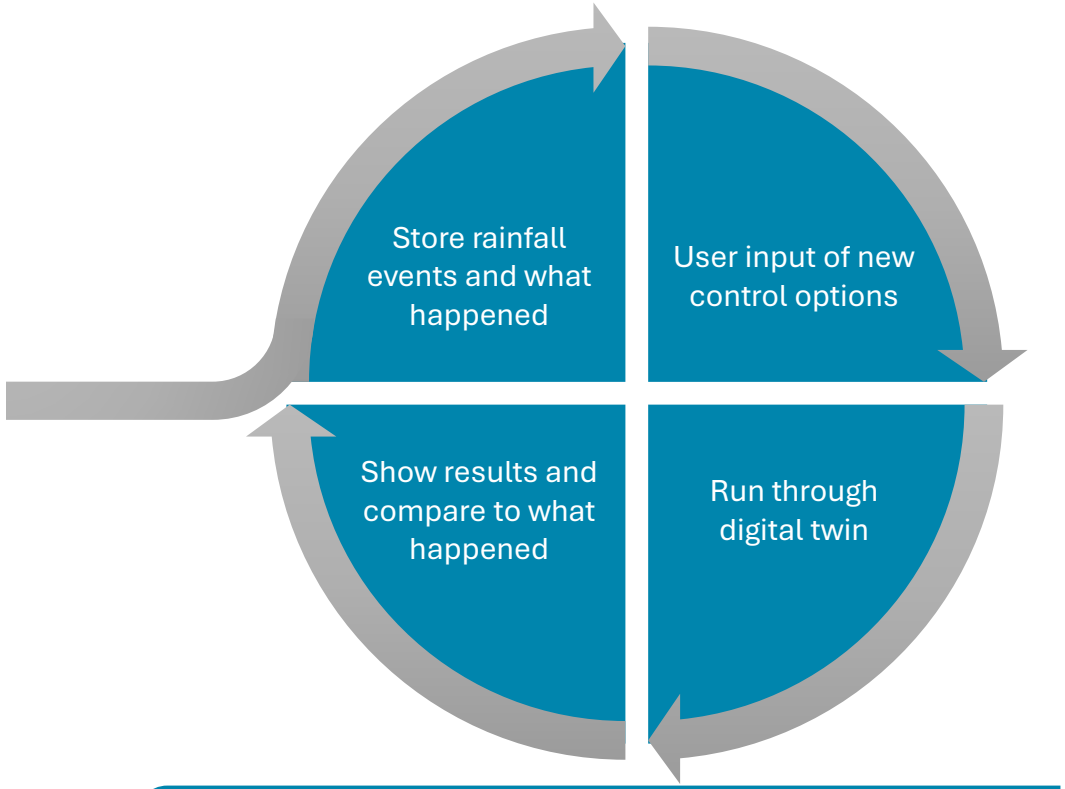
Capture and build knowledge

OPTIMIZE



Decision support

Supporting staff with evidence for emergency response situations decisions.



Operator training

Build familiarity and understanding without risking any real impact.

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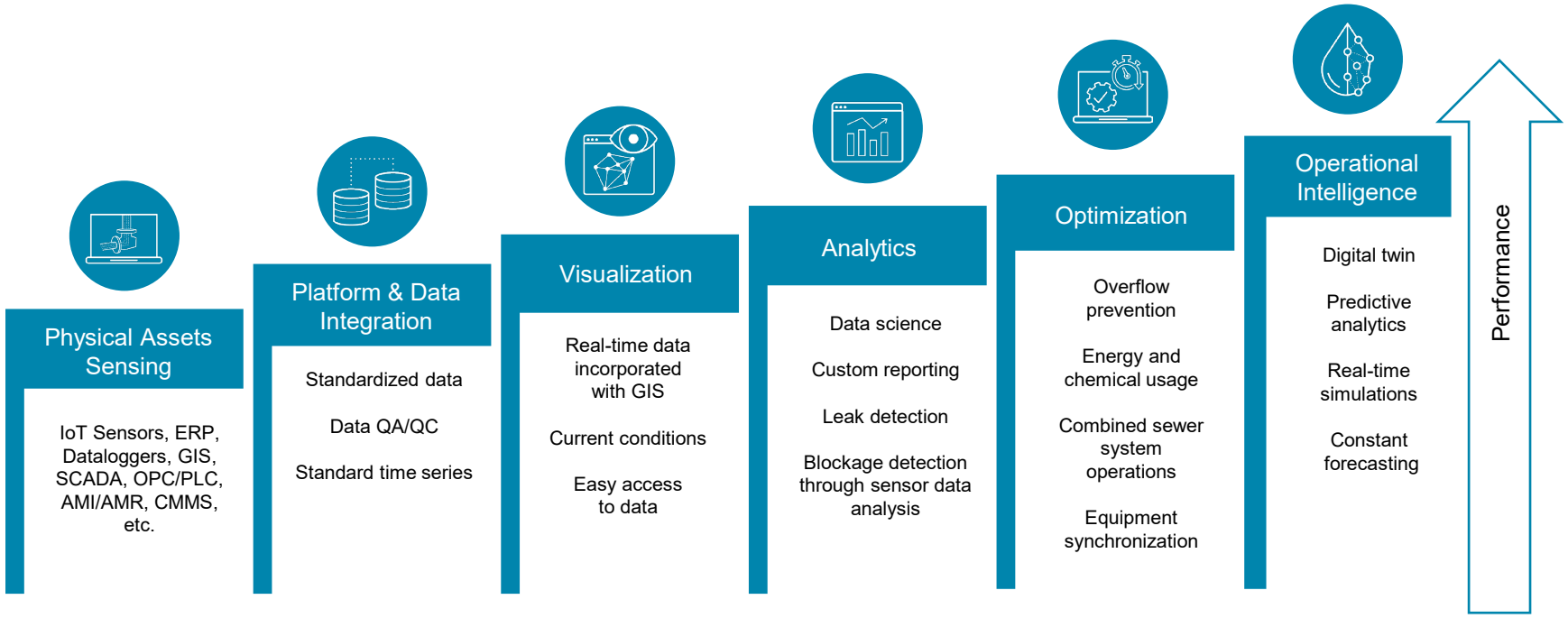
Conclusions

OPTIMIZE

Start where you are – get value at every step



Capture knowledge – before it is lost

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Thank You

Cybersecurity – MultiSmart Powered by Nexicon®

OPTIMIZE

“Secure by Design” pledge

- Robust cybersecurity measures throughout its development lifecycle
- Secure from inception to deployment and beyond
- Pledge driven by CISA and co-signed by all major security government agencies in the US and Canada

IEC 62443-4-1 certification

The Xylem office responsible for developing the product is certified under IEC 62443-4-1, a standard specializing in industrial automation and control systems security.

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Cybersecurity – Xylem Avensor

OPTIMIZE

- All data is stored in AWS (which is certified with ISO 27001)
- Secure Provisioning
- Role-based access
- 24/7 monitoring
- Regular backups are stored to restore the system in case of accidental loss.
- Data at rest is encrypted
- Continuously monitoring new software

IEC 62443-4-1 certification

The Xylem office responsible for developing the product is certified under IEC 62443-4-1, a standard specializing in industrial automation and control systems security.

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Treat

Partner with Xylem for full lifecycle expertise, services & aftermarket support to treat water for residential, municipal, industrial, & commercial applications.

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TREAT

Nutrient Removal Options

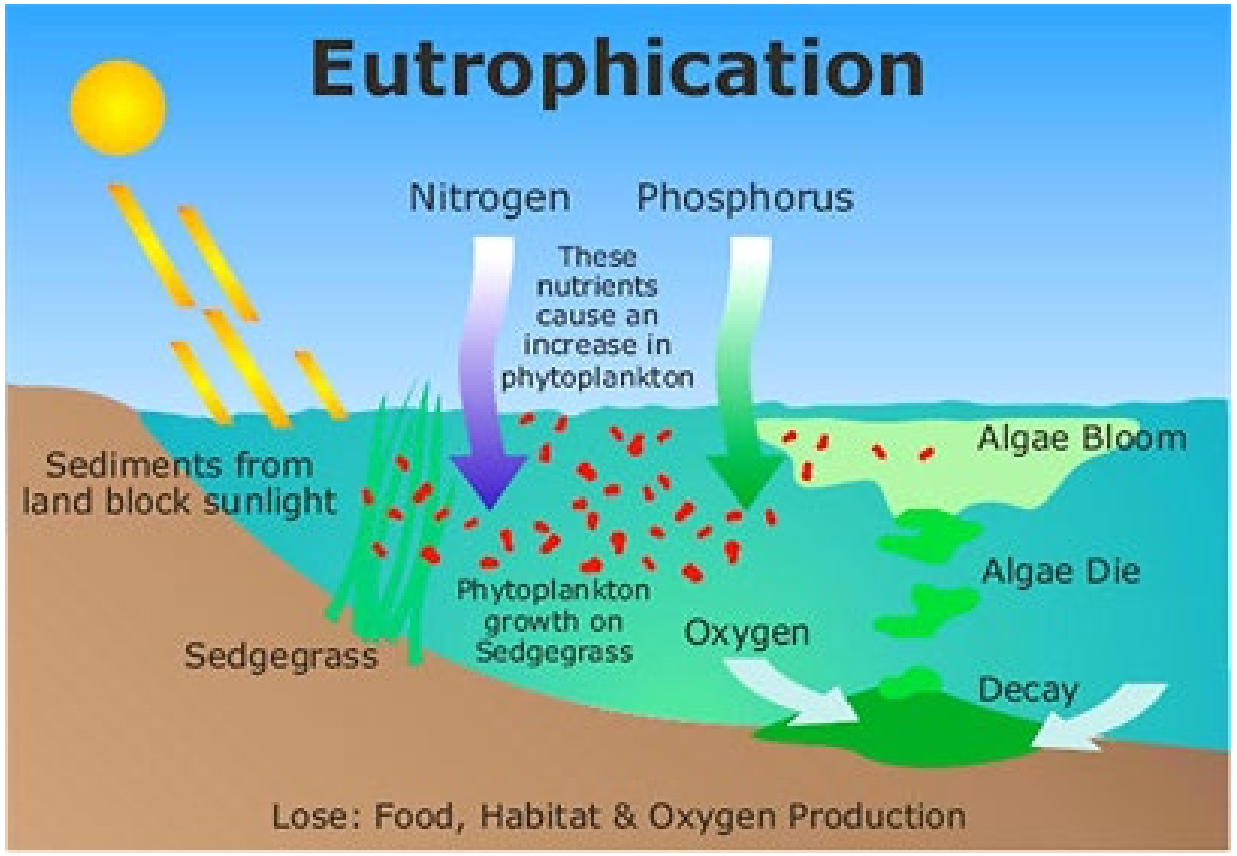
Expanded Xylem Expertise

October 8, 20024

The Problem: *Eutrophication*

Increased nutrients (phosphorus and nitrogen) lead to algae blooms

These algae blooms lead to reduced oxygen in the water, creating dead zones



Increased nutrients in waterways decreases biological health, biodiversity of marine life, and access to clean water for drinking and swimming

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Our agenda

Nutrient removal expertise for all permit requirements

TREAT

1

Total Nitrogen Removal Options
- Casperon
- Omniflo
- ICEAS
- Orbal / VLR / Verticel
- Bioloop
- Elimi-NITE

2

Phosphorus Removal Options
- Casperon
- Omniflo
- ICEAS
- Orbal / VLR / Verticel
- Bioloop
- Disc Filter
- CoMag
- Vorelodos

Wisconsin River

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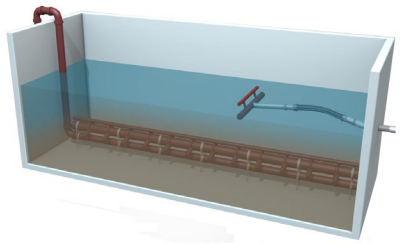
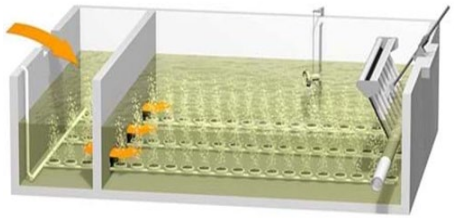
Nitrogen Removal Options

Omniflo® SBR



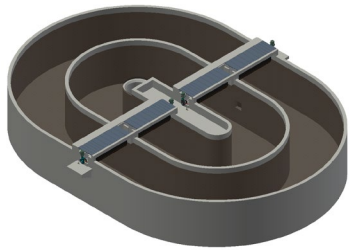
True-Batch Sequence Batch Reactor provides excellent treatment and low maintenance jet aeration

ICEAS® SBR



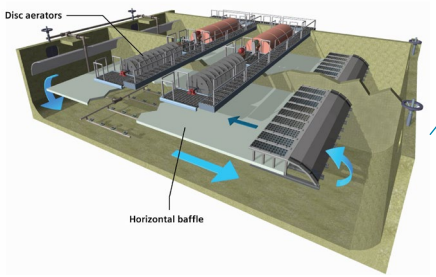
Continuous-Fill Sequencing Batch Reactor provides simplicity and high efficiency diffused aeration

Orbal®



SND process provides high efficiency and easy operation

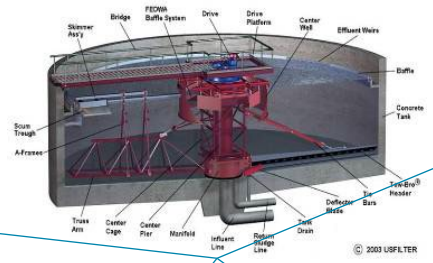
VLR® & Verticel®



SND process in a compact form factor

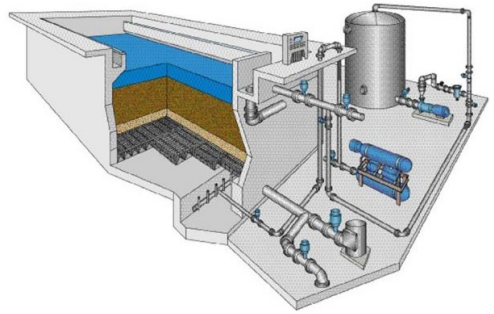
Towbro ®

High performance clarifier

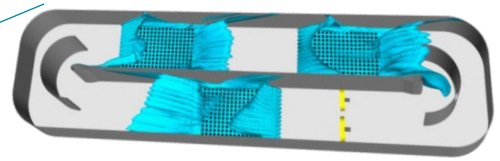


elimi·Nite®

High performance Denite Filter

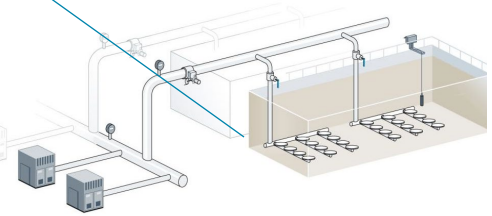


Bioloop™



Oxidation ditch with high efficiency Sanitaire diffusers and high efficiency mixing

Casperon™



Conventional Activated Sludge treatment with high efficiency Sanitaire diffusers

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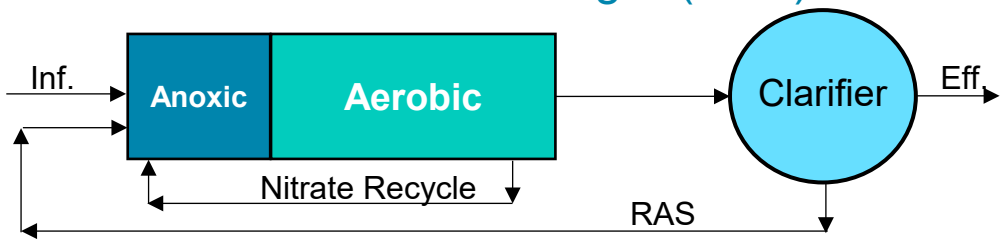
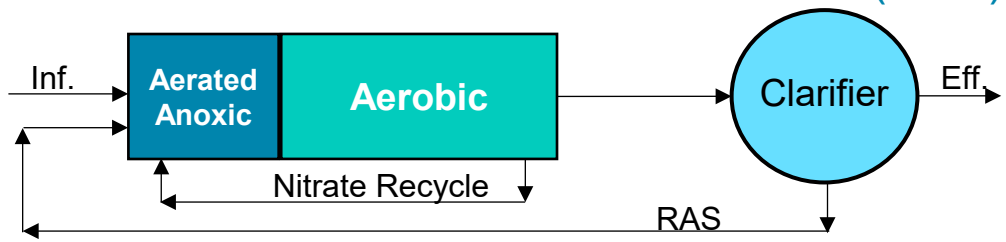
Nitrogen Removal Options

Xylem's Casperon® conventional activated sludge control system

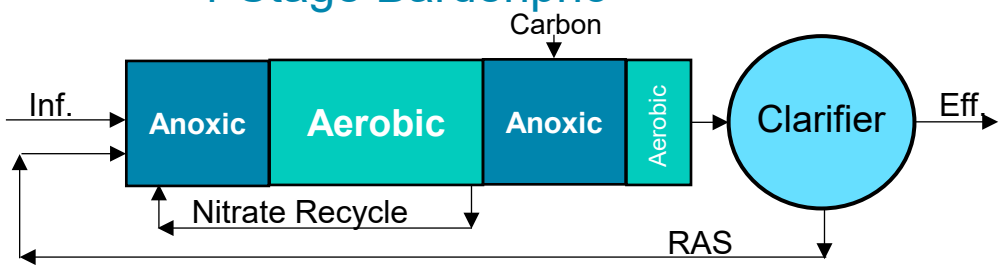
Modified Ludzack-Ettinger (MLE)



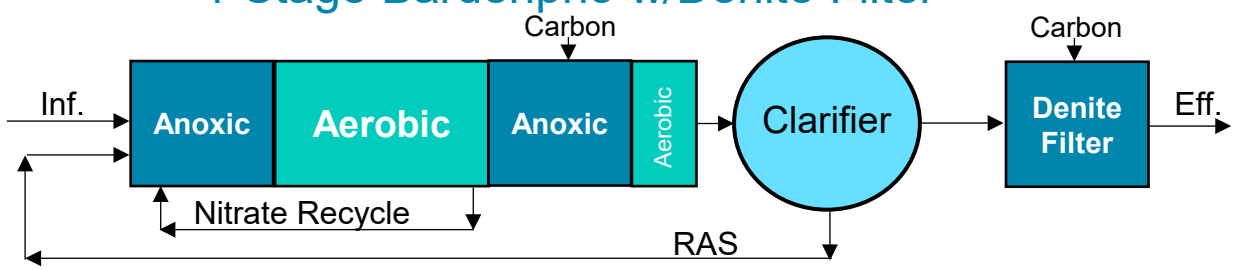
Simultaneous Nitrification/Denitrification (SND)



4-Stage Bardenpho



4-Stage Bardenpho w/Denite Filter



Ability to meet TN limits from 10 mg/l down to 3 mg/l

FLYGT a xylem brand · YSI a xylem brand · SANITAIRE a xylem brand · LEOPOLD a xylem brand

xylem

Nitrogen Removal Options

Fond Du Lac, WI – CASPERON with VEMA Controller with SNDN Process

Project Overview

- 9.8 MGD Average Daily FLow
- 15 MGD Max Month Flow
- 50 MGD Peak Hour Flow

- 3 parallel trains, each with anaerobic zone and 3 aeration passes in series;
- Up to 3 of 9 aeration grids will pulse at the any time

- Utilizes Simultaneous Nitrification and Denitrification (SNDN) with VEMA Controller to reduce nitrate concentrations, allowing better enhanced biological Phosphorus removal

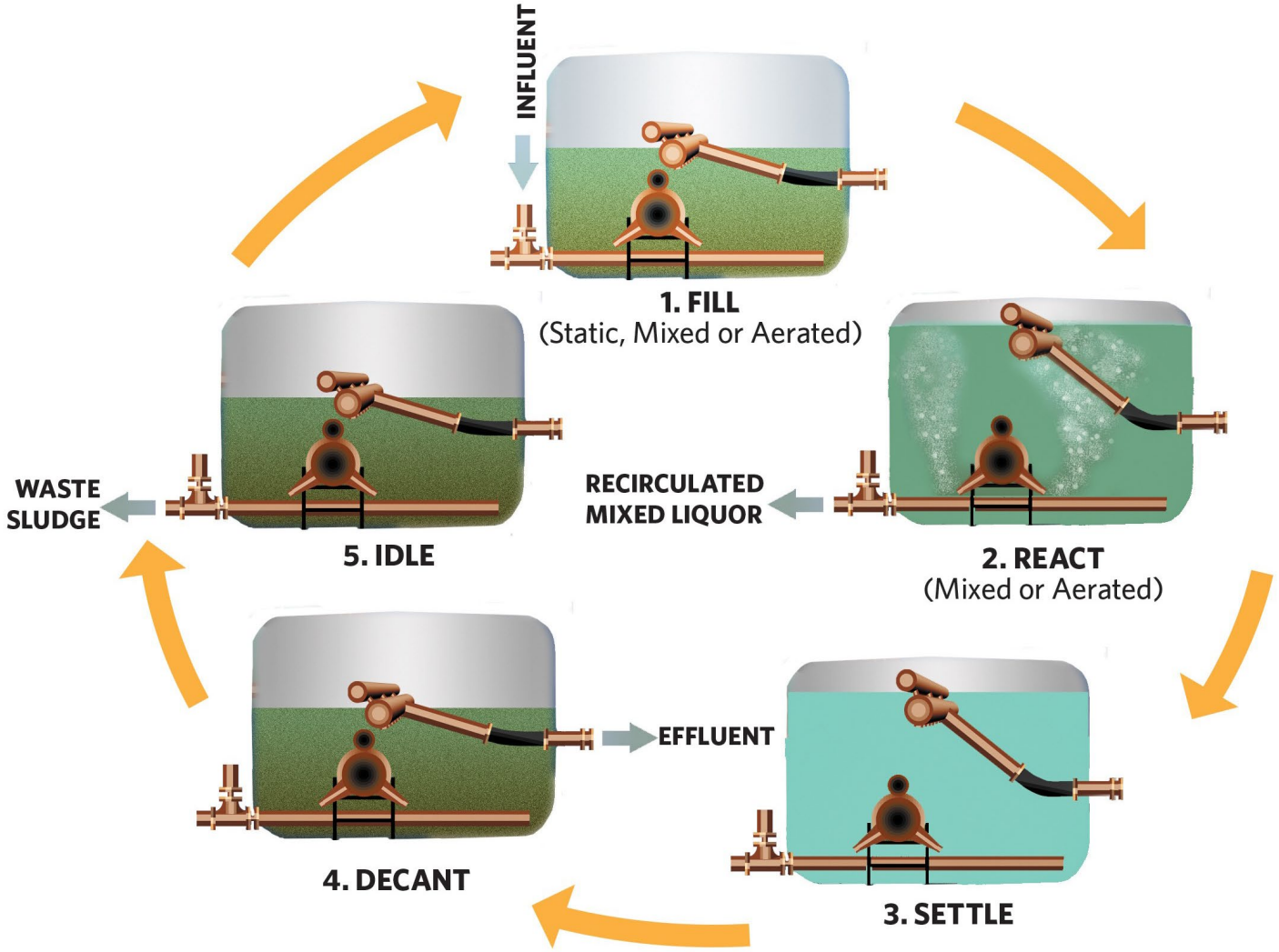
- Startup in 2018

xylem

Nitrogen Removal Options

Omniflo® True Batch SBR

The flexibility of an SBR produces high quality effluent at widely varying flows and loadings.



