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

WATER TECHNOLOGIES

SPEAKER INTRODUCTION

Terry Desmarais
Engineering Supervisor
City of Portsmouth, NH

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

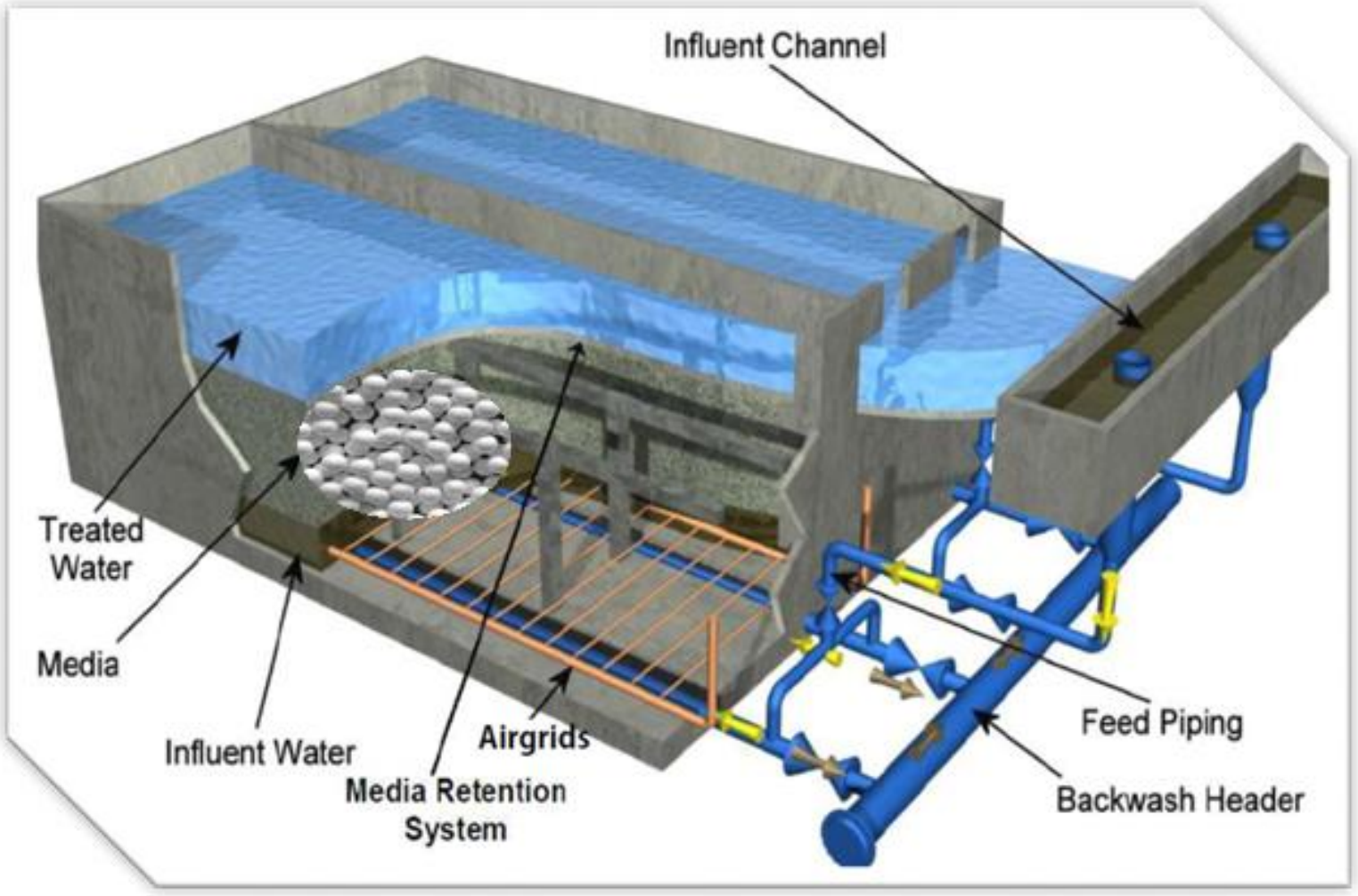
Agenda

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

BIOSTYR® & DUO: A Unique Technology

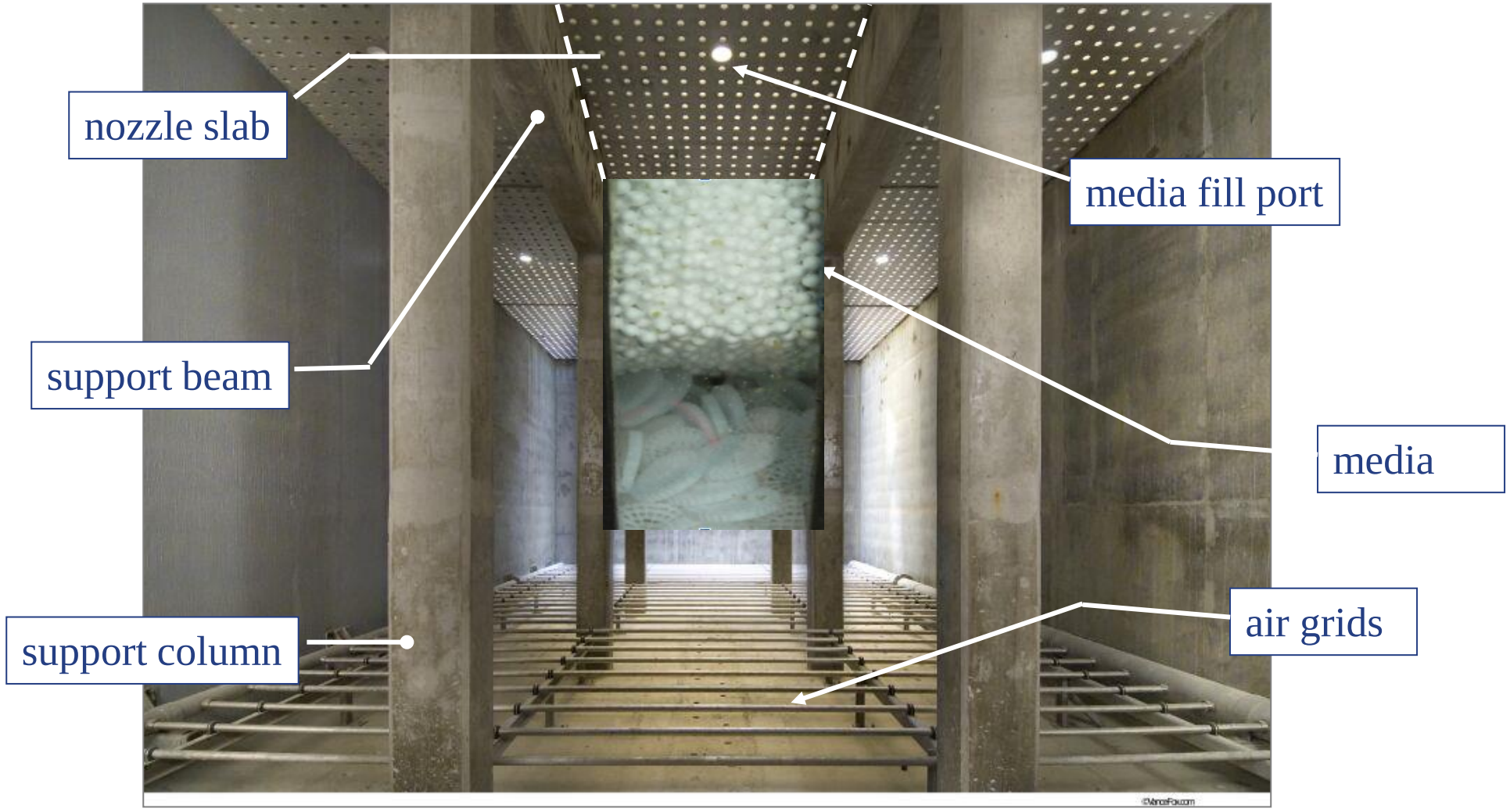
- Elegance
- Automation
- Versatility
- Performance
- Space
- Environment

