Lake Country Water Supply Plan
&
Drought Response Plan

For

County of Brunswick
Town of Alberta
Town of Brodnax
Town of Lawrenceville
County of Mecklenburg
Town of Boydton
Town of Chase City
Town of Clarksville
Town of La Crosse
Town of South Hill

Adopted 2011

Lake Country Water Supply Plan
&
Conservation & Drought Response Plan

Participating Localities

Brunswick County
Alberta
Brodnax
Lawrenceville

Mecklenburg County
Boydton
Chase City
Clarksville
La Crosse
South Hill

Prepared by Southside Planning District Commission

Submission Date: August 2011

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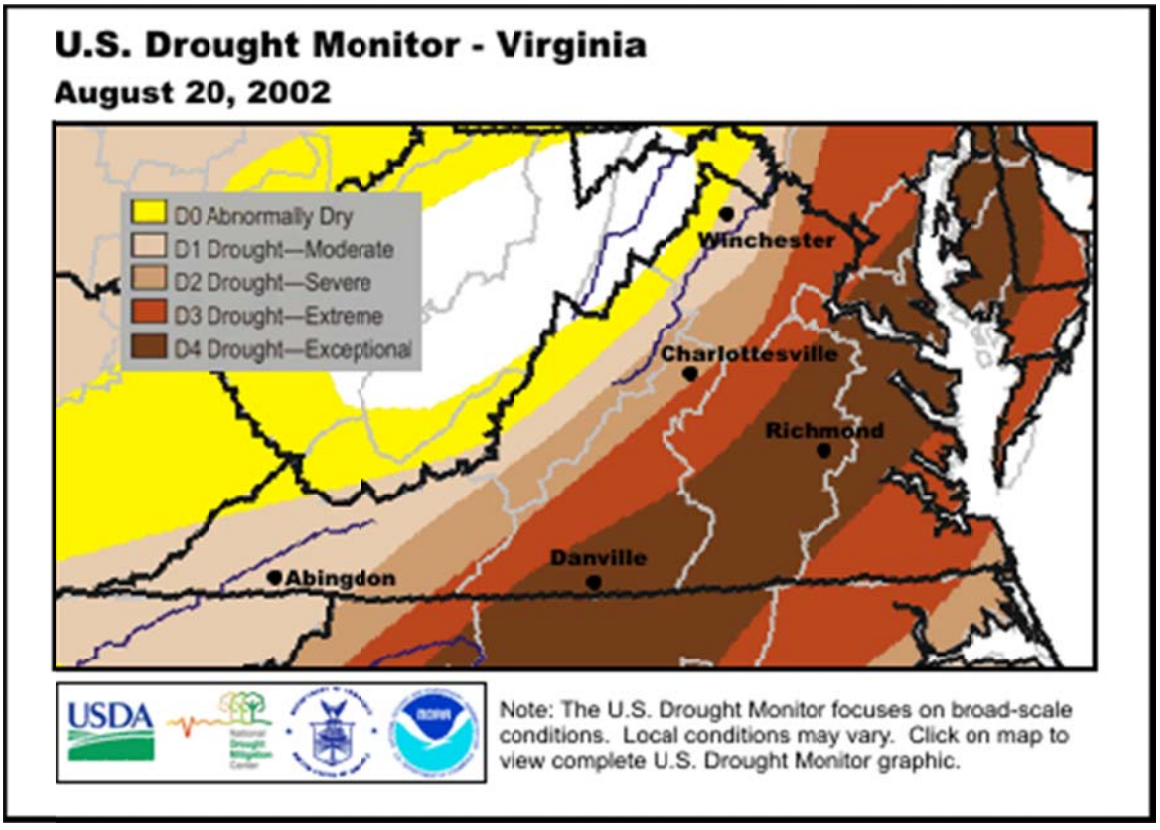
1—PREFACE

Background

In November 2005, the Virginia Regulation for Local and Regional Water Supply Planning (9 VAC 25-780), was amended to require that all localities develop water supply plans and established the criteria which must be followed in plan development:

> *These plans will be reviewed by the Department of Environmental Quality and a determination will be made by the State Water Control Board on whether the plans comply with this regulation. Within five years of a compliance determination by the board the plans will be reviewed to assess adequacy, and significant changes will require the submission of an amended plan and review by the board. All local programs will be reviewed, revised and resubmitted to the Department of Environmental Quality every ten (10) years after the last approval.*

In 1977 the State Water Study Commission was charged with the task of overseeing water supply planning for the state. However, the implementation of the Clean Water Act diverted resources and attention from water supply matters. In part in reaction to the severe drought of 1999-2002, the Virginia Water Supply Task Force was organized. Following their recommendations, in 2003 the Virginia General Assembly authorized the Department of Environmental Quality (DEQ) to develop a statewide water supply plan. The need to determine adequacy of future water supply and formulate plans to react to future drought became apparent in those years of rainfall shortages.



In order to comply with the regulation localities within Brunswick and Mecklenburg counties agreed to collaborate in a regional plan. Participants in the regional plan include Brunswick County and its municipalities—Lawrenceville, Alberta and Brodnax; and, Mecklenburg County and its municipalities—Boydton, Chase City, Clarksville, La Crosse and South Hill. The state regulation stipulated that regional plans must be submitted no later than November 2011; while single governments had deadlines from November 2008 to November 2010 depending upon population size for plan submittal. The Southside Planning District Commission served as project coordinator of the regional Lake Country Water Supply Plan (LCWSP).

The Southside Planning District (SPDC) was awarded a grant in 2006 to begin the plan development and immediately struck out to obtain the necessary data to fulfill its task. At that time the Department of Environmental Quality was just formulating guidance for preparing the local plans as required by the state regulation. Consequently data collected from localities may not be to the same standard or consistency as later local plan submissions. As guidance, spreadsheet templates and checklists were made available, the SPDC took note and was able to adapt some of the formatted spreadsheets. The PDC submitted its draft plan for review and comments to DEQ in 2008. Comments were not received until August 2010. The Lake Country Plan is regional and therefore had a longer submission deadline. This quick start but subsequent delay has resulted in a number of issues that will be dealt with during the five-year update.

Five-Year Update Changes

Also during the planning period a number of significant changes have occurred that affect the water use patterns of the region—directly and indirectly. A few issues and changes that will be addressed during the five-year plan update include:

- The Brunswick County Correctional Unit was closed by the Virginia Department of Corrections. This was the Town of Lawrenceville's second largest water user, accounting for approximately 10% of its water use.

- A regional jail facility that will serve Brunswick, Mecklenburg, Dinwiddie and Halifax counties is under development near Alberta. Town of Lawrenceville will be the water source. The facility is projected to use .05 MGD.

- At the time of the initial water plan draft, a large industrial water user was planning to locate near Chase City with Roanoke River Service Authority (RRSA) as the provider. Osage, an ethanol producer, was slated to use approximately 1.2 MGD but has since postponed those plans indefinitely. However, the construction of a water line to the town of Chase City is still underway. Chase City's groundwater system will be replaced by surface water from RRSA.

- Several landowners have placed conservation easements on their property, which were not contained in the DCR database during the original data-gathering period.

- The information collection process for this initial plan was a learning experience and the five-year plan update will enable more accurate results. The data requested from localities should be more defined. The data submitted by localities contained inconsistencies in reporting

periods and increments (gallons per month versus million gallons per day). Water use data obtained from the localities and water purveyors was for similar time periods, i.e. more or less the same year but some may have been initiated 3 or 4 months earlier or later than other providers. Furthermore during the update a longer window usage over additional years should be obtained and compared.

- Data tables from state departments, DEQ (2004) and VDH (2005), which were the most recent available at the time, were of slightly differing time periods both from each other and from the localities. This information was difficult to get at the time; therefore, the plan typically used the state reporting information for withdrawal amounts and the local data for typical usage and categorical calculations. During the plan update data requested and collected should contain overlapping annual information.

Plan Design

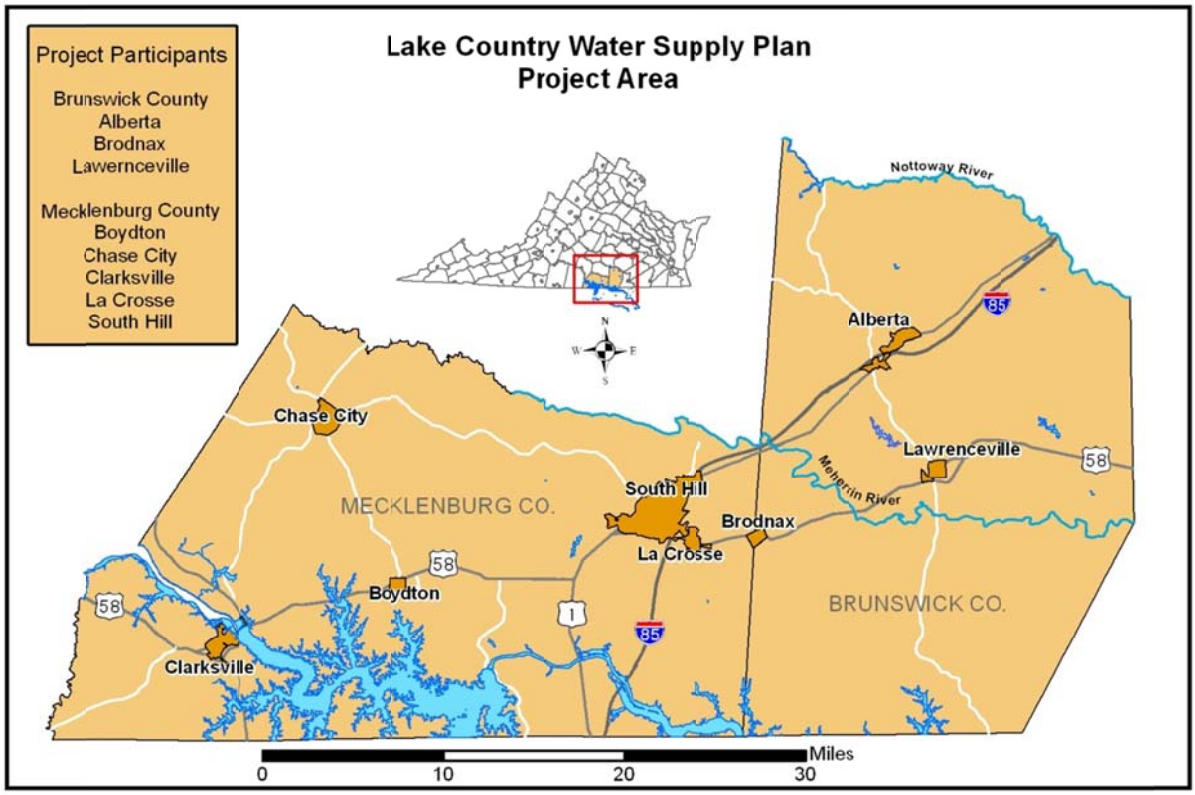
State regulations set forth that the local water supply plan include three components—1) Evaluation of Existing Resources, Water Supply and Water Usage, 2) Assessment of Future Water Demands, Needs, and Alternatives, and 3) Water Demand Management and Drought Response. The following chapters will follow this design in order to document the existing water resources, usage and estimate future needs. The DEQ Local and Regional Water Supply Planning Checklist, which is based on VAC 25-780, is attached as Appendix F and is referenced in section headings.

Data for this planning study were collected from a variety of available public sources, including DEQ's withdrawal permits records (2004), Virginia Department of Health (VDH) Public Water System permits (2005), local water providers, Army Corps of Engineers, U.S.G.S., and miscellaneous resource reports.

2—EXECUTIVE SUMMARY

Project Area

This water supply plan will examine the needs and supply demand for Brunswick and Mecklenburg counties and their eight incorporated towns, encompassing a total area of 1,249 square miles. The counties are located in the Piedmont region of Virginia along the North Carolina border, and are within the Southside Planning District. The planning region has long been known for agriculture and growing tobacco. A good portion of Lake Gaston and John H. Kerr Reservoir are located within these two counties, which are often called "Lake Country."



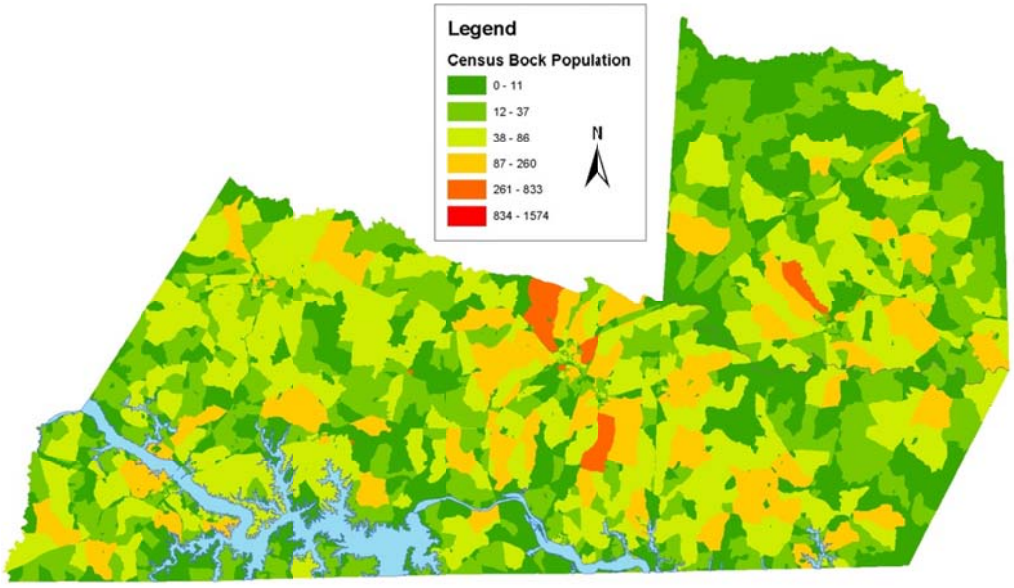
Population

In 2000 approximately 50,800 persons were residing in Brunswick and Mecklenburg counties, which was an increase of 12 percent since the 1990 Census. The population centers are the eight townships. Additionally there is a concentration of housing developments around the lakes. The 2000 Census of Population indicated that 22% of the region's residents lived within the incorporated limits of a town. The overall population density is 42.7 persons per mile: Brunswick County—32.5 ppmi^2 and Mecklenburg County—51.9 ppmi^2.

Estimates show this growth in population has leveled off and projections now indicate little or no growth is anticipated through the next several decades. The state demographer, Virginia Employment Commission, projects growth of less than 1% is anticipated based on current conditions. The economic downturn is one factor used in preparing the projections. Local officials are constantly endeavoring to reverse this trend.

Lake Country Population Summary

	2000 Census		Area in Square Miles			Density per sq. mi. of land area	
Locality	Population	Housing Units	Total Area	Water Area	Land Area	Population	Housing Unit
Brunswick County	*18,419*	*7,541*	*569.37*	*3.23*	*566.14*	*32.5*	*13.3*
Town of Alberta	306	158	1.1	0	1.1	278.2	143.6
Town of Brodnax	317	139	0.71	0.01	0.7	452.9	198.6
Town of Lawrenceville	1,275	459	0.92	0	0.92	1385.9	498.9
Mecklenburg County	*32,380*	*17,403*	*679.29*	*55.36*	*623.93*	*51.9*	*27.9*
Town of Boydton	454	165	0.82	0	0.82	553.7	201.2
Town of Chase City	2,457	1,249	2.19	0	2.19	1121.9	570.3
Town of Clarksville	1,329	753	2.01	0.03	1.98	671.2	380.3
Town of La Crosse	618	314	1.16	0	1.16	532.8	270.7
Town of South Hill	4,403	1,988	6.35	0.03	6.32	696.7	314.6
Lake Country Planning Area	***50,799***	***24,944***	***1,249***	***59.0***	***1,190***	***42.7***	***21.0***



Local Economy

While the Planning Area counties are rural they are in excellent proximity to large regional markets and have an outstanding transportation system, which includes an interstate and several U.S. highways, two municipal and one regional airport. Two international airports are located within a 100-mile radius. The region has an abundance of resources including educational facilities, industrial and residential sites, medical services, outdoor recreational facilities and the two lakes comprising over 1,100 miles of shoreline. These resources enhance the area's competitive advantage as an attractor of people and business.

However, this region has been experiencing an economic decline in the last few decades as farming became less and less viable for the small farmer. For decades, even centuries, the economic structure of the region has revolved around agriculture with tobacco being the principal crop. As a result of the Tobacco Buyout Bill, which eliminates tobacco market quotas and price supports, most tobacco farming is expected to shift to the large corporate operations. Some farmers will seek to alternative crops or agri-businesses. Many will leave farming entirely.

During the fifties, sixties and seventies many textile manufacturers built businesses in Southside Virginia, benefiting from readily available labor exiting the farms. As the textile sector grew the area's economy developed a dependence upon this industry. With the passing of the North American Free Trade Agreement (NAFTA), the region began experiencing another severe economic blow. Industries have been attracted by the cheap labor in Mexico and overseas, and thousands of jobs have been lost. Since 2000, approximately 4,000 jobs have been lost in Planning District 13; of these 43% or 1,600 were in the textile/apparel sector. One of the textile industries that closed was Burlington Industries, a major water user in the town of Clarksville.

From 2001 to 2005 the District experienced an average unemployment rate of 8.2 percent. In comparison, the state average unemployment rate over the same time period was 3.7 percent.

As traditional manufacturing and agricultural jobs disappear, local economic development offices strive to develop new strategies and programs to improve the economy. These programs include workforce training, infrastructure improvements including water and wastewater treatment facilities, provisions for high-speed communications, development of business and industrial parks, downtown redevelopment, and development of the tourism industry as a further attractor of business and people to the area.

Two primary components of this strategy as mentioned are the provision of water and at the same time protection of the region's natural resources—the lakes and river in particular—as tourism is developed as an industry. This water supply planning process will help local official ensure that both resources are available as the counties and its communities grow.

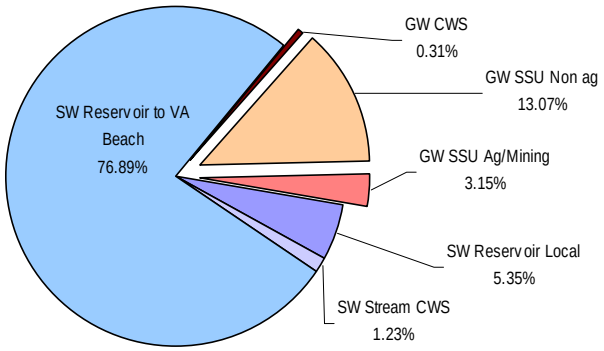
Data Summary

Sources

Brunswick and Mecklenburg counties are located within the Chowan River and Roanoke River Drainage Basins. Surface water provides for most municipal water supplies. The primary surface water source is the Roanoke River through its impoundments—John H. Kerr Lake and Gaston Lake. Great Creek is the water source for the towns of Lawrenceville and Alberta. The town of Chase City and most of the residential subdivisions surrounding Lake Gaston utilize community wells. Approximately 65% of the region's population is served by individual, un-metered dug or drilled wells.

Regional water sources are plentiful and desired by outside urban centers. Lake Gaston and Kerr Reservoir offer a Safe Yield of 352 MGD. Detailed water source tabular data may be found in Appendix A.

Lake Country Withdrawals by Source (MGD)



Water Use

During the study period (2004-2006) community water systems withdrew 2.2 MGD (million gallons per day) of surface water and 0.4 MGD of groundwater. Most of the Lake Country reporting self-supplied users (SSU) are primarily non-consumptive. Agricultural self-supplied users reported use of approximately .06 MGD. Consumptive users from outside the region have withdrawal permits for 80 MGD. Users of individual wells are estimated to withdraw 2.6 MGD. Detailed water use tabular data may be found in Appendix B.

Resource Conditions

Lake Country is primarily rural. Impervious surfaces make up less than 5% of the Lake Country total land area. The lakes and expansive forested lands have provided extensive recreational property and uses and account for more than 75% of the land cover according to the Virginia Non-Point Source (NPS) Assessment. Detailed data regarding area existing resources potentially relevant to water quality may be found in Appendix C.

Water Demand

Current population projections indicate little growth is anticipated over the next decades. Local projections indicate the total Lake Country population of 50,799 in 2000 will grow to only 51,998 by 2040. Industry closures starting in 2000 have contributed to this slow growth. To counter the economic downturn, state and local economic development officials actively market the Southside and Lake Country areas. The ample water resources are an important enticement. While these economic development efforts could result in additional industrial water need and usage; resources are more than adequate to meet this future need.

