

# Down the Drain: An Investigation of PFAS in an Island Community's Wastewater Collection System

Sarah Jakositz, EIT  
CDM Smith  
Eric Spargimino, PE, PMP  
CDM Smith

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**CDM  
Smith**



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# Outline

- Background
- Source Identification Approach
- Data Evaluation
- Ongoing Evaluation



# About Nantucket

- Located 30 miles off the south coast of Cape Cod
- Solely dependent on the infrastructure and resources existing within 48 square miles
- Population of around 14,000 swells to around 80,000 or more in the summer
- Drinking water is dependent on **Sole Source Aquifer**
  - No reasonable available alternative drinking water sources should the aquifer become contaminated
- Protection of the aquifer and public health is a top priority



# Project Objectives



Develop a PFAS management plan focused on protecting groundwater resources



Create a public outreach plan to inform residents and ensure consistent communication



*Long-Term Goal:* Develop and implement a PFAS source control and reduction plan to reduce risks associated with PFAS releases into the environment

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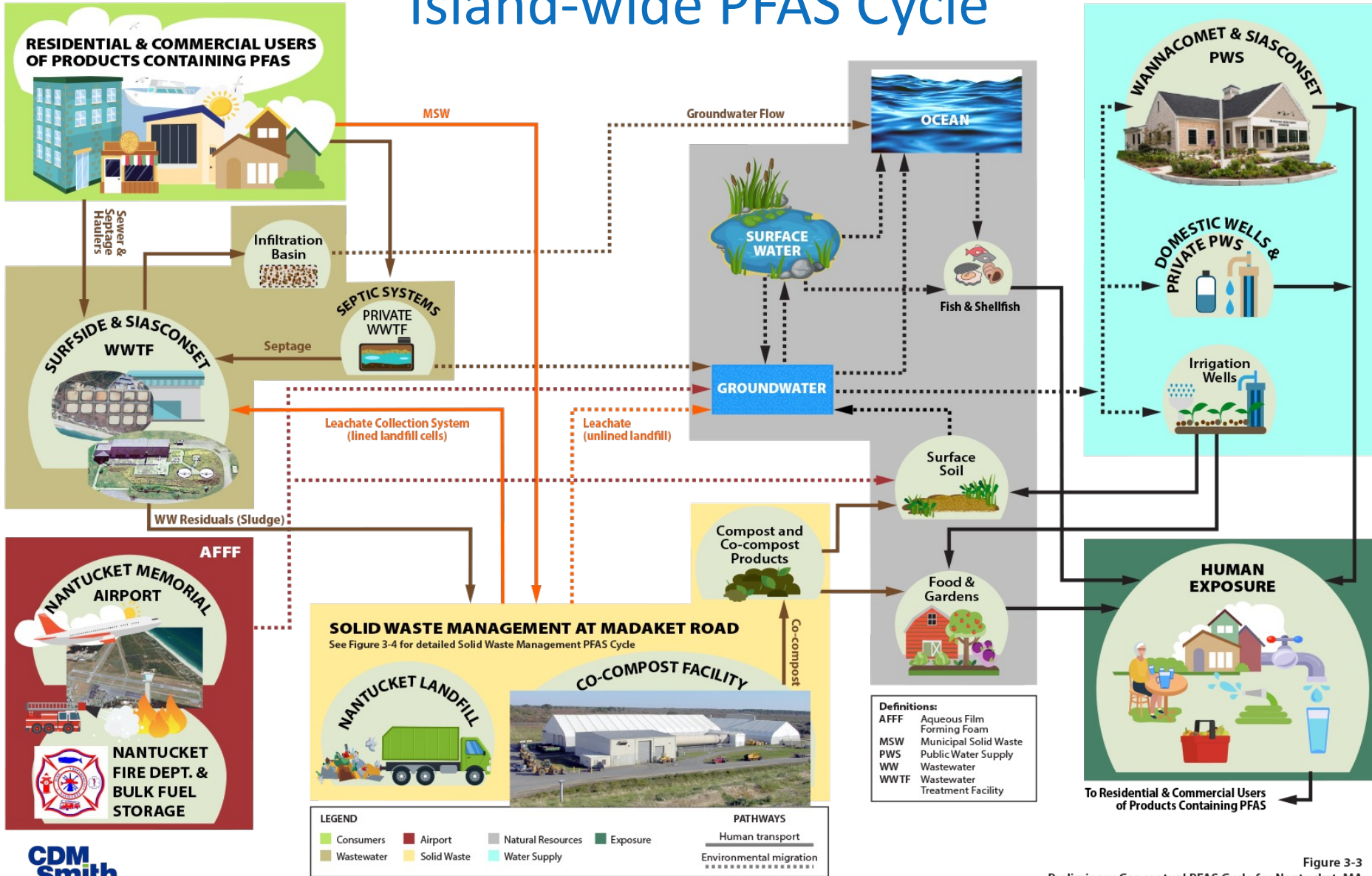


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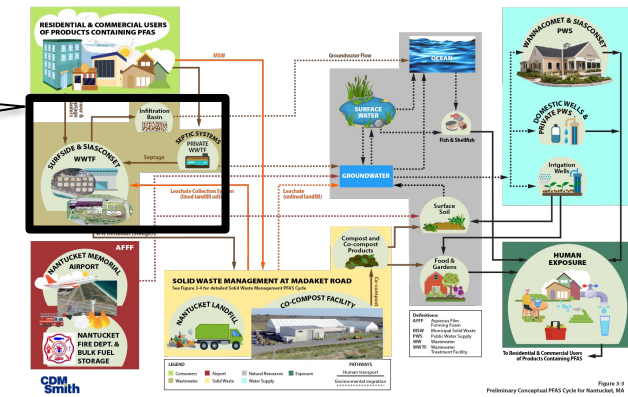
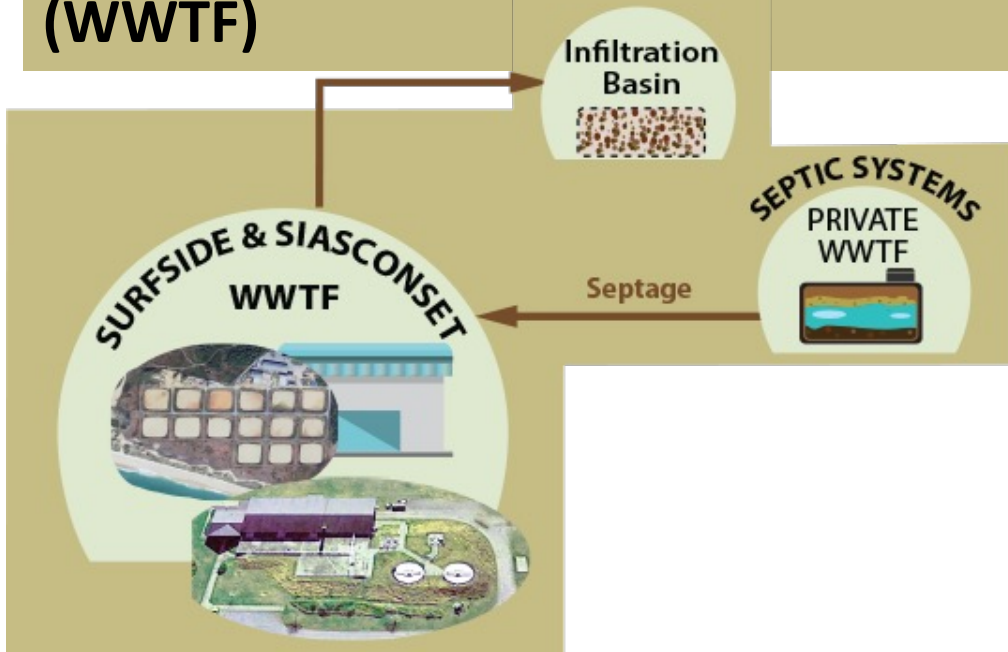
# Island-wide PFAS Cycle



- Sources
- Handlers and/or Transporters
- Receptors
- Pathways

Figure 3-3  
Preliminary Conceptual PFAS Cycle for Nantucket, MA

# Surfside Wastewater Treatment Facility (WWTF)



## Goals

- Identification and management of PFAS at the Surfside WWTF

## Actions

- Decision matrix and sampling plan
- Evaluation of PFAS destruction technologies

