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# MAXIMIZING PLANT CAPACITY A BIOMAG® IMPLEMENTATION

## FLOYD BRANCH REGIONAL WASTEWATER TREATMENT PLANT

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January 25, 2019

NORTH TEXAS MUNICIPAL WATER DISTRICT

# AGENDA

- Project Background - FBRWWTP
- BioMag® Fundamentals
- Pilot Set-Up and Schedule
- Results and Recommendations

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# Project Background

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# Project Background – FBRWWTP


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- Location: City of Richardson
- Permitted Flow
  - AADF: 4.75 MGD
  - P2HF: 10 MGD
- Treatment Process
  - Trickling Filter Train (2.5 MGD)
  - Conventional Activated Sludge Train (2.25 MGD)
- Key Features
  - 1986 Expansion
  - 2009 Improvements
  - 2012 Odor Control Improvements
  - 2014 UV Improvements

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# Project Scope

## Evaluation of the Plant to maintain current and future operations

- Condition Assessment and Scenario Planning
- Determination of improvements needed
  - Conventional  Activated Sludge Expansion
  - Membrane Biological Reactors (MBRs)
  - BioMag® System

| | | Alt. 1 – Conventional AS | | Alt. 2 – Parallel MBR Treatment Train | | Alt. 3 – BioMag® System | |
|---|---|---|---|---|---|---|---|
| **Criteria** | **Priority Weight*** | **Assigned Value**** | **Weighted Value***** | **Assigned Value**** | **Weighted Value***** | **Assigned Value**** | **Weighted Value***** |
| Reliability | 7 | 4 | 28 | 3 | 21 | 2 | 14 |
| Safety | 6 | 2 | 12 | 3 | 18 | 3 | 18 |
| Constructability | 5 | 4 | 20 | 1 | 5 | 2 | 10 |
| Complexity | 4 | 2 | 8 | 3 | 12 | 3 | 12 |
| Maintenance | 3 | 2 | 6 | 3 | 9 | 3 | 9 |
| Regulatory | 2 | 1 | 2 | 3 | 6 | 3 | 6 |
| Expandability | 1 | 5 | 5 | 2 | 2 | 3 | 3 |
| **Totals** | | 81 | | 73 | | 72 | |

# Pilot Scope

## BioMag® Pilot

- Evaluate the biological treatment configuration
- Evaluate the treatment capacities
- Evaluate anticipated effluent quality
- Evaluate treatment chemistry/chemical doses
- Evaluate mixing requirements in basins and channels

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# BioMag® Fundamentals

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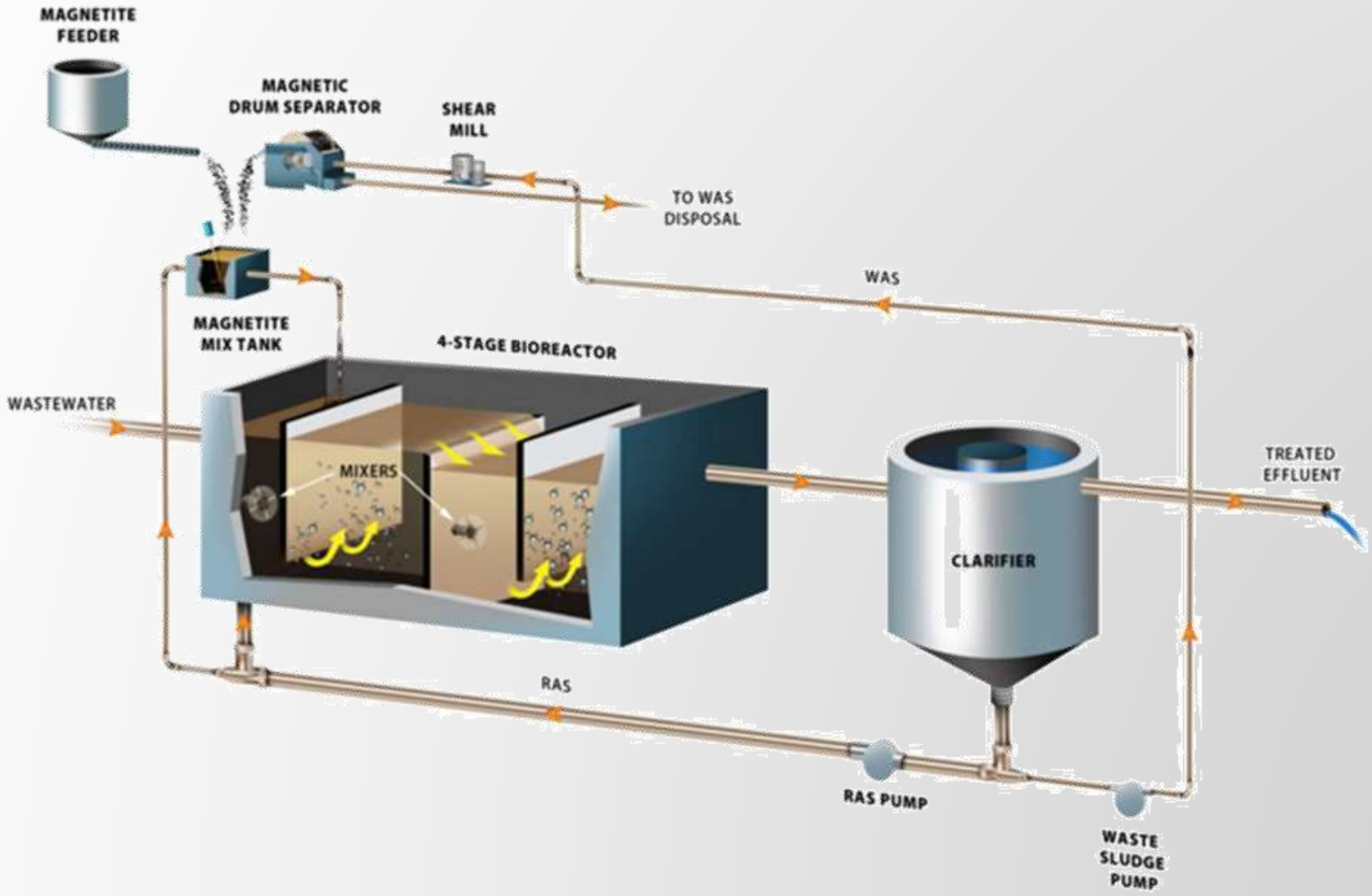
# Project Background – BioMag®