BIOSTYR® System

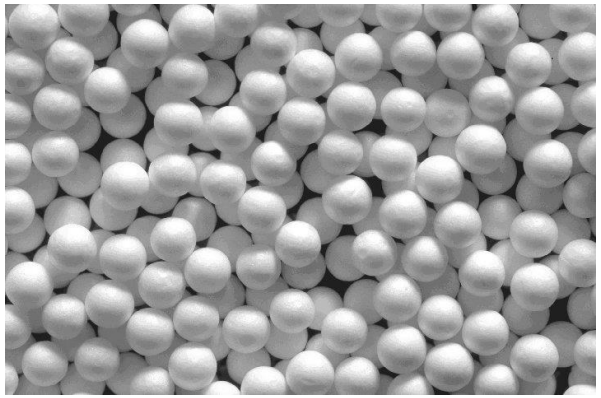


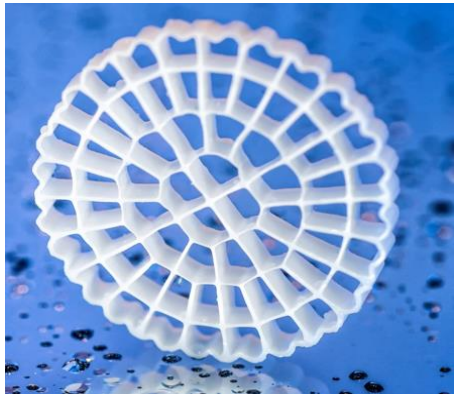
- Biological filter: inert media + biofilm
- Bio-reactor and clarifier in one “box” (cell)
- Multiple cells in parallel
- Sludge wasted via backwashing

BIOSTYR®/DUO Treatment Cell



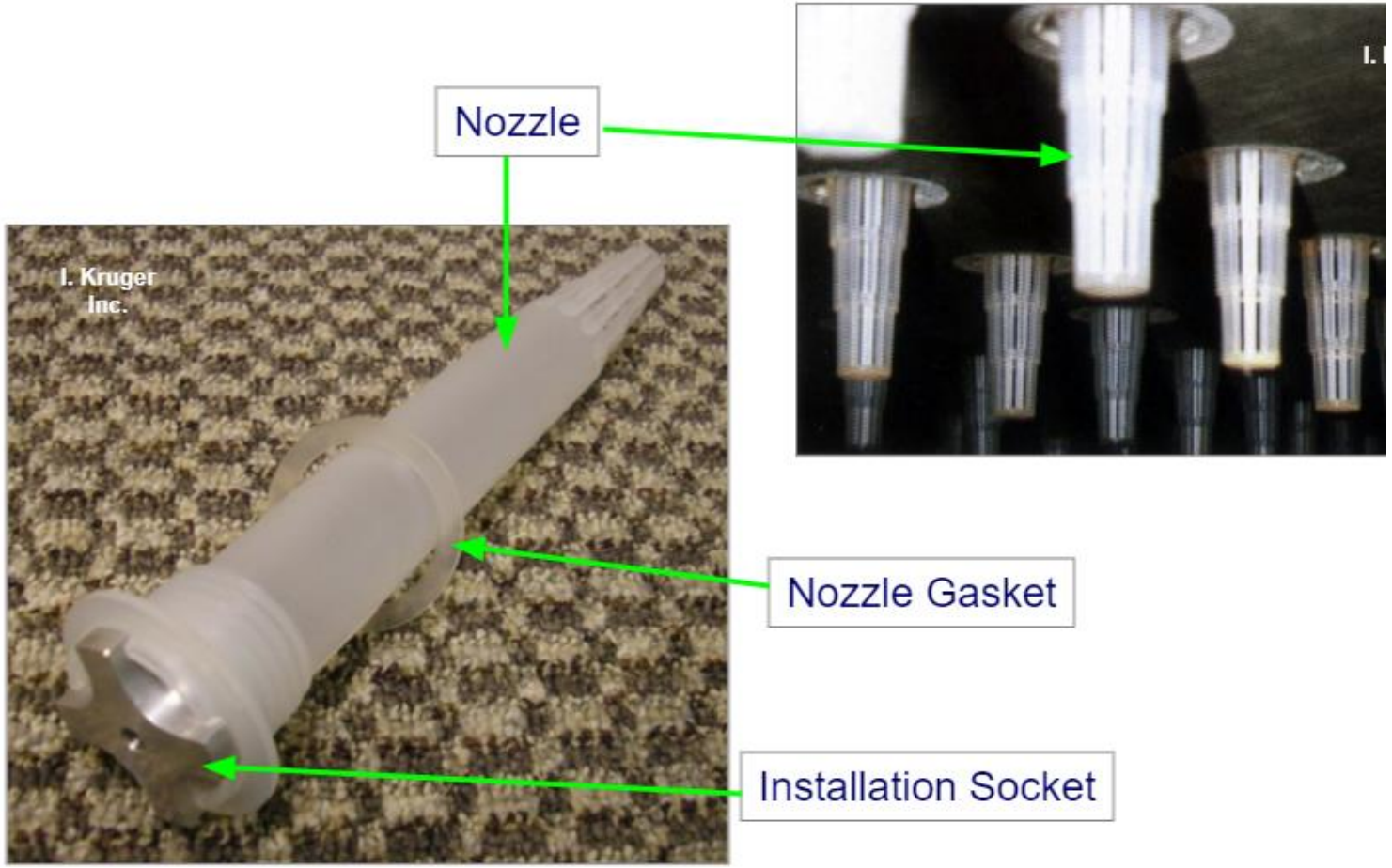
BIOSTYR®/DUO Media





- Polystyrene Beads
- Engineered. **Strict requirements**.
- Diameter: 3.6 - 5.0 mm
- Specific surface: **1,000 m^2/m^3**
- Porosity: 0.35
- Specific Gravity: 0.05

BIOSTYR® Nozzles



BIOSTYR® Applications

- Secondary cBOD & NH_3 Removal (secondary nitrification)
- Pre - Denitrification
- Tertiary Nitrification
- Tertiary Denitrification

Parameter	2^{nd}	2^{nd}-Nit	Tert-Nit	Denit
CBOD	10-20	5-15	5-10	5-10
TSS	15-25	10-15	5-10	5-10
NH_3-N	-	≤1.0	≤0.5	-
NO_3-N	-	-	-	≤1.0

