Interbasin Transfer Petition

Prepared for

Pender County, North Carolina

Submitted to

North Carolina Environmental Management Commission

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Executive Summary

Pender County (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 close to Wilmington, Interstate 40 (I-40), U.S Route 421 (US 421), and U.S Route 17 (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. To meet these growing water demands, the County has engaged in long-range planning efforts. The first steps in meeting long-term goals included a supply source change in 2012 from groundwater obtained from within the Central Coastal Plain Capacity Use Area, provided by the Town of Wallace, to surface water provided by the Lower Cape Fear Water & Sewer Authority (LCFWASA). At that time, Pender County Utilities (PCU) began operation of its own water treatment plant (WTP). Multiple referendums have also been passed in support of continued service area expansion within the County, including the development of six Water and Sewer Districts (WSDs) and the extension of the water distribution system. County residents not currently connected to PCU's water system have increased concerns regarding the reliability of quality and supply of their private groundwater wells as a potable drinking source, leading voters to approve a bond referendum to expand the PCU's water system. The proposed expanded water service and improved water quality requires the interbasin transfer (IBT) certificate process in which this Petition is prescribed. PCU's water and wastewater infrastructure and history are discussed in further detail in the environmental assessment (EA) (HIGHFILL and CH2M, 2017).

With their water supply demand drivers, PCU currently has an interbasin transfer (IBT) under the threshold requiring a certificate. Planning for the future, PCU is thoughtfully 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 towns of Burgaw, Surf City, Topsail Beach, and Wallace (in neighboring Duplin County), and Utilities, Inc.

PCU obtains its raw water supply from the Cape Fear River via the LCFWASA. Pender County has a Water Supply Agreement with LCFWASA that states that the LCFWASA will deliver raw water in an amount sufficient to meet the County's raw water supply needs. Currently, the County has purchased 6 million gallons per day (MGD) of raw water supply capacity from LCFWASA, and will expand this capacity in the future to meet the growing needs of the WSDs and communities that are served. The County's Water Supply Agreement with the LCFWASA and the LCFWASA resolution of support for PCU's long-range water supply planning and this IBT petition are provided in the appendix to this request's EA (HIGHFILL and CH2M, 2017).

The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are located just above Lock and Dam 1 (L&D1) in the Cape Fear River. LCFWASA expanded its intake in 2010 to accommodate the future projected demand of 96 MGD across its customer base by the year 2030 (McKim and Creed, 2008). Pender County proposes to extend its contract with LCFWASA to meet its future water supply needs, including those of the co-applicants. The Study Area for this project encompasses PCU and the co-applicants service areas, as well as the water supply source, including the Cape Fear River, South River, Northeast Cape Fear River, and New River IBT basins (NCDWR, 1993).

PCU's WTP was completed in 2012, and at present, has the ability to treat 2 MGD. The facility is readily expandable to 6 MGD. System process water used at the WTP is treated and returned to the Cape Fear River. 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). A common issue with

shallow private groundwater wells in the area is high iron content and hardness (LMGI, 2014a, 2014b). To meet these future water demands, PCU and the co-applicants intend to increase their transfer from the Cape Fear River IBT basin (basin 2-3) by obtaining an IBT certificate. 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 IBT river basin in which it is used.

Pender County and its co-applicants are requesting an authorized transfer between designated IBT river basins of the lower Cape Fear River major basin. Specifically, the requested transfer is 14.5 MGD, calculated as a daily average of a calendar month, from the Cape Fear River IBT basin to the South River, Northeast Cape Fear River, and New River IBT basins. The proposed transfer amount is based on updated water demand projections for the next 30 years, to meet 2045 demand projections. Of the water produced, some remains in the Cape Fear River IBT basin via the estimated consumptive use and wastewater flow from the small portion of the Moore's Creek WSD within the basin and the US 421 wastewater treatment plant (WWTP) direct discharge to the Cape Fear River. The majority of the transferred water is to the Northeast Cape Fear River IBT basin, with smaller amounts transferred to the New River IBT basin and the South River IBT basin. The IBT certificate request includes:

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

The potential for impacts to source IBT basin hydrology were assessed in the *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer* (CH2M, 2016). The proposed IBT certificate will not significantly change Cape Fear River elevations above and below L&D1, downstream flows, or water quality. Therefore, the water supply needs of other public water systems are not expected to be affected by the proposed transfer. 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 Water Shortage Response Plans (WSRPs). During anadromous fish spawning periods, the hydrologic modeling has indicated that there will be sufficient flow for anadromous fish to pass at L&D1 during the lowest flow conditions in the spawning period (CH2M, 2016).

In working toward the development of this preferred alternative of an increase in IBT, PCU continues to ensure continued water service to the WSDs, their expanding service areas, and the co-applicants. The following steps have been undertaken by PCU to plan for future demands:

1. Entered into a long-term, expandable contract with LCFWASA for raw water supply.
2. Constructed a readily expandable WTP, with the initial stage online in 2012.
3. Constructed the US 421 WWTP; when online in 2017, the WWTP will return a small portion of transfer to the Cape Fear River.
4. Submitted a Notice of Intent to North Carolina Environmental Management Commission (EMC) for increased IBT (2016).
5. Obtained resolutions of support from LCFWASA and the co-applicants (2016).
6. Developed water demand projections as the daily average of a maximum calendar month, and conducted an evaluation of impacts using the combined Cape Fear and Neuse River Basin Hydrologic Model (NCDWR, 2013) (2016).

7. Submitted an EA, which reflects the requirements of §143-215.22L; a Finding of No Significant Impact was published by the North Carolina Environmental Review Clearinghouse (2017).
8. Updated its Water Shortage Response Plan (WSRP).
9. Began planning for a public hearing required as part of the IBT statute (2017).

The next step in the certification process is this petition submittal to the EMC requesting an IBT certificate, followed by an associated public hearing and opportunity for public comment prior to an EMC decision on the petition. This petition for an IBT certificate includes the following elements in support of the request for IBT:

1. Organization of PCU and the Requested Action.
2. Overview of PCU infrastructure.
3. Present and future water supply needs of PCU and its co-applicants, including consumptive and nonconsumptive uses.
4. Environmental resources discussion, including water quality and quantity information for the source river basin and the receiving river basins; and information on aquatic habitat for rare, threatened, and endangered species.
5. Water usage data, including water conservation, water efficiency, and water stewardship measures used by PCU.
6. Alternative sources of water to avoid or minimize an increase in IBT.
7. Registered water transfers and withdrawals from the source IBT basin, and planned transfers or withdrawals.
8. How the proposed transfer, if added to all other transfers and withdrawals within the Cape Fear River basin, would not reduce the amount of water available for use to a degree that would impair existing uses or existing and planned uses of the water.
9. Future water supply needs within the Cape Fear River basin.

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Acronyms and Abbreviations

§	section
µg/L	microgram(s) per liter
AEC	Area of Environmental Concern
AICW	Atlantic Intracoastal Waterway
AL	aquatic life
amsl	above mean sea level
Aqua	Aqua North Carolina
BOD	biochemical oxygen demand
Burgaw	Town of Burgaw
CAMA	Coastal Area Management Act
CCPCUA	Central Coastal Plain Capacity Use Area
CFNRBHM	Cape Fear and Neuse River Basin Hydrologic Model
CFPUA	Cape Fear Public Utility Authority
CFS	cubic foot (feet) per second
CH2M	CH2M HILL North Carolina, Inc.
COG	Council of Governments
County	Pender County
CWA	Clean Water Act
DMAC	Drought Management Advisory Council
DO	dissolved oxygen
EA	environmental assessment
EFC	Environmental Finance Center
EMC	North Carolina Environmental Management Commission
EPA	U.S. Environmental Protection Agency
FOG	fats, oils, and grease
FONSI	Finding of No Significant Impact
FSC	Federal Species of Concern
ft^2	square foot (feet)
FW	fresh waters
gal	gallon(s)
GPD	gallon(s) per day
HIGHFILL	Highfill Infrastructure Engineering, P.C.

HQW	high-quality water
I-40	Interstate 40
IBT	interbasin transfer
ID	identification
IP	International Paper
L&D1	Cape Fear River Lock and Dam 1
LCFRE	Lower Cape Fear River Estuary
LCFWASA	Lower Cape Fear Water & Sewer Authority
LMGI	Land Management Group, Inc.
LWSP	Local Water Supply Plan
mg/L	milligram(s) per liter
MGD	million gallons per day
mi^2	square mile(s)
N.C.G.S	North Carolina General Statutes
NC 210	North Carolina Highway 210
NC 50	North Carolina Highway 50
NCAC	North Carolina Administrative Code
NCDAQ	North Carolina Division of Air Quality
NCDEQ	North Carolina Department of Environmental Quality
NCDHHS	North Carolina Department of Health and Human Services
NCDWR	North Carolina Division of Water Resources
NCNHP	North Carolina Natural Heritage Program
NCWRC	North Carolina Wildlife Resources Commission
NFIP	National Flood Insurance Program
NH_3-N	ammonia nitrogen
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
ONWASA	Onslow Water and Sewer Authority
ORW	outstanding resource water
PPT	parts per trillion
PCU	Pender County Utilities
PD	Planned Development
Pluris	Pluris Holdings, LLC
POI	Parameter of Interest

PWC	Public Works Commission
PWSID	Public Water System Identification
RM	Residential Mixed
S.U.	Standard Units
SA	shellfishing waters
SB	tidal water
SH	shellfish harvesting
SR	North Carolina Secondary Road
SSO	sanitary sewer overflow
STEP	septic tank effluent pump
Surf City	Town of Surf City
Sw	swamp water
TMDL	total maximum daily load
Topsail Beach	Town of Topsail Beach
U.S.	United States
UDO	Unified Development Ordinance
UNC	University of North Carolina
US 17	U.S Route 17
US 421	U.S Route 421
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Wallace	Town of Wallace
WHPA	Wellhead Protection Area
WSD	Water and Sewer District
WSRP	Water Shortage Response Plan
WTP	water treatment plant
WWTP	wastewater treatment plant

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SECTION 1

Project Overview

Pender County (County) is a fast-growing coastal county with a 2015 population of over 56,000. The County's growth has been and will continue to be driven by its location close to Wilmington, Interstate 40 (I-40), U.S Route 421 (US 421), and U.S Route 17 (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. County residents not currently connected to PCU's water system have increased concerns regarding the reliability of quality and supply of their private groundwater wells as a potable drinking source, leading voters to approve a bond referendum to expand the PCU's water system. The proposed expanded water service and improved water quality requires the interbasin transfer (IBT) certificate process in which this Petition is prescribed. Pender County Utility's (PCU's) water and wastewater infrastructure and history are discussed in further detail in the environmental assessment (EA) (HIGHFILL and CH2M, 2017).

1.1 Applicants

In addition to the currently underway and planned near-term water system expansion, 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 towns of Burgaw, Surf City, Topsail Beach, and Wallace (in neighboring Duplin County), and Utilities, Inc. Table 1-1 presents the Public Water System Identification (PWSID) for each utility. Signed support resolutions from the co-applicants are included in an appendix to this request's EA (HIGHFILL and CH2M, 2017).

Table 1-1. Public Water System Identifications for Pender County Utilities and Co-applicants

Utility	PSWID
PCU	70-71-011[a]
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[b]

[a] The request for the IBT certificate is being submitted under PCU's PWSID.

[b] The PSWIDs for Utilities, Inc. correspond to the Belvedere Plantation and Olde Point developments, respectively.

Within Pender County and under PCU's operations, maintenance, and management, six Water and Sewer Districts (WSDs) were established through referendum for the purposes of expanding service to existing residents:

1. Central Pender
2. Columbia-Union
3. Maple Hill
4. Moore's Creek

5. Rocky Point/Topsail
6. Scotts Hill

The Pender County Board of County Commissioners serves as the governing body for each WSD.

Aqua North Carolina (Aqua) 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 Aqua serves are within PCU's WSDs, and those areas, along with their respective water demand projections, were included in the appropriate WSD's demand projections in the EA to provide for a comprehensive evaluation (HIGHFILL and CH2M, 2017). Aqua understands that the IBT Certificate, if granted, will have to be amended prior to Aqua receiving water via transfer.

Figure 1-1 provides a map presenting the WSD's and co-applicant's service boundaries, overlaid with the IBT river basin boundaries. In addition, the project Study Area used for this request's EA is presented.

1.2 Project Description

In light of Pender County's historical 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 is anticipated to exceed 2 million gallons per day (MGD). Initiating a transfer of 2 MGD or more per day from one river basin to another, calculated as a daily average of a calendar month and not to exceed 3 MGD per day in any one day, requires obtaining an IBT from the Commission per N.C.G.S. § 143-215.22L. ***Pender County and its co-applicants are requesting an authorized transfer between designated IBT river basins, from the Cape Fear River IBT basin (2-3) to the South River, Northeast Cape Fear River, and New River IBT 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 3. Figure 1-1 provides a map of the PCU and co-applicants' planning areas and these IBT river basins.

1.3 Guiding Legislation

Per N.C.G.S. § 143-215.22L, an EA was developed to assess potential environmental impacts associated with the County's proposed transfer that will occur within a single major 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 River, and New River (N.C.G.S. § 143-215.22G). The County also qualifies as a "coastal county" under N.C.G.S. § 143-215.22L (w). This section dictates the regulatory requirements for coastal counties to request and acquire an IBT certificate. Upon the North Carolina Department of Environmental Quality's (NCDEQ's) determination that the EA was adequate to meet the intent of the statute, a Finding of No Significant Impact (FONSI) was prepared by NCDEQ. NCDEQ will publish notice of this petition and hold one public hearing. After a 30-day public comment period following the public hearing and preparation of a hearing officer's report by the North Carolina Division of Water Resources (NCDWR), the North Carolina Environmental Management Commission (EMC) will be responsible for the final determination of whether to grant the IBT certificate.

1.4 Finding of No Significant Impact

The IBT request process was initiated in 2016 by filing a Notice of Intent (NOI) to the EMC. The NOI was signed by the Pender County Manager and the PCU Director. An EA and associated FONSI was submitted to the North Carolina Environmental Review Clearinghouse for publication on May 2, 2017. This followed a review period for NCDEQ agencies, the U.S. Fish and Wildlife Service (USFWS), and the U.S. Army Corps of Engineers (USACE). Appendix A provides a copy of the FONSI.

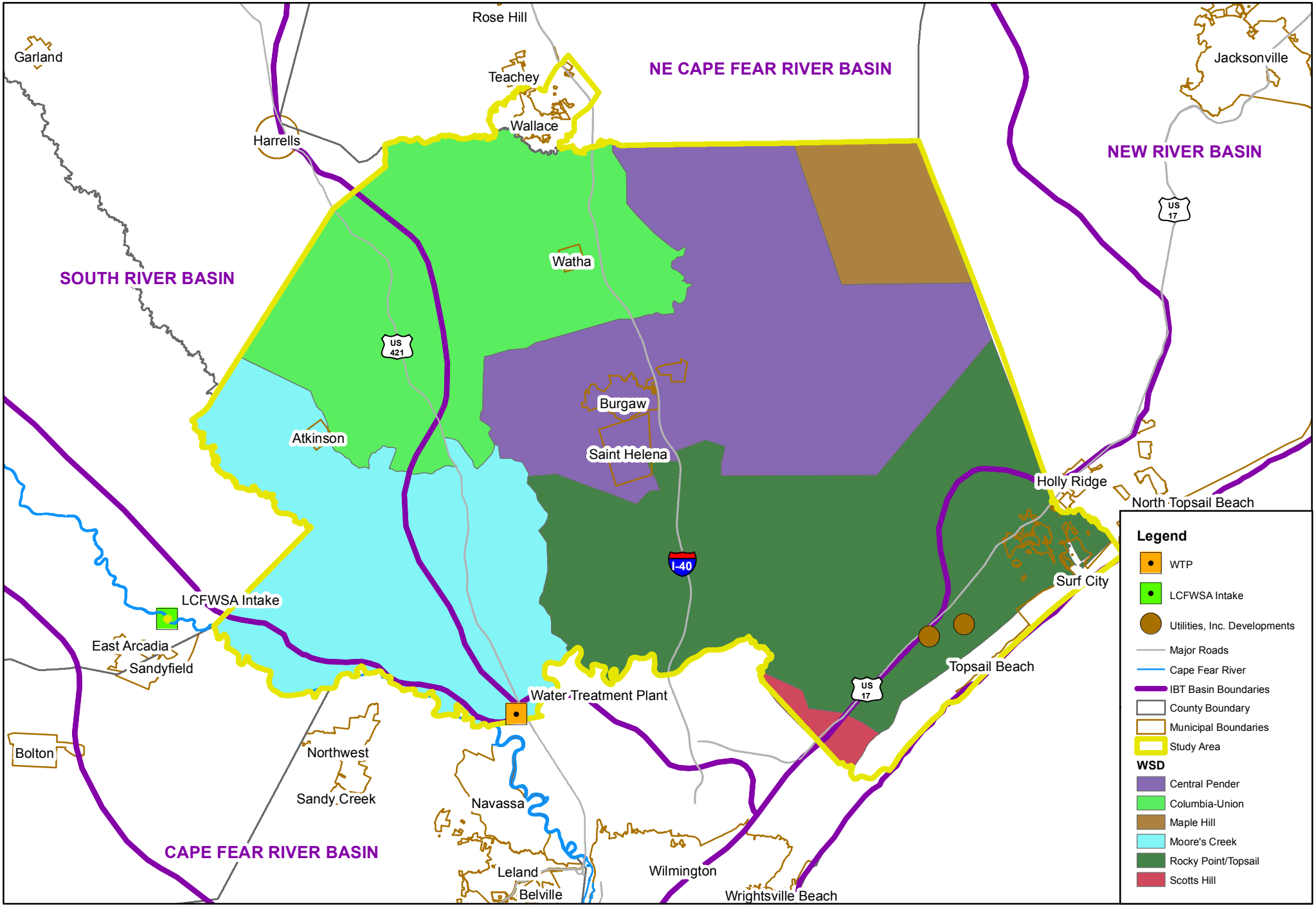

Figure 1-1
Study Area Overview Map
Petition
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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SECTION 2

Description of Facilities and the Transfer of Water

2.1 Water Supply and Treatment

2.1.1 Conclusion of Use of Groundwater from the Central Coastal Plain Capacity Use Area

Prior to contracting with the Lower Cape Fear Water & Sewer Authority (LCFWASA) for raw water and completing construction of its water treatment plant (WTP) in 2012, PCU obtained its water from the Town of Wallace (Wallace) in Duplin County. Wallace's wells withdraw groundwater in the Central Coastal Plain Capacity Use Area (CCPCUA). Switching PCU's supply source from CCPCUA groundwater to LCFWASA surface water was a positive step in reducing demands from the impacted aquifers in the designated CCPCUA (HIGHFILL and CH2M, 2017).

2.1.2 Current Water Supply Source

PCU obtains its raw water supply from the Cape Fear River via the LCFWASA, and PCU has a Water Supply Agreement with LCFWASA. 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 has purchased 6 MGD of raw water supply capacity from LCFWASA and will purchase additional capacity to meet future water supply needs. The Water Supply Agreement and a signed resolution of support from LCFWASA are included in Appendix B.

The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are located just above Lock and Dam 1 (L&D1) on the Cape Fear River. LCFWASA expanded its intake in 2010 to accommodate a cumulative projected demand of 96 MGD across its customer base. LCFWASA transmits raw water via its existing 48- and 60-inch-diameter transmission main to PCU's WTP, which is also located within the Cape Fear River basin, as defined in N.C.G.S. § 143-215.22G. LCFWASA completed EAs for the increased withdrawal and for its 60-inch-diameter transmission main (McKim and Creed, 2008 and 2015); FONSIs for these projects are included in an appendix to this request's EA (HIGHFILL and CH2M, 2017).

Figure 2-1 shows the connection point where PCU taps into the LCFWASA transmission main in the Cape Fear River IBT basin and the location of the WTP. PCU's WTP was completed in 2012, and at present, has the ability to treat 2 MGD. The facility is readily expandable to 6 MGD. System process water used at the WTP is treated and returned to the Cape Fear River (HIGHFILL and CH2M, 2017).

The co-applicants all currently obtain their water supply from groundwater sources. The Town of Burgaw (Burgaw) is considering drilling additional wells, connecting with PCU, or both to meet future supply needs. The Town of Topsail Beach (Topsail Beach) has an emergency connection with the Town of Surf City (Surf City). Likewise, Surf City has an emergency connection with Topsail Beach and another with Onslow Water and Sewer Authority (ONWASA). The Town of Wallace (Wallace) has an emergency connection with Duplin County. Wallace's wells are 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 (HIGHFILL and CH2M, 2017).

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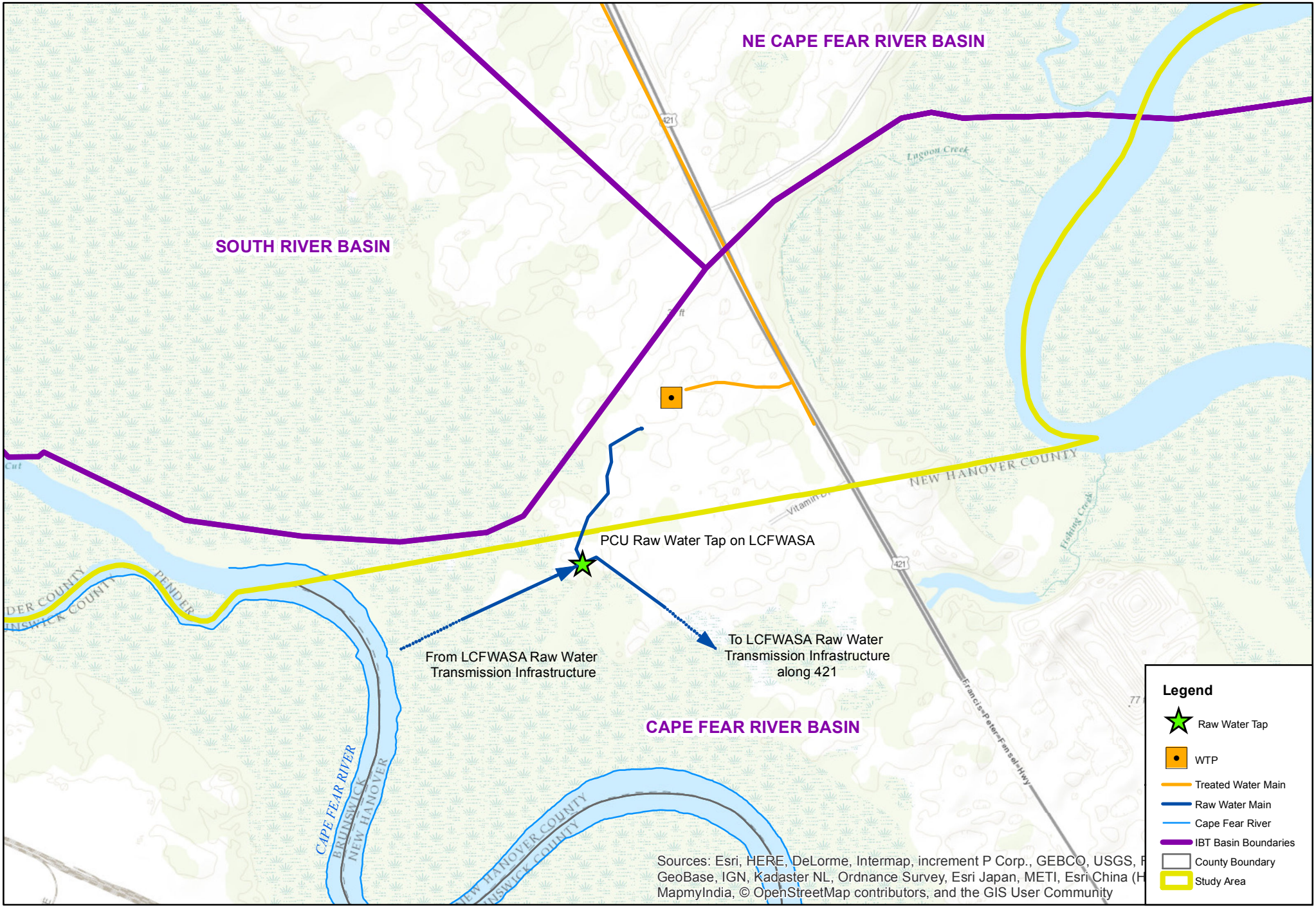

Figure 2-1
Pender County Utilities Connection from LCFWASA Transmission Main
Petition
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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2.2 Water Distribution

Six WSDs are served within Pender County, as shown on Figure 1-1. The water distribution system in the Rocky Point/Topsail WSD was built in five phases after its founding in 1996; after which, PCU constructed the Scotts Hill water distribution system. All of the other WSDs were formed in 2006. 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 the towns of St. Helena and Watha. 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.

To accommodate increasing demands along the US 17 corridor, PCU is planning for a larger water main along North Carolina Highway 210 (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, 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 (LMGI, 2014a, 2014b).

2.3 Wastewater Collection and Discharge

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, each 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) will be online in April 2017 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 a National Pollutant Discharge Elimination System (NDPES) permit to discharge up to 4 MGD to the Cape Fear River.
- A septic tank effluent pump (STEP) system serves 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 serve 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 downstream of the confluence with the Northeast Cape Fear River.
- PCU has 2.0 MGD of purchased capacity at the 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 Holdings, LLC (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 County's wastewater collection and treatment needs, as described. 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, infiltrated, and discharged within the river basin in which it is used via septic systems, community wastewater disposal, and public wastewater disposal methods. Ultimately, wastewater collection and treatment requirements for future development will be governed by the current County Unified Development Ordinance (UDO) requirements for septic systems and community and 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 that outlines options for a 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 potential future system could operate in unison with the existing wastewater systems currently in operation if the need arises.

Sewer service for the co-applicants varies. Burgaw has a treatment contract in place to send all wastewater to the Wallace WWTP, which discharges to a water body within the Northeast Cape Fear River basin. In 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 gallons per day (GPD), and several communities operate low-pressure pipe systems. Surf City does operate a centralized sewer and WWTP, but much of the extraterritorial jurisdiction is currently served by onsite septic systems. This 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 used (HIGHFILL and CH2M, 2017).

2.4 Transfer of Water

In total, PCU is requesting an IBT certificate to transfer on an average day in a calendar month basis 14.5 MGD out of the Cape Fear River basin. All of these transfers are accounted for based on where the water is consumed or discharged. For example, water must flow through the Northeast Cape Fear River basin to reach customers in the New River basin, but is accounted for as a transfer from the Cape Fear River basin to the New River basin. The small amount of consumptive use that occurs in the Cape Fear River basin does not constitute IBT.

The requested IBT amount of 14.5 MGD reflects a 30-year planning period to 2045. Additional water supply planning data to 2050 are presented in Section 3 as a look at projected long-term water demand and supply trends. According to 2016 Local Water Supply Plan (LWSP) data, discussed in Section 6.1, transfers to the Northeast Cape Fear River, South River, and New River basins are expected to continue increasing beyond 2045.

SECTION 3

Proposed Uses of the Transferred Water

Drivers for increased water demand and projected IBT for Pender County include projected population growth, commercial and industrial growth, service area expansion, and extending services to those currently served by private wells. The rate of population growth increased in the 1990s, and that rate of growth has been sustained over the last 5 to 10 years. Service area expansion is planned and will continue to increase the number of connections to PCU's system in unincorporated areas. In addition, many factors will continue to increase the water demand, including coastal community access in Pender County, as well as New Hanover and Brunswick counties; and proximity to Wilmington and Pender County Commerce Park on US 421 (HIGHFILL and CH2M, 2017). These demands represent both consumptive and nonconsumptive uses. As water services are expanded, an increased number of residents will switch from their private groundwater wells to public water supply. 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). A common issue with shallow private groundwater wells in the area is high iron content and hardness (LMGI, 2014a, 2014b). To meet these future water demands, PCU and the co-applicants have proposed to increase their transfer from the Cape Fear River basin by obtaining an IBT Certificate.

Some municipalities within the County such as Burgaw, Surf City, and Topsail Beach have continued the use of groundwater, as well as many residents in the unincorporated areas of Pender County. The requested IBT takes all of these factors into account.

