NC Division of Water Resources
Water Sciences Section

July 26, 2021

Memorandum

To: Danny Smith – Water Resources Director

CC: Julie Grzyb

From: Sean Buczek

Through: Eric Morris

Subject: Identification of Select Emerging Compounds in Public Water Supply Reservoirs of the Neuse River Basin.

Purpose: The objective of this study is to provide the NC Division of Water Resources with baseline information on the presence of per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane in public drinking water supply reservoirs in the Neuse River Basin. Specifically, this includes collection, testing, and analysis of water samples taken from public drinking water supply reservoirs to identify levels of the aforementioned emerging compounds.

Identification of Select Emerging Compounds in Public Water Supply Reservoirs of the Neuse River Basin

Neuse River Basin

HUC: 03020201, 03020203

North Carolina Department of Environmental Quality

Division of Water Resources

Water Sciences Section

Intensive Survey Branch

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Introduction

In response to the rising interest in the public health effects associated with per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane in drinking water sources, the Intensive Survey Branch (ISB) conducted a special study alongside our Ambient Lakes Monitoring Program to characterize the presence and concentrations of these emerging compounds (EC) in public drinking water supply reservoirs of the Neuse River basin. Beginning in May of 2020, ISB staff collected surface water samples for 1,4-dioxane and 28 different per- and polyfluoroalkyl substances at ambient lakes monitoring stations nearest to the surface water intake of ten public water supply reservoirs in the Neuse River basin. Analytical results indicated the presence of at least one PFAS analyte above the laboratory practical quantitation limit (PQL [2 ng/L]) in each waterbody during the 2020 sampling season. All 1, 4-dioxane samples collected during this study period were below the PQL (1.0 µg/L). It is important to note that all analytical data presented in this document reflect levels of target analytes detected in untreated surface waters, as opposed to finished drinking water.

Background

This study follows a previous survey conducted by ISB in 2018 evaluating the presence of PFAS and 1,4-dioxane in public water supply reservoirs in the Cape Fear, New, and Watauga River Basins[1], which highlighted the ubiquitous distribution of these emerging compounds. PFAS and 1,4-dioxane were selected as compounds of interest for this study in response to the rising interest in the public health effects of consumption of these compounds in drinking water sources. In 2020, the Division of Water Resources (DWR) expansion of the Organic Chemistry Branch to include the capability of analyzing PFAS allowed for increased analytical capacity. Samples from the selected locations (Table 1 & Figure 1) were collected monthly from May to September 2020.

1,4-dioxane is a synthetic industrial organic compound that is completely miscible in water. It is persistent in the environment and is difficult to remove through standard water and wastewater treatment processes[2]. 1,4-dioxane is used as an industrial solvent and is formed as a byproduct of some industrial processes. The compound has been characterized as “likely to be carcinogenic to humans” and is identified in the Third Unregulated Contaminant Monitoring Rule (UCMR) as a potential compound of concern in public drinking water by the United States Environmental Protection Agency (USEPA)[3]. The 1,4-dioxane NC Protective Value for Surface Waters Fresh Water, Water Supply (Class WS I-IV) is 0.35 µg/L[4]. Please note that North Carolina protective values are health-based guidelines, not regulatory limits, and may be based on limited toxicological information.

Per- and Polyfluorinated Alkyl Substances (PFAS) are a class of synthetic chemicals used in the production of a wide variety of manufactured goods. These compounds are composed of fluorinated carbon chains that readily transport in the environment and are highly resistant to degradation. There are many different possible sources of PFAS contamination in surface water, including industrial and consumer derived waste. PFAS are used in various consumer products including non-stick cookware, water-repellent clothing, stain resistant fabrics, cosmetics, food packaging materials, and fire-retardant foams. Although 28 PFAS compounds were the focus of this study, thousands of PFAS compounds exist. Of these compounds, PFOA and PFOS have been the most extensively produced and studied. The USEPA has stated that exposure to PFAS can lead to adverse health effects in humans[5]. Though many companies have significantly decreased or ceased use of PFOA and PFOS in manufacturing, other PFAS compounds are currently being used as replacements. The USEPA established health advisory level for PFOA, PFOS, or combined PFOA and PFOS, is 70 ppt (ng/L)[6] in finished drinking water. Health Advisory levels identify the concentration of a compound in drinking water below which adverse health effects in the most sensitive populations are not anticipated to occur over specific exposure durations. A health advisory value is not a legally enforceable federal standard and is subject to change as additional information becomes available. The 28 PFAS compounds selected for this study are abbreviated throughout this document for better readability but are identified more fully in Appendix 1.

