Rutherford County / Municipalities
Joint Sewer Study

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Client Information:

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Executive Summary

ES.1 Project Purpose:

Rutherford County, the Town of Forest City, the Town of Lake Lure, the Town of Spindale, and the Town of Rutherfordton have elected to evaluate the best long term strategies for providing sewer service within the County and Towns.

ES.2 Project Description:

This project involved providing Professional Engineering Services for the Rutherford County / Municipalities Joint Sewer Study for Rutherford County, North Carolina**.** Rutherford County (Owner) has eight (8) Towns within its boundaries. The Town of Lake Lure, the Town of Spindale and the Town of Rutherfordton own and operate one (1) Wastewater Treatment Plant (WWTP) each. The Town of Forest City owns and operates two (2) WWTPs (and owns an additional WWTP not currently in operation that was formerly owned by an industry). The Town of Ellenboro has a sanitary collection system that pumps to the Town of Forest City's collection system and WWTP for treatment. In addition, the Cliffside Sanitary District also owns and operates its own WWTP and collection system.

The dramatic reduction in the textile industry that occurred in Rutherford County, beginning in the 1990's and continuing until the last few years, has resulted in a dramatic reduction in sewer flows to the various WWTP's. Many of the WWTP's need extensive upgrades to meet current treatment requirements. And, many of the Town's wastewater collection systems are plagued by Infiltration and Inflow (I&I).

ES.3 Project Scope:

The project included the following tasks:

a. The compilation of a composite GIS map of the Project Stakeholders sewer systems including sewer lines, force mains, pump stations and WWTP based on GIS data provided by the Project Stakeholders.
b. The development of a summary of average daily flows, peak daily flows and peak hour flows for each sewer collection system based on data provided by the Project Stakeholders.
c. The development of a reasonable assessment of the volume of Inflow & Infiltration in each Project Stakeholder's collection system.
d. An evaluation of the consolidation of sewer collection and treatment systems, including the abandonment of inefficient WWTP's for and between the Project Stakeholders along with opinions of probable cost.
e. An evaluation of the consolidation of collection system operations making use of shared resources that included the identification of practical management systems for the consolidation of the various sewer collection systems while taking into consideration current and proposed legislation regarding utility management systems.
f. An analysis of areas within the County needing domestic sewer service.
g. An analysis of areas within the County needing sewer service for economic development.

h. Building a utility financial model for proposed projects to determine and demonstrate the financial feasibility of consolidation and to show multiyear cash flows as municipal systems are interconnected in phases and provide the likely impacts on sewer rates.

ES.4 Findings:

Options for Consolidation

After reviewing the viable options for consolidation as well as discussion with Project Stakeholders staff and elected officials, the following observations were noted:

a. Ownership of the sewer systems should be run responsibly.
b. Operational structures, policy and practices should remain sensitive to the specific needs of the geographic areas that are served by the selected management system.
c. A new management system should be able to provide administrative and management functions more efficiently and economically by a single organizational entity due to economies of scale.
d. Economies of scale should result in lower long term unit costs for operation and maintenance.
e. The individual Project Stakeholders may not be able to capitalize substantial investments in new system capacity or new service infrastructure on their own.
f. New economic growth could be stunted by the Project Stakeholders inability to respond to new demands beyond their existing service limits.
g. Financing mechanisms available to a new management entity should be flexible and should approximate those available to municipal and county government in North Carolina.
h. Improved planning and more effective investment of capital into the County's sewer systems should lead to improved sewer system reliability; and,
i. Both Spindale and Lake Lure are experiencing compliance issues associated with meeting their NPDES permit limits.

In light of the findings and conclusions, the list of viable alternatives was reduced to the following:

a. Inter-Local Contracts or Inter-Governmental Agreements (IGA)
b. Joint Management Agency (JMA)
c. Sewer Authority
d. Sanitary District
e. County Sewer District

A summary of the primary aspects and differences of the alternatives are listed below.

a. An IGA is different than a JMA in that a JMA requires action by each participating unit on items / expenditures in order to move forward.
b. An IGA is applicable in situations where the other prescribed intergovernmental mechanisms do not exactly apply to the situation and where complexities are too great to deal with within the confines of the statutes for other organizational alternatives.
c. IGAs and JMAs are typically viewed as an interim step to some other form of management entity.

d. An IGA and a JMA are different than a Sewer Authority, Sanitary District, and a County Sewer District in that Legal title to real property must remain or rest with the participating governments or government, or property may be held jointly as tenants in common.
e. A JMA cannot issue revenue bonds or general obligation bonds, establish its rates & charges, or levy property taxes or special assessments.
f. The Authority alternative is the best-known vehicle among the entities that are considered viable options to independent municipal systems.
g. An Authority is an independent public body with a governing board; the number of board members elected is left to the discretion of the respective local governments and membership is appointed by the governmental units that organized it.
h. Authorities have the power to set and collect fees for service and to issue revenue bonds.
i. Except for the appointment of membership, Authorities stand alone and its powers are governed by statute and only limited by its charter of incorporation.
j. A Sanitary District or a County Sewer District do possess the power to levy property taxes or special assessments whereas an Authority does not.
k. A Sanitary District becomes an independent, corporate political body, and the county commissioners elect a sanitary district board to serve as the district's governing body.
l. In order for a Sanitary District to be created, 51 percent or more of the property owners within the proposed district must petition the board of commissioners in the county that contains the largest portion of the district's land area.
m. A County Sewer District is a corporate political body, governed by the board of commissioners of the county in which the district is established.
n. The fact that Broad River Water Authority is already in existence is seen as a vehicle for creating a new sewer management entity.

Financial Analysis

As part of the project, a comparison of the Project Stakeholders rates was conducted. Below in Table ES.1 please find a sewer rate comparison amongst the project stakeholders.

Table ES.1 Sewer Rate Comparison for a 5,000 gallon per month Residential Customer

Stakeholder		Base	Per 1,000	3,000	5,000	10,000
Cliffside		$26.00	$5.05	$36.10	$46.20	$71.45
Lake Lure	Inside	$21.00	$3.68	$32.04	$39.40	$57.80
	Outside	$42.00	$7.35	$64.05	$78.75	$115.50
Forest City	Inside	$14.95	$3.71	$14.95	$22.37	$40.92
	Outside	$27.15	$6.97	$27.15	$41.09	$75.94
Rutherfordton	Inside	$12.09	$4.70	$21.49	$30.89	$54.39
	Outside	$36.27	$14.11	$64.49	$92.71	$163.26
Spindale	Inside	$16.00	$5.69	$27.38	$38.76	$67.21
	Outside	$32.00	$11.38	$54.76	$77.52	$134.42
Average				$38.05	$51.97	$86.77
Average Inside				$26.39	$35.52	$58.35
Average Outside				$52.61	$72.52	$122.28

Various capital projects were identified should consolidation occur. As a result, opinions of probable costs for the various options are presented below in Table ES.2.

Table ES.2 County / Joint Municipalities Opinions of Probable Cost

	Alternative	Probable Cost
A.	Lake Lure to Rutherfordton WWTP	$9,901,000
B.	Cost to Upgrade Lake Lure WWTP	$7,014,000
C.	Rutherfordton WWTP Upgrades to Handle Lake Lure & Equestrian Center	$304,000
D.	Rutherfordton to Spindale WWTP	$5,171,000
E.	Upgrades to Spindale WWTP to Handle Rutherfordton & Lake Lure	$11,205,000
F.	Spindale to Rutherfordton WWTP	$8,292,000
G.	Spindale to Forest City Second Broad River WWTP	$5,628,000
H.	Spindale and Rutherfordton to Forest City WWTP	$8,294,000
I.	Cliffside to Forest City Second Broad River WWTP	$5,423,000
J.	Cliffside to Riverstone WWTP	$4,799,000
K.	Cliffside to Forest City DRG WWTP w/o Riverstone WWTP	$6,226,000
L.	Cliffside to Forest City DRG WWTP with Riverstone WWTP	$6,509,000
M.	Forest City Second Broad River WWTP Upgrades to Handle Cliffside, Rutherfordton, and Spindale WWTP	$13,960,000
N.	Upgrades to Forest City Riverstone WWTP to Handle Cliffside	$889,000
O.	Upgrades to Forest City DRG WWTP to Handle Cliffside and Riverstone	$1,348,000
P.	Rutherford County Airport to Spindale	$1,551,000
Q.	Area North of Rutherfordton / Hwy 221 to Rutherfordton	$1,551,000
R.	Sewer Service to Ellenboro Henrietta Rd Interchange at Hwy 74 via FM to Ellenboro	$2,231,000
S.	Sewer Service to Ellenboro Henrietta Rd Interchange at Hwy 74 via FM to Henrietta	$1,979,000
T.	Service to Industrial Area on HWY 221 near Harris Elementary via PS & FM to Spindale Torrington PS on Hwy 221	$1,914,000
U.	Service to Industrial Area on Hwy 221 near Harris Elementary via PS & FM to Riverstone Blvd Gravity Sewer to Riverstone WWTP	$2,145,000
V.	Hwy. 221 / US 74 Interchange PS Upgrade – Spindale	$150,000

In addition, other capital needs were identified by WK Dickson and in individual reports supplied to WK Dickson by the project stakeholders and prepared by the project stakeholders consulting engineers as referenced in the reference section of this study. As a result, Table ES.3 as presented on the next page has been prepared.

Table ES.3 Other Rutherford County Opinions of Probable Cost

	Additional Capital Needs	Probable Cost
A.	Forest City Central Business District Sewer Rehab (Post Bid)	$944,197
B.	Forest City Mill Street Area Sewer Rehabilitation	$928,000
C.	Forest City WWTP Large Aeration Basin & Digester Improvements	$1,711,000
D.	Spindale – Rehabilitation of Trunk Line A3	$968,000
E.	Spindale – Rehabilitation of Trunk Line A2	$1,449,000
F.	Spindale – Rehabilitation of Oak Street PS – Southern Trunk Line	$641,000
G.	Spindale – Rehabilitation of Oak Street PS – Northern Trunk Line	$410,000
H.	Rutherfordton – Sewer Outfall to the Second Broad River	$8,003,000
I.	Cliffside to Forest City Second Broad River WWTP	$5,423,000
J.	Sewer Operation & Maintenance Programs	$200,000
K.	Cliffside Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$262,000
L.	Forest City Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$435,000
M.	Lake Lure Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$452,000
N.	Rutherfordton Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$379,000
O.	Spindale Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$364,000
P.	Upgrading the Rutherfordton WWTP from 3 MGD to 6 MGD	$15,000,000

After reviewing the limited financial analysis conducted for the Project Stakeholders as well as interviewing their respective staff's, the following observations were noted:

a. All project stakeholders assume that the full cost of service is currently being charged to their rate payers.
b. A more regionalized approach will benefit rate paying customers through operations and maintenance efficiencies and economies of scale that can be recognized through the shared use of labor, equipment, purchasing agreements, and capital resources.
c. These savings and efficiencies can be passed on to the ratepayer in the form of reduced rates, or the provision of greater rate stability.
d. Cliffside Sanitary District, Forest City, and Rutherfordton have declining rate block structures.
e. Spindale has a flat rate structure.
f. Lake Lure has an inclining rate block structure.
g. Rutherfordton's outside rates are over double the inside rates.
h. Forest City's outside rates are less than double the inside rates.
i. Lake Lure's and Spindale's outside rates are approximately double the inside rates.
j. Rutherfordton currently maintains minimal reserves.
k. Rutherfordton has not adjusted rates in accordance with their 2011 Financial Model.
l. It is assumed this means Rutherfordton has not kept up with the capital improvements planned in the CIP contained in the Financial Model.
m. Decreasing rate block structures are not looked upon favorably by loan and grant agencies.
n. Outside rates that are significantly higher than inside rates are not looked upon favorably by loan and grant agencies as well as the legislature.
o. The cost to upgrade the Rutherfordton WWTP and transfer wastewater flow from Spindale to Rutherfordton is $8,292,000 + $15,000,000 = $23,292,000.
p. The cost to upgrade the Spindale WWTP and transfer flow from Rutherfordton to Spindale $5,171,000 + $11,205,000 = $16,376,000.

q. The cost to upgrade the Forest City WWTP and transfer wastewater flow from Spindale and Rutherfordton to Forest City is $8,294,000 + $5,171,000 + $13,960,000 = $27,425,000.

r. In order to make one (1) of the three (3) forms of consolidation viable, capital costs for the projects need to be offset with a combination of grants and/or low interest loans and additional forms of financing such as Tax Increment Financing Districts.

s. If Lake Lure upgrades their WWTP on their own without any financial assistance at an estimated project cost of $7,014,000 and an interest rate of 3%, it has been estimated that Lake Lure would have to raise rates 200%.

t. If Lake Lure connects to Rutherfordton for wastewater treatment on their own without any financial assistance at an estimated project cost of $9,901,000 and an interest rate of 3%, it has been estimated that Lake Lure would have to raise rates 240%.

u. If Rutherfordton upgrades their WWTP on their own without any financial assistance at an estimated project cost of $4,000,000 ($1,000,000 grant already secured) and an interest rate of 3%, it has been estimated that Rutherfordton would have to raise rates 130%.

v. If Rutherfordton upgrades their WWTP on their own without any financial assistance at an estimated project cost of $5,000,000 and an interest rate of 3%, it has been estimated that Rutherfordton would have to raise rates 135%.

w. If Rutherfordton upgrades their WWTP on their own without any financial assistance at an estimated project cost of $11,200,000 and an interest rate of 3%, it has been estimated that Rutherfordton would have to raise rates 180%.

x. Assuming a conservative 20% savings in overall operating and management costs, 2% increases in operating and management costs per year, a 3% interest rate, and conversion to a flat rate structure, three financial model scenarios were developed:
   i. Scenario 1 - Consolidating Lake Lure, Rutherfordton and Spindale;
   ii. Scenario 2 - Consolidating Cliffside, Lake Lure, Rutherfordton and Spindale with Forest City; and,
   iii. Scenario 3 - Consolidating Cliffside with Forest City.

y. The three financial model scenarios have been compiled to include the necessary capital projects to show a potential time line for rate increases and the capital projects as well as the projected rate increases.

System Descriptions

After reviewing the wastewater collection and treatment system descriptions and the WWTP's respective NPDES permit limits as well as debriefing with their respective Project Stakeholders, the following observations were noted:

a. According to NPDES permit limits and available 7q10 stream flow data, the assimilative capacity of the Town of Rutherfordton WWTP's effluent receiving stream is nominal.

Flow Analysis

A flow analysis was conducted as part of this study. The flow analysis took a limited look at infiltration, inflow, and peak daily flows in the Project Stakeholders wastewater collection and treatment systems. Infiltration information is presented in Table ES.4, Inflow information is presented in Table ES.5, and Peak Daily Flow information is presented in Table ES.6.

Table ES.4 Infiltration Parameter Check

System	Inch-Miles	gpdim	Infiltration Percentage of Total Wastewater
Cliffside	51	382	45%
Forest City	360	1,555	44%
Lake Lure	148	1640	71%
Rutherfordton	274	760	42%
Spindale	430	1,065	53%

Table ES.5 – Inflow Calculations

System	Average Daily Flow (gpd)	Estimated Average Daily Water Consumption (gpd)	Inflow (gpd)	Estimated Sewer System Population	gpdpc
Cliffside	43,000	23,500	19,500	130	150
Forest City	1,260,000	700,000	560,000	5,650	100
Lake Lure	340,000	97,000	243,000	1,000	243
Rutherfordton	500,000	291,000	209,000	2,752	76
Spindale	870,000	413,000	457,000	2,212	205

Note: Population calculated using 2.0 persons per residential customer

Table ES.6 Capacities of Project Stakeholders WWTP's

WWTP	Permitted Capacity	Avg. Daily Flow	Peak Daily Flow	Available Capacity	Calculated Peaking Factor
	(MGD)	(MGD)	(MGD)	(MGD)	
Forest City Second Broad WWTP	4.95	1.26	16.69	3.69	13.2
Forest City Riverstone WWTP	0.05	< 0.005	N/A	0.045	N/A
Forest City DRG WWTP	0.91	Inactive	N/A	> 0.91	N/A
Rutherfordton WWTP	1.0 / 3.0	0.5	4.3	2.5	8.6
Spindale WWTP	3.0 / 4.5 /6.0	0.87	6.1	5.13	7
Cliffside WWTP	0.05 / 1.75	0.043	1.117	1.71	26
Lake Lure WWTP	0.995	0.34	0.63	N/A	1.9

After reviewing the flow analysis conducted for the Project Stakeholders as well as debriefing with their respective staffs, the following observations were noted:

a. Although none of the Project Stakeholders collection systems as a whole are considered excessive by the 3,000 gpdim standard when comparing average daily wastewater flow to estimated average daily water consumption, all project stakeholders collection systems appear to be experiencing significant infiltration when average daily wastewater flows are compared to peak daily wastewater flows as shown in Table 4.11 – Capacities of Project Stakeholders WWTPs.

b. Although none of the Project Stakeholders collection systems as a whole are considered excessive by the 275 gpdpc standard when comparing average daily wastewater flow to estimated average daily water consumption and estimated sewer system population, all project stakeholders collection systems appear to be experiencing significant inflow when average daily wastewater flows are compared to peak daily wastewater flows as shown in Table 4.11 – Capacities of Project Stakeholders WWTPs. And, Lake Lure and Rutherfordton appear to have the highest inflow rates per capita.
c. Peak Daily Flows at each of the Project Stakeholder's wastewater treatment plants are of concern since the peaks appear to demonstrate excessive inflow –for all sewer collection systems except Lake Lure. Peaking factors should range from 1.5 to 4 whereas for the Project Stakeholders, they ranged from 1.9 to 26 with Cliffside's and Forest City's peaking factors being calculated at 26 and 13, respectively.

Physical Condition Analysis

After reviewing the physical condition analysis as well as debriefing with their respective Project Stakeholders, the following observations were noted:

a. The Cliffside, Lake Lure, Forest City Second Broad River, Rutherfordton, and Spindale WWTPs are subject to influence from significant collection system I&I issues.
b. The Forest City Second Broad River and Spindale WWTPs are the best area facilities for use as regional WWTPs because of their size and the assimilative capacity of their receiving streams.
c. The only Project Stakeholders with an Asset Management Plan and detailed Capital Improvement Plan were the Town of Forest City and the Town of Spindale.
d. Lake Lure and Spindale need to upgrade their respective wastewater treatment plants to return to compliance with their NPDES permits or find an alternative means for wastewater disposal.
e. Rutherfordton and Cliffside need to maintain their respective wastewater treatment plants in order to maintain compliance with the NPDES permits.
f. The available assimilative capacity of Cleghorn Creek limits the ability of Rutherfordton's WWTP. Therefore, the Rutherfordton WWTP should not be considered a viable candidate for the location of a consolidated primary WWTP without the relocation of their WWTP discharge.
g. The small size of the Riverstone WWTP limits its ability to take on a large water user and subsequent large wastewater discharger.
h. The condition of the DRG WWTP will require significant capital investment to bring this WWTP back on line to handle any potential industry in the area.
i. A proposed Forest City water intake located downstream of the discharge of the DRG WWTP could impact the future return to service of this WWTP.

Staffing & Operations

After reviewing the staffing and operational analysis as well as debriefing with their respective Project Stakeholders, the following observations were noted:

a. According to published guidelines by EPA Region 4 in their Guide to Collection and Transmission System Management, Operation, and Maintenance Programs and EPA's

manual on Estimating Staffing for Municipal Wastewater Treatment Facilities, all of the project stakeholders are not adequately staffed to conduct sufficient minimum collection system and treatment operations.

b. Project Stakeholders do not appear to have sufficiently documented programmatic elements mandated by NCDENR and EPA and have incomplete Sanitary Sewer Evaluation Study's.

Domestic Sewer Service Analysis

An analysis of areas within the County needing domestic sewer service was conducted as part of the project. As a result, please find Table ES.7 – Rutherford County Domestic Sewer Service Analysis Opinions of Probable Costs on the following page.

Table ES.7 – Rutherford County Domestic Sewer Service Analysis Opinions of Probable Costs

Project	Opinion of Probable Cost
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Ellenboro	$2,231,000
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Henrietta	$1,979,000
Industrial Site on Hwy 221 / Harris Elementary – to Spindale	$1,914,000
Industrial Site on Hwy 221 / Harris Elementary – to Riverstone WWTP	$2,145,000

Economic Development Sewer Service Analysis

An analysis of areas within the County needing sewer service for economic development was conducted as part of the project. As a result, please find Table ES.8 – Rutherford County Economic Development Sewer Service Analysis Opinions of Probable Costs below.

Table ES.8 – Rutherford County Economic Development Sewer Service Analysis Opinions of Probable Costs

Project	Opinion of Probable Cost
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Ellenboro	$2,231,000
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Henrietta	$1,979,000
Hwy 74 – Hwy 221 Interchange – to Spindale	$150,000
Riverstone Industrial Park	$889,000
DRG WWTP	$1,348,000
Area North of Rutherfordton / Hwy 221	$1,551,000
Rutherford County Airport / Hwy 64 to Spindale	$1,551,000

Mapping / GIS

After reviewing the Project Stakeholders existing digital mapping of their sewer systems and GIS databases as well as debriefing with their respective staffs, the following observations were noted:

a. Existing digital mapping of each of the Project Stakeholders sewer systems provides a somewhat reasonable representation of their facilities. The composite GIS map will provide a foundation as the Project Stakeholders continue to develop their sewer system GIS geodatabases.
b. The Forest City / Ellenboro geodatabase appears to be missing 2 force mains and one pump station appears to have two force mains coming from it. It is suspected that the two pump stations that do not have a force main are actually not pump stations, rather pieces of property owned by the Ellenboro.
c. Lake Lure is missing diameter information for its main trunk lines.
d. Most Project Stakeholders compiled all of their available source documents to complete the inventory as well as some field inventory information. It is imperative that the GIS information be kept up to date and that spatial and attribute discrepancies such as those noted are updated.
e. It appears that each Project Stakeholder has been able to complete a significant part of their sewer system inventory by utilizing source documents. It appears that there are areas of each Project Stakeholders sewer system, however, where source documents do not exist or the information is subject to inaccuracies. Moving forward, these areas should be field verified to ensure system accuracy.
f. Collected data for the manholes in all cases did not include depth, size and material of inlets and outlet for the majority of the Project Stakeholders sewer systems. This information should be obtained for each of the Project Stakeholders sewer systems.
g. It is recommended that each Project Stakeholders sanitary sewer system mapping be updated to greater accuracy to better meet guidelines emphasized by the United States Environmental Protection Agency (USEPA) Capacity, Management, Operations and Maintenance (CMOM) Program and the Project Stakeholder's System Wide Collection Permits.

ES.5 Recommendations:

Options for Consolidation

Finding an organizational solution for organizing a new sewer management entity must consider the varying interests of all of the Project Stakeholders and find ways to mitigate differing philosophies and equities. As a result, the best solution may not necessarily be the same in all instances. And, flexibility should be considered as the most important aspect when initiating consolidation.

Considering these points, it is recommended that Inter-Local Agreements be created for the short-term while a Joint Management Agency structure be pursued to achieve a more efficient level of service to the Project Stakeholders in the intermediate term, with the long term solution being a combination of management structures and entities to manage the complex nature of wastewater service within Rutherford County.

After reviewing the viable options for consolidation as well as discussion with Project Stakeholders staff and elected officials, we have outlined four (4) of the strongest potential paths as follows:

Path One – Consolidation of Cliffside and Forest City

a. Form an Advisory Committee between Cliffside, Forest City, and Rutherford County.
b. Investigate forming Inter-Local Contracts between Cliffside, Forest City, and Rutherford County under the auspices of Forest City treating Cliffside's wastewater.
c. The Inter-Local Agreement between Cliffside, Forest City and the County could be for the County to form a Tax Increment Financing District for the area that would become developable due to the availability of sewer service between Cliffside and Forest City in an effort to help offset user charges for the proposed project.
d. The Inter-Local Agreement between Cliffside and Forest City would be for the treatment of Cliffside's wastewater.

Path Two – Joint Management Agency for the Consolidation of Wastewater Treatment Management of Lake Lure, Rutherfordton, and Spindale

a. Form an Advisory Committee between Luke Lure, Rutherfordton, Spindale, and possibly Broad River Water Authority.
b. Investigate forming Inter-Local Contracts between Rutherfordton, Lake Lure, Spindale, Rutherford County, and Broad River Water Authority under the auspices of working towards forming a Joint Management Agency and a long term management entity for the treatment of wastewater.
c. Since it appears that the Town of Lake Lure's median household income is above both the National and State median household incomes, it does not appear that Lake Lure would qualify for a grant from USDA. And, due to these same conditions, would only qualify for a market rate loan (versus an intermediate or poverty rate). However, since user rates for Lake Lure customers would become unreasonable when compared to comparable systems and systems with similar economic and income conditions, the potential for a USDA loan and grant needs to be more fully explored.
d. The Inter-Local Agreement between the Town's and possibly Broad River Water Authority could be for the treatment of wastewater at each of the Town's respective wastewater treatment plants.

Path Three – Consolidation of Lake Lure, Rutherfordton, and Spindale – Abandonment of Lake Lure's Wastewater Treatment Plant

a. Form an Advisory Committee between Luke Lure, Rutherfordton, Spindale, Rutherford County, and Broad River Water Authority.
b. Investigate forming Inter-Local Contracts between Rutherfordton, Lake Lure, Spindale, Rutherford County, and Broad River Water Authority under the auspices of working towards forming a Joint Management Agency, a new Sewer Authority, County Sewer District or absorbing sewer as a new operational function within Broad River Water Authority.
c. Lake Lure in conjunction with Rutherford County needs to investigate the feasibility of upgrading their WWTP or tying on to the Town of Rutherfordton including the new wastewater treatment option provided by WK Dickson.

d. Since it appears that the Town of Lake Lure's median household income is above both the National and State median household incomes, it does not appear that Lake Lure would qualify for a grant from USDA. And, due to these same conditions, would only qualify for a market rate loan (versus an intermediate or poverty rate). However, since user rates for Lake Lure customers would become unreasonable when compared to comparable systems and systems with similar economic and income conditions, the potential for a USDA loan and grant needs to be more fully explored.
e. If the Town determines upgrading their WWTP is the most viable option, the Town should consider fully investigating and possibly applying for a USDA loan and grant.
f. If the Town determines connecting to Rutherfordton is the most viable alternative, the Town and the County and the Town and Rutherfordton should consider executing Inter-Local Agreements.
g. The Inter-Local Agreement between the Town and the County could be for the County to form a Tax Increment Financing District for the area that would become developable due to the availability of sewer service on the corridor between Lake Lure and Rutherfordton in an effort to help offset user charges for the proposed project.
h. The Inter-Local Agreement between the Town and Rutherfordton would be for the treatment of Lake Lure's wastewater.
i. Consider investigating and pursuing an Inter-Local Agreement between the Town's and Broad River Water Authority for the Authority to treat the wastewater from Lake Lure, Rutherfordton, and Spindale at Rutherfordton's and Spindale's wastewater treatment plants.

Path Four – Consolidation of Lake Lure, Rutherfordton, and Spindale – Abandonment of Lake Lure's and Rutherfordton's Wastewater Treatment Plant's

a. Form an Advisory Committee between Luke Lure, Rutherfordton, Spindale, Rutherford County, and Broad River Water Authority.
b. Investigate forming Inter-Local Contracts between Rutherfordton, Lake Lure, Spindale, Rutherford County, and Broad River Water Authority under the auspices of working towards forming a Joint Management Agency, a new Sewer Authority, County Sewer District or absorbing sewer as a new operational function within Broad River Water Authority.
c. Lake Lure in conjunction with Rutherford County needs to investigate the feasibility of upgrading their WWTP or tying on to the Town of Rutherfordton including the new wastewater treatment option provided by WK Dickson.
d. Since it appears that the Town of Lake Lure's median household income is above both the National and State median household incomes, it does not appear that Lake Lure would qualify for a grant from USDA. And, due to these same conditions, would only qualify for a market rate loan (versus an intermediate or poverty rate). However, since user rates for Lake Lure customers would become unreasonable when compared to comparable systems and systems with similar economic and income conditions, the potential for a USDA loan and grant needs to be more fully explored.
e. If the Town determines upgrading their WWTP is the most viable option, the Town should consider fully investigating and possibly applying for a USDA loan and grant.
f. If the Town determines connecting to Rutherfordton is the most viable alternative, the Town and the County and the Town and Rutherfordton should consider executing Inter-Local Agreements.

g. The Inter-Local Agreement between the Town and the County could be for the County to form a Tax Increment Financing District for the area that would become developable due to the availability of sewer service on the corridor between Lake Lure and Rutherfordton in an effort to help offset user charges for the proposed project.
h. The Inter-Local Agreement between the Town and Rutherfordton would be for the treatment of Lake Lure's wastewater.
i. Then, the Town of Rutherfordton and the Town of Spindale should consider executing an Inter-Local Agreement for the Town of Spindale to treat Rutherfordton's wastewater.
j. Consider investigating and pursuing an Inter-Local Agreement between the Town's and Broad River Water Authority for the Authority to treat the wastewater from Lake Lure, Rutherfordton, and Spindale at Spindale's wastewater treatment plant.

