



# Davie County



# East Davie Wastewater Master Plan

July 2012

# EAST DAVIE SEWER SYSTEM WASTEWATER MASTER PLAN

DAVIE COUNTY, NORTH CAROLINA

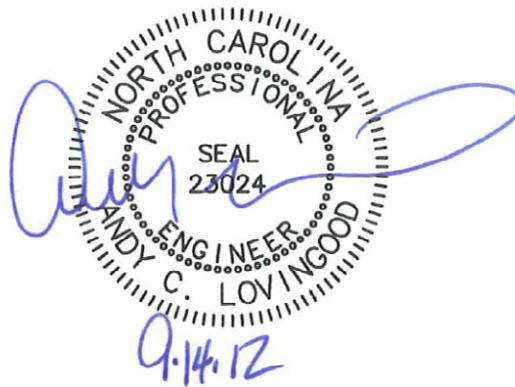


Engineering • Planning • Finance  
1240 19th Street Lane NW  
Hickory, North Carolina 28601

Firm License No.: C-0459

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## EXECUTIVE SUMMARY

Davie County provides sewer service to approximately 1,200 wastewater customers in the East Davie sewer system through a series of wastewater lift stations, force mains, and gravity sewers. The County has an inter-local agreement to discharge up to 550,000 gpd of wastewater to the Winston-Salem / Forsyth County Utility Commission (“WS/FC Utilities” or “Commission”) system for collection and treatment. The Town of Bermuda Run owns and operates a separate wastewater collection and treatment system that is permitted for 193,000 gallons per day (gpd).

Although not over-allocated yet, Davie County is concerned that its limited unallocated capacity could hamper economic development. Therefore, the County would like to maximize capacity in the existing system while planning for more capacity to accommodate anticipated growth in the eastern Davie County service area.

The County is reliant upon WS/FC Utilities for the treatment of the East Davie sewer flows. As such, the County has little control and influence over future wastewater treatment costs and future capacity.

McGill Associates was commissioned to prepare this Master Plan as a road map for the future of the East Davie Sewer System. This plan considers capacity needs, conveyance and treatment alternatives and costs to meet these capacity needs, and a Capital Improvements Plan with a financial model to carry the system into the next 10 years.

## **Goals and Objectives**

This study evaluated the East Davie sewer system to accomplish these major goals:

- Maximize / increase capacity to accommodate future growth and economic development
- Develop a realistic pathway forward through capital improvements planning (CIP)
- Review the financial viability of water and sewer fund while accomplishing the projects developed through the CIP process

## **Key Deliverables**

1. A Capital Improvements Plan (CIP) with prioritized projects
2. A financial analysis with related revenue models
3. Capacity analysis tool for determining allowable flow contributions.
4. Alternative analysis to determine the most appropriate long-term treatment solution.

## **Master Plan Sections**

The Master Plan includes the following sections. We have highlighted the key aspects and condensed those for your review on the following pages.

- Section 2 – Existing System Evaluation
- Section 3 – Capacity Analysis
- Section 4 – Alternatives Analysis
- Section 5 – Capital Improvements Plan
- Section 6 – Financial Analysis and Plan
- Section 7 – Conclusion
  - Bermuda Run Considerations

## Existing System Evaluation

Wastewater generated from residential, commercial, and industrial customers is collected by the wastewater collection systems. The County's collection system is divided into three (3) separate basins. The East Davie system receives flow from the eastern portions of the County as well as portions of Bermuda Run, and is treated by WS/FC Utilities' Muddy Creek WWTP. The Central Davie system serves areas in the central portion of the County (north and just east of the Town of Mocksville), and is generally treated at Mocksville's Dutchmans Creek WWTP with some waste being treated in Cooleemee. The Southwestern system generally serves the Town of Cooleemee and adjacent areas, and is treated at the County's Cooleemee WWTP. The focus of this report is the East Davie sewer system.

The Existing System Evaluation reviews the condition and capacity of existing wastewater collection, pumping, and treatment facilities related to the East Davie sewer system. Major discussion items include:

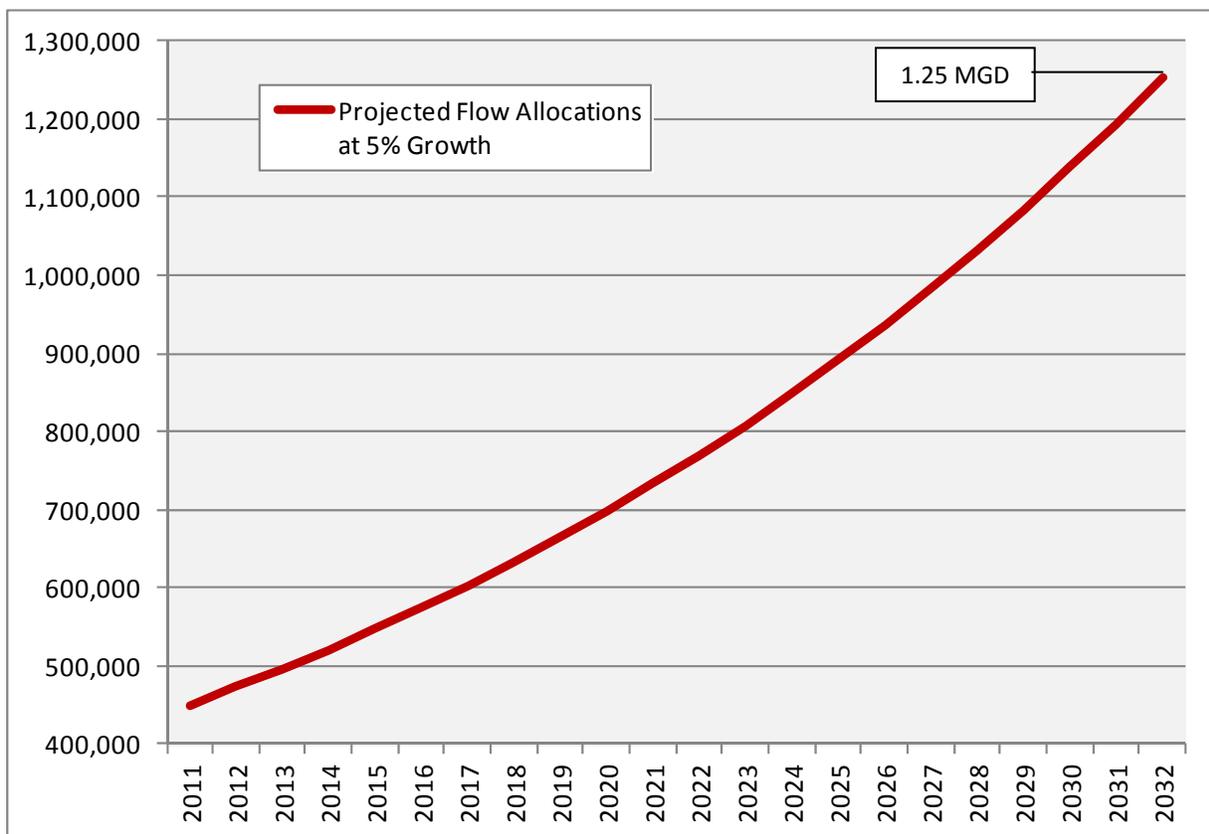
- Condition and capacity of major sewers in the East Davie system
- Condition and capacity of pump stations in the East Davie system
- Bermuda Run WWTP in eastern Davie County owned by Town of Bermuda Run
- Cooleemee WWTP in southwestern Davie County owned by Davie County
- Dutchman Creek WWTP in central Davie County owned by Town of Mocksville
- Inflow and infiltration (I/I) impacts upon the East Davie system

## Capacity Analysis

Projected wastewater flow allocations and average daily flows have been projected over the 20-year planning period. The State Data Center population projections for Davie County were somewhat minimal at 0.63%. Reviewing these projections with County staff, an annual growth rate of 5.0% for the 20-year planning period was chosen for the wastewater flows. The chart below outlines those projections for both the flow allocations and average daily flows.

**Figure ES.1 – Wastewater Flow Projections**

*East Davie Wastewater Master Plan*



Based upon the projected flow allocations at 5.0% growth for the East Davie sewer system, an estimated capacity of 1.25 million gallons per day (MGD) is needed in the Year 2032. With the current allocation to WS/FC Utilities at 0.55 MGD, additional capacity is needed in the very near future.

## Alternatives Analysis

Insufficient capacity is a concern for the County for the East Davie Sewer System. Many viable capacity management alternatives for the East Davie sewer collection system were considered. The three (3) most feasible alternatives for future system capacity are as follows:

1. Continue Pumping to WS/FC Utilities with Expanded Capacity
2. Pump to an Expanded Cooleemee WWTP
3. Construct a New Wastewater Treatment Facility

The County pumps all wastewater collected in the East Davie Sewer System to WS/FC Utilities for final treatment. The County's flow allocation is currently limited to 550,000 gallons per day. Capacity limitations within that portion of WS/FC Utilities' collection system would require facility upgrades. Davie County's Cooleemee WWTP is over 18 miles away from the eastern service area and located in a separate sub-basin of the Yadkin River Basin. Hence, the costs of wastewater conveyance to the opposite side of the County plus expanded capacity and upgraded treatment are excessive. Pumping wastewater to Cooleemee also brings long-term operational challenges with many pump stations and with wastewater traveling through long force mains. Although a new wastewater treatment plant involves planning and permitting considerations, the initial capital costs are the lowest of the alternatives. As wastewater flows and rates increase, the 20-year present worth is considerably less than that of retaining service with WS/FC Utilities.

**Table ES.1 – Alternatives Summary**  
*East Davie Wastewater Master Plan*

<b>Alternative No.</b>	<b>Alternative Description</b>	<b>Total Project (Capital) Costs</b>
1	Continue Pumping to WS/FC Utilities with Expanded Capacity (includes capacity charge)	\$18,012,000
2	Pump to an Expanded Cooleemee WWTP	\$25,482,000
3	Construct a New Wastewater Treatment Facility	<b>\$16,944,000</b>

## **Capital Improvements Plan**

The Capital Improvements Plan (CIP) is a plan and schedule of anticipated and required capital expenditures for facilities with project needs, estimated project costs, and timing of work over a planning period. The CIP is an important planning tool that allows the County to prepare for upcoming projects and to proactively determine funding. The CIP considers that each project is planned to be paid using the following sources:

1. Grant funds,
2. A capital outlay in a specific fiscal year,
3. New debt issuances resulting in annual debt service payments, or
4. A combination of the above items.

The recommended capital projects are identified needs to maintain existing facilities, and for the County to continue providing a high level of service over the next 10+ years. The required capacity and timing of each recommended project is provided for budgeting and financial projection purposes only. Actual design parameters should be evaluated at the commencement of the design phase of each project using updated and project specific information.

In order to coordinate potential revenue sources to short-term and long-term needs, the CIP prioritizes the capital projects over the 10-year planning period. The recommended capital projects and tentative schedules are more thoroughly discussed in Sections 5 and 6 of the Master Plan.

## **Financial Analysis and Plan**

An essential component of the overall approach is to establish a realistic and strategic path for addressing the wide range of financial issues in implementing the recommended capital projects. This fiscal planning process begins with the understanding that the financial approach must be integrated into the planning process. This financial analysis and plan represents a joint effort with Davie County to address the County's water and sewer capital improvements plan (CIP), financial status, and rates. Below are the objectives:

- Categorize the County's costs of providing water and sewer service.
- Determine the adequacy of existing rates and charges to fund operating and capital costs.
- Develop a financial analysis and rate model for Davie County
- Propose rates that address State drought legislation and maintain positive net income.

As a result of this analysis, water and sewer revenue increases have been modeled for financing system growth, inflation, and capital needs. These increases would affect only fixed and volume charges. Revenue increases are arranged in time to minimize the impact to most users. Proposed revenue increases are based upon the County's flow projections.

The County should begin updating the 10-Year Water and Sewer CIP on an annual basis. As water and sewer capital projects are added or revised over the years, the CIP is a very beneficial tool for setting annual budgets and planning for future expenditures. Water and sewer rates can be revised to match not only the needs for the upcoming year, but for the long-term requirements of the water and sewer fund.

## Conclusion

The planning effort for the East Davie Sewer System was timely and beneficial considering the County's growth situation. The major recommendations from this report include:

1. **Obtain an additional 200,000 gallons per day (gpd) capacity from WS/FC Utilities.** This would increase the total allocation for the East Davie Sewer System to 750,000 gpd.
2. **Begin planning efforts for a New WWTP.** Planning for a new wastewater treatment plant requires many years. The permitting process for a new wastewater discharge and property location process will require proper planning.
3. **Continue to prepare the water and sewer fund financially for a new WWTP and sewer system improvements.** The revenues and expenditures need to be managed with respect to rates and fund balance to prepare for future capital investments. The County should update the 10-Year Water and Sewer CIP on an annual basis. Actual flows, expenditures, and revenues each year may affect the timing and need of CIP projects.
4. **Prepare an interceptor sewer analysis for the new gravity sewer and other sewers needed for a new WWTP.** Once the WWTP site is established, an analysis is warranted to maximize the existing capacity and provide capacity for future flows.

## Bermuda Run Considerations

The Town of Bermuda Run has an aging packaged wastewater treatment plant with a capacity of 0.19 MGD. The facility's limited remaining capacity coupled with future anticipated nutrient removal requirements could greatly impact the Bermuda Run WWTP.

The County's new WWTP is proposed to be situated in eastern Davie County, south of Bermuda Run, providing a centralized system for wastewater treatment in the eastern area of the County. The new WWTP would be sized for current wastewater flows with capacity to allocate flows for other entities within the County. If the Town of Bermuda Run considers abandoning its plant in the future, the County could work with the Town to serve those customers on the Bermuda Run package plant. If the Town chose to decommission its package plant, a pump station and force main would be needed at a cost of approximately \$990,000 to direct wastewater flows to the County's new WWTP.

Davie County is located in the Piedmont region of North Carolina, just west of the Triad of Winston Salem/Greensboro/High Point. Being located near a growing metropolitan area, Davie County shares in the residential, commercial, and industrial growth. To accommodate the current growth, Davie County has developed a wastewater collection system that serves a portion of the area surrounding Bermuda Run and around the exit 180 interchange on I-40.

Davie County provides sewer service to approximately 1,200 wastewater customers in the East Davie sewer system through a series of wastewater lift stations, force mains, and gravity sewers. The County has an inter-local agreement to discharge up to 550,000 gpd of wastewater to the Winston-Salem / Forsyth County Utility Commission (“WS/FC Utilities” or “Commission”) system for collection and treatment. The Town of Bermuda Run owns and operates a separate wastewater collection and treatment system that is permitted for 193,000 gallons per day (gpd).

### **1.1. Need for Assessment**

Although not over-allocated yet, Davie County is concerned that its limited unallocated capacity could hamper economic development. Therefore, the County would like to maximize capacity in the existing system while planning for more capacity to accommodate anticipated growth in the eastern Davie County service area. The County is also reliant upon WS/FC Utilities for the treatment of the East Davie sewer flows. As such, the County has little control and influence over future wastewater treatment costs and future capacity in East Davie.

Davie County has identified the need to perform a comprehensive analysis of its eastern sewer service area. Long term planning and recommendations are needed for wastewater capital improvement projects. The County desires to identify and prioritize wastewater system improvements needed to comply with future regulatory requirements, maintain system capacity and reliability, and accommodate growth within the eastern Davie County service area.

McGill Associates was commissioned to prepare this Master Plan as a road map for the future of the East Davie Sewer System. This plan considers capacity needs, conveyance and treatment alternatives and costs to meet these capacity needs, and a Capital Improvements Plan with a financial model to carry the system into the next 10 years.

## **1.2. Goals and Objectives**

The County desires to plan for future growth in eastern Davie County. Based upon discussions with staff, this study evaluated the East Davie sewer system to accomplish these major goals:

- Maximize / increase capacity to accommodate future growth and economic development in the eastern Davie service area.
- Develop a realistic pathway forward through capital improvements planning (CIP)
- Review the financial viability of the Water and Sewer Fund while accomplishing the projects developed through the CIP process

While completing this study, McGill Associates reviewed permits, reports, and all documents provided by the County. Criteria and assumptions were developed to form the basis for the recommendations. Flow projections were based upon anticipated population growth by Davie County staff. Also, water capital projects are included with input from Davie County staff.

## **1.3. Key Deliverables**

We understand that the key deliverables are as follows:

1. A Capital Improvements Plan (CIP) with prioritized projects
2. A financial analysis with related revenue models
3. Capacity analysis tool for determining allowable flow contributions.
4. Alternative analysis to determine the most appropriate long-term treatment solution.

This master plan includes the following major topics and sections:

- Section 2 – Evaluation of Existing Sewer Facilities
- Section 3 – Capacity analysis
- Section 4 – Alternatives analysis
- Section 5 – Capital projects and costs
- Section 6 – Financial analysis and plan
- Section 7 – Conclusion
  - Bermuda Run Considerations

Wastewater generated from residential, commercial, and industrial customers is collected by the wastewater collection systems. The County's collection system is divided into three (3) separate basins. The East Davie system receives flow from the eastern portions of the County as well as portions of Bermuda Run, and is pumped treated by WS/FC Utilities' Muddy Creek WWTP. The Central Davie system serves areas in the central portion of the County (north and just east of the Town of Mocksville), and is generally treated at Mocksville's Dutchmans Creek WWTP with some waste being treated in Cooleemee. The Southwestern system generally serves the Town of Cooleemee and adjacent areas, and is treated at the County's Cooleemee WWTP. The focus of this report is the East Davie sewer system.

