TITLE
BIOSTYR® Enables Award Winning Peirce Island WWTF to meet the City of Portsmouth, New Hampshire’s Nutrient Removal Goals

DATE & TIME
March 24, 2022
1:00 PM EST

PRESENTERS
Terry Desmarais - City of Portsmouth, NH
Larry Li - Veolia Water Technologies
SPEAKER INTRODUCTION

Terry Desmarais
Engineering Supervisor
City of Portsmouth, NH

Larry Li
BIOSTYR Product Manager
Veolia Water Technologies (dba Kruger)
Agenda

• BIOSTYR® BAF Technology Introduction
• City of Portsmouth, NH
• Pilot Testing
• Peirce Island WWTF Upgrade
BIOSTYR® & DUO: A Unique Technology

- Elegance
- Automation
- Versatility
- Performance
- Space
- Environment
BIOSTYR® System

- Biological filter: inert media + biofilm
- Bio-reactor and clarifier in one “box” (cell)
- Multiple cells in parallel
- Sludge wasted via backwashing
BIOSTYR®/DUO Media

- Polystyrene Beads
- Engineered. **Strict requirements.**
- Diameter: 3.6 - 5.0 mm
- Specific surface: **1,000 m²/m³**
- Porosity: 0.35
- Specific Gravity: 0.05
BIOSTYR® Nozzles
BIOSTYR® Applications

- Secondary cBOD & NH$_3$ Removal (secondary nitrification)
- Pre - Denitrification
- Tertiary Nitrification
- Tertiary Denitrification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2$^{nd}$</th>
<th>2$^{nd}$-Nit</th>
<th>Tert-Nit</th>
<th>Denit</th>
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<tr>
<td>CBOD</td>
<td>10-20</td>
<td>5-15</td>
<td>5-10</td>
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<td>TSS</td>
<td>15-25</td>
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<td>≤1.0</td>
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<td>NO$_3$-N</td>
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BIOSTYR® Compact

BIOSTYR® Footprint ~25% of Suspended Growth System

100 MGD BIOSTYR®

100 MGD Activated Sludge
BIOSTYR® Experience
BIOSTYR® Pilot Capability
Agenda

• BIOSTYR® BAF Technology Introduction
• City of Portsmouth, NH
• Pilot Testing
• Peirce Island WWTF Upgrade
City of Portsmouth

- Seacoast New Hampshire
- Historic
- Tourist Destination
- Access to Waterways
- Pease International Tradeport
Infrastructure

- Regional Water and Sewer System
- Sewer Collection System Since 1800’s
  > 3 Permitted Combined Sewer Overflows
- Storm Drain Collection System
- Two Wastewater Treatment Facilities
  > Peirce Island WWTF: 6.1 MGD BAF
  > Pease WWTF: 1.2 MGD SBR
Great Bay Estuary

- Major Tidal Estuary = ~ 1,000 square miles
  - 52 Communities in NH and Maine
- 17 Wastewater Treatment Plants
  - NH = 13, Maine = 4
- Diverse Ecosystem of Marine Fisheries, Waterfowl and Terrestrial Wildlife
- Major Economic Resource for Recreational and Commercial Fisheries, Shellfish and Aquaculture
Peirce Island WWTF NPDES Permit

- 1985 NPDES Permit with 301(h) Waiver
- 2007 Secondary NPDES Permit
- 2009 Consent Decree
- 2012 Consent Decree Modification
- 2016 – 2021 Upgrade Construction
- 2021 Great Bay Total Nitrogen General Permit
Background: Pre-Upgrade Project

- Design Average Flow 4.8 MGD
- Peak Flow 22 MGD
- Grit Removal
- Chemically Enhanced Primary Treatment
- Sodium Hypochlorite / Bisulfite Disinfection
- Gravity Thickener & Belt Filter Press
- 3.7 Acres
Pilot Program – Technology Selection

- Fit Within Space Constraints
- Nitrogen Removal
- Future Treatment Capacity
  > Address permit unknowns
  > No additional capital costs
- Confirm Sizing Criteria
  > Wet Weather
  > Loading Rates

Pilot Plant
Technologies List

- Biological Aerated Filter (BAF)
- Sequencing Batch Reactor (SBR) with BioMag
- Conventional Activated Sludge (CAS) with BioMag
- Moving Bed Bioreactor (MBBR) & ACTIFLO® Clarification
- Moving Bed Bioreactor (MBBR) & CoMag
- Moving Bed Bioreactor (MBBR) & DAF
- Membrane Bioreactor (MBR)
- Conventional Activated Sludge (CAS)
## Piloting Technology Priority Matrix

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<tr>
<th>Evaluation Criteria</th>
<th>Weight</th>
<th>BAF Rating</th>
<th>BAF Score</th>
<th>CAS-BioMag Rating</th>
<th>CAS-BioMag Score</th>
<th>MBBR-DAF Rating</th>
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<td>Operational Track Record/Established Process</td>
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<td>Ability to Retrofit TN of 8 mg/l to Meet Future TN of 3 mg/l</td>
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<td>Ability to Exceed Treatment Performance Goals</td>
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<td>Capital Cost (estimated - in millions)</td>
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Proposed Layout Within Fence
Background: Upgrade Design

- Design Average Flow 6.1 MGD
- Peak Flow 22 MGD
- Screening
- Two-Stage BIOSTYR® BAF
- Sodium Hypochlorite / Bisulfite Disinfection
- Wet Weather Flow Management
- Solids Building
Biological Aerated Filter (BAF) Building

- Small Footprint
  - Attached Growth vs. Suspended Growth
  - Treatment & Solids Separation in Same Reactor
- High Level of Automation
- First Stage for Carbon Removal and Nitrification
- Second Stage for Denitrification
Peirce Island WWTF Construction

Baseline Enhanced Primary Treatment

4.5 Years Construction and $92M

Upgraded BIOSTYR® Biological Aerated Filter
Overall WWTF Load Reductions

Biochemical Oxygen Demand: 90%
Total Suspended Solids: 87%
Total Nitrogen: 83%
Peirce Island Biological Oxygen Demand (BOD) Effluent

BAF Operating

Average Load (lbs/d)

Average Concentration (mg/L)

BAF Operating
Great Bay Total Nitrogen General Permit

Pounds of TN Discharged Less Than Permit:
~38,000 (growing season)

Estimate 50,000 to 70,000 lb TN/year reduction
Summary

✓ Space Constraints Addressed

✓ Nitrogen Removal Performance Allows for Credit

✓ Future Capital Upgrades Minimized
Any Questions?

Interested in Pilot Testing?

Contact Us

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