

City of Los Angeles
Los Angeles Sanitation and Environment
Hyperion Water Reclamation Plant and Terminal Island Water Reclamation Plant

Special Study Proposal
(May 1, 2020 to March 31, 2022)
Constituents of Emerging Concern Work Plan
Per and Polyfluoroalkyl Substances

Introduction:

Per and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that are persistent in the environment and may accumulate in the human body. Due to their distinct properties, including resistance to heat, water, and oil, PFAS have been used industrially in the manufacturing and processing of consumer goods since the 1940s.¹ Various toxicology and epidemiology studies provide evidence that exposure to PFAS may cause adverse health outcomes in humans, including increased cholesterol levels, disruption in thyroid hormones, immune system effects, decreased fertility in women, and low infant birth weights.² Exposure to PFAS may occur through contact with contaminated air, water, soil, and food.²

In March of 2019, the California State Water Resources Control Board (SWRCB) announced a three-phased PFAS investigation plan to identify PFAS in discharges and drinking water sources across California.³ The third phase of the investigative plan (Phase III) would require wastewater treatment plants and industrial users regulated by our pretreatment program to test their discharge for the presence of PFAS. The Phase III findings would inform the SWRCB about potential sources upstream of the wastewater treatment plants.

In recent years, the Los Angeles Regional Water Quality Control Board (LARWQCB) has required that National Pollution Discharge Elimination System (NPDES) permittees, including LA Sanitation and Environment (LASAN), conduct special studies to monitor and quantify constituents of emerging concern (CECs) in their discharges. The results from previous CEC monitoring studies conducted by the Environmental Monitoring Division (EMD) indicated the presence of select PFAS, including perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), in Hyperion Water Reclamation Plant (HWRP) and Terminal Island Water Reclamation Plant (TIWRP) effluent.^{4,5} However, the contract labs employed for these studies that indicated the presence of PFAS in HWRP and TIWRP effluents, utilized modified versions of USEPA Method 537, which is intended for the determination of 14 PFAS in potable water. Such variations across environmental laboratories in the development of modified analytical methods raises concerns over the lack of standardization among laboratories and the lack of reliable, comparable data.

This CEC special study is submitted to fulfill the mandate in the Monitoring and Reporting Program of the TIWRP NPDES Permit (Order No. R4-2015-0119, NPDES Permit No. CA0053856) and the HWRP NPDES Permit (Order No. R4-2017-0045, NPDES Permit No. CA0109991). For the years 2020-2021 and 2021-2022, LASAN is proposing here to conduct a CEC special study for TIWRP in conjunction with HWRP to inform and improve effluent and

recycled water quality. This CEC special study is intended to evaluate PFAS concentrations in the influent and effluent between 2020 and 2022 for HWRP and TIWRP. Additionally, this CEC special study proposes to quantify PFAS concentrations in advanced-treated recycled water produced at the TIWRP Advanced Water Purification Facility (AWPF), which will provide useful information about the near-future AWPF projects at HWRP. The quality assurance protocol outlined in the Department of Defense's (DoD) Quality Systems Manual (QSM) version 5.3, Table B-15⁶ will be used for PFAS analysis in wastewater matrices by a liquid chromatography tandem mass spectrometry (LC/MS/MS) system. The method outlined in the United States Environmental Protection Agency's (USEPA) Method 537.1⁷ will be used for PFAS analysis in advanced-treated recycled water produced at TIWRP.

Background:

The Hyperion Water Reclamation Plant is part of a joint outfall system commonly known as the Hyperion Treatment System, which consists of the wastewater collection system, the Hyperion Water Reclamation Plant and three upstream water reclamation plants: Donald C. Tillman Water Reclamation Plant (DCTWRP), Los Angeles-Glendale Water Reclamation Plant (LAGWRP), Burbank Water Reclamation Plant (BWRP) (owned and operated by a contract city), and their associated outfalls. The Hyperion Treatment System collects, treats, and disposes of sewage from the entire city (except the Wilmington-San Pedro area, the strip north of San Pedro, and Watts) and from a number of cities and agencies under contractual agreements. Approximately 80% of the sewage treated at HWRP is generated from domestic sources, while the remaining 20% is from industrial and commercial discharge. Approximately 85% of the sewage and commercial/industrial wastewater comes from the City of Los Angeles (City). The remaining 15% comes from the contract cities and agencies.⁸ Sludge from the City's two upstream plants (DCTWRP and LAGWRP) and the BWRP is returned to the wastewater collection system and flows to the HWRP for treatment.

