County of Brunswick

3954 Clearwell Dr NE
Leland, NC 28451

Northwest Water Plant

Leland, NC
Samples Received: 12/22/22

Analytical Report
1222-775

Isotope Dilution Method

PFAS

Enthalpy Analytical, LLC – Ultratrace

Mark Hager
O: 910-876-6894/ F: 910-212-6886
mark.hager@enthalpy.com / www.enthalpy.com
2714 Exchange Drive, Wilmington, NC 28405

I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF) and contains __21__ pages.

QA Review Performed by: Laura K. Boivin

Report Issued Date: 1/16/2023

ENTHALPY ANALYTICAL

Summary of Results

Enthalpy Analytical

Job No.: 1222-775-1 PFAS by Isotope Dilution (non-potable water)

Brunswick County Public Utilities - NC Client Project: N/A Site: Northwest Water Plant

Summary

	Compound	CAS	122222-SO1 ng/L	122222-EO1 ng/L
Acids	PFBA	375-22-4	3.56	4.06
	PFPeA	2706-90-3	5.67	5.59
	PFHxA	307-24-4	5.27	5.53
	PFHpA	375-85-9	2.68	2.71
	PFOA	335-67-1	5.20	4.12
	PFNA	375-95-1	0.809	0.725
	PFDA	335-76-2	0.394 J	0.300 J
	PFUnDA	2058-94-8	ND U	ND U
	PFDoDA	307-55-1	ND U	ND U
	PFTrDA	72629-94-8	ND U	ND U
	PFTeDA	376-06-7	ND U	ND U
Sulfonates	PFBS	375-73-5	3.77	4.46
	PFPeS	2706-91-4	0.441 J	0.488 J
	PFHxS	355-46-4	2.95	2.93
	PFHpS	375-92-8	0.0122 L	ND U
	PFOS	1763-23-1	8.11	6.74
	PFNS	68259-12-1	ND U	ND U
	PFDS	335-77-3	ND U	ND U
	4:2 FTS	757124-72-4	ND U	ND U
	6:2 FTS	27619-97-2	0.521	0.467 J
	8:2 FTS	39108-34-4	ND U	ND U
Other	PFOSA	754-91-6	ND U	ND U
	N-MeFOSAA	2355-31-9	ND U	ND U
	N-EtFOSAA	2991-50-6	ND U	ND U
	HFPO-DA	13252-13-6	1.62	1.62
	PFMOAA	674-13-5	9.16	9.30
	PFMOPrA	377-73-1	ND U	ND U
	PFO2HxA	39492-88-1	1.77	2.00
	PFO3OA	39492-89-2	0.656 L	0.500 L
	PFO4DA	39492-90-5	ND U	ND U
	Nafion Byproduct 1	29311-67-9	ND U	ND U
	ADONA	919005-14-4	ND U	ND U
	9Cl-PF3ONS	756426-58-1	ND U	ND U
	11Cl-PF3OUdS	763051-92-9	ND U	ND U
	10:2 FTS	120226-60-0	ND U	ND U
	EVE Acid	69087-46-3	ND U	ND U
	FBSA	30334-69-1	0.452 J	0.582
	Hydro-EVE Acid	773804-62-9	ND U	ND U
	Hydrolyzed PSDA	2416366-19-1	1.21 L	1.69
	Nafion Byproduct 2	749836-20-2	ND U	ND U
	N-EtFOSA	4151-50-2	ND U	ND U
	N-EtFOSE	1691-99-2	ND U	ND U
	NFDHA	151772-58-6	ND U	ND U
	N-MeFOSA	31506-32-8	ND U	ND U
	N-MeFOSE	24448-09-7	ND U	ND U
	NVHOS	1132933-86-8	ND U	ND U
	PEPA	267239-61-2	0.506 L	0.401 L
	PFECA-G	801212-59-9	ND U	ND U
	PFEESA	113507-82-7	ND U	ND U
	PFHxDA	67905-19-5	ND U	ND U
	PFMOBA	863090-89-5	ND U	ND U
	PFO5DA	39492-91-6	ND U	ND U
	PMPA	13140-29-9	2.20	2.37
	R-EVE	2416366-22-6	1.35	1.60
	R-PSDA	2416366-18-0	ND U	ND U
	R-PSDCA	241636-21-5	ND U	ND U

Detailed Results

Enthalpy Analytical

Job No.: 1222-775-1 PFAS by Isotope Dilution (non-potable water)
Brunswick County Public Utilities - NC Client Project: N/A Site: Northwest Water Plant

Enthalpy ID	1222-775-001-1	Prep Batch	EU14504	Sample Vol (mL)	293.51
Sample Name	122222-SO1	Prep Date	2022-12-22 12:00	Extract Vol (mL)	0.4
Matrix	AQ	Analysis Date	12/23/2022 12:03:27 AM	Split Factor	N/A
Sampling Date	20221222 09:30	Analyst	wicleve	Method Code	WM-026
Received Date	2022-12-22 10:12	Instrument	Pippin	Sample Type	Sample

