FLYING HIGH AT THE FAIRHAVEN, MA WWTF – THE UPS & DOWNS OF CONDUCTING A FULL-SCALE PILOT STUDY FOR NITROGEN REDUCTION

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NEWEA ANNUAL CONFERENCE

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PRESENTATION OUTLINE

1 - Introduction to Fairhaven WWTF
2 - Reasons for Pilot Study
3 - Pilot Study Setup & Results
4 - Full-Scale Pilot Study Challenges
5 - Future Recommendations

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1 - INTRODUCTION TO FAIRHAVEN WWTF

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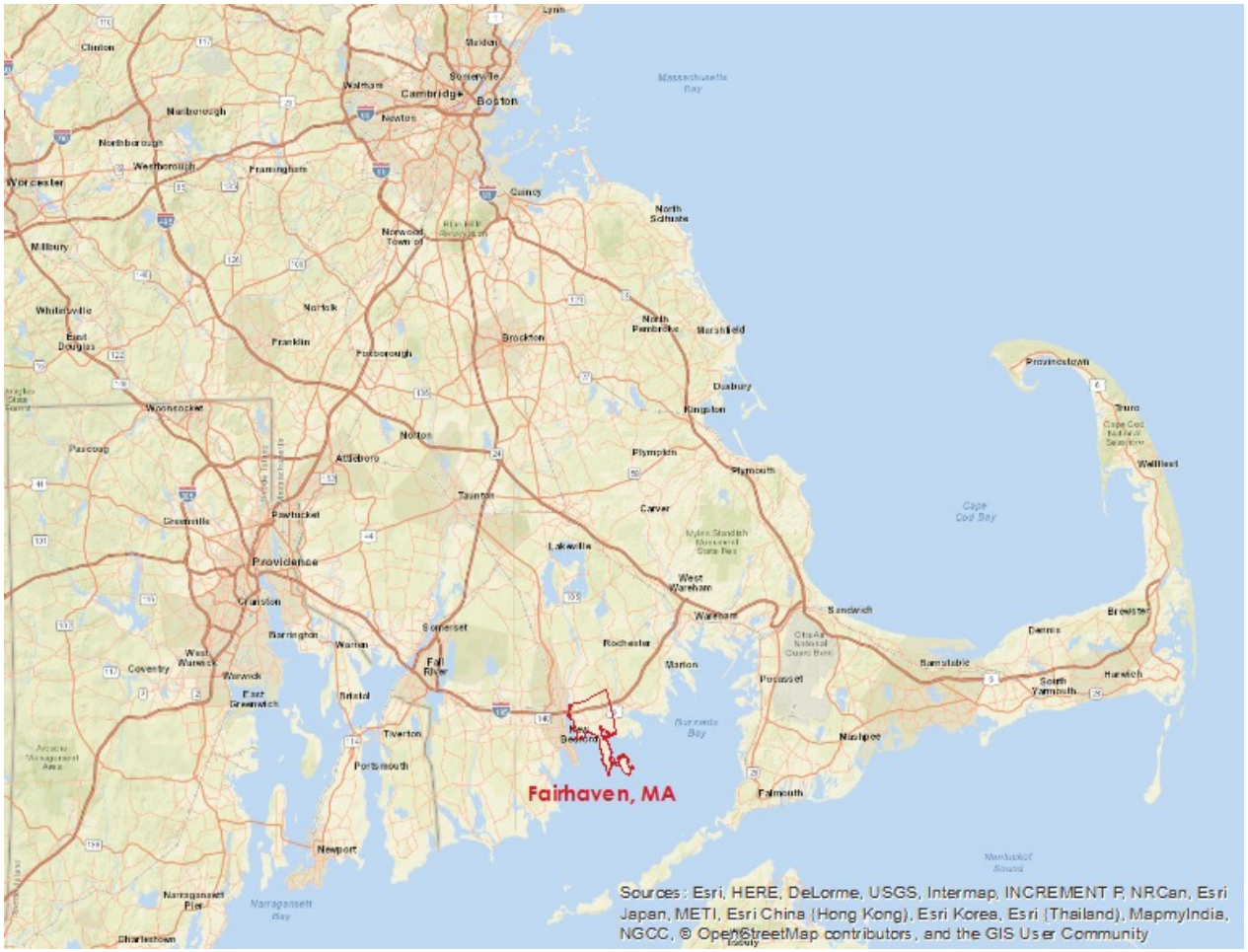
TOWN OF FAIRHAVEN, MA



