FINAL

Environmental Assessment for an Interbasin Transfer from the Cape Fear River

Prepared for:

Pender County, North Carolina

Submitted to:

North Carolina Division of Water Resources

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Acronyms and Abbreviations

AADD	Annual Average Daily Demand
AEC	Area of Environmental Concern
AICW	Atlantic Intracoastal Waterway
AQI	Air Quality Index
ATC	Authorization to Construct
BBWC	Bogue Banks Water Company
CAA	Clean Air Act
CAMA	Coastal Area Management Act
CCPCUA	Central Coastal Plain Capacity Use Area
CERCLA	Response, Compensation, and Liability Act
CFNRBHM	Cape Fear and Neuse River Basin Hydrologic Model
CFPUA	Cape Fear Public Utility Authority
CFS	Cubic feet per second
CIC	Criteria Implementation Committee
COG	Council of Government
CRC	Coastal Resources Commission
CWA	Clean Water Act
CWMTF	Clean Water Management Trust Fund
DNP	Dedicated Natural Preserves
DO	Dissolved Oxygen
DMAC	Drought Management Advisory Council
EA	Environmental Assessment
EFC	Environmental Finance Center
EMC	Environmental Management Commission
EO	Executive Order
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM(s)	Flood Insurance Rate Map(s)
FONSI	Finding of No Significant Impact
FRIS	Flood Risk Information System
FSC	Federal Species of Concern
GHG	Greenhouse Gas
GIS	Geographic Information System
GPCD	Gallons per Capita per Day
GPM	Gallons Per Minute
HQW	High Quality Waters
IBT	Interbasin Transfer

L&D#1	Cape Fear River Lock and Dam #1
LCFRE	Lower Cape Fear River Estuary
LCFWASA	Lower Cape Fear Water and Sewer Authority
LWSP	Local Water Supply Plan
MAREA	Managed Area
MDD	Maximum Daily Demand
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
MMAD	Maximum Month Average Day
MSL	Mean Sea Level
NCCREWS	North Carolina Coastal Region Evaluation of Wetland Significance
NCDCM	North Carolina Division of Coastal Management
NCDEQ	North Carolina Department of Environmental Quality
NCDAQ	North Carolina Division of Air Quality
NCDEMLR	North Carolina Division of Energy, Mineral and Land Resources
NCDWR	North Carolina Division of Water Resources
NCGAP	North Carolina Gap Analysis Program
NCGS	North Carolina General Statute
NCNHP	North Carolina Natural Heritage Program
NCSHPO	North Carolina State Historic Preservation Office
NCWRC	North Carolina Wildlife Resources Commission
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NHHA	Natural Heritage Natural Areas
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
ONWASA	Orange Water and Sewer Authority
ORW	Outstanding Resource Waters
PCU	Pender County Utilities
PER	Preliminary Engineering Report
PNA	Primary Nursery Areas
POI	Parameter of Interest
PWSD	Public Water System Identification
RCRA	Resource Conservation and Recovery Act
RPW	Relatively Permanent Water
SAESHs	Significant Aquatic Endangered Species Habitat
SCI	Secondary and Cumulative Impacts

SDWA	Safe Drinking Water Act
SRF	State Revolving Fund
SSO(s)	Sanitary Sewer Overflow(s)
STEP	Septic Tank Effluent Pump
TMDL	Total Maximum Daily Load
TNW	Traditional Navigable Waters
TSS	Total Suspended Solids
UDO	Unified Development Ordinance
ug/l	Micrograms per Liter
UNC	University of North Carolina
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
USNPS	United States National Park Service
WHPA	Wellhead Protection Area
WSD(s)	Water and Sewer District(s)
WSW	Water Supply Watershed
WSRP(s)	Water Shortage Response Plan(s)
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

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SECTION 1

1 Background and Project Description

1.1 Background

Pender County is a fast growing coastal county with a 2015 population of over 56,000. The growth in Pender County has been and will continue to be driven by its location in the vicinity of Wilmington, Interstate 40, US 421 and US 17, its coastal communities and its strategic priorities related to economic development and expansion of public infrastructure into areas of the County that do not currently have water utility services. In addition to the currently underway and planned near-term water system expansion, Pender County Utilities (PCU) is engaging in this planning process as a regional provider of surface water. PCU has reached out to other neighboring utilities, including all other utility providers within Pender County, to determine who may consider obtaining surface water through PCU's system in the future. These utilities are currently reliant on groundwater for their potable water needs. The utilities that have decided to partner with PCU as a co-applicant as part of the IBT certificate process include the Town of Burgaw, Town of Topsail Beach, Town of Surf City, Town of Wallace (in neighboring Duplin County), and Utilities, Inc. Exhibit 1-1 presents the Public Water System Identification (PWSID) for each utility. Signed support resolutions from the co-applicants are included in Appendix A.

EXHIBIT 1-1
PWSIDs for PCU and Co-applicants

Utility	PSWID
PCU	70-71-011[1]
Town of Burgaw	04-71-010
Surf City	04-71-015
Topsail Beach	04-71-020
Wallace	04-31-010
Utilities, Inc.	04-71-111 and 04-71-112[2]

[1] The request for the IBT certificate is being submitted under PCU's PWS ID.
[2] The PSWIDs for Utilities, Inc correspond to the Belvedere Plantation and Olde Point developments, respectively.

Within Pender County, six water and sewer districts (WSDs) were established through referendum for the purposes of expanding service to existing residents: Central Pender, Columbia/Union, Maple Hill, Moore's Creek, Rocky Point/Topsail, and Scotts Hill. The water distribution system in the Rocky Point/Topsail WSD was built in five phases, after which PCU constructed the Scotts Hill water distribution system. Water system expansion is now underway in the Central Pender and Moore's Creek WSDs. The Maple Hill WSD is provided water by the Chinquapin Water Association, which uses a groundwater supply source. The Rocky Point/Topsail WSD was formed in 1996 and all of the other WSDs were formed in 2006. The Pender County Board of County Commissioners serves as the governing body for each WSD, and PCU operates, maintains and manages all water and wastewater infrastructure within each WSD. In addition, two municipalities within the County, the Village of St. Helena and the Town of Watha, receive water service from PCU.

AQUA North Carolina also expressed interest to PCU in receiving water in the future. They have not been included as a named co-applicant at this time because of the small service footprint and distant location of AQUA's service areas from PCU's currently planned water system. The areas served by AQUA are within PCU's WSDs, and those areas, along with their respective water demand projections are included in this environmental assessment (EA) to provide for a comprehensive evaluation.

Exhibit 1-2 provides a map presenting the project Study Area.

Water Supply and Treatment

Prior to contracting with the Lower Cape Fear Water and Sewer Authority (LCFWASA) for raw water and completing construction of its water treatment plant in 2012, PCU obtained its water from the Town of Wallace in Duplin County. Wallace's wells are located in the Central Coastal Plain Capacity Use Area (CCPCUA). This action eliminated the flow of groundwater from the CCPUA to PCU, which was a positive step in maintaining the water balance in the CCPCUA.

PCU obtains its raw water supply from the Cape Fear River via the LCFWASA, and PCU's current contract provides the ability to obtain up to 6 million gallons per day (MGD). The contract includes the following clause, "LCFWASA will deliver raw water to the County in an amount sufficient to meet the County's raw water needs from the Authority, which currently does not exceed 6 MGD." Pender County will extend their contract with LCFWASA to meet their future water supply needs. The Water Supply Agreement is included in Appendix B.

The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are located just above Lock and Dam 1 (L&D #1). LCFWASA expanded its intake in 2010 to accommodate a cumulative projected demand of 96 MGD across its customer base. LCFWASA completed an EA and received a Finding of No Significant Impact (FONSI), also included in Appendix B, addressing impacts associated with the increased withdrawal. The screen slot size for the new screens is approximately 0.118 inch, and the through velocity is less than 0.5 feet per second to reduce the potential for fish entrainment and impingement (McKim & Creed, 2008a).

LCFWASA transmits raw water via its existing 48-inch and 60-inch diameter transmission main to PCU's water treatment plant (WTP), which is also located within the Cape Fear River basin, as defined in N.C.G.S. § 143-215.22G. An EA was completed and FONSI received for the construction of LCFWASA's 60-inch transmission main, which is also included in Appendix B. Exhibit 1-3 shows the connection point where PCU taps into the LCFWASA transmission main in the Cape Fear River IBT basin. LCFWASA has planned for the increased raw water supply of its customers and outlined the infrastructure expansions required to provide this raw water supply (McKim & Creed. 2008b). PCU's WTP was completed in 2012, at present has the ability to treat 2 MGD, and is readily expandable to 6 MGD. System process water used at the WTP is treated and returned to the Cape Fear River. Prior to this, Pender County purchased groundwater from the Town of Wallace. The signed support resolution from LCFWASA is included in Appendix A.

The co-applicants all currently obtain their water supply from groundwater sources. The Town of Burgaw is considering drilling additional wells and/or a connection with PCU to meet future supply needs. The Town of Topsail Beach has an emergency connection with the Town of Surf City. Likewise, the Town of Surf City has an emergency connection with Topsail Beach and another with Onslow Water and Sewer Authority (ONWASA). The Town of Wallace has an emergency connection with Duplin County. The Town of Wallace is located in the Central Coastal Plain aquifer system. Utilities Inc. currently provides water service to two developments in the US 17 corridor, Belvedere Plantation and Olde Pointe, from groundwater sources. The Town of Atkinson provides water service within its corporate limits and is not a co-applicant in this process.

Water Distribution

PCU currently provides potable water to approximately 7,500 customers in the Rocky Point/Topsail and Scotts Hill WSDs. PCU also currently serves customers in St. Helena and Watha. To accommodate increasing demands along the US 17 corridor, PCU is planning for a larger water main along NC 210 that will enable distribution of more than 2 MGD across multiple designated IBT river basins. The need for this increased transmission capacity is driving the timing of PCU's IBT request. The US 17 corridor is a major growth area for the County due to its proximity to the coast and to the population centers of Jacksonville and Wilmington.

Private groundwater wells serve County residents who are not currently connected to PCU's water system. Concerns related to the reliability of the groundwater as a potable drinking water source, as well as groundwater quality variability, led voters in the Moore's Creek and Central Pender WSDs to approve a bond referendum to expand PCU's water system into areas of these WSDs that are not currently served. As a result of this vote, PCU is constructing over 70 miles of water lines in the Moore's Creek and Central Pender WSDs this year, with more than 200 miles of water infrastructure planned over the next 20 years. The bond referendum approved expenditures of up to $45 million in Moore's Creek WSD and $27 million in Central Pender WSD for the expansion and the availability of PCU's water system. Future service expansions within the six WSDs are also expected over the next 30 years.

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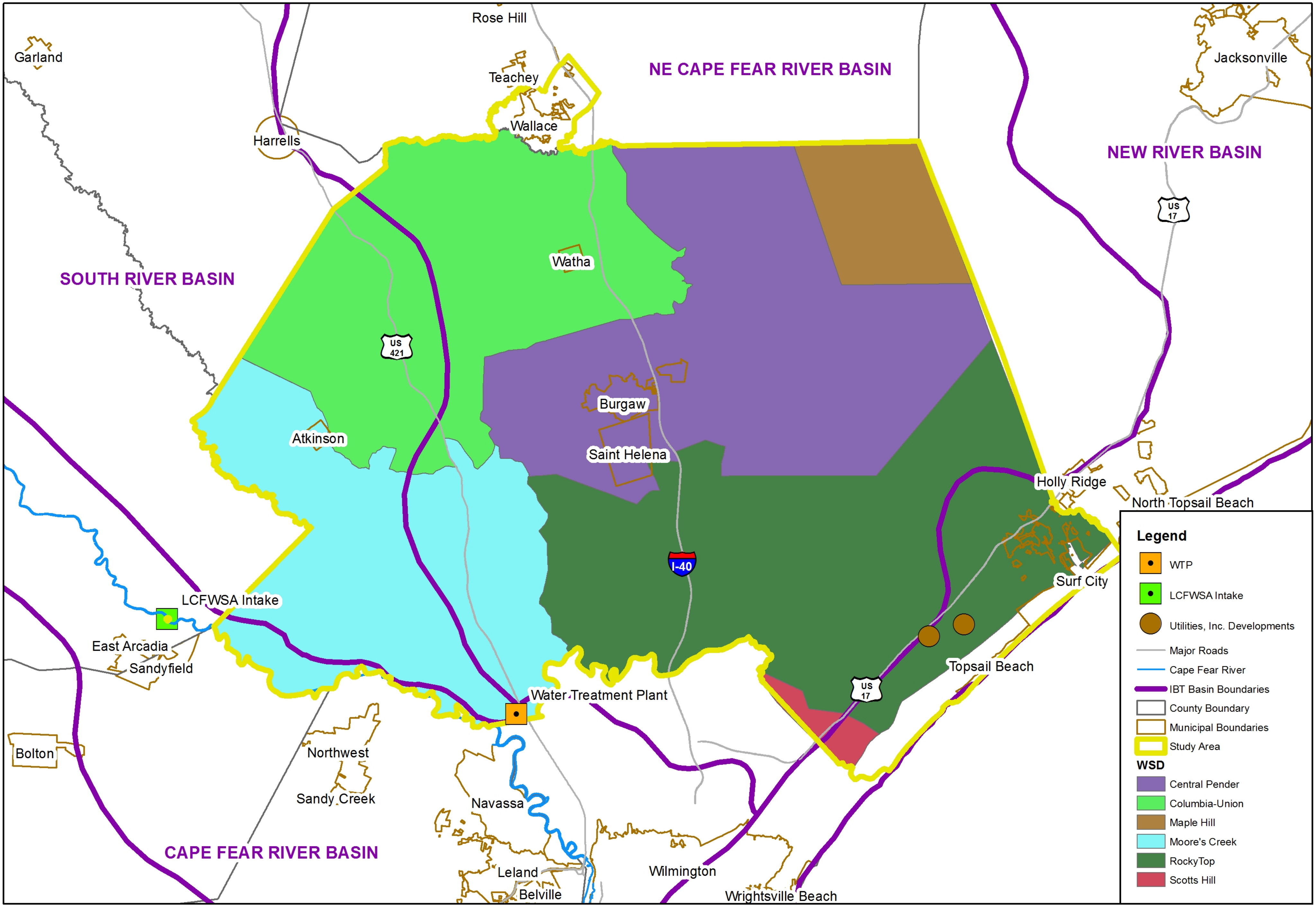

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Exhibit 1-2

Study Area Overview Map

Environmental Assessment

Pender County Utilities

Interbasin Transfer from the Cape Fear River

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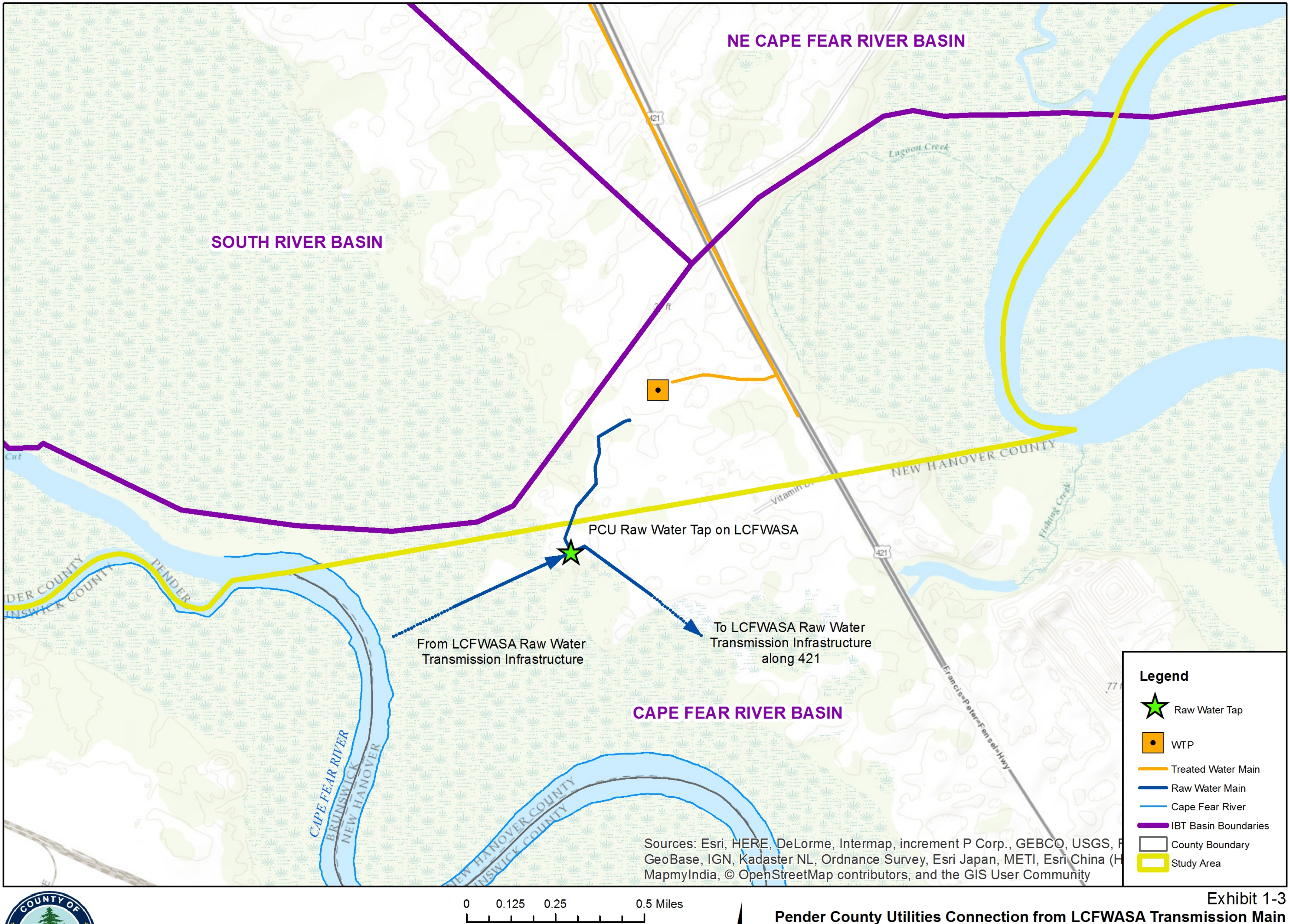

Exhibit 1-3

Pender County Utilities Connection from LCFWASA Transmission Main

Environmental Assessment

Pender County Utilities

Interbasin Transfer from the Cape Fear River

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Wastewater Collection and Treatment

Centralized sanitary sewer service in the County is very limited. Residential wastewater treatment needs are primarily being met by onsite treatment (septic systems). In recent years, large developments have constructed community wastewater systems with a small treatment facility and an effluent infiltration system. In addition, a combination of public and private systems are in use or under construction as follows:

- A 0.5 MGD wastewater treatment plant (WWTP) is currently under construction to serve the US 421 corridor in the southwestern portion of Pender County. This WWTP is owned and will be operated by PCU, and has an NDPES permit to discharge up to 4 MGD to the Cape Fear River.
- A Septic Tank Effluent Pump (STEP) system serving approximately 180 customers in the Maple Hill WSD with onsite treatment units and a centralized effluent spray irrigation system.
- A manifold force main system and pump stations serving approximately 20 commercial and institutional customers in the Rocky Point/Topsail WSD. This system ultimately can convey up to 0.25 MGD to the neighboring Cape Fear Public Utility Authority (CFPUA) in New Hanover County for treatment. There is the potential to expand capacity with CFPUA, if they have available capacity at the time it is needed. CFPUA provides treatment at its Northside WWTP, which discharges to the Cape Fear River.
- PCU has 2.0 MGD of purchased capacity at the Town of Wallace WWTP, which discharges to the Northeast Cape Fear River basin. This capacity is available to PCU to handle wastewater flows in the future.
- Pluris, a private utility provider in the region, recently completed the development of a regional WWTP with 0.5 MGD of capacity in the US 17 corridor. This WWTP has a combined discharge strategy, partial infiltration and partial NPDES discharge. In addition, Pluris is also constructing a force main paralleling US 17 as a conveyance backbone to the WWTP. PCU has seen an increase in developers expressing interest in partnering with Pluris for wastewater treatment at this facility. This current facility is expandable up to 3 MGD.

In the IBT planning horizon, PCU will continue with its current wastewater strategy that includes a range of systems to meet the wastewater collection and treatment needs of the County, as outlined above. Large-scale addition of a centralized sanitary sewer system is not expected within the current IBT planning window and the majority of water distributed within the PCU WSDs will, therefore, be treated and infiltrated within the river basin in which it is utilized. Ultimately, wastewater collection and treatment requirements for future development will be governed by the current County UDO requirements for septic systems and community/public wastewater disposal (Pender County, 2010a).

If at such time the current wastewater strategy is determined to not provide sufficient wastewater treatment capacity, PCU will look to implement portions of their 2006 Wastewater Master Plan which outlines options for centralized sanitary sewer collection and treatment system. Any centralized system constructed will be a long-term, incremental plan, similar to PCU's water system expansion. This system will operate for a long-period of time in unison with the existing wastewater systems in operation.

Sewer service for the co-applicants varies. The Town of Burgaw no longer operates a WWTP because they have a treatment contract in place to send all wastewater to the Town of Wallace WWTP, which discharges to a waterbody within the Northeast Cape Fear River basin. The Town of Wallace also receives wastewater from the Town of Greenevers. In the Town of Topsail Beach, located in the New River basin, most water service connections have septic systems although they currently have an active permit for a high rate infiltration system which is permitted at approximately 20,000 GPD and several communities operate low-pressure pipe systems. The Town of Surf City does operate a centralized sewer and WWTP, but much of the ETJ is served by onsite septic systems. Surf City's WWTP has a permitted treatment capacity of 1.5 MGD, and the treated effluent is spray irrigated in the New River basin. The wastewater from the developments served by Utilities, Inc. is treated with an onsite WWTP and effluent spray irrigation fields, also in the New River basin. Some water service connections in these developments have individual septic systems. There are no planned changes in the near future for wastewater treatment for the co-applicants and all water distributed to these co-applicants is expected to be treated and infiltrated within the river basin in which it is utilized.

1.2 Project Description

In light of Pender County's historical efforts and planning related to service area expansions, and resultant expansion of the water distribution system, as well as planning to meet the needs of future growth, near-term demands within the IBT river basins will increase above the transfer limit of 2 MGD, calculated as a daily average of a calendar month per N.C.G.S. § 143-215.22. ***Pender County and its co-applicants are requesting an authorized transfer between designated IBT river basins, from the Cape Fear River to the South River, Northeast Cape Fear River, and New River basins of 14.5 MGD, calculated as a daily average of a calendar month.*** The proposed transfer amount is based on updated water demand projections for the next 30 years, as defined in Section 2. Exhibit 1-2 provides a map of PCU and co-applicants' planning areas and the IBT river basins.

1.3 Study Area

This EA provides the supporting documentation of the analysis of impacts in the study area associated with the proposed increase in IBT. PCU's water supply source, the Cape Fear River at L&D #1, as well as receiving basins within PCU's and the co-applicants' service areas, are included in the study area defined in Exhibit 1-2. The study area includes the following:

- Cape Fear River basin (source basin): LCFWASA's surface water intake on the Cape Fear River near L&D #1.
- Cape Fear River basin (receiving basin): A small portion of the Moore's Creek WSD is located in this basin.
- South River basin (receiving basin): The area contained within the western portion of the study area including portions of the Moore's Creek and Columbia-Union WSDs.
- Northeast Cape Fear River basin (receiving basin): The majority of the study area including portions of the Moore's Creek, Columbia-Union, Rocky Point/Topsail, and Scotts Hill WSDs as well as all of the Central Pender and Maple Hill WSDs. The Towns of Burgaw, Wallace, Saint Helena, and Watha are located in this basin.
- New River basin (receiving basin): The area contained within the eastern boundary of the study area and along the Atlantic coastline including a portion of the Rocky Point/Topsail WSDs and the Scotts Hill WSD. The Towns of Topsail Beach and Surf City as well as the Utilities, Inc. developments are located in this basin.

Within the study area, the land area within each IBT river basin is as follows:

- Cape Fear River basin: 2%
- South River basin: 20%
- Northeast Cape Fear River basin: 72%
- New River basin: 6%

1.4 Guiding Legislation

Per N.C.G.S. § 143-215.22L, an EA may be used to assess the environmental impacts associated with a proposed transfer that occurs within a major river basin, in this case the Cape Fear River basin. Pender County is entirely within the Cape Fear River basin, subdivided by the following basins as defined in the IBT statute: Cape Fear River, South River, Northeast Cape Fear and New River. Pender County also qualifies as a "coastal county" under the N.C.G.S. § 143-215.22L (w). This section dictates the regulatory requirements for coastal counties to request and acquire an IBT certificate.

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SECTION 2

2 Project Purpose and Need

2.1 Historic Population and Water Demand

Drivers for increased water demand and projected IBT for Pender County include population growth and service area expansion. Exhibit 2-1 presents Pender County's overall population from 1970 to 2015 as well as the current population served by PCU. The difference in overall and service area population is due to the use of groundwater by municipal areas within the County (for example, Burgaw, Surf City, Topsail Beach) and by many residents in the unincorporated areas of Pender County. The rate of overall population growth picked up in the 1990s and that rate of growth has been sustained over the last five to ten years. Service area expansion is planned and will increase the number of people connected to PCU's system in unincorporated areas. Planned projects include:

- Central Pender WSD - 102 miles of new distribution water main by 2034, approved by current Central Pender WSD voters
- Moore's Creek WSD - 129 miles of new distribution water mains by 2034, approved by current Moore's Creek WSD voters
- Columbia-Union WSD - New mains planned for growth in this area around 2045

In addition, many factors will continue to drive and increase the water demand, including coastal community access in Pender County as well as New Hanover and Brunswick Counties, proximity to Wilmington, and Pender County Commerce Park on US 421.

Exhibit 2-2 presents PCU's historic finished water demand from 2010 to 2015.

Exhibit 2-1
Pender County Historic Population

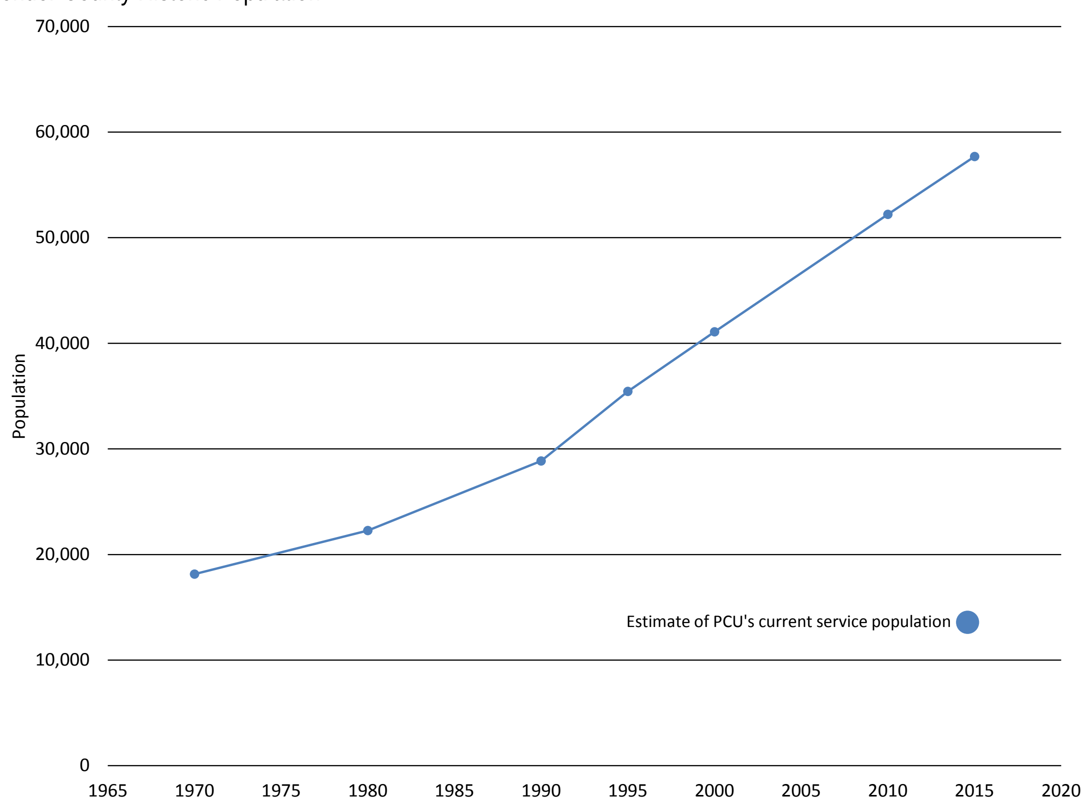
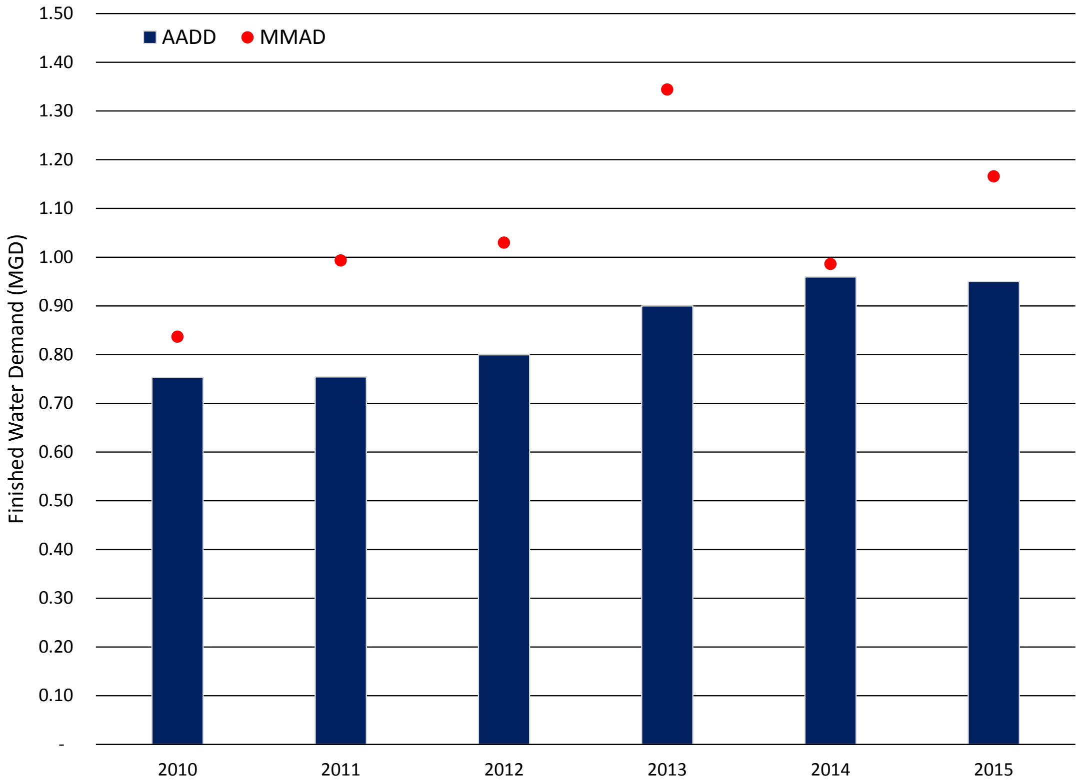


Exhibit 2-2
Pender County Utilities Historic Finished Water Demand



Notes: AADD – average annual daily demand, MMAD – maximum month average day

2.2 Population and Water Demand Projections

2.2.1 Future Population Forecast

In order to develop population forecasts for the water demand forecast, population projections were developed for each WSD. Exhibit 2-3 provides the population forecast for Pender County by WSD, through the year 2050. Population projections for municipalities within Pender County are not included in these values. The projections were developed from and compared to various sources including the North Carolina Office of State Budget and Management (NC OSBM, 2016), Pender County Water Master Plan (McKim & Creed, 2006a), Pender County Wastewater Master Plan (McKim & Creed, 2006b), Pender County Comprehensive Land Use Plan (Pender, 2010), and the Central and Moore's Creek Water and Sewer District Water System Expansion USDA Preliminary Engineering Reports (PERs) (Highfill & The Wooten Company, 2014a and b).

In general, the methodology used to develop the population forecast has the following characteristics:

- Methodology utilized was initially developed in the Water and Wastewater Master Plans in 2006 and was updated in 2014 for the preparation of the USDA PERs.
- The growth pattern that was previously developed was utilized and based on Brunswick County growth (i.e. Moderate Growth Rate) since both are coastal counties experiencing similar growth.
- The growth pattern for the Moore's Creek and Rocky Point/Topsail WSDs were updated to a less aggressive pattern than the original plans from 2020 to 2035.

- The base Census data utilized was 2010 Census data for each Township. The population was projected based on Township and estimated for each WSD based on the amount of land area of the WSD within the respective Township.
- The 2010 people per unit figure for each Township was utilized to estimate housing units for each WSD based on the amount of land area of the WSD within the Township.

These population forecasts were inputs to the future water demand forecast, which is described in Section 2.2.2.

EXHIBIT 2-3
Pender County Water and Sewer District Population Forecast, 2015–2050

Year	Central Pender WSD	Moore's Creek WSD	Columbia Union WSD	Maple Hill WSD	Rocky Point Topsail WSD	Scotts Hill WSD	TOTAL
2015	6,000	5,200	6,900	1,600	34,500	1,600	55,900
2020	6,500	6,100	7,500	1,600	44,800	2,000	68,600
2025	8,000	8,600	8,100	1,700	49,300	2,200	77,800
2030	9,500	10,300	8,800	1,700	53,800	2,300	86,400
2035	11,000	11,800	9,300	1,800	57,500	2,500	94,000
2040	12,800	13,000	10,000	1,800	61,500	2,600	101,800
2045	14,100	14,700	10,600	1,900	65,900	2,800	109,900
2050	15,200	16,300	11,200	2,000	70,500	3,000	118,100

Note: Numbers may not sum due to rounding.

2.2.2 Water Demand Forecast

2.2.2.1 Calculations and Methodology

The following summarizes the basis of the water demand forecast methodology for PCU and the co-applicants. Detailed description of the methodology is provided in *Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County* included in Appendix C:

- PCU:
  - Residential water demand: projected water demands were developed for each WSD for existing and future conditions based on water meter billing data (to develop unit consumption values), WSD population forecasts, assumed persons per household (to convert population to customer accounts), assumed percent of customers-with access to a County water line, and an assumed percent connection of customer accounts to the water distribution system. The assumed percent connection was used to capture the effect of PCU expanding its water distribution system into new areas of the WSD service areas that are not currently served. The percent connection assumption is intended to be representative of the fact that not all of the area will voluntarily connect to the system and will stay on groundwater. Any new subdivision (or home) that is built adjacent to a County water line will be required to connect to the distribution system.
  - Commercial/Industrial water demand: projected water demands were developed by WSD for existing and future conditions based on water meter billing data (for current WSD customers and to develop unit consumption values), existing and future land use information, and an assumed growth rate. Included in this demand is a use sector that represented commercial business in place solely to support the residential population; this demand is based on the population forecast and an assumed

unit consumption value. All commercial and industrial customers will be required to connect to the distribution system if adjacent to an existing PCU water line.

- The total future system finished water demand consists of the existing demand, projected future demand, future non-revenue water, and operational requirements.
- Projected water demands were attributed to each IBT river basin based on the land area of each basin within an individual WSD. Exhibit 2-4 presents the percentage of each WSD that falls within each river basin.

EXHIBIT 2-4
IBT River Basin Percentage by WSD

Water and Sewer District	Basin	Percentage
Central Pender	NE Cape Fear	100%
Moore's Creek	Cape Fear	9%
Moore's Creek	NE Cape Fear	32%
Moore's Creek	South River	59%
Columbia Union	NE Cape Fear	60%
Columbia Union	South River	40%
Maple Hill	NE Cape Fear	100%
Rocky Point-Topsail	NE Cape Fear	79%
Rocky Point-Topsail	New River	21%
Scott's Hill	NE Cape Fear	55%
Scott's Hill	New River	45%

- Co-applicants:
  - Projected water demands for the co-applicants were developed for existing and future conditions based on each co-applicant's Local Water Supply Plan (LWSP). Utilities, Inc. provided their own demand projections for use. All co-applicants are currently supplied by groundwater. Due to increasing water quality concerns regarding salt water intrusion, however, these systems are seeking a surface water source to meet at least a portion of future demands through 2045. The base assumptions related to the percentage of the co-applicants' demands and timing of the need for each co-applicant is provided in Exhibit 2-5:

EXHIBIT 2-5
Co-applicant Water Supply Requirements

	Start Year for Supply Need	Percent of Supply Need to be Provided by PCU	Average Day Supply to be Provided in 2050 by PCU (MGD)
Town of Burgaw[1]	See Note 1	N/A	0.8
Surf City	2030	25%	0.3
Topsail Beach	2030	25%	0.1
Wallace	2030	25%	0.2
Utilities Inc.	2020	100%	0.4

[1] - The Town of Burgaw will be served by PCU when their demand exceeds their supply of 1.0 MGD. The LWSP indicates a demand above the current supply in year 2030 (1.1 MGD).

The water demand forecasts reflect the influence of PCU and each of the individual stakeholder's current water resources management programs and policies affecting water demand, and are based on the assumption that these programs and policies will continue in the future absent any influence of major technology or regulatory changes.

Variability is an inherent part of water demand and uncertainty is inherent in any type of forecast. With an understanding of the variables that influence the need for future water supply and future IBT, several factors were incorporated in the forecast to represent both variability and uncertainty in the forecast of future water demand. These factors included the following:

- Unit consumption values
- Growth rate (rate at which new development occurs) change
- Person per household (for future growth)
- Percent of residential accounts fronted by water lines
- Percent of future residential connection to the expanded distribution system
- Magnitude and timing of water supply needs for individual co-applicants
- Non-revenue water (percentage of total finished water demand)
- Maximum month average day (MMAD) peaking factors (maximum month versus annual average daily demand [AADD])

A Monte Carlo simulation technique was used to aid in estimating the magnitude and likelihood of an individual water demand forecast, and ultimately IBT. This methodology provides the ability to incorporate uncertainty into the water demand forecast, as well as to understand the variability in the potential future demands, based on the factors outlined above. Further details regarding the forecasting calculation, methodology, and analysis can be found in Appendix C.

2.2.2.2 Water Demand Forecast

Exhibit 2-6 presents the annual average finished water demand expected values, 2015 through 2050, that resulted from the forecasting. Expected values are a statistical measure of the likely outcome under conditions of future variability and uncertainty, reflecting expected average future conditions. Exhibit 2-7 presents the co-applicant forecast of water demand to be satisfied by water provided by PCU. Exhibit 2-8 presents the total combined system demand.

EXHIBIT 2-6
County Water and Sewer District Annual Average Daily Finished Water Demand Forecast Expected Values, 2015–2050

Water and Sewer District	Basin	Annual Average Daily Finished Water Demand (MGD)							
		2015	2020	2025	2030	2035	2040	2045	2050
Central Pender	NE Cape Fear	-	0.1	0.2	0.4	0.5	0.6	0.7	0.8
Moore's Creek	Cape Fear	-	<0.1	<0.1	0.1	0.1	0.1	0.1	0.2
Moore's Creek	NE Cape Fear	-	0.1	0.2	0.3	0.4	0.4	0.5	0.6
Moore's Creek	South River	-	0.1	0.3	0.5	0.7	0.8	0.9	1.1
Columbia Union	NE Cape Fear	-	-	-	-	-	-	0.1	0.1
Columbia Union	South River	-	-	-	-	-	-	0.1	0.1
Maple Hill	NE Cape Fear	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rocky Point Topsail	NE Cape Fear	0.8	1.1	1.3	1.6	2.0	2.5	3.1	3.6
Rocky Point Topsail	New River	0.2	0.3	0.4	0.4	0.5	0.7	0.8	0.9
Scotts Hill	NE Cape Fear	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Scotts Hill	New River	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Demand		**1.1**	**1.9**	**2.6**	**3.4**	**4.4**	**5.4**	**6.7**	**7.7**

Note: Numbers may not sum due to rounding.

EXHIBIT 2-7
Co-applicant Annual Average Daily Water Supply Forecast Expected Values, Provided by PCU, 2015–2050

Co-applicant	Basin	Annual Average Daily Finished Water Demand (MGD)							
		2015	2020	2025	2030	2035	2040	2045	2050
Town of Burgaw	NE Cape Fear	-	-	-	<0.1	0.6	1.1	1.0	0.8
Surf City	New River	-	-	-	<0.1	0.3	0.3	0.4	0.4
Topsail Beach	New River	-	-	-	<0.1	0.1	0.1	0.1	0.1
Wallace	NE Cape Fear	-	-	-	<0.1	0.2	0.3	0.3	0.3
Utilities Inc.	New River	-	-	0.2	0.2	0.3	0.3	0.3	0.3
Total Demand		**-**	**-**	**0.3**	**0.6**	**1.5**	**2.2**	**2.1**	**2.0**

Data source: 2014 LWSPs - Burgaw, Surf City and Topsail; 2015 LWSP - Wallace; System details for Utilities Inc.; assumed timing of water supply requirement provided by Pender County Utilities.

EXHIBIT 2-8
Total Annual Average Daily Water Supply Forecast Expected Values, 2015–2050

Co-applicant	Annual Average Daily Finished Water Demand (MGD)							
	2015	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Total County Demand	1.1	1.9	2.6	3.4	4.4	5.4	6.7	7.7
Total Co-applicant Demand	-	-	0.3	0.6	1.5	2.2	2.1	2.0
Total System Demand	**1.1**	**1.9**	**2.9**	**4.0**	**5.9**	**7.6**	**8.8**	**9.7**

2.3 Interbasin Transfer

In accordance with the recent legislative changes to GS 143-215.22L, the forecast of IBT is calculated as a daily average of a calendar month (instead of on a maximum day basis) and, for the month in which IBT is expected to be highest, is generally described by the following formula:

$$IBT_x = \textit{Withdrawal from Source basin}_x - \textit{Return to Source basin}_x$$

$$\textit{Return to Source basin}_x = (\textit{Total Consumptive Use}_x * \%\ \textit{of Total Demand in Source River basin}_x) + \textit{Source River basin Wastewater Discharge}_x$$

In which 'x' represents a future year

As outlined in Section 1, centralized sanitary sewer system is currently very limited within the County's WSDs and the co-applicants primarily treat wastewater and discharge effluent within the receiving basin they are located in (via direct discharge or infiltration). Large-scale addition of a centralized sewer system is not within the current IBT planning window (30 years). Therefore, under the County's proposed IBT, most of the forecasted water demand to occur in each respective receiving basin will be used and infiltrated or discharged within that basin. Pender County is currently constructing a 0.5 MGD WWTP to serve the US 421 corridor in southwestern Pender County. When the US 421 WWTP comes online in approximately 2017, the County will begin returning wastewater to the source basin. While not yet online, the future discharge will increase with time in direct correlation to increasing water demands, partially offsetting the withdrawal above L&D #1.

The estimated wastewater flow for the Moore's Creek water and sewer district, in the Cape Fear River basin, and the US 421 WWTP direct discharge to the Cape Fear River are shown in Exhibit 2-9. These flows are excluded from the calculation of the proposed IBT, since these flows do not leave or are returned to the source basin.

EXHIBIT 2-9
Forecast of Wastewater Flows Infiltrated or Discharged within the Cape Fear River basin, 2015–2050, Average Day Wastewater Flow

	2015	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Moore's Creek WSD[1]	-	<0.1	<0.1	0.1	0.1	0.1	0.1	0.2
US 421 WWTP	-	<0.1	0.1	0.2	0.2	0.3	0.3	0.4

[1] Wastewater treatment and infiltration within the Cape Fear River basin through septic systems.

The following exhibits show the IBT forecasts for PCU and its co-applicants. Exhibit 2-10 presents the forecast of future IBT for the transfer from the Cape Fear River basin to the Northeast Cape Fear River basin through 2050. Exhibit 2-11 presents the forecast of future IBT for the transfer from the Cape Fear River basin to the South River basin. Exhibit 2-12 presents the forecast of future IBT from the Cape Fear River basin to the New River basin. Exhibit 2-13 presents the total IBT from the Cape Fear River basin to the Northeast Cape Fear River basin, South River basin, and New River basin combined. The IBT forecast presented in each of these tables is the maximum daily average of a calendar month (the maximum average day IBT as compared to all months in a calendar year), referred to as the maximum month average day. The future IBT forecast is based on continuation of the current water resources management policies and programs of PCU and the co-applicants as well as the potentially expected timing and quantities of co-applicants' needs for surface water supply.

Exhibits 2-10 through 2-13 present transfers developed from the forecast analyses under conditions driven by weather and usage patterns that deviate from average, or expected value, conditions. IBT forecasts based on average future conditions would not accurately reflect the range of transfers that can reasonably be anticipated to occur under the full range of anticipated conditions. Since an IBT certificate limit cannot ever be exceeded, the maximum IBT has been calculated as the transfer resulting from conditions outside the average which could reasonably be expected to potentially occur. Appendix C contains additional details on the forecast analysis.

EXHIBIT 2-10
Forecast of IBT from the Cape Fear River basin to the Northeast Cape Fear River basin, 2015–2050, Maximum Month Average Day

	2015	2020	2025	2030	2035	2040	2045	2050
IBT (MGD)	1.2	2.2	2.9	4.1	5.9	7.9	9.2	10.2

EXHIBIT 2-11
Forecast of IBT from the Cape Fear River basin to the South River basin, 2015–2050, Maximum Month Average Day

	2015	2020	2025	2030	2035	2040	2045	2050
IBT (MGD)	-	0.2	0.5	1.0	1.4	1.6	2.1	2.5

EXHIBIT 2-12
Forecast of IBT from the Cape Fear River basin to the New River basin, 2015–2050, Maximum Month Average Day

	2015	2020	2025	2030	2035	2040	2045	2050
IBT (MGD)	0.3	0.6	0.9	1.5	2.5	2.8	3.2	3.6

EXHIBIT 2-13
Forecast of IBT from the Cape Fear River basin to the Northeast Cape Fear River basin, South River basin, and New River basin, 2015–2050, Maximum Month Average Day

	2015	2020	2025	2030	2035	2040	2045	2050
IBT (MGD)	1.3	3.0	4.3	6.6	9.6	12.3	14.5	16.3

According to the forecasts of future water supply needs and IBT, with the continuation of the LCFWASA intake on the Cape Fear River as PCU's primary water supply, the need was identified to petition the State of North Carolina (State) for an IBT Certificate. PCU submitted a notice to the Environmental Management Commission (EMC) on March 31, 2016 of the intent to request an IBT certificate in accordance with NCGS 143-215.22L, as amended by Session Law 2013-388. A copy of the Notice of Intent is included in Appendix D. The IBT certificate request includes:

- **Cumulative IBT from the Cape Fear River basin of 14.5 MGD**; based on rounded projections for 2045:
  - 9.2 MGD to the Northeast Cape Fear River basin
  - 2.1 MGD to the South River basin
  - 3.2 MGD to the New River basin

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SECTION 3

3 Alternatives Evaluation

3.1 Description of Alternatives

The general categories of alternatives to IBT include managing water demand, identifying water supplies in the receiving basins, and returning water to the source basin. Demand management tools include water conservation programs, especially during times of drought, and water reuse programs. These concepts have been considered with each of the alternatives for water sources presented below. PCU desires to minimize environmental impacts while meeting their water supply needs. Selecting alternatives that have lower environmental impacts also meets the requirements of federal and state environmental legislation. While water conservation programs can reduce the IBT, they likely cannot eliminate the need for an IBT. In addition, growth would still occur and water use will increase as new water service is extended to existing residents who currently utilize groundwater throughout the County. Furthermore, since PCU has already made a significant investment in surface water treatment infrastructure, regardless of the alternative, PCU will continue to obtain surface water from LCFWASA and transfer it under the minimum threshold for an IBT certificate.

Several alternatives were defined and evaluated for their ability to meet PCU's water supply needs through 2050. The following alternatives were evaluated:

1. No action.
2. Increase IBT to meet projected water needs by using the available supply from the Cape Fear River (Preferred Alternative).
3. Avoid or minimize IBT by discharging treated wastewater effluent to the Cape Fear River basin.
4. Avoid or minimize IBT by using surface water sources in the respective South River, Northeast Cape Fear River, and New River basins.
5. Avoid or minimize an increase in IBT by using coastal water sources and desalination technology.
6. Avoid or minimize an increase in IBT by using groundwater as a source.
7. Avoid or minimize an IBT increase by utilizing additional water resources management tools.

3.2 No Action (Alternative 1)

Under Alternative 1, no increase in IBT would occur and no alternatives to meeting projected demands would be implemented. No additional water would be transferred from the Cape Fear River basin, and additional transfer to the South River, Northeast Cape Fear River, and New River basins would collectively remain less than 2 MGD, calculated as a daily average of a calendar month. Under this alternative, PCU would continue to provide water to customers in the Rocky Point/Topsail and Scotts Hill WSDs and provide the needs of the Moore's Creek and Central WSDs, which are currently under construction. This alternative would preclude PCU and its co-applicants from fully meeting future water needs of their customers.

This alternative would not meet the project purpose and need and would not allow PCU to meet the future needs of its customers; therefore, it is not recommended.

3.3 Increase in Interbasin Transfer to Meet Projected Water Needs by using the Available Supply from the Cape Fear River (Alternative 2 – Preferred Alternative)

Under Alternative 2, PCU would increase their purchase of raw water from the Cape Fear River from the LCFWASA consistent with future water demand projections.

Alternative 2 would meet the PCU and co-applicant water demands by transferring up to 14.5 MGD from the Cape Fear River, initially expanding the existing PCU WTP to 6 MGD, using existing water infrastructure, and continuing water resources management measures to minimize IBT. PCU is currently constructing a 0.5 MGD WWTP in the US421 corridor, which can be expanded to 4 MGD. The WWTP will discharge treated wastewater effluent to the Cape Fear River basin, thereby minimizing IBT.

This alternative would continue to build upon the regional partnerships between the LCFWASA, PCU, and its co-applicants for providing surface water from the Cape Fear River for treatment at the PCU WTP and potable water distribution service to current and future customers as well as expanded service areas. This alternative would also build upon the existing contract that PCU holds with the LCFWASA for raw water and the historic investment in PCU's WTP and distribution infrastructure. With the introduction of PCU's water treatment plant in 2012 and use of water from LCFWASA, groundwater stopped flowing from the CCPCUA to PCU, which was a positive step for maintaining the water balance in the CCPCUA. Expansion of the use of surface water from LCFWASA under this alternative would give PCU and its co-applicants growth potential without infringing on the CCPCUA groundwater sources or exceeding aquifer yields or risking salt water encroachment in existing Pender County well fields. Alternative 2 is considered the most viable and preferred alternative, and will be analyzed further in this EA.

3.4 Avoid or Minimize Interbasin Transfer by Discharging Treated Wastewater Effluent to the Cape Fear River Basin (Alternative 3)

Under Alternative 3, the water supply would continue to be from the Cape Fear River, similar to Alternative 2, above, but treated wastewater effluent would be returned to the Cape Fear River basin to ultimately avoid or minimize IBT. Currently, PCU provides a limited amount of wastewater collection and treatment.

Certain areas of denser development are targeted for wastewater collection and treatment infrastructure. PCU is currently constructing a 0.5 MGD WWTP to serve the US 421 corridor in southwestern Pender County. This WWTP has an NDPES permit to discharge up to 4 MGD to the Cape Fear River. A STEP system serves approximately 180 customers in the Maple Hill district with onsite treatment units and a centralized effluent spray irrigation system. Approximately 20 commercial and institutional customers are served by pump stations and a manifold force main system that can ultimately convey up to 0.25 MGD to neighboring CFPUA in New Hanover County for treatment. CFPUA provides treatment at two WWTPs, both of which discharge to the Cape Fear River. As described in Section 1.1, onsite wastewater treatment is utilized throughout the remainder of the County, with only a few noted exceptions, with no plans for large scale addition of a centralized sanitary sewer collection system. In the near future, therefore, PCU will have limited potential to discharge up to 4.25 MGD to the Cape Fear River Basin.

Sewer service for the co-applicants currently varies. The Town of Burgaw provides wastewater collection to a portion of its water service area but no longer operates a WWTP. Instead, Burgaw conveys all wastewater to the Town of Wallace WWTP for treatment per contract. After treatment, the Wallace WWTP discharges to a waterbody within the Northeast Cape Fear River basin. Wallace maintains a central collection system and also serves water customers with onsite septic systems. In the Town of Topsail Beach, located in the New River basin, all water service connections have a septic system. In the Town of Surf City wastewater is treated and spray irrigated in the New River basin. The wastewater from the developments served by Utilities, Inc. is mostly treated at an onsite WWTP with effluent spray irrigation fields, but some water service connections in these developments have septic systems.

In order to return wastewater to the Cape Fear River to avoid an IBT, significant investment in wastewater collection, pumping, and treatment infrastructure would be required since the majority of the wastewater generated in the study area is treated onsite. The source basin is geographically removed from almost all of the existing and anticipated development, the cost for the wastewater collection and treatment facilities required to avoid the IBT would be significant. A Wastewater Master Plan was completed by PCU in 2006 that outlined an implementation strategy to serve Pender County with a wastewater conveyance system including two wastewater reclamation facilities, corresponding centrally located regional pumping stations, and corresponding gravity sewer. The opinion of probable cost for these facilities was over $350 million at the time, which cannot feasibly be supported by the relatively small number of rate payers that would be served. Large-scale addition of a centralized sanitary sewer system is not expected in the future. While this alternative would meet the purpose and need, the significant infrastructure expenditures required are not sustainable, and direct environmental impacts due to the significant amount of construction required would be the highest of all alternatives evaluated. This alternative is not recommended.

3.5 Avoid or Minimize Interbasin Transfer by Using Surface Water Sources in the respective South River, Northeast Cape Fear River, and New River Basins (Alternative 4)

Under Alternative 4, PCU would use surface water sources in the South River, Northeast Cape Fear River, and New River basins to meet future demands.

The 2006 Water Master Plan included an evaluation of the option to construct a new raw water intake on the Northeast Cape Fear River. The alternative would involve the construction of an intake, a raw water pump station, and a large raw water transmission main from the intake to the proposed surface water treatment facility location. Significant regulatory issues and costs are associated with this option as well as the potential for brackish water conditions in the source water, which would necessitate higher treatment and operational costs. The estimated available water supply for the Northeast Cape Fear River near Chinquapin, NC is evaluated below.

For a run-of-river intake, a commonly used estimate of expected low flow levels is a measure of flow called the 7Q10. The 7Q10 low flow is defined as the lowest average flow for seven consecutive days expected to occur on average once in a 10-year period. NC Division of Water Resources (NCDWR) has a planning guideline for available water supply in North Carolina, which is 20 percent of the 7Q10 flow. Minimal effects on local aquatic habit and other users is assumed when the proposed instantaneous surface water withdrawal, in combination with other withdrawals in the stream reach, will not result in cumulative withdrawals that remove more than 20 percent of the 7Q10 flow.

The estimated 7Q10 flow for the Northeast Cape Fear River was evaluated by the USGS in a study released in 2001 (USGS, 2001). The most representative point along the Northeast Cape Fear River where a 7Q10 estimate could be evaluated was near Watha, NC. Partial flow measuring records available for this location were used to estimate a 7Q10 of approximately 18 cubic feet per second (CFS) or 11.63 MGD. Using the NCDWR planning guideline, 20 percent of this value would be the assumed allowable surface water withdrawal, which is approximately 2.33 MGD. Higher withdrawals may potentially be justified after more detailed analysis of impacts on aquatic habitat, but even 100 percent of the 7Q10 would not meet the future demand requirements. The Northeast Cape Fear River, therefore, does not have sufficient flow to create a run-of-river intake to meet the future needs of PCU and its co-applicants.

The South River basin is smaller than the Northeast Cape Fear River basin, and it is assumed that the availability of a run-of-river intake is even more limited than the Northeast Cape Fear River; therefore, it is considered not to be a feasible water source. The New River Basin is on the coast and there is no freshwater source (surface water) in the service area from which to withdraw water, so development of a surface water source within that IBT basin is not an option.

Utilization of surface water sources within the IBT receiving basins to avoid an IBT is, therefore, not a feasible alternative to meet the project purpose and need. Also, since PCU already operates an existing WTP, trying to minimize the IBT by adding another surface water source would necessitate construction of additional smaller treatment plants and/or extensive distribution infrastructure and the blending of water sources. This approach is not advisable from an operational standpoint, and the facilities would lack economies of scale and result in higher cost than the preferred alternative. Consequently, this alternative is not recommended.

3.6 Avoid an Increase in Interbasin Transfer by Using Coastal Water Sources and Desalination Technology (Alternative 5)

Under Alternative 5, PCU would utilize the Atlantic Ocean as a water supply to meet future demands. While the necessary amount of yield would be available, the water would need to undergo a desalination treatment process before it could be used as a drinking water source. An example of this practice is the Bogue Banks Water Corporation (BBWC), which constructed a new reverse-osmosis water treatment plant in Emerald Isle, NC in 2013. BBWC has found that it takes 10 gallons of saline water to produce seven to eight gallons of fresh water, with about two gallons of wastewater being returned to Bogue Sound (Hibbs 2016). Since 20 to 30 percent of the saline water treated is considered wastewater and is typically returned to the source, it is typically better to site the water treatment plant near the water source. The existing WTP is incapable of treating saline water, so a new desalination facility would presumably be constructed near the coast. Since the new desalination facility would need to meet all demand above the 2 MGD IBT threshold, the existing WTP would not be utilized to its original design capacity of 6 MGD.

An attempt to fully utilize the existing WTP with the saline water source would require, in addition to a new desalination facility to meet any demand above 6 MGD, an extensive pretreatment facility that is larger and more expensive to construct and operate than the existing WTP itself. The source water would need to be pumped to the pretreatment facility and the WTP, requiring a significant amount of additional infrastructure, energy and ongoing operational costs. Another complicating factor is that pumping saline water long distances would pose additional operation and maintenance issues for conveyance and pumping infrastructure, since saline waters are highly corrosive. Since the higher demands are currently along the coast, this scenario would also result in pumping the water across nearly the entire width of the County twice.

The additional infrastructure required for this alternative would result in significant increased direct environmental impacts and much higher cost to rate payers compared to other alternatives. According to an article written for Scientific American, sea life can be harmed through the use of desalination plants in that small aquatic life can be pulled in through intake lines, potentially upsetting the food chain (Gleik, 2008). High capacity passive intake screens can be utilized to mitigate this risk, as they are at the LCFWASA intake, but the screens are more expensive for saltwater application due to the necessity for higher corrosion-resistant materials. Another challenge with desalination plants concerns what to do with the highly concentrated brine that is generated by the treatment process. The brine is generally not suitable for land application, infiltration, or discharge to fresh waters. If directly pumped back into brackish or saline waters, it may still be harmful to aquatic life. This issue can be mitigated, but the solutions will add to the already elevated cost of treatment and, likely, to the direct environmental impacts related to construction.

Because this alternative adds a new desalination WTP near the coast, significant transmission infrastructure modifications and a different pumping scheme are required to interconnect with the existing distribution system and serve the demands across WSDs. The result will be increased impacts to land use, wetlands, aquatic and terrestrial resources in the Study Area. The extensive pumping and treatment needs related to this type of treatment would result in energy demand and consequently higher greenhouse gas (GHG) emissions than the preferred alternative. Because of the significant increase in direct environmental impacts and costs that would be greater than the preferred alternative, as described above, this alternative is not recommended.

3.7 Avoid an Increase in Interbasin Transfer by Using Groundwater as a Source (Alternative 6)

Under Alternative 6, new groundwater sources would reduce use of surface water from the Cape Fear River basin and avoid or minimize the need for IBT. This alternative would require the development of a groundwater supply by PCU or the purchase of groundwater from other systems.

PCU could potentially develop groundwater supplies in the Castle Hayne and Pee Dee aquifers and construct full-scale groundwater treatment facilities located near Hampstead and/or US 421. Detailed information on water quality at these locations is unknown; however, a USGS report released in 2014 evaluated hydrogeology, hydraulic characteristics, and water-quality conditions of groundwater throughout the greater New Hanover County Area (including southern Pender County). The report indicated that the surficial and Castle Hayne aquifers are the primary aquifers for water supply in the area. The surficial aquifer well yields were typical less than 10 gallons per minute (GPM) and water quality was generally affected by high iron and acidity. The Castle Hayne aquifer, on the other hand, had yields that could exceed 300 GPM but could be limited by water with a chloride concentration exceeding 250 milligrams per liter (mg/L). The report also indicated that the 250 mg/L line of equal chloride concentration has moved inland in both the Castle Hayne and the underlying Pee Dee aquifer since 1965. The poor water quality in these areas would likely necessitate membrane treatment, which is significantly more expensive and requires more energy than traditional treatment (USGS, 2014a).

PCU's co-applicants are all currently reliant on groundwater for their potable water needs. Some of these utilities may have some limited additional supply capacity to provide to PCU, but they are not able to supply the full needs of PCU. The co-applicants are currently able to meet their own respective needs with their groundwater supplies. Many, however, will exceed their current groundwater availability and will need an alternate source of water within the planning period. Furthermore, the risk of saltwater intrusion in the existing groundwater wells makes an alternate source of water desirable, particularly for the island co-applicants. Since the co-applicants will continue to rely on groundwater as a primary source, the IBT will be minimized to meet only the estimated future projected needs of the co-applicants above their available groundwater supply.

Finally, if the Capacity Use regulations were extended to Pender County in the future because of continuing indications of aquifer overuse in the vicinity, PCU and its co-applicants would be required to significantly reduce their withdrawal and dependency on groundwater. PCU has already developed an expandable surface WTP to limit its reliance on groundwater. This facility is not capable of treating brackish groundwater with increasing chloride concentrations without a complete change in treatment processes such as the utilization of membranes. At this point, developing wells would be more expensive than the preferred alternative, and increased aquifer withdrawal may pose irreparable environmental damage. Upon consultation with DWR, this alternative is not recommended.

3.8 Avoid or Minimize Interbasin Transfer Increase by Utilizing Additional Water Resources Management Tools (Alternative 7)

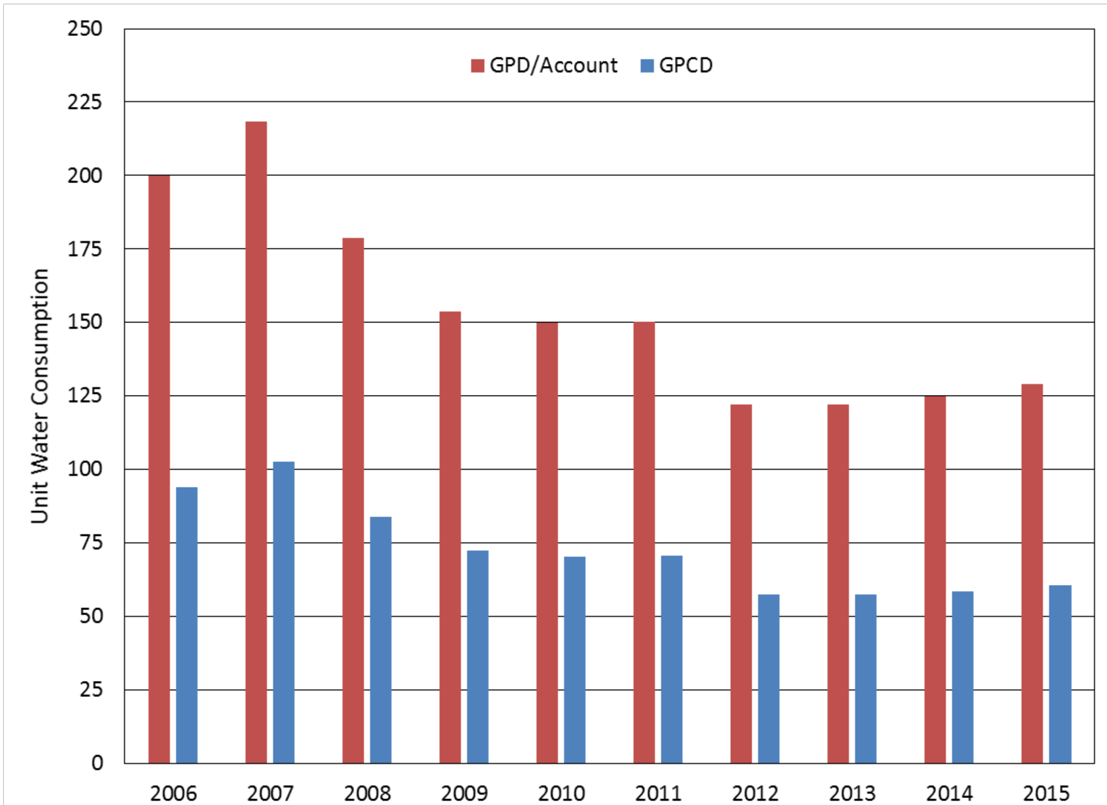
Under Alternative 7, PCU would use water resource management tools to reduce water demands, thereby reducing the required IBT. These tools may include new policies and regulations, financial incentives, rate structure modifications, reclaimed water use, water efficiency improvements, and conservation.

PCU has the opportunity to implement water resources management tools to encourage conservation and wise water use practices. PCU has provided extensive information related to water conservation for their users on the Pender County website (Pender County, 2016a). Alternative 7 would continue and expand PCU's programs with the implementation of water resources management tools to reduce future water demands. Examples may include new educational programs, new policies and regulations, new financial incentives such as rate structure modifications, new system operating practices, additional development planning, reclaimed water use, and new water efficiency improvements. The following conservation measures are already in place:

- Education materials referenced above and available on the County's website.
- PCU's fixed rate structure, which is equivalent to a second or third tier rate of other utilities in the region and this sends a conservation signal to all users, not just the highest volume users, and minimizes non-essential water use. In general practice, a tiered rate structure is typically considered to promote conservation and PCU is accomplishing this through their higher rate structure. To minimize non-essential water usage PCU has implemented elevated water rates that encourage conservation, see Section 6.2 for further information on the County's water rates and structure.
- Continued use of groundwater wells for use in irrigation by most residents since the County-wide system has only been implemented in the past ten years. This reduces the potential peak seasonal demand on the County water system.
- A relatively new water system infrastructure which limits the potential for distribution system water losses.
- Low per capita water use due to implementation of the above measures.

PCU's current water system multi-year (2006 to 2015) annual average daily residential water usage is approximately 59 gallons per capita per day (GPCD) within the Rocky Point/Topsail WSD and approximately 31 GPCD within Scotts Hill WSD, which are less than the annual average GPCD identified as part of the recent residential end use study completed by the Water Research Foundation: 95 GPCD (Range: 58 – 217 GPCD) (WRF, 2016). PCU's total water system unit consumption values (residential and commercial use combined), GPD per account (GPD/account) and GPCD, for 2006 through 2015 are presented in Exhibit 3-1. The PCU system unit consumption values for 2009 through 2015 presented in Exhibit 3-1 are less than the annual average system unit consumption values identified by the USGS for North Carolina, 70 GPCD, and the nation, 88 GPCD (Range: 55 – 168 GPCD) (USGS, 2014b).

Exhibit 3-1
PCU Water System Annual Average Unit Water Consumption Values, 2006-2015



With the growth that Pender County is experiencing and the need for PCU to extend their system to unserved WSDs, as well as the current level of unit consumption and water management tools, PCU does not expect that implementing additional water resources management tools alone will reliably and predictably reduce future potable water supply demands enough to avoid an increase in IBT.

PCU anticipates implementing new programs as those programs are determined to be effective and appropriate for the communities. These programs will increase the reliability with which PCU can meet customer demands. Alternative 7 is not, however, considered feasible as a sole means to meet projected growth needs while reducing PCU's long-term water demand. While water resource management will be an important part of implementation of the preferred alternative, Alternative 7 is not a feasible solution by itself.

3.9 Selection of the Preferred Alternative

All of the identified alternatives are technically feasible but Alternative 2 (Increase in Interbasin Transfer to Meet Projected Water Needs by using the Available Supply from the Cape Fear River) appears to be the most appropriate alternative to meet the long-range water supply needs through the year 2047 for PCU and its co-applicants. Alternative 2 is PCU's preferred alternative. The other alternatives present significantly greater technical, environmental, and/or economic challenges. The discussion of existing environment, direct effects and SCI are presented in the following sections focus in detail on the preferred alternative.

Exhibit 3-2 provides a summary of the alternatives.

EXHIBIT 3-2
Summary of Alternatives

Alternative	Meets Purpose and Need?	Requires New Infrastructure?	Potential Environmental Impacts	Anticipated Cost Relative to the Preferred Alternative (Alternative 2)[1]
1. No action.	No	No	No direct environmental impacts; growth would still occur	Lower
2. Increase IBT to meet projected water needs by using the available supply from the Cape Fear River.	Yes	Yes (for future WTP capacity expansion and distribution infrastructure)	Potential impacts to construct linear infrastructure to provide water to unserved areas of the County	N/A
3. Avoid or minimize IBT by discharging treated wastewater effluent to the Cape Fear River basin.	Yes	Yes (development of a new centralized wastewater system)	Same as Alternative 2 plus significant potential for environmental impacts from the construction of an entire wastewater collection, pumping & treatment infrastructure system	Much Higher
4. Avoid or minimize IBT by using surface water sources in the respective South River, Northeast Cape Fear River, and New River basins.	No, uncertain if full supply need could be met without further detailed study	Yes (new raw water withdrawal infrastructure, new WTPs for each source basin and new distribution infrastructure)	Significant potential environmental impacts likely in Northeast Cape Fear, South or New River basins from habitat alteration and flow regime alternation associated with new surface water withdrawal(s); direct impacts associated with new WTP(s) and distribution infrastructure	Higher
5. Avoid an increase in IBT by using coastal water sources and desalination technology.	Yes	Yes (new raw water withdrawal infrastructure, new desalination WTP and new distribution infrastructure)	High level of potential environmental impacts due to new distribution infrastructure, new desalination WTP, higher energy use WTP, as well as environmental issues associated with the disposal of brine from a new desalination WTP	Much Higher
6. Avoid an increase in IBT by using groundwater as a source.	No, uncertain if new groundwater supplies in coastal area are viable for long-term water supply	Yes (new groundwater wells, potentially new WTPs and new distribution infrastructure)	High level of potential environmental impacts from new WTP(s), new distribution infrastructure, as well as increased potential for impacts on aquifers from new groundwater supply withdrawals	Higher
7. Avoid or minimize IBT increase by utilizing additional water resources management tools.	No	No (reuse infrastructure if included (only feasible if WWTPs are constructed))	None, direct impacts from reuse lines if constructed	Lower

[1] Anticipated costs relative to the preferred alternative are based on information presented in Section 3.2 through 3.8 and is primarily associated with a comparison of the required infrastructure for each alternative to Alternative 2.

SECTION 4
4 Existing Environment

4.1 Water Resources

This section includes a description of surface water, groundwater, and wetlands in the Study Area.

4.1.1 Surface Water

Both water quantity and water quality are important factors in the function of aquatic systems. This is especially true in tidally influenced areas, such as in Pender County streams, the adjacent Cape Fear River, and in intracoastal waters. Water quantity, and its seasonal variability, influences in-stream and adjacent riparian and floodplain ecosystems as well as intracoastal and ocean waters. Water quantity is a critical concern for those who depend on surface water for water supply and wastewater discharge; the assimilative capacity of a stream is important to protect water quality. It also an important factor in salinity concentrations in tidally influenced areas.

The Clean Water Act (CWA) is the basis for water quality standards and other water quality programs. The overall goal of the CWA is for all waters to be fishable and swimmable. Water quality standards consist of the usage classification of a water body and the numeric and narrative criteria that have been set to protect that use. At a minimum, all waters are classified to protect aquatic life and secondary recreation. Other classifications may be added to reflect uses such as drinking water supply, high quality waters, tidal salt waters, swamp waters, and primary recreation. In North Carolina, all water bodies used for public water supply are given a “WS” classification. Minimum statewide water supply protection standards (certain watershed development and wastewater discharge restrictions) apply to the water supply watershed areas (NCDWR, 2016a).

Exhibit 4-1 shows major waterbodies within and adjacent to the Study Area. The major surface water bodies in the Study Area include the Cape Fear River, Black River, Northeast Cape Fear River, Intracoastal Waterway, and Atlantic Ocean. L&D #1 is located on the Cape Fear River to the west of Pender County in Bladen County. The LCFWASA raw water intake, PCU’s source of raw water supplier, is located in this vicinity within the water supply watersheds.

The Study Area is situated on the coast of North Carolina, including coastal streams, the Intracoastal Waterway, and the Atlantic Ocean. Many rivers and streams throughout the entire Study Area are classified by NCDWR as Swamp Water (Sw). The Cape Fear River at L&D #1 is classified as a water supply source (WS-IV); the designated water supply watershed is presented in Exhibit 4-1. The Atlantic Ocean, classified as Tidal Water (SB), lies to the east.

The portion of the Atlantic Intracoastal Waterway (AICW) within the Study Area falls in the New River Basin. It is classified for shellfishing (SA) and is a high quality water (HQW) through Surf City and Topsail Beach, and it is classified as SA and an outstanding resource water (ORW) below the mouth of Old Topsail Creek (NCDWR, 2016b). Development of the AICW began in the 1800s, and it runs 3,000 miles from New York to the Gulf of Mexico. It is utilized by shipping companies as a trade route and by residents and tourists for boating and recreation (Outer Banks, 2016).

Exhibit 4-2 presents classifications of the surface waters in the region. As defined by NCDWR, the water classifications mentioned above are as follows:

Swamp Waters (Sw) are defined as:

> *“Supplemental classification intended to recognize those waters which have low velocities*

and other natural characteristics which are different from adjacent streams (NCDWR, 2016c)."

Water Supply IV (WS-IV) waters are defined as:

"Waters used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I, II or III classification is not feasible. These waters are also protected for Class C uses. WS-IV waters are generally in moderately to highly developed watersheds or Protected Areas (NCDWR, 2016c)"

Class C waters are defined as:

"Waters protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner (NCDWR, 2016c)."

Class SA waters are defined as:

"Tidal salt waters that are used for commercial shellfishing or marketing purposes and are also protected for all Class SC and Class SB uses. All SA waters are also HQW by supplemental classification (NCDWR, 2016c)."

Class SB waters are defined as:

"Tidal salt waters protected for all SC uses in addition to primary recreation. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis (NCDWR, 2016c).*"*

Class SC waters are defined as:

"All tidal salt waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; fish and noncommercial shellfish consumption; aquatic life propagation and survival; and wildlife (NCDWR, 2016c)."

High Quality Waters (HQW) are defined as:

"Supplemental classification intended to protect waters which are rated excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission. The following waters are HQW by definition: WS-I, WS-II, SA (commercial shellfishing), ORW, primary nursery areas (PNA) or other functional nursery areas designated by the Marine Fisheries Commission, or waters for which DWR has received a petition for reclassification to either WS-I or WS-II (NCDWR, 2016c)."

Outstanding Resource Waters (ORW) are defined as:

"All outstanding resource waters are a subset of High Quality Waters. This supplemental classification is intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. To qualify, waters must be rated Excellent by DWR and have one of the following outstanding resource values: outstanding fish habitat and fisheries, unusually high level of waterbased recreation or potential for such kind of recreation, some special designation such as North Carolina

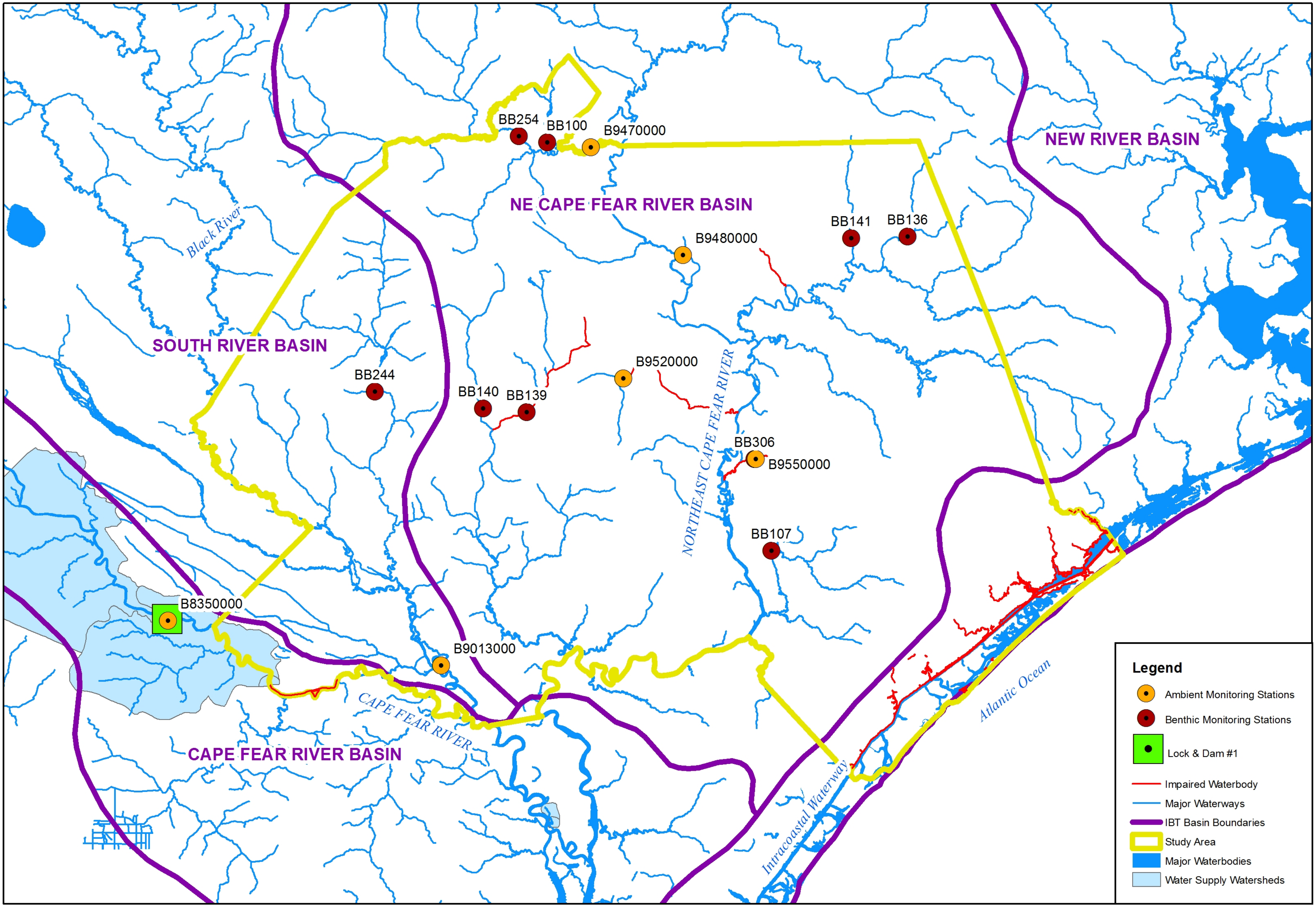


Exhibit 4-1
Surface Water
Environmental Assessment
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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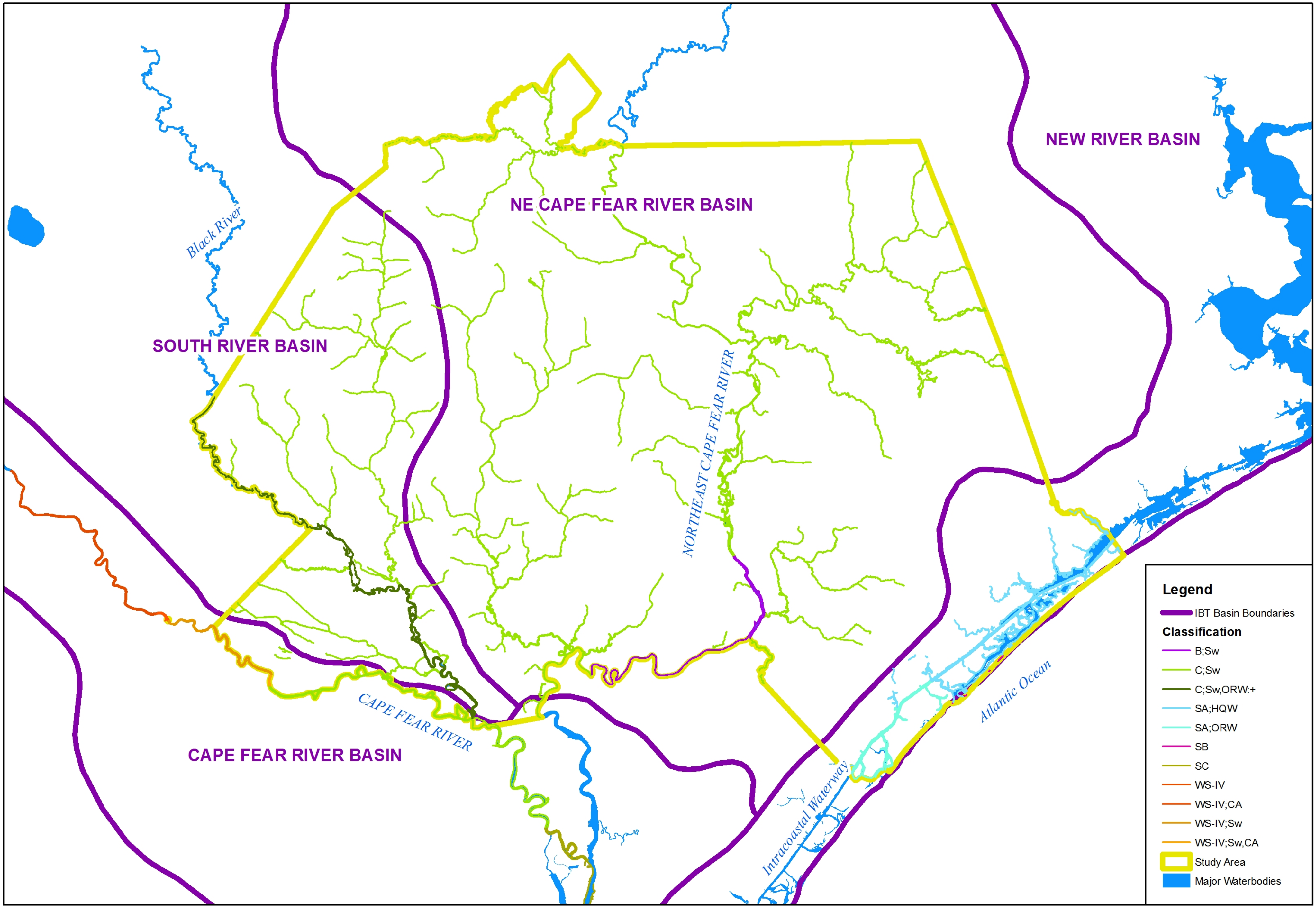

Exhibit 4-2
Surface Water Classification
Environmental Assessment
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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Natural and Scenic River or National Wildlife Refuge, important component of state or national park or forest, or special ecological or scientific significance (rare or endangered species habitat, research or educational areas) (NCDWR, 2016c)."

The Study Area is within five subbasins within the major Cape Fear River Basin. These Cape Fear River subbasins and their total watershed areas are: 03-06-16 (438 mi^2), 03-06-20 (343 mi^2), 03-06-22 (829 mi^2), 03-06-23 (795 mi^2), and 03-06-24 (162 mi^2) (NCDENR, 2005).

PCU's water supply source is the Cape Fear River at L&D #1. The dam crest is at an elevation of 11 feet above mean sea level (MSL), and the water level below the dam is 0 feet MSL at low water with an average tide of approximately 2 feet observed at the dam (USACE, 2011). A USGS gaging station at this location (02105769), Cape Fear River at L&D #1 near Kelly, NC, has a drainage area of 5,255 mi^2. Historical annual river stage and discharge measured at this gage are presented in Exhibits 4-3 and 4-4. Exhibit 4-3 presents the river stage, in relation to the L&D #1 dam crest, and Exhibit 4-4 presents the river discharge rate from 2007 through 2016; the variable cycles in water level and discharge can be observed.

Another USGS gaging station on the Northeast Cape Fear River near Chinquapin (02108000) has a drainage area of 599 mi^2. Historical annual flows measured at this gage are presented in Exhibits 4-5 and 4-6. Exhibit 4-5 presents the river stage and Exhibit 4-6 presents the river discharge rate from 2007 through 2016; the variable cycles in water level and discharge can be observed here as well.

EXHIBIT 4-3
River Stage from 2007 to 2016 for the USGS Gaging Station on the Cape Fear River at L&D #1
Data Source: USGS, 2016

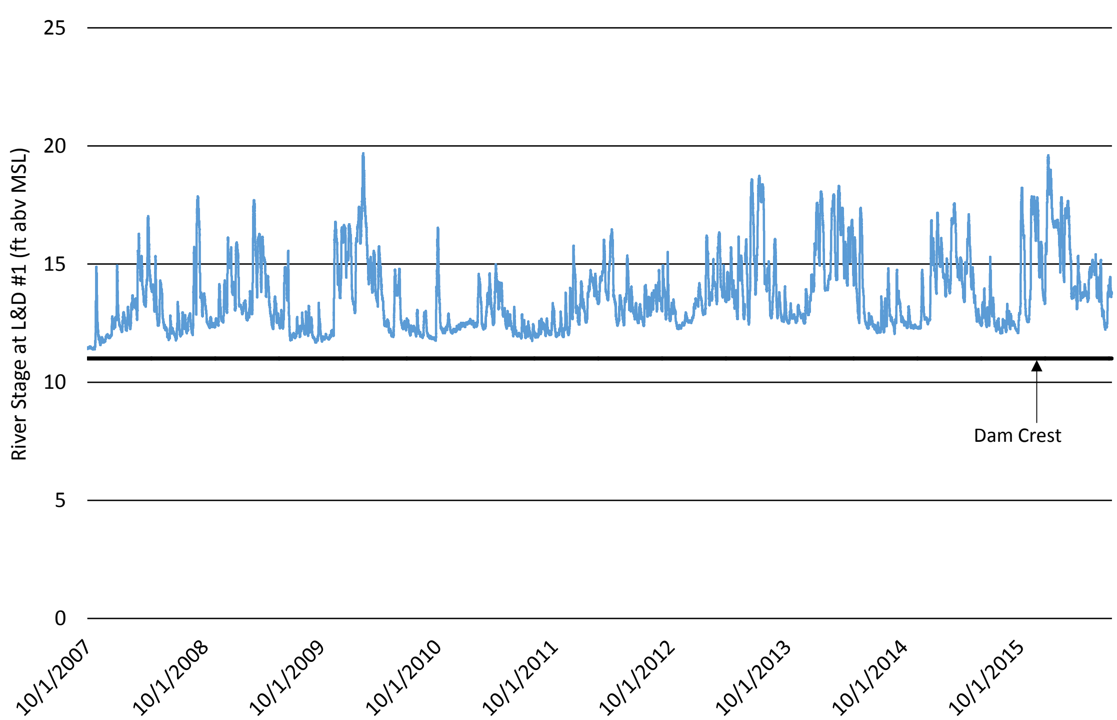


EXHIBIT 4-4

Discharge Rate from 2007 to 2016 for the USGS Gaging Station on the Cape Fear River at L&D #1

Data Source: USGS, 2016

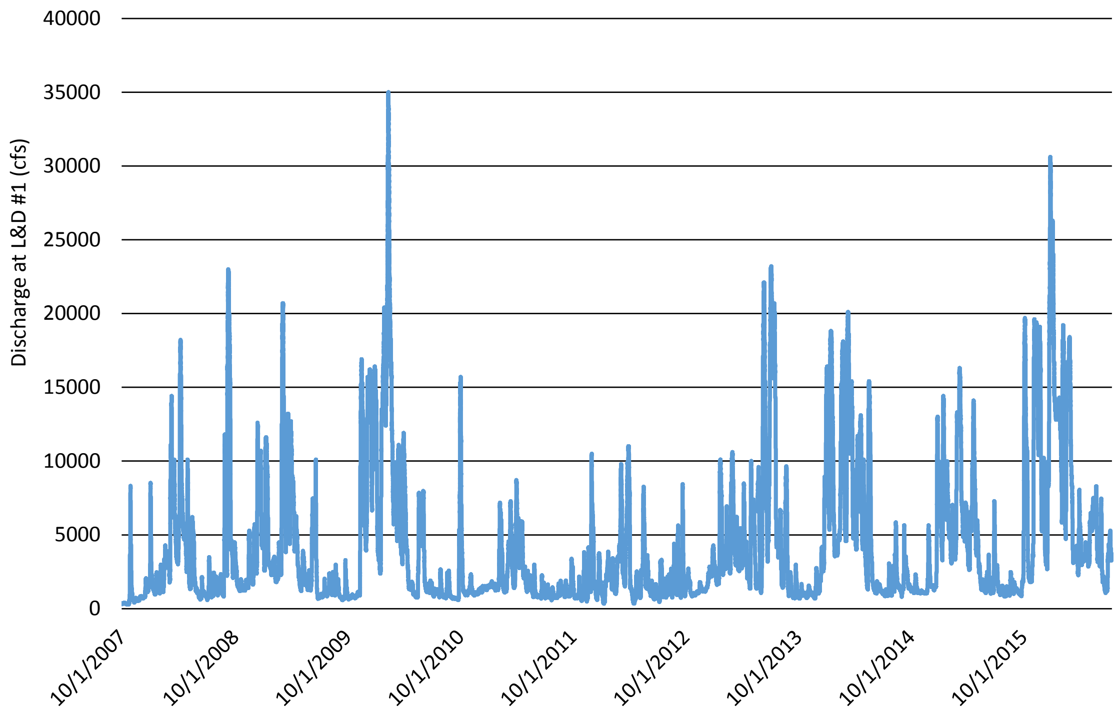


EXHIBIT 4-5

River Stage from 2007 to 2016 for the USGS Gaging Station on the Northeast Cape Fear River in Chinquapin

Data Source: USGS, 2016

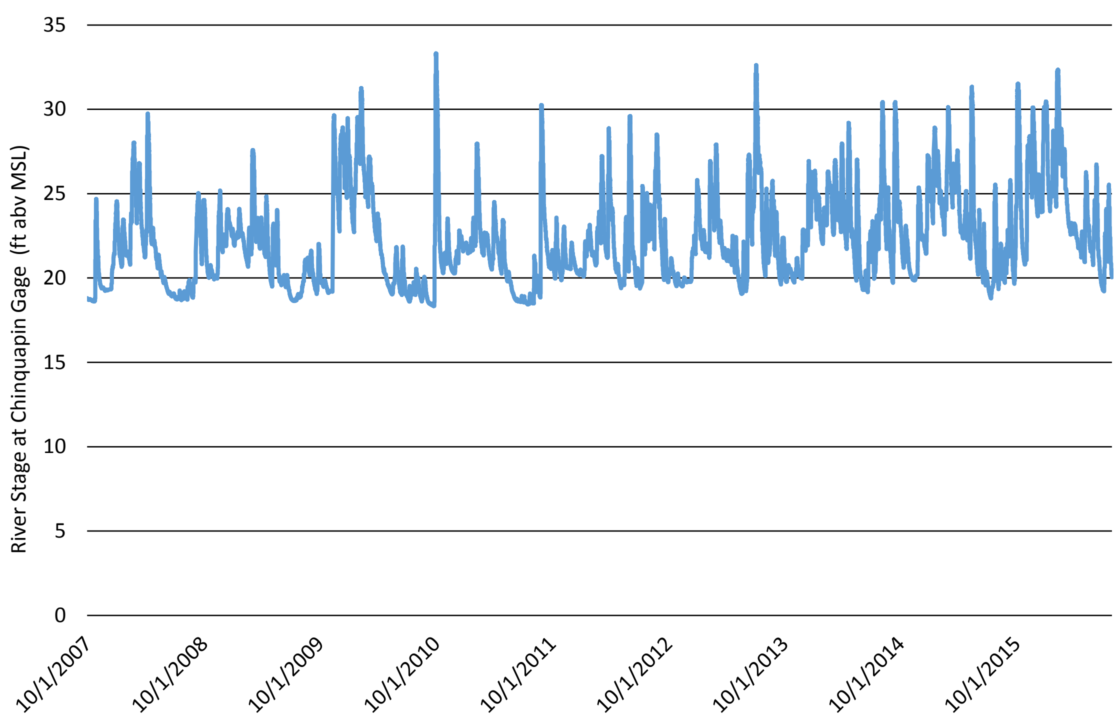
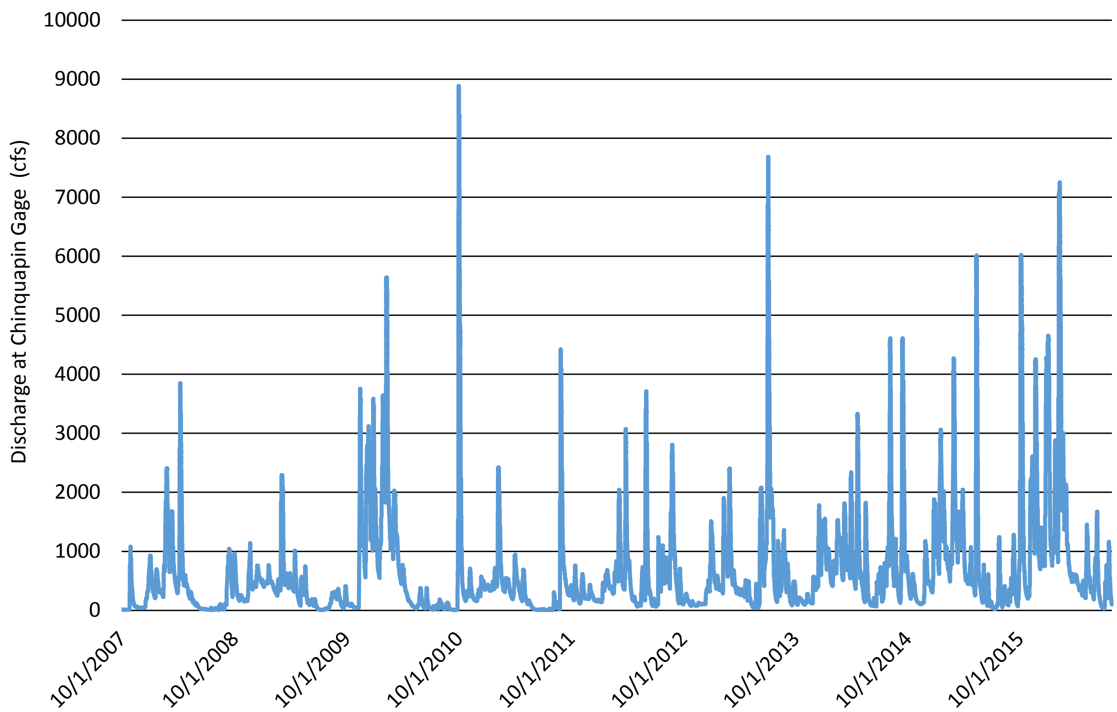


EXHIBIT 4-6
Discharge Rate from 2007 to 2016 for the USGS Gaging Station on the Northeast Cape Fear River in Chinquapin
Data Source: USGS, 2016



Ambient water quality monitoring stations in the Study Area are listed below including their stream index and classifications; Exhibit 4-1 presents the location of each monitoring station. The parameters that did not meet their respective evaluation levels (applicable numeric or narrative water quality standards) for each station between 2004 and 2008 are as follows (NCDENR, 2005).

- Cape Fear River at Lock 1 near Kelly (B8350000), 18-(59), WS-IV Sw
    - turbidity, total iron, total manganese
- Rockfish Creek at I-40 at Wallace (B9470000), 18-74-29, C Sw
    - total iron
- Northeast Cape Fear River at SR-1318 near Watha (B9480000), 18-74-(29.5), C Sw
    - total iron
- Burgaw Creek at US-117 at Burgaw (B9520000), 18-74-39, C Sw
    - fecal coliform, total copper, total iron
- Lillington Creek at SR-1520 near Stag Park (B9550000), 18-74-42, C Sw
    - pH, turbidity
- Black River at Raccoon Island near Huggins (B9013000)_, 18-68, C Sw ORW +
    - total iron

Benthic monitoring stations in the Study Area are listed below including their stream index, benthic community rating, and which year the rating was determined; Exhibit 4-1 presents the location of each monitoring station. There are no fish monitoring stations located in the Study Area (NCDENR, 2005).

- Moores Creek from source to Buxton Branch (BB224), 18-68-18a, Moderate Stress, 2003
    - This segment of stream is rated Supporting for aquatic life, and for a swamp stream the habitat is generally good.
    - The segment of Moores Creek below this to the Black River is Impaired in the fish consumption category.
- Little Rock Fish Creek (Boney Mill Pond) from source to Rock Fish Creek (BB100), 18-74-29-6, Not Rated, 2003
    - In order for a benthic community rating to be assigned, NCDWR will resample Little Rockfish Creek using Coastal A criteria.
- Rock Fish Creek (New Kirk Pond) from SR 1165 to Little Rockfish Creek (BB254), 18-74-29c, Good-Fair, 2003
- Holly Shelter Creek from source to Northeast Cape Fear River (BB136), 18-74-33, Moderate Stress, 2003
    - This segment of stream is rated Supporting for aquatic life, it had a diverse benthic community, and a rare species was found.
- Angola Creek from source to Holly Shelter Creek (BB141), 18-74-33-3, Good, 2003
    - This segment of stream is rated Supporting for aquatic life, dissolved oxygen (DO) was low, and organic particulate matter were indicated.
- Lillington Creek from source to Northeast Cape Fear River (BB306), 18-74-42, Natural, 2003
- Long Creek from source to Cypress Creek (BB139), 18-74-55a, Severe Stress, 2003
    - This segment of stream is rated Impaired for aquatic life because of this benthic rating, had poor habitat, was channelized, and had high conductivity.
    - The segment of Long Creek below this to the Northeast Cape Fear River is Impaired in the fish consumption category.
- Cypress Creek from source to Long Creek (BB140), 18-74-55-2, Moderate Stress, 2003
- Merricks Creek from source to Harrisons Creek (BB107), 18-74-49-2, Natural, 1999 and 2003

Not all waterbodies in the vicinity of the Study Area are currently supporting their surface water classification designated uses. NCDEQ has identified the Burgaw Creek and Lillington Creek locations as Areas of Concern for statistically significant exceedances of fecal coliform and pH, respectively (NCDENR, 2009). Section 303(d) of the CWA requires that states develop a list of waters that do not meet water quality standards or which have impaired uses. These waterbodies are presented in Exhibit 4-1 and listed in Exhibit 4-7. All are category 5 impairments, and the State must prioritize these waterbodies and prepare a management strategy or total maximum daily load (TMDL), however these strategies or limits may not have yet been developed. The major waterways included on the State 303(d) list include 3.8 miles of the Cape Fear River, related to narrative criteria to protect aquatic life in fresh water. In addition, the AICW and Topsail Sound are included on the list for impairments related to fecal coliform criteria to protect shellfish harvesting. Most of the other streams and tributaries listed in the Study Area are also related to fecal coliform criteria to protect shellfish harvesting (NCDEQ, 2016).

The Cape Fear River from Bladen County to the coast was mostly Supporting or Not Rated for Aquatic Life and Recreation in the 2005 Cape Fear River Water Quality Plan. Two exceptions include: 1) the Cape Fear River from the International Paper intake to Bryant Mill Creek (3.8 miles) is considered Impaired on a monitored basis in the fish consumption category, and 2) the Cape Fear River from Toomers Creek to Snows Cut is Impaired for aquatic life due to violation of the DO standard as well as pH below the standard. Swamp drainage from the Black and Northeast Cape Fear Rivers, areas with Sw classifications, may contribute to lower DO and pH (NCDENR, 2005).

Beginning in 1998, the section of the Lower Cape Fear River Estuary (LCFRE) from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been listed on the State of North Carolina's 303(d) List as impaired for DO. In 2006, NCDEQ added pH as impaired for this segment, and in 2008, NCDEQ added copper and turbidity to the listing, as well. The draft 2016 303(d) List maintains these impairments despite some changes to the listing methodology (NCDEQ, 2016).

Until recently, NCDEQ had been pursuing development of a TMDL to establish what were originally believed to be reduction needs for oxygen-demanding pollutants, including biochemical oxygen demand (BOD) and ammonia nitrogen (NH3-N). However, NCDEQ has recently determined that, based on the technical information compiled and assessed to date, developing a TMDL using the existing water quality standard for the LCFRE of 5.0 milligrams per liter (mg/L) (at all times) would not be appropriate because water quality modeling results indicate that even significant reductions in both natural and anthropogenic pollutant loads would not result in attainment of the current standard for considerable periods of time during the summer (NCDENR, 2015; CH2M HILL, 2014a and 2014b; Tetra Tech, 2014a and 2014b).

In 2014, NCDEQ indicated that changes to the classification of the LCFRE from Class SC to Class SC Sw were appropriate to recognize the influence of natural drainage from riverine and saltwater marsh systems in the watershed on DO concentrations. The SC classification is a primary classification whereas the Sw classification is a supplemental classification that can accompany a primary classification. The SC Sw standards allow DO levels of less than 5.0 mg/L if caused by natural conditions and pH levels of as low as 4.3 if resulting from natural conditions.

NCDEQ held a public hearing on February 5, 2015 to present the proposed classification change. On September 10, 2015 NCDEQ provided a recommendation to the Environmental Management Commission (EMC) to reclassify the segment of the Cape Fear River from upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut from Class SC to Class SC Sw and to codify the current permitting policy already in existence for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters.

On May 12, 2016 the EMC passed the final recommended changes to the subject statute. A number of objections to the change were received, triggering a legislative review of the changes. Due to the timing, a review of the issue will not occur until the next legislative session beginning in January 2017.

EXHIBIT 4-7
303(d) Listed Waters

Unit Number	Name	Parameter of Interest (POI)[1]	Classification	Major River Basin
18-87-10-1a2	Banks Channel	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-10-1a3	Banks Channel	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-10-1b	Banks Channel	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-6	Batts Mill Creek (Barlow Creek)	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New
18-87-8b	Beckys Creek (Bishops Creek)	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-8a	Beckys Creek (Bishops Creek)	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-74-39b	Burgaw Creek	Copper (7 ug/l, AL, FW)	C;Sw	Cape Fear
18-(63)a	CAPE FEAR RIVER	Benthos Fair (Nar, AL, FW)	C;Sw	Cape Fear
18-87-6-1	County Line Branch	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New
18-87-19a	Futch Creek	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-19b	Futch Creek	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-(5.5)	Intracaostal Waterway	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-74-42	Lillington Creek	pH (4.3 su, AL, Sw)	C;Sw	Cape Fear
18-74-55a	Long Creek	Benthos Severe (Nar, AL, FW)	C;Sw	Cape Fear
18-87-14	Mill Creek (Betts Creek)	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-74-33-5	Mill Pond	pH (4.3 su, AL, Sw)	C;Sw	Cape Fear
18-87-9-1	Mullett Run	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New
18-87-11	Nixons Creek	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-7	Old Mill Creek	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-12a	Old Topsail Creek	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-12b	Old Topsail Creek	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-10a2	Topsail Sound	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-10d	Topsail Sound	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New
18-87-10a4	Topsail Sound	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New
18-87-10c	Topsail Sound	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-10b	Topsail Sound	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-10a5	Topsail Sound	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-87-10a3	Topsail Sound	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New

Unit Number	Name	Parameter of Interest (POI)[1]	Classification	Major River Basin
18-87-11.7d	Topsail Sound and Middle Sound ORW Area	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;ORW	New
18-87-11.7c	Topsail Sound and Middle Sound ORW Area	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;ORW	New
18-87-11.7e	Topsail Sound and Middle Sound ORW Area	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;ORW	New
18-87-9b	Virginia Creek	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New
18-87-9a	Virginia Creek	Shellfish Growing Area-Conditionally Approved Closed (Fecal, SH, SA)	SA;HQW	New

Source: NCDEQ, 2016
Notes:
[1] Parameter of interest codes:
SH – shellfish harvesting
SA – class SA waters
AL – aquatic life
FW – fresh waters
Sw – Swamp supplemental classification

4.1.2 Groundwater

The Study Area, which is shown in Exhibit 1-2 and further defined in Section 1.3, is located within the Atlantic Coastal Plain, which is underlain by four major aquifers: surficial, Yorktown, Castle Hayne, and Cretaceous, in increasing depth (Winner and Coble, 1996). Of these, the Yorktown aquifer is not present within the Study Area. The surficial aquifer in the Coastal Plain is unconfined and ranges from around 20 to 50 feet thick. The composition of the surficial aquifer is generally 50 to 70 percent sand, allowing high infiltration rates and recharge of the aquifer beneath; however, this varies across the region. The surficial aquifer is the source for many shallow wells where deeper waters are too salty, especially near the coast. In the southern part of the coastal plain, beneath the surficial aquifer in the Study Area, the Castle Hayne aquifer is close to the surface. It can be over 300 feet thick in places and is the most productive aquifer in the state. Limestone in the aquifer contributes to hard water. The Cretaceous aquifer is the deepest aquifer in this region and the primary source of water for the western half of the coastal plain. The aquifer is thick, and extracted groundwater requires little treatment (Huffman, 1996). The Cretaceous aquifer includes the Peedee and Black Creek aquifers, which are present in the Study Area (USGS, 2014a and NCDWR, 2016d).

Groundwater is currently a primary source for water within the Study Area for those that are not currently customers of PCU, both for the co-applicants and for residences not connected to the PCU water system. Typical residential groundwater wells withdraw water from the surficial aquifer. In Pender County, citizens have expressed concerns related to the variability in water quality, issues with iron, and the reliability of the groundwater. As discussed in Section 1.1, citizens approved a bond referendum to extend the PCU water system into two of Pender County's WSDS to connect customers that are currently reliant on groundwater as their source of water supply. In addition, all of the co-applicants currently rely on groundwater, Burgaw withdraws water from the Black Creek aquifers, Topsail withdraws water from the Peedee aquifer, Surf City withdraws water from the Peedee aquifer, Wallace withdraws water from Black Creek aquifer, and Utilities, Inc. withdraws water from the Castle Hayne aquifer.

A groundwater monitoring station, "Topsail Beach" or BB 28J5, is located within the Study Area, adjacent to US Highway 17/NC Highway 210. Four wells are monitored at the station. They were constructed in 1983 in the Surficial, Castle Hayne, Peedee, and Black Creek aquifers, in increasing depth. The groundwater level in the Black Creek aquifer has been steadily declining over time and the groundwater level in the Peedee was declining until 2013, but since has made some recovery (NCDEQ, 2016).