## Accomplishments

- Sampling program underway
- Identification of contributions to WWTF
- Path forward for source identification and mitigation



## Source Identification and Characterization





# Source Identification – From EPA’s PFAS Roadmap and Pretreatment (March 2023)

## Recommendations for POTWs

Establish universe in the service area & downstream of the POTW

- Conduct IU inventory of PFAS industries, including non-SIUs
- Collaborate with drinking water to determine downstream intakes
- Consider sludge disposal goals

Develop sampling plan

- Use method 1633 in conjunction with 1621
- Include IUs identified in PFAS inventory
- Select collection system monitoring locations to differentiate industrial vs. domestic influent contributions where possible
- Frequency recommendation: quarterly

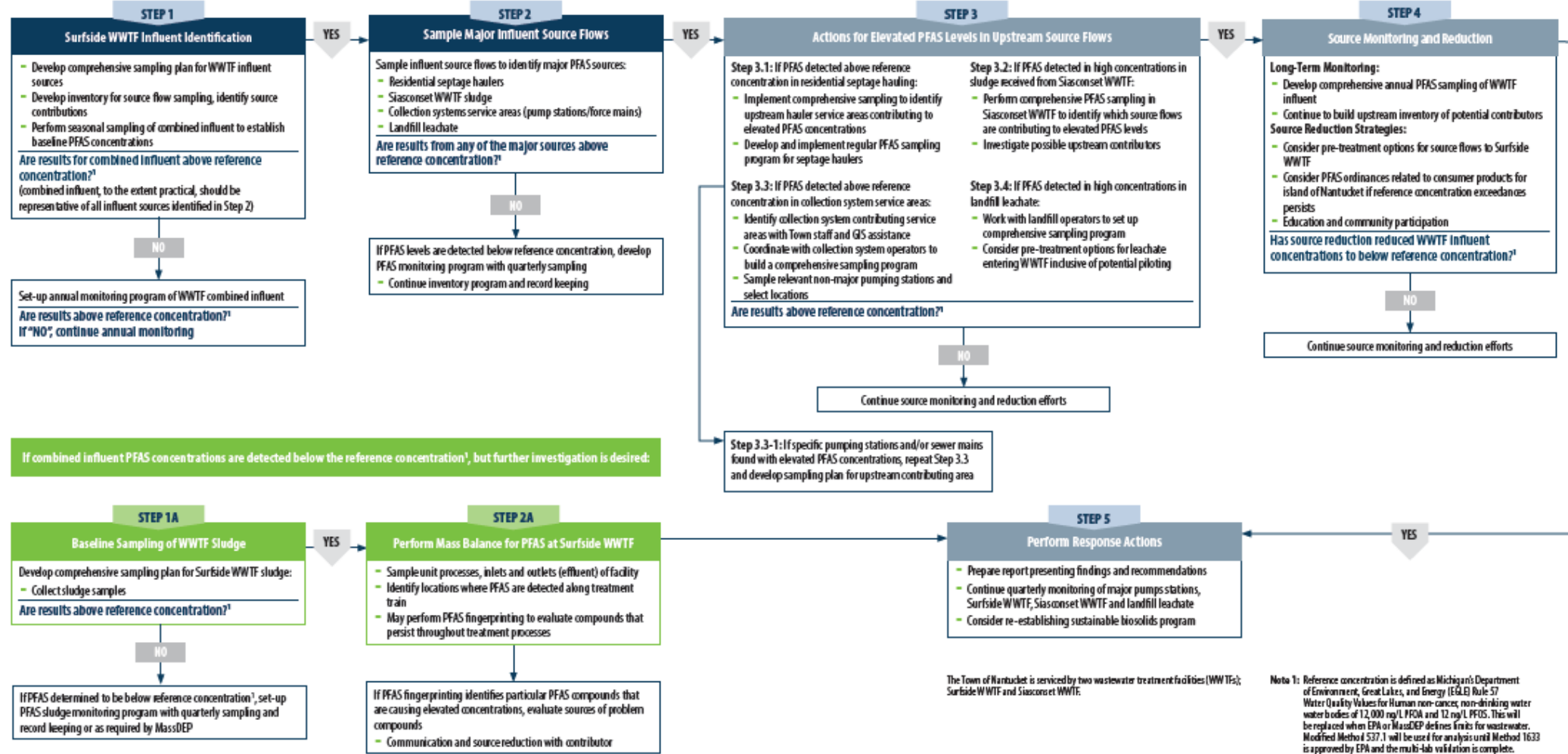
Implement solutions

- Incorporate monitoring requirements into IU control mechanisms
- Incorporate local limits into IU control mechanisms
- Local limits can be BMPs
- Ensure IUs are in ICIS and submitting data electronically
- Notify affected public water suppliers



**Purpose:** Establish a long-term program to identify and assess PFAS sources to the wastewater treatment facility (WWTF) such that influent concentrations can be understood, and plans can be directed towards the goal of identifying, building a baseline of, and reducing PFAS concentrations.

## WASTEWATER TREATMENT PFAS ASSESSMENT



If combined influent PFAS concentrations are detected below the reference concentration<sup>1</sup>, but further investigation is desired:

**STEP 1A**

**Baseline Sampling of WWTF Sludge**

- Develop comprehensive sampling plan for Surfside WWTF sludge:
  - Collect sludge samples

Are results above reference concentration?<sup>1</sup>

NO

If PFAS determined to be below reference concentration<sup>1</sup>, set-up PFAS sludge monitoring program with quarterly sampling and record keeping or as required by MassDEP

**STEP 2A**

**Perform Mass Balance for PFAS at Surfside WWTF**

- Sample unit processes, inlets and outlets (effluent) of facility
- Identify locations where PFAS are detected along treatment train
- May perform PFAS fingerprinting to evaluate compounds that persist throughout treatment processes

If PFAS fingerprinting identifies particular PFAS compounds that are causing elevated concentrations, evaluate sources of problem compounds

- Communication and source reduction with contributor

The Town of Nantucket is serviced by two wastewater treatment facilities (WWTFs): Surfside WWTF and Siasconset WWTF.

**Note 1:** Reference concentration is defined as Michigan's Department of Environment, Great Lakes, and Energy (EGLE) Rule 57 Water Quality Values for Human non-cancer, non-drinking water water bodies of 12,000 ng/L PFOA and 12 ng/L PFOS. This will be replaced when EPA or MassDEP defines limits for wastewater. Modified Method 537.1 will be used for analysis until Method 1633 is approved by EPA and the multi-lab validation is complete.

**Note 2:** Steps 1A, 2A, 3, 4, and 5 may be modified as needed after Steps 1 and 2 are complete.

CONTINUED IMPLEMENTATION OF ISLAND-WIDE PFAS PUBLIC OUTREACH PLAN

### STEP 1

#### Surfside WWTF Influent Identification

- Develop comprehensive sampling plan for WWTF influent sources
- Develop inventory for source flow sampling, identify source contributions
- Perform seasonal sampling of combined influent to establish baseline PFAS concentrations

**Are results for combined influent above reference concentration?<sup>1</sup>**

(combined influent, to the extent practical, should be representative of all influent sources identified in Step 2)

NO

Set-up annual monitoring program of WWTF combined influent

**Are results above reference concentration?<sup>1</sup>**  
If "NO", continue annual monitoring

YES

### STEP 2

#### Sample Major Influent Source Flows

Sample influent source flows to identify major PFAS sources:

- Residential septage haulers
- Siasconset WWTF sludge
- Collection systems service areas (pump stations/force mains)
- Landfill leachate

**Are results from any of the major sources above reference concentration?<sup>1</sup>**

NO

If PFAS levels are detected below reference concentration, develop PFAS monitoring program with quarterly sampling