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FAIRHAVEN WWTF LOCATION

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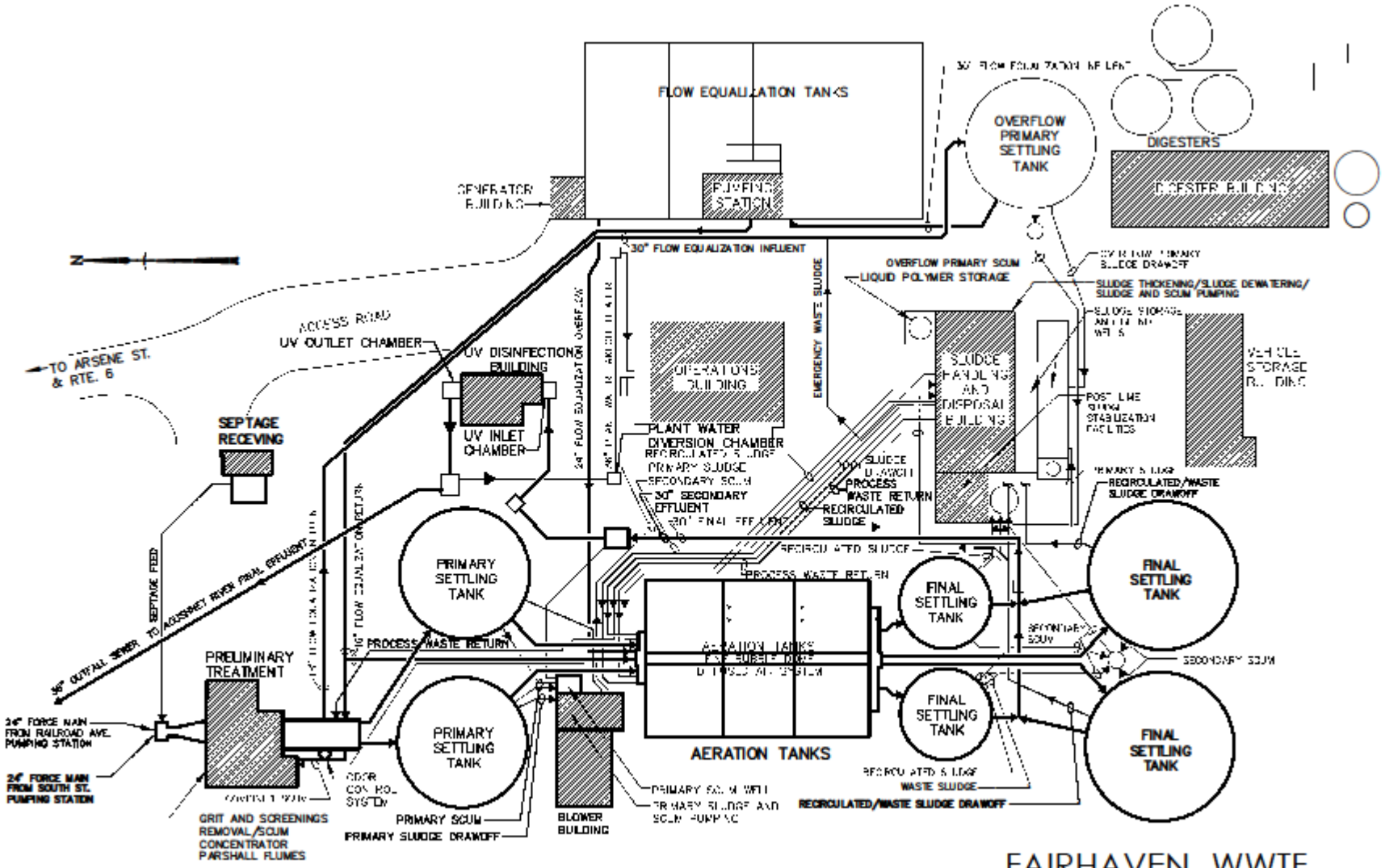

FAIRHAVEN WWTF
PROCESS FLOW DIAGRAM

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EXISTING NPDES PERMIT (2003)
Monthly Averages

- Flow – 5.0 MGD
- BOD – 30 mg/L
- TSS - 30 mg/L
- Fecal Coliform – 88 cfu/100 mL
- Total Nitrogen (TN) - Report

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FINAL EFFLUENT AVERAGE ANNUAL OPERATING DATA (2014)

- Flow – 3.1 MGD
- BOD – 6.6 mg/L
- TSS – 8.4 mg/L
- Fecal Coliform – 10 cfu/100 mL
- Enterococci – Not Monitored
- Total Nitrogen (TN) – 15.1 mg/L

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2 - REASONS FOR PILOT STUDY

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MA ESTUARIES PROJECT
NEW BEDFORD INNER HARBOR EMBAYMENT SYSTEM

- Modeling to Determine Critical N Loadings
- Draft Report Completed 2008
- Updated Final Report Completed 2015
- Fairhaven WWTF Significant Source of Nitrogen to New Bedford Inner Harbor

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DRAFT NPDES PERMIT (2010)
Monthly Averages

- Flow – 5.0 MGD
- BOD – 30 mg/L
- TSS - 30 mg/L
- Fecal Coliform – 88 cfu/100 mL
- Enterococci – 35 cfu/100 mL
- TN – 125 lbs/day, or 3 mg/L @ 5.0 MGD

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WASTEWATER MANAGEMENT PLAN (2013)

- Investigated N Reduction at WWTF
- Biowin Modeling Identified 3 Treatment Alternatives:
  - Denitrification Filter
  - BioMag
  - Membrane Bioreactor
- Alternatives Incorporated 4-Stage Bardenpho Process

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2014 - Buzzards Bay National Estuary Program Grant - Nitrogen Reduction Pilot Study

