Presence of PFAS in Domestic Wastewater and Potential Sources

Jennifer Harfmann, Ph.D.

NHDES Drinking Water and Groundwater Bureau

PFAS in Wastewater & Septic Systems – NEWMOA webinar, December 11th, 2024

Widespread PFAS detections in New Hampshire groundwater

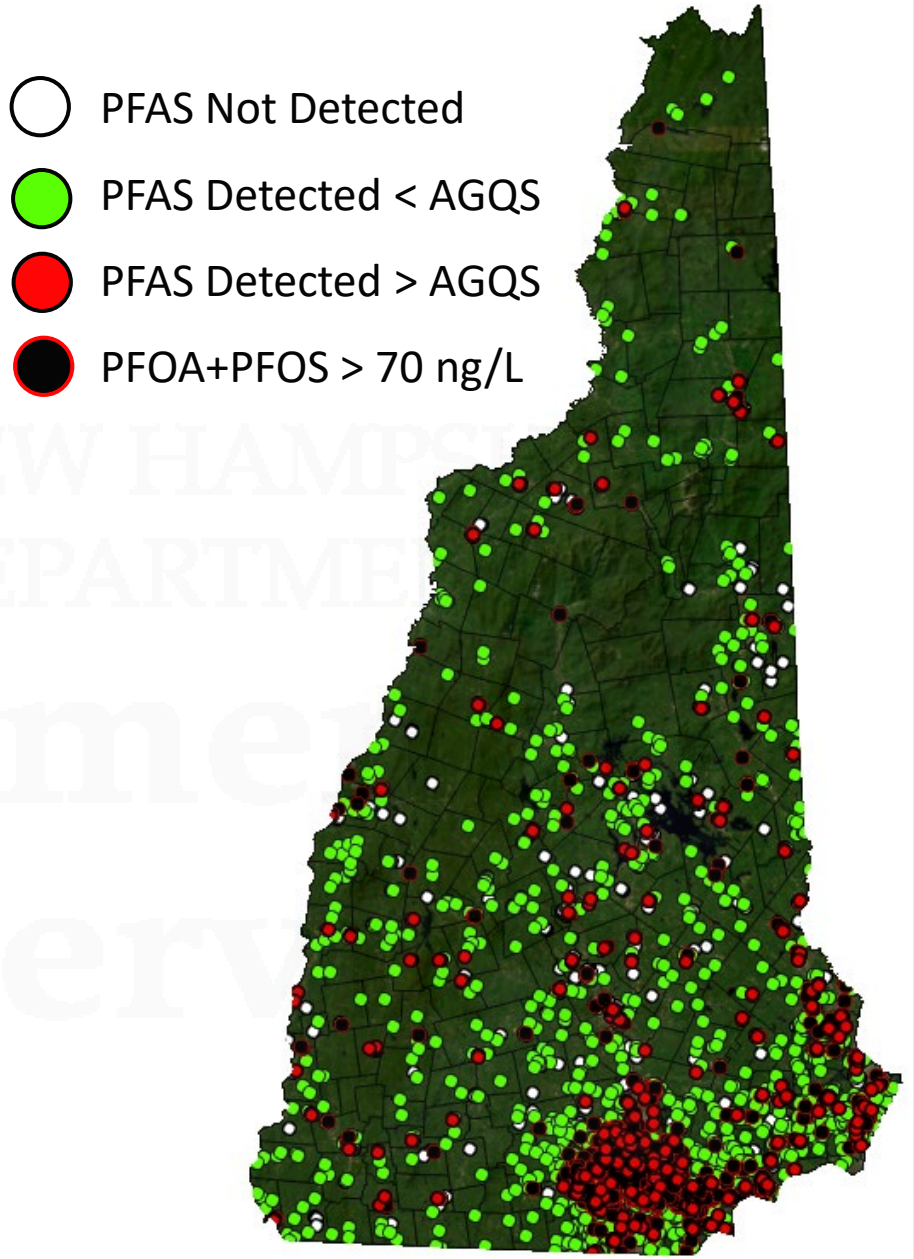
Major site investigations:

- Pease Air Force Base
- Saint Gobain Performance Plastics

NH Ambient Groundwater Quality Standards (AGQS)
PFOA: 12 ng/L
PFOS: 15 ng/L
PFNA: 11 ng/L
PFHxS: 18 ng/L

Statewide:

- Waste sites
  (landfills, septage lagoons, etc.)
- AFFF releases
- Industrial facilities



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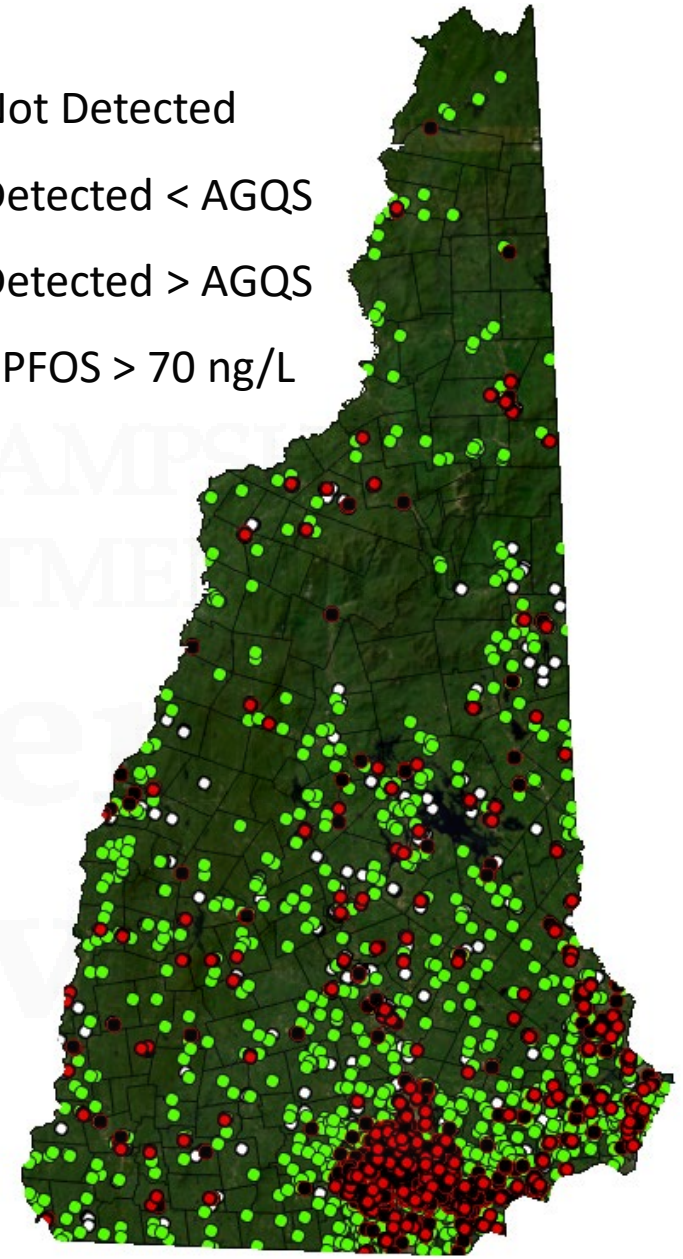
PFAS Detected > AGQS
PFOA+PFOS > 70 ng/L



Statewide:

- Waste sites
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- Industrial facilities
- **Septic systems**
  - Small commercial facilities