3.1 Population and Water Demand Projections

To develop population forecasts for the water demand forecast, population projections were developed for each WSD. Table 3-1 provides the population forecast for Pender County by WSD, through the year 2050. Population projections for municipalities within the County are not included in these values. These projections were developed from and compared to various sources, as described in the EA (HIGHFILL and CH2M, 2017), and then input into the water demand forecast.

Table 3-1. Pender County Population Forecast by Water and Sewer District, 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.

3.2 Water Demand Forecast

The total future system finished water demand consists of the existing demand, projected future demand, future nonrevenue 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. The breakdown of WSDs by IBT basin is included in Table 3-2. A Monte Carlo simulation technique was used to aid in estimating the magnitude and likelihood of an individual water demand forecast, helping PCU develop a realistic IBT request. 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. Further details regarding the forecasting methodology and analysis can be found in an appendix to the EA (HIGHFILL and CH2M, 2017).

Table 3-2. Interbasin Transfer River Basin Percentage by Water and Sewer District

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
Scotts Hill	NE Cape Fear	55
Scotts Hill	New River	45

NE = northeast

Projected water demands for the co-applicants were developed for existing and future conditions based on each co-applicant's 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 are provided in Table 3-3.

Table 3-3. Co-applicant Water Supply Requirements

Co-applicants	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)
Burgaw[a.]	2030	10-100	0.7
Surf City	2030	25	0.4
Topsail Beach	2030	25	0.1
Wallace	2030	25	0.3
Utilities Inc.[b.]	2020	100	0.3

[a.] Burgaw will be served by PCU when their supply is switched from groundwater to surface water. The LWSP indicates this switch begins taking place in year 2030.

[b.] Utilities, Inc. currently has two developments within the Study Area, Belvedere Plantation and Olde Point. The supply and

demand forecast numbers are captured in the 2016 Belvedere LWSP since the Olde Point development is not large enough to require a LWSP at this time.

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.

Table 3-4 presents the annual average finished water demand expected values, 2015 through 2050. Expected values are a statistical measure of the likely outcome under conditions of future variability and uncertainty, reflecting expected average future conditions. Table 3-5 presents the co-applicant forecast of annual average daily water demand to be satisfied by water provided by PCU. Table 3-6 presents the total annual average daily combined system demand.

Table 3-4. County Water and Sewer District Annual Average Daily Finished Water Demand Forecast Expected Values, 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 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.

Table 3-5. Co-applicant Annual Average Daily Water Supply Forecast Expected Values, Provided by Pender County Utilities, 2015–2050

Co-applicant	Basin	Annual Average Daily Finished Water Demand (MGD)							
		2015	2020	2025	2030	2035	2040	2045	2050
Burgaw	NE Cape Fear	-	-	-	0.1	0.4	0.7	0.7	0.7
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		**-**	**-**	**0.2**	**0.6**	**1.3**	**1.7**	**1.8**	**1.8**

Sources:

2016 LWSPs – (Burgaw, 2016a), (Surf City, 2016), (Topsail, 2016), and (Wallace, 2016a)

System details for Utilities Inc. (Utilities, Inc., 2016)

Assumed timing of water supply requirement provided by PCU.

Table 3-6. 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	-	-	0.2	0.6	1.3	1.7	1.8	1.8
Total System Demand	**1.1**	**1.9**	**2.8**	**4.0**	**5.7**	**7.1**	**8.5**	**9.5**

3.3 Interbasin Transfer

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. As outlined in Section 2, centralized sanitary sewer system use 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).

A small amount of consumptive use occurs in the Cape Fear River basin, including wastewater treatment and infiltration via septic systems, in the Moore's Creek WSD. Additionally, a small amount of wastewater will be returned to the Cape Fear River via a 0.5-MGD WWTP currently under construction by the County to serve the US 421 corridor in southwestern Pender County. When the US 421 WWTP comes online later in 2017, the County will begin returning wastewater to the source IBT 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&D1.

Water returned to the Cape Fear River basin via the estimated wastewater flow from the small portion of the Moore's Creek WSD in the Cape Fear River basin and the US 421 WWTP direct discharge to the Cape Fear River are shown in Table 3-7. These flows are excluded from the calculation of the proposed IBT, since these flows do not leave or are returned to the source IBT basin.

Table 3-7. Forecast of Wastewater Flows Infiltrated or Discharged within the Cape Fear River Basin, 2015–2050, Average Day Wastewater Flow

	MGD							
Wastewater	2015	2020	2025	2030	2035	2040	2045	2050
Moore's Creek WSD[a]	-	<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

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

The IBT forecast is presented as 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. IBT values were 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. The following tables summarize the IBT forecasts for PCU and its co-applicants through 2050:

- Table 3-8 presents the forecast for the transfer from the Cape Fear River basin to the Northeast Cape Fear River basin.
- Table 3-9 presents the forecast for the transfer from the Cape Fear River basin to the South River basin.
- Table 3-10 presents the forecast for the transfer from the Cape Fear River basin to the New River basin.
- Table 3-11 presents the total IBT from the Cape Fear River basin to the Northeast Cape Fear River, South River, and New River basins combined.

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. Additional details on the forecast analysis are contained in an appendix in the EA (HIGHFILL and CH2M, 2017).

Table 3-8. Forecast of Interbasin Transfer from the Cape Fear River Basin to the Northeast Cape Fear River Basin, 2015–2050, Maximum Month Average Day

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

Table 3-9. Forecast of Interbasin Transfer from the Cape Fear River Basin to the South River Basin, 2015–2050, Maximum Month Average Day

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

Table 3-10. Forecast of Interbasin Transfer from the Cape Fear River Basin to the New River Basin, 2015–2050, Maximum Month Average Day

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

Table 3-11. Forecast of Interbasin Transfer from the Cape Fear River Basin to the Northeast Cape Fear River, South River, and New River Basins, 2015–2050, Maximum Month Average Day

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

Note: Numbers may not sum due to rounding.

The IBT certificate request includes:

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

A water balance table summarizing the water demand forecast and the IBT certificate request is presented in Table 3-12.

Table 3-12. PCU Water Balance – 2015, 2025, and 2045

		2015 (MGD)		2025 (MGD)		2045 (MGD)	
Water Usage	**Basin**	**AADD**	**MMAD**	**AADD**	**MMAD[2]**	**AADD**	**MMAD[2]**
Finished Water from WTP[1]	Cape Fear	1.1	1.5	2.8	4.4	8.5	15.0
Consumptive Use	Cape Fear	-	-	<0.1	<0.1	0.1	0.2
	South	-	-	0.3	0.5	1.0	2.1
	Northeast Cape Fear	0.9	1.2	1.8	2.9	5.4	9.2
	New	0.2	0.3	0.6	0.9	1.7	3.2
Wastewater Discharge from US 421 WWTP	From Northeast Cape Fear to Cape Fear	-	-	0.1	0.1[3]	0.3	0.3[3]
Total Return To	Cape Fear	-	-	0.1	0.1	0.4	0.5
IBT	IBT to South	-	-	0.3	0.5	1.0	2.1
	IBT to Northeast Cape Fear	0.9	1.2	1.8	2.9	5.4	9.2
	IBT to New	0.2	0.3	0.6	0.9	1.7	3.2

Notes:

AADD – annual average daily demand
MMAD – maximum month average day

[1] Process water used during the treatment of raw water from the Cape Fear River at the PCU WTP is treated and discharged back to the Cape Fear River.

[2] MMAD demand and IBT values were developed from forecast analyses under conditions driven by weather and usage pattern that deviate from average, or expected, conditions. IBT forecasts based on average conditions would not accurately reflect the range of transfers that can reasonably be anticipated to occur under a full range of potential conditions. Since the IBT cannot ever be exceeded, the maximum IBT has been calculated as the transfer resulting from conditions outside of average conditions which could be reasonably expected to potentially occur ((HIGHFILL and CH2M, 2017)).

[3] MMAD wastewater discharges are set equal to average day discharge values to conservatively reflect the fact that during maximum month conditions (dry weather) wastewater flows will not be greater than average flows during the course of a calendar month.

Environmental Resources

4.1 Surface Water

4.1.1 Water Quality

Both water quantity and 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 instream 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's also an important factor in salinity concentrations in tidally influenced areas.

Figure 4-1 shows major water bodies within and adjacent to the Study Area. Figure 4-2 presents classifications of the surface waters in the region. The major surface water bodies in the Study Area include the Cape Fear River, Black River, Northeast Cape Fear River, Atlantic Intracoastal Waterway (AICW), and Atlantic Ocean. L&D1 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, is located in this vicinity within the water supply watersheds, and as such, a section of the Cape Fear River is designated for use as a public water supply with the "WS" classification (WS-IV) (NCDWR, 2016a).

Many rivers and streams throughout the entire Study Area are classified by NCDWR as Swamp Water (Sw). The Atlantic Ocean, classified as Tidal Water (SB), lies to the east. The portion of the 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; it is classified as SA and an outstanding resource water (ORW) below the mouth of Old Topsail Creek (NCDWR, 2016b).

Ambient water quality monitoring stations in the Study Area are listed as follows, including their stream index and classifications; Figure 4-1 presents the location of each monitoring station. The parameters of concern that did not meet their respective evaluation levels (applicable numeric or narrative water quality standards) for each station between 2004 and 2008 are also listed (NCDENR, 2009).

- 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 North Carolina Secondary Road (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

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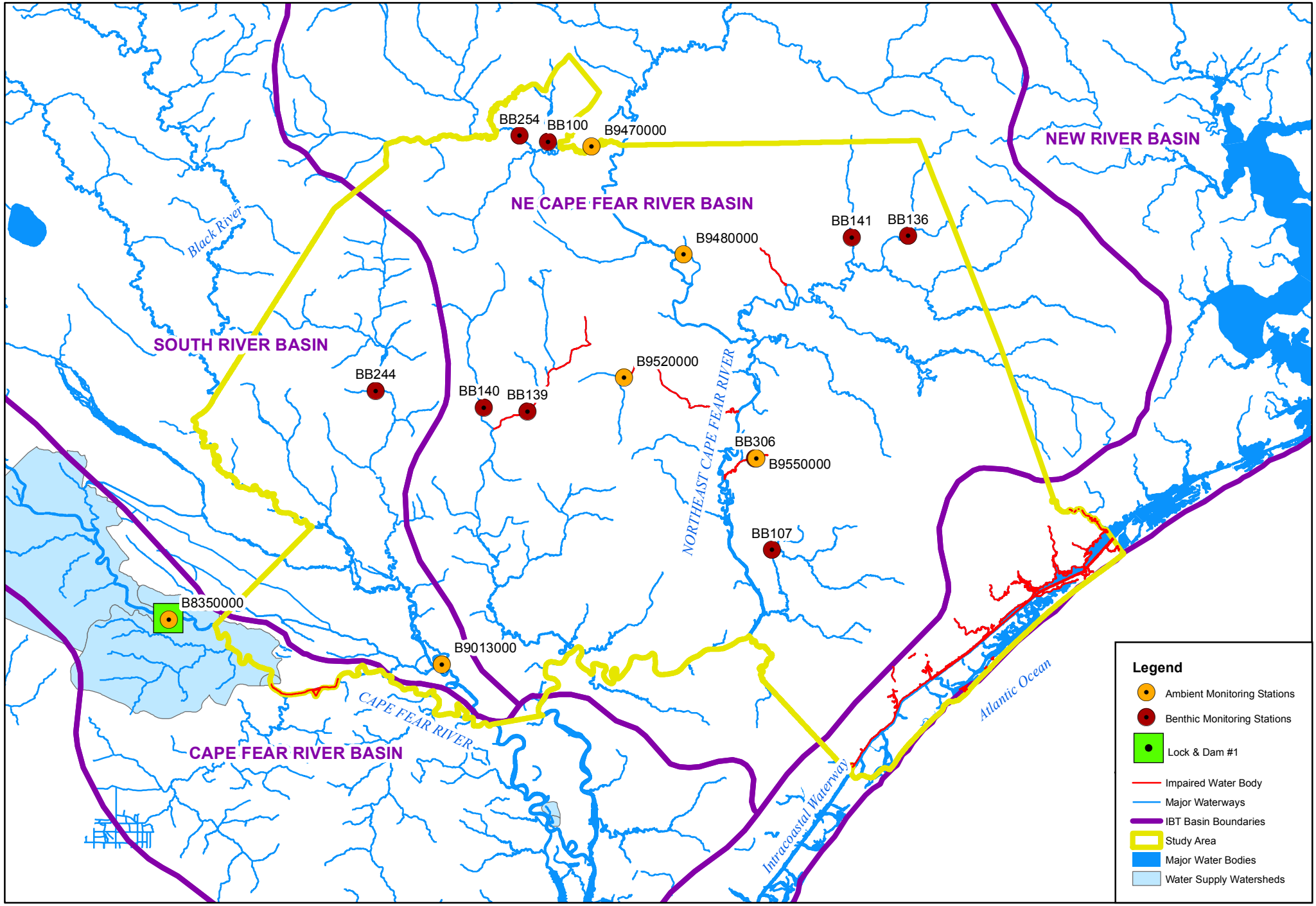

Figure 4-1
Surface Water
Petition
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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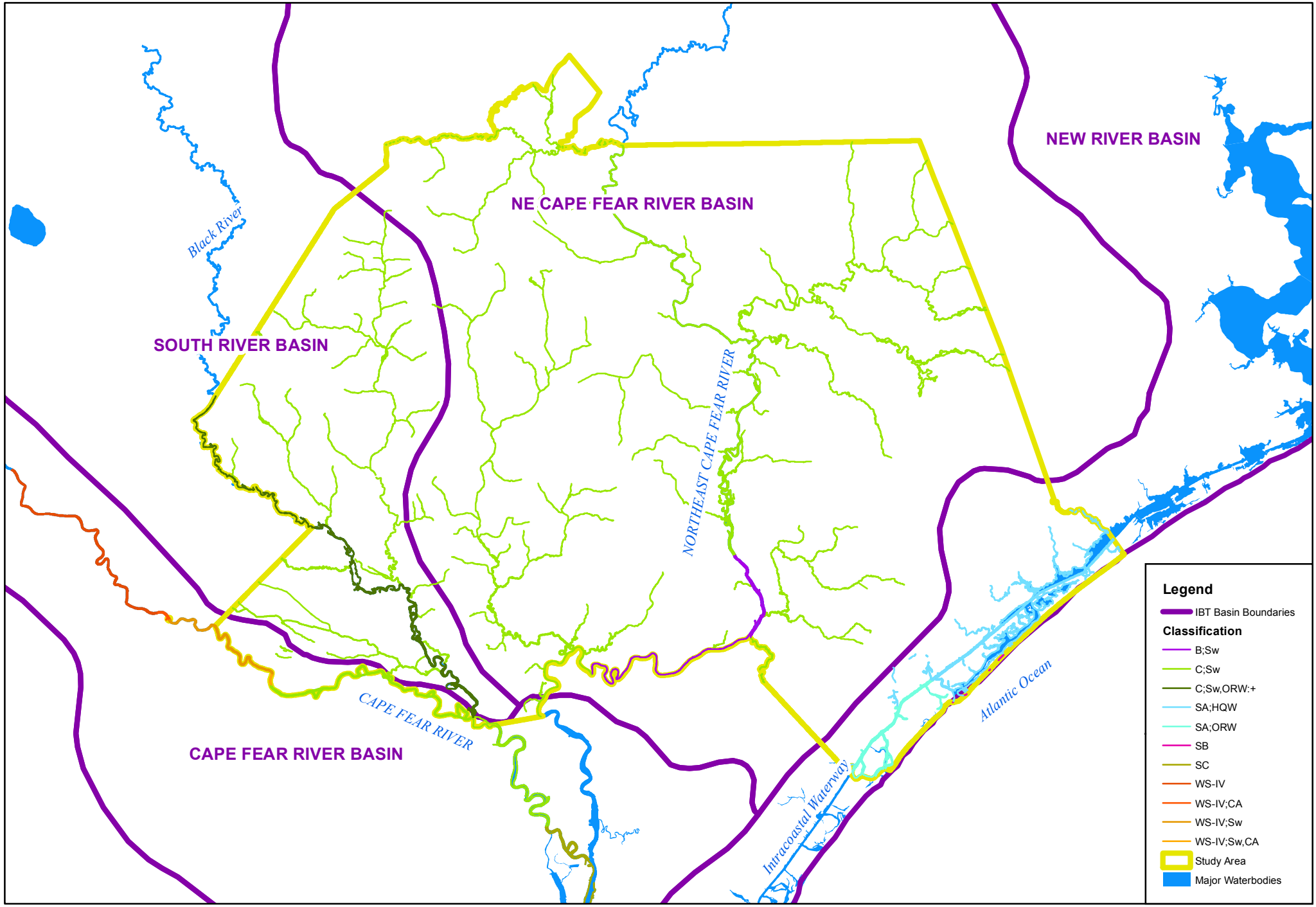

Figure 4-2
Surface Water Classification
Petition
Pender County Utilities
Interbasin Transfer from the Cape Fear River

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

- Moore's Creek from source to Buxton Branch (BB224), 18-68-18a, Moderate Stress, 2003:
  - This segment of stream is rated Supporting for aquatic life; for a swamp stream, the habitat is generally good.
  - The segment of Moore's Creek below this to the Black River is Impaired in the fish consumption category.
- Little Rockfish Creek (Boney Mill Pond) from source to Rockfish Creek (BB100), 18-74-29-6, Not Rated, 2003:
  - To assign a benthic community rating, NCDWR will resample Little Rockfish Creek using Coastal A criteria.
- Rockfish 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 was 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 water bodies 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 Clean Water Act (CWA) requires that states develop a list of waters that do not meet water quality standards or have impaired uses. These water bodies are presented on Figure 4-1 and listed in Table 4-1. All are category 5 impairments, and the State must prioritize these water bodies 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.
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 less than 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).

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 303(d) List as impaired for DO, pH, copper, and turbidity. 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 (NH_3-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) of dissolved oxygen (DO) 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, 2014a, 2014b; Tetra Tech, 2014a, 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 (NC EMC, 2014). 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 and pH levels 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 EMC to reclassify the segment of the Cape Fear River from the 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 (NCDENR, 2015).

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 that began in January 2017. If the changes are not altered following the legislative session, they will be submitted to the U.S. Environmental Protection Agency (EPA) for review and approval.

Table 4-1. Draft 2016 303(d) Listed Waters

Unit Number	Name	POI[a]	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	Becky's Creek (Bishops Creek)	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-87-8a	Becky's Creek (Bishops Creek)	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	SA;HQW	New
18-74-39b	Burgaw Creek	Copper (7 µg/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)	Intracoastal Waterway	Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	SA;HQW	New
18-74-42	Lillington Creek	pH (4.3 S.U., 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 S.U., 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	Nixon's 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

Table 4-1. Draft 2016 303(d) Listed Waters

Unit Number	Name	POI[a]	Classification	Major River Basin
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
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

[a] POI codes:

AL = aquatic life

FW = fresh waters

Nar = Narrative aquatic life standard

SA = class SA waters

SH = shellfish harvesting

Sw = swamp supplemental classification

Notes:

µg/L = microgram per liter

POI = Parameter of Interest

S.U. = Standard Units

4.1.1.1 Emerging Contaminants

In June 2017, state and local officials began sampling to monitor concentrations of "GenX," an unregulated chemical, in the lower Cape Fear River. The action was prompted after publication of a research paper (Sun, et al. 2016) indicating the presence of GenX and other per- and polyfluoroalkyl substances (PFAS) in the river downstream of a chemical manufacturing facility. Initial sampling confirmed elevated concentrations of the unregulated compounds, the potential human health risks of which have not yet been fully characterized, although the North Carolina Department of Health and Human Services (NCDHHS) established a provisional health goal of 140 parts per trillion (PPT) for GenX, and EPA set a health goal of 70 PPT for two PFAS compounds. (NCDHHS 2017)

In the ensuing months, DEQ ordered the manufacturing facility to cease discharge of fluorinated compounds to the Cape Fear River, urged EPA to provide health risk guidance for GenX, and has continued to monitor levels of GenX and other PFAS compounds in the river, in finished water, and in groundwater wells. Affected public water providers, including PCU, CFPUA, Bladen Bluffs, IP, and Brunswick County, have collaborated with DEQ, EPA, and with North Carolina State University (NCSU) to provide samples for analysis, to maintain compliance with all drinking water regulations, and to keep customers informed as the situation has developed. Monitoring data from Fall 2017 indicate that the concentrations of GenX and other PFAS compounds in the lower Cape Fear are generally below the provisional health goals. Concentrations well above the health goals have, however, been associated with two recent spills at the manufacturing facility, which have led DEQ to begin the process of revoking the facility's NPDES permit. (NCDEQ 2017)

Brunswick County's and PCU's transfers from the source basin have been operational for years, so the potential for introduction of emerging contaminants from the source basin to receiving basins pre-dates this transfer petition. This risk is best mitigated by eliminating the pollution source, which state and federal regulators continue to work to accomplish. Meanwhile, extensive monitoring of the river and finished drinking water continues, along with efforts to keep the public informed. As improved technology enables the detection of more compounds at lower concentrations, these public water providers will continue to comply with all state and federal regulations to protect human health and the environment.

4.1.2 Instream Flow

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 square miles [mi^2])
- 03-06-20 (343 mi^2)
- 03-06-22 (829 mi^2)
- 03-06-23 (795 mi^2)
- 03-06-24 (162 mi^2) (NCDENR, 2005)

PCU's water supply source is the Cape Fear River at L&D1. The dam crest is at an elevation of 11 feet above mean sea level (amsl), and the water level below the dam is 0 feet amsl at low water, with an average tidal influence range of approximately 2 feet observed at the dam (USACE, 2011). A U.S. Geological Survey (USGS) gaging station at this location (02105769), Cape Fear River at L&D1 near Kelly, has a drainage area of 5,255 mi^2. Historical annual river stage and discharge measured at this gage are presented on Figures 4-3 and 4-4. Figure 4-3 presents the river stage, in relation to the L&D1 dam crest, and Figure 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 on Figures 4-5 and 4-6. Figure 4-5 presents the river stage, and Figure 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.

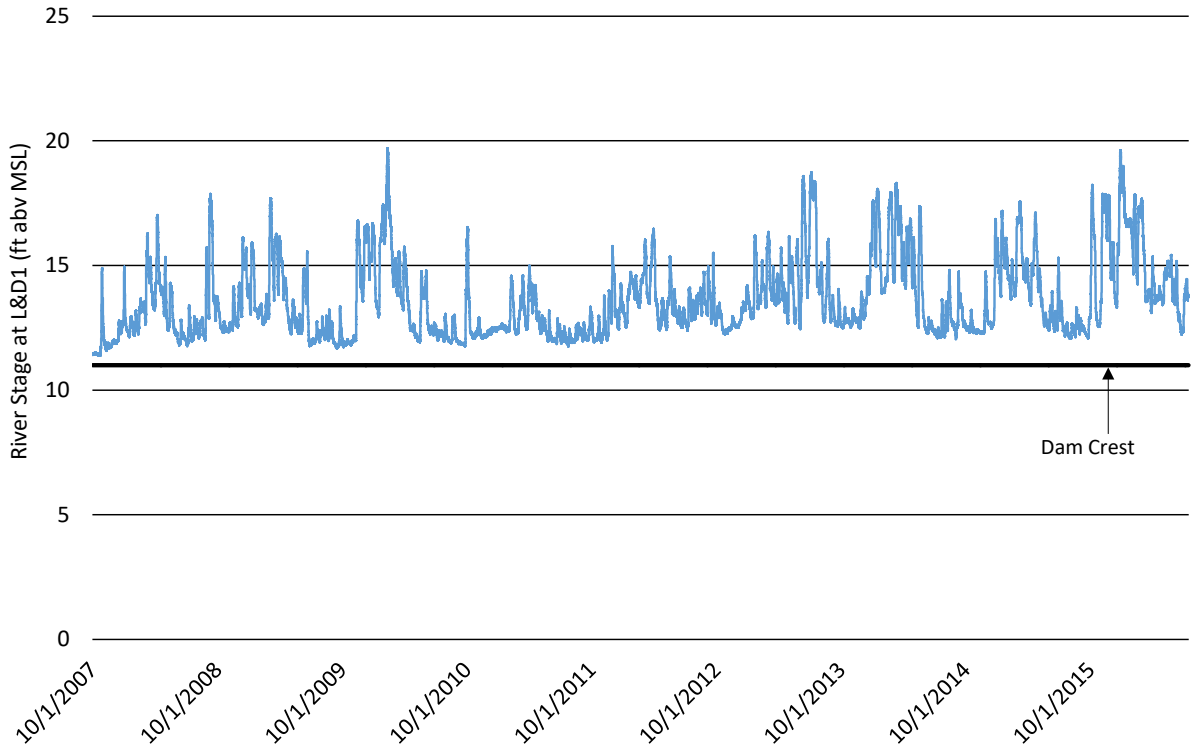

Figure 4-3. River Stage from 2007 to 2016 for the USGS Gaging Station on the Cape Fear River at L&D1
Data Source: USGS, 2016

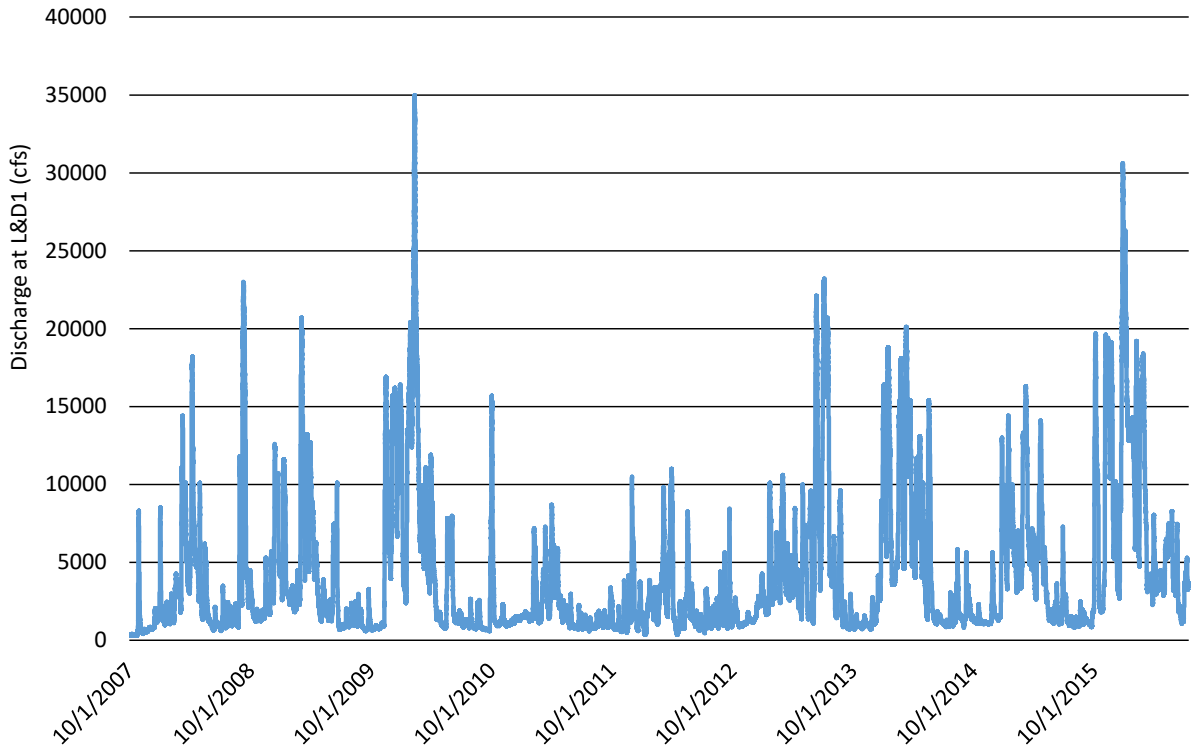

Figure 4-4. Discharge Rate from 2007 to 2016 for the USGS Gaging Station on the Cape Fear River at L&D1
Data Source: USGS, 2016