The Castle Hayne aquifer in the southeastern area of Pender County is fresh according to the Topsail Beach and Eagle Point Monitoring stations, with salt water encroachment likely along the coast. The Castle Hayne is nonexistent along Hwy 421; however, the Peedee aquifer does exist. The Peedee aquifer is fresh in the northeastern part of Pender County. The transition zone for the salt water/fresh water interface is mapped approximately 4.5 miles south of the intersection of NC- 210 and US-421.

As demands on the aquifers increase, water levels and quality in the aquifers slowly decline as withdrawals exceed the rate at which the aquifers are recharging. The Central Coastal Plain Capacity Use Area (CCPCUA) is a group of 15 coastal counties designated by the EMC with the intention to reduce demands on groundwater, specifically the Cretaceous aquifer, within areas of the State that have experienced significant aquifer drawdown. In 2002, the EMC approved and implemented rules for this area, which created a groundwater use permitting process. These rules include requiring permits for groundwater users of more than 100,000 GPD and annual registration and reporting of withdrawals for both ground and surface water users of more than 100,000 GPD. As part of the

CCPCUA rules, a 75 percent reduction in water withdrawals from the Cretaceous aquifer over a 16-year period is required. Alternative water supplies (surface water or alternative aquifers) are required to meet this reduction goal. NCDWR has observed recovery in the Cretaceous aquifer levels since the implementation of the CCPCUA. The Study Area is adjacent to the CCPCUA. The Town of Wallace, a co-applicant, is located in Duplin County, and Onslow County is adjacent to Pender County to the northeast. Both are counties in the CCPCUA (NCDWR, 2016e).

4.1.3 Wetlands

According to the United States Environmental Protection Agency (USEPA), wetlands are lands of transition between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water at least part of the year (Title 40 Code of Federal Regulations Part 230.3(t)). For regulatory purposes under the CWA, the term wetlands means “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” In general, wetlands share three key characteristics: wetland hydrology, hydric soils, and hydrophytic plants. Wetlands and vegetated riparian areas are valuable because they are biologically productive natural ecosystems, provide wildlife habitat, protect water quality, control erosion, and prevent flooding damage.

The Study Area is located within the Coastal Plain, where the flat topography and hydrology contribute to the presence of wetlands. The general type and area of wetlands within the Study Area were determined using the North Carolina Division of Coastal Management (NCDCM) North Carolina Coastal Region Evaluation of Wetland Significance (NCCREWS) data in GIS format (NCDCM, 2016a). Although the NCCREWS does not map all wetlands areas, it is useful in terms of classifying types of wetlands and their approximate locations within the Study Area.

The inventory of NCCREWS wetlands in the Study Area identifies 310,873 acres of wetlands (approximately 54 percent of the Study Area). These wetlands are shown in Exhibit 4-8. The major type of NCCREWS wetlands identified in the Study Area is Pocosin, evergreen scrub-shrub communities that typically occur on saturated, acidic, nutrient poor, sandy or peaty soils. Pocosins comprise 109,655 acres, approximately 35 percent, of the total wetland area identified within Study Area. Salt/Brackish Marsh is the most prevalent wetland type along the coastline (approximately 2 percent of the total wetland area). Managed Pineland, Swamp Forest, and Pine Flat comprise the majority of the remaining wetland area with approximately 25, 21, and 11 percent of the total wetland area, respectively. Freshwater Emergent Wetlands make up approximately 1 percent of the total wetland area within the Study Area, and open water including Lakes, Freshwater Ponds, and Rivers make up the remaining 3 percent (NCDCM, 2016a). The NCCREWS wetlands data defines significance with three relative rating scores: beneficial significance, substantial significance, and exceptional significance. This Overall Wetland Rating (OWR) is based on each wetland’s functionality in regards to water quality, hydrology, and wildlife habitat. Wetlands of beneficial significance comprise 1,988 acres or approximately 1 percent, wetlands of substantial significance comprise 146,386 acres or approximately 47 percent, and wetlands of exceptional significance comprise 159,073 acres or approximately 51 percent of the total wetland area identified within Study Area. Much of these wetlands are located within the Holly Shelter and Angola Game Lands.

Analysis of the soils mapping within the Study Area indicate the presence of hydric soils, a wetland indicator (USDA, 2016). These soils are located primarily along stream channels, concurring with NCCREWS data indicating that wetlands within the Study Area are primarily located within riparian and floodplain areas. Within these floodplains, riverine wetlands function as storage areas for floodwaters, slowing runoff and thereby lessening flood levels downstream. These wetlands also serve as areas of deposition for sediment and other material carried by floodwaters.

4.2 Topography

The Study Area is located in the North Carolina Coastal Plain, with flat to gently sloping terrain. With the relatively flat topography, wide floodplains are adjacent to waterways, making them important topographical features in the Study Area. Floodplains are low, relatively flat areas adjacent to streams, and they function as storage areas for surface water during large rainfall events. Within floodplains, micro topographical variations often create pockets of riverine wetlands, which are prevalent within the Study Area. These riparian floodplain areas provide multiple functions, including flood water storage, sediment depositional areas, wildlife habitat, corridors for wildlife movement, and water quality functions such as infiltration zones and surface water filtering.

Flood Insurance Rate Maps (FIRMs) for the area indicate approximately 308 mi^2 of open water, including the Intracoastal Waterway, and Federal Emergency Management Agency (FEMA)-regulated floodplains inside the Study Area. The majority of the open water and 100-year floodplain area occurs along the coast, along rivers, and within the game lands. (FRIS, 2016). Floodplains within watersheds greater than one square mile are regulated by FEMA. FIRMs for the Study Area are dated February 16, 2006 and February 16, 2007. The floodways and 100-year floodplains as currently defined by FEMA are presented in Exhibit 4-9 (NCDEM, 2016). FIRMs in this area are currently being updated; some are anticipated to become effective in 2016 and others as late as 2020 or beyond (NFIP, 2016). This will include new limited detailed floodplain studies and future flood conditions in some areas, which will likely increase the floodplain information available to Pender County and the co-applicants. The floodplains may change in the future based on the revisions reflected in the updated FIRMs.

A unique feature present in this region are Carolina Bays. They are oval depressions oriented in a northwest to southeast direction and range from a few hundred feet to six miles in length. Some still hold water while others have become bogs or dried up, and although there are theories, their origin has not been determined (Powell, 2006).

In addition, the portion of the Study Area along the coast presents the threat of coastal storm surge. The beach areas, particularly around Topsail Beach and Surf City along the Atlantic Ocean, are classified under the Coastal Area Management Act (CAMA) as an Ocean Hazard System Area of Environmental Concern (AEC). This AEC includes beaches, primary dunes, frontal dunes, and other areas in which conditions indicate a substantial possibility of excessive erosion or flood damage, as defined in 15A NCAC 7H. 0300 (NCDCM, 2014).

4.3 Soils

According to the Pender County Soil Survey, the majority of soils are poorly drained and hydric (USDA, 2016). The dominant soil series at 26 percent of Pender County is Murville-Croatan-Torhunta. These mucky or loamy soils have poor drainage and are found in interstream areas in the eastern portion of the county. Other poorly drained mucky soils are included in the Muckalee-Dorovan soil group, which covers 9 percent of the county. Other interstream poorly drained soils are within the Rains-Woodington-Liddell soil group, which covers 19 percent of Pender County. Chewacla-Chastain soils are found along the Cape Fear River. In the southeast portion of the county, the Leon-Mandarin soil group is the most prevalent and comprises 7 percent of the county overall. These sandy soils are nearly level and poorly to somewhat poorly drained. Along the coast, the sandy Carteret-Newhan-Corolla soil group is most prevalent (USDA, 1986).

More well drained soils include the loamy Goldsboro-Norfolk-Exum soil group, at 15 percent of Pender County, and Foreston-Autryville-Baymeade soil group covering 10 percent of the county. In the southern and western portions of the county, the Alpin-Pactolus-Kureb soil group is comprised of well drained to moderately well drained sandy soils.

According to the USDA Web Soil Survey, soils present in Wallace that are not already represented in Pender County include Marvyn and Gritney soils, Rumford loamy fine sand, and Noboco loamy fine sand. Noboco loamy fine sand is the most dominant, covering 36 percent of Wallace (USDA, 2016).

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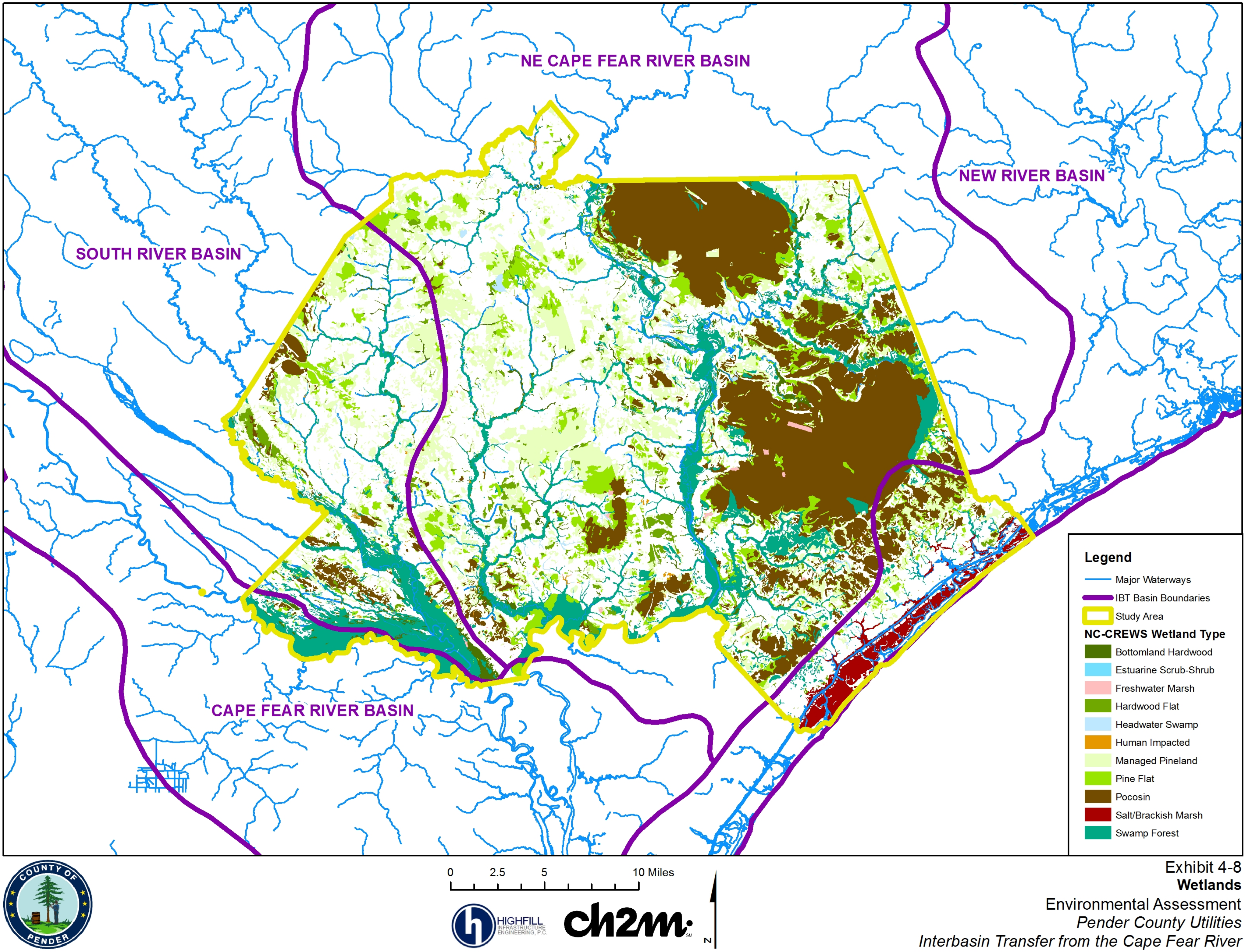

Exhibit 4-8
Wetlands
Environmental Assessment
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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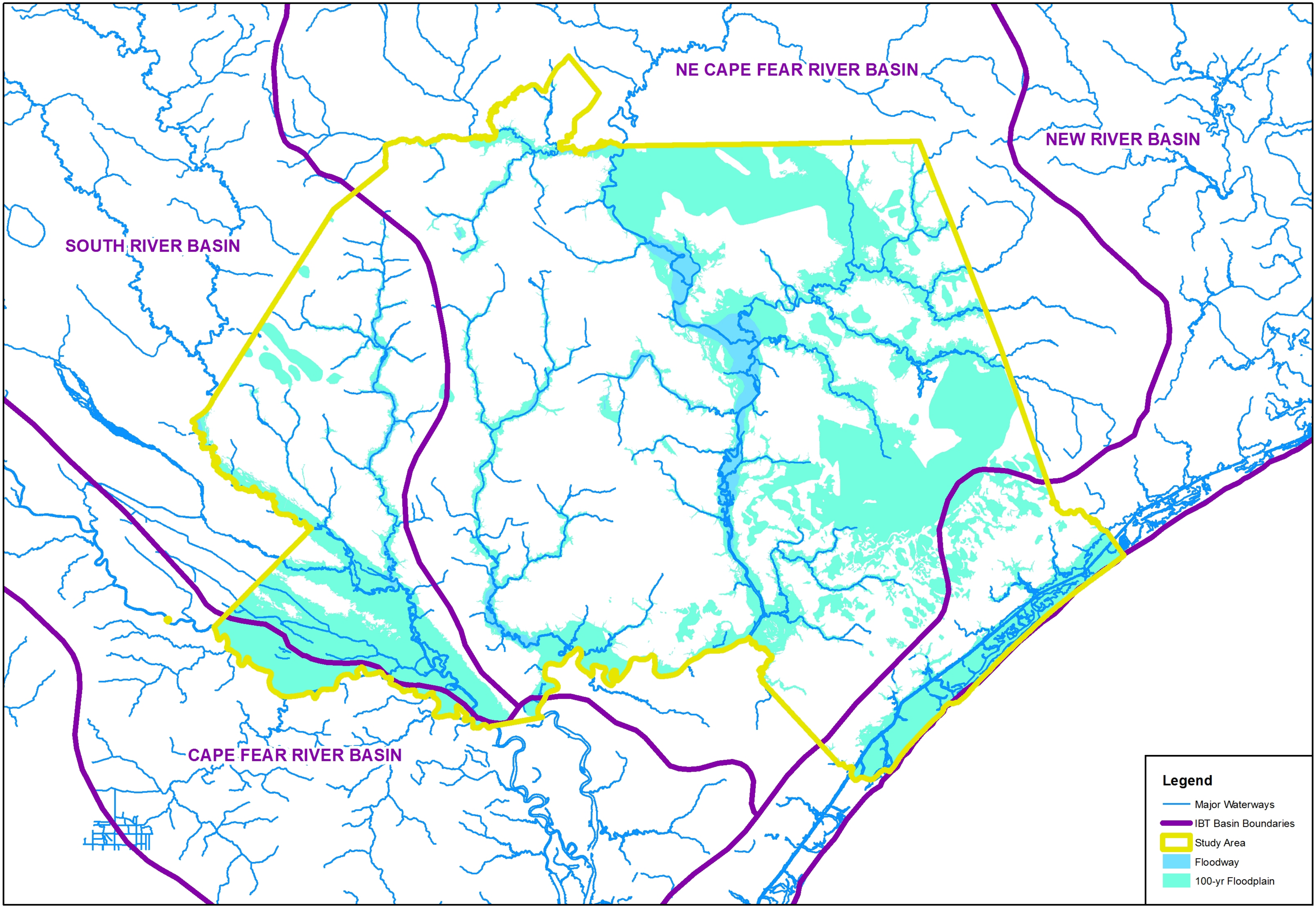

Exhibit 4-9

Floodplains

Environmental Assessment

Pender County Utilities

Interbasin Transfer from the Cape Fear River

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Murville muck and Croatan muck are the most prevalent individual soil types within the Study Area. Murville muck, a part of the Murville Series, is a very poorly drained soil in interstream areas and depressions. The soil color is black, grayish brown, or mottled grayish brown. The thickness of this soil ranges from 40 to 60 inches. Murville muck texture includes sand grains coated with organic matter,sand, fine sand, or loamy fine sand. The soil is soft and loamy to the touch. Seasonal wetness, caving of ditchbanks, a poor filtering capacity, seepage, and ponding are general limitations that prevent the use of Murville muck in building site development, sanitary facilities, or recreational development (USDA, 1986).

Croatan muck, from the Croatan Series, is a very poorly drained soil in interstream divides between natural drainageways. The soil color is black, dark brown, or dark grayish brown. The soil has a thickness range from 16 to 51 inches. Croatan muck has a granular, sandy loam, clay loam, sand, or clay texture. Seasonal wetness and low soil strength are general limitations that prevent the use of Croatan muck in building site development, sanitary facilities, or recreational development (USDA, 1986).

4.4 Wildlife Resources and Natural Vegetation

4.4.1 Wildlife and Natural Vegetation

The Study Area includes upland coastal plain, coastal, and outer banks habitats, providing a variety of habitat for wildlife and migration of birds. A large portion of coastal plain habitat in the Study Area is protected within the Holly Shelter Game Lands.

Correspondence with NCNHP regarding this project has occurred. Earlier during project planning, a request for documentation of the known presence of protected species within the Study Area was sent to North Carolina Natural Heritage Program (NCNHP). The response letter from the NCNHP is dated June 22, 2016 and included in Appendix E. Further discussion of terrestrial and aquatic threatened and endangered species is included in Sections 4.4.2 and 4.5.2, respectively.

Within the Study Area, natural vegetation is typical of coastal plain, coastal, and outer banks communities. Smaller, unique ecosystems are present. These areas represent specific assemblages of upland forest, wetland, and pocosin natural communities. Exhibit 4-10 below presents a listing of documented natural communities within the Study Area (NCNHP, 2015).

The Sand Ridge and Bryant Mill (Greenbank) Bluffs are the largest occurring upland natural communities in the Study Area by acreage (NCNHP, 2015). The most dominate subtypes found within these natural communities are described below.

- Xeric Sandhill Scrub (Typic Subtype) is found with the Sand Ridge upland natural community. This subtype is distinguished from similar subtypes by high plant cover in the herb layer, specifically Wiregrass (*Aristida stricta)*. Another distinguishing feature of this subtype is the presence of a scrub oak layer, which is dominated by Turkey Oak (*Quercus laevis)* (Schafale, 2012).

- Dry-Mesic Oak—Hickory Forest (Coastal Plain Subtype) and Mesic Mixed Hardwood Forest (Coastal Plain Subtype) are found within the Bryant Mill (Greenbank) Bluff upland natural community. These subtypes are listed in the fourth approximation of “Classification of the Natural Communities of North Carolina” as Mixed Moisture Hardpan Forest and Calcareous Oak—Walnut Forest respectively. The Mixed Moisture Hardpan Forest is distinguished by co-occurrence by wetland and upland species including Willow Oak (*Quercus phellos*) and

Southern Shagbark Hickory (*Carya carolinae-septentrionalis*). The Calcareous Oak—Walnut Forest is distinguished by canopy composition, and includes the Chinkapin Oak (*Quercus muehlenbergii*) and/or Eastern Black Walnut (*Juglans nigra*) species (Schafale, 2012).

EXHIBIT 4-10
Natural Communities

Blackwater Bottomland Hardwoods (High Subtype)	Peatland Atlantic White Cedar Forest
Blackwater Bottomland Hardwoods (Low Subtype)	Pine/Scrub Oak Sandhill (Coastal Fringe Subtype)
Blackwater Bottomland Hardwoods (Swamp Transition Subtype)	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)
Brackish Marsh (Needlerush Subtype)	Pocosin Opening (Pitcher Plant Subtype)
Brownwater Bottomland Hardwoods (Swamp Transition Subtype)	Pocosin Opening (Sedge-Fern Subtype)
Brownwater Levee Forest (High Levee Subtype)	Pond Pine Woodland (Typic Subtype)
Brownwater Levee Forest (Low Levee Subtype)	Salt Flat
Coastal Plain Cliff	Salt Marsh (Carolinian Subtype)
Coastal Plain Depression Swamp (Mixed Subtype)	Sandy Pine Savanna (Rush Featherling Subtype)
Coastal Plain Small Stream Swamp	Sandy Pine Savanna (Typic Subtype)
Cypress--Gum Swamp (Blackwater Subtype)	Small Depression Drawdown Meadow (Typic Subtype)
Dry-Mesic Oak--Hickory Forest (Coastal Plain Subtype)	Small Depression Pocosin (Typic Subtype)
Dune Grass (Southern Subtype)	Streamhead Atlantic White Cedar Forest
High Pocosin (Evergreen Subtype)	Streamhead Pocosin
Low Pocosin (Titi Subtype)	Tidal Swamp (Cypress--Gum Subtype)
Maritime Dry Grassland (Typic Subtype)	Very Wet Loamy Pine Savanna
Maritime Evergreen Forest (Mid Atlantic Subtype)	Wet Loamy Pine Savanna
Maritime Shrub (Stunted Tree Subtype)	Wet Marl Forest
Mesic Mixed Hardwood Forest (Coastal Plain Subtype)	Wet Pine Flatwoods (Sand Myrtle Subtype)
Mesic Pine Savanna (Coastal Plain Subtype)	Wet Pine Flatwoods (Typic Subtype)
	Xeric Sandhill Scrub (Coastal Fringe Subtype)
	Xeric Sandhill Scrub (Typic Subtype)

Source: NCNHP, 2015

The largest contiguous occurring wetland natural communities are found within the Holly Shelter Game Lands and Angola Bay game lands (NCNHP, 2015). The most dominate subtypes found within these natural communities are described below.

- Low Pocosin (Titi Subtype) is prevalent within both the Holly Shelter and Angola Bay game lands. This subtype is distinguished from similar subtypes by the presence of Swamp Titi (*Cyrilla racemiflora*). This subtype also includes the Honeycup (*Zenobia pulverulenta*), Fetterbush Lyonia (*Lyonia lucida*), and Inkberry (*Ilex glabra*) species (Schafale, 2012).
- Pocosin Opening (Pitcher Plant Subtype) is prevalent within Holly Shelter game lands. This subtype is distinguished by having more than 25 percent cover by Trumpet Pitchers (*Sarracenia* spp.) This species is the most dominant vegetation within the subtype (Schafale, 2012).

- Pond Pine Woodland (Typic Subtype) is prevalent within both the Holly Shelter and Angola Bay game lands. This subtype is distinguished from similar subtypes by a significant tree canopy presence. This tree canopy includes the Pond Pine (*Pinus serotine*) and Loblolly-Bay (*Gordonia lasianthus*) species (Schafale, 2012)
- High Pocosin (Evergreen Subtype) is prevalent within both the Holly Shelter and Angola Bay game lands. This subtype is distinguished from similar subtypes by lacking a well-developed tree canopy, and by having shrub layers greater than 1.5 meters tall. This subtype also includes the Fetterbush Lyonia (*Lyonia lucida*) and Inkberry (*Ilex glabra*) species (Schafale, 2012).
- Pocosin Opening (Pitcher Plant Subtype) is prevalent within the Angola Bay game lands. This subtype is distinguished from similar subtypes by having more than 25 percent cover by Trumpet Pitchers (*Sarracenia* spp.) This species is the most dominant vegetation within the subtype (Schafale, 2012).

4.4.2 Federally Listed Threatened and Endangered Species

Thirty-five terrestrial wildlife species are federally listed with current records in the counties within the Study Area, as presented in Exhibit 4-11 below; of these, four species are listed as endangered, three are listed as threatened, one is listed as candidate, and one, the bald eagle (*Haliaeetus leucocephalus*), is protected by the Bald and Golden Eagle Protection Act (BGPA). An additional 26 species are listed as federal species of concern (FSC) (U.S. Fish & Wildlife Service [USFWS], 2015; USFWS, 2010). Federally listed aquatic species and Significant Aquatic Endangered Species Habitats (SAESHs) are discussed in Section 4.5.2.

EXHIBIT 4-11
Federally Listed Terrestrial Wildlife and Plant Species Potentially Listed Within the Study Area

Common Name	Scientific Name	Federal Status	County
Bachman's sparrow	*Peucaea aestivalis*	FSC	Pender
Bald eagle	*Haliaeetus leucocephalus*	BGPA	Pender
Buchholz’s dart moth	*Agrotis buschholzi*	FSC	Pender
Carolina bishopweed	*Ptilimnium ahlesii*	FSC	Pender
Carolina bogmint	*Macbridea caroliniana*	FSC	Pender
Carolina gopher frog	*Rana capito capito*	FSC	Pender
Carolina grass-of-parnassus	*Parnassia caroliniana*	FSC	Pender
Carter's noctuid moth	*Photedes carterae*	FSC	Pender
Carolina trillium	*Trillium pusillum var. pusillum*	FSC	Pender
Coastal goldenrod	*Solidago villosicarpa*	FSC	Pender
Cooley's meadowrue	*Thalictrum cooleyi*	E	Pender
Eastern Henslow's sparrow	*Ammodramus henslowii susurrans*	FSC	Pender
Eastern painted bunting	*Passerina ciris ciris*	FSC	Pender
Georgia lead-plant	*Amorpha georgiana var. georgiana*	FSC	Pender
Golden sedge	*Carex lutea*	E	Pender
Grassleaf arrowhead	*Sagittaria weatherbiana*	FSC	Pender, Duplin

EXHIBIT 4-11
Federally Listed Terrestrial Wildlife and Plant Species Potentially Listed Within the Study Area

Common Name	**Scientific Name**	**Federal Status**	**County**
Pineland plantain	*Plantago sparsiflora*	FSC	Pender
Piping plover	*Charadrius melodus*	T	Pender
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	FSC	Pender, Duplin
Rattlesnake-Master borer moth	*Papaipema eryngii*	C	Pender
Red-cockaded woodpecker	*Picoides borealis*	E	Pender, Duplin
Red knot	*Calidris cantutus rufa*	T	Pender
Rough-leaf loosestrife	*Lysimachia asperulifolia*	E	Pender
Sandhills milk-vetch	*Astragalus michauxii*	FSC	Pender
Savanna onion	*Allium sp. 1*	FSC	Pender
Seabeach amaranth	*Amaranthus pumilus*	T	Pender
Small-leaved meadowrue	*Thalictrum macrostylum*	FSC	Pender
Smooth-seeded hairy nutrush	*Scleria sp. 1*	FSC	Pender
Southeastern myotis bat	*Myotis austroriparius*	FSC	Pender
Southern hognose snake	*Heterodon simus*	FSC	Pender, Duplin
Spring-flowering goldenrod	*Solidago verna*	FSC	Pender
*****Thin-wall quillwort	*Isoetes microvela*	FSC	Pender
Thorne's beakrush	*Rhynchospora thornei*	FSC	Pender
Venus fly-trap	*Dionaea muscipula*	FSC	Pender, Duplin
Venus flytrap cutworm	*Hemipachnobia subporphyrea*	FSC	Pender

Notes:
BGPA = Bald and Golden Eagle Protection Act
C = Candidate
E = Endangered
FSC = Federal Species of Concern
T = Threatened
**This species was listed with a Federal Status in the NCNHP letter, but not listed by USFWS.*
Source: Pender County: USFWS, 2015 (Last updated 3-25-2015); Duplin County: USFWS, 2010 (Last updated 9-22-2010)

4.5 Aquatic Resources

4.5.1 Common Species and Natural Habitats

Water resources within the Study Area provide aquatic habitat for various species of fish, freshwater mussels, and other aquatic organisms. The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are included in the Study Area, and are located just above Lock and Dam 1 (L&D #1) on the Cape Fear River. Downstream of L&D #1 the river becomes tidally influenced. A fish passage structure at L&D #1 provides a means for anadromous fish to migrate up the river during spawning season. Species that commonly use the fish ladder in their migration include Shortnose sturgeon (*Acipenser brevirostrum*), American shad (*Alosa sapidissima*), and Striped bass (*Morone saxatilis*), all of which spawn in late winter and spring, estimated to have peak spawning from February through June (NCDEQ, 2015a). The Atlantic sturgeon (*Acipenser oxyrinchus*), a federally listed endangered species, may also use this fish ladder. Managed under a fishery management plan implemented by the Atlantic States Marine Fisheries Commission, critical habitat for this species has been proposed.

The proposed rivers include the Cape Fear River and the Northeast Cape Fear River within Pender and Duplin Counties (USFWS, 2016).

Managed Areas (MAREA) are properties and easements where natural resource conservation is one of the primary management goals of the NCNHP. The Watha Fish Hatchery is a MAREA located within the Study Area (NCNHP, 2015). It is a warmwater hatchery used to produce channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropeterus salmoies*), striped bass (*Morone saxatilis*), Bodie bass (*Morone saxatillis x Morone chrysops*), bluegill sunfish (*Lepomis macrochirus*), redear sunfish (Lepomis microlophus), redbreast sunfish (*Lepomis auritus*), hybrid sunfish (*Lepomis spp.*), and American shad (*Alosa sapidissima)* for stocking public waters across North Carolina (NCWRC, 2016).

4.5.2 Federally Listed Threatened and Endangered Species

Information obtained from the USFWS list of Endangered and Threatened Species and Species of Concern within the Study Area counties was analyzed to identify protected aquatic species with the potential to be present within the Study Area. Exhibit 4-12 below presents the list of federally listed aquatic species with current (not historical) records within the Study Area.

Eight aquatic wildlife species are federally listed in the Study Area; of these, two species are listed as endangered, two are listed as threatened, and one is listed as threatened due to similarity of appearance. Three additional species are listed as federal species of concern (FSC) (USFWS, 2015; USFWS, 2010).

EXHIBIT 4-12
Federally Listed Aquatic Wildlife and Plant Species Potentially Occurring Within the Study Area

Common Name	Scientific Name	Federal Status	County
American Alligator	*Alligator mississippiensis*	T(S/A)	Pender, Duplin
American eel	*Anguilla rostrata*	FSC	Pender, Duplin
Atlantic pigtoe	*Fusconaia masoni*	FSC	Pender
Green Seaturtle	*Chelonia mydas*	T	Pender
Leatherback sea turtle	*Dermochelys coriacea*	E	Pender
Loggerhead Seaturtle	*Caretta caretta*	T	Pender
West Indian Manatee	*Trichechus manatus*	E	Pender
Yellow lampmussel	*Lampsilis Cariosa*	FSC	Pender

Notes:
E = Endangered
FSC = Federal Species of Concern
T = Threatened
S/A = Listed because of similarity of appearance
Source: Pender County: USFWS, 2015 (updated 3-25-15); Duplin County: USFWS, 2010 (updated 9-22-10)

Only one Aquatic Habitat is listed in the National Heritage Natural Areas in the Study Area, the CPF/Black River Aquatic Habitat which covers approximately 209 acres and is located along the Black River along the Western boundary of Pender County. Some of the species that this habitat supports include the cape fear spike (*Elliptio marsupiobesa*), eastern creekshell (*Villosa delumbis*), Atlantic pigtoe (*Fusconaia masoni)*, eastern lampmussel (*Lampsilis radiata*), and yellow lampmussel (*Lampsilis Cariosa)*, among others (NCNHP, 2015).

4.6 Land Use and Land Cover

The primary source for land cover information covering the entire Study Area is the 2006 National Land Cover Database (NLCD) (USGS, 2011). The satellite-based dataset was developed through efforts of a consortium of federal and state agencies to provide detailed land cover information. Data are provided as a 30-meter grid of land cover characterized into more than a dozen developed and undeveloped cover categories. Exhibit 4-13 provides a tabular summary of land cover within the Study Area and statistics on the acreage and percentage of land area for each land cover category within the Study Area. Exhibit 4-14 provides an illustration of the distribution of land cover across the Study Area. The largest single land cover is woody wetland, covering approximately 42 percent of the Study Area. While some development has occurred since this land cover information was developed, it remains an accurate representation of the Study Area's land cover.

EXHIBIT 4-13
Study Area Land Cover

Land Cover Category	Area (Acres)	Percentage
Open Water	14,521	2.54%
Urban - Low Intensity Residential	6,647	1.16%
Urban - High Intensity Residential	196	0.03%
Urban - Commercial	2,403	0.42%
Barren - Rock, Sand	731	0.13%
Barren - Quarries	1,283	0.22%
Deciduous Forest	3,384	0.59%
Evergreen Forest	167,269	29.25%
Mixed Forest	13,676	2.39%
Shrubland	155	0.03%
Agriculture - Hay, Pasture	20,814	3.64%
Agriculture - Row Crops	92,238	16.13%
Woody Wetland	242,293	42.37%
Herbaceous Wetland	6,255	1.09%

Source: USGS, 2011

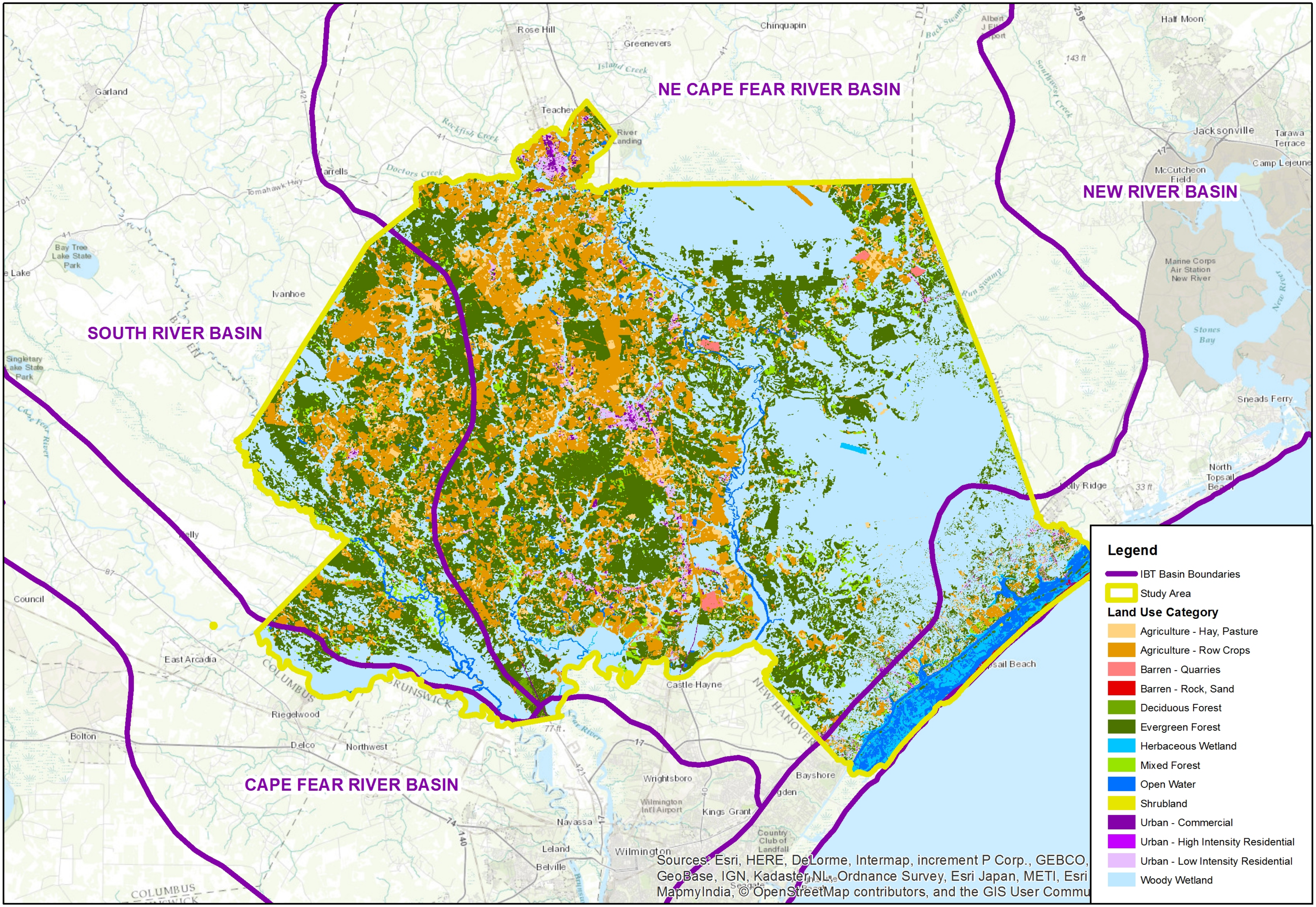

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Exhibit 4-14
Land Cover
Environmental Assessment
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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4.7 Agricultural Land and Prime or Unique Farmland

North Carolina Executive Order (EO) 96 charges all state agencies to minimize the loss of prime agricultural and forested lands as defined in the Federal Farmland Protection Policy Act. The USDA Natural Resources Conservation Service (NRCS) has classified lands into three categories based on suitability for agricultural uses: prime farmlands, unique farmlands, and farmland of statewide importance (USDA, 1998).

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture. Prime farmland is of major importance for meeting the nation's short and long range needs for food and fiber with minimal input of energy and economic resources and the least damage to other environmental resources. Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary of Agriculture. Farmland, other than prime of unique farmland, is land that is of statewide or local importance for the production of food feed, fiber, forage, or oilseed crops (USDA, 1981).

The total acreage of these soils in the Study Area is 445,874 acres. According to the Pender County Soil Survey the following soils are identified as prime farmland: Rains fine sandy loam, Goldsboro fine sandy loam, Woodington fine sandy loam, Liddell silt loam, Torhunta mucky fine sandy loam, Foreston loamy fine sand, Norfolk loamy fine sand, Exum loam, Exum-Urban land*, Grantham loam, Grifton loamy fine sand, Norfolk loamy fine sand, Pantego mucky fine sandy loam, Lumbee fine sandy loam, Aycock loam*, Johns fine sandy loam, Onslow loamy fine sand, Altavista fine sandy loam, Invershiel-Pender complex, and Kalmia loamy fine sand. In Wallace 2,660 acres of Noboco loamy find sand was classified as prime farmland (USDA, 2016).

The soils identified in the Pender County Soil Survey as unique farmland are Murville muck, Leon fine sand. The total acreage of these soils in the Study Area is 91,689 acres. No unique farmland is identified in Wallace. (USDA, 2016).

The soils identified in the Pender County Soil Survey as farmland are Autryville fine sand, Baymeade fine sand, Marvyn and Craven soils, Kenansville fine sand, and Meggett loam. The total acreage of these soils in Pender County is 37,207 acres. In addition, 25 acres of Marvyn and Gritney soils and 34 acres of Rumford loamy find sand were identified as farmland in Wallace (USDA, 2016).

4.8 Forested Resources

Much of the original forest community in the Study Area remains intact through preservation in Game Lands, forestry land uses, and lack of development in certain areas. These forested lands consist of a combination of woody wetlands, deciduous forest, evergreen forests, and mixed forests. Currently, approximately 77.5 percent (426,621 acres) of the Study Area is considered forested land cover (USGS, 2011).

The North Carolina Gap Analysis Program (GAP) describes forested resources within the Study Area. NC GAP is based on land cover data not land use data, which are limited by parcel boundaries. These data provide a better understanding of the types of forest resources present within the Study Area (USGS, 2006). The most dominant forest types within the Study Area are listed in Exhibit 4-15.

EXHIBIT 4-15
Study Area Forest Types

Type	Description	Area (Acres)
Pocosin Woodlands and Shrubland	Includes pond pine woodland, low pocosin and high pocosin shrub dominated areas. Canebrakes and bay forests may be present.	133,550
Coniferous Cultivated Plantation	Managed pine plantations, densely planted. Most planted stands are loblolly, but slash and longleaf occur as well.	100,262
Coniferous Regeneration	Regenerating pine stands. Predominantly loblolly pine, but slash and longleaf stands occur as well.	31,799
Coastal Plain Mixed Bottomland	Includes forests dominated by a variety of hardwood species, including sweetgum, cottonwood, red maple.	22,769
Coastal Plain Oak Bottomland	Bottomland forests dominated by deciduous oak alliances. Oaks represented can include swamp chestnut, cherrybark, willow, and/or overcup oak. Inclusions of loblolly pine temporarily flooded forests occur in patches. Hydrology includes temporary to seasonal flooding.	22,113
Xeric Longleaf Pine	Sandhills including a range of longleaf pine density from predominantly wiregrass, scrub oak dominated to true longleaf pine woodland. This does not include mesic or saturated flatwood types.	20,345
Cypress-Gum Floodplain	Swamps dominated by black or swamp tupelo with or without Taxodium. Seasonally to semi-permanently flooded hydrology.	20,157
Coastal Plain Nonriverine Wet Flat	Loblolly pine - Atlantic white-cedar - red maple - swamp tupelo saturated forests as well as forests dominated by loblolly, sweetgum, and red maple in non-riverine flats.	16,441
Wet Longleaf or Slash Pine Savannas	Wet flatwoods and pine savannas, typically dominated by longleaf pines, but slash or pond pines may be the dominant pines.	14,423
Mesic Longleaf Pine	Longleaf pine woodlands without a major scrub oak component. Slash or loblolly pines may be present as well.	14,262
Coastal Plain Mixed Successional Forest	Generally loblolly mixed with successional hardwoods. Sweetgum, tulip poplar and red maple are common co-dominants in these successional forests.	9,604
Tidal Swamp	Swamp tupelo dominated forest with or without black tupelo and/or cypress trees. Restricted to the tidal zones in the coastal plain. May have inclusions of coastal red cedar woodlands.	4,316
Dry Mesic Oak Pine	Mixed forests of the coastal plain and piedmont. Includes loblolly pine with white, southern red and/or post oak and loblolly with water oak.	4,072
Successional Deciduous	Regenerating deciduous trees with a shrub stature. Commonly dominated by sweetgum, tulip poplars and maples.	2,490
Peatland Atlantic White Cedar	Dense stands of Atlantic white cedar with saturated hydrology. Can include swamp tupelo, red maple, and pond pines with a moderate shrub and herb layer.	1,301
Maritime Forest and Hammock	Maritime forests and woodlands dominated by live or sand laurel oak. Estuarine Fringe forests dominated by loblolly pine.	600
Coastal Plain Dry to Dry-Mesic Oak	Oak dominated forests of the coastal plain. Includes white oak forests with water oak or northern red oak and hickories as co-dominants.	513
Coastal Plain Mesic Hardwood	Beech dominated forests with white oak and northern red oak as possible co-dominants. Dry-mesic to mesic forests on slopes and small stream bottoms in the coastal plain.	382
Pond Cypress- Gum Swamps, Savannas, and Lakeshores	Cypress dominated swamps and lakeshores. Can include bays dominated by pond cypress or shorelines of coastal plain lakes with a narrow band of cypress.	89

Source: USGS, 2006

In the Study Area, large tracts of forest are utilized for continued silviculture use. About 24 percent (100,262 acres) of the Study Area are classified as Coniferous Cultivated Plantation, where conifers trees are cultivated for timber and other resources. However, about 32 percent (133,550 acres) of the forested lands in the Study Area are preserved. These areas, mainly Pocosin Woodlands and Scrublands, are located in the Angola Bay and Holly Shelter Game Lands (USGS, 2006).

4.9 Public Lands and Scenic and Natural Areas

This section includes discussion of public or conservation lands, federal, State and local parks, and other scenic and recreational areas including recreation areas, greenways, and game lands. Open spaces provide scenic and recreational opportunities for residents. These public lands, generally held in perpetuity, cannot typically be redeveloped. Within the Study Area, state Game Lands, parks, trails and greenways, and multiple beach and waterfront access points to the Atlantic, including two regional beach accesses near Surf City, are present (NCDCM, 2016b).

Game lands within the Study Area were identified by using the North Carolina Wildlife Resources Commission (NCWRC) GIS coverage (NCWRC, 2013). Game lands provide the public with recreational opportunities including hunting, in addition that include natural communities that support a variety of wildlife. The game lands within the Study Area are listed in Exhibit 4-16. Exhibit 4-17 is a map of the game lands within the Study Area.

EXHIBIT 4-16
Study Area Game Lands

Game Land	Acres within Study Area	Total Acres
Angola Bay	26,313	33,108
Cape Fear River Wetlands	6,326	7,266
Holly Shelter	63,494	63,494

Source: NCWRC, 2013

Natural Heritage Natural Areas (NHNA) includes those spaces within public lands or private conservation lands held by non-profit organizations. These areas are home to rare plant or animal species, high-quality natural communities, and/or geologic features and may provide scenic and recreational value to the community. The NCNHP compiles the list of NHNAs, as required by the Nature Preserve Act (GS Chapter 113-A-164 of Article 9A). The sites included in the list are the best representatives of the natural diversity of North Carolina and, therefore, have priority for protection. Inclusion in the list does not imply that any protection or public access exists. The NHNAs within the Study Area are listed in Exhibit 4-18.

EXHIBIT 4-18
Study Area Natural Heritage Natural Areas

NHNA	Acres within Study Area	NHNA Total Acres
421 Sand Ridge	5,318	7,423
Angola Bay	29,105	35,784
Angola Creek Flatwoods	254	254
B.W. Wells Savanna	121	121
Bear Garden	3,928	3,928
Big Colly Swamp	505	9,499
Black River Cypress Swamp	1,360	2,582
Blake Savanna	108	109
Bryant Mill (Greenbank) Bluff	2	382
Canetuck Loop Road Sandhills	402	402
Clarks Landing Coastal Goldenrod Site	677	677
Colvin's Bay	2,224	2,311
Colvin's Creek Sand Ridge Mesic Slopes	59	59
Cones Folly	2,929	2,929
CPF/Black River Aquatic Habitat	210	387
Futch and Foy Creeks Natural Area	61	157
Holly Shelter Game Land	48,552	48,552
Lea-Hutaff Island	4,851	5,056
Lower Black River Swamp	10,342	10,466
Maple Hill School Road Savanna	34	34
McLean Savanna	904	904
Moore's Creek Floodplain	162	162
Moore's Creek National Battlefield	38	38
Neils Eddy Landing	<1	138
Northeast Cape Fear River Floodplain	16,645	25,471
Parker's Savanna	19	19
Rocky Point Marl Forest	653	653
Rocky Point Sandhills	218	218
Sandy Run Swamp and Savannas	788	1,739
Shaken Creek Savannas	1,262	1,262
Shaky Bay Sandhills	294	397
Shelter Swamp Creek Flatwoods	2,668	2,668
Sidbury Road Savanna	2	181
The Neck Savanna	393	393
Topsail Sound Maritime Forests	2,179	2,179
Upper Black River Bottomlands	29	5,365
Watkins Savanna	265	265
Webbtown Road Savanna	20	20
Northeast Creek/Panther Creek Dikes and	499	499
Parkers Creek Ridges	227	227
TOTAL	**138,883**	**174,489**

Source: NCNHP, 2015

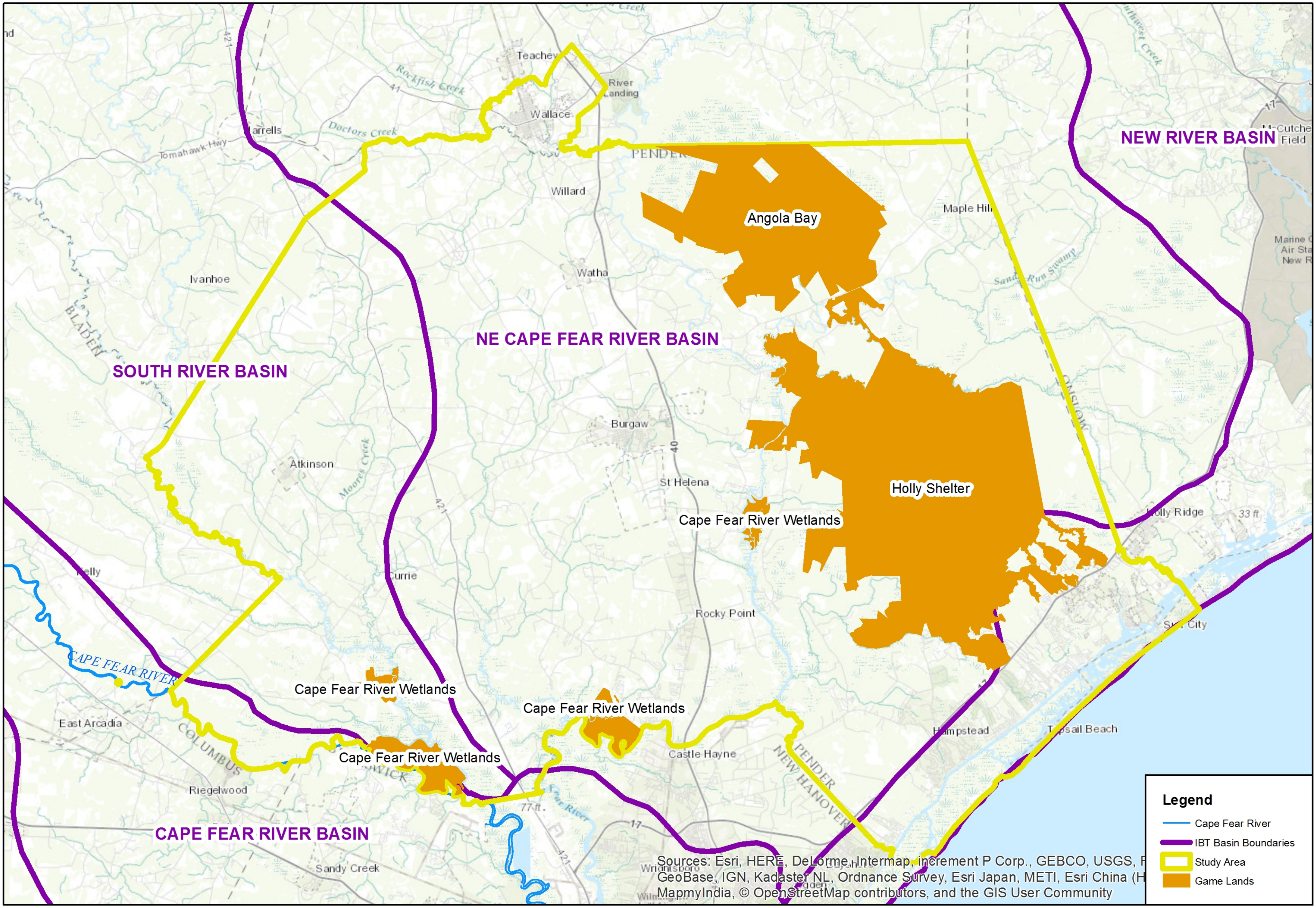

Exhibit 4-17
Game Lands
Environmental Assessment
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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Angola Bay and Holly Shelter Game Lands are recognized both here and in Exhibit 4-16 for game lands above. However, the acreages are different as the areas are defined differently for each data purpose.

Dedicated Nature Preserves (DNP) are ecologically important natural areas in which an estate, interest, or right in the natural areas has been transferred to the State of North Carolina in any manner authorized in G.S. 113A-164.6. The intention of the dedication is to protect and preserve the biodiversity and natural character of the natural area. The following DNPs are located within the Study Area: Angola Bay Game Land, Angola Creek Flatwoods Preserve, Cape Fear River Wetlands Game Land, Holly Shelter Game Land, and Sandy Run Savannas State Natural Area (NCNHP, 2015). MAREA are properties and easements where natural resource conservation is one of the primary management goals of the NCNHP. The Haws Run Conservation Site is a MAREA located within the Study Area (NCNHP, 2015).

4.10 Areas of Archaeological and Historic Value

Archaeological sites are important because they contain the only material remains of Native American cultures dating back 12,000 years throughout North Carolina. The Cape Fear River basin contains many archeological sites that have been surveyed. Several of these sites have significant archeological resources from many native groups that lived in the region up until 200 years ago. More than 7,000 recorded archaeological sites are located within the Cape Fear River basin, over 300 of which are located in Pender County (North Carolina Department of Cultural Resources, 1999).

A 1997 survey, *Historic and Architectural Resources of Pender County* contains details about how the community has changed since the 18th century. This document highlights inhabitants that made significant cultural, economic, and regional impacts. Pender County has been home to a generational farming culture that endured from the early 1720s through the Civil War, to the end of World War II and beyond. During these time periods the area saw growth marked by agricultural production, railroad construction, and eventually some suburban expansion including highways and industrial development. Recent growth and development in the late 20th century has marked Pender County as one of the fastest growing counties in the State (Turberg, 1997).

Because of the size of the Study Area and because no construction will occur with the proposed project, preparation of an archeological survey was not completed.

The U.S. Environmental Protection Agency (USEPA) requires the conservation and protection of the state's natural resources and preservation of "the important historic and cultural elements of our common inheritance." The National Register of Historic Places (NRHP) is the formal repository of information pertaining to historic structures and districts. Places considered for listing include historic structures and districts, cemeteries, and archaeological sites. The Study Area contains 17 listings (USNPS, 2015). Exhibit 4-19 lists the historic places within the Study Area.

EXHIBIT 4-19
Historic Places

Study Area
Bannerman House
Belvidere Plantation House
Burgaw Depot
Burgaw Historic District

EXHIBIT 4-19
Historic Places

Study Area
Governor Samuel Ash Grave
Isaac M. Powers House
Moore’s Creek National Battlefield
Moore’s Creek National Military Park
Panderlea Homesteads Historic District
Pender County Courthouse
Poplar Grove
Sloop Point
US Naval Ordnance Testing Facility Assembly Building
US Naval Ordnance Testing Facility Control Tower
US Naval Ordnance Testing Facility Observation Tower Number 2
Wallace Commercial Historic District
W. Stokes Boney House

Source: USNPS, 2015

4.11 Air Quality

The USEPA uses the Air Quality Index (AQI) to report ambient air quality conditions. The AQI includes these classifications: good, moderate, unhealthy for sensitive groups, unhealthy, and hazardous. In 2015, the AQI in New Hanover County, the closest available data, recorded an AQI as “good” for 332 of 360 AQI days, while the remaining 28 days recorded an AQI as “moderate” (USEPA, 2015a). While this is not the Study Area, it is considered representative of good air quality conditions in the coastal counties.

Pender County is an attainment area for the six criteria pollutants listed in the Clean Air Act (CAA). This means that the air concentrations for ozone, particulate matter, sulfur dioxide, lead, carbon monoxide, and nitrogen dioxide are less than the limits set by the CAA standards (USEPA, 2015b).

4.12 Noise Levels

Existing sources of noise within the Study Area include traffic along the adjacent roadways, including Interstate 40, US Highway 421, and US Highway 17. Other ambient day-to-day noise conditions include those associated with agriculture and silviculture practices and those representative of the typical residential and commercial uses.

Noise levels are highest along traffic corridors, with lower noise levels in residential areas. Seasonal use of beaches, such as Topsail Beach and Surf City, for recreational purposes contributes to increased noise during the warm months. Lesser contributors to noise include industrial and agricultural activities. Undeveloped rural and conservation land is naturally devoid of significant human noises.

Sound is measured in decibels, a logarithmic scale; the measure of decibels on an A-weighted scale (dBA) is used to characterize sound levels sensed by the human ear. The auditory threshold is 0 dBA; a deafening sound is about 120 dBA. Typical daytime suburban noise levels, which would reasonably apply to the residential and commercial portions of the Study Area, are about 55 dBA. Noises associated with vehicular traffic and localized noises associated with flight patterns often exceed suburban noise levels. Noise in rural areas is typically less than 50 dBA unless the area is close to roads or railroads.

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SECTION 5

5 Environmental Effects

This section describes the predicted environmental effects of the proposed increase in IBT from the Cape Fear River basin to the South River, Northeast Cape Fear River, and New River basins. The discussion provided in this section reflects an analysis of the potential for the expansion of the PCU municipal water service area to affect specific resources within the Study Area. Discussion of the potential for direct impacts to resources is discussed first, followed by a discussion of the potential for secondary and cumulative impacts (SCI) resulting from the continued development within Pender County and the co-applicant communities.

For the Study Area, the direct and SCI environmental effects, if any, are described for the resources discussed in Section 4. The discussion in this section focuses on the evaluation of direct effects on water resources, topography, aquatic resources, and other resources in the Study Area as a result of the proposed increase in IBT. Continued development within Pender County and the co-applicant communities leads to a continued need for water supply; PCU intends to meet this demand from its surface water source, the Cape Fear River while its co-applicants intend to supplement their groundwater sources with surface water as needs arise. This discussion includes a comparison of the potential impacts against the no action alternative, which does not include an increase in IBT. Under both the no action alternative and the preferred alternative, it is expected that water demands would be met through individual or small community private groundwater wells and individual septic systems or small package WWTPs. Advantages to a centralized and orderly approach to providing water utilities are discussed herein.

Important SCI definitions include the following:

- *Cumulative effects* are defined as "resulting from the incremental impact of the proposed activity when added to other past, present, and reasonably foreseeable future activities regardless of what entities undertake such other activities" (15A NCAC 1C .0101(d)(2)).
- *Indirect effects*, or secondary effects, are "caused by and result from the proposed activity although they are later in time or further removed in distance, but they are still reasonably foreseeable" (15A NCAC 1C .0101(d)(4)).

The data were gathered through literature reviews, internet searches, GIS queries, phone conversations, letters, and meetings with NCDWR.

Section 6 includes a comprehensive description of mitigation programs to avoid or minimize SCI to environmental resources that could occur with the continued development in the Study Area and provision of water utilities by PCU and the co-applicants.

5.1 Direct Impacts

This EA concludes that the direct effects of the proposed increase in IBT on the Study Area would be insignificant. As discussed in this section, the proposed IBT certificate will not significantly change Cape Fear River elevations above and below L&D #1, downstream flows, or water quality. Based on the hydrologic modeling completed, there is a small shift in river flows between the 2045 Requested IBT scenario and the 2045 Baseline scenario. During drought periods, the reduction of flow will be mitigated by the implementation of State required WSRPs. During the anadromous fish spawning periods there are passing flows at L&D #1 during the lowest flow conditions in the spawning period. Details of the application of this model and the results of analyses of the scenarios are included in the *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County*

Interbasin Transfer (CH2M, 2016) included in Appendix F. No significant direct effects to environmental resources are expected as a result of the water transfer.

No construction is directly associated with this requested IBT approval; any construction activity associated with facilitating the transfer of water in the future may require its own environmental review process, depending on characteristics of the project. With that, there is little potential for direct effects on land-based resources, and those effects would be addressed in environmental documents for construction of the specific facilities and infrastructure.

Previous, related projects include the LCFWASA intake and associated Kings Bluff Raw Water Pumping Station located just above L&D #1, as well as the LCFWASA 60-inch transmission main which transmits raw water to PCU's WTP. An EA was completed and FONSI received for both projects, addressing associated impacts. These FONSIs are included in Appendix B.

5.1.1 Water Resources

5.1.1.1 Surface Water

The primary potential impact associated with IBT in a river system is typically water flow changes resulting from the transfer of surface water. To evaluate the potential for water flow effects within the Study Area resulting from the IBT, the primary tool used was the combined Cape Fear–Neuse River Basin Hydrologic Model (CFNRBHM). NCDWR originally developed individual hydrologic models for the Cape Fear and Neuse River basins. In 2012, a combined model was created to facilitate analysis of the numerous interconnections between the two basins. The resulting model was developed using the OASIS water resources program which combines graphic representations of components such as river sections, demands, and withdrawals, with logical statements that describe the components' behavior. These statements, including operational rules, demands, and elevation–storage relationships are evaluated within a linear programming environment to determine the state of each component within the system (HydroLogics, 2006).

The revised base CFNRBHM was completed in January 2014 and includes all withdrawals and discharges in both river basins greater than 100,000 GPD (0.1 MGD). NCDWR modified the base model by incorporating future demands to create several future scenarios. Estimates of existing demands and discharges as well as projections to the year 2045 were developed by NCDWR by using LWSPs, which is information provided directly from public water supplies. The 2010 and 2045 OASIS model scenarios were obtained from NCDWR to evaluate the hydrologic effects of the proposed IBT on water resources. NCDWR typically develops OASIS model scenarios in 5-year increments.

In North Carolina, units of local government that provide public water service and large community water systems shall develop and implement a Water Shortage Response Plan (WSRP) to require the reduction of water use during drought conditions. The WSRPs must include an expected reduction in demand resulting from water restrictions which are implemented based on a set of triggers. WSRPs for public water suppliers in the Cape Fear River and Neuse River basins were incorporated into the CFNRBHM model during the model development when the triggers are based on physical conditions tracked by the model such as stream flow or reservoir level. Many WSRPs for public water suppliers in the Cape Fear and Neuse River basins are not tied to physical triggers and therefore cannot be explicitly represented in the model. This includes all water withdrawals downstream of Jordan Lake on the Cape Fear River, and therefore, the modeling results are a conservative representation of the effects during drought conditions without the beneficial impact of the implementation of the State required WSRPs on flow at L&D #1.

In addition, Pender County is currently constructing a 0.5 MGD WWTP to serve the US 421 corridor in southwestern Pender County. When the US 421 WWTP comes online in approximately 2017, the

County will begin returning additional wastewater to the source basin. This WWTP has an NDPES permit to discharge up to 4 MGD to the Cape Fear River downstream of L&D #1. While not yet online, the future discharge will increase with time in direct correlation to increasing water demands. This discharge will be a return to the Cape Fear River basin and is not captured in the CFNRBHM because the model's most downstream node is at L&D #1.

Additional model background, further details regarding the structure of the CFNRBHM, and the model scenarios are discussed further in the *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer*, included in Appendix F. The remainder of this section summarizes that evaluation.

The following four CFNRBHM scenarios were developed to establish baseline scenarios for the years 2010 and 2045, and to allow evaluation of the potential relative effects of the proposed IBT and alternatives:

- 2010 Baseline – represents 2010 conditions as defined by NCDWR.
    - The objective of the 2010 baseline scenario is to provide a basis of comparison to identify changes in river flow that results from increased future withdrawals and discharges throughout the Cape Fear River basin, from a historical point in time.
- 2045 Baseline – represents Alternative 1 (no action) and Alternatives 3 through 6 (avoid an increase in IBT).
    - The 2045 Baseline scenario is intended to approximate 2045 conditions in the Cape Fear and Neuse River basin without Pender County's proposed increase in IBT. The objective of this model scenario is to represent EA alternatives where the Pender County demand (total or net) does not increase above 2 MGD. This objective could be simulated by either constraining the water supply withdrawn from the Cape Fear River, returning wastewater to the river or by finding alternative sources of water supply. This model scenario is a modified version of the final CFNRBHM 2045 scenario (Demand2045), and represents Pender County demands from the Cape Fear River remaining below 2 MGD.
- 2045 Requested IBT – represents Alternative 2 (proposed IBT).
    - The 2045 Requested IBT scenario represents 2045 conditions for Pender County and the Cape Fear and Neuse River basin, with withdrawals and discharges as projected by public water suppliers, and the County demands that would result in the proposed increase in IBT.
- 2045 Maximum Withdrawal
    - An additional scenario was developed to provide a conservative analysis and ultimately test the sensitivity of the model results to the potential changes which would be seen in the assessment metrics if the maximum allowable withdrawal were to occur at L&D #1 and the Jordan Lake water supply pool was 100 percent allocated. The maximum allowable withdrawal, based on current DWR planning guidance for run-of-the-river water supplies, of 106.6 MGD is based on the withdrawal volume from the Cape Fear River behind L&D #1 as reported in the LCFWASA's Kings Bluff Raw Water Pump Station 60-Inch Parallel Raw Water Intake Pipe and Screen Project Environmental Assessment (McKim and Creed, 2008a) and the Brunswick County IBT Certificate Hearing Officers Report (NCDENR, 2013).

River flow statistics reviewed, for all scenarios, included average and median flows, which are representative of average climatic conditions, and 10th and 5th percentile flows, which are representative of low flow periods. These percentiles were selected to reflect typical low flow statistics including the use of the 10th percentile by USGS as an indicator for flows that are "much below normal" and the use of the 5th and 10th percentile by the Drought Management Council (DMAC) to define the start of "severe" and "extreme" droughts, respectively. Note that no modeling is intended for the receiving basin(s), as the CFNRBHM does not cover these basins, and there are no planned direct discharges beyond the current permitted discharge capacity in the receiving basins.

5.1.1.1.1 Flow Above L&D #1

Flow to L&D #1 is not expected to be affected by the proposed increase in IBT since the intake is at L&D #1, and this assessment point (model node) is above the LCFWASA and CFPUA withdrawal locations. River flow and low flow frequency at this point were analyzed to provide an estimate of water availability for the withdrawals at L&D #1, and simulated changes in river flow are more indicative of what is occurring upstream in the Cape Fear River basin.

As shown in Exhibit 5-1, below, the largest difference in average, median, 10th percentile, and 5th percentile flows is between the different time periods (2010 vs. 2045) due to the increased future withdrawals within the Cape Fear River basin. The decreases in flow from the 2045 Baseline scenario to the 2045 Maximum Withdrawal scenario are primarily attributed to the 100 percent utilization of the Jordan Lake water supply pool.

The increased flow identified in Exhibit 5-1 for the 10th and 5th percentile flows could potentially be attributed to two factors: (1) model "noise" (based on the algorithm in the model that allocates flows within model) or (2) increased returns to the basin downstream of Jordan Lake. These returns are associated with the full utilization of the water supply pool and assumed returns downstream of the Jordan Lake for the volume of water between the 2045 allocation (2045 Baseline) and 100 percent use of the water supply pool. The first factor is a characteristic of any complex system model, which is especially pronounced when reviewing the extremes of a data set. The second factor is linked to the only change in the model at this evaluation point for the 2045 Maximum Withdrawal scenario, full utilization of the Jordan Lake water supply pool.

EXHIBIT 5-1
Model Scenario Comparison - Cape Fear River Statistics Above L&D #1

Scenario	**Average**	**Median**	**10th Percentile**	**5th Percentile**
2010 Baseline - River Flow (CFS)	5,355	3,114	917	767
2045 Baseline - River Flow (CFS)	5,289	3,050	904	748
2045 Requested IBT - River Flow (CFS)	5,289	3,050	904	748
Difference from 2045 Baseline (CFS)	0	0	0	0
Difference from 2045 Baseline (percent)	0.0%	0.0%	0.0%	0.0%
2045 Maximum Withdrawal- River Flow (CFS)	5,261	3,036	907	757
Difference from 2045 Baseline (CFS)	-28	-14	+3	+9
Difference from 2045 Baseline (percent)	-0.5%	-0.5%	+0.3%	+1.2%

CFS = cubic feet per second

5.1.1.1.2 Flow Below L&D #1

Appendix F includes a comprehensive summary of the magnitude, duration, and frequency of monthly flow and stage statistics below L&D #1 as a result of the proposed increase in IBT, as developed from the hydrologic modeling evaluation. These results were used for a comparative analysis of the alternatives based on the scenarios defined above. The review of these metrics is valuable to capture not only the potential for low flows to occur with the proposed increase in IBT, but to also capture changes in the length of period of these low flows (duration) and the potential for reoccurrence of low flow events (frequency). River stage and timing are also important metrics, most specifically as they relate to the flow over L&D #1 and the functionality of its fish ladder, as discussed in Section 5.1.3.1.

During periods of extreme low flow, each of the 2045 scenarios exhibit a reduction in flow below L&D #1 compared to the 2010 Baseline scenario, as would be expected; the greatest cumulative changes during these periods can be attributed to increased withdrawals upstream of L&D #1. The comparison of the 2045 Baseline and 2045 Requested IBT scenarios in Figure 14 of Appendix F shows little difference between the two scenarios in relation to the magnitude, duration and frequency of river flow and stage elevations. The magnitude of predicted flow changes is provided in Exhibit 5-2. For the 2045 time period, average flows decrease less than 0.5 percent whereas the 10th and 5th percentiles flows decrease 2.5 and 3.5 percent, respectively. Even with a 3.5 percent reduction in the 5th percentile flow for the period of record (95 percent of flows during this period are greater) there is still 585 cfs (378 MGD) of flow passing at L&D #1. Similar results were observed for the 2045 Maximum Withdrawal scenario; less than 2.0 percent change on average and a 11.6 percent change for low flow periods, as indicated by the 5th percentile flows.

EXHIBIT 5-2
Model Scenario Comparison - Cape Fear River Statistics Below L&D #1

Scenario	Average	Median	10th Percentile	5th Percentile
2010 Baseline - River Flow (CFS)	5,297	3,055	858	649
2045 Baseline - River Flow (CFS)	5,214	2,971	825	606
2045 Requested IBT - River Flow (CFS)	5,196	2,953	805	585
Difference from 2045 Baseline (CFS)	-19	-18	-20	-21
Difference from 2045 Baseline (percent)	-0.4%	-0.6%	-2.5%	-3.5%
2045 Maximum Withdrawal - River Flow (CFS)	5,112	2,881	747	538
Difference from 2045 Baseline (CFS)	-103	-90	-78	-68
Difference from 2045 Baseline (percent)	-2.0%	-3.0%	-9.7%	-11.6%

As detailed in Appendix F, the largest modeled change in flow duration resulting from the proposed IBT is an additional four days in January (non-spawning month) with the flow potentially less than 1,000 cfs. The model results also predict a potential increase of 5 days in December for a river stage between 11.0 and 11.5 feet above MSL (dam crest is 11.0 feet above MSL). The model shows these potential additional low flow/lower stage days occurring in non-spawning months, with the predicted stage always above the dam crest elevation, and the maximum duration is five days out of 365.

The effect below L&D #1 from Pender County's IBT, as well as other public water supplies accessing water from the Cape Fear River, during drought periods will be mitigated by the implementation of the State-required WSRPs. WSRPs for public users downstream of Jordan Lake are required to be as stringent as others in the basin, as required by 15A NCAC 02E .0600. Per the NCAC, industrial users shall be "consistent with industry water efficiency and drought response guidelines"; in addition, agricultural users shall "reduce water usage to the maximum extent possible." All WSRPs are reviewed and approved by the State. The language within the rule states that during exceptional drought designation "water users shall reduce water use by at least 20% below the amount used in the month prior." As stated previously, the WSRPs for public water supplies downstream of Jordan Lake are not built into the CFNRBHM. Based on the 20% reduction target in the NCAC, the reduction in water withdrawal for those withdrawals downstream of Jordan Lake could be approximately 43 - 52 MGD (66 - 80 CFS) depending on the time of year of the drought occurrence. This estimate includes reductions for Pender County and all withdrawals at L&D #1. Therefore, the results of hydrologic modeling represent a conservative evaluation of flows during drought conditions.

A flow-duration plot for the Cape Fear River flows below L&D #1 is provided in Exhibit 5-3. This plot shows the percent of time that river flow is below a specified flow rate. A plot focusing on the lowest 10 percent of lowest flows for the period of record (1930-2011) is provided in Exhibit 5-4. Exhibit 5-5 presents the time series plot for the 2007 drought period. Exhibit 5-6 presents a low flow comparison of the 2045 scenarios to the 2010 Baseline scenario for the 2007 drought. Appendix F contain plots that provide the same data presented in Exhibit 5-5 and 5-6 for the other two droughts or record (1950's and 2002 drought periods).

EXHIBIT 5-3
Period of Record Flow Duration Comparison below L&D #1

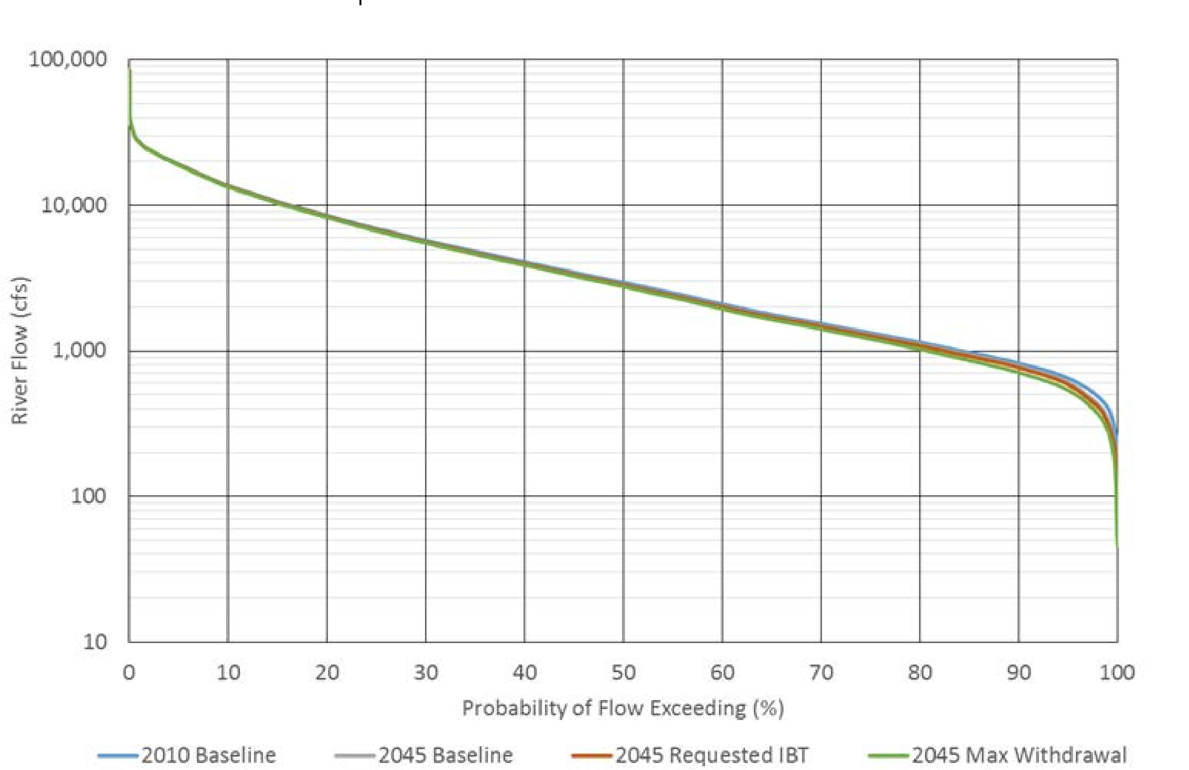


EXHIBIT 5-4
Low Flow Duration Comparison below L&D #1

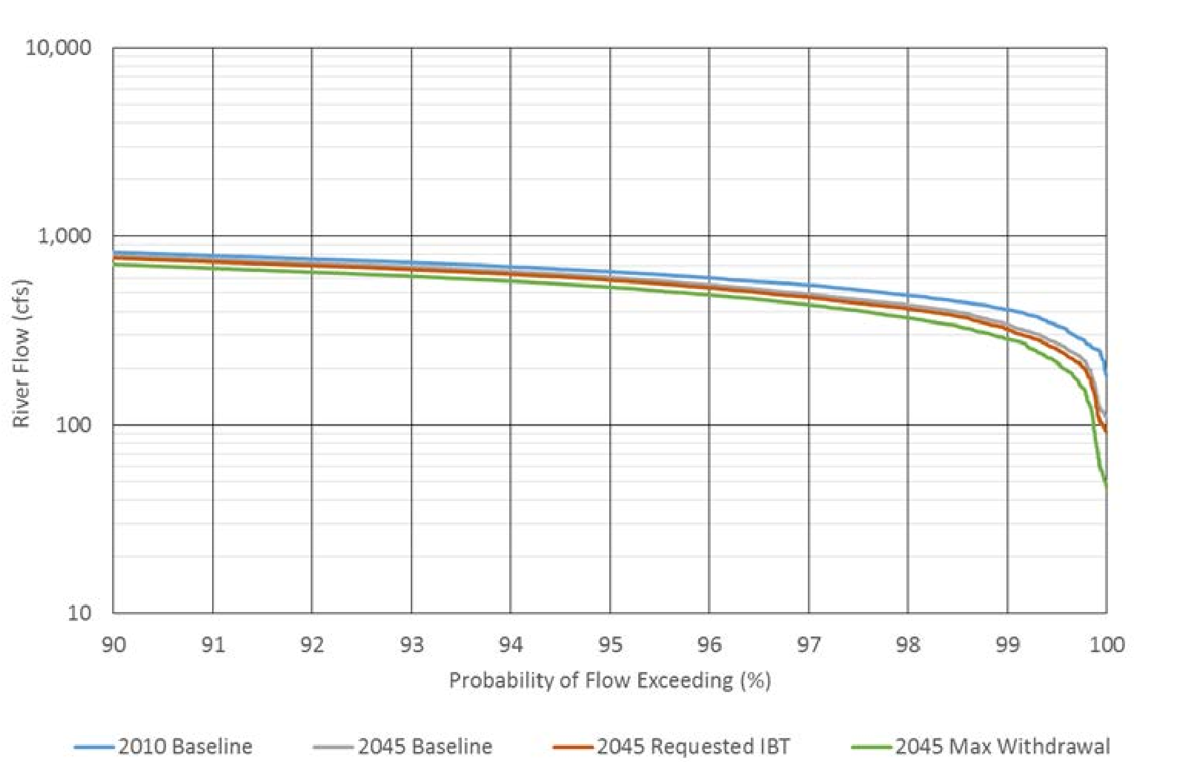


EXHIBIT 5-5
Flow Comparison for the 2007 Drought (below L&D #1)

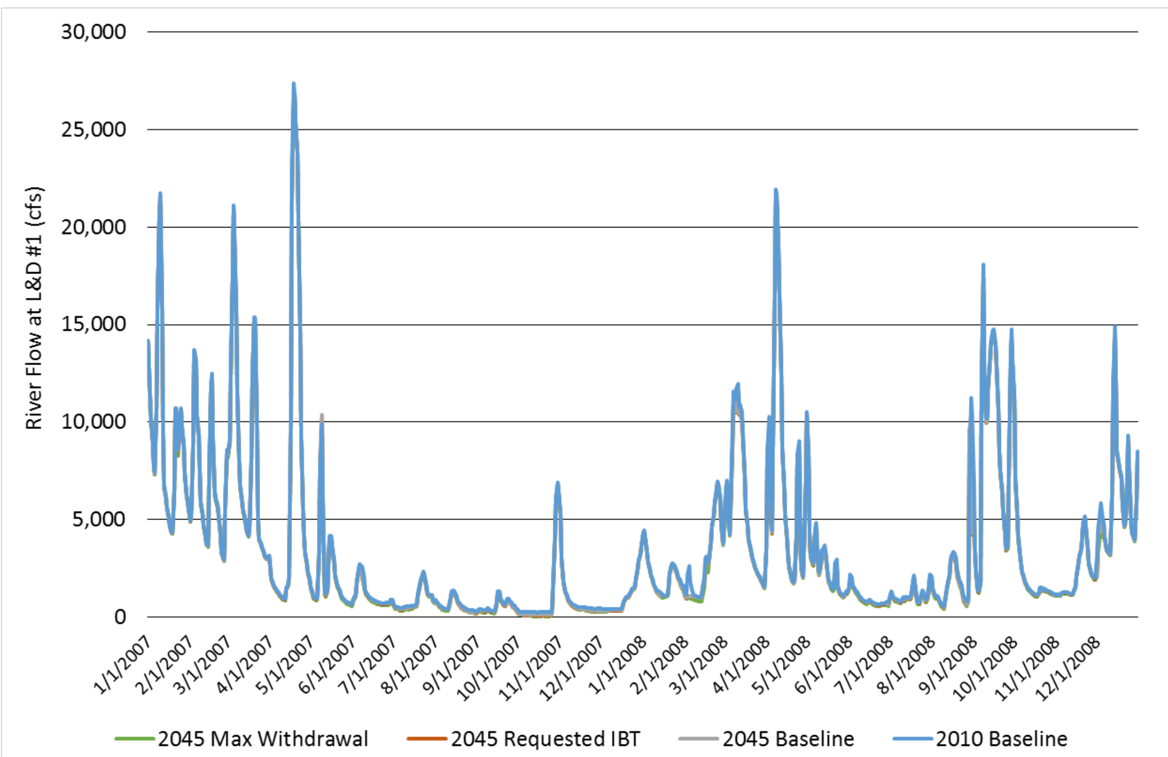
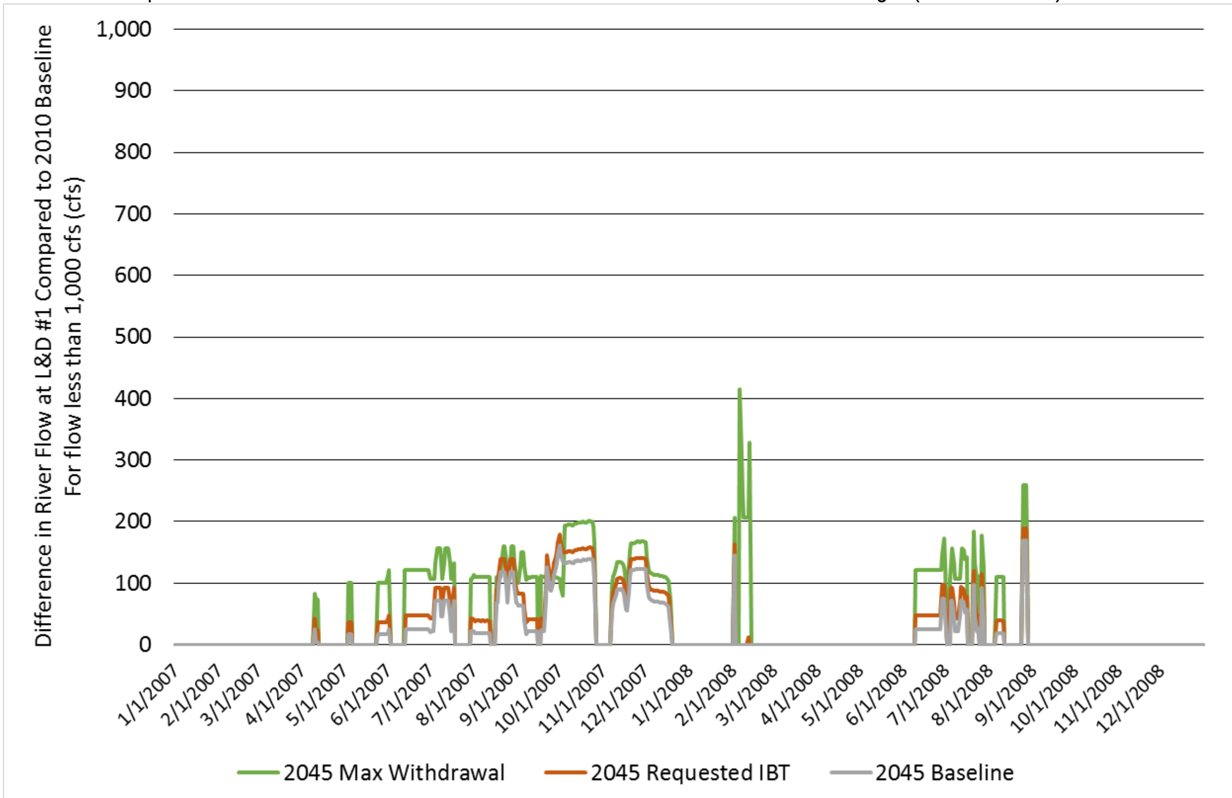


EXHIBIT 5-6
Low Flow Comparison of 2045 Scenarios to the 2010 Baseline Scenario for the 2007 Drought (below L&D #1)



5.1.1.1.3 Water Supply

The small shift in river flows in 2045 will not impact the downstream water withdrawal of International Paper. While no significant public water supply withdrawals are located downstream of L&D 1, a small amount of water is supplied by International Paper to the Town of Riegelwood. Implementation of WSRPs will also mitigate the effects below L&D #1 from increased water withdrawals upstream during periods of drought.

5.1.1.1.4 Water Quality

The small shifts in instream flows in 2045 were also evaluated in the context of the potential to impact water quality in the Cape Fear River downstream of L&D #1. Previous water quality analyses conducted as part of the evaluation for the Brunswick County IBT and as part of the reclassification of the LCRFE from Class C to Class SC Sw were reviewed. River flow and temperature were found to not be strongly correlated to DO and pH in the evaluation conducted as part of the Brunswick County IBT. Water quality conditions in this reach, including DO and pH, are influenced by the adjacent natural systems (Tetra Tech, 2013). In addition, immediately downstream of L&D #1, a lunar tidal influence of up to 2 feet is also present and contributes to water quality conditions (USACE, 2011).

In 2014, NCDEQ indicated that a change to the classification of the LCFRE from Class SC to Class SC Sw was appropriate to recognize the primary influence of natural drainage from riverine and saltwater marsh systems in the watershed on DO concentrations. The SC Sw standards allow DO levels of less than 5.0 mg/L if caused by natural conditions and pH levels of as low as 4.3 if resulting from natural conditions. Further analysis including a review of two decades of water quality data at five stations in this reach supported this reclassification and provided for the conclusion that water quality in the LCFRE is dominated by local, natural conditions found in the swamps adjacent to the river below L&D 1, as documented in a series of technical memos (CH2M HILL, 2014a and 2014b; Tetra Tech, 2014a and 2014b) developed for the reclassification process. It was concluded that these studies are also applicable to the proposed IBT and that any changes in instream flow from the IBT would result in insignificant changes in the factors that control water quality downstream of L&D #1.

It is not anticipated that the IBT will have a significant effect on the natural factors that control the water quality in the Lower Cape Fear River. This is due to the small volume of water the IBT represents in comparison to the typical river flow and range of natural variability in flow, as well as the adjacent swamp/marsh and tidal influences downstream of L&D #1.

Water quality impacts related to wastewater discharge are not expected to be significant. The County UDO requires community or public wastewater treatment systems for more dense development and if soils are unsuitable for a septic systems then the County Health Department will not issue a septic system permit, unless an engineered solution is constructed (ex. a mounded infiltration area). Water quality modeling of the LCFRE showed only a 0.3 mg/L change in DO as a result of the complete elimination of all wastewater point source discharges in the model (Bowen et al., 2009), reinforcing the conclusions presented in relation to water quality in the preceding paragraphs. This is because of the dominance of natural factors and tidal influences. NPDES permit values, which are based on low flows, will not be impacted as assimilative capacity in the Cape Fear River will not be affected by the small change in low flow that will result from the proposed increase in IBT.

5.1.1.2 Groundwater

As water services are expanded, fewer residents will rely on groundwater as a public water supply source. Residents are voluntarily switching to municipal water service due to concerns including iron content, taste and odor, as well as well failure from siltation (Gray, 2016). This is a positive impact to the groundwater resources of the Study Area by reducing the demand for groundwater as a source for drinking water and the risk of salt water intrusion impacting the water supply, a growing concern in coastal areas. Groundwater is also vulnerable to improperly operating septic tanks and other surface discharges of contaminants, such as agricultural use, which can contribute to exposure to bacteria, viruses, and other pathogens in untreated water sources including private groundwater wells. A common issue with shallow private groundwater wells in the area is high iron content and hardness (Land Management Group, Inc., 2014a and 2014b).

5.1.1.3 Wetlands

Wetland complexes within the Study Area are primarily located within the game lands, as presented in Exhibit 4-17, as well as coastal, riparian and floodplain areas. The wetlands nearest to the Cape Fear River would have the potential to be impacted by water withdrawal if the withdrawal pattern changes the surface water elevation of the Cape Fear River. Results of the hydrologic modeling show that long-term changes to river stage and in-stream flow in the Cape Fear River were minimal for all scenarios. The primary difference is a result of growth in future withdrawals in the Cape Fear River basin upstream of L&D #1.

During periods of extreme low flow (drought periods), the river level shows a greater reduction in flow below L&D #1, with the greatest cumulative changes during these periods attributed to increased withdrawals upstream of L&D #1. The effect from the proposed increase in IBT as well as other public water supplies from the Cape Fear River will be mitigated by the implementation of the

State required WSRPs. These periods should not have long-term effects on wetland areas as water needs for wetlands adjacent to the Cape Fear River should still be met.

5.1.2 Topography

Topography, including floodplains adjacent to the Cape Fear River and downstream, will not be impacted by the IBT. The impacts on water surface elevation, identified during the review of hydrologic modeling, were minimal for all scenarios. Floodplain functions will be unaltered.

5.1.3 Aquatic Resources

Aquatic resources in the Cape Fear River, Black River, Northeast Cape Fear River, their tributaries, the Intracoastal Waterway, and in the Atlantic Ocean downstream are not expected to be directly impacted by the proposed increase in IBT. The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are located just above L&D #1. LCFWASA expanded its intake in 2010 to accommodate a cumulative projected demand of 96 MGD across its customer base. LCFWASA completed an EA and received a FONSI, also included in Appendix B, addressing impacts associated with the increased withdrawal. The screen slot size for the new screens is approximately 0.118 inch, and the through velocity is less than 0.5 feet per second to reduce the potential for fish entrainment and impingement (McKim & Creed, 2008a). Considering the cumulative water demand projections for all LCFWASA customers for the planning period, the projected PCU water demand and IBT presented in Section 2 of this document will not require further modification to the intake and, therefore, will not alter the findings of the EA and FONSI mentioned above.

River stage levels in the Cape Fear are not expected to be significantly altered both above and below L&D #1. The proposed IBT itself would not have any direct impacts on protected aquatic species and their habitats in the Study Area, since no construction is planned with the IBT.

5.1.3.1 Anadromous Fish

The maintenance of downstream flow is important to anadromous fish, especially with regard to flows from late winter through spring (February through June). Anadromous fish including the Shortnose Sturgeon, American Shad, and Striped Bass travel from the Cape Fear estuary to areas above L&D #1 during their spawning periods in late winter and spring. As discussed in Section 4, a rock arch fish ladder was built at L&D #1 by the USACE to provide passage for spawning fish. The design of the fish ladder accounts for flows during the spawning period including an assumed "spawning flow" of 5,000 CFS (USACE, 2010). The average simulated flow using the CFNRBHM during the spawning period for the 2010 Baseline model scenario is 6,927 CFS, and the median flow is 4,450 CFS.

A frequency analysis was performed to quantify the percent of time the Cape Fear River was at or below the spawning flow of 5,000 CFS. The increase in the frequency of flows below 5,000 CFS between the 2010 Baseline and the 2045 Maximum Withdrawal scenarios is 0.9 percent above L&D #1 and 1.7 percent below L&D #1. These percent changes are small in comparison to the natural variability of the flow in the Cape Fear River during this period of the year. In addition to the frequency analysis for the spawning flow, the Cape Fear River flow statistics for the spawning period below L&D #1 were also reviewed and are presented in Exhibit 5-7. The spawning period reviewed was from February through June to cover the range of time for peak spawning for all of the identified anadromous fish species for the Cape Fear River (NCDEQ, 2015a).

EXHIBIT 5-7
Model Scenario Comparison - Cape Fear River Statistics Below L&D #1 for the Anadromous Fish Spawning Period (February-June)

Scenario	Average	Median	10th Percentile	5th Percentile
2010 Baseline - River Flow (CFS)	6,927	4,450	1,093	875
2045 Baseline - River Flow (CFS)	6,856	4,358	1,059	846
2045 Requested IBT - River Flow (CFS)	6,837	4,339	1,038	825
Difference from 2045 Baseline (CFS)	-19	-18	-21	-21
Difference from 2045 Baseline (percent)	-0.3%	-0.4%	-2.0%	-2.4%
2045 Maximum Withdrawal - River Flow (CFS)	6,746	4,267	972	757
Difference from 2045 Baseline (CFS)	-109	-90	-87	-89
Difference from 2045 Baseline (percent)	-1.6%	-2.1%	-8.4%	-10.8%

During the spawning period, reductions at the 5th percentile flow level of 2.4% may result from the proposed IBT. In addition, there is only a 0.8 percent change in the frequency of flow below the assumed average "spawning flow." Based on a review of USGS gaging station data for 2007 through 2016, at L&D #1, it was identified that the water surface elevation for the 5th percentile flow for the 2045 Baseline scenario, 846 cfs, equated to a river stage of between 12.1 and 12.7 ft above MSL. The minimum water stage simulated as part of this evaluation was approximately 11.5 feet above MSL for the spawning period, 6 inches above the dam crest for L&D #1. To mitigate the effect of low flows during the spawning period, the center of the fish ladder was designed to be between one and two feet lower that the rest of the ladder. This allows the concentration of flow in the middle of the fish ladder to allow continued fish passage during low flow events (USACE, 2011).

In-stream flow patterns will not be significantly impacted, which protect in-stream aquatic habitat, aquatic resources and water quality, as well as fish passage access.

5.1.4 Other Resources

Within the Study Area, other resources, as categorized in Section 4, include:

- Soils
- Wildlife Resources and Natural Vegetation
- Land Use and Land Cover
- Agricultural Land and Prime or Unique Farmland
- Forested Resources
- Public Lands and Scenic and Natural Areas
- Areas of Archaeological and Historic Value
- Air Quality
- Noise Levels

These resources are not expected to be directly affected by the proposed increase in IBT. This conclusion is based on the following:

- There are no construction activities directly associated with the proposed IBT.
- The results of the hydrologic modeling indicate that no significant impacts are expected in the future.
- Any future facility construction needed to meet future water demands may require its own environmental review process and/or environmental permitting depending on the characteristics of the project.

5.2 Secondary and Cumulative Impacts

This section outlines the SCI associated with the continued development expected in the Study Area and the provision of water service to meet these new demands, as well as expand PCU's service area. While water service is being expanded, Pender County is not planning large-scale addition of a centralized sanitary sewer system. The continuation of onsite wastewater treatment, either with septic system or small community systems, approach will in general keep development densities lower than with a centralized system. It is predicted that the potential for SCI to most resources associated with an increase in IBT is similar to that of the no action alternative in that water demands could be met with an increase in individual and/or community system groundwater wells.

It is generally expected that the potential for SCI will be occur along major, existing transportation corridors such as US 17 and NC 210 and along the coast. Population growth will occur at a slower pace throughout the more rural portions of the Study Area, and therefore, the likelihood of any SCI in these areas is limited. Any development within the Study Area is subject to coastal area protection programs that are designed to both protect natural resources and protect development from the hazards of the coastal region.

The discussion provided in the following sections reflect a general analysis of the potential for development to impact specific resources in the Study Area, given current land use practices, growth patterns, literature records and input from State agencies. Mitigation efforts to limit the potential for SCI, or significance of SCI, are discussed in Section 6.

5.2.1 Water Resources

5.2.1.1 Surface Water

SCI to surface water resources have the potential to occur across the Study Area, as development occurs and water distribution infrastructure is added. Population density is not expected to significantly increase in areas where water service is being provided to existing residents; however it is expected to increase to a limit achievable with a decentralized sanitary sewer system along major transportation routes and within the eastern portion of the county. The following SCI resulting from an increase in impervious area could occur without mitigative measures:

- Increase in stormwater runoff velocities
- Increase in stormwater quantities
- Increase in pollutant loading in runoff

As a result of the increase in population and associated development, the impervious area within the Study Area will increase, resulting in an increase in stormwater runoff during a rain event due to a decrease in pervious areas. Pollutant loads and scouring will increase without practices to control runoff rates. Without adequate controls, typical urban stormwater pollutants include sediment, nutrients (nitrogen, phosphorus), bacteria (fecal coliform as indicators), and potential toxicants (metals, oil and grease, hydrocarbons, and pesticides). The increase in runoff may increase pollutant loads, which will cause a decline in water quality and create subsequent secondary impacts on aquatic habitat, wetlands, and sensitive aquatic and amphibian species in the area.

Increases in impervious surface will increase the rate of runoff, which also may impact fluvial system stability, stream channel sinuosity, streambank slopes, floodplain and adjacent wetland dynamics, and hydrologic flow rates, and thus aquatic and riverine habitats. For example, during storms, a higher amount of rainfall will flow directly to streams, causing higher storm event flows, which may cause streambank erosion and a degraded aquatic habitat. Less rainfall will percolate to groundwater, which can reduce base stream flow during dry weather.

Infrastructure construction including roads may impact water quality, particularly where they cross streams. There are sediment impacts from construction, although the use of proper erosion and sediment controls help minimize this impact. In general, there is also a cumulative direct impact from previous crossings and other future crossings.

NCDEQ monitoring of both benthic macroinvertebrate and fish communities within the Study Area will indicate if any water quality declines are impacting aquatic communities. The composition of these aquatic communities provides insight into the effects of sediment loading, nutrient enrichment, and stream temperature changes, to name a few parameters.

Land use changes may impact both water quality and quantity in the Study Area. These impacts may limit or impede the ability of the State to prepare and effectively implement management strategies to improve water quality in Section 303(d)-listed waterbodies, which are discussed in Section 4.1.1.

As previously mentioned, significant water resources protection programs are in place at the local level and in accordance with the coastal stormwater rules and CAMA. Implementation and enforcement of these programs will prevent significant SCI to water resources; further discussion of these programs are included in Section 6.

5.2.1.2 Groundwater

As evidenced by local approvals for water and sewer districts and associated infrastructure investment discussed in Section 1, residents desire the reliability of a centralized water system. As water services are expanded, fewer residents will rely on groundwater as a public water supply source. This is a positive secondary impact to the groundwater resources of the Study Area by reducing the demand on groundwater as a source for drinking water. Provision of a centralized water system also lowers the risk of salt water intrusion impacting the groundwater supply, a cumulative impact of overuse that is a growing concern in coastal areas.

Future development may cumulatively degrade groundwater quality if contaminants common to urban activities reach the groundwater. These contaminants include fertilizers, petroleum products, semi-volatile and volatile organic compounds, and metals and nutrients from stormwater runoff. Such pollution can contaminate drinking water wells for communities and individual homes, making them unsuitable for potable water use. Potential sources of groundwater contamination include solid waste disposal sites, storage or use of hazardous substances, poorly designed or maintained septic systems, accidental spills, and leaking underground storage tanks. A general increase in impervious surfaces may also impede groundwater recharge and the groundwater's ability to maintain base flow during drought conditions.

Shallow groundwater resources are connected to surface waters and wetlands and, therefore, have a potential to be indirectly impacted if surface water hydrology is altered. Results of the hydrologic modeling show that long-term changes to river stage and in-stream flow in the Cape Fear River were minimal for the proposed increase in IBT. The primary difference is a result of growth in future withdrawals in the Cape Fear River basin upstream of L&D #1. This minimal reduction in flow is not expected to affect nearby groundwater levels. Increased withdrawal from the Cape Fear River is not expected to impact river levels; therefore, no impacts on groundwater levels near the Cape Fear River are expected.

5.2.1.3 Wetlands

Growth that is partially facilitated by the availability of additional water supply, regardless of source, could impact wetlands in the Study Area. Wetlands occur throughout the Study Area but are primarily located within the game lands as presented in Exhibit 4-17 as well as coastal, riparian and floodplain areas. They are important habitats both environmentally and economically, as healthy coastal wetlands are important for the shellfish industry. Impacts could be direct and cumulative, in terms of filling or draining of wetlands for construction of roads, building sites, or utilities, although coastal program protections are greater than in other areas. The facilitation of more dense development along major transportation corridors and coastal areas could also have indirect impacts on wetlands, in terms of increased levels of silt and sediment from grading activities and the increased amount of nonpoint source pollutants entering the wetlands over the long term from development activities and urban land uses.

Wetland losses may occur as land use changes occur and population density increases in the Study Area. Cumulative, wetland loss can result in habitat loss, habitat fragmentation, and reduction in species diversity.

Wetland functions may also be decreased if pollutant impacts occur. For example, sediment loading from stormwater runoff may impact hydrology and vegetation within a wetland. Nutrient enrichment and other surface water pollutants may impact amphibians and aquatic organisms inhabiting a wetland. In the long term, overall quality and total acreage of wetlands may be decreased by SCI resulting from land use changes in the Study Area. As discussed in Sections 4 and 6, the majority of wetlands will be protected within the large game land areas as well as by existing coastal programs and floodplain regulations. Programs which protect wetlands are described in Section 6. These potential SCI are not expected to be significant and are not considered different from that expected with land use changes that could occur regardless of water source.

5.2.2 Topography

Within the Study Area, topographic features of importance are floodplains and coastal dunes. Growth and development could require grading and clearing activities, which can change a site's topography, though current ordinances and regulations would protect topographic features to some extent.

Floodplains, if left undisturbed, provide numerous functions, including wildlife habitat, surface water filtration, infiltration, and wildlife movement corridors. If development within the floodplain were permitted, the function of the floodplain would be reduced. Coastal dunes are present along the eastern edge of the Study Area and are protected as part of the coastal shoreline and ocean hazard system AECs. Structures must be built in accordance with building codes that account for floodplains, wave action, and the erosion setback line from the coast, and these actions protect against damage from storm surges. Changes to topography and protection against the loss of soils are addressed through federal and local floodplain and shoreline protection requirements and building codes as discussed in Section 6. These potential SCI are not expected to be significant and are not considered different from that expected with land use changes that could occur regardless of water source.

5.2.3 Soils

As land is developed, clearing and grading result in soil disturbance. When heavy equipment is used on development sites, soils become compacted. During grading, soil is moved; in some areas, it is removed, while in other areas it is replaced. Thus, the locations of soil types may change. During clearing and grading, some soils are eroded, but the resulting impacts can be minimized through the enforcement of sediment and erosion control permitting and by following an approved site plan in accordance with Pender County's and the co-applicants regulations described in Section 6.

Another disturbance to soils occurs with increased site runoff, increasing the volume and rate of stormwater entering stream channels. In these stream channels, increased stresses and altered hydrology could occur, creating the potential for more erosion and loss of soils into stream channels unless adequate development restrictions, buffers, and ordinances are in place.

All stormwater plans and programs, as required under the coastal stormwater rules, are currently implemented or in development by Pender County and the co-applicants as discussed in Section 6. These measures, in addition to sediment and erosion control permitting, will limit cumulative impacts of increased land disturbance and associated stormwater runoff on soils and topography. These potential SCI are not expected to be significant and are not considered different from that expected with development that could occur regardless of water source.

5.2.4 Wildlife Resources and Natural Vegetation

Wildlife resources are primarily impacted by reductions in available habitat. While areas of concentrated development within the Study Area may impact wildlife resources through the continued loss, fragmentation, or degradation of sensitive and non-sensitive aquatic and terrestrial species and their habitats, this will be limited by the continued implementation of Pender County's land use regulations as well as those of the co-applicants. While pockets of concentrated development are expected along the coastal corridor and along major transportation corridors, significant land use changes across the majority of the Study Area are not anticipated.

Other potential cumulative impacts of habitat loss may include an increase in distances between suitable habitats for a given species and may overall result in the loss of species diversity. Habitat fragmentation makes wildlife movement more difficult. Over time, a loss in the number of wildlife individuals may occur as fewer and fewer acres of suitable habitat remain. Large tracts of pocosins are protected within the Holly Shelter and Angola Bay game lands, limiting potential impacts to these unique coastal plain features within Pender County and providing significant undisturbed areas of habitat.

While the Endangered Species Act (ESA) protects threatened and endangered species from takings, SCI to a species' habitat may, over the long term, reduce the number of individuals of a species. A list of potentially present federally listed species within the Study Area is included in Section 4.4.2. These potential impacts to wildlife, including protected species, and natural areas are not expected to be significant with continued implementation of CAMA programs and local land use planning. Impacts to fish communities, as well as forested areas and habitats, are discussed below.

5.2.5 Aquatic Resources

Aquatic resources within the Study Area include a variety of species ranging from those dependent on freshwater habitats to anadromous species to those species that thrive along the coast. Degradation of water quality and aquatic habitats can impact aquatic resources, including fish and shellfish communities. Sources of degradation include increasing erosion of stream channels, sedimentation from construction activities, changed hydrology from increased impervious surfaces, and increased stormwater runoff containing high levels of nonpoint source pollutants. These changes may affect a fish or mussel community by altering species diversity and/or the number of individuals within a community, thus decreasing the potential for a sustainable healthy community. Those species that are less tolerant of habitat stress and pollutants may disappear from a community, causing a decrease in species diversity. This may occur without a change in the overall quantity of individuals present, or both may occur: a community may lose diversity and population.

One of the changes that may impact the community is sediment loading from construction activities and runoff from increased impervious areas. Channel substrate can be altered. Insectivorous fish species dependent on healthy benthic macroinvertebrate communities may be impacted by a loss or change in their food source. Darters and other fish species dependent on riffle habitats may disappear with habitat impacts. Increased algal growth from additional nutrient loading may also contribute to water quality degradation or impact habitat. Another factor that can change a fish community is the replacement of sensitive fish species by pollutant-tolerant exotic species.

The use of proper erosion and sediment controls and implementation of the coastal stormwater rules helps minimize such impacts. In addition, construction measures such as properly burying road culverts to a sufficient depth to preserve natural substrates and provide aquatic habitat connectivity. In general, these impacts are direct impacts, but there is also a cumulative direct impact from previous crossings and other future crossings.

Besides water quality changes, water quantity changes could also impact aquatic resources and their available habitat. The hydrologic modeling results indicate that water quantity changes below L&D #1 are not expected to be significant even during low flow conditions.

As with wildlife, while the ESA protects threatened and endangered species from takings, SCI to aquatic species' habitat may, over the long term, reduce the number of individuals of a species. A list of potentially present federally listed aquatic species within the Study Area is included in Section 4.5.2.

These potential impacts to aquatic life, including protected species, and aquatic habitats are not expected to be significant and are not considered different from that expected with those that could occur regardless of water source.

5.2.6 Land Use and Land Cover

Impacts of land use changes would result from residential, commercial, and industrial growth, converting more rural or undeveloped land to suburban uses. Development activities are predicted to occur mainly along Interstate 40 and US 421 and US 17, and coastal areas. Additionally, the lack of a centralized sanitary sewer system will limit the density of growth. The pattern of development is expected to be in line with Pender County's land use plan and those of the co-applicants. These plans guide development away from environmentally sensitive areas. Further land cover discussion is provided in Section 6. These potential SCI are not expected to be significant and are not considered different from that expected with land use changes that could occur regardless of water source.

5.2.7 Agricultural Land and Prime or Unique Farmland

The amount of agricultural lands could be reduced in the Study Area as lands are converted. This includes the conversion of acres of prime farmland soils. Recent slow growth has already converted some acres of agriculture and prime farmland soils within the Study Area to other land uses, especially near the main transportation corridors. This conversion and disturbance of soils would likely continue to occur even without the proposed IBT as residential lots and commercial growth along the transportation corridors could be serviced by wells and septic systems or private wastewater systems. While the pattern of growth may be different than predicted, and density may be lower, some prime farmland soils will still likely be converted and/or disturbed. These potential SCI are not expected to be significant and are not considered different from that expected with development that could occur regardless of water source.

5.2.8 Forested Resources

Approximately 77.5 percent of the Study Area is considered forested land cover (USGS, 2011). The majority of the forested lands within the Study Area are preserved through game lands, forestry land uses, and a generally rural residential land use density throughout the majority of Pender County. Overall, as development progresses, forested wildlife habitat will be reduced within the Study Area and may become more fragmented. The potential for impacts is expected to be concentrated along the major transportation corridors. Forested communities are likely to remain along stream channels.