The overall demand projections for Lake Country Planning Area users indicate a current use of approximately 10 MGD that is anticipated increase to 11.2 MGD by 2040. Additionally users from outside the area have permits to withdraw 80 MGD from the Roanoke River system. Detailed water demand tabulations may be found in Appendix D.

An assessment of Community Water Systems shows that the Lake Country Region's resources—safe yield and permitted capacities—are more than adequate to meet its projected water demand needs. See Appendix D for Population and Demand Projections and Assessment (Table I) and are summarized below.

	Water Supply Adequacy Assessment surplus (+) or deficit (-), MGD				
	2005	**2010**	**2020**	**2030**	**2040**
Lawrenceville					
Average Annual Demand	1.230	1.231	1.225	1.219	1.213
Peak Day Demand	0.845	0.847	0.838	0.829	0.819
Chase City					
Average Annual Demand	0.711	0.711	0.709	0.708	0.706
Peak Day Demand	0.617	0.616	0.614	0.612	0.609
Clarksville					
Average Annual Demand	0.750	0.749	0.747	0.745	0.743
Peak Day Demand	0.459	0.458	0.454	0.450	0.450
RRSA					
Average Annual Demand	2.961	2.959	2.950	2.940	2.930
Peak Day Demand	2.352	2.349	2.334	2.319	2.305
Private CWS					
Average Annual Demand	1.700	1.700	1.698	1.696	1.695
Peak Day Demand	1.600	1.600	1.597	1.595	1.592

Projected Annual Average, Peak Demand, & Capacity						
System	**Year**	**Estimated Annual Average Water Demand (MGD)**	**Estimated Peak Water Demand (MGD)**	**VDH Permitted System Capacity (MGD)**	**Stream Safe Yield (MGD)**	**Source**
Lawrenceville	2040	0.787	1.181	2	3.85	Great Creek
Chase City	2040	0.194	0.291	0.9	NA	GW
Clarksville	2040	0.257	0.555	1	352	SW: Kerr Res.
RRSA	2040	1.250	1.875	4.18	352	SW: Gaston
Non-Municipal CWS	2040	0.205	0.308	1.9	NA	GW
Total Lake Country	2040	2.693	4.210	9.980	Sufficient	

Existing use, contract obligations and other limits, and projected peak demand for the Lake Country systems is summarized below by water source.

Lake Country Water Systems Use & Capacity Summary

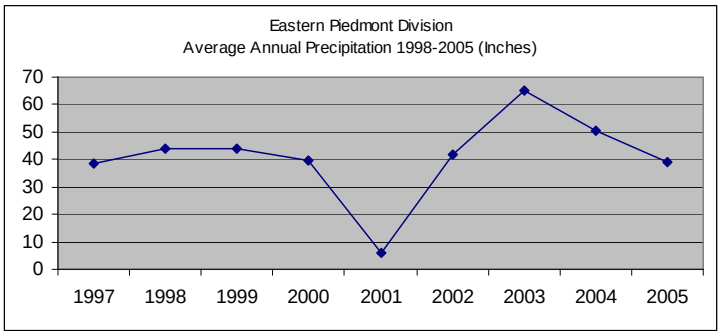
Water System: Name or Type	**Current Use** Ave. annual withdrawals (MGD) Source DEQ 2004	VDH Permit: Water Treatment Plant Capacity (MGD)	Contract Withdrawals or Storage Limits	Projected Peak Demand 2040 MGD
Roanoke River Basin				
Roanoke River Service Authority	1.22	4.18	7.0 MGD	1.88
Future Industrial User (Osage)				1.20 [1]
Town of Clarksville	.25	1.0	Design limit only: 1 MGD or 4 GPM/s.f.	.55
SSUs:. Cogen	2.41	Non-consumptive	2.3 MGD	2.4
Prison	Unused	N.A.	.06	0
Reservoir Withdrawal w/in LC	**3.9 ***	**5.2**	**10.4**	**6.0**
Users from outside LC				
City of VA Beach	60	N.A.	60	60
KLRWP	6.5	10 [2]	20 [2]	20 [2]
Reservoir Withdrawal For water supply	**70.4 ***		**90.4**	**86.0**
Chowan River Basin				
Town of Lawrenceville (includes Alberta)	.73	2.0	2.0	1.2
Stream Withdrawal	**.73**	**2.0**	**2.0**	**1.2**
Groundwater—Lake Country				
Town of Chase City	.185	N.A.	.883	.29
Total Other CWS (24)	.19	N.A.	1.06	.31
SSUs	2.06	N.A. Non-consumptive		2.06
Individual Wells	2.62	N.A.	None	2.7
Groundwater Withdrawal	**5.1**		**1.9**	**5.4**

No user in Lake Country purchases or utilizes water from outside the Planning Area.
Detailed information regarding the existing water sources for the Lake Country Planning Area may be found in **Appendix A**.
N.A. Not Applicable
[1]Includes Osage 1.2 MGD
[2]Source: KLRWP; 20 MGD applied for
* John H. Kerr Hydroelectric power plant not included in total—separate allocation in reservoir & non-consumptive. [5,621.7 MGD]

3—EVALUATION OF EXISTING RESOURCES, WATER SUPPLY, & WATER USE

A. Existing Water Sources *9 VAC 25-780-70*

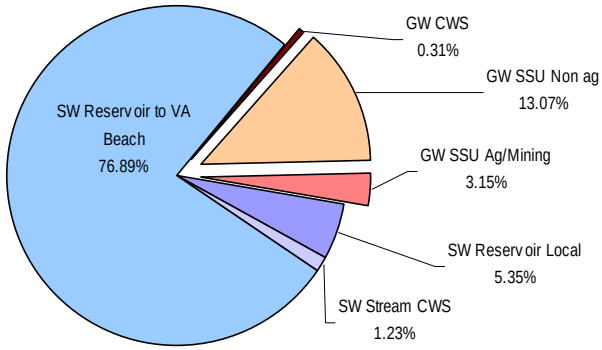
In order to evaluate the local water resources and adequately predict future demand to assess needs if any, an inventory of existing water supply and usage must be prepared. The following sections will identify current water supply sources, systems capacities, local users and usage. The supporting information was collected from a variety of available public sources, including DEQ's withdrawal permits records (2004), Virginia Department of Health (VDH) Public Water System permits (2005), local water providers, Corps of Engineers and miscellaneous resource reports. Additionally most local information was provided for 2005. These two years are considered fairly typical rainfall years and should offer a fair assessment of the existing water supply conditions.



Lake Country Water Sources Summary

Water sources in Lake Country are varied. In Lake Country, the counties do not own or operate any water systems. Most community water supplies are owned by the municipalities, public service authority or are privately owned by homeowners associations and well companies serving subdivisions. Currently only the town of Chase City and most of the residential subdivisions surrounding Lake Gaston utilize groundwater through community wells. In Brunswick County, Lawrenceville owns the municipal system and provides treated water to the town of Alberta. In Mecklenburg, Clarksville and Chase City own and operate their systems. The remaining county towns are served by Roanoke River Service Authority (RRSA), which provides water to the towns of Boydton, South Hill, La Crosse, Brodnax, and several subdivisions in the Bracey community on Lake Gaston. All the towns own their own transmission systems. Surface water provides for most municipal water supplies. Clarksville and the Roanoke River Service Authority withdraw from reservoirs—John H. Kerr Lake and Gaston Lake respectively, which are impoundments of the Roanoke River. Lawrenceville withdraws from Great Creek and the Meherrin River. In addition to the local municipalities, the City of Virginia Beach has a permit to withdraw up to 60 MGD from Lake Gaston and has 10,200 acre-feet of water supply storage space in Kerr Reservoir. Non-

Lake Country Withdrawals by Source (MGD)

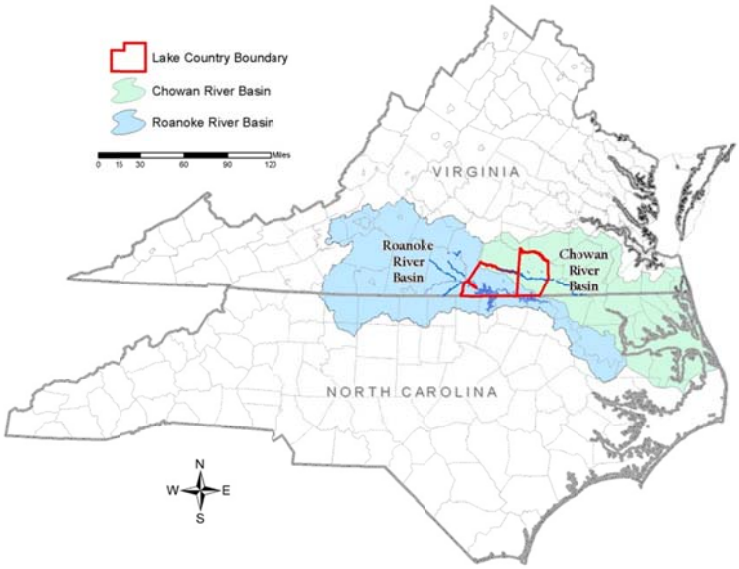


consumptive users include the Kerr Hydroelectric Power Plant and the Mecklenburg Cogeneration Facility.

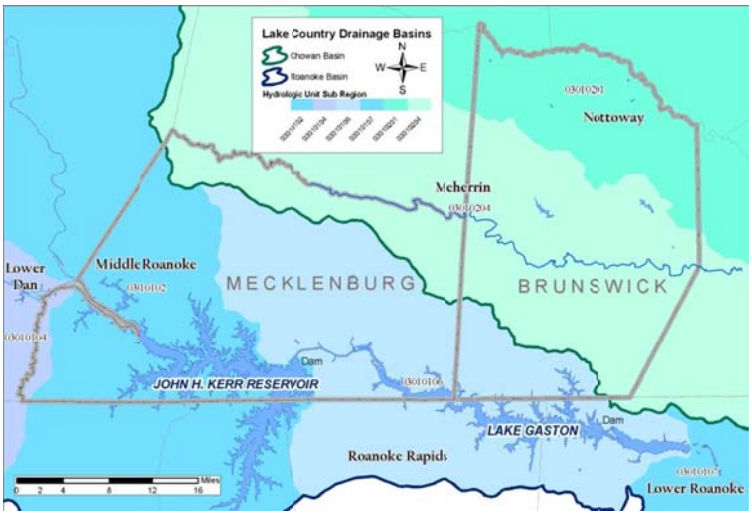
Predominately, as the towns are the principal business and commercial centers for the area, industrial and commercial water users are located within public water system service areas. Groundwater is the water source outside public service authority areas and the municipalities (with the exception of Chase City). This withdrawal is primarily for domestic use, as typically the businesses located outside of community service areas are small water users, such as gas stations, convenience stores and occasionally small offices. Other groundwater users include a limited amount of farm operations and Vulcan Materials. The following sections provide a more detailed discussion of ground and surface water source information. A map showing all permitted community wells and intake structures is found in Appendix E.

DRAINAGE AREAS

Lake Country lies in two drainage basins—Roanoke River and Chowan River. Mecklenburg primarily drains to the Roanoke River, while most of Brunswick drains to the Meherrin, which flows into the Chowan River. Both systems flow into the Albemarle Sound in North Carolina.



The entire Roanoke River watershed is approximately 9,666 square miles in size, 6,066 of which are in Virginia. As can be seen in the figure below, the drainage basins are divided into subareas or units. Mecklenburg lies primarily in the Roanoke River Basin covered by Subarea 3 or Hydrologic Units 03010102 (Middle Roanoke) and 03010106 (Roanoke Rapids). The intakes for the Clarksville and Kerr Lake Regional Water System are located in the Middle Roanoke sub-basin. The intake for the RRSA that serves most of the municipalities in Mecklenburg is located in the Roanoke Rapids sub-basin.



In Brunswick County the Lawrenceville intake is located in the Meherrin sub-basin of the Chowan River Drainage Area. The Chowan River Basin is approximately 130 miles long and drains about 4,900 square miles of land in Virginia and North Carolina. The drainage areas statistics for the reservoirs and streams serving Lake Country are provided in Appendix A, Tables 70C and 70D.

COMMUNITY WATER SYSTEMS-- GROUNDWATER SOURCES

The Virginia Department of Health (VDH) Public Water System permits for 2005 were studied to gather information for the Lake Country Region. Detailed groundwater community water systems data is provided in Appendix A, Table 70B. Some of the groundwater data requested for this study was unavailable and is noted on the attached spreadsheets. There was no information on the screen depth and little for the casing depth. Currently, neither Brunswick County nor Mecklenburg County fall within the Virginia Ground Water Management Area.

Within Lake Country there were VDH permits for 24 systems utilizing wells with a total permitted capacity of 1.59 MGD (million gallons per day). The town of Chase City is the only municipality in the region utilizing wells. Their system has 11 permitted wells, however, three are out of service and therefore only eight of the wells are used. VDH permits indicate a total permitted capacity of .884 MGD for the Chase City system. An ethanol plant that is seeking to locate on the outskirts of Chase City needs 1.2 MGD, which the existing groundwater system could not supply. Should the plant decide to locate they will be served by RRSA via a water line extension from Boydton. The town would then be in a good position to switch sources if desired. *[1/2011 Note: The ethanol plant has postponed its plans to locate in Chase City however, the town has elected to connect to the RRSA.]*

The remaining 23 systems include 20 subdivisions, two trailer parks and one apartment complex. One subdivision, Lake Gaston Americamps, as the name indicates includes a campground in addition to a residential housing section. Additionally no location or knowledge of two systems on the VDH list—Pine Creek Apartments and Sunnybrook Subdivision—could be found.

Figure 1a

Groundwater Systems-2006	# Wells	# Well Systems	Estimated Population	VDH System Permitted Capacity	Average Daily Withdrawal MGD
Community Water Systems—Total	47	24	4,413	1.59 GPD	0.22 MGD [1]

[1] Based on DEQ (2004), VDH (2005) records and Local sources

The surface water sources in Lake Country are John H. Kerr Reservoir and Gaston Lake; and the Meherrin River and Great Creek. Kerr and Gaston Lakes are both impoundments of the Roanoke River. The tables below and in Appendix A, Table 70-C, offer a summary of the capacities and limitations of the streams and reservoirs serving Lake Country. As of 2005 DEQ reports show there were community water system withdrawal permits for a total of 21 million gallons per day (MGD) from Kerr Reservoir and 67 MGD from Lake Gaston. The combined safe yield for the Roanoke River impoundments was 352 MGD based on the drought of record 1980-81.[4] Data for the Great Creek Reservoir is shown below, however, currently the Town of Lawrenceville withdraws from the creek below the dam with the reservoir serving as storage. The Meherrin River serves as an alternate source for the town. None of the community water systems operate a series of interconnected reservoirs.

Figure 1b

Lake Country Surface Water Sources—see also Appendix A, Table 70C

CWS	Treatment Capacity (MGD)	Withdr. Permit Limit (MGD)	Reservoir	Intake Sub-basin	Drainage Area (Sq. Miles)	Surface Area (acres)	On Stream Storage	Safe Yield MGD
Clarksville	1.0	1.0	John H. Kerr	Middle Roanoke	7,780	48,900[1]	Volume= 2,770,000 Ac-ft at elevation 320' msl See table, page 20	352 MGD[4]
KLRWS*	10	20.0						
RRSA	4.18	7.0	Lake Gaston	Roanoke Rapids	7,320	20,300	450,000 Ac-ft 20,000 Ac-ft usable storage	352 MGD[4]
VA Beach*	Not Applicable	60.0						
Lawrenceville	2.0	2.0	Great Creek (Future Supply)	Chowan/ Meherrin	46	590[2]	10,509 Ac-ft[3] 950 Ac-ft water supply storage	Storage See below.
Stream			**Stream**	**Sub-basin**	**Drainage Area (Sq. Miles)**	**Median Daily Flow (7/7/06)**	**Lowest Daily Flow of Record—USGS (cubic feet per second)**	**Safe Yield Million gallons per day**
Lawrenceville (Primary Source)	2.0	2.0	Great Creek	Chowan/ Meherrin	46	Ungaged —Info NA	Ungaged—Info not available	3.85 MGD
(Alternate)			Meherrin R.	Chowan/ Meherrin	552	144 cfs.	2.2 cfs (2002)	2.4 MGD

*Outside Lake Country Planning Area

[1] At full power pool—excludes flood storage volume; elevation 300'.

[2] At crest of emergency spillway

[3] At crest of emergency spillway—excludes 916 AF of sediment and 950 AF water supply storage allocated to the permanent pool.

[4] Based on drought of record 1980-81; Source: 1982 Phase I Study Roanoke River Basin Water Resource Development Plan, VA Beach

A map of groundwater and surface water Community Water Systems is found in Appendix E, Map 1.

Reservoirs

John H. Kerr Reservoir

John H. Kerr Dam is located about 179 river miles above the mouth of the Roanoke River in Mecklenburg County, Virginia and about 20 miles downstream of Clarksville, Virginia. Kerr Reservoir at elevation 300 feet, mean sea level (msl), covers an area of 48,900 acres and has a shoreline length of 800 miles. Kerr Reservoir extends into Mecklenburg, Charlotte and Halifax counties in Virginia and Granville, Vance and Warren counties in North Carolina. In Virginia, Kerr Reservoir is more commonly known as Buggs Island Lake. This name came from an island located just below the dam structure.

John H. Kerr Reservoir is a federal project authorized for recreation, flood control, hydroelectric power generation, fish and wildlife, and water supply. Kerr Reservoir was constructed in 1950 with flood control as its primary function as it was developed in response to a devastating flood in 1940. For this reason its flood storage capacity (1,278,000 acre-ft.) is greater than Lake Gaston or Roanoke Rapids Lake, which are located downstream.

Figure 1c

Kerr Reservoir Storage Allocations—*Source USACE, John H. Kerr Project website*

Objective	Elevation (feet, msl)	Storage capacity (acre-feet)	Storage capacity (MG)
Total Volume	326 ft, msl	3,364,500 (8.09 inches)	1,096,325.7
Uncontrolled Flood Storage	326 to 320 ft, msl	594,500 ac.-ft. (1.43 inches)	193,718.4
Controlled Flood Storage	300 to 320 ft, msl	1,281,400 ac.-ft. (3.08 inches)	417,545.5
Power Drawdown (conservation pool)	300 to 268 ft, msl	1,027,000 ac.-ft. (2.47 inches)	334,649.0
Water Supply	300 to 268 ft, msl	Available in conservation pool—(2006) 50,000 ac-ft designated for water supply storage & 28,885 available; 21,117 allocated by agreement	16,292.6 3,526.7

The project is managed by the U.S. Army Corps of Engineers (ACOE), Wilmington District. As a federal project, any changes to the original purposes and water storage allocations for this multipurpose reservoir would have to be authorized by Congress. The ACOE provides storage of the water supply, while the states control the water supply and water rights. According to the ACOE in May of 2008 of the 50,000 acre-feet of water storage space in Kerr Reservoir, 28,885 acre-feet have not been allocated. The ACOE manages the water storage on a first come, first serve basis. Kerr Reservoir storage contracts and withdrawal permits are listed in Figure 1d on the following page. The John H. Kerr Reservoir Reconnaissance Report, March 2001, states "the Army Corps of Engineers Division Commander may grant requests for water supply storage re-allocation of 499 acre-feet or less. For water supply requests not greater than 50,000 acre-feet, the ACOE Headquarters Commander has the authority to grant the request. Requests that exceed 50,0000 acre-feet would require the approval of the Secretary of the Army and/or Congress. There currently is and will likely continue to be heated competition for John H. Kerr Dam and Reservoir's water supply storage."

Figure 1d
Water Storage Contracts & Withdrawal Permits—John H. Kerr Reservoir/Lake Gaston (Roanoke River)

CWS/SSU	Date of Agreement	Storage Space	Storage	Withdrawal Limits
Clarksville, VA	Pre-project	Allowed to withdraw without storage allocations.	Not applicable Grandfathered	No restriction (2001)
Burlington Industries	Pre-project	Allowed to withdraw without storage allocations; Industry closed in 2002	Not applicable Grandfathered	Industry closed.
Kerr Lake Regional Water System (KLRWS)	2/12/1974	2001 withdrawal: 5.9 MGD		20 MGD
City of Henderson, NC	3/17/2006		10,292 ac.-ft.	
City of Virginia Beach, VA	1/13/1984	1.066 % of the usable storage space between 268 & 300 ft., msl	10,200 ac.-ft. 3,323.7 MG	60 MGD
VA Dept. of Corrections	4/7/1989	.0024 % of conservation (power) storage between 268 to 300 ft., msl	23 ac.-ft 7.49 MG	.06 MGD
Mecklenburg Cogeneration Limited Partnership (MCLP)	6/20/1991	.063 % of conservation storage	600 ac.-ft. 195.5 MG	Daily restriction not found; 2.3 MGD used 2001
RRSA	No agreement			7 MGD

There are five local entities that have agreements for water supply and water storage rights in John Reservoir as long as storage space is available in the conservation pool between elevation 268 and 300 feet, msl. Of these, three are within the Lake Country Planning Area—the town of Clarksville, the Mecklenburg Cogeneration plant, and the Virginia Department of Corrections. In 2005, the town of Clarksville had 784 connections and withdrawals that averaged .23 MGD. According to Corps of Engineer records there are no limits to the town withdrawal as per agreements prior to Kerr Dam construction. The town's treatment plant capacity is one million gallons per day (1.0 MGD). Mecklenburg Cogeneration Limited Partnership (MCLP), a 120 megawatt coal-fired cogeneration facility, which utilizes Kerr Reservoir as process water, cooling water and steam supply, is allocated .063% of the lake's conservation storage or approximately 2.3 MGD. In 1989, a water storage contract was executed between the Corps and the Virginia Department of Corrections. The withdrawal is not to exceed .060 MGD. This pipeline has not been constructed, as the Roanoke River Service Authority, which withdraws from Lake Gaston, now serves the two Mecklenburg prisons.