- Continue inventory program and record keeping

YES

# Suspect Industries Identified as Potential Commercial and Industrial PFAS Users



Fire-fighting Foams



Oil & Gas Industry



Mining



Plastics



Cleaning Products



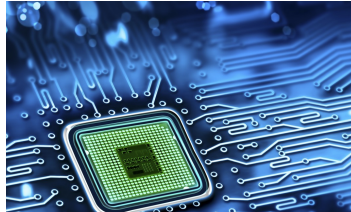
Medicine



Metal Plating



Paper & Packaging



Electronics



Coatings: waxes, paints, inks, varnish



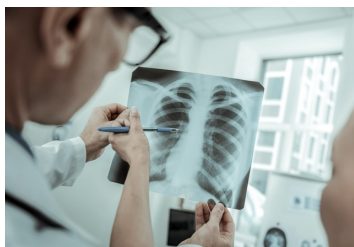
Personal Care Products



Building & Construction



Textiles, Leather & Apparel



Photography



Pesticides



Refrigerants



Explosives

# Source Characterization

## Paper and Food Packaging

- Side-chain fluoropolymers
- PAPs/diPAPs
- NEtFOSE, NEtFOSAA, PFBS, PFOA, PFHxA



## Textile and Leather

- Polymers
- Polymer raw materials
- PFOA, FTOHs



## AFFF

- PFOA, PFOS, PFHxS
- C8 fluorotelomers (8:2 FTS)
- C6 fluorotelomers, PFOA



## WWTPs and Landfills

- n:2 FTUCA
- n:3 FTCA (5:3 FTCA)
- n:2 FTSA
- EtFOSA



## Metal Plating

- PFOS
- 6:2 FTS, 8:2 FTS
- F53B





# Data Evaluation



# Laboratory Analysis

## Targeted Analysis

- Year 1 – USEPA Method Modified 537.1
  - Was the best available test when we started
- Year 2 – Draft USEPA Method 1633 for 40 PFAS Compounds
  - Using the lab where the draft method has been accepted

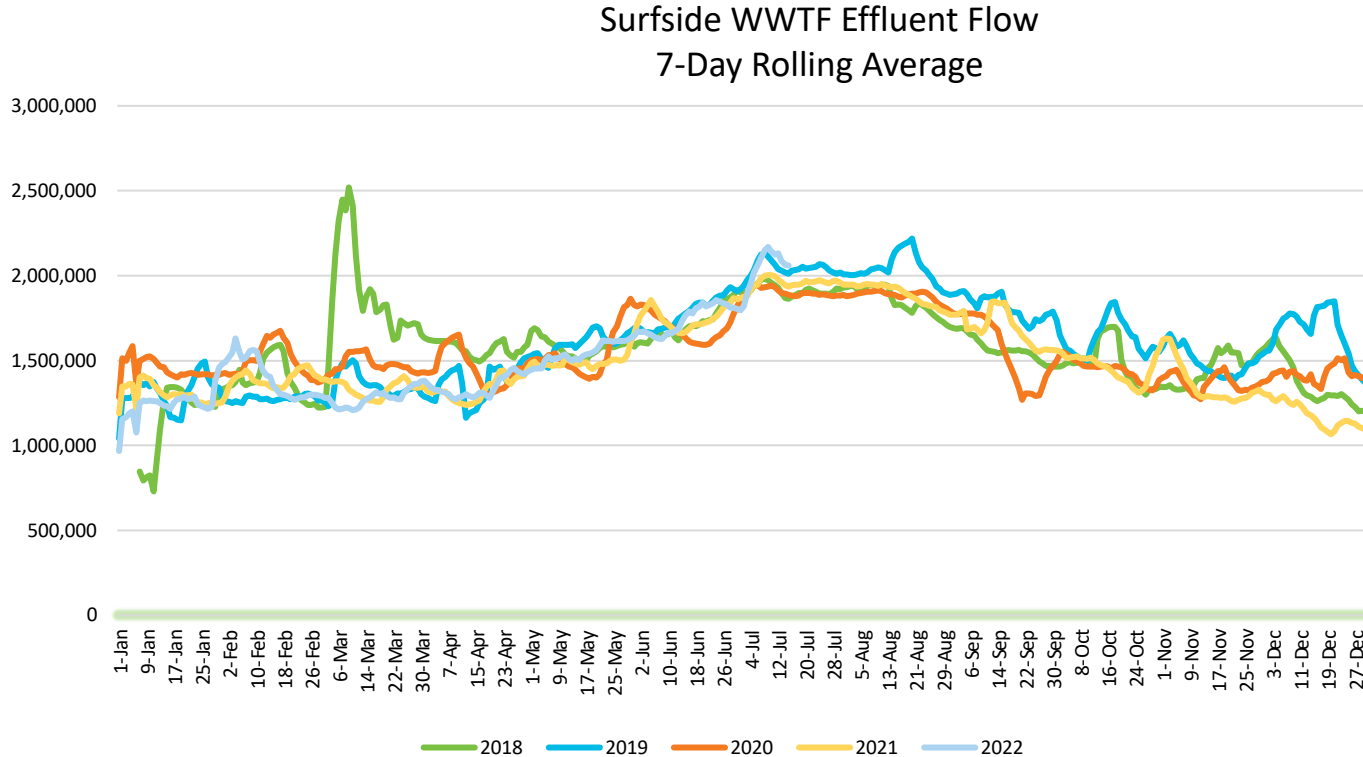
## Non-Target Analyses

- Goal: Better understand fate and transport throughout system
- Total Oxidizable Precursor (TOP) Assay
  - Converts Precursors to PFAAs
- Total Organic Fluorine by combustion ion chromatography
  - All organic fluorine compounds (~0.4 ppb detection limits)
  - Extractable Organic Fluorine (EOF) for solids
  - Absorbable Organic Fluorine (AOF) for aqueous



# Nantucket Wastewater – Seasonal Variation

- Peak flow in summer (Jul/Aug)
- Lowest flows observed in winter (Nov/Dec/Jan)



