New Jersey Water Supply Authority & Delaware River Basin Commission

Delaware & Raritan Canal PFAS Passive Sampler Report

Kyle Clonan & Heather Desko (NJWSA); Jeremy Conkle, PhD (DRBC)

August 2026

NJWSA Watershed Protection Programs Technical Report 2026-01

Introduction

The 60-mile Delaware and Raritan (D&R) Canal originates on the Delaware River near Raven Rock (Kingwood Township) and terminates at the Raritan River near New Brunswick. Along the way, the D&R Canal, operated by the New Jersey Water Supply Authority (NJWSA), can transfer up to 100 million gallons per day (MGD) from the Delaware River Basin to the Raritan River Basin, supplying raw water to drinking water treatment plants and irrigation customers in central New Jersey. The Raritan Basin system, including the D&R Canal, serves over 1,500,000 service connections, including customers of New Jersey American Water Company, Middlesex Water Company, the Township of North Brunswick, the City of New Brunswick, and Veolia Water New Jersey (formerly Suez Water Lambertville). Water supply and water quality in the Delaware River Basin is overseen by the Delaware River Basin Commission (DRBC). As the D&R Canal transfers water from the Delaware Basin into the Raritan Basin, it crosses the watershed divide at Port Mercer, NJ.

Since the Canal is clay-lined and well maintained by NJWSA, the influence of groundwater is believed to be minimal. Most streams in the Canal's watersheds are culverted or piped underneath the Canal in order to drain directly to the Delaware River, Assunpink Creek, Stony Brook, Millstone River, or Raritan River. There are exceptions, notably four main tributaries beyond the Delaware River, that drain into the Canal:

- the Lockatong Creek (23.3 mi^2 watershed) and Wickecheoke Creek (26.6 mi^2 watershed), both entering the feeder Canal in Stockton;
- Duck Pond Run (4.6 mi^2 watershed) entering the main Canal in West Windsor;
- and the Cedar Grove Brook (also known as Al's Brook, 2.8 mi^2 watershed) entering the Canal in Franklin (Somerset County).

A small number of unnamed tributaries and various municipal stormwater discharges also enter the Canal along its entire length. Figure 1 shows the watershed inputs into the Canal.

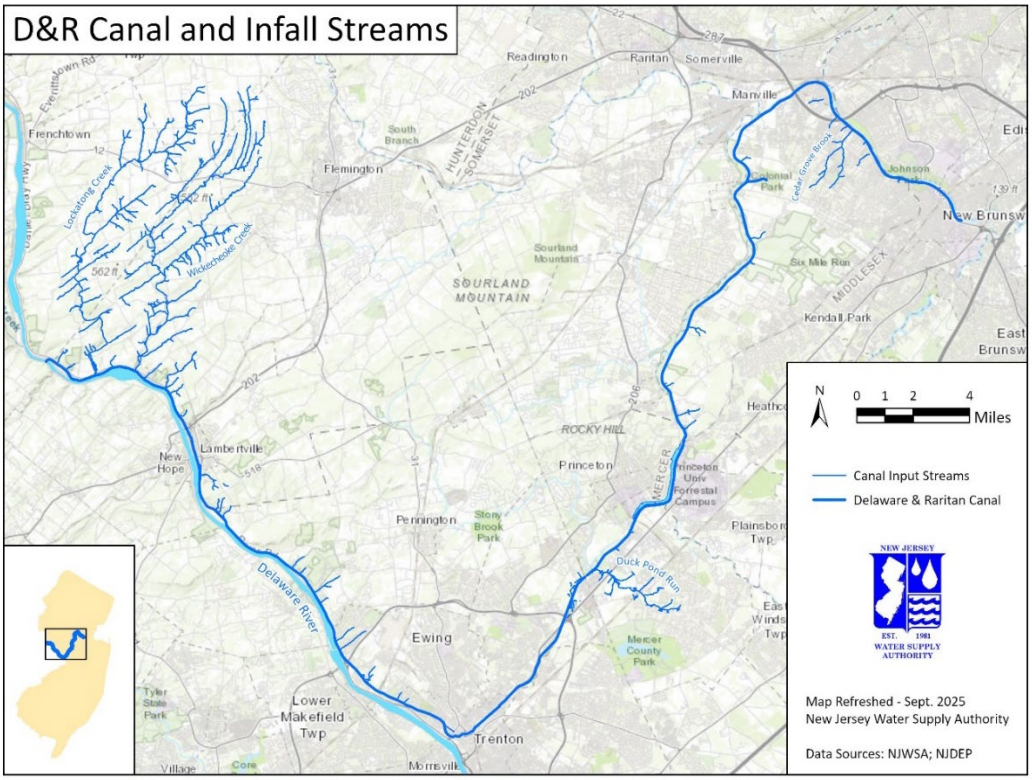

Figure 1 Delaware and Raritan Canal Input Watersheds

Beyond these watershed inputs into the Canal, NJWSA operates hydraulic and flow control structures, including spillways, wastegates, and locks to maintain flow in the Canal for water supply needs and ensure compliance with the maximum passing flow of 100 MGD at the US Geological Survey (USGS) Port Mercer Gage (Delaware and Raritan Canal at Port Mercer NJ - USGS-01460440). The Canal is "self-leveling," meaning that the discharge over spillways is uncontrolled, while Canal staff operate wastegates for controlled release of excess water, including during and following rain events. Ten wastegates and 28 spillways discharge to neighboring waterways, including the Delaware River, Assunpink Creek, Stony Brook, Millstone River, and Raritan River. A map of major discharges from the Canal is visible in Figure 2. NJWSA can also transfer water from the Millstone River into the Canal at Carnegie Lake only when the Canal level is lower than the Millstone River, which would only be expected during a loss of flow within the Canal. Additionally, NJWSA can transfer water to the Canal from the Raritan and Millstone River confluence at 10-Mile Lock using a pumping station. This can be directed upstream or downstream of the lock, depending on operational needs. During high flows and/or rain events, NJWSA operates the Perdicaris Waste Gate in Trenton to release water into the Delaware River before Port Mercer—the watershed divide and location of the maximum daily passing flow monitoring gage. With the release of water at Perdicaris, the Canal can experience a backflow event at Port Mercer, as the water is hydraulically pulled southwest towards Trenton. The USGS gage at Port Mercer displays negative discharge values during these situations.