The HWRP has a dry-weather design treatment capacity of 450 million gallons per day (MGD) and a wet-weather peak hydraulic capacity of approximately 850 MGD. Approximately 35 MGD of the HWRP's secondary effluent is sent to the Edward C. Little Water Recycling Plant (West Basin Plant) for advanced treatment and reuse. The West Basin Municipal Water District (WBMWD) operates the West Basin Plant in El Segundo, CA. The West Basin Plant provides tertiary treatment and/or advanced treatment such as microfiltration and reverse osmosis (RO) to the HWRP secondary effluent to produce Title 22 and high purity recycled water. The Title 22 recycled water is beneficially reused for irrigation, industrial applications, including cooling water and boiler feed water, and other purposes. The RO-treated recycled water is primarily injected into the West Coast Basin Barrier Project to control seawater intrusion. In addition, about 35 MGD of secondary-filtered effluent is used at HWRP for in-plant use. The remainder of the treated secondary effluent is discharged into Santa Monica Bay (SMB) through the 5-Mile Outfall. In 2018, HWRP discharged an average of 225 MGD into SMB.⁸

The Terminal Island Water Reclamation Plant, located within the Los Angeles Harbor (LAH), produces tertiary-treated effluent with a minor brine component resulting from the AWPF process. The TIWRP has a dry-weather design capacity of 30 MGD and peak wet-weather design capacity of 50 MGD. Approximately 60% of the wastewater is from the industrial and

commercial sector, while the remaining 40% is generated by domestic sources in San Pedro, Harbor City, and parts of Wilmington.⁹ From January 2016 to December 2017, TIWRP discharged an average of 12.6 MGD of effluent into the Los Angeles Outer Harbor through the TIWRP Outfall. The AWPf receives tertiary-treated municipal wastewater from TIWRP and produces advanced-treated recycled water suitable for injection into the Dominguez Gap Barrier Project and for various non-potable uses throughout the harbor area. The treatment train at the AWPf consists of microfiltration, reverse osmosis, and advanced oxidation disinfection systems. In 2017, the AWPf delivered approximately 1.9 MGD of treated water to the Dominguez Gap Barrier Project. In the near future, when the AWPf expansion is complete, only brine will be discharged into LAH.

Objectives:

The objective of this special study for HWRP and TIWRP is the following:

To develop and validate the LC/MS/MS methods for determining PFAS concentrations in the HWRP and TIWRP influents and effluents as well as in the TIWRP advanced-treated recycled water.

Benefits:

In February of 2019, City of Los Angeles Mayor Eric Garcetti announced his goal to transform HWRP to a 100% recycled water facility by 2035 in order to source over 50% of the City's water supply with local water.^{10,11} By 2035, the City of Los Angeles will recycle 100% of its wastewater for beneficial reuse in order to reduce reliance on imported water.

With this goal in mind, the City has been operating an Advanced Water Purification Facility at TIWRP to perform advanced water treatment of tertiary effluent and is in the process of constructing one at HWRP to perform advanced water treatment of primary effluent. Once at 100% recycling capacity by 2035, recycled water produced at HWRP will be used for potable reuse and will improve the quality and quantity of recycled water delivered to the WBMWD. Under the Recycled Water Policy and the Water Reclamation Requirements for Recycled Water Use, these advanced water treatments require monitoring of recycled water for constituents, including priority pollutants, CECs, and micropollutants, depending on their intended uses. Monitoring of CECs, such as PFAS, in influent, effluent, and advanced-treated recycled water will support further understanding of the propensity, persistence, and effects of CECs in the environment and the risks they may present to public health.

There are several significant benefits of this study:

1. To increase knowledge of water quality conditions that can help inform municipal programs/projects and efforts to improve water quality in Santa Monica Bay and in Los Angeles Harbor.

2. To support the City's dedication to increase recycling of wastewater and reduce reliance on imported or potable water sources, thereby reducing its impact on state resources and increasing local water reliability.
3. To support the City's commitment to deliver a safe and reliable water supply and assure water quality to the public.
4. To provide data that inform about the impacts of PFAS on effluent at the City's publicly owned treatment works that may serve as source water for recycled water or drinking water.
5. To provide baseline data, acquired using an approved and reliable method that may inform future design projects and improvements.
6. To develop the capability of conducting time- and cost-saving in-house LC/MS/MS methods by EMD for the detection and quantification of PFAS concentrations in influent, effluent, and advanced-treated recycled water matrices.