	Compound	CAS	Extract Concentration ng/L	Sample Concentration ng/L	Formatted Result ng/L	LOD ng/L	LOQ ng/L	Recovery Limits	Recovery	Flags
Acids	PFBA	375-22-4	2612.74	3.56	3.56	0.130	0.545			
	PFPeA	2706-90-3	4159.74	5.67	5.67	0.145	0.545			
	PFHxA	307-24-4	3868.97	5.27	5.27	0.164	0.545			
	PFHpA	375-85-9	1969.11	2.68	2.68	0.104	0.545			
	PFOA	335-67-1	3817.87	5.20	5.20	0.151	0.545			
	PFNA	375-95-1	593.92	0.809	0.809	0.0648	0.545			
	PFDA	335-76-2	289.35	0.394	0.394	0.0720	0.545			J
	PFUnDA	2058-94-8	ND	ND	ND	0.158	0.545			U
	PFDoDA	307-55-1	ND	ND	ND	0.172	0.545			U
	PFTrDA	72629-94-8	ND	ND	ND	0.129	0.545			U
	PFTeDA	376-06-7	ND	ND	ND	0.186	0.545			U
Sulfonates	PFBS	375-73-5	2766.78	3.77	3.77	0.302	0.637			
	PFPeS	2706-91-4	323.83	0.441	0.441	0.175	0.514			J
	PFHxS	355-46-4	2162.74	2.95	2.95	0.163	0.499			
	PFHpS	375-92-8	8.99	0.0122	0.0122	0.115	0.519			L
	PFOS	1763-23-1	5952.07	8.11	8.11	0.136	0.505			
	PFNS	68259-12-1	ND	ND	ND	0.0736	0.525			U
	PFDS	335-77-3	ND	ND	ND	0.164	0.525			U
	4:2 FTS	757124-72-4	ND	ND	ND	0.101	0.511			U
	6:2 FTS	27619-97-2	382.19	0.521	0.521	0.0988	0.519			
	8:2 FTS	39108-34-4	ND	ND	ND	0.146	0.522			U
Other	PFOSA	754-91-6	ND	ND	ND	0.111	0.545			U
	N-MeFOSAA	2355-31-9	ND	ND	ND	0.123	0.545			U
	N-EtFOSAA	2991-50-6	ND	ND	ND	0.0928	0.545			U
	HFPO-DA	13252-13-6	1189.00	1.62	1.62	0.194	0.545			
	PFMOAA	674-13-5	6724.68	9.16	9.16	1.23	1.23			
	PFMOPrA	377-73-1	ND	ND	ND	0.204	0.545			U
	PFO2HxA	39492-88-1	1302.03	1.77	1.77	1.23	1.23			
	PFO3OA	39492-89-2	481.13	0.656	0.656	1.23	1.23			L
	PFO4DA	39492-90-5	ND	ND	ND	1.29	1.29			U
	Nafion Byproduct 1	29311-67-9	ND	ND	ND	0.259	0.545			U
	ADONA	919005-14-4	ND	ND	ND	0.102	0.516			U
	9Cl-PF3ONS	756426-58-1	ND	ND	ND	0.102	0.508			U
	11Cl-PF3OUdS	763051-92-9	ND	ND	ND	0.102	0.514			U
	10:2 FTS	120226-60-0	ND	ND	ND	0.204	0.545			U
	EVE Acid	69087-46-3	ND	ND	ND	1.23	1.23			U
	FBSA	30334-69-1	332.02	0.452	0.452	0.204	0.545			J
	Hydro-EVE Acid	773804-62-9	ND	ND	ND	1.23	1.23			U
	Hydrolyzed PSDA	2416366-19-1	891.02	1.21	1.21	1.23	1.23			L
	Nafion Byproduct 2	749836-20-2	ND	ND	ND	0.259	0.545			U
	N-EtFOSA	4151-50-2	ND	ND	ND	0.204	0.545			U
	N-EtFOSE	1691-99-2	ND	ND	ND	6.13	6.13			U
	NFDHA	151772-58-6	ND	ND	ND	0.204	0.545			U
	N-MeFOSA	31506-32-8	ND	ND	ND	0.204	0.545			U
	N-MeFOSE	24448-09-7	ND	ND	ND	6.13	6.13			U
	NVHOS	1132933-86-8	ND	ND	ND	1.23	1.23			U
	PEPA	267239-61-2	371.51	0.506	0.506	1.23	1.23			L
	PFECA-G	801212-59-9	ND	ND	ND	0.259	1.23			U
	PFEESA	113507-82-7	ND	ND	ND	0.204	0.545			U
	PFHxDA	67905-19-5	ND	ND	ND	1.23	1.23			U
	PFMOBA	863090-89-5	ND	ND	ND	1.23	1.23			U
	PFO5DA	39492-91-6	ND	ND	ND	1.29	1.29			U
	PMPA	13140-29-9	1611.06	2.20	2.20	1.23	1.23			
	R-EVE	2416366-22-6	988.47	1.35	1.35	1.23	1.23			
	R-PSDA	2416366-18-0	ND	ND	ND	1.23	1.23			U
	R-PSDCA	241636-21-5	ND	ND	ND	1.23	1.23			U
ES	MPFBA		4744.93	6.47				20-150%	94.9%	
	M5PFPeA		5736.17	7.82				20-150%	114.7%	
	M3PFBS		6609.89	9.01				20-150%	132.2%	
	M2-4:2 FTS		5792.33	7.89				20-150%	115.8%	
	M5PFHxA		4564.38	6.22				20-150%	91.3%	
	M3HFPO-DA		5247.50	7.15				20-150%	105.0%	
	M4PFHpA		4631.79	6.31				20-150%	92.6%	
	M3PFHxS		4726.08	6.44				20-150%	94.5%	
	M2-6:2 FTS		5137.68	7.00				20-150%	102.8%	
	M8PFOA		4575.01	6.23				20-150%	91.5%	
	M9PFNA		3928.35	5.35				20-150%	78.6%	
	M8PFOS		5100.53	6.95				20-150%	102.0%	
	M2-8:2 FTS		4418.52	6.02				20-150%	88.4%	
	M8FOSA-I		2992.91	4.08				20-150%	59.9%	
	M6PFDA		4253.79	5.80				20-150%	85.1%	
	d3-N-MeFOSAA		4104.17	5.59				20-150%	82.1%	
	d5-N-EtFOSAA		3471.60	4.73				20-150%	69.4%	
	M7PFUdA		2873.97	3.92				20-150%	57.5%	
	MPFDoA		2179.51	2.97				20-150%	43.6%	
	M2PFTeDA		830.36	1.13				20-150%	16.6%	Q
	d3-N-MeFOSA		437.39	0.596				10-200%	4.4%	Q
	d5-N-EtFOSA		326.19	0.445				10-200%	3.3%	Q
	d7-N-MeFOSE		3760.93	5.13				10-200%	37.6%	
	d9-N-EtFOSE		2979.49	4.06				10-200%	29.8%	

Enthalpy Analytical

Job No.: 1222-775-1 PFAS by Isotope Dilution (non-potable water)
Brunswick County Public Utilities - NC Client Project: N/A Site: Northwest Water Plant

