Environmental Assessment for an Interbasin Transfer from the Roanoke River Basin

Prepared for

Kerr Lake Regional Water System

January 2015

CH2MHILL®

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Acronyms and Abbreviations

ADD	Average Daily Demand
ADDs	Average Daily Demands
ADFs	Average daily flows
AF	Acre-feet
AQI	Air Quality Index
ATC	Authorization to Construction
CA	Critical Area
CAA	Clean Air Act
CCPCUA	Central Coastal Plain Capacity Use Area
cfs	Cubic feet per second
CO	carbon monoxide
CWA	Clean Water Act
CWMTF	Clean Water Management Trust Fund
DEMLR	Division of Energy, Mineral, and Land Resources
DO	Dissolved oxygen
EA	Environmental Assessment
EE&T	Environmental Engineering & Technology, Inc.
EIS	Environmental Impact Statement
EMC	Environmental Management Commission
EO	Executive Order
ESA	Endangered Species Act
ESC	Earth Satellite Corporation
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FSC	federal species of concern
GHG	Greenhouse Gas
GIS	Geographic information system
gpm	Gallons per minute
HQW	High Quality Waters
HUBZone	Historically Underutilized Business Zone
IBT	Interbasin Transfer

KLRWS	Kerr Lake Regional Water System
Kerr Lake	John H. Kerr Reservoir
LWSP	Local Water Supply Plan
MCLP	Mecklenburg Co-Generation Limited Partnership
MDD	Maximum Daily Demand
mgd	Million gallons per day
MMAD	Maximum month average day
MSA	Metropolitan Statistical Area
msl	Mean Sea Level
MW	megawatts
NCDENR	North Carolina Department of Environmental and Natural Resources
NCCGIA	North Carolina Center for Geographic Information and Analysis
NCDAQ	North Carolina Division of Air Quality
NCDLR	North Carolina Division of Land Resources
NCDWR	North Carolina Division of Water Resources
NCEPA	North Carolina Environmental Policy Act
NCFMP	North Carolina Floodplain Mapping Program
NCGS	North Carolina General Statute
NCNHP	North Carolina Natural Heritage Program
NCSHPO	North Carolina State Historic Preservation Office
NCWRC	North Carolina Wildlife Resources Commission
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NHPHA	Natural Heritage Program Natural Areas
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSW	Nutrient sensitive waters
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
ORW	Outstanding Resource Waters
PA	Protected Area

PCB	Polychlorinated biphenyl
PFL	Prime Farmlands
RPW	Relatively permanent water
RRBHM	Roanoke River Basin Hydrologic Model
SCI	Secondary and Cumulative Impacts
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
SGWSA	South Granville Water and Sewer Authority
NHPNA	Significant Natural Heritage Area
SRF	State Revolving Fund
SSOs	Sanitary Sewer Overflows
TESI	Total Environmental Solutions, Inc.
TMDL	Total Maximum Daily Load
UDO	Unified Development Ordinance
ug/L	Micrograms per liter
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
VAC	Virginia Administrative Code
VDCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VOCs	Volatile Organic Compounds
WS	Water Supply
WSRP	Water Shortage Response Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

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SECTION 1

Project Description

1.1 Introduction

The Kerr Lake Regional Water System (KLRWS) currently provides water directly or indirectly to municipal and county systems in four counties and three river basins in northeastern North Carolina. The water supply for the system is John H. Kerr Reservoir (Kerr Lake) on the Roanoke River (Figure 1-1), and the water is used in the Roanoke, Tar-Pamlico, and Neuse River basins. The owners of the KLRWS and primary bulk customers served by the system are the City of Henderson, the City of Oxford, and Warren County, known as the "Partners." Ownership responsibility is 60 percent, 20 percent, and 20 percent, respectively. They also currently sell water to secondary bulk customers that include communities in Warren, Vance, Franklin, and Granville Counties. These include Stovall, Warrenton, Norlina, Vance County, Kittrell, and Franklin County. Future sales will occur from Oxford to South Granville Water and Sewer Authority (SGWSA) for use by Creedmoor and its customer, Wilton. Franklin County now owns the Youngsville water system and also sells water to Bunn and Lake Royale. Franklin County also obtains a small amount of additional supply from Louisburg (Figure 1-2).

The system currently produces on average 6.0 million gallons per day (mgd) of finished water. Maximum month production was 7.8 mgd in 2013 and maximum day production approached 10 mgd. In 2013, the KLRWS maximum month interbasin transfer (IBT) from the Roanoke River basin was approximately 4.6 mgd, which is below the current maximum day grandfathered IBT of 10 mgd. Recent updates to North Carolina G.S. 143-215.22L now allows IBT compliance to be measured as the daily average of a calendar month.

Of the water produced, some stays in the Roanoke River basin through (1) consumptive use, (2) discharge and treatment through septic systems, and (3) treatment at the City of Henderson's wastewater treatment plant and effluent discharge into Nutbush Creek, a tributary of Kerr Lake.

Using Local Water Supply Plan (LWSP) data and an understanding that a portion of water is returned to the Roanoke River basin, projected maximum month IBT was calculated for the planning years of 2045 and 2060 and broken into transfer amounts to the Tar River basin, the Fishing Creek subbasin, and the Neuse River basin. In 2045, the projected withdrawal from Kerr Lake is 17.4 mgd and the projected maximum month average day IBT is 14.2 mgd including:

- 10.7 mgd to the Tar River basin
- 1.7 mgd to the Fishing Creek subbasin
- 1.8 mgd to the Neuse River basin

Predictions to 2060 include an average day withdrawal of 15.9 mgd, which is less than the Partners' 20 mgd annual average day storage allocation in Kerr Lake. This correlates to a maximum month average day withdrawal of 20.1 mgd. After factoring in the wastewater return and consumptive use in the Roanoke River basin, average day and maximum month average day IBT out of the basin are 12.7 and 16.4 mgd, respectively. The break down by receiving basin for the maximum month average day IBT is:

- 12.8 mgd to the Tar River basin
- 1.9 mgd to the Fishing Creek subbasin
- 1.7 mgd to the Neuse River basin

KLRWS is working to increase its permitted IBT in a timely manner to ensure continued water service to the Partners, their expanding service areas, and the local utilities that have contracts with the Partners. The following steps have been undertaken by the Partners to plan for future demands:

- Completed design and an environment assessment (EA) for Kerr Lake Regional water treatment plant (WTP) expansion (2003) and received extension on the Authorization to Construction (ATC) through March 2015
- Cooperated with U.S. Army Corps of Engineers (USACE) on a Reallocation Report after requesting a conversion from a water use agreement to a water supply storage agreement in Kerr Lake in order to increase withdrawals (2005) and began compensating USACE for lost hydropower potential
- Submitted a Notice of Intent to North Carolina Environmental Management Commission (NC EMC) for increased IBT (2009)
- Summarized available water demand projections based on 2007 Local Water Supply Plans developed by the primary and secondary bulk customers of the Partners (2008)
- Prepared a Scoping Document to comply with recent IBT regulations (2009)
- Conducted public notification efforts and held a series of public meetings within the source basin and receiving basins of the proposed IBT to gather input from citizens in North Carolina and Virginia, community organizations, and public agencies to comply with recently adopted IBT regulations (2009)
- Submitted preliminary draft Environmental Impact Statement (EIS) to North Carolina Department of Environment and Natural Resources (NC DENR) and received comments (late 2011 and early 2012)
- Received the updated Roanoke River basin hydrologic model and basin-wide future demand projections based on 2012 Local Water Supply Plans (LWSP) (2014)
- Updated water demand projections to reflect recent statute which measures IBT as the daily average of a maximum calendar month, based on 2013 LWSPs developed by the primary and secondary bulk customers of the Partners (2014)
- Updated environmental document and converted to an EA to reflect recent statutory changes from Session Law 2014-120 (2014)

The Notice of Intent and other scoping materials are provided in Appendix A. The letter documenting NCDWR's 10 mgd grandfathered IBT amount and the full USACE report are included in Appendix B.

1.2 Project Background

1.2.1 Kerr Lake

The water source, Kerr Lake, was formed in 1952 by construction of the John H. Kerr dam, an impoundment of the Roanoke River in Mecklenburg County, Virginia. This reservoir is also known as Buggs Island Lake in Virginia. It is part of a series of reservoirs on the river. The USACE-owned reservoir encompasses approximately 50,000 acres of surface area and 850 miles of shoreline. The reservoir was originally conceived for the purposes of generating hydropower (primary objective), reducing flood damage, improving navigation, and promoting recreational (such as fishing) opportunities. The Water Supply Act of 1958 expanded the function of the reservoir to include providing water supply.

Several entities hold existing water supply agreements to use John H. Kerr Reservoir as a water source:

- Town of Clarksville, Virginia
- City of Virginia Beach, Virginia
- Virginia Department of Corrections, Virginia
- Mecklenburg Co-Generation Limited Partnership (MCLP), Virginia
- Burlington Industries, Virginia (facility closed in 2005)
- KLRWS - City of Henderson, North Carolina

1.2.2 Water Treatment Plant Expansion

The KLRWS infrastructure includes the Kerr Lake Regional WTP, which is a conventional surface water treatment facility, distribution mains, storage tanks, and water meters. The raw water intake is located on the Anderson Creek arm of Kerr Lake. Raw water is drawn from the lake intake and sent to the nearby WTP pumping station wet well. From there, it is pumped via a raw water transmission line to the WTP's rapid mix basin.

The Partners completed an EA for expansion of their water plant in 2003 (EE&T, 2003). This EA received a Finding of No Significant Impact (FONSI) and plan approvals were obtained for a water plant expansion. The EA is a comprehensive document that includes data and information that can be referenced in this Environmental Impact Statement (EIS) to support an IBT certificate. The expiration dates of the FONSI and the ATC have been extended, as conditions have remained relatively unchanged, and as of the date of this document are valid through March 2015. These documents are included in Appendix B.

The 2003 EA concluded that the plant expansion to 20 mgd is necessary, noting that the plant experienced water demands of up to 80 percent of the current maximum daily demand (MDD) (10 mgd) on multiple occasions. The capacity of the 20-mgd facility will serve the KLRWS well beyond the 2045 planning period used herein. The existing ordinances and regulations in place were deemed adequate to counter any secondary and cumulative impacts (SCI) that could occur as the result of the facility expansion. The SCI identified for the WTP expansion would be similar to those associated with an increase in IBT, since the WTP would provide more treatment capacity than could be used within its service area in the Roanoke River basin. SCI will be a focus of the EA related to the IBT certificate request.

1.2.3 KLRWS Infrastructure

From the WTP, infrastructure first conveys finished water to each of the Partners. Finished water is then conveyed to bulk customers, as depicted in Figure 1-2. Table 1-1 presents details of each of these connections, including age of infrastructure. Given the sizes and ages of the existing infrastructure, it is not anticipated that additional conveyance capacity will be needed or that lines will need to be replaced during the planning period.

TABLE 1-1
KLRWS Distribution System Infrastructure

Connection	Pipe Size (inches)	Installation Year [c]	Pipe Age (years) [d]
KLRWS to City of Henderson	24[a], 36	1974[a]	40
KLRWS to City of Oxford	20[b], 24[a], 30, 36	1974[a], 2003[b]	40, 11
KLRWS to Warren County	20, 24[a], 26	1974[a]	40

[a] 24" Pipe installed in 1974
[b] 20" Pipe installed in 2003
[d] If not noted, installation year not known
[c] Pipe age calculated in 2014

1.2.4 Kerr Lake Allocation

The 2005 EA and its FONSI support expanding the existing facility to 20 mgd. In addition to the WTP EA, KLRWS also requested that the USACE evaluate an increase in the allocation of water supply storage in Kerr Lake. The 2005 reallocation report issued by USACE (Appendix B) approves a request by the City of Henderson for a reallocation of 10,292 acre-feet (AF) from the usable conservation pool storage at Kerr Lake for water supply storage. This volume corresponds to an average annual daily withdrawal of 20 mgd and is approximately 1 percent of the total conservation pool storage (980,054 AF). As a result, the total water supply storage allocation for all Kerr Lake water supply agreements increased to 21,115 AF. Reallocation finalizes the conversion of an original average annual 20-mgd "water use" agreement to a "storage

agreement" which could meet average day of a calendar month demands of approximately 25 mgd using the current demand factor of 1.26. This demand factor was conservatively calculated as the maximum ratio between WTP average annual and maximum month water use data for the period of fiscal year 2007 through fiscal year 2013 (KLRWS maintains data by fiscal year). This reallocation also reduces the amount of water storage available for hydropower generation. The allocations summarized in Table 1-2 highlight the three primary functions of Kerr Lake: hydropower, flood control, and water supply.

TABLE 1-2
Kerr Lake Pertinent Reallocation Data

Drainage Area (square miles)		7,800
Storage[a] (AF)	Total Usable Pool (Elevation 268-320 ft msl)	2,262,421
	Flood Control Pool (Elevation 300-320 ft msl)	1,282,367
	Conservation Pool (Elevation 268-300 ft msl	980,054
	Hydropower	958,939
	Water Supply	21,115

[a] Storage remaining after 100 years of sedimentation from July 1953
Source: 2005 USACE Reallocation Report

This allocation supports the needs of the KLRWS to withdraw water to meet its projected needs through a typical water supply planning period of 30 years. As documented in the alternatives analysis presented in the Reallocation Report, meeting future water demands of the KLRWS is most reliably met with the supply available in Kerr Lake. However an increase in IBT is still required to provide KLRWS with the flexibility it needs to distribute water to its customers, which lie in multiple river basins as defined in the IBT statute (North Carolina General Statute [NCGS] 143.215.22L).

1.3 Projection Description

1.3.1 Project Area and Study Area Descriptions

The project area includes portions of the Roanoke, Tar-Pamlico, and Neuse River basins in Vance, Granville, Warren, and Franklin Counties, which make up the service areas of the Partners and their customers. The study area is larger, including the Roanoke River basin upstream of the KLRWS intake and the downstream reaches of the Roanoke River for the purposes of analyzing impacts of the water withdrawal on surface waters. Finally, the study area also includes reaches of the Tar River and Fishing Creek downstream of the service area, to account for the potential for impacts to these waterways related to growth and increased wastewater discharge in the service area. The service area and study area are shown in Figure 1-1.

The Roanoke River begins in the Blue Ridge Mountains of northwestern Virginia and flows in a generally southeastern direction for 400 miles, entering North Carolina at Lake Gaston. The Anderson Creek arm of Kerr Lake is in North Carolina, as are upstream tributaries including the Dan River. Lake Gaston flows directly into Roanoke Rapids Lake, and on through the coastal plain before emptying into Albemarle Sound in eastern North Carolina. Thirty-six percent of the basin is within North Carolina, with the remaining 64 percent located in Virginia.

The Neuse and Tar-Pamlico River basins are the second and third largest wholly contained river basins, respectively, in North Carolina. The Neuse River originates in Person and Orange Counties and flows southeasterly until it becomes a tidal estuary near New Bern, which flows into Pamlico Sound. The Tar River originates in Person, Granville, and Vance Counties, and flows southeasterly until it becomes a tidal estuary, near Washington where its name changes to the Pamlico River, and then flows into Pamlico Sound. The Tar-

Pamlico River basin includes the Fishing Creek subbasin, which includes portions of Vance and Warren Counties, and is considered a separate subbasin under the IBT statute (NCGS 143-215.22L).

A portion of the water transferred becomes collected wastewater, which is then discharged through National Pollutant Discharge Elimination System (NPDES) permitted discharges into those watersheds. This is the main reason that the study area includes downstream portions of these waterways. Another reason is the potential for water quality and quantity impacts related to growth in the project area, facilitated in part by the availability of an adequate water supply.

1.3.2 Project Description

The KLRWS has prepared water demand projections to plan for its future supply needs. In doing so, the Partners are in the process of requesting an increase in their current IBT of 6 mgd to meet 2045 demand projections. These 2045 average day of a calendar month demand projections show need for 10.7 mgd to be transferred to the Tar River basin, 1.7 mgd to the Fishing Creek subbasin, and 1.8 mgd to the Neuse River basin.

This EA builds on the previous efforts to work toward securing a future water supply for the Partners and their customers. The purpose and need for this IBT are presented. Alternatives to increasing the existing IBT are evaluated, as well as impacts of the proposed transfer on the source basin, the Roanoke River basin, and the three receiving basins: the Tar River basin, the Fishing Creek subbasin, and the Neuse River basin. These impacts include direct, secondary, and cumulative impacts. In addition, mitigative measures, including local ordinances and planning efforts, are presented.

1.3.3 Guiding Legislation

In 2014, Senate Bill 734 was ratified as Session Law 2014-120 and includes a rewrite of G.S. 143-215.22L(w), “Requirements for Coastal Counties and Reservoirs Constructed by the United States Army Corps of Engineers.” This section of the law allows for an expedited IBT process for Kerr Lake given the USACE approved the withdrawal or transfer on or before July 1, 2014. This process does not require an EIS unless it would otherwise be required by Article 1 of Chapter 113A of the General Statutes, includes that upon NCDENR’s determination that the environmental document is adequate to meet the intent of the statute that NCDENR shall publish notice of the petition and hold one public hearing, and simplifies the written notice process for the public hearing. After a 30-day public comment period following the public hearing, the NC EMC shall make a final determination whether to grant the IBT certificate.

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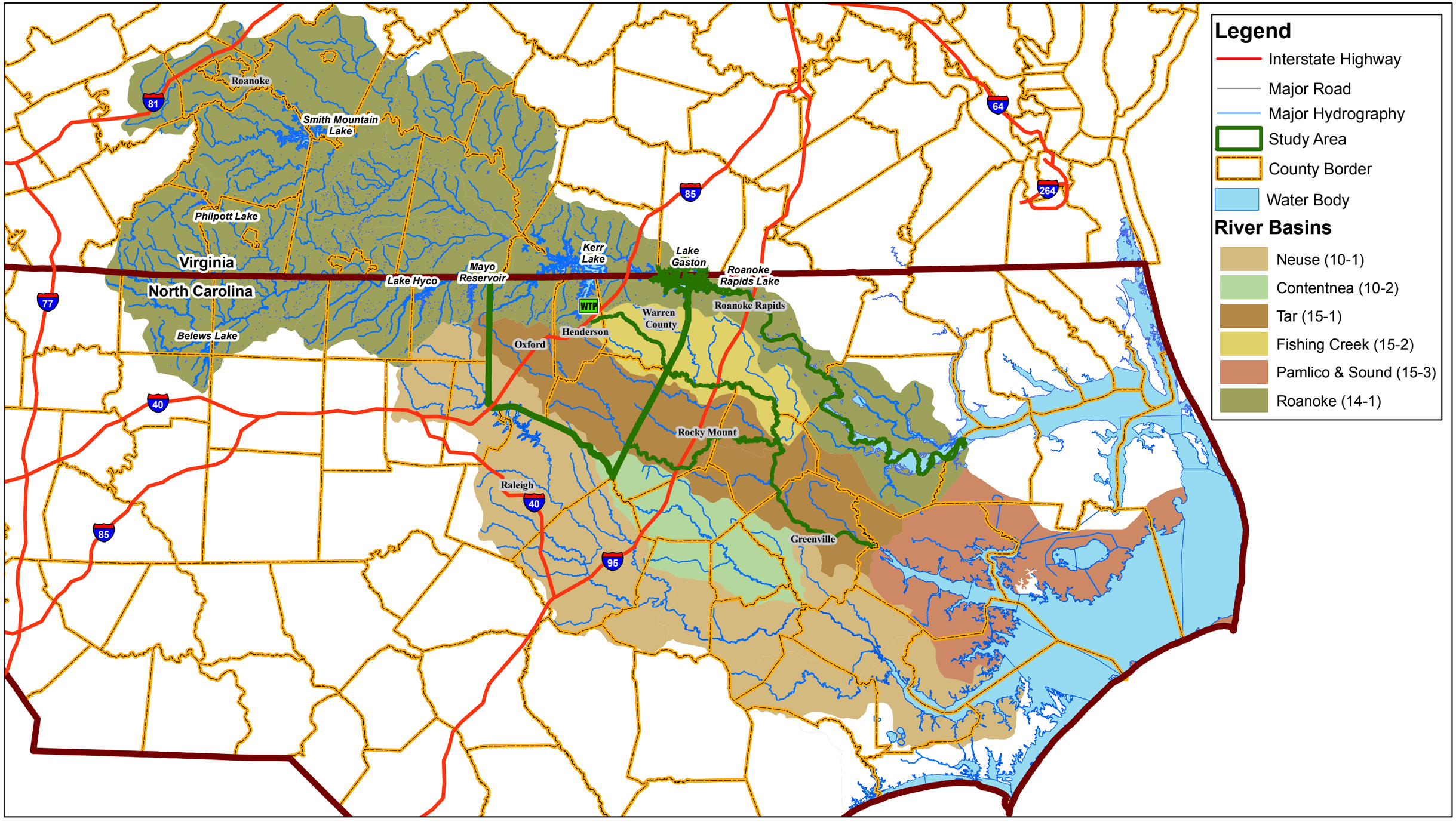

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Figure 1-1
Study Area
Interbasin Transfer from Roanoke River Basin
Kerr Lake Regional Water System

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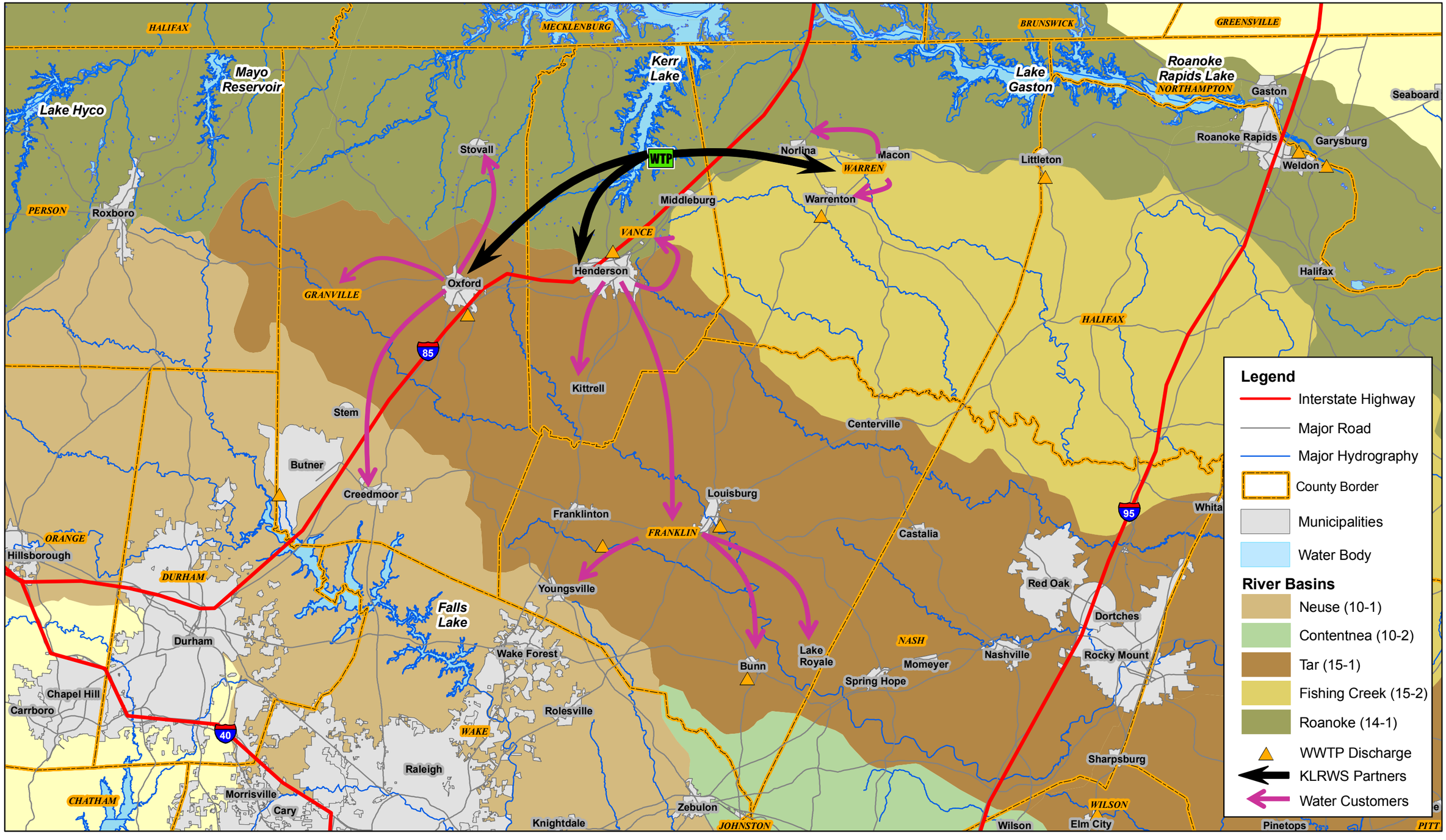

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Figure 1-2
Water Sales
Interbasin Transfer from Roanoke River Basin
Kerr Lake Regional Water System

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SECTION 2

Purpose and Need

2.1 Purpose and Need Statement

KLRWS is actively planning to meet its Partners' and the Partners' customers' needs for a safe, reliable water supply into the future. Using a typical 30-year water supply planning period to 2045, KLRWS shows a projected average day demand of 13.8 mgd and average day of a maximum month demand (MMD) of 17.4 mgd. This demand is based on population projections, service area expansion plans, planned connections to the water supply, and Local Water Supply Plans (LWSPs) developed by the customers of this regional water supplier. The Partners provide a cost-effective solution to water supply needs for their customers and are securing water agreements to continue serving as a regional supplier into the future.

The Partners desire to provide a solution to their increased water supply needs that is fiscally responsible to their customers and is environmentally responsible. They also want to continue building upon the partnerships they have created through the KLRWS. Alternatives to increasing their IBT have previously been considered, but the Partners reached the conclusion that the most reliable and cost-effective future water source remains Kerr Lake and worked with the USACE to secure water supply in Kerr Lake.

To meet future water demands, the Partners intend to increase their withdrawal from Kerr Lake in the Roanoke River basin by expanding their WTP (addressed in previous environmental documents as noted in Appendix B). Portions of the Partners' service areas and service areas of their bulk customers are outside the Roanoke River basin, which will increase IBT of water to the Tar River, Fishing Creek, and Neuse River basins. The Partners believe that this approach meets their goals of being fiscally and environmentally responsible and building on their existing partnerships for the following reasons:

- The proposed project would continue to build on existing work completed by the KLRWS to obtain an allocation of water supply storage in Kerr Lake and to expand its WTP to 20 mgd. The WTP construction is pending the outcome of this request to increase IBT.
- Existing infrastructure connecting the WTP and the Partners' distribution systems is sufficient to meet future water demands. The City of Henderson has a 24-inch and 36-inch line from the WTP, the Town of Oxford has 20-inch, 24-inch, 30-inch and 36-inch lines, and Warren County has 20-inch, 24-inch, and 26-inch lines. Since essentially no new water main infrastructure would be required, the Partners would not need to make capital investments beyond the expansion of the WTP. Therefore, there would be no direct environmental impacts from construction or operation of new transmission lines, pumping facilities, or other infrastructure. Any smaller water line constructed as part of a service area expansion would be handled and permitted by the individual water customers, although any construction that may occur would most likely be within road rights-of-way.

To meet the demands within these service areas, the Partners are asking for an increase in IBT to meet their future water needs. In the case of the KLRWS, IBT water use is measured 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 demand or MMD. These 2045 transfers, represented in MMD, include:

- 10.7 mgd to the Tar River basin
- 1.7 mgd to the Fishing Creek subbasin
- 1.8 mgd to the Neuse River basin

In total, the KLRWS is requesting an IBT certificate to transfer on an MMD basis 14.2 mgd out of the Roanoke 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 Tar River basin to reach customers in the Neuse River

basin but is accounted for as a transfer from the Roanoke River basin to the Neuse River basin. This section further details the need of this request, describing development of water demands for the Partners and their customers, available water supply storage, and how these relate to watershed boundaries.

2.2 Historical Water Demands

KLRWS's previous average daily demands (ADDs) for 5-year intervals beginning in 1992 are listed in Table 2-1. The most recent complete year of data, 2013, is also shown. This slow but steady increase in demand shows an increasing trend over time, even as industrial demands have generally decreased. A slight drop in the 2010 and 2013 ADD since the 2007 ADD is reflective of the drought and the economic downturn that occurred during this timeframe. The 2013 average day water use reflects the wet weather pattern in 2013. However the maximum day water use in 2010 was 10.3 mgd, higher than the maximum day value of 8.52 mgd in 2007. The economic downtown has impacted water use. Demands are expected to return to the previous increasing trend as the economy recovers and service area expansions occur.

TABLE 2-1
KLRWS Past Average Daily Water Demands

Year	1992	1997	2002	2007	2010	2013
Amount (mgd)	4.99	5.07	5.89	6.54	6.02	5.96

Source: Data provided by KLRWS, updated 2014

2.3 Water Demand Projections

When the KLRWS first began preparing for a WTP expansion in 2004, water demand projections were prepared. These water demand projections supported expansion of the WTP to 20 mgd and the request for a reallocation of water supply storage in Kerr Lake, which was approved by USACE in the 2005 Reallocation Report.

The Partners recognize that an IBT certificate is also required if this expansion in water treatment capabilities is constructed because service areas and water sales occur outside the Roanoke River basin. According to projection data, population growth will occur at a slow rate in Vance and Warren Counties, while more rapid growth is occurring in Granville County (where Oxford is located) and Franklin County, which is in relatively close proximity to the Research Triangle area.

In addition to serving future population and commercial growth, the Partners and their customer systems are extending water service areas and obtaining new customers who are currently served by private wells. This is occurring in Vance and Warren Counties. Residents in Vance County have complained about the quality of their well water caused by a high mineral content, which creates taste and odor issues. Residents have also complained that their water has stained bathroom fixtures, appliances, and light-colored clothing. In addition, their wells have not been reliable during recent droughts. Some residents have had to drill new wells to address quantity issues that have resulted from the drought. Connection to the KLRWS will address these local needs. In addition, Franklin County has recently purchased Youngsville's water system making it no longer an independent public water system.

In addition to population increases and the need to extend water service to customers currently being served by private wells, commercial and industrial water demands are also projected to increase. The local governments will be providing service to Triangle North Business Parks. Granville County is also attracting technology-based businesses such as pharmaceutical companies, which may use larger amounts of water.

Using information included in the 2013 Local Water Supply Plans, updated demand projections were developed for each of the Partners and the communities to which they provide water. These demand projections help to more accurately quantify the IBT needed as both service area expansions and population

growth are driving future water demands. The population projections through 2030 are shown in Table 2-2. While Franklin County has additional sources of water besides KLRWS, the entire county's population projections are shown for trend analysis purposes.

Average day water demand projections through 2060 are shown in Table 2-3. The trends for these projections are depicted in Figure 2-1.

TABLE 2-2
Past and Projected Annual County Population Totals

County	2000	2005	2010	2013	2015	2020	2025	2030
Franklin	47,260	53,880	60,813	62,697	63,433	66,009	68,611	71,211
Granville	48,498	53,090	57,577	57,910	59,310	61,336	63,361	65,388
Vance	42,954	43,192	45,358	45,056	45,583	45,692	45,802	45,913
Warren	19,972	20,072	20,939	20,453	20,456	20,088	19,855	19,705

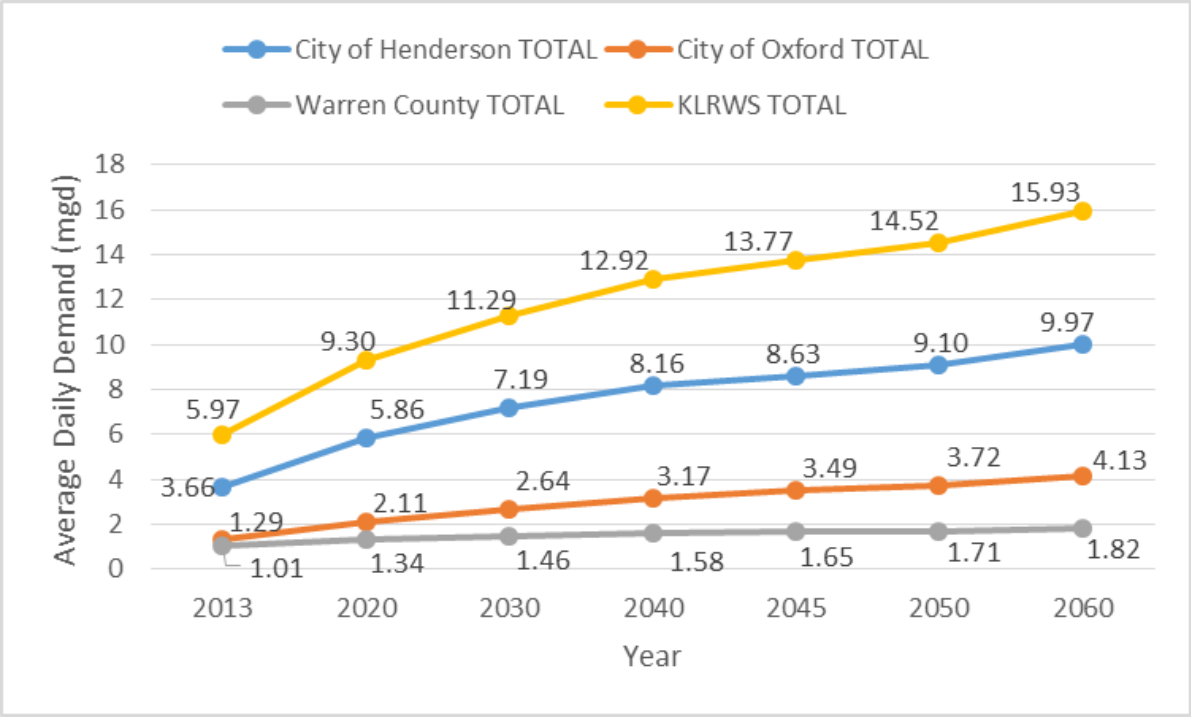
Source: North Carolina Office of State Budget and Management, 2013

TABLE 2-3
Past and Projected Total Average Daily Demands and Sales for KLRWS (mgd)

Partner	Entity Served	2013	2020	2030	2040	2045	2050	2060
City of Henderson		1.37	2.96	3.19	3.49	3.54	3.59	3.70
	Franklin County	1.95	2.08	3.04	3.65	4.05	4.45	5.15
	Bunn	0.12	0.17	0.24	0.30	0.32	0.34	0.40
	Lake Royale	0.17	0.37	0.43	0.43	0.43	0.43	0.43
	Kittrell	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Vance County	0.00	0.22	0.23	0.23	0.23	0.24	0.24
	City of Henderson TOTAL	**3.66**	**5.86**	**7.19**	**8.16**	**8.63**	**9.10**	**9.97**
City of Oxford		1.28	1.35	1.44	1.53	1.58	1.63	1.74
	Stovall	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Granville County	0.00	0.30	0.60	0.90	1.10	1.20	1.50
	SGWSA (for Creedmoor)	0.00	0.42	0.57	0.71	0.78	0.85	0.85
	Wilton	0.00	0.02	0.02	0.02	0.02	0.02	0.02
	City of Oxford TOTAL	**1.29**	**2.11**	**2.64**	**3.17**	**3.49**	**3.72**	**4.13**
Warren County		0.67	0.89	1.01	1.13	1.19	1.25	1.36
	Norlina	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Warrenton	0.19	0.31	0.31	0.31	0.31	0.31	0.32
	Littleton	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Warren County TOTAL	**1.01**	**1.34**	**1.46**	**1.58**	**1.65**	**1.71**	**1.82**
KLRWS TOTAL		**5.97**	**9.30**	**11.29**	**12.92**	**13.77**	**14.52**	**15.93**

Source: Data provided by KLRWS, updated in 2014

FIGURE 2-1
Projected Average Daily Demands for KLRWS and Partners



For KLRWS, the current relationship between average day demands and maximum month demands produces a demand factor of 1.26. This demand factor was conservatively calculated as the maximum ratio between WTP average annual and maximum month water use data for the period of fiscal year 2007 through fiscal year 2013 (KLRWS maintains data by fiscal year). Irrigation water demands are a very low percentage of overall water demands. Much of the residential development in the existing service areas is older, so irrigation systems are not as common as in more recently developed areas. Customers will be added as water service is extended to current well water users in Vance, Granville, and Warren Counties. While recent and future residential development is more likely to include irrigation, it is not predicted that the demand factor will increase over time. Also, conservation efforts would aid in minimizing the likelihood of a rise in the demand factor over time. Therefore, this 1.26 demand factor was used to predict future maximum month demands to 2060. Summarized maximum month demands are presented in Table 2-4 and Figure 2-2.

TABLE 2-4
Past and Projected Total Maximum Month Demands and Sales for KLRWS (mgd)

Partner (Total Including Sales)	2013	2020	2030	2040	2045	2050	2060
City of Henderson	4.62	7.38	9.06	10.28	10.87	11.47	12.57
City of Oxford	1.63	2.65	3.32	4.00	4.40	4.68	5.20
Warren County	1.27	1.69	1.84	2.00	2.07	2.15	2.30
KLRWS TOTAL	**4.62**	**7.38**	**9.06**	**10.28**	**10.87**	**11.47**	**12.57**

Source: Data provided by KLRWS, updated in 2014
Values were calculated using data in Table 2-3 with a demand factor of 1.26

2.4 Proposed Interbasin Transfer

The Regulation of Surface Water Transfer Act (G.S. 143-215.L) was initially adopted in 1993 and required the issuance of a transfer certificate for new transfers of 2.0 mgd or greater. Additionally, a transfer certificate is required for an increase in an existing transfer ≥ 25 percent. Facilities that were in existence prior to 1993 are said to have a "grandfathered" IBT based on 25 percent of their average daily flow (ADF) in 1993, their maximum system capacity in 1993, or 2 mgd, whichever is greatest. Although these criteria or their application have been modified by modification to the General Statute. Existing and future IBTs needs are best estimated by completing a water balance table for a particular water system. A water balance table takes into account water use, consumptive loss, and wastewater discharge in the overall calculation to determine total required IBT. Consumptive loss and wastewater discharge may occur in either the source or receiving basin. If consumptive loss and wastewater discharge predominantly return to the source basin, then the total required IBT is lower. However, if consumptive loss and wastewater discharge predominantly occur in the receiving basin, then the total required IBT is higher.

Basin boundaries are shown in Figure 1-1. Based on basin boundaries and wastewater discharge locations, the demand and IBT projections are summarized in Table 2-5. Figure 2-2 illustrates current and projected demands by river basin and Figure 2-3 shows the relative distribution and use of the water.

FIGURE 2-2
Projected Maximum Month Demands and IBT for KLRWS

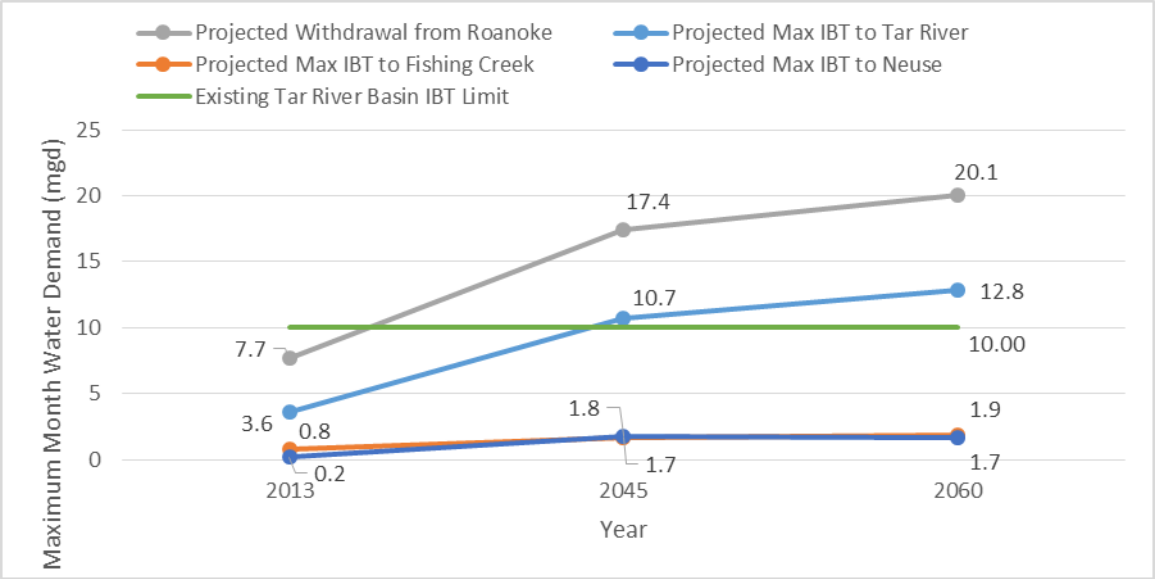


FIGURE 2-3
Total Demands and Sales per Basin from KLRWS

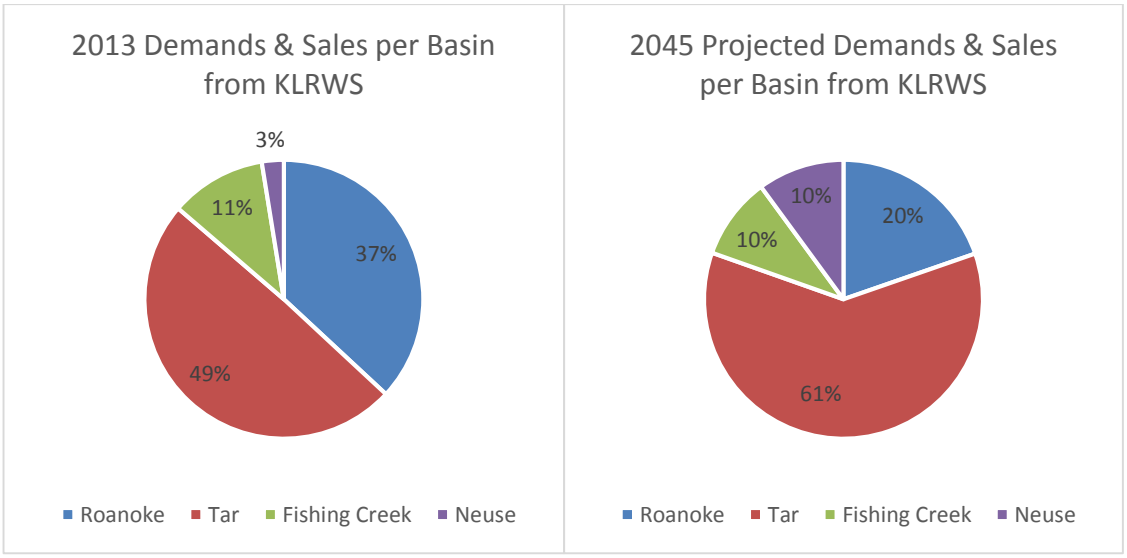


TABLE 2-5
IBT Summary for KLRWS – 2013, 2045, and 2060

		2013 (mgd)		2045 (mgd)		2060 (mgd)	
Water Usage	**Subbasin**	**ADD**	**MMD**	**ADD**	**MMD**	**ADD**	**MMD**
Withdrawal	Roanoke	6.0	7.7	13.8	17.4	15.9	20.1
Consumptive Loss	Roanoke	-0.1	0.2	0.8	1.2	0.6	0.9
	Tar	0.7	1.8	4.3	6.8	5.2	6.9
	Fishing Creek (subbasin to Tar)	0.3	0.4	0.6	0.8	0.6	0.9
	Neuse	0.2	0.2	0.4	1.3	0.6	0.7
Wastewater Discharge	Roanoke	2.3	2.5	2.3	2.0	2.4	2.1
Total Return To	Roanoke	2.2	2.7	3.0	3.2	2.9	3.0
	IBT Tar	2.8	3.6	8.1	10.7	9.8	12.8
	IBT Fishing Creek	0.7	0.8	1.4	1.7	1.5	1.9
	IBT to Neuse	0.2	0.2	1.2	1.8	1.4	1.7

Notes:
1. MMD values were determined using a 1.26 demand factor building from on 2013 water production data.
2. Water from Franklinton and Louisburg was subtracted from Franklin County totals since it is non-KLRWS water.
3. Consumptive use allocation is based on percent of system in each basin and number of septic connections within each system.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation, and other consumptive uses.
5. Average day consumptive loss in 2013 in the Roanoke River basin is negative and is skewed by a few wet weather events.

EXHIBIT 1
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2013 Max Month - August

LEGEND
- KERR LAKE REGIONAL WATER SUPPLY
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE USE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MMAD	MAXIMUM MONTH AVERAGE DAY
WW	WASTEWATER

GRANVILLE COUNTY

ROANOKE RIVER BASIN

ADD	Stovall	MMAD	
0.01	Demands	0.03	
0.01	Sum Below	0.03	
-0.01	Con. Use	0.01	to Roanoke
0.02	WW	0.02	to Roanoke

TAR RIVER BASIN

ADD	Granville Co.	MMAD	
0.00	Demands	0.00	
0.00		0.00	
0.00	Con. Use	0.00	to Roanoke
0.00	Con. Use	0.00	to Tar
0.00	Con Loss	0.00	to Neuse
0.00	WW	0.00	to Tar

NEUSE RIVER BASIN

ADD	Creedmoor	MMAD	
0.00	Demands	0.00	
0.00	Sum Below	0.00	
0.00	Con. Use	0.00	to Tar
0.00	WW	0.00	to Tar

ADD	OXFORD	MMAD	
1.28	**Tar IBT**	**1.40**	
0.00	**Neuse IBT**	**0.00**	
1.28	Service Area	1.40	
1.29	Total	1.42	
0.06	Con. Use	0.31	to Tar
1.22	WW	1.09	to Tar
0.00	Sale	0.00	to Creedmoor
0.01	Sale	0.03	to Stovall
0.00	Sale	0.00	to Granville Co.