Aerial view of Surfside WWTF



Madaket Landfill In-Vessel Composter

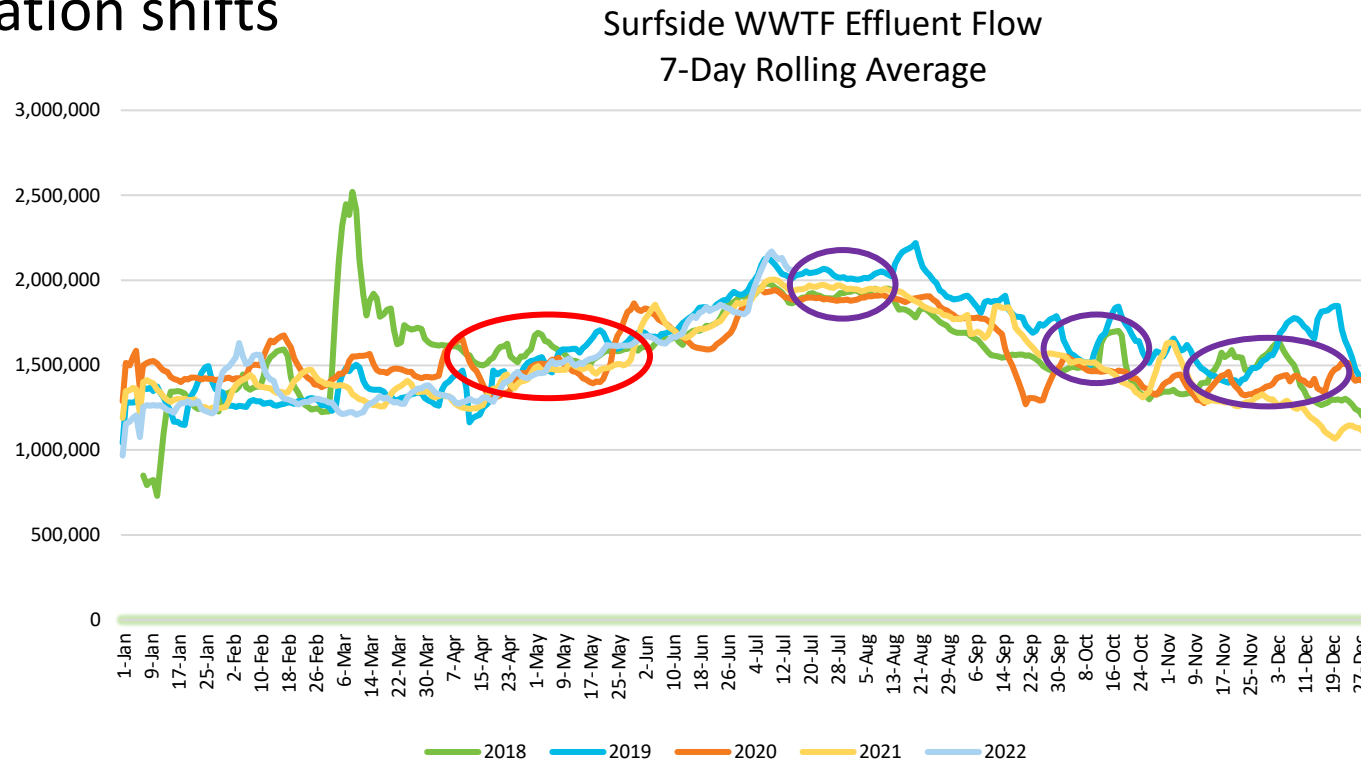


# Nantucket Wastewater – Seasonal Variation

- Peak flow in summer (Jul/Aug)
- Lowest flows observed in winter (Nov/Dec/Jan)
- Sample dates selected with Town to represent on-island population shifts

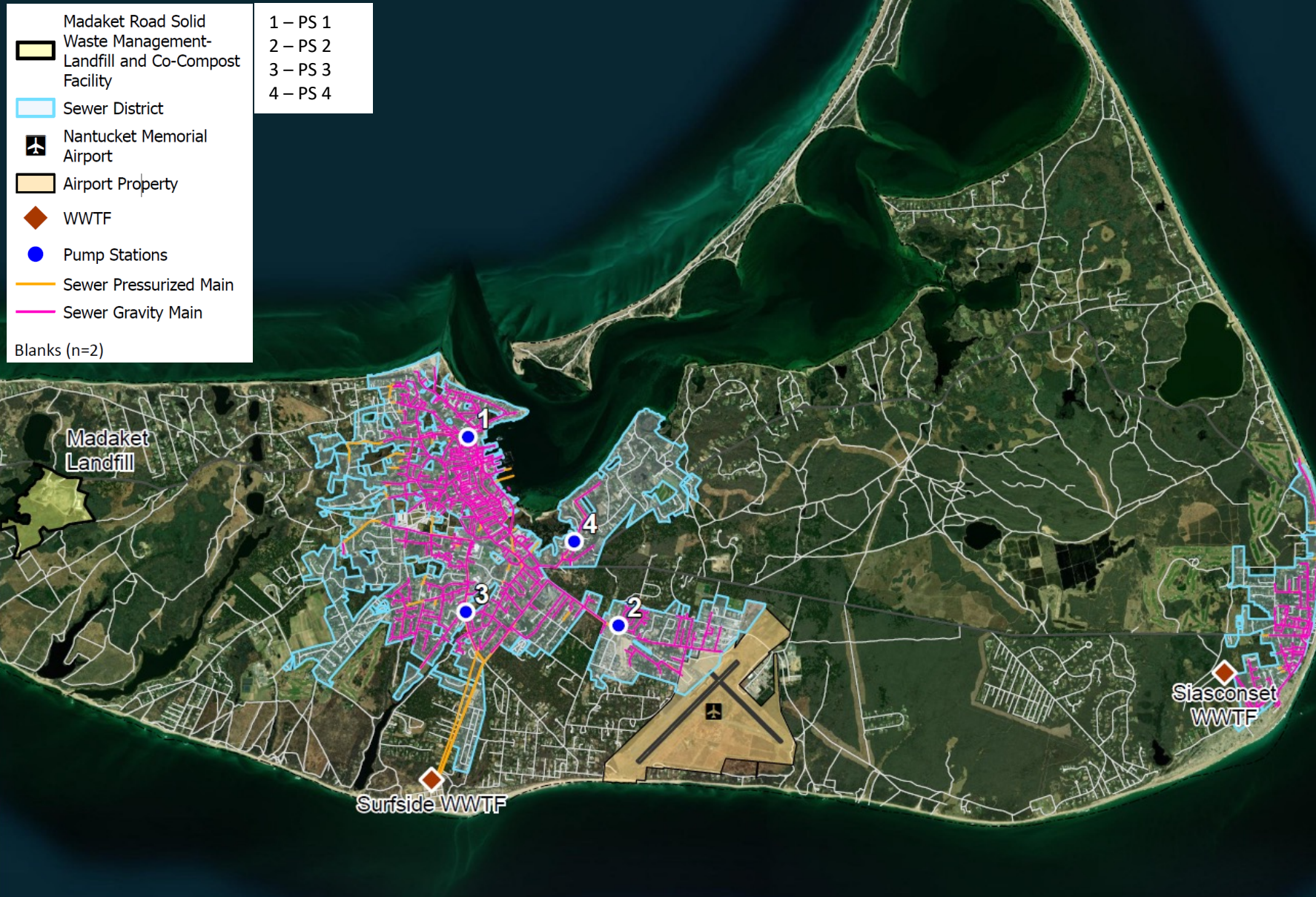


Aerial view of Surfside WWTF



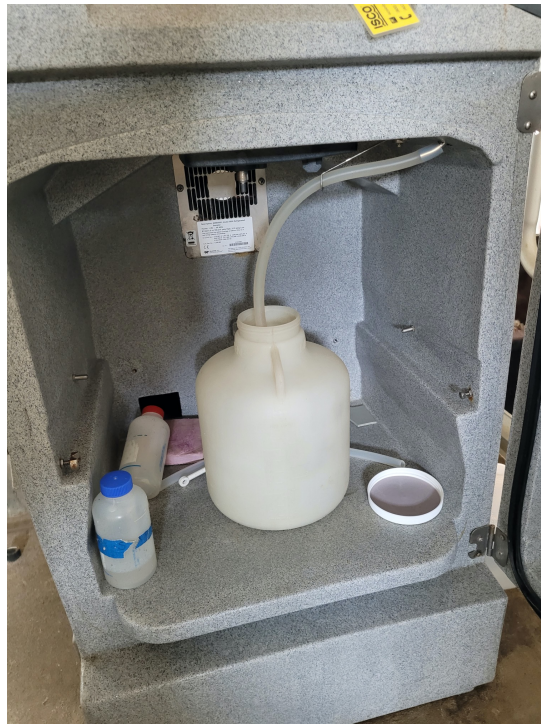
- Aug. 10 & 11, 2022
- Oct. 10 & 11, 2022
- Nov. 28 & 29, 2022
- April/May, 2023