Methods

Selected sites were sampled in conjunction with regularly scheduled sampling events as part of ALMP monitoring. Samples were collected in accordance with ISB's *Standard Operating Procedures Manual: Physical and Chemical Monitoring v2.1, Dec. 2014*[7] and *Ambient Lakes Quality Assurance Project Plan v2.0, March 2014*[8], as well as ISB's Draft *Standard Operating Procedures Manual: Per- and Polyfluorinated Alkyl Substances (PFAS) - Field Collection Method*. Physical parameters were collected at surface (0.15 m) using an In-Situ multiparameter hydrosonde. Chemical samples were collected as surface grab samples. All PFAS and 1,4- dioxane samples were analyzed by the DWR central laboratory in Raleigh, NC. Appropriate QA/QC samples were collected during each sampling event including trip blanks, field blanks, duplicates, matrix spikes and matrix spike duplicates. Guidance on acceptable supplies, equipment, and personal care products is provided within the ISB Draft *Standard Operating Procedures Manual: Per- and Polyfluorinated Alkyl Substances (PFAS) - Field Collection Method*. Physical and chemical parameters collected are shown below in Table 2.

Lake Name	Station	Station Description	Latitude	Longitude
CORPORATION LAKE	NEU00C1	CORPORATION LAKE NEAR DAM NEAR EFLAND NC	36.08487	-79.14157
FALLS RESERVOIR	NEU020D	FALLS OF THE NEUSE RESERVOIR AT MARKER #1	35.95591	-78.58444
LAKE BEN JOHNSON	NEU00D	LAKE BEN JOHNSON AT DAM NEAR SR 1144	36.07111	-79.13089
LAKE BENSON	NEU055A4	LAKE BENSON AT LOWER END NEAR GARNER NC	35.66568	-78.62462
LAKE BUTNER	NEU007B	LAKE BUTNER NEAR DAM	36.16902	-78.7722
LAKE MICHIE	NEU0061L	LAKE MICHIE NR SR 1622 NR BAHAMA NC	36.158	-78.828
LAKE ROGERS	NEU017A	LAKE ROGERS NEAR DAM NEAR CREEDMOOR NC	36.13084	-78.70383
LITTLE RIVER RESERVOIR	NEU006U	LITTLE RIVER RESERVOIR NEAR DAM	36.11229	-78.87
TOISNOT RESERVOIR	NEU096E	TOISNOT RESERVOIR NEAR DAM NEAR NC 58	35.74476	-77.90246
WIGGINS MILL RESERVOIR	NEU084F	WIGGINS MILL RESERVOUR US DAM	35.688312	-77.94941