Other users of Lake Country water resources, located outside the planning area, are the Kerr Lake Regional Water System (KLRWS) and the City of Virginia Beach. KLRWS is the public water service provider for portions of North Carolina counties of Vance, Granville, and Warren. Its three bulk customers are the City of Henderson, City of Oxford and Warren County. These governments in turn supply the towns of Kittrell, Norlina, Warrenton and Middleburg and part of Franklin County. On April 22, 1998, a grandfathered capacity of 10 MGD was approved by the North Carolina Division of Water Resources (DWR) for the KLRWS to transfer from the Roanoke to the Tar and Neuse River Basins. In June 2003, KLRWS submitted an Environmental Assessment

(EA) to the North Carolina Department of Environment and Natural Resources (NCDENR) for the Kerr Lake Water System Expansion to increase their existing water treatment plant capacity from 10 mgd to 20 mgd. This EA was granted a Finding of No Significant Impact (FONSI) on June 19, 2003.[1] The intake structure for KLRWS is located in North Carolina on Nutbush Creek of Kerr Reservoir. In 2001 the regional system withdrew an average of 5.9 MGD from the lake.

[1] Kerr Lake Regional Water System Interbasin Transfer Request & Draft Environmental Assessment Scope

Since 2002 there have been murmurings of a request from Raleigh, Durham and Granville County for a 50 MGD allocation. This chatter has increased since the 2007 drought and the near depletion of Falls Lake and Jordan Lake, which are primary water sources for the Triangle in North Carolina.

The City of Virginia Beach withdraws water from Lake Gaston with the intake located in Brunswick County; however, the storage contract is with the Army Corps of Engineers and Kerr Reservoir due to the interconnectivity of the reservoirs and water level agreements. The Virginia Beach withdrawal is discussed in the Lake Gaston section that follows.

The Phase I Study—Roanoke River Basin Water Resource Development Plan prepared by C.E. Maguire, Inc. for the City of Virginia Beach in 1982 states that "the yield of the three reservoir system (Kerr-Gaston-Roanoke Rapids) is estimated to be at least 352 MGD …" This yield was calculated based on the drought of record at that time--1980-81, when the low flow for non-required purposes such as water supply was 545 cfs (352 MGD). However, the Roanoke Basin Water Supply Plan prepared by the Virginia State Water Control Board in March 1988 using 1984 data estimated the Kerr Reservoir safe yield to be 934 MGD. This plan will use the lower amount.

Lake Gaston

Lake Gaston was constructed between 1960 and 1962. Owned and operated by Dominion (Virginia/North Carolina) Power its function is energy production. The lake's water level fluctuation is generally within one foot when the reservoir is being operated for energy production. Lake Gaston has an additional three feet of storage for flood control, which translates to an additional storage of 63,000 acre-feet.

The Roanoke River Service Authority (RRSA) withdraws water from Lake Gaston, and provides treated water to the towns of Boydton, South Hill, La Crosse, Brodnax and several subdivisions in the Bracey community. Formerly these towns operated separate systems, with South Hill withdrawing from the Meherrin River and the rest utilizing wells. To address deficiencies in capacity available from the Meherrin and low yielding wells, local governments formed the Roanoke River Public Service Authority to operate and maintain a regional water system. Construction on this multi-year project began in 1996 with the installation of 17.5 miles of water main from South Hill southwest along U.S. Highway 58, with branches to the Baskerville and Mecklenburg Correctional Units in Mecklenburg County. The plant began operation in September 2002 with the completion of its 4.0 MGD treatment plant. A 16" water main connects Brodnax and La Crosse to South Hill's existing system, and water transmission lines connect the WTP to Bracey/River Ridge, a populated but unincorporated area of Mecklenburg with particularly low yielding and poor water quality wells. RRSA sells the treated water to the municipalities who still own and maintain their transmission systems. RRSA has several individual customers, located along the transmission lines but outside of the towns' service areas. The raw water intake structure is located near U.S. Route 1, approximately 5.5 miles downstream from Kerr Dam. RRSA withdrawals in 2005 averaged 1.22 MGD. An ethanol plant that is interested in locating in Mecklenburg County will require an additional 1.2 MGD. The potential site is south of Chase City; outside of the town's service area and capacity. Therefore to meet the plant's needs RRSA will provide the water via a water line extended from Boydton. While the water line is two miles outside of the town limits, the construction would place the town in a good position to connect to the RRSA in the future. *[1/2011 Note: The ethanol plant has postponed its Mecklenburg County location plans; however, the town of Chase City has implemented its connection to the RRSA.]*

After years of court battles and arguments against inter-basin transfers, in 1995 the City of Virginia Beach began construction of 76 miles of 60-inch pipeline. The pipeline withdraws water from Lake Gaston, which is in the Roanoke River Basin, into existing reservoirs in southeast Virginia, which are in the Chowan River Basin, to serve the City's needs. Operation of the pipeline began in January 1998. The intake structure and pump station is located on a tributary of Pea Hill Creek in Brunswick County. Virginia Beach is permitted to withdraw 60 million gallons per day from Gaston. The City of Chesapeake is a partner with Virginia Beach and can receive up to 10 MGD of the 60 MGD permitted. The following table provides a history of Virginia Beach water withdrawals since 1998, the first full year of withdrawals. Note highest annual withdrawals were during the height of two droughts—2000-01 and 2007.

Figure 1e--City of Virginia Beach Withdrawals from Lake Gaston

	Total (MG)	Average (MGD)	Min (MGD)	Minimum monthly withdrawal (MG)	Max (MGD)	Maximum monthly withdrawal	Contract limits
1998	10,442	28.5	0.0	352	49.4	1,388	60 MGD
1999	6,200	16.9	0.0	18	49.4	1,320	
2000	6,777	18.5	0.0	144	59.9	1,429	
2001	14,498	39.8	7.0	573	52.2	1,498	
2002	10,095	27.7	4.5	694	44.0	1,055	
2003	2,989	8.2	7.2	218	30.5	350	
2004	5,642	15.4	5.0	218	50.0	1,369	
2005	8,825	24.2	7.0	206	50.4	1,410	
2006	8,640	23.7	0.0	204	50.3	1,449	
2007	13,469	36.8	3.4	199	60.05	1,831	

Tidewater Divisional Precipitation Trend

NOAA—Climatological Data Annual Summaries

	Precipitation	Departure
1998	49.90	6.25
1999	53.69	10.04
2000	47.51	3.86
2001	34.38	-9.27
2002	46.07	2.42
2003	63.61	19.96
2004	54.62	10.97
2005	44.61	-1.02

Dry Year

Figure 1g—Lower Roanoke River Basin Reservoir Physical Attributes

Source: Roanoke Basin Water Supply Plan, March 1988 & ACOE J.H. Kerr Project website: http://epec.saw.usace.army.mil/kerr05.htm

Reservoir	Reservoir Length (miles)	Length of Shoreline (miles)	Elevation at full power pool (ft.)	Surface area at full power pool (acres)	Volume at full power pool[1] (acre-ft.)	Hydro-power drawdown (ft.)	Flood storage volume (acre-ft.)	Retention Time (days)[2]
Kerr	56	800	300	48,900	1,472,000	7	1,278,000	93
Gaston	34	350	200	20,300	450,000	1	63,000	29
Roanoke Rapids[3]	8	47	132	4,600	77,140	3-5	0	5

[1] Excludes flood storage volume.

[2] Based on full power pool volume and annual mean flow of 7,951 cfs as measured at Roanoke Rapids gage for water years 1964-1993.

[3] Located 8 miles below Gaston Dam in NC; created by Roanoke Rapids Power Station (Dominion Power) dam.

The town of Lawrenceville obtains its water from Great Creek, with an auxiliary supply from the Meherrin River. In 1993 an impoundment of Great Creek was completed just west of Lawrenceville to provide flood control. The 212-acre Great Creek reservoir was a project of the Soil Conservation Service, USDA, and is owned and operated by Brunswick County. The reservoir is a future water resource for the town, currently serving as raw water storage (see Future Water Source section below). The primary intake for Lawrenceville is on Great Creek, approximately one mile below (east of) the lake dam. The creek, which has a 46 square mile drainage area, is ungaged therefore long-term data is unavailable. However, the town reported that during the 2002 drought the water level at the intake did not fall more than one foot and the town did not experience an emergency situation at that time. Lawrenceville's Meherrin River auxiliary intake and pump is sized for 1.0 MGD capacity. There is good volume and flow in the Meherrin River and its tributary, Great Creek, during periods of normal rainfall. According to USGS records, the Meherrin River stream-gage at Lawrenceville recorded a minimum daily flow of 2.2 cfs in September of 2002. The previous minimum daily flow rate of 4.2 cfs was set in 1954. USGS also indicated the median daily discharge as 144 cfs (July 7, 2006).

The Lawrenceville water treatment plant has a maximum design capacity of two million gallons per day (2 MGD). The town's five elevated water tanks, two ground storage tanks, and plant clear well provide a total treated storage capacity of 1.89 million gallons. Under contractual agreement, Lawrenceville supplies up to 0.2 MGD of finished water to the town of Alberta. Currently Alberta uses 0.05 MGD on average. Alberta has two elevated storage tanks for a total storage capacity of 275,000 gallons (0.275 MGD). The table below and Appendix A Table 70D provide the system design capacities, safe yield and withdrawal permit limitations.

Figure 1h

Water System Name	Stream or River Name	Drainage Area sq. mi.)	Avg. Daily Withdrawals (MGD)	Maximum Daily Withdrawals (MGD)	Safe Yield of Stream ** (MGD)	Lowest Daily Flow of Record	WTP Capacity / Pump Station Capacity
Lawrenceville	Great Creek	46	.716	.827	3.23 at intake**	Ungaged stream; Data not Available	2.0 MGD / 2.0 MGD
Lawrenceville (auxiliary source)	Meherrin River	552	0	0	1.95 at intake**	2.2 cfs	2.0 MGD / 1.0 MGD
Alberta	Great Creek*	See L'ville					

* *Alberta purchases water from Lawrenceville*

** *Source: Comprehensive Water & Sewer Study for Brunswick County, VA, B&B Consultants, 1997*

Future Source— Great Creek Reservoir & Dam

Lawrenceville plans to construct lines directly to the Great Creek Reservoir so as to have access to better quality raw water. The town would like to have this construction in place by 2012 but the timing is largely dependent on funding availability. "County Park at Great Creek," located on the shores adjacent to the reservoir dam, provides recreation for area residents. Virginia Game and Inland Fisheries constructed a boat ramp and courtesy pier at the park; however, use of gasoline

engines and swimming are prohibited on the lake. For greater use, the capacity of the pump, intake, and lines to the intake should be increased to accommodate that of the water treatment plant. If the Lawrenceville water treatment plant were upgraded, the two water sources—Meherrin River and Great Creek Watershed Lake—would be combined.

Great Creek Reservoir & Dam—Future Source								
Element of Structure	**Determining Factor**	**Elevation**	**Surface Area (Ac.)**	**Storage**		**Inflow**		**Peak Outflow CFS**
				Acre-Ft	**In***	**Vol. In***	**Max. Rate CFS**	
Crest of Riser	100 Year Sediment & 950 AF Water Supply	214.0	205.0	1,809	0.83	-	-	-
Creast of Emergency Spillway	100 Year Frequesncy Moisture Con. II	238.6	590.0	10,509[1]	4.84	-	-	765
Design High Water	TR-60, 52 & Sec. 14	243.0	695.0	13,397[1]	6.17	7.79	16,032	4,201
Top of Dam	TR-60 & 52	256.8	1180.0	25,988[1]	11.96	25.14	51,849	33,899

SELF-SUPPLIED USERS (SSU) ***9 VAC 25-780-70C-1E, 1F & 1I***

The Regulations define "self-supplied user" as any person making a withdrawal of surface or ground water from an original source (e.g., a river, lake, reservoir, etc.) for their own use. Self-supplied users do not receive water from a community water system. In the Lake Country Planning area available records from DEQ and VDH indicate that as of 2004 there are four (4) such users that withdrew at least 300,000 gallons per month.

SSU—Surface Water: Mecklenburg Cogeneration and John H. Kerr Hydroelectric Power Plant are self-supplied users of surface water, and were discussed in the previous "John H. Kerr Reservoir" section. Both facilities are non-consumptive uses. The John H. Kerr Power Plant uses the greatest volume of water; however most is returned to the source stream. The Cogeneration Plant maximum daily withdrawal is limited to 3.55 MGD and is limited to 600 acre-feet of the reservoir conservation storage pool. See Appendix A Table 70E for non-agricultural self supplied surface water user information.

SSU —Groundwater: The Department of Environmental Quality, Division of Water Resources Management, maintains records of entities withdrawing more than 300,000 gallons a month of ground water for beneficial use—domestic, including public water supply, commercial, industrial, or agricultural. According to the DEQ web site, the Virginia Water Withdrawal Reporting Requirements (9 VAC 25-200-10, et seq.) require reporting for any withdrawal whose daily average withdrawal exceeds 10,000 gallons per day, with the exception of crop irrigation. Reporting of crop irrigation applies to withdrawals exceeding one million gallons in any single month (except for ponds that collect from diffuse surface water unless they are dug ponds that intercept the groundwater table).

The DEQ report showed that only one **non-agricultural self supplied water user** reported using more than 300,000 gallons per month of ground water—Lawrenceville Vulcan Materials plant. This mining operation uses a pit sump to remove groundwater, which is pumped into Robinson Creek, a Meherrin River tributary, located about 6 miles east (downstream) of the Lawrenceville

Water Treatment plant. The report shows withdrawals of 2 MGD in 2004. Appendix A Table 70F for non-agricultural self supplied groundwater user information.

Agricultural Self-supplied Water User—Only one farm operation reported to DEQ as withdrawing more than 300,000 gallons per month in 2004. SJB Farms, Inc. is a hog farm, which uses a well and ponds. There are no meters on the farm wells so the estimates are based on a multiplier of two gallons per hog and DEQ's records for the number of hogs permitted. Discussions with DEQ field staff indicated several other farms had permits but their operations were decreasing. A calculation using animal population indicated the potential for slightly more withdrawal. Even though these farms were reducing stock and water use, the higher estimate of .06 MGD was used to allow for increases. Both estimates are shown in Appendix A, Table 70-I.

Self-Supplied Users-- See Appendix A, Tables 70-E, 70F, 70I, 70-2I.

Water System (User) Name	Source/ Type	Description	2004 Average Daily Withdrawals
Mecklenburg Cogeneration*	Kerr Reservoir	PF Power Plant/Fossil fuel (Coal)	2.40 MGD
John H. Kerr Hydropower Plant*	Kerr Reservoir	Power Plant—Hydro power	5,621.70 MGD
Vulcan, Lawrenceville Quarry*	Groundwater	Stone Quarry—Pit Sump	2.00 MGD
SJB Farms, Inc.	Groundwater & Ponds	Hog Farm	0.06 MGD

**Non-consumptive*

WATER PURCHASES OUTSIDE THE PLANNING AREA 9 VAC 25-780-70C-1G & H

There are no contracts or proposals by Community Water Systems within the planning area to purchase water from water supply systems outside the Lake Country planning area. There is no data available regarding water available to be purchased outside the planning area.

As noted in the earlier discussion under "Reservoirs" of Kerr Reservoir and Lake Gaston, the City of Virginia Beach has an intake in Brunswick County and a contract with Virginia Power to withdraw and maximum of 60 MGD from Lake Gaston. Additionally the Kerr Lake Regional Water System, which is located outside the Lake Country Planning Area, has a contract to withdraw a maximum of 20 MGD from Kerr Reservoir. See Appendix A, Tables 70C and 70H-2.

An estimated 30,791 persons and 31 businesses are served by approximately 12,786 individual wells in the planning area, and with few exceptions, these are located outside of the community systems service areas. These numbers were estimated based on the 2000 Census of Population. Household size was determined by dividing the population by the number of housing units. Population using individual wells was estimated by subtracting the population on a community water system from the total county population. The population outside a community water system was divided by the household size factor to quantify the number of residential wells. The approximation of individual wells for businesses is derived from the Virginia Department of Health Waterworks/Owners listing of users of greater than 300 gallons per month. This list indicates only 31 wells for non-residential users that withdraw more than 300,000 gallons per month. While this is a very basic estimate, the commercial uses not captured in this method would largely consist of very low water users such as convenience stores or gas stations.

Estimate of Individual Wells-- *See Appendix A, Table 70J*

Location	Lake Country Total Population 2005 Estimate	Population on CWS	Household size factor[1]	Estimated population on Individual Wells[2]	Estimated # of Residential Wells[3]	Estimated Businesses on wells[4]
Brunswick Co.	18,400	6,288	2.47	11,934	4,832	12
Mecklenburg Co.	32,400	13,357	2.38	18,857	7,923	19
Lake Country Total	**50,800**	**19,645**		**30,791**	**12,755**	**31**

[1]2000 Census Population per Household
[2] Census Population Estimate – Population in CWS
[3] Population on wells / Household size factor
[4] Number of non-community systems on VDH Waterworks Owners and Operators list 2005

No recent source water assessment plans for the study region were found. The Phase I Study—Roanoke River Basin Water Resource Development Plan for the City of Virginia Beach in 1982, provides a good discussion of the appropriateness, condition, and available water supply in Kerr/Gaston/Roanoke Rapids Lakes and has been referenced in the text. Additionally no wellhead protection programs were found to be in place or developed.

The Virginia State Water Control Board prepared the Roanoke Basin Water Supply Plan in March 1988 (Planning Bulletin 339). This study is dated as it was done prior to the Virginia Beach withdrawal was approved and constructed as well as the development of the Roanoke River Service Authority. The study that the "Available Supply (Outflow + consumptive use)" was 2,381 MGD and gave the Lower Roanoke safe yield as 112 MGD. Additionally, no source or system deficits were identified in the LR Subarea. "Surface water sources, which will continue to supply the majority of water in the Subarea, appear to be capable of supplying an adequate amount of water during the planning period. Also, groundwater supplies, which will continue to be used by some of the smaller systems, appear to be sufficient to supply groundwater demands in the Subarea during the planning period," [which extended to 2030].

B. Existing Water Use *9 VAC 25-780-80*

The Virginia Regulation defined a community water system as a waterworks that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents, and is regulated by the Virginia Department of Health Waterworks Regulation (12 VAC 5-590).

Data for community water systems was obtained from the localities and service providers. Information for many of the private well systems was not readily obtainable; and therefore data from DEQ's permits records (2004) and the Virginia Department of Health (VDH) Public Water System permits (2005 data, obtained April 2006) were used. Records for water usage for individual wells are non-existent; therefore several alternatives were explored to approximate usage:

1. The first employs a standard "Equivalent Residential Connection" (ERC), of 400 gallons per day per residential connection: 400 GPD X 12,755 residential connections = 5.1 MGD by individual well users.
2. Alternatively per capita use found in the USGS National Water Information System (NWIS) may be used: 75 GPD X 30,791 (estimated population not served by community water = 2.3 MGD by individual well users.
3. Due to the disparity of these two methods another approximation was performed using the total average daily use and population within all groundwater community service areas. The groundwater systems include the town of Chase City and 23 private systems. Appendix B, Table 80-B1-B5 indicates the groundwater systems population was 4,413 and used .4 MGD. Thus a per capita daily use of **85 GPD** was established. This was selected as the most appropriate usage for the region, which indicated usage of 2.6 MGD through individual wells.