TAR RIVER BASIN

FRANKLIN COUNTY

NEUSE RIVER BASIN

ADD	Franklin Co.	MMAD	
1.95	Service Area	2.00	
2.24	Total	2.30	
1.05	Con. Use	1.06	to Tar
0.19	Con. Use	0.19	to Neuse
0.71	WW	0.75	to Tar
0.12	Sale	0.14	to Bunn
0.17	Sale	0.17	to Lake Royale

Louisburg Contract: 0.67 From Tar

ADD	Bunn	MMAD	
0.12	Demands	0.14	
0.12	Sum Below	0.14	
0.00	Con. Use	0.14	to Tar
0.11	WW	0.00	to Tar

ADD	Lake Royale	MMAD	
0.17	Demands	0.17	
0.17	Sum Below	0.17	
0.17	Con. Use	0.17	to Tar
0.00	WW	0.00	to Tar

ADD	KLRWS	MMAD	
2.70	**Tar IBT**	**3.64**	
0.74	**Fishing Cr IBT**	**0.82**	
0.19	**Neuse IBT**	**0.19**	
5.97	Withdrawal	7.36	
3.23	Sales	7.05	from Roanoke
0.24	Process Loss	0.31	from Roanoke
			to Roanoke

ROANOKE RIVER BASIN

5.72

ADD	HENDERSON	MMAD	
1.43	**Tar IBT**	**2.24**	
0.19	**Neuse IBT**	**0.19**	
1.37	Service Area	2.55	
3.66	Total	4.62	
-0.27	Con. Use	0.03	to Roanoke
-0.62	Con. Use	0.06	to Tar
2.26	WW	2.16	to Roanoke
0.06	Sale	0.07	to Kittrell
2.24	Sale	2.30	to Franklin Co.
0.00	Sale	0.00	to Vance Co.

4.95

ADD	Kittrell	MMAD	
0.06	Demands	0.07	
0.06	Sum Below	0.06	
0.06	Con. Use	0.06	to Tar
0.00	WW.	0.00	to Tar

TAR RIVER BASIN

VANCE COUNTY

ADD	Vance Co	MMAD	
0.00	Demands	0.00	
0.00	Sum Below	0.00	
0.00	Con. Use	0.00	to Roanoke
0.00	Con. Use	0.00	to Tar
0.00	WW.	0.00	to Roanoke

ROANOKE RIVER BASIN

ADD	WARREN CO	MMAD	
0.74	**Fishing Cr IBT**	**0.82**	to Fishing Crk
0.58	Service Area	0.58	
0.94	Total	1.01	
0.17	Con. Use	0.17	to Roanoke
0.28	Con. Use	0.28	to Fishing Crk
0.14	WW	0.13	to Fishing Crk
0.15	Sale	0.13	to Norlina
0.19	Sale	0.30	to Warrenton

ADD	Norlina	MMAD	
0.15	Demands	0.13	
0.15	Sum Below	0.13	
0.03	Con. Use	0.02	to Roanoke
0.03	Con. Use	0.02	to Fishing Crk
0.09	WW	0.09	to Fishing Crk

FISHING CREEK (SUBBASIN TO TAR)

ADD	Warrenton	MMAD	
0.19	Demands	0.30	
0.19	Sum Below	0.30	
-0.03	Con. Use	0.12	to Fishing Crk
0.23	WW	0.18	to Fishing Crk

WARREN COUNTY

IBT SUMMARY FOR KLRWS

		ADD	MMAD
Withdrawal	ROANOKE	5.97	7.67
Consumptive Loss	ROANOKE	-0.07	0.23
	TAR	0.72	1.79
	FISHING CREEK (subbasin to Tar)	0.27	0.42
	NEUSE	0.19	0.19
Wastewater Discharge	ROANOKE	2.26	2.47
	TAR	2.04	1.84
	FISHING CREEK (subbasin to Tar)	0.46	0.40
	NEUSE	0.00	0.00
Total Return to	ROANOKE	2.19	2.69
	IBT TAR	**2.76**	**3.63**
	IBT FISHING CREEK	**0.74**	**0.82**
	IBT NEUSE	**0.19**	**0.19**
	Total IBT	**3.68**	**4.63**
	check	5.87	7.33

NOTES:
1. Values were determined using the 2013 LWSPs.
2. Consumptive use dispersement based on % of system in each basin, as noted in LWSPs.
3. Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.
4. Future sales customers and new water systems not fully online in 2013 are shown as zero.

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EXHIBIT 2
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2045

LEGEND
- KERR LAKE REGIONAL WATER SYSTEM
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE USE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MMAD	MAXIMUM MONTH AVERAGE DAY
WW	WASTEWATER

GRANVILLE COUNTY

ROANOKE RIVER BASIN

ADD	Stovall	MMAD	
0.01	Demands	0.02	
0.01	Sum Below	0.02	
0.01	Con. Use	0.01	to Roanoke
0.01	WW	0.01	to Roanoke

TAR RIVER BASIN

ADD	Granville Co.	MMAD	
1.10	Demands	1.39	
1.10	Sum Below	1.39	
0.55	Con. Use	0.69	to Tar
0.55	WW	0.69	to Tar

NEUSE RIVER BASIN

ADD	SGWSA	MMAD	
0.78	Service Area	0.98	
0.80	Total	1.01	
0.04	Con. Use	0.49	to Neuse
0.74	WW	0.49	to Neuse
0.02	Sale	0.03	to Wilton

ADD	Wilton	MMAD	
0.02	Demands	0.03	
0.02	Sum Below	0.03	
0.02	Con. Use	0.03	to Neuse
0.00	WW	0.00	to Neuse

ADD	KLRWS	MMAD	
8.16	Tar IBT	10.70	
1.39	Fishing Cr IBT	1.68	
1.19	Neuse IBT	1.77	
10.74	Total IBT	14.16	
-	Demand Factor	1.26	
13.77	Withdrawal	17.40	from Roanoke
13.77	Check	17.35	
0.18	Process Water	0.23	to Roanoke

ADD	OXFORD	MMAD	
2.68	Tar IBT	3.38	
0.80	Neuse IBT	1.01	
1.58	Service Area	1.99	
3.49	Total	4.40	to Tar & Neuse
0.07	Con. Use	1.00	to Tar
1.51	WW	1.00	to Tar
0.80	Sale	1.01	to SGWSA
0.01	Sale	0.02	to Stovall
1.10	Sale	1.39	to Granville Co.

TAR RIVER BASIN

ADD	HENDERSON	MMAD	
5.48	Tar IBT	7.33	
0.39	Neuse IBT	0.76	
3.54	Service Area	4.46	
8.63	Total	10.92	
0.38	Con. Use	0.66	to Roanoke
0.89	Con. Use	1.55	to Tar
2.26	WW	2.02	to Roanoke
0.06	Sale	0.07	to Kittrell
4.80	Sale	6.32	to Franklin Co.
0.23	Sale	0.30	to Vance Co.

ROANOKE RIVER BASIN

VANCE COUNTY

ADD	Vance Co	MMAD	
0.23	Demands	0.30	
0.23	Sum Below	0.30	
0.12	Con. Use	0.15	to Roanoke
0.12	Con. Use	0.15	to Tar
0.00	WW	0.00	

TAR RIVER BASIN

ADD	Kittrell	MMAD	
0.06	Demands	0.07	
0.06	Sum Below	0.07	
0.06	Con. Use	0.07	to Tar
0.00	WW	0.00	to Tar

FRANKLIN COUNTY

NEUSE RIVER BASIN

ADD	Franklin Co.	MMAD	
4.05	Service Area	5.10	
4.80	Total	6.32	
2.19	Con. Use	2.76	to Tar
0.39	Con. Use	0.76	to Neuse
1.47	WW	1.85	to Tar
0.32	Sale	0.40	to Bunn
0.43	Sale	0.55	to Lake Royale

Louisburg Contract	
0.67	From Tar

ADD	Bunn	MMAD	
0.32	Demands	0.40	
0.32	Sum Below	0.40	
0.01	Con. Use	0.01	to Tar
0.31	WW	0.39	to Tar

ADD	Lake Royale	MMAD	
0.43	Demands	0.55	
0.43	Sum Below	0.55	
0.43	Con. Use	0.54	to Tar
0.01	WW	0.01	to Tar

ADD	WARREN CO	MMAD	
1.39	Fishing Cr IBT	1.68	
1.19	Service Area	1.50	
1.65	Total	2.07	
0.23	Con. Use	0.34	to Roanoke
0.37	Con. Use	0.55	to Fishing Crk
0.59	WW	0.60	to Fishing Crk
0.15	Sale	0.18	to Norlina
0.32	Sale	0.39	to Warrenton

ADD	Norlina	MMAD	
0.15	Demands	0.18	
0.15	Sum Below	0.18	
0.04	Con. Use	0.05	to Roanoke
0.04	Con. Use	0.05	to Fishing Crk
0.07	WW	0.07	to Fishing Crk

ADD	Warrenton	MMAD	
0.32	Demands	0.39	
0.32	Sum Below	0.39	
0.16	Con. Use	0.23	to Fishing Crk
0.16	WW	0.16	to Fishing Crk

FISHING CREEK (SUBBASIN TO TAR)

WARREN COUNTY

IBT SUMMARY FOR KLRWS

		ADD	MMAD
Withdrawal	ROANOKE	13.77	17.40
Consumptive Loss	ROANOKE	0.77	1.21
	TAR	4.26	6.76
	FISHING CREEK (subbasin to Tar)	0.56	0.84
	NEUSE	0.45	1.28
Wastewater Discharge	ROANOKE	2.26	2.02
	TAR	3.85	3.94
	FISHING CREEK (subbasin to Tar)	0.83	0.84
	NEUSE	0.74	0.49
Total Return to	ROANOKE	3.03	3.23
	IBT TAR	**8.10**	**10.70**
	IBT FISHING CREEK	**1.39**	**1.68**
	IBT NEUSE	**1.19**	**1.77**
	Total IBT	**10.68**	**14.16**
	check		14.16

NOTES:
1. MMAD values were determined using a 1.260 Demand Factor, based on 2007-2013 water production data.
2. Water from Louisburg subtracted from Franklin County totals since non-KLRWS water.
3. Consumptive use dispersement based on % of system in each basin, as noted in LWSPs.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.

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EXHIBIT 3
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2060

LEGEND
- KERR LAKE REGIONAL WATER SUPPLY
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE USE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MMAD	MAXIMUM MONTH AVERAGE DAY
WW	WASTEWATER

GRANVILLE COUNTY

ROANOKE RIVER BASIN

ADD	Stovall	MMAD	
0.01	Demands	0.02	
0.01	Total	0.02	
0.01	Con. Use	0.01	to Roanoke
0.01	WW	0.01	to Roanoke

TAR RIVER BASIN

ADD	Granville Co.	MMAD	
1.50	Demands	1.89	
1.50	Total	1.89	
0.75	Con Loss	0.94	to Tar
0.75	WW	0.94	to Tar

NEUSE RIVER BASIN

ADD	SGWSA	MMAD	
0.85	Service Area	1.08	
0.87	Total	1.10	
0.04	Con. Use	0.05	to Neuse
0.81	WW	1.02	to Neuse
0.02	Sales	0.03	to Neuse

ADD	Wilton	MMAD	
0.02	Demands	0.03	
0.02	Total	0.03	
0.02	Con. Use	0.03	to Neuse
0.00	WW	0.00	to Neuse

ADD	OXFORD	MMAD	
3.24	**Tar IBT**	**4.08**	
0.87	**Neuse IBT**	**1.10**	
1.74	Service Area	2.19	
4.13	Total	5.20	
0.08	Con. Use	0.10	to Tar
1.66	WW	2.09	to Tar
0.87	Sale	1.10	to SGWSA
0.01	Sale	0.02	to Stovall
1.50	Sale	1.89	to Granville Co.

TAR RIVER BASIN

FRANKLIN COUNTY

NEUSE RIVER BASIN

ADD	Franklin Co.	MMAD	
5.15	Service Area	6.48	
5.98	Total	7.53	
2.78	Con. Use	3.51	to Tar
0.49	Con. Use	0.62	to Neuse
1.87	WW	2.36	to Tar
0.40	Sale	0.51	to Bunn
0.43	Sale	0.55	to Lake Royale

Louisburg Contract	
0.67	From Tar

ADD	KLRWS	MMAD	
9.84	**Tar IBT**	**12.84**	
1.74	**Fishing Cr IBT**	**1.85**	
1.37	**Neuse IBT**	**1.72**	
	Demand Factor	1.26	
15.93	Withdrawal	20.07	from Roanoke
15.93	Check	20.07	
0.19	Process Water	0.23	to Roanoke

ROANOKE RIVER BASIN

ADD	HENDERSON	MMAD	
6.60	**Tar IBT**	**8.76**	
0.49	**Neuse IBT**	**0.62**	
3.70	Service Area	4.66	
9.97	Total	12.57	
0.40	Con. Use	0.69	to Roanoke
0.93	Con. Use	1.62	to Tar
2.36	WW	2.11	to Roanoke
0.06	Sale	0.07	to Kittrell
5.98	Sale	7.53	to Franklin Co.
0.24	Sale	0.30	to Vance Co.

ADD	Kittrell	MMAD	
0.06	Demands	0.07	
0.06	Total	0.07	
0.06	Con. Use	0.07	to Tar
0.00	WW	0.00	to Tar

TAR RIVER BASIN

ADD	Bunn	MMAD	
0.40	Demands	0.51	
0.40	Total	0.51	
0.01	Con. Use	0.02	to Tar
0.39	WW	0.49	to Tar

ADD	Lake Royale	MMAD	
0.43	Demands	0.55	
0.43	Total	0.55	
0.43	Con. Use	0.54	to Tar
0.01	WW	0.01	to Tar

VANCE COUNTY

ADD	Vance Co	MMAD	
0.24	Demands	0.30	
0.24	Total	0.30	
0.12	Con. Use	0.15	to Roanoke
0.12	Con. Use	0.15	to Tar
0.00	WW	0.00	to Roanoke

WARREN COUNTY

ADD	WARREN CO	MMAD	
1.74	**Fishing Cr IBT**	**1.85**	to Fishing Crk
1.36	Service Area	1.72	
1.82	Total	2.30	
0.26	Con. Use	0.39	to Roanoke
0.42	Con. Use	0.63	to Fishing Crk
0.68	WW	0.69	to Fishing Crk
0.15	Sale	0.18	to Norlina
0.32	Sale	0.40	to Warrenton

ADD	Warrenton	MMAD	
0.32	Demands	0.40	
0.32	Total	0.40	
0.19	Con. Use	0.24	to Fishing Crk
0.13	WW	0.16	to Fishing Crk

FISHING CREEK (SUBBASIN TO TAR)

ADD	Norlina	MMAD	
0.15	Demands	0.18	
0.15	Total	0.18	
0.04	Con. Use	0.05	to Roanoke
0.04	Con. Use	0.05	to Fishing Crk
0.07	WW	0.07	to Fishing Crk

IBT SUMMARY FOR KLRWS

		ADD	MMAD
Withdrawal	ROANOKE	15.93	20.07
Consumptive Loss	ROANOKE	0.56	0.91
	TAR	5.16	6.95
	FISHING CREEK (subbasin to Tar)	0.65	0.93
	NEUSE	0.55	0.70
WW Discharge	ROANOKE	2.36	2.11
	TAR	4.68	5.90
	FISHING CREEK (subbasin to Tar)	0.88	0.93
	NEUSE	0.81	1.02
Total Return to	ROANOKE	2.93	3.02
	IBT TAR	**9.84**	**12.84**
	IBT FISHING CREEK	**1.53**	**1.85**
	IBT NEUSE	**1.37**	**1.72**
	Total IBT	**12.73**	**16.42**
	check		16.42

NOTES:
1. MMAD values were determined using a 1.260 Demand Factor, based on 2007-2013 water production data.
2. Water from Louisburg subtracted from Franklin County totals since non-KLRWS water.
3. Consumptive use dispersement based on % of system in each basin, as noted in LWSPs.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.

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SECTION 3

Project Alternatives

The general categories of alternatives to IBT include managing water demand, identifying water supplies in the receiving basins, and returning water to the source basin. Demand management tools include water conservation programs, especially during times of drought, and water reuse programs. These concepts have been considered with each of the alternatives for water sources presented below. The Partners desire to minimize environmental impacts while meeting their water supply needs; in addition, selecting alternatives that have lower environmental impacts 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. KLRWS supplies little irrigation water, as evidenced by their relatively low peak day to average day ratio (peaking factor) of 1.3 (compared with many systems that have peaking factors of 1.5 and above). Most water is used for indoor purposes and, while conservation helps reduce demand, these reductions are typically modest. In addition, growth would still occur and water use will increase. New water service will also be extended to existing residents currently on well water, such as with the Vance County Water System. Conservation and reuse would extend the life of the water supply but would not eliminate the need for an IBT. The projected transfers would increase at a slower rate than under current conservation and reuse policies.

This section evaluates the no action alternative, the proposed project including IBT, new water supply sources, and returning wastewater to the Roanoke River basin. These alternatives were selected to meet the requirements of the IBT rules (NCGS 143-215.22L) and to address comments received during the scoping process. These alternatives are evaluated in this section for their ability to meet the KLRWS demands, as described in Section 1, through the planning window of 2045, their need for additional infrastructure, environmental considerations, and planning level costs.

Alternatives described in this section were screened, based on the following criteria, to determine whether they should be evaluated in greater detail in Section 5:

- Ability to meet 2045 water supply needs – alternatives which do not meet these water supply needs were eliminated from further consideration, as they do not meet the project purpose and need.
- Environmental considerations – alternatives which were likely to have a significant impact on environmental resources in comparison with other alternatives were eliminated from further consideration. Water resources impacts are of particular focus and could include impacts to water supply in the Roanoke River basin, impacts to aquatic resources in the source and receiving basins, and impacts to hydropower generation in the Roanoke River basin.
- Cost considerations – the no action alternative and IBT alternatives have essentially no costs since little or no new infrastructure is proposed. The proposed WTP expansion will be constructed regardless of the selected alternative, although sizing may be revisited if the no action alternative were to move forward. Costs for the WTP expansion are accounted for in the Partners' rate model and budget. Costs are therefore compared among the other alternatives. Alternatives that have costs significantly higher than other alternatives to the proposed project would be eliminated. These alternatives would not meet the KLRWS purpose of being fiscally responsible to their customers. Existing infrastructure would remain for all alternatives; thus operation and maintenance (O&M) costs to maintain existing infrastructure would be identical under all alternatives.

3.1 Alternative 1 – No Action

No action. Under this alternative, KLRWS would continue to provide water to customers in Warren, Vance, Franklin, and Granville Counties. However, no increase in IBT would be requested; KLRWS would not exceed the grandfathered IBT of 10 mgd to the Tar and Fishing Creek River basins, however a request would be

made to update the certificate to reflect the average day of a calendar month compliance measure that was incorporated in statute through Session Law 2013-388. This alternative would preclude KLRWS from providing additional reliable water service at reasonable cost to its Partners and the public water systems that have contracts with the Partners. This alternative is deficient because it would limit the ability of KLRWS to meet future peak day demands and would provide KLRWS with no resilience to drought. In addition, planned connections to users who currently have individual wells would not occur. Some homeowners have had to construct new wells to obtain water during recent droughts. These wells are not monitored continuously and may be more prone to drought or contamination than a regional supply. Also, some residents have noted that their groundwater wells produce water with odors and discoloration that stains appliances, bath fixtures, and light-colored clothing. This alternative would not meet the project purpose and need; instead, water demands could only be met until approximately 2015.

USACE has allocated the storage equivalent of 20 mgd of average day demand (ADD) to KLRWS. USACE has not approved an IBT, as that is outside its authority; the North Carolina Environmental Management Commission (EMC) is responsible for approving IBTs. The USACE allocation of storage would continue under this alternative.

This alternative would result in essentially no new infrastructure or connections. Thus, direct environmental impacts and impacts to hydropower and lake levels from this alternative would be insignificant. However, new wells would be constructed to meet the needs of residents, as the need for water would remain. As indicated above, this alternative would not meet the project purpose and need.

3.2 Alternative 2 – Increase IBT to Meet Needs of Customers

This alternative would result in an increased IBT to the Tar, Fishing Creek, and Neuse River basins. This alternative would continue to build on the regional partnerships that have formed in the area for providing water service and both current and future customers are included, as requested during the scoping process. This alternative would also build upon existing approvals: USACE has approved an increased water supply storage allocation for KLRWS to an ADD of 20 mgd, and an EA has been completed to expand the WTP to 20 mgd.

Under this alternative, KLRWS would continue to be a regional provider of water and would serve its customers in Granville, Franklin, Vance, and Warren Counties. This would involve expanding the WTP to 20 mgd initially and meeting all contracted and future demands of the system within the planning period. To distribute water to the expanded system, the KLRWS would need an increase in its authorized IBT on a maximum month basis from the Roanoke River basin (Kerr Lake) to the Tar River of 10.7 mgd, of 1.7 mgd to the Fishing Creek basin and 1.8 mgd to the Neuse River basin.

Essentially no new infrastructure would be built as part of this alternative. Major transmission mains are in place. Smaller distribution lines could be built within a given public water system's service area to meet their needs, but the proposed project is not dependent on them. These smaller lines would be subject to a separate permitting process led by the public water system, and their impact would be evaluated in a separate environmental document if they exceeded minimum thresholds defined in the North Carolina Department of Environment and Natural Resources (NCDENR) regulations. Since this alternative would not include construction, environmental impacts to most resources would be minimal. There is potential for impacts to water resources as a result of moving water from one basin to another basin. These impacts could include water supply, lake level, and hydropower impacts in the Roanoke River basin, which are considered in Section 5. USACE previously evaluated the impacts of the storage reallocation (2005); regardless of where the water is used, the cost of that reallocation on hydropower would be approximately $3,455,000 (2005 dollars). The KLRWS is currently compensating the USACE annually for the lost hydropower.

3.3 Alternative 3 – Avoid Additional IBT by Finding Alternative Surface Water Sources

Under this alternative, the IBT would not be increased from current authorized levels and alternative water sources in the Tar River basin would be found. A potential new intake location was identified near the Town of Louisburg's water supply intake on the Tar River. A U.S. Geological Survey (USGS) gaging station (station number 02081747) is located at US Highway 401, and the period of record extends from October 1973 to August 2010, which provides data for analyses. In addition, the Town of Louisburg is in the central part of Franklin County, where a large portion of the projected water demand will occur. Since Franklin County includes the Neuse and Tar-Pamlico River basins, the analysis was completed on the 2045 maximum month IBT of 12.4 mgd for both basins (1.8 mgd would be transferred to the Neuse River).The equivalent ADD is 9.3 mgd. It is assumed that the IBT to the Fishing Creek basin would be served as part of the grandfathered IBT amount and is not included in this alternative.

Water supply planning is typically completed on an ADD basis, so the remaining authorized IBT amount available for use in the Tar and Neuse River basins is 6.3 mgd. Given the ADD within these basins is 9.3 mgd ADD, an additional supply of 3.0 mgd would be necessary to meet 2045 demands. . There would be some loss of water between withdrawal and the completion of the treatment process; the industry standard is a ratio of 1.1, which results in a raw water demand of 3.3 mgd on an ADD basis.

This alternative has been divided into three sub-alternatives:

- Alternative 3a – Avoid IBT by using a surface water withdrawal from the Tar River basin
- Alternative 3b – Avoid IBT by constructing a new water supply reservoir on the Tar River
- Alternative 3c – Avoid IBT by using a surface water withdrawal and offline storage in the Tar River basin

Each of these sub-alternatives is described in further detail below.

Alternative 3a: Avoid Additional IBT by using a surface water withdrawal from the Tar River Basin

This alternative would eliminate the need for an increased IBT between the Roanoke and Tar River basins. A new WTP or additional infrastructure and an expansion of an existing WTP would be necessary.

One potential water source is Lake Devin, which historically had been the City of Oxford's water source. Lake Devin lies on Hatchers Run at a point which drains 1.55 square miles. The City historically pumped water from the Tar River to Lake Devin to meet its water supply needs. After discontinuing use, the clearwell at the offline WTP was used for wastewater storage, and mercury remains in the Simplex gases at the plant. Thus it is not feasible to re-establish the WTP. Oxford did investigate building a package WTP with a raw water withdrawal from Lake Devin, but the study indicated that it would be more cost-effective to continue with the KLRWS to meet its water supply needs (USACE, 2005). USGS has estimated that the 20-year safe yield from Lake Devin is approximately 2 mgd (Yonts, personal communication, 2010). This water supply source would not result in adequate water to meet the long-term needs. Thus it does not meet the project purpose and need and has been eliminated from further consideration.

Another potential water source is the main stem of the Tar River. The Town of Louisburg could expand its water supply intake to meet the needs of KLRWS's Franklin County customers or a parallel intake could be constructed. In 1995, the NCDWR completed an instream flow study in the Tar River to evaluate the impacts of the Town of Louisburg increasing its withdrawal from the Tar River to 3 mgd. Based on the analysis, agencies requested that an instream flow between 9.0 and 11.5 cubic feet per second (cfs) be maintained at the stream gage on the Tar River at US Highway 401 for habitat purposes (NCDWR, 2004). A review of USGS data from January 1, 2000 through December 29, 2009 indicates that flows occasionally fall below those target levels during summer months. The following ADFs were observed (USGS, 2009a):

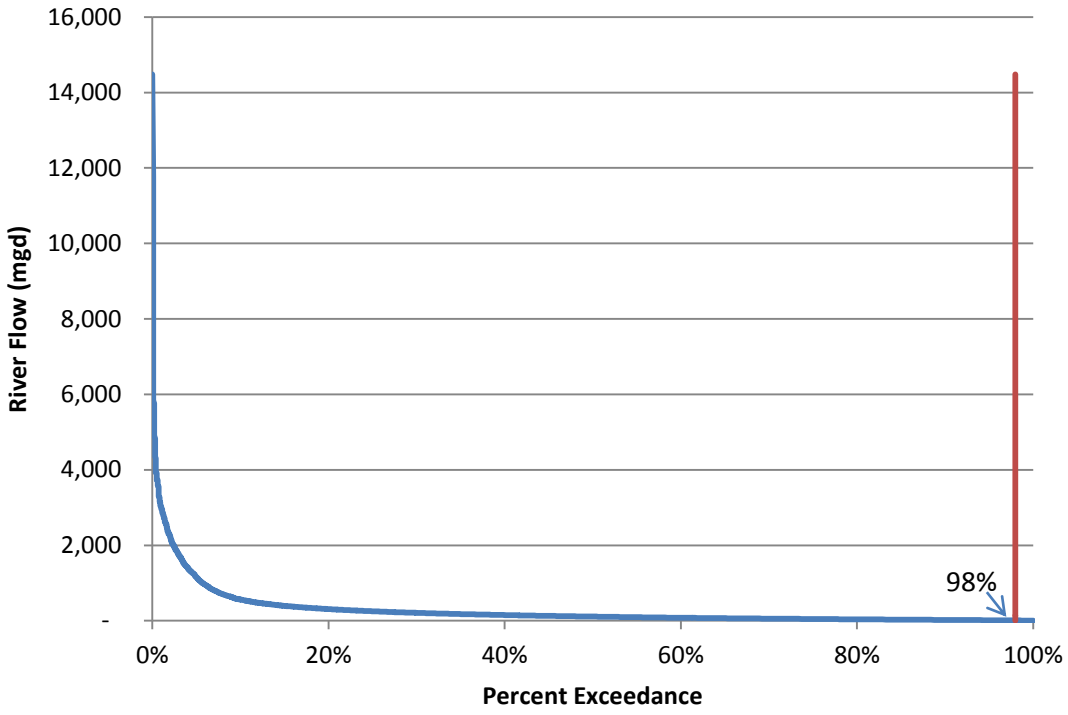
- August 2008--6.3 cfs
- October 2007--2.7 cfs
- September 2007-- 2.2 cfs
- August 2007--6.0 cfs
- October 2005--6.5 cfs
- September 2005--6.0 cfs
- August 2002--2.1 cfs
- June 2002--5.9 cfs

During each of these periods, flows below the target flows existed for several days. Given the low flows at the gage, it appears the Tar River is not a viable source to meet long-term water supply needs as a run-of-the-river source.

In addition, the Town of Louisburg's water supply plan indicates that the Tar River at this location has a 20-year safe yield of 3 mgd. When the 2 mgd safe yield of Lake Devin is added into consideration, the total 5-mgd safe yield of these two sources meets the 2045 ADD of 3.3 mgd estimated above. However infrastructure would be required to resume use of Lake Devin.

To further evaluate the potential use of the Tar River, a spreadsheet model was developed to evaluate how often the projected flow needs would be met by that source. It was assumed that 11.5 cfs (7.4 mgd) should be maintained at the USGS flow gage based on NCDWR's 1995 instream flow study. As illustrated in Figure 3-1, for 2 percent of the estimated period of record, no withdrawals would be allowed in efforts to meet the recommended instream passing flow of 11.5 cfs. Thus, using the Tar River as a water supply source would not meet the project purpose and need and has been eliminated from further consideration. Given this would not meet the necessary safe yield, adding storage was considered as discussed in alternatives 3b and 3c.

FIGURE 3-1
Percent of Period of Record USGS Tar River Gage Data Exceeding Critical Flow Values



Alternative 3b – Avoid IBT by constructing a new water supply reservoir on the Tar River. A new reservoir could be built in the upper reaches of the Tar River in Granville County. Building a new reservoir typically has greater environmental impact than other alternatives. A new reservoir would modify the flow regime in the river, would impact many acres of wetlands, and would modify instream habitat. Within the reservoir footprint, and potentially downstream, the flow regime would be altered directly, potentially causing a change in species composition of the aquatic community. This has the potential to significantly impact aquatic species such as the federally endangered Tar River spinymussel and dwarf wedgemussel. More information related to environmental conditions in the Tar River is included in Section 4. Because of the environmental impacts associated with building a new reservoir and the potential for a limited safe yield, this alternative has been eliminated from further consideration.

An impoundment and associated pumping and conveyance infrastructure could be constructed in Franklin County on the Tar River to meet County demands. A new supply of approximately 3.3 mgd on an ADD basis would be needed to serve the Tar and Neuse River basins. In order to meet future needs and comply with the instream flow requirement of 11.5 cfs in the Tar River at Louisburg, approximately 980 acre-feet of storage would be required. Assuming an average depth of 6 feet, a depth similar to the average depth of Lake Devin in Oxford and Tar River Reservoir in Rocky Mount, results in a reservoir that is approximately 160 acres which would likely result in significant impacts to aquatic habitat and federally listed species. This alternative has been eliminated from further consideration.

Alternative 3c: Avoid IBT by using a water withdrawal with offline storage in the Tar River Basin. An offline reservoir which uses the Tar River as a water supply source could be used. During low flow conditions as illustrated under Alternative 3a, water could not be withdrawn based on the instream flow targets established by the NC DWR based on the 1995 instream flow study. The use of offline storage was considered to determine if the Tar River plus offline storage would meet the 2045 water supply needs of

KLRWS. The benefits of offline storage include the ability to withdraw flows at greater rates when water levels are high and to rely on the storage volume to manage peak demands and extended periods of low river flow. Two scenarios were evaluated: (1) yearlong withdrawal with offline storage and (2) seasonal withdrawal with offline storage. Both scenarios were included, as resource agencies may wish to avoid a summer withdrawal in order to protect baseflows and endangered mussel populations in the Tar River watershed. Table 3-1 shows the storage volume and pumping rates needed to meet demands under both seasonal and yearlong withdrawal scenarios.

TABLE 3-1
Pumping Rate and Withdrawal Scenarios

	Withdrawal Scenario		Max Storage Scenarios (MG)				
			2,000	2,500	3,000	3,250	3,500
Max Pumping Rate (mgd)	1	Seasonal Withdrawal	NF [a]	NF [a]	34.0	31.5	29.0
	2	Yearlong Withdrawal	13.5	13.5	13.0	13.0	13.0

[a] NF indicates that the scenario is not feasible for meeting 2045 KLRWS projected demands in the Tar and Neuse River basins
MG = million gallons

As seen in Table 3-1, a seasonal withdrawal would require more storage capacity and higher pumping rates than a yearlong withdrawal. Both yearlong and seasonal withdrawal scenario volumes are driven by the need to meet demand during extremely low flow periods such as the 2002 drought. Also, it can be assumed based on the results in Table 3-1 that the cost of an increased pumping rate would likely be justified by savings in storage size. Using the seasonal withdrawal scenario, therefore, 3.0 billion gallons of storage with a 34 mgd pumping rate could be necessary to avoid an additional IBT in 2045 in the Tar and Neuse River basins. The scenario assumes an intake downstream of Louisburg, no withdrawal from April to September, and storage that is initially full while still meeting minimal passing flow recommendations in the Tar River.

The results in Table 3-1 represent theoretical scenarios; however, cost and availability of sites to build the storage remain significant limitations. Offline storage options include damming a tributary to the Tar River, using aboveground storage tanks, or filling abandoned quarries. Damming tributaries to the Tar River would require approximately 2,600 acre-feet of usable water supply storage covering approximately 4200 acres assuming an average depth of 6 feet. This depth is similar to the average depth of Lake Devin in Oxford and Tar River Reservoir in Rocky Mount. The total storage requirement could be accomplished cumulatively in more than one tributary drainage area.

A dead storage allowance, or unusable supply storage volume due to sedimentation, is not included in these calculations. If 15 percent dead storage was included, or what is included for the Tar River Reservoir, 2,990 acre-feet of useable water supply storage would be required. In addition, a WTP would be required to treat water from these impoundments. Damming tributaries would likely have impacts on aquatic habitat in the tributaries, and a smaller impact on aquatic habitat in the Tar River. This alternative will be evaluated in greater detail in this EA.

Aboveground tanks would be costly. The cost to develop storage ranges from $0.50 to $1.00 per gallon depending on the cost of land. Even if the resource agencies were to allow yearlong withdrawals, the cost of aboveground storage would be significant. Other alternatives have costs which are two orders of magnitude lower (see Alternative 5); thus this alternative has been eliminated from further consideration.

A quarry could be a feasible option. There are four quarries registered with the NCDENR Land Resources Division, three of which are used to mine sand, and as such would not likely have sufficient storage capacity. Sand quarries tend to be smaller, and do not have the required geology to promote water storage. Bedrock geology would be needed to store the water; stored water would seep through the sand. Thus, these three

quarries are not feasible. A crushed stone quarry was originally issued a permit in 2005, and would likely still be in use in 2045. However, even if it were not being used in 2045, it would be in use when water demands would require an increase in the grandfathered IBT. Finally, quarries are privately owned, and their availability for future use is not guaranteed. There are no known quarries which provide a feasible storage option, and this alternative has been eliminated from further consideration.

3.4 Alternative 4 – Avoid Additional IBT by Finding Alternative Groundwater Sources

Under this alternative, a groundwater source would be used to supply water to meet future needs in the Tar and Neuse River basins. The current grandfathered IBT would be used to meet needs in the Fishing Creek watershed. As evaluated with Alternative 3, this would be the equivalent of approximately 3.0 mgd on an ADD basis. This alternative would avoid any additional IBT. There would also be no additional impact on hydropower. There would be some environmental impacts around any proposed well field, and there could be impacts to groundwater resources in the area. USACE evaluated this alternative when reviewing the request for additional allocation from Kerr Lake to the KLRWS. USACE (2005) found that well yields in the region are low; the maximum yield is 100 gallons per minute (gpm), which is the equivalent of 0.144 mgd, and the best producing well that the Town of Bunn operated had a capacity of 40 gpm. Based on the maximum yield of 100 gpm, KLRWS would need to install 21 wells to meet the 2045 ADD and 24 wells to meet the MDD; this assumes that the grandfathered 10-mgd IBT would continue. Since well yields would likely not be at the maximum levels, more wells would likely be required to meet 2045 demands. The USACE report also indicates that Warren County wells showed yields similar to those in Bunn. The USACE concluded that expected well yields would not produce an adequate supply of water to meet future needs.

The USACE report is supported by reports by other agencies. Huffman (1996) reports that average well yields in the Piedmont Province are 18 to 21 gpm. USGS also reports that well yields in crystalline rocks in North Carolina, which are present throughout the study area, are 18 gpm (Trapp and Horn et al., 1997).

In addition to problems with well yield, Vance County has indicated that many of its residents have complained about odor and discoloration issues with their private wells. This impacts the taste and stains bath fixtures, appliances, and light-colored clothing. While the individual homeowner or KLRWS could provide groundwater treatment to address this issue, the supply is likely inadequate to meet the project purpose and need, may not provide adequate water quality for customers, and was eliminated from further consideration.

3.5 Alternative 5 – Minimize IBT by Discharging to Roanoke River Basin

This alternative could be accomplished by either (1) returning raw wastewater to the Roanoke River basin for treatment at the City of Henderson's wastewater treatment plant (WWTP) and discharge to the Nutbush Creek arm of Kerr Lake, or (2) returning treated effluent to the Roanoke River basin. Returning treated effluent has the following advantages:

- Uses existing wastewater treatment infrastructure in the Tar, Fishing Creek and Neuse River basins
- Provides opportunities for reuse of the treated effluent as it is being conveyed back to the Roanoke River basin
- Poses less risk, as treated effluent would be transferred, which would have fewer potential environmental impacts from spills than a spill of untreated wastewater

Given the advantages of returning treated effluent to the source basin, this alternative is reviewed further in this section, and the return of untreated wastewater was eliminated from further consideration.

Minimize IBT by discharging treated effluent to the source basin, the Roanoke River Basin. This alternative would require the construction of new wastewater effluent force mains and pump stations to convey treated wastewater from one or more of the WWTPs in the service area that discharge to the Tar River, Neuse River (once sales begin to SGWSA) or Fishing Creek basins. The City of Henderson currently discharges back to the Roanoke River basin. As shown in Figure 3-1, the City of Oxford discharges to Fishing Creek within the Tar River basin, the Town of Bunn discharges to Crooked Creek in the Tar River basin, Franklin County discharges to Cedar Creek in the Tar River basin, and the Lake Royale Subdivision discharges to Cypress Creek in the Tar River basin. Warrenton discharges to Fishing Creek. SGWSA discharges into Knapp of Reed Creek in the Neuse River basin. Consumptive use in these basins would still occur, so the need for additional IBT could be reduced but not avoided.

Preliminary pipeline routes were identified for returning the Town of Oxford's, Franklin County's, and the Town of Warrenton's wastewater to the Roanoke River basin. It was assumed that the Town of Oxford and Franklin County would discharge to the Nutbush Creek arm of Kerr Lake, near the City of Henderson's discharge point. It was also assumed that the Town of Warrenton would discharge to a tributary to Lake Gaston. Pumping would be required to transfer wastewater back over the basin boundaries. Costs of this infrastructure and associated operational and maintenance costs would be significant.

This alternative could also include opportunities for reuse. If treated wastewater were pumped back to the Roanoke River basin (source basin), opportunities would be available along the transmission line routes for reuse of the treated effluent. This could also reduce potable demand for water.

There would be direct environmental impacts associated with this alternative because new infrastructure would be built to convey the treated effluent back to the Roanoke River basin. This could impact water resources and hydropower within the Roanoke River basin, but these impacts would be less than the proposed IBT because some reclaimed water would be returned to the basin so that the overall loss of water from the basin would be reduced.

This alternative would not eliminate IBT due to the large amounts of consumptive use in the receiving basins. There are also water users who discharge wastewater (through onsite wastewater systems) that is not treated at a centralized WWTP or returned directly to surface water. In 2045, the estimated consumptive use in the Tar River basin would be 6.8 mgd, 0.7 mgd in the Neuse River basin, and 0.8 in the Fishing Creek basin out of a total IBT request of approximately 14.2 mgd. Thus, approximately 8.3 mgd could be returned to the Roanoke River under this alternative, but there would remain an IBT of approximately 3.9 mgd. This alternative would minimize the IBT and likely keep it under the grandfathered IBT amount. It would meet water demands, require construction of new transmission lines back to the Roanoke River basin, and continue to promote the partnerships created by the local governments. While this project meets the purpose and need, significant infrastructure costs would be necessary and direct environmental impacts would occur with construction.

3.6 Alternative 6 – Use Coastal Water as a Source

In this alternative, either coastal surface water or groundwater would be used as a source. As described under Alternative 3, 7.4 mgd would need to be provided on a maximum month average day (MMAD) basis beyond the grandfathered IBT. This alternative has been divided into two subalternatives:

- Alternative 6a – Avoid an increase in IBT by using coastal water as source water through desalination technology.
- Alternative 6b – Avoid an increase in IBT by using groundwater from the coastal area.

Estuarine water would need to come from the Pamlico Sound to avoid an IBT and meet the purpose of this alternative. Using estuary water would require desalination which is evaluated further in this section. Groundwater could also be supplied from the coast; groundwater is not regulated as an IBT and is therefore considered an alternative avoiding IBT. Each of these alternatives is evaluated below.

Alternative 6a: Avoid IBT by Using Coastal Water as Source Water through Desalination Technology. Using Albemarle Sound water to supply areas in the Tar River, Fishing Creek, and Neuse River basins would still be an IBT of water; thus, using Pamlico Sound water was also evaluated. The sounds have varying salinity levels, depending on location, freshwater inflow, and tidal influence. Water would need to undergo a desalination treatment process before it could be used as a drinking water source. In general, it is better to site the plant near the water source, which would not allow use of the current treatment facility. One reason for this is that the wastewater from the treatment process needs to be discharged, and there would be problems in permitting a brackish discharge near Kerr Lake. Technologists who have worked on desalination plants indicated that approximately 60 percent of the water that would be withdrawn could be used, and approximately 40 percent would need to be discharged as wastewater (Elarde, 2010). In addition, there would need to be a pretreatment facility prior to the WTP. A rule of thumb is that these pretreatment facilities would be approximately twice the size of the WTP. Water would also need to be pumped up to the WTP, requiring a significant amount of energy. Pumping saline water long distance would also pose O&M issues for conveyance and pumping infrastructure, since saline waters are highly corrosive.

This additional infrastructure would result in significant increased cost to ratepayers. In addition to high costs, using coastal estuary water would have significant direct environmental impacts. Transmission infrastructure would need to be built from the coast to the KLRWS service area, resulting in land use, wetlands, aquatic and terrestrial resource, and many other impacts because of the distance from the service area. In addition, energy-intensive pumping of the water back would result in higher greenhouse gas (GHG) emissions than the proposed project. A new WTP would also be required, along with desalination technology. This alternative would not impact water supply or hydropower use in the Roanoke River basin, but it would require a new wastewater discharge to the estuary. Using coastal estuary water does not meet the purpose and need and has potential significant direct environmental impacts. It was therefore eliminated from further consideration.

Alternative 6b: Avoid IBT by Using Groundwater from the Coastal Area. To address public comments indicating that alternative coastal water sources should be evaluated, using water from the PCS Phosphate Mine in Aurora, North Carolina was also evaluated. PCS Phosphate uses multiple wells to relieve artesian pressure on the mining floor. Thus, they produce a large quantity of groundwater that could be used as a drinking water supply. Eagle Water Company has contracted with PCS Phosphate for 58 mgd of water that it could sell. Their website includes potential pipeline routes to the Triangle Area, so it is feasible that lines could be constructed to the KLRWS service area.

The transmission infrastructure would result in impacts to land use, wetlands, aquatic and terrestrial resource, and many other impacts because of the distance of the required pipeline route. This alternative would result in higher GHG emissions associated with pumping the water. There would be no impacts on water supply or hydropower in the Roanoke River basin.

Costs related to this alternative include transmission mains, pump stations, and costs associated with obtaining access to the water from the mine.

These costs are an order of magnitude higher than the costs to pump wastewater back to the Roanoke River basin. Thus, they do not meet the KLRWS goal to provide cost-effective water to its users. In addition, the water supply source may not be viable once mining is discontinued. The KLRWS would not have control over the mining operation or schedule for operation. Thus this alternative does not meet the purpose and need and has been eliminated from further consideration.

3.7 Summary of Alternatives

Table 3-2 summarizes each of the project alternatives. Note that the planned WTP expansion is necessary regardless of the selected alternative and therefore is not accounted for in the assessment of new infrastructure requirements.

Based on the analyses above, Alternative 2 was selected as the preferred alternative. The rationale for this selection instead of other technically feasible but more costly options can be summarized as follows:

- Alternative 1 - No Action Alternative – While this alternative does not meet the project purpose and need, it is a requirement of the North Carolina SEPA to review this alternative in the EIS.
- Alternative 2 – Increase IBT – This option meets the stated purpose and need and is evaluated in this EA.
- Alternative 3c – Minimize IBT by finding an alternative water supply source with offline storage in the Tar-Pamlico River basin. This alternative meets the purpose and need, but would result in higher wetland and stream impacts compared to the proposed project; this alternative could impact federally listed species in the Tar-Pamlico River basin.
- Alternative 5 – Minimize IBT by discharging treated wastewater back to the Roanoke River basin. This alternative would meet the stated purpose and need and would provide opportunities for reclaimed water. This alternative would require more piping infrastructure than the proposed project, and thus may have greater wetland and stream impacts.

The other alternatives do not meet the screening criteria established at the beginning of this section. They either did not meet 2045 water supply needs, had much higher environmental impacts than other alternatives, had costs that were significantly higher than other alternatives to the proposed project, or some combination of the above.