Table 1. *Station ID, description, and coordinates of sampled sites*

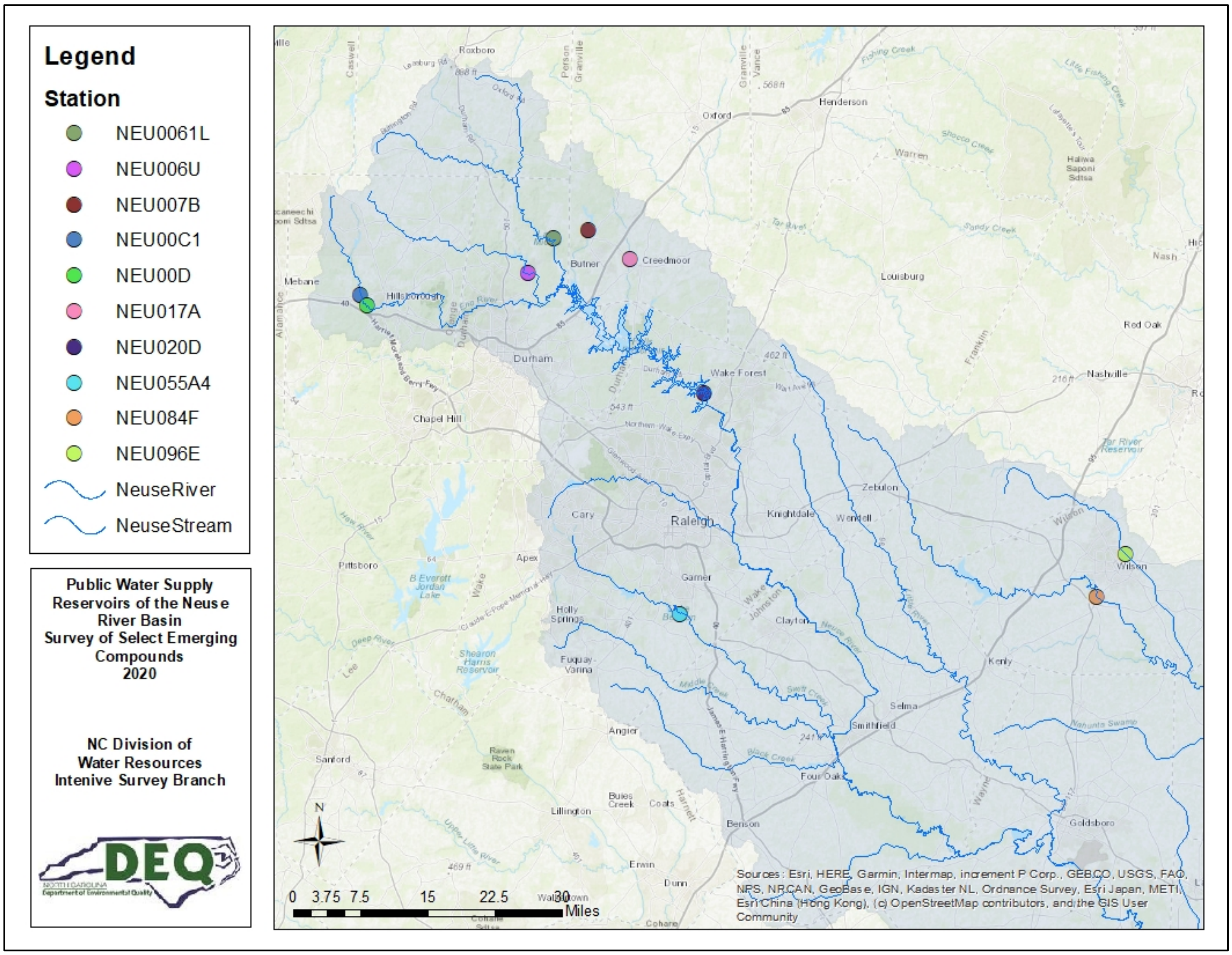


Figure 1. *Neuse River Basin EC monitoring locations*

Physical Parameters	Chemical Parameters (ng/L unless otherwise noted)		
Temperature (°C) pH (s.u.) Dissolved Oxygen (mg/L) Conductivity (µS/cm) Secchi Depth (m)	4:2FTS 6:2FTS 8:2FTS ADONA I HFPO-DA N-EtFOSAA N-MeFOSAA PFBA PFBS 11Cl-PFOUdS	PFDA PFDoA PFDS PFHpA PFHpS PFHxA PFHxS PFNA PFNS PFOA	PFOS PFPeA PFPeS PFTeDA PFTrDA PFUnA PFUdA 9Cl-PF3ONS 1,4-Dioxane (µg/L)

Table 2. *Summary of physical and chemical parameters collected. See Appendix I for a detailed list of PFAS chemical parameters*

Results

Physical Results

Physical water quality conditions remained within North Carolina 15A NCAC 02B Water Quality Standards for Surface Waters[4] standards throughout the duration of the study, with few exceptions. Sites NEU0061L, NEU017A, and NEU020D experienced elevated pH values (9.4, 9.1, and 9.1 s.u., respectively) during the 2020 season. Exceedances to the narrative temperature standard (32°C) for lower piedmont waters were also recorded at NEU0061L and NEU020D. See Table 3 for complete list of ranges of values for each physical parameter for all monitored sites.