Carpet cleaning businesses

Marinas/boat washing

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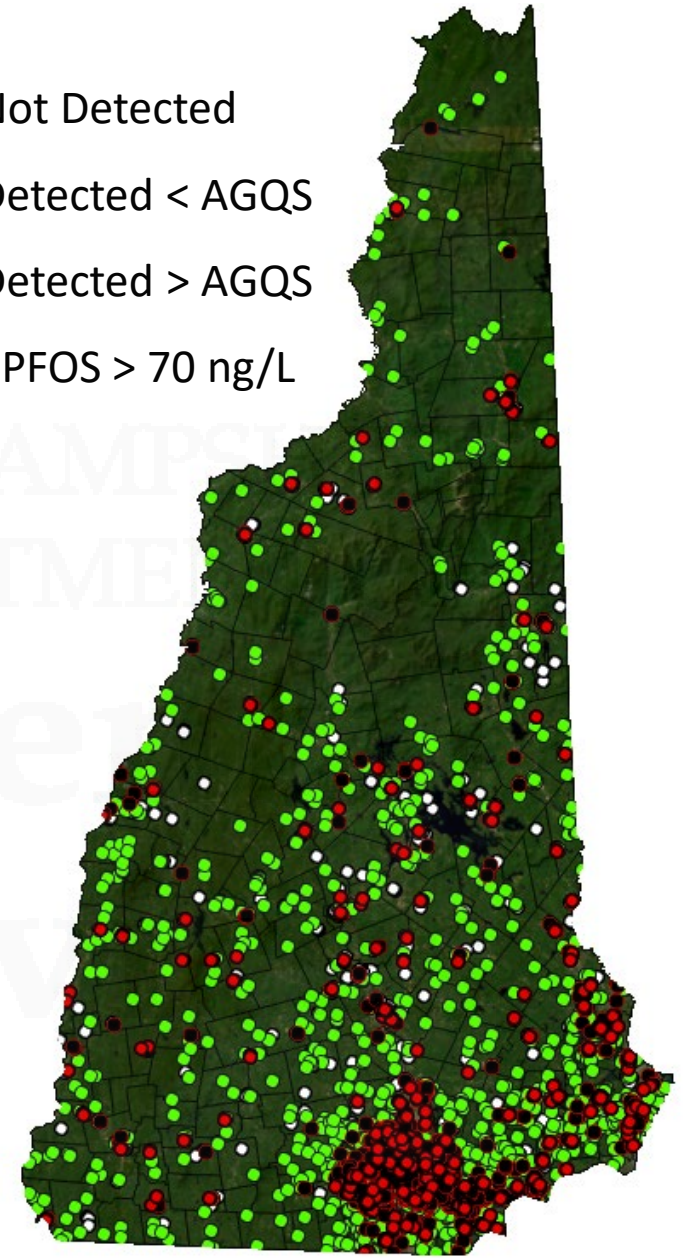

Statewide:

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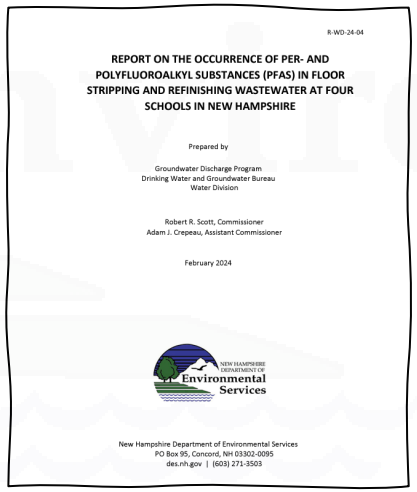
Schools during floor stripping/refinishing



R-WD-24-04

REPORT ON THE OCCURRENCE OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN FLOOR STRIPPING AND REFINISHING WASTEWATER AT FOUR SCHOOLS IN NEW HAMPSHIRE

Prepared by

Groundwater Discharge Program
Drinking Water and Groundwater Bureau
Water Division

Robert R. Scott, Commissioner
Adam J. Crepeau, Assistant Commissioner

February 2024

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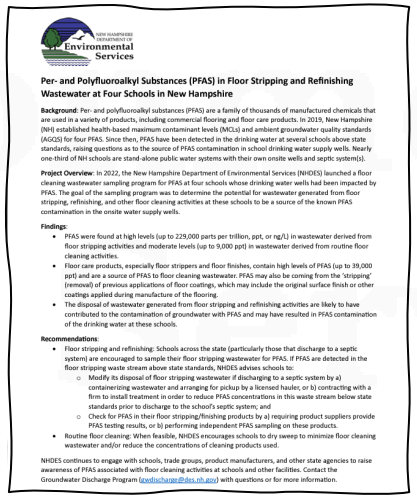

Per- and Polyfluoroalkyl Substances (PFAS) in Floor Stripping and Refinishing Wastewater at Four Schools in New Hampshire

Background: Per- and polyfluoroalkyl substances (PFAS) are a family of thousands of manufactured chemicals that are used in a variety of products, including commercial flooring and floor care products. In 2019, New Hampshire (NH) established health-based maximum contaminant levels (MCLs) and ambient groundwater quality standards (AGQS) for four PFAS. Since then, PFAS have been detected in the drinking water at several schools above state standards, raising questions as to the source of PFAS contamination in school drinking water supply wells. Nearly one-third of NH schools are stand-alone public water systems with their own onsite wells and septic system(s).

Project Overview: In 2022, the New Hampshire Department of Environmental Services (NHDES) launched a floor cleaning wastewater sampling program for PFAS at four schools whose drinking water wells had been impacted by PFAS. The goal of the sampling program was to determine the potential for wastewater generated from floor stripping, refinishing, and other floor cleaning activities at these schools to be a source of the known PFAS contamination in the onsite water supply wells.

Findings:

- PFAS were found at high levels (up to 229,000 parts per trillion, ppt, or ng/L) in wastewater derived from floor stripping activities and moderate levels (up to 9,000 ppt) in wastewater derived from routine floor cleaning activities.
- Floor care products, especially floor strippers and floor finishes, contain high levels of PFAS (up to 39,000 ppt) and are a source of PFAS to floor cleaning wastewater. PFAS may also be coming from the 'stripping' (removal) of previous applications of floor coatings, which may include the original surface finish or other coatings applied during manufacture of the flooring.
- The disposal of wastewater generated from floor stripping and refinishing activities are likely to have contributed to the contamination of groundwater with PFAS and may have resulted in PFAS contamination of the drinking water at these schools.

Recommendations:

- Floor stripping and refinishing: Schools across the state (particularly those that discharge to a septic system) are encouraged to sample their floor stripping wastewater for PFAS. If PFAS are detected in the floor stripping waste stream above state standards, NHDES advises schools to:
  - Modify its disposal of floor stripping wastewater if discharging to a septic system by a) containerizing wastewater and arranging for pickup by a licensed hauler, or b) contracting with a firm to install treatment in order to reduce PFAS concentrations in this waste stream below state standards prior to discharge to the school's septic system; and
  - Check for PFAS in their floor stripping/finishing products by a) requiring product suppliers provide PFAS testing results, or b) performing independent PFAS sampling on these products.
- Routine floor cleaning: When feasible, NHDES encourages schools to dry sweep to minimize floor cleaning wastewater and/or reduce the concentrations of cleaning products used.

NHDES continues to engage with schools, trade groups, product manufacturers, and other state agencies to raise awareness of PFAS associated with floor cleaning activities at schools and other facilities. Contact the Groundwater Discharge Program (gwdischarge@des.nh.gov) with questions or for more information.

