James Thompson & Company, Inc.
PFAS Investigation Project
Data Summary Report

Prepared by

Delaware Department of Natural Resources and Environmental Control

Division of Water

Commercial and Government Services Section
&
Resource Protection Section

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Table of Contents

List of Tables

List of Figures

Executive Summary

In July 2023, the Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Water (DW) launched a screening study of PFAS in wastewater which included sampling of influent, effluent, soils from spray application fields and rapid infiltration basins (RIBs), groundwater and adjacent surface water. Fourteen wastewater treatment facilities and disposal sites over the entire state were selected for the study. Sites were chosen to include varying sources of influent (residential, municipal, industrial) and disposal methods. The sampling plan called for a total of 56 influent, 56 effluent, 92 groundwater, 20 surface water, and 39 soil samples to be collected from wastewater treatment and disposal facilities in this screening study.

Upon the receipt and evaluation of the laboratory analysis results from the first rounds of sampling, James Thompson and Company, Inc, a fabric processing plant with an onsite wastewater treatment and disposal facility, was selected as a site for further studies due to elevated PFAS levels in the samples. The facility has a long operational history, and a broad range of media available for characterization around the site including, influent, effluent, soil, surface water, groundwater, and treatment residuals/sediments. This data summary report documents the findings of the PFAS studies performed at the James Thompson and Company facility.

As our understanding of PFAS in the environment continues to evolve, the available analytical methods, data reporting structures (e.g. lists of PFAS compounds reported by laboratories) and data analysis techniques are also rapidly changing. As a result, the data collected and analyzed during this study have been summarized and presented in several different ways, in hopes that any anomalies or variations will stand out. Results will also help to direct resources towards areas in need of further investigation and/or evaluation.

This assessment was not conducted to evaluate human health or ecological risk from exposure to PFAS compounds, or to make any final conclusions about disposal methods. Additional human health and ecological risk characterization were not conducted and presented as part of this study because there are very few established criteria for PFAS compounds to provide adequate perspective. More importantly, the improper interpretation and application of criteria can lead to incorrect conclusions. However, in review of the information presented in this data summary report, actions have already taken place to protect domestic water use and an investigation into wastewater facility closing procedures.

Acronyms and Abbreviations

4:2 FTS	1H,1H,2H,2H-Perfluorohexane Sulfonic Acid
5:3 FTCA	5:3 Fluorotelomer Carboxylic Acid
6:2 FTCA	6:2 fluorotelomer Carboxylic Acid
6:2 FTS	1H,1H,2H,2H-Perfluorooctane Sulfonic Acid
6:2 FTUCA	6:2 Fluorotelomer Alpha, Beta-Unsaturated Carboxylate
8:2 FTS	1H,1H,2H,2H-Perfluorodecane Sulfonic Acid
ADONA	4,8-Dioxa-3H-Perfluorononanoic Acid
AFFF	Aqueous Film Forming Foam
COPC	Contaminant of Potential Concern
DNREC	Delaware Department of Natural Resources and Environmental Control
DI	Deionized
DW	Division of Water
DWHS	Division of Waste & Hazardous Substances
ECF	Electrochemical Fluorination
EDD	Electronic Data Deliverable
ELS	DNREC Environmental Laboratory Section
EQuIS	Environmental Quality Information System
ESA	Ether Sulfonic Acid
FASA	Perfluoroalkane Sulfonamide
FCA	Fish Consumption Advisory
FOSA	Perfluorooctane Sulfonamide
FOSAA	Perfluorooctane Sulfonamido Acetic Acid
FOSE	Perfluorooctane Sulfonamide Ethanol
FTCA	Fluorotelomer Carboxylic Acid
FTSA	Fluorotelomer Sulfonic Acid
HDPE	High Density Polyethylene
HFPO-DA	Hexafluoropropylene Oxide Dimer Acid (aka Gen-X)
HSCA	Delaware Hazardous Substance Cleanup Act
ITRC	Interstate Technology and Regulatory Council
LC-MS/MS	Liquid Chromatography with Tandem Mass Spectrometry
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
N-EtFOSAA	N-Ethyl Perfluorooctane Sulfonamido Acetic Acid
N-MeFOSAA	N-Methyl Perfluorooctane Sulfonamido Acetic Acid
PDF	Portable Document Format
PFAA	Perfluoroalkyl Acid
PFAS	Per and Polyfluoroalkyl Substances
PFBA	Perfluorobutanoic Acid
PFBS	Perfluorobutane sulfonic Acid
PFCA	Perfluoroalkyl Carboxylic Acid
PFDA	Perfluorodecanoic Acid
PFDS	Perfluorodecanesulfonic Acid
PFDoA	Perfluorododecanoic Acid
PFECA	Per- and Polyfluoroether Carboxylic Acid

PFECA B	Perfluoro-3,6-dioxaheptanoic Acid (aka NFDHA)
PFEESA	Perfluoro-2-Ethoxyethanesulfonic Acid (aka PES)
PFHpA	Perfluoroheptanoic Acid
PFHpS	Perfluoroheptanesulfonic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexanesulfonic Acid
PFMBA	Perfluoro-4-Methoxybutanoic Acid
PFMOAA	Perfluoro-2-Methoxyacetic Acid
PFMPA	Perfluoro-3-Methoxypropanoic Acid
PFNA	Perfluorononanoic Acid
PFO2HxA	Perfluoro-3,5-Dioxahexanoic Acid
PFO3OA	Perfluoro-3,5,7-Trioxaoctanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFPeA	Perfluoropentanoic Acid
PFPeS	Perfluoropentanesulfonic Acid
PFPrA	Pentafluoropropionic Acid or PFF Acid
PFSA	Perfluoroalkyl Sulfonic Acid
PFTeDA	Perfluorotetradecanoic Acid
PFTrDA	Perfluorotridecanoic Acid
PFUnA	Perfluoroundecanoic Acid
PPB	Parts Per Billion (equivalent to micrograms per liter or µg/L)
PPM	Parts Per Million (equivalent to milligrams per liter or mg/L)
PPT	Parts Per Trillion (equivalent to nanograms per liter or ng/L)
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
QC	Quality Control
RL	Reporting Limit
SOP	Standard Operating Procedure
USEPA	U.S. Environmental Protection Agency
WWTP	Wastewater Treatment Plant

1. Introduction

In July 2023, the Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Water (DW) launched a screening study of PFAS in wastewater which included sampling of influent, effluent, soils from spray application fields and rapid infiltration basins (RIBs), groundwater and adjacent surface water. Fourteen wastewater treatment facilities and disposal sites over the entire state were selected for the study. Sites were chosen to include varying sources of influent (residential, municipal, industrial) and disposal methods. The sampling plan called for a total of 56 influent, 56 effluent, 92 groundwater, 20 surface water, and 39 soil samples to be collected from wastewater treatment and disposal facilities in this screening study. (DNREC, 2023a).

Upon the receipt and evaluation of the laboratory analysis results from the first rounds of sampling, James Thompson and Company, Inc, (JT) a fabric processing plant with an onsite wastewater treatment and disposal facility, was selected as a site for further studies due to elevated PFAS levels in the samples. The facility has a long operational history, and a broad range of media available for characterization around the site including, influent, effluent, soil, surface water, groundwater, and treatment residuals/sediments from the storage lagoon.

1.1 Project Need

Per- and polyfluoroalkyl substances (PFAS) which are a large class of human-made emerging contaminants of concern that include perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). PFAS have been used since the 1950's as stain and soil repellents for carpets and clothing textiles, oil and grease resistance for food contact paper and surfactants in firefighting foams. PFAS are highly persistent in the environment and some bioaccumulate in humans (Brunn, 2023). There is evidence that continued exposure to certain PFAS above specific levels may lead to adverse health effects. (NTP, 2016)

According to existing data, PFAS are found in virtually all wastewater and biosolids at varying concentrations (PCWR et. al, 2020; Bogdan, 2021). To examine PFAS in the waste stream, DNREC developed a project design and sampling plan to investigate the concentrations of certain PFAS compounds in wastewater influent, effluent, and biosolids at selected wastewater treatment plants across the state, as well as the soils and groundwater from related wastewater disposal (land application) sites. Preliminary analysis has shown elevated levels of PFAS in some of the waste streams and groundwater from related land application sites investigated via this study. James Thompson (JT) in particular exhibited high levels of PFAS in groundwater from land application activities. Therefore, to protect the public and better understand PFAS fate and transport, a further investigation was conducted at the JT facility to better quantify the impacts of PFAS to the area.

1.2 Site Description

James Thompson and Company, Inc. is a fabric processing facility located at 301 S. Church Street Greenwood, Delaware (38.7993, -75.5970). Opened in 1971, the company originally had been producing 60,000 to 100,000 gallons per day (GPD) of wastewater from fabric finishing, fabric dying, fabric rinsing, burlap bleaching, boiler blow down water, and water conditioner back washing. Daily wastewater discharge had decreased in recent years with an average of 27,700 GPD in 2022. Dying and bleaching operations had been reduced in recent years and totally ceased as of late April 2023. Currently, no wastewater is being discharged into the storage lagoon or onto the spray irrigation fields for disposal.

While in operation, the wastewater disposal consisted of a sediment ditch with bar screens, two sediment pits and two pumps to convey wastewater to the aerated storage lagoon. From the lagoon the wastewater was spray irrigated via three center pivot system and a stationary sprinkler zone onto 45.15 acres planted in orchard grass, alfalfa and corn.

According to design plans the storage lagoon is a structure 315 feet by 130 feet in surface area with 2:1 side slopes. It is divided into two basins with the waste inflow located in the smaller 130 by 115 feet basin with a 6 ft. berm between the two basins. Each basin has a bottom elevation of 44.0 ft. and a surrounding bank elevation of nominally 55.0 ft. The irrigation suction pipe invert is at elevation of 49.0 ft. and is centered in the larger basin. There is an emergency overflow located in the receiving basin at an elevation of 53.0 ft.

The wastewater had been spray irrigated on fields of the Woodstown-Fallsington class of sandy loam soils. These soils have a permeability of 0.63 to 6.3 inches per hour and a transmissivity of 3000-4000 ft^2/day. (USDA, 1974) In a normal year the depth to groundwater is 6-9 ft. but can range from 0-19 ft. (DGS, 2006). The thickness of the surficial aquifer in the area is 40 to 60 feet and groundwater flow is generally towards the southeast (DGS, 2006). The fields slope from an elevation of 50 ft. to 45 ft. NAVD88. (DGS, 2019)

Thirteen wells were previously installed at or nearby the facility for monitoring during spray irrigation activities. Three of these wells were selected for groundwater sampling in the initial study (JT-GW78710, JT-GW50018 and JT-GW10234).

Figure 1 shows regional location of the JT facility and Figure 2 shows soil and groundwater sampling locations in the original screening study.

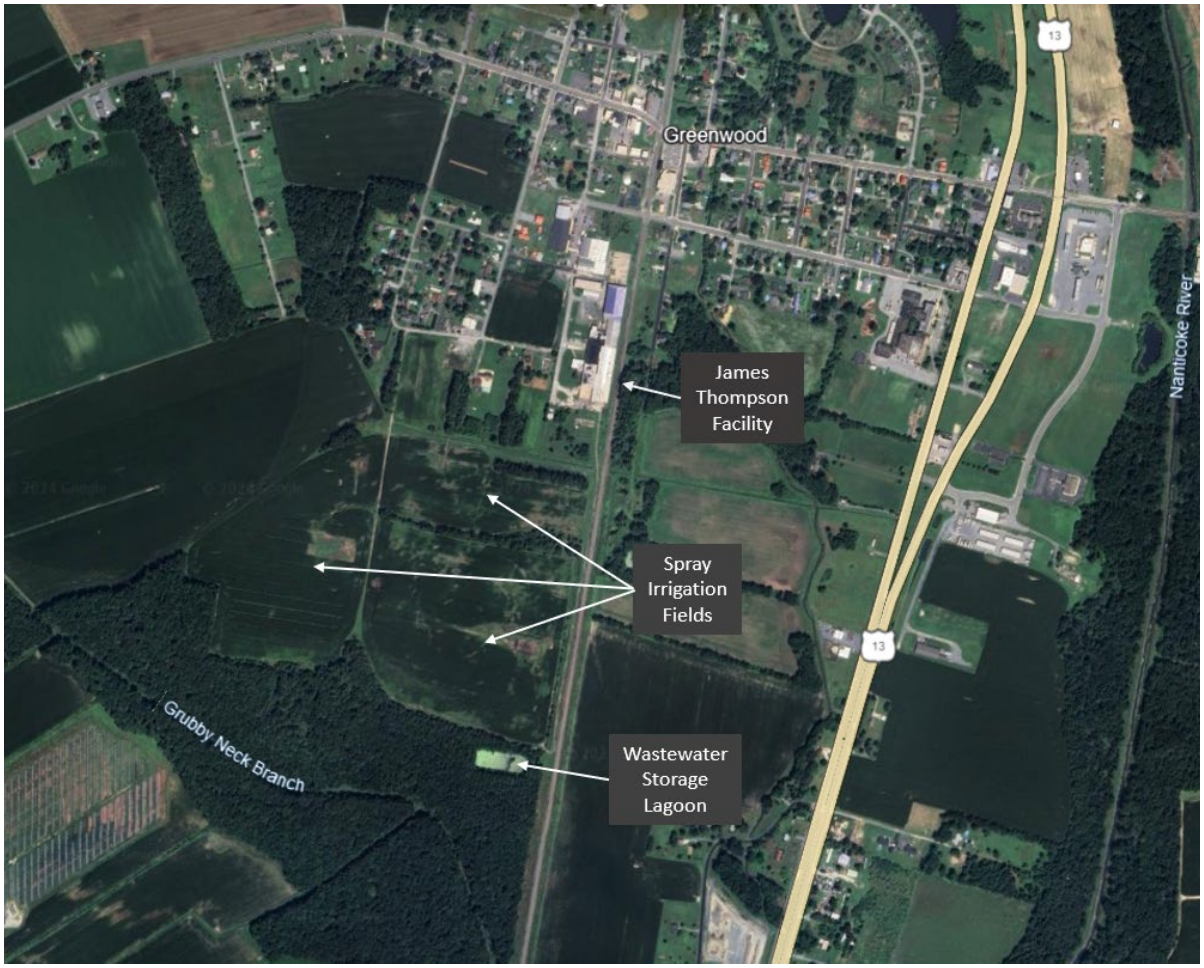

Figure 1. James Thompson and Company location.

Figure 2. Original screening study sampling locations

2. Sample Collection

During the original screening study, started in July 2023, there was not any active wastewater operations occurring at the facility; therefore, wastewater samples from the storage lagoon were collected as representative of effluent (JT-EF1 though 4). A total of 12 groundwater samples were collected from 3 selected monitoring wells at the facility. Additionally, 5 soil samples were collected from 2 locations at different depths (JT-SL1, JT-SL2; see Figure 2 for site locations).

Due to the elevated levels of PFAS detected in the original screening, as well as the opportunity to assess PFAS fate and transport from multiple environmental media pathways, a decision was made to conduct a further PFAS investigation of the site which included additional sampling of:

- groundwater from two additional monitoring wells at the facility
- surface water from the two creeks downgradient from the facility
- groundwater from nearby downgradient domestic wells
- the facility water supply prior to any processing, and
- sediments from the effluent pre-spray storage lagoon.

2.1 Groundwater

Of the thirteen monitoring wells at the facility, three wells JT-GW78710 (MW-8), JT-GW50018 (MW-6) and JT-GW10234 (MW-2) were sampled during the original screening study. For the enhanced study two more downgradient wells were selected: JT-GW91988 (MW-10) and JT-GW10237 (MW-05), as shown on Figure 3. With the addition of those two monitoring wells, the wells utilized for the expanded study now consist of one upgradient (JT-GW78710), one within the spray field and three downgradient of the groundwater flow near the boundary of the facility (one of which was downgradient of the storage lagoon). Groundwater from the wells for this expanded study was sampled quarterly for a year, same as the other three sampled during the original screening study.