This section reviews the condition and capacity of existing wastewater collection, pumping, and treatment facilities related to the East Davie sewer system. Major discussion items include:

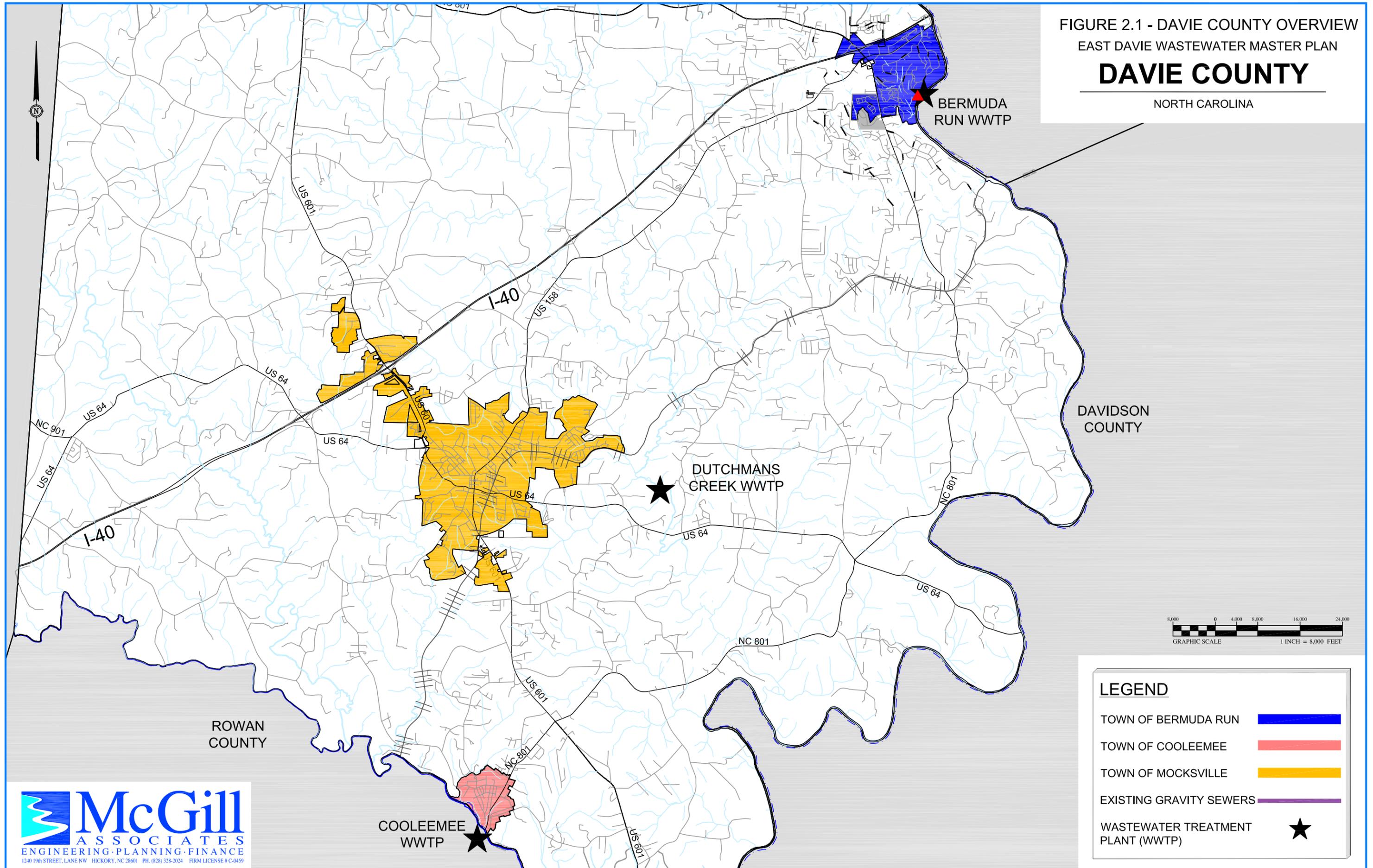
- Condition and capacity of major sewers in the East Davie system
- Condition and capacity of pump stations in the East Davie system
- Bermuda Run WWTP in eastern Davie County owned by Town of Bermuda Run
- Cooleemee WWTP in southwestern Davie County owned by Davie County
- Dutchman Creek WWTP in central Davie County owned by Town of Mocksville
- Inflow and infiltration (I/I) impacts upon the East Davie system

### **2.1. Wastewater Collection**

Davie County owns and maintains approximately 40 miles of wastewater collection lines with six (6) wastewater pump stations in the East Davie sewer system. Existing gravity sewer lines range in size from 8-inch to 10-inch in diameter.

Figure 2.1 shows an overview map of Davie County and the related treatment facilities.

FIGURE 2.1 - DAVIE COUNTY OVERVIEW  
 EAST DAVIE WASTEWATER MASTER PLAN  
**DAVIE COUNTY**  
 NORTH CAROLINA



**LEGEND**

- TOWN OF BERMUDA RUN
- TOWN OF COOLEEMEE
- TOWN OF MOCKSVILLE
- EXISTING GRAVITY SEWERS
- WASTEWATER TREATMENT PLANT (WWTP)

### 2.1.1. Existing Infrastructure Capacities

Davie County provides sewer service to approximately 1,200 wastewater customers in the East Davie sewer system. This service area includes six (6) wastewater lift stations, force mains, and gravity sewers. The County has an interlocal agreement to send up to 550,000 gpd of wastewater to Winston-Salem Forsyth County Utility Commission (WS/FC Utilities) for treatment. This agreement includes surcharge fees for influent wastewater constituents. The Town of Bermuda Run has a separate wastewater collection and treatment system for its service area.

Table 2.1 includes a summary of the existing pump stations in the East Davie service area.

**Table 2.1. Wastewater Pump Stations**  
*East Davie Wastewater Master Plan*

Name	Pump Type	Capacity	Wet Well Diam.	Downstream Pump Station	Sewer In	Force Main	Standby Generator
JeffCo	Piranha	-----	4 ft	Yadkin River	8" (assumed)	2" PVC	No
Kinderton	Gorman-Rupp	-----	8 ft	Yadkin River	8" PVC (GS)	6" PVC	Yes
Medical Park	Piranha	32 gpm	6 ft	Yadkin River	8" PVC (GS)	3" PVC	No
Oak Valley	F.E. Myers	245 gpm	6 ft	Smith Creek	(3) 8" PVC (GS)	8" PVC	Yes
Smith Creek	Fairbanks-Morse	610 gpm	8 ft	Yadkin River	8" PVC (FM) / 10" PVC (GS)	10" PVC	Yes
Yadkin River	Gorman-Rupp	520 gpm	10 ft	<i>Tanglewood</i>	10" PVC (GS)	10" DI	Yes

- Notes:
1. Smith Creek Pump Station is planned to be upgraded to 1,050 gpm pumps to handle additional wastewater flow the from Baptist Hospital facility.
  2. Yadkin River Pump Station is planned to be upgraded to 1,286 gpm pumps to handle additional wastewater flow from the Smith Creek Pump Station.
  3. Tanglewood Pump Station is owned and operated by WS/FC Utilities.
  4. The I-40 Rest Area Pump Station also contributes flow to this system.

We have reviewed previous sources of wastewater collection system mapping for the East Davie sewer system. Several key sections of the sewer collection system appear to have inadequate capacity to carry future peak flows. The first section is the existing 10-inch gravity sewer line flowing to the Yadkin River Pump Station. Drawings are not available to confirm the slope of the existing sewer line. However, if the sewer was originally installed at a minimum grade of 0.30 percent, the existing full pipe (i.e. peak) capacity would be 0.78 MGD (538 gpm). For comparison purposes, a slope of 1.0 percent would provide a full pipe capacity of 1.42 MGD (983 gpm). The grade and capacity of this line should be verified prior to completion of the Smith Creek Pump Station improvements.

Further, the existing gravity sewer along Smith Creek, through the Oak Valley community is only an 8-inch line, which likely is near minimum grade (full pipe capacity of 0.49 MGD). Finally, the last section of piping that gives concern for limited capacity is the 10-inch force main from the Yadkin River pump station, which carries flow to WS/FC Utilities. This force main would have a capacity of 1,470 gpm assuming a maximum velocity of 6.0 feet per second.

### **2.1.2. Existing Infrastructure Conditions**

The wastewater collection facilities in the East Davie Sewer System are newer than most systems of comparable size. Most of the pump stations and sewer lines were installed within the past 20 years. Most sewer lines in the ground are constructed of PVC, which generally have a service life of at least 50 years.

The presence of infiltration (*water entering a wastewater collection system from the ground through open joints, manhole walls, and other cracks or leaks in the system*) and inflow (*water entering a collection system through roof drains, storm drains, manhole covers, etc., and is generally a result of significant rainfall*) -- referred to as (I/I) -- in a sewer system results in sanitary sewer overflows in a collection system, solids washout and overflows at wastewater treatment facilities, and increased costs for wastewater treatment. The issue of I/I could be a costly one, particularly for Davie County since every gallon of wastewater collected and transferred from the East Davie Sewer System to WS/FC Utilities is assessed unit volume charges. Obviously, any flow from I/I sources would result in unnecessary sewer use charges.

Since the entire amount of wastewater in the East Davie sewer system flows to the Yadkin River Pump Station, flow records were reviewed to determine any abrupt increases in wastewater flows during rain events. This would indicate a certain amount of I/I in the collection system. Further, the Yadkin River Pump Station flow records were used in combination with individual wastewater pump station run times throughout the system. By comparing these two sets of data, I/I could be indicated by high pump run times at a particular pump station coinciding with high flows at the Yadkin River Pump Station. The resulting data outliers would have given Davie County staff a general location within the system to pinpoint as likely sources of inflow and/or infiltration. No specific problem areas stood out during the cursory review.

The next step would be to further dissect potential problems using sewer system maps to target areas for I/I investigation. Typically, when viewing sewer mapping, target areas include manholes with intersecting pipe lines, manholes at creek crossings, and manholes along low lying creek beds which are prone to flooding, all of which are historically good indicators and observation points for I/I issues. Once these areas have been identified with mapping, staff members should perform field visits and physically locate points in the collection system that are, or obviously have been, points of I/I in the collection system.

An infiltration/inflow program for Davie County would include the following items:

1. Sewer System Field Inspection: This task includes a physical inspection of the sewer lines that would be identified as outlined above, to detect obvious sources of inflow (i.e., sewer line joints in streams, ponds or wetlands, storm sewer cross connections, removed or damaged manhole covers, etc.) Identify specific sewer lines to be smoke tested.
2. Monitoring of wastewater pump stations: This task involves closely monitoring and recording pump run times during rain events.
3. Smoke Testing: This task includes smoke testing sections of specific gravity sewer lines only. A large number of lines are force mains that will not need to be tested.
4. Flow Monitoring: This task includes flow monitoring at several strategic locations to quantify the amount of inflow in the system.
5. Findings: Summarize findings of sewer system evaluation, identify rehabilitation measures to reduce inflow, and estimate costs to implement the rehabilitation measures.

Repairs to a wastewater collection system may vary from simplistic to complex and relatively expensive. Root intrusion can be remedied with aquatic herbicides and existing sewer easements can be cleared of vegetation to avoid future pipeline and manhole intrusions. Leaking manholes should be closely inspected, and sealed with a non-shrink grout at all precast section joints. Decrepit manholes that are excessively leaking could be rehabilitated using one of the several types of spray-on lining system while installing water-tight manhole lids. When installing water-tight manhole lids, special attention should be given to ensure the sewer lines are properly vented.

In addition to the repairs described above, the County may also want to consider implementing a Sewer System Inspection and Rehabilitation program to continually track and locate specific sources of I/I into the sanitary sewer system. While field investigations and smoke testing are typically beneficial in locating numerous sources of I/I, smoke testing usually will not locate sources of I/I in areas where sewer lines are located *below* the groundwater table or in force main sewers. The county could include funds in their annual budget for I/I removal, consisting of cleaning and video inspecting existing sewer lines to locate additional leaks, deficiencies, and sources of I/I. Thereafter, problem areas could be repaired or corrected using County staff.

## **2.2. Wastewater Treatment**

There are three (3) primary wastewater treatment facilities in Davie County. The Cooleemee WWTP is located in southwestern Davie County and treats wastewater flows for the Town of Cooleemee and other wastewater generated in the County. The Dutchman Creek WWTP is located to the east of Mocksville and treats primarily the Town of Mocksville's wastewater flows. The Bermuda Run WWTP is located in eastern Davie County on the edge of Bermuda Run on the Yadkin River. This facility treats a portion of the Town of Bermuda Run's wastewater flows. The remainder of wastewater generated in Davie County, primarily in the eastern area of the County and Bermuda Run, is pumped to WS/FC Utilities' system in Forsyth County. This flow is ultimately collected and treated at the Muddy Creek WWTP owned and operated by WS/FC Utilities.

The Bermuda Run WWTP noted above is an aging package plant with a capacity of 193,000 gpd. The other two (2) WWTPs in the County include Davie County's Cooleemee WWTP that discharges to South Yadkin River and the Town of Mocksville's WWTP that discharges to Dutchman Creek.

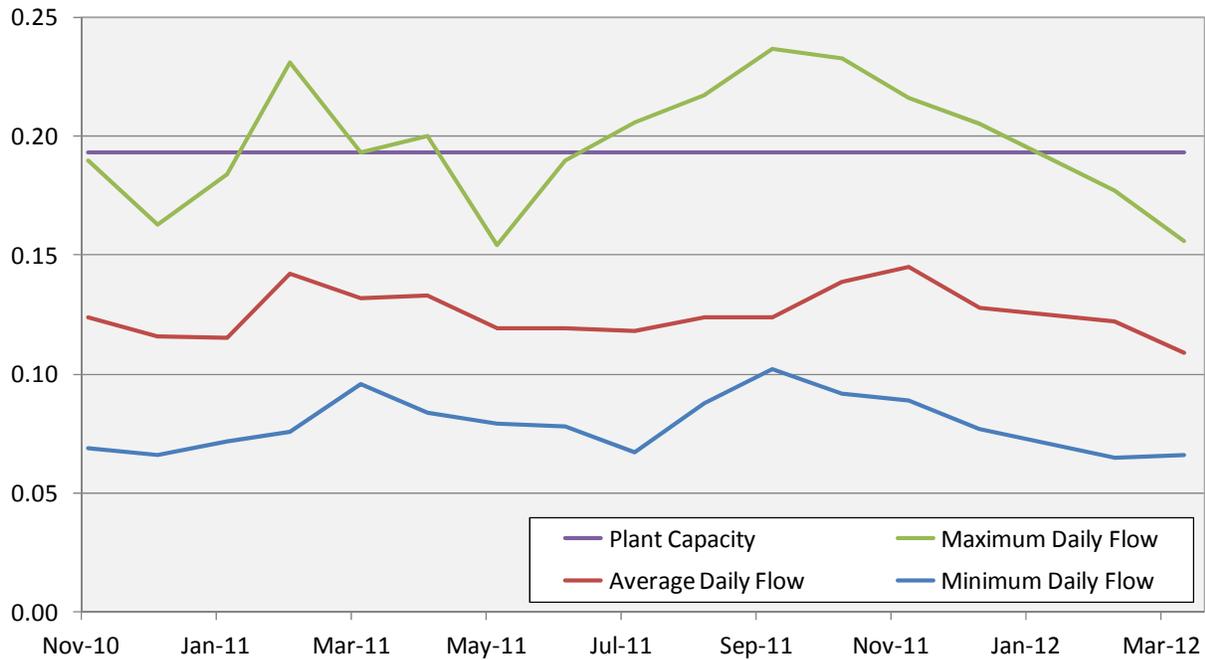
This section reviews the Bermuda Run and Cooleemee WWTPs to determine if they would be feasible for gaining system capacity. We understand from discussions with County staff that the Town of Mocksville is not interested in combined wastewater infrastructure. The Dutchman Creek WWTP has only been considered briefly in this section.

### 2.2.1. Bermuda Run WWTP

The Bermuda Run Wastewater Treatment Plant, which serves a portion of the Town of Bermuda Run in eastern Davie County, is owned by the Town of Bermuda Run. The facility is rated to treat and discharge up to **193,000 gpd** of treated effluent to the Yadkin River under NPDES Permit No. NC0055158. The plant treated an average daily flow of 0.13 MGD between December 2010 and April 2012. Refer to Figure 2.2 for average wastewater flow treated at this facility.



**Figure 2.2. Bermuda Run WWTP Flow Rates**  
*East Davie Wastewater Master Plan*



The Town of Bermuda Run has approximately 800 customers in its original gated community bounded by Highways 158 & 801 that flow to its plant. The Bermuda Run WWTP is an aging, package plant with an extended aeration wastewater treatment process. The package plant includes the following treatment components: influent pumping with high-level alarm, bar screen, flow splitter box, two (2) extended aeration tanks in parallel, two (2) clarifiers in parallel, two (2) aerobic sludge digesters, chlorinator, and chlorine contact tank.

The NPDES permit issued by the North Carolina Department of Environment and Natural Resources includes effluent limits for flow, BOD<sub>5</sub>, total suspended solids (TSS), fecal coliform, total residual chlorine, and pH. The permit requires the performance of chronic toxicity tests on a quarterly basis. Table 2.2 presents a summary of the effluent limits, and the current NPDES permit is provided in Appendix C.

**Table 2.2. Bermuda Run WWTP NPDES Permit**  
*East Davie Wastewater Master Plan*

Effluent Characteristics	Effluent Limits	
	Monthly Average	Weekly Average
Flow	0.193 MGD	---
BOD, 5-Day	30 mg/L	45 mg/L
Total Suspended Solids	30 mg/L	45 mg/L
NH <sub>3</sub> -N	None	None
Fecal Coliform	200/100 ml	400/100 ml
Total Residual Chlorine	Daily maximum = 28 µg/L	
pH	≥ 6.0 and ≤ 9.0 (at all times)	

Note: Permit expires on January 31, 2014

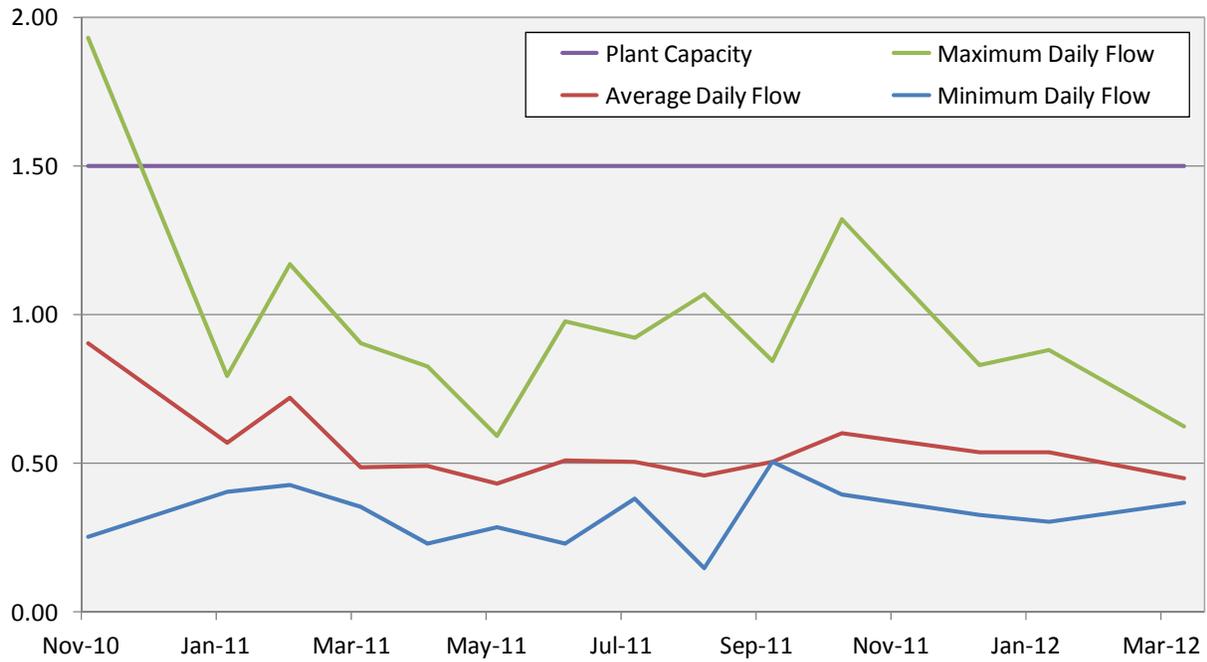
We understand that this facility is aging and nearing the end of its useful life. The 2010 Annual Performance Report reported no violations for the 2010 calendar year, however the facility continues to age. DWQ reports stated that a new chlorination and dechlorination system was planned to be installed in early 2011, and that an I/I study was prepared in 2010-2011 for the Bermuda Run collection system.

### 2.2.2. Cooleemee WWTP

The Cooleemee Wastewater Treatment Plant, which generally serves the southwestern corner of Davie County, is owned and operated by Davie County. The facility is rated to treat and discharge **1.50 MGD** of treated effluent to the South Yadkin River under NPDES Permit No. NC0024872. The plant treated an average daily flow of 0.55 MGD between December 2010 and April 2012. Refer to Figure 2.2 for average wastewater flow treated at this facility.



**Figure 2.3. Cooleemee WWTP Flow Rates**  
*East Davie Wastewater Master Plan*



The Cooleemee WWTP has an extended aeration wastewater treatment process. The plant was previously a dye / industry plant that was converted to a domestic wastewater treatment plant by partitioning basins. The facility includes the following treatment components: mechanical fine screen, influent pump station, 3 million gallon equalization/surge basin, extended aeration, clarifiers, chlorination, contact chamber, dechlorination, flow measurement, aerobic digester, and land application. Residuals are land applied by EMA Associates under Non-Discharge Permit No. WQ0010583.