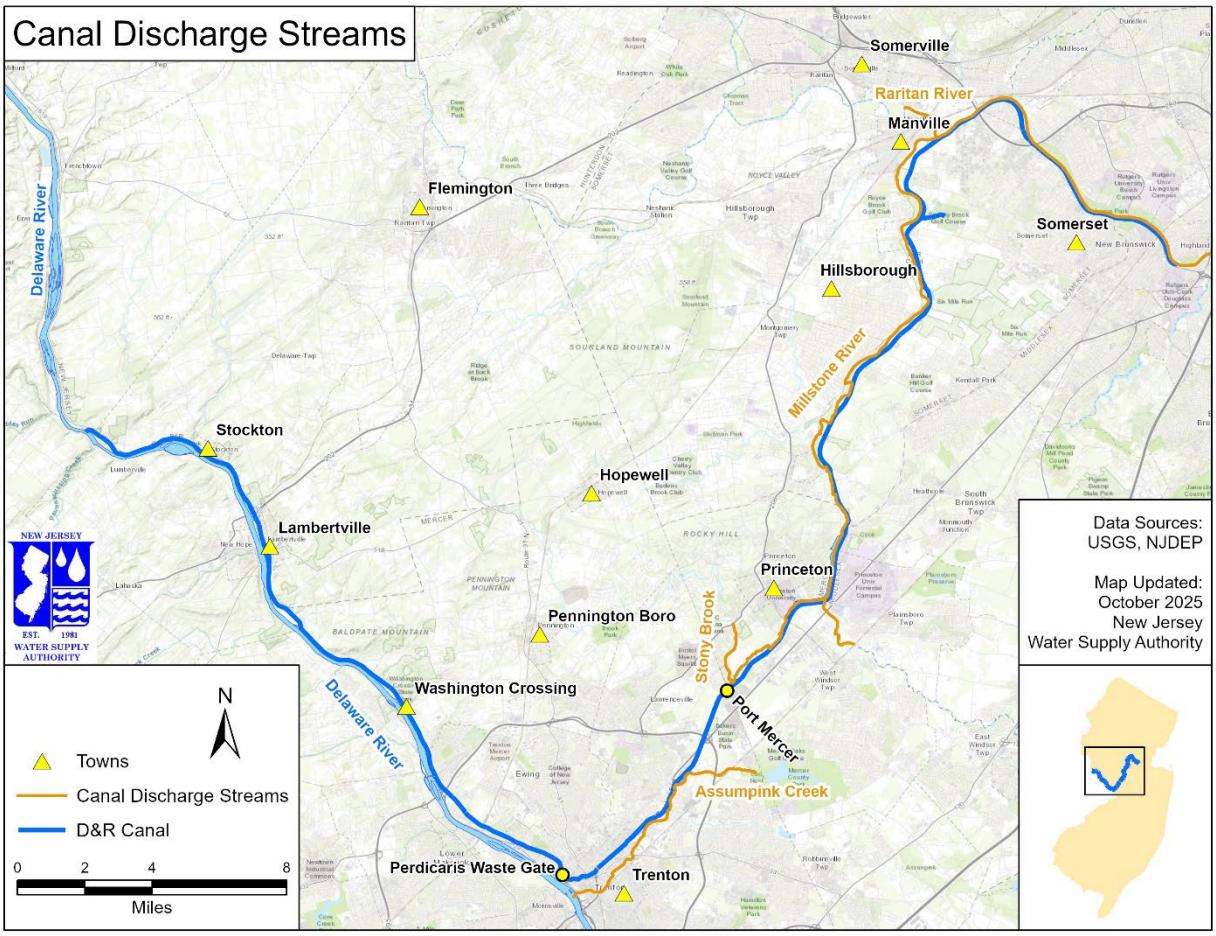

Figure 2 Delaware and Raritan Canal Discharge Streams

As the NJWSA operates the D&R Canal water transmission complex and the DRBC oversees water quality protection, water allocation, and watershed planning in the Delaware River Basin, which supplies water to the Canal, there is joint interest between the two organizations in the Canal's water quality. In preparation for drinking water regulatory requirements, the Canal has been sampled for per- and polyfluoroalkyl ("PFAS") compounds through various efforts from the New Jersey Department of Environmental Protection, the United States Geological Survey, and NJWSA's drinking water purveyor customers. While PFAS detections in surface waters are widespread across the state of New Jersey, PFAS levels detected in the Canal during these recent sampling efforts have remained just above the method reporting limits for several compounds. During the time of project design (2023 - 2024), Canal water purveyors noted an increase in detections and concentrations of three PFAS compounds which have maximum contamination limits (MCLs) for finished drinking water. This includes PFOA, which has an NJDEP MCL of 14 parts per trillion (ppt), as well as PFOS and PFNA, both of which have NJDEP MCLs of 13 ppt. In April 2024, the US EPA proposed new MCLs for these compounds: 4.0 ppt for PFOA and PFOS, plus 10 ppt for PFNA. The US EPA webpage regarding PFAS Drinking Water Regulations states, at the time of this writing, "On May 18, 2026, EPA announced two proposed rules related to PFAS in drinking water for public comment. These actions deliver on the agency's path forward announced on May 14, 2025. One proposed rule upholds the NPDWR [National Primary Drinking Water Regulations] for PFOA and PFOS while strengthening practical implementation by providing an option for drinking

water systems to request two additional years - to 2031 - to comply with enforceable limits. Another proposed rule would […] rescind drinking water regulations for PFHxS, PFNA, HFPO-DA (commonly known as GenX), and the Hazard Index mixture of these three PFAS plus PFBS." (U.S. Environmental Protection Agency, 2026).

These new MCLs concern Canal drinking water purveyors as previous grab samples indicated concentrations in the raw water ranged from 0-6 ppt for PFOS, 0-11 ppt for PFOA and 0-2 ppt for PFNA.

In December 2023, the NJDEP collected grab samples at six points along the Canal both before (December 8) and after (December 11) 1.65 inches of rain fell on December 10. The pre-storm results (Figure 3, top bar) indicated low concentrations (<2 ppt each) of PFHpA, PFHxA, PFOA, and PFOS at Raven Rock and Lambertville, likely entering the Canal with the Delaware River. At Kingston Wastegate near Princeton, concentrations of PFOA and PFOS increased and additional PFAS compounds (N-EtFOSAA, PFBA, PFNA, and PFPeA) were detected. Concentrations and distributions of PFAS compounds remained relatively consistent among sites down-canal (downstream) of Kingston.

Post-storm results were not as consistent along the down-canal gradient. In the post-storm results, all compounds showed increased concentrations at the up-canal (upstream) sites on the feeder Canal, Raven Rock, and Lambertville (Figure 3, bottom bar). Unlike the pre-storm results, the post-storm results detected PFBS and PFPeA at Raven Rock and Lambertville, possibly due to increased runoff and inflow from the Delaware River, that had not been detected in the pre-storm samples. However, compared to the pre-storm results, overall PFAS concentrations were lower post-storm at the down-canal sites Kingston Gate, Zarephath, and 5-Mile Lock. For example, PFBA, which was detected pre-storm at each site from Kingston Gate to Landing Lane, was not detected post-storm until Landing Lane (the most down canal site). PFOA concentrations varied between sites, and the inconsistent detections of other PFAS compounds make the post-storm results difficult to interpret. This may be because many PFAS compounds were detected just above their laboratory detection limits. The detection of new compounds up-canal might suggest an increase in PFAS in the Delaware River post-storm, while lower concentrations at Kingston, Zarephath, and 5-Mile Lock could indicate the stormwater diluted existing PFAS in the Canal to below detectable limits.

Previous studies and travel time modeling conducted by NJWSA indicate the average velocity in the Canal is 0.31 miles per hour, and water moves approximately 8-10 miles per day, depending upon the exact start and end points in the Canal. With this in mind, two interesting findings are possible between these two dates. First, the post-storm distribution at Landing Lane closely resembled the pre-storm distribution from Kingston to Landing Lane. Based on NJWSA's modeling, the water sampled at Landing Lane on December 11 was likely near the Griggstown Causeway on December 8, just 6 miles downstream of the Kingston Gate sampling location. Comparing the December 8 Kingston Gate and December 11 Landing Lane results, the PFAS profile did not change much during its travel between these points, suggesting that no significant PFAS sources were discharging into the Canal between these two locations during this storm period. Secondly, the water passing Raven Rock on December 8 was likely near Kingston Gate on December 11. Comparing the pre-storm Raven Rock sample and the post-storm Kingston Gate sample, the concentration of PFOS was nearly the same, but PFHpA, PFHxA, and PFOA increased and PFHpA and N-EtFOSAA were now detected. This again indicates that PFAS compounds are likely entering the Canal between Raven Rock and Kingston.

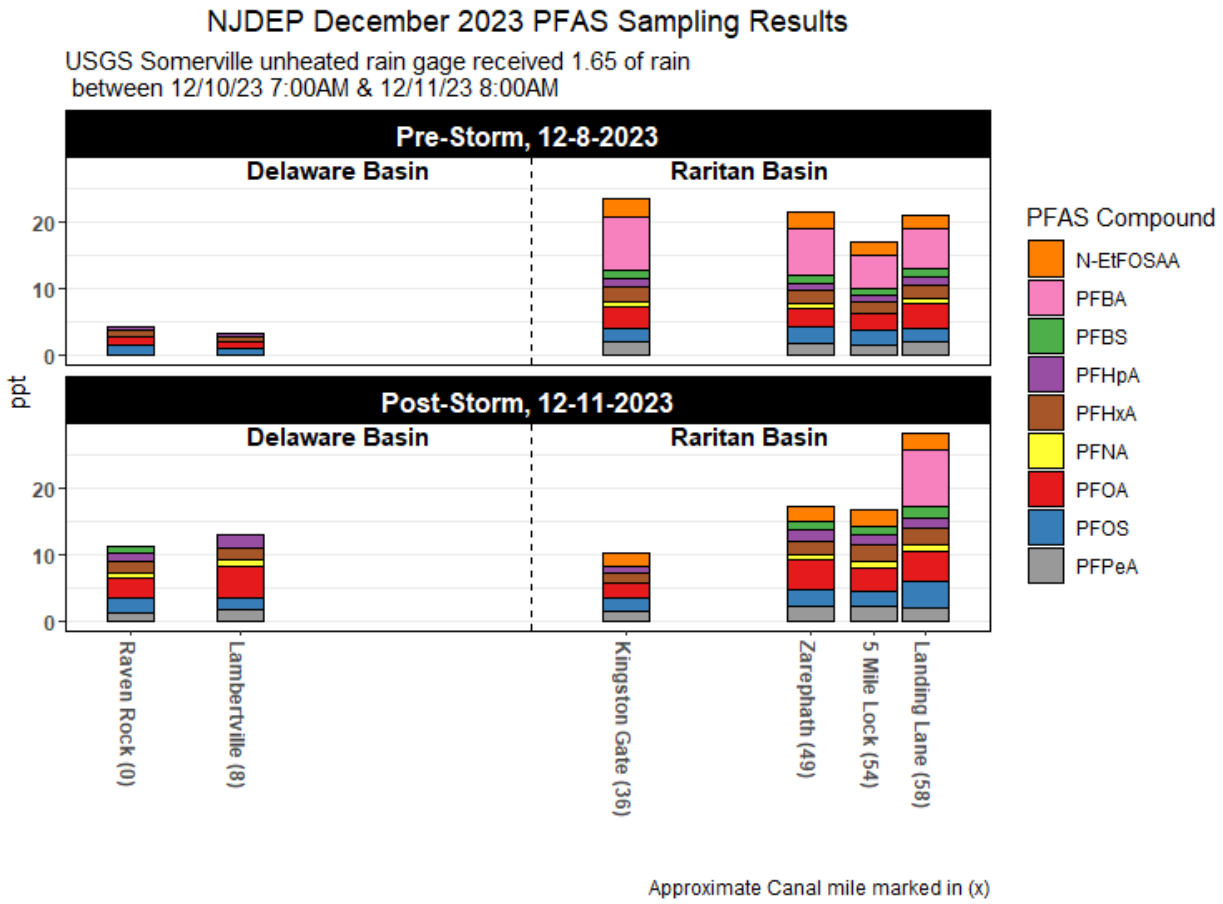

Figure 3 NJDEP December 2023 Sampling Results; bars are spaced along the horizontal axis to indicate their relative position along the Canal's length

Following these results, the DRBC and NJWSA jointly recognized a need to identify the potential source(s) of PFAS to the Canal. In particular, the NJDEP sampling identified the need to further investigate the 28-mile stretch between Lambertville and Kingston Gate, between which the results from the December 8, 2023 NJDEP sampling suggested a potential PFAS source was draining into the Canal. Due to the low concentrations observed—typically 2-4 ppt for most compounds, the decision was made to use passive samplers instead of typical grab samples. Long deployment passive samplers are advantageous when dealing with analytes with low ambient concentrations, such as PFAS compounds. In these cases, the continuous accumulation of PFAS compounds allows for increased chances of target analyte detections, while ambient concentrations may be below the detection limits in samples collected by traditional discrete water sampling.

The DRBC and NJWSA entered into a Cooperative Agreement to deploy a type of passive sampler, Polar Organic Chemical Integrative Samplers (POCIS), for PFAS detection at 16 sampling sites along the Canal. DRBC committed to funding the deployment of rented POCIS canisters, sample collection, shipping, and analysis by DRBC's contract lab, SGS Axys, for the 8 sites within the Delaware basin portion of the Canal (upstream of and including Port Mercer, the watershed divide), while the NJWSA reimbursed the DRBC for the same costs at the 8 sites within the Raritan Basin (downstream of Port Mercer and ending at Landing Lane).

