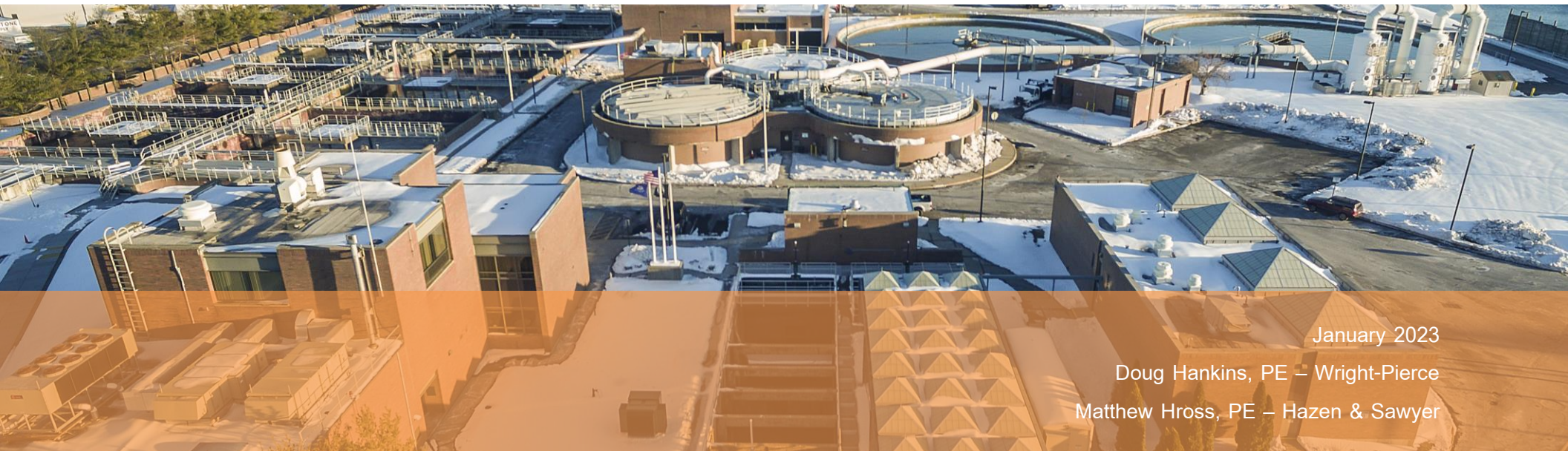


# Force main break during construction adds complexity to difficult project

Stamford, CT WPCF



January 2023

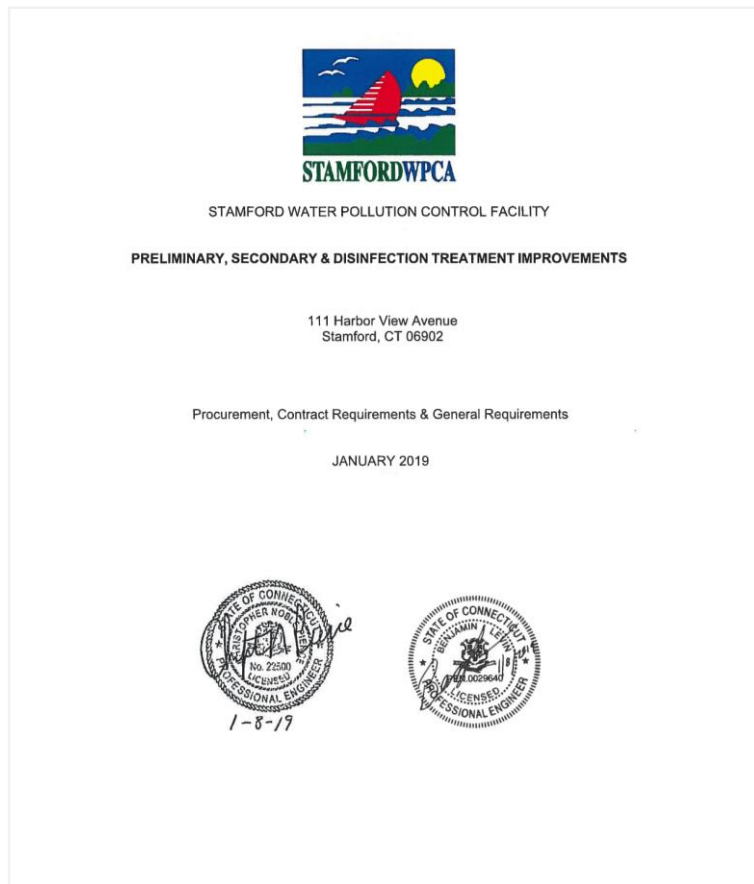
Doug Hankins, PE – Wright-Pierce  
Matthew Hross, PE – Hazen & Sawyer

## Project background

### Stamford WPCA - RFQs

Title	Award
Upgrade Raw Sewage Pump Station, Screening, Septage Receiving	Wright-Pierce
Improve Flow Distribution to Secondary Clarifiers	Hazen & Sawyer
Replace Aeration Blowers/Upgrade D.O. Control	Wright-Pierce
Primary Sludge Degritting Improvements	Gannett Fleming
Upgrade SCADA System	Arcadis
Effluent Pump Station Improvements	Hazen & Sawyer
UV Disinfection Improvements	Hazen & Sawyer

## Project background



Studies/designs proceeded separately

WPCA combined projects for bidding

- Economy of scale
- Single contractor

Separate funding sources

- Three bid forms
- Three Schedules of Values
- Common front end but separate technical specs and drawings
- Three Payment Requisitions