The NPDES permit issued by the North Carolina Department of Environment and Natural Resources includes effluent limits for flow, BOD<sub>5</sub>, total suspended solids (TSS), fecal coliform, total residual chlorine, and pH. The permit requires the performance of chronic toxicity tests on a quarterly basis. Table 2.3 presents a summary of the effluent limits, and the current NPDES permit is provided in Appendix D.

**Table 2.3. Cooleemee WWTP NPDES Permit**  
*East Davie Wastewater Master Plan*

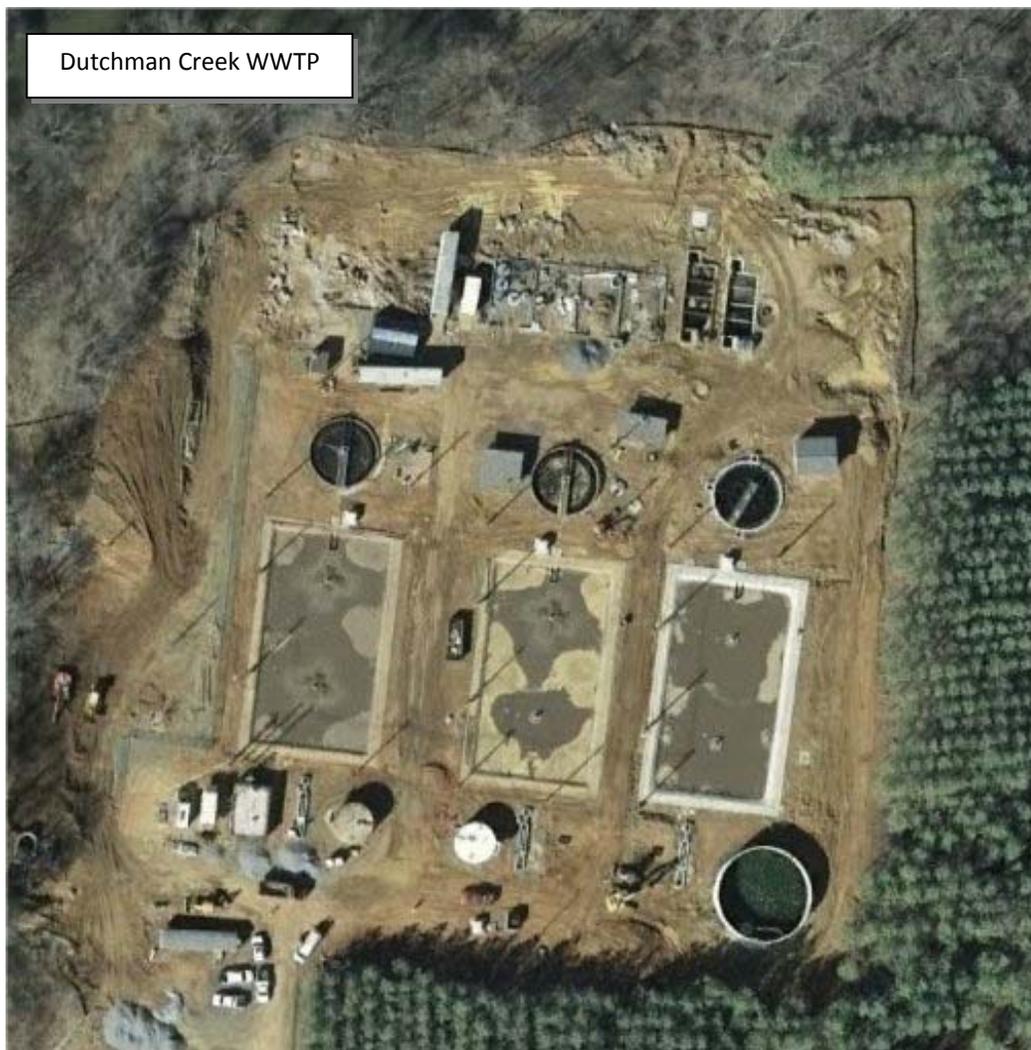
Effluent Characteristics	Effluent Limits	
	Monthly Average	Weekly Average
Flow	1.50 MGD	---
BOD, 5-Day	30 mg/L	45 mg/L
Total Suspended Solids	30 mg/L	45 mg/L
NH <sub>3</sub> -N	None	None
Fecal Coliform	200/100 ml	400/100 ml
Total Residual Chlorine	Daily maximum = 28 µg/L	
pH	≥ 6.0 and ≤ 9.0 (at all times)	

Note: Permit expires on April 30, 2014

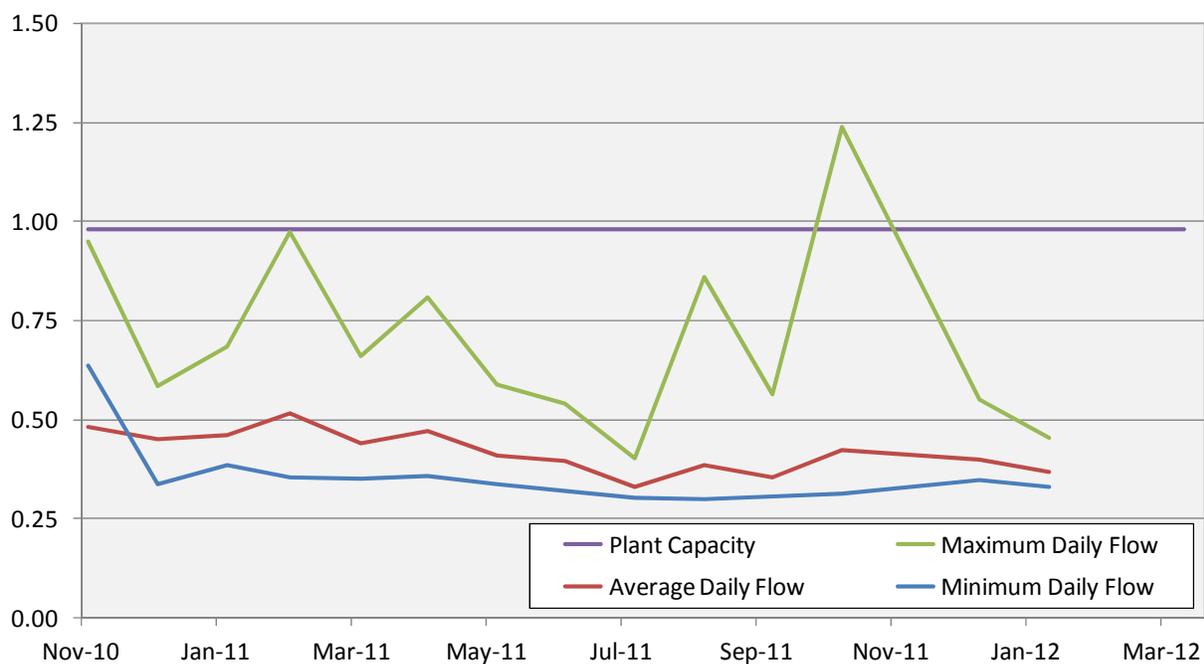
The plant appears to be in general compliance with its NPDES permit. The facility has violated its total suspended solids limit several times over the past few years due to rainfall induced I/I. For example, in January 2010, the facility received 6.3 MG over a three-day period resulting in a peak effluent suspended solids of 150 mg/L.

### 2.2.3. Dutchmans Creek WWTP

The Dutchmans Creek Wastewater Treatment Plant, which serves the Town of Mocksville and surrounding areas in Davie county, is owned by the Town of Mocksville and contract operated by Davie County. The facility is rated to treat and discharge **0.98 MGD** of treated effluent to the Dutchmans Creek upstream of Yadkin River under NPDES Permit No. NC0021491. The plant treated an average daily flow of 0.42 MGD between December 2010 and April 2012. Refer to Figure 2.3 for average wastewater flow treated at this facility.



**Figure 2.4. Dutchmans Creek WWTP Flow Rates**  
*East Davie Wastewater Master Plan*



The Dutchmans Creek WWTP has an extended aeration wastewater treatment process. The facility includes the following treatment components: influent pump station with mechanical fine screening, flow splitter box, grit removal chambers with manual bar screens, flow measurement, three (3) aeration basins, three (3) secondary clarifiers, chlorination and dechlorination units, sludge recirculation and wasting, aerobic digester, and solids storage.

The NPDES permit issued by the North Carolina Department of Environment and Natural Resources includes effluent limits for flow, BOD<sub>5</sub>, total suspended solids (TSS), fecal coliform, ammonia, total residual chlorine, cadmium, dissolved oxygen, and pH. The permit requires the performance of chronic toxicity tests on a quarterly basis. Table 2.4 presents a summary of the effluent limits, and the current NPDES permit is provided in Appendix E.

**Table 2.4. Dutchmans Creek WWTP NPDES Permit**  
*East Davie Wastewater Master Plan*

Effluent Characteristics	Effluent Limits	
	Monthly Average	Weekly Average
Flow	0.98 MGD	---
BOD <sub>5</sub> (4/1 – 10/30)	5.0 mg/L	7.5 mg/L
BOD <sub>5</sub> (11/1 – 3/31)	10 mg/L	15 mg/L
Total Suspended Solids	30 mg/L	45 mg/L
Fecal Coliform	200/100 ml	400/100 ml
NH <sub>3</sub> -N (4/1 – 10/30)	2.0 mg/L	6.0 mg/L
NH <sub>3</sub> -N (11/1 – 3/31)	4.0 mg/L	12.0 mg/L
Total Residual Chlorine	Daily maximum = 28 µg/L	
Cadmium	7 µg/L	15 µg/L
Dissolved Oxygen (4/1 – 10/30)	Daily average = 6.0 mg/L	
Dissolved Oxygen (11/1 – 3/31)	Daily average = 5.0 mg/L	
pH	≥ 6.0 and ≤ 9.0 (at all times)	

Note: Permit expires on June 30, 2014

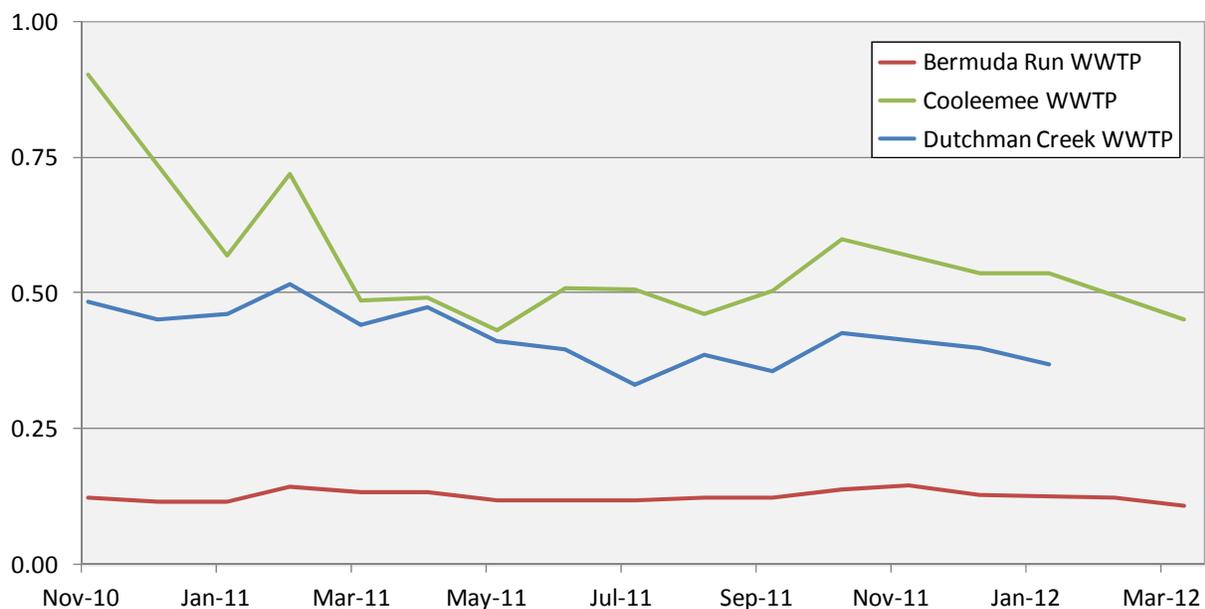
The plant appears to be in general compliance with its NPDES permit. The facility has violated its BOD limit several times in 2010, with individual violations for toxicity, ammonia, and dissolved oxygen.

## 2.2.4. WWTP Summary

The Bermuda Run WWTP treated monthly average flows ranging from 0.11 to 0.15 MGD from late 2010 to early 2012. During this same time period, the Cooleemee WWTP treated monthly average flows ranging from 0.43 to 0.90 MGD. Mocksville’s Dutchman Creek WWTP treated monthly average flows ranging from 0.33 to 0.51 MGD. Figure 2.5 shows these flow rates, while Table 2.5 summarizes the minimum, average, and maximum flow rates.

**Figure 2.5. Monthly Average Flow Rates**

*East Davie Wastewater Master Plan*



**Table 2.5. Daily Flow Rates (Dec. 2010 to April 2012)**

*East Davie Wastewater Master Plan*

Description	Bermuda Run WWTP	Cooleemee WWTP	Dutchman Creek WWTP
Minimum Daily Flow	0.07	0.15	0.30
<b>Average Daily Flow</b>	<b>0.13</b>	<b>0.55</b>	<b>0.42</b>
Maximum Daily Flow	0.24	1.93	1.24
<b>Plant Capacity</b>	<b>0.193</b>	<b>1.50</b>	<b>0.98</b>
Average Flow %	65%	37%	43%

### 2.3. Operation and Maintenance Costs

Davie County has published its current Fiscal Year 2013 budget for the Public Utilities Fund. The East Davie Sewer budget has been reviewed with a summary in Table 2.6.

**Table 2.6. East Davie Sewer Budget (FY 2013)**

*East Davie Wastewater Master Plan*

Category	East Davie Sewer Budget
Employee Salaries & Benefits	\$ 45,088
Supplies	\$ 7,600
Chemicals	\$ 2,500
General Employee Expenses	\$ 7,600
Utilities	\$ 28,000
Purchased Services	\$ 2,500
WS/FC Utilities Charge	\$ 636,000
Consultants	\$ 2,000
Maintenance	\$ 92,000
Equipment and Furniture	\$ 11,000
Sewer Improvements	\$ 15,000
<b>Budget Totals</b>	<b>\$ 849,288</b>

The East Davie sewer system has a total FY 2013 budget of \$849,288. This budget includes collection O&M costs, pumping O&M costs, and WS/FC Utilities payments for collection and treatment. Based upon the average wastewater flow of 0.258 MGD discussed later in this report, the average cost for WS/FC Utilities is estimated to be \$6.75 per 1,000 gallons treated. Considering the total system budget required for the East Davie sewer budget, the effective rate for East Davie sewer is \$9.02 per 1,000 gallons treated.

$$\text{WS/FC Effective Rate} = \$636,000 / (0.258 \text{ MGD} \times 365 \text{ days} \times 1,000) = \underline{\$6.75 \text{ per 1,000 gallons}}$$

$$\text{Total Effective Rate} = \$849,288 / (0.258 \text{ MGD} \times 365 \text{ days} \times 1,000) = \underline{\$9.02 \text{ per 1,000 gallons}}$$

The next section will review the current usages and flow allocations in eastern Davie County. Flow projections will be provided to plan for 10-year and 20-year County expenditures.

Of growing concern for sewer system owners is the allocation of system capacity, particularly the capacity of wastewater treatment infrastructure. New emphasis is being placed on efficiently managing the allocation of capacities to preserve valuable capacity for future development and to insure that allocations result in the revenues necessary to sustain the enterprise fund. The effective management of capacity allocation encompasses the efficient allocation of future system capacity and reclaiming unused past allocations, either in the form of forfeited allocations or realizing compensation for such unused allocations.

This section involves the following major components:

- Review of current usage in East Davie sewer system
- Review of current flow allocations
- Population projections for East Davie County
- Flow projections related to anticipated population and commercial/industrial growth

As part of this effort, we have coordinated with Davie County Planning staff to address short and long-term growth projections and to determine wastewater capacity needs for East Davie service. Discussions have been held with the Davie County Economic Development Commission and the Town of Bermuda Run.

### 3.1. Current Usage

The East Davie sewer system collects wastewater from residential, commercial, and industrial users. Table 3.1 below lists the major wastewater users and the typical wastewater usages based upon billing information provided by the County.

**Table 3.1. Large Wastewater Users**  
*East Davie Wastewater Master Plan*

<b>Wastewater User</b>	<b>Average Monthly Usage (gallons)</b>	<b>Average Daily Usage (gallons)</b>
LCNRC OF Davie Co, LLC	327,675	10,773
NC Department of Transportation	237,317	7,802
CFC of the Carolinas	149,325	4,909
Nelson, Raymond	107,275	3,527
Orsban, Laura	102,242	3,361
BRCC / SPE GO Holdings, Inc.	65,050	2,139
Lowes Foods Store #205	50,125	1,648
Davie County Board of Education	47,483	1,561
Wendelta / Triad Store #534	41,092	1,351
Davie County Board of Education	38,950	1,281
Bojangles #633	36,292	1,193
Captains Galley	34,925	1,148
Condos at Kinderton	33,192	1,091
Food Lion #1359	33,150	1,090
Condos at Kinderton Village	31,733	1,043
A Cleaner World	31,533	1,037
Twin Cities Youth Soccer	30,167	992
Jimmy the Greek	25,367	834
RAH, LLC	22,867	752

The table below includes a summary of the actual wastewater flows from Davie County to WS/FC Utilities. The following figure graphically compares the wastewater flows with the capacity allocation.