Enthalpy ID	1222-775-002-1	Prep Batch	EU14504	Sample Vol (mL)	289.14
Sample Name	122222-EO1	Prep Date	2022-12-22 12:00	Extract Vol (mL)	0.4
Matrix	AQ	Analysis Date	12/23/2022 12:26:07 AM	Split Factor	N/A
Sampling Date	20221222 09:30	Analyst	wicleve	Method Code	WM-026
Received Date	2022-12-22 10:12	Instrument	Pippin	Sample Type	Sample

	Compound	CAS	Extract Concentration ng/L	Sample Concentration ng/L	Formatted Result ng/L	LOD ng/L	LOQ ng/L	Recovery Limits	Recovery	Flags
Acids	PFBA	375-22-4	2933.16	4.06	4.06	0.132	0.553			
	PFPeA	2706-90-3	4041.62	5.59	5.59	0.147	0.553			
	PFHxA	307-24-4	3998.42	5.53	5.53	0.167	0.553			
	PFHpA	375-85-9	1959.00	2.71	2.71	0.105	0.553			
	PFOA	335-67-1	2978.82	4.12	4.12	0.153	0.553			
	PFNA	375-95-1	523.87	0.725	0.725	0.0658	0.553			
	PFDA	335-76-2	216.88	0.300	0.300	0.0731	0.553			J
	PFUnDA	2058-94-8	ND	ND	ND	0.160	0.553			U
	PFDoDA	307-55-1	ND	ND	ND	0.175	0.553			U
	PFTrDA	72629-94-8	ND	ND	ND	0.131	0.553			U
	PFTeDA	376-06-7	ND	ND	ND	0.188	0.553			U
Sulfonates	PFBS	375-73-5	3220.66	4.46	4.46	0.307	0.646			
	PFPeS	2706-91-4	353.08	0.488	0.488	0.178	0.521			J
	PFHxS	355-46-4	2120.84	2.93	2.93	0.165	0.507			
	PFHpS	375-92-8	ND	ND	ND	0.117	0.527			U
	PFOS	1763-23-1	4874.78	6.74	6.74	0.138	0.513			
	PFNS	68259-12-1	ND	ND	ND	0.0747	0.533			U
	PFDS	335-77-3	ND	ND	ND	0.166	0.533			U
	4:2 FTS	757124-72-4	ND	ND	ND	0.102	0.518			U
	6:2 FTS	27619-97-2	337.31	0.467	0.467	0.100	0.527			J
	8:2 FTS	39108-34-4	ND	ND	ND	0.148	0.530			U
Other	PFOSA	754-91-6	ND	ND	ND	0.112	0.553			U
	N-MeFOSAA	2355-31-9	ND	ND	ND	0.125	0.553			U
	N-EtFOSAA	2991-50-6	ND	ND	ND	0.0943	0.553			U
	HFPO-DA	13252-13-6	1169.23	1.62	1.62	0.197	0.553			
	PFMOAA	674-13-5	6721.16	9.30	9.30	1.25	1.25			
	PFMOPrA	377-73-1	ND	ND	ND	0.208	0.553			U
	PFO2HxA	39492-88-1	1443.21	2.00	2.00	1.25	1.25			
	PFO3OA	39492-89-2	361.72	0.500	0.500	1.25	1.25			L
	PFO4DA	39492-90-5	ND	ND	ND	1.31	1.31			U
	Nafion Byproduct 1	29311-67-9	ND	ND	ND	0.263	0.553			U
	ADONA	919005-14-4	ND	ND	ND	0.104	0.524			U
	9Cl-PF3ONS	756426-58-1	ND	ND	ND	0.104	0.516			U
	11Cl-PF3OUdS	763051-92-9	ND	ND	ND	0.104	0.521			U
	10:2 FTS	120226-60-0	ND	ND	ND	0.208	0.553			U
	EVE Acid	69087-46-3	ND	ND	ND	1.25	1.25			U
	FBSA	30334-69-1	420.57	0.582	0.582	0.208	0.553			
	Hydro-EVE Acid	773804-62-9	ND	ND	ND	1.25	1.25			U
	Hydrolyzed PSDA	2416366-19-1	1221.59	1.69	1.69	1.25	1.25			
	Nafion Byproduct 2	749836-20-2	ND	ND	ND	0.263	0.553			U
	N-EtFOSA	4151-50-2	ND	ND	ND	0.208	0.553			U
	N-EtFOSE	1691-99-2	ND	ND	ND	6.23	6.23			U
	NFDHA	151772-58-6	ND	ND	ND	0.208	0.553			U
	N-MeFOSA	31506-32-8	ND	ND	ND	0.208	0.553			U
	N-MeFOSE	24448-09-7	ND	ND	ND	6.23	6.23			U
	NVHOS	1132933-86-8	ND	ND	ND	1.25	1.25			U
	PEPA	267239-61-2	290.00	0.401	0.401	1.25	1.25			L
	PFECA-G	801212-59-9	ND	ND	ND	0.263	1.25			U
	PFEESA	113507-82-7	ND	ND	ND	0.208	0.553			U
	PFHxDA	67905-19-5	ND	ND	ND	1.25	1.25			U
	PFMOBA	863090-89-5	ND	ND	ND	1.25	1.25			U
	PFO5DA	39492-91-6	ND	ND	ND	1.31	1.31			U
	PMPA	13140-29-9	1713.03	2.37	2.37	1.25	1.25			
	R-EVE	2416366-22-6	1157.78	1.60	1.60	1.25	1.25			
	R-PSDA	2416366-18-0	ND	ND	ND	1.25	1.25			U
	R-PSDCA	241636-21-5	ND	ND	ND	1.25	1.25			U
ES	MPFBA		5004.61	6.92				20-150%	100.1%	
	M5PFPeA		5633.51	7.79				20-150%	112.7%	
	M3PFBS		5858.78	8.11				20-150%	117.2%	
	M2-4:2 FTS		8301.98	11.5				20-150%	166.0%	Q
	M5PFHxA		4259.63	5.89				20-150%	85.2%	
	M3HFPO-DA		4743.77	6.56				20-150%	94.9%	
	M4PFHpA		4622.23	6.39				20-150%	92.4%	
	M3PFHxS		6043.14	8.36				20-150%	120.9%	
	M2-6:2 FTS		6726.51	9.31				20-150%	134.5%	
	M8PFOA		5055.48	6.99				20-150%	101.1%	
	M9PFNA		4142.84	5.73				20-150%	82.9%	
	M8PFOS		6955.06	9.62				20-150%	139.1%	
	M2-8:2 FTS		5807.28	8.03				20-150%	116.1%	
	M8FOSA-I		6302.20	8.72				20-150%	126.0%	
	M6PFDA		5415.97	7.49				20-150%	108.3%	
	d3-N-MeFOSAA		6461.93	8.94				20-150%	129.2%	
	d5-N-EtFOSAA		6019.51	8.33				20-150%	120.4%	
	M7PFUdA		5292.03	7.32				20-150%	105.8%	
	MPFDoA		5398.27	7.47				20-150%	108.0%	
	M2PFTeDA		4911.35	6.79				20-150%	98.2%	
	d3-N-MeFOSA		2471.07	3.42				10-200%	24.7%	
	d5-N-EtFOSA		2592.38	3.59				10-200%	25.9%	
	d7-N-MeFOSE		9187.13	12.7				10-200%	91.9%	
	d9-N-EtFOSE		8630.34	11.9				10-200%	86.3%	