Jet Tech an EVOQUA technology

FLYGT a xylem brand

YSI a xylem brand

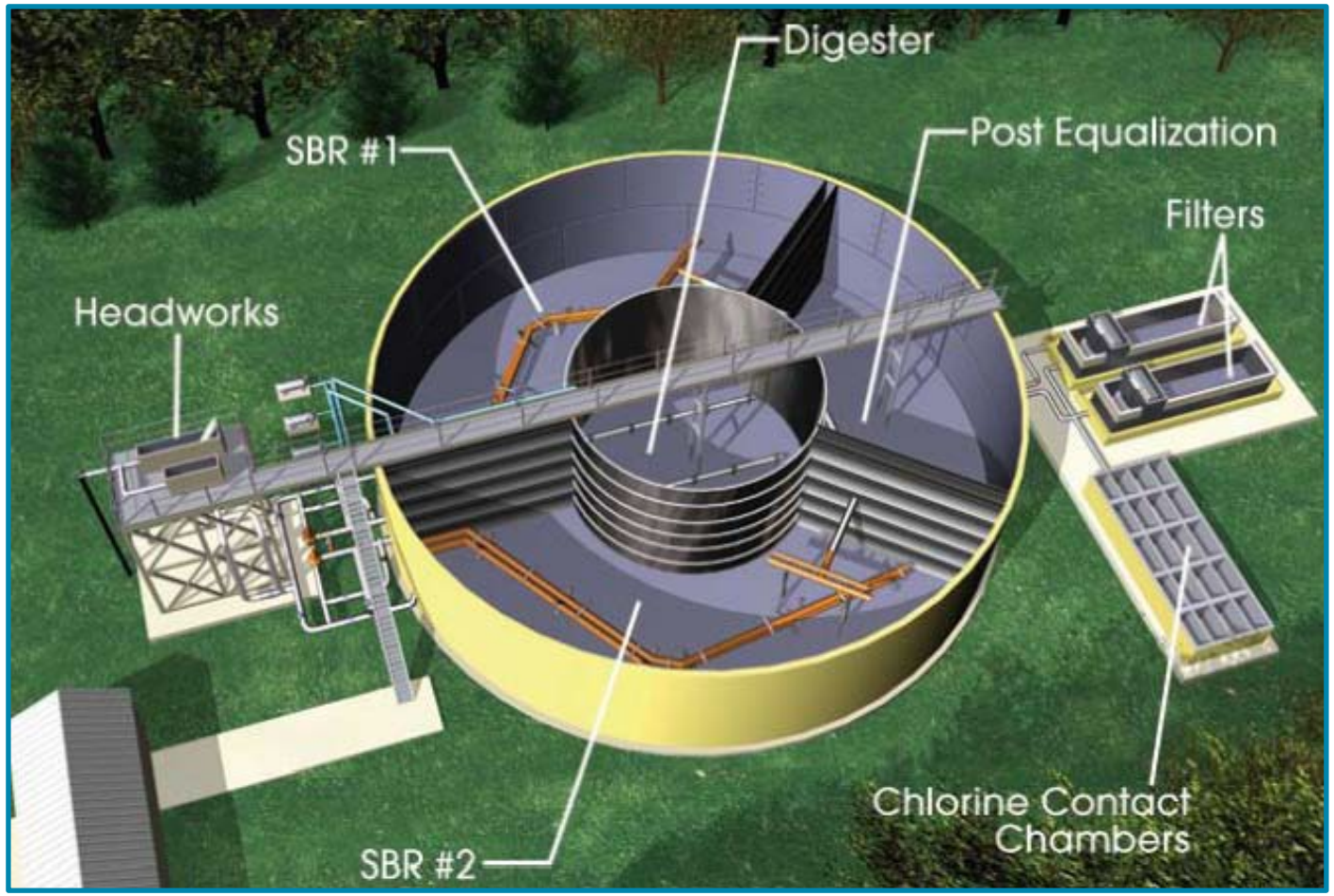
LEOPOLD a xylem brand

xylem

Nitrogen Removal Options

Omniflo® SBR in a Field-Erected Steel Tank = Omnipac® SBR

1. **Small Footprint**
2. **Treatment Flexibility**
3. **Tank Configuration Flexibility**
4. **Economical**
5. **Turnaround Time**

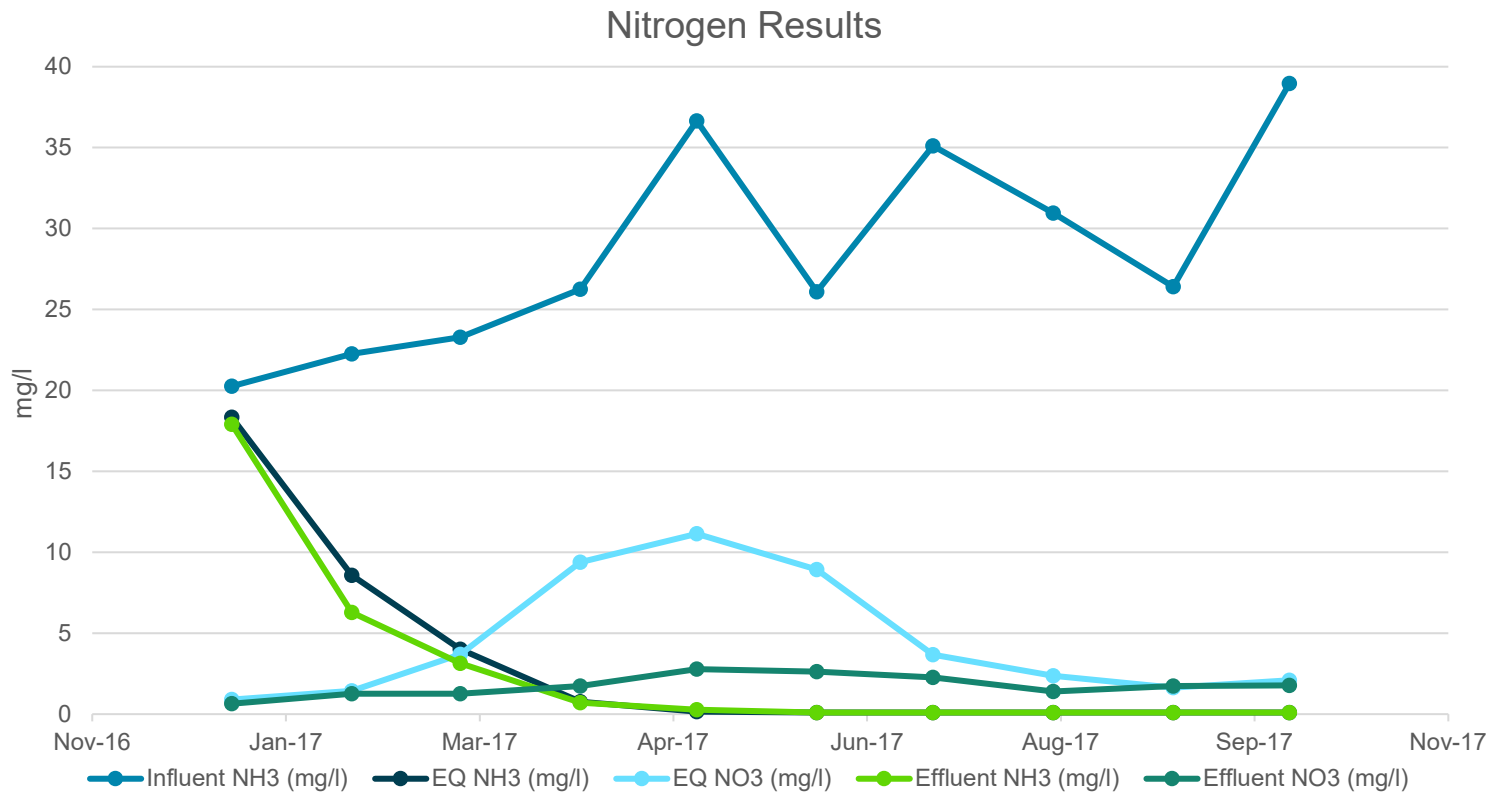


xylem

Nitrogen Removal Options

Omniflo® SBR - Greensboro, MD

Concrete Circular tank with Jet aeration system and Denite filter



Startup in Winter with 0.15 MGD avg flow

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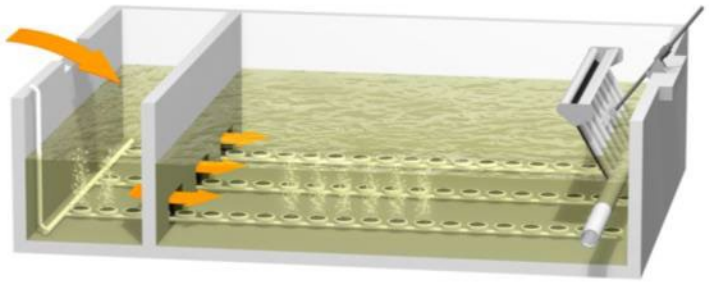
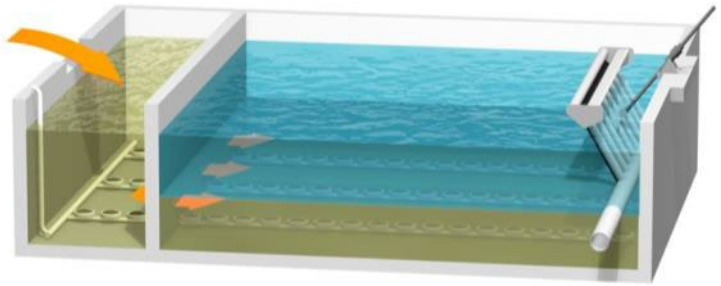
Nitrogen Removal Options

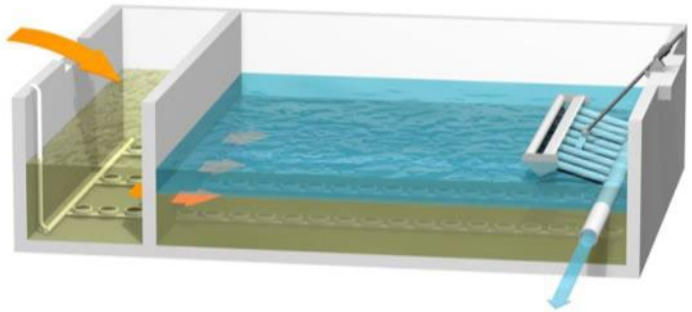
ICEAS® SBR



1. React



2. Settle



3. Decant

Treated Effluent

Continuous Fill

FLYGT a xylem brand YSI a xylem brand SANITAIRE a xylem brand LEOPOLD a xylem brand

xylem

Nitrogen Removal Options

ICEAS NIT & NDN Control features and Operating Modes

Nitrification (NIT)

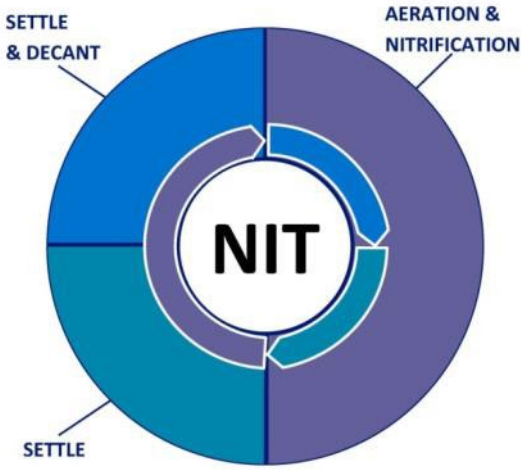
- BOD & TSS Removal
- Nitrification
- Partial Denitrification

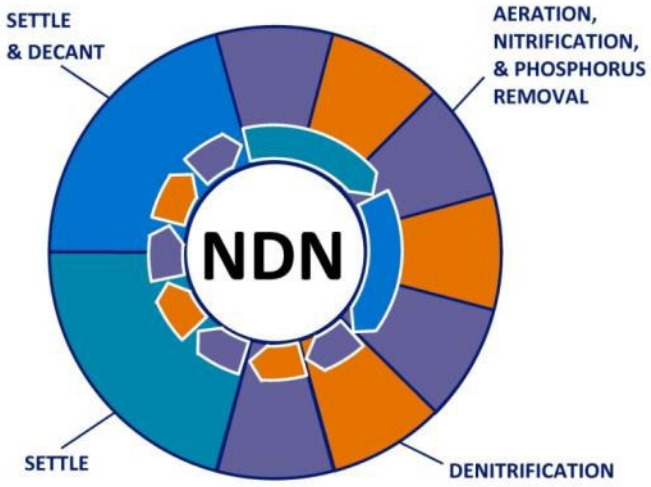
Nitrification, Denitrification (NDN) and Phosphorus Removal (NDNP)

- Complete nutrient removal
- Nitrogen
- Phosphorus

High flow variation

- Variable cycle times





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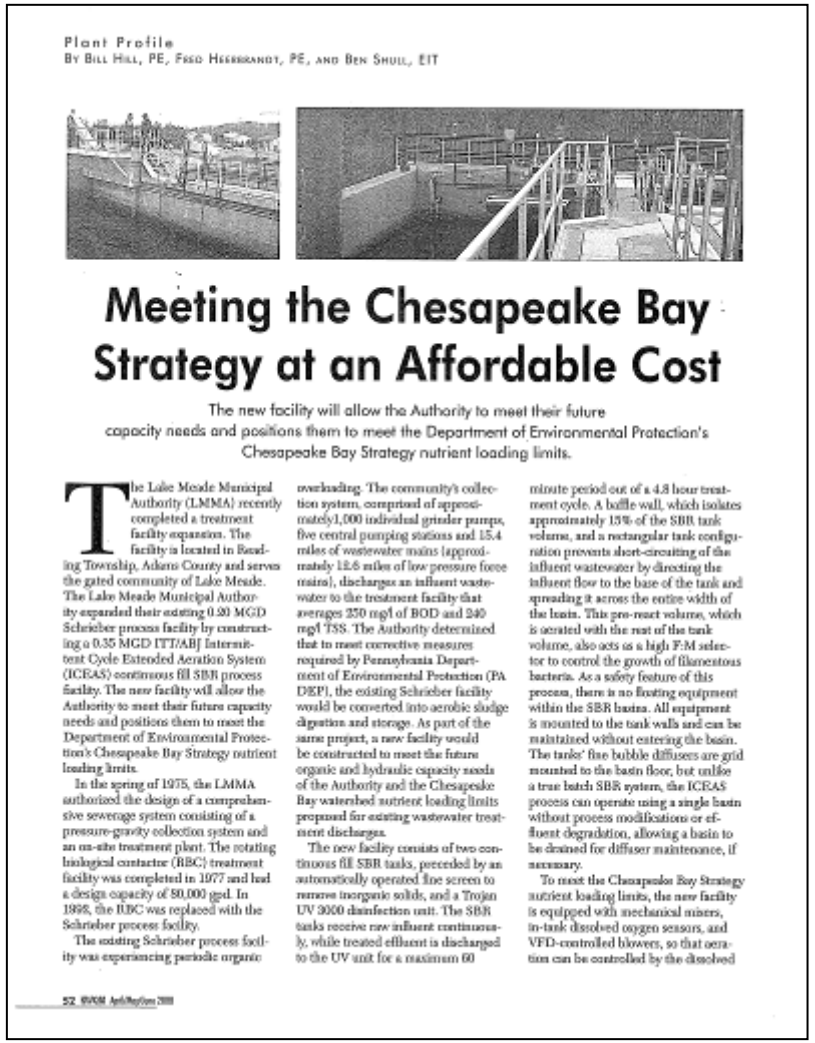
Nitrogen Removal Options

ICEAS installed in Lake Meade Municipal Authority WWTP, PA

- Stringent Chesapeake Bay nutrient removal requirements
- Effluent results from 14 day process performance test:
  - CBOD – <2mg/L
  - TSS – 7 mg/L
  - NH3-N – 0.38 mg/L
  - Total N – 3.1 mg/L
  - Total P – 0.7 mg/L



Plant Profile

By Bill Hill, PE, Fred Heerbrandt, PE, and Ben Shull, EIT

Meeting the Chesapeake Bay Strategy at an Affordable Cost

The new facility will allow the Authority to meet their future capacity needs and positions them to meet the Department of Environmental Protection's Chesapeake Bay Strategy nutrient loading limits.

The Lake Meade Municipal Authority (LMMA) recently completed a treatment facility expansion. The facility is located in Reading Township, Adams County and serves the gated community of Lake Meade. The Lake Meade Municipal Authority expanded their existing 0.80 MGD Schreiber process facility by constructing a 0.35 MGD ITT/ABJ Intermittent Cycle Extended Aeration System (ICEAS) continuous fill SBR process facility. The new facility will allow the Authority to meet their future capacity needs and positions them to meet the Department of Environmental Protection's Chesapeake Bay Strategy nutrient loading limits.

In the spring of 1975, the LMMA authorized the design of a comprehensive sewerage system consisting of a pressure-gravity collection system and an on-site treatment plant. The rotating biological contactor (RBC) treatment facility was completed in 1977 and had a design capacity of 80,000 gpd. In 1998, the RBC was replaced with the Schrieber process facility.

The existing Schrieber process facility was experiencing periodic organic overloading. The community's collection system, comprised of approximately1,000 individual grinder pumps, five central pumping stations and 15.4 miles of wastewater mains (approximately 12.6 miles of low pressure force mains), discharges an influent wastewater to the treatment facility that averages 250 mg/l of BOD and 240 mg/l TSS. The Authority determined that to meet corrective measures required by Pennsylvania Department of Environmental Protection (PA DEP), the existing Schrieber facility would be converted into aerobic sludge digestion and storage. As part of the same project, a new facility would be constructed to meet the future organic and hydraulic capacity needs of the Authority and the Chesapeake Bay watershed nutrient loading limits proposed for existing wastewater treatment discharges.

The new facility consists of two continuous fill SBR tanks, preceded by an automatically operated fine screen to remove inorganic solids, and a Trojan UV 3000 disinfection unit. The SBR tanks receive raw influent continuously, while treated effluent is discharged to the UV unit for a maximum 60 minute period out of a 4.8 hour treatment cycle. A baffle wall, which isolates approximately 15% of the SBR tank volume, and a rectangular tank configuration prevents short-circuiting of the influent wastewater by directing the influent flow to the base of the tank and spreading it across the entire width of the basin. This pre-react volume, which is aerated with the rest of the tank volume, also acts as a high F:M selector to control the growth of filamentous bacteria. As a safety feature of this process, there is no floating equipment within the SBR basins. All equipment is mounted to the tank walls and can be maintained without entering the basin. The tanks' fine bubble diffusers are grid mounted to the basin floor, but unlike a true batch SBR system, the ICEAS process can operate using a single basin without process modifications or effluent degradation, allowing a basin to be drained for diffuser maintenance, if necessary.

To meet the Chesapeake Bay Strategy nutrient loading limits, the new facility is equipped with mechanical mixers, in-tank dissolved oxygen sensors, and VFD-controlled blowers, so that aeration can be controlled by the dissolved

52 WWOM April/May/June 2008

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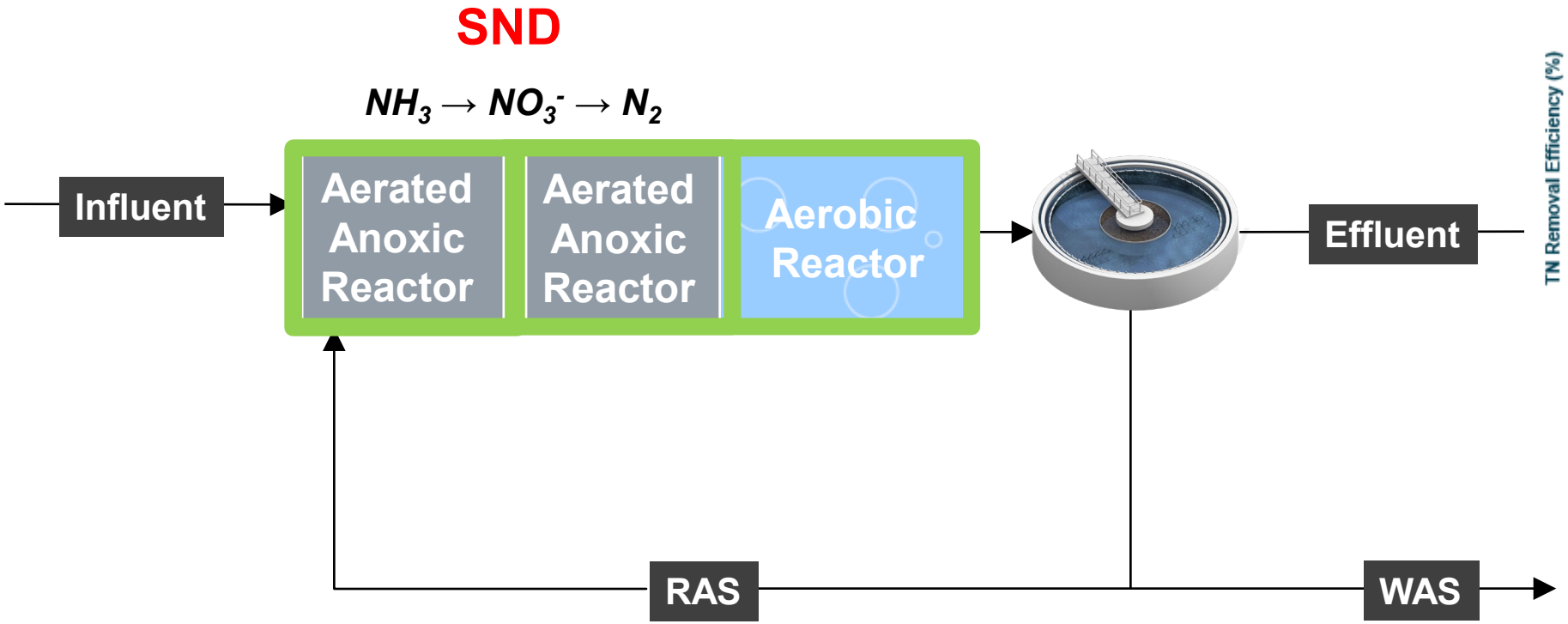
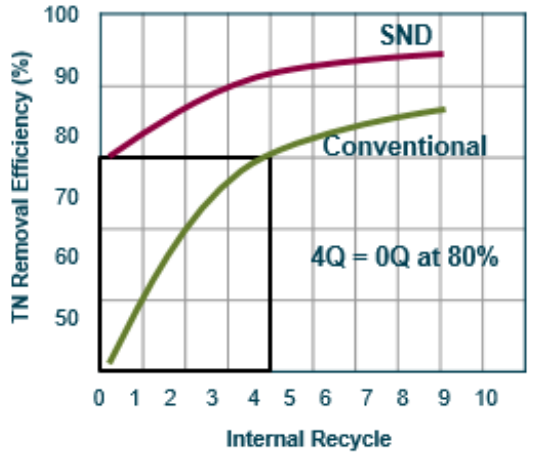
Nitrogen Removal Options

Simultaneous Nitrification-Denitrification (SND)





- Up-front reactors are **Aerated-Anoxic**. Mild aeration. Majority of total volume.
- No dedicated anoxic basin required.
- No internal recycle required for total nitrogen removal (80% TN removal).
- Bio-P also achievable in Aerated-Anoxic environment.