https://www.pfas.des.nh.gov/groundwater

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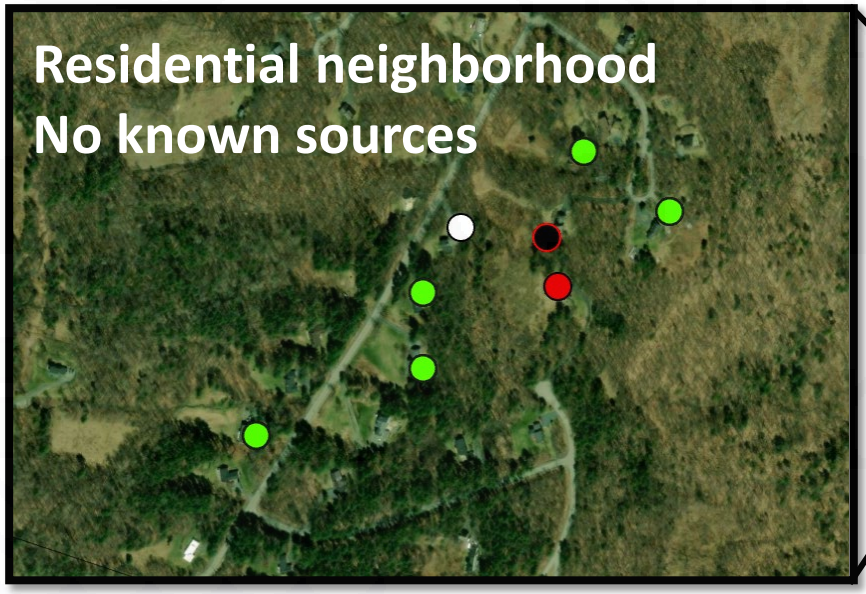
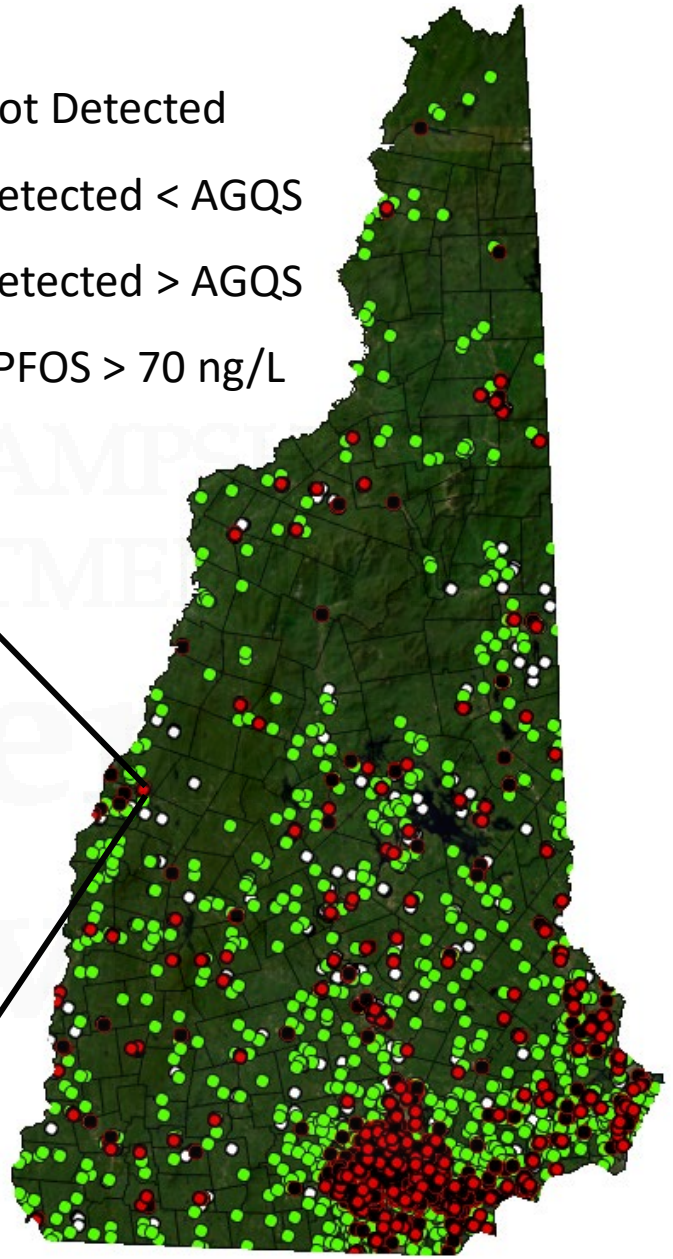
- Industrial facilities
- **Septic systems**
  - Small commercial facilities
  - **Domestic ??**





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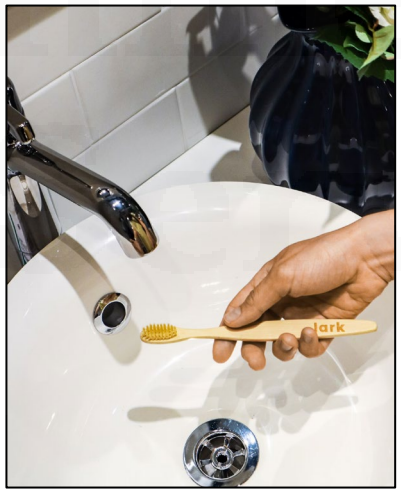
Why might there be PFAS in domestic wastewater?




Soaps, detergents, cleaning products, fabrics/textiles, shampoos, cosmetics, toothpaste, toilet paper…



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NHDES investigation of PFAS in domestic wastewater

What is a typical domestic PFAS load to the environment?

Case study: Wastewater sampling from a 24-unit residential community septic system

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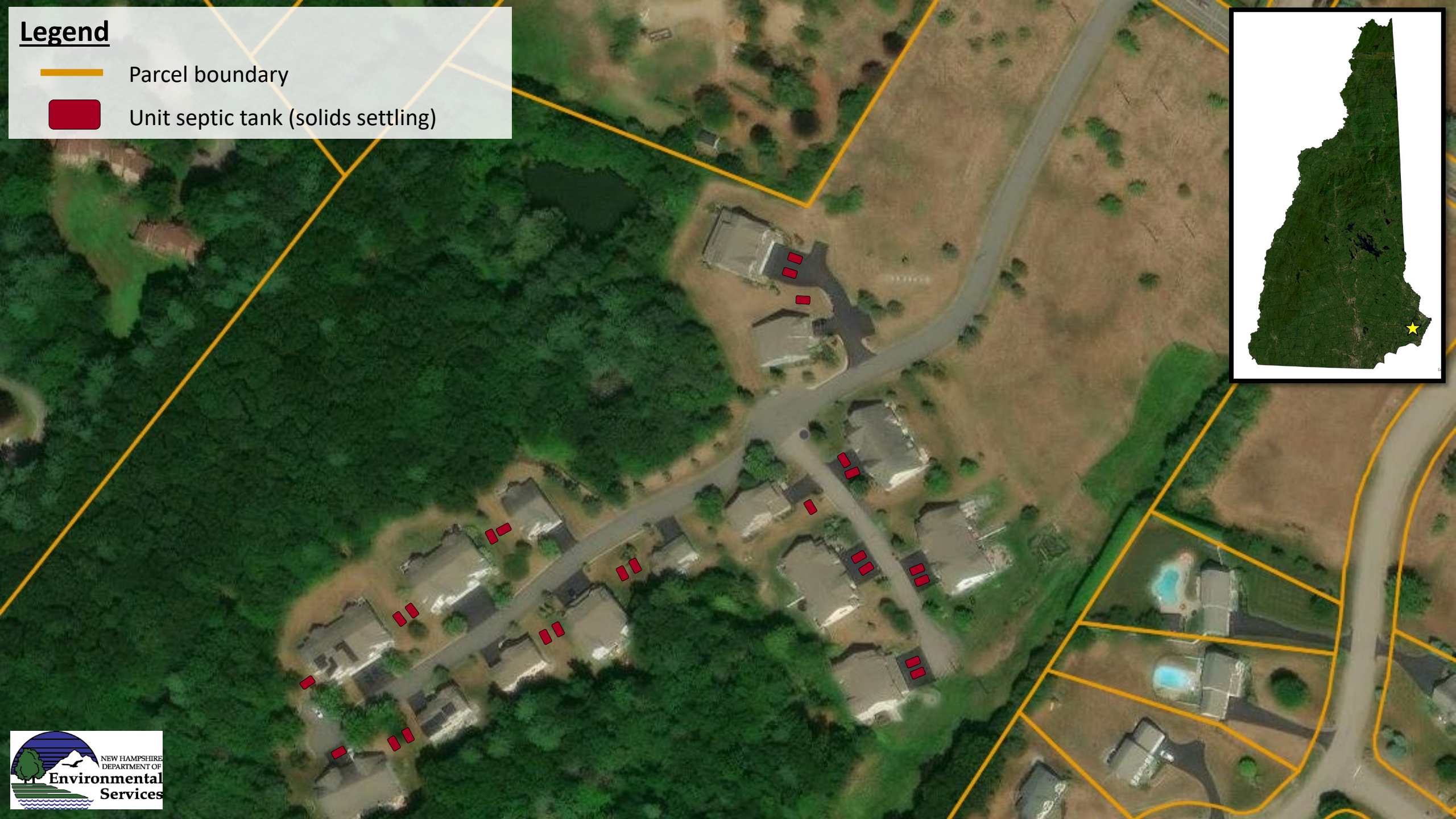
Legend
Parcel boundary
Unit septic tank (solids settling)
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Environmental Services