Financial Analysis

As a result of the financial analysis and utility financial model conducted, we recommend the following:

a. Decreasing rate block structures are not looked upon favorably by loan and grant agencies. Cliffside Sanitary District, Forest City, and Rutherfordton should eliminate their declining rate structures due to conservation efforts and the fact that they are complex in nature and change to either a flat block rate structure or inclining block rate.
b. Outside rates that are significantly higher than inside rates are not looked upon favorably by loan and grant agencies as well as the legislature. Lake Lure, Rutherfordton, and Spindale should consider lowering their outside rates to less than double their inside rates.

System Descriptions

As a result of reviewing the wastewater collection and treatment system descriptions and the WWTP's respective NPDES permit limits, we recommend the following:

a. Since the assimilative capacity of the Town of Rutherfordton WWTP's effluent receiving stream is nominal, the Town should consider other long term options for wastewater treatment and discharge including relocation of its discharge and/or treatment by a neighboring facility for ultimate treatment and disposal.

Flow Analysis

As a result of the limited flow analysis and inflow and infiltration analysis performed, we recommend the following:

a. Each Project Stakeholder should conduct a more detailed review of their available records and information related to their existing pump stations and collection systems to include pump manufacturer, pump size, design pumping capacity, discharge head, wet well size, and pump run-time records. Utilizing available existing collection system GIS records, continue to quantify collections system / drainage basins associated with each pump station. Utilizing pump station runtime and capacity data with rainfall

records, evaluate individual collection systems / drainage basins by comparison of wet and dry weather periods to identify and prioritize collection systems / drainage basins that have the highest potential I&I impact on the overall system. This will allow Project Stakeholders to document preliminary I&I findings and move towards providing recommendations and associated costs for the performance of a more extensive Sanitary Sewer Evaluation Survey's (SSES) in the highest priority collection systems / drainage basins.

b. Consider conducting more extensive SSES's in the highest priority collection systems / drainage basins. The Sanitary Sewer Evaluation Surveys will provide for more detailed assessments of the sanitary sewer collection systems / drainage basins in an effort to construct a prioritized approach for the rehabilitation of the surveyed sewers. The SSES should include, but not be limited to: Dyed Water Flooding; Corrosion Defect Identification; Routine Manhole Inspections; Rainfall & Flow Monitoring; CCTV work; Gravity System Defect Analysis; Smoke Testing; and, Pump Station Performance and Adequacy Analysis.

Physical Condition Analysis

As a result of the limited physical condition analysis conducted, we recommend the following:

a. Cliffside, Lake Lure, Forest City, Rutherfordton, and Spindale should all continue to work towards addressing collection system I&I issues.
b. The Forest City Second Broad River and Spindale WWTPs are the strongest candidates for use as regional WWTPs because of their size and the assimilative capacity of their receiving streams.
c. Cliffside, Lake Lure, and Rutherfordton should endeavor to prepare an Asset Management Plan and Capital Improvement Plan.
d. Due to the limited assimilative capacity of Cleghorn Creek, Rutherfordton's WWTP receiving stream, Rutherfordton should fully investigate either moving their discharge point if they are to be considered as a consolidated treatment facility and/or transferring their wastewater to a neighboring facility for treatment if they intend to expand or treat a significant increase in wastewater flows beyond their permitted limit.

Staffing and Operations

As a result of the limited staffing and operational analysis conducted, we recommend the following:

a. All project stakeholders should consider conducting a MOM audit of their collection system and collection system programs in accordance with EPA's published guidance and CMOM self-assessment checklist.
b. All project Stakeholders should consider conducting a WWTP facility audit or assessment in accordance with industry standards.

Mapping / GIS

As a result of generating a composite GIS map, we recommend the following:

a. Each Project Stakeholder should consider updating their sewer system inventory in relation to questionable sewer structures. This task would include not only the accurate location of structures, but also the inventory of each structure to confirm size, material, depth, direction of flow and overall condition.
b. Each Project Stakeholder should establish formal data maintenance procedures to ensure the GIS information stays up to date.
c. Each Project Stakeholder should consider the development of a secured Internet Mapping Site for each Project Stakeholder services including Planning and Zoning in coordination with Rutherford County.

ES.6 Obstacles:

Primary obstacles to providing the best long term strategies for sewer service within the County and Towns are seen as follows:

a. The misconception that all project stakeholders are providing all necessary required and recommended wastewater collection and treatment services and that the full cost of service is currently being charged to their rate payers;
b. The value the project stakeholders place on their wastewater collection and treatment system assets;
c. The misconception that the selling of existing project stakeholders wastewater collection and treatment systems assets to the final management entity is fair and reasonable (i.e. project stakeholders rate payers in effect would then pay twice for the wastewater collection and treatment systems);
d. The financial ability of the project stakeholders to implement a better long term strategy or strategies for providing sewer service in the County and Towns without additional financial assistance;
e. The form of control or the interim and the final potential management entity or entities;
f. Condition of the project stakeholders existing wastewater collection and treatment systems; and,
g. Determination of the project stakeholders that intend to implement a better long term strategy or strategies for providing sewer service in the County and Towns.

ES.7 Conclusions:

Primary conclusions and items that need to be addressed in order to provide the best long term strategy or strategies for sewer service within the County and Towns are seen as follows:

a. All Project Stakeholders assume that the full cost of service is currently being charged to their rate payers when all capital improvements and recommended programs are not funded.
b. A more regionalized approach will benefit rate paying customers in the long term through operations and maintenance efficiencies and economies of scale that can be recognized through the shared use of labor, equipment, purchasing agreements, and capital resources.
c. Savings and efficiencies can be passed on to the ratepayer in the form of reduced rates, or the provision of greater rate stability.

d. The only Project Stakeholders with an Asset Management Plan and detailed Capital Improvement Plan were the Town of Forest City and the Town of Spindale and all Project Stakeholders need them.
e. According to published guidelines by EPA Region 4 in their Guide to Collection and Transmission System Management, Operation, and Maintenance Programs and EPA's manual on Estimating Staffing for Municipal Wastewater Treatment Facilities, all of the Project Stakeholders are not adequately staffed to conduct sufficient minimum collection system and treatment operations.
f. Project Stakeholders do not appear to have sufficiently documented programmatic elements mandated by NCDENR and EPA and have incomplete Sanitary Sewer Evaluation Study's.
g. Based on the number of sewer collection and treatment systems in the County, the overall population served, and the land area, consolidation of sewer services within the County while taking into account economies of scale is logical instead of all of the collection and treatment systems trying to be managed independently.
h. All of the Project Stakeholders are experiencing significant Inflow and Infiltration (I&I) and it needs to be addressed in order to maintain the long term viability of the Project Stakeholders wastewater collection and treatment systems as well as maintain compliance with NCDENR and EPA.
i. Lake Lure and Rutherfordton are limited in their ability to expand beyond their permitted flow limits therefore a more regionalized solution may be in order.
j. Lake Lure and Spindale are experiencing compliance problems with their wastewater treatment plants therefore a more regionalized solution may be in order.
k. The Cliffside Sanitary District is not financial viable as a standalone sewer entity.
l. Consolidation and the resulting economies of scale resulting from consolidation can be seen as a mechanism to fund needed substantial capital investment into the Project Stakeholders collection and treatment systems.
m. Maintaining the status-quo or a do nothing approach will result in the following:
    i. Lake Lure's rate payers being subject to substantial rate increases to fund capital improvements.
    ii. Solvency and operational issues associated with the long term viability of the Cliffside Sanitary District as a standalone sewer entity.
    iii. All Project Stakeholders not completely addressing I&I.
    iv. All Project Stakeholders not completely maintaining their collection and treatment systems / funding necessary capital improvements and programmatic mandates.
    v. The possibility of stymieing economic development because a Project Stakeholder may not have the resources necessary to fund the capital improvements associated with a potential economic development project.
n. Recommendations for consolidation include the following:
    i. Short term - Inter-Local Agreement(s)
    ii. Intermediate term - Joint Management Agency
    iii. Long term - a combination of management structures & entities to manage the complex nature of wastewater service within Rutherford County.
o. The fact that Broad River Water Authority is already in existence is seen as a mechanism for creating a new sewer management entity.

End of Section

Section 1 – Introduction

1.1 Project Description:

This project involved providing Professional Engineering Services for the Rutherford County / Municipalities Joint Sewer Study for Rutherford County, North Carolina. Rutherford County has eight (8) Towns within its boundaries. The Town of Lake Lure, the Town of Spindale and the Town of Rutherfordton own and operate one (1) Wastewater Treatment Plant (WWTP) each. The Town of Forest City owns and operates two (2) WWTPs (and owns an additional WWTP not currently in operation that was formerly owned by an industry). The Town of Ellenboro has a sanitary collection system that pumps to the Town of Forest City's collection system and WWTP for treatment. In addition, the Cliffside Sanitary District also owns and operates its own WWTP and collection system.

The dramatic reduction in the textile industry that occurred in Rutherford County, beginning in the 1990's and continuing until the last few years, has resulted in a dramatic reduction in sewer flows to the various WWTP's. Two of the WWTP's need extensive upgrades to meet current NPDES permit limits. And, many of the Town's wastewater collection systems are plagued by Inflow and Infiltration (I&I). As a result, Rutherford County has joined with the Town of Forest City, the Town of Lake Lure, the Town of Spindale, and the Town of Rutherfordton to fund a Joint Sewer Study to evaluate the best long term strategies for providing sewer service within the County and Towns.

1.2 Definitions:

For the purposes of this study, please refer to the following definitions:

Owner -	Rutherford County
Consultant -	WK Dickson & Co., Inc.
Model -	Utility Financial Model
NPDES -	National Pollutant Discharge Elimination System
Project Representative -	David Odom, PE, of Odom Engineering, PLLC
Project Stakeholders -	the Towns of Forest City, Lake Lure, Rutherfordton, and Spindale; Cliffside Sanitary District.
WWTP -	Wastewater Treatment Plant
I&I -	Inflow & Infiltration

1.3 Project Scope

The project included the following tasks:

1.3.1 Compilation of a composite GIS map of the Project Stakeholders sewer systems including sewer lines, force mains, pump stations and WWTP based on GIS data provided by the Owner, the Project Representative, and Project Stakeholders.

1.3.2 Development of a summary of average daily flows, peak daily flows and peak hour flows for each sewer collection system for a select period based on flow information provided by the Owner, the Project Representative, and/or Project Stakeholders.

1.3.3 Identification of sewer flows within each Project Stakeholder's sewer system based on flow information provided by the Owner, the Project Representative, and/or Project Stakeholders.

1.3.4 Using existing studies and data provided by the Owner, the Project Representative, and Project Stakeholders, prepare a reasonable determination of the volume of Inflow & Infiltration (I&I) in each Project Stakeholder's sewer system.

1.3.5 Evaluate the possible consolidation of sewer collection and treatment systems, including the abandonment of inefficient WWTP's for and between the Project Stakeholders. This evaluation includes the identification of improvements most likely required for consolidation (including necessary upgrades to the receiving system) along with opinions of probable cost.

Opinions of probable cost associated with WWTP abandonment are provided along with a recommendation as to how to make efficient use of the existing WWTP NPDES permits including the following alternatives:

a. Lake Lure to Rutherfordton
b. Rutherfordton to Spindale
c. Spindale to Rutherfordton
d. Spindale to Forest City
e. Spindale and Rutherfordton to Forest City
f. Cliffside Sanitary District to Forest City (Second Broad River WWTP)
g. Cliffside Sanitary District to Forest City (Riverstone WWTP)
h. Cliffside Sanitary District to Forest City (Dan River WWTP)

Additional assessment of the respective WWTP's to serve as a consolidated WWTP facility included:

a. Evaluating the respective receiving streams assimilative capacities based on data provided by NCDENR and related NPDES Permit issues required by a consolidated WWTP.
b. Overall treatment system performance and capability to achieve existing and future NPDES permit limits.

c. Identification of probable system improvements to facilitate transfer of wastewater associated with the consolidation of treatment systems.
d. Identification of the possible implications and costs for potential closure of WWTP's associated with a system consolidation.

1.3.6 Evaluate the consolidation of collection system operations making use of shared resources using information provided by the Owner, the Project Representative, and/or the Project Stakeholders as well as survey data from operations staff. Practical management systems are identified for the consolidation of the various sewer collection systems. This evaluation considers current and proposed legislation regarding utility management systems.

Workshops were conducted with each Project Stakeholders individually to identify and discuss the following concerns and issues:

a. Consolidation of management and administrative issues;
b. Personnel issues and current and/or proposed shared responsibilities;
c. The implications of current system maintenance equipment transfer to new entity;
d. Rate structures;
e. Existing debt service and transfer of ownership issues;
f. Projected costs associated with consolidation and potential impact on user fees;
g. Present and future infiltration and inflow issues;
h. Pretreatment issues and the impact of joint wastewater system;
i. Future system expansion of infrastructure to serve new businesses, industry or annexations; and,
j. Perceptions, problems, concerns and opportunities regarding the potential merger of the respective wastewater collection and treatment systems.

1.3.7 Analysis of areas within the County needing domestic sewer service. This analysis utilized input from the Owner, the Project Representative, and Project Stakeholders as well as Isothermal Planning and Development.

1.3.8 Analysis of areas within the County needing sewer service for economic development. This analysis utilized input from the Owner, the Project Representative, and Project Stakeholders as well as the Rutherford County Economic Development Commission.

1.3.9 Construction of a utility financial model for proposed projects. The model addresses the phased interconnection and consolidation of the various sewer collection and treatment systems under the previously noted scenarios. The model is meant to be a tool to determine and demonstrate the financial feasibility of consolidation. The model also provides the likely impacts on sewer rates.

End of Section

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Section 2 – System Descriptions

2.1 Cliffside:

The Cliffside Sanitary District (CSD) was formed in the 1970's to primarily serve three (3) large textile facilities. The CSD constructed a 1.75 million gallon per day (mgd) extended aeration plant, formally known as the Cliffside Wastewater Treatment Plant (WWTP). In the 1980's Cone Mills, a textile manufacturing facility, reached an agreement with CSD to have the operating permit changed from CSD to Cone Mills in response to the Clean Water Act. The agreement left ownership of the facility with CSD, but Cone Mills was to operate and hire all staff necessary to operate the systems. In 2005, Cone Mills shut down their operations, which resulted in a significant reduction of daily flow. The average daily flow into the 1.75 mgd plant from 2012 to October of 2013 was 0.047 mgd with a peak daily flow of 1.173 mgd.

The Cliffside Sanitary Sewer District WWTP currently operates under NPDES Permit No. NC0004405 which expired on July 31, 2013. NCDENR has instructed the facility to continue to operate under this permit until a new permit is issued.

2.1.1 Collection System

Gravity Collection Lines

Cliffside's sewer collection system is composed of approximately 29,500 linear feet (LF) of gravity collection lines and approximately 155 manholes. The material, size, and time of installation of the pipe system can be seen in Table 2.1.

Table 2.1 Cliffside Collection System Line Descriptions

Pipe (inch)	Material	Length (LF)	Installation
8	VCP	18,222	1950's
10	CIP	4,147	1970's
10	Concrete	493	N/A
12	CIP	6,432	1970's

Lift Stations

Cliffside Sanitary Sewer District's sewer system includes two (2) lift stations – the Haynes Lift Station and Bridge Lift Station.

Haynes Lift Station

The Haynes Lift Station was converted from a small wastewater treatment plant to a lift station in the 1980's. An aeration basin and two aerators from the original plant are still in operation for odor control. Currently the lift station is served by two (2) Gorman Rupp T-4 25 horsepower (Hp) suction lift pumps. The design capacity of the pumps is approximately 210 gallons per minute (gpm), which equates to a daily capacity of approximately 75,000 gallons per day (gpd). As of 2010, only three (3) users were discharging into Haynes Lift Station. The three (3) users are the Thomas Jefferson Classical Academy, Haynes Memorial Baptist Church, and the Holland Furniture

Company, which equates to a daily flow of 2,080 gpd. A 75 KW diesel generator is on site for emergency power.

Bridge Lift Station

The Bridge Lift Station receives all the flow from the Cliffside Sanitary District, which is then pumped, via a 10-inch force main, to the CSD wastewater treatment plant. The Bridge Lift Station is served by two (2) Gorman-Rupp T8 75 Hp suction lift pumps and a 200 KW diesel generator for emergency power. The design capacity of the pumps is approximately 1,400 gpm, which equates to either 2.0 mgd for continuous, unpeaked, industrial flow, or 500,000 gpd for commercial and residential flow. Pump control is by a radar and bubbler system. The wet well at this station is approximately 12 feet in diameter and 30 feet deep.

2.1.2 Treatment System

A summary of the Cliffside Sanitary District WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the Cliffside Sanitary District WWTP is the Second Broad River. And, due to the size (i.e. significant 7Q10 flow and high toxicity dilution requirements in the NPDES permit) of the Second Broad River, the assimilative capacity of the river is substantial. The existing CWWTP consists of the following treatment unit processes:

Headworks

The existing treatment plant headworks consists of an influent grit removal basin. Grit and floating solids are periodically removed from the basin manually. The grit removal basin originally included provisions for mixing and sulfuric acid addition for pH adjustment installed when the original installation in the 1970's. The sulfuric acid storage tank and mechanical mixer are not currently in service and condition of this equipment for return to service is questionable.

Return activated sludge (RAS) from the secondary clarifiers is returned to the headworks upstream of the grit basin. Valves in the RAS force main permit the diversion of the RAS flow to a submersible pump station for transfer of waste activated sludge (WAS) to the above ground sludge holding tanks or diversion directly to a sludge loading station.

Aeration Basin

Flow from the headworks wastewater is diverted to a single 7.7 MG (64,375 SF with depth of 16 feet) basin. The basin previously utilized a number of floating aerators providing mixing and aeration within the basin. The basin now serves as a facultative lagoon with only five (5), 10-horsepower floating aerators utilized. Each aerator is controlled by a timer that is set to periodically rotate operation between the aerators to provide minimal mixing and aeration for odor control. The basin is an earthen basin with concrete sidewalls and suspected to have a significant accumulation of biosolids within the basin.

With no provisions for influent screening or wasting of biosolids returned from the clarifiers, these solids currently settle and accumulate within the basin. This could represent a significant disposal issue in the future in the event the basin is closed or modified.

Secondary Clarification

Aeration basin effluent overflows outlet weirs and into a flow diversion box with sluice gates for controlling flow to two (2), 70 foot secondary clarifiers. Both clarifiers appear to be operational with only one unit currently operated. Scum is currently set up to overflow to collection drums located adjacent to the clarifier opposed to diversion into the sludge pump station. The volume of each clarifier is estimated to be approximately 306,400 gallons. This provides a hydraulic retention time at the current average flow of 47,000 gpd with one clarifier operational of over 6.5 days and a surface overflow rate of only 12.2 gpd/sf.

The clarifier mechanisms and sludge sweeps are reported to have been replaced in 1990's. Weir plates and scum baffles are fiberglass and appear to be in good condition but the access walkways and handrails and other exposed metal features are showing signs of corrosion and needs painting. Sludge removed from the clarifiers drains into a "Return Sludge" wet well and is pumped back to the plant headworks or to the sludge holding tanks via the waste sludge pump station. There are three (3) Wimco, variable speed return sludge pumps housed in a brick building.

Effluent from the secondary clarifiers can be diverted to a tertiary filtration/color removal system or directly to disinfection.

Tertiary Filtration / Color Removal System

The tertiary filtration/color removal system includes provisions for polymer addition, flocculation and filtration utilizing an Aqua Aerobic "Aqua Disk" filtration system. Flocculation is provided within a concrete flocculation basin with provisions for mechanical mixing. The disk filter system consists of three (3), 6 disk filters in stainless steel tanks, housed within a metal building. While the system is not currently in service, the equipment and building appears to be in good condition with minor signs of corrosion.

When operational, filter backwash from the disk filters and scum from the secondary clarifiers flows into a "Color Removal Pump Station" for return to the headworks or diversion to the sludge storage tanks.

Disinfection System

Disinfection is accomplished within a single, 148,642 gallon, concrete lined contact basin with a floating aerator for mixing and aeration. Chlorination and dechlorination is currently provided by a tablet system, which utilizes tablets to generate concentrated hypochlorite and bisulfite liquid feed solutions. At the current 0.043 mgd flow, the contact basin provides approximately a hydraulic retention time of over 3 days.

Effluent flow monitoring utilizes an effluent v-notch weir and ISCO 4210 flow meter and automatic, refrigerated flow proportional sampler.

Effluent Outfall

Effluent from the disinfection system flows directly to the Second Broad River by a pipe outfall.

Aerobic Digester and Disposal

Sludge from the secondary clarifiers and backwash from the filter system may be diverted to a waste sludge pump station to assist with the transfer into either of two (2), 500,000 gallon, bolted steel, above ground tanks containing floating aerators. These tanks are not currently used.

Sludge may be transferred from the sludge holding tanks to a sludge transfer station for off-site liquid biosolids disposal utilizing a top loading sludge transfer hose system.

Emergency Power Generator

There is no emergency power provided for the WWTP operations. On loss of power, flow will flow through the plant by gravity.

Administration / Lab Building

The original building was constructed with the plant in the early 1970's with a back section added in 1995. The building had a new HDPE membrane roof installed in 2012. The lab was previously certified for all of the monitoring parameters but is now only certified for field parameters (i.e., temperature, D.O., pH and TRC).

2.2 Forest City:

The Town of Forest City owns three (3) wastewater treatment plants (WWTP) (only two are currently operated) and the associated sewer collection systems. The main plant for Forest City is the Second Broad River WWTP. The Second Broad River Wastewater Treatment Plant was originally constructed and began operation in 1960 with major upgrades in 1983, 1988, 1991 and 1997. The plant operates under NPDES Permit No. NC00254984 with a permitted flow of 4.95 mgd. The current NPDES Permit was issued on July 1, 2009 with an expiration date of July 31, 2013. A new permit has not been issued at this date but NCDENR has instructed Forest City to continue operation under the expired permit until a new permit is issued

The second treatment facility is the Riverstone WWTP. The Riverstone WWTP was constructed in 2002 to serve an industrial park located off Highway 221 on the Broad River below Harris, NC. Until 2013, the WWTP was utilized as a holding tank for small volume flow and periodic truck transfer to the Second Broad River WWTP. The Riverstone WWTP currently serves the Horsehead Corporation and Meriton Inc. plants located in the area with the first discharge beginning in November 2013. The RWWTP is a sequencing batch reactor (SBR) treatment system rated at 0.05 mgd operating under NPDES Permit #NC0087084 with an expiration date of July 31, 2018.

The third treatment facility is the DRG Wastewater Treatment Plant (DRG WWTP). This WWTP was originally constructed by Dan River, Inc. and began operation in approximately 1994 by Dan River Inc. The plant was permitted under NPDES Permit No. NC0083275 for flow of 0.91 mgd with a discharge to the Broad River. The NPDES Permit observed in the files at the plant was effective on September 1, 2004 with an expiration date of July 31, 2008. The status of the NPDES Permit is unknown. The DRG WWTP is not currently operational.

2.2.1 Collection System

Forest City has a total of approximately 237,132 LF of collective sewer lines that range from 3 years old to 80+ years old. The description and details of the Second Broad River collection system can be found in Table 2.2. Additionally, Table 2.3 gives the details on the 19 pump stations in the Second Broad River sewershed.

Table 2.2 Forest City Second Broad River Collection System Line Descriptions

Pipe Diameter	Description	Length (feet)	Material	Age (years)	Condition
3"	Force Main	6,300	PVC	15	Good
4"	Force Main	220	DIP	40	Fair
4"	Force Main	16,640	PVC	15	Good
8"	Force Main	7,700	DIP	2	Good
4"	Force Main	6,810	CIP	50+	Fair
4"	Force Main	4,473	CIP	45	Fair
4"	Force Main	2,773	PVC	40	Good
6"	Force Main	5,944	CIP	30	Fair
6"	Force Main	4,000	DIP	40	Fair
8"	Force Main	1,888	PVC	33	Good
6"	Gravity	3,951	VCP	80+	Fair/Poor
8"	Gravity	1,968	VCP	80+	Fair/Poor
8"	Gravity	6,335	PVC	20+	Good
8"	Gravity	5,428	PVC	30+	Good
8"	Gravity	130,894	VCP	50+	Fair/Poor
10"	Gravity	4,118	VCP	50+	Fair/Poor
12"	Gravity	1,055	CIP	45+	Fair
12"	Gravity	5,473	VCP	50+	Fair/Poor
18"	Force Main	2,500	PVC	3	Good
18"	Gravity	1,900	PVC	3	Good
24"	Gravity	500	DIP	3	Good
24"	Gravity	14,414	PVC	26	Good
30"	Gravity	1,848	PVC	26	Good

Table 2.3 Forest City Pump Station Details

Sewer Lift Station	Wet Well Capacities (gallons)	Construction Date	Voltage	HP	GPM
221 Pump Station	2,535	1999	230	20	190
Cemetery Station	1,900	1999	230	15	150
Kimbrell Street	2,950	2001	230	15	190
Pine Street	2535	2001	460	40	195
Alexander Station	3,380	2000	460	7.5	100
Bethany Church Rd Station	2,535	1997	460	25	80
Bracket Creek Station	35,000	1981	480	150	2800
Chase High Station	3,170	2005	230	7.5	86
Chase Middle Station	6,385	1997	460	20	105
Dogwood Station	4,240	1997	230	30	500
Erwin Station	8,975	1996	240	30	455
Forest Hills Station	2,110	1995	230	10	100
Forest Hunt Station	2,110	2004	208	5	124
Knollwood Station	5,260	1991	230	50	125
Nursery Rd Station	2,960	2006	460	15	163
Pointer Rd Station	2,950	2002	230	15	100
Social Circle Station	9,020	2011	480	25	480
Woodburn Station	3,065	2004	230	15	115
Rollins Station	2,353	2004	208	15	90

2.2.2 Treatment Systems

Second Broad River WWTP

A summary of the Second Broad River WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the Second Broad River WWTP is the Second Broad River. And, due to the size (i.e. significant 7q10 flow and ample toxicity dilution requirements in the NPDES permit) of the Second Broad River, the assimilative capacity of the river is substantial. The existing Second Broad River WWTP consists of the following unit processes:

Influent Pump Station

A large percentage of the influent flow comes to the plant from the Bracket Creek pump station plus several gravity sewer lines. The Bracket Creek pump station is a triplex pump station with a capacity of approximately 2 mgd.

Headworks

The plant headworks include influent screening and grit/grease removal. The influent screening is provided by a "Vulcan" mechanical step screen installed around 2005 with a manually cleaned bar screen available as a backup unit. The grit/grease removal system is a "Schreiber" system consisting of a two parallel channels. One channel is an aerated channel designed for grit removal utilizing a traveling bridge grit pump to transfer the grit to a discharge trough which flows by gravity to a grit classifier. The second channel utilized to collect floating grease. Grease removal was originally designed to be removed by a traveling surface skimmer to a grease conveyor. The grease removal system has been a problem and grease is currently removed manually with a

backhoe to a dumpster.

Influent sampling is provided immediately following the influent screen by an ISCO 4210/4710 automatic refrigerated sampler. The plant also utilizes a portable metering pump to add caustic from a drum supply to manually adjust influent pH if needed.

Influent Flow Diversion Structures

There are flow diversion structures provided in the site piping between the headworks and aeration basins facilitating the diversion of flow and return activated sludge (RAS) to any of the six (6) aeration basins.

