Department of Environmental Quality
Division of Water Resources
Water Planning Section – Basin Planning Branch

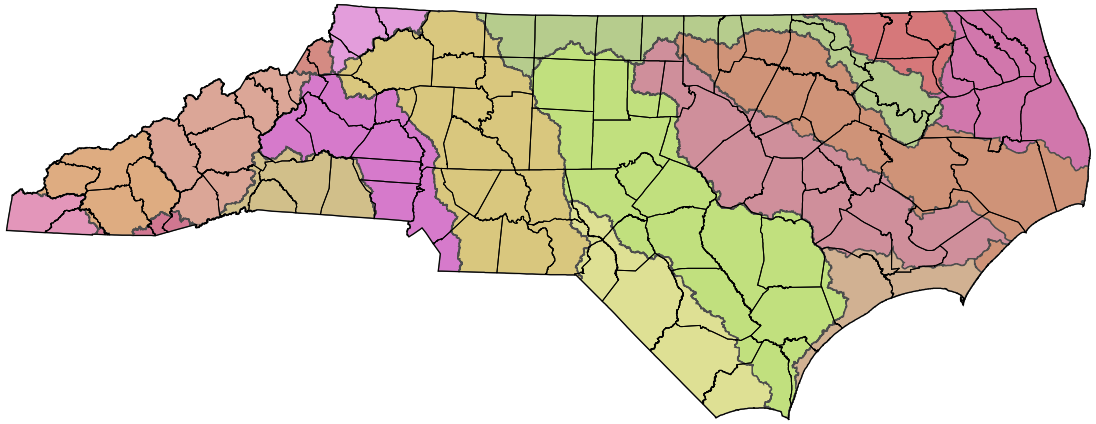
DRAFT Cape Fear River Basin Plan

June 21, 2023

Nora Deamer

Basinwide Water Resources Management Plans

- Watershed-based approach to managing water resources
- Considers the cumulative impacts to all activities across a river basin (point and nonpoint sources of pollution)
- Provides a single location to present water resource related issues
- Support state and local programs aimed to protect/improve water resources
- Basin plan required every 10 years (General Statute 143-215.8B)



Basinwide Water Resources Management Plans

- Goals
  - Provide scientifically-based water quality and quantity analysis for planning purposes
  - Provide recommendations for implementation measures by water resource agencies and volunteer watershed groups
  - Provide ongoing support for watershed restoration and protection efforts
- Public education
  - Water quality and water quantity (water demand)
  - Point and nonpoint sources of pollution
  - Protection measures
- Provide guidance to support decisions about water resources management
  - Permitting strategies
  - Nutrient management strategies
  - Watershed restoration planning and implementation of best management practices
  - Water supply and demand

Basinwide Water Resources Management Plan Outline

Basin Characteristics
- Geography
- Population and land cover
- Pollution Sources

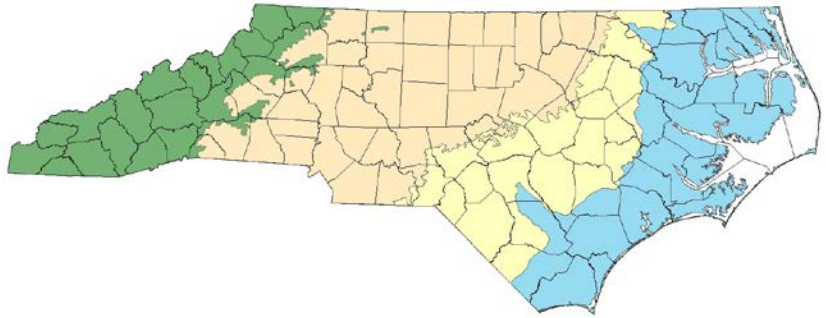
Monitoring Data and Water Quality Assessment
- Overview of biological, chemical and physical parameters

Permitted and Registered Activities
- General descriptions of existing water resource programs

Local Water Quality Initiative and Funding Opportunities
- Descriptions of stakeholder groups and watershed activities

Water Use and Availability
- Summary of water use in the basin

Watershed Chapters (HUC 8)
- Watershed specific information and recommendations



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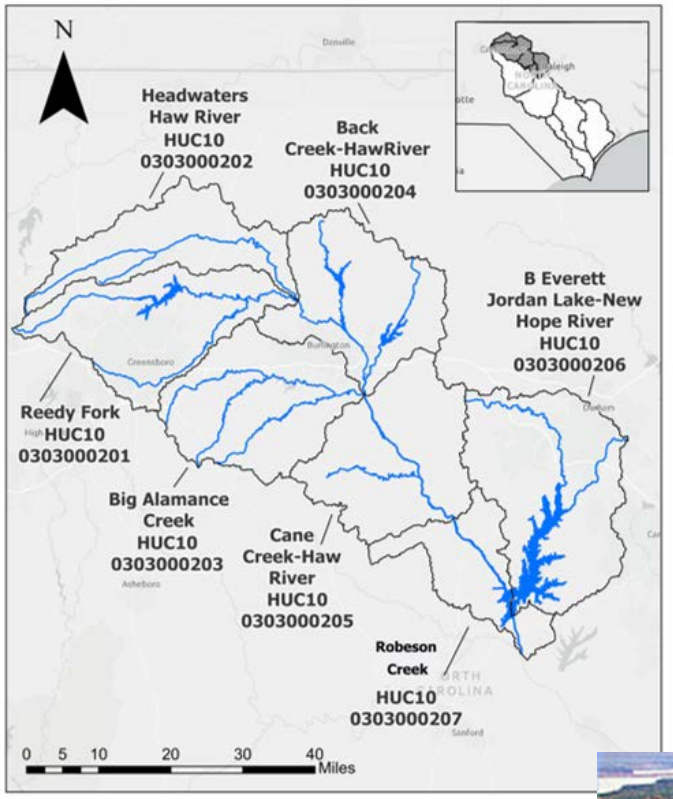

BASINWIDE WATER RESOURCES MANAGEMENT PLAN

CYCLE 4 – CAPE FEAR RIVER BASIN 2023

North Carolina
Department of Environmental Quality
Division of Water Resources
Basin Planning Branch

Chapter 6 Haw River Subbasin (HUC8 03030002) - DRAFT

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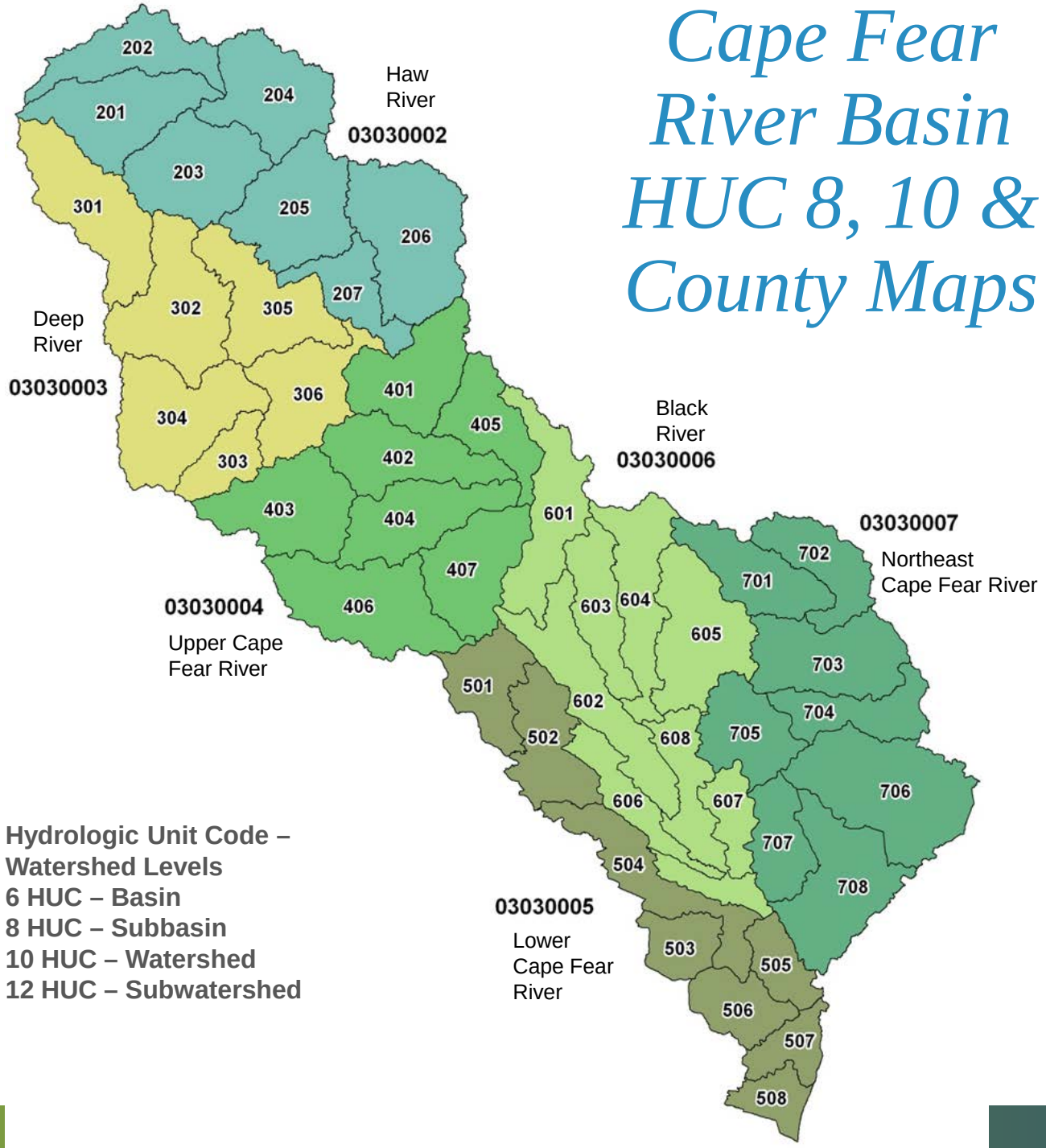
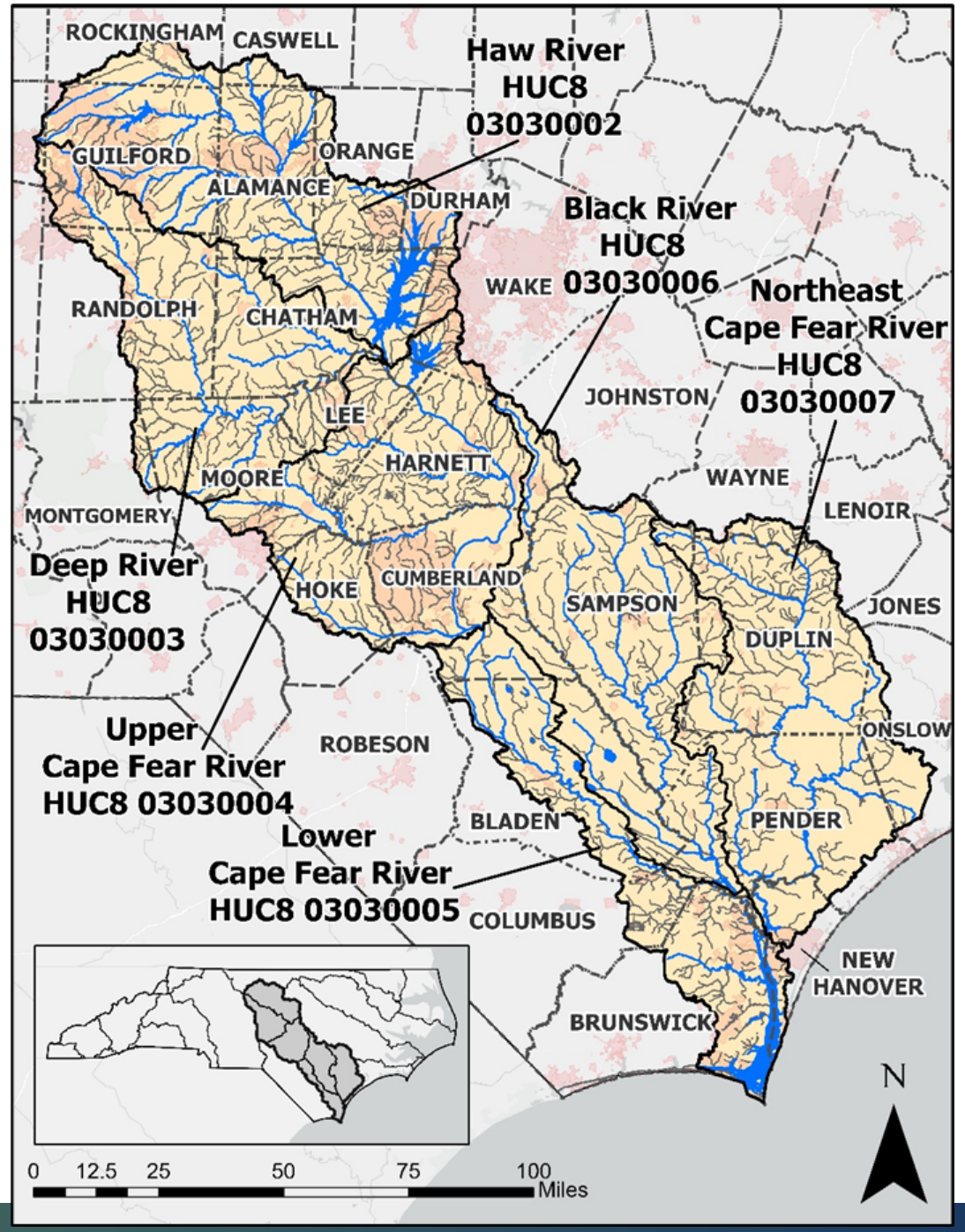
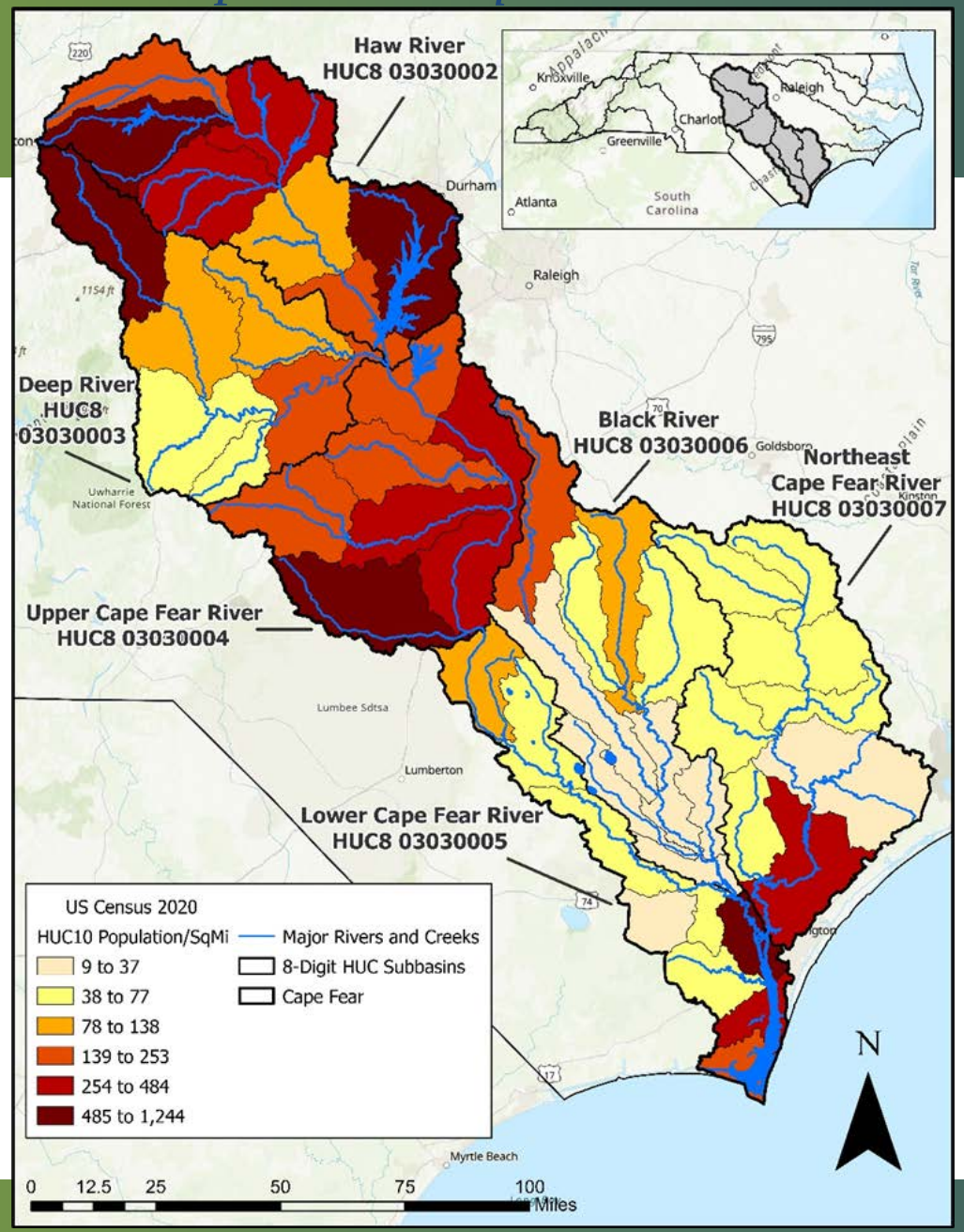
Cape Fear River Basin HUC 8, 10 & County Maps



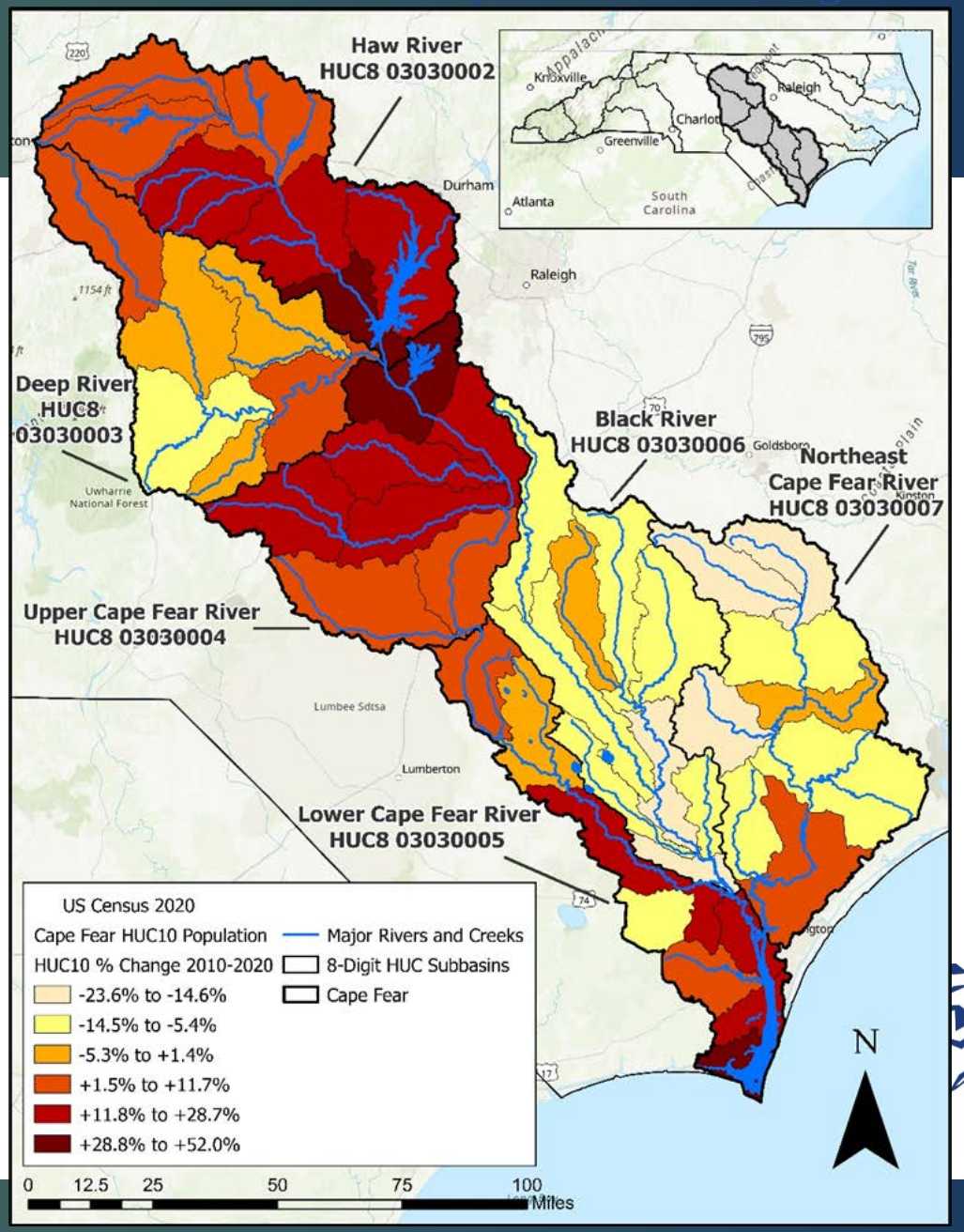
Hydrologic Unit Code – Watershed Levels
6 HUC – Basin
8 HUC – Subbasin
10 HUC – Watershed
12 HUC – Subwatershed



2020 Census HUC-10 Population/ Square Mile



2020 Census HUC-10 2010-2020 Population Change



Cape Fear River Basin Estimated HUC 8 Subbasin Population

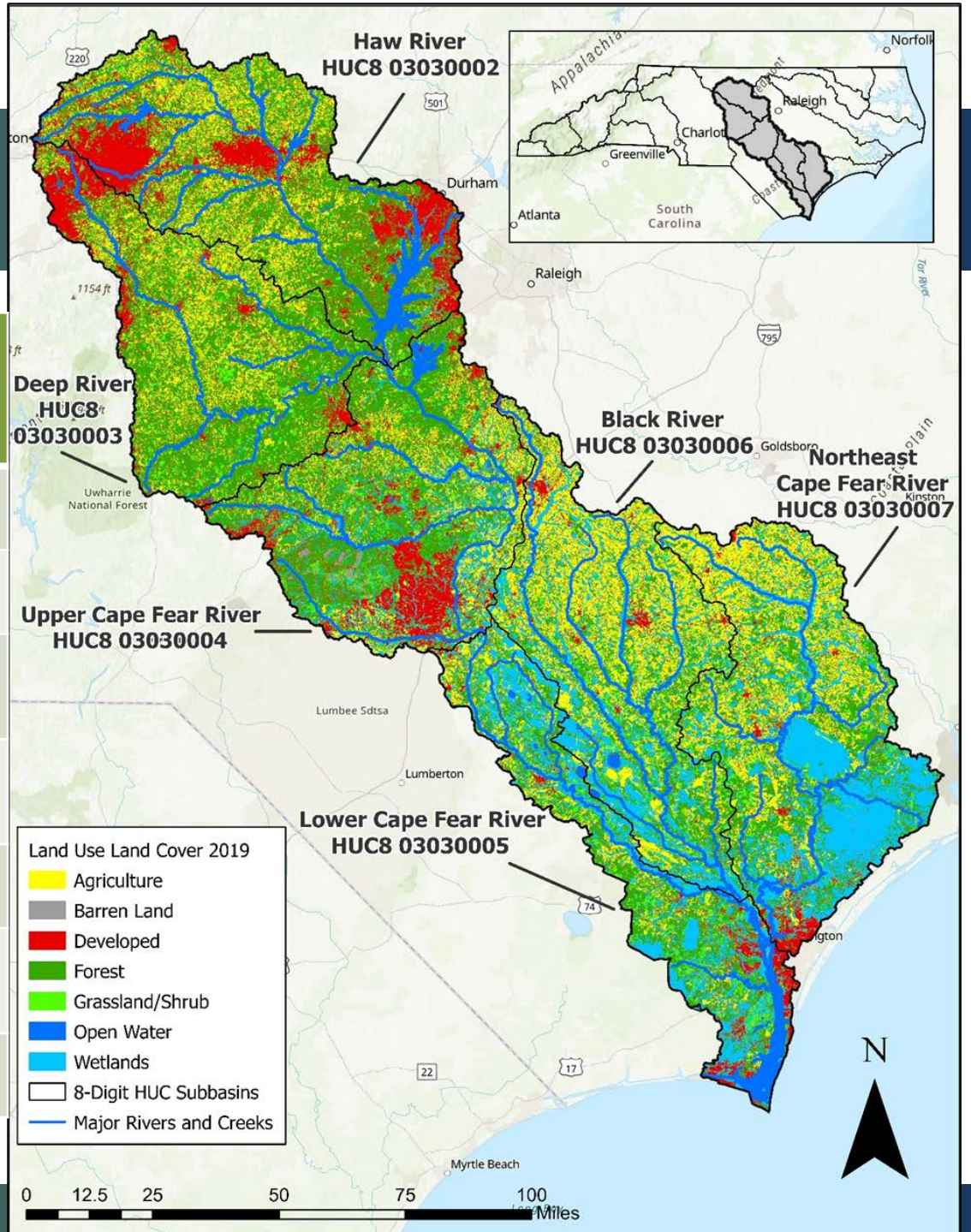
8-Digit HUC	Subbasin	2000 Population	2010 Population	2020 Population	2000 - 2010 Pop. Change	2010 - 2020 Pop. Change	Area (Mi^2)	2020 Population per Mi^2
03030002	**Haw**	696,110	846,200	**1,000,759**	150,090	154,559	1,708	586
03030003	Deep	265,578	299,359	**311,579**	33,781	12,220	1,450	215
03030004	Upper Cape Fear	443,889	510,529	**577,652**	66,640	67,123	1,630	354
03030005	Lower Cape Fear	102,467	139,273	**165,663**	36,806	26,390	1,061	156
03030006	Black	104,395	111,987	**104,199**	7,592	-7,788	1,574	66
03030007	Northeast Cape Fear	138,385	167,203	**164,048**	28,818	-3,155	1,741	94
Total		1,750,824	2,074,551	**2,323,900**	323,727	249,349	9,165	Ave = 253.6