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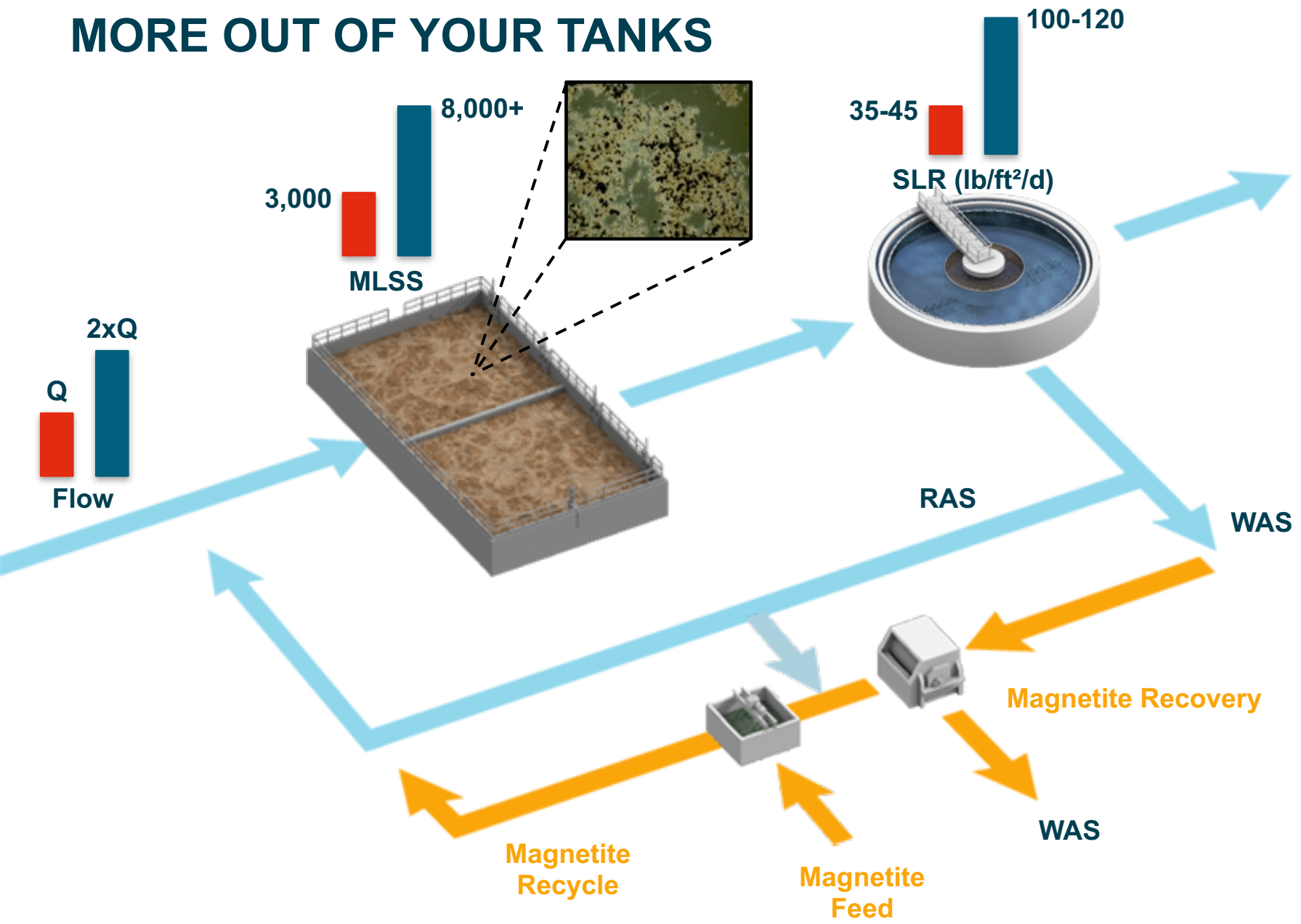
3 - PILOT STUDY SETUP & RESULTS

MORE OUT OF YOUR TANKS



Design Basis For BioMag Pilot Demonstration

- Split Plant into two (2) Trains
- MLE Process Train utilizing BioMag
  - Process Targets
    - ~1.6 MGD
    - SRT – 12-15 Day
    - RAS 100%
    - BOD – N Ratio 4.5-1
    - 4Q IR flow
- Conventional Train to handle excess flows

Actual Operation BioMag Pilot

- Full flow through one Train
- MLE Process Train utilizing BioMag
  - Process
    - ~2.6 MGD
    - SRT – 12-15 Day
    - RAS 100%
    - BOD – N Ratio 2.7-1
    - 1.2Q IR flow
  - Supplemental Carbon source utilized