Aeration Basin

There are six (6) aeration basins at the site but only one basin is currently in operation. Aeration is provided by floating aerators in all basins. Aeration Basins "A", "B" and "C" are 60 foot diameter concrete tanks with 60 horsepower floating aerators for aeration. Aeration Basin "A" was originally a primary clarifier that was converted into an aeration basin and Aeration Basins "B" & "C" were originally trickling filters converted into aeration basins. All three of these basins have been out of services since the early 1990's and the floating aerators do not appear to be operable.

The rectangular aeration basin noted as Aeration Basin "D" on the plant schematic diagram was initially installed as supplemental aeration to the trickling filter system. It has two (2) separate basins separated by a center dividing wall with a floating aerator in each basin. These two (2) basins have also been out of service since approximately 2010 and the floating aerators do not appear to be operable.

Aeration Basin "E" was originally a rectangular secondary clarifier with the trickling filter system that was converted into aeration. It now serves as an emergency sludge digester/holding tank that can be utilized in the event the sludge dewatering and dryer system were out of service. A truck loading station is provided adjacent to the tank for transfer to a truck for off-site land application.

The "Secondary Aeration Basin" is the only aeration basin currently in service. It is a 3.99 million gallon, concrete lined basin with an average depth of 14 to 16 feet and seven (7), 75 horsepower floating aerators for mixing/aeration.

Secondary Clarification

Secondary clarification is provided by two (2), 75 foot diameter concrete secondary clarifiers with 14.5 foot sidewall depths. These units were retrofitted in 1997 with new Enviroquip, stainless steel draft tube mechanisms, full surface skimmers and fiberglass scum baffles and effluent weir plates. Clarifiers appear to be in good operating condition.

It was noted that one or both of the telescoping valves for adjustment of sludge withdrawal have an issue that currently does not permit operation of the valve(s).

RAS/WAS Pumps

Two (2) return activated sludge (RAS) pumps were previously utilized with the trickling filter system. They have a capacity of approximately 1800 to 2000 gpm and are operated on timers to maintain the sludge blanket within the clarifiers. Waste activated sludge (WAS) is transferred to the dewatering/dryer system by two (2), 10 horsepower pumps.

Disinfection

Effluent disinfection utilizes flow proportional chlorine and sulfur dioxide solution feed systems with ton cylinders. A Strantrol control system was observed in the chlorinator and sulfonator room but was in the "off" position and did not appear to be in operation.

The ton cylinder storage at the site is maintained below the threshold level requiring a "Risk Management Plan".

The chlorine contact chamber is a two (2) channeled basin followed by a common dechlorination area overflowing a rectangular weir to a final step aeration system. A mechanical blower and diffusers are utilized to maintain dissolved oxygen levels at times. The plant also utilizes a portable metering pump to feed caustic as needed for final pH control.

Effluent sampling utilizes an ISCO 3710 FR refrigerated automatic sampler.

Effluent Outfall

Final effluent is discharged to the Second Broad River via a pipe outfall. The Second Broad River is currently classified as a Class WS-IV stream in the Broad River Basin.

Aerobic Digester System

The aerobic digester system includes two (2) concrete digester tanks, a belt thickener and polymer feed system. WAS can be pumped to either digester or to the belt thickener. One digester is approximately 250,000 gallon and equipped with a 60 horsepower floating aerator sludge. The second digester has a volume of approximately 600,000 gallon and is equipped with a coarse bubble aeration system with two (2), 40 horsepower blowers. WAS pumped to the belt thickener is discharged to the larger digester.

Digested sludge is transferred to the sludge dewatering system or can be diverted to the emergency sludge storage tank or directly to a truck loading station located adjacent to the emergency sludge storage tank. The truck loading station and emergency storage tank have not been utilized in some time.

Biosolids Dewatering and Drying System

The biosolids dewatering and drying system was installed in 1997 and includes the following equipment:

a. Enviroquip 2 meter, stainless steel belt press with polymer feed system

b. "US Filter Dragon Dryer" with feed hopper, feed and discharge screw conveyors
c. Bulk storage silo with pneumatic feeder

The dewatering and dryer system has a capacity of 50 wet tons per day and produces a final dry product of approximately 8 to 10 dry tons per day. The system has an approximate 3.5 hour detention time and operates at a temperature of approximately 230 degrees Fahrenheit. The dryer is a gas fired dryer that produces a "Class A" biosolids for use as fertilizer. Due to the low plant flows, the dryer is currently only run 6 weeks per year. The dryer was installed with a projected 10 year life and is now approaching 15 years old.

Emergency Power Generator

The plant has an emergency generator (315 Kw Kohler, 394 KVA) with automatic transfer switch. The generator is capable of providing electrical power for all of the plant except the large aeration basin (i.e. 7 each 75 Hp aerators) and the Lab Building. There is a second older generator that is not used.

The plant power is supplied from two (2) substations and the power company is very attentive to minimizing any power disruption to the plant.

Plant Buildings

Primary plant buildings include an Administration, Lab, Maintenance / Storage, Headworks, Sludge Thickener and a plant building housing the chlorine, generator and RAS sludge pumps. The site buildings appear to be generally in good condition but are showing age.

Significant Industrial Users

Significant industrial users include:
a. Eaton Corporation
b. Simeus Food International Inc.
c. AGI- In Store
d. Parker Hannifin

Riverstone WWTP

A summary of the Riverstone WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the Riverstone WWTP is the Broad River. And, due to the size (i.e. significant 7q10 flow and ample toxicity dilution requirements in the NPDES permit) of the Broad River, the assimilative capacity of the river is substantial. The existing Riverstone WWTP consists of the following unit processes:

Influent Pump Station

The RWWTP receives influent from a pump station containing duplex, 25 horsepower, 105 gpm pumps and 400 LF of 4" force PVC main. The pump station includes a back-up diesel generator.

Headworks

The headworks includes a mechanically cleaned Parkson "step screen" with a dewatering screw conveyor rated for a peak flow of 0.15 mgd consistent with the influent pump capacity. A by-pass manually cleaned bar screen is provided for backup. An automatic ISCO 4700 refrigerated sampler is provided for influent sampling.

Biological Treatment System

The biological treatment system utilizes a multi compartment concrete tank with Aqua Aerobic Inc. equipment to provide the following unit processes:

Pre-equalization Tank

The pre-equalization tank consists of a 33,000 gallon (12′ x 23′ x 16′ deep) tank with diffused aeration mixing providing storage for influent flow between SBR cycles. Transfer to the SBR tank is provided by submersible duplex, 105 gpm transfer pumps. Aeration is provided by two (2), 5 horsepower, 95 scfm blowers.

Sequencing Batch Reactor (SBR)

The SBR consists of a single, 63,000 gallon (23′ x 23′ x 16′) reactor with a 3 horsepower (3,560 gpm) floating mixer, diffused aeration and 313 gpm decanter. Aeration is provided by two (2), 15 horsepower, 250 scfm blowers. The SBR provides a phased treatment consisting of anoxic mix, aerated mix, settling, decant and sludge wasting. Sludge wasting is provided by a 100 gpm submersible transfer pump.

Aerobic Digester/Sludge Storage

The aerobic digester/sludge holding tank consists of a 33,000 gallon (12′ x 23′ x 16′) tank with diffused aeration. Aeration is provided by a 254 scfm blower. Ultimate sludge disposal is accomplished by truck transfer to the Forest City Riverside WWTP.

Disinfection System

The disinfection system includes two (2) contact basins providing 30 minutes contact, duplex tablet chlorination units and a final effluent tablet dechlorination unit. A recirculation pump is provided for recirculating flow to the chlorine contact tanks for mixing. Effluent flow is measured on a 22-1/2° v-notch weir with an ISCO 4700 refrigerated sampler provided for sampling.

Standby Generator

A standby generator is present for providing backup power.

SCADA

Remote monitoring of the plant is provided by a telephone dialer providing an alarm for critical process alarm situation.

DRG WWTP

A summary of the DRG WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the DRG WWTP is the Broad River. And, due to the size (i.e. significant 7q10 flow and ample toxicity dilution requirements in the NPDES permit) of the Broad River, the assimilative capacity of the river is substantial. While not operational, the existing DRG WWTP consists of the following unit processes:

Influent Basin

An in-ground concrete basin is located immediately adjacent to the above ground WWTP structure and is believed be an influent wet well receiving gravity flow from the former manufacturing plant with lift pumps located inside the plant mechanical room.

Three Static Screens

Three (3) side hill wedge wire static screens are provided for influent solids and fiber removal.

Equalization / Neutralization Basins

Two (2) equalization / neutralization basins are provided with jet mixing and aeration systems. A carbon dioxide tank located outside of the tank is believed to have been utilized for pH adjustment within these tanks. These tanks have a sluice gate in the dividing wall permitting them to be utilized together as one basin. Flow from these basins is pumped to a steel flow splitter box located on the top of the structure. The flow splitter box includes a number of weirs and option for splitting flow between the aeration basins or returning it to the equalization / neutralization basins.

Aeration Basins

Two (2) aeration basins are provided in the system with fine bubble aerations. Each basin consists of a "U" shaped channel with a center wall. Flow enters one end and loops around the wall to an overflow weir in the adjacent channel. Each basin was drained with the PVC header piping and fine bubble diffuser exposed. The aeration piping and diffuser system appeared to be in good condition but the PVC materials may have been impacted by long term exposure to ultraviolet light.

Final Clarifiers

The plant has two (2), 42'-6" diameter secondary circular clarifiers. It is believed that the plant piping provides the option to isolate each clarifier with one aeration basin or operate with the combined flow from both aeration basins. Clarifiers appear to have spiral sludge collectors steel scum baffles and fiberglass weirs. Overall condition of clarifiers appears to be good with steel beginning to show signs of corrosion. The surface overflow rate of the two clarifier at 0.91 mgd is approximately 320 gpm/sf.

Effluent Parshall Flume

An effluent parshall flume, flow meter and refrigerated sampler are provided adjacent to the

secondary clarifiers for effluent monitoring. The parshall flume appears to be a 6-inch flume.

Sludge Holding Tanks

One (1) large sludge holding tank is provided with DIP aeration diffuser header piping similar to the sludge digesters. Tank dimensions are estimate to be approximately 70' wide x 140.

Standby Generator

An emergency diesel engine standby generator with automatic transfer switch is in place for emergency power but the capacity is unknown.

2.3 Lake Lure:

The wastewater collection system was installed during the construction of Lake Lure with the wastewater collection lines run along the bottom of the lake. The WWTP was originally constructed from 1968 to 1971 as an aerated lagoon system with headworks system (dual bar screen and grit removal), chlorine contact chamber, and a sludge-holding tank. Several major upgrades have been completed over the past several decades. These upgrades have converted the plant from a biological WWTP to a physical chemical WWTP and also increased the permitted capacity from the design flow of 250,000 gallons per day (GPD) in 1969 to 995,000 GPD around 2008. The plant was converted to a physical chemical plant due to the low concentration of wastewater constituents (Biological Oxygen Demand and Suspended Solids) in the influent.

2.3.1 Collection System

The main gravity sewer collection system for Lake Lure is twelve (12.35) miles of cast iron pipe (CIP) that was installed 80+ years ago prior to the lake being flooded. There are approximately 65 gravity sewer laterals along the perimeter of the lake, which are tapped off the main collection system. In 2009 Lake Lure was awarded a $3,000,000 ARRA grant to seal approximately 25% of the joints in the system. Many of the other unwrapped joints are inaccessible due to a deep silt overburden blanket, which is believed to have sealed the joints[4]. The gravity sewer lines flow to a pumping station, which conveys the flow to the WWTP.

2.3.2 Treatment System

A summary of the Lake Lure WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the Lake Lure WWTP is the Broad River. And, due to the size (i.e. significant 7q10 flow and ample toxicity dilution requirements in the NPDES permit) of the Broad River, the assimilative capacity of the river is substantial. The existing Lake Lure WWTP consists of the following treatment processes:

Influent Pump Station

The influent pump station is located at the base of the dam and contains three (3) Gorman-Rupp pumps. The pumps do not have provisions for variable speed operation and on-off operation produce "slug" flows to the plant.

Plant influent is measured based upon pump run time and is not accurate if two (2) pumps run simultaneous.

Headworks

The influent enters the plant at a flow splitter box that directs flow to the influent mechanically cleaned screen or to a manually cleaned screen and piping to a point downstream of the mechanical screen. The influent mechanical screen is a "step" screen with screenings discharged into a piston compactor which dewaters and transfers screenings to a waste dumpster.

Flash Mix / Flocculation Basins

Following screening, the influent wastewater flows through a flash mix basin and flocculation basin. The flash mix basin consists of a 3′ x 3′ square basin with a flash mixer that was to be rehabilitated as part of the 2007 SOC issued in 2007. The flocculation basin is the previous sludge holding tank that was converted into a flocculation basin in 1991. The flocculation basin is provided with a slow constant speed mixer with impellers similar to the flash mixer opposed to flocculators and a variable speed drive to promote better floc formation.

Sedimentation Basin

The sedimentation basin was originally the aeration basin with the original design and has been converted into a sedimentation basin by addition of inlet and outlet baffles. A vacuum sludge removal system consisting of a PVC pipe header system is installed in the basin bottom. The basin is estimated to be approximately 90′ L x 46′ W x 8′-9″ deep with 1.5:1 sloped walls on each end. Operational issues identified with the utilization of this basin for sedimentation include inadequate depth, considerable short-circuiting due to poor inlet and outlet design, and difficulty in removal of settled sludge materials.

Clarifier

The effluent clarifier was part of the original plant construction in 1967 and has a 27′ diameter concrete tank with an 8′ side water depth and 1/12 bottom slope. The surface overflow rate is 595 gpd/sf and weir overflow rate is 4344 gpd/ft at the current average daily flow of 0.341 mgd.

2.4 Rutherfordton:

The Rutherfordton wastewater treatment plant (RWWTP) was originally constructed as a lagoon treatment system in the 1950's with upgrades completed in 1980, 1997 and 2006 to the current extended activated sludge facility. The facility operates under NPDES Permit NC0025909 with a tiered treatment capacity of 1.0 and 3.0 mgd with an expiration date of July 31, 2013. The paperwork for the permit renewal is currently delayed by NCDENR with instruction to Rutherfordton to continue operation under the existing permit until the new permit is issued.

2.4.1 Collection System

Rutherfordton's collection system consists of approximately 180,161 LF of gravity lines, approximately 55,610 LF of force main, and 620 manholes. There are five (5) pump stations which

include the Water Works Pump Station, John Smith Pump Station, and Charlotte Rd. Pump Station.

2.4.2 Treatment System

A summary of the Rutherfordton WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the Rutherfordton WWTP is the Cleghorn Creek. And, due to the size (i.e. minimal 7q10 flow and the least toxicity dilution requirements in the NPDES permit) of the Cleghorn Creek, the assimilative capacity of Cleghorn Creek is nominal. The existing RWWTP consists of the following treatment unit processes:

Influent Screening

As plant influent enters the RWWTP, it passes through micro-strainer basket screen with a central screw conveyor for washing, dewatering and conveying screening to a collection dumpster. This unit was manufactured by the Lakeside Corporation and was recently installed in October 2013 replacing a previous vertical bar screen unit. A manually cleaned bar screen is provided as a backup to the mechanically cleaned screen with an open area permitting overflow passage of the bar screen should the manually cleaned screen create excessive head loss.

Influent Flow Diversion Structure

As flow is conveyed by gravity to the aeration basins, it passes through a flow diversion structure containing sluice gates permitting the manual diversion of flow into a former aerated lagoon for emergency storage if needed. A sodium hydroxide storage tank and feed system are also included at this location for adding sodium hydroxide if needed to maintain the aeration basin pH level above 6.5 to provide alkalinity necessary to promote nitrification within the aeration basins.

Aeration Basins

A dike was added to the former large aerated lagoon system in 2006 to provide a large emergency holding basin and two (2), 1 million gallon activated sludge aeration basins with a flexible membrane lining. The plant currently operates one (1) basin on-line with the second basin in reserve. Aeration within the active basin is provided by six (6), 25 horsepower floating aerators. The inactive basin contains two (2), 25 horsepower floating aerators for periodic aeration/mixing and three (3) additional 25 horsepower aerators are maintained in dry storage for aerator replacement as needed for maintenance. Flow to the two aeration basins is controlled by a flow splitter structure located between the basins containing two (2) sluice gates. Effluent from the two aeration basins overflows to a clarifier flow splitter structure also containing sluice gates for the diversion of flow between two (2) secondary clarifiers.

Secondary Clarification

Two (2), 50-foot diameter secondary clarifier clarifiers are provided. Telescoping valves are utilized in a common wet well located between the clarifiers for controlling sludge withdrawal. The wet well contains two (2), 60 horsepower, 2000 gpm submersible return activated sludge (RAS) pumps with variable speed drives for returning sludge to the aeration basin influent flow

splitter. Another 60 horsepower submersible pump is maintained as a shelf-spare for installation in event of a failure of one of the pumps in service.

Disinfection

The disinfection system includes a dual channel chlorine contact basin with liquid sodium hypochlorite and sodium bisulfite feed systems for achieving disinfection and dechlorination prior to discharge.

The chlorine contact chamber provides two (2), independent contact channels for reaction with liquid sodium hypochlorite added for achieve disinfection. Liquid sodium bisulfite is added for dechlorination as the two (2) channels combine immediately prior to overflowing a six (6) foot rectangular effluent weir for effluent flow monitoring. Effluent flow is monitored with an ISCO 4250 flow meter with chart recorder and effluent samples taken with an ISCO 4700 refrigerated automatic sampler.

Effluent Outfall

Effluent from the plant currently is discharged into the Cleghorn Creek approximately 5.4 miles upstream of the confluence with the Broad River.

Aerobic Digester and Disposal

Waste activated sludge (WAS) is periodically transferred to an aboveground 441,600 gallon bolted steel aerobic digester. Aeration is provided by three (3), 25 horsepower floating aerators. Waste biosolids are periodically disposed by land application by surface application through a contract with Southern Soils Builders.

Emergency Power Generator

An emergency diesel engine standby generator with automatic transfer switch is in place for emergency power but the capacity is unknown.

2.5 Spindale:

The Town of Spindale is divided into two (2) major drainage basins generally defined by a natural ridge line extending along US 74/221 Bypass or Main Street. The two (2) drainage basins have been identified as Basin A and Basin B with Basin A located to the north and Basin B located to the south of the ridge line. Basin B currently has the most flow and is served by seven (7) pumping station to transfer flow over the ridge line into Basin A for gravity conveyance to the Spindale WWTP.

Average daily flows to the Spindale WWTP currently average approximately 0.8 mgd with a peak daily flow reported as high as 6.1 mgd in May 2013.

There are presently three (3) Significant Industrial Users (SIU's) in the Spindale system. These SIU's include Spindale Colormasters, Ultimate Textiles, and the Timken Company. Isothermal Textiles, an industrial laundry facility, might also be considered a potential SIU. These industries currently

make up approximately twenty (20) percent of the flow to the Spindale WWTP.

2.5.1 Collection System

Collection Lines

Basin A is serviced by 161,400 LF of gravity sewer lines. Also, basin A includes 610 manholes. All the gravity sewers flow and converge at the WWTP. Basin B is serviced by 123,000 LF of gravity sewer lines and 37,848 LF of force main. Additionally, there are 521 manholes in basin B[5].

Pump Stations

All pump stations in Spindale are located in Basin B. Table 2.4 shows the details of the Spindale pump stations.

Table 2.4 Spindale Pump Station Details

Pump Station	Sub-Basin	GPM	TDH (feet)	Serves
All American PS	B1	Inactive	Inactive	Single Industrial Customer-no public sewer discharging into PS
Ultimate Textile PS	B1	451	128	Single Industrial Customer-no public sewer discharging into PS
Oak Street PS	B1	1400	275	Receives flow from 99,705 LF of public gravity pipe
Oakland Heights PS	B2	85	113	Receives flow from 12,739 LF of public gravity pipe
Oakland Rd. PS	B2	120	39	Receives flow from 4,836 LF of public gravity pipe
White Oak Plaza PS	B2	250	69	Receives flow from 6,502 LF of public gravity pipe
Fairgrounds PS	B2	450	103	Receives flow from 7,378 LF of public gravity pipe as well as all PS in B2

2.5.1 Treatment System

The Spindale WWTP was originally constructed from 1968 to 1970 and commissioned into service in 1971. The originally WWTP was an extended aeration activated sludge plant designed to meet secondary treatment limits. The initial unit processes included:

- Influent manually cleaned bar screen
- Influent parshall flume
- Grit chamber
- Aeration basin (8 million gallon volume) with eight (8), platform mounted 100 Hp aerators/mixers.
- Two (2) secondary clarifiers, 75' diameter, 9.83' SWD.
- Return activated sludge (RAS) and waste activated sludge (WAS) Pumps
- Biosolids holding tank (80' dia. x 16' SWD, 600,000 gallons)
- Chlorine contact basin (85,380 gallons) with ton cylinder chlorine gas feed system

- Outfall to Holland Creek
- Control building

A major plant upgrade was performed in 1989 that included the following major additions:

- New mechanical bar screen
- Clarifier No. 3 (110′ dia. x 13.61′ SWD)
- Chlorine contact basin No. 2 (85,830 gallons)
- Scum pump station
- New chlorine equipment
- Post aeration (2 each 325 scfm blowers)
- Biosolids tank No. 2 (100′ dia. x 14′ SWD, 995,000 gallons)
- Three (3) new floating aerators in aeration basin (40 Hp each)

Additional plant modifications were completed in 1991 and 1999. In 1991, the chlorination equipment was replaced and sulfur dioxide gas dechlorination equipment was added. In 1999, the existing 36″ plant outfall was extended 6654 lf along Holland Creek to a new discharge point into Cathey's Creek near Hudlow Road (SR1510) plus several other improvements to the WAS pumps and piping and replacement of the weirs/scum baffles on Clarifiers No. 1 and 2.

A summary of the Spindale WWTP's NPDES permit limits is attached in Appendix 2.1. The receiving stream for the Spindale WWTP is the Cathey's Creek. And, due to the size (i.e. moderate 7q10 flow and modest toxicity dilution requirements in the NPDES permit) of Cathey's Creek, the assimilative capacity of Cathey's Creek is ample. The WWTP includes the following unit treatment processes:

Headworks

The headworks includes the following units:

- Vulcan mechanically cleaned bar screen with a manually cleaned bar screen by-pass
- Influent parshall flume utilizing a HydroRanger ultrasonic level monitor.
- EIMCO grit separator with a paddle and Jim Myers & Sons, Inc. grit screw dewatering conveyor

Aeration Basin

A single, 8 million gallon aeration basin is provided as part of the extended aeration activated sludge process. The original eight (8) platform mounted, 100 Hp mechanical aerators/mixers are still present but operational status is uncertain. Operation of these aerators/mixers is on a timer with operating units rotated to minimize power consumption with the current low flow. Two (2) SolarBee mixers, one (1) Airmaster aerator and a self-priming pump have been added to the basin to promote mixing within the basin.

Secondary Clarifiers

Effluent from the aeration basin outlets flows to three (3) flow distribution boxes for division of flow between the three clarifiers. Only Clarifier No. 3 (110′ dia. x 13.61′ SWD) was observed to be in currently in service due to the low flow.

RAS / WAS Pumps

The RAS and WAS pumps are operated on timer to transfer biosolids from the clarifier back to the aeration basin or to one of the sludge holding tanks.

Chlorination / Dechlorination System

Effluent from the three (3) clarifiers flows to a distribution box for division between the two (2) chlorine contact basins. Currently, only one (1) contact basin was in service due to the low flow. The plant utilizes ton cylinder gas chlorine with a vacuum operated chlorination system to produce a liquid chlorine solution for chlorine addition at the entrance to the chlorine contact basin. The chlorine contact basins overflow to a common channel for post aeration and dechlorination.

Dechlorination is accomplished utilizing a sulfur dioxide gas to generate liquid dechlorination solution feed at the overflow of the contact basins. The plant has the capability of utilizing either sulfur dioxide gas ton cylinders but a 150 lbs gas cylinder is currently utilized due to the low demand with the current low plant flows.

Effluent from the chlorination/dechlorination system overflows a five (5) foot wide rectangular weir for effluent flow monitoring. Flow monitoring for NPDES Permit reporting purposes utilizes the influent parshall flume. The plant final effluent flows through a 36″ plant outfall sewer extending to a discharge point at Cathey's Creek near Hudlow Road.

Biosolids Handling System

The plant has two (2) concrete waste biosolids holding tanks with floating aerators and multilevel decanting valves that are utilized to hold and concentrate waste solids for final disposal by contract land application. There are no provisions for biosolids dewatering currently available at the facility.

2.6 Findings:

After reviewing the wastewater collection and treatment system descriptions and the WWTP's respective NPDES permit limits as well as debriefing with their respective Project Stakeholders, the following observations were noted:

a. According to NPDES permit limits and available 7q10 stream flow data, the assimilative capacity of the Town of Rutherfordton WWTP's effluent receiving stream is nominal.

2.7 Conclusions:

As a result of reviewing the wastewater collection and treatment system descriptions and the WWTP's respective NPDES permit limits, we have concluded the following:

a. Since the assimilative capacity of the Town of Rutherfordton WWTP's effluent receiving stream is nominal, the Town should consider other long term options for wastewater

treatment and discharge including relocation of it's discharge and/or treatment by a neighboring facility for ultimate treatment and disposal.

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Section 3 – Mapping / GIS

3.1 Summary:

As part of the study, WK Dickson compiled a composite GIS map of available sewer system information from the Project Stakeholders including sewer lines, force mains, pumps stations and WWTP. All GIS information for the composite map was supplied to WK Dickson by the Owner, the Project Representative, and/or Project Stakeholders.

3.2 Background:

This phase of the Rutherford County / Municipalities Joint Sewer Study focused on the collection, compilation and conversion of digital mapping and other data sets provided by Rutherfordton, Lake Lure, Spindale, Cliffside, Forest City, Rutherford County, and Odom Engineering. This effort has resulted in the creation of a composite Geographic Information System (GIS) database for all of the Project Stakeholders wastewater systems. Based on the information contained in the composite GIS map, WK Dickson developed Mapping / GIS Findings and Conclusions in section 3.08 of this report. This section of the report provides background on the current composite GIS map status, potential future goals and some of the additional steps needed to achieve an enterprise GIS solution.

Typically, the Project Stakeholders GIS systems contained the following elements:

a. WWTPs
b. Pump Stations
c. Manholes
d. Sewer Force Mains
e. Gravity Lines

This portion of the Joint Sewer Study yielded the following:

a. A composite GIS map of all of the Project Stakeholders wastewater collection systems.
b. An approximate delineation of sewer service basins and sub-basins in each Project Stakeholders wastewater collection system.

The first step was the collection of several formats of digital data for each of the Project Stakeholders. The Project Stakeholders furnished GIS data that is presented in Table 3.1. A portion of this information was accurate and needed minimal verification. The remainder of the data overlapped with another Project Stakeholder's data or was inaccurate. Working with the Project Stakeholders, the majority of the overlaps and inaccuracies were resolved.

Table 3.1 GIS Received From Each Respective Town

	Complete Sewer Lines	Sewer Type Distinction	Gravity Sewer			Force Main			Pump Stations		Manholes	WWTP/ Connecting Line
			Quantity	Diameter	Material	Quantity	Diameter	Material	Quantity	Description		
Lake Lure	Partially	Partially	103,240 LF	Partially	yes	5 (8,915 LF)	Yes	Yes	7	Hp and Capacity	698	Yes
Rutherfordton	Yes	Yes	180,161 LF	Yes	Partially	5 (55,610 LF)	No	No	5	No	621	Yes
Spindale	Yes	Yes	376,935 LF	Partially	Yes	6 (30,0027 LF)	Partially	Yes (+age)	7	No	965	Yes
Forest City	Yes	Yes	117,796 LF	Yes	Yes	27 (61,228 LF)	Yes	Yes (+age)	27	Capacity and Age	No	Yes
Cliffside	Yes	No	177,884 LF	Yes	Partially	No	No	No	No	No	208	Yes

The next step was the development of the sewer service basins and sub-basins. A GIS dataset of polygons was prepared that delineated the natural boundaries of each Project Stakeholders wastewater collection system. These basins (which are sometimes referred to as drainage basins or subsystems) define the natural drainage boundaries of a particular service area. The major basins and sub-basins were developed based on the collection main layout and topography.

The GIS geodatabase was instrumental in assessing each of the Project Stakeholders wastewater collection systems and completing this Joint Sewer Study. It allowed reconnaissance of the potential consolidation related projects to determine potential corridors for new sewer lines. In the future, the geodatabase would be the backbone of and could allow for the allocation of the wastewater usage into a sewer interceptor model to better recognize and understand the bottlenecks and problem areas.