# Wastewater Sample Locations

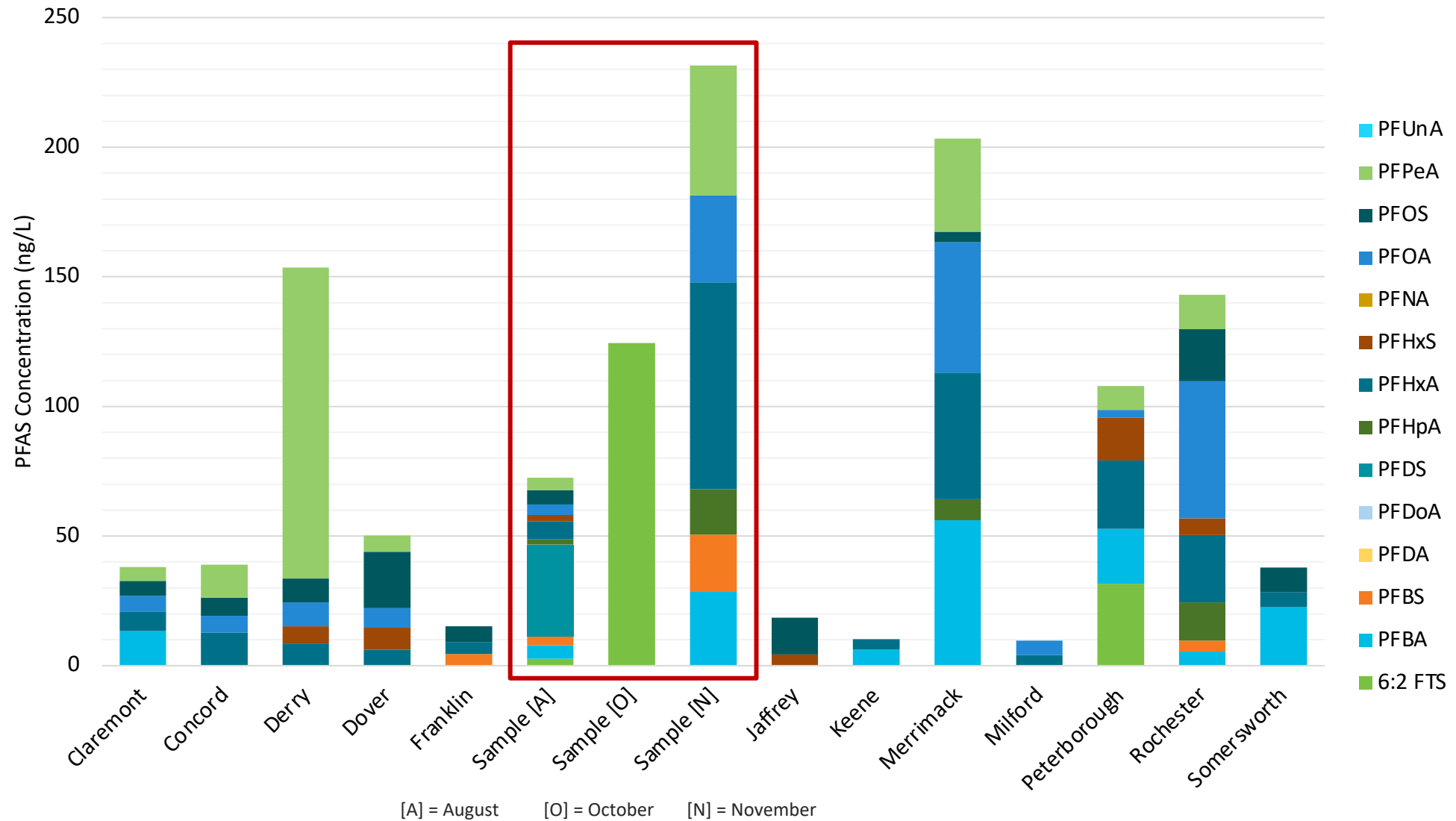


# Data Qualifications

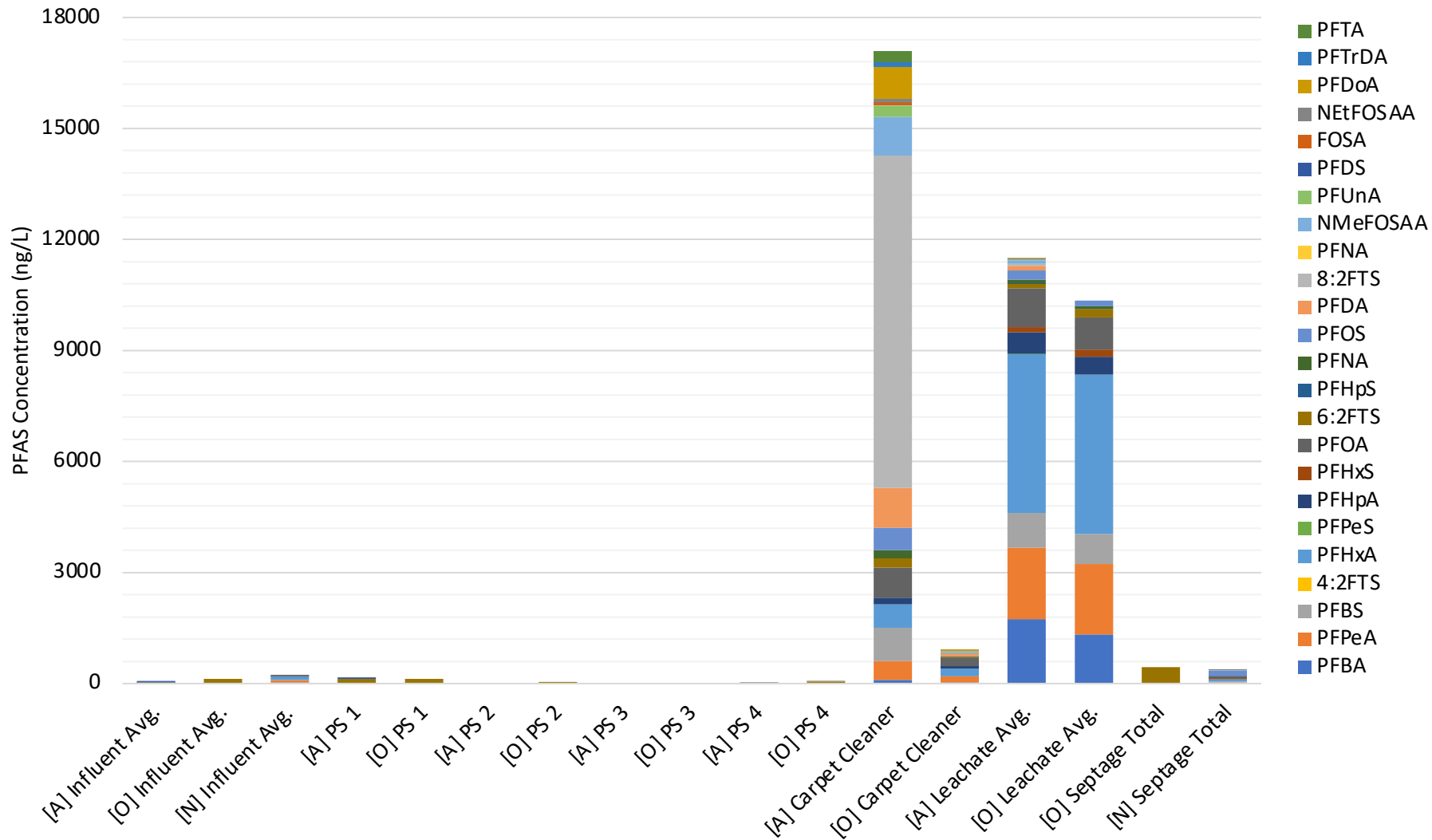
- Preliminary observations only
- Year 1 completed (4 rounds), Year 2 ongoing
- Additional quality review needed