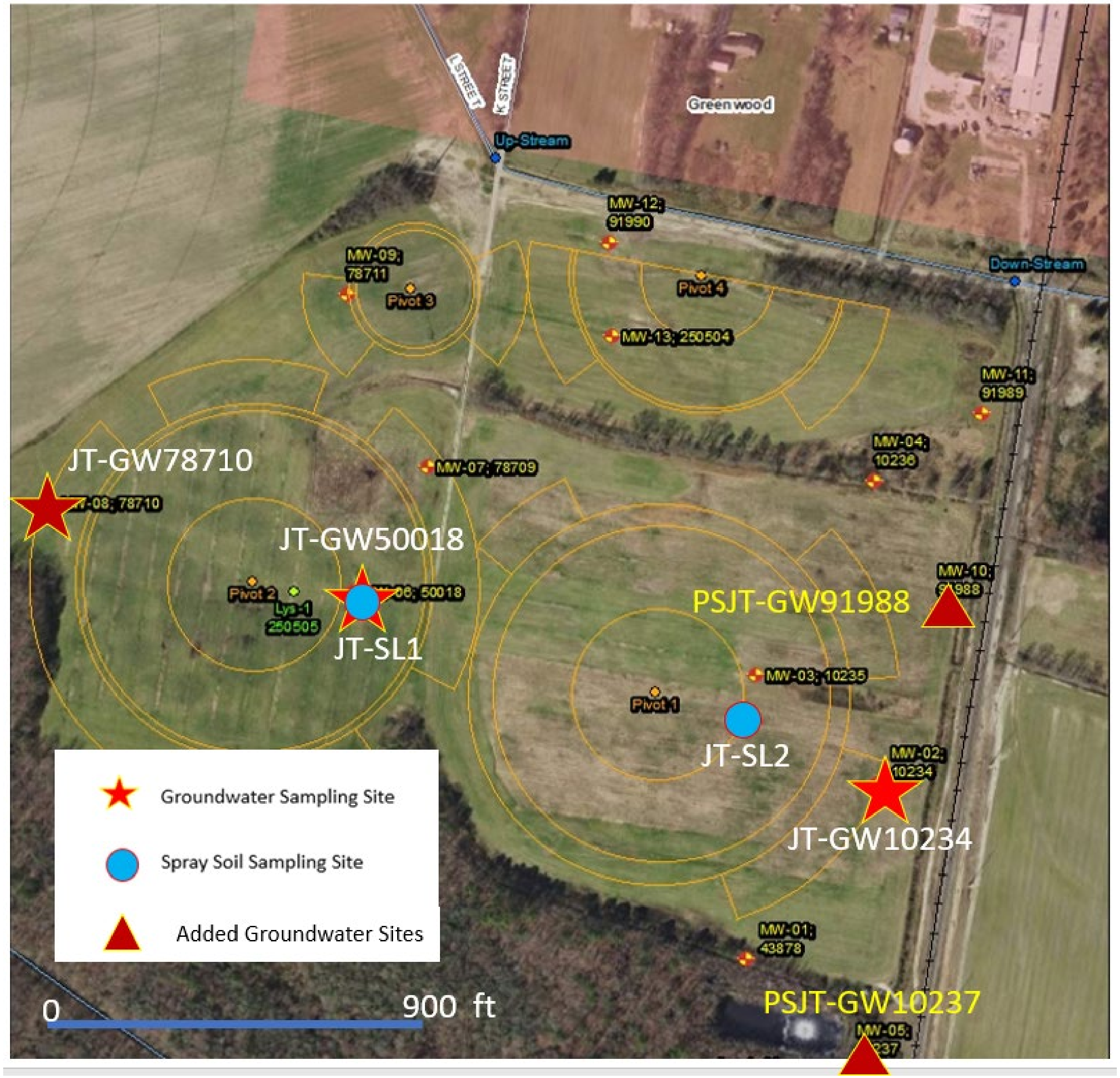

Figure 3. Additional groundwater sampling sites.

2.2 Soil

There are two soil sample locations (JT-SL1, 2, see Figure 2) within the spray irrigation fields. Samples were collected with a hand auger at depths of 1 foot, 3 feet and 6 feet below the surface. The groundwater table was encountered before reaching the desired depth of 6 feet at JT-SL2; therefore, only 2 samples were collected for that sample location (at 1 and 3 ft). Soil samples were collected once in July 2023 as part of the initial screening study.

2.3 Surface Water

The Grubby Neck Branch, to the south of the facility and the Cart Branch, to the east of the facility, are both likely receiving groundwater inflow from the spray fields of the facility. Five surface water sampling locations were selected (JT-SW1 through 5, Figure 4). Samples were collected using SiREM PFASsive passive samplers with a seven-day deployment. The samplers are a diffusion-based equilibrium passive sampling device that was developed and validated for relevant PFAS in porewater and surface water. Passive sampling involves deploying a sampler consisting of a receiving phase that can accumulate the analytes of interest due to chemical potential differences (Salim, 2019). Upon retrieval, the water from the sampler is treated like a regular water sample; the PFAS can be concentrated and measured using traditional United States Environmental Protection Agency laboratory methods without the additional extraction steps required for sorbents. (https://www.siremlab.com/sediment-pore-water-sampler/pfassive , Shoemaker, 2020) The results are presented as concentrations in nanograms per liter (ng/L).

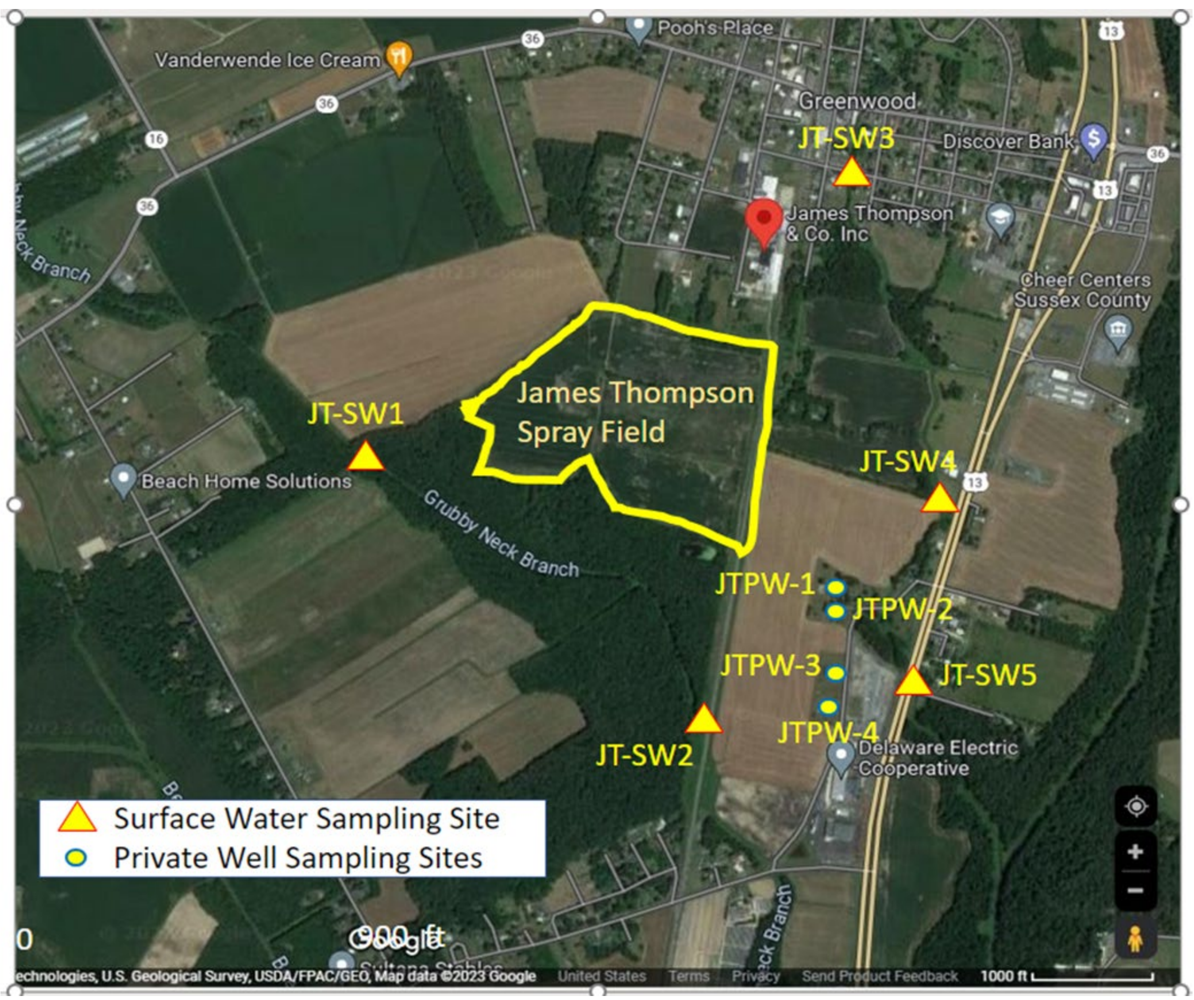

Figure 4. Surface water and domestic well sampling sites

2.4 Downgradient Offsite Domestic Wells

There are four residences downgradient from the effluent spray field with domestic wells as their drinking water supply, which were identified for sampling for this study (JTPW-1 through 4, Figure 4). While one of the four wells is screened at a depth of 300 feet (within a confined aquifer), the rest were installed in the unconfined aquifer ranging in screened depth from 30 to 60 feet below the surface.

As part of the sampling plan, it was anticipated that domestic wells at the residences would be sampled a maximum of two times. If there was a presence of PFAS compounds above existing criteria (i.e., EPA MCLs or DE HSCA SLs; see Section 3) in any of the first-round samples, a second confirmatory sample from the same well would be collected. If PFAS was not detected, no additional sampling would be conducted. Only JTPW-2 was sampled twice in this study(see Section 4).

2.5 Water Supply

Source water from the well used for the production processes at the facility was sampled to identify the potential existence of PFAS in the water supply (JT-Plant). PFAS was detected but at levels below existing criteria thus no additional sample was collected (see Section 3 and Section 4). Water supply for current activities at the plant is sourced from the town of Greenwood. No analysis was performed on this water since the Greenwood water supply was sampled for PFAS in another study by DNREC.

2.6 Lagoon Sediments

Historically, effluent from the facility process operations only was discharged into a storage lagoon before being used for crop irrigation. Over time, suspended solids in treated wastewater accumulated as residual sediment on the bottom of the storage lagoon. Since no wastewater is generated with current limited operations at the facility, sediments from the bottom of the storage lagoon will likely resemble the historic sludge generated from the wastewater treatment plant of the facility. Three sediment samples from different locations of the storage lagoon were collected from three sampling locations (PSJT-SD1 through 3, Figure 5). These samples were collected from the surface of the sediment layer using a petit ponar sampler.

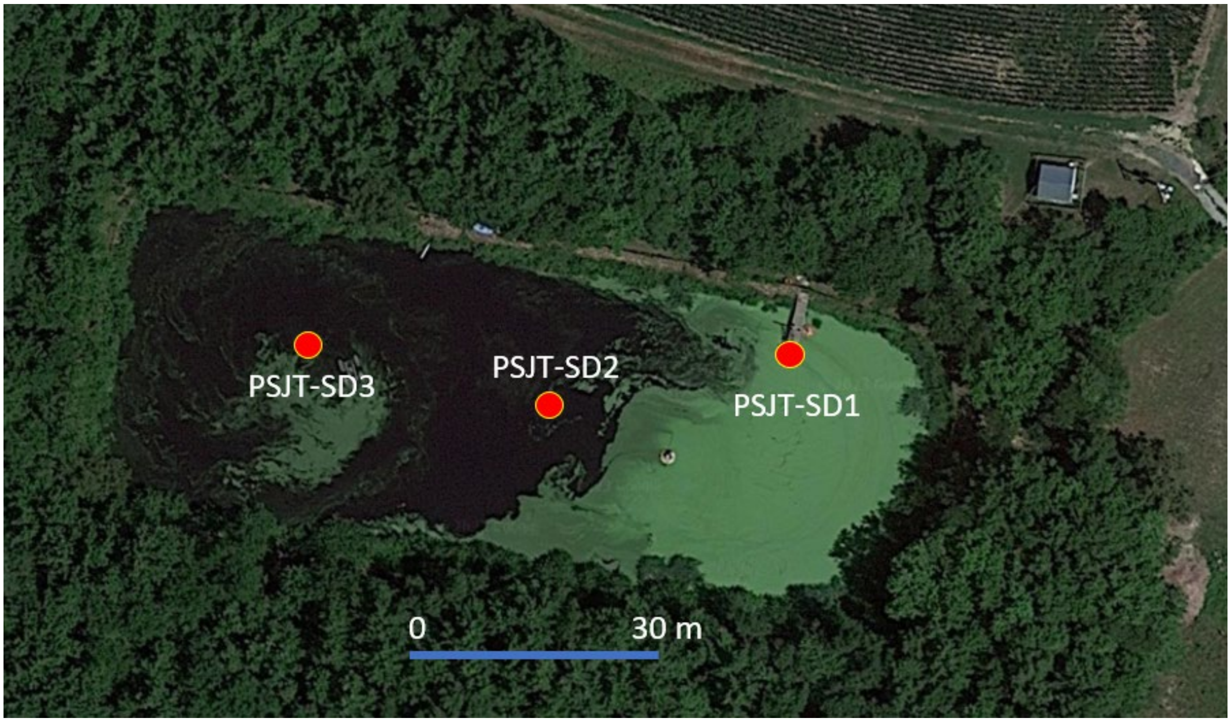

Figure 5. Sediment sampling locations at the bottom of the effluent storage lagoon

3. Data Evaluation and Presentation Methods

As our understanding of PFAS in the environment continues to evolve, the available analytical methods, data reporting structures (e.g. lists of PFAS compounds reported by laboratories) and data analysis techniques are also rapidly changing. As a result, the data collected and analyzed during this study have been summarized and presented in several different ways, in hopes that any anomalies or variations will stand out. Results will also help to direct resources towards areas in need of further investigation and/or evaluation.

In general, laboratories have a 'lowest concentration' that can be confidently measured in a sample using the available analytical instruments and methods. This value is called the Reporting Limit (RL). A Method Detection Limit (MDL) is lower than the RL and is a statistical calculation of the lowest concentration that can be detected by the instruments and methods. Typically, each compound that is part of analysis has its own RL and MDL, which are different from the RL and MDL of other compounds in the same analysis. When laboratories detect a compound in a sample, but the concentration is between the RL and the MDL, the result is marked with a letter "J" to indicate it is an approximate value. In these cases, the laboratory is confident that the compound is present in the sample because the result is greater than the MDL, but the laboratory cannot say exactly how much of that compound is present because the result is less than the RL. When compounds are not detected in a sample, the laboratory will still report the result as the MDL concentration but will mark it with a letter "U" to show that "the analyte was analyzed for, but not detected." In these cases, the compounds may be present in a sample, but if so, they are at concentrations that are too low to detect. Therefore, results marked with a "U" should more realistically be reported as "< MDL". However, for this report, any result that was reported by the laboratory and marked with a "U" was assigned a concentration of zero for purposes of data display and computations. This was done for ease of public understanding of the large quantity of data summarized in this report and because the intent of data evaluation is to identify anomalies when data is compared to each other.

3.1 Individual Compounds

Using USEPA Method 1633, forty PFAS compounds were reported in the analysis. Concentrations from eight specific PFAS compounds were extracted from the dataset and evaluated individually because there are currently state and/or federal criteria for these compounds in groundwater and/or drinking water, and because they have been the subject of the most research to date. Those eight compounds include HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA.

3.2 Summed Compounds

Concentrations of each of the previously identified eight individual compounds were summed ("sum of 8 compounds") to represent another point of comparison between sample locations. Concentrations of each of the reported PFAS compounds were also summed ("Total PFAS") to represent the total magnitude of measured and reported PFAS in the samples.

3.3 Family Groups and Subgroups

Data were also aggregated further to compute and compare total concentrations of specific PFAS family groups/subgroups described below. Classification of PFAS into specific family groups/subgroups is primarily based on shared chemical structure characteristics. PFAS within these groups tend to act similarly and by assessing them together, scientists may be able to better determine sources and the potential impacts. More general PFAS information and information about each of the families of PFAS can be found on the Interstate Technology and Regulatory Council (ITRC) webpage, under their Available Resources heading (www.itrcweb.org/PFAS).

Perfluoroalkyl carboxylic acids (PFCAs): PFCAs are one of two major subgroups of perfluoroalkyl acids (PFAAs), and one of the most commonly researched PFAS (ITRC, 2020). PFAAs do not degrade under ambient conditions and are called terminal PFAS or terminal transformation products. PFCAs are grouped together based on a shared chemical structure: a chain of two or more fully fluorinated carbon atoms (the "tail") connected to a carboxylic acid group (the "head"). PFCAs in particular are commercially used as surfactants and are manufactured through Electrochemical Fluorination (ECF) or fluorotelomerization (ITRC, 2023). The most frequently detected PFCA is PFOA (NEMA, 2022).