BIOSTYR® Compact

BIOSTYR® Footprint ~25% of Suspended Growth System

BIOSTYR® Experience

BIOSTYR® Pilot Capability

Agenda

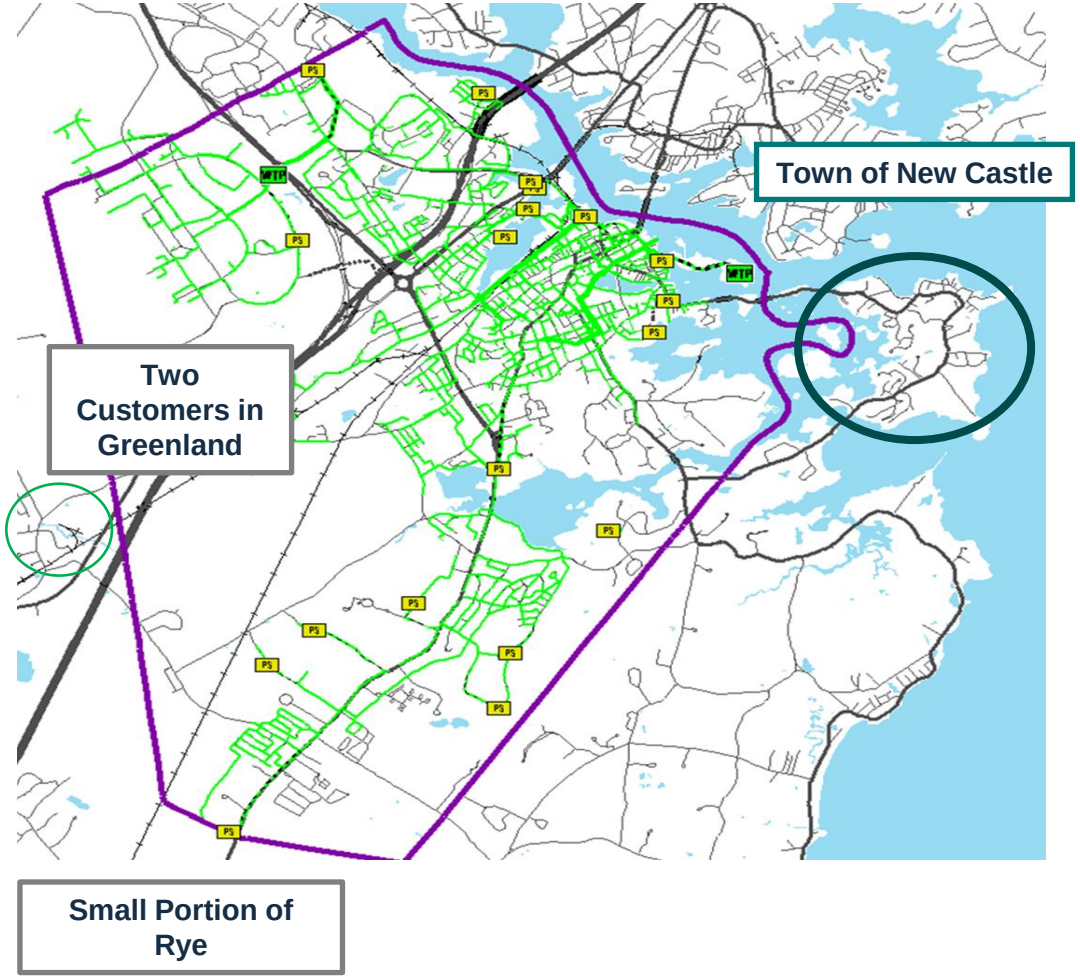
- BIOSTYR® BAF Technology Introduction
- City of Portsmouth, NH
- Pilot Testing
- Peirce Island WWTF Upgrade

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

Figure 1. New Hampshire coastal watershed communities.
Map provided by the Piscataqua Region Estuaries Project (PREP).

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: Location

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)