Method information:

Recent concerns over PFAS have prompted several standard-setting organizations to publish new methods or to update existing methods for the analysis of PFAS in various matrices. Currently, the available quality assurance procedures and analytical methods for PFAS analysis are DoD QSM version 5.1 (or newer) Table B-15, USEPA Method 537.1, USEPA Method 8327 (draft), ASTM D7979, and ISO 21675. All of the aforementioned methods, except for USEPA Method 537.1, may be used for PFAS determination in wastewater. EMD has chosen to use DoD QSM Version 5.3, Table B-15, the only California ELAP-certified method for PFAS analysis in non-drinking water matrices, due to the confidence the Division has in the protocols and the reliability of the results obtained. In April of 2019, the California ELAP updated the Field of Testing Form 111 to include analysis of 23 required PFAS in addition to 15 optional PFAS analytes in non-drinking water matrices per Department of Defense's Quality Systems Manual (version 5.1 or later), Table B-15. Additionally, EMD has chosen to use USEPA 537.1, the only California ELAP-certified method for PFAS analysis in drinking water. In April of 2019, the California ELAP updated the Field of Testing Form 105 to include analysis of 18 PFAS analytes in drinking water matrices per USEPA 537.1.

The LC/MS/MS method following DoD QSM Version 5.3, Table B-15 will be established in EMD's laboratory to determine the concentrations of 23 required and 15 optional (38 total) PFAS analytes (Appendix 1) in influent and effluent from both HWRP and TIWRP. Concurrently, the LC/MS/MS method following USEPA 537.1 will be established in EMD's laboratory to determine the concentrations of 18 PFAS analytes (Appendix 2) in advanced-treated recycled water produced at the TIWRP AWPF. The USEPA Method 537.1, *Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)*, will be used for additional technical guidance in the sample preparation and analysis for wastewater matrices. Once method development is complete, EMD will submit applications for DoD ELAP and California ELAP accreditation for PFAS analysis by DoD QSM Version 5.3, Table B-15, as well as for California ELAP accreditation for USEPA 537.1.

Sampling information:

As illustrated in Appendices 1 and 2, EMD proposes to monitor PFAS levels in HWRP and TIWRP influent and effluent and TIWRP advanced-treated recycled water in dry weather and wet weather. A single grab sample of influent will be collected from each of the five influent sewers at HWRP in wet and dry weather. A single grab sample of influent will be collected from TIWRP in wet and dry weather. Grab samples of effluent from HWRP and TIWRP will be collected throughout a 24-hour period both in wet and dry weather. A single grab sample of advanced-treated recycled water will be collected from TIWRP AWPf in wet and dry weather. Per and polyfluoroalkyl substances are expected to be a concern during wet-weather at both HWRP and TIWRP because PFAS may be found in household dust, as well as industrial and commercial waste streams.

There will be two sampling periods and four sampling events: the first dry weather and wet weather sampling period is from October 2020 to March 2021, and the second dry-weather and wet-weather sampling period is from October 2021 to January 2022. A dry-weather event is defined as a sampling event when there is no rain within the previous 72 hours. A wet-weather event is defined as a sampling event when there is rainfall amounting to 0.1 inches of rain or greater.¹²

Per and polyfluoroalkyl substances pose several significant sampling dilemmas due to their chemical properties and prevalence. These compounds are composed of a hydrophilic head and a highly fluorinated, hydrophobic tail, which causes them to aggregate and form layers along air/water interfaces. Due to this tendency, all analytical testing methods prohibit sample aliquoting and require an extraction of full bottle contents followed by a bottle rinse.^{6,7} This creates a complication when attempting to create a flow-weighted composite sample, which requires the hourly proportioning of volumes based on hourly flows. The Environmental Monitoring Division will refrain from the use of autosamplers to generate composite samples due to the inability to prevent contamination that may be caused by autosampler tubing and containers. To best control and monitor for any contamination, EMD proposes to manually collect four individual grab samples of effluent spread evenly across 24 hours for each site. These four effluent samples will be extracted and analyzed as individual samples.