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Nitrogen Removal Options

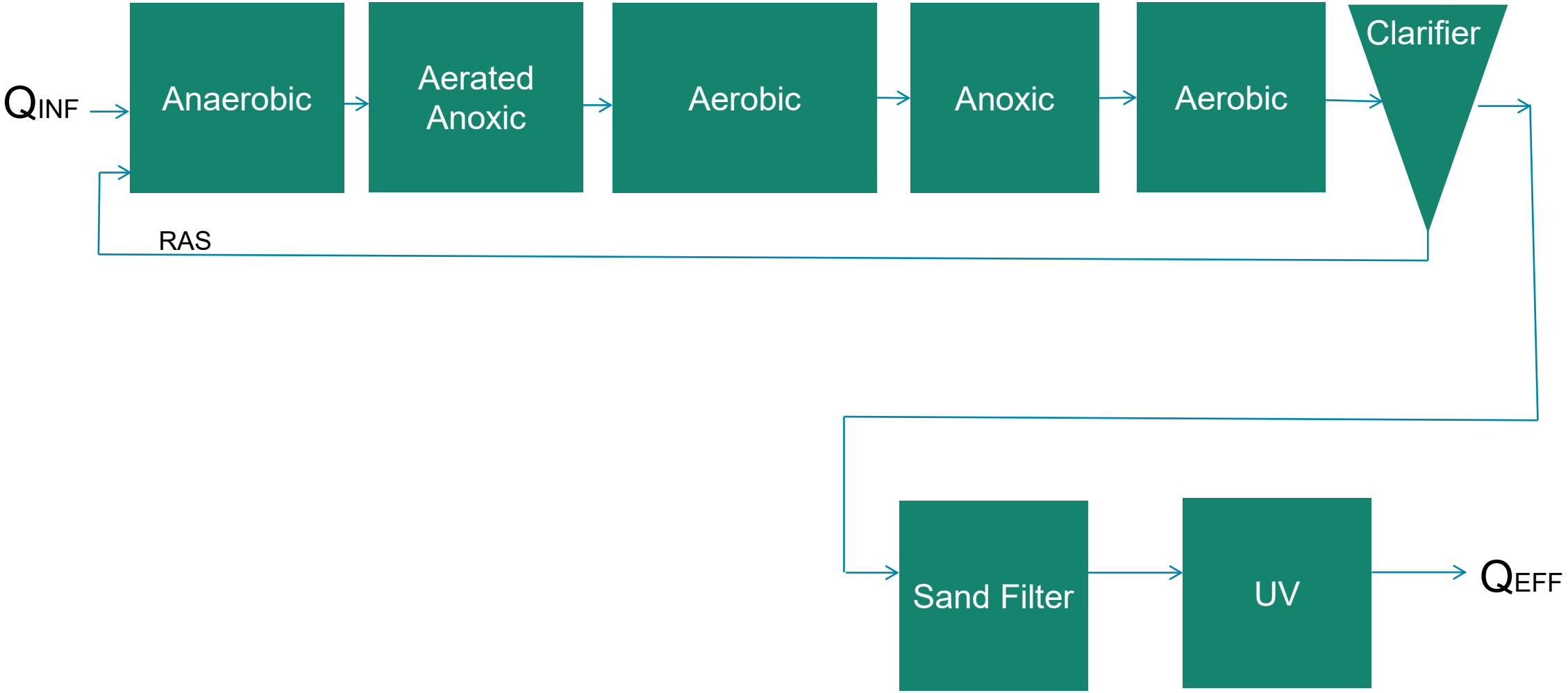
Orbal®,VLR® & Verticel® options

Configuration	Effluent Quality*
2 reactors in series	<15 mg/L TN
3 reactors in series	< 10 mg/L TN < 1 mg/L TP
3 reactors in series with internal recycle	< 5 mg/L TN
3 reactors in series with internal recycle and anaerobic selector	< 5 mg/L TN < 1 mg/L TP
3 reactors in series with internal recycle, anaerobic selector, and post-anoxic zone	< 3 mg/L TN < 1 mg/L TP

** TP w/o chemicals. < 10 mg/L BOD and < 10 mg/L TSS.*

Nitrogen Removal Options

Elkton, MD - 3.2 MGD Orbal®



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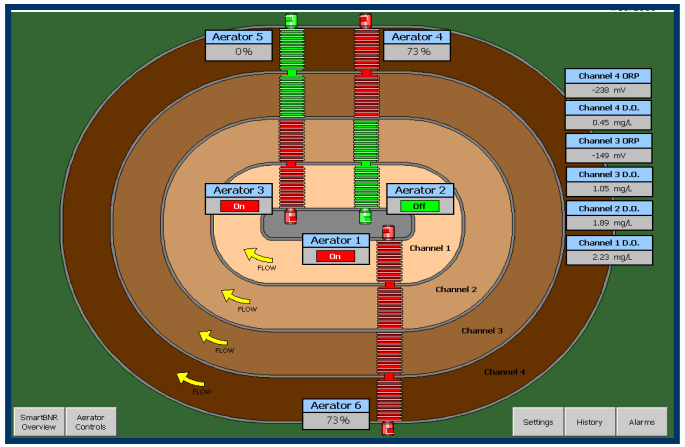
Nitrogen Removal Options

Elkton, MD Orbal® solution



DMR Values 2020-2021

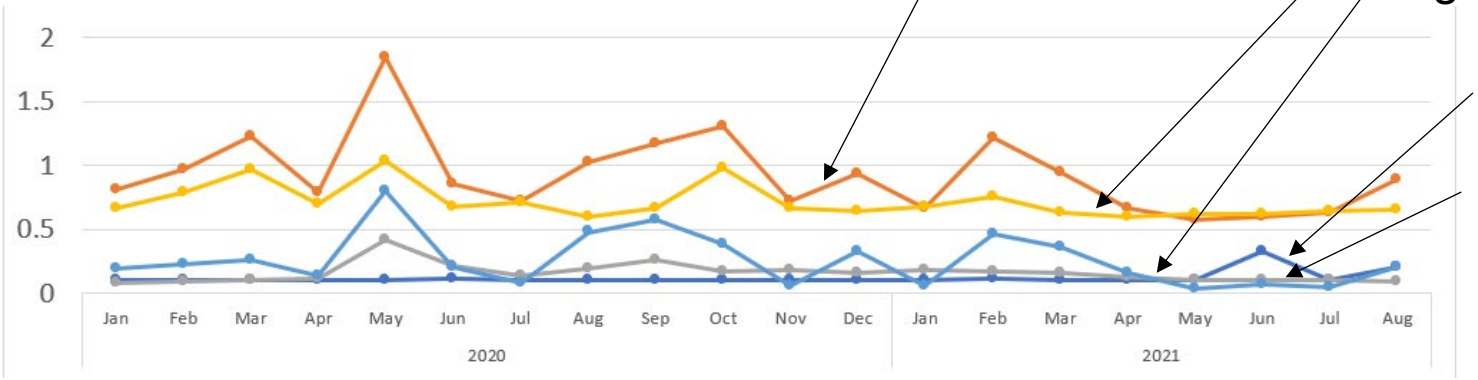
Orange = Total N

Yellow = Organic N

Light Blue = Nitrate & Nitrite N

Dark Blue = Ammonia N

Gray = Phosphorus



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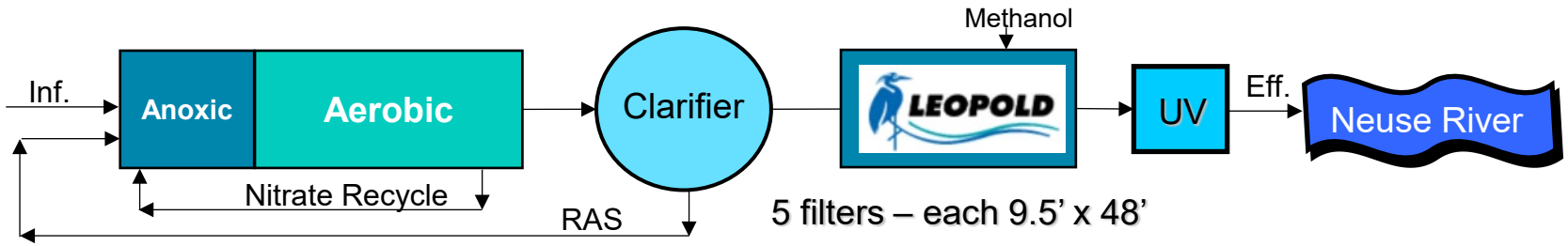
Nitrogen Removal Options

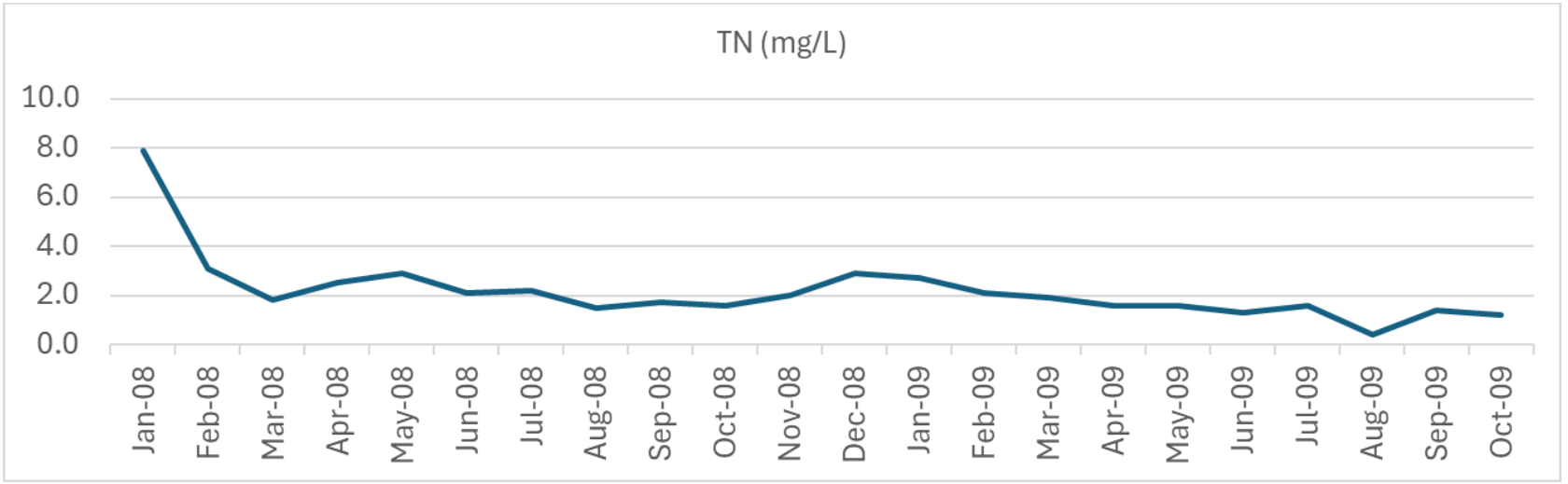
Bioloop SNDN Retrofit – Navarre, FL

- Operating Since 2007
- Demonstrates simultaneous nitrification and denitrification (SNDN)
- Meets effluent TN < 2 mg/l without anoxic zone or nitrate recycle pumps
- Diffusers have been in service since commissioning without draining basin

Nitrogen Removal Options

Central Johnston County, Smithfield, NC – elimi-NITE® Filter





Plant effluent flow of 2.8 – 6.4 MGD over period

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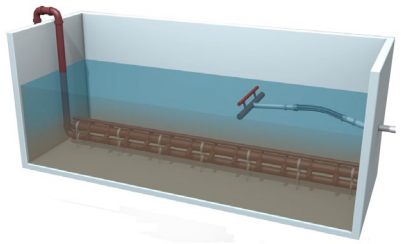
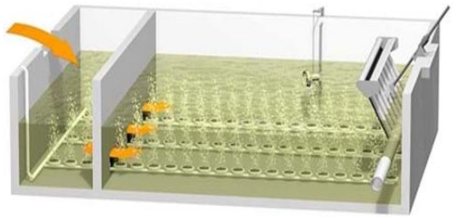
Phosphorus Removal Options

Omniflo® SBR



True-Batch Sequence Batch Reactor provides excellent treatment and low maintenance jet aeration

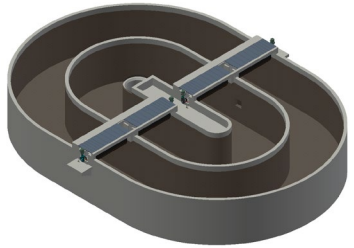
ICEAS® SBR



Continuous-Fill Sequencing Batch Reactor provides simplicity and high efficiency diffused aeration

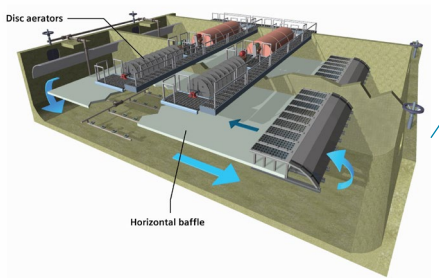
Orbal®

SND process provides high efficiency and easy operation



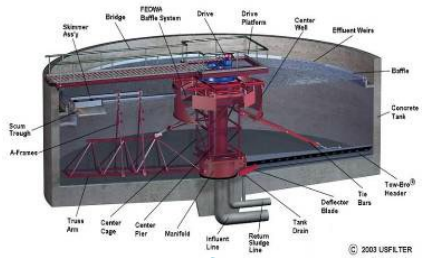
VLR® & Verticel®

SND process in a compact form factor

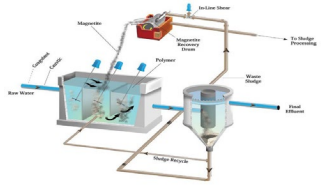


Towbro ®

High performance clarifier



CoMag®

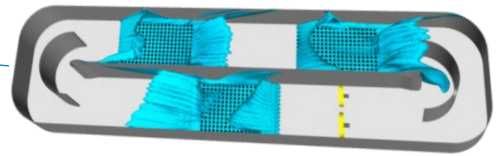


40X Disc Filter

Best in Class Disc Filter

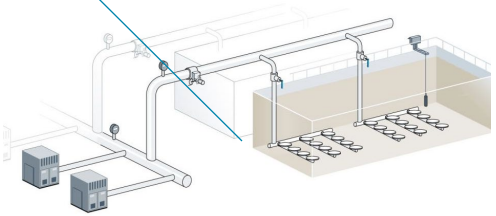
Bioloop™

Oxidation ditch with high efficiency Sanitaire diffusers and high efficiency mixing



Casperon™

Conventional Activated Sludge treatment with high efficiency Sanitaire diffusers



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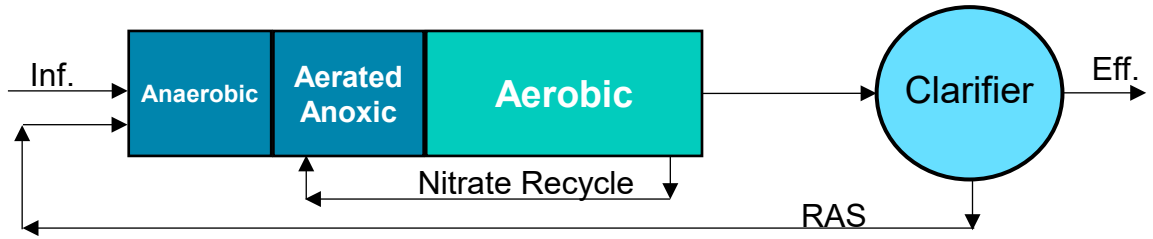
Phosphorus Removal Options

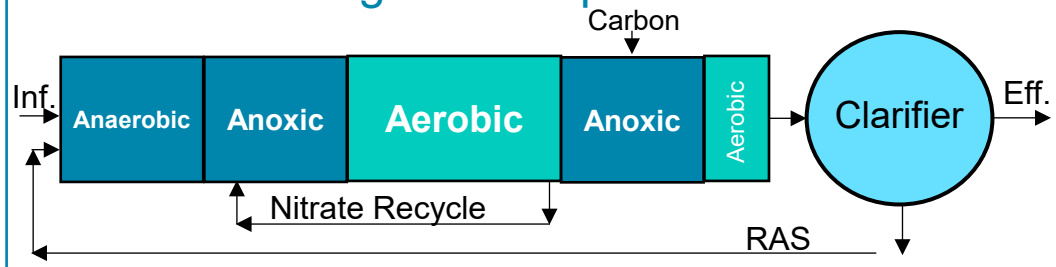
Xylem's Casperon® conventional activated sludge control system

Anaerobic-Anoxic-Oxic (A2O)

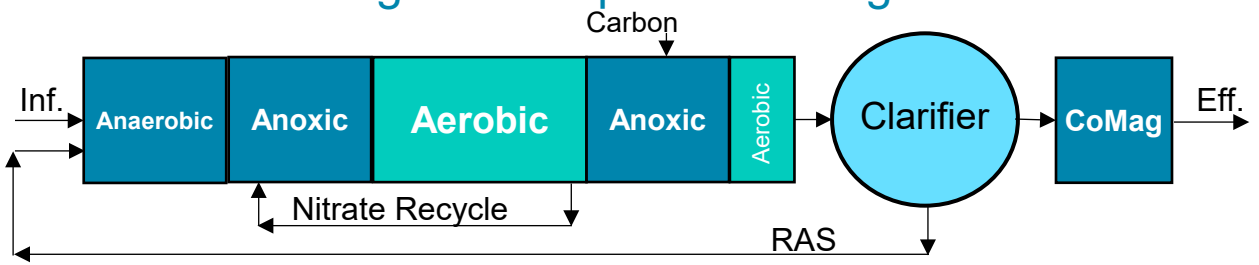
Simultaneous Nitrification/Denitrification w/Anaerobic



5-Stage Bardenpho



5-Stage Bardenpho w/CoMag



Ability to meet TP limits from 1 mg/l down to .05 mg/l

FLYGT a xylem brand · YSI a xylem brand · SANITAIRE a xylem brand · LEOPOLD a xylem brand · CoMag®

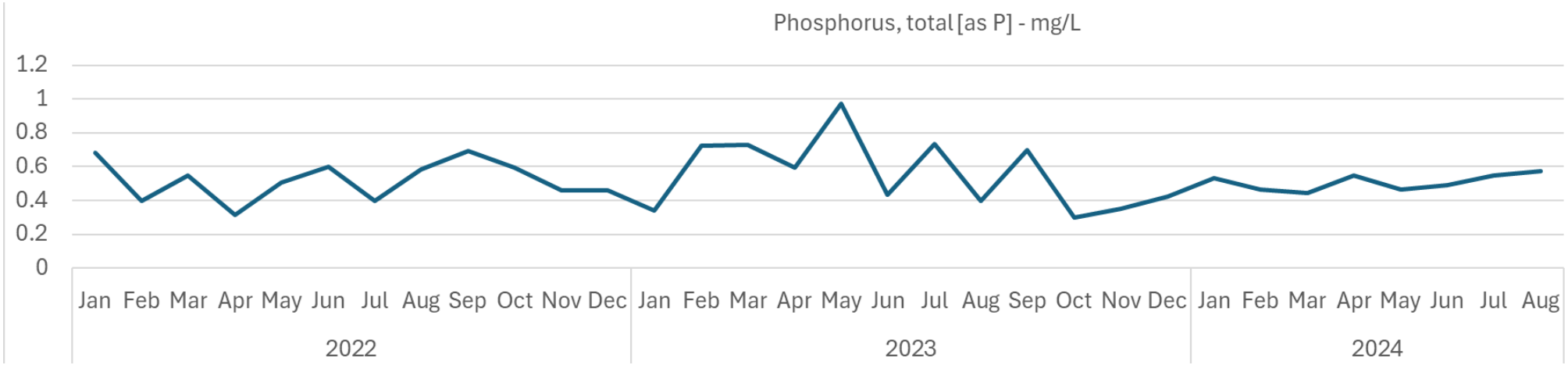
xylem

Phosphorus Removal Options

Zeeland, MI - CASPERON A2O Process

Complete Solution was provided:

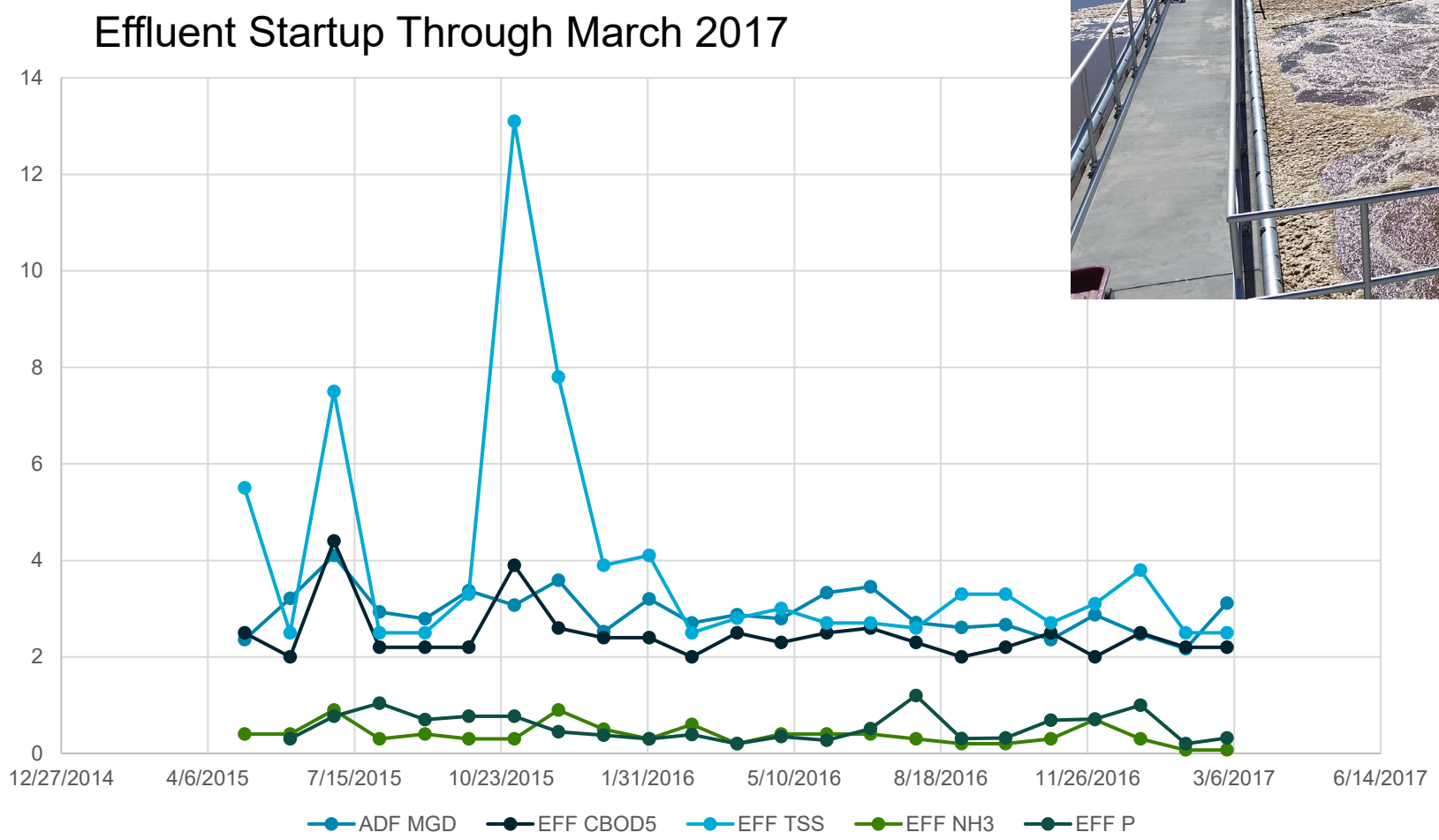
- Aeration (aerobic tanks and digester)
- Flygt mixers (six 4410 and two 4630)
- OSCAR™ Process Optimizer with DO, NH4, NO3 & PO4 control
- Blowers
- Air control valves and air flow meters
- FRP Baffle walls
- Operating since 2018