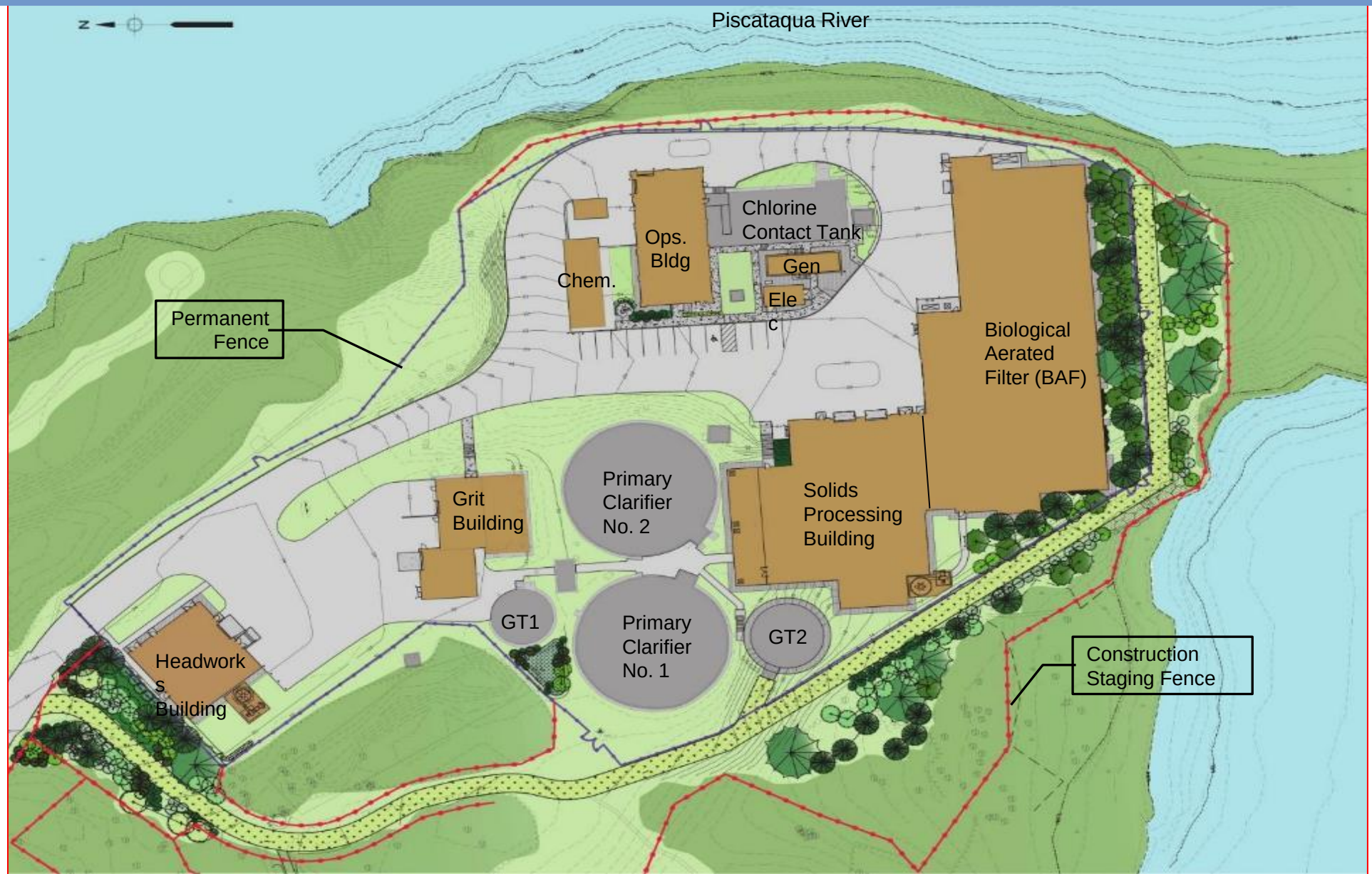
2-Stage Biological Aerated Filter

BIOSTYR® Pilot Study

Piloting Technology Priority Matrix

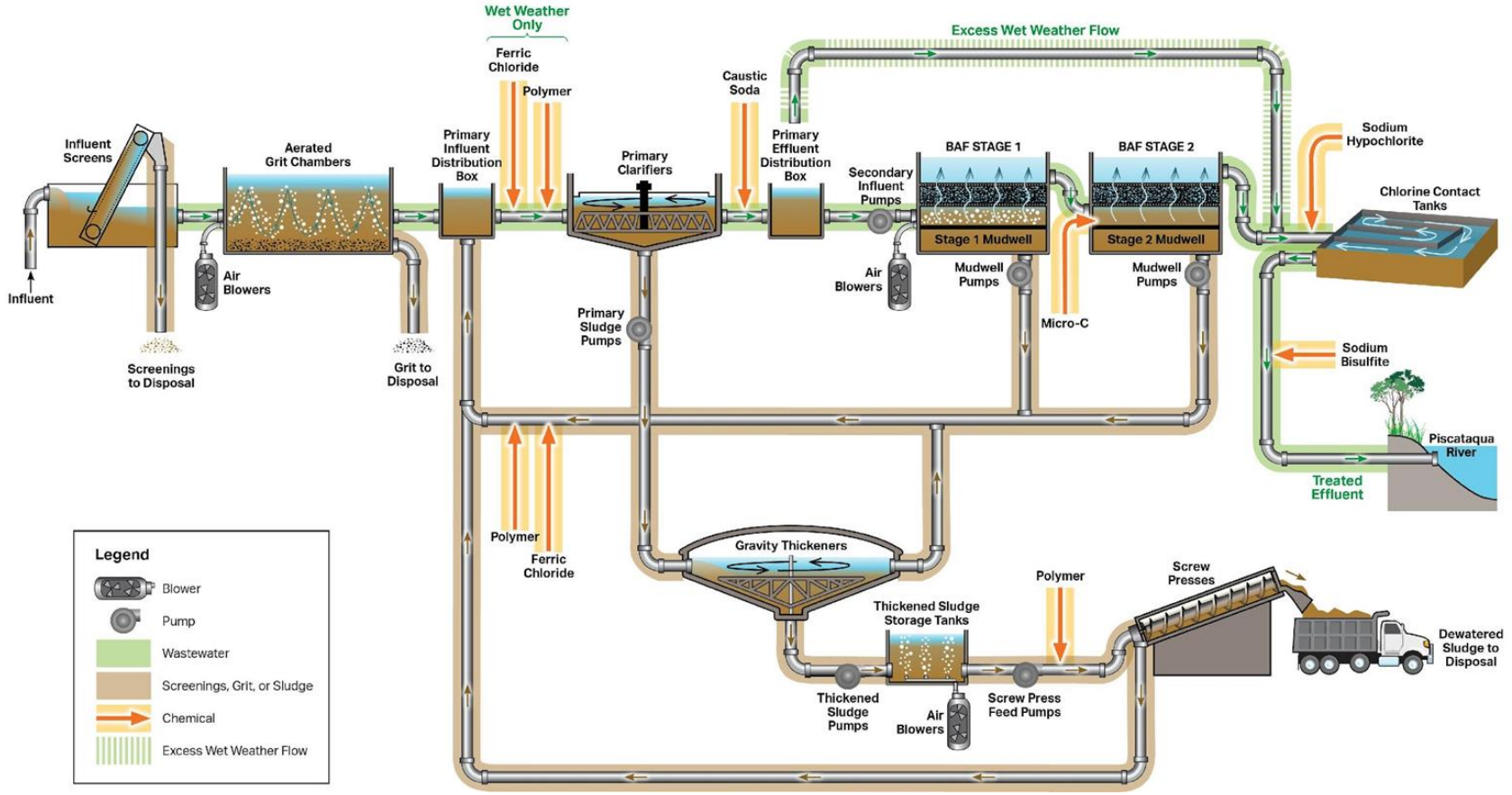
Evaluation Criteria	Weight	BAF		CAS-BioMag		MBBR-DAF	
		Rating	Score	Rating	Score	Rating	Score
Operations Factors	10	3.0	30	2.1	21	3.2	32
Maintenance Factors	3	3.2	9.6	1.6	4.8	3.5	10.5
Health & Safety Factors	27	3.2	86.4	2.0	54	3.3	89.1
Operational Track Record/Established Process	19	4.0	76	2.0	38	3.0	57
Ability to Retrofit TN of 8 mg/l to Meet Future TN of 3 mg/l	3	5.0	15	2.5	7.5	3.0	9
Response to Sustained Wet Weather Flows	13	3.5	45.5	4.0	52	3.5	45.5
Response to Process Disruption	18	4.0	72	3.0	54	4.0	72
Potential for Technology Optimization	0	2.5		2.5		4.0	
Ability to Exceed Treatment Performance Goals	6	3.0	18	4.0	24	3.0	18
Total Weighted Criteria		353		255		333	
Capital Cost (estimated - in millions)		$60.5		$54.0		$56.5	
Value Ratio (criteria/capital cost)		**5.8**		**4.7**		**5.9**	
Life Cycle Cost (in millions)		$75.1		$73.3		$74.8	
Value Ratio (criteria/ life cycle cost)		**4.7**		**3.5**		**4.5**	

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

BIOSTYR®

Peirce Island WWTF Construction

Baseline
Enhanced Primary
Treatment

4.5 Years Construction and
$92M

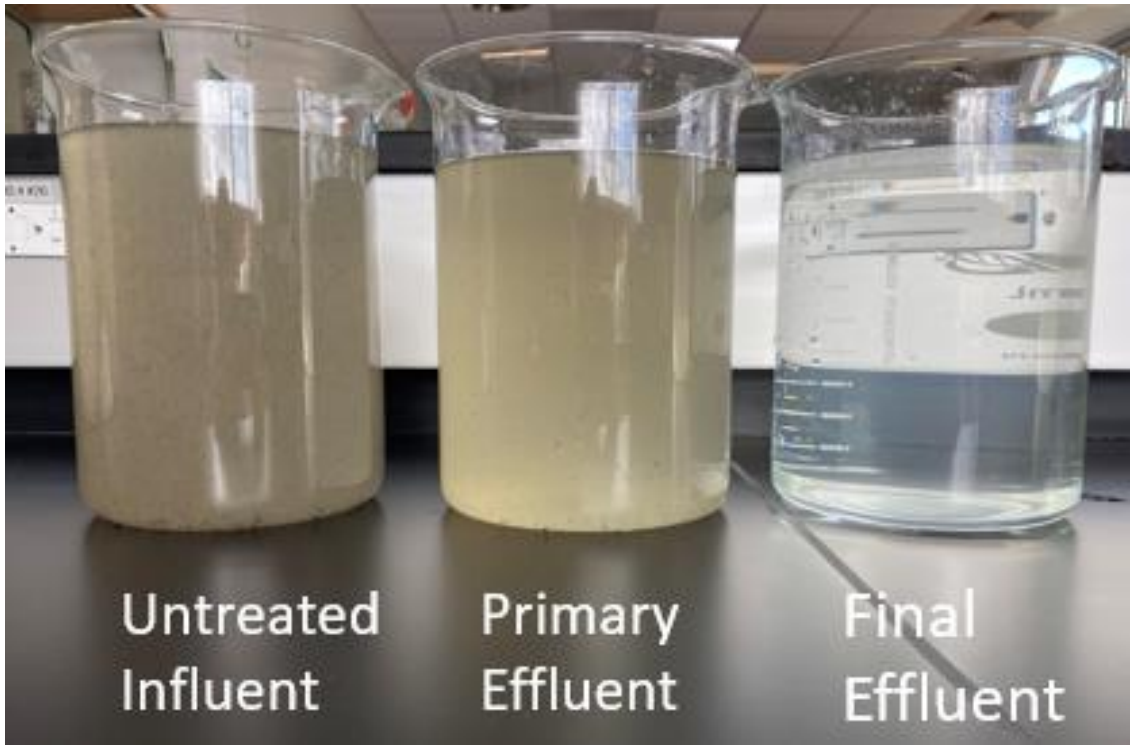
Upgraded
BIOSTYR®
Biological Aerated Filter