61% of the 2010-2020 growth occurred in the Haw River Subbasin

US Census population estimates

Land Use Land Cover (2019 NLCD)

HUC8	Subbasin	Agriculture %	Barren %	Developed %	Forest %	Grassland/ Shrub %	Open Water %	Wetlands %
03030002	Haw	**19.87%**	**0.10%**	**24.35%**	**47.44%**	**3.69%**	**2.70%**	**1.85%**
03030003	Deep	19.63%	0.13%	14.80%	55.32%	8.03%	1.10%	0.97%
03030004	Upper CFR	14.71%	1.18%	18.20%	42.08%	9.31%	1.59%	12.93%
03030005	Lower CFR	10.18%	0.38%	9.94%	28.65%	9.97%	5.39%	35.50%
03030006	Black	32.11%	0.06%	6.72%	24.13%	8.03%	0.77%	28.18%
03030007	Northeast CFR	24.25%	0.13%	7.04%	24.95%	6.12%	0.70%	36.81%
Totals		**20.72%**	**0.33%**	**13.79%**	**37.33%**	**7.30%**	**1.85%**	**18.67%**



Cape Fear River Basin NPDES Wastewater Discharge Permitted Facilities

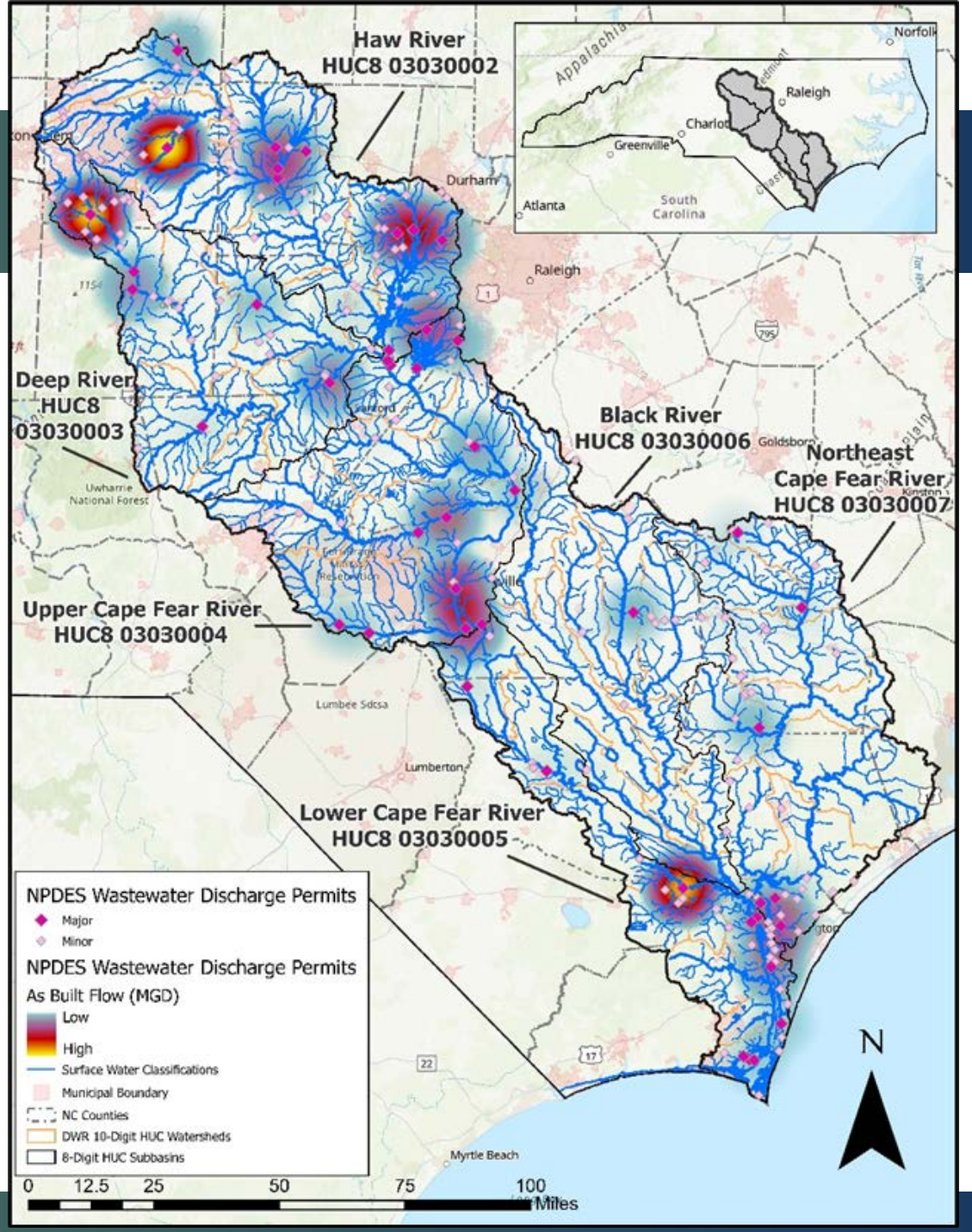
Cape Fear River Basinwide Total				
Permit Type	**Major**	**Minor**	**Permitted Facilities[2, 3]**	**Permitted As-Built [2,4] (MGD)**
Municipal Wastewater Discharge, < 1MGD	1	18	19	8.921
Municipal Wastewater Discharge, Large	32	0	32	339.105
Industrial Process & Commercial Wastewater Discharge	17	30	47	69.4352
Discharging 100% Domestic < 1MGD	0	49	49	3.3386
Fish Farms, Packing and Rinsing Wastewater Discharge COC	0	5	5	0
Groundwater Remediation Discharge	0	3	3	0.5904
Groundwater Remediation Wastewater Discharge COC	0	10	10	0
Non-contact Cooling, Boiler Blowdown Wastewater Discharge COC	0	27	27	0
Water Plants and Water Conditioning Discharge	0	17	17	0
Water Treatment Plant Dischargers - Backwash Wastewater from Green Sand & Conventional Systems COC	0	9	9	4
Single Family Domestic Wastewater Discharge COC	0	252	252	0.078305
Basinwide Total	**50**	**420**	**470**	**425.468505**

218 Total without Single Family

2Active and expired permitted facilities and associated permit data were queried from the NC DWR Basinwide Management Systems (BIMS) in May 2022. All permits are associated with active facilities.

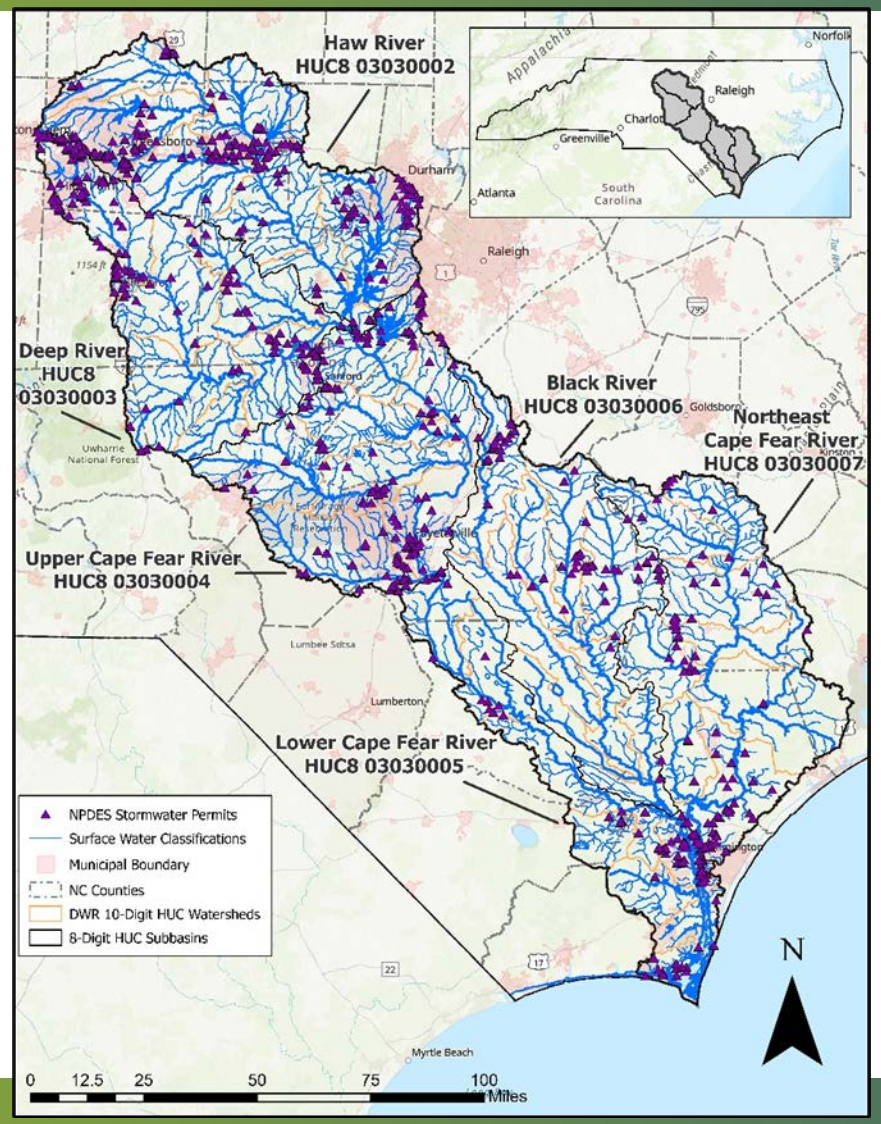
3 Permitted facility summary information is based on the number of facilities and as-built totals that discharge to the Cape Fear River Basin, two facilities (NC0078344 and NCG590020) included in the tally discharge to the Lower Cape Fear subbasin but are located in the adjacent Lumber River Basin, one facility (NC0088692) was excluded which is located in the Haw River subbasin and discharges to the Roanoke River Basin.

4The permitted as-built subbasin totals are based on the location of the facility with the exception of NC0078344, NCG590020, and NC0088692. All facilities with a permitted as-built discharge have a single total limit for the entire facility even if there are multiple outfalls, however facilities have outfalls located in two different HUC8 subbasins. One facility (NC0082295) is located in in the Northeast subasin and discharges 0.834 MGD to the Lower Cape Fear subbasin, for this analysis the 0.834 MGD is included in the Northeast Cape Fear Total.



Cape Fear River Basin Stormwater Permits

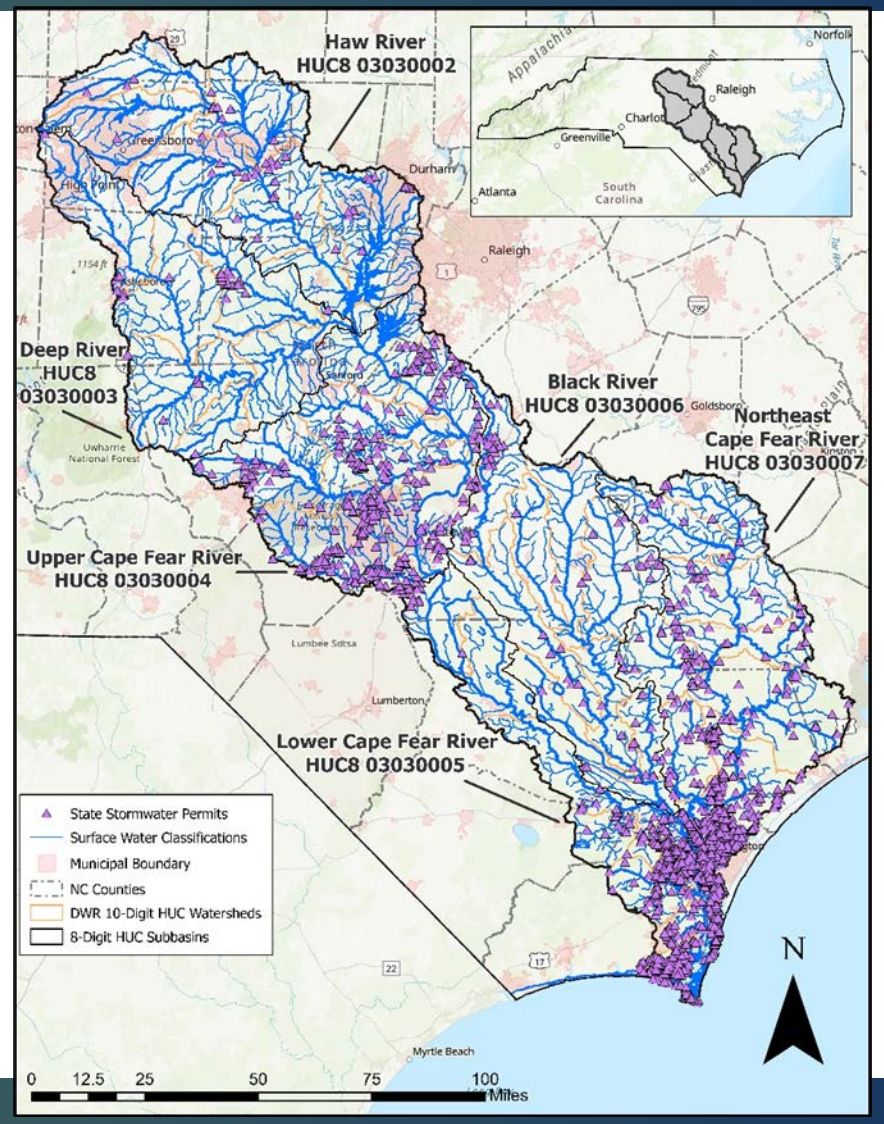
NPDES Stormwater



HUC8	NPDES stormwater[1]		State Stormwater [1]
	Permitted Facilities	Number of Outfalls	Permitted Projects
3030002	202	431	49
3030003	146	250	30
3030004	130	247	407
3030005	76	133	1,516
3030006	57	113	104
3030007	79	124	1,825
Total	**690**	**1,298**	**3,931**

[1]Active and expired permitted facilities and associated permit data were queried from the NC DWR Basinwide Management Systems (BIMS) in May 2022. All permits are associated with active facilities.

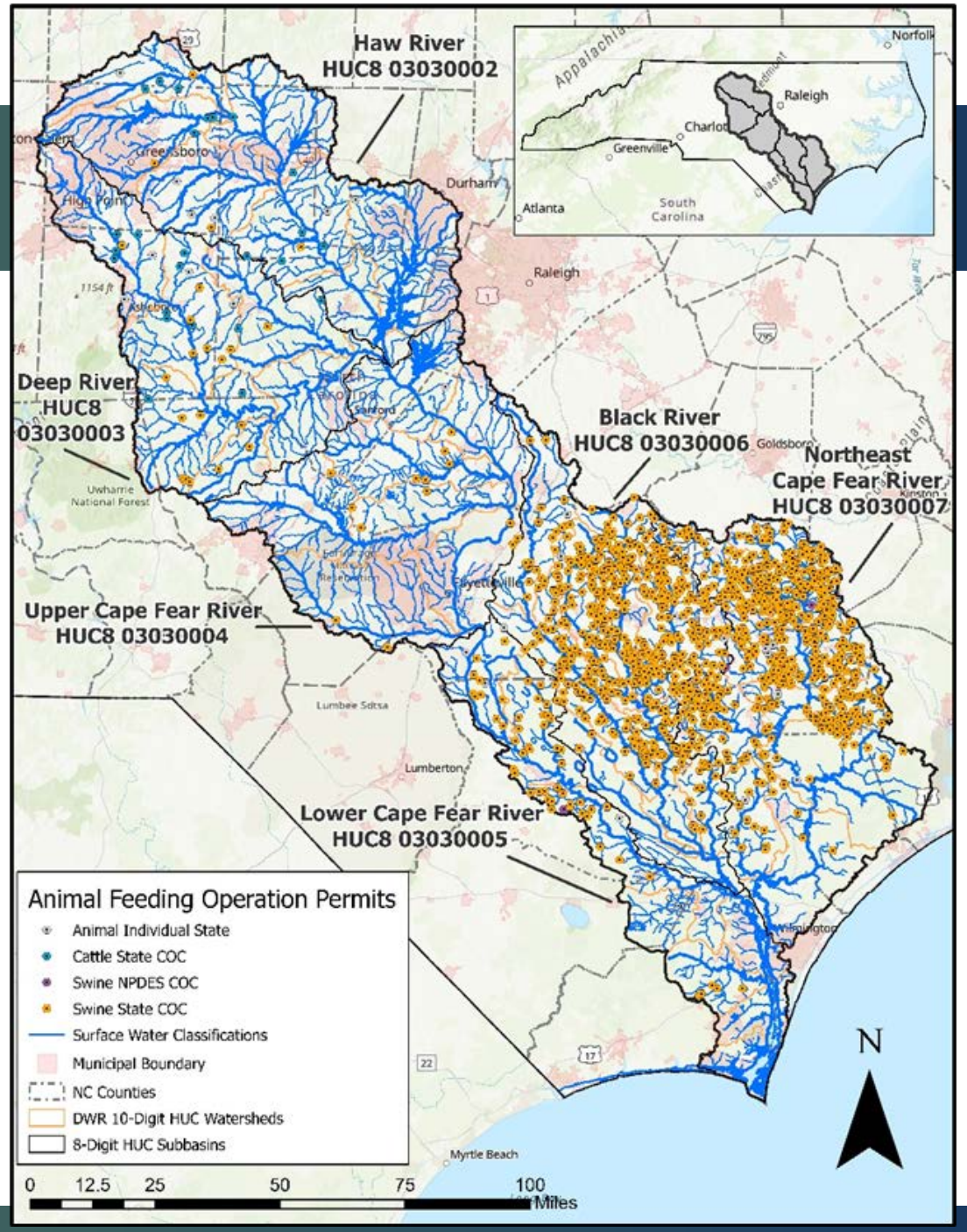
State Stormwater

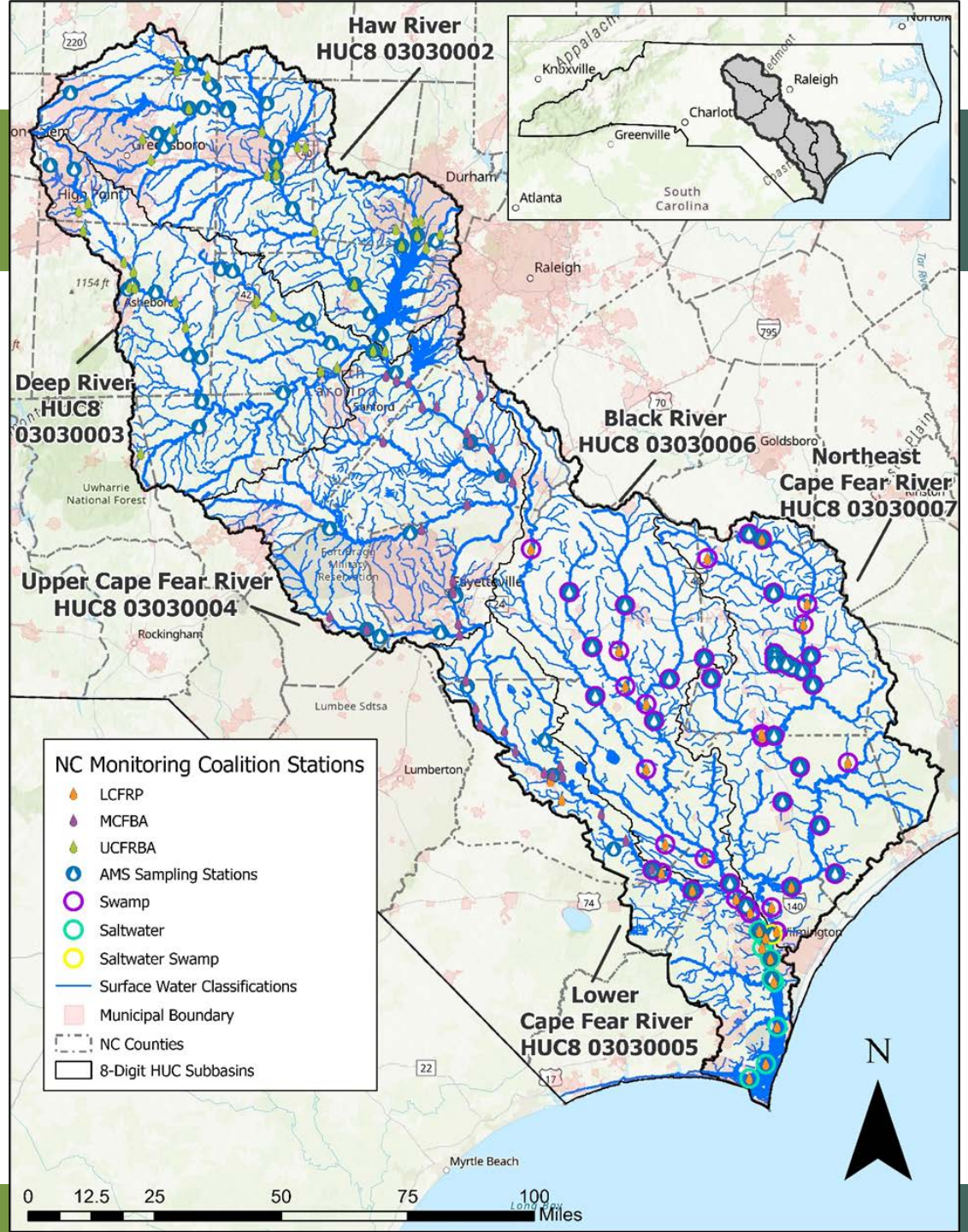


Cape Fear River Basin Animal Feeding Operations (AFO)

Permit Type	Permitted Facilities[1]	Allowable Count[1]	Allowable Live Weight (lb) [1]	Number of Lagoons / Wasteponds[1]
Cape Fear River Basinwide Total				
Animal Individual State	39	224,119	32,471,157	50
Cattle State COC	26	20,988	25,028,350	39
Swine NPDES COC	5	22,224	3,000,240	6
Swine State COC	1,118	5,249,690	689,009,401	2,155
Basinwide Total	**1,188**	**5,517,021**	**749,509,148**	**2,250**

[1]Active and expired permitted facilities and associated permit data were queried from the NC DWR Basinwide Management Systems (BIMS) in May 2022. All permits and structures are associated with active facilities.





Monitoring Stations

Monitoring Program	Number of stations (2020)		
DWR–AMS	75		167
UCFRBA	40	104	
MCFBA	33		
LCFRP	31		
Colocated stations	12		

New Stations

+ 2 UCFRBA
  (Robeson Cr. & Crooked Cr.)
+ 1 MCFBA
  (CFR below North Harnett WWTP)
+ 1 DWR-AMS
  (Robeson Cr.)

