Elton Pond PFAS
Analysis of Freshwater Fish

2024 Results

By

Callie Mathieu

For the

Environmental Assessment Program

Washington State Department of Ecology

Olympia, Washington

September 2025, Publication 25-03-019

Publication Information

This report is available on the Department of Ecology's website at:
https://apps.ecology.wa.gov/publications/SummaryPages/2503019.html.

Data for this project are available in Ecology's EIM Database.[1] Study ID: PBTMON007

The Activity Tracker Code for this study is: 24-002.

Suggested Citation:
Callie Mathieu. 2025. Elton Pond PFAS Analysis of Freshwater Fish, 2024 Results. Publication 25-03-019. Washington State Department of Ecology, Olympia.
https://apps.ecology.wa.gov/publications/SummaryPages/2503019.html.

Water Resource Inventory Area (WRIA) and 8-digit Hydrologic Unit Code (HUC) numbers for the study area:

- WRIA: 39 – Upper Yakima
- HUC numbers: 17030001 – Upper Yakima

Contact Information

Publications Coordinator
Environmental Assessment Program
Washington State Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 564-669-3028

Washington State Department of Ecology – https://ecology.wa.gov

• Headquarters, Olympia	360-407-6000
• Northwest Regional Office, Shoreline	206-594-0000
• Southwest Regional Office, Olympia	360-407-6300
• Central Regional Office, Union Gap	509-575-2490
• Eastern Regional Office, Spokane	509-329-3400

---

[1] https://www.ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database

Elton Pond PFAS Analysis of Freshwater Fish, 2024 Results

By
Callie Mathieu

Environmental Assessment Program
Washington State Department of Ecology
Olympia, WA

September 2025 | Publication 25-03-019

The following document is a technical memorandum from the Washington Department of Ecology to the Washington Department of Fish and Wildlife. The technical memorandum is a non-standard report. Data provided and summarized in this technical memorandum are publicly available in Ecology's EIM Database (Study ID: PBTMON007).

Background

Groundwater in and near the Army's Yakima Training Center (YTC) is contaminated with per- and polyfluoroalkyl substances (PFAS) from military use of aqueous film-forming foams (AFFFs). AFFF is a type of foam used to fight liquid-based fires (those started by oil, gasoline, or other flammable liquids). PFAS create the "film" in AFFF. Investigations and sampling of groundwater monitoring wells on the military base and in the surrounding area have been ongoing since 2020. In the spring and fall of 2024, the Washington State Department of Ecology (Ecology) tested PFAS in surface waters surrounding the YTC that had not been previously sampled, including irrigation canals, the Yakima River, and Elton Pond (Carnes 2024). Data from this work will help to establish whether PFAS contamination is reaching surface waters in the area.

Freshwater fish in Elton Pond have not been previously tested for the presence of PFAS. The Washington Department of Fish and Wildlife (WDFW) stocks Elton Pond with rainbow trout and provides information to the public on angling for other freshwater species from the pond. In August 2024, WDFW staff collected rainbow trout and largemouth bass from Elton Pond for PFAS analysis. This technical memo provides the methods, data quality, and PFAS analytical results of four composite fish fillet tissue samples collected from Elton Pond.

Field and Processing Methods

Fish were collected and processed following a Project Work Plan Memo (Mathieu 2024) and the following standard operating procedures (SOPs):

- EAP009, Version 1.3: Field Collection, Processing, and Preservation of Finfish Samples at the Time of Collection in the Field. (Sandvik 2023a)
- EAP007, Version 1.3: Resecting Finfish Whole Body, Body Parts, or Tissue Samples. (Sandvik 2023b)

WDFW biologists collected nine individual largemouth bass and three individual rainbow trout from Elton Pond on August 13, 2024. Samples were collected throughout the pond using an electrofishing boat and gill netting. After collection, WDFW took measurements of individual fish lengths to the nearest millimeter (mm) and weight to the nearest gram (g). Fish were then given a unique identification number, double-wrapped in aluminum foil, and stored in plastic ziplock bags on ice. The fish were kept frozen until they were transported to Ecology Headquarters on August 21, 2024.