Data Source: EPA

Phosphorus Removal Options

Pigeon Forge, TN – Omniflo® SBR with Disc Filters



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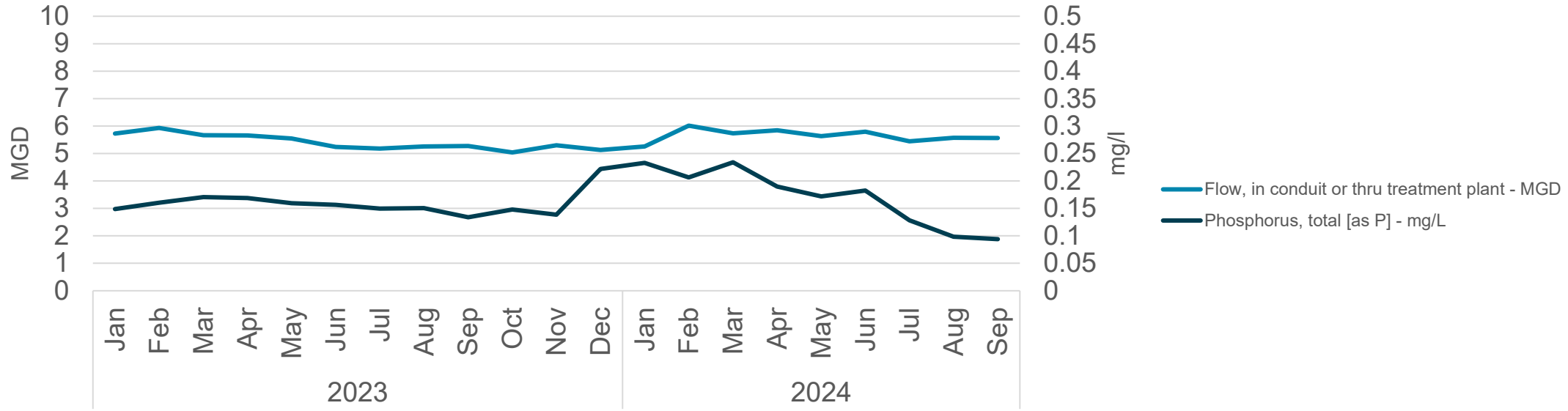
Phosphorus Removal Options

ICEAS® SBR - Fitgerald Creek, GA

- ICEAS® SBR followed by sand filters
- Started up in 2008
- Designed for 6.0 MGD



Data source: EPA

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Phosphorus Removal Options

Orbal® - Village of Johnson Creek, WI

- Plant needed to upgrade capacity and achieve BNR removal. Original secondary process was RBC.
- Orbal® system was started up in May 2019
- Plant has anaerobic tank upstream of 3-channel Orbal which allows for optimization of TN and TP removal, and **no chemical needed for TP removal**.
- The Village of Johnson Creek plant has all the latest Orbal® system equipment innovations

Effluent Composite average values from September, 2020 to January, 2023			
Parameter	Flow, MGD	TN, mg/l	Effluent TP, mg/l
Average	0.349	Not reported	0.19*

* = No chemical used for P removal

Data source: EPA

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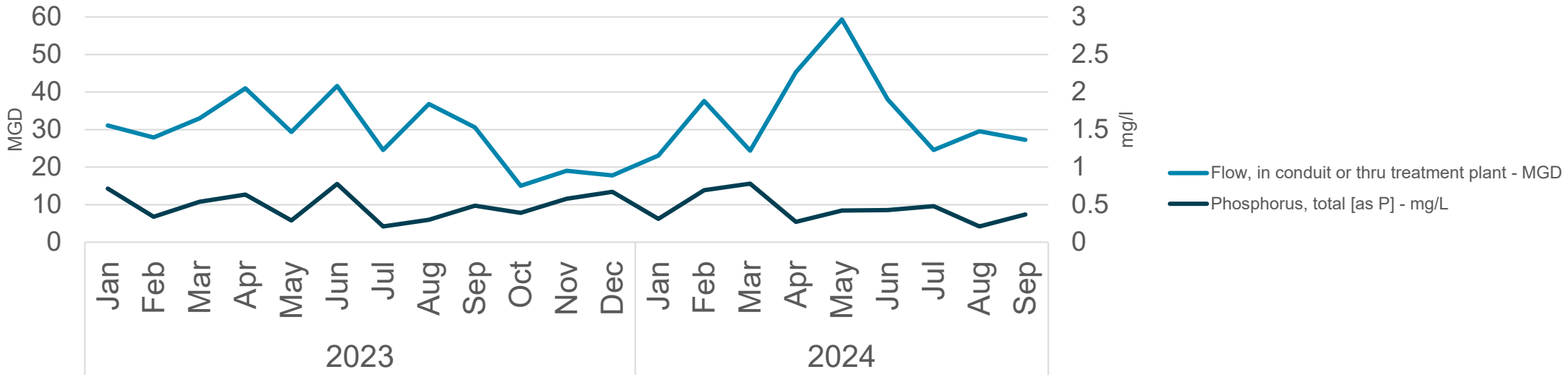
Phosphorus Removal Options

VLR® System – Springfield, IL

- VLRs & Clarifiers installed in 2009/2010
- Plant design for 32 MGD average



Data source: EPA

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Phosphorus Removal Options

Bioloop - South Water Reclamation Facility, Orlando, FL – 21 MGD

- One of two parallel ditches was converted from vertical-shaft mechanical aerators to fine bubble and the two ditches were operated in parallel
- The fine bubble system produced similar effluent quality while processing 3x the load

52% energy savings!

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Phosphorus Removal Options

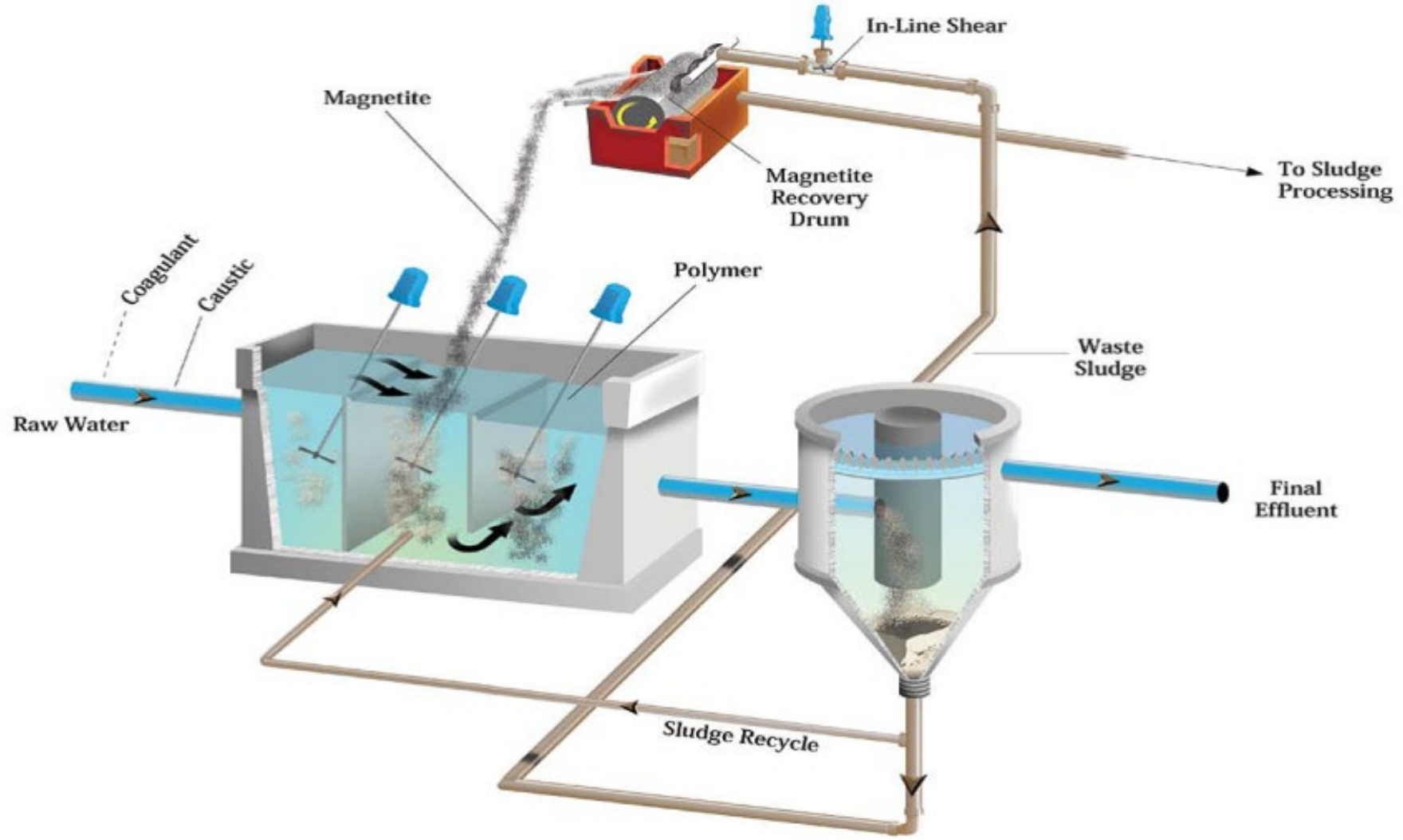
40X Disc Filter in Panama City Beach, FL

- Retrofitted disc filters in existing traveling bridge filter
- Greater effluent flow achieved in a smaller footprint with expansion capabilities - 225% more capacity in 50% less space

CoMag® System Overview

Major Components

Chemical Floc



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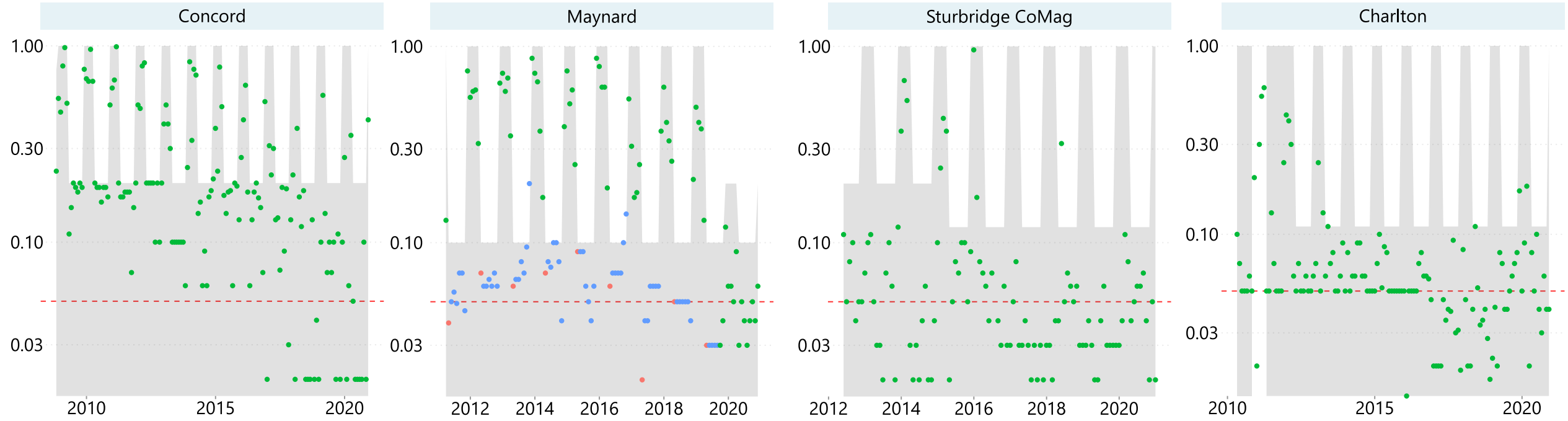
Phosphorus Removal Options

Long-term data from operating plants

Effluent TP Concentration – mg/l

MEDIAN
MO AVG
ROLL AVG

Source: US EPA
echo.epa.gov



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Phosphorus Removal Options

Vorelodos Aerobic Digester – Green Lake, WI

		US Units	Metric Units
Flow (Average)	gpd | lpd	5,380	20,360
WAS feed TSS	mg/L	8,000	8,000
Temp	F | C	41-77	5-25
Total Volume	Gals | m^3	185,000	700
SRT	days	34.4	34.4

- Added DO, ORP and Varion sensors (NH4, K, NO3)
- >90% Energy Savings
- >90% reduction in phosphate returned to main plant
- >90% reduction in chemical consumption for phosphorus removal*
- Controls included DINO for digester and NURO control in mainstream ICEAS process to enhance Biological Phosphorus removal

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TREAT

Thank You

David Dubey
Product Manager - Anaerobic Digestion and Biological Processes
david.dubey@xylem.com

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Maintain

Partner with Xylem to maintain predictability & reliability across the entire water cycle.

WEFTEC 2024

MAINTAIN

Data-Driven Forcemain Management

Proactively Manage Critical Wastewater Pipelines

Eric Toffin, P.Eng.

Global Product Manager,
Metallic Pipeline Solutions

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Data-Driven Forcemain Management

MAINTAIN

30+ Years of pipeline assessment experience & data

1,000+
Miles of pipeline monitored

7,030+
Miles of pipe wall inspected

16,800+
Miles of pipeline inspected for leaks

3,000+
Structural evaluations

13,280+
Leaks detected

55+
Countries where we've worked

xylem

MAINTAIN

Data-Driven Forcemain Management

Xylem partners with pipeline owners to perform full lifecycle asset management planning with the goal of right-sizing solutions to maximize your risk return on investment.

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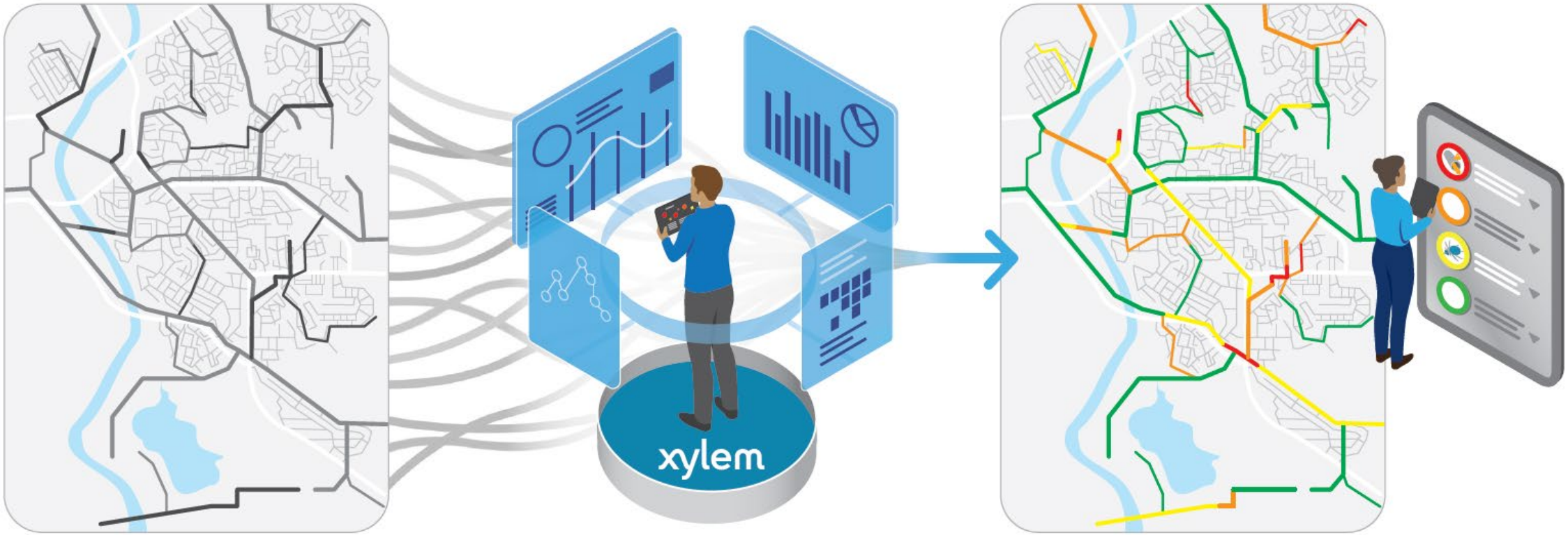
Data-Driven Forcemain Management

MAINTAIN



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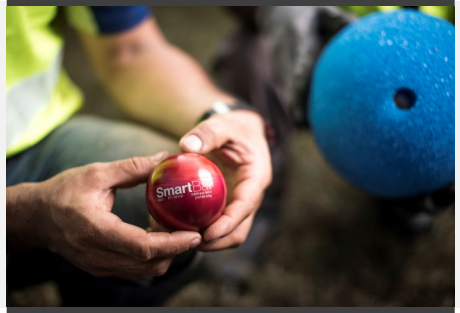
Data-Driven Forcemain Management

MAINTAIN

Typical Approach

01

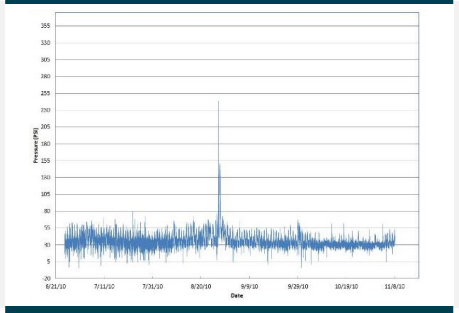


LEAK & GAS POCKET DETECTION

02

PIPE WALL INSPECTION

03



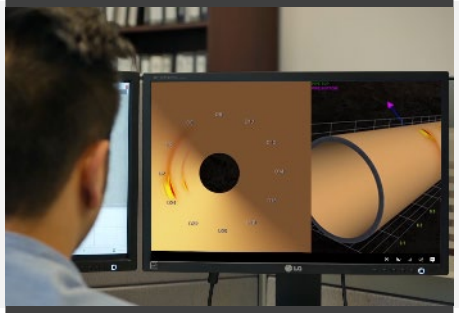
PRESSURE MONITORING

DATA COLLECTION

04

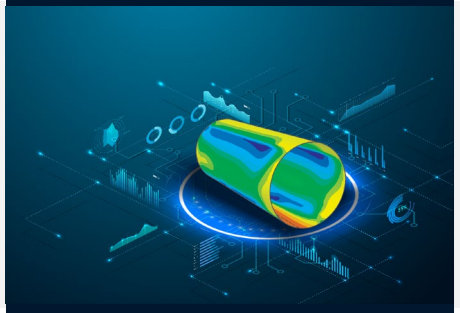
DESIGN CHECK

05



ENGINEERING ANALYSIS

06



PREDICTIVE ANALYTICS

ADVANCED ANALYSIS

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Let's Solve Water

MAINTAIN

Remote tracking

Live tracking

Confirm air valve functionality

H_2S gas pocket

Live tracking

Check valve insertion

Traverse vertical sections

H_2S-induced corrosion

Bar screen extraction

Leak

SmartBall®

Free-swimming inspection platform for leak and gas pocket detection and pipeline mapping

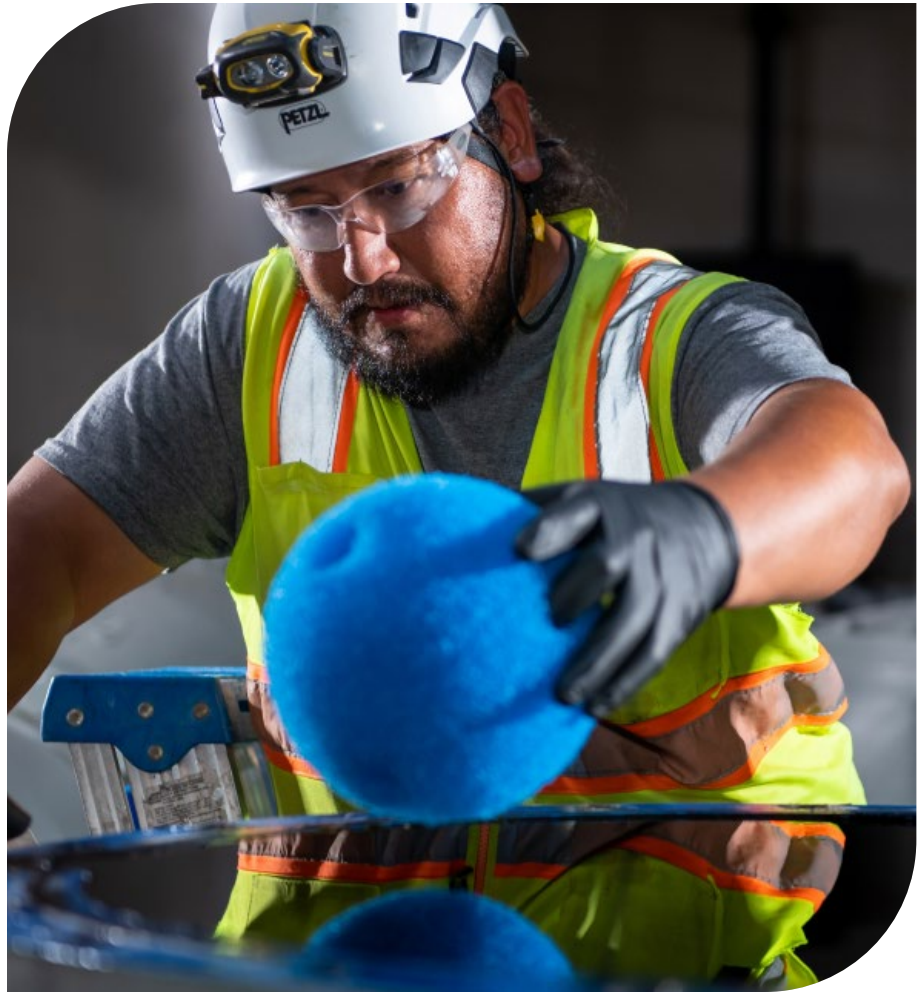
Data-Driven Forcemain Management

Free-swimming Leak & Gas Pocket Inspection with SmartBall

MAINTAIN

Benefits for managing forcemains:

- **Identifying and locating hidden leaks and gas pockets with high accuracy**
- **Mapping the pipeline to confirm alignment**
- **Measuring the pressure along the pipeline to identify partial blockages and confirm pipeline elevations**
- **Identifying and locating potential undocumented features and pipe type changes**
- **Contributing current inspection data to engineering analysis used for capital planning**



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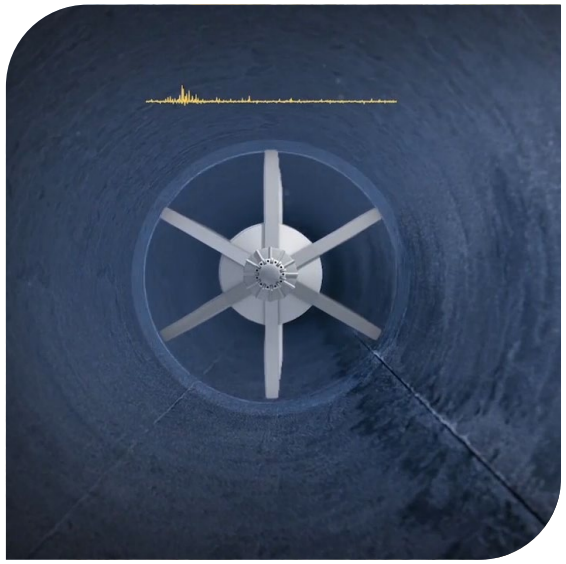
Data-Driven Forcemain Management

How Does the PipeDiver Platform Work?