Station	DO (mg/L)	Temp (°C)	pH (s.u.)	Cond (µS/cm)	Secchi Depth (m)
NEU00C1	7.6 (5.8-9.0)	20.9 (17.9-25.0)	7.1 (6.6-7.3)	70 (63-84)	0.5 (0.4-0.6)
NEU00D	7.2 (4.8-8.6)	22.9 (18.5-29.0)	7.3 (7.0-7.6)	79 (72-91)	0.7 (0.5-0.9)
NEU006U	8.4 (5.9-11.7)	27.1 (23.0-30.5)	7.4 (7.1-7.9)	66 (61-70)	1.1 (0.7-1.3)
NEU0061L	9.5 (7.5-12.8)	26.0 (21.2-**32.8**)	8.1 (7.0-**9.4**)	67 (47-76)	1.1 (0.6-1.6)
NEU007B	8.1 (7.1-9.6)	26.3 (20.8-30.8)	7.3 (7.1-7.5)	44 (40-48)	1.3 (0.9-1.8)
NEU017A	7.2 (5.6-10.3)	28.0 (24.1-30.2)	7.3 (6.5-**9.1**)	60 (52-67)	0.4 (0.3-0.5)
NEU020D	8.3 (5.1-9.8)	29.2 (25.0-**33.4**)	8.2 (6.9-**9.1**)	76 (72-81)	1.2 (0.9-1.5)
NEU055A4	8.6 (6.8-10.9)	26.6 (21.4-29.8)	7.4 (7.1-8.3)	73 (61-85)	0.7 (0.6-0.8)
NEU084F	6.5 (4.4-7.8)	26.5 (22.6-28.8)	6.4 (6.3-6.6)	63 (61-66)	0.6 (0.4-0.8)
NEU096E	6.5 (5.6-8.5)	25.4 (22.0-28.3)	**5.8** (**5.3**-6.4)	73 (36-97)	0.6 (0.5-0.6)

Table 3. *Physical parameter means (range). Values in bold exceed NC State Surface Water Standards*

Results

Chemical Results

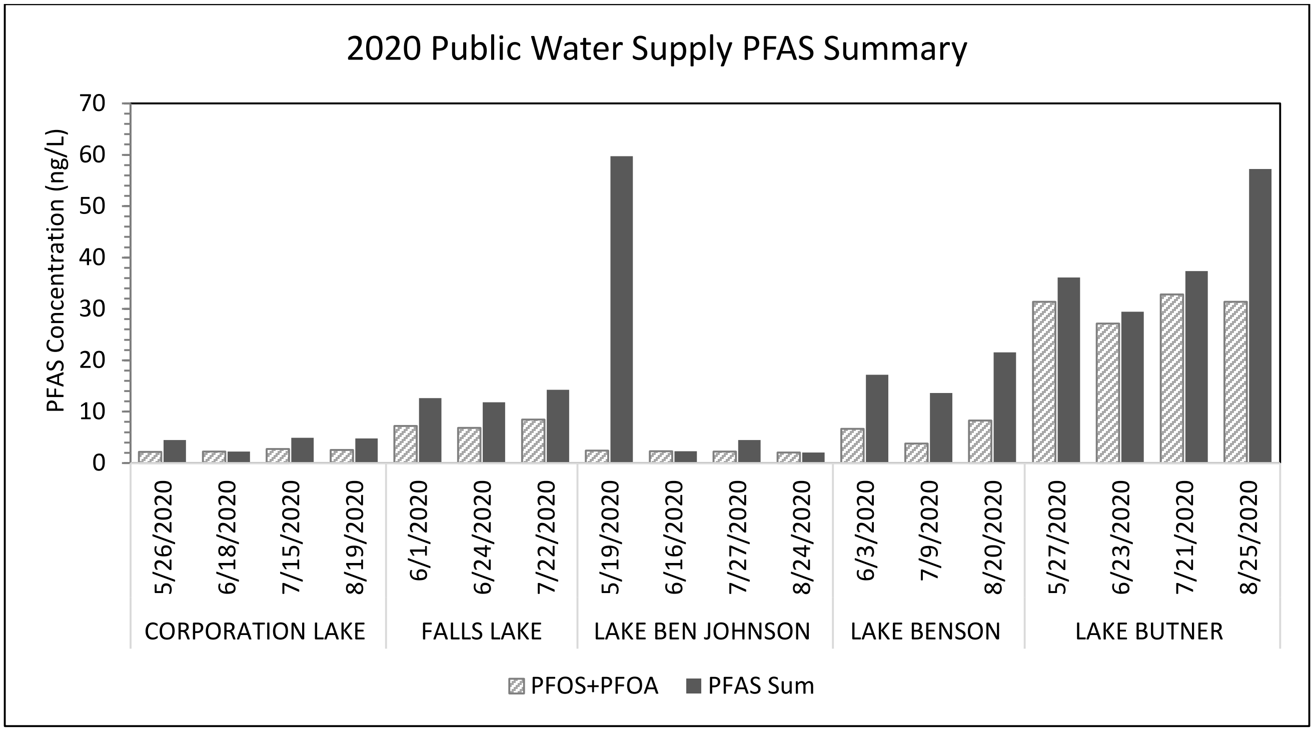
Laboratory analysis for 1,4-dioxane was conducted by DWR at the Central Laboratory in Raleigh. No returned values above the practical quantitation limit (PQL) of 1.0 µg/L were reported at any site throughout the duration of the study. NCDWR defines the PQL as the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