Perfluoroalkyl sulfonic acids (PFSAs): PFSAs are the second of two major subgroup of PFAAs, and one of the most commonly researched PFAS (ITRC, 2020). PFAAs do not degrade under ambient conditions and are called terminal PFAS or terminal transformation products. PFSAs are grouped together based on a shared chemical structure: a chain of two or more fully fluorinated carbon atoms (the "tail") connected to a sulfonic acid group (the "head"). PFSAs in particular are commercially used as surfactants and manufactured by ECF. The most frequently detected PFSA is PFOS (NEMA, 2022).

Fluorotelomer sulfonic acids (FTSAs): FTSAs are polyfluoroalkyl substances produced through the fluorotelomerization process (ITRC, 2023). Polyfluoroalkyl substances, unlike perfluoroalkyl substances, do not contain fully fluorinated chains of carbon atoms in the "tail". Instead, some of the carbon atoms in the "tail" of polyfluoroalkyl substances are more weakly connected to hydrogen atoms. FTSAs contain a sulfonic acid "head" group and are examples of PFAS precursors that may degrade or transform into terminal PFAS in the environment. FTSAs are especially prone to degradation at the weak carbon-to-hydrogen bonds in the "tail". The transformation of fluorotelomer-based substances is a potential source of PFCAs in the environment (ITRC, 2020). FTSAs are commonly detected at sites where Aqueous Film-Forming Foam (AFFF) is a primary source, in wastewater treatment plant (WWTP) effluent, and in landfill leachate (NEMA, 2022).

Perfluorooctane sulfonamides (FOSAs): FOSAs are a subgroup of the family of fully fluorinated perfluoroalkane sulfonamides (FASAs) which are used as raw material to make surfactants and surface treatment/protection products. They are also products and intermediates of the ECF process (ITRC, 2020). FASAs, including FOSA, can be precursors and can transform into PFAAs such as PFOS. (NEMA, 2022).

Perfluorooctane sulfonamidoacetic acids (FOSAAs): FOSAAs are a subgroup of the family of Perfluoroalkane Sulfonamido Substances. Although Perfluoroalkane Sulfonamido Substances have fully fluorinated carbon chain "tails", these compounds are considered polyfluoroalkyl substances because some carbon atoms in the "head" group are bonded to hydrogen atoms. FOSAAs are Perfluoroalkane Sulfonamido Substances that contain acetic acid as the "head" group. FOSAAs can be raw materials for the production of surfactant and surface treatment products (ITRC, 2020). They are also typically present as intermediate environmental transformation products of other PFAS compounds (NEMA, 2022).

Perfluorooctane sulfonamide ethanols (FOSEs): FOSEs are also a subgroup of the family of Perfluoroalkane Sulfonamido Substances. FOSEs have similar chemical structures to FOSAAs except that FOSEs contain ethanol as the "head" group instead of acetic acid. FOSEs can be raw materials for the production of surfactant and surface treatment products (ITRC, 2020). They are also typically present as intermediate transformation products of other PFAS compounds (NEMA, 2022).

Per- and Polyfluoroether carboxylic acids (PFECAs): PFECAs are a combined subgroup of per- and polyfluoroalkyl ether acids that each contain a carboxylic acid "head". These compounds were "developed as replacements for other PFAS that have been phased out of production and use (e.g. GenX or ADONA)" (ITRC, 2020). They are surfactants and polymerization aids used in production of other products.

Ether sulfonic acids (ESAs): ESAs are another combined subgroup of per- and polyfluoroalkyl ether acids that each contain a sulfonic acid "head" and include some fluoropolymer polymerization aids "developed as replacements for other PFAS" (ITRC, 2020). ESAs include some fluoropolymer polymerization aids that were developed to replace PFOS (NEMA, 2022).

Fluorotelomer carboxylic acids (FTCAs): FTCAs are a subgroup of polyfluoroalkyl substances that are produced by the fluorotelomerization process (ITRC, 2023) and contain carboxylic acid "head" groups. FTCAs can be biotransformation products of fluorotelomer alcohols, which are used to make plastics. Some FTCAs are present in carpet and therefore may end up in landfill leachates (NEMA, 2022).

To make identification of different family groups easier, a standardized color scheme was generated by the DNREC team that is carried throughout this evaluation and data display (e.g. all PFCAs are colored a shade of green; all PFSAs are colored a shade of blue). The graphical data were arranged into these family groups.

3.4 Family Group and Subgroups Signatures

Building on the previous aggregation of data into family groups and subgroups, DNREC's data evaluation technique calculates the percent contribution of each of the nine family group and subgroups to the total measured PFAS concentration for each sample. This represents a sort of "family group signature," which removes any bias caused by the magnitude of PFAS concentrations, directing focus to the chemical makeup of each sample instead. This evaluation could allow DNREC scientists to determine whether a source of PFAS might be present within a media source is contributing to a localized concentration of a particular family group elsewhere, even if the detected concentrations are not at a significant concentration.

3.5 Comparison to Existing Criteria

DNREC's intentions with this study were to identify the impacts of the disposal of PFAS laden effluent and its movement from the application area. This assessment was not conducted to evaluate human health or ecological risk from exposure to PFAS compounds, or to make any final conclusions about disposal methods. Additional human health and ecological risk characterization were not conducted and presented as part of this study because there are very few established criteria for PFAS compounds to provide adequate perspective. More importantly, the improper interpretation and application of criteria can lead to incorrect conclusions.

It is important, however, to have some context for framing the data presented in this data summary report. To ensure that all evaluators of this data are comparing information consistently, below are the existing criteria that have been established and adopted by the USEPA and the State of Delaware at the time of report publication. Close attention should be paid to the description of how the criteria are meant to be applied and what exceedances of the criteria represent.

3.6 USEPA Drinking Water Standards

As more research and understanding of the impacts of PFAS occur, the Drinking Water Standards are likely to be modified. The most current standards can be found from USEPA at https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas. As of July 2024, the standards are as follows:

Compound	Maximum Contaminant Level (MCL)
PFOA	4 ng/L (ppt)
PFOS	4 ng/L (ppt)
PFNA	10 ng/L (ppt)
PFHxS	10 ng/L (ppt)
HFPO-DA	10 ng/L (ppt)
Mixture of two or more: PFNA, PFHxS, HFPO-DA, and PFBS	Hazard Index of 1

Table 1. USEPA Drinking Water Standards.

Maximum Contaminant Levels (MCLs) for drinking water are established under the USEPA National Primary Drinking Water Regulations (USEPA, 2009). MCLs for several PFAS compounds were set by the USEPA in April 2024 (USEPA, 2024a). These criteria are applicable to finished drinking water only (after treatment) in regulated public drinking water systems, and not to "raw" water samples collected from a surface water body or from groundwater. The MCLs for PFNA, PFHxS, PFBS and/or HFPO-DA are to be combined and used in the calculation of a Hazard Index as noted on EPAs website (USEPA, 2024b) to determine if an exceedance of the criterion has occurred.

3.7 HSCA Screening Levels for Groundwater and Soil

As more research and understanding of the impacts of PFAS occur the Hazardous Substance Cleanup Act (HSCA) standards for groundwater and soil are likely to be modified. The most current standards can be found from DNREC at https://documents.dnrec.delaware.gov/dwhs/remediation/HSCA-Screening-Level-Table-Guidance.pdf. As of July 2024, the standards are as follows:

Compound	HSCA Groundwater Screening Value		HSCA Soil Screening Value	
	ug/L (ppb)	ng/L (ppt)	mg/kg (ppm)	ug/kg (ppt)
Hexafluoropropylene oxide dimer acid (HFPO-DA)	0.006	6	0.023	23
Perfluorobutanesulfonic acid (PFBS)	0.6	600	1.9	1900
Perfluorobutanoic acid (PFBA)	1.8	1800	7.8	7800
Perfluorohexanesulfonic acid (PFHxS)	0.039	39	0.13	130
Perfluorohexanoic acid (PFHxA)	0.61	610	3.2	3200
Perfluorononanoic acid (PFNA)	0.0059	5.9	0.019	19
Perfluorooctanesulfonic acid (PFOS)	0.004	4	0.013	13
Perfluorooctanoic acid (PFOA)	0.006	6	0.019	19

Table 2. HSCA Screening Levels as of July 2024

Per the aforementioned document, the screening levels "should be used for screening purposes only for the protection of human health and the environment. The screening levels are not to be construed as site specific clean up levels. The HSCA Screening Level Table combines background, risk-based and regulatory values in soil, groundwater, soil gas, sediment, and surface water. The screening levels should be used to determine the contaminants of potential concern (COPCs) in the HSCA risk assessment process." Further, "The screening levels for groundwater are primarily based on the EPA [Regional Screening Levels] RSLs for tap water. When the EPA RSL for tap water exceeds the Delaware or Federal Maximum Contaminant Level (MCL) for drinking water, then the MCL replaces the RSL as the screening level." (DNREC, 2023b).

To reiterate, an exceedance of any value in the HSCA screening level table only means that the compound should be retained for further risk assessment as defined by DNREC regulations and guidance and is applicable only to sites that are being regulated under Delaware's HSCA program.

3.8 QA/QC Samples

Duplicate samples, equipment blanks, field blanks and trip blanks were collected throughout this and other PFAS studies conducted by Division of Water (DW) and its contractor. Due to the combined sampling schemes, fully separating out Quality Control (QC) data for this study would be confusing for the reader and of minimal value. The complete dataset with QC data is available on request and will be included in the DW comprehensive PFAS report later in 2024. Results from all but one equipment and field blank samples were below the MDL. Data associated with the single equipment blank that showed a detection were included in this report for reference, only (Table 10).

4. Results

Results are graphically and tabularly shown in this section. In the graphs, values that were below the method detection limit (MDL) where entered as 0.0, and any values greater than the MDL, but below the reporting limit (RL) where used for graphing purposes. The data table follows, with values above the RL highlighted in green and values between the MDL and RL in beige. All other values correspond to the MDL. The tables present the analytical results from each media source, excluding duplicate samples, for each of the 40 reported PFAS compounds.

All sampling was done by a DNREC approved contractor. The samples were shipped to Eurofins Sacramento for analysis using USEPA Method 537M for surface water samples or USEPA Method 1633 for all other samples. All sampling plans, Standard Operation Procedures, Quality Assurance Program and Projects Plans are on file and available for public review. (https://dnrec.delaware.gov/waste-hazardous/remediation/pfas/)

In the first-round groundwater samples from domestic wells, PFAS was detected in JTPW-2 with PFOA concentration of 3.2 ng/L, close to the USEPA MCL of 4 ng/L. The decision was made to resample the well and the second-round sample showed a PFOA concentration of 5.7 ng/L above the EPA MCL of 4 ng/L (Figure 13). The property owner was contacted by DNREC and the free installation of a PFAS treatment unit was offered.

4.1 Sampling Timetable

Source	Code	Date	Note
Effluent	JT-EF1	7/19/2023	
Effluent	JT-EF2	10/11/2023	
Effluent	JT-EF3	1/23/2024	
Effluent	JT-EF4	4/15/2024	
Groundwater	JT-GW10234-1	7/11/2023	
Groundwater	JT-GW50018-1	7/11/2023	
Groundwater	JT-GW78710-1	--	Not Sampled
Groundwater	JT-GW10234-2	10/18/2023	
Groundwater	JT-GW10237-2	10/18/2023	
Groundwater	JT-GW50018-2	10/18/2023	
Groundwater	JT-GW78710-2	10/18/2023	
Groundwater	JT-GW91988-2	10/18/2023	
Groundwater	JT-GW10234-3	1/10/2024	
Groundwater	JT-GW50018-3	1/10/2024	
Groundwater	JT-GW10237-3	1/11/2024	
Groundwater	JT-GW78710-3	1/11/2024	
Groundwater	JT-GW91988-3	1/11/2024	
Groundwater	JT-GW10234-4	4/23/2024	
Groundwater	JT-GW10237-4	4/23/2024	
Groundwater	JT-GW50018-4	4/23/2024	
Groundwater	JT-GW78710-4	4/23/2024	
Groundwater	JT-GW91988-4	4/23/2024	
Soil	JT-SL1a	7/17/2023	1' depth
Soil	JT-SL1b	7/17/2023	3' depth
Soil	JT-SL1c	7/17/2023	6' depth
Soil	JT-SL2a	7/17/2023	1' depth
Soil	JT-SL2b	7/17/2023	3'depth
Lagoon Sediment	PSJT-SD1	4/16/2024	0-6" depth
Lagoon Sediment	PSJT-SD2	4/16/2024	0-6" depth
Lagoon Sediment	PSJT-SD3	4/16/2024	0-6" depth
Surface Water	JT-SWP1-1PS	4/19/2024-4/26/2024	
Surface Water	JT-SWP2-1PS	4/19/2024-4/26/2024	
Surface Water	JT-SWP3-1PS	4/19/2024-4/26/2024	
Surface Water	JT-SWP4-1PS	4/19/2024-4/26/2024	
Surface Water	JT-SWP5-1PS	4/19/2024-4/26/2024	
Production well	JT-Plant	4/23/2024	
Private Well	JT PW - 1	1/17/2024	
Private Well	JT PW - 2	1/17/2024	
Private Well	JT PW - 3	1/17/2024	
Private Well	JT PW - 4	1/17/2024	
Private Well	JT PW - 2	4/23/2024	

Table 3. Dates of sampling

4.2 Total PFAS and Sum of 8 PFAS

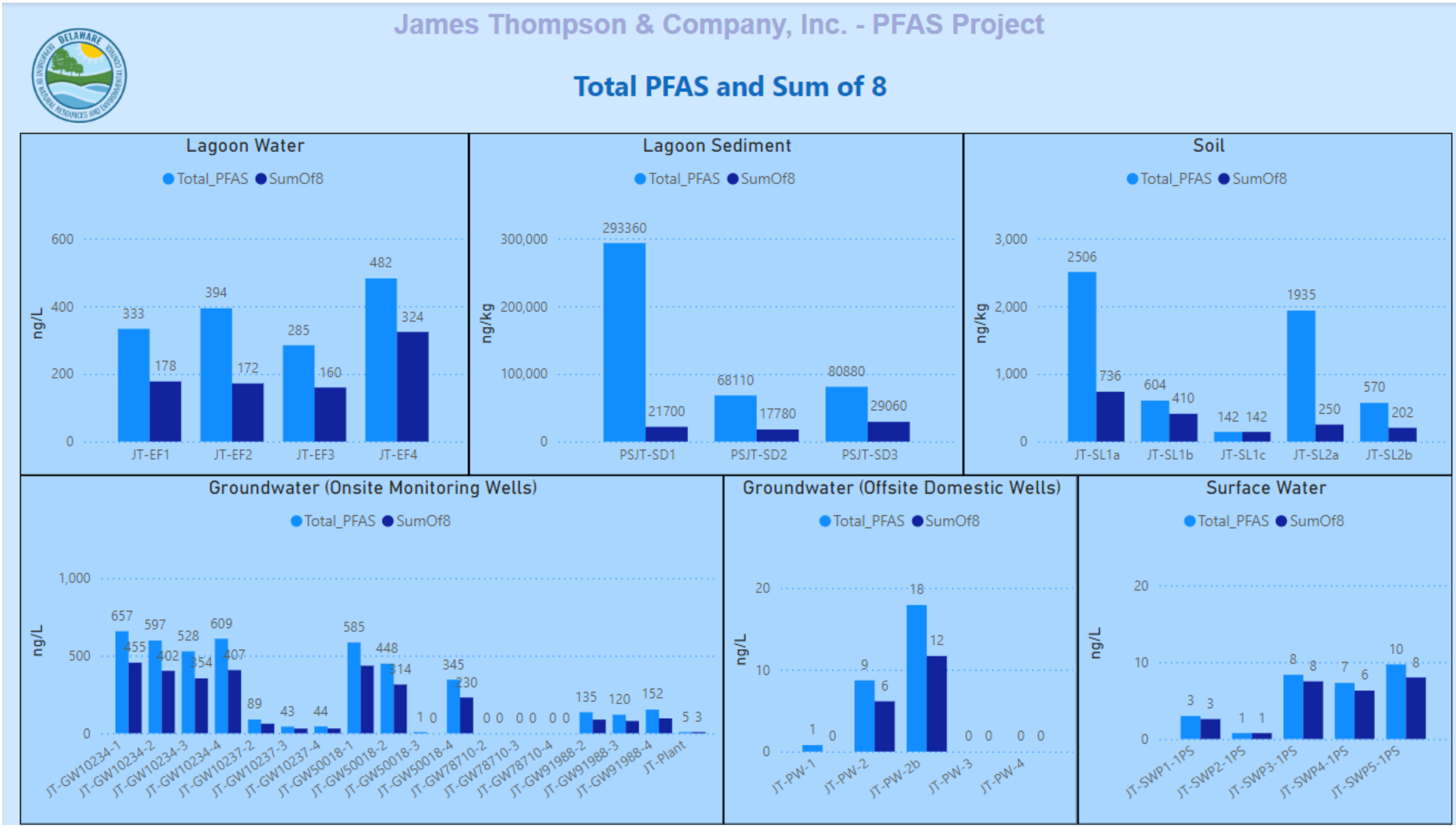

Figure 6. Total PFAS and Sum of 8 PFAS data are presented for all samples grouped by sample source. *Note: In cases, the plots are shown at different scales.*