POCIS are a passive sampling method used for monitoring hydrophilic contaminants and were recommended by the DRBC after their use in a previous DRBC study. POCIS continually adsorb individual PFAS compounds during deployment. Three (3) POCIS, which contain a sorption medium between two porous membranes housed in a stainless-steel ring, were placed in a stainless-steel canister. One canister was placed below the water line at each site. The project's goal was to identify areas where PFAS, especially PFOA, are entering the Canal and guide future studies to pinpoint potential PFAS source(s).

Figure 4 POCIS, membranes, rings inside a sampling canister

Methods

POCIS Deployment

Sample sites were identified by NJWSA staff based upon the previously mentioned NJDEP sampling data, geospatial reconnaissance for suspected PFAS discharges, and known watershed influences. DRBC and NJWSA staff jointly deployed the samplers at pre-determined locations on March 19-20, 2024. All POCIS were handled while wearing clean nitrile gloves by DRBC and NJWSA employees, employing a "Clean Hands/Dirty Hands" pairing between employees, where the "clean hands" worker handled the membranes and the inside of the sampling canisters, while the "dirty hands" clamped the canister and set up any necessary hardware to deploy the sampler. Sampling canisters were secured, clamped to metal chains, and lowered into the Canal. Depending upon available infrastructure at each location, chains were either tied around metal posts on the bank or across the center of the Canal. One set of three Field Blank replicates was collected during deployment on March 19, 2024.

Pictures of the canister deployment at each site are available in Appendix A. Deployment locations are shown in Figure 5, and Table 1 includes each deployment location's latitude/longitude, dates of deployment, and notes regarding deployment.

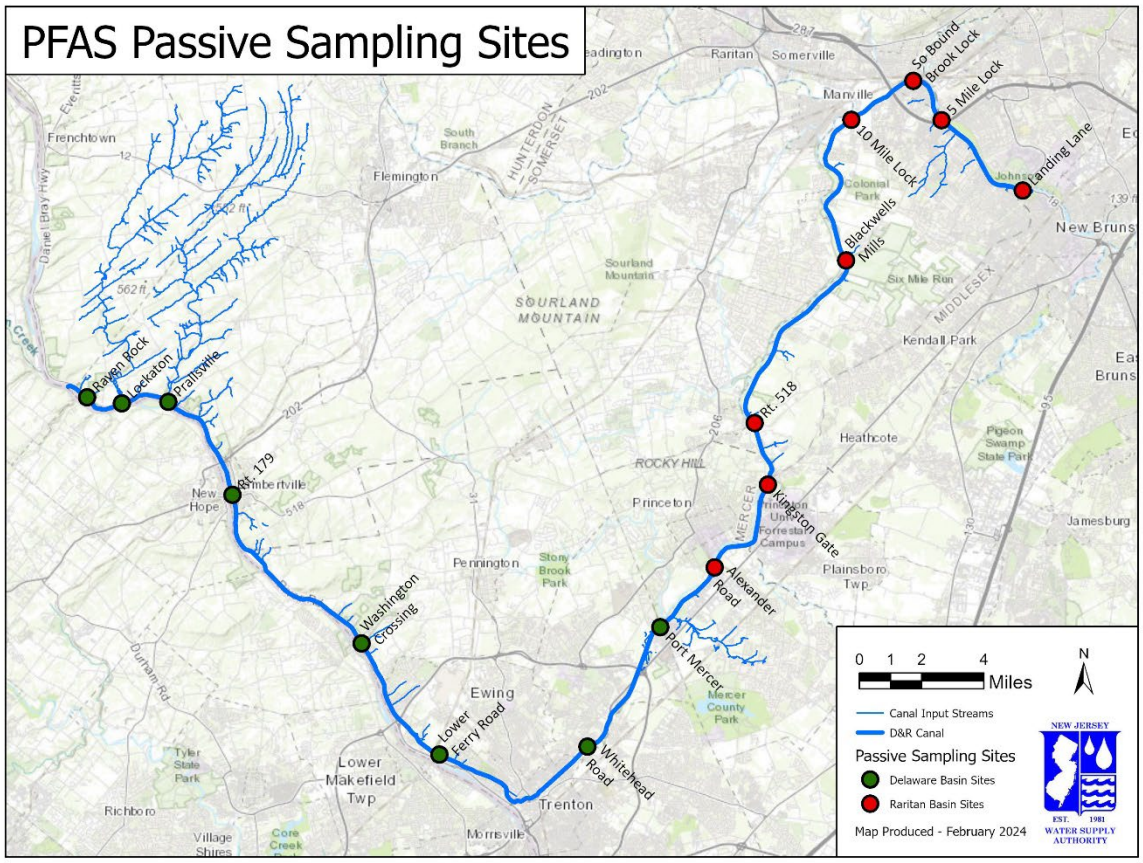

Figure 5 D&R Canal PFAS POCIS Deployment Sampling Sites

Table 1 POCIS Deployment Site Information

Site Name	Mile Number	Latitude	Longitude	Rationale	Deployment Dates	Deployment Notes
Raven Rock	0	40.410382	-75.03489	Inflow from Delaware River	3/19-4/18/24	Chained to tree on left bank, downstream of lock, canister on sediment.
Lockatong Creek Inlet	1.3	40.407615	-75.013719	Downstream of Lockatong Creek	3/19-4/18/24	Chained to rebar installed into left bank, canister on sediment.
Prallsville	2.9	40.408466	-74.985314	Downstream of Wickecheoke Creek	3/19-4/18/24	Chained to rebar installed into right bank, canister on sediment.
Lambertville	7.2	40.3652778	-74.945833	Upstream of purveyor intake	3/19-4/18/24	Chained to guard fencing on right bank. Canister on sediment.
Washington Crossing	13.6	40.296416	-74.866798	Existing continuous flow gage	3/19-4/18/24	Chained to structure on right bank, upstream of bridge. Canister on sediment.
Lower Ferry Road	18.1	40.244928	-74.819183	Upstream of Trenton	3/19-4/18/24	Center of flow deployment, chain hanging off monitoring well on upstream side of bridge.
Whitehead Road	24.2	40.248683	-74.729171	Downstream of Trenton	3/19-4/18/24	Attached to staff gage on left bank upstream side of bridge.
Port Mercer	28.8	40.304371	-74.685147	Delaware-Raritan Watershed divide	3/19-4/18/24	Attached to monitoring well downstream of bridge on left bank.
Alexander Road	31.4	40.332362	-74.651947	Downstream of Duck Pond Run & mall	3/19-4/18/24	Chained to part of retaining wall, downstream of bridge, right bank.
Kingston Lock	35.2	40.370878	-74.619723	Above Active Intakes	3/19-4/18/24	Chained to bridge pillar, downstream of Lock, center of flow.

Rt. 518	37.2	40.399499	-74.627662	Downstream of stormwater discharge	3/20/24	Chained to part of retaining wall, downstream of bridge, left bank.
Blackwells Mills Causeway	43.7	40.475239	-74.572026	Existing Continuous flow gage, downstream of WWTP	3/20/24	Chained to pillar on downstream side of bridge, center of flow.
10-Mile Lock	49.1	40.540719	-74.568986	Transfer point to Millstone River	3/20/24	Chained to existing monitoring well, upstream of Lock, right bank. Canister on sediment.
South Bound Brook Lock / Lock 11	51.5	40.558805	-74.531154	Previous sampling location	3/20/24	Chained to staff gage on right bank upstream of Lock.
5-Mile Lock in S Bound Brook	53.2	40.5405667	-74.513808	Upstream of Cedar Grove Brook	3/20/24	Chained to staff gage, upstream of Lock, left bank.
Landing Lane	56.8	40.5086111	-74.463888	Canal terminus, purveyor intakes	3/20/24	Chained to structure under bridge on downstream side, left bank. Canister on sediment.

POCIS Retrieval & Analysis

All POCIS were retrieved on April 18, 2024, a total of 28-29 days of deployment depending upon the site, as noted in Table 1. Once retrieved, the “dirty hands” partner opened the canister the “clean hands” partner pulled out the set of 3 membrane replicates, wrapped them individually in foil, and then placed all 3 in a single, labeled and sealed plastic bag. Samples were stored in a cooler with ice and brought to the DRBC laboratory at –4 ˚C until shipment to the contract analytical lab, SGS Axys. Samples were extracted and then analyzed using MLA 110 (equivalent to EPA Method 1633). The target analytes are shown in Table 2. This method targets 40 PFAS compounds out of the >13,000 known in this group of chemicals. While the focus of this effort was to examine compounds with MCL values, data on the other compounds provide additional context to understand the extent of PFAS pollution in the D&R Canal. Additionally, this data will inform future actions if MCL values are established for other PFAS compounds. The POCIS stainless steel rings and canisters were rented from Environmental Sampling Technologies (EST).

Table 2. Targeted PFAS analytes.