QC Data

ENTHALPY ANALYTICAL

Enthalpy Analytical

Job No.: 1222-775-1 PFAS by Isotope Dilution (non-potable water)
Brunswick County Public Utilities - NC Client Project: N/A Site: Northwest Water Plant

Enthalpy ID	MB-14504-PFAS	Prep Batch	EU14504	Sample Vol (mL)	250
Sample Name	MB-14504-PFAS	Prep Date	2022-12-22 12:00	Extract Vol (mL)	0.4
Matrix	aqueous	Analysis Date	12/22/2022 8:16:53 PM	Split Factor	N/A
Sampling Date		Analyst	wicleve	Method Code	WM-026
Received Date		Instrument	Pippin	Sample Type	Blank

	Compound	CAS	Extract Concentration ng/L	Sample Concentration ng/L	Formatted Result ng/L	LOD ng/L	LOQ ng/L	Recovery Limits	Recovery	Flags
Acids	PFBA	375-22-4	ND	ND	ND	0.153	0.640			U
	PFPeA	2706-90-3	ND	ND	ND	0.170	0.640			U
	PFHxA	307-24-4	ND	ND	ND	0.193	0.640			U
	PFHpA	375-85-9	ND	ND	ND	0.122	0.640			U
	PFOA	335-67-1	ND	ND	ND	0.177	0.640			U
	PFNA	375-95-1	ND	ND	ND	0.0761	0.640			U
	PFDA	335-76-2	ND	ND	ND	0.0845	0.640			U
	PFUnDA	2058-94-8	ND	ND	ND	0.185	0.640			U
	PFDoDA	307-55-1	ND	ND	ND	0.202	0.640			U
	PFTrDA	72629-94-8	ND	ND	ND	0.151	0.640			U
	PFTeDA	376-06-7	ND	ND	ND	0.218	0.640			U
Sulfonates	PFBS	375-73-5	ND	ND	ND	0.355	0.747			U
	PFPeS	2706-91-4	ND	ND	ND	0.206	0.603			U
	PFHxS	355-46-4	ND	ND	ND	0.191	0.586			U
	PFHpS	375-92-8	ND	ND	ND	0.135	0.610			U
	PFOS	1763-23-1	ND	ND	ND	0.160	0.593			U
	PFNS	68259-12-1	ND	ND	ND	0.0864	0.616			U
	PFDS	335-77-3	ND	ND	ND	0.192	0.616			U
	4:2 FTS	757124-72-4	ND	ND	ND	0.118	0.600			U
	6:2 FTS	27619-97-2	ND	ND	ND	0.116	0.610			U
	8:2 FTS	39108-34-4	ND	ND	ND	0.171	0.613			U
Other	PFOSA	754-91-6	ND	ND	ND	0.130	0.640			U
	N-MeFOSAA	2355-31-9	ND	ND	ND	0.144	0.640			U
	N-EtFOSAA	2991-50-6	136.20	0.218	0.218	0.109	0.640			J
	HFPO-DA	13252-13-6	ND	ND	ND	0.228	0.640			U
	PFMOAA	674-13-5	ND	ND	ND	1.44	1.44			U
	PFMOPrA	377-73-1	ND	ND	ND	0.240	0.640			U
	PFO2HxA	39492-88-1	ND	ND	ND	1.44	1.44			U
	PFO3OA	39492-89-2	ND	ND	ND	1.44	1.44			U
	PFO4DA	39492-90-5	ND	ND	ND	1.52	1.52			U
	Nafion Byproduct 1	29311-67-9	ND	ND	ND	0.304	0.640			U
	ADONA	919005-14-4	ND	ND	ND	0.120	0.606			U
	9Cl-PF3ONS	756426-58-1	ND	ND	ND	0.120	0.596			U
	11Cl-PF3OUdS	763051-92-9	ND	ND	ND	0.120	0.603			U
	10:2 FTS	120226-60-0	ND	ND	ND	0.240	0.640			U
	EVE Acid	69087-46-3	ND	ND	ND	1.44	1.44			U
	FBSA	30334-69-1	ND	ND	ND	0.240	0.640			U
	Hydro-EVE Acid	773804-62-9	ND	ND	ND	1.44	1.44			U
	Hydrolyzed PSDA	2416366-19-1	ND	ND	ND	1.44	1.44			U
	Nafion Byproduct 2	749836-20-2	ND	ND	ND	0.304	0.640			U
	N-EtFOSA	4151-50-2	ND	ND	ND	0.240	0.640			U
	N-EtFOSE	1691-99-2	ND	ND	ND	7.20	7.20			U
	NFDHA	151772-58-6	ND	ND	ND	0.240	0.640			U
	N-MeFOSA	31506-32-8	ND	ND	ND	0.240	0.640			U
	N-MeFOSE	24448-09-7	ND	ND	ND	7.20	7.20			U
	NVHOS	1132933-86-8	ND	ND	ND	1.44	1.44			U
	PEPA	267239-61-2	ND	ND	ND	1.44	1.44			U
	PFECA-G	801212-59-9	ND	ND	ND	0.304	1.44			U
	PFEESA	113507-82-7	ND	ND	ND	0.240	0.640			U
	PFHxDA	67905-19-5	ND	ND	ND	1.44	1.44			U
	PFMOBA	863090-89-5	ND	ND	ND	1.44	1.44			U
	PFO5DA	39492-91-6	ND	ND	ND	1.52	1.52			U
	PMPA	13140-29-9	ND	ND	ND	1.44	1.44			U
	R-EVE	2416366-22-6	ND	ND	ND	1.44	1.44			U
	R-PSDA	2416366-18-0	ND	ND	ND	1.44	1.44			U
	R-PSDCA	241636-21-5	ND	ND	ND	1.44	1.44			U
ES	MPFBA		4051.62	6.48				20-150%	81.0%	
	M5PFPeA		4449.59	7.12				20-150%	89.0%	
	M3PFBS		3506.35	5.61				20-150%	70.1%	
	M2-4:2 FTS		5066.99	8.11				20-150%	101.3%	
	M5PFHxA		3730.57	5.97				20-150%	74.6%	
	M3HFPO-DA		4472.74	7.16				20-150%	89.5%	
	M4PFHpA		4109.96	6.58				20-150%	82.2%	
	M3PFHxS		3974.86	6.36				20-150%	79.5%	
	M2-6:2 FTS		3942.63	6.31				20-150%	78.9%	
	M8PFOA		4242.86	6.79				20-150%	84.9%	
	M9PFNA		3414.40	5.46				20-150%	68.3%	
	M8PFOS		3940.28	6.30				20-150%	78.8%	
	M2-8:2 FTS		4052.08	6.48				20-150%	81.0%	
	M8FOSA-I		3767.34	6.03				20-150%	75.3%	
	M6PFDA		4175.71	6.68				20-150%	83.5%	
	d3-N-MeFOSAA		3861.56	6.18				20-150%	77.2%	
	d5-N-EtFOSAA		3495.37	5.59				20-150%	69.9%	
	M7PFUdA		4556.10	7.29				20-150%	91.1%	
	MPFDoA		4128.69	6.61				20-150%	82.6%	
	M2PFTeDA		3404.76	5.45				20-150%	68.1%	
	d3-N-MeFOSA		2536.31	4.06				10-200%	25.4%	
	d5-N-EtFOSA		2578.02	4.12				10-200%	25.8%	
	d7-N-MeFOSE		6494.37	10.4				10-200%	64.9%	
	d9-N-EtFOSE		6356.38	10.2				10-200%	63.6%	