3.3 Benefits of a GIS Database:

The composite GIS map and associated GIS geodatabase provides a foundation to access collection system infrastructure on a common digital platform. This will prove to be a useful planning tool for Rutherford County and the Project Stakeholders. The intent of this portion of the project was to compile a County-wide sewer GIS geodatabase or composite sewer map. Some of the advantages the Project Stakeholders now have available to them from the compilation of the composite GIS map include:

a. Attribute data specific to each component of the Project Stakeholders collection systems is now available in one location.
b. Complying with infrastructure accounting and permitting regulations may be easier.
c. Multiple departments within each Project Stakeholder and the County can now benefit from being able to use this data.
d. The compiled data will allow the Project Stakeholders to utilize and share it to make working together more efficient.

3.4 Collecting Attribute Data Specific to each System Component:

WK Dickson recommends each Project Stakeholder upgrade their GIS inventory to include updated GPS data collection of the components of each wastewater system. This would include:

a. Wastewater system
    i. Pipes
    ii. Manholes
    iii. Pump stations

iv. Force mains
v. Air release valves

The degree of accuracy of the data can be tailored to meet the needs of each Project Stakeholder using either survey grade Global Positioning System (GPS) or mapping grade GPS units. The most accurate is survey grade GPS data collection. This advanced mapping technology provides "sub-centimeter" accuracy for the X, Y and Z coordinates for each feature. This is typically preferred and recommended on wastewater collection systems where capturing the Z coordinate (vertical elevation) is important in determining pipe slopes and depth of bury. Mapping-grade or sub-meter GPS data collection provides horizontal (X, Y) locations in the sub-foot order; however, vertical coordinates are generally twice the horizontal. This renders the elevation from mapping-grade GPS unreliable for analysis, design, or planning.

A distinct advantage to an upgraded GIS inventory includes the ability to specify the attributes to be associated with each element. For example, when collecting information on pipes, data related to diameter, material, condition, and approximate age can be captured. This allows someone in the office to have easy access to information about a specific component without having to make a field visit.

3.5 Accurate and Up-to-Date Data:

The advantage of maintaining a GIS system is that accurate and up-to-date data is available immediately, which is beneficial to the end user. The composite mapping component of this project included the collection of attribute data for the Project Stakeholders sewer system features. The advantages of this mapping system include:

a. Wide range of uses including preliminary design, analysis of existing sewer systems, and ability to access data in one location.
b. GIS will allow for an easy method to value assets to meet Governmental Accounting Standards Board, Statement 34 (GASB-34) requirements.
c. Gives approximate location of critical infrastructure.
d. GIS information is easily shared among the Project Stakeholders, multiple departments and the County and can be incorporated with multiple software platforms.

3.6 Ease of Compliance with Accounting Regulations:

Continued upgrades to and further development of a detailed GIS database and composite map will allow the Project Stakeholders to more easily comply with regulations, such as the System Wide Collection Permit mandated by NCDENR in addition to GASB-34.

For instance, System Wide Collection Permits were created by NCDENR to address concerns of sanitary sewer overflows (SSOs) and collection systems that are aging and not being properly upgraded. This regulation requires each Project Stakeholder keep an up-to-date, accurate, and comprehensive map of their respective wastewater collection systems. It also requires up-to-date records of pipe size, material, and approximate age. All other associated infrastructure, such as service connections and pumps must be recorded as well. A comprehensive wastewater GIS geodatabase easily handles these aspects of the permit.

In 1999, GASB-34 revised the current financial reporting requirements for state and local governments. GASB 34 requires state and local governments to begin reporting all financial transactions, including the value of their infrastructure assets, roads, bridges, water and sewer facilities, dams, and lighting systems in their annual financial reports on an accrual accounting basis. This statement requires the reporting of infrastructure assets. A fully developed GIS system supports many of the key elements that are required for reporting infrastructure assets.

3.7 Sharing Data between the Towns and the County:

Multiple departments within each Project Stakeholder and the County can benefit from having access to a full scale GIS system, as well as the advantage of allowing different groups the ability to share data in a common format. Some of the uses for different departments are:

a. Public Works (and/or Engineering) Departments tend to gain the most benefit from this tool. Potential uses include preliminary design, analysis of existing infrastructure, and the ability to access the data in a system wide format.
b. Maintenance crews can utilize the data to identify locations of manholes, air release valves, pipes, and other infrastructure as a planning tool for work areas, and to prepare the crews with the correct size and material for handling replacement and repair issues.
c. The GIS can be used as a platform for daily operation and maintenance tasks such as manhole inspections, CCTV inspections, condition assessment and pump station reporting.
d. Work orders can be linked to the GIS for historical tracking of maintenance tasks and updated asset inventories.
e. With the population of the data base with parcel information and other attributes, Planning and/or Zoning Departments can use the information to quickly identify zoning, parcel information, and the availability of utility infrastructure as the database is populated.
f. Finance Departments would find the system useful for annual asset inventories and could adapt it to assist in water and sewer billings.

With advantages such as those listed above, the goal of maintaining a full scale GIS system is worthwhile and needed.

3.8 Findings:

After reviewing the Project Stakeholders existing digital mapping of their sewer systems and GIS databases as well as debriefing with their respective staffs, the following observations were noted:

a. Existing digital mapping of each of the Project Stakeholders sewer systems provides a somewhat reasonable representation of their facilities. The composite GIS map provides a foundation as the Project Stakeholders continue to develop their sewer system GIS geodatabases.

b. The Forest City / Ellenboro geodatabase appears to be missing 2 force mains and one pump station appears to have two force mains coming from it. It is suspected

that the two pump stations that do not have a force main are actually not pump stations, rather pieces of property owned by the Ellenboro.

c. Ellenboro's and Forest City's sewer GIS information overlaps. Some information in the table for Ellenboro includes the overlapping information for Forest City. Information obtained from Forest City does not seem to provide service to entire service area.

d. Lake Lure is missing diameter information for its main trunk lines.

e. Most Project Stakeholders compiled all of their available source documents to complete the inventory as well as some field inventory information. It is imperative that the GIS information be kept up to date and that spatial and attribute discrepancies such as those noted are updated.

f. It appears that each Project Stakeholder has been able to complete a significant part of their sewer system inventory by utilizing source documents. It appears that there are areas of each Project Stakeholders sewer system, however, where source documents do not exist or the information is subject to inaccuracies. Moving forward, these areas should be field verified to ensure system accuracy.

g. Collected data for the manholes in all cases did not include depth, size and material of inlets and outlet for the majority of the Project Stakeholders sewer systems. This information should be obtained for each of the Project Stakeholders sewer systems.

h. It is recommended that each Project Stakeholders sanitary sewer system mapping be updated to greater accuracy to better meet guidelines emphasized by the United States Environmental Protection Agency (USEPA) Capacity, Management, Operations and Maintenance (CMOM) Program and the Project Stakeholder's System Wide Collection Permits.

3.9 Recommendations:

The Project Stakeholders now have a working composite geodatabase and composite map of all of their sewer systems. WK Dickson recommends each Project Stakeholder upgrade their GIS inventory to include updated survey grade GPS data collection of the components of each wastewater system. The Project Stakeholders can accomplish this goal by allocating resources to do the work internally and/or by outsourcing the mapping to qualified consultants. The following plan of action is recommended for each Project Stakeholder to achieve these goals:

a. Update your sewer system inventory in relation to questionable sewer structures. This task would include not only the accurate location of structures, but also the inventory of each structure to confirm size, material, depth, direction of flow and overall condition.

b. Each Project Stakeholder should establish formal data maintenance procedures to ensure the GIS information stays up to date.

c. Consider the development of a secured Internet Mapping Site for each Project Stakeholder services including Planning and Zoning in coordination with Rutherford County.

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Section 4 – Flow Analysis

4.1 Summary:

As part of the study, WK Dickson requested a summary of average daily flows, peak daily flows and peak hour flows for each sewer collection system for the past 24 months. All flow information was supplied to WK Dickson by the Owner, the Project Representative, and/or Project Stakeholders. WK Dickson met independently with all of the Project Stakeholders to collect this data. In addition, as part of the study, WK Dickson was requested to identify sewer flows for drainage basins within each Project Stakeholder's sewer system with flows to each pump station. All necessary flow information was to be supplied to WK Dickson by the Owner, the Project Representative, and/or Project Stakeholders. However, none of the Project Stakeholders had complete information available to allow completion of this task.

As a part of the study, some site visits to some of the Project Stakeholder's major wastewater pump stations were made to stations that could be impacted by consolidation scenarios. were made to evaluate the current equipment with regard to operational condition, reliability, potential equipment repairs or upgrades, established equipment replacement schedules and the capability of the respective wastewater pump stations to accept flows from consolidation. No flow monitoring was done as part of this project. However, due to the extent of inflow and infiltration present in all of the Project Stakeholder's collection systems, it was determined for the purposes of this study that for consolidation to occur all wastewater transferred from one Project Stakeholder to another for the purposes of treatment would have to be conveyed to the other Project Stakeholder's WWTP.

Using existing studies and data provided by the Owner, the Project Representative, and Project Stakeholders, WK Dickson has made a reasonable determination of the volume of Inflow & Infiltration in each Project Stakeholder's system. WK Dickson has identified potential projects to reduce Inflow & Infiltration, particularly where future system interconnects may occur. As a result of this information, WK Dickson has provided planning level opinions of probable costs and scope for the potential projects identified.

4.2 Inflow and Infiltration

4.2.1 Definition of Inflow & Infiltration

Inflow and infiltration or I & I are terms used to describe the ways that groundwater and stormwater enter into dedicated wastewater or sanitary sewer systems. Dedicated wastewater or sanitary sewers are created from pipes located in the street or on easements that are designed strictly to transport wastewater from sanitary fixtures inside your house or place of business. Sanitary fixtures include toilets, sinks, bathtubs, showers and lavatories.

Inflow is stormwater that enters into sanitary sewer systems at points of direct connection to the systems. Various sources contribute to the inflow, including footing/foundation drains, roof drains or leaders, downspouts, drains from window wells, outdoor basement stairwells, drains from driveways, groundwater/basement sump pumps, and even streams. These sources are typically improperly or illegally connected to sanitary sewer systems, via either direct connections or discharge into sinks or tubs that are directly connected to the sewer system. An improper connection lets water from sources other than sanitary fixtures and drains to enter the sanitary

sewer system. That water should be entering the stormwater sewer system or allowed to soak into the ground without entering the sanitary sewer system.

Improper connections can be made in either residential homes or businesses and can contribute a significant amount of water to sanitary sewer systems. Eight inch sanitary sewer lines can adequately move the domestic wastewater flow from up to 200 homes, but only six homes with downspouts connected to the sanitary sewer pipe can overload the capacity of the same eight inch sewer lines.

Infiltration is groundwater that enters sanitary sewer systems through cracks and/or leaks in the sanitary sewer pipes. Cracks or leaks in sanitary sewer pipes or manholes may be caused by age related deterioration, loose joints, poor design, installation or maintenance errors, damage or root infiltration. Groundwater can enter these cracks or leaks wherever sanitary sewer systems lie beneath water tables or the soil above the sewer systems becomes saturated. Often sewer pipes are installed beneath creeks or streams because they are the lowest point in the area and it is more expensive to install the pipe systems beneath a roadway. These sewer pipes are especially susceptible to infiltration when they crack or break and have been known to drain entire streams into sanitary sewer systems. Average sewer pipes are designed to last about 20 - 50 years, depending on what type of material is used. Often sanitary sewer system pipes along with the lateral pipes attached to households and businesses have gone much longer without inspection or repair and are likely to be cracked or damaged.

4.2.2 The Problem Associated with Inflow and Infiltration

Sanitary sewer systems are designed to carry wastewater from toilets, dishwashers, sinks, or showers in homes or businesses. Inflow and infiltration add clear water to sewer systems increasing the load on the systems. Clear water belongs in stormwater sewers or on the surface of the ground, and not in the sanitary sewers. A stormwater sewer is a pipe system designed to carry rainwater away. Stormwater sewers are normally much larger than sanitary sewer systems because they are designed to carry much larger amounts of water. Drainage ditches also act the same way in many neighborhoods. When clear water enters sanitary sewer systems, it must be transported and treated like sanitary waste water. During dry weather the impact of inflow and infiltration can vary from minimal impact to a significant portion of the sewer pipe flow. Wet weather magnifies existing inflow and infiltration sources. As a rain or snow melt event begins the inflow and infiltration sources start filling the sanitary sewer systems with clear water, eventually filling the sewer systems to capacity. Once the sanitary sewer systems have reached capacity or becomes overloaded, wastewater flows at much higher water level than normal and if sanitary fixtures or drains are below this overload level, water will flow backward through the sanitary sewer pipe, flooding basements or households and causing manholes to pop open releasing wastewater onto the street.

Overflow occurrences put public health at risk and violate state and federal environmental regulations. Sanitary sewer overflows release wastewater and potential pathogens onto streets, into waterways, and basements increasing potential health risks. As wastewater overflows into creeks, rivers, lakes, and streams it contaminates all bodies of water fed by the waterways and all creatures/plants coming in contact with the polluted water. Sewer overflows also contribute to lake and stream advisories and closures due to contamination.

Many communities are likely to experience at least a few overflows in their sanitary sewer systems,

but older communities located downstream from these overloaded sewer systems will experience the most overflows and basement backups because of their low location in the watershed. The sanitary sewer systems in these older communities not only carry their own wastewater and inflow and infiltration, they also receive the wastewater flow from the upstream neighboring community's sewer systems. The network of integrated sewer collection system pipes throughout a regional service area makes it essential for all municipalities to collaborate on and share responsibility for developing and implementing long-term solutions to the inflow and infiltration problem.

Inflow and infiltration reduce the ability of sanitary sewer systems and treatment facilities to transport and treat domestic and industrial wastewater. As a result of the inflow and infiltration, wastewater treatment processes are disrupted and poorly treated wastewater is discharged to the environment.

There are various costs associated with inflow and infiltration including sanitary sewer system overflow, with wastewater treatment and transportation facilities, and funding opportunities. Overflow costs are associated with road and waterway cleanup and the potential for fines if the overflow problem is not corrected. Additionally, sewer system backups into basements or households can result in litigation and potential liabilities for the responsible city or agency. Eventually, new homes or businesses may not be allowed to connect to the sanitary sewer system if the inflow and infiltration issues are not corrected, increasing costs to residents as new sanitary sewer systems are installed or potentially lowering housing values due to the inability to develop land for future growth.

Inflow and infiltration costs water treatment facilities and consumers large amounts of money in water treatment operating expenses. All wastewater entering a wastewater treatment facility must be treated as wastewater causing an increase in operating costs proportional to the amount of clean water entering the sanitary sewer system due to inflow and infiltration. For example, the Town of Rutherfordton's WWTP typically receives 0.5 million gallons a day (mgd) of wastewater from its sanitary sewer collection system. During a rain event, the load on the Town's sewer systems can multiple more than eight (8) fold to 4.3 mgd or more. Costs associated with processing the added clean water from inflow and infiltration are eventually passed back to the consumer in the form of rate increases. By reducing inflow and infiltration, capital and operating costs can be lowered. Minimizing inflow and infiltration can also increase the lifetime-capacity of a treatment facility and sanitary sewer collection system. The pumps that are involved with wastewater treatment and transport operate 24 hours a day seven days a week; however they must work harder as the sewer system's water level load increases. This puts an unneeded strain on the pumps and shortens the life expectancy of these expensive pumps.

4.2.3 History & Scope of the Inflow and Infiltration Problem.

Inflow and infiltration problems are difficult to resolve because of the enormity of the infrastructure in place. It is estimated that there are approximately 4.0 billion feet of sanitary sewer pipe in the United States and more being installed daily. This estimate does not include "combined sewer systems" that serve as both storm and sanitary sewer system. If these sewer systems were laid end-to-end, they would represent about 290 parallel pipelines that would stretch from New York to California. Most sewer pipe inventory for older cities pre-dates World War II, were installed with materials that are well beyond their expected service life and used methods of construction that are no longer considered to be state of the art. Due to their nature, many of these sewer collection

systems experience sanitary sewer overflows during storm events. In response to this many cities utilities are retrofitting or redesigning their systems to better meet the State and Federal requirements and the load their community places on their sewer collection system.

The EPA requires any regulated utility with a NPDES permit to eliminate all sanitary sewer overflows that reach the waters of the United States. The ability to achieve such a goal is virtually impossible for a large majority of utilities, since inflow and infiltration cannot be completely stopped. Initial efforts in the 1970's to reduce inflow and infiltration in sanitary sewer systems were typically unsuccessful in spite of substantial funding from the EPA's Clean Water Programs. In the late 1980's, most inflow and infiltration control programs were reduced to emergency programs that tried to resolve isolated issues in the sanitary sewer collection systems. However, during this time period, several major sanitary sewer collection systems were evaluated in cities such as Nashville, Atlanta, and Houston. These evaluations raised public interest in the repair and replacement of sanitary sewer collection system infrastructure. Additionally new and better sewer system technologies allowed for reduction or elimination of inflow and infiltration sources.

Public interest in sanitary sewer collection systems has also been aroused by the project growth estimates of many metropolitan areas. Growth projections are used to predict and plan for wastewater flows through the sanitary sewer systems and wastewater treatment plants. Typically the sewer systems and treatment plants are designed using national standards for average and peak flows of wastewater through the sewer systems.

If the inflow and infiltration levels are not reduced or eliminated, projecting their contribution to the sanitary sewer systems show that utilities will be required to make significant investments in relief sewer systems and pumping stations. However, it is not feasible to add capacity to transport and treat the stormwater introduced by inflow and infiltration. Wastewater treatment infrastructure is an expensive investment for a community. Additionally most existing wastewater treatment plants are not able to treat the additional flow of an ever increasing inflow and infiltration problem because of space constraints at the wastewater treatment sites.

4.2.4 Solving the Inflow and Infiltration Problem

The reduction and control of inflow and infiltration in sanitary sewer collection systems should be considered with regard to a disciplined, long-term monitoring and maintenance program. The first step to resolving any inflow and infiltration problems is determining how significant the problem is. Typically a sanitary sewer collection system evaluation is performed to assess the system. An evaluation of the sewer collection system helps determine the quantity of inflow and infiltration, determine their sources and provide guidance to determine a cost effective corrective action plan.

As with most situations you can't manage what you can't measure and the first step to managing the inflow and infiltration issue is to measure the extent of problem. To quantify the inflow and infiltration into a sanitary sewer system means a significant attempt to locate and record information that relating to a variety of issues including but not limited to observed overflows, measured or observed surcharges, reported bypasses, customer backup complaints, and chronic maintenance activities. The information should be obtained from different places including maintenance records, sewer maps, complaint records, assorted department files, work orders, past studies, engineering reports, and interviews with personnel who are responsible for maintenance and management of the sanitary sewer system. A large amount of information can be found using

these sources as well as others. Once the data has been found it must be recorded and displayed in a way that will show possible relations between overflows, bypasses and other related factors such as capacity models, rainfall records, maintenance activities, and reported backups. If electronic maps of the sanitary sewer system are available, they should also be used to confirm the result of the data findings.

Once the data has been researched and correlations found the city or agency must establish sewer flow monitoring points at various locations within the system. Typically sanitary sewer systems can be broken down into associated watersheds. Then those watersheds can be separated into basins and if necessary sub-basins.

Flow monitoring instrumentation must be placed in sanitary sewer systems at locations appropriate to obtain the data desired. To measure wastewater flows through the sanitary sewer system it is important to select the appropriate flow meter. Many types of flow monitoring instrumentation are available and pricing varies accordingly. Simple instruments like a flow probe measure water velocity and depth but do not record data. This type of instrument is good for spot flow checks or random checks of permanently installed flow meters. Often long term flow measurements can be made using simple water level recorders. In this case only water level is recorded then the data is exported into a spreadsheet and the data can be processed through an equation or lookup table that cross references water level to flow for that particular site. The advantage of water level recorders is that they are relatively inexpensive and multiple units can be purchased with a moderate investment to monitor the water level (flow) throughout the sanitary sewer system. Alternatively more sophisticated flow meters can output, display, and record flow information directly. Often these instruments also have output that can trigger wastewater samplers or other devices. These instruments are typically a larger investment, but have greater monitoring abilities.

The following "rules-of-thumb" may be used to determine a monitoring and evaluation strategy to adequately measure amount of inflow and infiltration in a sanitary sewer system. These parameters vary depending on the overall city or agency goals.

a. One flow meter for every 30,000 - 50,000 feet of sanitary sewer pipe
b. The flow meter recording should be set at 15-minute intervals
c. Flow meter capable of measuring surcharges
d. One rain gauge for every 2-4 flow meters
e. Minimum monitoring period - 45 days with 60 days being optimal
f. Measurement of between 6-8 separate rainfall events
g. The system should be monitored during a period of high seasonal groundwater

Once the flow monitoring data has been collected it should be carefully evaluated. Adjustments to account for periodic flow profiling at the monitoring site, errors associated with grease or deposits on the sensors, drift of the depth recordings, and downtimes related to flow meter malfunction. The corrected data should be tabulated and analyzed to make comparisons between the measured inflow and infiltration and the corresponding rainfall intensity. Data under surcharge conditions should be avoided for analysis purposes. The analysis will provide two essential parameters that are used to quantify the inflow and infiltration problem. The first parameter is a comparison between different basins so that basins can be prioritized for future studies and potential inflow and infiltration reduction. The second parameter is information that will be useful if subsequent relief or replacement sewer systems are necessary to reduce or eliminate overflow or bypass conditions.

Basins can be ranked in a range of ways. Rankings might include unit inflow or infiltration rates such as gallons/day/foot, mgd/1,000', gpd/inch-mile of pipe, mgd/acre, etc. By changing the raw flow data into a measured unit rate, comparisons may be made between basins as well as comparisons relating factors such as general age of the sanitary sewer system, frequency of reported overflows, etc.

In addition to flow monitoring there are other tests that a city or agency can use to identify sources of inflow and infiltration. These tests include dye and smoke testing and visual inspection. Smoke and dye testing work by introducing either dye or smoke into the sanitary sewer system and determining where it comes out. Visual inspection can be done with remote television monitoring devices and used to look for cracks or other damage in a sewer pipe.

Once a source of inflow and infiltration has been discovered the city or agency will take appropriate action to resolve the problem, including fixing or replacing damaged or leaky sewer pipes and notifying property owners of improper connections. Periodically the city or agency must monitor and measure their sanitary sewer system to maintain the integrity of the system and determine new sources of inflow and infiltration. Continuous monitoring is also beneficial to the cities and agencies so appropriate cost increases can be applied to communities/basins that are heavy contributors to inflow and infiltration into the sanitary sewer system.

4.3 Cliffside:

4.3.1 Effluent WWTP Flow Analysis

WK Dickson received twenty-one (21) months of WWTP effluent flow data beginning from January 2012 to September 2013 from the Town of Cliffside. The overall average daily flow during this time period was 0.043 mgd and the overall average maximum daily flow was 1.173 mgd. Table 4.1 shows the average daily flow for the month and the maximum daily flow per month.

Table 4.1 Cliffside WWTP Effluent Flow Data

	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
Monthly Avg.	0.047	0.019	0.031	0.024	0.025	0.027	0.046	0.017	0.026
Max Daily Flow per Month	0.198	0.072	0.098	0.078	0.161	0.157	0.326	0.067	0.167
	Oct-12	**Nov-12**	**Dec-12**	**Jan-13**	**Feb-13**	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**
Monthly Avg.	0.023	0.018	0.072	0.112	0.062	0.043	0.050	0.092	0.038
Max Daily Flow per Month	0.130	0.040	0.558	1.173	0.468	0.170	0.412	0.989	0.156
	Jul-13	**Aug-13**	**Sep-13**						
Monthly Avg.	0.144	0.038	0.037						
Max Daily Flow per Month	0.909	0.103	0.208						

4.3.2 Sewer Flow

Currently, the Cliffside Sanitary District serves 65 residential customers and 19 commercial, institutional, governmental, and industrial customers with 29,500 LF of gravity lines.

4.3.3 Inflow and Infiltration

An Inflow and Infiltration (I &I) study was performed in 2009, which came to the conclusion that the Cliffside Sanitary District does have significant inflow. Additionally, the inflow analysis showed the system does not experience excessive infiltration. The infiltration was calculated to be 280 gpd/in-mile (gpdim). Infiltration greater than 3,000 gpdim is considered excessive.

4.4 Forest City:

4.4.1 WWTP Effluent Flow Analysis

WK Dickson received twenty-four (24) months of flow and rainfall data during from October 2011 through September 2013. During this time period the overall average daily flow was 1.26 mgd with the overall daily maximum flow per month being 16.69 mgd. Table 4.03-1 shows the average daily flow and maximum daily flow for each month.

Table 4.2 Forest City Second Broad River WWTP Effluent Flow Data

	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12
Monthly Avg. mgd	1.01	1.186	1.445	1.337	1.16	1.138	1.079	1.135
Max Daily Flow per Month (mgd)	1.52	3.02	3.291	3.63	1.61	1.44	1.64	4.55
	Jun-12	**Jul-12**	**Aug-12**	**Sep-12**	**Oct-12**	**Nov-12**	**Dec-12**	**Jan-13**
Monthly Avg. mgd	0.985	1.153	1.030	1.039	1.013	0.948	1.129	1.79
Max Daily Flow per Month (mgd)	1.37	2.058	1.48	1.747	2.19	1.07	3.925	13.78
	Feb-13	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**	**Jul-13**	**Aug-13**	**Sep-13**
Monthly Avg. mgd	1.42	1.34	1.39	1.93	1.36	2.05	1.19	1.048
Max Daily Flow per Month (mgd)	4.51	2.14	4.56	16.68	3.09	6.49	1.82	1.621

4.4.2 Sewer Flow

Currently, Forest City serves 2,825 residential customers and 660 commercial, institutional, governmental, and industrial customers with 237,000 LF of gravity lines.

4.4.3 Inflow and Infiltration

Comparing the flow and rainfall data given to WK Dickson by Forest City, it can be seen in Figure 4.1 the flow vs. rainfall graph. Additionally, an I&I study was done between 2009 and 2010 on the Brackett Creek, Erwin, Woodburn, and Dogwood Pump Station sewer basins. The range of infiltration rates from 2009 to 2010 in gpdim in Table 4.3 below. It can be seen from Figure 4.1 and Table 4.3 that Forest City does have a significant inflow and infiltration problem.