## Preliminary treatment improvements



### Upgrade raw sewage pumps/piping/valves

- Five 250-hp pumps

### Upgrade mechanical screens

- Reduced bar spacing to 3/8-inch
- Screenings grinder and washpress

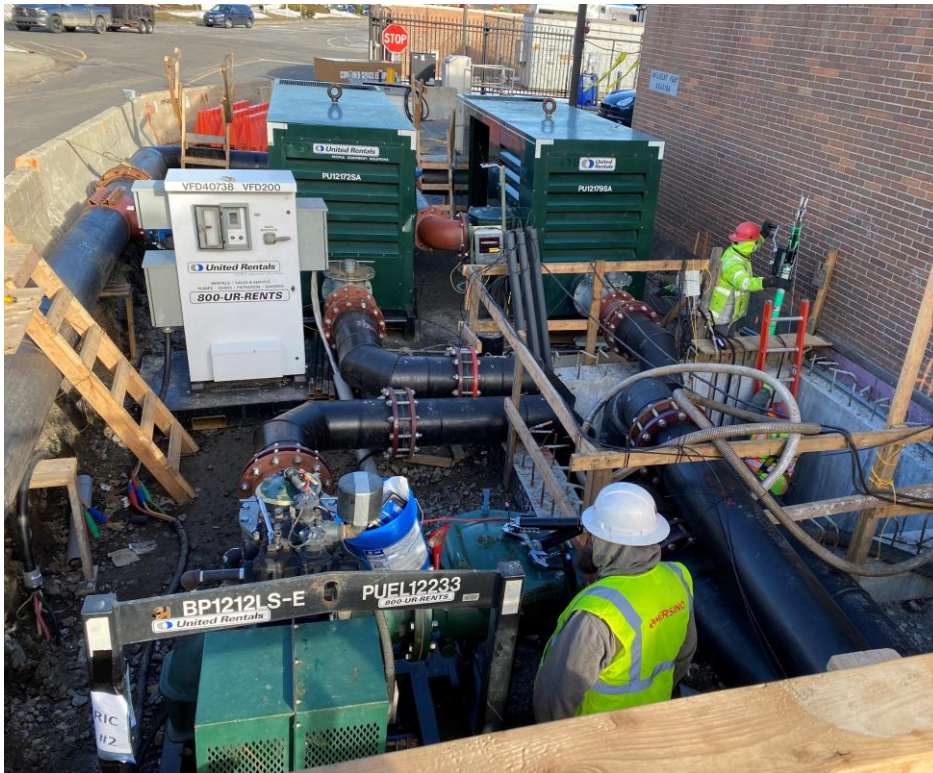
### Odor control improvements

### Septage receiving improvements

### Replacement of air release valve on force main



## Preliminary treatment improvements



### Bypass System @ 36 MGD

- Triple 18-inch HDPE Force Mains
- Six bypass pumps
- Excavated to meet suction lift

### 3 Existing Pumps @ 32 MGD

- 42-inch force main

## Seemed like a great plan until . . .

Initial leak at air release structure



Longitudinal crack in 42-inch pipe





# Installed additional bypass system

Dual 24-inch Force Mains

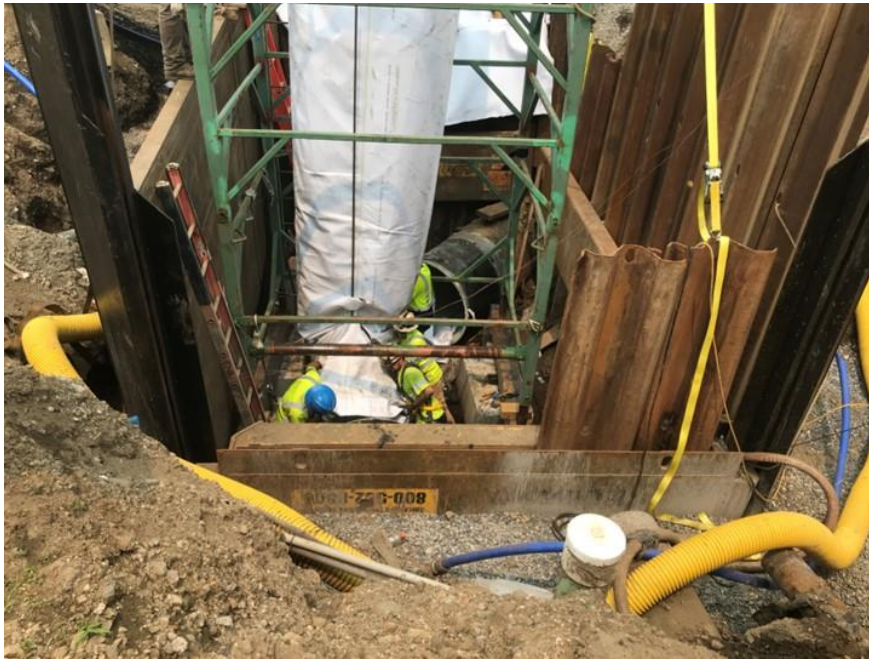


18-inch & 24-inch Force Mains



# CIPP lining

Inserting liner



Pressure testing liner

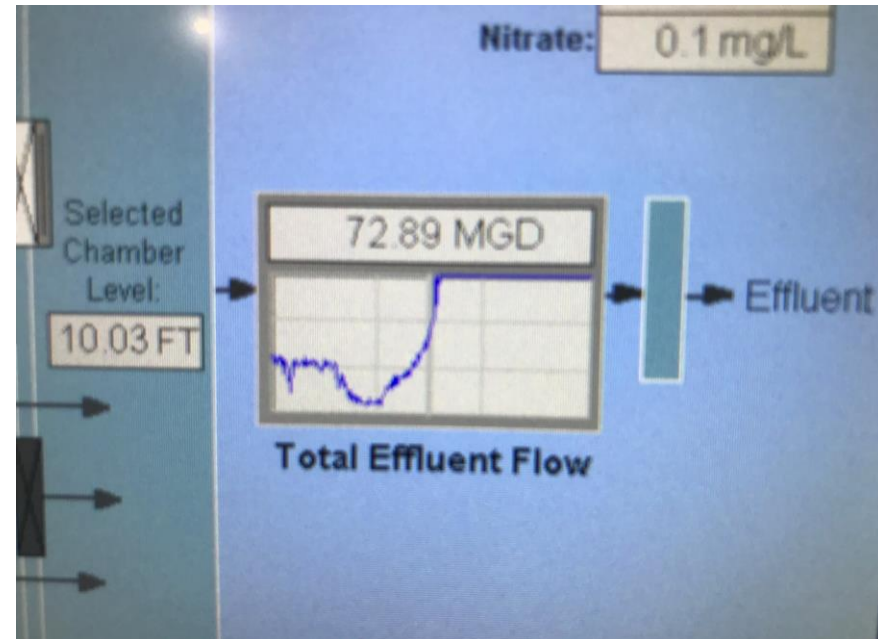




## Preliminary treatment improvements



*Flooding around WPCF*



### Hurricane Ida – September 2nd, 2022

- Worked around clock to get 42-inch force main back into service
- 8 inches of rain in short duration
- Pumped and maintained 72+ MGD