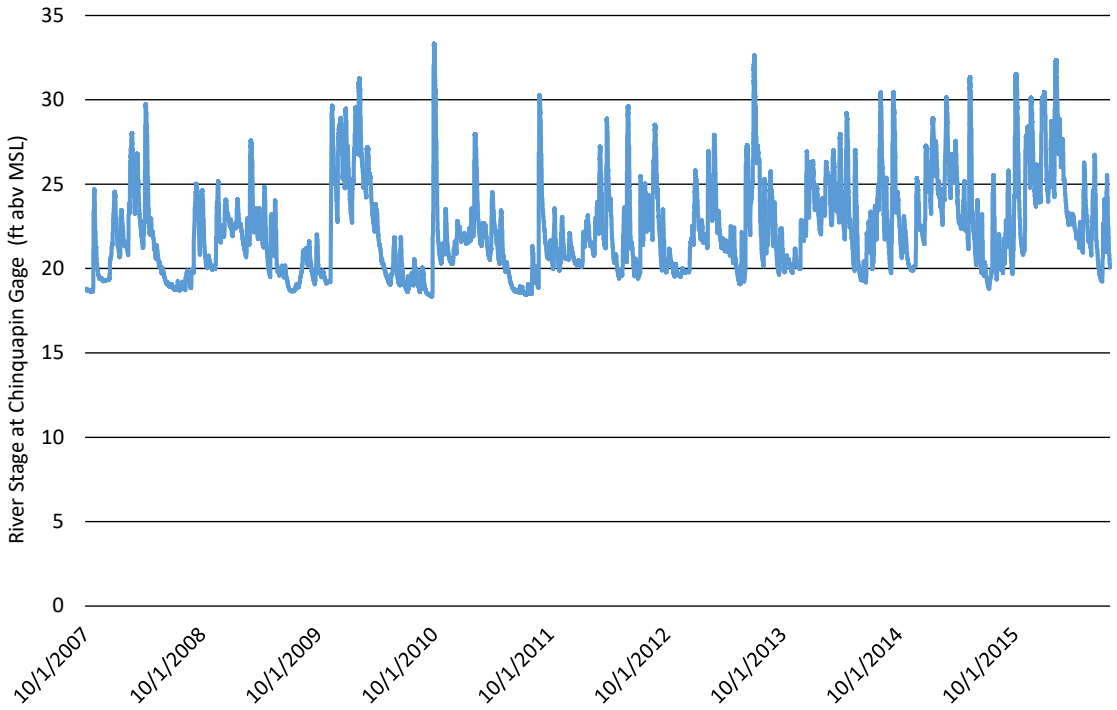

Figure 4-5. River Stage from 2007 to 2016 for the USGS Gaging Station on the Northeast Cape Fear River in Chinquapin
Data Source: USGS, 2016

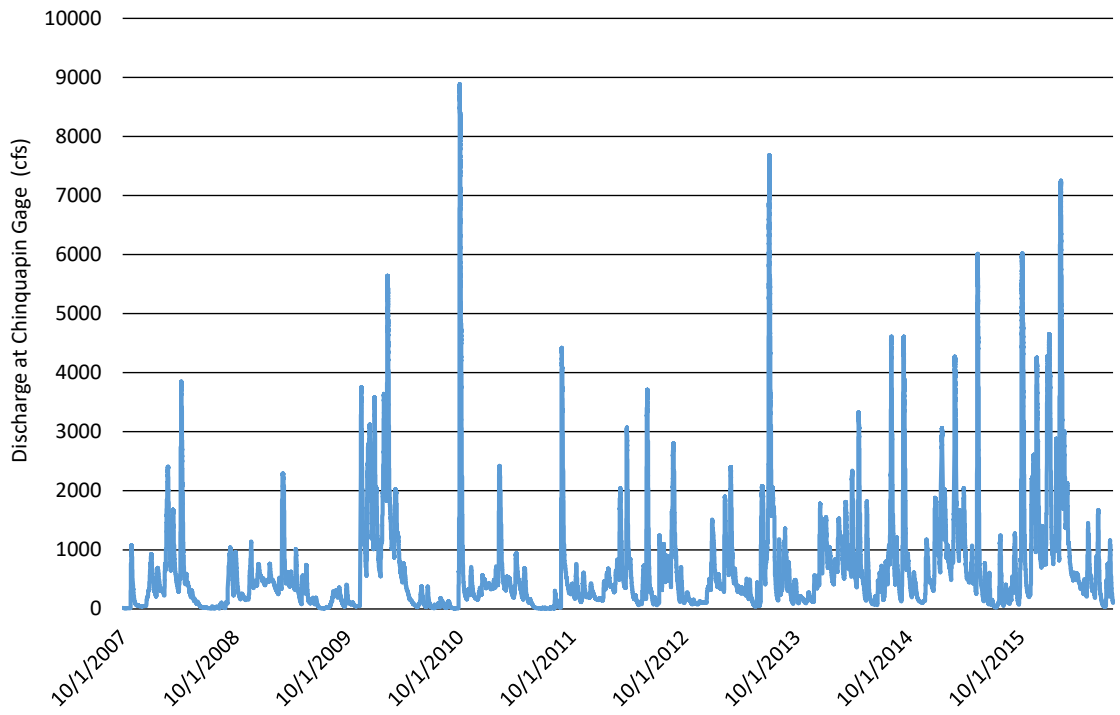

Figure 4-6. Discharge Rate from 2007 to 2016 for the USGS Gaging Station on the Northeast Cape Fear River in Chinquapin

Data Source: USGS, 2016

4.2 Aquatic Species

Water resources within the Study Area provide aquatic habitat for various species of fish, freshwater mussels, and other aquatic organisms. Freshwater, tidally influenced, and saltwater resources are present in the Study Area.

4.2.1 Fish Passage

The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are located just above L&D1 on the Cape Fear River. Downstream of L&D1, the river becomes tidally influenced. A fish passage structure at L&D1 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, 2015). 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).

4.2.2 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. Table 4-2 presents the list of federally listed aquatic species with current (not historical) records within the Study Area.

Eight aquatic 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, 2010, 2015).

Table 4-2. Federally Listed Aquatic Wildlife 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 sea turtle	*Chelonia mydas*	T	Pender
Leatherback sea turtle	*Dermochelys coriacea*	E	Pender
Loggerhead sea turtle	*Caretta caretta*	T	Pender
West Indian manatee	*Trichechus manatus*	E	Pender
Yellow lampmussel	*Lampsilis cariosa*	FSC	Pender

Sources: Pender County: USFWS, 2015 (updated March 25, 2015); Duplin County: USFWS, 2010 (updated September 22, 2010)

Notes:

E = Endangered

FSC = Federal Species of Concern

T = Threatened

S/A = Listed because of similarity of appearance

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).

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SECTION 5

Mitigation and Antidegradation

In this section, 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; therefore, it falls under the ordinances and programs for Pender County.

5.1 Pender County

5.1.1 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 Coastal Area Management Act (CAMA) permit decisions. Within the Land Use Plan, priorities are established for conservation lands, which currently comprise 25 percent of the county. The conservation areas primarily comprise 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)

The plan also lists a goal to increase the number of public boat ramps available within unincorporated Pender County (where the County has jurisdiction to add them).

5.1.2 Water Shortage Response Plans

Water Shortage Response Plans (WSRPs) are required by General Statute 143-355.2 to put in place water conservation measures during drought conditions. Pender County's WSRP is included in its Water and Sewer Ordinance, and is attached as Appendix C. The WSRP has been incorporated into PCU's Drought Management Plan, which is included as Appendix E. The purpose of the plan is to declare official stages of water shortage response and identify voluntary and mandatory conservation measures for each stage, along with enforcement measures for each. Each current PCU water customer will be notified of any change in the water shortage response stage, and will be required to implement the appropriate water use reduction activities. Co-applicants are required to adopt PCU's WSRP prior to receiving water from PCU so that all users receiving water under the proposed IBT will be required to comply with the same water shortage response measures, which equal or exceed the most stringent requirements among public water systems in the source IBT basin.

The WSRP includes five phases of water conservation, as follows:

1. Voluntary Reductions – Customer education and outreach programs will encourage water conservation and efficiency measures. The goal for water reduction is 5 percent.

2. Mandatory Reduction I – In addition to the voluntary measures, multiple mandatory water use restrictions are implemented with the goal of further reducing water usage by 10 percent in comparison to the previous month's water bill.
3. Mandatory Reductions II – In addition to previous restrictions, additional restrictions are implemented to ban all nonessential uses of drinking water. The goal is water reduction by 20 percent compared to the previous month's water bill. A drought surcharge of 1.5 times normal rates is implemented.
4. 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. The drought surcharge increases to 2 times normal rates.
5. Water Rationing – All customers are only permitted to use water at the minimum required for public health protection. The drought surcharge increases to 5 times normal rates.

The enforcement for each stage is outlined in Table 5-1.

Table 5-1. Pender County WSRP Enforcement

Water Shortage Stage	First Violation	Second Violation	Third Violation
Voluntary Reductions	-	-	-
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

Source: (Pender County, 2010d)

5.1.3 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 (ft^2) and larger may use traditional onsite septic and well services
- Within Planned Development (PD) or Residential Mixed (RM) districts, lots ranging between 12,000 and 14,999 ft^2must provide at least one of the following:
  - Community or public water service
  - Community or public wastewater treatment service
- All lots under 12,000 ft^2 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 ft^2 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 sanitary sewer overflows (SSOs). Article XIII of this ordinance is in place to aid in the prevention of SSOs from contributions and accumulation of fats, oils, and grease (FOG) 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).

5.1.4 Water Conservation

PCU's Water Conservation Plan and Drought Management Plan are included as Appendices D and E, respectively. These plans include discussions of strategies and policies implemented to ensure that PCU fosters continued responsible water stewardship as its customer base increases. To accomplish this goal, PCU has implemented water conservation measures equal to or exceeding the most stringent of any public water supply within the source IBT basin.

Following is a summary outline of PCU's water conservation strategy, which is discussed in full detail within the Water Conservation Plan and detailed on Pender County's website (Pender County, 2016a):

- Rate structure that discourages excessive water use
- Water resources planning to promote conservation
- Supply-side management
    - Water use efficiency
    - Water supply flexibility
- Demand-side management
    - Education
    - Incentives
    - Regulation

5.1.5 Use of Rate Structures to Encourage Water Conservation

PCU has a uniform rate for residential customers, with a base charge plus a uniform usage charge per 1,000 gallons used per month. Irrigation customers are required to pay a higher base rate and a higher usage rate, with the usage rate increasing significantly for usage over 10,000 gallons per month. Commercial and institutional customers pay the same rates as irrigation customers. PCU's current rates are available on Pender County's website and provided in comparison to those of other utilities in the Cape Fear River Basin in Appendix A of the Water Conservation Plan, which is included as Appendix D of this document (Pender County, 2016 b). The following paragraph describes the comparison results.

A comparison of monthly water bills and conservation signal costs was generated utilizing the UNC Environmental Finance Center (EFC) NC Water and Wastewater Rates Dashboard (hereafter, EFC Dashboard). Table 5-2 shows that PCU has the highest monthly water bill per 5,000 gallons ($57.50) among the utilities shown, which include utilities in the geographic region plus several from upstream in the major basin. The EFC considers the conservation signal to be the cost per 1,000 gallons above 10,000 gallons. PCU's conservation signal, which is the top tier for PCU's irrigation customers and commercial customers, was increased from $6.00 to $9.95/ 1,000 gallons as of July 1, 2017, making PCU's the highest among all utilities shown. This comparison shows that PCU's rates strongly promote efficient water use. (UNC)

TABLE 5-2
Water Usage Bills of Comparable Regional Utilities

Utility Provider	Monthly Water Bill (5,000 gallons)	Conservation Signal – Cost per 1,000 gallons above 10,000 gallons
PCU	$57.50	$9.95*

Surf City	$33.42	$4.06
ONWASA	$26.35	$3.75
Cary	$25.87	$6.46
Fayetteville	$23.02	$4.52
Harnett County	$34.25	$5.25
Cape Fear PUA	$31.26	$3.67
Topsail	$55.42	$5.50
Brunswick County	$27.25	$3.10
Pittsboro	$40.40	$6.84
Wallace	$23.65	$2.13
Jacksonville	$25.94	$4.83
Burgaw	$23.75	$5.07

* This rate was effective July 1, 2017, and is not yet reflected in the EFC Dashboard.

The EFC Dashboard also shows that PCU's average residential customer water bill for 1,000 gallons ($33.50) is more than double the median statewide water bill for the same volume ($16.44) (UNC, 2016).

5.2 Town of Topsail Beach

5.2.1 Coastal Area Management Act Core Land Use Plan

As mentioned, 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 the planning assets in place for each. To ensure that public infrastructure systems protect or restore quality of Areas of Environmental Concern (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 National Flood Insurance Program (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 no public wastewater system; however, development of one is under consideration. All individual lots are served by septic systems, which are permitted by Pender County Health Department. Wastewater from two subdivisions within Topsail Beach are treated by private wastewater systems. These new systems are the Queen's Grant system permitted in 2007 and the Serenity Point system permitted in 2013 (Cape Fear COG, 2015).

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 of the EA (HIGHFILL and CH2M, 2017).

5.2.2 Water Shortage Response Plan

Before receiving water from PCU, Topsail Beach will adopt PCU's WSRP. Topsail Beach has a WSRP in place now, which is available from NCDWR's website (Topsail Beach, 2010).

5.2.3 Water Conservation

Topsail Beach adopted the following limited watering schedule in August 2015 to promote water conservation:

- Property owners north of Davis Ave can irrigate during the hours of 2 and 4 a.m. on Mondays, Wednesdays, and Fridays only.
- Property owners south of Davis Ave can irrigate during the hours of 2 and 4 a.m. on Tuesdays, Thursdays, and Saturdays only.

All in-ground irrigation systems using Topsail Beach 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 Topsail Beach water for owners without in-ground irrigation systems is restricted to 2 hours per day using the same addressing system already described. Any manual watering must take place between the hours of 5 and 10 a.m. during these assigned days (Topsail Beach, 2015a).

5.2.4 Wellhead Protection Plan

Topsail Beach, which currently uses groundwater for its water supply, has a Wellhead Protection Plan that was approved in April 2007. The Wellhead Protection Plan allows Topsail Beach to protect 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 10-year time of travel. All four wells are located north along North Carolina Highway 50 (NC 50). The WHPAs span from the intersection of Empie Avenue approximately 0.5 mile north, with a gap of approximately 0.5 mile, and continues approximately 1.5 miles north along NC 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 include public education, as well as an emergency contingency plan (Topsail Beach, 2007).

5.2.5 Use of Rate Structures to Encourage Water Conservation

Topsail Beach has an increasing block rate structure. They bill a facility charge for no usage, and an increasing rate per 1,000 gallons is billed for each block of usage (that is, from 1-3,333 gallons) to encourage water conservation. The current increasing block rate structure is outlined in Table 5-3.

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] versus $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.

Table 5-3. Topsail Beach Water Rates as of July 2015

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

Source: Topsail Beach, 2015b

5.3 Town of Surf City

5.3.1 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" (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 decisions.

Surf City has developed Environmental Classes within their Land Use Plan. The classes indicated include I, II, and 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 of the EA (HIGHFILL and CH2M, 2017). Zoning also includes a Conservation District 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).

5.3.2 Water Shortage Response Plan

Before receiving water from PCU, Surf City will adopt PCU's WSRP. Surf City has a WSRP in place now, which is available from NCDWR's website (Surf City, 2010).

5.3.3 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 are linked on their website (Surf City, 2017).

5.3.4 Use of Rate Structures to Encourage Water Conservation

To further encourage water conservation, Surf City has an increasing block rate structure. They bill 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 (that is, from 2,001-5,000 gallons). The increasing rate structure is only for residential customers. The increasing block rate structure is outlined in Table 5-4.

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] versus $23.45 [Surf City]) (UNC, 2016).

Table 5-4. 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

(Surf City, 2015c)

Effective July 1, 2015

5.4 Town of Burgaw

5.4.1 Land Use Plan

Burgaw completed a Land Use Plan in June 2013 (Burgaw, 2013). A primary goal of land use in Burgaw as indicated in the Land Use Plan is to institute regulations that protect and acknowledge the topographical and hydrological features that exist. The policies to ensure this goal is met include setting aside environmentally sensitive areas, considering floodplain and wetland information in development decisions, avoiding future development in the floodway, and encouraging on-site stormwater systems that mimic natural systems. Likewise, actions include prioritizing areas containing sensitive and/or unique natural resources for conservation and preservation, quickly stabilizing soils with native seed mixes during construction, clarifying the function of the Conservation/Preservation (C/P) overlay zoning district, and limiting the density of development in the floodway (Burgaw, 2013).

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 of the EA (HIGHFILL and CH2M, 2017).

5.4.2 Water Shortage Response Plan

Before receiving water from PCU, Burgaw will adopt PCU's WSRP. Burgaw has a WSRP in place now, which is available from NCDWR's website (Burgaw, 2010).

5.4.3 Wellhead Protection Plan

Burgaw currently uses groundwater for water supply needs and has a Wellhead Protection Plan that was approved in December 1999. The Wellhead Protection Plan allows Burgaw to protect 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 Burgaw, and WHPAs encompass a large majority of the town. A map of the WHPA can be found in Appendix G of the EA (HIGHFILL and CH2M, 2017).

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).

5.4.4 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 conduct home audits to find leaks. Burgaw also provides information related to indoor consumption of conventional fixtures versus water-saving devices (Burgaw, 2016b, 2016c).

5.4.5 Use of Rate Structures to Encourage Water Conservation

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 (that is, from 2,001-3,000 gallons). The increasing block rate structure is summarized in Table 5-5. 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 (UNC, 2016).

Table 5-5. 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

Source: Burgaw, 2017

Effective July 1, 2015

5.5 Town of Wallace

5.5.1 Land Use Plan

Wallace's Land Use Plan was developed to manage change resulting from growth (Wallace, 2011). 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 encouraging the use of conservation or cluster subdivision design and compact growth, limiting the percentage of allowed impervious surface, working with land owners to identify opportunities for their land other than development, improving the municipal storm water system, preventing the establishment of polluting industries, and acquiring easements or fee simple ownership of environmentally sensitive land. These actions will aid in preserving open space and protecting water quality (Wallace, 2011).

One way 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 Plan 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. One goal is to 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 encouraging the preservation of natural areas and 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)

5.5.2 Water Shortage Response Plan

Before receiving water from PCU, Wallace will adopt PCU's WSRP. Wallace has a WSRP in place now, which is available from NCDWR's website (Wallace, 2010).

5.5.3 Wellhead Protection Plan

Wallace has a Wellhead Protection Plan that was approved in August 2015. The Wellhead Protection Plan allows Wallace to protect 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 10-year time of travel used. There are five wells that form a cluster, with their 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
- 9 percent right-of-way

A map of the WHPA can be found in Appendix G of the EA (HIGHFILL and CH2M, 2017). 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).

5.5.4 Use of Rate Structures to Encourage Water Conservation

Wallace has a flat rate structure, meaning that the price per gallon of water is fixed, regardless of how much water is used.

Table 5-6. Wallace Water Rates

Meter Size (inch)	Base Charge ($)	Usage Rate per 1,000 gal ($)
¾	13.00	2.13
1	37.00	1.75
1½	73.00	1.75
2	116.00	1.75
3	235.00	1.75
4	364.00	1.75
6	727.00	1.75
8	1,313.00	1.75

Source: (Wallace, 2016b)

Effective July 1, 2016

SECTION 6

Water Supply and Interbasin Transfer Alternatives

6.1 Local Water Supply Plans

LWSPs developed within the last 2 years for PCU and the co-applicants have been used in the development of the future water demands forecast and associated IBT planning. Utilities, Inc. currently has two developments within the Study Area, Belvedere Plantation and Olde Point. The supply and demand forecast numbers for all Utilities, Inc. developments in the future are captured in the 2016 Belvedere LWSP since the Olde Point development is not large enough to require a LWSP at this time. The LWSPs used in support of this IBT request are available on NCDWR's website: http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/search.php.

6.2 Water Supply and Interbasin Transfer Alternatives

The general categories of alternatives to the Pender County 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 in this section.

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 use 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 2045, including:

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 using additional water resources management tools.

Each identified alternative is believed to be technically feasible, except for Alternative 4. The 7Q10 values for primary surface water sources within the respective IBT river basins do not appear to be

adequate to satisfy the projected demands in those basins. Alternative 2 appears to be the most appropriate alternative to meet the long-range water supply needs through the year 2045 for PCU and its co-applicants. Alternative 2 is PCU's Preferred Alternative. The other alternatives present significantly greater technical, environmental, and economic challenges. Table 6-1 provides a summary comparison of the IBT alternatives.

6.3 Reinjection Storage

In addition to the alternatives considered in the EA, as described in Section 6.2, G.S. 143-215.22L, Regulation of surface water transfers, includes language requiring the consideration of reinjection storage as a water source. Reinjection storage and recovery, also known as aquifer storage and recovery, or ASR, is a resource management strategy that allows a water utility to store potable drinking water produced during the months when demand is at its seasonal low and recover this water from storage during the summer months to assist in meeting peak summertime demands. This practice has been approved for use by two utilities in eastern North Carolina and is typically used to augment water supplies for communities with high seasonal water demands.

Pender County does not currently have the infrastructure in place for this option. In addition, this option is typically considered for utilities with significant seasonal increases in demand, and the PCU service area does not currently demonstrate a high seasonal peaking factor. Reinjection storage alone is not sufficient to avoid IBT for Pender County and in consideration of the findings of the EA, no significant impacts from the IBT, this approach could be considered by Pender County in the future to augment water supply during seasonal peaks if the future water demand profile shifts to become more affected by seasonal demands not accounted for in the water demand projections that are the basis of the projected 2045 IBT.

6.4 Water Purchase

Pender County currently purchases water from the LCFWASA, and an increase in this purchase amount is proposed to meet County and co-applicants' future water supply needs. Prior to contracting with the LCFWASA for raw water, PCU obtained its water from Wallace in Duplin County. Wallace's wells are located in the CCPCUA. PCU's switch to surface water supply eliminated the flow of groundwater from the CCPCUA to PCU, which was a positive step in maintaining the water balance in the CCPCUA. PCU's other neighboring utilities also use groundwater, although outside of the CCPCUA (HIGHFILL and CH2M, 2017). Their current well supplies are not sufficient to meet projected demands; instead of expanding groundwater usage and the associated potential environmental impacts, these utilities are co-applicants for this proposed IBT. These utilities are looking to obtain future surface water supplies from PCU to meet demands beyond their current supplies.

Table 6-1. Summary of Interbasin Transfer Alternatives

Alternative	Meets Purpose and Need?	Requires New Infrastructure?	Potential Environmental Impacts	Planning Level Anticipated Cost (2017 dollars)
1. No action.	No	No	No direct environmental impacts; growth would still occur	$0
2. Increase IBT to meet projected water needs by using the available supply from the Cape Fear River.	Yes	Yes (Capacity fee for future water supply, WTP capacity expansion and distribution infrastructure)	Potential impacts to construct linear infrastructure to provide water to unserved areas of the County	$42M - $46M plus distribution
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 in addition to the future WTP capacity expansion and distribution infrastructure)	Same as Alternative 2, plus significant potential for environmental impacts from the construction of an entire wastewater collection, pumping and treatment infrastructure system	$170M - $180M in addition to the costs in Alternative 2, above
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, but current 7Q10 values do not support it	Yes (new raw water withdrawal infrastructure, new WTPs for each source basin, in addition to 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	Not evaluated since the Purpose and Need are not satisfied
5. Avoid an increase in IBT by using coastal water sources and desalination technology.	Yes	Yes (new ocean intake, new desalination WTP, new concentrate discharge outfall, new high service pumps and transmission in addition to new distribution infrastructure)	High level of potential environmental impacts due to new ocean intake and discharge, new desalination WTP, higher energy use WTP, as well as environmental issues associated with the disposal of brine from a new desalination WTP	$290M - $310M plus distribution
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, new WTP(s), 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	$130M - $160M plus distribution (if sufficient supply is available)
7. Avoid or minimize IBT increase by using additional water resources management tools.	No	No (reuse infrastructure if included [only feasible if WWTPs are constructed])	None, but direct impacts from reuse lines if constructed	Not evaluated since the Purpose and Need are not satisfied

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Water Withdrawals and Transfers from the Source Basin

To meet the requirements of G.S. 143-215.22L, regulation of surface water transfers, the following tables list registered water systems within the Cape Fear River basin. Only one registered transfer exists from the source IBT basin (2-3) – Brunswick County holds an IBT certificate. Table 7-1 lists the public water systems in the Cape Fear River Basin, and Table 7-2 lists the registered water withdrawals in the source IBT basin (2-3). Transfers do occur upstream of the source IBT basin, including a transfer by the Towns of Cary and Apex from the Haw River IBT basin (2-1) to the Cape Fear River IBT basin (2-3).

Only one water supply withdrawal exists downstream of the source location for PCU's water supply from LCFWASA at L&D1. The intake for International Paper (IP) is located downstream of the LCFWASA intake and does provide a small public water supply to the Town of Riegelwood. Since the Cape Fear and Neuse River Basin Hydrologic Model (CFNRBHM) domain terminates at L&D1, this intake is outside of the model domain. The river below L&D1 is tidally influenced; therefore, IP only withdraws and discharges water on an outgoing tide.

Hydrologic analyses were completed using the CFNRBHM, received from NCDWR on May 14, 2016 and are discussed in more detail in Section 8 (NCDWR, 2013). The analyses identified no impacts to source IBT basin water withdrawals from an increase in Pender County's IBT through year 2045. IP demands were compared to low flow data at L&D1 given the geographic limitations of the model. The 5th percentile low flow at L&D1, 585 CFS or 378 MGD, is 8 times more than IP's maximum pumping capacity of 49 MGD, indicating that sufficient flow is available for IP's intake. To further support this conclusion, results from the application of the modified Tennant method, as discussed in Section 8, predict, in the worst case, a 2.0 to 3.5 percent increase in the number of lowest flow days during the driest season of the year. Implementation of WSRPs will help to limit the potential for negative impacts to the IP intake and its associated discharge during such events.