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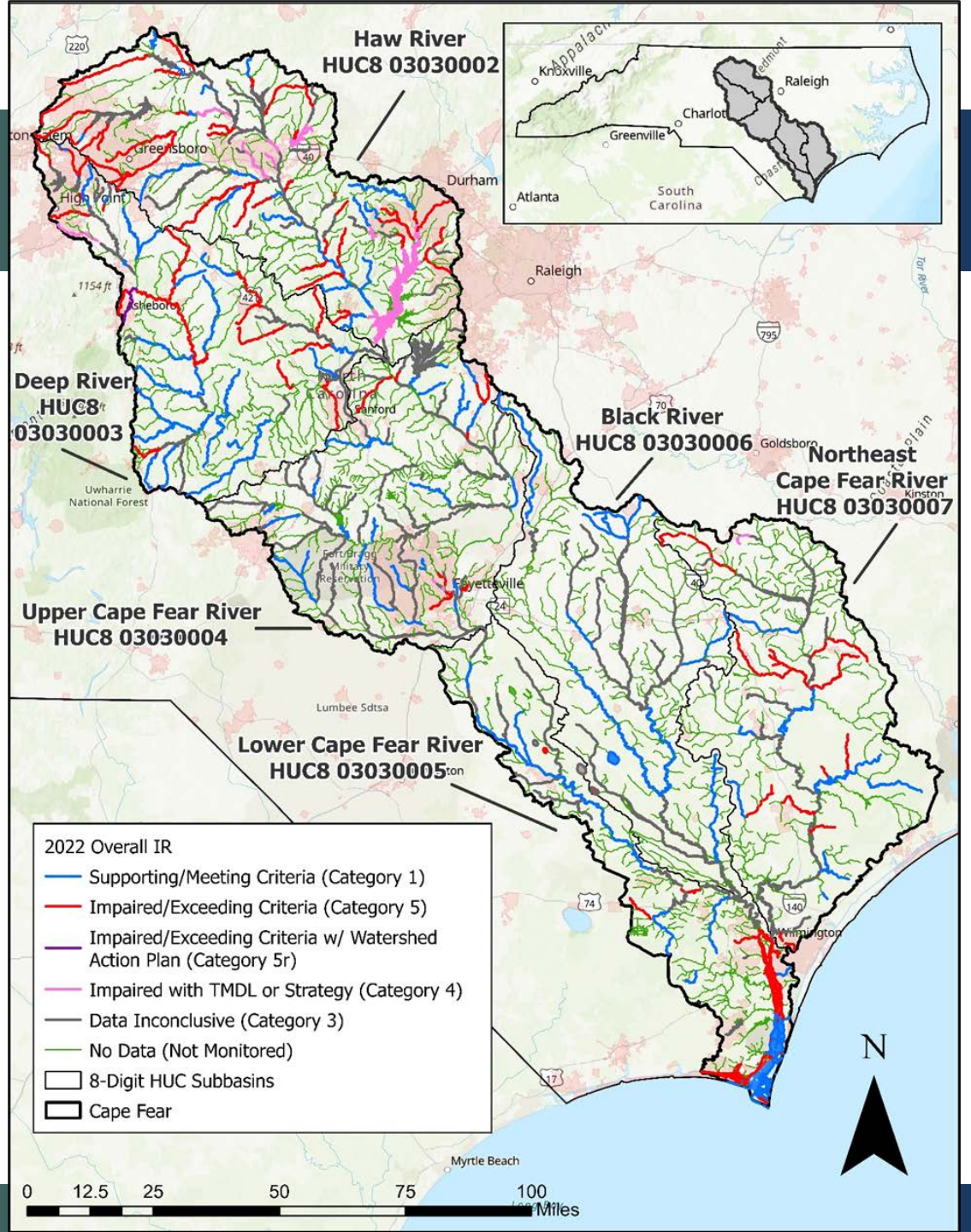
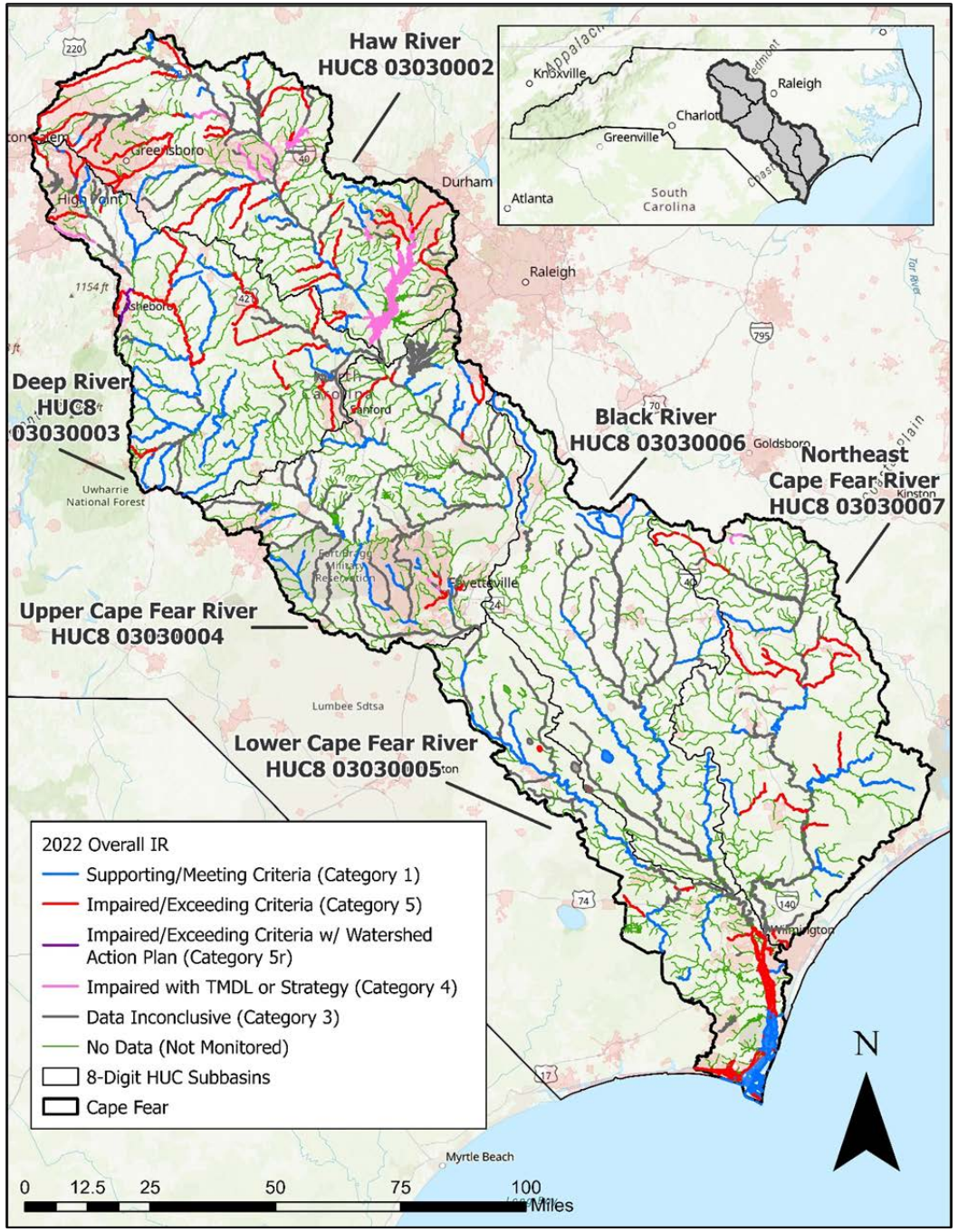
Cape Fear River Basin 2022 Integrated Report Totals

Assessment Unit[1]	Map Color	FW Miles[2]	FW Acres[2]	SW Acres[2]
Total	All Colors Combined	6,611.1	34,932.4	24,821.9
Total Monitored	Combined Blue, Gray, Red, Purple, Pink	2,649.4	28,492.1	24,235.7
Not Monitored	Green	3,961.7	6,440.3	586.2
Meeting Criteria (Category 1)	Blue	922.3	1,630.9	14,316.8
Data Inconclusive (Category 3)	Gray	1,083.0	14,432.1	375.6
Exceeding Criteria 303(D) (Category 5)[3]	Red	590.9	1,160.5	9,543.3
Exceeding Criteria with Watershed Action Plan (Category 5r)	Purple	7.4		
Exceeding Criteria with TMDL (Category 4)	Pink	45.8	11,268.6	
Exceeding Criteria (Combined Category 4, 5, and 5r)	**Combined Red, Purple, Pink**	**644.1**	**12,429.1**	**9,543.3**
% Exceeding of Monitored Exceeding (Combined Category 4, 5, and 5r)	Combined Red, Purple, Pink / Total	24.3%	43.6%	39.4%

1 All waterbodies in North Carolina are impaired for Fish Tissue Mercury and was not included Category 4, 5, and 5r impairments on this table;
2 FW - Freshwater, SW –Saltwater;
3 Added Brunswick River's 743.7 saltwater acres not originally captured on 2022 IR category 5 list.





Water Quality
2022 Integrated Report (IR) (2016-2020)

Parameter	Total Impairment
Benthic (aquatic life)	390.6 miles
Fish (aquatic life)	127.8 miles
Chlorophyll *a* (aquatic life)	34 miles 11,723.6 acres
Fecal coliform bacteria (recreational use)	107.4 miles
Turbidity (aquatic life)	30.6 miles 3,752.1 acres
Dissolved Oxygen (aquatic life)	24.4 miles 5,025.6 acres
Shellfish growing areas (saltwater)	2,408.6 acres
Copper (aquatic life)	59.7 miles

Addressing Impaired Waterbodies

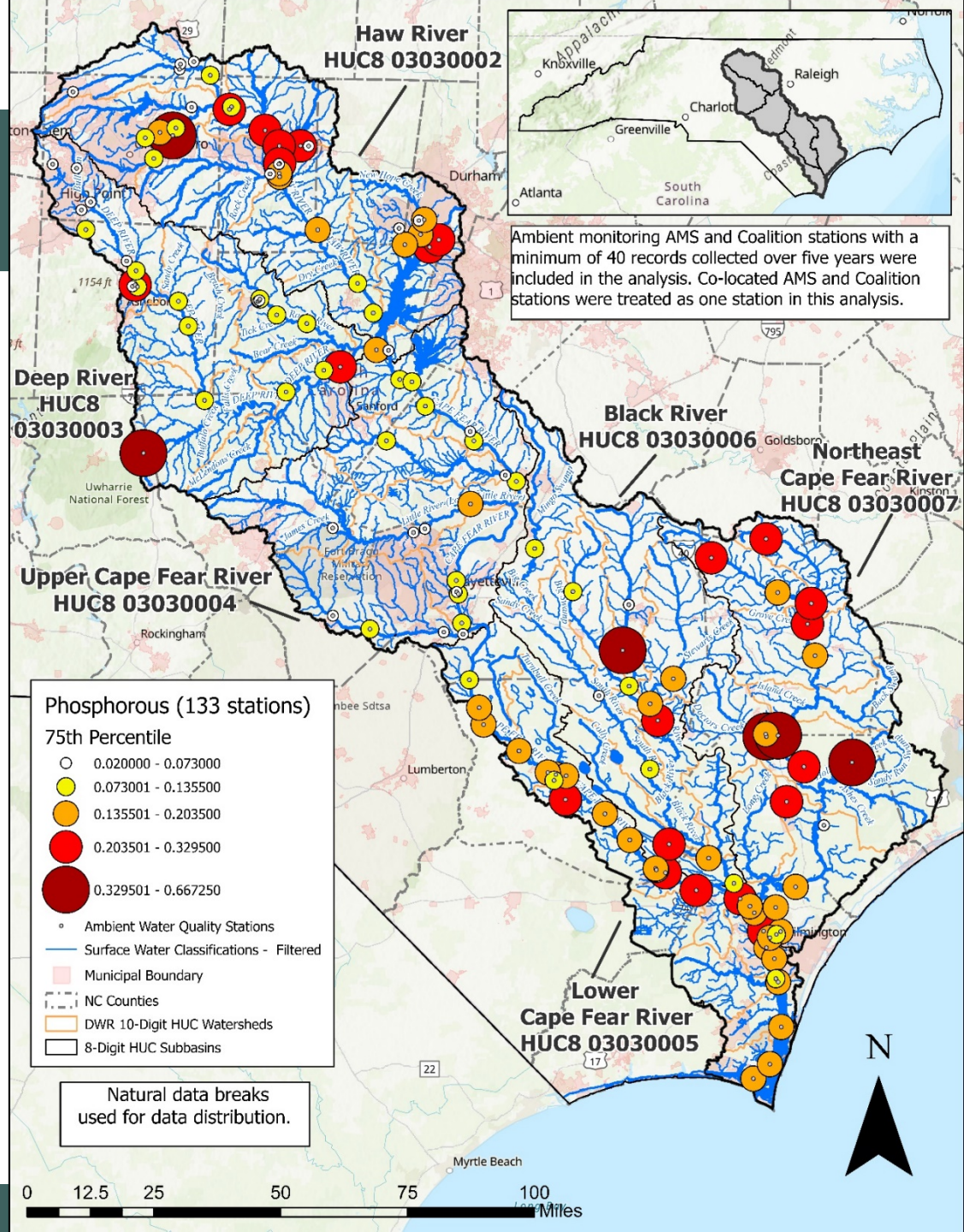
- Total maximum daily loads (TMDLs)
- Watershed action plans
  - Restoration
  - Protection
  - Conservation practices
- Management strategies
  - Point source reductions
  - Nutrient management/reductions
  - Voluntary implementation of BMPs

Cape Fear River HUC-8

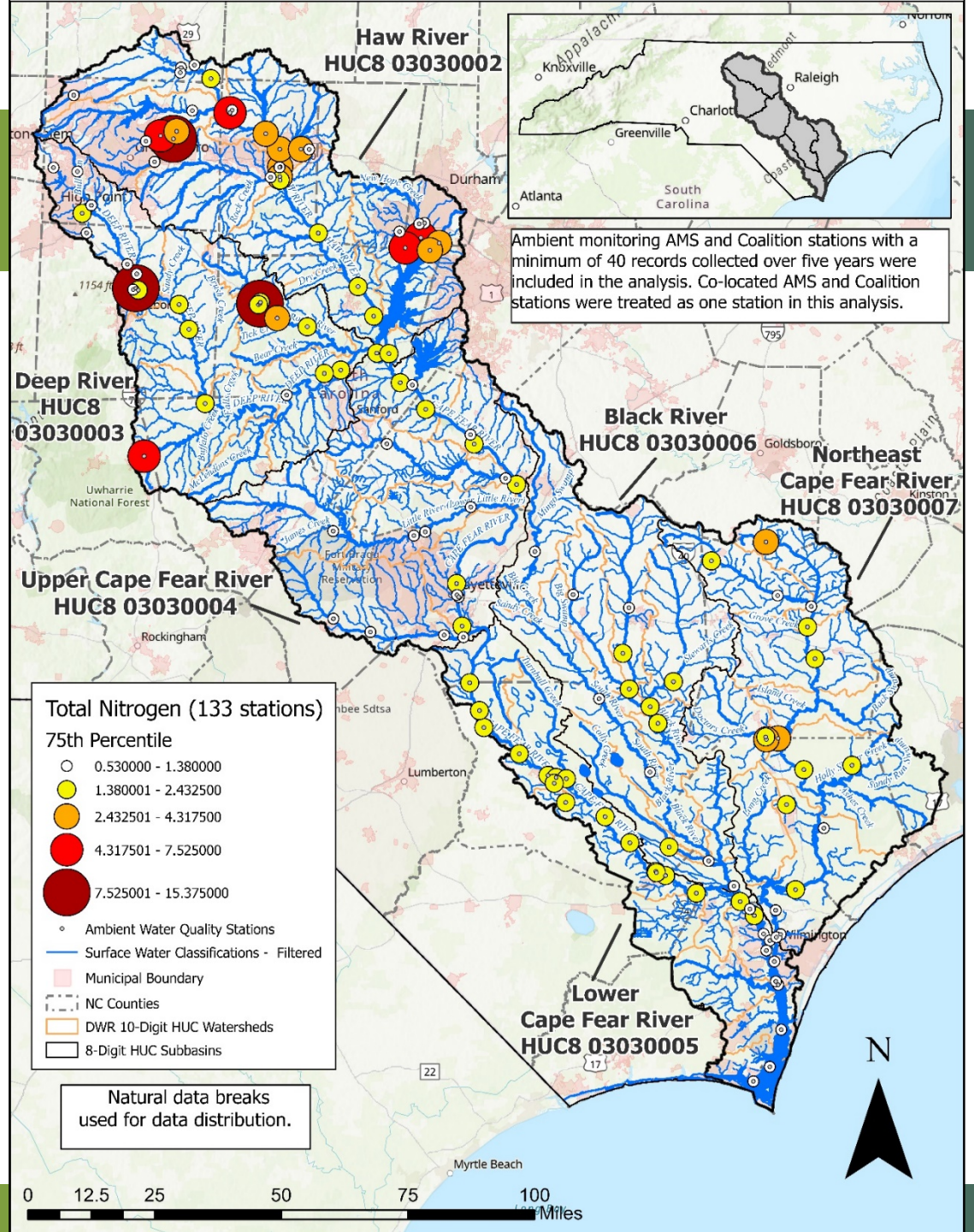
Ambient Water Quality Means (2016-2020)

Cape Fear River (CFR) HUC 030300_ _		Number of Stations*	pH	DO (mg/L)	Conductivity (µS/cm)	NH3 (mg/L)	TKN (mg/L)	NOx (mg/L)	TN (mg/L)	TP (mg/L)	Turbidity (NTU)	TSS (mg/L)	Fecal Coliform (CFU/100 mL)
CPF Basin Mean 030300*		**140**	**6.84**	**7.83**	**217**	**0.06**	**0.77**	**0.84**	**1.61**	**0.13**	**14.52**	**19.17**	**668**
Haw River[1]	**01**	35	7.20	8.27	222	0.06	0.77	1.34	2.10	0.13	20.19	22.90	749
Deep River	**03**	24	7.16	8.34	189	0.06	0.76	1.32	2.08	0.11	16.32	16.83	732
Upper CPF	**04**	20	6.52	8.21	90	0.03	0.65	0.35	1.00	0.07	13.08	16.38	360
Lower CPF[2]	**05**	30	6.74	7.20	117	0.06	0.75	0.53	1.29	0.15	13.64		423
Black River	**06**	14	6.14	7.06	101	0.07	0.86	0.43	1.29	0.13	4.83		754
Northeast CPF[3]	**07**	17	6.47	6.96	711	0.09	0.92	0.61	1.54	0.21	6.45		1,093
Healthy Piedmont Stream**					12-90	0.05		0.30	0.80	0.05			
EPA Nutrient Criteria - Piedmont+									0.70	0.038			
EPA Nutrient Criteria - Coastal Plain+									0.72	0.032			

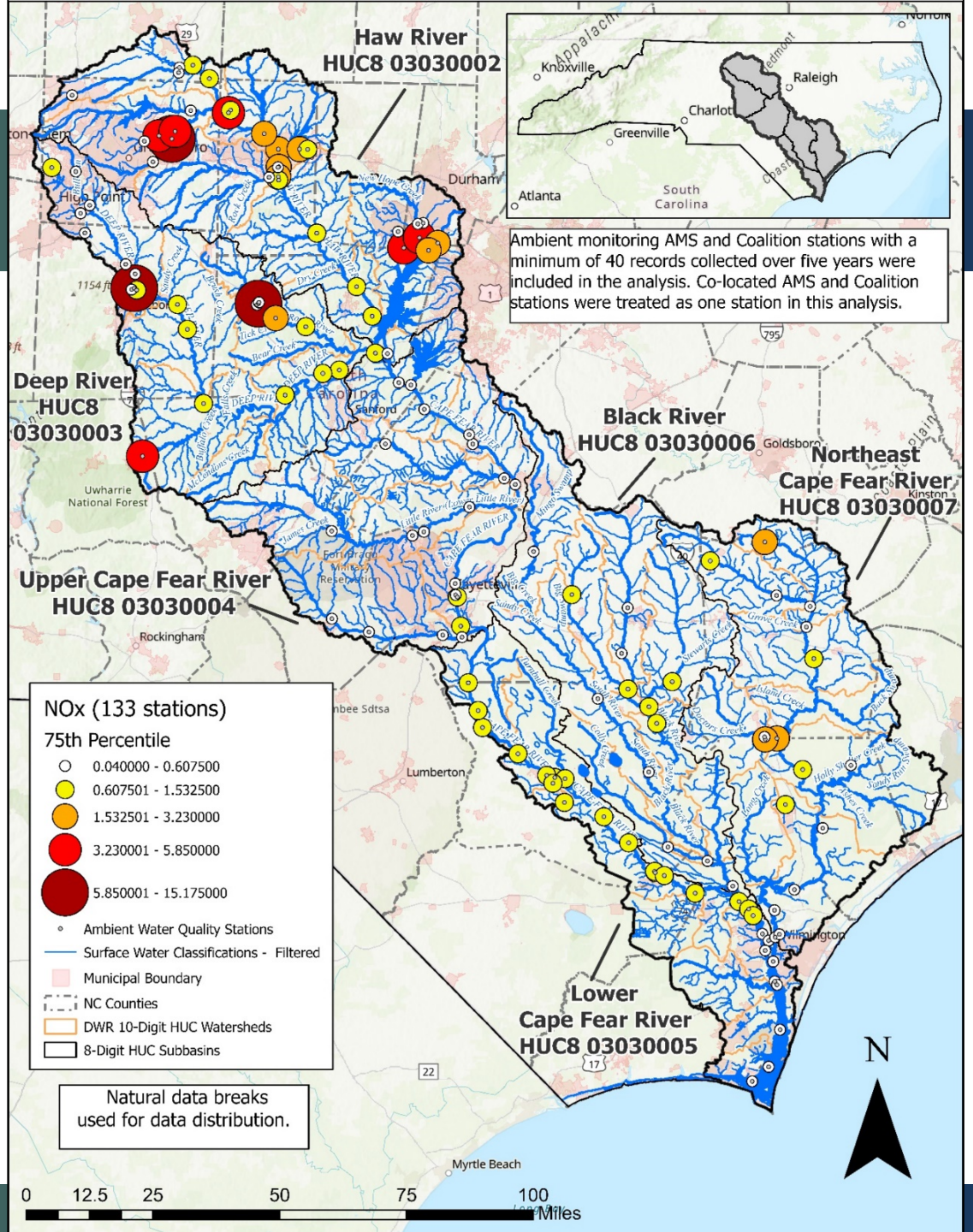
*Ambient stations with a minimum of data collected for 5 years from 2016 to 2020 and 40 average day records were included in the analysis.
Lower portion of subbasin watershed influenced by salt water from Atlantic Ocean.
^ Portions of the subbasin influenced by Mount Olive Pickle NPDES permitted discharge. They have an NPDES permit variance for discharging high concentrations of salt in their wastewater. Lower portion of the watershed influenced by natural saltwater influences.
**DWQ ESS- ISU Special Study. March 24, 2004, Rocky River Survey (Chatham County) Subbasin 03-06-12.
+ USGS Circular #1350 – The Quality of Our Nation's Water – Nutrients in the Nation's Streams and Groundwater, 1992-2004. Neil Dubrovsky et al., 2010.
Orange highlighted values represent the highest mean instream concentration in comparison to the other HUC 8 watersheds.
Green highlighted row represents the overall basin watershed mean for each constituent for comparison purposes.
[1]The Haw River subbasin has one Reservoir station, all 34 other stations are River/Stream stations.
[2]The Lower CPF River subbasin includes nine Estuary stations, all 21 other stations are River/Stream stations.
[3]The Northeast CPF River subbasin includes one Estuary station, all 17 other stations are River/Stream stations.