## Stamford WPCF nitrogen removal



Google Earth

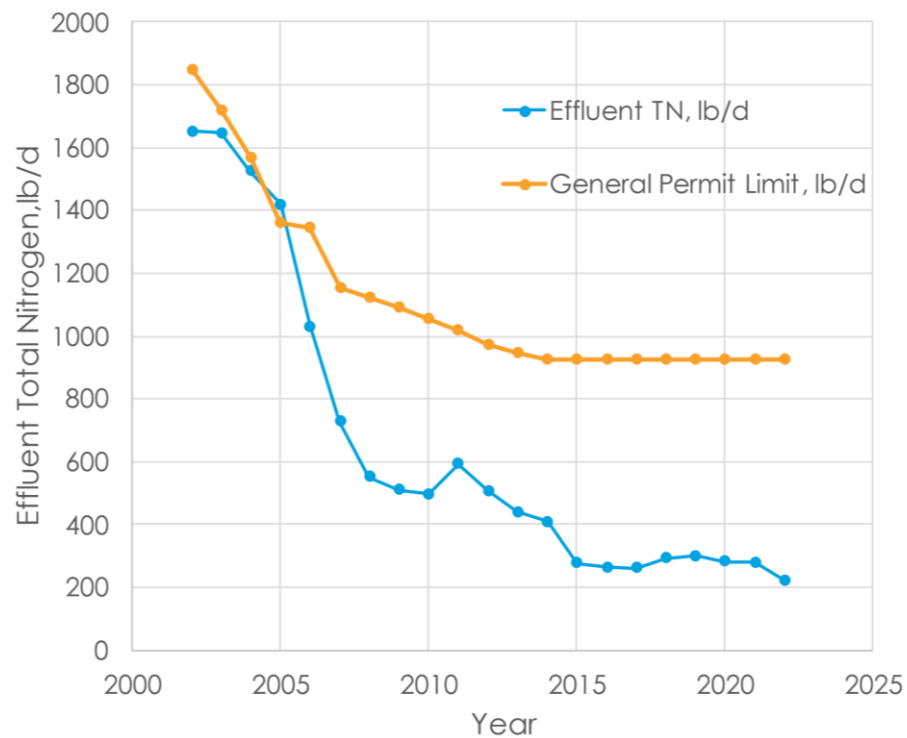
### 2004 BNR upgrade

- Increased aeration tank volume
- Four-stage nitrogen removal
- Fourth secondary clarifier
- Methanol storage and feed system

### 2016 Upgrade Goals

- Replace existing blowers
- Improve energy efficiency
- Improved D.O. control system

## Stamford WPCF nitrogen removal



### Nitrogen Removal Performance

#### Excellent Performance

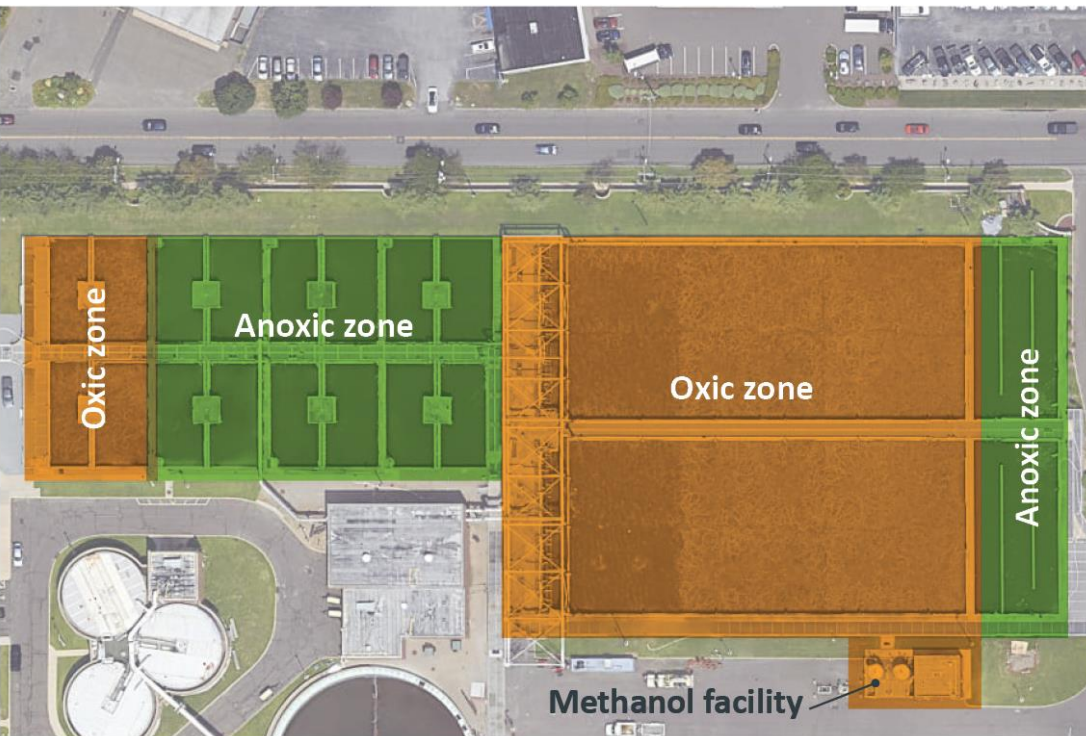
- General Permit Limit = 926 lb/d (2014)

