

Study Plan for the Identification of Select Emerging Contaminants at Surface Water Intakes in Three North Carolina River Basins

May to September 2018

Purpose

The objective of this study is to provide the NC Division of Water Resources information on select emerging contaminants (ECs) in surface waters at public water supply (PWS) reservoirs throughout the Cape Fear, New and Watauga River basins. Specifically, the Intensive Survey Branch (ISB) will collect samples for microcystins, 1,4-dioxane and bromide, as well as 23 per- and polyfluoroalkyl substances (PFAS).

Study Plan

Design

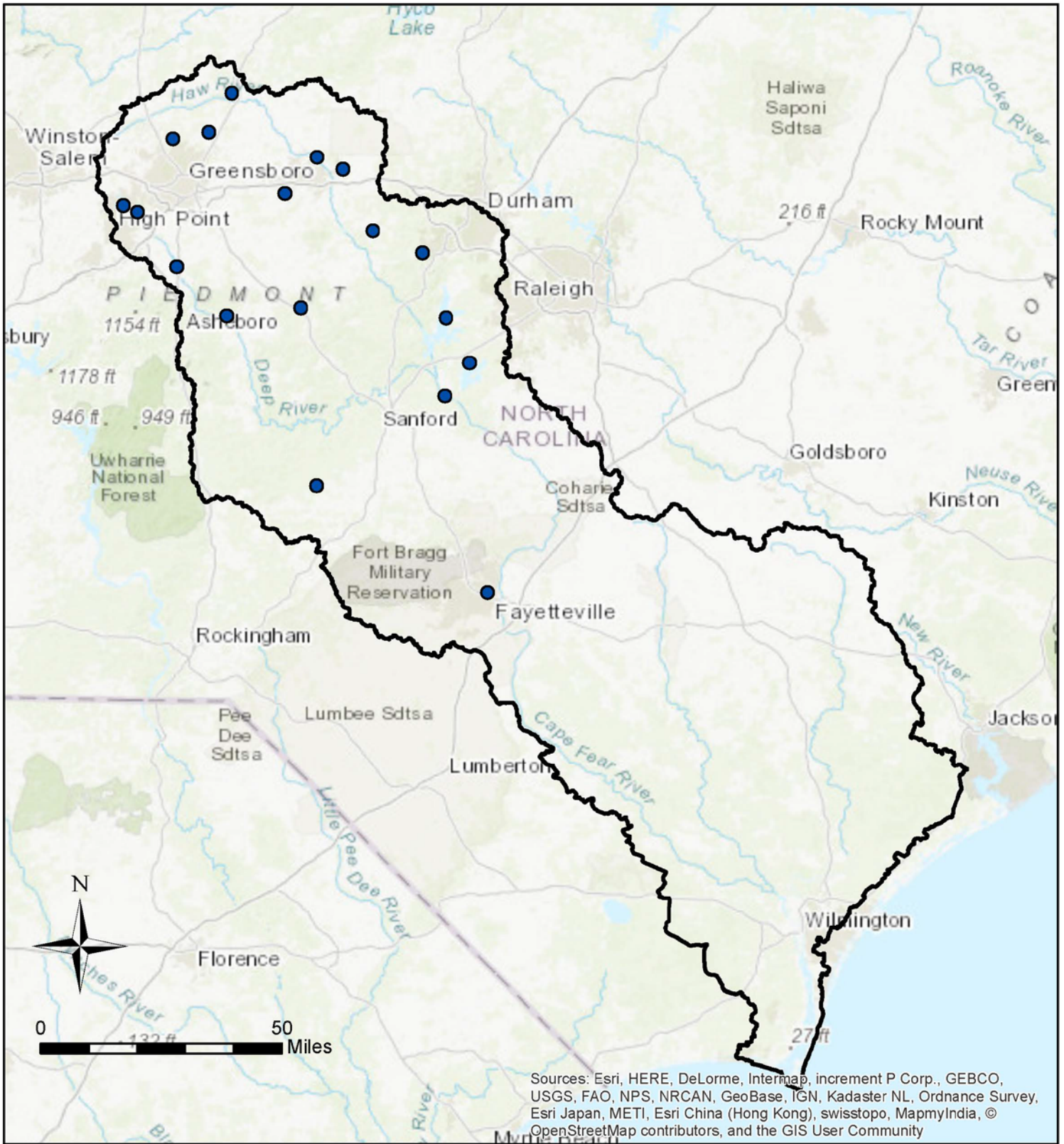
This study will be carried out in conjunction with ISB's Ambient Lakes Monitoring Program (ALMP) which focuses on lakes and reservoirs throughout North Carolina. ISB staff will visit 34 lakes during the 2018 sampling season of May to September. Out of these, 21 are classified as Water Supply lakes and will be sampled for supplementary EC parameters. Additional information on the ALMP can be found at <https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/intensive-survey-branch>. Due to limited analytical capacity, a single (n=1) sample for each of the above-mentioned parameters will be collected from each PWS intake location over the course of the study, except for microcystins which will be collected monthly at each location.