- Manufacturer: Evoqua Water Technologies
- Principle: Enhanced existing secondary treatment system with magnetite ballast
  - Enhance settleability of MLSS
  - Increase solids loading in secondary clarifiers
  - Increase MLSS in aeration basin to increase treatment capacity
- Benefits:
  - Increased Treatment Capacity without Additional Aeration Basins and Clarifiers

# The BioMag® process



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# Pilot Set-Up and Schedule

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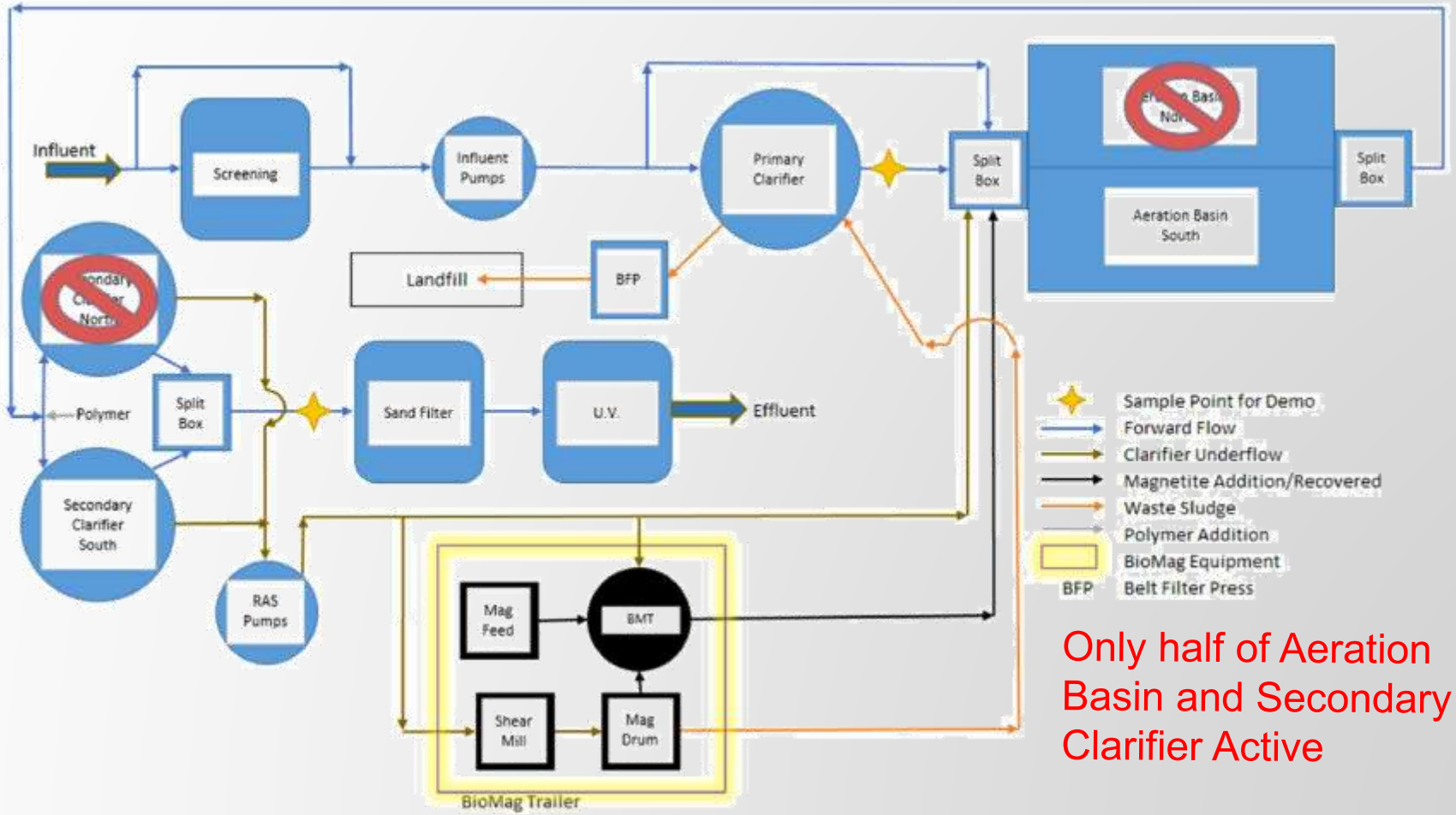
# BioMag® Pilot Set-Up