TABLE 3-2
Summary of Alternatives

Alternative	Meets Purpose and Need?	Increase Allocation from Kerr Lake?	Requires New Infrastructure ?	Potential Environmental Impacts	Anticipated Cost Relative to the Preferred Option (Alternative 2)
1. No Action	No	No	No	No direct environmental impacts; growth would still occur	Lower
2. Increase IBT to Meet Needs of KLRWS	Yes	No	No	Potential impacts to water resources in Roanoke River basin (water supply, lake levels, hydropower)	N/A
3a. Avoid additional IBT by using a surface water withdrawal from the Tar River basin	No	No	Yes	Flow regime and aquatic impacts (habitat and species) on Tar River	Not evaluated since adequate water would not be provided under this alternative
3b. Avoid additional IBT by constructing a new water supply reservoir on the Tar River	No	No	Yes	Significant environmental impacts likely in Tar basin from habitat alteration and flow regime alternation associated with new impoundment; aquatic wildlife impacts ; reduced potential for impacts in Roanoke River basin compared to proposed project	Higher
3c. Avoid additional IBT by using a water withdrawal with offline storage in the Tar River basin	Yes	No	Yes	Flow regime impacts on Tar River: potential land use and wetland impacts from offline storage; reduced potential for impacts in Roanoke River basin compared to proposed project	Much Higher
4. Avoid additional IBT by using groundwater	No	No	Yes	New wellfields; potential impacts to slowly renewable groundwater; reduced impacts to water supply, hydropower, and lake level in Roanoke River basin compared to proposed project	Higher
5. Minimize IBT by discharging wastewater to Roanoke River basin	Yes	No	Yes	Increased environmental impacts compared to proposed project due to linear infrastructure required;); increased GHG emissions from pumping; reduced potential for impacts in Roanoke River basin compared to proposed project	Higher, including significant operations and maintenance costs
6a. Avoid additional IBT by using Pamlico Sound as source	No	No	Yes	Higher level of environmental impacts due to linear infrastructure; environmental issues with disposing brackish water (from WTP); increased GHG emissions from pumping; fewer impacts in Roanoke River basin compared to proposed project	Much higher
6b. Avoid additional IBT by using groundwater from coastal area	No	No	Yes	Higher level of environmental impacts; increased GHG emissions from pumping; fewer impacts in Roanoke River basin compared to proposed project	Much higher

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SECTION 4

Existing Environmental Characteristics of Project Area

This section provides information on the current environmental characteristics of the project area.

The section is organized by topic:

- 4.1 – Water Resources
- 4.2 – Topography
- 4.3 – Soils
- 4.4 - Land Use and Land Cover
- 4.5 – Wetlands
- 4.6 – Prime and Unique Agricultural Lands
- 4.7 – Public Lands and Scenic, Recreational, and Significant Natural Heritage Areas
- 4.8 – Areas of Archaeological or Historic Value
- 4.9 – Air Quality
- 4.10 – Noise Level
- 4.11 - Forest Resources
- 4.12 – Shellfish or Fish and their Habitats
- 4.13 – Wildlife and Natural Vegetation

Quantitative evaluations for existing conditions were performed using ESRI ArcGIS software, NC One Map data, and other references as noted. The study area includes the counties of Vance, Warren, Granville, and Franklin; the county boundaries were used to quantify the existing conditions. The environment within the Roanoke River basin upstream of the intake was also considered where appropriate. Additionally, a 1-mile buffer along the Roanoke and Tar Rivers and along Fishing Creek was included in the study area for resources which are water-dependent (water resources, wetlands, floodplains [topography], recreational areas, and shellfish and fish) since the proposed IBT could impact these resources over a larger area. Existing conditions are presented by topic as outlined above, with the aquatic resources also presented at the river basin level, by source or receiving basin. In general, water resources-related information is organized from upstream to downstream, beginning in Virginia.

4.1 Water Resources (Surface Water and Groundwater)

4.1.1 Surface Waters

Surface water quality standards consist of the designated use of water along with the numeric and narrative criteria that have been set to protect that use. North Carolina General Statutes (NCGS 143-214.1) and the Clean Water Act (CWA) serves as the basis for water quality standards and other water quality programs. The overall goal of the CWA is to have all applicable waters fishable and swimmable.

4.1.1.1 Source Basin – Roanoke River Basin

General Overview and Water Quantity

The Roanoke River basin begins in Virginia and continues through North Carolina to Albemarle Sound and the Atlantic Ocean. The Virginia portion of the Roanoke River basin encompasses 6, 393 square miles (Virginia Department of Environmental Quality [VADEQ], 2014). The downstream North Carolina portion consists of 3,493 square miles and 2,213 miles of streams and rivers (NCEE, 2013). The Roanoke River basin includes seven major hydrologic units, which in turn include several tributaries. Table 4-1 lists the seven major hydrologic units and related major tributaries.

TABLE 4-1
Roanoke River Basin Major Hydrologic Units

Subbasin Name	USGS 8-Digit Hydrologic Unit	State	Major Tributaries
Upper Roanoke	03010101	VA	Black Creek, Goose Creek, Smith Mountain Lake, Leesville Lake, Little Otter Creek
Banister	03010105	VA	Cherrystone Creek, Banister River, Terrible Creek
Upper Dan	03010103	VA/NC	Horse Pasture Creek, Leatherwood Creek, Marrowbone Creek, Town Fork Creek, Snow Creek, Wolf Island Creek, Big Beaver Island Creek, Belews Lake, Mayo River, Smith River
Lower Dan	03010104	VA/NC	Lawless Creek, Birch Creek, Dan River, County Line Creek, Hyco Reservoir, Hogans Creek, Country Line Creek, Hyco Creek, Marlowe Creek, Hyco River, Mayo Reservoir
Middle Roanoke	03010102	VA/NC	Roanoke Creek, Difficult Creek, Kerr Lake, Grassy Creek, Island Creek, Nutbrush Creek
Roanoke Rapids	03010106	VA/NC	Allen Creek, Lake Gaston, Smith Creek, Sixpound Creek, Deep Creek, Roanoke Rapids Lake
Lower Roanoke	03010107	NC	Cashie River, Roquist Creek, Conoho Creek, Hardison Mill Creek, Quankey Creek, Conconnara Swamp, Connaritsa Swamp, Kehukee Swamp

Source: VADEQ, 2014; North Carolina Division of Water Resources (NCDWR, 2011)

The Virginia State Water Control Board classifies all applicable waters to support aquatic life, recreation, and fish and shellfish harvesting in accordance with the CWA. The criteria established to protect these uses also protect industrial water supply, irrigation, and navigation uses. Additional or more stringent criteria may be established to protect other uses such as public water supply. Virginia's water quality standards are found in 9 Virginia Administrative Code (VAC) 25-260. The Smith Mountain project (includes Smith Mountain and Leesville Lakes) is approved for public water supply; Smith Mountain Lake is currently used as a public water supply in the Roanoke River Basin (9 VAC 25-260-450).

The State Water Control Board further classifies its waters as follows:

I. Open Ocean

II. Estuarine Waters (tidal water-coastal zone to fall line)

III. Nontidal waters (coastal and piedmont zones)

IV. Mountainous zone waters

V. Stockable Trout Waters

VI. Natural Trout Waters

VII. Swamp Waters

These classifications are assigned different criteria for dissolved oxygen (DO), pH, and temperature. For lakes in Classes III, IV, V, and VI, the DO standard applies only to the epilimnion of the water body; if the waters are not stratified, the DO standard applies throughout the water column.

The State of Virginia has also established nutrient criteria for man-made lakes and reservoirs (9 VAC 25-260-187). Smith Mountain Lake, Leesville Lake, Kerr Lake, and Lake Gaston have all been assigned a chlorophyll *a* criterion of 25 ug/L and a total phosphorus criterion of 30 ug/L (Kerr Lake and Lake Gaston have waters in both Virginia and North Carolina). The total phosphorus criterion applies only if the lake received algicide treatment during the monitoring period (April 1 through October 31).

Downstream, NCDWR classifies all waters according to their uses. At a minimum, all waters are classified to support aquatic life and for secondary recreation (Class C). Other uses may be added such as drinking water supply (WS), primary recreation (B), and other supplemental uses. The WS classification is further broken out by the amount of development in the watershed as follows:

- Class WS-I: Waters protected as water supplies that are in natural and uninhabited drainage basins, and by definition also classed as High Quality Waters (HQW)
- Class WS-II: Waters protected as water supplies that are generally in predominantly undeveloped drainage basins, and by definition also classed as HQW
- Class WS-III: Waters protected as water supplies that are generally in low to moderately developed drainage basins
- Class WS-IV: Waters protected as water supplies that are generally in moderately to highly developed drainage basins
- Class WS-V: Waters protected as water supplies that are generally upstream of and draining to Class WS-IV waters

NCDWR also identifies the extent of protected (PA) and critical areas (CA) for water supply watersheds in which development directly affects a water supply intake.

The North Carolina portion of the Roanoke River basin contains water supply areas under the classifications of WS-II, WS-III, and WS-IV. Table 4-2 identifies the water supply areas by classification and user.

TABLE 4-2
North Carolina Water Supply Classifications for the Roanoke River Basin

Stream Name	Classification	User
Unnamed Tributary to Dan River	WS-II	Camp Sertoma
Country Line Creek	WS-II	Town of Yanceyville
South Hyco Creek	WS-II	City of Roxboro
Storys Creek	WS-II	City of Roxboro
Anderson Creek	WS-III	KLRWS
Fullers Creek	WS-III	Town of Yanceyville
Belews Creek	WS-IV	Town of Kernersville
Dan River	WS-IV	Town of Madison and City of Eden
Mayo River	WS-IV	Town of Stoneville
Roanoke River	WS-IV	Roanoke Rapids
Smith River	WS-IV	City of Eden

Source: North Carolina Center for Geographic Information and Analysis (NCCGIA), 2014; NCDWR, 2013a

The KLRWS source water is the Anderson Creek arm of Kerr Reservoir, which is located at the Virginia/North Carolina state line (Figure 1-1). The tributaries flowing directly into Kerr Reservoir cover portions of Vance, Warren, and Granville Counties in North Carolina and Mecklenburg, Charlotte, and Halifax Counties in Virginia. USACE owns and operates the reservoir for the purposes of recreation, flood control, hydroelectric power generation, fish and wildlife, and water supply, controlling the release regime at the dam. It is a 2,785-ft long concrete gravity dam with a maximum height of 134 ft. USACE attempts to maintain the water level of Kerr Reservoir at approximately 295 feet above mean sea level (msl). At this elevation, the reservoir has a surface area of about 48,900 acres (76.4 square miles). Since 1974, when the USACE changed their management rules to maintain a level about 4.5 ft higher than the previous target of 291 ft, the reservoir's elevation has only dropped to the low of 291 ft above msl twice, both during the 2002 drought (USACE, 2014a).

Water Quality

303(d) Lists

Section 303(d) of the CWA requires that states develop a list of waters not meeting water quality standards or having impaired uses. Both Virginia and North Carolina must prioritize these water bodies and prepare a management strategy or total maximum daily load (TMDL).

Table 4-3 identifies the percentage of impaired water size by water body type in the Roanoke River and its major tributaries, summarized by impairment type, in Virginia; the 2012 list is shown. Further details on the major impaired streams listed are shown in Table 4-5, however there are many other tributaries that are impaired for the reasons listed in Table 4-3.

Table 4-4 shows the miles and acreages of impaired waters from the North Carolina 2012 list, summarized by impairment type, within the North Carolina portion of the Roanoke River basin. All waters in North Carolina are in Category 5 on the 2012 303(d) List for mercury due to statewide fish

consumption advisories for several fish species. Further details on all of the listed waters in North Carolina's portion of the Roanoke River basin are shown in Table 4-6.

TABLE 4-3
2012 Impairments in the Virginia Portion of the Roanoke River Basin, Roanoke River and Major Tributaries

Impairment Type	Rivers (% of impaired water size)	Lakes (% of impaired water size)
Bacteria	87	
Benthics	18	
Mercury in Fish Tissue	12	71
PCBs in Fish Tissue	12	93
Temperature	6	
DO	3	54
DDD/DDE		<1
DDT in Fish Tissue		<1

Source: VADEQ, 2014

TABLE 4-4
Impairments in the North Carolina Portion of the Roanoke River Basin

Impairment Type	Stream (miles)	Waterbody (acres)
Aquatic Weeds		4,185
Cadmium	18.3	
Chlorophyll *a*		901.5
Copper	13.2	
Dioxin	31.6	
Ecological/Biological Integrity - Benthos	495.6	
Ecological/Biological Integrity – Fish Community	344.4	
Fecal Coliform (recreation)	212.0	
High pH		4,185
High Water Temperature		6,371.4
Low DO	28.5	
Turbidity	58.0	90.7
Water Quality Standards Aquatic Life	53.7	25,027.2
Water Quality Standards Water Supply	14.2	
Zinc	4.5	

Source: NCDWR, 2013

TABLE 4-5
303(d) Listed Waters in the Virginia Portion of the Roanoke River Basin, Roanoke River, Dan River, and Smith River

Cause Group Code	Waterbody	Impairment Cause	Miles/Acres
L03R-01-TEMP	Roanoke River	Temperature	13.08 Miles
L04R-01-HG	Roanoke River	Mercury in Fish Tissue	10.20 Miles
L42R-01-TEMP	Dan River	Temperature	15.10 Miles
L50R-01-TEMP	Smith River	Temperature	9.182 Miles
L60R-01-HG	Dan River, Banister River and Hyco River	Mercury in Fish Tissue	61.66 Miles/1,655.60 Acres
L60R-01-PCB	Dan River, Banister River and Hyco River	PCB in Fish Tissue	61.66 Miles/1,655.60 Acres

Source: VADEQ, 2014

TABLE 4-6
303(d) Listed Streams in the North Carolina Portion of the Roanoke River Basin

Assessment Unit Number	Stream or Waterbody	Parameter of Interest	Miles/Acres
23-8-(1)a	Nutbush Creek	Ecological/Biological Integrity Benthos	1.7 Miles
23-8-(1)b	Nutbush Creek	Ecological/Biological Integrity Benthos, & Ecological/Biological Integrity Fish Community	1.6 Miles
22-(1)b	Dan River	Turbidity	11.6 Miles
22-27-(1.5)	Belews Creek (Kernersville Lake)	Chlorophyll *a*	46.1 Acres
22-(38.5)	Dan River	Turbidity	0.6 Miles
22-40-(1)	Smith River	Copper	2.8 Miles
22-40-(2.5)	Smith River	Copper	0.5 Miles
22-(39)a	Dan River	Turbidity	13.8 Miles
22-40-(3)	Smith River	Copper	1.8 Miles
22-39(b)	Dan River	Turbidity	9.6 Miles
22-56-(3.5)a	County Line Creek (Farmers Lake)	Chlorophyll a, Turbidity	90.7 Acres
22-58-4-(1.4)	South Hyco Creek (Lake Roxboro)	Chlorophyll a	493.6 Acres
22-58-12-6a	Marlowe Creek	Ecological/Biological Integrity Benthos	6.6 Miles
22-58-12-6b	Marlowe Creek	Copper, Zinc, Ecological/Biological Integrity Benthos	4.5 Miles

TABLE 4-6
303(d) Listed Streams in the North Carolina Portion of the Roanoke River Basin

Assessment Unit Number	Stream or Waterbody	Parameter of Interest	Miles/Acres
23-10-2	Newmans Creek (Little Deep Creek)	Ecological/Biological Integrity Benthos	6.1 Miles
23-10a	Smith Creek	Ecological/Biological Integrity Benthos	6.1 Miles
23-10c	Smith Creek	Turbidity	3.0 Miles
23-30b	Quankey Creek	Ecological/Biological Integrity Benthos	3.4 Miles
23-(26)b3	Roanoke River	Low DO	17.8 Miles
26	Albemarle Sound	Dioxin	6.5 Miles

Source: NCDWR, 2013.

There are three TMDLs for the Roanoke River. Most recently, the Decision Rationale for the PCB TMDL was published in 2010 after PCBs were included in the 1998 303(d) list (USEPA, 2010). One notable difference is the new impairment cause of PCB in the water column. The benthic TMDL for aquatic life use impairments and the bacteria TMDL for primary contact use impairment both went into effect in 2006 (USEPA, 2006a; USEPA, 2006b). When the bacteria impairment was initially listed in 1996, Virginia was using fecal coliform as the indicator. Since 2003, E. coli and enterococci have been adopted as the indicators. Other TMDLs exist for major tributaries within the Virginia portion of the Roanoke River basin; the documents can be found on the USEPA's website.

Lower Roanoke River water quality is influenced by the amount and timing of water releases from upstream dams. Seasonal flooding is an important habitat component for much of the flora and fauna living in the river floodplains. Low DO levels have been recorded in this reach in late spring, summer, and early fall. It is likely that this water quality concern is related to upstream release regimes which are timed to provide more water during spring spawning seasons and decreased releases in the summer months. Lower water releases can cause adjacent backwater wetlands to drain into the river, lowering DO levels. DO levels can fall below the standard of 5 mg/L (North Carolina Wildlife Resources Commission [NCWRC], 2005a).

In 2000, DO samples taken from Lake Gaston were at or below the standard, which was due to deep releases from Kerr Reservoir (North Carolina Environmental Management Commission (EMC, 2006). Modifications were made to the turbines at Kerr Reservoir to improve downstream DO levels; improvements in DO levels at Gaston Lake were seen in the 2004 samplings (NCDWR, 2006). The DO concentrations were greater than the minimum state water quality standard in 2009 (NCDWR, 2010a).

Wastewater Dischargers

Treated wastewater effluent is discharged into the Roanoke River upstream of Kerr Lake, including the City of Henderson's discharge, into Nutbush Creek (Table 4-7). Nutbush Creek is on the 2012 303(d) list of impaired waters based on benthic and fish community data (Table 4-6). Of the KLRWS Partners and their customers, the only return of treated wastewater to its source basin is by the City of Henderson. Given the water flow patterns and the location of the KLRWS's intake on a cove of

Kerr Lake, it is unlikely that any of the upstream NPDES discharges would impact the quality of KLRWS's water supply. Considering this lack of potential for water quality to be affected, other discharges are omitted from this discussion.

TABLE 4-7
WWTP Dischargers within the Roanoke River Basin

WWTP Permit Holder	Monthly Average Flow Limit (mgd)	Receiving Stream
City of Henderson – NC0020559	6.0	Nutbush Creek

Source: NCDWR, 2014

4.1.1.2 Receiving Basin – Tar River

General Review

The Tar River originates in Person, Granville, and Vance Counties of North Carolina and flows southeasterly until it becomes a tidal estuary near Washington, where its name changes to the Pamlico River (lower 40 miles of river), and then flows into Pamlico Sound. The watershed totals 5,440 square miles and lies entirely within North Carolina. The Tar River basin includes five major hydrologic units (Table 4-8), with the Fishing Creek unit being considered separate from the other units when evaluating IBTs (for example, under North Carolina law it is an IBT to transfer water from the Tar River to Fishing Creek). The Fishing Creek watershed is described in similar detail in the following section.

TABLE 4-8
Tar-Pamlico River Major Hydrologic Units

Subbasin Name	USGS 8-Digit Hydrologic Unit	Major Tributaries
Tar River Headwater	03020101	Tar River, Fishing Creek [a], North Fork Tar River, Stoney Creek, Whiteoak Swamp, Swift Creek, Sandy Creek
Fishing Creek	03020102	Fishing Creek, Little Fishing Creek, Shocco Creek, Reedy Creek, Rocky Swamp, Beech Swamp, Deep Creek
Tar River	03020103	Tar River, Cokey Swamp, Little Cokey Swamp, Otter Creek, Town Creek, Conetoe Creek, Grindle Creek, Chicod Creek, Cow Creek, Tranters Creek
Pamlico River	03020104	Pamlico River, Pungo River, Whitehurst Creek, South Creek, Kennedy Creek
Pamlico Sound	03020105	Pamlico Sound, Lake Mattamuskeet

[a] Fishing Creek in HU 03020101 is a different stream from Fishing Creek in 03020102.

Source: NCDWR, 2010b

The Tar River basin contains water supply areas under the classifications of WS-II and WS-IV. Table 4-9 and Figure 4-1 show the water supply areas by classification and location. All waters in this watershed have a supplemental classification as nutrient sensitive waters (NSW). This is assigned to waters that either experience or are subject to microscopic and macroscopic vegetation growth due

to the presence of excess nutrients (NCDWR, 2004); the Tar River basin is classified as NSW to protect the estuary from excessive nutrient loading. Waters at Pamlico Sound, including Swanquarter Bay Refuge, Juniper Bay and many of its tributaries, and parts of the sound itself, are classified as Outstanding Resource Waters (ORW).

TABLE 4-9
Water Supply Classifications for the Tar River Basin

Stream Name	Classification	User
Cedar Creek	WS-II NSW	City of Louisburg
Fishing Creek (Enfield)	WS-IV NSW	Town of Enfield
Hatchers Run	WS-II NSW	Town of Oxford (not in use)
Sally Kearney Creek	WS-II NSW	City of Louisburg
Tar River	WS-IV NSW	City of Greenville
Tar River	WS-IV NSW	City of Louisburg
Tar River	WS-IV NSW	Town of Oxford (not in use)
Tar River and Tar River Reservoir	WS-IV NSW	City of Rocky Mount
Tar River	WS-IV NSW	Town of Tarboro

Source: NCCGIA, 2014; NCDWR, 2013a

Note: Fishing Creek subbasin is not included in this table (see Section 4.1.1.3).

Drought conditions in the early 1950s prompted the Town of Oxford to construct Lake Devin, which served as a more reliable water supply for the town than the Tar River headwaters. In 1974-1975, the Town of Oxford partnered with the City of Henderson and Warren County to form a regional system, KLRWS, which acquires its water supply from Kerr Lake. Currently, Lake Devin is not in use as a water supply. The river is also impounded at Rocky Mount for water supply. Other water withdrawals include agricultural users, although not all are of sufficient size to be registered water withdrawals.

Water Quality

Overall, water quality in the Tar River basin is good; modest water quality improvements have been observed during the most recent monitoring efforts by NCDWR. The upper Tar River basin is utilized heavily for agricultural purposes, such as swine, dairy, and poultry production. These agricultural activities include withdrawals and discharges that contribute to excess nutrients, erosion, and sedimentation among waterways in the Tar River basin (NCDWR, 2010b; NCWRC, 2005a). Reductions in nutrients including phosphorus and nitrogen in surface waters are a priority of NCDWR.

One area of continued concern related to water quality is the lower reach of Fishing Creek (Granville County), where elevated amounts of turbidity, copper, zinc, and fecal coliform bacteria were again recorded during the most recent NCDWR sampling events. To improve water quality in this tributary to the Tar River, restoration and watershed protection efforts are occurring (NCDWR, 2010b).

DO concentrations declined measurably throughout the Tar River basin over the 2005-2007 monitoring period. This decline is due largely to the 2007 drought, which resulted in extremely low flows and consequently low DO concentrations (NCDWR, 2010b).

303(d) List

Table 4-10 indicates the miles and acreage of impaired waters located in the Tar River basin, with the exception of the Fishing Creek subbasin presented in Table 4-13, summarized by impairment type. All waters in North Carolina are in Category 5 of the 2012 303(d) List for mercury due to statewide fish consumption for several fish species. Further details on impaired stream miles listed are presented in Table 4-11.

TABLE 4-10
Summary of 303(d) Listed Waters in the Tar River Basin

Impairment Type	Stream (miles)
Ecological/Biological Integrity Benthos	47.9
Low DO	41.7
Turbidity	33.0

Source: NCDWR, 2013b

TABLE 4-11
303(d) Listed Streams in the Tar River Basin

Assessment Unit Number	Stream	Parameter of Interest	Stream Miles
28-5a	North Fork Tar River	Ecological/Biological Integrity Benthos	5.9
28-11c	Fishing Creek	Ecological/Biological Integrity Benthos	0.9
28-11d	Fishing Creek	Ecological/Biological Integrity Benthos	1.0
28-11e	Fishing Creek	Turbidity	6.1
28-11-2	Foundry Branch	Low DO	5.5
28-(15.5)	Tar River	Turbidity	14.8
28-29-(2)b	Cedar Creek	Turbidity	12.1
29-30a	Crooked Creek	Low DO	15.1
28-30b	Crooked Creek	Low DO	5.4
28-68b	Stony Creek (Boddies Millpond)	Low DO, Ecological/Biological Integrity Benthos	5.9
28-(36)b	Tar River	Low DO	3.4
28-(64.5)	Tar River	Low DO	6.4
28-78-1(8)b1	Sandy Creek	Ecological/Biological Integrity Benthos	5.3
28-83ut8	UT to Town Creek	Ecological/Biological Integrity Benthos	2.6
28-81	Hendricks Creek	Ecological/Biological Integrity Benthos	3.9

TABLE 4-11
303(d) Listed Streams in the Tar River Basin

Assessment Unit Number	Stream	Parameter of Interest	Stream Miles
28-5a	North Fork Tar River	Ecological/Biological Integrity Benthos	5.9
28-11c	Fishing Creek	Ecological/Biological Integrity Benthos	0.9
28-87-(0.5)d	Conetoe Creek	Ecological/Biological Integrity Benthos	6.7
28-87-1.2	Ballahack Canal	Turbidity, Ecological/Biological Integrity Benthos	8.4
28-96	Greens Mill Run	Ecological/Biological Integrity - Benthos	7.3

Source: NCDWR, 2013b
UT = unnamed tributary

Wastewater Dischargers

Municipal treated wastewater effluent dischargers into the Tar River basin within the service area are listed in Table 4-12. As the headwaters of the Tar River are mainly within the service area, no NPDES permitted discharges are upstream of the service area. Additionally, Tar River tributaries of Fishing Creek (Granville County) and Sandy Creek are also on the 2012 303(d) list of impaired waters based on benthic data (NCDWR, 2013).

The local governments and industries with NPDES permits for WWTPs within the Tar-Pamlico River basin are members of the Tar-Pamlico Basin Association, which is discussed in Section 5.1.

TABLE 4-12
WWTP Dischargers within the Tar River Basin Portion of the Service Area

WWTP Permit Holder	Monthly Average Flow Limit (mgd)	Receiving Stream
Town of Bunn – NC0042269	0.3	Crooked Creek
Franklin County – NC0069311	3.0	Cedar Creek
Lake Royale – NC0042510	0.08	Cypress Creek
City of Oxford – NC0025054	3.5	Fishing Creek (Granville County)

Source: NCDWR, 2014

4.1.1.3 Receiving Basin - Fishing Creek

General Overview

The Fishing Creek subbasin, which is part of the Tar River basin and includes portions of Vance and Warren Counties, is considered a separate subbasin from the Tar River basin under IBT statute. The Fishing Creek subbasin includes two water supply areas classified WS-IV NSW, which are located near the Town of Enfield and the Town of Tarboro; neither of the towns is currently using these supply areas (Figure 4-1).

Water Quality

303(d) List

As shown in Table 4-13, the 2012 list includes the mainstem of Fishing Creek due to low DO levels and an unnamed tributary to Beech Swamp for mercury and zinc. All waters in North Carolina are in Category 5 of the 303(d) List for mercury due to statewide fish consumption for several fish species.

The Fishing Creek watershed contains diverse aquatic species, and its biological ratings have generally been assessed as good and excellent. The NCWRC has recognized it as a priority area for habitat protection, but there are no waters currently classified as HQW or ORW (NCDWR, 2010b). The majority of the Fishing Creek subbasin lands consist of forest and wetlands; small municipalities are also present (NCDWR, 2010b).

TABLE 4-13
303(d) Listed Streams in the Fishing Creek Subbasin

Assessment Unit Number	Stream	Parameter of Interest	Stream Miles
28-79-(1)	Fishing Creek	Low DO	36.7
28-79-30ut1	UT to Beech Swamp	Water Column Mercury, Zinc	2.2

Source: NCDWR, 2013b

Wastewater Dischargers

The Town of Warrenton discharges its treated wastewater effluent to Fishing Creek. This small facility, as noted in Table 4-14, has a monthly average flow limit of 2.0 mgd.. This WWTP is a member of the Tar-Pamlico Basin Association, which is further discussed in Section 5.1.

TABLE 4-14
WWTP Dischargers within the Fishing Creek Subbasin Portion of the Service Area

WWTP Permit Holder	Monthly Average Flow Limit (mgd)	Receiving Stream
Town of Warrenton – NC0020834	2.0	Fishing Creek

Source: NCDWR, 2014

4.1.1.4 Receiving Basin – Neuse River

General Overview

The Neuse River is formed by the confluence of the Flat and Eno Rivers, originating in Orange, Person, and Granville Counties, North Carolina. The Neuse River flows southeasterly across North Carolina to New Bern, where it flows into the Pamlico Sound. For this project, the receiving basin in the Neuse River basin is limited to the watersheds of the eastern tributaries draining to Falls Lake, within NCDWR's Neuse River basin 03-04-01 and USGS's Upper Falls Lake Watershed 0302020104. These eastern tributaries, as noted in Table 4-15, originate in Granville, Franklin, Vance, and Wake Counties. As of January 15, 2011, these waters and watersheds are subject to the Falls Water Supply Nutrient Strategy which is outlined in 15A NCAC 02B .0275-.0282 and 15A NCAC 02B .0235 and .0315. The Neuse River receiving basin, as defined herein, is described in similar detail in the following section.

TABLE 4-15
Upper Neuse River Major Eastern Tributaries

Subbasin Name	USGS 12-Digit Hydrologic Unit	Major Eastern Tributaries
Upper Falls Lake Watershed 03020201	030202010401	Knap of Reeds Creek, Dickens Creek, Camp Creek
	030202010402	Knap of Reeds Creek, Picture Creek
	030202010501	Ledge Creek, Little Ledge Creek Holman Creek
	030202010503	Robertson Creek, Cedar Creek, Beaverdam Creek, Reedy Branch, Smith Creek, Little Beaverdam Creek
	030202010601	Buckhorn Creek, West Prong, Mill Creek
	030202010603	Lowery Creek, Mud Branch, Horse Creek
	030202010701	Richland Creek
	030202010702	Smith Creek
	030202011501	Headwaters Little River

Source: NCDWR, 2009a

The service area portion of the Neuse River basin contains water supply areas under the classification of WS-II and WS-IV. Table 4-16 and Figure 4-1 identify the water supply areas by classification and location. All waters in the lower Neuse River basin are assigned a supplemental classification of NSW, for waters that either experience or are subject to microscopic and macroscopic vegetation growth due to the presence of excess nutrients (NCDWR, 2009a).

TABLE 4-16
Water Supply Classifications for the Eastern Tributaries to Falls Lake Portion of Neuse River Basin

Stream Name	Classification	User
Knap of Reeds Creek (Lake Butner)	WS-II NSW	Town of Butner
Ledge Creek (Lake Rogers)	WS-II NSW	City of Creedmoor
Falls Lake	WS-IV NSW	Durham, Granville, & Wake Counties

Source: NCCGIA, 2014; NCDWR, 2013a

Water Quality

303(d) List

Table 4-17 indicates the miles of impaired waters located in the eastern tributaries to Falls Lake. Within this scope, only Knap of Reeds Creek and Smith Creek are listed for impairment. All waters in North Carolina are in Category 5 of the 2012 303(d) List for mercury due to statewide fish consumption for several fish species.

TABLE 4-17
303(d) Listed Streams in the Eastern Tributaries to Falls Lake Portion of Neuse River Basin

Assessment Unit Number	Stream	Parameter of Interest	Stream Miles
27-4-(6)	Knap of Reeds Creek	Zinc	5.6
27-4-(8)	Knap of Reeds Creek	Ecological/Biological Integrity Benthos	0.6
27-23-(2)	Smith Creek	Ecological/Biological Integrity Fish Community	5.8

Source: NCDWR, 2013b

The tributaries within the WS-II watersheds, including Knap of Reeds Creek, Ledge Creek, and Holman Creek, are listed as HQW. Lake Butner, Lake Rogers (Ledge Creek), and Falls Lake are listed as CA.

Wastewater Dischargers

Municipal treated wastewater effluent dischargers into the eastern tributaries to Falls Lake are listed in Table 4-18. The South Granville Water & Sewer Authority discharges the Town of Butner's treated wastewater effluent to Knap of Reeds Creek, which is on the 2012 303(d) list for benthic impairment (NCDWR, 2013b).

TABLE 4-18
WWTP Dischargers within the Neuse River Basin Portion of the Service Area

WWTP Permit Holder	Monthly Average Flow Limit (mgd)	Receiving Stream
South Granville Water & Sewer Authority WWTP – NC0026824	5.5	Knap of Reeds Creek

Source: NCDWR, 2014

4.1.2 Groundwater

Groundwater occurs in a zone of saturation below the water table. Its major source is precipitation that infiltrates the recharge zone on the land surface and moves down through the vadose zone. Groundwater travels slowly through small openings in or between sand grains of subsurface materials. It then moves through fractured rock, sand, or limestone. Groundwater in sufficient quantities and at sufficient recharge rates can be a suitable water supply.

4.1.2.1 Source Basin – Roanoke River

Within the source basin, many residents in rural areas use groundwater wells for their water supply. This is also true of more rural areas within the service area; however, as the water system is expanded over time individuals are connecting to the more reliable public supply. Wellhead Protection Programs are in place in both Virginia and North Carolina.

The service area is located in the physiographic region described as the Piedmont region, and in the Carolina Slate Belt and Triassic Basins eco-regions. These eco-regions have fragmented rock formations that have limited water storage capacity (NCDWR, 2010). Wells drilled in valleys typically have higher yields than those drilled from ridges or upland areas. Within the Carolina Slate Belt, well yields typically range from 15 to 16 gpm while the Triassic Basin wells yield lower amounts, between 11 and 12 gpm (North Carolina Cooperative Extension Service, 1996). Various sources describe

similar well yields for the four-county service area (USACE, 2005; U.S. Department of Agriculture [USDA], 2004; USDA, 1980). Deeper wells (beyond 250 feet deep) may yield up to 100 gpm in rare cases (USDA, 2004).

While individuals and some community systems in the region use groundwater, it is not an appropriate source for centralized use by the Partners because of insufficient yield and the costs associated with combining surface and groundwater resources.

4.1.2.2 Receiving Basin – Tar River

In Vance County, groundwater wells typically yield 14 gpm. Wells drilled deep into bedrock do not have a history of running dry during droughts (USDA, 1980). According to the Vance County Water District (2009), during county public informational sessions held in 2005 and 2006, residents expressed concerns that their wells produced undesirable water quality. County residents complained of discoloration, odor, and high mineralization. Residents reported high incidence of yellowing of light clothing and staining of appliances, sinks, toilets, and bathtubs. Still, the groundwater is safe for drinking (USDA, 2004). This area is mainly within the Tar River basin.

The Soil Survey for Franklin County describes underground rock formations (aquifers) which store water, similar to formations in the other counties in the receiving basin and service area (USDA, 2004). Private wells produce typical yields near 15 gpm, while the best producing deeper well that the Town of Bunn operated had a capacity of 40 gpm.

Downstream within the study area, the Tar-Pamlico and Roanoke Rivers flow into the Coastal Plain. The primary aquifers in the Coastal Plain regions include: the surficial aquifer, Yorktown aquifer, Castle Hayne aquifer, and cretaceous aquifer. Many of these aquifers are heavily relied on for residential and commercial use. Due to this heavy reliance resulting in lower aquifer levels and increased susceptibility to contamination, a region in North Carolina has been designated as the Central Coastal Plain Capacity Use Area (CCPCUA). As a result of this designation, large groundwater users within these aquifers are regulated by EMC. Additionally, the EMC has set specific goals for the CCPCUA to reduce the overall use of many threatened aquifers and promote the use of available surface waters and/or less impacted aquifers (NCDWR, 2009b).

4.1.2.3 Receiving Basin – Fishing Creek

The Soil Survey for Warren County describes groundwater conditions and yields similar to those of other portions of the service area (USDA, 2009). The USACE report also indicates that Warren County wells showed yields similar to those in Bunn (2005).

4.1.2.4 Receiving Basin – Neuse River

The Soil Survey for Granville County describes plentiful supplies of groundwater at well depths around 100 feet (USDA, 1997).

4.1.3 Hydropower

4.1.3.1 Source Basin – Roanoke River

The Roanoke River basin has many dams and reservoirs. The Virginia portion of the basin includes two major reservoirs, both of which are used to produce electricity using the main channel of the Roanoke River. Eleven major reservoirs are located in North Carolina or along the state line and three of these are used to generate power and regulate flows on the main channel of the Roanoke River (NCWRC, 2005a) (Table 4-19).

TABLE 4-19
Hydroelectric Production Dams on the Main Channel of the Roanoke River

Dam Name	Owner and Operator
Smith Mountain Dam	American Electric Power
Leesville Dam	American Electric Power
J.H. Kerr Dam	U.S. Army Corps of Engineers
Gaston Dam	Dominion North Carolina Power
Roanoke Rapids Dam	Dominion North Carolina Power

The Smith Mountain Project includes both Smith Mountain Dam and Leesville Dam. The project is designed such that water can be pumped back from Leesville Lake to Smith Mountain Lake during periods when power is not generated at Smith Mountain Dam. The project obtained a new license effective April 1, 2010 (FERC, 2011). Smith Mountain Dam includes five generators capable of producing 586 megawatts (MW), and Leesville Dam includes two generators capable of producing 50 MW (Hydropower Reform Coalition, 2014). The revised license includes a condition for the project to release water from Leesville Lake to meet target flows, which vary by month at the Brookneal gage. The condition also specifies minimum hourly flow releases: 375 cfs from November 1 to February 29 and 400 cfs from March 1 to October 31 (USFERC, 2011).

USACE operates the J.H. Kerr powerhouse, which includes seven generators capable of producing 227 MW. Additionally, two generators are used for in-house power. The average yearly production from the J.H. Kerr powerhouse is 426,749 MW (USACE, 2014b). The Water Control Plan (USACE, 1995) provides operation instructions for the generation of power in relation to the other objectives of the reservoir, including flood control.

Dominion North Carolina Power manages hydropower generation at Lake Gaston and Roanoke Rapids Lake. The Gaston hydro station houses four generators, each with a capacity of 56-MW production. The total capacity of the entire station is 224-MW generation. The Roanoke Rapids power station is 8 miles downstream of the Gaston hydro station and houses four generators, which can produce a total capacity of 104 MW (Dominion, 2010).

The North Carolina Dam Safety Law is administered by the Division of Land Resources and ensures that minimum stream flows below dams are maintained. The Federal Energy Regulatory Commission (FERC) licenses all hydroelectric dams. Individual dams may have conditional operation plans, which state mandatory minimum flow releases. These required conditional operation plans ensure adequate water quality and quantity the length of the waterway. Several entities collaborate to ensure that these conditional operation plans are in place for each dam. The NCDWR, in collaboration with the NCWRC, recommends the release of flows to meet minimum in-stream flow requirements. Roanoke Rapids and Gaston power stations operate collaboratively with J.H. Kerr Reservoir. USACE provides weekly declarations indicating the volume to be released by the three dams. As part of the Roanoke Rapids and Gaston Dam FERC license, Dominion is required to maintain specific lake levels and certain flows downstream from Roanoke Rapids Dam. Roanoke Rapids Dam always operates on a minimum flow regime (Table 4-20), while Gaston dam operates in an on/off mode.

TABLE 4-20
Roanoke and Gaston Power Station Operational Modes

Normal Yearly Operations	Minimum Flow (cfs)
December 1 - January 15, Kerr declaration < 6,000 cfs	2,000
December 1 - January 15, Kerr declaration > 6,000 cfs	2,500
January 16 - February 29, Kerr declaration < 6,000 cfs	2,500
January 16 - February 29, Kerr declaration > 6,000 cfs	3,000
June 16 - June 30	2,800
July 1 - September 15	2,000
September 16 - November 15	1,500
November 16- November 30	2,000

Source: Dominion, 2010

Additionally, Roanoke Rapids Dam has specific flow regimes regarding flood control, fish spawning season, and times of drought. Flood control releases are under the direction of USACE and are primarily dictated by J.H. Kerr Reservoir levels. Table 4-21 shows the flood control releases associated with J.H. Kerr Reservoir (Dominion, 2010).

TABLE 4-21
Flood Control Operations for Roanoke Rapids Dam Based on J.H. Kerr Reservoir Levels

J.H. Kerr Reservoir Level (feet above msl)	Release (cfs)
300 - 312	Up to 20,000
312 - 315	25,000
315 - 320	35,000
320 - 321	Greater of 85% of inflow or 35,000
>321	Greater of 100% of inflow or 35,000

Source: Dominion, 2010

During the fish spawning season, March 1 to June 15, a continuous sustained flow with little variation is desired. For this reason, a specific flow regime for this season is used at the Roanoke Rapids Dam. Table 4-22 indicates the fish spawning season flow regime (Dominion, 2010).

TABLE 4-22
Fish Spawning Season Flow Operations at Roanoke Rapids Dam

Yearly Period	Target Flow (cfs)	Lower Limit (cfs)	Upper Limit (cfs)
March 1 - 31	Average of J.H. Kerr Reservoir weekly declaration	3,500	-
April 1 - 15	8,500	6,600	13,700
April 16 – 30	7,800	5,800	11,000
May 1 - 5	6,500	4,700	9,500
May 16 - 31	5,900	4,400	9,500
June 1 - 15	5,300	4,000	9,500

Source: Dominion, 2010

During times of drought (as determined by consultation with USACE and NCDWR), the FERC license held by Dominion for the Roanoke Rapids and Gaston power stations states that minimum flows are 2,000 cfs for December – October and 1,500 cfs for September – November (Dominion, 2010).

4.1.3.2 Receiving Basin – Tar River

The Tar River is not used for hydropower generation.

4.1.3.3 Receiving Basin – Fishing Creek

Fishing Creek is not used for hydropower generation.

4.1.3.4 Receiving Basin – Neuse River

The Neuse River is not currently used for hydropower generation. The remaining hydropower dam on the Neuse River, Milburnie Dam (located 15 miles below Falls Lake Dam), is currently being considered for removal (USACE, 2013).

4.2 Topography

This discussion addresses general topography of the source and receiving basins and how topography in turn influences floodplains along waterways.

4.2.1 Topography

4.2.1.1 Source Basin – Roanoke River

The source basin, the Roanoke River basin, begins in the rocky landscape of Virginia. It flows through Virginia to the North Carolina state line and continues to the North Carolina coast. In Virginia, the Roanoke River basin passes through the Valley and Ridge Province, which is noted for steep slopes and valleys (VADEQ, 2014).

In North Carolina, Vance, Warren, Granville, and Franklin Counties are located in the Piedmont Plateau of the state. The Piedmont Plateau has characteristic rolling hills of red clay, which range from 30 feet above msl in the east near the fall line to 600 feet above msl. Crystalline or sedimentary rocks underlie the Piedmont Plateau (USDA, 2004). The fall line separates the Piedmont Plateau from the Coastal Plain region just to the east of the service area. It extends across the Roanoke River just downstream of the Roanoke Rapids Lake Dam. The topography then declines to the outer Coastal Plain, which is swampy and flat.

4.2.1.2 Receiving Basin – Tar River

The portion of the service area in the Tar River basin is also part of the Piedmont Plateau. The fall line continues across the Tar River near Rocky Mount (USDA, 2004). Downstream of the fall line, the elevations range from sea level to 30 feet above msl. Here, the outer Coastal Plain is swampy and flat and is home to many of North Carolina's natural lakes.

4.2.1.3 Receiving Basin – Fishing Creek

The Fishing Creek watershed lies within the Piedmont Plateau and has topography similar to the other portions of the service area. This watershed is above the fall line, joining the Tar River upstream of Rocky Mount.

4.2.1.4 Receiving Basin – Neuse River

The portion of the service area in the Neuse River basin lies above the fall line within the Piedmont Plateau and has topography similar to the other portions of the service area.

4.2.2 Floodplains

Floodplains are characterized by the flat surface adjacent to the river channel, and are periodically inundated by floodwater. Sediments deposited by lateral migration of meanders in a stream and by periodic overflow of the stream banks form a floodplain. The magnitude and frequency of flooding are inversely related and are functions of the intensity and distribution of precipitation; the rate of infiltration of water into the soil and rock; and topography. River flooding is the most universally experienced natural hazard. Factors that control damage caused by flooding include land use on the floodplain, magnitude and frequency of the flooding, the season, and the amount of sediment deposited.

The National Flood Insurance Program (NFIP) is a federal program enabling property owners to purchase flood insurance. NFIP participation helps to discourage unwise development and to prevent floodplain destruction by requiring permits which ensure that construction materials are adequate to withstand flooding.

The Virginia Flood Damage Reduction Act was passed by the General Assembly in 1989, and the Virginia Department of Conservation and Recreation (VDCR) enforces the act. The act requires VDCR to develop a flood protection plan for Virginia, which includes an inventory of flood-prone areas. The purpose of the regulations is to protect human lives and prevent property damage from flood events by preserving the ability of floodplains to carry the 100-year flood. The act provides a basis for compliance with the NFIP. VDCR has created model ordinances for local governments to regulate how development may occur within floodplains.

North Carolina, in a partnership with FEMA, is a Cooperating Technical State and has the primary responsibility for creation and maintenance of its floodplain mapping. Ongoing maintenance of the floodplain maps is necessary for two main reasons: (1) development impacts hydrology and the extent of floodplains and (2) new data may be available following a large storm event. An effort to update mapping in the eastern portion of North Carolina was initiated following Hurricanes Floyd and Dennis. In addition, Vance, Warren, Granville, and Franklin Counties in North Carolina participate in the NFIP and discourage construction in floodplains.

4.2.2.1 Source Basin – Roanoke River

Floodplains in the upper reaches of the Roanoke River basin are narrower where slopes are steeper. Flood storage is provided by the series of reservoirs. One of Kerr Lake's many functions is to provide flood storage capacity for the Roanoke River basin. Flood storage is balanced with downstream flow requirements to minimize potential damage from large flooding events.