Enthalpy Analytical

Job No.: 1222-775-1 PFAS by Isotope Dilution (non-potable water)

Brunswick County Public Utilities - NC Client Project: N/A Site: Northwest Water Plant

Enthalpy ID	OPR-14504-PFAS	Prep Batch	EU14504	Sample Vol (mL)	250
Sample Name	OPR-14504-PFAS	Prep Date	2022-12-22 12:00	Extract Vol (mL)	0.4
Matrix	aqueous	Analysis Date	12/22/2022 8:39:29 PM	Split Factor	N/A
Sampling Date		Analyst	wicleve	Method Code	WM-026
Received Date		Instrument	Pippin	Sample Type	Control

	Compound	CAS	Extract Concentration ng/L	Sample Concentration ng/L	Formatted Result ng/L	LOD ng/L	LOQ ng/L	Recovery Limits	Recovery	Flags
Acids	PFBA	375-22-4	10886.88	17.4	17.4	0.153	0.640	73-129%	87.1%	
	PFPeA	2706-90-3	10903.74	17.4	17.4	0.170	0.640	72-129%	87.2%	
	PFHxA	307-24-4	11299.98	18.1	18.1	0.193	0.640	72-129%	90.4%	
	PFHpA	375-85-9	9583.16	15.3	15.3	0.122	0.640	72-130%	76.7%	
	PFOA	335-67-1	10614.15	17.0	17.0	0.177	0.640	71-133%	84.9%	
	PFNA	375-95-1	11501.40	18.4	18.4	0.0761	0.640	69-130%	92.0%	
	PFDA	335-76-2	10672.87	17.1	17.1	0.0845	0.640	71-129%	85.4%	
	PFUnDA	2058-94-8	10484.61	16.8	16.8	0.185	0.640	69-133%	83.9%	
	PFDoDA	307-55-1	9482.68	15.2	15.2	0.202	0.640	72-134%	75.9%	
	PFTrDA	72629-94-8	12913.36	20.7	20.7	0.151	0.640	65-144%	103.3%	
	PFTeDA	376-06-7	9710.51	15.5	15.5	0.218	0.640	71-132%	77.7%	
Sulfonates	PFBS	375-73-5	8403.42	13.4	13.4	0.355	0.747	72-134%	75.8%	
	PFPeS	2706-91-4	9509.94	15.2	15.2	0.206	0.603	71-127%	80.8%	
	PFHxS	355-46-4	8562.51	13.7	13.7	0.191	0.586	68-131%	74.9%	
	PFHpS	375-92-8	10172.83	16.3	16.3	0.135	0.610	69-134%	85.4%	
	PFOS	1763-23-1	9861.14	15.8	15.8	0.160	0.593	65-140%	85.0%	
	PFNS	68259-12-1	9807.05	15.7	15.7	0.0864	0.616	69-127%	81.6%	
	PFDS	335-77-3	9162.07	14.7	14.7	0.192	0.616	53-142%	76.0%	
	4:2 FTS	757124-72-4	10040.97	16.1	16.1	0.118	0.600	63-143%	85.7%	
	6:2 FTS	27619-97-2	8927.66	14.3	14.3	0.116	0.610	64-140%	75.1%	
	8:2 FTS	39108-34-4	7661.71	12.3	12.3	0.171	0.613	67-138%	63.8%	Q
Other	PFOSA	754-91-6	9193.15	14.7	14.7	0.130	0.640	67-137%	73.5%	
	N-MeFOSAA	2355-31-9	11357.32	18.2	18.2	0.144	0.640	65-136%	90.9%	
	N-EtFOSAA	2991-50-6	11635.22	18.6	18.6	0.109	0.640	61-135%	93.1%	
	HFPO-DA	13252-13-6	9974.66	16.0	16.0	0.228	0.640	70-130%	79.8%	
ES	MPFBA		4986.29	7.98				20-150%	99.7%	
	M5PFPeA		4405.82	7.05				20-150%	88.1%	
	M3PFBS		4621.66	7.39				20-150%	92.4%	
	M2-4:2 FTS		5519.30	8.83				20-150%	110.4%	
	M5PFHxA		4757.24	7.61				20-150%	95.1%	
	M3HFPO-DA		5666.15	9.07				20-150%	113.3%	
	M4PFHpA		5126.95	8.20				20-150%	102.5%	
	M3PFHxS		5474.27	8.76				20-150%	109.5%	
	M2-6:2 FTS		5264.23	8.42				20-150%	105.3%	
	M8PFOA		4858.47	7.77				20-150%	97.2%	
	M9PFNA		4090.73	6.55				20-150%	81.8%	
	M8PFOS		4800.25	7.68				20-150%	96.0%	
	M2-8:2 FTS		4477.29	7.16				20-150%	89.5%	
	M8FOSA-I		4569.36	7.31				20-150%	91.4%	
	M6PFDA		4520.14	7.23				20-150%	90.4%	
	d3-N-MeFOSAA		4693.03	7.51				20-150%	93.9%	
	d5-N-EtFOSAA		4451.02	7.12				20-150%	89.0%	
	M7PFUdA		4452.94	7.12				20-150%	89.1%	
	MPFDoA		4836.65	7.74				20-150%	96.7%	
	M2PFTeDA		2987.23	4.78				20-150%	59.7%	