Bypass Primaries as Carbon unavailable

evoqua WATER TECHNOLOGIES

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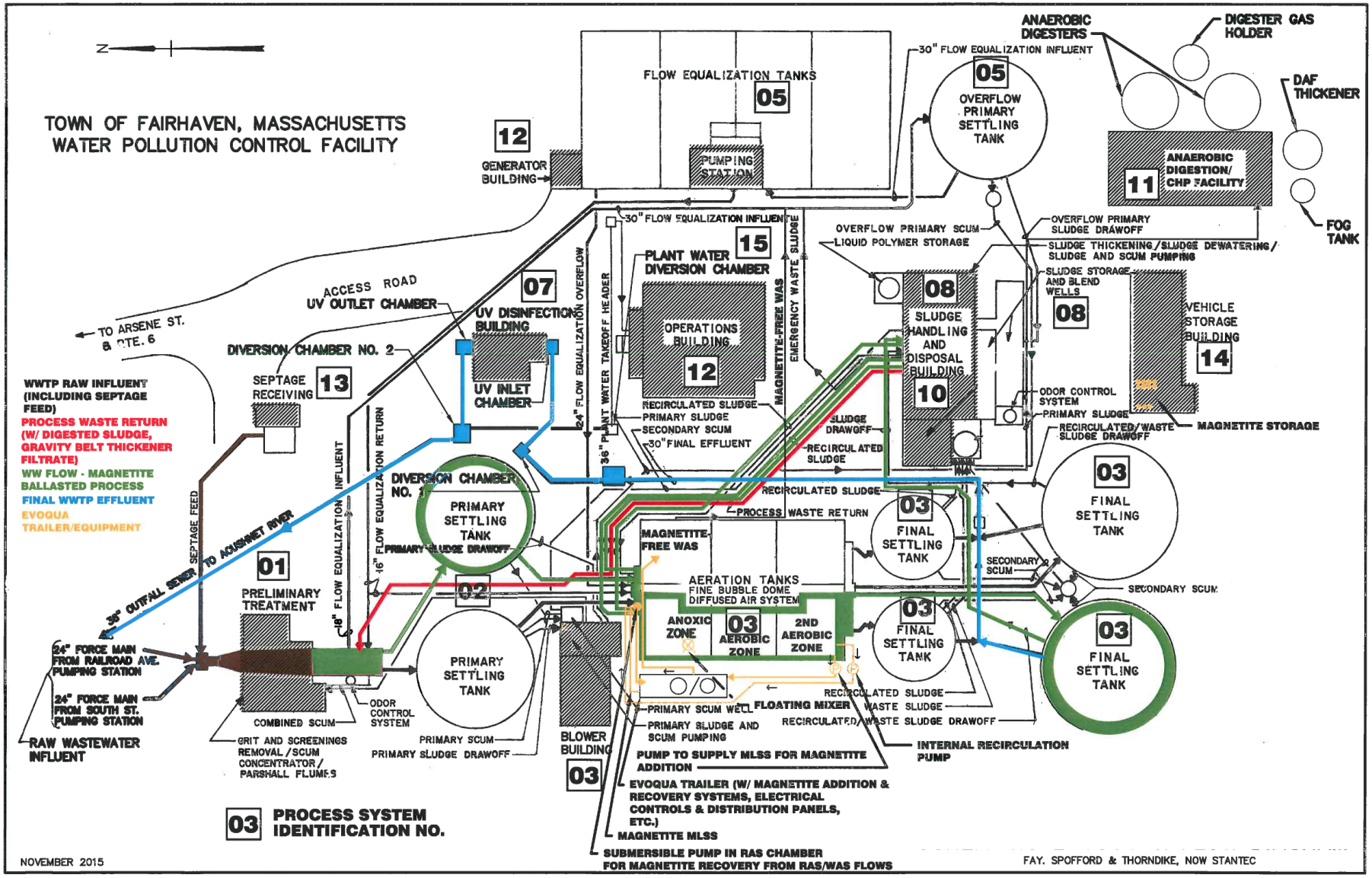