Floodplains along the lower Roanoke River downstream of the service area (but included in the study area) are up to 5 miles wide and are protected in many areas. These floodplains function to provide water quality benefits, wooded habitats for wildlife, and recreational opportunities. Further detail concerning these protected areas is presented in Section 4.7.

4.2.2.2 Receiving Basin – Tar River

Reservoirs with flood storage capacity are not in place on the Tar River as they are on the Roanoke River. With the previously mentioned focus on creating updated floodplain maps in eastern North Carolina, updated Vance and Granville County maps were approved in 2007 (North Carolina Floodplain Mapping Program [NCFMP], 2009). These maps include portions of both the Tar and Roanoke River basins. Franklin County mapping of the Tar-Pamlico River watershed was completed earlier and was approved in 2004 and 2007 (NCFMP, 2009).

4.2.2.3 Receiving Basin – Fishing Creek

Warren County was included in recent floodplain mapping updates. Including both the Roanoke and Fishing Creek (Tar River) basins, Warren County's updated maps were approved in 2007 and 2009 (NCFMP, 2009).

4.2.2.4 Receiving Basin – Neuse River

The floodplain mapping of the smaller portion of Franklin County in the Neuse River watershed was approved in 2006 (NCFMP, 2009). Granville County's floodplain maps are effective as of 2007 and are currently undergoing maintenance (NCFMP, 2009).

4.3 Soils

Soils data are presented in detail for the service area only, as no development or disturbance would occur outside the service area as a result of this project. Thus, impacts to soils outside the service area would not occur. Information regarding soils in the source basin outside of the service area is available in local soil surveys. Soil type changes significantly from the basins' headwaters to the coastal plain. In this section, information is not presented by source and receiving basins but instead at a county level since development patterns would not necessarily be influenced by basin boundaries.

Soil surveys were completed by the USDA NRCS for Franklin, Granville, Vance, and Warren Counties and the digitized data is available through the Web Soil Survey. Tables 4-23 through 4-26 detail the predominant soils (soils accounting for the approximately top 50 percent of soils) in the service area, calculated using digital data available from the Web Soil Survey (USDA, 2014). Additional information regarding the predominant type's soil associations is also provided. Soil associations, depicted as map units on the soil surveys' general soil map, show "broad areas that have a distinctive pattern of soils, relief, and drainage" (USDA, 1980).

TABLE 4-23
Vance County Predominant Soil Types

Soil Name	Percentage	Description
Appling Sandy Loam (Ap)	22.7%	well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Cecil Sandy Loam (Ce)	19.4%	well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Wedowee Sandy Loam (We)	16.5%	well drained, moderate permeability, poorly suited for agricultural development, suitable for pasture & hay lands, woodlands, suitable for urban development
Other	**41.4%**	-
TOTAL	**100%**	

Source: USDA, 2009; USDA, 1980

The soil associations for these types are Appling, Cecil, and Wedowee-Louisburg-Pacolet. Appling is an upland soil, making up the majority of Vance County. Cecil soils typically occur on broad ridges and upland slopes. Wedowee soils, of the Wedowee-Louisburg-Pacolet association, are located along the slopes of creeks and streams. (USDA, 1980).

TABLE 4-24
Granville County Predominant Soil Types

Soil Name	Percentage	Description
Georgeville Silt Loam (Ge)	16.8%	very well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Creedmoor Coarse Sandy Loam (Cr)	11.7%	moderately to poorly drained, very slow permeability, well suited for agricultural development, poorly suited for urban development
Chewacla & Wehadkee (Ch)	7.1%	poorly drained, moderate permeability, poorly suited for agricultural development, not suited for urban development
Vance Sandy Loam (Va)	6.8%	well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Cecil Sandy Loam (Ce)	6.5%	well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Lignum Silt Loam (Lm)	6.2%	moderately to poorly drained, very slow permeability, well suited for agricultural development, poorly suited for urban development
Other	**44.9%**	-
TOTAL	**100%**	

Source: USDA, 2009; USDA, 1997

The Georgeville silt loam is the dominant part of the Iredell-Enon-Georgeville association, which is located on the broad ridges and hillsides in northern Granville County. The upland Creedmoor soils

are the dominant part of the Creedmoor soil association that occurs in the southwest portion of the county. Commonly along floodplains, Chewacla and Wehadkee soils are considered minor soils that are affiliated with several associations, including Creedmoor and Cecil. Vance Sandy Loam is part of the Vance-Helena association, found on knolls and ridges in central Granville County. Cecil soils are located in the upland central and southeastern parts of the county. The Nason-Herndon-Lignum association includes the Lignum silt loam. This association is located along ridges, hillslopes, and at the headwaters of streams. (USDA, 1997).

TABLE 4-25
Franklin County Predominant Soil Types

Soil Name	Percentage	Description
Wedowee Sandy Loam (We)	27.0%	well drained, moderate permeability, suited for agricultural development, suitable for urban development
Wake Sandy Loam (Wa)	8.4%	well to excessively drained, moderate to rapid permeability, suited for agricultural development, poorly suited for urban development
Wake-Wateree-Wedowee (Wb) complex	8.3%	well to excessively drained, moderate to rapid permeability, suited for agricultural development, poorly suited for urban development
Chewacla and Wehadkee soils (Ch)	7.5%	poorly drained, moderate permeability, poorly suited for agricultural development, not suited for urban development
Other	**48.8%**	-
TOTAL	**100%**	

Source: USDA, 2009; USDA, 2004

The predominant soil types in Table 4-25 occur within multiple soil associations: Wedowee-Helena, Wake-Wedowee-Wateree, and Chewacla-Wedhakee-Altavista, among others. The Wedowee and Wake soils occur throughout Franklin County, located on side slopes, ridges, and knolls. Chewacla and Wehadkee soils are typically along floodplains and low terraces of large streams and creeks. (USDA, 2004).

TABLE 4-26
Warren County Predominant Soil Types

Soil Name	Percentage	Description
Pacolet Sandy Loam (Ph)	22.3%	well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Cecil Sandy Loam (Ce)	19.1%	well drained, moderate permeability, well suited for agricultural development, suitable for urban development
Wedowee Sandy Loam (Ww)	8.2%	well drained, moderate permeability, poorly suited for agricultural development, suitable for pasture & hay lands, woodlands, suitable for urban development
Other	**50.4%**	-
TOTAL	**100%**	

Source: USDA, 2009

The Warren County soil survey is currently not available online. Therefore, the soil association information is not provided at this time.

In addition to soil types throughout the service area, predominant soil types along rivers, streams, and creeks were assessed. The predominant soil types along rivers, streams, and creeks in the service area are as follows:

- Vance County – Wedowee Sandy Loam
- Granville County - Chewacla & Wehadkee
- Franklin County - Chewacla & Wehadkee
- Warren County – Cecil Sandy Loam

4.4 Land Use and Land Cover

Land use patterns affect upland and wetland ecological communities and wildlife populations. Land uses are important when assessing water quality and quantity. As development occurs, a higher percentage of water enters rivers and streams through surface water runoff, and less water infiltrates the soil to replenish groundwater supplies. Surface water runoff transports sediment and other pollutants. For these reasons, land use is discussed in this document.

Land use within the source basin varies from the more rural farming communities to the urban development patterns associated with major cities.

Land use in the Virginia portion of the Roanoke River basin is predominantly forested, followed by agricultural uses, such croplands and pastures. The basin contains approximately 10 percent urban areas (VADEQ, 2014).

Land use within the service area is primarily agricultural and forested land. Larger communities within the service area include Oxford, Henderson, and Warrenton. There is very little industrial land use at this time, although business parks are set aside in each of the counties within the service area. Table 4-27 indicates the land cover types in the service area.

TABLE 4-27
Land Cover within the Service Area

	Vance County		Warren County		Granville County		Franklin County	
Land Cover	**Acres**	**Percent**	**Acres**	**Percent**	**Acres)**	**Percent**	**Acres**	**Percent**
High Intensity	1,716.3	1.0%	96.9	<0.1%	1,956.4	0.6%	1,734.5	0.6%
Low Intensity	3,119.8	1.8%	162.0	<0.1%	2,734.6	0.8%	890.4	0.3%
Cultivated	22,007.3	12.7%	20,201.8	7.1%	30,214.1	8.8%	47,206.1	14.9%
Managed Herbaceous Cover	9,964.7	5.8%	15,096.5	5.3%	33,943.7	9.9%	21,820.3	6.9%
Unmanaged Herbaceous Cover, Upland	106.4	<0.1%	190.9	<0.1%	551.6	0.2%	6.8	<0.1%
Unmanaged Herbaceous Cover, Wetland	0.00	0.0%	7.6	<0.1%	10.6	<0.1%	6.2	<0.1%
Evergreen Shrubland	26,706.7	15.5%	47,964.0	16.9%	37,032.7	10.8%	56,802.5	17.9%
Deciduous Shrubland	1,695.1	1.0%	5,798.4	2.0%	3,502.9	1.0%	4,513.4	1.4%
Mixed Shrubland	1,348.6	0.8%	3,354.1	1.2%	2,715.1	0.8%	1,822.7	0.6%
Mixed Upland Hardwoods	27,102.8	15.7%	31,956.7	11.3%	93,541.9	27.3%	30,820.8	9.7%
Bottomland Forest/Hardwood Swamps	18,576.4	10.8%	33,849.4	11.9%	35,796.8	10.4%	42,634.9	13.5%
Southern Yellow Pine	35,612.6	20.6%	90,223.3	31.8%	72,095.1	21.0%	82,380.6	26.0%
Other Needleleaf Evergreen Forest	0.00	0.0%	0.00	0.0%	11.4	<0.1%	0.00	0.0%
Broadleaf Evergreen Forest	0.00	0.0%	0.00	0.0%	18.3	<0.1%	0.00	0.0%
Mixed Hardwoods/Conifers	12,837.2	7.4%	24,782.7	8.7%	25,662.7	7.5%	22,829.7	7.2%
Oak/Gum/Cypress	23.5	<0.1%	0.00	0.0%	258.9	0.1%	4.0	<0.1%
Water Bodies	11,701.0	6.8%	10,082.1	3.6%	2,973.3	0.9%	3,208.5	1.0%
Unconsolidated Sediment	206.7	0.1%	0.00	0.0%	217.3	0.1%	5.0	<0.1%
TOTAL	**172,725**	**100%**	**283,766**	**100%**	**343,237**	**100%**	**316,686**	**100%**

Source: Earth Satellite Corporation (ESC), 1997

[a] Franklin County population has increased since these data were developed. There is likely less forested and agricultural land and more developed land in the county than shown in this table.

The data in Table 4-27 represent 1996 land cover. Although these data are not current, the information remains a fairly accurate representation of land cover in the service area for Vance, Warren, and Granville Counties. This is due in part to the predominantly rural and agricultural land uses throughout these counties and the lack of recent development. However, the 1996 land use data for Franklin County are less accurate because of increased population growth in the county, due primarily to its proximity to Raleigh and Research Triangle Park, a rapidly growing area.

According to Franklin County's zoning map, more than 50 percent of the land use is agricultural mixed with low density residential, particularly in the northeast portion of the county. A large portion of area near the center and southern parts of Franklin County is zoned as rural business district. This zoning designation includes small parcels (less than 1 acre) utilized by rural businesses. The southeast portion of the county has experienced increased growth, due to its proximity to Raleigh. As indicated on the zoning map, this portion of Franklin County has a large percentage of commercial and medium/high intensity residential developments (Franklin County, 2007). Additionally, the county's subdivision map reveals that the majority of subdivisions are located in the southeast portion of the county (Franklin County, 2008).

Table 4-27 clearly shows that Vance, Warren, and Granville Counties have predominantly forested and agricultural land. These land uses have been common for these rural counties for many decades; however, increasing populations and growth from the Raleigh-Durham region has spurred growth and development in these counties With the increasing development from the Raleigh-Durham region, Vance County has seen increases in residential development in the south near Franklin County (Warren County, 2002).

Vance, Warren, Granville, and Franklin Counties have collaboratively initiated rural economic development through the creation of Triangle North, formerly called the Kerr-Tar Hub. The Triangle North economic development is divided into four parks, all suited to spur business and growth via a multitude of incentives, such as state tax credits and a federally designated Historically Underutilized Business Zone (HUBZone). The following describes each development park:

- Triangle North Granville – This 527-acre life sciences and technology park in Granville County is located along Interstate 85, including exits 206 through 209. The Vance-Granville Community College is adjacent to the development park.
- Triangle North Franklin – This 252-acre high-technology park in Franklin County is located adjacent to the Triangle North Executive Airport.
- Triangle North Vance – This 422-acre business and manufacturing park in Vance County is located along Interstate 85 at exit 209, across from Vance-Granville Community College.
- Triangle North Warren – This 1,000-acre development park geared for logistics, distribution, and manufacturing is located in Warren County off of Highway 1/158 in Manson, NC, which is 3 miles from Interstate 85.

The Roanoke River basin continues southeast of the service area to the coastal areas of North Carolina. Land use in this portion of the Roanoke River basin consists of mainly forested areas with some areas of agricultural use (NCDWR, 2011). The study area includes the downstream reaches of the Roanoke River. The Roanoke River floodplain is wide and largely undeveloped; this floodplain includes the largest intact and least disturbed bottomland hardwood forest in the mid-Atlantic region (The Nature Conservancy, 2010).

4.5 Wetlands

The term "wetland" refers to landscape features such as swamps, marshes, bogs, marsh-like ponds, and depressions that sometimes hold water. The common feature and operational definition of a wetland is land inundated by water or saturated to a depth of a few centimeters for at least a few days of the year. The major components used to determine the presence or absence of wetlands are hydrology, vegetation type, and soil type. Hydrology is often the most difficult to define because some wetlands are only wet for a very

short period each year. However, the presence of water, even for a short period on a regular basis, gives rise to characteristics seen in wetlands.

To assess the potential for wetlands in the study area, United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) data were used. NWI is the best available source of data for estimation of wetlands. Wetlands within the study area were not delineated.

The Virginia portion of the Roanoke River basin within the study area, upstream of the service area, includes common wetland types: lacustrine and limnetic (lakes); palustrine forested; and palustrine wetlands with unconsolidated bottoms (USFWS, 2009; Cowardin, et. al., 1979). Most wetlands are adjacent to water bodies.

Table 4-28 lists and describes the wetland types located in the service area. The most common wetland types include those classified as lacustrine, limnetic (associated with ponds or lakes) and palustrine, forested. These forested wetlands are riparian and mostly located along the tributaries and backwater areas of Kerr Lake, the Tar River, and Fishing Creek. In addition to typical wetland functions, forested riparian wetlands provide shade and stability to soils.

Downstream of the service area along the Roanoke and Tar Rivers included in the study area, the most common wetland types are palustrine, forested and estuarine and subtidal nearer the coast (USFWS, 2009). These bottomland hardwood forests are ecologically unique, given their size and habitats, and are discussed in more detail in Section 4.13.

TABLE 4-28
Wetland Types and Acreage in the Service Area

Wetland Type	Acres [1]	Description
L1	65,208	Lacustrine and limnetic
L2	46	Lacustrine and littoral
PAB	13	Palustrine and aquatic bed
PEM/FO	31	Palustrine and emergent/forested
PEM/SS	8	Palustrine and emergent/scrub-shrub
PEM	1,633	Palustrine and emergent
PFO/EM	30	Palustrine and forested/emergent
PFO/SS	53	Palustrine and forested/scrub-shrub
PFO	37,889	Palustrine and forested
PSS/EM	32	Palustrine and scrub-shrub/emergent
PSS/FO	5	Palustrine and scrub-shrub/forested
PSS	3,112	Palustrine and scrub-shrub
PUB/SS	3	Palustrine, unconsolidated bottom, and scrub-shrub
PUB	6,680	Palustrine and unconsolidated bottom
PUS	1	Palustrine and unconsolidated shore
R2	945	Riverine and lower perennial

Sources: USFWS, 2009; Cowardin et al., 1979
[1] Wetland areas are approximate and not field-verified

4.6 Prime or Unique Agricultural Lands

North Carolina Executive Order 96 charges all state agencies to minimize the loss of prime agricultural and forested lands as defined in the Federal Farmland Protection Policy Act. The USDA NRCS has classified lands into three categories based on suitability for agricultural uses. These classifications incorporate soil type, slope, and water capacity. Prime Farmlands (PFL) are those soils with slopes between 0 and 8 percent in capability classes I and II, and some in capability class III. Unique Farmlands are recognized for having a certain set of parameters necessary to produce certain high-value crops. The third category, Farmland of Statewide Importance, includes those soils that do not quite qualify as PFL. Factors include steepness of slope, susceptibility to erosion, and permeability (USDA, 1998).

Prime farmlands are described for Vance, Granville, and Franklin Counties in their soil survey reports. Only digital soil mapping data are available for Warren County at this time; therefore, soil types designated prime farmlands are assumed to be similar to those found in Vance County. Agricultural soils within the project service area have been historically used for tobacco production. As tobacco's value as a high cash crop has decreased, some prime farmlands in the project area have been converted to developed uses. Other key crops include corn and soybeans. However, agriculture remains a main land use and economic driver in the study area.

In Vance County, prime farmlands of Appling, Cecil, and Durham soils have been historically used for tobacco production. These soils are well-drained sandy loams and loamy sands. Over 38 percent of land here are designated prime farmland (USDA, 1980).

In Granville County, approximately 52 percent of the soils are classified as prime farmlands. The predominant prime farmlands are Georgeville silt loam and Creedmoor sandy loam soils (USDA, 1997).

In Franklin County, approximately 47 percent of the soils meet the criteria of prime farmland. The general soil map units that include these prime farmlands are Wedowee-Helena, Cecil-Pacolet, and Appling-Vance-Helena. These soils have loamy surface layers and clayey subsoils. The Wedowee-Helena map unit comprises 35 percent of the county's soils (USDA, 2004).

4.7 Public Lands and Scenic, Recreational, and Natural Heritage Program Natural Areas

This section addresses the federal and state-owned lands, parks, and other scenic and recreational areas that are within the study area and service area. This identification was based on information provided by the VDCR and Natural Heritage Program Natural Areas (NHPHA) database (North Carolina Natural Heritage Program [NCNHP], 2014). This information was analyzed to identify areas of exemplary or unique natural ecosystems and special wildlife habitats. Recreation opportunities within the source basin are plentiful along the Roanoke River in both states. These opportunities are available along both the free flowing reaches of the Roanoke River and its reservoirs. However, this discussion is limited to the major areas.

4.7.1 Public Lands

4.7.1.1 Source Basin – Roanoke River

The reservoirs upstream of Kerr Lake support important recreational fisheries for small and largemouth bass, walleye, crappie, and catfish. Smith Mountain Lake is known for its striped bass fishery, which is stocked annually, and supports a fisheries-related niche in the local economy with guide businesses, marinas, and related businesses. Lake Philpott supports a stocked walleye fishery in Virginia, attracting much public interest. Surrounding public land uses include boat ramps, campgrounds, and other natural areas.

The VDCR designates the state's natural area preserves. There are two natural area preserves in the Roanoke River basin: Poor Mountain and Grassy Hill. Poor Mountain provides ample hiking throughout its pine-oak woodland community. Grassy Hill provides 6 miles of hiking trails and is known for bird watching. There are three wildlife management areas in the Roanoke River basin: Dick Cross, Fairy Stone Farms, and

White Oak Mountain. Dick Cross and White Oak Mountain provide hunting of small game, waterfowl, and some deer and turkey. Fairy Stone Farms provides excellent hunting for deer, turkey, squirrel, and raccoon. All three wildlife management areas provide access to fishing. Additionally, there are five state parks located in the Virginia portion of the Roanoke River basin (Table 4-29).

TABLE 4-29
Virginia State Parks in the Roanoke River Basin

Name	County	Recreational Use
Occoneechee	Mecklenburg	18 miles of trails (hiking, bicycling, and horseback riding), fishing and boating, camping sites (cabin, tent or RV)
Staunton River	Halifax	Nature trails, campgrounds, Olympic size pool and 70 foot waterslide
Staunton River Battlefield	Halifax	Hiking, biking, self-guided historical and nature trails
Fairy Stone	Patrick	9 miles of trails (hiking, bicycling, and horseback riding), public swimming (beach area), camping (cabin, tent, or RV)
Smith Mountain Lake	Pittsylvania	13 hiking trails (0.5 – 3 miles) public swimming (500-foot beach area), Fishing and boating, camping (cabin, tent, or RV)

Source: Virginia Department of Cultural Resources, 2014

Kerr Lake straddles the state line between Virginia and North Carolina and includes many access points within both states and numerous recreational opportunities. These opportunities range from camping and hunting on the bordering USACE-owned and -managed 70,000 acres to fishing and boating on Kerr Lake. State fishing licenses are valid throughout Kerr Lake and Lake Gaston, even though these reservoirs have waters in both states. USACE manages access on the reservoir and an estimated 4 million people visit every year; a map depicting the locations and types of opportunities is included in Appendix C. Boat ramps and their elevations are presented in Appendix C. The boat ramp with the highest minimum elevation for access is Satterwhite Point Marina at 294.0 feet above msl.

USACE estimates that more than 1 million hours of fishing occur on the reservoir every year; more information regarding sport fishing is presented in Section 4.12 (USACE, 2010). Fishing tournaments include competitions for bass and catfish and events specifically for children, with some annual events registering over 100 boats in 2010. These events, as well as outfitters and others providing guide services, are important to the local economy.

In addition to Kerr Lake, the Roanoke River basin in North Carolina include numerous adjacent public lands, scenic areas, recreational areas, and NHPNAs. Table 4-30 lists areas in the North Carolina portion of the Roanoke River basin designated for recreational activities.

TABLE 4-30
North Carolina Scenic and Recreational Areas in the Roanoke River Basin

Name	County	Location within the Study Area (Upstream, Within, or Downstream of Service Area)	Recreational Use
Hanging Rock State Park	Stokes	Upstream	18 miles of hiking trails, rock climbing by permit, family camping sites, fishing and swimming
Mayo River State Park	Rockingham	Upstream	2 miles of hiking trails, picnic areas, and fishing
Kerr Lake State Recreational Area	Vance and Warren	Service Area	Several natural paths, family camping sites, boating, fishing and swimming
Chestnut Street Park	Vance	Service Area	Small park located in the City of Henderson
Morning Star Wildlife Refuge	Martin	Downstream	18 short educational trails
Roanoke River National Wildlife Refuge	Bertie	Downstream	1-mile hiking trail for wildlife observation, fishing and hunting by permit

Downstream of Kerr Lake, the Roanoke River also affords many opportunities for outdoor, aquatic recreation. In addition to reservoir boating, fishing, and swimming, the free flowing sections of channel are accessible to the public in many areas. Fishing opportunities in Lake Gaston and Roanoke Rapids Lake are similar to those in Kerr Lake, although these reservoirs are smaller.

For example, the 5 river mile reach of the Roanoke River, including channel braids, from the NC 48 Gaston Landing bridge to the Weldon boat ramp, offers paddlers excellent opportunities to experience whitewater. The level of difficulty depends on water levels, with more whitewater at low river flows. Dominion publishes release schedules (subject to change) in an effort to attract and educate paddlers, with most opportunities in the summer and fall, as included in Dominion's FERC license. Spring releases are managed more for fish spawning and migration than for recreational uses.

On the Lower Roanoke, the Roanoke River Partners manage a "200-mile wilderness eco-adventure" of paddling and land trails on the Roanoke and Cashie Rivers and their backwaters, including 15 camping platforms (Roanoke River Partners, 2011).

4.7.1.2 Receiving Basin – Tar River

The Tar-Pamlico River basin contains 3,977 acres of lakes, 2,566 miles of streams and rivers, 663,593 acres of estuaries, and 17 miles of coastline along Pamlico Sound, which include numerous public lands. Table 4-31 lists areas in the Tar-Pamlico River basin designated for recreational activities.

TABLE 4-31
Scenic and Recreational Areas in the Tar-Pamlico River Basin

Name	County	Service Area (within) Downstream	Recreational Use
Fox Pond Park	Vance	Service Area	2.5 miles of trails for hiking and biking Padding is permitted
Joy LaRue Joyner Park	Franklin	Service Area	Hiking trails along the Tar River
Medoc Mountain State Park	Halifax	Downstream	11 miles of hiking trails, 2.5-mile paddling trail along Fishing Creek
Tar River Paddle Trail	Nash Edgecombe	Downstream	10 canoe access points with over 20 miles of paddling along the Tar River and Stony Creek
Indian Lake Park	Edgecombe	Downstream	Three hiking and biking trails
Princeville Heritage Trail	Edgecombe	Downstream	3 miles of paved hiking and biking trails
Tar River Trail	Edgecombe	Downstream	3 miles of paved trails connecting five city parks
Riverfront Park	Edgecombe	Downstream	Paddling access to Tar River
North Carolina Estuarium	Beaufort	Downstream	0.75-mile boardwalk along the Pamlico River
Tar River Park North	Pitt	Downstream	2.5 miles of hiking nature trails
Green Mile Run Greenway	Pitt	Downstream	1.3 miles of paved hiking and biking trail connecting to 2.9 miles of the South Tar Greenway
Stewart Parkway	Beaufort	Downstream	0.75 mile of paved trail and wetland boardwalk on the Washington waterfront
Goose Creek State Park	Beaufort	Downstream	7 miles of hiking trails and 4 miles of paddle trails
Washington Waterfront	Beaufort	Downstream	Access to Runyon Creek at the NC Estuarium
Mattamuskeet National Wildlife Refuge	Hyde	Downstream	Nature trail at park headquarters, plus hiking and biking along the refuge roads
Lake Mattamuskeet	Hyde	Downstream	10.4 miles of paddling trails
Swanquarter National Wildlife Refuge	Hyde	Downstream	2 miles of refuge road
Pungo River	Hyde	Downstream	11-mile paddling trail

4.7.2 Natural Heritage Program Natural Areas

The service area, consisting of Vance, Warren, Granville, and Franklin Counties, contains 17,360 acres of NHPAs. Table 4-32 indicates the NHPNA acreage for each of the four counties. Section 4-12 describes the aquatic NHPNAs.

TABLE 4-32
Natural Heritage Program Natural Areas within the Service Area

County	Number of Areas	Total Acreage
Vance	11	2,030
Warren	14	3,336
Granville	45	8,928
Franklin	28	3,066
Total	**101**	**17,360**

Source: NCNHP, 2014

4.8 Areas of Archaeological or Historic Value

NEPA and SEPA require a review of archaeological and historic resources, and these are described in this section. The National Register of Historic Places (NRHP) is the formal repository of information pertaining to historic structures and districts. Places considered for listing include historic structures and districts, cemeteries, and archaeological sites. Since the proposed project would not cause any growth outside the service area, no impacts to archaeological and historic resources in Virginia would occur. Thus, this section focuses on resources in the North Carolina portion of the study area.

4.8.1 Areas of Archaeological Value

The North Carolina State Historic Preservation Office (NCSHPO) recognizes and aids in the documentation of archaeological sites throughout the state. Vance, Warren, Granville, and Franklin Counties have numerous archaeological sites on record with the NCSHPO (Table 4-33) (NCSHPO, 1999). Many of these include archaeological work conducted at abandoned historic cemeteries and home sites. Other sites have been investigated for more insight into the Native American populations present in the area prior to colonization.

TABLE 4-33
Archaeological Sites within the Service Area

County	Number of Archaeological Sites
Vance	250+
Granville	270+
Warren	185
Franklin	100+

Source: NCSHPO, 1999.

4.8.2 Areas of Historic Value

Vance, Warren, Granville and Franklin Counties have a rich architectural and historic inventory. Properties included on the NRHP are listed in Appendix C. The following paragraphs describe the historic landmarks found in both the urban and rural portions of the service area.

The 137 historic landmarks located throughout the service area include private homes, plantations, farms, mills, educational institutions, municipal buildings, churches, museums, businesses and historic districts (NRHP, 2014). Historic landmarks are deemed of historic significance and categorized by four areas:

architecture, person of historical relevance, event, and informational potential. The majority of historic landmarks are private homes of architectural significance.

Vance County has 21 historic landmarks, which include 20 buildings and one historic district. The historic landmarks display a range of diversity, including private homes, plantations, and municipal buildings. The majority of the historic landmarks are located in the City of Henderson, which is the largest municipality in the county and includes the Henderson Central Business District. St. James Episcopal Church and Rectory, located in Kittrell, is a historically recognized religious structure from the 1850s (NRHP, 2014).

Restoration of some Vance County sites has occurred using grants and technical assistance from the NCSHPO, including the LaGrange and Ashburn Hall bed and breakfast inns, the former Maria Parham Hospital, the former First National Bank, and the Henderson Fire Station, which dates back to the early 1900s (NCSHPO, 1999).

Granville County has 45 historic landmarks, which include 11 buildings and 34 historic districts. The high number of historic districts includes predominantly farms and plantations consisting of multiple buildings and large tracts of land. Many of the historic farms and plantations are located in more rural areas of Granville County. By the 1860s, many expert farmers resided in Granville County producing large yields of tobacco crops. Additionally, using large numbers of slaves to work the farms and plantations required outbuildings (slave quarters) on the properties. The Marcus Royster Plantation, the largest remaining in the area, is situated on 3,070 acres. Other examples include the Red Hill Plantation (restored), Puckett Family Farm, Rose Hill, and Sycamore Valley. The City of Oxford is home to the Oxford Historic District, which includes municipal buildings such as the county court house (NRHP, 2014).

Warren County has 25 historic landmarks, which include 21 buildings, one historic district, two sites, and one structure. Many of the historic buildings in Warren County are private homes, churches, and municipal buildings that are noted for their architectural significance. The designation of the large Warrenton Historic District has encouraged economic development there. Additionally, the Hebron Methodist Church in Warrenton flourished during the 1800s, and today is a historic landmark (NRHP, 2014). Many restoration efforts have occurred, with Cherry Hill preserved as a cultural center. A walking tour guide was also developed for Warrenton to encourage heritage tourism (NCSHPO, 1999).

Franklin County has 46 historic landmarks, which include 40 buildings, 5 historic districts, and one site. The majority of historic landmarks are situated in the Town of Louisburg, which is the county seat, or the Town of Franklinton. Three of the historic districts are located within the Town of Louisburg: Louisburg Historic District, Dean Farm, and Cascine. The Louisburg Historic District includes the Williamson House, Main Building, and Louisburg College. The Williamson House was home to John H. Williamson, a slave who became a legislator and publisher after emancipation. The Town of Franklinton is home to the Franklin Depot, a historically recognized train depot dating back to the late 1800s. Some of the architecturally denoted homes in the rural areas of Franklin County date back to the 1750s. These include Locust Grove (Foster House) and the Monreath Building.

4.9 Air Quality

Air quality data are presented in detail for the service area only and data are not divided by basin, as these topography factors do not significantly influence air movement or quality in this area. Information regarding quality in the source basin outside of the service area can be obtained via the USEPA and individual state departments of air quality. Air quality may change significantly from the basin's headwaters to the coastal plain based on various land uses, weather patterns, and proximity to urban areas.

The Clean Air Act (CAA) and its associated amendments established NAAQS for six criteria pollutants: carbon monoxide (CO), lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide. The NAAQS established primary standards set at concentrations that protect human health, and secondary standards set to protect the public welfare, particularly vegetation, livestock, building materials, and other elements of the environment.

The North Carolina Division of Air Quality (NCDAQ) classifies Granville, Vance, and Warren Counties as its Northeastern Piedmont Area, while Franklin County is part of the Raleigh metropolitan area. In Granville County (Butner), a seasonal ozone monitor is in place (NCDAQ, 2013a). Ozone is not directly emitted, but is formed when sunlight reacts with volatile organic compounds (VOCs) and NOx and is a component of smog. This area is in attainment for ozone (USEPA, 2014).This more rural area is only monitored for ozone; it does not contain any facilities that emit lead above the level now required for monitoring under the 2008 lower lead limits set forth by the EPA.

A seasonal ozone monitor is also in place in Franklin County (Franklinton) as part of the Raleigh-Durham-Chapel Hill metropolitan area monitoring program (NCDAQ, 2013a). The area is in attainment for ozone (USEPA, 2014). Lead monitoring is currently not conducted in this area and the Raleigh area does not have a large facility that emits lead.

As part of the Raleigh-Durham-Chapel Hill metropolitan area, Franklin County has available Air Quality Index (AQI) data. EPA uses the AQI to report ambient air quality conditions, and the AQI includes the following range: good (green), moderate (yellow), unhealthy for sensitive groups (orange), unhealthy (red), to hazardous (purple). Table 4-34 indicates that, in the recent past, Wake County and surrounding areas have typically experienced good or moderate air quality during more than 90 percent of the year.

TABLE 4-34
Wake County Metropolitan Statistical Area (MSA) Air Quality Index Summaries from 2005 to 2011

Air Quality Index	2007		2008		2009		2010		2011	
	Days	Annual %	Days	Annual %	Days	Annual %	Days	Annual %	Days	Annual %
Good (Green)	207	56.7	229	62.6	289	79.2	242	66.3	257	70.4
Moderate (Yellow)	137	37.5	125	34.1	76	20.8	118	32.3	102	27.9
Unhealthy for Sensitive Groups (Orange)	21	5.8	11	3.0	0	--	5	1.4	6	1.6
Unhealthy (Red)	0	--	1	0.3	0	--	0	--	0	--
Hazardous (Purple)	0	--	0	--	0	--	0	--	0	--
Total	**365**	**100**	**366**	**100**	**365**	**100**	**365**	**100**	**365**	**100**

Source: USEPA, 2008; NCDAQ, 2009; NCDAQ, 2012a; NCDAQ, 2012b; NCDAQ, 2013a

4.10 Noise Level

Within the service area, noises are associated with development along the I-85, US 1, and US 401 corridors; rural agricultural activities; and residential activities. Noise levels are highest along traffic corridors, with lower noise levels in residential areas. Construction activities, which occur with development, are temporary. Land use within the service area is primarily agricultural and forested land, and noise is also associated with agricultural activities. Typical residential noise sources include lawn mowers, leaf blowers, and barking dogs. This noise is generally concentrated during daylight hours.

4.11 Forest Resources

Forest and agricultural resources encompass a majority of the service area among the counties of Vance, Warren, Granville, and Franklin. Table 4-35 shows the acres of related forest types in the service area. Additionally, the primary land use along the river is forested and includes some NHPNAs. While available data are more than a decade old, this information still shows the relative relationships between herbaceous

(mainly managed agriculture) and forested cover, and shows the prevalence of bottomland hardwood forest.

The most common forest type in the service area is Southern yellow pine. This forest type includes longleaf, shortleaf, loblolly, and slash pine trees. Southern yellow pine forests are often managed for logging activities. These pine forests are resistant to fire. Upland hardwood forests in the area are likely to include a diversity of canopy (mainly oaks, sycamore, maples, beech, and poplar) and understory species (dogwood, holly, and viburnum). Many hardwood forests also may include pines, especially if some disturbance has occurred. Herbaceous vegetation on the forest floor includes various herbs, wildflowers, ferns. Vines including smilax species, poison ivy, and creeper also stretch from the forest floor into the canopy (Schafale and Weakley, 1990).

TABLE 4-35
Forest Resources within the Service Area

Forest Type	Vance County (Acres)	Warren County (Acres)	Granville County (Acres)	Franklin County (Acres) [a]
Managed Herbaceous Cover	9,965	15,097	33,944	21,820
Unmanaged Herbaceous Cover - Upland	107	1971	552	7
Unmanaged Herbaceous Cover - Wetland	0	8	11	6
Evergreen Shrubland	26,707	47,964	37,033	56,802
Deciduous Shrubland	1,696	5,798	3,503	4,513
Mixed Shrubland	1,349	3,354	2,715	1,823
Mixed Upland Hardwoods	27,103	31,957	93,542	30,821
Bottomland Forest/Hardwood Swamp	18,576	33,849	35,797	42,635
Southern Yellow Pine	35,613	90,222	72,095	82,381
Other Needleleaf Evergreen Forest	0		11	0
Broadleaf Evergreen Forest	0	0.00	18	0
Mixed Hardwoods/Conifers	12,8370	24,783	25,663	22,830
Oak/Gum/Cypress	24	0	259	4

Source: ESC, 1997
[a] Franklin County population has grown since these data were developed; thus forested acres may be overestimated.

4.12 Shellfish or Fish and Their Habitats

Specific regulations exist at the state and federal levels to protect endangered and threatened species and their habitats from impacts due to public or private projects and land-disturbing activities. The primary law that protects sensitive wildlife species is the federal Endangered Species Act (ESA) of 1973. The North Carolina Endangered Species Act (North Carolina General Statutes [NCGS] 113-331-350) and Virginia Endangered Species Act **(**VA ST §§ 29.1-563 – 570) also protect listed species.

4.12.1 Federally Listed Threatened and Endangered Aquatic Species

Source Basin – Roanoke (Virginia Portion)

Table 4-36 contains a list of aquatic federally listed species known to occur within the Roanoke River basin, the source basin. These species were listed and described by the United States Fish and Wildlife Service

(USFWS, 2014a) and the Virginia Natural Heritage Program (VDCR, 2014). Six aquatic species are federally listed and of these, three are listed as a federal species of concern (FSC). Species found in North Carolina's portion of the Roanoke River basin are also presented in the following section so that all species within the service area are presented holistically.

TABLE 4-36
Federally Listed Aquatic Species within the Virginia Portion of the Roanoke River Basin

Common Name	Scientific Name	Federal Status	Subbasin(s) [a]
Vertebrates			
Orangefin Madtom	Noturus gilberti	FSC	Upper Roanoke, Middle Roanoke, Upper Dan
Roanoke Logperch	Percina rex	E	Upper Roanoke, Upper Dan
Bog Turtle	Glyptemys muhlenbergii	T	Upper Dan
Invertebrates			
Atlantic Pigtoe	Fusconaia masoni	FSC	Lower Dan
James Spinymussel	Pleurobema collina	E	Upper Dan
Virginia Stonefly	Acroneuria kosztarabi	FSC	Upper Roanoke

Source: VDCR, 2014

[a] Subbasin defined according to the Virginia Department of Conservation & Recreation Natural Heritage Database

E = Listed Endangered

T = Listed Threatened

FSC = Federal Species of Concern

Roanoke Logperch

Of the aquatic vertebrate species listed, only the Roanoke logperch is endemic to Virginia. One record is present in North Carolina, just inside the state line (Virginia Polytechnic University, 2010). This fish is found in only a few watersheds and therefore is inherently lower in population numbers and more likely to suffer from impacts such as habitat loss and water quality degradation. Large impoundments in the Roanoke River basin have contributed significantly to the decline of this species. Preferring clear water, this insectivore flips over gravel with its snout to locate food and lays eggs in gravel runs (USFWS, 2003). During its typical reproduction window from March 15 to June 30, construction is not permitted in the river and tributaries where the small fish resides. A recovery plan was prepared and approved by USFWS in 1992; however, critical habitat has not been established.

Southern Bog Turtle

The Southern bog turtle population, ranging from Virginia to Georgia, receives protections which ban collection and interstate trading of the turtles. However, there are no restrictions on land management activities associated with Southern bog turtle habitats (USFWS, 2).

James Spinymussel

The James spinymussel inhabits the Upper Dan basin, which straddles Virginia and North Carolina. The primary cause of the species decline was habitat loss or modification. Therefore, the James spinymussel would likely suffer from impacts associated with habitat loss and water quality degradation (USFWS, 2014b; NCWRC, 2014).

4.12.1.1 Receiving Basins – Tar River, Fishing Creek, and Neuse River

Table 4-37 contains a list of aquatic federally listed species known to occur within the service area including in the Roanoke River basin, as described by USFWS and the NCNHP. Thirteen aquatic species are federally listed and of these, 11 are listed as FSC.

TABLE 4-37
Federally Listed Aquatic Species within the Service Area

Common Name	Scientific Name	Federal Status	Watershed (Roanoke, Tar, Neuse)	County [a]	County Status [a]
Vertebrates					
American Eel	*Anguilla rostrata*	FSC	All [a]	Franklin, Granville, Vance, Warren	Current
Carolina Darter	*Etheostoma collis lepidinion*	FSC	Neuse, Tar [b]	Granville, Vance	Current
Carolina Madtom	*Noturus furiosus*	FSC	Tar, Neuse [c]	Franklin, Granville, Vance	Current
Neuse River Waterdog	*Necturus volucellus*	FSC	Neuse, Tar [b]	Franklin, Vance, Warren	Current
Pinewoods Shiner	*Lythrurus matutinus*	FSC	Neuse, Tar [c]	Franklin, Granville, Vance, Warren	Obscure
Roanoke Bass	*Ambloplites cavifrons*	FSC	All [c]	Franklin, Granville, Warren	Current
Invertebrates					
Atlantic Pigtoe	*Fusconaia masoni*	FSC	All [c]	Franklin, Granville, Warren	Current
Brook Floater	*Alasmidonta varicosa*	FSC	Roanoke [c]	Granville	Current
Chowanoke Crayfish	*Orconectes virginiensis*	FSC	Roanoke [a]	Granville	Current
Dwarf Wedgemussel	*Alasmidonta heterodon*	E	Tar [c]	Franklin, Granville, Vance, Warren	Current
Green Floater	*Lasmigona subviridis*	FSC	Tar [c]	Granville	Current
Mountain River Cruiser	*Macromia margarita*	FSC	All	Franklin, Granville	Current
Tar River Spinymussel	*Elliptio steinstansana*	E	Tar, Neuse [c]	Franklin, Warren	Current
Yellow Lampmussel	*Lampsilis cariosa*	FSC	Tar [c]	Franklin, Granville, Vance	Current
Yellow Lance	*Elliptio lanceolata*	FSC	Tar [c]	Franklin, Granville, Vance, Warren	Current

[a] USFWS, 2014a
[b] NCNHP, 2014
[c] NCWRC, 2014

E = Endangered
FSC = Federal Species of Concern

Of the aquatic fish species listed, two are endemic to North Carolina: the Carolina madtom and the pinewoods shiner. These fish are found in only a few watersheds and therefore are inherently lower in population numbers and more likely to suffer from impacts such as habitat loss and water quality

degradation. Others have wider distribution ranges along the east coast, with the American eel being a catadromous species, also occupying oceanic waters for a portion of its life cycle.

Two federally listed endangered aquatic invertebrate species have known populations within the service area and in the Tar River portion of the study area, the dwarf wedgemussel and the Tar River spinymussel.

Dwarf Wedgemussel

Dwarf wedgemussel populations are located in the Tar River basin in all counties (Franklin, Granville, Vance, and Warren) (NCWRC, 2009). This species is also found in the Neuse River basin, but its populations have dwindled there due to habitat loss. The dwarf wedgemussel's shell rarely exceeds 1.5 inches in length. It is also the only North American freshwater mussel that has two lateral teeth on the right valve, but only one on the left. The dwarf wedgemussel inhabits creek and river areas with slow to moderate currents, which must be nearly silt-free and have well established wooded buffers (NCWRC, 2014). The dwarf wedgemussel does not have a designated critical habitat (USFWS, 2008).

Tar River Spinymusssel

Known Tar River spinymussel populations are located in the Tar River watershed in Franklin, Nash, and Edgecombe Counties and to a lesser extent in the Neuse River basin. The Tar River spinymussel's shell rarely exceeds 2.5 inches in length; this species has one or two rows of distinctive spines on each valve. It prefers fast-flowing stream habitats with unconsolidated bottoms of coarse sand and gravel and well established wooded buffers. The water must be nearly silt-free and well-oxygenated (NCWRC, 2009). No critical habitat rules have been published for the Tar River spinymussel. However, the species' Recovery Action Plan is currently undergoing a 5-year review (initiated in 2009) (USFWS, 2011).

4.12.2 Aquatic Natural Areas

A full list of NHPNAs within the source and receiving basins is included in Appendix C.

4.12.2.1 Source Basin – Roanoke River

Two aquatic NHPNAs are present within the portion of the Roanoke River basin in the service area, Aarons Creek and Little Grassy Creek. Both are located in the northern portion of Granville County and flow north towards the Roanoke River. Within the Roanoke River basin in North Carolina, 10 NHPNAs are present.

4.12.2.2 Receiving Basin – Tar River

The majority of the listed freshwater mussel species known to occur within the service area and study area are in the Tar River basin (Table 4-38) and as a result, the NHP has designated a significant amount of aquatic natural areas in the basin. Its smaller watersheds and the main stem of the Tar River are home to a diversity of mussel species. As such, these areas have been designated as aquatic NHPNAs.

TABLE 4-38
Aquatic Natural Areas within the Upper Tar River Subbasin

Aquatic Habitat Name	County
Cedar Creek	Franklin
Crooked Creek (Franklin)	Franklin
Cub Creek	Granville
Fox Creek	Granville
Middle Tar River	Franklin, Granville, Vance
North Fork (Tar River)	Granville
Ruin Creek/Tabbs Creek	Vance

TABLE 4-38
Aquatic Natural Areas within the Upper Tar River Subbasin

Aquatic Habitat Name	County
Shelton Creek	Granville
Swift Creek (Vance/Warren/Franklin/Nash/Edgecombe)	Franklin, Vance, Warren
Upper Tar River	Granville

Source: NCNHP, 2014

4.12.2.3 Receiving Basin – Fishing Creek

Most of the creeks that comprise the Fishing Creek subbasin are designated as aquatic NHPNAs for their freshwater mussel habitat. Table 4-39 lists the aquatic NHPNA habitats.

TABLE 4-39
Aquatic Natural Areas within the Fishing Creek Subbasin

Aquatic Habitat Name	County
Fishing Creek	Franklin, Warren
Little Fishing Creek	Warren
Reedy Creek	Warren
Little Shocco Creek	Franklin, Warren
Shocco Creek	Franklin, Warren

Source: NCNHP, 2014

4.12.2.4 Receiving Basin – Neuse River

The eastern tributaries to Falls Lake are not designated as NHPNAs.