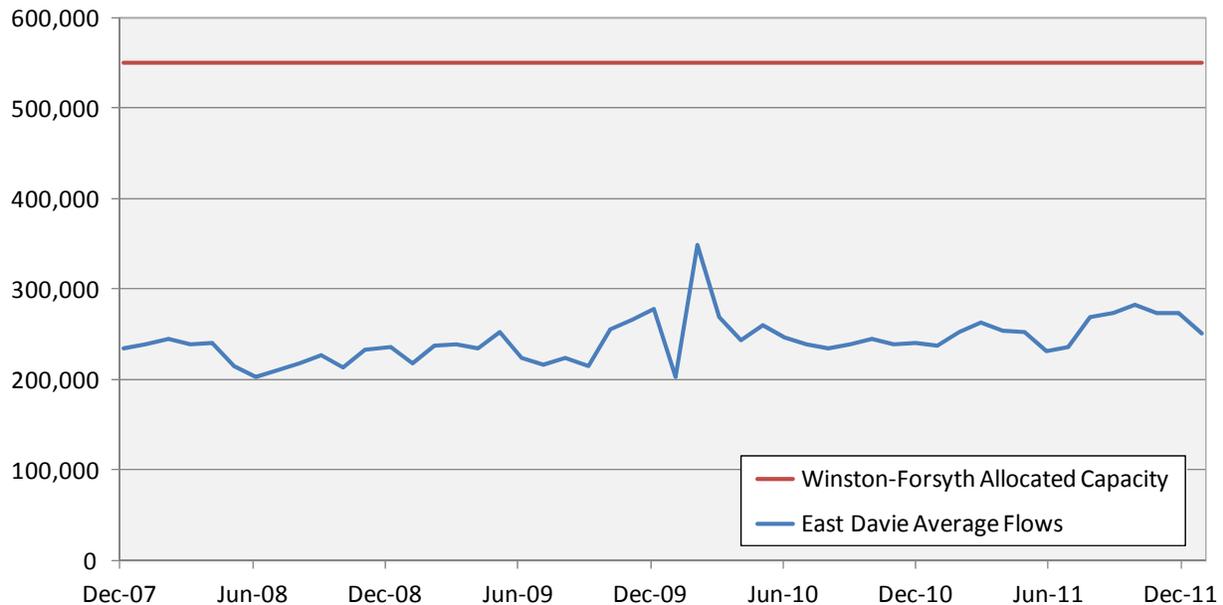
**Table 3.2. East Davie Average Annual Wastewater Flows**

*East Davie Wastewater Master Plan*

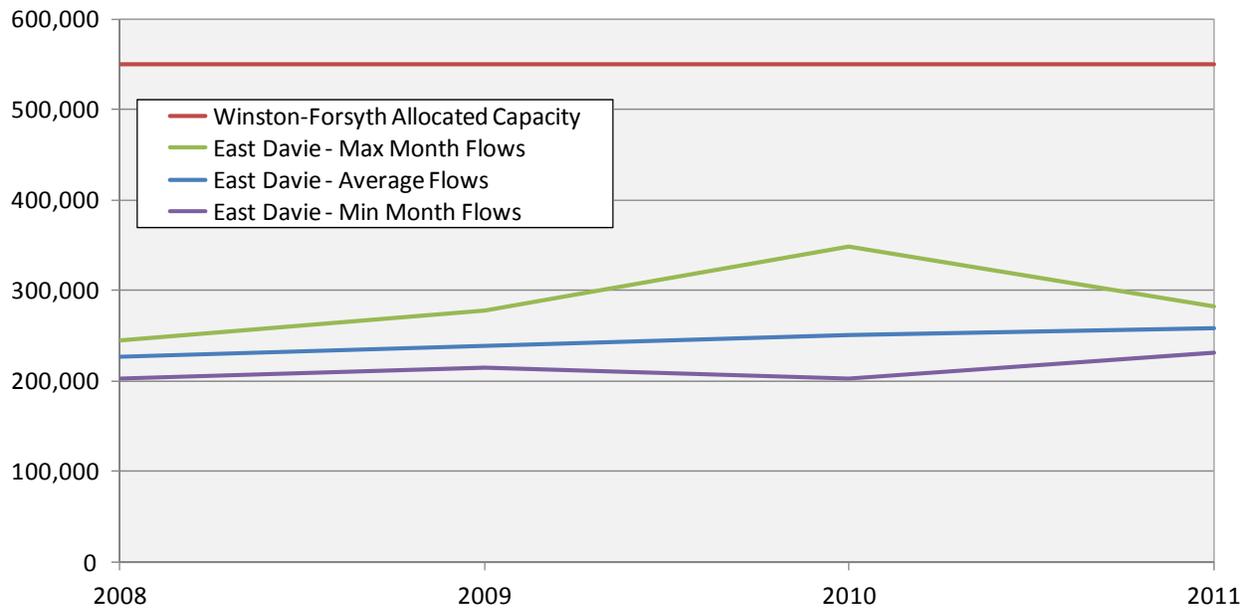
Year	East Davie Average Wastewater Flows (gallons/day)	Annual Percent Increase
2008	226,699	---
2009	238,516	5.21%
2010	250,857	5.17%
2011	258,144	2.90%

**Figure 3.1. East Davie Average Monthly Wastewater Flows**

*East Davie Wastewater Master Plan*



**Figure 3.2. East Davie Wastewater Flow Trend**  
*East Davie Wastewater Master Plan*

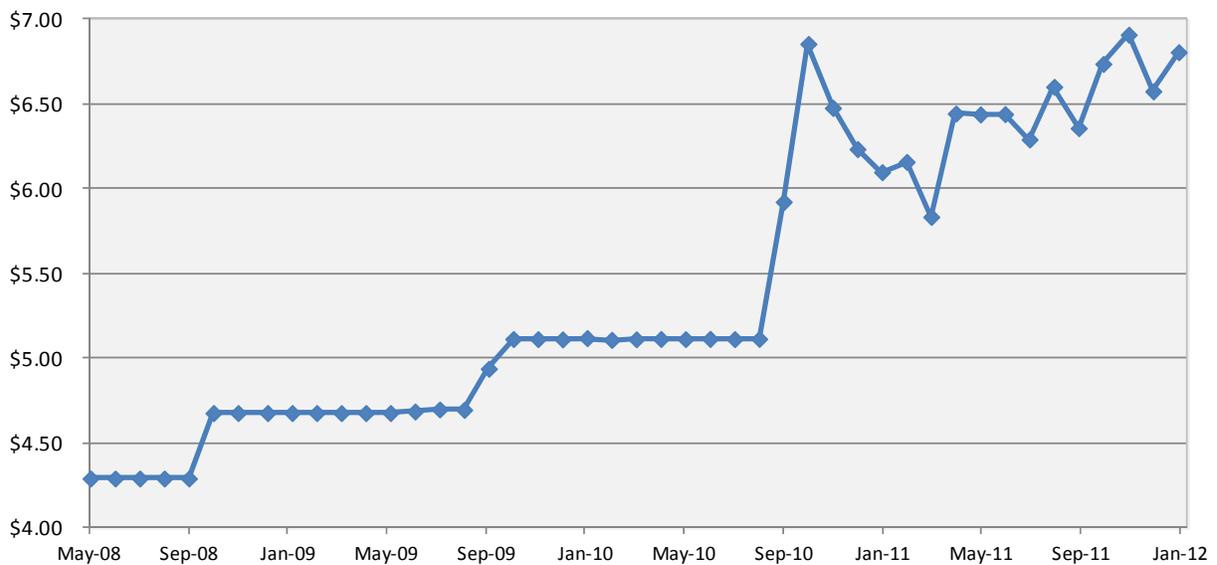


### 3.2. Flow Allocations

Davie County has an existing interlocal agreement with WS/FC Utilities to send wastewater to the Muddy Creek WWTP in Forsyth County for treatment. Davie County’s flow allocation is for a maximum of 550,000 gallons per day. Wastewater is pumped across the Yadkin River to the Tanglewood Pump Station, where it enters the WS/FC Utilities System. The agreement does not include a minimum wastewater flow by Davie County. The agreement does however include surcharge fees for influent wastewater constituents of BOD and TSS exceeding a threshold of 200 mg/L.

As shown in Section 3.1, Davie County discharged an average of 258,144 gallons per day to WS/FC Utilities’ system in 2011. The average wastewater flow has increased by 14% between 2008 and 2011. However, the effective sewer rate charged by WS/FC Utilities have increased by 54% during that time period. A portion of the increases are attributed to annual increases in sewer rates, while a large increase is due to surcharges for BOD and TSS. Figure 3.3 below represents the monthly effective sewer charges from WS/FC Utilities including surcharges.

**Figure 3.3. WS/FC Utilities Effective Sewer Rate**  
*East Davie Wastewater Master Plan*



Note: This chart includes the effective sewer rate including surcharges.

## **FLOW ALLOCATION TOOL**

In preparing this report, we worked with the County to update and enhance its current flow allocation / tracking spreadsheet. The County has a running list of residential and commercial customers with wastewater flows that have been allocated and permitted in the East Davie sewer area. We have updated this list by reviewing current wastewater flows and consideration of completed developments or commercial units. This comprehensive list has been split into two (2) separate lists: (1) entities with completed developments that no longer require a flow allocation, and (2) entities with partial or full allocations remaining. The latter list includes the current wastewater flows in the system, as well as committed flows that are not yet connected or tributary to the system. This updated list shows that the County is nearing 100,000 gpd of remaining unallocated capacity in the East Davie sewer system.

We recommend that the County continue to update and refine this tool as wastewater flows change. As entities or developments are completed, their flow allocation should be removed from the list – that flow is now part of the current wastewater flow in the system. Also, as new permits are issued, the list should be updated to include permit numbers and permitted flows. This tool can be used to update the flow tracking forms that must be submitted to DWQ when a new permit is requested. If updated regularly with current wastewater flows, this tool will show the remaining capacity in the system and provide guidance to Davie County for planning for future wastewater infrastructure improvements.

The flow allocation lists are included in Tables 3.3 and 3.4 on the following pages.

**Table 3.3 - Flow Allocations - Completed**  
*Davie County Wastewater Master Plan*

<b>Line No.</b>	<b>Customer Name</b>	<b>Original or Amended Allocation</b>
1	A Child's World	850
2	A Cleaner World	2,500
3	Ace Hardware	300
4	Bank of Davie	150
5	BB&T	100
6	BP Gas	300
7	Car Wash	7,000
8	Carl Johnson	4,500
9	Country Cove	6,480
10	Dr. Beeson	500
11	Dr. Emily Robinson	400
12	Dr. Jerry Hauser	800
13	Dr. Suzanne Hess	150
14	H & V - Walgreens	350
15	Hillsdale Baptist Church	400
16	Hillsdale Commons	8,800
17	Hillsdale Group - Dr. Barabe Dentist	350
18	Hillsdale Group - Hampton Inn	10,320
19	Hillsdale Kennel	750
20	Hillsdale UMC	400
21	Calvary Baptist Church (Image Matters)	1,600
22	Jeff Harrison	22,500
23	Meg Brown Home Furnishings	100
24	Moby's	150
25	NC DOT - I-40 Rest Area	30,000
26	Oak Valley (700 lots)	140,000
27	Shady Grove School	10,000
28	Texaco Express Lube	250
29	Todd Bailey	200
30	CVS Pharmacy (Tribeh Properties)	80
31	Twin Cities Youth Soccer	1,000
32	Vanhoy Johnson	175
33	W. Ellis Middle School	10,536
34	Wayne Webb	2,500
35	Wendys	3,760
36	WFBMC Medical	650
37	Yadkin Valley Telephone	50
<b>Totals</b>		<b>268,951</b>

Note: Blank cells are for the County's future use in flow tracking.

**Table 3.4 - Flow Allocations - Remaining**  
*Davie County Wastewater Master Plan*

Line No.	Customer Name	Original or Amended Allocation	Amended Date	Percent Complete	Allocated Flows, Not Tributary	No. of Equiv. Lots at 360 gpd	Current Status
1	Adams Egloff - Kinderton Residential	69,000		60%	27,600	77	
2	Ashley Furniture Industries	20,000		0%	20,000	56	
3	B R West, Hidden Creek Nursing Home, Golf Course, Residential	75,000		95%	3,750	10	
4	Bermuda Run Area	17,500		0%	17,500	49	BR Board reserved for Hospital
5	Briar Patch	200		0%	200	1	
6	Bandy Insurance	400		0%	400	1	
7	Baptist Hospital	20,000		---	40,000	111	20,000 from Creekwood
8	Brandon Rehab	125	12/2/09	0%	125	0	
9	Coldwell Banker, Triad	600		0%	600	2	
10	Cox Auto	100		0%	100	0	
11	Creekwood	50,000		---	30,000	83	Original = 50,000 (20,000 to Baptist)
12	Dr. Thomas Browder	1,000		80%	200	1	
13	Hillsdale Group	21,940		0%	21,940	61	Original = 80,000
14	Hillsdale West	2,925	2/16/09	0%	2,925	8	
15	Hillsdale West - In-flight Gym	75	3/17/10	0%	75	0	
16	Kinderton Village - Advance Neurology	150	1/21/10	0%	150	0	
17	Kinderton Village - Classic Sports Grill	3,640	3/15/10	0%	3,640	10	
18	Kinderton Village - Coffey Bomar, LLP	275	1/21/10	0%	275	1	
19	Kinderton Village - Davie Construction	350	1/21/10	0%	350	1	
20	Kinderton Village - Emmert Reporting	50	1/21/10	0%	50	0	
21	Mrs. Carl Johnson	550		0%	550	2	
22	State Employees Credit Union	425	5/16/12	0%	425	1	
23	Wells Fargo	175		0%	175	0	
24	Winmock @ Kinderton	3,030	2/21/10	0%	3,030	8	
<b>Totals</b>		<b>287,510</b>	<b>gpd</b>		<b>174,060</b>	<b>484</b>	

Note: Blank cells are for the County's future use in flow tracking.

Flow Allocation with Winston-Forsyth	550,000 gpd
Current Average Wastewater Flow (2nd half 2011 average flows to WSFCUC)	267,860 gpd
Remaining Capacity = 550,000 gpd - Current Average Wastewater Flow	282,140 gpd
<b>Remaining Allocation = Remaining Capacity - Allocated Flows Not Tributary</b>	<b>108,080 gpd</b>

### 3.3. Population Projections

According to the State Data Center (SDC) of the North Carolina Office of State Planning, the population in Davie County had an average growth rate of 2.3% per year between 1990 and 2000, and 1.7% per year between 2000 and 2010. SDC data also indicates that 18% of the population lived in the municipalities of Davie County. The SDC data predicts that the County will grow a total of 6.7% from 2012 to 2022 and another 6.3% from 2022 to 2032, for a 2032 population of 47,477.

The above projections result in a minimal annual growth rate of 0.63% over the next 20 years in the County. Based upon meetings and discussions with key agencies, the growth rate could approach 5.0% in eastern Davie County. 20-Year projections based upon this growth rate would result in a 2032 population of 9,549 for the East Davie sewer system. 20-year population projections are provided in the table below.

**Table 3.5. Population Projections**  
*East Davie Wastewater Master Plan*

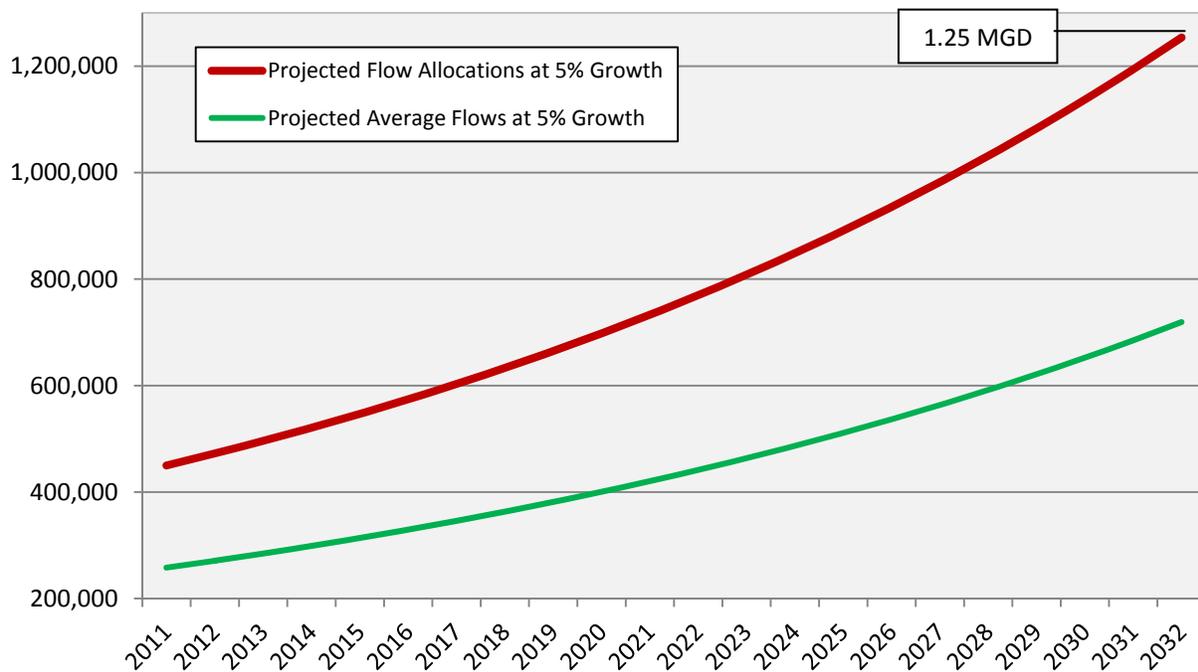
<b>Year</b>	<b>Davie County (SDC population projections)</b>	<b>East Davie Sewer (based upon SDC projections)</b>	<b>East Davie Sewer (5% growth projections)</b>
2012	41,843	3,600	3,600
2017	43,251	3,721	4,594
2022	44,661	3,842	5,863
2027	46,067	3,963	7,482
2032	47,477	4,085	9,549

### 3.4. Flow Projections

Projected wastewater flow allocations and average daily flows have been projected over the 20-year planning period. The State Data Center population projections for Davie County were somewhat minimal at 0.63%. Reviewing these projections with County staff, an annual growth rate of 5.0% for the 20-year planning period was chosen for the wastewater flows. The chart below outlines those projections for both the flow allocations and average daily flows.

**Figure 3.4. Wastewater Flow Projections**

*East Davie Wastewater Master Plan*



Based upon the projected flow allocations at 5.0% growth for the East Davie sewer system, an estimated capacity of 1.25 million gallons per day (MGD) is needed in the Year 2032. With the current allocation to WS/FC Utilities at 0.55 MGD, additional capacity is needed in the very near future.

The full 20-year projections are provided in Table 3.6 on the next page.

**Table 3.6. Flow Projections**  
*East Davie Wastewater Master Plan*

<b>Year</b>	<b>Projected Average Flows at 5% Growth</b>	<b>Projected Flow Allocations at 5% Growth</b>	<b>Equivalent Residential Units</b>
2009	238,566	450,000	---
2010	250,857	450,000	---
2011	258,144	450,000	---
2012	271,051	472,500	63
2013	284,604	496,125	66
2014	298,834	520,931	69
2015	313,776	546,978	72
2016	329,464	574,327	76
2017	345,938	603,043	80
2018	363,235	633,195	84
2019	381,396	664,855	88
2020	400,466	698,098	92
2021	420,489	733,003	97
<b>2022</b>	<b>441,514</b>	<b>769,653</b>	<b>102</b>
2023	463,590	808,135	107
2024	486,769	848,542	112
2025	511,107	890,969	118
2026	536,663	935,518	124
2027	563,496	982,294	130
2028	591,671	1,031,408	136
2029	621,254	1,082,979	143
2030	652,317	1,137,128	150
2031	684,933	1,193,984	158
<b>2032</b>	<b>719,180</b>	<b>1,253,683</b>	<b>166</b>

The identified need for additional capacity in the East Davie sewer collection system warrants the exploration of alternatives to solve this pending issue. As previously discussed, the County currently pumps all of the wastewater generated and collected in the eastern portion of the County to WS/FC Utilities for final treatment at the Muddy Creek WWTP. Capacity is limited within that portion of the collection system. Davie County's Cooleemee WWTP is over 18 miles away from the eastern service area and located in a separate sub-basin of the Yadkin River Basin. Hence, costs of wastewater conveyance to this remote facility could be excessive. The construction of a new wastewater treatment facility could be the most financially feasible option.

Insufficient capacity in the East Davie sewer system is a concern for the County. Many viable capacity management alternatives for the East Davie sewer system were considered. The three (3) most feasible alternatives for future system capacity are as follows:

1. Continue Pumping to WS/FC Utilities with Expanded Capacity
2. Pump to an Expanded Cooleemee WWTP
3. Construct a New Wastewater Treatment Facility

The above alternatives involve the ultimate discharge of treated wastewater effluent to the Yadkin River basin. The receiving waters for all options are upstream of High Rock Lake, which has an ongoing Total Maximum Daily Load (TMDL) study to address the Chlorophyll A impairment. The pending TMDL or nutrient management strategy for this river basin will impact all of these alternatives. Regulatory limitations will likely be significant for existing wastewater treatment facilities as well as a new wastewater treatment facility. Existing, new, and expanding facilities will likely face nutrient limits, including total nitrogen (TN) and total phosphorus (TP) to reduce nutrients to High Rock Lake. Treatment facilities in the Yadkin River basin including Bermuda Run WWTP, Cooleemee WWTP, Dutchman Creek WWTP, and Muddy Creek WWTP, will need to enhance existing or construct new biological nutrient removal processes to meet these pending limits.