Table 4.3 Forest City I&I Study Results for Brackett Creek, Erwin, Woodburn, and Dogwood Pump Station Sewer Basins

Pump Station Service Area	Max (gpdim)	Min. (gpdim)
Brackett	12,595	1,255
Erwin	25,076	1,827
Woodburn	6,797	580
Dogwood	10,419	755

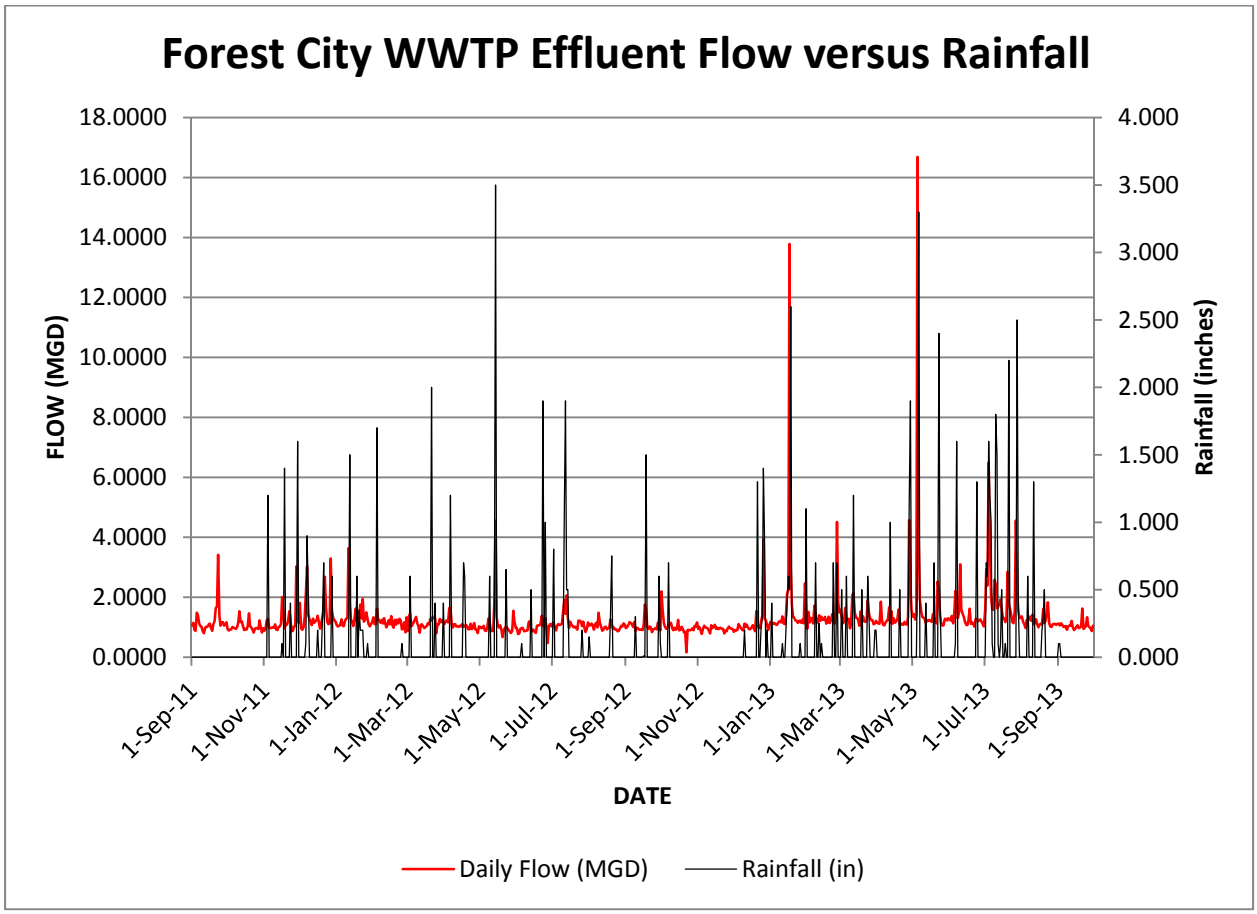

Figure 4.1 Forest City WWTP Effluent Flow Data versus Rainfall

4.4 Lake Lure:

4.4.1 WWTP Effluent Flow Analysis

WK Dickson received thirteen (13) months of flow data during from May 2012 through September 2013. During this time period the overall average daily flow was 0.324 mgd with the overall daily maximum flow per month being 0.687 mgd. Table 4.4 shows the average daily flow and maximum daily flow for each month.

Table 4.4 Lake Lure WWTP Effluent Flow Data

	May-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13
Monthly Avg.	0.3643	0.406	0.382	0.359	0.293	0.27	0.309
Max Daily Flow per Month	0.531	0.477	0.532	0.401	0.339	0.456	0.63
	Feb-13	**Mar-13**	**Apr-13**	**Jul-13**	**Aug-13**	**Sep-13**	
Monthly Avg.	0.27	0.281	0.308	0.36	0.331	0.278	
Max Daily Flow per Month	0.431	0.37	0.521	0.687	0.443	0.444	

4.4.2 Sewer Flow

Currently, Lake Lure serves 869 residential customers and 127 commercial, institutional, governmental, and industrial customers with 12.35 LF of gravity lines.

4.4.3 Inflow and Infiltration

The inflow and infiltration is difficult to gauge for Lake Lure due to the fact that the piping for the collection system runs under the lake, which makes it difficult to inspect for I&I sources. Consequently, there are no spikes in the flow during a rain event at the WWTP. Since receiving $3,000,000 in grant money to wrap pipe joints, the overall flow to the plant has decreased.

4.5 Rutherfordton:

4.5.1 WWTP Effluent Flow Analysis

WK Dickson received twenty-four (24) months of flow and rainfall data during from October 2011 through September 2013. During this time period the overall average daily flow was 0.502 mgd with the overall daily maximum flow per month being 4.305 mgd. Table 4.5 shows the average daily flow and maximum daily flow for each month.

Table 4.5 Rutherfordton WWTP Effluent Flow Data

	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12
Monthly Avg.	0.352	0.368	0.402	0.454	0.4260	0.405	0.65	0.526
Max Daily Flow per Month	0.545	0.926	1.0	1.5	0.5550	0.481	2.04	2.374
	Jun-12	**Jul-12**	**Aug-12**	**Sep-12**	**Oct-12**	**Nov-12**	**Dec-12**	**Jan-13**
Monthly Avg.	0.4030	0.424	0.423	0.445	0.43	0.463	0.572	0.647
Max Daily Flow per Month	0.6460	0.724	0.551	0.993	0.91	0.933	1.87	3.942
	Feb-13	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**	**Jul-13**	**Aug-13**	**Sep-13**
Monthly Avg.	0.478	0.461	0.582	0.579	0.731	1.059	0.347	0.43
Max Daily Flow per Month	2.075	0.946	2.33	4.305	2.138	4.022	0.578	0.747

4.5.2 Sewer Analysis

Currently, Rutherfordton serves 1376 residential customers and 212 commercial, institutional, governmental, and industrial customers with 180,000 LF of gravity lines.

4.6 Spindale:

4.6.1 WWTP Effluent Flow Analysis

WK Dickson received twenty-three (23) months of flow data during from January 2011 through November 2013. During this time period the overall average daily flow was 0.868 mgd with the overall daily maximum flow per month being 6.1 mgd. Table 4.6 shows the average daily flow and maximum daily flow for each month.

Table 4.6 Spindale WWTP Effluent Flow Data

	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12
Monthly Avg.	0.900	0.700	0.700	0.700	0.900	0.700	0.800	0.900
Max Daily Flow per Month	2.800	1.000	1.200	1.600	4.000	1.000	1.300	1.300
	Sep-12	**Oct-12**	**Nov-12**	**Dec-12**	**Jan-13**	**Feb-13**	**Mar-13**	**Apr-13**
Monthly Avg.	0.800	0.800	0.800	0.9	1.1	1	0.9	1
Max Daily Flow per Month	1.700	1.900	0.900	2.7	5.6	3.4	1.8	3
	May-13	**Jun-13**	**Jul-13**	**Aug-13**	**Sep-13**	**Oct-13**	**Nov-13**	
Monthly Avg.	1.116	0.9	1.3	0.8	0.7	0.732	0.809	
Max Daily Flow per Month	6.1	2	3.4	1.1	1.1	0.92	3.78	

4.6.2 Sewer Flow Analysis

Currently, Spindale serves 1,106 residential customers and 250 commercial, institutional, governmental, and industrial customers with 161,000 LF of gravity lines.

4.6.3 Inflow and Infiltration

A 2004 study of Spindale's collection system found that the system is in failing condition and experienced significant inflow and infiltration. These findings were found through smoke testing and closed circuit television (CCTV).

4.7 System Inflow & Infiltration Summary:

4.7.1 Hydraulic Capacity

Each of the Project Stakeholders collection systems are designed to convey wastewater from their customers to their respective wastewater treatment plants. However, the collection systems also carry excess water that should not be collected and treated. This excess water is commonly referred to as inflow and infiltration (I&I). The hydraulic capacity of the system refers to quantity of the combined customer flow and I&I the system can convey without resulting in a sanitary sewer overflow (SSO).

4.7.3 Infiltration and Inflow

I&I develops from deficiencies in the collection system such as cleanouts missing their caps, cracked or crushed joints of pipe, misaligned joints, holes in the manhole covers, misalignment of manhole rims as well as cracking and other structural defects in the manhole structure. Infiltration is groundwater or stormwater that enters the sanitary sewer system indirectly through deficiencies in the infrastructure. Inflow is stormwater which enters the sanitary sewer system directly from cross connections with storm sewers; from stormwater collectors such as roof drains, catch basins, or inlets; or from flooding of manhole covers in low-lying areas.

I&I is a common but serious problem for many collection systems throughout the country. It adversely affects the operation and performance of a wastewater collection, pumping and treatment system by reducing the hydraulic capacity of pipes and pumps. Additionally it affects the Project Stakeholders treatment plant's ability to sufficiently process peak flow and can damage the plant process.

4.7.4 Regulatory Requirements

In 1996 NCDENR adopted the Minimum Design Criteria for permitting of Gravity Sewers (MDC). Prior to the implementation of the MDC, gravity sewers were required to convey peak wastewater flows with the pipe flowing half full and maintain a minimum velocity of 2 feet per second (fps). Minimum design slopes were defined in the MDC that would allow for a minimum velocity of 2 fps to be maintained while allowing for a construction allowance of 10%. This means that an 8-inch gravity line designed at 0.40% slope could be installed at 0.36% slope.

NCDENR has also enacted Collection System Permits which holistically covers the entire wastewater collection systems. NCDENR traditionally reviewed only sewer line extension permits. While the extension permits required that "facilities must be properly maintained and operated at all times", the requirements were not explicit. Furthermore, a significant portion of an entity's collection system may have been constructed prior to any permitting requirements. These older sewers have never been permitted even though the state statutes require a permit for the operation of all sewers. The goal, therefore of the holistic system wide permit is to permit older systems that have never been permitted, ensure adequate operation and maintenance, and examine the need for rehabilitation and repair (system renewal).

4.7.5 Limited Collection System Assessment – Inflow and Infiltration Analysis

Table 4.7 tabulates the average infiltration rate (the difference between average daily wet weather flow and average daily water consumption records) for each of the project stakeholders collection systems the sewer basins which were metered for sewer flows and have corresponding water consumption records.

Criteria for excessive infiltration has changed over the years. However, one version that has not changed is EPA's criteria. The criteria are based on a per capita assessment of infiltration and inflow. The criteria uses a basis of gallons per day per inch-mile (gpdim) of sewer and sets non-excessive rates based on the tributary length of sewer as summarized in Table 4.8 below.

Table 4.7 Criteria for Non-Excessive Infiltration Determination

Non-Excessive Infiltration Rate (gpdim)	Length of Sewer (LF)
2,000 – 3,000	> 100,000
3,000 – 6,000	10,000 – 99,999
6,000 – 10,000	< 10,000

NCDENR has historically defined infiltration as excessive if it exceeds 3,000 gpd per inch-mile (gpdim) of gravity sewer. An inch-mile is the total length of gravity pipe in miles multiplied by the respective pipe diameters in inches.

Table 4.8 Infiltration Estimates

System	Average Daily Wastewater Flow (gpd)	Estimated Average Daily Water Consumption (gpd)	Infiltration (gpd)
Cliffside	43,000	23,500	19,500
Forest City	1,260,000	700,000	560,000
Lake Lure	340,000	97,000	243,000
Rutherfordton	500,000	291,000	209,000
Spindale	870,000	413,000	457,000

Average daily wastewater flow was based on the historical records provided by the Project Stakeholders. And, the estimated average daily water consumption was based on FY 2012 / 2013 estimated sewer usage information provided by the Project Stakeholders.

Table 4.9 Infiltration Parameter Check

System	Inch-Miles	gpdim	Infiltration Percentage of Total Wastewater
Cliffside	51	382	45%
Forest City	360	1,555	44%
Lake Lure	148	1640	71%
Rutherfordton	274	760	42%
Spindale	430	1,065	53%

Although none of the Project Stakeholders collection systems as a whole are considered excessive by the 3,000 gpdim standard when comparing average daily wastewater flow to estimated average daily water consumption, all project stakeholders collection systems appear to be experiencing significant infiltration when average daily wastewater flows are compared to peak daily wastewater flows as shown in Table 4.11 – Capacities of Project Stakeholders WWTPs.

Excessive inflow can be expressed by sudden peak flows at the wastewater treatment plant following a peak rainfall event, normally one inch or more. The rain events that are selected for the analyses should be preceded by at least five days of dry weather.

Table 4.10 presents the inflow calculations. Using the average number of persons per household from the 2010 census multiplied by the number of residential customers returns an estimated population for the sewer systems. The gpdpc was calculated using the inflow quantity and population. Excessive inflow is considered to be 275 gpdpc by NCDENR. Although none of the Project Stakeholders collection systems as a whole are considered excessive by the 275 gpdpc standard when comparing average daily wastewater flow to estimated average daily water consumption and estimated sewer system population, all project stakeholders collection systems appear to be experiencing significant inflow when average daily wastewater flows are compared to peak daily wastewater flows as shown in Table 4.11 – Capacities of Project Stakeholders WWTPs. And, Lake Lure and Rutherfordton appear to have the highest inflow rates per capita.

Table 4.10 – Inflow Calculations

System	Average Daily Flow (gpd)	Estimated Average Daily Water Consumption (gpd)	Inflow (gpd)	Estimated Sewer System Population	gpdpc
Cliffside	43,000	23,500	19,500	130	150
Forest City	1,260,000	700,000	560,000	5,650	100
Lake Lure	340,000	97,000	243,000	1,000	243
Rutherfordton	500,000	291,000	209,000	2,752	76
Spindale	870,000	413,000	457,000	2,212	205

Note: Population calculated using 2.0 persons per residential customer

Table 4.11 presented permitted capacity, average daily flows, peak daily flows, available capacity and calculates a peaking factor for all of the Project Stakeholders wastewater treatment plants. It should be noted that industry standard for peaking factors are on the order of 1.5 to 4.0. Therefore, the only sewer collection system that falls within these guidelines is the Town of Lake Lure's.

Table 4.11 Capacities of Project Stakeholders WWTP's

WWTP	Permitted Capacity	Avg. Daily Flow	Peak Daily Flow	Available Capacity	Calculated Peaking Factor
	(MGD)	(MGD)	(MGD)	(MGD)	
Forest City Second Broad WWTP	4.95	1.26	16.69	3.69	13.2
Forest City Riverstone WWTP	0.05	< 0.005	N/A	0.045	N/A
Forest City DRG WWTP	0.91	Inactive	N/A	> 0.91	N/A
Rutherfordton WWTP	1.0 / 3.0	0.5	4.3	2.5	8.6
Spindale WWTP	3.0 / 4.5 /6.0	0.87	6.1	5.13	7
Cliffside WWTP	0.05 / 1.75	0.043	1.117	1.71	26
Lake Lure WWTP	0.995	0.34	0.63	N/A	1.9

4.7 Findings:

After reviewing the flow analysis conducted for the Project Stakeholders as well as debriefing with their respective staffs, the following observations were noted:

a. Although none of the Project Stakeholders collection systems as a whole are considered excessive by the 3,000 gpdim standard when comparing average daily wastewater flow to estimated average daily water consumption, all project stakeholders collection systems appear to be experiencing significant infiltration when average daily wastewater flows are compared to peak daily wastewater flows as shown in Table 4.11 – Capacities of Project Stakeholders WWTPsAlthough none of the Project Stakeholders collection systems as a whole are considered excessive by the 275 gpdpc standard when comparing average daily wastewater flow to estimated average daily water consumption and estimated sewer system population, all project stakeholders collection systems appear to be experiencing significant inflow when average daily wastewater flows are compared to peak daily wastewater flows as shown in Table 4.11 – Capacities of Project Stakeholders WWTPs. And, Lake Lure and Rutherfordton appear to have the highest inflow rates per capita.
b. Peak Daily Flows at each of the Project Stakeholder's wastewater treatment plants are of concern since the peaks appear to demonstrate excessive inflow –for all sewer collection systems except Lake Lure. Peaking factors should range from 1.5 to 4 whereas for the Project Stakeholders, they ranged from 1.9 to 26 with Cliffside's and Forest City's peaking factors being calculated at 26 and 13, respectively.

4.8 Recommendations:

As a result of the limited flow analysis and inflow and infiltration analysis performed, we recommend the following:

a. Each Project Stakeholder should conduct a more detailed review of their available records and information related to their existing pump stations and collection systems to include pump manufacturer, pump size, design pumping capacity, discharge head, wet well size, and pump run-time records. Utilizing available existing collection system GIS records, continue to quantify collections system / drainage basins associated with each pump station. Utilizing pump station runtime and capacity data with rainfall records, evaluate individual collection systems / drainage basins by comparison of wet and dry weather periods to identify and prioritize collection systems / drainage basins

that have the highest potential I&I impact on the overall system. This will allow Project Stakeholders to document preliminary I&I findings and move towards providing recommendations and associated costs for the performance of a more extensive Sanitary Sewer Evaluation Survey's (SSES) in the highest priority collection systems / drainage basins.

b. Consider conducting more extensive SSES's in the highest priority collection systems / drainage basins. The Sanitary Sewer Evaluation Surveys will provide for more detailed assessments of the sanitary sewer collection systems / drainage basins in an effort to construct a prioritized approach for the rehabilitation of the surveyed sewers. The SSES should include, but not be limited to: Dyed Water Flooding; Corrosion Defect Identification; Routine Manhole Inspections; Rainfall & Flow Monitoring; CCTV work; Gravity System Defect Analysis; Smoke Testing; and, Pump Station Performance and Adequacy Analysis.

End of Section

Section 5 – Staffing & Operations

5.1 Summary:

As part of this study, WK Dickson evaluated the consolidation of collection system operations making use of shared resources using information provided by the Owner, the Project Representative, and the Project Stakeholders as well as survey data from operations staff.

As part of this task, workshops were conducted with each of the project stakeholders individually to identify and discuss the following concerns and issues:

a. Consolidation of management and administrative issues;
b. Personnel issues and current and/or proposed shared responsibilities;
c. The implications of current system maintenance equipment transfer to new entity;
d. Perceptions, problems, concerns and opportunities regarding the potential merger of the respective wastewater collection and treatment systems.

5.2 Cliffside:

5.2.1 Staffing & Responsibilities

The Cliffside Sanitary District WWTP and collection system is operated by a contract operator who visits the plant and pump station sites on a daily basis. Management of the District is conducted by Rutherford County and Harris Septic Tank (HST), Inc. of Mooresboro, North Carolina with limited oversight. For the purposes of this report, it has been estimated that Cliffside's contract operator spends a quarter of their day operating and maintaining the collection system and pump stations and a quarter of their day operating and maintaining the WWTP.

5.2.2 Assets

No known assets of the Cliffside Sanitary District exist based on information provided by the Owner, Project Representative, and Project Stakeholders.

5.2.3 Programs

No known programs exist for the Cliffside Sanitary District based on information provided by the Owner, Project Representative, and Project Stakeholders.

5.6.4 Other Notable Information

No additional information beyond the 2010 Cliffside Sanitary District Study has been made available to WK Dickson from the Owner, Project Representative, and Project Stakeholders.

5.3 Forest City:

5.3.1 Staffing & Responsibilities

Staff associated with the sanitary sewer system in Forest City includes staff from four (4) departments: Administration, Finance, Sewer Collection, and Sewer Treatment. According to the Town Manager, Administration staff spends minimal time on the Town's sanitary sewer collection and treatment system.

Forest City's finance department has a separate utility billing and collection system and has estimated it spends 15% of it's time on sewer system related financial issues. Sewer bills are based on water meter reading. Significant Industrial Users (SIU) bills are based on water consumption. Utility billing staff includes three (3) meter readers, three (3) collection clerks and one (1) supervisor.

According to the Town, legal and human resources involvement related to the sanitary sewer collection and treatment system are negligible.

The Town's WWTP staff include the following:

a. Six (6) people on staff as Town employees including an ORC, Pretreatment Coordinator, three (3) operators, and a Lab Technician;
b. Sludge drying requires a shift operator; and,
c. The Town's lab does all of testing except for metals and toxicity.

The Town's collection system staff includes the following:

a. Collection system staff includes three (3) maintenance employees plus one (1) supervisor;
b. Pump station maintenance is separate department with three (3) employees; and,
c. Pump station maintenance staff maintain all Town pump stations, including wastewater (thirty [30]) and water.

5.3.2 Assets

The Town of Forest City owns and maintains the following WWTP assets:

a. Three (3) vehicles / service trucks;
b. Bob cat front end loader.
c. Plant operates a compost operation for City limbs and leaves with contract grinder processing approximately 2 times per year.

The Town owns and maintains the following collection system assets:

a. Two (2) vehicles / service trucks;
b. A rubber tired backhoe;

The Town's pump station maintenance department owns and maintains two (2) service trucks.

5.3.3 Programs

Current Town programs include the following:

a. FOG program – The Town maintains a FOG program and has identified several areas with issues.
b. Gravity System Maintenance Program – The Town budgets improvements each fiscal year to target problem areas.
c. Sanitary Sewer System Assessment Program – The Town attempts to clean approximately 10% of the sanitary sewer collection system each year and contracts about 75% of the cleaning.
d. Capital Improvement Plan (CIP) – The Town maintains a CIP a budgets specific projects as necessary. The Town has set up a "set aside" fund within the rate structure for projects each year.

5.3.4 Other Notable Information

Other notable information provided by the Town staff includes the following:

a. The Town conducts its own meter reading and billing.
b. The Town has separate water, sewer and electric departments but can share personnel.
c. Monthly meter reading is done at or near the first of the month with approximately 25% of the Town's meters being electronically read.
d. The Town does not maintain service laterals – these are the responsibility of individual property owners.
e. The Town supervises installation of taps by plumber. The tap fee of $750 covers cost of supervision. Property owners are responsible for street repairs and any necessary materials including saddles.
f. The Town significant amounts of clay pipe in their sanitary sewer collection system which is subject to Infiltration & Inflow.
g. The Town is currently completing a I&I project from areas targeted in 2010 which is approximately 60% complete.
h. The Town has not had a SSO event at their WWTP but has occasional issues in the sanitary sewer collection system (i.e. 2 to 3 events in last 12 years).
k. The Town is of the opinion that their water & sewer reserve fund in "healthy".
l. The Town is of the opinion that the project drivers are the situations associated with Lake Lure, Spindale and Cliffside.
m. The Town currently accepts flow from Ellenboro.
n. The Town is open to any opportunities to use its excess capacity.
o. The Town is aware of several recent studies previously conducted concerning consolidation between Rutherfordton and Spindale.
p. The Town is concerned about I&I issues present in other project stakeholders systems and the condition of other project stakeholders assets that would be taken on with consolidation as well as the division of capital costs.
q. Forest City's only debt service is for DENR SRF 0% loan for its ongoing I&I program.
r. Forest City is not interested it relinquishing their sewer system and separating it from their water and power utilities.
s. Forest City sees excess capacity as their biggest asset and would accept wastewater from others for treatment but other Towns would have to maintain their own collection system.
t. Forest City believes they have a good handle on their assets.
u. Forest City would consider operating other plants but doubts that other project stakeholders would consider this as a viable option.

v. Forest City sees future annexations opportunities associated with the Riverstone industrial park and Horsehead development.
x. The Forest City DRG WWTP permit is still active but would require significant rehabilitation in order to place it back on line.
y. Recent annexation laws have made it difficult to annex adjacent areas.
z. Areas outside of Town will require pump stations as the Town currently serves most areas capable of gravity flow.
aa. Forest City would likely not accept anything other than taking in additional flow for treatment.
bb. Ellenboro is billed on volume with any major repair greater than $1500 billed to Ellenboro.
cc. Forest City does not have any regulatory issues other than waiting on their new NPDES permit.

5.4 Lake Lure:

5.4.1 Staffing & Responsibilities

Staff associated with the sanitary sewer system in Lake Lure includes staff from four (4) departments: Administration, Finance, Sewer Collection and Sewer Treatment. According to the Town Manager, time spent on the Town's sanitary sewer collection and treatment system includes the following:

a. Town Manager - estimates 15% of time is spent on sanitary sewer related issues.
b. Finance Director – estimates less than 5% of the Finance Director's time is spent on sanitary sewer related issues.
c. Clerk – estimates 50% of the Clerk's time is spent on sanitary sewer related issues.
d. WWTP ORC – Full time (100%) between WWTP, paperwork and sampling.
e. Collection System – estimates 25% of the time for a Sewer Collection System Technician and 50% of the time for a Customer Service Supervisor

According to the Town, legal and human resources involvement related to the sanitary sewer collection and treatment system are negligible.

5.4.2 Assets

The Town of Lake Lure owns and maintains one (1) service vehicle that is split between the sewer department and the hydropower department. The Town does not own, operate, or maintain and sewer collection system service equipment.

5.4.3 Programs

Current Town programs include the following:

a. FOG Program – The Town maintains a FOG program and communicates FOG issues with customers as well as regularly checks grease traps.
b. SSO Response Plan – The Town maintains a Sanitary Sewer Overflow (SSO) Response Plan. Manholes in Lake Lure are inspected annually and the lake is drawn down annually to allow access.

5.4.4 Other Notable Information

Other notable information provided by the Town staff includes the following:

a. Plant requires a Grade II Physical Chemical Operator License
b. Services lines to collection manholes in lake are property owner's responsibility.
c. The Town has experienced problems at times getting service lines fixed due to multiple home owners on one line or a service line crossing another property owner's lot.
d. Some of newer collection systems are established as a "private collection system" with regulations for getting lines fixed.
e. Collection manholes are approximately 1-1/2 feet deep in lake.
f. The Town has had an overflow at the manhole downstream of the dam just before pump station due to a pump failure.
g. The Town believes they have limited options for wastewater treatment and compliance with their NPDES permit including difficulty associated with upgrading at their existing WWTP site due to limited site availability, moving to a new site would involve costs associated with land and rock, and transfer to Rutherfordton would have a high capital costs and rock issues.
h. The Town recently completed their Pipe Wrapping Project in 2012 with a high degree of success.
i. The existing outfall in Lake Lure is heavy duty cast iron pipe in low oxygen condition with minimal corrosion potential.
j. As part of the project, the Town wrapped approximately 60% of the pipe joints (i.e. all exposed joints) and reduced flow to their WWTP significantly.
k. Due to the nature of their collection system and customer base, wastewater influent to WWTP has BOD of approximately 30 ppm and iron at 40 – 140 ppm which is and continues to be problematic for treatment.
l. The Iron creates suspended solids and sludge issues at WWTP when oxidized.
m. Sags within the lake outfall piping also create septic areas resulting in a black color and odor in the morning flush.
n. The Town believes the current WWTP is under designed with no room for expansion at the current site.
o. The Town is interested in connecting their sewer system to Rutherfordton for treatment as documented in the provided study.
p. This transfer of wastewater from Lake Lure to Rutherfordton has the potential to pick up several developments and drainage basins along Hwy 64. However, concerns related to the secondary and cumulative impact (environmental impact) of opening these two (2) additional drainage basins to sewer service has discouraged development in these areas. The Town has previously been informed that if USDA funding is to be utilized, USDA will not allow new connections to be built into connection to Rutherfordton.
q. Chimney Rock is not officially part of Lake Lure but all of it's sewer goes to into Lake Lure System for conveyance and treatment.
r. Rutherford County owns the sanitary sewer collection system in Chimney Rock.

5.5 Rutherfordton:

5.5.1 Staffing & Responsibilities

Staff associated with the sanitary sewer system in Lake Lure includes staff from four (4) departments: Administration, Finance, Sewer Collection and Sewer Treatment. According to the

Town, legal and human resources involvement related to the sanitary sewer collection and treatment system are negligible.

Staffing for the Town's collection system is provided as follows:

a. The Town has 13-½ staff available when all positions are filled to maintain their wastewater collection system, provide custodian duties at public buildings, conduct garbage collection, conduct street & sidewalk maintenance, and maintain the Town's cemetery.
b. The Town has estimated that 20 to 30% of time staff time or 3 full time personnel maintain the wastewater collection system.
c. The Town has estimated that approximately 20% of the Public Works Director's time is spent on the Town's collection system.

Staffing for the Town's WWTP and pump stations is provided by a contract operator, United Water (UW), and includes two (2) full time staff covering the WWTP seven (7) days a week.

Notable items from the Town's contract with UW include the following:

a. Town assists with significant maintenance.
b. Use a "deductible cost system" for equipment repairs with major repairs covered by Town.
c. Operates on 5 year renewable contract with current contract extending to 2015 or 16 with an escalation clause.
d. Town purchases chemicals.
e. WWTP monitoring and testing costs are covered by the operations contract with UW.

5.5.2 Assets

The Town of Rutherfordton owns and maintains the following sewer system assets:

a. Jet –Vac Truck
b. Four wheel drive vehicle for sewer right-of-way access and inspections purchased in 2004
c. CCTV camera for sewer inspection
d. Backhoe
e. Bobcat loader
f. Other Town vehicles including trucks and trailers
g. Portable generator

5.5.3 Programs

Current Town programs include the following:

a. FOG Program
b. Pretreatment Program
c. Capital Improvement Program (CIP) – the Town has an unfunded Capital improvement Program.