4.12.3 Common Aquatic Species and Habitats

A diversity of fishes and freshwater mussels, in addition to the federally listed species described in the previous section, are present in the watersheds of the Roanoke and Tar River basins.

4.12.3.1 Source Basin – Roanoke River

The run of river from Leesville Dam to Kerr Lake offers diverse fishing opportunities, as do water bodies on the Roanoke River. The upstream area between Leesville Dam and Brookneal has excellent habitat for smallmouth bass and walleye. Channel catfish and flathead catfish also inhabit this portion of the river (VDGIF, 2010).

The lower section of the Roanoke River (downstream of Brookneal to Kerr Lake) has a lower gradient. Smallmouth, largemouth, and spotted bass are found here but in lower numbers than in the upper portion of the river. Catfish are also abundant. In spring, there is a thriving striped bass fishery.

Kerr Lake is managed for fisheries cooperatively by the VDGIF and the NCWRC. A diverse sport fishery adds to the recreational value of Kerr Lake. These fishes can be supported only by an overall healthy native fish community structure. Striped bass and other bass species are the main sport fish species, while crappie and catfish are also of recreational interest. Striped bass reproduce naturally in the reservoir, supported by

annual stocking of over 350,000 fish (Virginia Outdoors, 2010). Of the catfish species native to the reservoir, the blue catfish grows the largest.

In the North Carolina portion of the Roanoke River basin, the Wildlife Action Plan lists 36 priority aquatic species: 23 fishes, 12 mussels, and 1 crayfish (NCWRC, 2005a). The Roanoke River supports important fish communities, including striped bass, river herring, and hickory shad. These species have provided opportunities for highly popular sport fisheries to flourish in the Roanoke River basin, resulting in economic value being placed on particular fish species and aquatic habitat. Downstream of the Roanoke River impoundments in the Coastal Plain, the river is heavily used by anadromous fishes and the American eel (NCWRC, 2005a). Anadromous fish spawning season is protected via specific flow regimes required at the Roanoke Rapids dam. See Section 4.1.3 and Table 4-40 for specific details on fish spawning flow regimes.

4.12.3.2 Receiving Basins – Tar River and Fishing Creek

Common species are similar in the Tar River and Fishing Creek basins of the service area. Information regarding this area is typically discussed in the context of the greater Tar-Pamlico River basin, as is done in this section. The 2005 Wildlife Action Plan (NCWRC, 2005a) lists 40 priority aquatic species in the Tar-Pamlico River basin: 21 fish, 17 mussels, and 2 crayfish. Many of these species are found above the fall line (majority of study area), while some are more likely to be found below the fall line in the Coastal Plain. The Tar River basin provides extensive fisheries habitats, which support important economic activities throughout the basin. The Tar River is home to various anadromous fish species, such as striped bass, American shad, and river herring.

Habitat loss and water quality degradation are the primary causes of the decline in freshwater mussel populations in these watersheds. Clearing for agriculture and other uses has increased siltation in their habitats. In addition, pollution sources such as septic systems, poultry and swine facilities, industries, and other domestic sources have altered water quality and habitat conditions. These species evolved in clean, flowing water and have more limited survival rates in the water conditions found today. Management strategies to protect freshwater mussel populations include protection and establishment of vegetated stream buffers and preservation and restoration of high water quality and aquatic habitats (NCNHP, 2009b).

4.13 Wildlife and Natural Vegetation

This section identifies the federally listed species of concern, threatened, and endangered terrestrial species and habitats within or near the study area. A summary of terrestrial species and habitat types common to the study area is also provided.

4.13.1 Federally Listed Threatened and Endangered Species

4.13.1.1 Source Basin – Roanoke River

Table 4-40 contains a list of federally listed terrestrial species known to occur within the Roanoke River basin in Virginia, as described by the Virginia Natural Heritage Program (VDCR, 2014).

TABLE 4-40
Federally Listed Terrestrial Species within the Virginia Portion of the Roanoke River Basin

Common Name	Scientific Name	Federal Status	Subbasin(s) [a]
Vertebrates			
Bald Eagle	*Haliaeetus leucocephalus*	BGPA	All
Peaks of Otter Salamander	*Plethodon hubrichti*	FSC	Upper Roanoke
Invertebrates			
A Cave Springtail	*Pseudosinella bona*	FSC	Upper Roanoke

TABLE 4-40
Federally Listed Terrestrial Species within the Virginia Portion of the Roanoke River Basin

Common Name	Scientific Name	Federal Status	Subbasin(s) [a]
Spirit Supercoil	*Paravitrea hera*	FSC	Upper Roanoke
Ellett Valley Cave Beetle	*Pseudanophthalmus pusio*	FSC	Upper Roanoke
Ellett Valley Pseudotremia Millipede	*Pseudotremia cavernarum*	FSC	Upper Roanoke
Plants			
Keever's Bristle-moss	*Orthotrichum keeverae*	FSC	Upper Roanoke
Addison's Leatherflower	*Clematis addisonii*	FSC	Upper Roanoke
Canby's Mountain-lover	*Paxistima canbyi*	FSC	Upper Roanoke
Piedmont Fameflower	*Phemeranthus piedmontanus*	FSC	Upper Roanoke
Roan Mountain Sedge	*Carex roanensis*	FSC	Upper Dan
Small Whorled Pogonia	*Isotria medeoloides*	T	Upper Roanoke
Small-anthered Bittercress	*Cardamine micranthera*	E	Upper Dan
Smooth Coneflower	*Echinacea laevigata*	E	Upper Roanoke, Middle Roanoke
Sword-leaved Phlox	*Phlox buckleyi*	FSC	Upper Roanoke
Tall Barbara's-buttons	*Marshallia legrandii*	FSC	Middle Roanoke
Torrey's Mountain-mint	*Pycnanthemum torrei*	FSC	Upper Roanoke, Middle Roanoke
Virginia Quillwort	*Isoetes virginica*	FSC	Banister
Winter Quillwort	*Isoetes hyemalis*	FSC	Middle Roanoke
Yadkin hedge-nettle	*Stachys matthewsii*	FSC	Middle Roanoke

Source: VDCR, 2014
[a] Subbasin defined according to the Virginia Department of Conservation & Recreation Natural Heritage Database
E = Listed Endangered
T = Listed Threatened
FSC = Federal Species of Concern
BGPA = Bald and Golden Eagle Protection Act

In the Virginia portion of the Roanoke River basin, 20 terrestrial species are federally listed and of these, 16 are listed as FSC. Two species, the smooth coneflower and small-anthered bittercress, are federally listed as endangered, while one, the small whorled pogonia, is federally listed as threatened. The bald eagle (*Haliaeetus leucocephalus*) is now protected by the Bald and Golden Eagle Protection Act of 2007. These four species are further described below.

Smooth Coneflower

Smooth coneflower is a federally listed endangered vascular plant. This herb grows to 5 feet in height. The flowering portion of the herb is typically light pink to purple in coloration. Flowering occurs from late May through July. The plant requires open space with abundant sunlight and little competition. Additionally, periodic disturbances from wild fires or other events reduce shade and competition from other plants. Today, this species is most likely to be found along roadways or utility ROWs since these areas are frequently disturbed (mowed) for maintenance reasons.

Small-anthered Bittercress

Small-anthered bittercress is a small perennial herb, which is listed as endangered. This species is native to small streamside seeps, sandbars, and stream banks of the Dan River basin. The existing populations are very small, containing less than six plants. Additionally, many are close to pastures and fields, increasing their vulnerability to erosion and pesticides.

Small Whorled Pogonia

Small whorled pogonia is federally listed as threatened and is a member of the orchid family. The plant produces a smooth, hollow stem from 2 to 14 inches tall and the top of plant has a five- to six-leaf circular arrangement. The plant produces one or two flowers and the leaves are milk-green to grayish-green, while the flower is yellowish-green in color. This plant is most vulnerable to habitat destruction, due mostly to residential and commercial development.

Bald Eagle

The bald eagle has been delisted because of recent recovery of the species and is now protected by the Bald and Golden Eagle Protection Act of 2007 (USFWS, 2014a). The bald eagle is a large raptor and is recognized by the characteristic white head of an adult. Nests are often constructed near water and can measure up to 6 feet in diameter. Nests are reused by the same pair year after year. Bald eagles primarily feed on fish, but can consume other small animals including frogs, smaller birds, and turtles. The recovery of this species is largely due to the banning of harmful pesticides, including dichlorodipenyltrichloroethane (DDT).

4.13.1.2 Receiving Basins – Tar River, Fishing Creek, and Neuse River

Table 4-41 presents a list of terrestrial federally listed species known to occur within the service area (USFWS, 2014a; NCNHP, 2014). Because many of these terrestrial species (such as the bald eagle) are highly mobile, data are presented at the county level.

TABLE 4-41
Federally Listed Terrestrial Species within the Service Area

Common Name	Scientific Name	Federal Status	County	County Status
Vertebrates				
Bachman's Sparrow	*Aimophila aestivalis*	FSC	Warren	Current
Bald Eagle	*Haliaeetus leucocephalus*	BGPA	Vance, Granville, Warren	Current
Northern Long-eared Bat	*Myotis septentrionalis*	P	Granville	Current
Plants				
Butner's Barbara's-buttons	*Marshallia legrandii*	FSC	Granville	Current
Buttercup Phacelia	*Phacelia covillei*	FSC	Franklin, Vance	Current
Carolina Birdfoot-trefoil	*Acmispon helleri*	FSC	Granville	Current
Harperella	*Ptilimnium nodosum*	E	Granville	Current
Michaux's Sumac	*Rhus michauxii*	E	Franklin	Current
Oak Barrens Barbara’s buttons	*Mashallia legrandii*	FSC	Granville	Current
Smooth Coneflower	*Echinacea laevigata*	E	Granville	Current
Tall Larkspur	*Delphinium exaltatum*	FSC	Granville	Current
Prairie Birdsfoot-trefoil	*Lotus unifoliolatus var. helleri*	FSC	Granville/Warren	Current/Historic

TABLE 4-41
Federally Listed Terrestrial Species within the Service Area

Common Name	Scientific Name	Federal Status	County	County Status

Source: USFWS, 2014a; NCNHP, 2014
E = Endangered
FSC = Federal Species of Concern
P = Proposed
BGPA = Bald and Golden Eagle Protection Act

Twelve terrestrial species are federally listed in the service area and of these, seven are listed as FSC. Three species, the smooth coneflower, Michaux's sumac (*Rhus michauxii*), and harperella (*Ptilimnium nodosum*), are federally listed as endangered, while one, the bald eagle, is now protected by the Bald and Golden Eagle Protection Act of 2007. These four species are further described below. One species has been listed as proposed, the northern long-eared bat (*Myotis septentrionalis).*

Smooth Coneflower

This species is discussed earlier in this Section.

Michaux's Sumac

Michaux's sumac is an upland terrestrial vascular plant that is federally endangered. This shrub grows to between 1 and 3 feet tall and flowers between June and July. Most plants are unisexual, and reproductive capacity is low. This may partly explain the plant's rarity. Typical habitat includes sandy or rocky open woods with basic soils. Repeated disturbance is necessary to provide open areas for this plant to be successful. Remaining populations are found along maintained roadway ROWs and areas managed with frequent fires. Threats to remaining populations include habitat loss due to development and fire suppression.

Harperella

Harperella is a federally endangered vascular plant that grows to a height of 6 to 36 inches beginning in late June or July and continuing until frost. The leaves are reduced to hollow, quill-like structures. The small, white flowers occur in heads, or umbels, that are similar to those of Queen Anne's lace (*Daucus carota*). This plant is relatively prolific and large numbers may occur within each population, especially along rivers. Harperella is noted along the Tar River in Granville County.

4.13.2 Natural Vegetation & Common Wildlife

4.13.2.1 Source Basin – Roanoke River

The Virginia portion of the Roanoke River basin is within the Piedmont Plateau and supports diverse plants and wildlife. Natural vegetation along waterways includes mesophytic forests, commonly found on ravines and river slopes. Additionally, forests of silver maple, sycamore, American elm, boxelder, and other flood-tolerant trees are present in areas along larger rivers in the Roanoke River basin. Common aquatic species found within the flowing water of the Roanoke River include grass-leaf mud-plantain, American eel-grass, pondweeds, waterweeds, and water nymphs. The horn-leaf riverweed is often rooted on shallowly submerged boulders and rock outcrops. Shoreline eddies and pools support mats of floating duckweeds, duckmeats, and Carolina mosquito-fern. As the basin extends into North Carolina, natural communities associated with mountains are present, including Canada hemlock forest, rich cove forest, low elevation rocky summit, spray cliff, and Carolina hemlock bluff.

North Carolina's portion of the Roanoke River basin has healthy populations of white-tailed deer, black bear, and wild turkey. Wild turkey, a game species, has increased in population following efforts by the NCWRC. Populations are present in all counties of the basin, totaling more than 150,000 birds. Populations in Vance,

Granville, and Warren Counties are well established, while fewer birds are present in Franklin County. This is likely due to Franklin County being more developed and having a higher human population density than counties to its north (NCWRC, 2005a; NCWRC, 2005b).

The Roanoke River downstream of its impoundments and within the Coastal Plain is bordered by extensive, diverse floodplain forests: the largest intact bottomland hardwood swamp forest east of the Mississippi (Roanoke River Partners, 2011). Much of these bottomland hardwood and cypress forests are protected by The Nature Conservancy and as federal and state lands. Additionally, the Coastal Plain includes high quality wetland communities such as Coastal Plain bottomland hardwoods, cypress-gum swamps, and habitat types such as peat forests and pocosins, backwater swamps, and alluvial flats. Common wildlife in the Lower Roanoke riparian areas includes black bear, white-tailed deer, river otter, beaver, bald eagle, osprey, and great blue heron, as well as turtles and snakes (Roanoke River Partners, 2011).

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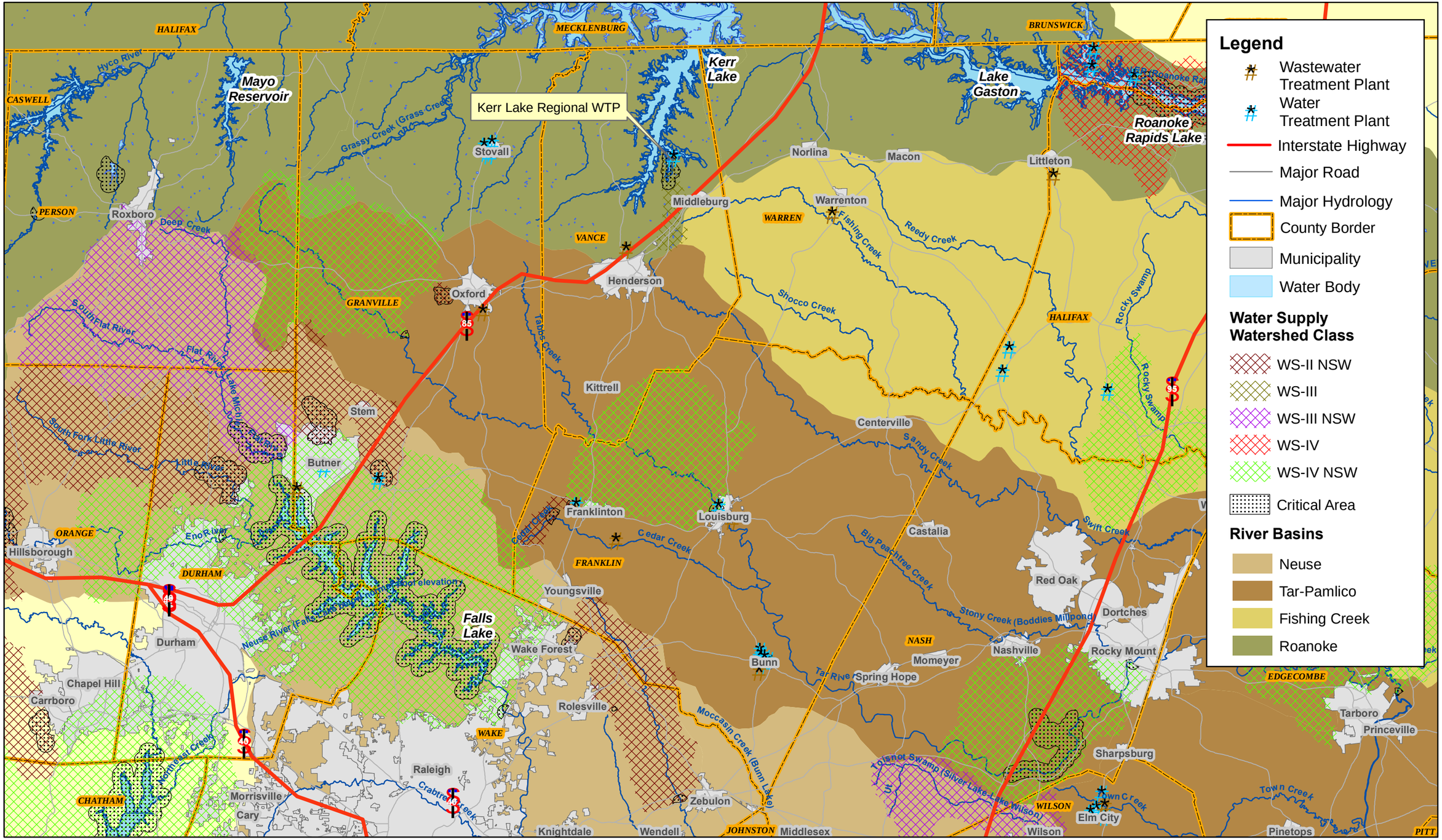

Figure 4-1
Interbasin Transfer from Roanoke River Basin
Water Supply Resources
Kerr Lake Regional Water System

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SECTION 5

Environmental Consequences/Predicted Environmental Effects of the Project

This section describes the environmental consequences and/or predicted environmental effects of the proposed water transfer from the Roanoke River basin to the Tar River, Neuse River, and Fishing Creek basins. The direct and secondary and cumulative effects of the water transfer are described within the context of the projected time frame for the transfer – through 2045. This section describes the impacts as follows:

- **Source Basin**, which describes the predicted environmental direct and SCI on the Roanoke River basin portion of the study area. These potential impacts focus on issues related the water withdrawal. No additional infrastructure would be constructed as part of this project. Impacts related to potential development (SCI) within the portions of the service area in Granville, Vance, and Warren Counties within the Roanoke River basin are discussed in the Receiving Basin section.
- **Receiving Basins**, which describe the predicted environmental direct and SCI impacts in the Tar River, Neuse River, and Fishing Creek basins and within the service area of the Partners. No additional infrastructure would be constructed as part of this project. The Neuse River basin is included in discussions with the Tar River basin, in that these areas within Franklin and Granville Counties would experience similar growth patterns. The portions of the study area within the Tar River and Fishing Creek downstream of the service area are also discussed due to increases in wastewater discharges in the basins and the potential for population growth in these watersheds.

For both **Source** and **Receiving Basins**, the direct and SCI consequences, if any, are described for each area studied. “Cumulative Effects” are defined in 15A NCAC 1C .0101(d)(2) as “resulting from the incremental impact of the proposed activity when added to other past, present, and reasonably foreseeable future activities regardless of what entities undertake such other activities.” “Indirect Effects” or secondary, are “caused by and result from the proposed activity although they are later in time or further removed in distance, but they are still reasonably foreseeable” (15A NCAC 1C .0101(d)(4)).

The data were gathered through literature reviews, internet searches, geographic information system (GIS) queries, phone conversations, letters, and meetings with various resource agencies.

The direct impacts discussion focuses mainly on the potential for impacts to water resources in the Roanoke River basin portion of the study area using a hydrological model. The SCI discussion provided in the following section reflects a general analysis of the potential for urbanization to impact specific resources in the receiving basin and service area, given current trends and literature records. Federal, state, and local programs that provide mitigation to offset SCI are discussed in Section 6.

Previous related projects, the USACE 2005 water storage allocation and the EA and associated FONSI for the KLRWS water treatment plant expansion, found that no significant SCI would result from the availability of additional water supply (Appendix B). The recommendations state “The reallocation of storage discussed in this report is economically justified and will not significantly impact the authorized purposes of Kerr Lake. The reallocation will not require any structural or operational change” (USACE, 2005).

5.1 Water Resources (Surface Water and Groundwater)

This section describes potential impacts to surface water and groundwater in the source and receiving basins.

5.1.1 Water Resources: Surface Water

Of the water withdrawn from Kerr Lake, a portion would be returned via treated wastewater discharge and a portion would be consumptively used in the Roanoke River basin, thus not representing a transfer. Projections for the balance of water movements are discussed in Section 2. The water transferred from the Roanoke River basin that then enters the receiving basins, the Tar-Pamlico River basin (Fishing Creek and Tar River basins) and the Neuse River basins, would be both consumptively used and discharged to streams as treated wastewater effluent.

5.1.1.1 Source Basin – Roanoke River

The projected average day withdrawal from Kerr Lake in 2045, approximately 16 mgd, is less than the allocated 20 mgd of water supply storage allocated to the Partners by the USACE. As part of the 2005 study in support of the water supply storage allocation, the USACE determined that this was the most reliable alternative for future water supply and that no significant impacts to the other USACE uses for Kerr Lake would occur.

Direct Impacts

Overview

Direct impacts to the Roanoke River basin from the increase in water transfer from the basin were evaluated by using the updated NCDWR Roanoke River Basin Hydrologic Model (RRBHM). Details of the application of this model and the results of analyses of a wide range of scenarios are included in Appendix D.

A hydrological model for a river basin can be used to assess changes in hydrological indicators for current and future conditions based on a time series of hydrological inputs to the basin. Key indicators that the model can estimate are river flows at various points within the river basin, reservoir water levels, and changes in hydroelectric power generation. These indicators can be used to evaluate and/or describe various potential environmental and economic impacts related to key issues identified during scoping for the EIS, as summarized in Appendix A. These potential impacts can be summarized as follows:

- Reduced water for downstream fisheries and recreation
- Inability of communities to obtain future water supply for growth
- Reduced lake property values from altered aesthetics or access related to lower water levels
- Impacts to recreation and tourism due to lower water levels
- Precedent setting, such that other communities could transfer water from the basin

All except the last of these potential impacts can be evaluated based on the results generated using the updated RRBHM. The last issue is a policy question for the EMC and NCDWR.

The updated RRBHM was used to evaluate changes in indicators for the following alternatives:

- 2010 Baseline –IBT is about 4.6 mgd
- 2045 Baseline – includes grandfathered IBT amount (10 mgd)
- 2045 IBT – IBT increases to 14.2 mgd

- 2060 Baseline - includes grandfathered IBT amount (10 mgd)
- 2060 IBT – IBT increases to 17.3 mgd

Each of these is discussed within the context of direct impact to water quantity and water quality in the following subsections.

Water Quantity

As noted above, river flows at various points within the river basin, reservoir water levels, and changes in hydroelectric power generation were selected as indicators to evaluate the impact of transfer using the updated RRBHM. This subsection will addresses changes based on the indicators of lake levels and stream flows, while hydropower effects are discussed in Section 5.1.3.

Proposed 2045 IBT

The proposed IBT is based on water demand and wastewater flow projections to 2045 as described in Section 2. The IBT from the Roanoke River basin in 2045 would be 14.2 mgd MDD and the average IBT would be 10.7 mgd (all receiving basins).

Lake Level

Lake levels were evaluated for each of the reservoirs in the Roanoke River basin for the period of record and specifically during periods of extreme drought. In evaluating this alternative, lake levels for three different bases of comparison were used:

- Lake levels during the modeling simulation period, 1930 through 2011, based on estimated water demands and returns during 2010 - referred to as the 2010 Baseline,
- Lake levels with all water demands in the basin projected to 2045 and with the KLRWS IBT capped at the grandfathered amount (10 mgd) - referred to as the 2045 Baseline
- Lake levels with all water demands in the basin projected to 2045 and with the KLRWS IBT at 14.2 mgd MDD - referred to as the 2045 IBT.

The detailed modeling analysis presented in Appendix D indicates that lake level estimates are fairly insensitive to changes in demand due to the large inflows from the watershed and volume of the reservoir. Changes to elevation are relatively insensitive even during drought periods but show the largest change due to overall increase in demand in comparing the 2010 to 2045 Baseline results.

Five sets of graphs are shown for Kerr Lake in Figures 5-1 to 5-5:

- Lake level during the model simulation period from 1930 through 2011
- Lake level during the most severe drought period during 2001-2002
- Close-up of lake level during extreme drought in 2002
- Lake level duration for the model simulation period from 1930 through 2011
- Lake level duration focused on the lowest 5 percent of the duration curve

Table 5-1 summarizes the average changes in elevation during the simulation period and during the two extreme drought periods in the 2000s for three reservoirs in the Roanoke system: Kerr Lake, Lake Gaston, and Roanoke Rapids Reservoir. None of the reservoirs showed a discernible difference in elevation between the 2045 baseline and IBT 2045 scenarios during the 2002 and 2007 droughts.

Kerr Lake was the only reservoir that showed any differences, albeit slight, during the exceptional drought periods. The model runs simulate the operation of the reservoirs based on the guide curves specified for each reservoir. This operational mode tends to maintain the reservoir level by regulating releases. For this reason, average lake elevation is usually the same for the different scenarios. In the case of the 2002 drought, Kerr Lake did show a slight difference in elevation of 0.2

feet. Because of the drought, the elevation falls below the guide curve, and the discharge is maintained at the same elevation for the IBT and non-IBT. This results in a slightly lower elevation in the IBT scenario.

TABLE 5-1
Lake Level Difference for Proposed 2045 IBT for Entire Simulation Period and during 2002 and 2007 Droughts

Scenario Comparison	Results (feet)	Roanoke River Reservoirs		
		Kerr	Gaston	Roanoke Rapids
2045 Baseline versus 2045 IBT	Average Baseline Elevation	299.8	200.0	132.0
	Average Elevation during 2002 Drought	284.8	200.0	132.0
	Average Difference with IBT during 2002 Drought	-0.2	0.0	0.0
	Average Elevation during 2007 Drought	284.6	200.0	132.0
	Average Difference with IBT during 2007 Drought	-0.1	0.0	0.0

Figures 5-1 to 5-5 illustrate the results for Kerr Lake for the Proposed 2045 IBT based on the updated RRBHM simulations. These simulations show little discernible differences between any of the three simulations depicted based on increased basin demands between 2010 and 2045 or the added influence of the IBT even during the 2002 drought (Figure 5-2) or in the lower end of the duration curve (Figure 5-5).

FIGURE 5-1
Lake level changes for Proposed 2045 IBT for Kerr Lake – entire simulation period.

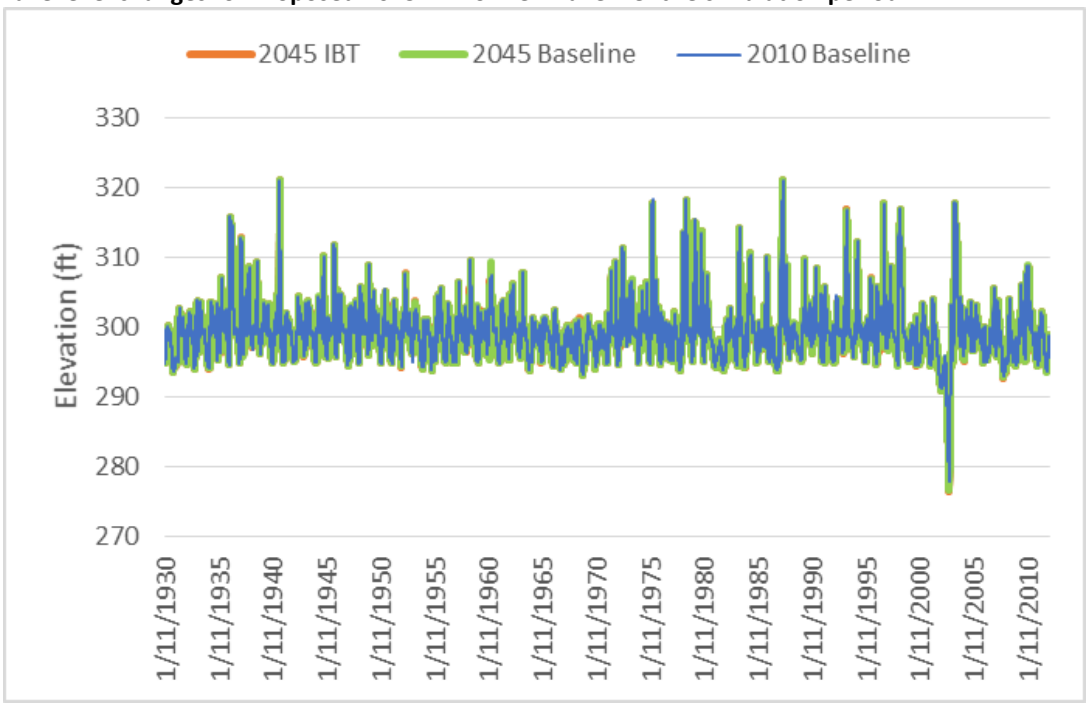


FIGURE 5-2
Lake level changes for Proposed 2045 IBT for Kerr Lake – during 2002 drought.

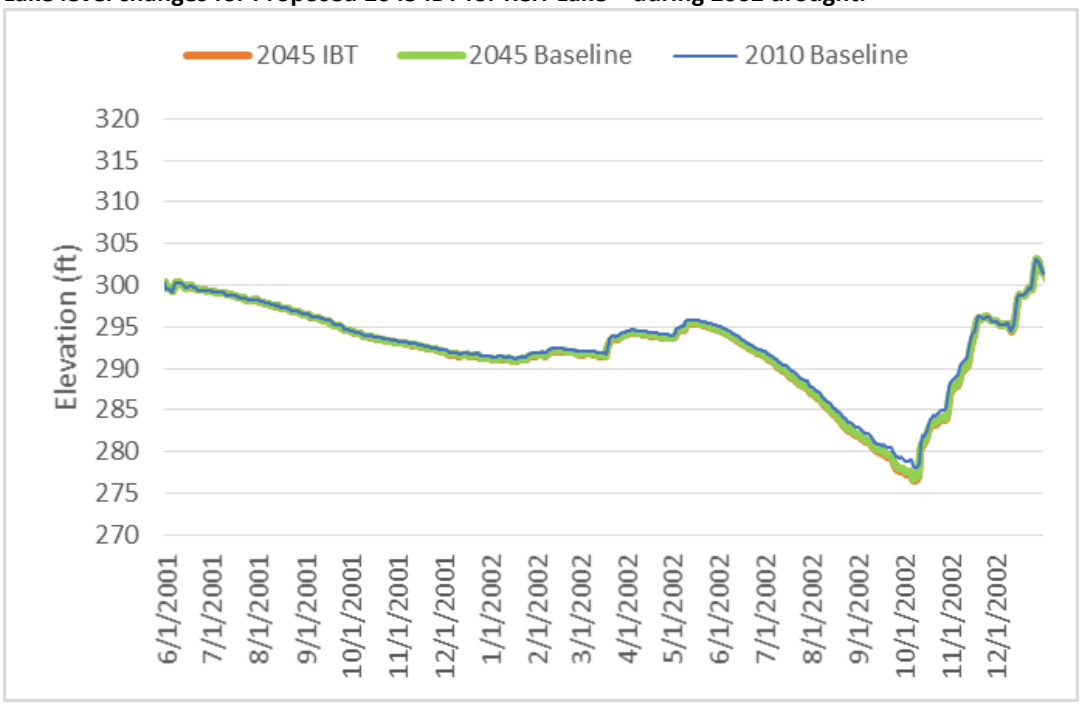


FIGURE 5-3
Lake level changes for Proposed 2045 IBT for Kerr Lake – 2002 drought close-up.

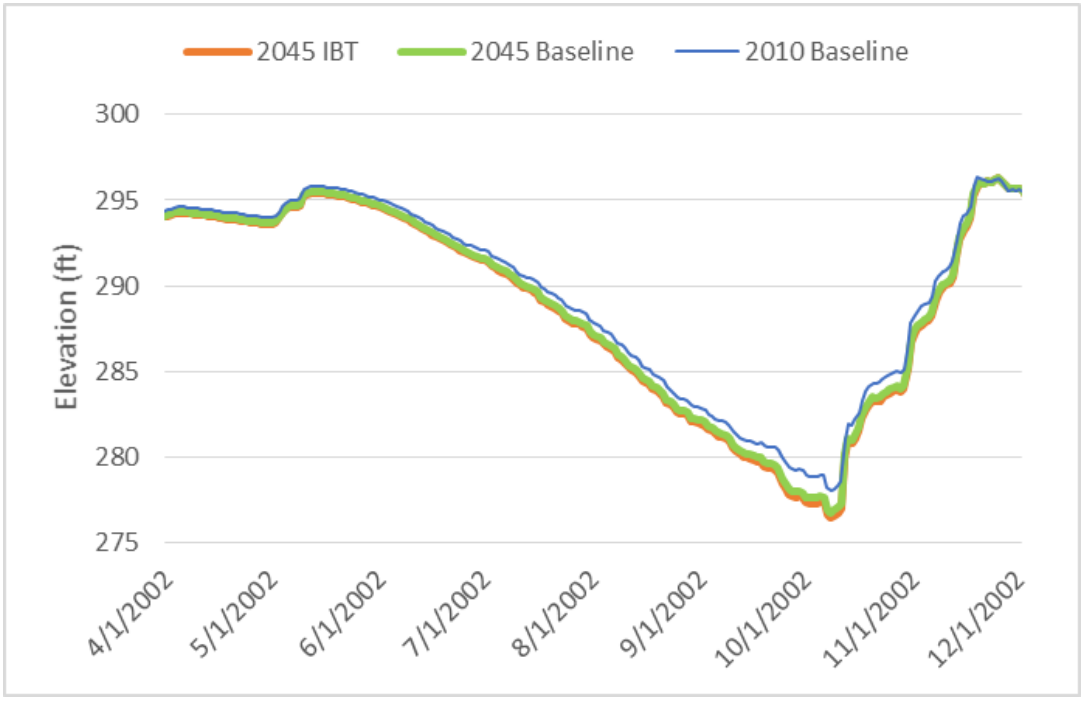


FIGURE 5-4
Lake level duration for Proposed 2045 IBT for Kerr Lake – entire simulation period.

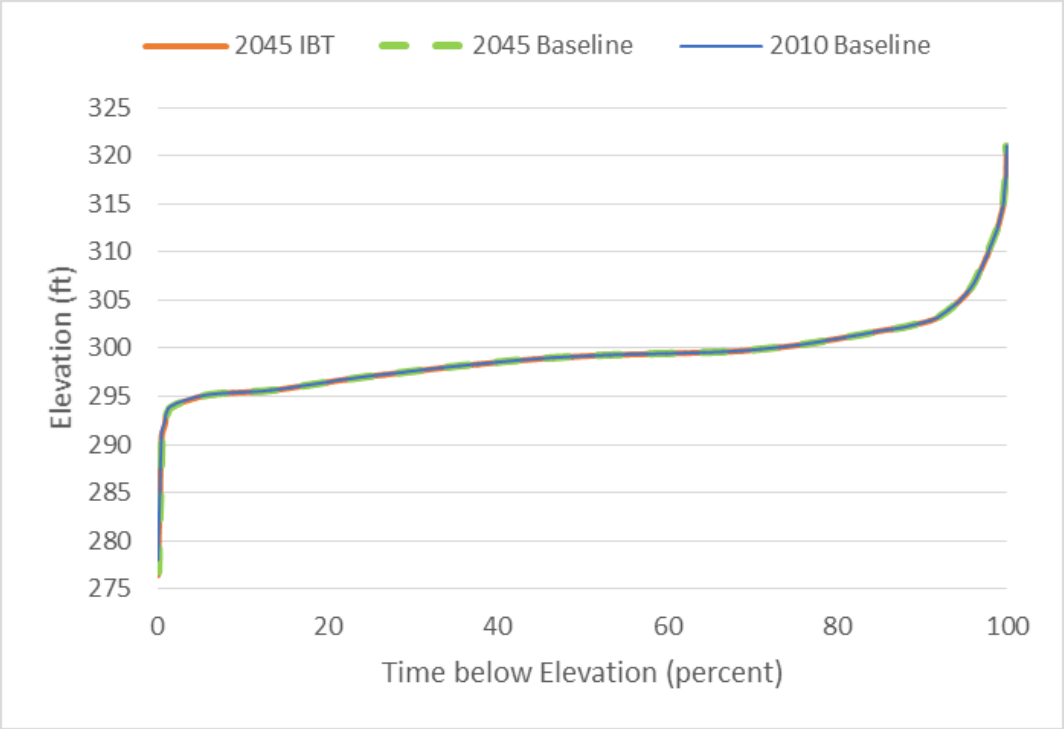
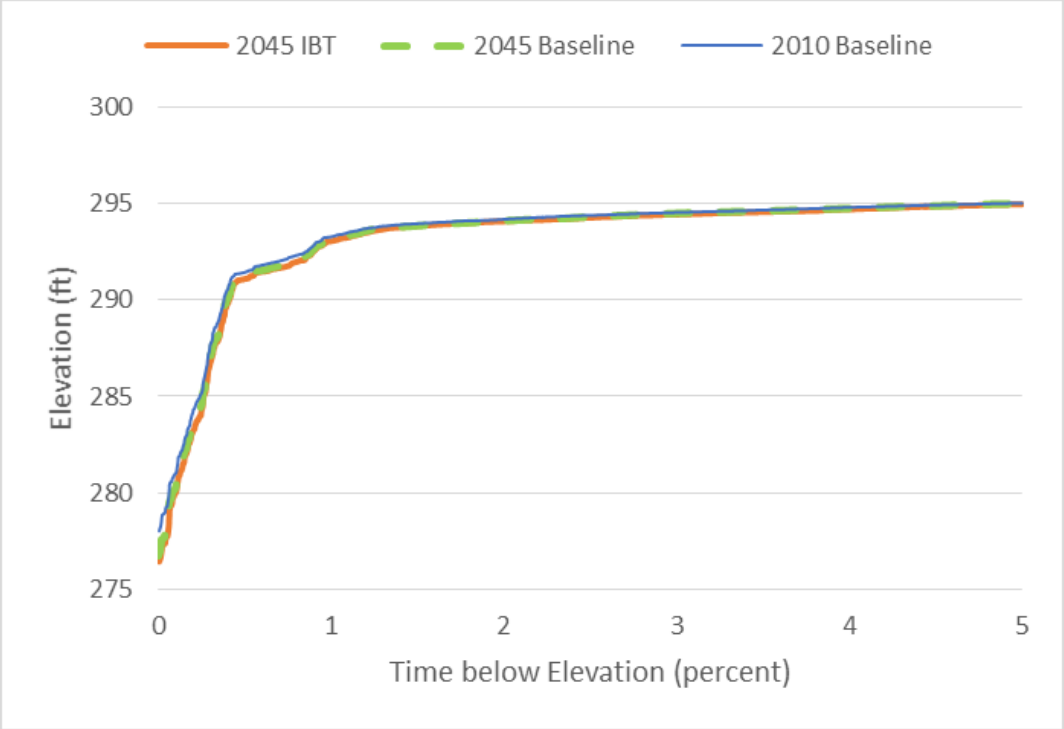


FIGURE 5-5
Lake level duration for Proposed 2045 IBT for Kerr Lake for entire simulation period – lowest 5 percent of duration curve



Moving downstream, due to the lack of major differences between the Proposed 2045 IBT, the 2045 Baseline and the 2010 baseline results, only two graphs are shown for Lake Gaston (Figures 5-6 to 5-7) and Roanoke Rapids Reservoir (Figures 5-8 to 5-9) including:

- Lake level during the most severe drought period during 2002 drought
- Lake level duration focused on the lowest 5 percent of the duration curve

These graphs show no discernible difference between the 2010 and 2045 Baseline conditions or the Proposed 2045 IBT, which is similar to the results summarized in Table 5-1.

FIGURE 5-6
Lake level changes for Proposed 2045 IBT for Lake Gaston – during severe 2002 drought

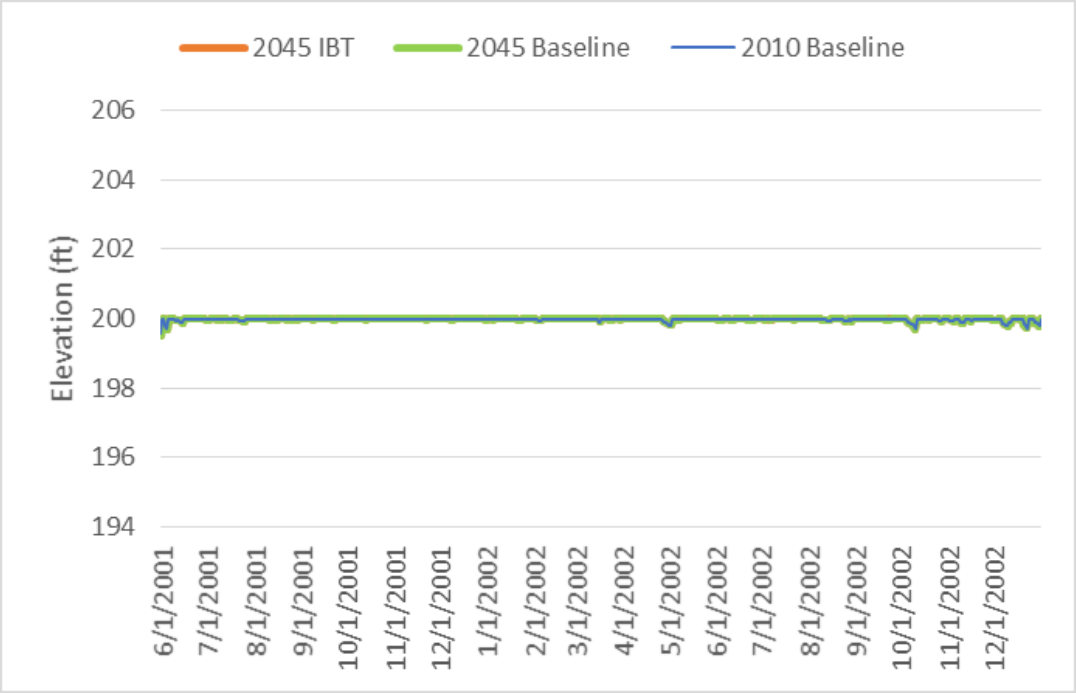


FIGURE 5-7
Lake level duration for Proposed 2045 IBT for Lake Gaston for entire simulation period – lowest 5 percent of duration curve

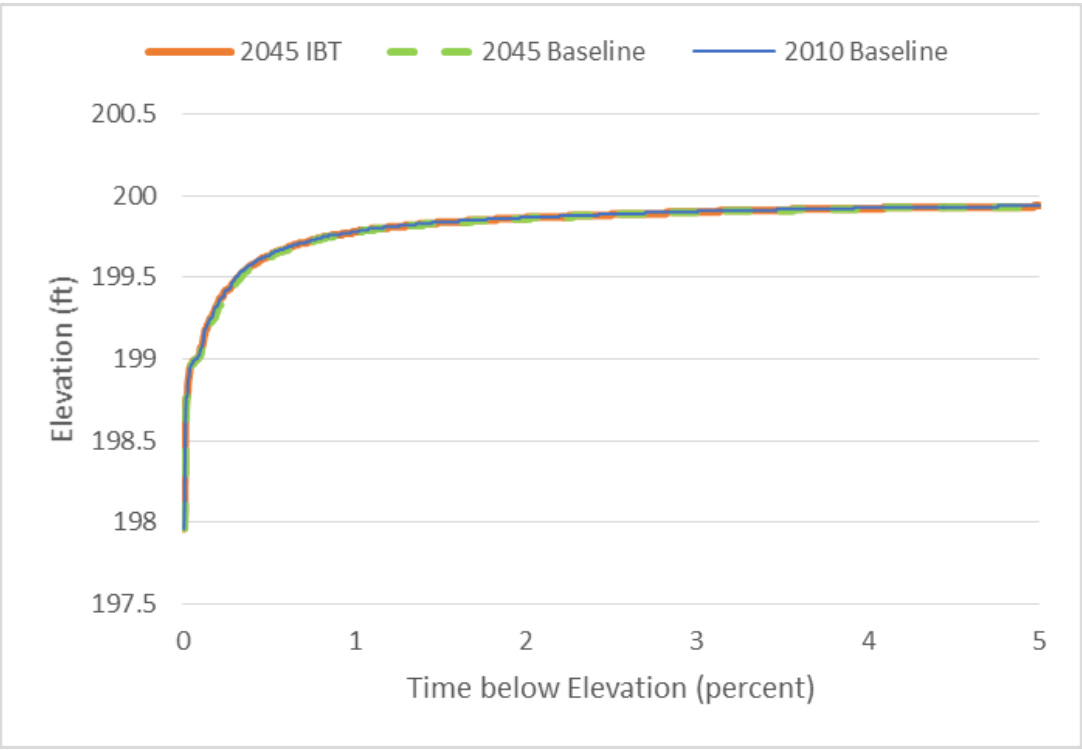


FIGURE 5-8
Lake level changes for Proposed 2045 IBT for Roanoke Rapids Reservoir – during severe 2002 drought

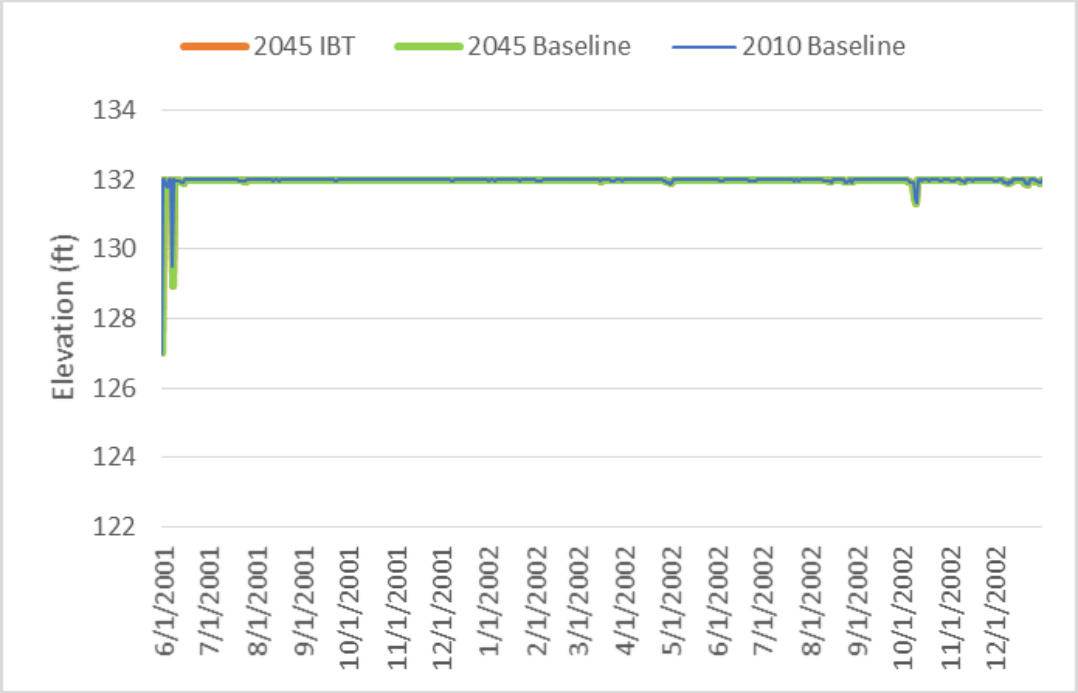
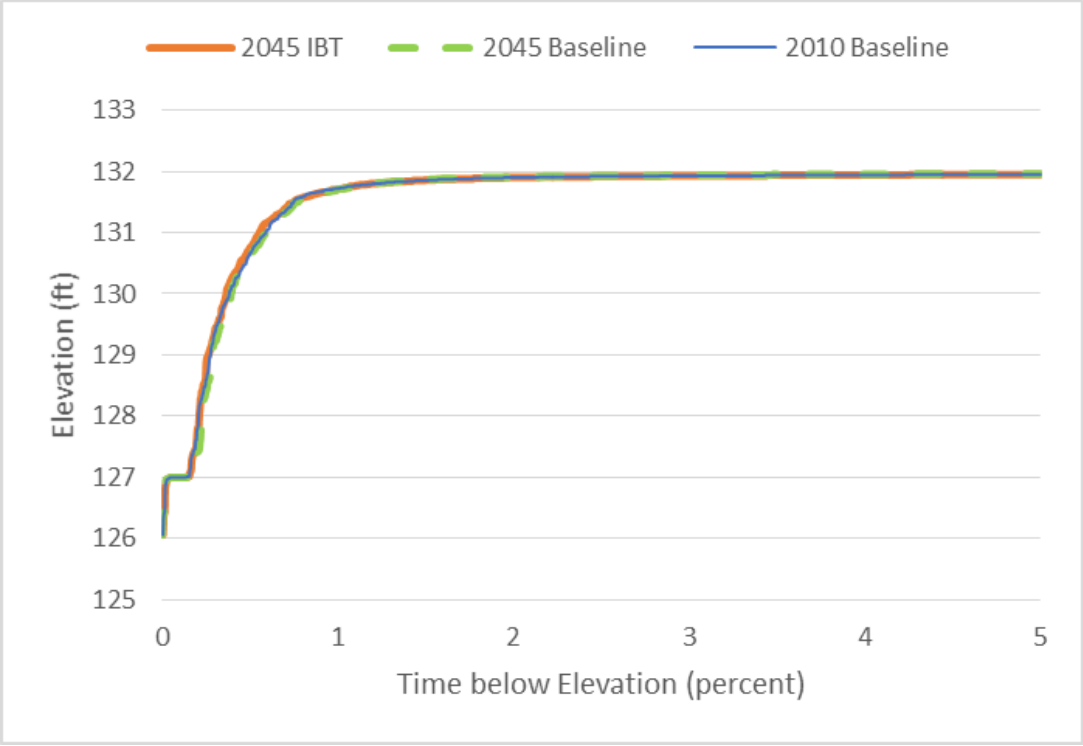


FIGURE 5-9
Lake level duration for Proposed 2045 IBT for Roanoke Rapids Reservoir for entire simulation period – lowest 5 percent of duration curve



Reservoir Release

Reservoir releases were also evaluated for each of the mainstem reservoirs in the Roanoke River basin for the period of record and during the period of extreme drought. As with lake level, there were no projected changes in releases for reservoirs upstream of Kerr Lake. Detailed results for these reservoirs are shown in Appendix D. Table 5-2 summarizes differences in water releases for three reservoirs in the system: Kerr Lake, Lake Gaston, and Roanoke Rapids Reservoir. Figures 5-10 through 5-13 show release results for Kerr Lake, while Figure 5-14 and 5-15 show results for Lake Gaston and Figures 5-16 and 5-17 show results for Roanoke Rapids Reservoir.