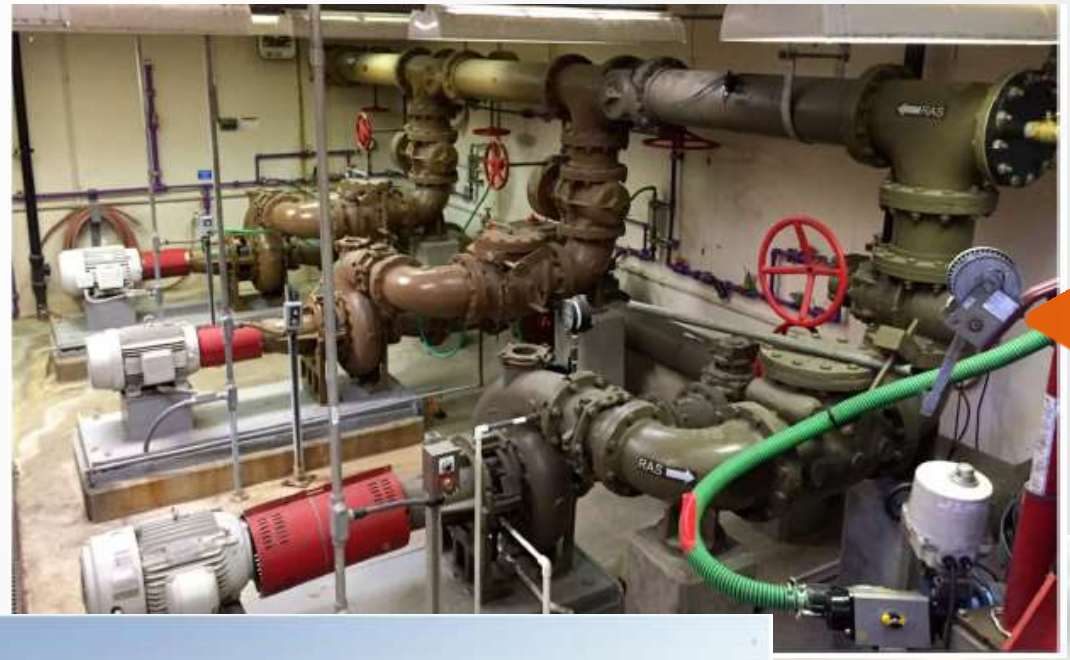

Only half of Aeration Basin and Secondary Clarifier Active

# BioMag® Pilot Set-Up

# Pilot Schedule

## Total Duration: Aug 30 to Dec 6, 2017 (~4 months)

| | AUG | SEPT | OCT | NOV |
|---|---|---|---|---|
| Pilot Trailer Arrival and Setup: | | | | |
| System Start-Up: | | | | |
| Testing Period: | | | | |
| Stress Test I/ P2H1: | | | Nov 8 (5.9 MGD, equals 11.7 MGD full plant) | |
| Stress Test II / P2H2: | | | Nov 17 (7.2 MGD, equals 14.3 MGD full plant) | |




BioMag® WAS Feed
from RAS Blind Flange

BioMag® WAS to Pilot Trailer

Magnetite Dosing

Shear Mill



Mag Drum


Ballast Mix Return

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# Results and Recommendations