Legend
Parcel boundary
Unit septic tank (solids settling)
Lift station
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Legend
Parcel boundary
Unit septic tank (solids settling)
Lift station
Nitrification/denitrification treatment
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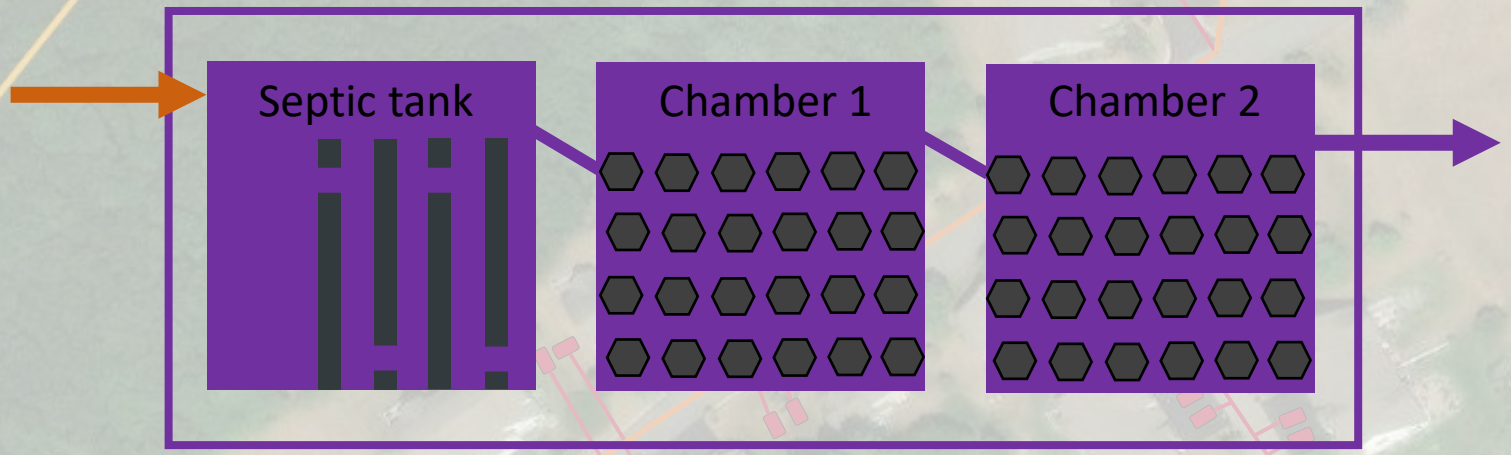
Legend

- Parcel boundary
- Unit septic tank (solids settling)
- Lift station
- Nitrification/denitrification treatment

Nitrification/denitrification treatment system



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Legend
Parcel boundary
Unit septic tank (solids settling)
Lift station
Nitrification/denitrification treatment
Leach field
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Domestic wastewater effluent sampling

- 16 monthly grab samples of wastewater effluent (Jan 2023 - Oct 2024)
- PFAS analyses: 70 PFAS custom (4), 36 PFAS custom (2), EPA 1633 (10)

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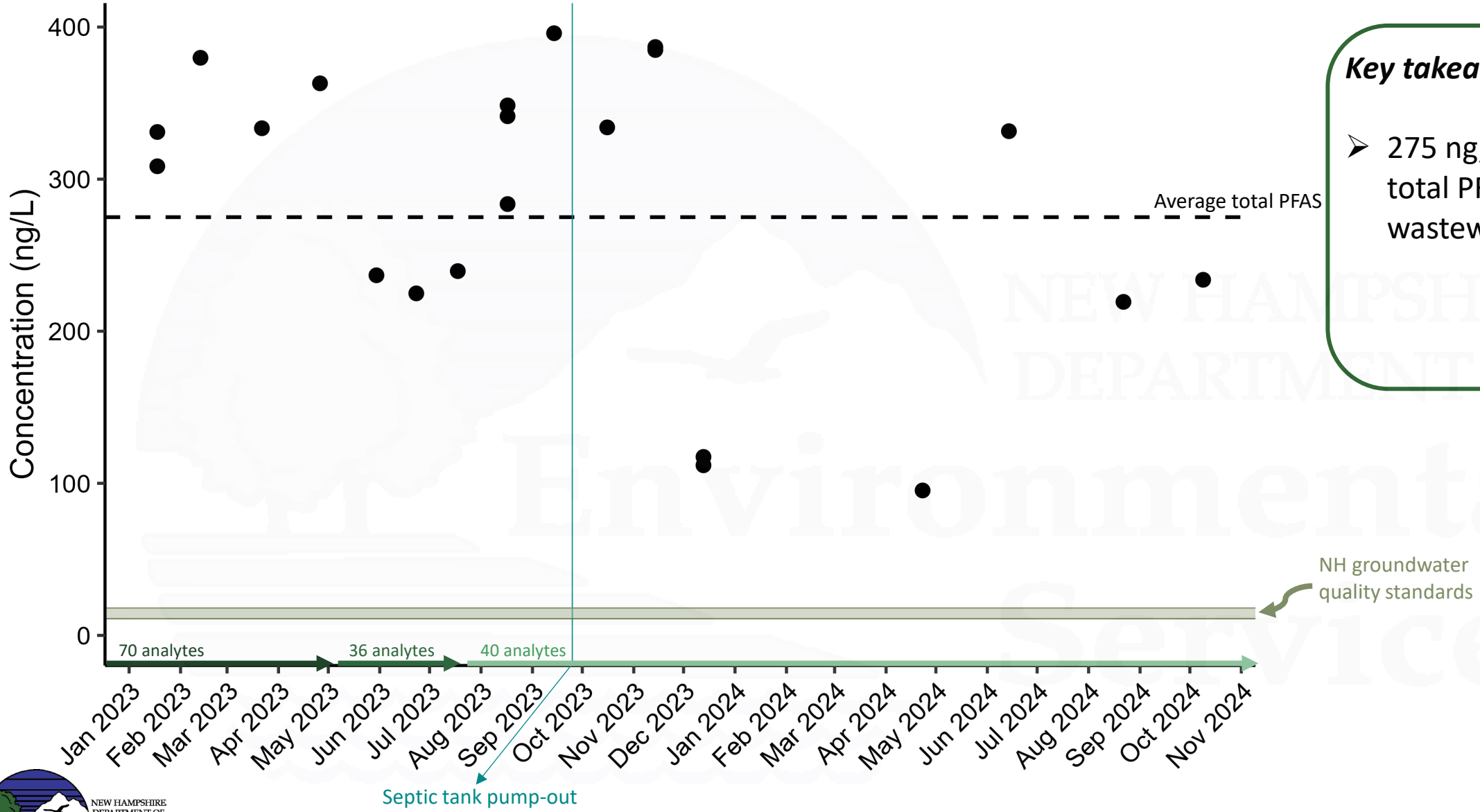
PFAS in domestic wastewater effluent



Key takeaways:

- 275 ng/L average total PFAS in domestic wastewater

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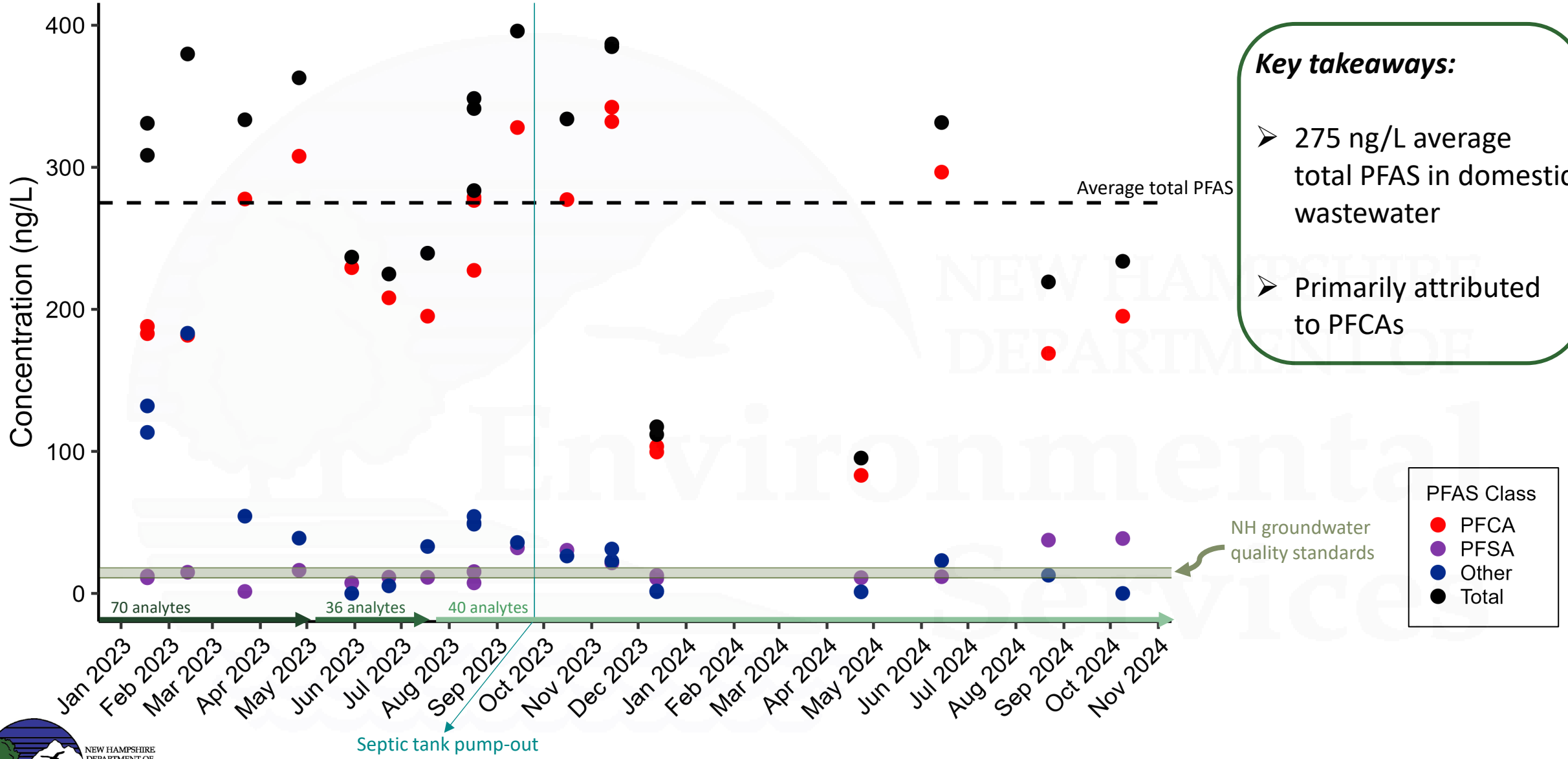
Data is subject to revision – do not cite.

PFAS in domestic wastewater effluent



Key takeaways:

- 275 ng/L average total PFAS in domestic wastewater
- Primarily attributed to PFCAs

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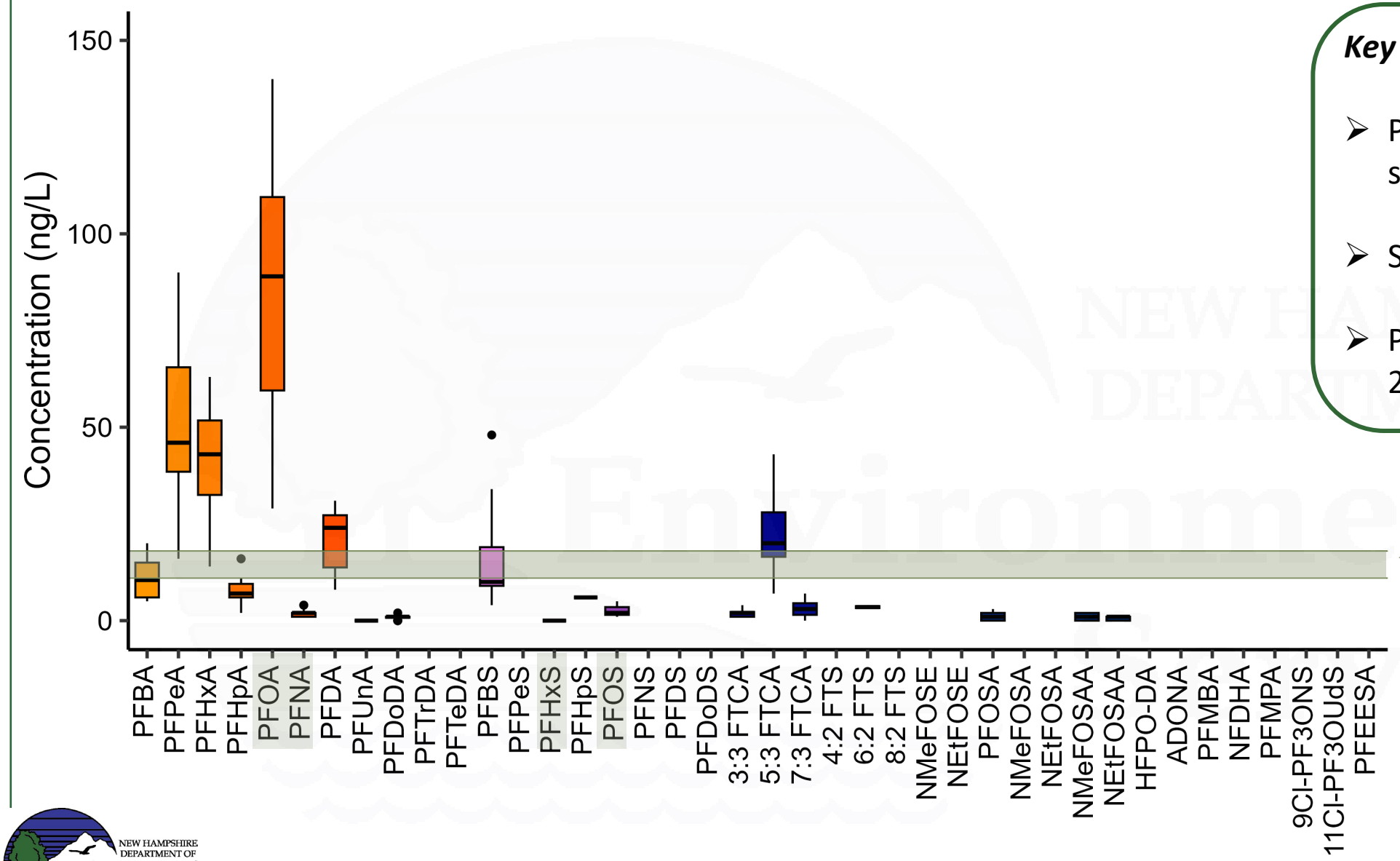
PFAS in domestic wastewater effluent by compound



Key takeaways:

- PFOA > groundwater quality standards (avg. 92 ng/L)
- Short-chains > long-chains
- Prevalence of 5:3 FTCA (avg. 23 ng/L)

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How much domestic-derived PFAS is discharged daily? Annually?

Using wastewater discharge flow data…

EACH DAY,

67 µg PFAS/household or approximately 22 µg PFAS/person is discharged to septic system leach fields.

EACH YEAR,

24 mg PFAS/household or approximately 8 mg PFAS/person is discharged to septic system leach fields.