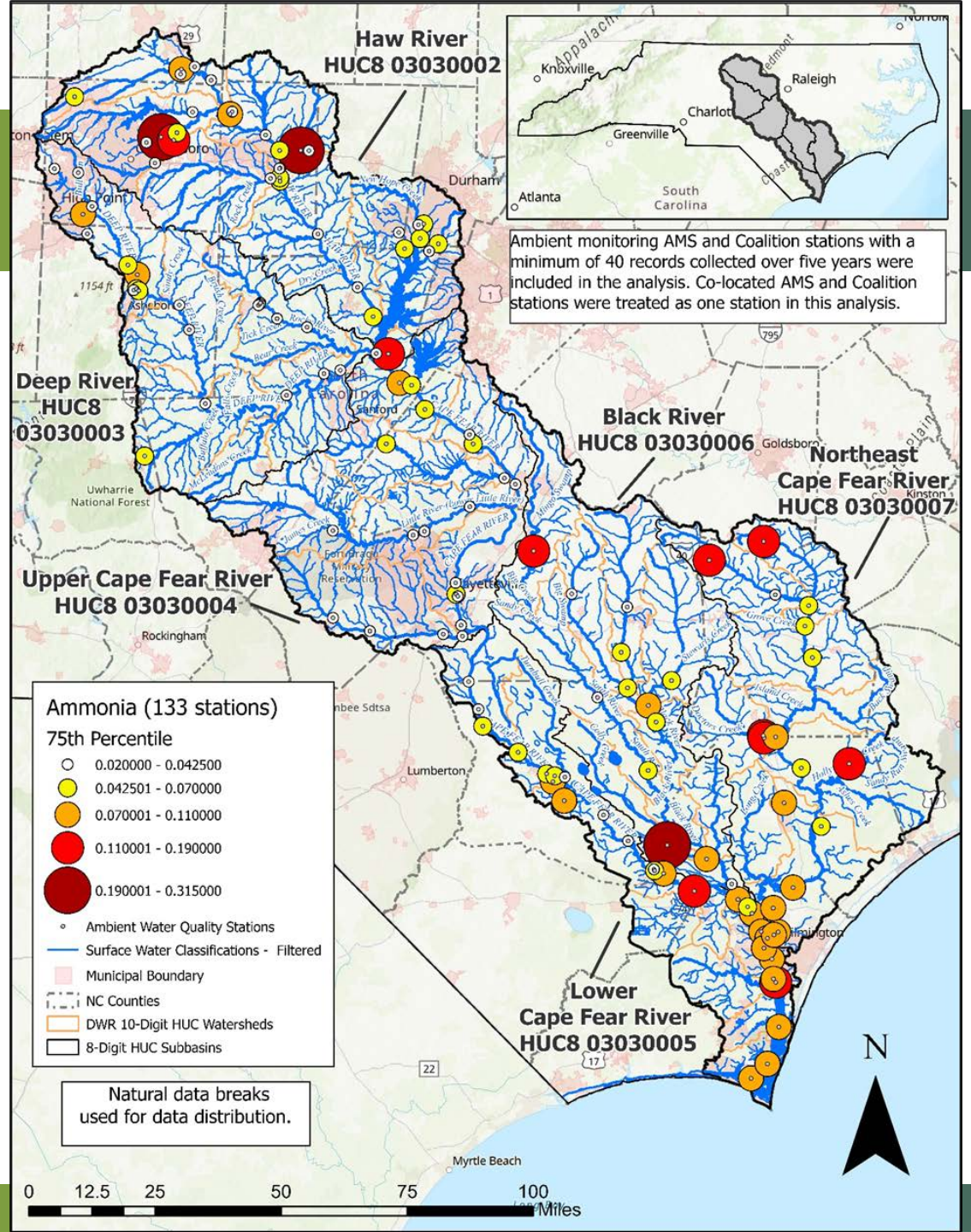
Hot Spots



2022 IR Data Window (2016-2020)



Hot Spots



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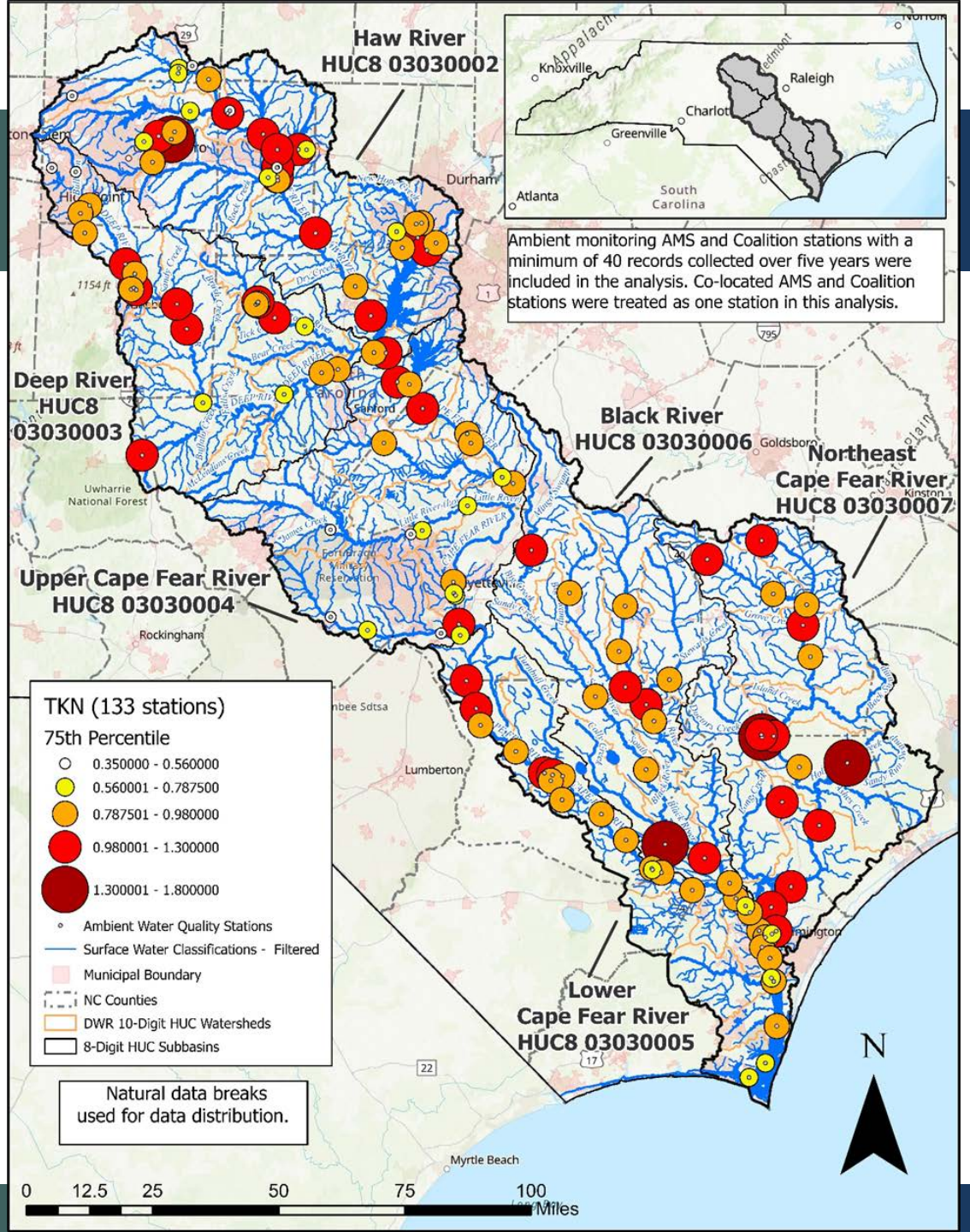
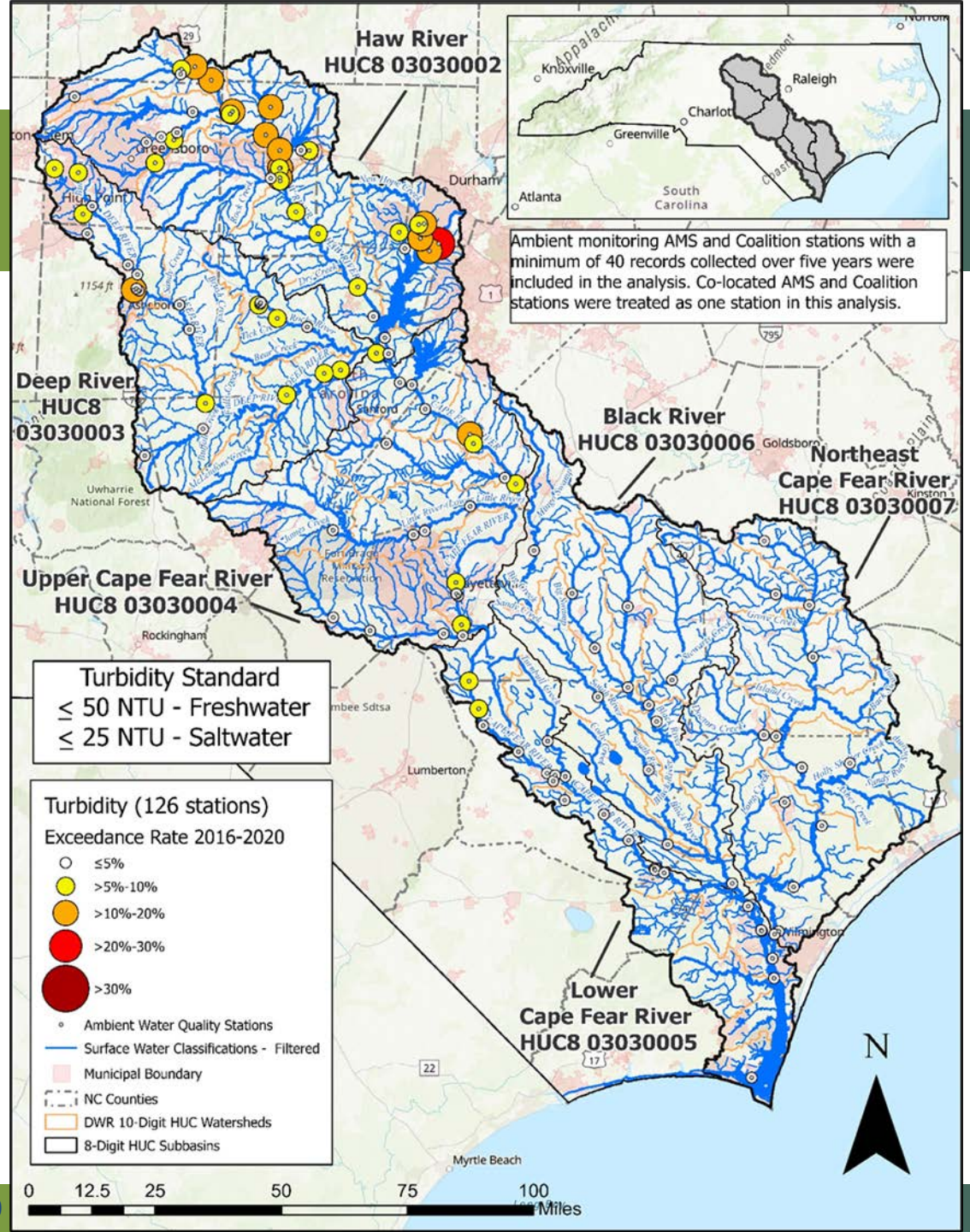
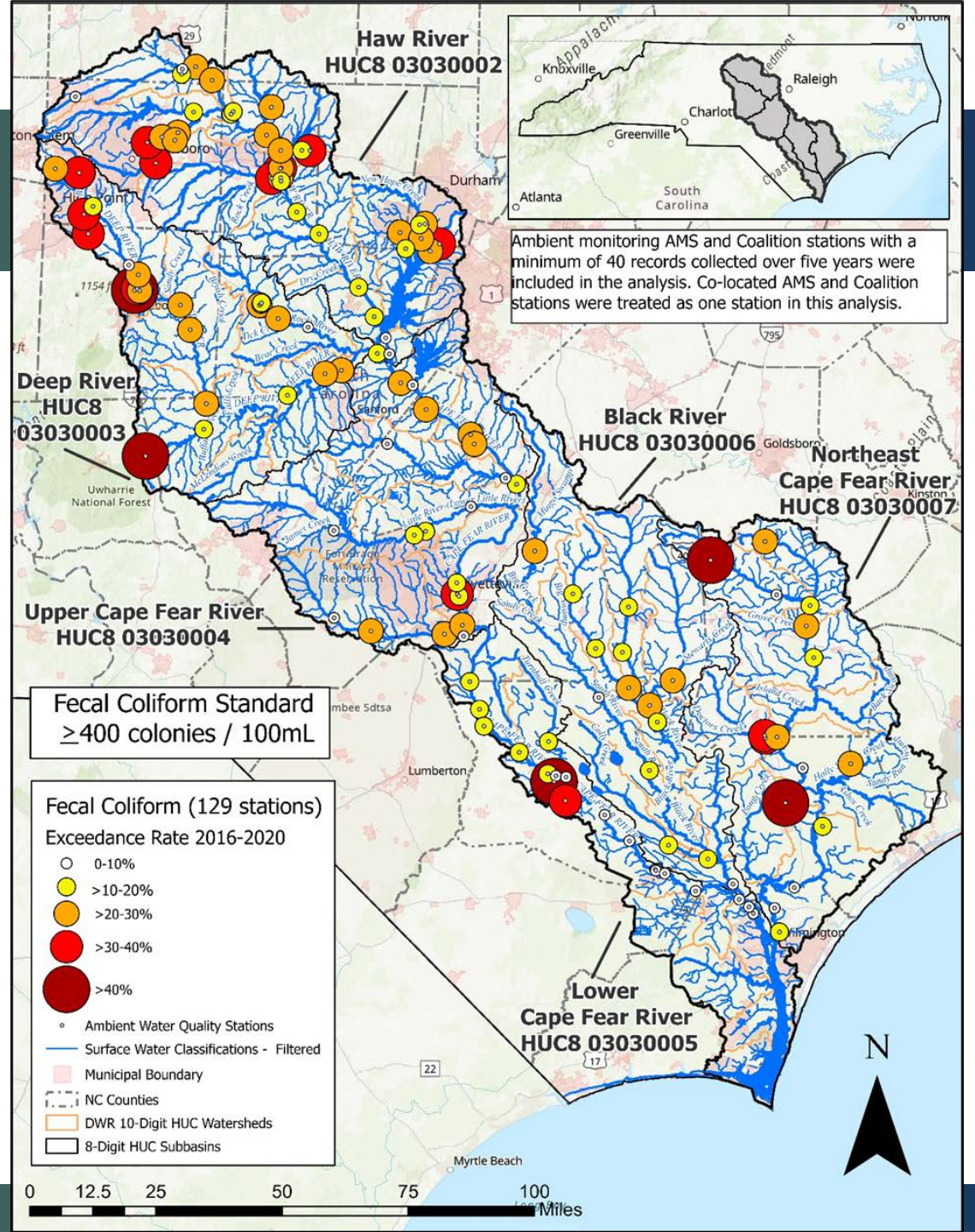


Hot Spots



2022 IR Data Window (2016-2020)



Parameter	TN# (mg/L)	NOx (mg/L)	TKN (mg/L)	NH3 (mg/L)	TP (mg/L)	Fecal C. (cfu/100 mL)	Turbidity (NTU)	Conductivity (µS/cm)	Station Trend* Information 2000-2019 & 2010-2019 Decreasing (↓) or Increasing (↑) Seasonal (S) or Non-Seasonal (NS)	Watershed Information
B3020000	0.83	0.15	0.68	0.03	0.06	821	25.89	135	NH3 - ↓ S 10-19; TP - ↓S 00-19 & S 10-19	**New Hope Creek**
B3039000	3.94	2.91	1.03	0.10	0.15	515	20.4	280	New station 2019 & 2020 only; Replaced B3040000	**New Hope Creek** Downstream of Major WWTP (20 MGD)
B3040000	3.26	2.33	0.92	0.05	0.18	797	33.2	302	NH3 - ↓ S 00-19; TP - ↓ S 00-19; TKN - ↑ S 00-19; NOx - ↓ S 10-19	**New Hope Creek** Downstream of Major WWTP (20 MGD
B3025000	0.94	0.20	0.74	0.04	0.12	1391	31.2	242	TP - ↓ S 00-19 & 10-19; NH3 - ↓ S 10-19	**Third Fork Creek**
B3300000	0.87	0.11	0.76	0.04	0.09	642	76.7	198	(Missing 2016-2019 data) Sampling Restarted 3/2020	**Northeast Creek**
B3660000	2.94	2.13	0.83	0.05	0.23	603	42.4	417	TP - ↓S 00-19; NOx - ↓S 00-19; TKN - ↓S 00-19 & S 10-19; NH3 - ↓S 00-19 & S 10-19; Fecal C - ↑S 10-19 Turbidity – ↑ NS 10-19;	**Northeast Creek** Downstream of Major WWTP (12 MGD)
B3670000	2.5	1.50	0.99	0.07	0.23	557	42.8	354	TP - ↓S 00-19; NH3 - ↓S 10-19; Fecal C - ↑S 00-19 Turbidity – ↑ S 10-19;	**Northeast Creek** Downstream of Major WWTP (12 MGD)

TN is calculated as NOx + TKN. Both values were required to develop a TN value.

* DWR conducted a seasonal or nonseasonal Mann-Kendall trend test at most AMS stations that had sufficient data available; reporting only significant increasing or decreasing trends, calculated at 95% confidence from data collected from 2000-2019 and 2010-2019.

For Non-detects or records below the detection limit, the detect limit value is used in the overall summary means and half the detection limit for trends analysis.

2022 IR period

(2016-2020)

Mean Concentrations & Mann-Kendall Trends

Trends analysis: Screening level seasonal and non-seasonal Mann-Kendall trends test at 95% confidence level (not flow adjusted). Trends assessment periods include: 2000-2019 and 2010-2019.

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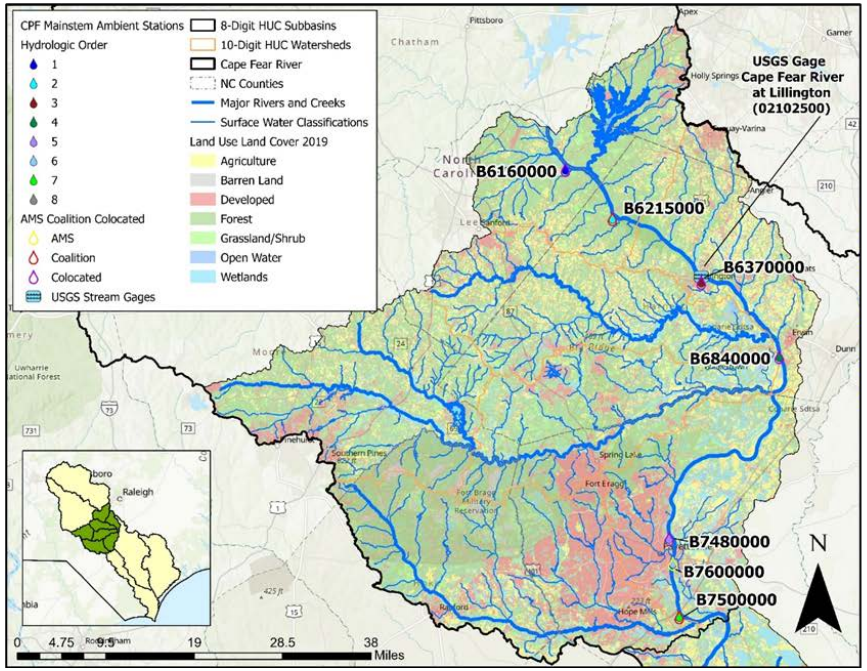
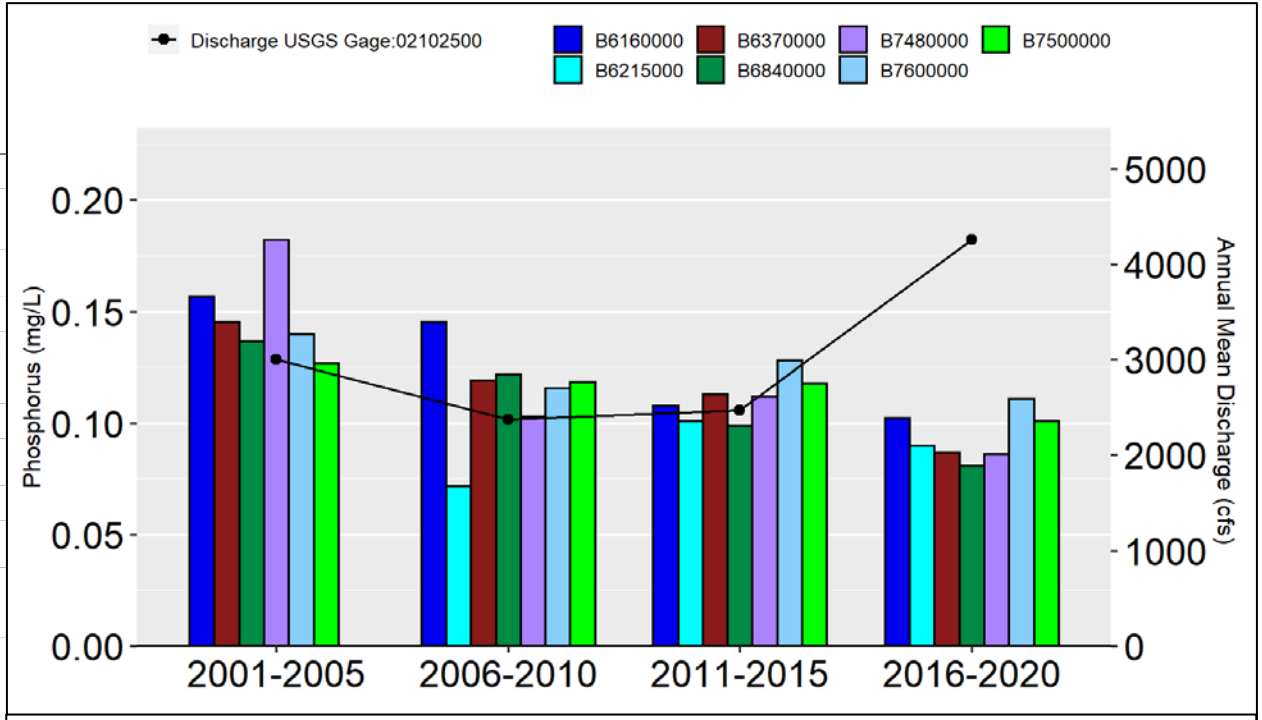
Upper Cape Fear River Subbasin