The HWRP and TIWRP operations staff will collect 250-mL influent, effluent, and TIWRP advanced-treated recycled water samples in preserved bottles and deliver them with chain-of-custody (COC) records to EMD's Sample Receiving Unit for holding. Samples will be uniquely identified. At a minimum, they will be labeled with sample date, sample time, sampling point, and the name of the sampler. This information, as well as other pertinent information, such as sample type, preservative added, and analyses will be recorded on the COC form. After samples are collected in the field, samples will be delivered to EMD's Sample Receiving Unit, located at the HWRP Pregerson Technical Support Building, Room 550. The sample information will be entered into EMD's Laboratory Information Management System (LIMS) and a unique laboratory registration number will be generated for that sample. After the sample has been recorded in the LIMS system, it will be stored between 2 – 6 °C. The samples will be picked up by EMD's Instrumental Chemistry Section for preparation and analysis within method-specified sample holding times.

Sample data will be reported in two forms: the first as individual grab sample data points and the second as a *calculated* 24-hour flow-weighted average (for effluent samples only). Due to the compositing limitations mentioned above, EMD is proposing a modified approach to traditional 24-hour composite reporting; each grab sample data generated for the effluent will be adjusted mathematically based on the flow during the time it is collected. All adjusted data points will then be summed to provide a total 24-hour flow-weighted average value for the effluent. Results for the grab influent and advanced-treated recycled water will be reported without any adjustments.

Sample Contamination:

The ubiquitous nature of PFAS in the environment and their extensive use in consumer products raises the potential for many sources of contamination during sampling, extraction, and analysis and thus increases the probability of false positives. In order to minimize potential sources of contamination, strict sampling guidelines will be followed.^{13,14}

Samples shall be collected in high density polyethylene (HDPE) 250-mL bottles fitted with unlined plastic screw caps. Sample containers will be provided by EMD's Sample Receiving Unit and will include preservative. The sampler shall wash their hands prior to sample collection and wear nitrile gloves while filling and sealing the sample bottles. The sampler shall not wear clothing and footwear items that are labeled as waterproof and or stain/dirt repellent. Personal care products such as sunscreen, insect repellent, and moisturizers that contain PFAS shall also not be used. Markers, such as Sharpies, shall not be used to label bottles. Only ballpoint pens shall be used while sample bottles are closed and before filling. The sampler shall change gloves after handling pens. All samples shall be collected directly from a flowing sample tap. The sample will be kept sealed from time of collection until extraction. The reagent water used for the Field Reagent Blanks (FRB) will be initially analyzed for method analytes as a Laboratory Reagent Blank (LRB) (using the same lot of sample bottles as the field samples) and must meet the LRB criteria as specified in the method. A Field Reagent Blank shall be included with each set and shall be accompanied by an empty sample bottle (no preservative). At the sampling site, the sampler must open the shipped FRB and pour the preserved reagent water into the empty shipped sample bottle, seal, and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS were not introduced into the sample during sample collection and handling.

The LC/MS/MS system may have PFAS contamination from instrument components, such as tubing, fittings, and filters. To minimize background contamination of PFAS the following modifications may be made: replacing polytetrafluoroethylene (PTFE) solvent frits with stainless steel frits, installing a delay column before the analytical column, and replacing the liquid chromatograph (LC) PTFE solvent lines with PEEK tubing.¹⁵

The Environmental Monitoring Division will strictly follow all the quality control (QC) criteria as stated in DoD QSM Version 5.3, Table B-15⁶ and USEPA 537.1⁷. A reference matrix method blank will be analyzed with each analytical batch to demonstrate freedom from contamination. If any analyte is detected in the method blank at $> \frac{1}{2}$ limit of quantitation, $>$ one-tenth the amount measured in any associated sample, or one-tenth the regulatory limit, then all data for the

problem analyte(s) will be considered invalid along with data for all samples in the extraction batch. Subtracting blank values from sample results will not be permitted. Analysis of samples will be halted until the sample batch is re-extracted and the extracts re-analyzed, and the method blank associated with the sample batch shows no evidence of contamination at quality control levels. A laboratory control sample will also be analyzed with each analytical batch to ensure the precision and accuracy of the analytical data.