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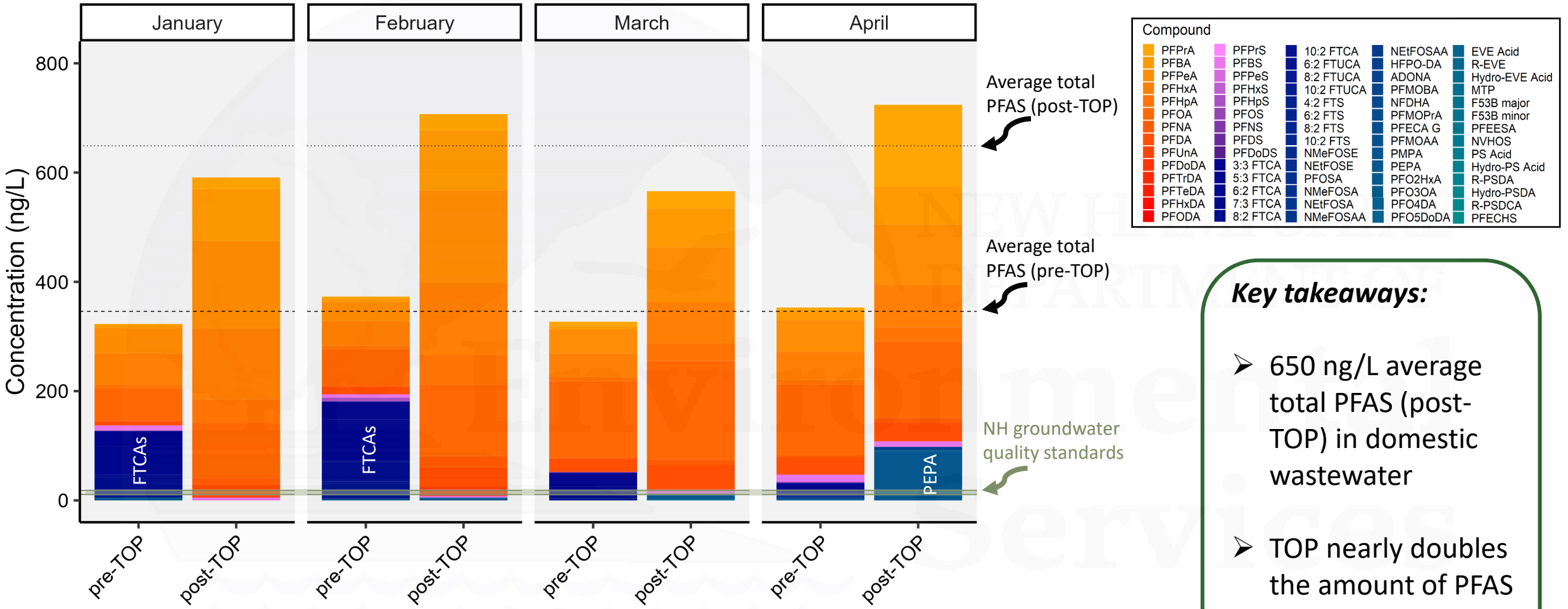
PFAS in domestic wastewater effluent – TOP assay



Key takeaways:

- 650 ng/L average total PFAS (post-TOP) in domestic wastewater
- TOP nearly doubles the amount of PFAS detected

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NHDES investigation of PFAS in domestic wastewater

What is a typical domestic PFAS load to the environment at this site from wastewater effluent?

- **275 ng/L**, primarily attributed to PFOA, short-chain PFCAs, and 5:3 FTCA
- **24 mg PFAS/household/year** or **8 mg PFAS/person/year**
  - **TOP** nearly **doubles** these estimates

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NHDES investigation of PFAS in domestic waste streams

BONUS

Triennial septic tank pumping (September 2023)

How much PFAS is retained in septic tank solids?

<u>Case study</u>: Sampling of household septic tank supernatant and sludge

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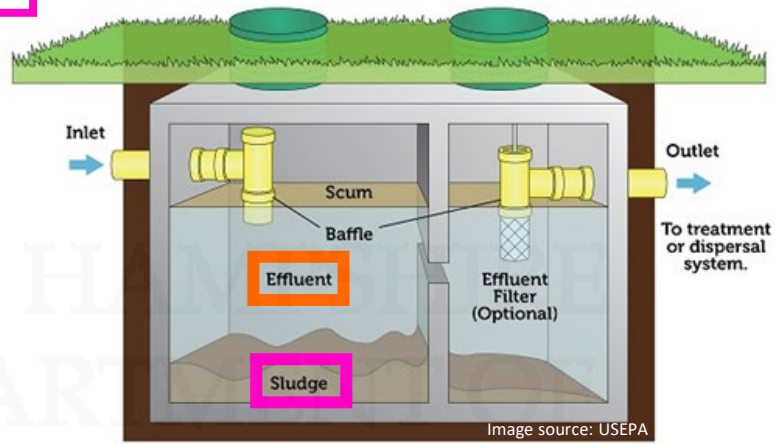
Domestic septic tank sampling

- Three grab samples from septic tanks (Sep 2023)
  - Supernatant and sludge
- PFAS analysis by EPA 1633



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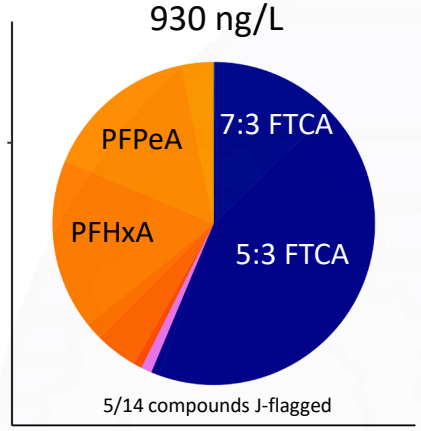
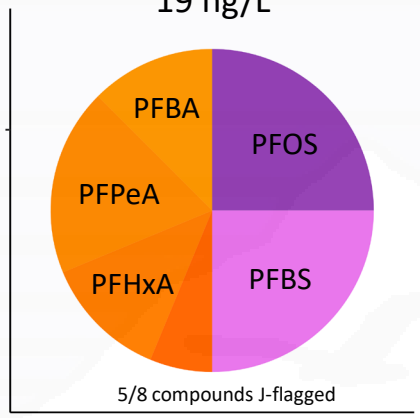
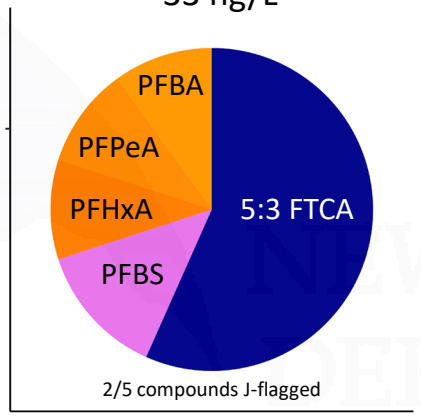
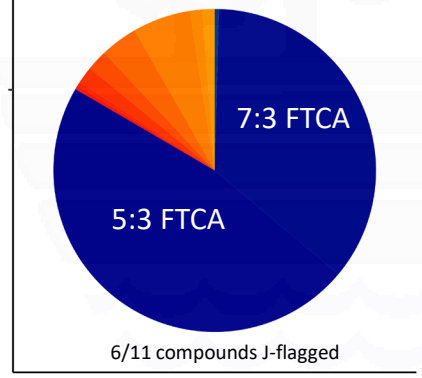
PFAS in domestic septic tank supernatant and sludge

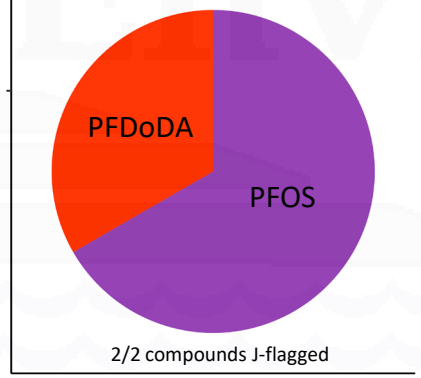
	Tank #1	Tank #2	Tank #3
Supernatant	930 ng/L	19 ng/L	33 ng/L
Sludge	246 ng/g	4 ng/g	No detections











Key takeaways:

- Tank to tank variability in PFAS concentration and composition
- PFAS fractionation: Long-chains/sulfonates in sludge
- Prevalence of FTCAs

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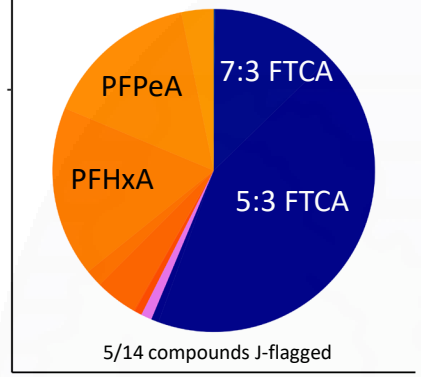
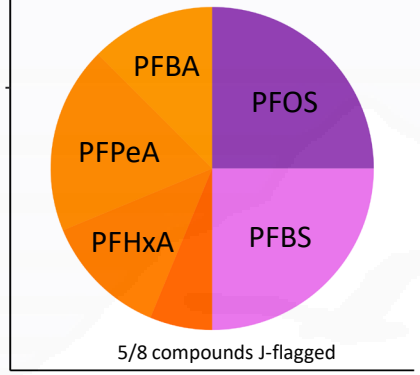
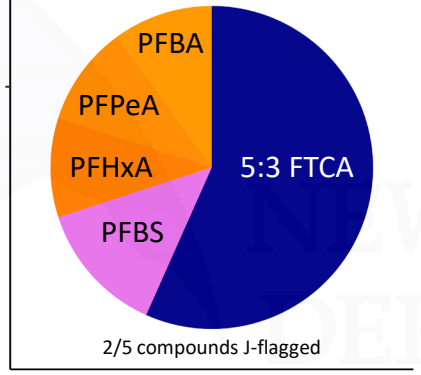
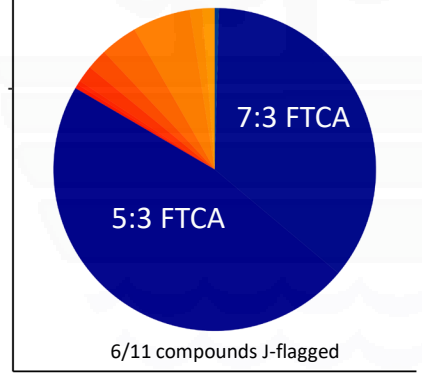
PFAS in domestic septic tanks: mass estimates