#### At what cost?

- Generated significant credits
- Significant credit income
  - \$900,000/year (2006 to 2017)
  - Fewer buyers in 2021 - \$273,000
- Significant operational cost
  - Aeration/blowers
  - Supplemental Carbon



## Operational issues



Google Earth

### Small Initial Anoxic Zone

- Ineffective BOD use
- Not maximizing TN removal potential

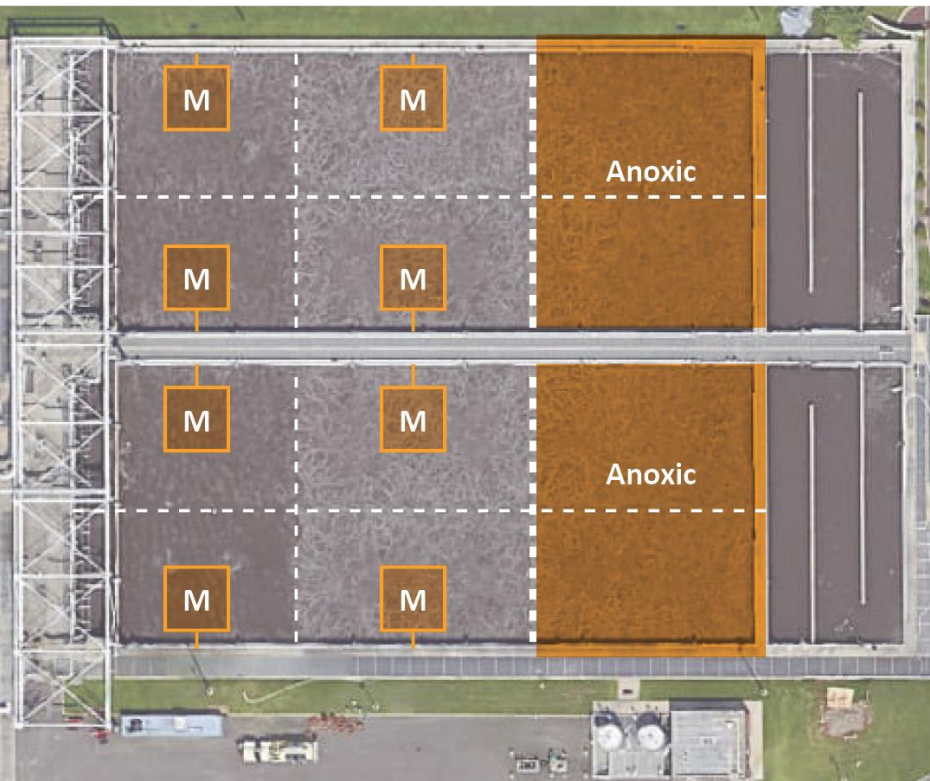
### Large oxic zones

- Excessive DO levels
- Mixing limited conditions encountered
- Limited DO control/balancing

### Post anoxic zones

- High levels of methanol required

## Process modifications



Google Earth

### Convert first oxidic zone to anoxic/swing

- Modify baffle wall (still submerged)
- Additional mixing (adaptive mixers)

### Minimize mixing limitation in last oxidic zone

- Smaller surface area for aeration/mixing
- Reduced D.O. levels, especially at night
- Minimized D.O. in nitrate recycle

### Modeling results

- 30% to 40% reduction in air flow requirements
- Significant reduction in methanol usage
- 10% to 15% reduction in waste sludge