COMMUNITY WATER SYSTEMS (CWS): ***9 VAC 25-780—80B***

There are 33 community water systems (CWS) within the planning area, which includes eight towns, the Roanoke River Service Authority, and 24 housing developments. Of the housing subdivisions, only three have estimated usage of more than 300,000 per month. With the exception of River Ridge in the Bracey community of Mecklenburg, all the subdivisions outside of the municipal systems utilize groundwater. Appendix B, Table 80B1-B5 provides the population, number of connections, average and maximum daily withdrawal, as well as annual and monthly average use for each community water system in Lake Country. Of the 33 community water systems, 23 are private systems utilizing groundwater. These non-municipal systems have 1,220 total connections with a population of 2,171 that according to local and DEQ records, withdraw .2 MGD (million gallons per day). Many (14) of these private systems are in close proximity to the lakes and consequently many of the residences are occupied seasonally.

The public community water systems have a total population of 17,474, with 8,253 connections, and use 2.4 MGD. Adding private systems usage brings total CWS use to 2.6 MGD. A planned extension for an industrial user needing 1.2 MGD could raise this total to approximately 3.8 MGD.

Self Supplied Users:

Among self-supplied non-agricultural users of more than 300,000 gallons per month of surface water is the Mecklenburg Power Station (a.k.a. Mecklenburg Cogen). The plant has a contract for 2.3 MGD, although DEQ records indicated a withdrawal in 2004 of 2.4 MGD. The Cogen, which is physically located within the Clarksville Water Service area, uses raw water to create steam to generate power. A portion of the water may return to the stream but for the purpose of this study the full amount has been included with the community water systems use summary table on page 28. The Department of Corrections (DOC) has a contract that would allow withdrawal of .06 MGD from Kerr Reservoir; however, this has not been activated. The two prisons in Mecklenburg County are now supplied by water through the RRSA Treatment Plant and therefore there is no planned use by the DOC. Additionally non-consumptive use of the Kerr Reservoir includes 5,624 MGD for power generation. Water use data for facilities using more than 300,000 gallons per month of surface water are found in Appendix A, Table 70E.

No self-supplied agricultural users of greater than 300,000 gallons per month were found to be located in a CWS.

Records do not indicate individual residential well use within a CWS. According to DEQ 2004 records, two self-supplied non-agricultural users of groundwater were found to be located within the Clarksville Community Water Service Area although each used less than 300,000 gallons per month. Kinderton Country Club has a well for the clubhouse. According to DEQ records the Club used .12 million gallons (MG) annually or .01 MG monthly. Also the Mecklenburg Cogen has a well for the employees use in the facility, and uses .339 million gallons annually (DEQ 2004). See Appendix A, Table 70J.

Disaggregated Use

Most of the municipal systems do not keep metering records by water use category; therefore these values are very approximate. All the towns provided some estimates of the disaggregated information except Chase City, as the town keeps no record of the type of connection. To find an approximate usage by category, the VEC list of employers was used to determine a number of businesses. This listing includes the NAICS code that explains the type of business, enabling the extraction of industrial from commercial uses. Appendix B Table 80B9 provides disaggregated average monthly uses for each Community Water System. A summation of the entire planning area shows the following percentages of disaggregated water use:

Water Use By CWS	% of Use	MGD
Residential	29%	.80
Commercial/ Lt. Industrial	24%	.60
Industrial	7%	.20
Schools/Institutional	2%	.05
Prisons	17%	.40
Processing or Unaccounted for Losses	19%	.50
Water Sold by LC CWS to other areas	2%	.05

In Stream Beneficial Uses

Lawrenceville is the only system utilizing a stream for its intake. The primary in-stream beneficial use of Great Creek is water supply. Secondly the creek serves recreation through its scenic value. The creek is not deep enough for navigation or to fish. The intake does not negatively affect the scenic value.

SELF SUPPLIED USERS OUTSIDE CWS 9 VAC 25-780—80C & D

The Vulcan Materials uses a pit sump to remove 2.04 MGD of groundwater from the Lawrenceville Quarry, which is outside a CWS. As stated earlier this is also non-consumptive use. SSU non-agricultural water use data for facilities using more than 300,000 gallons per month of ground water are found in Appendix A, Table 70F.

Among self-supplied agricultural users of groundwater outside a CWS, one operation withdrew .014 MGD of groundwater in 2004 according to DEQ records. Interviews with DEQ field staff indicated that three other farms had permits to withdraw water but had fallen below the reporting requirement. Furthermore these operations were reducing stock making it likely the withdrawals would decrease even more. Table 70I in Appendix A shows water withdrawal estimates for the agricultural uses both based on usage per animal as well as reported to DEQ in 2004. Use by animal is a maximum likely scenario, and which could equal .06 MGD.

INDIVIDUAL WELLS USE 9 VAC 25-780—80E

As stated in the Water Sources section on page 21, the methodology used to estimate the number of wells and population served by individual wells is as follows:

The 2000 Census was used to determine household size in each county. Population using individual wells was estimated by subtracting the population on a community water system from the total county 2005 Census population estimates. The population outside a community water system was divided by the household size factor to quantify the number of residential wells. The approximation of individual wells for businesses is derived from the Virginia Department of Health Waterworks/Owners listing of users of greater than 300 gallons per month. This list indicates only 32 wells for non-residential users that withdraw more than 300,000 gallons per month. While this is a very basic estimate, the commercial uses not captured in this method would largely consist of very low water users such as convenience stores or gas stations.

As stated earlier, a per capita daily use of 85 GPD was established using the total average daily use and population within all groundwater community service areas. Thus using the above methodology and worksheet found in Appendix A, Table 70J it is estimated that there are 12,755 residences and 31 businesses served by individual wells in the planning area. A population of approximately 30,791 is served by individual wells. Using the daily per capita use factor of 85 gallons per day, 2.6 MGD are being used outside of a community water system service area.

As can be seen in the summary table below the planning area uses a total average of 9.8 million gallons per day.

Lake Country Usage Estimates

Community Water System Area	# Systems/ SS User	Estimated Population	Connections	Average Daily Use [1] **MGD**	Other Average Daily Use **MGD**	Daily Per Capita Use **Gallons**
Community Water Systems	33	19,645	9,473	2.6 [1]	0	132
Self-supplied Users w/in CWS—Ag> 300K/month	0	0	0	0	0	NA
Self-supplied Users w/in CWS—Non-Ag > 300K/month	1	NA	1	2.41 [2]	0	NA
Self-supplied Users w/in CWS—< 300K/month	2	NA	2	0.12	0	NA
Outside Community Water System Area						
Self-supplied Users—Non-Agricultural > 300K/month:						
Vulcan-L,ville Quarry	1	NA	NA	2.04 [2]	0	NA
Kerr Hydropower Plant	1	NA	NA	0	5,621	NA
Self-supplied Users—Agricultural > 300K/month *(SJB Farms, Inc.)*	1	NA	NA	0.06 [5]	0	NA
Individual wells: Brunswick	NA	11,934	4,832 Wells	1.01 [3]	0	85
Individual wells: Mecklenburg	NA	18,857	7,923 Wells	1.60 [3]	0	85
TOTAL		**50,436**		**9.84**	**5,621 ***	**106**

[1] Based on DEQ, VDH records and Local sources

[2] Non-consumptive

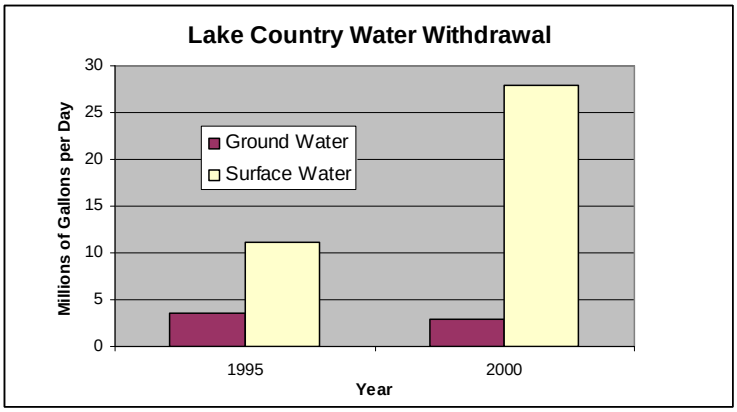
[3] Estimates based on: Population on wells (Census 2005 Estimates – Population in CWS) X 85 gallons per capita

[4] Estimates based on: Estimated # Wells X 400 Gallons per connection

[5] Estimates based on livestock population

* Never leaves stream; Non-consumptive

N.A: Not applicable

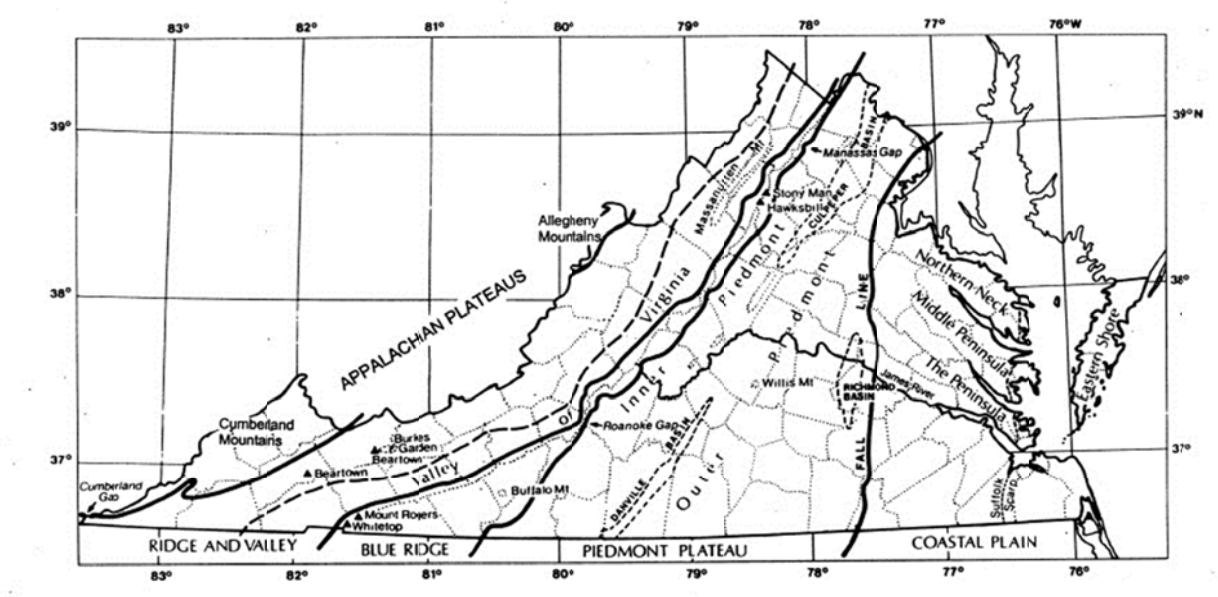


C. Existing Resources *9 VAC 25-780-90*

GEOGRAPHY, GEOLOGY, AND SOILS— ***9 VAC 25-780—90 (3 a)***

The Lake Country Planning Area is located in the southern portion of the Piedmont Region of Virginia. The Piedmont's geology is diverse, which leads to a wide range of water availability and quality levels. The Piedmont's geology is diverse, which leads to a wide range of water availability and quality levels. The Piedmont of Virginia extends eastward from the Blue Ridge to the Fall Line, where unconsolidated sediments of the Atlantic Coastal Plain cover Paleozoic-age and older igneous and metamorphic rocks. The Piedmont is characterized by deeply weathered, poorly exposed bedrock and a high degree of geological complexity. [DMME website [http://www.dmme.virginia.gov/Dmr/DOCS/Geol/pied.html]. The terrain is characterized by gently rolling hills with elevations varying from 150 feet to 700 feet above sea level. The availability of both groundwater and surface water resources are present throughout the District. The most common use of groundwater for the area is for rural and domestic supplies. Soil associations and underlying rock formations produce water of generally good quality, dependent upon well construction and location.

Geomorphic, or *physiographic*, regions are broad-scale subdivisions based on terrain texture, rock type, and geologic structure and history. Lake Country lies in the Piedmont Plateau physiographic region and in the Outer Piedmont Sub-province. The Outer Piedmont sub-province is broad upland with low to moderate slopes. The surface of this region rises in elevation from approximately 150 feet above sea level at the eastern boundary of Brunswick (which is approximately 10 miles west of the Fall Line and the beginning of the Coastal Plain) to about 700 feet in western Mecklenburg County. The underlying bedrock is igneous metamorphic.

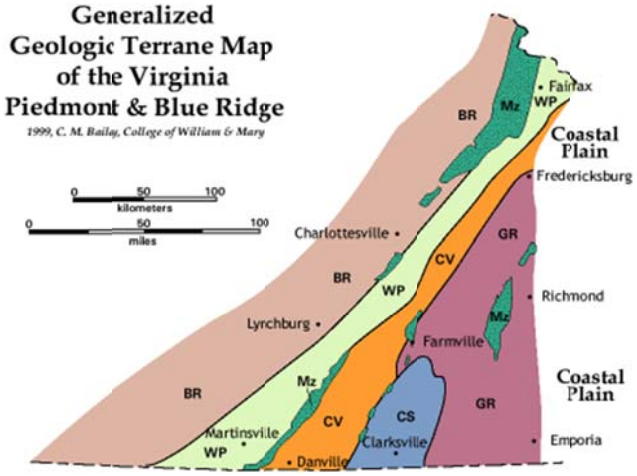


The terrain is distinguished by gently rolling hills, deeply weathered bedrock, and very little solid rock at the surface. Most rocks at the surface become weathered in the humid climate and buried under a blanket of "rotten rock", called saprolite several meters thick. Outcrops of solid rock may

be found in stream valleys where the saprolite has been removed by erosion. Most of the rocks range in age from the late Pre-Cambrian to Paleozoic.

Source: http://www.wm.edu/geology/virginia/phys_regions.html#piedmont

Piedmont Geologic Terrane



Many of the rocks in the Piedmont have a complex geologic history, and some may have formed in areas outside of North America. Geologic terranes are groups of rock with very different pasts and are separated from one another by faults. Lake Country lies within the Goochland Raleigh Belt and the Carolina Slate Belt**.**
The Goochland Raleigh Belt consists of Proterozoic rocks that may have formed in and on the margin of ancient North America. Granite rocks of the Paleozoic age are common. The *Carolina Slate Belt* consists of Neoproterozoic meta- volcanic, plutonic, and sedimentary rocks that formed outboard of North America.

Brunswick County Geology & Groundwater Resources

Bedrock throughout Brunswick County is comprised of igneous and metamorphic, covered in most places by a layer of soil and weathered rocks approximately 10 to 60 feet thick. These rocks are generally considered poor aquifers and successful wells usually obtain groundwater from either the adjacent soil cover or from fractures occurring in the bedrock.

Shallow large-diameter bored wells generally furnish adequate water supplies for domestic and agricultural use throughout the county. The most successful wells of this type are located in relatively low or flat areas where bedrock is generally covered by 25 feet or more of soil and weathered rock. Contamination by surface sources and decreased yields due to inadequate rainfall are major problems associated with these wells.

Drilled wells are constructed to exclude near surface waters by casing off all unconsolidated materials above firm bedrock. Wells of this nature are usually six inches in diameter and range in depth from 32 to 1,575 feet. Reported yields from these wells range from 0 to 115 gallons per minute. Approximately three-fourths of all reported wells are less than 200 feet deep and yield less than 15 gallons per minute. It is important to note that well yield is not proportional to well depth. Well location is a more important factor. Although drilling seems to have been most successful in the western portion of the county and least successful in the central portion, moderate quantities of groundwater are thought to be available in all areas at selected drilling sites. Wells in granite and gneiss rocks must be located to intersect fracture zones beneath the water table, and wells underlain by schistose and phyllitic rocks should be located at lower elevations and in close proximity to surface water sources.

The chemical quality of groundwater is fair to good in most of the county. Water is sometimes acidic in the eastern and central locations of the county and may also be high in iron content in the south and southeast. Ground water from rocks in the western portion of the county is reported to be of the best chemical quality, seldom irony or acidic, and usually soft and low in dissolved mineral content.

Mecklenburg County Geology & Groundwater Resources

Mecklenburg County is underlain by igneous and metamorphic bedrock covered by 30 to 50 feet of soil and weathered rock in most areas. Greenstone and slate are interlayered and steeply inclined in the western two-thirds of the county and steeply dipping gneisses and schists underlie the eastern third. A zone of granite about five miles wide occurring near Baskerville and North View and extending northward across the county separates these two areas.

Many of the wells occurring in the rural areas are either bored or dug in the zone of soil and weathered rock, generally at depths of 30 to 50 feet. These large diameter wells usually obtain sufficient quantities of water for agricultural and domestic needs. These shallow wells may be susceptible to decreased yields during periods of inadequate rainfall and also contamination from nearby sources of surface pollution. Drilled wells are constructed to eliminate near surface water by casing off the zone of soil and weathered rock, obtaining water from bedrock fractures, which usually occur at depths of less than 300 feet. Nearly two-thirds of reported wells are 100 to 300 feet deep and almost one-fourth are 300 to 500 feet deep. Approximately 60 percent of these wells produce between 1 and 25 gallons per minute, and 35 percent range from 25 to 90 gallons per minute in yield. The chemical quality of groundwater obtained from granite rock is usually good, but other bedrock in the county may produce moderately hard water and contain small amounts of iron.

RIVER BASINS

Lake Country lies in two drainage basins—Roanoke River and Chowan River. Mecklenburg primarily drains to the Roanoke River, while Brunswick drains to the Meherrin, which flows into the Chowan River. Both systems flow into the Albemarle Sound in North Carolina.

Roanoke River Basin

The Roanoke River originates in the Blue Ridge Mountains of Virginia and flows east/southeast through the Piedmont and Coastal Plain to the Albemarle Sound in North Carolina. The entire watershed is approximately 9,666 square miles in size, 6,066 of which are in Virginia.

The Roanoke River Basin includes all or portions of the Virginia counties of Botetourt, Bedford, Appomattox, Campbell, Roanoke, Prince Edward, Montgomery, Salem, Charlotte, Franklin, Pittsylvania, Floyd, Halifax, Brunswick, Carroll, Mecklenburg, Patrick, Henry; and, the cities of Lynchburg, Bedford, Roanoke, Martinsville, and Danville. Five (5) impoundments are located in the Roanoke River—Smith Mountain Lake, Philpott Reservoir, John H. Kerr Reservoir, Lake Gaston and Roanoke Rapids Lake. Smith Mountain and Philpott Reservoir, located above, and Roanoke Rapids Lake, located below Lake Country, are outside the planning area.

Chowan River Basin

The Meherrin River has its headwaters in the Piedmont of Lunenburg County and flows southeast into the coastal plain of North Carolina, joining the Chowan River in North Carolina, approximately 12 miles south of the state line. The Meherrin River forms the boundary line between Mecklenburg and Lunenburg counties and flows for a distance of 37 miles through the center of Brunswick. The Brunswick County portion of the Meherrin was designated a Virginia Scenic River by the Virginia General Assembly in 2006, which has no impact on its status as an auxiliary water source for the Town of Lawrenceville. Additional drainage basin information is presented in the Existing Water Sources Section on page 10.

The **Chowan River Basin** is approximately 130 miles long and drains about 4,900 square miles of land in Virginia and North Carolina. Approximately 76 percent of the watershed is located in Virginia. Thirteen Virginia counties or portions thereof are in the Chowan River Basin: Brunswick, Mecklenburg, Charlotte, Lunenburg, Greensville, Southampton, Nottoway, Dinwiddie, Sussex, Prince George, Prince Edward, Surry and Isle of Wight. Also located in this basin are the cities of Virginia Beach, Chesapeake, Franklin, Emporia, Suffolk, and Petersburg. The Chowan River is located entirely in North Carolina, formed by the confluence of Virginia's Blackwater and Nottoway rivers at the state line. Like the Roanoke River, the Chowan is a major contributor of fresh water to the Albemarle Sound in North Carolina.

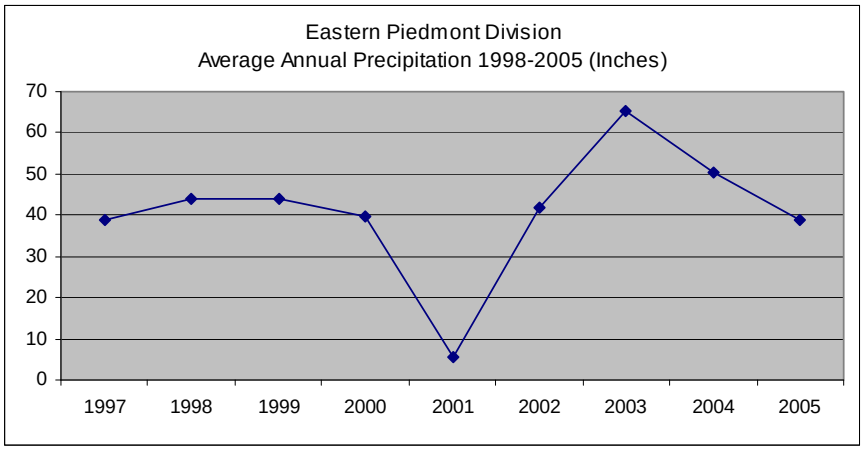
CLIMATE AND RAINFALL

This area of Southside Virginia has a fairly moderate climate. The average annual temperature is 57 degrees Fahrenheit, with summer and winter temperature averages of 76.5 degrees Fahrenheit and 42 degrees Fahrenheit, respectively. The average annual precipitation ranges from 45 to 55 inches in the Southern Piedmont. Prevailing winds are south to southwest. The growing season lasts about 205 to 235 days.