Parameters

Sample collection will focus on microcystins, 1,4-dioxane, bromide, and PFAS water quality parameters. Sites and parameters to be evaluated in this study are shown in Table 2. In-lake chemical water quality samples will be collected from the surface (0.15 m) as grab samples, except for microcystins which will be collected as a composite sample of the photic zone, defined as two times the secchi depth. Depth-stratified physical parameters will be collected at the surface (0.15 m), in 1 m increments to a depth of 10 m, and every 5 m thereafter. Water quality sample collections and field operations will follow ISU Standard Operating Procedures: Physical and Chemical Monitoring Version 2.1 (December 2013) and Ambient Lakes Quality Assurance Project Plan Version 2.0 (March 2014). Quality control documents can be found on the ISB website at: <https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/intensive-survey-branch>. Bromide, microcystins and 1,4-dioxane samples will be analyzed by DWR Water Sciences Section in Raleigh, and PFAS samples will be shipped to EPA's Science and Ecosystem Support Division (SESD) in Athens, GA for analysis. Individual PFAS analytes to be evaluated for this study are summarized in Table 1. This list represents all PFAS analyses available to the Department through a cooperative relationship with SESD.

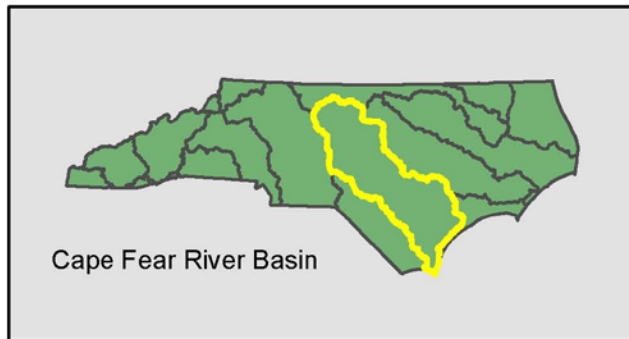
Assessment

Evaluation of water quality data collected during this study will focus on the compounds listed in Table 2 and their respective concentrations versus location in the watershed. If additional data or changes to the study area are required, this study plan will be re-evaluated and updated accordingly. Sampling will begin in May 2018.