## Aeration system upgrade



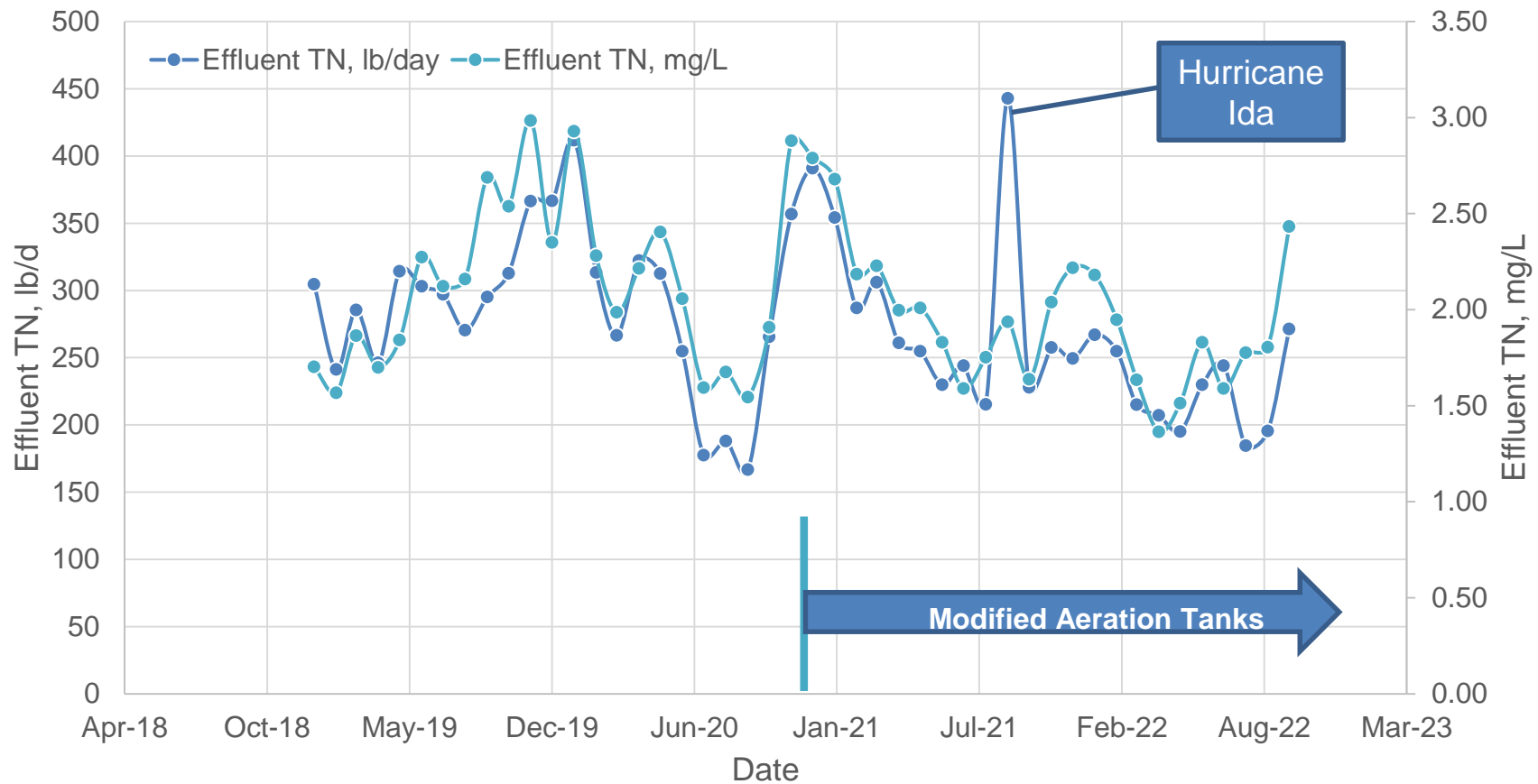
### Integrally-gear blowers

- Three blowers at 400-hp each
- Space for fourth blower
- Dual vane control

Automated control valve, D.O. probe, air flow meter at each air drop zone

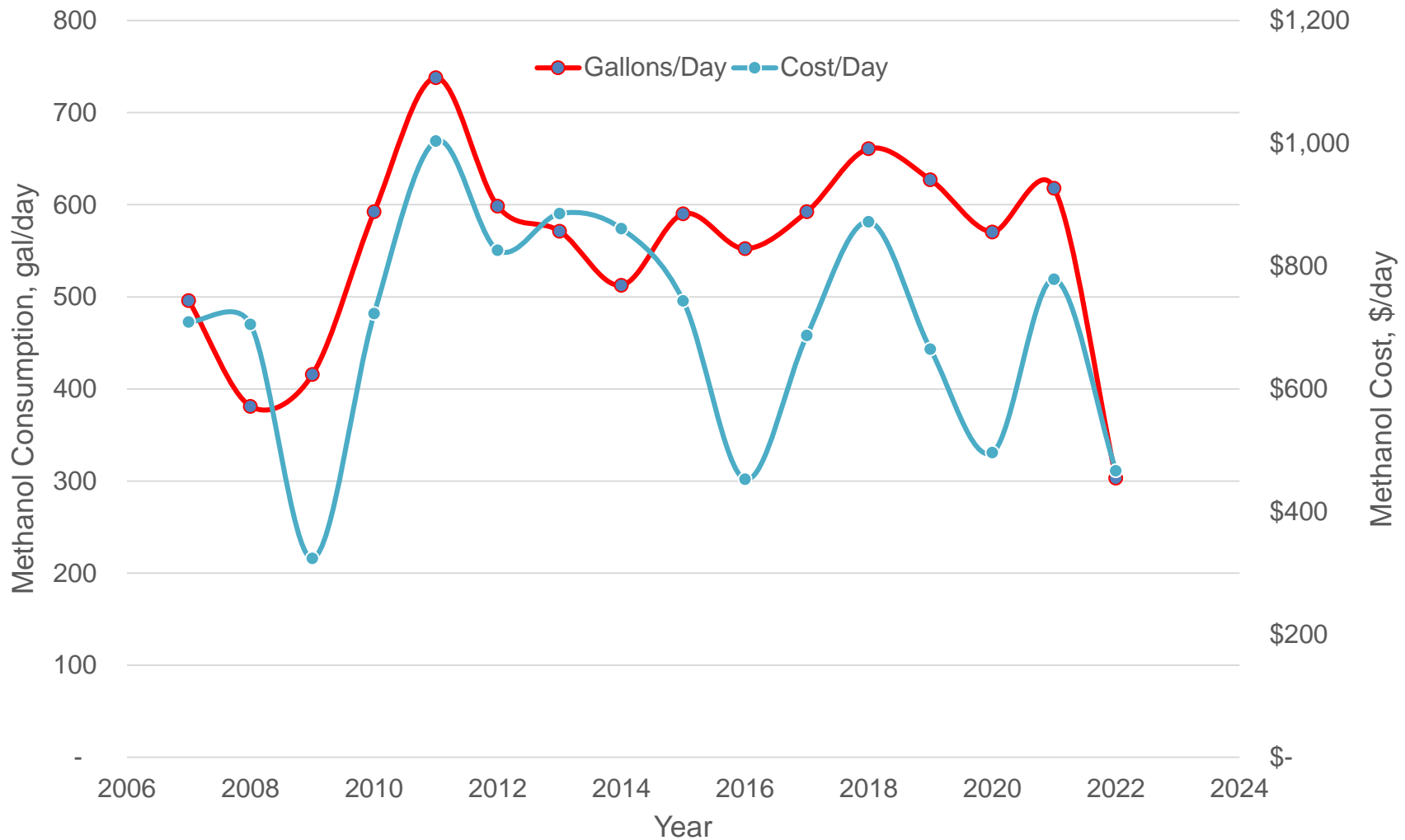


## Nitrogen removal performance

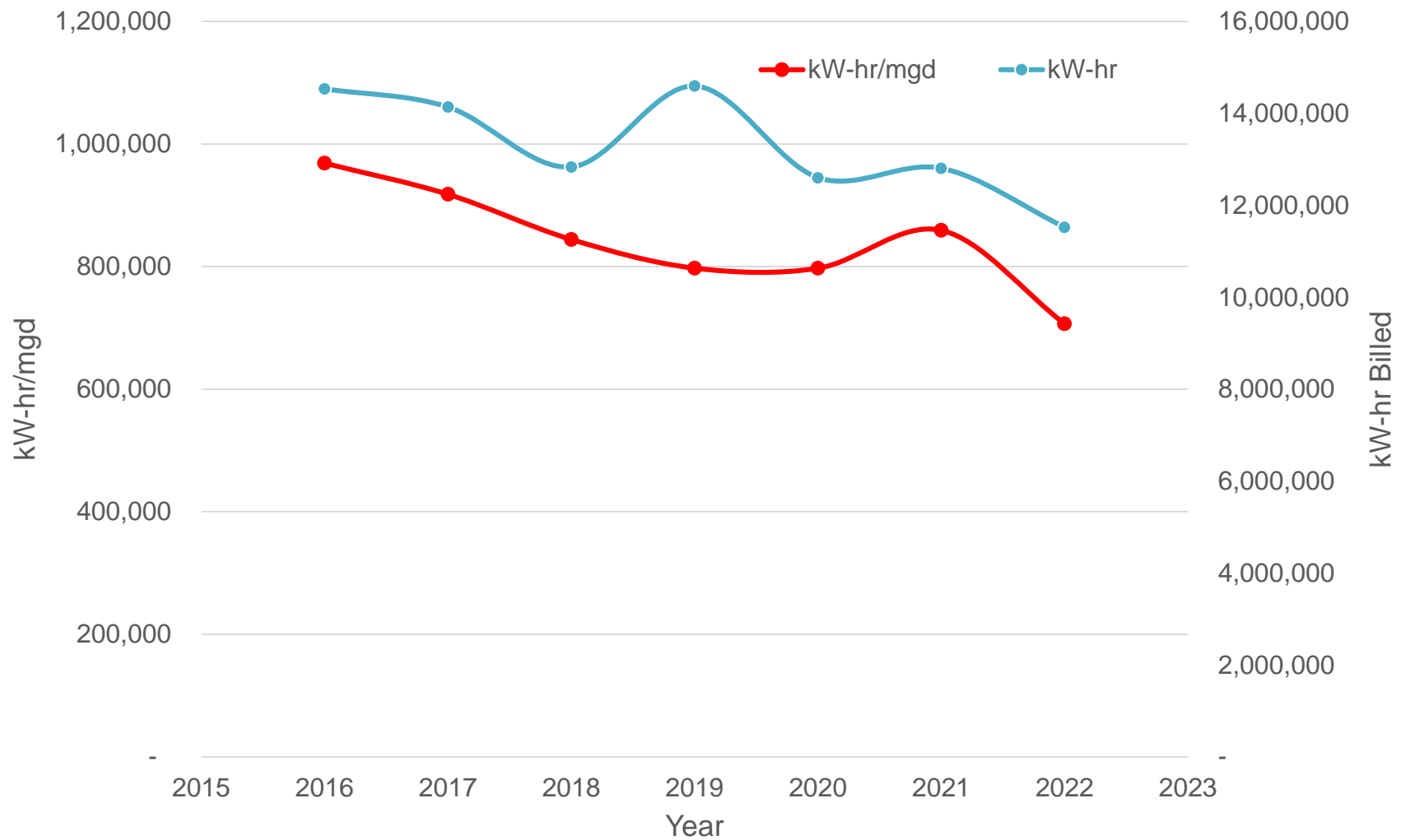


- Avg Effluent TN = 273 lb/d (2019 – present)
- Avg Effluent TN = 2.0 mg/L (2019 - present)

## Methanol consumption



## Power usage – fiscal year





## UV disinfection improvement drivers

Aging equipment

Algae impacts

Occasional lamp shutdowns due to low water levels

Inadequate disinfection redundancy

More-stringent bacteriological limits (i.e., Enterococcus)

Solution: replace and expand the existing UV disinfection system



## NPDES permit limits

Parameter	Sampling Frequency	Sampling Type	Limit	Notes
<b>Bacteriological Limits</b>				
Fecal coliform	3 / week	Grab	88 cfu / 100 mL	Monthly geometric mean
Fecal coliform	3 / week	Grab	< 10%	Percent of samples per month with > 260 cfu / 100 mL
Fecal coliform	3 / week	Grab	2,400 cfu / 100 mL	Maximum