The following table provides a summary of precipitation data from the National Climatic Data Center. See also Appendix C, Table 90A for the precipitation data from the weather monitoring stations that are located in the Lake Country Planning Area.

Annual	Precipitation	Precipitation	Precipitation	Precipitation	Precipitation	Precipitation	*Departure*
	Camp Pickett	Lawrenceville	Chase City	Clarksville	Kerr Dam	Eastern Piedmont Division	
1995	43.62	40.48			39.51	44.78	*1.5*
1996	60.7	55.91	49.62	45.76	46.97	54.09	*10.82*
1997	37.74	45.97	42.6	34.55	38.47	38.74	*-4.53*
1998	50.52	49.68	44.06	38.55	45.23	44.02	*0.75*
1999	48.59	62.0	52.08	38.99	46.68	43.89	*0.62*
2000	44.1	39.4	34.16	41.15	37.89	39.56	*-3.71*
2001	9.2	8.45	6.63	44.32	7.39	5.73	*2.1*
2002	42.16	44.97	57.43	4.3	41.27	42.01	*-1.26*
2003	73.1		61.7		61.49	65.2	*21.93*
2004	54.55		45.65		44.55	50.55	*7.28*
2005						39.04	*-5.96*

Drought Years



PROTECTED SPECIES & HABITATS OF CONCERN— 9 VAC 25-780—90 (3 b-i)

A listing of species in need of protection within the Southern Piedmont is included in Appendix C, Table 90-B1. The conservation need is tiered. Several species that are listed as Tier I, the greatest need, are found within the Lake Country Planning Area. These include the Roanoke logperch (Fish), Bachman's sparrow (Bird), Loggerhead shrike (Bird) and the James spinymussel (Aquatic Mollusks). The loggerhead shrike habitat includes open fields with scattered shrubs, small trees and/or hedges; the Bachman's sparrow primarily uses open-canopy pine woods/savannah and may also be found in oak scrub and recent clearcuts. Neither of these species is generally associated with streams or wetlands.

The Roanoke logperch is a Federal and State endangered species found only in the Roanoke and Nottoway river systems of Virginia. It feeds on immature benthic invertebrates and exhibits a feeding behavior of flipping rocks to expose prey items. The Roanoke logperch spawns in spring and early summer. In the Roanoke River, this species occupies warm, moderate to large streams and small rivers, however at some lifestages the fish prefers runs, pools and backwaters. Historically found in the James River, a population of the James spinymussel was recently discovered in the Dan River, which is a tributary of the Roanoke but outside the planning area. This mollusk prefers unpolluted, well-oxygenated streams. Threats to these aquatic species include channelization, siltation, chemical spills, and impoundment. (Source: Virginia's Comprehensive Wildlife Conservation Strategy, Chapter 5, DGIF)

ANADROMOUS FISH, TROUT, AND OTHER SIGNIFICANT FISHERIES— 9 VAC 25-780—90 (3 b-ii)

Anadromous fish are those that live in the sea primarily but breed in fresh water. Anadromous fish that are found in the waters of the Roanoke River Basin include the Black Bass and the Striped Bass. See Appendix C, Table 90-B2. The flow from Kerr Reservoir and the downstream lakes is carefully managed so that the fisheries in the river are not negatively impacted. According to the DGIF Trout Fishing Guide website [http://www.dgif.virginia.gov/fishing/trout/], no trout waters occur within the planning area. However, the Meherrin River, Nottoway River, Brunswick Lake, Great Creek Watershed Lake, Lake Gaston, Lake Gordon, and Kerr Reservoir provide significant fisheries and a variety of recreational opportunities for citizens and visitors to the Lake Country region [http://www.dgif.virginia.gov/fishing/waterbodies/?type=1].

RIVER SEGMENTS OF RECREATIONAL SIGNIFICANCE INCLUDING STATE SCENIC RIVER STATUS—(3 b-iii)

On June 25, 2006, Governor Tim M. Kaine signed legislation that added the 37-mile section of the Meherrin River flowing through Brunswick County to the Virginia Scenic River System. This designation official recognizes the Meherrin River's natural, scenic, historic, and recreational value. Additionally the Staunton River through Halifax and Charlotte counties is a designated Virginia Scenic River. The Staunton River is outside the water supply planning area but is located upstream and flows into the John H. Kerr Reservoir, as it is part of the Roanoke River. See Appendix C, Table 90-B3

SITES OF ARCHAEOLOGICAL AND HISTORICAL SIGNIFICANCE— 9 VAC 25-780—90 (3 b-iv)

Archaeological and historical sites are numerous in Mecklenburg and Brunswick Counties. There

are 11 sites in Brunswick County listed on the Virginia Landmarks Register (VLR) and the National Register of Historic Places (NRHP). In Mecklenburg 32 sites are listed on the VLR and 22 listed on the NRHP, plus 10 nominations pending National Register listing. Those that are listed on the National Register of Historic Places and the Virginia Landmarks Register are found in Appendix C, Table 90-B4. A few are located in the vicinity of the Meherrin River (Fort Christanna) and Kerr Lake (Archaeological Sites at Kerr Reservoir Area, Prestwould, Clarksville,). They do not affect the in stream flow or use.

UNIQUE GEOLOGY & NATURAL COMMUNITIES— 9 VAC 25-780—90 (3 b-v)

A unique geological feature exits in Brunswick County near the banks of Lake Gaston in Gasburg but is not within the lake flood elevation. The approximate 20-acre Gasburg Granite Flatrocks Preserve is owned and managed by the Nature Conservancy [http://www.nature.org/wherewework/northamerica/states/virginia/preserves/art15031.html]. This community of Southern Piedmont Granite Flatrock consists of smooth, exfoliated outcrops of massive granite, which is unusual in Virginia. Soil accumulates in the outcrop depressions and provides habitat for three globally rare plant species. Two other natural communities are designated as needing protection by the Department of Conservation and Recreation—Piedmont Hardpan Forests and Piedmont savanna—Loblolly pine. There is no indication that these exist in areas affected by the water sources. See Appendix C, Table 90B5.

WETLANDS— 9 VAC 25-780—90 (3 b-vi)

The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency define wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Typically criteria used to delineate jurisdictional wetlands include evidence of hydric soils, hydrophytic vegetation and hydrology. Protection of wetlands is important for maintaining water quality as these soils help filter impurities and allow for recharge of groundwater. Section 404 of the Clean Water Act is the primary vehicle for Federal regulation of some of the activities that occur in wetlands. The following table indicates the acreage of non-tidal wetlands, deep-water acreage, linear wetlands, and linear deep-water habitat for Mecklenburg and Brunswick Counties. A map of the Non-Tidal Wetlands Inventory for Brunswick and Mecklenburg Counties is provided in Appendix E, Map 2.

	Brunswick		**Mecklenburg**	
Land Acres	362,353		399,590	
Wetland Acres*	13,452	(3.6%)	16,390	(3.6%)
Deep Water Habitat (acres)	2,047	(.5%)	35,402	(7.7%)
Total Acres	**364,400**		**434,992**	
Linear Wetlands (miles)	48	miles	69	miles
Linear Deep Water Habitat	40	miles	103	miles

*Included in Land Acres

*Source: *The Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, Virginia Non-Tidal Wetland Inventory, 1990.*

Riparian forest buffers provide critical wildlife habitat and improve water quality. Studies have shown that riparian forests as narrow as 50 feet in width can completely remove excess nitrogen as it moves from farm fields through the forests to the adjacent stream. These forested areas also filter sediments and phosphorus, thereby acting as buffers to nutrient inputs to streams. Nutrient retention by a 100-foot forest adjacent to agricultural land is estimated at 80% for phosphorus and 89% for nitrogen. The retention varies depending on width of forest, slope, and other factors.
Tree roots help stabilize streambanks by holding soil in place. Riparian forests also lower flow velocities, causing sediment to settle out. Based on the Virginia Department of Forestry's 2003 assessment, many of the streams in Brunswick and Mecklenburg have 50 and 100 foot forested buffers on both sides of the stream. Preservation of the buffer zones is encouraged through state regulation of land disturbance and the enforcement of the Clean Water Act.

The U.S. Army Corps of Engineers owns and controls most of the property surrounding Kerr Reservoir. The ACOE retains ownership approximately 100 feet from the mean water line as flowage easement; the Kerr reservoir easements total approximately 8,000 acres, which includes the Upper Butcher Creek Public Access Area (see Conservation Areas Map in Appendix D). As a result the land bordering the water source has experienced little development. Conversely Lake Gaston, owned by Dominion Power and operated for hydroelectric power and recreation, has experienced significant residential and associated commercial growth. Most of the subdivisions in the planning region are utilizing deep wells, but with individual septic systems.

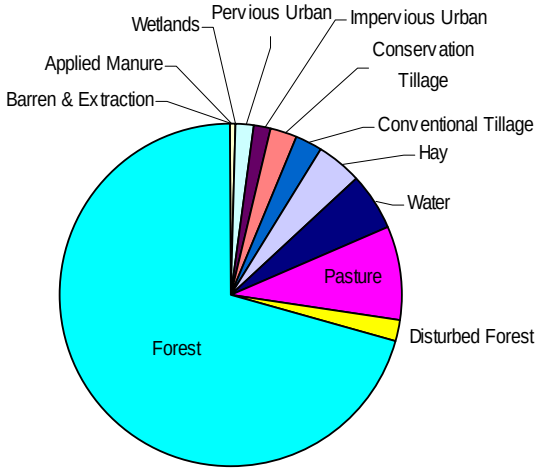
Conservation lands in Brunswick County include Great Creek Watershed Lake, Lake Brunswick, a public fishing lake owned by VDGIF, and the Gasburg Granite Flatrocks Preserve owned by The Nature Conservancy. Currently, there are no conservation easements on private property within Brunswick County. According to the DCR Land Conservation Data Explorer (http://www.vaconservedlands.org/gis.aspx), there are four conservation easements totaling approximately 1,490 acres within Mecklenburg County. In addition to the ACOE property surrounding Kerr Reservoir, additional conservation lands in Mecklenburg include: Occoneechee State Park, Lake Gordon (a public a public fishing lake owned by VDGIF), and on Lake Gaston there are four VDGIF sites and boat ramps and the Dick Cross Wildlife Management Area.
Riparian buffers are important for overall stream health, filtering nutrients, sediments, and other pollutants before they can enter a waterway and water supplies. Conservation areas are also important to water quality.

A map of Conservation Areas and Riparian Buffers for Mecklenburg and Brunswick Counties is provided in Appendix E, Map 3.

LAND USE— ***9 VAC 25-780—90 (3 b-viii)***

Lake Country, as are most areas of Southside Virginia, is predominantly rural. Agriculture and forestry dominate land use. The towns are urban focal points within the District and serve as major shopping and employment centers. Brunswick and Mecklenburg counties encompass a total land area of 1,249 square miles or 799,360 acres. According to the 2002 Census of Agriculture there were 247,195 acres of land in farms—reflecting a reduction of 1.3 percent since 1997. The incorporated towns account for less than two (2) percent or 9,722 acres (15 sq. miles) of the land area. The industrial and commercial land uses are primarily located in or around these "urbanized" areas. Due to the rural nature of the Lake Country planning area, impervious surfaces are limited to parking lots, shopping centers, and roadways and account for less than 5% of the Lake Country total land area. The lakes and expansive forested lands have provided extensive recreational property and uses and account for more than 75% of the land cover according to the Virginia Non Point Source (NPS) Assessment.

Land Use maps for Mecklenburg and Brunswick Counties are provided in Appendix E, Maps 4 and 5.



IMPAIRED STREAMS, POINT SOURCE DISCHARGES, AND OTHER THREATS TO WATER SOURCES—(3 b-ix, x, xi)

A number of factors can threaten the water supply. As can be expected, periods of droughts can result in increased numbers of failed or dry wells. Dug or shallow wells are particularly susceptible. Groundwater contamination from leaking underground tanks and/or failing septic systems are typical threats. A list of impaired waters within Brunswick and Mecklenburg is found in Appendix A, Table 90-B9 and shown on Appendix E, Map 6. Impairments include Fecal Coliform, Escherichia coli (E coli), Dissolved Oxygen, pH, PCB in fish tissue. Sources noted include livestock, domestic waste, sediments; and, therefore could be caused by farming operations, chemicals from field runoff, sewer plant discharge and /or failing septic systems. There are 27 Point Source Discharges in the planning area. These are listed in Appendix A, Table 90-B10 and are located on Appendix E Map 6.

In terms of quantity of water, fast growing metropolitan areas are competing for Lake Country's local water resources. Jurisdictions outside of the local drainage basin including neighboring North Carolina and Tidewater Virginia are interested in the ample supply in the Roanoke River Basin. Raleigh's main water sources (Fall's Lake & Jordan Lake) were almost depleted in the most recent drought (2007-08).

4—ASSESSING FUTURE WATER DEMANDS, NEEDS, & ALTERNATIVES

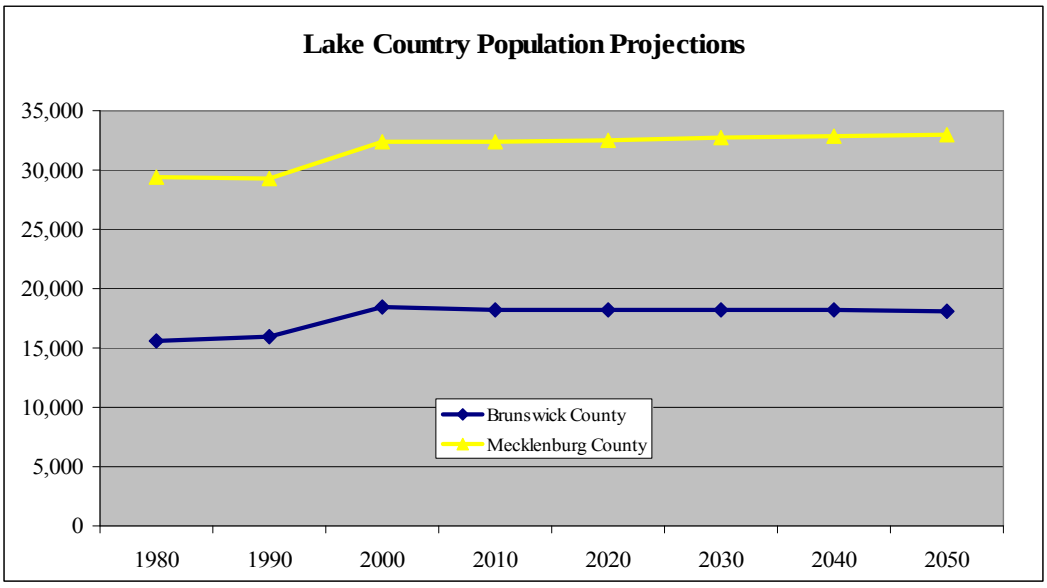
A. Projected Water Demand *9 VAC 25-780-100*

PROJECTIONS METHODOLOGY *9 VAC 25-780—100 (4 a)*

To estimate Lake Country's future demand on its water supply a per capita model was used. This simple method, which is recognized by the AWWA, was deemed appropriate since there are no immediate water needs and minimal population growth is anticipated. In this model the current per capita water use is multiplied by the projected population to estimate future need. The 2000 Census of Population and Virginia Employment Commission (VEC) population projections were utilized. The VEC population projections estimate the growth to 2030. The existing population projections and Census were used to generate a trend graph to extrapolate projections to 2040. A negative .03 percent annual average population change was calculated for Brunswick County; while a (somewhat) positive .04 annual change was applied to Mecklenburg County. This equates to "no anticipated growth" in the Planning Area based on the current economic climate; therefore projections were only extended to 2040. Detailed population projections for Brunswick and Mecklenburg and their towns is provided in Appendix D, Table 100 A

***POPULATION PROJECTIONS*—VIRGINIA EMPLOYMENT COMMISSION**

		Census		VEC Projections			Trend Line projections
	Annual Ave. % Change 2000-40	2000	2005 Estimate	2010	2020	2030	2040
Brunswick Co.	**-0.03%**	18,419	18,222	18,263	18,258	18,258	18,200
Mecklenburg Co.	**0.04%**	32,380	32,214	32,369	32,511	32,755	32,821
Lake Country		**50,799**	**50,436**	**50,632**	**50,769**	**51,013**	**50,998**



DECADAL ESTIMATE WATER DEMAND FOR LAKE COUNTRY REGION 9 VAC 25-780—90 (4b,c)

Lake Country population changes, projections, and projected water demand are provided in Appendix D, Tables 100-D1—D5, and water demand projections are summarized in the table below. While little to no population growth is anticipated, some industrial growth has been added in 2020, based on the postponed development of Osage, which will need 1.2 MGD. The overall demand projections for Lake Country Planning Area users indicate a current use of approximately 9.8 MGD that is anticipated increase to 11.2 MGD by 2040. Users from outside the area have permits for 80 MGD as well; since this is considered a maximum withdrawal this amount is projected as constant across the decades.

	REGIONAL WATER DEMAND (MGD)				
	Existing	Projected			
	2005	2010	2020	2030	2040
Community Water Systems					
Lawrenceville Service Area	0.768	0.769	0.775	0.781	0.787
Chase City Service Area	0.189	0.189	0.191	0.192	0.194
Clarksville Water Service Area	0.251	0.251	0.253	0.255	0.257
Roanoke River Service Area	1.219	1.221	1.230	1.240	1.250
Future Industrial User			1.200	1.200	1.200
Private CWS	0.200	0.200	0.202	0.204	0.205
Self-Supplied Users					
Non-Agricultural in CWS	0.12	0.12	0.12	0.12	0.12
Agricultural (1 farm using GW) outside CWS	0.06	0.06	0.06	0.06	0.06
Individual Wells					
Brunswick County Residences & Businesses	1.014	1.015	1.023	1.031	1.040
Mecklenburg County Residences & Businesses	1.603	1.605	1.618	1.631	1.644
SUBTOTAL REGIONAL DEMAND	**5.424**	**5.430**	**6.672**	**6.714**	**6.757**
Self-Supplied Users--(non-Consumptive)					
Non-Agricultural (2)	4.45	4.45	4.45	4.45	4.45
TOTAL REGIONAL DEMAND	**9.874**	**9.880**	**11.122**	**11.164**	**11.207**
CWS Outside the Planning Area (Permitted Capacity)	80	80	80	80	80
TOTAL RESOURCE DEMAND	**89.874**	**89.880**	**91.122**	**91.164**	**91.207**

WATER USE PROJECTIONS FOR COMMUNITY WATER SYSTEMS 9 VAC 25-780—90 (4 d)

Population projections, annual average and peak monthly demand projections by community water systems are listed in Appendix D, Tables 100 D1-D5. A map of the service areas of each community water system may be found in Appendix E, Map 1.

For the purpose of demand projections, the per capita use for each Community Water System (CWS) was determined and multiplied by the projected population for each decade. To calculate the per capita use factor, the amount of water used in gallon per day was divided by the population of each community water service area, which generally has a greater population than its principal town(s). A total population of 19,645 (2005) are served by 27 community water systems. In 2005 the annual average total usage by CWS was 2.6 MGD and is only expected to increase to 2.7 MGD by 2040 based on an annual average growth factor of .01%.

To determine monthly peak use demand a peaking factor was multiplied by the projected water use. For most community systems meter readings are done monthly, making inclusion of meaningful peak day usage difficult. The systems using surface water (and operating a treatment facility) have provided peak day readings. A peaking factor was determined by dividing the peak day withdrawal by the average day withdrawal. The resulting factor was multiplied by "Estimated Annual Average Water Demand." If peak day use was less that the industry standard of 1.5 or was unavailable, the peak day use was estimated as being 1.5 times the annual average use. If the system "peaking factor" was greater than the industry average, larger number was used to err on the side of caution. The peak day demand estimates for all Lake Country Community Water Systems was 4.1 MGD in 2005 and was projected to increase to 4.2 MGD by 2040.