4.3 PFAS Family Groups and Subgroups

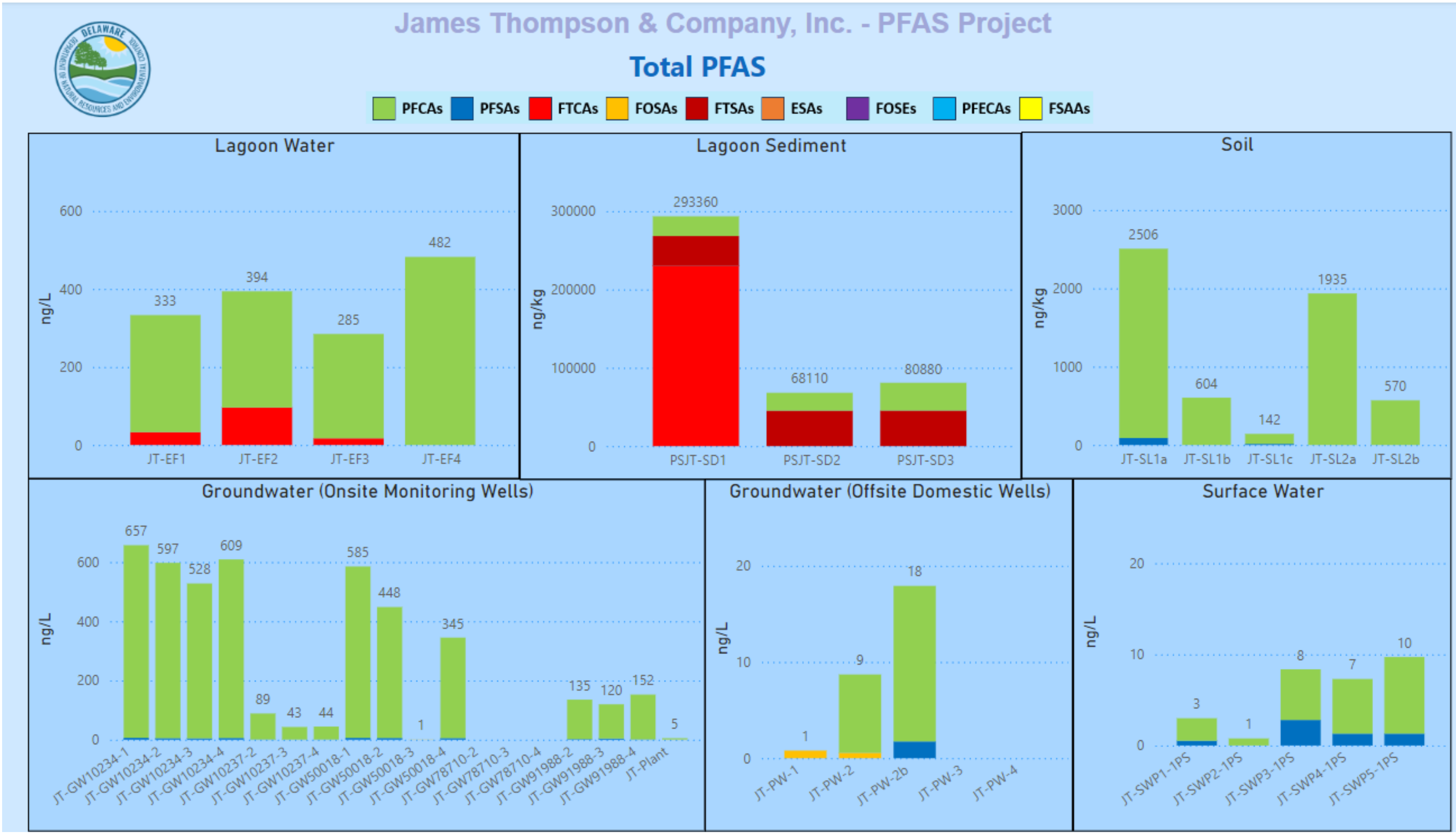

Figure 7. The distribution of PFCAs, PFSAs, FTSAs, FOSAs, FOSAAs, PFECAs, ESAs and FTCAs across all samples. *Note: In some cases, the plots are shown at different scales.*

4.4 PFAS Signatures

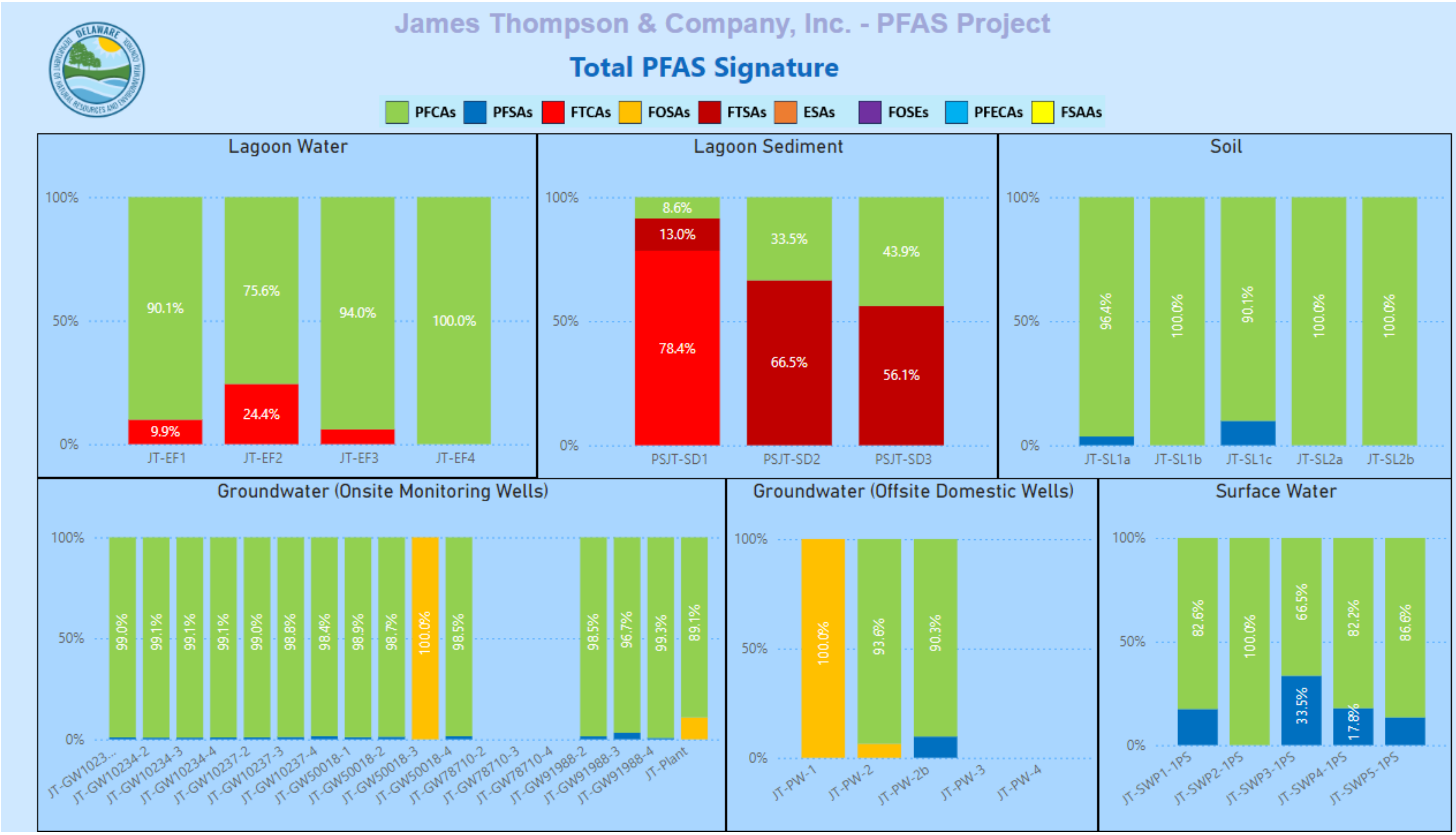

Figure 8. PFAS Family Group Signature as described in Section 2.4.4.

4.5 Lagoon Water

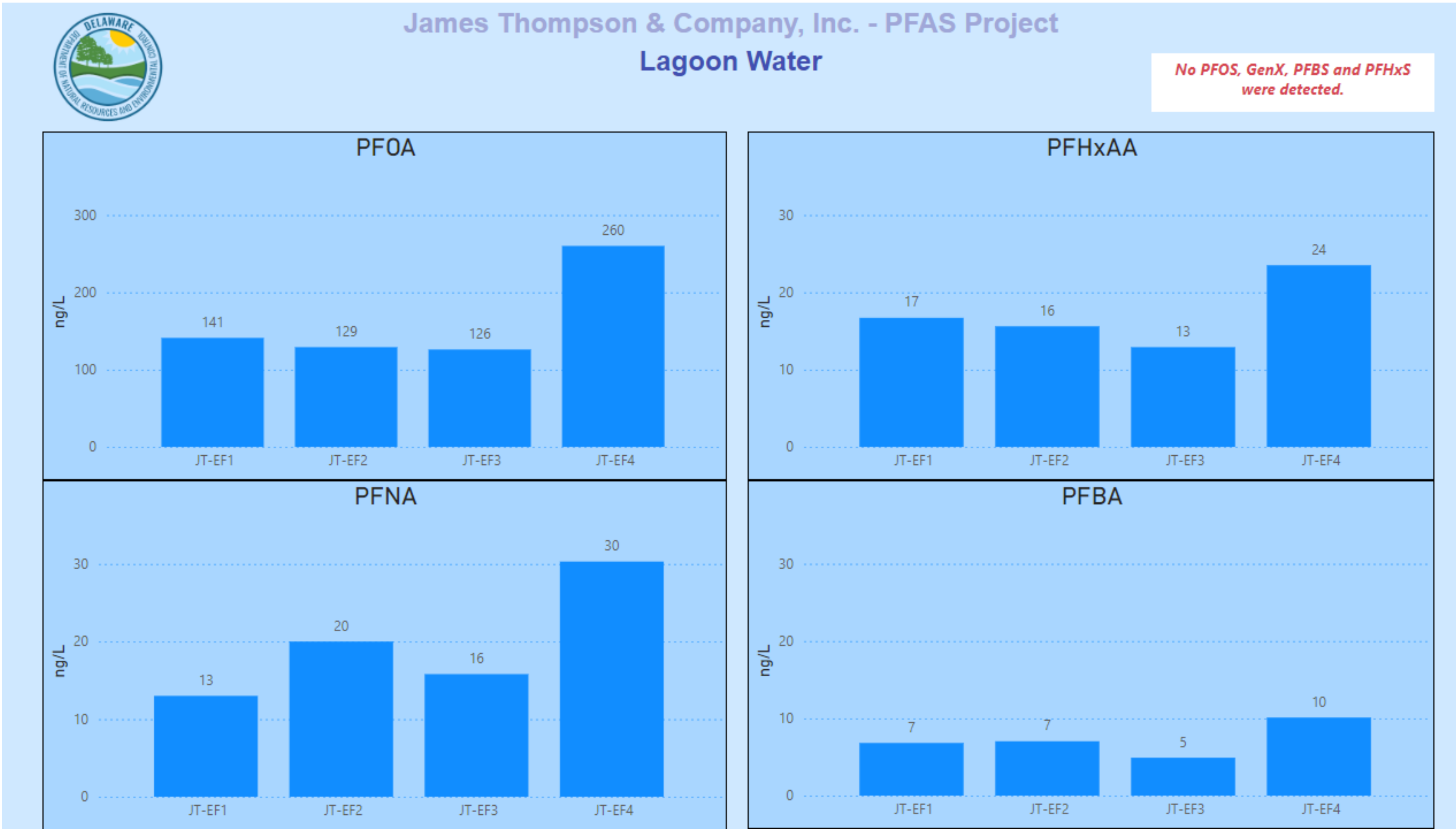

Figure 9. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA, (if present) for samples of the lagoon water, considered effluent for this study. *Note: In some cases, the plots are shown at different scales.*

Client ID		JT-EFI			JT-EF2			JT-EF3			JT-EF4		
Lab Sample ID		460-284806-12			460-290393-14			460-297095-16			460-302417-16		
Sampling Date		7/20/2023			10/11/2023			1/23/2024			4/15/2024		
Matrix		Water			Water			Water			Water		
Dilution Factor		1			1			1			1		
Unit		ng/l			ng/l			ng/l			ng/l		
LCMS-DRAFT 1633-WATER WATER BY DRAFT 1633	CAS#	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
11Cl-PF3OUdS	763051-92-9	1.64	U	1.64	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
3:3 FTCA	356-02-5	1.72	U	1.72	5.00	U	5.00	2.41	U	2.41	2.54	U	2.54
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	3.34	U	3.34	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
4:2 FTS	757124-72-4	3.3	U	3.3	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
5:3 FTCA	914637-49-3	11.1	U	11.1	25.00	U	25.00	12	U	12	12.7	U	12.7
6:2 FTS	27619-97-2	2.14	U	2.14	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
7:3 FTCA	812-70-4	33.1	J	13.1	96.40	J	25.00	17.1	J	12	12.7	U	12.7
8:2 FTS	39108-34-4	2.82	U	2.82	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
9Cl-PF3ONS	756426-58-1	1.51	U	1.51	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
HFPO-DA (GenX)	13252-13-6	3.7	U	3.7	4.00	U	4.00	1.92	U	1.92	2.03	U	2.03
NEtFOSA	4151-50-2	0.73	U	0.73	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
NEtFOSAA	2991-50-6	1.11	U	1.11	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
NEtFOSE	1691-99-2	3.72	U	3.72	10.00	U	10.00	4.81	U	4.81	5.08	U	5.08
NFDHA	151772-58-6	1.26	U	1.26	2.00	U	2.00	0.96	U	0.96	1.02	U	1.02
NMeFOSA	31506-32-8	0.91	U	0.91	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
NMeFOSAA	2355-31-9	1.47	U	1.47	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
NMeFOSE	24448-09-7	4.66	U	4.66	10.00	U	10.00	4.81	U	4.81	5.08	U	5.08
Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.58	U	0.58	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorobutanoic acid (PFBA)	375-22-4	6.81	J	1.88	7.03	J	4.00	4.9	J	1.92	10.1		2.03
Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.66	U	0.66	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorodecanoic acid (PFDA)	335-76-2	83.7		1.62	75.30		1.00	63.8		0.48	79.9		0.51
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	0.86	U	0.86	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorododecanoic acid (PFDoA)	307-55-1	2.07	J	1.21	1.59	J	1.00	0.48	U	0.48	0.51	U	0.51
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.79	U	0.79	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluoroheptanoic acid (PFHpA)	375-85-9	29.8		1	33.40		1.00	31.9		0.48	56.4		0.51
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.79	U	0.79	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorohexanoic acid (PFHxA)	307-24-4	16.7		0.91	15.60		1.00	12.9		0.48	23.5		0.51
Perfluorononanesulfonic acid (PFNS)	68259-12-1	0.8	U	0.8	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorononanoic acid (PFNA)	375-95-1	13		1.31	20.00		1.00	15.8		0.48	30.3		0.51
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.69	U	0.69	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.88	U	0.88	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorooctanoic acid (PFOA)	335-67-1	141		0.73	129.00		1.00	126		0.48	260		0.51
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.7	U	0.7	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluoropentanoic acid (PFPeA)	2706-90-3	1.1	U	1.1	9.63		2.00	8.3		0.96	13.1		1.02
Perfluorotetradecanoic acid (PFTeA)	376-06-7	1.11	U	1.11	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.96	U	0.96	1.00	U	1.00	0.48	U	0.48	0.51	U	0.51
Perfluoroundecanoic acid (PFUnA)	2058-94-8	6.78		1.22	5.90		1.00	4.28		0.48	8.84		0.51
PFEESA	113507-82-7	1.46	U	1.46	2.00	U	2.00	0.96	U	0.96	1.02	U	1.02
PFMBA	863090-89-5	1.22	U	1.22	2.00	U	2.00	0.96	U	0.96	1.02	U	1.02
PFMPA	377-73-1	1.16	U	1.16	2.00	U	2.00	0.96	U	0.96	1.02	U	1.02