Legend

- ALMP Sites
- EC Screening Sites

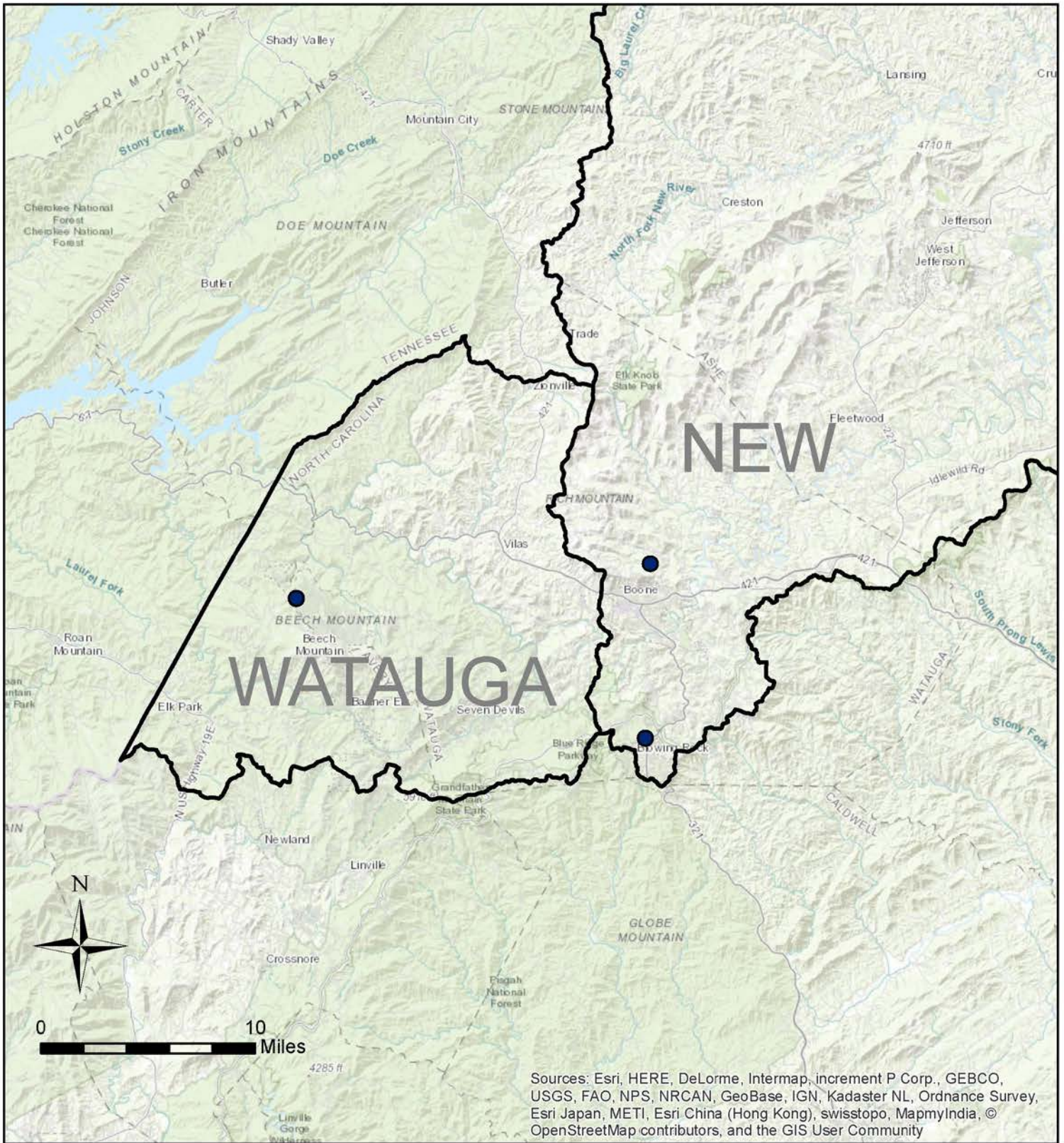


2018 Basinwide Screening for Select Emerging Contaminants

Cape Fear River Basin

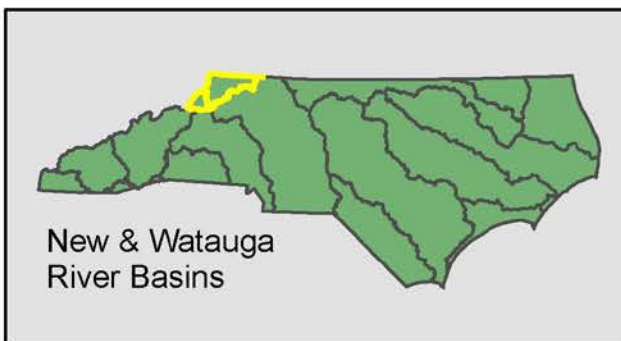
DWR
Division of Water Resources

DEQ
North Carolina Department of Environment and Natural Resources



Legend

- ALMP Sites
- EC Screening Sites



2018 Basinwide Screening for Select Emerging Contaminants

New & Watauga River Basins

Table 1. Description of PFAS analytes

Target Compound	CAS Registry Number
Perfluoro- <i>n</i> -tridecanoic acid	72629-94-8
Perfluoro- <i>n</i> -dodecanoic acid	307-55-1
Perfluoro- <i>n</i> -undecanoic acid	2058-94-8
Perfluoro- <i>n</i> -decanoic acid	335-76-2
Perfluoro- <i>n</i> -nonanoic acid	375-95-1
Perfluoro- <i>n</i> -octanoic acid	335-67-1
Perfluoro- <i>n</i> -heptanoic acid	375-85-9
Perfluoro- <i>n</i> -hexanoic acid	307-24-4
Perfluoro- <i>n</i> -pentanoic acid	2706-90-3
Perfluoro- <i>n</i> -butanoic acid	375-22-4
Perfluoro- <i>n</i> -decanesulfonate	335-77-3
Perfluoro- <i>n</i> -nonanesulfonate	68259-12-1
Perfluoro- <i>n</i> -octanesulfonate ⁽¹⁾	1763-23-1
Perfluoro- <i>n</i> -heptanesulfonate	375-92-8
Perfluoro- <i>n</i> -hexanesulfonate ⁽¹⁾	355-46-4
Perfluoro- <i>n</i> -pentansulfonate	2706-91-4
Perfluoro- <i>n</i> -butanesulfonate	375-73-5
Perfluoro- <i>n</i> -octanesulfonamide	754-91-6
8:2 Fluorotelomer sulfonate	39108-34-4
6:2 Fluorotelomer sulfonate	27619-97-2
4:2 Fluorotelomer sulfonate	757124-72-4
N-methylperfluoro-1-octanesulfonamidoacetic acid	2355-31-9