Cumulative forest impacts related to growth are not dependent on a specific water source, only that an adequate water supply and other resources are available. Development activities are predicted to occur mainly in along Interstate 40 and US 421 and US 17, and coastal areas. The pattern of development is expected to be in line with Pender County's land use plan and those of the co-applicants. These plans guide development away from environmentally sensitive areas, as well as large tracts of forested conservation areas. These potential SCI are not expected to be significant and are not considered different from that expected with development that could occur regardless of water source.

5.2.9 Public Lands and Scenic and Natural Areas

Growth in the Study Area should have limited impact on scenic and recreational areas that are currently in use. These areas could become more valued by the community as open spaces are converted to other land uses. Other planned open spaces in Pender County's land use plan and those of the co-applicants could also be added and prioritized by parks and recreation departments in the future. A large percentage of the open space in the Study Area is the NCWRC game lands, as illustrated on Figure 4-17.

Adverse SCI to public lands, NHNAs, and recreational lands within the Study Area are not likely to occur. Many NHNAs are present within these areas, and growth and development within the Study Area could instead increase the value of these public areas and their scenic value and natural resources.

Growth in the Study Area is expected regardless of the water source available. These potential SCI are not expected to be significant and are not considered different from that expected with development that could occur regardless of water source.

5.2.10 Areas of Archaeological and Historic Value

SCI to areas of archaeological or historic value within this Study Area would be limited. Those places already listed would be protected in accordance with current regulations. Large development activities would require investigation of the potential for historic value, according to current regulations. Historic areas could be impacted directly by future projects creating cumulative impacts, but secondary impacts would be unlikely. Impacts to historic resources would be assessed individually during project planning, likely at the county level, if properties are not listed on a NRHP. The greatest potential for SCI is along the transportation corridors of Interstate 40 and US 421 and US 17, and its coastal areas, where most of the growth is predicted to occur, but historic resources are limited throughout the Study Area. A list of historic places within the Study Area is included in Section 4.10.

Some loss of historic resources could inadvertently occur with development. For example, an unknown cemetery could be destroyed. Where historic resources are known, they should be protected over time. These potential SCI are not expected to be significant and are not considered different from that expected with development that could occur regardless of water source.

5.2.11 Air Quality

The cumulative impacts of a growing population may impact air quality in the Study Area. These impacts would be more likely to occur along the major routes of transit along Interstate 40, US 421, and US 17. As more vehicles travel within the Study Area, levels of emitted air pollution may locally increase. Even without the proposed IBT, the population within the area is likely to increase and contribute to higher levels of air pollution. While industrial emissions may also increase in the Study Area, the primary source of air pollution is likely to continue to be vehicles. Without improved roadways, it is likely that traffic problems would increase, which could create air quality problems. Currently, Pender County is an attainment area for the six criteria pollutants listed in the Clean Air Act (CAA) ozone, particulate matter, sulfur dioxide, lead, carbon monoxide, and nitrogen dioxide.

While air quality impacts could occur, long-term cumulative effects of development in the Study Area are unlikely to have a significantly different impact on air quality than if water were obtained through another source. It is worthy to note that if water from the Atlantic Ocean or brackish groundwater were utilized as a source water, which require significant amounts of energy to treat (Alternative 5), or pumping facilities were built to return treated wastewater to the Cape Fear River (Alternative 3) there will be greater energy demands for PCU operation and an increased potential for impacts to air quality. The major pollutant of concern in the region as a whole is ozone. This would continue to be managed by the current vehicle testing program, thereby limiting impacts. Any additional commercial or industrial sources would comply with air quality regulations.

5.2.12 Noise Levels

The predicted growth in the Study Area will produce greater amounts of noise from a greater density of land uses, more people living in the area, more businesses and industries operating in the area, and an increase in number of vehicles using local roadways. The continued growth and development of the Study Area will impact community noise levels through the introduction of additional domestic and commercial traffic and intensification of industry. High noise levels can also impact human health but are not expected. Development will increase the base level of noise, potentially impacting wildlife behavior. This growth is expected to occur primarily along the transportation corridors of Interstate 40 and US 421 and US 17, and coastal areas. However, these SCI are not expected to be significant as they would occur regardless of the water supply source provided.

5.2.13 Introduction of Toxic Substances

Toxic substances and their cleanup are regulated primarily by the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The main goals of these laws and their associated regulations are to eliminate or reduce toxic waste, clean up waste that has been leaked, spilled, or improperly disposed of, and protect people from harmful wastes.

As development continues in the Study Area, the potential for release of toxic substances from residential and commercial sources increases. The improper disposal of these substances could have adverse impacts on the environment by entering the groundwater system. Improper disposal could impact groundwater and surface water quality and potentially impact human health through drinking water supplies, fish consumption, and other means.

The long-term impact of new toxic discharges to surface- and groundwater from increased development, associated stormwater runoff, and accidental and/or intentional spill of household and industrial chemicals in the Study Area, could lead to declines in water quality without proper protective measures in place. These potential SCI are not expected to be significant and are not considered different from that expected with development that could occur regardless of water source.

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SECTION 6

6 Mitigation

Pender County is a growing area due to local beach community access as well as its location near Wilmington. Pender County has set strategic priorities related to economic development, has invested in the Pender Commerce Park on US 421, and is expanding public infrastructure into areas of Pender County that do not currently have water utility services. In addition to the water system expansion that is currently underway and planned near-term, PCU has engaged in this planning process with neighboring utilities, including all other utility providers within Pender County, to ensure that they can support the water needs of these communities in the future. The communities that have decided to partner with PCU as a co-applicant in the IBT certificate process include the Town of Burgaw, Town of Topsail Beach, Town of Surf City, Town of Wallace, and Utilities, Inc.

Expansion of PCU's water service area will require additional permits and other regulatory activities outside those addressed in this EA to help protect the natural environment. These activities include construction of water lines and expansion of the WTP, which is expected to be necessary within this planning period. PCU understands it will be required to follow the current permit requirements and reviews applicable for the expansion of a public water supply system, including NCDEQ Public Water Supply Section requirements.

This section identifies and discusses the federal, state, and local programs that mitigate the potential direct impacts and SCI discussed in Section 5. With these measures in place, it is not expected that any significant impacts would occur as a result of obtaining an IBT certificate and providing additional surface water supply to Pender County and its co-applicants.

6.1 Summary of Federal and State Regulations and Programs

Numerous federal and state regulations and programs mitigate impacts related to growth. These include: the ESA, the CWA, the CAMA, the National Flood Insurance Program (NFIP), stormwater regulations, nutrient management strategies, various laws and programs related to archaeological protection, the Sedimentation and Pollution Control Act, and the Water Supply Watershed (WSW) Protection Program. Exhibit 6-1 summarizes these programs and indicates whether local involvement is needed to fully implement them. Where local programs are needed to implement the state and federal regulations/programs, the program description is provided under the local regulations and programs discussion later in Section 6.2.

6.1.1 Endangered Species Act

The 1973 ESA conserves ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, through federal action and state programs (16 U.S.C. 1531-1544, 87 Stat. 884). The ESA (USFWS, 2013):

- Authorizes the determination and listing of species as endangered and threatened.
- Prohibits unauthorized taking, possession, sale, and transport of endangered species.
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds.
- Authorizes establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for endangered and threatened wildlife and plants.

- Authorizes the assessment of civil and criminal penalties for violating the ESA or regulations.
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the ESA or any regulation issued thereunder.
- Requires federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

6.1.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. 662) states that whenever the waters or channel of a body of water are modified by a department or agency of the US, the department must first consult the USFWS, the National Marine Fisheries Service (NMFS), and the lead state wildlife agency. The purpose of the Fish and Wildlife Coordination Act is to prevent or minimize impacts to wildlife resources and habitat due to water or land alterations. When modifications occur, provisions must be made for the conservation, maintenance, and management of wildlife resources and habitat in accordance with a plan developed with the wildlife protection agencies noted above (USBR, 1997).

6.1.3 Clean Water Act

In 1972, the CWA (33 U.S.C. 1251 et seq.) was enacted to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The CWA includes a number of sections that are relevant to this project:

- Section 303(d) of the CWA established a program to identify waters that do not support their designated uses and develop plans to address the impairments of these waters.
- Section 401 of the CWA requires certification that a project does not violate the state's water quality standards as administered by NCDEQ.
- Section 404 of the CWA established a program to regulate the discharge of dredged and fill material into waters of the US, including wetlands.

Additionally, the CWA provides the regulatory authority for managing sanitary sewer overflows and NPDES stormwater programs.

6.1.3.1 Section 303(d) of the Clean Water Act

Section 303(d) of the CWA requires states to identify waters that do not support their classified uses. These waters must be prioritized, and a total maximum daily load (TMDL) must subsequently be developed. TMDLs are calculations that determine the maximum amount of a pollutant that a water body can assimilate and still meet water quality standards, and an allocation of that amount to the pollutant's sources. As part of the TMDL development process, the sources of the pollutant must be identified and the allowable amount of pollutant must be allocated among the various sources within the watershed. Waterways in the Study Area that are included on the State 303(d) list are discussed in Section 4.1.1.

EXHIBIT 6-1
Summary of Existing State and Federal Programs and the Environmental Resources They Protect

Program or Regulation	Local Govt. Program Required	Wetlands	Land Use	Fish and Wildlife	Sensitive Species	Water Quality and/or Quantity	Air Quality	Ground-water	Noise	Toxics
ESA		X	X	X	X	X				
Fish and Wildlife Coordination Act				X	X					
CWA Section 303(d)		X		X		X				X
CWA Section 404		X	X	X	X	X				
CWA Section 401		X	X	X	X	X				
CAMA	X	X	X	X	X	X				X
Sanitary Sewer Overflow Regulations		X	X	X	X	X		X		X
Coastal Stormwater Requirements	X	X	X	X	X	X				X
Protection of Wetlands		X	X	X	X	X				
Isolated Wetland Protection		X	X	X	X	X				
Safe Drinking Water Act		X	X			X		X		X
Clean Air Act (CAA)							X			
Floodplain Management		X	X			X				
National Flood Insurance Program (NFIP)	X	X	X	X	X	X				X
Archaeological Protection			X							
Archaeological and Historic Preservation Act			X							
National Historic Preservation Act			X							
Protection and Enhancement of Cultural Environment			X							
Farmland Protection Policy Act			X							
Sediment and Erosion Control	X	X	X	X	X	X				
Clean Water Management Trust Fund (CWMTF)/ State Revolving Fund (SRF)		(X)	(X)	(X)	(X)	(X)				
Division of Mitigation Services		X		X	X	X				
Groundwater Protection			X					X		X
Nutrient Criteria Development Plan		X		X	X	X				
WSW Protection Program	X	X	X	X	X	X				
Land Conservation Incentives		(X)	(X)	(X)	(X)	(X)				

X = Demonstrates clear environmental benefits
(X) = Shows potential for environmental benefits (policy only, program not mandatory, or regulation not yet adopted)

NCDWR is responsible for developing TMDLs or management strategies for the waters identified in Section 4.1.1. Currently, there are no drafted or approved TMDLs for the Study Area other than the statewide TMDL for mercury, but the PCU and the co-applicants will continue to work with NCDWR to implement TMDLs and associated management strategies if they are developed (NCDWR, 2016b).

6.1.3.2 Sections 404 and 401 of the Clean Water Act

Two main regulatory programs currently regulate impacts to jurisdictional waters, including streams and wetlands in the project area, both of which originate from CWA: Section 404, regulation of dredge and fill activities (which is administered by the USACE), and Section 401, certification that a project does not violate the state's water quality standards (which is administered by NCDWR). All private and public construction activities over a specific acreage or stream length that affect jurisdictional waters are required to obtain certifications and permits from NCDEQ (Section 401 WQ Certification) and USACE (Section 404 Permits).

The state's 401 Water Quality Certification Program and the federal 404 Wetlands Protection Program protect jurisdictional waters by requiring avoidance and mitigation for wetlands and streams across the state. However, it is possible for permits to be issued under both the state and federal programs that allow small impacts to jurisdictional waters.

Section 401 of the CWA (33 U.S.C. 1341) requires any applicant for a federal license or permit that conducts any activity that may result in a discharge of a pollutant into waters of the United States to obtain a certification from the state in which the discharge originates or would originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the affected waters. The jurisdiction is determined at the point where the discharge originates or would originate, and the discharge is required to comply with the applicable effluent limitations and water quality standards (USEPA, 2016)

In 2006, the Supreme Court addressed the jurisdictional scope of Section 404 of the CWA specifically in terms of the scope of "the waters of the U.S." statement, in *Rapanos v. U.S.* and in *Carabell v. U.S.* The rulings of each case provide analytical standards for the determination of jurisdiction of water bodies that are not traditional navigable waters (TNW) or wetlands adjacent to TNWs. Wetlands adjacent to non-TNWs are subject to jurisdiction of the CWA if (1) the water body is a relatively permanent water (RPW), i.e., flows year-round or at least 3 months of the year, or is a wetland that directly abuts an RPW; or (2) a water body, including adjacent wetlands, has a significant nexus, based on the biological, physical, or chemical integrity, with TNWs (USACE, 2008).

6.1.4 Coastal Area Management Act

In 1974, the CAMA (G.S 113A-134.9) was enacted by the NC General Assembly to "establish a comprehensive plan for the protection, preservation, orderly development, and management of the coastal area of North Carolina." Twenty counties, including Pender County, are designated as coastal counties under CAMA's jurisdiction. The purpose of the rule is to insure the orderly and balanced use of the state's coastal resources.

The goals of CAMA are to provide for the:

- Protection, preservation, and conservation of natural resources and management of transitional or intensely developed areas and areas especially suited to intensive use or development, as well as areas of significant natural value.
- Economic development of the coastal area.

- Recreation and tourist facilities and parklands.
- Transportation and circulation patterns for the coastal area including major thoroughfares, transportation routes, navigation channels and harbors, and other public utilities and facilities.
- Preservation and enhancement of the historic, cultural, and scientific aspects of the coastal area.
- Protection of present common-law and statutory public rights in the lands and waters of the coastal area.
- Any other purposes deemed necessary or appropriate to effectuate the policy of this Article.

Under CAMA, the Coastal Resources Commission (CRC) reviews and permits development activities in coastal areas, but especially in areas defined as AEC. These AECs include small surface WSWs and public water supply well fields. The permitting process monitors development activities to prevent harm to AEC functions. The Commission designates development activities in either a major development or minor development class. Some minor maintenance and improvement activities are exempt from permit requirements. The Commission may consider the development size, impact on AEC, frequency of development class, onsite oversight, and public review when issuing a permit. In Section 6.2 the initiatives and plans in place for Local governments to meet the planning requirements included in CAMA are discussed (NCDCM, 2016c).

6.1.5 Sanitary Sewer Overflows

The USEPA prohibits discharges to waters of the United States from municipal separate storm sewer systems (MS4s), unless authorized by an NPDES permit. In April 2000, the USEPA released the *Compliance and Enforcement Strategy Addressing Combined Sewer Overflows and Sanitary Sewer Overflows* (USEPA, 2000). In summary, each USEPA region is responsible for developing an enforcement response plan, which includes an inventory of sanitary sewer overflow (SSO) violations. Municipalities typically obtain guidance from the NCDEQ and USEPA for their systems. While PCU and the co-applicants maintain small collection system networks, eliminating SSO is a high priority for public health, environmental, and regulatory reasons, as it is for the State of North Carolina. PCU and its co-applicants seek not only to comply with the minimum requirements regulating its operations, but also to eliminate SSOs in their system to the maximum extent feasible.

State regulations (15A NCAC 2B.05.06) require municipalities and other wastewater treatment operators to report wastewater spills from discharges of raw sewage from broken sewer lines and malfunctioning pump stations within 24 hours. NCDWR adopted policies that include strict fines and other enforcement programs to protect surface water quality from wastewater spills. Other state regulations (15A NCAC 02T 0.0100) require permit applications for systems that do not discharge to surface waters. These systems includes sewer systems, disposal systems, treatment works, residual disposal/utilization systems, animal waste management systems, treatment of contaminated soils, and stormwater management systems. These permits apply to any activity that constructs, alters, extends, operates or contaminates these systems and apply to systems which discharge waste onto or below land surface (NCDEQ, 2006a).

The North Carolina Clean Water Bill of 1999 provides for the development of permits for collection systems. PCU and the co-applicants must obtain Wastewater Collection System Permits, as necessary, that include requirements for inspections, sewer maintenance, and other operational items.

6.1.5.1 Coastal Stormwater Requirements

Pender and Duplin Counties fall under the coastal county stormwater requirements set forth in 15A NCAC 02H .1005. Both residential and nonresidential developments are subject to these rules, depending on the size of the built upon area and proximity to waterways. Exemptions and exclusions are provided for in the rule. The following triggers apply:

- All nonresidential development activities that will add more than 10,000 square feet of built upon area or that require a sediment and erosion control plan or a CAMA Major permit
- All residential development that requires a sediment and erosion control plan and disturbs more than one acre of land that is part of a larger common plan of development

Vegetative buffers are required in all developments subject to these rules. Vegetated conveyances should be used to transport stormwater runoff where possible. A 50-foot vegetative buffer is required for new development while a 30-foot wide buffer is required for redevelopment. In the case of streams, this buffer is measured from each bank. For other tidal waters and impounded structures, this buffer is measured perpendicular to the shoreline at the mean high waterline. Stormwater controls are permitted within these buffers.

Built upon areas as defined in the rule are averaged, meaning that a portion of a development may be higher density than the overall project density, which may protect more open space, provided the higher density development is in upland lands.

To protect Outstanding Resource Waters (ORW) and coastal fisheries, as defined by statute, a development within 575 feet of the mean high waterline of an ORW shall comply with applicable low density or high density requirements. Measures to protect ORW include a development density of 25 percent or less. Other requirements for ORW and for areas within one-half miles of a Class SA water include:

- Low density development by definition has a built upon area of 12 percent or less and is to include vegetated conveyances to transport stormwater runoff where possible
- High density development with a built upon area greater than 12 percent shall have no direct outlet channels or pipes to Class SA (shellfish) waters unless specially permitted.
    - Low impact development (LID) measures are to be employed so as to control and treat stormwater generated by one and one-half inches of rainfall, or the difference in the stormwater runoff from all surfaces from the predevelopment and postdevelopment conditions for a one-year, 24-hour storm.
    - Any stormwater runoff from development that is in excess of the design volume must flow overland through a vegetative filter with a minimum length of 50 feet measured from the mean high water of Class SA waters
- New points of stormwater discharge to Class SA waters are prohibited for all development activities.
- An increase in volume or capacity of stormwater flow through conveyances to Class SA waters is prohibited, including any modification or redesign of a stormwater conveyance system. The net amount or rate of stormwater discharge through existing outfalls to Class SA waters is prohibited from increasing.

Other coastal development not subject to the rules summarized above fall under rules depending on the density of development. If the development is low density, in this application defined as having a built upon area of 24 percent or less, or high density development, there are separate requirements. Low density developments are subject to the requirements for vegetative buffers and the use of vegetative conveyances while high density developments must use other stormwater control measures to store, control, and treat stormwater runoff generated by one and one-half inches of rainfall.

Other developments that do not require a sediment and erosion control plan or a CAMA major development permit must obtain a stormwater management permit and use stormwater best management practices to control the first one and one-half inches of rain. Stormwater controls must be designed to:

- Remove 85 percent of the average annual amount of total suspended solids (TSS)
- Discharge the storm volume at a rate equal to or less than the predevelopment discharge rate for the one-year, 24-hour storm
- For detention ponds, draw down the treatment volume no faster than 48 hours and no slower than 120 hours to limit velocities of runoff reaching waterways
- Require separation from the high water table where practicable
- And meet other criteria as defined in the rule

6.1.6 Protection of Wetlands, Executive Order 11990

EO 11990 (Protection of Wetlands) was issued to avoid long- and short-term adverse impacts associated with the destruction or modification of wetlands. Every federal agency must minimize the destruction, loss, and degradation of wetlands, as well as work to preserve and enhance the natural and beneficial values of wetlands. Federal projects must avoid wetland impacts to the extent possible and, where avoidance is not possible, minimize impacts to wetlands (FEMA, 2015a).

6.1.7 Isolated and Other Non-Jurisdictional Wetlands and Waters Protection

NCDWR has jurisdiction over wetlands and waters within the state's borders that the USACE determines are not jurisdictionally under Section 404 of the CWA, which includes isolated wetlands and surface waters. Its requirements include permitting and mitigation measures for activities that results in a disturbance to a stream, wetland, or open water, which includes filling, excavating, draining, and flooding (NCDWR, 2016f).

6.1.8 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) provides protection of public health by regulating the nation's drinking water supply. The SDWA authorizes the USEPA to set national health standards for drinking water to protect against natural and man-made contaminants that may be found in public drinking water. The USEPA is charged with the responsibility of assessing and protecting drinking water sources, as well as ensuring the appropriate treatment of water by qualified operators. The USEPA is also responsible for ensuring the integrity of water delivery systems and informing the public of the quality of their drinking water supply (USEPA, 2004).

6.1.9 Clean Air Act

The CAA (42 U.S.C. 7401 et seq.) is intended to “protect and enhance the quality of the Nation’s air resources so as to promote the public health and welfare and the productive capacity of its population.” Section 118 of the CAA (42 U.S.C. 7418) requires that each federal agency with jurisdiction over any property or facility engaged in any activity that might result in the discharge of air pollutants comply with “all Federal, state, interstate, and local requirements” with regard to the control and abatement of air pollution (USCEP, 2004).

In 2015, the 8-hour ozone NAAQS was revised to 0.070 parts per million (ppm). No air quality monitors in North Carolina violated the 8-hour ozone standard during the 2013-2015 ozone seasons (NCDEQ, 2015b). The declining ozone levels coincided with lower emissions from the state’s power plants. The state’s coal-fired power plants have reduced their NOx emissions, a primary industrial contributor to ozone pollution, by more than 80 percent since the General Assembly enacted the Clean Smokestacks Act in 2002 (NCEMC, 2013). Pender County is also in an attainment area for the five other criteria pollutants, which include particulate matter, sulfur dioxide, lead, carbon monoxide, and nitrogen dioxide (USEPA, 2015b).

NCDAQ continues to implement an aggressive Air Awareness Education Program that encompasses daily reports on the ozone forecasts by meteorologists reported using media such as the internet, television, newspapers, and radio. The public has become very informed of ozone issues and steps they can take to reduce ozone emissions, which include combining errands into one trip, maintaining vehicles and lawn equipment, and using lawn equipment in the evening (NCDAQ, 2016).

In addition to the effects on transportation, new and expanding industries in the Study Area are subject to strict emission control requirements. Air permits may be required for new or expanding treatment plants, depending on what technologies are utilized.

6.1.10 Floodplain Management, Executive Order 11988

EO 11988 (Floodplain Management) addresses the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Federal agencies must take action to reduce the risk of flood loss and flood impacts on human safety, health, and welfare. Agencies are also charged with the responsibility to restore and preserve the natural and beneficial values of a floodplain. Federally supported projects that directly impact floodplains need to consider alternatives which avoid the floodplain (FEMA, 2015b).

6.1.11 National Flood Insurance Program

The NFIP, managed by the FEMA, was created in the 1960s in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. Floodplain management under the NFIP is an overall program of corrective and preventive measures for reducing flood damage. It includes, but is not limited, to emergency preparedness plans, flood control works, and floodplain management regulations; and it generally covers zoning, subdivision, or building requirements and special-purpose floodplain ordinances. One aspect of the program is that it aids in the protection of stream riparian areas, wetlands, and coastal areas, and serves to protect water quality by restricting development in the floodplain. Information on the Study Area’s flood protection programs is presented in Section 6.2 (FEMA, 2015c).

6.1.12 Archaeological Protection

Archaeological resources are protected on private and public lands through the North Carolina Archaeological Resources Protection Act, the Unmarked Human Burial and Human Skeletal Remains Protection Act, the North Carolina Archaeological Record Program, State Environmental Policy Act (SEPA), and various federal laws. These laws are only applicable to projects that are state or federally approved, permitted, or funded, or exist on state or federal lands. Although this often exempts many private development projects, USACE does require archaeological reviews for any project that needs a CWA Section 404 permit.

6.1.12.1 Archaeological and Historic Preservation Act

The Archaeological and Historic Preservation Act of 1974 provides protection of historical American sites, buildings, objects, and antiquities of national significance, as well as protecting all historical and archaeological data that could potentially be lost due to:

- Flooding
- Building of access roads
- Erection of laborer communities
- Relocation of highways and railroads
- Alteration of terrain caused by the construction of dams (by the US government and private corporations)
- Any alteration of terrain as a result of any federal construction project or any federally licensed project

If any federal agency finds that a federally supported project may cause irreparable loss or destruction of scientific, prehistorical, historical, or archaeological data, the agency must notify the Department of the Interior so it may undertake recovery, protection, and preservation of the data (USNPS, 2000).

6.1.12.2 National Historic Preservation Act

The National Historic Preservation Act (NHPA) is the central act that establishes historic preservation law. The NHPA sets the policy for the US government to promote conditions in which historic properties can be preserved in harmony with modern society. The NHPA authorizes the Department of the Interior to establish, maintain, and expand the National Register of Historic Places (NRHP). The NHPA establishes responsibility to the NCSHPO to develop a statewide plan for preservation, surveying historic properties, nominating properties to the NRHP, providing technical assistance to federal, state, and local agencies, and undertaking the review of federal activities that affect historic properties (NCSHPO, 2008).

6.1.12.3 Protection and Enhancement of the Cultural Environment, Executive Order 11593

EO 11593 (Protection and Enhancement of the Cultural Environment) requires the federal government to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation. Federal agencies, in cooperation with state historic preservation agencies, are to locate, inventory, and nominate sites, buildings, districts, and objects as candidates for the NHRP. All sites listed within the NRHP shall be maintained to professional standards set by the Secretary of the Interior. Federal agencies that are directly or indirectly involved with the alteration or destruction of property listed on the NHRP will take timely steps to make a record of all data present in that property. That record is kept in the Library of Congress (USNA, 1999).

6.1.13 Farmland Protection Policy Act

The purpose of the Farmland Protection Policy Act is to minimize the extent to which federal programs contribute to unnecessary and irreversible conversion of farmland to non-agricultural uses. The Farmland Protection Policy Act, enforced by the USDA, assures that federal programs will be administered in such a manner that they are not incompatible with state and local governments, as well as private programs with policies to protect farmland (USNRCS, 1999).

6.1.14 Sediment and Erosion Control

NCDEMLR administers programs to control erosion and sedimentation caused by land-disturbing activities on one or more acres of land. Control measures must be planned, designed, and constructed to protect from the calculated peak rate of runoff from a 10-year storm. Enforcement of the program is at the state level, but may be delegated to local governments with certified erosion control programs. PCU and the co-applicants either require development to demonstrate compliance with the North Carolina Sedimentation Pollution Control Act or run a designated Sediment and Erosion Control program, as discussed further in Section 6.2.

6.1.15 North Carolina Clean Water Management Trust Fund

The CWMTF was created by the 1996 North Carolina Legislature to help finance projects that specifically address water pollution problems. Its purpose was modified through the passage of the 2013-2014 North Carolina budget and the fund is administered by NCDEQ. The non-regulatory program has funds to acquire lands with ecological, cultural and historic significance to the state as well as provide buffers around military bases. Usage of the CWMTF have been reduced due to the amount of money annually available in the fund.

In 2013, The Nature Conservancy received CWMTF funding for acquisition for the Godwin Tracts on the Northeast Cape Fear in the Study Area (CWMTF, 2014). The 134-acre tract is to become part of Angola Bay Game Land, which it borders, to preserve habitat for several rare mussels and fish (The Nature Conservancy, 2014).

6.1.16 State Revolving Fund

As part of Session Law 2013-360, the funding of drinking water, wastewater improvements and conventional stormwater projects is now administered by the Division of Water Infrastructure and the State Water Infrastructure Authority. Most recently, the Town of Burgaw, a co-applicant, received funding for Fiscal Year 2014 from the Drinking Water State Revolving Fund for a rehabilitation of water lines, installation of an emergency generator, and installation of Automated Meter Reading (AMR) technology (NCDEQ, 2013). This type of project can limit water loss and therefore improve water conservation.

6.1.17 Division of Mitigation Services

The Division of Mitigation Services (DMS) was established as a non-regulatory program within NCDEQ to:

- Provide a systematic approach for meeting NCDOT’s compensatory mitigation requirements.

- Maximize the ecological benefit of compensatory mitigation projects.
- Reduce delays in the construction of transportation improvement projects associated with compensatory mitigation requirements.

The DMS also provides a compensatory mitigation option for permit applicants other than the NCDOT and administers the Statewide Stream/Wetland Program, Riparian Buffer Mitigation Program, and Nutrient Offset program (NCDMS, 2016a).

There are three sites within the Study Area that listed under the Tier 1 High Quality Preservation Sites from the 2014-2015 DMS Report (NCDMS, 2016b). Even though the purchase of these properties did not go to closing, it shows that properties within the Study Area are worthy of preservation and use of the DMS to meet mitigation needs is an opportunity for local resource protection.

6.1.18 Groundwater Protection/Management

Several regulations and programs exist at the state and local levels that protect groundwater from urban growth:

- Wellhead Protection Program
- Regulation of potential contamination sources
- Management of groundwater contamination incidents
- Ambient groundwater monitoring
- Regulation of well construction

These regulations and programs may afford some protection to groundwater wells from the most common forms of groundwater pollution—point sources such as chemical manufacturing facilities, underground storage tanks, and accidental spills. However, more diffuse and evasive groundwater pollutants from agricultural uses (livestock facilities and chemical application on crops) and urban land uses (over-application of fertilizers and improper use of toxic household chemicals) may not be well managed under these regulations and programs. As a result of unreliable groundwater supplies, Pender County has already changed to surface water to limit its impacts on aquifers. The county planning division has noted the need to reduce water demand to allow natural groundwater recharge and to enhance the protection of groundwater resources (Pender County, 2011).

6.1.18.1 Central Coastal Plain Capacity Use Area

The CCPCUA is a group of 15 coastal counties designated by the NC Environmental Management Commission. In 2002, this commission approved and implemented rules for this area which created a groundwater use permitting process. These rules includes requiring permits for groundwater users of more than 100,000 GPD and annual registration and reporting of withdrawals for both ground and surface water users of more than 100,000 GPD. While Pender County is not within the CCPCUA, the Town of Wallace, a co-applicant, is located in Duplin County, which is one of the 15 counties in the CCPCUA. With implementation of the program, continued water level recovery in the aquifers including a portion under Pender and Duplin Counties has been observed (NCDWR, 2016e).

6.1.19 Nutrient Criteria Development Plan

The NCDWR is evaluating nutrient criteria for three water body types in North Carolina: reservoirs/lakes, rivers/streams, and estuaries. First, they will develop nutrient criteria with one body of water from each body type. For the river/streams, the NCDWR chose the Middle Cape Fear River, which is upstream of the Study Area. North Carolina wants to create nutrient criteria that are scientifically defensible and cost-effective. A panel, called the Scientific Advisory Council (SAC), has been assembled of experts from the fields of water quality, engineering, nutrient management, and nutrient biogeochemistry. This panel, along with a Criteria Implementation Committee (CIC), will assist the NCDWR and stakeholders with the nutrient criteria development and associated implementation and management and meet USEPA's expectations for nutrient management programs (NCDWR, 2016g).

6.1.20 Water Supply Watershed Protection Program

The N.C. Environmental Management Commission (EMC) and NCDEQ have administered the WSW Protection Program since 1986. Initially, the program was administered voluntarily by counties and municipalities pursuing protective measures for their WSWs. The measures included limitations on the number and type of wastewater discharges that were allowed in the WSWs.

In 1989, the North Carolina General Assembly ratified the Water Supply Watershed Protection Act, codified as General Statutes 143-214.5 and 143-214.6. The WSW Protection Act mandated the EMC to adopt minimum statewide water supply protection standards by January 1, 1991, and to reclassify all existing surface WSWs to the appropriate classification by January 1, 1992. The goals of the WSW Protection Program include:

- Protection of surface drinking water supplies in North Carolina from nonpoint source and point source pollution from urban runoff and wastewater discharges.
- Provision of a cooperative program of watershed management and protection that is administered by local governments consistent with minimum statewide standards.

The NCDWR Water Quality Program manages the WSW program through oversight of local planning ordinances and monitoring of land use activities. Local WSW programs must be approved by the EMC. The WSW program requires local governments to adopt a number of land use controls and limitations based on watershed classifications. Specifically, this program:

- Limits impervious surfaces around water supplies unless stormwater controls are used.
- Requires protection of riparian buffers (100-foot buffers in all development that exceeds the low-density option, or 30-foot buffers otherwise along perennial waters).
- Limits some land uses.
- Limits dischargers (NPDES permits in certain situations).
- Allows the use of clustering and density-averaging to meet overall development density limits.

Watersheds in the WSW Protection Program have a classification of WS-I through WS-V, where WS-I has the most restrictive controls (NCDEMLR, 2016b).

A portion of the Study Area including the LCFWASA intake is within the Cape Fear River (Reigelwood) WSW. This watershed is classified as WS-IV, which means it is developed watershed. The state has developed watershed protection overlays and restrictions associated for development in this type of WSW. The local application of these rules is described further in Section 6.2 (NCDWR, 2009).

6.1.21 Conservation Reserve Enhancement Program

The USDA and NCDEQ manage the Conservation Reserve Enhancement Program with the participation of the NRCS, the Farm Service Agency, DMS, and the North Carolina Division of Soil and Water. This program uses financial incentives to encourage farmers to voluntarily remove sensitive land from agricultural use or implement BMPs. Riparian buffers and wetlands may be removed from agricultural production under this program with a minimum of a 10-year agreement (NCDSWC, 2006).

6.1.22 Miscellaneous Land Conservation Incentive Programs

Other voluntary strategies exist at federal and state levels that provide incentives to protect natural lands, wetlands, agricultural lands, and sensitive species habitat and forest lands from development. These non-regulatory approaches include providing tax credits for donating lands to specific organizations (usually land trusts) and offering funding for various grants and trust funds to purchase or protect undeveloped lands. The function of the Pender County Soil and Water Conservation District is to foster incentive-driven management of natural resources, including promoting the use of these programs to private land owners.

6.2 Local Mitigation Measures

Local mitigation measures include programs that implement state and federal regulations. These programs differ slightly among the applicants, but achieve a level of mitigation necessary to minimize the potential for environmental impacts related to growth. Each applicant is discussed individually beginning with the primary applicant, Pender County. Utilities, Inc. is a private water provider and its service area is within Pender County and therefore falls under the ordinances and programs for Pender County.

6.2.1 Pender County

6.2.1.1 Riparian Buffers

Pender County has developed a Unified Development Ordinance (UDO), which was adopted June 2010. The UDO does not govern areas located outside the planning jurisdiction of any incorporated city or town. Per the UDO, a riparian buffer is defined as "an area of trees, shrubs, or other vegetation that permits inundation by water and is at least 35 feet in width, measured outward from both sides of a natural waterway beginning along the slope of the ground from the channel scar line. A riparian buffer is managed to maintain the integrity of stream channels and reduce the effect of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals." All activities in the Watershed Districts shall maintain a 35-foot vegetated buffer adjacent to all perennial waters as shown on the most recent addition of the USGS 1:24,000 (7.5 minute) topographic map; thus, protecting natural resources. The buffer shall remain vegetated and shall be used only for access and utilities (Pender County, 2010a).

6.2.1.2 Floodplain Protection

Pender County adopted its most recent Flood Damage Prevention Ordinance in December 2013. The ordinance meets FEMA requirements. If any development occurs within a "Special Flood Hazard Area" or "Future Conditions Flood Hazard Area", the structure must be raised 2 feet above the base flood elevation. If no base flood elevation has been established, this elevation shall be at least 2 feet above the highest adjacent grade for "Special Flood Hazard Areas" and shall be the Future Conditions Flood

Elevation plus 2 feet of freeboard for "Future Conditions Flood Hazard Areas" (Pender County, 2013). The NFIP is available in Pender County.

6.2.1.3 Erosion and Sediment Control

The County has not adopted local erosion and sedimentation rules and instead relies on State sedimentation and erosion control regulation; however, the County indicated in the Land Use Plan that it will make a concentrated effort to see that development is sensitive to the issue of stormwater run-off. The County indicates that in the future it may utilize locally adopted rules more stringent than the state sedimentation and erosion control regulations (Pender County, 2010b).

6.2.1.4 Stormwater Management

Pender County has outlined the requirements for a stormwater management plan for different stages of development in Article 6 of the UDO. For example, for master development plan contents for residential, commercial, industrial, and mixed use districts, a conceptual plan for stormwater management must be provided. For preliminary plat contents the developer must supply a stormwater management plan as approved by the Division of Water Resources (with letter of approval).

Furthermore, the County has established overlay districts that are applied in conjunction with their base zoning districts. These districts limit the amount of built-upon area within its water supply watersheds. The Pender County UDO establishes a Watershed Critical Area District, WS-CA, and a Watershed Protected Area, WS-PA, where the principal use of land is very low density single-family residential purposes. The regulations of this district are to permit residential developments which are compatible with the rural character of the area while protecting the sensitive ecology and hydrology of the critical watershed near the intake of the public water supply. New residential developments shall be permitted at a maximum of one dwelling unit per two acres. No new development shall exceed 24 percent total lot coverage (Pender County, 2010a).

6.2.1.5 Land Use Plan

Pender County developed a Land Use Plan that was adopted in 2010. Throughout the planning process, Pender County strived for "a higher quality of life and sustainable development within the context of preservation of cultural and natural resources" (Pender County, 2010b). The Land Use Plan was certified by the North Carolina Coastal Resources Commission in August 2012; therefore, the Division of Coastal Management uses the plan in making CAMA permit decision.

Within the Land Use Plan, an issue that is addressed are Natural Resources, Historic, Cultural Preservation. The County understands that as communities develop, natural, historic and cultural resources can be damaged or eliminated through the development of private property which often are quality of life resources which add to the community's character. The County recognizes that the protection, maintenance and enhancement of these scarce resources are a legitimate function of local government as part of the government's role in protecting the public welfare and providing for the common good. They have taken the first step which is to identify these resources and, through their planning and ordinances, have addressed this concern and ensure that they are maintained or enhanced through acquisition, investment or regulation (Pender County, 2010b). The goals within this portion of the Land Use Plan include to ensure that natural resources and historic and cultural resources are maintained or enhanced as development occurs.

Furthermore, the Land Use Plan addresses Parks, Recreation, Open Space and Waterway Access. The goals within this section of the Land Use Plan include the following:

- Ensure adequate, appropriately located parks, recreation and open spaces to serve the needs of Pender County residents and visitors
- Increase the amount of land available and the funding for parks, recreation and open spaces to serve Pender County residents and visitors.
- Increase the number of public boat ramps available within unincorporated Pender County.
- Pender County will support expansion of public access locations based on CAMA Site Classification Standards, through public and private actions as a high priority.

The County has an ordinance that addresses open space, Section 7.6 of the UDO. The ordinance requires that “every Subdivider of land for residential purposes shall dedicate a portion of such land…for the purpose of providing, active and passive recreation areas to serve the residents of the immediate neighborhood within the subdivision” (Pender County, 2010a). The Land Use Plan indicates that the County recognizes the need for open space and in response the Board of Commissioners adopted the Pender County Recreation and Open Space Plan in 1998. The County developed the Parks and Recreation Community Partnership program and despite limited funding and staff resources to implement the 1998 Plan, the County has been able to provide considerable recreation activities (Pender County, 2010b).

The County has since developed a Parks and Recreation Master Plan in 2010. The purpose of this plan is to analyze the existing and future conditions of parks and recreation in regard to supply and demand throughout the County, the operations associated with parks and recreation, and to make recommendations for improvements (Pender County, 2010c). Note that unlike the UDO, the Parks and Recreation Master Plan encompasses the entire County including areas located within the planning jurisdiction of incorporated cities or towns.

The Land Use Plan also addresses existing land use and zoning as well as future land use planning. The County’s current zoning contains Special Purpose Districts. The County has developed specific regulations in their UDO that provide for the preservation of environmentally sensitive lands, opens space and natural habitat through an Environmental Conservation District. The construction and land disturbing activities in this district are limited and should have very low impact on the environment and surrounding settings (Pender County, 2010a).

Furthermore, there are six Future Land Use Classifications, one being Conservation. Currently, conservation areas comprise approximately 25 percent of the land area within Pender County zoning jurisdiction. The conservation areas are comprised primarily of the Holly Shelter Game Land and Angola Bay Game Land. The Land Use Plan indicates that “in the future, the Conservation land use classification may be applied to areas along major streams and rivers and immediately adjacent to existing conservation areas. Future conservation areas will most likely include land and water features where there are serious hazards to personal safety or property, where new development would cause serious damage to the values of natural systems, or where new development is not permitted by local, State or Federal policy” (Pender County, 2010b).

In addition to the larger context of future land use planning, the County has also developed Small Area Plans. According to the Land Use Plan, a Small Area Plan is suitable for a specific area of the community that has special attributes to be protected, such as rural character, historic significance, downtown business district, or an area that is experiencing more significant growth pressures comparatively. The Small Area Plans developed include Coastal Pender, Rocky Point, and US 421 South Corridor (Pender County, 2010b). The Pender County Future Land Use Plan maps (including small area plans) can be found in Appendix G.

6.2.1.6 Water Shortage Response Plans

Pender County has developed a Water Shortage Response Plan (WSRP) that is included in its Water and Sewer Ordinance. The purpose of the plan is to declare official phases of water supply shortage and voluntary and mandatory conservation measures for those phases along with enforcement measures for each.

The WSRP includes five phases of water conservation:

- Voluntary Reductions – customer education and outreach programs will be utilized to encourage water conservation and efficiency measures; the goal for water reduction is 5 percent.
- Mandatory Reduction I – irrigation will be limited to a half inch per week and outdoor use of drinking water for washing impervious surfaces is prohibited; the goal for water reduction is 10 percent in comparison to the previous month's water bill.
- Mandatory Reductions II – customers must continue actions from all previous stages and all non-essential uses of drinking water are banned; the goal for water reduction is 20 percent compared to the previous month's water bill.
- Emergency Reductions – customers must continue actions from all previous stages and must further reduce their water use by 25 percent compared to their previous month's water bill.
- Water Rationing – all customers are only permitted to use water at the minimum required for public health protection.

The enforcement for each phase are outlined in Exhibit 6-2 (Pender County, 2010d).

EXHIBIT 6-2
Pender County WSRP Enforcement

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A
Mandatory Reductions (I and II)	Warning	$250	Discontinuation of Service
Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

6.2.1.7 Water Quality Protection

Pender County's Code of Ordinances includes a Water and Sewer Ordinance, as defined in §12, which requires that all new construction and development meet the following water supply and wastewater treatment requirements:

- Lots 15,000 square feet and larger may utilize traditional on-site septic and well services
- Within Planned Development (PD) Districts or Residential Mixed (RM) Districts, lots ranging between 12,000 square feet and 14,999 square feet must provide at least one of the following:
    - Community or public water service
    - Community or public wastewater treatment service

- All lots under 12,000 square feet require community or public wastewater disposal and water service.

The lot size limitations mitigate water quality impacts by requiring that sites less than 15,000 square feet have community water and wastewater service. Furthermore, Pender County Environmental Health Specialists within the County's Health Department conduct appropriate soils tests to determine the suitability of a property for a septic system before a building permit is issued.

Another aspect of water quality protection in the Water and Sewer Ordinance relates to SSOs. Article XIII of this ordinance is in place to aid in the prevention of SSO from contributions and accumulation of fats, oils, and grease discharged into the sanitary sewer system from industrial and commercial establishments. The article outlines facilities that are required to have grease interceptors as well as design guidelines for the grease interceptors. The County has also put in place penalties against the generator or contributor of grease causing sewer overflows (Pender County, 2008).

6.2.1.8 Water Conservation

Pender County has a comprehensive list of tips to help educate its residents on water conservation on their website. The County has compiled practical tips related to different facets of water conservation including general tips to conserve water for indoor and outdoor water use, conservation measures for your bathroom, and water conservation outdoors. There is also information related to making your own rain barrel and a link to rainwater harvesting (Pender County, 2016a).

6.2.1.9 Rate Structures

Generally, Pender County has a flat or fixed rate structure, meaning that the price per gallon of water is fixed regardless of how much water is used. For commercial customers and irrigation, there is an increased cost per 1,000 gallons for usage over 10,000 gallons per month. Overall, the rates in the County are slightly higher than surrounding areas in that the fixed rate is equivalent to the second or third tier rate of other utilities in the region. Also, the County’s water rates are identified by the UNC EFC as more than or close to double the statewide median for 1,000 gallons (UNC, 2016). These higher base rates encourage water conservation and discourage non-essential water use. Rates vary per district and current rates are outlined in Exhibit 6-3 (Pender County, 2016b). A review of the University of North Carolina (UNC) Environmental Finance Center (EFC) NC water and wastewater rates dashboard shows that Pender County water bills are more than double that of the median statewide water bill for 1,000 gallons ($16.44 (statewide median) vs. $33.50 (Pender County Rocky Point/Topsail WSD). In addition, the County rates are also relatively high on the conservation rate signal measure; $1.30 more per 1,000 gallons for high usage compared to the Statewide median.

EXHIBIT 6-3
Pender County Water Rates

District	Residential Monthly Base Charge	Residential Rate per 1,000 gal	Commercial Monthly Base Charge	Commercial Rate per 1,000 gal <10,000 gal	Commercial Rate per 1,000 gal >10,000 gal
Maple Hill WSD	$17.50	$5.00	$19.50	$5.50	N/A
Pender Commerce Park WSD	N/A	N/A	$29.50	$6.50	$9.45
Rocky Point/Topsail WSD & Scotts Hill WSD	$27.50	$6.00	$29.50	$6.50	$9.45

Effective July 1, 2016

6.2.2 Town of Topsail Beach

6.2.2.1 Riparian Buffers

The Town of Topsail Beach adopted a CAMA Core Land Use Plan in 2015. The Land Use Plan indicates that "Topsail Beach policy is to work, whenever possible, to require the retention of natural vegetation in buffer areas along creeks, sounds, and islands" (Cape Fear Council of Governments (COG), 2015).

6.2.2.2 Floodplain Protection

Chapter 14 of the Town of Topsail Beach's Code of Ordinances includes a Flood Damage Prevention Ordinance that meets FEMA requirements. The NFIP is available to Topsail Beach and they have a brochure of information they provide to their residents. The brochure is attached in Appendix G (Topsail Beach, 2015a).

6.2.2.3 Erosion and Sediment Control

All new development must demonstrate compliance with the North Carolina Sedimentation Pollution Control Act. The Land Use Plan addresses erosion control by implementing the following conditions and policies within the plan (Cape Fear COG, 2015):

- While the causes of erosion - the ocean's wind and waves - cannot be stopped, the effects of these processes can be mitigated or corrected.
- The most effective corrective measures and mitigation methods are those which are ecologically sound, and economically feasible.
- The best method of correcting erosion damage (consistent with the policy stated immediately above) is through re-nourishment of the berm and dune system.
- The best methods of mitigating and preventing damage from erosion are land use controls and dune protection and maintenance.
- The beach is a resource of statewide significance and the value of a healthy productive dune system extends to users throughout the region and state.
- Because of the uncertain and conflicting policies at the state and federal levels for assistance to local governments in protecting the dune and berm system, every effort must be made at the local level to generate funds for corrective and mitigating measures.

6.2.2.4 Stormwater Management

Chapter 16 of the Topsail Beach Code of Ordinances is the Land Development Ordinance which addresses stormwater runoff in that it requires any land activity that disturbs more than one acre of land to obtain a NCDWR water quality major development permit and must comply with the NCDWR permit requirements (Topsail Beach, 2012).

One of the key issues discussed throughout the Land Use Plan is stormwater runoff. Topsail Beach desires to manage stormwater runoff to reduce non-point source pollution of adjacent water bodies. They plan to employ innovative policies such as a stormwater management program. Topsail Beach will implement various methods it considers appropriate to reduce runoff (Cape Fear COG, 2015). The following are examples provided that could be used to minimize runoff in single family construction:

- Use of pervious or semi-pervious materials, such as pebbles, “turf stone”, for driveways and walks.
- Retaining natural vegetation along marsh and waterfront areas.

They have developed stormwater policies in their Land Use Plan which outlines their coordination with the NCDOT to ensure proper stormwater runoff. The following coordination has been outlined:

- It is the policy of the Town of Topsail Beach to create and to implement a systematic and comprehensive construction and maintenance plan for municipal stormwater runoff. NCDOT system drains located within the Town of Topsail Beach will be monitored by the municipality for service as necessary and recommendations on service needs and requirements will be shared with NCDOT.
- The Town of Topsail Beach will allow municipal public right-of-ways and easements to be used for the purpose of correcting stormwater runoff problems. The NCDOT will also be allowed to use these right-of-ways for the correction of stormwater runoff problems.
- It is the continuing policy of the Town of Topsail Beach to seek drainage improvements to state system roads in Topsail Beach, and to construct drainage improvements to municipal streets in Topsail Beach.
- It is the policy of Topsail Beach that new construction will minimize stormwater impact for established residents, and the Town will support all efforts to minimize surface water pollution from wastewater sources.
- It is the policy of Topsail Beach to implement stormwater control systems and mechanisms to reduce the threat of stormwater runoff to Topsail Sound.

6.2.2.5 Coastal Area Management Act Core Land Use Plan

As mentioned above, Topsail Beach adopted a CAMA Core Land Use Plan in 2015. The primary concerns of Topsail Beach, as indicated in the plan, are “protection of our environment, preserving our family beach character and maintaining our existing resources.” Topsail Beach does not have many of the typical growth concerns that face other towns due to the physical configuration of the island with very little land that has not been platted into individual lots or developed. The Land Use Plan outlines several key management topics and outlines the planning assets in place for each. To ensure that public infrastructure systems protect or restore quality of AECs, Topsail Beach has buffers, open space and protection regulations enforced for these areas. For the conservation of the protective functions of barrier dunes, beaches, flood plains and other coastal features, Topsail Beach employs use of dune protection regulations, is a NFIP participant and has a Flood Protection Ordinance. For the maintenance, protection and restoration of coastal waters, Topsail Beach is developing a comprehensive stormwater management program (Cape Fear COG, 2015).

Topsail Beach has also developed Environmental Classes within their Land Use Plan. The Classes indicated include Class I, Class II and Class III. Class I is characterized by land containing only minimal hazards and having only slight limitations. Class II is characterized by land containing developmental hazards and limitations that may be addressed by methods such as restriction on type of land use, special site planning, or provision of public services. Class III is characterized by land containing serious hazards for development or lands where the impacts of development would cause serious damage to the values of natural systems. These lands provide for extremely limited development opportunity. A map from the Land Use Plan which is a composite map of environmental conditions can be found in Appendix G (Cape Fear COG, 2015).

Topsail Beach's Land Use Plan also indicates that one of their primary concerns is the protection of the environment through recognizing the importance of the island's environmental resources. Topsail Beach has developed specific regulations in their Code of Ordinance that addressees Maritime Forest protection and the designation of Conservation Areas (Cape Fear COG, 2015). Within Division 6 of the Code of Ordinance, Topsail Beach has created a Zoning Overlay District known as the Maritime Forest Overlay District which was developed to protect the remaining maritime forests located within town whereby any development within this district should be designed to cause the least practical disruption to maritime forest cover (Topsail Beach, 2015a).

It is estimated that Topsail Beach only has approximately 55 acres of undeveloped land. The Future Land Use Map shows a portion of land use as Residential with some Business/Commercial areas. A significant amount of land is designated as Conservation with Limited Residential and Conservation. The Existing and Future Land Use Map from the Land Use Plan can be found in Appendix G (Cape Fear COG, 2015).

Finally, the Town is working with the USACE to establish a beach re-nourishment program (Cape Fear COG, 2015).

6.2.2.6 Water Shortage Response Plan

The Town of Topsail Beach has a WSRP. The purpose of the plan is to declare official phases of water supply shortage and voluntary and mandatory conservation measures for those phases along with enforcement measures for each.

The WSRP includes five phases of water conservation:

- Voluntary Reductions – customer education and outreach programs will be utilized to encourage water conservation and efficiency measures; the goal for water reduction is 5 percent.
- Mandatory Reduction I – irrigation will be limited to a half inch per week and outdoor use of drinking water for washing impervious surfaces is prohibited; the goal for water reduction is 10 percent.
- Mandatory Reductions II – customers must continue actions from all previous stages and all non-essential uses of drinking water are banned; the goal for water reduction is 20 percent.
- Emergency Reductions – customers must continue actions from all previous stages and must further reduce their water use by 25 percent compared to their previous month's water bill.
- Water Rationing – all customers are only permitted to use water at the minimum required for public health protection.

The enforcement for each phase are outlined in Exhibit 6-4 (Topsail Beach, 2010).

EXHIBIT 6-4
Topsail Beach WSRP Enforcement

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A
Mandatory Reductions (I and II)	Warning	$250	Discontinuation of Service

Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

6.2.2.7 Water Conservation

In order to be good stewards of their water, Topsail Beach adopted the following watering schedule in August 2015 to promote water conservation:

- Property owners North of Davis Ave can irrigate during the hours of 2 A.M. and 4 A.M. on Monday, Wednesday and Friday only.
- Property owners South of Davis Ave can irrigate during the hours of 2 A.M. and 4 A.M. on Tuesday, Thursday and Saturday only.

All in-ground irrigation systems using Town water must have rainfall cut off sensors installed, or must be manually shut off to prevent watering during active rainfall within any assigned irrigation time and day.

Manual Watering with Town water for owners without in-ground irrigation systems is restricted to two (2) hours per day using the same addressing system described above. Any manual watering must take place between the hours of 5 A.M. and 10 A.M. during these assigned days (Topsail Beach, 2015b).

6.2.2.8 Wellhead Protection Plan

Topsail Beach has a Wellhead Protection Plan that was approved in April 2007. The Wellhead Protection Plan allows Topsail Beach to take charge of protecting the quality of their drinking water by identifying and carefully managing areas that supply groundwater to their public wells. Topsail Beach owns and operates four groundwater wells. A Wellhead Protection Area (WHPA) has been delineated for each of these wells using the aquifer-source volume method with a ten-year time of travel utilized. All four wells are located north along NC Highway 50. The WHPAs span from the intersection of Empie Avenue approximately a half of a mile north with a gap of approximately a half of a mile and continues approximately one and a half miles north along NC Highway 50. Topsail Beach indicated potential contaminant sources within the WHPAs, such as swimming pools and abandoned wells, in order to understand and mitigate the risks of contamination to these sensitive areas. The plan outlines management strategies for the WHPAs which includes public education as well as an emergency contingency plan (Topsail Beach, 2007).

6.2.2.9 Rate Structures

Topsail Beach has an increasing block rate structure. Topsail Beach bills a facility charge for no usage and an increasing rate per 1,000 gallons is billed for each block of usage (i.e., from 1-3,333 gallons) in order to encourage water conservation. The current increasing block rate structure is outlined below in Exhibit 6-5. A review of the UNC EFC NC water and wastewater rates dashboard shows that Topsail Beach's water bills are more than double that of the median statewide water bill at 1,000 gallons ($16.44 (statewide median) vs. $35.00 (Topsail Beach) (UNC, 2016). In addition, Topsail Beach's water rates are also relatively high on the conservation signal measure; almost $1.00 more per 1,000 gallons for high usage compared to the Statewide median.

EXHIBIT 6-5
Topsail Beach Water Rates

Town	Facility Charge (0 gal)	Usage Rate per 1,000 gal 1 – 3,333 gal	Usage Rate per 1,000 gal 3,334 – 10,000 gal	Usage Rate per 1,000 gal 10,001 – 20,000 gal	Usage Rate per 1,000 gal Above 20,000
Topsail Beach	$30.00	$5.00	$5.25	$5.50	$5.75

6.2.3 Town of Surf City

6.2.3.1 Floodplain Protection

Chapter 8 of the Town of Surf City's Code of Ordinances includes a Flood Damage Prevention Ordinance that meets FEMA requirements. The NFIP is available to Surf City (Surf City, 2015a).

6.2.3.2 Erosion and Sediment Control

All new development must demonstrate compliance with the North Carolina Sedimentation Pollution Control Act.

6.2.3.3 Stormwater Management

One of the key issues as indicated in the Surf City Land Use Plan is stormwater runoff. Out of an extensive list of key issues, Surf City rated the issues and determined a priority for each. Stormwater runoff ranks number two on the list of priorities. The Land Use Plan states that "our vital heritage of a strong connection with the waters in and around the island has been greatly improved through a filtered drainage system for stormwater runoff. Our water quality is excellent. Surf City always considers the implications of development projects to the environment prior to ordinance modification or the granting of subdivision approval" (Cape Fear Council of Government (COG), 2005).

It is the policy of Surf City to promote the best available management practices to minimize the threat of pollution from stormwater runoff. The Land Use Plan indicates that the town's development ordinances for zoning and subdivisions require site plan reviews. Examples of practices that are reviewed in these plans include using pervious or semi-pervious materials for driveways and walks, retaining natural vegetation along marsh and waterfront areas to retain its filtering properties, and allowing stormwater to percolate into the ground rather than discharging it directly to coastal waters. Other examples include stormwater detention ponds which can also reduce the direct discharge of pollutants to coastal waters. Although Surf City does not currently have a stormwater management ordinance, their Land Use Plan indicates that they plan to develop this within the next planning period (Cape Fear COG, 2005).

6.2.3.4 Land Use Plan

The Land Use Plan developed by Surf City and adopted in 2005 is "a plan, which will establish long-range general policies for the physical development of the community. With a plan, decisions can be made in a coordinated and unified manner. The Land Use Plan Update will provide the Town of Surf City with this sort of an instrument. The plan can be continually referred to as an important source for decisions on those development issues which arise on a regular basis" (Cape Fear COG, 2005). The Land Use Plan was certified by the North Carolina Coastal Resources Commission in June 2006; therefore, the Division of Coastal Management uses the plan in making CAMA permit decision.

Surf City has developed Environmental Classes within their Land Use Plan. The Classes indicated include Class I, Class II and Class III. Class I is characterized by land containing only minimal hazards and having only slight limitations. Class II is characterized by land containing developmental hazards and limitations that may be addressed by methods such as restriction on type of land use, special site planning, or provision of public services. Class III is characterized by land containing serious hazards for development or lands where the impacts of development would cause serious damage to the values of natural systems. A map from the Land Use Plan which is a composite map of environmental conditions can be found in Appendix G (Cape Fear COG, 2005).

Contained within the Land Use Compatibility Goal and Policies is the goal of Surf City to maintain maritime forests. Surf City has developed specific regulations in their Code of Ordinance that addresses maritime forest as well as estuarine waters and coastal wetlands protection. Within Appendix A of the Code of Ordinance, Surf City has created a Zoning Overlay District known as the Coastal Forest Overlay District which was developed to protect the remaining maritime forests and natural vegetation located in the most vulnerable natural areas. Also within Appendix A, the Conservation District is established "to give the highest priority to the protection and management of estuarine waters and coastal wetlands so as to safeguard and perpetuate their biological, social, aesthetic, and economic values. Suitable land and water uses shall be those consistent with the above objective" (Surf City, 2015b).

6.2.3.5 Water Shortage Response Plan

The Town of Surf City has a WSRP. The purpose of the plan is to declare official phases of water supply shortage and voluntary and mandatory conservation measures for those phases along with enforcement measures for each.

The WSRP includes five phases of water conservation:

- Voluntary Reductions – customer education and outreach programs will be utilized to encourage water conservation and efficiency measures with an extensive list of efficiency measures included in the WSRP; the goal for water reduction is 5 percent.
- Mandatory Reduction I – irrigation will be limited to a half inch per week and outdoor use of drinking water for washing impervious surfaces is prohibited; the goal for water reduction is 10 percent.
- Mandatory Reductions II – customers must continue actions from all previous stages and all non-essential uses of drinking water are banned; the goal for water reduction is 20 percent.
- Emergency Reductions – customers must continue actions from all previous stages and must further reduce their water use by 25 percent compared to their previous month's water bill.
- Water Rationing – all customers are only permitted to use water at the minimum required for public health protection.

The enforcement for each phase are outlined in Exhibit 6-6 (Surf City, 2010).

EXHIBIT 6-6
Surf City WSRP Enforcement

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A

Mandatory Reductions (I and II)	Warning	$250	Discontinuation of Service
Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

6.2.3.6 Water Conservation

Surf City encourages its residents towards water conservation and has led by example through the installation of rain barrels at the Town Hall. They desire to be an example for their residents on how rainwater can be used for watering their landscape. On their website, Surf City offers extensive information related to water conservation. A “Smart Irrigation” newsletter and “Watering Can Be Efficient” brochure that were created by the EPA, and are linked on their website, can be found in Appendix G.

6.2.3.7 Rate Structures

In order to further encourage water conservation, Surf City has an increasing block rate structure. Surf City bills a base charge for up to 2,000 gallons of usage and an increasing rate per 1,000 gallons is billed for each block of usage (i.e., from 2,001-5,000 gallons). The increasing rate structure is only for residential customers. The increasing block rate structure is outlined in Exhibit 6-7 (Surf City, 2015c). A review of the UNC EFC NC water and wastewater rates dashboard shows that Surf City’s water bills are greater than the median statewide water bill at 1,000 gallons ($16.44 (statewide median) vs. $23.45 (Surf City) (UNC, 2016).

EXHIBIT 6-7
Surf City Water Rates

User Type	Base Charge (2,000 gal)	Usage Rate per 1,000 gal 2,001 – 5,000 gal	Usage Rate per 1,000 gal >5,001 gal
Residential	$23.46	$3.32	$3.69
Commercial	$23.86	$3.69	$3.69
Irrigation	$23.46	$3.69	$3.69

Effective July 1, 2015

6.2.4 Town of Burgaw

6.2.4.1 Riparian Buffers

A goal within the Burgaw Land Use Plan is to “develop appropriate riparian buffer requirements to enhance the environmental function of streams and creeks”. Although no riparian buffer requirements have been developed at this time, Burgaw has made this a priority in their planning efforts related to environmental protection (Burgaw, 2013).

6.2.4.2 Floodplain Protection

Article 8 of the Burgaw’s UDO is the Flood Damage Prevention Ordinance that meets FEMA requirements. Burgaw has designed the provision to do the following:

- Restrict or prohibit uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion, flood heights, or velocities;
- Require that uses vulnerable to floods be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging, and all other development that may increase erosion of flood damage; and
- Prevent or regulate the construction of flood barriers that will unnaturally divert flood waters or that may increase flood hazards to other lands (Burgaw, 2000).

Burgaw understands the importance of floodplains and provides information on their website dedicated to understanding their importance. The following is the explanation Burgaw provides to its citizens; "Floodplains are a natural component of the environment. Understanding and protecting the natural functions of floodplains helps reduce flood damage and protect resources. When flooding spreads out across the floodplain, its energy is dissipated, which results in lower flood flows downstream, reduce erosion of earthen stream banks and channel bottoms, deposition of sediments higher in the watershed, and improved groundwater surcharge. Floodplains are scenic, valued wildlife habitat. Poorly planned development in floodplains can lead to increased erosion, loss of valuable property, increased flooding to downstream properties, and degradation of water quality." They include helpful links on their website including the Town of Burgaw Flood Map, National Flood Insurance Program, and NC Floodplain Mapping Program (Burgaw, 2016a)

6.2.4.3 Erosion and Sediment Control

The Town of Burgaw has developed a UDO that outlines requirements for Erosion and Sedimentation Control in relation to different zoning types. For development within the Office & Institutional (O&I) and Business districts (B-1 & B-2), an erosion and sedimentation control plan is required. An erosion and sedimentation control plan is also required for residential development. The UDO also references compliance with the North Carolina Sedimentation Pollution Control Act (Burgaw, 2000).

6.2.4.4 Stormwater Management

The Town of Burgaw has developed a Stormwater Discharge Control Ordinance which is Article 13 of the UDO. The purpose of this article is to "protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse effects of increased stormwater associated with future land development within the Town of Burgaw." The Stormwater Discharge Control Ordinance requires that a preliminary stormwater discharge control plan be submitted to Burgaw for review for each development to determine if stormwater discharge control facilities will be needed to control runoff from the proposed development. A final plan is to be submitted with the construction plans once the preliminary plans are approved (Burgaw, 2000).

Burgaw has also developed a Stormwater Management Technical Manual which includes the design of facilities for stormwater discharge control measures that limit 10-year developed peak discharge rates to existing peak discharge rates. The minimum stormwater control requirements must utilize control measures necessary to regulate velocities of flow from stormwater discharge control facilities to a level which will comply with both the North Carolina Soil Erosion Act and North Carolina Administrative Code Section 15A NCAC 2H.1000, Stormwater Management (Burgaw, 2000).

6.2.4.5 Land Use Plan

The Town of Burgaw completed a Land Use Plan in June 2013. The purpose of the plan is for "the town to educate itself about its existing conditions, to elucidate its vision for the community, and to provide a forum for all citizens to become engaged in the future of the town." The document is intended to be the map for the Town's endeavors over the next decade, in order to achieve the vision of Burgaw 2030 (Burgaw, 2013).

A primary goal of Burgaw for Land Use as indicated in the Land Use Plan is to institute regulations that protect and acknowledge the topographical and hydrological features that exist. The policies and actions to ensure this goal is met are as follows:

Policies

- Promote the set-aside of environmentally sensitive areas, including riparian buffers and stream corridors, wetlands, and floodplains, within new developments
- Consider floodplain and wetland information when making infrastructure, rezoning, and development regulation decisions
- Avoid the placement of infrastructure that may encourage future development in the floodway
- Encourage the provision of on-site stormwater systems that mimic natural systems like rain gardens and constructed wetlands

Actions

- Identify areas containing sensitive and/or unique natural resources and open space and prioritize such areas for conservation and preservation
- Require the stabilization of soils as quickly as possible during and after construction and encourage the use of native seed mixes for soil stabilization and erosion control
- Clarify the function of the Conservation/Preservation overlay zoning district and update regulations regarding development in C/P zones Update flood regulations and encourage best management practices to mitigate flood hazards
- Limit the density and intensity of development in the floodway and 100- year floodplain

The primary goals related to Environmental Protection within the plan include:

- To reduce waste and energy consumption in such a way as to minimize local and regional environmental impacts.
- To protect and improve the town's air, land, and water resources.
- To protect the integrity of wetlands and wildlife habitats.
- To preserve and enhance the town's tree canopy.

Burgaw has a current C/P zoning district, and designates land use for Recreation and Open Space (Burgaw, 2013). The existing zoning map and future land use map can be found in Appendix G**.**

6.2.4.6 Water Shortage Response Plan

The Town of Burgaw has a WSRP. The purpose of the plan is to declare official phases of water supply shortage and voluntary and mandatory conservation measures for those phases along with enforcement measures for each.

The WSRP includes five phases of water conservation:

- Voluntary Reductions – customer education and outreach programs will be utilized to encourage water conservation and efficiency measures; the goal for water reduction is 5 percent.
- Mandatory Reduction I – irrigation will be limited to a half inch per week and outdoor use of drinking water for washing impervious surfaces is prohibited; the goal for water reduction is 10 percent.
- Mandatory Reductions II – customers must continue actions from all previous stages and all non-essential uses of drinking water are banned; the goal for water reduction is 20 percent.
- Emergency Reductions – customers must continue actions from all previous stages and must further reduce their water use by 25 percent compared to their previous month's water bill.
- Water Rationing – all customers are only permitted to use water at the minimum required for public health protection.

The enforcement for each phase is outlined in Exhibit 6-8 (Burgaw, 2010).

EXHIBIT 6-8
Burgaw WSRP Enforcement

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A
Mandatory Reductions (I and II)	Warning	$250	Discontinuation of Service
Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

6.2.4.7 Wellhead Protection Plan

The Town of Burgaw has a Wellhead Protection Plan that was approved in December, 1999. The Wellhead Protection Plan allows Burgaw to take charge of protecting the quality of their drinking water by identifying and carefully managing areas that supply groundwater to their public wells. Burgaw owns and operates four groundwater wells. A WHPA has been delineated for each of these wells using the "Calculated Fixed Radius" method. The four wells are located throughout Town, and WHPAs encompass a large majority of the Town. A map of the WHPA can be found in Appendix G. Burgaw indicated potential contaminant sources within the WHPAs such as gas stations, auto shops, and car washes, in order to understand and mitigate the risks of contamination to these sensitive areas. The plan outlines management strategies for the WHPAs which includes public education as well as an emergency contingency plan (Burgaw, 1999).

6.2.4.8 Water Conservation

Burgaw encourages its residents towards water conservation and has included information on their website for their customers to learn about water efficiency related to water usage and water meters. The information on their website encourages customers to replace old fixtures and to conduct home audits in order to find leaks. Burgaw also provides information related to indoor consumption of conventional fixtures versus water saving devices (Burgaw, 2016b and 2016c).

6.2.4.9 Rate Structures

In order to further encourage water conservation, Burgaw has an increasing block rate structure. Burgaw bills a base charge for up to 2,000 gallons of usage and an increasing rate per 1,000 gallons is billed for each block of usage (i.e., from 2,001-3,000 gallons). The increasing block rate structure is outlined in Exhibit 6-9. Burgaw's water rates are high on the conservation signal measure; a little less than $1.00 more per 1,000 gallons for inside city limits and $5.00 more per 1,000 gallons for outside city limits for high usage compared to the Statewide median.

EXHIBIT 6-9
Burgaw Water Rates

Location	Base Charge (2,000 gal)	Usage Rate per 1,000 gal 2,001 – 3,000 gal	Usage Rate per 1,000 gal 3,001 – 9,000 gal	Usage Rate per 1,000 gal 9,001 – 20,000 gal	Usage Rate per 1,000 gal >20,001 gal
Inside City Limits	$9.26	$4.63	$4.93	$5.07	$5.22
Outside City Limits	$18.54	$9.27	$9.87	$10.15	$10.44

Effective July 1, 2015

6.2.5 Town of Wallace

6.2.5.1 Riparian Buffers

The Town of Wallace's UDO outlines priority tree retention areas and riparian buffers are included in the tree protection zone; therefore, a certain percent of trees and vegetation must be retained during development. The Tree Protection Standards are included as Section 6.2 of the UDO and are implemented to "protect and promote the public health, safety, and general welfare by requiring the preservation, maintenance, and protection of the tree coverage area" (Wallace, 2013).

6.2.5.2 Floodplain Protection

The Town of Wallace's UDO includes a Flood Damage Prevention Ordinance within Chapter 4 in accordance with FEMA requirements. The NFIP is available to Wallace (Wallace, 2013).

6.2.5.3 Erosion and Sediment Control & Stormwater Management

The Town of Wallace has a Stormwater Ordinance included in their UDO as Section 6.20. The policy requires that "all new developed land, which results in greater than 30 percent impervious area or greater than 15,000 square feet of impervious area, and redeveloped land which results in additional impervious area resulting in greater than 30 percent within its jurisdiction have sufficient stormwater management controls in place so as to ensure the adequate protection of life and property." The ordinance requires that stormwater controls are provided that are capable of managing after-development runoff from a ten-year storm, in order that the on-site effects of development are the same or better than the predevelopment state. The ordinance was developed to be consistent with the State of North Carolina rules and regulations, but where conflicts occur the more stringent or higher requirement will govern. An objective of the ordinance is to reduce erosion associated with stormwater runoff. The purpose of the ordinance is "to protect and promote the public health, safety and general welfare, and to safeguard the natural and manmade resources of the town by regulating stormwater runoff." The ordinance includes information related to policies, development, assessments for region projects, right of entry, enforcements and appeals, illicit discharges and improper disposal, and industrial and related activities (Wallace, 2013).

6.2.5.4 Land Use Plan

The Town of Wallace's Land Use Plan was developed because planning indicates that a municipality has determined that change is occurring, and a course of action must be developed to direct the way in which it desires to grow (Wallace, 2011).

One way the Town of Wallace guides this development is by applying a historic preservation ordinance as an overlay to the National Register Historic District that currently exists in the downtown area. The regulations of this ordinance are in place to ensure that redevelopment activities or the rehabilitation of historic structures are carried out in a manner that will contribute to the historic nature of the downtown core (Wallace, 2011).

The Town of Wallace also developed a Revitalization Plan in 2012. There are two existing areas in need of revitalization including the downtown Commercial Historic District as well as the Highway 117 corridor which has three large deteriorating shopping centers which are mostly vacant. The Town Board, the Wallace Committee of 100, the Wallace Chamber of Commerce and the Wallace Revitalization Association are aware of the need to improve both these areas if the town is to attract new residents, industry and retail businesses (Eastern Carolina Council, 2012).

A goal within the Land Use Plan is to ensure that future development is respectful to the natural environment. The policies and actions outlined to meet this goal include the following:

- Encourage the use of conservation or cluster subdivision design guidelines to preserve open space and protect water quality.
- Limit the percentage of allowed impervious surface for new nonresidential development.
- Follow a growth strategy that encourages compact growth and discourages the premature conversion of open space.
- Work with land owners to identify opportunities other than development, such as conservation easements, for their land.
- Continue to improve the municipal storm water system, and seek funding for remedying existing problems.
- Develop regulations to prevent the establishment of polluting industries in the Town's jurisdiction.
- Work with state and agencies and nonprofits to acquire easements or fee simple ownership of environmentally sensitive land (Wallace, 2011).

One way the Town of Wallace currently preserves open space is through their Open Space Ordinance included as Section 6.13 in their UDO. The intent of this ordinance is to "protect and promote the public health, safety, and general welfare by requiring the dedication of a portion of land for the purpose of preserving open space and the protection of significant natural features and/or cultural resources." The ordinance identifies permitted and prohibited uses within open space and outlines land characteristics related to open space (Wallace, 2013).

Although the existing zoning does not include any conservation classifications, the Future Land Use outlines an area called the Southeastern Rural Preservation Area. The area is currently primarily agricultural while the southern portion of the area remains mostly in a natural, forested state. The goals for the future are as follows:

- Work with land owners to develop strategies to preserve and protect farmland and open space in the area.
- Apply development regulations in the area that will prevent any dense residential development or other inappropriate uses from locating here as long as intensive agricultural uses remain in operation.
- Explore the possibility of establishing a regional nature park in the southern portion of the area along Rockfish Creek with assistance from the Clean Water Management Trust Fund and other State and local entities and nonprofits (Wallace, 2011).

Also outlined in Future Land Uses is the Northwestern Rural Transition Area. The recommendations for this area include to encourage the preservation of natural areas and to encourage the use of conservation subdivisions in the area to lessen the environmental impacts of new development (Wallace, 2011). The UDO outlines that a conservation subdivision is "a subdivision containing 20 or more lots in which the individual building lot size is reduced and common open space area equal to or greater than the reduction of individual lot sizes is provided. The provided open space must protect irreplaceable natural features" (Wallace, 2013). The existing zoning map can be found in Appendix G.

6.2.5.5 Water Shortage Response Plan

The Town of Wallace has a WSRP. The purpose of the plan is to declare official phases of water supply shortage and voluntary and mandatory conservation measures for those phases along with enforcement measures for each.

The WSRP includes five phases of water conservation:

- Voluntary Reductions – customer education and outreach programs will be utilized to encourage water conservation and efficiency measures; the goal for water reduction is 5 percent.
- Mandatory Reduction I – irrigation will be limited to a half inch per week and outdoor use of drinking water for washing impervious surfaces is prohibited; the goal for water reduction is 10 percent.
- Mandatory Reductions II – customers must continue actions from all previous stages and all non-essential uses of drinking water are banned; the goal for water reduction is 20 percent.
- Emergency Reductions – customers must continue actions from all previous stages and must further reduce their water use by 25 percent compared to their previous month's water bill.
- Water Rationing – all customers are only permitted to use water at the minimum required for public health protection.

The enforcement for each phase are outlined in Exhibit 6-10 (Wallace, 2010).

EXHIBIT 6-10
Wallace WSRP Enforcement

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A
Mandatory Reductions (I and II)	Warning	$250	Discontinuation of Service
Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

6.2.5.6 Wellhead Protection Plan

The Town of Wallace has a Wellhead Protection Plan that was approved in August, 2015. The Wellhead Protection Plan allows Wallace to take charge of protecting the quality of their drinking water by identifying and carefully managing areas that supply groundwater to their public wells. Wallace owns and operates nine groundwater wells. A WHPA has been delineated for each of these wells using the aquifer-source volume method with a ten-year time of travel utilized. There are five wells that form a cluster of radii centered in Wallace so there is one larger WHPA that encompasses these wells. The three remaining wells have their own individual WHPA. The breakdown of land within the WHPAs is as follows: approximately 32 percent residential, 26 percent agricultural, 20 percent local businesses, 13 percent forested, and 9 percent right-of-way. A map of the WHPA can be found in Appendix G. The map also indicates potential contaminant sources within the WHPAs, including auto repair shops, laundromats, and dry cleaners, in order to understand and mitigate the risks of contamination to these sensitive areas. The plan outlines management strategies for the WHPAs which includes public education as well as an emergency contingency plan (Wallace, 2015).

6.2.5.7 Rate Structures

The Town of Wallace has a flat rate structures, meaning that the price per gallon of water is fixed regardless of how much water is used. The base charge is higher than some other neighboring utilities.

EXHIBIT 6-11
Wallace Water Rates

Meter Size	Base Charge	Usage Rate per 1,000 gal
¾-inch	$13.00	$2.13
1-inch	$37.00	$1.75
1 ½-inch	$73.00	$1.75
2-inch	$116.00	$1.75
3-inch	$235.00	$1.75
4-inch	$364.00	$1.75
6-inch	$727.00	$1.75
8-inch	$1,313.00	$1.75

Effective July 1, 2016

6.2.6 Summary of Local Government Programs

Exhibit 6-12 summarizes the local government programs in the service area.

EXHIBIT 6-12
Summary of Local Government Programs

Local Government	Riparian Buffers	Floodplain[1]	ESC	Stormwater[2]	WHPP[3]	Conservation Rates or Rate Structure[4]
Pender County	X	(X)	X	WS	N/A	Yes
Town of Topsail Beach		(X)	X	X	X	Yes
Town of Surf City		(X)	X	X		Yes
Town of Burgaw		(X)	X	X	X	Yes
Town of Wallace		(X)	X	X	X	No

[1] X = Local government has floodplain ordinance | (X) = Community is NFIP

[2] X = Local government has stormwater ordinance | WS = LGU limits built-upon area in water supply watersheds

[3] Wellhead Protection Plan

[4] Rates that send a conservation signal (rates high enough to effect consumption) or a conservation rate structure (such as inclining blocks).

SECTION 7

7 References

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APPENDIX A

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Resolution in Support of Pender County Utilities Long Range Water Supply Planning and Proposed Interbasin Transfer Permit Petition to the North Carolina Environmental Management Commission

WHEREAS, the Lower Cape Fear Water and Sewer Authority is located within the Cape Fear River watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase agreement of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a 6 MGD water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County Utilities has invested in a forward-thinking, long range water supply planning and investment effort to meet the needs of its growing customer base for decades to come; and

WHEREAS, Pender County lies within the Cape Fear River watershed, but is subject to Interbasin Transfer rules based on smaller sub-basin delineations within Pender County and is engaging in the pursuit of an Interbasin Transfer Certificate; and

WHEREAS, the Lower Cape Fear Water and Sewer Authority appreciates Pender County Utilities' efforts to involve its neighboring utilities and stakeholders in its long range planning:

NOW THEREFORE BE IT RESOLVED, that the Chairman and the Board of Directors for the Lower Cape Fear Water and Sewer Authority hereby support the Pender County Utilities Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process and the associated effort to work with the NC Department of Environmental Quality as an efficient means to meet the projected water demands of Pender County.

Adopted this 8th day of February, 2016.

Bill Saffo

Bill Saffo, Chairman

ATTEST:

Larry Sneeden, Secretary

RESOLUTION

Co-applicant With Pender County Utilities Long Range Water Supply Planning
And Proposed Interbasin Transfer Certificate

WHEREAS, the Town of Wallace is located within the Cape Fear River Basin watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County lies within the Cape Fear River watershed but is subject to interbasin transfer rules based on smaller subbasin delineations given conveyance of potable water supply from its water treatment plant to customers across the county; and

WHEREAS, Pender County Utilities is making every effort to involve its neighboring utilities and stakeholders in its long range planning; and

WHEREAS, the Town of Wallace also has growing water supply needs for its customers; and

WHEREAS, the Town of Wallace may be able to reliably meet these water supply needs by purchasing surface water from Pender County Utilities in the future:

NOW, THEREFORE BE IT RESOLVED that the Wallace Town Council, Wallace, NC: accepts Pender County Utilities offer to participate in the Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process as a co-applicant in the interbasin transfer petition and will support Pender County Utilities in their efforts by providing necessary data and support throughout the interbasin certificate process.

Adopted this 11 day of February, 2016.

Charles C. Farrior, Jr.

Charles C. Farrior, Jr., Mayor

Jacqueline Nicholson

Jacqueline Nicholson, Town Clerk

TOWN OF BURGAW - RESOLUTION 2016-06
CO-APPLICANT WITH PENDER COUNTY UTILITIES
LONG RANGE WATER SUPPLY PLANNING AND PROPOSED INTERBASIN TRANSFER CERTIFICATE

WHEREAS, the Town of Burgaw is located within the Cape Fear River watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase agreement of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County lies within the Cape Fear River watershed but is subject to interbasin transfer rules based on smaller subbasin delineations given conveyance of potable water supply from its water treatment plant to customers across the county; and

WHEREAS, Pender County Utilities is making every effort to involve its neighboring utilities and stakeholders in its long range planning; and

WHEREAS, the Town of Burgaw also has growing water supply needs for its customers; and

WHEREAS, the Town of Burgaw may be able to reliably meet these water supply needs by purchasing surface water from Pender County Utilities in the future:

WHEREAS, the Town of Burgaw is under no financial obligation as part of this co-application process; and

WHEREAS, the Town of Burgaw is not obligated or implying a commitment to purchase water from Pender County Utilities in the event that the IBT certificate is granted by the State of North Carolina.

NOW THEREFORE, the Town of Burgaw Board of Commissioners resolves that:

> *The Town of Burgaw Board of Commissioners accepts Pender County Utilities' offer to participate in the Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process as a co-applicant in the interbasin transfer petition and will support Pender County Utilities in their efforts by providing the necessary data and support throughout the interbasin transfer certificate process.*

Adopted this eighth day of March, 2016.

Eugene Mulligan, Mayor

Attest:
Sylvia W. Raynor, Town Clerk

SURF CITY

NORTH CAROLINA

RESOLUTION No. 2016-10

Co-applicant with Pender County Utilities
Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate

WHEREAS, the Surf City Town Council is located within the Cape Fear River watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase agreement of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County lies within the Cape Fear River watershed but is subject to interbasin transfer rules based on smaller subbasin delineations given conveyance of potable water supply from its water treatment plant to customers across the county; and

WHEREAS, Pender County Utilities is making every effort to involve its neighboring utilities and stakeholders in its long range planning; and

WHEREAS, the Town Council also has growing water supply needs for its customers; and

WHEREAS, the Town Council may be able to reliably meet these water supply needs by purchasing surface water from Pender County Utilities in the future:

NOW THEREFORE, the Surf City Town Council resolves that:

The Surf City Town Council accepts Pender County Utilities' offer to participate in the Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process as a co-applicant in the interbasin transfer petition and will support Pender County Utilities in their efforts by providing the necessary data and support throughout the interbasin transfer certificate process.

This Resolution adopted this 1st day of March, 2016.

A.D. (Zander) Guy Jr., Mayor

Attest: SEHobbs
Stephanie Edwards Hobbs, Town Clerk

PO Box 2475
Surf City, NC 28445

Phone: (910) 328-4131
Fax: (910) 328-1746

TOWN OF TOPSAIL BEACH NORTH CAROLINA

INCORPORATED 1963

RESOLUTION NO. 1-2-10a-16

CO-APPLICANT WITH PENDER COUNTY UTILITIES LONG RANGE WATER SUPPLY PLANNING AND PROPOSED INTERBASIN TRANSFER CERTIFICATE

WHEREAS, the Town of Topsail Beach is located within the Cape Fear River watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase agreement of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County lies within the Cape Fear River watershed but is subject to interbasin transfer rules based on smaller subbasin delineations given conveyance of potable water supply from its water treatment plant to customers across the county; and

WHEREAS, Pender County Utilities is making every effort to involve its neighboring utilities and stakeholders in its long range planning; and

WHEREAS, the Town of Topsail Beach also has growing water supply needs for its customers; and

WHEREAS, the Town of Topsail Beach may be able to reliably meet these water supply needs by purchasing surface water from Pender County Utilities in the future:

NOW THEREFORE, the Board of Commissioners of Topsail Beach resolves that:
The Town of Topsail Beach accepts Pender County Utilities' offer to participate in the Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process as a co-applicant in the interbasin transfer petition and will support Pender County Utilities in their efforts by providing the necessary data and support throughout the interbasin transfer certificate process.

Adopted this the 10th day of February, 2016.

Howard M Braxton Jr. Ed.D.
Howard M. Braxton Jr., Mayor

ATTEST:

Christina Watkins
Christina Watkins, Town Clerk

Utilities, Inc.

February 9, 2016

Statement of Support
Co-applicant with Pender County Utilities
Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate

WHEREAS, Carolina Water Service, Inc. of North Carolina (CWS, Inc. of NC) owns public water systems within the Cape Fear River watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase agreement of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County lies within the Cape Fear River watershed but is subject to interbasin transfer rules based on smaller subbasin delineations given conveyance of potable water supply from its water treatment plant to customers across the county; and

WHEREAS, Pender County Utilities is making every effort to involve its neighboring utilities and stakeholders in its long range planning; and

WHEREAS, CWS, Inc. of NC also has growing water supply needs for its customers; and

WHEREAS, CWS, Inc. of NC may be able to reliably meet these water supply needs by purchasing surface water from Pender County Utilities in the future:

NOW THEREFORE, CWS, Inc. of NC resolves that:

> CWS, Inc. of NC accepts Pender County Utilities' offer to participate in the Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process as a co-applicant in the interbasin transfer petition and will support Pender County Utilities in their efforts by providing the necessary data and support throughout the interbasin transfer certificate process.

Danny Lassiter

Danny Lassiter

Regional Manager

Carolina Water Service, Inc. of NC (Utilities, Inc.)

A Utilities, Inc. company Carolina Water Service, Inc. of North Carolina

P.O. Box 240908 • Charlotte, NC 28224 • P: 704-525-7990 • F: 704-525-8174
5701 Westpark Dr., Suite 101 • Charlotte, NC 28217 • www.uiwater.com

APPENDIX B

WATER SUPPLY AGREEMENT

THIS WATER SUPPLY AGREEMENT, dated as of the 1st day of Sept., 2006, by and between the **Lower Cape Fear Water and Sewer Authority**, a public body and a body politic and corporate of the State of North Carolina (the "Authority"), and **Pender County**, a political subdivision of the State of North Carolina, (the "County");

W I T N E S S E T H :

WHEREAS, the Authority is a public body and body politic and corporate of which Bladen, Brunswick, Columbus, New Hanover and Pender Counties plus the City of Wilmington are members, each member appointing representatives to the Authority's Board of Directors; and

WHEREAS, the Authority owns and operates a raw Water System located in Bladen, Brunswick, Columbus and New Hanover Counties; and

WHEREAS, the Authority has entered into Water Supply Agreements with Brunswick County, and the City of Wilmington, plus BASF, Praxair, and Invista, industries located on US H/W 421 in New Hanover County; and

WHEREAS, the County has requested immediate raw water service from the Authority.

NOW, THEREFORE, in consideration of the premises and the mutual covenants and agreements hereinafter contained, the parties hereto agree as follows:

1. STANDARD PROVISIONS. The Authority's Standard Provisions for Water Supply Agreements (the "Standard Provisions"), a copy of which is attached hereto, shall be a part of this Water Supply Agreement and binding on the County and the Authority as if fully set out herein.

2. TERM. This Agreement shall be in full force and effect for a period of 40 years from the date of its execution and shall continue in effect beyond the initial 40 year term for successive 10-year terms unless terminated by the Authority or the County by either giving to the other written notice of termination at least one year prior to the expiration of the initial term or any extended term hereof.

3. RAW WATER SERVICE. Subject to the terms of Article IV of the Standard Provisions, the Authority will deliver raw water to the County in an amount sufficient to meet the County's raw water needs from the Authority, which currently do not exceed 6 million gallons per day (mgd). The Authority shall not treat the raw water delivered to the County or undertake any processes that will change the quality of the raw water. The Authority shall deliver raw water to the County at the Point of Delivery.

In order to provide for the public health and welfare, the Authority will strive to develop additional water capacity for the Water System before it is required to provide water to Users whose demands on the Water System require a limitation or curtailment of water service pursuant to Section 4.1. of the Standard Provisions. In the event that the Authority is required to provide water to Users whose demands on the Water System may require a limitation or curtailment of water service pursuant to Section 4.1 of the Standard Provisions, the Authority shall make plans and take necessary steps which do not constitute a violation of any laws applicable to the Authority or a violation or breach of any instrument of debt authorization adopted by the Authority, including the Bond Order, to enable the Authority to cease the limitation or curtailment of water service.

The Authority hereby gives its express written consent for the County to acquire or produce raw water from wells now owned or operated by the County.

4. LIMITATION ON COUNTY'S OBLIGATION TO PAY. The obligation of the County to pay the Water Rates of the Authority pursuant to Article III of the Standard Provisions and the Availability Charge pursuant to paragraph 7 set out below is limited to revenues received by the County from the charges to be paid by the users of the County's water and sewerage system and available to it for such purposes, including availability, connection, consumption and service charges or fees and any other revenues of such system. The County covenants and agrees to fix and collect from the users of its water and sewerage system rates and charges sufficient to make the payments required of the County under this Water Supply Agreement. The County shall not be required to pay the Water Rates or other charges of the Authority, other than the Availability Charge, until the County takes water from the Water System, if ever. The taxing power of the County is not pledged directly or indirectly to secure any payments due under this Agreement.

5. SYSTEM DEVELOPMENT CHARGE. Simultaneously with the execution of this Water Supply Agreement, the County shall pay to the Authority in lawful money of the United States of America a non-refundable System Development Charge of $935,082.00 and a Connection Charge, at cost, as provided for in the Authority's Rules and Regulations. At the County's option, it may pay the System Development Charge over 10 years in semiannual installments of $46,754.10 each, together with interest on the unpaid principal amount thereof at the rate of 5.25% per annum. If the County elects to pay in installments, the first installment will be due on or before the first day of January, 2007, with a like amount due on or before the first day of each July 1 and January 1 thereafter until the first day of July, 2016, at which time the remaining principal amount the System Development Charge plus all accrued interest shall be due and payable in full. The System Development Charge shall be payable notwithstanding that the County may be unable or unwilling to accept delivery of raw water from the Authority. The County shall not be required to pay a System Development Charge after the effective date of this Agreement unless the Authority is required to make improvements to provide the County with more than 6 mgd of raw water from the Water System.

6. RECORDS. The Authority shall in each Fiscal Year provide to the County within 30 days after the same are made available to the Authority, copies of:

a) The Authority's Annual Budget and any amendments thereto;

b) The Authority's annual audit;

c) All results of testing or calibration of the County's water meter; and

d) The reports of the consulting engineer of the Authority required by Section 2.5 of the Standard Provisions.

7. CONDITION TO COUNTY OBLIGATION. In the event the $17,500,000.00 general obligation bond issue of the County scheduled for a vote of the people on the 7th day of November, 2006 does not pass, then either party may terminate this Agreement.

8. EFFECTIVE DATE. This Water Supply Agreement shall become effective on the date first above written, subject however to the provisions of paragraph 7 hereof.

IN WITNESS WHEREOF, the parties hereto, acting by and through their duly authorized representatives pursuant to the resolutions of their respective governing bodies, have caused this Agreement to be executed as of the day and year first above written.

LOWER CAPE FEAR WATER AND SEWER AUTHORITY

By: William A. Carter
Chairman, Lower Cape Fear Water and Sewer Authority

ATTEST:

Secretary, Lower Cape Fear Water and Sewer Authority

(SEAL)

PENDER COUNTY

By:
Chairman

ATTEST:

County Clerk

(CORPORATE SEAL)

North Carolina
Division of
Environmental Health

Division of Environmental Health

Terry L. Pierce, Director

Public Water Supply Section
Jessica G. Miles, Chief

State of North Carolina
Beverly Eaves Perdue, Governor

Department of Environment and Natural Resources
Dee Freeman, Secretary

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Cape Fear River Kings Bluff Raw Water Pump Station 60 Inch Parallel Intake Pipe and Screen Project

Bladen County, North Carolina

The State Environmental Policy Act (G.S. 113A) requires that the Division of Environmental Health determine whether a proposed major agency action will significantly affect the environment. The Lower Cape Fear Water and Sewer Authority's Cape Fear River Kings Bluff Raw Water Pump Station 60-Inch Parallel Intake Pipe and Screen Project is such a major action.

In order to determine whether the construction of approximately 1,200 linear feet of 60 inch intake pipe and screen structure placed parallel with an existing 48-inch intake pipe and screen structure that consists of three 27.5 MGD wedge-wire screens with air backwash capability to clean the screens of sand and sediment will cause significant environmental impacts, an environment assessment has been prepared. This environmental assessment is attached. It contains detailed information on the key issues, including a brief description of the proposed project and a summary of probable environmental impacts with proposed mitigations. None of the impacts were found to be significant.

This project has a beneficial impact of providing raw surface water for treatment in the surrounding area in place of ground water to both municipal and industrial customers per the Lower Cape Fear Water and Sewer Authority's long term objectives as outlined in the original 1973 Environmental Assessment for the initial 48-inch pipeline.

On the basis of the analysis of the impacts as shown in the environmental assessment, no environmental impact statement (EIS) will be prepared. This FONSI completes the environmental review record. The FONSI and Environmental Assessment shall be available for inspection and comment for 30 days at the State Clearinghouse.

Summary of FONSI for publication in the Environmental Bulletin: After completion of an environmental assessment under G.S. 113A, a FONSI has been made in the case of the Lower Cape Fear Water and Sewer Authority's Cape Fear River Kings Bluff Raw Water Pump Station 60-Inch Parallel Intake Pipe and Screen Project. Information supporting the need for the proposed project was reviewed, along with relative impacts, other alternative approaches and mitigating measures.

01/20/09
Terry L. Pierce (Date)
Director, Environmental Health

1634 Mail Service Center | Raleigh, North Carolina 27699-1634
Phone (919) 733-2321 / Fax (919) 715-4374
http://ncdrinkingwater.state.nc.us/

NCDENR

North Carolina Department of Environment and Natural Resources

Division of Environmental Health

Beverly Eaves Perdue Governor	Terry L. Pierce Director	Dee Freeman Secretary

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Lower Cape Fear Water and Sewer Authority 60-inch Parallel Raw Water Distribution Transmission Main Project

Bladen/Brunswick/Pender/Columbus/New Hanover County, North Carolina

The State Environmental Policy Act (G.S. 113A) requires that the Division of Environmental Health determine whether a proposed major agency action will significantly affect the environment. The Lower Cape Fear Water and Sewer Authority 60-inch Parallel Raw Water Distribution Transmission Main Project is such a major action.

In order to determine whether the construction of approximately 75,000 LF of new 60-inch raw water transmission main to parallel an existing 48-inch raw water transmission main, currently discharging raw water to the authority's three (3) MG storage tank will cause significant environmental impacts, an environmental assessment has been prepared. The environmental assessment is attached. It contains detailed information on the key issues, including a brief description of the proposed project and a summary of probable environmental impacts with proposed mitigations. None of the impacts were found to be significant.

On the basis of the analysis of the impacts as shown in the environmental assessment, no environmental impact statement (EIS) will be prepared. This FONSI completes the environmental review record. The FONSI and Environmental Assessment shall be available for inspection and comment for 30 days at the State Clearinghouse.

Summary of FONSI for publication in the Environmental Bulletin: After completion of an environmental assessment under G.S. 113A, a FONSI has been made in the case of the Lower Cape Fear Water and Sewer Authority 60-inch Parallel Raw Water Distribution Transmission Main Project. Information supporting the need for the proposed project was reviewed, along with relative impacts, other alternative approaches and mitigating measures.

07/16/10

Terry L. Pierce (Date)
Director, Environmental Health

Public Water Supply Section – Jessica G. Miles, Chief
1634 Mail Service Center, Raleigh, North Carolina 27699-1634
Phone 919-733-2321 \ FAX: 919-715-4374 \ Lab Form FAX: 919-715-6637 \ Internet: ncdrinkingwater.state.nc.us

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APPENDIX C

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Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County

PREPARED FOR:	Pender County Utilities
PREPARED BY:	CH2M North Carolina, Inc. and Highfill Infrastructure Engineering, PC
DATE:	August 19, 2016 (Updated October 26, 2016 based on DWR comments on the Draft Environmental Assessment)

1.0 Introduction

Water demand forecasting is a critical element of Pender County Utilities' (PCU) ability to plan for future water supply needs over the next 35 years. In addition, the forecast helps to support decisions on timing for expansion, renewal and replacement activities to ensure the long-term reliability of water treatment plant (WTP) operations for providing high quality finished water to PCU's water service area. Water availability is one item of significance in that near-term demands within the Interbasin Transfer (IBT) river basins will increase above the transfer limit of 2 million gallons per day (MGD), average day in a calendar month, from the Cape Fear River basin within the planning period. The PCU's water service area includes six water and sewer districts (WSDs): Rocky Point/Topsail, Scott's Hill, Central Pender, Moore's Creek, Maple Hill, and Columbia Union as well as Watha and St. Helena. The municipalities within Pender County are not included within the PCU water service area.

This summary document describes the historical water demand for PCU's water service area and Countywide population estimates, as well as the forecasting methodology and forecast results for projected water demand, wastewater flow and IBT need.

2.0 Historical Water Use

The drivers for increased water demand and projected IBT for PCU include service area expansion and population growth. Past water demands for PCU have been driven by a number of factors including population growth, extension of water service to new WSDs, and new industry. The annual demands have a typical seasonal pattern, with generally higher demands throughout the summer. This seasonal pattern has an additional influence, different than other areas within the State, of demand increases associated with seasonal residents or tourists visiting beach communities during the late spring, summer and fall time periods. Exhibit 1 presents the historical annual average daily finished water production by month, through 2015, from PCU's WTP, which came online in 2012.

Exhibit 2 presents the billed water consumption for the water service area and account growth from 2005 through 2015. These exhibits show that water consumption has increased over time, which is expected to continue as growth in Pender County continues and new areas are provided water service. Exhibit 3 presents the historic residential average daily unit water demand in gallons per day per customer account (GPD/account) for the two existing WSDs; from 2005 through 2015 for Rocky Point/Topsail WSD and 2012 to 2015 for Scott's Hill WSD. Exhibit 4 presents the historic commercial, industrial and institutional average daily unit water demand (also GPD/account) for the Rocky Point/Topsail WSD. Exhibit 5 represents water billed versus water produced at the WTP to estimate a reasonable non-revenue water percentage for PCU.

EXHIBIT 1

Historic Finished Water Annual Average Production, PCU

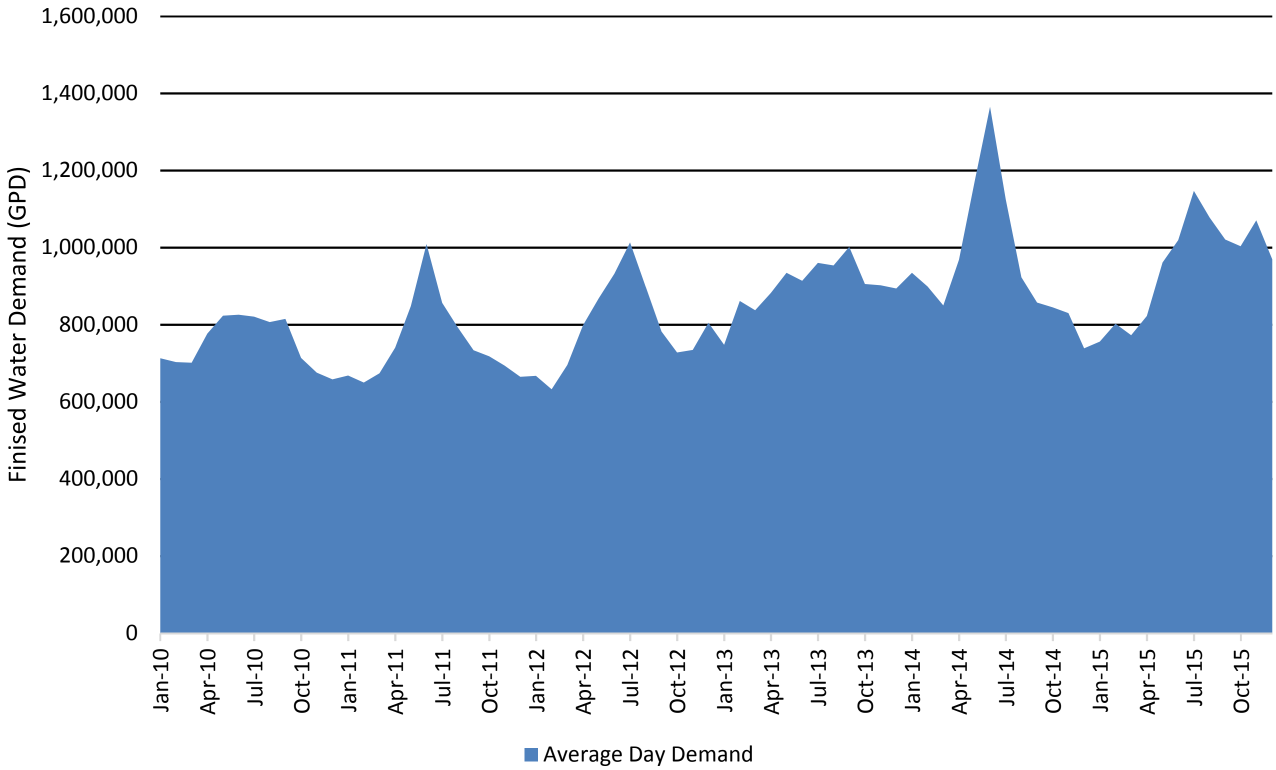


EXHIBIT 2

Historic Billed Annual Average Daily Water Consumption, PCU

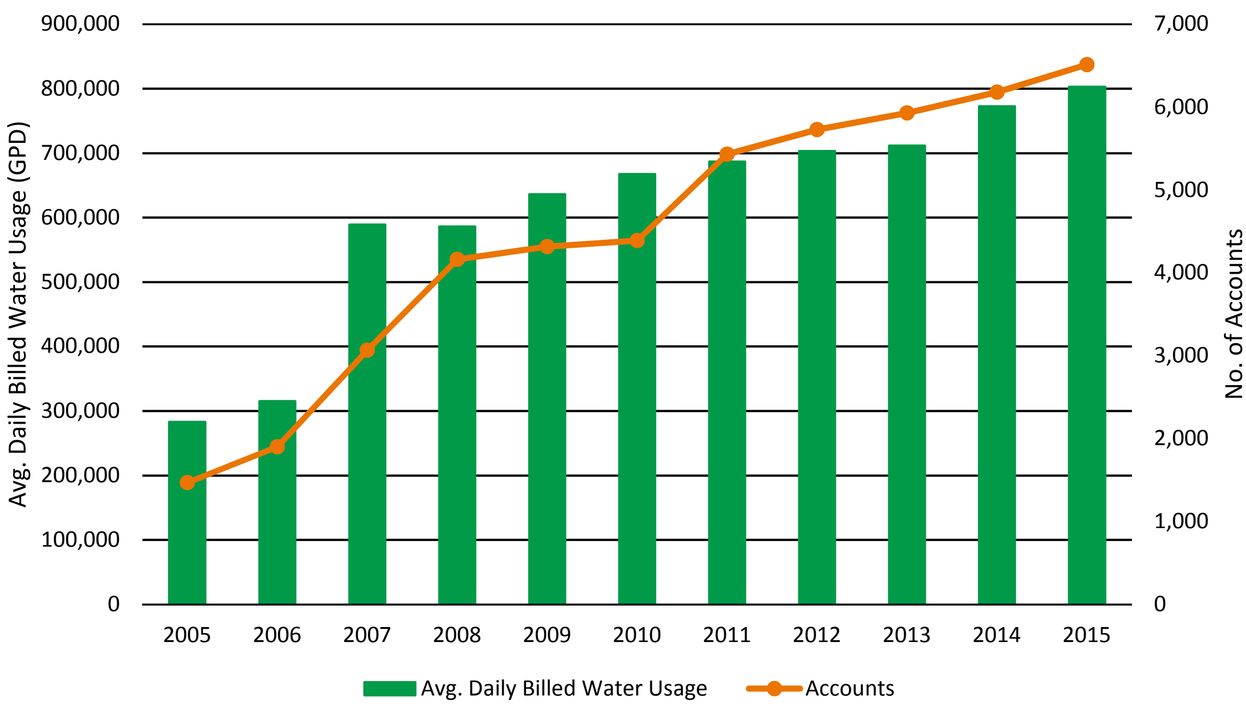


EXHIBIT 3

Historic Residential Gallons per Account per Day, PCU

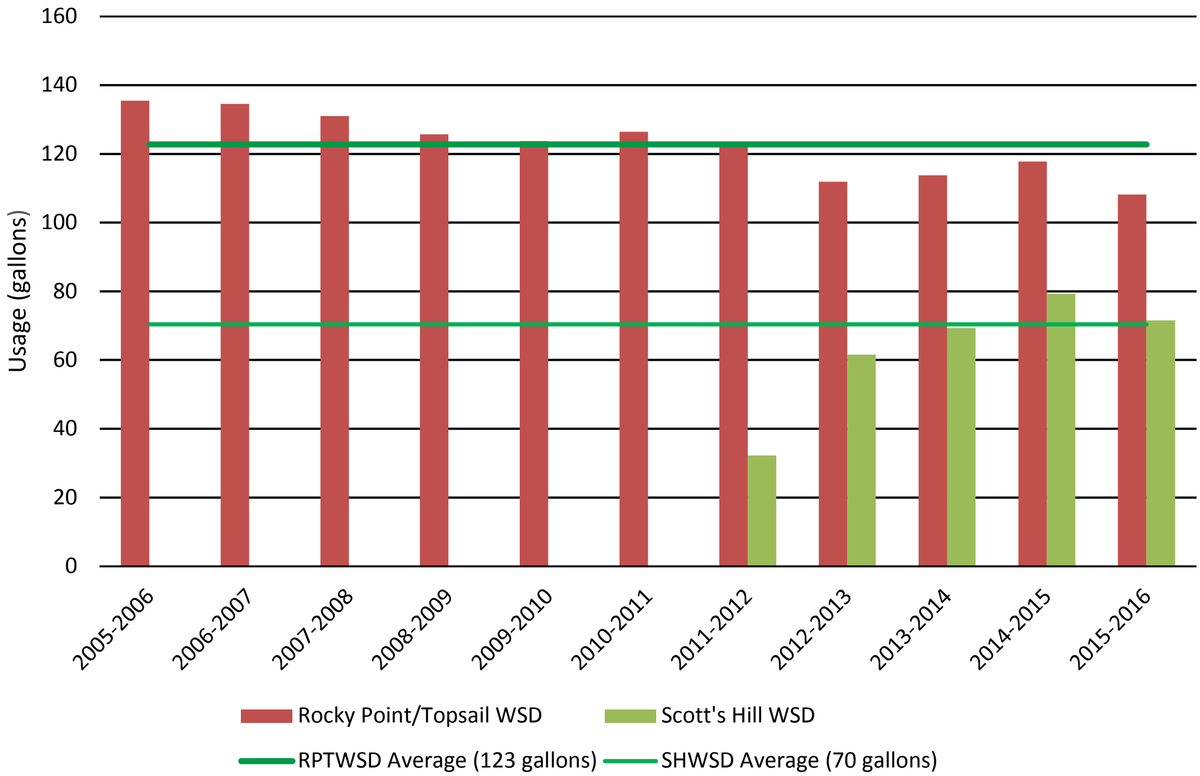


EXHIBIT 4

Historic Commercial, Industrial and Institutional Gallons per Account per Day, PCU

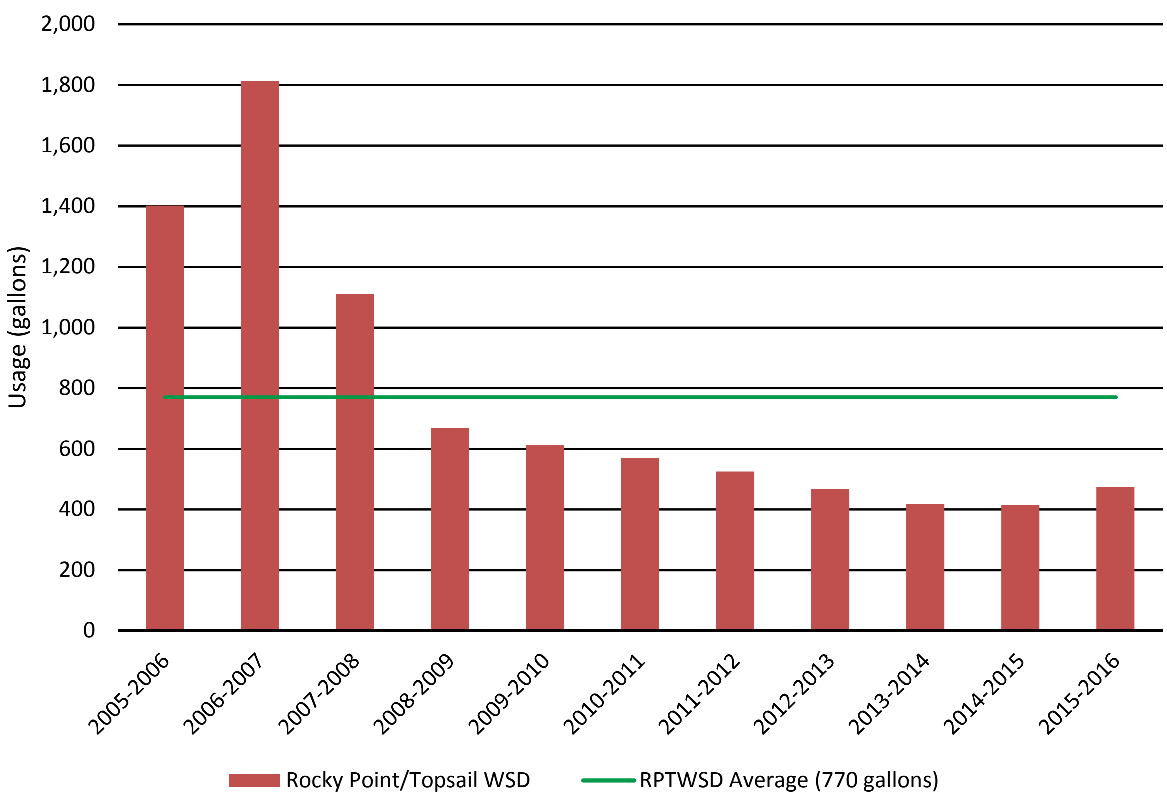
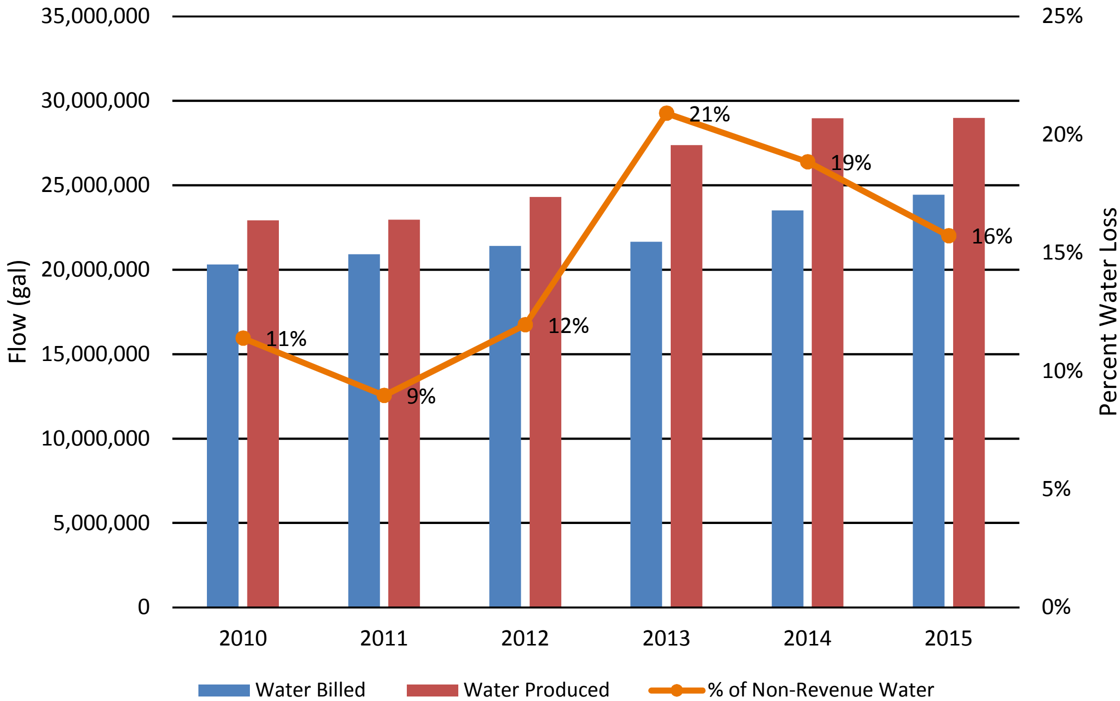


EXHIBIT 5
Historic Yearly Water Billed vs. Water Produced, PCU



3.0 Population Projections

The forecast of future water demand and wastewater flow is primarily based upon population projections and historical system demands and flows. A detailed analysis is essential to characterize water use within the system and recognize trends that will affect future needs.