Overall WWTF Load Reductions

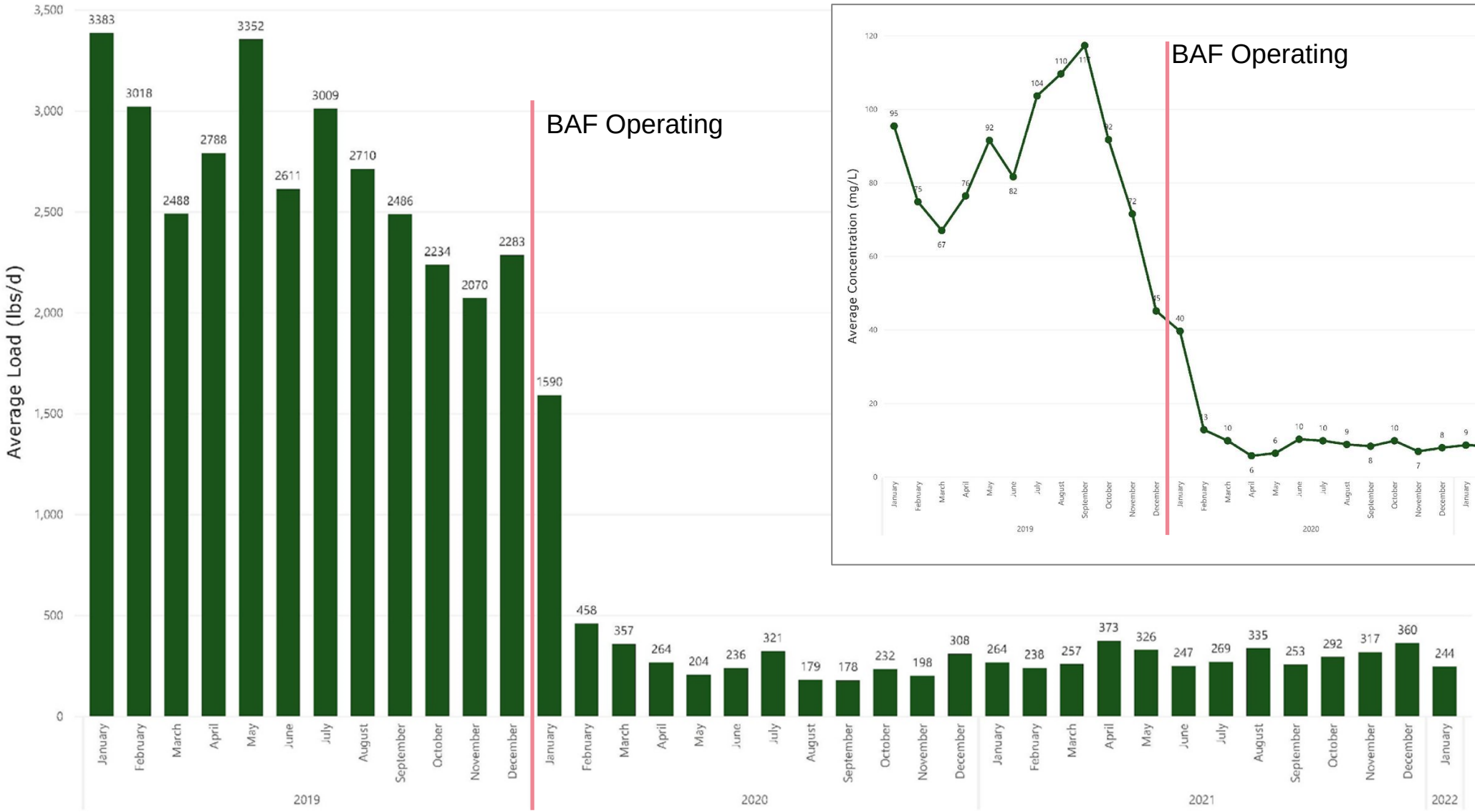
Biochemical Oxygen Demand → **90%**

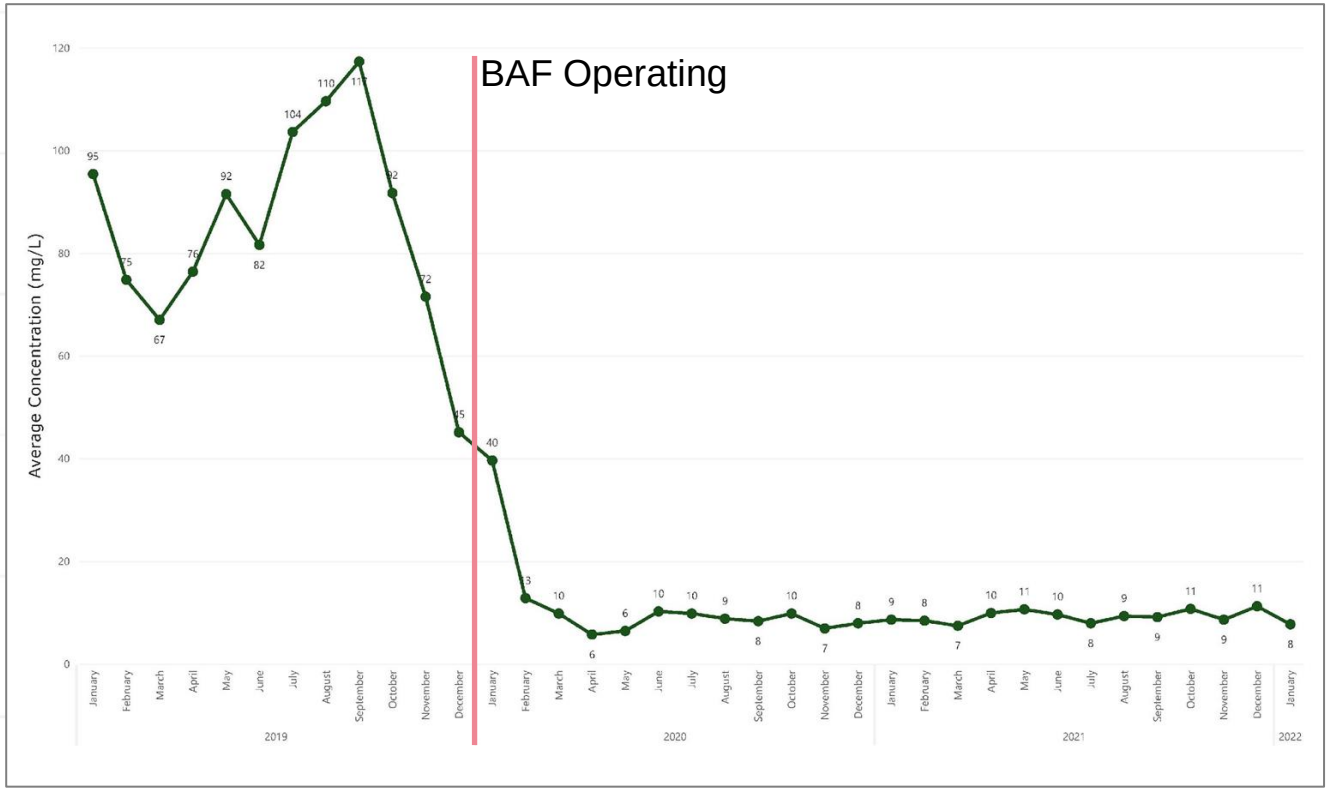
Total Suspended Solids → **87%**