Project Duration:

This special study will begin in May 2020 and is expected to be completed in two years (March 2022). There is a possibility that this study may be extended beyond two years due to the difficulties of new method validation and complexity of wastewater matrices.

Approach:

Year one: May 2020 to March 2021 (four quarters)

1. During the **first quarter**, EMD's Instrumental Chemistry Section (ICS) will review the existing DoD QSM Version 5.3, application notes from Agilent and other vendors, and peer-reviewed journals. All of the consumables required for the study (e.g., columns and standards) will be ordered.
2. During the **second quarter**, ICS will develop in-house extraction methods and instrumental run methods for the determination of PFAS by LC/MS/MS for wastewater and drinking water matrices.
3. During the **third quarter**, ICS will continue optimizing the extraction methods and the instrumental run methods to meet method requirements. The standard operating procedures (SOPs) for PFAS analyses will be generated. EMD will submit an application for accreditation to a DoD ELAP accreditation body for PFAS analysis by LC/MS/MS compliant with Table B-15 of QSM version 5.3. Samples will be collected for the first dry-weather and wet-weather sampling period. All samples will be prepared and analyzed.
4. During the **fourth quarter**, sampling for the first dry-weather and wet-weather sampling period will continue. All samples will be prepared and analyzed. The annual progress report will be prepared and submitted to the LARWQCB by March 2021.

Year two: April 2021 to March 2022 (four quarters)

5. During the **first and second quarters**, ICS will tabulate the available PFAS data and will begin to write the final report.
6. During the **third quarter**, the second dry-weather and wet-weather sampling will be conducted, and samples will be analyzed.
7. During the **fourth quarter**, ICS will perform data analysis, tabulate all data collected, and complete the final report to be submitted to the LARWQCB. The Environmental Monitoring Division will submit an application to California ELAP for PFAS analysis (DoD QSM Version 5.3 compliant and USEPA 537.1) and complete the accreditation process.

Deliverables:

Annual progress reports will be submitted to the LARWQCB. The final report shall include a compilation of influent, effluent, and advanced-treated recycled water monitoring data of PFAS listed in Appendix 1 and 2, Reporting Limits (RLs), sample type, analytical methodology used, sampling date/time, quality assurance and quality control information, and an evaluation of the cumulative PFAS data collected to date. The final report is expected to be submitted by April 2022.

Literature Cited:

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Appendix 1. CEC parameters by DoD QSM Version 5.3, RLs, and sample event.

Analyte	Water Boards* RL (ng/L)	Sample Event(s)
N-ethyl perfluorooctanesulfonamido Acetic Acid (NEtFOSAA)	20.0	Dry weather Wet weather
4:2 Fluorotelomer Sulfonic Acid (4:2 FTS)	20.0	Dry weather Wet weather
6:2 Fluorotelomer Sulfonic Acid (6:2 FTS)	20.0	Dry weather Wet weather
8:2 Fluorotelomer Sulfonic Acid (8:2 FTS)	20.0	Dry weather Wet weather
N-methyl perfluorooctanesulfonamido Acetic Acid (NMeFOSAA)	20.0	Dry weather Wet weather
Perfluorobutanoic Acid (PFBA)	8.0	Dry weather Wet weather
Perfluorobutane Sulfonic Acid (PFBS)	5.0	Dry weather Wet weather
Perfluorodecanoic Acid (PFDA)	5.0	Dry weather Wet weather
Perfluorododecanoic Acid (PFDoA)	5.0	Dry weather Wet weather
Perfluorodecane Sulfonic Acid (PFDS)	5.0	Dry weather Wet weather
Perfluoroheptanoic Acid (PFHpA)	5.0	Dry weather Wet weather
Perfluoroheptane Sulfonic Acid (PFHpS)	5.0	Dry weather Wet weather
Perfluorohexane Sulfonic Acid (PFHxS)	5.0	Dry weather Wet weather
Perfluorohexanoic Acid (PFHxA)	5.0	Dry weather Wet weather
Perfluorononanoic Acid (PFNA)	5.0	Dry weather Wet weather
Perfluorooctanoic Acid (PFOA)	5.0	Dry weather Wet weather
Perfluorooctane Sulfonic Acid (PFOS)	5.0	Dry weather Wet weather
Perfluorooctane Sulfonamide (PFOSAm)	8.0	Dry weather Wet weather
Perfluoropentanoic Acid (PFPeA)	5.0	Dry weather Wet weather
Perfluoropentane Sulfonic Acid (PFPeS)	5.0	Dry weather Wet weather