Narrative Summary

Enthalpy Analytical Narrative Summary

Company	Brunswick County Public Utilities - NC
Job No.	1222-775-1 PFAS by Isotope Dilution (non-potable water)
Client ID.	N/A Site: Northwest Water Plant Leland, N.C

1. Custody

Josie Morton received the samples on December 22, 2022 at 4.7 °C after being relinquished by Brunswick County Public Utilities - NC. The samples were received in good condition.

Prior to, during, and after analysis, the samples were kept under lock with access only to authorized personnel by Enthalpy Analytical, LLC.

Table 1 - Sample Inventory

EU Lab Sample ID	Client Sample ID	Matrix
1222-775-001-1	122222-SO1	AQ
1222-775-002-1	122222-EO1	AQ

2. Methods and Analytes

A list of analytes of interest and corresponding methods of analysis is shown in Table 3. Abbreviations are defined in the listed Appendices.

Table 3 - Methods and Analytes

EU Method	Analytes	Cleanup Method
EU-047	Brunswick PFAS List	ENVI-Carb

3. Analysis

The samples were analyzed using Waters Acquity UPLC equipped with Xevo TQ MS (LC/MS/MS "Pippin").

For aqueous samples, the sample volume was measured gravimetrically by the laboratory, and spiked with Extraction Standard (ES). The sample was then mixed well and centrifuged, if needed. The samples were then extracted via SPE, and the extracts were cleaned up using ENVI-Carb.

Each final sample extract was transferred to an autosampler vial, spiked with Injection Standard (IS), and brought to a final volume of 400µL prior to analysis.

4. Calibration

In the initial calibration, the reported analytes exhibited R^2 of ≥ 0.99. The reported analytes in the calibration standards, continuing calibration (concal) and Initial Calibration Verification (ICV) met the 30% accuracy criterion for native analytes.

5. QC Notes

Except where noted below, the QC sample analyses passed all method criteria.

Enthalpy Analytical Narrative Summary

Company	Brunswick County Public Utilities - NC
Job No.	1222-775-1 PFAS by Isotope Dilution (non-potable water)
Client ID.	N/A Site: Northwest Water Plant Leland, N.C

OPR-14504-PFAS 8:2 FTS fell below method recovery limits but met SOP minimum recovery criteria for reporting. The analyte was not detected in the samples; therefore, the data is reportable without adverse impact.

The samples were extracted within the 28-day from collection holding time and analyzed within the 28-day from extraction to analysis holding time required by the method.

6. Reporting Notes

Due to acquisition requirements for analytes requested, the sample was analyzed in more than one sequence.

Analyte(s) were detected in the method blank (MB) at less than 1/2 LOQ. Any of these analyte(s) detected in the samples with less than 10 times the amount detected in MB were notated with a B qualifier and are reported with no adverse impact.

Some labeled extraction standards in the sample analyses fell outside the control limits for ES recovery, as denoted by the "Q" qualifier. The target analytes are quantified based on their ratio to their labeled standard analogs. As a result, low or high labeled standard recovery do not cause any change to ratios or contribute any additional error in the measurement of the target analytes. When detected at a signal-to-noise above 10:1 the ES peak area is used to quantify its respective target analyte using accepted isotope dilution principles. The data is reported without adverse impact.

Manual integrations were performed on analytes in the ICAL, controls, and samples to correct baseline-to-baseline integration as well as integrate all isomers for compounds that have both linear and branched isomers.

The results presented in this report are representative of the samples as provided to the laboratory.

These analyses met the requirements of the TNI Standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

Enthalpy Analytical, LLC in Wilmington NC is accredited by the Louisiana Department of Environmental Quality to the 2009 TNI Standard under certificate number 05075.

General Reporting Notes – Data Qualifiers

The following are general reporting notes that are applicable to all Enthalpy Analytical, LLC - Wilmington, NC data reports, unless specifically noted otherwise.