Samples were stored frozen at -20°C at Ecology Headquarters until homogenization. Ecology staff processed the fish into skin-on composite samples on November 6, 2024, following the compositing plan outlined in the Project Work Plan. Due to the limited number of samples, each composite sample consists of 2 – 4 individual fish. Fish were deslimed, descaled, and filleted. Staff ground each fish fillet a minimum of two times using a KitchenAid mixer with grinding attachment until a consistent color and texture was reached (fillet homogenate). To make the composite sample, an equal portion of each fillet homogenate was then combined and passed through the grinding equipment a third time. After the final compositing pass through the grinder, the tissue was then stirred and homogenized. Final homogenized composite samples were placed in laboratory-provided, pre-cleaned high-density polyethylene (HDPE) jars and stored frozen at -20°C.

All equipment used for filleting and homogenizing the fish was decontaminated both before and between each composite sample following standard operating procedures (Friese 2021). The decontamination process included the following sequence: scrubbing with tap water and Liquinox, rinsing with hot tap water, drying, and completing a final rinse with methanol.

One equipment blank was collected during fish processing to assess potential contamination in the fish homogenization process. Laboratory-provided blank water was poured over resectioning utensils and through grinding equipment used for homogenization, and the rinseate was collected and stored frozen at -20°C until shipment to the laboratory.

Ecology staff shipped the samples to the laboratory with double-bagged wet ice, following chain of custody protocols, on November 18, 2024.

Laboratory Methods and Data Quality

The sample holding time for fish tissue is 90 days after homogenization and samples were received by the lab 13 days after homogenization. SGS AXYS Analytical Services Ltd. received the samples within the proper temperature range and holding times. However, the laboratory did not extract the samples until February 18, 2025 (104 days after homogenization). The delay was attributed to laboratory capacity issues.

SGS AXYS Analytical Services Ltd. analyzed the four fish fillet composite samples, as well as the equipment blank, for 40 PFAS analytes. The analysis was conducted using EPA Method 1633A, following the laboratory's internal procedure MLA-110: Analytical Procedure for the Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS by EPA Method 1633A.

Ecology's Data Validation Chemist with Manchester Environmental Laboratory (MEL) completed a State 4 Data Validation using manual review and verification of reported results per specifications in the EPA method (EPA 2024), the laboratory's procedures, the Project Work Plan Memo for this study (Mathieu 2024), EPA National Functional Guidelines (EPA 2020), and MEL's data validation standard operating procedure (SOP 770046). A data validation report and validated electronic data deliverables were submitted to the project manager on May 27, 2025.

Overall, the results were usable as qualified by the data validator. An exception to this was one result for N-MEFOSE that was rejected due to a poor extracted internal standard recovery. N-MEFOSE was not detected in any other sample.

All results were qualified "J" as estimates due to being extracted after holding times. However, this delay is unlikely to affect the usability of the results as the analytes of interest are typically preserved in tissue well past 90 days.

One method blank was extracted and analyzed with the batch. Three analytes were detected in the method blank: Perfluorooctanoate (PFOA), perfluoroundecanoate (PFUNA), and N-ethyl perfluorooctanesulfonamidoethanol (N-ETFOSE). These compounds were detected in the fish tissue samples, but at less than five times the method blank contamination levels. The affected results were qualified "UJ" as non-detects.

No PFAS were detected in the equipment blank collected during fish tissue processing.

Results

Four fillet tissue composite samples collected from Elton Pond in August 2024 were analyzed for 40 PFAS via EPA Method 1633. At least one PFAS was detected in all four samples. Of the 40 analytes, only two were detected in the fish tissue samples: perfluorooctane sulfonate (PFOS) and perfluorodecanoate (PFDA).

Results of PFOS and PFDA are presented in Table 1. The full results of the 40 PFAS analyzed are provided in the Appendix.

PFOS in largemouth bass samples ranged from 11.7 ng/g in the composite sample with the smallest fish to 39.4 ng/g in the composite sample with the largest fish. The median and mean PFOS concentrations in largemouth bass samples were 25.0 and 25.4 ng/g, respectively. Two of the three samples contained trace amounts of PFDA, both at concentrations less than 0.2 ng/g.