Total Nitrogen → **83%**

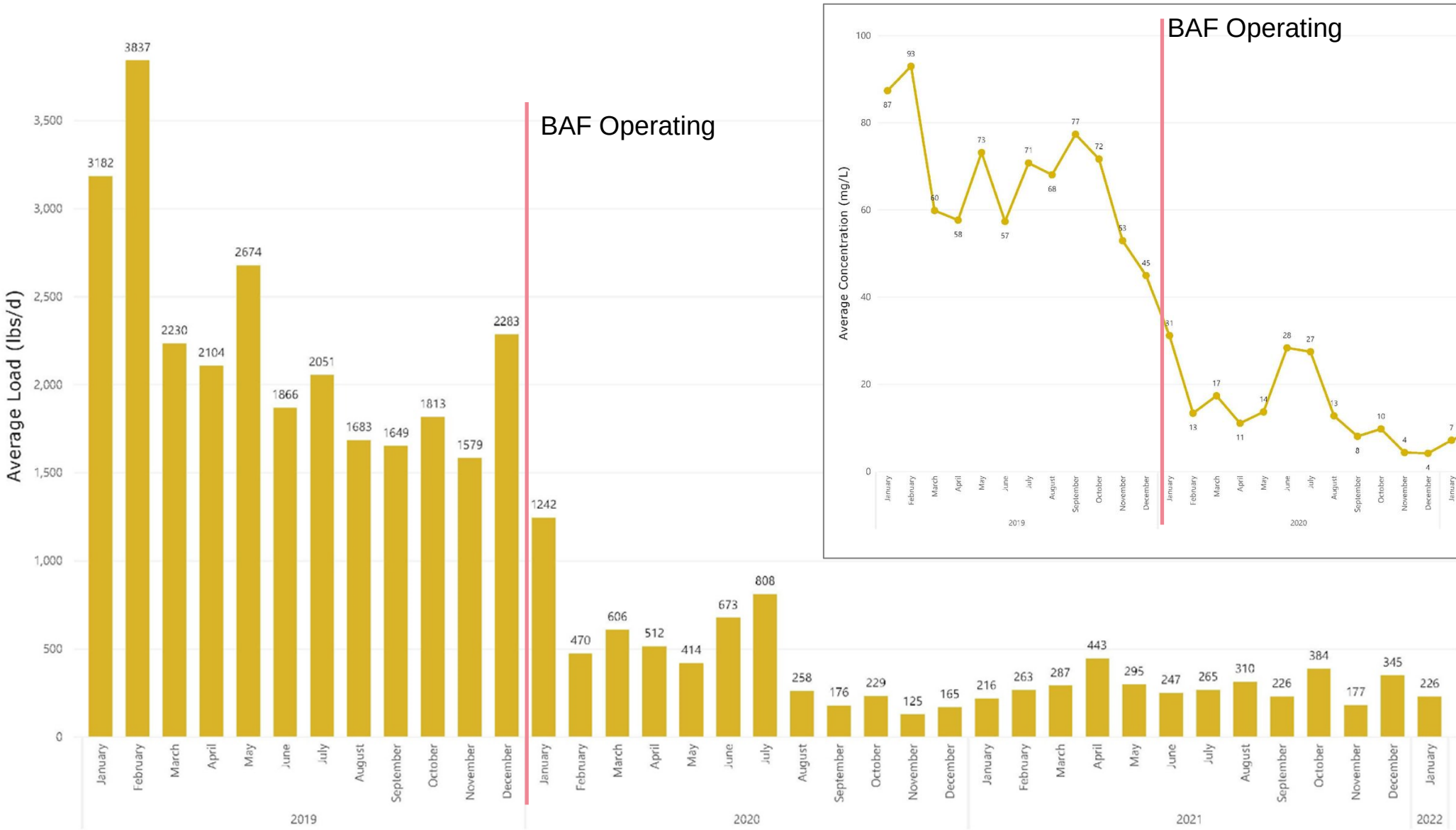


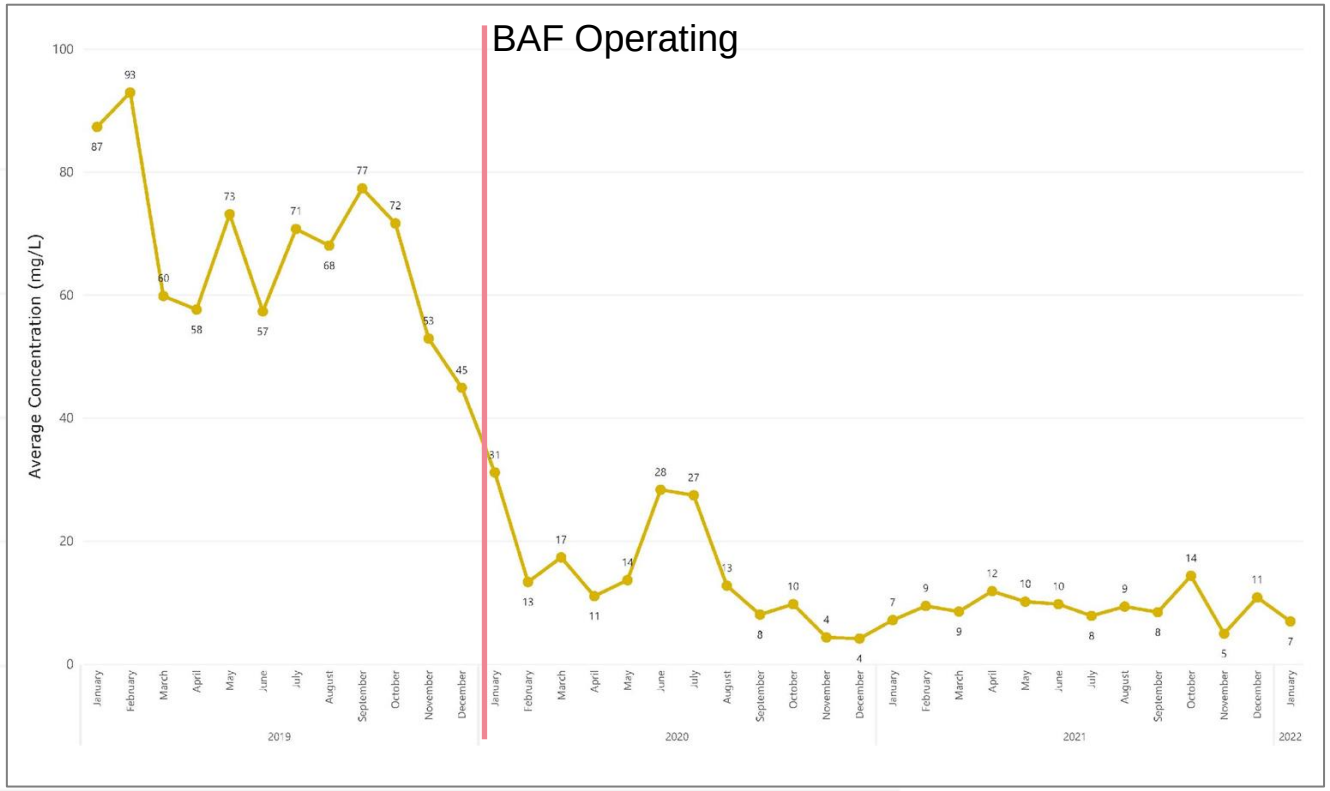
Peirce Island Biological Oxygen Demand (BOD) Effluent