Perfluorotetradecanoic Acid (PFTA)	8.0	Dry weather Wet weather
Perfluorotridecanoic Acid (PFTrDA)	5.0	Dry weather Wet weather
Perfluoroundecanoic Acid (PFUnDA)	5.0	Dry weather Wet weather
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic Acid (11C1-PF3OUdS)	8.0	Dry weather Wet weather
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic Acid (9C1-PF3ONS)	8.0	Dry weather Wet weather
4,8-Dioxa-3H-perfluorononanoic Acid (ADONA)	8.0	Dry weather Wet weather
N-Ethylperfluorooctane Sulfonamide (EtFOSAm)	8.0	Dry weather Wet weather
N-Ethylperfluorooctane Sulfonamido Ethanol (EtFOSE)	8.0	Dry weather Wet weather
10:2 Fluorotelomer Sulfonic Acid (10:2 FTS)	8.0	Dry weather Wet weather
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	20.0	Dry weather Wet weather
N-Methylperfluorooctane Sulfonamide (MeFOSAm)	8.0	Dry weather Wet weather
N-Methylperfluorooctane Sulfonamido Ethanol (MeFOSE)	8.0	Dry weather Wet weather
Perfluorohexadecanoic Acid (PFHxDA)	8.0	Dry weather Wet weather
Perfluorononane Sulfonic Acid (PFNS)	8.0	Dry weather Wet weather
Perfluorooctadecanoic Acid (PFODA)	8.0	Dry weather Wet weather
2H,2H,3H,3H-Perfluorodecanoic Acid (7:3 FTCA)	8.0	Dry weather Wet weather
2H,2H,3H,3H-Perfluorohexanoic Acid (3:3 FTCA)	8.0	Dry weather Wet weather
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3 FTCA)	8.0	Dry weather Wet weather

*Reporting Limits (RL) published by the California State Water Resources Control Board for LC/MS/MS analysis of Per- and Polyfluorinated Alkyl Acids by Department of Defense Quality Systems Manual (version 5.1 or later) in the aqueous matrix of groundwater.

Denotes the additional 15 PFAS analytes that are not required for analysis.

Appendix 2. CEC parameter by USEPA 537.1, LCMRL, and sample event.

Analyte	USEPA 537.1 LCMRL* (ng/L)	Sample Event(s)
N-ethyl perfluorooctanesulfonamido Acetic Acid (NEtFOSAA)	4.8	Dry weather Wet weather
N-methyl perfluorooctanesulfonamido Acetic Acid (NMeFOSAA)	4.3	Dry weather Wet weather
Perfluorobutane Sulfonic Acid (PFBS)	6.3	Dry weather Wet weather
Perfluorodecanoic Acid (PFDA)	3.3	Dry weather Wet weather
Perfluorododecanoic Acid (PFDoA)	1.3	Dry weather Wet weather
Perfluoroheptanoic Acid (PFHpA)	0.63	Dry weather Wet weather
Perfluorohexane Sulfonic Acid (PFHxS)	2.4	Dry weather Wet weather
Perfluorohexanoic Acid (PFHxA)	1.7	Dry weather Wet weather
Perfluorononanoic Acid (PFNA)	0.83	Dry weather Wet weather
Perfluorooctanoic Acid (PFOA)	0.82	Dry weather Wet weather
Perfluorooctane Sulfonic Acid (PFOS)	2.7	Dry weather Wet weather
Perfluorotetradecanoic Acid (PFTA)	1.2	Dry weather Wet weather
Perfluorotridecanoic Acid (PFTrDA)	0.53	Dry weather Wet weather
Perfluoroundecanoic Acid (PFUnA)	5.2	Dry weather Wet weather
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic Acid (11C1-PF3OUdS)	1.5	Dry weather Wet weather
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic Acid (9C1-PF3ONS)	1.8	Dry weather Wet weather
4,8-Dioxa-3H-perfluorononanoic Acid (ADONA)	0.55	Dry weather Wet weather
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	4.3	Dry weather Wet weather

*Lowest Concentration Minimum Reporting Level (LCMRL) is the lowest true concentration for which the future recovery is predicted to fall, with high confidence (99%), between 50 and 150% recovery.