MAINTAIN



METALLIC PIPE

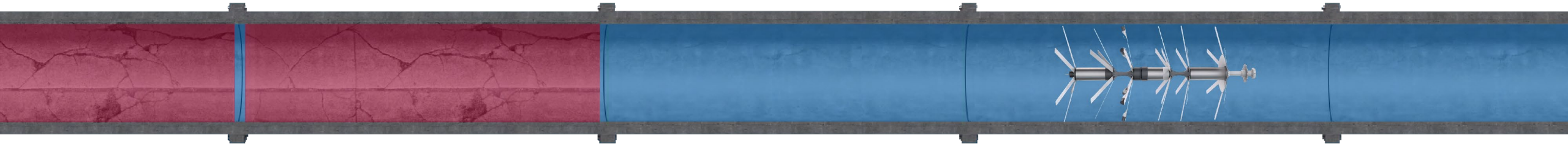
Wall loss

PRESTRESSED CONCRETE PIPE

Broken wire wraps

BAR-WRAPPED PIPE

Broken bar wraps and cylinder wall loss



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Data-Driven Forcemain Management

Free-swimming Pipe Wall Inspection with PipeDiver

MAINTAIN

Benefits for managing forcemains:

- **Locating and quantifying pipe wall distress using electromagnetic technology**
- **Inspecting metallic and concrete forcemains in a single deployment**
- **Collecting high-resolution data without shutdowns, dewatering, excavations, or extensive civil work**
- **Pairing with complementary Xylem services to support economic and proactive asset management**

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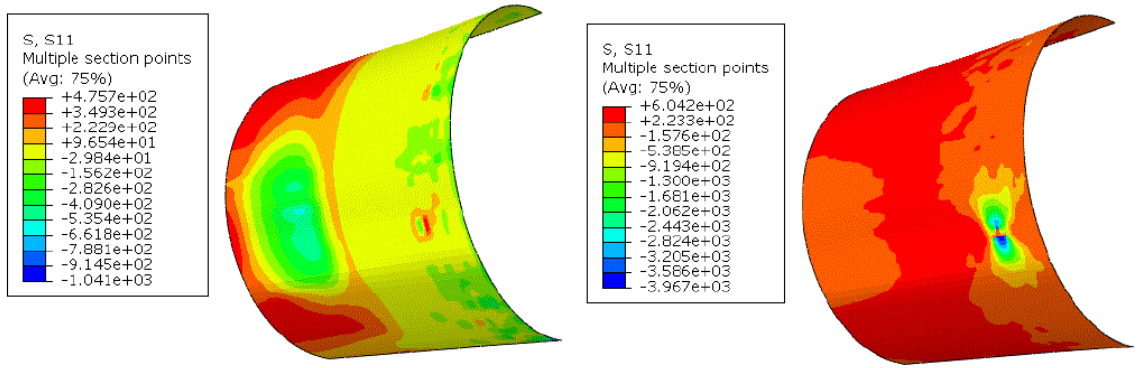
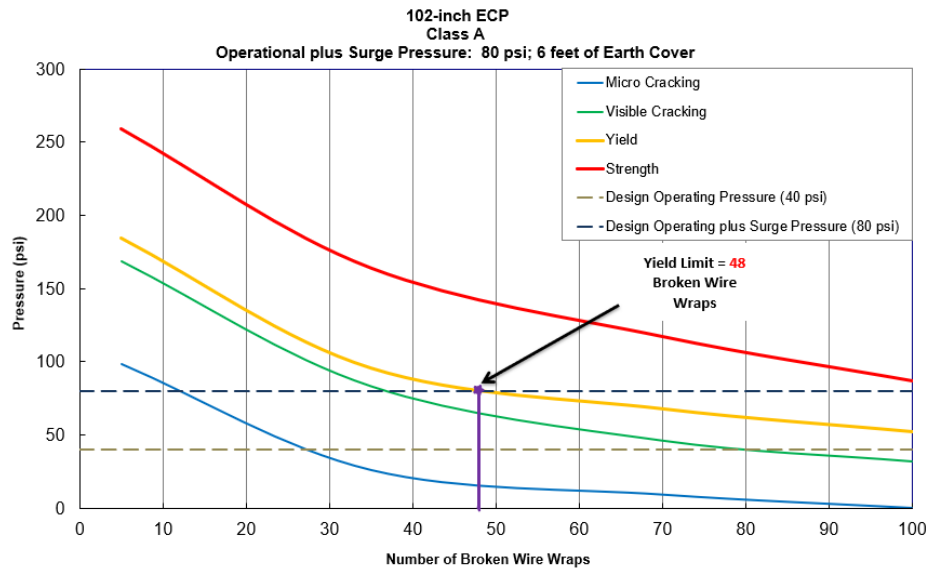
Finite Element Analysis

Understand Structural Consequence of Pipe Damage

MAINTAIN

Finite Element Analysis & Risk Curves





Determine What Action Is Warranted

Near-term decisions
Inform near-term decisions about whether pipes need to be repaired or replaced

Prioritize
Prioritize pipes for future repair or reinspection

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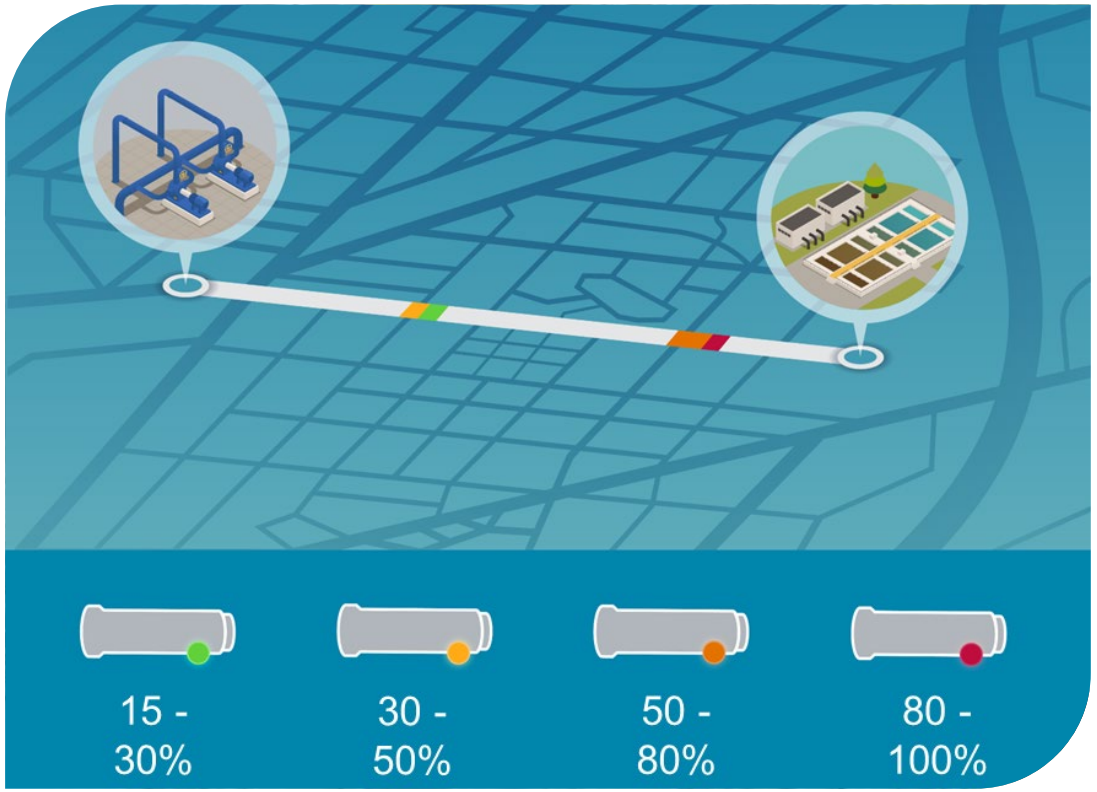
Remaining Useful Life Analysis

Map Expected Failures Into The Future

MAINTAIN

Probability Of Exceeding Yield Limit By 2045



Model Future Serviceability

Right Pipe
Forecast the future condition of each pipe using statistical methods

Right Time
Gain reliable, actionable information about when intervention will be justified

Right Risk Tolerance
Manage force mains long term, within acceptable levels of risk

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Data-Driven Forcemain Management

Comprehensive Solutions with Xylem

MAINTAIN

Trusted partner for sewage bypass projects

- Maintain uninterrupted service during the maintenance work
- Temporary
  - Short term (Days/Weeks)
  - Long term (Months/Years)

Odor Reduction Corrosion Abatement (ORCA)

- Digitally enabled odor and corrosion control service
- Reduce odorous compounds which cause corrosion
- Minimize nuisance odors, these can be a health hazard (H_2S)

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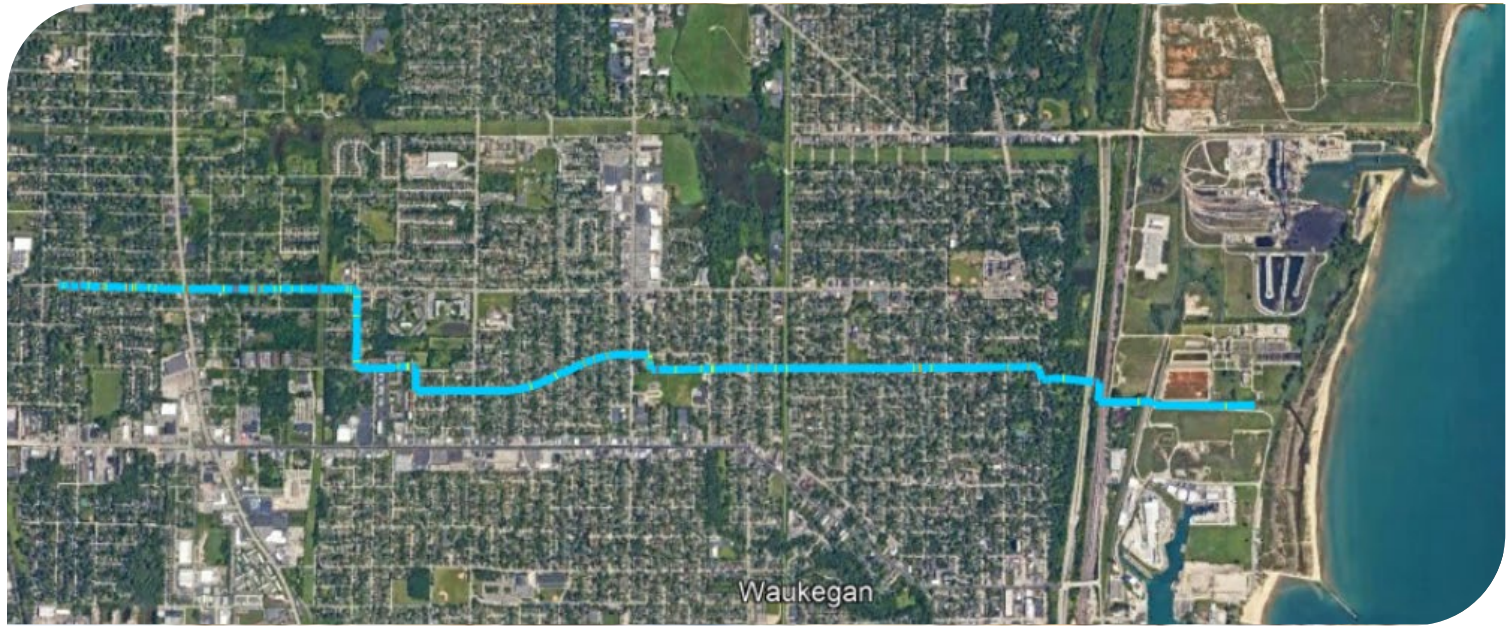
Case study: Safeguarding the Waukegan Forcemain

North Shore Water Reclamation District, Illinois, United States

MAINTAIN



Ø54-inch
treated effluent PCCP forcemain

2
Catastrophic failures

Challenge

The Waukegan forcemain, constructed in 1976, is responsible for transporting treated effluent near Lake Michigan. It experienced catastrophic failures in 1996 and 1998.

Solution

Since 2002 **Xylem's Data-driven Pipeline Management** recommendations, informed by **PipeWalker** and **Visual & Sounding** inspections, provide NSWRD both short-term and long-term management guidance to ensure the forcemains continued reliability.

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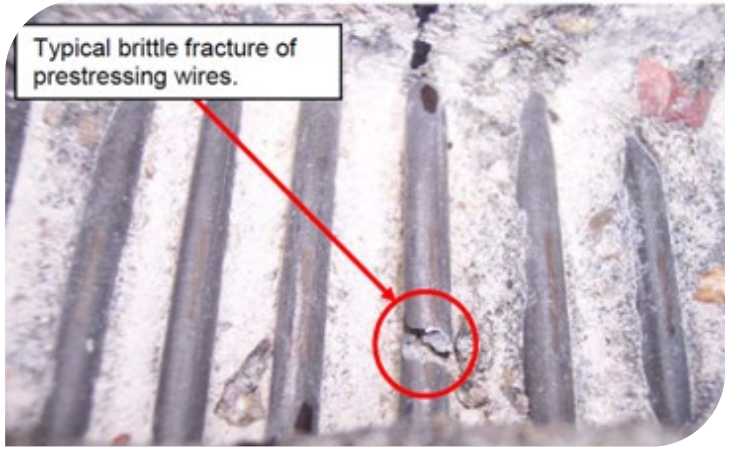
Case study: Safeguarding the Waukegan Forcemain

Data-driven Pipeline Management Approach

MAINTAIN

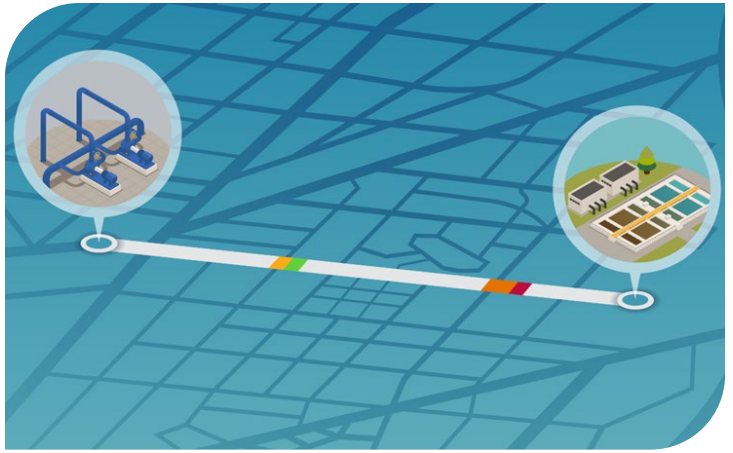
Condition Inspections

- PipeWalker™ electromagnetic inspection
- Interior visual & sounding
- Exterior visual
- Validations



Material Testing

- Mortar coating
- Soil
- Groundwater
- Petrographic



Engineering Analyses

- Pipe design checks
- Risk curves & repair priorities
- Remaining useful life

Given the potential for property damage & lacking redundancy the Waukegan forcemain has a high consequence of failure.

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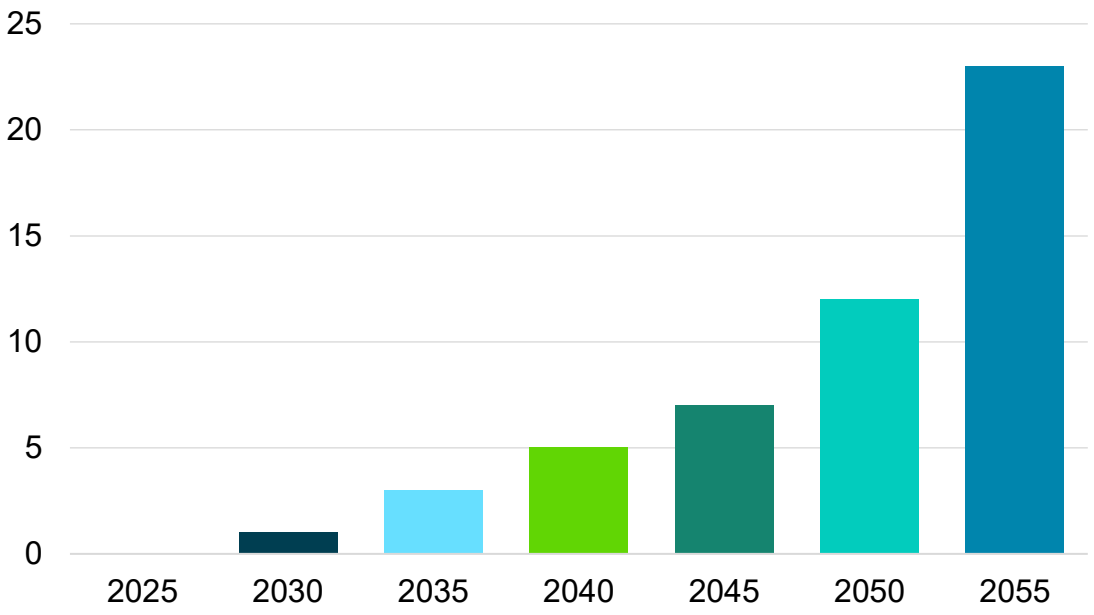
Case study: Safeguarding the Waukegan Forcemain

From Risk to Reliability

MAINTAIN

Predicted Cumulative Pipe Failures



Reliability Roadmap

Short Term Repairs
Lining spalls, joints, air void in CFRP & eight distressed pipe sections

Re-inspection Timeframe
3 or 5 year, depending on the extent of repairs; to monitor for increasing distress

Consider Active Monitoring
SoundPrint AFO observes prestressing wire breaks in real time

Active monitoring with SoundPrint AFO will allow NSWRD to perform repairs on an as-needed and when-needed basis.

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Data-Driven Forcemain Management

MAINTAIN

Key Takeaways

Full-scale pipeline **replacement may be unnecessary**

Target only the pipes that need repair or replacement **with condition assessment data**

Reduce failures, risk, and capital expenditures while increasing operational confidence

Extend forcemain life and empower defensible long-term planning

Our approach optimizes fiscal efficiency and long-term reliability for our client's systems.

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Thank You

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Move

Build America, Buy America (BABA) Act Update – Pumps and Mixers

WEFTEC 2024

Agenda

1. Build America, Buy America (BABA) Updates
2. Flygt Product Localization
3. Marketing Campaign and Resources
4. BABA Waivers & Support
5. Summary

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Build America, Buy America (BABA) Updates

Build America, Buy America (BABA) Requirements

BABA requirements are more stringent than in the past and now cover manufactured products:

- the manufactured product was manufactured in the United States; and
- (ii) the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation;

Additional Guidance:

- OMB released a Guidance Document October 2023 (codified BABA part 184, 2 CFR) https://www.whitehouse.gov/wp-content/uploads/2023/10/M-24-02-Buy-America-Implementation-Guidance-Update.pdf
- EPA released a BABA Guidance Document. https://www.epa.gov/system/files/documents/2022-11/OW-BABA-Implementation-Procedures-Final-November-2022.pdf
- EPA sought input and comment and continues to assess state of water industry to comply with BABA. Additional guidance is months away

BABA Compliant Product Requirements: #1 - Manufactured in the U.S., #2 55% U.S. Component Cost BABA is about federal awards, BAA is about federal procurement

OMB Guidance Impact to Xylem

- Intent is clear – **significant local production in the US**,
- No appetite or support for broad general waivers. Delegates waivers fully to agencies.
- Guidance is generally favorable to Xylem
  - **Manufactured article**, manufactured in the US (complex and meaningful assembly - definitions are consistent with our guidance
    - Supportive of Xylem localization efforts and logic
  - **Services are not subject to BABA** as long as there is no permanent installation

Specific waivers are alive and well and viewed as necessary to address short term supply and non availability of products. Xylem is still months to years away from BABA production depending on product line.

How does BABA compare to prior U.S. Content Rules?

	BABA (May 2022)	**American Iron & Steel (AIS)**	**Buy American Act**
Applicability	*Applies to Infrastructure Projects using federal financial assistance*		*Applies to Federal Gov Spending*
Construction Materials	✓	✓	✓
Manufactured Products	✓	Largely Exempt	✓
U.S. content %	✓ 55%	✓ 100%	✓ 65% (As of 1/1/2024)
Trade Agreements	No	No	✓
Waivers	✓	✓	✓ (COTS)

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Product Localization

BABA Localization – Scope of Work

In Scope “with 2024 production”

Flygt small & Mid-range Pumps in N-Hard Iron Impellers, FM Version, 208, 230/460V (w/power Range 5HP up to 160HP, and discharge volute size 3" up to 8")

3085.070 → Adaptive

3102.070 → Adaptive

3127.070 → Adaptive

3153.095, 3171.095

3202.095, 3301.095

3315.095

Mixers in 316 Stainless Steel, FM, 230/460V

4630.492, 4640.492

4650.492, 4660.492

4670.492, 4680.492

In Scope “with 2025 production”

Great & Grey 3001 series, Propeller and mixed flow 7000 series **subject to approval**

In Low voltage up to 1.1kV, and Midium Voltage up to 6.6kV

(w/power Range 70HP up to 1000HP, and discharge volute size 8" up to 32")

Out of Scope "Future Development"

- Concertor “Smart Pump”, adaptive, and low speed 4400 series mixers
- Premium Efficiency Motors "IE3/4'
- Dewatering Pumps (2000 series)
- Hydroturbine
- Fiberglass tanks “Kit Provision”

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Mechanical Accessories and Controls – Defined KITS

- P Discharge connection, guide rail system
- T and Z accessories
- PL cable system
- Adaptors, Flygt Connect
- Flygt Mix flush Valve
- Flygt Lifting systems & Dock-Lock
- Flygt TOP basin for concrete sumps
- Flygt Floats and level regulator
- Vortex protection shield (Mixer)
- Extended jet ring (Mixer)
  - ….etc.

- MultiSmart 3MP/3PC
- MultiSmart Powered by Nexicon
- Smart-Run
- VFD's
- MAS801
- MiniCAS II // US-MiniCAS
- Level Regulators

OMB Guidance on defined KITS

- **Kit provision allows** **“in certain cases a manufactured product purchased from a single supplier as a “kit” may be classified as a single manufactured product even if its components are brought to the site separately or at different times.** Leaning toward simple site assembly

  - “limited to **discreet products, machines or devices performing a unified function**”
  - “wide ranging system of interconnected products, machines or devices (example HVAC system) should not be considered a kit – construction on site may be a disqualifier
  - Cannot be an entire project (treatment plant) --> Significant for Treatment and Evoqua
  - Guidance in flux, **significant influence from OMB / MIAO**

Pre-defined Pumps and Accessories Kits …. examples ….