#### 4.1. Pumping to WS/FC Utilities

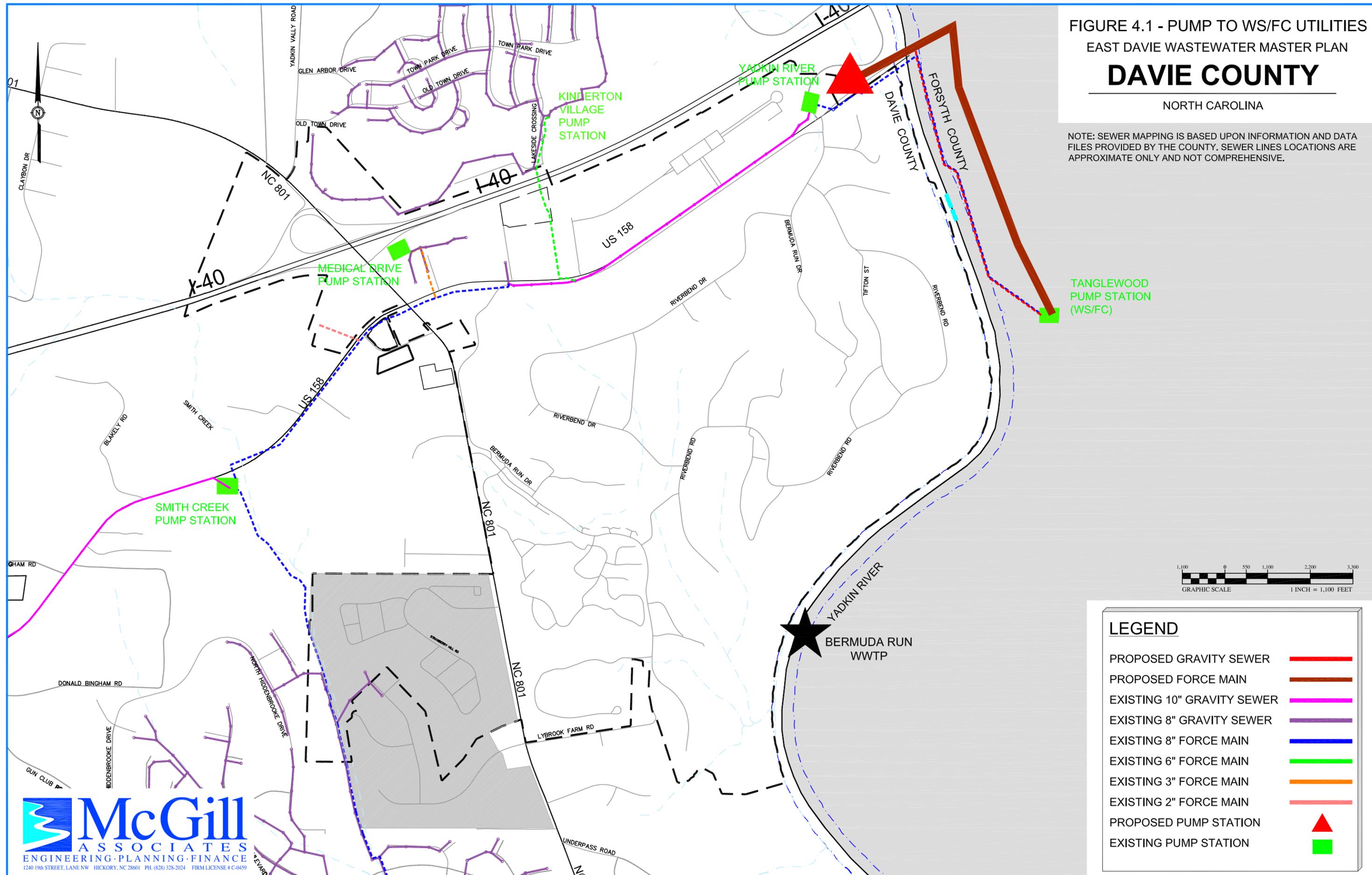
This alternative involves the East Davie sewer system continuing to pump wastewater flows to the WS/FC Utilities system in Forsyth County with an expanded flow allocation to meet future wastewater needs. The County currently pumps the wastewater collected in the East Davie sewer system to the Tanglewood Pump Station in the WS/FC Utilities system. The Tanglewood Pump Station transports Davie County wastewater flows along with other WS/FC Utilities flows to the Muddy Creek WWTP for treatment.



In meeting with WS/FC Utilities staff, we understand the hydraulic capacity is limited within that portion of their collection system. An additional flow allocation of 200,000 gallons per day would be feasible, but pump station and force main improvements may be needed to carry additional wastewater flows. From discussions with WS/FC Utilities, a capacity charge of \$24 per gallon or more may be required to secure capacity beyond the initial 200,000 gallons per day. Considering this fee could increase in the future for additional flows this has a significant impact on Alternative No. 1. Figure 4.1 presents a schematic/map for Alternative No. 1.

FIGURE 4.1 - PUMP TO WS/FC UTILITIES  
 EAST DAVIE WASTEWATER MASTER PLAN  
**DAVIE COUNTY**  
 NORTH CAROLINA

NOTE: SEWER MAPPING IS BASED UPON INFORMATION AND DATA FILES PROVIDED BY THE COUNTY. SEWER LINES LOCATIONS ARE APPROXIMATE ONLY AND NOT COMPREHENSIVE.



**LEGEND**

- PROPOSED GRAVITY SEWER —
- PROPOSED FORCE MAIN —
- EXISTING 10" GRAVITY SEWER —
- EXISTING 8" GRAVITY SEWER —
- EXISTING 8" FORCE MAIN —
- EXISTING 6" FORCE MAIN —
- EXISTING 3" FORCE MAIN —
- EXISTING 2" FORCE MAIN —
- PROPOSED PUMP STATION ▲
- EXISTING PUMP STATION ■

**TABLE 4.1 - PRELIMINARY OPINION OF PROBABLE COSTS  
ALTERNATIVE 1 - PUMP 1.25 MGD TO WINSTON/FORSYTH  
EAST DAVIE WASTEWATER MASTER PLAN  
DAVIE COUNTY, NORTH CAROLINA**

ITEM	DESCRIPTION	UNITS	QUANTITY	UNIT COST	TOTAL COST
1	Mobilization	LS	3%	\$ 135,000	\$ 135,000
2	Pump Station (Yadkin)	LS	1	\$ 1,000,000	\$ 1,000,000
3	Upgrade Tanglewood PS	LS	1	\$ 750,000	\$ 750,000
4	16" Force Main	LF	7,000	\$ 90	\$ 630,000
5	River Crossing	EA	2,000	\$ 1,000	\$ 2,000,000
<b>SUBTOTAL</b>					<b>\$ 4,515,000</b>
Contingencies				15%	\$ 677,000
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$ 5,192,000</b>
Engineering Design, Bid and Award					\$ 340,000
Construction Administration and Observation					\$ 230,000
<b>Capacity Purchase (500,000 x \$24/gal)</b>					<b>\$ 12,000,000</b>
Legal, Permit Fees, and Easement Acquisition					\$ 250,000
<b>TOTAL ESTIMATED PROJECT COST</b>					<b>\$ 18,012,000</b>

- Notes:
1. This opinion of probable costs represents our judgement as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from these costs.
  2. From discussions with WS/FC Utilities, a capacity charge of \$24 per gallon or more may be required to secure capacity beyond the initial 200,000 gallons per day. This estimate assumes \$24/gallon.
  3. All estimated costs are in 2012 dollars.

Wastewater collection system capacities would need to be improved in order to accommodate the additional flows. Wastewater Pump Station upgrades would be required for the Yadkin Pump Station and Tanglewood Pump Station. New wastewater force main piping would be needed to transfer the additional wastewater flows, including a new force main across the Yadkin River to convey wastewater flows to the Tanglewood Pump Station.

Understandably, a large amount of collection system improvements places a significant constraint upon Alternative No. 1. Additionally, the assumed capacity charge of \$24 per gallon will have a bearing on future flow capacities within the East Davie County Wastewater Collection System.

## 4.2. Pumping to Cooleemee

This alternative involves the East Davie sewer system pumping its wastewater flows to the County's Cooleemee WWTP. Rather than pumping to the WS/FC Utilities system, new pump stations and force mains would be installed to deliver flow over 100,000 linear feet to the southwestern area of Davie County. The new wastewater facilities would need to be designed for the future flows to the plant and sized for future peak flows.

The Cooleemee WWTP discharges treated effluent to the South Yadkin River sub-basin, while East Davie currently discharges flow to the Muddy Creek WWTP in the Yadkin River sub-basin. For transfers above 2.0 MGD, regulatory review and approval is required. The proposed transfer would be well less than 2.0 MGD and therefore an IBT certificate would not be required. However, future growth resulting in wastewater flows exceeding this threshold should be considered for the future of sewer service in Davie County. Also, this facility will face the need to upgrade to meet nutrient removal requirements with TMDLs as discussed earlier in the report.

Alternative No. 2 creates a situation in which Davie County would retain wastewater flows for treatment. Currently, there are no treatment facilities in eastern Davie County with appropriate capacities for such wastewater flows. Therefore, the wastewater flows would need to be pumped to the Cooleemee WWTP, located in the southwestern limits of the county. Pumping wastewater over this distance would be a challenge and would constitute major improvements and additions to the current collection system infrastructure. In order to convey wastewater from the eastern to southwestern portion of the county, five (5) new pump stations would be required.

Multiple wastewater force main segments would be required for this alternative. Transferring wastewater flows across the county would require over 100,000 linear feet of force main piping. Understandably, such a large amount of pipeline construction would result in major easement and right-of-way costs, fees, and negotiations.

The pump stations and force main needed for this alternative would result in a major expenditure for the County. Also, this alternative involves the County spending funds to expand and upgrade the Cooleemee WWTP to accommodate increased wastewater flows and future nutrient limits. Figure 4.2 includes a schematic/map for Alternative No. 2.

**TABLE 4.2 - PRELIMINARY OPINION OF PROBABLE COSTS  
ALTERNATIVE 2 - PUMP 1.25 MGD TO COOLEEMEE WWTP  
EAST DAVIE WASTEWATER MASTER PLAN  
DAVIE COUNTY, NORTH CAROLINA**

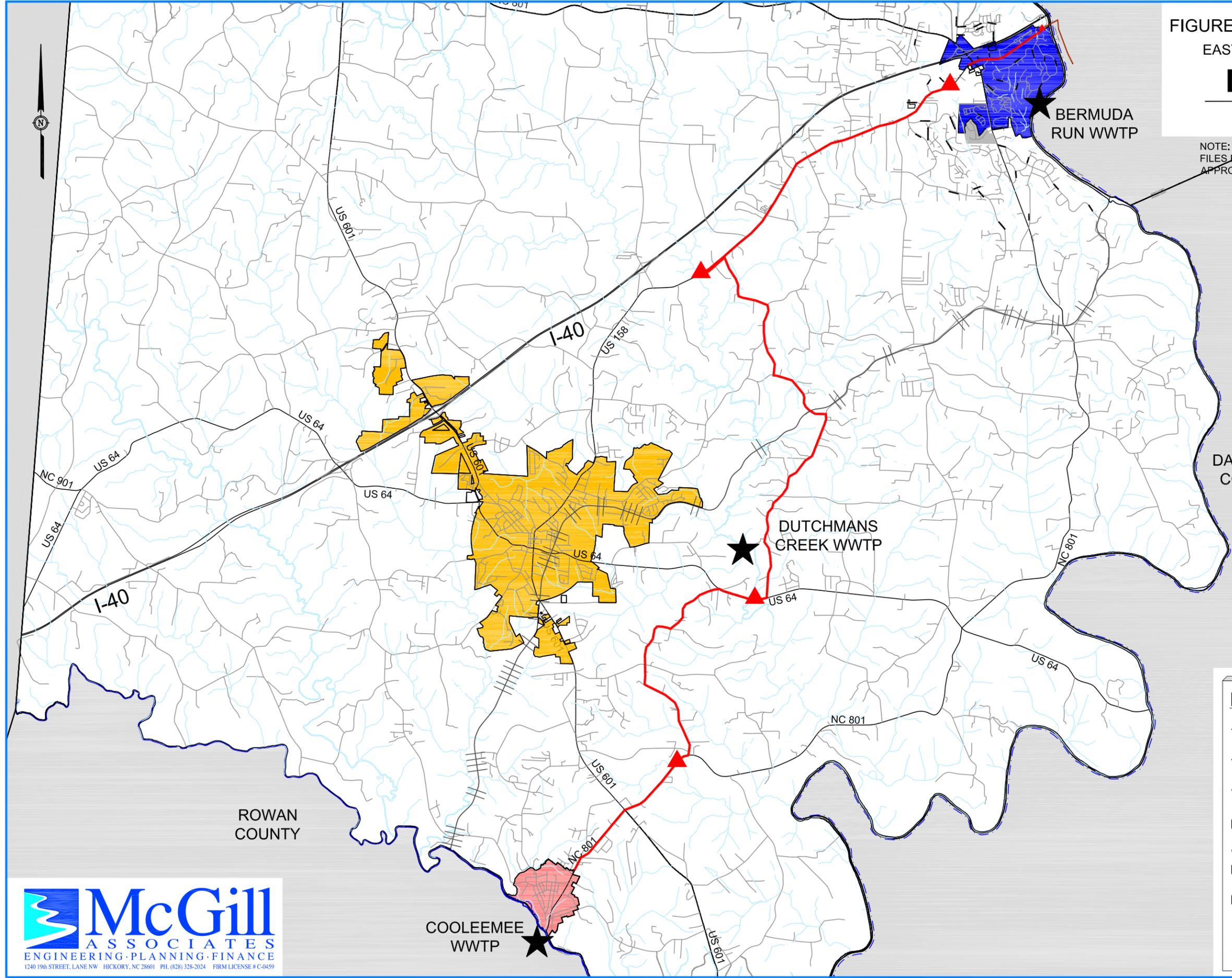
ITEM	DESCRIPTION	UNITS	QUANTITY	UNIT COST	TOTAL COST
1	Mobilization	LS	3%	\$ 597,000	\$ 597,000
2	Pump Station (NC 158)	LS	1	\$ 1,200,000	\$ 1,200,000
3	Pump Station (Farrington)	LS	1	\$ 900,000	\$ 900,000
4	Pump Station (Dutchman)	LS	1	\$ 900,000	\$ 900,000
5	Pump Station (801)	LS	1	\$ 800,000	\$ 800,000
6	8" Force Main	LF	1,500	\$ 50	\$ 75,000
7	8" Force Main (Yadkin to 158)	LF	7,500	\$ 50	\$ 375,000
8	16" Force Main	LF	105,000	\$ 75	\$ 7,875,000
9	River Crossing	EA	1,500	\$ 1,000	\$ 1,500,000
10	Influent Pump Station Upgrade	LS	1	\$ 200,000	\$ 200,000
11	Headworks Upgrade	LS	1	\$ 200,000	\$ 200,000
12	Process Upgrade/Expansion	LS	1	\$ 2,000,000	\$ 2,000,000
13	Clarifiers	LS	2	\$ 250,000	\$ 500,000
14	RAS/WAS Pumping Upgrade	LS	1	\$ 250,000	\$ 250,000
15	Filtration	LS	1	\$ 1,000,000	\$ 1,000,000
16	Disinfection Upgrade	LS	1	\$ 50,000	\$ 50,000
17	Sludge Holding Upgrade	LS	1	\$ 250,000	\$ 250,000
18	Sitework	LS	1	\$ 100,000	\$ 100,000
19	Yard Piping	LS	1	\$ 200,000	\$ 200,000
20	Generator / Transfer Switch	LS	1	\$ 300,000	\$ 300,000
21	Electrical/Controls	LS	1	\$ 500,000	\$ 500,000
22	Outfall Expansion	LS	1	\$ 125,000	\$ 125,000
<b>SUBTOTAL</b>					<b>\$ 19,897,000</b>
Contingencies				15%	\$ 2,985,000
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$ 22,882,000</b>
Engineering Design, Bid and Award					\$ 1,300,000
Construction Administration and Observation					\$ 800,000
<b>Capacity Purchase</b>					<b>N/A</b>
Legal, Permit Fees, and Easement Acquisition					\$ 500,000
<b>TOTAL ESTIMATED PROJECT COST</b>					<b>\$ 25,482,000</b>

Notes: 1. This opinion of probable costs represents our judgement as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from these costs.  
2. All estimated costs are in 2012 dollars.

FIGURE 4.2 - PUMP TO COOLEEMEE WWTP  
 EAST DAVIE WASTEWATER MASTER PLAN  
**DAVIE COUNTY**

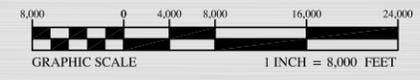
NORTH CAROLINA

NOTE: SEWER MAPPING IS BASED UPON INFORMATION AND DATA FILES PROVIDED BY THE COUNTY. SEWER LINES LOCATIONS ARE APPROXIMATE ONLY AND NOT COMPREHENSIVE.



DAVIDSON COUNTY

ROWAN COUNTY



**LEGEND**

- TOWN OF BERMUDA RUN
- TOWN OF COOLEEMEE
- TOWN OF MOCKSVILLE
- PROPOSED SEWERS
- WASTEWATER TREATMENT PLANT (WWTP)
- PROPOSED PUMP STATIONS

### **4.3. New Wastewater Treatment Plant**

Alternative No. 3 involves the construction of a new wastewater treatment plant within the East Davie Sewer System to provide control over wastewater treatment costs. This alternative would allow Davie County to treat its own wastewater flows rather than paying high consumption charges and pollutant surcharges to send wastewater flows to WS/FC Utilities. The existing collection system would need to be extended south past Oak Valley Pump Station to the new site. Additional force mains and gravity sewers would be needed to direct flows to the WWTP.

The wastewater treatment plant would have an initial capacity of 1.25 MGD. The facility would likely include a new influent pump station, headworks facility, biological treatment process, clarifiers, disinfection, sludge pumping/handling/digestion, operations building, electrical, piping, site work, and related appurtenances. The treatment plant would be constructed in eastern Davie County, likely south of Bermuda Run, providing a centralized system to allow wastewater flows to remain in the eastern portion of the county.

This alternative involves a major expenditure and significant effort by Davie County, yet would be the most financially feasible of the options considered. Additionally, a major benefit would be greater control of the County's wastewater system. Maintaining control over billing, charges, and expansions could prove invaluable in the future.

#### **Implementation Timeline**

Planning, design, and construction for a wastewater treatment plant (WWTP) takes significant time from initial work through to placing the facility into operation. For a new WWTP, this process could require significantly more time. The overall schedule from project initiation to plant start-up could take anywhere from 5 to 8 years or longer for completion.

The first step would be to review all available properties that might fit the need and location requirements for a new plant. Topography, access, site suitability, and proximity to the Yadkin River are just a few of the factors that should be considered. Once a site has been selected, initial communication would commence with the property owner to discuss acquisition. After selection of a property, an in-depth property review and evaluation would be needed.

Parallel to this effort would be initiating the application process for a new NPDES (discharge) permit. New wastewater discharges are highly scrutinized, particularly for a discharge located upstream of impaired waters. Speculative effluent limits would be requested from the NC Division of Water Quality (DWQ) to determine the limitations upon the treated flow that would be discharged to the river. The speculative limits will drive much of the treatment process decisions for the planning and design.

Other critical planning efforts include the preparation of a Preliminary Engineering Report (PER) and also an Environmental Assessment (EA). The PER is a planning document needed for conceptual design to determine clear direction and a systematic approach to construct a new wastewater treatment plant. The PER forms the technical basis for the planning and design efforts and is often required in the permitting process as well as many financing programs such as the SRF loan program. The EA is needed both for the NPDES discharge permit as well as to obtain funding agency approval and the construction permit.