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

The "Z" qualifier means the transition mass ratio for the indicated analyte was above/below the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgment was used to positively identify the analyte

Table 4. Analytical results of lagoon water samples for all 40 compounds with qualifiers and MDLS. *Note: Values above RL highlighted in green and values above MDL highlighted in beige.*

4.6 Soil

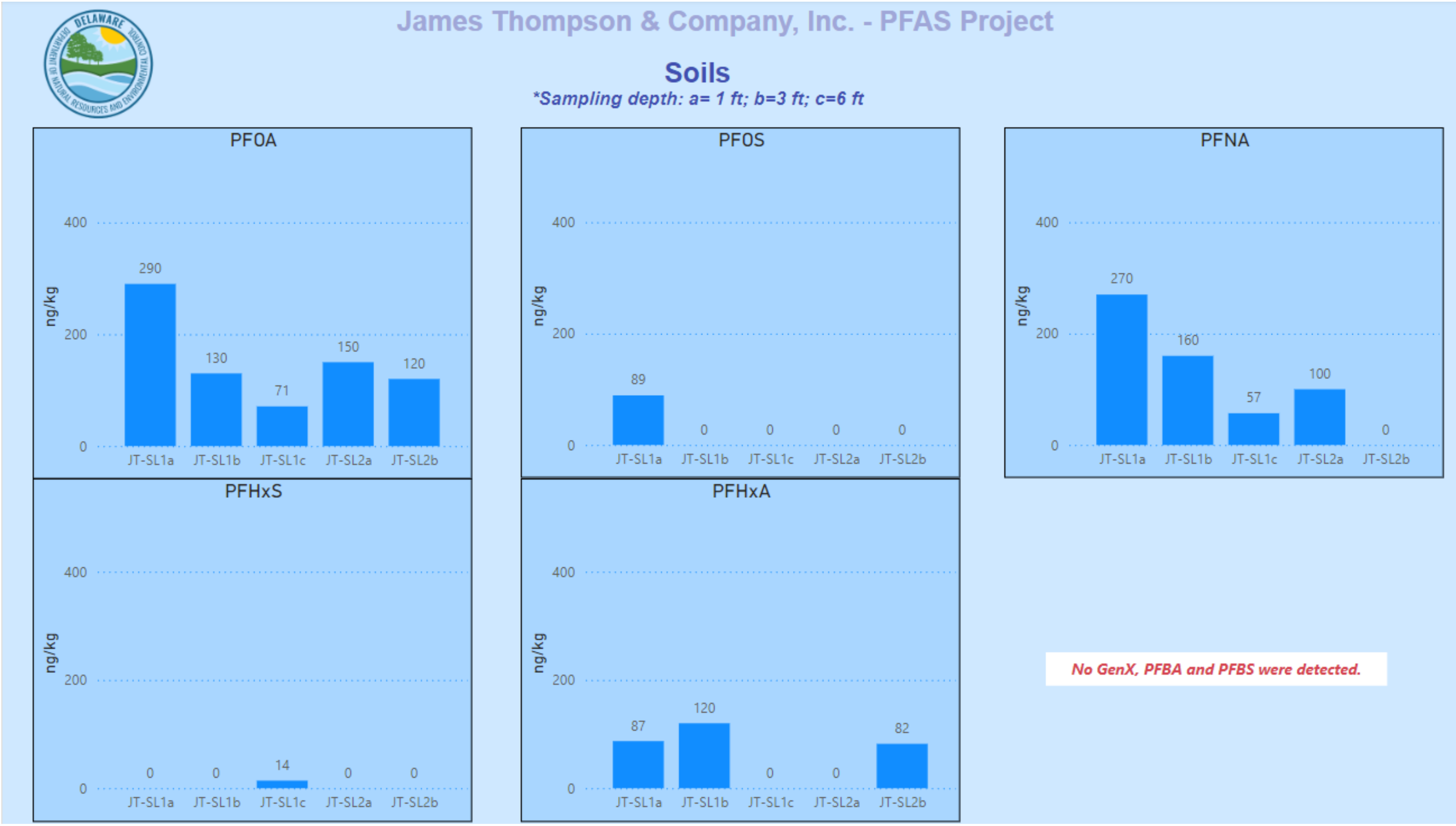

Figure 10. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for samples in soil samples from spray fields.

Client ID		JT-SL1a (1 ft.)			JT-SL1b (3 ft.)			JT-SL1c (6 ft.)			JT-SL2a (1 ft.)			JT-SL2b (3 ft.)		
Lab Sample ID		460-284589-18			460-284589-19			460-284589-20			460-284589-16			460-284589-17		
Sampling Date		7/17/2023			7/17/2023			7/17/2023			7/17/2023			7/17/2023		
Matrix		Soil			Soil			Soil			Soil			Soil		
Dilution Factor		1			1			1			1			1		
Unit		ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
LCMS-DRAFT 1633-SOIL SOIL BY DRAFT 1633	CAS#	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
11Cl-PF3OUdS	763051-92-9	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28
3:3 FTCA	356-02-5	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	0.19	U	0.19	0.18	U	0.18	0.18	U	0.18	0.19	U	0.19	0.19	U	0.19
4:2 FTS	757124-72-4	0.31	U	0.31	0.31	U	0.31	0.31	U	0.31	0.31	U	0.31	0.31	U	0.31
5:3 FTCA	914637-49-3	0.73	U	0.73	0.73	U	0.73	0.72	U	0.72	0.74	U	0.74	0.74	U	0.74
6:2 FTS	27619-97-2	0.14	U	0.14	0.14	U	0.14	0.14	U	0.14	0.14	U	0.14	0.14	U	0.14
7:3 FTCA	812-70-4	0.98	U	0.98	0.98	U	0.98	0.96	U	0.96	0.99	U Z	0.99	0.99	U	0.99
8:2 FTS	39108-34-4	0.11	U	0.11	0.11	U	0.11	0.1	U	0.1	0.11	U	0.11	0.11	U	0.11
9Cl-PF3ONS	756426-58-1	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24
HFPO-DA (GenX)	13252-13-6	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22
NEtFOSA	4151-50-2	0.051	U	0.051	0.05	U	0.05	0.05	U	0.05	0.051	U	0.051	0.051	U	0.051
NEtFOSAA	2991-50-6	0.053	U	0.053	0.053	U	0.053	0.052	U	0.052	0.053	U	0.053	0.054	U	0.054
NEtFOSE	1691-99-2	0.12	U	0.12	0.12	U	0.12	0.12	U	0.12	0.12	U	0.12	0.12	U	0.12
NFDHA	151772-58-6	0.11	U	0.11	0.11	U	0.11	0.11	U	0.11	0.11	U	0.11	0.11	U	0.11
NMeFOSA	31506-32-8	0.092	U	0.092	0.091	U	0.091	0.09	U	0.09	0.092	U	0.092	0.093	U	0.093
NMeFOSAA	2355-31-9	0.099	U	0.099	0.099	U	0.099	0.097	U	0.097	0.1	U	0.1	0.1	U	0.1
NMeFOSE	24448-09-7	0.4	U	0.4	0.39	U	0.39	0.39	U	0.39	0.4	U	0.4	0.4	U	0.4
Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.03	U	0.03	0.029	U	0.029	0.029	U	0.029	0.03	U	0.03	0.03	U	0.03
Perfluorobutanoic acid (PFBA)	375-22-4	0.14	U	0.14	0.14	U	0.14	0.13	U	0.13	0.14	U	0.14	0.14	U	0.14
Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.056	U	0.056	0.056	U	0.056	0.055	U	0.055	0.056	U	0.056	0.057	U	0.057
Perfluorodecanoic acid (PFDA)	335-76-2	0.62		0.13	0.14	J	0.13	0.12	U	0.12	0.64		0.13	0.2		0.13
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	0.058	U	0.058	0.058	U	0.058	0.057	U	0.057	0.058	U	0.058	0.059	U	0.059
Perfluorododecanoic acid (PFDoA)	307-55-1	0.3		0.11	0.11	U	0.11	0.11	U	0.11	0.27		0.11	0.11	U	0.11
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.042	U	0.042	0.042	U	0.042	0.041	U	0.041	0.042	U	0.042	0.042	U	0.042
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.11	J	0.042	0.054	J	0.042	0.041	U	0.041	0.045	J	0.042	0.058	J	0.043
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.015	U	0.015	0.015	U	0.015	0.014	J	0.014	0.015	U	0.015	0.015	U	0.015
Perfluorohexanoic acid (PFHxA)	307-24-4	0.087	J	0.057	0.12	J	0.057	0.056	U	0.056	0.057	U	0.057	0.082	J	0.057
Perfluorononanesulfonic acid (PFNS)	68259-12-1	0.062	U	0.062	0.062	U	0.062	0.061	U	0.061	0.062	U	0.062	0.063	U	0.063
Perfluorononanoic acid (PFNA)	375-95-1	0.27		0.057	0.16	J	0.057	0.057	J	0.056	0.1	J	0.058	0.058	U	0.058
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.096	U	0.096	0.096	U	0.096	0.094	U	0.094	0.096	U	0.096	0.097	U	0.097
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.089	J	0.041	0.04	U	0.04	0.04	U	0.04	0.041	U	0.041	0.041	U	0.041
Perfluorooctanoic acid (PFOA)	335-67-1	0.29		0.044	0.13	J	0.044	0.071	J	0.044	0.15	J	0.045	0.12	J	0.045
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.025	U	0.025	0.025	U	0.025	0.024	U	0.024	0.025	U	0.025	0.025	U	0.025
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.07	U	0.07	0.07	U	0.07	0.069	U	0.069	0.071	U	0.071	0.071	U	0.071
Perfluorotetradecanoic acid (PFTeA)	376-06-7	0.15	J	0.055	0.055	U	0.055	0.054	U	0.054	0.13	J	0.055	0.056	U	0.056
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.22		0.04	0.039	U	0.039	0.039	U	0.039	0.31		0.04	0.11	J	0.04
Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.37		0.1	0.1	U	0.1	0.098	U	0.098	0.29		0.1	0.1	U	0.1
PFEESA	113507-82-7	0.053	U	0.053	0.053	U	0.053	0.052	U	0.052	0.053	U	0.053	0.053	U	0.053
PFMBA	863090-89-5	0.05	U	0.05	0.05	U	0.05	0.049	U	0.049	0.05	U	0.05	0.051	U	0.051
PFMPA	377-73-1	0.086	U	0.086	0.085	U	0.085	0.084	U	0.084	0.086	U	0.086	0.086	U	0.086

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.
The "Z" qualifier means the transition mass ratio for the indicated analyte was above/below the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgment was used to positively identify the analyte

Table 5. Analytical results of soil samples for all 40 compounds with qualifiers and MDLS. *Note: Values above RL highlighted in green and values above MDL highlighted in beige.*

4.7 Groundwater from Onsite Monitoring Wells

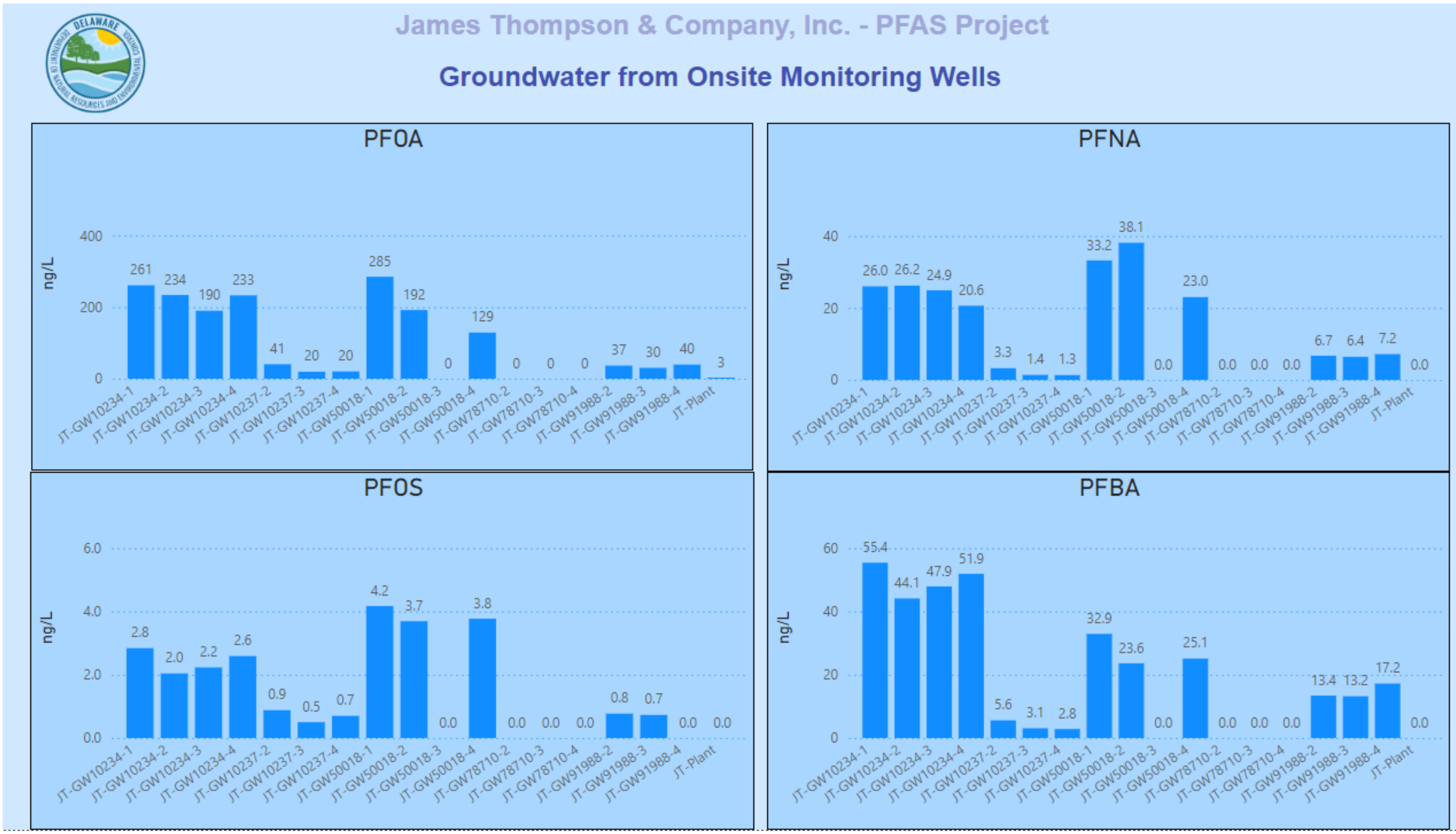

Figure 11. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for onsite groundwater samples from the monitoring wells and the facility production well. *Note: In some cases, the plots are shown at different scales.*