TABLE 5-2
Reservoir release differences for the entire simulation period and during the 2002 and 2007 droughts

Scenario Comparison	Results (cfs)	Roanoke River Reservoirs		
		Kerr	Gaston	Roanoke Rapids
2045 Baseline versus 2045 IBT	Average Baseline Discharge	7,443.5	7,888.8	7,491.5
	Average Discharge during 2002 Drought	3,077.3	3,247.8	2,921.0
	Average Difference during 2002 Drought	5.0	4.9	5.2
	Average Discharge during 2007 Drought	2,691.2	2,989.8	2,681.7
	Average Difference during 2007 Drought	-8.1	-8.1	-8.1

2002 Drought – 6/18/2002 through 10/15/2002
2007 Drought – 10/16/2007 through 3/10/2008

These modeling results indicate that most of the changes resulting from the IBT are predicted to occur as outflow from Kerr Lake. The average difference in release from Kerr Lake is approximately 5.0 mgd, which is less than the average IBT. Since the model is balancing water, this is likely due to very small changes in lake elevation predicted as a result of the IBT (less than 0.05 foot, which is rounded to 0.0 in Table 5-1). The reductions in release are predicted to be identical in Lake Gaston and Roanoke Rapids Reservoir to those occurring from Kerr Lake, indicating that the changes as a result of the IBT are occurring in outflow or storage in Kerr Lake. The actual changes in the flows as a result of the IBT are quite small, representing 0.07 percent on average and up to 0.30 percent during the 2007 drought. Predicted changes to inflows during the critical spring spawning periods on the Roanoke River are discussed in Section 5.12.

FIGURE 5-10
Reservoir releases for Proposed 2045 IBT for Kerr Lake – entire simulation period

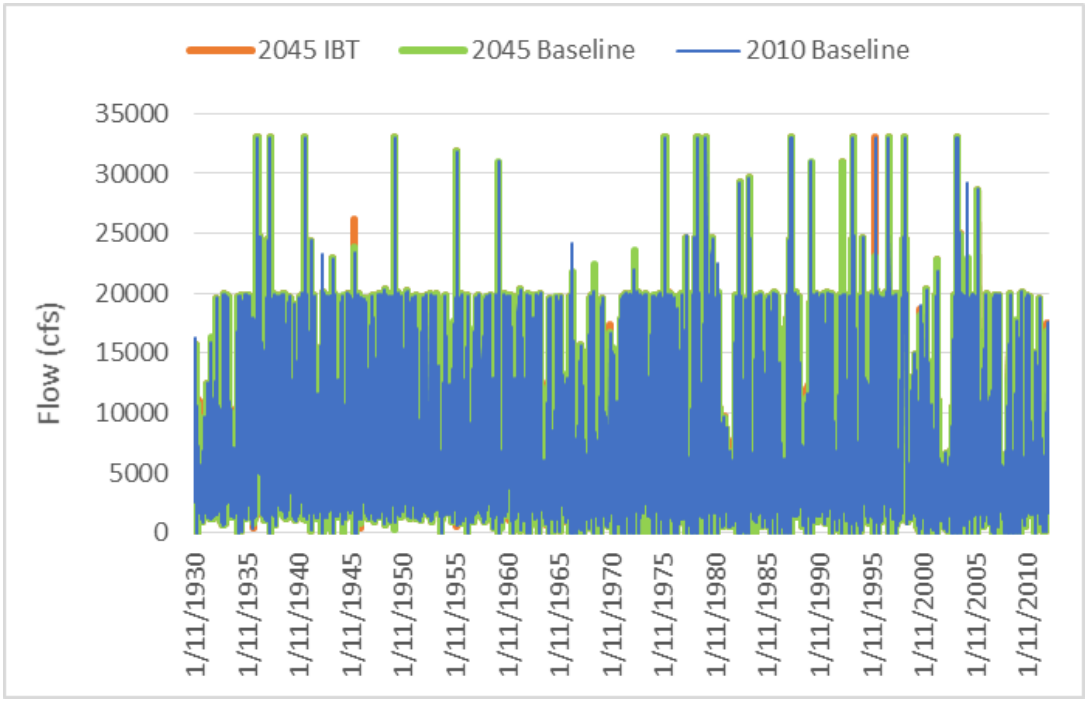


FIGURE 5-11
Reservoir releases for Proposed 2045 IBT for Kerr Lake – during 2002 drought

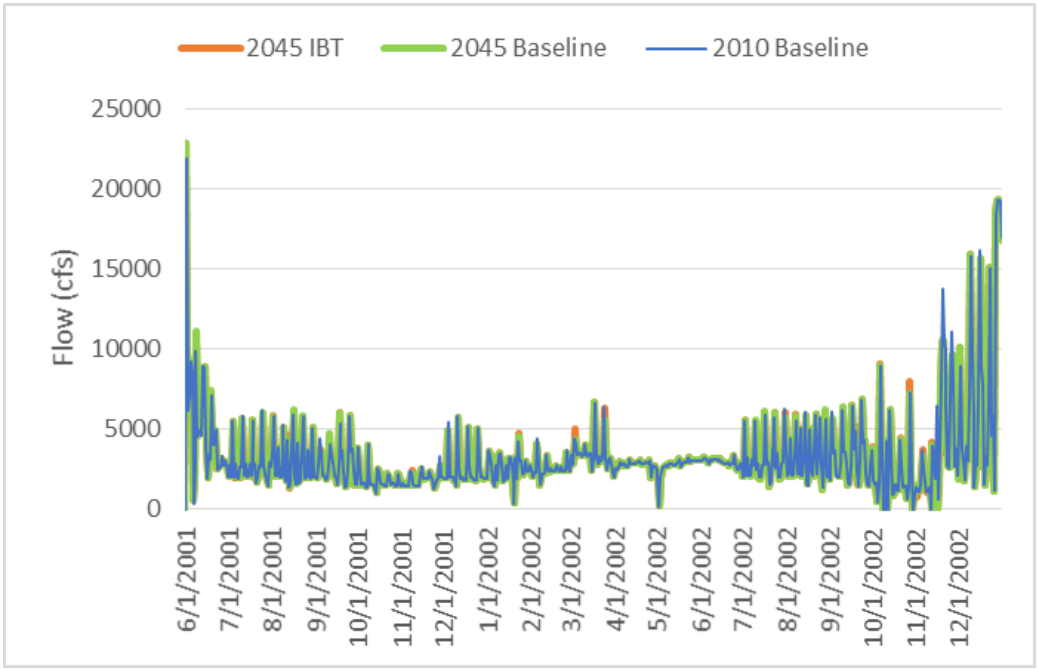


FIGURE 5-12
Reservoir releases duration for Proposed 2045 IBT for Kerr Lake for entire simulation period

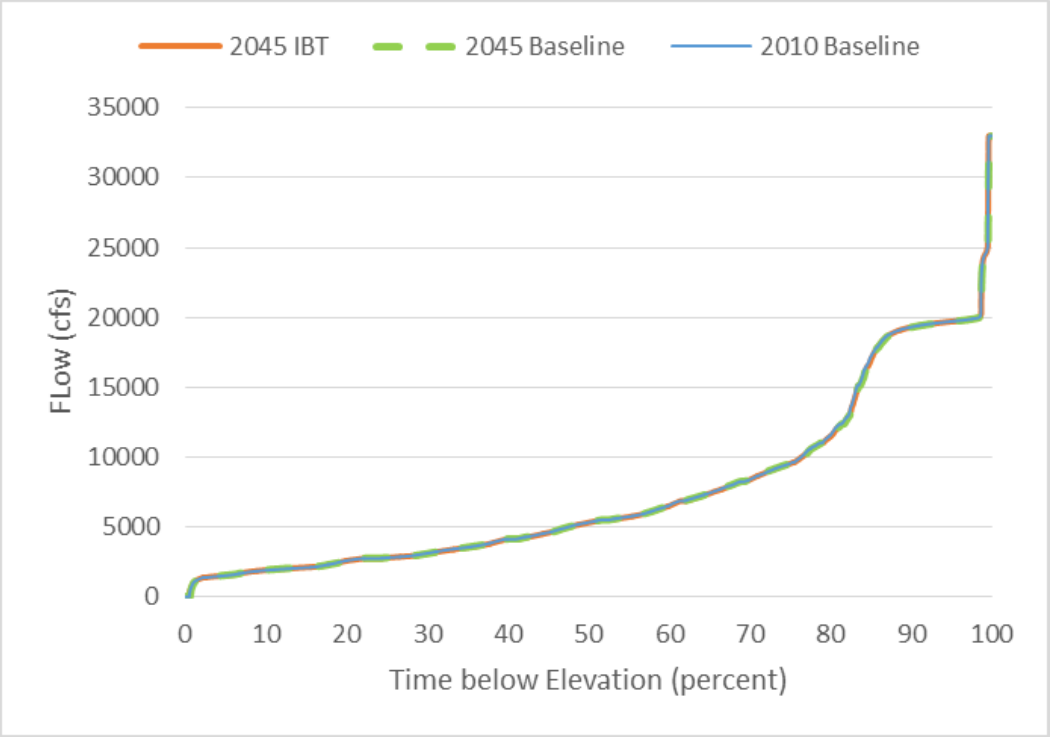


FIGURE 5-13
Reservoir releases duration for Proposed 2045 IBT for Kerr Lake for entire simulation period – lowest 5 percent of the duration curve

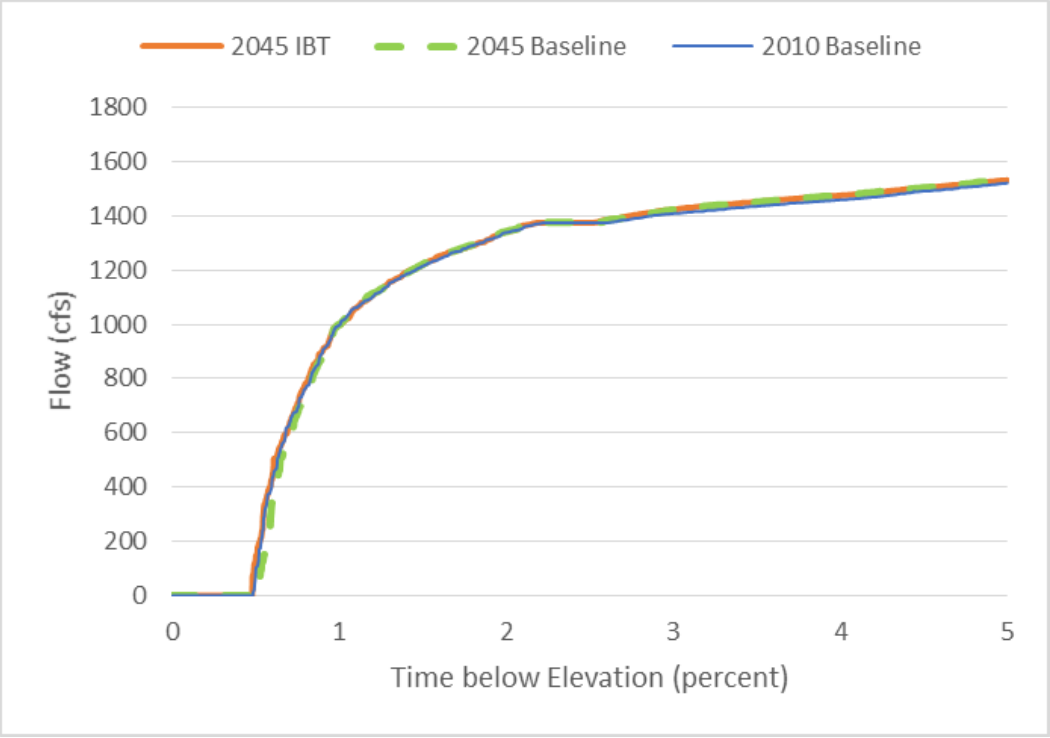


FIGURE 5-14
Reservoir releases for Proposed 2045 IBT for Lake Gaston – during severe 2002 drought

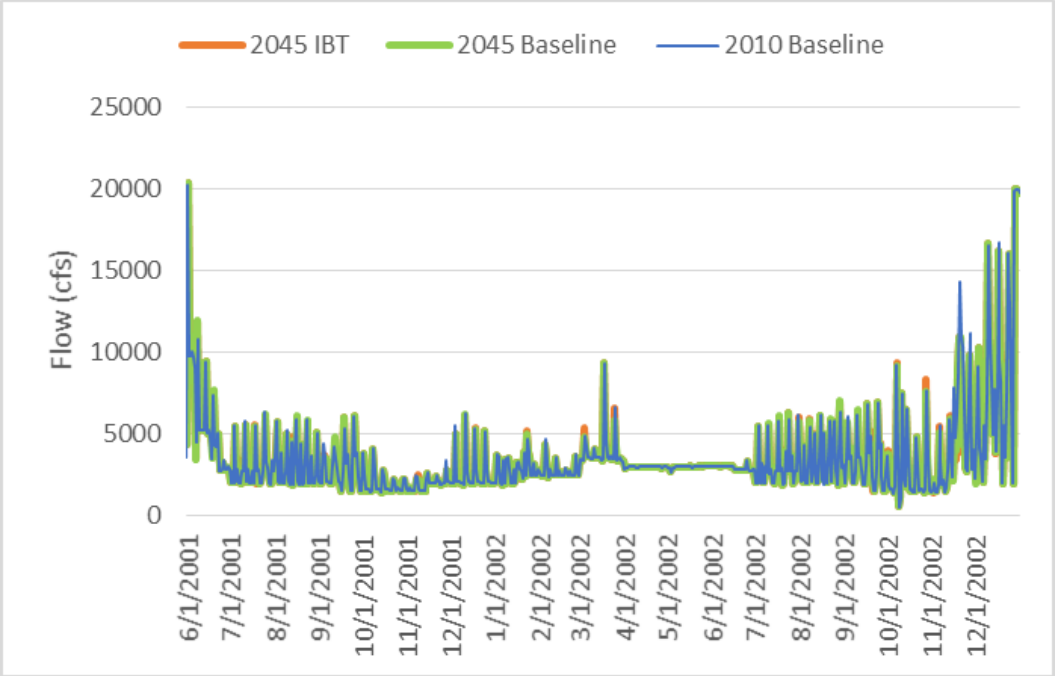


FIGURE 5-15
Reservoir releases duration for Proposed 2045 IBT for Lake Gaston for entire simulation period – lowest 5 percent of the duration curve

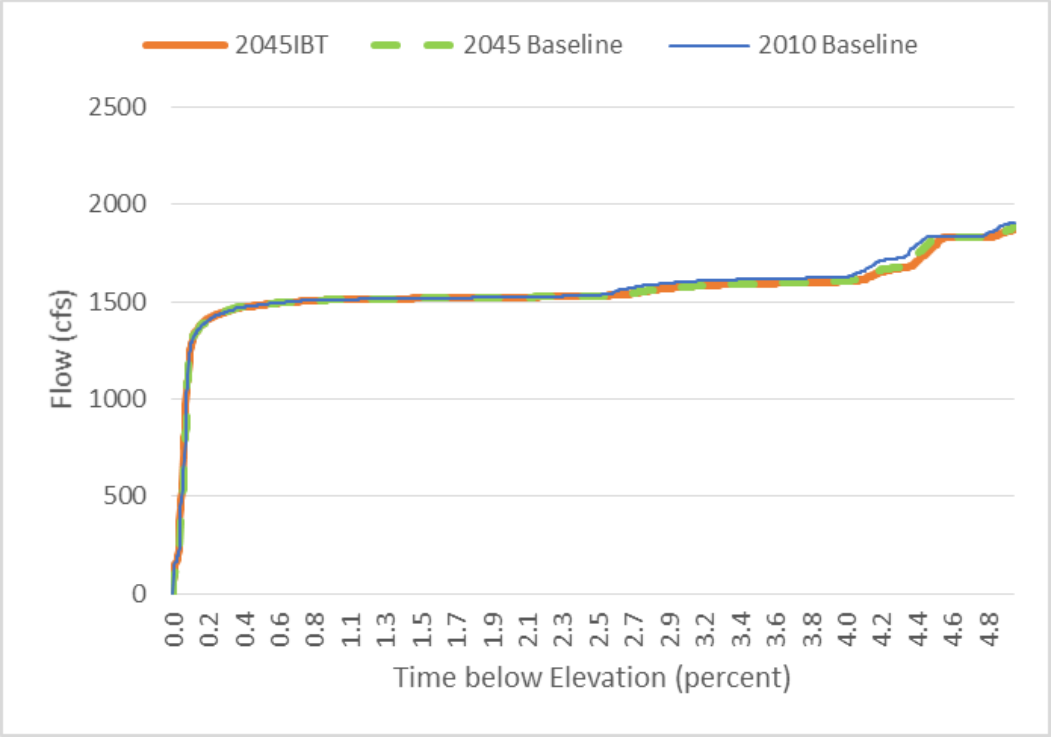


FIGURE 5-16
Reservoir releases for Proposed 2045 IBT for Roanoke Rapids Reservoir – during severe 2002-2003 drought

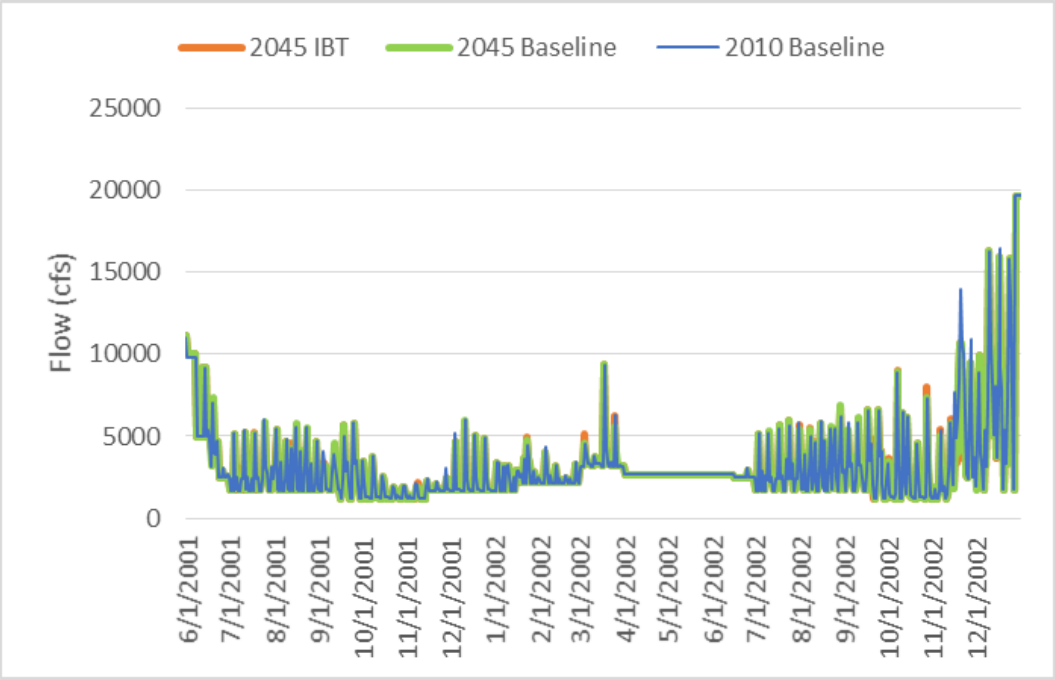


FIGURE 5-17
Reservoir releases duration for Proposed 2045 IBT for Roanoke Rapids Reservoir for entire simulation period – lowest 5 percent of the duration curve

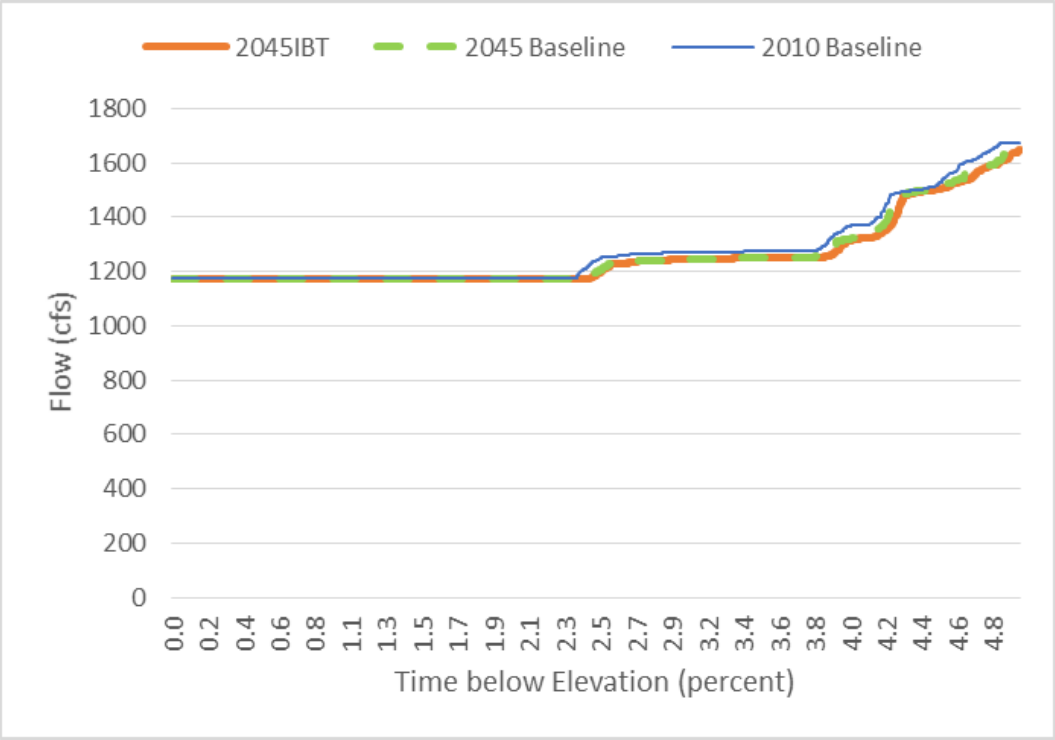


TABLE 5-3
Comparison of Lake Levels for the 2010 and 2045 Baseline Scenarios

Scenario Comparison	Results (feet)	Roanoke River Reservoirs		
		Kerr	Gaston	Roanoke Rapids
2010 Baseline	Average Baseline Elevation	299.2	200.0	132.0
	Average Elevation during 2002 Drought	285.5	200.0	132.0
	Average Elevation during 2007 Drought	294.9	200.0	132.0
2045 Baseline	Average Baseline Elevation	299.2	200.0	132.0
	Average Elevation during 2002 Drought	284.8	200.0	132.0
	Average Elevation during 2007 Drought	294.8	200.0	132.0

2002 Drought - 6/18/2002 through 10/15/2002
2007 Drought - 10/16/2007 through 3/10/2008

TABLE 5-4
Comparison of Reservoir Releases for the 2010 and 2045 Baseline Scenarios

Scenario Comparison	Results (cfs)	Roanoke River Reservoirs		
		Kerr	Gaston	Roanoke Rapids
2010 Baseline	Average Baseline Discharge	7,463.1	7,931.1	7,532.8
	Average Discharge during 2002 Drought	3,056.4	3,203.4	2,878.0
	Average Discharge during 2007 Drought	2,719.0	3,038.4	2,731.4
2045 Baseline	Average Baseline Discharge	7,443.5	7,888.8	7,491.5
	Average Discharge during 2002 Drought	3,077.3	3,247.8	2,921.0
	Average Discharge during 2007 Drought	2,691.2	2,989.8	2,681.7

2002 Drought - 6/18/2002 through 10/15/2002
2007 Drought - 10/16/2007 through 3/10/2008

Water Quality

The City of Henderson discharges to Nutbush Creek, which is a 303(d)-listed stream for biological impairment. The City's current NPDES permit includes a provision to allow expansion of the discharge to 6.0 mgd. The facility has not had a violation or penalty since 2001 and thus has a long track record of compliance. Nutbush Creek is not a large stream; the instream waste concentration (IWC) for the discharge is 97 percent, so continued compliance when expansion to 6.0 mgd occurs is important to the continued protection of water quality in Nutbush Creek and Kerr Lake (NCDENR, 2009). The drainage area (3.8 square miles) to flow (6.0 mgd or 69 cfs) ratio is 0.41. Increased impacts to Nutbush Creek are not expected with the increased wastewater discharge. The NPDES

permit has already been approved to 6.0 mgd; the limits in the permit are designed to preserve instream water quality.

Some water customers in the Roanoke River basin do not have sewer service; instead, they have on-site (septic) systems for treatment. Septic systems are permittable if soil and hydrogeological conditions are suitable. If functioning properly, these systems provide adequate treatment of wastewater. The number of septic systems is likely to increase in the Roanoke River basin portion of the service area given its more rural landscape.

In summary, water quality in the Roanoke River basin would likely not be impacted by the proposed IBT.

Secondary and Cumulative Impacts

The predicted direct impacts to lake levels, all less than 0.5 feet, are not expected to secondarily impact other features of the reservoirs, such as boat ramps, docks, or water intake structures. Water levels are not predicted to decrease by such an amount that the water intake structures would be impacted, and the guide curves in place aid in the balancing of water levels among the reservoirs. These existing structures are not likely to be impacted by the proposed project.

The total amount of water leaving the Roanoke River basin is considered as part of the cumulative impacts analysis for the proposed project. In addition to this IBT request, the City of Virginia Beach, Virginia has an intake in Lake Gaston and has permission to transfer a maximum of 60 mgd. Current transfers average much less, 25.7 mgd in 2010 (Virginia Power, 2011). The City of Virginia Beach also paid the USACE for its storage of 10,200 acre-feet in Kerr Lake and as part of its easement agreement for its intake in Lake Gaston reimburses Virginia Power for the lost energy production capability due to the transfer of water. This lost hydropower generation is not considered in the cumulative impacts for hydropower because Virginia Power is compensated.

Virginia Beach's transfer (also referred to as the Lake Gaston Project) does not impact Lake Gaston levels because lake levels are controlled by both FERC licensing and Virginia Power. However, lake releases are impacted by the Lake Gaston Project. Downstream flows are reduced by approximately 1 percent; during drought this impact could approach 3 to 4 percent. Also during droughts, downstream flow must be maintained to protect instream habitats and when necessary augmented flows from the storage purchased in Kerr Lake are used. This amounts to an impact, specifically a decrease in Kerr Lake water levels of 2 to 4 inches (City of Virginia Beach, 2009). This impact, when considered with the 0.1 feet of impact during times of drought for the IBT, is similar with no discernable increase in impact. Cumulatively, these impacts are not significantly different from that previously approved for the Lake Gaston Project and the City of Virginia Beach. Cumulatively with this proposed IBT, downstream flows in the Roanoke River would not be impacted beyond the 1 percent anticipated for the City of Virginia Beach withdrawal (City of Virginia Beach, 2009). Aquatic habitat impacts related to this decrease in downstream flows are discussed in later sections.

Other water quality SCI to the Roanoke River basin, particularly to Kerr Lake, could result from the proposed project. The watershed of Nutbush Creek, the receiving stream for the City of Henderson's wastewater discharge, includes a portion of the City of Henderson. This stream is on the 303(d) list for biological impairment and urban stormwater impacts are a factor. According to NCDENR, these continued impacts would likely keep the creek on the 303(d) list even with the WWTP operating well into the future (NCDENR, 2006). Degradation of the habitat conditions in the channel has already occurred; this project would not significantly impact the ability of Nutbush Creek to meet standard Class C waters metrics. Impacts would not be significantly different from those of the No Action Alternative.

5.1.1.2 Receiving Basins – Tar River and Neuse River

Direct Impacts

Water Quantity

There would be no anticipated impacts to public water supply in the Tar River. Other municipalities do use the Tar River for water supply; however, because the initial withdrawal is from another river basin, the available water supply in the Tar River would not be reduced by the IBT.

Water Quality

Primary impacts to water quality from the IBT would originate from operation of existing WWTPs. The increased transfer of water to the Tar River and Fishing Creek basins would translate into an increase in wastewater discharges at the Oxford, Warrenton, Bunn, and Franking County WWTPs. The Tar-Pamlico River basin has a nutrient management strategy in place; Phase III is currently underway. Phosphorus and nitrogen reduction goals are the focus, with trading and other mechanisms set up to cost-effectively reduce nutrient loading. The four WWTPs associated with this project, listed above, are owned by members of the Tar-Pamlico Basin Association (Association) and have nutrient monitoring without limits as part of their permits; instead, there is an overall nutrient loading cap for the Association (Tables 5-5 and 5-6).

TABLE 5-5
Tar-Pamlico Basin Association Phase III Nutrient Caps

Total Nitrogen		Total Phosphorus	
(lb/year)	**(kg/year)**	**(lb/year)**	**(kg/year)**
891,272	404,274	161,070	73,060

Phase III agreed to on April 14, 2005

TABLE 5-6
Tar-Pamlico Basin Association Nitrogen Offset Credits

	Nitrogen Credits	
Timeframe	**(lb)**	**(kg)**
Phase I	10,138	4,608
Phase II	30,276	13,762
Phase III	10,564	4,802

Phase III agreed to on April 14, 2005

The Association has a cap for total nitrogen and total phosphorus loading, which has not been exceeded since the inception of the program even though flows have increased, as shown in annual reports documenting monthly mass loadings of nutrients. The Association has accomplished this performance by instituting biological nutrient removal (BNR) at individual facilities and monitoring water quality at over 35 stations throughout the basin, including upstream and downstream of these WWTPs. In addition, nitrogen offset credits have been banked and can be used against future nutrient exceedances. The loading cap and other efforts by the Association would minimize any

potential impacts to downstream water quality as a result of this project. The Pamlico Sound would not likely see additional nutrient impacts due to the increased wastewater discharge that could result from this project. Impacts would likely not be significantly different from those of the No Action Alternative.

These NPDES permits were issued to protect instream water quality while allowing for flexibility with adaptive management strategies. The permitting process for each of these facilities has complied with the North Carolina Environmental Policy Act (NCEPA) requirements. NCDWR's anti-degradation policy requires that only the alternative that causes the least amount of environmental damage can be permitted under the NPDES program. Direct impacts related to flooding and streambank erosion due to an increase in stream flow (from effluent) could be minor. The City of Oxford's WWTP already has a permitted IWC of 99 percent at 3.5 mgd and a ratio of watershed size to wastewater concentration of 0.16. Again, the permitted NPDES flows would accommodate the proposed IBT flow amounts without creating additional significant impacts.

Some water customers in the receiving basins do not have sewer service; instead, they have septic systems for treatment. Septic systems must be permitted and, if functioning properly, provide adequate treatment of wastewater.

Secondary and Cumulative Impacts

Urban development of the receiving basins could adversely affect water quality. Potentially significant indirect or secondary impacts on water quality and aquatic habitat in areas adjacent to and downstream of these areas could occur with full urbanization. Urbanization is most likely in Franklin County, with lower densities of development occurring in Granville and Vance Counties.

Short-term declines in water quality from installation of sewer and water lines, as well as public facility construction projects, and long-term declines in water quality from land use changes could have significant impacts on water quality and subsequent impacts on aquatic habitat, wetlands, and sensitive aquatic and amphibian species in the service area and downstream within the study area. While no new construction is associated with this proposed IBT project, other projects could include additional infrastructure. Connections between the Partners and their customers are currently in place and of adequate capacity to accommodate projected sales to 2045.

Changes in land use can have a major effect on both the quantity and quality of stormwater runoff. Land use changes associated with urbanization, for example, if not properly planned and managed, can dramatically alter the natural hydrology of an area. Impervious surfaces increase the volume and rate of stormwater runoff. These changes lead to more frequent and severe flooding and also to degradation of water quality from the various stormwater pollutants that wash off impervious areas during rain events (for example, sediments, nutrients, pathogen-indicators). As imperviousness increases, the more impacted surface waters become from pollution and flooding. The cumulative effects of stormwater runoff are evident in the frequent correlation between the location of a stream and its water quality, where urban streams overall have poorer water quality than rural streams.

5.1.1.3 Receiving Basin – Fishing Creek

Direct Impacts

As no construction is associated with this IBT and little to no increase in wastewater discharge to Fishing Creek is expected, direct impacts to the Fishing Creek basin are not likely to occur. The IWC of wastewater in Fishing Creek downstream of the Warrenton WWTP would be 76 percent if the

facility were operating at full capacity. At this permit level, the ratio of drainage area to wastewater flow is 0.44.

Secondary and Cumulative Impacts

The population projections for Warren County, including the Fishing Creek watershed, presented in Section 2 show almost flat growth; therefore, no development-related SCI would likely occur in this basin. Some industrial growth could occur, however it is not expected to be significant enough to influence population growth projections.

5.1.2 Water Resources: Groundwater

This section identifies potential impacts to groundwater quality and quantity.

5.1.2.1 Source Basin – Roanoke River

Direct Impacts

There is no construction associated with the IBT, and the increased withdrawal of surface water would not affect groundwater resources. According to Basic Elements of Ground-Water Hydrology with Reference to Conditions in North Carolina (USGS, 1980), groundwater recharge occurs by precipitation in all inter-stream areas (except along streams and their adjoining floodplains). Streams and floodplains are, under most conditions, discharge areas for groundwater; therefore, no direct impacts to groundwater resources would occur in the source basin due to the project.

Secondary and Cumulative Impacts

As described in the Direct Impacts section above, any change in lake elevations (which would occur only as a result of operational decisions made during extreme droughts) due to the IBT would not affect groundwater resources; therefore, no detrimental SCI on groundwater resources would be expected as a result of the project. If some customers have individual wells and opt for public supply, this could have locally beneficial impacts on groundwater.

5.1.2.2 Receiving Basins – Tar River and Neuse River

Direct Impacts

As the Vance County Water System brings residents online, the use of groundwater for residential water supply will decrease in this portion of the Tar River basin. This is a beneficial direct impact to the Tar River basin, as fewer impacts to groundwater will occur over time. As residents will have an option to connect to the water system and some new development will likely be connected, these benefits cannot be quantified at this time.

Secondary and Cumulative Impacts

Development of most urban areas has followed major roads. These roads facilitate the installation of water supply systems from municipal sources. In the project area, growth patterns are likely to be low- to medium-density residential except in Warren County, where growth is expected to remain predominantly low-density residential. In Franklin County, the growth is expected to be more dense; however, this is influenced as much by its proximity to the City of Raleigh and its amenities and economic climate as by the availability of an additional water supply. This is expected to be the case during continued development of the receiving basin study area. The increased roads, houses, and other infrastructure would increase imperviousness in the receiving basin study area. A potentially adverse impact to groundwater availability is the reduced infiltration capacity due to the increased amount of impervious area; this would be a cumulative impact of full build-out of the project area—thus secondarily affecting the recharge capacity of groundwater storage.

Land use activities and growth in the receiving basin could impact groundwater quality by introducing toxic contaminants into or onto the soil, where they could seep into the aquifer. Such pollution can contaminate drinking water wells for communities and individual homes, making them unsuitable for potable water use. Potential sources of groundwater contamination include solid waste disposal sites, storage or use of hazardous substances, poorly designed or maintained septic systems, accidental spills, and leaking underground storage tanks. These potential SCI resulting from land use activities would likely not be significantly different from those of the No Action Alternative.

A beneficial cumulative impact of the project would be the connection of some existing well users to the water system. These customers would either abandon their drinking water wells or reduce usage and maintain the wells for irrigation uses only. This would have a beneficial cumulative impact on groundwater resources in the area by reducing groundwater withdrawals. The formation of the Vance County Water System is one example of this, expanding the customer base of KLRWS without new development.

5.1.2.3 Receiving Basin – Fishing Creek

Direct Impacts

No groundwater impacts would likely occur in the Fishing Creek portion of the service area, as population growth is expected to remain relatively flat.

Secondary and Cumulative Impacts

No SCI would likely occur in the Fishing Creek portion of the service area, as growth is not expected to impact natural resources there.

5.1.3 Water Resources: Hydropower

5.1.3.1 Source Basin – Roanoke River

Direct Impacts

Hydropower, a renewable energy resource, is generated in the Roanoke River basin including from Kerr Lake. The evaluation of potential impacts to hydropower using the updated RRBHM was similar to the evaluation of impacts to water quantity. Since no changes to lake levels or releases in reservoirs upstream of Kerr Lake would occur, hydropower issues were evaluated only for Kerr Lake, Lake Gaston, and Roanoke Rapids Reservoir.

The 2005 USACE water storage allocation study also considered hydropower impacts from the withdrawal of the annual average 20 mgd allocation. While the USACE determined that there would be a small reduction in power capability from Kerr Lake as a result of the withdrawal, the USACE could quantify that amount and the Partners are now compensating the USACE on an annual basis (USACE, 2005). Similar findings using the updated OASIS model are presented here.

Proposed 2045 IBT

Releases from the three upstream reservoirs are the same between scenarios. For this reason, power generation is also equal. Table 5-7 summarizes the differences in total annual power generation for the three lower reservoirs.

TABLE 5-7
Power Generation Differences for Proposed 2045 IBT for Entire Simulation Period and during the 2002 and 2007 Droughts

Scenario Comparison	Results (MWh)	Roanoke River Reservoirs		
		Kerr	Gaston	Roanoke Rapids
2045 Baseline versus 2045 IBT	Average Baseline Power	471,074	342,548	348,778
	Average Power during 2002 Drought	185,668	161,193	159,085
	Average Difference during 2002 Drought with IBT	-680	-346	-372
	Average Power during 2007 Drought	342,152	249,559	253,131
	Average Difference during 2007 Drought with IBT	-378	-156	-168

Notes:

2002 Exceptional Drought Period – 6/18/2002 through 10/15/2002

2007 Exceptional Drought Period – 10/16/2007 through 3/10/2008

The power results are consistent with the results for releases. Small average generation differences are observed based upon the very slight reduction in annual flow during the droughts.

Figure 5-18 through 5-23 illustrate power generation results for the entire simulation period and for the drought periods in the 2000s for Kerr Lake, Lake Gaston, and Roanoke Rapids Reservoir. The predicted minor reductions in power are consistent with the predicted changes in reservoir releases.

