Identifying Revenue Sources for Land Conservation to Protect Drinking Water:

A "Revenueshed" Analysis for the Catawba River Basin of North Carolina

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ENVIRONMENTAL FINANCE CENTER

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1. Executive Summary

This report examines the potential for generating a cooperative, sustainable revenue stream among the local governments and public utilities in the North Carolina Catawba River Basin (CRB) for the conservation of watershed lands and implementation of other watershed protection strategies.

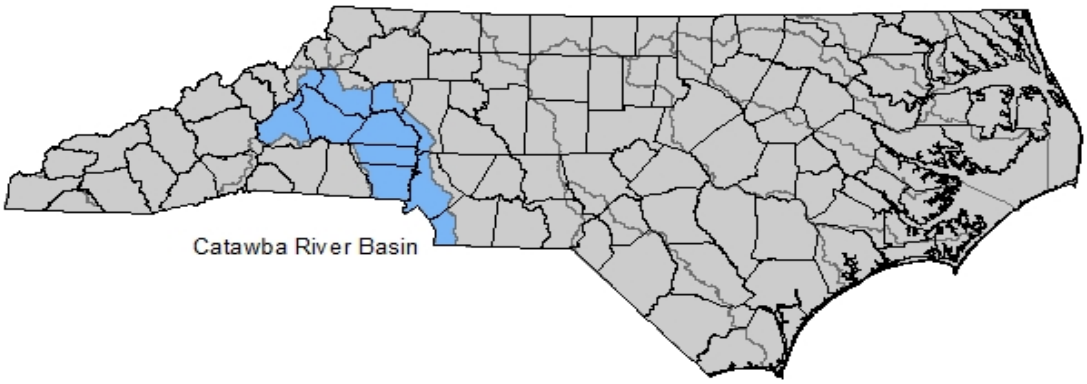

Figure 1: Catawba River Basin, North Carolina

One of the primary challenges of watershed protection is that jurisdictional and watershed boundaries rarely align. This generates questions about who is responsible, and who should pay, for watershed protection. In this report, the EFC developed and applied the concept of a **revenueshed**, which is the area within which revenue is generated for watershed protection, in order to address these challenges. This concept addresses four objectives: (1) to cultivate accountability, (2) to generate discussions among local governments, (3) to develop interactive financial tools to assist in policy decision-making, and (4) to discuss strategies for implementing watershed protection financing as a sustainable revenue stream among watershed beneficiaries and "impactors".

Examples of policy implications highlighted in the report:

1. **Hydrological connectedness bonds residents up- and downstream.** Upstream communities' land-use decisions, stormwater runoff, and wastewater treatment plants have a significant impact on water quality in the CRB. Despite this obvious connection, there are limited examples of local governments "connecting" their revenue-generating authority in ways that mirror hydrological boundaries.

2. **Watershed restoration regulations promote the "polluter pays" principle, resulting in less attention towards the "beneficiary pays" principle.** Downstream communities located outside of the CRB use water impounded in the watershed's reservoirs. This water has helped fuel regional growth and now supports a population exceeding 1.5 million. These downstream communities do not directly impact the water quality and quantity flowing into the Catawba River, but they are heavily invested in up-stream water supply and quality.

3. **Leveraging the resources necessary for comprehensive restoration requires jurisdictional collaboration.** The population in the CRB and adjacent areas has grown rapidly in recent decades, placing increased stress on the quality and quantity of water resources. Growing populations require advance, proactive planning to increase water security. Collaboration between local jurisdictions within and adjacent to the CRB is critical to effectively manage and protect

water resources and meet growing demand. Piecemeal restoration and preservation financing lack economies of scale and the beneficiary pooling advantages of a more comprehensive approach.

4. **North Carolina law provides the autonomy to implement watershed protection taxes and pay for it through utility fees (N.C. General Statutes §160A-314, §162A-9, §162A-49).** The boundaries of water utilities often expand outside of their base municipality, as opposed to stormwater utilities, whose jurisdictional boundaries are limited to those customers located inside the municipality. Stormwater fees are collected to minimize the impact of a city on its watershed and are often used to protect the water flowing downstream. Water utilities are an ideal conduit through which to leverage watershed protection fees because their concern is upstream and they focus on protecting their own water supply source. Additionally, wastewater utilities are already collecting fees to ensure downstream water quality.

5. **Watershed protection often costs less than watershed restoration.** It costs less money to protect a watershed now than to attempt to restore a watershed to health in the future. A study from Duke University's Nicholas School of the Environment estimated the average willingness-to-pay for watershed protection in the Catawba River watershed is $139 per year per residential household (Kramer & Eisen-Hecht 2002). Most examples of explicit watershed protection fees cost less than $20 per year per resident/user.

6. **Utilities in the CRB watershed already contribute a great deal to watershed protection.** In 2014, water, wastewater, and stormwater utilities in the CRB collected nearly $3.6 billion (water and wastewater) and over $66 million (stormwater), respectively, to protect water quality. This money was spent on disinfecting and distributing clean drinking water, treating wastewater, and mitigating the impact of urban stormwater run-off.

2. Water Quality in the Catawba River Basin and the Importance of Boundaries: Applying the Revenueshed Concept

The Catawba River Basin (CRB) is located in the southwestern part of North Carolina, flowing approximately 3,004 miles southeast into South Carolina (NC DWR 2007, 2-36). It is divided into four sub-basins, including the Upper Catawba, South Fork, Lower Catawba, and Wateree (NC DWR 2007). The CRB is the eighth largest river system in North Carolina, containing over 9,000 miles of rivers and streams. It is also one of the most densely populated. According to the 2010 US Census Bureau, over 1.5 million people live in the Catawba Basin, an increase of nearly 50% from 2000. For the purposes of this report, the CRB boundaries include the entire City of Charlotte, nearly two-thirds of Mecklenburg County, as well as 47 other municipalities, 10 counties, and 38 water, wastewater, and stormwater utilities.

This major population base generates pressure for growth, development, and natural resource management, placing considerable strain on water quality, open space, and wildlife habitat. According to the Catawba Riverkeeper, at least one-third of the surface water in the basin is impaired. Sources of water pollution include nutrient runoff from fertilizers, fecal coliform runoff from improper sewage treatment, animal waste, sewage spills, and boat discharges, sedimentation from development and land conversion, and mercury pollution from industrial processes (Catawba Riverkeeper, nd).

Currently, several local municipalities, Duke Energy, and non-governmental organizations share major responsibilities in protecting and managing the basin's water resources. Additionally, there is a group of Catawba River Basin communities that have come together to form the nonprofit Catawba-Wateree Water Management Group. Per their website (www.catawbawatereewmg.org), a key driver to the communities that comprise the Catawba-Wateree Water Management Group is the recognition that if we keep dealing with water in the same manner that we have done historically, we will not be able to meet anticipated needs. The group is comprised of 18 public water utilities[1] in NC and SC and Duke Energy Carolinas, LLC.

In an effort to better understand the CRB water system and to help inform local government initiatives, the EFC developed an analytical approach to examining watershed protection challenges. We refer to this approach as a *revenueshed analysis*, which is used to explore the complex relationships between environmental services, local government jurisdictions, and watershed boundaries. The revenueshed analysis provided the framework to identify and analyze potential revenue streams for watershed protection, with the ultimate goal of providing information that generates discussions and assists in the development of a dedicated watershed protection revenue stream.

Our revenueshed analysis is not designed to be a complete "ecosystem services" study of the CRB, but rather to serve as a pragmatic snapshot of the user entities and current revenues based around water supply, demand, wastewater discharge, and stormwater management. For example, our analysis does not include economic assessments of less tangible and more difficult revenue capture services such as the value of natural capital providing goods (water, fish, forests) and services (flood protection, recreation clean water, forests removing nutrients and sediment, biodiversity, etc.). As a result, the baseline characterization and potential revenue solutions outlined in the analysis only assess existing governmental services such as stormwater, land use planning, and drinking water provision.

[1] Public utility members include City of Belmont (NC), City of Camden (SC), Union-Lancaster Catawba River Water Treatment Plant (NC/SC), Charlotte Water (NC), Chester Metropolitan District (SC), City of Gastonia (NC), Town of Granite Falls (NC), City of Hickory (NC), City of Lenoir (NC), Lincoln County (NC), Town of Mooresville (NC), City of Morganton (NC), City of Mount Holly (NC), City of Rock Hill (SC), City of Statesville (NC), Two Rivers Utilities (NC), and Town of Valdese (NC).

2.1 Introduction to the Catawba River Basin (CRB)

This section provides background information on the CRB and describes the attributes and advantages of the revenueshed approach.

The CRB contains four sub-basins spanning both North Carolina and South Carolina, including the Upper Catawba, South Fork Catawba, Lower Catawba, and Wateree (Table 1, Figure 2). The analysis in this report and analysis is limited to local governments and public utilities in North Carolina. It does not include South Carolina local governments or public utilities, nor does it include private utilities, like Aqua America, that have a significant role in the water resources of the Catawba Riverbasin. It also does not include distributed systems, such as onsite wastewater treatment systems. Future analysis could include these entities, but data was not readily available to the Environmental Finance Center on their finances.

Table 1: Sub-Basins of the Catawba River

Hydrologic Unit Code (HUC)	Sub-Basin Name	States	Major Streams
03050101	Upper Catawba	NC, SC	Linville Rv., Johns Rv., Catawba Main Stem, Long Cr
03050102	South Fork Catawba	NC	South Fork Catawba, Henry Fork, Jacob Fork
03020103	Lower Catawba	NC, SC	Catawba Main Stem, Irwin Cr., Sugar Cr., Briar Cr.
03020104	Wateree	SC	Wateree Rv., Colonels Cr

Source: NC DWR 2007, 2-36. Access at:
http://www.ncwater.org/files/publications/Final_Draft_Catawba_River_Basin_Plan_2007.pdf

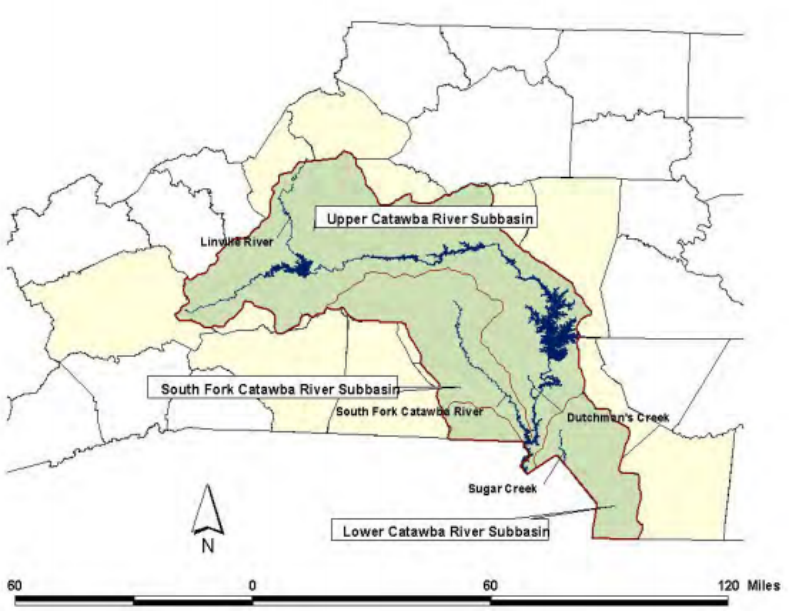

Figure 2: Hydrologic Sub-basins in Catawba, NC
Source: NC DWR 2007, 2-37. Access at:
http://www.ncwater.org/files/publications/Final_Draft_Catawba_River_Basin_Plan_2007.pdf

Upper Catawba River Sub-Basin

The Upper Catawba River Sub-Basin is located primarily in North Carolina, though approximately 138 square miles extends into South Carolina (See Figure 3) (NRCS 2010, 2). It is a highly urbanized sub-basin, with approximately 8 percent impervious coverage within the sub-basin watershed and continued urbanization from areas such as Charlotte, North Carolina and Rock Hill, South Carolina (NRCS 2010, 3). An estimated 72 percent of land in the Sub-Basin is considered "highly erodible" according to 2010 data (NRCS 2010, 8). Water withdrawals to support urban development, agriculture, and livestock drive water quality and quantity concerns, and upstream pressure from urban areas in Cabarrus and Mecklenburg Counties also compound water resource issues (NRCS 2010, 10).