Propanoic acid, 2,3,3,3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)	13252-13-6

Table 2. Sites and parameters to be evaluated

Station	Station Description	Physical	Chemical	Parameters
NEW006E	ASU LAKE AT DAM NEAR BOONE NC	X	X	Physical: Temperature (°C) pH (s.u.) Dissolved Oxygen (mg/L) Conductivity (µs/cm) Secchi Depth (m)
NEWBTP1	BLOWING ROCK TOWN POND NEAR INTAKE	X	X	
WATBL1	BUCKEYE LAKE NEAR DAM	X	X	
CPF087D	JORDAN LAKE AT MOUTH OF WHITE OAK CREEK NR SEAFORTH	X	X	
CPF138B	GLENVILLE LAKE AT DAM NEAR FAYETTEVILLE NC	X	X	
CPF126A4	HARRIS LAKE NR RR BRIDGE NR HOLLEMANS CROSSROAD	X	X	
CPFBDL2	BUCKHORN DAM LAKE UPSTREAM OF DAM	X	X	
CPFUL6	UNIVERSITY LAKE AT DAM NR CHAPEL HILL NC	X	X	
CPFCCR6	CANE CREEK RESERVOIR AT DAM NR OAKS NC	X	X	
CPFGMR4	GRAHAM-MEBANE RESERVOIR AT DAM NEAR HAW RIVER NC	X	X	
CPFSCR4	STONY CREEK RESERVOIR AT DAM NR CAROLINA NC	X	X	Chemical: 1,4-Dioxane Bromide Microcystins PFAS 4:2FTS, 6:2FTS, 8:2FTS, FOSA, HFPO-DA, N-MeFOSAA, PFBA, PFBS, PFDA, PFDoA, PFDS, PFHpA, PFHpS, PFHxA, PFHxS, PFNA, PFNS, PFOA, PFOS, PFPeA, PFPeS, PFTTrDA, PFUdA
CPF113R	CARTHAGE CITY LAKE AT DAM NR CARTHAGE NC	X	X	
CPFTR01	TURNER RESERVOIR AT DAM	X	X	
CPF038N	LAKE MACKINTOSH AT DAM NR ALAMANCE NC	X	X	
CPF002A2	REIDSVILLE LAKE AT INTAKE AT DAM	X	X	
CPFSC1	SANDY CREEK RESERVOIR AT DAM NEAR RAMSEUR NC	X	X	
CPFLT8	LAKE TOWNSEND AT DAM NEAR GREENSBORO NC	X	X	
CPFRD8	LAKE RANDLEMAN NEAR DAM	X	X	
CPF007B	LAKE BRANDT AT DAM NEAR HILLSDALE NC	X	X	
CPF089E4	HIGH POINT LAKE ABOVE DEEP RIVER	X	X	
CPF089D5	OAK HOLLOW LAKE AT DAM NR HIGH POINT	X	X	