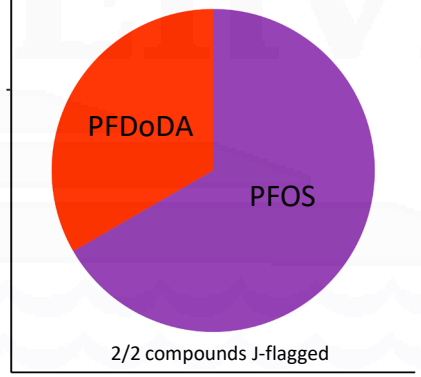
	Tank #1	Tank #2	Tank #3
Supernatant	3,500 µg	70 µg	120 µg
Sludge	130,000 µg	2,200 µg	No detections











Key takeaway:

- Up to 130 mg PFAS accrued in septic tank sludge over 3 years…up to 43 mg/year

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NHDES investigation of PFAS in domestic waste streams

How much PFAS is retained in septic tank solids?

- Up to **43 mg/year** - Variable concentration and composition
- **Sludge** may be a **significant reservoir** for domestic-derived PFAS

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Ongoing domestic wastewater initiatives at NHDES

Emerging Contaminants in Small or Disadvantaged Communities

Community

How will PFAS concentrations and composition change over time?

Continued sampling at this site

Ongoing domestic wastewater initiatives at NHDES

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How will PFAS concentrations and composition change over time?

Continued sampling at this site

Statewide

Are results representative of other residential communities in NH?

Sampling at 3 additional sites

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Ongoing domestic wastewater initiatives at NHDES

Emerging Contaminants in Small or Disadvantaged Communities

National

What are the primary sources of PFAS to the domestic waste stream?

Targeted household sampling

Statewide

Are results representative of other residential communities in NH?

Sampling at 3 additional sites

Community

How will PFAS concentrations and composition change over time?

Continued sampling at this site

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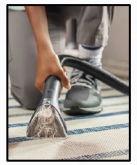
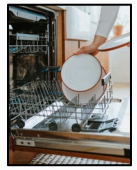
Poll question

Which household activity do **you** think contributes the most to PFAS in domestic wastewater?



A) Cleaning surfaces



B) Dishwashing

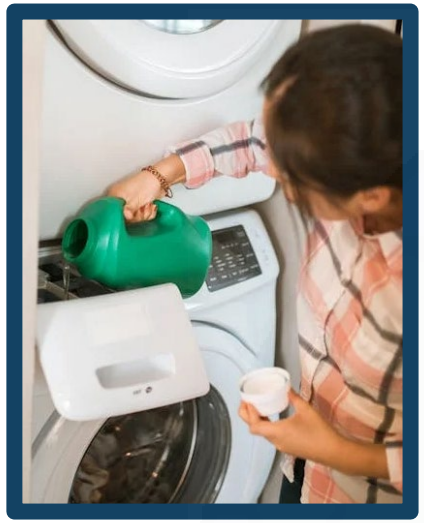
C) Laundry

D) Showering

?

E) Other

PFAS in household laundry wastewater



- Sampling of detergent, source water, and wastewater
- Two variables
  - Material type (natural fiber/synthetic)
  - Wash type (with/without detergent)
- Analysis of 70 PFAS compounds

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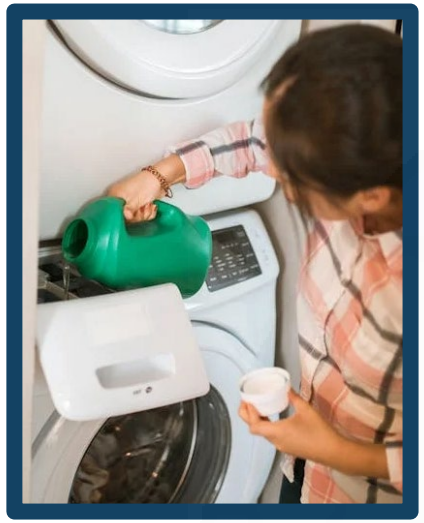
PFAS in household laundry wastewater



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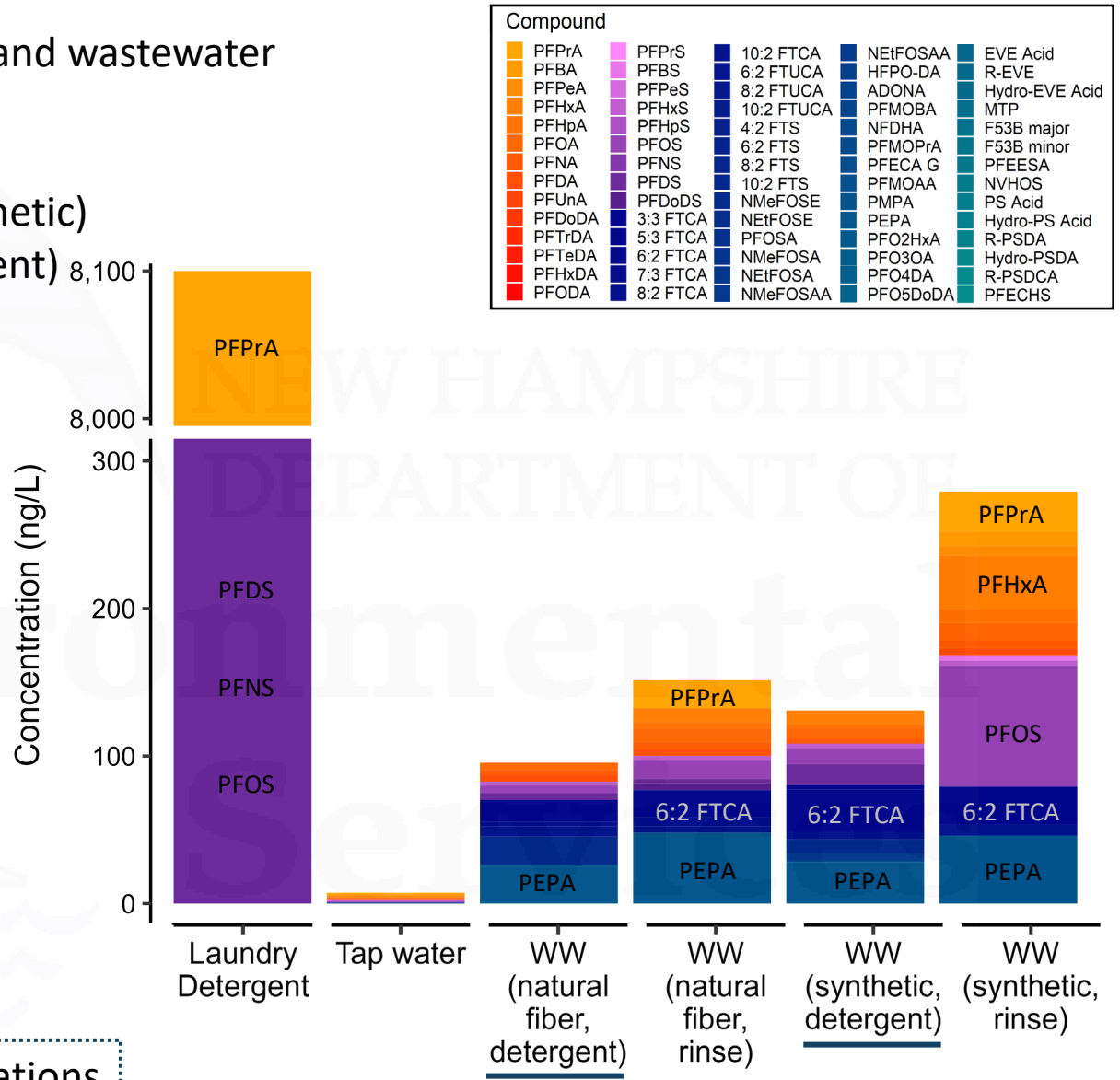

Key takeaways:

- PFAS are present in laundry detergent and wastewater
- PFAS may leach from both natural fiber and synthetic clothing

TOP assay substantially increased PFAS concentrations

Data is subject to revision – do not cite.