Table 7-1. Public Water Systems in the Cape Fear River Basin

Public Water System ID	System Name	Water Source Name
50-09-012	Bladen Bluffs	Cape Fear River
02-01-010	Burlington	Stoney Creek
02-01-010	Burlington	Great Alamance Creek
04-65-010	Cape Fear Public Utility Authority - Wilmington	Cape Fear River
04-65-010	Cape Fear Public Utility Authority - Wilmington	NPDES Recycle
03-63-025	Carthage	Nicks Creek
03-19-126	Chatham County North Water System	Haw River-Jordan Lake
03-43-010	Dunn	Cape Fear River
03-26-010	Fayetteville	Cape Fear River
03-26-010	Fayetteville	Little Cross Creek
03-26-010	Fayetteville	Big Cross Creek

Table 7-1. Public Water Systems in the Cape Fear River Basin

Public Water System ID	System Name	Water Source Name
02-01-015	Graham	Back Creek
02-41-010	Greensboro	Reedy Fork Cr.
02-41-010	Greensboro	Reedy Fork Cr.Horsepen Cr.
02-41-010	Greensboro	Brush Creek.
03-43-045	Harnett County Regional Water System	Cape Fear
02-41-020	High Point	Deep River (Oak Hollow)
02-41-020	High Point	Deep River (City Lake)
04-24-820	International Paper Company	Cape Fear River
50-09-013	LCFWSA - Kings Bluff	Cape Fear River
03-68-010	Orange Water and Sewer Authority	Cane Creek
03-68-010	Orange Water and Sewer Authority	Morgan Creek
03-68-010	Orange Water and Sewer Authority	Haw River
30-76-010	Piedmont Triad Regional Water Authority	Deep River
03-19-015	Pittsboro	Haw River
02-76-020	Ramseur	Sandy Creek
02-79-020	Reidsville	Troublesome Creek
02-79-020	Reidsville	Troublesome Creek
03-63-015	Robbins Water System	Bear Creek
03-53-010	Sanford	Cape Fear
03-19-010	Siler City	Rocky River

Table 7-2. Registered Water Withdrawals in the Cape Fear River IBT Basin (2-3)

ID	Owner Name	Facility Name	County
0832-0001	Big Sky Blueberry Farm	Big Sky Blueberry Farm	Bladen
0843-0001	The Chemours Company FC, LLC	Chemours Company – Fayetteville Works	Bladen
0009-0001	Archer Daniels Midland Company	Southport Plant 789	Brunswick
0033-0001	Duke Energy Progress, LLC	Brunswick Steam Electric Plant	Brunswick
0056-0001	Capital Power Corp. NC	Capital Power Corp. - Southport Facility	Brunswick
0608-0001	Bald Head Island Club	Bald Head Island Club	Brunswick
0662-0001	The Clubs at St. James, LLC	Founders Club at St. James Plantation	Brunswick
0662-0002	The Clubs at St. James, LLC	Members Club at St. James Plantation	Brunswick
0662-0004	The Clubs at St. James, LLC	Reserve Club at St. James Plantation	Brunswick

Table 7-2. Registered Water Withdrawals in the Cape Fear River IBT Basin (2-3)

ID	Owner Name	Facility Name	County
0687-0001	Magnolia Greens, Inc.	Magnolia Greens Golf Plantation	Brunswick
0690-0001	Leisure Investments of NC, Inc.	Oak Island Golf Club	Brunswick
0794-0001	Funston Land & Timber	Cape Fear National Golf Club	Brunswick
0848-0001	Town of Oak Island	Oak Island Golf Club	Brunswick
0033-0004	Duke Energy Progress, LLC	Cape Fear Steam Electric Plant	Chatham
0066-0001	International Paper	Riegelwood Mill	Columbus
0218-0003	Aqua North Carolina	Mill Creek Farms	Cumberland
0218-0004	Aqua North Carolina	Stoney Point - Cumberland	Cumberland
0218-0006	Aqua North Carolina	Bragg Estates	Cumberland
0218-0066	Aqua North Carolina	Braxton Hills/Simmons Heights	Cumberland
0218-0116	Aqua North Carolina	Copeland Acres	Cumberland
0219-0006	Martin Marietta Materials, Inc.	Cumberland Quarry	Cumberland
0378-0057	Utilities, Inc.	Tanglewood Estates	Cumberland
0380-0001	Mcneill Farms	McNeill Farms	Cumberland
0381-0001	Methodist University	Methodist College Golf Course	Cumberland
0381-0002	Methodist University	King's Grant Golf Course	Cumberland
0615-0001	Birchwood Farms, Inc.	Cypress Lakes Golf Course	Cumberland
0644-0001	MDC II, LLC	Gates Four Golf & Country Club	Cumberland
0646-0001	Highland Country Club	Highland Country Club	Cumberland
0804-0001	United States Army	Stryker Golf Course	Cumberland
0804-0002	United States Army	Ryder Golf Course	Cumberland
0823-0001	American Materials	Wade Mine	Cumberland
0340-0007	Hanson Aggregates Southeast, LLC	Elliot Sand & Gravel	Harnett
0340-0016	Hanson Aggregates Southeast, LLC	Gardner Quarry	Harnett
0772-0001	Anderson Creek Partners	Anderson Creek Golf Club	Harnett
0785-0001	Campbell University	Keith Hills Country Club	Harnett
0790-0001	G.S. Materials, Inc.	Hall Rackley & Cameron Pits	Harnett
0218-0008	Aqua North Carolina	Wrightsboro	Hoke
0638-0001	Carolina Turf Farms	Bayonet At Puppy Creek	Hoke
0219-0043	Martin Marietta Materials, Inc.	Lemon Springs Quarry	Lee
0378-0053	Utilities, Inc.	Quail Ridge	Lee
0681-0001	Tobacco Road Golf, LLC	Tobacco Road Golf, LLC	Lee
0763-0001	Carl Bunnell	Quail Ridge Golf Course	Lee

Table 7-2. Registered Water Withdrawals in the Cape Fear River IBT Basin (2-3)

ID	Owner Name	Facility Name	County
0780-0001	Carolina Trace Country Club	Carolina Trace Country Club	Lee
0150-0007	Pinehurst, Inc.	Pinehurst Resort #8	Moore
0218-0235	Aqua North Carolina	Happy Valley	Moore
0293-0001	Pine Needles & Mid Pines Lodge And Country Club	Pine Needles Lodge & Country Club	Moore
0293-0002	Pine Needles & Mid Pines Lodge And Country Club	Mid Pines Inn & Golf Club	Moore
0628-0002	Carolina Golf Development	Woodlake Resort and Country Club	Moore
0694-0001	Seven Lakes Country Club	Seven Lakes Country Club	Moore
0703-0002	Avestra, LLC	Southern Pines Country Club	Moore
0712-0001	Forest Creek Development	Forest Creek Golf Club (North Course)	Moore
0712-0002	Forest Creek Development	Forest Creek Golf Club (South Course)	Moore
0725-0001	Oceanico USA	Little River Golf Resort	Moore
0734-0002	Robert Levy Jr.	Talamore Resort	Moore
0742-0001	Pinewild Country Club of Pinehurst	Azalea/Challenge Course	Moore
0765-0001	Bob Hanson	Dormie Club	Moore
0825-0001	BGWP LLC	Country Club of Whispering Pines	Moore
0033-0007	Duke Energy Progress, LLC	Sutton Steam Electric Plant	New Hanover
0218-0215	Aqua North Carolina	Glynnwood	New Hanover
0296-0001	General Electric Company	GE Wilmington	New Hanover
0358-0002	Invista Sarl	Invista Sarl	New Hanover
0648-0001	Charlie Walker	Beau Rivage Golf Resort	New Hanover
0661-0001	Cape Fear Country Club, Inc.	Cape Fear Country Club, Inc.	New Hanover
0779-0001	Corning Incorporated	Corning - Wilmington Plant	New Hanover
0033-0011	Duke Energy Progress, LLC	Harris Nuclear Plant	Wake
0218-0163	Aqua North Carolina	Duncan Ridge	Wake
0218-0232	Aqua North Carolina	Hampton Park	Wake
0218-0266	Aqua North Carolina	Holland Downs	Wake
0218-0314	Aqua North Carolina	Lake Springs	Wake
0218-0649	Aqua North Carolina	Whitetail Farm	Wake
0218-0704	Aqua North Carolina	Vintage Acres	Wake
0218-0705	Aqua North Carolina	Avocet	Wake
0219-0039	Martin Marietta Materials, Inc.	Fuquay Quarry	Wake
0340-0010	Hanson Aggregates Southeast, LLC	Holly Springs Quarry	Wake

Table 7-2. Registered Water Withdrawals in the Cape Fear River IBT Basin (2-3)

ID	Owner Name	Facility Name	County
0379-0001	Devils Ridge Golf Club	Devils Ridge Golf Club	Wake

ID = identification

NCWRC = North Carolina Wildlife Resources Commission

U.S. = United States

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Hydrologic Impact Analysis for the Proposed Transfer

8.1 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 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 (NCDWR, 2013). The resulting model was developed using HydroLogics' OASIS water resources program, which combines graphic representations of components, such as river sections, demands, and withdrawals, with logical statements that describe the components' behaviors (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 provided directly from public water supply systems. 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 develop and implement WSRPs to require the reduction of water use during drought conditions. WSRPs must include an expected reduction in demand resulting from water restrictions that 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 during model development when the triggers were 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; therefore, they cannot be explicitly represented in the model. This includes all water withdrawals downstream of Jordan Lake on the Cape Fear River, so 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&D1.

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 IBT basin. This WWTP has an NDPES permit to discharge up to 4 MGD to the Cape Fear River downstream of L&D1. 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&D1.

The 2010 Baseline scenario 7Q10 estimate is 348 cfs at L&D1. The US 421 WWTP discharge location is several miles downstream with another major river (Black River) confluence between the two points on the Cape Fear River. Thus, a direct comparison is not appropriate. A 7Q10 value was not used as part of the water quality analysis for the WWTP discharge permit because the discharge location is in a tidally influenced portion of the Cape Fear River (Tetra Tech, 2010).

Additional model background, 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* (CH2M, 2016). 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:

1. 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 result from increased future withdrawals and discharges throughout the Cape Fear River basin, from an historical point in time.
2. 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 basins 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 exceed 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 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 less than 2 MGD.
3. 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 basins, with withdrawals and discharges as projected by public water suppliers, and the County demands that would result in the proposed increase in IBT.
4. 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 that would be seen in the assessment metrics if the maximum allowable withdrawal were to occur at L&D1 and the Jordan Lake water supply pool was 100 percent allocated. The maximum allowable withdrawal, based on current NCDWR 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&D1, as reported in the LCFWASA's Environmental Report *Kings Bluff Raw Water Pump Station 60-Inch Parallel Raw Water Intake Pipe and Screen Project* (McKim and Creed, 2008) and the Brunswick County IBT Certificate Hearing Officers Report (NCDENR, 2015).

River flow statistics reviewed for all scenarios included average and median flows, which are representative of normal climatic conditions, and 10^{th} and 5^{th} percentile flows, which are representative of low-flow periods. These percentiles were selected to reflect typical low-flow statistics, including the use of the 10^{th} percentile by USGS as an indicator for flows that are "much below normal" and the use of the 5^{th} and 10^{th} percentile by the Drought Management Advisory Council (DMAC) to define the start of "severe" and "extreme" droughts, respectively (USGS, 2016). Note that no modeling is intended for the receiving basins, 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.

8.1.1 Flow Above L&D1

Flow to L&D1 is not expected to be affected by the proposed increase in IBT, since the intake is at L&D1, and this assessment point (model node 810) 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&D1, and simulated changes in river flow are more indicative of what is occurring upstream in the Cape Fear River basin. As shown in Table 8-1, the largest difference in average, median, 10th percentile, and 5th percentile flows is between the different time periods (2010 versus 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 use of the Jordan Lake water supply pool.

The increased flow identified in Table 8-1 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 use of the water supply pool and assumed returns downstream of 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 use of the Jordan Lake water supply pool.

Table 8-1. Model Scenario Comparison - Cape Fear River Statistics Above L&D1

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 2010 Baseline (CFS)	-66	-64	-13	-19
Difference from 2010 Baseline (%)	-1.2	-2.0	-1.4	-2.4
Difference from 2045 Baseline (CFS)	0	0	0	0
Difference from 2045 Baseline (%)	0.0	0.0	0.0	0.0
2045 Maximum Withdrawal- River Flow (CFS)	5,261	3,036	907	757
Difference from 2010 Baseline (CFS)	-94	-78	-10	-10
Difference from 2010 Baseline (%)	-1.7	-2.5	-1.0	-1.3
Difference from 2045 Baseline (CFS)	-28	-14	+3	+9
Difference from 2045 Baseline (%)	-0.5	-0.5	+0.3	+1.2

CFS = cubic feet per second

8.1.2 Flow Below L&D1

Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer (CH2M, 2016) includes a comprehensive summary of the magnitude, duration, and frequency of monthly flow and stage statistics below L&D1 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 already defined. 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 also changes in the length 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&D1 and the functionality of its fish ladder, as discussed in Section 8.2.

During periods of extreme low flow, each of the 2045 scenarios exhibit a reduction in flow below L&D1 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&D1. The comparison of the 2045 Baseline and 2045 Requested IBT scenarios on Figure 14 of *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer* (CH2M, 2016) 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 Table 8-2.

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&D1. 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.

Table 8-2. Model Scenario Comparison - Cape Fear River Statistics Below L&D1

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 2010 Baseline (CFS)	-101	-102	-53	-64
Difference from 2010 Baseline (%)	-1.9	-3.3	-6.2	-9.9
Difference from 2045 Baseline (CFS)	-19	-18	-20	-21
Difference from 2045 Baseline (%)	-0.4	-0.6	-2.5	-3.5
2045 Maximum Withdrawal - River Flow (CFS)	5,112	2,881	747	538
Difference from 2010 Baseline (CFS)	-185	-174	-111	-111
Difference from 2010 Baseline (%)	-3.5	-5.7	-12.9	-17.1
Difference from 2045 Baseline (CFS)	-103	-90	-78	-68
Difference from 2045 Baseline (%)	-2.0	-3.0	-9.7	-11.6

As detailed in *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer* (CH2M, 2016), the largest modeled change in flow duration resulting from the proposed IBT is an additional 4 days in January (nonspawning 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 amsl (dam crest is 11.0 feet amsl). The model shows these potential additional low-flow and lower stage days occurring in nonspawning months, with the predicted stage always above the dam crest elevation, and the maximum duration is 5 days out of 365. These predicted variations of flow can be expected to occur annually. The effect below L&D1 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 are required to be as stringent as others in the basin, as stipulated by 15A North Carolina Administrative Code (NCAC) 02E .0600, Water Use During Droughts and Water Supply Emergencies. Per the NCAC, industrial users will be "consistent with industry water efficiency and drought response guidelines"; in addition, agricultural users will "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 percent below the amount used in the month prior." Based on the 20 percent reduction target in the NCAC, the reduction in water withdrawal for those 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&D1. Since drought restrictions have not been more severe than Stage 2 since the requirement for WSRPs was implemented, no data exist to show actual reductions during extreme drought conditions. Accordingly, no reductions are included in the hydrologic model. The hydrologic modeling results, therefore, represent a conservative evaluation of flows during extreme drought conditions.

A flow-duration plot for the Cape Fear River flows below L&D1 is provided on Figure 8-1. 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 on Figure 8-2. Figure 8-3 presents the time series plot for the 2007 drought period. Figure 8-4 presents a low-flow comparison of the 2045 scenarios to the 2010 Baseline scenario for the 2007 drought. *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer* (CH2M, 2016) contains plots that provide the same data presented on Figures 8-3 and 8-4 for the other two droughts or record (1950s' and 2002's drought periods).

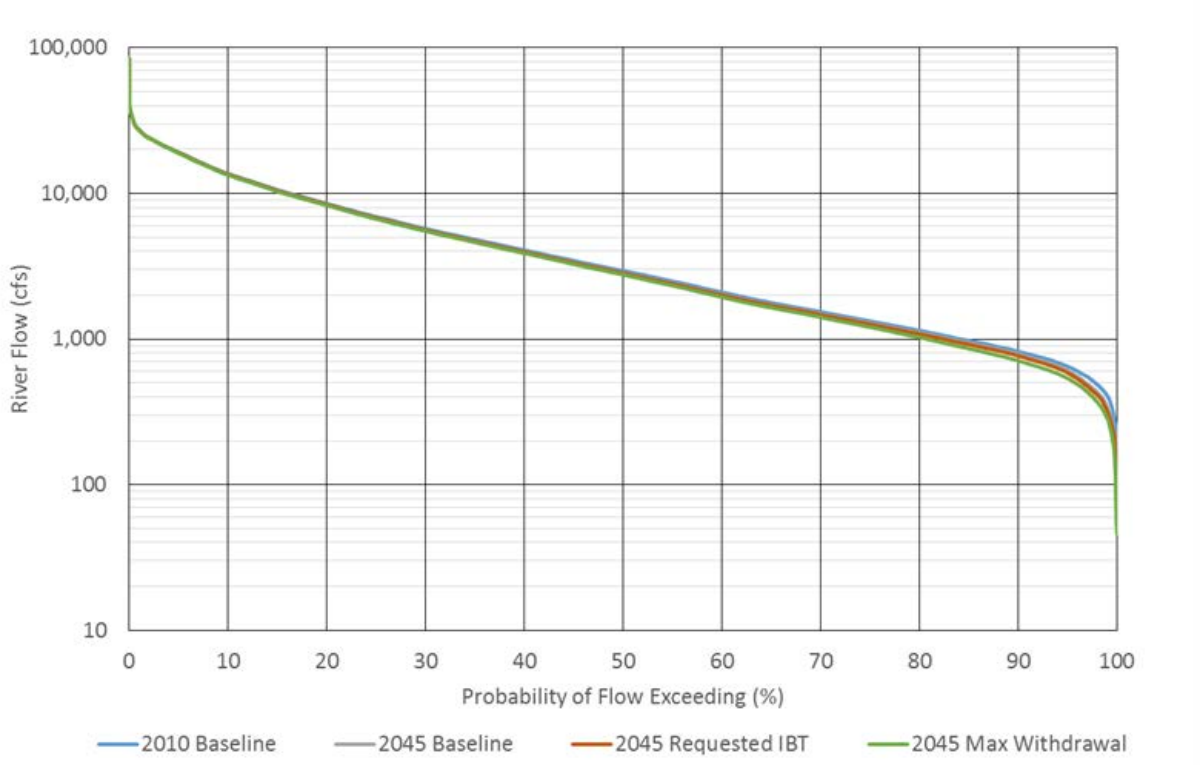

Figure 8-1. Period of Record Flow Duration Comparison Below L&D1

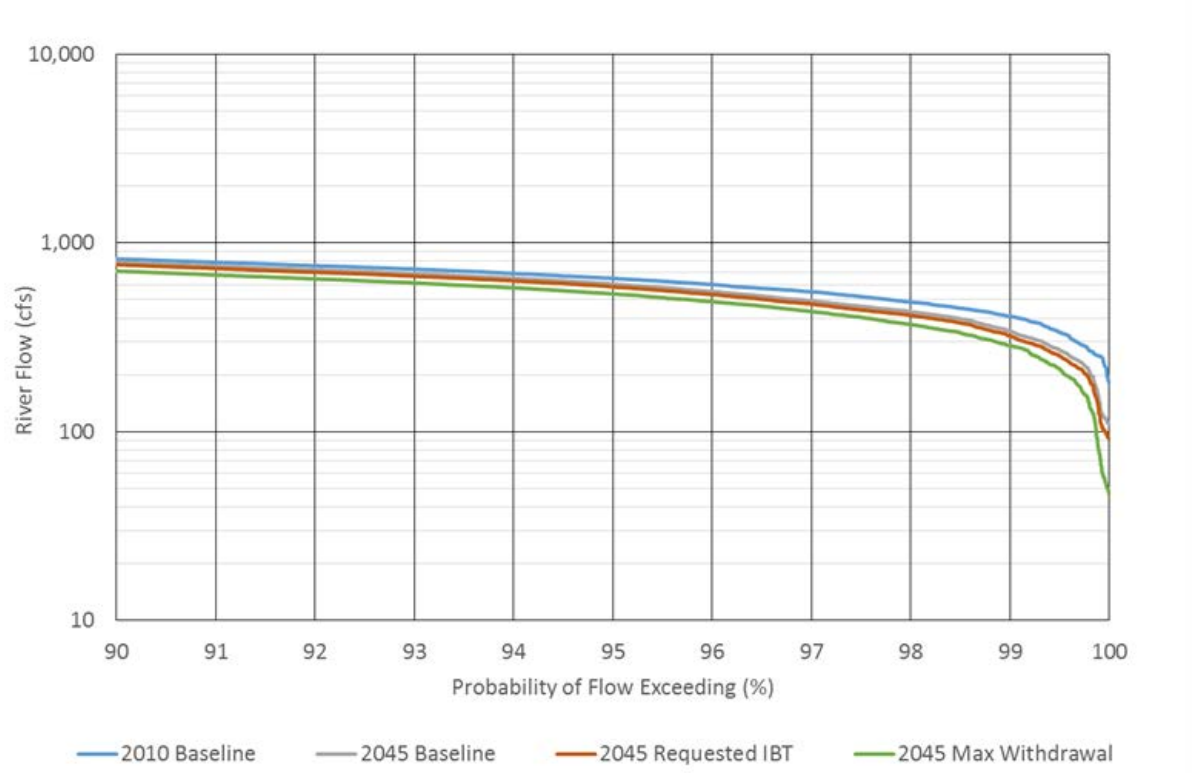

Figure 8-2. Low-flow Duration Comparison Below L&D1

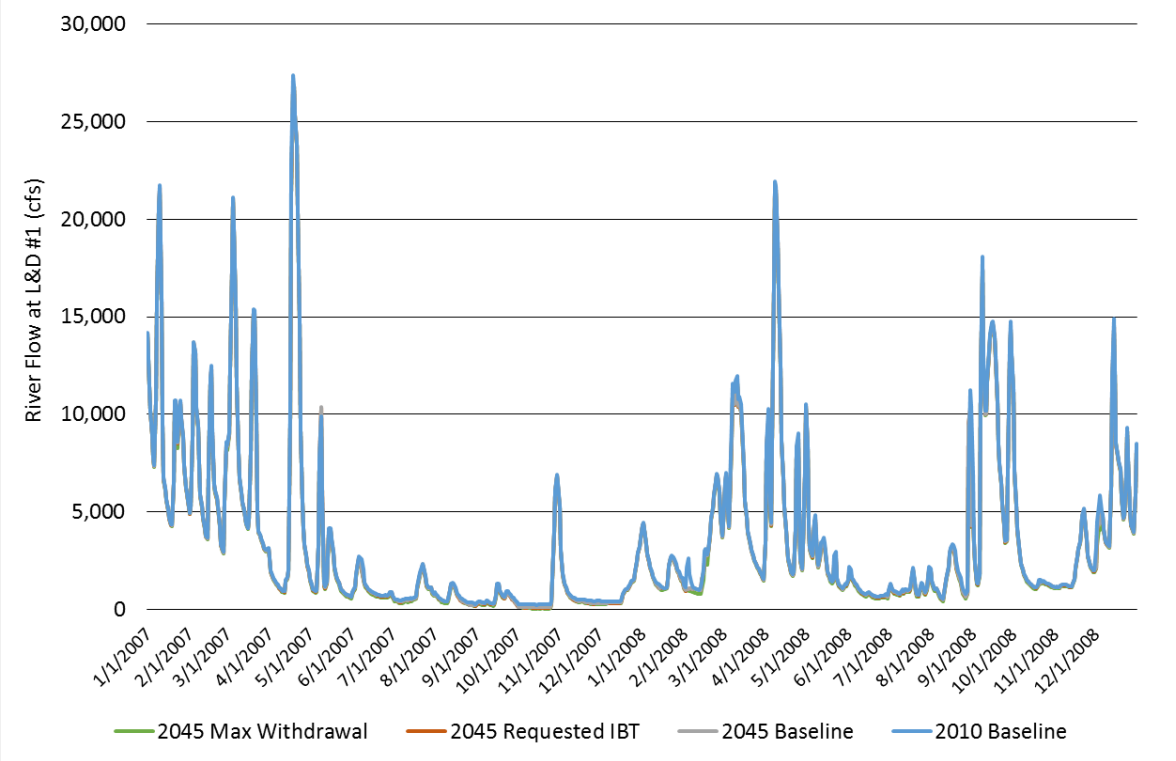

Figure 8-3. Flow Comparison for the 2007 Drought Below L&D1

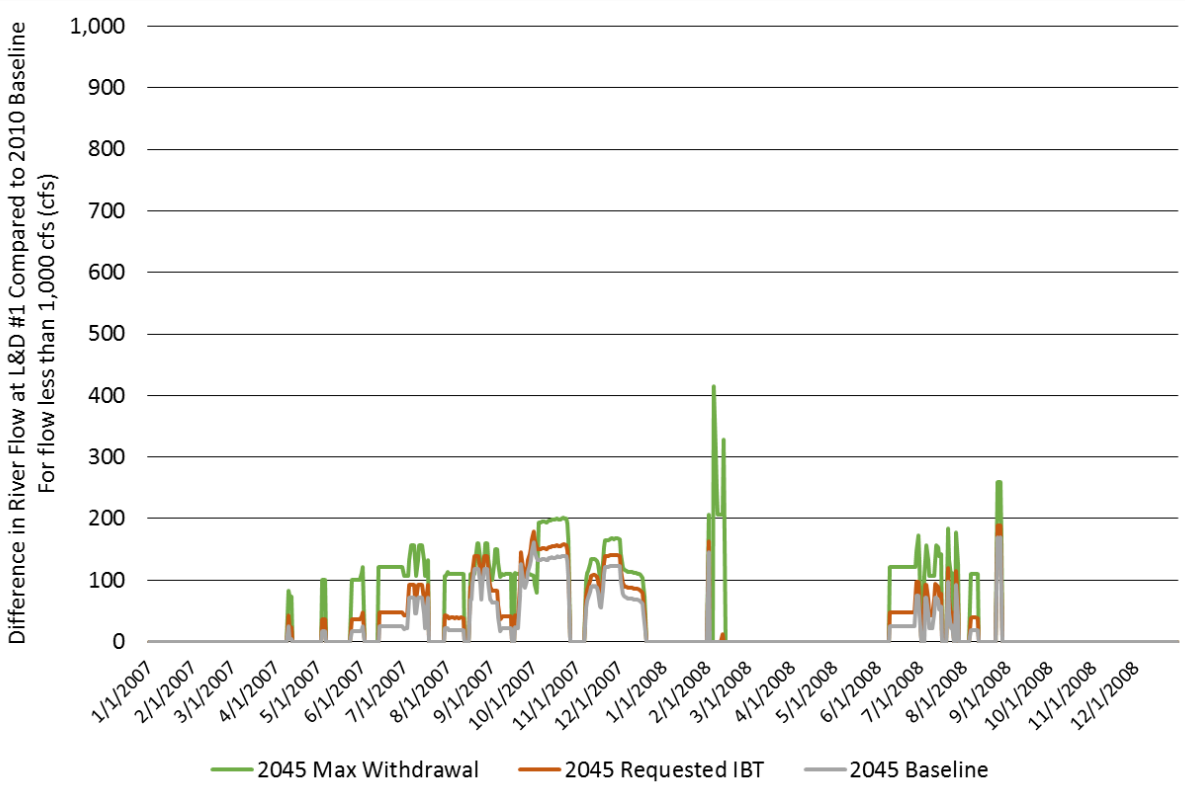

Figure 8-4. Low-flow Comparison of 2045 Scenarios to the 2010 Baseline Scenario for the 2007 Drought Below L&D1

8.1.3 Water Supply

While no primary public water supply withdrawals are located downstream of L&D1, IP does supply a small amount of water to the Town of Riegelwood. IP's demand in 2016, including water provided to Riegelwood, was 33.2 MGD average day and 42.4 MGD maximum day. The projected year 2045 low flow of 585 cfs (378 MGD) at L&D1 is approximately 9 times IP's maximum day demand and approximately 8 times IP's pumping capacity of 49 MGD (NCDWR, 2016c), therefore no significant impact to IP's water withdrawal is anticpated. In addition, basinwide implementation of WSRPs will help to mitigate the effects below L&D1 from cumulatively increased water withdrawals upstream during periods of drought.

8.1.4 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&D1. Previous water quality analyses conducted as part of the evaluation for the Brunswick County IBT and as part of the reclassification of the LCFRE from Class SC 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&D1, 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 and Sw standards allow DO levels of less than 5.0 mg/L and pH levels 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&D1, as documented in a series of technical memos (CH2M, 2014a, 2014b; Tetra Tech, 2014a, 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&D1.

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&D1.

Water quality impacts related to wastewater discharge are not expected to be significant. The County UDO requires community or public wastewater treatment systems for denser development, and if soils are unsuitable for a septic system, then the County Health Department will not issue a septic system permit unless an engineered solution is constructed (for example, 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.

8.2 Aquatic Resources

Aquatic resources in the Cape Fear, Black, and Northeast Cape Fear rivers; their tributaries; the AICW; 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&D1. 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 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 foot per second to reduce the potential for fish entrainment and impingement (McKim and Creed, 2008). 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; therefore, will not alter the findings of the EA and FONSI mentioned.

River stage levels in the Cape Fear River are not expected to be significantly altered either above or below L&D1. The proposed IBT itself would not have any impacts on protected aquatic species and their habitats in the Study Area, since no construction is planned with the IBT.

8.2.1 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&D1 during their spawning periods in late winter and spring. A rock arch fish ladder was built at L&D1 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 less than the spawning flow of 5,000 CFS. The increase in the frequency of flows less than 5,000 CFS between the 2010 Baseline and the 2045 Maximum Withdrawal scenarios is 0.9 percent above L&D1 and 1.7 percent below L&D1. 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&D1 were also reviewed and are presented in Table 8-3. 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, 2015).

Table 8-3. Model Scenario Comparison - Cape Fear River Statistics Below L&D1 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 2010 Baseline (CFS)	-90	-111	-55	-50
Difference from 2010 Baseline (%)	-1.3	-2.5	-5.0	-6.1
Difference from 2045 Baseline (CFS)	-19	-18	-21	-21
Difference from 2045 Baseline (%)	-0.3	-0.4	-2.0	-2.4
2045 Maximum Withdrawal - River Flow (CFS)	6,746	4,267	972	757
Difference from 2010 Baseline (CFS)	-181	-183	-121	-118
Difference from 2010 Baseline (%)	-2.6	-4.1	-11.1	-13.5
Difference from 2045 Baseline (CFS)	-109	-90	-87	-89
Difference from 2045 Baseline (%)	-1.6	-2.1	-8.4	-10.8

During the spawning period, reductions at the 5th percentile flow level of 2.4 percent may result from the proposed IBT. In addition, there is only a 0.8 percent change in the frequency of flow less than the assumed average spawning flow. Based on a review of USGS gaging station data for 2007 through 2016 at L&D1, it was determined 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 feet amsl. The minimum water stage simulated as part of this evaluation was approximately 11.5 feet amsl for the spawning period, 6 inches above the dam crest for L&D1. To mitigate the effect of low flows during the spawning period, the center of the fish ladder was designed to be 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 support continued fish passage during low-flow events (USACE, 2011).