Lake Country Disaggregated Water Use Demand Projections for CWS					
System/Land Use **Year**	**2005***	**2010**	**2020**	**2030**	**2040**
CWS--Residential	0.855	0.855	0.861	0.868	0.875
CWS—Commercial/ Lt. Industrial	0.584	0.584	0.589	0.594	0.598
CWS--Industrial	0.178	0.178	0.179	0.181	0.182
CWS—Schools/ Institutional	0.051	0.051	0.051	0.052	0.052
CWS--Prisons	0.435	0.435	0.439	0.443	0.446
CWS--Sales to other Systems	0.051	0.051	0.051	0.052	0.052
CWS--Unaccounted	0.484	0.485	0.488	0.493	0.496
Total CWS Projected Water Demand (MGD)	**2.637**	**2.639**	**2.658**	**2.683**	**2.701**

*Current Use

WATER USE DEMAND BY CATEGORIES OF USE FOR COMMUNITY WATER SYSTEMS (4 d—iv, v)

To apply demand by disaggregated water use in the region's community service areas, the amounts by category of use as provided by the local suppliers were converted to percentages of use and applied to the projected water demand. As summarized in the table above water demand for Lake Country Community Water Systems is projected to be 2.64 MGD in 2010; 2.66 MGD in 2020; and, 2.68 MGD in 2030 and 2.7 in 2040. See also Appendix D, Table 100D—iv and v. Water demand projections by disaggregated use for each community water system are shown in Appendix D, Tables D1—D5. All "Non-Municipal" Community Water Systems were residential and are not listed individually. The demand projections for these private systems are shown in Appendix D, Table 100 D5.

WATER USE PROJECTIONS FOR SELF-SUPPLIED NON-AGRICULTURAL USERS 100 (4 e)

Per DEQ's water withdrawal reporting database, there were three Self-Supplied Non-Agricultural users located in Lake Country that withdraw greater than 300,000 gallons of water per month. All three were non-consumptive users. One "user" is a hydropower plant (John H. Kerr Hydroelectric Power Plant) and since this water (5,622 MGD) does not leave the stream its use has not been included in demand calculations. Although the other two non agricultural facilities—Mecklenburg Cogen and Vulcan Quarry—are also non-consumptive, this water use was included in the demand table but is assumed to remain constant. Most (typically 90 to 95%) of the water used for power production and the quarry residual groundwater is returned to the source. For current and permitted withdrawal amounts see Appendix A, Table 70E.

WATER USE PROJECTIONS FOR SELF-SUPPLIED AGRICULTURAL USERS 100 (4 f)

There was only one Agricultural Self Supplied User located outside the service areas of the community water systems in Lake Country reporting withdrawal of more than 300,000 gallons per month in 2005. A check of withdrawals amounts in 2009 indicates this hog farm operation has added a well resulting in increased withdrawal; therefore the projection reflects this amount of .06 MGD. Consumptive use by self-supplied users for agriculture is expected to remain constant and all agricultural use is not anticipated to increase more than 1% by 2050. See Appendix D, Table 100A-B.

WATER USE PROJECTIONS FOR SELF-SUPPLIED SMALL USERS (< 300K GALLONS/MO) 100 (4 g)

Small users are determined by a threshold of less than 300,000 gallons per month. Typically this includes those utilizing individual wells. To calculate demand, a per capita usage of 85 gallons per person per day was multiplied by the projected population of those not living in a water service area. The population served by a Community Water System was subtracted from the Census estimates for 2005 to establish the population utilizing individual wells. The per capita use for individual well users in Brunswick and Mecklenburg was based on withdrawals by other groundwater residential well systems in the counties. Thus assuming 85 gallons per person per day, usage by small users was estimated to be 2.6 MGD in 2005 and projected to increase to 2.7 by 2040. See Appendix D, Table 100A-B.

As summarized in the following table, water demand across all water use sectors in the Lake Country Planning Area is projected to be 9.9 MGD in 2010; 11.1 MGD in 2020; and, 11.2 MGD in 2030 and 2040. Adding the Outside Permitted Users the demand increases to 89.9 in 2010; 91.1 in 2020; and, 91.2 in 2030 and 2040.

Lake Country Demand Projections (MGD)					
Year	**2005***	**2010**	**2020**	**2030**	**2040**
All CWS (MGD)	**2.6**	**2.6**	**3.9**	**3.9**	**3.9**
Non-Ag SSU demand	4.6	4.6	4.6	4.6	4.6
Ag SSU demand	0.1	0.1	0.1	0.1	0.1
Small, SSU demand	**2.6**	**2.6**	**2.6**	**2.7**	**2.7**
TOTAL REGIONAL DEMAND	**9.9**	**9.9**	**11.1**	**11.2**	**11.2**
CWS Outside the Planning Area (Permitted Capacity)	80	80	80	80	80
TOTAL RESOURCE DEMAND	**89.9**	**89.9**	**91.1**	**91.2**	**91.2**

*Current Use

CUMULATIVE DEMAND, USE CONFLICT, IN-STREAM FLOW INFORMATION ***100 (4 h)***

The State Water Resources Plan is not complete and therefore cumulative demand, use conflict, or in-stream flow information for the Lake Country planning area is not available at this time.

FUTURE NEEDS ***100 (4 i)***

To address positive changes that may occur in an otherwise dire economic and consequently low growth environment, the projections have assumed some demand increases. A future industrial user mentioned in the Water Resources section (page 16) that was to use 1.2 MGD and be a part of the RRSA, has postponed location plans; however this usage was included in decades 2020-2040. To build in the potential for increased domestic use by individual well users, a higher groundwater use estimate of 85 gallons per day per person was used rather than the national average of 75 gallons. This figure was derived from groundwater systems in the planning area. These projections assumed the region's conservation practices that are currently in practice would continue and not change substantially until the next plan update. Other community systems outside the planning area are permitted to withdraw up to 80 MGD from the Roanoke River system. This maximum withdrawal has been noted as constant across the planning period.

An assessment of Community Water Systems shows that the region's resources—safe yield and permitted capacities—are more than adequate to meet its projected water demand needs.

Lake Country Demands by CWS	**2040 Projected Peak Demand (MGD)**	**Safe Yield (MGD)**
Lawrenceville: Great Creek/Meherrin	1.2	3.85
Chase City—Groundwater	0.3	Unknown
Clarksville Water System	0.5	352 [1]
Roanoke River Service Authority	1.9	352 [1]
Non-Municipal CWS—Groundwater	0.3	Unknown
Total	**4.2**	

[1]Safe yield from 1982 study and low flow of 1980-81

DEMAND, SAFE YIELD CAPACITY DISCUSSION BY SYSTEM

Chase City & Other Groundwater Systems

Chase City's groundwater system total permitted capacity is .884 MGD according to VDH records. Demand projections indicate .4 MGD may be needed by 2050. While this permitted capacity seems sufficient, it is generally felt that the wells were not intended to pump concurrently which would be required to achieve the maximum capacity. Therefore the water supply for Chase City appears to be adequate for the projected growth however, if any (other) large water users were to locate the town may wish to connect to the RRSA. The RRSA will be constructing a water line to near the south side of the town limits to serve an industry that required 1.2 MGD, which the town's system did not have the capacity to provide. The Roanoke River Service Authority system has the capacity to meet its projected supply demand plus add on the town of Chase City (.3 MGD) if it were needed.

Roanoke River Basin/Kerr Reservoir Systems

As can be seen from the table on the following page, peak demand for the Kerr reservoir system in 2040 is projected to be 6.0 MGD. If Chase City were added to the RRSA as in the above scenario, the demand would be almost 7 MGD. Adding the contracted withdrawal and storage amounts brings the demand total to 96 MGD, which is well below the Safe Yield of 352 MGD for the Kerr Reservoir system. This yield was calculated based on the lowest flow during the 1980-81 drought.

The Phase I Study—Roanoke River Basin Water Resource Development Plan prepared by C.E. Maguire, Inc., for the City of Virginia Beach in 1982 states that "the yield of the three reservoir system (Kerr-Gaston-Roanoke Rapids) is estimated to be at least 352 MGD is more than adequate to meet the projected public water supply demands of Virginia Beach (48 MGD annual average) as well as the lower Roanoke River Basin (48.2 MGD annual average) fifty year planning period." This study is dated now; however it gives an idea of the projected demand to 2030 for the lower Roanoke River and for Virginia Beach. Furthermore the Maguire Group document cited a 1977 study entitled, Water Resources Evaluation and Planning (South Shore), which contained yield calculations of 500 MGD for the Roanoke River Basin. Therefore while it is difficult to anticipate the demand for entities outside of the planning area that may wish to tap on to the Roanoke River supply, based on the yield estimates and projected local demand of less than 3.0 MGD (including Chase City) and there appears to be sufficient flow and volume to meet the public water supply needs of the Lake Country Region.

Lawrenceville System

Demand on the Lawrenceville system and the Great Creek/Meherrin River in Brunswick are projected to reach 1.2 MGD by 2040. The safe yield of the Creek is an ample 3.85 MGD. The Meherrin River adds 2.4 MGD and the Great Creek Reservoir adds storage capacity. Therefore the existing water supply for the Lawrenceville system is adequate and has room to grow due to its auxiliary resources.

A summary of existing use, contract obligations and other limits, and projected peak demand for the Lake Country systems may be found below.

Lake Country Water Systems Use & Capacity Summary

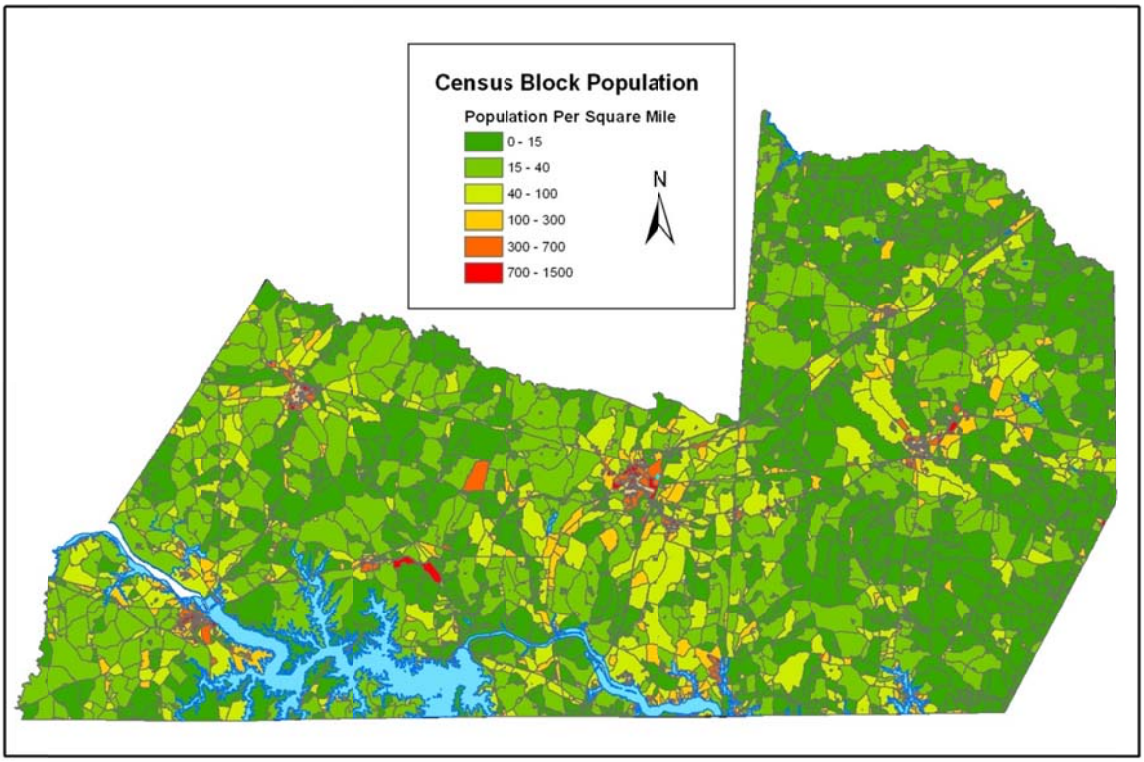
Water System: Name or Type	**Current Use** Ave. annual withdrawals (MGD) Source DEQ 2004	VDH Permit: Water Treatment Plant Capacity (MGD)	Contract Withdrawals or Storage Limits	Projected Peak Demand 2040 MGD
Roanoke River Basin				
Roanoke River Service Authority	1.22	4.18	7.0 MGD	1.88
Future Industrial User (Osage)				1.20 [1]
Town of Clarksville	.25	1.0	Design limit only: 1 MGD or 4 GPM/s.f.	.55
SSUs:. Cogen	2.41	Non-consumptive	2.3 MGD	2.4
Prison	Unused	N.A.	.06	0
Reservoir Withdrawal w/in LC	**3.9 ***	**5.2**	**10.4**	**6.0**
Users from outside LC				
City of VA Beach	60	N.A.	60	60
KLRWP	6.5	10 [2]	20 [2]	20 [2]
Reservoir Withdrawal For water supply	**70.4 ***		**90.4**	**86.0**
Chowan River Basin				
Town of Lawrenceville (includes Alberta)	.73	2.0	2.0	1.2
Stream Withdrawal	**.73**	**2.0**	**2.0**	**1.2**
Groundwater—Lake Country				
Town of Chase City	.185	N.A.	.883	.29
Total Other CWS (24)	.19	N.A.	1.06	.31
SSUs	2.06	N.A. Non-consumptive		2.06
Individual Wells	2.62	N.A.	None	2.7
Groundwater Withdrawal	**5.1**		**1.9**	**5.4**

No user in Lake Country purchases or utilizes water from outside the Planning Area.
Detailed information regarding the existing water sources for the Lake Country Planning Area may be found in **Appendix A**.
N.A. Not Applicable
[1]Includes Osage 1.2 MGD
[2]Source: KLRWP; 20 MGD applied for
* John H. Kerr Hydroelectric power plant not included in total—separate allocation in reservoir & non-consumptive. [5,621.7 MGD]

Based on these current population projections and the existing contractual arrangements described in the projected water demand and existing water source sections, the current water supply is ample to provide for the Lake Country water needs for the next 40 years. Since the existing sources are adequate to meet the projected water demands during this planning period, an alternatives analysis is not required (per 9 VAC 25-780-130.B) and therefore not included in this iteration of the plan.

8/1/2011 NOTE: The 2010 Census indicates the 2010 projections for Mecklenburg and Brunswick counties were on target as shown by the table and map below. The map provides the 2010 population distribution.

County	2010 VEC Population Projection	2010 Census of Population (available 3/2011)
Brunswick	*18,263*	*17,434*
Mecklenburg	*32,369*	*32,727*



Source 2010 US Census Bureau (2010)

6—WATER DEMAND MANAGEMENT & DROUGHT RESPONSE

A. Water Demand Management & Water Conservation Practices *9 VAC 25-780-110*

Water Conservation Practices (AWWA) include:

- *Methods to promote reasonable and efficient use and reuse of available supplies*
- *Those practices, techniques, and technologies that will reduce the consumption of water, reduce loss or waste of water, improve the efficiency of the use of water or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.*

AWWA supported water conservation principles and practices:

1. Efficient utilization of sources of supply;
2. Appropriate facility rehabilitation or replacement;
3. Leak detection and repair;
4. Accurate monitoring of consumption and billing based on metered usage;
5. Full cost pricing;
6. Establishment of water-use-efficiency standards for new plumbing fixtures and appliances and the encouragement of conversion of existing high-water-use plumbing fixtures to more efficient designs;
7. Encouragement of the use of efficient irrigation systems and landscape materials;
8. Development and use of educational materials on water conservation;
9. Public information programs promoting efficient practices and water conservation by all customers;
10. Integrated resource planning;
11. Water reuse for appropriate uses; and
12. Continued research on efficient water use practices.

EXISTING LOCAL WATER CONSERVATION EFFORTS *110 a-i*

A review of the public water systems within the Lake Country Region found the following programs and practices in place.

All the localities within the planning area have adopted the Uniform Statewide Building Code.

Roanoke River Service Authority (RRSA) is considering installation of more accurate water meters at main entry points to customers (towns) to better account for actual amount of water use. However if the purchase is not approved, the meters can be recalibrated to find percent of efficiency and then that percentage could be calculated into the meter reading. They would know that 10 gallons left plant and meter at entry point read only 8 gallons then meter readings would be

adjusted up 20%. More accurate meter reading and resulting higher water bills might encourage more efficient (conservative) water use.

River Ridge is a campground and subdivision on Lake Gaston in Bracey. The facility includes a nine-hole golf course. The RRSA provides the water to the subdivision while River Ridge owns its own water lines and operates a small package plant for the wastewater. The golf course is integrated into the wastewater system. The treated wastewater makes up the ponds or water features and is used to irrigate the course.

Chase City has active leak detection and maintenance program. The Town routinely inspects for leaks on their lines. The Town has an ordinance provision to encourage residents to report leaks and not waste water—leaks must be corrected.

Brodnax has an active leak detection program. Meters equipped with leak detector, which will turn if leak is on resident or customer's side. Town encourages residents to check more frequently.

South Hill has an ordinance provision requiring water conservation in the case of emergency. The town uses AMR meters with wands to read.

La Crosse indicated that most of the town's meters have leak detectors; although some need replacing. The town does not have an Ordinance requirement for water restrictions during water emergencies.

Clarksville has replaced all meters with new AMR (Automatic Meter Reading) wand meters. The system has leak detection—if water use is greater than previous reading, program sends up a red flag and the town goes and checks the meter so make sure it is a true leak or a sensor problem. The system has reduced re-reads from 100 re-reads to about 20. Meters have backflow prevention. The town does not have an Ordinance requirement for water restrictions for water emergencies. Rather the Town asked residents for voluntary conservation during the last drought.

Lawrenceville has AMR meters and mobile leak detection equipment, which can be used to listen to lines to detect for leakage and can be used on either side—town's or customer's to determine where the leak is.
The town's ordinance authorizes charges in the event of line break on the customer's side. [Ord. No. 01-02, art. III, S 7, 7-10-2001].
Additionally Lawrenceville's ordinance contains a provision authorizing the mayor or town manager to restriction certain water uses in the event of a declared water emergency. [Ord. No. 01-02, art. VII, S 1, 7-10-2001]

Alberta has leak detectors on meters. The town does not have anything regarding conservation or water demand in its ordinance. Utilizing a grant from VDH, Timmons Group designed a wastewater reuse system for the town. They found they could retreat their wastewater to use to sanitize the tanks, saving 5,000 to 8,000 gallons of drinking water. Formerly 6,000 to 10,000 gallons of potable water, which was purchased from Lawrenceville, was used to disinfect the wastewater tanks.

Boydton does not have anything regarding conservation or water demand in its ordinance but generally sends out letters about conserving water during dry periods. The mayor felt that water rates encourage conservation. The town meters have leak detectors. Also there are back-flow preventers on the yoke of each meter. Although there are leak detectors on the meters, a leak at a vacant former laundromat was detected after RRSA noticed a spike in town use. The leak was on the customer side, which is usually not found with that type of meter particularly in unoccupied facilities.

LOCAL EXISTING WATER DEMAND MANAGEMENT EFFORTS

	System	**Conservation efforts**
RRSA	RRSA	Improve water metering
River Ridge	RRSA	Wastewater reuse for golf course irrigation and ponds
Brodnax	RRSA	Leak detection
South Hill	RRSA	Ordinance requires conservation during emergencies; Use wands for meter readings
La Crosse	RRSA	Most meters have leak detection; some need replacement
Boydton	RRSA	Meters equipped with leak detectors Town sends letters regarding conservation during dry periods.
Clarksville	Clarksville	Meters replaced; use wand Leak detection Voluntary conservation during emergency
Chase City	Chase City	Leak detection: Ordinance provision to prevent residents from wasting water—leaks must be corrected. Leak detection & maintenance program—routinely inspect for leaks.
Lawrenceville	Lawrenceville	Leak detection: mobile leak detection equipment. Ordinance provision for line breaks Ordinance for water supply emergencies
Alberta	Lawrenceville	Meters equipped with leak detectors Wastewater reuse to sanitize wastewater tanks

B. Water Conservation Plan Recommendations

Water conservation means measures intended to improve the efficiency of water use and reduce waste. The intent of this definition is to focus on technical methods of reducing water demands through efficiency and reuse of available supply. This definition is not to be equated with a similar level of sacrifice by end users to comply with temporary emergency measures that are implemented during drought conditions or a water supply emergency. Efficient use of water not only benefits the natural environment but also offers economic perks to citizens, business owners, and even local governments—lower use equals lower bills.

The following are techniques that have been found to increase water savings in many localities and, if not currently, may be employed in Lake Country systems to produce added water conservation.