5.5.4 Other Notable Information

Other notable information pertaining to the Town's wastewater collection system includes:

a. Billing for sewer usage is conducted for the Town by Broad River Water Authority and is based on water usage.
b. Notable items from the Town's contract with UW include the following:
    i. Town assists with significant maintenance.
    ii. Use a "deductible cost system" for equipment repairs with major repairs covered by Town.
    iii. Operates on 5 year renewable contract with current contract extending to 2015 or 16 with an escalation clause.
    iv. Town purchases chemicals; and,
    v. WWTP monitoring and testing costs are covered by the operations contract with UW.
c. Customers in Rutherfordton are required to connect to sewer if sewer is available and within 100' of the property without crossing someone else's property.
d. 60% of existing collection system is > 75 years old and constructed of vitrified clay pipe.
e. Town is only responsible for collection lines with homeowner's responsible up to tap.
f. Home taps are installed by homeowner (plumber) but require Town inspection at time of installation.
g. The Town currently requires installation of backflow protection.
h. The Town completed an I&I study approximately seven (7) years ago.
i. The Town hasn't performed smoke testing recently. However, the Town attempts to completely cleaning and inspect of most of wastewater collection system each year.
j. The Town believes I&I s primarily inflow during flooding events as small rains have minimal effect on the wastewater collection system.
k. The Town maintains a budget for point repairs.

5.6 Spindale:

5.3.1 Staffing & Responsibilities

Staff associated with the sanitary sewer system in Spindale includes staff from four (4) departments: Administration, Finance, Sewer Collection, and Sewer Treatment. According to the Town Manager, Administration staff spends approximately 25% of its time on the Town's sanitary sewer collection and treatment system. And, the Town Clerk spends approximately 50% of their time on the sanitary sewer and collection system. Spindale's finance department has estimated it spends 40% of its time on sewer system related financial issues. According to the Town, legal and human resources involvement related to the sanitary sewer collection and treatment system are negligible.

The Town's WWTP staff includes three (3) operators and no contract employees. In addition, the Town utilitizes laborers from the prison for some maintenance issues. The Town's collection system staff includes two (2) full time employees plus one (1) employee at 50% and one employee at 20%.

5.3.2 Assets

The Town of Forest City owns and maintains the following WWTP assets:

a. two (2) pickup trucks and one (1) trailer
b. two (2) riding lawn mowers

The Town owns and maintains the following collection system assets:

a. One (1) jet truck with high pressure and mechanical rodder
b. One (1) Backhoe (50%)
c. One (1) Tractor (100%)
d. One (1) Camera (100%)
e. Two (2) trucks dedicated to the sewer system
f. Shop tools and couplings
g. Two (2) mobile generators (for two of the seven pump stations that do not have permanent standby power)
h. Shop tools, couplings, spare pumps, valves, electrical parts, etc.

5.6.3 Programs

Current Town programs include the following:

a. Pretreatment Program – for 3 Significant Industrial Users (SIU's)
b. FOG Program – The Town maintains a FOG program. Additional FOG program information includes:
    i. The Town sends a FOG newsletter once per year to customers;
    iii. The Town maintain FOG Program information on its web site; and,
    ii. The Town conducts periodic checks of all grease traps.
c. Sewer System Assessment Program – The Town maintains a sanitary sewer assessment program. The Town attempts to clean approximately 10% of the sanitary sewer collection system each year.
d. Assess Management Program – The Town recently completed an Asset Management Program.

5.6.4 Other Notable Information

Other notable information provided by the Town staff includes the following:

a. Billing for sewer usage is conducted for the Town by Broad River Water Authority and is based on water usage.
b. The Town estimates 50 – 60% of its gravity sewer pipe is vitrified clay pipe (VCP).
c. The Town's WWTP accepts septic trucks at the influent splitter box at the WWTP headworks and charges per load based on the size of the truck. A break in cost is provided for multiple loads.
d. The Town has the perception that Spindale should transfer its wastewater it's Forest City or Rutherfordton.
e. Spindale would not be comfortable in becoming a customer of another entity but would consider a 3rd party as a management entity.
f. Spindale believes setting up a new Authority would require significant time and legal costs whereas Broad River Water Authority as a management entity is seen as having some immediate benefits.

g. Spindale is concerned about job security for current employees depending on the study outcome.
h. Spindale recognizes that sewer system is subject to politics regarding raising rates for needed improvements and believes an Authority would have some advantages with regard to raising rates without impacting elections.
i. Spindale is concerned about the transfer of assets under a new entity.
j. Spindale indicated they have had discussions regarding consolidation going back over 20 years.
k. Spindale believes consolidation must be a "win-win" situation for all parties involved.
l. Spindale has 4 year rate projection showing steps to adjust the sewer rate for SRF repayment (i.e. $4,000,000 / 20 years / 1,700 customers / 12 month per year = $9.80 increase per customer).
m. Spindale believes there are opportunities or benefits of a Sewer Authority –
    i. Easier to maintain without politics;
    ii. Less concern about rate increases;
    iii. Removes politics; and,
    iv. Less likely to rely on "Band-Aid" fixes.
n. Spindale's sanitary sewer and collection system in 1995 - 96 was funded 80% by industry and 20% by residential. In 2009 - 10 this ratio reversed with residential now funding 80%.
o. Spindale previously transferred substantial revenue to their general fund from their gross revenue fund in an effort to keep taxes low.
p. Spindale currently has 31 total staff compared to more than 80 staff in the 1990's.
q. Spindale believes there would be benefits from consolidation in the form of management operating savings such as:
    i. Lab costs
    ii. Chemical costs
r. Spindale has the perception that through consolidation, no positions would be eliminated but there could be the addition of management staff.
s. Spindale is more willing to raise consumption charges before adjustment to base charge impacting small users.
t. Spindale has worked to reduce I&I by sealing lines, correcting cleanouts, etc. They have seen high flows reduced and now most pump station do not get to high level alarms. They continue to identify sources of I&I and fix issues as they are found. The system capacity seems to handle flows with no SSO's other than those due to blockages.
u. They have tried to get Rutherfordton to consider consolidation of sewer 4 times.
v. One engineering study recommended sending flow to Spindale with saving of $150,000 to each party. Rutherfordton has just upgrade WWTP and politics prevented towns from coming to terms.
w. Spindale is concerned about who controls rates under a new entity.
x. Spindale is concerned about splitting excess capacity between project stakeholders under a new entity.

5.7 Regulatory Climate:

EPA Region 4 as well as NCDENR and other southeastern state's regulatory agencies are currently and systematically entering into Consent Decrees, Consent Orders, Administrative Orders, and/or Administrative Orders on Consent with southeastern sewer utilities for sewer system compliance

associated with Sanitary Sewer Overflows (SSO's) and Management, Operation & Maintenance (MOM) programs.

Our understanding is that under the current Administration, EPA intends to place the majority of systems in the Southeast under Order SSO / MOM programs serving a population of greater than 100,000 by 2016. After 2016, they intend to enter orders with all sewer systems sewer between 50,000 to 100,000 people and so on. In the short term, it has estimated that if a utility (private or public) has greater than 5 – 8 SSO's a year per 100 miles of collection system, EPA is pursuing or will be pursuing these sanitary sewer collection systems shortly regardless of population served.

The results of these Orders typically require programmatic development as well as Sewer System Evaluation Surveys (SSES) and assessments which result in substantial sanitary sewer rehabilitation.

MOM programmatic elements can and have included all or part of the following:

a. Sewer Overflow Response Plans (SORP)
b. Continuing Sewer Assessment Programs (CSAP) / Continuing Sewer System Assessment Programs (CSSAP)
c. FOG Control Programs
d. Gravity Line Preventative Maintenance Programs (GLMP) / Transmission system Operation & Maintenance Programs (TSOMP) / Gravity System Operation & Maintenance Programs (GSOMP)
e. Infrastructure Rehabilitation Plans (IRP)
f. Information Management Systems (IMS)
g. Computerized Maintenance Management System (CMMS)
h. Sewer System Evaluation Surveys (SSES)
i. Continuing Infrastructure Rehabilitation Program (CIRP)
j. Remediation Plans
k. Contingency & Emergency Response Plan (CERP)
l. Corrective Action Plan
m. Capital Improvement Program (CIP)
n. Sewer Mapping Program
o. Capacity Assurance Program
p. WWTP Operations Plan
q. WWTP Process Control Plan
r. WWTP Compliance Monitoring Plan
s. WWTP Training Program
t. Financial Analysis Program / Capability Assessments
u. Satellite Sewer System Agreement / Inter-Jurisdictional Agreement Program
v. Sewer System Hydraulic Model

Compliance schedules associated with the compliance actions have varied in length as follows:

a. Tega Cay, South Carolina (Utilities, Inc.) – min. of 18 months
b. City of Lancaster, South Carolina – min. of 6.5 years
c. City of Eden, North Carolina – min. of 3.5 years
d. City of Columbia, South Carolina – min. of 5.5 years
e. Cape Fear Public Utility Authority (CFPUA), New Hanover County / City of Wilmington, North Carolina – min. of 2.75 years

Some relevant details concerning compliance schedules is provided below:

a. Programmatic development and implementation typically requires all programs to be developed & implemented within 6 months to three (3) years.
b. Physical sanitary sewer collection system rehabilitation follows programmatic development and typically is required to occur within two (2) to five (5) years or longer depending on the size of the sanitary sewer collection system and the extent of problems / need for rehabilitation.
c. Operation under the Order typically follows physical sanitary sewer system rehabilitation for two (2) to five (5) years or longer.

There are successful strategies available to assist utilities in significantly decreasing the scope of their compliance actions as well as successfully negotiating realistic compliance schedules. In addition, depending on the sanitary sewer collection system, most entities have been required to begin conducting Continuing Sewer Assessment Programs (another acronym for Sewer System Evaluation Surveys [SSES]) for all or part of their sewer basins.

These programs and/or surveys typically include some or all of the following:

a. Dyed Water Flooding
b. Corrosion Defect Identification
c. Routine Manhole Inspections
d. Flow Monitoring
e. CCTV
f. Gravity System Defect Analysis
g. Smoke Testing
h. Pump Station Performance and Adequacy Analysis

Most if not all compliance actions are accompanied by a monetary fine. Example monetary fines and currently available expected capital costs as well as other available relevant information is as follows:

a. City of Lancaster, South Carolina - $70,800.00. Compliance Cost estimated at $7.5-15M. Field assessment tied to their Order only requires work in 3 of Lancaster's 23 sewer basins.
b. City of Eden, North Carolina - Compliance Cost estimated at $15M. Field assessment / work tied to their Order only requires a fraction of their sewer basins.
c. City of Columbia, South Carolina - $476,400.00 plus $1M Supplement Environmental Project (which resulting in this decreased penalty). Compliance Cost estimated at $750M. Field assessment / work tied to their Order requires all sewer basins to be assessed within 5.5 years.
d. Utilities, Inc. is paying $10,000/day for violations associated with their Tega Cay sewer systems.
e. CFPUA - $300,000.00.

Additional details regarding some of the typical MOM programs are provided as attached.

5.7.1 Sewer Overflow Response Plans (SORP)

SORP's are meant to provide for the timely and effective response to all SSOs. Program elements typically include procedures for the following:

a. Overflow Response
b. Receipt of Information Regarding an SSO
c. Dispatch of Sewer Maintenance Personnel to Site of Sewer Overflow
d. Overflow Correction, Containment, and Clean Up
e. Overflow Reporting
f. Customer Satisfaction
g. Public Advisory
h. Temporary Signage
i. Other Public Notification
j. Regulatory Agency Notification Plan

5.7.2 Continuing Sewer Assessment Programs (CSAP)

CSAP's are meant to provide for a continuing analysis of sanitary sewer collection system infrastructure. CSAP's establish procedures for setting sewershed priorities and schedules for undertaking the continual assessment of the sanitary sewer collection system. CSAP's typically take into consideration the following elements:

a. Nature & extent of customer complaints;
b. Flow monitoring, including flow isolation studies;
c. Locations & causes of SSOs;
d. Any remediation work already ongoing;
e. Field crew work orders;
f. Any preliminary sewer assessments, such as midnight flow monitoring;
g. Community input; and,
h. Any other relevant information.

Program elements typically include procedures for the following:

a. Dyed Water Flooding
b. Corrosion Defect Identification
c. Routine Manhole Inspections
d. Flow Monitoring
e. CCTV
f. Gravity System Defect Analysis
g. Smoke Testing
h. Pump Station Performance and Adequacy Analysis

5.7.3 FOG Control Programs

Program elements typically include procedures for the following:

a. Permitting Program
b. Inspections

c. Information Management System
d. Enforcement
e. Best Management Practices
f. FOG Training
g. Public Education

5.7.4 Gravity Line Preventative Maintenance Programs (GLMP)

Program elements typically include procedures for the following:

a. Preventive Cleaning Maintenance Program
b. Comprehensive Condition Assessment and Monitoring Program
c. Gravity Line PM – Blockage Abatement Program
d. Chemical Root Abatement Program
e. Hydraulic Cleaning Procedures
f. Mechanical Root Abatement Procedures
g. Record-Keeping
h. Performance Measures
i. Gravity Line PM – Comprehensive Hydraulic Cleaning Program
j. Comprehensive Condition Assessment and Monitoring Program

5.7.5 Infrastructure Rehabilitation Plans (IRP)

IRP's typically include the procedures necessary to implement rehabilitation measures for the following:

a. I/I;
b. Structural issues in the sanitary sewer collection system; and,
c. Other conditions causing SSOs.

The goal is the elimination of future SSOs. IRP's typically prioritize rehabilitation measures based upon the following:

a. The relative likely human health and environmental impact risks;
b. SSO frequencies; and,
c. SSO volumes.

Program elements typically include procedures for the following:

a. Gravity Sewer Line Rehabilitation
b. Rehabilitation of all gravity sewer lines & related appurtenances that have been identified as in need of rehabilitation under the CSAP.

IRP's typically establish the following:

a. A process for setting gravity sewer line rehabilitation priorities and schedules;
b. An ongoing inventory of gravity sewer line rehabilitation, including identification of the rehabilitation techniques used;
c. An analysis of the effectiveness of completed rehabilitation; and,

d. Identification of scheduled gravity sewer line rehabilitation.

5.7 Staffing Assessment:

In Appendix 5.1, please find a table concerning Staff Complements for Wastewater Collection System Maintenance based on Population Size. In Appendix 5.2 please find a table concerning Recommended Collection System Staffing. In Appendix 5.3, please find a table concerning Recommended Treatment Staffing. In Table 5.1, please find a summary of Appendix 5.2, Recommended Collection System Staffing. In Table 5.2, please find a summary of Appendix 5.3, Recommended Treatment Staffing.

Table 5.1 Recommended Collection System Staffing

Entity	FTE's Recommended	Current FTE's	Surplus (Deficit)
Cliffside	1	0.25	(0.75)
Forest City – 2nd Broad	8	7	(1)
Forest City – Riverstone	1	-	-
Forest City – DRG	1	-	-
Lake Lure	3	0.75	(2.25)
Rutherfordton	5	3.5	(1.5)
Spindale	5	2.75	(2.25)
All	16	14.25	(1.75)
All Excluding Forest City	8	7.25	(0.75)

Based on this analysis, all project stakeholders on their own are not adequately staffing their sanitary sewer collection systems.

Table 5.2 Recommended WWTP Staffing

Entity	FTE's Recommended	Current FTE's	Surplus (Deficit)
Cliffside	1	0.25	(0.75)
Forest City – 2nd Broad	8	7	(1)
Forest City – Riverstone	1	-	-
Forest City – DRG	3	-	-
Lake Lure	3	1	(2)
Rutherfordton	6	2	(4)
Spindale	8	3	(5)
All	14	13	(1)
All Excluding Forest City	8	6	(2)

Based on this analysis, all project stakeholders on their own are not adequately staffing their sanitary sewer treatment systems.

5.8 Findings:

After reviewing the staffing and operational analysis as well as debriefing with their respective Project Stakeholders, the following observations were noted:

a. According to published guidelines by EPA Region 4 in their Guide to Collection and Transmission System Management, Operation, and Maintenance Programs and EPA's manual on Estimating Staffing for Municipal Wastewater Treatment Facilities, all of the project stakeholders are not adequately staffed to conduct sufficient minimum collection system and treatment operations.

b. Project Stakeholders do not appear to have sufficiently documented programmatic elements and have incomplete Sanitary Sewer Evaluation Study's. EPA Region 4 as well as NCDENR are currently and systematically entering into compliance schedules associated with Sanitary Sewer Overflows (SSO's) and Management, Operation & Maintenance (MOM) programs. Our understanding is that EPA intends to place the majority of sewer systems into compliance schedules over the coming years. Currently, they have been targeting sewer systems serving a population of greater than 100,000 by 2016 as well as smaller systems in non-compliance for excessive Sanitary Sewer Overflows (SSO's). In the short term, it has estimated that if a utility (private or public) has greater than 5 – 8 SSO's a year per 100 miles of collection system, EPA is pursuing or will be pursuing these sanitary sewer collection systems shortly regardless of population served. After 2016, they intend to enter orders with all sewer systems sewer between 50,000 to 100,000 people and so on. The results of the compliance schedules typically require programmatic development as well as Sewer System Evaluation Surveys (SSES) and assessments which result in substantial sanitary sewer rehabilitation.

5.9 Recommendations:

As a result of the limited staffing and operational analysis conducted, we recommend the following:

a. All project stakeholders should consider conducting a MOM audit of their collection system and collection system programs in accordance with EPA's published guidance and CMOM self-assessment checklist.

b. All project Stakeholders should consider conducting a WWTP facility audit or assessment in accordance with industry standards.

End of Section

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Section 6 – Options for Consolidation

6.1 Summary:

As part of this study, WK Dickson evaluated potential management systems for the consolidation of the various sanitary sewer collection systems including but not limited to inter-local agreements, independent authority, and consolidation into one of the current systems. This evaluation has considered current and proposed legislation regarding utility management systems.

As part of this task, workshops were conducted with each of the project stakeholders individually to identify and discuss the following concerns and issues:

a. potential management systems for the consolidation of the various sanitary sewer collection systems; and,
b. Perceptions, problems, concerns and opportunities regarding the potential merger of the respective wastewater collection and/or treatment systems.

6.2 Potential Management Systems:

Finding alternative approaches for the management of water and/or sewer systems in North Carolina is becoming increasingly attractive to Town governments in North Carolina. The North Carolina General Statutes provide for approximately nine (9) alternatives for owning and operating water and/or wastewater distribution, collection, and/or treatment systems. These options include the following:

a. Municipal and/or County Government
b. Inter-Local Contracts or Inter-Governmental Agreements
c. Joint Management Agency
d. County Service District
e. Sanitary District
f. Water and/or Sewer Authority
g. Metropolitan Water District
h. Metropolitan Sewer District
i. County Water and/or Sewer District

Each of these options is reviewed below and in the table presented in Appendix 6.1. The table in Appendix 6.1 summarizes the organizational statutory and financial characteristics of the available options. The list of options for the Project Stakeholders would allow for eight (8) of the nine (9) available options. However, it appears that only five (5) of the nine (9) options are viable.

6.2.1 Municipal and/or County Government

Municipalities and counties possess general authority to provide water supply service. An incorporated municipality has the power to "acquire, construct, enlarge, improve, maintain, own, and operate" a water supply and distribution system. Any county in North Carolina also may operate a water system. The county government may establish charges for its services; finance the system through grant, debt, or tax levy; and promulgate ordinances to regulate the system.

Both municipalities and counties may issue general obligation bonds to finance water systems under authority of the Local Government Bond Act.3 For water systems, voter approval is not required for issuance unless the amount exceeds 2/3 of the sum by which the total county or city debt was reduced the previous year. For example, if debt were reduced by $90,000 in 1980, an additional $60,000 of general obligation bonds could be issued in 1981 without a voter referendum. In addition, municipalities and counties may issue revenue bonds without a public referendum, as authorized by the Local Government Revenue Bond Act.

To issue either type of bond, a local government must gain the approval of the Local Government Commission (LCG), a state regulatory agency. LCG bases its decision on the current and past financial status of the local government, the marketability of the issue, and the ability of the locality to bear the extra taxes in the case of general obligation bonds. For revenue bonds, approval depends upon the probability that receipts will meet the outstanding indebtedness attributable to the bond issue.

Two or more local political subdivisions may create a joint agency to plan, develop, operate, and maintain a public enterprise such as a water system. The applicable jurisdictions may confer any powers necessary, including the power to hold title to real estate, to the joint agency. Appropriations from the member governments finance the agency.

6.2.2 Inter-Local Contracts or Inter-Governmental Agreements

One of the most flexible options available to local governments for accomplishing regional solutions for multi-jurisdictional programs is an Inter-Local Contract or Agreement. The following considerations are relevant to this alternative:

a. Contracts must be of reasonable duration, as established by the parties to the contract.
b. Legal title to real property must remain or rest with the participating governments or government, or property may be held jointly as tenants in common.
c. Appropriations may be made annually by participating units by incorporation into their approved budgets.
d. Inter-local contracts must stipulate a formula for ownership by participating units.
e. Capital financing must be accomplished by participating units.

In summary, the inter-local contract or agreement has its greatest applicability in situations where the other prescribed intergovernmental mechanisms do not exactly apply to the situation, or where complexities are too great to deal with within the confines of the statutes for other organizational alternatives. Its greatest drawback is probably its open ended nature, which requires that the agreement be fully conceptualized and its details be thoroughly negotiated before the contract becomes effective. Its applicability is often as a supplemental device for dealing with specific problems or as an interim step toward a more permanent solution, such as a Joint Management Agency.

6.2.3 Joint Management Agency

Another flexible option available to local governments for accomplishing regional solutions for multi-jurisdictional programs is the Joint Management Agency. The following considerations are relevant to this alternative:

a. Units of government may establish a joint agency charged with responsibility for the proposed service or undertaking. Such Joint Management Agencies are products of inter-local contracts.
b. Legal title to real property must remain or rest with the participating governments or government, or property may be held jointly as tenants in common.
c. Appropriations may be made annually by participating units by incorporation into their approved budgets.
d. Capital financing must be accomplished by participating units.
e. All agency revenues are generated by fees or charges.
f. Agencies do not have taxing power, may not own real estate and similarly, may not issue general obligation bonds.
g. Part or all of the personnel are appointed and employed by the Joint Management Agency.

The Joint Management Agency is a special form of intergovernmental agreement or contract. In the typical intergovernmental contract, one or more of the participating units employs the management staff. However, in the pure Joint Management Agency, all employees are attached to the agency, which is separate from any of the participating units. The main advantage of the Joint Management Agency is that it may make joint action possible. Each of the participating units is sometimes unwilling for the staff to report to another unit but is willing to cooperate if the staff is independent.

6.2.4 County Service District

The county board of commissioners may define within a county any number of service districts, whose primary purpose is to provide more intensive services in certain areas than are provided countywide, including water supply and distribution as well as a wastewater collection and treatment system. The district is created by resolution and governed by the county government.

To support the additional services provided, the county government may levy within the district taxes greater than those applicable in other areas of the county. Extending the district requires a petition signed by 100 percent of the real property owners within the proposed annexation area. Two or more districts may consolidate to provide more efficient service.

The county has authority to issue general obligation bonds to finance district services. If proceeds from the issue will provide services only within the district, a concurrent majority vote in both the district and county is required.

6.2.5 Sanitary District

A sanitary district may be created for the purpose of "preserving and promoting the public health and welfare." Boundaries are established without regard to county, township, or municipal boundaries, but no municipal corporation, in whole or in part, can be included within the boundaries of a district unless the municipality's governing body consents.

For district creation, 51 percent or more of the property owners within the proposed district must petition the board of commissioners in the county that contains the largest portion of the district's land area. The county board(s), in conjunction with the Commission for Health Services (CHS) decide(s) whether the district should be created. Upon creation, a sanitary district becomes an

independent, corporate political body, and the county commissioners elect a sanitary district board to serve as the district's governing body.

6.2.6 Water and/or Sewer Authority

The governing bodies of two or more cities, counties, towns, incorporated villages, sanitary districts, or any other type of incorporated political subdivision may signify their desire to form a water and sewer authority by resolution. Once created, an authority is an independent public body with a governing board; the number of board members elected is left to the discretion of the respective local governments. Authorities have the power to set and collect fees for service and to issue revenue bonds.

The authority alternative is the best-known vehicle among the entities that are considered viable options to independent municipal systems. The following considerations are relevant to this alternative:

a. The authority is created by local initiative; however, it is finally chartered by the Secretary of State and does not constitute a municipal corporation.
b. Membership is appointed by the "organizing (governmental) units".
c. The jurisdiction of the authority is established by its articles of incorporation; however, multiple jurisdictions may be a problem under the present statute
d. Except for the appointment of membership, the authority stands alone and its powers are governed by statute and only limited by its charter of incorporation.
e. The authority is a corporate entity and not a unit of local government; however, financial oversight is by the Local Government Commission.
f. The authority's principal vehicle for financing capital improvements is the revenue bond, which constitutes a serious shortcoming. It is therefore, not able to participate in any program which relies on the general obligation bond instrument, such as the Rural Development-USDA programs. As a result of recent legislative action, the authority is now able to achieve financing under General Statute 160A-20.
g. The authority does not possess the power to levy property taxes or special assessments, which is also a serious limitation when undertaking substantial capital programs.

In summary, the water and sewer authority is a hybrid corporate body that possesses powers of a government and of a corporate entity. It has three principal limitations.

First, it is removed from its creators and often alienates itself from them. Secondly, it is sometimes viewed as a competitor or an outside force by local government. Finally, the authority has certain financing limitations which sometimes hinder its capacity to finance needed improvements. Revenue bonds are its principal external source of financing and this aspect is certainly a limitation, particularly for small systems.

6.2.7 Metropolitan Water District

Any two or more cities, towns, incorporated villages, sanitary districts, water districts, other political subdivisions, or unincorporated areas within a county can petition the county board of commissioners to create a metropolitan water district. However, a metropolitan water district can exist only within a single county. If an unincorporated area is to be included, a petition first must be submitted by at least 15 percent of the voters in the area.

Upon district creation, the county board of commissioners must appoint a district board of three members, and the government of each jurisdiction involved must each appoint one member. The district, after having been petitioned, may add more political subdivisions or unincorporated areas.

A metropolitan water district is an independent, corporate political body. Its powers include issuing both general obligation and revenue bonds and imposing taxes on property within the district.

6.2.8 County Water and/or Sewer District

After a public hearing, a county board of commissioners can create a county water and/or sewer district by resolution upon determining the following:

a. There is a demonstrable need for providing a district to provide water services, sewer services, or both;
b. The residents of all the territory to be included in the district will benefit from the district's creation; and;
c. It is economically feasible to provide the proposed service or services in the district without unreasonable or burdensome annual tax levies.

The territory within the corporate limits of a city or town cannot be included in the district unless the city or town government gives approval by resolution.

The created district is regarded as a corporate political body, governed by the board of commissioners of the county in which the district is established. The governing body has the power to exercise eminent domain; to issue revenue and general obligation bonds for the provision of water systems; to levy property taxes within the district; to finance the operation and maintenance of the district's water and/or sewer system; or to finance debt service on general obligation bonds issued by the district.

The district's governing body also is authorized to make special assessments against benefited property within the district for financing the costs of "constructing, reconstructing, extending, or otherwise building or improving water and/or sewer systems". It has the power to enter into contracts and to establish, revise, and collect rates for the services furnished by the water system.

6.3 Findings:

After reviewing the viable options for consolidation as well as discussion with Project Stakeholders staff and elected officials, the following observations were noted:

a. Ownership of the sewer systems should be run responsibly.
b. Operational structures, policy and practices should remain sensitive to the specific needs of the geographic areas that are served by the selected management system.
c. A new management system should be able to provide administrative and management functions more efficiently and economically by a single organizational entity due to economies of scale.
d. Economies of scale should result in lower long term unit costs for operation and maintenance.

e. The individual Project Stakeholders may not be able to capitalize substantial investments in new system capacity or new service infrastructure on their own.
f. New economic growth could be stunted by the Project Stakeholders inability to respond to new demands beyond their existing service limits.
g. Financing mechanisms available to a new management entity should be flexible and should approximate those available to municipal and county government in North Carolina.
h. Improved planning and more effective investment of capital into the County's sewer systems should lead to improved sewer system reliability; and,
i. Both Spindale and Lake Lure are experiencing compliance issues associated with meeting their NPDES permit limits.