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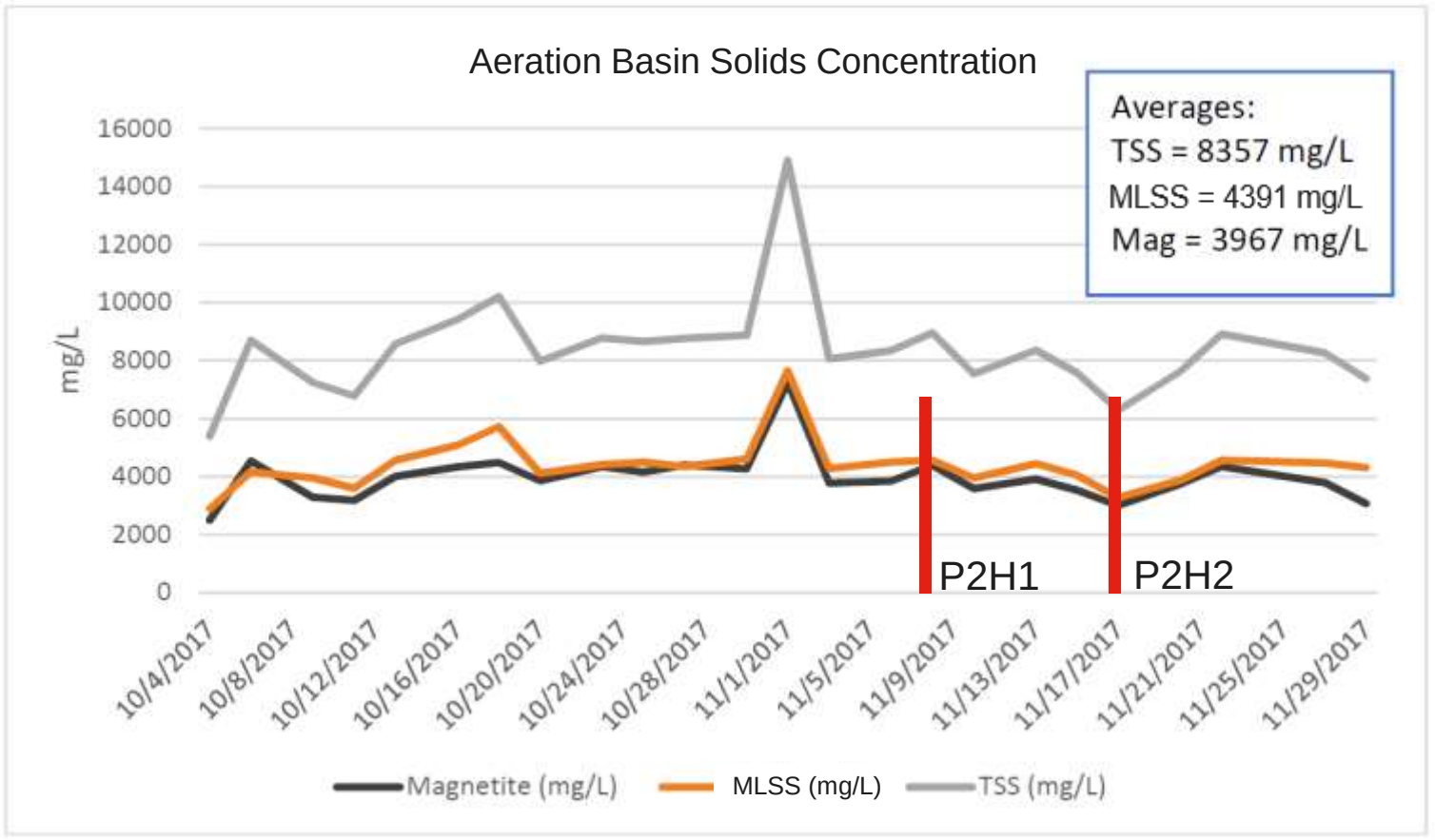
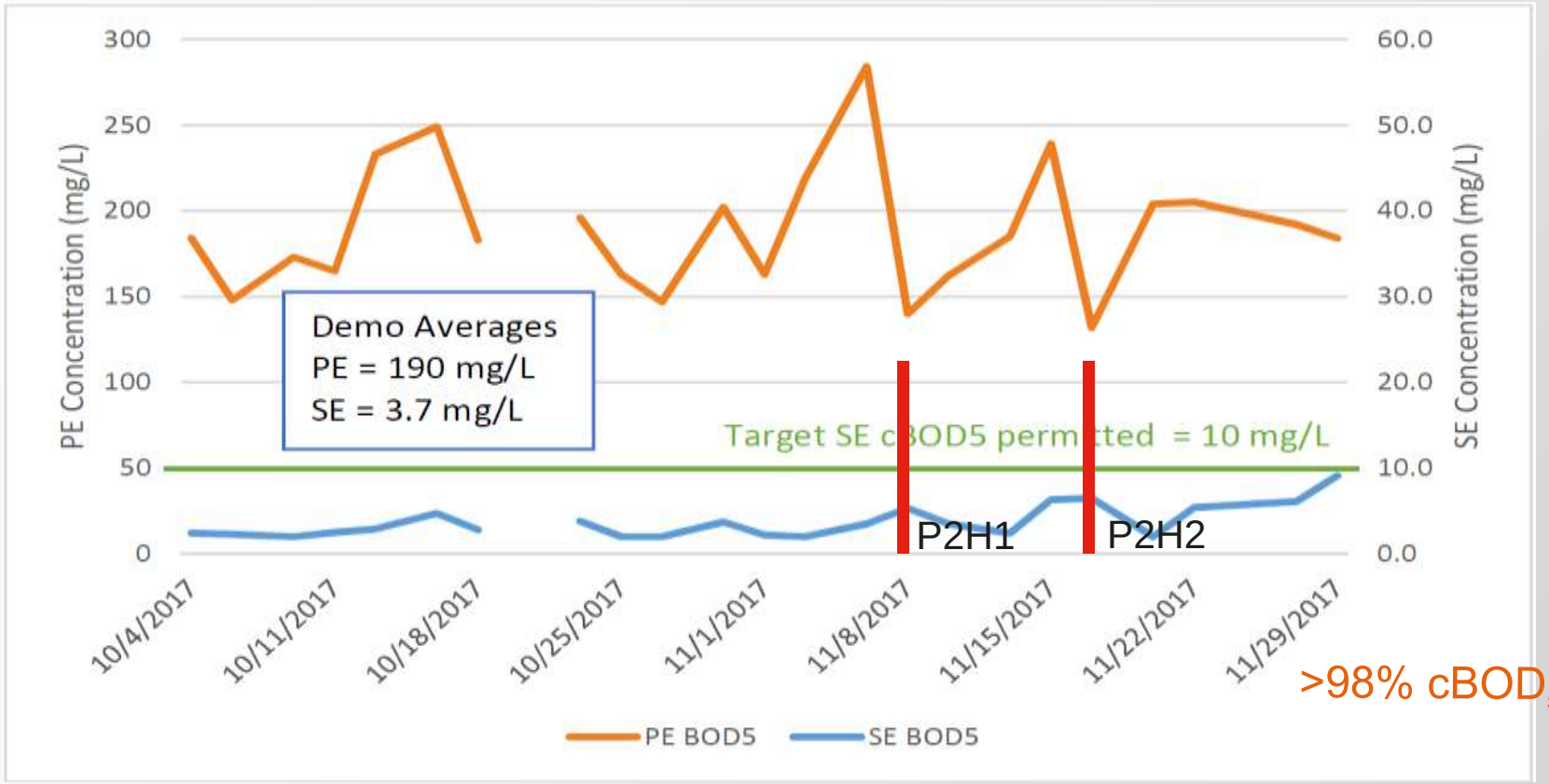
# Floyd Branch Discharge Permit

| Parameter | Daily Ave (mg/L) | 7-day Ave (mg/L) | Daily Max (mg/L) | Single Grab (mg/L) |
|---|---|---|---|---|
| $cBOD_5$ | 10 | 15 | 25 | 35 |
| TSS | 15 | 25 | 40 | 60 |
| $NH_3$-N (Mar-Nov) | 2 | 4 | 10 | 15 |
| $NH_3$-N (Dec-Feb) | 4 | 6 | 10 | 15 |