1. **Public Information & Education:**
    - Educate citizens of local public water supply issues and problems.
    - Raise public awareness of the region's water supply and the need to use water efficiently
    - Inform citizens of the benefits of water conservation that include:
        - · Optimized use and efficiency of public water supplies.
        - · Cost savings through conservation
        - · Reduced risk of public water supply shortages
        - · Protection of economic viability of the area
    - Educate citizens on water-conserving measures such as water efficient landscaping and low flow fixtures.

    Target groups for education:
    - Homeowners associations
    - Industrial and commercial establishments
    - Students and teachers—SOLs
    - Community service organizations (Lion's club, Rotarian)
    - Professionals and tradesmen, landscape contractors, irrigation contractors, nursery owners, builders and developers)
    - High water use industries and business (golf course, laundries, motels, hotels, car washes, and restaurants)

2. Water Conserving Plumbing Code

The Federal Energy Policy Act of 1992 requires that essentially all toilets, urinals, and faucets manufactured after January 1994 achieve maximum-use standards. Since March 1993, the Commonwealth of Virginia requires low-water-use plumbing fixtures in new construction. Brunswick and Mecklenburg counties and the Town of South Hill have adopted the Uniform Statewide Building Code as the local code. The remaining towns are governed by the County Building Code and enforcement.

The chart below provides current state code requirements for plumbing fixtures.

Current Plumbing Fixture-Flow Standards for Water Use Efficiency

Plumbing Fixture or Fixture Fitting	**Maximum Flow Rate or Quantity**
Water closet (toilet)	1.6 gallons per flushing cycle
Urinal	1.0 gallon per flushing cycle
Showerhead	2.5 gallons per minute at 80 psi
Lavatory (nonpublic)	2.2 gallons per minute at 60 psi
Lavatory (public)	0.5 gallon per minute at 80 psi
Lavatory (public metering self-closing)	0.25 gallons per metering cycle
Sink faucet	2.2 gallons per minute at 60 psi

Source: Virginia Uniform Statewide Building Code, 1990 Edition-Third Amendment, Effective March 1, 1993.

Owners of older home or businesses should be encouraged to replace any existing high water use fixtures with water-conserving fixtures.

3. Metering and Meter Repair and Replacement

Although individual water meters have often been considered impractical in homes with private wells or in multifamily buildings, the U.S. Environmental Protection Agency estimates that metering alone can reduce consumption by 20 to 40 percent[EPA]. In addition to raising consumer awareness of their water use, metering is also an important way to identify and localize water leaks.

All Lake Country Public Water Suppliers meter all customer accounts. Studies show that metering results in lower water use since customers become "sensitized" to the amount of water used through the effect it has on the water bill. Metering is also an aid to detecting leaks on both sides of the meter.

Maintenance programs for water meters are essential to ensure that an accurate measure of system integrity is obtained. Under-registration by meters may result in a significant percentage of unaccounted for water and loss of revenue. Some localities have meter replacement programs that require the replacement of residential meters every so many years. Fifteen (15) years is the average service life of residential meters. Improved meters

and routine calibration can help track water use (and loss) and lead to water and money savings.

4. **Water Conserving Landscaping**

Landscape irrigation use is largely dependent on weather conditions so large variations in peak demand occur between wet, normal, and dry years. Drought conditions typically increase total water use and peak water demands.

When landscaping employ water-wise landscape design and management techniques. Water-wise landscape design and management focuses on working with nature and environmental factors such as rainfall, to create an attractive, livable landscape, while using less water from the local supply.

- Plan and design to maximize water efficiency.
- Replace turf with landscaped beds, mulched areas, ground covers, or hard structures.
- Improve soil to ensure water holding capacity, absorption properties, and nutrients for plant growth.
- Use indigenous/native and other adapted low-water-use plants. A list of native species is available from the Virginia Cooperative Extension
- Efficient irrigation. Drip irrigation is considered to be the most efficient.

5. **Water Conserving Agricultural Practices**

For crop irrigation, optimal water efficiency means minimizing losses due to evaporation or runoff. An evaporation pan can be used to determine how much water is required to irrigate the land. Overhead irrigation, using center-pivot or lateral-moving sprinklers, gives a much more equal and controlled distribution pattern, but in extremely dry conditions much of the water may evaporate before it reaches the ground. Drip irrigation is the most expensive and least-used type, but offers the best results in delivering water to plant roots with minimal losses.

As changing irrigation systems can be a costly undertaking, conservation efforts often concentrate on maximizing the efficiency of the existing system. This may include chiseling compacted soils, creating furrow dikes to prevent runoff, and using soil moisture and rainfall sensors to optimize irrigation schedules. [Wikipedia & US EPA, "Clean Water Through Conservation", Practices for Agricultural Users]

6. **Leak Detection and Water Audits**

Good construction standards for public water systems and a water main replacement program for areas where leaks recur will result in fewer leaks. The Lake Country water providers currently carry on active leak detection programs. The systems are encouraged to continue aggressive leak detection and repair programs.

Water audits offer a way to identify and eliminate excessive use of public water. Public water purveyors routinely compare the metered amount of water they produce with the metered consumption of their customers to determine the amount and percentage of unaccounted for water in their system(s). The national average unaccounted for water loss is 10-15%. Regular audits may be used by purveyors to identify areas for ongoing leak detection and repair programs. Areas of recurring leaks should be targeted for line replacement and included in the capital improvement program.

7. Wastewater Reuse and Recycling as a Conservation Measure

In certain applications, (treated) wastewater reuse has been found to be a viable alternative water source. The U.S. Environmental Protection Agency (EPA) defines wastewater reuse as, "using wastewater or reclaimed water from one application for another application. The deliberate use of reclaimed water or wastewater must be in compliance with applicable uses for a beneficial purpose (landscape irrigation, agricultural irrigation, aesthetic uses, ground water recharge, industrial uses, and fire protection)." Wastewater reuse is a deliberate strategy of directly reusing wastewater effluent, treated to the degree appropriate for the intended reuse, to satisfy non- potable demands. Examples of use include irrigation of public parks urban landscapes, and golf courses, irrigation of nonfood crops and commercial nurseries, recreational impoundments, artificial wetlands, sustaining stream flows, and for industrial process and cooling tower water.

Some wastewater use applications are already taking place in the Lake Country region. After a study by Timmons Group, the town of Alberta began to use retreated effluent to disinfect its wastewater tanks**.** The town formerly used 6,000 to 10,000 gallons of potable water washing the tanks. They found they could retreat the wastewater and use it to sanitize the tanks, saving 5,000 to 8,000 gallons of drinking water.

River Ridge, a subdivision and golf course on Lake Gaston in Bracey, is a customer of the Roanoke River Service Authority. The RRSA provides the water to the subdivision while River Ridge owns its own water lines and operates a small package plant for the wastewater. The golf course is integrated into the wastewater system, by pumping the treated effluent into the course's ponds/water features. These ponds are in turn used to irrigate the course.

7—LAKE COUNTRY REGIONAL DROUGHT RESPONSE & CONTINGENCY PLAN
9 VAC 25-780-120

"A drought management plan is a document that (1) defines the conditions under which a drought-induced water supply emergency exists and (2) specifies the actions that are to be taken in response." AWWA Drought Management Handbook, 2002

A. Purpose of Drought Plan
B. Identifying Drought Conditions
C. Drought Stage Indicators & Responses
D. Notifications of Drought Conditions
E. Non-Essential Water Uses
F. Public Notification Process
G. Termination procedures
H. Implementation plan: Local Ordinance Adoption
I. Procedures for periodic review & revision

A. Plan Background and Purpose

Background

In 2005, the Southside Planning District began to prepare a regional water supply plan for the counties of Brunswick and Mecklenburg and the towns therein—Alberta, Boydton, Brodnax, Chase City, Clarksville, La Crosse, Lawrenceville and South Hill. This activity was in response to the Commonwealth of Virginia, Local and Regional Water Supply Planning Regulation, 9VAC 25-780, which established a planning process and criteria for local governments to use in the development of local or regional water supply plans. This plan is a cooperative effort among these localities to inventory existing water resources, supply, and use and to project future water demand. Additionally these regulations include a component regarding drought response and contingency plans. Communities that withdraw more than 300,000 gallons per month of surface water and ground water must develop a drought contingency and response plan. The need for such a plan resulted from the severe drought of 2001-2002, brought about by precipitation deficits from 1999, which raised awareness for the need to prepare for future drought events.

Although the 2002 drought was not as severe as the drought of record (1930-1932), increased water demand when compared to the 1930's resulted in significant impacts to all sectors of Virginia's economy and society. The intensity of these drought impacts peaked in late August 2002. Wildfire indices were at levels previously unrecorded in Virginia, the vast majority of Virginia agricultural counties had applied for Federal drought disaster designation, streamflows reached period of record lows, and thousands of individual private wells failed. As a result of the severity of the drought effect, the Governor declared a drought emergency for most of the state by Executive Order #33 and mandatory restrictions of outdoor water uses were imposed.

Locally during the 2002 drought, while the water supplies were adequate and no emergencies were

declared, there were concerns. Kerr Lake was five (5) feet below normal at the worst of the event (August 2002) and Clarksville did not experience supply problems. Great Creek Reservoir, which holds the water supply for the town of Lawrenceville, was approximately 22 inches below normal but was able to maintain streamflow below the dam to service the town's intake. Voluntary conservation measures were encouraged. As in the rest of the state, numerous private individual wells failed within the two counties.

South Hill, which utilized the Meherrin River as its water source at the time, experienced the most severe dilemma during the drought. In August of 2002 the town estimated that there were only about 28 days of supply available in the river. Pumps and generators were being utilized to fill the tank, as stream flow was so low the intake pumps were not functioning properly. Fortunately in September 2002 the Roanoke River Service Authority plant went into operation and the town's supply was switched to Lake Gaston along with three municipalities utilizing groundwater—the towns of Brodnax, La Crosse and Boydton.

Purpose

While these local experiences were not as dire as the rest of the state, rather than face emergency mandates in the future, a regional drought response plan that meets local need has been prepared. This plan will identify the conditions under which conservation measures should be implemented and the level of response needed based on the drought severity. In addition to establishing a method to monitor drought conditions, the plan provides a public notification system, tiered responses to the drought stages, and recommends appropriate actions by residents, businesses as well as local governments. In order to implement the plan, each municipality must draft and adopt a local ordinance. This Plan will serve as a guide for the development of the ordinances.

Authority

Code of Virginia

The Code of Virginia includes two sections that authorize localities to restrict water use in declared emergencies. Section 15.2-923 states that any locality may by ordinance (i) require installation of water conservation devices in the case of the retrofitting of buildings constructed prior to July 1, 1978 and (ii) restrict the nonessential use of ground water during declared water shortages or water emergencies. ("Non-essential use" shall not include agricultural use.) This section would apply to private wells.

Section 15.2-924, Water Supply Emergency Ordinances, gives authority to localities to adopt an ordinance restricting the use of water during a water emergency or to prevent the occurrence of a water supply emergency. This section of the Code is applicable to water supplied by a locality, authority, or company distributing water for a fee or charge. Furthermore, Virginia allows local restrictions to take precedence if an ordinance is in place. Therefore, if the Governor declares an emergency because of severe conditions in another part of the state and conditions in Lake Country do not warrant it, the local governments do not have to initiate.

B. Identifying Drought Conditions

For the Lake Country localities the drought response indicators have been established based on the local water resource.

Identifying Drought Conditions in Lake Country

As detailed in the previous Water Supply Plan sections, Existing Resources and Water Sources, the public water suppliers of the Lake Country region utilize all three water source types—streams, groundwater and reservoirs. Additionally given the rural nature of both Brunswick and Mecklenburg counties, most of the population is served by individual wells. The plan inventory estimates that there are more than 12,800 individual wells in the two counties. In Mecklenburg purveyors of public water are the town of Clarksville (Kerr Reservoir), Chase City (wells), and Roanoke River Service Authority (Lake Gaston), which serves the towns of South Hill, La Crosse, Boydton and Brodnax. In Brunswick County, Lawrenceville (Great Creek and the Meherrin River) is the service provider for itself and the town of Alberta.

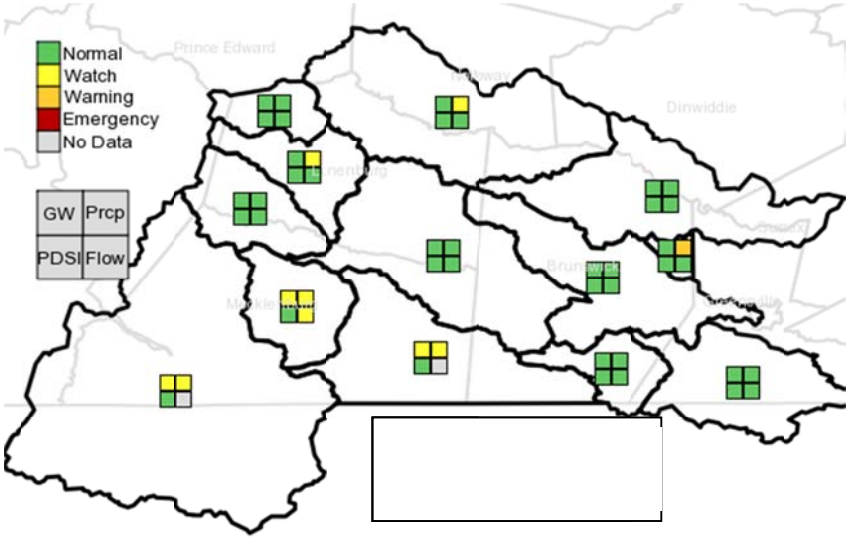
Therefore these water purveyors will be responsible for recognizing changes in the water sources and the potential impact to their customers. These purveyors will:

1. Determine when the indicators of drought stage conditions are met as described below in Paragraph C, and
2. Recommend that the Board of Supervisors of Brunswick and/or Mecklenburg counties and, the town councils of Alberta, Boydton, Brodnax, Chase City, Clarksville, La Crosse, Lawrenceville, and South Hill declare the appropriate drought stage and implement the designated response measures. The purveyors should provide a written memo or report to the authorities, which sets forth the water source data and factors utilized in determining the drought stage threshold has been met.

DROUGHT INDICATOR ANALYSIS--*LAKE COUNTRY MONITORING TOOL*

To assist local system operators in assessing drought conditions, DEQ has developed a web tool to present the current drought indicator data by the state drought management regions.
A Sub-region map customized to cover the Lake Country Region is available at: http://www.deq.virginia.gov/watersupplyplanning/drought/southside/current.html and a screen capture is shown below. This will provide the Lake Country localities better access to monitoring tools and drought response triggers.
By reviewing the graphs on the site an individual can assess the region's relative position in each drought indicator. The drought metrics that are calculated and presented in the on-line map follow:

- **Precipitation** - Precipitation totals are calculated for the water year (from the previous October 1st) and are compared to the normal annual values (indicated in the map legend as "Prcp").
- **Stream Flow** - Mean daily stream flows over the previous 7 days are used to determine stream drought condition (indicated in the map legend as "Flow").
- **Groundwater** - Current groundwater surface elevation is evaluated against historical normals (indicated in the map legend as "GW"). It is important to note that groundwater levels are measured as feet *below* the surface, therefore, *lower* numbers are equivalent to a *higher* amount of groundwater, and vice-versa.
- **Reservoir Levels** - The current level of reservoirs are evaluated against historical normals for some of the state drought regions.
- **Palmer Drought Severity Index** - The Palmer Drought Severity Index is a measure of "the relative dryness or wetness effecting water sensitive communities," such as agriculture (indicated in the map legend as "PDSI"). The Palmer index is calculated for the previous week by NOAA Climate Prediction Center for various regions in the United States, with 6 different geographical regions inside of the state of Virginia



The colored boxes provide a quick indication of the drought stage by indicator—groundwater, precipitation, Palmer Drought Severity Index (PDSI), and streamflow.

C. Drought Stage Indicators & Responses

DROUGHT WATCH—STAGE I

Drought Watch stage responses are intended to increase public and private sector awareness that climatic conditions are favorable for an oncoming significant drought event. Public outreach activities shall be identified targeted to prepare citizens for the onset of a drought event, to inform the population served by community water systems of the potential for drought conditions, and prepare the public for any potential water conservation activities that may be utilized. In rural areas public outreach to individual well owners during early drought conditions may be critical, especially if such users institute conservation measures that may reduce the likelihood of well failures during significant drought conditions (warning or emergency stages).

Municipality/Community Water System (CWS)	**Water Source**	**Drought Watch Indicator** *(Public Notice)*
Alberta	Great Creek	*Trigger:* Great Creek Reservoir level =214 msl
Lawrenceville		*Trigger:* Gauge Valve #3 open 13 turns
RRSA	Kerr Reservoir/Lake Gaston	*Trigger: Kerr Lake level = 292' msl*
Boydton Brodnax La Crosse South Hill River Ridge & all RRSA individual customers		
Clarksville	Kerr Reservoir	*Trigger: Kerr Lake level = 292' msl*
Chase City	Municipal Wells	If any of the other localities go into drought watch stage, town will enter drought watch stage.
Brunswick County Mecklenburg County	Individual Wells	If any of the other localities go into drought watch stage, county will enter drought watch stage.

***Stage I*—The Drought Watch Stage response** will include a public outreach campaign to notify all citizens in the region that a significant drought is likely given the current climatic conditions. The public will be notified via billing inserts, newspapers, televisions, local websites, and/or radio announcements.

Once a drought watch declaration is issued, the following actions are recommended:

- A public awareness and education process will be implemented to distribute water-conservation information and other special notices to customers to encourage each resident of the county and each customer to employ restraint in water usage.

DROUGHT WARNING—STAGE II

Drought Warning stage responses are required when the onset of a significant drought is imminent, the water supply in the planning area is threatened by these drought conditions, and restrictions are necessary to preserve an available supply of water. During the drought warning stage, voluntary water conservation activities are enacted with the goal of reducing water use by 5 – 10%, as such conservation measures may result in delayed progression towards a drought emergency stage.

Municipality/Community Water System (CWS)	**Water Source**	**Drought Warning Indicator** *(Voluntary restrictions)*
Alberta	Great Creek	*Trigger:* Great Creek Reservoir level = 211 msl
Lawrenceville		*Trigger:* Gauge Valve #3 open 13 turns
RRSA	Kerr Reservoir/Lake Gaston	*Trigger: Kerr Lake level = 290' msl*
Boydton Brodnax La Crosse South Hill River Ridge & all RRSA individual customers		
Clarksville	Kerr Reservoir	*Trigger: Kerr Lake level = 290' msl*
Chase City	Municipal Wells	If any of the other localities go into drought warning stage, town will enter drought warning stage.
Brunswick County Mecklenburg County	Individual Wells	If any of the other localities go into drought warning stage, county will enter drought warning stage.

Stage II—Drought warning responses

When any of the individual locality drought warning stage indicators are met, the Water System manager will notify the local governments and recommend a drought warning declaration for the respective locality(ies). Proximate localities in the regional planning area whose indicators have not reached the warning level will be recommended to declare a drought watch stage and initiate or maintain public outreach measures. Press releases will be distributed to the media to publicize updates to the drought conditions and needed actions. Voluntary water conservation measures will be encouraged. Encourage reduction in non-essential water use as detailed in Paragraph E. In the event of a drought warning, the public will be notified via billing inserts, newspaper, television, and/or radio announcements.

During a Drought Warning declaration, the following **voluntary** restrictions are strongly encouraged:

- Encourage that the watering of outside shrubbery, trees, lawns, grass, plants, home vegetable gardens, or any other vegetation be conducted only between the hours of 8:00 p.m. and 9:00 a.m., and only as necessary to preserve plant life.

- Washing of automobiles, trucks, trailers, boats, airplanes, or other types of mobile equipment except from a bucket or other container not exceeding three (3) gallons in capacity;
- Washing of streets, driveways, parking lots, service station aprons, office buildings, the exterior of homes or apartments, or other outdoor surfaces by commercial washing/cleaning services except from a bucket or other container not exceeding three (3) gallons of capacity.
- The operation of any ornamental fountain or other structure making similar use of water.
- The filling of swimming and/or wading pools, or the refilling of swimming and/or wading pools that were drained after the effective date of the declaration is not permitted.
- The use of water from fire hydrants for any purpose other than fire suppression or other emergency is not permitted except as authorized by the Locality.
- Serving of water in restaurants except upon request of customers.
- All public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day should reduce or eliminate non-essential uses of water including the elimination of non-essential flushing of water lines.
- All persons who utilize any source of water for outdoor irrigation will assure that the minimum amount of water is utilized in the most efficient manner practical.
- All self-supplied users who withdraw less than 10,000 gallons per day, including private well users, will be encouraged to voluntarily reduce or eliminate non-essential uses of water.
- Local governments and public waterworks may impose water use restrictions consistent with local water supply conditions at any time.