In order to develop population forecasts for the water demand forecast, population projections were developed for each WSD. The projections were developed from and compared to various data sources including the North Carolina Office of State Budget and Management (NC OSBM) (NC OSBM, 2016), the Pender County Water Master Plan (McKim & Creed, 2006a), the Pender County Wastewater Master Plan (McKim & Creed, 2006b), the Pender County Comprehensive Land Use Plan (Pender, 2010), and the Central and Moore's Creek Water and Sewer District Water System Expansion United States Department of Agriculture (USDA) Preliminary Engineering Reports (PERs) (Highfill & The Wooten Company, 2014a and 2014b). In order to compare the different population projections, all projections were initially evaluated for Pender County as a whole, including municipalities. The overview of the populations including a comparison to Brunswick County's historic growth are outlined in Exhibit 6.

EXHIBIT 6
Population Projection Comparison, Pender County and Brunswick County

Year	NC OSBM	2006 Master Plan	2010 Land Use Plan	2014 USDA PERs	Brunswick County
1970	*18,150*	-	-	-	*24,230*
1980	*22,260*	-	-	-	*35,780*
1990	*28,860*	-	-	-	*50,990*
1995	*35,440*	-	-	-	*61,700*
2000	*41,080*	41,080	41,080	-	*73,140*

EXHIBIT 6
Population Projection Comparison, Pender County and Brunswick County

Year	NC OSBM	2006 Master Plan	2010 Land Use Plan	2014 USDA PERs	Brunswick County
2010	*52,220*	52,510	54,760	52,220	*107,430*
2015	*57,690*	63,010	61,330	63,140	*121,580*
2020	63,400	78,770	67,890	78,890	-
2025	*69,110*	92,950	74,220	92,470	-
2030	*74,720*	104,100	80,560	103,270	-
2035	*80,400*	-	-	113,170	-
2040	86,110	-	-	-	-
2045	92,050	-	-	-	-
2050	98,220	-	-	-	-

Note: *Italicized* populations are NC OSBM which correspond with Census Data populations. *Source: NC OSBM, 2016. The NC OSBM projections from 2040 to 2050 were estimates based on the percent growth per year from 2015 to 2035.*

The County 2006 Water and Wastewater Master Plans utilized a growth pattern developed from Brunswick County's historic growth rates since it shares common attributes with Pender County. Most specifically, they are both coastal counties and experiencing pressure from the outward growth of New Hanover County. A moderate growth rate from Brunswick County, from 1984 to 2004, was utilized to project Pender County's growth to 2030 within the Master Plans. In 1984, Brunswick County's population was roughly equal to Pender County's population in 2005, approximately 42,000.

The Master Plan population projection methodology was utilized to extend the population projections to 2050 with some minor adjustments for the two existing districts, Rocky Point/Topsail WSD and Central Pender WSD, which were adjusted to a less aggressive growth pattern from 2020 to 2035 based on actual growth observed since the completion of the Master Plans.

Population projections were developed for each WSD; the base of the projection was the 2010 Census data for each Township within the County. The Countywide Census population estimates were spatially attributed to each WSD by the land area of a Township within an individual WSD. Exhibit 7 represents the 2010 Census population per Township (rounded). Note that the line item titled "Remainder" indicates the population within the Census defined Townships that reside in unincorporated areas.

EXHIBIT 7
Pender County Census 2010 Population Estimate per Township

Township	TOTAL
Burgaw	8,410
Town of Burgaw	3,870
St. Helena Village	390
Remainder	4,140
Canetuck	370
Caswell	1,420
Atkinson	300
Remainder	1,120
Columbia	2,300

EXHIBIT 7
Pender County Census 2010 Population Estimate per Township

Township	TOTAL
Grady	2,370
Holly	2,360
Long Creek	2,240
Rocky Point	7,270
Topsail	21,250
Surf City	1,850
Topsail Beach	370
Remainder	19,030
Union	4,230
Watha	190
Remainder	4,040

Source: US Census, 2010

The population from Exhibit 7 was then multiplied by the percentage of land area for each Township within the corresponding WSD to attribute the 2010 population to each WSD. Exhibit 8 indicates the estimated percentage of Township land area within each WSD.

EXHIBIT 8
Percentage of Township Land Area within WSD

WSD	Burgaw	Canetuck	Caswell	Columbia	Grady	Holly	Long Creek	Rocky Point	Topsail
Central Pender	88%	-	-	2%	-	69%	8%	1%	<1%
Columbia/ Union	2%	-	8%	97%	3%	-	-	-	-
Maple Hill	-	-	-	-	-	19%	-	-	-
Moore's Creek	-	100%	92%	1%	97%	-	48%	-	-
Rocky Point/ Topsail	10%	-	-	-	<1%	12%	44%	99%	94%
Scott's Hill	-	-	-	-	-	-	-	-	6%

After the 2010 population estimate was established by WSD, the growth profile utilized to estimate the percentage of population growth per year in the 2006 Master Plan was used to project population for 2015 through 2050. Pender County municipalities are not included in these projections except for Watha and St. Helena, which are served by PCU.

Exhibit 9 presents the population forecast for the six WSDs, excluding unserved municipalities, from 2015 to 2050.

EXHIBIT 9
PCU WSD Population Forecast, 2015–2050

Year	Central Pender WSD	Moore's Creek WSD	Columbia Union WSD	Maple Hill WSD	Rocky Point Topsail WSD	Scotts Hill WSD	TOTAL
2015	6,000	5,200	6,900	1,600	34,500	1,600	**55,900**
2020	6,500	6,100	7,500	1,600	44,800	2,000	**68,600**
2025	8,000	8,600	8,100	1,700	49,300	2,200	**77,800**
2030	9,500	10,300	8,800	1,700	53,800	2,300	**86,400**
2035	11,000	11,800	9,300	1,800	57,500	2,500	**94,000**
2040	12,800	13,000	10,000	1,800	61,500	2,600	**101,800**
2045	14,100	14,700	10,600	1,900	65,900	2,800	**109,900**
2050	15,200	16,300	11,200	2,000	70,500	3,000	**118,100**

Note: Numbers may not sum due to rounding.

The historic annual average population growth rate for Pender County from 1980 through 2010 was 3.1 percent, based on the NC OSBM population estimates for Pender County population outside of municipalities. The forecasted growth in population from 2015 to 2050, as presented in Exhibit 9, is 3.2 percent growth per year on average for the 35-year planning period; the forecasted growth rate actually varies by each 5-year time step and by WSD. Attachment A contains the deterministic assumptions related to annual growth rates used to forecast future population by WSD.

Residential Service Population/Accounts

The population outlined in Exhibit 9 is the overall population that could eventually be served by PCU. The actual service area will depend on water service extension throughout Pender County as well as existing customer interest in water service; if water service is available, new customers are required to connect to the County water system.

The number of residential accounts actually served by PCU throughout the planning period was estimated for each WSD. The forecasted population was converted to customer accounts based on 2010 Census persons per household (pph) values. The pph values used for each WSD are identified in Attachment A. Assumptions were applied for each WSD regarding the percentage of customers that would have access to a water main and the percentage of those customers who would elect to connect to the water system.

The Moore's Creek WSD and Central Pender WSD assumptions were generated from the recent PERs completed for those WSDs. It is estimated that initially, approximately 30 percent of existing housing units will be fronted by water lines with the current water line extensions under construction, and that 80 percent of those fronted by a water line will elect to connect to the water system. Note that this was only utilized for districts that are not yet developed as it is a requirement that all new development fronting an existing PCU water line will be required to connect. Within the planning period through 2050, it is assumed that 90 percent of both Moore's Creek WSD and Central Pender WSD will be fronted by water lines. The Rocky Point/Topsail WSD and Scott's Hill WSD are currently served by PCU with approximately 35 percent in Rocky Point/Topsail WSD and 75 percent in Scott's Hill WSD served in 2015. It is assumed that approximately 75 percent of the Rocky Point/Topsail WSD and 95 percent of Scott's Hill WSD will be served by PCU within the planning period. A water line extension project for Columbia

Union WSD is not expected until 2045, so no usage is projected until that time. The Maple Hill WSD was assumed to grow from the current 43 percent served by PCU to 80 percent by 2050. Attachment A contains the deterministic assumption related to the percentage of residential accounts fronted by a water line and the percent connecting to the County water system, by WSD.

Exhibit 10 represents the estimated number of residential accounts per WSD within the planning period.

EXHIBIT 10
PCU WSD Residential Customer Account Forecast, 2015–2050

Year	Central Pender WSD	Moore's Creek WSD	Columbia Union WSD	Maple Hill WSD	Rocky Point/ Topsail WSD	Scotts Hill WSD	TOTAL
2015	-	-	-	350	5,500	550	6,400
2020	850	870	-	420	7,630	700	10,460
2025	1,490	1,730	-	470	8,820	770	13,280
2030	2,320	2,700	-	530	10,070	850	16,470
2035	3,100	3,580	-	590	12,240	920	20,430
2040	3,830	4,200	-	650	15,720	1,000	25,395
2045	4,480	5,050	820	720	19,620	1,130	31,820
2050	5,120	5,930	1,370	790	22,500	1,260	36,970

Note: Numbers may not sum due to rounding.

Commercial, Industrial, Institutional Growth

The future land use, defined in the County's Land Use Plan, was used to develop estimates for commercial, industrial and institutional growth (Pender County, 2010). The future land use categories in the Land Use Plan include residential (Rural Growth and Suburban Growth), conservation, industrial, mixed use (residential and commercial), and commercial (Office, Institutional, and Business). It was assumed that no growth would occur within the conservation land use category areas, as prescribed in the County's Land Use Plan. The percentage of land area within each WSD that was assigned to Suburban Growth land use category was utilized to determine the "supporting infrastructure" (i.e., office, shopping centers, gas stations, etc.) that would be necessary to support the growing residential areas. The percentage of land area for each WSD that was designated as Suburban Growth was multiplied by the estimated number of residential customers and used to forecast "residential support" water demands; described further in the Water Demand Forecast section.

If a WSD contained a future land use category for Mixed Use or Office, Institutional, and Business, future commercial growth was assigned. It was assumed that 70 percent of the Mixed Use land area would develop as commercial. Assumptions for growth percentage per year were applied to each WSD based on the percentage of Mixed Use and Office, Institutional, and Business land area. Attachment A contains the deterministic assumption related to growth rates for commercial development for each WSD.

Finally, the only WSDs that include a future land use category designated for industrial are the Moore's Creek and Rocky Point/Topsail WSDs. The overall land area for industrial land use was utilized for each WSD, and it was estimated that approximately one percent of the overall acreage would be developed in year 2020 and 10 percent by the end of the planning period, year 2050.

Exhibits 11 and 12 represent the estimated growth in commercial and industrial acreage through 2050.

EXHIBIT 11
PCU WSD Commercial Acreage Growth Forecast, 2015–2050

Year	Moore's Creek WSD	Columbia Union WSD	Rocky Point Topsail WSD	Scotts Hill WSD
2015	-	-	90	1
2020	6	-	110	2
2025	10	-	130	3
2030	20	-	150	3
2035	40	-	190	4
2040	50	-	240	5
2045	60	-	290	5
2050	70	2	360	6

EXHIBIT 12
PCU WSD Industrial Acreage Growth Forecast, 2015–2050

Year	Moore's Creek WSD	Rocky Point Topsail WSD
2015	-	-
2020	70	30
2025	210	100
2030	350	170
2035	480	240
2040	550	270
2045	620	300
2050	690	340

4.0 Water Demand Forecast

Deterministic Water Demand and Wastewater Flow Forecast

Projected PCU water service area water demands were developed for existing and future conditions based on the population projections and projected growth in commercial and industrial growth presented in Section 3. In addition, a number of neighboring utilities have identified the potential long-term need for water supply from PCU. These utilities have decided to partner with PCU for water supply and are co-applicants in the current IBT certificate process with PCU. These partners will be referred to as co-applicants from this point forward and include the Town of Burgaw, Town of Topsail Beach, Town of Surf City, Town of Wallace (in neighboring Duplin County), and Utilities, Inc.

The following summarizes the basis of the water demand forecast methodology for PCU's water services area and the co-applicants:

- PCU:
  - Residential water demand: projected water demands were developed for each WSD for existing and future conditions based on water meter billing data (to develop unit consumption values), WSD population forecasts, assumed persons per household (to convert population to customer accounts), assumed percent of customers with access to a PCU water line, and an assumed percent connection of customer accounts to the water system. The assumed percent connection was used to capture the effect of PCU expanding its water distribution system into new areas of the WSD service areas that are currently not served; the percent connection assumption is intended to be representative of the fact that not all of the area will voluntarily connect to the system and will stay on groundwater. Any new subdivision (or home) that is built which is adjacent to a PCU water line will be required to connect to the distribution system.
    - Historic residential unit consumption values are presented in Section 2.
    - Population projections and future customer accounts are presented in Section 3.
  - Commercial/Industrial water demand: projected water demands were developed by WSD for existing and future conditions based on water meter billing data (for current WSD customers, also to develop unit consumption values), existing and future land use information, and an assumed growth rate. Included in this demand is a use sector that represented commercial business in place solely to support the residential population; this demand is based on the population forecast and an assumed unit consumption value. All commercial and industrial customers will be required to connect to the distribution system if adjacent to an existing PCU water line.
    - Historic commercial unit consumption values are presented in Section 2.
    - Projection of future commercial and residential growth is presented in Section 3.
  - The total future system finished water demand consists of the existing demand, projected future demand, future non-revenue water, and operational requirements.
    - Total projected demands include all use sectors: residential, commercial and industrial.
    - Additionally, as discussed in Section 3, a residential support use sector was included in the demand forecast.
  - Projected water demands were attributed to each IBT river basin, as defined in NCGS 143-215.22L, based on the land area of each basin within an individual WSD. Exhibit 13 presents the percentage of each WSD that falls within each river basin.

EXHIBIT 13
IBT River Basin Percentage by WSD

WSD	Basin	Percentage
Central Pender	NE Cape Fear	100%
Moore's Creek	Cape Fear	9%
Moore's Creek	NE Cape Fear	32%
Moore's Creek	South River	59%
Columbia Union	NE Cape Fear	60%
Columbia Union	South River	40%
Maple Hill	NE Cape Fear	100%

EXHIBIT 13
IBT River Basin Percentage by WSD

WSD	Basin	Percentage
Rocky Point-Topsail	NE Cape Fear	79%
Rocky Point-Topsail	New River	21%
Scott's Hill	NE Cape Fear	55%
Scott's Hill	New River	45%

- Co-applicants:
  - Projected water demands for the co-applicants were developed for existing and future conditions based on each co-applicant's Local Water Supply Plan (LWSP), as submitted to the North Carolina Division of Water Resources (DWR). Utilities, Inc. provided their own demand projections for use. All co-applicants are currently supplied by groundwater, however due to increasing water quantity and quality concerns, these systems are seeking a surface water source to meet at least a portion of future demands through 2045. The base assumptions related to the percentage of the co-applicants demands and timing of the need for each co-applicant is provided in Exhibit 14.
  - AQUA North Carolina also expressed interest to PCU in receiving water in the future. They have not been included as a co-applicant at this time because of the small service footprint and distant location of AQUA's service areas from PCU's currently planned water system. The areas served by AQUA are within PCU's WSDs, and those areas, along with their respective water demand projections are included to provide for a comprehensive evaluation.

EXHIBIT 14
Co-applicant Water Supply Requirements

	Start Year for Supply Need	Percent of Supply Need to be Provided by PCU	Average Day Supply to be Provided in 2050 by PCU (MGD)
Town of Burgaw[1]	See Note 1	N/A	0.8
Surf City	2030	25%	0.3
Topsail Beach	2030	25%	0.1
Wallace	2030	25%	0.2
Utilities Inc.	2020	100%	0.4

[1] - The Town of Burgaw will be served by PCU when their demand exceeds their supply of 1.0 MGD. The LWSP indicates a demand above the current supply in year 2030 (1.1 MGD).

The water demand forecasts developed are representative of the influence of PCU and each of the individual stakeholder's current water resources management programs and policies effecting water demand, and based on the assumption that these programs and policies will continue in the future, absent of any influence of major technology or regulatory changes.

To determine the total annual average daily finished water demand, the sum of all use sectors (residential, commercial, and industrial) was multiplied by a non-revenue water factor of 15 percent.

Projected average day wastewater flows were determined based on a wastewater generation factor of 90 percent, based on review of winter versus summer historic demand. The percentage of flow going to the US 421 WWTP was based on the percentage of commercial and industrial demand in the Northeast Cape Fear River basin.

Probabilistic Water Demand and Wastewater Flow Forecast

The starting point of a forecasting process is a deterministic projection methodology, which is based on a number of single fixed-point estimate assumptions and results in single estimate of future annual demands. The deterministic water demand forecast method for the PCU service area is overviewed in the preceding section.

Uncertainty is inherent in any forecast, the water demand and wastewater flows for PCU's service area over the next 35 years will be dependent on a number of conditions that may vary from assumptions that are based on historical patterns. Therefore, using the deterministic forecast model developed based on the information described in the preceding sections, probabilistic variables were integrated to represent a likely range of values instead of single fixed-point estimate assumptions. A Monte Carlo simulation technique was used to aid in estimating the magnitude and likelihood of an individual demand forecast, and ultimately IBT. This methodology provides the ability to incorporate uncertainty into the water demand forecast, as well as understand the variability in the potential future demands, based on the factors outlined below. The factors that were integrated as probabilistic variables in the water demand forecast model are:

- Unit Consumption
    - By use sector (residential, residential support, commercial, industrial).
- Connection Assumptions
    - Percent of customers fronted by water line; variation in customer with direct access to PCU water line.
- Growth rate
    - Represented as a drift in projected growth rates from the projections developed, as discussed in Section 3.
- Person per household by WSD
    - Based on values from the 2010 US Census data (established based on Townships).
- Stakeholder water supply
    - Percentage of future demand
    - Start year for supply need
- System Factors
    - Non-revenue water
        - Percentage of total finished water demand
    - Maximum-month average day water flow peaking factors
        - Maximum month average day versus average daily flow
- Wastewater generation factor
    - Applied to average day water demand
- Wastewater return to Cape Fear River basin
    - Percent of wastewater flow going to the US 421 wastewater treatment plant (WWTP) from the Northeast Cape Fear River basin (based on percent of commercial and industrial demand).

The factors that were included in the original deterministic forecast model and included in probabilistic analysis but not as a probabilistic variables (maintained as single point estimates) include:

- Mixed use residential to commercial ratio
    - Based on an assumed typical ratio of 70 percent commercial and 30 percent residential for a mixed use land use.
- Connection Assumptions
    - Percent of customers electing to connect to the PCU water system, which are fronted by a water line, as discussed in Section 3.
- Future suburban/commercial growth percentage by WSD
    - Assumed from geographic information system (GIS) analysis of land area, as discussed in Section 3.
- IBT River Basin percentage by WSD
    - Assumed from GIS analysis of land area, as presented in Exhibit 13.

The above variables were used to identify the uncertainty related to the timing of and the cumulative water demand, wastewater flow or IBT for the PCU service area. Attachment B provides additional details on the above variables.

5.0 Results

Exhibit 15 displays the probabilistic annual average daily finished water demand forecast. Exhibit 16 displays the probabilistic maximum month average day finished water demand forecast. Exhibit 17 presents the 50th percentile (median) annual average finished water demand, 2015 through 2050, in tabular format. Exhibit 18 presents the co-applicant 50th percentile annual average finished water demand to be satisfied by water provided from PCU in tabular format. Exhibit 19 presents the total combined system 50th percentile annual average finished demand forecast.

The 50th percentile, or expected value, is a statistical measure of the likely outcome under conditions of future variability and uncertainty, reflecting expected future conditions

EXHIBIT 15

Annual Average Daily Finished Water Demand Forecast, 2010-2050

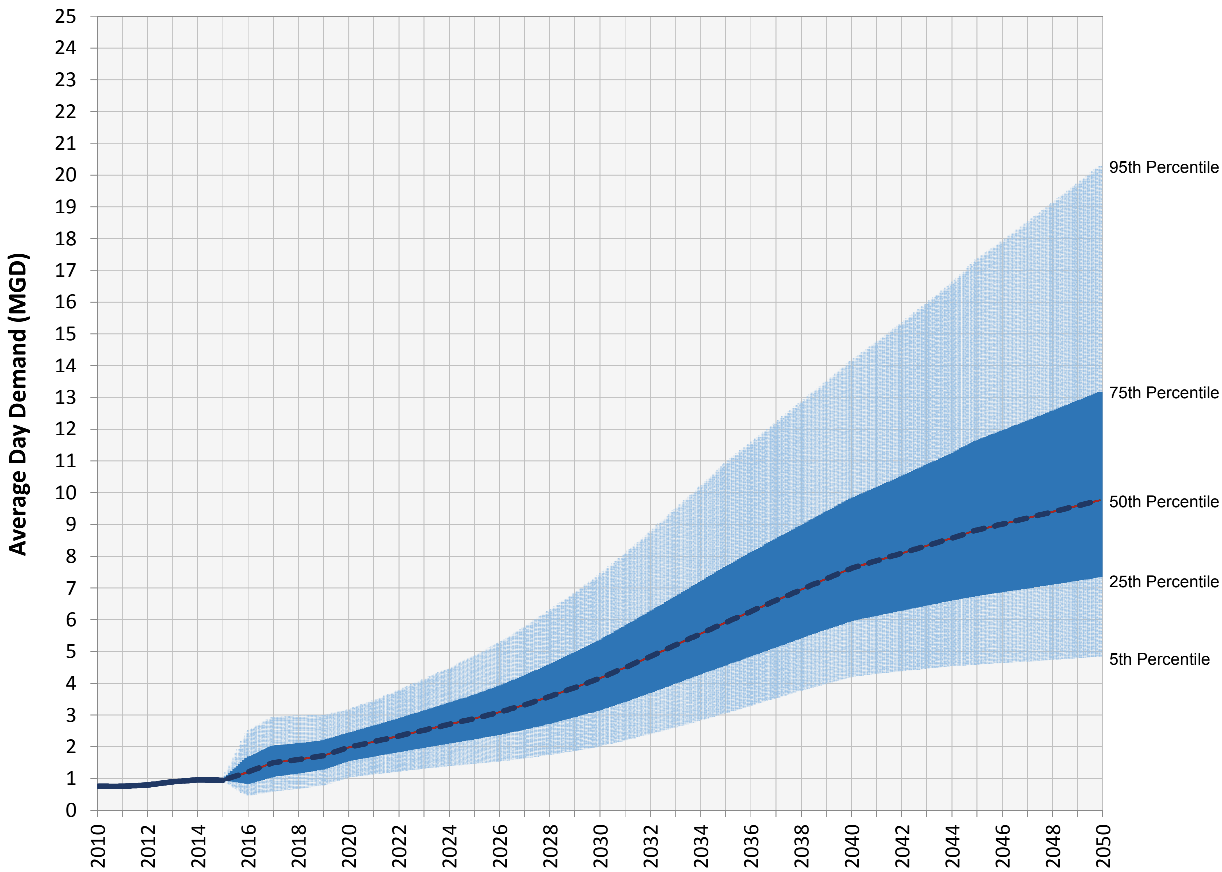


EXHIBIT 16

Maximum Month Average Day Finished Water Demand Forecast, 2010-2050

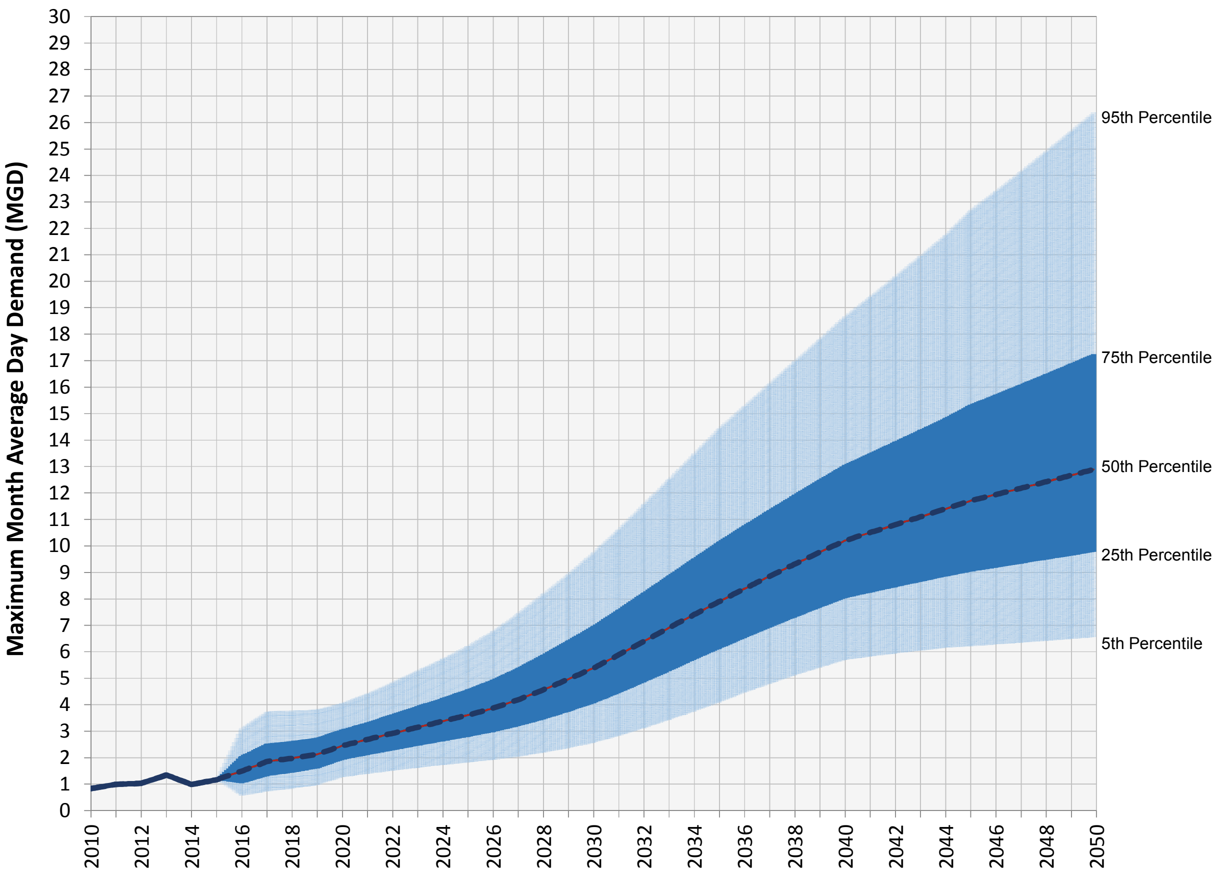


EXHIBIT 17
PCU WSD Annual Average Daily Finished Water Demand Forecast, 50th percentile, 2015–2050

WSD	Basin	Annual Average Daily Finished Water Demand (MGD)							
		2015	2020	2025	2030	2035	2040	2045	2050
Central Pender	NE Cape Fear	-	0.1	0.2	0.4	0.5	0.6	0.7	0.8
Moore's Creek	Cape Fear	-	<0.1	<0.1	0.1	0.1	0.1	0.1	0.2
Moore's Creek	NE Cape Fear	-	0.1	0.2	0.3	0.4	0.4	0.5	0.6
Moore's Creek	South River	-	0.1	0.3	0.5	0.7	0.8	0.9	1.1
Columbia Union	NE Cape Fear	-	-	-	-	-	-	0.1	0.1
Columbia Union	South River	-	-	-	-	-	-	0.1	0.1
Maple Hill	NE Cape Fear	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rocky Point Topsail	NE Cape Fear	0.8	1.1	1.3	1.6	2.0	2.5	3.1	3.6
Rocky Point Topsail	New River	0.2	0.3	0.4	0.4	0.5	0.7	0.8	0.9
Scotts Hill	NE Cape Fear	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Scotts Hill	New River	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total County Demand		**1.1**	**1.9**	**2.6**	**3.4**	**4.4**	**5.4**	**6.7**	**7.7**

Note: Numbers may not sum due to rounding.

EXHIBIT 18
Co-applicant Annual Average Daily Water Supply Forecast, 50th percentile, Provided by PCU, 2015–2050

Co-applicant	Basin	Annual Average Daily Finished Water Demand (MGD)							
		2015	2020	2025	2030	2035	2040	2045	2050
Town of Burgaw	NE Cape Fear	-	-	-	<0.1	0.6	1.1	1.0	0.8
Surf City	New River	-	-	-	<0.1	0.3	0.3	0.4	0.4
Topsail Beach	New River	-	-	-	<0.1	0.1	0.1	0.1	0.1
Wallace	NE Cape Fear	-	-	-	<0.1	0.2	0.3	0.3	0.3
Utilities Inc.	New River	-	-	0.2	0.2	0.3	0.3	0.3	0.3
Total Co-applicant		**-**	**-**	**0.3**	**0.6**	**1.5**	**2.2**	**2.1**	**2.0**

Data source: 2014 LWSPs - Burgaw, Surf City and Topsail; 2015 LWSP - Wallace; System details for Utilities Inc.; assumed timing of water supply requirement provided by PCU.
Note: Numbers may not sum due to rounding.

EXHIBIT 19
Total Annual Average Daily Finished Water Supply Forecast, 50th percentile , 2015–2050

Co-applicant	Annual Average Daily Finished Water Demand (MGD)							
	2015	2020	2025	2030	2035	2040	2045	2050
Total County Demand	1.1	1.9	2.6	3.4	4.4	5.4	6.7	7.7
Total Co-applicant Demand	-	-	0.3	0.6	1.5	2.2	2.1	2.0
Total System Demand	**1.1**	**1.9**	**2.9**	**4.0**	**5.9**	**7.6**	**8.8**	**9.7**

Note: Numbers may not sum because of rounding.

Wastewater Flow Forecasts

Large-scale addition of a centralized sanitary sewer system is not expected within the current IBT planning window. Potential sewer expansion associated with the US 421 WWTP during the planning period is expected to be within the 4 MGD permit limit. The majority of water distributed within the PCU water service area will, therefore, be treated and infiltrated within the river basin it is utilized. Exhibit 20 displays the probabilistic annual average day wastewater flow forecast for the PCU service area by WSD.

EXHIBIT 20
PCU WSD Annual Average Daily Wastewater Flow Forecast, 50th Percentile, 2015–2050

WSD		Annual Average Daily Wastewater Flow (MGD)							
	Basin	2015	2020	2025	2030	2035	2040	2045	2050
Central Pender	NE Cape Fear	-	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Moore's Creek	Cape Fear	-	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1
Moore's Creek	NE Cape Fear	-	0.1	0.2	0.2	0.3	0.4	0.5	0.5
Moore's Creek	South River	-	0.1	0.3	0.5	0.6	0.7	0.8	1.0
Columbia Union	NE Cape Fear	-	-	-	-	-	-	0.1	0.1
Columbia Union	South River	-	-	-	-	-	-	0.1	0.1
Maple Hill	NE Cape Fear	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rocky Point Topsail	NE Cape Fear	0.7	1.0	1.2	1.4	1.8	2.2	2.8	3.2
Rocky Point Topsail	New River	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8
Scotts Hill	NE Cape Fear	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Scotts Hill	New River	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1
Total County Wastewater		**1.0**	**1.8**	**2.4**	**3.2**	**4.0**	**4.8**	**6.0**	**6.8**

Note: Numbers may not sum due to rounding.

When the US 421 WWTP comes online, in approximately 2017, PCU will begin returning additional wastewater to the Cape Fear River basin. These values are shown in Exhibit 21.

EXHIBIT 21
Forecast of returns to the Cape Fear River basin, 50th Percentile, 2015–2050, Average Day Wastewater Flow (MGD)

	2015	2020	2025	2030	2035	2040	2045	2050
US 421 WWTP	-	<0.1	0.1	0.2	0.2	0.3	0.3	0.4

Interbasin Transfer

In accordance with the recent legislative changes to GS 143-215.22L, the forecast of IBT is calculated as a daily average of a calendar month (instead of on a maximum day basis) and, for the month in which IBT is expected to be highest, is generally described by the following formula:

$$IBT_x = \text{Withdrawal from Source basin}_x - \text{Return to Source basin}_x$$

$$\text{Return to Source basin}_x = (\text{Total Consumptive Use}_x * \text{\% of Total Demand in Source River basin}_x) + \text{Source River basin Wastewater Discharge}_x$$

In which 'x' represents a future year

Exhibit 22 displays the probabilistic maximum month average day IBT forecast for PCU. Exhibit 23 displays the probabilistic maximum month average day IBT forecast for PCU and the co-applicants.

IBT forecasts based on average future conditions do not accurately reflect the range of transfers that can reasonably be anticipated to occur under the full range of anticipated conditions. Because an IBT certificate limit cannot ever be exceeded, the maximum IBT has been calculated as the transfer resulting from conditions outside the average which could reasonably be expected to potentially occur, in this case a 75th percentile forecast. Exhibit 24 presents the 75th percentile IBT forecast for PCU and it's co-applicants. The IBT forecast presented is the average day of a calendar month (the maximum average day IBT as compared to all months in a calendar year), referred to as the maximum month average day. The future IBT forecast is based on continuation of the current water resources management policies and programs of PCU and the co-applicants as well as the potentially expected timing and quantities of co-applicants' needs for surface water supply.

EXHIBIT 22
Maximum Month Average Day IBT Forecast, PCU Only, 2010-2050

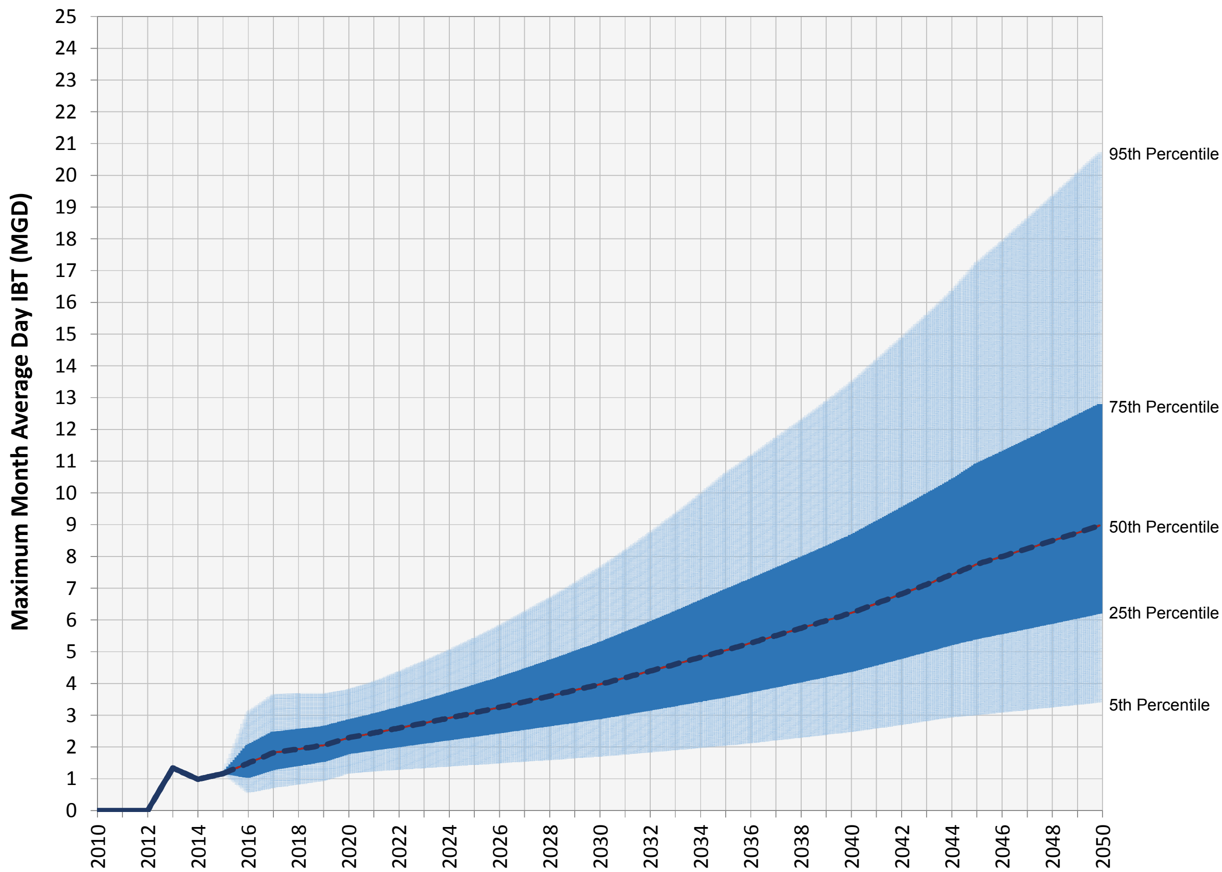


EXHIBIT 23
Maximum Month Average Day IBT Forecast, PCU and Co-applicants, 2010-2050

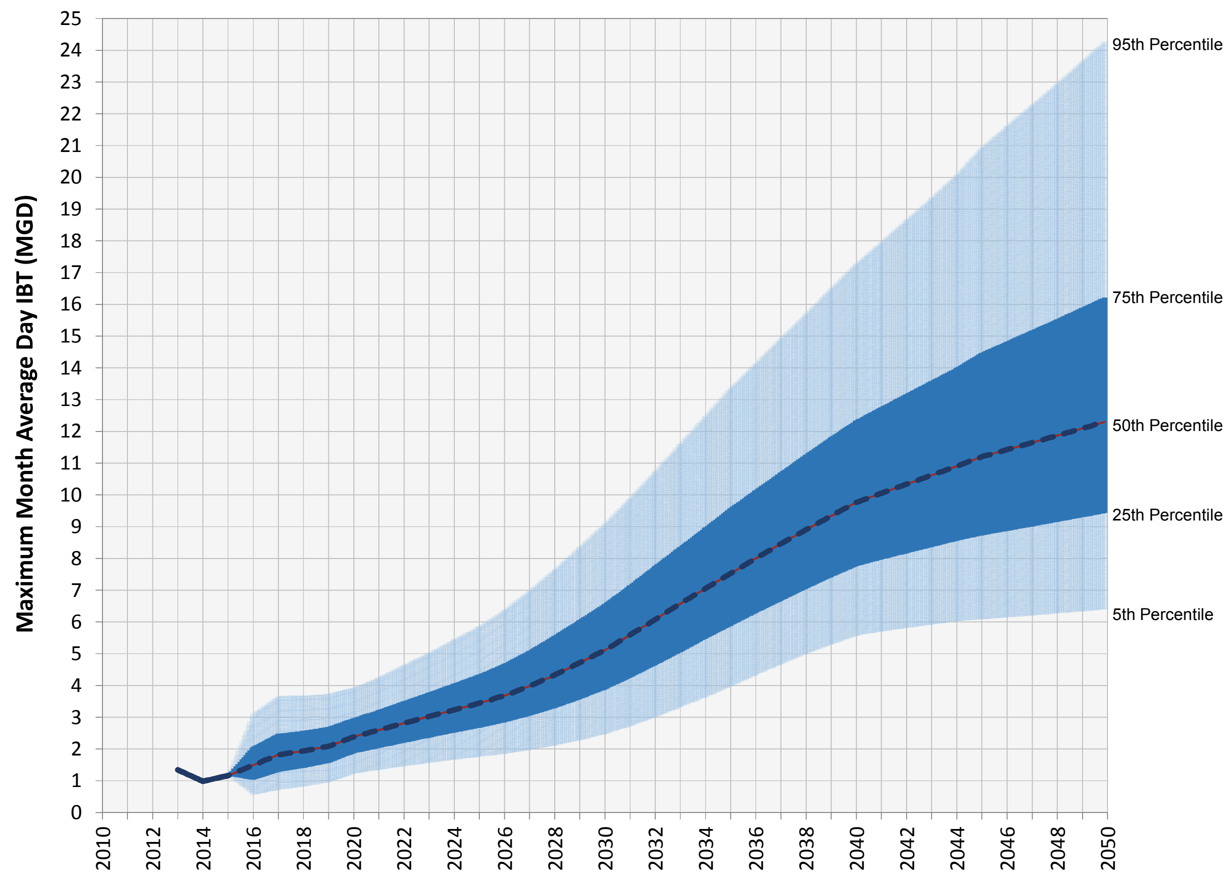


EXHIBIT 24
Forecast of IBT from the Cape Fear River basin to the Northeast Cape Fear River basin, South River basin, and New River basin, 2015–2050, Maximum Month Average Day, PCU and Co-applicants

Basin Transferred To IBT (MGD)	2015	2020	2025	2030	2035	2040	2045	2050
NE Cape Fear	1.2	2.2	2.9	4.1	5.9	7.9	9.2	10.2
South	-	0.2	0.5	1.0	1.4	1.7	2.2	2.6
New	0.3	0.6	0.9	1.6	2.4	2.9	3.3	3.6
Total IBT	**1.5**	**3.0**	**4.3**	**6.6**	**9.6**	**12.3**	**14.5**	**16.3**

Note: Numbers may not sum due to rounding.

6.0 References

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Attachment A
Deterministic Projections

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Pender County Population Projections per District										
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Avg % Growth/Yr**
Central Pender WSD	5,700	6,000	6,500	8,000	9,500	11,000	12,800	14,100	15,200	2.45%

Pender County Housing Units Projections per District									
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Central Pender WSD	2,680	2,830	3,032	3,731	4,468	5,163	5,990	6,589	7,116

	Future Land Use (as portion of Sewer District)											
	Rural Growth		**Suburban Growth**		**Conservation**		**Industrial**		**Mixed Use**		**Office, Institutional, Business**	
Central Pender WSD	**41,226**	**32.61%**	**15,221**	**12.04%**	**69,969**	**55.35%**	**0**	**0.00%**	**0**	**0.00%**	**0**	**0.00%**
UPDATED (Remove Conservation)		73%		27%				0%		0%		0%

River Basin

100% NE Cape Fear River

Estimated Growth per User Type				
	% Customers fronted by water line	# of Customers fronted by water line	% of Customers served by PCU water	# of Residential Customers served by PCU water
mplementation (assume 2017)[1]	30%	850	80%	680
2020	35%	1,061	80%	850
2025	50%	1,866	80%	1,490
2030	65%	2,904	80%	2,320
Year 2035[2]	75%	3,873	80%	3,100
2040	80%	4,792	80%	3,830
2045	85%	5,600	80%	4,480
Year 2050	90%	6,404	80%	5,120

[1]-From CPWSD 2014 USDA PER - # of housing units fronted by initial water system layout X 80% of people will sign up for water

[2]- Same methodology as CPWSD 2014 USDA PER - # of housing units in 2035, assume 75% will be fronted by waterline and 80% will sign up for water

Pender County Population Projections per District										
	2010	2015	2020	2025	2030	2035	2040	2045	2050	Avg % Growth/Yr
Moore's Creek WSD	4,800	5,200	6,100	8,600	10,300	11,800	13,000	14,700	16,300	3.76%

Pender County Housing Units Projections per District									
	2010	2015	2020	2025	2030	2035	2040	2045	2050
Moore's Creek WSD	2,426	2,643	3,090	4,327	5,192	5,971	6,568	7,422	8,238

	Future Land Use (as portion of Sewer District)											
	Rural Growth		Suburban Growth		Conservation		Industrial		Mixed Use		Office, Institutional, Business	
Moore's Creek WSD	60,842	61.87%	18,769	19.08%	10,269	10.44%	6,907	7.02%	1,262	1.28%	295	0.30%
UPDATED (Remove Conservation)		69%		21%				8%		1%		0%

River Basin

9%	Cape Fear River
59%	South River
32%	NE Cape Fear River

Estimated Growth per User Type									
	% Customers fronted by water line	# of Customers fronted by water line	% of Customers served by PCU water	# of Residential Customers served by PCU water	Estimated Mixed Use/O,I,B Growth %	Mixed Use & O,I,B Acreage	Mixed Use & O,I,B Flow Contribution	Estimated Industrial Growth %	Industrial Acreage
Implementation (assume 2017)[1]	31%	812	80%	650	0.25%	3	4,419		
2020	35%	1,082	80%	870	0.50%	6	8,839	1%	69
2025	50%	2,163	80%	1,730	1.00%	12	17,677	3%	207
2030	65%	3,375	80%	2,700	2.00%	24	35,355	5%	345
Year 2035[2]	75%	4,478	80%	3,580	3.00%	35	53,032	7%	484
2040	80%	5,254	80%	4,200	4.00%	47	70,710	8%	553
2045	85%	6,308	80%	5,050	5.00%	59	88,387	9%	622
Year 2050	90%	7,414	80%	5,930	6.00%	71	106,065	10%	691

[1]-From MCWSD 2014 USDA PER - # of housing units fronted by initial water system layout X 80% of people will sign up for water

[2]- Same methodology as MCWSD 2014 USDA PER - # of housing units in 2035, assume 75% will be fronted by waterline and 80% will sign up for water

70/30 split for mixed use

Pender County Population Projections per District										
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Avg % Growth/Yr**
Columbia-Union	6,400	6,900	7,500	8,100	8,800	9,300	10,000	10,600	11,200	1.48%

Pender County Housing Units Projections per District									
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Columbia-Union	2,922	3,163	3,417	3,719	4,019	4,281	4,580	4,855	5,146

	Future Land Use (as portion of Sewer District)											
	Rural Growth		**Suburban Growth**		**Conservation**		**Industrial**		**Mixed Use**		**Office, Institutional, Business**	
Columbia-Union	**93,883**	**81.81%**	**17,104**	**14.90%**	**3,178**	**2.77%**	**0**	**0.00%**	**544**	**0.47%**	**49**	**0.04%**
UPDATED (Remove Conservation)		84%		15%				0%		0.49%		0.04%

River Basin

40%	South River
60%	NE Cape Fear River

Estimated Growth per User Type							
	% Customers fronted by water line	# of Customers fronted by water line	% of Customers served by PCU water	# of Residential Customers served by PCU water	Estimated Mixed Use/O,I,B Growth %	Mixed Use & O,I,B Acreage	Mixed Use & O,I,B Flow Contribution
2015							
2020							
2025							
2030							
2035							
2040							
Implementation (assume 2045)[1]	30%	1,025	80%	820			
2050	40%	1,712	80%	1,370	1%	2	3,224

[1]-Implementation in 30 years at 2045 per PCU. From 2014 USDA PERs - # of housing units fronted by initial water system layout X 80% of people will sign up for water

Pender County Population Projections per District										
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Avg % Growth/Yr**
Maple Hill	1,500	1,600	1,600	1,700	1,700	1,800	1,800	1,900	2,000	0.62%

Pender County Housing Units Projections per District									
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Maple Hill	776	803	829	856	883	904	931	959	988

	Future Land Use (as portion of Sewer District)											
	Rural Growth		**Suburban Growth**		**Conservation**		**Industrial**		**Mixed Use**		**Office, Institutional, Business**	
Maple Hill	**17,476**	**70.46%**	**3,717**	**14.98%**	**3,610**	**14.56%**	**0**	**0.00%**	**0**	**0.00%**	**0**	**0.00%**
UPDATED (Remove Conservation)		82%		18%				0%		0%		0%

River Basin

100%	NE Cape Fear River

Estimated Growth per User Type			
	% of Total Housing Units	# of Residential Customers served by PCU water	
2010 Average			
2015 Average	44%	350	439 with 80 inactive
2020	50%	420	
2025	55%	470	
2030	60%	530	
Year 2035	65%	590	
2040	70%	650	
2045	75%	720	
Year 2050	80%	790	

Pender County Population Projections per District										
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Avg % Growth/Yr**
Rocky Point/Topsail WSD	26,700	34,500	44,800	49,300	53,800	57,500	61,500	65,900	70,500	3.13%

Pender County Housing Units Projections per District									
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Rocky Point/Topsail WSD	11,356	14,681	19,085	20,993	22,883	24,485	26,199	28,032	29,995

	Future Land Use (as portion of Sewer District)											
	Rural Growth		**Suburban Growth**		**Conservation**		**Industrial**		**Mixed Use**		**Office, Institutional, Business**	
Rocky Point/Topsail WSD	**25,763**	**16.70%**	**34,248**	**22.21%**	**58,612**	**38.00%**	**3,374**	**2.19%**	**31,008**	**20.10%**	**1,230**	**0.80%**
UPDATED (Remove Conservation)		27%		36%				4%		32%		1%

River Basin

79%	NE Cape Fear River
21%	New River

Estimated Growth per User Type							
	% of Total Housing Units	# of Residential Customers served by PCU water	Estimated Mixed Use/O,I,B Growth %	Mixed Use & O,I,B Acreage	Mixed Use & O,I,B Flow Contribution	Estimated Industrial Growth %	Industrial Acreage
2010 Average	36%	4,100	0.41%	93	139,568	0.00%	0
2015 Average	37%	5,500	0.39%	90	135,714	0.00%	0
2020	40%	7,630	0.50%	115	172,014	1.00%	34
2025	42%	8,820	0.58%	132	197,817	3.00%	101
2030	44%	10,070	0.68%	155	232,219	5.00%	169
Year 2035[2]	50%	12,240	0.83%	189	283,824	7.00%	236
2040	60%	15,720	1.03%	235	352,630	8.00%	270
2045	70%	19,620	1.28%	292	438,637	9.00%	304
Year 2050	75%	22,500	1.58%	361	541,845	10.00%	337

**Note that there is still a good portion of RPTWSD that is not have access to PCU water system.

**Per PCU, approximately 30% of District is served by water. The majority of district to be served in 25 years.

Pender County Population Projections per District										
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Avg % Growth/Yr**
Scott's Hill WSD	1,200	1,600	2,000	2,200	2,300	2,500	2,600	2,800	3,000	2.76%

Pender County Housing Units Projections per District									
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Scott's Hill WSD	543	722	908	977	1,046	1,105	1,171	1,253	1,328

	Future Land Use (as portion of Sewer District)											
	Rural Growth		**Suburban Growth**		**Conservation**		**Industrial**		**Mixed Use**		**Office, Institutional, Business**	
Rocky Point/Topsail WSD	**0**	**0.00%**	**0**	**0.00%**	**684**	**14.33%**	**0**	**0.00%**	**4,087**	**85.67%**	**0**	**0.00%**
UPDATED (Remove Conservation)		0%		0%				0%		100%		0%

River Basin

55%	NE Cape Fear River
45%	New River

Population Currently Served & Projected					
	% of Total Housing Units	# of Customers that choose to be served by PCU water	Estimated Mixed Use/O,I,B Growth %	Mixed Use & O,I,B Acreage	Mixed Use & O,I,B Flow Contribution
2012 Average	N/A	N/A	0.00%	0	
2015 Average	76%	550	0.04%	1	1,752
2020	77%	700	0.07%	2	2,825
2025	79%	770	0.09%	3	3,898
2030	81%	850	0.12%	3	4,971
Year 2035[2]	83%	920	0.14%	4	6,044
2040	85%	1,000	0.17%	5	7,117
2045	90%	1,130	0.19%	5	8,190
Year 2050	95%	1,260	0.22%	6	9,263

Attachment B
Probabilistic Variables

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Water Demand and Wastewater Flow Forecast Model

Global Input Data

PCU_Forecast_Model_V2_PA_forTMAppendix 8/16/16

Parameters	Units	Name	In Use	Index	Low	Base	High		Prob. Distribution	Notes	
Globals											
Base Year		baseYear	2015	2		2015					
First Year		firstYear	2015	2		2015					
Time Horizon		timeHorizon	35	2		35				Units = years	
					5th Perc.	50th Perc.	95th Perc.				
Drift Rate (Growth)											
Drift Rate		driftRate	0.0%	2	-100%	0%	100%			Drift in growth rate from project average condition	
Unit Water Consumption Values											
Residential (RES)		resUnitCons	125	2	115	125	135			Units = gpd/customer account, based on historic billing data	
Residential Support (RES-Com)		resSupUnitCons	25	2	20	25	30			Units = gpd/customer account	
Commercial (COM)		comUnitCons	1500	2	750	1500	2250			Units = gpd/acre	
Industrial (IND)		indUnitCons	1000	2	500	1000	1500			Units = gpd/acre	
Connection Assumptions											
% customers fronted by line (variation)		percCustConnVar	0.0%	2	-50%	0%	50%			variation in customer with direct access to PCU water line (variaiton from USDA PER assumptions)	
% of customers connected to water line (served by PCU)		percCustConn								not used as a probabilistic variable	
Person per household (by WSD)											
Central		pphCentral	2.13	2	1.90	2.13	2.35			base value from 2010 US Census data (establised based on Townships)	
Moore's Creek		pphMC	1.98	2	1.80	1.98	2.20			base value from 2010 US Census data (establised based on Townships)	
Columbia Union		pphCU	2.18	2	1.95	2.18	2.40			base value from 2010 US Census data (establised based on Townships)	
Maple Hill		pphMH	1.98	2	1.80	1.98	2.20			base value from 2010 US Census data (establised based on Townships)	
Rocky Point-Topsail		pphRP	2.35	2	2.10	2.35	2.60			base value from 2010 US Census data (establised based on Townships)	
Scott's Hill		pphSH	2.23	2	2.00	2.23	2.45			base value from 2010 US Census data (establised based on Townships)	
Mixed Use RES to COM ratio											
RES %		percRES	30%	2		30%					
COM %		percCOM	70%	2		70%					
Percent Suburban Growth - COM growth area											
Central		percCentralSubGr	27.0%	2	20%	27%	35%			based assumption from GIS analysis of land area	
Moore's Creek		percMCISubGr	21.0%	2	15%	21%	25%			based assumption from GIS analysis of land area	
Columbia Union		percCUSubGr	15.0%	2	10%	15%	20%			based assumption from GIS analysis of land area	
Maple Hill		percMHSubGr	18.0%	2	15%	18%	25%			based assumption from GIS analysis of land area	
Rocky Point-Topsail		percRPSubGr	36.0%	2	25%	36%	45%			based assumption from GIS analysis of land area	
Scott's Hill		percSHSubGr	0.0%	2	0%	0%	0%			based assumption from GIS analysis of land area	all suburban growth
IBT River Basin Percentage by WSD											
Central	NE Cape Fear	centralNECF	100%	2		100%				based assumption from GIS analysis of land area	
Moore's Creek	Cape Fear	mooresCF	9%	2		9%				based assumption from GIS analysis of land area	
Moore's Creek	NE Cape Fear	moresNECF	32%	2		32%				based assumption from GIS analysis of land area	
Moore's Creek	South River	mooresSR	59%	2		59%				based assumption from GIS analysis of land area	
Columbia Union	NE Cape Fear	cuNECF	60%	2		60%				based assumption from GIS analysis of land area	
Columbia Union	South River	cuSR	40%	2		40%				based assumption from GIS analysis of land area	
Maple Hill	NE Cape Fear	mhNECF	100%	2		100%				based assumption from GIS analysis of land area	
Rocky Point-Topsa	NE Cape Fear	rpNECF	79%	2		79%				based assumption from GIS analysis of land area	
Rocky Point-Topsa	New River	rpNR	21%	2		21%				based assumption from GIS analysis of land area	
Scott's Hill	NE Cape Fear	shNECF	55%	2		55%				based assumption from GIS analysis of land area	
Scott's Hill	New River	shNR	45%	2		45%				based assumption from GIS analysis of land area	
Non-Revenue Water (Real Losses only) Factor											
Non-revenue water as a factor of finished water		nonRevWater	1.15	2	1.05	1.15	1.25			defined based on historic data	
Maximum Month Average Day Peaking Factor											
MMAD PF		watermmadPF	1.24	2	1.10	1.24	1.40			defined based on historic data (water demand)	
Wastewater Generation Factor											
WW generation	RES	wwGenFactors	90.0%	2	80%	90%	100%			applied to average day, based on review of winter vs. summer historic demand	
US 421 WWTP											
% of WW flow to WWTP (from NE Cape Fear basin)		us421NECF	52.0%	2	25%	52%	75%			based on % of COM/IND demand	
Moore's Creek WSD, NE Cape Fear Basin											
Stakeholder Water Supply Requirements											
Aqua/Utiltiies Inc.		staholdAqUtil	100%	2	0%	100%	100%			percent of future demand	
Burgaw		staholdBurgaw	1.01	2	0.00	1.01	2.03			units = mgd, existing supply limitation, PCU provide for demands over supply	
Surf City		staholdSurfCity	25%	2	0%	25%	100%			percent of future demand	
Topsail Beach		staholdTopBeach	25%	2	0%	25%	100%			percent of future demand	
Wallace		staholdWallace	25%	2	0%	25%	100%			percent of future demand	
Start Year for Supply Need											
Aqua/Utiltiies Inc.		stakYearAqUt	2020	2	2018	2020	2030			based on input from PCU	
Burgaw		stakYearBurgaw	2025	2	2020	2025	2045			based on input from PCU	
Surf City		stakYearSurfCity	2030	2	2025	2030	2045			based on input from PCU	
Topsail Beach		stakYearTopBeach	2030	2	2025	2030	2045			based on input from PCU	
Wallace		stakYearWallace	2030	2	2025	2030	2045			based on input from PCU	
Max Month Average Day Peaking Factor											
Aqua/Utiltiies Inc.		watermmadPFAqUt	1.45	2	1.15	1.45	1.80			defined based on historic data (water demand) for Utilities Inc.	
Burgaw		watermmadPFBurg	1.39	2	1.10	1.39	1.75			defined based on historic data (water demand) from LWSP	
Surf City		watermmadPFSurf	2.36	2	1.90	2.36	2.95			defined based on historic data (water demand) from LWSP	
Topsail Beach		watermmadPFTops	2.11	2	1.70	2.11	2.65			defined based on historic data (water demand) from LWSP	
Wallace		watermmadPFWall	1.39	2	1.10	1.39	1.75			defined based on historic data (water demand) from LWSP	

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APPENDIX D

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Board of Commissioners
George R. Brown Jr., Chairman
Fred McCoy, Vice-Chairman
David Williams Jr.
David Piepmeyer
Demetrice Keith

Randell Woodruff, County Manager
Carl W. "Trey" Thurman, County Attorney

March 31, 2016
(FedEX – Direct Signature)

Mr. Steve J. Rowlan, Chairman
NC Environmental Management Commission
c/o Lois Thomas, EMC Recording Clerk
Directors Office – Division of Water Resources
512 Salisbury Street
Raleigh, NC 27604

Subject: Notice of Intent to Request an Interbasin Transfer Certificate for Pender County

Dear Mr. Rowlan:

Pender County is a fast growing coastal county with a 2015 population of over 56,000. The growth in the County has been and will continue to be driven by its location in the vicinity of Wilmington, its coastal community access and its strategic priorities related to economic development and expansion of public infrastructure into areas of the County that do not currently have water utility services.

The County is in the process of developing long-range water supply plans for water service to its six (6) water and sewer districts and two municipalities within the County, St. Helena and Watha, which currently receive water service. The Pender County Board of County Commissioners (BoCC) serves as the governing body for each of the water and sewer districts. The districts are shown in Exhibit 1 and are identified as follows: Central Pender, Columbia/Union, Maple Hill, Moore's Creek, Rocky Point/Topsail, and Scotts Hill. The municipalities are also shown.

The County currently owns and operates a two (2) million gallon per day (MGD) water treatment plant (WTP) that treats surface water from the Cape Fear River. The County is a wholesale raw water customer of the Lower Cape Fear Water and Sewer Authority (LCFWASA). When the WTP was constructed in 2012, taking the County system off of groundwater as a water supply source, it was constructed such that it was easily expandable to be able to treat and distribute up to 6 MGD. Potable water from the WTP is distributed from the Cape Fear River to three IBT river basins, including the South River, Northeast Cape Fear and the New River (Exhibit 1), as defined by N.C.G.S § 143-215.22G.

In the implementation of one of the County's strategic priorities to expand public infrastructure, the County is constructing over 70 miles of water lines in the Moore's Creek and Central Pender districts this year, and over 200 miles of water infrastructure is planned over the next 20 years. The residents of the Moore's Creek and Central Pender districts voted in support of a $45 million and $27 million bond referendum, respectively, for the expansion and the availability of a reliable potable water supply.

In addition to the currently underway and planned near-term water system expansion, the County is engaging in this planning process as a regional provider of surface water. The County has reached out to other neighboring utilities, including all other utility providers within Pender County, to see who may consider obtaining surface water through the County's system in the future. These utilities are currently reliant on groundwater for their potable water needs.

In light of the County's planning related to service area expansion and meeting the needs of future growth, near-term demands in the water and sewer districts within the IBT river basins will increase above the transfer limit of 2 MGD, per N.C.G.S. § 143-215.22, within the next few years. Therefore, Pender County is respectfully submitting this Notice of Intent to notify the Environmental Management Commission (EMC) of its plans to request an Interbasin Transfer (IBT) Certificate. The following utilities that are currently reliant on groundwater have identified the need to receive water from the County in the future and will be co-applicants in this process: Town of Burgaw; Town of Topsail Beach; Town of Surf City; Utilities, Inc; and the Town of Wallace, which is located within Duplin County. Pender County and its co-applicants are requesting an authorized transfer between designated IBT river basins, from the Cape Fear River to the South River, Northeast Cape Fear River, and New River basins of up to 15 million gallons per day (mgd), calculated as a daily average of a calendar month. This transfer amount is based on updated water use projections to year 2050. Exhibit 1 shows the study area for this request.

Pender County is aware of the IBT Certificate process outlined in N.C.G.S. § 143-215.22 and qualifies as a "coastal county" under the N.C.G.S. § 143-215.22L (w). This section dictates the requirements for these counties to request and acquire an IBT certificate, and Pender County intends to comply with the components of the process outlined therein. Pender County is submitting this notice as the primary applicant with the support of the communities to whom they provide water and may provide water in the future. These communities will be co-applicants during the petition process.

Pender County has actively reached out to its regional neighboring utilities, will engage the public interests during this process, and will work closely with the North Carolina Division of Water Resources to ensure compliance with the various steps of the process. As an initial step of this process, Pender County has obtained a resolution of support from the Lower Cape Fear Water and Sewer Authority (LCFWASA), the raw water provider to Pender County (attached).

Please direct any correspondence regarding this Notice of Intent and subsequent process to Michael Mack, Director of Pender County Utilities at 910-259-1570. Questions may also be directed to Ray Cox with Highfill Infrastructure Engineering, P.C. at 910-313-1516.

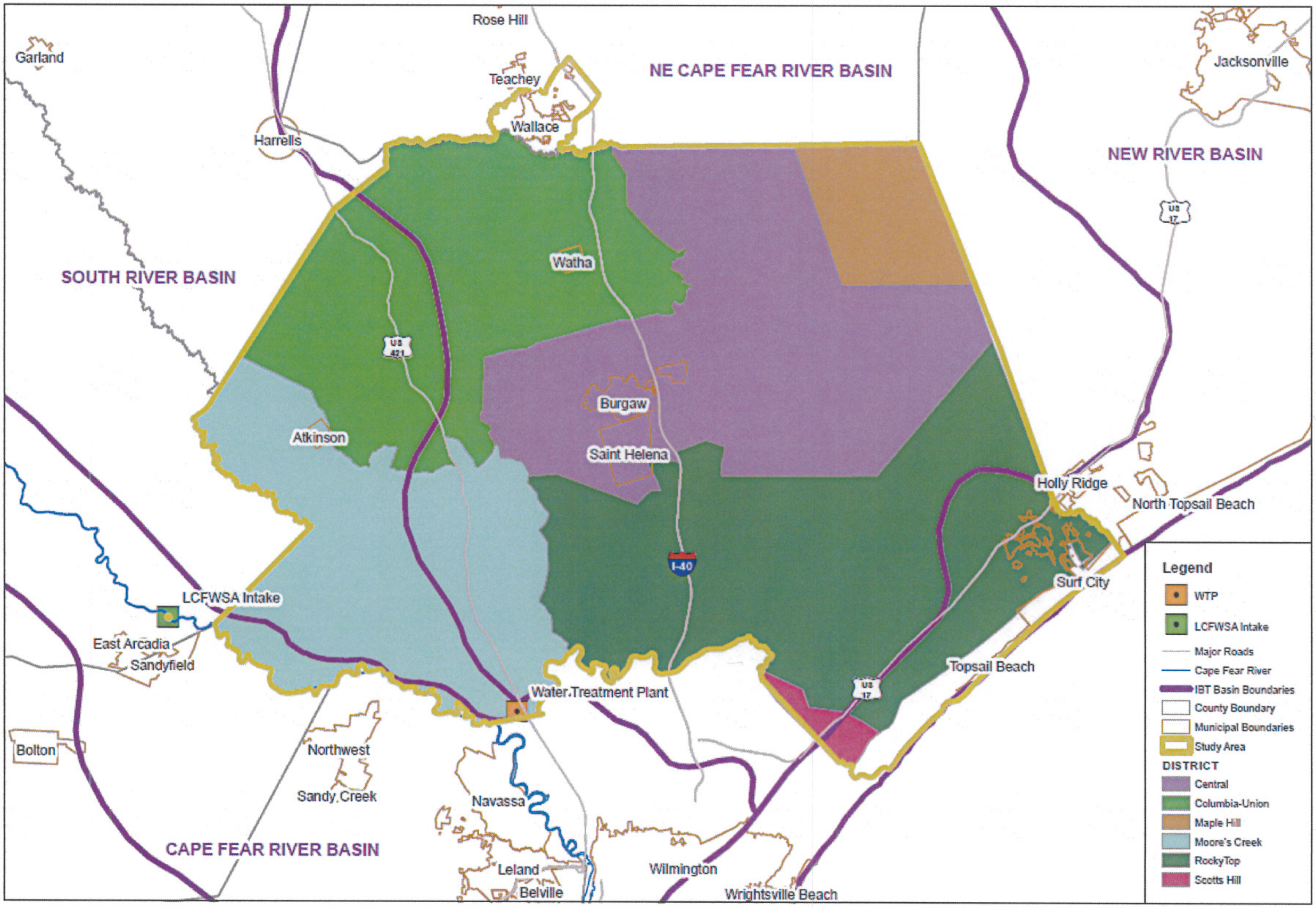
Sincerely,

Randall Woodruff, County Manager
Pender County

Michael Mack, Director
Pender County Utilities

cc: Mr. Jay Zimmerman, Director, NC DEQ Division of Water Resources
Mr. Tom Fransen, Water Planning Section Chief, NC DEQ Division of Water Resources
Mr. Ray Cox, Highfill Infrastructure Engineering, P.C.
Mr. Adam Sharpe, CH2M HILL North Carolina, Inc.

Exhibit 1



Garland
Rose Hill
Teachey
Wallace
Harrells
NE CAPE FEAR RIVER BASIN
Jacksonville
NEW RIVER BASIN
US 17
SOUTH RIVER BASIN
Watha
US 421
Burgaw
Saint Helena
Atkinson
Holly Ridge
North Topsail Beach
I-40
Surf City
LCFWSA Intake
East Arcadia
Sandyfield
Topsail Beach
Water Treatment Plant
Bolton
Northwest
Sandy Creek
Navassa
CAPE FEAR RIVER BASIN
Leland
Belville
Wilmington
Wrightsville Beach
Legend
WTP
LCFWSA Intake
Major Roads
Cape Fear River
IBT Basin Boundaries
County Boundary
Municipal Boundaries
Study Area
DISTRICT
Central
Columbia-Union
Maple Hill
Moore's Creek
RockyTop
Scotts Hill

Resolution in Support of Pender County Utilities Long Range Water Supply Planning and Proposed Interbasin Transfer Permit Petition to the North Carolina Environmental Management Commission

WHEREAS, the Lower Cape Fear Water and Sewer Authority is located within the Cape Fear River watershed; and

WHEREAS, Pender County has secured a long term, reliable water supply via purchase agreement of surface water from the Lower Cape Fear Water and Sewer Authority, invested in a 6 MGD water treatment plant in 2012; and

WHEREAS, the customers of Pender County Utilities have projected reasonable increases in water demand based on expanded service areas, moderate growth projections and continued efforts to replace groundwater supplies; and

WHEREAS, Pender County Utilities has invested in a forward-thinking, long range water supply planning and investment effort to meet the needs of its growing customer base for decades to come; and

WHEREAS, Pender County lies within the Cape Fear River watershed, but is subject to Interbasin Transfer rules based on smaller sub-basin delineations within Pender County and is engaging in the pursuit of an Interbasin Transfer Certificate; and

WHEREAS, the Lower Cape Fear Water and Sewer Authority appreciates Pender County Utilities' efforts to involve its neighboring utilities and stakeholders in its long range planning:

NOW THEREFORE BE IT RESOLVED, that the Chairman and the Board of Directors for the Lower Cape Fear Water and Sewer Authority hereby support the Pender County Utilities Long Range Water Supply Planning and Proposed Interbasin Transfer Certificate process and the associated effort to work with the NC Department of Environmental Quality as an efficient means to meet the projected water demands of Pender County.

Adopted this 8th day of February, 2016.

Bill Saffo

Bill Saffo, Chairman

ATTEST:

Larry Sneeden, Secretary

APPENDIX E

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NORTH CAROLINA DEPARTMENT OF NATURAL AND CULTURAL RESOURCES

Pat McCrory Governor	**Bryan Gossage** Executive Director Clean Water Management Trust Fund	**Susan Kluttz** Secretary

NCNHDE-1776

June 22, 2016

Verd Anna Pettigrew
CH2M
3120 Highwoods Blvd
Raleigh, NC 27604
verdanna.pettigrew@ch2m.com

RE: Pender Co Water Supply

Dear Verd Anna Pettigrew:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources from our database that have been compiled for the project referenced above.

A query of the NCNHP database indicates that there are records for rare species, important natural communities, natural areas, or conservation/managed areas within the proposed project boundary submitted with your request for information. These results are presented in the attached 'Documented Occurrences' table and map.

Also attached is a table summarizing rare species and natural communities that have been documented within a one-mile radius of the project boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists and is included for reference. In the event that rare species are found within the project area, please contact the NCNHP so that we may update our records. Tables of natural areas and conservation/managed area within a one-mile radius, if any, are also included in this report.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NC Natural Heritage Program data may not be redistributed without permission from the NCNHP.

Also please note that the NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve (DNP), Registered Heritage Area (RHA), or an occurrence of a Federally-listed species is documented within or near the project area.

Thank you for your inquiry. If you have questions regarding the information provided in this letter or need additional assistance, please contact Suzanne Mason at suzanne.mason@ncdcr.gov or 919.707.8637.

Sincerely,
NC Natural Heritage Program

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Intersecting the Project Area
Pender Co Water Supply
June 22, 2016
NCNHDE-1776

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	1783	Ambystoma mabeei	Mabee's Salamander	1976-02-06	Historical	3-Medium	---	Significantly Rare	G4	S2
Amphibian	21469	Anaxyrus quercicus	Oak Toad	2012-05-23	Current	2-High	---	Significantly Rare	G5	S3
Amphibian	35974	Anaxyrus quercicus	Oak Toad	1966-08-06	Historical	3-Medium	---	Significantly Rare	G5	S3
Amphibian	21223	Anaxyrus quercicus	Oak Toad	1991-08-06	Current	2-High	---	Significantly Rare	G5	S3
Amphibian	35495	Eurycea quadridigitata	Dwarf Salamander	2003-01-04	Current	3-Medium	---	Special Concern	G5	S2
Amphibian	24854	Hemidactylium scutatum	Four-toed Salamander	2007-06-03	Current	2-High	---	Special Concern	G5	S3
Amphibian	35097	Hyla andersonii	Pine Barrens Treefrog	2008-07-23	Current	3-Medium	---	Significantly Rare	G4	S3
Amphibian	19152	Lithobates capito	Carolina Gopher Frog	1998-05-19	Current	3-Medium	Species of Concern	Threatened	G3	S1
Amphibian	11021	Lithobates capito	Carolina Gopher Frog	2014-03-21	Current	1-Very High	Species of Concern	Threatened	G3	S1
Amphibian	35863	Pseudacris nigrita	Southern Chorus Frog	2004-04-22	Current	2-High	---	Significantly Rare	G5	S2
Animal Assemblage	31223	Colonial Wading Bird Colony	---	2012	Current	3-Medium	---	---	G5	S3
Animal Assemblage	32244	Colonial Wading Bird Colony	---	2009-05-02	Current	2-High	---	---	G5	S3
Animal Assemblage	32255	Colonial Wading Bird Colony	---	2009-05-04	Current	2-High	---	---	G5	S3
Animal Assemblage	32242	Colonial Wading Bird Colony	---	2009-06-02	Current	2-High	---	---	G5	S3
Animal Assemblage	32401	Colonial Wading Bird Colony	---	2009-05-02	Current	2-High	---	---	G5	S3

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Animal Assemblage	11649	Gull-Tern-Skimmer Colony	---	2011	Current	3-Medium	---	---	G5	S3
Animal Assemblage	18729	Gull-Tern-Skimmer Colony	---	2014-05-22	Current	3-Medium	---	---	G5	S3
Animal Assemblage	1335	Gull-Tern-Skimmer Colony	---	1977	Historical	3-Medium	---	---	G5	S3
Animal Assemblage	23852	Gull-Tern-Skimmer Colony	---	2007	Current	3-Medium	---	---	G5	S3
Animal Assemblage	15820	Gull-Tern-Skimmer Colony	---	1983-06	Historical	3-Medium	---	---	G5	S3
Animal Assemblage	5782	Gull-Tern-Skimmer Colony	---	1976	Historical	3-Medium	---	---	G5	S3
Animal Assemblage	15294	Gull-Tern-Skimmer Colony	---	2011	Current	3-Medium	---	---	G5	S3
Bird	8767	Ammodramus henslowii susurrans	Eastern Henslow's Sparrow	1984-08-18	Current	3-Medium	Species of Concern	Special Concern	G4T4	S1B,S1N
Bird	27208	Charadrius wilsonia	Wilson's Plover	2007	Current	3-Medium	---	Special Concern	G5	S2B
Bird	8192	Columbina passerina	Common Ground-Dove	1988	Historical	3-Medium	---	Significantly Rare	G5	SXB
Bird	32243	Egretta caerulea	Little Blue Heron	2009-06-02	Current	2-High	---	Special Concern	G5	S3B,S3N
Bird	31957	Elanoides forficatus	Swallow-tailed Kite	2013-05-07	Current	2-High	---	Significantly Rare	G5	S1B
Bird	22211	Haliaeetus leucocephalus	Bald Eagle	2009	Current	2-High	Bald/Golden Eagle Protection Act	Threatened	G5	S3B,S3N
Bird	31300	Haliaeetus leucocephalus	Bald Eagle	2012	Historical	2-High	Bald/Golden Eagle Protection Act	Threatened	G5	S3B,S3N
Bird	32256	Ixobrychus exilis	Least Bittern	2009-05-04	Current	3-Medium	---	Special Concern	G5	S2S3B
Bird	17486	Passerina ciris ciris	Eastern Painted Bunting	2002-04-13	Current	3-Medium	Species of Concern	Special Concern	G5T3T4	S3B

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Bird	7272	Peucaea aestivalis	Bachman's Sparrow	1988-06	Current	3-Medium	Species of Concern	Special Concern	G3	S3B,S2N
Bird	20014	Peucaea aestivalis	Bachman's Sparrow	1989-06-17	Current	3-Medium	Species of Concern	Special Concern	G3	S3B,S2N
Bird	7946	Picoides borealis	Red-cockaded Woodpecker	1999	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	15722	Picoides borealis	Red-cockaded Woodpecker	1976-09	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	11251	Picoides borealis	Red-cockaded Woodpecker	1999	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	4763	Picoides borealis	Red-cockaded Woodpecker	1976-11	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	11250	Picoides borealis	Red-cockaded Woodpecker	1999-PRE	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	3960	Picoides borealis	Red-cockaded Woodpecker	1999	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	14084	Picoides borealis	Red-cockaded Woodpecker	1976-11	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	6259	Picoides borealis	Red-cockaded Woodpecker	1999-PRE	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	23332	Picoides borealis	Red-cockaded Woodpecker	2005	Current	2-High	Endangered	Endangered	G3	S2
Bird	23327	Picoides borealis	Red-cockaded Woodpecker	2005	Current	2-High	Endangered	Endangered	G3	S2
Bird	26025	Picoides borealis	Red-cockaded Woodpecker	2008-03-06	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	24665	Picoides borealis	Red-cockaded Woodpecker	2007-02-28	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	24666	Picoides borealis	Red-cockaded Woodpecker	2007-02-28	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	15831	Picoides borealis	Red-cockaded Woodpecker	1989-01-24	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	8600	Picoides borealis	Red-cockaded Woodpecker	1991-11-04	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	7890	Picoides borealis	Red-cockaded Woodpecker	1988	Historical	3-Medium	Endangered	Endangered	G3	S2

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Bird	6958	Rynchops niger	Black Skimmer	2014-05-23	Current	3-Medium	---	Special Concern	G5	S2B,S3N
Bird	10389	Rynchops niger	Black Skimmer	2007	Current	3-Medium	---	Special Concern	G5	S2B,S3N
Bird	15488	Rynchops niger	Black Skimmer	1997	Current	3-Medium	---	Special Concern	G5	S2B,S3N
Bird	10083	Sterna hirundo	Common Tern	2001	Current	3-Medium	---	Special Concern	G5	S2B
Bird	1804	Sterna hirundo	Common Tern	2011	Current	3-Medium	---	Special Concern	G5	S2B
Bird	5383	Sterna hirundo	Common Tern	2001	Current	3-Medium	---	Special Concern	G5	S2B
Bird	27098	Sterna hirundo	Common Tern	2007	Current	3-Medium	---	Special Concern	G5	S2B
Bird	19274	Sternula antillarum	Least Tern	2014	Current	3-Medium	---	Special Concern	G4	S3B
Bird	35718	Sternula antillarum	Least Tern	2014-05-22	Current	3-Medium	---	Special Concern	G4	S3B
Bird	11554	Sternula antillarum	Least Tern	2011	Current	3-Medium	---	Special Concern	G4	S3B
Bird	18148	Sternula antillarum	Least Tern	2011	Current	3-Medium	---	Special Concern	G4	S3B
Bird	18783	Sternula antillarum	Least Tern	2011	Historical	3-Medium	---	Special Concern	G4	S3B
Bird	35722	Sternula antillarum	Least Tern	2014	Current	3-Medium	---	Special Concern	G4	S3B
Bird	35723	Sternula antillarum	Least Tern	1977	Historical	3-Medium	---	Special Concern	G4	S3B
Bird	23853	Sternula antillarum	Least Tern	2007	Current	3-Medium	---	Special Concern	G4	S3B
Butterfly	2765	Amblyscirtes alternata	Dusky Roadside-Skipper	1997-08-31	Current	3-Medium	---	Significantly Rare	G2G3	S2
Butterfly	2766	Amblyscirtes alternata	Dusky Roadside-Skipper	1995-08-24	Current	3-Medium	---	Significantly Rare	G2G3	S2
Butterfly	5296	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-08-18	Current	3-Medium	---	Significantly Rare	G3G4	S3

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Butterfly	3089	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-08-24	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	285	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-05-02	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	7623	Amblyscirtes reversa	Reversed Roadside-Skipper	1997-08-31	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	3090	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-06-28	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	15061	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-07-20	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	9698	Calephelis virginiensis	Little Metalmark	2014-09-22	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	23171	Calephelis virginiensis	Little Metalmark	2007-10-07	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	11507	Calephelis virginiensis	Little Metalmark	2014-10-10	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	15031	Calephelis virginiensis	Little Metalmark	2014-09-22	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	7264	Calephelis virginiensis	Little Metalmark	1991-10-11	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	12510	Callophrys hesseli	Hessel's Hairstreak	1995-04-13	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	12851	Callophrys irus	Frosted Elfin	2014-04	Current	3-Medium	---	Significantly Rare	G3	S2
Butterfly	12707	Euphyes bimacula	Two-spotted Skipper	1997-08-03	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	34480	Neonympha areolatus	Georgia Satyr	2009-09-13	Current	3-Medium	---	Significantly Rare	G3G4	S2
Butterfly	34481	Neonympha areolatus	Georgia Satyr	2014-10	Current	3-Medium	---	Significantly Rare	G3G4	S2
Dragonfly or Damselfly	32078	Arigomphus pallidus	Gray-green Clubtail	1992-07-08	Current	3-Medium	---	Significantly Rare	G5	S1
Dragonfly or Damselfly	33697	Lestes vidua	Carolina Spreadwing	2011-04-18	Current	3-Medium	---	Significantly Rare	G5	S2?
Dragonfly or Damselfly	33359	Stylurus ivae	Shining Clubtail	1967-10-06	Historical	3-Medium	---	Significantly Rare	G4	S2S3

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Dragonfly or Damselfly	33367	Triacanthagyna trifida	Phantom Darner	1971-10-26	Current	3-Medium	---	Significantly Rare	G5	S1?
Freshwater Bivalve	6037	Anodonta couperiana	Barrel Floater	2008-10-08	Current	3-Medium	---	Endangered	G4	S1
Freshwater Bivalve	18640	Elliptio folliculata	Pod Lance	1990-09-07	Historical	3-Medium	---	Special Concern	G2G3Q	S2
Freshwater Bivalve	1439	Elliptio marsupiobesa	Cape Fear Spike	2005-05-12	Current	3-Medium	---	Special Concern	G3Q	S2
Freshwater Bivalve	26076	Elliptio marsupiobesa	Cape Fear Spike	2000-04-12	Current	3-Medium	---	Special Concern	G3Q	S2
Freshwater Bivalve	31409	Elliptio roanokensis	Roanoke Slabshell	2008-10-08	Current	3-Medium	---	Threatened	G3	S3
Freshwater Bivalve	1450	Fusconaia masoni	Atlantic Pigtoe	1995-09-27	Current	3-Medium	Species of Concern	Endangered	G2	S3
Freshwater Bivalve	25392	Lampsilis cariosa	Yellow Lampmussel	1990-07-12	Historical	3-Medium	Species of Concern	Endangered	G3G4	S3
Freshwater Bivalve	708	Lampsilis radiata	Eastern Lampmussel	2001-10-16	Current	3-Medium	---	Threatened	G5	S3
Freshwater Bivalve	25941	Lampsilis radiata	Eastern Lampmussel	1990-07-12	Historical	3-Medium	---	Threatened	G5	S3
Freshwater Bivalve	29609	Villosa delumbis	Eastern Creekshell	2008-10-08	Current	3-Medium	---	Significantly Rare	G4	S4
Freshwater Bivalve	29612	Villosa delumbis	Eastern Creekshell	1995-08-25	Current	3-Medium	---	Significantly Rare	G4	S4
Freshwater Bivalve	29616	Villosa delumbis	Eastern Creekshell	2004-07-30	Current	3-Medium	---	Significantly Rare	G4	S4
Freshwater Fish	31805	Enneacanthus chaetodon	Blackbanded Sunfish	1962-07-30	Historical	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	31793	Enneacanthus chaetodon	Blackbanded Sunfish	1962-08-01	Historical	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	31803	Enneacanthus chaetodon	Blackbanded Sunfish	1962-07-20	Historical	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	32374	Enneacanthus obesus	Banded Sunfish	2000-04-13	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32347	Enneacanthus obesus	Banded Sunfish	1974-03-01	Historical	3-Medium	---	Significantly Rare	G5	S3

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Freshwater Fish	32373	Enneacanthus obesus	Banded Sunfish	2000-04-13	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32357	Enneacanthus obesus	Banded Sunfish	1995-05-19	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32370	Enneacanthus obesus	Banded Sunfish	1999-05-04	Current	2-High	---	Significantly Rare	G5	S3
Freshwater Fish	33045	Heterandria formosa	Least Killifish	2002-05-26	Current	3-Medium	---	Special Concern	G5	S2
Freshwater Fish	33043	Heterandria formosa	Least Killifish	2002-07-19	Current	3-Medium	---	Special Concern	G5	S2
Freshwater Fish	10158	Noturus sp. 2	Broadtail Madtom	1973	Historical	3-Medium	Species of Concern	Special Concern	G2	S2
Grasshopper or Katydid	34516	Melanoplus decorus	Decorated Spur-throat Grasshopper	2014-06-23	Current	3-Medium	---	Significantly Rare	G2G3	S2S3
Grasshopper or Katydid	21323	Melanoplus decorus	Decorated Spur-throat Grasshopper	2014-10-10	Current	3-Medium	---	Significantly Rare	G2G3	S2S3
Grasshopper or Katydid	35106	Melanoplus decorus	Decorated Spur-throat Grasshopper	2014-10-10	Current	2-High	---	Significantly Rare	G2G3	S2S3
Grasshopper or Katydid	34513	Stethophyma celatum	Broad-winged Sedge Grasshopper	2014-06-23	Current	3-Medium	---	Significantly Rare	G4	S1S2
Grasshopper or Katydid	18460	Stethophyma celatum	Broad-winged Sedge Grasshopper	2000-05-26	Current	3-Medium	---	Significantly Rare	G4	S1S2
Mammal	27748	Condylura cristata pop. 1	Star-nosed Mole - Coastal Plain population	2007-12-08	Current	3-Medium	---	Special Concern	G5T2Q	S2
Mammal	18574	Neotoma floridana floridana	Florida Eastern Woodrat	1997-08-18	Current	3-Medium	---	Threatened	G5T5	S1
Mammal	5571	Neotoma floridana floridana	Florida Eastern Woodrat	1987	Current	3-Medium	---	Threatened	G5T5	S1
Mayfly	35325	Amercaenis cusabo	a mayfly	1993-08	Current	3-Medium	---	Significantly Rare	G3	S1
Moss	23413	Bruchia brevifolia	A Pygmy Moss	1954-02-18	Historical	3-Medium	---	Significantly Rare Throughout	G3G4	S1?
Moth	33627	Acronicta sinescripta	a Dagger Moth	1992-09-01	Current	3-Medium	---	Significantly Rare	G3G4	S1S3

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Moth	26171	Acronicta sinescripta	a Dagger Moth	1995-07-25	Current	3-Medium	---	Significantly Rare	G3G4	S1S3
Moth	26172	Agrotis carolina	a Dart Moth	1996-04-18	Current	3-Medium	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	6119	Agrotis carolina	a Dart Moth	1991-09-10	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	26202	Agrotis carolina	a Dart Moth	1995-04-27	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33601	Agrotis carolina	a Dart Moth	1995-08-01	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33590	Agrotis carolina	a Dart Moth	1995-08-29	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33589	Agrotis carolina	a Dart Moth	1995-04-04	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33598	Agrotis carolina	a Dart Moth	1996-04-18	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	35060	Argyrostrotis quadrifilaris	Four-lined Chocolate	2011-04-18	Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	34052	Argyrostrotis quadrifilaris	Four-lined Chocolate	1995-04-12	Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26178	Eubaphe meridiana	Little Beggar Moth		Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	21194	Eubaphe meridiana	Little Beggar Moth	1991-05-09	Obscure	2-High	---	Significantly Rare	G4	S2S3
Moth	34515	Exyra ridingsii	a Pitcher-plant Moth	2014-06-23	Current	3-Medium	---	Significantly Rare	G2G4	S2
Moth	26138	Exyra semicrocea	a Pitcher-plant Moth		Obscure	3-Medium	---	Significantly Rare	G3G4	S2S3
Moth	26201	Gabara sp. 1	a Noctuid Moth		Obscure	3-Medium	---	Significantly Rare	G1G3	S1S2
Moth	22583	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	1996-04-18	Current	3-Medium	Species of Concern	Significantly Rare	G1	S1?
Moth	22584	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	2004-04-19	Current	3-Medium	Species of Concern	Significantly Rare	G1	S1?
Moth	22582	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	1995-04-17	Historical	3-Medium	Species of Concern	Significantly Rare	G1	S1?