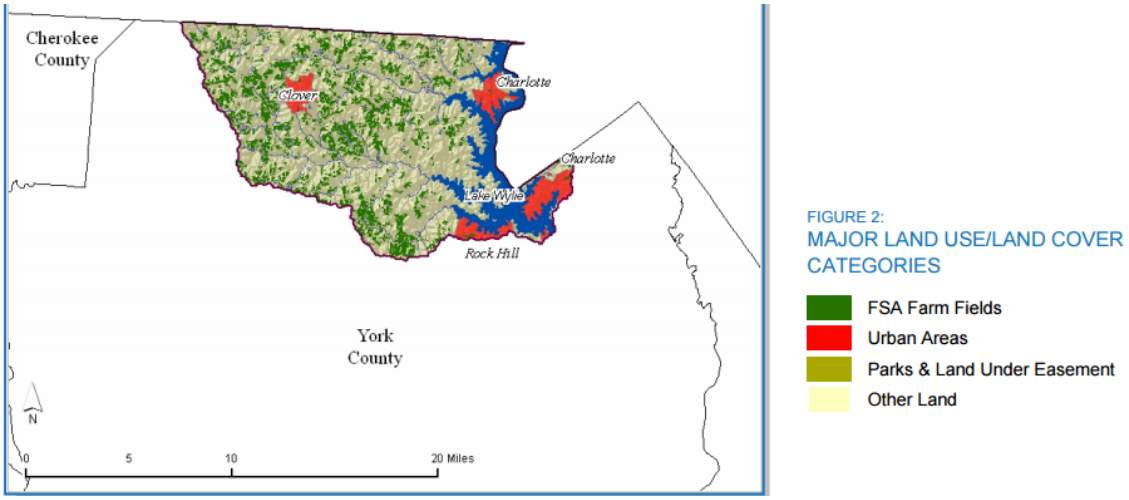

Figure 3: Upper Catawba River Sub-Basin, Land Use and Land Cover

Source: NRCS 2010, 3

Access at: http://www.esri.sc.edu/projects/usda/conservation_documents/RWAs/Upper%20Catawba.pdf

South Fork Sub-Basin

The South Fork Sub-Basin is the second largest in the Catawba River Basin, covering an estimated 661 square miles (Figure 4). Based on 2010 data, approximately 47 percent of land in the sub-basin is forest, 30 percent agricultural, and 18 percent urban (NC DWQ 2010, 2.1). There are 11 major discharge facilities serving Hickory, Newton, Lincolnton, Gastonia, and Belmont (NC DWQ 2010, 2.1). Water quality issues from urban development, outdated septic systems, and stormwater runoff have resulted in excess bacterial levels and low pH for much of the watershed (NC DWQ 2010, 2.3).

Figure 4: South Fork Catawba River Sub-Basin

Source: NC DWQ 2010

Access at: http://www.piedmontnutrientsourcebook.org/Assetts/lid/SouthFork_Catawba_Subbasin.pdf

Lower Catawba Sub-Basin

The Lower Catawba sub-basin covers approximately 927 square miles and begins downstream of Lake Wylie (Figure 5) (NRCS 2010, 2). Approximately 11 percent of the sub-basin watershed is urbanized, largely from areas such as Rock Hill, South Carolina and Charlotte, North Carolina (NRCS 2010. 4). Water withdrawals from the Lower Catawba Sub-Basin to areas throughout Cabarrus County, North Carolina have caused ongoing legal battles and resource disputes between entities in the southern part of North Carolina and rapidly growing Lancaster County in South Carolina.

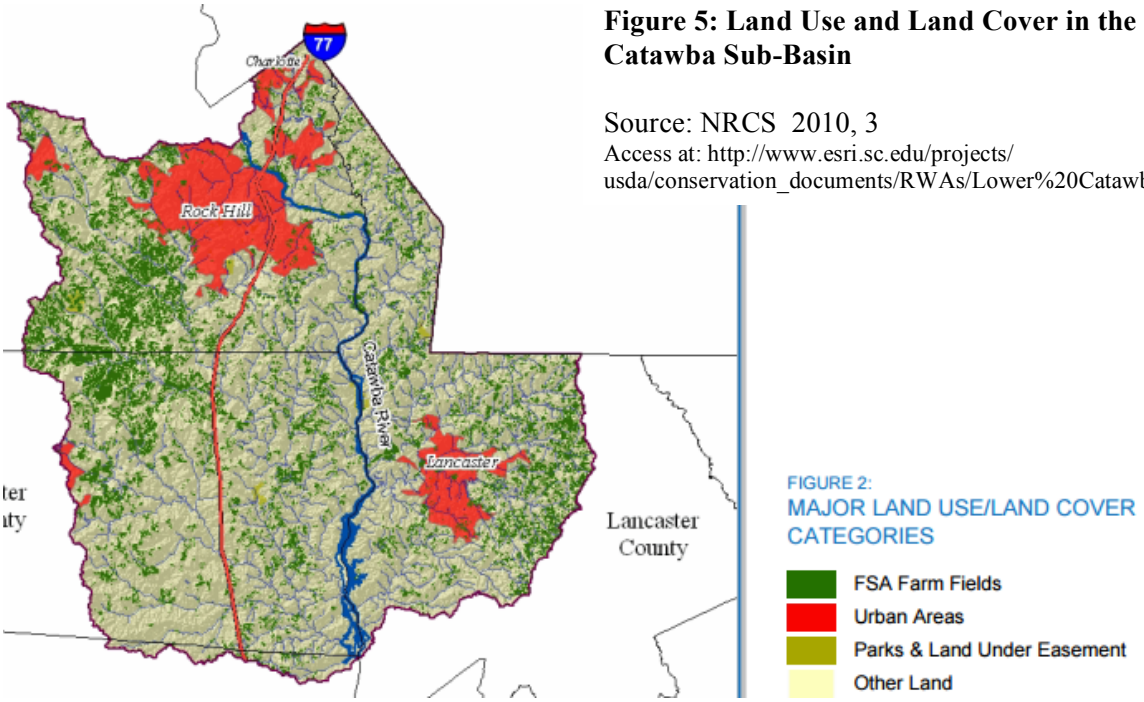

Figure 5: Land Use and Land Cover in the Lower Catawba Sub-Basin

Source: NRCS 2010, 3
Access at: http://www.esri.sc.edu/projects/usda/conservation_documents/RWAs/Lower%20Catawba.pdf

These three sub-basins and their many tributaries, reservoirs, and impoundments serve as sources of drinking water, electricity, commerce, and recreation for millions of residents, businesses, and tourists in North and South Carolina. Seven dams serve as energy sources for 11 hydropower and steam plants, coolants for 4 coal-fired and 2 nuclear power plants, and water sources for several major local communities (See Figure 6) (Catawba Riverkeeper(b), nd; NC DWR 2007, 1-1). The river also supports several paper plants, textile factories, water bottling companies, and chemical facilities (Catawba Riverkeeper (b), nd).

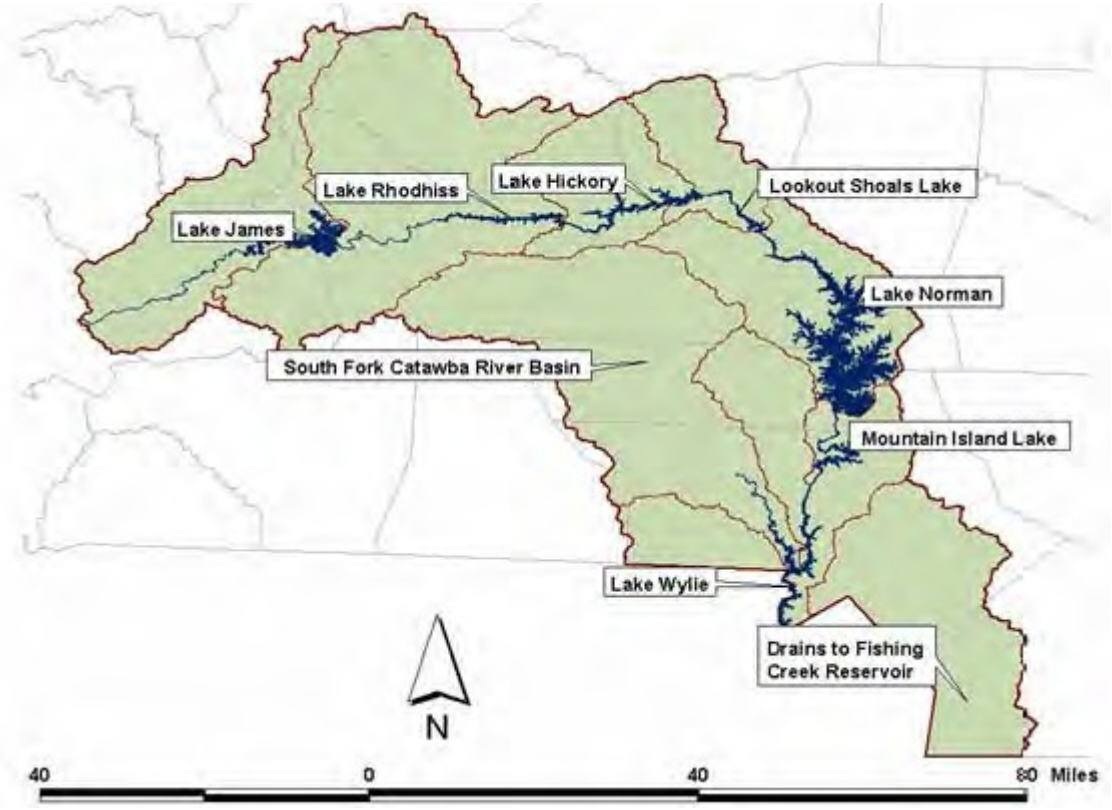

Figure 6: Catawba River Lakes and Drainage Areas
Source: NC DWQ Catawba River Basin Plan 2007

More than 1.5 million people live in the Catawba River Basin jurisdiction, making it one of the most urbanized watersheds in the state (NC DENR, Office of Environmental Education and Public Affairs, nd). Future planning is of high concern, particularly with areas such as Charlotte-Mecklenburg experiencing growth rates of 32 percent between 2010 and 2013, with estimations of total populations reaching 1.8 million by 2050 (Steinmetz and Perkins 2011; NC DWR 2007, 2-87).

Water flow throughout the CRB is monitored by the US Geological Survey (USGS). Of the 27 flow stations throughout the CRB, only four[2] provide usable data (NC DENR 2007). Peak monthly flow occurs in March, and annual drought occurs in late summer (NC DENR 2007). At normal flow levels, eleven impoundments store 240.81 billion gallons of water (Catawba Riverkeeper(c), nd). However, according to

[2] Catawba River, Linville River, Johns River, Henry Fork.

NC DENR, approximately 50 percent of the time, water flow varies at or below 110 cubic feet per second (cfs) to 275 cfs. Ninety percent of the time, flow varies between 52 cfs to 125 cfs (NC DWR 2007, 2-46). In 2006, water withdrawals in the CRB totaled 420 million gallons per day (MGD), and 323 gallons per individual (Catawba Riverkeeper(c), nd). Three reservoirs, including Mountain Island Lake, Fishing Creek Reservoir, and Lake Wylie provide a majority of drinking water in the basin. These three reservoirs are located near the Cities of Charlotte and Gastonia, which are the major municipal communities responsible for some of the basin's largest surface-water withdrawals (NC DWR 2007, 2-4). Additionally, approximately two-dozen municipalities are responsible for wastewater discharges throughout the basin. In 2009, the City of Charlotte Municipal Utilities Department discharged over 30 billion gallons through its three wastewater treatment plants (Catawba Riverkeeper(c), nd).

In addition to stresses from urbanization and growing demand, the CRB has long struggled with a range of ecological issues that impact water quality. According to the Catawba Riverkeeper, there are approximately 550 permitted pollution discharge areas throughout the CRB, and many more unpermitted discharge areas. Some of the most prevalent environmental issues associated with effluent waste include sedimentation, bacterial contamination, and nutrient loading (Catawba Riverkeeper(c), nd).