- Duplex Pump NP-3153.095-XXXX
- Qty 2 - 6” Flygt Discharge Connection
  Qty 1 Flygt Mix flush Valve
- Qty 3 Flygt Level Regulator

- Duplex Pump NT-3301.095-XXXX
- Qty 2 – T-Installation KIT

- Mixer 4630.492.XXXX
- Floor Mounting Bracket OR Support Arm

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Full Package Lift station

"In accordance with EPA thinking on pump stations"

Pre-engineered FRP Lift Stations (Wet-pit)

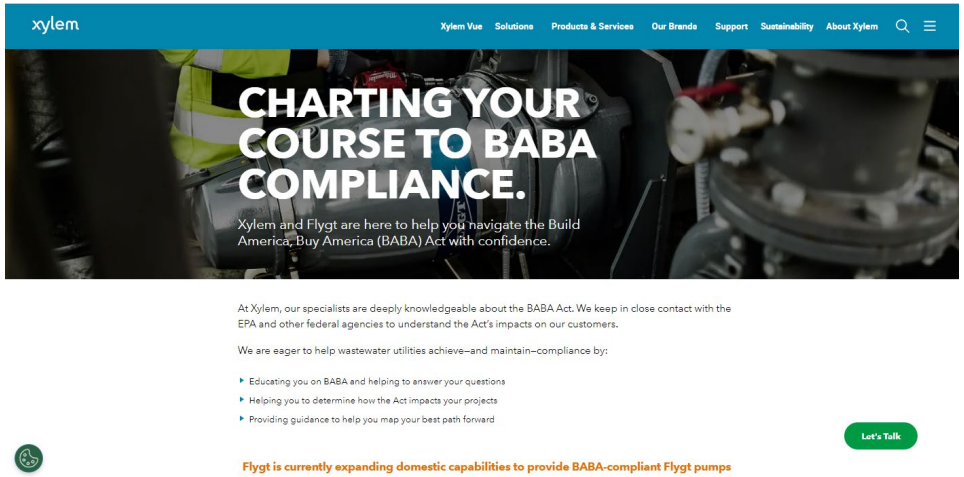
- Flygt Submersible Pumps
- Mechanical Accessories
- Power Cables
- Valves
- Pipes
- Brackets and supports
- Access Covers / Hatches
- Electric accessories
- Control Panel
- FRP tank "Fiber-glass station"

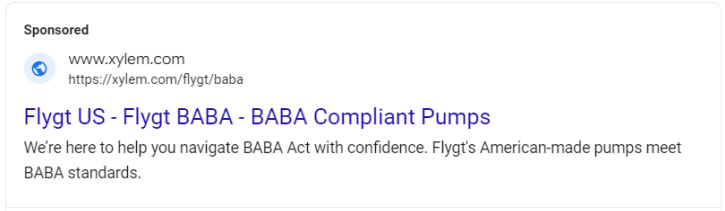
Dry/Submersible (Concrete) Lift Station

- Flygt Submersible Pumps
- Mechanical Accessories
- Power Cables
- Valves
- Pipes
- Brackets and supports
- Access Covers / Hatches
- Electric accessories
- Control Panel
- **Concrete "NOT INCLUDED"**

Marketing Campaign and Resources

BABA Marketing Campaign





- New landing page - https://www.xylem.com/en-us/campaigns/act/flygt-baba/
- Contact us form for BABA questions and project support!

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Let's Solve Water

BABA Waivers & Support

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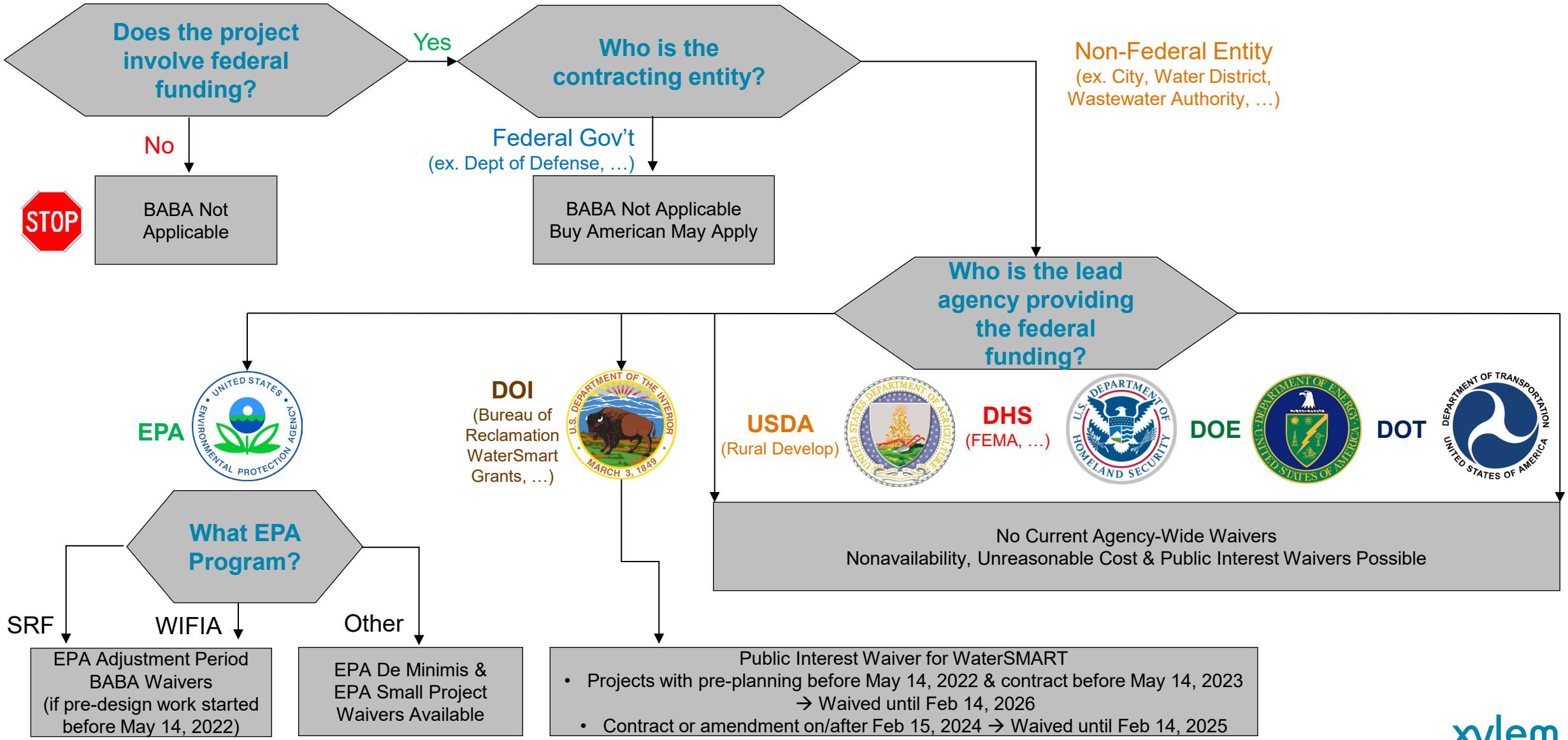
BABA Waivers

Types of Waivers Available Under BABA. Funding recipients are responsible for applying for waivers:

- **Nonavailability Waivers** – Waivers addressing the unavailability of American made iron, steel, manufactured products, or construction materials. **Xylem Dec-2023 response to EPA RFI, requesting nonavailability product waivers.**
- **Unreasonable Cost Waivers** – Waivers reflecting that the overall cost of the infrastructure project with domestic iron, steel, manufactured products, or construction materials exceeds by more than **25% the overall cost of the project** with foreign iron, steel, manufactured products, or construction materials.
- **Public Interest Waivers**, which include:
  - De Minimis Standard Waivers that exempt up to 5% of project costs up to the Simplified Acquisition Threshold when this would advance the public interest
  - Small Grants Waivers for grants below the Simplified Acquisition Threshold when this would advance the public interest.
  - Adjustment Period Waivers such as brief, time limited waivers to allow grantees to transition to new rules and processes when this would advance the public interest;
  - International Trade Obligations Waivers when a grantee has assumed procurement obligations pursuant to the Government Procurement Agreement or any other trade agreement, and waivers to ensure compliance with such obligations may be in the public interest. and
  - General Applicability Waivers that are issued under limited conditions, e.g., product-specific waivers for which there are known domestic sourcing challenges

BABA: Flowchart for Current Waiver Status



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Summary, Q&A

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Summary

BABA applies to infrastructure projects that receive federal assistance (SRF, EPA, etc.).

BABA has two main requirements that impact Xylem and our customers:

- Manufactured Products must be manufactured in the US
- Manufactured Products must have > 55% US content by cost ($)

Xylem is working actively with the Made in America Office and EPA to advocate for our business and our customers in a challenging environment

We have established specific workflows to help you navigate BABA

- An approval process with specific Approvers who you need to consult
- A procedure and a BABA Cert Required check box in Salesforce to help us decide what projects we are able to pursue

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Summary

For products and projects where we do not meet BABA, we need to project waivers. Contact us at InfrastructureFunding@xylem.com or reach out to any of the individuals on this call for waiver support.

Our team will help you by meeting with the customer and/or consultant and walking through the waiver process.

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Speakers and Q&A

Product Management

Rana Elbittibssi, Director Product Management Americas, rana.elbittibssi@xylem.com

Vertical Marketing & BABA Commercialization

David Sam, Business Development Manager, david.sam@xylem.com

Chris Thomson, Director, Vertical Marketing, chris.thomson@xylem.com

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Thank You

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Optimize

Partner with Xylem for digital expertise, services & support to optimize water operations & infrastructure.

WEFTEC 2024

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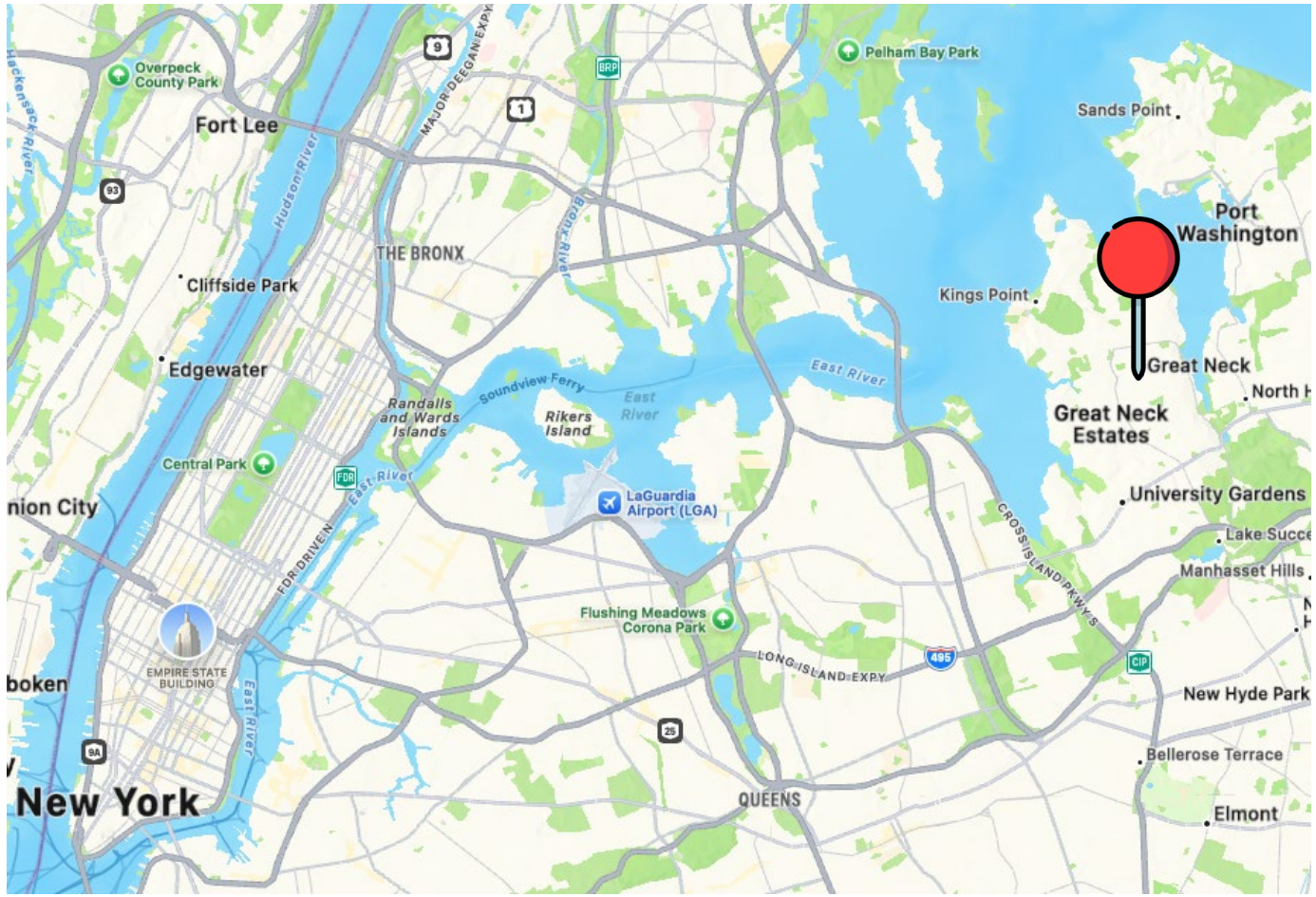
OPTIMIZE

Great Neck Water Pollution Control District

Increasing Efficiency with Xylem Technology

GNWPCD Primer



- Created in 1914
- The “Gold Coast” of Long Island, NY
- The West Egg in *The Great Gatsby*
- Comprised of numerous Villages and their sewerage systems
- Consolidated into a single Sanitary Sewer District with 10 pump stations and 1 treatment facility

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Our Former Selves

OPTIMIZE

10 Pumping Stations consisting of numerous:

Pump Manufacturers

PLC Manufacturers

PLC Programs (and Designers)

Pumping Technologies – dry shaft, dry pit centrifugal, dry pit submersible…

The one thing they had in common was what they were pumping!

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Inefficiencies of Being Different

OPTIMIZE

1. Only certain staff members knew certain stations
2. Spare Parts Not Interchangeable
3. 4 Companies Providing PLC Ladder Logic
4. Multiple Sales/Service Reps
5. Greatly Increased Learning Curves
   - Every Employee Had to Learn 10 Stations
   - Had to be proficient in all locations to be considered for alarm coverage

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Station	Upgrade Date	Design Flow (gpm)	Previous Pumps	Upgraded Pumps
Shelter Rock	2019	350	Davis EMU	Flygt N-Type
Manhasset	2022	2,400	Chicago-Yeomans	Flygt N-Type
Spring Lane	2022	500	Cornell	Flygt N-Type
Redbrook	2022	300	Wilo	Flygt N-Type
Bayview	2023	2,780	Chicago-Yeomans	Flygt N-Type
Steamboat	2024	1,000	Cornell	Flygt N-Type
Gristmill	2024	90	Homa	Flygt Concertor
Greenleaf	2024	105	FLUSH-KLEEN	Flygt Concertor
Piccadilly	2025	5,560	Wilo	Flygt N-Type
Strathmore	*Soon to be eliminated*			

Enter...Standardization

The law allows municipalities to pass Standardization Resolutions when they produce:

OPTIMIZE

1. Greater efficiencies
2. Savings to taxpayers
3. More reliable operation
4. Higher safety for the public

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Which to Choose?

- Most pump stations were 25+ years since being upgraded
- Capital plan allowed for grading severity and order priority
- District contacted manufacturer’s reps to set up site visits of current pump station installations
- Considered many pump manufacturers
- Came down to a neighboring County with many Flygt Pump Installations and positive reviews from maintenance staff

Piggyback on Public Bids

- The lowest responsible bidder decides what pump equipment they submit
  - Might be specified
  - Might be “or equal”
- It is very difficult to force a contractor to use specific equipment in a bid setting
- District discovered neighboring Suffolk County had a purchasing contract with Flygt that was publicly bid
- By obtaining a piggyback agreement with Suffolk County, we could pre-purchase pumps. This allowed us to:
  - Get the exact equipment we wished to be installed
  - Save on the 20% mark up from bidding contractor

Controls Should be Simple

The Microsoft Excel of Pump Station Controllers

Standardized on MultiSmart Controller

- Canned process – anyone can set up
- Easily adaptable to N+1, N+2, etc. stations
  - Modular!
  - Replacements can be done by wastewater staff
  - Spare MultiSmart controllers are good for any station
  - Flash Card stores and transfers all programming

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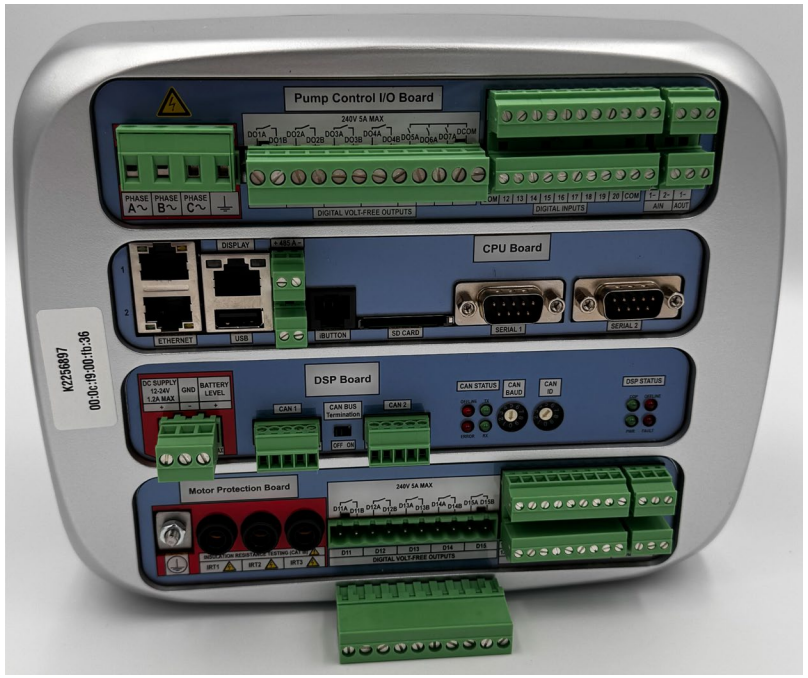
Programming and Replacement Controllers

Every District pump station control program in a single case



One spare controller part works for all of my stations

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Manhasset Valley Pump Station

Wet Pit Submersible, Interior Control Panel

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Shelter Rock Pump Station

Wet Pit Submersible, Exterior Control Panel

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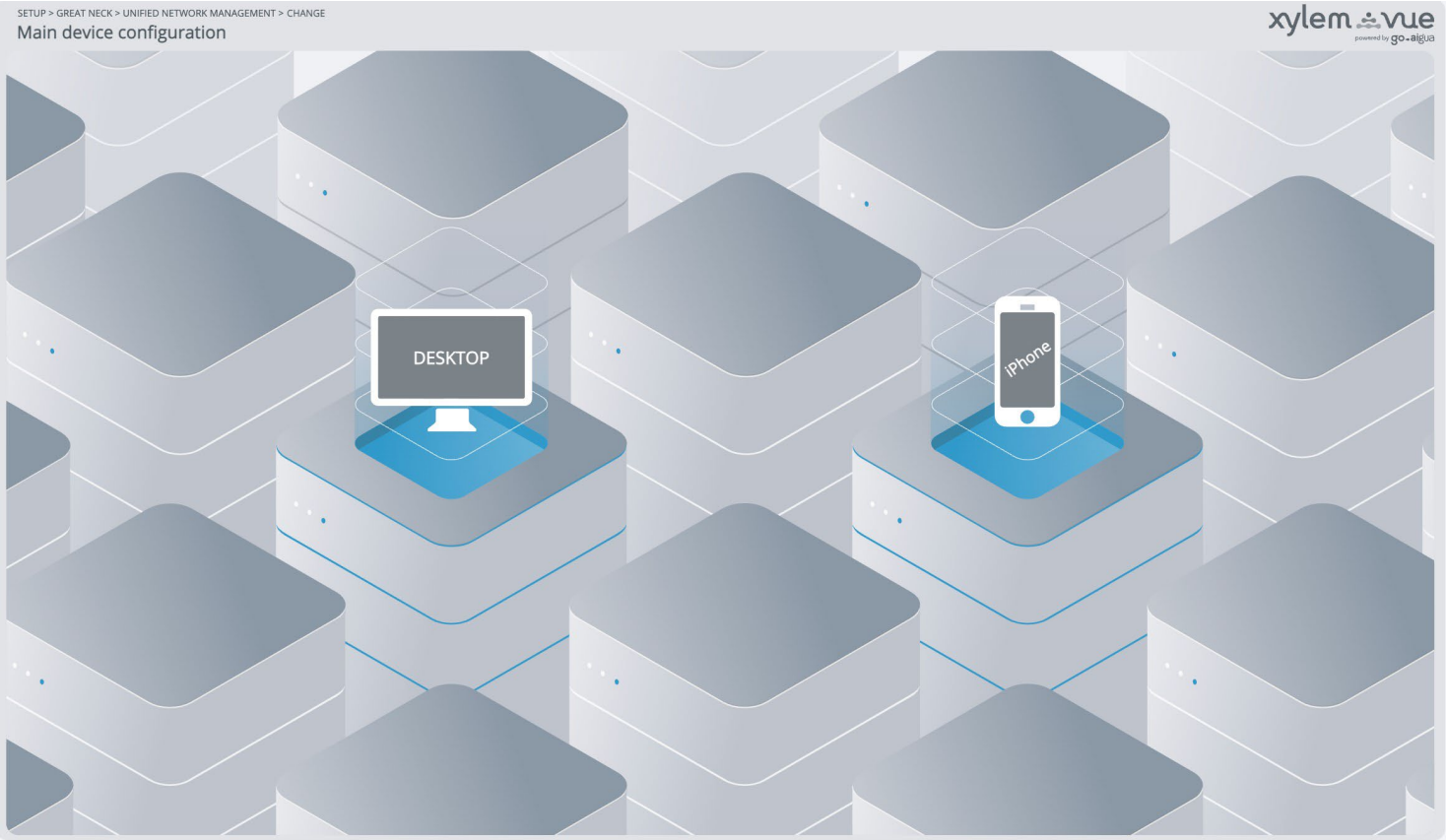
Data Systems Standardization

- Just like our pumps and controls, we were looking for a simplified data experience
- Xylem Vue powered by GoAigua allows us to leverage our pumping station data
- Operators and Road Crew staff can access information with a few clicks