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Moth	20043	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	2000-05-26	Current	3-Medium	Species of Concern	Significantly Rare	G1	S1?
Moth	5558	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	2005-05-26	Current	2-High	Species of Concern	Significantly Rare	G1	S1?
Moth	26141	Hypagyrtis brendae	Brenda's Hypagyrtis Moth		Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26140	Iridopsis cypressaria	Small Cypress Looper	1995-04-04	Current	3-Medium	---	Significantly Rare	GU	S2S3
Moth	26203	Lagoa pyxidifera	Yellow Flannel Moth		Obscure	3-Medium	---	Significantly Rare	G4G5	S2S3
Moth	26182	Lagoa pyxidifera	Yellow Flannel Moth		Obscure	3-Medium	---	Significantly Rare	G4G5	S2S3
Moth	26143	Lithophane laceyi	a Pinion Moth		Obscure	3-Medium	---	Significantly Rare	G4	S1S3
Moth	26142	Nematocampa baggettaria	Baggett's Nematocampa		Obscure	3-Medium	---	Significantly Rare	G2G4	S1S2
Moth	34514	Papaipema appassionata	Pitcher-plant Borer Moth	2014-06-23	Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26169	Papaipema appassionata	Pitcher-plant Borer Moth		Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26170	Papaipema eryngii	Rattlesnake-master Borer Moth	1995-10-19	Historical	3-Medium	Candidate	Significantly Rare	G1G2	S1
Moth	26137	Photedes carterae	Carter's Noctuid Moth		Obscure	3-Medium	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	35108	Photedes carterae	Carter's Noctuid Moth	2009-10-17	Current	2-High	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	21197	Photedes carterae	Carter's Noctuid Moth	1991-10-10	Current	2-High	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	16337	Photedes carterae	Carter's Noctuid Moth	1991-10-10	Current	2-High	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	26134	Schinia carolinensis	Carolina Schinia Moth		Current	3-Medium	---	Significantly Rare	G3	S2S3
Moth	26186	Schinia jaguarina	Jaguar Flower Moth		Current	3-Medium	---	Significantly Rare	G4	S1S3

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	490	Blackwater Bottomland Hardwoods (High Subtype)	---	2010	Current	3-Medium	---	---	G3G4	S2S3
Natural Community	30968	Blackwater Bottomland Hardwoods (Low Subtype)	---	2010	Current	3-Medium	---	---	G4?	S3
Natural Community	30967	Blackwater Bottomland Hardwoods (Swamp Transition Subtype)	---	2010	Current	3-Medium	---	---	G3G5	S3
Natural Community	24673	Blackwater Bottomland Hardwoods (Swamp Transition Subtype)	---	2006-05-20	Current	2-High	---	---	G3G5	S3
Natural Community	29544	Brackish Marsh (Needlerush Subtype)	---	2002-02-28	Current	3-Medium	---	---	G5	S5
Natural Community	15542	Brownwater Bottomland Hardwoods (Swamp Transition Subtype)	---	2010	Current	2-High	---	---	G3G4	S3
Natural Community	20126	Brownwater Levee Forest (Low Levee Subtype)	---	2010	Current	2-High	---	---	G3G4	S3S4
Natural Community	17440	Coastal Plain Cliff	---	1994-10-07	Current	3-Medium	---	---	G2?	S1
Natural Community	15074	Coastal Plain Cliff	---	1985-03	Current	2-High	---	---	G2?	S1
Natural Community	12581	Coastal Plain Small Stream Swamp	---	1997-09-21	Current	2-High	---	---	G4?	S4
Natural Community	8168	Coastal Plain Small Stream Swamp	---	2010-10-07	Current	2-High	---	---	G4?	S4
Natural Community	757	Cypress--Gum Swamp (Blackwater Subtype)	---	2008-01-30	Current	2-High	---	---	G4?	S4
Natural Community	3672	Cypress--Gum Swamp (Blackwater Subtype)	---	1991-08-22	Current	3-Medium	---	---	G4?	S4
Natural Community	31528	Dune Grass (Southern Subtype)	---	2011-08-24	Current	3-Medium	---	---	G3	S2
Natural Community	24410	High Pocosin (Evergreen Subtype)	---	2012	Current	3-Medium	---	---	G3	S3S4

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	14650	Low Pocosin (Titi Subtype)	---	2010	Current	3-Medium	---	---	G2G3	S2S3
Natural Community	31529	Maritime Dry Grassland (Typic Subtype)	---	2011-08-24	Current	3-Medium	---	---	G2G3	S2
Natural Community	247	Maritime Evergreen Forest (Mid Atlantic Subtype)	---	1999-12-11	Current	3-Medium	---	---	G2	S2
Natural Community	12680	Maritime Evergreen Forest (Mid Atlantic Subtype)	---	1999-11-06	Current	3-Medium	---	---	G2	S2
Natural Community	20098	Maritime Evergreen Forest (Mid Atlantic Subtype)	---	2010	Current	2-High	---	---	G2	S2
Natural Community	31530	Maritime Shrub (Stunted Tree Subtype)	---	2011-08-24	Current	2-High	---	---	G3	S2
Natural Community	9417	Mesic Mixed Hardwood Forest (Coastal Plain Subtype)	---	2007-06-27	Current	2-High	---	---	G3	S3
Natural Community	17618	Mesic Pine Savanna (Coastal Plain Subtype)	---	1995-10	Current	3-Medium	---	---	G2G3	S2
Natural Community	10818	Mesic Pine Savanna (Coastal Plain Subtype)	---	1992-06-06	Current	3-Medium	---	---	G2G3	S2
Natural Community	6794	Peatland Atlantic White Cedar Forest	---	2005	Current	3-Medium	---	---	G2	S1
Natural Community	14218	Pine/Scrub Oak Sandhill (Coastal Fringe Subtype)	---	1992-06-13	Current	3-Medium	---	---	G2	S2
Natural Community	10194	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)	---	2010	Current	3-Medium	---	---	G3?	S3
Natural Community	16090	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)	---	2010	Current	3-Medium	---	---	G3?	S3
Natural Community	11807	Pond Pine Woodland (Typic Subtype)	---	2006-04-24	Current	2-High	---	---	G3	S3
Natural Community	19779	Pond Pine Woodland (Typic Subtype)	---	1992-06	Current	3-Medium	---	---	G3	S3
Natural Community	16048	Pond Pine Woodland (Typic Subtype)	---	1995-08-03	Current	3-Medium	---	---	G3	S3

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	4158	Pond Pine Woodland (Typic Subtype)	---	2010-10-07	Current	2-High	---	---	G3	S3
Natural Community	19156	Pond Pine Woodland (Typic Subtype)	---	1985-03	Obscure	2-High	---	---	G3	S3
Natural Community	31534	Salt Flat	---	2011-08-24	Current	3-Medium	---	---	G5	S4
Natural Community	31533	Salt Marsh (Carolinian Subtype)	---	2011-08-24	Current	2-High	---	---	G5	S4
Natural Community	15860	Sandy Pine Savanna (Rush Featherling Subtype)	---	1995-10	Current	3-Medium	---	---	G1	S1
Natural Community	16807	Sandy Pine Savanna (Typic Subtype)	---	1999-06-14	Current	3-Medium	---	---	G3	S1
Natural Community	30420	Sandy Pine Savanna (Typic Subtype)	---	2010	Current	2-High	---	---	G3	S1
Natural Community	17321	Small Depression Drawdown Meadow (Boggy Pool Subtype)	---	2010-10-07	Current	2-High	---	---	G2	S1
Natural Community	11641	Small Depression Drawdown Meadow (Typic Subtype)	---	1999-09-13	Current	3-Medium	---	---	G2?	S2S3
Natural Community	5610	Small Depression Pocosin (Typic Subtype)	---	2012	Current	3-Medium	---	---	G2G3	S2S3
Natural Community	9597	Small Depression Pocosin (Typic Subtype)	---	1985-03	Current	2-High	---	---	G2G3	S2S3
Natural Community	17600	Streamhead Atlantic White Cedar Forest	---	1999-09-30	Current	3-Medium	---	---	G2	S2
Natural Community	6554	Streamhead Pocosin	---	1998-07-01	Current	3-Medium	---	---	G4	S4
Natural Community	19546	Tidal Swamp (Cypress--Gum Subtype)	---	2006-04-28	Current	2-High	---	---	G3G4	S4
Natural Community	25634	Tidal Swamp (Cypress--Gum Subtype)	---	2000-06-06	Current	2-High	---	---	G3G4	S4
Natural Community	18875	Tidal Swamp (Cypress--Gum Subtype)	---	2008-03-22	Current	2-High	---	---	G3G4	S4

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	1664	Tidal Swamp (Cypress--Gum Subtype)	---	2002-03-06	Current	2-High	---	---	G3G4	S4
Natural Community	26898	Tidal Swamp (Cypress--Gum Subtype)	---	2008-03-20	Current	2-High	---	---	G3G4	S4
Natural Community	17378	Very Wet Loamy Pine Savanna	---	1997-08-18	Current	3-Medium	---	---	G1	S1
Natural Community	4582	Very Wet Loamy Pine Savanna	---	1999-06-14	Current	3-Medium	---	---	G1	S1
Natural Community	6159	Very Wet Loamy Pine Savanna	---	1998-09-25	Current	3-Medium	---	---	G1	S1
Natural Community	13706	Very Wet Loamy Pine Savanna	---	1996-10-29	Current	3-Medium	---	---	G1	S1
Natural Community	7046	Very Wet Loamy Pine Savanna	---	2012	Current	2-High	---	---	G1	S1
Natural Community	18997	Wet Loamy Pine Savanna	---	2010	Current	3-Medium	---	---	G1	S1
Natural Community	16411	Wet Loamy Pine Savanna	---	1992-06-13	Current	3-Medium	---	---	G1	S1
Natural Community	4254	Wet Loamy Pine Savanna	---	1999-06-14	Current	3-Medium	---	---	G1	S1
Natural Community	2405	Wet Loamy Pine Savanna	---	1999-08-11	Current	3-Medium	---	---	G1	S1
Natural Community	9295	Wet Loamy Pine Savanna	---	1998-07-09	Current	3-Medium	---	---	G1	S1
Natural Community	15193	Wet Loamy Pine Savanna	---	1995-10-10	Current	3-Medium	---	---	G1	S1
Natural Community	6243	Wet Loamy Pine Savanna	---	1998-09-28	Current	3-Medium	---	---	G1	S1
Natural Community	7995	Wet Marl Forest	---	2006-03	Current	3-Medium	---	---	G1	S1
Natural Community	14836	Wet Marl Forest	---	2005-03-21	Current	1-Very High	---	---	G1	S1
Natural Community	18454	Wet Pine Flatwoods (Sand Myrtle Subtype)	---	2010	Current	3-Medium	---	---	G2?	S1
Natural Community	24414	Wet Pine Flatwoods (Typic Subtype)	---	2006-04-24	Current	1-Very High	---	---	G3	S3

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	18057	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	31411	Wet Pine Flatwoods (Typic Subtype)	---	2012-09-13	Current	2-High	---	---	G3	S3
Natural Community	7860	Wet Pine Flatwoods (Typic Subtype)	---	2010-10-07	Current	3-Medium	---	---	G3	S3
Natural Community	12633	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	11677	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	2-High	---	---	G3	S3
Natural Community	1920	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	13130	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	15537	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	16499	Xeric Sandhill Scrub (Coastal Fringe Subtype)	---	2006	Current	3-Medium	---	---	G2?	S2
Natural Community	9220	Xeric Sandhill Scrub (Typic Subtype)	---	1985-03	Current	2-High	---	---	G3?	S3S4
Natural Community	8190	Xeric Sandhill Scrub (Typic Subtype)	---	1995-08-03	Current	3-Medium	---	---	G3?	S3S4
Natural Community	3500	Xeric Sandhill Scrub (Typic Subtype)	---	1991-08-21	Current	2-High	---	---	G3?	S3S4
Reptile	14044	Alligator mississippiensis	American Alligator	1994	Current	3-Medium	Threatened Similar Appearance	Threatened	G5	S3
Reptile	33389	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1974-06-06	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33384	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1975-07-08	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	5159	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1976-08-13	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	16962	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1969-10-01	Historical	3-Medium	Species of Concern	Endangered	G4	S1

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Reptile	17690	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1973-07-23	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	22914	Crotalus adamanteus	Eastern Diamondback Rattlesnake	2002-09-04	Current	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	7371	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1975-11-13	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	16314	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1977-05-01	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	13849	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1979-04-22	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33383	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1973-10-29	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33380	Crotalus adamanteus	Eastern Diamondback Rattlesnake	2006-08	Current	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	9066	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1973-09-21	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33109	Crotalus adamanteus	Eastern Diamondback Rattlesnake	2013-05-23	Current	2-High	Species of Concern	Endangered	G4	S1
Reptile	7511	Crotalus horridus	Timber Rattlesnake	2003-07-17	Current	3-Medium	---	Special Concern	G4	S3
Reptile	17717	Deirochelys reticularia	Chicken Turtle	1996-08-18	Current	3-Medium	---	Significantly Rare	G5	S3
Reptile	35661	Deirochelys reticularia	Chicken Turtle	1995-PRE	Current	3-Medium	---	Significantly Rare	G5	S3
Reptile	34907	Farancia erytrogramma	Rainbow Snake	1996-05-19	Current	3-Medium	---	Significantly Rare	G4	S3
Reptile	34909	Farancia erytrogramma	Rainbow Snake	1996-05-15	Current	3-Medium	---	Significantly Rare	G4	S3
Reptile	34908	Farancia erytrogramma	Rainbow Snake	1989-05	Historical	3-Medium	---	Significantly Rare	G4	S3
Reptile	16801	Malaclemys terrapin	Diamondback Terrapin	2008-04-13	Current	3-Medium	FSC, in part	Special Concern	G4	S3
Reptile	19499	Malaclemys terrapin	Diamondback Terrapin	2014-05-18	Current	3-Medium	FSC, in part	Special Concern	G4	S3
Reptile	35470	Ophisaurus attenuatus	Slender Glass Lizard	2004-09-28	Current	3-Medium	---	Significantly Rare	G5	S2

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Reptile	35587	Ophisaurus mimicus	Mimic Glass Lizard	2004-04-22	Current	3-Medium	Species of Concern	Special Concern	G3	S1
Reptile	35611	Seminatrix pygaea	Black Swampsnake	2009-04-02	Current	3-Medium	---	Significantly Rare	G5	S2
Reptile	3883	Seminatrix pygaea	Black Swampsnake	1975-04-15	Historical	3-Medium	---	Significantly Rare	G5	S2
Reptile	16354	Seminatrix pygaea	Black Swampsnake	1971-10-02	Historical	3-Medium	---	Significantly Rare	G5	S2
Vascular Plant	2498	Agalinis virgata	Branched Gerardia	1991-10-08	Current	3-Medium	---	Threatened	G3G4Q	S2
Vascular Plant	23461	Agalinis virgata	Branched Gerardia	2002-10-13	Current	2-High	---	Threatened	G3G4Q	S2
Vascular Plant	23450	Agrostis altissima	Tall Bentgrass	2011-10-23	Current	2-High	---	Significantly Rare Throughout	G4	S2
Vascular Plant	23458	Agrostis altissima	Tall Bentgrass	1991-10-08	Current	3-Medium	---	Significantly Rare Throughout	G4	S2
Vascular Plant	23452	Agrostis altissima	Tall Bentgrass	1996-10-29	Current	3-Medium	---	Significantly Rare Throughout	G4	S2
Vascular Plant	33028	Aletris lutea	Yellow Colic-root	2011-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S1
Vascular Plant	33320	Allium sp. 1	Savanna Onion	2012-09-01	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	12601	Allium sp. 1	Savanna Onion	2006-08-30	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	4846	Allium sp. 1	Savanna Onion	2007-05-10	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	6579	Allium sp. 1	Savanna Onion	2009-09-13	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	9745	Allium sp. 1	Savanna Onion	1999-06-14	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	23015	Allium sp. 1	Savanna Onion	1992-09-23	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	23014	Allium sp. 1	Savanna Onion	2012-09-27	Current	2-High	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	1320	Amaranthus pumilus	Seabeach Amaranth	2014-08-18	Current	2-High	Threatened	Threatened	G2	S1S2

Element Occurrences Documented Within Project Area

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Vascular Plant	9714	Amaranthus pumilus	Seabeach Amaranth	2014-08-21	Current	3-Medium	Threatened	Threatened	G2	S1S2
Vascular Plant	19187	Amaranthus pumilus	Seabeach Amaranth	2010-08-05	Current	3-Medium	Threatened	Threatened	G2	S1S2
Vascular Plant	318	Amorpha georgiana	Georgia Indigo-bush	1995-10-20	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	33325	Amorpha georgiana	Georgia Indigo-bush	2011-11-06	Current	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	24481	Amorpha georgiana	Georgia Indigo-bush	2006-06-27	Current	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	22776	Andropogon mohrii	Bog Bluestem	2005-08-26	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	3923	Andropogon mohrii	Bog Bluestem	1997-08-18	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	15495	Andropogon mohrii	Bog Bluestem	1995-09-28	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	8919	Andropogon mohrii	Bog Bluestem	1999-08-13	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	22777	Andropogon mohrii	Bog Bluestem	2005-10-02	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	3403	Andropogon mohrii	Bog Bluestem	1997-10-26	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	31081	Andropogon mohrii	Bog Bluestem	1993-06-08	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	21495	Arenaria lanuginosa var. lanuginosa	Spreading Sandwort	1950-07-01	Historical	3-Medium	---	Significantly Rare Peripheral	G5T5	S1
Vascular Plant	22787	Aristida condensata	Big Three-awn Grass	2005-11-08	Current	2-High	---	Threatened	G4?	S2
Vascular Plant	1727	Aristida simpliciflora	Chapman's Three-awn	1999-10-28	Current	3-Medium	---	Endangered	G3G4	S1S2
Vascular Plant	10657	Aristida simpliciflora	Chapman's Three-awn	2002-10-09	Current	3-Medium	---	Endangered	G3G4	S1S2
Vascular Plant	22793	Aristida simpliciflora	Chapman's Three-awn	2005-10-02	Current	3-Medium	---	Endangered	G3G4	S1S2
Vascular Plant	22792	Aristida simpliciflora	Chapman's Three-awn	2007-05-10	Current	2-High	---	Endangered	G3G4	S1S2
Vascular Plant	22790	Aristida simpliciflora	Chapman's Three-awn	2004-11-09	Current	2-High	---	Endangered	G3G4	S1S2
Vascular Plant	23400	Aristida tenuispica	Hillsboro Three-awn Grass	1999-10-28	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	11184	Arnoglossum ovatum	Savanna Indian-plantain	1992-06-08	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	20108	Arnoglossum ovatum	Savanna Indian-plantain	1997-08-18	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	701	Arnoglossum ovatum	Savanna Indian-plantain	1998-06-21	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	16169	Arnoglossum ovatum	Savanna Indian-plantain	1996-08-05	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	11838	Arnoglossum ovatum	Savanna Indian-plantain	1999-08-13	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	33327	Arnoglossum ovatum	Savanna Indian-plantain	2011-08-26	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	24483	Arnoglossum ovatum	Savanna Indian-plantain	2006-05-31	Current	2-High	---	Endangered	G4G5	S2
Vascular Plant	3896	Arnoglossum ovatum	Savanna Indian-plantain	2001-09-11	Current	2-High	---	Endangered	G4G5	S2
Vascular Plant	8626	Asclepias pedicellata	Savanna Milkweed	1995-07-19	Current	3-Medium	---	Special Concern Vulnerable	G4	S3

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	17742	Asclepias pedicellata	Savanna Milkweed	2009-08-04	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	1338	Asclepias pedicellata	Savanna Milkweed	1995-08-08	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	5631	Asclepias pedicellata	Savanna Milkweed	2012-06-03	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	3554	Asclepias pedicellata	Savanna Milkweed	1995-08-11	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	5072	Asclepias pedicellata	Savanna Milkweed	1998-07-21	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	15853	Asclepias pedicellata	Savanna Milkweed	1998-07-01	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	14137	Asclepias pedicellata	Savanna Milkweed	1995-08-31	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	223	Asclepias pedicellata	Savanna Milkweed	1995-06-29	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	13406	Asclepias pedicellata	Savanna Milkweed	1995-06-06	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	3294	Asclepias pedicellata	Savanna Milkweed	1997-08-12	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	19636	Asclepias pedicellata	Savanna Milkweed	1995-05-24	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	15371	Asclepias pedicellata	Savanna Milkweed	1997-07-29	Current	3-Medium	---	Special Concern Vulnerable	G4	S3

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	26744	Asclepias pedicellata	Savanna Milkweed	2007-06-15	Current	2-High	---	Special Concern Vulnerable	G4	S3
Vascular Plant	26064	Asclepias purpurascens	Purple Milkweed	2008-05-30	Current	2-High	---	Significantly Rare Throughout	G5?	S1?
Vascular Plant	11290	Astragalus michauxii	Sandhills Milk-vetch	1997-05-22	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S3
Vascular Plant	30851	Baccharis glomeruliflora	Silverling	2010-10-26	Current	2-High	---	Special Concern Historical	G4	S1
Vascular Plant	14003	Bacopa caroliniana	Blue Water-hyssop	1981-05-22	Current	3-Medium	---	Threatened	G4G5	S1
Vascular Plant	15276	Bacopa caroliniana	Blue Water-hyssop	1946-PRE	Historical	3-Medium	---	Threatened	G4G5	S1
Vascular Plant	8160	Bacopa caroliniana	Blue Water-hyssop	1981-04-27	Current	3-Medium	---	Threatened	G4G5	S1
Vascular Plant	31106	Bacopa rotundifolia	Round-leaf Water-hyssop	2004-06-17	Current	2-High	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	31105	Bacopa rotundifolia	Round-leaf Water-hyssop	2004-06-17	Current	2-High	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	23756	Calopogon multiflorus	Many-flower Grass-pink	2004-06-01	Current	3-Medium	Species of Concern	Endangered	G2G3	S1
Vascular Plant	5963	Cardamine longii	Long's Bittercress	2003-07-25	Current	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	16150	Cardamine longii	Long's Bittercress	1981-05-22	Historical	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	2914	Cardamine longii	Long's Bittercress	1981-05-22	Historical	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	1337	Cardamine longii	Long's Bittercress	1981-05-22	Historical	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	5225	Cardamine longii	Long's Bittercress	1997-05-11	Current	3-Medium	---	Special Concern Vulnerable	G3?	S1

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	21513	Carex austrodeflexa	Canebrake Sedge	2000-03-27	Current	3-Medium	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	26079	Carex austrodeflexa	Canebrake Sedge	2008-05-30	Current	2-High	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	27781	Carex austrodeflexa	Canebrake Sedge	2009-04-09	Current	2-High	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	6090	Carex basiantha	Widow Sedge	1999-06-12	Current	2-High	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	10629	Carex basiantha	Widow Sedge	1999-06-12	Current	2-High	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	19378	Carex basiantha	Widow Sedge	1999-11-05	Current	3-Medium	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	7103	Carex cherokeensis	Cherokee Sedge	1999-06-12	Current	2-High	---	Endangered	G4G5	S1
Vascular Plant	26306	Carex emmonsii	Emmons's Sedge	1980-04-10	Current	3-Medium	---	Significantly Rare Other	G5T5	S2
Vascular Plant	24068	Carex lutea	Golden Sedge	2005-05-05	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	17710	Carex lutea	Golden Sedge	2013-06-06	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	29877	Carex lutea	Golden Sedge	2012-06-15	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	7859	Carex lutea	Golden Sedge	2011-06-02	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	6956	Carex lutea	Golden Sedge	2013-05-13	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	16767	Carex lutea	Golden Sedge	2013-05-30	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	16768	Carex lutea	Golden Sedge	1998-06-21	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	24069	Carex lutea	Golden Sedge	2005-05-05	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	27051	Carex lutea	Golden Sedge	2013-05-30	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31276	Carex lutea	Golden Sedge	2012-05-04	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	24072	Carex lutea	Golden Sedge	1988-05-25	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	23013	Carex lutea	Golden Sedge	1996-06-03	Historical	2-High	Endangered	Endangered	G2	S2
Vascular Plant	1947	Carex lutea	Golden Sedge	2014-06-22	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31272	Carex lutea	Golden Sedge	2012-06-08	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	24071	Carex lutea	Golden Sedge	2006-05-30	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	23012	Carex lutea	Golden Sedge	2011-05-06	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31270	Carex lutea	Golden Sedge	2012-06-08	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	27050	Carex lutea	Golden Sedge	2007-06-20	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	28736	Carex reniformis	Kidney Sedge	2004-06-20	Current	2-High	---	Threatened	G4?	S1
Vascular Plant	9845	Carex socialis	Social Sedge	1998-05-12	Current	3-Medium	---	Significantly Rare Peripheral	G4	S1

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Vascular Plant	33175	Carex verrucosa	Warty Sedge	1999-06-14	Current	2-High	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	514	Carya myristiciformis	Nutmeg Hickory	2015-03-20	Current	2-High	---	Endangered	G4	S1
Vascular Plant	16871	Carya myristiciformis	Nutmeg Hickory	2008-09-21	Current	2-High	---	Endangered	G4	S1
Vascular Plant	11409	Chasmanthium nitidum	A Spanglegrass	1995-09-27	Current	3-Medium	---	Threatened	G3G4	S1
Vascular Plant	5169	Chasmanthium nitidum	A Spanglegrass	1997-07-29	Current	3-Medium	---	Threatened	G3G4	S1
Vascular Plant	12885	Cirsium lecontei	Leconte's Thistle	2015-06-29	Current	2-High	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	2681	Cirsium lecontei	Leconte's Thistle	1966-08-07	Historical	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	8591	Cirsium lecontei	Leconte's Thistle	1998-07-06	Current	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	3723	Cirsium lecontei	Leconte's Thistle	2012-05-24	Current	2-High	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	10291	Cirsium lecontei	Leconte's Thistle	2010-08-17	Current	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	33331	Cirsium lecontei	Leconte's Thistle	2012-07-26	Current	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	33197	Cirsium nuttallii	Nuttall's Thistle	1999-06-14	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	10279	Cladium mariscoides	Twig-rush	2007-05-10	Current	2-High	---	Significantly Rare Other	G5	S3
Vascular Plant	19456	Cladium mariscoides	Twig-rush	1999-08-03	Current	3-Medium	---	Significantly Rare Other	G5	S3
Vascular Plant	1974	Cladium mariscoides	Twig-rush	1997-09-02	Current	3-Medium	---	Significantly Rare Other	G5	S3
Vascular Plant	14196	Clinopodium georgianum	Georgia Calamint	1994-03-19	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	601	Clinopodium georgianum	Georgia Calamint	2007-06-27	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	22819	Clinopodium georgianum	Georgia Calamint	2015-09-17	Current	2-High	---	Endangered	G5	S1
Vascular Plant	22818	Clinopodium georgianum	Georgia Calamint	2005-10-03	Current	2-High	---	Endangered	G5	S1

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Vascular Plant	19730	Clinopodium georgianum	Georgia Calamint	2015-09-20	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	31481	Coreopsis aristulata	Short-awned Coreopsis	2008-10-17	Current	3-Medium	---	Significantly Rare Limited	G1?	S1
Vascular Plant	26394	Coreopsis palustris	Beadle's Coreopsis	1957-10-05	Historical	3-Medium	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26375	Coreopsis palustris	Beadle's Coreopsis	1996-10-04	Current	3-Medium	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26395	Coreopsis palustris	Beadle's Coreopsis	1981-10-02	Historical	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26373	Coreopsis palustris	Beadle's Coreopsis	2001-09-11	Current	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26991	Coreopsis palustris	Beadle's Coreopsis	2000-10-16	Current	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	4738	Cornus asperifolia	Roughleaf Dogwood	1999-11-05	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	13342	Crocanthemum carolinianum	Carolina Sunrose	1981-04-23	Historical	3-Medium	---	Endangered	G4	S1
Vascular Plant	9052	Crocanthemum carolinianum	Carolina Sunrose	1995-04-11	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	33208	Crocanthemum carolinianum	Carolina Sunrose	1992-06-07	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	3641	Cyperus tetragonus	Four-angled Flatsedge	1999-11-06	Current	3-Medium	---	Special Concern Vulnerable	G4?	S1
Vascular Plant	12656	Dichanthelium caerulescens	Blue Witch Grass	2006-05-30	Current	3-Medium	---	Endangered	G2G3	S1S2
Vascular Plant	27783	Dichanthelium caerulescens	Blue Witch Grass	1998-06-21	Current	2-High	---	Endangered	G2G3	S1S2
Vascular Plant	24526	Dichanthelium cryptanthum	Hidden-flowered Witchgrass	2006-06-16	Current	2-High	---	Significantly Rare Throughout	G2G3	S2
Vascular Plant	33880	Dichanthelium spretum	Eaton's Witch Grass	1999-06-14	Current	3-Medium	---	Significantly Rare Disjunct	G5	S1S2
Vascular Plant	15978	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2

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Vascular Plant	12724	Dionaea muscipula	Venus Flytrap	1981-06	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8628	Dionaea muscipula	Venus Flytrap	1995-10-20	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	7475	Dionaea muscipula	Venus Flytrap	2004-06-22	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	13017	Dionaea muscipula	Venus Flytrap	1995-09-26	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3595	Dionaea muscipula	Venus Flytrap	2013-06-01	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	19344	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3593	Dionaea muscipula	Venus Flytrap	2015-06-29	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	21384	Dionaea muscipula	Venus Flytrap	2005-04-26	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8116	Dionaea muscipula	Venus Flytrap	1995-05-04	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3178	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	17111	Dionaea muscipula	Venus Flytrap	1987-06-17	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	18493	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2

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Vascular Plant	18141	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	17112	Dionaea muscipula	Venus Flytrap	1986-05	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	24381	Dionaea muscipula	Venus Flytrap	2006	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	4698	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8277	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	2654	Dionaea muscipula	Venus Flytrap	2005-08-31	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	1312	Dionaea muscipula	Venus Flytrap	2002-02-21	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	2747	Dionaea muscipula	Venus Flytrap	1995-06-30	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	16928	Dionaea muscipula	Venus Flytrap	1995-04-14	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	6774	Dionaea muscipula	Venus Flytrap	2007-06-14	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12512	Dionaea muscipula	Venus Flytrap	2002-06-19	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	442	Dionaea muscipula	Venus Flytrap	2015-06-03	Historical	2-High	Species of Concern	Special Concern Vulnerable	G3	S2

Element Occurrences Documented Within Project Area

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Vascular Plant	4618	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	31415	Dionaea muscipula	Venus Flytrap	2012-09-13	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8110	Dionaea muscipula	Venus Flytrap	2002-06-18	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	25544	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	25764	Dionaea muscipula	Venus Flytrap	2004-06	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	1113	Dionaea muscipula	Venus Flytrap	1995-06-09	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	9525	Dionaea muscipula	Venus Flytrap	2002-05-29	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	25540	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	23233	Ditrysinia fruticosa	Sebastian-bush	1961-06	Historical	3-Medium	---	Special Concern Vulnerable	G5	S2
Vascular Plant	21584	Eleocharis vivipara	Viviparous Spikerush	1998-07-14	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	12199	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	17953	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	19251	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	17837	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	17950	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	14107	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	29873	Eryngium aquaticum var. ravenelii	Marsh Eryngo	1999-09-29	Current	2-High	---	Significantly Rare Peripheral	G4T2T3	S1

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Vascular Plant	19553	Gelsemium rankinii	Swamp Jessamine	1995-04-12	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	11233	Gelsemium rankinii	Swamp Jessamine	1995-09-27	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	11234	Gelsemium rankinii	Swamp Jessamine	1995-08-30	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	10111	Gelsemium rankinii	Swamp Jessamine	1981-04-16	Historical	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22888	Gratiola aurea	Golden Hedge-hyssop	2004-06-06	Current	3-Medium	---	Special Concern Vulnerable	G5	S1
Vascular Plant	22002	Gratiola aurea	Golden Hedge-hyssop	1980-07-21	Historical	3-Medium	---	Special Concern Vulnerable	G5	S1
Vascular Plant	5479	Helenium pinnatifidum	Dissected Sneezeweed	1991-04-24	Current	3-Medium	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	15427	Helenium pinnatifidum	Dissected Sneezeweed	2000-04-21	Current	3-Medium	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	31852	Hymenocallis pygmaea	Waccamaw River Spiderlily	2004-06-20	Current	2-High	Species of Concern	Threatened	G1G2Q	S1
Vascular Plant	22942	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2004-11-09	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22941	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2004-11-09	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22945	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2002-10-09	Current	2-High	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22940	Hypericum brachyphyllum	Coastal Plain St. John's-wort	1996-10-19	Current	2-High	---	Special Concern Vulnerable	G5	S1S2

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	22943	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2004-11-09	Current	2-High	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22948	Hypoxis juncea	Fringed Yellow Stargrass	2009-08-04	Current	3-Medium	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	25891	Hypoxis juncea	Fringed Yellow Stargrass	1995-05-24	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	33411	Hypoxis juncea	Fringed Yellow Stargrass	1999-06-14	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	25890	Hypoxis juncea	Fringed Yellow Stargrass	1995-05-24	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	25931	Hypoxis juncea	Fringed Yellow Stargrass	1995-05-23	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	28655	Isoetes microvela	Thin-wall Quillwort	2010-05-28	Current	2-High	Species of Concern	Threatened	G1	S1
Vascular Plant	33335	Isolepis carinata	Keeled Beakrush	2012-03-26	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	13959	Lachnocaulon minus	Brown Bogbutton	1984-07-22	Current	3-Medium	---	Threatened	G3G4	S2
Vascular Plant	11363	Lechea torreyi var. congesta	Torrey's Pinweed	1999-10-07	Historical	3-Medium	---	Endangered	G4	S1
Vascular Plant	5704	Lechea torreyi var. congesta	Torrey's Pinweed	1997-09-21	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	27002	Leersia lenticularis	Catchfly Cutgrass	2003-10-25	Current	2-High	---	Significantly Rare Peripheral	G5	S2?
Vascular Plant	22955	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	2004-07-06	Current	3-Medium	---	Threatened	G5?T3?	S1S2
Vascular Plant	12479	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	1991-09-12	Current	3-Medium	---	Threatened	G5?T3?	S1S2
Vascular Plant	19999	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	1995-08-09	Current	3-Medium	---	Threatened	G5?T3?	S1S2
Vascular Plant	27007	Lupinus villosus	Lady Lupine	1997-05-22	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	27006	Lupinus villosus	Lady Lupine	1997-05-11	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	27506	Lupinus villosus	Lady Lupine	2006-04-23	Current	2-High	---	Significantly Rare Peripheral	G5	S1

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	27787	Lupinus villosus	Lady Lupine	2015-09-17	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	16717	Luziola fluitans	Southern Water Grass	2003-10-03	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	12650	Luziola fluitans	Southern Water Grass	1995-08-29	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	9952	Luziola fluitans	Southern Water Grass	2002-04-27	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	22965	Luziola fluitans	Southern Water Grass	2005-12-08	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	10466	Lysimachia asperulifolia	Rough-leaf Loosestrife	2002-06-20	Historical	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	5146	Lysimachia asperulifolia	Rough-leaf Loosestrife	1999-06-14	Current	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	13675	Lysimachia asperulifolia	Rough-leaf Loosestrife	2000-06-28	Current	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	14584	Lysimachia asperulifolia	Rough-leaf Loosestrife	2014-06-30	Current	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	9048	Lysimachia asperulifolia	Rough-leaf Loosestrife	2002-06-18	Historical	2-High	Endangered	Endangered	G3	S3
Vascular Plant	29989	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009-07-13	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	1317	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009-07-13	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	2907	Lysimachia asperulifolia	Rough-leaf Loosestrife	2014-05	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	1909	Lysimachia asperulifolia	Rough-leaf Loosestrife	2010-07-20	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	9176	Lysimachia asperulifolia	Rough-leaf Loosestrife	2010-07-20	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	35634	Lysimachia asperulifolia	Rough-leaf Loosestrife	2015-06-29	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	10164	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009-07-13	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	32596	Lysimachia asperulifolia	Rough-leaf Loosestrife	2006-06-07	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	22479	Lysimachia hybrida	Lowland Loosestrife	1997-07-29	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2?
Vascular Plant	22480	Lysimachia hybrida	Lowland Loosestrife	1995-08-10	Current	2-High	---	Significantly Rare Peripheral	G5	S2?
Vascular Plant	35784	Lythrum lanceolatum	Southern Winged-loosestrife	1957-07-26	Historical	3-Medium	---	Significantly Rare Throughout	G5	S1
Vascular Plant	35785	Lythrum lanceolatum	Southern Winged-loosestrife	1997-07-29	Current	3-Medium	---	Significantly Rare Throughout	G5	S1
Vascular Plant	35783	Lythrum lanceolatum	Southern Winged-loosestrife	2007-08-12	Current	2-High	---	Significantly Rare Throughout	G5	S1

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	1196	Macbridea caroliniana	Carolina Bogmint	1997-07-29	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	4968	Macbridea caroliniana	Carolina Bogmint	1997-07-29	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	95	Macbridea caroliniana	Carolina Bogmint	2001-08-23	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	13838	Macbridea caroliniana	Carolina Bogmint	2001-08-23	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	7643	Malaxis spicata	Florida Adder's-mouth	1979-08	Historical	3-Medium	---	Special Concern Vulnerable	G4?	S1
Vascular Plant	12603	Muhlenbergia torreyana	Pinebarren Smokegrass	2006-05-30	Current	3-Medium	---	Special Concern Vulnerable	G3	S2
Vascular Plant	24843	Muhlenbergia torreyana	Pinebarren Smokegrass	2004-06-04	Current	2-High	---	Special Concern Vulnerable	G3	S2
Vascular Plant	27013	Oenothera riparia	Riverbank Evening-primrose	2004-06-18	Current	3-Medium	---	Significantly Rare Limited	G2G3	S2S3
Vascular Plant	26902	Oenothera riparia	Riverbank Evening-primrose	2000-07-06	Current	2-High	---	Significantly Rare Limited	G2G3	S2S3
Vascular Plant	27469	Oplismenus hirtellus ssp. setarius	Shortleaf Basket Grass	1999-06-13	Current	2-High	---	Significantly Rare Peripheral	G5T5	S1
Vascular Plant	24556	Packera crawfordii	Bog Ragwort	2006-04-26	Current	2-High	---	Significantly Rare Throughout	G2G3	S1
Vascular Plant	35107	Packera crawfordii	Bog Ragwort	2012-04-04	Current	2-High	---	Significantly Rare Throughout	G2G3	S1
Vascular Plant	31507	Panicum dichotomiflorum var. puritanorum	Puritan Panic Grass	2011-08-19	Current	2-High	---	Significantly Rare Peripheral	G5T4	S1
Vascular Plant	644	Parnassia caroliniana	Carolina Grass-of-parnassus	2009	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	18448	Parnassia caroliniana	Carolina Grass-of-parnassus	2015-06-29	Current	3-Medium	Species of Concern	Threatened	G3	S2

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Vascular Plant	31279	Parnassia caroliniana	Carolina Grass-of-parnassus	2012-07-11	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	14283	Parnassia caroliniana	Carolina Grass-of-parnassus	1995-09-29	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	5938	Parnassia caroliniana	Carolina Grass-of-parnassus	1997-09-23	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	1887	Parnassia caroliniana	Carolina Grass-of-parnassus	2009	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	13339	Parnassia caroliniana	Carolina Grass-of-parnassus	2005-05-05	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	17167	Parnassia caroliniana	Carolina Grass-of-parnassus	1995-10-19	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	14285	Parnassia caroliniana	Carolina Grass-of-parnassus	2006-05-30	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	24822	Parnassia caroliniana	Carolina Grass-of-parnassus	2007-05-10	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	24557	Parnassia caroliniana	Carolina Grass-of-parnassus	2006-05-30	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	11217	Parnassia grandifolia	Large-leaved Grass-of-parnassus	1994-10-07	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	7731	Parnassia grandifolia	Large-leaved Grass-of-parnassus	1994-10-07	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	9896	Paspalum dissectum	Mudbank Crown Grass	1995-09-29	Current	3-Medium	---	Endangered	G4?	S2
Vascular Plant	5844	Peltandra sagittifolia	Spoonflower	1995-10-19	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	3091	Peltandra sagittifolia	Spoonflower	1995-07-19	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	17240	Peltandra sagittifolia	Spoonflower	1995-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12648	Peltandra sagittifolia	Spoonflower	1989-06-21	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12110	Peltandra sagittifolia	Spoonflower	1987-06-17	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	1011	Peltandra sagittifolia	Spoonflower	1995-08-11	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3

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Vascular Plant	4638	Peltandra sagittifolia	Spoonflower	1998-07-21	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	4640	Peltandra sagittifolia	Spoonflower	1999-06-23	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	23398	Phanopyrum gymnocarpon	Swamp Panic Grass	2003-10-25	Current	3-Medium	---	Significantly Rare Other	G5	S1
Vascular Plant	27796	Pinguicula lutea	Yellow Butterwort	1998-04-04	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27798	Pinguicula lutea	Yellow Butterwort	1995-05-05	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27799	Pinguicula lutea	Yellow Butterwort	1995-04-16	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27800	Pinguicula lutea	Yellow Butterwort	1995-05-03	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27797	Pinguicula lutea	Yellow Butterwort	1995-04-15	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	29887	Pinguicula lutea	Yellow Butterwort	1995-04-16	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	33341	Pinguicula pumila	Small Butterwort	2012-05-28	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	16233	Pinguicula pumila	Small Butterwort	1995-05-05	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	12461	Pinguicula pumila	Small Butterwort	2009-08-04	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	24332	Pinguicula pumila	Small Butterwort	2007-05-10	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	15788	Pinguicula pumila	Small Butterwort	1995-04-13	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	16234	Pinguicula pumila	Small Butterwort	1995-04-15	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	18614	Pinguicula pumila	Small Butterwort	1995-05-04	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	27683	Pinguicula pumila	Small Butterwort	2009-06-09	Current	2-High	---	Endangered	G4	S2
Vascular Plant	23161	Pinguicula pumila	Small Butterwort	2010-05-29	Current	2-High	---	Endangered	G4	S2
Vascular Plant	19513	Plantago sparsiflora	Pineland Plantain	2015-06-29	Current	2-High	Species of Concern	Threatened	G3	S1S2
Vascular Plant	11660	Plantago sparsiflora	Pineland Plantain	2009	Current	2-High	Species of Concern	Threatened	G3	S1S2
Vascular Plant	16811	Plantago sparsiflora	Pineland Plantain	2009	Current	3-Medium	Species of Concern	Threatened	G3	S1S2
Vascular Plant	7351	Platanthera integra	Yellow Fringeless Orchid	1997-09-02	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2

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Vascular Plant	11287	Platanthera integra	Yellow Fringeless Orchid	1995-08-31	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	11852	Platanthera integra	Yellow Fringeless Orchid	1995-08-30	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	11289	Platanthera integra	Yellow Fringeless Orchid	1995-09-14	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	15322	Platanthera nivea	Snowy Orchid	1988-07-09	Current	3-Medium	---	Threatened	G5	S1
Vascular Plant	18558	Polygala hookeri	Hooker's Milkwort	1993-06-06	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	7720	Polygala hookeri	Hooker's Milkwort	1998-06-24	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	5752	Polygala hookeri	Hooker's Milkwort	1995-08-30	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	4133	Polygala hookeri	Hooker's Milkwort	1995-08-11	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	12008	Polygala hookeri	Hooker's Milkwort	2003-06-27	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	12289	Polygala hookeri	Hooker's Milkwort	2015-06-29	Current	2-High	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	13840	Polygala hookeri	Hooker's Milkwort	1995-09-26	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	13836	Polygala hookeri	Hooker's Milkwort	1995-09-27	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3

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Vascular Plant	11689	Polygala hookeri	Hooker's Milkwort	1995-09-28	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	15189	Polygala hookeri	Hooker's Milkwort	1995-08-07	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	438	Polygala hookeri	Hooker's Milkwort	1995-09-28	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	700	Ponthieva racemosa	Shadow-witch	1959-09-20	Historical	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	19854	Ponthieva racemosa	Shadow-witch	1995-09-27	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	15834	Ponthieva racemosa	Shadow-witch	1991-10-11	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	4612	Ponthieva racemosa	Shadow-witch	1995-08-30	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	17685	Ponthieva racemosa	Shadow-witch	1999-10-05	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	8731	Ponthieva racemosa	Shadow-witch	1988-09-08	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	26494	Ponthieva racemosa	Shadow-witch	2008-09-21	Current	2-High	---	Threatened	G4G5	S2
Vascular Plant	28292	Pycnanthemum setosum	Awned Mountain-mint	1999-06-13	Current	3-Medium	---	Significantly Rare Throughout	G4	S2
Vascular Plant	33344	Pycnanthemum setosum	Awned Mountain-mint	2012-09-12	Current	2-High	---	Significantly Rare Throughout	G4	S2
Vascular Plant	28298	Quercus elliottii	Running Oak	1968-06-01	Historical	3-Medium	---	Significantly Rare Peripheral	G3G5	S2
Vascular Plant	593	Rhynchospora decurrens	Swamp Forest Beaksedge	1996-10-29	Current	3-Medium	Species of Concern	Threatened	G3G4	S1S2
Vascular Plant	33345	Rhynchospora decurrens	Swamp Forest Beaksedge	2012-06-15	Current	2-High	Species of Concern	Threatened	G3G4	S1S2
Vascular Plant	7368	Rhynchospora divergens	White-seeded Beaksedge	1996-08-05	Current	3-Medium	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	18342	Rhynchospora divergens	White-seeded Beaksedge	1999-07-16	Current	2-High	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	19350	Rhynchospora galeana	Short-bristled Beaksedge	1993-06-06	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	14942	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3

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Vascular Plant	12900	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-09	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	2146	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-07	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	8560	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12138	Rhynchospora galeana	Short-bristled Beaksedge	2000-07-11	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12136	Rhynchospora galeana	Short-bristled Beaksedge	1995-05-25	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	1989	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-30	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	18522	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-08	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	23284	Rhynchospora galeana	Short-bristled Beaksedge	2005-05-26	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	35641	Rhynchospora galeana	Short-bristled Beaksedge	2015-06-29	Current	2-High	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	33347	Rhynchospora microcarpa	Southern Beaksedge	2011-07-21	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	13767	Rhynchospora pinetorum	Small's Beaksedge	2007-05-10	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	10560	Rhynchospora pinetorum	Small's Beaksedge	1997-08-18	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	10561	Rhynchospora pinetorum	Small's Beaksedge	1998-06-21	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	5561	Rhynchospora pinetorum	Small's Beaksedge	2003-06-14	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	33348	Rhynchospora pinetorum	Small's Beaksedge	2011-06-10	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2

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Vascular Plant	7318	Rhynchospora pinetorum	Small's Beaksedge	2001-06-19	Current	2-High	---	Significantly Rare Throughout	G5?T3 ?	S2
Vascular Plant	23286	Rhynchospora pinetorum	Small's Beaksedge	2004-06-04	Current	2-High	---	Significantly Rare Throughout	G5?T3 ?	S2
Vascular Plant	6679	Rhynchospora thornei	Thorne's Beaksedge	2001-06-19	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	6877	Rhynchospora thornei	Thorne's Beaksedge	1991-06-27	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12546	Rhynchospora thornei	Thorne's Beaksedge	2009	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12047	Rhynchospora thornei	Thorne's Beaksedge	2009	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	23291	Rhynchospora thornei	Thorne's Beaksedge	2005-07-17	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	15993	Ruellia strepens	Limestone Wild-petunia	2008-05-25	Current	2-High	---	Endangered	G4G5	S1
Vascular Plant	7876	Ruellia strepens	Limestone Wild-petunia	1999-06-12	Current	2-High	---	Endangered	G4G5	S1
Vascular Plant	17079	Sageretia minutiflora	Small-flowered Buckthorn	1999-12-11	Current	3-Medium	---	Threatened	G4	S1
Vascular Plant	10396	Sagittaria filiformis	Water Arrowhead	1958-06-10	Historical	3-Medium	---	Significantly Rare Peripheral	G4G5	SH
Vascular Plant	13408	Sagittaria filiformis	Water Arrowhead	1981-04-27	Historical	3-Medium	---	Significantly Rare Peripheral	G4G5	SH
Vascular Plant	2605	Sagittaria weatherbiana	Grassleaf Arrowhead	2001-08-02	Current	3-Medium	Species of Concern	Endangered	G3G4	S2
Vascular Plant	12093	Sagittaria weatherbiana	Grassleaf Arrowhead	1949-04-23	Historical	3-Medium	Species of Concern	Endangered	G3G4	S2
Vascular Plant	11390	Schoenoplectus etuberculatus	Canby's Bulrush	1958-07-15	Historical	3-Medium	---	Significantly Rare Peripheral	G3G4	S3
Vascular Plant	16917	Scirpus lineatus	Drooping Bulrush	1998-05-20	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	4861	Scirpus lineatus	Drooping Bulrush	2008-05-25	Current	3-Medium	---	Threatened	G4	S2

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	2436	Scirpus lineatus	Drooping Bulrush	2006-05-31	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	29769	Scirpus lineatus	Drooping Bulrush	2011-06-10	Current	2-High	---	Threatened	G4	S2
Vascular Plant	1662	Scleria baldwinii	Baldwin's Nutrush	2011-09-16	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	22060	Scleria sp. 1	Smooth-seeded Hairy Nutrush	2013-05-30	Current	3-Medium	Species of Concern	Significantly Rare Limited	G2G3	S1
Vascular Plant	22061	Scleria sp. 1	Smooth-seeded Hairy Nutrush	2013-05-30	Current	3-Medium	Species of Concern	Significantly Rare Limited	G2G3	S1
Vascular Plant	9953	Scleria verticillata	Savanna Nutrush	1991-08-04	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	842	Scleria verticillata	Savanna Nutrush	1991-09-12	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	2148	Scleria verticillata	Savanna Nutrush	1996-10-04	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	31921	Solidago tortifolia	Twisted-leaf Goldenrod	1992-06-09	Current	3-Medium	---	Endangered	G4G5	S1
Vascular Plant	1905	Solidago verna	Spring-flowering Goldenrod	1984-05-16	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	3412	Solidago verna	Spring-flowering Goldenrod	1998-05-19	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	14430	Solidago verna	Spring-flowering Goldenrod	2006-05-01	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	15	Solidago verna	Spring-flowering Goldenrod	1981-05	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	11681	Solidago verna	Spring-flowering Goldenrod	1980-04-22	Historical	2-High	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	10835	Solidago verna	Spring-flowering Goldenrod	2003-05-26	Current	2-High	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	24361	Solidago villosicarpa	Coastal Goldenrod	2006-10-17	Current	3-Medium	Species of Concern	Endangered	G1	S1
Vascular Plant	1152	Solidago villosicarpa	Coastal Goldenrod	2006-10-17	Current	3-Medium	Species of Concern	Endangered	G1	S1
Vascular Plant	22362	Solidago villosicarpa	Coastal Goldenrod	2015-09-17	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	22320	Solidago villosicarpa	Coastal Goldenrod	2007-02-02	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	22361	Solidago villosicarpa	Coastal Goldenrod	2009-04-23	Current	2-High	Species of Concern	Endangered	G1	S1

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	24358	Solidago villosicarpa	Coastal Goldenrod	2006-11-01	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	22363	Solidago villosicarpa	Coastal Goldenrod	2005-10-20	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	23883	Spiranthes eatonii	Eaton's Ladies'-tresses	2003-06-09	Current	3-Medium	---	Endangered	G2G4	S2
Vascular Plant	32250	Spiranthes eatonii	Eaton's Ladies'-tresses	1995-06-08	Current	3-Medium	---	Endangered	G2G4	S2
Vascular Plant	27814	Spiranthes eatonii	Eaton's Ladies'-tresses	2012-06-03	Current	2-High	---	Endangered	G2G4	S2
Vascular Plant	33351	Spiranthes eatonii	Eaton's Ladies'-tresses		Obscure	1-Very High	---	Endangered	G2G4	S2
Vascular Plant	33353	Spiranthes laciniata	Lace-lip Ladies'-tresses	2011-06-09	Obscure	3-Medium	---	Special Concern Vulnerable	G4G5	S2
Vascular Plant	9581	Spiranthes longilabris	Giant Spiral Orchid	1997-10-26	Current	3-Medium	---	Endangered	G3	S1
Vascular Plant	15402	Thalictrum cooleyi	Cooley's Meadowrue	2005-05-05	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	12545	Thalictrum cooleyi	Cooley's Meadowrue	2013-05-29	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	12124	Thalictrum cooleyi	Cooley's Meadowrue	2013-05-30	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	2020	Thalictrum cooleyi	Cooley's Meadowrue	1998-06-21	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	16311	Thalictrum cooleyi	Cooley's Meadowrue	2015-06-29	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	8690	Thalictrum cooleyi	Cooley's Meadowrue	2013-06-14	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	29952	Thalictrum cooleyi	Cooley's Meadowrue	2011-08	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31269	Thalictrum cooleyi	Cooley's Meadowrue	2012-06-14	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	29951	Thalictrum cooleyi	Cooley's Meadowrue	2014-07-09	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	24576	Thalictrum cooleyi	Cooley's Meadowrue	2014-07-07	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31268	Thalictrum cooleyi	Cooley's Meadowrue	2012-07-11	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	23011	Thalictrum cooleyi	Cooley's Meadowrue	2001-06-19	Historical	2-High	Endangered	Endangered	G2	S2
Vascular Plant	22463	Thalictrum macrostylum	Small-leaved Meadowrue	2010-06-12	Current	3-Medium	Species of Concern	Significantly Rare Throughout	G3G4	S2
Vascular Plant	23312	Tridens chapmanii	Chapman's Redtop	2005-11-08	Current	2-High	---	Threatened	G3	S1S2
Vascular Plant	21325	Trillium pusillum var. pusillum	Carolina Least Trillium	2006-04-26	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21326	Trillium pusillum var. pusillum	Carolina Least Trillium	2002	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21327	Trillium pusillum var. pusillum	Carolina Least Trillium	2005-04-08	Current	3-Medium	Species of Concern	Endangered	G3T2	S2

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	7558	Trillium pusillum var. pusillum	Carolina Least Trillium	1963-06	Historical	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21333	Trillium pusillum var. pusillum	Carolina Least Trillium	2004	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	12579	Trillium pusillum var. pusillum	Carolina Least Trillium	1987-06-16	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	474	Trillium pusillum var. pusillum	Carolina Least Trillium	2005-04-01	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	11195	Trillium pusillum var. pusillum	Carolina Least Trillium	2012-04-04	Current	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21328	Trillium pusillum var. pusillum	Carolina Least Trillium	2002	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	2528	Utricularia geminiscapa	Two-flowered Bladderwort	1998-09-30	Current	3-Medium	---	Special Concern Vulnerable	G4G5	S1
Vascular Plant	3712	Utricularia olivacea	Dwarf Bladderwort	1989-06-22	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	26571	Vaccinium virgatum	Small-flower Blueberry	2004-06-19	Current	2-High	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	7373	Xyris floridana	Florida Yellow-eyed-grass	2003-09-20	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	11875	Xyris floridana	Florida Yellow-eyed-grass	1996-10-29	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	33621	Xyris floridana	Florida Yellow-eyed-grass	1992-06-08	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	33623	Xyris floridana	Florida Yellow-eyed-grass	1992-06-08	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	14049	Xyris stricta	Pineland Yellow-eyed-grass	2003-07-12	Historical	3-Medium	---	Endangered	G4	S1
Vascular Plant	19391	Yucca gloriosa	Moundlily Yucca	1999-12-11	Current	3-Medium	---	Significantly Rare Peripheral	G4?	S2?
Vascular Plant	19964	Yucca gloriosa	Moundlily Yucca	1999-10-31	Current	3-Medium	---	Significantly Rare Peripheral	G4?	S2?

Natural Areas Documented Within Project Area

Site Name	Representational Rating	Collective Rating
421 Sand Ridge	R2 (Very High)	C1 (Exceptional)

Natural Areas Documented Within Project Area

Site Name	Representational Rating	Collective Rating
Angola Bay	R2 (Very High)	C3 (High)
Angola Creek Flatwoods	R2 (Very High)	C3 (High)
B.W. Wells Savanna	R2 (Very High)	C4 (Moderate)
Bear Garden	R3 (High)	C4 (Moderate)
Big Colly Swamp	R4 (Moderate)	C4 (Moderate)
Black River Cypress Swamp	R1 (Exceptional)	C3 (High)
Blake Savanna	R5 (General)	C5 (General)
Bryant Mill (Greenbank) Bluff	R1 (Exceptional)	C3 (High)
Canetuck Loop Road Sandhills	R5 (General)	C4 (Moderate)
Clarks Landing Coastal Goldenrod Site	R2 (Very High)	C4 (Moderate)
Colvins Bay	R5 (General)	C4 (Moderate)
Colvins Creek Sand Ridge Mesic Slopes	R2 (Very High)	C5 (General)
Cones Folly	R2 (Very High)	C2 (Very High)
Futch and Foy Creeks Natural Area	R5 (General)	C5 (General)
Holly Shelter Game Land	R1 (Exceptional)	C1 (Exceptional)
Hood Creek Floodplain and Slopes	R3 (High)	C4 (Moderate)
Lea-Hutaff Island	R2 (Very High)	C2 (Very High)
Lower Black River Swamp	R2 (Very High)	C4 (Moderate)
Maple Hill School Road Savanna	R3 (High)	C3 (High)
McLean Savanna	R1 (Exceptional)	C1 (Exceptional)
Moores Creek Floodplain	R1 (Exceptional)	C5 (General)
Moores Creek National Battlefield	R2 (Very High)	C3 (High)
Neils Eddy Landing	R2 (Very High)	C4 (Moderate)
Northeast Cape Fear River Floodplain	R1 (Exceptional)	C1 (Exceptional)
Parkers Savanna	R2 (Very High)	C3 (High)
Rocky Point Marl Forest	R1 (Exceptional)	C3 (High)
Rocky Point Sandhills	R2 (Very High)	C4 (Moderate)
Sandy Run Swamp and Savannas	R1 (Exceptional)	C1 (Exceptional)
Shaken Creek Savanna	R1 (Exceptional)	C1 (Exceptional)
Shaky Bay Sandhills	R2 (Very High)	C4 (Moderate)
Shelter Swamp Creek Flatwoods	R1 (Exceptional)	C2 (Very High)
Sidbury Road Savanna	R3 (High)	C4 (Moderate)
Southwest Ridge Savanna	R3 (High)	C2 (Very High)
Surf City Maritime Forest	R4 (Moderate)	C4 (Moderate)
The Neck Savanna	R1 (Exceptional)	C1 (Exceptional)
Topsail Sound Maritime Forests	R2 (Very High)	C4 (Moderate)
Upper Black River Bottomlands	R1 (Exceptional)	C3 (High)
Watkins Savanna	R2 (Very High)	C2 (Very High)

Natural Areas Documented Within Project Area

Site Name	Representational Rating	Collective Rating
Webbtown Road Savanna	R5 (General)	C4 (Moderate)
CPF/Black River Aquatic Habitat	n/a (Not Applicable)	C3 (High)

Managed Areas Documented Within Project Area*

Managed Area Name	Owner	Owner Type
Angola Bay Game Land	NC Wildlife Resources Commission	State
Angola Creek Flatwoods Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
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Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Haws Run Conservation Site	NC Department of Transportation	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State

Managed Areas Documented Within Project Area*

Managed Area Name	Owner	Owner Type
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea/Hutaff Island Audubon Sanctuary	National Audubon Society	Private
McLean Savanna Preserve	The Nature Conservancy	Private
Moores Creek National Battlefield	US National Park Service	Federal
NC Submerged Lands	NC Department of Administration	State
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Shaken Creek Preserve	The Nature Conservancy	Private
Shaken Creek Preserve	The Nature Conservancy	Private
Watha Fish Hatchery	NC Wildlife Resources Commission	State
Watha Fish Hatchery	NC Wildlife Resources Commission	State
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State

Managed Areas Documented Within Project Area*

Managed Area Name	Owner	Owner Type
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
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NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State

Managed Areas Documented Within Project Area[*]

Managed Area Name	Owner	Owner Type
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
Nature Conservancy Easement	The Nature Conservancy	Private
Nature Conservancy Easement	The Nature Conservancy	Private
Nature Conservancy Easement	The Nature Conservancy	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
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North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Swine Buyout Easement	NC Department of Agriculture, Division of Soil and Water Conservation	State
US Fish and Wildlife Service Easement	US Fish and Wildlife Service	Federal
Angola Bay Game Land DNP	NC Wildlife Resources Commission	State
Angola Creek Flatwoods Preserve DNP	The Nature Conservancy	Private
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Clarks Landing Coastal Goldenrod Site RHA	TC&I Timber Company, LLC	Private
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State

Managed Areas Documented Within Project Area*

Managed Area Name	Owner	Owner Type
Moores Creek National Battlefield RHA	US National Park Service	Federal
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State

*NOTE: If the proposed project intersects with a conservation/managed area, please contact the landowner directly for additional information. If the project intersects with a Dedicated Nature Preserve (DNP), Registered Natural Heritage Area (RHA), or Federally-listed species, NCNHP staff may provide additional correspondence regarding the project.

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on June 22, 2016; source: NCNHP, Q4 October 2015. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Pender Co Water Supply
June 22, 2016
NCNHDE-1776

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	8703	Ambystoma mabeei	Mabee's Salamander	1976-01-31	Historical	3-Medium	---	Significantly Rare	G4	S2
Amphibian	1783	Ambystoma mabeei	Mabee's Salamander	1976-02-06	Historical	3-Medium	---	Significantly Rare	G4	S2
Amphibian	35976	Anaxyrus quercicus	Oak Toad	1976-05-15	Historical	4-Low	---	Significantly Rare	G5	S3
Amphibian	21469	Anaxyrus quercicus	Oak Toad	2012-05-23	Current	2-High	---	Significantly Rare	G5	S3
Amphibian	35975	Anaxyrus quercicus	Oak Toad	1972-05-27	Historical	4-Low	---	Significantly Rare	G5	S3
Amphibian	35961	Anaxyrus quercicus	Oak Toad	1968-07-11	Historical	4-Low	---	Significantly Rare	G5	S3
Amphibian	35974	Anaxyrus quercicus	Oak Toad	1966-08-06	Historical	3-Medium	---	Significantly Rare	G5	S3
Amphibian	24855	Anaxyrus quercicus	Oak Toad	2007-06-03	Current	3-Medium	---	Significantly Rare	G5	S3
Amphibian	21223	Anaxyrus quercicus	Oak Toad	1991-08-06	Current	2-High	---	Significantly Rare	G5	S3
Amphibian	35495	Eurycea quadridigitata	Dwarf Salamander	2003-01-04	Current	3-Medium	---	Special Concern	G5	S2
Amphibian	4848	Hemidactylium scutatum	Four-toed Salamander	1975-04	Current	4-Low	---	Special Concern	G5	S3
Amphibian	5405	Hemidactylium scutatum	Four-toed Salamander	1979-PRE	Current	4-Low	---	Special Concern	G5	S3
Amphibian	24854	Hemidactylium scutatum	Four-toed Salamander	2007-06-03	Current	2-High	---	Special Concern	G5	S3
Amphibian	35097	Hyla andersonii	Pine Barrens Treefrog	2008-07-23	Current	3-Medium	---	Significantly Rare	G4	S3
Amphibian	19152	Lithobates capito	Carolina Gopher Frog	1998-05-19	Current	3-Medium	Species of Concern	Threatened	G3	S1
Amphibian	11021	Lithobates capito	Carolina Gopher Frog	2014-03-21	Current	1-Very High	Species of Concern	Threatened	G3	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	35863	Pseudacris nigrita	Southern Chorus Frog	2004-04-22	Current	2-High	---	Significantly Rare	G5	S2
Animal Assemblage	12981	Colonial Wading Bird Colony	---	1996-05	Current	4-Low	---	---	G5	S3
Animal Assemblage	9184	Colonial Wading Bird Colony	---	1996-05	Current	4-Low	---	---	G5	S3
Animal Assemblage	5076	Colonial Wading Bird Colony	---	2007	Current	4-Low	---	---	G5	S3
Animal Assemblage	25879	Colonial Wading Bird Colony	---	2009	Current	3-Medium	---	---	G5	S3
Animal Assemblage	31223	Colonial Wading Bird Colony	---	2012	Current	3-Medium	---	---	G5	S3
Animal Assemblage	32244	Colonial Wading Bird Colony	---	2009-05-02	Current	2-High	---	---	G5	S3
Animal Assemblage	32255	Colonial Wading Bird Colony	---	2009-05-04	Current	2-High	---	---	G5	S3
Animal Assemblage	32242	Colonial Wading Bird Colony	---	2009-06-02	Current	2-High	---	---	G5	S3
Animal Assemblage	32476	Colonial Wading Bird Colony	---	2009-04-27	Current	2-High	---	---	G5	S3
Animal Assemblage	32248	Colonial Wading Bird Colony	---	2009-05-04	Current	2-High	---	---	G5	S3
Animal Assemblage	32401	Colonial Wading Bird Colony	---	2009-05-02	Current	2-High	---	---	G5	S3
Animal Assemblage	11649	Gull-Tern-Skimmer Colony	---	2011	Current	3-Medium	---	---	G5	S3
Animal Assemblage	35710	Gull-Tern-Skimmer Colony	---	2014-05-14	Current	4-Low	---	---	G5	S3
Animal Assemblage	18729	Gull-Tern-Skimmer Colony	---	2014-05-22	Current	3-Medium	---	---	G5	S3
Animal Assemblage	1335	Gull-Tern-Skimmer Colony	---	1977	Historical	3-Medium	---	---	G5	S3
Animal Assemblage	23852	Gull-Tern-Skimmer Colony	---	2007	Current	3-Medium	---	---	G5	S3
Animal Assemblage	15820	Gull-Tern-Skimmer Colony	---	1983-06	Historical	3-Medium	---	---	G5	S3

Element Occurrences Documented Within a One-mile Radius of the Project Area

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Animal Assemblage	5782	Gull-Tern-Skimmer Colony	---	1976	Historical	3-Medium	---	---	G5	S3
Animal Assemblage	15294	Gull-Tern-Skimmer Colony	---	2011	Current	3-Medium	---	---	G5	S3
Bird	451	Ammodramus henslowii susurrans	Eastern Henslow's Sparrow	1986	Current	4-Low	Species of Concern	Special Concern	G4T4	S1B,S1N
Bird	8767	Ammodramus henslowii susurrans	Eastern Henslow's Sparrow	1984-08-18	Current	3-Medium	Species of Concern	Special Concern	G4T4	S1B,S1N
Bird	15574	Charadrius melodus melodus	Piping Plover - Atlantic Coast subspecies	2014-06	Current	4-Low	Threatened	Threatened	G3T3	S1B,S1N
Bird	18156	Charadrius melodus melodus	Piping Plover - Atlantic Coast subspecies	2013-06	Current	4-Low	Threatened	Threatened	G3T3	S1B,S1N
Bird	7507	Charadrius melodus melodus	Piping Plover - Atlantic Coast subspecies	2014-06	Current	3-Medium	Threatened	Threatened	G3T3	S1B,S1N
Bird	27209	Charadrius wilsonia	Wilson's Plover	2007	Current	4-Low	---	Special Concern	G5	S2B
Bird	4761	Charadrius wilsonia	Wilson's Plover	2007	Current	4-Low	---	Special Concern	G5	S2B
Bird	27208	Charadrius wilsonia	Wilson's Plover	2007	Current	3-Medium	---	Special Concern	G5	S2B
Bird	27205	Charadrius wilsonia	Wilson's Plover	2007	Current	3-Medium	---	Special Concern	G5	S2B
Bird	8192	Columbina passerina	Common Ground-Dove	1988	Historical	3-Medium	---	Significantly Rare	G5	SXB
Bird	32243	Egretta caerulea	Little Blue Heron	2009-06-02	Current	2-High	---	Special Concern	G5	S3B,S3N
Bird	31957	Elanoides forficatus	Swallow-tailed Kite	2013-05-07	Current	2-High	---	Significantly Rare	G5	S1B
Bird	27220	Haematopus palliatus	American Oystercatcher	2007	Current	5-Very Low	---	Special Concern	G5	S2S3B,S3N
Bird	26009	Haematopus palliatus	American Oystercatcher	2007	Current	4-Low	---	Special Concern	G5	S2S3B,S3N
Bird	26008	Haematopus palliatus	American Oystercatcher	2007	Current	3-Medium	---	Special Concern	G5	S2S3B,S3N

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Bird	22211	Haliaeetus leucocephalus	Bald Eagle	2009	Current	2-High	Bald/Golden Eagle Protection Act	Threatened	G5	S3B,S3N
Bird	31300	Haliaeetus leucocephalus	Bald Eagle	2012	Historical	2-High	Bald/Golden Eagle Protection Act	Threatened	G5	S3B,S3N
Bird	25231	Ixobrychus exilis	Least Bittern	1995-05-26	Current	4-Low	---	Special Concern	G5	S2S3B
Bird	32256	Ixobrychus exilis	Least Bittern	2009-05-04	Current	3-Medium	---	Special Concern	G5	S2S3B
Bird	35812	Laterallus jamaicensis	Black Rail	1986-06-01	Current	4-Low	Species of Concern	Special Concern	G3G4	S2S3B, S2N
Bird	31224	Mycteria americana	Wood Stork	2012	Current	3-Medium	Threatened	Endangered	G4	S1B,S1N
Bird	1777	Passerina ciris ciris	Eastern Painted Bunting	1999	Current	4-Low	Species of Concern	Special Concern	G5T3T4	S3B
Bird	19936	Passerina ciris ciris	Eastern Painted Bunting	1997	Current	4-Low	Species of Concern	Special Concern	G5T3T4	S3B
Bird	17486	Passerina ciris ciris	Eastern Painted Bunting	2002-04-13	Current	3-Medium	Species of Concern	Special Concern	G5T3T4	S3B
Bird	2211	Peucaea aestivalis	Bachman's Sparrow	1981-06	Current	4-Low	Species of Concern	Special Concern	G3	S3B,S2N
Bird	11861	Peucaea aestivalis	Bachman's Sparrow	1987	Current	4-Low	Species of Concern	Special Concern	G3	S3B,S2N
Bird	7272	Peucaea aestivalis	Bachman's Sparrow	1988-06	Current	3-Medium	Species of Concern	Special Concern	G3	S3B,S2N
Bird	20014	Peucaea aestivalis	Bachman's Sparrow	1989-06-17	Current	3-Medium	Species of Concern	Special Concern	G3	S3B,S2N
Bird	17429	Picoides borealis	Red-cockaded Woodpecker	1997-03	Current	4-Low	Endangered	Endangered	G3	S2
Bird	14375	Picoides borealis	Red-cockaded Woodpecker	1979-02	Historical	4-Low	Endangered	Endangered	G3	S2
Bird	5915	Picoides borealis	Red-cockaded Woodpecker	1999-PRE	Historical	4-Low	Endangered	Endangered	G3	S2

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Bird	8746	Picoides borealis	Red-cockaded Woodpecker	1999-PRE	Historical	4-Low	Endangered	Endangered	G3	S2
Bird	17501	Picoides borealis	Red-cockaded Woodpecker	1998	Current	4-Low	Endangered	Endangered	G3	S2
Bird	1498	Picoides borealis	Red-cockaded Woodpecker	1978-09	Historical	4-Low	Endangered	Endangered	G3	S2
Bird	7946	Picoides borealis	Red-cockaded Woodpecker	1999	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	15722	Picoides borealis	Red-cockaded Woodpecker	1976-09	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	3806	Picoides borealis	Red-cockaded Woodpecker	1989-06-07	Current	4-Low	Endangered	Endangered	G3	S2
Bird	11251	Picoides borealis	Red-cockaded Woodpecker	1999	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	4763	Picoides borealis	Red-cockaded Woodpecker	1976-11	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	11250	Picoides borealis	Red-cockaded Woodpecker	1999-PRE	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	3960	Picoides borealis	Red-cockaded Woodpecker	1999	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	14084	Picoides borealis	Red-cockaded Woodpecker	1976-11	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	6259	Picoides borealis	Red-cockaded Woodpecker	1999-PRE	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	23332	Picoides borealis	Red-cockaded Woodpecker	2005	Current	2-High	Endangered	Endangered	G3	S2
Bird	23327	Picoides borealis	Red-cockaded Woodpecker	2005	Current	2-High	Endangered	Endangered	G3	S2
Bird	26025	Picoides borealis	Red-cockaded Woodpecker	2008-03-06	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	24665	Picoides borealis	Red-cockaded Woodpecker	2007-02-28	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	24666	Picoides borealis	Red-cockaded Woodpecker	2007-02-28	Current	3-Medium	Endangered	Endangered	G3	S2
Bird	15831	Picoides borealis	Red-cockaded Woodpecker	1989-01-24	Historical	3-Medium	Endangered	Endangered	G3	S2

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Bird	8600	Picoides borealis	Red-cockaded Woodpecker	1991-11-04	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	7890	Picoides borealis	Red-cockaded Woodpecker	1988	Historical	3-Medium	Endangered	Endangered	G3	S2
Bird	6958	Rynchops niger	Black Skimmer	2014-05-23	Current	3-Medium	---	Special Concern	G5	S2B,S3N
Bird	10389	Rynchops niger	Black Skimmer	2007	Current	3-Medium	---	Special Concern	G5	S2B,S3N
Bird	15488	Rynchops niger	Black Skimmer	1997	Current	3-Medium	---	Special Concern	G5	S2B,S3N
Bird	10083	Sterna hirundo	Common Tern	2001	Current	3-Medium	---	Special Concern	G5	S2B
Bird	1804	Sterna hirundo	Common Tern	2011	Current	3-Medium	---	Special Concern	G5	S2B
Bird	5383	Sterna hirundo	Common Tern	2001	Current	3-Medium	---	Special Concern	G5	S2B
Bird	27098	Sterna hirundo	Common Tern	2007	Current	3-Medium	---	Special Concern	G5	S2B
Bird	19274	Sternula antillarum	Least Tern	2014	Current	3-Medium	---	Special Concern	G4	S3B
Bird	35718	Sternula antillarum	Least Tern	2014-05-22	Current	3-Medium	---	Special Concern	G4	S3B
Bird	11554	Sternula antillarum	Least Tern	2011	Current	3-Medium	---	Special Concern	G4	S3B
Bird	18148	Sternula antillarum	Least Tern	2011	Current	3-Medium	---	Special Concern	G4	S3B
Bird	18783	Sternula antillarum	Least Tern	2011	Historical	3-Medium	---	Special Concern	G4	S3B
Bird	35722	Sternula antillarum	Least Tern	2014	Current	3-Medium	---	Special Concern	G4	S3B
Bird	35723	Sternula antillarum	Least Tern	1977	Historical	3-Medium	---	Special Concern	G4	S3B
Bird	23853	Sternula antillarum	Least Tern	2007	Current	3-Medium	---	Special Concern	G4	S3B
Butterfly	2765	Amblyscirtes alternata	Dusky Roadside-Skipper	1997-08-31	Current	3-Medium	---	Significantly Rare	G2G3	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

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Butterfly	2766	Amblyscirtes alternata	Dusky Roadside-Skipper	1995-08-24	Current	3-Medium	---	Significantly Rare	G2G3	S2
Butterfly	5296	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-08-18	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	3089	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-08-24	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	285	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-05-02	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	7623	Amblyscirtes reversa	Reversed Roadside-Skipper	1997-08-31	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	3090	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-06-28	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	15061	Amblyscirtes reversa	Reversed Roadside-Skipper	1995-07-20	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	6899	Calephelis virginiensis	Little Metalmark	1995-08-31	Current	4-Low	---	Significantly Rare	G4	S2
Butterfly	9698	Calephelis virginiensis	Little Metalmark	2014-09-22	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	23171	Calephelis virginiensis	Little Metalmark	2007-10-07	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	11507	Calephelis virginiensis	Little Metalmark	2014-10-10	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	15031	Calephelis virginiensis	Little Metalmark	2014-09-22	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	7264	Calephelis virginiensis	Little Metalmark	1991-10-11	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	12510	Callophrys hesseli	Hessel's Hairstreak	1995-04-13	Current	3-Medium	---	Significantly Rare	G3G4	S3
Butterfly	12851	Callophrys irus	Frosted Elfin	2014-04	Current	3-Medium	---	Significantly Rare	G3	S2
Butterfly	12707	Euphyes bimacula	Two-spotted Skipper	1997-08-03	Current	3-Medium	---	Significantly Rare	G4	S2
Butterfly	34478	Neonympha areolatus	Georgia Satyr	2003-09-03	Current	5-Very Low	---	Significantly Rare	G3G4	S2
Butterfly	34480	Neonympha areolatus	Georgia Satyr	2009-09-13	Current	3-Medium	---	Significantly Rare	G3G4	S2

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Butterfly	34481	Neonympha areolatus	Georgia Satyr	2014-10	Current	3-Medium	---	Significantly Rare	G3G4	S2
Butterfly	13643	Papilio cresphontes	Giant Swallowtail	2002-04-21	Current	4-Low	---	Significantly Rare	G5	S2S3
Dragonfly or Damselfly	32078	Arigomphus pallidus	Gray-green Clubtail	1992-07-08	Current	3-Medium	---	Significantly Rare	G5	S1
Dragonfly or Damselfly	33545	Coryphaeschna ingens	Regal Darner	2007-06-13	Current	4-Low	---	Significantly Rare	G5	S2?
Dragonfly or Damselfly	35682	Coryphaeschna ingens	Regal Darner	2015-07-09	Current	2-High	---	Significantly Rare	G5	S2?
Dragonfly or Damselfly	33705	Lestes vidua	Carolina Spreadwing	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G5	S2?
Dragonfly or Damselfly	33697	Lestes vidua	Carolina Spreadwing	2011-04-18	Current	3-Medium	---	Significantly Rare	G5	S2?
Dragonfly or Damselfly	33739	Somatochlora georgiana	Coppery Emerald	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G3G4	S2?
Dragonfly or Damselfly	33771	Somatochlora georgiana	Coppery Emerald	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G3G4	S2?
Dragonfly or Damselfly	33738	Somatochlora georgiana	Coppery Emerald	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G3G4	S2?
Dragonfly or Damselfly	33737	Somatochlora georgiana	Coppery Emerald	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G3G4	S2?
Dragonfly or Damselfly	33765	Somatochlora georgiana	Coppery Emerald	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G3G4	S2?
Dragonfly or Damselfly	33781	Stylurus ivae	Shining Clubtail	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G4	S2S3
Dragonfly or Damselfly	33779	Stylurus ivae	Shining Clubtail	2004-PRE	Historical	5-Very Low	---	Significantly Rare	G4	S2S3
Dragonfly or Damselfly	33359	Stylurus ivae	Shining Clubtail	1967-10-06	Historical	3-Medium	---	Significantly Rare	G4	S2S3
Dragonfly or Damselfly	33367	Triacanthagyna trifida	Phantom Darner	1971-10-26	Current	3-Medium	---	Significantly Rare	G5	S1?
Freshwater Bivalve	6037	Anodonta couperiana	Barrel Floater	2008-10-08	Current	3-Medium	---	Endangered	G4	S1
Freshwater Bivalve	18640	Elliptio folliculata	Pod Lance	1990-09-07	Historical	3-Medium	---	Special Concern	G2G3Q	S2

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Freshwater Bivalve	1439	Elliptio marsupiobesa	Cape Fear Spike	2005-05-12	Current	3-Medium	---	Special Concern	G3Q	S2
Freshwater Bivalve	26076	Elliptio marsupiobesa	Cape Fear Spike	2000-04-12	Current	3-Medium	---	Special Concern	G3Q	S2
Freshwater Bivalve	31409	Elliptio roanokensis	Roanoke Slabshell	2008-10-08	Current	3-Medium	---	Threatened	G3	S3
Freshwater Bivalve	1450	Fusconaia masoni	Atlantic Pigtoe	1995-09-27	Current	3-Medium	Species of Concern	Endangered	G2	S3
Freshwater Bivalve	25392	Lampsilis cariosa	Yellow Lampmussel	1990-07-12	Historical	3-Medium	Species of Concern	Endangered	G3G4	S3
Freshwater Bivalve	708	Lampsilis radiata	Eastern Lampmussel	2001-10-16	Current	3-Medium	---	Threatened	G5	S3
Freshwater Bivalve	25941	Lampsilis radiata	Eastern Lampmussel	1990-07-12	Historical	3-Medium	---	Threatened	G5	S3
Freshwater Bivalve	29609	Villosa delumbis	Eastern Creekshell	2008-10-08	Current	3-Medium	---	Significantly Rare	G4	S4
Freshwater Bivalve	29612	Villosa delumbis	Eastern Creekshell	1995-08-25	Current	3-Medium	---	Significantly Rare	G4	S4
Freshwater Bivalve	29616	Villosa delumbis	Eastern Creekshell	2004-07-30	Current	3-Medium	---	Significantly Rare	G4	S4
Freshwater Fish	12176	Acipenser brevirostrum	Shortnose Sturgeon	1993	Current	5-Very Low	Endangered	Endangered	G3	S1
Freshwater Fish	32417	Acipenser oxyrinchus	Atlantic Sturgeon	2012-04-04	Current	4-Low	Endangered	Special Concern	G3	S2
Freshwater Fish	31805	Enneacanthus chaetodon	Blackbanded Sunfish	1962-07-30	Historical	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	31793	Enneacanthus chaetodon	Blackbanded Sunfish	1962-08-01	Historical	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	31803	Enneacanthus chaetodon	Blackbanded Sunfish	1962-07-20	Historical	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	31836	Enneacanthus chaetodon	Blackbanded Sunfish	1998-08-25	Current	3-Medium	---	Significantly Rare	G3G4	S3
Freshwater Fish	32358	Enneacanthus obesus	Banded Sunfish	1997-06-10	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32374	Enneacanthus obesus	Banded Sunfish	2000-04-13	Current	3-Medium	---	Significantly Rare	G5	S3

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Freshwater Fish	32347	Enneacanthus obesus	Banded Sunfish	1974-03-01	Historical	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32372	Enneacanthus obesus	Banded Sunfish	2000-04-12	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32373	Enneacanthus obesus	Banded Sunfish	2000-04-13	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32357	Enneacanthus obesus	Banded Sunfish	1995-05-19	Current	3-Medium	---	Significantly Rare	G5	S3
Freshwater Fish	32370	Enneacanthus obesus	Banded Sunfish	1999-05-04	Current	2-High	---	Significantly Rare	G5	S3
Freshwater Fish	33045	Heterandria formosa	Least Killifish	2002-05-26	Current	3-Medium	---	Special Concern	G5	S2
Freshwater Fish	33043	Heterandria formosa	Least Killifish	2002-07-19	Current	3-Medium	---	Special Concern	G5	S2
Freshwater Fish	10158	Noturus sp. 2	Broadtail Madtom	1973	Historical	3-Medium	Species of Concern	Special Concern	G2	S2
Grasshopper or Katydid	35061	Arphia granulata	Southern Yellow-winged Grasshopper	2007-05-31	Current	4-Low	---	Significantly Rare	G5	S2S3
Grasshopper or Katydid	35102	Eotettix pusillus	Little Eastern Grasshopper	2012-05-31	Current	4-Low	---	Significantly Rare	G2G3	S2?
Grasshopper or Katydid	34516	Melanoplus decorus	Decorated Spur-throat Grasshopper	2014-06-23	Current	3-Medium	---	Significantly Rare	G2G3	S2S3
Grasshopper or Katydid	21323	Melanoplus decorus	Decorated Spur-throat Grasshopper	2014-10-10	Current	3-Medium	---	Significantly Rare	G2G3	S2S3
Grasshopper or Katydid	35106	Melanoplus decorus	Decorated Spur-throat Grasshopper	2014-10-10	Current	2-High	---	Significantly Rare	G2G3	S2S3
Grasshopper or Katydid	34513	Stethophyma celatum	Broad-winged Sedge Grasshopper	2014-06-23	Current	3-Medium	---	Significantly Rare	G4	S1S2
Grasshopper or Katydid	18460	Stethophyma celatum	Broad-winged Sedge Grasshopper	2000-05-26	Current	3-Medium	---	Significantly Rare	G4	S1S2
Grasshopper or Katydid	35134	Stethophyma celatum	Broad-winged Sedge Grasshopper	2008-06-26	Current	2-High	---	Significantly Rare	G4	S1S2
Liverwort	22127	Cephalozia connivens var. bifida	A Liverwort	1961-PRE	Historical	4-Low	---	Significantly Rare Throughout	G5T1Q	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Liverwort	22664	Plagiochila ludoviciana	A Liverwort	1992-06-07	Current	4-Low	---	Significantly Rare Peripheral	G5	S1
Mammal	27748	Condylura cristata pop. 1	Star-nosed Mole - Coastal Plain population	2007-12-08	Current	3-Medium	---	Special Concern	G5T2Q	S2
Mammal	24390	Corynorhinus rafinesquii macrotis	Rafinesque's Big-eared Bat - Coastal Plain subspecies	2006-PRE	Current	5-Very Low	Species of Concern	Special Concern	G3G4T3	S3
Mammal	17113	Corynorhinus rafinesquii macrotis	Rafinesque's Big-eared Bat - Coastal Plain subspecies	2007-05-17	Current	3-Medium	Species of Concern	Special Concern	G3G4T3	S3
Mammal	18854	Myotis austroriparius	Southeastern Bat	1986	Current	4-Low	Species of Concern	Special Concern	G3G4	S2
Mammal	4409	Myotis austroriparius	Southeastern Bat	1986	Current	4-Low	Species of Concern	Special Concern	G3G4	S2
Mammal	32126	Myotis septentrionalis	Northern Long-eared Bat	1994-POST	Current	5-Very Low	T-4(d)	Significantly Rare	G2G3	S2
Mammal	13380	Neotoma floridana floridana	Florida Eastern Woodrat	1986	Historical	4-Low	---	Threatened	G5T5	S1
Mammal	18574	Neotoma floridana floridana	Florida Eastern Woodrat	1997-08-18	Current	3-Medium	---	Threatened	G5T5	S1
Mammal	10338	Neotoma floridana floridana	Florida Eastern Woodrat	2002-05-03	Current	3-Medium	---	Threatened	G5T5	S1
Mammal	5571	Neotoma floridana floridana	Florida Eastern Woodrat	1987	Current	3-Medium	---	Threatened	G5T5	S1
Mammal	17664	Trichechus manatus	West Indian Manatee	2012-08-18	Current	5-Very Low	Endangered	Endangered	G2	S1N
Mayfly	35325	Amercaenis cusabo	a mayfly	1993-08	Current	3-Medium	---	Significantly Rare	G3	S1
Moss	23413	Bruchia brevifolia	A Pygmy Moss	1954-02-18	Historical	3-Medium	---	Significantly Rare Throughout	G3G4	S1?
Moss	23417	Bruchia hallii	A Pygmy Moss	1938-03-26	Historical	4-Low	---	Significantly Rare Throughout	G2	SH
Moth	33627	Acronicta sinescripta	a Dagger Moth	1992-09-01	Current	3-Medium	---	Significantly Rare	G3G4	S1S3

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Moth	26171	Acronicta sinescripta	a Dagger Moth	1995-07-25	Current	3-Medium	---	Significantly Rare	G3G4	S1S3
Moth	26172	Agrotis carolina	a Dart Moth	1996-04-18	Current	3-Medium	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	6119	Agrotis carolina	a Dart Moth	1991-09-10	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	26202	Agrotis carolina	a Dart Moth	1995-04-27	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33601	Agrotis carolina	a Dart Moth	1995-08-01	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33590	Agrotis carolina	a Dart Moth	1995-08-29	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33589	Agrotis carolina	a Dart Moth	1995-04-04	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33598	Agrotis carolina	a Dart Moth	1996-04-18	Current	2-High	Species of Concern	Significantly Rare	G2G3Q	S2S3
Moth	33975	Apameine new genus 2 sp. 1	a Cane Borer	1996-05-28	Current	3-Medium	---	Significantly Rare	GNR	S2S3
Moth	35060	Argyrostrotis quadrifilaris	Four-lined Chocolate	2011-04-18	Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	34052	Argyrostrotis quadrifilaris	Four-lined Chocolate	1995-04-12	Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26178	Eubaphe meridiana	Little Beggar Moth		Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	21194	Eubaphe meridiana	Little Beggar Moth	1991-05-09	Obscure	2-High	---	Significantly Rare	G4	S2S3
Moth	34515	Exyra ridingsii	a Pitcher-plant Moth	2014-06-23	Current	3-Medium	---	Significantly Rare	G2G4	S2
Moth	26138	Exyra semicrocea	a Pitcher-plant Moth		Obscure	3-Medium	---	Significantly Rare	G3G4	S2S3
Moth	26201	Gabara sp. 1	a Noctuid Moth		Obscure	3-Medium	---	Significantly Rare	G1G3	S1S2
Moth	22583	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	1996-04-18	Current	3-Medium	Species of Concern	Significantly Rare	G1	S1?
Moth	22584	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	2004-04-19	Current	3-Medium	Species of Concern	Significantly Rare	G1	S1?

Element Occurrences Documented Within a One-mile Radius of the Project Area

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Moth	22582	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	1995-04-17	Historical	3-Medium	Species of Concern	Significantly Rare	G1	S1?
Moth	20043	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	2000-05-26	Current	3-Medium	Species of Concern	Significantly Rare	G1	S1?
Moth	5558	Hemipachnobia subporphyrea	Venus Flytrap Cutworm Moth	2005-05-26	Current	2-High	Species of Concern	Significantly Rare	G1	S1?
Moth	26141	Hypagyrtis brendae	Brenda's Hypagyrtis Moth		Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26140	Iridopsis cypressaria	Small Cypress Looper	1995-04-04	Current	3-Medium	---	Significantly Rare	GU	S2S3
Moth	26203	Lagoa pyxidifera	Yellow Flannel Moth		Obscure	3-Medium	---	Significantly Rare	G4G5	S2S3
Moth	26182	Lagoa pyxidifera	Yellow Flannel Moth		Obscure	3-Medium	---	Significantly Rare	G4G5	S2S3
Moth	26143	Lithophane laceyi	a Pinion Moth		Obscure	3-Medium	---	Significantly Rare	G4	S1S3
Moth	26142	Nematocampa baggettaria	Baggett's Nematocampa		Obscure	3-Medium	---	Significantly Rare	G2G4	S1S2
Moth	34514	Papaipema appassionata	Pitcher-plant Borer Moth	2014-06-23	Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26169	Papaipema appassionata	Pitcher-plant Borer Moth		Current	3-Medium	---	Significantly Rare	G4	S2S3
Moth	26170	Papaipema eryngii	Rattlesnake-master Borer Moth	1995-10-19	Historical	3-Medium	Candidate	Significantly Rare	G1G2	S1
Moth	26137	Photedes carterae	Carter's Noctuid Moth		Obscure	3-Medium	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	35108	Photedes carterae	Carter's Noctuid Moth	2009-10-17	Current	2-High	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	21197	Photedes carterae	Carter's Noctuid Moth	1991-10-10	Current	2-High	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	16337	Photedes carterae	Carter's Noctuid Moth	1991-10-10	Current	2-High	Species of Concern	Significantly Rare	G2G3	S2S3
Moth	26134	Schinia carolinensis	Carolina Schinia Moth		Current	3-Medium	---	Significantly Rare	G3	S2S3
Moth	26186	Schinia jaguarina	Jaguar Flower Moth		Current	3-Medium	---	Significantly Rare	G4	S1S3

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	490	Blackwater Bottomland Hardwoods (High Subtype)	---	2010	Current	3-Medium	---	---	G3G4	S2S3
Natural Community	14066	Blackwater Bottomland Hardwoods (High Subtype)	---	2010	Current	4-Low	---	---	G3G4	S2S3
Natural Community	8449	Blackwater Bottomland Hardwoods (High Subtype)	---	2010	Current	4-Low	---	---	G3G4	S2S3
Natural Community	30968	Blackwater Bottomland Hardwoods (Low Subtype)	---	2010	Current	3-Medium	---	---	G4?	S3
Natural Community	30973	Blackwater Bottomland Hardwoods (Low Subtype)	---	2010	Current	4-Low	---	---	G4?	S3
Natural Community	30967	Blackwater Bottomland Hardwoods (Swamp Transition Subtype)	---	2010	Current	3-Medium	---	---	G3G5	S3
Natural Community	24673	Blackwater Bottomland Hardwoods (Swamp Transition Subtype)	---	2006-05-20	Current	2-High	---	---	G3G5	S3
Natural Community	29544	Brackish Marsh (Needlerush Subtype)	---	2002-02-28	Current	3-Medium	---	---	G5	S5
Natural Community	15542	Brownwater Bottomland Hardwoods (Swamp Transition Subtype)	---	2010	Current	2-High	---	---	G3G4	S3
Natural Community	17558	Brownwater Levee Forest (High Levee Subtype)	---	2010	Current	4-Low	---	---	G3G5	S3
Natural Community	20126	Brownwater Levee Forest (Low Levee Subtype)	---	2010	Current	2-High	---	---	G3G4	S3S4
Natural Community	25604	Brownwater Levee Forest (Low Levee Subtype)	---	2010	Current	3-Medium	---	---	G3G4	S3S4
Natural Community	17440	Coastal Plain Cliff	---	1994-10-07	Current	3-Medium	---	---	G2?	S1
Natural Community	15074	Coastal Plain Cliff	---	1985-03	Current	2-High	---	---	G2?	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	14901	Coastal Plain Depression Swamp (Mixed Subtype)	---	2010	Current	4-Low	---	---	G3	S3?
Natural Community	6592	Coastal Plain Small Stream Swamp	---	1995-10	Current	4-Low	---	---	G4?	S4
Natural Community	12581	Coastal Plain Small Stream Swamp	---	1997-09-21	Current	2-High	---	---	G4?	S4
Natural Community	8168	Coastal Plain Small Stream Swamp	---	2010-10-07	Current	2-High	---	---	G4?	S4
Natural Community	26578	Cypress--Gum Swamp (Blackwater Subtype)	---	2010	Current	4-Low	---	---	G4?	S4
Natural Community	757	Cypress--Gum Swamp (Blackwater Subtype)	---	2008-01-30	Current	2-High	---	---	G4?	S4
Natural Community	3672	Cypress--Gum Swamp (Blackwater Subtype)	---	1991-08-22	Current	3-Medium	---	---	G4?	S4
Natural Community	25603	Cypress--Gum Swamp (Brownwater Subtype)	---	2004-10-11	Current	2-High	---	---	G5?	S4
Natural Community	5435	Cypress--Gum Swamp (Intermediate Subtype)	---	1985-03	Current	2-High	---	---	G4	S3S4
Natural Community	14906	Dry-Mesic Oak--Hickory Forest (Coastal Plain Subtype)	---	2010	Current	4-Low	---	---	G3G4	S3
Natural Community	31528	Dune Grass (Southern Subtype)	---	2011-08-24	Current	3-Medium	---	---	G3	S2
Natural Community	24410	High Pocosin (Evergreen Subtype)	---	2012	Current	3-Medium	---	---	G3	S3S4
Natural Community	6435	High Pocosin (Evergreen Subtype)	---	1980-08-28	Current	4-Low	---	---	G3	S3S4
Natural Community	6086	High Pocosin (Evergreen Subtype)	---	1999-10-05	Current	4-Low	---	---	G3	S3S4
Natural Community	9530	High Pocosin (Evergreen Subtype)	---	1999-08-03	Current	4-Low	---	---	G3	S3S4
Natural Community	5625	High Pocosin (Evergreen Subtype)	---	1999-08-27	Current	4-Low	---	---	G3	S3S4
Natural Community	12287	Low Pocosin (Titi Subtype)	---	2010	Current	5-Very Low	---	---	G2G3	S2S3

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	14650	Low Pocosin (Titi Subtype)	---	2010	Current	3-Medium	---	---	G2G3	S2S3
Natural Community	31529	Maritime Dry Grassland (Typic Subtype)	---	2011-08-24	Current	3-Medium	---	---	G2G3	S2
Natural Community	247	Maritime Evergreen Forest (Mid Atlantic Subtype)	---	1999-12-11	Current	3-Medium	---	---	G2	S2
Natural Community	12680	Maritime Evergreen Forest (Mid Atlantic Subtype)	---	1999-11-06	Current	3-Medium	---	---	G2	S2
Natural Community	20098	Maritime Evergreen Forest (Mid Atlantic Subtype)	---	2010	Current	2-High	---	---	G2	S2
Natural Community	31530	Maritime Shrub (Stunted Tree Subtype)	---	2011-08-24	Current	2-High	---	---	G3	S2
Natural Community	18808	Mesic Mixed Hardwood Forest (Coastal Plain Subtype)	---	1985-03	Current	4-Low	---	---	G3	S3
Natural Community	9417	Mesic Mixed Hardwood Forest (Coastal Plain Subtype)	---	2007-06-27	Current	2-High	---	---	G3	S3
Natural Community	17618	Mesic Pine Savanna (Coastal Plain Subtype)	---	1995-10	Current	3-Medium	---	---	G2G3	S2
Natural Community	9290	Mesic Pine Savanna (Coastal Plain Subtype)	---	1991-08-23	Current	4-Low	---	---	G2G3	S2
Natural Community	10818	Mesic Pine Savanna (Coastal Plain Subtype)	---	1992-06-06	Current	3-Medium	---	---	G2G3	S2
Natural Community	14696	Oxbow Lake (Blackwater Subtype)	---	1995-11-21	Current	2-High	---	---	G3?	S2
Natural Community	4564	Peatland Atlantic White Cedar Forest	---	1995-08-03	Current	4-Low	---	---	G2	S1
Natural Community	6794	Peatland Atlantic White Cedar Forest	---	2005	Current	3-Medium	---	---	G2	S1
Natural Community	14218	Pine/Scrub Oak Sandhill (Coastal Fringe Subtype)	---	1992-06-13	Current	3-Medium	---	---	G2	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

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Natural Community	10194	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)	---	2010	Current	3-Medium	---	---	G3?	S3
Natural Community	7717	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)	---	2010	Current	4-Low	---	---	G3?	S3
Natural Community	9436	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)	---	1998	Current	3-Medium	---	---	G3?	S3
Natural Community	16090	Pine/Scrub Oak Sandhill (Mixed Oak Subtype)	---	2010	Current	3-Medium	---	---	G3?	S3
Natural Community	30442	Pocosin Opening (Pitcher Plant Subtype)	---	2010	Current	5-Very Low	---	---	G1	S1?
Natural Community	30444	Pocosin Opening (Sedge-Fern Subtype)	---	2010	Current	5-Very Low	---	---	G1G2	S1S2
Natural Community	11807	Pond Pine Woodland (Typic Subtype)	---	2006-04-24	Current	2-High	---	---	G3	S3
Natural Community	19779	Pond Pine Woodland (Typic Subtype)	---	1992-06	Current	3-Medium	---	---	G3	S3
Natural Community	2455	Pond Pine Woodland (Typic Subtype)	---	1999-08-27	Current	4-Low	---	---	G3	S3
Natural Community	16048	Pond Pine Woodland (Typic Subtype)	---	1995-08-03	Current	3-Medium	---	---	G3	S3
Natural Community	15647	Pond Pine Woodland (Typic Subtype)	---	1999-08-03	Current	4-Low	---	---	G3	S3
Natural Community	19871	Pond Pine Woodland (Typic Subtype)	---	1999-06-14	Current	4-Low	---	---	G3	S3
Natural Community	1507	Pond Pine Woodland (Typic Subtype)	---	1999-09-11	Current	4-Low	---	---	G3	S3
Natural Community	4158	Pond Pine Woodland (Typic Subtype)	---	2010-10-07	Current	2-High	---	---	G3	S3
Natural Community	17339	Pond Pine Woodland (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	19156	Pond Pine Woodland (Typic Subtype)	---	1985-03	Obscure	2-High	---	---	G3	S3
Natural Community	31534	Salt Flat	---	2011-08-24	Current	3-Medium	---	---	G5	S4
Natural Community	10733	Salt Marsh (Carolinian Subtype)	---	2002-05-15	Current	4-Low	---	---	G5	S4

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	31533	Salt Marsh (Carolinian Subtype)	---	2011-08-24	Current	2-High	---	---	G5	S4
Natural Community	29539	Salt Marsh (Carolinian Subtype)	---	2002-02-28	Current	4-Low	---	---	G5	S4
Natural Community	15860	Sandy Pine Savanna (Rush Featherling Subtype)	---	1995-10	Current	3-Medium	---	---	G1	S1
Natural Community	17702	Sandy Pine Savanna (Rush Featherling Subtype)	---	1999-06-14	Current	4-Low	---	---	G1	S1
Natural Community	10590	Sandy Pine Savanna (Typic Subtype)	---	1995-10	Current	4-Low	---	---	G3	S1
Natural Community	11023	Sandy Pine Savanna (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S1
Natural Community	16807	Sandy Pine Savanna (Typic Subtype)	---	1999-06-14	Current	3-Medium	---	---	G3	S1
Natural Community	30420	Sandy Pine Savanna (Typic Subtype)	---	2010	Current	2-High	---	---	G3	S1
Natural Community	17321	Small Depression Drawdown Meadow (Boggy Pool Subtype)	---	2010-10-07	Current	2-High	---	---	G2	S1
Natural Community	7528	Small Depression Drawdown Meadow (Typic Subtype)	---	1991-04-26	Current	4-Low	---	---	G2?	S2S3
Natural Community	11641	Small Depression Drawdown Meadow (Typic Subtype)	---	1999-09-13	Current	3-Medium	---	---	G2?	S2S3
Natural Community	11219	Small Depression Pocosin (Typic Subtype)	---	1991-04-26	Obscure	4-Low	---	---	G2G3	S2S3
Natural Community	5610	Small Depression Pocosin (Typic Subtype)	---	2012	Current	3-Medium	---	---	G2G3	S2S3
Natural Community	9597	Small Depression Pocosin (Typic Subtype)	---	1985-03	Current	2-High	---	---	G2G3	S2S3
Natural Community	17600	Streamhead Atlantic White Cedar Forest	---	1999-09-30	Current	3-Medium	---	---	G2	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

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Natural Community	6554	Streamhead Pocosin	---	1998-07-01	Current	3-Medium	---	---	G4	S4
Natural Community	19546	Tidal Swamp (Cypress--Gum Subtype)	---	2006-04-28	Current	2-High	---	---	G3G4	S4
Natural Community	25634	Tidal Swamp (Cypress--Gum Subtype)	---	2000-06-06	Current	2-High	---	---	G3G4	S4
Natural Community	18875	Tidal Swamp (Cypress--Gum Subtype)	---	2008-03-22	Current	2-High	---	---	G3G4	S4
Natural Community	1664	Tidal Swamp (Cypress--Gum Subtype)	---	2002-03-06	Current	2-High	---	---	G3G4	S4
Natural Community	15308	Tidal Swamp (Cypress--Gum Subtype)	---	2009-12-03	Current	4-Low	---	---	G3G4	S4
Natural Community	26898	Tidal Swamp (Cypress--Gum Subtype)	---	2008-03-20	Current	2-High	---	---	G3G4	S4
Natural Community	17378	Very Wet Loamy Pine Savanna	---	1997-08-18	Current	3-Medium	---	---	G1	S1
Natural Community	4582	Very Wet Loamy Pine Savanna	---	1999-06-14	Current	3-Medium	---	---	G1	S1
Natural Community	6159	Very Wet Loamy Pine Savanna	---	1998-09-25	Current	3-Medium	---	---	G1	S1
Natural Community	13706	Very Wet Loamy Pine Savanna	---	1996-10-29	Current	3-Medium	---	---	G1	S1
Natural Community	7046	Very Wet Loamy Pine Savanna	---	2012	Current	2-High	---	---	G1	S1
Natural Community	488	Wet Loamy Pine Savanna	---	1989-06-22	Current	4-Low	---	---	G1	S1
Natural Community	12356	Wet Loamy Pine Savanna	---	1991-08-23	Current	4-Low	---	---	G1	S1
Natural Community	18997	Wet Loamy Pine Savanna	---	2010	Current	3-Medium	---	---	G1	S1
Natural Community	16411	Wet Loamy Pine Savanna	---	1992-06-13	Current	3-Medium	---	---	G1	S1
Natural Community	2698	Wet Loamy Pine Savanna	---	1995-09-29	Current	3-Medium	---	---	G1	S1
Natural Community	4254	Wet Loamy Pine Savanna	---	1999-06-14	Current	3-Medium	---	---	G1	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	2405	Wet Loamy Pine Savanna	---	1999-08-11	Current	3-Medium	---	---	G1	S1
Natural Community	9295	Wet Loamy Pine Savanna	---	1998-07-09	Current	3-Medium	---	---	G1	S1
Natural Community	15193	Wet Loamy Pine Savanna	---	1995-10-10	Current	3-Medium	---	---	G1	S1
Natural Community	6243	Wet Loamy Pine Savanna	---	1998-09-28	Current	3-Medium	---	---	G1	S1
Natural Community	7995	Wet Marl Forest	---	2006-03	Current	3-Medium	---	---	G1	S1
Natural Community	14836	Wet Marl Forest	---	2005-03-21	Current	1-Very High	---	---	G1	S1
Natural Community	18454	Wet Pine Flatwoods (Sand Myrtle Subtype)	---	2010	Current	3-Medium	---	---	G2?	S1
Natural Community	9249	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	4-Low	---	---	G3	S3
Natural Community	19333	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	4-Low	---	---	G3	S3
Natural Community	15253	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	4-Low	---	---	G3	S3
Natural Community	24414	Wet Pine Flatwoods (Typic Subtype)	---	2006-04-24	Current	1-Very High	---	---	G3	S3
Natural Community	18057	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	9248	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	4-Low	---	---	G3	S3
Natural Community	31411	Wet Pine Flatwoods (Typic Subtype)	---	2012-09-13	Current	2-High	---	---	G3	S3
Natural Community	7860	Wet Pine Flatwoods (Typic Subtype)	---	2010-10-07	Current	3-Medium	---	---	G3	S3
Natural Community	12633	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	11677	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	2-High	---	---	G3	S3
Natural Community	1920	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3

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Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Natural Community	13130	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	4304	Wet Pine Flatwoods (Typic Subtype)	---	1998	Current	3-Medium	---	---	G3	S3
Natural Community	15537	Wet Pine Flatwoods (Typic Subtype)	---	2010	Current	3-Medium	---	---	G3	S3
Natural Community	16499	Xeric Sandhill Scrub (Coastal Fringe Subtype)	---	2006	Current	3-Medium	---	---	G2?	S2
Natural Community	3499	Xeric Sandhill Scrub (Typic Subtype)	---	1991-08-21	Current	4-Low	---	---	G3?	S3S4
Natural Community	9220	Xeric Sandhill Scrub (Typic Subtype)	---	1985-03	Current	2-High	---	---	G3?	S3S4
Natural Community	10571	Xeric Sandhill Scrub (Typic Subtype)	---	1989-07-06	Current	4-Low	---	---	G3?	S3S4
Natural Community	8190	Xeric Sandhill Scrub (Typic Subtype)	---	1995-08-03	Current	3-Medium	---	---	G3?	S3S4
Natural Community	3500	Xeric Sandhill Scrub (Typic Subtype)	---	1991-08-21	Current	2-High	---	---	G3?	S3S4
Natural Community	18029	Xeric Sandhill Scrub (Typic Subtype)	---	1999-02-05	Current	4-Low	---	---	G3?	S3S4
Natural Community	8527	Xeric Sandhill Scrub (Typic Subtype)	---	1999-09-03	Current	4-Low	---	---	G3?	S3S4
Natural Community	6351	Xeric Sandhill Scrub (Typic Subtype)	---	1998	Current	3-Medium	---	---	G3?	S3S4
Reptile	3970	Alligator mississippiensis	American Alligator	2005-10-17	Current	4-Low	Threatened Similar Appearance	Threatened	G5	S3
Reptile	14044	Alligator mississippiensis	American Alligator	1994	Current	3-Medium	Threatened Similar Appearance	Threatened	G5	S3
Reptile	13363	Caretta caretta	Loggerhead Seaturtle	2012	Current	4-Low	Threatened	Threatened	G3	S3B,S3N
Reptile	16294	Caretta caretta	Loggerhead Seaturtle	2012	Current	4-Low	Threatened	Threatened	G3	S3B,S3N
Reptile	1733	Caretta caretta	Loggerhead Seaturtle	2012	Current	4-Low	Threatened	Threatened	G3	S3B,S3N

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Reptile	34145	Chelonia mydas	Green Seaturtle	2012	Current	4-Low	Threatened	Threatened	G3	S1B,SUN
Reptile	1505	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1976-06-15	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	1412	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1968-09	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	13197	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1976-06	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	3317	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1979-10-02	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	19307	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1995-PRE	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	33391	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1979-09	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	13982	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1963-07-15	Historical	4-Low	Species of Concern	Endangered	G4	S1
Reptile	33389	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1974-06-06	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33384	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1975-07-08	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	5159	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1976-08-13	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	16962	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1969-10-01	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	17690	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1973-07-23	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	22914	Crotalus adamanteus	Eastern Diamondback Rattlesnake	2002-09-04	Current	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	7371	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1975-11-13	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	16314	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1977-05-01	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	13849	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1979-04-22	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33383	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1973-10-29	Historical	3-Medium	Species of Concern	Endangered	G4	S1

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Reptile	33380	Crotalus adamanteus	Eastern Diamondback Rattlesnake	2006-08	Current	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	7535	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1974-05-05	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	9066	Crotalus adamanteus	Eastern Diamondback Rattlesnake	1973-09-21	Historical	3-Medium	Species of Concern	Endangered	G4	S1
Reptile	33109	Crotalus adamanteus	Eastern Diamondback Rattlesnake	2013-05-23	Current	2-High	Species of Concern	Endangered	G4	S1
Reptile	7511	Crotalus horridus	Timber Rattlesnake	2003-07-17	Current	3-Medium	---	Special Concern	G4	S3
Reptile	35663	Deirochelys reticularia	Chicken Turtle	2001-06	Current	4-Low	---	Significantly Rare	G5	S3
Reptile	17717	Deirochelys reticularia	Chicken Turtle	1996-08-18	Current	3-Medium	---	Significantly Rare	G5	S3
Reptile	9650	Deirochelys reticularia	Chicken Turtle	1974-06	Historical	4-Low	---	Significantly Rare	G5	S3
Reptile	35661	Deirochelys reticularia	Chicken Turtle	1995-PRE	Current	3-Medium	---	Significantly Rare	G5	S3
Reptile	11400	Deirochelys reticularia	Chicken Turtle	1995-PRE	Historical	4-Low	---	Significantly Rare	G5	S3
Reptile	34907	Farancia erytrogramma	Rainbow Snake	1996-05-19	Current	3-Medium	---	Significantly Rare	G4	S3
Reptile	34909	Farancia erytrogramma	Rainbow Snake	1996-05-15	Current	3-Medium	---	Significantly Rare	G4	S3
Reptile	34908	Farancia erytrogramma	Rainbow Snake	1989-05	Historical	3-Medium	---	Significantly Rare	G4	S3
Reptile	34723	Farancia erytrogramma	Rainbow Snake	1974-04-13	Historical	3-Medium	---	Significantly Rare	G4	S3
Reptile	10077	Heterodon simus	Southern Hognose Snake	1985-06	Current	4-Low	Species of Concern	Special Concern	G2	S2
Reptile	8366	Heterodon simus	Southern Hognose Snake	2002-04-28	Current	4-Low	Species of Concern	Special Concern	G2	S2
Reptile	17515	Heterodon simus	Southern Hognose Snake	1995-PRE	Current	4-Low	Species of Concern	Special Concern	G2	S2
Reptile	1910	Heterodon simus	Southern Hognose Snake	1969-08	Historical	4-Low	Species of Concern	Special Concern	G2	S2

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Reptile	14496	Heterodon simus	Southern Hognose Snake	1991-09	Current	4-Low	Species of Concern	Special Concern	G2	S2
Reptile	12915	Heterodon simus	Southern Hognose Snake	1973-10	Current	4-Low	Species of Concern	Special Concern	G2	S2
Reptile	6768	Heterodon simus	Southern Hognose Snake	1985-10	Current	4-Low	Species of Concern	Special Concern	G2	S2
Reptile	31371	Heterodon simus	Southern Hognose Snake	2008-10-13	Current	3-Medium	Species of Concern	Special Concern	G2	S2
Reptile	737	Heterodon simus	Southern Hognose Snake	1990-04-28	Current	3-Medium	Species of Concern	Special Concern	G2	S2
Reptile	31881	Lepidochelys kempii	Kemp's Ridley Seaturtle	2010	Current	4-Low	Endangered	Endangered	G1	S1B,SUN
Reptile	16801	Malaclemys terrapin	Diamondback Terrapin	2008-04-13	Current	3-Medium	FSC, in part	Special Concern	G4	S3
Reptile	19499	Malaclemys terrapin	Diamondback Terrapin	2014-05-18	Current	3-Medium	FSC, in part	Special Concern	G4	S3
Reptile	10471	Malaclemys terrapin	Diamondback Terrapin	1981-07	Historical	4-Low	FSC, in part	Special Concern	G4	S3
Reptile	7823	Masticophis flagellum	Coachwhip	1989-08	Current	4-Low	---	Significantly Rare	G5	S3
Reptile	15965	Masticophis flagellum	Coachwhip	1978-07	Historical	4-Low	---	Significantly Rare	G5	S3
Reptile	10576	Masticophis flagellum	Coachwhip	1990-05	Current	4-Low	---	Significantly Rare	G5	S3
Reptile	13171	Micrurus fulvius	Eastern Coralsnake	1995-04	Current	4-Low	---	Endangered	G5	S1
Reptile	2454	Micrurus fulvius	Eastern Coralsnake	1922-PRE	Historical	4-Low	---	Endangered	G5	S1
Reptile	35470	Ophisaurus attenuatus	Slender Glass Lizard	2004-09-28	Current	3-Medium	---	Significantly Rare	G5	S2
Reptile	35587	Ophisaurus mimicus	Mimic Glass Lizard	2004-04-22	Current	3-Medium	Species of Concern	Special Concern	G3	S1
Reptile	9564	Regina rigida	Glossy Crayfish Snake	2013-05-15	Current	3-Medium	---	Significantly Rare	G5	S2S3
Reptile	35611	Seminatrix pygaea	Black Swampsnake	2009-04-02	Current	3-Medium	---	Significantly Rare	G5	S2
Reptile	3883	Seminatrix pygaea	Black Swampsnake	1975-04-15	Historical	3-Medium	---	Significantly Rare	G5	S2

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Reptile	16354	Seminatrix pygaea	Black Swampsnake	1971-10-02	Historical	3-Medium	---	Significantly Rare	G5	S2
Reptile	11431	Sistrurus miliarius	Pigmy Rattlesnake	1995-09-29	Current	4-Low	---	Special Concern	G5	S3
Reptile	15398	Sistrurus miliarius	Pigmy Rattlesnake	1990-04	Current	4-Low	---	Special Concern	G5	S3
Reptile	16757	Sistrurus miliarius	Pigmy Rattlesnake	1977-09	Historical	4-Low	---	Special Concern	G5	S3
Reptile	5889	Sistrurus miliarius	Pigmy Rattlesnake	1992-09	Current	4-Low	---	Special Concern	G5	S3
Vascular Plant	2498	Agalinis virgata	Branched Gerardia	1991-10-08	Current	3-Medium	---	Threatened	G3G4Q	S2
Vascular Plant	23461	Agalinis virgata	Branched Gerardia	2002-10-13	Current	2-High	---	Threatened	G3G4Q	S2
Vascular Plant	23450	Agrostis altissima	Tall Bentgrass	2011-10-23	Current	2-High	---	Significantly Rare Throughout	G4	S2
Vascular Plant	23458	Agrostis altissima	Tall Bentgrass	1991-10-08	Current	3-Medium	---	Significantly Rare Throughout	G4	S2
Vascular Plant	23452	Agrostis altissima	Tall Bentgrass	1996-10-29	Current	3-Medium	---	Significantly Rare Throughout	G4	S2
Vascular Plant	33028	Aletris lutea	Yellow Colic-root	2011-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S1
Vascular Plant	33320	Allium sp. 1	Savanna Onion	2012-09-01	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	12601	Allium sp. 1	Savanna Onion	2006-08-30	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	4846	Allium sp. 1	Savanna Onion	2007-05-10	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	16823	Allium sp. 1	Savanna Onion	1992	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	6579	Allium sp. 1	Savanna Onion	2009-09-13	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	9745	Allium sp. 1	Savanna Onion	1999-06-14	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2

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Vascular Plant	23015	Allium sp. 1	Savanna Onion	1992-09-23	Current	3-Medium	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	23014	Allium sp. 1	Savanna Onion	2012-09-27	Current	2-High	Species of Concern	Significantly Rare Limited	G1G2	S1S2
Vascular Plant	1320	Amaranthus pumilus	Seabeach Amaranth	2014-08-18	Current	2-High	Threatened	Threatened	G2	S1S2
Vascular Plant	9714	Amaranthus pumilus	Seabeach Amaranth	2014-08-21	Current	3-Medium	Threatened	Threatened	G2	S1S2
Vascular Plant	14273	Amaranthus pumilus	Seabeach Amaranth	2013	Current	3-Medium	Threatened	Threatened	G2	S1S2
Vascular Plant	19187	Amaranthus pumilus	Seabeach Amaranth	2010-08-05	Current	3-Medium	Threatened	Threatened	G2	S1S2
Vascular Plant	318	Amorpha georgiana	Georgia Indigo-bush	1995-10-20	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	33325	Amorpha georgiana	Georgia Indigo-bush	2011-11-06	Current	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	24481	Amorpha georgiana	Georgia Indigo-bush	2006-06-27	Current	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	22776	Andropogon mohrii	Bog Bluestem	2005-08-26	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	3923	Andropogon mohrii	Bog Bluestem	1997-08-18	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	15495	Andropogon mohrii	Bog Bluestem	1995-09-28	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	8919	Andropogon mohrii	Bog Bluestem	1999-08-13	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	22777	Andropogon mohrii	Bog Bluestem	2005-10-02	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	3403	Andropogon mohrii	Bog Bluestem	1997-10-26	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	31081	Andropogon mohrii	Bog Bluestem	1993-06-08	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	21493	Arenaria lanuginosa var. lanuginosa	Spreading Sandwort	1978-08-19	Historical	5-Very Low	---	Significantly Rare Peripheral	G5T5	S1
Vascular Plant	21495	Arenaria lanuginosa var. lanuginosa	Spreading Sandwort	1950-07-01	Historical	3-Medium	---	Significantly Rare Peripheral	G5T5	S1
Vascular Plant	22535	Aristida condensata	Big Three-awn Grass	2013-11	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	22533	Aristida condensata	Big Three-awn Grass	1999-11-01	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	22534	Aristida condensata	Big Three-awn Grass	1999-11-01	Current	3-Medium	---	Threatened	G4?	S2
Vascular Plant	22787	Aristida condensata	Big Three-awn Grass	2005-11-08	Current	2-High	---	Threatened	G4?	S2
Vascular Plant	1727	Aristida simpliciflora	Chapman's Three-awn	1999-10-28	Current	3-Medium	---	Endangered	G3G4	S1S2
Vascular Plant	10657	Aristida simpliciflora	Chapman's Three-awn	2002-10-09	Current	3-Medium	---	Endangered	G3G4	S1S2
Vascular Plant	22793	Aristida simpliciflora	Chapman's Three-awn	2005-10-02	Current	3-Medium	---	Endangered	G3G4	S1S2
Vascular Plant	22792	Aristida simpliciflora	Chapman's Three-awn	2007-05-10	Current	2-High	---	Endangered	G3G4	S1S2
Vascular Plant	22790	Aristida simpliciflora	Chapman's Three-awn	2004-11-09	Current	2-High	---	Endangered	G3G4	S1S2
Vascular Plant	23400	Aristida tenuispica	Hillsboro Three-awn Grass	1999-10-28	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1