EVOQUA WATER TECHNOLOGIES

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WATER TECHNOLOGIES

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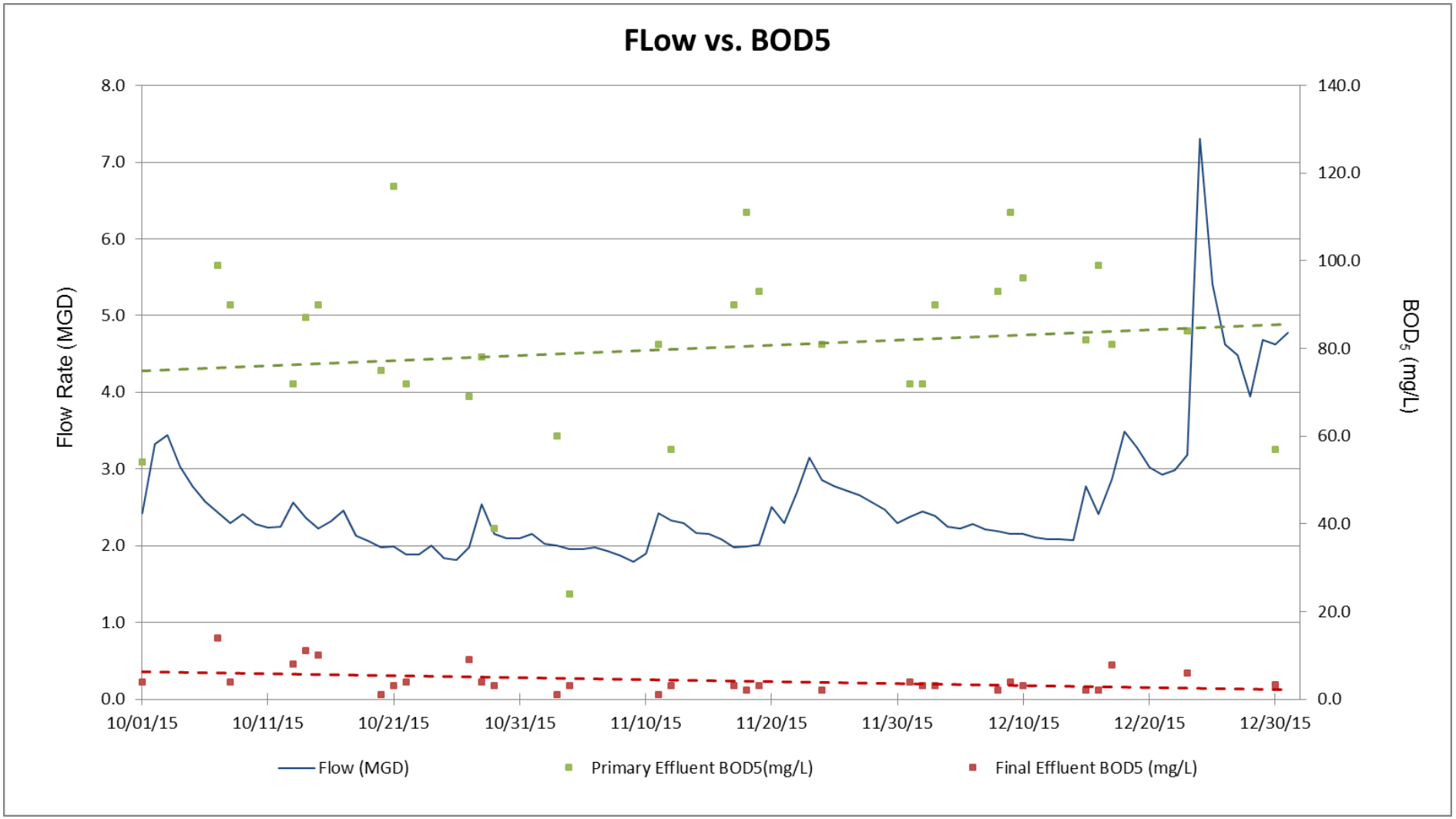
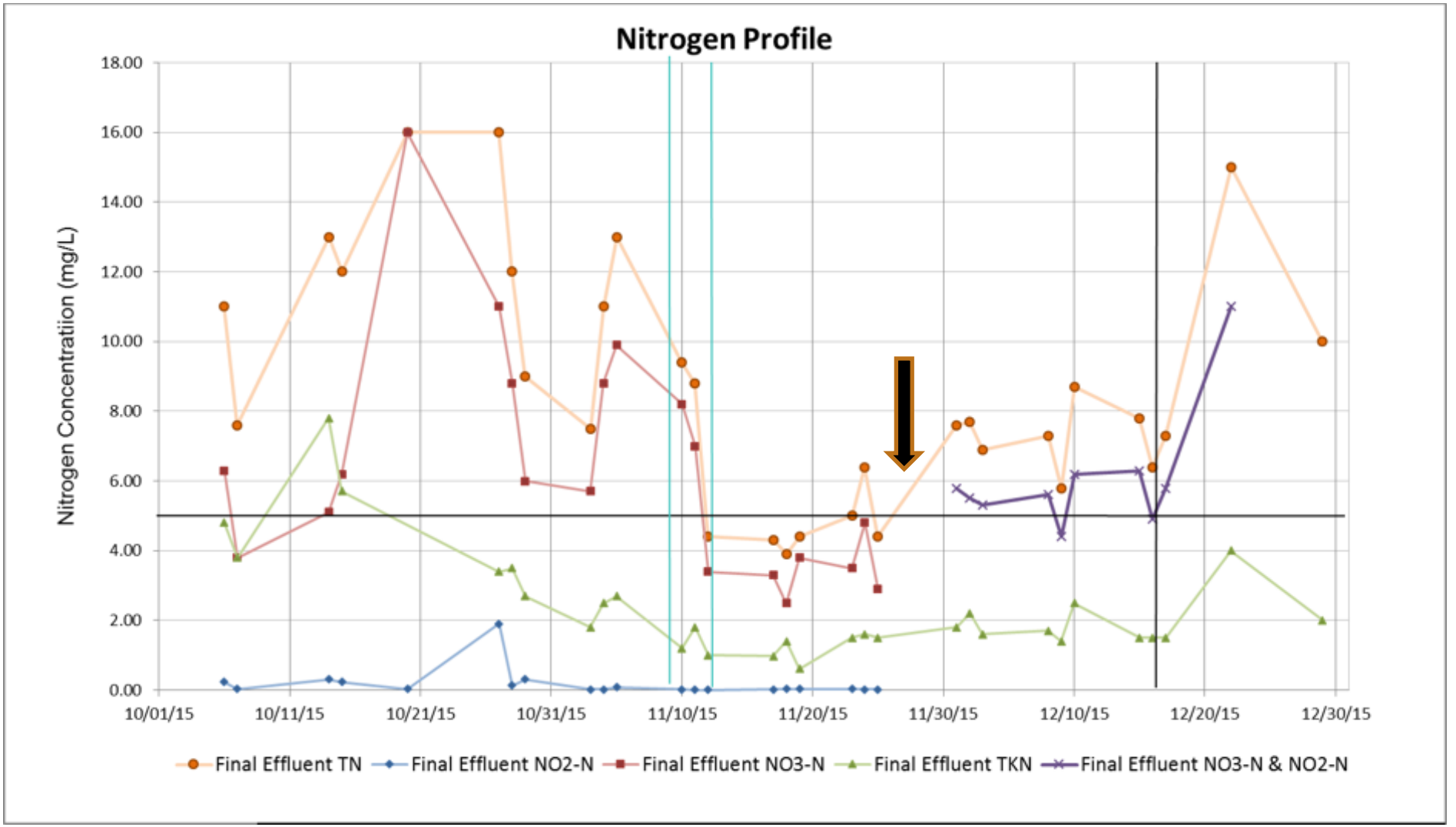
WATER TECHNOLOGIES