The composite sample of rainbow trout fillet tissue had a PFOS concentration of 2.17 ng/g. No other PFAS were detected in the rainbow trout sample.

No other PFAS analytes were detected. Reporting limits were 0.1 ng/g for perfluoroalkyl acids, except for perfluoropentanoate (PFPeA) and perfluorobutanoate (PFBA), which were 0.2 and 0.4 ng/g, respectively. Reporting limits for the other 20 PFAS analyzed were in the range of 0.1 – 2.5 ng/g.

Table 1. Detected PFAS Results in Elton Pond Fish Fillet Tissue Samples.

Sample ID	Collection Date	Species	Number of Fish in Composite	Ave Age (year)	Ave Length (mm)	Ave Weight (g)	PFOS	PFDA
2411059-01	8/13/2024	LMB	2	4.5	253	241	**11.7 J**	0.1 UJ
2411059-02	8/13/2024	LMB	4	8.5	406	1039	**25 J**	**0.126 J**
2411059-03	8/13/2024	LMB	3	9.7	432	1290	**39.4 J**	**0.182 J**
2411059-04	8/13/2024	RBT	3	2.0	375	554	**2.17 J**	0.098 UJ

Ave = average.
Bold = Visual aid to show that the results was a detection.
J = The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was not detected at or above the reported quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

References

Carnes, J. 2024. Addendum 1 to Programmatic Quality Assurance Project Plan Statewide Preliminary PFAS Assessments. Publication 24-03-102. Washington State Department of Ecology, Olympia. https://apps.ecology.wa.gov/publications/SummaryPages/2403102.html

EPA [U.S. Environmental Protection Agency]. 2020. National Functional Guidelines for Organic Superfund Methods Data Review. OLEM 9240.0-51, EPA 540-R-20-005.

EPA [U.S. Environmental Protection Agency]. 2024. Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS. U.S. Environmental Protection Agency, Office of Water (4303T), Office of Science and Technology, Engineering and Analysis Division, Washington, D.C. EPA 821-R-24-001.

Friese, M. 2021. Standard Operating Procedure EAP090, Version 1.2: Decontaminating Field Equipment for Sampling Toxics in the Environment. Publication 21-03-202. Washington State Department of Ecology, Olympia. https://apps.ecology.wa.gov/publications/SummaryPages/2103202.html

Mathieu, C. 2024 [not published]. Project Work Plan Memorandum: Elton Pond PFAS Analysis of Freshwater Fish. For a copy of this document, please submit a request online or visit ecology.wa.gov/publicrecords.

Sandvik, P. 2023a. Standard Operating Procedure EAP009, Version 1.3: Field Collection, Processing, and Preservation of Finfish Samples at the Time of Collection in the Field. Publication 23-03-202. Washington State Department of Ecology, Olympia. [Recertified 2021]. https://apps.ecology.wa.gov/publications/SummaryPages/2303202.html.

Sandvik, P. 2023b. Standard Operating Procedure EAP007, Version 1.3: Resecting Finfish Whole Body, Body Parts, or Tissue Samples. Publication 23-03-234. Washington State Department of Ecology, Olympia. [Recertified 2021] https://apps.ecology.wa.gov/publications/SummaryPages/2303234.html.

Appendix A.

Table A-1. PFAS Analytical Results of Elton Pond Freshwater Fish Samples Collected in 2024.