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Vascular Plant	23399	Aristida tenuispica	Hillsboro Three-awn Grass	1999-11-01	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	5744	Arnoglossum ovatum	Savanna Indian-plantain	1957-07-26	Historical	4-Low	---	Endangered	G4G5	S2
Vascular Plant	11184	Arnoglossum ovatum	Savanna Indian-plantain	1992-06-08	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	20108	Arnoglossum ovatum	Savanna Indian-plantain	1997-08-18	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	701	Arnoglossum ovatum	Savanna Indian-plantain	1998-06-21	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	16169	Arnoglossum ovatum	Savanna Indian-plantain	1996-08-05	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	11838	Arnoglossum ovatum	Savanna Indian-plantain	1999-08-13	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	33327	Arnoglossum ovatum	Savanna Indian-plantain	2011-08-26	Current	3-Medium	---	Endangered	G4G5	S2
Vascular Plant	24483	Arnoglossum ovatum	Savanna Indian-plantain	2006-05-31	Current	2-High	---	Endangered	G4G5	S2
Vascular Plant	3896	Arnoglossum ovatum	Savanna Indian-plantain	2001-09-11	Current	2-High	---	Endangered	G4G5	S2
Vascular Plant	33832	Asclepias pedicellata	Savanna Milkweed	1923-07	Historical	4-Low	---	Special Concern Vulnerable	G4	S3
Vascular Plant	8626	Asclepias pedicellata	Savanna Milkweed	1995-07-19	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	17742	Asclepias pedicellata	Savanna Milkweed	2009-08-04	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	1338	Asclepias pedicellata	Savanna Milkweed	1995-08-08	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	5631	Asclepias pedicellata	Savanna Milkweed	2012-06-03	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	3554	Asclepias pedicellata	Savanna Milkweed	1995-08-11	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	5072	Asclepias pedicellata	Savanna Milkweed	1998-07-21	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	15853	Asclepias pedicellata	Savanna Milkweed	1998-07-01	Current	3-Medium	---	Special Concern Vulnerable	G4	S3

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Vascular Plant	14137	Asclepias pedicellata	Savanna Milkweed	1995-08-31	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	223	Asclepias pedicellata	Savanna Milkweed	1995-06-29	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	13406	Asclepias pedicellata	Savanna Milkweed	1995-06-06	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	3294	Asclepias pedicellata	Savanna Milkweed	1997-08-12	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	19636	Asclepias pedicellata	Savanna Milkweed	1995-05-24	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	15371	Asclepias pedicellata	Savanna Milkweed	1997-07-29	Current	3-Medium	---	Special Concern Vulnerable	G4	S3
Vascular Plant	26744	Asclepias pedicellata	Savanna Milkweed	2007-06-15	Current	2-High	---	Special Concern Vulnerable	G4	S3
Vascular Plant	26064	Asclepias purpurascens	Purple Milkweed	2008-05-30	Current	2-High	---	Significantly Rare Throughout	G5?	S1?
Vascular Plant	11290	Astragalus michauxii	Sandhills Milk-vetch	1997-05-22	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S3
Vascular Plant	30851	Baccharis glomeruliflora	Silverling	2010-10-26	Current	2-High	---	Special Concern Historical	G4	S1
Vascular Plant	14003	Bacopa caroliniana	Blue Water-hyssop	1981-05-22	Current	3-Medium	---	Threatened	G4G5	S1
Vascular Plant	15276	Bacopa caroliniana	Blue Water-hyssop	1946-PRE	Historical	3-Medium	---	Threatened	G4G5	S1
Vascular Plant	8160	Bacopa caroliniana	Blue Water-hyssop	1981-04-27	Current	3-Medium	---	Threatened	G4G5	S1
Vascular Plant	31106	Bacopa rotundifolia	Round-leaf Water-hyssop	2004-06-17	Current	2-High	---	Significantly Rare Disjunct	G5	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

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Vascular Plant	31105	Bacopa rotundifolia	Round-leaf Water-hyssop	2004-06-17	Current	2-High	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	26265	Boltonia asteroides var. glastifolia	White Doll's-daisy	2002-07-12	Current	3-Medium	---	Significantly Rare Other	G5TNR	S2
Vascular Plant	23756	Calopogon multiflorus	Many-flower Grass-pink	2004-06-01	Current	3-Medium	Species of Concern	Endangered	G2G3	S1
Vascular Plant	5963	Cardamine longii	Long's Bittercress	2003-07-25	Current	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	16150	Cardamine longii	Long's Bittercress	1981-05-22	Historical	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	2914	Cardamine longii	Long's Bittercress	1981-05-22	Historical	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	1337	Cardamine longii	Long's Bittercress	1981-05-22	Historical	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	5225	Cardamine longii	Long's Bittercress	1997-05-11	Current	3-Medium	---	Special Concern Vulnerable	G3?	S1
Vascular Plant	21513	Carex austrodeflexa	Canebrake Sedge	2000-03-27	Current	3-Medium	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	21516	Carex austrodeflexa	Canebrake Sedge	1996-04-26	Current	3-Medium	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	26079	Carex austrodeflexa	Canebrake Sedge	2008-05-30	Current	2-High	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	22291	Carex austrodeflexa	Canebrake Sedge	1996-05-29	Current	2-High	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	27781	Carex austrodeflexa	Canebrake Sedge	2009-04-09	Current	2-High	---	Significantly Rare Limited	G3G4	S2
Vascular Plant	6090	Carex basiantha	Widow Sedge	1999-06-12	Current	2-High	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	10629	Carex basiantha	Widow Sedge	1999-06-12	Current	2-High	---	Significantly Rare Disjunct	G5	S1

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Vascular Plant	19378	Carex basiantha	Widow Sedge	1999-11-05	Current	3-Medium	---	Significantly Rare Disjunct	G5	S1
Vascular Plant	7103	Carex cherokeensis	Cherokee Sedge	1999-06-12	Current	2-High	---	Endangered	G4G5	S1
Vascular Plant	26306	Carex emmonsii	Emmons's Sedge	1980-04-10	Current	3-Medium	---	Significantly Rare Other	G5T5	S2
Vascular Plant	24068	Carex lutea	Golden Sedge	2005-05-05	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	17710	Carex lutea	Golden Sedge	2013-06-06	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	29877	Carex lutea	Golden Sedge	2012-06-15	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	7859	Carex lutea	Golden Sedge	2011-06-02	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	6956	Carex lutea	Golden Sedge	2013-05-13	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	9521	Carex lutea	Golden Sedge	2009	Current	1-Very High	Endangered	Endangered	G2	S2
Vascular Plant	16767	Carex lutea	Golden Sedge	2013-05-30	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	16768	Carex lutea	Golden Sedge	1998-06-21	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	24069	Carex lutea	Golden Sedge	2005-05-05	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	27051	Carex lutea	Golden Sedge	2013-05-30	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31276	Carex lutea	Golden Sedge	2012-05-04	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	24072	Carex lutea	Golden Sedge	1988-05-25	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	23013	Carex lutea	Golden Sedge	1996-06-03	Historical	2-High	Endangered	Endangered	G2	S2
Vascular Plant	1947	Carex lutea	Golden Sedge	2014-06-22	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31272	Carex lutea	Golden Sedge	2012-06-08	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	24071	Carex lutea	Golden Sedge	2006-05-30	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	23012	Carex lutea	Golden Sedge	2011-05-06	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31270	Carex lutea	Golden Sedge	2012-06-08	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	27050	Carex lutea	Golden Sedge	2007-06-20	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	26115	Carex reniformis	Kidney Sedge	2007-05-24	Current	2-High	---	Threatened	G4?	S1
Vascular Plant	28736	Carex reniformis	Kidney Sedge	2004-06-20	Current	2-High	---	Threatened	G4?	S1
Vascular Plant	9845	Carex socialis	Social Sedge	1998-05-12	Current	3-Medium	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	8433	Carex socialis	Social Sedge	1994-05-02	Current	3-Medium	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	26077	Carex socialis	Social Sedge	2008-05-07	Current	2-High	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	33175	Carex verrucosa	Warty Sedge	1999-06-14	Current	2-High	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	514	Carya myristiciformis	Nutmeg Hickory	2015-03-20	Current	2-High	---	Endangered	G4	S1

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Vascular Plant	16871	Carya myristiciformis	Nutmeg Hickory	2008-09-21	Current	2-High	---	Endangered	G4	S1
Vascular Plant	11409	Chasmanthium nitidum	A Spanglegrass	1995-09-27	Current	3-Medium	---	Threatened	G3G4	S1
Vascular Plant	5169	Chasmanthium nitidum	A Spanglegrass	1997-07-29	Current	3-Medium	---	Threatened	G3G4	S1
Vascular Plant	9226	Cirsium lecontei	Leconte's Thistle	1957-07-27	Historical	4-Low	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	12885	Cirsium lecontei	Leconte's Thistle	2015-06-29	Current	2-High	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	2681	Cirsium lecontei	Leconte's Thistle	1966-08-07	Historical	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	8591	Cirsium lecontei	Leconte's Thistle	1998-07-06	Current	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	3723	Cirsium lecontei	Leconte's Thistle	2012-05-24	Current	2-High	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	10291	Cirsium lecontei	Leconte's Thistle	2010-08-17	Current	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	33331	Cirsium lecontei	Leconte's Thistle	2012-07-26	Current	3-Medium	---	Special Concern Vulnerable	G2G3	S2
Vascular Plant	33197	Cirsium nuttallii	Nuttall's Thistle	1999-06-14	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	10279	Cladium mariscoides	Twig-rush	2007-05-10	Current	2-High	---	Significantly Rare Other	G5	S3
Vascular Plant	19456	Cladium mariscoides	Twig-rush	1999-08-03	Current	3-Medium	---	Significantly Rare Other	G5	S3
Vascular Plant	1974	Cladium mariscoides	Twig-rush	1997-09-02	Current	3-Medium	---	Significantly Rare Other	G5	S3
Vascular Plant	14196	Clinopodium georgianum	Georgia Calamint	1994-03-19	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	601	Clinopodium georgianum	Georgia Calamint	2007-06-27	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	22819	Clinopodium georgianum	Georgia Calamint	2015-09-17	Current	2-High	---	Endangered	G5	S1
Vascular Plant	22818	Clinopodium georgianum	Georgia Calamint	2005-10-03	Current	2-High	---	Endangered	G5	S1

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Vascular Plant	19730	Clinopodium georgianum	Georgia Calamint	2015-09-20	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	16278	Clinopodium georgianum	Georgia Calamint	2015-09-20	Current	4-Low	---	Endangered	G5	S1
Vascular Plant	31481	Coreopsis aristulata	Short-awned Coreopsis	2008-10-17	Current	3-Medium	---	Significantly Rare Limited	G1?	S1
Vascular Plant	26394	Coreopsis palustris	Beadle's Coreopsis	1957-10-05	Historical	3-Medium	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26375	Coreopsis palustris	Beadle's Coreopsis	1996-10-04	Current	3-Medium	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26395	Coreopsis palustris	Beadle's Coreopsis	1981-10-02	Historical	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26373	Coreopsis palustris	Beadle's Coreopsis	2001-09-11	Current	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26376	Coreopsis palustris	Beadle's Coreopsis	1999-06-24	Current	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26991	Coreopsis palustris	Beadle's Coreopsis	2000-10-16	Current	2-High	---	Significantly Rare Peripheral	G3G4Q	S1S2
Vascular Plant	26297	Cornus asperifolia	Roughleaf Dogwood	1999-06-12	Current	4-Low	---	Endangered	G4	S1
Vascular Plant	10748	Cornus asperifolia	Roughleaf Dogwood	1999-06-13	Current	4-Low	---	Endangered	G4	S1
Vascular Plant	4738	Cornus asperifolia	Roughleaf Dogwood	1999-11-05	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	27782	Crataegus munda	Batesburg Hawthorn	2003-07-01	Current	2-High	---	Significantly Rare Throughout	G3G5Q	S2?
Vascular Plant	13342	Crocanthemum carolinianum	Carolina Sunrose	1981-04-23	Historical	3-Medium	---	Endangered	G4	S1
Vascular Plant	9052	Crocanthemum carolinianum	Carolina Sunrose	1995-04-11	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	33208	Crocanthemum carolinianum	Carolina Sunrose	1992-06-07	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	3641	Cyperus tetragonus	Four-angled Flatsedge	1999-11-06	Current	3-Medium	---	Special Concern Vulnerable	G4?	S1
Vascular Plant	12656	Dichanthelium caerulescens	Blue Witch Grass	2006-05-30	Current	3-Medium	---	Endangered	G2G3	S1S2
Vascular Plant	27783	Dichanthelium caerulescens	Blue Witch Grass	1998-06-21	Current	2-High	---	Endangered	G2G3	S1S2

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Vascular Plant	24526	Dichanthelium cryptanthum	Hidden-flowered Witchgrass	2006-06-16	Current	2-High	---	Significantly Rare Throughout	G2G3	S2
Vascular Plant	33880	Dichanthelium spretum	Eaton's Witch Grass	1999-06-14	Current	3-Medium	---	Significantly Rare Disjunct	G5	S1S2
Vascular Plant	15978	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	17802	Dionaea muscipula	Venus Flytrap	1938-05	Historical	4-Low	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	5464	Dionaea muscipula	Venus Flytrap	1993-11-14	Historical	4-Low	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	20029	Dionaea muscipula	Venus Flytrap	1948-06	Historical	4-Low	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3556	Dionaea muscipula	Venus Flytrap	1949-04	Historical	4-Low	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12724	Dionaea muscipula	Venus Flytrap	1981-06	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8628	Dionaea muscipula	Venus Flytrap	1995-10-20	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	7475	Dionaea muscipula	Venus Flytrap	2004-06-22	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	13017	Dionaea muscipula	Venus Flytrap	1995-09-26	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3595	Dionaea muscipula	Venus Flytrap	2013-06-01	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2

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Vascular Plant	2859	Dionaea muscipula	Venus Flytrap	1992-06-01	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	19344	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	14879	Dionaea muscipula	Venus Flytrap	2012-05-31	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	5117	Dionaea muscipula	Venus Flytrap	2002-05-22	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3593	Dionaea muscipula	Venus Flytrap	2015-06-29	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	21384	Dionaea muscipula	Venus Flytrap	2005-04-26	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8116	Dionaea muscipula	Venus Flytrap	1995-05-04	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	3178	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	17111	Dionaea muscipula	Venus Flytrap	1987-06-17	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	18493	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	18141	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	17112	Dionaea muscipula	Venus Flytrap	1986-05	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2

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Vascular Plant	24381	Dionaea muscipula	Venus Flytrap	2006	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	4698	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8277	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	2654	Dionaea muscipula	Venus Flytrap	2005-08-31	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8444	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	1312	Dionaea muscipula	Venus Flytrap	2002-02-21	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	2747	Dionaea muscipula	Venus Flytrap	1995-06-30	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	16928	Dionaea muscipula	Venus Flytrap	1995-04-14	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	6774	Dionaea muscipula	Venus Flytrap	2007-06-14	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12512	Dionaea muscipula	Venus Flytrap	2002-06-19	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	442	Dionaea muscipula	Venus Flytrap	2015-06-03	Historical	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	4618	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2

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Vascular Plant	19776	Dionaea muscipula	Venus Flytrap	2002-SUM	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	31415	Dionaea muscipula	Venus Flytrap	2012-09-13	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	8110	Dionaea muscipula	Venus Flytrap	2002-06-18	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	25544	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	25764	Dionaea muscipula	Venus Flytrap	2004-06	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	1113	Dionaea muscipula	Venus Flytrap	1995-06-09	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	9525	Dionaea muscipula	Venus Flytrap	2002-05-29	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	25540	Dionaea muscipula	Venus Flytrap	2007-06-15	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	23233	Ditrysinia fruticosa	Sebastian-bush	1961-06	Historical	3-Medium	---	Special Concern Vulnerable	G5	S2
Vascular Plant	17390	Eleocharis robbinsii	Robbins' Spikerush	1977-06-18	Current	3-Medium	---	Special Concern Vulnerable	G4G5	S2
Vascular Plant	21584	Eleocharis vivipara	Viviparous Spikerush	1998-07-14	Current	3-Medium	---	Endangered	G5	S1
Vascular Plant	22878	Epidendrum magnoliae	Green Fly Orchid	1981-FALL	Current	4-Low	---	Threatened	G4	S1S2
Vascular Plant	12199	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	17953	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	19251	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	17837	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2

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Vascular Plant	17950	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	14107	Epidendrum magnoliae	Green Fly Orchid	1981	Current	3-Medium	---	Threatened	G4	S1S2
Vascular Plant	23815	Eriogonum tomentosum	Southern Wild-buckwheat	1890	Historical	5-Very Low	---	Special Concern Historical	G4G5	SH
Vascular Plant	29873	Eryngium aquaticum var. ravenelii	Marsh Eryngo	1999-09-29	Current	2-High	---	Significantly Rare Peripheral	G4T2T3	S1
Vascular Plant	24097	Erythrina herbacea	Coralbean	2006-08-26	Current	2-High	---	Endangered	G5	S2
Vascular Plant	19553	Gelsemium rankinii	Swamp Jessamine	1995-04-12	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	11233	Gelsemium rankinii	Swamp Jessamine	1995-09-27	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	14027	Gelsemium rankinii	Swamp Jessamine	1984-03-23	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	11234	Gelsemium rankinii	Swamp Jessamine	1995-08-30	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	10111	Gelsemium rankinii	Swamp Jessamine	1981-04-16	Historical	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	21994	Gratiola aurea	Golden Hedge-hyssop	1993-10-29	Current	4-Low	---	Special Concern Vulnerable	G5	S1
Vascular Plant	22003	Gratiola aurea	Golden Hedge-hyssop	1953-07-26	Historical	4-Low	---	Special Concern Vulnerable	G5	S1
Vascular Plant	22888	Gratiola aurea	Golden Hedge-hyssop	2004-06-06	Current	3-Medium	---	Special Concern Vulnerable	G5	S1
Vascular Plant	22002	Gratiola aurea	Golden Hedge-hyssop	1980-07-21	Historical	3-Medium	---	Special Concern Vulnerable	G5	S1

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Vascular Plant	9420	Helenium pinnatifidum	Dissected Sneezeweed	1960-05	Historical	4-Low	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	5479	Helenium pinnatifidum	Dissected Sneezeweed	1991-04-24	Current	3-Medium	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	15427	Helenium pinnatifidum	Dissected Sneezeweed	2000-04-21	Current	3-Medium	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	31852	Hymenocallis pygmaea	Waccamaw River Spiderlily	2004-06-20	Current	2-High	Species of Concern	Threatened	G1G2Q	S1
Vascular Plant	22942	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2004-11-09	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22941	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2004-11-09	Current	3-Medium	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22945	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2002-10-09	Current	2-High	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22940	Hypericum brachyphyllum	Coastal Plain St. John's-wort	1996-10-19	Current	2-High	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	22943	Hypericum brachyphyllum	Coastal Plain St. John's-wort	2004-11-09	Current	2-High	---	Special Concern Vulnerable	G5	S1S2
Vascular Plant	23772	Hypoxis juncea	Fringed Yellow Stargrass	1923-07-25	Historical	4-Low	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	22948	Hypoxis juncea	Fringed Yellow Stargrass	2009-08-04	Current	3-Medium	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	25891	Hypoxis juncea	Fringed Yellow Stargrass	1995-05-24	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	33411	Hypoxis juncea	Fringed Yellow Stargrass	1999-06-14	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	25890	Hypoxis juncea	Fringed Yellow Stargrass	1995-05-24	Current	2-High	---	Significantly Rare Peripheral	G4?	S1
Vascular Plant	25931	Hypoxis juncea	Fringed Yellow Stargrass	1995-05-23	Current	2-High	---	Significantly Rare Peripheral	G4?	S1

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Vascular Plant	19299	Hypoxis sessilis	Sessile Yellow Stargrass	1981-04	Historical	4-Low	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	12054	Hypoxis sessilis	Sessile Yellow Stargrass	1957-06	Historical	4-Low	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	28655	Isoetes microvela	Thin-wall Quillwort	2010-05-28	Current	2-High	Species of Concern	Threatened	G1	S1
Vascular Plant	33335	Isolepis carinata	Keeled Beakrush	2012-03-26	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	4058	Lachnocaulon minus	Brown Bogbutton	1991-06-06	Current	4-Low	---	Threatened	G3G4	S2
Vascular Plant	13552	Lachnocaulon minus	Brown Bogbutton	1964-09-02	Historical	4-Low	---	Threatened	G3G4	S2
Vascular Plant	4059	Lachnocaulon minus	Brown Bogbutton	1990-08-07	Current	4-Low	---	Threatened	G3G4	S2
Vascular Plant	13959	Lachnocaulon minus	Brown Bogbutton	1984-07-22	Current	3-Medium	---	Threatened	G3G4	S2
Vascular Plant	16390	Lechea torreyi var. congesta	Torrey's Pinweed	1997-07-29	Current	4-Low	---	Endangered	G4	S1
Vascular Plant	11363	Lechea torreyi var. congesta	Torrey's Pinweed	1999-10-07	Historical	3-Medium	---	Endangered	G4	S1
Vascular Plant	5704	Lechea torreyi var. congesta	Torrey's Pinweed	1997-09-21	Current	3-Medium	---	Endangered	G4	S1
Vascular Plant	27001	Leersia lenticularis	Catchfly Cutgrass	2004-10-11	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2?
Vascular Plant	27002	Leersia lenticularis	Catchfly Cutgrass	2003-10-25	Current	2-High	---	Significantly Rare Peripheral	G5	S2?
Vascular Plant	22955	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	2004-07-06	Current	3-Medium	---	Threatened	G5?T3?	S1S2
Vascular Plant	12479	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	1991-09-12	Current	3-Medium	---	Threatened	G5?T3?	S1S2
Vascular Plant	19999	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	1995-08-09	Current	3-Medium	---	Threatened	G5?T3?	S1S2
Vascular Plant	10702	Litsea aestivalis	Pondspice	1974-04	Historical	4-Low	Species of Concern	Special Concern Vulnerable	G3?	S2S3
Vascular Plant	17555	Litsea aestivalis	Pondspice	1990-03-23	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3?	S2S3
Vascular Plant	27007	Lupinus villosus	Lady Lupine	1997-05-22	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1

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Vascular Plant	27006	Lupinus villosus	Lady Lupine	1997-05-11	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	27506	Lupinus villosus	Lady Lupine	2006-04-23	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	27004	Lupinus villosus	Lady Lupine	2008-06-03	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	28490	Lupinus villosus	Lady Lupine	2010-05	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	27787	Lupinus villosus	Lady Lupine	2015-09-17	Current	2-High	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	16717	Luziola fluitans	Southern Water Grass	2003-10-03	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	12650	Luziola fluitans	Southern Water Grass	1995-08-29	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	9952	Luziola fluitans	Southern Water Grass	2002-04-27	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	22965	Luziola fluitans	Southern Water Grass	2005-12-08	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	3635	Lysimachia asperulifolia	Rough-leaf Loosestrife	1879-08	Historical	4-Low	Endangered	Endangered	G3	S3
Vascular Plant	10466	Lysimachia asperulifolia	Rough-leaf Loosestrife	2002-06-20	Historical	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	5146	Lysimachia asperulifolia	Rough-leaf Loosestrife	1999-06-14	Current	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	13675	Lysimachia asperulifolia	Rough-leaf Loosestrife	2000-06-28	Current	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	14584	Lysimachia asperulifolia	Rough-leaf Loosestrife	2014-06-30	Current	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	9048	Lysimachia asperulifolia	Rough-leaf Loosestrife	2002-06-18	Historical	2-High	Endangered	Endangered	G3	S3
Vascular Plant	29869	Lysimachia asperulifolia	Rough-leaf Loosestrife	2011-06-01	Historical	3-Medium	Endangered	Endangered	G3	S3
Vascular Plant	29989	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009-07-13	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	1317	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009-07-13	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	2907	Lysimachia asperulifolia	Rough-leaf Loosestrife	2014-05	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	1909	Lysimachia asperulifolia	Rough-leaf Loosestrife	2010-07-20	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	9176	Lysimachia asperulifolia	Rough-leaf Loosestrife	2010-07-20	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	35634	Lysimachia asperulifolia	Rough-leaf Loosestrife	2015-06-29	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	10164	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009-07-13	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	24761	Lysimachia asperulifolia	Rough-leaf Loosestrife	2009	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	32596	Lysimachia asperulifolia	Rough-leaf Loosestrife	2006-06-07	Current	2-High	Endangered	Endangered	G3	S3
Vascular Plant	22479	Lysimachia hybrida	Lowland Loosestrife	1997-07-29	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2?

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Vascular Plant	22480	Lysimachia hybrida	Lowland Loosestrife	1995-08-10	Current	2-High	---	Significantly Rare Peripheral	G5	S2?
Vascular Plant	35784	Lythrum lanceolatum	Southern Winged-loosestrife	1957-07-26	Historical	3-Medium	---	Significantly Rare Throughout	G5	S1
Vascular Plant	35785	Lythrum lanceolatum	Southern Winged-loosestrife	1997-07-29	Current	3-Medium	---	Significantly Rare Throughout	G5	S1
Vascular Plant	35783	Lythrum lanceolatum	Southern Winged-loosestrife	2007-08-12	Current	2-High	---	Significantly Rare Throughout	G5	S1
Vascular Plant	1196	Macbridea caroliniana	Carolina Bogmint	1997-07-29	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	4968	Macbridea caroliniana	Carolina Bogmint	1997-07-29	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	95	Macbridea caroliniana	Carolina Bogmint	2001-08-23	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	13838	Macbridea caroliniana	Carolina Bogmint	2001-08-23	Historical	3-Medium	Species of Concern	Endangered	G2G3	S2
Vascular Plant	7643	Malaxis spicata	Florida Adder's-mouth	1979-08	Historical	3-Medium	---	Special Concern Vulnerable	G4?	S1
Vascular Plant	12603	Muhlenbergia torreyana	Pinebarren Smokegrass	2006-05-30	Current	3-Medium	---	Special Concern Vulnerable	G3	S2
Vascular Plant	24843	Muhlenbergia torreyana	Pinebarren Smokegrass	2004-06-04	Current	2-High	---	Special Concern Vulnerable	G3	S2
Vascular Plant	33495	Myriophyllum pinnatum	Cutleaf Water-milfoil	2005-07-20	Current	2-High	---	Significantly Rare Throughout	G5	S1
Vascular Plant	27013	Oenothera riparia	Riverbank Evening-primrose	2004-06-18	Current	3-Medium	---	Significantly Rare Limited	G2G3	S2S3
Vascular Plant	26902	Oenothera riparia	Riverbank Evening-primrose	2000-07-06	Current	2-High	---	Significantly Rare Limited	G2G3	S2S3

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Vascular Plant	27015	Oenothera riparia	Riverbank Evening-primrose	2002-07-12	Current	2-High	---	Significantly Rare Limited	G2G3	S2S3
Vascular Plant	33945	Oenothera riparia	Riverbank Evening-primrose	2004-06-18	Current	2-High	---	Significantly Rare Limited	G2G3	S2S3
Vascular Plant	27469	Oplismenus hirtellus ssp. setarius	Shortleaf Basket Grass	1999-06-13	Current	2-High	---	Significantly Rare Peripheral	G5T5	S1
Vascular Plant	27018	Oplismenus hirtellus ssp. setarius	Shortleaf Basket Grass	2004-10-11	Current	2-High	---	Significantly Rare Peripheral	G5T5	S1
Vascular Plant	24556	Packera crawfordii	Bog Ragwort	2006-04-26	Current	2-High	---	Significantly Rare Throughout	G2G3	S1
Vascular Plant	35107	Packera crawfordii	Bog Ragwort	2012-04-04	Current	2-High	---	Significantly Rare Throughout	G2G3	S1
Vascular Plant	31507	Panicum dichotomiflorum var. puritanorum	Puritan Panic Grass	2011-08-19	Current	2-High	---	Significantly Rare Peripheral	G5T4	S1
Vascular Plant	644	Parnassia caroliniana	Carolina Grass-of-parnassus	2009	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	18448	Parnassia caroliniana	Carolina Grass-of-parnassus	2015-06-29	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	31279	Parnassia caroliniana	Carolina Grass-of-parnassus	2012-07-11	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	14283	Parnassia caroliniana	Carolina Grass-of-parnassus	1995-09-29	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	5938	Parnassia caroliniana	Carolina Grass-of-parnassus	1997-09-23	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	5817	Parnassia caroliniana	Carolina Grass-of-parnassus	1992-10-12	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	1887	Parnassia caroliniana	Carolina Grass-of-parnassus	2009	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	13339	Parnassia caroliniana	Carolina Grass-of-parnassus	2005-05-05	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	17167	Parnassia caroliniana	Carolina Grass-of-parnassus	1995-10-19	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	14285	Parnassia caroliniana	Carolina Grass-of-parnassus	2006-05-30	Current	2-High	Species of Concern	Threatened	G3	S2

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Vascular Plant	24822	Parnassia caroliniana	Carolina Grass-of-parnassus	2007-05-10	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	24557	Parnassia caroliniana	Carolina Grass-of-parnassus	2006-05-30	Current	2-High	Species of Concern	Threatened	G3	S2
Vascular Plant	11217	Parnassia grandifolia	Large-leaved Grass-of-parnassus	1994-10-07	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	7731	Parnassia grandifolia	Large-leaved Grass-of-parnassus	1994-10-07	Current	3-Medium	Species of Concern	Threatened	G3	S2
Vascular Plant	9896	Paspalum dissectum	Mudbank Crown Grass	1995-09-29	Current	3-Medium	---	Endangered	G4?	S2
Vascular Plant	19904	Peltandra sagittifolia	Spoonflower	1995-05-15	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	5844	Peltandra sagittifolia	Spoonflower	1995-10-19	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	3091	Peltandra sagittifolia	Spoonflower	1995-07-19	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	17240	Peltandra sagittifolia	Spoonflower	1995-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12648	Peltandra sagittifolia	Spoonflower	1989-06-21	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12110	Peltandra sagittifolia	Spoonflower	1987-06-17	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	1011	Peltandra sagittifolia	Spoonflower	1995-08-11	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	4638	Peltandra sagittifolia	Spoonflower	1998-07-21	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	4640	Peltandra sagittifolia	Spoonflower	1999-06-23	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	23398	Phanopyrum gymnocarpon	Swamp Panic Grass	2003-10-25	Current	3-Medium	---	Significantly Rare Other	G5	S1
Vascular Plant	27588	Phanopyrum gymnocarpon	Swamp Panic Grass	2004-10-11	Current	3-Medium	---	Significantly Rare Other	G5	S1
Vascular Plant	27809	Pinguicula lutea	Yellow Butterwort	1954-04-19	Historical	4-Low	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27793	Pinguicula lutea	Yellow Butterwort	1995-04-13	Current	4-Low	---	Significantly Rare Peripheral	G4G5	S2

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Vascular Plant	27792	Pinguicula lutea	Yellow Butterwort	1995-04-13	Current	4-Low	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27796	Pinguicula lutea	Yellow Butterwort	1998-04-04	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27798	Pinguicula lutea	Yellow Butterwort	1995-05-05	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27799	Pinguicula lutea	Yellow Butterwort	1995-04-16	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27800	Pinguicula lutea	Yellow Butterwort	1995-05-03	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	20494	Pinguicula lutea	Yellow Butterwort	2002-05-16	Current	3-Medium	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	27797	Pinguicula lutea	Yellow Butterwort	1995-04-15	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	29887	Pinguicula lutea	Yellow Butterwort	1995-04-16	Current	2-High	---	Significantly Rare Peripheral	G4G5	S2
Vascular Plant	33341	Pinguicula pumila	Small Butterwort	2012-05-28	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	16233	Pinguicula pumila	Small Butterwort	1995-05-05	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	12461	Pinguicula pumila	Small Butterwort	2009-08-04	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	24332	Pinguicula pumila	Small Butterwort	2007-05-10	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	15788	Pinguicula pumila	Small Butterwort	1995-04-13	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	16234	Pinguicula pumila	Small Butterwort	1995-04-15	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	18614	Pinguicula pumila	Small Butterwort	1995-05-04	Current	3-Medium	---	Endangered	G4	S2
Vascular Plant	27683	Pinguicula pumila	Small Butterwort	2009-06-09	Current	2-High	---	Endangered	G4	S2
Vascular Plant	23161	Pinguicula pumila	Small Butterwort	2010-05-29	Current	2-High	---	Endangered	G4	S2
Vascular Plant	19513	Plantago sparsiflora	Pineland Plantain	2015-06-29	Current	2-High	Species of Concern	Threatened	G3	S1S2
Vascular Plant	11660	Plantago sparsiflora	Pineland Plantain	2009	Current	2-High	Species of Concern	Threatened	G3	S1S2
Vascular Plant	16811	Plantago sparsiflora	Pineland Plantain	2009	Current	3-Medium	Species of Concern	Threatened	G3	S1S2
Vascular Plant	19512	Plantago sparsiflora	Pineland Plantain	2006-05-31	Current	3-Medium	Species of Concern	Threatened	G3	S1S2
Vascular Plant	15733	Platanthera integra	Yellow Fringeless Orchid	1967-08	Historical	4-Low	---	Special Concern Vulnerable	G3G4	S2

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Vascular Plant	7351	Platanthera integra	Yellow Fringeless Orchid	1997-09-02	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	11287	Platanthera integra	Yellow Fringeless Orchid	1995-08-31	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	11852	Platanthera integra	Yellow Fringeless Orchid	1995-08-30	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	11289	Platanthera integra	Yellow Fringeless Orchid	1995-09-14	Current	3-Medium	---	Special Concern Vulnerable	G3G4	S2
Vascular Plant	14005	Platanthera nivea	Snowy Orchid	1937-07-13	Historical	4-Low	---	Threatened	G5	S1
Vascular Plant	3678	Platanthera nivea	Snowy Orchid	1966-10-18	Historical	4-Low	---	Threatened	G5	S1
Vascular Plant	15322	Platanthera nivea	Snowy Orchid	1988-07-09	Current	3-Medium	---	Threatened	G5	S1
Vascular Plant	18558	Polygala hookeri	Hooker's Milkwort	1993-06-06	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	7720	Polygala hookeri	Hooker's Milkwort	1998-06-24	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	5752	Polygala hookeri	Hooker's Milkwort	1995-08-30	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	4133	Polygala hookeri	Hooker's Milkwort	1995-08-11	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	12008	Polygala hookeri	Hooker's Milkwort	2003-06-27	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	12289	Polygala hookeri	Hooker's Milkwort	2015-06-29	Current	2-High	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	13840	Polygala hookeri	Hooker's Milkwort	1995-09-26	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3

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Vascular Plant	13836	Polygala hookeri	Hooker's Milkwort	1995-09-27	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	11689	Polygala hookeri	Hooker's Milkwort	1995-09-28	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	15189	Polygala hookeri	Hooker's Milkwort	1995-08-07	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	438	Polygala hookeri	Hooker's Milkwort	1995-09-28	Current	3-Medium	---	Special Concern Vulnerable	G3	S2S3
Vascular Plant	2094	Ponthieva racemosa	Shadow-witch	1979-08	Current	4-Low	---	Threatened	G4G5	S2
Vascular Plant	700	Ponthieva racemosa	Shadow-witch	1959-09-20	Historical	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	19854	Ponthieva racemosa	Shadow-witch	1995-09-27	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	15834	Ponthieva racemosa	Shadow-witch	1991-10-11	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	4612	Ponthieva racemosa	Shadow-witch	1995-08-30	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	17685	Ponthieva racemosa	Shadow-witch	1999-10-05	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	8731	Ponthieva racemosa	Shadow-witch	1988-09-08	Current	3-Medium	---	Threatened	G4G5	S2
Vascular Plant	26494	Ponthieva racemosa	Shadow-witch	2008-09-21	Current	2-High	---	Threatened	G4G5	S2
Vascular Plant	28292	Pycnanthemum setosum	Awned Mountain-mint	1999-06-13	Current	3-Medium	---	Significantly Rare Throughout	G4	S2
Vascular Plant	33344	Pycnanthemum setosum	Awned Mountain-mint	2012-09-12	Current	2-High	---	Significantly Rare Throughout	G4	S2
Vascular Plant	28298	Quercus elliottii	Running Oak	1968-06-01	Historical	3-Medium	---	Significantly Rare Peripheral	G3G5	S2
Vascular Plant	5860	Rhynchospora alba	Northern White Beaksedge	1946-03	Historical	5-Very Low	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	593	Rhynchospora decurrens	Swamp Forest Beaksedge	1996-10-29	Current	3-Medium	Species of Concern	Threatened	G3G4	S1S2
Vascular Plant	33345	Rhynchospora decurrens	Swamp Forest Beaksedge	2012-06-15	Current	2-High	Species of Concern	Threatened	G3G4	S1S2
Vascular Plant	7368	Rhynchospora divergens	White-seeded Beaksedge	1996-08-05	Current	3-Medium	---	Significantly Rare Peripheral	G4	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	18342	Rhynchospora divergens	White-seeded Beaksedge	1999-07-16	Current	2-High	---	Significantly Rare Peripheral	G4	S2
Vascular Plant	19350	Rhynchospora galeana	Short-bristled Beaksedge	1993-06-06	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	14942	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12900	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-09	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	2146	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-07	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	8560	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-28	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12138	Rhynchospora galeana	Short-bristled Beaksedge	2000-07-11	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	12136	Rhynchospora galeana	Short-bristled Beaksedge	1995-05-25	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	1989	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-30	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	18522	Rhynchospora galeana	Short-bristled Beaksedge	1995-06-08	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	23284	Rhynchospora galeana	Short-bristled Beaksedge	2005-05-26	Current	3-Medium	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	35641	Rhynchospora galeana	Short-bristled Beaksedge	2015-06-29	Current	2-High	---	Significantly Rare Peripheral	G3G4	S2S3
Vascular Plant	33347	Rhynchospora microcarpa	Southern Beaksedge	2011-07-21	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	4843	Rhynchospora odorata	Fragrant Beaksedge	1957-06	Historical	4-Low	---	Special Concern Vulnerable	G4	S1
Vascular Plant	13767	Rhynchospora pinetorum	Small's Beaksedge	2007-05-10	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	17751	Rhynchospora pinetorum	Small's Beaksedge	1996-06-13	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	10560	Rhynchospora pinetorum	Small's Beaksedge	1997-08-18	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	10561	Rhynchospora pinetorum	Small's Beaksedge	1998-06-21	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	5561	Rhynchospora pinetorum	Small's Beaksedge	2003-06-14	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	33348	Rhynchospora pinetorum	Small's Beaksedge	2011-06-10	Current	3-Medium	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	7318	Rhynchospora pinetorum	Small's Beaksedge	2001-06-19	Current	2-High	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	23286	Rhynchospora pinetorum	Small's Beaksedge	2004-06-04	Current	2-High	---	Significantly Rare Throughout	G5?T3?	S2
Vascular Plant	6679	Rhynchospora thornei	Thorne's Beaksedge	2001-06-19	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	6877	Rhynchospora thornei	Thorne's Beaksedge	1991-06-27	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12546	Rhynchospora thornei	Thorne's Beaksedge	2009	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	1794	Rhynchospora thornei	Thorne's Beaksedge	1995-08-07	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	15745	Rhynchospora thornei	Thorne's Beaksedge	1992-07-09	Current	3-Medium	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	12047	Rhynchospora thornei	Thorne's Beaksedge	2009	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	23291	Rhynchospora thornei	Thorne's Beaksedge	2005-07-17	Current	2-High	Species of Concern	Special Concern Vulnerable	G3	S2
Vascular Plant	15993	Ruellia strepens	Limestone Wild-petunia	2008-05-25	Current	2-High	---	Endangered	G4G5	S1
Vascular Plant	7876	Ruellia strepens	Limestone Wild-petunia	1999-06-12	Current	2-High	---	Endangered	G4G5	S1
Vascular Plant	17079	Sageretia minutiflora	Small-flowered Buckthorn	1999-12-11	Current	3-Medium	---	Threatened	G4	S1
Vascular Plant	10396	Sagittaria filiformis	Water Arrowhead	1958-06-10	Historical	3-Medium	---	Significantly Rare Peripheral	G4G5	SH
Vascular Plant	13408	Sagittaria filiformis	Water Arrowhead	1981-04-27	Historical	3-Medium	---	Significantly Rare Peripheral	G4G5	SH
Vascular Plant	2605	Sagittaria weatherbiana	Grassleaf Arrowhead	2001-08-02	Current	3-Medium	Species of Concern	Endangered	G3G4	S2
Vascular Plant	12093	Sagittaria weatherbiana	Grassleaf Arrowhead	1949-04-23	Historical	3-Medium	Species of Concern	Endangered	G3G4	S2
Vascular Plant	11390	Schoenoplectus etuberculatus	Canby's Bulrush	1958-07-15	Historical	3-Medium	---	Significantly Rare Peripheral	G3G4	S3
Vascular Plant	8605	Schwalbea americana	Chaffseed	1953-05-16	Historical	4-Low	Endangered	Endangered	G2G3	S2
Vascular Plant	14898	Schwalbea americana	Chaffseed	1951-05	Historical	4-Low	Endangered	Endangered	G2G3	S2
Vascular Plant	16917	Scirpus lineatus	Drooping Bulrush	1998-05-20	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	4861	Scirpus lineatus	Drooping Bulrush	2008-05-25	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	12397	Scirpus lineatus	Drooping Bulrush	2002-05-03	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	2436	Scirpus lineatus	Drooping Bulrush	2006-05-31	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	29769	Scirpus lineatus	Drooping Bulrush	2011-06-10	Current	2-High	---	Threatened	G4	S2
Vascular Plant	1662	Scleria baldwinii	Baldwin's Nutrush	2011-09-16	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	22060	Scleria sp. 1	Smooth-seeded Hairy Nutrush	2013-05-30	Current	3-Medium	Species of Concern	Significantly Rare Limited	G2G3	S1
Vascular Plant	22061	Scleria sp. 1	Smooth-seeded Hairy Nutrush	2013-05-30	Current	3-Medium	Species of Concern	Significantly Rare Limited	G2G3	S1
Vascular Plant	24565	Scleria sp. 1	Smooth-seeded Hairy Nutrush	2006-05-30	Current	2-High	Species of Concern	Significantly Rare Limited	G2G3	S1
Vascular Plant	15265	Scleria verticillata	Savanna Nutrush	1995-09-06	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	9953	Scleria verticillata	Savanna Nutrush	1991-08-04	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	842	Scleria verticillata	Savanna Nutrush	1991-09-12	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	2148	Scleria verticillata	Savanna Nutrush	1996-10-04	Current	3-Medium	---	Significantly Rare Peripheral	G5	S2
Vascular Plant	28361	Sclerolepis uniflora	One-flower Hardscale	1978-09-30	Historical	4-Low	---	Significantly Rare Throughout	G4	S2
Vascular Plant	22043	Sesuvium portulacastrum	Shoreline Sea-purslane	2002-05-15	Current	3-Medium	---	Significantly Rare Peripheral	G5	S1
Vascular Plant	31921	Solidago tortifolia	Twisted-leaf Goldenrod	1992-06-09	Current	3-Medium	---	Endangered	G4G5	S1
Vascular Plant	12312	Solidago verna	Spring-flowering Goldenrod	1953-05	Historical	4-Low	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	1905	Solidago verna	Spring-flowering Goldenrod	1984-05-16	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	3412	Solidago verna	Spring-flowering Goldenrod	1998-05-19	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	14430	Solidago verna	Spring-flowering Goldenrod	2006-05-01	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	15	Solidago verna	Spring-flowering Goldenrod	1981-05	Current	3-Medium	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	11681	Solidago verna	Spring-flowering Goldenrod	1980-04-22	Historical	2-High	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	10835	Solidago verna	Spring-flowering Goldenrod	2003-05-26	Current	2-High	Species of Concern	Significantly Rare Other	G3	S3
Vascular Plant	24361	Solidago villosicarpa	Coastal Goldenrod	2006-10-17	Current	3-Medium	Species of Concern	Endangered	G1	S1
Vascular Plant	1152	Solidago villosicarpa	Coastal Goldenrod	2006-10-17	Current	3-Medium	Species of Concern	Endangered	G1	S1
Vascular Plant	22362	Solidago villosicarpa	Coastal Goldenrod	2015-09-17	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	22320	Solidago villosicarpa	Coastal Goldenrod	2007-02-02	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	22361	Solidago villosicarpa	Coastal Goldenrod	2009-04-23	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	24358	Solidago villosicarpa	Coastal Goldenrod	2006-11-01	Current	2-High	Species of Concern	Endangered	G1	S1
Vascular Plant	22363	Solidago villosicarpa	Coastal Goldenrod	2005-10-20	Current	2-High	Species of Concern	Endangered	G1	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	23883	Spiranthes eatonii	Eaton's Ladies'-tresses	2003-06-09	Current	3-Medium	---	Endangered	G2G4	S2
Vascular Plant	32250	Spiranthes eatonii	Eaton's Ladies'-tresses	1995-06-08	Current	3-Medium	---	Endangered	G2G4	S2
Vascular Plant	27814	Spiranthes eatonii	Eaton's Ladies'-tresses	2012-06-03	Current	2-High	---	Endangered	G2G4	S2
Vascular Plant	33351	Spiranthes eatonii	Eaton's Ladies'-tresses		Obscure	1-Very High	---	Endangered	G2G4	S2
Vascular Plant	17253	Spiranthes floridana	Florida Ladies'-tresses	1925-05-18	Historical	4-Low	---	Significantly Rare Peripheral	G1	S1
Vascular Plant	33353	Spiranthes laciniata	Lace-lip Ladies'-tresses	2011-06-09	Obscure	3-Medium	---	Special Concern Vulnerable	G4G5	S2
Vascular Plant	9581	Spiranthes longilabris	Giant Spiral Orchid	1997-10-26	Current	3-Medium	---	Endangered	G3	S1
Vascular Plant	16199	Stylisma pickeringii var. pickeringii	Pickering's Dawnflower	1958-06-12	Historical	3-Medium	Species of Concern	Special Concern Vulnerable	G4T3	S3
Vascular Plant	13411	Stylisma pickeringii var. pickeringii	Pickering's Dawnflower	2004-09-23	Current	2-High	Species of Concern	Special Concern Vulnerable	G4T3	S3
Vascular Plant	15402	Thalictrum cooleyi	Cooley's Meadowrue	2005-05-05	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	12545	Thalictrum cooleyi	Cooley's Meadowrue	2013-05-29	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	2221	Thalictrum cooleyi	Cooley's Meadowrue	2014-06-22	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	12124	Thalictrum cooleyi	Cooley's Meadowrue	2013-05-30	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	2020	Thalictrum cooleyi	Cooley's Meadowrue	1998-06-21	Current	3-Medium	Endangered	Endangered	G2	S2
Vascular Plant	16311	Thalictrum cooleyi	Cooley's Meadowrue	2015-06-29	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	8690	Thalictrum cooleyi	Cooley's Meadowrue	2013-06-14	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	29952	Thalictrum cooleyi	Cooley's Meadowrue	2011-08	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31269	Thalictrum cooleyi	Cooley's Meadowrue	2012-06-14	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	29951	Thalictrum cooleyi	Cooley's Meadowrue	2014-07-09	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	24576	Thalictrum cooleyi	Cooley's Meadowrue	2014-07-07	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	31268	Thalictrum cooleyi	Cooley's Meadowrue	2012-07-11	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	27826	Thalictrum cooleyi	Cooley's Meadowrue	2009-06-19	Current	2-High	Endangered	Endangered	G2	S2
Vascular Plant	23011	Thalictrum cooleyi	Cooley's Meadowrue	2001-06-19	Historical	2-High	Endangered	Endangered	G2	S2
Vascular Plant	22463	Thalictrum macrostylum	Small-leaved Meadowrue	2010-06-12	Current	3-Medium	Species of Concern	Significantly Rare Throughout	G3G4	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	23940	Trichostema setaceum	Narrowleaf Bluecurls	1997-09-13	Current	3-Medium	---	Significantly Rare Throughout	G5	S2
Vascular Plant	23312	Tridens chapmanii	Chapman's Redtop	2005-11-08	Current	2-High	---	Threatened	G3	S1S2
Vascular Plant	21325	Trillium pusillum var. pusillum	Carolina Least Trillium	2006-04-26	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21326	Trillium pusillum var. pusillum	Carolina Least Trillium	2002	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21327	Trillium pusillum var. pusillum	Carolina Least Trillium	2005-04-08	Current	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	7558	Trillium pusillum var. pusillum	Carolina Least Trillium	1963-06	Historical	3-Medium	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21333	Trillium pusillum var. pusillum	Carolina Least Trillium	2004	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	12579	Trillium pusillum var. pusillum	Carolina Least Trillium	1987-06-16	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	474	Trillium pusillum var. pusillum	Carolina Least Trillium	2005-04-01	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	11195	Trillium pusillum var. pusillum	Carolina Least Trillium	2012-04-04	Current	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	21328	Trillium pusillum var. pusillum	Carolina Least Trillium	2002	Historical	2-High	Species of Concern	Endangered	G3T2	S2
Vascular Plant	2528	Utricularia geminiscapa	Two-flowered Bladderwort	1998-09-30	Current	3-Medium	---	Special Concern Vulnerable	G4G5	S1
Vascular Plant	3712	Utricularia olivacea	Dwarf Bladderwort	1989-06-22	Current	3-Medium	---	Threatened	G4	S2
Vascular Plant	26571	Vaccinium virgatum	Small-flower Blueberry	2004-06-19	Current	2-High	---	Significantly Rare Peripheral	G4	S1
Vascular Plant	7373	Xyris floridana	Florida Yellow-eyed-grass	2003-09-20	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	11875	Xyris floridana	Florida Yellow-eyed-grass	1996-10-29	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	33621	Xyris floridana	Florida Yellow-eyed-grass	1992-06-08	Current	3-Medium	---	Threatened	G5T4T5	S1
Vascular Plant	33623	Xyris floridana	Florida Yellow-eyed-grass	1992-06-08	Current	3-Medium	---	Threatened	G5T4T5	S1

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	14049	Xyris stricta	Pineland Yellow-eyed-grass	2003-07-12	Historical	3-Medium	---	Endangered	G4	S1
Vascular Plant	19391	Yucca gloriosa	Moundlily Yucca	1999-12-11	Current	3-Medium	---	Significantly Rare Peripheral	G4?	S2?
Vascular Plant	19964	Yucca gloriosa	Moundlily Yucca	1999-10-31	Current	3-Medium	---	Significantly Rare Peripheral	G4?	S2?

Natural Areas Documented Within a One-mile Radius of the Project Area

Site Name	Representational Rating	Collective Rating
421 Sand Ridge	R2 (Very High)	C1 (Exceptional)
Angola Bay	R2 (Very High)	C3 (High)
Angola Creek Flatwoods	R2 (Very High)	C3 (High)
B.W. Wells Savanna	R2 (Very High)	C4 (Moderate)
Bear Garden	R3 (High)	C4 (Moderate)
Big Colly Swamp	R4 (Moderate)	C4 (Moderate)
Black River Cypress Swamp	R1 (Exceptional)	C3 (High)
Blake Savanna	R5 (General)	C5 (General)
Bryant Mill (Greenbank) Bluff	R1 (Exceptional)	C3 (High)
Canetuck Loop Road Sandhills	R5 (General)	C4 (Moderate)
Cape Fear River Lowlands	R2 (Very High)	C4 (Moderate)
Clarks Landing Coastal Goldenrod Site	R2 (Very High)	C4 (Moderate)
Colvins Bay	R5 (General)	C4 (Moderate)
Colvins Creek Sand Ridge Mesic Slopes	R2 (Very High)	C5 (General)
Cones Folly	R2 (Very High)	C2 (Very High)
Figure Eight Island Marsh	R2 (Very High)	C3 (High)
Futch and Foy Creeks Natural Area	R5 (General)	C5 (General)
Holly Shelter Game Land	R1 (Exceptional)	C1 (Exceptional)
Hood Creek Floodplain and Slopes	R3 (High)	C4 (Moderate)
Lea-Hutaff Island	R2 (Very High)	C2 (Very High)
Lower Black River Swamp	R2 (Very High)	C4 (Moderate)
Maple Hill Limesink Complex	R5 (General)	C5 (General)
Maple Hill School Road Savanna	R3 (High)	C3 (High)
McLean Savanna	R1 (Exceptional)	C1 (Exceptional)
Moores Creek Floodplain	R1 (Exceptional)	C5 (General)
Moores Creek National Battlefield	R2 (Very High)	C3 (High)
Neils Eddy Landing	R2 (Very High)	C4 (Moderate)

Natural Areas Documented Within a One-mile Radius of the Project Area

Site Name	Representational Rating	Collective Rating
Northeast Cape Fear River Floodplain	R1 (Exceptional)	C1 (Exceptional)
Parkers Savanna	R2 (Very High)	C3 (High)
Rocky Point Marl Forest	R1 (Exceptional)	C3 (High)
Rocky Point Sandhills	R2 (Very High)	C4 (Moderate)
Sandy Run Swamp and Savannas	R1 (Exceptional)	C1 (Exceptional)
Shaken Creek Savanna	R1 (Exceptional)	C1 (Exceptional)
Shaky Bay Sandhills	R2 (Very High)	C4 (Moderate)
Shelter Swamp Creek Flatwoods	R1 (Exceptional)	C2 (Very High)
Sidbury Road Savanna	R3 (High)	C4 (Moderate)
Southwest Ridge Savanna	R3 (High)	C2 (Very High)
Surf City Maritime Forest	R4 (Moderate)	C4 (Moderate)
Tate Road Savanna	R2 (Very High)	C4 (Moderate)
The Neck Savanna	R1 (Exceptional)	C1 (Exceptional)
Topsail Sound Maritime Forests	R2 (Very High)	C4 (Moderate)
Upper Black River Bottomlands	R1 (Exceptional)	C3 (High)
Watkins Savanna	R2 (Very High)	C2 (Very High)
Webbtown Road Savanna	R5 (General)	C4 (Moderate)
CPF/Black River Aquatic Habitat	n/a (Not Applicable)	C3 (High)

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
Angola Bay Game Land	NC Wildlife Resources Commission	State
Angola Creek Flatwoods Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
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Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Black River Cypress Forest Preserve	The Nature Conservancy	Private
Camp Lejeune	US Department of Defense	Federal
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
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Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land	NC Wildlife Resources Commission	State
Haws Run Conservation Site	NC Department of Transportation	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Holly Shelter Game Land	NC Wildlife Resources Commission	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea Island State Natural Area	NC DNCR, Division of Parks and Recreation	State
Lea/Hutaff Island Audubon Sanctuary	National Audubon Society	Private
McLean Savanna Preserve	The Nature Conservancy	Private
Moores Creek National Battlefield	US National Park Service	Federal
NC Submerged Lands	NC Department of Administration	State
NC Submerged Lands	NC Department of Administration	State
NC Submerged Lands	NC Department of Administration	State
New Hanover County Open Space	New Hanover County: multiple local government	Local Government
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Preserve	North Carolina Coastal Land Trust	Private
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Pender County Open Space	Piedmont Triad Regional Water Authority	Local Government
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area	NC DNCR, Division of Parks and Recreation	State
Shaken Creek Preserve	The Nature Conservancy	Private
Shaken Creek Preserve	The Nature Conservancy	Private
Watha Fish Hatchery	NC Wildlife Resources Commission	State
Watha Fish Hatchery	NC Wildlife Resources Commission	State
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Clean Water Management Trust Fund Easement	NC DNCR, Clean Water Management Trust Fund	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Department of Transportation Mitigation Site	NC Department of Transportation	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
Nature Conservancy Easement	The Nature Conservancy	Private
Nature Conservancy Easement	The Nature Conservancy	Private
Nature Conservancy Easement	The Nature Conservancy	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Coastal Land Trust Easement	North Carolina Coastal Land Trust	Private
North Carolina Swine Buyout Easement	NC Department of Agriculture, Division of Soil and Water Conservation	State
US Fish and Wildlife Service Easement	US Fish and Wildlife Service	Federal
Angola Bay Game Land DNP	NC Wildlife Resources Commission	State
Angola Creek Flatwoods Preserve DNP	The Nature Conservancy	Private
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Cape Fear River Wetlands Game Land DNP	NC Wildlife Resources Commission	State
Clarks Landing Coastal Goldenrod Site RHA	TC&I Timber Company, LLC	Private
Figure Eight Island Marsh RHA	Northeast New Hanover Conservancy	Private
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Holly Shelter Game Land DNP	NC Wildlife Resources Commission	State
Moores Creek National Battlefield RHA	US National Park Service	Federal
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State
Sandy Run Savannas State Natural Area DNP	NC DNCR, Division of Parks and Recreation	State

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on June 22, 2016; source: NCNHP, Q4 October 2015. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

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APPENDIX F

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Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer

PREPARED FOR:	Pender County Utilities
COPY TO:	Highfill Infrastructure Engineering, PC
PREPARED BY:	CH2M North Carolina, Inc.
DATE:	September 9, 2016 (Updated October 28, 2016 based on DWR Comments on the Draft Environmental Assessment)

1.0 Introduction

Pender County is a fast growing coastal county with a 2015 population of over 56,000. The growth in the County has been and will continue to be driven by its location in the vicinity of Wilmington, its coastal community access and its strategic priorities related to economic development and expansion of public infrastructure into areas of the County that do not currently have water utility services. In addition to the currently underway and planned near-term water system expansion, the County is engaging in a planning process as a regional provider of surface water. The County has reached out to other neighboring utilities, including all other utility providers within Pender County, to determine who may consider obtaining surface water through the County's system in the future. These utilities are currently reliant on groundwater for their potable water needs. The utilities that have decided to partner with the County as co-applicants as part of the interbasin transfer (IBT) certificate process includes the Town of Burgaw, Town of Topsail Beach, Town of Surf City, Town of Wallace, and Utilities, Inc.

Within Pender County, six water and sewer districts were established through referendum for the purposes of expanding service to existing residents: Central Pender, Columbia/Union, Maple Hill, Moore's Creek, Rocky Point/Topsail, and Scotts Hill. Figure 1 provides a map presenting the County's water and sewer districts, as well as the co-applicants.

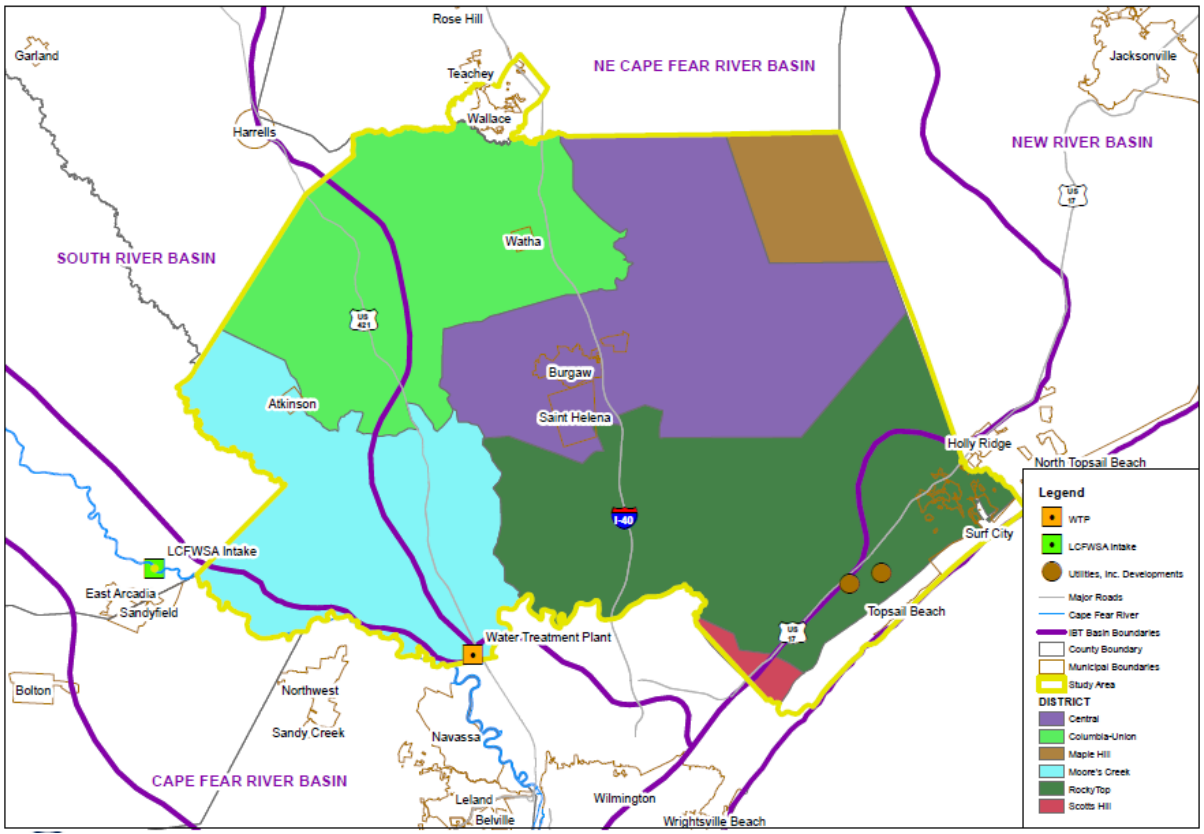
The County's water distribution system in the Rocky Point/Topsail water and sewer district was built in five phases, and then the County constructed the Scotts Hill water distribution system. Currently, water system expansion is occurring in the Central Pender and Moore's Creek districts. The Pender County Board of County Commissioners serves as the governing body for each district, and Pender County Utilities operates, maintains and manages all water and wastewater infrastructure within each district. In addition, two municipalities within the County, St. Helena and Watha, receive water service from Pender County.

The Pender County WTP is currently permitted for a production capacity of 2 million gallons per day (MGD), but it is expandable to 6 MGD capacity with relatively minor modification. Pender County's ability to deliver water is currently restricted by a 12-inch diameter transmission main along NC 210. The County plans to supplement the main with a larger line in order for the distribution system to accommodate increasing demands. The heaviest growth in Pender County is generally along the US 17 corridor, which includes the Rocky Point/Topsail and Scott's Hill Water and Sewer Districts. Because the larger main will enable Pender County to distribute water from the Cape Fear River basin across multiple designated IBT river basins (Figure 1), an IBT Certificate is required. ***Pender County and its co-applicants are requesting an authorized transfer between designated IBT river***

basins, from the Cape Fear River to the South River, Northeast Cape Fear River, and New River basins of 14.5 MGD, calculated as a daily average of a calendar month.

Centralized sanitary sewer service in Pender County is very limited; residential wastewater treatment needs are primarily being met by onsite treatment (septic systems). A combination of public and private systems are in use or under construction. A County-owned 0.5 MGD wastewater treatment plant (WWTP) is currently under construction to serve the US 421 corridor in southwestern Pender County. This WWTP has an NDPES permit to discharge up to 4 MGD to the Cape Fear River and expansion during the planning window is expected to be within the 4 MGD permit limit. In the IBT planning horizon, PCU will continue with its current wastewater strategy that includes a range of systems to meet the wastewater collection and treatment needs of the County. Large-scale addition of a centralized sanitary sewer system is not expected within the current IBT

FIGURE 1
Pender County and Co-applicant Study Area Overview Map



planning window and the majority of water distributed within the PCU WSDs will, therefore, be treated and infiltrated within the river basin in which it is utilized.

2.0 Purpose of the Hydrologic Modeling Evaluation

The purpose of the hydrologic modeling is to evaluate the potential effects of Pender County's proposed IBT on surface water resources in the Cape Fear River. This evaluation has been completed to support the development of an Environmental Assessment (EA) required under NCGS 143-215.22L for an IBT certification. The EA has to correspond with State Environmental Policy Act (SEPA) requirements.

CH2M analyzed the potential effects of the proposed IBT and alternatives using the North Carolina Division of Water Resources' (DWR) Cape Fear River and Neuse River Basin Hydrologic Model (CFRNRBHM) (Hydrologics, 2013). The model was modified to represent the project alternatives and model results were compared to evaluate the potential effect of each alternative.

3.0 Hydrologic Model Overview

3.1 Background on the CFNRBHM

DWR originally developed individual hydrologic models for the Cape Fear River and Neuse River basins. In 2012, to recognize the numerous interconnections between the two basins, they contracted with HydroLogics, Inc. to develop a combined Cape Fear River basin and Neuse River basin hydrologic model. This revised model was completed in January 2014. The resulting system is modeled using the OASIS water resources program which combines graphical representations of components such as river sections, withdrawals and discharges with logical statements which describe their behavior. These statements, including operational rules, demand values, and elevation-storage relationships are evaluated within a linear programming environment to determine the state of each component within the system (HydroLogics, Inc., 2006).

CH2M obtained the CFNRBHM OASIS model from DWR on May 14, 2016 to evaluate the hydrologic impacts of the proposed increase in IBT on water resources in the Cape Fear River basin. The model includes a number of scenarios used to represent current and future water demands, discharges, and reservoir operations. The specific scenarios which would be used for this hydrologic analysis was confirmed by DWR on June 13, 2016.

3.2 Model Structure

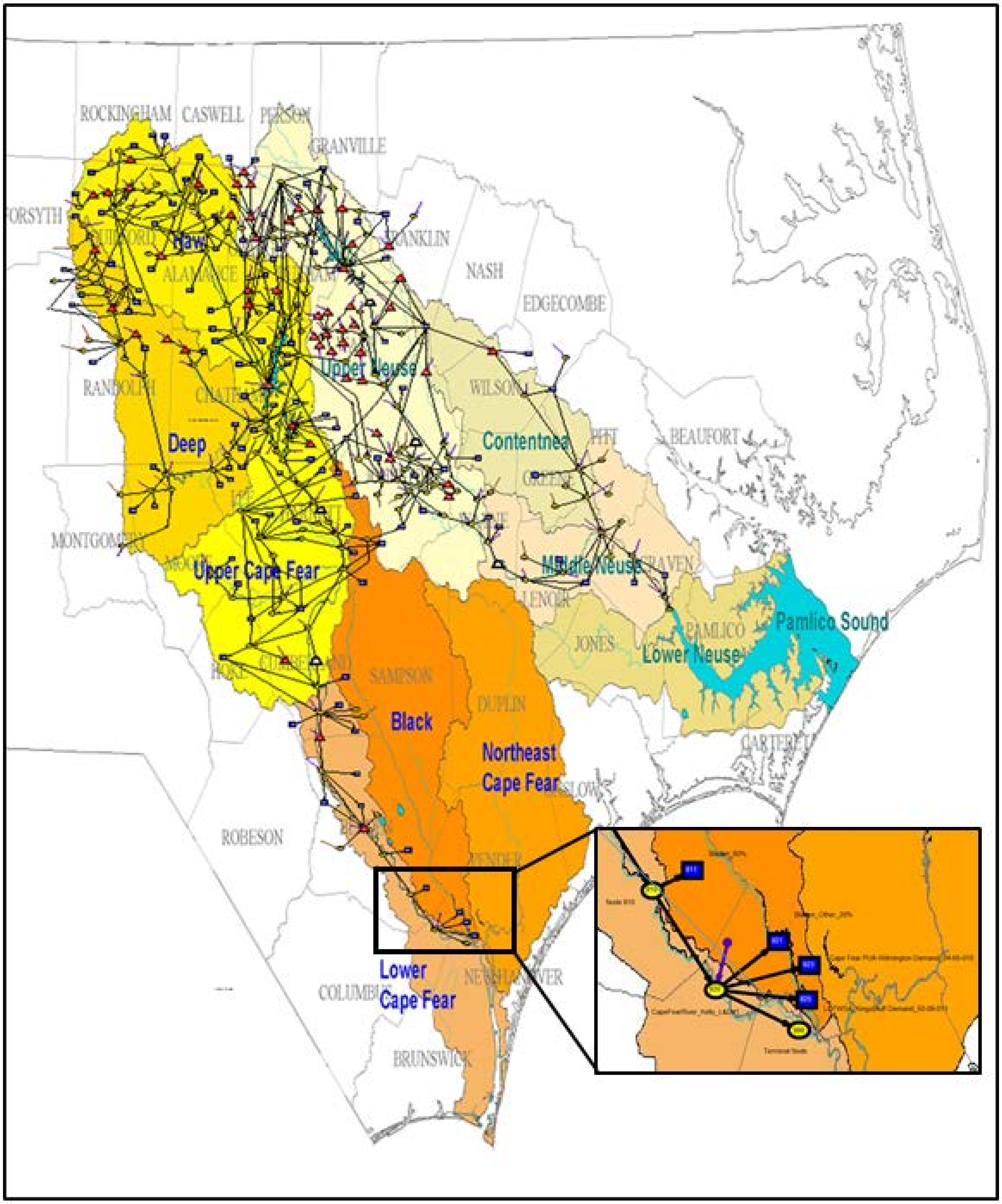
The CFNRBHM includes all withdrawals and discharges in both river basins greater than 100,000 gallons per day (gpd, or 0.1 MGD). A schematic of the CFNRBHM showing the model layout and all model nodes is provided in Figure 2; it should be noted that the Black River and Northeast Cape Fear River basins depicted in the schematic are not included in the CFNRBHM. The model schematic shows reservoirs represented as red triangles. The blue squares represent surface water withdrawals, and yellow circles represent collection nodes or surface water discharges. The model extends from the headwaters of the Cape Fear and Neuse Rivers in north-central North Carolina to Lock and Dam #1 (L&D#1), north-west of Wilmington. The Cape Fear River is tidally influenced below L&D#1. River flow cannot be accurately calculated for these conditions by a water balance model such as OASIS. The model includes one node below L&D #1 so that net outflow past L&D #1 can be tracked. The LCFWASA intake is directly upstream of L&D #1 in the pool created by the lock and dam structure.

The latest revision of the CFNRBHM model structure greatly increases the spatial resolution of the model over previous versions for the Cape Fear River basin. A major focus of the DWR model refinement was to explicitly specify and directly link withdrawals and discharges for individual entities, including municipalities and industries. This linkage allows for a better representation of the many regular and emergency interconnections used to meet water demands.

As part of the model refinement, HydroLogics, Inc. also extended the simulation period to simulate the time frame from January 1930 through September 2011. This period covers a wide range of hydrologic conditions. This was an important update because North Carolina experienced two of the most extreme droughts on record. Both droughts (2002 and 2007) included periods of exceptional drought, the most extreme drought classification. The exceptional drought of the 1950's is also included in the simulation period, which is one of the most severe droughts of record for the period.

Watershed inflows are specified on a daily basis through an underlying database. Withdrawals and discharges can be specified in the model, typically as monthly values. The model can predict instream flow and reservoir storage for each component of the model structure on a daily, weekly, or monthly basis. Hydrologic modeling scenarios were run on a daily time step for this evaluation.

FIGURE 2
Schematic Showing the Cape Fear and Neuse River Basin Hydrologic Model Layout and Nodes



Source: (Hydrologics, 2006)

3.3 Water Shortage Response Plans

In North Carolina, units of local government that provide public water service and large community water systems shall develop are required to develop and implement a Water Shortage Response Plan (WSRP) to require the reduction of water use during drought conditions. The WSRPs must include an expected reduction in demand resulting from water restrictions which are implemented based on a set of triggers. WSRPs for public water suppliers in the Cape Fear River and Neuse River basins were incorporated into the CFNRBHM model by HydroLogics, Inc. during the model development when the triggers are based on physical conditions tracked by the model such as stream flow or reservoir level. Many WSRPs for public water suppliers in the Cape Fear and Neuse River basins are not tied to physical triggers and therefore cannot be explicitly represented in the model. This includes all water withdrawals downstream of Jordan Lake on the Cape Fear River.

For the hydrologic analyses presented herein, the WSRPs were turned "on." Therefore, the modeling results include the effect of the WSRPs built into the model.

3.4 Current and Future Withdrawals and Discharges

Current Withdrawals and Discharges

Estimates of existing withdrawals and discharges were compiled by DWR from sources including, but not limited to, Local Water Supply Plans (LWSP), information provided directly from municipalities, national pollutant discharge elimination system (NPDES) reporting, water withdrawal and transfer registration, and from the Department of Agriculture. These estimates, as part of DWR's existing conditions model scenario, were provided for public review on September 6, 2013.

The CFNRBHM refinement occurred in 2012. The most up to date, completed LWSPs at that time were based on 2010 data. For this reason, the baseline model scenario, as defined by DWR, uses 2010 withdrawals and discharges. It should be noted that Pender County is not included as an explicit withdrawal in the 2010 baseline since its purchases from LCFWASA did not begin until 2012, when its current WTP began operation. Prior to this, Pender County purchased groundwater from the Town of Wallace.

Future Water Demand Projections

Water withdrawal and discharge projections for future periods, including the year 2045, were compiled for the Cape Fear and Neuse River basins by DWR from LWSPs and information provided directly from public water supplies to DWR. These estimates, as part of DWR's future conditions model scenarios, were provided for public review on September 6, 2013. These future withdrawals and discharges are the basis of the CFNRBHM 2045 model scenarios developed by DWR, which were the starting point for the model scenario developed for this evaluation.

Pender County demands and returns for 2045 were used to update the information in the model for the purposes of this evaluation. A detailed description of the development of the future demands is provided in *Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County* (HIEPC and CH2M, 2016).

Future Wastewater Discharge Projections

Under the County's proposed IBT, most of the forecasted water demand to occur in each respective basin will be used and infiltrated or discharged within that basin. Pender County is currently constructing a 0.5 MGD WWTP to serve the US 421 corridor in southwestern Pender County. When the US 421 WWTP comes online in approximately 2017, the County will begin returning wastewater to the source basin. This WWTP has an NDPES permit to discharge up to 4 MGD to the Cape Fear River below L&D #1. While not yet online, the future discharge will increase with time in direct correlation to increasing water demands, partially offsetting the withdrawal above L&D #1. This return to the Cape Fear River basin is not captured in the CFRNRBHM as the model's most downstream node is at L&D #1.

Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County (HIEPC and CH2M, 2016) provides a detailed description of the development of the future wastewater flows.

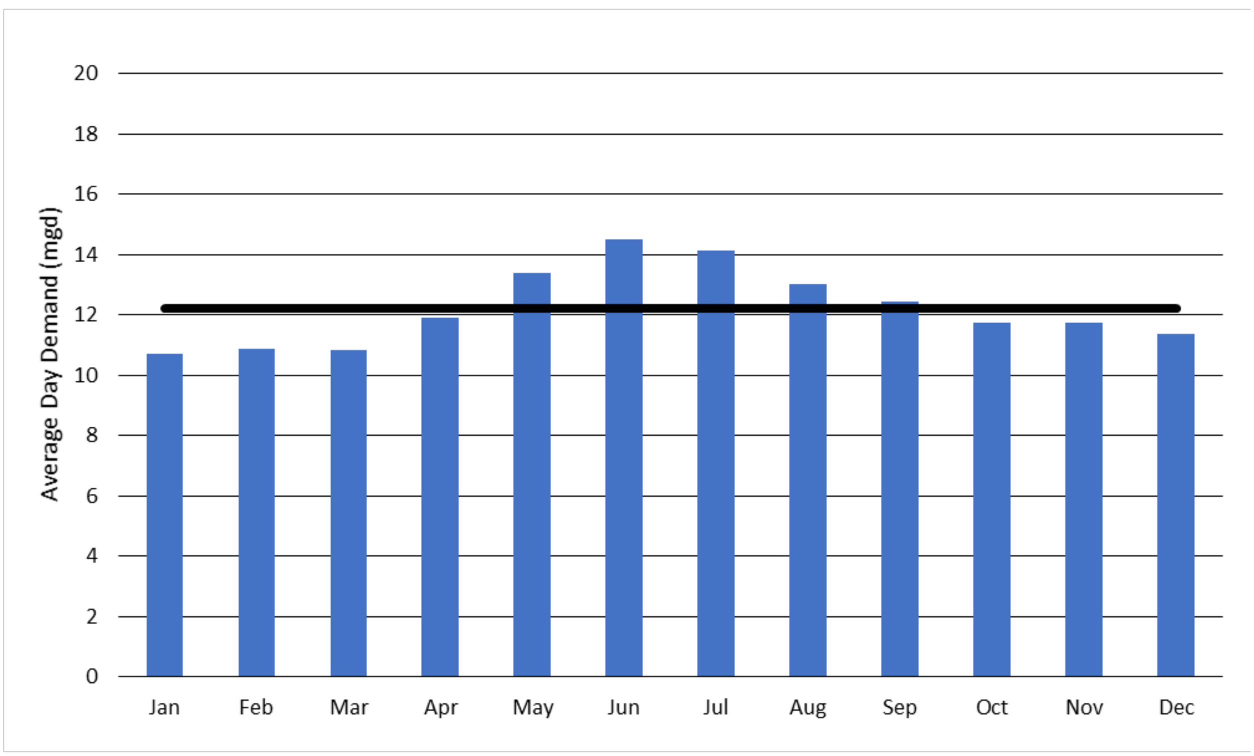
Future IBT Projections

In accordance with the NC General Statute 143-215.22L, the forecast of IBT is calculated as a daily average of a calendar month. Historical data for Pender County were analyzed to develop a monthly demand pattern to develop the seasonal water demand pattern for the County's water users, and ultimately the maximum month to average day peaking relationship. A detailed description of the development of the future IBT is included in *Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County* (HIEPC and CH2M, 2016).

The 2045 IBT value, 14.5 MGD, is reflective of the net transfer from the Cape Fear River basin to the Northeast Cape Fear, South, and New River basins, with returns from the portion of the Moore's Creek water and sewer district in the Cape Fear River basin and the US 421 WWTP. In addition, the County's WTP returns its treated process wastewater to the river.

A plot of the monthly water demand pattern that is reflective of the 2045 transfer from the Cape Fear River basin is provided in Figure 3. This pattern is entered into the CFRNRBHM to represent potential future demands, and ultimately the proposed maximum month average day IBT in 2045 for Pender County.

FIGURE 3
Pender County's Projected 2045 Monthly Average Demand Pattern used in the CFRNRBHM



4.0 Hydrologic Model Use for Evaluating IBT

The Pender County demand is supplied by the LCFWASA's raw water intake at King's Bluff, directly upstream of L&D #1. The Cape Fear River below this point is tidally influenced and is not included in the model other than the inclusion of a link and terminal load which allows tracking of flows below L&D #1. For this reason, two specific evaluations points were selected:

- River flows to L&D #1 - these flows are representative of water available to both the LCFWASA as well as the Cape Fear Public Utility Authority (CFPUA) raw water intakes directly upstream of L&D #1.
- River flows below L&D #1 - downstream from the raw water intake location at L&D #1 (after raw water withdrawals)

At each of these points, the following model results were reviewed:

- River flow statistics
  - Average and median flows – representative of “normal” climatic conditions
  - 10th and 5th percentile flows – representative of low flow periods
    - The USGS uses the 10th percentile, based on historical flow records, as an indicator for flows that are “much below normal” at a gaging station.
    - The Drought Management Advisory Council (DMAC) use the 10th percentile, based on historical flow records, to define the start of a “severe” drought and the 5th percentile to define the start of an “extreme” droughts.
- Time series plots
  - Entire period of record (1930-2011)
  - Droughts of record (1950’s, 2002, 2007) – extreme low flow periods; simulated future conditions for these droughts would require the implementation of each public water suppliers WSRP to reduce withdrawals.
- Frequency duration plots

The hydrologic modeling evaluation process included the development of an assessment strategy, development of alternative model scenarios, revision of the CFNRBHM (to reflect the alternative scenarios), and evaluation of differences between the model scenarios.

5.0 Hydrologic Model Scenarios

The CFNRBHM was used to evaluate the potential effects of the proposed IBT. The specifics of the modeling scenarios were developed through discussions with NCDWR.

5.1.1 Environmental Assessment Alternatives

Alternatives to be evaluated as part of the EA in support of Pender County’s proposed IBT include the following:

- No action
  - No increase in public water supply and no increase in IBT to meet 2045 demands (Alternative #1)
- Obtain an IBT certificate, allowing the increase in water supply from the Cape Fear River to meet 2045 demands
  - Proposed action (Alternative #2)
- Avoid IBT certificate by

- Return of wastewater to the Cape Fear River basin (Alternative #3)
    - Under this alternative Pender County would increase its water supply from the Cape Fear River, the wastewater return to the river would eliminate the need for an IBT certificate.
- Using other surface water supply sources in the South, Northeast Cape Fear, and New River basins (Alternative #4)
- Using coastal water supply sources and desalination technology (Alternative #5)
- Using groundwater as a water supply source (Alternative #6)

The specific details on each alternative are presented in the EA.

5.1.2 Hydrologic Model Scenarios

Four hydrologic model scenarios were used to evaluate the various EA alternatives described in the preceding section. These model scenarios were developed to represent the alternatives and allow for a comparative evaluation of the alternatives to the County's proposed increased Cape Fear water supply withdrawal and IBT. These model scenarios provide a comprehensive understanding of the effects from an increased withdrawal and IBT, and the results from EA alternatives not explicitly included in the model scenarios would be similar. Table 1 provides an outline of the model scenarios representing each EA alternative.

TABLE 1
Modeling Scenarios Representing EA Alternatives

EA Alternative	Description	Modeling Scenario Representing an EA Alternative
1 (Existing)	2010 Conditions	2010 Baseline
1 (Future)	2045 Conditions	2045 Baseline
2	Increase Cape Fear withdrawals to meet 2045 demands (Proposed Alternative)	2045 Requested IBT
3	Avoid or minimize IBT by discharging treated wastewater effluent to the Cape Fear River basin.	2045 Baseline
4	Avoid or minimize IBT by using surface water sources in the respective South River, Northeast Cape Fear River, and New River basins.	
5	Avoid an increase in IBT by using coastal water sources and desalination technology	
6	Using groundwater as a water supply source	
n/a	Maximum allowable withdrawal at L&D #1	2045 Maximum Withdrawal

The following sections provide a summary of each model scenario.

2010 Baseline

The 2010 Baseline scenario represents 2010 conditions for Pender County and the Cape Fear and Neuse River basins. This scenario is an unmodified version of the final 2010 CFNRBHM scenario (Simbase_Jan_2014). Water supply withdrawals and discharges throughout the basins are set to actual

2010 levels. This Pender County WTP began operation in 2012; prior to this the County utilized groundwater purchased from other systems. A Pender County demand for 2010 is not explicitly specified in the 2010 baseline model. The objective of the 2010 baseline scenario is to provide a basis of comparison to identify changes in river flow that results from increased future withdrawals and discharges throughout the Cape Fear River basin, from a historical point in time.

2045 Baseline (EA Alternative 1 and Alternatives 3 through 6)

The 2045 Baseline scenario is intended to approximate 2045 conditions in the Cape Fear and Neuse River basin without Pender County's proposed IBT. The objective of this model scenario is to represent EA alternatives where the Pender County demands (total or net) does not increase above 2 MGD. This objective could be simulated by either constraining the water supply withdrawn from the Cape Fear River, returning wastewater to the river or by finding alternative sources of water. This model scenario is a modified version of the final CFNRBHM 2045 scenario (Demand2045), and represents Pender County demands from the Cape Fear River remaining below 2 MGD.

2045 Requested IBT (EA Alternative 2)

The 2045 Requested IBT scenario represents 2045 conditions for Pender County and the Cape Fear and Neuse River basin, with withdrawals and discharges as projected by public water suppliers, and the County demands that would result in the requested IBT. This model scenario is a modified version of the final CFNRBHM 2045 scenario (Demand2045).

The future scenarios developed by DWR do not include a demand for Pender County. For this reason, an additional demand node, representing the County's demand, was added to the CFNRBHM. The demands associated with this node are those presented in Section 3.4. The withdrawal pattern was set to match that of the current Pender County demand pattern as shown in Figure 3.

2045 Maximum Withdrawal

An additional scenario was developed to provide a conservative analysis and ultimately test the sensitivity of the model results to the potential changes which would be seen in the assessment metrics if the maximum allowable withdrawal were to occur at L&D #1 and the Jordan Lake water supply pool was 100 percent allocated. The maximum allowable withdrawal, based on current DWR planning guidance for run-of-the-river water supplies, of 106.6 MGD is based on the withdrawal volume from the Cape Fear River behind L&D #1 as reported in the LCFWASA's Kings Bluff Raw Water Pump Station 60-Inch Parallel Raw Water Intake Pipe and Screen Project Environmental Assessment (McKim and Creed, 2008) and the Brunswick County IBT Certificate Hearing Officers Report (NCDENR, 2013).

6.0 Hydrologic Modeling Results

Each scenario was run using the CFNRBHM and scenario results were compared. Cape Fear River flows were evaluated by running the scenarios and doing a direct day to day comparison of each scenario; e.g., 2010 Baseline vs. 2045 Baseline vs. 2045 Requested IBT.

6.1 Scenario Comparisons

The comparison of Cape Fear River flows for the 2010 baseline, 2045 Baseline, and 2045 Requested IBT scenarios was performed for flows above and below L&D #1. Tabular comparisons, time series and frequency duration plots are provided in this section for Cape Fear River flow to illustrate the similarities or differences between the scenarios.

6.1.1 Flow to L&D #1

Flow to L&D #1 is not expected to be affected by the proposed IBT since the intake is at L&D #1, and this assessment point is above the withdrawal location. Small differences may occur due to the objectives within the model that allocate flow to the different demands within the basin. Flow and low flow frequency at this point are analyzed to provide an estimate of water availability for the withdrawals at L&D #1, and simulated changes in river flow are more indicative of what is occurring upstream in the Cape Fear River basin.

As shown in Table 2, the largest difference in average, median, 10^{th} percentile, and 5^{th} percentile flows is between the different time periods (2010 vs. 2045) due to the increased future withdrawals within the Cape Fear River basin. The decreases in flow from the 2045 Baseline scenario to the 2045 Maximum Withdrawal scenario is primarily attributed to the 100 percent utilization of the Jordan Lake water supply pool, an attribute of this scenario as described in Section 5, and the subsequent returns to the basin. The increased flow identified in Table 2 for the 10^{th} and 5^{th} percentile flows could potentially be attributed to two factors: (1) model "noise" (based on the algorithm in the model that allocates flows within model) or (2) increased returns to the basin downstream of Jordan Lake. These returns are associated with the full utilization of the water supply pool and assumed returns downstream of the Jordan Lake for the volume of water between the 2045 allocation (2045 Baseline) and 100 percent use of the water supply pool. The first factor is a characteristic of any complex system model, which is especially pronounced when reviewing the extremes of a data set. The second factor is linked to the only change in the model at this evaluation point for the 2045 Maximum Withdrawal scenario, full utilization of the Jordan Lake water supply pool.

TABLE 2
Model Scenario Comparison - Cape Fear River Flow Statistics Above L&D#1

Scenario	Average	Median	10^{th} Percentile	5^{th} Percentile
2010 Baseline - River Flow (cfs)	5,355	3,114	917	767
2045 Baseline - River Flow (cfs)	5,289	3,050	904	748
2045 Requested IBT - River Flow (cfs)	5,289	3,050	904	748
Difference from 2045 Baseline (cfs)	0	0	0	0
Difference from 2045 Baseline (percent)	0.0%	0.0%	0.0%	0.0%
2045 Maximum Withdrawal- River Flow (cfs)	5,261	3,036	907	757
Difference from 2045 Baseline (cfs)	-28	-14	+3	+9
Difference from 2045 Baseline (percent)	-0.5%	-0.5%	+0.3%	+1.2%

cfs = cubic feet per second

6.1.2 Flow below L&D #1

A similar review of model results below L&D #1, after withdrawals from LCFWASA and CFPUA, shows small differences in flow between time periods as well as the expected decrease as a result of the additional withdrawals. Results are provided in Table 3. For the 2045 time period, average flows decrease less than 0.5 percent whereas for the 10^{th} and 5^{th} percentiles, flows decrease 2.5 and 3.5 percent, respectively.

TABLE 3
Model Scenario Comparison - Cape Fear River Flow Statistics Below L&D#1

Scenario	Average	Median	10th Percentile	5th Percentile
2010 Baseline - River Flow (cfs)	5,297	3,055	858	649
2045 Baseline - River Flow (cfs)	5,214	2,971	825	606
2045 Requested IBT - River Flow (cfs)	5,196	2,953	805	585
Difference from 2045 Baseline (cfs)	-19	-18	-20	-21
Difference from 2045 Baseline (percent)	-0.4%	-0.6%	-2.5%	-3.5%
2045 Maximum Withdrawal- River Flow (cfs)	5,112	2,881	747	538
Difference from 2045 Baseline (cfs)	-103	-90	-78	-68
Difference from 2045 Baseline (percent)	-2.0%	-3.0%	-9.7%	-11.6%

cfs = cubic feet per second

A flow-duration plot for the Cape Fear River flows below Lock and Dam #1 is provided in Figure 4. This plot shows the percent of time that river flow is above a specified flow rate. A plot focusing on the lowest 10 percent of lowest flows for the period of record is provided in Figure 5.

FIGURE 4
Period of Record Flow Duration Comparison below L&D #1

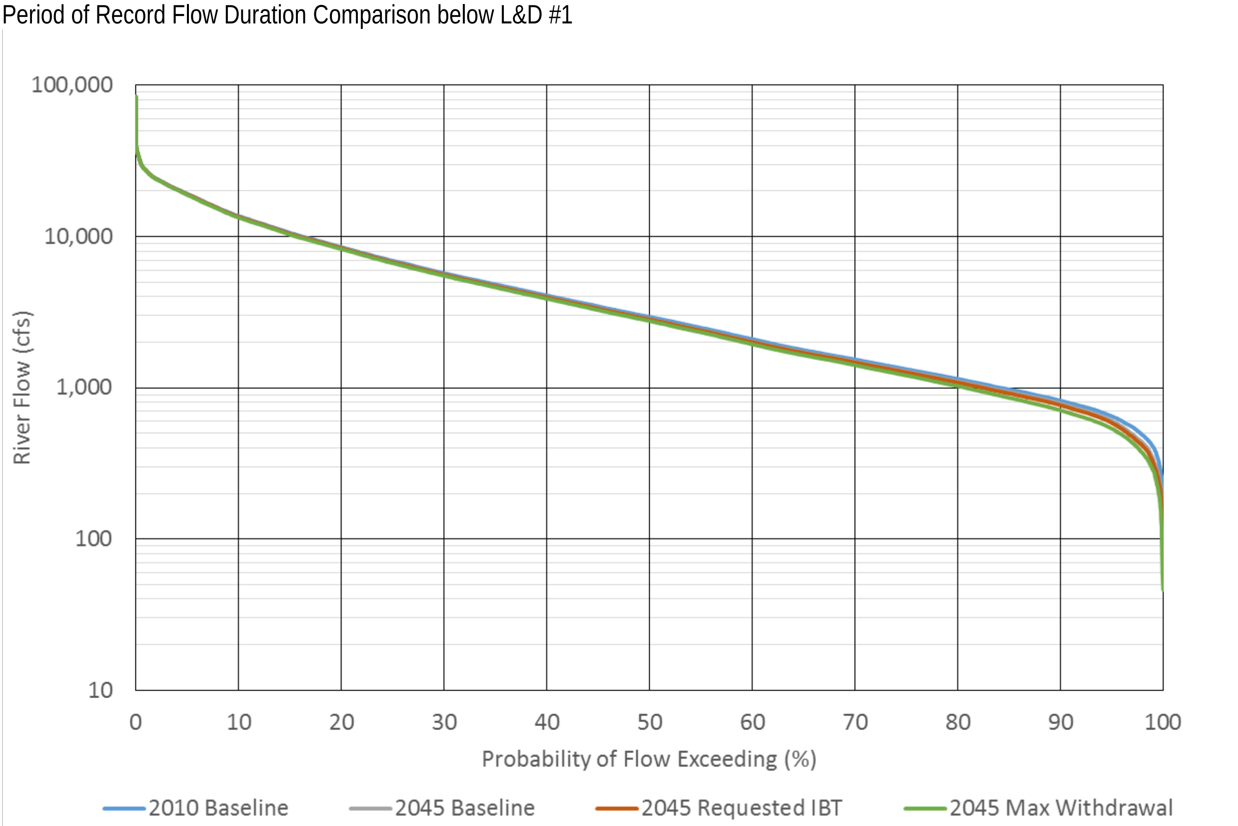
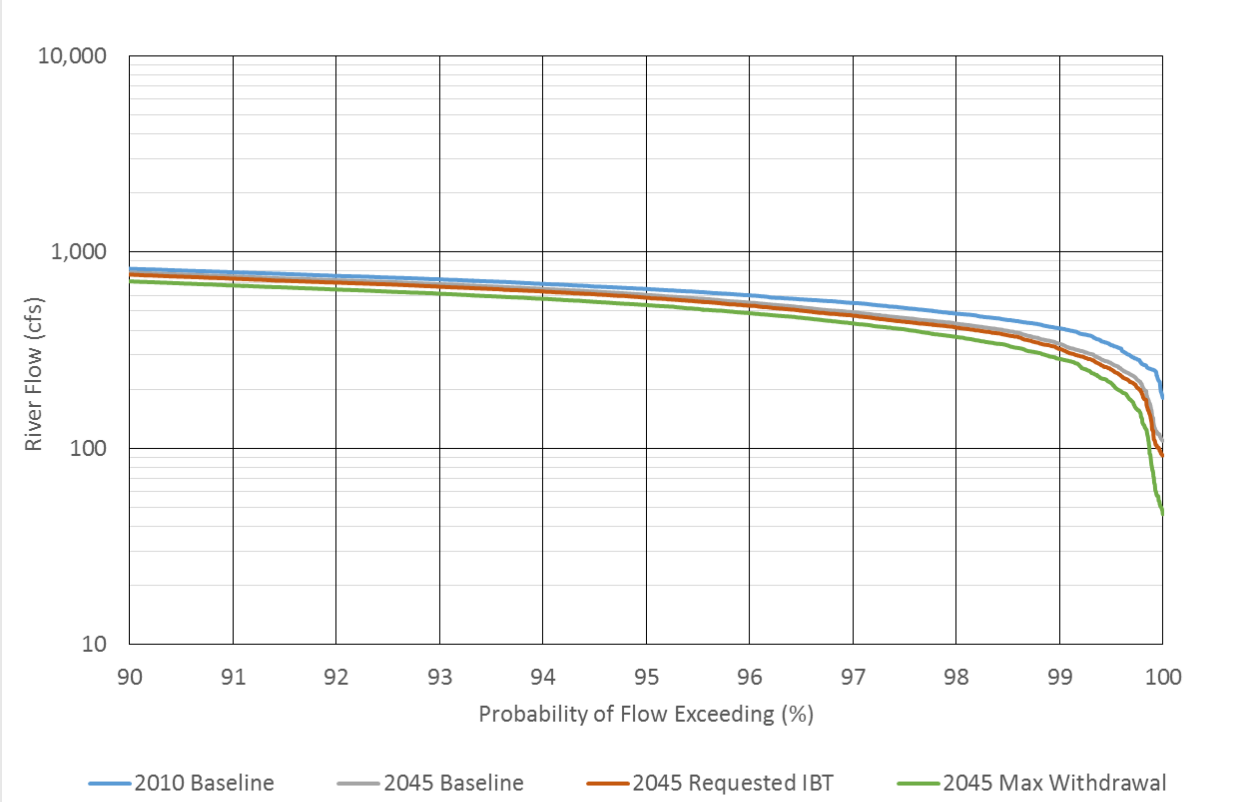


FIGURE 5
Low Flow Duration Comparison below L&D #1



The largest difference during the drought periods is greatest between the 2010 and 2045 Baseline scenarios. This difference, as well as the difference in the flows presented in Table 3, can be attributed primarily to the growth in future withdrawals in the Cape Fear River basin upstream of L&D #1, as well as the assumed full utilization of the Jordan Lake water supply pool in 2045 for the 2045 Maximum Withdrawal scenario. The difference in flows between the 2045 baseline and 2045 Requested IBT is up to 1 percent different during the extreme droughts of the 1950's, 2002 and 2007.

In addition to the flow statistics presented in Table 3, the CFNRBHM was used to calculate the 7Q10 flow estimate below L&D #1 for each of the model scenarios. The 7Q10 flow is the seven-day low flow estimate with a 10-year recurrence interval; DWR uses this statistic as planning guidance for run-of-the-river water supply withdrawals in the absence of a more detailed modeling evaluation or study. The 2010 Baseline scenario 7Q10 estimate is 348 cfs, this value is reduced by 68 cfs in the 2045 Baseline scenario and 89 cfs in the 2045 Requested IBT scenario. The reduction in this flow statistic that can be attributed to the proposed IBT is 21 cfs.

Figure 6 presents the time series plot for the 1950's drought period. Figure 7 presents a low flow comparison of the 2045 scenarios to the 2010 Baseline scenario for the 1950's drought. Figure 8 presents the time series plot for the 2002 drought period. Figure 9 presents a low flow comparison of the 2045 scenarios to the 2010 Baseline scenario for the 2002 drought. Figure 10 presents the time series plot for the 2007 drought period. Figure 11 presents a low flow comparison of the 2045 scenarios to the 2010 Baseline scenario for the 2007 drought.