According to the North Carolina Department of Water Quality (NC DWQ), the CRB suffers from basin-wide low pH levels caused by a combination of low stream flows, atmospheric deposition, development impacts, or decreased buffering capacity (NC DWQ 2010). An increase in stormwater runoff also has severe impacts on basin-wide water quality. Nonpoint source pollution in stormwater runoff in the Charlotte-Mecklenburg area alone has increased 55 percent since 1987 (Charlotte-Mecklenburg Stormwater Services 2007). This increase in volume and velocity intensifies flooding and can cause stream bank erosion and ecological damage (NC DWQ 2010).

Impacts from poultry and farm productions are also driving sedimentation and erosion throughout the basin, especially along the CRB's high quality headwaters. Agricultural practices are currently exempt from having to complete a sediment and erosion control plan, which is a state requirement for any land disturbing activity over an acre (NC DWQ 2010). Nitrogen loading from septic systems is also increasing nutrient levels throughout the CRB. In 1990, the CRB had the highest average septic system density on a river basin scale of all other basins in the state (NC DWQ 2010). Based on 1990 data, a population of 406,797 people using septic systems resulted in nitrogen loading of nearly 4.1 million pounds per year, a rate that has only increased with the area's tremendous growth (NC DWQ 2010).

In 2008, American Rivers listed the Catawba River as the most endangered river in the United States due to development trends, poor water management practices, and the threat of pollution from coal ash ponds (American Rivers 2008, 8). The following year, the EPA released a report identifying 44 of the most hazardous coal ash ponds in the United States. The report revealed that three facilities with a total of five ponds are located in the CRB, all of which are positioned on reservoirs that are used as drinking water sources for neighboring jurisdictions (Catawba Riverkeeper(a), nd)**.**

Pollution and development practices in the CRB are compounded by a tremendous increase in water demand. Based on 2005 data, approximately 170 millions of water gallons per day were pumped from the Catawba to other river basins. By the year 2058, as much as 458 mgd could be sent to other basins (Catawba Riverkeeper(b), nd). The CRB's dwindling capacity has caused ongoing disputes between neighboring jurisdictions as several entities struggle to balance economic growth and sustainable resource management.

One major legal battles over the Catawba Riverbasin over the last several years has been between North Carolina and South Carolina. In 2007, the Towns of Kannapolis and Concord, in Cabarrus County North Carolina, received a certificate from the North Carolina Environmental Management Commission (EMC)

to withdraw 10 mgd from the Catawba River Basin and 10 mgd from the Yadkin River basin and to discharge water into the Rocky River Sub basin, located in the Yadkin River Basin. Originally, this transfer was intended to accommodate nearly all of the local water supply needs of Kannapolis and Concord, which were projected to have a major water shortage by 2035 (Artz 2008, 5). A portion of the transferred water was slated to help support new development in the City of Concord, including a proposed water park (Catawba Riverkeeper(b), nd). In response to the proposed transfer, South Carolina filed a complaint with the Supreme Court claiming the transfer would harm residents of South Carolina. A settlement was eventually reached limiting withdrawals during moderate and severe droughts (Stabley 2009).

There are a multitude of challenges facing the Catawba River Basin that involve an entangled web of stakeholders. The following sections will summarize resource use and financial resources in the CRB by a sub-set of these stakeholders, including local governments and water, wastewater, and stormwater utilities.

2.2 Revenueshed Concept

The EPA identifies a "watershed planning approach" as one of the four pillars of sustainable infrastructure. However, many watershed plans, despite receiving wide public support, have yet to be implemented due to a lack of coordination and financial resources. If stakeholders in the river basin can coordinate their thinking and objectives, and implement protection on a watershed level, a small amount of financial resources can be leveraged to make a big impact.

2.2.1. What is a revenueshed?

We define a revenueshed as the geographic area within which revenue is generated for a specific purpose. Here, a revenueshed describes the area within which revenue is generated for watershed protection.

2.2.2. What are the advantages of the revenueshed analysis framework?

Jurisdictional boundaries were developed to meet social, economic, and/or political needs, rather than to coincide with hydrologic boundaries. As a result, jurisdictional boundaries (sources of revenue for watershed protection) often do not match watershed boundaries. This leads to:

- Multiple jurisdictions being responsible for financing watershed protection in a single watershed. This often results in a free-rider problem whereby all jurisdictions want the benefit of clean water, but nobody wants to pay for it. Pooling revenue from these communities for efforts that exceed their jurisdictional boundaries is difficult. A consequence is that water quality is not directly addressed until it approaches a crisis point where action is necessary.
- Single jurisdictions become responsible for watershed protection in multiple watersheds. All jurisdictions have limited financial resources; therefore, decisions have to be made regarding how much money is invested in each watershed. In addition, each watershed may have different legislative requirements for water quality and/or watershed protection.
- Water quality and quantity are affected by decisions made upstream. Who is responsible for ensuring the quality and quantity of water available for downstream users? The upstream impacting jurisdictions, the downstream benefitting jurisdictions, or both?

2.2.3. How can revenuesheds be used as a tool for watershed protection?

Grigg (1999) stated that the main challenge for water resource management in the future will be institutional, particularly regarding questions about who is responsible for, and who should pay for, water resource management. We have applied the revenueshed concept to address these challenges along three main avenues (Figure 7):

Figure 7: Revenueshed concept Venn diagram

1. Revenuesheds are used to cultivate accountability by providing an unbiased documentation of the baseline revenue generated by each jurisdiction from water, wastewater, and stormwater fees within a specific watershed. Additional sources of revenue may also be considered, such as property taxes, grants, and corporate contributions. These sources of revenue can be explored with respect to the proportion of the jurisdiction within the watershed, per capita, per impaired streams, etc.

2. Revenuesheds are used to generate discussions among jurisdictions directly related to the watershed. The data are summarized to give local context to the effort.

3. Revenuesheds can be used to develop scenarios to assist in policy decision-making and fund watershed protection. This includes examining how to collaboratively and intentionally finance a project or generate a dedicated revenue stream, which is particularly important if there is unclear leadership or responsibility. Commonly, this ambiguity is the result of a negative externality where personal or community decisions have a broader impact on the watershed as a whole. For example, land conversion or poor agricultural practices are land use decisions that impact water quality in surrounding streams. Downstream water users are impacted by the cumulative effect of decisions that lead to water quality degradation, but it is unclear who is directly responsible and whether the polluters or the water users are responsible for improving water quality to the level required for its desired use. The accompanying financial tool can be used to promote the implementation of actual policies that lead to sustainable watershed protection financing.

2.3 Integrating Revenuesheds with North Carolina State Legislation for Watershed Protection

In the mid-1980s, the Pamlico River estuary had excess nutrients in the water that led to algal blooms and stressed biota. North Carolina responded by designating the entire Tar-Pamlico River Basin as Nutrient Sensitive Waters (NSW) in 1990 and has worked towards developing basin-wide strategies to reduce the nutrient load entering the estuary. This approach to watershed protection can be labeled a "problemshed" approach, whereby the specific water body is the problem and the watershed draining into that region is the problemshed (Gerlak, 2006). This approach has been taken by the State of North Carolina on multiple occasions since the 1990s. Currently, there is no such legislation concerning the Catawba River Basin. The two most recent and controversial watershed rules were passed for Jordan Lake in 2009 and Falls Lake in 2011. The controversy highlights two challenges to the problemshed approach:

1. First, the problemshed only looks to the upstream jurisdictions as a resource to improve water quality to the benefit of downstream users. This is particularly problematic for those jurisdictions that receive no benefit from water quality improvements (e.g. Durham is affected by Jordan Lake and Falls Lake Rules but neither lake is a main water supply for Durham). Revenuesheds address this issue by considering both the polluters and the beneficiaries as being viable financing options for sustainable watershed protection. The different jurisdictions are responsible for collaborating and discussing which options are feasible for their particular situation.

2. Second, serious implementation discussions and actions to improve water quality often occur only after a problem has been identified and mandatory legislation enacted. The process is reactive and likely more expensive than if proactive measures to improve water quality had been taken. The revenueshed approach provides an alternative means to examine jurisdictions and watersheds simultaneously and to proactively engage discussions on how to generate sustainable revenue for watershed protection. The goal is for sustainable watershed protection funding and implementation to occur prior to water quality impairment.

2.3.1. Implementation of Inter-Governmental Watershed Protection

As part of previous research conducted for the Upper Neuse River Basins of NC, the EFC reviewed the underlying legal authority behind the most prevalent and promising multi-jurisdictional models for sharing water resource protection costs (Hughes, 2014). That research found that there are many models to consider for sharing resources to support watershed protection efforts. It also recommended that inter-governmental watershed protection efforts have trusted agents with strong leadership, that they link their model to basic objectives, and determine the importance of governance structures. Finally, it concludes that it is important to take into account multiple factors when exploring options for sharing contributions/payments.

3. Revenueshed Analysis Applied to the Catawba River Basin

In North Carolina, the CRB provides water and natural resources to approximately 11 counties, 48 municipalities, nine water utilities, 4 wastewater utilities, 38 combined water and wastewater utilities, and 17 stormwater utilities. The following section summarizes the counties, cities, and the property tax revenue they collected in fiscal year 2014.

This report and accompanying tool also explore three types of utilities and their relationship to watershed protection in the CRB. First, we look at drinking water utilities, for which revenue focus is on protecting their water supply. Second, we look at wastewater utilities, for which revenue focus is on discharging clean, treated water back into the watershed and meeting federal regulations. Third, we look at stormwater utilities whose revenue focus is on mitigating and improving the water quality of non-point source discharge as well as restoring impaired water bodies. All three types of utilities provide the opportunity to offer administrative and monetary resources for watershed protection.

In this section we will outline the process of creating a revenueshed to cultivate financial accountability and generate discussions between jurisdictions. We will examine the jurisdictions that are directly tied to the CRB, explore the revenueshed characteristics for "impactors" (those jurisdictions located upstream that impact water quality), and "benefactors" (those jurisdictions benefiting from improved water quality downstream) with the understanding that these designations are rarely clear-cut and communities often are both impactors and benefactors of watersheds.

3.1 Cities and Counties in the Catawba River Basin

Based on latitudinal and longitudinal data, this report evaluates 11 counties and 48 municipalities in the North Carolina Catawba River Basin (Figure 8).