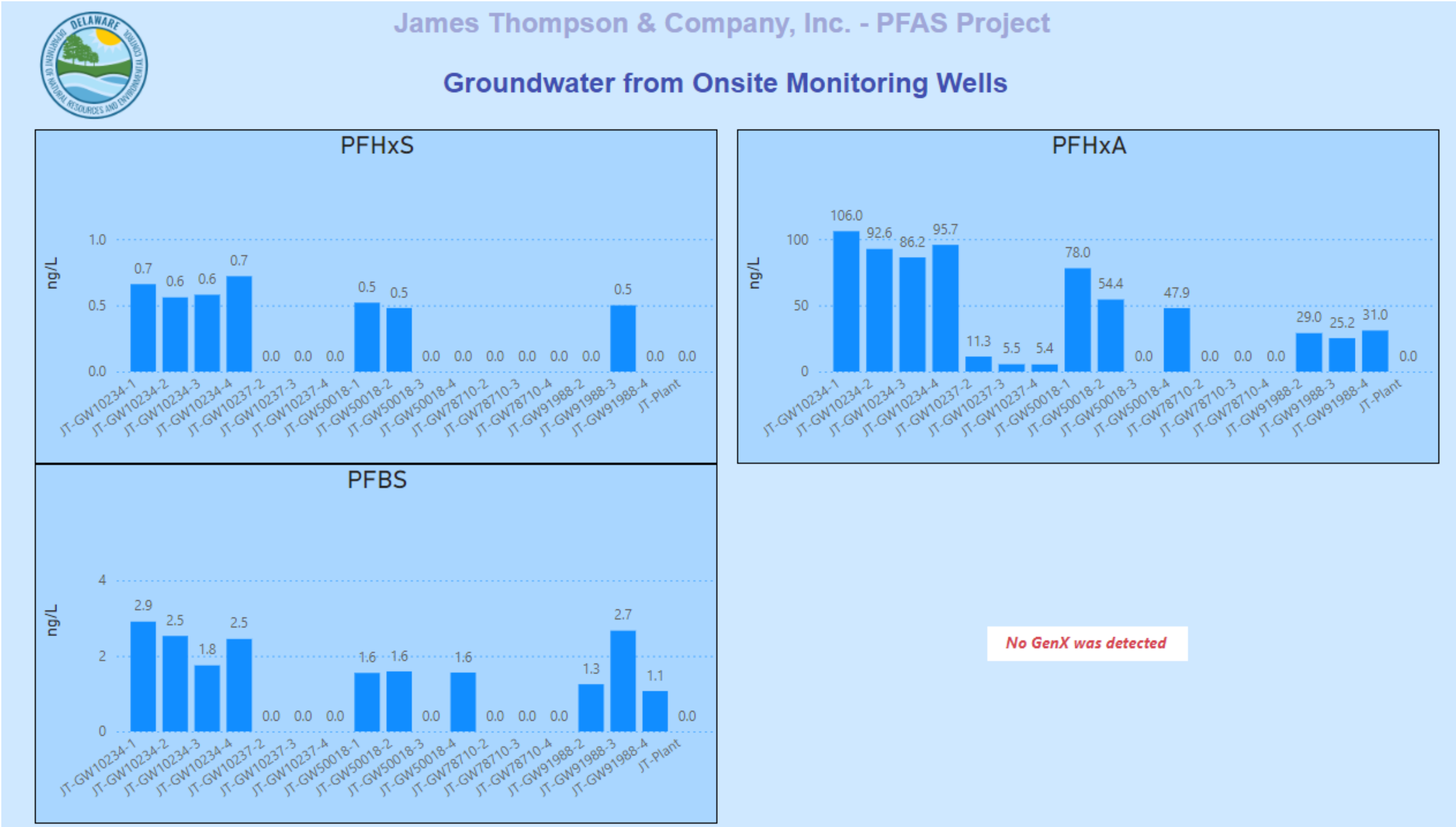

Figure 12. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for onsite groundwater samples from the monitoring wells and the facility production well. *Note: In some cases, the plots are shown at different scales.*

Client ID		JT-GW10234-1			JT-GW50018-1			JT-GW10234-2			JT-GW50018-2			JT-GW10237-2			JT-GW78710-2			JT-GW91988-2		
Lab Sample ID		460-284097-8			460-284097-9			460-290913-21			460-290913-23			460-290913-27			460-290913-24			460-290913-22		
Sampling Date		7/11/2023 9:14			7/11/2023 10:11			10/18/2023 8:55			10/18/2023 11:00			10/18/2023 12:50			10/18/2023 11:55			10/18/2023 10:00		
Matrix		Water			Water			Water			Water			Water			Water			Water		
Dilution Factor		1			1			1			1			1			1			1		
Unit		ng/l			ng/l			ng/l			ng/l			ng/l			ng/l			ng/l		
LCMS-DRAFT 1633-WATER WATER BY DRAFT 1633	CAS#	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
11Cl-PF3OUdS	763051-92-9	0.76	U	0.76	0.72	U	0.72	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
3:3 FTCA	356-02-5	0.8	U	0.8	0.75	U	0.75	2.27	U	2.27	2.26	U	2.26	2.24	U	2.24	2.3	U	2.3	2.19	U	2.19
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	1.55	U	1.55	1.46	U	1.46	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
4:2 FTS	757124-72-4	1.53	U	1.53	1.44	U	1.44	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
5:3 FTCA	914637-49-3	5.15	U	5.15	4.85	U	4.85	11.4	U	11.4	11.3	U	11.3	11.2	U	11.2	11.5	U	11.5	11	U	11
6:2 FTS	27619-97-2	1	U	1	0.94	U	0.94	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
7:3 FTCA	812-70-4	6.07	U	6.07	5.72	U	5.72	11.4	U	11.4	11.3	U	11.3	11.2	U	11.2	11.5	U	11.5	11	U	11
8:2 FTS	39108-34-4	1.31	U	1.31	1.23	U	1.23	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
9Cl-PF3ONS	756426-58-1	0.7	U	0.7	0.66	U	0.66	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
HFPO-DA (GenX)	13252-13-6	1.72	U	1.72	1.62	U	1.62	1.82	U	1.82	1.81	U	1.81	1.8	U	1.8	1.84	U	1.84	1.75	U	1.75
NEtFOSA	4151-50-2	0.34	U	0.34	0.32	U	0.32	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
NEtFOSAA	2991-50-6	0.52	U	0.52	0.49	U	0.49	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
NEtFOSE	1691-99-2	1.73	U	1.73	1.63	U	1.63	4.54	U	4.54	4.52	U	4.52	4.49	U	4.49	4.6	U	4.6	4.38	U	4.38
NFDHA	151772-58-6	0.59	U	0.59	0.55	U	0.55	0.91	U	0.91	0.9	U	0.9	0.9	U	0.9	0.92	U	0.92	0.88	U	0.88
NMeFOSA	31506-32-8	0.42	U	0.42	0.4	U	0.4	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
NMeFOSAA	2355-31-9	0.68	U	0.68	0.64	U	0.64	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
NMeFOSE	24448-09-7	2.17	U	2.17	2.04	U	2.04	4.54	U	4.54	4.52	U	4.52	4.49	U	4.49	4.6	U	4.6	4.38	U	4.38
Perfluorobutanesulfonic acid (PFBS)	375-73-5	2.91		0.27	1.55	J	0.25	2.53		0.45	1.59	J	0.45	0.45	U	0.45	0.46	U	0.46	1.25	J	0.44
Perfluorobutanoic acid (PFBA)	375-22-4	55.4		0.88	32.9		0.82	44.1		1.82	23.6		1.81	5.58	J	1.8	1.84	U	1.84	13.4		1.75
Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.31	U	0.31	0.29	U	0.29	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorodecanoic acid (PFDA)	335-76-2	0.75	U	0.75	10		0.71	0.45	U	0.45	12.8		0.45	0.68	J	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	0.4	U	0.4	0.38	U	0.38	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorododecanoic acid (PFDoA)	307-55-1	0.56	U	0.56	0.53	U	0.53	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.37	U	0.37	0.35	U	0.35	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluoroheptanoic acid (PFHpA)	375-85-9	136		0.47	98.6		0.44	134		0.45	90.9		0.45	15.9		0.45	0.46	U	0.46	26.8		0.44
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.66	J	0.37	0.52	J	0.34	0.56	J	0.45	0.48	J	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorohexanoic acid (PFHxA)	307-24-4	106		0.42	78		0.4	92.6		0.45	54.4		0.45	11.3		0.45	0.46	U	0.46	29		0.44
Perfluorononanesulfonic acid (PFNS)	68259-12-1	0.37	U	0.37	0.35	U	0.35	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorononanoic acid (PFNA)	375-95-1	26		0.61	33.2		0.58	26.2		0.45	38.1		0.45	3.25		0.45	0.46	U	0.46	6.72		0.44
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.32	U	0.32	0.3	U	0.3	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2.84	Z	0.41	4.17	Z	0.39	2.04		0.45	3.69		0.45	0.88	J	0.45	0.46	U	0.46	0.77	J	0.44
Perfluorooctanoic acid (PFOA)	335-67-1	261		0.34	285		0.32	234		0.45	192		0.45	40.6		0.45	0.46	U	0.46	36.7		0.44
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.33	U	0.33	0.31	U	0.31	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluoropentanoic acid (PFPeA)	2706-90-3	66.2		0.51	41.2		0.48	61.4		0.91	30.6		0.9	10.4		0.9	0.92	U	0.92	20.7		0.88
Perfluorotetradecanoic acid (PFTeA)	376-06-7	0.52	U	0.52	0.49	U	0.49	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.44	U	0.44	0.42	U	0.42	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.57	U	0.57	0.53	U	0.53	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.44	U	0.44
PFEESA	113507-82-7	0.68	U	0.68	0.64	U	0.64	0.91	U	0.91	0.9	U	0.9	0.9	U	0.9	0.92	U	0.92	0.88	U	0.88
PFMBA	863090-89-5	0.57	U	0.57	0.53	U	0.53	0.91	U	0.91	0.9	U	0.9	0.9	U	0.9	0.92	U	0.92	0.88	U	0.88
PFMPA	377-73-1	0.54	U	0.54	0.51	U	0.51	0.91	U	0.91	0.9	U	0.9	0.9	U	0.9	0.92	U	0.92	0.88	U	0.88

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.
The "Z" qualifier means the transition mass ratio for the indicated analyte was above/below the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgment was used to positively identify the analyte

Table 6. Analytical results of onsite monitoring well groundwater samples and production well for all 40 compounds with qualifiers and MDLs. Note: *Values above RL highlighted in green and values above MDL highlighted in beige*.

Client ID		JT-GW10234-3			JT-GW50018-3			JT-GW10237-3			JT-GW78710-3			JT-GW91988-3			JT-GW10234-4			JT-GW50018-4			JT-GW10237-4			JT-GW78710-4			JT-GW91988-4		
Lab Sample ID		460-296551-17			460-296551-16			460-296551-19			460-296551-23			460-296551-20			460-302900-19			460-302900-18			460-302900-20			460-302900-12			460-302900-13		
Sampling Date		1/10/2024 14:35			1/10/2024 13:50			1/11/2024 9:10			1/11/2024 10:50			1/11/2024 9:55			4/23/2024 11:55			4/23/2024 11:15			4/23/2024 12:25			4/23/2024 8:45			4/23/2024 9:25		
Matrix		Water			Water			Water			Water			Water			Water			Water			Water			Water			Water		
Dilution Factor		1			1			1			1			1			1			1			1			1			1		
Unit		ng/l			ng/l			ng/l			ng/l			ng/l			ng/l			ng/l			ng/l			ng/l			ng/l		
LCMS-DRAFT 1633-WATER WATER BY DRAFT 1633	CAS#	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
11Cl-PF3OUdS	763051-92-9	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
3:3 FTCA	356-02-5	2.37	U	2.37	2.38	U	2.38	2.37	U	2.37	2.37	U	2.37	2.36	U	2.36	2.63	U	2.63	2.59	U	2.59	2.59	U	2.59	2.6	U	2.6	2.58	U	2.58
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
4:2 FTS	757124-72-4	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
5:3 FTCA	914637-49-3	11.8	U	11.8	11.9	U	11.9	11.8	U	11.8	11.8	U	11.8	11.8	U	11.8	13.2	U	13.2	12.9	U	12.9	12.9	U	12.9	13	U	13	12.9	U	12.9
6:2 FTS	27619-97-2	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
7:3 FTCA	812-70-4	11.8	U	11.8	11.9	U	11.9	11.8	U	11.8	11.8	U	11.8	11.8	U	11.8	13.2	U	13.2	12.9	U	12.9	12.9	U	12.9	13	U	13	12.9	U	12.9
8:2 FTS	39108-34-4	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
9Cl-PF3ONS	756426-58-1	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
HFPO-DA (GenX)	13252-13-6	1.9	U	1.9	1.9	U	1.9	1.89	U	1.89	1.9	U	1.9	1.89	U	1.89	2.11	U	2.11	2.07	U	2.07	2.07	U	2.07	2.08	U	2.08	2.07	U	2.07
NEtFOSA	4151-50-2	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
NEtFOSAA	2991-50-6	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
NEtFOSE	1691-99-2	4.74	U	4.74	4.76	U	4.76	4.74	U	4.74	4.74	U	4.74	4.73	U	4.73	5.27	U	5.27	5.18	U	5.18	5.17	U	5.17	5.19	U	5.19	5.17	U	5.17
NFDHA	151772-58-6	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	1.05	U	1.05	1.04	U	1.04	1.03	U	1.03	1.04	U	1.04	1.03	U	1.03
NMeFOSA	31506-32-8	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
NMeFOSAA	2355-31-9	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U Z	0.52	0.52	U Z	0.52
NMeFOSE	24448-09-7	4.74	U	4.74	4.76	U	4.76	4.74	U	4.74	4.74	U	4.74	4.73	U	4.73	5.27	U	5.27	5.18	U	5.18	5.17	U	5.17	5.19	U	5.19	5.17	U	5.17
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1.75	J	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	2.67	Z	0.47	2.45		0.53	1.56	J	0.52	0.52	U	0.52	0.52	U	0.52	1.07	J	0.52
Perfluorobutanoic acid (PFBA)	375-22-4	47.9		1.9	1.9	U	1.9	3.08	J	1.89	1.9	U	1.9	13.2		1.89	51.9		2.11	25.1		2.07	2.83	J	2.07	2.08	U	2.08	17.2		2.07
Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluorodecanoic acid (PFDA)	335-76-2	0.69	J	0.47	0.48	U	0.48	0.82	J	0.47	0.47	U	0.47	0.47	U	0.47	0.75	J	0.53	11.4		0.52	1.42	J Z	0.52	0.52	U Z	0.52	0.52	U Z	0.52
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluorododecanoic acid (PFDoA)	307-55-1	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluoroheptanoic acid (PFHpA)	375-85-9	117		0.47	0.48	U	0.48	7.99		0.47	0.47	U	0.47	24.8		0.47	134		0.53	75.8		0.52	7.72		0.52	0.52	U	0.52	32.2		0.52
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.58	J	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.5	J	0.47	0.72	J	0.53	0.52	U Z	0.52	0.52	U	0.52	0.52	U Z	0.52	0.52	U Z	0.52
Perfluorohexanoic acid (PFHxA)	307-24-4	86.2		0.47	0.48	U	0.48	5.51		0.47	0.47	U	0.47	25.2		0.47	95.7		0.53	47.9		0.52	5.37		0.52	0.52	U	0.52	31		0.52
Perfluorononanesulfonic acid (PFNS)	68259-12-1	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluorononanoic acid (PFNA)	375-95-1	24.9		0.47	0.48	U	0.48	1.39	J	0.47	0.47	U	0.47	6.42		0.47	20.6		0.53	23		0.52	1.33	J	0.52	0.52	U	0.52	7.15		0.52
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.47	U	0.47	0.69	J	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2.23		0.47	0.48	U	0.48	0.5	J	0.47	0.47	U	0.47	0.73	J	0.47	2.59	Z	0.53	3.77		0.52	0.7	J Z	0.52	0.52	U	0.52	0.52	U	0.52
Perfluorooctanoic acid (PFOA)	335-67-1	190		0.47	0.48	U	0.48	19.6		0.47	0.47	U	0.47	30.4		0.47	233		0.53	129		0.52	20.4		0.52	0.52	U	0.52	39.5		0.52
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluoropentanoic acid (PFPeA)	2706-90-3	56.5		0.95	0.95	U	0.95	4.08		0.95	0.95	U	0.95	15.7		0.95	67.4		1.05	27.4		1.04	4.61		1.03	1.04	U	1.04	24.3		1.03
Perfluorotetradecanoic acid (PFTeA)	376-06-7	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.47	U	0.47	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47	0.53	U	0.53	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52	0.52	U	0.52
PFEESA	113507-82-7	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	1.05	U	1.05	1.04	U	1.04	1.03	U	1.03	1.04	U	1.04	1.03	U	1.03
PFMBA	863090-89-5	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	1.05	U	1.05	1.04	U	1.04	1.03	U	1.03	1.04	U	1.04	1.03	U	1.03
PFMPA	377-73-1	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	0.95	U	0.95	1.05	U	1.05	1.04	U	1.04	1.03	U	1.03	1.04	U	1.04	1.03	U	1.03

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.
The "Z" qualifier means the transition mass ratio for the indicated analyte was above/below the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgment was used to positively identify the analyte

Table 7. Analytical results of onsite monitoring well groundwater samples and production well for all 40 compounds with qualifiers and MDLs (continued). *Note: Values above RL highlighted in green and values above MDL highlighted in beige.*