Instream flow patterns will not be significantly impacted, which protect instream aquatic habitat, aquatic resources, and water quality, as well as fish passage access.

8.2.2 Flow and Aquatic Resources

At the request of NCDWR, a desktop analysis of instream flow at L&D1 was conducted to evaluate the potential for impacts on aquatic systems that could result from changes in river flows as a result of the proposed IBT. The Modified Tennant method for North Carolina was applied to data output from the CFNRBHM following guidance provided by NCDWR (NCDEQ, 2008). The 2010 baseline condition established in the model by NCDWR was compared to projected flows with and without the IBT in 2045. Using daily time steps, a comparison of the average annual flow was made between the 2010 Baseline and the following three scenarios as defined in this section and *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer* (CH2M, 2016):

- 2045 Baseline
- 2045 Requested IBT
- 2045 Maximum Withdrawal

This approach considers seasonal instream flow needs and variability, breaking the analysis into 3 periods: December through February, March through May, and June through November. The Modified Tennant method describes 9 levels of flow, segmented by percentage of the average annual flow (QAA). The range begins with Level 1, defined as flow less than 10 percent of the QAA, and ends with Level 9, defined as flow greater than 200 percent of the QAA. Results are presented as the percentage of days at each flow level during each of the 3 analysis periods. These results for each of the scenarios listed above were compared to the 2010 Baseline and are summarized in Table 8-3.

Across all scenarios and the 2010 Baseline, the percentage of days with flows at or above the QAA is highest in the period from December to February, as expected, because evapotranspiration is lowest while trees are without leaves. The percentage of days with flows of less than 50 percent of the QAA increases during the period between June and November, typically the warmest period of the year. This seasonal pattern is to be expected.

Results depicting the percent of days at each of the 9 flow levels are shown for the December to February period in Figure 8-5 while a comparison of each scenario to the 2010 Baseline during this period is shown in Figure 8-6. Results for the March through May and June through November time periods are shown in Figures 8-7 through 8-10.

The largest predicted change is a 2.0 to 3.5 percent increase in the number of lowest flow days and corresponding reductions in the number of days with higher flows, which occurs during the period typically exhibiting the highest number of lower flow days: from June to November. This period includes summer months which typically exhibit the lowest flows of the year and is also outside the critical spawning seasons for most species. This lowest level, with flows less than 10 percent of the QAA, is reflective of drought conditions. When these low flow days occur for multiple, consecutive days, all utilities within the basin would be implementing their Water Shortage Response Plans to minimize impacts to aquatic resources. These results are similar to the other modeling results presented in the EA and the *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer* (CH2M, 2016), showing that the predicted changes to the flow regime below L&D1 as a result of the proposed IBT are not significant. Impacts on aquatic systems are not expected to result from this proposed IBT.

Time Period		December - February				March - May				June - November			
	Level	2010 Baseline	2045 Baseline	2045 Requested IBT	2045 Maximum Withdrawal	2010 Baseline	2045 Baseline	2045 Requested IBT	2045 Maximum Withdrawal	2010 Baseline	2045 Baseline	2045 Requested IBT	2045 Maximum Withdrawal
Duration of Time at each Flow Level													
1	<10% of QAA	0.3%	0.3%	0.4%	0.4%	0.0%	0.0%	0.0%	0.0%	2.7%	4.3%	5.0%	6.2%
2	10-20% of QAA	1.2%	1.5%	1.5%	1.6%	3.7%	4.0%	4.3%	5.4%	19.4%	19.9%	20.3%	22.0%
3	20-30% of QAA	4.1%	4.2%	4.3%	4.4%	7.9%	8.2%	8.2%	8.1%	19.9%	19.5%	19.1%	18.2%
4	30-40% of QAA	7.2%	7.1%	7.2%	7.1%	6.7%	6.8%	6.8%	6.4%	12.8%	12.6%	12.3%	11.5%
5	40-50% of QAA	5.7%	5.8%	5.6%	5.5%	5.4%	5.5%	5.5%	5.5%	7.8%	7.5%	7.4%	6.8%
6	50-60% of QAA	5.3%	5.5%	5.5%	5.3%	4.9%	4.9%	4.8%	5.1%	5.4%	5.4%	5.3%	5.4%
7	60-100% of QAA	19.4%	19.1%	18.9%	18.9%	18.1%	18.0%	17.9%	17.6%	12.4%	12.0%	11.9%	11.5%
8	100-200% of QAA	27.2%	26.8%	26.7%	26.5%	24.9%	24.6%	24.6%	24.6%	10.8%	10.2%	10.2%	9.8%
9	>200% of QAA	29.5%	29.8%	29.9%	30.2%	28.3%	28.0%	27.9%	27.4%	8.9%	8.6%	8.6%	8.4%
Difference in Duration of Time at each Flow Level													
1	<10% of QAA	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	2.3%	3.5%
2	10-20% of QAA	0.0%	0.2%	0.2%	0.4%	0.0%	0.3%	0.6%	1.7%	0.0%	0.5%	1.0%	2.7%
3	20-30% of QAA	0.0%	0.1%	0.1%	0.3%	0.0%	0.3%	0.3%	0.2%	0.0%	-0.4%	-0.8%	-1.7%
4	30-40% of QAA	0.0%	-0.1%	0.0%	-0.1%	0.0%	0.1%	0.0%	-0.3%	0.0%	-0.2%	-0.5%	-1.3%
5	40-50% of QAA	0.0%	0.1%	-0.1%	-0.2%	0.0%	0.1%	0.1%	0.1%	0.0%	-0.3%	-0.4%	-1.0%
6	50-60% of QAA	0.0%	0.2%	0.2%	-0.1%	0.0%	-0.1%	-0.1%	0.1%	0.0%	0.0%	-0.1%	0.0%
7	60-100% of QAA	0.0%	-0.3%	-0.5%	-0.5%	0.0%	-0.1%	-0.2%	-0.6%	0.0%	-0.4%	-0.5%	-0.9%
8	100-200% of QAA	0.0%	-0.4%	-0.4%	-0.7%	0.0%	-0.2%	-0.2%	-0.2%	0.0%	-0.6%	-0.6%	-0.9%
9	>200% of QAA	0.0%	0.3%	0.4%	0.6%	0.0%	-0.3%	-0.4%	-0.9%	0.0%	-0.3%	-0.3%	-0.5%

Table 8-4. Modified Tennant Method Results

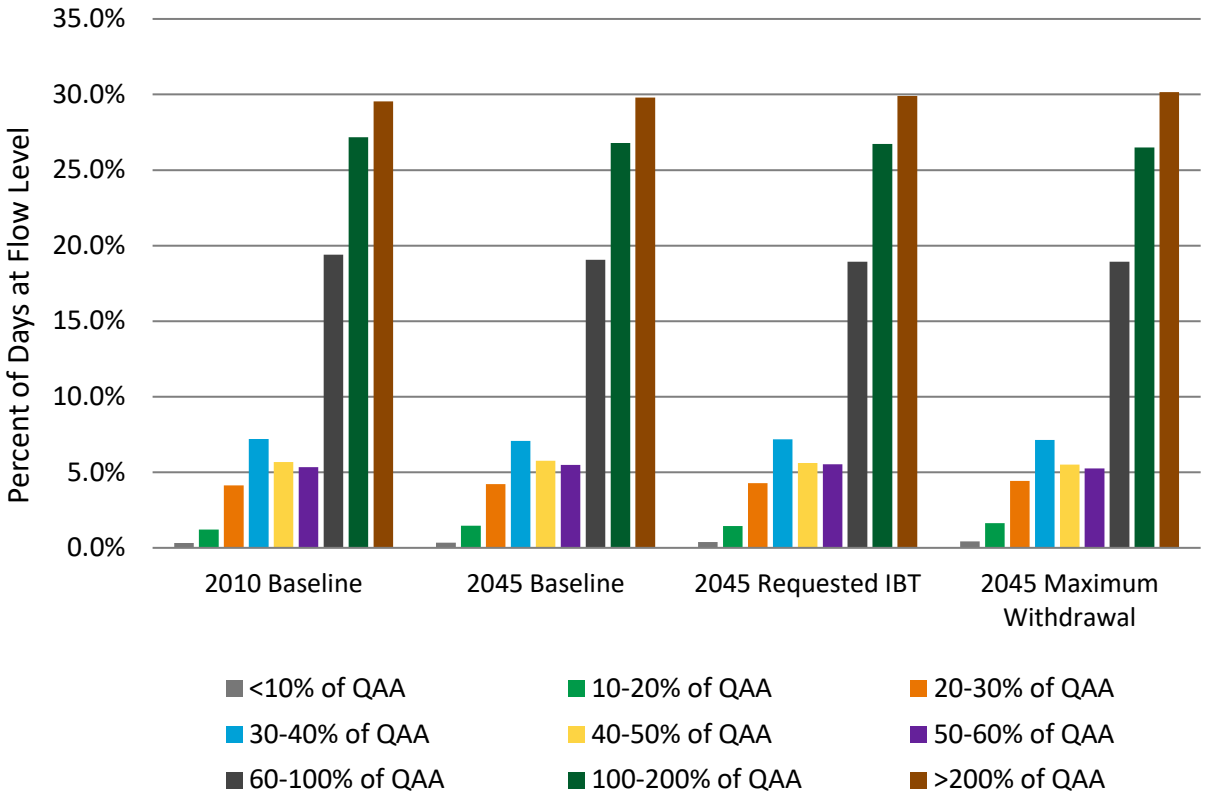

Figure 8-5. Modified Tennant Method: Instream Flows at L&D1, December through February

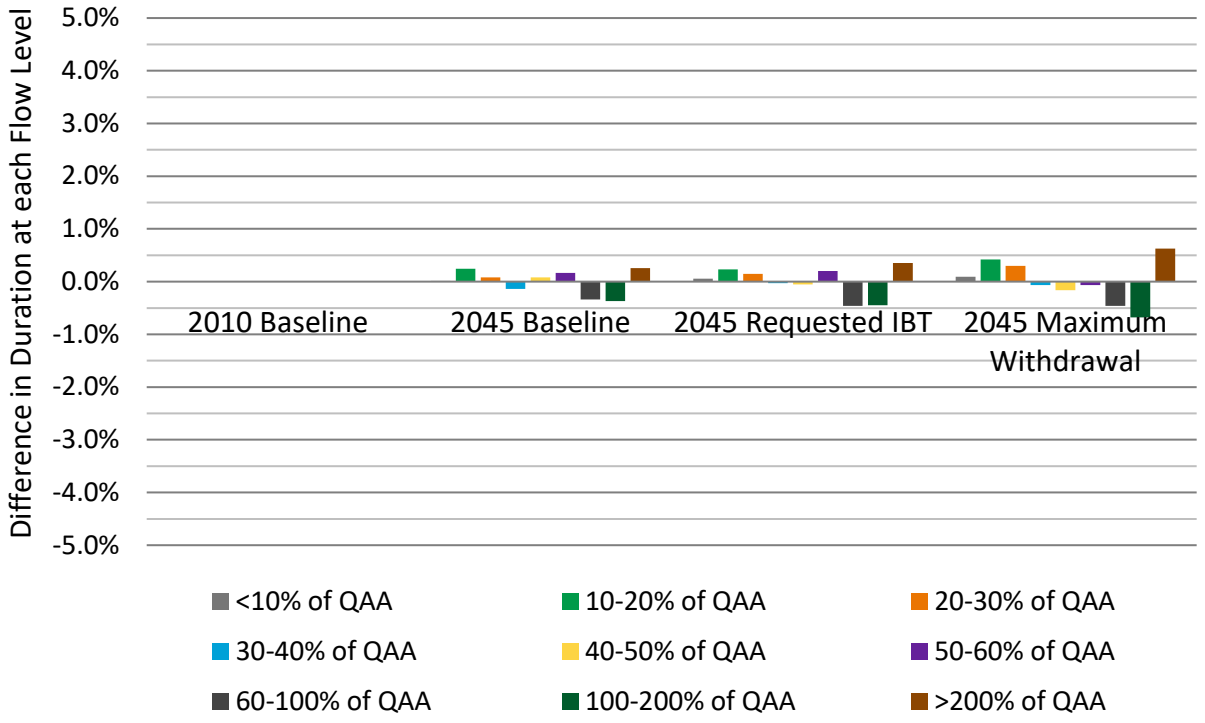

Figure 8-6. Modified Tennant Method: Instream Flow Differences to 2010 Baseline, December through February

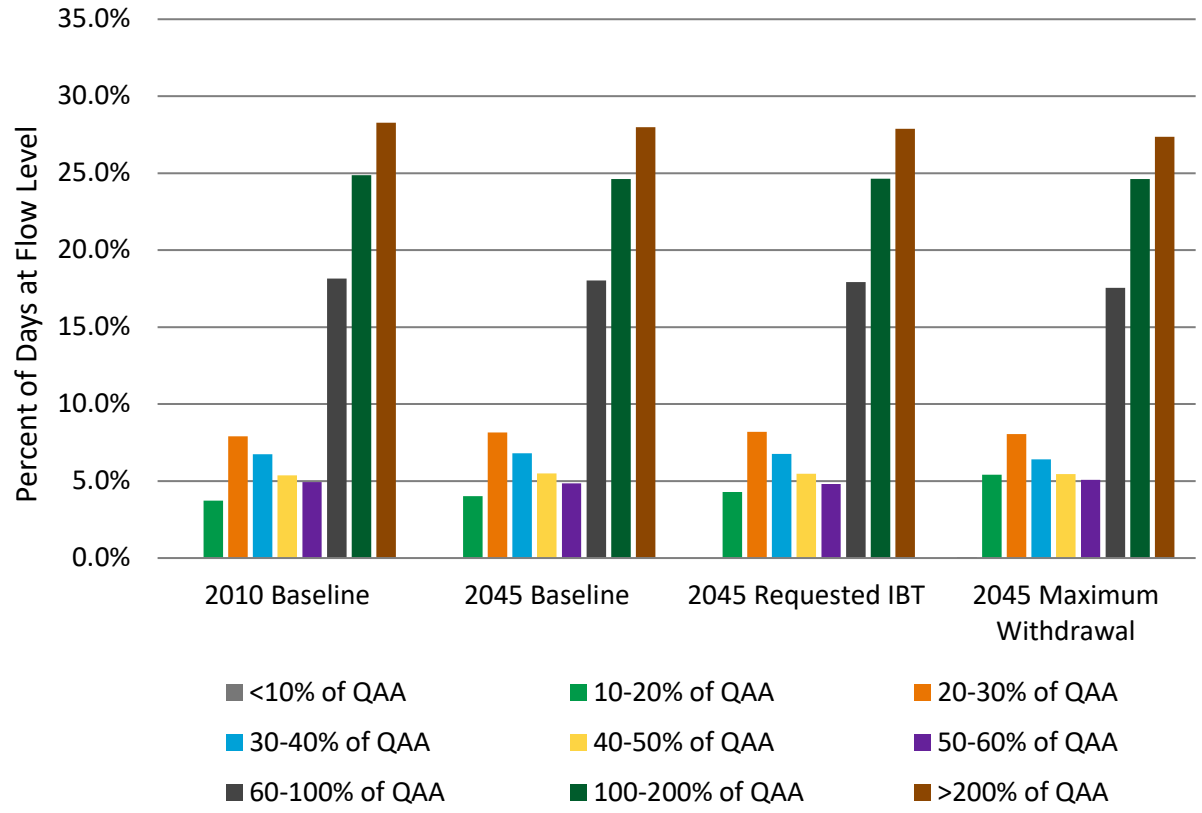

Figure 8-7. Modified Tennant Method: Instream Flows at L&D1, March through May

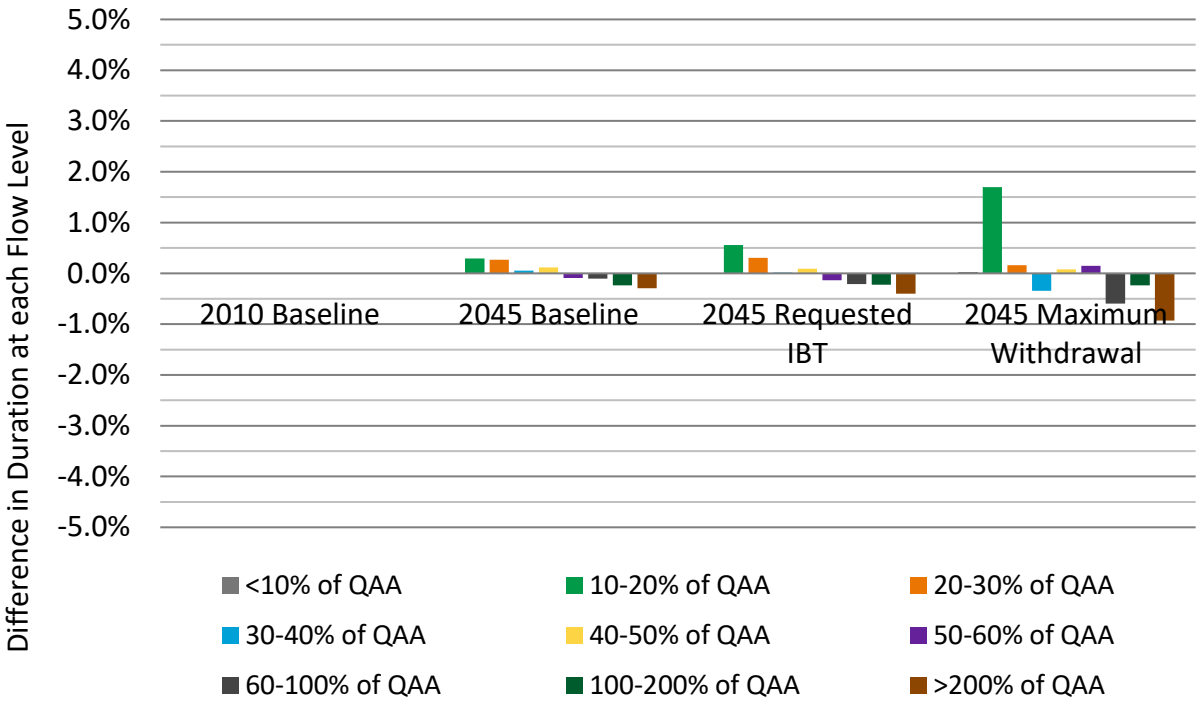

Figure 8-8. Modified Tennant Method: Instream Flow Differences to 2010 Baseline, March through May

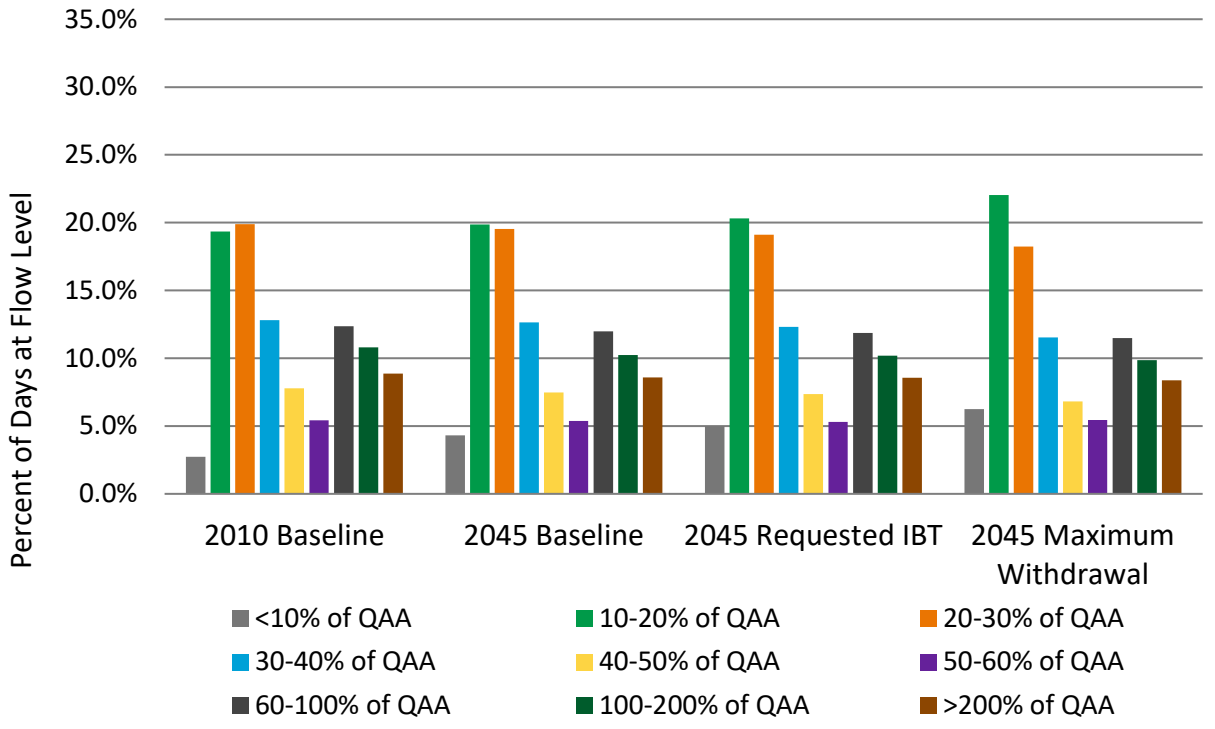

Figure 8-9. Modified Tennant Method: Instream Flows at L&D1, June through November

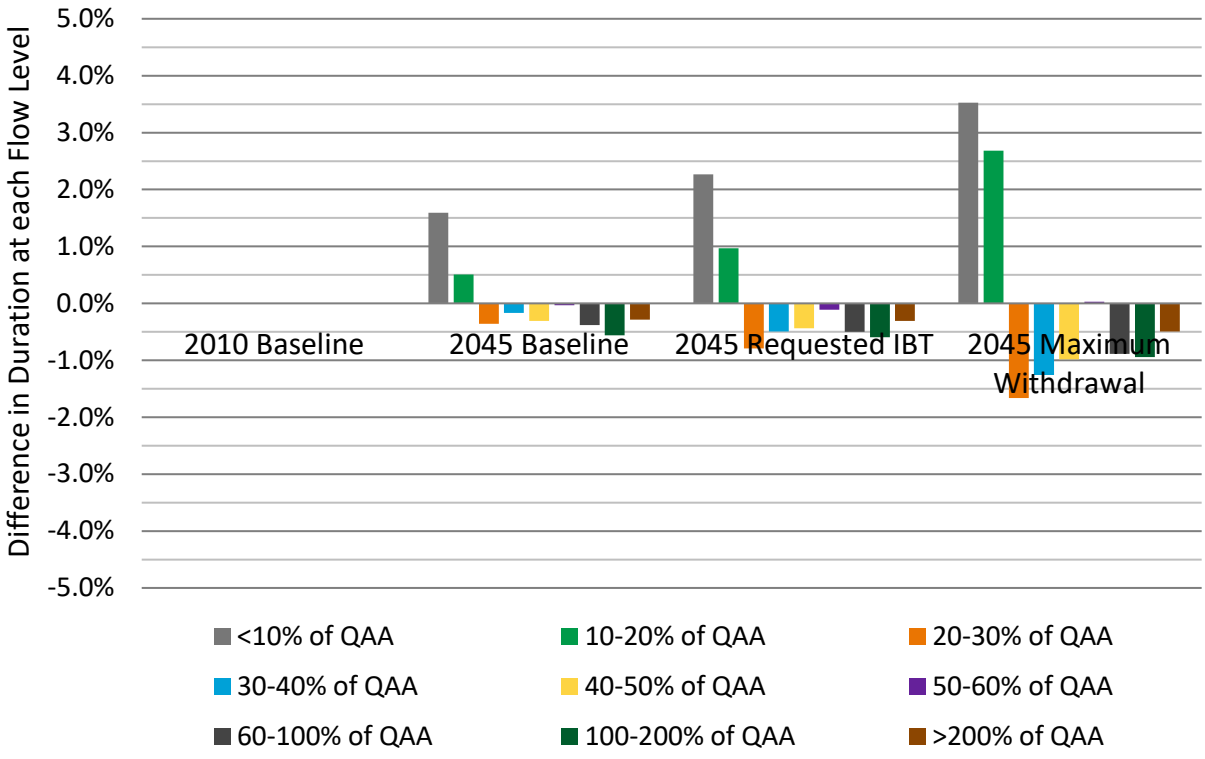

Figure 8-10. Modified Tennant Method: Instream Flow Differences to 2010 Baseline, June through November

Future Water Supply Needs

Future water supply needs in the Cape Fear River basin, including public water supply, agricultural, recreational, industrial, and hydropower uses, are included in the combined CFNRBHM that was used for the analysis supporting the IBT request. Estimates of existing withdrawals and discharges were compiled by NCDWR from sources, including LWSPs for the year 2010, information provided directly from municipalities, NPDES reporting, and water withdrawal and transfer registration, as well as from the Department of Agriculture.

PCU is engaging in the 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. The PCU service area is planned to include the Central Pender WSD, Moore's Creek WSD, and Columbia-Union WSD. Population growth will continue due to the proximity of Wilmington, Interstate 40, US 421, and US 17; coastal communities across Pender County, New Hanover County, and Brunswick County are anticipated to join the PCU service area over the next 30 years.

The general categories of alternatives to IBT include managing water demand, identifying water supplies in the receiving basins, and returning water to the source IBT basin. Demand management tools include water conservation programs, especially during times of drought, and water reuse programs. While water conservation programs can reduce the IBT, they likely cannot eliminate the need for an IBT. 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, PCU will continue to obtain surface water from LCFWASA and transfer it under the minimum threshold for an IBT certificate.

The CFNRBHM has been used by NCDWR to assess the ability of the watershed to meet future supply needs within the Cape Fear River basin. Results show that the river basin is able to meet future water needs through the planning period. Additional analysis conducted to evaluate the Pender County IBT request and presented in the EA (HIGHFILL and CH2M, 2017) and associated FONSI support this conclusion.

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References

Bowen, James D., et al. 2009. *Development and Use of a Three-Dimensional Water Quality Model to Predict Dissolved Oxygen Concentrations in The Lower Cape Fear River Estuary, North Carolina*. Prepared for NCDENR.

Cape Fear Council of Governments (Cape Fear COG). 2005. *Land Use Plan*. Prepared for Surf City.

Cape Fear Council of Governments (Cape Fear COG). 2015. *CAMA Core Land Use Plan*. Prepared for Topsail Beach.

CH2M HILL North Carolina, Inc. (CH2M). 2014a. *Technical Memo: Task 1 – Summary of Background Information and Previous Studies for the Lower Cape Fear River*. Prepared for the Lower Cape Fear River Program.

CH2M HILL North Carolina, Inc. (CH2M). 2014b. *Technical Memo: Task 3 – Analysis of Water Quality Data at Cape Fear River Estuary Model Boundaries*. Prepared for the Lower Cape Fear River Program.

CH2M HILL North Carolina, Inc. (CH2M). 2016. *Hydrologic Modeling Evaluation of the Effects of the Proposed Pender County Interbasin Transfer*. Prepared for Pender County Utilities.

Gray, Margaret, Project Manager, Pender County Utilities. 2016. Personal communication. August.

Highfill Infrastructure Engineering, P.C. and CH2M HILL North Carolina, Inc. (HIGHFILL and CH2M). 2017. *Final Environmental Assessment for an Interbasin Transfer from the Cape Fear River*. Prepared for Pender County, North Carolina. Accessed February 2017. https://deq.nc.gov/about/divisions/water-resources/planning/water-supply-planning/interbasin-transfer-certification/pender-county.

HydroLogics. 2006. *User Manual for OASIS with OCL*. Raleigh, NC.