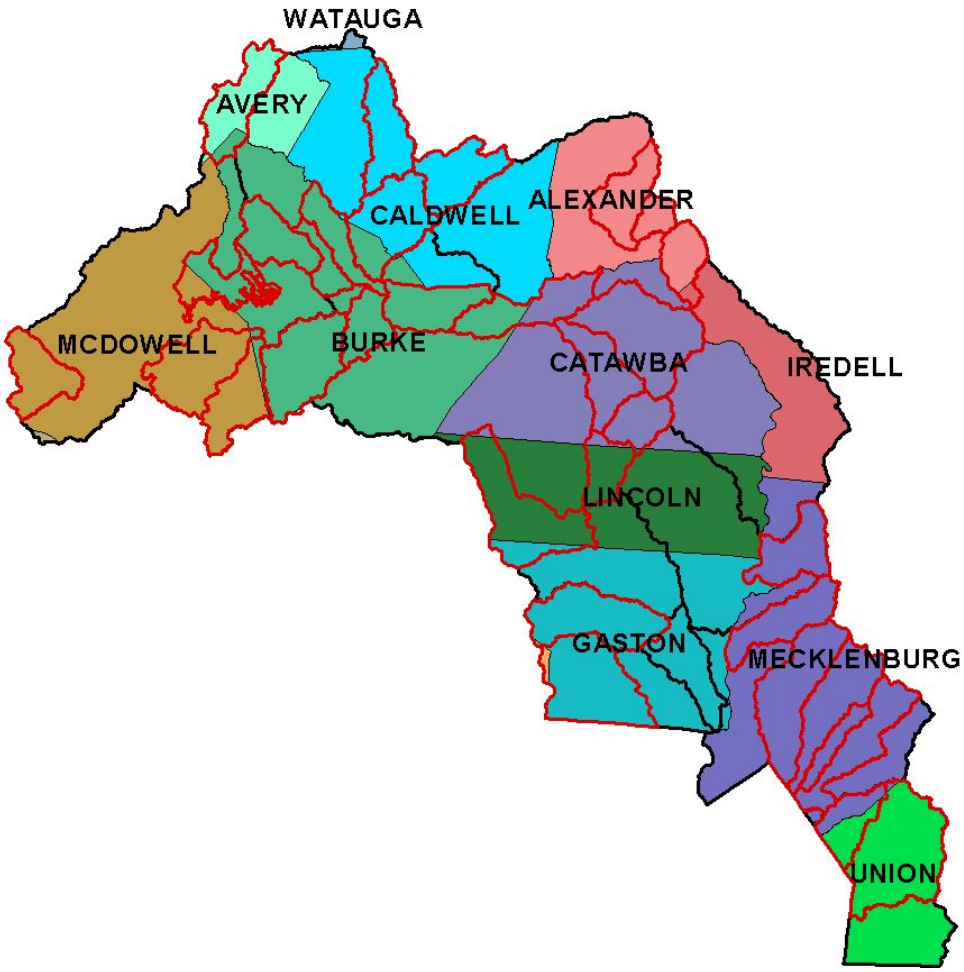

Figure 8: Counties in the Catawba River Basin**.**
Source: NC Ecosystem Enhancement Program

Between July 2013 and June 2014, the 11 counties in the CRB collected over $1.3 billion in property taxes. During the same time period, the 48 municipalities in the CRB collected over $576 million in property taxes (Table 2). The demands on this revenue are great and a portion (which is relatively difficult to parse out) is already either directly or indirectly allocated towards water quality protection in the form of funding for park management, land acquisition, floodplain management, public education, planning, and other efforts.

Table 2: Percent of Jurisdictions Located Inside the Catawba River Basin
* Property revenue data unavailable for municipalities in italics; excluded from total annual property tax

County	Area (mi^2)	% in CRB	List of municipalities included in analysis County*	Total Annual Property Tax Revenue (County)	Total Annual Property Tax Revenue (Municipalities)
McDowell	446	86%	Marion, Old Fort	$ 18,650,830	$ 2,694,844
Avery	247	35%	Crossnore	$ 16,310,682	$ 25,719
Burke	515	100%	Connelly Springs, Drexel, Glen Alpine, Hildebran, Morganton, *Rhodhiss*, Rutherford College, Valdese	$ 35,266,516	$ 53,004,024
Caldwell	474	75%	*Cajah's Mountain, Gamewell*, Granite Falls, Lenoir, Sawmills, *Rhodiss*	$ 39,022,556	$ 9,645,391
Alexander	263	68%	*Bethlehem,* Taylorsville	Not listed	$ 656,663
Catawba	414	100%	Claremont, Conover, Hickory, *Long View,* Maiden, Newton	$ 84,410,735	$ 40,816,172
Iredell	597	22%	Mooresville, Statesville, Troutman	$ 108,104,434	$ 45,418,977
Lincoln	307	93%	Lincolnton	$ 50,453,671	$ 4,905,832
Gaston	364	97%	*Belmont*, Bessemer City, *Cherryville*, Cramerton, Dallas, Gastonia, High Shoals, Lowell, McAdenville, Mount Holly, Ranlo, *Spencer Mountain*, Stanley	$ 125,293,607	$ 40,085,380
Mecklenburg	546	74%	Charlotte, Cornelius, Davidson, Huntersville, Matthews, Mint Hill, Pineville	$ 682,682,436	$ 375,901,689
Union	640	25%	Stallings	$ 157,703,452	$ 3,261,509
Total				**$1,317,898,919**	**$576,416,200**

3.2 Drinking Water Utilities

More than 47 water utilities draw their water from the CRB, some from surface water, some from groundwater, and some from both. The following section contains information on each of these utilities relevant to their use of water resources in the CRB and their finances. Table 3 presents the utilities and local entities that depend on the CRB for water and wastewater operations (see Appendix I for the municipalities and counties that withdraw water from the CRB or purchase water from entities within the CRB).

Table 3: Drinking Water Utilities and Municipalities in the CRB

Utilities	Number of entities in CRB	Utilities
Water Only	9	Brentwood Water Corporation, Caldwell County, Catawba County, Connelly Springs, Icard Township Water Corp., McDowell County, Triple Community Water Corp.
Combined Water and Wastewater	38	Bethlehem, Baton Water Corporation, Belmont, Bessemer City, Brentwood Water Corporation, Burke County, Caldwell County, Carolina Water Service Inc., Catawba County, Charlotte Water, Cherryville, Claremont, Connelly Springs, Conover, Crossnore, Dallas, Drexel, Granite Falls, Hickory, High Shoals, Icard Township Water Corp., Lenoir, Lincoln County, Lincolnton, Long View, Lowell, Maiden, Marion, McAdenville, McDowell County, Mooresville, Morganton, Mount Holly, Newton, Old Fort, Ranlo, Rhodhiss, Rutherford College, Sawmills, Stanley, Statesville, Taylorsville, Triple Community Water Corp., Troutman, Two Rivers, Union County, Valdese

Some drinking water utilities in the Catawba River Basin directly withdraw from the CRB watershed and others that purchase water from those utilities. Our analysis includes direct and indirect surface water withdrawal utilities. For some utilities, the CRB is a secondary source of water. In 2014, on average, the average daily withdrawal from the CRB was 6.6 million gallons per day; the median was 2.1 million gallons per day. The average maximum daily withdrawal was 8.9 million gallons per day; the median maximum daily withdrawal was 2.5 million gallons per day. Over 504 million gallons per day are available to those utilities that directly withdraw from the CRB.

For those utilities that purchase water from the CRB via another water utility, the mean of average daily withdrawals in 2014 was 2.27 million gallons per day; the median was 0.36 million gallons per day. The largest contract is for 28 million gallons per day.

Table 4 outlines the 15 water utilities responsible for the largest water withdrawals or water purchases in the CRB (see Appendix II for complete list).

Table 4: 15 Largest Surface Water Withdrawals (or Max Contract) in 2014 (2013 if 2014 Local Water Supply data were not available)

Water Utility	Reservoir	Avg Daily Withdrawal (MGD)	Max Day Withdrawal (MGD)**	Available Raw Water Supply (MGD)	Avg Daily Purchased (MGD)	Max Contract
Charlotte Water	Lake Norman	17.910	25.75	55.0		
	Mt. Island Lake	79.0	104.9	108.0		
Union County	Purchases regular water from Anson County and Catawba River Water Supply Project				11.15	28
Two Rivers Utilities	Mountain Island Lake	17.73	27.11	75.0		
	South Fork Catawba River	0	0	15.5		
Hickory	Lake Hickory	11.076	14.1	54.0		
Morganton	Catawba River	8.6	13.6	18.0		
Mooresville	Lake Norman	5.349	7.497	18.00		
Lenoir	Lake Rhodhiss	5.934	7.115	12.0		
Lincolnton	South Fork Catawba River	3.063	5.871	12.0		
Valdese	Lake Rhodhiss	2.9	5.3	12.0		
Statesville	Lookout Shoals Lake	3.144	4.517	15		
Marion	Buck Creek	0.624	2.8	2.8		
	Clear Creek	0.286	0.4	0.4		
	Mackey's Creek	0.52	0.9	0.9		
Mount Holly	Mt. Island Lake	2.56	3.59	13.1		
Maiden	Purchases regular water from Hickory				1.241	3.25
Conover	Purchases regular water from Hickory (Lake Hickory)				1.498	3.0
Belmont	Lake Wylie	1.753	2.722	10.0		

(Source: NC Local Water Supply Plans)
*Ratio withdraw / supply was taken from LWSP and reflects purchase agreements and GW sources as well
**Some systems reported a maximum of "0" on their Local Water Supply Plans

In 2014, the drinking water and wastewater utilities in the CRB collectively collected over $3.5 billion in revenues from over 465,000 residential customers and over 40,000 commercial customers. Far and above the rest, Charlotte Water accounted for $3.3 billion with 241,439 residential and 19,925 commercial customers. The least amount collected in annual revenues for an individual utility was $68,937 in McDowell County from 184 residential and 11 commercial customers. On average, the utilities in the CRB collected over $89 million in revenues; the median annual water and wastewater revenue was $2.3 million. The average number of residential customers was 10,582; the median was 2,834. The average number of commercial customers was 993; the median was 243.

Charges for water service are typically divided between base charges and volumetric charges. Base charges may vary based on meter size or customer type and are charged on a regular basis, no matter the customer's consumption. The minimum fixed base charge in the CRB is $0 (Mount Holly); the maximum base charge for residential and commercial customers was $30.18 per month (Catawba County). The average base charge for residential customers was $15.01 per month; the median was very close at $15.09 per month. For commercial customers, the average base charge was slightly higher at $15.87; the mean base charge for commercial customers was $15.24.

Volumetric rates may vary by customer type, as well. A common consumption point to compare for residential customers is 5,000 gallons per month. This is slightly higher than the average residential water use in the CRB at 3,924 gallons per month. The minimum rate at 5,000 gallons charged by water utilities to residential in the CRB is $1.14 per thousand gallon (Morganton); the maximum rate was $7.62 per thousand gallon (Troutman). The average rate was $4.06 per thousand gallon; the median rate was $4.18 per thousand gallon.

Commercial customers typically use more water than residential customers. The average water use for commercial customers in the CRB was 22,644 gallons per month; the median was 14,413 gallons per month. One utility reported very small demand from its commercial customers at 3,696 gallons per month (Stanley). The maximum average commercial water use reported in 2014 was 187,500 gallons per month by Drexel.

The goal of the Catawba-Wateree River Basin Water Supply Master Plan is to "protect and preserve our available water supply and extend it into the next century." The Catawba-Wateree Water Management Group recognizes that water efficiency will be critical in that effort. Water pricing will be an important method for achieving both water efficiency and financial resiliency. The Environmental Finance Center maintains a comprehensive database of water prices in the State of North Carolina and visualizes this data on the North Carolina Water and Wastewater Rates Dashboard. One dial on the dashboard evaluates water efficiency price signals in rates. It is important to note that if water (or wastewater) rates were increased for the purposes of raising money for watershed protection, it would have an additional benefit of encouraging water efficiency due to the price elasticity of demand.

Table 5 summarizes current water rates charged by 15 largest revenue-generating utilities in the CRB (see Appendix III for complete list). Data was obtained from the local water supply plan (LWSP), annual financial data report (AFIR), and the 2014 EFC rate survey. This information was incorporated into the dashboard for the CRB to produce scenarios for the average impact on a household and the total revenue generated with an increase in the base or rate charge.

Table 5: Water Utility Rates for 15 Largest Utilities Based on Annual Revenue

Rates were converted to kgal for comparison.

	Annual Water and Wastewater Revenues	Number of Connections (Res.)	Number of Connections (Comm.)	Existing Water Base Charge (Res.)	Water Rate at 5,000 Gallons (Res.)	Existing Water Base Charge (Comm.)	Water Rate at 20,000 Gallons (Comm.)
Charlotte Water	$3,356,959,937	241,439	19,925	$2.47	$3.56	$4.93	$3.49
Two Rivers Utilities	$34,229,137	24,728	2,802	$11.86	$2.64	$11.86	$2.89
Union County	$29,773,736	41,347	2,215	$6.10	$2.65	$6.10	$2.70
Hickory	$22,956,285	19,212	3,472	$15.09	$1.47	$15.09	$1.47
Mooresville	$19,635,753	11,232	1,864	$7.11	$5.19	$7.11	$4.87
Morganton	$10,526,607	8,605	1,301	$8.70	$1.14	$8.70	$1.14
Statesville	$9,433,727	9,527	2,095	$7.00	$2.77	$7.00	$2.77
Lincolnton	$8,380,928	4,352	581	$15.32	$4.13	$15.32	$4.57
Lenoir	$8,367,409	9,080	741	$10.02	$3.17	$10.02	$3.17
Lincoln County	$7,673,169	9,810	711	$20.00	$4.72	$20.00	$5.72
Mount Holly	$6,530,248	5,789	371	$0.00	$3.35	$0.00	$5.09
Belmont	$6,046,318	4,543	324	$13.57	$6.98	$13.57	$6.04
Newton	$6,002,377	5,485	464	$23.05	$2.75	$23.05	$2.75
Valdese	$4,799,219	4,999	179	$27.24	$2.60	$26.26	$2.60
Conover	$3,945,895	4,975	314	$11.00	$1.86	$11.00	$1.86

(Source: EFC 2015 Rates Survey and NC Local Government Commission)

3.3 Point Source (Municipal Wastewater Discharge in the CRB)

Wastewater systems with sanitary overflow from pipes also contribute to water pollution in the CRB, particularly during heavy rain events. As a result, the analysis explores the revenue potential for watershed protection of wastewater utilities serving customers in the CRB. More than 42 wastewater utilities discharge into the CRB (Table 6). The following section contains information on each of these utilities relevant to their discharge into the CRB and their finances.