# Benchmark – Preliminary Influent PFAS Concentrations



# PFAS Concentrations Detected

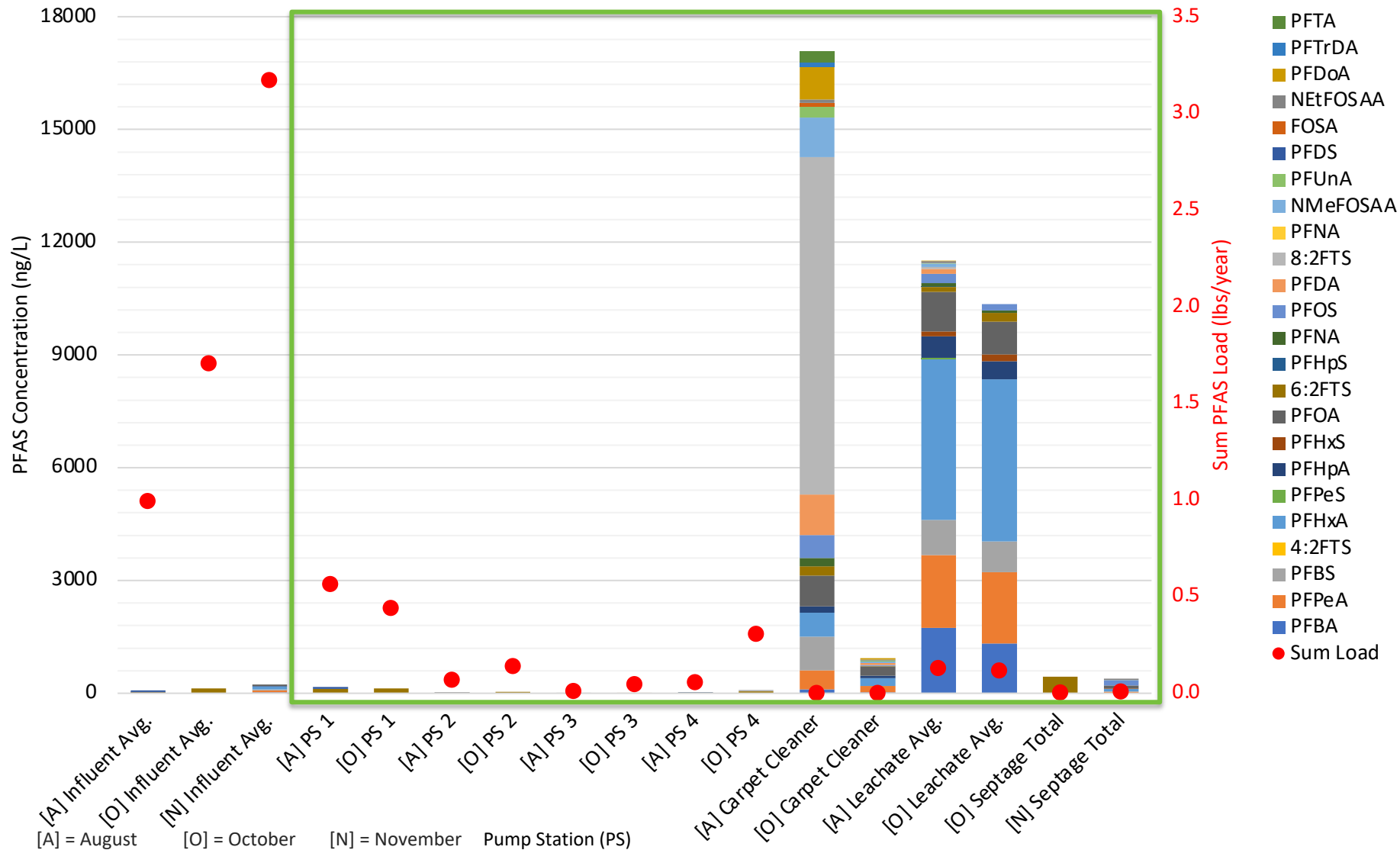


## Initial Observations:

- Highest PFAS concentrations detected in carpet cleaners and landfill leachate samples
- November Influent PFAS sum was 3x August
- Carpet cleaner sample concentrations appear higher in Aug. than Oct.
- Higher concentrations of PFAS were detected in landfill leachate samples

[A] = August [O] = October [N] = November [PS] = Pump Station

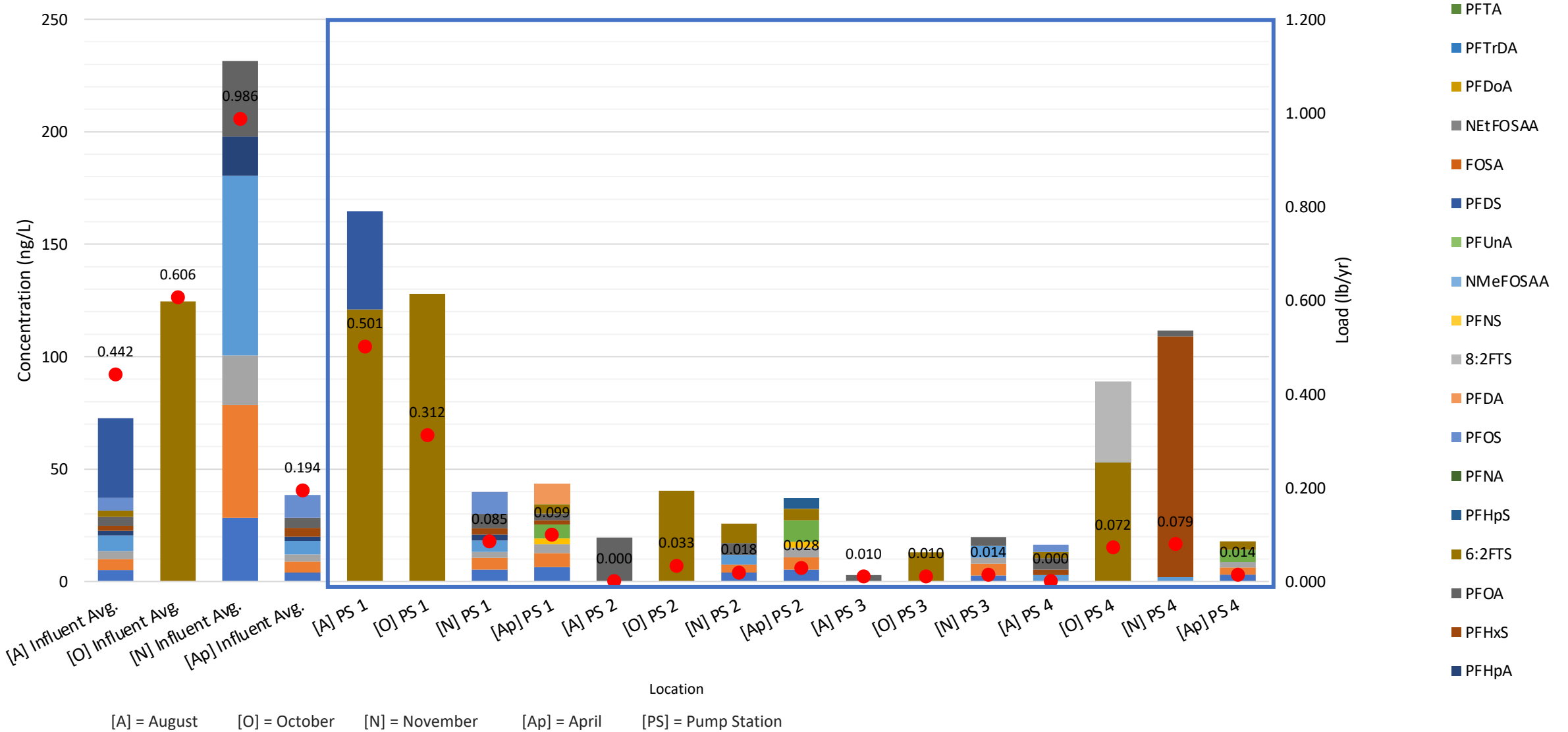
# PFAS Concentrations Versus Load



## Initial Observations:

- Not final data analysis; one sampling event remaining
- Carpet cleaners and landfill leachate loads contribute to less of the overall load compared to influent
- From initial analysis, Pump Station 1 contributes a greater load of PFAS compared to other pump stations