Land Management Group, Inc. (LMGI). 2014a. *Environmental Assessment Central District Water System Expansion Pender County, North Carolina*. Prepared for U.S. Department of Agriculture Rural Development.

Land Management Group, Inc. (LMGI). 2014b. *Environmental Assessment Moore's Creek District Water System Expansion Pender County, North Carolina*. Prepared for U.S. Department of Agriculture Rural Development.

McKim and Creed. 2008. *Environmental Report Lower Cape Fear Water and Sewer Authority Kings Bluff Raw Water Pump Station 60-inch Parallel Raw Water Intake Pipe and Screen Project*. Prepared for NC DENR Division of Water Quality.

McKim and Creed. 2015. *Environmental Assessment (Revised June 2015) Lower Cape Fear Water and Sewer Authority Parallel Raw Water Transmission Main Project.* Prepared for NC DENR Division of Water Quality.

North Carolina Department of Environment and Natural Resources (NCDENR). 2005. *Cape Fear River Basinwide Water Quality Plan*. Division of Water Resources. October. Accessed July 2016. http://deq.nc.gov/about/divisions/water-resources/planning/basin-planning/water-resource-plans/cape-fear-2005.

North Carolina Department of Environment and Natural Resources (NCDENR). 2009. *Cape Fear River Basin Ambient Monitoring System Report, January 1, 2004 through December 31, 2008*. Raleigh, North Carolina: Division of Water Quality

North Carolina Department of the Environment and Natural Resources (NCDENR). 2015. *Report of Proceedings on the Proposed Reclassification of a Cape Fear River Segment, in Brunswick and New Hanover Counties (Broad River Basin) from SC to SC Sw with a Water Quality Management Plan*.

North Carolina Department of Environmental Quality (NCDEQ). 2015. *2015 North Carolina Coastal Habitat Protection Plan Source Document*.

North Carolina Department of Environmental Quality (NCDEQ). 2016. Draft 2016 Category 5 Assessments EPA Submittal – 303(d) List. Division of Water Resources. Accessed November 2016. https://ncdenr.s3.amazonaws.com/s3fs-public/Water%20Quality/Planning/TMDL/303d/2016/NC_2016_Category_5_20160606.pdf.

North Carolina Department of Environmental Quality (NCDEQ). 2017. October, early November data shows high GenX concentrations at Chemours wastewater discharge outfall. https://deq.nc.gov/news/press-releases/2017/11/22/october-early-november-data-shows-high-genx-concentrations-chemours (accessed November 22, 2017).

North Carolina Department of Health and Human Services (NCDHHS). 2017. Questions and Answers Regarding North Carolina Department of Health and Human Services Updated Risk Assessment for GenX (Perfluoro-2-propoxypropanoic acid). https://ncdenr.s3.amazonaws.com/s3fs-public/GenX/NC%20DHHS%20Risk%20Assessment%20FAQ%20Final%20Clean%20071417%20PM.pdf (accessed November 21, 2017).

North Carolina Division of Water Resources (NCDWR). 1993. River Basins as defined in GS 143-215.22G. Accessed February 2017. https://deq.nc.gov/about/divisions/water-resources/planning/water-supply-planning/interbasin-transfer-certification

North Carolina Division of Water Resources (NCDWR). 2008. *Cape Fear River Basin Model Instream Flow Analysis.*

North Carolina Division of Water Resources (NCDWR). 2013. *Cape Fear and Neuse River Basin Hydrologic Model.* Obtained May 14, 2016.

North Carolina Division of Water Resources (NCDWR). 2016a. *DWR Primary Surface Water Classifications*. Accessed July 2016. http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications.

North Carolina Division of Water Resources (NCDWR). 2016b. *Draft and Approved TMDLs*. Accessed July 2016. https://deq.nc.gov/about/divisions/water-resources/planning/modeling-assessment/tmdls/draft-and-approved-tmdls.

North Carolina Division of Water Resources (NCDWR). 2016c. *Annual Water Use Report 2016*. Accessed June 14, 2017. http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report/view/0066-0001/2016.

North Carolina Environmental Management Commission (NC EMC). 2014. *Memorandum for July 9, 2014 Water Quality committee (WQC) Meeting.*

North Carolina Natural Heritage Program (NCNHP). 2015. Geographic Information System (GIS) data. Raleigh, NC: NCDNCR. Accessed June 2016. https://ncnhde.natureserve.org/content/data-download.

Pender County. 2008. *Water and Sewer Ordinance*. Adopted June 16, 2008.

Pender County. 2010a. *Unified Development Ordinance*. Adopted June 21, 2010.

Pender County. 2010b. *Pender County Comprehensive Land Use Plan*.

Pender County. 2010c. *Water Shortage Response Plan*.

Pender County. 2016. *Rates and Fees*. Accessed March 2017. http://www.pendercountync.gov/Government/Departments/Utilities/RatesandFees.aspx

Pender County. 2016a. *Water Conservation Tips*. Accessed July 2016. http://www.pendercountync.gov/Government/Departments/Utilities/WaterConservationTips.aspx.

Pender County. 2016b. *Rates and Fees Schedule*. Accessed July 2016 http://www.pendercountync.gov/Government/Departments/Utilities/RatesandFees.aspx.

Sun, M., Arevalo, E., Strynar, M.J., Lindstrom, A.B., Richardson, M., Kearns, B., Smith, C., Pickett, A., and Knappe, D.R.U. 2016. "Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina." *Environmental Science and Technology Letters*, 3(12): 415-419, 2016.

Tetra Tech. 2010. CFPUA Proposed Discharge Model Results. Prepared for CFPUA and McKim & Creed. April 2010.

Tetra Tech. 2013. Environmental Assessment Brunswick County Interbasin Transfer. Prepared for Brunswick County, North Carolina. June 2013.

Tetra Tech. 2014a. *Technical Memo: Dissolved Oxygen Trend Analysis for the Lower Cape Fear River Estuary*. Prepared for the Lower Cape Fear River Program.

Tetra Tech. 2014b. *Technical Memo: The Relationship of Adjacent Wetlands and Salt Marsh to Dissolved Oxygen in the Lower Cape Fear River Estuary*. Prepared for the Lower Cape Fear River Program.

Town of Burgaw (Burgaw). 1999. *Wellhead Protection Plan*.

Town of Burgaw (Burgaw). 2010. *Water Shortage Response Plan*.

Town of Burgaw (Burgaw). 2013. *Land Use Plan*.

Town of Burgaw (Burgaw). 2016a. *Burgaw Local Water Supply Planning*.

Town of Burgaw (Burgaw). 2016b. *Understanding Your Water Usage*. Accessed October 2016. http://www.townofburgaw.com/Data/Sites/1/media/understanding-your-water-usage.pdf.

Town of Burgaw (Burgaw). 2016c. *Understanding Your Water Meter*. Accessed October 2016. http://www.townofburgaw.com/Data/Sites/1/media/understanding-your-water-meter.pdf.

Town of Burgaw (Burgaw). 2017. *Billing & Rates*. Accessed February 2017. http://townofburgaw.com/billing-rates.

Town of Surf City (Surf City). 2010. *Water Shortage Response Plan*.

Town of Surf City (Surf City). 2015a. *Code of Ordinances – Zoning*.

Town of Surf City (Surf City). 2015b. *FY 2015-2016 Water and Sewer Fee Schedule*.

Town of Surf City (Surf City). 2016. *Surf City Local Water Supply Planning*.

Town of Surf City (Surf City). 2017. *Water Conservation, Surf City Going Green*. http://www.surfcity.govoffice.com/index.asp?Type=B_BASIC&SEC={E94DAF46-F193-4FB7-8452-428ECDF87518} Accessed February 2017.

Town of Topsail Beach (Topsail Beach). 2007. *Wellhead Protection Plan*.

Town of Topsail Beach (Topsail Beach). 2010. *Water Shortage Response Plan*.

Town of Topsail Beach (Topsail Beach). 2015a. *Topsail Beach Watering Schedule*. Adopted August 12, 2015. Accessed July 2016. http://www.topsailbeach.org/Residents/WaterRestrictions/tabid/100/Default.aspx.

Town of Topsail Beach (Topsail Beach). 2015b. *Water Rate Schedule 7-1-15*. Accessed February 2017. http://www.topsailbeach.org/Residents/WaterandGarbageService/tabid/154/Default.aspx

Town of Topsail Beach (Topsail Beach). 2016. *Topsail Beach Local Water Supply Planning*.

Town of Wallace (Wallace). 2010. *Water Shortage Response Plan*.

Town of Wallace (Wallace). 2011. *Land Use Plan*.

Town of Wallace (Wallace). 2013. *Unified Development Ordinance*. Adopted November 14, 2013.

Town of Wallace (Wallace). 2015. *Wellhead Protection Plan*.

Town of Wallace (Wallace). 2016a. *Wallace Local Water Supply Planning*.

Town of Wallace (Wallace). 2016b. *Water and Sewer Usage Rates and Administrative Fees Fiscal Year 16-17*. http://www.wallacenc.gov/DocumentCenter/Home/View/26 Accessed February 2017.

U.S. Army Corps of Engineers (USACE). 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.

U.S. Army Corps of Engineers (USACE). 2011. *Review Plan for Pre-construction and Engineering Phase of the Fish Passage at Lock & Dam No. 1. Cape Fear River Basin, Bladen County, North Carolina*.

U.S. Fish and Wildlife Service (USFWS). 2010. *Endangered Species, Threatened Species, Federal Species of Concern, and Candidate Species, Duplin County, North Carolina*. September 22. . Accessed July 2016. https://www.fws.gov/raleigh/species/cntylist/duplin.html.

U.S. Fish and Wildlife Service (USFWS). 2015. *Endangered and Threatened Species and Species of Concern by County for North Carolina*. Accessed June 2016. http://www.fws.gov/raleigh/species/cntylist/nc_counties.html.

U.S. Fish and Wildlife Service (USFWS). 2016. *Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus)*. June 10. Accessed July 2016. http://www.fisheries.noaa.gov/pr/species/fish/atlantic-sturgeon.html.

United States Geological Survey (USGS). 2016. *Drought Monitor classification for streamflow gaging stations*. https://nc.water.usgs.gov/drought/dm-streamflow.html

University of North Carolina (UNC). 2016. *North Carolina Water and Wastewater Rates Dashboard*. Environmental Finance Center. January 2016 rates. Accessed October 2016. http://www.efc.sog.unc.edu/reslib/item/north-carolina-water-and-wastewater-rates-dashboard

Utilities, Inc. 2016. System Details for Belvedere Plantation and Olde Point.

Appendix A
Finding of No Significant Impact

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Water Resources
ENVIRONMENTAL QUALITY

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
S. JAY ZIMMERMAN
Director

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Pender County Interbasin Transfer (IBT) Certificate Request
Pender County, North Carolina

The North Carolina Environmental Policy Act (G.S. §113A) requires that the Division of Water Resources determine whether a proposed major agency action will significantly affect the environment. The Pender County Interbasin Transfer (IBT) is such a major action. The proposed project will transfer 14.5 million gallons of water per day (mgd), calculated as the average day of a (maximum) calendar month, from the Cape Fear River IBT basin to the South River, Northeast Cape Fear, and New River IBT basins, as shown in Exhibit 1-2 of the environmental assessment. This transfer volume represents the projected 2045 demands of the existing customer base and anticipated growth of the service area.

Pender County Utilities (PCU) plans to expand public infrastructure into parts of the county that do not currently have water utility services. In addition, PCU is also taking steps to become a regional water provider both as the primary source and emergency interconnections to neighboring utilities that are currently reliant on groundwater for their potable water source. The utilities that have decided to partner with PCU as co-applicants to the requested IBT certificate include the Town of Burgaw, Town of Topsail Beach, Town of Surf City, Town of Wallace (in neighboring Duplin County), and Utilities, Inc.

PCU obtains its raw water supply from the Cape Fear River via the Lower Cape Fear Water and Sewer Authority (LCFWASA). The LCFWASA intake and associated Kings Bluff Raw Water Pumping Station are located just above Lock and Dam #1. The raw water is then transmitted via LCFWASA's transmission lines to PCU's water treatment plant, located in the Cape Fear River basin. The finished water is proposed to be distributed throughout the PCU service area including the Cape Fear River, South River, Northeast Cape Fear River, and the New River IBT basins.

To determine whether the proposed Pender County IBT 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 detailed description of the proposed project, and potential environmental impacts with proposed mitigation measures. The following is a summary of the findings from the environmental impact analysis conducted:

- No construction is directly associated with this requested IBT approval, and any construction activity associated with facilitating the transfer of water in the future may

require its own environmental review process. Therefore, direct impacts to land and water resources are anticipated to be insignificant.

- The combined Cape Fear–Neuse River Basin OASIS Hydrologic Model was utilized to demonstrate that the proposed IBT will not significantly change anticipated future flow and water quality conditions in the source basin. A summary of secondary and cumulative impacts is included in Chapter 5 of the environmental assessment and mitigation efforts associated with any potential secondary and cumulative impacts are detailed in Chapter 6.

The preferred alternative was selected because it meets the projected water supply demands while minimizing any potential impacts resulting from the IBT. Based on the analysis conducted for the environmental assessment, it has been concluded that the Pender County IBT Certificate will not have a significant adverse effect on the quality of the environment.

No environmental impact statement 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 proposed Pender County Interbasin Transfer Certificate. Information supporting the need for the proposed project was reviewed along with relative impacts, other alternative approaches, and mitigating measures.

4/27/2017

S. Jay Zimmerman (Date)
Director, Division of Water Resources

Appendix B
PCU/LCFWASA Water Supply Agreement
LCFWASA Support Resolution

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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)

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, Chairman

ATTEST:

Larry Sneeden, Secretary

Appendix C
Water Shortage Response Plan

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WATER SHORTAGE RESPONSE PLAN
PENDER COUNTY UTILITIES, NORTH CAROLINA

The procedures herein are written to reduce potable water demand and supplement existing drinking water supplies whenever existing water supply sources are inadequate to meet current demands for potable water.

I. AUTHORIZATION

The Pender County Utilities Director shall enact the following water shortage response provisions whenever the trigger conditions outlined in Section IV are met. In his/her absence, an authorized representative will assume this role.

Mr. Bryan McCabe, PE
Pender County Utilities Director
605 E. Fremont Street
Burgaw, NC 28425
910-259-1570
bmccabe@pendercountync.gov

II. NOTIFICATION

The following notification methods will be used to inform water system employees and customers of a water shortage declaration: employee e-mail announcements, notices at municipal buildings, notices in water bills. Required water shortage response measures will be communicated through *The Pender Post*, the *Topsail Voice*, PSA announcements on local radio and cable stations. Declaration of emergency water restrictions or water rationing will be communicated to all customers by telephone through the County's Connect – CTY (reverse 911) system.

III. LEVELS OF RESPONSE

Five levels of water shortage response are outlined in the table below. A detailed description of each response level and corresponding water reduction measures are provided below.

Stage	Response	Description
1	Voluntary Reductions	Water users are encouraged to reduce their water use and improve water use efficiency; however, no penalties apply for noncompliance. Water supply conditions indicate a potential for shortage.
2	Mandatory Reductions I	Water users must abide by required water use reduction and efficiency measures; penalties apply for noncompliance. Water supply conditions are significantly lower than the seasonal norm and water shortage conditions are expected to persist.

3	Mandatory Reductions II	Same as in Stage 2, with more aggressive water use restrictions
4	Emergency Reductions	Water supply conditions are substantially diminished and pose an imminent threat to human health or environmental integrity.
5	Water Rationing	Water supply conditions are substantially diminished and remaining supplies must be allocated to preserve human health and environmental integrity.

Stage 1, Voluntary Reductions:

- All water users will be asked to reduce their normal water use by 5%.
- Customer education and outreach programs will encourage water conservation and efficiency measures including:
    - o Irrigating landscapes a maximum of one inch per week.
    - o Preventing water waste, runoff and watering impervious surfaces.
    - o Watering plants deeply to encourage root growth.
    - o Washing only full loads in clothes and dishwashers.
    - o Using spring-loaded nozzles on garden hoses.
    - o Identifying and repairing all water leaks.
    - o Watering shrubbery the minimum amount required.
    - o Limiting vehicle and boat washing to the minimum.
    - o Refraining from washing down outside areas such as sidewalks and patios.
    - o Using showers for bathing rather than baths, and limiting showers to no more than four minutes.
    - o Refraining from leaving faucets running while shaving or while rinsing dishes.
    - o Installing water-flow restrictive devices in showerheads.
    - o Using disposable and biodegradable dishes.
    - o Installing water-saving devices such as plastic bottles or commercial units in toilet tanks to reduce volume.
    - o Ensuring toilet flapper valves are not leaking: This flapper can be checked by adding a food coloring to the toilet tank and visually checking to see if the color appears in the bowl. If it does show color, the toilet is leaking.
    - o Storing drinking water in refrigerator to avoid trying to run it cool from the tap.

Stage 2, Mandatory Reductions I:

- All customers are expected to reduce their water use by 10% in comparison to their previous month's water bill.
- In addition to continuing to encourage all voluntary reduction actions, the following restrictions apply:
    - o Irrigation is limited to a half inch per week between 8PM and 8AM.
    - o Outdoor use of drinking water for washing impervious surfaces is prohibited.
    - o All testing and training purposes requiring drinking water (e.g. fire protection) will be limited.
    - o The use of water for washing or cleaning of equipment including vehicles, boats and fleet vehicles is prohibited unless water use is deemed essential to maintain the safe operational use or equipment integrity.

- o The use of water for power washing of buildings and other structures is prohibited, except for paint prep only (permit required).
- o The use of water from fire hydrants and hose bibs is prohibited, except for:
  - fighting fire and fire protection purposes
  - testing or training fire fighters if it is necessary to protect public safety
  - jetting piles to facilitate construction
  - construction site hose bibs
- o The filling of family, public or private swimming pools, including hot tubs, spas and whirlpool tubs, is prohibited, except for the minimal amount of make-up water necessary to maintain a pool's structural integrity and filtration system.

Stage 3, Mandatory Reductions II:

• Customers must continue actions from all previous stages and further reduce water use by 20% compared to their previous month's water bill.
• All non-essential uses of drinking water are banned and garden and landscape irrigation must be reduced to the minimum amount necessary for survival.
• No using water outside of structures for any use other than emergencies involving fire.
• No introducing water into swimming pools.
• No use of fire hydrants except for fighting fire.
• All other uses of water will be limited to uses necessary to meet the essential health and safety needs of the people of Pender County.
• No serving water in restaurants except upon request.
• Encourage use of disposable utensils and plates in homes and restaurants.
• Additionally, in Stage 3, a drought surcharge of 1.5 times the normal water rate applies.

Stage 4, Emergency Reductions:

• Customers must continue all actions from previous stages and further reduce their water use by 25% compared to their previous month's water bill.
• A ban on all use of drinking water except to protect public health and safety is implemented and drought surcharges increase to 2 times the normal water rate.

Stage 5, Water Rationing:

The goal of Stage 5, Water Rationing, is to provide drinking water to protect public health (e.g. residences, residential health care facilities and correctional facilities). In Stage 5, all customers are only permitted to use water at the minimum required for public health protection. Firefighting is the only allowable outdoor water use, and pickup locations for distributing potable water will be announced according to PCU's Emergency Response Plan. Drought surcharges increase to 5 times the normal water rate.

• It will be unlawful to fail to act in accordance with this section or use water contrary to this section or attempt to evade or avoid such water rationing restrictions.
• Fire protection will be maintained, but where possible, tank trucks shall use raw water.
• Close all swimming pools.
• No washing of any motor vehicles, including commercial washing.
• All industrial uses of water are prohibited.

• All other uses of water will be limited to those necessary to meet minimum health and safety needs of the customers.

IV. TRIGGERS

Pender County Utilities (PCU) draws raw surface water from the Lower Cape Fear Water and Sewer Authority's intake in the Cape Fear River in Bladen County. The triggers based on the potable water demand percentages below are dependent on this water source. A number of additional triggers are provided for each of the water shortage stages.

Stage 1, Voluntary Reductions:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. Declaration of D0 drought.

Stage 2, Mandatory Reductions I:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 1 conditions have not resulted in sufficient reduction of the average day demand; OR
3. When there are three consecutive days where water demand exceeds 80% of the supply/treatment capacity; OR
4. Finished water storage less than 2.5 million gallons in the distribution system; OR
5. Declaration of a D1 drought.

Stage 3, Mandatory Reductions II:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 2 conditions have not resulted in sufficient reduction of the average day demand; OR
3. When there are two consecutive days where water demand exceeds 90% of of supply/treatment capacity; OR
4. Finished water storage less than 1.5 million gallons in the distribution system; OR
5. Declaration of a D2 drought.

Stage 4, Emergency Reductions:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 3 conditions have not resulted in sufficient reduction of the average day demand; OR
3. When there is one day where water demand exceeds 100% of supply/treatment capacity; OR
4. Finished water storage less than 1.5 million gallons in the distribution system; OR
5. Declaration of a D3 drought.

Stage 5, Water Rationing:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 4 conditions have not resulted in sufficient reduction of the average day demand; OR
3. Finished water storage less than 1.0 million gallons in the distribution system; OR
4. Declaration of a D4 drought.

V. RETURN TO NORMAL

When water shortage conditions have abated and the situation is returning to normal, water conservation measures employed during each phase should be decreased in reverse order of implementation. Permanent measures directed toward long-term monitoring and conservation should be implemented or continued so that the community will be in a better position to prevent shortages and respond to recurring water shortage conditions.

VI. ENFORCEMENT

The provisions of the water shortage response plan will be enforced by Pender County Utilities personnel. Citations are assessed according to the following schedule depending on the number of prior violations and current level of water shortage.

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A
Mandatory Reductions (Stages 2 and 3)	Warning	$250	Discontinuation of Service
Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

Drought surcharge rates are effective in Stages 3, 4 and 5.

VII. VARIANCE PROTOCOLS

Applications for water use variance requests are available from the office of Pender County Utilities. All applications must be submitted to Pender County Utilities for review by the Director or his designee. A decision to approve or deny individual variance requests will be determined within two weeks of submittal after careful consideration of the following criteria: impact on water demand, expected duration, alternative source options, social and economic importance, purpose (i.e. necessary use of drinking water) and the prevention of structural damage.

VIII. EFFECTIVENESS

The effectiveness of the Pender County Utilities water shortage response plan will be determined by comparing the stated water conservation goals with observed water use reduction data. Other factors to be considered include frequency of plan activation, any problem periods without activation, total number of violation citations, desired reductions attained and evaluation of demand reductions compared to the previous year's seasonal data.

IX. REVISION

The water shortage response plan will be reviewed and revised as needed to adapt to new circumstances affecting water supply and demand, following implementation of emergency restrictions, and at a minimum of every five years in conjunction with the updating of our Local Water Supply Plan. Further, a water shortage response planning work group will review procedures following each emergency or rationing stage to recommend any necessary improvements of the plan to the Pender County Utilities Board. The Pender County Utilities Director is responsible for initiating all subsequent revisions.

Appendix D
Water Conservation Plan

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2017 Interbasin Transfer Certificate

Water Conservation Plan

Prepared for:

Pender County Utilities

Submitted to:

North Carolina Division of Water Resources

August 2017

Prepared by:

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A Water Conservation Program Comparison Matrix

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SECTION 1

Introduction

Pender County Utilities (PCU) is committed to effectively managing water resources and ensuring safe and reliable water supply for the communities they serve while being good stewards of the natural environment. As part of long-range planning efforts, PCU is engaging in the 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 interbasin transfer (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. PCU 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 IBT basins of 14.5 million gallons per day (MGD), calculated as a daily average of a calendar month. The proposed transfer volume is based on updated water demand projections for the next 30 years.

Under the authority of North Carolina General Statute (NCGS) 143-215.22L, a Water Conservation Plan must be in place that specifies the mandatory water conservation measures that will be implemented by PCU and its co-applicants to ensure the efficient use of the transferred water.

This Water Conservation Plan is structured to:

- Summarize PCU's water resources planning effort and water conservation programs.
- Summarize PCU's implementation plans for the water conservation strategy that meets the intent of the NCGS language for such a plan.

1.1 Water Conservation History

PCU is a small rural NC utility with 7,500 customers and average day demands less than 1.0 MGD. Based on billing records, PCU customers do not currently exhibit high levels of discretionary water use or resource mismanagement. To foster continued responsible stewardship, the following conservation measures are currently in place and are discussed in more detail in subsequent sections of this document:

- Rate structure that discourages excessive water use
- Water resources planning to promote conservation
- Supply-side management
    - Water use efficiency
    - Water supply flexibility
- Demand-side management
    - Education
    - Incentives
    - Regulation

1.2 Water Consumption and Utility Rate Structure

PCU's current water system annual average daily residential water usage is approximately 40 gallons per capita per day (GPCD). This figure is significantly less than the annual average GPCD identified as part of the recent residential end use study completed by the Water Research Foundation (WRF). According to WRF, the average annual per capita usage across 23 cities throughout the United States is 95 GPCD, with a minimum of 52 GPCD and maximum of 217 GPCD (WRF, 2016). Neighboring Brunswick County reported 67 GPCD for its year-round population in 2016. Onslow Water and Sewer Authority (ONWASA) reported 51 GPCD for the same period, Warsaw (in Duplin County) reported 64 GPCD, and East Bladen County Water District reported 115 GPCD. (NCDWR, 2017)

The PCU system unit consumption value is also well below 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). As additional customers are added to PCU's system, the unit consumption values are expected to remain relatively steady. Factors driving this expectation are the prevalence of low-flow fixtures and newer technologies for household appliances in newly constructed houses, along with a reduced need for distribution system flushing as customers are added to the system. These factors will help to balance the addition of services for potentially less efficient existing homes as the system is expanded.

A comparison of monthly water bills and conservation signal costs was generated utilizing the UNC Environmental Finance Center (EFC) NC Water and Wastewater Rates Dashboard (hereafter, EFC Dashboard). Table 1 shows that PCU has the highest monthly water bill per 5,000 gallons ($57.50) among the utilities shown, which include utilities in the geographic region plus several from upstream in the major basin. The EFC considers the conservation signal to be the cost per 1,000 gallons above 10,000 gallons. PCU's conservation signal, which is the top tier for PCU's irrigation customers and commercial customers, was increased from $6.00 to $9.95/ 1,000 gallons as of July 1, 2017, making PCU's the highest among all utilities shown. This comparison shows that PCU's rates strongly promote efficient water use. (UNC)

TABLE 1
Water Usage Bills of Comparable Regional Utilities

Utility Provider	Monthly Water Bill (5,000 gallons)	Conservation Signal – Cost per 1,000 gallons above 10,000 gallons
PCU	$57.50	$9.95*
Surf City	$33.42	$4.06
ONWASA	$26.35	$3.75
Cary	$25.87	$6.46
Fayetteville	$23.02	$4.52
Harnett County	$34.25	$5.25
Cape Fear PUA	$31.26	$3.67
Topsail	$55.42	$5.50
Brunswick County	$27.25	$3.10
Pittsboro	$40.40	$6.84
Wallace	$23.65	$2.13
Jacksonville	$25.94	$4.83
Burgaw	$23.75	$5.07

* This rate was effective July 1, 2017, and is not yet reflected in the EFC Dashboard.

1.3 Water Resources Planning

PCU has implemented multiple water conservation and efficiency programs in their continued effort to be among the most stringent in the source basin. A comparison of PCU's water conservation program with other entities utilizing the Cape Fear River as a water source is included in Appendix A. A brief summary of the comparison is provided below:

- Rates: PCU has higher usage rates and conservation signal rates than neighboring utilities. Implementing higher rates is the single most effective method of reducing water usage.
- Education: PCU provides extensive water conservation tips on their website, including links to rainwater harvesting information. PCU plans to include periodic conservation fliers with monthly water bills beginning in 2018.
- Regulation: PCU requires separate irrigation services with meters per NCGS 143-355.4. PCU is recommending that the Pender Board of County Commissioners (BOCC) amend the water and sewer ordinance to ban irrigation of impervious surfaces and to require irrigation customers to install rain sensors on new automated irrigation systems effective Spring 2018.
- Other: Two specific programs offered by other utilities are not feasible for PCU at this time.
    - Reclaimed water – PCU is primarily a water utility now, with only limited centralized wastewater treatment available to an isolated portion of the County. As a small rural utility, capital expenditures for significant new infrastructure typically require some combination of grants (if available) and long-term financing. With water rates already among the highest in the state, the debt service required to enable construction of collection, treatment and reclaimed water distribution infrastructure is cost prohibitive.
    - Aquifer Storage and Recovery (ASR) – With recent concerns over emerging contaminants in regional drinking water and their fate in the environment, the investment required to investigate the hydrogeologic possibility of utilizing ASR, and the capital investment required for the infrastructure to implement ASR, water storage via ASR is not currently considered a feasible water conservation measure for PCU.