PFAS analysis was conducted by DWR at the Central Laboratory in Raleigh, NC. Of the 28 PFAS compounds selected for this study, the following fifteen compounds were found at or above the PQL on at least one occasion: 6:2FTS, 11Cl-PFOUdS, N-EtFOSAA, N-MeFOSAA, PFBS, PFBA, PFHpA, PFHxA, PFHxS, PFDoA, PFDS, PFHpS, PFOA, PFOS, and PFPeA. One or more of these compounds were detected at all 10 selected sites during the 2020 sampling season (May to September). These results again demonstrate the widespread distribution of detectable PFAS in public water supply reservoirs; however, surface water results for PFOA and PFOS combined did not exceed the USEPA established finshed drinking water health advisory level for PFOA, PFOS, or combined PFOA and PFOS, of 70 ppt (ng/L)[6] in in any sample collected for this study. Values of detected compounds and the associated detection dates for sites with compounds above the PQL are listed in Appendix 2.

Summary

Evaluation of physical and chemical results from this study suggest that while there are detectable levels of target analytes at all public water supply reservoirs tested in the Neuse River Basin, additional long-term monitoring would need to be conducted to evaluate persistence of these compounds and their associated effects on drinking water. Lake Ben Johnson (NEU00D) exhibited the greatest diversity of target analytes (n=11) and highest total single event PFAS concentration (59.7 ng/L), however these results were transitory and were not consistent with subsequent sampling events. Alternatively, Lake Butner (NEU007B) exhibited the second highest total PFAS concentration for a single sampling event (57.3 ng/L) but was constantly elevated throughout the sampling season, primarily driven by a single analyte (PFOS). While this study found detectable levels of PFAS in public drinking water reservoirs of the Neuse River basin, these values were not found to exceed the USEPA established health advisory level for PFOA, PFOS, or combined PFOA and PFOS, of 70 ppt (ng/L)[6] for finished drinking water. All 1,4-dioxane samples analyzed during this study were below the laboratory PQL of 1.0 µg/L, however the NC Protective Values for Surface Waters Fresh Water, Water Supply (Class WS I-V) is 0.35 µg/L; a concentration currently unattainable by the DWR due to equipment limitations. Precipitation events were not specifically targeted during this study, and no relationship between storm flows and presence or concentration of target analytes was evaluated. As noted earlier, all analytical data presented in this document reflect levels of target analytes detected in untreated surface waters, and do not represent contaminant concentrations in finished drinking water.

For further questions regarding this or other studies, please contact Eric Morris, Intensive Survey Branch Supervisor, directly at (919) 743-8496 or eric.morris@ncdenr.gov.