General Data Qualifiers

- B – The analyte was found in the method blank, at a concentration that was at least 10% of the amount in the sample.
- Cxx – Two or more congeners co-elute. In EDDs, C denotes the lowest IUPAC congener in a co-elution group and additional co-eluters for the group ('xx') are shown with the number of the lowest IUPAC co-eluter.
- E – The reported concentration exceeds the calibration range (upper point of the calibration curve). For HRMS data, this condition does not imply additional measurement uncertainty. For LC-MS/MS data, these values should be considered as having measurement uncertainty higher than values within the calibration range.
- EDL – Estimated Detection Level: The EDL is unique to isotope dilution methods and reflects the conditions of analysis at the time of analysis, including the equipment used. Where the MDL is a static value, the EDL is a dynamic value.
- EMPC – Estimated Maximum Possible Concentration: EMPC is specific to Dioxin/Furan tests to indicate the determined ion-abundance ratio was outside the allowed theoretical range (usually due to being near the detection limit, although it can very rarely be caused by a co-eluting interference). The EMPC concentration is adjusted to reflect the value at the theoretical ion-abundance ratio.
- IR – The ion ratio between the primary and secondary ions was observed to be outside the method criteria. The analyte concentration may be inaccurate due to interference.
- J – The analyte has a concentration below the minimum calibration level (LOQ value) but greater than the LOD. These values should be considered as having measurement uncertainty higher than values within the calibration range
- L - Indicates that an analyte has a concentration below the Minimum Detection Limit (MDL). The reported concentration is not recommended for regulatory use as the analyte signal may have a signal-to-noise ratio less than the criteria deemed necessary to be considered a detected analyte.
- LOD – Limit of Detection: For reports conforming to the DOD ELAP QSM, this is the QSM-defined LOD. For reports conforming to TNI requirements (but not DOD ELAP QSM requirements), this value is the minimum detection limit (MDL). The LOD is adjusted for sample weight or volume.
- LOQ – Limit of Quantitation: For reports conforming to the DOD ELAP QSM, this is the QSM-defined LOQ. For reports conforming to TNI requirements (but not DOD ELAP QSM requirements), this value is the reporting limit (RL). The LOQ is adjusted for sample weight or volume.

General Reporting Notes – Data Qualifiers

- <LOD() – Analyte was not found at a concentration high enough to be reported as detected. It is reported as less than the LOD, and the LOD is given in the parentheses.
- <LOQ() – Analyte was not found at a concentration high enough to be reported as above the QSM-defined LOQ or TNI defined Reporting Limit. It is reported as less than the LOQ, and the LOQ is given in the parentheses.
- ND – Indicates a non-detect.
- NR – Indicates a value that is not reportable due to issues observed in sample preparation or analysis.
- PR – The associated congener(s) is(are) poorly resolved.
- QI – Indicates the presence of a quantitative interference.
- RL – Reporting Limit. Lowest reportable value. The level is higher than the MDL.
- SI – Denotes "Single Ion Mode" and is utilized for PCBs where the secondary ion trace has a significantly elevated noise level due to background PFK. Responses for such peaks are calculated using an EMPC approach based solely on the primary ion area(s) and may be considered estimates.
- U – The analyte was not detected.
- V / Q – The labeled standard recovery is not within method control limits.
- X – Indicates the result is from re-injection/repeat/second-column analysis.

Lab Identifiers/ Data Attributes

- AR – Indicates use of the archived portion of the sample extract.
- CU – Indicates a sample that required additional clean-up prior to HRMS injection/processing.
- D – Dilution Data. Result was obtained from the analysis of a dilution. The number that follows the "D" indicates the dilution factor.
- DE – Indicates a dilution performed with the addition of ES (Extraction Standard) solution.
- DUP – Designation for a duplicate sample.
- MS – Designation for a matrix spike.
- MSD – Designation for a matrix spike duplicate.
- R – Indicates a re-extraction of the sample.
- RJ – Indicates a reinjection of the sample extract.

- S – Indicates a sample split. The number that follows the "S" indicates the split factor.
- SAT – Indicates an analyte saturated the detector.

PFAS Compound Acronym List		
Acronym	CAS #	Compound Name
Target Analytes		
* Analyte is not accredited		
PFBA	375-22-4	Perfluorobutanoic Acid
PFPeA	2706-90-3	Perfluoropentanoic Acid
PFHxA	307-24-4	Perfluorohexanoic Acid
PFHpA	375-85-9	Perfluoroheptanoic Acid
PFOA	335-67-1	Perfluorooctanoic Acid
PFNA	375-95-1	Perfluorononanoic Acid
PFDA	335-76-2	Perfluorodecanoic acid
PFUnA (PFUnDA)	2058-94-8	Perfluoroundecanoic acid
PFDoA (PFDoDA)	307-55-1	Perfluorododecanoic acid
PFTrDA (PFTriA)	72629-94-8	Perfluorotridecanoic acid
PFTeDA (PFTA)	376-06-7	Perfluorotetradecanoic acid
PFBS	375-73-5	Perfluorobutane sulfonic acid
PFPeS	2706-91-4	Perfluoropentane sulfonic acid
PFHxS	355-46-4	Perfluorohexane sulfonic acid
PFHpS	375-92-8	Perfluoroheptane sulfonic acid
PFOS	1763-23-1	Perfluorooctane sulfonic acid
PFNS	68259-12-1	Perfluorononane sulfonic acid
PFDS	335-77-3	Perfluorodecane sulfonic acid
4:2 FTS	757124-72-4	4:2 fluorotelomer sulfonic acid
6:2 FTS	27619-97-2	6:2 fluorotelomer sulfonic acid
8:2 FTS	39108-34-4	8:2 fluorotelomer sulfonic acid
PFOSA (FOSA)	754-91-6	Perfluorooctane sulfonamide
N-MeFOSAA	2355-31-9	N-methyl perfluorooctane sulfonamido acetic acid
N-EtFOSAA	2991-50-6	N-ethyl perfluorooctane sulfonamido acetic acid
HFPO-DA	13252-13-6	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (Gen-X)
11Cl-PF3OUdS	763051-92-9	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid
9Cl-PF3ONS	756426-58-1	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid
ADONA	919005-14-4	4,8-dioxa-3H-perfluorononanoic acid
PFEESA	113507-82-7	Perfluoro(2-ethoxyethane)sulphonic acid
PFMOBA (PFMBA)	863090-89-5	Perfluoro-4-methoxybutanic acid
NFDHA	151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid
PFMOPrA (PFMPA)	377-73-1	Perfluoro-3-methoxypropanoic acid
* PFMOAA	674-13-5	Perfluoro-2-methoxyacetic acid
* PFO2HxA	39492-88-1	Perfluoro (3,5-dioxahexanoic) acid
* PFO3OA	39492-89-2	Perfluoro (3,5,7-trioxaoctanoic) acid
* PFO4DA	39492-90-5	Perfluoro (3,5,7,9-tetraoxadecanoic) acid
* PFO5DA	39492-91-6	Perfluoro(3,5,7,9,11-pentaoxadodecanoic) acid
* Nafion Byproduct 1	29311-67-9	Nafion Byproduct 1
* Nafion Byproduct 2	749836-20-2	Nafion Byproduct 2
* PEPA	267239-61-2	Perfluoro-2-ethoxypropanoic acid
* PMPA	13140-29-9	Perfluoro-2-methoxypropanoic acid
* 10:2 FTS	120226-60-0	Fluorotelomer sulfonate 10:2
* N-EtFOSA	4151-50-2	N-ethylperfluoro-1-octanesulfonamide
* N-EtFOSE	1691-99-2	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
* N-MeFOSA	31506-32-8	N-methylperfluoro-1-octanesulfonamide
* N-MeFOSE	24448-09-7	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
* PFECA-G	801212-59-9	4-(Heptafluoroisopropoxy)hexafluorobutanoic acid
* PFHxDA	67905-19-5	Perfluorohexadecanoic acid
* R-PSDA (Nafion Byproduct 4)	2416366-18-0	Perfluoro-4-(2-sulfoethoxy)pentanoic acid