# Collection System: Concentration vs Load



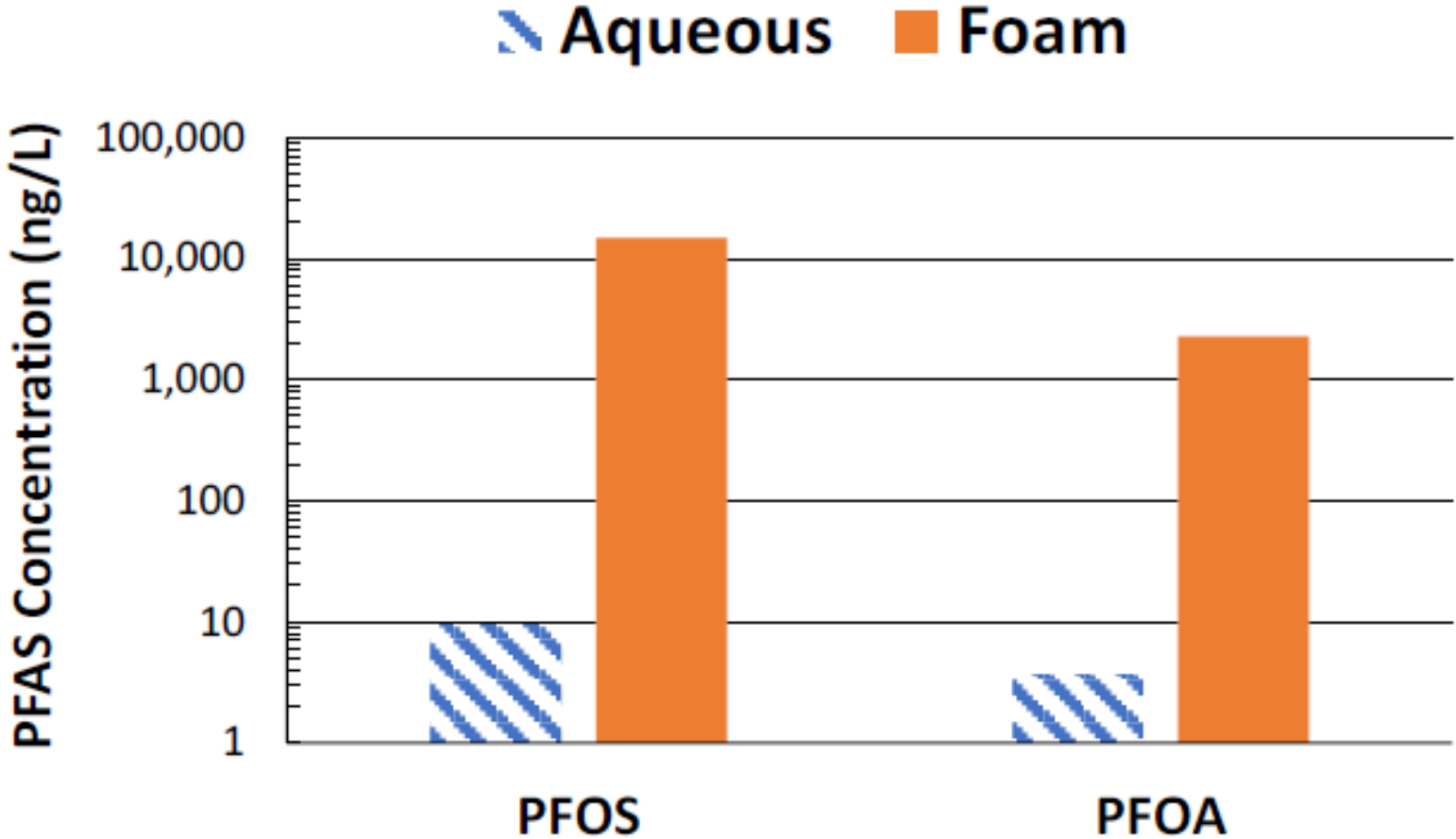


## Next Steps





# PFAS in Foam vs Aqueous Phase

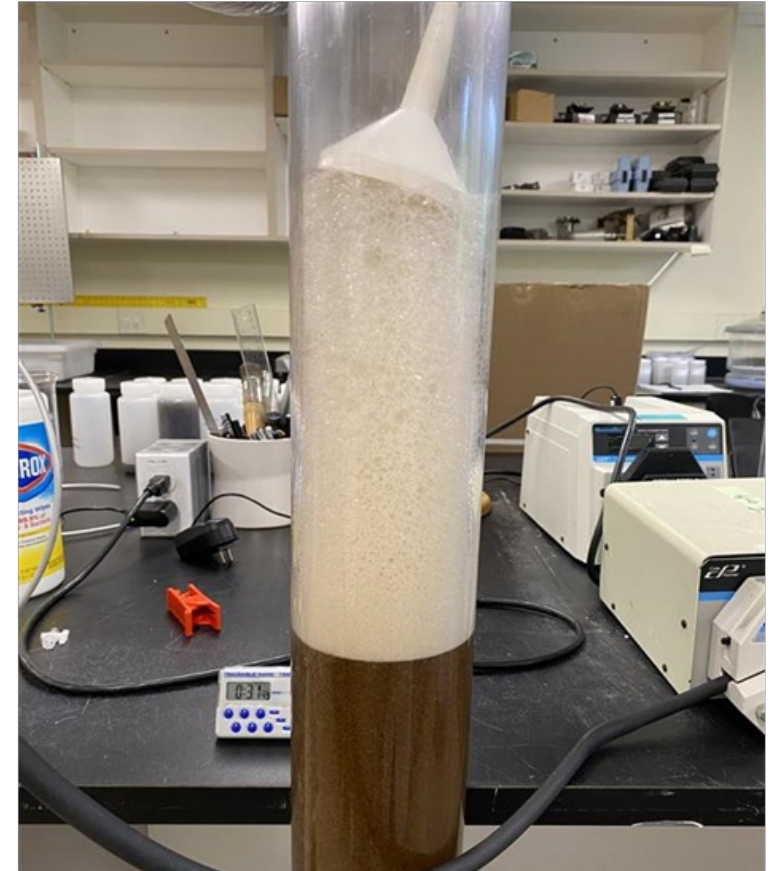
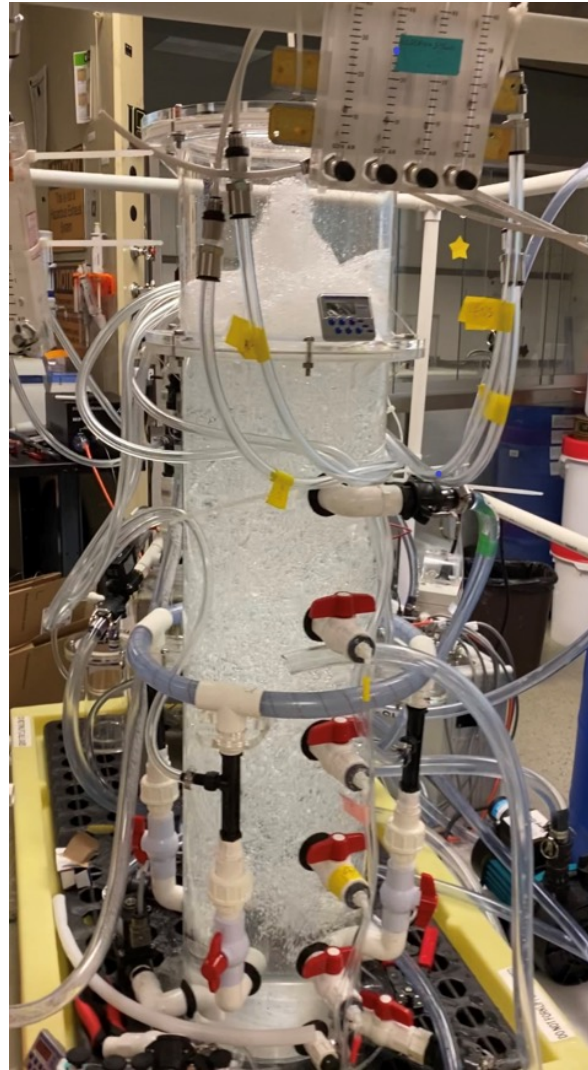


PFOS and PFOA concentrations measured in the aqueous phase and foam/scum during biological aeration.