FIGURE 6
Flow Comparison for the 1950's Drought (below L&D #1)

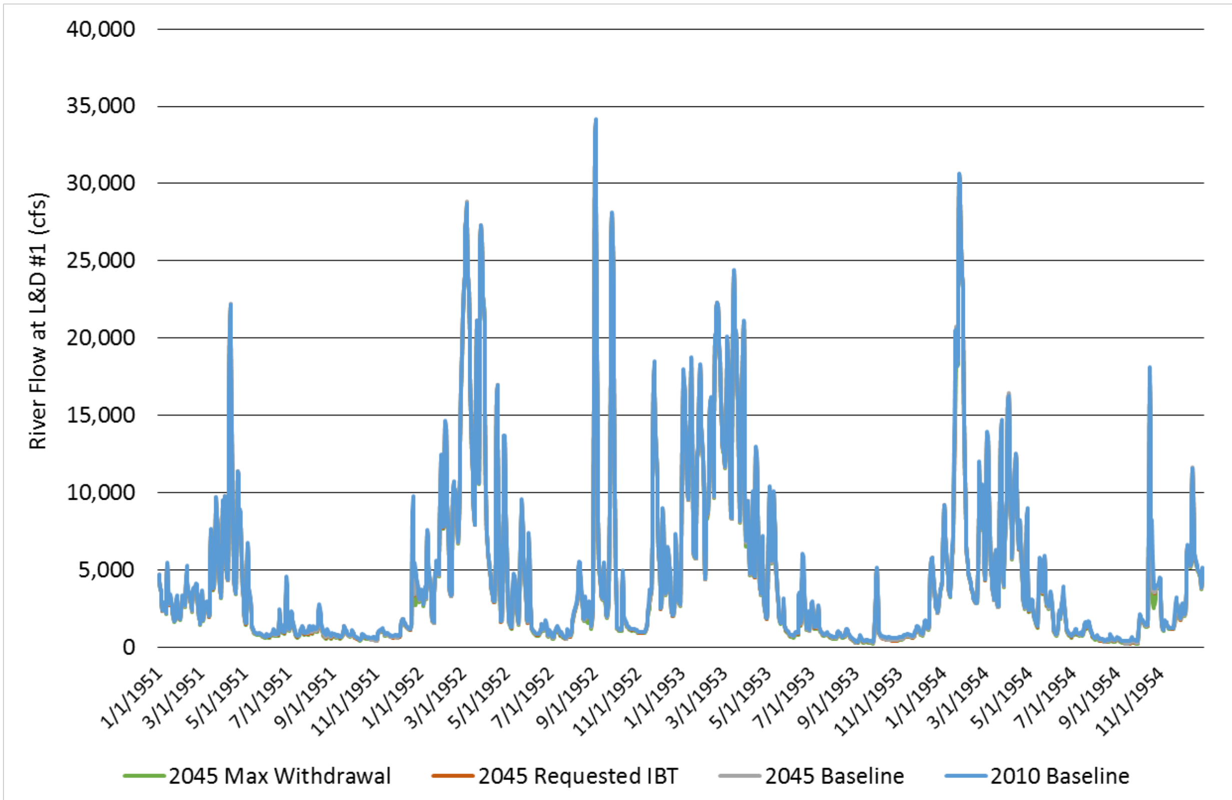


FIGURE 7
Low Flow Comparison of 2045 Scenarios to the 2010 Baseline Scenario for the 1950's Drought (below L&D #1)

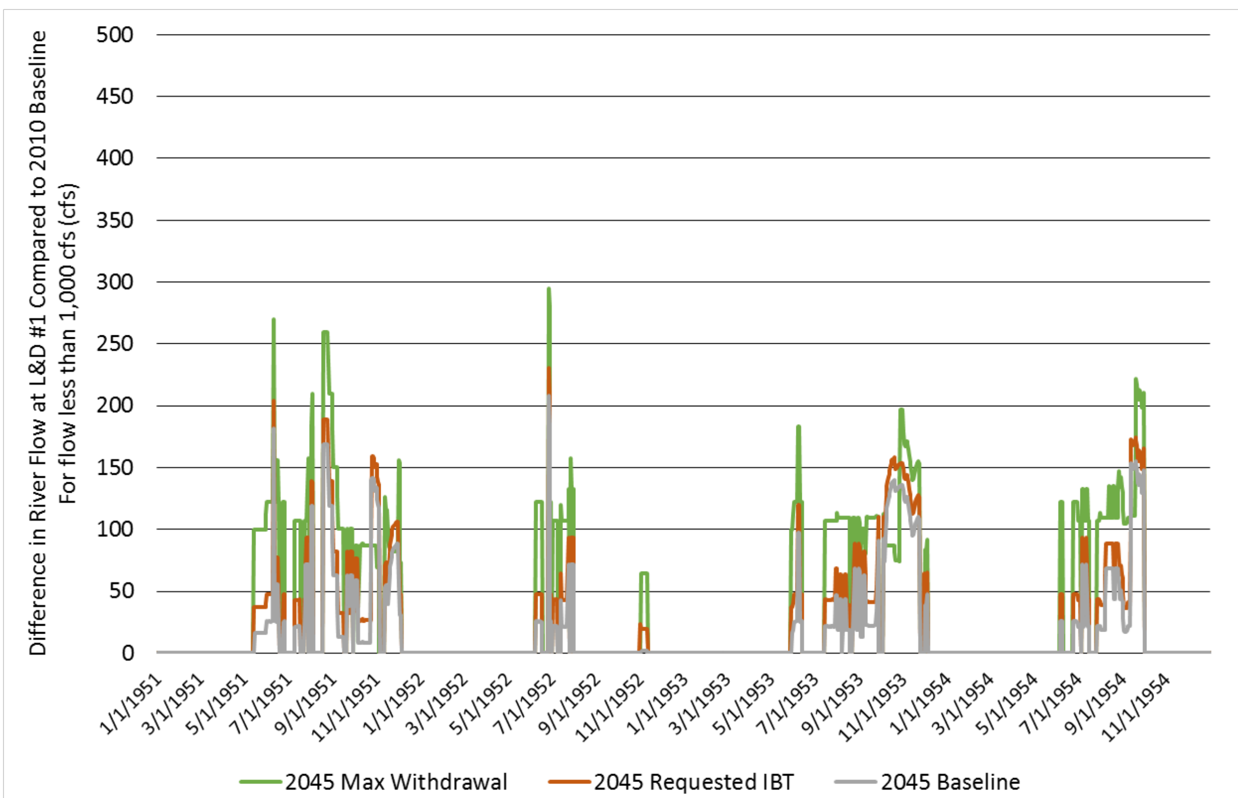


FIGURE 8
Flow Comparison for the 2002 Drought (below L&D #1)

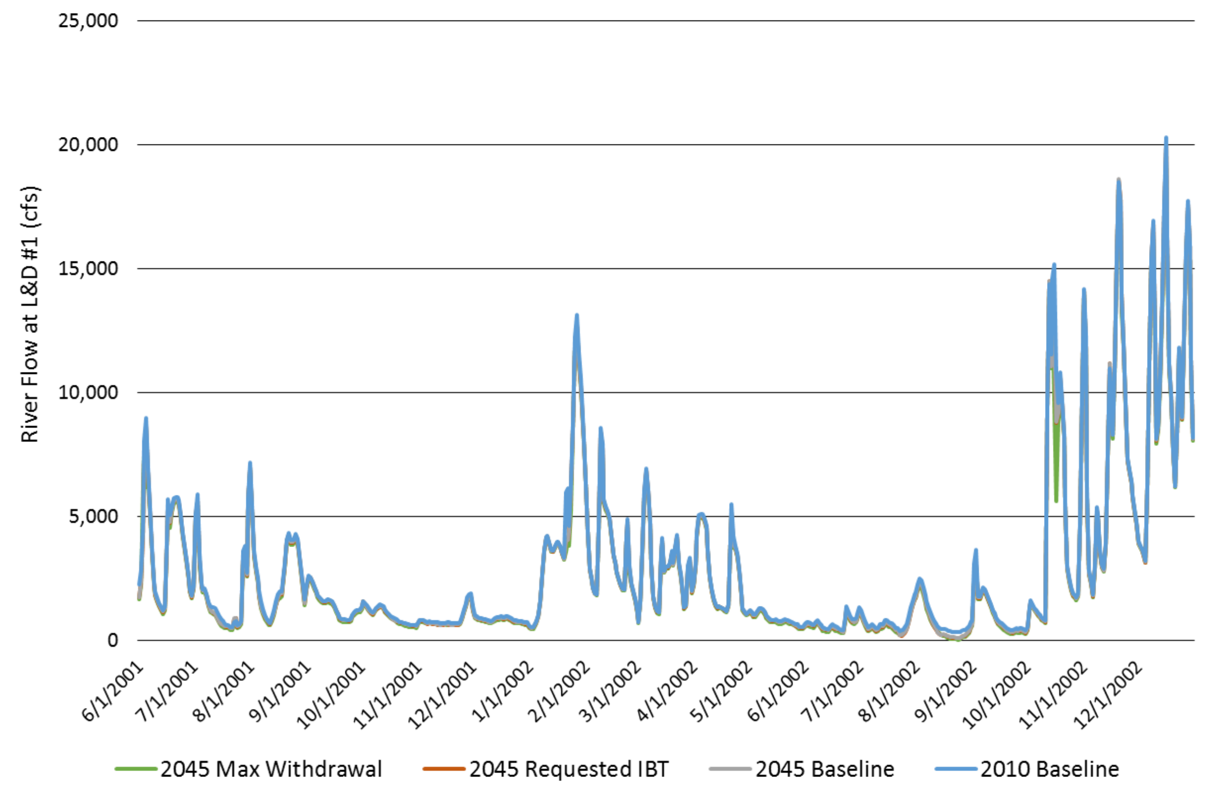


FIGURE 9
Low Flow Comparison of 2045 Scenarios to the 2010 Baseline Scenario for the 2002 Drought (below L&D #1)

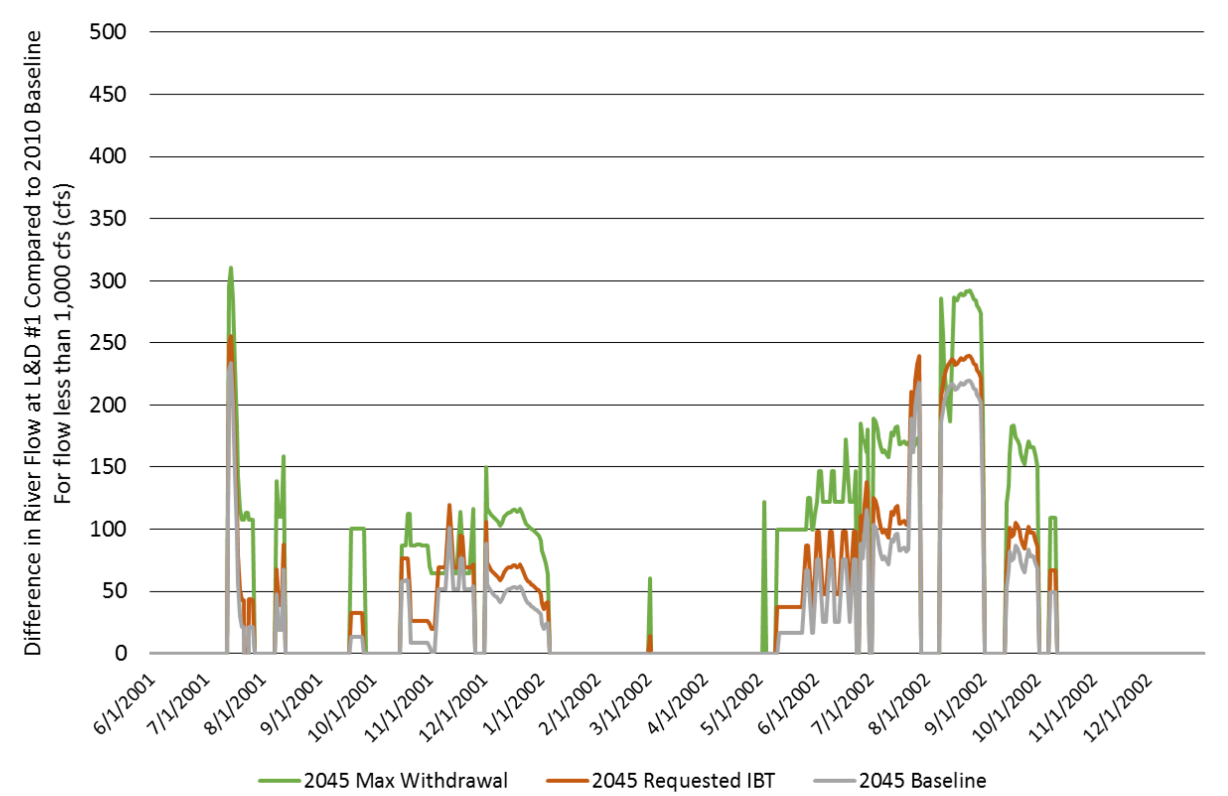


FIGURE 10
Flow Comparison for the 2007 Drought (below L&D #1)

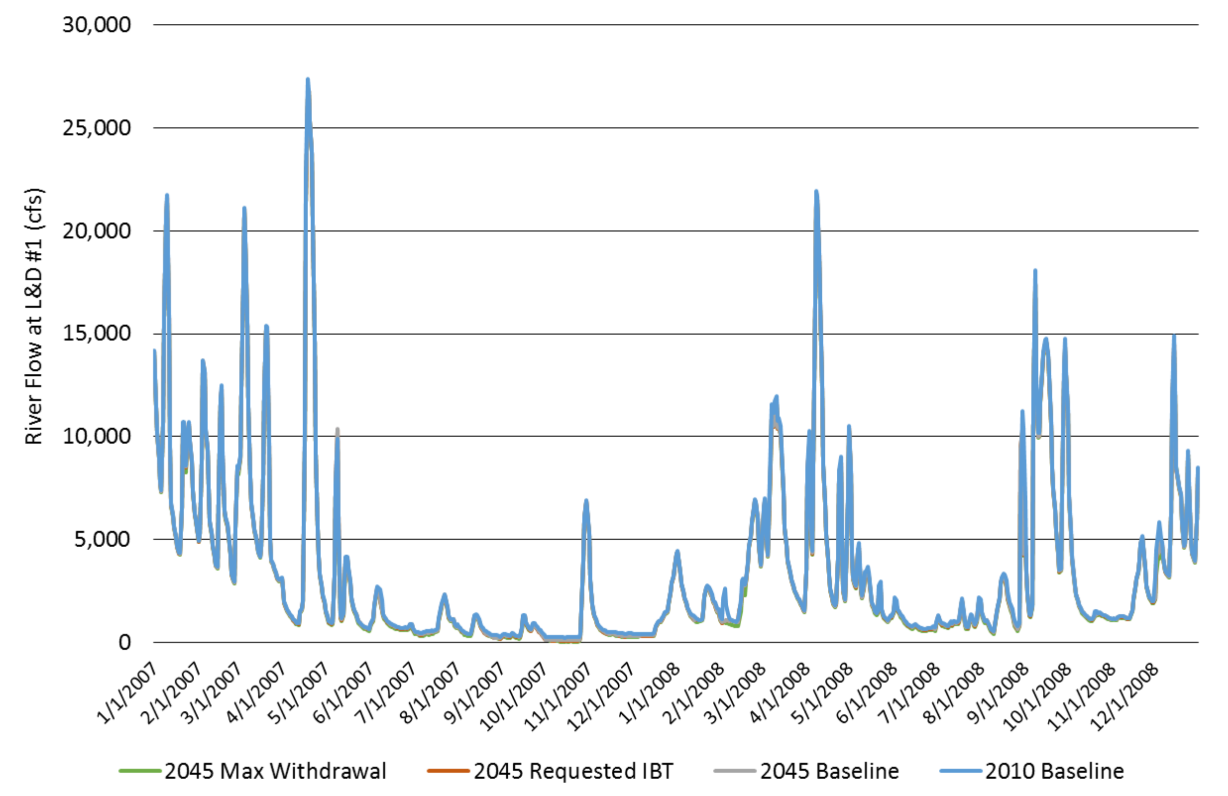
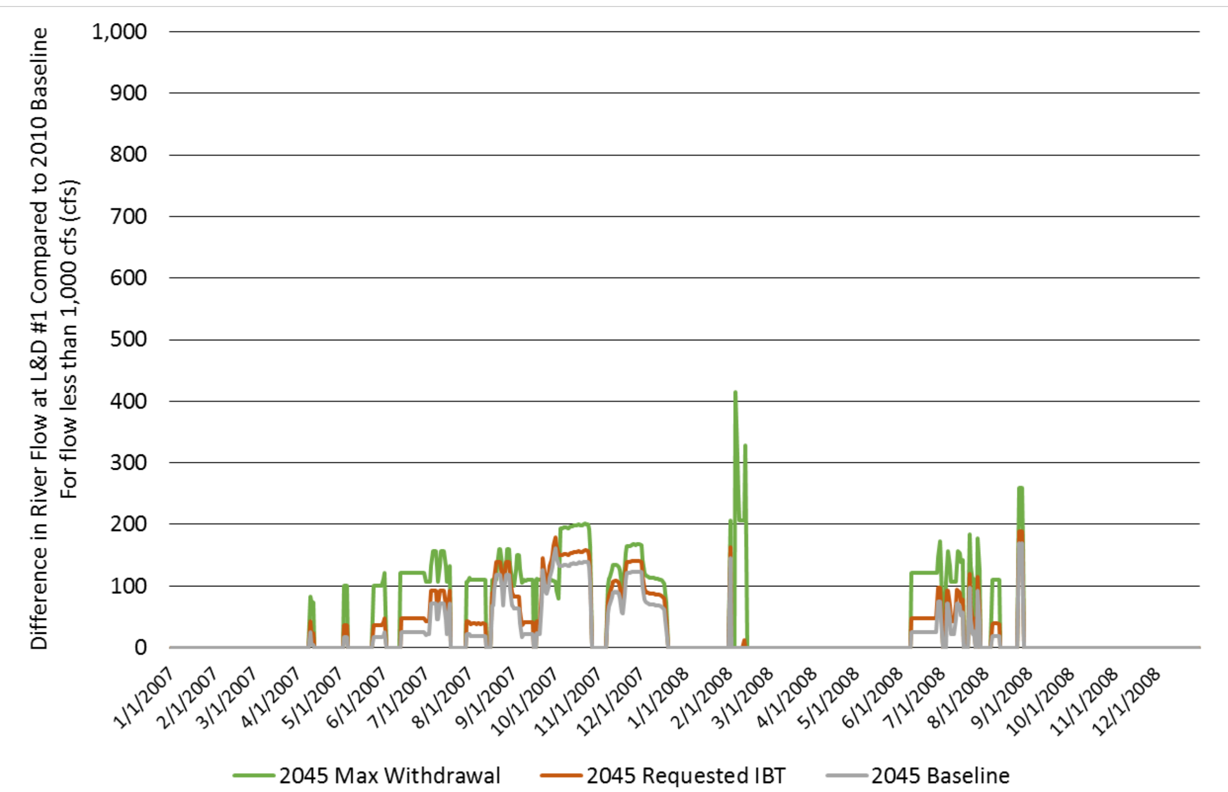


FIGURE 11
Low Flow Comparison of 2045 Scenarios to the 2010 Baseline Scenario for the 2007 Drought (below L&D #1)



6.1.3 Anadromous Fish

Anadromous fish including the Shortnose Sturgeon, American Shad, and Striped Bass travel from the Cape Fear estuary to areas above L&D #1 during their spawning periods in late winter and spring. A rock arch fish ladder was built at L&D #1 by the US Army Corps of Engineers to provide passage for spawning fish. The design of the fish ladder accounts for a range of flows during the spawning period, including an assumed average “spawning flow” of 5,000 cfs (US Army Corps of Engineers, 2010). The average simulated flow during the spawning period for the 2010 Baseline model scenario is 6,927 cfs, and the median flow is 4,450 cfs. To mitigate the effect of low flows during the spawning period the center of the fish ladder was designed to be between one and two feet lower that the rest of the ladder. This allows the concentration of flow in the middle of the fish ladder to allow continued fish passage during low flow events (USACE, 2011).

A frequency analysis was performed to quantify the percent of time the Cape Fear River was at or below the spawning flow of 5,000 cfs. The change in the frequency of flows below 5,000 cfs between the 2010 Baseline and the 2045 Maximum Withdrawal scenarios is +0.9 percent above L&D #1 and +1.7 percent below L&D #1. These percent changes are small in comparison to the natural variability of the flow in the Cape Fear River.

In addition to the frequency analysis for the spawning flow, the Cape Fear River flow statistics for the spawning period below L&D #1 were also reviewed and are presented in Table 4. The spawning period reviewed was from February through June to cover the range of time for peak spawning for all of the identified anadromous fish species for the Cape Fear River (Department of Environmental Quality (DEQ), 2015).

TABLE 4
Model Scenario Comparison - Cape Fear River Flow Statistics Below L&D#1 for the Anadromous Fish Spawning Period (February-June)

Scenario	Average	Median	10th Percentile	5th Percentile
2010 Baseline - River Flow (cfs)	6,927	4,450	1,093	875
2045 Baseline - River Flow (cfs)	6,856	4,358	1,059	846
2045 Requested IBT - River Flow (cfs)	6,837	4,339	1,038	825
Difference from 2045 Baseline (cfs)	-19	-18	-21	-21
Difference from 2045 Baseline (percent)	-0.3%	-0.4%	-2.0%	-2.4%
2045 Maximum Withdrawal - River Flow (cfs)	6,746	4,267	972	757
Difference from 2045 Baseline (cfs)	-109	-90	-87	-89
Difference from 2045 Baseline (percent)	-1.6%	-2.1%	-8.4%	-10.8%

cfs = cubic feet per second

An additional analysis was performed using USGS gaging station data and the hydrologic model data to determine whether the changes in flow would affect the functionality of the fish ladder. A stage-discharge relationship was developed for the Cape Fear River at L&D #1 based on USGS gage data from 2007 through 2015. The historic stage elevations for this time period are presented in Figure 12 and are compared the L&D #1 dam crest at 11 feet above mean sea level (MSL). The stage-discharge relationship, presented in Figure 13, was used to predict the potential future stage elevation during spawning periods based on simulated river flow for each model scenario. The analysis then compared the river stage to the dam crest elevation of 11 feet above MSL. The absolute minimum simulated stage for all of the hydrologic model scenarios using the developed stage-discharge relationship during the spawning period was approximately 11.5 feet above MSL, six inches above the dam crest.

In addition, based on a comparison of USGS gaging station stage-discharge data for 2007 through 2016, at L&D #1, to the water surface elevation for the 5th percentile flow for the 2045 Baseline scenario, 875 cfs, the river stage would be between 12.1 and 12.7 ft above MSL based on the gage data. A flow of 828 cfs (closest to the 2045 Requested IBT scenario flow of 825 cfs) equated to a river stage of between 12.0 to 12.7 ft above MSL based on the USGS gage data. The lack of difference in river stage for the absolute minimum flows and overlap of the low flow river stage ranges for the 2045 Baseline and 2045 Requested IBT scenarios provides an indication that the functionality of the fish ladder will not be any different under either scenario.

FIGURE 12
River Stage from 2007 to 2015 (L&D #1 River Stage Based on USGS Gaging Station Data)

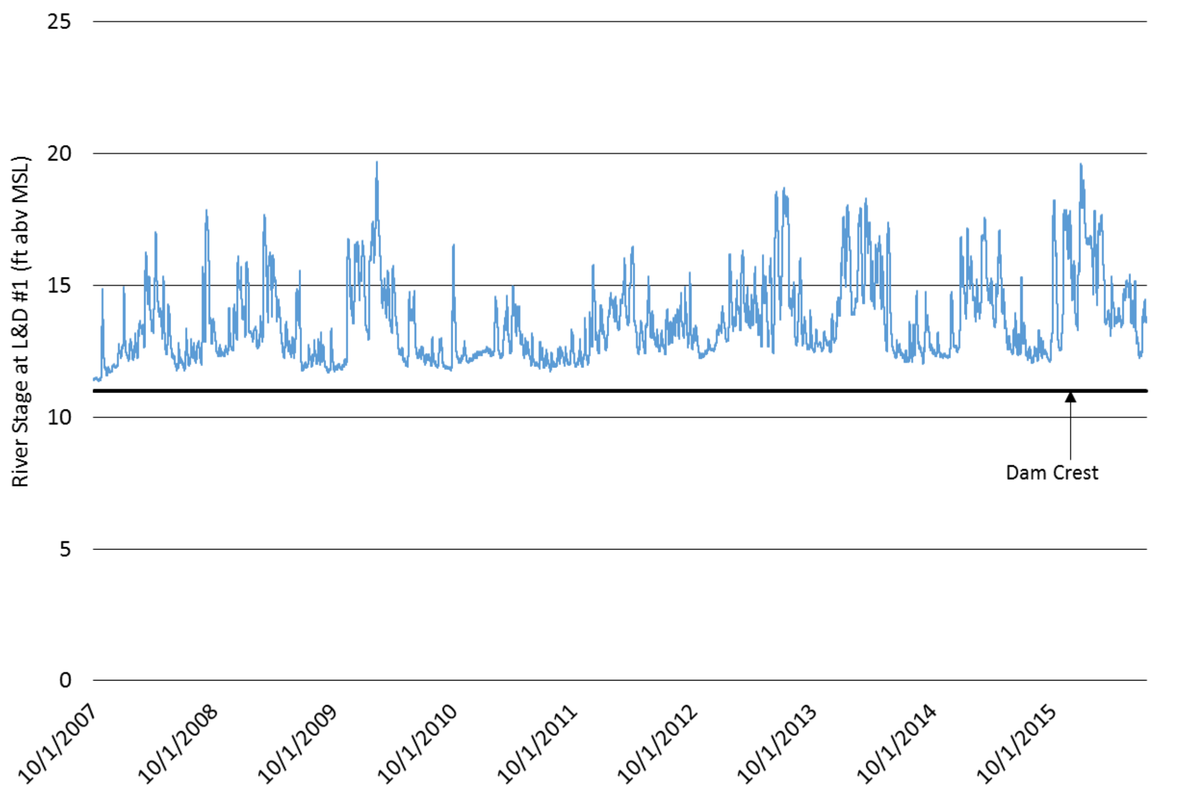
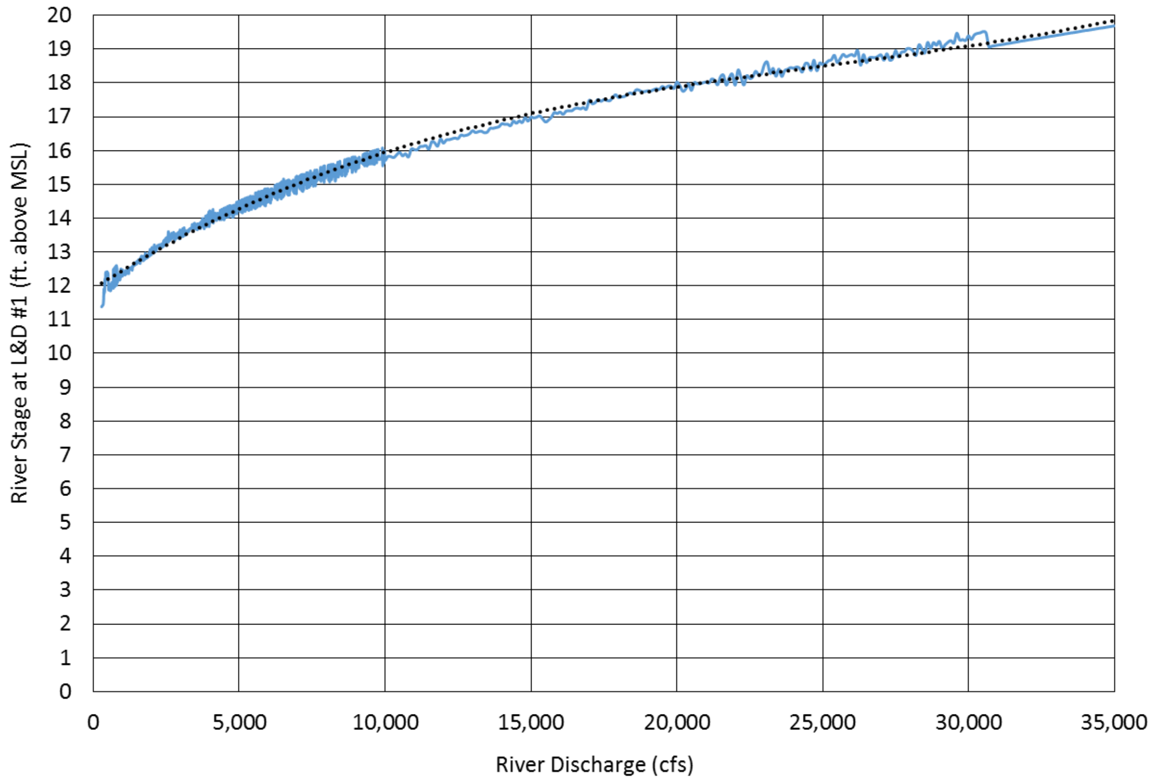


FIGURE 13
River Stage versus Discharge Rate (L&D #1 Based on USGS Gaging Station Data)



6.1.4 Comparison of Seasonal River Flows and River Stage for the 2045 Baseline and 2045 Requested IBT Scenarios and the 2010 Baseline and 2045 Baseline Scenarios

Figures 14 and 15 present box-and-whisker plots, as well as a series of statistical data identifying the range and frequency of river flows for each month, for the 2045 Baseline and 2045 Requested IBT scenarios as well as the 2010 Baseline and 2045 Baseline scenarios, respectively. In addition, these figures also provide the frequency of river stage elevations and statistics related to the full period of record and the 2002 and 2007 drought periods.

The comparison of the two scenarios presented in Figure 14 provides a comprehensive summary that can be used to determine changes, river flow and stage, that could potentially occur as a result of the proposed IBT. The comparison of the data in the Figure 14 shows little difference between the two scenarios in relation to the magnitude, duration and frequency of river flow and stage elevations. The largest change resulting from the proposed IBT is the increase in flow less than 1,000 cfs in January (non-spawning month) by 4 days and an increase of 5 days in December for a river stage between 11.0 and 11.5 feet above MSL (dam crest is 11.0 feet above MSL). These changes are not significant from a standpoint of when they occur and that there are 29,858 days of historical data included in the hydrologic evaluation.

As identified in the preceding sections, the most pronounced difference in river flow resulting from the proposed IBT is during low flows. Although as identified in Figure 14, the 5th percentile flow still provides between 368 and 1,839 cfs of passing flow, depending on month, below L&D #1. In addition, the small reduction in river flow as a result of the proposed IBT has a negligible effect on river stage, both water surface elevation and the duration of elevations; likely attributed to the presence of the dam at L&D #1. Figure 15 displays comparative results similar to Figure 14, the largest changes are at low flows (5th percentile flows) but significant volumes of passing flow still remain in the river below L&D #1.

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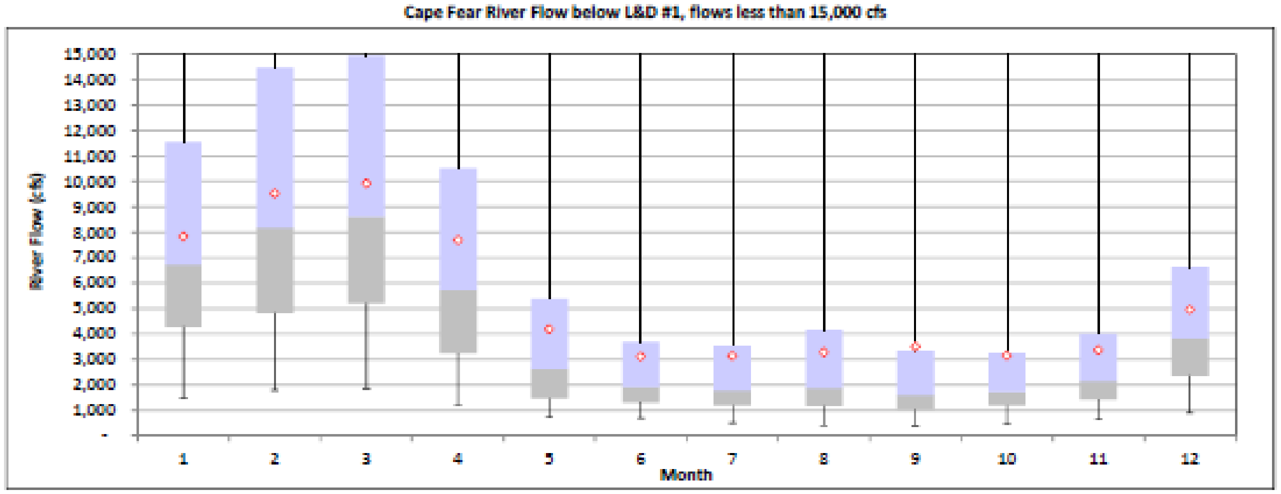
FIGURE 14
Comparison of the 2045 Baseline and 2045 Requested IBT Scenarios

Proposed Pender County Interbasin Transfer - Hydrologic Modeling Evaluation
Model Scenario: 2045 Baseline

Cape Fear River Flow below L&D #1, flows less than 15,000 cfs



Month	1	2	3	4	5	6	7	8	9	10	11	12
Period of Record (1930-2011) Flow Statistics (in cfs)												
5th Percentile	1,482	1,793	1,855	1,199	727	683	502	392	387	445	621	890
25th Percentile	3,318	3,937	4,118	2,770	1,262	993	848	896	799	856	1,110	1,778
Median	5,758	7,297	7,526	5,254	2,450	1,603	1,439	1,610	1,367	1,411	1,834	3,257
75th Percentile	10,582	13,596	13,845	10,041	5,190	3,344	3,176	3,889	3,100	2,915	3,685	6,068
95th Percentile	21,242	23,897	24,683	22,876	13,735	10,963	12,151	11,655	14,823	13,438	12,249	15,359
Mean	7,836	9,529	9,910	7,688	4,184	3,112	3,130	3,278	3,507	3,148	3,356	4,953
Standard Deviation	6,241	7,180	7,481	6,903	4,627	4,028	4,363	4,169	6,197	4,881	4,157	4,771
Average No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	17.5	18.4	21.0	15.6	8.1	4.9	5.0	6.1	4.9	4.5	5.1	10.1
>=1,000 cfs and <5,000 cfs	13.2	9.8	9.9	13.7	18.3	17.5	15.8	15.6	14.1	16.0	18.5	18.4
> Minimum cfs and < 1,000cfs	0.2	0.0	0.1	0.7	4.6	7.6	10.1	9.3	11.0	10.1	6.0	2.1
Minimum cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	31	29	31	30	28	23	31	29	29	29	28	31
>=1,000 cfs and <5,000 cfs	31	28	29	28	29	30	31	31	30	31	30	31
> Minimum cfs and < 1,000cfs	13	3	5	17	21	28	27	31	30	31	30	31
Minimum cfs	1	1	1	1	1	1	1	1	1	1	1	1
Average No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31.0	28.2	31.0	30.0	30.1	28.8	28.3	28.2	26.8	28.0	28.4	30.2
>=11.75 feet and <12.0 feet	0.0	0.0	0.0	0.0	0.9	1.2	2.3	1.5	2.0	1.6	1.0	0.3
>=11.5 feet and <11.75 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1
>=11.0 feet and <11.5 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.7	0.3	0.1	0.1
<11.0 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31	29	31	30	31	30	31	31	30	31	30	31
>=11.75 feet and <12.0 feet	3	0	0	1	10	12	13	11	11	13	14	9
>=11.5 feet and <11.75 feet	0	0	0	0	0	1	1	1	2	1	5	5
>=11.0 feet and <11.5 feet	0	0	0	0	0	0	10	7	10	10	8	10
<11.0 feet	0	0	0	0	0	0	0	0	0	0	0	0

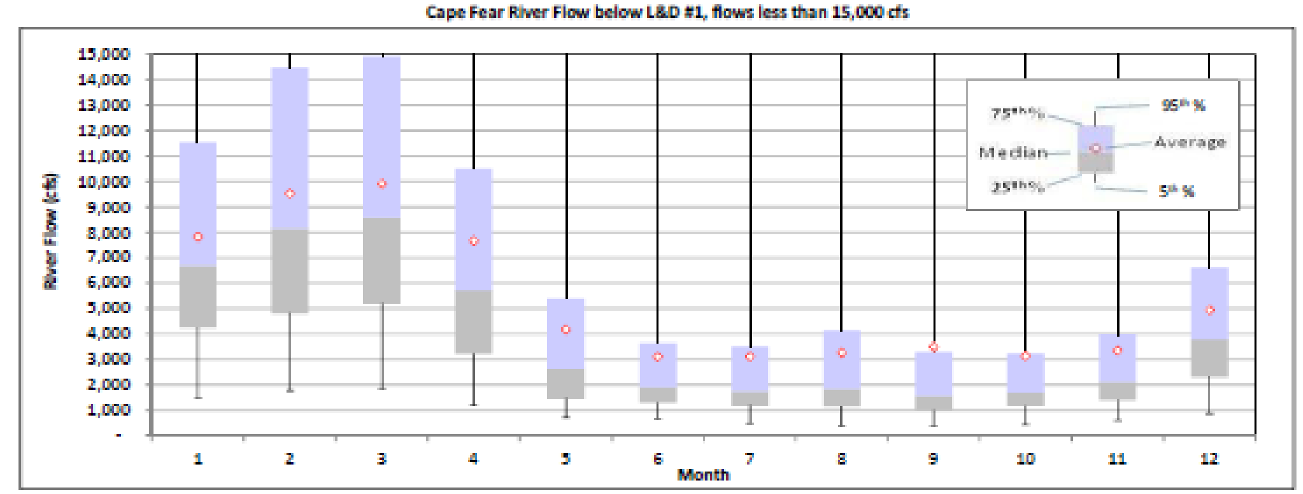
Period of Record (1930-2011)
Flow Level & River Stage Summary

	# of days	% of POR	2002 Drought % of drought	2007 Drought % of drought	2002 Drought Max Consec. Days	2007 Drought Max Consec. Days
>=5,000 cfs	9,951	33%	21%	22%	26	15
>=1,000 cfs and <5,000 cfs	14,829	50%	44%	29%	36	44
> Minimum cfs and < 1,000cfs	5,065	17%	34%	47%	43	43
Minimum cfs	12	0%	1%	1%	1	1
>= 12.0 feet	28,616	96%	90%	79%		
>=11.75 feet and <12.0 feet	888	3%	8%	7%		
>=11.5 feet and <11.75 feet	30	<1%	1%	2%		
>=11.0 feet and <11.5 feet	148	<1%	1%	12%		
<11.0 feet	0	0%	0%	0%		

**Based on monthly minimum flows.

Proposed Pender County Interbasin Transfer - Hydrologic Modeling Evaluation
Model Scenario: 2045 Requested IBT

Cape Fear River Flow below L&D #1, flows less than 15,000 cfs



Month	1	2	3	4	5	6	7	8	9	10	11	12
Period of Record (1930-2011) Flow Statistics (in cfs)												
5th Percentile	1,466	1,776	1,839	1,181	707	661	480	372	368	427	603	873
25th Percentile	3,301	3,920	4,102	2,752	1,241	971	826	876	780	838	1,092	1,760
Median	5,741	7,280	7,510	5,236	2,429	1,581	1,418	1,590	1,349	1,394	1,816	3,240
75th Percentile	10,566	13,580	13,828	10,022	5,170	3,306	3,154	3,865	3,081	2,897	3,667	6,051
95th Percentile	21,226	23,880	24,666	22,858	13,715	10,978	12,129	11,635	14,804	13,420	12,231	15,342
Mean	7,820	9,512	9,893	7,670	4,163	3,090	3,108	3,258	3,488	3,130	3,338	4,935
Standard Deviation	6,242	7,180	7,481	6,903	4,627	4,030	4,363	4,169	6,197	4,878	4,157	4,771
Average No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	17.5	18.4	21.0	15.6	8.0	4.9	5.0	6.1	4.9	4.5	5.1	10.0
>=1,000 cfs and <5,000 cfs	13.2	9.8	9.9	13.6	18.1	17.3	15.6	15.4	13.9	15.8	18.4	18.3
> Minimum cfs and < 1,000cfs	0.3	0.1	0.1	0.7	4.9	7.8	10.4	9.5	11.1	10.4	6.1	2.3
Minimum cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	31	29	31	30	28	23	31	29	29	29	28	31
>=1,000 cfs and <5,000 cfs	31	28	29	28	29	30	31	30	30	31	30	31
> Minimum cfs and < 1,000cfs	17	3	5	18	21	28	27	31	30	31	30	31
Minimum cfs	1	1	1	1	1	1	1	1	1	1	1	1
Average No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31.0	28.2	31.0	30.0	30.1	28.8	28.0	27.7	26.4	27.9	28.4	30.1
>=11.75 feet and <12.0 feet	0.0	0.0	0.0	0.0	0.9	1.2	2.5	1.8	2.2	1.7	1.0	0.4
>=11.5 feet and <11.75 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
>=11.0 feet and <11.5 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.8	0.3	0.2	0.2
<11.0 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31	29	31	30	31	30	31	31	30	31	30	31
>=11.75 feet and <12.0 feet	3	0	1	2	10	10	14	9	12	13	16	9
>=11.5 feet and <11.75 feet	0	0	0	0	0	0	4	2	3	1	0	0
>=11.0 feet and <11.5 feet	0	0	0	0	0	2	9	6	11	8	10	15
<11.0 feet	0	0	0	0	0	0	0	0	0	0	0	0

Period of Record (1930-2011)
Flow Level & River Stage Summary

	# of days	% of POR	2002 Drought % of drought	2007 Drought % of drought	2002 Drought Max Consec. Days	2007 Drought Max Consec. Days
>=5,000 cfs	9,921	33%	21%	22%	26	15
>=1,000 cfs and <5,000 cfs	14,709	49%	44%	29%	36	44
> Minimum cfs and < 1,000cfs	5,215	17%	34%	47%	44	43
Minimum cfs	12	0%	1%	1%	1	1
>= 12.0 feet	28,491	96%	88%	81%		
>=11.75 feet and <12.0 feet	963	3%	10%	7%		
>=11.5 feet and <11.75 feet	25	<1%	0%	0%		
>=11.0 feet and <11.5 feet	173	<1%	2%	11%		
<11.0 feet	0	0%	0%	0%		

**Based on monthly minimum flows.

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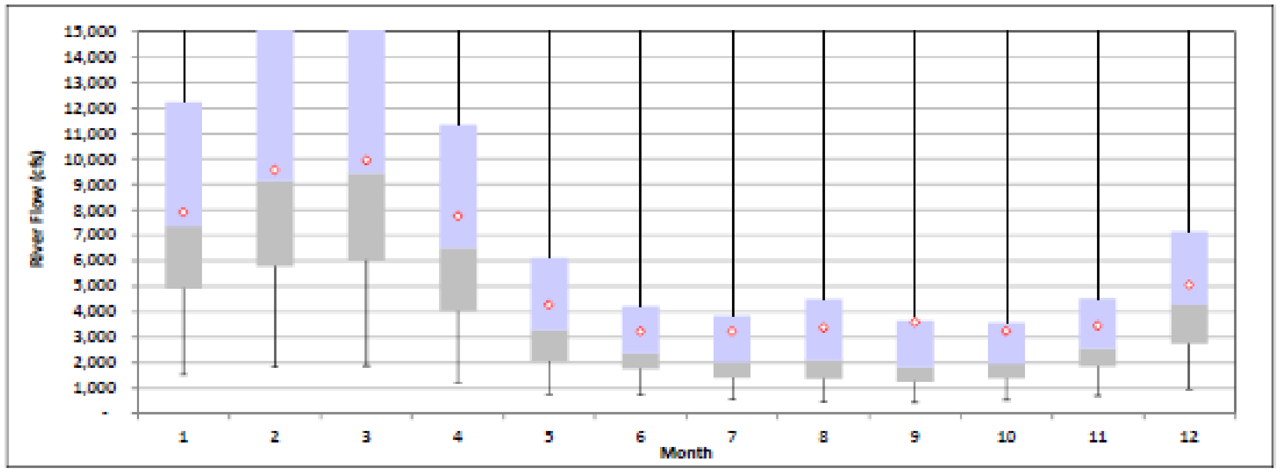
FIGURE 15
Comparison of the 2010 Baseline and 2045 Baseline Scenarios

Proposed Pender County Interbasin Transfer - Hydrologic Modeling Evaluation
Model Scenario: 2010 Baseline

Cape Fear River Flow below L&D #1, flows less than 15,000 cfs



Month	1	2	3	4	5	6	7	8	9	10	11	12
Period of Record (1930-2011) Flow Statistics (in cfs)												
5th Percentile	1,528	1,821	1,865	1,207	750	718	538	445	439	527	694	948
25th Percentile	3,394	3,965	4,160	2,835	1,306	1,049	882	937	830	884	1,171	1,822
Median	5,837	7,322	7,594	5,317	2,567	1,677	1,501	1,667	1,408	1,450	1,885	3,340
75th Percentile	10,702	13,661	13,898	10,151	5,366	3,489	3,329	4,047	3,211	3,044	3,830	6,215
95th Percentile	21,284	23,954	24,714	22,955	13,939	11,343	12,298	12,046	14,892	13,662	12,382	15,443
Mean	7,909	9,572	9,956	7,751	4,271	3,215	3,226	3,381	3,587	3,237	3,451	5,044
Standard Deviation	6,251	7,178	7,483	6,912	4,658	4,079	4,405	4,234	6,227	4,941	4,210	4,789
Average No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	17.7	18.5	21.1	16.0	8.3	5.2	5.2	6.3	5.1	4.6	5.3	10.4
>=1,000 cfs and <5,000 cfs	13.1	9.7	9.8	13.4	18.4	18.0	16.3	16.0	14.4	16.5	18.9	18.2
> Minimum cfs and < 1,000cfs	0.3	0.1	0.1	0.6	4.3	6.8	9.5	8.7	10.5	9.5	5.5	2.0
Minimum cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	31	29	31	30	28	23	31	30	29	29	28	31
>=1,000 cfs and <5,000 cfs	31	28	29	28	30	30	31	31	30	31	30	31
> Minimum cfs and < 1,000cfs	13	4	5	17	21	27	27	31	30	31	30	31
Minimum cfs	1	1	1	1	1	1	1	1	1	1	1	1
Average No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31.0	28.2	31.0	30.0	30.2	29.3	28.7	28.5	27.4	28.2	28.8	30.5
>=11.75 feet and <12.0 feet	0.0	0.0	0.0	0.0	0.8	0.7	2.1	1.5	2.0	1.9	0.9	0.1
>=11.5 feet and <11.75 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
>=11.0 feet and <11.5 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.3	0.2	0.0	0.0
<11.0 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31	29	31	30	31	30	31	31	30	31	30	31
>=11.75 feet and <12.0 feet	3	0	0	1	10	7	14	11	12	19	13	4
>=11.5 feet and <11.75 feet	0	0	0	0	0	0	1	2	2	1	0	0
>=11.0 feet and <11.5 feet	0	0	0	0	0	0	6	15	6	13	0	0
<11.0 feet	0	0	0	0	0	0	0	0	0	0	0	0

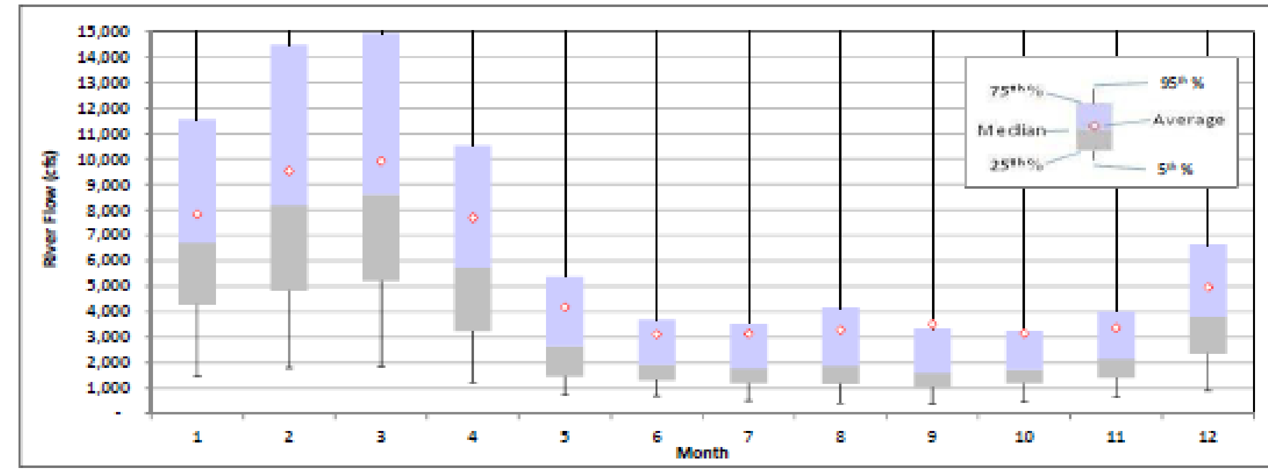
Period of Record (1930-2011)
Flow Level & River Stage Summary

	# of days	% of POR	2002 Drought % of drought	2007 Drought % of drought	2002 Drought Max Consec. Days	2007 Drought Max Consec. Days
>=5,000 cfs	10,144	34%	22%	23%	26	17
>=1,000 cfs and <5,000 cfs	14,975	50%	44%	30%	36	54
> Minimum cfs and < 1,000cfs	4,739	16%	33%	47%	43	43
Minimum cfs	12	0%	1%	0%	1	1
>= 12.0 feet	28,847	97%	91%	87%		
>=11.75 feet and <12.0 feet	818	3%	8%	11%		
>=11.5 feet and <11.75 feet	14	<1%	0%	1%		
>=11.0 feet and <11.5 feet	107	<1%	1%	2%		
<11.0 feet	0	0%	0%	0%		

**Based on monthly minimum flows.

Proposed Pender County Interbasin Transfer - Hydrologic Modeling Evaluation
Model Scenario: 2045 Baseline

Cape Fear River Flow below L&D #1, flows less than 15,000 cfs



Month	1	2	3	4	5	6	7	8	9	10	11	12
Period of Record (1930-2011) Flow Statistics (in cfs)												
5th Percentile	1,482	1,793	1,855	1,199	727	683	502	392	387	445	621	890
25th Percentile	3,318	3,937	4,118	2,770	1,262	993	848	896	799	856	1,110	1,778
Median	5,758	7,297	7,526	5,254	2,450	1,603	1,439	1,610	1,367	1,411	1,834	3,257
75th Percentile	10,582	13,596	13,845	10,041	5,190	3,344	3,176	3,889	3,100	2,915	3,685	6,068
95th Percentile	21,242	23,897	24,683	22,876	13,735	10,963	12,151	11,655	14,823	13,438	12,249	15,359
Mean	7,836	9,529	9,910	7,688	4,184	3,112	3,130	3,278	3,507	3,148	3,356	4,953
Standard Deviation	6,241	7,180	7,481	6,903	4,627	4,028	4,363	4,169	6,197	4,881	4,157	4,771
Average No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	17.5	18.4	21.0	15.6	8.1	4.9	5.0	6.1	4.9	4.5	5.1	10.1
>=1,000 cfs and <5,000 cfs	13.2	9.8	9.9	13.7	18.3	17.5	15.8	15.6	14.1	16.0	18.5	18.4
> Minimum cfs and < 1,000cfs	0.2	0.0	0.1	0.7	4.6	7.6	10.1	9.3	11.0	10.1	6.0	2.1
Minimum cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at Flow Level (for Entire Period of Record)												
>=5,000 cfs	31	29	31	30	28	23	31	29	29	29	28	31
>=1,000 cfs and <5,000 cfs	31	28	29	28	29	30	31	31	30	31	30	31
> Minimum cfs and < 1,000cfs	13	3	5	17	21	28	27	31	30	31	30	31
Minimum cfs	1	1	1	1	1	1	1	1	1	1	1	1
Average No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31.0	28.2	31.0	30.0	30.1	28.8	28.3	28.2	26.8	28.0	28.4	30.2
>=11.75 feet and <12.0 feet	0.0	0.0	0.0	0.0	0.9	1.2	2.3	1.5	2.0	1.6	1.0	0.3
>=11.5 feet and <11.75 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1
>=11.0 feet and <11.5 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.7	0.3	0.1	0.1
<11.0 feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum No. of Days per Month at River Stage (for Entire Period of Record)												
>= 12.0 feet	31	29	31	30	31	30	31	31	30	31	30	31
>=11.75 feet and <12.0 feet	3	0	0	1	10	12	13	11	11	13	14	9
>=11.5 feet and <11.75 feet	0	0	0	0	0	1	1	1	2	1	5	5
>=11.0 feet and <11.5 feet	0	0	0	0	0	0	10	7	10	10	8	10
<11.0 feet	0	0	0	0	0	0	0	0	0	0	0	0

Period of Record (1930-2011)
Flow Level & River Stage Summary

	# of days	% of POR	2002 Drought % of drought	2007 Drought % of drought	2002 Drought Max Consec. Days	2007 Drought Max Consec. Days
>=5,000 cfs	9,951	33%	21%	22%	26	15
>=1,000 cfs and <5,000 cfs	14,829	50%	44%	29%	36	44
> Minimum cfs and < 1,000cfs	5,065	17%	34%	47%	43	43
Minimum cfs	12	0%	1%	1%	1	1
>= 12.0 feet	28,616	96%	90%	79%		
>=11.75 feet and <12.0 feet	888	3%	8%	7%		
>=11.5 feet and <11.75 feet	30	<1%	1%	2%		
>=11.0 feet and <11.5 feet	148	<1%	1%	12%		
<11.0 feet	0	0%	0%	0%		

**Based on monthly minimum flows.

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7.0 Summary and Conclusions

The results presented herein and summarized in Tables 2 and 3 show a shift in Cape Fear River flows between the 2010 to 2045 Baseline scenarios, which is a result of the combined effects of projected increased withdrawals and discharges throughout the basin upstream of L&D #1. To isolate the effect of the Pender County's proposed IBT, a comparison of the 2045 Baseline and the 2045 Requested IBT scenario is necessary, as presented in Table 2 and 3 and comprehensively reviewed in Section 6.1.4. A potential small shift in river flows is identified for the 2045 Requested IBT scenario, as compared to the 2045 Baseline scenario. This shift is less than a 0.5 percent change on average and a 3.5 percent change for low flow periods, as indicated by the 5th percentile flows, with approximately 585 cfs passing flow below L&D #1 during low flows. Similar results were observed for the 2045 Maximum Withdrawal scenario; less than 2.0 percent change on average and a 11.6 percent change for low flow periods, as indicated by the 5th percentile flows. The percent change for the 2045 Maximum Withdrawal scenario, as compared to the 2045 Baseline scenario, is greater than the 2045 Requested IBT scenario changes primarily due to the full utilization of the Jordan Lake water supply pool and the maximum allowable water supply at L&D #1. Under this scenario there is still approximately 535 cfs passing flow below L&D #1 during low flow periods.

The potential effect of the small change in river flows as a result of the proposed IBT are not significant due to the fact that:

- There are still passing flows below L&D #1 during low flow periods, defined by the 5th percentile flow, greater than 370 MGD for the 2045 Requested IBT scenario.
  - Ninety-five percent (95 percent) of the 82-year period of record used in the hydrologic modeling evaluation of the 2045 Requested IBT scenario are greater than this flow value.
- The changes in river flow do no result in significant changes in water surface elevation.
  - The difference in simulated water surface elevations for low flows at L&D #1 between the 2045 Baseline and the 2045 Requested IBT model scenarios is approximately 0.1 ft (approximately 12.2 ft above MSL vs. 12.3 ft above MSL).
- There is little difference between the 2045 Baseline and 2045 Requested IBT model scenario results in relation to the magnitude, duration and frequency of river flow and stage elevations.
- There are no significant water supply withdrawals downstream of L&D #1; International Paper does provide a small water supply to Riegelwood.
- Directly downstream of L&D #1, the Cape Fear River is tidally influenced (2 feet of tidal influence under a lunar tide (USACE, 2011)).

During periods of extreme low flow, each of the 2045 scenarios exhibit a greater reduction of flow below L&D #1 compared to the 2010 Baseline scenario, as would be expected; the greatest cumulative changes during these periods can also be attributed to increased withdrawals upstream of L&D #1. The effect below L&D #1 from Pender County's proposed IBT, as well as other public water supplies accessing water from the Cape Fear River, will be mitigated by the implementation of the State required WSRPs. These WSRPs can reduce water demands by up to 20 to 30 percent during these extreme low flow periods.

A review of hydrologic model scenario results for the anadromous fish spawning periods indicate a small shift both in average Cape Fear River flows and in low flow conditions. Even with the simulated changes there are passing flows at L&D #1, of approximately 825 cfs and 757 cfs for the 2045 Requested IBT and 2045 Maximum Withdrawal scenarios, respectively, during low flow conditions in the spawning period.

In addition, there is only a 0.8 percent change in the frequency of flow below the assumed average "spawning flow". The minimum water stage simulated as part of this evaluation was approximately 11.5 feet above MSL for the spawning period, 6 inches above the dam crest for L&D #1. To mitigate the effect of low flows during the spawning period, the center of the fish ladder was designed to be between one and two feet lower that the rest of the ladder. This allows the concentration of flow in the middle of the fish ladder to allow continued fish passage during low flow events (USACE, 2011).

8.0 References

HIEPC and CH2M. 2016. Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County.

Hydrologics. 2006. *User Manual for OASIS with OCL*. Raleigh, NC.

McKim and Creed. 2006. Pender County Wastewater System Master Plan.

NC Department of Environment and Natural Resources (NCDENR). 2013. Brunswick County IBT Certificate Hearing Officers Report.

NC Department of Environmental Quality (DEQ). 2015. Coastal Habitat Protection Plan.

NC General Assembly. 2009. § 143-215.22L. *Regulation of surface water transfers*. Raleigh, NC.

TetraTech. 2013. *Environmental Assessment, Brunswick County Interbasin Transfer*. Research Triangle Park, NC.

U.S. Army Corps of Engineers. 2011. Review Plan for Pre-construction and Engineering Phase of the Fish Passage at Lock and Dam No. 1.

U.S. Army Corps of Engineers. 2010. Fish Passage at Lock and Dam No. 1, Cape Fear River, Bladen County, North Carolina. 100% Design Submittal - Basis of Design. Prepared by SEPI Engineering and Construction, and Tetra Tech, Inc.

Attachment A

DWR Review Comment Matrix

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NC Division of Water Resources Comment Response Matrix

Draft Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer

Completed September 9, 2016 (Updated October 28, 2016 based on DWR comments on the Draft Environmental Assessment)

No.	Division	Point of Contact	Role/Office	Comment	Response to comment
1	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	This analysis of course only looks at quantity; however, water quality is also a great concern and some modeling of this nature is important, in anticipation of future comments.	Water quality will be addressed in the EA. The evaluation of water quality has been completed based on existing analyses already completed for the Lower Cape Fear River. These evaluations have pointed to the fact that the driving factors for water quality (nutrient and DO levels) in the Lower Cape Fear River (downstream of L&D #1) are local, naturally occurring sources (i.e. wetlands/marshes and sediment oxygen demand sources). This technical work has led the EMC to reclassify this portion of the river to Swamp Water (Sw) (CH2M HILL, 2014; Tetra Tech, 2014). In addition, another controlling factor for water quality for this reach of the river are tidal influences. In addition, previous water quality analyses were conducted as part of the evaluation for the Brunswick County IBT. An evaluation was completed to review the correlation between flow and temperature to dissolved oxygen and pH. No strong correlation was found between these parameters, and it was concluded that any changes in flow would result in insignificant changes in these parameters (Tetra Tech, 2013). The proposed IBT will slightly modify the pattern of flow past L&D #1; this effect will be greatest during the summer low flow periods. It is not anticipated that the IBT will have a significant effect on the natural factors that control the water quality in the Lower Cape Fear Rive rduring the summer months. This is due to the small volume the IBT represents in comparison to the typical river flow and range of natural variability in flow, as well as the tidal influences downstream of L&D #1.
2	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	"The most up to date, completed LWSPs at that time were based on 2010 data. For this reason, the "existing conditions" baseline model scenario, as defined by NC DWR, uses 2010 withdrawals and discharges. This 2010 baseline is used in this evaluation to represent current conditions. It should be noted that Pender County is not included as an explicit withdrawal in the 2010 baseline since its purchases from LCFWASA did not begin until 2012." ◦ A distinction should be made between "existing conditions" and "baseline conditions." "Existing conditions" are defined here as 2010 LWSPs. The "baseline conditions" should be defined as the year in which the present target flows from Jordan Reservoir were implemented and the LWSP use data during that year. For comparison purposes, a model run should be performed using this baseline and compared to existing and 2050 uses.	Text will be updated to identify the situation for Pender County in 2010. Text in the document will reflect an identification of baseline condition for comparison, not existing conditions.
3	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Table 2. Water destined for septic systems should not be used to offset water withdrawals because the timely return to the contributing body is tenuous and certainly not one-to-one.	This table is intended to represent water that is not subject to IBT; the US 421 WWTP would be the amount of direct return to the Cape Fear River. Table will be clarified.
4	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Figure 2 is misleading in that it gives the false impression that the Black and Northeast Cape Fear basins are included in hydrologic modeling.	This figure is the same as presented in the 2015 Cape Fear River Water Supply Evaluation Report. This figure is intended to depict the complexity of the hydrologic model and the setup of the model nodes; it is not intended to be a comprehensive model documentation. References to model documentation are included in the document and text will be included to identify the point that the Black and NE Cape Fear River basins are not in the model.
5	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	G.S.143-215.22L (d)(1): "A comprehensive analysis of the impacts that would occur in the source river basin and the receiving river basin if the petition for a certificate is granted." ◦ There is no modeling analysis for the receiving basins, i.e., Northeast Cape Fear River, New River, etcetera. The applicant should indicate whether or not they intend to perform quality/quantity modeling analysis in the receiving basins and the justifications for their decision.	No modeling is intended for the receiving basin(s), as the CFNRBHM does not cover these basins, and there are no planned direct discharges beyond the current permitted discharge capacity in the receiving basins.

NC Division of Water Resources Comment Response Matrix

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No.	Division	Point of Contact	Role/Office	Comment	Response to comment
6	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	The environmental document should examine all months at Lock and Dam 1 in terms of stage and flow for fish passage over the dam and up the rock arch.	Monthly flow and stage data comparison from the hydrologic modeling will be added to the document for the 2045 Baseline and Requested IBT scenarios.
7	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Figure 5: The Y-axis should be extended to a lower flow to capture the 100% exceedance value.	Figure 5 will be updated.
8	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Figure 13: At a flow of 0.0 cfs the crest elevation doesn't approach 11 msl. Although the document claims that there is 6 inches over the crest at 757 cfs (?), it doesn't state whether this is an adequate passage flow. The design average flow of 5000 cfs represents a stage of 14+ft, a change of 2.5 ft.	The 5,000 cfs value is an average flow during spawning periods, which the river flow is less than and greater then under current conditions. This can be observed in the data for the 2010 Baseline scenario presented in Table 4. For comparison, the 2045 Maximum Withdrawal scenario only changes the duration of time below 5,000 cfs by 0.8% over the entire model period of record and the design of the fish ladder has taken into account low flow periods in the design, as described below. As reported by the USACE the fish ladder was designed to allow for continued fish passage during low flow periods with the center of the fish ladder between 1 and 2 feet lower than the rest of the ladder. This allows the concentration of flow in the middle of the fish ladder to allow the continued passage of fish (USACE, 2011).
9	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	The applicant should also calculate and examine impacts to the 7Q10 statistic at each model node.	Data will be added to the document.
10	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	143-215.22L(d): "Notwithstanding G.S. 113A-4(2), the study shall include secondary and cumulative impacts." "During periods of extreme low flow (drought periods), as would be expected each of the 2045 scenarios exhibit a greater drawdown of flow below L&D #1; the greatest cumulative changes during these periods can also be attributed to increased withdrawals upstream of L&D #1." "In addition, there is only a 0.8 percent change in the frequency of flow below the assumed "spawning flow" than {sic} can attributed to the withdrawals at L&D #1…." ◦ Although attributable, the cumulative, as well as secondary, impacts require consideration in the environmental document.	The results of the hydrologic modeling will be summarized in the EA.
11	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Please examine model results with Water Shortage Response Plans (WSRP) turned OFF as an off-set for systems with WSRPs not captured in the model and those unknown number of withdrawals that are either unregistered or <100k gpd.	In the CFNRBHM public water supplier WSRPs were turned "on," and the effect of the WSRP is only included for systems with WSRP levels tied to physical triggers. Many WSRPs for public water suppliers in the Cape Fear and Neuse River basins are not tied to physical triggers and therefore cannot be explicitly represented in the model. This includes all water withdrawals downstream of Jordan Lake on the Cape Fear River. The current set up of the hydrologic model reflects current water system operational conditions. Operational conditions are part of the model that has gone through a public review process.
12	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Does the model capture Duke Energy expansion projects, e.g. Shearon Harris, that are reasonably foreseeable in the planning horizon?	The model version available from DWR when we started the modeling effort to evaluate the effect of the proposed IBT did not include the Duke expansion projects.
13	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Comparisons of baseline, existing and 2050 usages should be examined using Indicators of Hydrologic Alteration (IHA) to look at impacts to the 5 characteristics of stream flow regimes espoused by Poff et. al.: Duration, Frequency, Magnitude, Rate of Change, Timing.	This comparison will be covered by the DWR requested monthly data table; comparison will be made for the 2045 Baseline and 2045 Requested IBT scenarios.
14	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Page 8: "Average and median flows – representative of average climatic conditions." The median flow is the middle value—half the values are above and below, not the average.	Text will be clarified.
15	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	The applicant should make available the baseline, existing and 2050 daily flow values for the model nodes at and downstream of L&D1 in the contributing and all nodes in the receiving basins.	Adding these flow values for each scenario in table included in the document will add several hundred pages based on the 82 year record of flow data. We will make available, as requested, the data in excel format. In addition, all model scenarios with this data reside on the DWR servers.

NC Division of Water Resources Comment Response Matrix

Draft Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer

Completed September 9, 2016 (Updated October 28, 2016 based on DWR comments on the Draft Environmental Assessment)

No.	Division	Point of Contact	Role/Office	Comment	Response to comment
16	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.3: Please explain the apparent conflict between the last sentence of the first paragraph and the last sentence of the second paragraph.	The second paragraph describes that the modeling evaluation was conducted with the WSRPs turned "on" in the model and the results include the effect of the **WSRPs built into the model.** This excludes those referred to in the preceding paragraph that could not be built into the model.
17	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4, second paragraph, last sentence: Please state the Pender County water source prior to the LCFWASA contract.	Text will be updated - groundwater purchase from Wallace
18	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4, fifth paragraph, second sentence: Please identify the WWTP this discharge is referring to, and if this discharge will be directly in the Cape Fear River.	Text will be updated - US 421 WWTP.
19	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4, fifth paragraph, last sentence: Consider making it clear that the values in Table 2 are not part of the requested IBT value (i.e., the 2050 IBT value would be 16.9 without the wastewater plans detailed in Table 2).	Text will be updated to clarify that these values are not included in the calculation of the County's IBT.
20	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4, Table 3: Please describe exactly how the wastewater from the 14.5 MGD (2045) transferred will be dealt with (i.e., planned public and/or private WWTPs, septic, etc.). This is inherently complicated with significant planning efforts and may be better described in the EA document; however, these details will need to be addressed.	This is more comprehensively described in the EA; below provides a summary: - Centralized sanitary sewer service in the County is very limited. Residential wastewater treatment needs are primarily being met by onsite treatment (septic systems). A 0.5 MGD wastewater treatment plant (WWTP) is currently under construction to serve the US 421 corridor in the southwestern portion of Pender County. This WWTP has an NDPES permit to discharge up to 4 MGD to the Cape Fear River. Sewer service for the co-applicants varies, but treatment and discharge occurs within the river basin of the water usage (by direct discharge or infiltration). - There is no planned construction of a County-wide centralized sanitary sewer collection and treatment system. Wastewater will continue to be handled as it is currently (septic systems or community/localized WWTPs with infiltration of effluent). The US421 WWTP is being constructed to treat (and discharge to the CFR) wastewater flow from the US 421 corridor and the Pender County Commerce Park. A private developer is building a WWTP with infiltration in the US17 corridor. Co-applicants will continue their current practices, which discharge/infiltrate effluent within the river basin usage occurs.

NC Division of Water Resources Comment Response Matrix

Draft Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer

Completed September 9, 2016 (Updated October 28, 2016 based on DWR comments on the Draft Environmental Assessment)

No.	Division	Point of Contact	Role/Office	Comment	Response to comment
21	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.1.2, Table 6: A reduction of 3.5% of total flow at the 5th percentile directly attributable to the proposed IBT (between the 2045 Baseline and the 2045 Baseline with IBT) is potentially of concern, please describe the significance of this result. Section 6.1.2, third paragraph, last sentence: describes this difference as “small”, which is questionable. Consider tying the selection of percentiles studied back to existing criteria. USGS uses a classification system for estimating flow impacts for drought purposes as does the US Drought Monitor (USDM) with a similar classification system. This is not intended to limit which classifications should be used, but an outside classification/criteria selection of the percentiles should be used that allows for a greater understanding of what reductions in flow mean to the river system.	Even with a 3.5 percent reduction in the 5th percentile flow for the period of record (95 percent of flows during this period are greater) there is still 585 cfs (378 MGD) of flow passing at L&D #1. There are no significant water supply withdrawals downstream of L&D #1; water quality below L&D #1 is primarily driven by local, naturally occurring factors (marshes/wetlands and sediment); downstream of L&D #1 the CFR is tidally influenced (2 feet of tidal influence under a lunar tide (USACE, 2011)); and the difference in simulated water surface elevations at L&D #1 between the 2045 Baseline and the 2045 Requested IBT model scenarios is approximately 0.1 ft (approximately 12.2 ft MSL vs. 12.3 ft above MSL), which is over one foot above the dam crest. Based on this information, the effect of the proposed IBT is not considered significant. The current percentiles presented in the document will be linked to the USDM and USGS flow classifications.
22	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.1.3, fourth paragraph, last sentence: Please consider providing some duration statistics for the low flows at the dam crest. Also, consider researching what the adequate flows for fish passage/movement up the ladder would be (i.e., pools created by the rock structure that block upstream movement during severe low flow conditions.)	Duration statistics for river stage will be added as part of the DWR requested monthly river flow/stage table. Additional explanation on how the design of the fish ladder has included measures to allow for fish passage during low flow periods will be added.
23	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 7.0, first paragraph, first sentence: Consider deleting “and” between “throughout the basin” and “upstream of.”	Text will be updated.
24	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 7.0, Please describe the significance and meaning of a 2.4% reduction of flows directly attributable to the IBT at the 5th percentile of flows during the spawning season. Please refer back to the earlier comment of Table 6 in Section 6.1.2.	Even with a 2.4 percent reduction in the 5th percentile flow during the spawning period (95 percent of flows during this period are greater), there is still 825 cfs (533 MGD) of flow passing L&D #1 into the fish ladder. This level of flow equates to a simulated 12.2 ft MSL water surface elevation (the dam crest is 11 ft MSL). This level is not different than the 2010 Baseline scenario's 5th percentile flow's (875 cfs) simulated water surface elevation of 12.2 ft MSL. Note that based on USGS gaging station data for 2007-2016, at L&D #1, the water surface elevation for a flow of 875 cfs equated to a river stage between 12.1 and 12.7 ft above MSL. A flow of 828 cfs (closest to the 2045 Requested IBT scenario flow of 825 cfs) equated to a river stage between 12.0 to 12.7 ft above MSL.
25	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Paragraph 3.3 on page 5 states: "All public water supply systems in NC are required by the State to have a Water Shortage Response Plan..." o This is not correct. Pursuant to § 143-355.2, only units of local government that provide public water service and large community water systems shall develop and implement water shortage response plans.	Comment noted. Text will be updated.
26	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Paragraph 3.4 on page 5 states: "the “existing conditions” baseline model scenario, as defined by NC DWR, uses 2010 withdrawals and discharges." o A more recent approved local water supply plan should be used to represent current conditions. The 2014 local water supply plan is the most recently approved plan.	Pender County water demand, wastewater flow and IBT projections were developed in 2016. The 2010 Baseline scenario is representative of 2010 conditions and 2045 Baseline is representative of 2045 conditions.
27	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Table 1, Page 6: The data presented in Table 1 is not representative of data submitted in the 2015 local water supply plan. Data associated with the IBT petition must align with data submitted in the local water supply plan.	LWSPs are being updated currently by PCU and the co-applicants.

NC Division of Water Resources Comment Response Matrix

Draft Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer

Completed September 9, 2016 (Updated October 28, 2016 based on DWR comments on the Draft Environmental Assessment)

No.	Division	Point of Contact	Role/Office	Comment	Response to comment
28	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Table 3, Page 7; Paragraph states: "The IBT values are reflective of the net transfer from the Cape Fear River basin..." oAccording to data submitted in the 2015 local water supply plan, the average daily purchase for the max month was 1.345 MGD, so the net transfer could not have been 1.5 MGD for 2015. Please revise this table to show annual average day purchase, max month average day purchase, flow out of the source basin, expected returns, and peaking factor justification for the max month.	Table 3 has been removed from the document, see below (Comment No. 29 and 33)
29	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Figure 3, Page 8: Please provide the annual average day demand for 2045.	Figure 3 will be updated. Note that much of the demand and flow projection discussion and tables will be removed from this document and reference will be made to the County's document: Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County (HIEPC and CH2M, 2016) .
30	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.0: The Introduction should include the proposed IBT transfer amount as well as the source and receiving basins for the proposed transfer.	Introduction will be updated.
31	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.0, fifth paragraph: What modeling has been done to ensure Pender County has suitable soils and enough land to handle the extra water from the proposed IBT if most of the transferred water will be discharged to septic systems rather than centralized sanitary sewers?	No modeling has been done for this, if soils are unsuitable for a septic systems then the County Health Dept. will not issue a septic system permit, unless an engineered solution is constructed (ex. Mounded infiltration area). For clarity, approximately 46 percent of future growth within the PCU Service area will be from service area expansion to existing customers currently on private groundwater wells and septic. Therefore, not all new water demands for PCU from their Cape Fear River water supply equate to new wastewater loads in the receiving basin.
32	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.3, second paragraph: If WSRPs were turned "on," does this only include the systems tied to physical triggers, and does this mean that systems not tied to physical triggers are not accounted for in the model, at least with respect to the effects of their WSRPs?	Yes, all PWSs downstream of Jordan Lake that have a CFR water withdrawal and a WSRP do not have physical triggers in their WSRP to allow simulation in the hydrologic model.
33	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4: Some discussion would be useful to reconcile the numbers reported in Tables 1 and 3. If the overall total demand reported in Table 1 for the year 2045 is 8.8 mgd, why is the IBT forecasted in Table 3 for the year 2045 projected to be 14.5 mgd (and is this the IBT request for the certificate?). The difference can't just be process wastewater, what else accounts for the difference?	The focus of this document is on the 2045 IBT, therefore the much of the demand and flow projection discussion and all tables will be removed from this document and reference will be made to the County's document: Water Demand, Wastewater Flow and Interbasin Transfer Forecasting for Pender County (HIEPC and CH2M, 2016) . This document is the source document for projection in the EA, and will be included as an appendix to the EA.
34	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4, paragraph following Table 3: In the second sentence, it would be helpful to identify the receiving basins of the proposed transfer.	Table will be updated.
35	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.0, fourth primary bullet, first secondary bullet: Suggest defining the period of record here (1930-2011).	Period of record will be added.
36	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Figure 6.1.2, fourth paragraph: The numbering of figures appears to be off. The second time that "Figure 9" is referenced, it should be changed to "Figure 10," and where "Figure 10" is referenced, if should be changed to "Figure 11."	Figure #'s will be updated.
37	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	On duration plots (Figures 4 and 5) set low limit on cfs scale (y-axis) to 10 cfs rather than 100 cfs.	Figure will be updated.
38	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Regarding DWR's proposed matrix, attached, when presenting modeled monthly flow projections, show the percent of time that flow below Lock & Dam #1 is less than 5,000 cfs for each scenario.	The DWR requested table will developed for this comparison.
39	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Suggest refining the wording regarding the description of "2045 Maximum Withdrawal" (top of page 11) so it doesn't sound like 106.6 mgd is a guarantee, that it is meant for planning purposes.	Wording will be revised to state "maximum allowable withdrawal based on current DWR planning guidance" to define Maximum Withdrawal.

NC Division of Water Resources Comment Response Matrix

Draft Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer

Completed September 9, 2016 (Updated October 28, 2016 based on DWR comments on the Draft Environmental Assessment)

No.	Division	Point of Contact	Role/Office	Comment	Response to comment
40	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Information presented in the LWSP, EA, and petition needs to be consistent.	LWSPs are being updated currently by PCU and the co-applicants.
41	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Suggest clarifying and clearly stating the IBT amount that is requested (14.5 mgd?).	Text will be updated.
42	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Review to ensure the TM is specific to the hydrologic model results and not blurring content with the EA.	Comment noted.

APPENDIX G

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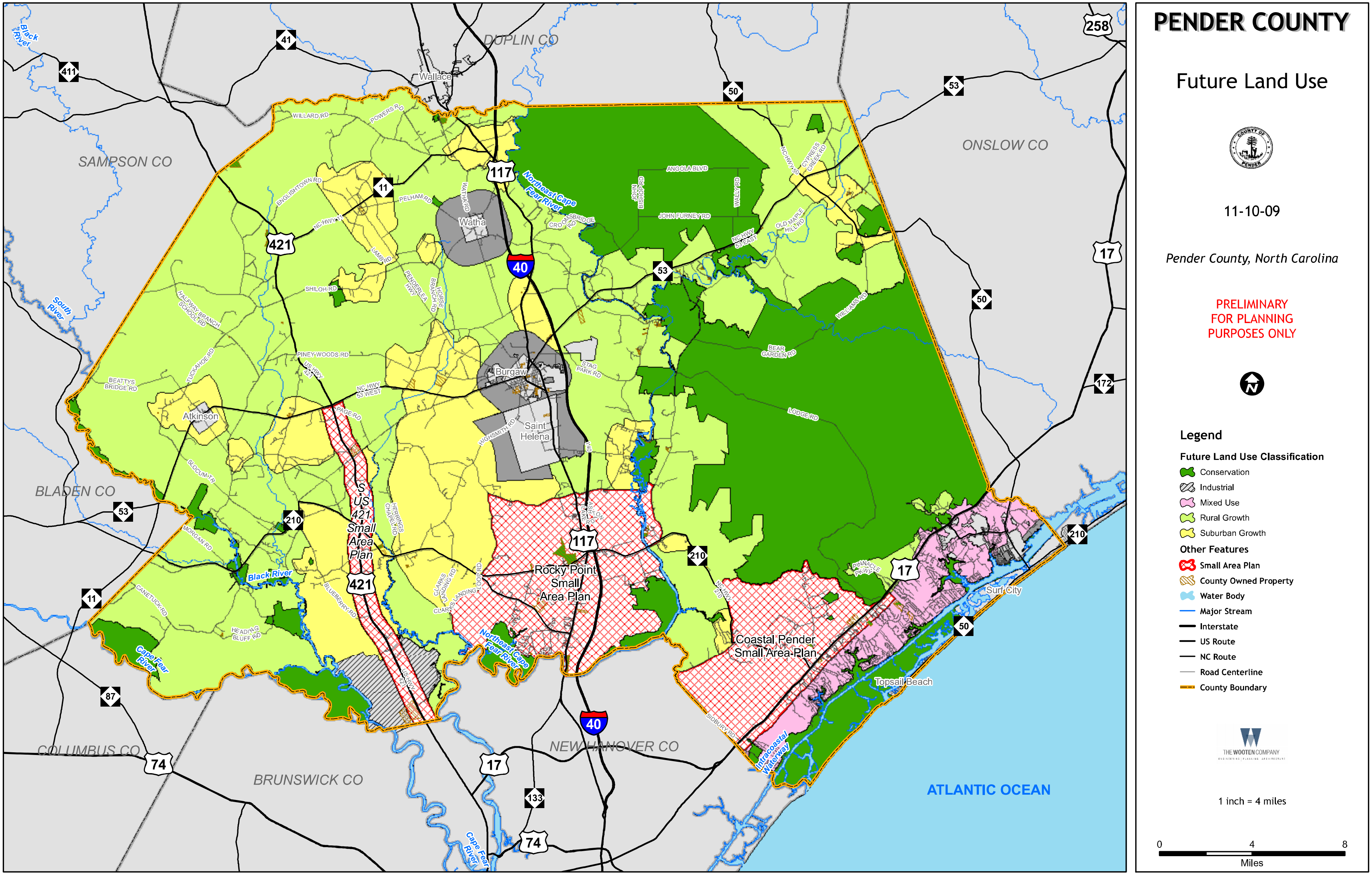
PENDER COUNTY
Future Land Use
11-10-09
Pender County, North Carolina
PRELIMINARY
FOR PLANNING
PURPOSES ONLY
Legend
Future Land Use Classification
Conservation
Industrial
Mixed Use
Rural Growth
Suburban Growth
Other Features
Small Area Plan
County Owned Property
Water Body
Major Stream
Interstate
US Route
NC Route
Road Centerline
County Boundary
THE WOOTEN COMPANY
1 inch = 4 miles
0
4
8
Miles
DUPLIN CO
SAMPSON CO
ONSLOW CO
BLADEN CO
COLUMBUS CO
BRUNSWICK CO
NEW HANOVER CO
ATLANTIC OCEAN
Wallace
Watha
Burgaw
Saint Helena
Atkinson
Surf City
Topsail Beach
S US 421 Small Area Plan
Rocky Point Small Area Plan
Coastal Pender Small Area Plan
Black River
South River
Northeast Cape Fear River
Cape Fear River
Intracoastal Waterway
WILLARD RD
POWERS RD
ENGLISHTOWN RD
PELHAM RD
SHILOH RD
PINEY WOODS RD
BEATTYS BRIDGE RD
SLOCUM TR
MORGAN RD
CANETUCK RD
HEADING BLUFF RD
BLUEBERRY RD
HIGHSMITH RD
STAG PARK RD
ANGOLA BLVD
JOHN FURNEY RD
WALLY RD
BEAR GARDEN RD
LODGE RD
WILLIAMS RD
OLD MAPLE HILL RD
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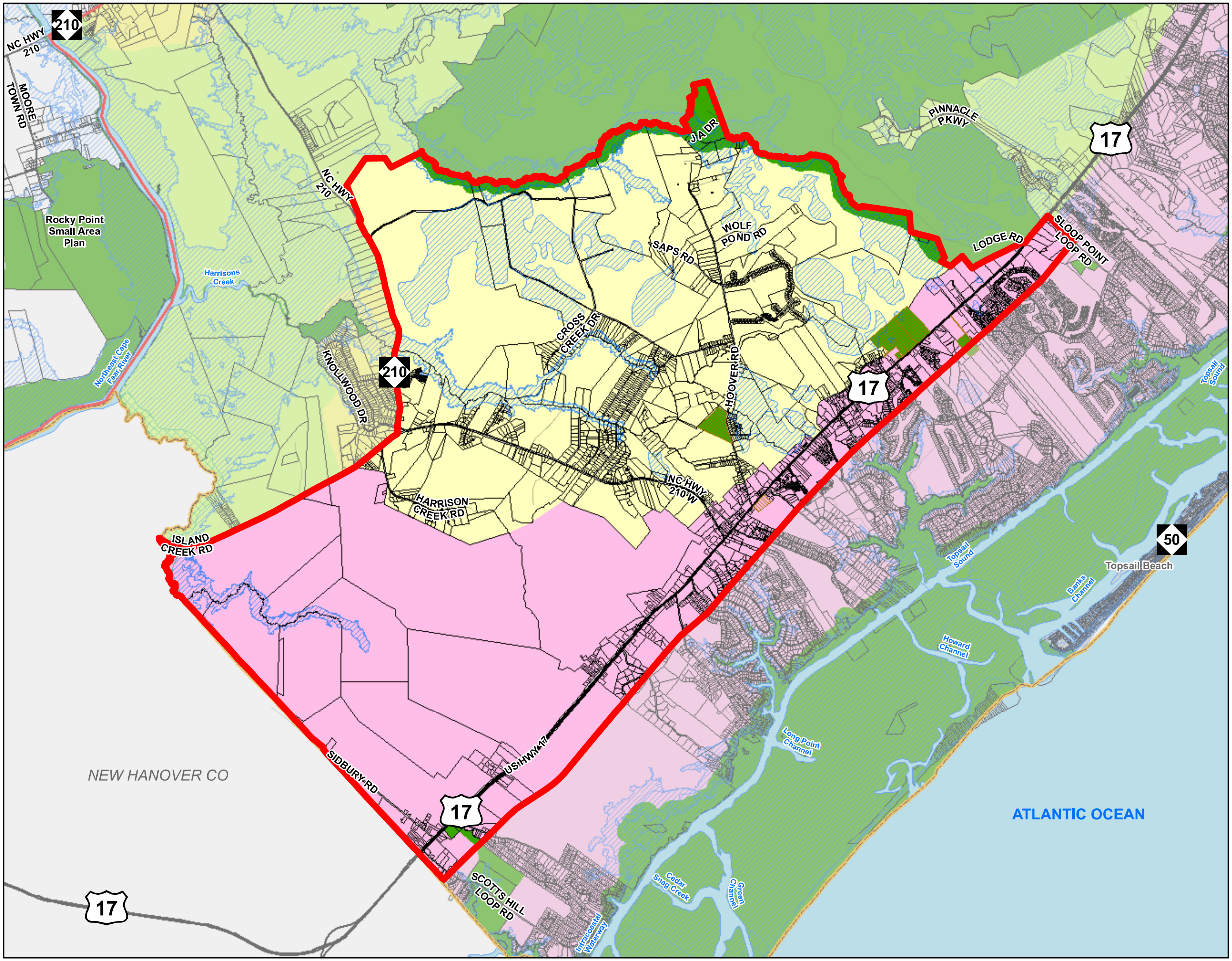


COASTAL PENDER SMALL AREA PLAN

Future Land Use

11-10-09

Pender County, North Carolina

PRELIMINARY
FOR PLANNING
PURPOSES ONLY

Legend

Future Land Use Classification

- Conservation
- Mixed Use
- Rural Growth
- Suburban Growth

Flood Zone

- 100 Year Floodplain
- Floodway

Other Features

- Planning Boundary
- County Owned Property
- Water Body
- US Route
- NC Route
- Road Centerline
- River Stream
- Parcel
- Municipality
- County Boundary

1 inch = 5,000 feet

0 5,000 10,000
Feet

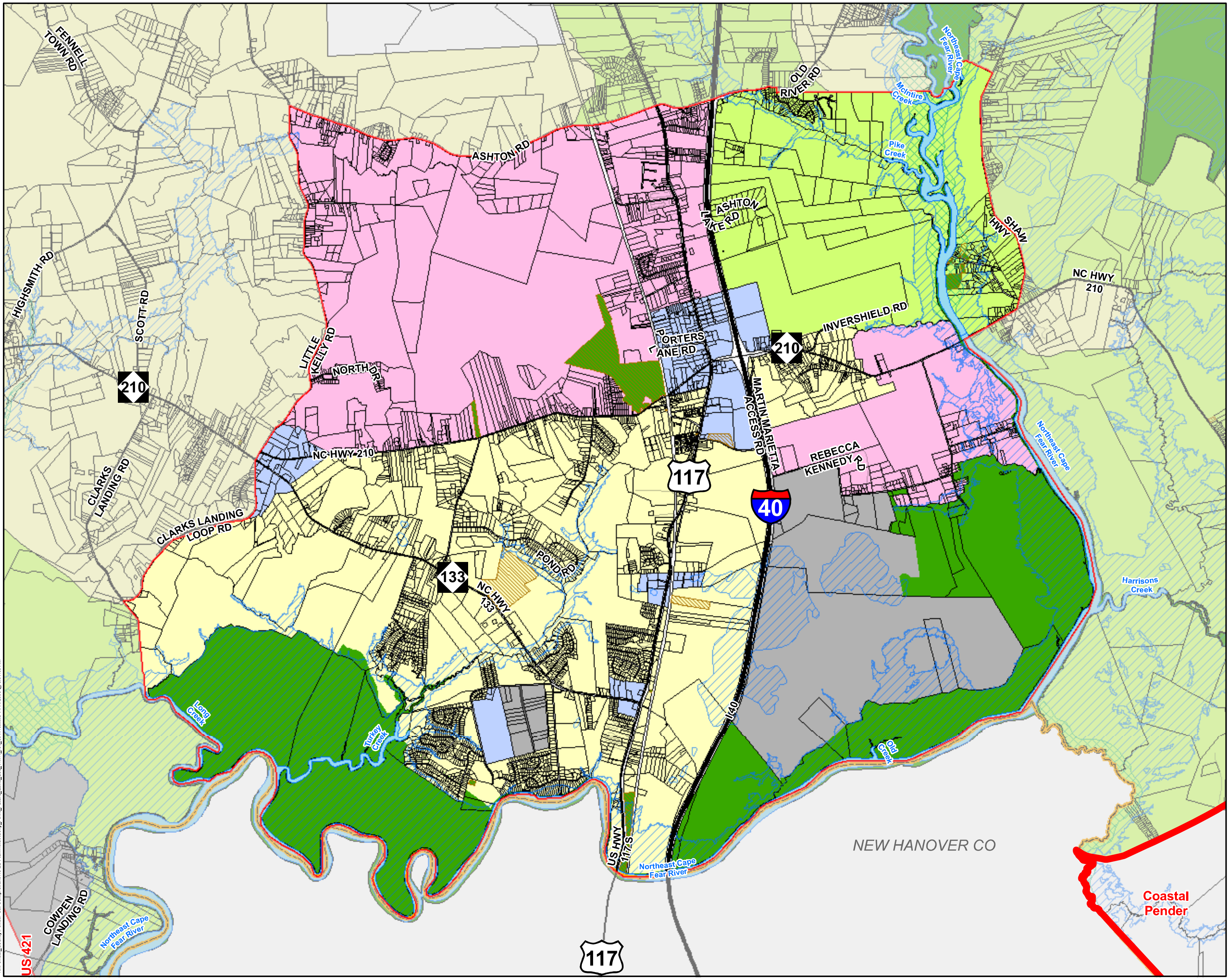
ROCKY POINT SMALL AREA PLAN

Future Land Use

11-10-09

Pender County, North Carolina

PRELIMINARY
FOR PLANNING
PURPOSES ONLY



Legend

Planning Boundary

Future Land Use Classification

- Conservation
- Industrial
- Mixed Use
- Office, Institutional, Commercial
- Rural Growth
- Suburban Growth

Other Features

- County Owned Property
- Water Body
- Interstate
- US Route
- NC Route
- Road Centerline
- hydromaj_arc
- Parcel
- County Boundary

Flood Zone

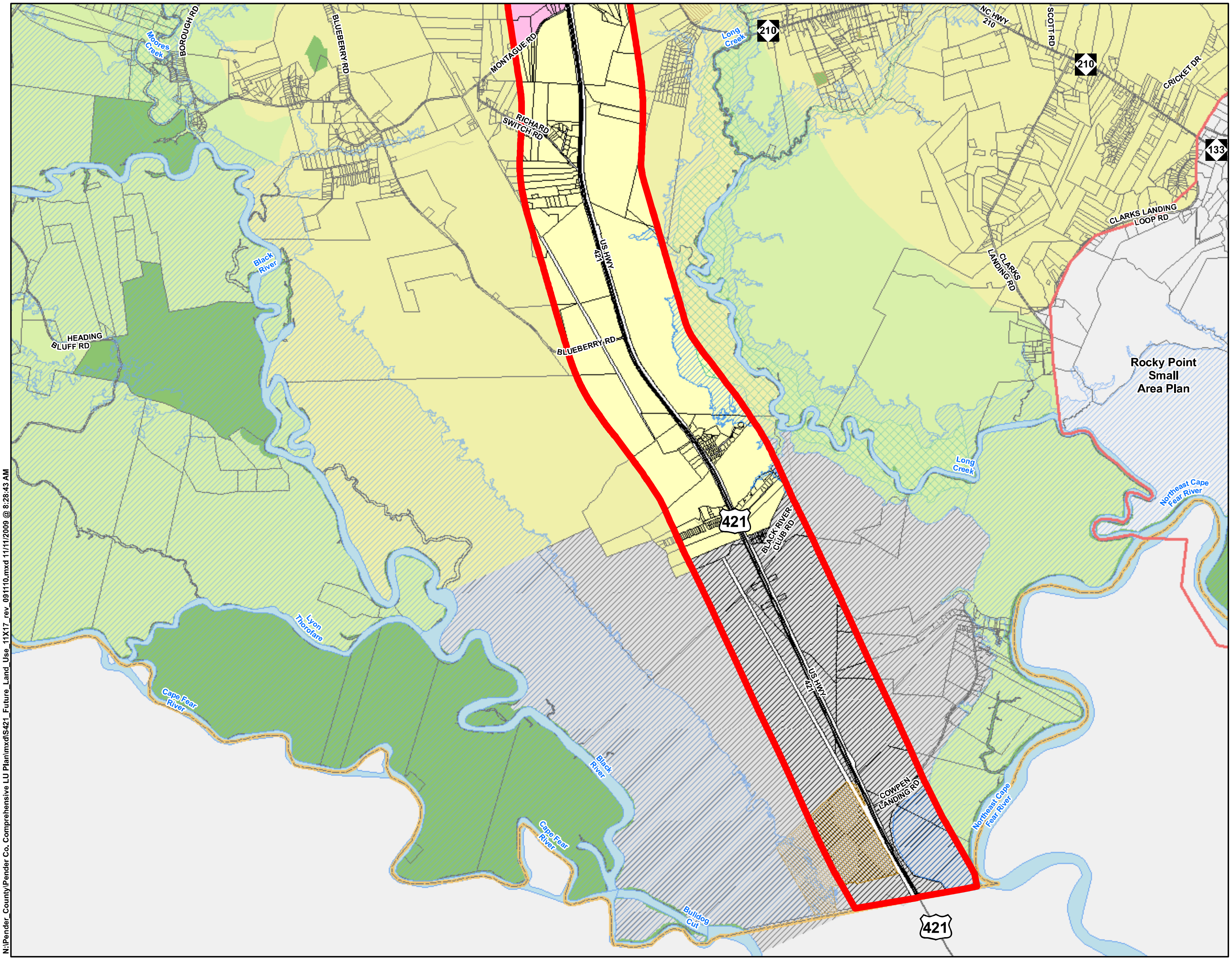
- 100 Year Floodplain
- Floodway

THE WOOTEN COMPANY

1 inch = 5,000 feet

0 5,000 10,000

Feet



US HWY 421 SOUTH CORRIDOR SMALL AREA PLAN MAP B

Future Land Use

11-10-09

Pender County, North Carolina

PRELIMINARY
FOR PLANNING
PURPOSES ONLY

Legend

Future Land Use Classification

- Conservation
- Industrial
- Mixed Use
- Office, Institutional, Commercial
- Rural Growth
- Suburban Growth

Flood Zone

- 100 Year Floodplain
- Floodway

Other Features

- Planning Boundary
- County Owned Property
- Water Body
- Interstate
- US Route
- NC Route
- Road Centerline
- River/Stream
- Parcel
- County Boundary

THE WOOTEN COMPANY

1 inch = 4,000 feet

0 2,000 4,000 8,000

Feet

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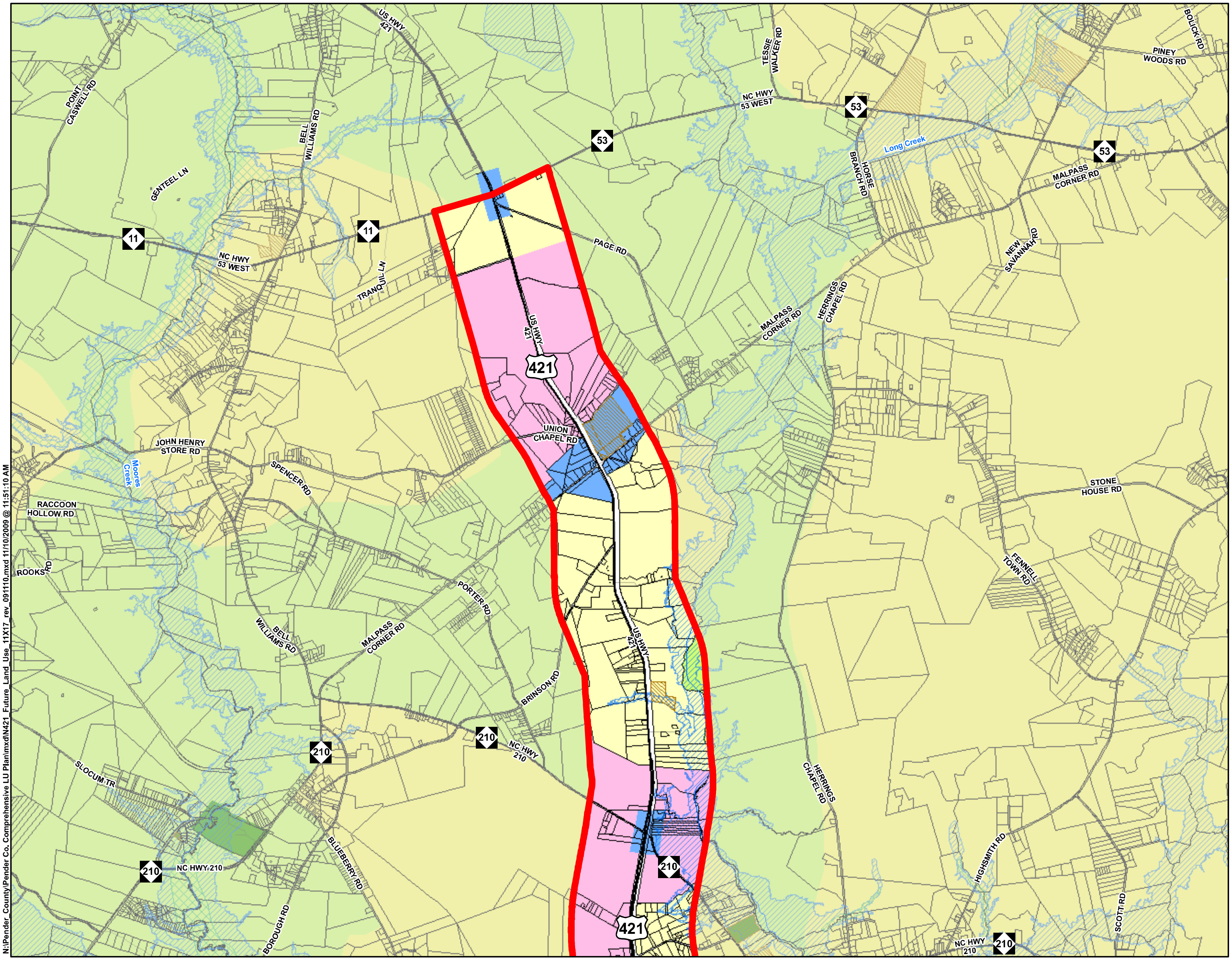

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US HWY 421 SOUTH CORRIDOR SMALL AREA PLAN MAP A

Future Land Use

11-10-09

Pender County, North Carolina

PRELIMINARY
FOR PLANNING
PURPOSES ONLY

Legend

Future Land Use Classification

- Conservation
- Mixed Use
- Office, Institutional, Commercial
- Rural Growth
- Suburban Growth

Flood Zone

- 100 Year Floodplain
- Floodway

Other Features

- Planning Boundary
- County Owned Property
- Water Body
- Interstate
- US Route
- NC Route
- Road Centerline
- River/Stream
- Parcel
- County Boundary

THE WOOTEN COMPANY

1 inch = 4,000 feet

0 2,000 4,000 8,000
Feet

Town of Topsail Beach
Flood Protection Information

The dominant source of flooding in Topsail Beach is wind driven water surge generated in the Atlantic Ocean by tropical storms and hurricanes. The surge extends into Topsail Inlet, Topsail Island, and Topsail Sound. The most serious threat of flooding is during the hurricane season, June through November. Most properties seaward of Topsail Beach are in the coastal AE Zone.

North Carolina experiences hurricanes, tropical storms, and severe extra-tropical cyclones, usually referred to as a "Northeaster". Unlike a hurricane, which may pass over a coastal location in a fraction of a day, a northeaster may blow from the same direction and over long distances for several days.

Storms, such as Hurricane Ophelia (2005), Hurricane Floyd (1999), and Hurricane Fran (1996), produced severe floods, as well as extensive structural damage. In September of 2005, Hurricane Ophelia produced over 14 inches of rainfall, covering roadways, prompting five dune breaches, producing extensive primary dune loss, and washing away over 90 percent of beach access stairs. Hurricane Irene hit the Town of Topsail Beach in 2011, producing between 10-14 inches of rainfall and hurricane force winds, destroying over 25% of the town's beach.

Town Flood Services

The first thing you should do is check your flood hazard zone. You can visit the Building Inspection Department Town Hall to see if you are in a mapped floodplain. If so, they can give you more information such as depth of flooding over a building's first floor and copies of Elevation Certificates on buildings built in the floodplain since 1997. Call the Department at 910-328-5841or drop by the Town Hall Town at 820 S. Anderson Blvd, Town of Topsail Beach, NC, where the information can be obtained. There is no charge for this service.

Every Family Should Have a Family Emergency Plan. For more information, visit:
www.ready.gov/america/index.html

Flood Protection and Safety

SAFETY IS THE #1 PRIORITY

- Turn off all utilities. Close the main gas valve.
- Store important documents in waterproof containers.
- Take your trash cart inside or tie it down.
- If you're caught in the house by suddenly rising water, move to a second floor and, if necessary, to the roof.
- Let your friends and relatives know where you are evacuating.
- Remember to include your pets as part of your evacuation plan.
- Stay away from power lines and electrical wires.
- Do not walk through flowing water. Do not drive through a flooded area.

Property Protection Measures

There are several different ways to protect a building from flood damage.

Emergency Measures:

- Place sandbags to hold back rising water
- Keep water away by re-grading your lot
- Keep water away by building leaves or a small floodwall
- Move furniture and equipment to upper floors

Permanent measures:

- Make your walls waterproof
- Place watertight closures over doorways
- Raise the house above flood levels
- Relocate

The Federal Emergency Management Agency (FEMA) published: **The Design Manual for Retrofitting Floodprone Residential Structures.** This publication presents a series of permanent retrofitting measures that can be incorporated into an existing building to reduce or eliminate the potential of future flooding. The manual can be ordered free of charge:

FEMA Distribution Center
8241-A Sandy Court
P. O. Box 2012
Jessup, MD 20794
ATTN: Publications
1-800-480-2520
http://www.fema.gov/nfip/forms.shtm

Natural and Beneficial Floodplain Functions

Undisturbed floodplains provide a wide range of benefits, such as:

- ***Natural flood and* erosion control:** provides flood storage and conveyance and reduces flood velocity.
- ***Water quality***: filters nutrients and impurities from runoff.
- ***Groundwater recharge****:* reduces frequency and duration of surface flow.
- ***Biological resources***: supports high rate of plant growth, provides breeding and feeding grounds and enhances waterfowl habitat.
- ***Societal resources:*** provides open space and aesthetic pleasures. Also, in areas of scientific study provides opportunities for environmental research.

Floodplain Development Permit Requirements

All properties located in the "Special Flood Hazard Area" on the community's Flood Insurance Rate Map are subject to regulations.

Q: *What is subject to these regulations?*

A: *Any man made change to improved or unimproved property, such as: Buildings-Excavation-Dredging-Filling-Grading-Paving.*

The community may levy a fine and/or obtain a court order to have the owner correct the construction, if built without a permit or if not built according to the approved plans. For information on floodplain development or to report illegal floodplain development, contact the local permit office at 910-328-5841.

Substantial Improvement Requirements

A "substantial improvement" is any reconstruction, rehabilitation, addition or other improvement to a building, when the cost exceeds 50% of the market value of the building before the start of construction of the improvement. However, when the building is damaged and the cost of restoring the building to its before-damage condition exceeds 50% of the market value prior to the damage occurring, it is termed "substantial damage". New construction or substantial improvement of any structure (residential, commercial, industrial, or nonresidential) located in a special flood hazard area shall have the lowest floor, including basement, elevated to or above the base flood elevation. Contact your local permit office for rules and requirements regarding "substantial improvement" and "substantial damages".

Topsail Beach Flood Plain Manager -
Tel: 910-328-5841

Flood Insurance Information

Take advantage of flood insurance, because flood damage is not covered by most standard homeowner policies. Separate Insurance policies are needed for protection against flood damage, which people frequently don't realize until it is too late.

Flood Insurance guarantees compensation for flood damages because the federal government backs the National Flood Insurance Program (NFIP). NFIP compensates all covered losses, even when Federal Disaster Aid is not available. Flood Insurance covers structural and mechanical damage resulting from flooding, as well as damages to floor surfaces (e.g., tile and carpeting) and flood debris cleanup. You can purchase additional coverage to insure most of your personal property and belongings. Plan ahead and purchase Flood Insurance today.

The National Flood Insurance Program is available in Topsail Beach! There is a 30-day waiting period before your coverage goes into effect. Contact your insurance company today for more information or visit: www.floodsmart.gov

THE MOST SERIOUS THREAT OF FLOODING…

IS DURING THE HURRICANE SEASON, JUNE THROUGH NOVEMBER.

Drainage System Maintenance

It is important to keep drainage systems properly maintained. Inlets, channels, and detention/retention basins lose their carrying capacities as a result of dumping, sedimentation, and growth of vegetation. When a drainage system loses a portion of its carrying or storage capacity, flooding occurs and water reaches higher levels.

Dumping in ditches, inlets, storm drains is illegal and should be reported to the local permit office at 910-328-5841 or to NCDENR at 910-796-7215.

Flood Warning Systems

Residents should listen to radio broadcasts, television announcements, and internet alerts. Please be alert to local advisories, including *calls from Town Hall.*

You may sign up to be on the call list at the Town's website: www.topsailbeach.org

Radio:

1620 AM: Sloop Point and Surf City
1640 AM: Hampstead and Topsail Beach
Surf City operates a radio station at 1610 AM.

Local TV Stations:

WECT (Channel 6)
WWAY (Channel 3)
WRAL (Channel 10)

Other Tools:

NOAA weather radio
www.nws.noaa.gov/nwr/
In the unlikely event a storm develops at night with no opportunity for prior warning to the public, the local fire and rescue, and law enforcement have the capability to deliver flood warning messages.

For more Information on Topsail Beach Flood Warnings, please call the Town of Topsail Beach at 910-328-5841 or Office of Emergency Management at 910-259-1210.

Important Websites:

Town of Topsail Beach Information and Ordinances:
www.topsailbeach.org

Pender County Emergency Management:
www.penderem.com

Federal Emergency Management Agency:
www.fema.gov

Government website great for pet owners, people with special needs or disabilities, and children:
http://www.ready.govamerica/index.html

North Carolina Department of Environmental and Natural Resources:
http://enr.state.nc.us

North Carolina Flood Mapping Program
www.ncfloodmaps.com

National Flood Insurance Program
www.floodsmart.gov

National Weather Service:
http://www.erh.noaa.gov/ilm/

Your property is in or near a "Special Flood Hazard Area"

ARE YOU PREPARED?

FLOOD TIPS

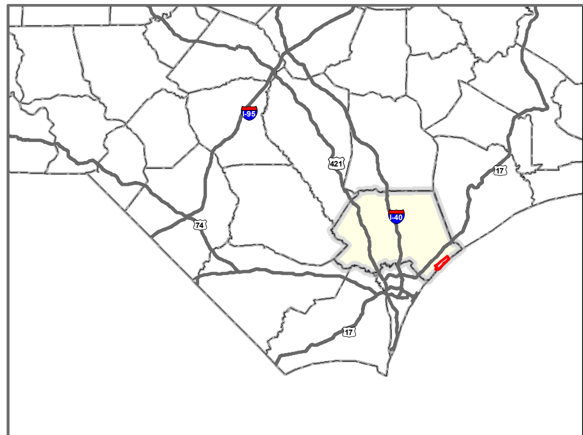
For Residents of

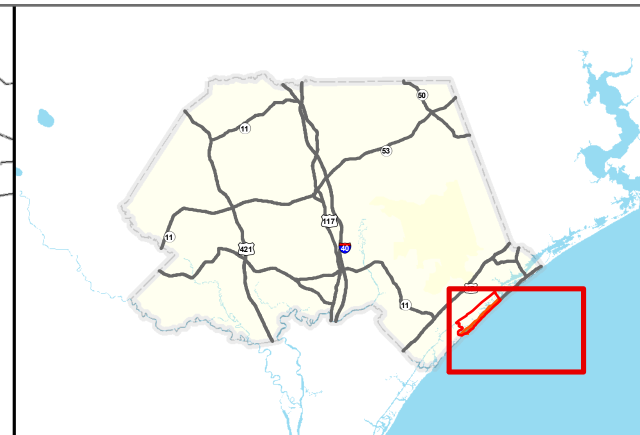
TOWN OF TOPSAIL BEACH

Published by the
Town of Topsail Beach
910-328-5841
www.topsailbeach.org
or
Office of Emergency Management
910-259-1210

The National Flood Insurance Program is available in Topsail Beach! There is a 30-day waiting period before your coverage goes into effect. Contact your insurance company today for more information or visit: www.floodsmart.gov

In compliance with CRS 330 (A)





Map is to be used for general purposes only. Spatial data used to generate this map was gathered from disparate sources and represent a condition at a fixed period in time. 100% accuracy of spatial data to current circumstances cannot be guaranteed. The Cape Fear Council of Governments is not legally responsible for the misuse of this map.

Class I: Land containing only minimal hazards and limitations that may be addressed by common land planning and development practices.

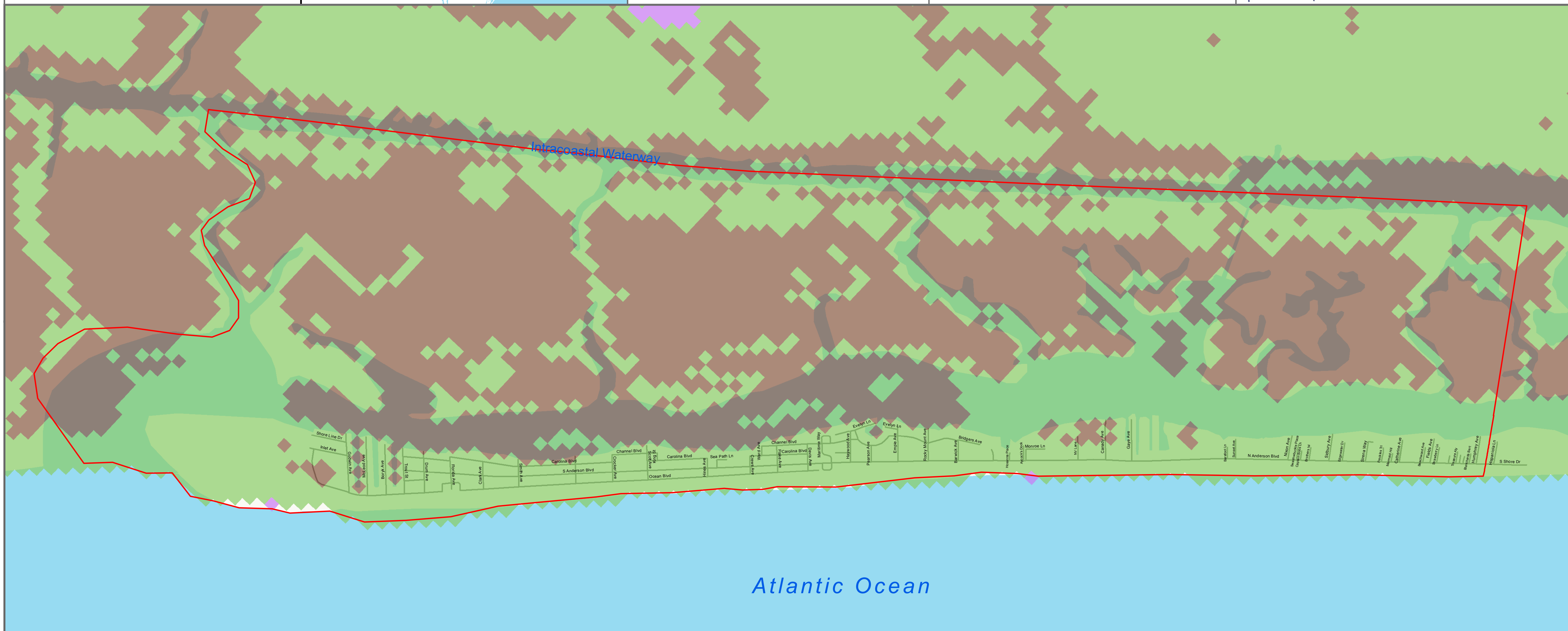
Class II: Land containing development hazards and limitations that may be addressed by methods such as restrictions on types.

Class III: Land containing serious hazards for development or lands where the impact of development may cause serious damage to the functions of natural systems.

Town of Topsail Beach

CAMA Land Use Plan

Environmental Composite Map



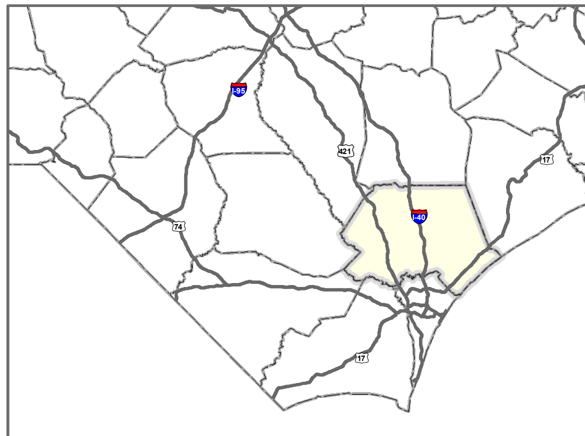
Data source provided by the North Carolina Center for Geographical and Information Analysis.