PFAS in household carpet cleaning wastewater

- Sampling of detergent, source water, and wastewater
- Two variables
  - Age (old/new)
  - Wash type (with/without detergent)
- Analysis of 70 PFAS compounds

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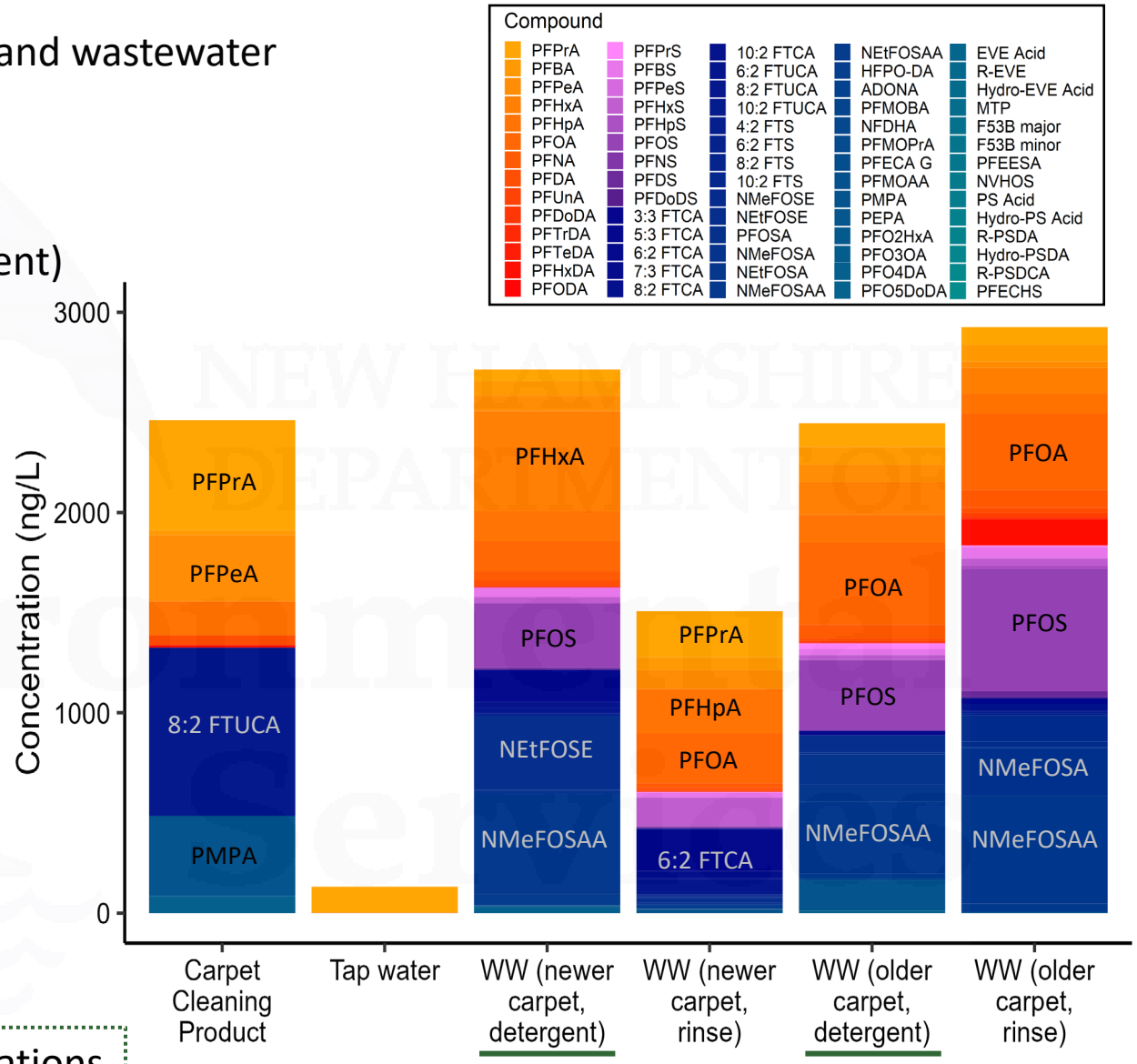
PFAS in household carpet cleaning wastewater

- Sampling of detergent, source water, and wastewater
- Two variables
  - Age (old/new)
  - Wash type (with/without detergent)
- Analysis of 70 PFAS compounds

Key takeaways:

- ➢ PFAS are present in carpet cleaning detergent and wastewater
- ➢ PFAS are extracted from carpets during cleaning, regardless of detergent use or carpet age



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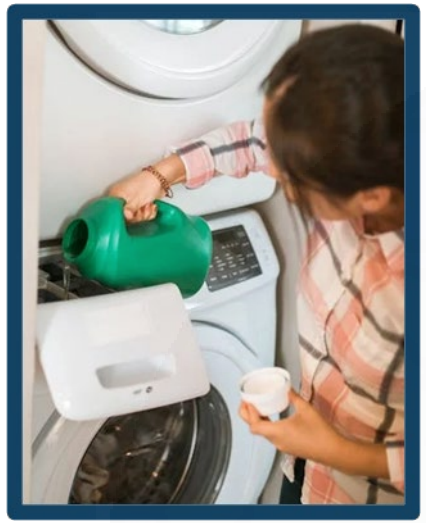
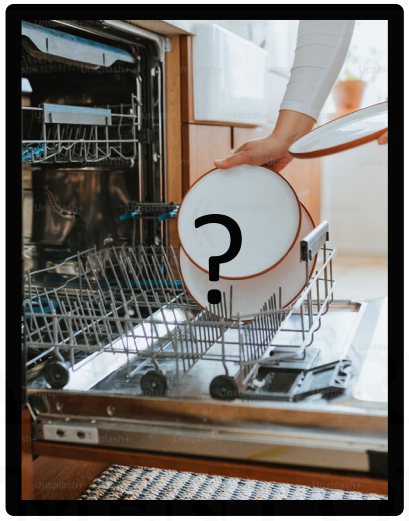
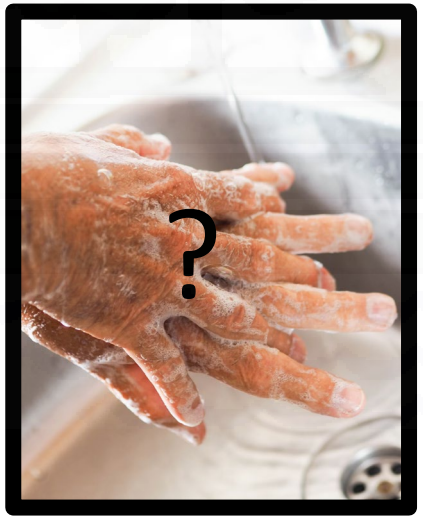
Identifying sources of PFAS to domestic wastewater





Soaps, detergents, cleaning products, fabrics/textiles, shampoos, cosmetics, toothpaste, toilet paper…



NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Thank you

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Additional Resources

The following resources – and many more – can be found on NHDES' PFAS Response webpage:

- NHDES' PFAS sampling of school floor cleaning wastewater
  - One-page briefing
  - Technical report

- Mapper of NH PFAS results in private wells and public water supplies: NHDES PFAS Sampling Dashboard

- Fact sheets pertaining to PFAS in New Hampshire well water, testing and treatment
  - PFAS in New Hampshire Well Water - Testing and Treatment
  - APPLETREE's New Hampshire-Specific Guidance on PFAS
  - Labs Providing PFAS Testing Services