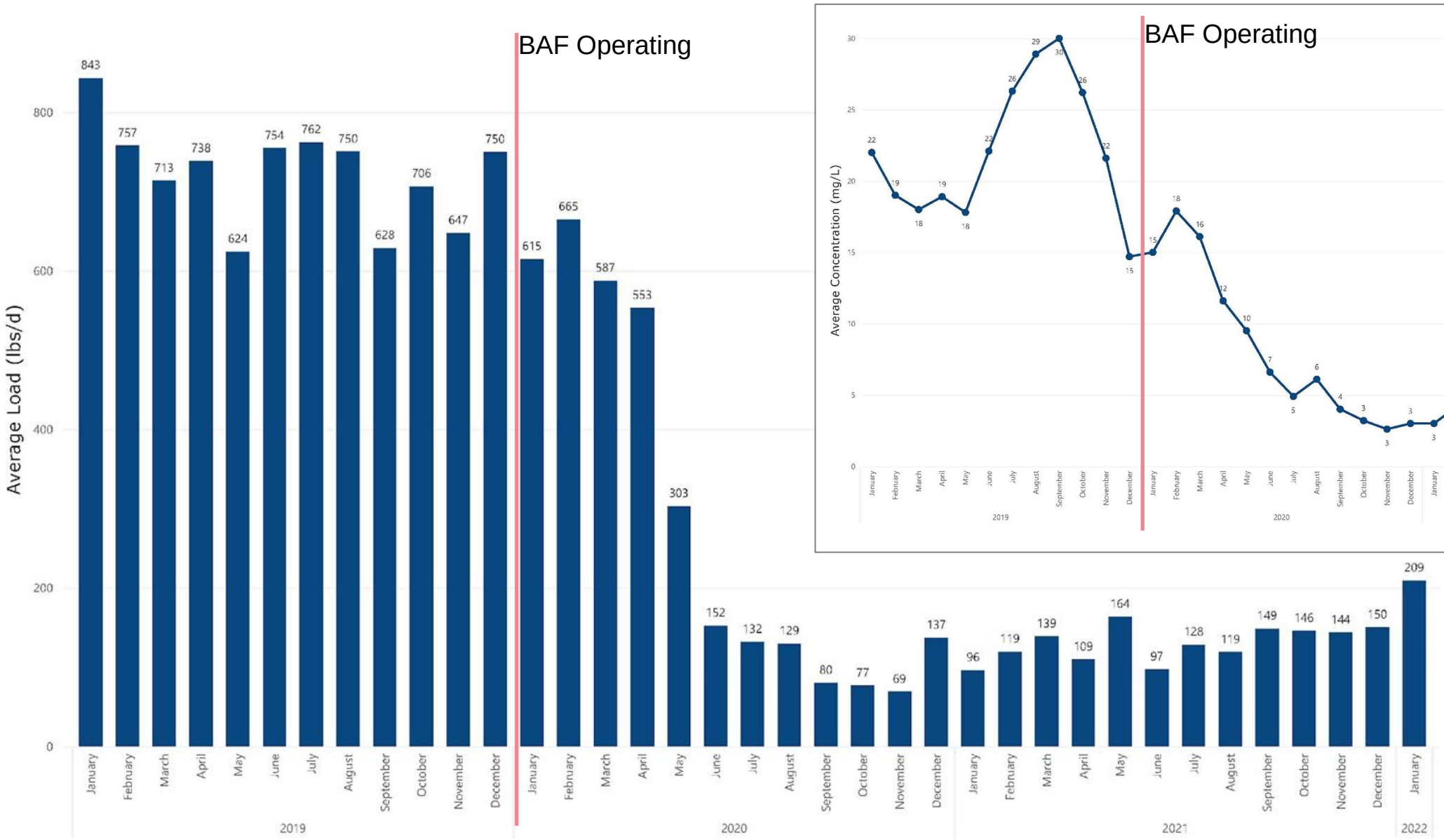


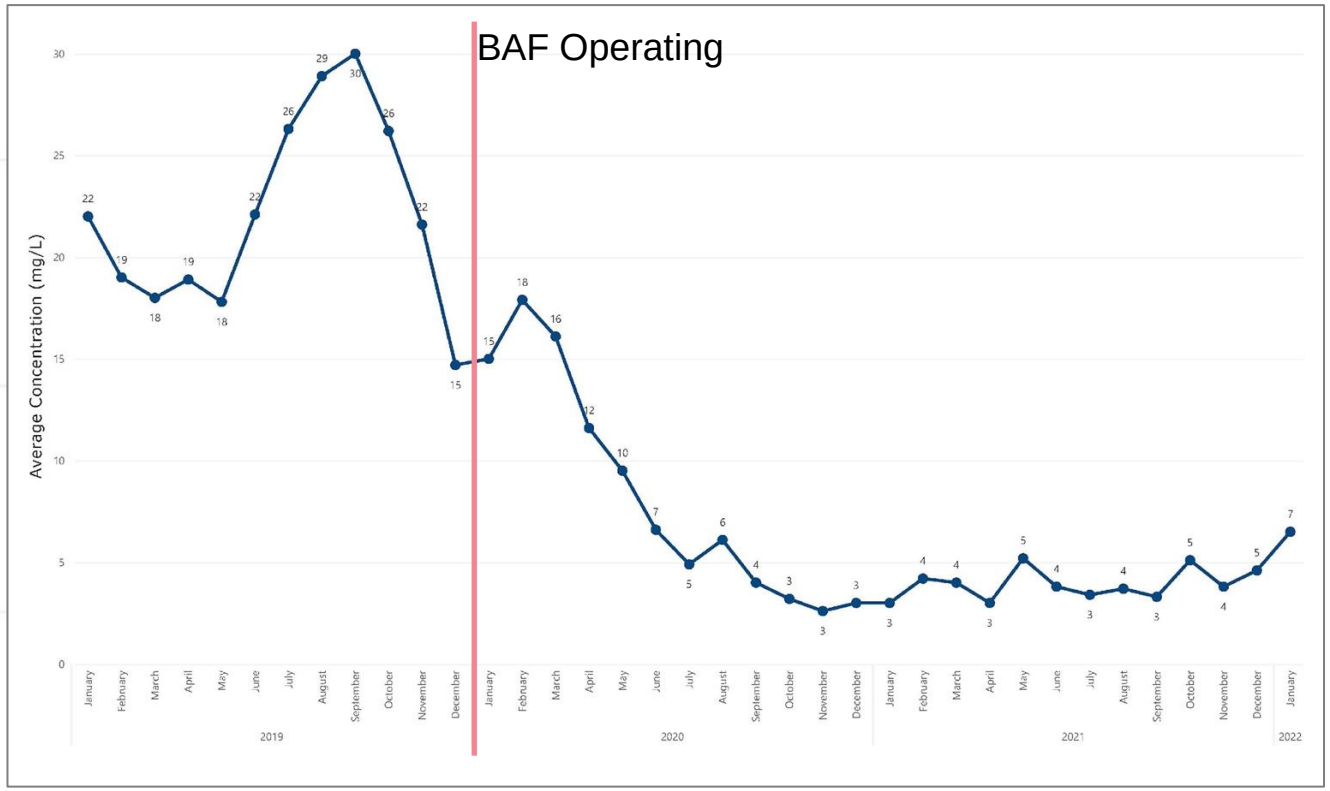
Peirce Island Total Suspended Solids (TSS) Effluent