Analyte Name	Acronym	Sample #2411059-01 (LMB)	Sample # 2411059-02 (LMB)	Sample # 2411059-03 (LMB)	Sample # 2411059-04 (RBT)
Perfluorobutanoic acid	PFBA	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
Perfluoropentanoic acid	PFPEA	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Perfluorohexanoic acid	PFHXA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluoroheptanoic acid	PFHPA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorooctanoic acid	PFOA	0.1 UJ	0.15 UJ	0.1 NUJ	0.1 UJ
Perfluorononanoic acid	PFNA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorodecanoic acid	PFDA	0.1 UJ	**0.126 J**	**0.182 J**	0.098 UJ
Perfluoroundecanoic acid	PFUNA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorododecanoic acid	PFDOA	0.08 UJ	0.08 UJ	0.08 UJ	0.08 UJ
Perfluorotridecanoic acid	PFTRDA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorotetradecanoic acid	PFTEDA	0.14 UJ	0.15 UJ	0.14 UJ	0.13 UJ
Perfluorobutanesulfonic acid	PFBS	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluoropentansulfonic acid	PFPES	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorohexanesulfonic acid	PFHXS	0.12 UJ	0.12 UJ	0.11 UJ	0.11 UJ
Perfluoroheptanesulfonic acid	PFHPS	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorooctanesulfonic acid	PFOS	**11.7 J**	**25 J**	**39.4 J**	**2.17 J**
Perfluorononanesulfonic acid	PFNS	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorodecanesulfonic acid	PFDS	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluorododecanesulfonic acid	PFDOS	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2 FTS	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2 FTS	0.36 UJ	0.36 UJ	0.36 UJ	0.35 UJ
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2 FTS	0.34 UJ	0.34 UJ	0.34 UJ	0.33 UJ
Perfluorooctanesulfonamide	PFOSA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
N-methyl perfluorooctanesulfonamide	N-MEFOSA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ

Analyte Name	Acronym	Sample #2411059-01 (LMB)	Sample # 2411059-02 (LMB)	Sample # 2411059-03 (LMB)	Sample # 2411059-04 (RBT)
N-ethyl perfluorooctanesulfonamide	N-ETFOSA	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ
N-methyl perfluorooctanesulfonamidoacetic acid	MEFOSAA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
N-ethyl perfluorooctanesulfonamidoacetic acid	ETFOSAA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
N-methyl perfluorooctanesulfonamidoethanol	N-MEFOSE	1.0 UJ	1.0 UJ	1.0 UJ	REJ
N-ethyl perfluorooctanesulfonamidoethanol	N-ETFOSE	4.0 NUJ	3.8 NUJ	4.5 NUJ	6.7 NUJ
Hexafluoropropylene oxide dimer acid	HFPO-DA	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9CL-PF3ONS	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11CL-PF3OUDS	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
3-Perfluoropropyl propanoic acid	3:3 FTCA	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
2H,2H,3H,3H-Perfluorooctanoic acid	5:3 FTCA	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
3-Perfluoroheptyl propanoic acid	7:3 FTCA	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Perfluoro-3-methoxypropanoic acid	PFMPA	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Perfluoro-4-methoxybutanoic acid	PFMBA	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ

Bold = Visual aid to show that the result was a detection. LMB = largemouth bass; RBT = rainbow trout.
J = The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was not detected at or above the reported quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
NUJ = The analyte was initially identified by the lab as tentatively identified at an estimated concentration in both the sample and the associated method blank. The reported value is quantified as not-detect because the sample value is less than 5x the value in the associated blank.
REJ = The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet the quality control criteria. The presence or absence of the analyte cannot be verified.

Table A-2. Ancillary Measurements of Individual Fish Used in Composites.

Sample ID	Field ID	Species	Fish Length (mm)	Fish Weight (g)	Fish Age (yr)
2411059-01	ELTLMB04	LMB	236	203	3
2411059-01	ELTLMB03	LMB	269	278	6
2411059-02	ELTLMB06	LMB	391	972	7
2411059-02	ELTLMB07	LMB	396	851	7
2411059-02	ELTLMB08	LMB	416	1125	13
2411059-02	ELTLMB09	LMB	419	1208	7
2411059-03	ELTLMB05	LMB	420	1039	7
2411059-03	ELTLMB02	LMB	426	1225	10
2411059-03	ELTLMB10	LMB	451	1607	12
2411059-04	ELTLBT01	RBT	356	478	2
2411059-04	ELTLBT02	RBT	366	585	2
2411059-04	ELTLBT03	RBT	404	598	n/a

n/a = fish age could not be read.