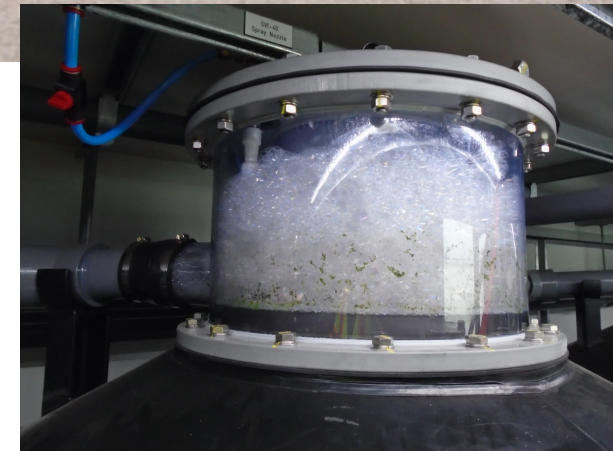
# PFAS in Foam vs Aqueous Phase



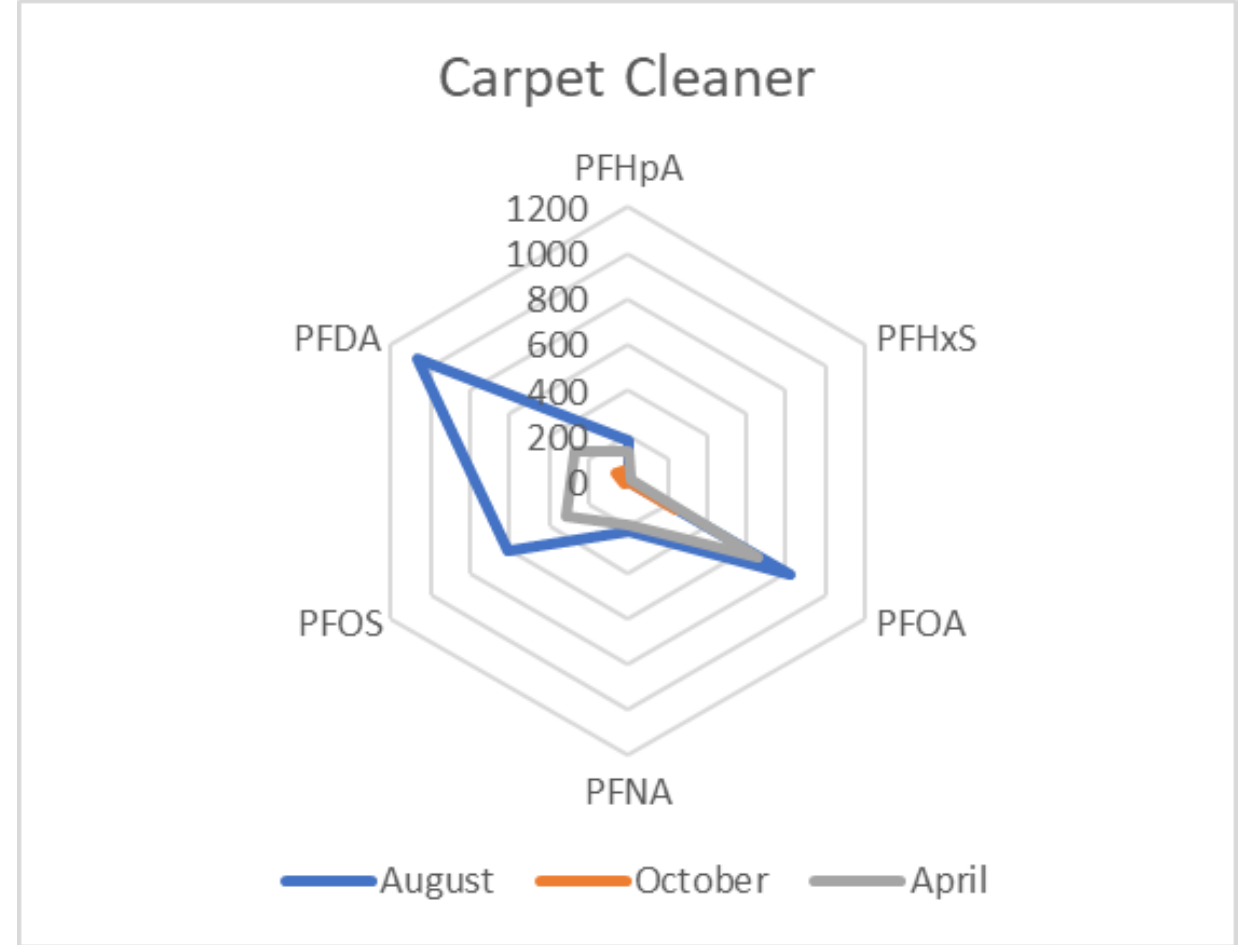
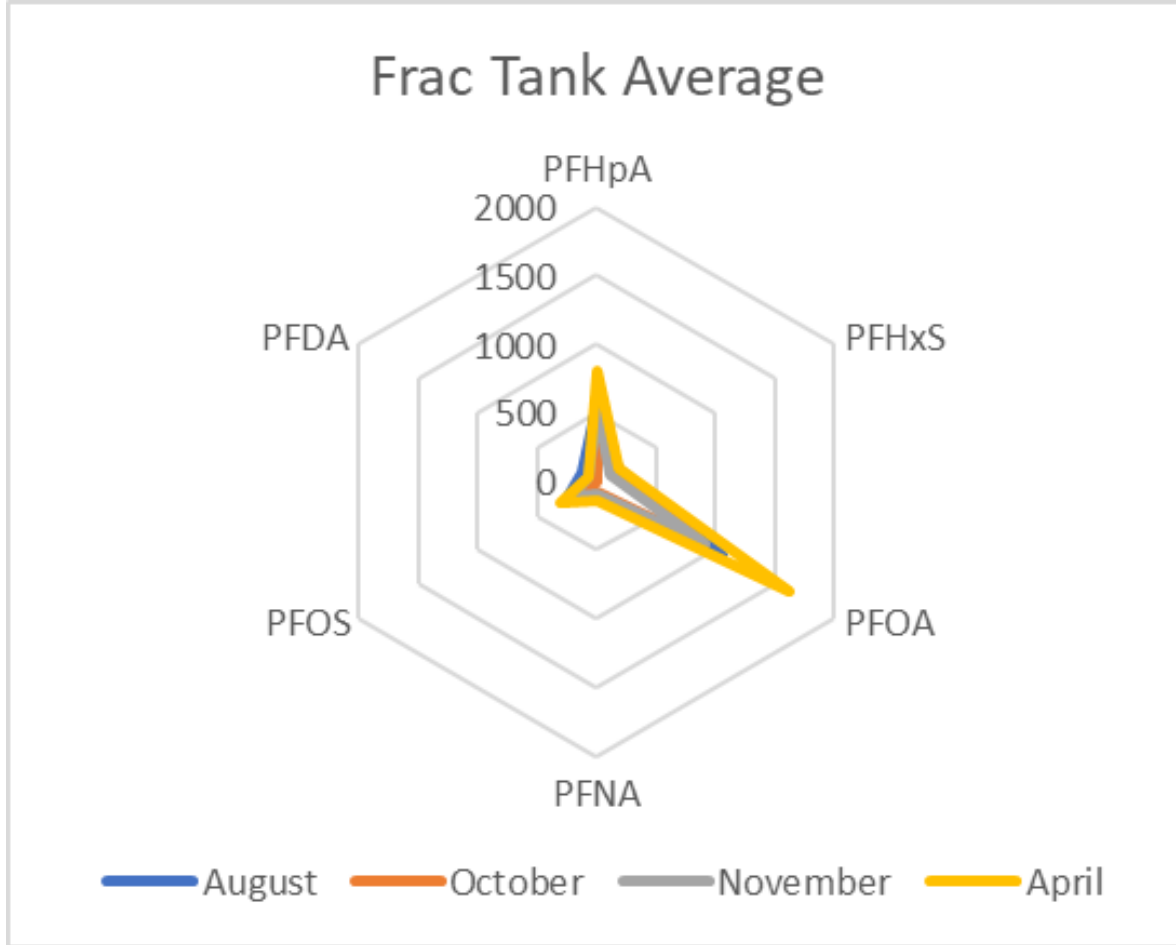
# Leachate and Foam Collection and Analysis



# Surface Active Foam Fractionation (SAFF®)



# Fingerprinting – Radar Plots



# Preliminary Observations and Next Steps

- Based upon current data sets...
  - Concentration vs. load
  - Pump Station 1 high loading
  - Landfill leachate loading may attribute to overall WW loading
  - Spike in November influent needs further investigation
- Aeration Tank and Leachate Foam Study
  - Further evaluation of concentration and destruction technologies
- Proceed with Steps 3 and 4 of Decision Matrix



# Acknowledgements



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# Questions?

Find more insights through our water partnership at [cdmsmith.com/water](https://cdmsmith.com/water) and [@CDMSmith](https://twitter.com/CDMSmith)



**Sarah Jakositz, PE**

CDM Smith

603-222-8358

[JakositzSA@cdmsmith.com](mailto:JakositzSA@cdmsmith.com)

**Eric Spargimino, PE**

CDM Smith

603-222-8366

[SpargiminoEM@cdmsmith.com](mailto:SpargiminoEM@cdmsmith.com)