Table 6: Wastewater Utilities in the CRB

Utilities	Number of entities in CRB	Cities, Counties, Utilities
Wastewater Only	4	Cajah's Mountain, Gamewell, Hildrebran, Sedgefield Sanitary District
Combined Water and Wastewater	38	Bethlehem, Baton Water Corporation, Belmont, Bessemer City, Brentwood Water Corporation, Burke County, Caldwell county, Carolina Water Service Inc., Catawba County, Charlotte Water, Cherryville, Claremont, Connelly Springs, Conover, Crossnore, Dallas, Drexel, Granite Falls, Hickory, High Shoals, Icard Township Water Corp., Lenoir, Lincoln County, Lincolnton, Long View, Lowell, Maiden, Marion, McAdenville, McDowell County, Mooresville, Morganton, Mount Holly, Newton, Old Fort, Ranlo, Rhodhiss, Rutherford College, Sawmills, Stanley, Statesville, Taylorsville, Triple Community Water Corp., Troutman, Two Rivers, Union County, Valdese

This section examines centralized, municipal-owned wastewater treatment plants. We acknowledge that decentralized wastewater, such as septic tanks, are located throughout the CRB; however, due to lack of sufficient data we have not addressed these systems from a revenueshed standpoint, and they are not currently included in this analysis.

Just as with the drinking water utilities, some wastewater utilities directly discharge into the Catawba River Basin, while others indirectly discharge through interconnections with other utilities. Across the basin, the mean average daily discharge for all wastewater utilities in the CRB was 1.9 million gallons per day; the mean was 0.3 million gallons per day. But the capacity that the systems have to discharge is much higher. The design capacity for direct dischargers or the maximum contract for indirect discharges averages around 3.7 million gallons per permit, with a mean of 0.75 million gallons per day.

Table 7 identifies the largest municipal wastewater dischargers into the CRB, based on the total average daily discharge from their direct discharges and/or interconnections. (See Appendix IV for complete list.)

Table 7: Attributes of 15 Largest Municipal Wastewater Treatment Plants Discharging Into CRB (Based on sum of average daily discharge into the Catawba

Wastewater Utility	Direct Discharge (DD) or Interconnection (I)	Wastewater Interconnect -ion	Design Capacity or Maximum Contract (MGD)	Average Daily Discharge (MGD)	Sum of Average Daily Discharge (MG)	Receiving Stream(s)
Charlotte Water	DD		20.0	11.42	84.0	Little Sugar Creek
	DD		15.0	9.13		Irwin Creek
	DD		64.0	46.67		McAlpine Creek
	DD		12.0	8.233		Mallard Creek
	DD		12.0	4.9		McDowell Creek
	I	Cabarrus County	0	3.660		Rocky River
Two Rivers Utilities	I	City of Mooresville	2.000	0.001	9.4	See Mooresville
	DD		4.0	0.595		South Fork
	DD		16.0	6.2		South Fork
	DD		0.75	0.22		Long Creek Tributary
	DD		6.0	2.4		Crowders
Union County	DD		0.05	0.031	8.4	Clear Creek
	DD		1.9	1.189		North Fork Crooked Creek
	DD		0.231	0		Goose Creek
	DD		6.0	3.291		Twelve Mile Creek
	DD		0.05	0.03		Crooked Creek
	DD		0.15	0.052		Land Application
	I	Charlotte Water	3.00	2.285		See Charlotte Water
	I	Lancaster County, SC	0.025	0.010		
	I	Monroe	2.650	1.503		
Hickory	DD		6.0	2.805	6.3	Catawba River
	DD		9.0	2.547		Henry Fork River
	DD		0	0.533		Catawba River
	I	City of Conover	0.625	0.423		See Conover
Morganton	DD		10.5	4.7	4.7	Catawba River
Mooresville	DD		7.5	3.957	4.0	Dye Creek

Wastewater Utility	Direct Discharge (DD) or Interconnection (I)	Wastewater Interconnect-ion	Design Capacity or Maximum Contract (MGD)	Average Daily Discharge (MGD)	Sum of Average Daily Discharge (MG)	Receiving Stream(s)
Lenoir	DD		2.0	1.209	3.6	Gunpowder Creek
	DD		6.0	2.408		Lower Creek
	DD		3.9	0.014		Lake Rhodhiss
	I	Town of Sawmills	0.250	0.010		See Sawmills
Lincolnton	DD		6.0	2.533	2.5	Catawba River South Fork
Mount Holly	DD		4.0	2.240	2.2	Catawba River
Newton	DD		7.5	1.753	1.8	Clark Creek
Conover	DD		1.5	0.658	1.5	Lyle Creek
	DD		0.3	0		McLin Creek
	DD		0.3	0		McLin Creek
	I	City of Newton	1.050	0.841		See Newton
Belmont	DD		5.0	1.36	1.4	Catawba River
			11.51 Dry Tons	0.272 Dry Tons		Land Application
Cherryville	DD		2.0	0.568	1.3	Indian Creek
	DD		2.0	0.763		Land Application
Marion	DD		3.0	0.977	1.3	Muddy Creek
	DD		0.68	0.288		Nicks Creek
McAdenville	DD		0.13	0.036		South Fork
Valdese	DD		7.5	1.9		Lake Rhodhiss

Wastewater utilities depend on customers to fund pollution control services. While there are some sources of subsidized state and federal wastewater funding, the vast majority of revenues for point source control are collected in the form of user fees and rates from wastewater customers. In some parts of the country, communities have begun turning towards alternative wastewater revenues such as sales taxes or property taxes, but this practice has not been adopted by North Carolina utilities. To put the scale of wastewater revenue in context, we have analyzed revenue trends for utilities that discharge into the CRB. Table 8 presents the 15 largest revenue-generating wastewater utilities (see Appendix 5 for complete list).

Similar to water utilities, wastewater utilities charge different rates for their services. All utilities have updated rates within the last year. Data were obtained from the local water supply plan (LWSP), annual financial data report (AFIR), and an EFC rate survey. Wastewater utilities have a monthly fixed base charge and a rate charge per unit of water consumed (based on water consumption). All of these wastewater utilities charge a uniform rate. The data in this table were incorporated into the dashboard for the CRB to produce scenarios for the average impact on a household and the total revenue generated with an increase in the base or rate charge.

In 2014, the drinking water and wastewater utilities in the CRB collectively collected over $3.5 billion in revenues from over 465,000 residential customers and over 40,000 commercial customers. Far and above the rest, Charlotte Water accounted for $3.3 billion with 241,439 residential and 19,925 commercial customers. The least amount collected in annual revenues for an individual utility was $68,937 in McDowell County from 184 residential and 11 commercial customers. On average, the utilities in the CRB collected over $89 million in revenues; the median annual water and wastewater revenue was $2.3 million. The average number of residential customers was 10,582; the median was 2,834. The average number of commercial customers was 993; the median was 243.

Charges for wastewater service is also divided between a base charge and volumetric charges. Base charges may vary based on meter size or customer type and are charged on a regular basis, no matter the customer's consumption. The minimum fixed base charge in the CRB is $0 (Mount Holly); the maximum base charge for residential and commercial customers was $33.02 per month (Carolina Water Service). The average base charge for residential customers was $14.60 per month; the median was very close at $15.25 per month. The average base charge for commercial customers was $15.28 per month; the median was $15.55.

Volumetric rates may vary by customer type, as well. A common consumption point to compare for residential customers is 5,000 gallons per month. This is slightly higher than the average residential water use in the CRB at 3,924 gallons per month. Since wastewater is typically billed against metered water consumption, this amount was used to compare wastewater rates, as well. The minimum rate per thousand gallon charged by wastewater utilities to residential in the CRB is $1.42 (Drexel); the maximum rate was $14.45 per thousand gallons (Stanley). The average rate was $5.31 per thousand gallons; the median rate was $4.84 per thousand gallons.

Commercial customers typically use more water than residential customers. The average water use for commercial customers in the CRB was 22,644 gallons per month. At 20,000 gallons per month, Drexel charged the least for wastewater services at $1.42 per thousand gallon. Stanley charged the most at $18.80 per thousand gallon.

Table 8 summarizes current water rates charged by 15 largest revenue-generating wastewater utilities in the CRB (see Appendix V for complete list). Data was obtained from the local water supply plan (LWSP), annual financial data report (AFIR), and an EFC rate survey. This information was incorporated into the dashboard for the CRB to produce scenarios for the average impact on a household and the total revenue generated with an increase in the base or rate charge.

Table 8: Wastewater Utility Rates for 15 Largest Entities (Based on Annual Revenue) Inside the City

All units shown in kgal for comparison

	Annual Water and Wastewater Revenues	Estimated Number of Sewer Connections (Res.)	Existing Sewer Base Charge (Res.)	Sewer Rate at 5,000 Gallons (Res.)	Estimated Number of Sewer Connections (Comm.)	Existing Sewer Base Charge (Comm.)	Sewer Rate at 20,000 Gallons (Comm.)
Belmont	$6,046,318	4,168	$15.62	$8.10	298	$15.62	$8.10
Bessemer City	$3,546,112	2,112	$12.00	$9.19	149	$12.00	$9.19
Charlotte Water	$3,356,959,937	220,646	$7.02	$6.03	18,209	$7.02	$6.03
Hickory	$22,956,285	12,238	$14.55	$2.88	2,212	$14.55	$2.87
Lenoir	$8,367,409	8,773	$8.41	$3.56	716	$8.41	$3.56
Lincoln County	$7,673,169	3,591	$20.00	$4.72	261	$20.00	$5.38
Lincolnton	$8,380,928	3,517	$22.94	$6.82	470	$22.94	$6.82
Mooresville	$19,635,753	11,465	$9.39	$6.28	1,903	$9.39	$6.28
Morganton	$10,526,607	5,799	$14.68	$2.74	877	$14.68	$2.74
Mount Holly	$6,530,248	5,149	$0.00	$3.07	330	$0.00	$4.74
Newton	$6,002,377		$27.90	$4.68		$27.90	$4.68
Statesville	$9,433,727		$10.34	$4.55		$10.34	$4.55
Two Rivers Utilities	$34,229,137	22,863	$15.81	$3.80	2,591	$15.81	$3.80
Union County	$29,773,736	29,378	$9.25	$4.40	1,574	$9.25	$4.40
Valdese	$4,799,219	2,124	$5.52	$1.84	77	$5.79	$1.93

1.1 Non-point Discharge – Catchment Basins and Stormwater Management

Precipitation events cause surface runoff that flows either directly into a stream or into treatment plants prior to entering the stream. Urbanization increases impervious surface area, preventing precipitation from soaking into the ground, thereby generating more stormwater, more stream scouring, erosion, and flooding. Since it is impossible to control precipitation, the next best solution is to manage the amount of stormwater generated to reduce flooding.

Stormwater management programs are often created and funded by local governments who generate revenue through: taxes, public enterprise fees (utility and impact fees), regulatory fees, fines and penalties, contractual agreements, and assessments (Hughes 2008). North Carolina has several additional stormwater programs in addition to NPDES Phase I and Phase II Stormwater Management requirements. These programs include the aforementioned Nutrient Sensitive Waters, Water Supply Watersheds, High Quality Waters, Outstanding Resource Waters, Coastal Stormwater, and a voluntary Universal Stormwater Management Program. We will not go into detail regarding each type of stormwater program, but want to highlight that it is a complicated and complex compilation of programs.