# Solids Concentration in Aeration Basin



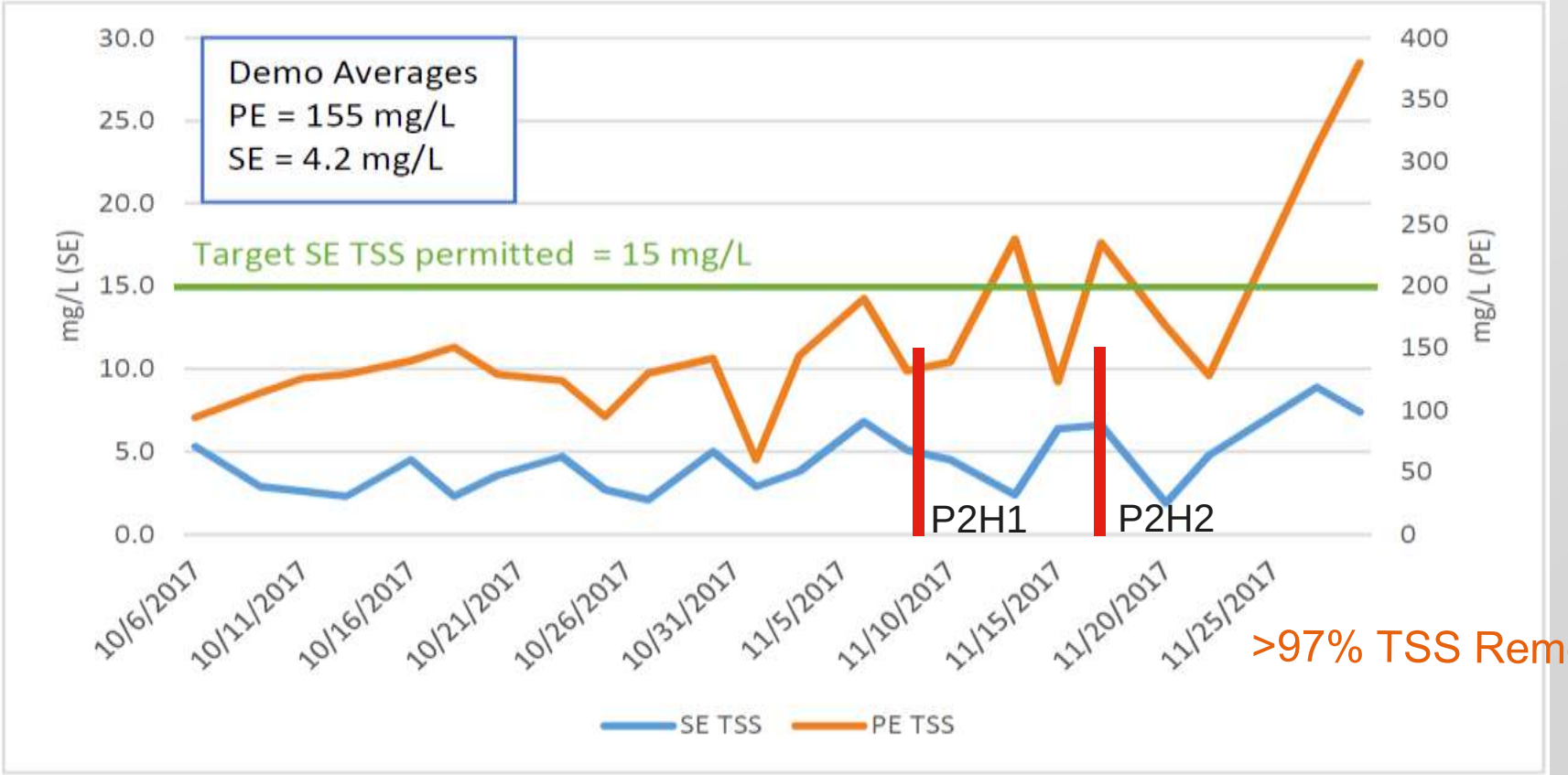
# Secondary Effluent Results – $cBOD_5$




>98% $cBOD_5$ Removal

**$cBOD_5$ was always lower than 10 mg/L and meet discharge limit**

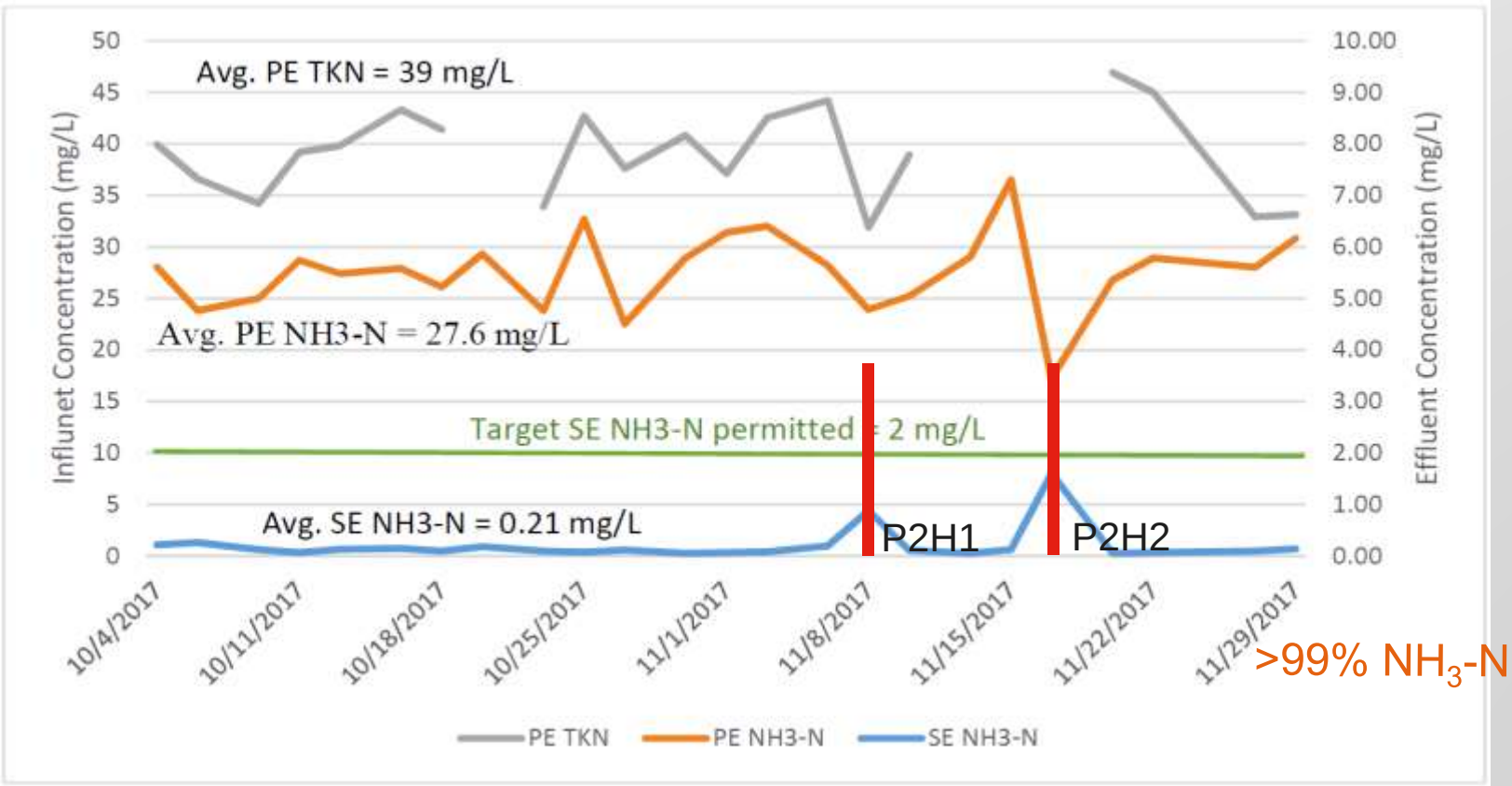
# Secondary Effluent Results – TSS




>97% TSS Removal

**TSS was always lower than 10 mg/L and met discharge limit**

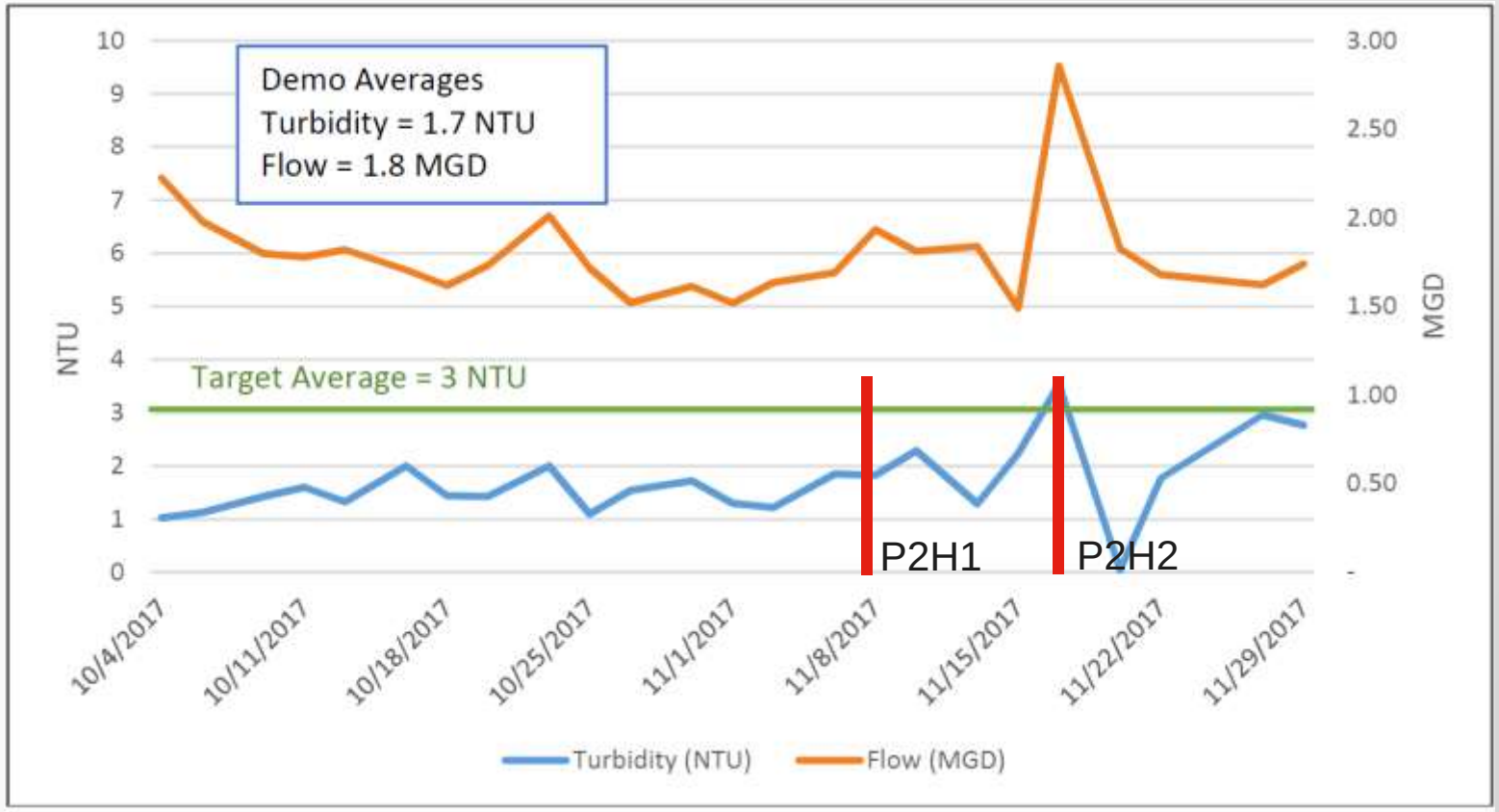
# Secondary Effluent Results – $NH_3$-N




>99% $NH_3$-N Removal