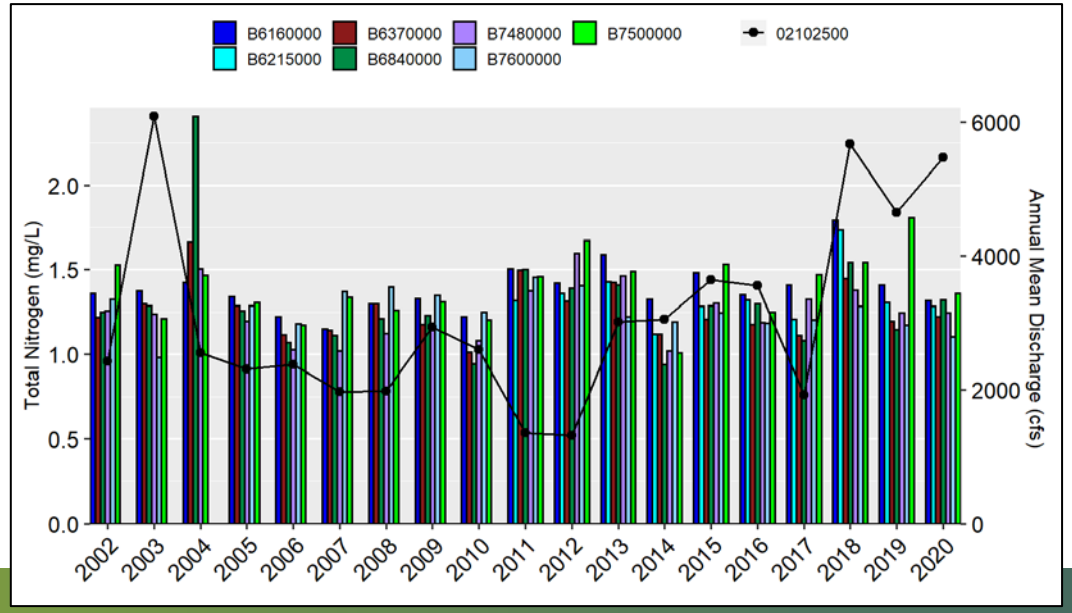


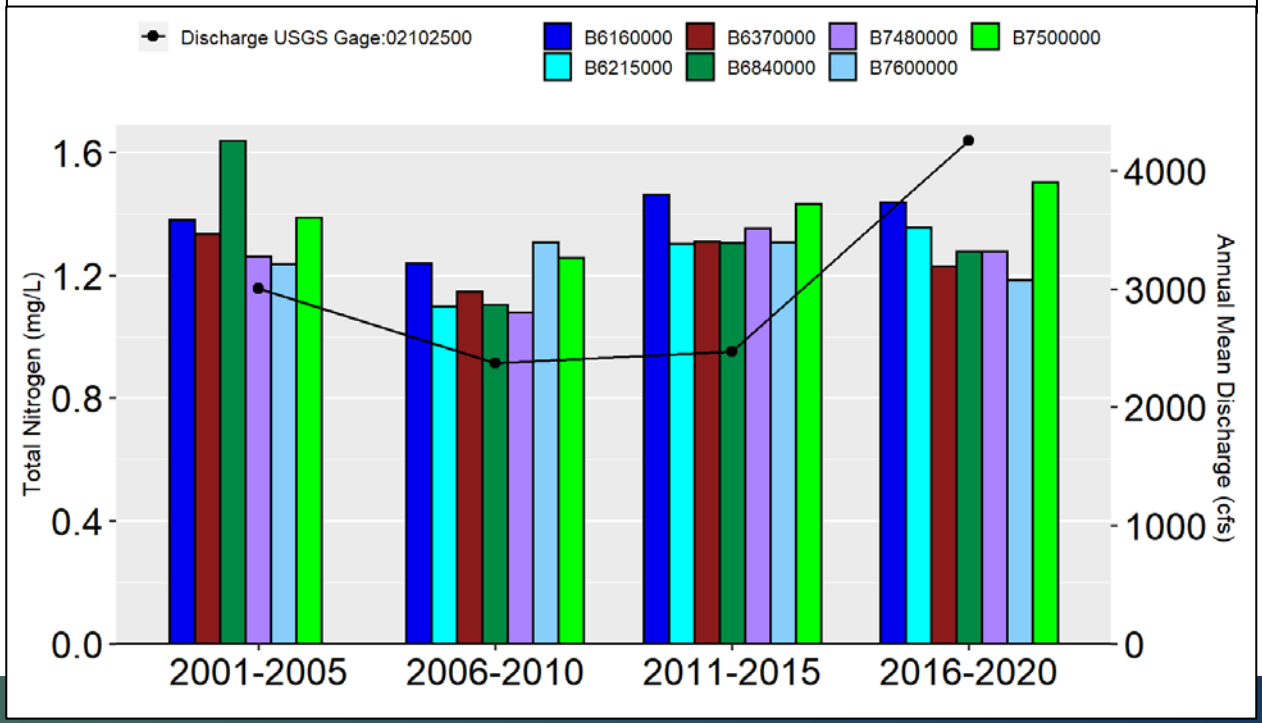
Upper Cape Fear Mainstem Stations

Cape Fear River Mainstem

1	B6160000	18-(4.5)
	Buckhorn Creek	
2	B6215000	18-(10.5)
	Avents Creek	
	Neills Creek	
3	B6370000	18-(16.7)
	North Harnett Regional WWTP (7.5 MGD)	
	Buies Creek	
	Upper Little River	
4	B6840000	18-(20.7)a
	Dunn WWTP (3.75 MGD)	
	Little River	
5	B7480000	18-(25.5)
	Cross Creek WWTP (25 MGD)	
	Cross Creek	
6	B7600000	18-(26)a
7	B7500000	18-(26)b
	Rockfish Creek WWTP (21 MGD)	
	Rockfish Creek	
	Cedar Creek Site(1.25 MGD)	

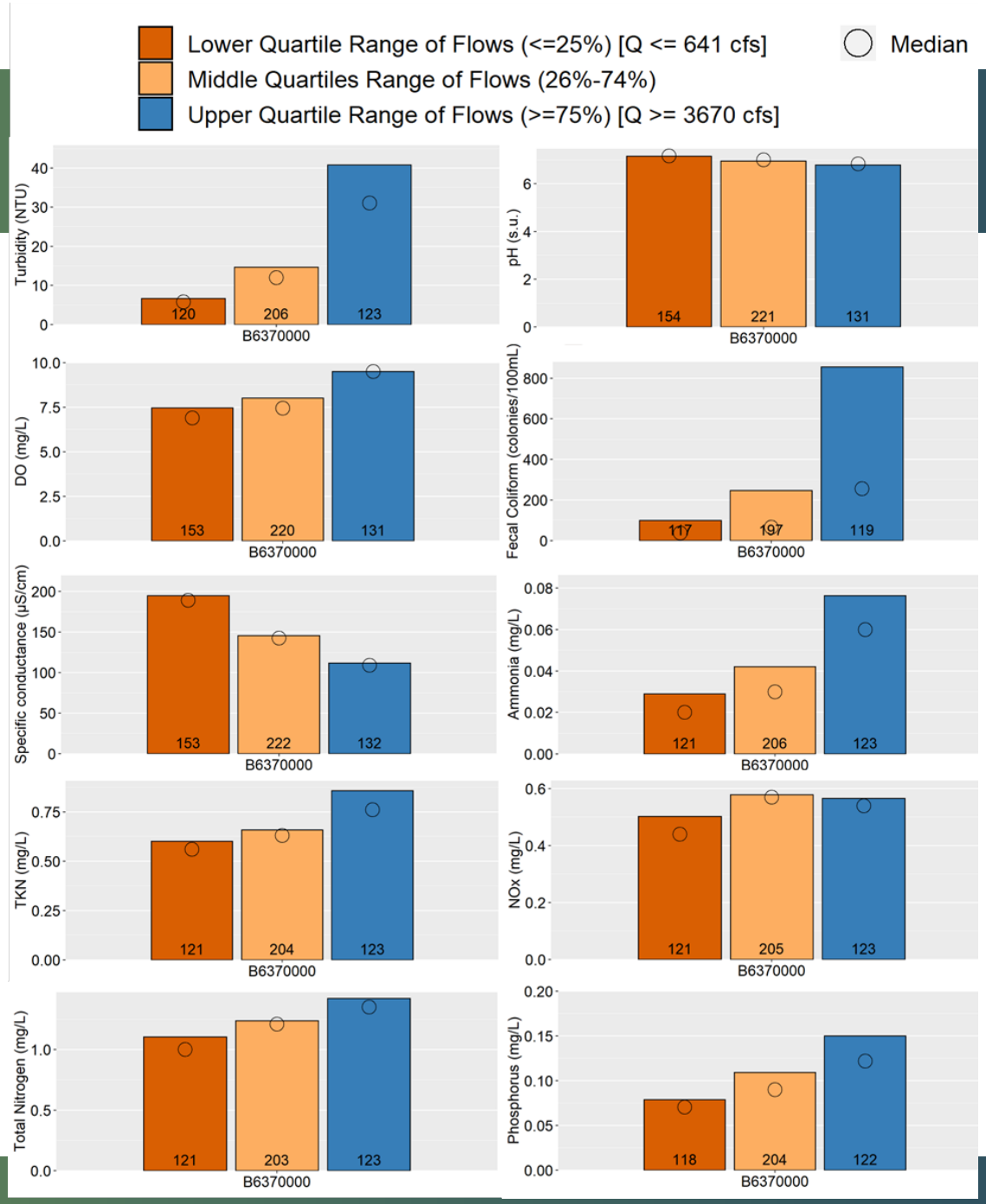






Flow Separated Analysis

Seventeen Year (2002-2019) Flow Separated Mean Concentrations at Water Quality Station **B6370000 at Lillington NC** and USGS Gage Colocated Station 02102500.

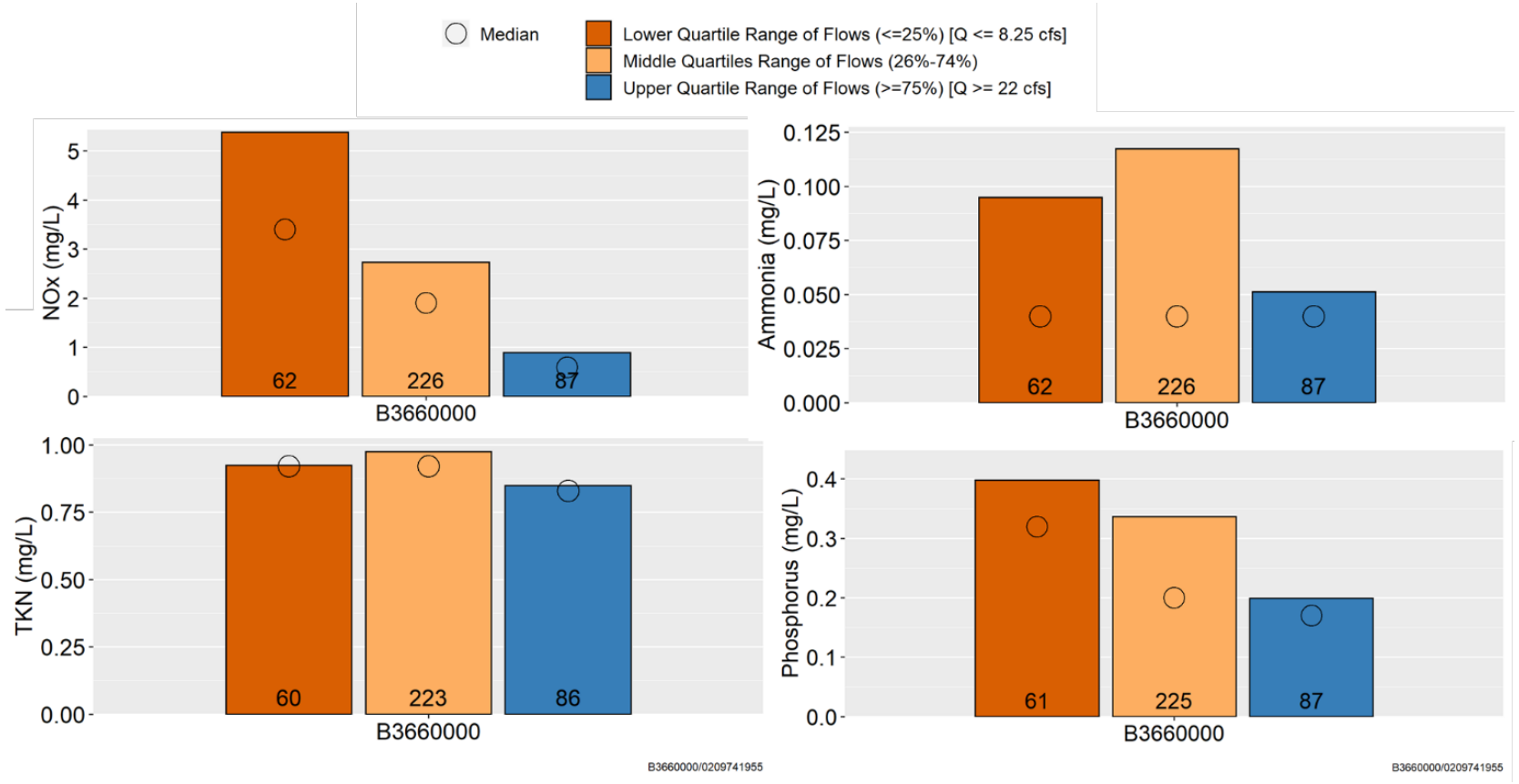


- Low flows ≤ 25th percentile
- Medium flows between 26th & 74th percentile;
- High flows ≥ 75th percentile;

At colocated USGS Gage Stations. Flow estimate based on 1991-2020 data when available.

Northeast Creek - Flow Separated Nutrients

Seventeen Year (2002-2019) Flow Separated Mean Turbidity and TSS Concentrations at AMS/USGS Flow Colocated Station.

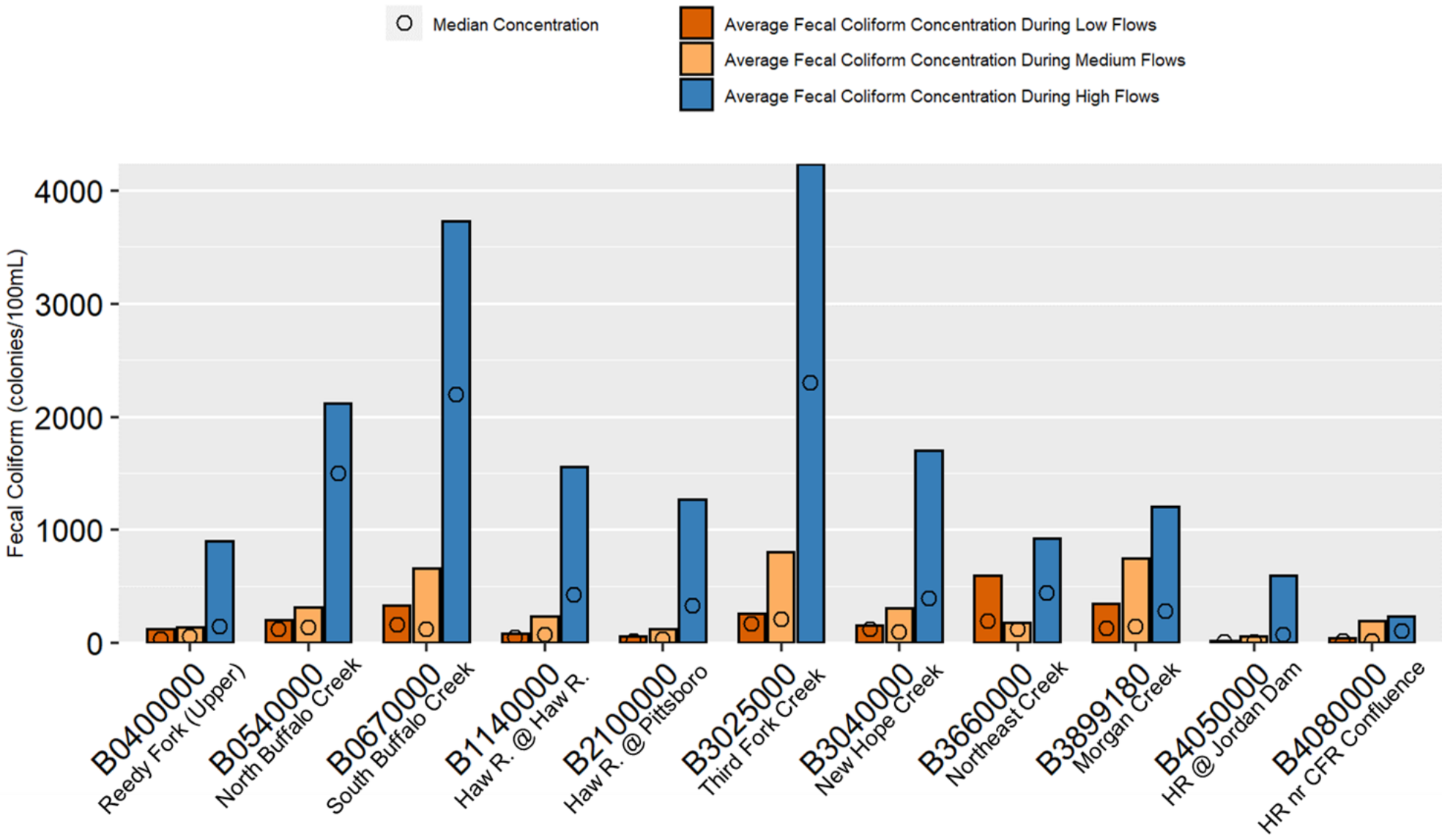


High flows ≥ 75th percentile; Medium flows between 26th and 74th percentile; Low flows ≤ 25th percentile at USGS Gage Station 0209741955. Flow estimate based on 1991-2020 data.

(NOx: L=5.38/3.4, M=2.73/1.9, H=0.89/0.59) (TKN: L=0.92/0.92, M=0.98/0.92, H=0.85/0.83) (NH3: L=0.1/0.04, M=0.12/0.04, H=0.05/0.04) (TP: L=0.40/0.32, M=0.34/0.2, H=0.20/0.17)

Haw River Subbasin - Flow Separated FCB Comparison

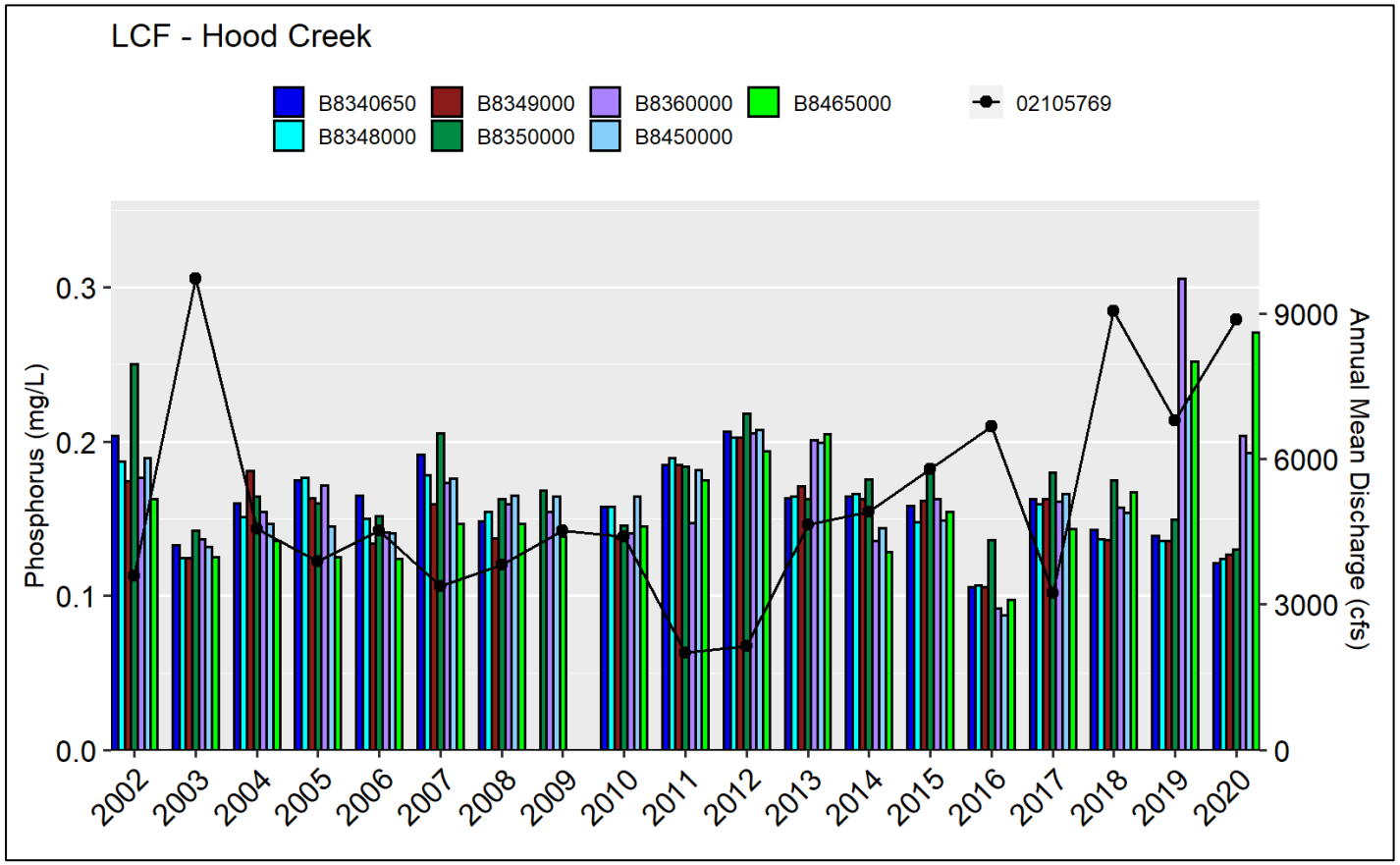
Seventeen Year (2002-2019) Flow Separated Mean and Median Fecal Coliform Bacteria Concentrations at AMS/USGS Flow Colocated Stations in Haw River Watershed.

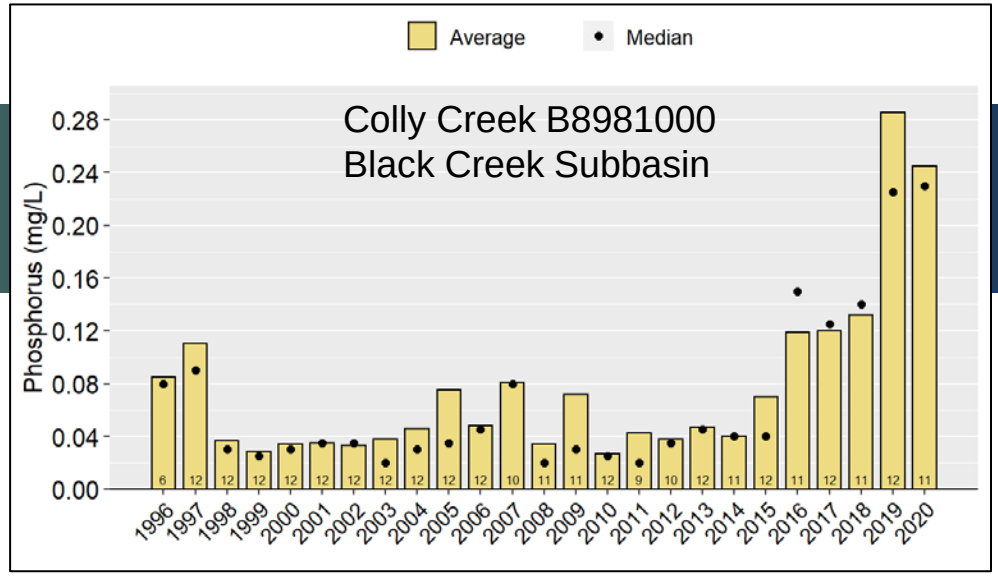


- Low flows ≤ 25th percentile
- Medium flows between 26th & 74th percentile;
- High flows ≥ 75th percentile;

At colocated USGS Gage Stations. Flow estimate based on 1991-2020 data when available.

What is the source of phosphorus?