Analyte		Group		CAS #
Full Name	**Abbreviation**	**Full Name**	**Abbreviation**	
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (*replacement*)	11Cl-PF3OUdS	Ether Sulfonic Acids	ESA	2196242-82-5
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (*replacement*)	9Cl-PF3ONS	Ether Sulfonic Acids	ESA	1621485-21-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	Ether Sulfonic Acids	ESA	113507-82-7
2H,2H,3H,3H-Perfluorooctanoate (*precursor*)	5:3 FTCA	Fluorotelomer Carboxylic Acids	FTCA	1799325-94-2
4,4,5,5,6,6,6-Heptafluorohexanoate (*precursor*)	3:3 FTCA	Fluorotelomer Carboxylic Acids	FTCA	1169706-83-5
4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Pentadecafluorodec-2-enoic acid (*precursor*)	7:3 FTCA	Fluorotelomer Carboxylic Acids	FTCA	755-03-3
4:2 fluorotelomersulfonic acid (*precursor*)	4:2 FTS	Fluorotelomer Sulfonic Acids	FTSA	414911-30-1
6:2 fluorotelomersulfonic acid (*precursor*)	6:2 FTS	Fluorotelomer Sulfonic Acids	FTSA	425670-75-3
8:2 fluorotelomersulfonic acid (*precursor*)	8:2 FTS	Fluorotelomer Sulfonic Acids	FTSA	481071-78-7
4,8-dioxa-3H-perfluorononanoate (*replacement*)	ADONA	Per- and Polyfluoroether Carboxylic Acids	PFECA	2127366-90-7
Hexafluoropropylene oxide dimer acid (*replacement*)	HFPO-DA	Per- and Polyfluoroether Carboxylic Acids	PFECA	13252-13-6
Perfluoro(4-methoxybutanoic) acid	PFMBA	Per- and Polyfluoroether Carboxylic Acids	PFECA	863090-89-5
Perfluoro-3-methoxypropanoic acid	PFMPA	Perfluoroalkyl Carboxylic Acids	PFCA	377-73-1
Perfluoro-3,6-dioxaheptanoic acid	NFDHA	Perfluoroalkyl Carboxylic Acids	PFCA	151772-58-6
Perfluorobutanoate	PFBA	Perfluoroalkyl Carboxylic Acids	PFCA	45048-62-2
Perfluorodecanoate	PFDA	Perfluoroalkyl Carboxylic Acids	PFCA	73829-36-4
Perfluorododecanoate	PFDoA	Perfluoroalkyl Carboxylic Acids	PFCA	171978-95-3
Perfluoroheptanoate	PFHpA	Perfluoroalkyl Carboxylic Acids	PFCA	120885-29-2
Perfluorohexanoate	PFHxA	Perfluoroalkyl Carboxylic Acids	PFCA	92612-52-7
Perfluorononanoate	PFNA	Perfluoroalkyl Carboxylic Acids	PFCA	72007-68-2
Perfluorooctanoic acid	PFOA	Perfluoroalkyl Carboxylic Acids	PFCA	45285-51-6
Perfluoropentanoate	PFPeA	Perfluoroalkyl Carboxylic Acids	PFCA	45167-47-3
Perfluorotetradecanoate	PFTeDA	Perfluoroalkyl Carboxylic Acids	PFCA	365971-87-5
Perfluorotridecanoate	PFTrDA	Perfluoroalkyl Carboxylic Acids	PFCA	862374-87-6

Perfluoroundecanoate	PFUnA	Perfluoroalkyl Carboxylic Acids	PFCA	196859-54-8
Perfluorobutanesulfonate	PFBS	Perfluoroalkyl Sulfonic Acids	PFSA	45187-15-3
Perfluorodecanesulfonate	PFDS	Perfluoroalkyl Sulfonic Acids	PFSA	126105-34-8
Perfluorododecanesulfonate	PFDoS	Perfluoroalkyl Sulfonic Acids	PFSA	343629-43-6
Perfluoroheptanesulfonate	PFHpS	Perfluoroalkyl Sulfonic Acids	PFSA	146689-46-5
Perfluorohexanesulfonic acid	PFHxS	Perfluoroalkyl Sulfonic Acids	PFSA	108427-53-8
Perfluorononanesulfonate	PFNS	Perfluoroalkyl Sulfonic Acids	PFSA	68259-12-1
Perfluorooctanesulfonate	PFOS	Perfluoroalkyl Sulfonic Acids	PFSA	45298-90-6
Perfluoropentanesulfonate	PFPeS	Perfluoroalkyl Sulfonic Acids	PFSA	175905-36-9
N-Ethyl perfluorooctane sulfonamido ethanol (*precursor*)	N-EtFOSE	Perfluorooctane Sulfonamide Ethanols	FOSE	1691-99-2
N-Methylperfluorooctane sulfonamido ethanol (*precursor*)	N-MeFOSE	Perfluorooctane Sulfonamide Ethanols	FOSE	24448-09-7
N-Ethylperfluorooctane-1-sulfonamide (*precursor*)	N-EtFOSA	Perfluorooctane Sulfonamides	FOSA	4151-50-2
N-Methyl perfluorooctane sulfonamide (*precursor*)	N-MeFOSA	Perfluorooctane Sulfonamides	FOSA	31506-32-8
Perfluorooctanesulfonamide (*precursor*)	PFOSA	Perfluorooctane Sulfonamides	FOSA	754-91-6
N-ethyl perfluorooctanesulfonamidoacetic acid (*precursor*)	EtFOSAA	Perfluorooctane Sulfonamidoacetic Acids	FOSAA	2991-50-6
N-methyl perfluorooctanesulfonamidoacetic acid (*precursor*)	MeFOSAA	Perfluorooctane Sulfonamidoacetic Acids	FOSAA	2355-31-9

Data Analysis

After analysis, SGS Axys reported the PFAS data in terms of "ng per sample" for each sampler. Using published, laboratory-derived sampling rates (Barber et al., 2023), results were then converted to average ambient water concentrations in parts per trillion (ppt) over the period of deployment; however, among the detected PFAS compounds, sampling rates were only available for PFBS, PFDA, PFHpA, PFHxS, PFHxA, PFNA, PFOS, and PFOA. Detected compounds without published conversion factors included N-EtFOSAA and PFUnDA.

For summarization and comparison purposes, averages, standard deviations, and relative standard deviations across the three samplers at each site were calculated and are compared here. Data analyses, calculations, and graphing were completed using Microsoft Excel, R, and RStudio.

For general data analysis, individual PFAS compounds that were not detected in any sample replicate were filtered out. At sites where a PFAS compound was detected in at least one, but not all three replicates, half the laboratory reporting limit was used in place of the non-detect results, following common statistical practices for environmental data (Hornung and Reed, 1990). The averages among the three replicates were calculated and are compared and discussed in the graphs below.

Additionally, to summarize similarities in PFAS profiles between sites, nonmetric multidimensional scaling (nMDS) was performed on the averaged dataset.

All raw data from this study is publicly available through the National Water Quality Monitoring Council's Water Quality Portal (WQP) https://www.waterqualitydata.us/.

Results

Flows, discharges and diversions

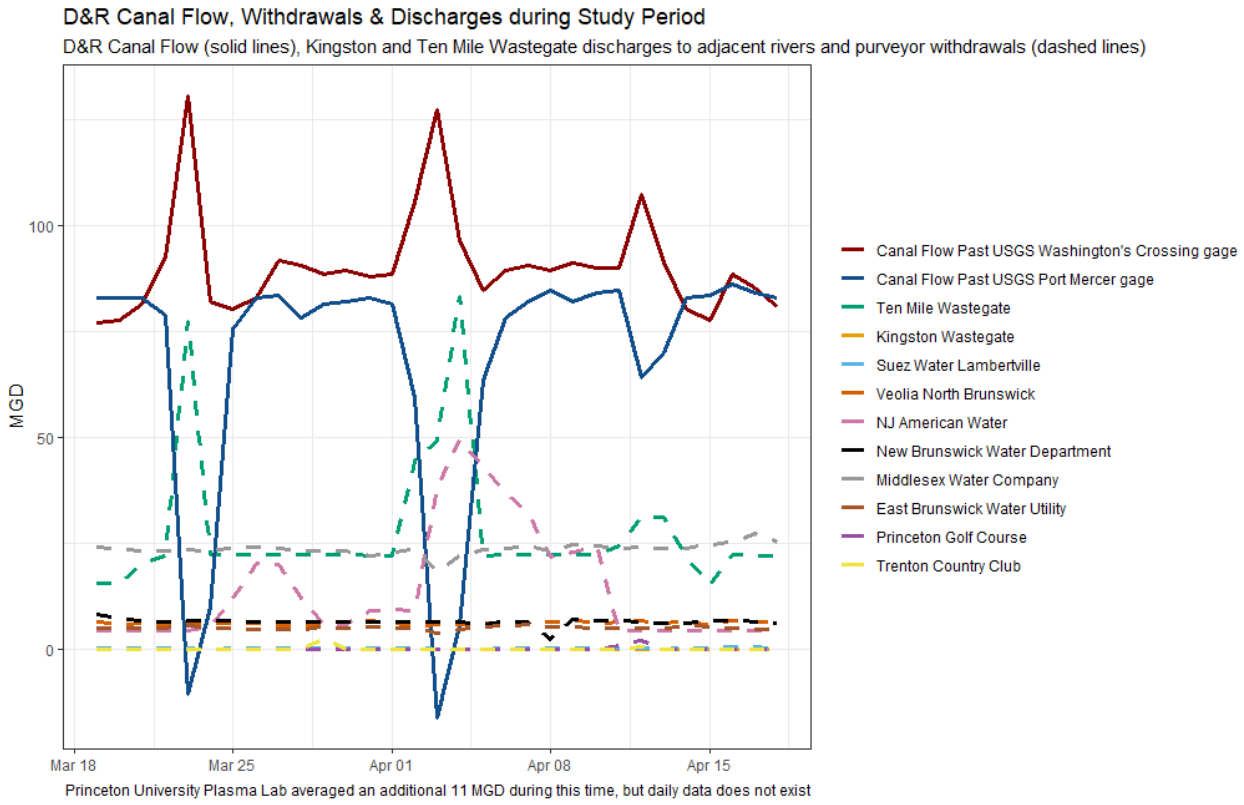

Figure 6 D&R Canal Flow, Withdrawals and Discharges during study period

The median daily flow at Washington's Crossing (Figure 6, solid red line) was 89.2 MGD while median flow at Port Mercer (solid navy line) was 82.1 MGD. Notable deviations from this flow regime were results of significant rainfall events, notably when 2.84" of rain fell on March 23, 2024, and a 2.73" rainfall event from April 2-4, 2024, according to data from the NJDEP South Branch Raritan River at South Branch NJ rain gage. As the graph shows, flow at Washington's Crossing spikes on both of these dates, while flow at Port Mercer is negative, indicating backflow events on this section of the Canal. Backflow events occur when Canal operations at the Perdicaris Wastegate draw water away from Port Mercer towards Trenton during and following significant rainfall events. This resulted in flows at Port Mercer of -10.6 MGD on March 23, 2024, and -16.2 MGD on April 3, 2024. The graph of Port Mercer's flow displays the amount of water flowing from the Delaware Basin into the Raritan Basin, but not the overall flow of the Canal; that is, downstream of Port Mercer, the flow still goes consistently towards Landing Lane to supply the drinking water intakes. At all times, water continues to enter the Canal downstream of Port Mercer at Duck Pond Run, Cedar Grove Brook, and various stormwater inlets.