Enterococcus	3 / week	Grab	35 cfu / 100 mL	Monthly geometric mean
Enterococcus	3 / week	Grab	500 cfu / 100 mL	Maximum
<b>UV-Specific Limits</b>				
UV Dose	Continuous	N/A	$\geq 30 \text{ mW-sec / cm}^2$	Minimum
UV Transmittance	Work day	Grab	N/A (%)	Monitoring only

## Selected alternative

Design Parameter/Characteristic	Value
Lamp Orientation	Horizontal
Water Depth at Upstream Lamp Bank (in)	35.16
Input Power per Lamp (W)	240
Lifting Device	External bridge crane
Wiper Drive Type	Hydraulic
Lamp Sleeve Cleaning	Mechanical & chemical
Number of Channels	3
UV Lamp Banks per Channel	3 (2 Duty, 1 Standby)
Total No. of UV Lamps	936
Total Power (kW)	236
Guaranteed Power at 24 mgd and 67% UVT (kW)	46
UV Dose at Design Conditions (mJ/cm <sup>2</sup> )	36.9
Head loss at Peak Flow (in)	4.48
Minimum Weir Length per UV Channel (in)	81.00

MAYOR  
DAVID R. MARTIN



CITY OF STAMFORD  
OFFICE OF ADMINISTRATION  
888 WASHINGTON BOULEVARD  
STAMFORD, CT 06904-2152

PURCHASING AGENT  
ERIK J. LARSON  
Phone: (203) 977-4107  
Fax: (203) 977-4393  
Email: [elanson@stamfordct.gov](mailto:elanson@stamfordct.gov)