In this report, we focus on stormwater utilities since they are responsible for generating a dedicated revenue stream for stormwater management. Stormwater programs that are not included in a utility are mostly funded through property tax revenues and administered through another branch of city or county government. While these programs spend money for stormwater protection, the revenue stream is embedded within other funds and it is difficult to get accurate quantitative data for stormwater revenue. In North Carolina there were 38 stormwater utilities in 2006 (defined as a separate fee for the explicit purpose of stormwater management) and 52 stormwater utilities in 2012 (EFC 2011).

A stormwater utility is responsible for finding the most cost effective way to comply with water quality standards and protect the quality of the receiving water body. The cities of Belmont, Bessemer, Cramerton, Gastonia, Mount Holly, Ranlo, and Stallings all operate stormwater utilities. Charlotte-Mecklenburg collects stormwater fees for a number of nearby municipalities, including Charlotte, Cornelius, Huntersville, Matthews, Mint Hill, Pineville, and unincorporated areas of Mecklenburg County. Geographically, each of the municipalities that currently have stormwater utilities are in the lower portions of the North Carolina Catawba Riverbasin. Table 9 includes revenue and rate data for each of these utilities.

Table 9: Stormwater Rates and Revenues for Stormwater Utilities in the CRB (FY14)

Stormwater Entity	Stormwater Annual Revenue (FY14)	Basis of Fee (Res.)	Monthly Rate (Res.)	Average Monthly Charge	Residential Units	Number of Accounts (Res.)	Basis of Fee (Comm.)	Monthly Rate (Comm.)	Commercial Unit	Number of Accounts (Comm.)
Belmont	Data unavailable	Flat	$3.00	$3.00		4,000	Flat	$14.00		325
Bessemer City	Data unavailable	Flat	$2.07	$2.07		2,149	Flat	$2.07		203
Charlotte	$56,976,805	Tiered	$10.18	$10.18	At Tier 2	142,666	Per Acre	$156.41	Per Acre of Impervious Surface	20,097
Cornelius	$639,290	Tiered	$4.17	$4.17	At Tier 2		Per Acre	$56.19	Per Acre of Impervious Surface	
Cramerton	$68,291	Data unavailable				1,682	Data unavailable			126
Dallas	$88,281	Data unavailable								
Davidson	$238,692	Tiered	$5.22	$5.22	At Tier 2	Data unavailable	Per Acre	$87.00	Per Acre of Impervious Surface	Data unavailable
Gastonia	$2,140,036	Flat	$3.25	$3.25		Data unavailable	ERU	$3.25		Data unavailable
Huntersville	$1,370,272	Tiered	$4.17	$4.17	At Tier 2	Data unavailable	Per Acre	$ 56.19	Per Acre of Impervious Surface	Data unavailable
Matthews	$1,013,697	Tiered	$4.17	$4.17	At Tier 2	Data unavailable	Per Acre	$ 56.19	Per Acre of Impervious Surface	Data unavailable

Stormwater Entity	Stormwater Annual Revenue (FY14)	Basis of Fee (Res.)	Monthly Rate (Res.)	Average Monthly Charge	Residential Units	Number of Accounts (Res.)	Basis of Fee (Comm.)	Monthly Rate (Comm.)	Commercial Unit	Number of Accounts (Comm.)
Mecklenburg County	$1,339,077	Tiered	$3.79	$3.79	At Tier 2	Data unavailable	Per Acre	$ 49.85	Per Acre of Impervious Surface	Data unavailable
Mint Hill	$584,225	Tiered	$4.17	$4.17	At Tier 2	Data unavailable	Per Acre	$56.19	Per Acre of Impervious Surface	Data unavailable
Mooresville	$814,602	ERU @ 2,700 sf	$3.40	$3.40	Per ERU	Data unavailable	ERU @ 2,700 sf	$3.40	Data unavailable	Data unavailable
Mount Holly	$244,522	ERU	$2.50	$2.50	Per ERU	Data unavailable	ERU	$ 2.50	Data unavailable	Data unavailable
Pineville	$550,249	Tiered	$4.17	$4.17	At Tier 2	Data unavailable	Per Acre	$ 56.19	Per Acre of Impervious Surface	Data unavailable
Ranlo	Data unavailable	Water Use (Per 1,000 Gallons)	$1.80	$9.00	Per 1,000 Gallons	Data unavailable	Water Use (Per 1,000 Gallons)	$1.80	Per Thousand Gallon	Data unavailable
Stallings	$464,000	Flat (One Charge Per Year; $46 divided by 12)	$3.83	$3.83	0	Data unavailable	ERU @ 2,060 sf	$33.00		Data unavailable

4. Conclusion: Ongoing applications of the revenueshed concept

The revenueshed concept was applied to the Catawba River Basin with the intention of generating conversations between multiple jurisdictions regarding how to protect the water quality of the nine water supply reservoirs located in CRB and how to generate a sustainable revenue fund dedicated to watershed protection. In conjunction with this report, a financial model (dashboard) was developed to help decision-makers test various scenarios for raising money (additional to existing revenue) to protect water quality in the Catawba River Basin.

5. Literature Cited

American Rivers 2008. *America's Most Endangered Rivers*. Accessed March 2015. http://www.americanrivers.org/MER/PDFs/MER_2008.pdf

Annual Financial Information Reports (North Carolina State Treasurer). 2014. County and Municipal Financial Data. http://www.nctreasurer.com/lgc/units/unitlistjs.htm.

Artz, Jessica. 2008. *Interbasin Water Transfers in the Southeastern United States: An Analysis of the Catawba Interbasin Transfer as a Water Management Tool.* http://www.law.sc.edu/environmental/papers/200811/eas/artz.pdf.

Catawba Riverkeeper. About the Catawba-Wateree River. http://www.catawbariverkeeper.org/about-the-catawba/catawba-wateree-facts/.

Catawba Riverkeeper(a), no date. EPA Report Shows Catawba River Threatened by Coal Ash Waste. *Accessed March 2015. http://www.catawbariverkeeper.org/epa-report-shows-catawba-river-threatened-by-coal-ash-waste*.

Catawba Riverkeeper(b), no date. The Endangered River. *Accessed March 2015.* http://www.catawbariverkeeper.org/the-endangered-river.

Catawba Riverkeeper(c), no date. The Water of the Catawba. *Accessed March 2015.* http://www.catawbariverkeeper.org/join/about-the-catawba/maps-of-the-basin/the-water-of-the-catawba

EPA (Environmental Protection Agency) 2011. NC 2010 Integrated Report Categories 4 and 5 Impaired Waters. http://portal.ncdenr.org/c/document_library/get_file?uuid=8ff0bb29-62c2-4b33-810c-2eee5afa75e9&groupId=38364. *Accessed through NCDENR portal on April 25, 2011.*

Georgoulias, B. 2010. DWQ's Stormwater Programs: Overview and Recent Changes. Presented at the Water Resources Research Institute & NC DWQ Stormwater Program Workshop in Clemmons, NC. April 22,2010. http://www.ncsu.edu/wrri/events/dwq/spring10/DWQ_SWPrograms_Overview_Apr2010.pdf. *Last Accessed June 2011.*

Gerlak, A.K. 2006. Federalism and U.S. Water Policy: Lessons for the Twenty-first Century. *Publius: The Journal of Federalism* 36 (2): pp. 231-257. DOI: 10.1093/publius/pji032.

Grigg, N.S. 1999. Integrated Water Resources Management: Who should lead, who should pay? *Journal of the American Water Resources Association* 35 (3): pp. 527-534.

Hughes, J. 2014. Institutional Models for Sharing Water Resource Protection Costs among Multiple Partners. The Environmental Finance Center at UNC Chapel Hill. http://www.efc.sog.unc.edu/reslib/item/institutional-models-sharing-water-resource-protection-costs-among-multiple-partners *Accessed May 2014.*

Kramer, R.A. and J.I. Eisen-Hecht. 2002. Estimating the Economic Value of Water Quality Protection in the Catawba River Basin. *Water Resources Research*. 38 (9), 1182, DOI: 10.1029/2001WR000755.

Natural Resources Conservation Service. 2010. Lower Catawba Subbasin. *Accessed March 2015.* http://www.esri.sc.edu/projects/usda/conservation_documents/RWAs/Lower%20Catawba.pdf.

Natural Resources Conservation Service. 2010. Upper Catawba Subbasin. *Accessed March 2015.* http://www.esri.sc.edu/projects/usda/conservation_documents/RWAs/Upper%20Catawba.pdf.

Natural Resources Conservation Service. 2010. Wateree Subbasin. *Accessed March 2015.* http://www.esri.sc.edu/projects/usda/conservation_documents/RWAs/Wateree.pdf.

North Carolina Department of Environment and Natural Resources, Office of Environmental Education and Public Affairs. No date. Catawba River Basin. http://www.eenorthcarolina.org/images/River%20Basin%20Images/final_web_catawba.pdf.

North Carolina Department of Environment and Natural Resources. 2009. Conservation Easement Program Annual Report to the Environmental Review Commission. *Accessed March 2011.* http://www.onencnaturally.com/PDFs/2009_Conservation_Tax_Credit_Program_Report_to_ERC.pdf

NC Division of Water Quality. 2007. Catawba River Basin Water Resources Plan.. *Accessed March 2015.* http://www.ncwater.org/files/publications/Final_Draft_Catawba_River_Basin_Plan_2007.pdf.

NC Division of Water Quality. 2010. South Fork of the Catawba River Basin. *Accessed March 2015.* http://portal.ncdenr.org/c/document_library/get_file?uuid=279b9508-0973-420f-b3d8-dfb67383f57e&groupId=38364.

Prahalad, P.P., M.P. Claggett, and N.T. Hoagland. 2007. Beyond Water Quality: can the Clean Water Act be used to reduce the quantity of stormwater runoff? *Urban Law* 39: pp. 85-110.

Stabley, Susan. 2010. Concord, Kannapolis Settle Catawba Water Dispute. *Charlotte Business Journal*. http://www.bizjournals.com/charlotte/stories/2010/01/18/daily22.html?page=all.

Steinmetz, Jeffrey A., and Reed M. Perkins. One Glass for Two People: C Case of Water Use Rights in the Eastern United States. *National Center For Case Study Teaching in Science.* http://sciencecases.lib.buffalo.edu/cs/files/water_rights.pdf.