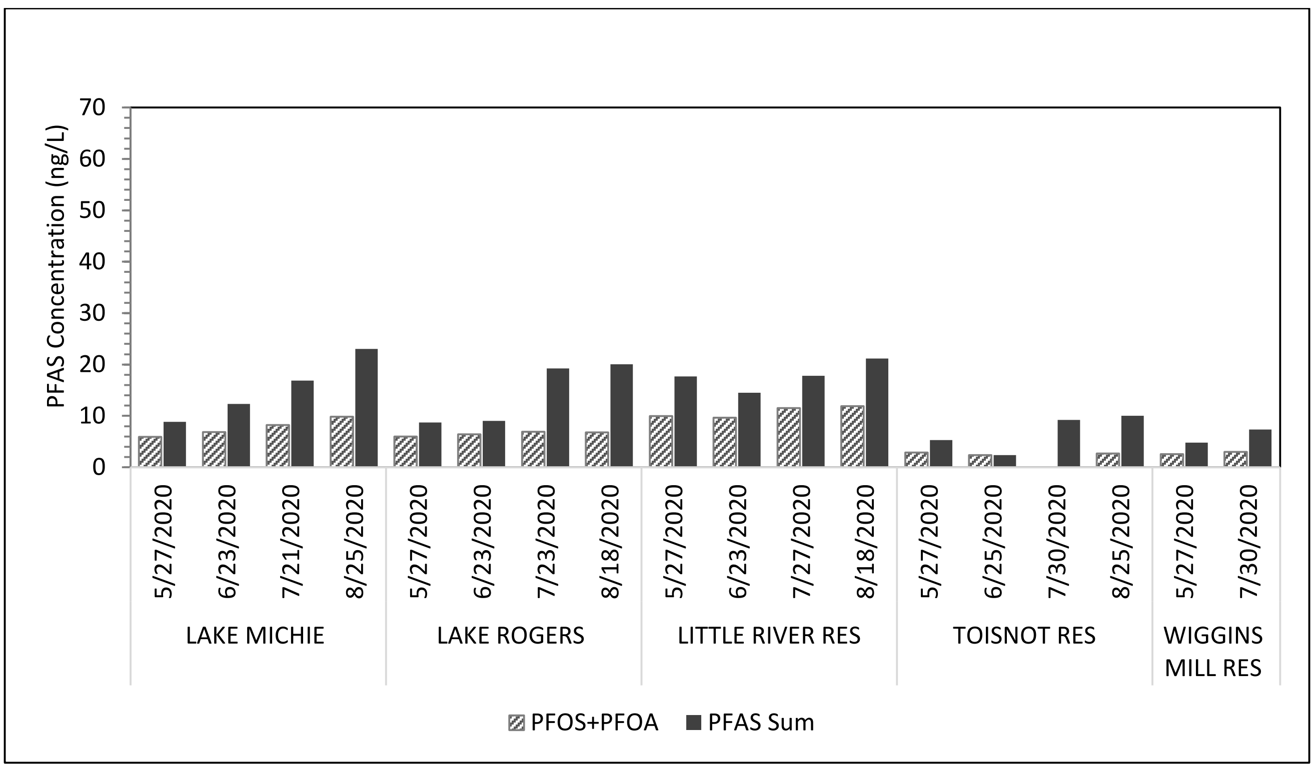


Figure 2. *Per- and polyfluoroalkyl concentrations at ambient lakes monitoring stations nearest the surface water intake of ten public water supply reservoirs in the Neuse River Basin. Only values greater than the PQL*

References

[1]Intensive Survey Unit. 2019. *Identification of Select Emerging Compounds in Public Water Supply Reservoirs in the Cape Fear, New, and Watauga River Basins*. https://files.nc.gov/ncdeq/Water%20Resources/files/ec/Identification-of-Select-Emerging-Compounds-in-Public-Water-Supply-Reservoirs-in-the-Cape-Fear-New-and-Watauga-River-Basins-FINAL.pdf

[2]USEPA. 2017. *Technical Fact Sheet – 1,4-Dioxane*. https://www.epa.gov/sites/production/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf

[3]USEPA. 2012. *The Third Unregulated Contaminant Monitoring Rule.* https://www.epa.gov/sites/production/files/2015-10/documents/ucmr3_factsheet_general.pdf

[4]NCDWR. 2017. *NC Surface Water Quality Standards Table.* https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/surface-water-standards#TriennialReviewInfo

[5]USEPA. 2018. *Basic Information on PFAS.* https://www.epa.gov/pfas/basic-information-pfas#health

[6]USEPA. 2016. *Fact Sheet: PFOA & PFOS Drinking Water Health Advisories.* https://www.epa.gov/ground-water-and-drinking-water/supporting-documents-drinking-water-health-advisories-pfoa-and-pfos

[6]DWR-WSS. 2013. *Intensive Survey Branch Standard Operating Procedures Manual: Physical and Chemical Monitoring.* Raleigh: State of North Carolina. https://files.nc.gov/ncdeq/Water%20Quality/Environmental%20Sciences/ISU/ISB%20SOP%20Version2.1%20%20FINAL.pdf

[7]NCDEQ. 2014. *Ambient Lakes Monitoring Program (ALMP) Quality Assurance Project Planv2.0.* https://files.nc.gov/ncdeq/Water%20Quality/Environmental%20Sciences/ISU/2014LakesAll.pdf

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Appendix 1 – List of PFAS Compounds