Discharge from the Canal into the Raritan River at 10-Mile Wastegate (dashed green line) increased during these two rain events, reaching 86 MGD during the second storm, but otherwise was consistent, averaging 27.4 MGD during the study. No releases were made from the Kingston Wastegate during this time, indicated by the dashed orange line around 0 MGD.

Canal withdrawals from NJ American Water (dashed pink line) ranged from 4.25-49.3MGD during the deployment period, averaging 14 MGD. Other users were more consistent in their withdrawals, with Middlesex Water (dashed grey line) averaging 23.7 MGD, New Brunswick (dashed blank line) averaging 6.46 MGD, Veolia North Brunswick (dashed orange line) averaging 6.16 MGD, East Brunswick (dashed brown line) averaging 5.06 MGD, and all other users averaging under 0.5 MGD.

Composite (Average) PFAS Concentrations per site

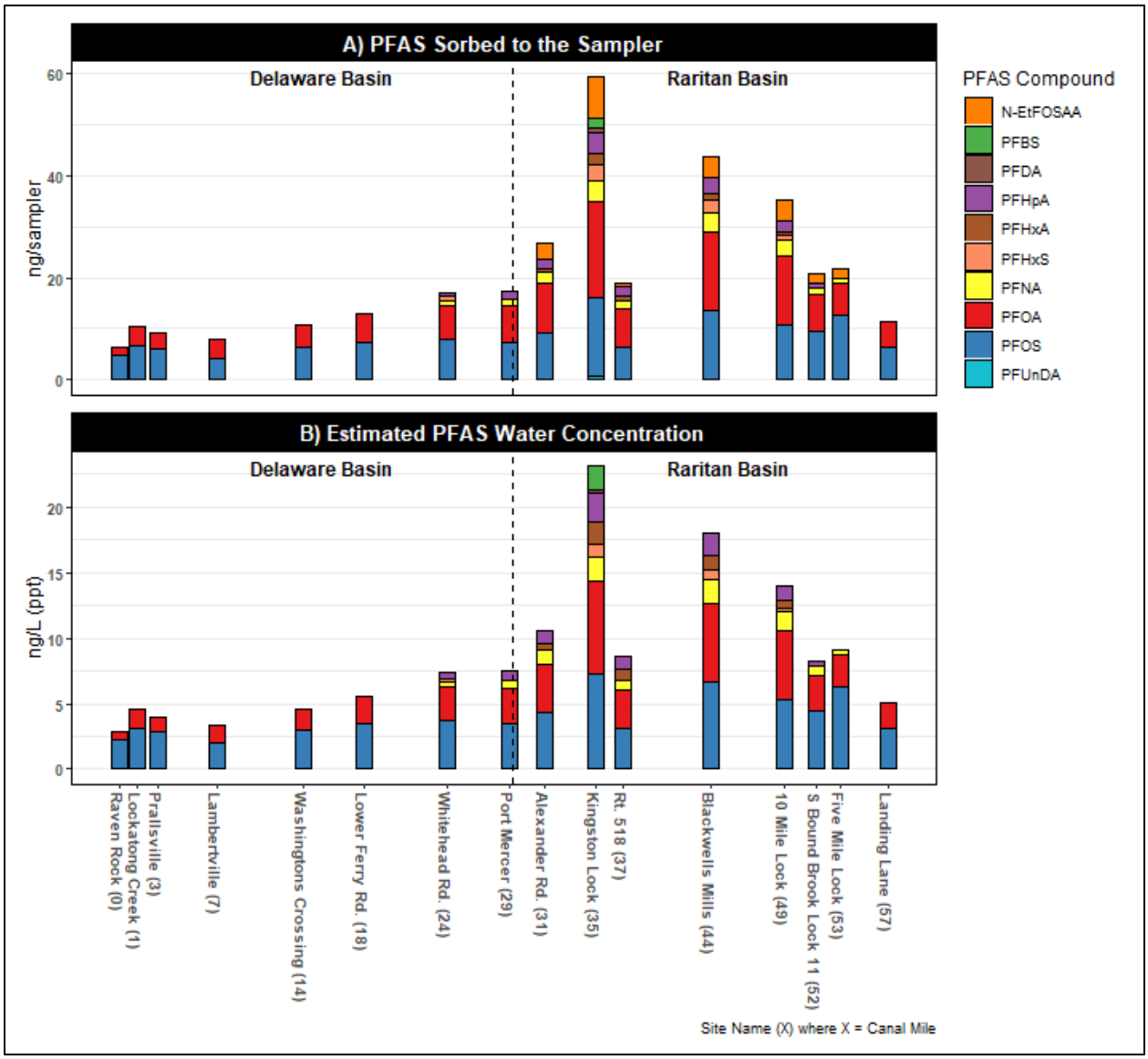

Figure 7 A & B: PFAS concentration, averaged over deployment period & site replicates; bars are spaced along the horizontal axis to indicate their relative position along the Canal's length

Figure 7A displays the mass of individual PFAS compounds sorbed to the POCIS samplers (ng/sampler). The mass sorbed to the POCIS was converted to time-weighted water concentrations (ng/L) in Figure 7B following methods by Barber et al. (2023). However, two of the detected PFAS compounds do not have published conversion factors: N-EtFOSAA and PFUnDA. PFUnDA was only detected at Kingston Lock, and it was only detected in one out of three replicates at the site. N-EtFOSAA was consistently detected

from Alexander Rd through 5-Mile Lock, as displayed in Figure 7A. Like other compounds, it had its highest mass sorbed at Kingston Lock, with lower amounts at subsequent sites until it was not detected at Landing Lane.

Figure 7B displays the estimated PFAS water concentration of each detected PFAS compound in terms of average ppt among replicates at each site over the deployment period (March 19 or 20, 2024 to April 18, 2024, depending on the site). A full data table of results is available in Appendix C.

Only PFOS and PFOA were detected from Raven Rock through Lower Ferry Road. Average concentrations were relatively consistent across these sites on the feeder Canal, with PFOS (blue) ranging from 2.02-3.52 ppt and PFOA (red) ranging from 0.50-2.08 ppt.

PFAS concentrations dropped 2 miles downstream at the Rt. 518 site, with several compounds (PFBS, PFDA, PFHxS) that were present at Kingston Lock below detection limits at Rt. 518. However, PFOS and PFOA still dominated the sample, although their concentrations also decreased. The PFOS and PFOA concentrations increased again, downstream at the Blackwells Mills site. Concentrations trended down over the remaining four sites stretching 13 canal miles.

Percent Composition of PFAS Concentrations between Sites

Reviewing the percent composition among different PFAS compounds helps to establish visual site "fingerprints" based upon ratios of different PFAS compounds, as visualized in Figure 8. This method accounts for dilution between sites and possible variation in sorption rate between sites. Figure 8A illustrates the percent composition in terms of ng sorbed to the sampler, reflective of Figure 7A. Figure 8B illustrates the percent composition in terms of estimated ng/L (ppt) of the water concentration, reflective of Figure 7B, and thus does not include the PFAS compounds without published conversion factors—N-EtFOSAA and PFUnDA.

Based on the percent composition graphs in Figure 8, three distinct fingerprint signal groupings emerge. First, PFAS sample composition is nearly identical at the first six sites from Raven Rock to Lower Ferry Rd with only PFOS and PFOA detected. It is likely that these PFAS enter the Canal in the Delaware River water, however there it is also possible that some contamination could enter from Lockatong Creek, which flows directly across the Canal and into the Delaware River. It isn't until canal mile 24 at Whitehead Rd. that new compounds, PFHpA, PFHxS, and PFNA are first detected, indicating a possible source between Lower Ferry and Whitehead Rd. PFBS and PFDA were also detected at Kingston Lock. These additional compounds gradually decrease to below detection limits as water moves downstream from Kingston Lock towards Landing Lane. This likely reflects dilution from other input sources between these sites, such as stormwater discharges and the Cedar Grove Brook.