PCU maintains awareness of information and operational technology developments to anticipate and support timely adoption of water conservation improvements. PCU has recently updated its Water Shortage Response Plan (WSRP) and is now among the most stringent in the Cape Fear River basin. The co-applicants will be required to meet or exceed PCU's standards in water conservation, water efficiency, and drought management prior to purchasing water from PCU. PCU anticipates implementing new conservation programs as they are determined to be effective and appropriate to maintain or minimize the already low per capita usage level for PCU customers. The programs that will be implemented when PCU becomes a regional provider include:

- An established notification system so that if PCU must implement a step in its WSRP that each co-applicant and their wholesale customers are notified prudently.
- Regular coordination among water system users involving PCU, co-applicants, and wholesale customer operators.
- Creating a long-term, shared regional vision for sustainable, reliable water resources.

SECTION 2

Water Conservation Plan

2.1 Objectives

Water is a valuable natural resource that every living thing needs to survive. Overuse in one area diminishes the availability of the resource to communities and ecosystems downstream. PCU realizes that efficient use of water from the Cape Fear River basin must be accomplished year-round and not just during drought periods. PCU has implemented multiple water resources management and conservation strategies to achieve these objectives, including supply-side management and demand-side management, which will result in the efficient use of water in the source and receiving river basins. Sections 2.2 and 2.3 highlight PCU's water conservation strategies.

2.2 Supply-side Management

2.2.1 Water Use Efficiency

PCU has relatively new water system infrastructure, which limits the potential for distribution system losses compared to older systems. PCU is committed, however, to operational optimization to ensure ongoing, timely, cost-effective, reliable, and sustainable performance improvements in all facets of its operations. PCU aims to minimize resource use, loss, and impacts from day-to-day operations. PCU maintains awareness of information and operational technology developments to anticipate and support timely adoption of improvements. The following programs are currently in place:

- PCU monitors and reviews water usage for non-revenue losses and unaccounted water each month following each billing cycle. Unmetered, non-revenue water is approximately 10% of potable water produced. The unmetered, non-revenue water includes firefighter training and emergency use, along with flushing to maintain water quality and other distribution system operations.
- Annual SCADA system calibration ensures accurate monitoring of tank levels and timely notification of significant changes in system pressure, which helps reduce the risk of tanks overflowing and alerts operators to potential line breaks or other system problems.
- The annual enterprise fund budget includes a line item for maintenance and repair of the water distribution system.
- Valves are exercised on a regular basis.
- Hydrants are flushed annually.
- All known defective meters are repaired or replaced expeditiously.
- Rates are established to adequately cover debt service and operational costs, provide for reserves, and plan and invest for future needs.

2.2.2 Water Supply Flexibility

The supply-side management focuses on maintaining flexibility in managing available water supplies and increasing the ability to adapt to changes in the future that are relatively uncertain, including economic and business climate, technological advances, hydrologic and climate variability, and environmental regulatory changes. Increasing PCU's water resources resilience will also improve the overall regional resilience. Many residents have access to private groundwater wells for irrigation purposes, potentially further reducing the demand on PCU's surface water supply.

The co-applicants currently obtain their water supply from groundwater sources. The Town of Burgaw is considering drilling additional wells and/or interconnecting 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 ONWASA. The Town of Wallace has an emergency connection with Duplin County. The Town of Wallace withdraws groundwater in the Central Coastal Plain Capacity

Use Area (CCPCUA), where restrictions have been implemented to limit groundwater use. Utilities Inc. currently provides water service to two developments in the US 17 corridor, Belvedere Plantation and Olde Pointe, from groundwater sources.

Co-applicant concerns with current groundwater supplies are primarily related to salt water intrusion. To maintain potential supplemental supply and to provide event management capabilities, no co-applicant currently is expected to fully decommission its groundwater supply sources unless water quality actually deteriorates or the threat of deterioration is imminent. The interconnections and the existing groundwater supplies, therefore, preserve the opportunity for supplemental or emergency use. While PCU is expected to eventually become the primary water provider, the regional system interconnectivity and availability of supplemental groundwater supply provides some flexibility for emergency event management.

2.3 Demand-side Management

PCU's demand-side management strategy focuses on influencing customers to use water efficiently, resulting in reduced water demand. Long-term water use reductions are achieved through a combination of changing technologies (for example, low-flow toilets) and behaviors (for example, fixing leaks). PCU has a threefold approach to achieving water conservation that includes the following elements:

- **Education**
    - Education materials are available on PCU's website and will soon be included in mailers. http://www.pendercountync.gov/Government/Departments/Utilities/WaterConservationTips.aspx Information provided includes:
        - Irrigation
            - Adjust your irrigation timer monthly – lawns require different amounts of water in winter than in spring. Thus irrigating with the same amount of water may result in water wasting.
            - The most efficient time for watering is early morning or late evenings, when temps are cooler and winds lighter.
            - Native or desert landscaping is another way to reduce watering. Replace lawns and water consuming plants with attractive native and drought tolerant plants. Native or desert landscaping is a responsible way to enhance the beauty of the gardens while conserving water and protecting the environment.
        - Look for leaks – and repair them right away
            - Check your toilet for leaks. A leak inside the toilet can waste up to 200 gallons of water a day. Check by adding a few drops of food coloring into the tank. If there is a leak, color will show in the bowl in about 30 minutes. Check for worn out, corroded, or bent parts. Replacement kits are relatively inexpensive and easily installed.
            - Faucet leaks are usually visible, but some unnoticeable leaks may occur in areas like the on/off handle or in the pipes below the basin.
        - Install water-saving devices
            - Install low flow toilets, aerators and showerheads.
            - Make sure all devices are properly installed.

- Wash dishes wisely
    - Run the dishwasher only when you have a full load. Automatic dishwashers use about 15 gallons per load.
    - If washing dishes by hand, don't let water run continuously for rinsing. If you have 2 sinks, fill one with rinse water. If you have only one sink, first gather all your washed dishes in a dish rack, and then rinse them quickly. Also, using the least amount of detergent necessary minimizes the rinse water needed.

- **Incentives**
    - Residential use is subject to a uniform rate structure (base monthly rate plus usage per 1,000 gallons) that incentivizes customers to use water efficiently by charging customers based on individual usage. The less water customers use, the more money they save. According to the EFC Dashboard, PCU's water rates are among the top 10% in the state (UNC) and, at $57.50 for 5,000 gallons used, nearly double the median statewide water bill of $32.50. *Note: Not yet reflected in the EFC Dashboard are PCU's rates effective July 1, 2017 ($27.50 base, plus $6.50 per 1,000 gallons per month), which increase the cost for 5,000 gallons per month to $60.00.*
    - All commercial, industrial, institutional, and irrigation customer rates are set using an inclining block rate to further discourage excessive usage. On July 1, 2017, PCU implemented an increase for the highest tier of the inclining block, usage above 10,000 gallons, to $9.95 per 1,000 gallons. The EFC Dashboard shows the median statewide conservation signal rate to be $4.38 per 1,000 gallons, so PCU's rates provide strong incentive to conserve water.

- **Regulations**
    - PCU is recommending to the Pender BOCC to amend the Pender County Water and Sewer Ordinance to ban irrigation of impervious surfaces and to require irrigation customers to install rain sensors on new automated irrigation systems effective Spring 2018.
    - PCU encourages water conservation and responsible water use at all times. The Pender County Water and Sewer Ordinance currently provides enforceable requirements to ensure the efficient use of water during water emergencies. PCU staff have the authority to issues citations for violations of the Water Shortage Response Plan (WSRP) based on the number of prior violations and level of water shortage.
    - Specific regulations currently include the following:
        - New construction with irrigation systems connecting to PCU require separate irrigation metering and will be charged based on the inclining block rate.
        - Drought surcharges are implemented in WSRP stages 3, 4, and 5.

Inherent in the implementation of any demand-side management strategy are the uncertainties related to the outcomes and the benefit from implementation. These uncertainties typically include customer (behavioral) response levels to conservation programs and messaging, market penetration, program funding levels, and growth, as well as larger societal trends. These factors not only impact the level of potential water savings on the potable water system from demand-side management, but also the timing of the potential savings.

2.4 Efficient Use of Water from the Interbasin Transfer Source Basin

The implementation of PCU's water conservation strategies (supply-side and demand-side management) will perpetuate the efficient use of water in the source basin (Cape Fear IBT basin) and receiving river basins (Cape Fear, South River, NE Cape Fear, and New River IBT basins). To maintain the achieved water use efficiency, continued

commitment to the supply-side management and demand-side management will be necessary. PCU has shown a strong commitment to water conservation to date and will maintain that commitment going forward.

PCU has also updated its WSRP to ensure consistent application of the water resource management triggers and measures during water emergencies. The co-applicants will be required to adopt PCU's WSRP prior to purchasing water. Having these policies in place will help conserve water in the Cape Fear River IBT basin.

2.5 Reporting on Water Conservation Effectiveness

PCU is required to submit a Local Water Supply Plan (LWSP) annually to NCDWR. As part of this submission, the annual GPCD (residential and overall system-wide GPCD) is calculated and can be used to track the long-term status of water use efficiency on a per capita basis. PCU tracks the quantity of water billed on a monthly basis. PCU will compare the quantity of water billed with the number of water customers each month as a measure of water conservation effectiveness. If the IBT Certificate is approved by the EMC, PCU will include water conservation effectiveness measures in the IBT quarterly and annual monitoring reports.

SECTION 3

References

EFC Resources: North Carolina Water and Wastewater Rates Dashboard. EFC Resources: North Carolina Water and Wastewater Rates Dashboard | Environmental Finance Center. N.p., 3 May 2017. Web. 05 July 2017.

Highfill Infrastructure Engineering, P.C. and CH2M. January 2017. *Environmental Assessment for an Interbasin Transfer from the Cape Fear River*.

North Carolina Division of Water Resources (NCDWR). 2017. *Local Water Supply Plans (searchable online)*. Accessed October 12 and 16, 2017. https://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/index.php

North Carolina General Statute (NCGS). 2014. Regulation of surface water transfers (NCGS 143-215.22L).

Pender County Utilities. 2017. Water Conservation Tips. http://www.pendercountync.gov/Government/Departments/Utilities/WaterConservationTips.aspx

University of North Carolina (UNC). 2016. North Carolina Water and Wastewater Rates Dashboard. Environmental Finance Center. January 2016 rates. Accessed October 2016.

USGS. 2006. A Gap Analysis of North Carolina. NC Division of Coastal Management. 2016. Beach & Coastal Waterfront Access. http://ims.ncdenr.org/Website/nccoastal_access/viewer.htm. Assessed April 2017.

Water Research Foundation (WRF). 2016. Residential End Uses of Water, Version 2. Report #: 4309b

Appendix A – Water Conservation Program Comparison Matrix

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Water Conservation Program Comparison

Utility	Pender County	Fayetteville PWC	Harnett County	Cape Fear PUA	Topsail	Brunswick Co	Cary	Pittsboro
Rates: (see rate comparison table)	Uniform structure for residential, tiered commercial and irrigation rate	Tiered residential structure, varies for in/out of city, all inside city rates lower than PCU	Flat structure, slightly higher than Maple Hill, but lower than Rocky Point/Topsail	Uniform structure, base charge lowest of those compared for residential-sized meter, highest for larger meters, consumption charge flat and lowest of compared	Tiered usage structure	Tiered rate structure. Overall rates are lower.	Tiered rate structure Water Budgets	Tiered rate structure
Education:	Water Conservation page on website including tips Links to: rainwater harvesting, Save Water NC, DWR, Water Wiser, H2ouse, and HomeAdvisor Mailers planned	Water Conservation page on website including tips Brochures: Water Wise Gardening, Water Conservation Water Wise Demo Garden	Links to: cold/summer weather tips, H2ouse Water Saver Home website, NC Clean Water Education Partnership website, and EPA WaterSense website	Conservation & Water Emergency Management page on website PDFs of tips Links to: drought monitor and Water Use it Wisely websites	N/A	Website states they can help you find ways to conserve	Public Education/Beat the Peak Campaign Fix a Leak Week Campaign Block Leader Program Residential Water and Irrigation Audits Website Festival Booths	Festival booths
Regulation:	Irrigation meters required Rain sensors planned Irrigation schedules planned	Irrigation meters required Irrigation schedules, alternate day	Irrigation meters required	Irrigation meters required	Irrigation meters required From May 27 – September 30 annually, Irrigation and manual watering are restricted to 2 hours per day, 3 days per week (alternating days by address). Manual watering is also allowed for an additional 2 hours on Saturday or Sunday. No watering between July 2 – 8. Rain sensors or manual cutoff required.	Irrigation meters required	Water Waste Ordinance Rain Sensor Ordinance Alternate Day Watering Ordinance New Development Land Development Ordinance Irrigation Plan Review Requirement for Separate Irrigation Meters	Voluntary Water Conservation Irrigation meters required
Other:		Reclaimed water utilized onsite at WRFs		ASR Bulk RCW		ASR (planning stages) RCW program (available for irrigation and non-potable uses), New golf courses required to utilize. Incentives to use.	High Efficiency Toilet Rebate Rain Barrels Give-aways RCW program	RCW program Town Operations Meter Replacement WTP Efficiency Waterline Replacement Landscape Watering Practices

Rates Comparison

Utility	Pender County			Fayetteville PWC	Harnett County
	Maple Hill	**Pender Commerce Park**	**Rocky Point-Topsail/ Scotts Hill**		
Base Charge	Residential Unit Base Fee (per single unit if multi-unit) $19.50 per month Commercial Unit Base Fee (per single unit if multi-unit) $21.50 per month	Commercial Unit Base Fee (per single unit if multi-unit) $29.50 per month	Residential Unit Base Fee (per single unit if multi-unit) $27.50 per month Commercial Unit Base Fee (per single unit if multi-unit) $29.50 per month	**Basic Faci** Meter Size / Inside City 5/8" or 3/4" $11.50 1" $18.40 1 1/2" $31.05 2" $51.75 3" $92.00 4" $149.50 6" $293.25 8" $460.00	
Residential	Usage Rate $6.00 per 1,000 gallons		Usage Rate $6.50 per 1,000 gallons	**Residential Inside City** (mgal / gallon) First 2 mgals/ (2,000 gallons) $2.36 $0.002360 Next 3 mgals (3-5)/ (next 3,000 gallons) $2.81 $0.002810 Next 5 mgals (6-10)/ (next 5,000 gallons) $3.82 $0.003820 Each Additional mgal/ (gallon) $4.56 $0.004560 Backflow Prevention Assembly Inspection Charge $1.60	Flat Rate Water, Res, 1st 2,000 gal $18.50 Per Thousand Water, Res $5.25
Commercial	Usage Rate $6.50 per 1,000 gallons	Usage Rate $7.00 per 1,000 gallons $9.95 per 1,000 gallons if over 10,000 gallons per month	Usage Rate $7.00 per 1,000 gallons $9.95 per 1,000 gallons if over 10,000 gallons per month	**Non-residential Water Service Inside City** (mgal / gallon) Usage Charge per mgal (gallon) $2.83 $0.00283 **Large Water User Inside City** Usage Charge per mgal (gallon) $2.34 $0.00234	Flat Rate Water, Com, 1st 2,000 gal $25.00 Per Thousand Water, Com $5.25
Irrigation		Irrigation Base Fee $29.50 per month Usage Rate $7.00 per 1,000 gallons $9.95 per 1,000 gallons if over 10,000 gallons per month	Irrigation Base Fee $29.50 per month Usage Rate $7.00 per 1,000 gallons $9.95 per 1,000 gallons if over 10,000 gallons per month	**Residential Water Irrigation Inside City** First 30 mgals/ (first 30,000 gallons) $4.90 $0.00490 Next 30 mgals/(31-60)/ (next 30,000 gallons) $6.01 $0.00601 Each Additional mgal/ (gallon) $9.33 $0.00933 Backflow Prevention Assembly Inspection Charge $1.60 **Non-residential Irrigation Inside City** Usage Charge per mgal (gallon) $4.55 $0.00455	

<table>
<tr><th>Utility</th><th>Cape Fear PUA</th><th>Topsail</th><th>Brunswick County</th></tr>
<tr><td>Base Charge</td><td>
<table>
<tr><td></td><td></td><td>Rates and Fees Effective 2/10/16</td><td>Rates and Fees Effective 7/1/16</td></tr>
<tr><td>1</td><td>WATER RATES</td><td></td><td></td></tr>
<tr><td></td><td>Water rates include both a fixed meter charge based on meter size and consumption charge based on metered consumption, billed bi-monthly (every two months).</td><td></td><td></td></tr>
<tr><td></td><td>Fixed Meter Charge by Meter Size*</td><td>Bi-Monthly</td><td>Bi-Monthly</td></tr>
<tr><td></td><td>5/8"</td><td>$ 25.81</td><td>$ 25.81</td></tr>
<tr><td></td><td>1" (Single-Family Residential with fire sprinkler system)</td><td>$ 25.81</td><td>$ 25.81</td></tr>
<tr><td></td><td>1"</td><td>$ 64.53</td><td>$ 64.53</td></tr>
<tr><td></td><td>1 1/2"</td><td>$ 129.05</td><td>$ 129.05</td></tr>
<tr><td></td><td>2"</td><td>$ 206.48</td><td>$ 206.48</td></tr>
<tr><td></td><td>3"</td><td>$ 387.15</td><td>$ 387.15</td></tr>
<tr><td></td><td>4"</td><td>$ 645.25</td><td>$ 645.25</td></tr>
<tr><td></td><td>6"</td><td>$ 1,290.50</td><td>$ 1,290.50</td></tr>
<tr><td></td><td>8"</td><td>$ 2,064.80</td><td>$ 2,064.80</td></tr>
<tr><td></td><td>10"</td><td>$ 3,226.25</td><td>$ 3,226.25</td></tr>
<tr><td></td><td>12"</td><td>$ 3,871.50</td><td>$ 3,871.50</td></tr>
<tr><td></td><td>* Fixed Meter Charge is not applied to Irrigation Meters if a separate Water Meter exists.</td><td></td><td></td></tr>
</table>
<td>Facility Charge (0 gallons) * $30.00/month

* $20/month for multiple units on a master meter (effective July 1, 2014)</td>
<td>Larger Industrial and Wholesale meters have designated base and usage rates as well.

Typical residential meter size assumed to be ¾”.</td></tr>
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<table>
<tr><td>Consumption Charge (per 1,000 gallons)**</td><td>$ 3.67</td></tr>
<tr><td>** Single-Family Residential is serviced by one domestic meter</td><td></td></tr>
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<table>
<tr><td>Additional Usage</td><td>(1-3,333 Gallons)</td><td>$5.00 per 1000 gal</td></tr>
<tr><td>Additional Usage</td><td>(3,334- 10,000 Gallons)</td><td>$5.25 per 1000 gal</td></tr>
<tr><td>Additional Usage</td><td>(10,001 – 20,000 Gallons)</td><td>$5.50 per 1000 gal</td></tr>
<tr><td>Additional Usage</td><td>(Above 20,000 Gallons)</td><td>$5.75 per 1000 gal</td></tr>
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<tr><td>3/4"</td><td>Retail Meter</td><td></td><td>Approved</td></tr>
<tr><td></td><td>Base Service Charge (plus usage)</td><td></td><td>$ 12.00 /month</td></tr>
<tr><td></td><td></td><td>0 - 6,000 gallons</td><td>$ 3.05 /1000-gallons</td></tr>
<tr><td></td><td></td><td>6,001 - 20,000 gallons</td><td>$ 3.10 /1000-gallons</td></tr>
<tr><td></td><td></td><td>>20,000 gallons</td><td>$ 3.15 /1000-gallons</td></tr>
</table>
</td></tr>
<tr><td>Commercial</td><td>
<table>
<tr><td>Consumption Charge (per 1,000 gallons)**</td><td>$ 3.67</td></tr>
<tr><td>** Single-Family Residential is serviced by one domestic meter</td><td></td></tr>
</table>
</td><td>
<table>
<tr><td>Additional Usage</td><td>(1-3,333 Gallons)</td><td>$5.00 per 1000 gal</td></tr>
<tr><td>Additional Usage</td><td>(3,334- 10,000 Gallons)</td><td>$5.25 per 1000 gal</td></tr>
<tr><td>Additional Usage</td><td>(10,001 – 20,000 Gallons)</td><td>$5.50 per 1000 gal</td></tr>
<tr><td>Additional Usage</td><td>(Above 20,000 Gallons)</td><td>$5.75 per 1000 gal</td></tr>
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</td><td>
<table>
<tr><td>1"</td><td>Retail Meter</td><td></td><td></td></tr>
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<tr><td></td><td></td><td>6,001 - 20,000 gallons</td><td>$ 3.10 /1000-gallons</td></tr>
<tr><td></td><td></td><td>>20,000 gallons</td><td>$ 3.15 /1000-gallons</td></tr>
<tr><td>1 1/2"</td><td>Retail Meter</td><td></td><td></td></tr>
<tr><td></td><td>Base Service Charge (plus usage)</td><td></td><td>$ 18.00 /month</td></tr>
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<tr><td>2"</td><td>Retail Meter</td><td></td><td></td></tr>
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<tr><td></td><td></td><td>0 - 20,000 gallons</td><td>$ 3.05 /1000-gallons</td></tr>
<tr><td></td><td></td><td>20,001 - 100,000 gallons</td><td>$ 3.10 /1000-gallons</td></tr>
<tr><td></td><td></td><td>>100,000 gallons</td><td>$ 3.15 /1000-gallons</td></tr>
<tr><td>3"</td><td>Retail Meter</td><td></td><td></td></tr>
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<tr><td></td><td></td><td>50,001 - 250,000 gallons</td><td>$ 3.10 /1000-gallons</td></tr>
<tr><td></td><td></td><td>>250,000 gallons</td><td>$ 3.15 /1000-gallons</td></tr>
<tr><td>4"</td><td>Retail Meter</td><td></td><td></td></tr>
<tr><td></td><td>Base Service Charge</td><td></td><td>$ 28.00 /month</td></tr>
<tr><td></td><td>Minimum Usage Charge</td><td></td><td>$ 632.50 /month</td></tr>
<tr><td></td><td></td><td>0 - 250,000 gallons</td><td>$ 3.05 /1000-gallons</td></tr>
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<tr><td></td><td></td><td>>500,000 gallons</td><td>$ 3.15 /1000-gallons</td></tr>
<tr><td>6"</td><td>Retail Meter</td><td></td><td></td></tr>
<tr><td></td><td>Base Service Charge</td><td></td><td>$ 32.00 /month</td></tr>
<tr><td></td><td>Minimum Usage Charge</td><td></td><td>$ 1,375.00 /month</td></tr>
<tr><td></td><td></td><td>0 - 500,000 gallons</td><td>$ 3.05 /1000-gallons</td></tr>
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<tr><td></td><td></td><td>>750,000 gallons</td><td>$ 3.15 /1000-gallons</td></tr>
</table>
</td></tr>
<tr><td>Irrigation</td><td></td><td></td><td>
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<tr><td></td><td>Irrigation Meter - Residential</td><td></td><td></td></tr>
<tr><td></td><td>Base Service Charge (Base Service charge is waived if used in conjunction with another retail meter, otherwise Base Service Charge is based on the Retail Meter Base Service Charge)</td><td></td><td>$ - /month</td></tr>
<tr><td></td><td></td><td>0 - 6,000 gallons</td><td>$ 3.05 /1000-gallons</td></tr>
<tr><td></td><td></td><td>6,001 - 12,000 gallons</td><td>$ 3.25 /1000-gallons</td></tr>
<tr><td></td><td></td><td>12,001 - 20,000 gallons</td><td>$ 3.50 /1000-gallons</td></tr>
<tr><td></td><td></td><td>20,001 - 50,000 gallons</td><td>$ 4.00 /1000-gallons</td></tr>
<tr><td></td><td></td><td>>50,000 gallons</td><td>$ 6.00 /1000-gallons</td></tr>
<tr><td></td><td>Irrigation Meter - Commercial/Multi-Family</td><td></td><td></td></tr>
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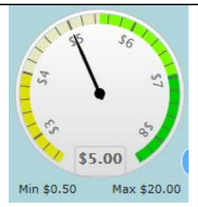
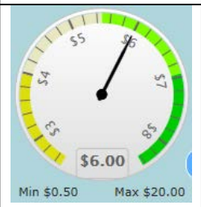
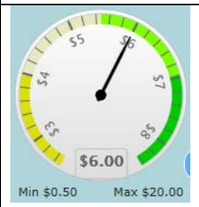
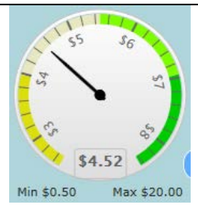
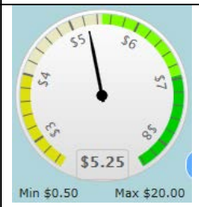
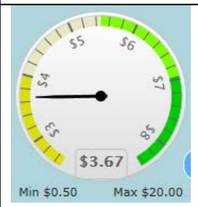
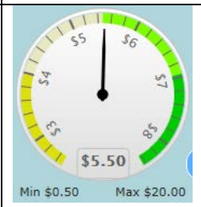
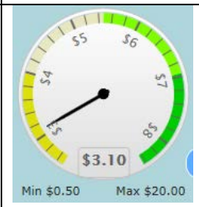
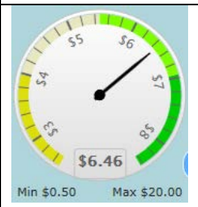
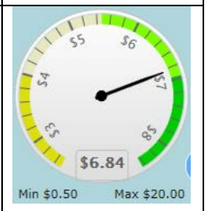
<tr><td></td><td></td><td>0 - 20,000 gallons</td><td>$ 3.05 /1000-gallons</td></tr>
<tr><td></td><td></td><td>20,001 - 50,000 gallons</td><td>$ 3.25 /1000-gallons</td></tr>
<tr><td></td><td></td><td>50,001 - 100,000 gallons</td><td>$ 3.50 /1000-gallons</td></tr>
<tr><td></td><td></td><td>100,001 - 200,000 gallons</td><td>$ 4.00 /1000-gallons</td></tr>
<tr><td></td><td></td><td>>200,000 gallons</td><td>$ 6.00 /1000-gallons</td></tr>
</table>
</td></tr>
</table>

Utility	Cary	Pittsboro
Base Charge	**Meter Size** 5/8" & 3/4" 1" *Base Charge Inside Cary or Morrisville Corporate Limits* 3.07 3.07	Water Inside **Basic Service Charge** (Flat monthly fee Meters ≤ 1 inch $ 13.26 Meters > 1 inch $ 24.48
Residential	**Single-Family Residential: Customers Inside Cary or Morrisville Corporate Limits (charge per 1,000 gallons)** Tier 1 (usage 0 - 5,000 gallons) 4.56 Tier 2 (usage 5,001 - 8,000 gallons) 5.11 Tier 3 (usage 8,001 - 23,000 gallons) or up to water budget amount 6.46 Tier 4 (usage > 23,000 gallons) or over water budget amount 12.19	Plus a monthly usage fee per 1,000 gallo 0 to 2,000 gallons $ 4.93 2,001 to 6,000 gallons $ 5.76 > 6,000 gallons $ 6.84
Commercial	**Non-Residential & Multifamily: Customers Inside Cary or Morrisville Corporate Limits (charge per 1,000 gallons)** Tier 1 (usage 0 - Water Budget Amount) 5.11 Tier 2 (usage > than Water Budget Amount) 12.38	Plus a monthly usage fee per 1,000 gallo 0 to 2,000 gallons $ 4.93 2,001 to 6,000 gallons $ 5.76 > 6,000 gallons $ 6.84
Irrigation		Plus a monthly usage fee per 1,000 gallo 0 to 2,000 gallons $ 4.93 2,001 to 6,000 gallons $ 5.76 > 6,000 gallons $ 6.84

UNC Environmental Finance Center Dashboard Comparison

Utility	Pender County			Fayetteville PWC	Harnett County	Cape Fear PUA	Topsail	Brunswick Co	Cary	Pittsboro
	Maple Hill	Rocky Point-Topsail	Scotts Hill							
Affordability (Water Bills as % MHI)	1.14%	1.54%	1.54%	0.63%	0.89%	0.75%	1.06%	0.70%	0.34%	0.91%
Conservation Signal (Water Price/1,000 gallons, after 10,000 gallons)										

Source: University of North Carolina (UNC) Environmental Finance Center, North Carolina Water and Wastewater Rates Dashboard. January 2017 rates. Accessed July 2017.