Abbreviation	***Name***	***CAS#***
PFBA	Perfluorobutanoate	45048-62-2
PFPeA	Perfluoropentanoate	45167-47-3
PFHxA	Perfluorohexanoate	92612-52-7
PFHpA	Perfluoroheptanoate	120885-29-2
PFOA	Perfluorooctanoate	45285-51-6
PFNA	Perfluorononanoate	72007-68-2
PFDA	Perfluorodecanoate	73829-36-4
PFUnA	Perfluoroundecanoate	196859-54-8
PFDoA	Perfluorododecanoate	171978-95-3
PFTrDA	Perfluorotridecanoate	862374-87-6
PFTeDA	Perfluorotetradecanoate	365971-87-5
PFBS	Perfluorobutanesulfonate	45187-15-3
PFPeS	Perfluoropentanesulfonate	175905-36-9
PFHxS	Perfluorohexanesulfonate	108427-53-8
PFHpS	Perfluoroheptanesulfonate	146689-46-5
PFOS	Perfluorooctanesulfonate	45298-90-6
PFNS	Perfluorononanesulfonate	474511-07-4
PFDS	Perfluorodecanesulfonate	126105-34-8
PFDoS	Perfluorododecanesulfonate	343629-43-6
4:2 FTS	4:2 fluorotelomersulfonate	414911-30-1
6:2 FTS	6:2 fluorotelomersulfonate	425670-75-3
8:2 FTS	8:2 fluorotelomersulfonate	481071-78-7
N-MeFOSAA	N-Methylperfluorooctanesulfonamidoacetic acid	2355-31-9
N-EtFOSAA	N-Ethylperfluorooctanesulfonamidoacetic acid	2991-50-6
HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6
ADONA	4,8-dioxa-3H-perfluorononanoic acid	919005-14-4
11Cl-PFOUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	756426-58-1

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Appendix 2. Values of detected PFAS compounds and detection date for sites with values above PQLs.

Station	Location Description	Sampling Date	Analyte	Result	PFOS+ PFOA	PFAS Sum
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	5/27/2020	PFOS	3.818	5.92	8.86
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	5/27/2020	PFBS	2.939		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	5/27/2020	PFOA	2.102		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	5/27/2020	PFOS	5.897	9.94	17.67
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	5/27/2020	PFBS	5.558		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	5/27/2020	PFOA	4.04		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	5/27/2020	PFBA	2.173		
NEU007BSUR	LAKE BUTNER NR DAM	5/27/2020	PFOS	22.104	31.38	36.15
NEU007BSUR	LAKE BUTNER NR DAM	5/27/2020	PFOA	9.275		
NEU007BSUR	LAKE BUTNER NR DAM	5/27/2020	PFHxS	2.64		
NEU007BSUR	LAKE BUTNER NR DAM	5/27/2020	PFBA	2.126		
NEU00C1SUR	CORPORATION LAKE NR DAM NR EFLAND	5/26/2020	PFBS	2.273	2.18	4.45
NEU00C1SUR	CORPORATION LAKE NR DAM NR EFLAND	5/26/2020	PFOS	2.176		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFTeDA	11.877	2.42	59.72
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFTrDA	9.967		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFDoA	6.611		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	11Cl-PF3ONS	6.501		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFDoS	6.301		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	N-EtFOSAA	4.174		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFDS	3.986		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFUnA	2.95		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	N-MeFOSAA	2.682		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFOS	2.422		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	5/19/2020	PFBS	2.253		
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	5/27/2020	PFOS	3.686	5.97	8.73
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	5/27/2020	PFBA	2.751		
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	5/27/2020	PFOA	2.288		
NEU084FSUR	WIGGINS MILL RES US DAM NR WIGGINS MILL	5/27/2020	PFOS	2.536	2.54	4.83
NEU084FSUR	WIGGINS MILL RES US DAM NR WIGGINS MILL	5/27/2020	PFBA	2.294		
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	5/27/2020	PFOS	2.881	2.88	5.31
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	5/27/2020	PFBA	2.425		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	6/23/2020	PFBS	5.472	6.88	12.35
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	6/23/2020	PFOS	4.204		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	6/23/2020	PFOA	2.673		