**$NH_3$-N was always lower than 2 mg/L and met discharge limit**

# Secondary Effluent Results – Turbidity




**Only one single point exceeded turbidity target of 3 NTU**

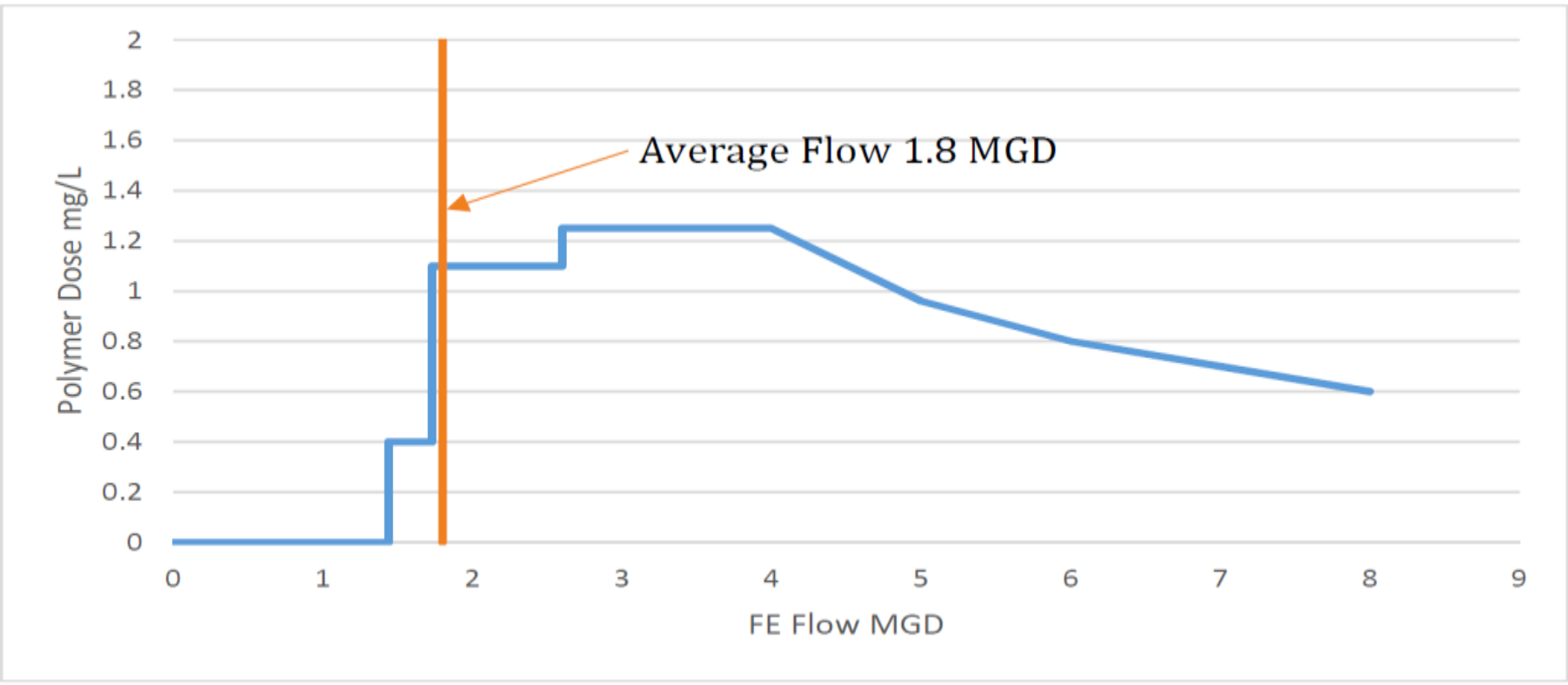
# Secondary Effluent Data Summary

| Parameter | Permit Daily Ave | Permit 7-day Ave | Pilot Ave Result |
|---|---|---|---|
| $cBOD_5$ (mg/L) | 10 | 15 | 3.7 |
| TSS (mg/L) | 15 | 25 | 4.2 |
| $NH_3$-N (mg/L) (Mar-Nov) | 2 | 4 | 0.21 |
| $NH_3$-N (mg/L) (Dec-Feb) | 4 | 6 | |

# Stress Test Effluent Results

| Condition | Permit Daily Ave | Permit Daily Max | P2H1 (5.9 MGD) | P2H2 (7.2 MGD) |
|---|---|---|---|---|
| $cBOD_5$ (mg/L) | 15 | 25 | 7 | 7.8 |
| TSS (mg/L) | 10 | 40 | 7.9 | 6.6 |
| $NH_3$-N (mg/L) (Mar-Nov) | 2 | 10 | 2.17 | 0.598 |
| Turbidity (NTU) | N/A | N/A | 2.84 | 2.32 |

# Polymer Use at Secondary Clarifier




**Certain polymer should be dosed based on site-specific conditions. Polymer dose gradually decreased as flow rate increased**