### REQUEST FOR PROPOSALS No. 732

#### ULTRA-VIOLET DISINFECTION SYSTEM FOR STAMFORD WATER POLLUTION CONTROL AUTHORITY

**PROPOSALS DUE:** FEBRUARY 7, 2018 @ 4:00 P.M.

**SUBMIT TO:** CITY OF STAMFORD  
888 WASHINGTON BOULEVARD  
STAMFORD, CT 06904-2152

**ATTENTION:** ERIK J. LARSON  
AT (203) 977-4107 OR  
[elanson@stamfordct.gov](mailto:elanson@stamfordct.gov)

**RFP BOND:** 5%

**NUMBER OF COPIES REQUIRED:**  
ONE ORIGINAL AND TWELVE (12)  
COPIES, ALONG WITH TWO (2)  
ELECTRONIC VERSIONS (USB  
DRIVE)

**NOTE THE FOLLOWING:** ALL PROPOSAL SPECIFICATIONS AND DOCUMENTS CAN BE PICKED UP DIRECTLY FROM COUNTY REPRODUCTIONS, INC., LOCATED AT 39 BELDEN STREET, STAMFORD, CT 06902. TELEPHONE (203) 348-3758. A NON-REFUNDABLE FEE WILL BE CHARGED FOR THESE DOCUMENTS.

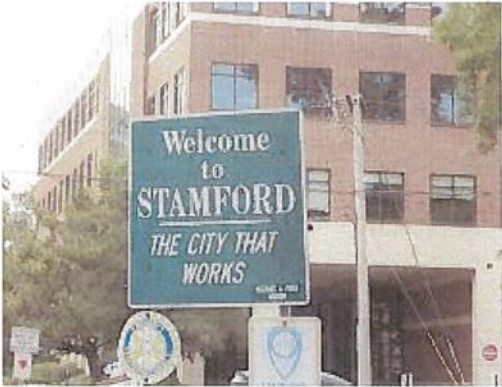
Date Issued: 1/9/2018  
(REV: 09-01-17)



# Project schedule

**TROJAN UV**  
WATER CONFIDENCE™


**CITY OF STAMFORD, CONNECTICUT**  
**STAMFORD WATER POLLUTION CONTROL AUTHORITY**  
UV DISINFECTION SYSTEM UPGRADE AND REPLACEMENT  
ULTRAVIOLET DISINFECTION EQUIPMENT  
**REQUEST FOR PROPOSAL No. 732**



**SUBMITTED BY TROJAN TECHNOLOGIES**  
Steve Payler, Trojan Technologies - spayler@trojanuv.com – 519.457.3400

**AND OUR LOCAL REPRESENTATIVES**  
Fred Croy, The Maher Corporation - fcroy@themaher.copr.com – 781.421.2600

**PROPOSAL DUE: FEBRUARY 7, 2018, @ 4:00 P.M.**



Design May 2018 – January 2019

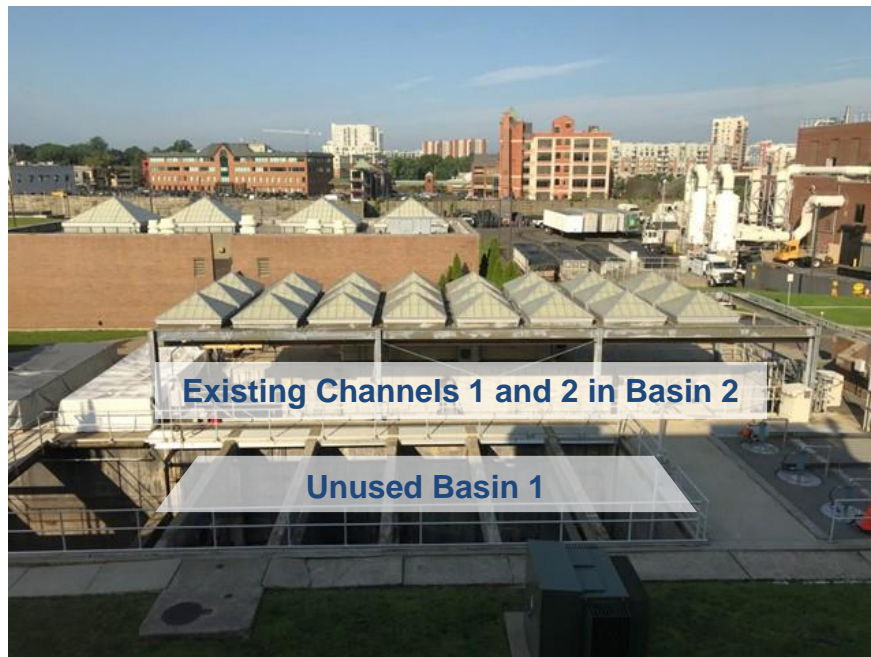
## Bidding

- Advertise 1/30/2019
- Bid opening 3/12/2019

## Construction

- May 2019 – August 2021
  - *Factory acceptance testing January 2020*
  - *UV Channels 1 and 2 commissioned July-August 2020*
  - *UV Channel 3 commissioned June 2021*

## Construction sequencing



Phase 1: Construction of New UV Channels 1 and 2 in Basin 1

- Continue operating existing UV channels in Basin 2

# System commissioning



## Functional testing

- Performed by Contractor and manufacturer
- Plant effluent recirculation

## Intensive performance testing

- Head loss
- Power demands
- Effluent quality
  - *Paired samples of influent/effluent microbiological*
  - *UVT and TSS*