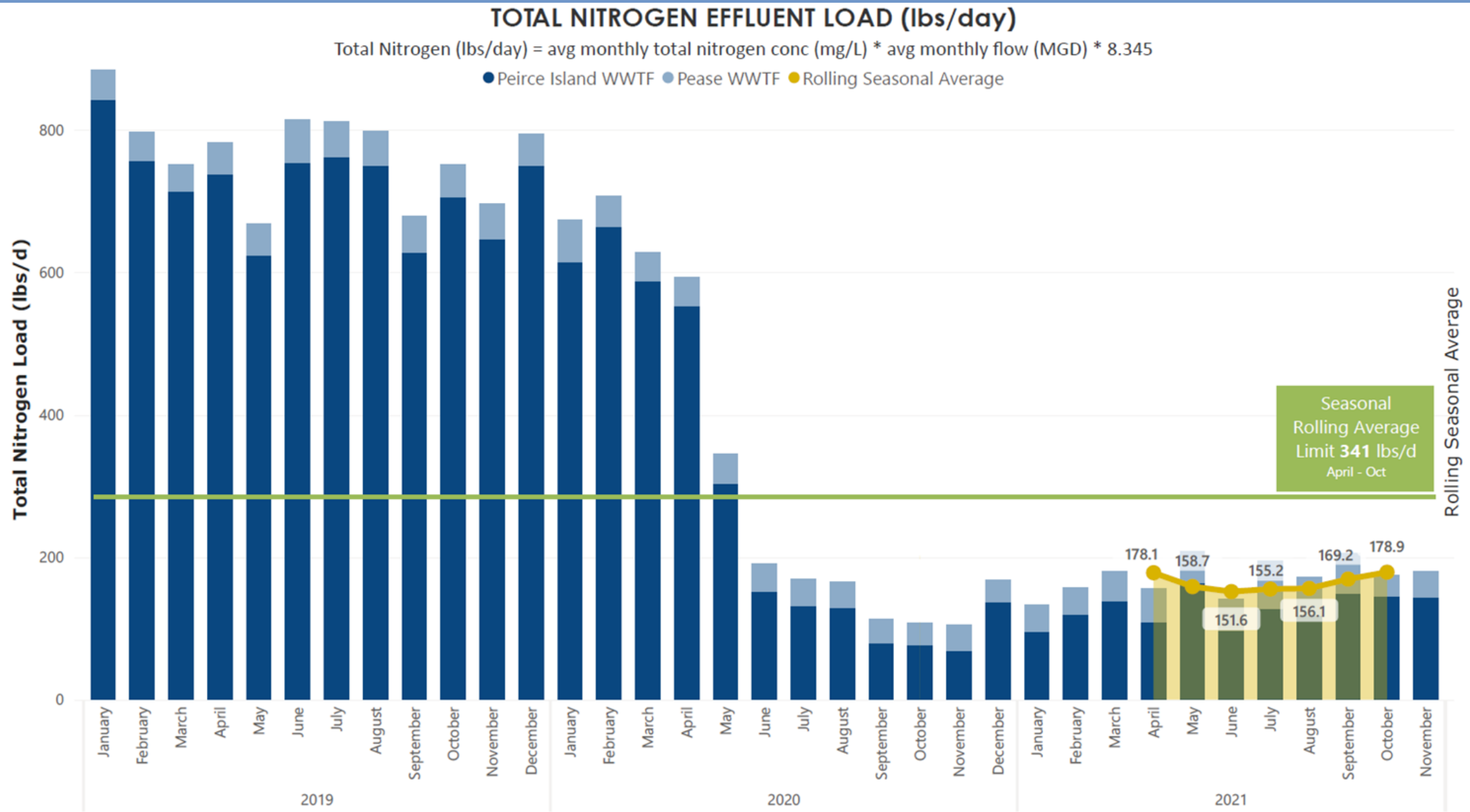


Peirce Island Total Nitrogen Effluent





Great Bay Total Nitrogen General Permit



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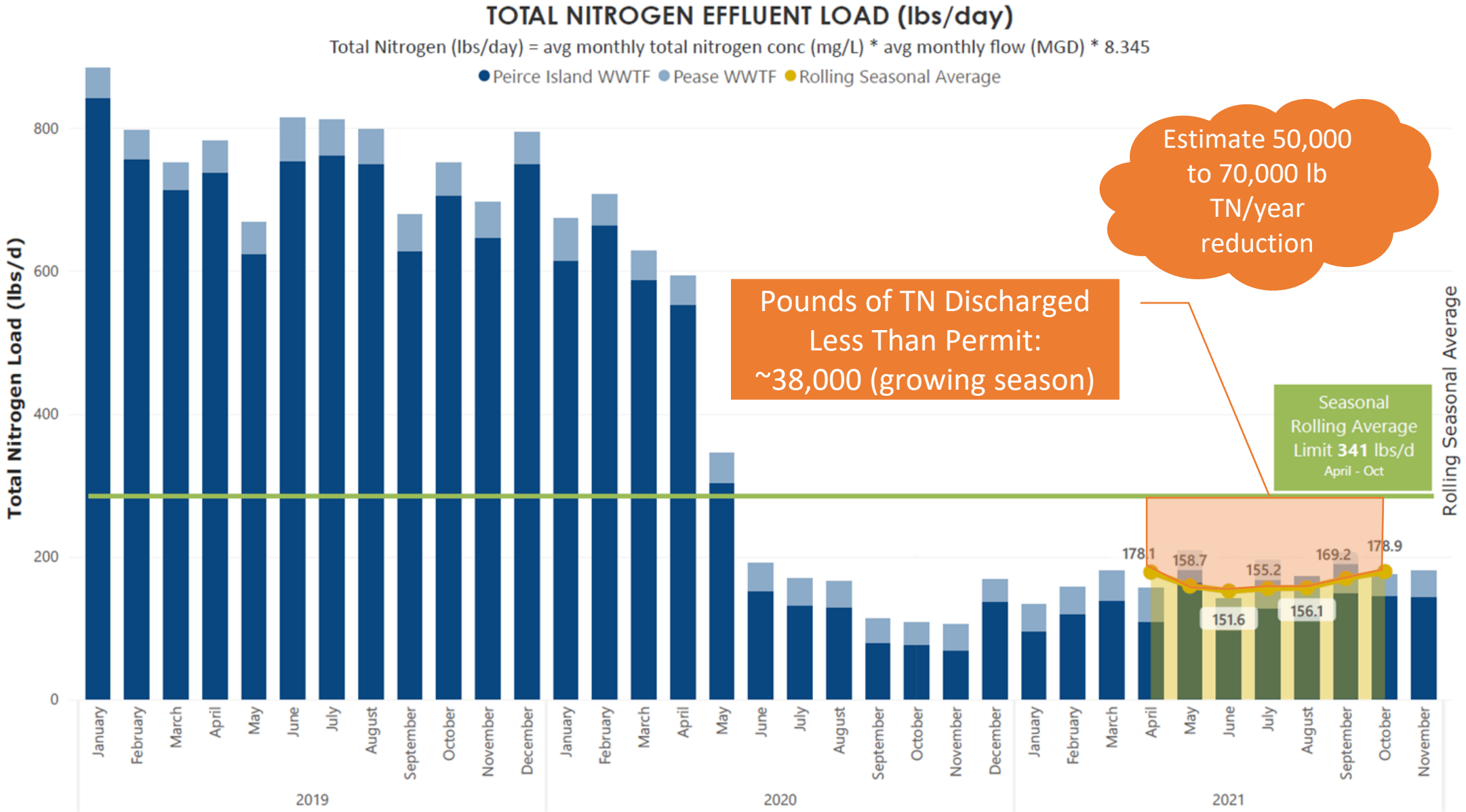

Summary

- ✓ 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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