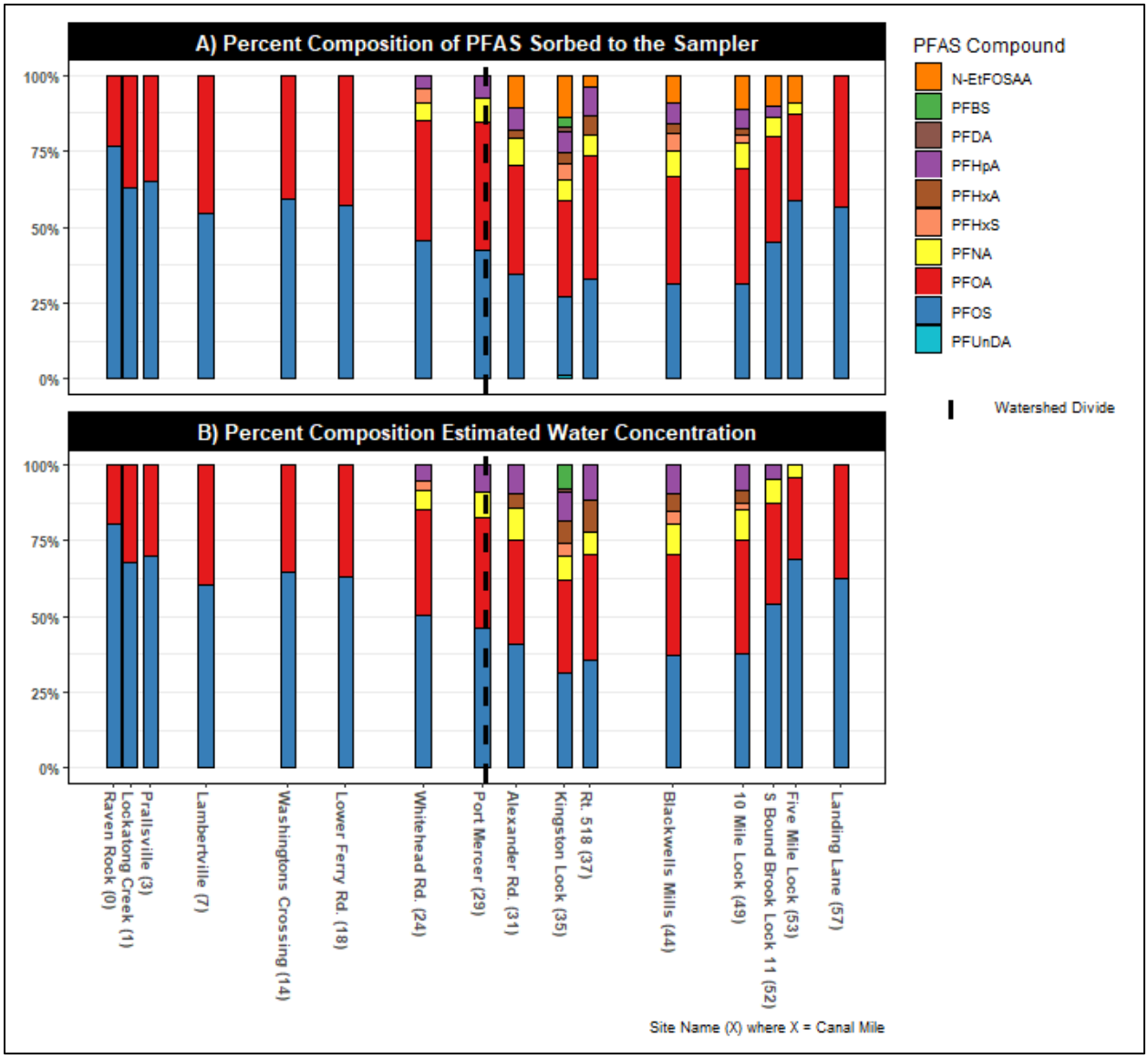

Figure 8 A&B Average Percent Composition of total PFAS compounds detected at each site, converted from ng/sample to ppt and averaged over 3 replicates for the entire deployment period

With the assumption that these new inputs are not adding more PFAS, their discharges may be diluting the PFAS concentrations that were detected at upstream sites. This dilution would further reduce levels of compounds with low concentrations, possibly pushing them below detection limits. This may explain why compounds such as PFBS, PFDA, PFHpA, PFHxS, and PFNA are detected at various sites between Whitehead Rd and 5-Mile Lock but gradually disappear from the sample detection profile by Landing Lane.

Figure 8A displays the percent composition data in terms of adsorbed ng per sample—a percent composition version of 7A. Here it is evident that N-EtFOSAA is consistently 10-12% of the sample composition from its detection at Alexander Rd. through 5-Mile Lock.

Nonmetric Multidimensional Scaling (nMDS)

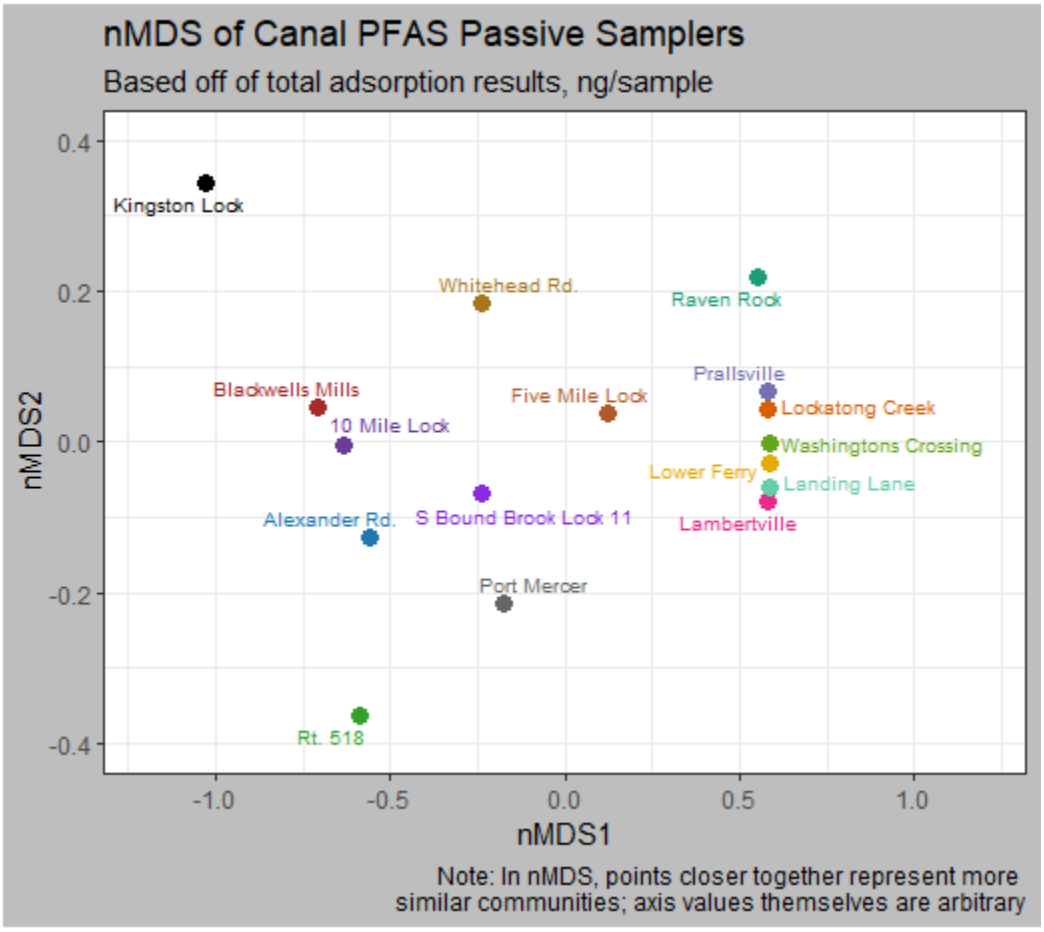

Figure 9 nMDS of Canal PFAS Passive sampler results, based off total sorption

nMDS was chosen over a Principal Component Analysis (PCA) and Principal Coordinates Analysis (PCoA) because the variances between samples were too large for metric scaling analysis; the data did not fit assumptions of normality. Given that leaving non-detects as zeros would disproportionately influence the results, non-detects were replaced with a value of 0.001 times the laboratory reporting limit. This approach helps to mitigate the impact of non-detects while still incorporating them into the analysis.

The nMDS was constructed in R using the metaMDS function within the *vegan* package with a maximum of 20 random starts to ensure the stability of the solution. A Bray-Curtis dissimilarity matrix was employed to quantify the distance/dissimilarities between samples. Stress plots and stress values were monitored to assess the goodness-of-fit of the nMDS configuration, with a stress value below 0.2 indicating a reliable ordination. A plot of the resulting nMDS was generated to visualize the relationship between dissimilarities in the samples.

The best nMDS solution was obtained 6 times out of 20 runs, with a final stress of 0.02, indicating a highly reliable ordination. The clusters and spacing of the nMDS largely verify what was seen in Figures 7 and 8.

On the right side of the graph, the nMDS closely clusters together the sites from the first 18 miles of the Canal—Raven Rock (canal Mile 0), Lockatong Creek (1), Prallsville (3), Lambertville (7), Washington's

Crossing (14), and Lower Ferry (18). They were grouped because they only had detections of PFOA and PFOS. The nMDS also included the Landing Lane site (57) with this grouping, which also contained only PFOA and PFOS.

After this, the center of the graph—Whitehead Rd. (24), Port Mercer (29), S Bound Brook Lock 11 (52), and 5-Mile Lock (53) indicate a deviation from the purely PFOA/PFOS profile and also include PFNA and PFHpA. All sites except Port Mercer also included N-EtFOSAA. As seen in Figures 7A and B, these four sites detected these PFAS compounds in relatively similar proportions. As indicated in Figure 7B and 8B, they are all located downstream of the first 6 sites, indicating the marked difference between the upstream sites, ending with Lower Ferry Road before the Canal enters the city of Trenton, and the downstream sites, beginning with Whitehead Rd., after the Canal has flowed through and under Trenton.

Just to the left of these four sites are Alexander Road (31), Blackwells Mills (44), and 10-Mile Lock (49). These sites' profiles are similar to those mentioned in the last paragraph, except they also detected small amounts of PFHxA and PFHxS. Along the downstream gradient of the Canal, these sites are interspersed with those mentioned in the last paragraph. The nMDS shows a small separation between these two groups, but they are relatively similar.

The two outlier sites include Rt. 518 (37) and, most of all, Kingston Lock (35). Rt. 518 does not fit into either of the groups in the two paragraphs above because it is the only site to detect PFHxA but not PFHxS. As mentioned in previous sections, Kingston Lock stands out with the highest overall concentrations and had detections for the most PFAS compounds, including PFUnDA and PFBS, which were not detected at any other site.

Overall, the nMDS shows that the upstream sites from Raven Rock to Lower Ferry are very similar, while the rest of the sites are clearly separated. As the rest of the site separations are not clearly in a downstream trend, trying to identify any trends among the separations highlighted by the nMDS is complicated.

Quality Assurance/Quality Control

Blanks, Recovery Rates, and Method Detection Limits

Four field blanks, two during deployment and two during retrieval, were collected. Four lab blanks were also analyzed. There were no detections in either of the eight blanks. The percent recovery of lab spikes ranged from 61% to 144%, which was within the acceptable range, demonstrating acceptable accuracy for most compounds, though with some variability. Overall, these QC results provide confidence in the data quality.

Method detection limits (MDLs) varied for each sample and each PFAS compound. Full results are included in Table 2 below. MDLs were between 0.200 and 0.400 ng/sample for most compounds. It should be noted that these units (ng/sample) are for the raw sample results, before they were transformed to water concentrations (ng/L or ppt) where possible. Treatment of non-detects was previously described in the Methods section.