FIGURE 5-18
Power generation for the Proposed 2045 IBT for Kerr Lake – entire simulation period

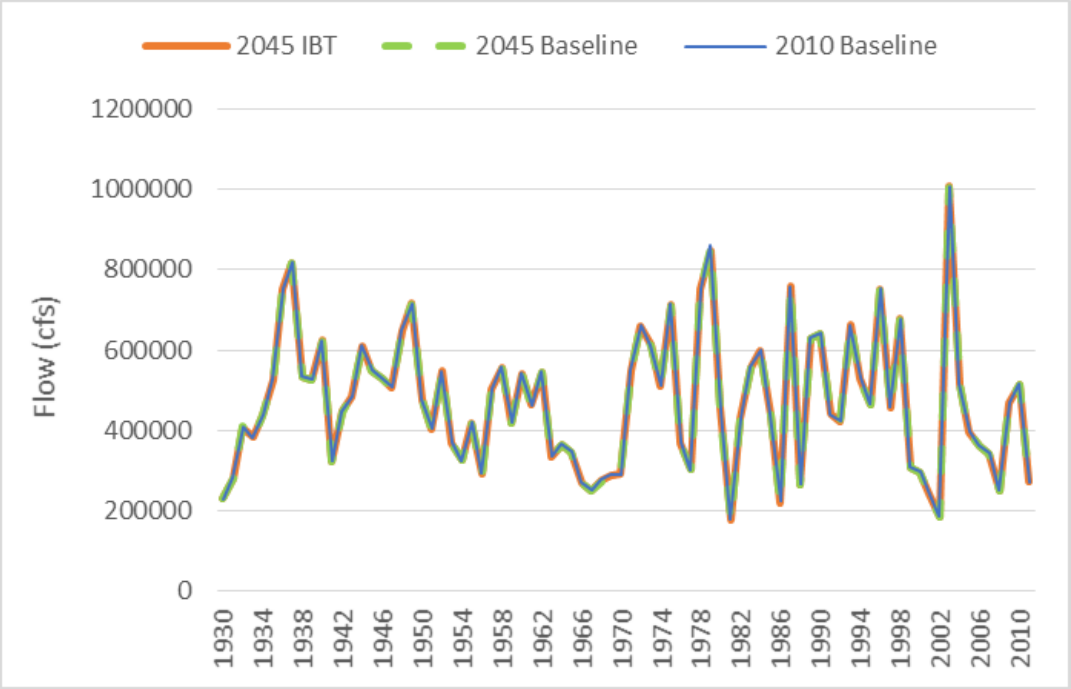


FIGURE 5-19
Power generation for the Proposed 2045 IBT for Kerr Lake – during 2000s

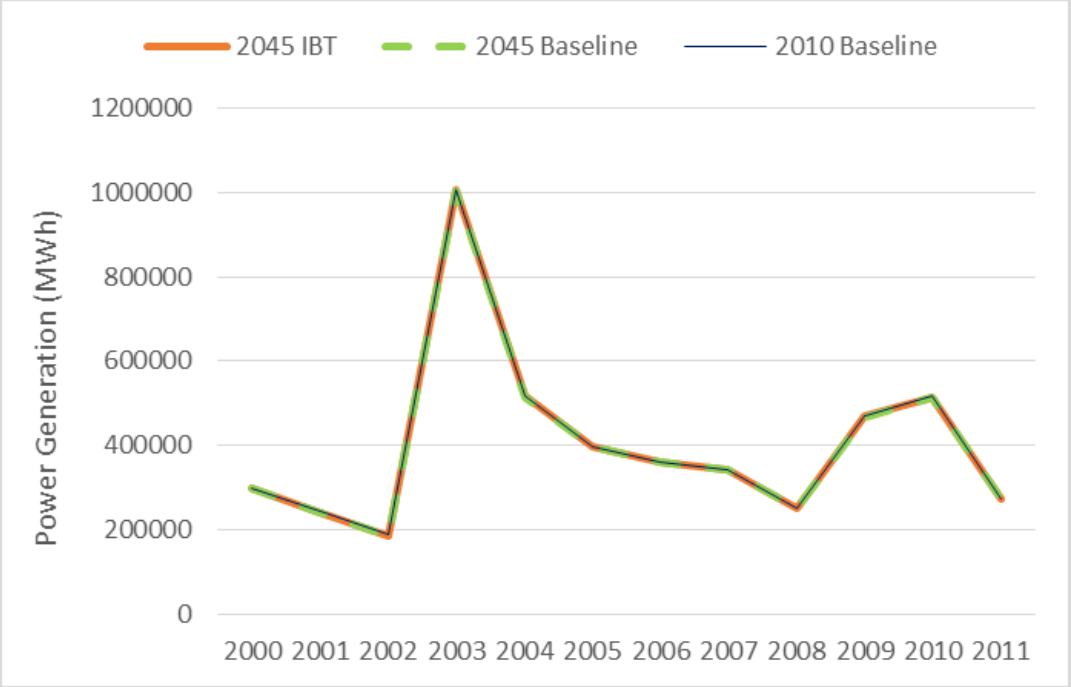


FIGURE 5-20
Power generation for the Proposed 2045 IBT for Lake Gaston – entire simulation period

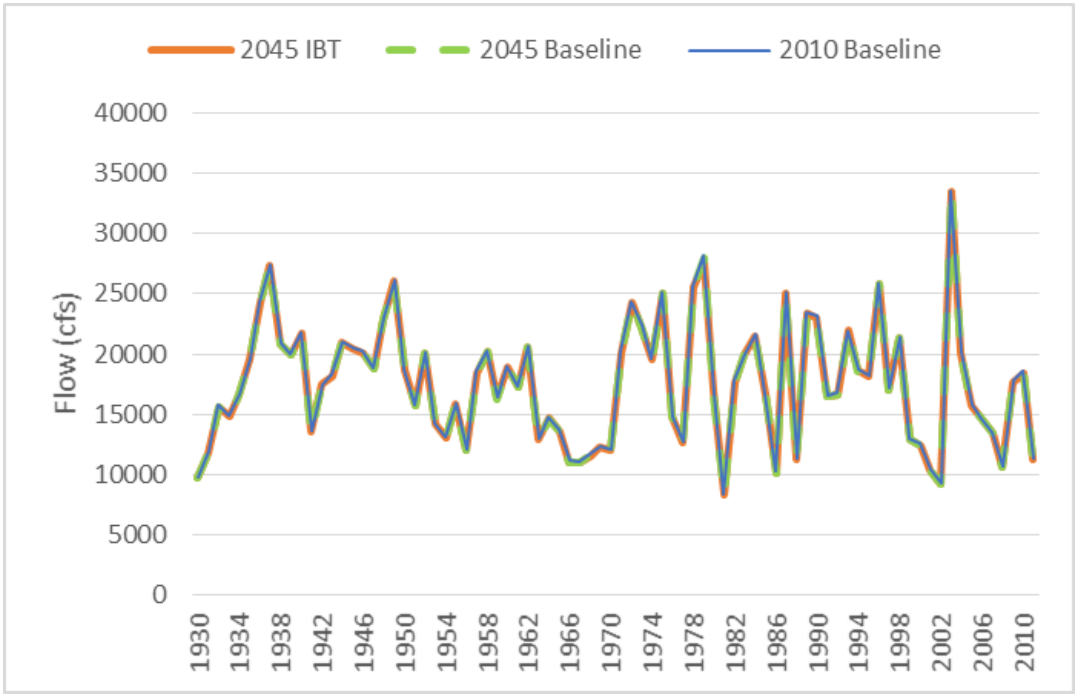


FIGURE 5-21
Power generation for the Proposed 2045 IBT for Lake Gaston – during 2000s

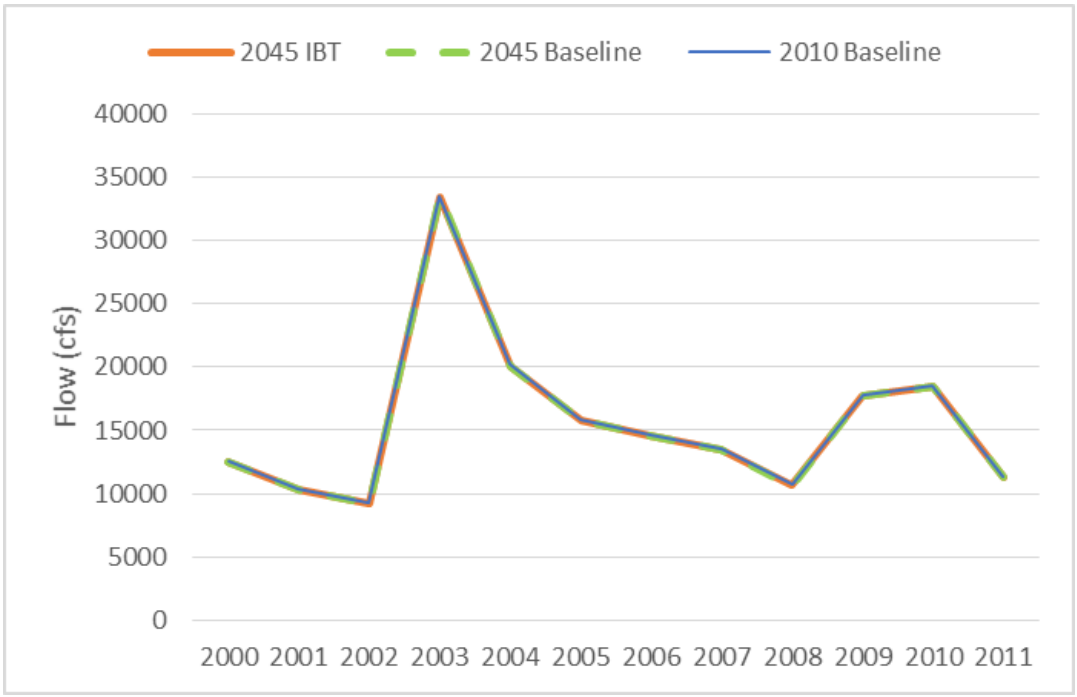


FIGURE 5-22
Power generation for the Proposed 2045 IBT for Roanoke Rapids Reservoir – entire simulation period

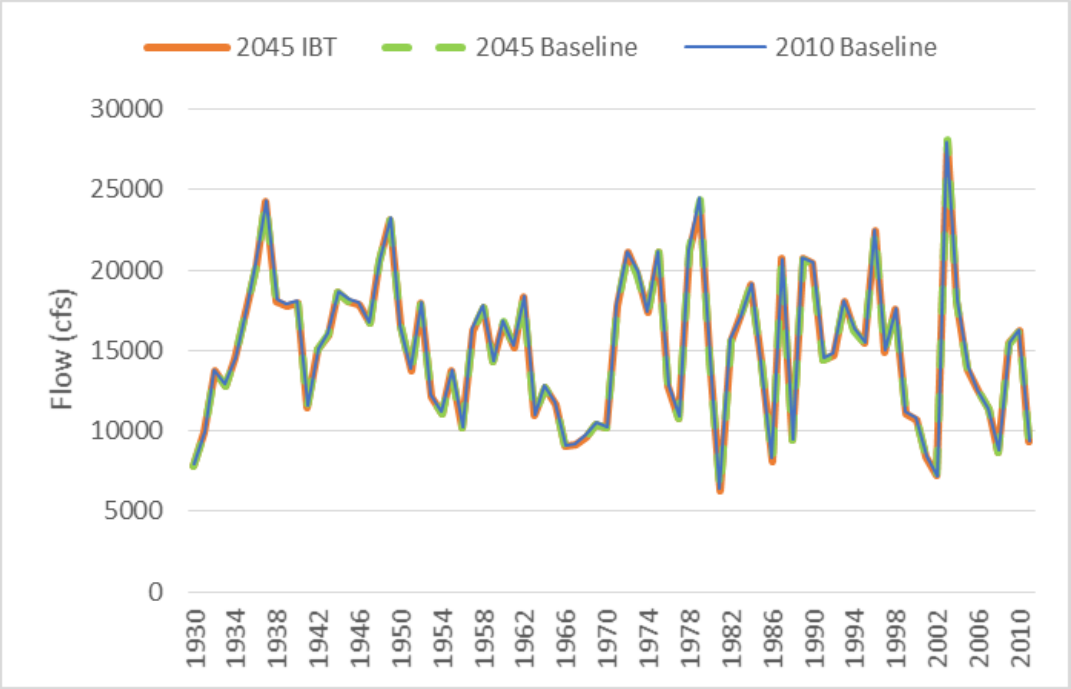


FIGURE 5-23
Power generation for the Proposed 2045 IBT for Roanoke Rapids Reservoir – during 2000s

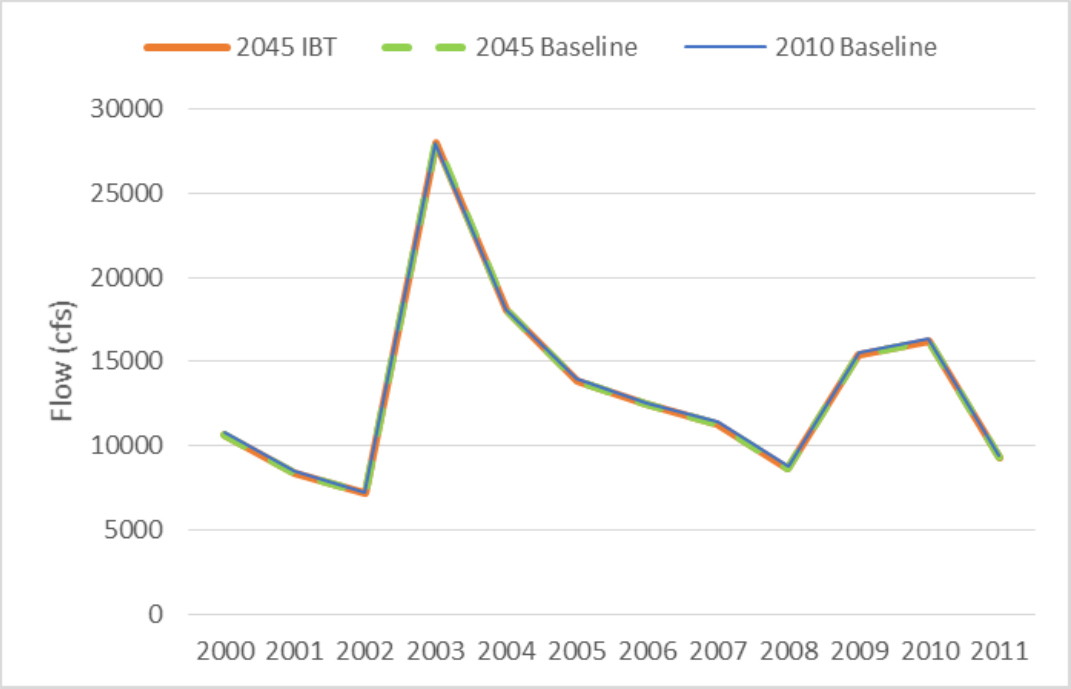


TABLE 5-8
Power Generation Differences for 2010 Baseline and 2045 Baseline Scenarios for the Entire Simulation Period during the 2002 and 2007 Droughts

Scenario Comparison	Results (MWh)	Roanoke River Reservoirs		
		Kerr	Gaston	Roanoke Rapids
2010 Baseline	Average Baseline Power	472,679	344,587	350,834
	Average Power during 2002 Drought	188,442	162,646	160,706
	Average Power during 2007 Drought	343,534	251,336	255,069
2045 Baseline	Average Baseline Power	471,074	342,548	348,778
	Average Power during 2002 Drought	185,668	161,193	159,085
	Average Power during 2007 Drought	342,152	249,559	253,131

2002 Drought - 6/18/2002 through 10/15/2002
2007 Drought - 10/16/2007 through 3/10/2008

Secondary and Cumulative Impacts

The total amount of water leaving the Roanoke River basin is considered as part of the cumulative impacts analysis. In addition to this IBT request, the City of Virginia Beach, Virginia has an intake in Lake Gaston and has permission to transfer a maximum of 60 mgd. The City of Virginia Beach also paid the USACE for its storage of 10,200 acre-feet in Kerr Lake and as part of its easement agreement for its intake in Lake Gaston reimburses Virginia Power for the lost energy production capability due to the transfer of water. This lost hydropower generation is not considered in the cumulative impacts for hydropower because Virginia Power is compensated.

5.1.3.2 Receiving Basins – Tar River and Neuse River

Direct Impacts

Hydropower generation does not occur along the Tar River; therefore, no direct impacts to hydropower in this basin would occur.

Secondary and Cumulative Impacts

Hydropower generation does not occur within this receiving basin; therefore, no SCI to hydropower in this basin would occur.

5.1.3.3 Receiving Basin – Fishing Creek

Direct Impacts

Hydropower generation does not occur along Fishing Creek; therefore, no direct impacts to hydropower in this basin would occur.

Secondary and Cumulative Impacts

Hydropower generation does not occur within this receiving basin; therefore, no SCI to hydropower in this basin would occur.

5.2 Topography and Floodplains

5.2.1 Topography and Floodplains: Source Basin – Roanoke River

Direct Impacts

There would be no direct impacts to topography or floodplains in the source basin as a result of this project. Construction is not associated with the proposed project. The capacity of Kerr Lake for flood storage would not be impacted or altered by this IBT. Kerr Lake is drawn down in the winter and spring according to its guide curve to meet one of its functions (flood storage). This project and its water withdrawal would not impact the ability of Kerr Lake to meet this function or impact the release regime from Roanoke Rapids Lake and its ability to meet minimum instream flow requirements.

Secondary and Cumulative Impacts

SCI within the portions of the service area in the Roanoke River basin are discussed in Section 5.2.2. There are no projected water storage changes to the reservoirs upstream of the withdrawal; therefore, flood storage capabilities of these reservoirs would not be impacted by this project, nor would floodplains along the Roanoke River and its tributaries.

In Kerr Lake and downstream, water storage and water release regimes would not be significantly impacted and therefore no impacts to floodplains downstream on the Roanoke River would occur. Floodplains in the lower Roanoke River are ecologically significant and would not be affected by this project. Downstream minimum flows would still be met with the implementation of this project. No significant SCI to topography and floodplains would be likely to occur.

5.2.2 Topography and Floodplains: Receiving Basins – Tar River and Neuse River

Direct Impacts

There would be no direct impacts to topography or floodplains in the Tar River basin as a result of this project. Construction is not associated with the proposed project. While wastewater flows could increase, which would increase stream base flows, these changes would be minor during larger flow events where floodplains would be in use. These wastewater flows would be covered under current permitting, so no additional impacts would likely occur.

Secondary and Cumulative Impacts

SCI to topography and floodplains in this receiving basin would likely not be significantly different from those of the No Action Alternative. Cumulative impacts from the multiple wastewater discharge flows that could increase would be minor during larger stream flow events where floodplains are in use.

Current land use trends within the service area (which includes source and receiving basins) are likely to continue into the future. Growth patterns are likely to be low- to medium-density residential except in Warren County, where growth is expected to remain predominantly low-density residential. In Franklin County, the growth is expected to be more dense; however this is influenced as much by its proximity to the City of Raleigh and its amenities and economic climate as by the availability of an additional water supply. Continued growth and development could require grading and clearing activities, though current ordinances and regulations would protect floodplains to some extent. If development within the floodplain were permitted, the function of the floodplain

would be reduced. Floodplains, if left undisturbed, provide numerous functions, including wildlife habitat, surface water filtration, infiltration, and wildlife movement corridors.

5.2.3 Topography and Floodplains: Receiving Basin – Fishing Creek

Direct Impacts

There would be no direct impacts to topography or floodplains in the Fishing Creek basin as a result of this project, as no construction would occur.

Secondary and Cumulative Impacts

No SCI are expected in the Fishing Creek subbasin, as population growth would remain relatively flat. With little residential growth and associated commercial growth predicted, development would not be significantly different than under the No Action Alternative, with no significant SCI expected.

5.3 Soils

5.3.1 Soils: Source Basin – Roanoke River

Direct Impacts

There would be no direct impacts to soils in the source basin as a result of this project. Construction is not associated with the proposed project. Water levels in the reservoirs would not be affected, so additional soils along the banks would not be exposed, as occurs during drawdown periods and droughts.

Secondary and Cumulative Impacts

As described in the Direct Impacts section above, any change in lake elevations (which would occur only as a result of operational decisions made during extreme droughts) due to the IBT would not affect soils resources. Therefore, no significant adverse SCI to soils resources would likely occur as a result of the project.

5.3.2 Soils: Receiving Basins – Tar River and Neuse River

Direct Impacts

There would be no direct impacts to soils in this receiving basin as a result of this project. Construction is not associated with the proposed project.

Secondary and Cumulative Impacts

Current land use trends within the service area are likely to continue. With the availability of additional water supply, growth patterns are likely to be low- to medium-density residential. Continued growth and development could require grading and clearing activities, which could disturb local soils. Cumulative impacts of soil loss and erosion would be limited by the implementation and enforcement of sediment and erosion control permits for disturbances greater than the minimums when permits are required.

This growth could increase runoff, increasing the volume and rate of stormwater entering stream channels. In these stream channels, increased stresses and altered hydrology could occur, creating the potential for more erosion and loss of soils into stream channels unless adequate development restrictions and ordinances are in place. Some stream channel impacts could occur, including in channels where cumulative impacts from increased base flow occur as a result of wastewater discharge increases; however, these wastewater discharge increases would be within currently

permitted limits. Overall, these activities would not likely differ significantly from those of the No Action Alternative.

5.3.3 Soils: Receiving Basin – Fishing Creek

Direct Impacts

There would be no direct impacts to soils in this receiving basin as a result of this project. Construction is not associated with the proposed project.

Secondary and Cumulative Impacts

No SCI are expected in the Fishing Creek watershed, as population growth would remain relatively flat. With little residential growth and associated commercial growth predicted, development would not be significantly different from that under No Action Alternative, with no significant SCI expected.

5.4 Land Use

5.4.1 Land Use: Source Basin – Roanoke River

Direct Impacts

There would be no direct impacts to land use in the Roanoke River basin associated with this IBT project. Construction is not a part of this project; the existing water intake structure in Kerr Lake would be used.

Secondary and Cumulative Impacts

Within the source basin, SCI would not likely occur upstream or downstream of the withdrawal location in Kerr Lake. The increased water withdrawal would not significantly impact water levels in Kerr Lake; therefore, land uses around Kerr Lake and downstream along Lake Gaston, Roanoke Rapids Lake, and the Roanoke River would not likely be impacted by this project. In turn, land values would not likely be influenced by this increased water withdrawal and IBT. Access to Kerr Lake would not be impacted.

5.4.2 Land Use: Receiving Basins – Tar River and Neuse River

Direct Impacts

There would be no direct impacts to land use in this receiving basin associated with this IBT project. No construction would occur as part of this project.

Secondary and Cumulative Impacts

Impacts of land use changes would result from residential, commercial, and industrial growth, converting more rural land to urban and suburban uses. Industrial growth is projected to occur in and around the Triangle North business park locations. Residential growth patterns are likely to be low- to medium-density residential except in Warren County, where growth is expected to be minimal and remain predominantly low-density residential, as documented in their 2012 LWSP. In Franklin County, the growth is expected to be more dense; however, this is influenced as much by its proximity to the City of Raleigh and its amenities and economic climate as by the availability of an additional water supply. The southern half of the county would see denser growth, while the portion north of Louisburg would likely maintain low density agricultural/rural residential land uses (Figure 5-49). Some subdivision is likely to occur in the northern portion of the county, as indicated by spatial trends evident in the County's subdivision mapping presented as Figure 5-50.

Typical impacts of land use changes could also include degradation of resources through the introduction of incompatible urban land uses adjacent to the resources. For example, the loss of viable farm income can occur when subdivisions are built adjacent to farmland. In addition, because the value of the farmland rises as urbanization of the area occurs, farmers can be forced out of business due to increased property taxes.

In summary, land use changes (especially in Franklin County) would likely occur with the No Action Alternative as well, so these changes would not likely differ from those of the No Action Alternative.

5.4.3 Land Use: Receiving Basin – Fishing Creek

Direct Impacts

There would be no direct impacts to land use in this receiving basin associated with the IBT project. No construction would occur as part of this project.

Secondary and Cumulative Impacts

In the Warren County portion of the service area, which consists of portions of the Roanoke River and Fishing Creek basins, minimal growth is expected. Therefore, the IBT would not result in land use changes significantly different from those of the No Action Alternative. The availability of additional water supply would not significantly alter the rate or pattern of development from what is currently occurring.

5.5 Wetlands

Wetlands are primarily located within the riparian zones or floodplains of streams and lakes. Wetlands are protected by Sections 401 and 404 of the CWA. According to the CWA, wetlands must be avoided if practical; otherwise, impacts must be minimized and mitigated.

5.5.1 Wetlands: Source Basin – Roanoke River

Direct Impacts

Direct impacts upstream of Kerr Lake are not likely to occur; the water withdrawal associated with the IBT would not likely cause changes in reservoir release regimes or in run-of-river levels, which could impact adjacent wetlands.

Downstream of Kerr Lake and at the water withdrawal location, direct impacts to wetlands could result from removal of the water from the system. However, the minimum flow releases from Roanoke Rapids Lake would not likely be significantly altered by the increased water withdrawal. Because of the minimum flow releases, adequate flow would remain available downstream, so impacts to adjacent wetlands would not likely occur with this project. With no significant changes to basin hydrology or water quality, the IBT project would not have a significant direct impact on wetlands within the service area or downstream in the study area.

Also, no construction is proposed in the Roanoke River basin, so no direct impacts to wetlands would occur as a result of the IBT.

Secondary and Cumulative Impacts

SCI associated with the portion of the Roanoke River basin in the service area are discussed in Section 5.5.2. Except for those impacts, no SCI related to wetlands would likely occur in the source basin.

5.5.2 Wetlands: Receiving Basins – Tar River and Neuse River

Direct Impacts

No construction would occur as part of this project; therefore, no direct impacts to wetlands would occur. With no significant changes to basin hydrology or water quality, the IBT project is not likely to have impacts on wetlands within the service area or downstream within the study area along the Tar River.

Secondary and Cumulative Impacts

Growth that is partially facilitated by the availability of additional water supply, regardless of source, could impact wetlands in the service area if it were to proceed unchecked. Impacts could be direct, in terms of filling or draining of wetlands for construction of roads, building sites, or utilities. Urban development could also have significant indirect impacts on wetlands, in terms of increased levels of silt and sediment from grading activities and the increased amount of nonpoint source pollutants entering the wetlands over the long term from upland development activities and urban land uses. However, most wetlands occur along waterways and major waterways are protected as part of Franklin County's conservation districts (Figure 5-49).

Typical urban stormwater pollutants include sediment, nutrients (nitrogen, phosphorus), bacteria (fecal coliform as indicators), and potential toxicants (metals, oil and grease, hydrocarbons, and pesticides). It is widely accepted that, in general, increased amounts of stormwater runoff from increased impervious surfaces in developed areas can cause erosion and collapse of stream banks, leading to loss of riparian canopy trees and degraded stream habitat.

The acreage of wetlands impacted by growth could increase as the level and intensity of land use changes increase in the basin.

5.5.3 Wetlands: Receiving Basin – Fishing Creek

Direct Impacts

No construction would occur as part of this project; therefore, no direct impacts to wetlands would occur. With no significant changes to basin hydrology or water quality, the IBT project is not likely to have direct impact on wetlands within the service area.

Secondary and Cumulative Impacts

In Warren County, which contains portions of the Roanoke River and Fishing Creek basins, little land use change would likely be associated with the IBT. Without development pressures for land use changes, the potential for SCI to wetlands in this basin is low and would not be significantly different from the potential under the No Action Alternative.

5.6 Prime and Unique Agricultural Lands

5.6.1 Prime and Unique Agricultural Lands: Source Basin – Roanoke River

Direct Impacts

There would be no source basin direct impacts to PFL and Farmland of Statewide Importance because no construction is associated with this project. Agricultural irrigation needs would not be impacted by the withdrawal.

Secondary and Cumulative Impacts

Within the source basin, SCI to PFL would be unlikely to occur. Upstream of the water withdrawal location, no SCI would be likely since reservoir release regimes would not likely change and run-of-river flows would not likely be impacted. Downstream of the water withdrawal, some cumulative impacts to water levels could occur. Irrigation demands are included in the modeling analysis presented in Section 5.1 and would not likely be impacted by any cumulative changes in water levels; the availability of water would not be discernibly different from that of existing conditions with existing water withdrawals. Water demands downstream of the withdrawal area, including those for public water supply, industry, and agricultural irrigation, would all increase in the future. These, cumulatively, could impact water levels in the Roanoke River. The results from the modeling presented in Section 5.1 show that all water needs in 2045 can be met without perceptible impacts to water resources.

5.6.2 Prime and Unique Agricultural Lands: Receiving Basins – Tar River and Neuse River

Direct Impacts

There would be no direct impacts to PFL and Farmland of Statewide Importance in this receiving basin because no construction is associated with the project.

Secondary and Cumulative Impacts

Mapping of PFL within the service area was not conducted, since the exact location of future development is impossible to predict. SCI to prime and unique agricultural lands would likely occur from the associated development within the service area. Acreage would likely be lost to development, mainly to residential uses. These SCI would likely occur primarily in the southern end of the service area, especially in Franklin County. Franklin County's future land use map (Figure 5-49) shows a plan for the northern portion of the county to remain in agricultural/rural residential land uses. Very little SCI are expected in the Fishing Creek subbasin in Warren County because population growth is minimal, as documented in their 2012 LWSP; in this area, impacts would likely be minor. While the number of water customers could grow, this would likely occur by offering water service to existing well users.

Development in the service area (primarily Franklin County) would occur and result in loss of PFL, even without increased water supply availability from Kerr Lake. Impacts related to growth are not dependent on a specific water source, only that an adequate water supply is available. It is possible that Franklin County could secure another water source if it were not a customer of KLRWS. The population growth predictions in Franklin County, as included in their 2012 LWSP, are dependent on an adequate water supply and availability of other resources. Franklin County's future land use planning focusing growth in towns and priority growth areas is included in its Comprehensive Development Plan (updated 2007) and is summarized in Section 6. While this project could provide that adequate water supply, it is possible that another water supply could be secured and these potential SCI could occur anyway, making these impacts not significantly different from those of the No Action Alternative.

Without the project, conversion of agricultural lands would likely continue in areas currently experiencing development pressures, such as Franklin County. Wells and septic systems could be used, or another water source. While the pattern of growth could be different and the density could be lower, farmland would likely be converted. These impacts of land use changes could also include degradation of a land use type through the introduction of adjacent incompatible urban land uses.

For example, the loss of viable farm income can occur when subdivisions are built adjacent to farmland. Because the value of the farmland rises as urbanization of the area occurs, farmers can be forced out of business due to increased property taxes. In addition, the use of farm equipment on local public roads becomes more dangerous with increased traffic. In some cases, the new residential growth could cause associated farming businesses to relocate.

5.6.3 Prime and Unique Agricultural Lands: Receiving Basin – Fishing Creek

Direct Impacts

There would be no receiving basin direct impacts to PFL and Farmland of Statewide Importance because no construction is associated with this project.

Secondary and Cumulative Impacts

In Warren County, which contains portions of the Roanoke River and Fishing Creek basins, little land use change would likely be associated with the IBT. Without development pressures for land use changes, the potential for SCI to PFL and Farmland of Statewide Importance in this basin would be minor and would not be significantly different from conditions under the No Action Alternative.

5.7 Public Lands and Scenic, Recreational, and Natural Heritage Program Natural Areas

Public lands could become more valued by the community as open spaces are converted to other land uses.

5.7.1 Public Lands and Scenic, Recreational, and Natural Heritage Program Natural Areas: Source Basin – Roanoke River

Direct Impacts

Public lands and NHPNAs are along the Roanoke River both upstream and downstream of Kerr Lake and the water withdrawal location. Direct impacts would not likely occur; the water withdrawal associated with the IBT would not be expected to cause changes in reservoir release regimes or in run-of-river levels, and no construction is associated with this project. Public access to facilities such as docks is not likely to be influenced by the increase in IBT. These findings are supported by the 2005 USACE water storage allocation report which found that “these small changes in pool elevation would not have a perceptible impact on reservoir recreation” (USACE, 2005).

Secondary and Cumulative Impacts

No SCI related to public lands and NHPNAs would occur upstream of Kerr Lake within the Roanoke River basin.

The water levels in Kerr Lake fluctuate by season and are managed to provide adequate downstream releases of water. Implementation of the guide curve leads to water level differences throughout the year which are not seen in the two downstream flow-through reservoirs. This Kerr Lake pattern would not likely be impacted by the increased water withdrawal. The guide curve would remain in place and followed, even in drought or other extreme situations. The timing of the guide curve trigger points could be slightly affected by water withdrawal (see Section 5.1.1 and Appendix D with associated plates); however, reservoir management activities would overcome any potential impacts. Recreational uses, NHPNAs, and public lands along Kerr Lake and downstream would not likely be impacted by the increased water withdrawal. Activities such as use of the

Roanoke River paddle trail, boat launching in the North Carolina reservoirs, and river uses downstream of Roanoke Rapids Lake would not likely be impacted by reduced access or use limitations.

Downstream of Kerr Lake, the Roanoke River is susceptible to cumulative impacts from the combined water withdrawals of the Partners and the City of Virginia Beach. Public Lands are along the river, protecting floodplains and bottomland hardwood forests. Cumulative water resources impacts are presented in Section 5.1.1, showing that no further cumulative impacts beyond those associated with the City of Virginia Beach transfer would likely occur with the proposed project. These reductions in downstream flow releases would not likely impact these lands.

5.7.2 Public Lands and Scenic, Recreational, and Natural Heritage Program Natural Areas: Receiving Basins – Tar River and Neuse River

Direct Impacts

Direct impacts to public lands within the receiving basin would not likely occur as construction is not associated with this project. Adequate infrastructure is in place to transfer water from the Partners to their wholesale customers.

Secondary and Cumulative Impacts

Adverse SCI to public lands, NHPNAs, and recreational lands within the receiving basin portion of the service area and downstream along the Tar River and Fishing Creek in the study area are not likely to occur. Many NHPNAs are present within these areas, primarily associated with aquatic resources along the Tar River and Fishing Creek (Figure 4-2). Growth and development within the service area could instead increase the value of these public areas and their scenic value and natural resources. The communities within the service area have parks and recreation departments to continue maintaining and/or creating public spaces.

Within the Tar River basin, impacts to factors that comprise the intrinsic value of these NHPNAs could be impacted, such as forested wildlife corridors, water quality, and air quality. The growth that would be partially facilitated by this project and the availability of additional water supply could generate SCI. Increased wastewater discharges are addressed in the facilities' current permits and through the Tar River nutrient management strategies, so no additional impacts to NHPNAs would result via changes in water quality. This growth would likely occur with or without the availability of additional water supply. Therefore, any potential SCI (although not likely to occur) would not be significant when compared to those of the No Action Alternative.

5.7.3 Public Lands and Scenic, Recreational, and Natural Heritage Program Natural Areas: Receiving Basin – Fishing Creek

Direct Impacts

Direct impacts within the Fishing Creek subbasin would likely not occur.

Secondary and Cumulative Impacts

Within Warren County and the Fishing Creek subbasin, the increase in population during the planning period is projected to be minimal, as documented in Warren County's 2012 LWSP. Fishing Creek has been considered for designation as an Outstanding Resource Water (ORW), and while that designation has not yet been approved, the watershed does exhibit good water quality, aquatic habitat, and recreational opportunities. With little growth and development pressure in the

watershed, the potential for SCI would likely not be significantly different from those of the No Action Alternative.

5.8 Areas of Archaeological or Historic Value

5.8.1 Areas of Archaeological or Historic Value: Source Basin – Roanoke River

Direct Impacts

The IBT would not have any direct impacts on archeological or historic resources in the source basin. No construction is associated with this project.

Secondary and Cumulative Impacts

SCI to areas of archaeological or historic value within the source basin and adjacent to the Roanoke River basin waterways would likely not occur, as no significant changes to water levels or discharge would likely occur with this project. SCI within the portion of the Roanoke River basin in the service area are discussed below.

5.8.2 Areas of Archaeological or Historic Value: Receiving Basins – Tar River and Neuse River

Assessing historic properties in the service area is beyond the scope of this document, but much work detailing historic properties has been conducted in the area.

Direct Impacts

The IBT would not have any direct impacts on archeological or historic resources in this receiving basin. Adequate infrastructure to convey water to the Partners and their wholesale customers is currently in place and no construction is associated with this project.

Secondary and Cumulative Impacts

SCI to areas of archaeological or historic value within this receiving basin would be limited. Those places already listed would be protected in accordance with current regulations. Historic downtown areas in Henderson and Oxford would not likely be impacted. Large development activities would require investigation of the potential for historic value, according to current regulations. Historic areas could be impacted directly by future projects creating cumulative impacts, but secondary impacts would be unlikely. Impacts to historic resources would be assessed individually during project planning, likely at the county level, if properties are not listed on a NRHP. The greatest potential for SCI is in the Tar River and Neuse River basins in Franklin County, where most of the growth is predicted to occur.

5.8.3 Areas of Archaeological or Historic Value: Receiving Basin – Fishing Creek

Direct Impacts

The IBT would not have any direct impacts on archeological or historic resources in this receiving basin. Adequate infrastructure to convey water to the Partners and their wholesale customers is currently in place and no construction is associated with this project.

Secondary and Cumulative Impacts

SCI to areas of archaeological or historic value within this receiving basin would be limited. Those places already listed would be protected in accordance with current regulations. The historic district

in Warrenton and other structures in Warren County would likely not be impacted, as growth in Warren County is expected to be minimal according to their 2012 LWSP.

5.9 Air Quality

5.9.1 Air Quality: Source Basin – Roanoke River

Direct Impacts

There is no construction associated with the IBT, and the increased withdrawal of water would not affect air quality. Therefore, no direct air quality impacts would occur in the source basin.

Secondary and Cumulative Impacts

No SCI to air quality would occur in the Roanoke River basin. The potential for SCI in the service area portion of the Roanoke River basin is discussed below.

5.9.2 Air Quality: Receiving Basins – Tar River and Neuse River

Direct Impacts

There is no construction associated with the IBT, and the increased withdrawal of water would not affect air quality. Therefore, no direct air quality impacts would occur in the receiving basins.

Secondary and Cumulative Impacts

The cumulative impacts of a growing population could impact air quality in the service area. These impacts would be more likely to occur in the southern portion of the service area in the Tar River basin. As more vehicles travel within the service area, levels of emitted air pollution could increase. Even without the proposed IBT, the population within the service area is likely to increase and contribute to higher levels of air pollution. While industrial emissions could also increase in the service area, the primary source of air pollution is likely to remain vehicles. Without improved roadways, it is likely that traffic problems would increase, exacerbating existing air quality problems. Smog, ozone, and carbon monoxide are pollutants of concern within the service area and are monitored.

While air quality impacts could occur, long-term cumulative effects of development in the service area are unlikely to have a significantly different impact on air quality than the No Action Alternative. The major pollutant of concern in the region as a whole is ozone. This would continue to be managed by the current vehicle testing program, thereby limiting impacts. Any additional commercial or industrial sources would comply with air quality regulations.

5.9.3 Air Quality: Receiving Basin – Fishing Creek

Direct Impacts

There is no construction associated with the IBT, and the increased withdrawal of water would not affect air quality. Therefore, no direct air quality impacts would occur in this receiving basin.

Secondary and Cumulative Impacts

In the Fishing Creek subbasin in Warren County, minimal population growth is expected, limiting the potential for air quality impacts in the watershed. However, air movement patterns are not bound by river basin boundaries and pollutants that could increase to the west of this basin as part of the project have the potential to travel eastward into the basin. While minor air quality impacts could occur, long-term cumulative effects of development in the service area would not likely have a significant impact on air quality.

5.10 Noise Level

5.10.1 Noise Level: Source Basin – Roanoke River

Direct Impacts

There is no construction associated with the IBT, and therefore no increase in noise levels from the IBT. The increased withdrawal and discharge of water would not affect noise levels in the source basin; therefore, no increased direct noise impacts would occur in the source basin.

Secondary and Cumulative Impacts

The IBT would not facilitate growth or recreational use in the source basin, so no secondary or cumulative noise impacts would result from the proposed project. Any potential for SCI in the service area portion of the Roanoke River basin are discussed in the following section.

5.10.2 Noise Level: Receiving Basins – Tar River and Neuse River

Direct Impacts

Direct impacts or changes to noise levels in this receiving basin would not likely occur, as no construction is associated with this project. The Partners currently have adequate infrastructure in place to transfer water to their wholesale customers.

Secondary and Cumulative Impacts

The predicted growth within the service area will produce higher amounts of noise from greater density of land uses, more people living in the service area, more businesses and industries operating in the area, and an increase in the number of vehicles using local roads and highways. This growth is expected to occur primarily in the southern portion of the service area in the Tar River basin. The continued growth and development of the service area is likely to significantly impact the community noise levels through the introduction of additional traffic and industry. Overall, the background outdoor noise level in the service area could be raised with increased development over time. This is most likely to be significant in the southern reaches of the service area.

5.10.3 Noise Level: Receiving Basin – Fishing Creek

Direct Impacts

Direct impacts or changes to noise levels in this receiving basin are not likely to occur, as no construction is associated with this project. The Partners currently have adequate infrastructure in place to transfer water to their wholesale customers.

Secondary and Cumulative Impacts

In the Fishing Creek subbasin in Warren County, population growth is predicted to be minimal according to its 2012 LWSP, so any increase in noise levels would be minor.

5.11 Forest Resources

5.11.1 Forest Resources: Source Basin – Roanoke River

Direct Impacts

There is no construction associated with the IBT, so no direct impact to forest resources would occur.

Secondary and Cumulative Impacts

Any change in lake elevations due to the IBT would not affect forest resources upstream or downstream of the water withdrawal location. Water release regimes or run-of-river levels upstream would not be affected. Short-duration changes in the Kerr Lake levels driven by the timing of the guide curve (described in Section 5.1 and Appendix D) would not be significant enough to impact forest resources along Kerr Lake or downstream reaches of the Roanoke River and its reservoirs. Bottomland hardwood forests downstream of the Roanoke Rapids Lake dam are important ecologically; these communities are not likely to be significantly impacted by the cumulative impacts of the City of Virginia Beach and KLRWS IBTs. Minimum instream flow requirements would be maintained, providing adequate water to these downstream forested communities.

The potential for impacts to forest resources in the service area portion of the Roanoke River basin is discussed in the following section.

5.11.2 Forest Resources: Receiving Basins – Tar River and Neuse River

Direct Impacts

There is no construction associated with the IBT, so no direct impacts on forest resources in this receiving basin would occur.

Secondary and Cumulative Impacts

Cumulative impacts to forest resources are expected as growth continues in the service area with or without the proposed project. Development activities are predicted to occur mainly in the southern portion of the service area in the Tar River basin and in Franklin County.

Cumulative forest impacts related to growth are not dependent on a specific water source, only that an adequate water supply is available. For example, it is possible that Franklin County could secure another water source if it were not a customer of KLRWS. The population growth predictions in Franklin County, as included in their 2012 LWSP, are dependent on an adequate water supply and the availability of other resources. While this project could provide that adequate water supply, it is possible that another water supply could be secured and these potential SCI could occur with or without the proposed project. Impacts to forest resources would likely occur with or without this proposed IBT. Therefore, the impacts would not be significant when compared to the No Action Alternative.

Forested land within portions of the service area will be converted to other uses. Even without the proposed IBT, forested land would likely be converted to low-density residential land that is serviced by wells and septic systems or to medium-density residential with the availability of an alternate water source. Forested communities would likely remain, primarily along stream channels where stream buffer rules are in place. Overall, forested wildlife habitat would be reduced within the service area and could become more fragmented.

5.11.3 Forest Resources: Receiving Basin – Fishing Creek

Direct Impacts

There is no construction associated with the IBT, so no direct impacts to forest resources in this receiving basin would occur.

Secondary and Cumulative Impacts

SCI to forest resources in the Fishing Creek subbasin in Warren County are unlikely, since predictions are for very slow growth in that portion of the service area.

5.12 Shellfish or Fish and their Habitat

5.12.1 Source Basin – Roanoke River

Several federally listed aquatic species are known to occur in the source basin in Virginia and North Carolina, as outlined in Section 4.12. Fishing, especially for striped bass and shad, is also an important recreational and commercial activity in the Roanoke River basin. In addition, one NHPNA is present in the source basin.

Direct Impacts

Both aquatic and terrestrial resources that inhabit lake or stream-side habitat, including freshwater mussels and fisheries in the source basin, could be directly affected by water quality and quantity changes from transfers of water from the basin, if lake elevations or the volume or rate of flow between reservoirs change dramatically. The proposed project would not likely have any direct effects on these species or their habitats in Kerr Lake, as no construction would occur and there are no known aquatic protected species near the water withdrawal location. In addition, no discernable water quality or quantity impacts result from the proposed transfer of water, as discussed throughout Section 5. With no construction and no discernable changes predicted, the upstream NHPNA in Granville County and the downstream Roanoke River Management Area for striped bass are not expected to be directly impacted by the proposed project. The NCWRC will continue to manage this fishery and its open seasons.

The proposed project is not likely to impact protected species or native communities in the Roanoke River basin.

Secondary and Cumulative Impacts

No SCI to shellfish or fish would likely occur upstream of Kerr Lake, the water withdrawal location. Reservoir release regimes and run-of-the-river levels would not be impacted by the water withdrawal. No water quality changes would be expected. Species such as the striped bass are unlikely to be impacted by this withdrawal because the release regime from Kerr Lake would not be altered by the IBT. The NCWRC will continue to manage this fishery and its open seasons. Water quantities needed to protect aquatic habitats would remain available. With no significant changes to lake elevation, lake and basin hydrology, or water quality in the source basin, the proposed project would not have any significant SCI on fish, aquatic, wildlife, or sensitive species, or the NHPNA within the source basin.

5.12.2 Receiving Basins – Tar River and Neuse River

Several listed freshwater mussel and fish species are federally listed in the Tar and Neuse River basins. The aquatic communities, especially in the Tar River basin, exhibit many rare species, as discussed in Section 4.12. In turn, many lengths of stream have been designated as NHPNAs in the Tar River basin.

Direct Impacts

The IBT itself would not have any direct impacts on fisheries or sensitive species and their habitats, including NHPNAs, in the service area and these basins, because no construction is associated with the IBT.

The proposed project is the preferred alternative because it would avoid adding a water supply source in the Tar River basin, which would remove water from the river, would likely impact aquatic habitats, and potentially have greater environmental impacts than the IBT (see Section 3).

Secondary and Cumulative Impacts

Growth within the service area is expected more in the Tar and Neuse River basins than in the Roanoke River basin or Fishing Creek basin. Land management activities influence water quality. Further development and growth within the service area could have minor impacts on fish and wildlife resources through the continued:

- Loss, fragmentation, or degradation of sensitive and non-sensitive aquatic species and their habitats through conversion of land and wetland areas and filling or piping of streams and creeks for residential, business, or public facility uses
- Degradation of water quality and adverse impacts on aquatic resources, fisheries, and wetlands through increasing erosion and sedimentation from construction activities; changed hydrology from increased impervious surfaces; and increased stormwater runoff containing high levels of nonpoint source pollutants
- Loss of species diversity through the combined cumulative impacts listed above

Federally listed aquatic species such as the Tar River spineymussel and many state-listed species are present in the Tar and Neuse River basins. Both the water quality and sensitive species aquatic habitat in the Tar River basin could be minimally impacted. To a lesser extent, some impacts could occur in the Neuse River basin. Moderate impacts are likely to occur in Franklin County (both basins) without adequate protection measures. Franklin County and other southern portions of the service area are likely, according to their 2012 LWSPs, to have moderate population growth, which in turn could generate moderate SCI to resources without adequate protection measures in place.

These species have some level of protection from the Tar-Pamlico nutrient reduction strategy, Falls Lake strategy, stream buffers, and other water quality and habitat preservation measures in place in the basin. The existing WWTPs within the service area could have increased flows associated with this growth; however, the nutrient reduction strategies and NPDES permits in place are sufficient to mitigate potential impacts to aquatic species and their habitats. Mitigation measures intended to reduce the potential for impacts to listed species and natural resources as a result of the IBT and its facilitation of population growth within the service area and downstream within the study area are discussed in Section 6. While some moderate SCI to aquatic habitat, and potentially to listed species, may occur these SCI are not expected to differ significantly from the other water supply alternatives considered.