White House Council on Environmental Quality. 2010. Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy. Pp 53. http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf

4. Appendix

Appendix I: Water supply intakes in the Catawba River Basin
(Source: NC Local Water Supply Plans 2014 and 2013 when 2014 unavailable)

Utility	Stream	Reservoir	Water Treatment Plant (WTP)	Use Type
Alexander County	Purchases regular water from Hickory			
Baton Water Corp.	Purchases regular water from Lenoir			
Belmont	Catawba	Lake Wylie	Belmont Water Plant	Regular
Bessemer City	Long Creek	Arrowood, Webber	J.V. Tarpley WT Facility	Regular
Brentwood Water Corporation	Purchases regular water from Morganton			
Burke County	Purchases Regular Water from Icard Township, Longview (Lake Hickory), Morganton (Catawba River), Valdese (Lake Rhodhiss)			
Caldwell County	Purchases regular water from Alexander County, Lenoir, ; purchases emergency water from Granite Falls			
Carolina Water Service Inc.	Data unavailable			
Catawba County	Purchases regular water from Hickory			
Charlotte Water	Catawba River	Lake Norman Mt. Island Lake	Franklin WTP Lee S. Dukes Vest WTP	Regular
Cherryville	Indian Creek	South Fork Catawba River	Cherryville WTP	Regular
	Purchase emergency water from City of Lincolnton			
Claremont	Purchase regular water from Conover (Conover purchases regular water from Hickory; Hickory withdraws regular water from Catawba River / Lake Hickory Reservoir and purchases regular water from Granite Falls / Lake Rhodhiss)			
Connelly Springs	Data unavailable			
Conover	Purchase regular water from Hickory (Catawba River/Lake Hickory)			
Crossnore	Ground water source			

Utility	Stream	Reservoir	Water Treatment Plant (WTP)	Use Type
Dallas	South Fork Catawba River	Town of Dallas Water Treatment Purchase emergency water from Gastonia	Dallas WTP	Regular
Drexel	Purchase regular water from: Icard Township WC Longview Morganton Valdese	NA	NA	Regular
Granite Falls	Catawba River	Lake Rhodhiss	Granite Falls WTP	Regular
Hickory	Catawba River	Lake Hickory	Hickory WTP	Regular
High Shoals	Purchases regular water from Lincoln County			
Lenoir	Catawba River	Lake Rhodhiss	Lenoir-Lake Rhodhiss WTP	Regular
Lincoln County	Catawba River	Lake Norman	Lake Norman WTP	Regular
Lincolnton	South Fork Catawba River	NA	City of Lincolnton WTP	Regular
	Purchase emergency water from City of Cherryville, Lincoln County			
Longview	Catawba River	Lake Hickory	Long View WTP	Regular
Lowell	Purchase 100% of water from Two Rivers Utilities			
Maiden	Purchase regular water from City of Hickory			
	Purchase emergency water from Newton			
Marion	Buck Creek Clear Creek Mackey's Creek	NA	Marion Water Treatment Plant	Regular
McAdenville	Purchase Regular Water from Gastonia (Two Rivers Utilities) and Emergency Water from Lowell			

Utility	Stream	Reservoir	Water Treatment Plant (WTP)	Use Type
McDowell County	Purchase regular water from City of Marion			
Mooresville	Catawba River	Lake Norman	WTP 1	Regular
			WTP 2	Regular
Morganton	Catawba River	NA	Catawba River WTP	Regular
Mount Holly	Catawba River	Mt. Island Lake	Mount Holly WTP	Regular
Newton	City Lake	City Lake	Newton Water Plant	Regular
	Jacob Fork River			
Old Fort	Sole Source: Ground Water			
Ranlo	Purchase regular water from Two Rivers Utilities (Catawba River)			
Rhodhiss	Purchase regular water from Burke County, Icard Township, Granite Falls			
Rutherford College	Purchase regular water from Town of Valdese (Catawba River)			
Sawmills	Purchase regular water from Baton WC (Lenoir/Lake Rhodhiss), Caldwell County, Lenoir (Lake Rhodhiss)			
Stanley	Purchase Regular Water from Mount Holly			
Statesville	Catawba River	Lookout Shoals Lake	City of Salisbury	Regular
	South Yadkin River	NA	City of Salisbury	Emergency
Taylorsville	Purchase regular water from Hickory (Catawba River/Lake Hickory)			
Troutman	Purchase regular water from Energy United Water Corp			
	Purchase emergency water from City of Statesville (Catawba River/Lookout Shoals Lake)			
Two Rivers Utilities	Catawba River	Mountain Island Lake	Gastonia WTP	Regular
	South Fork Catawba River	NA	Gastonia WTP	Emergency
Union County	Purchase regular water from Anson County and Catawba River Water Supply Project			
	Purchase emergency water from Lancaster County Water and Sewer District and Monroe			
Valdese	Catawba River	Lake Rhodhiss	Valdese Water Plant	Regular

Appendix II

Surface water supply use in 2014 (2013 if 2014 data not available)

(Source: NC Local Water Supply Plans)

Water Utility	Reservoir	Avg Daily Withdrawal (MGD)	Max Daily Withdrawal (MGD)	Available Raw Water Supply (MGD)	Avg Daily Purchased (MGD)	Max. Contract (MGD)
Alexander County	Purchases regular water from Hickory				1.020	2.0
Baton Water Corp.	Purchases regular water from Lenoir				0.474	0.333
Belmont	Lake Wylie	1.753	2.722	10.0		
Bessemer City	Long Creek	0.605	0	2.2		
	Arrowood	0.615	0	1.4		
	Webber	0	0	0.31		
Brentwood Water Corporation	Purchase regular water from Morganton				0.395	0.5
Burke County	Purchases regular water from Icard Township WC, Longview, Morganton, Valdese				0.421	1.23
Caldwell County	Purchases regular water from Alexander County; purchases emergency water from Granite Falls				1.589	>1.935
Carolina Water Service	Data unavailable					
Catawba County	Purchases regular water from Hickory				0.214	0.5
Charlotte Water	Lake Norman	17.910	25.75	55.0		
	Mt. Island Lake	79.0	104.9	108.0		
Cherryville	Indian Creek	0.67	1.001	3.2		
Claremont	Purchases regular water from Conover (Hickory/Lake Hickory)				0.326	0.580
Connelly Springs	Data unavailable					
Conover	Purchases regular water from Hickory (Lake Hickory)				1.498	3.0
Crossnore	Ground water source					

Water Utility	Reservoir	Avg Daily Withdrawal (MGD)	Max Daily Withdrawal (MGD)	Available Raw Water Supply (MGD)	Avg Daily Purchased (MGD)	Max. Contract (MGD)
Dallas	Town of Dallas Water Treatment	0.656	0.841	1.0		
Drexel	Purchases regular water from Morganton				0.9	0.860
Granite Falls	Lake Rhodhiss	1.168	2.329	2.5		
Hickory	Lake Hickory	11.076	14.1	54.0		
High Shoals	Purchases regular water from Lincoln County				0.029	0.1
Lenoir	Lake Rhodhiss	5.934	7.115	12.0		
Lincoln County	Lake Norman	2.5	0	12.0		
Lincolnton	South Fork Catawba River	3.063	5.871	12.0		
Longview	Lake Hickory	0.813	1.091	2.0		
Lowell	Purchases regular water from Two Rivers Utilities				0.279	0.618
Maiden	Purchases regular water from Hickory				1.241	3.25
Marion	Buck Creek	0.624	2.8	2.8		
	Clear Creek	0.286	0.4	0.4		
	Mackey's Creek	0.520	0.9	0.9		
McAdenville	Purchases regular water from Gastonia, purchases emergency water from Lowell				0.251	1
McDowell County	Purchases regular water from Marion				0.036	0.2
Mooresville	Lake Norman	5.349	7.497	18.00		
Morganton	Catawba River	8.6	13.6	18.0		
Mount Holly	Mt. Island Lake	2.56	3.59	13.1		
Newton	City Lake	3.747	0	8.0		
	Jacob Fork River	0	0	50.0		
Old Fort	Ground water source					
Ranlo	Purchases regular water from Two Rivers Utilities				0.321	0.5

Water Utility	Reservoir	2014 (2013) Avg Daily Withdrawal (MGD)	Maximum Day Withdrawal (MGD)	Available Raw Water Supply (MGD)	Average Daily Purchased (MGD)	Maximum Contract
Rhodhiss	Purchases regular water from Burke County, Granite Falls, Icard Township WC				0.04	0.18
Rutherford College	Negotiating purchase of regular water from Valdese				0.127	0.233
Sawmills	Purchases regular water from Baton WC, Caldwell County, Lenoir				0.312	0.225
Stanley	Purchases regular water from City of Mount Holly				0.541	1.2
Statesville	Lookout Shoals Lake	3.144	4.517	15		
Taylorsville	Purchase regular water from Hickory				1.020	2.0
Troutman	Purchases regular water from Energy United Water Corp.				0.316	1.5
Two Rivers Utilities	Mountain Island Lake	17.73	27.11	75.0		
	South Fork Catawba River	0	0	15.5		
Union County	Purchases regular water from Anson County and Catawba River Water Supply Project				11.15	28
Valdese	Lake Rhodhiss	2.9	5.3	12.0		

Appendix III

Table 5: Water utility rates for customers inside the city limits

(Source: EFC 2015 Rates Survey and NC Local Government Commission)

Rates were converted to kgal for comparison.

	Annual Water and Wastewater Revenues	Number of Connections (Res.)	Average Water Use (Res.)	Number of Connections (Comm.)	Average Water Use (Comm.)	Existing Water Base Charge (Res.)	Water Rate at 5,000 Gallons (Res.)	Existing Water Base Charge (Comm.)	Water Rate at 20,000 Gallons (Comm.)
Alexander County - Bethlehem	$2,328,982	4,638	3,913	264	26,023	$28.74	$1.47	$28.74	$1.47
Baton Water Corp.	Data unavailable	2,763	3,855	60	8,000	$18.55	$5.25	$18.55	$5.25
Belmont	$6,046,318	4,543	3,975	324	16,019	$13.57	$6.98	$13.57	$6.04
Bessemer City	$3,546,112	2,117	3,755	149	5,034	$8.80	$5.36	$8.80	$5.36
Brentwood Water Corporation	Data unavailable	4,172	4,214	64	6,563	$16.50	$5.55	$16.50	$5.55
Burke County	$1,481,228	1,739	3,399	32	75,000	$20.00	$4.56	$20.00	$4.56
Caldwell County	$3,423,028	8,784	3,825	131	18,550	$20.25	$4.95	$21.81	$4.00
Carolina Water Service, Inc.	Data unavailable					$18.25	$5.44	$18.25	$5.44
Catawba County		677	5,406	49	28,163	$30.18	$2.94	$30.18	$2.94

	Annual Water and Wastewater Revenues	Number of Residential Connections	Residential Average Water Use	Number of Commercial Connections	Commercial Average Water Use	Existing Water Base Charge (Residential)	Water Rate at 5,000 Gallons (Residential)	Existing Water Base Charge (Commercial)	Water Rate at 20,000 Gallons (Commercial)
Charlotte Water	$3,356,959,937	241,439	6,536	19,925	27,297	$2.47	$3.56	$4.93	$3.49
Cherryville	$2,133,598	2,621	3,537	267	24,494	$16.00	$4.84	$20.00	$4.84
Claremont	$1,140,507	771	3,424	-	-	$12.18	$2.90	$13.20	$3.90
Connelly Springs	Data unavailable								
Conover	$3,945,895	4,975	4,107	314	13,567	$11.00	$1.86	$11.00	$1.86
Crossnore	$75,814	130	5,769	-	-	$18.50	$2.00	$18.50	$2.00
Dallas	$2,121,425	2,518	3,443	308	14,708	$8.85	$5.86	$8.85	$6.29
Drexel	$541,794	1,058	4,112	32	187,500	$15.75	$1.20	$15.75	$1.20
Granite Falls	$1,748,471	2,216	3,736	243	10,123	$21.51	$3.21	$21.51	$3.37
Hickory	$22,956,285	19,212	4,825	3,472	18,957	$15.09	$1.47	$15.09	$1.47
High Shoals	$188,095	192	3,125	6	20,000	$15.00	$6.00	$27.00	$3.00
Icard Township Water Corporation	Data unavailable	2,774	2,920	67	76,119	$25.00	$3.85	$25.00	$3.85
Lenoir	$8,367,409	9,080	3,763	741	14,413	$10.02	$3.17	$10.02	$3.17

	Annual Water and Wastewater Revenues	Number of Residential Connections	Residential Average Water Use	Number of Commercial Connections	Commercial Average Water Use	Existing Water Base Charge (Residential)	Water Rate at 5,000 Gallons (Residential)	Existing Water Base Charge (Commercial)	Water Rate at 20,000 Gallons (Commercial)
Lincoln County	$7,673,169	9,810	4,281	711	8,439	$20.00	$4.72	$20.00	$5.72
Lincolnton	$8,380,928	4,352	3,971	581	17,246	$15.32	$4.13	$15.32	$4.57
Long View	$2,090,265	2,705	2,784	392	20,128	$15.10	$2.26	$15.10	$2.26
Lowell	$958,705	1,521	3,688	102	9,118	$7.66	$5.78	$10.55	$7.66
Maiden	$2,148,268	1,726	3,720	127	6,850	$14.16	$2.77	$14.16	$2.77
Marion	$3,088,810	4,000	3,315	296	22,601	$13.41	$2.20	$13.41	$2.20
McAdenville	$371,143	249	3,253	32	4,688	$3.64	$5.03	$3.64	$5.03
McDowell County	$68,937	184	3,261	11	13,636	$12.00	$4.50	$12.00	$4.50
Mooresville	$19,635,753	11,232	4,006	1,864	45,064	$7.11	$5.19	$7.11	$4.87
Morganton	$10,526,607	8,605	5,254	1,301	23,359	$8.70	$1.14	$8.70	$1.14
Mount Holly	$6,530,248	5,789	5,198	371	13,181	$0.00	$3.35	$0.00	$5.09
Newton	$6,002,377	5,485	3,506	464	13,836	$23.05	$2.75	$23.05	$2.75
Old Fort	$432,603	620	3,000	73	7,397	Data Unavailable			
Ranlo	$1,143,042	1,425	3,600	32	12,188	$11.05	$6.41	$11.05	$6.41