In light of the findings and conclusions, the list of viable alternatives was reduced to the following:

a. Inter-Local Contracts or Inter-Governmental Agreements
b. Joint Management Agency
c. Sewer Authority
d. Sanitary District
e. County Sewer District

A summary of the primary aspects and differences of the alternatives are listed below.

a. An IGA is different than a JMA in that a JMA requires action by each participating unit on items / expenditures in order to move forward.
b. An IGA is applicable in situations where the other prescribed intergovernmental mechanisms do not exactly apply to the situation and where complexities are too great to deal with within the confines of the statutes for other organizational alternatives.
c. IGAs and JMAs are typically viewed as an interim step to some other form of management entity.
d. An IGA and a JMA are different than a Sewer Authority, Sanitary District, and a County Sewer District in that Legal title to real property must remain or rest with the participating governments or government, or property may be held jointly as tenants in common.
e. A JMA cannot issue revenue bonds or general obligation bonds, establish its rates & charges, or levy property taxes or special assessments.
f. The Authority alternative is the best-known vehicle among the entities that are considered viable options to independent municipal systems.
g. An Authority is an independent public body with a governing board; the number of board members elected is left to the discretion of the respective local governments and membership is appointed by the governmental units that organized it.
h. Authorities have the power to set and collect fees for service and to issue revenue bonds.
i. Except for the appointment of membership, Authorities stand alone and its powers are governed by statute and only limited by its charter of incorporation.
j. A Sanitary District or a County Sewer District do possess the power to levy property taxes or special assessments whereas an Authority does not.
k. A Sanitary District becomes an independent, corporate political body, and the county commissioners elect a sanitary district board to serve as the district's governing body.

l. In order for a Sanitary District to be created, 51 percent or more of the property owners within the proposed district must petition the board of commissioners in the county that contains the largest portion of the district's land area.
m. A County Sewer District is a corporate political body, governed by the board of commissioners of the county in which the district is established.
n. The fact that Broad River Water Authority is already in existence is seen as a vehicle for creating a new sewer management entity.

More detail aspects of the alternatives are listed below.

6.3.1 Inter-Local Contracts or Inter-Governmental Agreements

Inter-Local Contracts or Inter-Governmental Agreements was viewed as a viable alternative because of its flexibility.

Aspects of Inter-Local Contracts or Inter-Governmental Agreements include:

a. Applicable in situations where the other prescribed intergovernmental mechanisms do not exactly apply to the situation.
b. Applicable where complexities are too great to deal with within the confines of the statutes for other organizational alternatives.
c. Applicable as a supplemental device for dealing with specific problems.
d. Applicable as an interim step toward a more permanent solution, such as a Joint Management Agency.
e. Open ended nature - requires that an agreement be fully conceptualized and its details be thoroughly negotiated before the contract becomes effective.
f. Typically viewed as an interim step to forming some other form of management entity.

6.3.2 Joint Management Agency

Joint Management Agencies (JMA) were also viewed as a viable alternative because of their flexibility.

Aspects of a Joint Management Agency include:

a. Typically begins as an Inter-Local Contract or Inter-Governmental Agreement.
b. Legal title to real property must remain or rest with the participating governments or government, or property may be held jointly as tenants in common.
c. Appropriations may be made annually by participating units by incorporation into their approved budgets.
d. Capital financing must be accomplished by participating units.
e. All agency revenues are generated by fees or charges.
f. Agencies do not have taxing power, may not own real estate and similarly, may not issue general obligation bonds.
g. Part or all of the personnel are appointed and employed by the Joint Management Agency.
h. A Joint Management Agency is a special form of intergovernmental agreement or contract.
i. An advantage of the Joint Management Agency is that it makes joint action possible.

j. Participating units are sometimes unwilling for the staff to report to another unit but are willing to cooperate if the staff is independent.
k. Typically viewed as an interim step towards some other form of management structure
l. Requires action by each participating unit on items / expenditures in order to move forward.
m. Cannot issue revenue bonds or general obligation bonds.
n. Cannot establish its rates & charges.
o. Cannot levy property taxes of special assessments.
p. Does not have the power to exercise eminent domain / condemn.

6.3.3 Sewer Authority

A Sewer Authority was viewed as a viable alternative because it allows the governing bodies of two or more cities, counties, towns, incorporated villages, sanitary districts, or any other type of incorporated political subdivision to signify their desire to form a water and/or sewer authority by resolution.

Aspects of a Sewer Authority include:

a. The authority alternative is the best-known vehicle among the entities that are considered viable options to independent municipal systems.
b. The authority is created by local initiative; however, it is finally chartered by the Secretary of State and does not constitute a municipal corporation.
c. Once created, an authority is an independent public body with a governing board; the number of board members elected is left to the discretion of the respective local governments and membership is appointed by the governmental units that organized it.
d. Authorities have the power to set and collect fees for service and to issue revenue bonds.
e. The jurisdiction of the authority is established by its articles of incorporation; however, multiple jurisdictions may be a problem under the present statute.
f. Except for the appointment of membership, the authority stands alone and its powers are governed by statute and only limited by its charter of incorporation.
g. The authority is a corporate entity and not a unit of local government; however, financial oversight is by the Local Government Commission.
h. The fact that Broad River Water Authority is already in existence is seen as a vehicle for creating a new sewer management entity.
i. Has the power to exercise eminent domain / condemn.
j. The authority's principal vehicle for financing capital improvements is the revenue bond and cannot issue general obligation bonds.
k. The authority does not possess the power to levy property taxes or special assessments.

An authority is a hybrid corporate body that possesses powers of a government and of a corporate entity. It has three perceived limitations. First, it is removed from its creators and could alienate itself from them. Secondly, it is sometimes viewed as a competitor or an outside force by local government. Finally, authority financing limitations sometimes hinder its capacity to finance needed improvements.

6.3.4 Sanitary District

A Sanitary District was viewed as a viable alternative because it may be created for the purpose of "preserving and promoting the public health and welfare."

Aspects of a Sanitary District include:

a. Boundaries are established without regard to county, township, or municipal boundaries, but no municipal corporation, in whole or in part, can be included within the boundaries of a district unless the municipality's governing body consents.
b. Upon creation, a sanitary district becomes an independent, corporate political body, and the county commissioners elect a sanitary district board to serve as the district's governing body.
c. Sanitary Districts can finance capital improvements using revenue bonds and general obligation bonds.
d. Sanitary Districts possess the power to levy property taxes and special assessments.
e. In order to be created, 51 percent or more of the property owners within the proposed district must petition the board of commissioners in the county that contains the largest portion of the district's land area.

6.3.5 County Sewer District

A County Sewer District was viewed as a viable alternative due to the ease of implementing. After a public hearing, a county board of commissioners can create a county sewer district by resolution upon determining the following:

a. There is a demonstrable need for providing a district to provide water services, sewer services, or both;
b. The residents of all the territory to be included in the district will benefit from the district's creation; and;
c. It is economically feasible to provide the proposed service or services in the district without unreasonable or burdensome annual tax levies.

Aspects of a County Sewer District include:

a. Service Districts can finance capital improvements using revenue bonds and general obligation bonds.
b. Service Districts possess the power to levy property taxes and special assessments.
c. Has the power to exercise eminent domain / condemn.
d. Service Districts are a corporate political body, governed by the board of commissioners of the county in which the district is established.
e. The territory within the corporate limits of a city or town cannot be included in the district unless the city or town government gives approval by resolution.

6.4 Recommendations:

Finding an organizational solution for organizing a new sewer management entity must consider the varying interests of all of the Project Stakeholders and find ways to mitigate differing philosophies and equities. As a result, the best solution may not necessarily be the same in all instances. And, flexibility should be considered as the most important aspect when initiating consolidation.

Considering these points, it is recommended that Inter-Local Agreements be created for the short-term while a Joint Management Agency structure be pursued to achieve a more efficient level of service to the Project Stakeholders in the intermediate term, with the long term solution being a combination of management structures and entities to manage the complex nature of wastewater service within Rutherford County.

After reviewing the viable options for consolidation as well as discussion with Project Stakeholders staff and elected officials, we have outlined four (4) of the strongest potential paths as follows:

6.4.1 Path One – Consolidation of Cliffside and Forest City

a. Form an Advisory Committee between Cliffside, Forest City, and Rutherford County.
b. Investigate forming Inter-Local Contracts between Cliffside, Forest City, and Rutherford County under the auspices of Forest City treating Cliffside's wastewater.
c. The Inter-Local Agreement between the Cliffside, Forest City and the County could be for the County to form a Tax Increment Financing District for the area that would become developable due to the availability of sewer service between Cliffside and Forest City in an effort to help offset user charges for the proposed project.
d. The Inter-Local Agreement between Cliffside and Forest City would be for the treatment of Cliffside's wastewater.

6.4.2 Path Two – Joint Management Agency for the Consolidation of Wastewater Treatment Management of Lake Lure, Rutherfordton, and Spindale

a. Form an Advisory Committee between Luke Lure, Rutherfordton, Spindale, and possibly Broad River Water Authority.
b. Investigate forming Inter-Local Contracts between Rutherfordton, Lake Lure, Spindale, Rutherford County, and Broad River Water Authority under the auspices of working towards forming a Joint Management Agency and a long term management entity for the treatment of wastewater.
c. Since it appears that the Town of Lake Lure's median household income is above both the National and State median household incomes, it does not appear that Lake Lure would qualify for a grant from USDA. And, due to these same conditions, would only qualify for a market rate loan (versus an intermediate or poverty rate). However, since user rates for Lake Lure customers would become unreasonable when compared to comparable systems and systems with similar economic and income conditions, the potential for a USDA loan and grant needs to be more fully explored.
d. The Inter-Local Agreement between the Town's and possibly Broad River Water Authority could be for the treatment of wastewater at each of the Town's respective wastewater treatment plants.

6.4.3 Path Three – Consolidation of Lake Lure, Rutherfordton, and Spindale – Abandonment of Lake Lure's Wastewater Treatment Plant

a. Form an Advisory Committee between Luke Lure, Rutherfordton, Spindale, Rutherford County, and Broad River Water Authority.
b. Investigate forming Inter-Local Contracts between Rutherfordton, Lake Lure, Spindale, Rutherford County, and Broad River Water Authority under the auspices of working towards forming a Joint Management Agency, a new Sewer Authority, County Sewer

District or absorbing sewer as a new operational function within Broad River Water Authority.

c. Lake Lure in conjunction with Rutherford County needs to investigate the feasibility of upgrading their WWTP or tying on to the Town of Rutherfordton including the new wastewater treatment option provided by WK Dickson.

d. Since it appears that the Town of Lake Lure's median household income is above both the National and State median household incomes, it does not appear that Lake Lure would qualify for a grant from USDA. And, due to these same conditions, would only qualify for a market rate loan (versus an intermediate or poverty rate). However, since user rates for Lake Lure customers would become unreasonable when compared to comparable systems and systems with similar economic and income conditions, the potential for a USDA loan and grant needs to be more fully explored.

e. If the Town determines upgrading their WWTP is the most viable option, the Town should consider fully investigating and possibly applying for a USDA loan and grant.

f. If the Town determines connecting to Rutherfordton is the most viable alternative, the Town and the County and the Town and Rutherfordton should consider executing Inter-Local Agreements.

g. The Inter-Local Agreement between the Town and the County could be for the County to form a Tax Increment Financing District for the area that would become developable due to the availability of sewer service on the corridor between Lake Lure and Rutherfordton in an effort to help offset user charges for the proposed project.

h. The Inter-Local Agreement between the Town and Rutherfordton would be for the treatment of Lake Lure's wastewater.

i. Consider investigating and pursuing an Inter-Local Agreement between the Town's and Broad River Water Authority for the Authority to treat the wastewater from Lake Lure, Rutherfordton, and Spindale at Rutherfordton's and Spindale's wastewater treatment plants.

6.4.4 Path Four – Consolidation of Lake Lure, Rutherfordton, and Spindale – Abandonment of Lake Lure's and Rutherfordton's Wastewater Treatment Plant's

a. Form an Advisory Committee between Luke Lure, Rutherfordton, Spindale, Rutherford County, and Broad River Water Authority.

b. Investigate forming Inter-Local Contracts between Rutherfordton, Lake Lure, Spindale, Rutherford County, and Broad River Water Authority under the auspices of working towards forming a Joint Management Agency, a new Sewer Authority, County Sewer District or absorbing sewer as a new operational function within Broad River Water Authority.

c. Lake Lure in conjunction with Rutherford County needs to investigate the feasibility of upgrading their WWTP or tying on to the Town of Rutherfordton including the new wastewater treatment option provided by WK Dickson.

d. Since it appears that the Town of Lake Lure's median household income is above both the National and State median household incomes, it does not appear that Lake Lure would qualify for a grant from USDA. And, due to these same conditions, would only qualify for a market rate loan (versus an intermediate or poverty rate). However, since user rates for Lake Lure customers would become unreasonable when compared to comparable systems and systems with similar economic and income conditions, the potential for a USDA loan and grant needs to be more fully explored.

e. If the Town determines upgrading their WWTP is the most viable option, the Town should consider fully investigating and possibly applying for a USDA loan and grant.

f. If the Town determines connecting to Rutherfordton is the most viable alternative, the Town and the County and the Town and Rutherfordton should consider executing Inter-Local Agreements.

g. The Inter-Local Agreement between the Town and the County could be for the County to form a Tax Increment Financing District for the area that would become developable due to the availability of sewer service on the corridor between Lake Lure and Rutherfordton in an effort to help offset user charges for the proposed project.

h. The Inter-Local Agreement between the Town and Rutherfordton would be for the treatment of Lake Lure's wastewater.

i. Then, the Town of Rutherfordton and the Town of Spindale should consider executing an Inter-Local Agreement for the Town of Spindale to treat Rutherfordton's wastewater.

j. Consider investigating and pursuing an Inter-Local Agreement between the Town's and Broad River Water Authority for the Authority to treat the wastewater from Lake Lure, Rutherfordton, and Spindale at Spindale's wastewater treatment plant.

End of Section

Section 7 – Management System Considerations & Timeframes

7.1 Summary:

As covered in the previous chapter, potential management systems for the consolidation of the various sanitary sewer collection systems were evaluated. In determining viable alternatives, relevant assumptions included the following:

a. Ownership of the water and sewer systems should be run responsibly.
b. Operational structures, policy and practices should remain sensitive to the specific needs of the geographic areas that are served by the selected management system.
c. A new management system should be able to provide administrative and management functions more efficiently and economically by a single organizational entity due to economies of scale.
d. Economies of scale should also result in lower unit costs for operation.
e. Developing new system capacities will benefit unserved areas more than areas that are presently served with sewer.
f. The Project Stakeholders may not be able to unilaterally capitalize substantial investments in new system capacity or new service infrastructure.
g. New economic growth could be stunted by the Project Stakeholders or a new management entity's inability to respond to new demands beyond their existing service limits.
h. Financing mechanisms available to a new management entity should be flexible and should approximate those available to municipal and county government in North Carolina.
i. The board and/or leadership of any new management entity should be responsible to local elected officials in areas served by sewer.

In light of the above assumptions, the list of viable alternatives were reduced to the following:

a. Inter-Local Contracts or Inter-Governmental Agreements
b. Joint Management Agency
c. Sewer Authority
d. Sanitary District
e. County Sewer District

As a result, the following issues need to be addressed:
a. Statutory Procedures
b. Organizational Mechanism
c. Time Considerations / Time Line

7.2 Statutory Procedures:

This process encompasses the tasks that are specifically provided for in the general statutes governing the organizational mechanism. The laws generally provide for:

a. Delegation of the responsibility for creation of the entity
b. Creation of the entity

c. Definition of its powers and jurisdiction
d. Linkages with participating units of government
e. Policy board membership composition and appointment or election

7.3 Organizational Mechanism:

The actual organization that might result from this approach must be planned and implemented beyond the actual point of its creation, which is governed by general statutes. Although the structure of the entity is stipulated by statute, its internal management mechanisms must be designed by its creators or their assigns. This process generally consists of the establishment of:

a. An internal organizational structure
b. Operational procedures and protocols
c. An operating budget
d. A revenue structure (rates and fees)
e. Management processes for personnel, debt and other financial resources and obligations

Careful planning of the organizational mechanism is very crucial, since each of the Project Stakeholders sewer departments are generally stand-alone enterprise funds which are totally self-reliant. This means that revenues must at least match or preferably exceed expenditures, which will be a complex formula when multiple programs are combined, the proposed rate structure is untested, the personnel structure is new, and management changes and financial obligations are unclear.

7.4 Time Considerations / Time Line:

Each of the alternatives discussed above is characterized by a period within which the organizational vehicle could be implemented. Each would involve a series of implementing processes that could be divided into statutory and organizational procedures.

A potential time line is proposed below:

Table 7.1 Management System Time Frame

1.	Create an Advisory Committee	Months 1 & 2
2.	Delegate the responsibility for creation of the management system	Months 1 & 2
3.	Establish the management system	Months 1 & 2
2.	Define powers and jurisdiction of the chosen management system	Months 1 & 2
3.	Define programmatic and financial objectives	Months 1 & 2
4.	Establish linkages with participating Project Stakeholders	Months 1 & 2
5.	Create concise statement of assumptions	Months 2 & 3
6.	Create, review and finalize a financial plan	Months 3 - 6
7.	Create an interim inter-local agreement	Months 3 - 6
8.	Conduct a detailed review of existing sewer rates	Months 3 - 6
9.	Conduct a detailed assessment of the total revenue requirements	Months 3 - 6
10.	Conduct a final sewer rates review and develop rate structure options	Months 3 - 6
11.	Finalize water and sewer rate structure	Months 3 - 6
12.	Develop cost recovery and other fees	Months 3 - 6
13.	Complete a Preliminary Engineering Report for the selected initial capital improvements	Months 3 - 9
14.	Define organizational framework	Month 7
15.	Address personnel issues	Month 8
16.	Develop applicable contracts	Month 9
17.	Create an operations and maintenance program	Month 9
18.	Define administrative and billing processes	Month 10
19.	Determine planning and budgeting procedures	Month 10
20.	Develop a Capital Improvement Program (CIP)	Months 10
21.	Create a draft of operating budget that includes:	Months 11 - 13
	a. Administration	
	b. Sewer Collection & Treatment System Operations	
	c. Capital Expenditures	
	d. Capital Improvement Program	
	e. Existing Debt Service	
22.	Review and amend user service policies	Month 14
23.	Consolidate program management policies and procedures	Month 14
24.	Review, assess, and combine sewer extension policies	Months 14
25.	Create and finalize a public information strategy	Month 14
26.	Review operational procedures and protocols	Month 15
27.	Create management processes for personnel, debt and other financial resources and obligations	Month 15
28.	Review and finalize board membership composition by appointment or election	Month 16
29.	Create entity	Months 16 - 18

End of Section

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Section 8 – Physical Condition Analysis

8.1 Summary:

WK Dickson evaluated the possible consolidation of sewer collection and treatment systems, including the abandonment of inefficient WWTP's for and between the Project Stakeholders. This evaluation will identify improvements most likely required for consolidation (including necessary upgrades to the receiving system). Opinions of probable cost are provided in Chapter 11, Financial Analysis.

WK Dickson performed a site visit and walk through inspection of each WWTP to collect data related to this task. The inspection included a meeting with the operations staff to evaluate the current treatment operations, equipment with regard to apparent operational condition, reliability, possible equipment repairs or upgrades, equipment replacement schedules and the capability of the plant to accept wastewater flows from consolidation.

Additional assessment of the respective WWTP's to serve as a consolidated WWTP facility included:

a. Evaluation of the respective receiving streams assimilative capacities based on data provided and related NPDES Permit issues required by a consolidated WWTP to include general discussions with NCDENR Division of Water Quality for input.
b. Overall treatment system performance and capability to achieve existing and future NPDES permit limits.
c. Identification of probable system improvements to facilitate transfer of wastewater associated with the consolidation of treatment systems.
d. Identification of the possible implications and costs for potential closure of WWTP's associated with a system consolidation.

8.2 Asset Management Plans and Capital Improvement Plans

All sewer systems should have detailed Asset Management Plans (AMP) and Capital Improvements Plans (CIP). According to NCDENR, asset management plans should have the following:

a. Narratives for the wastewater collection system and wastewater treatment plant;
b. Wastewater collection system maps, wastewater treatment plant schematics and hydraulic profiles;
c. An inventory of assets;
d. An assessment of the condition of the infrastructure in the inventory; A capital improvement plan (CIP); with projected cost estimates; and,
e. An operation and maintenance plan to ensure proper management of the assets.

The inventory of assets should include the following:

a. All wastewater collection system infrastructure assets including gravity sewers and force mains with a map showing the general age, type, and size of pipe materials as well as the age, size and materials of manholes;
b. All wastewater pump stations including a map and narrative with age, number and capacity of pumps, power reliability, and telemetry information;

c. All wastewater treatment plant assets including process schematics as well as age, number and capacity of each major treatment unit.

A condition assessment should be conducted for each asset item included in the inventory of assets and must be assigned a condition. The assessment of the condition of the infrastructure should be based on:

a. Operator knowledge;
b. Formal evaluations (e.g., sanitary sewer evaluation study);
c. Broad assumptions based on age and type of facilities (e.g., 40 year old concrete pipe can be assumed to be in poor condition); and,
d. Condition of other similar facilities in the system where formal evaluations have been conducted.

The condition assessment should include an assessment scale with a narrative describing the assessment scale and include a clear explanation of each category.

A CIP with Projected Opinions of Probable Costs should also be prepared. The CIP should address expected wastewater infrastructure needs for at least 10 years. The CIP should include specific project opinions of probable costs for projects scheduled in at least the first 5 years.

Finally, the AMP should also include an Operation and Maintenance Plan. The operation and maintenance (O&M) plan should be based on manufacturers' recommendations and/or typical industry best management practices.

8.3 Physical Condition of Sewer Collection Systems:

For the purposes of this study, the physical condition of each of the Project Stakeholders sewer collection systems is primarily discussed in the Flow Analysis chapter of this study. Additional information is provided below.

8.3.1 Cliffside

According to the Preliminary Engineering Report (PER) prepared by Odom & Associates Engineering, Inc. in 2010, the Cliffside sewer collection system has an older section, installed in the 1950's, and a newer section, installed in the 1970's. As documented in the report, it was previously determined via smoke testing that the older sections of pipes need to be replaced. Some pipes in the older section are underneath buildings and structures and it was recommended that these pipes be relocated into the road right-of-way. In addition, the PER also recommended replacing a concrete pipe running through the old Cliffside Mill. Finally, the report noted that the older section of the system has brick manholes that need to be replaced and/or lined. On the other hand, the newer sections of piping were determined to be cast iron and in good shape. Similarly, the manholes in the newer section were determined to be concrete and in reasonably good shape as well.

The PER also noted that Bridge Pump Station is in need of renovations and maintenance. The current capacities of the pumps are 1,400 gpm, which is unnecessarily high. The peak flow during 2009 was 238,000 gallons per day, which equates to 165 gpm if the flow were distributed evenly

over a 24-hour period. Using a peaking factor of 4, the lift station capacity could be reduced in size to approximately 660 gpm. However, to maintain the required scour velocity of 2.5 fps in the existing 12″ force main, the lift station would need to be able to pump at a rate no less than 900 gpm. The reduction in capacity could also allow for a reduction in the force main size. The bar screen in the pump station also needs to be replaced along with various maintenance needs on and around the building.

8.3.2 Forest City

The physical condition of the Forest City wastewater collection system was recently assessed in their Asset Management Plan completed in 2013 by McGill. Highlights of the report included the following:

a. The Town has identified the Central Business District and the Mill Street area within their sewer collection system in need of rehabilitation to reduce line failures due to deteriorating pipelines that contribute to Inflow and Infiltration (I&I). The existing vitrified clay pipe (VCP) gravity sewer lines within these areas were determined to be in poor condition and have been identified by Town staff as a major source of I&I. The existing manholes within these areas are constructed of brick, are in poor condition, and are also a source of I&I. The Town of Forest City has noticed significant surcharges that occur within their wastewater collection system and at their WWTP during significant rain events that they attribute in part to these areas.
b. The Town and their engineer have conducted smoke testing in the area of the Brackett Creek pump station / sewer basin as well as the Erwin, Woodburn & Dogwood Pump Station sewer basin.
c. As a result of previously conducted analyses, the Town is planning to replace 6,400 LF feet 8-inch VCP sewer line with PVC pipe and precast concrete manholes and lining in the Central Business District at an opinion of cost of approximately $944,000.
d. As a result of previously conducted analyses, the Town is planning to replace 4,100 LF feet of 15, 12 and 8-inch VCP sewer line with PVC pipe and precast concrete manholes and lining with cured in place pipe 2,100 linear feet of 15-inch, I2-inch and 8-inch VCP sewer line in the Mill Street Area at an opinion of probable cost of approximately $928,000.

8.3.3 Lake Lure

As documented by the Sewer System Study conducted for Lake Lure by Brown Consultants in 2010, Lake Lure's unique underwater sewer collection system has limited their ability to conduct pipe repairs and replacement due to the expense and difficulty in accessing the underwater sewer collection system. For these reasons it has recommended that Lake Lure continue to do the following:

a. Continued hydrophoning and wrapping accessible underwater pipe joints as leaks are identified to reduce I&I;
b. A focused approach on private systems around the lake that may contribute to I&I;
c. Identify land based I&I and target it for repair;
d. Targeting private, satellite collection systems around the lake that contribute I&I to the system and considering installing accurate flow meters at selected or larger volume

sewer connections to assess I&I from these satellite collection systems; and,

e. Initiating a manhole re-habilitation / replacement project.

8.3.4 Rutherfordton

No additional information pertaining to the condition of Rutherfordton's wastewater collection system has been provided. The Town of Rutherfordton does not have an Asset Management Program and/or an active or funded Capital Improvement Program.

8.3.5 Spindale

Kurt Wright & Associates recently completed an Asset Management Program for Spindale in March of 2013. According to the program, Spindale is facing several issues with its sewer collection system that it will be required to address. These include the significant age of the system and associated I&I.

According to the AMP, The first sewers installed within the Town coincided with the establishment of the textile industry in the 1920's. At the time, manholes were constructed by brick masonry, with standard brick mortar. And, the pipe material was vitrified clay pipe with lead joints, which have deteriorate over time. The oldest portions of the Town's sewer collection system have experienced significant decline and are plagued with root intrusion, infiltration and inflow, and degradation of the manholes.

As a result of the efforts put into data collection, assessing the condition of the manholes, GIS mapping, and interviewing Spindale staff, the AMP designated the following improvements for the Spindale sewer collection system, as summarized below:

Near Term (0-5 Years)
a. 2012 Sanitary Sewer System Replacements
b. Initiate Sewer Flow Monitoring Programs/Closed Circuit TV Inspections

Near Term (5-10 Years)
a. Rehabilitation of Sub-Basin A3 Trunk line, via Trenchless Technology

Intermediate Term (10-20 Years)
a. Rehabilitation of Sub-Basin A2 Trunk line, via Trenchless Technology
b. Rehabilitation of Sub-Basin B2 Trunk line, Southern Branch, via Trenchless Technology

Long Term (20-30 Years)
a. Rehabilitation of Sub-Basin B2 Trunk line, Northern Branch, via Trenchless Technology

8.4 Physical Condition of Treatment Plant(s):

8.4.1 Cliffside

At this point in time the Cliffside WWTP is classified as an industrial system, which is a large reason the plant is successfully treating the flow to meet current discharge limits. If the largest industrial user was to cease discharging into system, the plant would no longer be classified as an industrial user. This change in classification would include secondary treatment standards, which require 85% removal and typical effluent concentration limits of 30 mg/l for BOD_5 and TSS. These requirements will present significant compliance issues with the current facility.