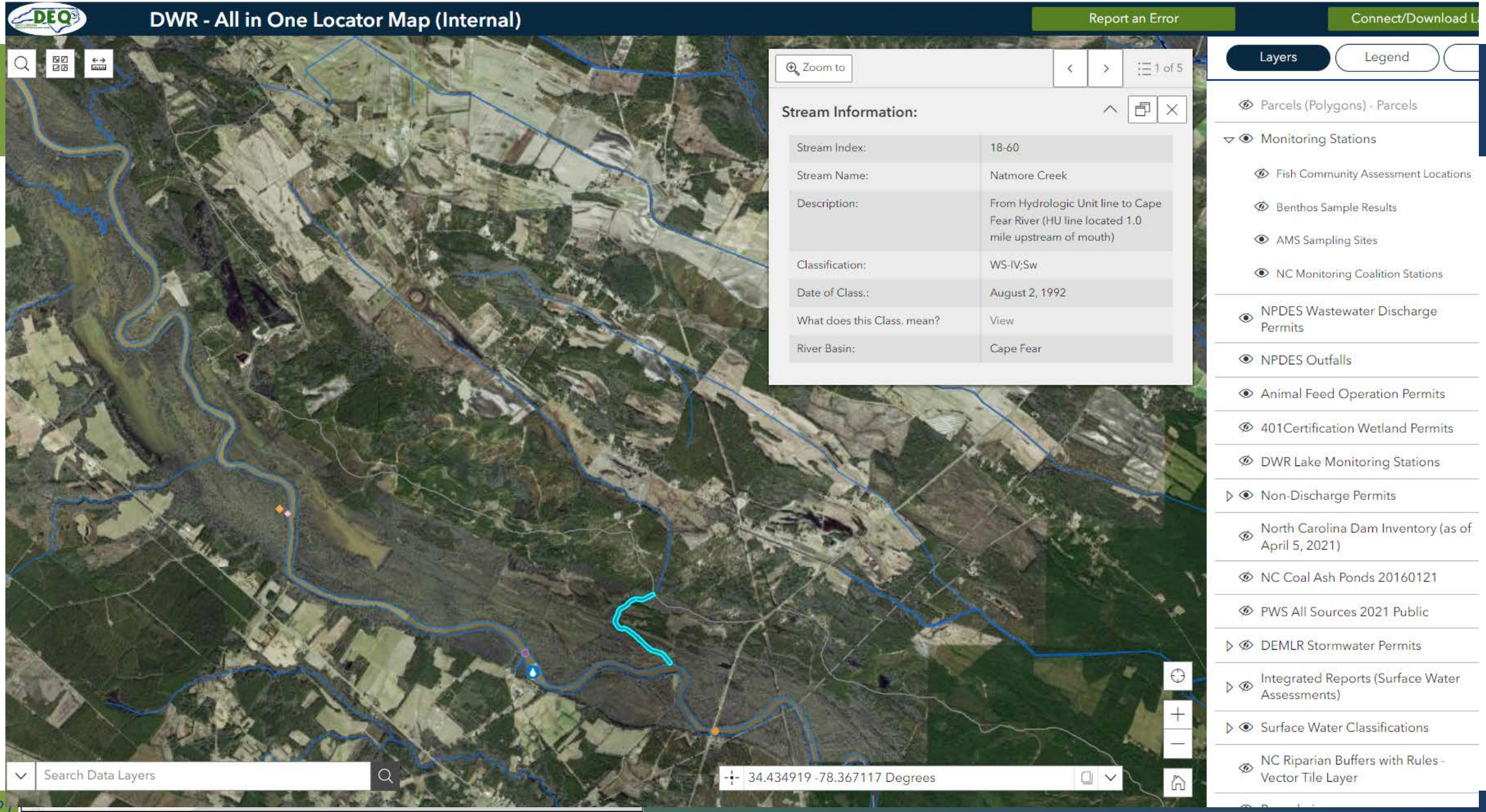


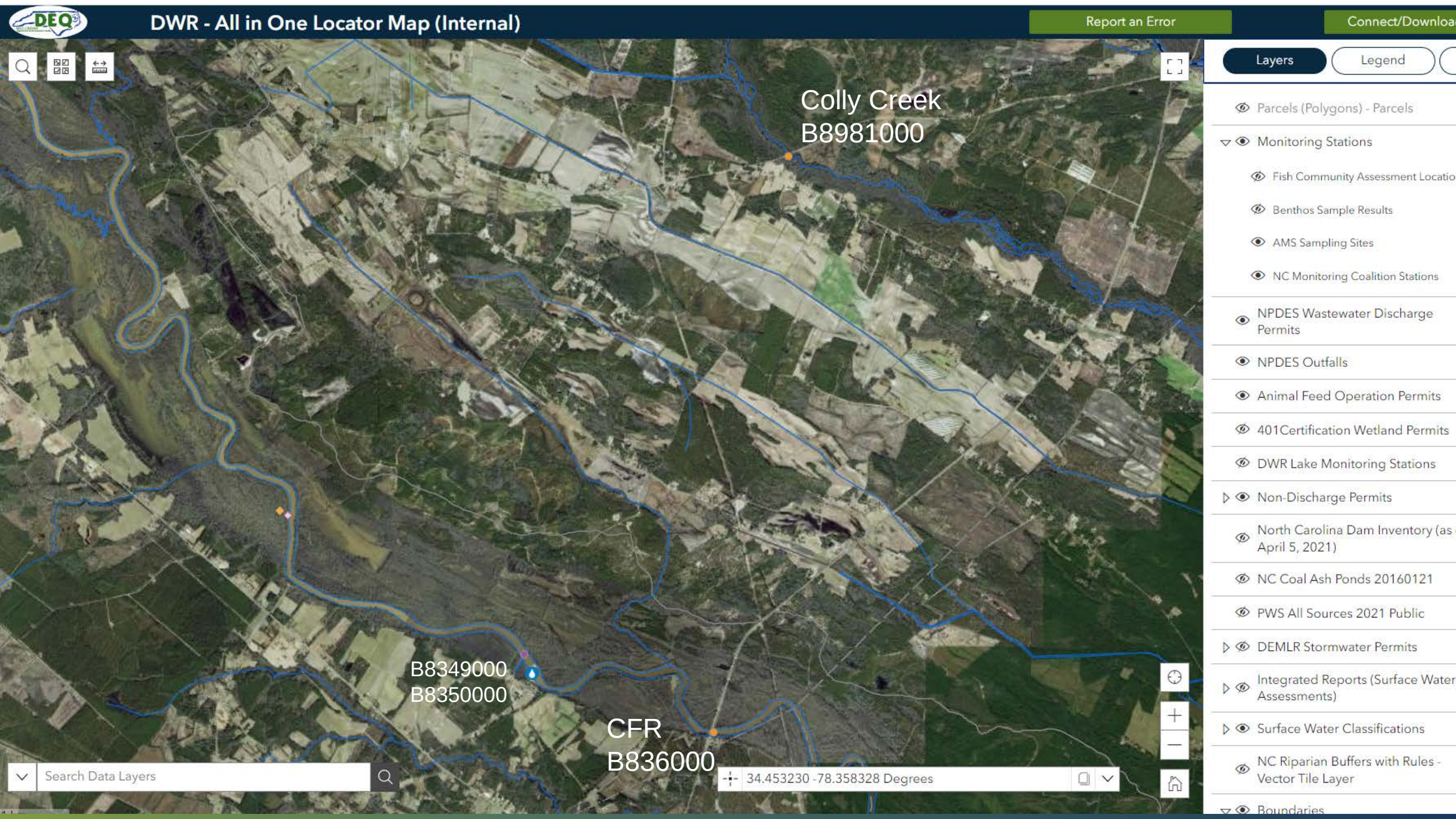
Hood Creek-Cape Fear Mainstem Stations

Cape Fear River Mainstem - 50.1 FW Miles

- Hammond Creek
- 1 **B8340650** 18-(49)
- 2 **B8348000** 18-(53.5)
- 3 **B8349000** 18-(58.5)
- Lock & Dam #1
- 4 **B8350000** 18-(59)
- Natmore Creek
- 5 **B8360000** 18-(59)
- Riegelwood Mill Facility (50 MGD)
- Livingston Creek
- 6 **B8450000** 18-(63)a
- Hood Creek
- 7 /* **B8465000** 18-(63)b

DEQ
Environmental Quality


DWR - All in One Locator Map (Internal)
Report an Error
Connect/Download L
Zoom to
1 of 5
Stream Information:
Stream Index: 18-60
Stream Name: Natmore Creek
Description: From Hydrologic Unit line to Cape Fear River (HU line located 1.0 mile upstream of mouth)
Classification: WS-IV;Sw
Date of Class.: August 2, 1992
What does this Class. mean? View
River Basin: Cape Fear
Layers
Legend
Parcels (Polygons) - Parcels
Monitoring Stations
Fish Community Assessment Locations
Benthos Sample Results
AMS Sampling Sites
NC Monitoring Coalition Stations
NPDES Wastewater Discharge Permits
NPDES Outfalls
Animal Feed Operation Permits
401Certification Wetland Permits
DWR Lake Monitoring Stations
Non-Discharge Permits
North Carolina Dam Inventory (as of April 5, 2021)
NC Coal Ash Ponds 20160121
PWS All Sources 2021 Public
DEMLR Stormwater Permits
Integrated Reports (Surface Water Assessments)
Surface Water Classifications
NC Riparian Buffers with Rules - Vector Tile Layer
Search Data Layers
34.434919 -78.367117 Degrees


DWR - All in One Locator Map (Internal)
Report an Error
Connect/Downloa
Layers
Legend
Colly Creek
B8981000
B8349000
B8350000
CFR
B836000
Parcels (Polygons) - Parcels
Monitoring Stations
Fish Community Assessment Locatio
Benthos Sample Results
AMS Sampling Sites
NC Monitoring Coalition Stations
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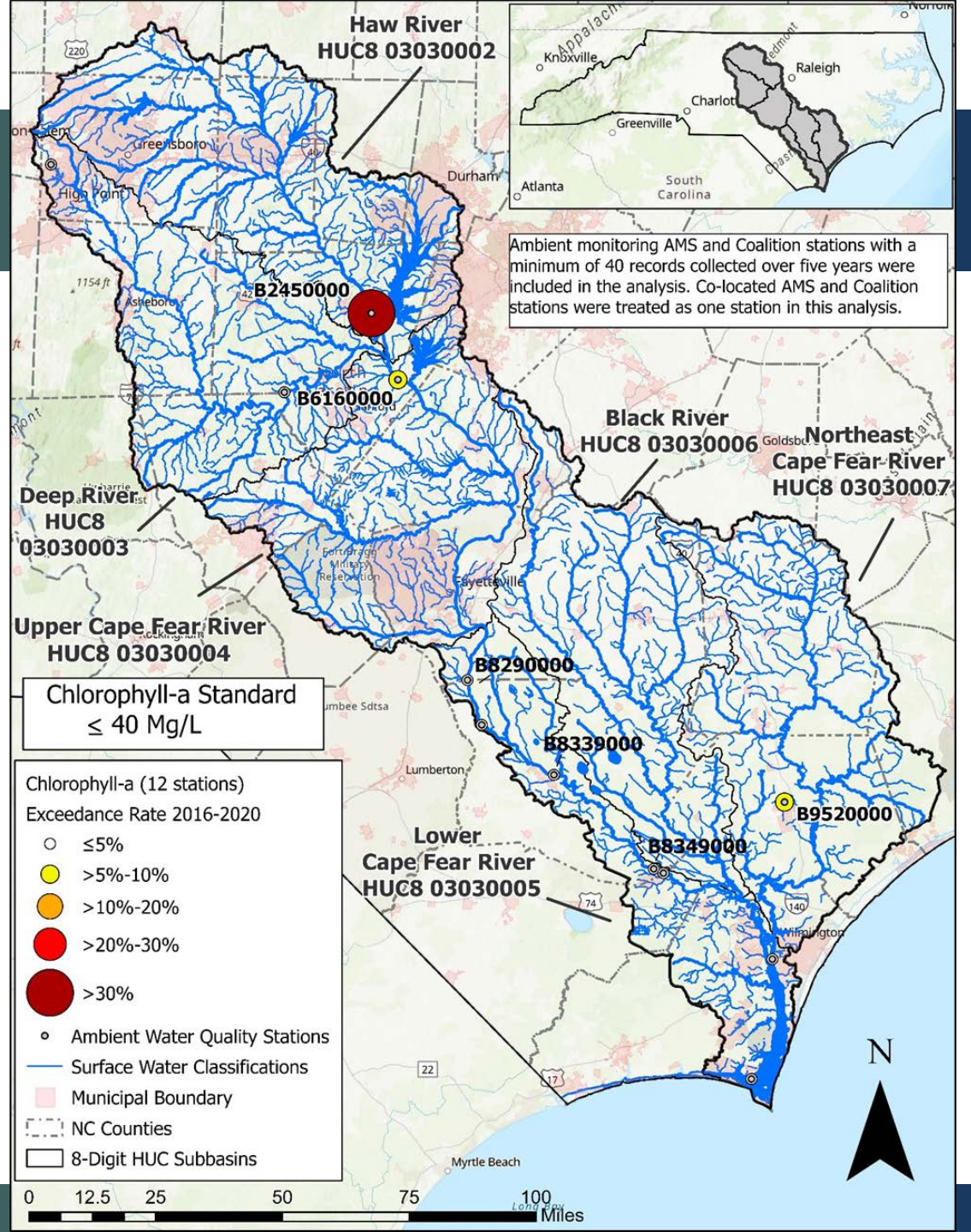
Integrated Reports (Surface Water Assessments)
Surface Water Classifications
NC Riparian Buffers with Rules - Vector Tile Layer
Boundaries
Search Data Layers
34.453230 -78.358328 Degrees

Do we have algal blooms issue in the CFR?

Integrated Report (IR) Year	Cape Fear River AU# 18-(4.5) B6160000* Upstream of Buckhorn Dam	Cape Fear River AU# 18-(5.5)a CPFBDL2# Behind Buckhorn Dam	Cape Fear River AU# 18-(26.25)b^ B8290000+ At LD3	IR Data Assessment Years
2006	**Impaired**	No Data	**Impaired**	2005 Basin Plan (9/1/98-8/31/2003)
2008	**Impaired**	No Data	**Impaired**	2002-2006[1]
2010	**Impaired**	No Data	Supporting	2004-2008[1]
2012	**Impaired**	Data Inconclusive	Supporting	2006-2010[1]
2014[2]	Supporting	Data Inconclusive	Supporting	2008-2012
2016	Supporting	**Impaired**	Supporting	2010-2014
2018	Supporting	**Impaired**	Supporting	2012-2016
2020	Supporting	**Impaired**	Supporting	2014-2018
2022	Supporting	**Impaired**	Supporting	2016-2020

^ Previously AU# was 18-(26)c;
* Middle Cape Fear River Basin Association Cape Fear River station B6160000 located at NC 42 near Corinth, upstream of Buckhorn Dam;
# DWR-Intensive Survey Branch, Lakes Ambient Monitoring Program station CFRBDL2 located in the Buckhorn Dam Lake upstream of dam;
+ Middle Cape Fear River Basin Association Cape Fear River station B8290000 located at Dupont water intake, upstream of LD3;
1 No data available between June 2004 and April 2007.
2 New 2014 IR assessment method, added the use of 90% Statistical Confidence

2022 IR Data Window (2016-2020) ~ 12 non-lake Chl a stations



Are nutrients an issue in the mainstem Cape Fear River?

*Chlorophyll a Concentrations at **Station CPFBDL2 on the Cape Fear River Behind Buckhorn Dam** with Corresponding 1-Day and 7-Day Average Flow at Lillington USGS Gage 02102500.*

Sample Date	Chl *a* (µg/L)	1-Day Average Flow (cfs)*	7-Day Average Flow (cfs)^
7/19/2010	**32**	691	673
8/12/2010	**48**	596	594
8/30/2010	**45**	628	908
9/23/2010	**46**	502	548
10/21/2010	**38**	621	597
5/22/2013	4	6,000	2,324
6/24/2013	**22**	1,480	3,014
7/22/2013	11	1,920	5,183
8/27/2013	14	996	4,042
9/30/2013	**48**	564	608
5/1/2018	5	6,180	8,911
6/11/2018	**20**	872	869
7/16/2018	**20**	561	597
8/28/2018	12	967	4,469

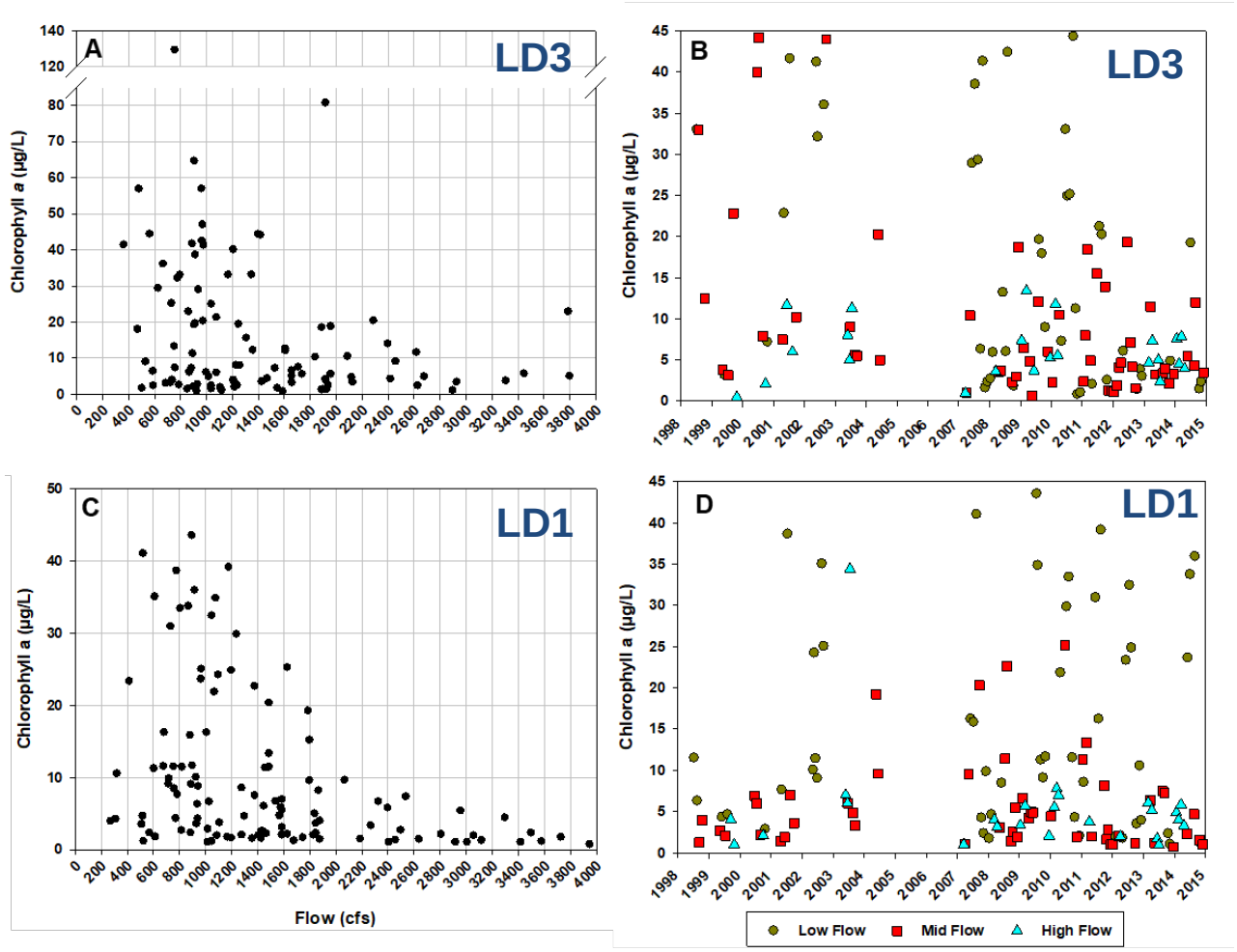
*Corresponding daily average USGS flow at Lillington USGS gage 0210500
^ Corresponding previous 7-day average USGS flow at Lillington USGS gage 0210500 (average of the 7 individual daily averages).

When the flow of the Cape Fear River drops below about 900 cfs at the Lillington USGS flow gage for an extended period of time, algae will likely bloom if the other environmental controlling factors are suitable (such as temperature, light and nutrients).

The non-drought low flow target at Lillington is 600 cfs (± 50 cfs).

Are nutrients an issue in the mainstem Cape Fear River?

Corresponding Chlorophyll a and Streamflow Data at the Cape Fear River Stations B8290000 (A and B) (LD3) and B8349000 (C and D) (LD1).



Chlorophyll-*a* Concentration	B8290000/ LD 3 Flow (02105500)	Percent of Time Below Flow at LD 3*	B8349000/ LD 1 Flow (02105769)	Percent of Time Below Flow at LD 1*
>10 µg/L	<2,625 cfs	~ 66 %	<1,800 cfs	~ 38 %
>20 µg/L	<2,300 cfs	~ 51 %	<1,650 cfs	~ 35 %
>30 µg/L	<1,450 cfs	~ 34 %	<1,250 cfs	~ 21 %

*Flow statistic based on the flow record of 1/1/1983-8/7/2016.
Chlorophyll-*a* data summaries for data collected between 1998 and 2014; No available data for the period of July 2004-Feburary 2007.

Hall and Rosman (2022) reported:

- "The highest chlorophyll-*a* values occurred on low flow days when the water column was thermally stratified and indicated that low flow thermally stratified conditions are conducive for net phytoplankton growth".
- That the highest chlorophyll-*a* concentrations were observed on a day with strong thermal stratification and was preceded by about a week of stable flow around 1,500 cfs.
- They concluded that thermal stratification was found to "suppress vertical mixing and isolates the surface layers from the bottom layer. With limited vertical mixing, phytoplankton remain close to the surface and experience higher average irradiance conditions that can stimulate blooms of the light limited Cape Fear River phytoplankton community"

Water quality sampling technique and data interpretation challenges include:

• 2006 IR based on 2005 approved CFR basin plan assessment. Data window was from 9/1/1998 to 8/31/2003 with samples collected using a grab sample technique.

• November 2004: Mainstem river water quality sampling technique changed from surface grab to depth integrated samples. Using depth integrated sampling techniques likely diluted the chlorophyll *a* concentrations reducing the appearance of a water quality concern.

• November 2004: Changed from summer critical period monitoring to year-round monitoring.

• June 2004 to April 2007: Coalition laboratory chlorophyll *a* methodology concerns, resulted in disqualification of data.

• 2014 303(d) use support methodology changed to include statistical confidence. For waters to be placed in Category 5, there has to be a > 10% excursion of the water quality standard with a 90% statistical confidence. This increases the number of excursions (based on the number of samples collected during a five-year assessment period) above the water quality standard needed before a waterbody can be listed as impaired. Statistical confidence was not needed to delist a stream.

• DWR received public comments on the 303(d) list with data to support modifying the sampling technique along the Cape Fear River mainstem due to the type of blooms and how the Cape Fear River system is influenced by flow, dams, and light limitation/turbidity levels.

• **Instream chlorophyll *a* concentrations do not reflect bloom conditions in the riverine system using the depth integrated sampling technique. Sampling results from routine ambient monitoring and from algal bloom responses have resulted in very few chlorophyll *a* exceedances despite visible algal blooms.** ***A recommendation in the 2024 Cape Fear River basin plan is to reassess sampling techniques for free-flowing waterbodies as well as review and modify the instream chlorophyll a criterion for flowing streams, as part of the NCDP process.***

Nutrient Criteria Development Plan (NCDP)

- EPA requires the development of appropriate instream nutrient criteria for the protection of designated uses.
  - May include large and small flowing rivers and streams
  - Criteria could include nitrogen, phosphorus, chlorophyll, etc.
- Middle Cape Fear chosen for pilot watershed study due to ongoing concerns with nutrient over-enrichment.
- May result in reduction requirements/nutrient management strategy for the basin

Cape Fear River Modeling Update
6/21/2023

Department of Environmental Quality

Purpose

- Develop dissolved oxygen and nutrient models for Middle Cape Fear
- Support NPDES permitting efforts
- Potentially support future nutrient management strategies (pending nutrient criteria development)
- Provide information of sources of loading to lower Cape Fear River system

Where?

Modeling Spatial Extent

Who is developing the models?

EPA Reg IV

Modeling Team working with DWR Modeling Branch

Parameters of Focus

- Nutrients (primarily nitrogen and phosphorus)
- Chlorophyll-a
- Dissolved Oxygen (DO)

2 Types of Models

1. Watershed model – provides information on the relative amounts of loading coming from different sources.
   - LSPC - Loading Simulation Program in C++

2. Receiving water (or nutrient response) model – provides information on the impact of loading to receiving water (i.e., mainstem Cape Fear River) such as chlorophyll a response to nutrient loading.
   - WASP – Water Quality Analysis Simulation Program

Next Steps

- Early 2024 – initial model completed
- Mid 2024 – DWR completes review and report
- Late 2024 – pending resources – third-party review

For more information:
https://www.deq.nc.gov/about/divisions/water-resources/water-planning/modeling-assessment/special-studies#MiddleCapeFearRiverNutrientsandDissolvedOxygen-2700

Proposed - Cape Fear River Basin Plan Timeline

Cape Fear River Basin Plan Process	Due Date
Public Review (~45 days)	Mid July – Late August 2023
Incorporate Changes	September - mid October 2023
Premeeting & WQC Materials	October 12, 2023
WQC Meeting	November 8, 2023
Premeeting & EMC Materials	December 14, 2023
EMC Meeting	January 11, 2024

Following CFR basin plan approval - Develop supporting ArcGIS StoryMap

Questions

Nora Deamer
nora.deamer@deq.nc.gov
919-707-9116

https://deq.nc.gov/about/divisions/water-resources/water-planning/basin-planning/river-basin-plans/cape-fear

Cape Fear Basin Mailing List

To subscribe to DWR's Cape Fear River Basin email list to receive emails regarding public comment periods and public meetings related to the basin, please fill out the form below. Public participation in the development of the basin plan is encouraged.