The EA will review property constraints and characteristics as well. If substantial environmental impacts are identified during the Environmental Assessment (EA) an Environmental Impact Statement (EIS) may be required by NC-DWQ. At this point, it is assumed that an EIS would not be required for this project. NPDES permits are renewed every 5 years. Similarly, an approved NPDES permit will remain in effect for 5 years, regardless of when plant construction begins. The EA process generally follows the following steps:

- Complete Engineering Alternatives Analysis (EAA) to evaluate all possible discharge options as required for permitting process and discharge permit justification
- Complete Environmental Assessment (EA) as required for NPDES permit
- Finding of No Significant Impact (FONSI) after review of EA by State agencies
- Prepare application and petition the NC-DWQ for a NPDES permit
- NC-DWQ issues a draft NPDES permit
- Public Notice (Advertisement in local newspaper) and Public Comment
- Public Hearing (if opposition encountered during public comment)
- NC-DWQ issues a final NPDES permit

The PER for plant projects are very important to establish the conceptual design for treatment components. Typical tasks at this stage include:

- Survey of the treatment plant site
- Review of pollutant and components of loading to meet treatment level objectives
- Preliminary plant hydraulic “flow through” design
- Preliminary arrangement and process structures layouts
- Review of space, site planning and accessory structures and yard piping

Final design will include more details of the tasks noted above as well as civil, process, geotechnical, mechanical, electrical/instrumentation and control, and structural designs. A transition plan would be developed to maintain wastewater flow in East Davie while redirecting wastewater to the new sewer interceptor and new wastewater treatment plant.

After receipt of the NPDES permit and completion of design, the drawings, specifications, and engineering calculations must be submitted to the NC-DWQ Infrastructure Finance Section (IFS), who review the plant design and ultimately issue an Authorization to Construct (ATC). This is your “*permit*” to build the plant. Only after receipt of the ATC can the County award the construction contract. The ATC itself typically has no expiration date, but it is related to the dates provided in the NPDES permit. This allows flexibility, in some cases as much as 3 years, in the timing of the start of construction. Other permits include the erosion control permit, US Army Corps of Engineers’ 404 permit, DWQ’s 401 permit, and local building permits.

The SRF loan program administered by DWQ-IFS currently receives applications twice per year. The overall process, from application through approval to construct, takes approximately 2 years.

In summary, the initial site selection, environmental planning, and NPDES discharge permit tasks could take 2 to 4 years to complete. The PER and final design efforts could take 1 to 2 years, depending upon how much is performed in parallel with the initial tasks. Finally, the funding process takes 2 years and includes overlap of several of the above tasks, including obtaining the ATC permit. Therefore, if expedited, the overall process to construct the new facility would require 5 years at a bare minimum without any substantial roadblocks. A more typical timeline would last approximately 7 to 8 years.

**TABLE 4.3 - PRELIMINARY OPINION OF PROBABLE COSTS**  
**ALTERNATIVE 3 - CONSTRUCT A NEW WASTEWATER TREATMENT PLANT**  
**EAST DAVIE WASTEWATER MASTER PLAN**  
**DAVIE COUNTY, NORTH CAROLINA**

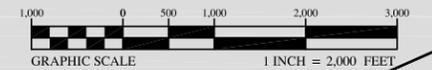
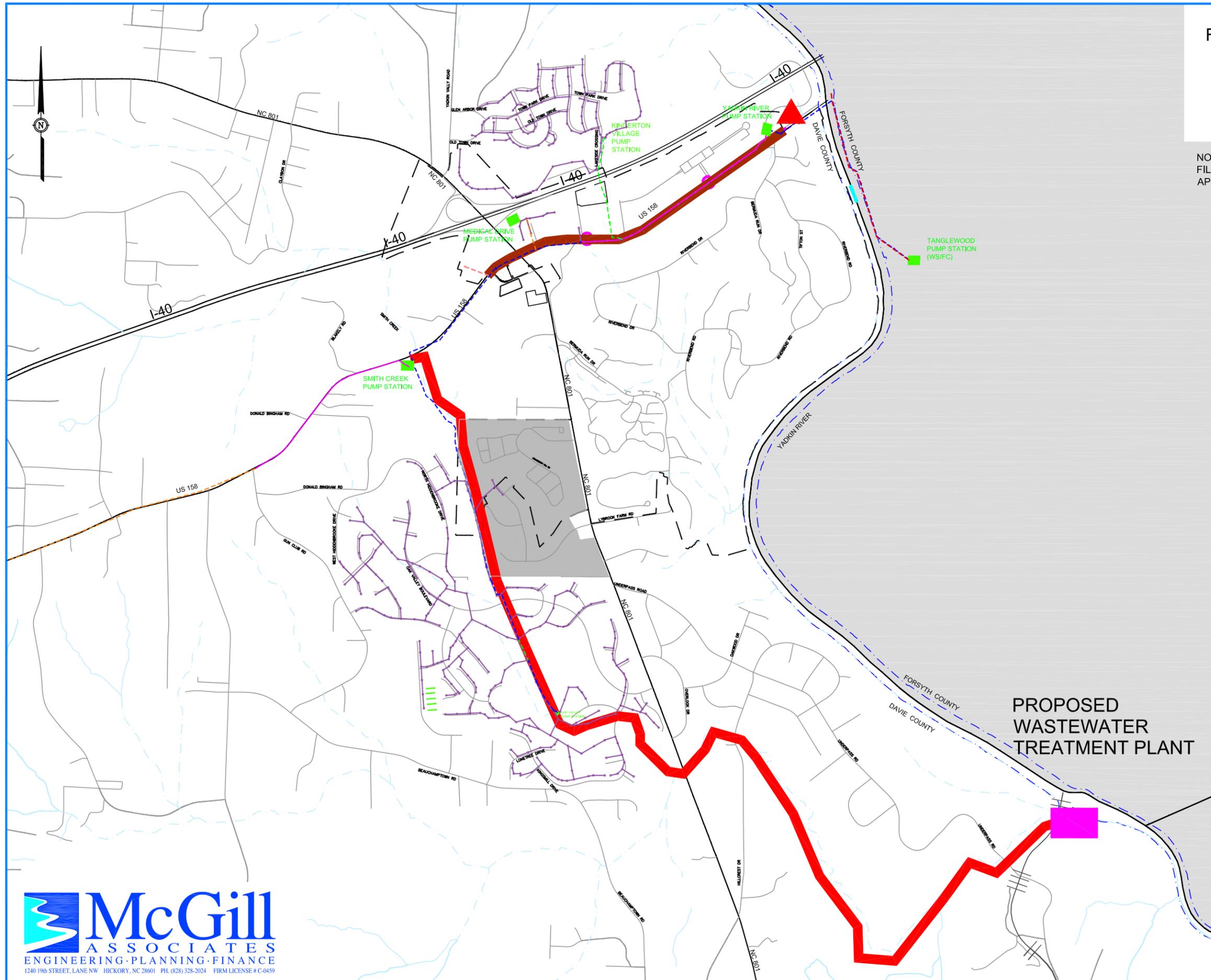
ITEM	DESCRIPTION	UNITS	QUANTITY	UNIT COST	TOTAL COST
1	Mobilization	LS	0	\$ 385,000	\$ 385,000
2	8" Force Main (Yadkin to 158)	LF	7,500	\$ 50	\$ 375,000
3	24" Gravity Sewer	LF	26,000	\$ 120	\$ 3,120,000
4	Influent Pump Station	LS	1	\$ 600,000	\$ 600,000
5	Headworks, Bar Screen	LS	1	\$ 400,000	\$ 400,000
6	BNR Biological Process	LS	1	\$ 3,200,000	\$ 3,200,000
7	Clarifiers	LS	2	\$ 250,000	\$ 500,000
8	RAS/WAS pump Station	LS	1	\$ 300,000	\$ 300,000
9	UV Disinfection	LS	1	\$ 400,000	\$ 400,000
10	Filtration	LS	1	\$ 600,000	\$ 600,000
11	Non-Potable Plant Water System	LS	1	\$ 150,000	\$ 150,000
12	Sludge Holding Tank	LS	1	\$ 450,000	\$ 450,000
13	Laboratory and Admin Building	SF	1,800	\$ 120	\$ 216,000
14	Sitework	LS	1	\$ 400,000	\$ 400,000
15	Yard Piping	LS	1	\$ 275,000	\$ 275,000
16	Generator / Transfer Switch	LS	1	\$ 350,000	\$ 350,000
17	Electrical/SCADA	LS	1	\$ 900,000	\$ 900,000
18	Outfall to Yadkin River	LS	1	\$ 200,000	\$ 200,000
<b>SUBTOTAL</b>					<b>\$ 12,821,000</b>
Contingencies				15%	\$ 1,923,000
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$ 14,744,000</b>
Engineering Design, Bid and Award					\$ 960,000
Construction Administration and Observation					\$ 640,000
<b>Capacity Purchase</b>					<b>N/A</b>
Legal, Permit Fees, and Easement Acquisition					\$ 600,000
<b>TOTAL ESTIMATED PROJECT COST</b>					<b>\$ 16,944,000</b>

- Notes:
1. This opinion of probable costs represents our judgement as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from these costs.
  2. All estimated costs are in 2012 dollars.
  3. Project assumes a 1.25 MGD BNR nutrient removal treatment plant with filtration.

FIGURE 4.3 - NEW EAST DAVIE WWTP  
 EAST DAVIE WASTEWATER MASTER PLAN  
**DAVIE COUNTY**

NORTH CAROLINA

NOTE: SEWER MAPPING IS BASED UPON INFORMATION AND DATA FILES PROVIDED BY THE COUNTY. SEWER LINES LOCATIONS ARE APPROXIMATE ONLY AND NOT COMPREHENSIVE.



**LEGEND**

- PROPOSED GRAVITY SEWER —
- PROPOSED FORCE MAIN —
- EXISTING 10" GRAVITY SEWER —
- EXISTING 8" GRAVITY SEWER —
- EXISTING 8" FORCE MAIN —
- EXISTING 6" FORCE MAIN —
- EXISTING 3" FORCE MAIN —
- EXISTING 2" FORCE MAIN —
- PROPOSED PUMP STATION ▲
- EXISTING PUMP STATION ■

#### 4.4. Recommendation

The alternatives evaluated in the section are all feasible for accommodating the sewer capacity needs related to potential high growth in eastern Davie County. This analysis considers sewer capacity needs, existing and future anticipated treatment costs by WS/FC Utilities, and the County's desire to control wastewater service and costs. Table 4.4 below presents the summary.

**Table 4.4. Alternatives Summary**  
*East Davie Wastewater Master Plan*

<b>Alternative No.</b>	<b>Alternative Description</b>	<b>Total Project Costs</b>
1	Continue Pumping to WS/FC Utilities with Expanded Capacity (includes capacity charge)	\$18,012,000
2	Pump to an Expanded Cooleemee WWTP	\$25,482,000
3	Construct a New Wastewater Treatment Facility	<b>\$16,944,000</b>

The County pumps all wastewater collected in the East Davie Sewer System to WS/FC Utilities for final treatment. The County's flow allocation is currently limited to 550,000 gallons per day. Capacity limitations within that portion of WS/FC Utilities' collection system would require facility upgrades. Davie County's Cooleemee WWTP is over 18 miles away from the eastern service area and located in a separate sub-basin of the Yadkin River Basin. Hence, the costs of wastewater conveyance to the opposite side of the County plus expanded capacity and upgraded treatment are excessive. Pumping wastewater to Cooleemee also brings long-term operational challenges with many pump stations and with wastewater traveling through long force mains.

Alternative No. 1 includes a significant capacity charge by WS/FC Utilities. Although a new wastewater treatment plant involves planning and permitting considerations, the initial capital costs are the lowest of the alternatives. As wastewater flows and rates increase, the 20-year present worth is less than that of retaining service with WS/FC Utilities. Based upon this analysis, it is recommended that the County begin planning efforts for a new wastewater treatment plant within the next few years.

## SECTION 5

## CAPITAL PROJECTS AND COSTS

The wastewater system capacity and major alternatives were reviewed in previous sections of this report. This section identifies immediate and long-term capital projects for Davie County's water and wastewater systems. This section also presents the recommended Capital Improvements Plan (CIP) based upon the findings of this master plan. The main objectives of this CIP include:

- Provide Davie County a planning tool with capital needs, costs, and funding sources.
- Provide a listing of capital projects to address facility capacity, reliability, maintenance, and regulatory compliance.
- Provide project descriptions and planning-level costs for recommended projects within the initial 10-year period.
- Include planned water distribution system and water treatment projects.
- Prioritize and schedule recommended projects with costs and funding assumptions to meet short-term and long-term needs.

The CIP reflects the combined efforts of the McGill Associates and Davie County staff to understand immediate and long-term capital needs. The CIP generally includes:

- Listing of recommended capital projects and planning-level costs;
- Project descriptions;
- Timeline for completion of recommended projects with capital expenditures to be incurred each year along with a phasing schedule;

It is important for the CIP to address state and federal requirements and guidance for capital improvements plans, since potential funding programs often contain specific requirements that influence the selection of proposed projects for grant or low-interest loan funding.

## 5.1. Previous Capital Projects

In preparing the CIP, we met with the County staff to review immediate and long-term capital needs for this system. For this fund, there were no previous CIP project descriptions and costs available.

## 5.2. New Capital Projects

In developing the recommended CIP, the two (2) major categories have been considered:

1. Improvements to accommodate future growth and comply with potential future regulatory limits;
2. Rehabilitation work and upgrades identified by physical condition assessments in order to maintain the facilities and equipment reliability over the 20-year planning period.

As discussed in Section 4, the recommended alternative to comply with anticipated growth and future regulatory requirements was Alternative 3. Therefore, the facilities and improvements recommended under this alternative were used for developing the capital improvements plan. Alternative 3 involves the construction of a new wastewater treatment plant in the East Davie sewer system to handle current and future wastewater needs instead of pumping wastewater flows to WS/FC Utilities. This alternative involves the construction of a new 1.25 MGD biological nutrient removal facility that is readily expandable in the future.

The existing facility condition assessments are summarized in Section 2. Recommendations from these assessments were combined with the recommendations from Alternative 3 in Section 4 to form the CIP.

Planning-level opinions of probable costs are based on our past experience in the planning, design, bidding, and construction of wastewater treatment facility improvements. Engineering services are estimated at 15 percent of the construction cost. A contingency is also included as 15 percent of the estimated construction cost.

## Wastewater CIP Projects

The wastewater system projects have been combined into common types of capital projects based on the nature, urgency, and duration of the related work. Planning-level costs were determined for the recommended improvements. The wastewater capital projects include:

**Table 5.1. Wastewater Capital Projects**  
*East Davie Wastewater Master Plan*

<b>Project No.</b>	<b>Project Name</b>	<b>Planning-Level Project Cost</b>
1	Hospital Sewer, Yadkin River Pump Station Upgrades, and Smith Creek Pump Station Upgrades	\$ 2,000,000
2	Ashley Furniture Sewer and Pump Station	\$ 1,500,000
3	Property / Easement Acquisitions for New WWTP and 24" Influent Gravity Sewer	\$ 460,000
4	New East Davie WWTP	\$ 12,900,000
5	New 24" Influent Gravity Sewer	\$ 4,300,000
6	Yadkin River PS Force Main	\$ 520,000
7	Jeffco PS Gravity Sewer	\$ 130,000
8	Pump Station Improvements	\$ 110,000

A description of each project is provided below along with the recommended implementation schedule and planning-level costs. A few projects include subprojects, which are also described below. Table 5.1 provides a detailed summary of all recommended CIP projects by fiscal year along with the engineering and construction costs. Project descriptions and costs are provided on the following pages.

### **Project 1: Hospital Sewer and Pump Station Upgrades**

This project is for the extension of a new gravity sewer underneath I-40 to the proposed site for Baptist Hospital just north Exit 180. An 18-inch diameter gravity sewer is to be installed from the site to the existing Smith Creek Pump Station in the East Davie sewer system. This project also involves upgrades to the Smith Creek Pump Station and Yadkin River Pump Station to handle the additional wastewater flows.

The total estimated cost for this project is \$2,000,000. The recommended implementation schedule for this project is to begin construction in FY 2013.

### **Project 2: Gravity Sewer Extension to Baptist Hospital and Pump Station Upgrades**

This project includes new gravity sewer, a new wastewater pump station, and new force main to connect the new Ashley Furniture site to the East Davie sewer system. A 4-inch diameter force main would run north along Baltimore Road to the extents of the East Davie sewer system.

The total estimated cost for this project is \$1,500,000. The recommended implementation schedule for this project is to begin design in FY 2013 with construction being completed within the same fiscal.

### **Projects 3 & 4: New East Davie WWTP**

This project involves the planning, design, and construction for a new 1.25 MGD biological nutrient removal treatment plant. The proposed facilities include the following:

- New headworks with mechanical bar screen and grit removal equipment
- New Influent Pump Station (including three influent pumps)
- New Biological Nutrient Removal (BNR) process with two (2) treatment trains
- New Secondary Clarifiers
- New Tertiary Filters
- New Return and Waste Activated Sludge Pump Station
- New Sludge Storage Tank and Solids Handling Facilities

The total estimated cost for this project is \$12,900,000. The recommended implementation schedule for this project is to begin planning work in FY 2013, acquire the new WWTP property in FY 2015, begin design in FY 2016, and complete construction by the end of FY 2019.

**Project 5: New 24-inch Influent Gravity Sewer**

This project involves the extension of a new 24-inch diameter gravity sewer from the new East Davie WWTP site upstream past the Oak Valley Pump Station to the Smith Creek Pump Station. A new interceptor sewer is needed to transport wastewater flows to the new wastewater treatment facility. This project would allow the elimination of two (2) major wastewater pump stations in the East Davie sewer system.

The total estimated cost for this project is \$4,300,000. The recommended implementation schedule for this project is to begin planning work simultaneously with the new WWTP project, design concurrently with the new WWTP, and complete construction by the end of FY 2019.

**Project 6: Yadkin River Pump Station Force Main**

This project involves the extension of a new 8-inch diameter force main sewer west along US 158 from the existing Yadkin River Pump Station to Commerce Drive. This new force main would connect to the existing force main to allow the Yadkin River Pump Station flow to be pumped west to the existing Smith Creek Pump Station. This wastewater flow would be directed to the new WWTP.

The total estimated cost for this project is \$520,000. The recommended implementation schedule for this project is to begin work after the new WWTP has been placed into operation.

**Project 7: JeffCo Pump Station – Gravity Sewer**

This project involves the extension of a new 8-inch diameter gravity sewer from the existing JeffCo Pump Station off-road to the Hospital Gravity Sewer line. The JeffCo Pump Station is somewhat limited in capacity for the area served by this lift station. The new gravity sewer would involve the elimination of a lift station in the East Davie sewer system.

The total estimated cost for this project is \$130,000. The recommended implementation schedule for this project is to complete construction in FY 2014, although this project could be completed anytime the County has the funds to proceed.

**Project 8: Pump Station Improvements**

This project is a placeholder for general upgrade(s) to wastewater pump station(s) located in the East Davie sewer service area. Reasons for this project could be due to age, condition, and/or capacity limitation of existing pump station(s). Project work could include replacement of pumps, electrical equipment, PLC, standby generator, or other needs. The placeholder cost for this project is \$110,000.

## Water CIP Projects

This section includes a summary of the water treatment plant and water distribution system projects that are either planned by the County, or may be needed in the 10-Year CIP schedule. The project costs listed herein are planning-level costs based upon a review of previous reports and discussions with County staff.