US Census Bureau American FactFinder Median Household Income Comparison

Utility	Pender County	Fayetteville PWC	Harnett County	Cape Fear PUA	Topsail	Brunswick Co	Cary	Pittsboro
Place	**Pender County, NC**	**Fayetteville, NC (Metro Area)**	**Harnett County, NC**	**Wilmington, NC (city)**	**Topsail, NC (township)**	**Brunswick County, NC**	**Cary, NC (town)**	**Pittsboro, NC (town)**
Median household income in the past 12 months (in 2015 Inflation-adjusted dollars)	$44,828	$43,861	$46,353	$42,128	$57,663	$46,859	$91,579	$53,422

Source: United States Census Bureau, American FactFinder, 2011-2015 American Community Survey 5-Year Estimates. Accessed August 2017.

Appendix E
Drought Management Plan

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2017 Interbasin Transfer Certificate

Drought Management Plan

Prepared for:

Pender County Utilities

Submitted to:

North Carolina Division of Water Resources

August 2017

Prepared by:

HIGHFILL
INFRASTRUCTURE
ENGINEERING, P.C.
3804 Park Avenue, Suite A
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B Pender County Utilities Water Shortage Response Plan

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SECTION 1

Drought Management Plan

1.1 Introduction

Pender County Utilities (PCU) is committed to effectively managing their water resources and ensuring safe and reliable water supply for the communities they serve while being good stewards of the natural environment. As part of long-range planning efforts, PCU is engaging in the 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 which entities 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. PCU 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 IBT 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. In addition to the permitted transfer volume, the IBT statute includes a condition that requires the development of a Drought Management Plan (DMP) that specifies how the IBT shall be managed to protect the source river basin (Cape Fear River IBT Basin) during drought conditions or other emergencies that occur within the source river basin.

Currently, PCU and the co-applicants have Water Shortage Response Plans (WSRPs), as required by North Carolina General Statute (NCGS) 143-355(l). The rules governing water use during droughts and water emergencies (15A North Carolina Administrative Code [NCAC] 02E. 0607) stipulate specific items that must be included in those plans. The WSRPs were developed in accordance with the NCAC and the *Water Shortage Response Plan Guidelines* (NCDWR, 2009) provided by the Division of Water Resources (NCDWR), and were approved by the NCDWR in 2010. One co-applicant is projected to begin purchasing water from PCU by year 2025, and the remainder are projected to begin by year 2030. Since the co-applicants' current WSRPs are related to their current groundwater supplies, they are not germane to PCU's DMP. Each co-applicant will be required to adopt PCU's WSRP and comply with this DMP prior to receiving water from PCU.

PCU updated their WSRP in 2017 to include appropriate triggers and to ensure they are protecting the water source and be among the most stringent WSRPs in the basin. A comparison matrix comparing PCU's WSRP to those of Brunswick County and Cape Fear Public Utility Authority (CFPUA), two neighboring utilities utilizing the same water source, is included in Appendix A and is discussed further in Section 1.3.

In contrast to PCU's and co-applicants' long-term water conservation program, the purpose of the WSRP is to deal with short-term or immediate water shortages that may be caused by drought, water quality problems, or disruptions in facility operations. PCU has authority to enact water shortage response provisions identified in the WSRP through Pender County's Water and Sewer Ordinance adopted June 16, 2008 and amended June 2010.

The following sections of this DMP summarize the provisions of PCU's WSRP and how the implementation of the WSRP helps to protect the IBT source river basin (Cape Fear River IBT Basin) during droughts or other emergencies.

1.2 Water Shortage Response Plan

The IBT certificate condition requiring a DMP focuses on the protection of the source river basin during low flow conditions. The authority of PCU and the co-applicants to require water use reductions across their service area, including wholesale customers, as described in the WSRP, will provide for reduced water withdrawals from the Cape Fear River IBT Basin during periods of drought or other water emergencies. PCU's WSRP is included in Appendix B.

The WSRP includes an estimate of the expected effectiveness of the mandatory water use reductions for each stage of water shortage response. Table 1 provides a summary of water reduction measures, and an estimate of the range of percentage reductions that might be expected in IBT for each WSRP stage.

TABLE 1
Estimated Range of Interbasin Transfer Reduction for PCU and its Co-applicants Water Shortage Response Plan Stages

WSRP Stage	Reduction Measures	Potential Decrease in IBT from WSRP Implementation (%)
1 (Voluntary)	All water users asked to reduce their normal water use by 5%. Customer education and outreach programs will encourage water conservation including: irrigating landscapes a maximum of 1 inch per week; preventing water waste through runoff and irrigation of impervious surfaces; watering plants deeply to encourage root growth; washing only full loads in clothes and dishwashers; using spring-loaded nozzles on garden hoses; and identifying and repairing all water leak.	0-5
2 (Mandatory I)	All customers are expected to reduce their water use by 10% in comparison to previous month's bill. Irrigation is limited to a half inch per week between 8 PM and 8 AM; outdoor use of drinking water for washing impervious surfaces is prohibited; and all testing and training purposes regarding drinking water (i.e. fire protection) will be limited.	5-10
3 (Mandatory II)	Mandatory II: Customers must continue actions from previous stages and further reduce water use by 20% compared to their previous month's bill. All non-essential uses of drinking water are banned, and landscape irrigation must be reduced to minimum volume necessary for survival. A drought surcharge of 1.5 times the normal water rate applies.	10-20
4 (Emergency)	Customers must continue all action from previous stages and further reduce their water use by 25% compared to their previous month's bill. A ban on all use of drinking water except to protect public health and safety is implemented. Drought surcharges increase to 2 times the normal water rate.	20-25
5 (Rationing)	Provide drinking water to protect only public health (e.g. residences, residential health care facilities, correctional facilities). All customers are only permitted to use water at the minimum level required for public health protection. Firefighting is the only allowable outdoor water use. Drought surcharges increase to 5 times the normal water rate.	20-25

The ranges are based on the projected water demand, consumptive use, surface water discharge, and resulting IBT for the 30-year planning period used for the IBT certificate (2045), as well as the expected effect of the time of year when the WSRP is implemented. The ranges reflect the amount of uncertainty inherent in predicting the potential impact of water use reductions on the multiple factors that go into estimating IBT.

1.3 Protection of the Source Basin

NCGS 143-215.22L(n)(2) states that a Drought Management Plan, as a condition of an IBT certificate, should specify how the IBT will be managed to protect the source basin during drought conditions with its mandatory implementation.

1. The WSRP for PCU and its co-applicants will reduce water withdrawals and IBT from the Cape Fear River IBT Basin during drought conditions, thereby protecting the source basin.

2. The restrictions on water use from the Cape Fear River IBT Basin will increase, and IBT will decrease, in direct proportion to the severity and duration of drought conditions, thereby protecting the source basin.

The Water Shortage Response Plan Comparison Matrix included in Appendix A compares the triggers and conservation measures of PCU's WSRP with those recently approved for CFPUA and Brunswick County. The matrix shows that PCU's requirements are the most stringent. Some notable observations regarding PCU's WSRP are provided below:

1. PCU has listed up to five "trigger" criteria in which it can mandate a water shortage response at each level. The multiple trigger criteria ensure that PCU can initiate a timely response to water emergencies.
2. PCU provides a prescriptive list of specific actions that are required to be taken at each water shortage stage. These lists help clarify what activities are allowed and prohibited to foster greater compliance.
3. PCU implements drought surcharges of up to 5 times the normal water rate to ensure that nonessential uses are curtailed. Cape Fear PUA and Brunswick County do not implement drought surcharges at any water shortage stage.

1.4 Model Scenario Comparison

The *Environmental Assessment for an Interbasin Transfer from the Cape Fear River* (EA) evaluated the potential changes in the source basin, Cape Fear River IBT basin. Table 2 provides a comparison of the four scenarios developed to establish baselines for the years 2010 and 2045 (assuming no increase in IBT), and to allow evaluation of the potential effects of the proposed IBT. The 2045 Maximum Withdrawal scenario represents a conservative analysis of flow if 100% of Jordan Lake water supply is allocated. River flow statistics include average and median flows, which are representative of average climatic conditions, and 10th and 5th percentile flows, which are representative of "severe" and "extreme" droughts, respectively.

TABLE 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%

Source: Highfill Infrastructure Engineering, P.C. and CH2M, 2017

For the 2045 scenario, 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 an 11.6 percent change for low flow periods, as indicated by the 5th percentile flows.

The effect below L&D #1 from PCU's IBT during drought periods, as well as other public water supplies accessing water from the Cape Fear River, will be further mitigated by the implementation of the State-required WSRPs. 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." 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." The WSRPs for public water supplies downstream of Jordan Lake are not built into the Cape Fear – Neuse River Hydrologic Model. 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 PCU and all withdrawals at L&D #1; therefore, the results of hydrologic modeling represent a conservative evaluation of flows during drought conditions.

1.5 Modifications to Water Shortage Response Plans

PCU has updated its WSRP to include triggers and required conservation measures that are among the most stringent in the source basin. The co-applicants will be required to update their WSRPs to include the same triggers and requirements as PCU prior to purchasing water from PCU. NCDWR approval of the updated plans will be required, and compliance will be monitored under this plan.

SECTION 2

References

Highfill Infrastructure Engineering, P.C. and CH2M. January 2017. Environmental Assessment for an Interbasin Transfer from the Cape Fear River.

North Carolina Administrative Code (NCAC). 2015. 15A NCAC 02E.0607: Publicly and Privately Owned Water System Water Shortage Response Planning Requirements. http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2002%20-%20environmental%20management/subchapter%20e/15a%20ncac%2002e%20.0607.pdf Accessed April 3, 2017.

North Carolina Division of Water Quality (NCDWR). 2009. *Water Shortage Response Plan Guidelines*. http://www.ncwater.org/Water_Supply_Planning/Water_Shortage_Response_Plans/documents/wsrp_guidelines.pdf. Accessed April 3, 2017.

North Carolina General Statute (NCGS). 2015. NCGS 143-355(l): Local Water Supply Plans. http://www.ncwater.org/rules_policies_and_regulations/Planning/gs143-355lm.pdf. Accessed April 3, 2015

Pender County. 2008. Water and Sewer Ordinance. Adopted June 16, 2008.

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Appendix A
Water Shortage Response Plan Comparison Matrix

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Water Shortage Response Plan Comparison Matrix

		Triggers			Conservation Measures		
No.	**Stage**	**PCU**	**Cape Fear PUA**	**Brunswick**	**PCU**	**Cape Fear PUA**	**Brunswick**
1	**Voluntary Reductions**	Stage 1: 1) PCU DPU identifies an immediate water shortage OR 2) declaration of D0 drought	Normal Conditions (water conservation measures and best management practices encouraged at all times)	Stage 1: 1) Immediate water shortage declared by state/local officials OR 2) 3 consecutive days where the actual/anticipated potable water demand is >= 80% of actual available treatment capacity (not necessarily rated capacity if available raw water supply or the treatment capacity is diminished)	1) Ask all water users to reduce normal water use by 5%. 2) Encourage water conservation & efficiency through customer education and outreach programs (including irrigating landscapes a maximum of one inch per week; preventing water waste, runoff and watering impervious surfaces; watering plants deeply to encourage root growth; washing only full loads in clothes and dishwashers; using spring-loaded nozzles on garden hoses; and identifying and repairing all water leaks. Include a prescriptive list of water conservation and efficiency measures.	Water conservation measures and best management practices are encouraged at all times.	No conservation measures are listed in the WSRP. All water use restriction information is listed in the Final EA - Brunswick IBT. The EA includes a prescriptive list of water conservation and efficiency measures.
2	**Mandatory Reductions I**	Stage 2: 1) PCU DPU identifies an immediate water shortage; 2) PCU DPU determines that Voluntary Reduction conditions have not resulted in sufficient reduction of the average day demand; 3) When there are three consecutive days where water demand exceeds 80% of the supply/treatment capacity; OR 4) Finished water storage less than 2.5 million gallons in the distribution system OR 5) declaration of a D1 drought	Stage 1: 1) voluntary restrictions have not resulted in "sufficient reduction" of average day demand; 2) necessary to implement additional mandatory water use rules to protect the public health, safety, and welfare; OR 3) declaration of a D1 drought	Stage 2: 1) declared immediate water shortage OR 2) 2 consecutive days where the actual/anticipated potable water demand is >= 90% of available treatment capacity	1) All customers are expected to reduce their water use by 10% in comparison to their previous month's water bill. 2) In addition to continuing to encourage all voluntary reduction actions, the following restrictions apply: irrigation is limited to a half inch per week between 8PM and 8AM; outdoor use of drinking water for washing impervious surfaces is prohibited; and all testing and training purposes requiring drinking water (e.g. fire protection) will be limited. The following are specifically prohibited: washing vehicles; power washing buildings except for paint prep (permit required); jetting piles to facilitate construction; filling swimming pools except for the minimal volume to maintain structural integrity and filtration system.	Spray irrigation limited to 3 times per week at night time only. Low volume drip irrigation allowed at any time. Irrigation well users are excluded.	No conservation measures are listed in the WSRP. All water use restriction information is listed in the Final EA - Brunswick IBT. THE EA prohibits the following: spray irrigation (hand hoses are allowed); filling new swimming pools; washing vehicles (busineses of washing vehicles may continue to operate; serving water at restaurants except upon request; and using water to control or compact dust. Commercial and industrial users have mandatory reductions of 20%.
3	**Mandatory Reductions II**	Stage 3: 1) PCU DPU identifies an immediate water shortage; 2) PCU DPU determines that water use under Stage 2 conditions have not resulted in sufficient reduction of the average day demand; 3) When there are two consecutive days where water demand exceeds 90% of supply/treatment capacity; OR 4) Finished water storage less than 1.5 million gallons in the distribution system OR 5) declaration of a D2 drought	Stage 2: 1) immediate water shortage; 2) three consecutive days when water demand exceeds 80% of the water production capacity; 3) necessary to implement additional mandatory water use rules to protect the public health, safety, and welfare; OR 4) declaration of a D2 drought	Stage 3: 1) declared immediate water shortage OR 2) >24 hours where the actual/anticipated potable water demand = 100% of available treatment capacity	1) Customers must continue actions from all previous stages and further reduce water use by 20% compared to their previous month's water bill. 2) All non-essential uses of drinking water are banned and garden and landscape irrigation must be reduced to the minimum amount necessary for survival. 3) Apply a drought surcharge of 1.5 times the normal water rate. The following are specifically prohibited: no using water outside of structures except for emergencies involving fire; no introducing water into swimming pools; no serving water in restaurants except upon request. All other water uses are limited to meet essential health and safety needs.	Spray irrigation limited to 2 times per week at night time only. Low volume drip irrigation allowed at any time. Residents are limited to pressure washing and washing vehicles on weekends only. Restaurants prohobited from serving water unless requested by customer. Well irrigation users are excluded.	No conservation measures are listed in the WSRP. All water use restriction information is listed in the Final EA - Brunswick IBT. The EA prohibits the following: watering lawns, trees, and flowers (vegetables can be watered by hand); washing vehicles at commercial car wash establishments. Commercial and industrial users have mandatory reductions of 50%.
4	**Emergency Reductions**	Stage 4: 1) PCU DPU identifies an immediate water shortage; 2) PCU DPU determines that water use under Stage 3 conditions have not resulted in sufficient reduction of the average day demand; 3) When there is one day where water demand exceeds 100% of supply/treatment capacity; OR 4) Finished water storage less than 1.5 million gallons in the distribution system; OR 5) declaration of a D3 drought	Stage 3: 1) immediate water shortage; 2) two consecutive days when water demand exceeds 90% of the water production capacity; 3) necessary to implement additional mandatory water use rules to protect the public health, safety, and welfare; OR 4) declaration of a D3	Not listed in the WSRP. This stage is only mentioned in the Final EA - Brunswick IBT.	1) Customers must continue all actions from previous stages and further reduce their water use by 25% compared to their previous month's water bill. 2) A ban on all use of drinking water except to protect public health and safety is implemented. 3) Apply drought surcharge increase to 2 times the normal water rate.	Spray irrigation limited to 2 times per week at night time only. Low volume drip irrigation allowed at any time. Using potable water to fill swimming pools is allowed with an approved permit. Residents are limited to pressure washing and washing vehicles on weekends only. Restaurants prohobited from serving water unless requested by customer. Using potable water to control or compact dust is prohibited. Commercial car washes must reduce total water consumption by 10% from "previous month."	No conservation measures are listed in the WSRP. All water use restriction information is listed in the Final EA - Brunswick IBT. A ban on all use of drinking water except to maintain public health and safety. Residential water use shall be limited to the amount necessary to sustain life through drinking, food preparation, and personal hygiene.
5	**Water Rationing**	Stage 5: 1) PCU DPU identifies an immediate water shortage; 2) PCU DPU determines that water use under Stage 4 conditions have not resulted in sufficient reduction of the average day demand; OR 3) Finished water storage less than 1.0 million gallons in the distribution system; 4) declaration of a D4 drought	Stage 4: 1) immediate water shortage or severe emergency; 2) when there is one day when water demand exceeds 100% of the water production capacity; 3) it is necessary to implement additional mandatory water use rules to protect the public health, safety, and welfare; OR 4) declaration of a D4 drought		The goal of Stage 5 is to provide drinking water to protect only public health (e.g. residences, residential health care facilities and correctional facilities). 1) All customers are only permitted to use water at the minimum required for public health protection. 2) Firefighting is the only allowable outdoor water use and pickup locations for distributing potable water will be announced according to (PCU'S) Emergency Response Plan. 3) Drought surcharge increases to 5 times the normal water rate.	Using water for irrigation prohibited except for low volume drip irrigation for commercial containerized plants. No new lawn permits will be issued. Using hand held hoses for cleaning purposes is prohibited.Filling new swimming pools with potable water is prohibited. Washing vehicles is prohibited. Using potable water to control or compact dust is prohibited. No commercial or residential pressure washing. Commercial car washes must demonstrate 20% reduction from previous month.	

Appendix B
Pender County Utilities Water Shortage Response Plan

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WATER SHORTAGE RESPONSE PLAN
PENDER COUNTY UTILITIES, NORTH CAROLINA

The procedures herein are written to reduce potable water demand and supplement existing drinking water supplies whenever existing water supply sources are inadequate to meet current demands for potable water.

I. AUTHORIZATION

The Pender County Utilities Director shall enact the following water shortage response provisions whenever the trigger conditions outlined in Section IV are met. In his/her absence, an authorized representative will assume this role.

Mr. Bryan McCabe, PE
Pender County Utilities Director
605 E. Fremont Street
Burgaw, NC 28425
910-259-1570
bmccabe@pendercountync.gov

II. NOTIFICATION

The following notification methods will be used to inform water system employees and customers of a water shortage declaration: employee e-mail announcements, notices at municipal buildings, notices in water bills. Required water shortage response measures will be communicated through *The Pender Post*, the *Topsail Voice*, PSA announcements on local radio and cable stations. Declaration of emergency water restrictions or water rationing will be communicated to all customers by telephone through the County's Connect – CTY (reverse 911) system.

III. LEVELS OF RESPONSE

Five levels of water shortage response are outlined in the table below. A detailed description of each response level and corresponding water reduction measures are provided below.

Stage	Response	Description
1	Voluntary Reductions	Water users are encouraged to reduce their water use and improve water use efficiency; however, no penalties apply for noncompliance. Water supply conditions indicate a potential for shortage.
2	Mandatory Reductions I	Water users must abide by required water use reduction and efficiency measures; penalties apply for noncompliance. Water supply conditions are significantly lower than the seasonal norm and water shortage conditions are expected to persist.

3	Mandatory Reductions II	Same as in Stage 2, with more aggressive water use restrictions
4	Emergency Reductions	Water supply conditions are substantially diminished and pose an imminent threat to human health or environmental integrity.
5	Water Rationing	Water supply conditions are substantially diminished and remaining supplies must be allocated to preserve human health and environmental integrity.

Stage 1, Voluntary Reductions:

- All water users will be asked to reduce their normal water use by 5%.
- Customer education and outreach programs will encourage water conservation and efficiency measures including:
    - o Irrigating landscapes a maximum of one inch per week.
    - o Preventing water waste, runoff and watering impervious surfaces.
    - o Watering plants deeply to encourage root growth.
    - o Washing only full loads in clothes and dishwashers.
    - o Using spring-loaded nozzles on garden hoses.
    - o Identifying and repairing all water leaks.
    - o Watering shrubbery the minimum amount required.
    - o Limiting vehicle and boat washing to the minimum.
    - o Refraining from washing down outside areas such as sidewalks and patios.
    - o Using showers for bathing rather than baths, and limiting showers to no more than four minutes.
    - o Refraining from leaving faucets running while shaving or while rinsing dishes.
    - o Installing water-flow restrictive devices in showerheads.
    - o Using disposable and biodegradable dishes.
    - o Installing water-saving devices such as plastic bottles or commercial units in toilet tanks to reduce volume.
    - o Ensuring toilet flapper valves are not leaking: This flapper can be checked by adding a food coloring to the toilet tank and visually checking to see if the color appears in the bowl. If it does show color, the toilet is leaking.
    - o Storing drinking water in refrigerator to avoid trying to run it cool from the tap.

Stage 2, Mandatory Reductions I:

- All customers are expected to reduce their water use by 10% in comparison to their previous month's water bill.
- In addition to continuing to encourage all voluntary reduction actions, the following restrictions apply:
    - o Irrigation is limited to a half inch per week between 8PM and 8AM.
    - o Outdoor use of drinking water for washing impervious surfaces is prohibited.
    - o All testing and training purposes requiring drinking water (e.g. fire protection) will be limited.
    - o The use of water for washing or cleaning of equipment including vehicles, boats and fleet vehicles is prohibited unless water use is deemed essential to maintain the safe operational use or equipment integrity.

- The use of water for power washing of buildings and other structures is prohibited, except for paint prep only (permit required).
- The use of water from fire hydrants and hose bibs is prohibited, except for:
    - fighting fire and fire protection purposes
    - testing or training fire fighters if it is necessary to protect public safety
    - jetting piles to facilitate construction
    - construction site hose bibs
- The filling of family, public or private swimming pools, including hot tubs, spas and whirlpool tubs, is prohibited, except for the minimal amount of make-up water necessary to maintain a pool's structural integrity and filtration system.

Stage 3, Mandatory Reductions II:

• Customers must continue actions from all previous stages and further reduce water use by 20% compared to their previous month's water bill.
• All non-essential uses of drinking water are banned and garden and landscape irrigation must be reduced to the minimum amount necessary for survival.
• No using water outside of structures for any use other than emergencies involving fire.
• No introducing water into swimming pools.
• No use of fire hydrants except for fighting fire.
• All other uses of water will be limited to uses necessary to meet the essential health and safety needs of the people of Pender County.
• No serving water in restaurants except upon request.
• Encourage use of disposable utensils and plates in homes and restaurants.
• Additionally, in Stage 3, a drought surcharge of 1.5 times the normal water rate applies.

Stage 4, Emergency Reductions:

• Customers must continue all actions from previous stages and further reduce their water use by 25% compared to their previous month's water bill.
• A ban on all use of drinking water except to protect public health and safety is implemented and drought surcharges increase to 2 times the normal water rate.

Stage 5, Water Rationing:

The goal of Stage 5, Water Rationing, is to provide drinking water to protect public health (e.g. residences, residential health care facilities and correctional facilities). In Stage 5, all customers are only permitted to use water at the minimum required for public health protection. Firefighting is the only allowable outdoor water use, and pickup locations for distributing potable water will be announced according to PCU's Emergency Response Plan. Drought surcharges increase to 5 times the normal water rate.

• It will be unlawful to fail to act in accordance with this section or use water contrary to this section or attempt to evade or avoid such water rationing restrictions.
• Fire protection will be maintained, but where possible, tank trucks shall use raw water.
• Close all swimming pools.
• No washing of any motor vehicles, including commercial washing.
• All industrial uses of water are prohibited.

• All other uses of water will be limited to those necessary to meet minimum health and safety needs of the customers.

IV. TRIGGERS

Pender County Utilities (PCU) draws raw surface water from the Lower Cape Fear Water and Sewer Authority's intake in the Cape Fear River in Bladen County. The triggers based on the potable water demand percentages below are dependent on this water source. A number of additional triggers are provided for each of the water shortage stages.

Stage 1, Voluntary Reductions:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. Declaration of D0 drought.

Stage 2, Mandatory Reductions I:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 1 conditions have not resulted in sufficient reduction of the average day demand; OR
3. When there are three consecutive days where water demand exceeds 80% of the supply/treatment capacity; OR
4. Finished water storage less than 2.5 million gallons in the distribution system; OR
5. Declaration of a D1 drought.

Stage 3, Mandatory Reductions II:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 2 conditions have not resulted in sufficient reduction of the average day demand; OR
3. When there are two consecutive days where water demand exceeds 90% of of supply/treatment capacity; OR
4. Finished water storage less than 1.5 million gallons in the distribution system; OR
5. Declaration of a D2 drought.

Stage 4, Emergency Reductions:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 3 conditions have not resulted in sufficient reduction of the average day demand; OR
3. When there is one day where water demand exceeds 100% of supply/treatment capacity; OR
4. Finished water storage less than 1.5 million gallons in the distribution system; OR
5. Declaration of a D3 drought.

Stage 5, Water Rationing:

1. PCU Utilities Director identifies an immediate water shortage or water quality emergency; OR
2. PCU Utilities Director determines that Stage 4 conditions have not resulted in sufficient reduction of the average day demand; OR
3. Finished water storage less than 1.0 million gallons in the distribution system; OR
4. Declaration of a D4 drought.

V. RETURN TO NORMAL

When water shortage conditions have abated and the situation is returning to normal, water conservation measures employed during each phase should be decreased in reverse order of implementation. Permanent measures directed toward long-term monitoring and conservation should be implemented or continued so that the community will be in a better position to prevent shortages and respond to recurring water shortage conditions.

VI. ENFORCEMENT

The provisions of the water shortage response plan will be enforced by Pender County Utilities personnel. Citations are assessed according to the following schedule depending on the number of prior violations and current level of water shortage.

Water Shortage Level	First Violation	Second Violation	Third Violation
Voluntary Reductions	N/A	N/A	N/A
Mandatory Reductions (Stages 2 and 3)	Warning	$250	Discontinuation of Service
Emergency Reductions	$250	Discontinuation of Service	Discontinuation of Service
Water Rationing	$500	Discontinuation of Service	Discontinuation of Service

Drought surcharge rates are effective in Stages 3, 4 and 5.

VII. VARIANCE PROTOCOLS

Applications for water use variance requests are available from the office of Pender County Utilities. All applications must be submitted to Pender County Utilities for review by the Director or his designee. A decision to approve or deny individual variance requests will be determined within two weeks of submittal after careful consideration of the following criteria: impact on water demand, expected duration, alternative source options, social and economic importance, purpose (i.e. necessary use of drinking water) and the prevention of structural damage.

VIII. EFFECTIVENESS

The effectiveness of the Pender County Utilities water shortage response plan will be determined by comparing the stated water conservation goals with observed water use reduction data. Other factors to be considered include frequency of plan activation, any problem periods without activation, total number of violation citations, desired reductions attained and evaluation of demand reductions compared to the previous year's seasonal data.

IX. REVISION

The water shortage response plan will be reviewed and revised as needed to adapt to new circumstances affecting water supply and demand, following implementation of emergency restrictions, and at a minimum of every five years in conjunction with the updating of our Local Water Supply Plan. Further, a water shortage response planning work group will review procedures following each emergency or rationing stage to recommend any necessary improvements of the plan to the Pender County Utilities Board. The Pender County Utilities Director is responsible for initiating all subsequent revisions.