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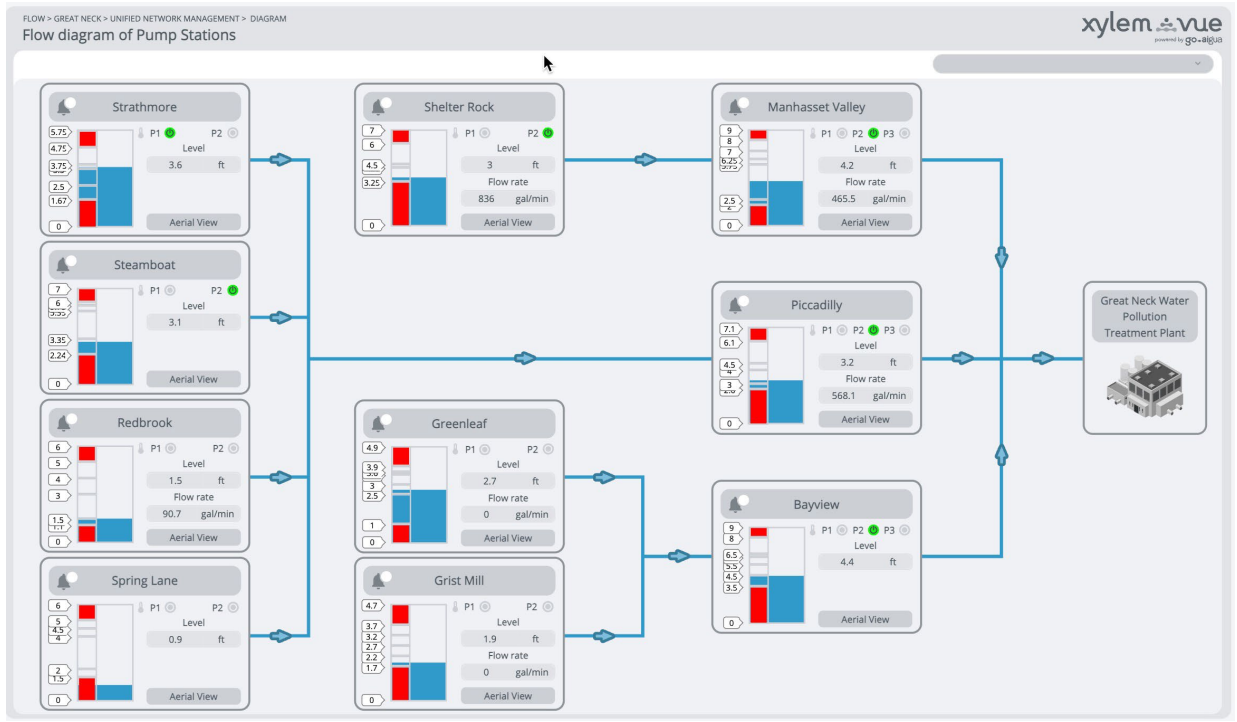
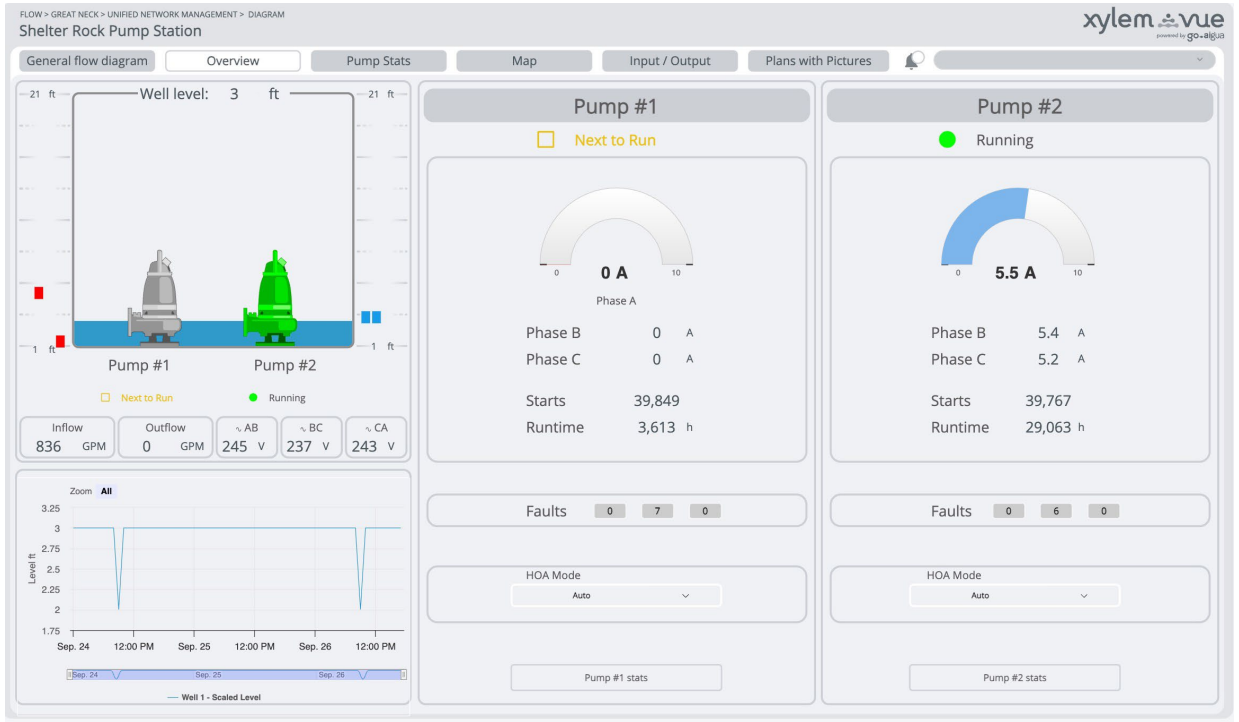
Access to all our Pumping Stations





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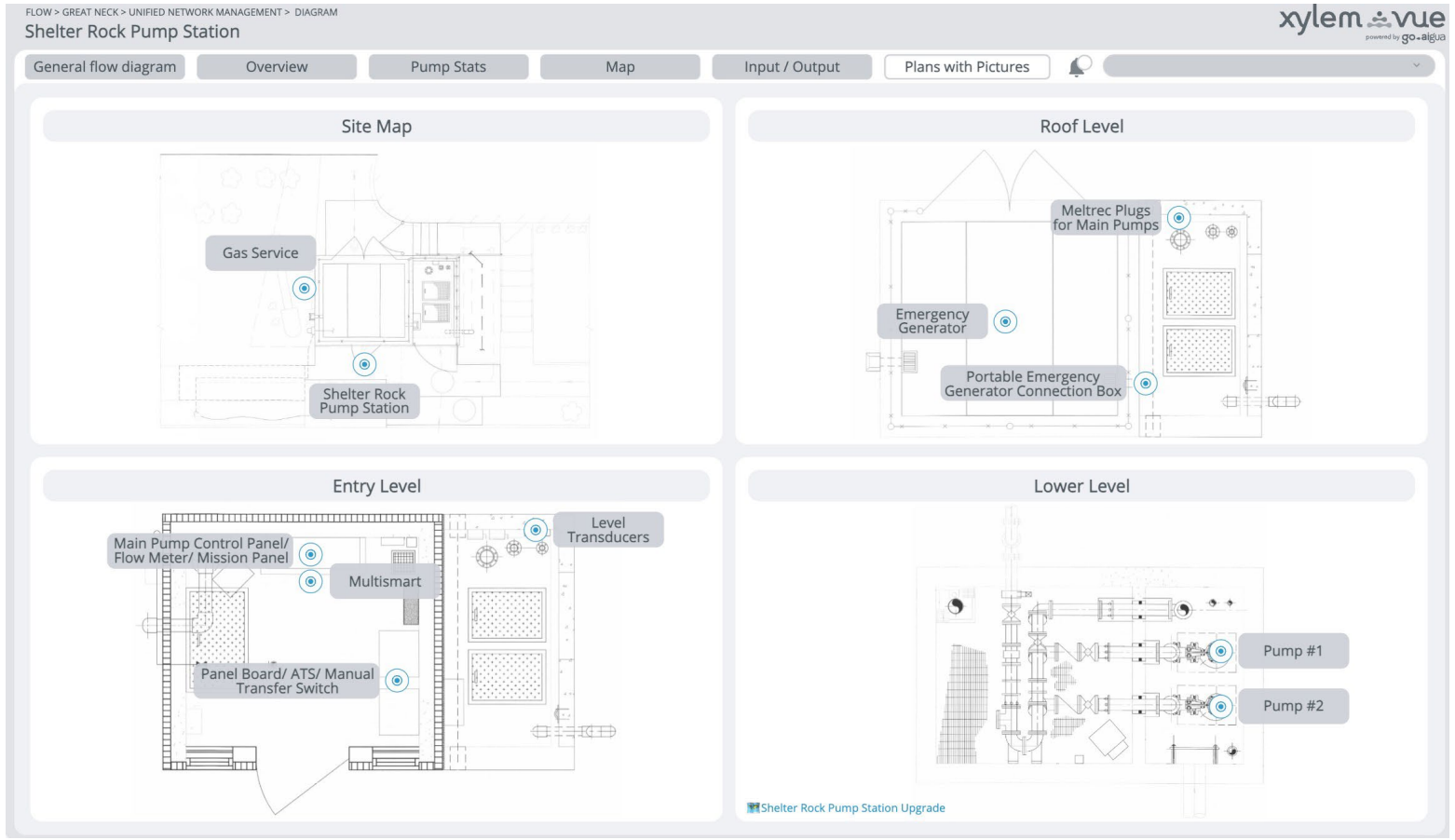
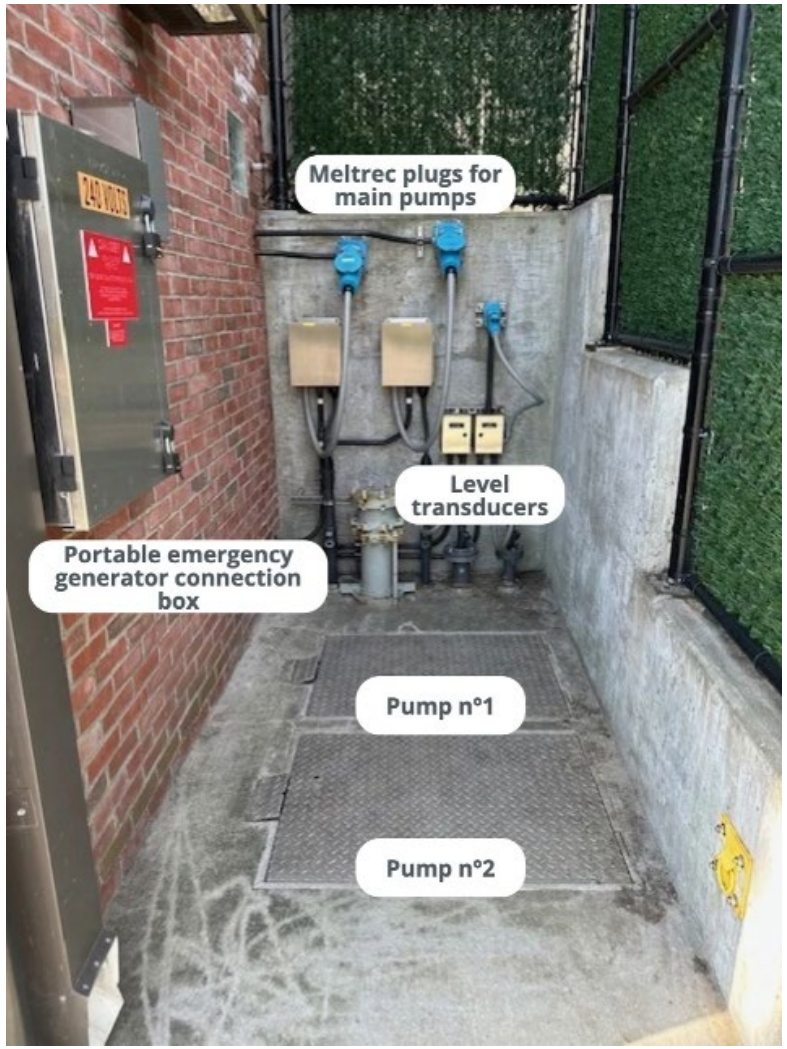
Incorporated CAD and Labeling for Ease of Identification





Analytics for the Future

We all have SO much data!!!

Tapping into that data will unleash all sorts of discoveries

We will be using Xylem Vue to perform analytics on our system

- Electrical Usage as Stations and Treatment Plant
- Demand Charge Reduction
- Flow Modeling
- Effects of Stormflows

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OPTIMIZE

Thank You

Christopher D. Murphy – Superintendent
Great Neck Water Pollution Control District
236 East Shore Road
Great Neck, NY 11023
(516) 482-0238

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Treat PFAS

Partner with Xylem for full lifecycle expertise, services & aftermarket support to treat water for residential, municipal, industrial, & commercial applications.

WEFTEC 2024

PFAS

New Rule & Xylem Solutions

Geoff Pellechia, PFAS Program Manager

Jeff Lopes, PFAS Technical Lead

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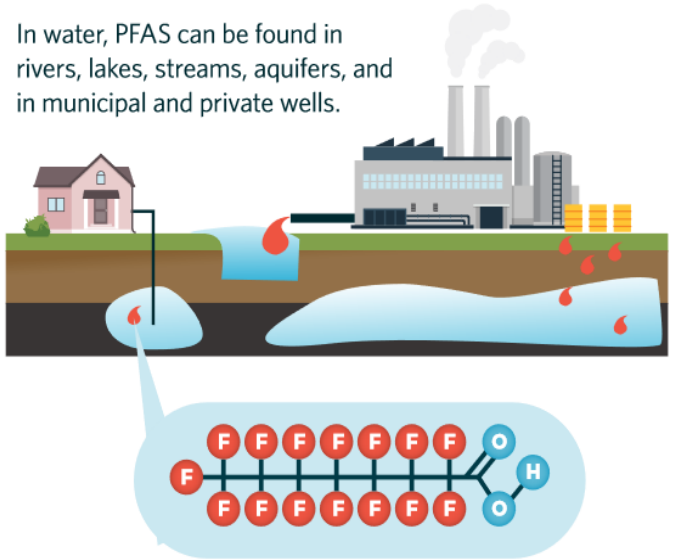
PFAS: New Rule & Xylem Solutions

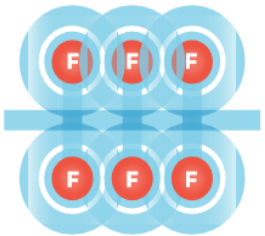
So what is PFAS?

TREAT

- Over 6,000 synthetic compounds used to make products resistant to stain, heat, oil, grease, & water
- In use since the 1940s (Teflon)
- USS Forrestal fire (1967) was triggering event for creation of PFAS firefighting foams; Navy revamped fire fighting practices
- Carbon-fluorine bond is one of the strongest in chemistry... very stable compounds and **Hard to Treat!**



The chemical bond of PFAS is so strong that it takes decades or longer to break down.



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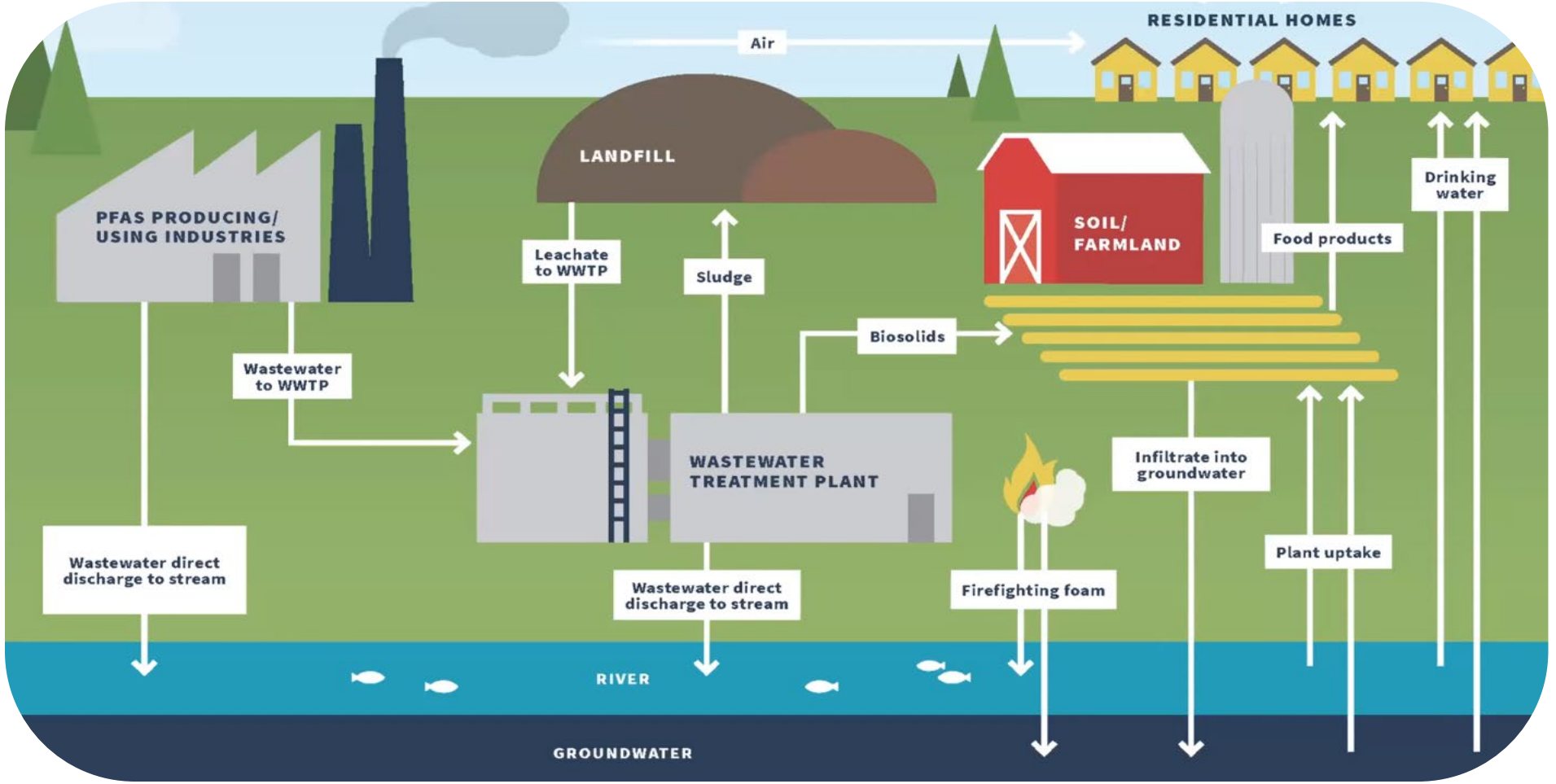
Sources of PFAS

TREAT



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Two Major Regulations Finalized in April 2024

TREAT

National Primary Drinking Water Regulation

- **MCLs** set **for six PFAS**
- Monitoring by 2027; compliance with MCLs by 2029
- **GAC, IX, RO/NF "Best Available Technologies"** for PFAS

CERCLA Hazardous Substance Designation for PFOA & PFOS

- Established **liability** for polluters, enables access to federal superfunds for **environmental remediation**
- EPA enforcement targets polluters, but tech providers, utilities, etc.… may be open to public lawsuits

Pending Global Regulatory Initiatives

- EU (2026), CA , UK, AU have pending PFAS drinking water regulations
- US EPA will regulate landfills, metals plating, organic chemicals industries through NPDES & studying many others, such as MicroE

PFAS	MCL	HBWC	Hazard Index
PFOA	4 ppt	N/A	
PFOS	4 ppt	N/A	
PFNA	10 ppt		If ≥ two present, divide level by HBWC and add. Total <1
PFHxS	10 ppt		
Gen-x	10 ppt		
PFBS	N/A	2000 ppt	

EPA estimates:

- **By 2027, 66,000 public drinking water utilities** must measure PFAS
- **By 2029, 4,000-6,500 utilities serving 100M people will need to reduce PFAS levels**

April 2024 final PFAS rule published, April 2027 initial monitoring deadline, April 2029 final compliance deadline

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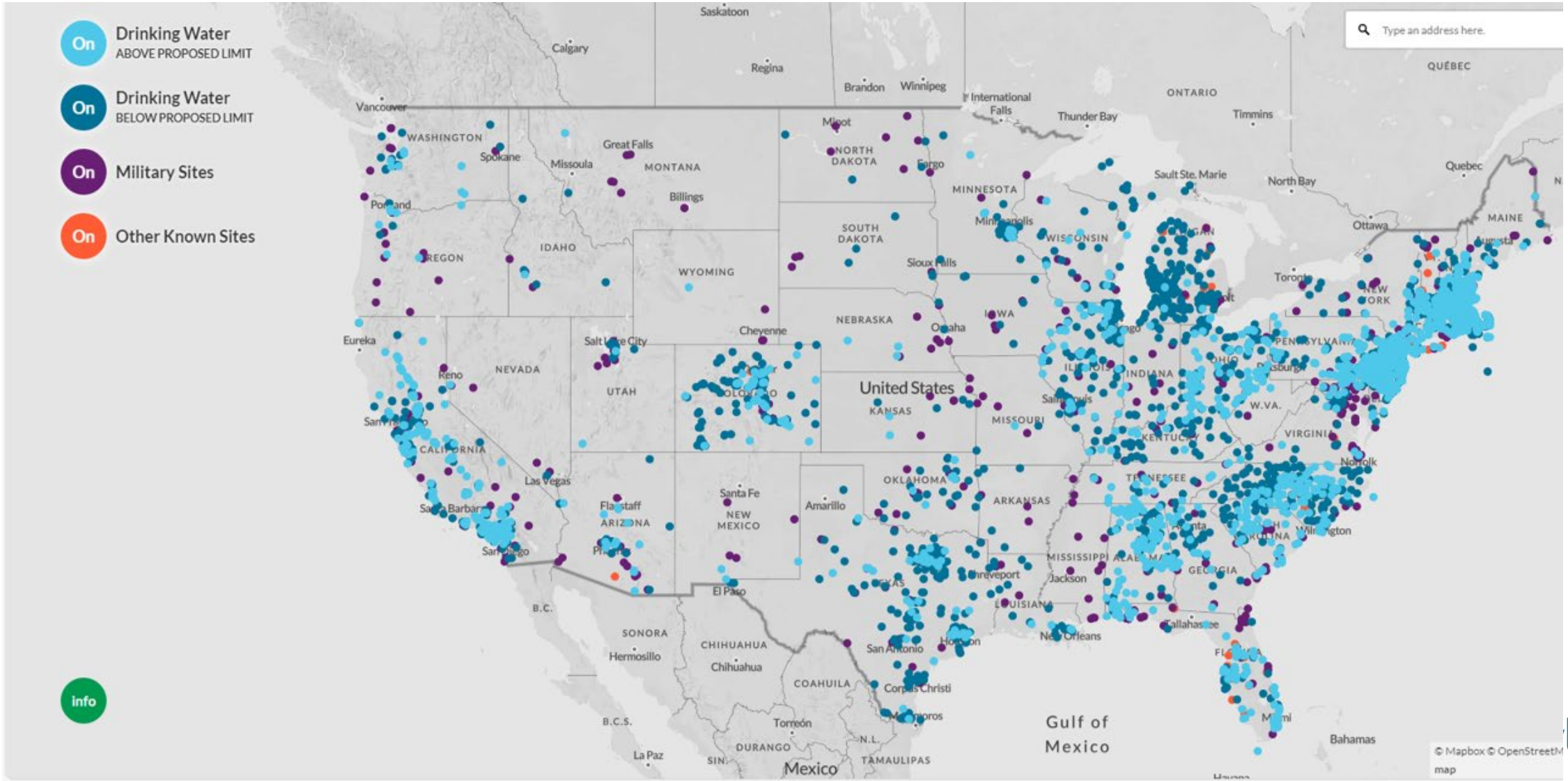
PFAS Contamination in the U.S.

TREAT



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State of Detection & Measurement

TREAT

- Current EPA analytical standards involve liquid chromatography and tandem mass spectroscopy; accurate for up to 40 PFAS compounds.
- They can detect concentrations in the low parts per trillion (ppt).
- They do not account for most of the over 9,000+ identified PFAS compounds.
- To compensate, the industry typically uses the Total Oxidizable Precursors Assay (TOPA).
- Precursor concentrations are estimated by evaluating amounts before and after.

EPA United States Environmental Protection Agency

Method 533: Determination of per- and polyfluoroalkyl substances in drinking water by **isotope dilution** anion exchange solid phase extraction and liquid chromatography/tandem mass spectrometry.