Water treatment plant projects include:

**Table 5.2. Water Treatment Capital Projects**

*East Davie Wastewater Master Plan*

<b>Project No.</b>	<b>Project Name</b>	<b>Planning-Level Project Cost</b>
1	Cooleemee WTP LT2 Upgrades	\$ 200,000
2	New Cooleemee WTP Property Purchase	\$ 250,000
3	New Cooleemee WTP Project	\$ 12,000,000

Water distribution system projects include:

**Table 5.3. Water System Capital Projects**

*East Davie Wastewater Master Plan*

<b>Project No.</b>	<b>Project Name</b>	<b>Planning-Level Project Cost</b>
1	Eastern Davie Loop	\$ 510,000
2	Davie Academy Loop	\$ 300,000
3	Misc. Water Lines (annually recurring)	\$ 50,000

### **5.3. Updated Capital Improvements Plan**

The CIP is a plan and schedule of anticipated and required capital expenditures for facilities with project needs, estimated project costs, and timing of work over a planning period. The CIP is an important planning tool that allows the County to prepare for upcoming projects and to proactively determine funding. The CIP considers that each project is planned to be paid using (1) grant funds, (2) a capital outlay in a specific fiscal year, (3) new debt issuances resulting in annual debt service payments, or (4) a combination of these items.

The recommended capital projects are identified needs to maintain existing facilities, and for the County to continue providing a high level of service over the next 10+ years. The required capacity and timing of each recommended project is provided for budgeting and financial projection purposes only. Actual design parameters should be evaluated at the commencement of the design phase of each project using updated population and flow data as applicable.

In order to coordinate potential revenue sources with short-term and long-term improvement needs, the CIP prioritizes the capital improvement projects over the 10-year planning period. The recommended capital projects and tentative schedules are provided in the 10-Year Water and Sewer CIP included in Section 6.

An essential component of the overall approach is to establish a realistic and strategic path for addressing the wide range of financial issues in implementing the recommended projects. This fiscal planning process begins with the understanding that the financial approach must be integrated into the planning process. This financial analysis and plan represents a joint effort with Davie County to address the County's water and sewer capital improvements plan (CIP), financial status, and rates. In conducting this study, we examined historical financial reports, reviewed capital needs, and projected their impact on the County and its users through the utilization of a rate model and financial analysis developed for the Davie County program.

The following study objectives were identified:

- Categorize the County's costs of providing water and sewer service.
- Determine the adequacy of existing rates and charges to fund operating and capital costs.
- Develop a financial analysis and rate model for Davie County.
- Propose rates that address State drought legislation and maintain positive net income.

Certain assumptions were made with respect to conditions that may occur in the future. While these assumptions are reasonable for the purposes of this study, they are dependent upon future events, and actual conditions may differ from those assumed. In addition, information has been used and relied upon which has been provided by others. This information includes, among other things, audited financial statements, annual operating budgets, capital projects, and customer billing information. While this information is deemed reliable, the information has not been independently verified and no assurances are offered with respect thereto. To the extent that actual future conditions differ from those assumed herein or provided by others, the actual results may differ from those anticipated.

## 6.1. Revenue Requirement

The revenue requirements of the County's water and sewer system consist of the costs required to assure the adequacy and continuity of safe and reliable service and includes costs associated with operations, maintenance, financing of capital improvements, and replacement of facilities. The determination of the water and sewer system's revenue requirement for the County was made in a manner consistent with standard American Water Works Association (AWWA) utility rate-making principles. The revenue requirement for the County's water and sewer systems consist of Administration, Operations, Water Treatment Plant, Cooleemee Wastewater Treatment Plant, Davie County Sewer, Capital Outlay and Debt Service. The total of all the above items is the required revenue for the County's water and sewer fund and are projected in the following table for FY 2011, the last audited year:

**Table 6.1. Water and Sewer Revenue Requirement**  
*East Davie Wastewater Master Plan*

<b>CATEGORY</b>	<b>FY 2011 COST</b>
WATER AND SEWER ADMINISTRATION	\$252,905
WATER OPERATIONS	\$629,876
WATER TREATMENT PLANT	\$1,201,933
WASTE TREATMENT PLANT - COOLEEMEE	\$289,729
WASTE TREATMENT PLANT - EAST DAVIE	\$655,422
WATER AND SEWER CAPITAL OUTLAY	\$771,689
WATER DEBT	\$223,600
<b>TOTAL</b>	<b>\$4,025,154</b>

The total water and sewer costs represent the system's water and sewer revenue requirements in order to break even. The water revenue requirement includes the operation and maintenance costs associated with water treatment, transmission, and capital outlays only paid for improvements to the water system. The sewer revenue requirement includes the operation and maintenance costs associated with sewer collection and treatment, and capital outlays only paid for improvements to the sewer system, as shown in Table 6.2.

**Table 6.2. FY 2011 Cost Allocation of Water and Sewer**  
*East Davie Wastewater Master Plan*

<b>WATER REVENUES</b>			<b>WATER EXPENDITURES</b>		
WATER CHARGES	\$3,347,296		ADMINISTRATION		\$126,453
TAPS	\$32,688		WATER OPERATIONS		\$629,876
OTHER	\$88,745		WATER TREATMENT PLANT		\$1,201,933
INTEREST	\$1,524		WATER AND SEWER CAPITAL OUTLAY		\$686,816
<b>WATER SUBTOTAL</b>	<b>\$3,470,252</b>	<b>82%</b>	<b>WATER SUBTOTAL</b>	<b>\$2,868,678</b>	<b>71%</b>
<b>SEWER REVENUES</b>			<b>SEWER EXPENDITURES</b>		
SEWER CHARGES	\$315,375		WATER AND SEWER ADMINISTRATION		\$126,453
EAST DAVIE SEWER	\$334,033		WASTE TREATMENT PLANT - COOLEEMEE		\$289,729
EAST DAVIE FEES	\$10,240		WASTE TREATMENT PLANT - EAST DAVIE		\$655,422
TAPS	\$32,688		WATER AND SEWER CAPITAL OUTLAY		\$84,873
OTHER	\$88,745		WATER DEBT		\$0
INTEREST	\$1,524		<b>SEWER SUBTOTAL</b>	<b>\$1,156,477</b>	<b>29%</b>
<b>SEWER SUBTOTAL</b>	<b>\$782,604</b>	<b>18%</b>	<b>SEWER SUBTOTAL</b>	<b>\$1,156,477</b>	<b>29%</b>
<b>TOTAL REVENUES</b>	<b>\$4,252,855</b>	<b>100%</b>	<b>TOTAL EXPENDITURES</b>	<b>\$4,025,154</b>	<b>100%</b>

The revenues generated from water and sewer users should ideally meet or exceed the respective revenue requirements. FY 2011 water revenues exceed water expenditures by a 1.2:1 ratio. In contrast, the sewer revenues are 68% of sewer expenditures. The FY 2011 revenues from sewer users make up \$782,604, or 18% of overall fund revenues. However, the expenditures for sewer collection and treatment make up \$1,156,477, or 29% of total expenditures, which is justification for the impending rate increases.

## 6.2. Financial Analysis

The County's audited financial statements from FY 2007 through FY 2011 were compiled along with year-end and budget data for FY 2012 and FY 2013, respectively. Non-recurring capital outlays were separated from other expenditures to ensure the costs used for projections were consistent with prior years. Historical trends were analyzed to anticipate revenue and expenditure changes over the next 10 years. After calculating growth trends and considering economic conditions, revenues from Water and Mocksville Sewer user revenues were projected to increase at an average annual rate of 1% from FY 2014 to FY 2015, and increase by an average annual rate of 1.5% thereafter. In addition, tap revenues and other revenues were assumed to increase at an average annual rate of 1%. Salaries and benefits were projected to increase by an annual rate of 4-5% and other operating costs would increase by 0.5% in FY 2014 and an annual rate of 3-4% thereafter. We also examined two (2) scenarios for usage in the East Davie system that assumed growth from 1% to 5% annually, which affected East Davie revenues and treatment costs. Finally, capital costs were assumed to be incurred as noted below.

### Capital Improvements Plan

The CIP reflects the County's planned water and sewer capital improvements for the next ten (10) years. As shown in Table 6.3, eight (8) improvement projects are proposed for the water system and nine (9) improvement projects for the sewer system through FY 2022. In addition, future nutrient regulations at the Cooleemee WWTP are listed but not included in the analysis due to unknowns in timing and costs. Due to financial hardships that CIP projects may place upon the fund, the analysis assumes that improvements are planned to be paid either by a cash outlay in a specific fiscal year or by new debt.

The funding plan is comprised of financing over \$40 million of projects in the Water and Sewer CIP during the next ten (10) years. Annual costs equal or exceed \$10 million during some years, which may place pressure upon the fund's budget. The largest projects in future dollars include:

- \$12,900,000 for a new East Davie WWTP
- \$12,000,000 for a new Cooleemee WTP
- \$4,300,000 for new 24" Influent Gravity Sewer

**TABLE 6.3**  
**DAVIE COUNTY WATER AND SEWER FUND**  
**CAPITAL IMPROVEMENTS PLAN**

PROJECT NAME	TOTAL COST	YEAR 1 2013	YEAR 2 2014	YEAR 3 2015	YEAR 4 2016	YEAR 5 2017	YEAR 6 2018	YEAR 7 2019	YEAR 8 2020	YEAR 9 2021	YEAR 10 2022
<b>WATER IMPROVEMENTS</b>											
VEHICLES & EQUIPMENT	2,193,000	393,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
WATER METERS	1,320,000	440,000	440,000	440,000							
EASTERN DAVIE LOOP	510,000		510,000								
DAVIE ACADEMY LOOP	300,000							300,000			
MISC. WATER LINES	500,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
COOLEEMEE WTP - LT2 UPGRADES	200,000		200,000								
NEW COOLEEMEE WTP PROPERTY PURCHASE	250,000		250,000								
NEW COOLEEMEE WTP PROJECT	12,000,000							12,000,000			
<b>WATER IMPROVEMENTS SUBTOTAL</b>	<b>17,273,000</b>	<b>883,000</b>	<b>1,650,000</b>	<b>690,000</b>	<b>250,000</b>	<b>250,000</b>	<b>250,000</b>	<b>12,550,000</b>	<b>250,000</b>	<b>250,000</b>	<b>250,000</b>
<b>WASTEWATER IMPROVEMENTS</b>											
VEHICLES & EQUIPMENT	1,005,000	105,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
COOLEEMEE WWTP - FUTURE TMDL UPGRADES											
HOSPITAL SEWER, YADKIN RIVER PS UPGRADES, AND SMITH CREEK PS UPGRADES	2,000,000	2,000,000									
ASHLEY FURNITURE SEWER AND PUMP STATION	1,500,000	1,500,000									
PROPERTY / EASEMENT ACQUISITIONS FOR NEW WWTP AND 24" INFLUENT GRAVITY SEWER	460,000		460,000								
NEW EAST DAVIE WWTP	12,900,000						12,900,000				
NEW 24" INFLUENT GRAVITY SEWER	4,300,000						4,300,000				
YADKIN RIVER PS FORCE MAIN	520,000						520,000				
JEFFCO PS GRAVITY SEWER	130,000		130,000								
MISC. PUMP STATION UPGRADES	110,000								110,000		
<b>WASTEWATER IMPROVEMENTS SUBTOTAL</b>	<b>22,925,000</b>	<b>3,605,000</b>	<b>690,000</b>	<b>100,000</b>	<b>100,000</b>	<b>100,000</b>	<b>17,820,000</b>	<b>100,000</b>	<b>210,000</b>	<b>100,000</b>	<b>100,000</b>
<b>TOTAL</b>	<b>40,198,000</b>	<b>4,488,000</b>	<b>2,340,000</b>	<b>790,000</b>	<b>350,000</b>	<b>350,000</b>	<b>18,070,000</b>	<b>12,650,000</b>	<b>460,000</b>	<b>350,000</b>	<b>350,000</b>



DEBT PKG 1



DEBT PKG 2



DEBT PKG 3

DEBT PACKAGES	31,570,000		1,550,000				17,720,000	12,300,000			
ANNUAL DEBT	31,570,000	0	1,550,000	0	0	0	17,720,000	12,300,000	0	0	0
ANNUAL CAPITAL OUTLAY	8,628,000	4,488,000	790,000	790,000	350,000	350,000	350,000	350,000	460,000	350,000	350,000

\* DOES NOT REFLECT CAPITAL COST ASSOCIATED WITH CONTINUED DISCHARGES TO WINSTON SALEM.

## Debt Service Requirements

The water and sewer fund had one outstanding debt obligation in FY 2011 that was issued to fund a water project. The FY 2011 payment of \$223,600 was the last obligation and the loan was settled; no additional payments are required.

In order to maintain a positive net income with large capital projects, the analysis assumes that funds will be acquired from two (2) grants and by borrowing capital. The Ashley Furniture sewer project will be 98% funded with a Community Development Block grant and Rural Center grant, and the Hospital Sewer project will be 50% funded with a Rural Center grant. The remaining \$1 million balance of the Hospital Sewer project cost is proposed to be funded with cash.

Proposed debt issuances are packaged and spaced within the schedule to avoid debt service stacking that could cause an unnecessary burden on the fund. The remaining annual capital requirements will be paid by annual capital outlays that range from \$350,000 in several years to \$4.49 million in FY 2013. The proposed method to finance the improvements in the CIP is shown in Table 6.4.

**Table 6.4. Proposed Future Debt Packages**  
*East Davie Wastewater Master Plan*

YEAR	TYPE	PRINCIPAL	YEARLY PAYMENT	RATE	TERM (YEARS)
2014	160A-20 WATER	\$ 1,550,000	\$ 143,218	4.5%	15
2018	SRF SEWER	\$ 17,720,000	\$ 1,559,000*	4%	20
2019	SRF WATER	\$ 12,300,000	\$ 1,082,000*	4%	20

\* SRF loans with declining total payment amortization.

## Financial Model

When including the debt packages in the combined financial analysis, we determined that the net income would remain positive during at least six (6) of the next ten (10) years. Fund balance is assumed to be used to pay for capital costs. The impact on the fund is shown in Table 6.5. The proposed rate increases over the next ten (10) years are high enough to yield feasible operations for the entire enterprise fund, yet not so high as to create excessive cumulative balances. An Unrestricted Net Assets to Total Expenditures ratio of 20-25% is deemed minimal for a water/sewer enterprise fund and a higher level is desirable to meet future contingencies.

Each of the columns in Table 6.5 represents the fund's revenues and expenditures for a specific fiscal year. Revenues and expenditures from past audited years appear in columns on the left side of the table followed by adjacent columns on the right showing projections for ten (10) fiscal years. Each row in the table shows a revenue or expense line item from the audit and/or projections. Revenues are listed at the top of the table, followed by operating expenses, capital outlays, and debt payments. Obligated debt payments from existing debt and new debt payments from proposed debt are highlighted in yellow. Also highlighted in yellow is each fiscal year's net income or loss, followed by projected Unrestricted Net Assets balances.

**TABLE 6.5**  
**DAVIE COUNTY WATER AND SEWER FUND**  
**FINANCIAL ANALYSIS**

	AUDIT 2007	AUDIT 2008	AUDIT 2009	AUDIT 2010	AUDIT 2011	ESTIMATE 2012	YEAR 1 2013	YEAR 2 2014	YEAR 3 2015	YEAR 4 2016	YEAR 5 2017	YEAR 6 2018	YEAR 7 2019	YEAR 8 2020	YEAR 9 2021	YEAR 10 2022
<b>REVENUES</b>																
WATER CHARGES	3,315,968	3,612,540	2,999,727	3,144,553	3,347,296	3,316,000	3,350,000	3,383,500	3,417,335	3,468,595	3,520,624	3,573,433	3,627,035	3,681,440	3,736,662	3,792,712
HOSPITAL WATER CHARGES								3,000	14,000	22,000	29,000	29,000	29,000	29,000	29,000	29,000
SEWER CHARGES	309,724	273,498	337,280	333,596	315,375	377,000	392,775	396,703	400,670	406,680	412,780	418,972	425,256	431,635	438,110	444,681
EAST DAVIE SEWER	281,902	305,788	278,634	294,797	334,033	345,000	600,000	624,542	639,365	661,373	685,035	721,500	759,788	799,991	842,204	886,528
HOSPITAL SEWER CHARGES								3,000	14,000	21,000	28,000	28,000	28,000	28,000	28,000	28,000
EAST DAVIE FEES	80,085	148,963	41,460	18,205	10,240	400	1,000	1,010	1,020	1,030	1,041	1,051	1,062	1,072	1,083	1,094
TAPS	205,682	164,263	118,566	73,875	65,375	48,000	45,000	45,450	45,905	46,364	46,827	47,295	47,768	48,246	48,729	49,216
OTHER	186,240	158,134	165,320	164,148	177,489	200,000	136,500	137,865	139,244	140,636	142,042	143,463	144,898	146,346	147,810	149,288
<b>TOTAL OPERATING REVENUE</b>	<b>4,379,601</b>	<b>4,663,186</b>	<b>3,940,987</b>	<b>4,029,174</b>	<b>4,249,808</b>	<b>4,286,400</b>	<b>4,525,275</b>	<b>4,595,070</b>	<b>4,671,539</b>	<b>4,767,678</b>	<b>4,865,349</b>	<b>4,962,714</b>	<b>5,062,807</b>	<b>5,165,731</b>	<b>5,271,597</b>	<b>5,380,519</b>
<b>NON OPERATING REVENUE:</b>																
INTEREST	117,709	68,926	49,947	16,108	3,047	3,000	3,000	1,700	1,700	1,700	1,800	2,000	2,200	2,400	2,200	2,100
GRANTS							2,470,000									
TRANSFERS IN - GENERAL FUND	23,000	23,000	23,000	23,000	23,000	23,000	32,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000
<b>TOTAL PRESENT REVENUES</b>	<b>4,520,310</b>	<b>4,755,112</b>	<b>4,013,934</b>	<b>4,068,282</b>	<b>4,275,855</b>	<b>4,312,400</b>	<b>7,030,275</b>	<b>4,619,770</b>	<b>4,696,239</b>	<b>4,792,378</b>	<b>4,890,149</b>	<b>4,987,714</b>	<b>5,088,007</b>	<b>5,191,131</b>	<b>5,296,797</b>	<b>5,405,619</b>
<b>NEW SOURCES OF REVENUE:</b>																
REVENUE FROM WATER RATE INCREASES								338,650	456,368	582,894	717,023	857,594	1,006,146	1,163,065	1,328,756	1,503,641
PROJECTED RATE OF INCREASE								10.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
REVENUE FROM COOLEEMEE SEWER RATE INCREASES								79,341	108,982	141,655	177,173	215,759	257,650	303,104	352,396	405,824
PROJECTED RATE OF INCREASE								20.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
REVENUE FROM EAST DAVIE SEWER RATE INCREASES								125,508	177,715	237,684	306,048	385,972	477,298	581,434	699,954	834,614
PROJECTED RATE OF INCREASE								20.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
<b>TOTAL REVENUES</b>	<b>4,520,310</b>	<b>4,755,112</b>	<b>4,013,934</b>	<b>4,068,282</b>	<b>4,275,855</b>	<b>4,312,400</b>	<b>7,030,275</b>	<b>5,163,269</b>	<b>5,439,304</b>	<b>5,754,611</b>	<b>6,090,393</b>	<b>6,447,039</b>	<b>6,829,101</b>	<b>7,238,735</b>	<b>7,677,904</b>	<b>8,149,698</b>
<b>EXPENDITURES</b>																
<b>ADMINISTRATION</b>																
SALARIES AND BENEFITS	139,412	136,487	158,958	169,185	184,449	184,000	195,096	204,851	215,093	225,848	237,140	248,997	261,447	274,520	288,246	302,658
OTHER	60,031	66,716	75,656	58,610	68,456	64,000	93,700	94,169	96,994	99,903	102,900	105,987	109,167	112,442	115,815	119,290
<b>WATER OPERATIONS</b>																
SALARIES AND BENEFITS	305,778	302,552	351,531	378,253	385,291	375,000	406,209	422,457	439,356	456,930	475,207	494,215	513,984	534,543	555,925	578,162
OTHER	231,736	308,104	270,770	206,991	244,585	219,000	303,000	304,515	313,650	323,060	332,752	342,734	353,016	363,607	374,515	385,750
<b>WATER TREATMENT PLANT</b>																
SALARIES AND BENEFITS	345,744	406,302	426,065	423,000	434,711	402,000	408,548	428,975	450,424	472,945	496,593	521,422	547,493	574,868	603,611	633,792
OTHER	523,749	732,310	1,008,336	856,751	767,222	928,000	1,279,700	1,286,999	1,337,542	1,391,044	1,446,686	1,504,553	1,564,735	1,627,325	1,692,418	1,760,115
<b>WASTE TREATMENT PLANT - COOLEEMEE</b>																
SALARIES AND BENEFITS	0	18,660	39,005	44,498	50,098	53,000	63,315	66,481	69,805	73,295	76,960	80,808	84,848	89,091	93,545	98,222
OTHER	207,231	238,801	252,806	345,759	239,631	356,000	437,550	439,738	452,930	466,518	480,513	494,929	509,777	525,070	540,822	557,047
<b>WASTE TREATMENT PLANT - EAST DAVIE</b>																
SALARIES AND BENEFITS	37,023	39,997	40,630	31,515	41,977	43,000	45,088	47,342	49,710	52,195	54,805	57,545				
TREATMENT						644,000	742,000	839,000	944,000	1,065,000	1,205,000	1,364,000				
OTHER	241,633	411,616	476,654	506,130	613,445	116,000	142,200	142,911	148,627	154,573	160,755	167,186				
<b>NEW OPERATING COSTS</b>													594,625	614,160	634,367	655,269
<b>TOTAL OPERATING EXPENDITURES</b>	<b>2,092,337</b>	<b>2,661,545</b>	<b>3,100,411</b>	<b>3,020,692</b>	<b>3,029,865</b>	<b>3,384,000</b>	<b>4,116,406</b>	<b>4,276,537</b>	<b>4,518,131</b>	<b>4,781,311</b>	<b>5,069,312</b>	<b>5,382,377</b>	<b>5,539,093</b>	<b>4,715,626</b>	<b>4,899,265</b>	<b>5,090,305</b>
<b>CAPITAL OUTLAY</b>																
TRANSFER TO CAPITAL PROJECTS FUND	1,456,754	997,059	1,586,786	522,139	771,689	939,000	4,488,000	790,000	790,000	350,000	350,000	350,000	350,000	460,000	350,000	350,000
EXISTING DEBT	620,865	393,455	370,000	346,600	223,600											
NEW DEBT							0	71,609	143,218	143,218	143,218	143,218	1,295,018	2,563,578	2,749,538	2,689,498
<b>TOTAL EXPENDITURES</b>	<b>4,169,956</b>	<b>4,243,829</b>	<b>5,057,197</b>	<b>3,889,431</b>	<b>4,025,154</b>	<b>4,323,000</b>	<b>8,604,406</b>	<b>5,138,146</b>	<b>5,451,349</b>	<b>5,274,529</b>	<b>5,562,529</b>	<b>5,875,595</b>	<b>6,184,111</b>	<b>7,739,204</b>	<b>7,998,803</b>	<b>8,129,803</b>
REVENUE OVER EXPENDITURES	350,354	511,283	(1,043,263)	178,851	250,701	(10,600)	(1,574,131)	25,122	(12,046)	480,082	527,864	571,444	644,990	(500,468)	(320,899)	19,896
ACCRUAL ADJUSTMENTS	1,350,880	(58,036)	1,065,341	(41,894)	525,308											
<b>NET INCOME</b>	<b>1,701,234</b>	<b>453,247</b>	<b>22,078</b>	<b>136,957</b>	<b>776,009</b>	<b>(10,600)</b>	<b>(1,574,131)</b>	<b>25,122</b>	<b>(12,046)</b>	<b>480,082</b>	<b>527,864</b>	<b>571,444</b>	<b>644,990</b>	<b>(500,468)</b>	<b>(320,899)</b>	<b>19,896</b>
<b>UNRESTRICTED NET ASSETS</b>																
UNRESTRICTED NET ASSETS / EXPENDITURES	7,619,539	8,293,967	7,095,217	7,112,186	7,241,484	7,230,884	5,656,753	5,681,875	5,669,830	6,149,912	6,677,776	7,249,220	7,894,210	7,393,742	7,072,843	7,092,739
	182.72%	195.44%	140.30%	182.86%	179.91%	167.27%	65.74%	110.58%	104.01%	116.60%	120.05%	123.38%	127.65%	95.54%	88.42%	87.24%
<b>NEW DEBT:</b>																
LOAN AMOUNT								1,550,000				17,720,000	12,300,000			
PAYMENT								71,609								
ANNUAL PAYMENTS								143,218								
RATE												4.00%	4.00%			
TERM									15			20	20			