4.8 Groundwater from Offsite Domestic Wells

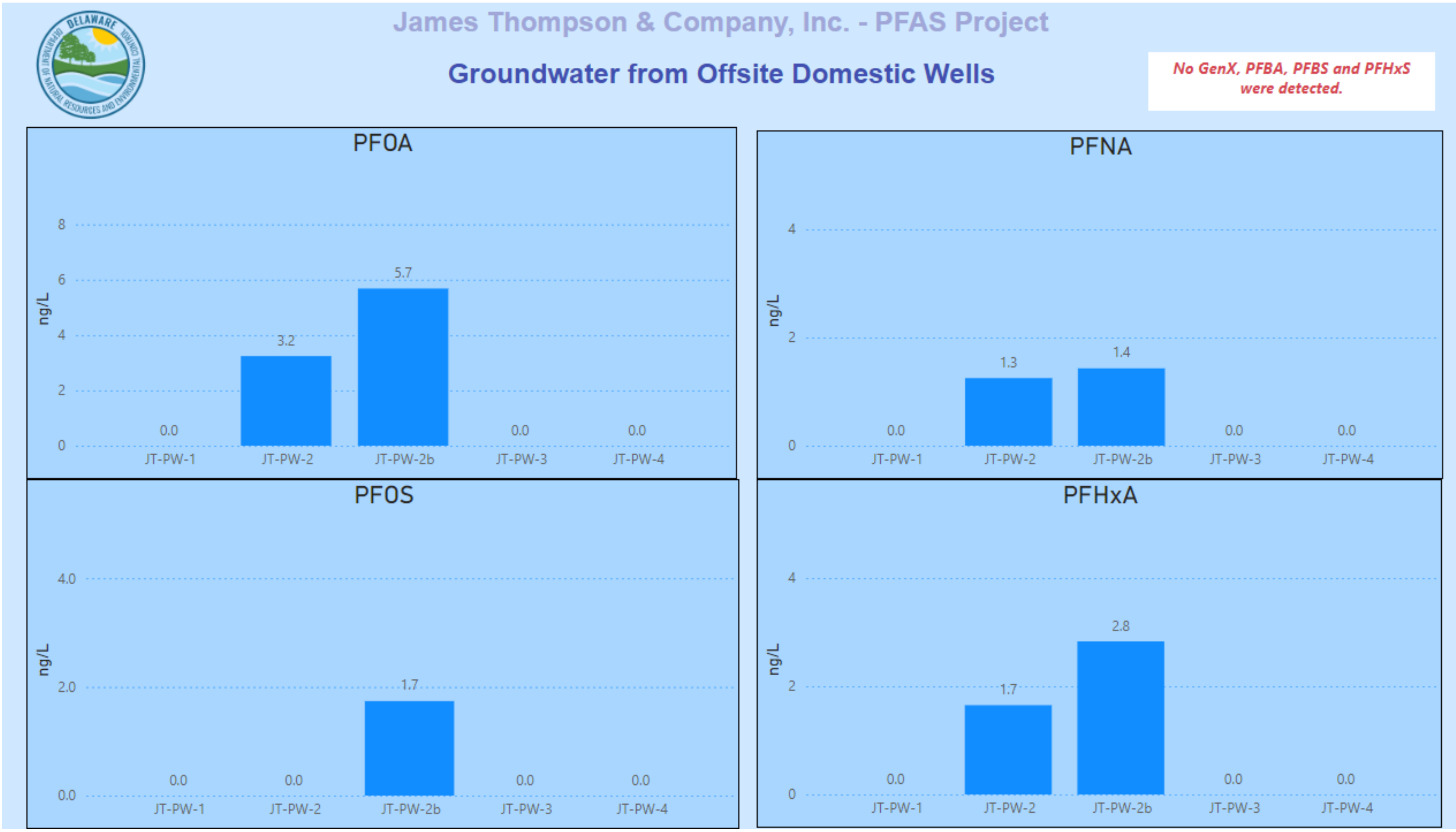

Figure 13. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for groundwater samples from offsite domestic wells. *Note: In some cases, the plots are shown at different scales.*

Client ID		JT PW - 1			JT PW - 2			JT PW - 3			JT PW - 4			JT-PW-2b		
Lab Sample ID		460-296611-3			460-296611-4			460-296611-6			460-296611-7			460-302900-17		
Sampling Date		1/17/2024 10:18			1/17/2024 10:42			1/17/2024 11:17			1/17/2024 11:45			4/23/2024 10:40		
Matrix		Water			Water			Water			Water			Water		
Dilution Factor		1			1			1			1			1		
Unit		ng/l			ng/l			ng/l			ng/l			ng/l		
LCMS-DRAFT 1633-WATER WATER BY DRAFT 1633	CAS#	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
11Cl-PF3OUdS	763051-92-9	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
3:3 FTCA	356-02-5	2.65	U	2.65	2.54	U	2.54	2.54	U	2.54	2.49	U	2.49	2.56	U	2.56
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
4:2 FTS	757124-72-4	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
5:3 FTCA	914637-49-3	13.3	U	13.3	12.7	U	12.7	12.7	U	12.7	12.4	U	12.4	12.8	U	12.8
6:2 FTS	27619-97-2	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
7:3 FTCA	812-70-4	13.3	U	13.3	12.7	U	12.7	12.7	U	12.7	12.4	U	12.4	12.8	U	12.8
8:2 FTS	39108-34-4	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
9Cl-PF3ONS	756426-58-1	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
HFPO-DA (GenX)	13252-13-6	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
NEtFOSA	4151-50-2	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
NEtFOSAA	2991-50-6	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
NEtFOSE	1691-99-2	5.31	U	5.31	5.07	U	5.07	5.08	U	5.08	4.98	U	4.98	5.11	U	5.11
NFDHA	151772-58-6	1.06	U	1.06	1.01	U	1.01	1.02	U	1.02	1	U	1	1.02	U	1.02
NMeFOSA	31506-32-8	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
NMeFOSAA	2355-31-9	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
NMeFOSE	24448-09-7	5.31	U	5.31	5.07	U	5.07	5.08	U	5.08	4.98	U	4.98	5.11	U	5.11
Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorobutanoic acid (PFBA)	375-22-4	2.12	U	2.12	2.03	U	2.03	2.03	U	2.03	1.99	U	1.99	2.05	U	2.05
Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorodecanoic acid (PFDA)	335-76-2	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.8	J	0.51
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorododecanoic acid (PFDoA)	307-55-1	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.53	U	0.53	2	J	0.51	0.51	U	0.51	0.5	U	0.5	2.78		0.51
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorohexanoic acid (PFHxA)	307-24-4	0.53	U	0.53	1.65	J	0.51	0.51	U	0.51	0.5	U	0.5	2.83		0.51
Perfluorononanesulfonic acid (PFNS)	68259-12-1	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorononanoic acid (PFNA)	375-95-1	0.53	U	0.53	1.25	J	0.51	0.51	U	0.51	0.5	U	0.5	1.43	J	0.51
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.79	J	0.53	0.56	J	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	1.74	J Z	0.51
Perfluorooctanoic acid (PFOA)	335-67-1	0.53	U	0.53	3.24		0.51	0.51	U	0.51	0.5	U	0.5	5.68		0.51
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluoropentanoic acid (PFPeA)	2706-90-3	1.06	U	1.06	1.01	U	1.01	1.02	U	1.02	1	U	1	2.65	J	1.02
Perfluorotetradecanoic acid (PFTeA)	376-06-7	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.53	U	0.53	0.51	U	0.51	0.51	U	0.51	0.5	U	0.5	0.51	U	0.51
PFEESA	113507-82-7	1.06	U	1.06	1.01	U	1.01	1.02	U	1.02	1	U	1	1.02	U	1.02
PFMBA	863090-89-5	1.06	U	1.06	1.01	U	1.01	1.02	U	1.02	1	U	1	1.02	U	1.02
PFMPA	377-73-1	1.06	U	1.06	1.01	U	1.01	1.02	U	1.02	1	U	1	1.02	U	1.02

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.
The "Z" qualifier means the transition mass ratio for the indicated analyte was above/below the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgment was used to positively identify the analyte

Table 8. Analytical results of domestic well groundwater samples for all 40 compounds with qualifiers and MDLs. *Note: Values above RL highlighted in green and values above MDL highlighted in beige.*

4.9 Surface Water Samples

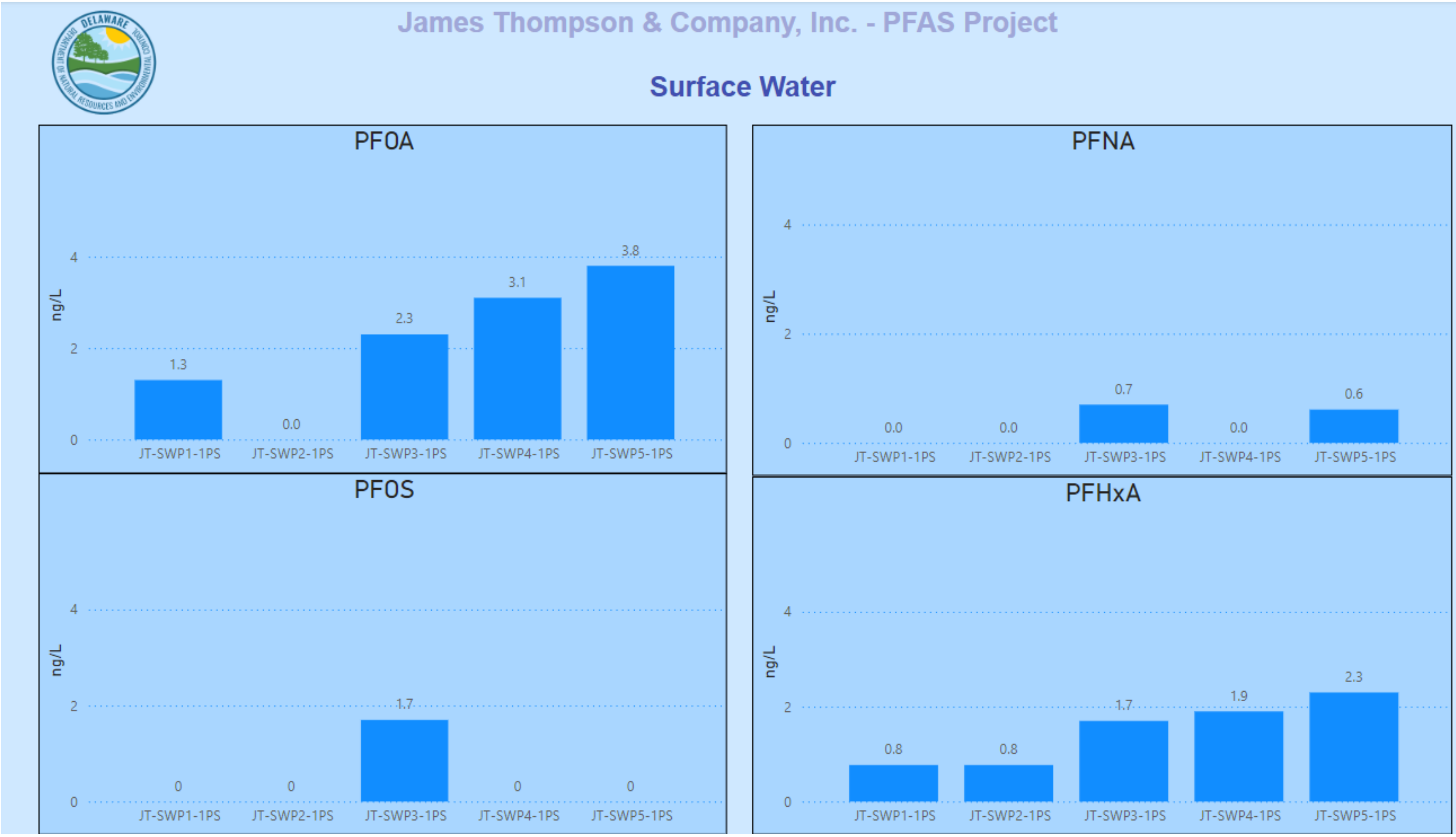

Figure 14. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for surface water samples.

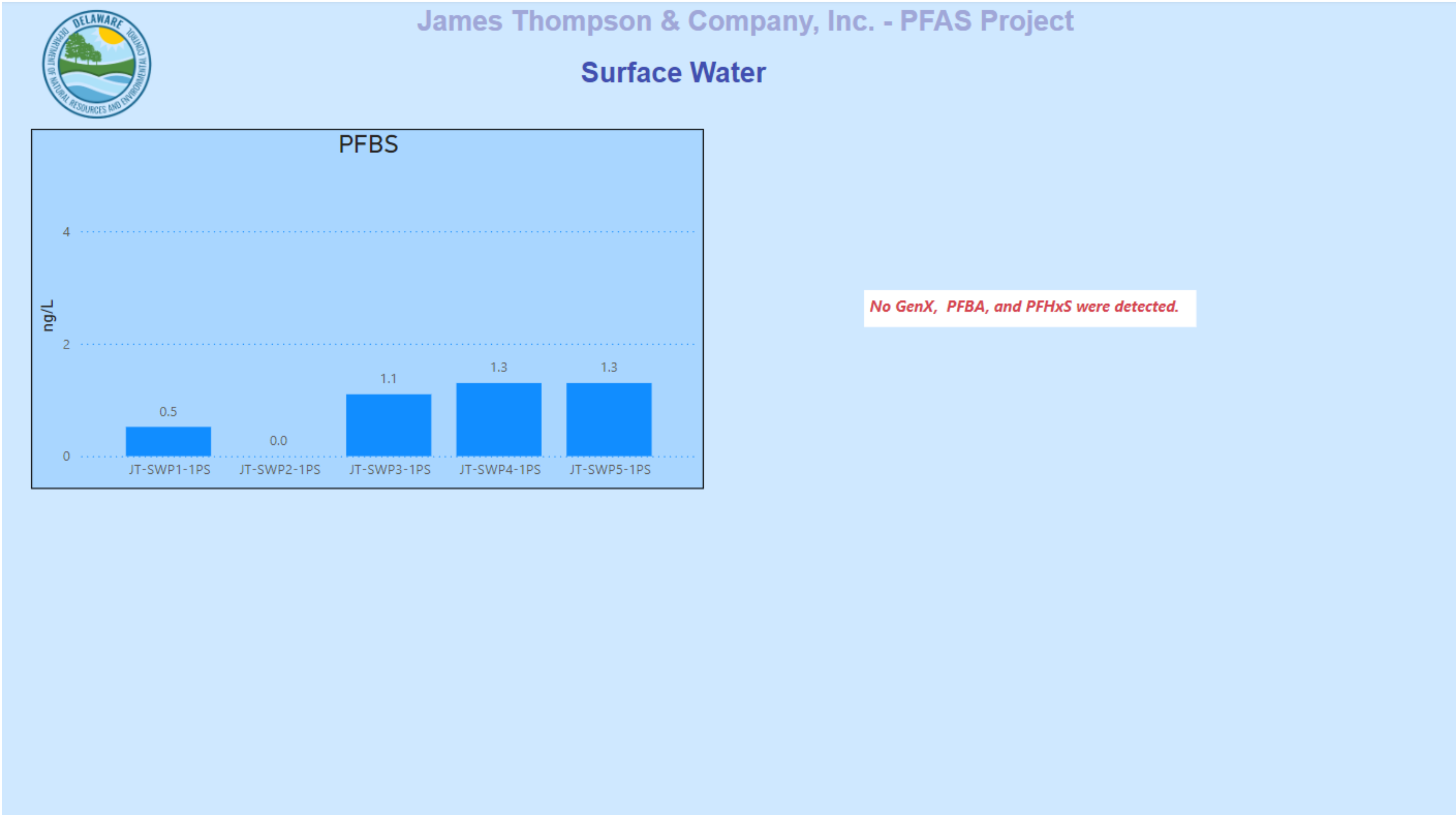

Figure 15. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for surface water samples.