Full Name:

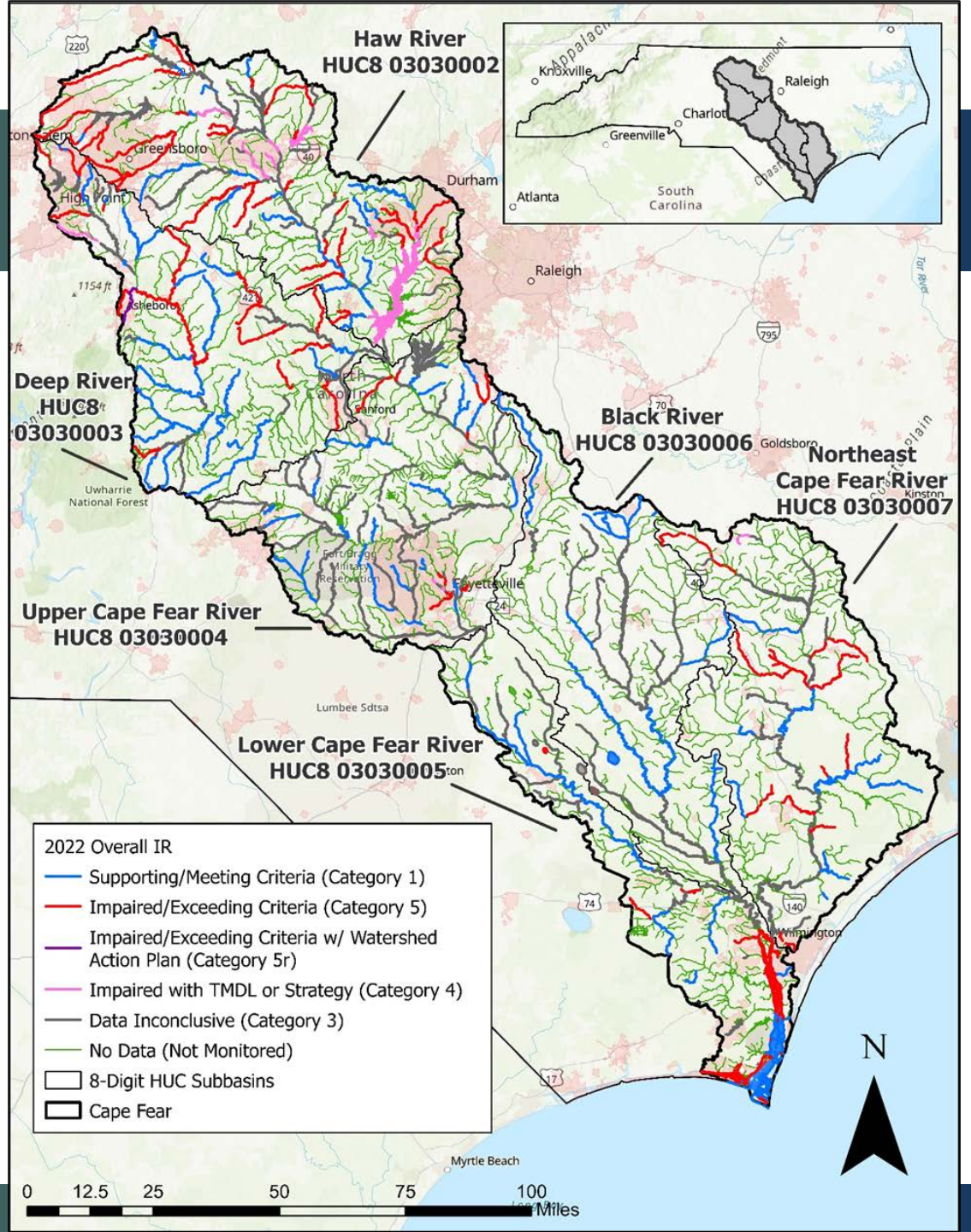
Email:

Daily digest summary format

Submit

Cape Fear River Basin ~ 2022 Integrated Report Totals

PARAMETER (Category 4, 5, and 5r Combined)[1,2]	FW Miles[3]	FW Acres[3]	SW Acres[3]
Aquatic Passage	8.6	0.0	0.0
Arsenic (10 µg/l, HH, NC)	0.0	0.0	715.1
Arsenic Fish Tissue Advisory (Advisory, FC, NC)	5.1	0.0	350.6
Benthos (Nar, AL, FW)	390.6	0.0	0.0
Chloride (230 mg/l, AL, FW)	3.4	0.0	0.0
Chlorophyll a (40 µg/l, AL, NC)	34.0	11,723.6	0.0
Copper (3 µg/l, AL, SW)	0.0	0.0	5,567.7
Copper (7 µg/l, AL, FW)	59.7	0.0	0.0
Copper Dissolved Chronic (Calcuated, AL, FW)	7.5	0.0	0.0
Dissolved Oxygen (4 mg/l, AL, FW)	24.4	0.0	0.0
Dissolved Oxygen (5 mg/l, AL, SW)	0.0	0.0	5,025.6
Fecal Coliform (GM 200/400 5 in 30, REC, FW)	52.3	0.0	0.0
Fecal Coliform (GM 200/400, REC, FW)	55.2	0.0	0.0
Fish Community (Nar, AL, FW)	127.8	0.0	0.0
Hexavalent Chromium Fish Tissue Advisory (Advisory, FC, NC)	5.1	0.0	350.6
Hydraulics	8.6	0.0	0.0
Mercury (0.012 µg/l, FC, FW)	1.9	0.0	0.0
Nickel (8.3 µg/l, AL, SW)	0.0	0.0	715.1
pH (4.3 su, AL, Sw)	13.0	576.1	0.0
pH (6 su, AL, FW)	1.9	214.1	0.0
pH (6.8 su, AL, SW)	0.0	0.0	743.7
pH (9.0, AL, FW)	0.0	2,761.9	0.0
Shellfish Growing Area Status (Fecal, SH, SA)	0.0	0.0	2,408.6
Total Nitrogen	0.0	11,375.9	0.0
Total Phosphorus	0.0	11,375.9	0.0
Total Suspended Solids	3.9	3,644.9	0.0
Turbidity (25 NTU, AL, FW acres & SW)	0.0	3,752.1	0.0
Turbidity (50 NTU, AL, FW miles)	30.6	0.0	0.0
Zinc (50 µg/l, AL, FW)	14.6	0.0	0.0

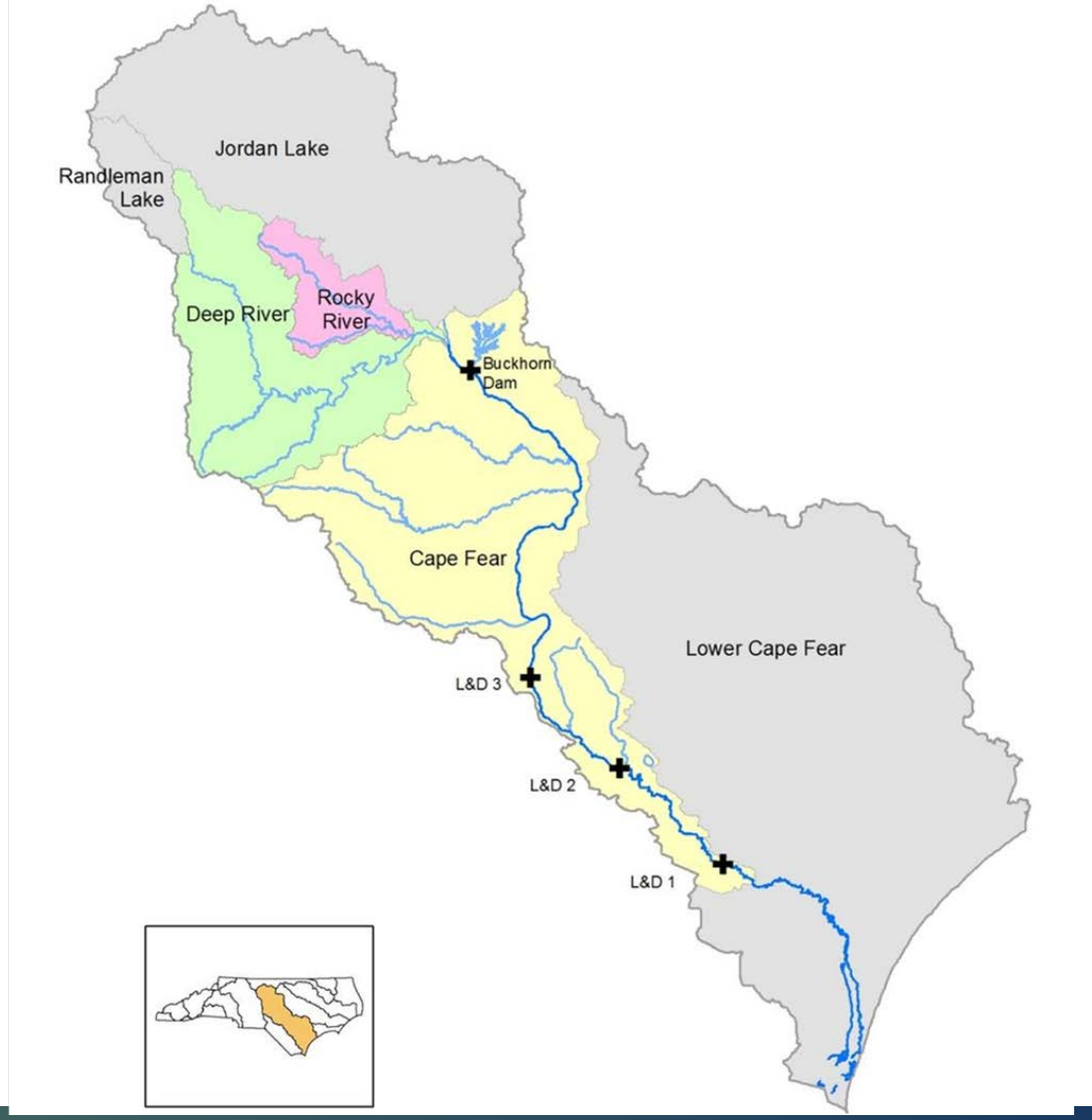


1Waterbody Uses: HH – Human Health, AL – Aquatic Life, FC – Fish Consumption, SH - Shellfish Harvesting, REC – Recreation;
2Other: GM – Geometric Mean, Nar – Narrative;
3Waterbody Type: FW – Freshwater, SW - Saltwater, Sw - Swamp Waters, SA - Shellfish Area, NC - All North Carolina waters.

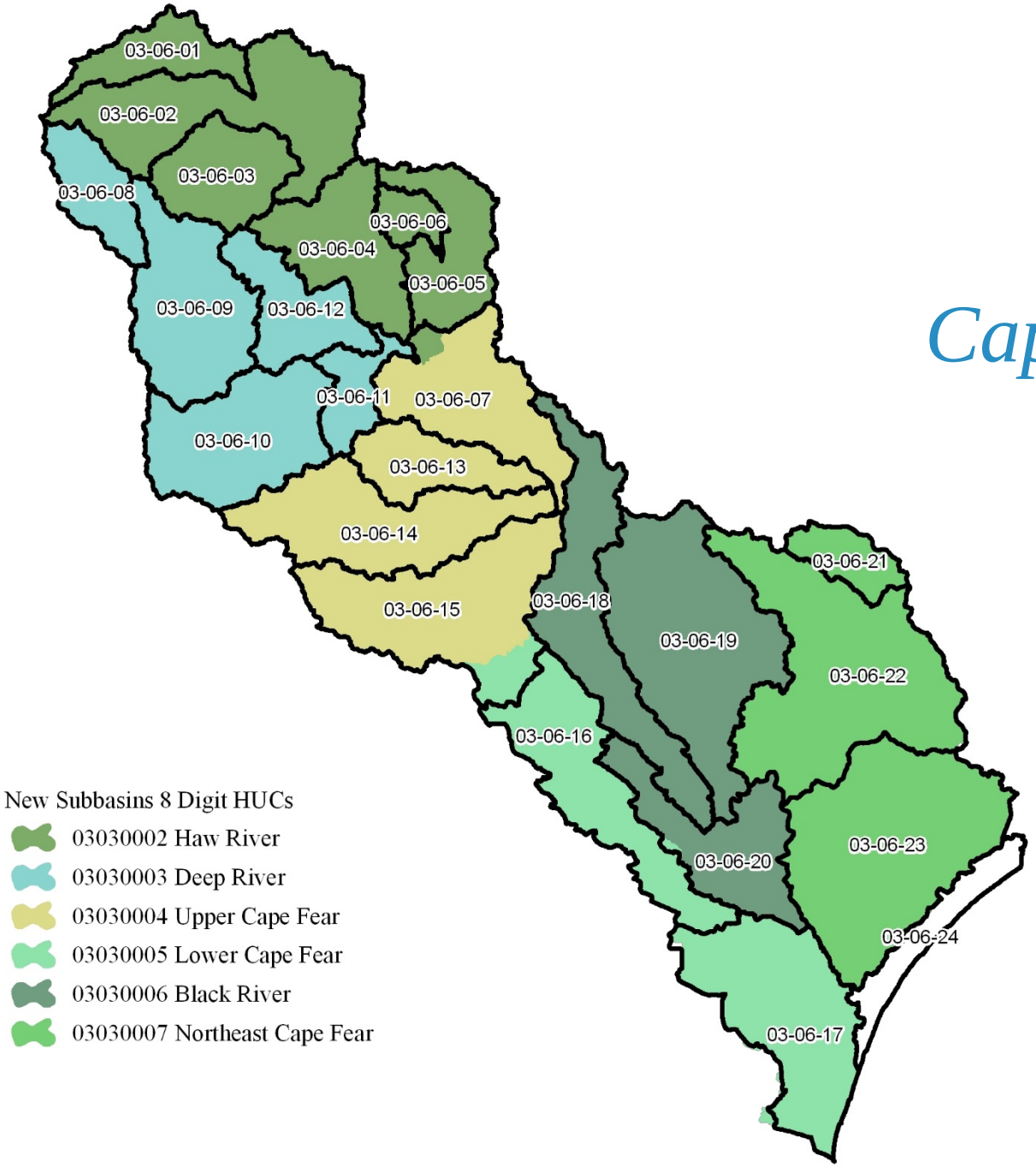
Modeling & Nutrient Criteria Development Plan (NCDP)

- Middle Cape Fear River Basin Model
  (Estimated completion date is towards the end of 2023)
  - Support NPDES permitting for nutrients
  - Provide permitting tool to allow for future growth
  - Provide information on existing impaired waters

- Nutrient Criteria Development Plan
  - EPA requires the development of appropriate instream nutrient criteria for the protection of designated uses
    - May include large and small flowing rivers and streams
    - Criteria could include nitrogen, phosphorus, chlorophyll, etc.
  - Middle Cape Fear chosen for pilot watershed study due to ongoing concerns with nutrient over-enrichment
  - May result in reduction requirements/nutrient management strategy for the basin



Cape Fear River Basin HUC 8 Map



NORTH CAROLINA
Department of Environmental Quality

Water Quantity – Haw River Subbasin

Durham County

Haw River Subbasin (03030002)

- Water demand and service-area population (Figure 1)
- Water supply, demand, residential consumption rate (Figure 2)

Ongoing Projects

- Western Intake Partnership
  - Durham JLR4 Allocation: 16.5 MGD
- Durham County Teer Quarry

Figure 1.

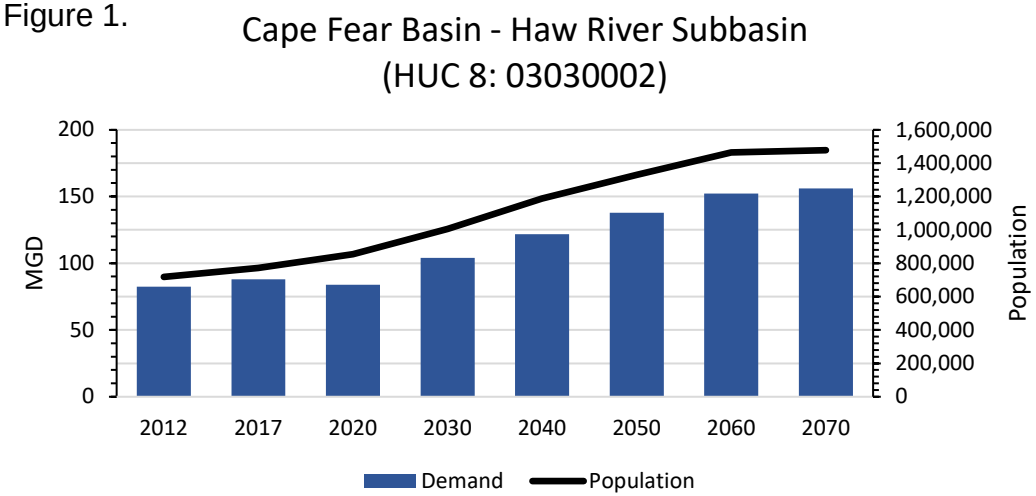
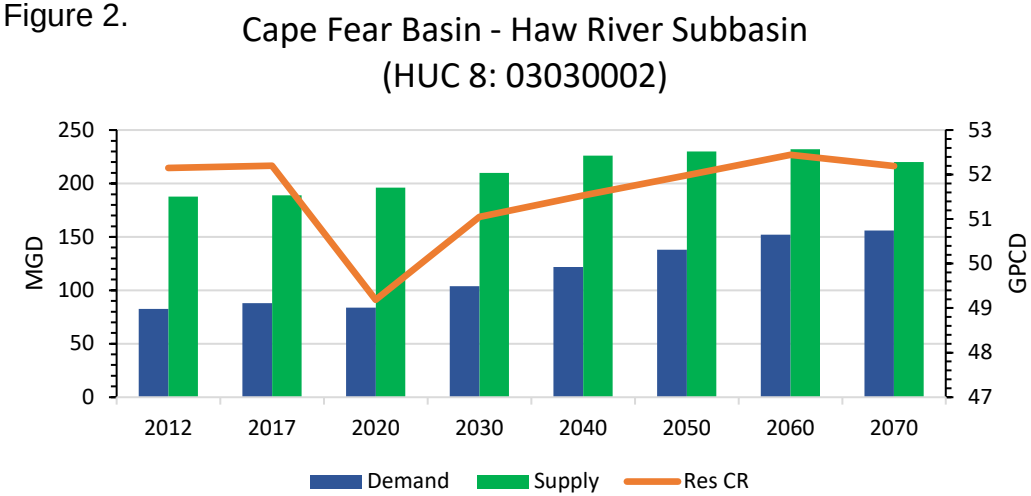


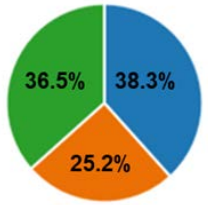
Figure 2.



Survey for the Cape Fear River Basin Water Resources Management Plan

2. Are you familiar with river basin plans?

Yes	88
No	58
Somewhat	84



4. In your opinion, how do you feel that waters in the Cape Fear River basin are being protected on a scale from 1 to 5, with 5 being very protected and 1 being not protected at all?

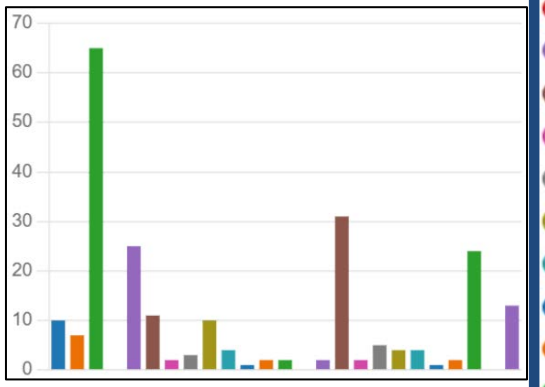
More Details

230 Responses

2.47 Average Number

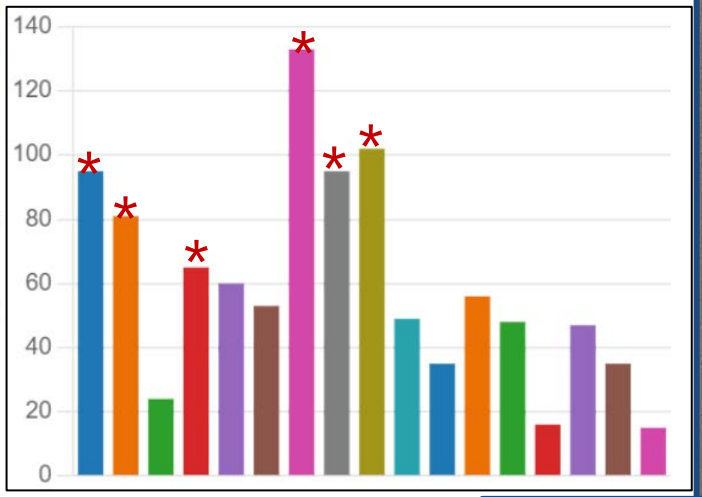
1. What North Carolina county do you reside in?

Alamance	10
Bladen	7
Brunswick	65
Caswell	0
Chatham	25
Cumberland	11
Duplin	2
Durham	3
Guilford	10
Harnett	4
Hoke	1
Johnston	2
Lee	2
Montgomery	0
Moore	2
New Hanover	31
Onslow	2
Orange	5
Pender	4
Randolph	4
Rockingham	1
Sampson	2
Wake	24
Wayne	0
Other	13



9. Besides emerging compounds, which of the following subjects are you most concerned about in regards to your water quality in the Cape Fear River basin? Please select your **top three to five** answers.

Aquatic habitat	95
Declining fisheries/shellfish	81
Sustenance (relying on the river ...	24
Animal agriculture	65
Algal blooms	60
Bacteria	53
Urban development and storm...	133
Wastewater infrastructure	95
Drinking water treatment	102
Groundwater resources	49
Drought	35
Flooding	56
Recreational use (swimming, wa...	48
Row crop or specialty agriculture	16
Nutrient Enrichment	47
Sea level rise	35
Other	15

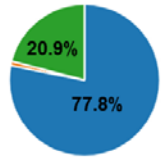


9.

- Aquatic habitat *
- Declining fisheries/shellfish *
- Sustenance (relying on the river as a primary food source)
- Animal agriculture *
- Algal blooms
- Bacteria
- Urban development and stormwater *
- Wastewater infrastructure *
- Drinking water treatment *
- Groundwater resources
- Drought
- Flooding
- Recreational use (swimming, wading, fishing)
- Row crop or specialty agriculture
- Nutrient Enrichment
- Sea level rise

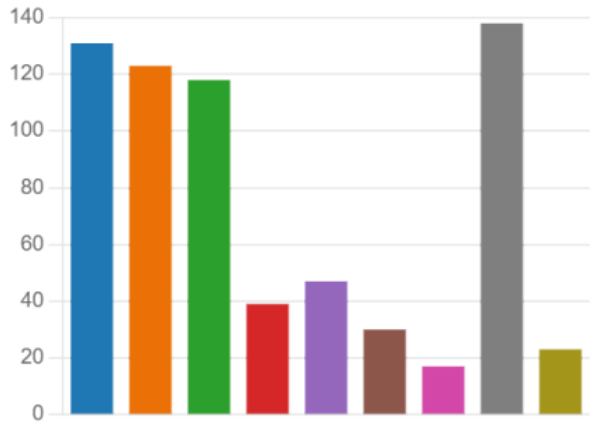
12. A riparian buffer is an area adjacent to a stream, lake, or wetland that contains a combination of trees, shrubs, and/or other perennial plants. Riparian buffers are often managed differently from the surrounding landscape and play a key role in protecting our water resources. Would you support basinwide riparian buffers?

Yes	179
No	2
Maybe	48



10. Of the examples listed below, which do you view as the **top three** biggest challenges regarding water quality in the Cape Fear River basin?