FLow vs. BOD5
Flow Rate (MGD)
BOD5 (mg/L)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
10/01/15
10/11/15
10/21/15
10/31/15
11/10/15
11/20/15
11/30/15
12/10/15
12/20/15
12/30/15
Flow (MGD)
Primary Effluent BOD5(mg/L)
Final Effluent BOD5 (mg/L)



EVOQUA WATER TECHNOLOGIES

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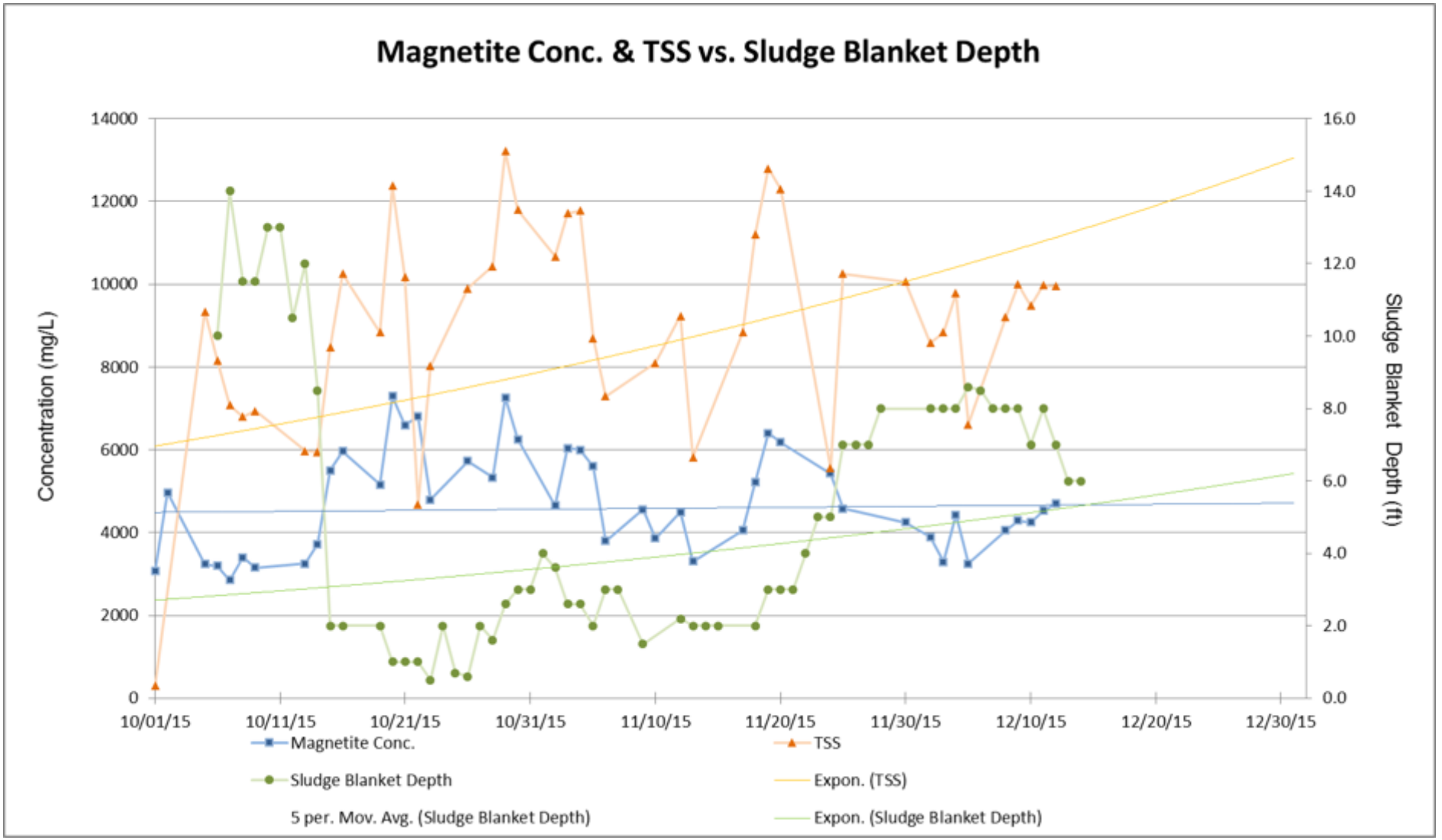
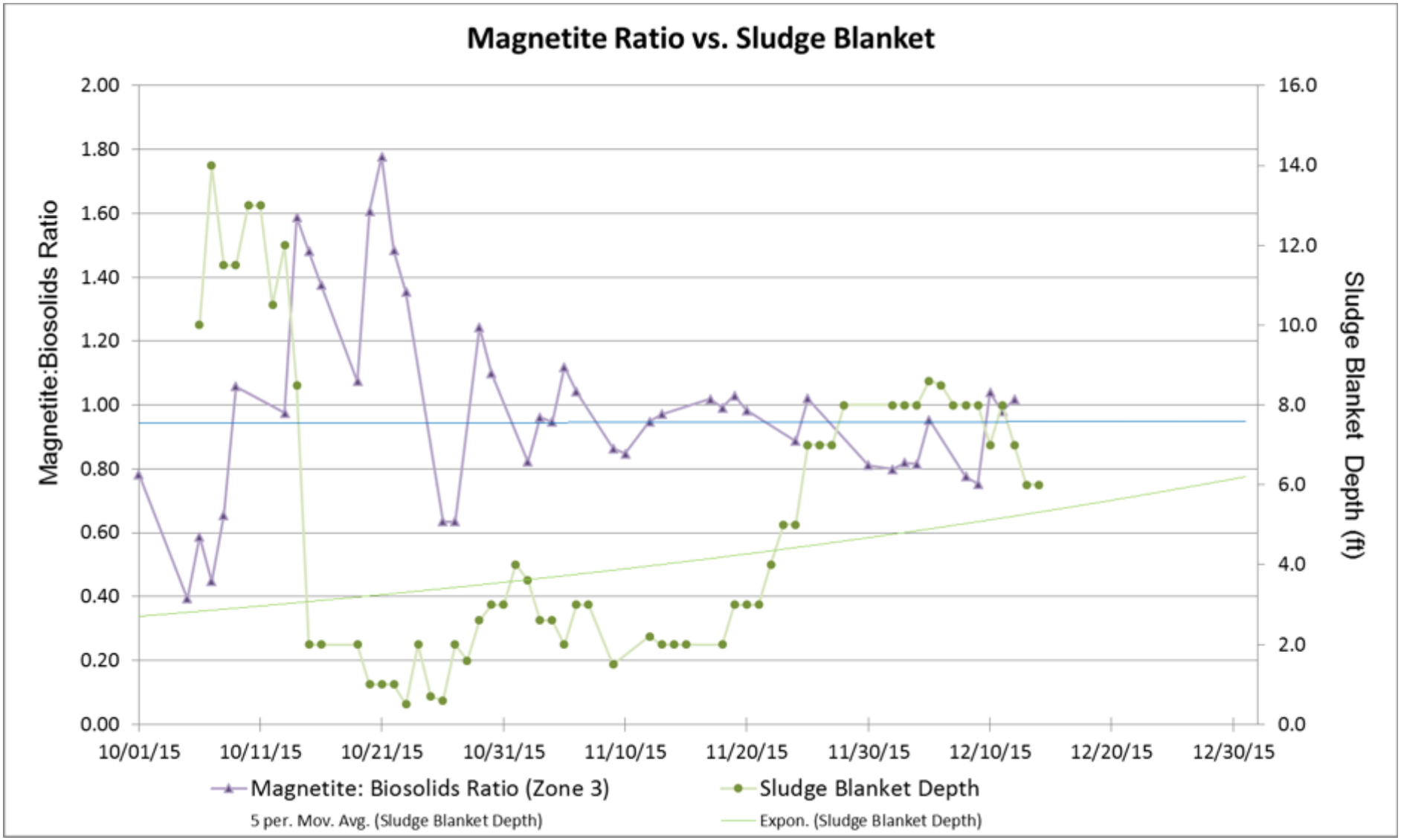

Magnetite Conc. & TSS vs. Sludge Blanket Depth
Concentration (mg/L)
Sludge Blanket Depth (ft)
14000
12000
10000
8000
6000
4000
2000
0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
10/01/15
10/11/15
10/21/15
10/31/15
11/10/15
11/20/15
11/30/15
12/10/15
12/20/15
12/30/15
Magnetite Conc.
TSS
Sludge Blanket Depth
Expon. (TSS)
5 per. Mov. Avg. (Sludge Blanket Depth)
Expon. (Sludge Blanket Depth)