	PFAS Compound Acronym List		
	Acronym	**CAS #**	**Compound Name**
	Target Analytes		
	*** Analyte is not accredited**		
*	Hydrolyzed PSDA (Nafion Byproduct 5)	2416366-19-1	2-fluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2-tetrafluoro-2-sulfoethoxy)propoxy]-acetic acid
*	R-PSDCA (Nafion Byproduct 6)	2416366-21-5	1,1,2,2-tetrafluoro-2-[1,2,2,3,3-pentafluoro-1-(trifluoromethyl)propoxy] ethanesulfonic acid
*	EVE Acid	69087-46-3	2,2,3,3-tetrafluoro-3-({1,1,1,2,3,3-hexafluoro-3-[(1,2,2-trifluoroethenyl)oxy]propan-2-yl}oxy)propionic acid
*	FBSA	30334-69-1	Perfluorobutylsulfonamide
*	Hydro-EVE Acid	773804-62-9	2,2,3,3-Tetrafluoro-3-{[1,1,1,2,3,3-hexafluoro-3-(1,2,2,2-tetrafluoroethoxy)propan-2-yl]oxy}propanoic acid
*	R-EVE Acid	2416366-22-6	4-(2-carboxy-1,1,2,2-tetrafluoroethoxy)-2,2,3,3,4,5,5,5-octafluoro-pentanoic acid
*	NVHOS	1132933-86-8	Perfluoroethoxysulfonic acid
*	PFDoS	79780-39-5	Perfluorododecane sulfonic acid
*	PFODA	16517-11-6	Perfluorooctadecanoic acid
*	3:3 FTCA	356-02-5	2H,2H,3H,3H-Perfluorohexanoic acid
*	5:3 FTCA	914637-49-3	2H,2H,3H,3H-Perfluorooctanoic acid
*	7:3 FTCA	812-70-4	2H,2H,3H,3H-Perfluorodecanoic acid
*	N-AP-FHxSA	50598-28-2	N-(3-(Dimethylamino)propyl)tridecafluoro-1-hexanesulfonamide
*	N-CMAmP-6:2 FOSA	34455-29-3	N-(Carboxymethyl)-N,N-dimethyl-3-(((3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluorooctyl)sulfonyl)amino)1-propanaminium

Sample Custody

Chain of Custody Record

ENTHALPY analytical

1222-775

Enthalpy Ultratrace Job#: _____ COC Page__1__of__1__

Special Handling:

X Standard Turn Around Time

☐ Rush Turn Around Time -- Date Needed_____

• All Fast TATs Subject to Approval by Enthalpy Analytical, Inc.

• All Samples Disposed of After 6 months Unless Otherwise Instructed.

Enthalpy Analytical-Wilmington, NC has added enhancements to standard methods to improve accuracy, precision and permit an assessment of laboratory performance in the context of your specific data needs. For more information email Cindy.James@enthalpy.com.

Client Name:__BRUNSWICK COUNTY UTILITIES_____

Project Manager:_GLENN WALKER_____

Report To:__SAME_____

Project Number:_____

Site Name:_NORTHWEST WATER PLANT_____

Location:_LELAND N.C._____

PO#:_____

Telephone#:_____

Email:_____

This Chain of Custody is applicable to Non-Air samples. Standard TAT differ per analysis and are provided by request.

Client Special Instructions:

Matrix: GW-Groundwater, WW-Wastewater, NW-Non-Potable Water, DW-Drinking Water, S-Soil, SL-Sludge, BT-Biological Tissue, O-Other

Type: G=Grab C=Composite Q=Quality Control

Sample ID	Date	Time	Sample Volume	Type	Matrix	Sample Containers: # of Bottles	# of Jars	# of Bags	# Other	Analyses: Method 1613	Method 8290	Method 1668A/B/C PCB	PFAS by LC/MS/MS	PAHs by HRGC/HRMS	Sample on Hold	Method 23	ALL PFAS	Notes:
122222-SO1	12/22/2022	0930AM	250 ml	G	NW	2											X	
122222-EO1	12/22/2022	0930AM	250 ml	G	DW	2											X	

courier, cooler, on ice, no seals, good condition
jmm 12-22-22

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Temperature Upon Receipt:
BILLY BENTON	12/22/2022	Josie Moton	12-22-22	1012	☒ Iced ☐ Ambient °C 4.7 TI
					☐ Iced ☐ Ambient °C_____
					☐ Iced ☐ Ambient °C_____

2714 Exchange Drive • Wilmington, NC 28405 • (910) 212-5858 • www.enthalpy.com

This Is The Last Page Of This Report.