Client ID	JT-SWP1-1PS			JT-SWP2-1PS			JT-SWP3-1PS			JT-SWP4-1PS			JT-SWP5-1PS			Duplicate 1PS		
Analyte	Result (ng/L)	Qualifier	MDL (ng/L)	Result (ng/L)	Qualifier	MDL (ng/L)	Result (ng/L)	Qualifier	MDL (ng/L)	Result (ng/L)	Qualifier	MDL (ng/L)	Result (ng/L)	Qualifier	MDL (ng/L)	Result (ng/L)	Qualifier	MDL (ng/L)
Perfluorobutanoic acid (PFBA)	ND	H	2.6	ND	H	2.8	ND	H	2.7	ND	H	2.6	ND	H	2.6	ND	H	2.5
Perfluoropentanoic acid (PFPeA)	ND	H	0.53	ND	H	0.59	1.3	J H	0.56	ND	H	0.53	1.2	J H	0.52	ND	H	0.52
Perfluorohexanoic acid (PFHxA)	0.77	J H	0.62	0.77	J H	0.71	1.7	J H	0.67	1.9	J H	0.65	2.3	H	0.63	0.78	J H	0.62
Perfluoroheptanoic acid (PFHpA)	0.4	J H	0.27	ND	H	0.32	0.86	J H	0.3	1	J H	0.28	1.7	J H	0.27	0.63	J H	0.27
Perfluorooctanoic acid (PFOA)	1.3	J H	0.94	ND	H	1.1	2.3	J H	1	3.1	H	0.96	3.8	H	0.92	1.5	J H	0.91
Perfluorononanoic acid (PFNA)	ND	H	0.3	ND	H	0.36	0.7	J H	0.33	ND	H	0.31	0.61	J H	0.3	ND	H	0.3
Perfluorodecanoic acid (PFDA)	ND	H	0.35	ND	H	0.42	ND	H	0.38	ND	H	0.36	ND	H	0.35	ND	H	0.34
Perfluoroundecanoic acid (PFUnA)	ND	H	1.2	ND	H	1.5	ND	H	1.3	ND	H	1.2	ND	H	1.2	ND	H	1.2
Perfluorododecanoic acid (PFDoA)	ND	H	0.64	ND	H	0.78	ND	H	0.72	ND	H	0.66	ND	H	0.64	ND	H	0.62
Perfluorotridecanoic acid (PFTrDA)	ND	H	1.6	ND	H	2.1	ND	H	1.7	ND	H	1.7	ND	H	1.5	ND	H	1.5
Perfluorotetradecanoic acid (PFTeA)	ND	H	1.1	ND	H	1.6	ND	H	1.4	ND	H	1.2	ND	H	1.1	ND	H	1
Perfluorobutanesulfonic acid (PFBS)	0.52	J H	0.21	ND	H	0.24	1.1	J H	0.23	1.3	J H	0.22	1.3	J H	0.22	0.27	J H	0.21
Perfluoropentanesulfonic acid (PFPeS)	ND	H	0.32	ND	H	0.36	ND	H	0.34	ND	H	0.33	ND	H	0.32	ND	H	0.32
Perfluorohexanesulfonic acid (PFHxS)	ND	H	0.62	ND	H	0.72	ND	H	0.67	ND	H	0.63	ND	H	0.62	ND	H	0.61
Perfluoroheptanesulfonic acid (PFHpS)	ND	H	0.21	ND	H	0.25	ND	H	0.23	ND	H	0.22	ND	H	0.21	ND	H	0.21
Perfluorooctanesulfonic acid (PFOS)	ND	H	0.59	ND	H	0.69	1.7	J H	0.64	ND	H	0.61	ND	H	0.6	ND	H	0.58
NMeFOSAA	ND	H	1.3	ND	H	1.3	ND	H	1.2	ND	H	1.3	ND	H	1.2	ND	H	1.2
NEtFOSAA	ND	H	1.4	ND	H	1.5	ND	H	1.3	ND	H	1.4	ND	H	1.3	ND	H	1.3
4:2 FTS	ND	H	0.26	ND	H	0.29	ND	H	0.27	ND	H	0.26	ND	H	0.26	ND	H	0.26
6:2 FTS	ND	H	2.9	ND	H	3.6	ND	H	3.3	ND	H	3	ND	H	2.9	ND	H	2.8
8:2 FTS	ND	H	0.65	ND	H	0.89	ND	H	0.78	ND	H	0.69	ND	H	0.65	ND	H	0.61
HFPO-DA (GenX)	ND	H	1.6	ND	H	1.7	ND	H	1.7	ND	H	1.6	ND	H	1.5	ND	H	1.5
9Cl-PF3ONS	ND	H	0.26	ND	H	0.31	ND	H	0.29	ND	H	0.27	ND	H	0.27	ND	H	0.26
11Cl-PF3OUdS	ND	H	0.36	ND	H	0.43	ND	H	0.39	ND	H	0.37	ND	H	0.36	ND	H	0.35
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ND	H	0.43	ND	H	0.46	ND	H	0.43	ND	H	0.43	ND	H	0.42	ND	H	0.41
5:3 FTCA	ND	H	0.37	ND	H	0.43	ND	H	0.4	ND	H	0.37	ND	H	0.37	ND	H	0.36
6:2 FTCA	ND	H	1	ND	H	1.2	ND	H	1.1	ND	H	1	ND	H	1	ND	H	1
6:2 FTUCA	ND	H	0.62	ND	H	0.68	ND	H	0.65	ND	H	0.63	ND	H	0.62	ND	H	0.61
NFDHA	ND	H	0.67	ND	H	0.75	ND	H	0.71	ND	H	0.68	ND	H	0.67	ND	H	0.66
PFMBA	ND	H	0.28	ND	H	0.31	ND	H	0.3	ND	H	0.28	ND	H	0.28	ND	H	0.28
PFMPA	ND	H	0.29	ND	H	0.32	ND	H	0.31	ND	H	0.3	ND	H	0.3	ND	H	0.29
PFEESA	ND	H	0.31	ND	H	0.35	ND	H	0.33	ND	H	0.31	ND	H	0.31	ND	H	0.31
PFMOAA	ND	H	0.43	ND	H	0.44	ND	H	0.42	ND	H	0.43	ND	H	0.42	ND	H	0.42
PFO3OA	ND	H	0.94	ND	H	1	ND	H	0.97	ND	H	0.95	ND	H	0.94	ND	H	0.93
PFO2HxA	ND	H	0.57	ND	H	0.6	ND	H	0.59	ND	H	0.58	ND	H	0.57	ND	H	0.57
Perfluoropropionic acid	5.2	J H	2.7	5.2	J H	2.9	5.5	J H	2.8	5.2	J H	2.7	5.1	J H	2.7	5.2	J H	2.6
M8 PFOA (PRC)	9.4	H	0.17	31	H	0.2	21	H	0.19	13	H	0.17	10	H	0.17	7.3	H	0.16

Notes

MDL: method detection limit

ND: Not detected at the MDL shown in the third column for each sample.

ng/L: Nanograms per litre

H: Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.

J: Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Table 9. Analytical results of surface water samples for all 40 compounds with qualifiers and MDLs. *Note: Values above RL highlighted in green and values above MDL highlighted in beige.*

4.9 Lagoon Sediment

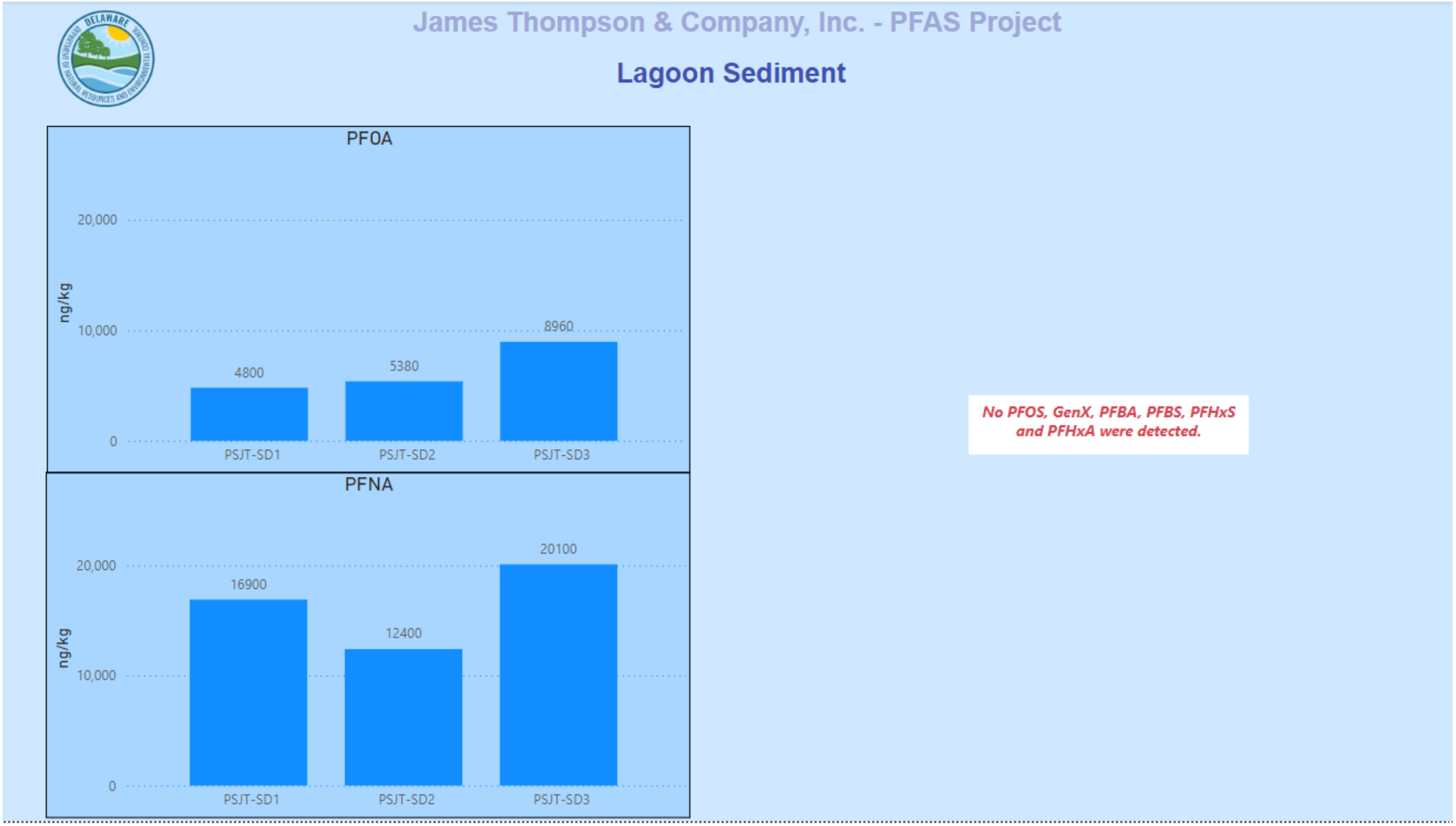

Figure 16. Distribution of HFPO-DA (Gen X), PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA (if present) for lagoon sediment samples.

Client ID		PSJT-SD1			PSJT-SD2			PSJT-SD3				EB-041624 (Blank)			EB-041624 (Blank)		
Lab Sample ID		460-302415-1			460-302415-2			460-302415-3				460-302415-5			460-302415-5		
Sampling Date		4/16/2024			4/16/2024			4/16/2024				4/16/2024			4/16/2024		
Matrix		Solid			Solid			Solid				Water			Water		
Dilution Factor		1			1			1				1			1		
Unit		ug/kg			ug/kg			ug/kg				ng/l			ng/l		
LCMS-DRAFT 1633-SOIL SOIL BY DRAFT 1633	CAS#	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL		Result	Q	MDL	Secondary	Q	MDL
11Cl-PF3OUdS	763051-92-9	12.5	U	12.5	26	U	26	29.8	U	29.8		1.89	U	1.89	NR		
3:3 FTCA	356-02-5	12.4	U	12.4	25.9	U	25.9	29.7	U	29.7		2.37	U	2.37	NR		
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	8.7	U	8.7	18.1	U	18.1	20.7	U	20.7		1.89	U	1.89	NR		
4:2 FTS	757124-72-4	8.7	U	8.7	18.1	U	18.1	20.7	U	20.7		1.89	U	1.89	NR		
5:3 FTCA	914637-49-3	73.5	U	73.5	153	U	153	175	U	175		11.8	U	11.8	NR		
6:2 FTS	27619-97-2	38.2	B	8.7	45.3	J B	18.1	45.4	J B	20.7		1.89	U	1.89	NR		
7:3 FTCA	812-70-4	230		80.9	168	U	168	193	U	193		11.8	U	11.8	NR		
8:2 FTS	39108-34-4	8.7	U	8.7	18.1	U	18.1	20.7	U	20.7		1.89	U	1.89	NR		
9Cl-PF3ONS	756426-58-1	10.4	U	10.4	21.5	U	21.5	24.7	U	24.7		1.89	U	1.89	NR		
HFPO-DA (GenX)	13252-13-6	9.44	U	9.44	19.6	U	19.6	22.5	U	22.5		1.89	U	1.89	NR		
NEtFOSA	4151-50-2	2.26	U	2.26	4.7	U	4.7	5.39	U	5.39		0.47	U	0.47	NR		
NEtFOSAA	2991-50-6	2.35	U	2.35	4.88	U	4.88	5.6	U	5.6		0.47	U	0.47	NR		
NEtFOSE	1691-99-2	22	U	22	45.8	U	45.8	52.5	U	52.5		4.74	U	4.74	NR		
NFDHA	151772-58-6	4.96	U	4.96	10.3	U	10.3	11.8	U	11.8		0.95	U	0.95	NR		
NMeFOSA	31506-32-8	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
NMeFOSAA	2355-31-9	4.39	U	4.39	9.13	U	9.13	10.5	U	10.5		0.47	U	0.47	NR		
NMeFOSE	24448-09-7	21.8	U	21.8	45.2	U	45.2	51.9	U	51.9		4.74	U	4.74	NR		
Perfluorobutanesulfonic acid (PFBS)	375-73-5	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluorobutanoic acid (PFBA)	375-22-4	8.7	U	8.7	18.1	U	18.1	20.7	U	20.7		1.89	U	1.89	NR		
Perfluorodecanesulfonic acid (PFDS)	335-77-3	2.48	U	2.48	5.16	U	5.16	5.91	U	5.91		0.47	U	0.47	NR		
Perfluorodecanoic acid (PFDA)	335-76-2	2.39	U	2.39	4.97	U	4.97	5.7	U	5.7		0.47	U	0.47	NR		
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	2.57	U	2.57	5.34	U	5.34	6.12	U	6.12		0.47	U	0.47	NR		
Perfluorododecanoic acid (PFDoA)	307-55-1	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluoroheptanoic acid (PFHpA)	375-85-9	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluorohexanoic acid (PFHxA)	307-24-4	2.52	U	2.52	5.25	U	5.25	6.01	U	6.01		0.47	U	0.47	NR		
Perfluorononanesulfonic acid (PFNS)	68259-12-1	2.74	U	2.74	5.7	U	5.7	6.53	U	6.53		0.47	U	0.47	NR		
Perfluorononanoic acid (PFNA)	375-95-1	16.9	B	2.52	12.4	J B	5.25	**20.1**	J B	6.01		0.5	J	0.47	0.47	U Z	0.47
Perfluorooctanesulfonamide (FOSA)	754-91-6	2.18	U	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2.7	U	2.7	5.61	U	5.61	6.43	U	6.43		0.47	U	0.47	NR		
Perfluorooctanoic acid (PFOA)	335-67-1	4.8	J	2.18	5.38	J	4.52	8.96	J	5.19		0.47	U	0.47	NR		
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	2.83	U	2.83	5.88	U	5.88	6.74	U	6.74		0.47	U	0.47	NR		
Perfluoropentanoic acid (PFPeA)	2706-90-3	4.35	U	4.35	9.04	U	9.04	10.4	U	10.4		0.95	U	0.95	NR		
Perfluorotetradecanoic acid (PFTeA)	376-06-7	2.44	U	2.44	5.06	U	5.06	5.81	U	5.81		0.47	U	0.47	NR		
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	3.46	J	2.18	4.52	U	4.52	5.19	U	5.19		0.47	U	0.47	NR		
Perfluoroundecanoic acid (PFUnA)	2058-94-8	2.18	U	2.18	5.03	J	4.52	6.42	J	5.19		0.47	U	0.47	NR		
PFEESA	113507-82-7	4.79	U	4.79	9.95	U	9.95	11.4	U	11.4		0.95	U	0.95	NR		
PFMBA	863090-89-5	4.35	U	4.35	9.04	U	9.04	10.4	U	10.4		0.95	U	0.95	NR		
PFMPA	377-73-1	4.35	U	4.35	9.04	U	9.04	10.4	U	10.4		0.95	U	0.95	NR		

Highlighted Concentrations shown in bold type face exceed limits

B : Compound was found in the blank and sample.

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

The "Z" qualifier means the transition mass ratio for the indicated analyte was above/below the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgment was used to positively identify the analyte

Table 10. Analytical results of lagoon sediment samples for all 40 compounds with qualifiers and MDLs. *Note: Values above RL highlighted in green and values above MDL highlighted in beige.*

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