EVOQUA WATER TECHNOLOGIES

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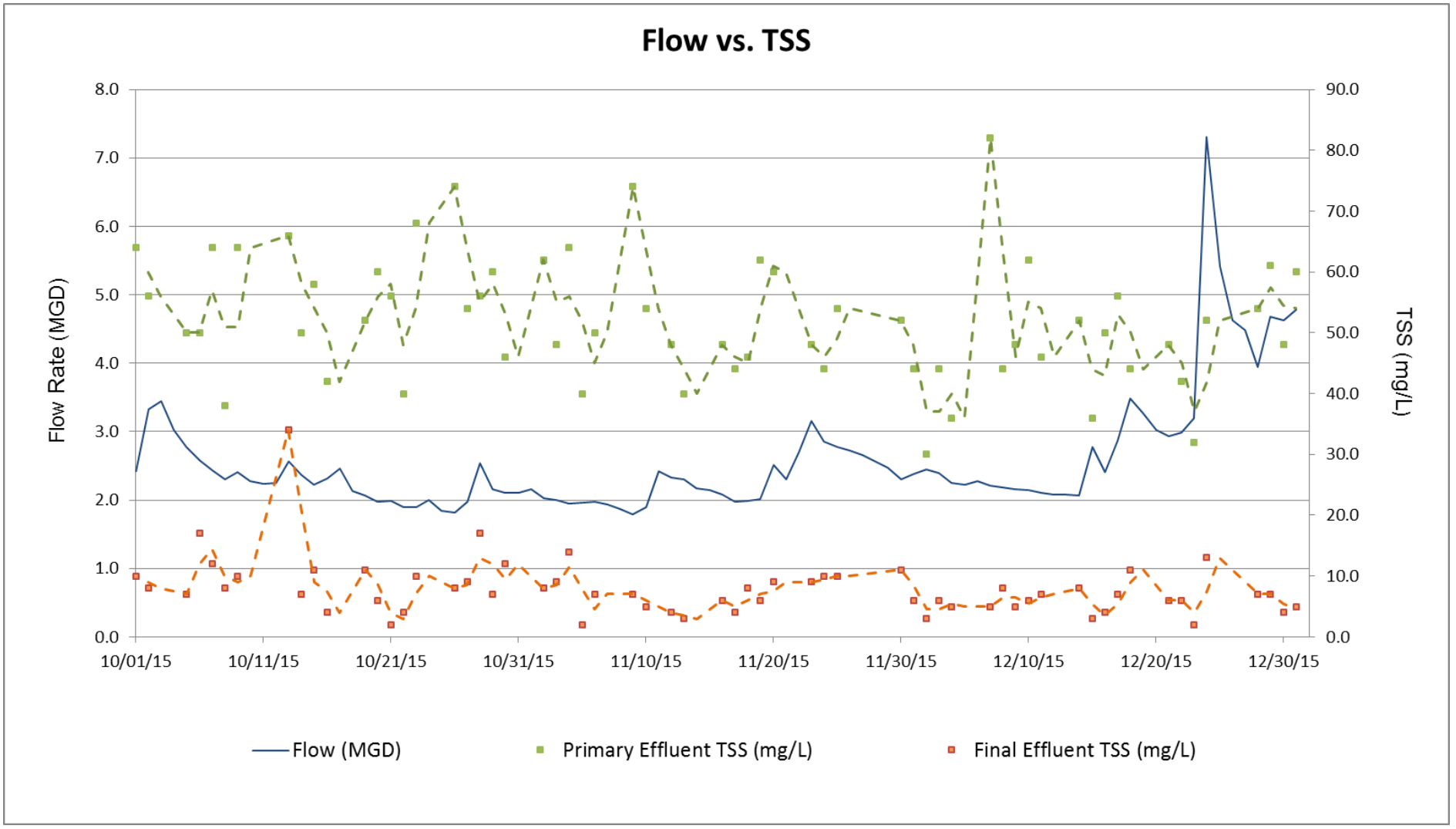
Flow vs. TSS
Flow Rate (MGD)
TSS (mg/L)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
10/01/15
10/11/15
10/21/15
10/31/15
11/10/15
11/20/15
11/30/15
12/10/15
12/20/15
12/30/15
Flow (MGD)
Primary Effluent TSS (mg/L)
Final Effluent TSS (mg/L)

4 - FULL-SCALE PILOT STUDY CHALLENGES

Limited Funding

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Fairhaven WWTF Staff

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Electricity Needs

Internal Recirculation Pump & Piping

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Microorganism Upset

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Limited Blower Turndown

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Sludge Wasting Modifications

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Damage to Final Clarifier Rake Arm

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Additional Lab Work

Intern Hire for Weekends

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OPERATOR TAKE-AWAYS

- Pilot Achieved Significant Nitrogen Removal
- 3-Month Pilot Took 18 Months – Conception to Completion
- Full-Scale Pilot Requires Ingenuity, Resource Optimization & Cooperation of all Parties

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5 - FUTURE RECOMMENDATIONS

- Complete Clarifier Equipment Repairs
- Investigate Alternative Carbon Addition
- Possibly Pilot Other Nitrogen Reduction Alternatives

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QUESTIONS?

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