5.12.3 Receiving Basin – Fishing Creek

Direct Impacts

The proposed project IBT itself would not have any direct impacts on aquatic communities and their habitats, including aquatic communities and NHPNAs, in the service area, since no construction is planned with the IBT.

Secondary and Cumulative Impacts

In Warren County, population growth rates are predicted to remain low, so only minor impacts from development are expected. This would preserve the habitat resources in Fishing Creek and its tributaries in the basin. Impacts would be minimal and likely not significant in the Fishing Creek

basin and Warren County. Fishing Creek is home to a sustainable, diverse aquatic community and would likely not be impacted by this project. Growth patterns are similar under the No Action Alternative and the 2012 LWSP, which predicts an almost flat growth rate for the planning period of this IBT.

5.13 Wildlife and Natural Vegetation

5.13.1 Wildlife and Natural Vegetation: Federally Listed Threatened and Endangered Species

Several federally listed threatened and endangered terrestrial species are known to occur or have occurred in the source and receiving basins, as outlined in Section 4.13. In addition, many terrestrial NHPNAs are present.

5.13.1.1 Source Basin – Roanoke River

In the Roanoke River basin, habitat diversity ranges from the mountainous headwaters to bottomland hardwood forests as the river reaches the Albemarle Sound as discussed in Section 4.13.

Direct Impacts

Listed species and their habitats would not be directly impacted by implementation of the proposed project. With no construction associated with the proposed project and no discernable projected impacts to water resources as a result of the increased withdrawal, no direct source basin impacts to wildlife and natural vegetation would likely occur in the source basin.

Secondary and Cumulative Impacts

No SCI to wildlife, including protected species, or natural communities would likely occur upstream of Kerr Lake, the water withdrawal location. With no significant changes to lake elevation, lake and basin hydrology, or water quality in the source basin, the proposed project would not have any measurable SCI on wildlife, avian species, or natural communities within the source basin.

5.13.1.2 Receiving Basins – Tar River and Neuse River

The headwaters of the Tar River basin fall within the service area. The portion of the Neuse River basin in Granville and Franklin Counties mainly drains to Falls Lake; some headwater tributaries drain to the run of river downstream of Falls Lake.

Direct Impacts

Listed terrestrial and avian species and their habitats would not be directly impacted by implementation of the proposed project. With no construction associated with the proposed project, no direct source basin impacts to wildlife and natural vegetation would likely occur in these receiving basins.

Secondary and Cumulative Impacts

Growth within the service area is expected more in the Tar and Neuse River basins than in the Roanoke River basin or Fishing Creek basin. Further development and growth within the service area could have minor impacts on wildlife resources mainly through the continued loss, fragmentation, or degradation of terrestrial habitats through conversion of land and wetland areas for residential, business, or public facility uses. These conversions of native vegetation to maintained lands or impervious surfaces reduce the amount and connectivity of available habitats. These potential impacts to wildlife, including protected species, and natural areas are not expected to be significant.

5.13.1.3 Receiving Basin – Fishing Creek

Direct Impacts

Listed species and their habitats would not be directly impacted by implementation of the proposed project. With no construction associated with the proposed project, no direct impacts to wildlife and natural vegetation would likely occur in these receiving basins.

Secondary and Cumulative Impacts

In Warren County, population growth rates are predicted to remain low, so only minor changes to the landscape are expected. These changes are not expected to create SCI. This would preserve the habitat resources in this basin. Growth patterns are similar under the No Action Alternative and the 2012 LWSP, which predicts an almost flat growth rate for the planning period of this IBT.

5.14 Introduction of Toxic Substances

5.14.1 Introduction of Toxic Substances: Source Basin – Roanoke River

Direct Impacts

The proposed project involves the transfer of water from Kerr Lake to other river basins. Water would be treated at the existing WTP location, and then finished water would be transferred through existing infrastructure to KLRWS's customers. The additional capacity and treatment operations at the WTP were addressed under a separate environmental document (EE&T, 2003). No increase in direct impacts associated with toxic substances would likely occur with the proposed project.

Secondary and Cumulative Impacts

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

As urbanization continues in the service area, the potential for releases of toxic substances from residential and commercial sources could increase. As previously discussed, much of the growth is likely to occur in the southern reaches of the service area and mainly outside Warren County. These substances, if improperly disposed of, could have adverse impacts on the environment by entering the surface water and groundwater system through landfill leachate or entering the sewer system and reaching a WWTP. Improper disposal could impact groundwater and surface water quality and could impact human health through drinking water supplies, fish consumption, and other means.

As the amounts of traffic and urban uses in the study area increase, stormwater runoff will contain increasing the levels of water pollutants, some of them toxic. Typical urban stormwater pollutants include sediment and silt, nitrogen and phosphorus from lawn fertilizers, oils and greases, rubber deposits, toxic chemicals, pesticides and herbicides, and road salts. Unless contained and treated before entering surface waters, this urban stormwater could impact water quality and sensitive species living within the study area.

The long-term impact of new toxic discharges to the surface water and groundwater from urban stormwater, landfill leachate, and accidental and/or intentional releases of household and industrial chemicals in the service area could lead to declines in water quality in the service area and

downstream without proper protective measures. This could contribute to the potential loss of wildlife, especially sensitive species, and their habitats.

5.14.2 Introduction of Toxic Substances: Receiving Basins – Tar River and Neuse River

Direct Impacts

No increase in direct impacts associated with toxic substances would likely occur with the proposed project, as no construction is associated with the IBT.

Secondary and Cumulative Impacts

SCI within the Tar River and Neuse River basins are expected to be minor, regardless of the alternative selected.

5.14.3 Introduction of Toxic Substances: Receiving Basin – Fishing Creek

Direct Impacts

No increase in direct impacts associated with toxic substances would likely occur with the proposed project, as no construction is associated with the IBT.

Secondary and Cumulative Impacts

SCI are not expected in Warren County and therefore any SCI related to the introduction of toxic substances are not expected.

SECTION 6

Programs to Minimize Environmental Impacts

The KLRWS Partners' proposed IBT will not have the potential to cause significant direct impacts to the environment, as discussed in Section 5. The IBT, however, may have the potential to significantly impact the environment through secondary and cumulative impacts as a result of facilitating growth in the Tar River receiving basin, as discussed in Section 5. The Fishing Creek receiving basin is not expected to experience any secondary and cumulative impacts as a result of this project.

The third receiving basin, the Neuse River basin, is expected to have future growth pressures similar to those of the Tar River receiving basin in Granville and Franklin Counties. The transfer to the Neuse River basin is included in the potential for SCI in Granville and Franklin Counties.

In order to evaluate the significance of the impacts discussed in Section 5, CH2M HILL has reviewed existing regulations and programs at the federal, state, and local levels to determine if these existing programs may mitigate the anticipated impacts of urbanization of the project area. A discussion of federal, state, and local programs is provided.

With the existing regulatory and non-regulatory environmental protection programs in effect at the local, state, and federal levels, the impacts of the proposed IBT would be minimal when compared to those of the no action alternative.

6.1 Summary of Federal and State Regulations and Programs

The following is a brief description of existing regulations and programs at the federal and state levels in the receiving basin. The discussion emphasizes the extent to which existing programs may adequately mitigate the anticipated impacts of urbanization in the project area. Table 6-1 presents an overview of the regulations and programs and the intent of each to minimize or avoid environmental impacts.

This analysis does not attempt to measure the performance of these regulations and programs to improve specific environmental conditions in the field. Such an "efficiency" analysis of each of these regulations and programs could determine the exact level of benefit received from each. However, an "efficiency" analysis is beyond the scope of this discussion.

Therefore, the following discussion addresses relevant regulations and programs from an environmental management and land use policy analysis perspective. The discussion provides a general overview of the existing regulatory and non-regulatory mitigation framework that protects natural resources from the effects of urbanization. The evaluation is used to identify opportunities for local governments in the study area to enhance environmental protection.

TABLE 6-1
Summary of Existing State and Federal Programs and Regulations and the Environmental Resources they Protect

Program or Regulation	Local Government Program Required	Wetlands	Land Use	Fish and Wildlife	Sensitive Species	Water Quality and/or Quantity	Air Quality	Groundwater	Noise	Toxics
Endangered Species Act (ESA)		X	X	X	X	X				
Fish and Wildlife Coordination Act				X	X					
Clean Water Act (CWA) Section 303(d)		X		X		X	X			X
CWA Section 401		X	X	X	X	X				
CWA Section 404		X	X	X	X	X				
Sanitary Sewer Overflow (SSO) Regulations		X	X	X	X	X		X		X
NPDES Regulations	X	X		X	X	X				X
Protection of Wetlands		X	X	X	X	X				
Isolated Wetland Protection		X	X	X	X	X				
Safe Drinking Water Act		X	X			X		X		X
Clean Air Act (CAA)							X			
Floodplain Management		X	X			X				
National Flood Insurance Program (NFIP)		X	X	X	X	X				X
Archaeological Protection			X							
Archaeological and Historic Preservation Act			X							
National Historic Preservation Act			X							
Protection and Enhancement of Cultural Environment			X							
Farmland Protection Policy Act			X							
Erosion and Sedimentation Control	X	X	X	X	X	X				
CWMTF										
State Revolving Fund		(X)	(X)	(X)	(X)	(X)				
Ecosystem Enhancement Program (EEP)		X		X	X	X				
Tar-Pamlico Nutrient Sensitive Waters (NSW) Program	X	X		X	X	X				
Neuse NSW Program	X	X		X	X	X				
Regulations for Water Main and Sanitary Sewer Extensions		X	X	X	X	X		X		x

TABLE 6-1
Summary of Existing State and Federal Programs and Regulations and the Environmental Resources they Protect

Program or Regulation	Local Government Program Required	Wetlands	Land Use	Fish and Wildlife	Sensitive Species	Water Quality and/or Quantity	Air Quality	Groundwater	Noise	Toxics
Groundwater Protection			X					X		X
WSW Protection Program	X	X	X	X	X	X				
Conservation Reserve Enhancement Program		X	X	X	X	X				
Land Conservation Incentives		(X)	(X)	(X)	(X)	(X)				

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

6.1.1 Endangered Species Act

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

- Authorizes the determination and listing of species as endangered and threatened
- Prohibits unauthorized taking, possession, sale, and transport of endangered species
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds
- Authorizes establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for endangered and threatened wildlife and plants
- Authorizes the assessment of civil and criminal penalties for violating the ESA or regulations
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the ESA of any regulation issued thereunder
- Requires federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat

6.1.2 Fish and Wildlife Coordination Act

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

6.1.3 Clean Water Act

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

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

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

6.1.3.1 Section 303(d) of the Clean Water Act

Section 303(d) of the CWA requires states to identify waters that do not support their classified uses. These waters must be prioritized, and a TMDL must subsequently be developed. TMDLs are calculations that determine the maximum amount of a pollutant that a water body can assimilate and still meet water quality standards, and an allocation of that amount to the pollutant’s sources. As part of the TMDL development process, the sources of the pollutant must be identified and the allowable amount of pollutant must be allocated among the various sources within the watershed. TMDLs were discussed further in Section 4.1.1.1.

6.1.3.2 Sections 404 and 401 of the Clean Water Act

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

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

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

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

6.1.4 Sanitary Sewer Overflows

The USEPA prohibits discharges to waters of the United States from municipal separate storm sewer systems (MS4s) unless authorized by an NPDES permit. In April 2000, USEPA released the *Compliance and Enforcement Strategy Addressing Combined Sewer Overflows and Sanitary Sewer Overflows* (USEPA, 2000). In summary, each USEPA region is responsible for developing an enforcement response plan which includes an inventory of SSO violations. Municipalities typically obtain guidance from NCDENR and USEPA for their systems.

State regulations (15A NCAC 2B.05.06) require municipalities and other wastewater treatment operators to report wastewater spills from discharges of raw sewage from broken sewer lines and malfunctioning pump stations within 24 hours. State policies include strict fines and other enforcement programs to protect surface water quality from wastewater spills.

The North Carolina Clean Water Bill of 1999 provides for the development of permits for collection systems. These permits include requirements for inspections, sewer maintenance, and other operational items.

6.1.5 NPDES Regulations

NPDES stormwater discharges are controlled by the federal NPDES regulations and enforced by NCDWR. The program regulates all major discharges of stormwater to surface waters. NPDES permits are designed to require the development and implementation of stormwater management measures. These measures reduce or eliminate pollutants in stormwater runoff from certain municipal storm sewer systems and industrial activities.

The NPDES stormwater permitting system is being implemented in two phases. Phase I was implemented in 1991 and applied to six MS4s in North Carolina with populations exceeding 100,000 at that time. No local

governments in the receiving basin portion of the project area are subject to Phase I NPDES stormwater requirements. Phase II rules, which were finalized on October 29, 1999 and published in the Federal Register on December 8, 1999, apply to smaller communities. Franklin County and Henderson are Phase II stormwater communities. As such, they must develop a post-construction stormwater program. The City of Oxford's program complies with rules specific to the Tar River basin, which are similar to those required of Phase II communities. More information regarding their programs is included in Section 6.2.

NPDES wastewater discharges are also enforced by NCDWR under authority of the USEPA and target point source pollution into waterways. A NPDES permit is required for discharges into waterways to ensure that water quality criteria are met and sustained. No local government would need to obtain an increase in the capacity of its NPDES permit because of this proposed IBT; planned growth has already been accounted for in the NPDES permits. These current NPDES permits include limits which are appropriate for protecting water quality criteria. No discharges from facilities with NPDES permits would cause impacts to water quality as a result of this proposed IBT. These permits are summarized in Section 4.

6.1.6 Protection of Wetlands, Executive Order 11990

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

6.1.7 Isolated Wetland Protection

Isolated wetlands are those that have no visible connection to surface waters, and are therefore not regulated under Section 404 of the CWA. NCDWR has jurisdiction over isolated wetlands within the state's boundaries. According to NCDWR, any activity that results in the loss of wetland function, including filling, excavating, draining, and flooding, shall be considered a wetland impact. Impacts to isolated wetlands are subject to the requirements of NCDWR permitting and mitigative measures.

6.1.8 Safe Drinking Water Act

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

6.1.9 Clean Air Act

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

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

The Clean Smokestacks Act of 2002 required coal-fired power plants to achieve a 77 percent reduction in NOx emissions by 2009. NOx is the main cause of ozone, one of North Carolina's biggest air quality problems, and it contributes to haze and acid rain. Under the Clean Smokestack Act, utility companies must achieve these emissions goals through actual reductions and not by buying or trading emissions credits from utilities in other states, as allowed under federal regulations. The utilities also cannot sell credits for their emissions reductions (NCDAQ, 2009b).

In 2013, North Carolina had its lowest ozone levels since air monitoring began in the early 1970s. The declining ozone levels coincided with lower emissions from the state's power plants. The state's coal-fired power plants have reduced their NOx emissions, a primary industrial contributor to ozone pollution, by more than 80 percent since the General Assembly enacted the Clean Smokestacks Act in 2002 (NCDAQ, 2013b).

6.1.10 Floodplain Management, Executive Order 11988

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

6.1.10.1 National Flood Insurance Program (NFIP)

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

6.1.11 Archaeological Protection

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

6.1.11.1 Archaeological and Historic Preservation Act

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

- Flooding
- Building of access roads
- Erection of laborer communities
- Relocation of highways and railroads

- Alteration of terrain caused by the construction of dams (by the US government and private corporations)
- Any alteration of terrain as a result of any federal construction project or any federally licensed project

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

6.1.11.2 National Historic Preservation Act

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

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

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

6.1.12 Farmland Protection Policy Act

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

6.1.13 Erosion and Sedimentation Control

The North Carolina Division of Energy, Mineral, and Land Resources (DEMLR) administers programs to control erosion and sedimentation caused by land-disturbing activities on one or more acres of land. Control measures must be planned, designed, and constructed to protect from the calculated peak rate of runoff from a 10-year storm. Enforcement of the program is at the state level, but may be delegated to local governments with certified erosion control programs. The City of Henderson has its own erosion and sediment control program (see Section 6.2.3); the North Carolina Division of Land Resources (NCDLR) administers the program for the other local governments.

6.1.14 North Carolina Clean Water Management Trust Fund

The Clean Water Management Trust Fund (CWMTF) was created by the 1996 Legislature to help finance projects that specifically address water pollution problems. Its purpose was modified through the passage of the 2013-2014 North Carolina budget. It is a non-regulatory program that focuses its efforts on upgrading surface waters in distress, eliminating pollution, protecting and conserving unpolluted surface waters, and

establishing a network of riparian buffers and greenways for environmental, educational, recreational benefits as well as acquiring lands of cultural and historic significance.

CWMTF monies could be used for wetland and/or riparian corridor identification and preservation (through acquisition and easement techniques), to allow comprehensive protection of wetlands and riparian buffers in the project area, and to protect water quality and sensitive aquatic species.

6.1.15 State Revolving Fund

In previous years, the CWMTF had been used to fund wastewater improvements and conventional stormwater projects as well as the acquisition of lands. As part of Session Law 2013-360, the funding of wastewater improvements and conventional stormwater projects is now handled through the State Revolving Fund (SRF) and is administered by the Division of Water Infrastructure and the State Water Infrastructure Authority.

6.1.16 North Carolina Ecosystem Enhancement Program

The EEP was established as a non-regulatory program within NCDENR to:

- Provide a systematic approach for meeting NCDOT's compensatory mitigation requirements.
- Maximize the ecological benefit of compensatory mitigation projects.
- Reduce delays in the construction of transportation improvement projects associated with compensatory mitigation requirements.

The EEP also provides a compensatory mitigation option for permit applicants other than the NCDOT, administers the Mitigation Program for Protection and Maintenance of Existing Riparian Buffers in the Neuse, Tar-Pamlico, and Catawba River basins, and provides a repository for nutrient offset payments in the Neuse River basin.

6.1.17 Tar-Pamlico NSW Program

The EMC designated the Tar-Pamlico River basin as NSW in 1989 because of algal blooms in the estuary which were linked to excessive nutrient loading. Subsequent to the NSW designation, NCDWR developed a strategy to reduce nutrient loading within the basin. This strategy has been modified over time and is currently in its third phase. In the first phase, point sources were targeted, but nutrient loading was largely from agricultural sources within the basin. Thus, a group of NPDES facilities formed an Association and worked with NCDWR to develop a nutrient trading program in which the NPDES facilities were collectively assigned nitrogen limits and made payments to the Division of Soil and Water Conservation. The point source facilities also provided funds to develop a water quality model of the estuary.

In the second phase of the NSW program, the water quality model was used to establish loading targets for nitrogen and phosphorus, which were then allocated between point and nonpoint sources. The trading agreement was updated with the revised nutrient loading target. Nonpoint source reductions were originally voluntary.

In July 1998, the EMC determined that mandatory nonpoint source rules were needed. The following rules were developed:

- Riparian buffer protection rule – The rule requires that a 50-foot buffer be maintained along waterbodies. The inner 30 feet must be relatively undisturbed, and the outer 20 feet must be vegetated. Mitigation requirements for impacts to protected buffers are outlined, as well as a process for local governments to follow to obtain delegation of their buffer program.

- Nutrient management rule – The rule requires people who apply fertilizer to land (exception is residential landowners who apply fertilizer to their own property) to receive state-sponsored training or develop a nutrient management plan.
- Stormwater rule – The rule requires the larger local governments to develop a stormwater program.
- Agriculture rules – These rules establish a nutrient reduction goal for agriculture in the basin. Local advisory committees develop nutrient reduction strategies and submit annual reports to a Basin Oversight Committee.

The third phase of the program continues the point source nutrient trading program until 2015. Franklin Water and Sewer Authority, Oxford, and Louisburg are members of the Phase III agreement with NCDWR.

6.1.18 Neuse NSW Program

The Falls Lake watershed was classified as NSW in 1983; the original NSW strategy included nutrient limits for point sources within the watershed. The entire Neuse River basin was classified as NSW in 1988. As a result of the NSW classification, a nutrient management strategy was initially developed to manage phosphorus from point source dischargers and nitrogen and phosphorus from nonpoint sources. At that time, most of the nutrient problems were occurring in the lower freshwater portion of the river, and phosphorous was considered the controlling nutrient.

Increasing algal blooms and fish kills in the estuarine portion of the Neuse River, attributed to nitrogen over-enrichment, led to a revision of the NSW strategy to address nitrogen inputs to the estuary. The Neuse River NSW Strategy Rules became effective August 1, 1998. New development and redevelopment that drains in whole or in part to NSW must implement stormwater BMPs that reduce nutrient loading. NCDENR has specified basinwide stormwater requirements for the Neuse River basin as described in 15A NCAC 02B .0235.

The Neuse River NSW rules require that existing riparian buffer areas be protected and maintained on both sides of intermittent and perennial surface waters. A 50-foot buffer consisting of 30 feet of undisturbed forest and 20 feet of grassed/vegetated area must be maintained. The rule does not require restoration of buffers that no longer exist. Perennial and intermittent stream determinations are to be based on soil survey maps prepared by the Natural Resources Conservation Service (NRCS) or the most recent version of USGS topographic maps (7.5 minute quadrangle).

While this revised strategy places more stringent nutrient removal requirements on point source dischargers, it also addresses other sources of nutrients, including urban stormwater, agricultural sources, and nutrient application management. In addition, the strategy includes special provisions to protect stream buffers to prevent further degradation of the watershed's ecological integrity.

Additional rules to protect the Falls Lake watershed were adopted by the EMC in November 2010 and became effective in January 2011. Both the Neuse River and Falls Lake NSW rules include the following:

- Riparian buffer protection rule – The rule requires that a 50-foot buffer be maintained along waterbodies. The inner 30 feet must be relatively undisturbed, and the outer 20 feet must be vegetated. Mitigation requirements for impacts to protected buffers are outlined, as well as a process for local governments to follow to obtain delegation of their buffer program.
- Nutrient management rule – The rule requires people who apply fertilizer to land (exception is residential landowners who apply fertilizer to their own property) to receive state-sponsored training or develop a nutrient management plan.
- Stormwater rule – The rule requires the larger local governments to develop a stormwater program to reduce nutrient loading from new development. The Falls Lake rules also include requirements for reductions from existing development.

- Agriculture rules – These rules establish a nutrient reduction goal for agriculture in the basin. Local advisory committees develop nutrient reduction strategies and submit annual reports to a Basin Oversight Committee.

6.1.19 Regulations for Water Main and Sanitary Sewer Extensions

State regulations (15A NCAC 01C .0100 – .0500) establish procedures for the extension of water mains, sanitary sewer, and other utility infrastructure expansions and new facilities that must conform to the SEPA. The regulations require the development of environmental documents for water and wastewater treatment plant development and expansions. In addition, unless site-specific adverse environmental consequences are identified: water main extensions must comply if they are greater than 5 miles in length, and sewer mains if they are greater than 3 miles in length.

6.1.20 Groundwater Protection

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

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

These regulations and programs may afford some protection to groundwater wells from the most common forms of groundwater pollution: point sources such as chemical manufacturing facilities, underground storage tanks, and accidental spills. However, more diffuse and evasive groundwater pollutants from agricultural uses (livestock facilities and chemical application on crops) and urban land uses (over-application of fertilizers and improper use of toxic household chemicals) may not be well managed under these regulations and programs.

6.1.21 Water Supply Watershed Protection Program

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

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

- Protection of surface drinking water supplies in North Carolina from nonpoint source and point source pollution from urban runoff and wastewater discharges.

- Provision of a cooperative program of watershed management and protection that is administered by local governments consistent with minimum statewide standards.

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

- Limits impervious surfaces around water supplies unless stormwater controls are used.

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

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

6.1.22 Conservation Reserve Enhancement Program

The USDA and NCDENR manage the Conservation Reserve Enhancement Program which is available in the Neuse and Tar-Pamlico River basins of the Study Area. This program uses financial incentives to encourage farmers to voluntarily remove sensitive land from agricultural use or implement BMPs.

6.1.23 Miscellaneous Land Conservation Incentive Programs

Other, voluntary strategies exist at federal and state levels that provide incentives to protect natural lands, wetlands, agricultural lands, sensitive species habitat, and forest lands from development. These non-regulatory approaches include providing tax credits for donating lands to specific organizations (usually land trusts) and providing funding for various grants and trust funds to purchase or protect undeveloped lands.

6.2 Local Regulations and Programs

6.2.1 Coordinated Programs

6.2.1.1 Water Shortage Response Plans

KLRWS has developed a Water Shortage Response Plan (WSRP) that was agreed to by the City of Henderson, the City of Oxford, and Warren County in 2011 (Ordinance Book 8, Ordinance 11-04, Chapter 15B). The purpose of the plan is to declare official phases of water supply shortage and voluntary and mandatory conservation measures for those phases. Enforcement measures are also included. The plan applies to the three bulk customers (Henderson, Oxford, and Warren County); each of which would notify their employees and customers (including wholesale) of the water shortage phase and corresponding conservation measures.

The KLRWS WSRP defines three classes of water use and provides examples of each:

1. Essential water use
2. Socially or economically important uses of water
3. Non-essential uses of water

The WSRP includes four phases of water conservation depending on the water level in Kerr Lake:

- Voluntary Conservation – when the water level in Kerr Lake approaches 294 feet, voluntary conservation is implemented. The Director of KLRWS must monitor the lake level and water use demand on a daily basis. All customers will be notified to voluntarily conserve water; the goal for water reduction is 5 percent.
- Mandatory Conservation – when the water level in Kerr Lake approaches 289 feet, mandatory conservation conditions exist. A ban shall be placed on all Class 3 uses throughout the shortage period, while voluntary conservation is in place for Class 1 and 2 water uses. The goal for water reduction is 10 percent.

- Water Shortage Emergency – when the water level in Kerr Lake has dropped to 284 feet or below and/or a serious shortage exists due to other reasons, mandatory measures are put in place such as a ban on all Class 2 and 3 water uses. Voluntary conservation would apply to Class 1. The goal for water reduction is 40 percent.
- Declaration of Rationing – when the water level in Kerr Lake has dropped to 280 feet, mandatory measures are put in place for all customers. The goal for water reduction is 50 percent or more.

The City of Oxford and Warren County further defined their conservation measures in their WSRP. The City of Oxford's plan, completed in 2007, is similar to KLRWS's plan. For rationing, Oxford limits its residential customers to 4,000 gallons per month, and non-residential users must reduce water use by 50 percent. Health care facilities must reduce water without endangering the health of its patients or residents (Oxford, 2007).

Warren County's WSRP, completed in 2010, indicates they will follow the KLRWS plan water shortage declarations and follow their triggers (Warren County, 2010). Norlina's WSRP, completed in 2011, mirrors Warren County's Plan (Norlina, 2011).

Franklin County and its bulk water customers in Bunn and Lake Royale have also developed WSRPs. Franklin County's WSRP, completed in 2010, is similar to KLRWS's, but includes mandatory year-round outdoor water use restrictions for Franklin County and its customers in Youngsville, Bunn and Lake Royale. These restrictions include allowing watering two days a week for odd and even addresses (no outdoor watering is allowed on Monday, Thursday, and Friday). Vehicle washing and pressure washing may occur only on Saturday and Sunday (Franklin County, 2010). The Bunn and Lake Royale plans, completed in 2010 and 2008, respectively, indicate that they follow Franklin County's requirements (Bunn, 2010) (Total Environmental Solutions, Inc. [TESI], 2008).

Stovall's WSRP was completed in 2010 and aligns with the KLRWS's, and indicates that, as a bulk customer of Oxford, they will follow the City of Oxford's water shortage declarations and follow their triggers (Stovall, 2010).

6.2.1.2 Study of Unaccounted for Water

The KLRWS is planning a study of its unaccounted for water to incorporate reductions in its future capital planning. This measure will increase the system's efficiency and stewardship of its water supply.

6.2.2 Warren County

An increase in available water supply through IBT would likely not lead to significant SCI since little growth will occur within Warren County. However, measures that protect the existing environment are discussed here.

6.2.2.1 Planning Approaches

Warren County adopted a 20-year Comprehensive Development Plan in 2002. The Plan indicates that one of the reasons for its development is to deter future negative impacts rather than react to such impacts after they have occurred. Tools to deter these impacts include: natural resources protection ordinances (including floodplain protection, erosion and sediment control, and developing a county-wide greenway system), zoning ordinance, subdivision ordinance, and proactive programs such as pursuing grant funds to preserve areas around water supplies and restore wetlands (Warren County, 2002). To date, the County has adopted a zoning map which shows Special Flood Hazard Areas. A portion of Warren County lies within the Tar River basin; as such, the state's riparian buffer rules described in Section 6.1.2 apply.

The Comprehensive Development Plan also encourages managed, quality growth in the County. There is potential for development in Warren County, but the main source of growth is identified as outgrowth from development in the Raleigh and Durham areas. It is noted that attracting financial investment is a challenge

and business and industrial growth is deficient, however, planning is needed to prepare for infrastructure needs and funding should the need arise (Warren County, 2002).

6.2.2.2 Rate Structures

Warren County, Warrenton, and Norlina all have flat or fixed rate structures, meaning that the price per gallon of water is fixed regardless of how much water is used.

6.2.3 Vance County

Riparian Buffers

Section 205 of the County's Watershed Protection Ordinance requires a 30-foot vegetated buffer along all perennial streams. All buffers must be shown as conservation areas on subdivision plats, development plans, and individual plot plans. Section 306.5 of the Subdivision Ordinance states that natural vegetation within 30 feet of an existing drainage, natural creek, river, natural spring, or pond shall be left intact. In addition, any roadway crossing a riparian buffer must do so at 90 degree angle. The portion of the county in the Tar River basin would also need to meet the state's riparian buffer rules described in Section 6.1.2.

The City of Henderson adopted a Stormwater Management Ordinance for the portion of the City which lies within the Tar River basin in 2004. Section 16-37.3 of the ordinance protects riparian buffers in accordance with the state requirements.

6.2.3.1 Floodplain Protection

Vance County has a Flood Damage Prevention Ordinance which exceeds FEMA requirements. If any development occurs within the floodplain, the structure must be raised 3 feet above the base flood elevation. The ordinance also directs the Floodplain Administrator to advise the applicant on whether any other state or federal regulations apply to their development, including: wetlands requirements, endangered species consultations, and riparian buffer rule in the Tar-Pamlico River basin.

6.2.3.2 Erosion and Sediment Control

The City of Henderson administers its own erosion and sediment control program, which meets or exceeds the requirements of the North Carolina Sedimentation Pollution Control Act of 1973. Any disturbance other than a single-family residence of 0.5 acre or more must develop a plan in accordance with the City's ordinance (City Ordinance Chapter 23A) and NCDENR's Erosion and Sediment Control Planning and Design Manual. Single-family residences must file a plan for any disturbance of 1 acre or more. All development, regardless of the disturbance area, must limit erosion in accordance with the statute and ordinance.

6.2.3.3 Stormwater

Vance County limits the built-upon area within its water supply watersheds at the low density levels allowed by NCDWR in its regulations (built-upon areas range from 12 percent within the CA to 36 percent in WS-IV watersheds in the Tar River basin if no curb and gutter are used). Their Watershed Protection Ordinance allows 10 percent of a watershed area to have up to 70 percent imperviousness, but stormwater must be directed away from streams to the maximum extent practicable.

The City of Henderson developed a stormwater program to comply with the Tar-Pamlico NSW program. The ordinance requires that peak flow mimic pre-development peak flow runoff for the 1-year, 24-hour storm event. Owners of new development must also treat total nitrogen to 4 lb/ac-yr and total phosphorus to 0.4 lb/ac-yr. Developers may offset part of their nutrient load offsite in accordance with NCDWR regulations, but must provide legal assurance of the dedicated use of the offsite area for stormwater management in perpetuity. Assurance of regular operation and maintenance of offsite and onsite treatment systems must also be provided. Currently, in the Roanoke River basin, no stormwater quantity or quality requirements are in place, but the City is modifying its stormwater ordinance to apply throughout the City, which will meet its Phase II requirements.

6.2.3.4 Planning Approaches

Vance County adopted a Land Use Plan in 1996 which was amended in 2010. The Introduction of the Plan indicates that its focus is to "establish a sustainable rural community by balancing economic development and environmental protection". The Plan identified a need for water throughout the county prompting a three-phase project to expand the service area, currently nearing completion. Grants have been used towards project costs receiving 25% of funding in grants in Phase 1A, 42% grants in Phase 2A, and 33% grants in Phase 2B (Vance County, 2014).

As a result of recommendations in the Land Use Plan, the County has developed proposed zoning maps and ordinances for the County, as well as for some of the smaller communities, including Kittrell. Zones include areas for open space protection, floodplains, and watershed overlay districts. The County also adopted a Subdivision Ordinance in 2004 and a Flood Damage Prevention Ordinance as recommended in the Land Use Plan.

The Land Use Plan also provides guidance for future growth. The introduction states "Growth is permitted in accordance with the ability of the County to supply public services, to build and maintain roads and schools, to retain the rural character and to protect historic sites and cultural resources." Throughout the document, growth is encouraged with planning and balance. For example, upgrading infrastructure to sustain new growth but limiting high density growth to areas where these services are already available (Vance County, 2010).

The City of Henderson also has a zoning ordinance and zoning map which dictate how land can develop if the owner chooses to develop those lands. The City's 2030 Comprehensive Development Plan mentions that incentive-based programs whether tax-based, zoning-based, providing technical and financial assistance, and streamlining the process for permitting, would encourage private development or redevelopment. These could support economic development including area business parks, downtown revitalization, and availability of affordable housing (City of Henderson, 2010).

6.2.3.5 Rate Structures

The City of Henderson has a flat or fixed rate structure.

6.2.4 Granville County

6.2.4.1 Riparian Buffers

The portions of Granville County that lie in the Neuse and Tar-Pamlico River basins must comply with the state's riparian buffer requirements as described in Section 6.1.2.

Article 300 of the City of Oxford's Stormwater Management Ordinance protects riparian buffers. The ordinance mirrors the requirements of NCDWR's Tar-Pamlico NSW riparian buffer rules in that it requires a two-zone 50-foot buffer along all intermittent and perennial streams, as shown on either the most recent soil survey or the applicable USGS 1:24,000 topographic map. In addition, the City requires that all riparian buffers be recorded on site plans, subdivision plans, and plats.

The City of Creedmoor's Stormwater Management Ordinance (Chapter 155) requires 50-foot wide riparian buffers as required by NCDWR's Neuse riparian buffer rules. The City requires that riparian buffers be noted on maps submitted for Stormwater Plan approval and must be noted on the final recorded map.

6.2.4.2 Floodplain Protection

Chapter 32 of Granville County's Code of Ordinances includes a Flood Damage Prevention Ordinance which exceeds FEMA requirements. If any development occurs within the floodplain, the structure must be raised 2 feet above the base flood elevation. The ordinance also directs the Floodplain Administrator to advise the applicant on whether any other state or federal regulations apply to their development including: wetlands requirements, endangered species consultations, and riparian buffer requirements. Floodplain boundaries must be shown on final plat plans.

Article 1100 of the City of Oxford's Zoning Ordinance addresses Flood Damage Protection. The ordinance largely meets FEMA requirements, but requires that any structures in the floodplain be raised 2 feet above the base flood elevation.

Chapter 152 of the City of Creedmoor's Code of Ordinances address Flood Damage Prevention and complies with FEMA requirements.

6.2.4.3 Erosion and Sediment Control

The NCDLR implements erosion and sediment control requirements for development in Granville County, the City of Oxford, and the City of Creedmoor. The City of Oxford requires state approval of the erosion and sediment control plan prior to issuing stormwater permits.

6.2.4.4 Stormwater

Granville County as well as the City of Creedmoor have independent stormwater utilities, however, to reduce costs, they share some services with the Towns of Butner and Stem (Granville County, 2014).

Granville County limits the amount of built-upon area within its water supply watersheds, which include the following:

- WS-II – Lake Rogers/Ledge Creek, Lake Butner/Knapp of Reeds Creek, Lake Devin/Hatchers Run (CA and general watershed)
- WS-III – Lake Michie/Flat River
- WS-IV – Historic Oxford water supply intake location/Tar River, Falls Lake/Neuse River (CA and general watershed)

The built-upon area limits are 6 percent in WS-II CA (2-acre lots), 12 percent in WS-II (1-acre lots), and 24 percent (1/2-acre lots) in WS-III and WS-IV. In WS-IV, 36 percent built-upon area (14,000-square-foot lots) is allowed if there is no curb and gutter. Clustering with smaller lots is allowed, but overall density requirements must be met. Watershed boundaries must be shown on final plat plans.

The City of Oxford's Stormwater Management Ordinance requires that drainage systems be designed to encourage natural infiltration. The ordinance requires that peak flow runoff mimic pre-development peak flow runoff for the 1-year, 24-hour storm event. New development must also treat total nitrogen to 4 lb/ac-yr and total phosphorus to 0.4 lb/ac-yr. New development may offset part of their nutrient load offsite in accordance with NCDWR regulations, but must provide legal assurance of the dedicated use of the offsite area for stormwater management in perpetuity. Assurance of regular operation and maintenance of offsite and onsite treatment must also be provided. Stormwater structures which serve more than one residence must be maintained through a homeowners association, and any buyers of those residences must make payments for stormwater maintenance. If the development property is sold, the deed must include notification about stormwater requirements and the purchaser's obligation to maintain and inspect the stormwater treatment mechanisms.

The City of Oxford also has land within the Lake Devin Watershed, a WS-II classified watershed. Within the CA of the watershed, development is limited to 6 percent built-upon area, and lots must be at least 2 acres. Within the balance of the watershed, development is limited to 12 percent built-upon area, and lots must be at least 2 acres.

The City of Creedmoor limits the amount of built-upon area in water supply watersheds in accordance with state regulations. Their Code of Ordinances specifies that all WS-IV GW watershed districts require between 64 percent to 76 percent open space or pervious area; in any designated WS-II CA, the City requires between 88 and 94 percent open space or pervious area.

Both Granville County, the portion in the Neuse River basin, and the City of Creedmoor are subject to the Falls Lake Nutrient Sensitive Water Management Strategy (Falls Lake Rules). These aim to reduce nutrient discharges to the lake from various sources including stormwater runoff, WWTPs, and agriculture.

6.2.4.5 Planning Approaches

The City of Oxford approved a Comprehensive Plan in 2009. One of the goals is to plan for future growth while protecting the City's environmental resources and providing quality public services at a reasonable cost. Included in this plan is a future Land Development Plan that will guide the timing, location, and intensity of future land development. Future development is also addressed in article 1400 of the City of Oxford Zoning Ordinance, Planned Unit Developments, stating that planned unit developments are encouraged as they facilitate planning for large areas and management of the infrastructure and services that will be required and impact the rate of growth (City of Oxford, 2003)." The City also proposes Conservation Lands that could include floodplains, riparian buffer areas, and severe soils as part of the plan (Oxford, 2009).

In 2012, the City of Creedmoor adopted City 2030, a land use and comprehensive master plan as an updated plan incorporating changing trends, environmental mandates, and the City's vision (Creedmoor, 2012).

The Granville County Code of Ordinances, Land Development Code establishes use regulations and standards for the land uses in each zoning district. The ordinances includes regulations such as making water and sewer extensions to promote community growth (section 44-151) and providing adequate school facilities for growth needs (section 37-4). This is applicable to a variety of uses including supporting growth of business parks in the area. Section 32-991 defines the duties of the planning board to prepare "plans for physical, social and economic growth, as will promote the public health, safety, convenience or general welfare, as well as efficiency and economy in the development of the county." Further, section 32-1231 implements the County's Comprehensive Plan which includes "managing and regulating the growth of the county, concentrating development in areas where adequate sewage and water facilities, roads, and schools now exist or can be provided."

Granville County has plans for other development initiatives as well including a Greenway Master Plan for conservation and recreation purposes, but also to promote physical activity for the health of the residents. The Plan proposes trails throughout the County as well as recommendations for planning, oversight, connectivity, acquisition, various types of trails, safety, and funding (LiveWell Granville, 2006).

6.2.4.6 Rate Structures

Oxford and Stovall both have a flat or fixed rate for water.

6.2.5 Franklin County

6.2.5.1 Riparian Buffers

Franklin County lies within the Neuse and Tar-Pamlico River basin, both of which require 50-foot riparian buffers as specified by state regulations described in Section 6.1.2. In addition, Section 7.3 of the County's stormwater ordinance requires new development to protect streams and riparian habitats using 50-foot riparian buffers as outlined in the state's regulations.

6.2.5.2 Floodplain Protection

Franklin County's Flood Damage Prevention Ordinance is found in Article 19 of its Unified Development Ordinance. The ordinance complies with FEMA regulations, requiring structures to be above the 100-year floodplain. In areas where a base flood elevation has not been established, structures must be elevated or floodproofed to 3 feet above the highest adjacent grade. The ordinance also directs the Floodplain Administrator to advise the applicant on whether any other state or federal regulations apply to their development, including: wetlands requirements, endangered species consultations, and riparian buffer requirements. Floodplain boundaries must be shown on final plat plans.

6.2.5.3 Erosion and Sediment Control

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

6.2.5.4 Stormwater Management

Franklin County contains WS-II watersheds and their CAs (Cedar Creek, Sam Kearney Creek, and Smith Creek) and a WS-IV watershed (Tar River) and its CAs. Within the WS-II CA, built-upon area is limited to 6 percent, and residential lots must be at least 2 acres, unless a cluster development has been approved. Within the remainder of the WS-II watershed, lots must be at least 1 acre (unless cluster development is approved) and built-upon area is limited to 12 percent. Non-residential development may have a built-upon area of 70 percent in up to 10 percent of the watershed. In the WS-IV C, residential lots must be at least 0.5 acre and built-upon area cannot exceed 24 percent. These values apply within the remaining WS-IV area as well, but if no curb and gutter is provided, built-upon area can be 36 percent, and lot sizes can be reduced to 15,000 square feet. New and expanding non-residential development may have a built-upon area of 70 percent in up to 10 percent of the watershed.

Franklin County adopted a Tar-Pamlico River basin Stormwater Ordinance for Nutrient Control in 2004 (Article 20 A of the Unified Development Ordinance [UDO]). This ordinance requires that peak flow for new development not exceed pre-development flow for the 1-year, 24-hour storm. In addition, new development must meet total nitrogen loads of 4 lb/ac-yr and total phosphorus loads of 0.4 lb/ac-yr. Higher thresholds can be achieved (10 lb/ac-yr for new commercial or industrial development and 6 lb/ac-yr for new residential development) with payment for offsite controls. Legal assurance of the dedicated use of the offsite area for stormwater management in perpetuity must be provided. Assurance of regular operation and maintenance of offsite and onsite treatment must also be provided.

6.2.5.5 Planning Approaches

The County's Comprehensive Land Use Plan was funded by a Federal Emergency Management Hazard Mitigation Grant and was completed in June 2000. The County Commissioners appointed a citizen's advisory committee, which included Franklin County citizens, to oversee preparation of the plan. It is to serve as a guide for review of development proposals and represents the land use and development formal policies of the county. The County's Comprehensive Land Use Plan and Zoning Map include a Conservation District along its streams (Franklin County, 2000).

The Plan discusses existing land use and incentives to guide growth. Needs for continued growth in respect to each of the six land use categories are listed below:

- Residential – varying lot size to provide a greater variety of housing as well as accommodate a range of affordable housing
- Industrial – continued development of infrastructure, such as water and sewer services, to support additional industrial growth, particularly the growth that is planned in business parks
- Commercial – additional commercial development in a non-strip commercial fashion while limiting/regulating strip commercial development
- Office and Institutional – consisting mainly of school sites, the largest concentrations are located in municipal areas, such as southwest of Louisburg in the Youngsville area
- Public and Transportation – conduct transportation planning to provide most cost effective use of tax dollars to ensure adequate carrying capacity for future development
- Agriculture and Open Space – consider land acquisition for public uses and ensure land dedication requirements in the subdivision ordinance are sufficient to preserve open space.

6.2.5.6 Rate Structures and Other Water Conservation

Franklin County and Lake Royale both have flat or fixed rate structures. Bunn and Youngsville both have increasing block structures, meaning that the more water a customer uses, the higher the rate. Increasing block rate structures promote water conservation.

Franklin County's Water Shortage Response Ordinance also allows the County Manager to declare mandatory water conservation when the Town of Louisburg or the Town of Franklinton (its other water sources) are experiencing water shortages, in addition to allowing the declaration when Kerr Lake is low, as described in the section above on WSRPs.

Franklin County has developed a Leak Adjustment Policy to encourage customers to make prompt and permanent repairs when leaks occur on their property. Franklin County will adjust water bills on receipt of information documenting the repair. Repairs must be made within one month after the leak is detected for indoor, easily accessible and noticeable fixtures. No adjustments will be made if the information is received more than 90 days after the billing date of the bill to be adjusted unless there are extraordinary circumstances.

6.2.6 Summary of Local Government Programs

Table 6-2 summarizes the local government programs in the service area.

TABLE 6-2
Summary of Local Government Programs

Local Government	Buffers[a]	Floodplain[b]	ESC	Stormwater[c]	Planning	Conservation Rate Structure
Warren County	(X)	(X)			X	No
Warrenton	(X)	(X)				No
Norlina	(X)					No
Vance County	(X)	X		WS	X	N/A
Henderson	X	X	X	X	X	No
Kittrell	(X)					No
Granville County	(X)	X		WS		N/A
Oxford	X	X		X	X	No
Creedmoor	(X)	(X)		WS	X	Yes
Stovall						No
Franklin County	X	X		X	X	No
Bunn	(X)					Yes
Lake Royale [d]	(X)		X			N/A
Youngsville	(X)	(X)				Yes

[a] X = Local government has riparian buffer ordinance | (X) = State regulations protect riparian buffers

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

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

[d] Lake Royale is a private development and as such does not have ordinances, but rather has a set of Rules and Regulations which include riparian buffer protection rules.

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SECTION 7

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