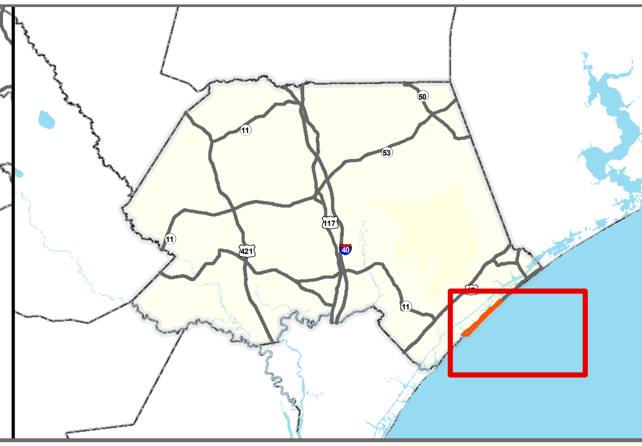
Map Prepared By:
Jacob Vares
Cape Fear Council of Governments
1480 Harbour Drive
Wilmington, NC 28401
6/23/15

Legend

Environmental Composite

- Class I
- Class II
- Class III





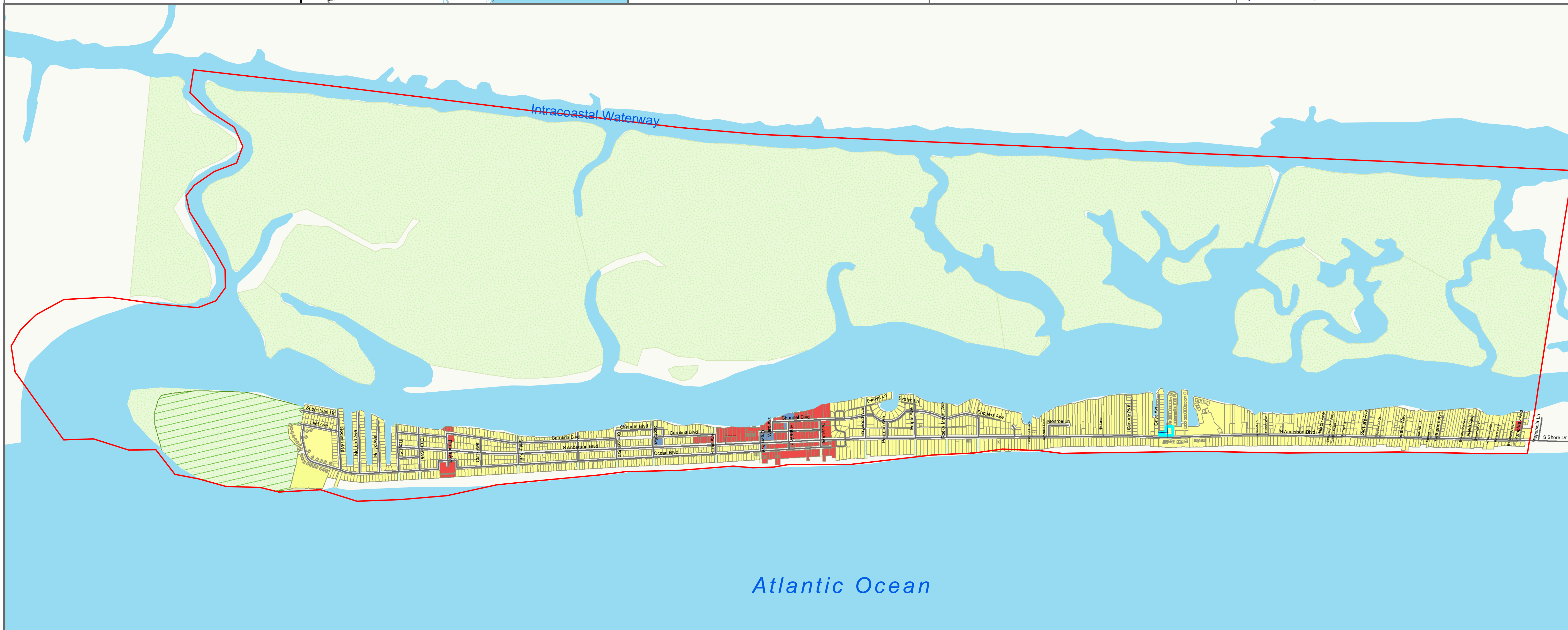
Map is to be used for general purposes only. Spatial data used to generate this map was gathered from disparate sources and represent a condition at a fixed period in time. 100% accuracy of spatial data to current circumstances cannot be guaranteed. The Cape Fear Council of Governments is not legally responsible for the misuse of this map.

This Future Land Use Map provides the geographic framework to guide the Town's land use policies and development decisions. Criterion include, but are not limited to, compatibility with the existing character of the surrounding area and impact on public services, infrastructure, traffic, hydrology, fire, safety, and parks and recreation. While the Future Land Use Map will influence future zoning, it does not alter current zoning or affect the right of property owners to use the land for its purpose as zoned at the time of this Plan's adoption. Future Land Use map is consistent with the policies in the CAMA - LUP and is created with a mixture of parcel data, land use data, zoning layers, building data, and adress point data.

Town of Topsail Beach

CAMA Land Use Plan

Future Land Use Map



0 1,150 2,300 4,600 6,900 9,200 Feet

0 0.25 0.5 1 1.5 2 Miles

N

Map Prepared By:
Jacob Vares
Cape Fear Council of Governments
1480 Harbour Drive
Wilmington, NC 28401

CAPE FEAR COUNCIL OF GOVERNMENTS

Legend

Water Features

Future Land Use

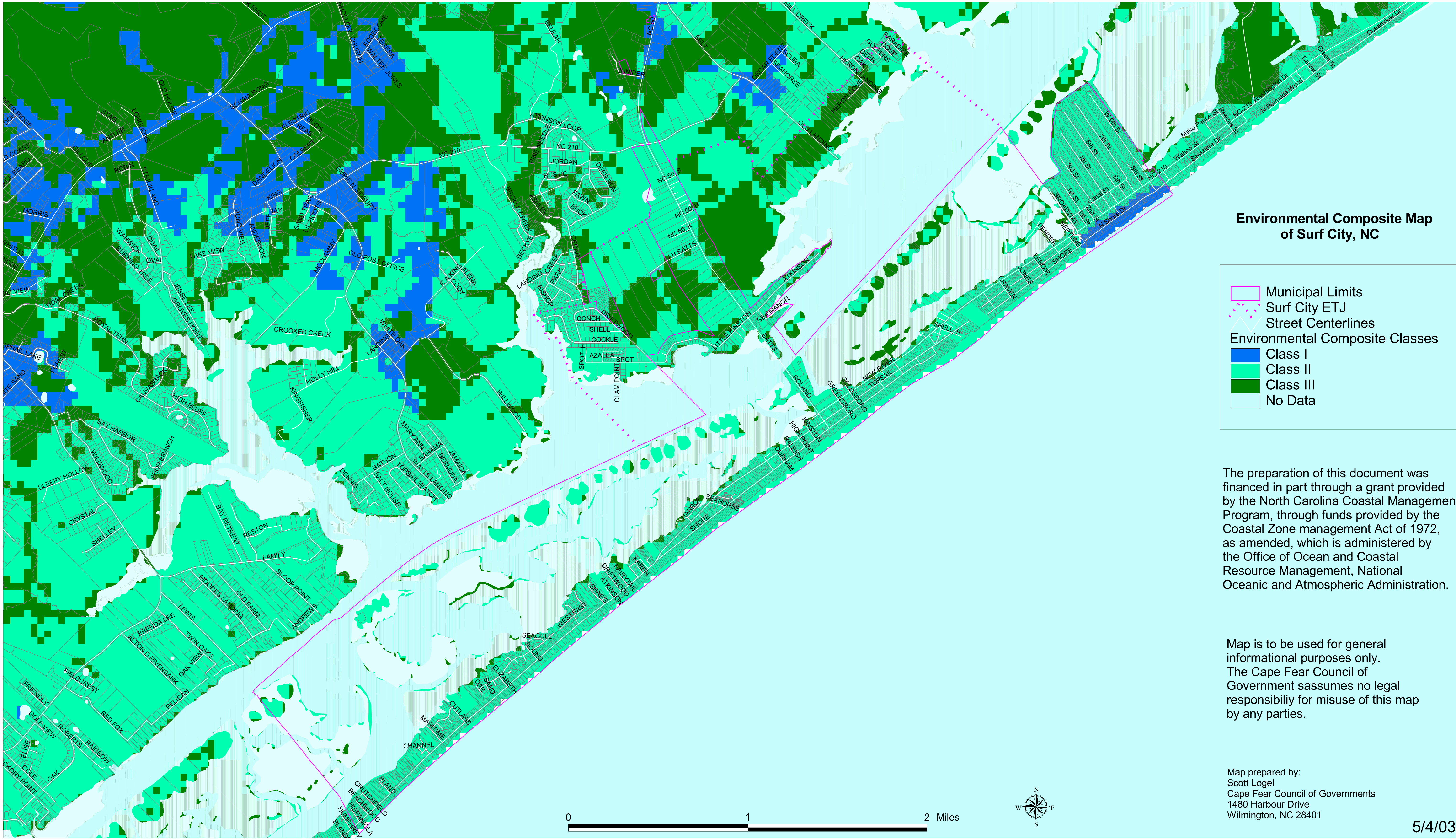
Business/Commercial

Conservation with Limited Residential

Residential

Institutional

Conservation


Environmental Composite Map
of Surf City, NC
Municipal Limits
Surf City ETJ
Street Centerlines
Environmental Composite Classes
Class I
Class II
Class III
No Data
The preparation of this document was financed in part through a grant provided by the North Carolina Coastal Management Program, through funds provided by the Coastal Zone management Act of 1972, as amended, which is administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration.
Map is to be used for general informational purposes only. The Cape Fear Council of Government sassumes no legal responsibiliy for misuse of this map by any parties.
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Map prepared by:
Scott Logel
Cape Fear Council of Governments
1480 Harbour Drive
Wilmington, NC 28401
5/4/03

For a healthy, drought- and stress-tolerant lawn and landscape, **use less water**.

Adopting water-savvy habits also is essential to maintaining and extending your community's water supply, especially during peak use. Water-efficient habits will result in a healthier lawn and landscape, in addition to conserving water and saving money.

With some simple practices and new technology, existing irrigation systems can be made more efficient—lowering your water bill, reducing run-off, and eliminating waste.

JULY SMART IRRIGATION MONTH

The Irrigation Association® has named July Smart Irrigation Month to provide tips about smart practices and new technology. Learn what you can do to operate your system at peak efficiency throughout the year at www.smartirrigationmonth.org.

To learn more, go to:

U.S. EPA WaterSense

www.epa.gov/watersense

IRRIGATION ASSOCIATION®

www.irrigation.org

Watering Can Be Efficient!

Fine-Tune Your Irrigation System to Save Water and Money

U.S. EPA WaterSense

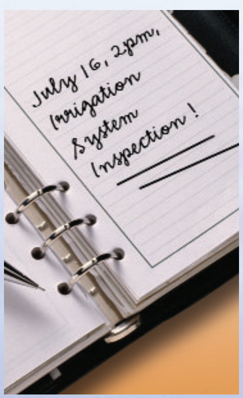
IRRIGATION ASSOCIATION®

Residential irrigation systems (e.g., automatic sprinkler systems) offer convenience and control in protecting your landscape investment. Sprinkler systems help you to enjoy your yard, and keep it healthy and beautiful. However, most homeowners tend to overwater their lawns or waste water through inefficient habits. The key to efficient outdoor irrigation is applying just enough water and only when necessary. The U.S. Environmental Protection Agency and the Irrigation Association® offer the following water-saving tips to maintain and update automatic irrigation systems:

Seasons change, so should your system. Familiarize yourself with the settings on your irrigation controller and adjust the watering schedule regularly to conform with seasonal weather conditions.

Play "zone" defense.

Schedule each individual zone in your irrigation system to account for the type of sprinkler, sun or shade exposure, and the soil type for the specific area. The same watering schedule rarely applies to all zones in the system.



Make it a date.

Inspect your irrigation system monthly. Check for leaks, broken or clogged heads, and other problems, or engage an irrigation professional to regularly check your system. Clean micro-irrigation filters as needed.

Get your head adjusted.

Correct obstructions in sprinkler heads that prevent sprinklers from distributing water evenly. Keep water off pavement and structures.

Go with a pro.

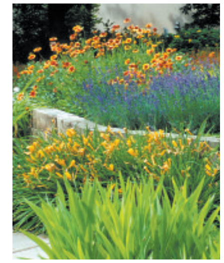
A professional can perform an irrigation audit and uniformity test to make sure areas are being watered evenly. This can be especially helpful if you have areas being under-watered or brown spots. The Irrigation Association (IA) maintains an online list of IA Certified Landscape Irrigation Auditors.

Get smart.

Climate or soil moisture sensor-based "smart" controllers evaluate weather or soil moisture conditions, then calculate and automatically adjust the irrigation schedule to meet the specific needs of your landscape.

Flip to a switch.

Rain shutoff switches, required by law in many states, turn off your system in rainy weather and help compensate for natural rainfall. This inexpensive device can be retrofitted to almost any system.



Easy does it.

Install low-volume micro-irrigation for gardens, trees, and shrubs. Micro-irrigation includes drip (also known as trickle), micro spray jets, micro-sprinklers, or bubbler irrigation to irrigate slowly and minimize evaporation, runoff, and overspray.

Watch the clock.

Water when the sun is low or down, winds are calm, and temperatures are cool—between the evening and early morning—to reduce evaporation. You can lose as much as 30 percent of water to evaporation by watering mid-day.

Less is more. Saturate root zones and let the soil dry. Watering too much and too frequently results in shallow roots, weed growth, disease, and fungus.

Don't Send Money Down the Drain!

Learn to water smart to save money this summer.

Most homeowners overwater their yard, unwittingly wasting money every time they take out the hose or turn on the sprinklers. Adopting water-savvy habits not only helps reduce this waste, it saves money while promoting a healthier lawn and landscape. To raise awareness of the benefits of smart irrigation practices, the Irrigation Association® has named July *Smart Irrigation Month*.

"Water use issues have become a big concern in communities across the United States," says Irrigation Association Executive Director Tom Kimmell. "A well-trained irrigation professional, working with today's technology can save homeowners time and money, and provide better results." One of the goals of *Smart Irrigation Month* is to provide homeowners with smart irrigation practices to help them get the best results when working with irrigation professionals whether installing, maintaining or improving their systems.

Right, From the Start

Create an efficient irrigation system.

Creating an efficient irrigation system requires specialized knowledge and understanding of irrigation design principles and local environmental conditions - something most weekend gardeners don't have. Complying with local installation codes is another consideration. Similarly, the best irrigation design won't perform well if the installation is done incorrectly or if inferior components are used. Something as simple as selecting the correct type of pipe can mean the difference between a system that lasts and one that suffers from ongoing repair problems.

Irrigation systems also need regular maintenance to keep them working efficiently year after year. Damage from lawn equipment or from improper winterization can cause leaks and failures. The best bet is to hire an Irrigation Association Certified Irrigation Designer or Contractor to design and install the new system for you. To make finding a qualified contractor easier, the Irrigation Association maintains a registry of trained, certified irrigation professionals. Always be sure to check the credentials of a prospective contractor and don't be afraid to ask questions. Hiring a well-trained contractor and insisting on high-quality components is the best start to ensure your system will operate at peak efficiency.

The Irrigation Association is offering these tips in conjunction with *Smart Irrigation Month* recognized in July, typically the month when the most water is used for irrigation, to draw attention to efficient irrigation technology and practices.

Design It Right

An efficient irrigation system is one that works properly all the time. Invest in a good designer or contractor at the start, one who takes into consideration the unique water requirements of your landscape and local weather conditions.

- **Plan your irrigation zones carefully.** Be sure that your system will have enough capacity to handle all the plant types you will be watering. The more irrigation zones you plan for, the more tailored the watering schedule can be.
- **Use the best components you can afford.** This will pay dividends in the end.
- **Check the water pressure.** Low or high water pressure can seriously affect sprinkler performance. Sprinklers should be selected to match the on-site pressure.

Contract It Right

A vital step in creating a high quality, efficient irrigation system is choosing the right irrigation contractor. Make sure the contractor is certified and, if required, licensed to install irrigation systems in your area. Check references.

- **Is the contractor properly insured?** Ask to review a copy of their policy.
- **Visit the Irrigation Association at: www.irrigation.org.** Review the *Tips for Hiring a Contractor* and the names of Certified Irrigation Contractors in your area.
- **Obtain several bids.** Understand the differences between them. The lowest bid may not be the best deal.

Install It Right

When installing a new system, use components that will provide the greatest flexibility in watering your landscape. Different types of plants have different watering needs that may change over time. Your system should allow you to apply the right amount of water for each type of plant by the most effective method.

- **Always install excess irrigation zone capacity.** Irrigation zones are areas of the yard that are watered by the same irrigation valve and plumbing. Installing extra connections now makes it easier and less expensive to expand your irrigation system later.
- **Install the required backflow prevention device.** A backflow prevention device is required by the National Plumbing Code for all irrigation systems. It keeps irrigation system water out of the main water supply, preventing contamination. Your contractor will know which type is specified for your area.
- **Install lines at the correct depth.** Irrigation lines should be installed at a depth where aeration and other lawn maintenance will not interfere with them.

Landscape It Right

A well-designed landscape and a well-designed irrigation system need to work well together to maximize savings.

- **Use turf or plant species appropriate to the climate** whenever possible.
- **Practice "hydro-zoning"** by grouping plants with similar water needs close together.
- **Confine non-turf plants to plant beds** to make it easier to water lawn areas.

Schedule It Right

Modern irrigation controllers allow the user to easily adjust their watering schedules to suit all sorts of landscape watering needs.

- **Schedule each individual zone** in your irrigation system to account for sun, shade and wind exposure.
- **Consider the soil type in each zone,** as it affects the how quickly water can be applied and infiltrate without runoff.
- **Adjust your watering schedules** at least seasonally to account for changing water needs. Monthly or weekly adjustments will save substantially more water and improve plant health.

Water It Right

Watering at the right time of day, when the sun is low, the winds are calm and temperatures are cool will save a lot of water - as much as 30% - by reducing evaporative losses. The best time to water is late afternoon, evening and just before sunrise.

- **Saturate the root zones.** Roots are generally within the top six inches of soil. Then let the soil dry. Watering too frequently results in shallow roots, weed growth, disease and fungus.
- **Don't water too long.** Water each zone several times for short periods rather than in one long session. For example, rather then watering for 15 minutes, water three times for 5 minutes, allowing time for the water to soak into the ground before watering again. This reduces run-off.
- **Take careful aim.** Be sure your sprinklers are not watering driveways, sidewalks, patios, or buildings. It's all water down the drain.

Finally, consider installing "smart" technology that automatically adjusts your system to apply water based on factors such as evaporation, precipitation, plant water use, or soil moisture. By replacing only the water that is needed, smart systems offer substantial savings - and convenience.

Another option is a rain sensor. This little device senses precipitation and, depending on the amount of rainfall, stops the system from irrigating. When the rain stops the system picks up right where it should. Soil moisture sensors are another innovation that can be added at any time. These long metal probes measure the soil's moisture content at the root zone. Basic sensors turn off the system when water is adequate; "smart" models turn on the system to maintain correct moisture levels.

Fine-Tune Your Irrigation System To Save Money and See Better Results

JULY SMART IRRIGATION MONTH

Residential irrigation systems offer convenience in protecting your landscape investment. Enjoy your yard, keep it healthy and beautiful while you water efficiently, save time *and* money.

With some simple practices and new technology, existing irrigation systems can be made more efficient, lowering your water bill, reducing run-off and eliminating waste. Waterwise habits will result in a *healthier* lawn and landscape, in addition to conserving water.

The Irrigation Association® offers these water-saving tips to maintain and update automatic irrigation systems:

1) **Adapt your watering schedule to the weather and the season**. Familiarize yourself with the settings on your irrigation controller. Adjust the watering schedule regularly to conform with current weather conditions.

2) **Schedule each individual zone in your irrigation system.** "Scheduling" accounts for the type of sprinkler, sun or shade exposure and the soil type for the specific area. The same watering schedule should almost never apply to all zones in the system.

3) **Inspect your system monthly**. Check for leaks, broken or clogged heads, and other problems, or engage an irrigation professional to regularly check your system. Clean micro-irrigation filters as needed.

4) **Adjust sprinkler heads**. Correct obstructions that prevent sprinklers from distributing water evenly. Keep water off pavement and structures.

5) **Get a professional system audit**. Hire a professional to conduct an irrigation audit and uniformity test to make sure areas are being watered evenly. This can be especially helpful if you have areas being under-watered or brown spots. The Irrigation Association maintains an online list of IA Certified Landscape Irrigation Auditors.

6) **Consider "smart" technology**. Climate- or soil moisture sensor-based controllers evaluate weather or soil moisture conditions and then calculate and automatically adjust the irrigation schedule to meet the specific needs of your landscape. Learn more at http://www.irrigation.org/swat/homeowners/.

7) **Install a rain shutoff switch…inexpensive and effective.** Required by law in many states, these money-saving sensors turn off your system in rainy weather and help to compensate for natural rainfall. The device can be retrofitted to almost any system.

8) **Consider low volume drip irrigation for plant beds.** Install micro irrigation for gardens, trees and shrubs. Micro irrigation includes drip (also known as trickle), micro spray jets, micro-sprinklers, or bubbler irrigation to irrigate slowly and minimize evaporation, runoff and overspray.

9) **Water at the optimum time.** Water when the sun is low or down, winds are calm and temperatures are cool - between the evening and early morning - to reduce evaporation. You can lose as much as 30% of water to evaporation by watering mid-day.

10) **Water only when needed.** Saturate root zones and let the soil dry. Watering too much and too frequently results in shallow roots, weed growth, disease and fungus.

Best advice for a healthy, drought- and stress-tolerant lawn and landscape: use less water. These tips will help keep more money in your wallet instead of sending it down the drain.

Irrigation Association® • www.irrigation.org
6540 Arlington Blvd. Falls Church, VA 22042-6638 USA • Tel: 703-536-7080

Keeping Up Appearances

A well-maintained irrigation system is an efficient irrigation system.

Whether you have a small urban yard using a simple irrigation system, or you are watering acres using the latest irrigation technology, proper maintenance is important. Without regular maintenance your water-stingy irrigation system could turn into a water guzzler. Irrigation systems are exposed to the elements year-round, as well as everything from lawn mower blades to the family dog. That means they need to be inspected and adjusted at least once a year.

The most convenient and effective way to verify your system is to have an Irrigation Association Certified Landscape Irrigation Auditor inspect it before the growing season begins. This Irrigation Association certified professional will inspect the entire system and adjust it for peak performance, replacing any damaged components. The auditor can conduct a uniformity test to make sure all areas are getting the proper amount of water and that your sprinklers are placed correctly. You may discover that a few sprinklers need adjustment to achieve proper “head-to-head” coverage in your yard. If needed, the auditor can even create a new watering schedule for an old system to make it more efficient.

Here are a few essential maintenance tips, offered by the Irrigation Association in recognition of the designation of July as *Smart Irrigation Month*, to ensure that your irrigation system is always operating at its best:

- **Learn how to program your irrigation controller.** Adjusting the run times (number of minutes) and the frequency of watering (daily, twice a week, etc.) based on current local weather conditions is the best way to give your plants the water they need. You should also adjust settings for seasonal changes in the plants’ water needs and the weather.

- **Inspect the irrigation system for leaks.** Leaks are a huge water waster. A good contractor can perform regular maintenance checks for leaks, broken or clogged spray heads, and other problems. Ask them to show you common problems to watch for between visits.

- **Clean the filter screens if clogged.** All sprinklers from the biggest to the smallest use filters to prevent spray nozzles and emitters from getting clogged and degrading the spray pattern.

- **Adjust sprinkler head height.** Stationary and rotary sprinkler heads need a certain amount of clearance over the plants to operate correctly. Over time plants grow and turf can build up around sprinklers interfering with the spray pattern. Periodically checking the sprinklers for proper clearance is very important. Taller risers may need to be added, or in-ground sprinklers reset so they can distribute water evenly.

- **Adjust spray patterns and positions.** Water that lands on sidewalks, patios, and decks, etc. is water wasted. Sprinklers can get whacked out of adjustment, so having their aim checked yearly is a must.

- **Winterize!** If you live in a climate where freezing can occur you need to have your system properly winterized in the fall. This is usually best left to an irrigation contractor, who has the equipment to ensure the system is clear of any water that could freeze and crack pipes, valve bodies, and sprinklers. A thorough winterization - and proper spring start up - is cheap insurance.

Finally, check the pressure. Just because the pressure was correct when the system was installed doesn’t mean it still is. Pressure that is too low or too high can seriously affect the efficiency of your irrigation system. So, have the pressure checked and adjusted every year.

Teaching an Old Irrigation System Some New Tricks

Update your irrigation system for greater efficiency.

Saving water is in every homeowner's best interest. You save money and help conserve the local water supply at the same time. Just because you have an old irrigation system installed in your yard doesn't mean that you can't update it to take advantage of the newest, most efficient technology. Your irrigation contractor can tell you what components are best suited to your system and offer the greatest benefit.

Here is a quick look at a few of the options offered by the Irrigation Association in recognition of *Smart Irrigation Month* in July:

- **Add "smart" technology.** Smart technology refers to irrigation devices that can adjust your watering schedule without direct input from you. Climate-based controllers that adjust watering schedules based on weather conditions and plant information can have a profound impact on your water usage. Find out more about smart technology at: www.irrigation.org/swat/homeowners.

- **Install a centralized irrigation controller.** Typically used on golf courses, these systems are finding their way into more residential and commercial applications, especially for large lawns where water is expensive. With just a few computer keystrokes or by remote control, the user can reprogram controllers in multiple locations. Plus, watering schedules can be saved and reused with ease.

- **Have a rain sensor installed...low-cost, excellent value!** This device can be added to almost any system and will automatically override the system settings to prevent watering when it rains. They are inexpensive, simple to install, and they save water and money.

- **Add a pressure regulator.** Incorrect water pressure can cause conditions such as "misting." Misting occurs when water is turned to vapor rather than droplets at the sprinkler from too much water pressure. Most of the misted water just gets blown away. While a pressure regulator may not help your neighbor's lawn, having one installed by a qualified contractor could do wonders for yours.

- **Install micro-irrigation.** Some of your old sprinklers may be replaceable with micro or drip irrigation components. Your irrigation professional can tell you if micro irrigation is suitable for any of your existing irrigation zones. The water savings from switching may be substantial. Micro irrigation works well in gardens and around trees and shrubs and minimizes evaporative water loss and runoff.

Other relatively inexpensive upgrades include installing check valves on the sprinkler lines and adding matched precipitation rate nozzles. Check valves installed on slopes prevent water from draining downhill and flooding around the lower sprinklers. Installing matched precipitation rate nozzles can save water by ensuring uniform water application in every zone. These nozzles are engineered to deliver water at the same rate, no matter what the pattern. So a zone that has full-circle patterns mixed with partial-circle patterns will be watered evenly, reducing wasteful overwatering.

Plan Right and Plant Right To Save Water

Plan your landscape carefully to save water and money.

Conserving water doesn't have to involve a lot of trenching and plumbing. Whether you own an automatic irrigation system or not there are many ways to save water in a landscape. These tips can be implemented as part of your normal landscaping and gardening routine.

- **Aerate your lawn and around trees** at least once a year to ensure good water penetration. Turn and cultivate soil, adding compost, or fertilizer, when planting. This helps the soil hold moisture and produces healthier plants that require less water to remain strong.

- **Mulch well around plants, bushes and trees.** Using 2-4 inches of mulch reduces evaporation, moderates soil temperatures, improves water penetration, and helps to control weeds that compete for water.

- **Landscape to suit your lot.** Evaluate conditions like sun and shade, dry and damp areas, what size plants you want now and at maturity, and how you want to use each section of your yard.

- **Purchase turf or plant species that have low water requirements and are well suited to the environment and the area of the yard** where they will be planted.

- **Hydro-zone your yard.** That means grouping landscape plants with similar moisture needs in the same area. Separate them from turf areas, which have different water requirements.

- **Plant in spring or fall** when less water is needed to establish new plants. Smaller plants also need less water to become established.

- **Create functional turf areas,** for example, in play areas. Avoid using turf where it's difficult to irrigate properly, such as on steep slopes. Good alternatives for hard-to-irrigate areas are ground covers, perimeter plants and mulch.

- **Plant shade trees** to lower the air and soil temperatures. This will reduce soil moisture loss.

- **Maintain your yard** by mowing, weeding, pruning and irrigating as needed. A well-maintained yard requires less water.

Saved Water Is Money in the Bank

Whether getting ready to install an efficient new irrigation system, or simply looking for ways to save money using an existing system, there are many choices available. Consulting with a qualified irrigation specialist will make those decisions easier. Watering your landscape with a properly planned, maintained and operated irrigation system will save you money *and* you'll be doing your part to help extend the local water supply. Most importantly, whether during *Smart Irrigation Month* in July, or any other time of year, practice better water-saving habits everyday.

For more information on products, services and certified irrigation professionals across the country, visit the Irrigation Association at www.irrigation.org.

Smart Irrigation Systems:
A "Greener" Idea

If you're a typical homeowner, you probably put your automatic sprinkler system into the same category as your home's heating and cooling system. You expect it to work reliably and efficiently with minimum fuss. The latest technology offers just that--and more.

A sprinkler system is one area of your home where a little knowledge can go a long way to conserve water while maintaining a healthy yard that's the envy of the neighborhood.

In conjunction with *Smart Irrigation Month* in July, the Irrigation Association® is offering information about efficient irrigation technology and tips. Since it's a peak month for water usage, July is a good time to learn more about making the most of water resources.

The new generation of "smart" sprinkler systems can be viewed as sophisticated communications systems that happen to dispense water, rather than a network of underground valves, pipes and pop-ups controlled by a wall-mounted timer.

Thanks to advances in electronics and communications, sprinkler systems can monitor data, such as climate, site conditions, or soil moisture, and automatically adjust your sprinkler's watering schedule. Smart systems keep your grass green while saving your "green."

The secret to smart systems is the controller. Smart controllers use either weather and/or site data to automatically determine when and how long to water. Then your sprinklers apply just enough water at exactly the right time in each zone of your yard.

Here are highlights of the substantial benefits that smart controllers offer:

Saves Water

Environmentally friendly smart systems conserve water by watering only as much as needed. Smart sprinklers work with Mother Nature to automatically suspend watering during rain, freezing or high wind conditions or compensate for rainfall. Plus a smart system can keep your lawn and landscape healthier by avoiding the pitfalls of inadequate watering, too frequent watering, or the more common problem of overwatering, which often results in disease or poor root systems.

Saves Money

Because smart systems water only when needed, time the applications to allow water to soak-in, and avoid application when water might evaporate or blow away, you may reduce your annual water bill as much as 30 percent. On top of that, you may qualify for rebates from your local water board or utility for the purchase of specific smart controllers.

Saves Time

Once your irrigation installer has programmed the site data into the smart system, the controller adjusts the watering schedule based upon local conditions and/or soil moisture and by zone. This "set and forget" technology is perfect for frequent travelers and ideal for vacations or second homes used only part of the year.

Adds Convenience

Smart controllers require little direct access, so they provide an excellent solution for sites where it is difficult to access the controller. There's no need to reprogram the controller due to seasonal weather changes.

Upgrading your current controller may be an option. Some new components are designed as easy add-ons to an existing controller, eliminating the need to replace your system's "brains."

So keep the green where it belongs--on your lawn and in your wallet--with a smart irrigation system. Learn more at www.irrigation.org/smartmonth.htm.

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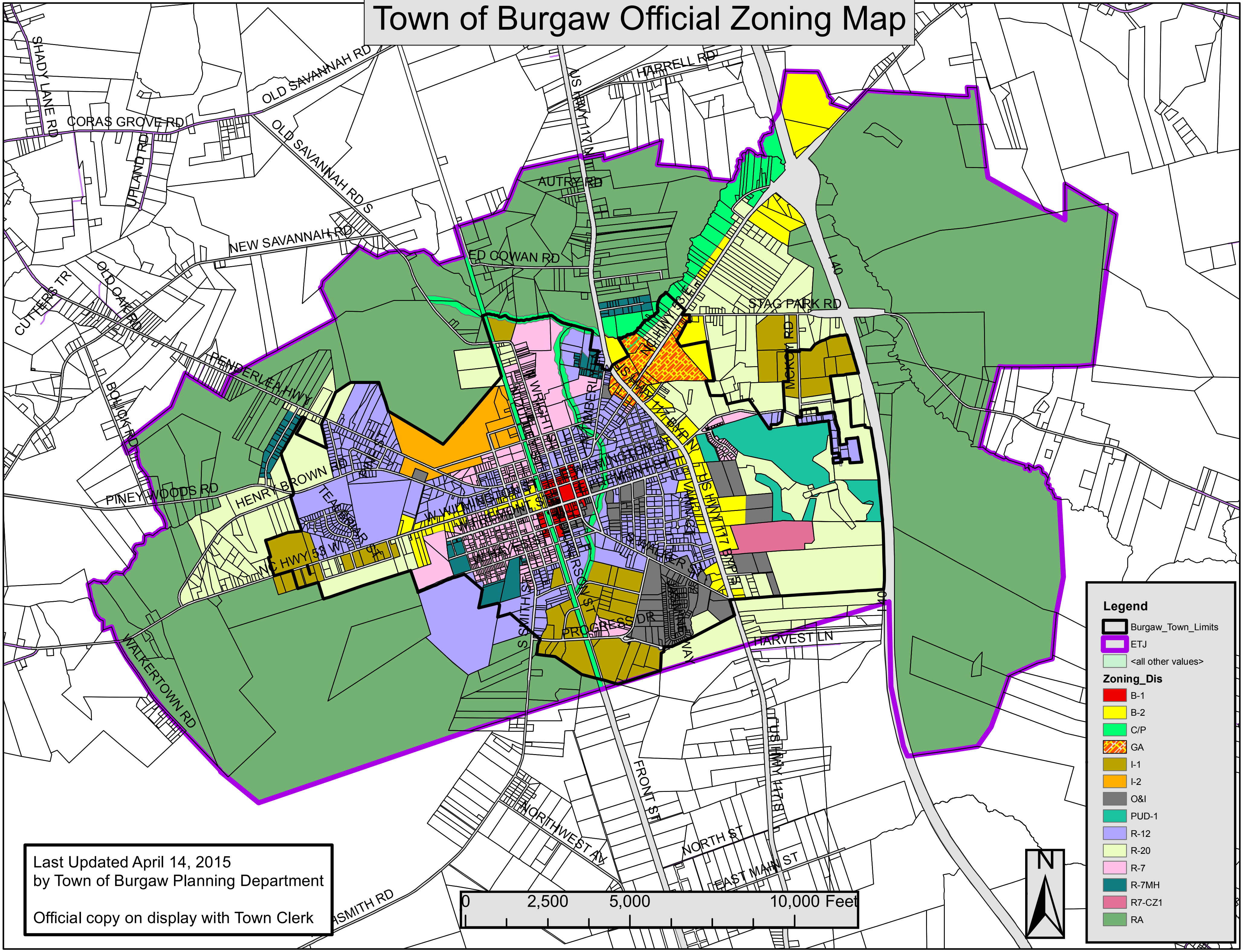
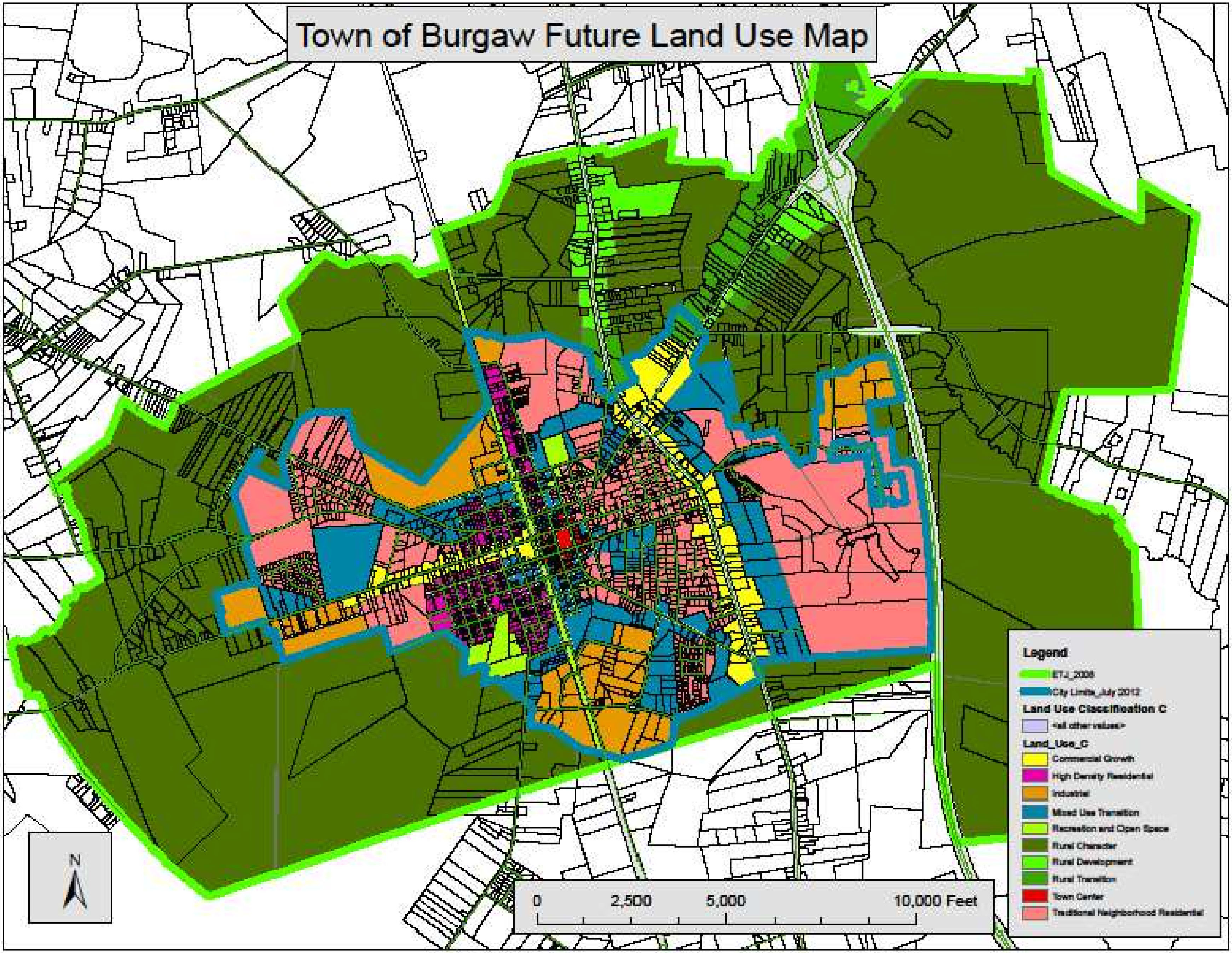
Irrigation Association® • www.irrigation.org
6540 Arlington Blvd. Falls Church, VA 22042-6638 USA • Tel: 703-536-7080

Town of Burgaw Official Zoning Map



Last Updated April 14, 2015
by Town of Burgaw Planning Department

Official copy on display with Town Clerk


Town of Burgaw Future Land Use Map
Legend
ETJ_2008
City Limits_July 2012
Land Use Classification C
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Land_Use_C
Commercial Growth
High Density Residential
Industrial
Mixed Use Transition
Recreation and Open Space
Rural Character
Rural Development
Rural Transition
Town Center
Traditional Neighborhood Residential
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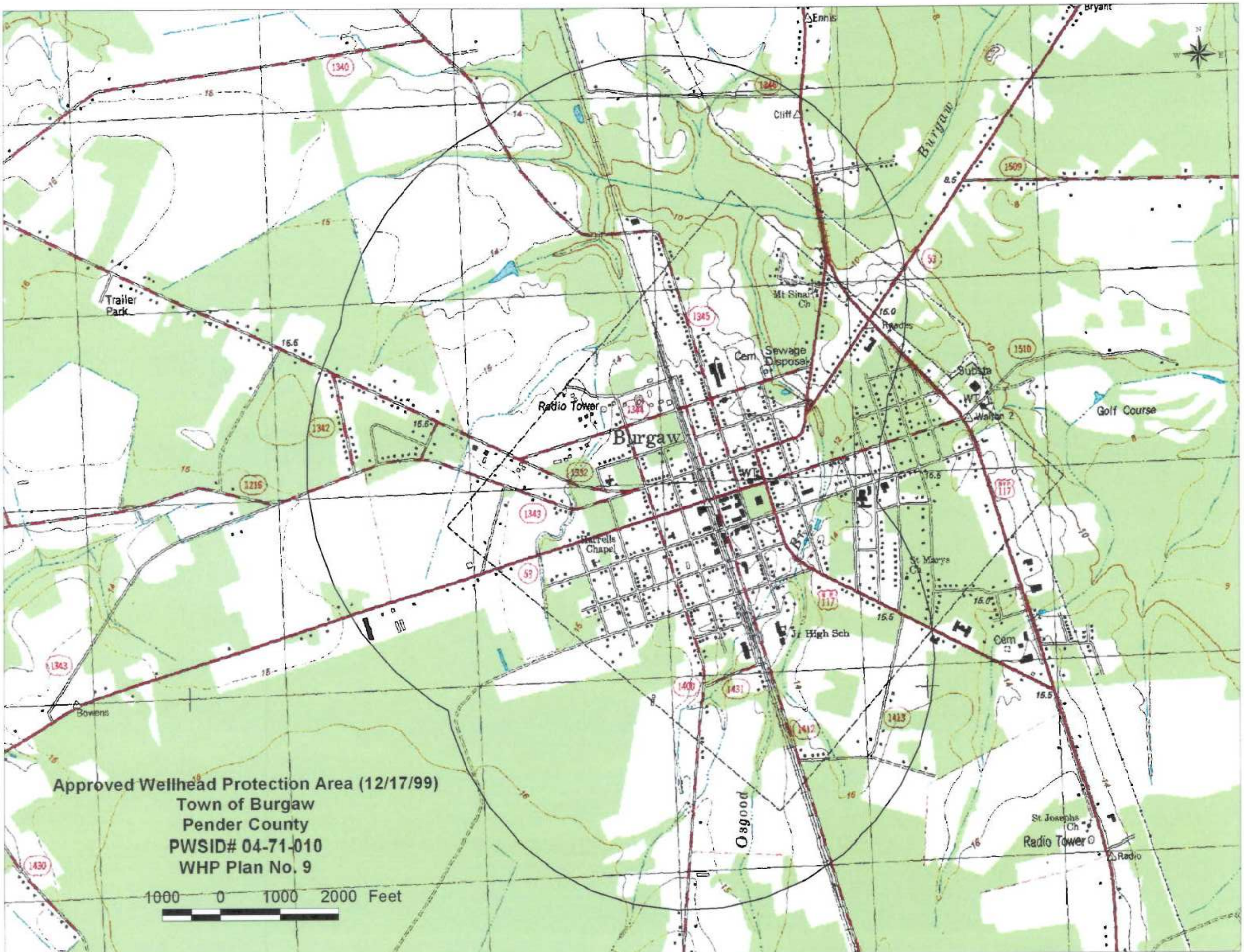


Approved Wellhead Protection Area (12/17/99)
Town of Burgaw
Pender County
PWSID# 04-71-010
WHP Plan No. 9

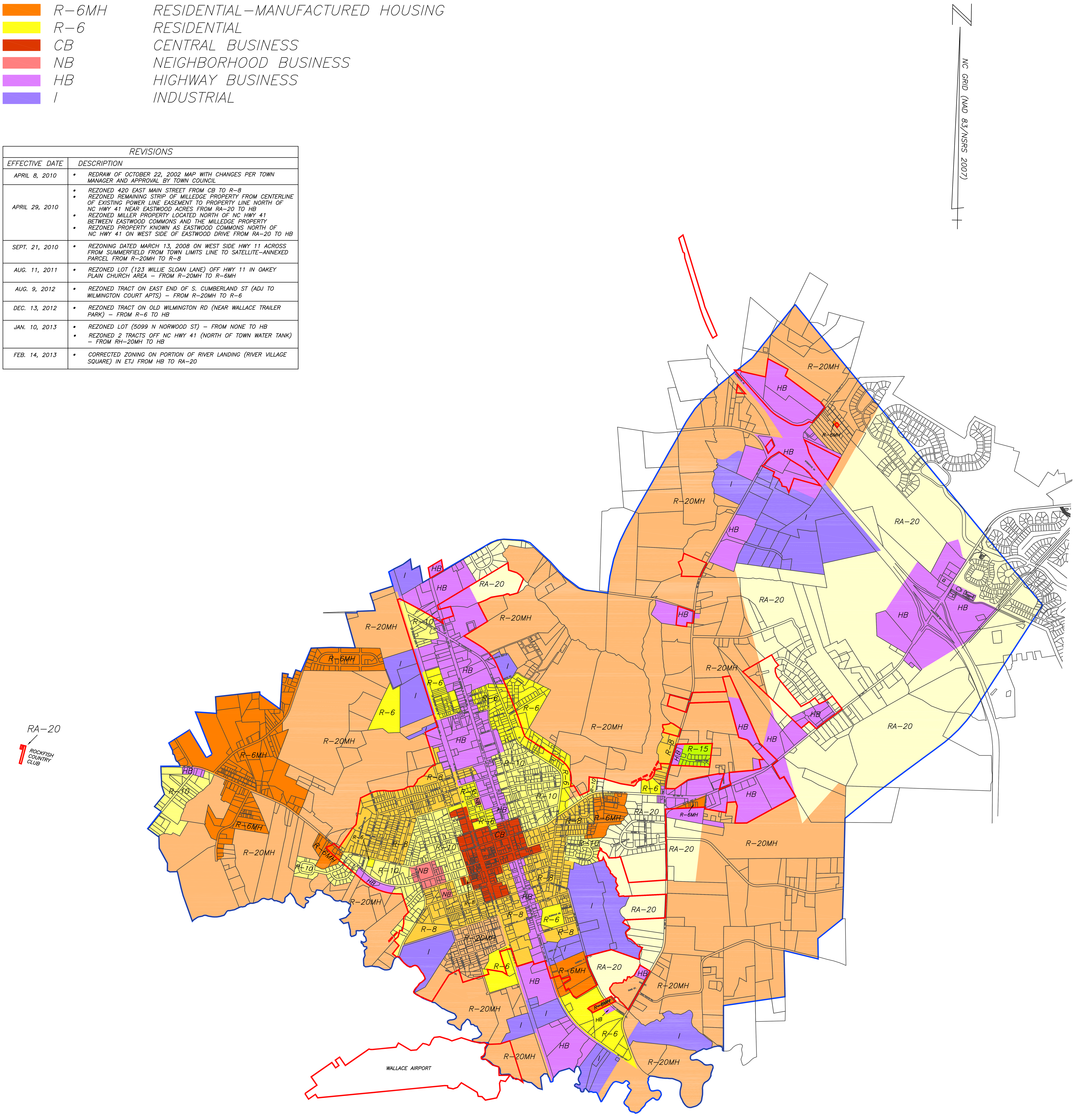
LEGEND

- TOWN LIMITS LINE
- EXTRATERRITORIAL JURISDICTION LINE
- TAX PARCEL LINE

ZONING CLASSIFICATIONS

RA–20	RESIDENTIAL/AGRICULTURAL
R–20MH	RESIDENTIAL–MANUFACTURED HOUSING
R–15	RESIDENTIAL
R–10	RESIDENTIAL
R–8	RESIDENTIAL
R–6MH	RESIDENTIAL–MANUFACTURED HOUSING
R–6	RESIDENTIAL
CB	CENTRAL BUSINESS
NB	NEIGHBORHOOD BUSINESS
HB	HIGHWAY BUSINESS
I	INDUSTRIAL

REVISIONS	
EFFECTIVE DATE	DESCRIPTION
APRIL 8, 2010	• REDRAW OF OCTOBER 22, 2002 MAP WITH CHANGES PER TOWN MANAGER AND APPROVAL BY TOWN COUNCIL
APRIL 29, 2010	• REZONED 420 EAST MAIN STREET FROM CB TO R–8 • REZONED REMAINING STRIP OF MILLEDGE PROPERTY FROM CENTERLINE OF EXISTING POWER LINE EASEMENT TO PROPERTY LINE NORTH OF NC HWY 41 NEAR EASTWOOD ACRES FROM RA–20 TO HB • REZONED MILLER PROPERTY LOCATED NORTH OF NC HWY 41 BETWEEN EASTWOOD COMMONS AND THE MILLEDGE PROPERTY • REZONED PROPERTY KNOWN AS EASTWOOD COMMONS NORTH OF NC HWY 41 ON WEST SIDE OF EASTWOOD DRIVE FROM RA–20 TO HB
SEPT. 21, 2010	• REZONING DATED MARCH 13, 2008 ON WEST SIDE HWY 11 ACROSS FROM SUMMERFIELD FROM TOWN LIMITS LINE TO SATELLITE–ANNEXED PARCEL FROM R–20MH TO R–8
AUG. 11, 2011	• REZONED LOT (123 WILLIE SLOAN LANE) OFF HWY 11 IN OAKEY PLAIN CHURCH AREA – FROM R–20MH TO R–6MH
AUG. 9, 2012	• REZONED TRACT ON EAST END OF S. CUMBERLAND ST (ADJ TO WILMINGTON COURT APTS) – FROM R–20MH TO R–6
DEC. 13, 2012	• REZONED TRACT ON OLD WILMINGTON RD (NEAR WALLACE TRAILER PARK) – FROM R–6 TO HB
JAN. 10, 2013	• REZONED LOT (5099 N NORWOOD ST) – FROM NONE TO HB • REZONED 2 TRACTS OFF NC HWY 41 (NORTH OF TOWN WATER TANK) – FROM RH–20MH TO HB
FEB. 14, 2013	• CORRECTED ZONING ON PORTION OF RIVER LANDING (RIVER VILLAGE SQUARE) IN ETJ FROM HB TO RA–20



MAP UPDATED FOR THE TOWN OF WALLACE BY:

MANLEY D. CARR, PLS
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LAND SURVEYORS – LAND PLANNERS
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EXISTING ZONING MAP
FOR THE

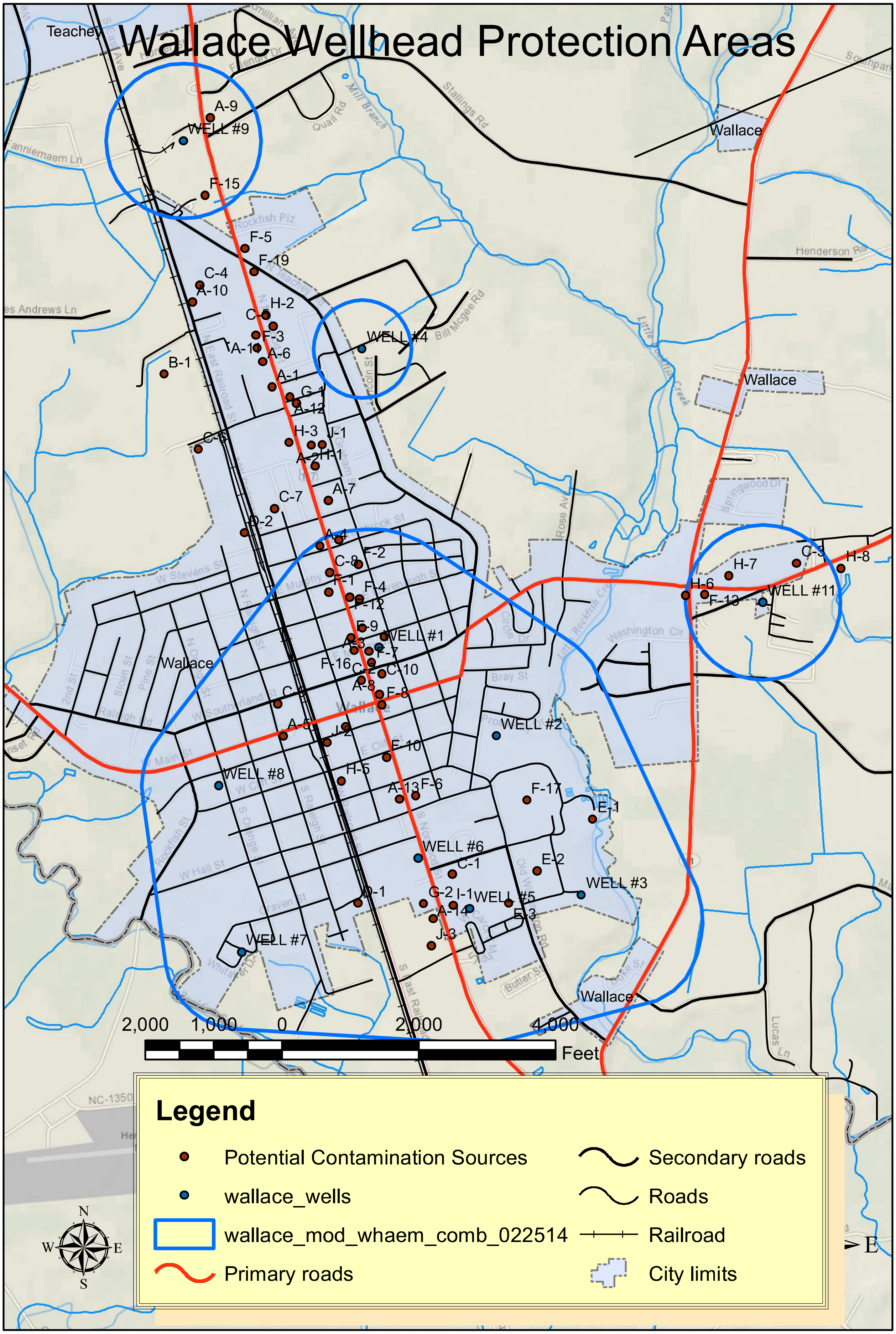
TOWN OF WALLACE

TOWN OF WALLACE –
ISLAND CREEK TOWNSHIP – DUPLIN COUNTY – NORTH CAROLINA
SCALE: 1" = 1500'

EFFECTIVE DATE: FEB. 14, 2013

1500 0 1500 3000 4500
GRAPHIC SCALE – FEET

FILE No. DG–18–64



Wallace Wellhead Protection Areas
Legend
Potential Contamination Sources
wallace_wells
wallace_mod_whaem_comb_022514
Primary roads
Secondary roads
Roads
Railroad
City limits
2,000 1,000 0 2,000 4,000
Feet

APPENDIX H

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Agency Comment Response Matrix

Environmental Assessment for the Proposed Pender County Interbasin Transfer

Completed January 4, 2017

No.	Division	Point of Contact	Role/Office	Comment	Response to comment
1	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	What peaking factor was used to determine the max month average day demand?	As discussed in the Section 2 to the EA and detailed in Appendix C to the EA, variability is an inherent part of water demand and uncertainty is inherent in any type of forecast. With an understanding of the variables that influence the need for future water supply and future IBT, several factors were incorporated in the forecast to represent both variability and uncertainty in the forecast of future water demand. These factors included the max month average day peaking factor. This peaking factor was included in the forecast analysis as a range of values from 1.10 to 1.40, based on historic water usage data.
2	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	According to the latest local water supply plan, Pender County currently has an available water supply of 6 MGD with plans to secure another 6 MGD in the future for a total of 12 MGD. How will the county supply the projected max month average day demand of 14.5 MGD?	Included on pg 1-2, the Water Supply Agreement states that "LCFWASA 'will deliver raw water to the County in an amount sufficient to meet the County's raw water needs from the Authority, which currently does not exceed 6 MGD". Pender County will extend their contract with LCFWASA for their future water supply from the Cape Fear River.
3	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	It is understood that the county and co-applicants are working on updating their local water supply plans. However, all relevant data presented in the Environmental Assessment must align with data in the 2015 local water supply plans.	Local Water Supply Plan Updates are in process. Information in the LWSP and EA will be aligned.
4	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	According to DWR's hosted site Water Resources Information, Storage, Analysis & Retrieval System (WRISARS), the 7Q10 for the water year (1 October - 30 September) from 1982 to 2016 (post-Jordan) is 277 cfs. The equivalent volume associated with the 20%7Q10 is 55 cfs, or 29 mgd. Although the FONSI included in the draft EA, Appendix B does not specifically state a withdrawal volume associated with the approved project, LCFWASA interest was long-range planning based on the calculated 20%7Q10 threshold of 106.6 mgd, or 165 cfs, and a 7Q10 value of 533 mgd, or 825 cfs from DWR's 2002 Cape Fear water supply plan. This difference in values illustrates one issue associated with long-range planning, the installation of infrastructure based on these long-range projections and the uncertainties inherent in the intervening meteorological conditions. The incremental increase of water withdrawals at L&D 1 toward full utilization may require a reevaluation of impacts at some point in the future.	Comment noted. We are aware of the holistic basin-wide analysis being completed by DWR - Draft Cape Fear River Water Supply Evaluation - that focuses on the water resources portion of this comment. One item this comment needs to consider is the importance of long-term utility planning for infrastructure that is often financed over a 20 to 30 year period, and can have life cycles that last as long as 100+ years (pipes). Not only do utilities need to consider natural resources when making their infrastructure planning decisions, they also have a direct responsibility to their utility customer (citizens of NC) to be making sound financial decisions on very expensive infrastructure, that in some cases can take up to a decade to permit, design, finance, and construct.
5	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Pages 5-5 and 5-6: "The effect below L&D #1 from Pender County's IBT, as well as other public water supplies accessing water from the Cape Fear River, during drought periods will be mitigated by the implementation of the State-required WSRPs. These WSRPs can reduce water demands by up to 20 to 30 percent during these extreme low flow periods; as stated previously the WSRPs for public water supplies downstream of Jordan Lake are not built into the CFNRBHM and therefore the results of hydrologic modeling represent a conservative evaluation of flows during drought conditions." The applicant needs to quantify the savings associated with water system's WSRPs not incorporated into the OASIS model that would serve to mitigate impacts during drought flow conditions. The document needs to provide in more detail and by system the supporting evidence for the proposed 20 to 30 percent savings. The document should discuss whether industrial/utility/agricultural uses are subject to WSRP reductions and the associated ramifications.	WSRPs for public users downstream of Jordan Lake are required to be as stringent as others in the basin, as required by 15A NCAC 02E .0600. Per the NCAC, industrial users shall be "consistent with industry water efficiency and drought response guidelines"; in addition, agricultural users shall "reduce water usage to the maximum extent possible". All WSRPs are reviewed and approved by the State. The language in the rule at the link below states that during exceptional drought designation "water users shall reduce water use by at least 20% below the amount used in the month prior". http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2002%20-%20environmental%20management/subchapter%20e/15a%20ncac%2002e%20.0614.pdf Based on the 20% reduction target in the NCAC, the reduction in water withdrawal for those withdrawals downstream of Jordan Lake could be approximately 43 - 52 MGD (66 - 80 CFS) depending on the time of year of the drought occurrence. This estimate includes reductions for Pender County and all withdrawals at L&D #1. This information will be added to the EA. .
6	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Exhibits 5-1 (page 5-4), 5-2 (page 5-5), and 5-7 (pages 5-10 and -11) should in addition provide comparisons to the 2010 Baseline. This comparison will provide insight into the cumulative impacts associated with upstream uses. Also, Exhibit 5-7 should be kept together on a single page for ease of comparison.	Values for the 2010 Baseline are already included in these exhibits for comparison. Formatting for Exhibit 5-7 has been updated.
7	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Page 5-5 and Page 18 of Appendix F: "These changes are not significant from a standpoint of when they occur and that there are 29,858 days of historical data included in the hydrologic evaluation." COMMENT: Although there are >29K days in the total 81 years of record there are <13k days within the spawning months' window. The applicant should clarify and revise percentages if necessary to reflect this.	Percentages for data within the spawning months are presented in Section 5.1.3.1.

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No.	Division	Point of Contact	Role/Office	Comment	Response to comment
8	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Pages 5-8 to 5-9: "In 2014, NCDEQ indicated that a change to the classification of the LCFRE from Class SC to Class SC Sw was appropriate to recognize the primary influence of natural drainage from riverine and saltwater marsh systems in the watershed on DO concentrations. The SC Sw standards allow DO levels of less than 5.0 mg/L if caused by natural conditions and pH levels of as low as 4.3 if resulting from natural conditions. Further analysis including a review of two decades of water quality data at five stations in this reach supported this reclassification and provided for the conclusion that water quality in the LCFRE is dominated by local, natural conditions found in the swamps adjacent to the river below L&D 1, as documented in a series of technical memos (CH2M HILL, 2014a and 2014b; Tetra Tech, 2014a and 2014b) developed for the reclassification process. It was concluded that these studies are also applicable to the proposed IBT and that any changes in instream flow from the IBT would result in insignificant changes in the factors that control water quality downstream of L&D #1. "It is not anticipated that the IBT will have a significant effect on the natural factors that control the water quality in the Lower Cape Fear River. This is due to the small volume of water the IBT represents in comparison to the typical river flow and range of natural variability in flow, as well as the adjacent swamp/marsh and tidal influences downstream of L&D #1." COMMENT: The reclassification of the Lower Cape Fear River to SC Sw is not a foregone conclusion. Also, not just the "small volume of water the IBT represents" should be considered but the cumulative impact of the entire pumping capacity at L&D1, as well as upstream impacts. Also, the tidal influence of the Cape Fear River below L&D1 may actually extend residence time of nutrients in the Lower Cape Fear River, which may in combination with extended low flows contribute to more frequent algal blooms.	We understand that the Legislature must approve, and update the rules, the NCDEQ and EMC's recommendations for reclassification of the Lower Cape Fear River. The recent water quality modeling analysis completed by a number of organizations, including modeling commissioned by DENR (now DEQ), identifying the factors that are driving water quality in the Lower Cape Fear River. The algal blooms in the Cape Fear River have typically occurred above L&D 1 and on one or two occasions were briefly apparent immediately below the L&D. Note that no blooms occurred in the river during the extremely low flows of 2002 and 2007 and have typically occurred during summers with moderately low flows (as identified in Comment #92), where the impacts of the cumulative withdrawals has a very minor effect. During extreme drought conditions, the saltwater wedge almost reaches L&D 1 which can have an inhibitory effect on bloom species. See Comment Response #92 for further discussion on low flows and water quality concerns.
9	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Page 5-11: "Based on a review of USGS gaging station data for 2007 through 2016, at L&D #1, it was identified that the water surface elevation for the 5th percentile flow for the 2045 Baseline scenario, 875 cfs, equated to a river stage of between 12.1 and 12.7 ft above MSL. The minimum water stage simulated as part of this evaluation was approximately 11.5 feet above MSL for the spawning period, 6 inches above the dam crest for L&D #1." COMMENT: Based on a review of the most up-to-date rating curve for the USGS gage located at L&D1, 875 cfs corresponds to a gage elevation of 14.96 ft. Apparently the rating curve's lowest reading is at 14.47 (458 cfs), so it's unclear if the gage is actually tied by survey to the dam crest and if the range from 12.1 to 12.7 actually is a much lower flow. The applicant should investigate and revise, reanalyze, and update if necessary. <waterdata.usgs.gov/nwisweb/cgi-src/get_ratings?file_type=exsa&site_no=02105769>	The USGS gaging station data, at Kelly, NC, was used to develop the stage-discharge relationship used in the water surface elevation comparison. It is noted on the USGS Kelly, NC gaging station webpage that there is a 2.9-foot NGVD gage correction factor for stage elevations. When applied to the gage elevations from the rating curve that brings those elevations in the range of those reported in the EA and Hydrologic Modeling Evaluation memo. This gage correction also brings the stage data from the USGS gage more inline with the elevation quoted by the USACE for the L&D #1 dam.

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No.	Division	Point of Contact	Role/Office	Comment	Response to comment
10	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F – Page 12: "The difference in flows between the 2045 baseline and 2045 Requested IBT is small even during the extreme droughts of the 1950's, 2002 and 2007." COMMENT: The applicant should refrain from qualitative descriptions as a substitute for quantitative comparisons. "In addition to the flow statistics presented in Table 3, the CFNRBHM was used to calculate the 7Q10 flow estimate below L&D #1 for each of the model scenarios. The 7Q10 flow is the seven-day low flow estimate with a 10-year recurrence interval; DWR uses this statistic as planning guidance for run-of-the river water supply withdrawals in the absence of a more detailed modeling evaluation or study. The 2010 Baseline scenario 7Q10 estimate is 348 cfs, this value is reduced by 68 cfs in the 2045 Baseline scenario and 89 cfs in the 2045 Requested IBT scenario. The reduction in this flow statistic that can be attributed to the proposed IBT is 21 cfs." COMMENT: The applicant should refrain from assigning a high degree of confidence to flow statistics generated by the hydrologic model out to 2045 given the high degree of uncertainty and "noise" associated with model data, project operations, and meteorological conditions during the intervening years.	Text has been updated to state: "...up to 1 percent different during the extreme droughts of the of the 1950's, 2002 and 2007." Comment noted, no confidence intervals have been identified in the text or assigned to any statistical values.
11	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F – Page 19, Table 14 COMMENT: The table does not include duration in terms of the number of consecutive days in low-flow windows. Also, table comparisons should be performed and presented to include 2010 and the 2045 Maximum withdrawal.	Figure has been updated to compare the number of consecutive days above the identified flow thresholds. NCDWR requested a comparison of the detailed nature of Figure 19 for the 2045 Baseline and 2045 Requested IBT scenarios as part of the review comments and meeting with CH2M on the Draft Hydrologic Modeling Evaluation memo. A comparison of the 2010 Baseline and 2045 Baseline will be added to the Hydrologic Modeling Evaluation memo.
12	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F – Attachment A: DWR Comment Matrix on Draft Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer • Response to Comment 5: "No modeling is intended for the receiving basin(s), as the CFNRBHM does not cover these basins, and there are no planned direct discharges in the receiving basins." Follow-up Comment: Clearly there are existing discharges to the receiving basins as Page 1-7 states the following: "PCU has 2.0 MGD of purchased capacity at the Town of Wallace WWTP, which discharges to the Northeast Cape Fear River basin. This capacity is available to PCU to handle wastewater flows in the future. Pluris, a private utility provider in the region, recently completed the development of a regional WWTP with 0.5 MGD of capacity in the US 17 corridor. This WWTP has a combined discharge strategy, partial infiltration and partial NPDES discharge. In addition, Pluris is also constructing a force main paralleling US 17 as a conveyance backbone to the WWTP. PCU has seen an increase in developers expressing interest in partnering with Pluris for wastewater treatment at this facility. This current facility is expandable up to 3 MGD." Also, reliance on DWR's decision to not fully incorporate these two sub-basins into the CFNRBHM does not negate the applicant's statutory responsibility to do a "comprehensive analysis of the impacts that would occur in the source river basin and the receiving river basin...." Given the number of mining and agricultural enterprises relying upon ground water in the two sub-basins, which may impact base flow conditions, and the number of wastewater discharges in the two sub-basins, which may impact water quality cumulatively, some degree of modeling is warranted. • Response to Comment 14: "Text will be clarified." Follow-up Comment: It does not appear that the text was clarified in the EA: Page 5-4: "River flow statistics reviewed, for all scenarios, included average and median flows, which are representative of average climatic conditions, and 10th and 5th percentile flows, which are representative of low flow periods."	Response to the comment on the Hydrologic Modeling Evaluation memo will be clarified. The effect of the transfer of water into the receiving basins will be a net positive gain in water quantity within these basins, and any modeling would demonstrate this benefit - albeit likely a small positive change If this water consumed in the receiving basin is infiltrated or is a direct discharge, water quality would need to be considered. In regards to the modeling of a direct discharge or a large community infiltration system, this will be warranted for each at the time of permitting. For an infiltration facility, a hydrogeological study will be required to ensure that the local conditions will be able to handle the infiltration loading. For a direct discharge, this discharge will need to be analyzed to ensure the receiving waters have sufficient assimilative capacity for the loading from the WWTP effluent. The appropriate time for this modeling is when a new or expanded facility requires a non-discharge permit or a NDPES permit. Text in the EA has been updated.
13	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.1, page 3-1: The numbered list of alternatives evaluated identifies the Proposed Project as number 3, while later text indicates that the preferred alternative is number 2.	The numbered list has been updated and indicates alternative number 2 as the Preferred Alternative.

Agency Comment Response Matrix

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14	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.9, page 3-7: It is unclear what the planning period is for the IBT request. Exhibit 2-13 presents the transfer amount of 14.5 mgd for the year 2045 and page 2-9 also references this total transfer amount based on rounded projections for 2045. So why does section 3.9 on page 3-7 refer to long-range water supply needs through the year 2047?	The planning period is through year 2045. Text has been updated.
15	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.1.1, page 4-11, second paragraph: There is now the final 2014 303(d) list and draft 2016 303(d) list. Suggest that you reference the most current list (draft 2016).	Removed reference to final 2014 303(d) list and added reference for draft 2016 303(d) list.
16	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Exhibit 4-12, page 4-25: The Atlantic sturgeon is not listed in Exhibit 4-12, after being identified in Section 4.5.1 as a federally listed endangered species. Is that because it is considered to be outside the Study Area?	Correct, the Atlantic sturgeon is located outside of the Study Area. It is not included in the USFWS threatened and endangered species list for Pender County. In addition, the Atlantic surgeon is not identified in the NCNHP NHEO data within the Study Area, but is identified within a one mile buffer on the coastal side of the Study Area.
17	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Exhibit 4-12, page 4-25: The first two abbreviations listed in the Notes section are not used in the table, therefore do not need to be included as footnotes. Also, consider adding a footnote to define "S/A."	Removed the first two abbreviations listed in the Notes sections. Added text "S/A = Listed because of similarity of appearance"
18	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1.3.1, page 5-11: The statement, "…it was identified that the water surface elevation for the 5th percentile flow for the 2045 Baseline scenario, 875 cfs, equated to…" appears to be incorrect. Exhibit 5-7 on page 5-10 indicates that the 5th percentile flow for 2045 Baseline is 846 cfs.	This value has been corrected in the text to 846 cfs.
19	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5-2, page 5-12: Would like more discussion/documentation that the soils in the projected area of growth will be able to accommodate the increased wastewater load.	Mitigation measures are discussed in Section 6, not Section 5. Section 6.2.1.7 Water Quality Protection documents Pender County's Water and Sewer Ordinance requirements for community or public wastewater treatment service for lot sizes greater than 12,000 square feet. Pender County Environmental Health Specialists within the County's Health Department conduct appropriate soils tests to determine the suitability of a property for a septic system. This reference to the Health Department will be added to Section 6.2.1.7. It is also important to note that a significant portion of the future demand will be from existing development currently served by groundwater wells. This is development that already has wastewater treatment in place (septic system or a community system).
20	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.1, page 6-1: Suggest first providing the full names for all of the federal and state regulations and programs listed before using their acronyms.	Comment noted. The first reference within the document to all federal and state regulations/programs is the full name while all following are listed by acronym.
21	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6: The subsections under Section 6.1 seem to provide a somewhat generic list of federal and state regulations and programs, but don't connect whether and how these programs will be applied to the proposed Pender County IBT, and don't address what the specific mitigation needs will be for the proposed IBT. Some programs included in this section don't seem applicable to an IBT, so are they necessary to include? If so, suggest providing a fuller explanation of how the programs are applicable.	Exhibit 6-1 provides linkage between each state and federal program presented in the EA and the environmental resources that they protect. These programs primarily mitigate for SCI related to growth and the increasing availability of public water infrastructure. Some growth is expected with the increasing availability of a reliable water supply, therefore all programs presented are applicable to an IBT.
22	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.1.3, page 6-14: This section appears to be based on review of the Pender County Land Use Plan; please confirm with the County and revise language to be more definitive.	Updated to be more definitive.
23	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Exhibit 6-2, page 6-16: Exhibit refers to "Mandatory Reductions (Stage 2 and 3)." This is slightly confusing, consider either "Phase 2 and 3" to agree with the WSRP's five phases of water conservation, or "Stage I and II" to be more consistent with the descriptions of the two different levels of mandatory reductions described in the text preceding Exhibit 6-2.	Text has been updated.
24	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.1.8, page 6-17: The EMC is very interested in seeing water conservation associated with IBT requests. Consider enhancing this section to include more information and specifics about Pender County's water conservation efforts.	See comment 73 response.
25	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2: As with the state and federal programs related to mitigation described under Section 6.1, many of the local mitigation measures described in subsections under Section 6.2 do not seem to be directly applicable to the proposed IBT since, as stated earlier in the EA, there is no construction directly related to the IBT. It would be helpful if brief statements are included to help illustrate the relevance of each local mitigation measure and why it's included in the EA.	See Comment Response #21.
26	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2, subsections related to rate structures: As outlined in these subsections, Pender County and the co-applicants all have varying rate structures. Suggest the most aggressive rate structure model be used by all applicants to the IBT certificate to improve consistency and make a stronger case that water conservation is a priority for any water obtained through an interbasin transfer.	Comment noted. See comment 74 response.

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27	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.5.6, page 6-31: Cut/paste typo in second sentence referring to Burgaw instead of Wallace.	Text has been corrected.
28	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.5.7, page 6-31: Please include specifics regarding the Town of Wallace's rate structure. No prices are provided for Wallace, but rates are provided for all other co-applicants.	Added Exhibit 6-11
29	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.6, page 6-31: Text should reference "Exhibit 6-11" instead of "Table 6-2."	Text has been corrected.
30	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.7 (Avoid an Increase in Interbasin Transfer by Using Groundwater as a Source (Alternative 6)): The Castle Hayne aquifer in the southeastern area of Pender County is fresh according to the Topsail Beach and Eagle Point Monitoring stations, with salt water encroachment likely along the coast. The Castle Hayne is nonexistent along Hwy 421; however, the Peedee aquifer does exist. The Peedee aquifer is fresh in the northeastern part of Pender County. The transition zone for the salt water/fresh water interface is mapped approximately 4.5 miles south of the intersection of NC- 210 and US-421. According to Exhibit 2, the location of the Water Treatment Plant on Hwy 421 is in the salt water/fresh water transition zone of the Peedee aquifer, so there is a distinct possibility of salt water encroachment. The last paragraph of this section states "...consultations with NCDWR officials revealed that Capacity Use regulations may be extended to Pender County in the future because of continuing indications of aquifer overuse in the vicinity." Currently there are no recommendations or indications of expanding the Capacity Use Area into Pender county. Based on the location of the salt water/fresh water interfaces in both the Castle Hayne and Peedee aquifers, Alternative 6 is not recommended. Prior to 2013 the Town of Wallace in Duplin County supplied Pender County with water. Wallace is located in the Central Coastal Plain Capacity Use Area. So, with the introduction of PCU's water treatment plant in 2012 and use of water from LCFWASA, ground water stopped flowing from the CCPCUA to PCU, which was a positive step for maintaining the water balance in the CCPCUA. Expansion of the use of surface water from LCFWASA would give PCU and its co-applicants growth potential without infringing on the CCPCUA ground water sources or exceeding aquifer yields or risking salt water encroachment in existing Pender County well fields.	Comment noted. However, note that the location of the water plant is not the location of the intake, which is above L&D 1. Text will be added to Section 1 reiterating the positive effect of further utilizing the LCFWASA surface water source minimizing impacts in the Central Coastal Plain Capacity Use Area.
31	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.1, second paragraph, fifth sentence: Consider removing "only".	Sentence now reads, "..other WSDs were formed in 2006."
32	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.1, second paragraph, last sentence: Consider adding "Village of" before "St. Helena" and "Town of" before "Watha".	Text has been modified as suggested.
33	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.1, fourth paragraph, second sentence: Delete the quotes	Sentence was restructured so that quotes are appropriate.
34	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.1, tenth paragraph, last sentence: Consider including a copy of the County's UDO as an appendix to the EA document and provide a reference here.	The UDO is included in the appendix, and the reference is already included.
35	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 1.3, second paragraph: Please also include an estimate of the water transferred to each basin, to provide perspective with the land areas.	IBT estimates are provided within the Purpose and Need section (Section 2). We added a paragraph to Section 2.3 to provide this perspective.

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36	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.1 second paragraph, third bullet: This is listed as the "proposed project", and since no other alternative is listed as the "preferred" in this list, Alternative 3 is taken as the preferred alternative; however, in the body of the document Alternative 2 is described as the preferred alternative. Please clarify this. Additionally, there is a need to consider more than a single alternative to return water back to the Cape Fear basin (source). The proposed US 421 WWTP appears to be underutilized by only using an 1/8 of its discharge capacity over the next 40 to 50 years. There should also be some consideration for citing other WWTPs both within source and receiving basins to deal with the anticipated concentrated wastewater flows from the US 70 corridor in the Rocky Point WSD. Therefore, multiple sub-alternatives should be considered under Alternative 3 that would serve to further minimize the transfer necessary.	Text has been modified to clearly indicate that Alternative 2 is the Preferred Alternative. Alternative 2 includes a small amount of wastewater effluent return, minimizing the transfer. The projected flows, as presented in the EA, to the US 421 WWTP are for a service area in Pender County within a reasonable proximity of the WWTP and are limited primarily to industrial development within the US 421 corridor and some potential commercial and residential development north of the Pender Commerce Park area. The origin of the US 421 WWTP was a concept to provide service to industrial customers within the Pender Commerce Park and industry along US 421 within New Hanover County. The location of this WWTP is near the New Hanover County line distant from much of the Pender County utility customer locations currently and as projected in the future. Cape Fear Public Utility Authority, whom provides utility service to the US 421 corridor in New Hanover County, has decided to serve the US 421 corridor from its Northside WWTP which limits the anticipated flow at the US 421 WWTP that was a large part of the flows that were originally attributed to the utilization of the 4 MGD permitted capacity. As outlined in Section 1.1 (Wastewater Collection and Treatment) and accounted for within Alternative 2, the Pender County wastewater strategy includes a range of systems to meet the wastewater collection and treatment needs of the County and does not solely rely on individual septic systems. This strategy includes the allowance for septic systems, community based systems, the use of contracted treatment capacity, and the use of centralized treatment facilities (the US 421 WWTP and the new Pluris WWTP). In the IBT planning horizon, the County will continue with its current wastewater strategy, governed by the County's UDO. If at such time the current wastewater strategy is determined to not provide sufficient wastewater treatment capacity, PCU will look to implement portions of their 2006 Wastewater Master Plan which outlines options for regional centralized sanitary sewer collection and treatment systems. Any expansion to the current centralized system(s) constructed will be a long-term, incremental plan, similar to the County's current water system expansion. The County's IBT is being driven primarily by growth in eastern Pender County (outside of the source basin and distant from the US 421 WWTP), and the infrastructure required to collect, convey, treat, and return the water to the source basin does not currently exist. If this infrastructure to return water to the source basin is constructed, it would have more significant direct impacts (environmental and cost factors) than the Preferred Alternative and would be cost-prohibitive especially for PCU which is currently a small rural utility with a limited customer base that is geographically distributed across the County. Given the consideration of these additional impacts, it is not necessary to further consider detailed options under Alternative 3. Instead, an increase in community-based systems and the construction of the Pluris WWTP and US 421 WWTP will meet the growing needs of the County and return a small amount of wastewater effluent to the Cape Fear River without being cost-prohibitive. Section 5 of the EA summarizes the analysis and information that defines the direct effects of the Alternative 2 as not significant.
37	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.4, second paragraph, last sentence: Please explain how there is "maximum utilization" of the WWTPs, when the US 421 plant is only planning to treat and discharge 0.5 mgd of a plant that has a permitted discharge of 4.0 mgd	Maximum utilization of built capacity at 0.5 MGD. Permitted to 4 MGD. See response to Comment Response #36.
38	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.5, sixth paragraph, second sentence: Delete "an" between "blending of" and "additional".	Text has been updated.
39	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.6, paragraphs one and two: Paragraph one states that "a new desalination facility would presumably be constructed near the coast," while paragraph two states that, "the source water would need to be pumped to the pretreatment facility and the [existing] WTP." Please clarify this alternative.	Comment noted. The first paragraph states that the we are assuming in this alternative that the "new desalination facility would need to meet all demand above the 2 MGD IBT threshold" and that "the existing WTP would not be utilized to its original design capacity of 6 MGD"; therefore, the second paragraph addresses how the existing WTP would be used to it's full capacity using the Atlantic Ocean. The alternative is a combination of a new desalination facility near the coast to meet demands above 6 MGD and a pretreatment facility to use the water from the Altantic Ocean to bring the current WTP up to its capacity of 6 MGD. See second paragraph "An attempt to fully utilize the existing WTP with the saline water source would require, in addition to a new desalination facility to meet any demand above 6 MGD, an extensive pretreatment facility that is larger and more expensive to construct and operate than the existing WTP itself."
40	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.6, third paragraph, second sentence: This statement is true if the intake was in the ocean, but if the desalination plant was withdrawing from saline groundwater this would not appear to be the case. Please clarify the various alternative options.	For this alternative, it is assumed that the intake will be withdrawing from the Atlantic Ocean. See paragraph 1 "Under Alternative 5, PCU would utilize the Atlantic Ocean as a water supply to meet future demands".
41	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.8, first paragraph, first sentence: Please insert "reduce" before "required IBT," or clarify the statement.	Text has been clarified.

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42	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.8, second paragraph, second sentence: Please provide a citation for the Pender County website referenced.	Citation has been added.
43	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.8, second paragraph, last sentence: In addition to the efforts that may be initiated, please also include a list of actions that have been done by the county, thereby providing justification that efforts are currently under way and that they will not alone provide the needed water demands.	Text has been added.
44	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 3.8, third paragraph, second sentence: Please state the multi-year average value for PCU of the water system unit consumption values.	Text has been added.
45	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.1.2: There are several references to the "Study Area" in this section that are somewhat confusing. Please clarify that the Town of Wallace is in the study area and also Duplin County, which is in the CCPCUA; therefore, part of the service area is in the CCPCUA. Additionally, Onslow County is not in the study area and is also in the CCPCUA. Consider providing the Exhibit 1-2 reference here to make it easier for the reader to understand.	A reference to Section 1.3, which defines the study area, as well as a reference to Exhibit 1-2 has been added to the beginning of Section 4.1.2.
46	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.1.2, first paragraph, fifth sentence: Consider removing this sentence since this formation is not present within the study area, or clarify the first sentence that not all four aquifers are located beneath the "study area."	Added a sentence to clarify that the Yorktown aquifer is not present within the Study Area. Deleted sentence referenced in the comment.
47	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.1.3, third paragraph: Consider including any wetland areas identified as having special significance. If this is discussed in other sections, please reference those.	The NCCREWS wetlands data defines significance with three relative rating scores: beneficial significance, substantial significance, and exceptional significance. This Overall Wetland Rating (OWR) is based on each wetlands functionality in regards to water quality, hydrology, and wildlife habitat. A summary will be provided in Section 4.1.3.
48	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.1.3, fourth paragraph, first sentence: Consider providing an estimate of the percentage of the study area containing hydric soils. This is could be important information with regards to areas unsuitable for on-site wastewater discharge.	There are options to construct engineered solutions for these type of conditions to allow the installation of a septic system. As with all septic systems, the Pender County Health Department would be required to permit such a system.
49	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.3: Please make sure the terminology (i.e., series, group, association) used is consistent with the Soil Survey referenced.	The soils terminology has been checked and updated accordingly.
50	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.3, first and third paragraphs: Please provide the total percentage of the study area identified as within a soil association of primarily poorly drained soil series.	The majority of soils within the study area are poorly drained. Section 4.3 states the percentage of area within Pender County for poorly drained soils by soil series.
51	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.4.1, fourth paragraph, first sentence: Please make sure the terminology (i.e., communities, type, sub-type) used is consistent with the NHP document referenced.	The text has been checked and the terminology is consistent with the referenced documents.
52	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.4.1, fifth paragraph, first sentence: Consider adding "contiguous" or "uninterrupted" between "largest" and "occurring."	"Contiguous" has been added between "largest" and "occurring".
53	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.5.1, first paragraph, second sentence: According to Exhibit 1-2, the LCFWASA intake does not appear to be within the study area; however, this sentence states that it is. Please clarify the extent/boundaries of the study area.	L&D #1 is located within study area as discussed in Section 1.3.
54	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 4.10, third paragraph: Consider adding "proposed" before "project."	"Proposed" has been added.
55	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.0, second paragraph, fifth sentence: This sentence states that under the "no action" alternative wastewater will continue to be dealt with by individual septic systems and small package WWTPs. This sentence suggests to the reader that the preferred alternative is different than the no action alternative. Please clarify or remove as appropriate.	Text has been clarified.
56	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1., first paragraph, first sentence: Consider stating that any direct effects/impacts of the proposed project would be insignificant at the end of the section, after the information is presented.	Comment noted. It is our opinion that it's important to provide this statement at the beginning of the section, as it is substantiated by the information following.
57	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1., first paragraph, first sentence: Please define "small" in terms of the data.	The data provided in Section 5-1 substantiates (quantifies) that the effects are not going to have any significant effect on water resources, topography, aquatic resources, or other resources.

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58	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1.1.1.2, second paragraph, fourth sentence: Please define what the percentage values mean in terms of any environmental impacts.	The percent changes in this section provide a understanding of the effect of the modeling scenarios on river flows. Section 5.1.1.1.3, 5.1.1.1.4, and 5.1.3 discuss the effect of these changes in river flow on water supply, water quality, and aquatic resources, respectively. These sections identify that the change in river flow from the proposed IBT will not have a significant effect on the environment. In addition, Figure 19 in the Hydrologic Modeling Evaluation memo provides data that show the changes, associated with the proposed IBT, in the magnitude, frequency, and duration of flows are negligible for typical river conditions (normal annual natural variability) even with a detailed review of monthly patterns and detailed review of the periods of drought. Any small effects at low flow, drought conditions (2-4%) from the proposed IBT will be mitigated by reduction in water demand from the State required Water Shortage Response Plans (WSRP), which will be estimated for Cape Fear River water withdrawals below Jordan Lake based on the 20% reduction target in the NCAC. See comment response #5 above for further detail on the estimated reduction.
59	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1.1.1.2, third paragraph, second sentence: Please define "negligible" in terms of the data.	Negligible in this context means insignificant or would be unrecognizable in a natural system. In this section changes are only a few days (5 days in a single month over the entire period of record) for duration at different river stages and flows would still be of a level that water would continue passing over the dam at L&D #1. In addition, the changes discussed in this section paragraph are during winter months and non-spawning periods.
60	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1.1.1.2, third paragraph, third sentence: Awkward sentence, please consider reworking.	Text has been updated.
61	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.1.1.1.4, third paragraph: Water quality impacts at flows at the 5th percentile are unclear. Please discuss any potential water quality impacts in terms of low flow conditions.	Per paragraph 3 of Section 5.1.1.1.4: *It is not anticipated that the IBT will have a significant effect on the natural factors that control the water quality in the Lower Cape Fear River. This is due to the small volume of water the IBT represents in comparison to the typical river flow and range of natural variability in flow, as well as the adjacent swamp/marsh and tidal influences downstream of L&D #1.* This statement also stands for low flows (drought conditions represented by the 5th percentile flows), especially in consideration of beneficial mitigative effect of the County's (and other's) WSRP on the reduction of water demands on the river during drought periods.
62	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.2, first paragraph, third sentence: It is questionable, especially in the Rocky Point WSD, that development densities will be kept low simply by not having a centralized wastewater system. The significant increases in water demands as outlined in the demand projections suggest significant population growth in the US 17 corridor, thereby significantly increasing the development densities and the potential for SCI. Please discuss and clarify.	It is agreed that the Rocky Point WSD has the greatest projected population growth for all of the Pender County WSDs, and development densities are likely to change over time. Pender County will continue to implement its current wastewater strategy, outlined in Section 1 of the EA, which has seen an increase in community based treatment systems and the development of a regional WWTP by Pluris. These centralized systems will allow for greater densities than without a centralized system. SCI from future growth in Rocky Point WSD, and all other WSDs, will continue to be managed by the regulations, programs and policies outlined in Section 6 of the EA. This type of development will also fall under the coastal stormwater rules, as discussed in Section 6 as well.
63	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.2.1.1, fifth paragraph, first sentence: It is highly questionable whether the current network of NC DEQ benthic macroinvertebrate and fish community stations will adequately detect water quality declines throughout the study area, especially within and downstream of the Rocky Point WSD where the highest concentration of growth is anticipated. Please identify the specific stations that could adequately monitor the conditions from this portion of the service area.	The benthic monitoring stations in the study area are discussed in Section 4.1.1. At this point in time, the Index of Biological Integrity is still being developed in the Lower Coastal Plain, which is influenced by salt water. A large part of the Rocky Point WSD drains to High Quality Waters (HQW) and Outstanding Resource Waters (ORW) in the coastal areas. These classifications are intended to protect these waters which are rated excellent based on biological and physical/chemical characteristics and may be an outstanding fish habitat or fishery or have a special designation, respectively. There are special requirements for development to protect these waters.
64	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 5.2.1.3, first paragraph, second sentence: Consider noting that wetland areas occur throughout the study area, not simply isolated to the games lands	Text has been updated.
65	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.0: Please make sure that all acronyms are adequately and appropriately defined	Verified.
66	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.0, second paragraph, last sentence: Consider adding a statement that makes it clear that an ATC application requires many more items than an engineering review.	The sentence will be revised to "PCU understands it will be required to follow the current permit requirements and reviews applicable for the expansion of a public water supply system, including state Public Water Supply Section requirements."
67	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.1.5, first paragraph, last sentence: Please cite any local rules, ordinances, or specific operating procedures that hold PCU to the standard "to eliminate SSOs in their system to the maximum extent feasible."	The Pender County Water and Sewer Ordinance addresses its programs to eliminate the potential for SSOs, including Article XIII where the prevention of sewer blockages is discussed. These prevention measures will be added to Section 6.2.1.7, Water Quality Protection.

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68	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.1.17, third paragraph: Please state if these three sites are currently being considered for mitigation by local governments and if they have made or are willing to make any additional action	The local governments currently do not have mitigation needs that would drive the local purchase of these properties. These sites will remain in consideration if such a need should arise over the planning period for this project.
69	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.1.22: Consider listing the agencies or non-governmental organizations (NGOs) involved in these programs.	A reference to the Pender County Soil and Water Conservation District and its function to foster incentive-driven management of resources, including promoting the use such programs to land owners, will be added to this section.
70	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2, first sentence: This is likely not limited to CAMA; therefore, please consider either including a more complete list or removing the last part of the sentence.	Text has been updated.
71	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.1.3: Please state if this is a commitment by the county by rule, ordinance, or operating procedure.	The commitment is not related to rule, ordinance or operating procedure. Text has been updated to indicate potential future plans as outlined in the Land Use Plan
72	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.1.7, first paragraph: Considering the soil limitations throughout the county and the anticipated growth from the increased water supply, it is concerning that within planned development districts 12,000 square-foot (0.28 acre) lot sizes are acceptable for a conventional on-site septic system which typically range in size from 4,500 to 9,000 square feet. Please clarify and discuss how this mitigates any water quality impacts.	Text has been added. Note that only sites greater than 15,000 square feet can utilize traditional on-site septic and well services.
73	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.1.8: It is concerning that the applicant does not have a formal water conservation program with ordinances and initiatives to encourage water conservation and water efficiency by its customers, as well as providing demand management tools to the system water resource professionals. According to IBT statute (143-215.22L (n)(1)) a certificate shall require, "A water conservation plan that specifies the water conservation measures that will be implemented by the applicant in the receiving river basin to ensure the efficient use of the transferred water. Except in circumstances of technical or economic infeasibility or adverse environmental impact, the water conservation plan shall provide for the mandatory implementation of water conservation measures by the applicant that equal or exceed the most stringent water conservation plan implemented by a public water system that withdraws water from the source river basin." In this case, the source basin includes two other IBT certificate holders who do have water conservation programs, and several other water systems who have strong water conservation programs out of necessity.	One element this comment does not take into consideration is the fact that Pender County Utilities (PCU) is a small rural NC utility with 7,500 customers currently and average day demands less than 1.0 MGD. With low discretionary water use, PCU is not any different than other rural water utilities across the state. In addition, residential unit water demands for PCU customers are less than national averages presented in 2 different published sources (see Section 3.8 of the EA) and the GPCD values for PCU customers are on the low end of the range for NC water utilities at 59 GPCD (average from 2006 through 2015). PCU customers do not exhibit high levels of discretionary water use that could be curtailed or water use inefficiencies seen in many other locations. The PCU water system is also relatively new, including the County's new WTP which was developed to replace its connection with the Town of Wallace which uses groundwater in the CCPCUA. Since the system is new, there is not a lot of unaccounted for system water loss. It should be recognized though that since PCU is a rural water utility, they are similar to other rural utilities with numerous dead end water lines that require flushing to maintain water quality and maintain compliance with the Safe Drinking Water Act. PCU recognizes the need to be a good water steward. To encourage efficient water use practices and minimize non-essential water usage, PCU publishes water conservation tips on their website and has implemented elevated water rates that encourage conservation. The County's water rates, as well as many of the co-applicants, are identified by the UNC EFC as more than or close to double the statewide median for 1,000 gallons, as well as rating high in regards to a conservation rate signal (see Section 6.2 for further information on the County's water rates and structures). In addition, since the County-wide system has only been implemented in the past ten years, most of the residents have access to groundwater wells for use in irrigation, reducing the potential peak seasonal demand on the County water system. The intent of the IBT statute is clear in ensuring the efficient use of any water subject to an IBT, and the requirement to develop a water conservation plan will be fulfilled as required by the statute. The conservation plan will take into account the need to ensure water use efficiency both for PCU and their customers, as well as taking into consideration the local context (such as the already low unit water demands and what level of conservation is necessary to maintain or minimize the already low water usage levels for the PCU customers).
74	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.1.9, first sentence: A flat or fixed rate structure is generally not considered a water conservation rate structure to incentivize water conservation by customers, thereby, not meeting the standards of the IBT statute cited in the preceding comment.	In general practice, a tiered rate structure is typically considered to promote conservation. In this case, the fixed rate is equivalent to a second or third tier rate of other utilities in the region - sending a conservation signal to all users, not just the highest volume users.
75	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.3.6: All co-applicants should consider coming up to the same or similar water conservation/efficiency standards as the applicant, who should demonstrate the highest standards	See response to comment 73.
76	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.3.7, first sentence: Please consider noting that the increasing rate structure is only for residential customers and there is a minimal change between the two rates.	Text has been updated.
77	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.4: Please note whether the Town of Burgaw has any existing water conservation or efficiency program or ordinances.	Water conservation efforts have been added.
78	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.5.4, fourth paragraph, last bullet: Awkward sentence, please consider reworking.	Sentence has been updated.

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79	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Section 6.2.5: Please note whether the Town of Wallace has any existing water conservation or efficiency program or ordinances.	Nothing formal exists.
80	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Exhibit 6-11: Pender County has a flat rate structure similar to the Town of Wallace; therefore, it does not have a conservation rate structure. Please correct.	See response to comment 74.
81	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	In general, it is critical to continually call the readers' attention to the fact that data derived from the hydrologic model is dependent on the assumptions and structure of the model scenarios used. When flow data that is not derived from the model is presented it cannot be compared to flow data generated by the model. It would be helpful for readers not familiar with the hydrologic model to remind them that the flow record is a reconstruction of historic flows base on available data. Also that the model evaluations are limited to the effects that could be noted over the range of flows included in the flow record.	The Hydrologic Modeling Evaluation memo is referenced in the EA text and included as an appendix. It has 9 pages of model background, description of the model, and the application of the model for a comparative analysis of the alternatives, rather than the identification of absolute future effects under any of the alternative model scenarios reviewed. In Section 5 some text will be added to increase the clarity on the evaluation of potential effects using the hydrologic model.
82	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	DWR has revised the model scenarios from those used for the December 2015 Draft Cape Fear River Water Supply Evaluation and the Draft Jordan Lake Water Supply Allocation Recommendations. The revisions respond to comments received to the draft documents, notably the need to update the demand estimates for the Lower Cape Fear Water and Sewer Authority and its dependent utilities. Demand projections were updated as needed for withdrawers in the model based on 2014 LWSP data which was also used to revise demands for LCFWSA. Additional withdrawals were added to capture potential expansion of electric generating facilities in the modeled areas based on information submitted by Duke Energy in response to the draft documents. Updated versions of the December 2015 Draft Cape Fear River Water Supply Evaluation and the Draft Jordan Lake Water Supply Allocation Recommendations, based on the revised model scenarios, are expected to be made public by January 2017 in preparation for review by the Environmental Management Commission.	Comment noted. We accessed the model data in May of 2016. The effect of these newly considered withdrawals will be consistent across each hydrologic modeling scenario evaluated as part of the EA.
83	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	The revised scenarios of the Cape Fear Neuse River Basin Hydrologic Model are available on the shared scenario section of the model server and should be used for future versions of the analyses in the EA for consistency with other publicly available information during the review of this IBT application.	Comment noted.
84	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix C: Exhibit 5 -For consistency with discussions in other areas you may want to change the label "% of Water Loss" to "% of Non-Revenue Water"	Exhibit has been updated.
85	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix C: Exhibit 6 -include the link to the exact location on the LINC website used to derive the 2035 to 2050 population projections.	A note was added to Exhibit 6 that states "The NC OSBM projections from 2040 to 2050 were estimates based on the percent growth per year from 2015 to 2035." for clarification.
86	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Apppendix C: Page 7 -the reference for the figures for persons per household directs the reader to Attachment A; I could only find the numbers in Attachment B	Attachment A is attached.
87	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix C: Global Input Table -the factor for Non-Revenue Water appears to be calculating that component at 115% of finished water	15% is the NR value, applied as 1.15 non-revenue factor.
88	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F: How was the maximum demand of 106.6 mgd used in the model? Was it entered as the annual average day demand or the maximum month average day demand?	106.6 MGD was entered as the maximum month demand in the model for the LCFWASA node, all other nodes at L&D #1 were zeroed out.
89	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F: 91. Figures 6, 8, and 10 should be presented on a log scale to improve the ability to differentiate between the plot lines.	There is not a significant amount of differentiation in the lines that represent each model scenario at this scale that includes the full range of flows for the entire period of record. The current presentation of this information is consistent with discussions and direction provided by DWR during the review of the Hydrologic Modeling Evaluation memo.
90	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F: 92. Figures 7, 9, and 11 should present the actual flow values on a linear scale for the range of flows from 0-1000 cfs. The current overlying lines cannot be differentiated.	Figures 7, 9, and 11 are presented as requested by DWR during the review of the Hydrologic Modeling Evaluation memo. The lack of differentiation between the lines is due to the fact that there is not a lot of difference between the model scenario results, except for the portions of the charts that represent the extreme low flow (drought) conditions, which are visible.
91	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Appendix F: 93. Section 6.1.3 Anadromous Fish -This discussion does not provide adequate differentiation between when model data, with its inherent uncertainty, and gage data, reflecting measured flow conditions, are being used and discussed in the text.	Text has been clarified to identify which data/results presented uses USGS gaging station data.

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92	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Reviewing the Water Quality sections of the Pender County IBT Draft EA, there is no discussion of the ongoing algal bloom issue that started in 2009, affecting the mid and lower portions of the Cape Fear River and estuary. There have been documented blue green algal blooms (cyanobacteria) in the Cape Fear River above lock and dam #3 to an area down below lock and dam #1 in the Cape Fear River Estuary. These are known to occur specifically during warmer months when flows are low, generally below ~ 1,400 cfs at lock and dam #1. The bloom occurrences are directly affected by low flow conditions. These potentially harmful blue green algal blooms have been found to produce the algal toxin, microcystin. These harmful algal blooms and their toxins can directly affect the surface drinking water supply quality. The lower the flow remains in this area, the more favorable the conditions will be for the development of the toxic harmful algal blooms. The cumulative effects of all the water withdrawals have on the flows in this segment of the Cape Fear should be assessed in order to understand how they affect the potential development of harmful algal blooms in this stretch of the Cape Fear River system. The current chlorophyll a water quality standards do not capture the issue with the algal blooms in the Cape Fear River system. This will likely be addressed as part of the Nutrient Criteria Development Plan process that is underway and discussed in 6.1.19. Using the current standards and collection methods do not identify a water quality violation even though there are serious concerns for public health when these harmful algal blooms occur.	The Middle Cape Fear River is outside the study area of the EA. The Lower Cape Fear River is within the study area. It is recognized that water volume is part of the equation of water quality, but it is only a portion of the larger natural and built systems that affect water quality. In reviewing the hydrologic model scenario results, the following was determined in regards to changes in frequency and duration of flows below 1400 cfs, as quoted in the comment, at L&D #1 between the 2010 baseline and 2045 scenarios: - 1% increase in frequency of flow below 1400 cfs over the entire period of record. - During the droughts of record and the summer months, each reviewed individually, the greatest increase in consecutive days below 1400 cfs is 3 to 4 days for each. These are small changes that are not likely to significantly change the frequency or duration of algal blooms over the baseline scenario, especially if looking at the incremental effect of just the proposed IBT (<1% change in frequency, 1-2 day change in duration for consecutive days). Comment noted, Pender County will comply in the future with any new standards that promulgated.
93	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	The current document refers to the Cape Fear reclassification as from Class SC to Class SC Sw. It should be the lower Cape Fear reclassification was from Class SC to Class SC Sw with a Water Quality Management Plan. The approval is directly related to the use of this management plan to protect the DO conditions from declining as a result of additional oxygen demanding waste from point source discharges. As stated in the document, the reclassification is not completed as it is going through the 2017 legislative process but I also believe it then must be approved by the US EPA.	See comment response #8 above. The Water Quality Management Plan will provide further mitigation for any future effects related to water quality from point source discharges.
94	**Division of Water Resources**	Kim Nimmer	IBT Program Coordinator	Washington Regional Office: Page 1-7 indicates that in the Town of Topsail Beach, all water service connections have septic systems. DWR currently has an active permit (WQ0028785) in Topsail Beach (Queens Grant) for a high rate infiltration system with a permitted flow of 20,160 GPD. There are also several other community LPP systems in Topsail Beach permitted by DHHS.	Text has been updated.
95	**Division of Coastal Management (Fisheries)**	Kim Nimmer	IBT Program Coordinator	Memo from Gregg Bodnar, DCM Fisheries Resource Specialist: The draft EA does mention future infrastructure plans to return wastewater to the source basin, and is strongly encouraged.	Comment noted.
				Additional concerns to fishery species besides flow includes entrainment and impingement at the intake...It is recommended the final EA provide information pertaining to the intake's existing design, intake velocity, entrainment and impingement minimization methods, etc. and how the increase to 14.5 MGD may change, if any, from existing.	Added text to describe the existing intake structure, which underwent its own EA and FONSI in 2008, to Section 1 and Section 5. The projected withdrawal associated with this IBT is not expected to require any modification to the existing intake.
				Finally, Alternative 7 indicates various water conservation measures that could have positive effects to reducing water consumption overall, but expecially during long lasting, intense drought events. It is strongly suggested that these conservation measures be investigated and considered as part of any final result.	Comment noted.
96	**Division of Waste Management - Hazardous Waste Section**	Kim Nimmer	IBT Program Coordinator	Any hazardous waste generated from the demolition, construction, operation, maintenance, and/or remediation (e.g. excavated soil) from the proposed project must be managed in accordance with the North Carolina Hazardous Waste Rules.	Comment noted.
97	**Division of Waste Management - Federal Remediation Branch**	Kim Nimmer	IBT Program Coordinator	The above-mentioned project covers a large portion of Southeastern North Carolina, including all of Pender County and portions of multiple drainage basins. No specific addresses were included in the project. For individual construction projecs with specific addresses, nearby regulated sites may be viewed via maps found at https://deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/waste-management-gis-maps. Information included on these various maps are Site Name and/or Site ID. If regulated sites are present in the area of a specific address or construction project, additional information for the sites can be accessed by following the "Access Online Files" link on the Superfund Section website: https://deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/e-documents. The sites may be searched by Site ID or Site Name. If you have any questions, please contact me at (919) 707-8377 or via e-mail at stuart.parker@ncdenr.gov.	Comment noted.

Agency Comment Response Matrix
Environmental Assessment for the Proposed Pender County Interbasin Transfer

Completed January 4, 2017

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98	**Division of Waste Management - Solid Waste Section**	Kim Nimmer	IBT Program Coordinator	In part 5.1 Direct Impacts, it is stated that no construction is directly associated with this requested IBT approval, however, should any land clearing occur or any construction associated with this project, Pender County and/or its contractors should make every feasible effort to minimize the generation of waste, to recycle materials for which viable markets exist, and to use recycled products and materials in the development of this project where suitable. Any waste generated by this project that cannot be beneficially reused or recycled must be disposed of at a solid waste management facility permitted by the Division. The Section strongly recommends that the owner require all contractors to provide proof of proper disposal for all waste generated.	Comment noted.
99	**Wilmington Regional Office**	Kim Nimmer	IBT Program Coordinator	Permit checklist and comment table.	No construction is proposed as part of the requested IBT approval. Any subsequent construction that may occur will first require compliance with all permitting programs and laws of the state.
100	**Wildlife Resources Commission**	Kim Nimmer	IBT Program Coordinator	To minimize impacts to terrestrial and aquatic wildlife species, including federal and state endangered, threatened, and species of concern, avoidance and minimization of impacts to wildlife habitats, including wetlands, should be implemented. Many line installation impacts will be avoided since some infrastructure is in place. However, any new installation of lines should include the directional boring of stream crossings and significant wetland features. In addition, any bottom disturbance activities in the Cape Fear River should adhere to the Februaruy 15 - Septemeber 30 PNA moratorium. This moratorium may also be applied to the Northeast Cape Fear, depending on the location within the river and its designation. Other areas of the Northeast Cape Fear, New River, and South Rivers should adhere to the AFSA moratorium of February 15 - June 30 for bottom disturbing activities. To minimize entrainment and impingement of eggs, larvae, and juveniles, a screen system must be incorporated into the intake design. This includes a minimum intake velocity of 0.25 ft/sec through a mesh or slotted surface with opening not to exceed 1.0 millimeter. Methodology to clean the screen system must also be designed and discussed to minimize impacts to eggs, larvae, and juveniles. The NCWRC encourages water conservation be a primary goal. Although the increased water resource management tools alternative was not chosen, aspects of water conservation should always be incorporated and the systems observed to see if increased water withdrawals from the Cape Fear are having significant negative impact that measures should be taken to mitigate conditions.	See response to comment 99, above. Comment noted. Information has been added to Sections 1 and 5 regarding LCFWASA's existing intake structure. This requested IBT approval is not expected to require any modification to the existing intake, which was installed in 2010 subsequent to its own EA and FONSI in 2008. Comment noted.
101	**Department of Public Safety - Division of Emergency Management**	Kim Nimmer	IBT Program Coordinator	Any construction within the Special Flood Hazard Area of Interbasin Transfer infrastructure will require a Floodplain Development Permit issued by the local municipality having jurisdiction. It appeared there would not be any effect on base flood flows due to the IBT operation. However, please notify the Department of Public Safety Risk Management group if there will be any changes to base flood hydrology due to the proposed IBT operation.	Comments noted.