**TABLE 6.5**  
**DAVIE COUNTY WATER AND SEWER FUND**  
**FINANCIAL ANALYSIS**

	AUDIT 2007	AUDIT 2008	AUDIT 2009	AUDIT 2010	AUDIT 2011	ESTIMATE 2012	YEAR 1 2013	YEAR 2 2014	YEAR 3 2015	YEAR 4 2016	YEAR 5 2017	YEAR 6 2018	YEAR 7 2019	YEAR 8 2020	YEAR 9 2021	YEAR 10 2022
<b>ASSUMPTIONS:</b>																
<b>EAST DAVIE FLOWS IN CUBIC FEET</b>																
EAST DAVIE SEWER FLOW SUBTOTAL (CU FT)		9,952,543	10,935,136	12,341,913	11,992,222	12,596,599	13,226,429	13,767,437	14,094,204	14,579,344	15,100,939	15,904,779	16,748,812	17,635,046	18,565,591	19,542,664
HOSPITAL SEWER FLOW (CU FT)								120,313	487,934	731,901	975,868	975,868	975,868	975,868	975,868	975,868
EAST DAVIE SEWER FLOW TOTAL (CU FT)		9,952,543	10,935,136	12,341,913	11,992,222	12,596,599	13,226,429	13,887,750	14,582,138	15,311,245	16,076,807	16,880,647	17,724,680	18,610,914	19,541,459	20,518,532
ANNUAL AVG UNIT CHARGE / 100 CU FT		\$ 3.14	\$ 3.41	\$ 3.74	\$ 4.13	\$ 4.64	\$ 5.15	\$ 5.60	\$ 6.05	\$ 6.55	\$ 7.10	\$ 7.70	\$ 8.35	\$ 9.05	\$ 9.80	\$ 10.60
TREATMENT CHARGE SUBTOTAL		312,065	372,474	461,679	495,519	584,848	681,640	777,714	882,219	1,002,887	1,141,453	1,299,810	1,480,011	1,684,288	1,915,063	2,174,964
INDUSTRIAL SURCHARGES		0	0	0	43,435	60,000	60,600	61,206	61,818	62,436	63,061	63,691	64,328	64,971	65,621	66,277
TREATMENT CHARGE TOTAL		312,065	372,474	461,679	538,954	644,848	742,240	838,920	944,037	1,065,323	1,204,514	1,363,501	1,544,339	1,749,259	1,980,684	2,241,242
PERCENT CHANGE			19%	24%	17%	20%	15%	13%	13%	13%	13%	13%	13%	13%	13%	13%
<b>EAST DAVIE FLOWS IN GALLONS</b>																
EAST DAVIE SEWER FLOW SUBTOTAL (GALLONS)		74,445,022	81,794,817	92,317,509	89,701,821	94,222,561	98,933,689	102,980,432	105,424,646	109,053,493	112,955,023	118,967,747	125,281,113	131,910,144	138,870,620	146,179,126
HOSPITAL SEWER FLOW (GALLONS)								899,938	3,649,747	5,474,620	7,299,493	7,299,493	7,299,493	7,299,493	7,299,493	7,299,493
EAST DAVIE SEWER FLOW TOTAL (GALLONS)		74,445,022	81,794,817	92,317,509	89,701,821	94,222,561	98,933,689	103,880,370	109,074,392	114,528,113	120,254,516	126,267,240	132,580,606	139,209,637	146,170,113	153,478,619
ANNUAL AVG UNIT CHARGE / 1000 GALLONS		\$ 4.19	\$ 4.55	\$ 5.00	\$ 5.52	\$ 6.21	\$ 6.89	\$ 7.49	\$ 8.09	\$ 8.76	\$ 9.49	\$ 10.29	\$ 11.16	\$ 12.10	\$ 13.10	\$ 14.17
TREATMENT CHARGE SUBTOTAL		312,065	372,474	461,679	495,519	584,848	681,640	777,714	882,219	1,002,887	1,141,453	1,299,810	1,480,011	1,684,288	1,915,063	2,174,964
INDUSTRIAL SURCHARGES		0	0	0	43,435	60,000	60,600	61,206	61,818	62,436	63,061	63,691	64,328	64,971	65,621	66,277
TREATMENT CHARGE TOTAL		312,065	372,474	461,679	538,954	644,848	742,240	838,920	944,037	1,065,323	1,204,514	1,363,501	1,544,339	1,749,259	1,980,684	2,241,242
PERCENT CHANGE			19%	24%	17%	20%	15%	13%	13%	13%	13%	13%	13%	13%	13%	13%

EAST DAVIE SEWER REVENUES, FLOWS, UNIT CHARGES, AND INDUSTRIAL CHARGES PROJECTED BY MCGILL ASSOCIATES.  
 DOES NOT CONSIDER USAGE FROM PROPOSED INDUSTRIAL USERS.  
 WATER AND SEWER REVENUES EXCLUDING EAST DAVIE INCREASE AT AVERAGE ANNUAL RATES OF 1% DURING YEARS 2-3 AND 1.5% EACH YEAR THEREAFTER.  
 FY 2013 EAST DAVIE SEWER REVENUE PROJECTED BY COUNTY STAFF.

## 6.3. Water and Sewer Rate Review

### Interlocal Agreements

The County has an agreement with the Winston-Salem Forsyth County Utility Commission (WS/FC Utilities) for wastewater treatment of its East Davie sewer system. The agreement was signed on December 12, 1996, and is in effect until the year 2030. An amendment to the agreement was signed November 10, 1997 that increased the maximum flow from 275,000 gallons per day to 550,000 gallons per day. It states that Davie County shall pay two times the “inside the City of Winston-Salem rate,” plus industrial surcharges. As a result, increases in the Winston-Salem rate directly influence East Davie’s operating costs and the rates required from the users. As discussed next, the current rates charged for water and sewer service are high enough to yield feasible operations in the current year but may not provide enough to fund higher costs in the future.

### User Summary

The following user characteristics are notable when analyzing the County’s usage data and current water and sewer rate structures shown in Table 6.6.

- The County has 11,815 water users, of which 767 are irrigation users and 11,222 are residential.
- The County has 1,775 sewer users, of which 1,328 are in the East Davie sewer system and 1,613 are residential.

**Table 6.6. FY 2013 Bi-Monthly Water & Sewer Rates**

*East Davie Wastewater Master Plan*

<b>WATER</b>		
Minimum	\$24.00	
3,001 + gal	\$4.06	per 1000 gal
<b>IRRIGATION</b>		
Minimum	\$24.00	
3,001 + gal	\$4.60	per 1000 gal
<b>SEWER</b>		
Minimum	\$14.00	
3,001 +	\$3.27	per 1000 gal
<b>SEWER - MOCKSVILLE</b>		
Minimum	\$14.00	
3,001 +	\$3.27	per 1000 gal
<b>SEWER - EAST DAVIE</b>		
Minimum	\$20.00	
3,001 +	\$8.00	per 1000 gal

### Rate Modeling

To analyze the present water and sewer rates in Table 6.6 and the impact of any changes, a rate model was created to show the financial impact of various rate modifications. Each user group, including residential and commercial users inside the County, was investigated to determine the number of users contained within and the groups' average monthly consumption and charges paid. We then made changes to the rates for each user group to determine how it would affect the charges to the users and the fund's revenues. In proposing changes to rates, the objectives are to maintain positive revenue generation, yet not create an excessive burden on users.

## 6.4. Recommendations

As a result of this analysis, water and sewer revenue increases have been modeled for financing system growth, inflation, and capital needs. These increases would affect only fixed and volume charges, not tap or other miscellaneous charges. Revenue increases are arranged in time to minimize the impact to most users. Proposed revenue increases are based upon the County's flow projections.

- 10% Water revenue increase in FY 2014, followed by 3% annual revenue increases from FY 2015 - 2022.
- 20% Sewer, Sewer Mocksville, and East Davie sewer revenue increase in FY 2014, followed by 6% annual revenue increases from FY 2015 - 2022.

The rate schedule for the next four (4) years is shown in Table 6.7. The rates generate the proposed revenue increases and rounds all future minimum charges and volume rates to the nearest \$0.05.

Finally, considering the extra revenue needed to accomplish the CIP and move the fund forward as described herein, the County may want to consider alternative sources of revenue generation. These sources could include capacity depletion fees, a mandatory connection policy, and/or property owner assessments for capital projects.

**TABLE 6.7****DAVIE COUNTY WATER AND SEWER FUND****CURRENT & PROPOSED BI-MONTHLY WATER AND SEWER RATES**

	<b>CURRENT 2013</b>	<b>YEAR 2 2014</b>	<b>YEAR 3 2015</b>	<b>YEAR 4 2016</b>	<b>YEAR 5 2017</b>	
<b>WATER</b>						
Minimum	\$24.00	\$27.15	\$28.55	\$30.00	\$31.50	
3,001 + gal	\$4.06	\$4.60	\$4.85	\$5.10	\$5.40	per 1000 gal
<b>IRRIGATION</b>						
Minimum	\$24.00	\$27.15	\$28.55	\$30.00	\$31.50	
3,001 + gal	\$4.60	\$5.20	\$5.50	\$5.80	\$6.10	per 1000 gal
<b>SEWER</b>						
Minimum	\$14.00	\$17.50	\$19.45	\$21.60	\$24.00	
3,001 +	\$3.27	\$4.10	\$4.60	\$5.15	\$5.75	per 1000 gal
<b>SEWER - MOCKSVILLE</b>						
Minimum	\$14.00	\$17.50	\$19.45	\$21.60	\$24.00	
3,001 +	\$3.27	\$4.10	\$4.60	\$5.15	\$5.75	per 1000 gal
<b>SEWER - EAST DAVIE</b>						
Minimum	\$20.00	\$25.00	\$27.75	\$30.85	\$34.25	
3,001 +	\$8.00	\$10.00	\$11.10	\$12.35	\$13.75	per 1000 gal
<b><u>SAMPLE BI-MONTHLY WATER CHARGES</u></b>						
8,000 GAL	\$44.30	\$50.15	\$52.80	\$55.50	\$58.50	
20,000 GAL	\$93.02	\$105.35	\$111.00	\$116.70	\$123.30	
100,000 GAL	\$417.82	\$473.35	\$499.00	\$524.70	\$555.30	
200,000 GAL	\$823.82	\$933.35	\$984.00	\$1,034.70	\$1,095.30	
<b><u>SAMPLE BI-MONTHLY SEWER CHARGES</u></b>						
8,000 GAL	\$30.35	\$38.00	\$42.45	\$47.35	\$52.75	
20,000 GAL	\$69.59	\$87.20	\$97.65	\$109.15	\$121.75	
100,000 GAL	\$331.19	\$415.20	\$465.65	\$521.15	\$581.75	
200,000 GAL	\$658.19	\$825.20	\$925.65	\$1,036.15	\$1,156.75	
MOCKSVILLE 8,000 GAL	\$30.35	\$38.00	\$42.45	\$47.35	\$52.75	
MOCKSVILLE 20,000 GAL	\$69.59	\$87.20	\$97.65	\$109.15	\$121.75	
MOCKSVILLE 100,000 GAL	\$331.19	\$415.20	\$465.65	\$521.15	\$581.75	
MOCKSVILLE 200,000 GAL	\$658.19	\$825.20	\$925.65	\$1,036.15	\$1,156.75	
EAST DAVIE 8,000 GAL	\$60.00	\$75.00	\$83.25	\$92.60	\$103.00	
EAST DAVIE 20,000 GAL	\$156.00	\$195.00	\$216.45	\$240.80	\$268.00	
EAST DAVIE 100,000 GAL	\$796.00	\$995.00	\$1,104.45	\$1,228.80	\$1,368.00	
EAST DAVIE 200,000 GAL	\$1,596.00	\$1,995.00	\$2,214.45	\$2,463.80	\$2,743.00	

## **Conclusions**

The financial analysis shows that the County recovers its water and sewer system costs through its current rates. However, the County's current rates do not generate enough revenue from sewer users to pay for sewer system costs. The proposed increases would allow the County to achieve more equity between its water and sewer users over time. In order to minimize the impact on users and their demand, the proposed revenue increases to water and sewer rates occur gradually over multiple years. It should be noted that rate changes of any magnitude might affect demand in unpredictable ways.

The estimated annual revenue increases would prepare the County for additional debt service payments, operating and capital costs associated with the CIP. The County should consider the issuance of debt for the long-term financing of the water and sewer system's capital improvements, as discussed in Section 6.2. This would allow debt service payments to be spread over a longer period to avoid rate shock for current customers and have future customers who will benefit from the improvements pay a fair share of the costs. The increases are estimated from the current fiscal year's data and projections of future events. It is recommended that these calculations be reviewed annually, using updated information to determine if adjustments are required at that time to meet established financial objectives.

The County should begin updating the 10-Year Water and Sewer CIP on an annual basis. As water and sewer capital projects are added or revised over the years, the CIP is a very beneficial tool for setting annual budgets and planning for future expenditures. Water and sewer rates can be revised to match not only the needs for the upcoming year, but for the long-term requirements of the water and sewer fund.

The planning effort for the East Davie Sewer System was timely and beneficial considering the County's growth situation. The County should begin efforts to gain and plan for additional sewer capacity in the East Davie Sewer System.

The major recommendations from this report include:

1. **Obtain an additional 200,000 gallons per day (gpd) capacity from WS/FC Utilities.**  
This would increase the total allocation for the East Davie Sewer System to 750,000 gpd.
2. **Begin planning efforts for a New WWTP.** Planning for a new wastewater treatment plant may require 5 to 7 years. The permitting process for a new wastewater discharge and property location process will require proper planning.
3. **Continue to prepare the water and sewer fund financially for a new WWTP and sewer system improvements.** The revenues and expenditures need to be managed with respect to rates and fund balance to prepare for future capital investments. The County should update the 10-Year Water and Sewer CIP on an annual basis. Actual flows, expenditures, and revenues each year may affect the timing and need of CIP projects.
4. **Prepare an interceptor sewer analysis for the new gravity sewer and other sewers needed for a new WWTP.** Once the WWTP site is established, an analysis is warranted to maximize the existing capacity and provide capacity for future flows.

### **Bermuda Run Considerations**

As described in Section 2.2.1, the Town of Bermuda Run has a wastewater treatment plant with a capacity of 0.19 MGD. This facility has average daily flows ranging from 0.11 to 0.15 MGD during our review period. The Bermuda Run WWTP is a package plant that is approaching the latter portion of its service life. The facility's limited available capacity coupled with future anticipated nutrient removal requirements could greatly impact the Bermuda Run WWTP.

The County's new WWTP is proposed to be situated in eastern Davie County, south of Bermuda Run, providing a centralized system for wastewater treatment in the eastern area of the County. The new WWTP would be sized for current wastewater flows with capacity to allocate flows for other entities within the County. If the Town of Bermuda Run considers abandoning its plant in the future, the County could work with the Town to serve those customers on the Bermuda Run package plant. If the Town chose to decommission its package plant, a pump station and force main would be needed at a cost of approximately \$990,000 to direct wastewater flows to the County's new WWTP.