Results Between Replicates

- Each site had 3 replicates, which were analyzed independently by the laboratory using EPA Method 1633. The previous sections discussed averages for each site set of replicates.

- If a PFAS compound was detected at a site, it was generally detected in all three of the site's replicates. The few exceptions to this include:
    - N-EtFOSAA: detected at 1 replicate of Rt. 518, near the detection limit.
    - PFDA: detected at 1 replicate at Kingston Lock, near the detection limit.
    - PFHpA:
        - Detected in 2 of 3 replicates at Port Mercer
        - Detected in 1 of 3 replicates at Whitehead Rd
        - Detected in 2 of 3 replicates at South Bound Brook Lock
    - PFHxS:
        - Detected in 1 of 3 replicates at Whitehead Rd
        - Detected in 1 of 3 replicates at 10-Mile Lock
    - PFHxA:
        - Detected in 1 of 3 replicates at Alexander Rd
        - Detected in 2 of 3 replicates at Rt. 518
        - Detected in 2 of 3 replicates at Blackwells Mills
        - Detected in 1 of 3 replicates at 10-Mile Lock
    - PFNA:
        - Detected in 2 of 3 replicates at Port Mercer
        - Detected in 1 of 3 replicates at Whitehead Rd
        - Detected in 2 of 3 replicates at Rt. 518
        - Detected in 1 of 3 replicates at South Bound Brook Lock
        - Detected in 1 of 3 replicates at 5-Mile Lock

Relative Standard Deviations (RSD) among replicates were calculated for each PFAS compound at each site. Compounds with % RSDs < 15% were considered highly precise, while those with 15-30% were deemed acceptable due to the trace-level and often non-detect PFAS compounds sampled. Values with %RSD > 30 were flagged for further review and are described below. Most RSDs were within 0-25%, representing good reliability between replicates for these types of trace-level compounds found near method detection limits. There were a few noteworthy exceptions with RSDs > 30%:

Raven Rock replicates: 45% RSD for PFOS among the three replicates, with individual results of 2.72, 7.10, and 4.72 ng/sampler. Replicate 2, with the 7.10 ng/sampler PFOS, was also the only one of the three replicates at Raven Rock to detect PFOA (4.01 ng/sampler). This may indicate that the positioning of Replicate 2 was more conducive to sorption, or more exposed to the water column than the other two replicates.

Whitehead Rd replicates: a high 30% RSD for PFOS and 34% for PFOA. Replicate 3 had higher readings for each compound compared to the other two replicates. Replicate 3 was also the only one with detectable amounts of PFNA, PFxS and PFHpA. This may indicate that its positioning was more conducive to the sorption of these compounds.

Kingston Lock: a 69% RSD on sampler sorption of N-EtFOSAA, with Replicate 2 featuring 14.70 ng/sampler while the other replicates had concentrations of 5.23 and 4.65 ng/sampler. Replicate 2 was also the only replicate with detectable amounts of PFDA and PFUnDA. This may indicate that its positioning was more conducive to the sorption of these compounds.

Landing Lane: a 57% RSD for PFOS and 46% RSD for PFOA. This is likely due to Replicate 1's concentrations being much lower for both compounds (2.47 and 2.30 ng/sampler, respectively) compared

to the other replicates' extracted concentrations (9.71-7.10 ng/sampler for PFOS and 6.29-6.07 ng/sampler for PFOA). This may indicate that Replicate 1's positioning was less conducive to PFAS sorption.

Possible Sample Biases

While the majority of replicates showed similar RSDs and compound detections, the previous section does identify differences in PFAS compound sorption between replicates at each site. There are also likely additional factors that influence differences in sorption rates between sites.

It is important to consider the position of the POCIS canister in the Canal—both in terms of depth and bank positioning—as position likely influences exposure and sorption potential. The positioning of each site's canister is described in Table 1. Most were deployed on a left or right bank. The only canisters placed in the center of flow were at Kingston Lock and Blackwells Mills. It is notable that these two center-of-flow sites had the highest total PFAS concentrations, as shown in Figure 7A. This may indicate that the higher concentrations at these two sites, compared to the sites adjacent or in between them (Alexander Rd, Rt. 518, 10-Mile Lock) may be due to their central position in the water column and not a new PFAS input. Meanwhile, PFAS uptake and concentrations may have been affected at sites where the canister rested on the bottom sediment or was attached to a sidewall positioned away from the center of flow. Based upon these results, if this study were to be repeated, the order of most ideal positioning (1) for any PFAS canister to least ideal positioning (4) would be: 1) in center of flow, 2) hanging from a structure but not resting on the bottom, 3) hanging from a structure and resting on the bottom, and 4) resting on the bottom near the shoreline.

Additionally, while there are many advantages to this sampling method's long-term passive approach, it also has the ability to miss several things that discrete sampling may pick up on. Passive sampling smooths out single, one-time spikes that well-timed discrete samples may detect—this includes intermittent discharges or surges in nonpoint source pollution or groundwater influences after rainstorms.

Discussion

Combining evidence from the PFAS passive sampler data — viewed as average concentration per day (Figure 7), percent composition (Figure 8), and nMDS (Figure 9) a few major points emerge:

1. From Raven Rock through Lower Ferry, the PFAS profile is characterized primarily by relatively low concentrations of PFOA (0.55-2.08ppt) and PFOS (2.02-3.11ppt). Their concentrations trend higher as water flows downstream towards the Whitehead Rd site. It is likely that much of the PFOA and PFOS in this stretch of the Canal entered with the feeder water from the Delaware River.
2. New PFAS compounds were detected at Whitehead Rd., indicating a source(s) of the chemicals to the Canal upstream of this site.
3. From Port Mercer to Kingston Lock, the concentration and the number of compounds increase.
4. Concentrations and compounds detected decrease after Kingston Lock, leaving only PFOA and PFOS at Landing Lane.
5. Passive sampler canister placement, such as the center of flow, hanging from a bank structure rather than sitting on or in the sediment, may affect PFAS sampler sorption. Evaluating sites by total sorption, percent composition, and multivariate analyses strengthens interpretation of the results

Point 1: PFOS and PFOA dominate samples throughout the 57-mile length of the Canal studied. However, they are the only compounds detected from Raven Rock to Lower Ferry Road (Figures 7 and 8). Additionally, along this stretch of the canal, concentrations of these two compounds are somewhat consistent, but do appear to increase from Lambertville to Lower Ferry Road. This implies that PFAS chemicals entered the Canal via the Delaware River feeder water, although additional inputs of PFOA and PFOS may be causing the steady increase observed between miles 7 and 18.

Point 2: Additional PFAS compounds, PFHpA, PFHxA and PFNA first appear at Whitehead Road. Coupled with more increases in PFOA and PFOS concentrations, this suggests a new source or sources of each compound that increased in the six-mile stretch between Lower Ferry Road and Whitehead Road. Samples dominated by a mixture of the compounds first identified at Whitehead Road could be from industrial sources (Zenobio et al., 2026). While the first 18 miles of the Canal have some patchy urbanization, they are mostly rural. This six-mile stretch from Lower Ferry Road to Port Mercer is highly developed, traveling around and under parts of Trenton, allowing for many potential PFAS sources. From Whitehead Road to the next site at Port Mercer, PFAS concentrations and compounds are largely consistent. Although at Port Mercer, PFHxS was not detected. This may be a more of a result of low limits—in the data report, PFHxS was only reported in one of three replicates at Whitehead Road (2.15 ng), but the lab reports notes the compound was “Present Below Quantification Limit” in the two other Whitehead Road replicates and the three Port Mercer replicates (with a Quantification limit of 0.466-0.468 ng/sampler).

Point 3: After Port Mercer, the number of PFAS compounds detected and their concentrations increase, peaking at Kingston Lock. It is unclear why there is a spike in PFAS along this stretch. The 21-mile stretch from Whitehead Road through Port Mercer to Kingston Lock is largely suburban sprawl, with various pockets of residential housing, preserved tracts of land, commercial real estate, Princeton University, and even farmland. At Kingston Lock, 10 compounds were detected and the summed amount of PFAS sorbed to the sampler tripled from 51.7 ng across the three replicates at Port Mercer to 179.0 ng at Kingston Lock. In addition to existing PFOS and PFOA, the newly detected compounds after Port Mercer include N-EtFOSAA, PFBS, PFDA, PFHxA and PFHxS. N-EtFOSAA is an electrochemical fluorination (ECF)-derived sulfonamide and a precursor to PFOS (McWayne, 2024; Zhang et al., 2016), while PFOS, PFHxS, and PFBS are all perfluoroalkyl sulfonic acids (PFSAs). Recent studies have linked PFAS mixtures dominated by PFSAs accompanied by the precursor N-EtOFSAA, to groundwater impacted by aqueous film-forming foam (AFFF) used between the 1970s-2016 (ITRC, 2023; Zenobio et al., 2026). Samples between Port Mercer and Kingston Lock also feature a small industrial signature as increases in PFOA and the first identification of PFBA could be linked to industrial uses such as protective coatings, textiles, paintings and building materials (McWayne, 2024; Zenobio et al., 2026). These possible AFFF and industrial sources may be entering the Canal through Duck Pond Run, which discharges to the Canal between Port Mercer and Alexander Road. This small 4.6 mi^2 watershed drains a highly developed area in West Windsor that includes farmland, retail, industry, golf courses and fire houses.

Point 4. After the spike at Kingston Lock, the next site just two miles downstream is Rt. 518, which has PFAS levels similar to Port Mercer. It is odd that the levels dropped so quickly and that the next site, Blackwells Mills, seven miles downstream, again had PFAS levels closer to Kingston Lock, although lower and with three fewer compounds, as PFBS, PFDA, and PFUnDA concentrations fell below laboratory reporting limits. Reasons for this sudden drop at Rt. 518 are unknown; however, it may also be

due to canister placement as discussed above. Despite this anomaly at Rt. 518, PFAS concentrations and detections after Kingston Lock decline overall over the last 22 miles of Canal sampled.