## Automatic control performance testing

- 30-day period
- Daily sampling





## Phase 1 commissioning

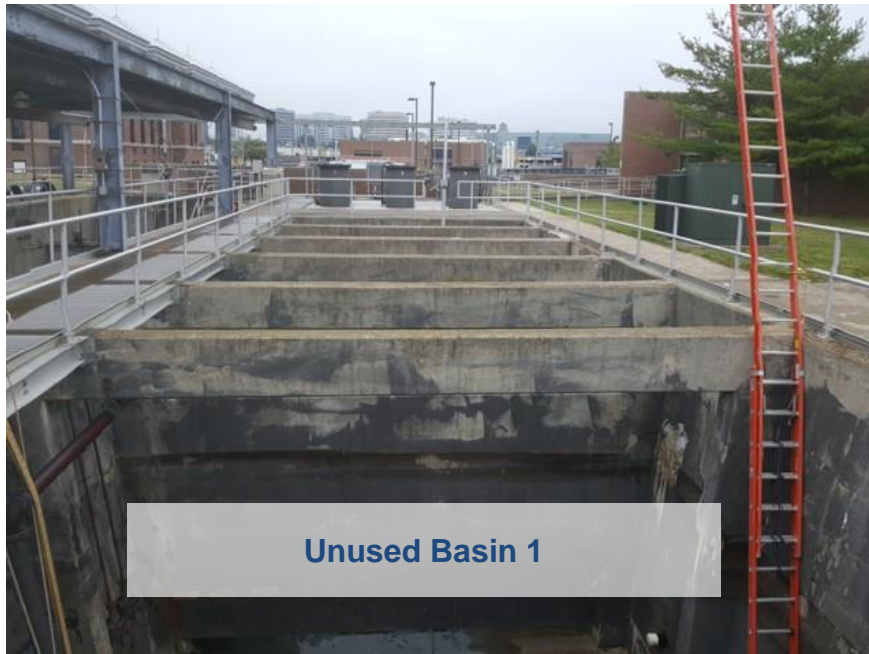


### UV channel flow measurement

- Existing approach: directly measure flow over UV channel effluent weir gates
- Revised approach: compare channel water depth to effluent weir gate position



## Construction sequencing



### Phase 2: Operate New UV Channels 1 and 2 in Basin 1

- Continue operating one existing UV channel in Basin 2

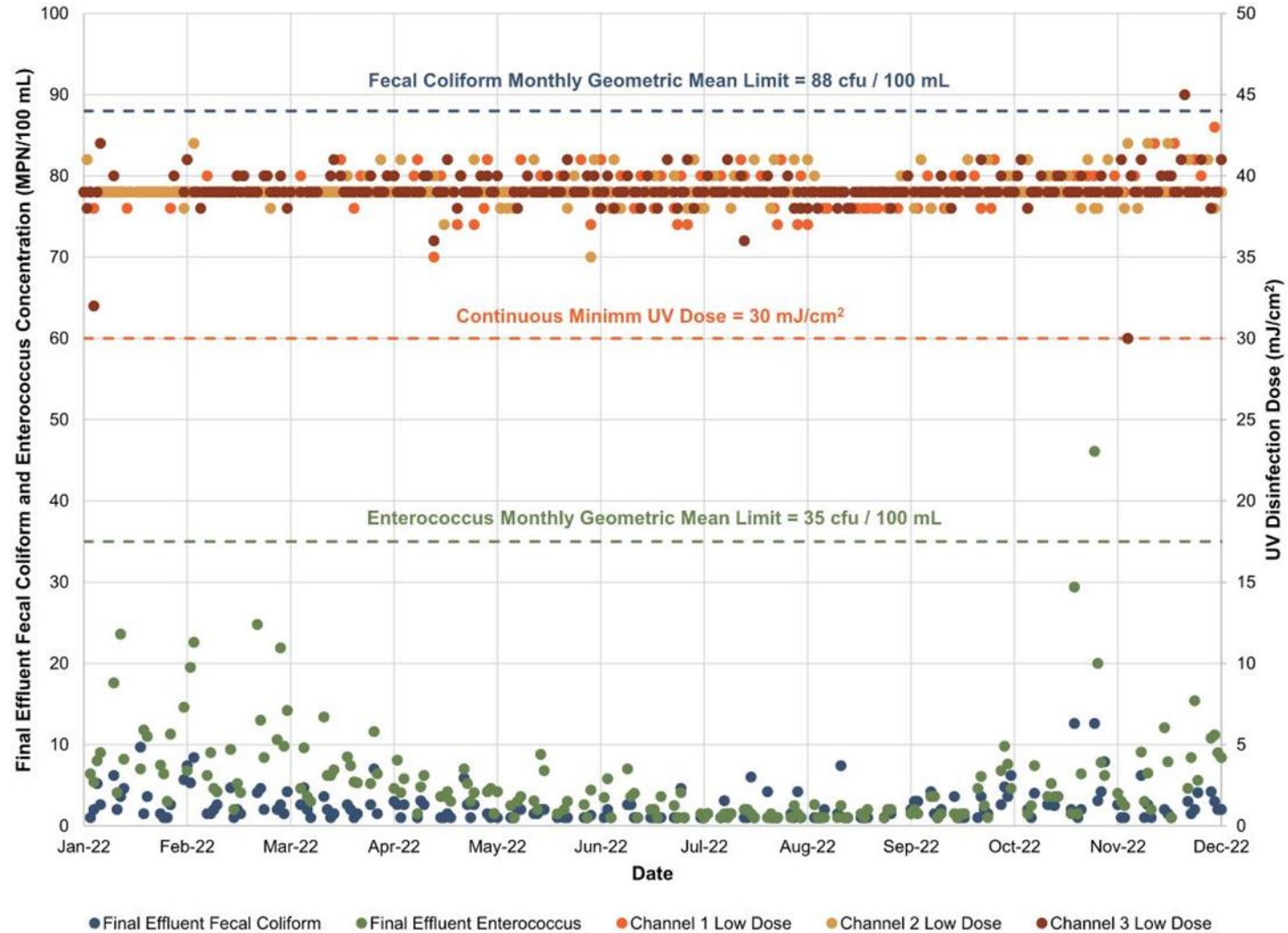
## Construction sequencing



### Phase 3: Operate New UV Channels 1-3 in Basins 1 and 2

- Prepare remaining channel for future UV disinfection equipment

# 2022 performance







## Conclusions

### Successful collaboration despite competing improvements

- Owner: Stamford WPCA
- Engineers: Wright-Pierce and Hazen and Sawyer
- Contractor: CH Nickerson