	Annual Water and Wastewater Revenues	Number of Residential Connections	Residential Average Water Use	Number of Commercial Connections	Commercial Average Water Use	Existing Water Base Charge (Residential)	Water Rate at 5,000 Gallons (Residential)	Existing Water Base Charge (Commercial)	Water Rate at 20,000 Gallons (Commercial)
Rhodhiss	$222,620	341	3,167	-	-	$15.60	$5.20	$15.60	$5.20
Rutherford College	$617,236	815	2,724	49	4,898	$28.00	$5.00	$28.00	$5.00
Sawmills	$703,961	2,101	4,212	39	5,385	$15.00	$4.50	$15.00	$4.50
Stanley	$2,338,768	1,608	4,216	138	3,696	$10.00	$6.80	$26.85	$26.85
Statesville	$9,433,727	9,527	3,634	2,095	12,558	$7.00	$2.77	$7.00	$2.77
Taylorsville	$2,212,668	4,638	3,913	264	26,023	$18.75	$6.00	$17.50	$5.75
Triple Community Water Corporation	Data unavailable					$23.31	$4.18	$23.31	$4.18
Troutman	$1,564,650	1,397	3,028	141	9,149	$15.24	$7.62	$15.24	$7.62
Two Rivers Utilities	$34,229,137	24,728	4,422	2,802	22,099	$11.86	$2.64	$11.86	$2.89
Union County	$29,773,736	41,347	5,131	2,215	13,693	$6.10	$2.65	$6.10	$2.70
Valdese	$4,799,219	4,999	3,745	179	22,626	$27.24	$2.60	$26.26	$2.60

Source: 2013/2014 Local Water Supply Plan, EFC 2015 Rate Survey

Appendix IV

Attributes of municipal wastewater treatment plants discharging to CRB

Wastewater Utility	Direct Discharge (DD) or Interconnection (I)	Wastewater Interconnection	Design Capacity or Maximum Contract (MGD)	Average Daily Discharge (MGD)	Receiving Stream(s)
Alexander County	I	City of Hickory	0.5	0.061	See Hickory
Baton Water Corp.	Data Unavailable				
Belmont	DD		5.0	1.36	Catawba River
			11.51 Dry Tons	0.272 Dry Tons	Land Application
Bessemer City	DD		1.5	0	Abernathy Creek
	I	City of Gastonia	1.609	0.686	See Gastonia
Burke County	I	City of Hickory	0.500	0.274	See Hickory
	I	City of Hickory	0.500	0.313	See Valdese
Cajah's Mountain	Data unavailable				
Carolina Water Service	Data unavailable				
Charlotte Water	DD		20.0	11.42	Little Sugar Creek
	DD		15.0	9.13	Irwin Creek
	DD		64.0	46.67	McAlpine Creek
	DD		12.0	8.233	Mallard Creek
	DD		12.0	4.9	McDowell Creek
	I	Cabarrus County	0	3.660	Rocky River
Cherryville	DD		2.0	0.568	Indian Creek
	DD		2.0	0.763	Land Application
Claremont	DD		0.1	0	Tributary
	DD		0.1	0.071	North
	DD		0.3	0.16	McLin Creek
Conover	DD		1.5	0.658	Lyle Creek
	DD		0.3	0	McLin Creek
	DD		0.3	0	McLin Creek
	I	City of Newton	1.050	0.841	See Newton
Crossnore	DD		0.07	0.014	Mill Timber Creek
Dallas	DD		0.6	0.37	UT Long Creek
	DD		0	0.07	South Fork Catawba River
Drexel	I	Town of Valdese	0.500	0.182	See Valdese
Gamewell	Data Unavailable				
Granite Falls	DD		0.75	0.305	Gundpowder Creek

	DD		0.063	0.018	Lake Rhodhiss
Wastewater Utility	**Direct Discharge (DD) or Interconnection (I)**	**Wastewater Interconnection**	**Design Capacity or Maximum Contract (MGD)**	**Average Annual Daily Discharge (MGD)**	**Receiving Stream(s)**
Hickory	DD		6.0	2.805	Catawba River
	DD		9.0	2.547	Henry Fork River
	DD		0	0.533	Catawba River
	I	City of Conover	0.625	0.423	See Conover
High Shoals	DD		0.018	0.03	South Fork Catawba River
	I	Two Rivers Utilities	0.100	0.025	See TWU
Hildebran	Data unavailable				
Lenoir	DD		2.0	1.209	Gunpowder Creek
	DD		6.0	2.408	Lower Creek
	DD		3.9	0.014	Lake Rhodhiss
	I	Town of Sawmills	0.250	0.010	See Sawmills
Lincoln County	DD		1.680	0.799	Killian Creek
Lincolnton	DD		6.0	2.533	Catawba River South Fork
Longview	I	City of Hickory	1.5	0.520	See Hickory
Lowell	DD		0.6	0.291	South Fork Catawba River
Maiden	DD		1.0	0.313	Clark Creek
Marion	DD		3.0	0.977	Muddy Creek
	DD		0.68	0.288	Nicks Creek
McAdenville	DD		0.13	0.036	South Fork
Mooresville	DD		7.5	3.957	Dye Creek
Morganton	DD		10.5	4.7	Catawba River
Mount Holly	DD		4.0	2.240	Catawba River
Newton	DD		7.5	1.753	Clark Creek
Old Fort	DD		0.9	0.142	Curtis Creek
Ranlo	I	Two Rivers Utilities	0.400	0.203	See TWU
Rhodhiss	I	Burke County	0.066	0.044	See Burke County
Rutherford College	I	Burke County	0.200	0.136	See Burke County
	I	Town of Valdese	0.200	0.165	See Town of Valdese
Sawmills	I	City of Lenoir	0.250	0.010	See Lenoir
Sedgefield Sanitary District	Data Unavailable				
Stanley	I	Two Rivers Utilities	0.200	0.163	See TWU
Taylorsville	I	City of Hickory	0.500	0.065	See Hickory
Troutman	I	City of Statesville	0.476	0.200	See Statesville
	I	City of Mooresville	2.000	0.001	See Mooresville
Two Rivers Utilities	DD		4.0	0.595	South Fork
	DD		16.0	6.2	South Fork
	DD		0.75	0.22	Long Creek Tributary
	DD		6.0	2.4	Crowders

Wastewater Utility	Direct Discharge (DD) or Interconnection (I)	Wastewater Interconnection	Design Capacity or Maximum Contract (MGD)	Average Annual Daily Discharge (MGD)	Receiving Stream(s)
Union County	DD		0.05	0.031	Clear Creek
	DD		1.9	1.189	North Fork Crooked Creek
	DD		0.231	0	Goose Creek
	DD		6.0	3.291	Twelve Mile Creek
	DD		0.05	0.03	Crooked Creek
	DD		0.15	0.052	Land Application
	I	Charlotte Water	3.00	2.285	See Charlotte Water
	I	Lancaster County, SC	0.025	0.010	
	I	Monroe	2.650	1.503	
Valdese	DD		7.5	1.9	Lake Rhodhiss

Appendix V: Wastewater utility rates for customers inside city limits
(All units shown in kgal for comparison)

	Annual Water and Wastewater Revenues	Estimated Number of Residential Sewer Connections	Existing Sewer Base Charge (Residential)	Sewer Rate at 5,000 Gallons (Residential)	Estimated Number of Commercial Sewer Connections	Existing Sewer Base Charge (Commercial)	Sewer Rate at 20,000 Gallons (Commercial)
Alexander County Bethlehem	$2,328,982	318	$19.55	$2.88	19	$19.55	$2.87
Baton Water Corporation		183			4		
Belmont	$6,046,318	4,168	$15.62	$8.10	298	$15.62	$8.10
Bessemer City	$3,546,112	2,112	$12.00	$9.19	149	$12.00	$9.19
Burke County	$1,481,228	126	$20.00	$4.54	3	$20.00	$4.54
Cajah's Mountain	$105,391		$21.82	$7.27		$21.82	$7.27
Carolina Water Service, Inc.			$33.02	$2.46		$33.02	$2.46
Charlotte Water	$3,356,959,937	220,646	$7.02	$6.03	18,209	$7.02	$6.03
Cherryville	$2,133,598	2,533	$16.00	$4.84	259	$20.00	$4.84
Claremont	$1,140,507	588	$18.27	$4.40	-	$20.30	$6.34
Conover	$3,945,895	3,451	$9.91	$3.33	218	$9.91	$3.33
Crossnore	$75,814	130	$15.50	$5.00	-	$15.50	$5.00
Dallas	$2,121,425	1,867	$9.70	$5.86	229	$9.70	$6.34
Drexel	$541,794	920	$15.75	$1.42	28	$15.75	$1.42
Gamewell	$47,867						$5.25
Granite Falls	$1,748,471	1,626	$12.85	$2.74	179	$14.33	$3.27
Hickory	$22,956,285	12,238	$14.55	$2.88	2,212	$14.55	$2.87
High Shoals	$188,095	109	$15.00	$10.00	4	$15.00	$15.00
Hildebran	$307,761		$18.00	$5.50		$22.00	$5.50
Lenoir	$8,367,409	8,773	$8.41	$3.56	716	$8.41	$3.56
Lincoln County	$7,673,169	3,591	$20.00	$4.72	261	$20.00	$5.38
Lincolnton	$8,380,928	3,517	$22.94	$6.82	470	$22.94	$6.82
Long View	$2,090,265	1,860	$18.00	$2.09	270	$18.00	$2.09

	Annual Water and Wastewater Revenues	Estimated Number of Residential Sewer Connections	Existing Sewer Base Charge (Residential)	Sewer Rate at 5,000 Gallons (Residential)	Estimated Number of Commercial Sewer Connections	Existing Sewer Base Charge (Commercial)	Sewer Rate at 20,000 Gallons (Commercial)
Lowell	$958,705	1,551	$8.75	$5.15	104	$9.04	$4.99
Maiden	$2,148,268	1,423	$14.47	$4.84	105	$14.47	$4.84
Marion	$3,088,810	2,841	$13.41	$2.20	211	$13.41	$2.20
McAdenville	$371,143	164	$4.00	$9.00	21	$4.00	$9.00
Mooresville	$19,635,753	11,465	$9.39	$6.28	1,903	$9.39	$6.28
Morganton	$10,526,607	5,799	$14.68	$2.74	877	$14.68	$2.74
Mount Holly	$6,530,248	5,149	$0.00	$3.07	330	$0.00	$4.74
Newton	$6,002,377		$27.90	$4.68		$27.90	$4.68
Old Fort	$432,603	400			47		
Ranlo	$1,143,042	1,343	$6.41	$6.41	31	$6.41	$6.41
Rhodhiss	$222,620	289	$15.60	$7.15	-	$15.60	$7.15
Rutherford College	$617,236	616	$16.00	$5.30	37	$16.00	$3.05
Sawmills	$703,961	383	$18.00	$5.00	8	$18.00	$5.00
Sedgefield Sanitary District	$115,360						$2.04
Stanley	$2,338,768	1,502	$10.00	$14.45	129	$26.65	$18.80
Statesville	$9,433,727		$10.34	$4.55		$10.34	$4.55
Taylorsville	$2,212,668	318	$18.78	$7.00	19	$17.50	$5.75
Troutman	$1,564,650	1,020	$21.60	$10.80	103	$21.60	$10.80
Two Rivers Utilities	$34,229,137	22,863	$15.81	$3.80	2,591	$15.81	$3.80
Union County	$29,773,736	29,378	$9.25	$4.40	1,574	$9.25	$4.40
Valdese	$4,799,219	2,124	$5.52	$1.84	77	$5.79	$1.93