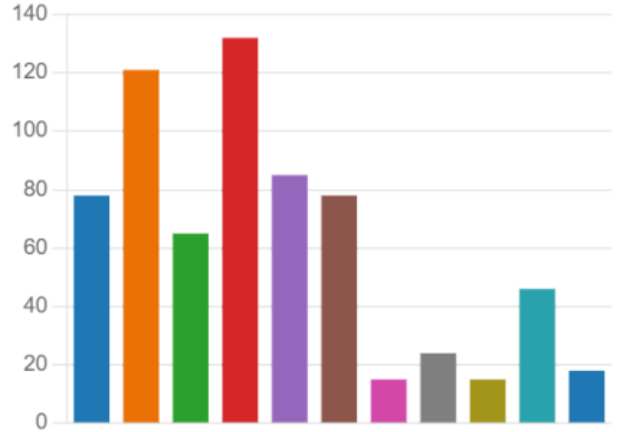
- Current management strategies ... 131
- Lack of prioritization at the state... 123
- Lack of oversight (i.e., inspectio... 118
- Not enough stream monitoring ... 39
- Lack of education and outreach ... 47
- Communities not connected to ... 30
- Too much water being withdraw... 17
- Development pressures 138
- Other 23



- [x] Current management strategies & protections
- [x] Lack of prioritization at the state or federal political level
- [x] Lack of oversight (i.e., inspections, reporting, etc.)
- [ ] Not enough stream monitoring data available
- [ ] Lack of education and outreach (community engagement)
- [ ] Communities not connected to the river because of limited or no access
- [ ] Too much water being withdrawn or used on a daily basis
- [x] Development pressures

11. In your opinion, what are **three** ways the challenges you identified in question 9 can be addressed?

- Improving management measur... 78
- Increasing oversight (i.e., inspec... 121
- Increased education and outrea... 65
- State elected officials prioritizin... 132
- Increasing funding and monitori... 85
- Providing technical and financial... 78
- Creating online tools and survey... 15
- Building communication efforts ... 24
- Opening up more access and o... 15
- Diversifying the people, organiz... 46
- Other 18



- [x] Improving management measures
- [x] Increasing oversight (i.e., inspections, reporting, etc.) of existing rules and regulations
- [ ] Increased education and outreach about our water resources (in school, for elected official etc.)
- [x] State elected officials prioritizing water protection
- [x] Increasing funding and monitoring for data collection, data monitoring, technical assistance, and planning
- [x] Providing technical and financial assistance to develop watershed action plans and/or implement best management practices (BMPs)
- [ ] Creating online tools and surveys to help identify areas of concern and track implementation efforts
- [ ] Building communication efforts across the basins
- [ ] Opening up more access and opportunities for Indigenous Communities to participate in decision making and water management
- [ ] Diversifying the people, organizations, and decision-making bodies to include representation of the communities the basin encompasses

What information do you want the river basin planner to know and/or consider while developing the basin plan? (137 responses)

General Topics	Information to know or consider while developing the plan
Water Quality (WQ)	Biological, instream and stream flow data; Use outside data; Advocation for more monitoring; Education of elected officials; Atmospheric deposition; fish consumption
Water Supply	Upstream impacts; Supply WQ; IBTs; Increasing demand and quantity; drought; Saltwater intrusion; Groundwater quality and quantity concerns; Treatment costs
Development Concerns	Growth and development projections; Nature-based solutions; Tree protections; Buffers needed; Land use changes documented
Pollutants/ Emerging Contaminants (EC)	Need for monitoring; Stronger and enforceable regulations; Hold upstream sources accountable; Improved response times; Violations reported; Use best available technologies to limit pollutants; Health Issues; Atmospheric deposition; Identify watersheds of concern; Source identification; Sources pays for cleanup and treatment costs; Groundwater contamination
Climate Impacts	Climate projections; Flooding; Nature-based solutions; Drought
Agriculture/ Industrial	Point and nonpoint sources of pollution; EC; Bacteria; Nutrients; Watershed poultry & Swine CAFO numbers and nutrient loadings
Buffers	Include recommendation for riparian buffers; Invasive species removal; Tree protection ordinances
Wastewater	Point sources - Nutrients; Contaminants; Violation; Enforcement actions; Use best available technologies throughout the basin; Contaminants in land applied sludge; Strengthen pre-treatment programs/rules; Infrastructure concerns/upgrades
Management Measures	Need for stronger protective measures; Enforcement of existing measures; Include recommendations for stronger watershed protective measures; collaborate with all users during development of protective measures; Education of elected officials; Regulations based on science; Work with JLOW
Watershed Stakeholders	Promote local watershed actions and restoration efforts; Education of the public and elected officials; Increase/Improve public river access; Inclusion; Coordination amongst NGOs
Wildlife	Sustainable fish and shellfish resource protection; Wildlife corridors; Prioritize resource
Technology	Include GIS and mapping tools; remote sensing

Next Steps

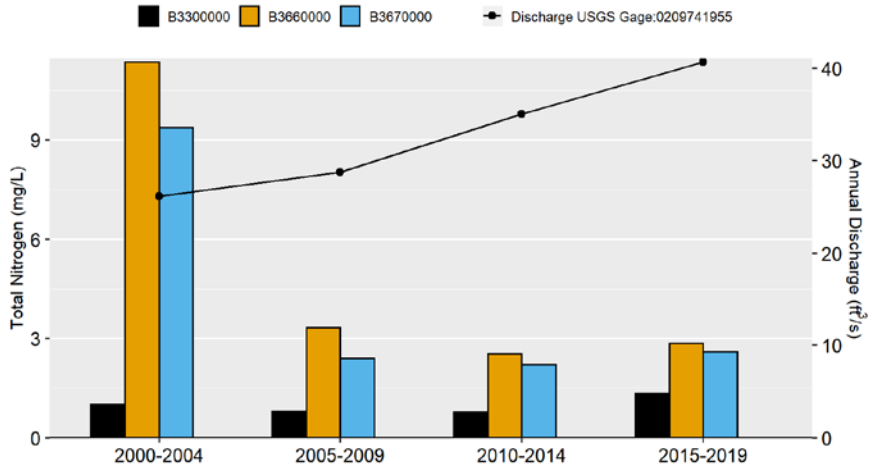
- Working internally to develop basinwide and watershed specific recommendations
  - NPDES management strategy on new or expanding facilities
  - Waste management (municipal and animal) to reduce bacteria and nutrient loading
  - Evaluate existing rules and regulations for animal waste management
  - Continue to encourage and implement BMPs (land conservation, riparian buffers, waste management structures, livestock exclusion, cover crops, etc.)
  - Evaluate existing monitoring programs to identify data gaps and needs

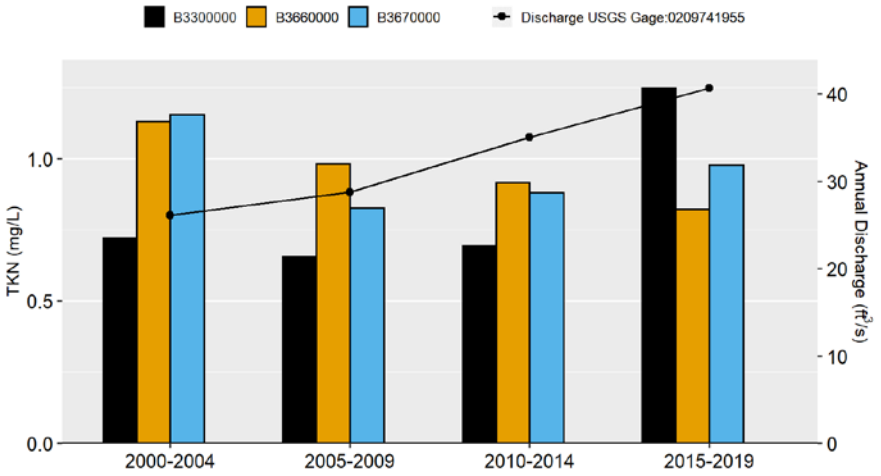
- Continue working with CFRA on survey results
  - Community outreach and education
  - Identify gaps and resource needs

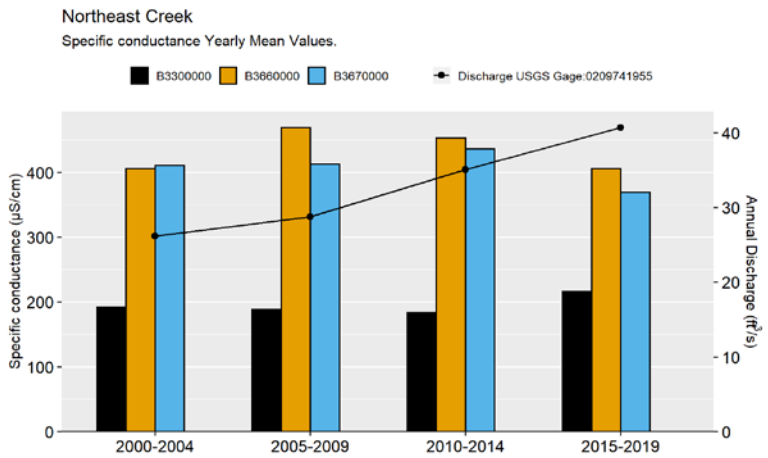
NORTH CAROLINA
Department of Environmental Quality

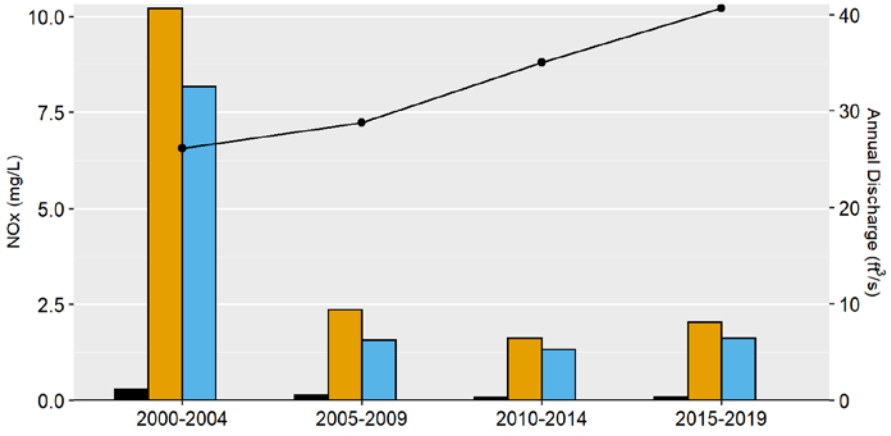
Northeast Creek – Five Year Averages

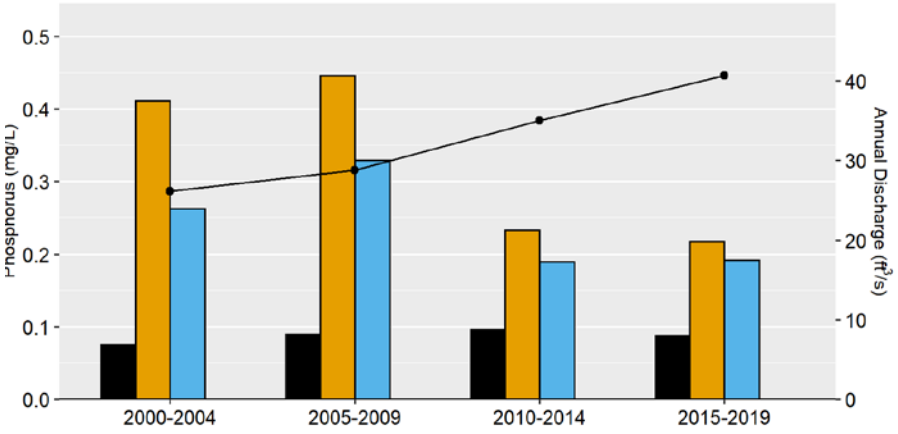
Note: Station B330000 only has a single year of data for 2015 in the last 5-yr period







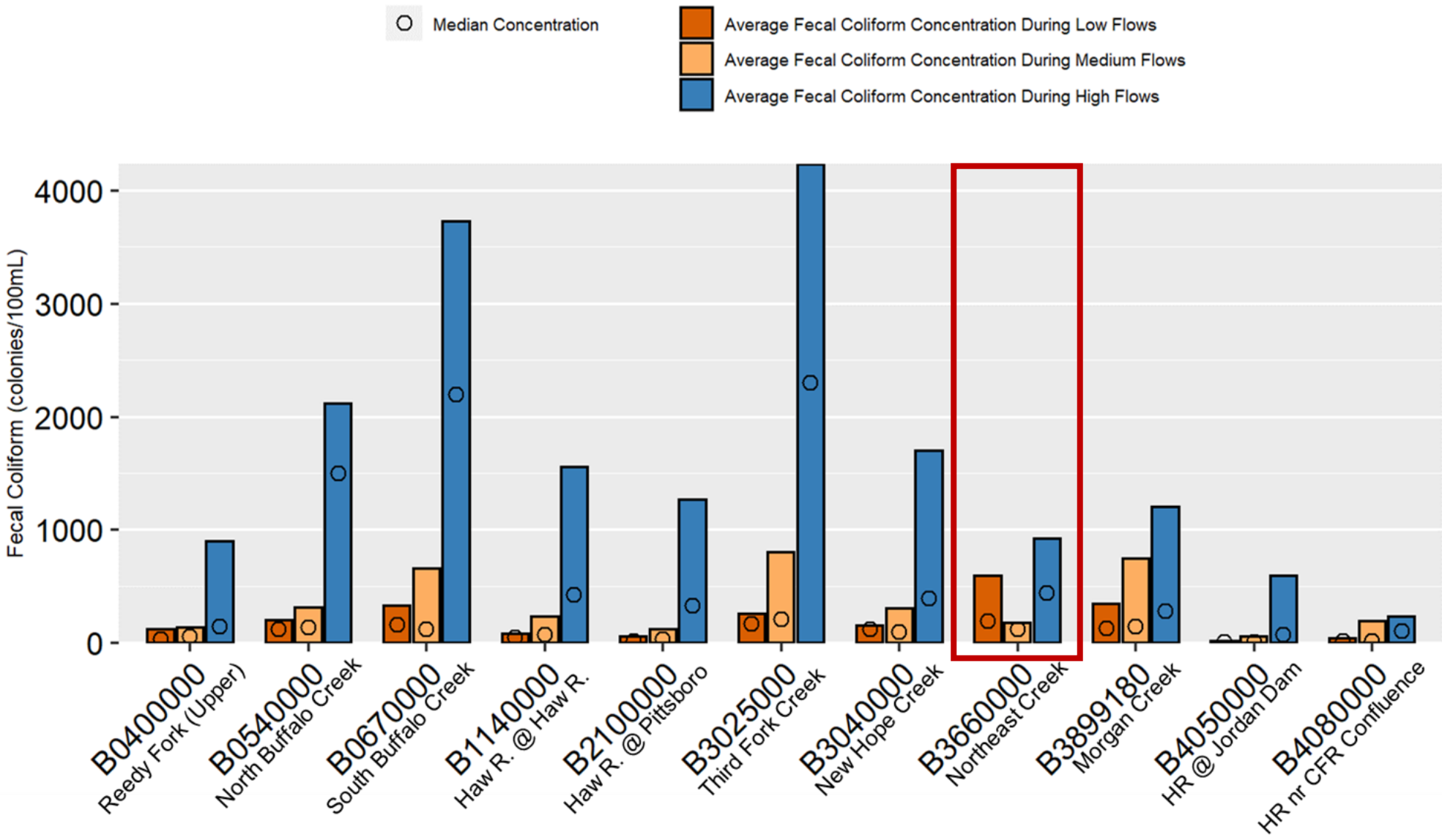




Triangle WWTP completed an expansion and upgrade from 6 MGD to a12 MGD BNR treatment plant in June 2005.

Haw River Subbasin - Flow Separated FCB Comparison

Seventeen Year (2002-2019) Flow Separated Mean and Median Fecal Coliform Bacteria Concentrations at AMS/USGS Flow Colocated Stations in Haw River Watershed.

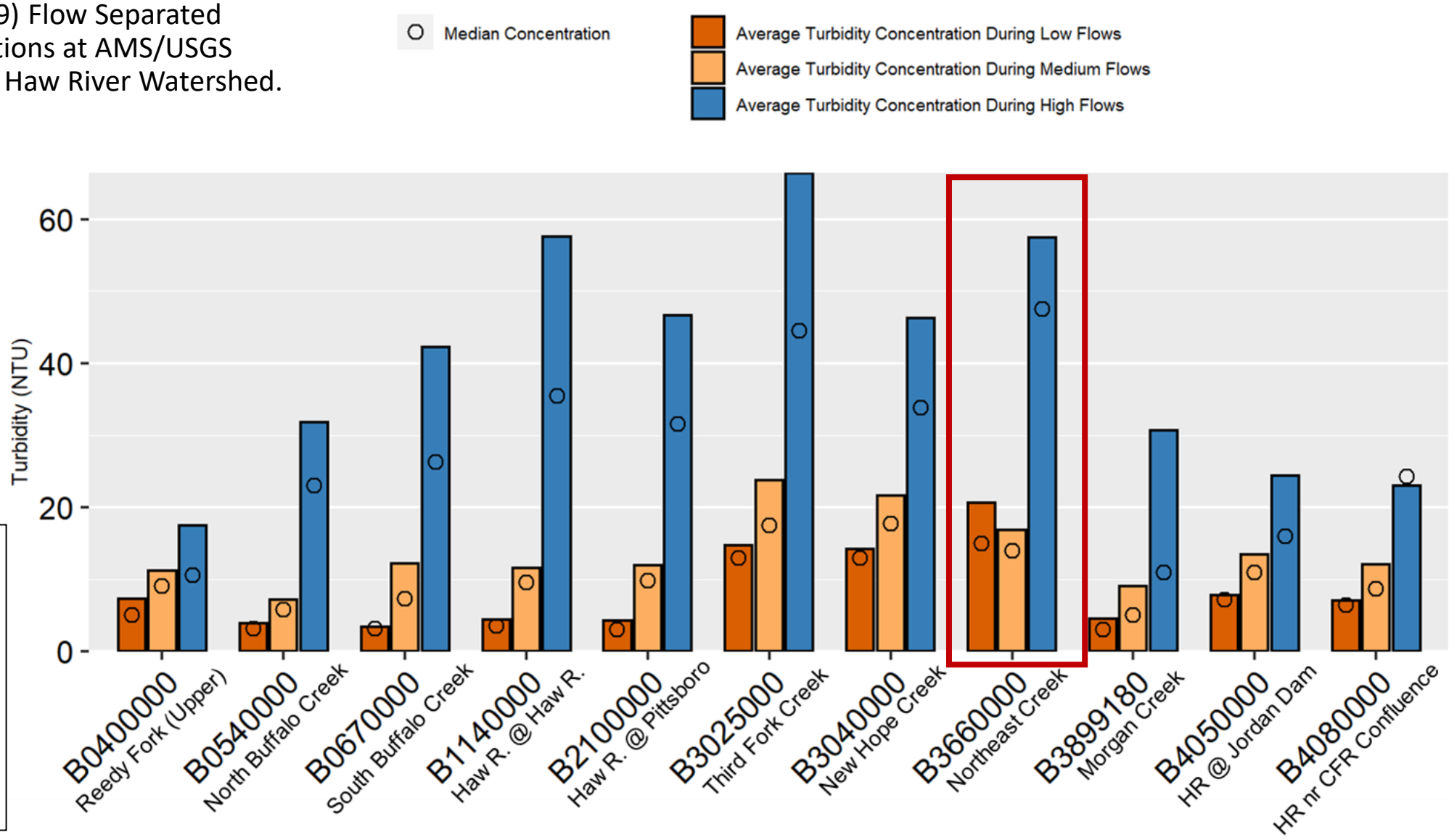


- Low flows ≤ 25th percentile
- Medium flows between 26th & 74th percentile;
- High flows ≥ 75th percentile;

At colocated USGS Gage Stations. Flow estimate based on 1991-2020 data when available.

Haw River Subbasin - Flow Separated Turbidity Comparison

Seventeen Year (2002-2019) Flow Separated Mean Turbidity Concentrations at AMS/USGS Flow Colocated Stations in Haw River Watershed.

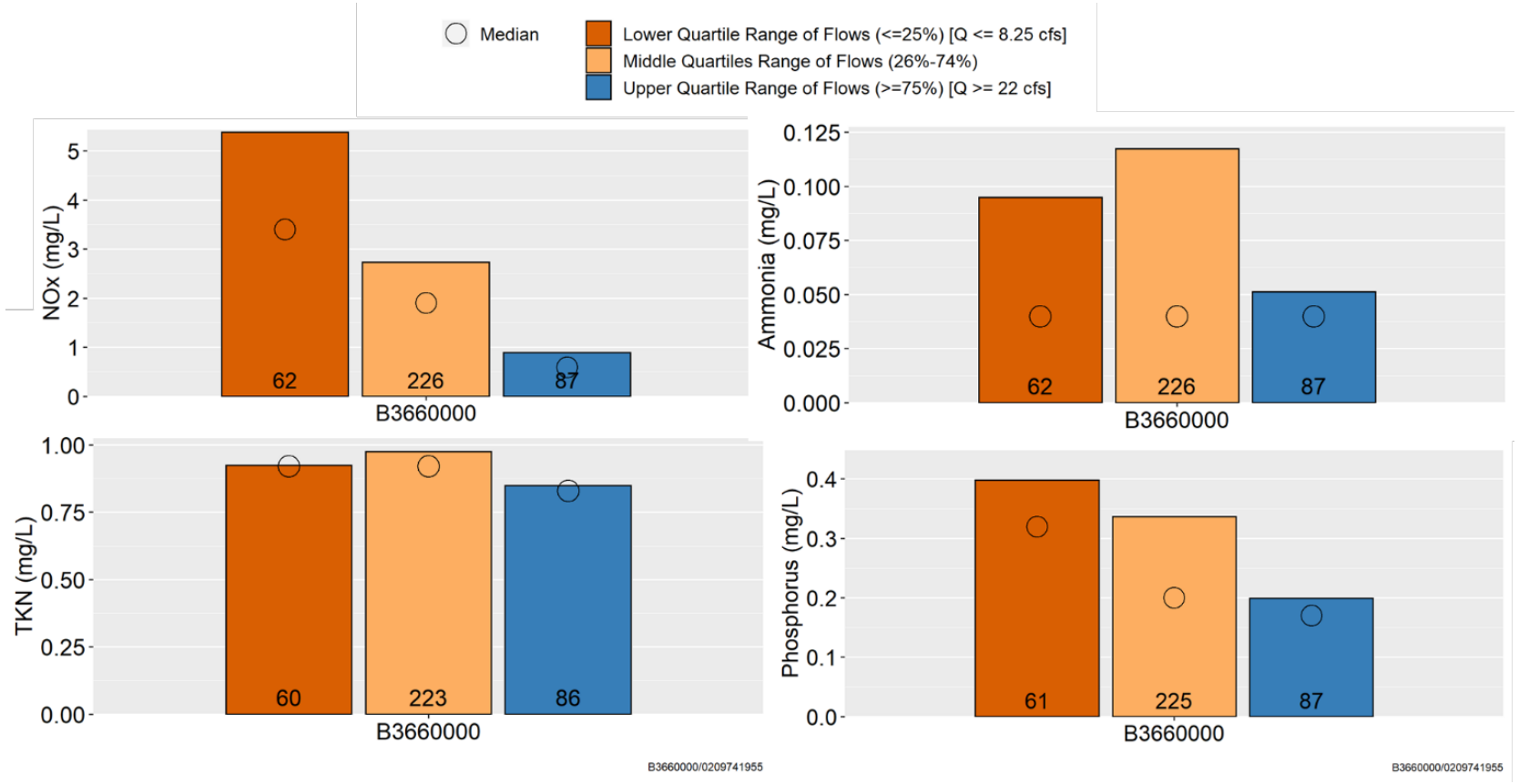


- Low flows ≤ 25th percentile
- Medium flows between 26th & 74th percentile;
- High flows ≥ 75th percentile;

At colocated USGS Gage Stations. Flow estimate based on 1991-2020 data when available.

Northeast Creek - Flow Separated Nutrients

Seventeen Year (2002-2019) Flow Separated Mean Turbidity and TSS Concentrations at AMS/USGS Flow Colocated Station.



High flows ≥ 75th percentile; Medium flows between 26th and 74th percentile; Low flows ≤ 25th percentile at USGS Gage Station 0209741955. Flow estimate based on 1991-2020 data.

(NOx: L=5.38/3.4, M=2.73/1.9, H=0.89/0.59) (TKN: L=0.92/0.92, M=0.98/0.92, H=0.85/0.83) (NH3: L=0.1/0.04, M=0.12/0.04, H=0.05/0.04) (TP: L=0.40/0.32, M=0.34/0.2, H=0.20/0.17)