Method 537.1: Determination of selected per- and polyfluorinated alkyl substances in drinking water by **solid phase extraction** and liquid chromatography/tandem mass spectrometry (LC/MS/MS).

Method 1633: Analysis of per- and polyfluoroalkyl substances (PFAS) in **aqueous, solid, biosolids, and tissue** samples by LC-MS/MS.

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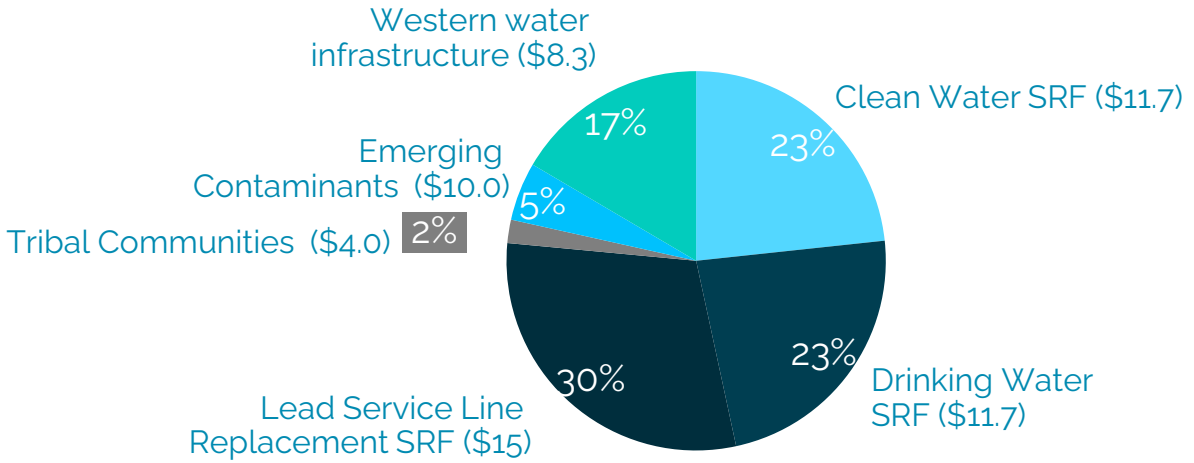
Infrastructure Investment and Jobs Act / Bipartisan Infrastructure Law

TREAT

- **$66B** for clean drinking water, generally dispersed over 5 years.
- Of this $66B, **$10B proposed for PFAS**/emerging contaminants funding:
  - $1B to address emerging contaminants in wastewater through the Clean Water State Revolving Fund
  - $4B to address PFAS in drinking water through the Drinking Water State Revolving Fund
  - $5B for small and disadvantaged communities to address emerging contaminants



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EPA issued first-ever national, legally enforceable PFAS drinking water standard

TREAT

EPA Key Facts

- EPA's first national drinking water standard for a contaminant since 1996
- Established maximum contaminant levels for five individual PFAS chemicals
- ~$1B in new funding to help communities address PFAS contamination
- Utilities have 3 years for monitoring compliance, 5 years to install technology

$10B allocated in Infrastructure Bill to PFAS remediation efforts

Xylem PFAS Treatment Capabilities

Granular Activated Carbon:
Selectively adsorb thousands of organic, certain inorganic materials

Ion Exchange Resins:
Remove or concentrate impurities across variety of applications

Membrane Systems Integrator:
Expertise in developing comprehensive filtration systems

Xylem has current installations with 80 utilities

Opportunities for Xylem

Services:
Utilities will require expertise for managing complex solutions

Equipment:
Utilities will need to upgrade infrastructure (e.g., membranes)

Innovation:
Exploring monitoring and destruction technologies

By 2029, ~6,000 utilities will need treatment and ~2,000 will need service[(a)]

Xylem capabilities (e.g., carbon, ion exchange) positioned to benefit from PFAS rules

Notes: (a) EPA estimates

PFAS: New Rule & Xylem Solutions

Technology Landscape

TREAT

	Separation / Concentration	Destruction / Sequestration	Detection / Monitoring
			
Considerations:	*PFAS are generally found in dilute concentrations. Volume reduction is key to **cost-effective** treatment.*	*Viable destruction technologies exist. **Regulations** on byproducts, maturity, and cost drive selection.*	*Low concentrations of regulated PFAS approach detection limits of existing **technologies**.*
Currently Accepted:	**Sorbents / Membranes:** • Granular Activated Carbon (GAC) • Ion Exchange Resins (IX) • Nanofiltration (NF) • Reverse Osmosis (RO)	**Thermal:** • Incineration • Reactivation **Sequestration:** • Deep Well Injection (DWI) • Landfilling	**Analytical**: • Liquid Chromatography / Tandem Mass Spectrometry (LC/MS/MS)
Gaining Acceptance:	**Sorbents:** • Novel Sorbents • Regenerable Media	**Destruction:** • Electrochemical Oxidation (EOX) • Plasma • Supercritical Water Oxidation (SCWO)	**Analytical**: • Combustion Ion Chromatography (CIC) • Nuclear Magnetic Resonance (NMR)
Viability Uncertain:	**Other Separations:** • Foam Fractionation (FF) • Electrodialysis (ED) • Catalytic media • Others	**Destruction:** • Advanced Reductive Processes • Biological Processes **Sequestration:** • Encapsulation	**Real-time Sensing**: • Molecularly Imprinted Polymers (MIP) • Metal Organic Frameworks (MOF) • Enzyme Linked Immunosorbent Assays (ELISA)

The above encompasses the critical technology landscape as understood today.

PFAS: New Rule & Xylem Solutions

Xylem Treatment Solutions & Services

TREAT

- Xylem is a global, stable company with world class PFAS experts and almost a decade of PFAS experience
- 80+ real world installations
- We offer all EPA Best Available Technology & supporting services to remove PFAS from drinking water
- We are continually investing in internal R&D & establishing innovation partnerships for emerging PFAS technologies to address the full PFAS lifecycle and lower cost/liability for customers
- Dedicated PFAS team collaborating across the company to drive the growth of our drinking water business to benefit our customers

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Questions?

Geoff Pellechia, PFAS Program Manager

Jeff Lopes, PFAS Technical Lead

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TREAT

Thank You

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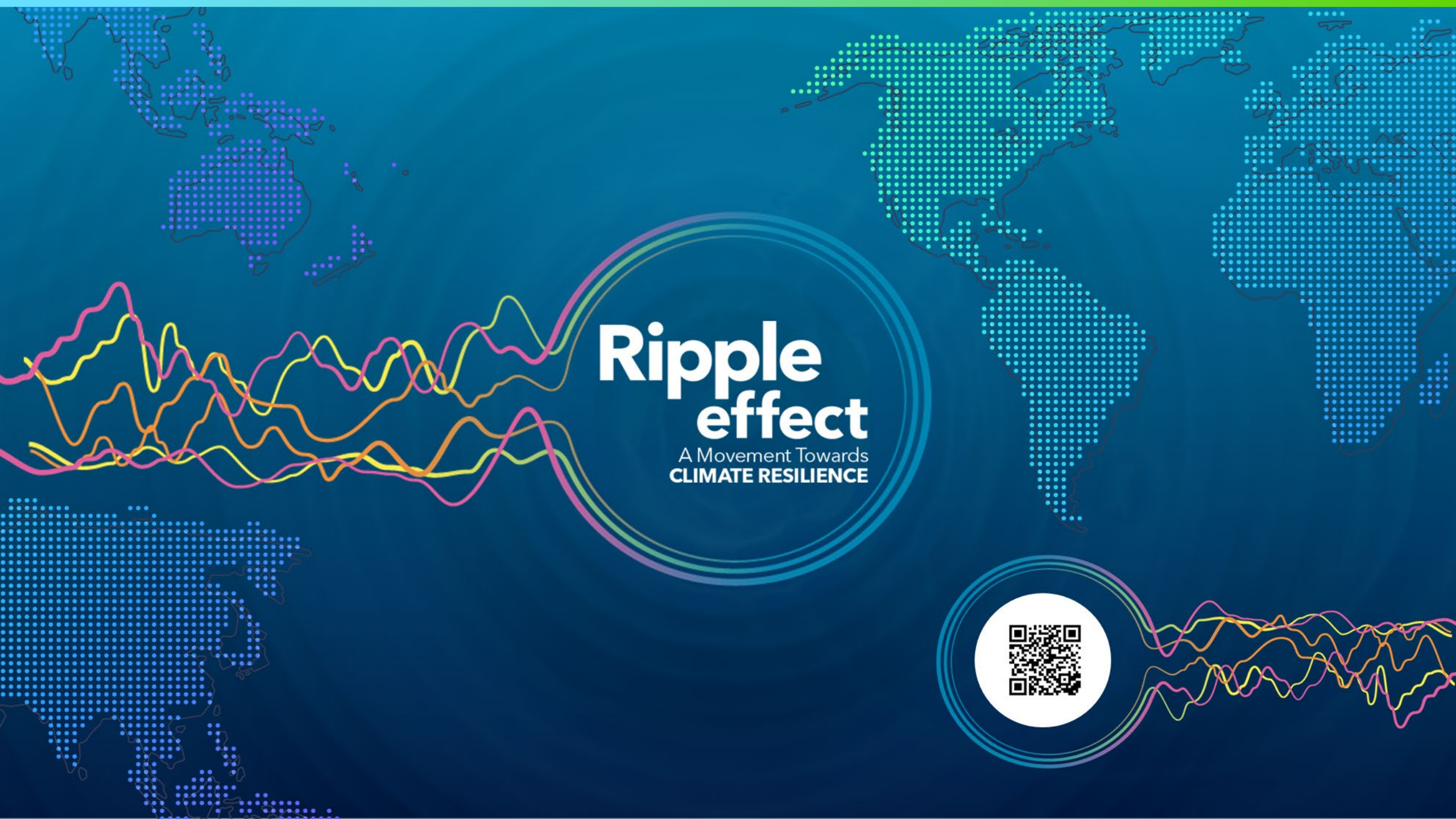
Ripple
effect
A Movement Towards
CLIMATE RESILIENCE

Michele Samuels
Strategic Accounts Manager
Xylem

William Fernandes
Director, Water Treatment and Supply
City of Toronto

George Hawkins
Founder and CEO
Moonshot Missions

Ripple effect
A Movement Towards
CLIMATE RESILIENCE

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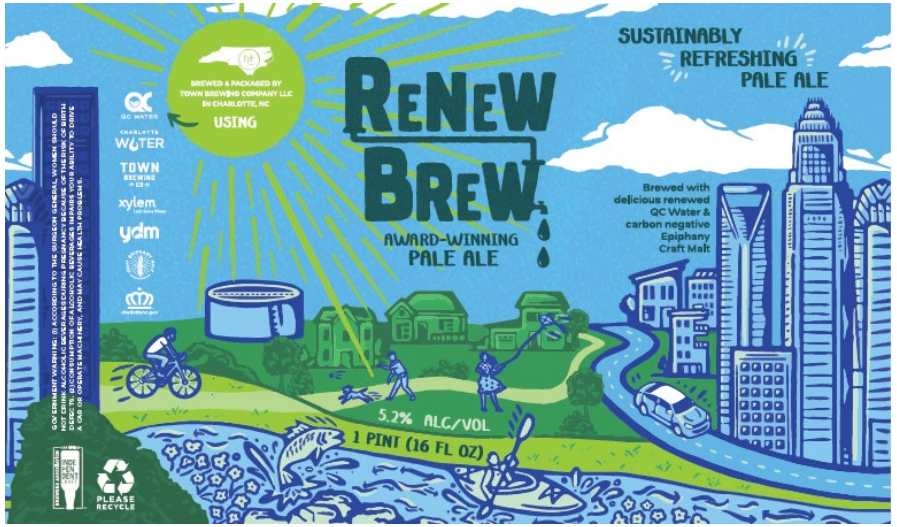
Treat

Partner with Xylem for full lifecycle expertise, services & aftermarket support to treat water for residential, municipal, industrial, & commercial applications.

WEFTEC 2024

Renew Brew: Partnering for a Sustainable Future

October 7, 2024



The Renew Brew Story

TREAT

“In an industry where the majority of our product is water; and knowing the large amount of it that it takes to make a single pint of beer, it is vastly important to be a part of any sustainability effort that we can. Especially an ingredient as important to us as water. Classic beer styles from around the world sprung up because of the water that was available to us brewers. We are lucky to have incredible water for brewing here in Charlotte."

- Federico De La Torre, Head Brewer at Town Brewing

The Partnership

QC Water Production

Renew Brew

Accolades

Next Steps

Q & A

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We have 3 presenters to introduce from the Renew Brew project

Angela Charles

Charlotte Water Director

Chris Thomson

Director, Drinking Water Utilities Marketing

Xylem Americas

Brandon Stirewalt

Director of Operations, Town Brewing

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- Department of the City of Charlotte, NC and governed by the City of Charlotte Council
- Largest water and wastewater service provider in the Carolinas, distributing more than 116 MGD of drinking water to 1.1M customers
- Treats more than 31 billion gallons of wastewater annually
- Service area is generally bounded by the Mecklenburg County border, with some municipal customers outside the county
- Has more than 9,000 miles of distribution and collection system piping

- $8.1B global leader in advanced technologies, solutions and services that address the world's biggest water challenges
- ~150 countries where Xylem solutions solve water
- 4,300+ patents and trademarks
- 100+ years of innovation and leadership with leading brands
- >23,000 colleagues with diverse water expertise
- Enable our customers to dramatically improve the way water and wastewater is used, managed, conserved, re-used and returned to nature

- Opened in the Wesley Heights neighborhood in 2018
- Homebrewers Allen West, George Sistrunk, Mark Kutny, and Richard Morton moved brewing out of their home garages, and rehabbed a commercial auto garage
- Major distribution expansion into multiple markets, now available statewide in North Carolina and upper South Carolina
- The taproom's grand 24-tap system sports small batch brews along with flagships and seasonals. Pints and bites from the taproom & kitchen are available 7 days a week

- Charlotte based marketing agency, opened in 2011
- Award-winning full-service niche marketing agency
- Provides customers a variety of integrated marketing services: research and consulting, web development / web project management, brand creation and positioning, advertising, public relations, interactive digital marketing and social media
- Community focused through active partnerships with nonprofits, local associations, and churches

It took strong local partnerships to make it happen

Charlotte Water provided the source water from the McDowell Creek WWTP in Huntersville & tested the water for quality

Xylem provided the post-plant polishing treatment equipment and oversaw the additional treatment operations to create QC Water (Charlotte Water's branded recycled water product)

Town Brewing in Charlotte, NC turned the QC Water into Renew Brew at their local facility

Yellow Duck Marketing provided all QC Water and Renew Brew Project brand naming, design, marketing materials, and strategic communications

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Charlotte Water and Xylem have worked across the utility's 6 strategic priorities including Environmental Stewardship and Community Engagement

High Performing Workforce

- Values of diversity, equity and inclusion, in addition to a safety-first and continuous development culture
- Training for products and solutions

Responsive Customer Service

- Responding to an RFP for advanced metering infrastructure (Sensus)
- Dewatering/ emergency pumping (Godwin)

Community Engagement

Renew Brew demonstration project

- Local events and volunteerism

Reliable Infrastructure

- Submersible wastewater pumps (Flygt)
- Centrifugal water pumps (Goulds)
- Chain and scrapers (Evoqua)
- Valve assessment (Wachs)

Financial Viability

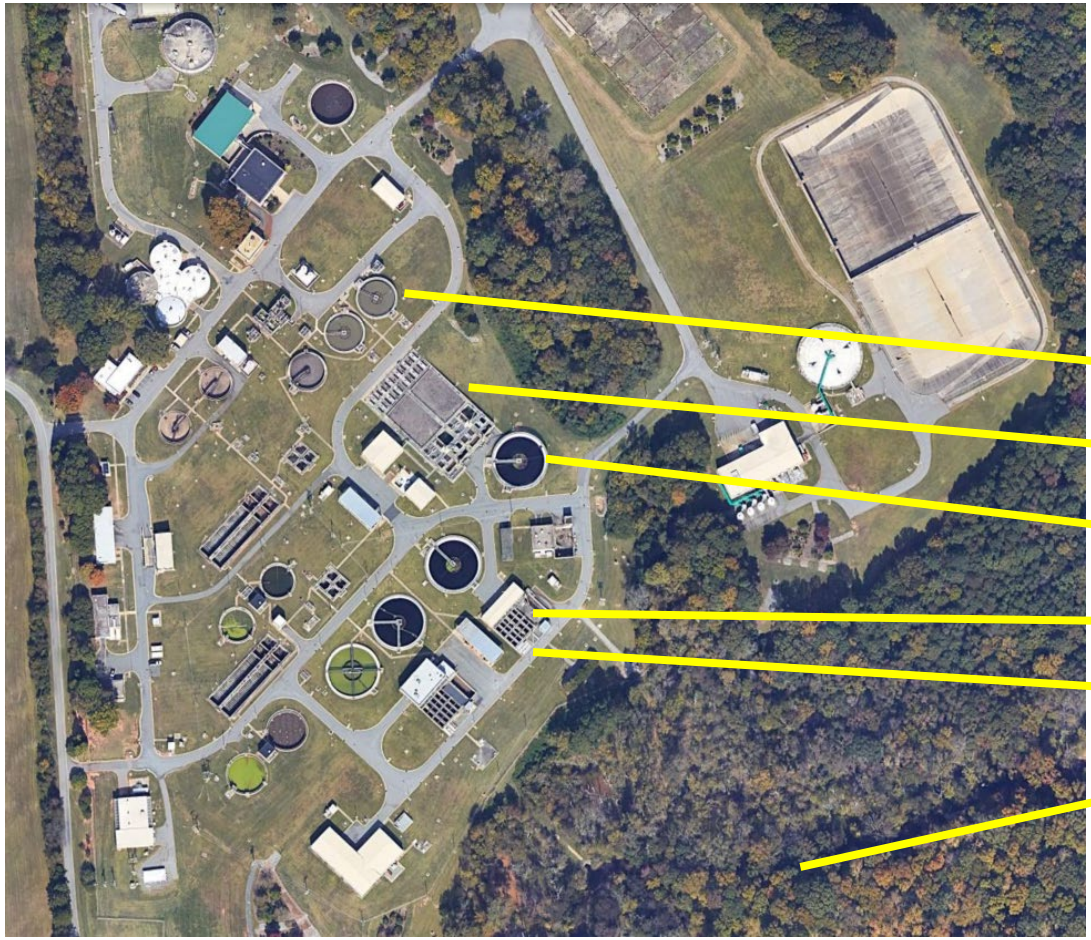
- High ROI for pipeline condition assessments (Pure)
- Eligibility for grants and favorable funding mechanisms e.g., IIJA, SRF

Environmental Stewardship

Renew Brew demonstration project

- Analyzers and sensors (YSI)
- Odor and corrosion control and Ostara (Evoqua)
- Filters (Leopold)
- Biological treatment (Sanitaire)
- UV and Ozone (Wedeco)

QC Water production began at the McDowell Creek WWTP where we received the high-quality effluent from Charlotte Water



- Permitted for 12 MGD; averages 5.7 MGD

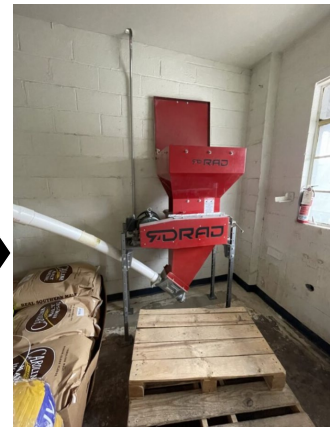
- Treatment Steps
  - Primary Clarification
  - Secondary / Biological Treatment
  - Secondary Clarification
  - Tertiary Sand Filtration
  - UV Disinfection
  - Outfall to McDowell Creek

Xylem provided the technology and treatment process steps to make the reuse water available for brewing

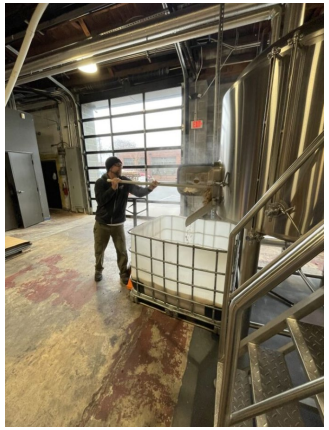
Town took it from renew to brew and made a delicious pale ale

QC Water

Epiphany Malt

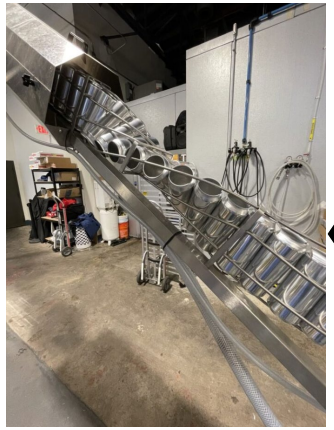


Brewing



Brewing

Fermentation



Canning

Renew Brew

xylem

Renew Brew has received overwhelmingly positive recognition and accolades during the initial demonstration phase

Best in show award at the 2024 Queen's City Brewer's Festival

Abstracts accepted for WEFTEC (Xylem booth), NC One Water and NC Craft Brewers Conference this year

Outstanding coverage (100 pieces, 8.8M views, 3.6B audience reach, 2k engagements and over 1k social shares)*, with much thanks to Yellow Duck

*Statistics as of 9/21/24

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TREAT

What’s Next in Our Sustainably Journey?

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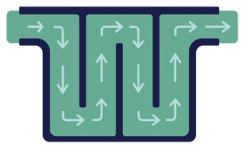
WATER THAT SPEAKS VOLUMES

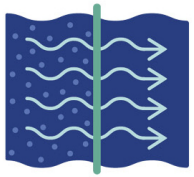
TREAT



1 STANDARD WASTEWATER TREATMENT PROCESS AT MCDOWELL CREEK WATER RESOURCE RECOVERY FACILITY

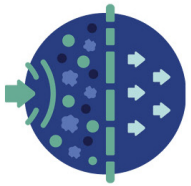
Water leaving Charlotte's McDowell Creek facility meets high national standards before returning to the Catawba River. Charlotte Water processes 85 million gallons daily.

For QC Water's smaller batches, the following additional purification steps are implemented:



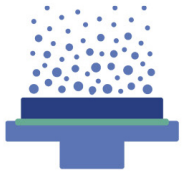
2 CARBON FILTRATION

Water is filtered through activated carbon media to reduce both solids and organic contaminants. This treatment is commonly used for beverage ingredient water.



3 REVERSE OSMOSIS

Membranes remove salt, organics, trace pollutants and remaining pathogens. This treatment, too, is used by premium water bottling companies.

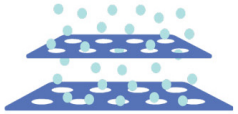


4 OZONE OXIDATION

Oxidants are produced on-site and on-demand, then transferred to the water being treated to kill pathogens and destroy trace pollutants.

5 ULTRAVIOLET DISINFECTION

UV light is used to disinfect and remove 99.9999% of viruses and pathogens from the water and irradiate other contaminants.



6 ANOTHER CARBON FILTERING ROUND

Water is filtered a second time through activated carbon media.

7 WATER TESTING & APPROVAL

Water moves through rigorous testing to ensure it exceeds highest water quality standards for human consumption as set by the Environmental Protection Agency (EPA).

8 BREW TIME

Approved QC Water is delivered to brewers for the brewing process, including mashing, lautering, boiling, chilling, fermentation, testing and packaging for consumption.

Thank You!

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