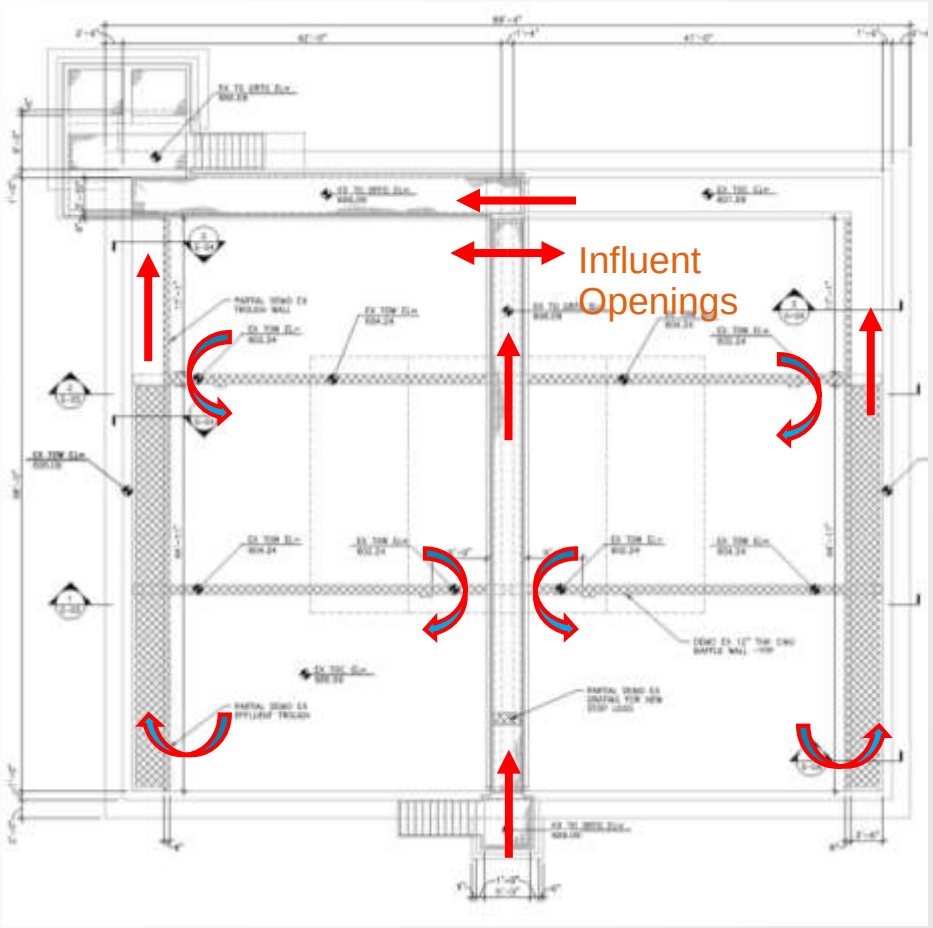
# Results Summary

- The Pilot demonstrated BioMag®'s ability to treat AADF and P2H with existing facilities
- Clarifier overflow rate of 1430 gpd/sf and increased solids loading
- The secondary effluent was consistently below the permitted parameters
- The BioMag® successfully showed the ability to obtain a variance on the filter process
- Full suspension of magnetite floc was maintained in the Aeration Basin

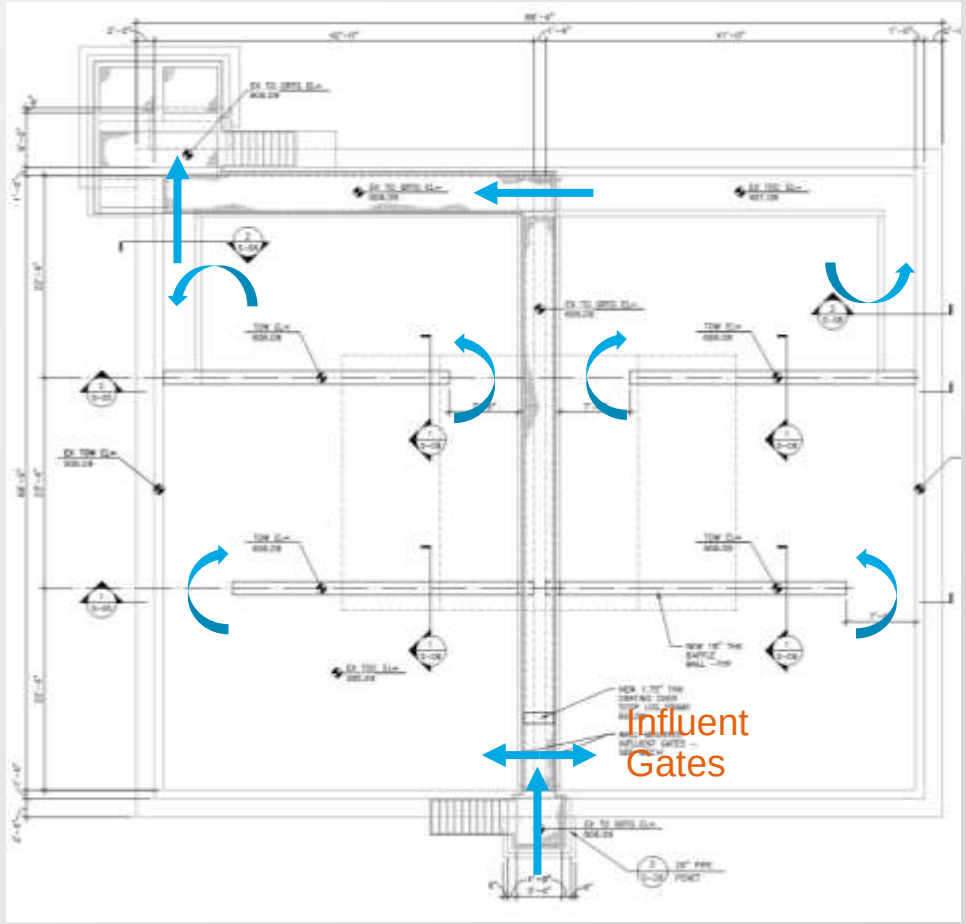
# Recommended Optimizations

- Extend the height of the Aeration Basins baffle walls to accommodate increased flow
- Optimize flow path to reduce settling
- Consider versatility in polymer injection points to optimize the reaction time and mixing energy.

# Aeration Basin Flow Path Optimization




Existing




Proposed

# Project Scope

## BioMag® Pilot

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# Acknowledgement

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evoqua WATER TECHNOLOGIES

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# Questions?


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