Land use surrounding Blackwells Mills is largely agricultural with some developments of single-family housing. Several aspects of agriculture, including the use of biosolids, pesticides, and treated effluent for irrigation, have been linked as PFAS sources (Islam et al., 2025). The Canal's adjacent lands become increasingly developed as it approaches New Brunswick, leading to potentially more historic and industrial sources of PFAS. This stretch of the Canal features a few major water extractions as well, including two drinking water intakes and the 10-Mile Wastegate, located just above the 10-Mile Lock site. Under normal operations, the NJWSA discharges water from the Canal into the Raritan River at 10-Mile Wastegate; during this study, the wastegate discharged 27.4 MGD. The Cedar Grove Brook is an urbanized tributary entering the Canal between the 5-Mile Lock and Landing Lane sites. While results are inconclusive in this area of the Canal for the NJDEP and POCIS studies thus far, PFAS concentrations appear to decrease between these sites, which may suggest that Cedar Grove Brook has lower, if any PFAS contamination, resulting in the dilution of PFAS concentrations in the Canal.

Point 5: The previous points focused on the measured PFAS mass sorbed to the samplers and their estimated concentrations. To help control biases in sampler sorption and incomplete mixing, comparing the differences in percent composition across sites (Figure 8) is a helpful way to evaluate this group of sites downstream of Lower Ferry. When looking solely at concentrations (Figure 7), the results at Kingston Lock and Blackwells Mills warrant attention, as increases in sorbed PFAS compounds suggest possible new PFAS inputs upstream of these sites. However, when examining the percent composition results (Figure 8) and relative separation from other sites in the nMDS (Figure 9), the profiles at these two sites are similar to neighboring sites —if one were to disregard the PFBS detection at Kingston Lock, all sites from Alexander Rd through 10-Mile Lock have PFOS, PFOA, PFHxA, PFHpA, and PFNA proportions that are similar within the limits of method precision, with intermittent detections of PFHxS. The similar PFAS compound profiles between these sites could mean their differences in total sorption are at least partially due to each sampler's individual position in the water channel, especially since the sites with the two highest PFAS sorption weights – Kingston Lock and Blackwells Mills—were uniquely positioned in the center of flow, rather than a new PFAS source, which would likely produce more noticeable changes in the PFAS compound composition profile.

Conclusions

This sampling revealed three main entry points for PFAS discharging into the Canal. First, the consistent PFAS profile of the Canal from Raven Rock through Lower Ferry Road indicates that these chemicals are entering via feeder water from the Delaware River (Point 1). Second, there is the potential influx of an industrial source(s), possibly historic, into the Canal between Lower Ferry Road and Whitehead Road (Point 2). As water approaches Princeton, another source(s) emerges between Port Mercer and Alexander Road, with several PFAS compounds linked to AFFF or another industry (Point 3). After this, PFAS concentrations slowly decline over the last 22 miles of the canal, particularly after Blackwells Mills (Point 4).

Between this POCIS study and the previously described NJDEP results (Figure 3), some subwatersheds of the Canal may be ruled as unlikely PFAS sources. This notably includes the Lockatong Creek and Wickecheoke Creek. There may be a slight increase in PFOA and PFOS concentrations after the

Lockatong Creek enters the Canal, but this study does not find it substantial enough to be conclusive. The Wickecheoke Creek enters the Canal just upstream of the Prallsville Mill site. Since there is no noticeable difference in the PFAS profile between the Lockatong Creek and Prallsville Mill sites, it is unlikely that Wickecheoke Creek contributes a substantial PFAS load to the D&R Canal. One major benefit of using passive samplers rather than discrete samples was the ability to detect long-term presence of compounds typically below discrete detection limits. In this study, this advantage may have helped to detect additional compounds, such as PFUnDA, PFDA and PFHxS, that were not previously detected in NJDEP's discrete sampling. The only PFAS compound detected in NJDEP's grab sampling and not the POCIS passive sampling was PFPeA.

Works Cited

Barber LB, Pickard HM, Alvarez DA, Becanova J, Keefe SH, LeBlanc DR, et al. Uptake of Per- and Polyfluoroalkyl Substances by Fish, Mussel, and Passive Samplers in Mobile-Laboratory Exposures Using Groundwater from a Contamination Plume at a Historical Fire Training Area, Cape Cod, Massachusetts. Environmental Science & Technology 2023; 57: 5544-5557.

Hornung RW, Reed LD. Estimation of Average Concentration in the Presence of Nondetectable Values. Applied Occupational and Environmental Hygiene 1990; 5: 46-51.

Islam MA, Parvin MI, Nguyen C, Alam MR, Kwong P, Zhou JL, et al. Per- and polyfluoroalkyl substances (PFAS) contamination in agriculture and its potential conflict with circular economy. Environmental Pollution 2025; 385: 127036.

ITRC. Aqueous Film-Forming Foams (AFFF). Interstate Technology Regulatory Council, 2023.

McWayne E. PFAS Transport, Fate, and Remediation. National Environmental Management Academy Online Training, 2024.

U.S. Environmental Protection Agency. Per- and Polyfluoroalkyl Substances (PFAS) Final PFAS National Primary Drinking Water Regulation. 2026. U.S. Environmental Protection Agency,, 2026.

Zenobio JE, Pazoki F, Forsberg A, Chiang S-YD. A structured forensic framework for PFAS source differentiation under target-only analytical constraints. Frontiers in Environmental Engineering 2026; Volume 5 - 2026.

Zhang X, Lohmann R, Dassuncao C, Hu XC, Weber AK, Vecitis CD, et al. Source attribution of poly- and perfluoroalkyl substances (PFASs) in surface waters from Rhode Island and the New York Metropolitan Area. Environ Sci Technol Lett 2016; 3: 316-321.

Appendix A—Site Pictures

Site Name	Site photo	Deployment Notes
D&R Ca feeder at Raven Rock		Chained to tree on left bank, downstream of lock, canister on sediment.
D&R Canal feeder at Lockatong Creek Inlet		Chained to rebar installed into left bank, canister on sediment.

D&R Canal feeder at Prallsville			Chained to rebar installed into right bank, canister on sediment.
D&R Canal feeder at Lambertville			Chained to guard fencing on right bank. Canister on sediment.

D&R Canal feeder at Washington Crossing				Chained to structure on right bank, upstream of bridge. Canister on sediment.
D&R Canal feeder at Lower Ferry Road				Center of flow deployment, chain hanging off monitoring well on upstream side of bridge.

D&R Canal at Whitehead Road		Attached to staff gage on left bank upstream side of bridge.
D&R Canal at Port Mercer		Attached to monitoring well downstream of bridge on left bank.
D&R Canal at Alexander Road		Chained to part of retaining wall, downstream of bridge, right bank.

D&R Canal at Kingston Lock			Chained to bridge pillar, downstream of Lock, center of flow.

D&R Canal at Rt. 518		Chained to part of retaining wall, downstream of bridge, left bank.
D&R Canal at Blackwells Mills Causeway		Chained to pillar on downstream side of bridge, center of flow.

D&R Canal at 10-Mile Lock			Chained to existing monitoring well, upstream of Lock, right bank. Canister on sediment.

D&R Canal at South Bound Brook Lock / Lock 11		Chained to staff gage on right bank upstream of Lock.
D&R Canal at 5-Mile Lock in S Bound Brook		Chained to staff gage, upstream of Lock, left bank.

D&R Canal at Landing Lane		Chained to structure under bridge on downstream side, left bank. Canister on sediment.

Appendix B—Method Detection Limits

All PFAS compounds analyzed by EPA Method 1644.

Characteristic Name	Minimum MDL (ng/sampler)	Max MDL (ng/sampler)
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.801	1.680
2H,2H,3H,3H-Perfluorooctanoate	5.000	10.500
4,4,5,5,6,6,6-Heptafluorohexanoate	0.800	1.680
4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Pentadecafluorodec-2-enoic acid	5.000	10.500
4,8-dioxa-3H-perfluorononanoate	0.800	1.680
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.802	1.680
FtS 4:2 ion	0.800	1.680
FtS 6:2 ion	0.721	1.510
FtS 8:2 ion	0.680	1.420
Hexafluoropropylene oxide dimer acid	0.800	1.680
N-Ethyl perfluorooctane sulfonamido ethanol	2.000	4.190
N-Ethylperfluorooctane-1-sulfonamide	0.560	1.170
N-Methyl perfluorooctane sulfonamide	0.200	0.419
N-Methylperfluorooctane sulfonamido ethanol	2.000	4.190
N-ethyl perfluorooctanesulfonamidoacetic acid	0.200	0.419
N-methyl perfluorooctanesulfonamidoacetic acid	0.200	0.419

Perfluoro(2-ethoxyethane)sulfonic acid	0.200	0.419
Perfluoro(4-methoxybutanoic) acid	0.200	0.419
Perfluoro-3,6-dioxaheptanoic acid	0.400	0.838
Perfluoro-3-methoxypropanoic acid	0.400	0.838
Perfluorobutanesulfonate	0.200	0.419
Perfluorobutanoate	0.800	1.680
Perfluorodecanesulfonate	0.200	0.419
Perfluorodecanoate	0.200	0.419
Perfluorododecanesulfonate	0.200	0.419
Perfluorododecanoate	0.160	0.335
Perfluoroheptanesulfonate	0.200	0.419
Perfluoroheptanoate	0.200	0.419
Perfluorohexanesulfonic acid	0.230	0.482
Perfluorohexanoate	0.200	0.419
Perfluorononanesulfonate	0.200	0.419
Perfluorononanoate	0.200	0.419
Perfluorooctanesulfonamide	0.200	0.419
Perfluorooctanesulfonate	0.200	0.419
Perfluorooctanoic acid	0.200	0.419
Perfluoropentanesulfonate	0.201	0.421
Perfluoropentanoate	0.400	0.838
Perfluorotetradecanoate	0.200	0.419
Perfluorotridecanoate	0.200	0.419
Perfluoroundecanoate	0.200	0.419