DROUGHT EMERGENCY—STAGE III

Drought Emergency Stage responses are required during the height of a significant drought event, when the water supply in its planning area is threatened by emergency drought conditions and where more water use restrictions than previously enacted are necessary to preserve an available supply of water. During this period, it is likely that some water supplies will not be able to provide the amount of water needed by all users and therefore, non-essential uses of water should be eliminated to reduce unnecessary water demands on the systems. During the drought emergency stage, mandatory water conservation activities are enacted with the goal of reducing water use by 10 – 15%.

Municipality/Community Water System (CWS)	**Water Source**	**Drought Emergency Indicator** *(Mandatory restrictions)*
Alberta	Great Creek	*Trigger:* Great Creek Reservoir level = 210 msl
Lawrenceville		*Trigger:* Gauge Valve #3 fully open
RRSA	Kerr Reservoir/Lake Gaston	*Trigger: Kerr Lake level = 288 msl*
Boydton Brodnax La Crosse South Hill River Ridge & all RRSA individual customers		
Clarksville	Kerr Reservoir	*Trigger: Kerr Lake level = 288 msl*
Chase City	Municipal Wells	If any of the other localities go into drought emergency stage, town will enter drought emergency stage.
Brunswick County Mecklenburg County	Individual Wells	If any of the other localities go into drought emergency stage, county will enter drought emergency stage.

Stage III—Drought emergency responses

When any of the individual locality drought emergency stage indicators are met, the Water System manager will notify the local governments and recommend a drought emergency declaration for the respective locality(ies). For those proximate localities within the planning area that have not reached the emergency level, the committee will recommend that these local governments declare or maintain the drought watch or warning status. In the event of a drought emergency, the public will be notified via billing inserts, newspaper, television, and/or radio announcements.

Stage III—Drought emergency responses are mandatory water conservation requirements:

- All public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day will initiate mandatory water conservation requirements listed in the mandatory non-essential water use restrictions as shown in Paragraph E and including the elimination of non-essential flushing of water lines.
- All self-supplied users, who withdraw less than 10,000 gallons per day, including private well users, will initiate the mandatory non-essential water use restrictions listed below.

D. Notification of Drought Conditions

The Water Purveyors will contact all the respective local government officials within their system to notify them that the drought stage indicator(s) has been met and make the recommendation to implement the appropriate drought stage response. The Purveyors will also notify the County Board of Supervisors through the County Administrator. Additionally all other purveyors in the region will be notified as a courtesy and so that a coordinated region-wide stage may be initiated if deemed warranted by a consensus of the localities.

- The purveyors should provide a written memo to the authorities that states the water source determining factors for drought stage announcement.
- The County Administrator may call a meeting of the Local Emergency Planning Committee [Brunswick] who may review the report of the water provider(s) and other data. Such additional local drought information may include the frequency of well failure reports and agricultural drought designation requests (FSA & VA Extension Service) as reported to the local governments.
- The declaration will be issued to the public, and to commercial and industrial customers through local newspapers, radio and cable television public access channels and any other means of communication deemed appropriate or identified in Paragraph F. The declaration will state specific conservation efforts to be taken.
- When the County declares a Drought Stage, the entire county will be under that Stage and the water conservation measures will be recommended for the entire area.

The following table indicates the party that each locality has determined to be the responsible party for drought monitoring and coordination.

Municipality	**Water System**	**Authority to declare**
Community Water System (CWS)	**Providers/ Monitor**	**Providers will contact: For Public Notification**
Alberta	Lawrenceville	Alberta Mayor
Lawrenceville		Lawrenceville manager & mayor
Boydton	Roanoke River Service Authority (RRSA)	Boydton mayor
Brodnax		Brodnax manager & mayor
La Crosse		La Crosse manager & mayor
South Hill		South Hill manager & mayor
River Ridge & all RRSA individual customers		RRSA Board
Clarksville	Clarksville	Clarksville manager & mayor
Chase City	Chase City	Chase City manager & mayor
Brunswick County	Various Groundwater CWS*	County Administrator (& LEPC)
Mecklenburg County	Various Groundwater CWS*	County Administrator

*Groundwater Systems outside the systems listed above should also notify the county(s) to assist with public notification.

E. Non-essential Water Use Restrictions

The following non-essential water uses will be prohibited during periods of declared drought emergencies. Please note the exceptions that follow each prohibited use. These prohibitions and exceptions will apply to uses from all sources of water. Water use restrictions shall not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials so long as best management practices are applied to assure the minimum amount of water is utilized.

1. **Unrestricted irrigation of lawns is prohibited.**
   a. Newly sodded and seeded areas may be irrigated to establish cover on bare ground at the minimum rate necessary for no more than a period of 60 days.
   b. Irrigation rates may not exceed one inch of applied water in any 7-day period.
   c. Gardens, bedding plants, trees, shrubs and other landscape materials may be watered with hand held containers, hand held hoses equipped with an automatic shutoff device, sprinklers or other automated watering devices at the minimum rate necessary but in no case more frequently than twice per week.
   d. Irrigation should not occur during the heat of the day.
   e. All allowed lawn irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
   f. Irrigation systems may be tested after installation, routine maintenance or repair for no more than ten minutes per zone.

2. **Unrestricted irrigation of golf courses is prohibited.**
   a. Tees and greens may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
   b. Localized dry areas may be irrigated with a hand held container or hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
   c. Greens may be cooled by syringing or by the application of water with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
   d. Fairways may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary not to exceed one inch of applied water in any ten-day period.
   e. Fairways, tees and greens may be irrigated during necessary overseeding or resodding operations in September and October at the minimum rate necessary. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period
   f. Newly constructed fairways, tees and greens and areas that are re-established by sprigging or sodding may be irrigated at the minimum rate necessary not to exceed one inch of applied water in any seven-day period for a total period that does not exceed 60 days.
   g. Fairways, tees and greens may be irrigated without regard to the restrictions listed above so long as:
      - The only water sources utilized are water features whose primary purpose is stormwater management,
      - Any water features utilized do not impound permanent streams,
      - During declared Drought Emergencies these water features receive no recharge from other water sources such as ground water wells, surface water intakes, or sources of public water supply, and,
      - All irrigation occurs between 9:00 p.m. and 10:00 a.m.

h. All allowed golf course irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
i. Rough areas may not be irrigated.

3. Unrestricted irrigation of athletic fields is prohibited.

a. Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at a rate not to exceed one inch per application or more than a total of one inch in multiple applications during any ten-day period. All irrigation water must fall on playing surfaces with no outlying areas receiving irrigation water directly from irrigation heads.
b. Localized dry areas that show signs of drought stress and wilt (curled leaves, foot-printing, purpling) may be syringed by the application of water for a cumulative time not to exceed fifteen minutes during any twenty-four hour period. Syringing may be accomplished with an automated irrigation system or with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
c. Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. during necessary overseeding, sprigging or resodding operations at the minimum rate necessary for a period that does not exceed 60 days. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period. Syringing is permitted during signs of drought stress and wilt (curled leaves, foot-printing, purpling).
d. All allowed athletic field irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
e. Irrigation is prohibited on athletic fields that are not scheduled for use within the next 120-day period.
f. Water may be used for the daily maintenance of pitching mounds, home plate areas and base areas with the use of hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary.
g. Skinned infield areas may utilize water to control dust and improve playing surface conditions utilizing hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary no earlier than two hours prior to official game time.

4. Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios is prohibited

a. Driveways and roadways may be pre-washed in preparation for recoating and sealing.
b. Tennis courts composed of clay or similar materials may be wetted by means of a hand-held hose equipped with an automatic shutoff device at the minimum rate necessary for maintenance. Automatic wetting systems may be used between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
c. Public eating and drinking areas may be washed using the minimum amount of water required to assure sanitation and public health.
d. Water may be used at the minimum rate necessary to maintain effective dust control during the construction of highways and roads.

5. Use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats is prohibited.

a. Mobile equipment may be washed using hand held containers or hand held hoses equipped with automatic shutoff devices provided that no mobile equipment is washed more than once per calendar month and the minimum amount of water is utilized.

b. Construction, emergency or public transportation vehicles may be washed as necessary to preserve the proper functioning and safe operation of the vehicle.
c. Mobile equipment may be washed at car washes that utilize reclaimed water as part of the wash process or reduce water consumption by at least 10% when compared to a similar period when water use restrictions were not in effect.
d. Automobile dealers may wash cars that are in inventory no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
e. Automobile rental agencies may wash cars no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
f. Marine engines may be flushed with water for a period that does not exceed 5 minutes after each use.

6. Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools is prohibited.
a. Fountains and other means of aeration necessary to support aquatic life are permitted.

7. Use of water to fill and top off outdoor swimming pools is prohibited.
a. Newly built or repaired pools may be filled to protect their structural integrity.
b. Outdoor pools operated by commercial ventures, community associations, recreation associations, and similar institutions open to the public may be refilled as long as:
   - Levels are maintained at mid-skimmer depth or lower,
   - Any visible leaks are immediately repaired,
   - Backwashing occurs only when necessary to assure proper filter operation,
   - Deck areas are washed no more than once per calendar month (except where chemical spills or other health hazards occur),
   - All water features (other than slides) that increase losses due to evaporation are eliminated, and
   - Slides are turned off when the pool is not in operation.
c. Swimming pools operated by health care facilities used in relation to patient care and rehabilitation may be filled or topped off.
d. Indoor pools may be filled or topped off.
e. Residential swimming pools may be filled only to protect structural integrity, public welfare, safety and health and may not be filled to allow the continued operation of such pools.

8. Water may be served in restaurants, clubs, or eating-places only at the request of customers.

9. All residential, business and industrial water users; whether supplied by public water supplies, self-supplied sources, or private water wells; who do not normally utilize water for any of the listed prohibited uses are requested to voluntarily reduce water consumption by

at least 10%. This reduction may be the result of elimination of other non-essential water uses, application of water conservation practices, or reduction in essential water uses.

F. Public Notification procedures

Official notification of a drought emergency and the associated drought stage shall be effective upon their publication in any newspaper of general circulation in the affected county or counties. Drought stages and procedures should also be broadcast on any radio station serving the region and a notice included with the water bills of customers of a community water system.

Ongoing Public Information

A successful drought response plan will require public acceptance and understanding. The public should understand the need for continual conservation measures as well as the impact of inaction during periods of low precipitation that might lead to drought. Methods to educate the public regarding conservation needs as well as to inform of drought response needs may include:

- Presentations to school groups by health department, DEQ, and/or utility personnel.
- Periodic letters advising of climatic conditions and reminder of water conservation methods will be mailed or enclosed with bills.
- Drought information and conservation efforts or needs may will be mailed or enclosed with bills.
- Initiate periodic press releases regarding water conservation methods and/or needs.
- Initiate radio commentary/advisories.
- Localities and public service agencies will include conservation tips on their websites
- School programs/curriculum include water conservation methods; water supply information; and, the cycle of water resources.
- Building code changes to require low water use equipment.

G. Termination of Drought Declaration

Drought stages may be reduced in severity when the drought indicators for the source of the community water system has been lowered as shown by the DEQ Drought Indicator Analysis on-line tool or the water purveyor has recorded that the improved water level status has remained at that designation for 15 consecutive days, or by mutual agreement of the water purveyors in the locality.

When the drought indicator for the source of the community water system has returned to Normal as calculated by DEQ Drought Indicator Analysis on-line tool and has remained at that designation for 15 consecutive days, or by mutual agreement of the water purveyors in the locality, or when the declaration of a water emergency is lifted by the Governor of Virginia, the drought management requirements for that stage may be lifted. All customers will be notified in accordance with Paragraph F. It should be emphasized that personal conservation efforts should be maintained to avert other emergency situations.

H. Implementation

A Drought Ordinance is the tool to enforce water conservation efforts during a drought emergency. Local governments of the Commonwealth are authorized to adopt local ordinances to enforce the mandatory non-essential water use restrictions and to establish,

collect, and retain fines for violations of these restrictions. The ordinances should provide for the following:

1. **Authority**—Define who has the authority to declare drought or emergency conditions and impose water conservation measures.

2. **Conditions for Drought Declaration—**Set forth the conditions (drought stages) for drought declaration and potential water shortage.

3. **Additional Measures—**Authorize the locality to implement additional restrictions if needed in extreme emergency situations and prior efforts were insufficient to produce adequate water savings. *(recommended)*

4. **Enforcement—**Specify actions and/or penalties that will be imposed upon violators of the drought management ordinance.

5. **Appeals Procedure—**Upon declaration of the Drought Warning stage, establish an appeals review board to review applications for exemptions and institute power to approve, modify, or revoke such determinations. *(recommended)*

6. **Public Notice and Duration of Restrictions—**Indicates that the above restrictions shall become effective upon their being printed in any newspaper of general circulation within the locality, and/or broadcast upon any radio or television station serving the locality. This section also states that the Drought Watch, Drought Warning, and Drought Emergency Stage restrictions shall remain in effect until the designated authority determines that a water emergency in the locality no longer exists.

Adopted Drought Response Ordinances and supporting resolutions from Lake Country localities are contained in Appendix F.

I. CONTINUOUS WATER SUPPLY PLANNING PROCESS

The Lake Country Regional Water Supply Planning Program is a "living" document and part of a continuous planning process to ensure the availability of safe and adequate drinking water for all citizens in the region and protection of the beneficial uses of the region's water resources.

In accordance with 9VAC25-780-50.D, this water supply planning program shall be reviewed no later than five years after a compliance determination by the State Water Control Board. Additionally, this regional program shall be reviewed, revised, and resubmitted to DEQ every 10 years after the date of the last approval (9VAC25-780-50.F).

Future updates of this program will include readily available data (at that time) on water sources, water uses, environmental resources, projected water demand, water demand management practices, drought planning and response, and water needs and alternatives. Information from the State Water Resources Plan regarding any cumulative demand, use conflict, or instream flows in the Lake Country region will be included in future updates of the program as well (per 9 VAC 25-780-140.G).

PLAN SOURCES

Virginia Department of Health, Danville Office, Jeff Wells, et al

Virginia Department of Environmental Quality, Edward Morrow & Bill Norris

Towns of Boydton, Brodnax, Chase City, South Hill, La Crosse, Clarksville, Lawrenceville, Alberta.

Roanoke River Service Authority, Jeff Hinkle & Tom Corker

US Army Corps of Engineers, Wilmington District, John H. Kerr Dam website: http://epec.saw.usace.army.mil/roankerr.htm

Dominion Virginia Power website: http://www.dom.com/about/companies/ncpower/modes.jsp
Dominion Generation, *Roanoke Rapids and Gaston Project FERC No. 2009, Downstream Water Quality Monitoring Plan*, September 30, 2005.

U.S.G.S: http://water.usgs.gov/

NC Department of Environment and Natural Resources, Division of Water Resources:
http://www.ncwater.org/basins/Roanoke/

Kerr Lake Regional Water Plant, Christy
http://www.ci.henderson.nc.us/Regional_Water/Default.asp

Kerr Lake Regional Water System Interbasin Transfer Request & Draft Environmental Assessment Scope:
http://www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/Status/Kerr/KLRWSIBTScope.pdf

Virginia Beach Pipeline: http://www.vbgov.com/dept/putility/lake_gaston/

Chowan River Basin:
http://www.nao.usace.army.mil/redesign/projects/civil%20works%20projects/Chowan%20River/homepage.asp
http://www.ncwater.org/basins/Chowan/

Phase I Study—Roanoke River Basin Water Resource Development Plan prepared by C.E. Maguire, Inc. for the City of Virginia Beach, Department of Public Utilities, 1982

Southside Planning District Commission, *Comprehensive Economic Development Strategy*, 2004.

LIST OF APPENDICES

Appendix A—Existing Water Sources tables

Appendix B—Existing Water Use tables

Appendix C—Existing Resource Conditions tables and supporting information

Appendix D—Projected Water Demand

Appendix E—Maps

- Map 1: Community Water Systems & SSU; Water Sources
- Map 2: Wetlands
- Map 3: Conservation Areas & Riparian Buffer
- Map 4: Land Use-Brunswick County
- Map 5: Land Use-Mecklenburg County
- Map 6: Impaired water Point Source Discharge

Appendix F—Local Resolutions and Drought Ordinances

Local and Regional Water Supply Planning

Existing Water Source and Water Use Data Entry Template

Local or Regional Plan:	Local ☐ Regional ☑
Political Locality(s):	
Locality FIPS Code(s):	025 117
Planning Area Population:	50,799
River Basin(s):	Roanoke
	Chowan
River Sub-basin(s):	Meherrin (03010204)
	Roanoke Rapids (03010106)
Contact Name:	Carol Corker
Title:	Regional Planner 2
Mailing Address:	P.O. Box 150
City and Zip Code:	South Hill, VA 23970
Phone:	434-447-7101
Fax:	434-447-7104
E-mail:	pdc@spdc.state.va.us

The following data entry spreadsheets will allow you to enter information regarding the existing water source (9 VAC 25-780-70) and existing water use (9 VAC 25-780-80) water supply planning criteria.

Office of Water Supply Planning
629 East Main Street,
P.O. Box 1105, Richmond, VA 23218
URL: http://www.deq.virginia.gov/watersupplyplanning/

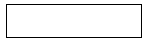
Water Supply Planning Water Source and Water Use Data Entry Template Key and Instructions:

Purpose:

- Include current information on existing water sources (9 VAC 25-780-70A).
- Include, at a minimum, current information documenting existing water use. Water use information shall be obtained from Department of Health waterworks compliance reports, Department of Environmental Quality ground water permit compliance reports or water use reports. Information shall be reported for the most recent previous annual compilation of such data that is available on the date of submission of the water plan (9 VAC 25-780-80A).

Instructions:

1). The spreadsheet tabs are numbered according to the regulation subsections:
70 = existing water source information
80 = existing water use information
***Please note that some spreadsheets cover multiple subsections.

2). Pay close attention to heading cells containing comments denoted by a red upper right hand corner tab: 
Such comment cells include data sources, data entry abbreviations and/or instructions.
To read comment, either 1) 'mouse over' red corner tab or 2) right click on cell and select "show comment".

3). For heading cells that include data years, designated YR **2XXX**, change the 2XXX to the appropriate year(s) (e.g. 2000 or 2002 - 2007).

4). Change the Header on each sheet (View --> Header and Footer --> Custom Header) to specify your locality or region.

5). If you cannot find a data element or if certain criteria are not applicable, note as such in the appropriate spreadsheet cell.
(**N.I. = no information available; N.A. = not applicable**)

6). List resources/references of information on each spreadsheet (using 'insert comment' feature or extra space below data entry cells).

7). The methods used herein are intended to provide baseline calculations only and may not be appropriate for every locality/region.

8). *If you change these spreadsheets in any way (i.e add/delete rows, colums and/or cells)* , **you are responsible for making sure that**: **a)** the water supply planning data criteria outlined in the regulation are met and **b)** spreadsheet formulas used to calculate such data are correct.

Spreadsheet Key

Spreadsheet Tabs:

	Universal Sheets
	Instructions and Supporting Sheets
	Community Water System Sheets (for municipal and private systems)
	Self-Supplied User Sheets ***Please note that self-supplied users *within CWS service areas* must be accounted for, if applicable, on these data sheets.

Spreadsheet Calculation Rows:

	Spreadsheet subsection totals
	Spreadsheet totals (including subsection totals)
	Calculations between 2 or more spreadsheets

Water Supply Planning Water Source and Water Use Data Entry Template Key and Instructions:

Abbreviations/Definitions

DEQ	= Virginia Department of Environmental Quality	
VDH	= Virginia Department of Conservation and Recreation	
DCR	= Virginia Department of Health	
CWS	= Community Water System:	A waterworks that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents and is regulated by the Virginia Department of Health Waterworks Regulation (12 VAC 5-590). **Service Area:** the geographical area served by a community water system.
SSU	= Self-Supplied Users:	Any person making a withdrawal of surface water or ground water from an original source (e.g. a river, stream, lake, aquifer, or reservoir fed by any such waterbody) for their own use. Self-supplied users do not receive water from a community water system.
NonAg	= Nonagricultural user (self-supplied) of more than 300,000 gallons per month	
Ag	= Agricultural user (self-supplied) of more than 300,000 gallons per month	
GW	= Ground Water	
SW	= Surface Water	
PA	= Planning Area:	The geographical area as defined by local government boundaries that is included in a local or regional water supply plan.
MGD	= million gallons per day	
Gal/Day	= gallons per day	
cfs	= cubic feet per second	

Conversion Factors

1 acre foot =	325,851	gallons