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Station	Location Description	Sampling Date	Analyte	Result	PFOS+ PFOA	PFAS Sum
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	6/23/2020	PFOS	5.9	9.63	14.51
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	6/23/2020	PFBS	4.879		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	6/23/2020	PFOA	3.73		
NEU007BSUR	LAKE BUTNER NR DAM	6/23/2020	PFOS	19.469	27.17	29.47
NEU007BSUR	LAKE BUTNER NR DAM	6/23/2020	PFOA	7.705		
NEU007BSUR	LAKE BUTNER NR DAM	6/23/2020	PFHxS	2.299		
NEU00C1SUR	CORPORATION LAKE NR DAM NR EFLAND	6/18/2020	PFOS	2.21	2.21	2.21
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	6/16/2020	PFOS	2.292	2.29	2.29
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	6/23/2020	PFOS	3.855	6.44	9.05
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	6/23/2020	PFBA	2.602		
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	6/23/2020	PFOA	2.589		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	6/3/2020	PFOS	4.201	6.64	17.19
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	6/3/2020	PFBA	2.783		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	6/3/2020	PFHxA	2.699		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	6/3/2020	PFBS	2.648		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	6/3/2020	PFOA	2.44		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	6/3/2020	PFPeA	2.414		
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	6/25/2020	PFOS	2.382	2.38	2.38
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	7/21/2020	PFBS	6.612	8.21	16.88
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	7/21/2020	PFOS	5.178		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	7/21/2020	PFOA	3.032		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	7/21/2020	PFHpA	2.057		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	7/27/2020	PFOS	7.418	11.55	17.78
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	7/27/2020	PFBS	6.235		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	7/27/2020	PFOA	4.13		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	7/9/2020	PFOS	3.786	3.79	13.63
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	7/9/2020	PFBA	2.553		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	7/9/2020	PFBS	2.52		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	7/9/2020	PFHxA	2.503		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	7/9/2020	PFPeA	2.265		
NEU084FSUR	WIGGINS MILL RES US DAM NR WIGGINS MILL	7/30/2020	PFOS	3.006	3.01	7.35
NEU084FSUR	WIGGINS MILL RES US DAM NR WIGGINS MILL	7/30/2020	PFBA	2.233		
NEU084FSUR	WIGGINS MILL RES US DAM NR WIGGINS MILL	7/30/2020	PFHpA	2.108		
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	7/30/2020	PFHpA	6.846	0.00	9.20
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	7/30/2020	PFBA	2.353		

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4405 Reedy Creek Rd, Raleigh, North Carolina 27607

Station	Location Description	Sampling Date	Analyte	Result	PFOS+ PFOA	PFAS Sum
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	8/25/2020	PFBS	7.575	9.84	23.02
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	8/25/2020	PFOS	6.087		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	8/25/2020	PFOA	3.755		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	8/25/2020	PFHpA	3.418		
NEU0061LSUR	LAKE MICHIE NEAR SR1622 NEAR BAHAMA NC	8/25/2020	PFBA	2.182		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	8/18/2020	PFOS	7.786	11.90	21.17
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	8/18/2020	PFBS	7.083		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	8/18/2020	PFOA	4.109		
NEU006USUR	LITTLE RIVER RESERVOIR NEAR DAM	8/18/2020	PFHxS	2.196		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	PFOS	22.741	31.39	57.25
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	PFOA	8.647		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	N-EtFOSAA	7.057		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	N-MeFOSAA	6.684		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	PFHxS	2.835		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	PFDoA	2.704		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	PFBS	2.251		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	PFDS	2.206		
NEU007BSUR	LAKE BUTNER NR DAM	8/25/2020	11Cl-PF3ONS	2.127		
NEU00C1SUR	CORPORATION LAKE NR DAM NR EFLAND	8/19/2020	PFOS	2.566	2.57	4.82
NEU00C1SUR	CORPORATION LAKE NR DAM NR EFLAND	8/19/2020	PFBA	2.253		
NEU00DSUR	LAKE BEN JOHNSON AT DAM NR SR 1144	8/24/2020	PFOS	2.07	2.07	2.07
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	8/18/2020	PFHpS	7.809	6.81	20.08
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	8/18/2020	PFOS	4.108		
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	8/18/2020	PFBA	3.267		
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	8/18/2020	PFOA	2.706		
NEU017ASUR	LAKE ROGERS NR DAM DR CREEDMOOR NC	8/18/2020	PFBS	2.186		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFOS	5.476	8.26	21.56
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFBA	2.992		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFOA	2.781		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFBS	2.78		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFHxA	2.563		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFHpA	2.556		
NEU055A4SUR	LAKE BENSON @ LOWER END NR GARNER NC	8/20/2020	PFPeA	2.413		
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	8/25/2020	PFBA	3.028	2.72	10.01
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	8/25/2020	PFOS	2.716		
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	8/25/2020	PFHpA	2.254		
NEU096ESUR	TOISNOT RESERVOIR NR DAM NR NC58	8/25/2020	PFBS	2.014		