Some of the observations made by WK Dickson are as follows:

a. The WWTP is subject to influence from significant collection system I&I issues.
b. The remote location of the Cliffside WWTP limits use of facility as regional WWTP.
c. Chronic toxicity tests are conducted with 4.2% effluent concentration indicating a significant dilution ratio of plant flow to the 7Q10 stream flow and possible favorable situation regarding a future increase in plant capacity.
d. The single large aeration basin does not have aerators/mixers.
e. The effluent tertiary filters would be favorable for use in future facility.
f. The overall plant is significantly oversized for the current flows with excessive retention time provided within the aeration (facultative lagoon) basin, clarifiers and chlorine contact basin. The plant was originally design for a flow of 1.75 mgd and is currently treating an average daily flow of only 0.047 mgd. With no provisions for influent screening or active waste biosolids disposal, the current facility continues to accumulate these solids within the lagoon.
g. Overall clarifier, pumps and filtration equipment continues to deteriorate with age and minimal operation and routine maintenance.
h. Algal growth within the aeration basin and clarifiers likely impacts both BOD_5 and TSS within the effluent. Addition of aerators or mixers within the aeration basin/lagoon would significantly impact annual operational costs.
i. The plant has sufficient capacity to accept additional flows but will need major equipment repairs and additional aeration/mixing.
j. A review of the EPA data base indicates three (3) informal enforcement actions within the last five (5) years as follows:

    i. April 15, 2009 – Letter of violation / warning letter (State)
    ii. October 10, 2013 – Notice of Violation (State)
    iii. June 18, 2010 – Letter of violation/warning letter (State)

8.4.2 Forest City

8.4.2.1 Second Broad River WWTP

The physical condition of the Forest City wastewater treatment system was recently assessed in their Asset Management Plan completed in 2013 by McGill. The Forest City Riverside Wastewater Treatment Plant was originally constructed and began operation in 1960 with major upgrades in 1983, 1988, 1991 and 1997. The plant operates under NPDES Permit No. NC00254984 with a permitted flow of 4.95 mgd. The current NPDES Permit was issued on July 1, 2009 with an expiration date of July 31, 2013. A new permit has not been issued at this date but NCDENR has instructed Forest City to continue operation under the expired permit until a new permit is issued.

The current NPDES Permit requires monitoring for total nitrogen and total phosphorus with no limits. There have been no indications from NCDENR of any anticipated future nutrient limitations to be imposed on this facility with the pending new permit.

From September 2011 through September 2013, the daily flows reported on the DMR's have averaged 1.263 mgd. Three (3) peak daily flows exceeding the 4.95 mgd permit limit have been

reported at 13.79 (January 2013), 16.69 (May 2013) and 6.50 (July 2013). The Town of Forest City's "Mandatory Public Notification Annual Performance Report" also reported the following permit violations in 2011 and 2012:

Table 8.1 Town of Forest City Permit Violations for 2011 and 2012

Date	Parameter	Report Value	Permit Limit
3/7/11	TSS	75.6 mg/L	45 mg/L (Weekly Limit)
3/11/11	Cyanide	83 ug/L	22 ug/L (Daily Maximum)
6/27/11	Cyanide	Failed to Sample	
5/15/12	TSS	Failed	45 mg/L (Weekly) 30 mg/L (monthly)

WK Dickson's assessment of the plant for future service is summarized as follows:

a. The WWTP is subject to influence from significant collection system I&I issues.
b. The Second Broad WWTP is the best area facility for use as regional WWTP.
c. Chronic toxicity tests are conducted with 18% effluent concentration indicating a significant dilution ratio of plant flow to the 7Q10 stream flow and possible favorable situation regarding a future increase in plant capacity.
d. Biosolids dewatering and drying facilities are favorable for service as regional facility.
e. The major operating components of the plant including headworks, large aeration basin, clarifiers, disinfection system , sludge digestion system and dewatering / dryer system are in generally good condition but are approaching 10 years or older with ongoing maintenance/replacement needs.
f. The plant includes one large aeration basin with five (5) smaller basins available but not currently in service. Aeration Basins A, B, C and D have been out of service for some time with floating aerators that would require significant maintenance and component replacement to return to service. The concrete tanks appear to be structurally sound and usable in a future treatment scheme.
g. The Secondary Aeration Basin has a volume estimated at 3.99 million gallons. Based upon the design conditions of 4.95 mgd and influent BOD_5 of 300 mg/L, this basin provides a hydraulic retention of 19.3 hours and BOD_5 loading of 23.2 lbs BOD_5/1000 CF. Typical design guidelines for extended aeration are 20 to 30 hours hydraulic retention and 10 to 25 lbs. BOD_5/1000 CF. At flows less than 4.95 mgd, the basin is well within guidelines for extended aeration.
h. The seven (7) existing 75 Hp aerators (535 Hp total) provide adequate mixing within the basin at 0.13 Hp/1000 Gallons (0.1 Hp/1000 Gallons recommended). The oxygen transfer capacity is not sufficient for the design BOD_5 loading at 300 mg/L and 4.95 mgd but would be adequate for lower flows and/or lower BOD_5 influent concentration. DMR reports indicate actual average influent BOD5 concentrations on the order of 200 mg/L.
i. The sludge dryer system is nearing the useful life and oversized for the current plant flows and biosolids production. While the Class A biosolids are a benefit, the economics of drying over dewatering and land application or landfill disposal may be difficult to justify.

j. The plant is in a generally remote location with a railroad extending along the west side of the plant site and the Second Broad extending along the east side of the site. The nearest residential homes are approximately 500 to 600 feet to the southeast. Development to the south other than several isolated residences appears to be commercial / warehouse structures. The areas to the north and east are largely undeveloped at this time.
k. The plant site topography and constraints imposed by the railroad to the west and Second Broad to the east could impact future plant expansions.
l. In addition, the Town's Asset Management Plan noted that when funding becomes available, the Town intends to replace the aeration systems at the Second Broad River WWTP with higher efficiency blower/diffuser systems to reduce power and provide savings in electrical costs. The opinion of probable cost for this upgrade is $1,700,000.

8.4.2.2 Riverstone WWTP

The Forest City Riverstone wastewater treatment plant was constructed in 2002 to serve an industrial park located off Highway 221 on the Broad River below Harris, NC. Between 2002 and 2013, the WWTP served as a holding basin with the wastewater received trucked to the Forest City Second Broad River WWTP for treatment and disposal. The WWTP currently serves the Horsehead Corporation and Meriton Inc. industrial plants located in the area with the first discharge beginning in or around November 2013. The WWTP is a sequencing batch reactor (SBR) treatment system rated at 0.05 mgd operating under NPDES Permit #NC0087084 with an expiration date of July 31, 2018.

WK Dickson's assessment of the plant for future service is summarized as follows:

a. The remote location and size of the Riverstone WWTP limits use of the facility as regional WWTP.
b. Discharge to Broad River provides assimilative capacity for future expansion of the WWTP as needed to serve the industrial park and immediate area.
c. The WWTP could be readily expanded by addition of additional SBR units.

8.4.2.3 DRG WWTP

The Forest City – Dan River Group Wastewater Treatment Plant (DRG WWTP) was originally constructed and began operation in approximately 1994 by Dan River Inc. The plant was permitted under NPDES Permit No. NC0083275 for flow of 0.91 mgd with a discharge to the Broad River. The NPDES Permit observed in the files at the plant was effective on September 1, 2004 with an expiration date of July 31, 2008. The status of the NPDES Permit is unknown.

A physical inspection of the DRG WWTP was conducted on January 15, 2014. Access was not available to the mechanical room containing pumps and blowers. Other than an in-ground influent basin and separate secondary clarifiers, the basic treatment structure consists of an above ground tank concrete tank structure with common walls providing compartments for equalization, aeration, sludge digestion and sludge storage.

WK Dickson's assessment of the plant for future service is summarized as follows:

a. The WWTP has been out of service for over 8 years.

b. Overall the WWTP appears to be in good condition with much of piping and steel beginning to show signs of corrosion. The WWTP structures appear to be in good shape and have been drained and cleaned with little evidence of residual solids.
c. The WWTP structures appear to be easily expandable.
b. Overall the WWTP seems to be much larger than a typical 0.91 mgd facility and likely provides extended aeration times required for biological treatment of textile wastewaters.
c. The remote location of this WWTP is the biggest detriment to the future use of this facility.
d. Discharge to the Broad River provides minimal impact and significant potential for increased discharge capacity. Remote location below Harris would require costly infrastructure to convert into a regional facility.
e. A proposed Forest City water intake located downstream of the discharge could impact the future return to service of this WWTP.

8.4.3 Lake Lure

The Lake Lure WWTP is located off US Highway 64/74 near the Lake Lure dam with an effluent discharge into the Broad River. The plant is currently permitted to operate under NPDES Permit NC0025381 with a capacity of 0.995 mgd with an expiration date of August 31, 2013. A new permit application was submitted prior to the expiration date but has not been issued. NCDENR has instructed Lake Lure to continue operation under the previous permit until a new permit is issued.

The plant daily flows reported on the DMR's over the period May 2012 to September 2013 averaged 0.341 mgd with a daily maximum of 0.687 mgd.

As documented in previous studies prepared for the Town of Lake Lure, a brief historical timeline of the LLWWTP is as follows:

1927 – The collection system consisting of approximately 11.3 miles of cast iron pipe ranging in size from 20″ to 8″ was installed following the natural drainage prior to the lake being filled and with a discharge into the Broad River below the lake dam.

1969 to 1989 – WWTP became hydraulically overloaded due to lake infiltration/inflow.

1969 – The original WWTP was constructed and permitted for a capacity of 0.350 mgd. The WWTP consisted of an activated sludge process including an aeration basin, clarifier, RAS pump station, chlorine contact tank and sludge holding tank.

1991 – The WWTP was upgraded to 1.0 mgd capacity with the treatment process converted to a physical chemical treatment process with the following additions and modifications:

- New mechanical bar screen.
- New flash mix basin with alum addition
- Conversion of sludge holding tank into a flocculation basin
- Conversion of existing aeration basin into a sedimentation basin with addition of inlet and outlet weirs, telescoping valve and bottom valve and piping for periodic sludge removal.

- Inlet and outlet piping modifications at the existing clarifier.
- New sludge holding tank
- New Alum bulk storage facility
- Effluent sand filter

1991 – 2006 – WWTP continued to be hydraulically overloaded and the sand filter was by-passed with plant receiving a number of DENR notice of violations (NOV's) associated with flow, total suspended solids (TSS) and ammonia nitrogen (NH_4).

2007 – Town of Lake Lure entered into a Special Order by Consent (SOC) to correct problems that produced the NOV's.

2008 – Second major upgrade was completed with permit set at 1.0 mgd for a Physical Chemical process.

2009 – New NPDES Permit was issued at 0.995 mgd, tighter limits and more testing.

2009 Town was awarded a $3,000,000 ARRA grant to reduce lake I/I.

2010 – WWTP inflow was reduced but consistent achievement of the discharge permit limits continues to be a serious challenge.

WK Dickson's assessment of the plant for future service is summarized as follows:

a. The WWTP's remote location limits plant's ability to be considered for regional treatment.
b. The WWTP has ongoing issues throughout the treatment process with low BOD, high concentrations of TSS and high concentrations of iron.
c. The WWTP has significant issues with meeting their NPDES permit ammonia nitrogen effluent limits.
d. Due to the nature of the influent, the WWTP is primarily a physical / chemical treatment facility instead of a biological facility.
e. The recent joint wrapping of the transmission line under the Lake by the Town has significantly reduced infiltration.
f. The perception is that the existing WWTP has expansion issues & recent evaluations have recommend transfer of Lake Lure's wastewater to Rutherfordton for treatment and disposal.

8.4.4 Rutherfordton

The plant has been in compliance with the current NPDES permit for the last seven (7) years without any "notice of violations" (NOV's) and is not subject to any DENR consent orders. The plant NPDES permit currently requires monitoring and reporting for total nitrogen and phosphorus but does not anticipate any future compliance limitations for total nitrogen or phosphorus.

The plant has good relationship with adjoining property owner and operates without any significant public complaints. Generally, the only time odor has been an issue is during sludge loading operations for off-site disposal during the summer months.

Plant wastewater contribution is largely domestic. The only industry requiring a pretreatment permit is Colorworks which produces camouflage coating on metal components. Other industries include Allied Dye, PCI and Broyhill with wastewaters limited to domestic waste.

WK Dickson's assessment of the plant for future service is summarized as follows:

a. The expansion of the Rutherfordton WWTP for future service may be limited by the assimilative capacity of the adjacent Cleghorn Creek (Chronic Toxicity P/F = 71% @ 3 mgd).
b. A potential discharge to the Broad River by outfall extension would be approximately 5.4 miles to accommodate expansion at an opinion of probable cost of $8,000,000.
c. The existing WWTP site lends itself to the expansion of aeration basins and use of existing lagoon for equalization. There is additional room within the adjacent aeration/equalization basin that could be utilized for additional future aeration basins of similar construction to the existing lined basins.
d. Biosolids disposal relies on liquid land application.
e. The Rutherfordton WWTP was last upgraded in 2006 and plant equipment appears to be well maintained.
f. The WWTP NPDES permit has tiered flows of 1.0 mgd and a 3.0 mgd future flow. The average daily flow over the period October 2011 to September 2013 is 0.5 mgd with a maximum daily flow reported at 6.8 mgd. Plant operations indicate a peak instantaneous flow of 11.42 mgd. The plant does have the capability to divert peak flows into the adjacent aeration/equalization basin for storage.
g. The current plant aeration basins have a combined volume of 2,000,000 gallons capacity. At the maximum permitted flow of 3.0 mgd, the total available aeration volume provides a hydraulic retention time of only 16 hours. This retention time is below the 18 – 36 hours typically recommended design valve for the extended aeration activated sludge process. Operation at lower hydraulic retention times typically results in higher solids production and may impact the ability to achieve consistent nitrification to meet the ammonia nitrogen limitation. Operation at flows approaching 3 mgd will also require additional aeration equipment estimated to approach 200 horsepower in each basin based on an influent design BOD_5 of 220 mg/l. The aeration basins are lined with a flexible membrane installed in 2006.
h. The existing secondary clarifiers provide 191 gpd/sf surface overflow rate (SOR) at the permitted 3.0 mgd condition.
i. The existing plant site includes approximately 65 acres and potential areas for plant expansion.

8.4.5 Spindale

The Town of Spindale wastewater treatment plant is permitted by the North Carolina Department of Environmental and Natural Resources (NCDENR) under National Pollutant Discharge Elimination System (NPDES) per permit number NC0020664. The current NPDES permit, effective November of 2013, includes a three (3) tier waste allocation based upon the average flow received by the WWTP. Treated effluent from this facility is discharged to Cathey's Creek, which is located with the Broad River Basin.

The WWTP was originally constructed from 1968 to 1971 as an extended aeration activated sludge secondary wastewater treatment plant. Several major upgrades have been completed over the past several decades. These plant upgrades occurred in 1988, 1991 and 1999.

Presently, the average daily flows at the Spindale WWTP are approximately 0.8 Million Gallons per Day (MGD) with a peak daily flow as high as 6.1 MGD. Presently, there are three (3) Significant Industrial User (SIU), these users include Spindale ColorMasters, Ultimate Textiles, and Timken. A potential SIU is Isothermal Textiles, which is an industrial laundry facility. Currently, these SIUs make up approximately twenty (20%) percent of the flow at the Spindale WWTP. As detailed within prior assessments of the Spindale collection system, Inflow and Infiltration (I&I) is prevalent. Currently, Spindale is working to correct I&I through systematic system rehabilitation. Additionally, the adoption of the Spindale Grease Ordinance has also help to aid in improving the overall operation and maintenance of the collection and conveyance systems as well as the WWTP.

In August 2013, the Town of Spindale submitted an application to NCDENR SRF for $5,000,000 for upgrades to its WWTP. The Town received notification in the fall of 2013 that their application had been accepted and they have been awarded the opportunity to apply for a $4,000,000 loan and $1,000,000 grant to fund their project. The project includes subdividing and lining their existing 8 MG aeration basin, adding drains to the aeration basin, rehabilitating the aeration system, rehabilitating the chemical feed systems to include better effluent metering, flow proportional chemical feeds, and improvements to the disinfection system.

WK Dickson's assessment of the plant for future service is summarized as follows:

a. The WWTP is subject to influence from significant collection system I&I issues.
b. The WWTP aeration basin is a single aeration basin and needs to be divided into multiple basins. In addition, significant biosolids have accumulated within the existing aeration basin. The Spindale WWTP is the second best area facility for use as regional WWTP.
c. Chronic toxicity tests are conducted with 32% effluent concentration indicating a significant dilution ration of plant flow to the 7Q10 stream flow and possible favorable situation regarding a future increase in plant capacity.
d. Biosolids disposal relies on liquid land application.

8.5 Findings:

After reviewing the physical condition analysis as well as debriefing with their respective Project Stakeholders, the following observations were noted:

a. The Cliffside, Lake Lure, Forest City Second Broad River, Rutherfordton, and Spindale WWTPs are subject to influence from significant collection system I&I issues.
b. The Forest City Second Broad River and Spindale WWTPs are the best area facilities for use as regional WWTPs because of their size and the assimilative capacity of their receiving streams.
c. The only Project Stakeholders with an Asset Management Plan and detailed Capital Improvement Plan were the Town of Forest City and the Town of Spindale.
d. Lake Lure and Spindale need to upgrade their respective wastewater treatment plants to return to compliance with their NPDES permits or find an alternative means for wastewater disposal.
e. Rutherfordton and Cliffside need to maintain their respective wastewater treatment plants in order to maintain compliance with the NPDES permits.

f. The available assimilative capacity of Cleghorn Creek limits the ability of Rutherfordton's WWTP. Therefore, the Rutherfordton WWTP should not be considered a viable candidate for the location of a consolidated primary WWTP without the relocation of the WWTP discharge.
g. The small size of the Riverstone WWTP limits its ability to take on a large water user and subsequent large wastewater discharger.
h. The condition of the DRG WWTP will require significant capital investment to bring this WWTP back on line to handle any potential industry in the area.
i. A proposed Forest City water intake located downstream of the discharge of the DRG WWTP could impact the future return to service of this WWTP.

8.6 Recommendations:

As a result of the limited physical condition analysis conducted, we recommend the following:

a. Cliffside, Lake Lure, Forest City, Rutherfordton, and Spindale should all continue to work towards addressing collection system I&I issues.
b. The Forest City Second Broad River and Spindale WWTPs are the strongest candidates for use as regional WWTPs because of their size and the assimilative capacity of their receiving streams.
c. Cliffside, Lake Lure, and Rutherfordton should endeavor to prepare an Asset Management Plan and Capital Improvement Plan.
d. Due to the limited assimilative capacity of Cleghorn Creek, Rutherfordton's WWTP receiving stream, Rutherfordton should fully investigate either moving their discharge point if they are to be considered as a consolidated treatment facility and/or transferring their wastewater to a neighboring facility for treatment if they intend to expand or treat a significant increase in wastewater flows beyond their permitted limit.

End of Section

Section 9 – County Domestic Sewer Service Analysis

9.1 Summary:

As part of this study, WK Dickson analyzed areas within the County needing domestic sewer service. This analysis was based on input provided from the municipalities, the County, and Isothermal Planning and Development. The analysis includes planning level opinions of probable costs and scope for the potential projects identified as well as an assessment of sewer flow to any impacted WWTP.

On March 6, 2014, WK Dickson staff met with the Isothermal Planning and Development Commission. Representing the Commission was Mr. James B. Edwards, the Executive Director. Mr. Edwards provided the following comments regarding wastewater collection and treatment needs in Rutherford County:

a. The Highway 74 corridor is best opportunity for economic development. Efforts are underway to get Highway 74 upgraded to an "interstate" classification. A key consideration for this upgrade is the Shelby by-pass. Having interstate access from I-85 and I-26 would be significant aid to development. The Highway 64 corridor does not seem to offer the development opportunity as that of Highway 74.

b. Potential economic growth areas of with needed sewer service were listed in order of need as follows:

   i. Highway 74 – Ellenboro Henrietta Rd Interchange

      This area offers significant potential for development based on the railroad access and land availability. Water is also available from Broad River Water and Cleveland County Water. Both Rutherford County and Cleveland County see this area as a prime area for development.

   ii. Industrial Site on Highway 221

      An industrial site off Highway 221 below the Harris Elementary School (near Hopper Rd) is considered to be a good area for development but lacks sewer service.

   iii. Highway 74 at Polk County

      The proposed Equestrian Center to be located off Pea Ridge Road in Polk County is expected to spur development in this area and possibly at the Union Road which does not currently have an interchange. Rutherfordton has a pump station at the White Oak development on Pea Ridge Road with force main back to the Rutherfordton WWTP that is expected to be utilized with the Equestrian Center development.

9.2. Opinions of Probable Cost:

Below please find Table 9.1 – Rutherford County Domestic Sewer Service Analysis Opinions of Probable Costs.

Table 9.1 – Rutherford County Domestic
Sewer Service Analysis Opinions of Probable Costs

Project	Opinion of Probable Cost
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Ellenboro	$2,231,000
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Henrietta	$1,979,000
Industrial Site on Hwy 221 / Harris Elementary – to Spindale	$1,914,000
Industrial Site on Hwy 221 / Harris Elementary – to Riverstone WWTP	$2,145,000

Detailed opinions of probable costs can be found in Appendix 9.1 Domestic Sewer System Analysis Opinions of Probable Costs.

End of Section

Section 10 – Economic Development Sewer Service Analysis

10.1 Summary:

As part of this study, WK Dickson analyzed areas within the County needing domestic sewer service. This analysis was based on input provided from the municipalities, the County, and Rutherford County Economic Development. The analysis includes planning level opinions of probable costs and scope for the potential projects identified as well as an assessment of sewer flow to any impacted WWTP.

On March 6, 2014, WK Dickson staff met with Rutherford County Economic Development. Representing the Economic Development was Mr. Matt Blackwell, the Executive Director. Mr. Blackwell identified the following areas as needing sewer service for economic development:

a. Highway 74 – Ellenboro / Henrietta Road Interchange

The Ellenboro Henrietta Road interchange was noted as a short term need. Water and railroad are available at this location and sewer is needed to allow development. It was suggested that one source for sewer service could be a connection into the existing sewer system at the Cone Mills location previously served by a sewer extending to the Cliffside WWTP. This is approximately 14,000 lf (2.6 miles) to south at Henrietta.

The Highway 120 location at Hwy 74 to the east was suggested as a long term need with a possible future interchange.

b. Highway 74 – Highway 221 Interchange

A new industrial facility has just been announced at the Highway 74 – Highway 221 interchange. Team Air will employ 70 people with their east coast manufacturing facility. Rutherford County has received a IDF grant to reactivate an existing pump station and 4″ force main at this location to transfer wastewater to the existing Spindale pump station located to the north on Highway 221 near the Timken plant site on Highway 221. Other potential development in the area could push for higher capacity of these two pump stations. Gravity service to this location could be possible by extending a gravity sewer along Long Branch to an existing pump station to the east at Holly Hills Drive.

c. Riverstone Business Park

Forest City's Riverstone WWTP has a capacity of 50,000 gpd with the ability to double capacity to 100,000 gpd to serve the future development of the business park and surrounding area.

d. DRG WWTP

The DRG WWTP offers tremendous capacity in area but it was noted that Forest City has a permit for a water intake below the DRG WWTP discharge.

e. White Oak Development

The existing Rutherfordton pump station serving the White Oak development is to be utilized with the future Equestrian center. Mr. Blackwell also sees an opportunity for the future development of a future interchange at Union Road with other development spinning off the Equestrian Center.

f. Area North of Rutherfordton / Hwy 221

Long term development is possible in the area north of Rutherfordton associated with a future Highway 221 by-pass around Rutherfordton.

g. Rutherford County Airport

Long term development is possible in the area surrounding the Rutherford County Airport out Highway 64.

10.2 Opinions of Probable Cost:

Below please find Table 10.1 – Rutherford County Economic Development Sewer Service Analysis Opinions of Probable Costs.

Table 10.1 – Rutherford County Economic Development Sewer Service Analysis Opinions of Probable Costs

Project	Opinion of Probable Cost
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Ellenboro	$2,231,000
Hwy 74 – Ellenboro / Henrietta Rd Interchange – to Henrietta	$1,979,000
Hwy 74 – Hwy 221 Interchange – to Spindale	$150,000
Riverstone Industrial Park	$889,000
DRG WWTP	$1,348,000
Area North of Rutherfordton / Hwy 221	$1,551,000
Rutherford County Airport / Hwy 64 to Spindale	$1,551,000

Detailed opinions of probable costs can be found in Appendix 10.1 Economic Development Sewer System Analysis Opinions of Probable Costs.

End of Section

Section 11 – Financial Analysis

11.1 Summary:

As part of the project, WK Dickson has conducted a financial analysis and prepared a utility financial model for the proposed consolidation and proposed projects. The model includes expected capital project costs, operating costs, revenues and debt financing. The model is a useful tool for aiding in the determination and demonstration of the financial feasibility of consolidation. The model also provides some of the likely impacts on sewer rates.

As part of this task, workshops were conducted with each of the project stakeholders individually to identify and discuss the following concerns and issues:

a. Rate structures;
b. Existing debt service and transfer of ownership issues;
c. Projected costs associated with consolidation and potential impact on user fees;
d. Perceptions, problems, concerns and opportunities regarding the potential merger of the respective wastewater collection and treatment systems from a financial perspective.

In addition, WK Dickson evaluated the possible consolidation of sewer collection and treatment systems, including the abandonment of inefficient WWTP's for and between the Project Stakeholders. This evaluation identified improvements most likely required for consolidation (including necessary upgrades to the receiving system) along with opinions of probable costs.

11.2 Financial Information:

11.2.1 Cliffside

The Cliffside Sanitary District provided a copy of their rate structure and excerpts from the FY 2012 / 2013 audit. Summarized rate information is presented in further detail in section 10.2 of this chapter and a copy of Cliffside's rates are attached in Appendix 10.1. A copy of the excerpts from Cliffside's FY 2012 / 2013 audit are attached in Appendix 10.2. Attached in Appendix 10.3, please find information pertaining to water usage in Cliffside during FY 2012 / 2013 used in the Financial Model. Other financial information pertaining to Cliffside was provided in the Cliffside Sanitary District PER prepared by Odom & Associates Engineering, Inc. and dated November 17, 2010.

11.2.2 Forest City

The Town of Forest City provided a copy of their rate structure and excerpts from the FY 2012 / 2013 audit. Summarized rate information is presented in further detail in section 10.2 of this chapter and a copy of Forest City's rates are attached in Appendix 10.4. A copy of the excerpts from Forest City's FY 2012 / 2013 audit are attached in Appendix 10.5. Attached in Appendix 10.6, please find information pertaining to water usage in Cliffside during FY 2012 / 2013 used in the Financial Model.

In addition, the Town of Forest City provided the following additional financial & billing related information:

a. The Town of Forest City has a separate utility billing and collection system department.
b. Sewer bills are based on water meter reading.
c. Water meters are read monthly reading with approximately 25% of the systems water meters being radio read meters.
d. Forest City believes a potential benefit of consolidation could be maximizing Forest City's sewer assets and centralized billing.
e. Forest City's only debt service is for a NCDENR SRF 0% interest loan for their ongoing I&I program.
f. Forest City sees their excess WWTP capacity as their biggest asset and would accept wastewater from others for treatment but other Towns would have to maintain their own collection system.
g. Forest City believes they have best handle on their assets.

11.2.3 Lake Lure

The Town of Lake Lure provided a copy of their rate structure and excerpts from the FY 2012 / 2013 audit. Summarized rate information is presented in further detail in section 10.2 of this chapter and a copy of Lake Lure's rates are attached in Appendix 10.7. A copy of the excerpts from Lake Lure's FY 2012 / 2013 audit are attached in Appendix 10.8. Attached in Appendix 10.9, please find information pertaining to water usage in Lake Lure during FY 2012 / 2013 used in the Financial Model.

In addition, the Town of Lake Lure provided the following additional financial and billing related information:

a. The Town of Lake Lure has 800 – 1,000 customers with 20 - 30% as year round residents including 50 to 60 customers in Chimney Rock.
b. Individuals with a well water supply are billed a base rate per month.
c. Lake Lure's only sewer debt is for their pipe wrapping project with NCDENR SRF. It includes $2.6 million with 50% principal forgiveness and $1.2 million at 0% interest loan. Payments currently approximate $60,000 - $65,000 per year. The project also included a $1 million grant from the Rural Center.
d. The Town of Lake Lure handles its own water and sewer utility billing and collection and bills are sent bimonthly.

11.2.4 Rutherfordton

The Town of Rutherfordton provided a copy of their rate structure and excerpts from the FY 2012 / 2013 audit. Summarized rate information is presented in further detail in section 10.2 of this chapter and a copy of Rutherfordton's rates are attached in Appendix 10.10. A copy of the excerpts from Rutherfordton's FY 2012 / 2013 audit are attached in Appendix 10.11. Attached in Appendix 10.12, please find information pertaining to water usage in Rutherfordton during FY 2012 / 2013 used in the Financial Model.

In addition, the Town of Rutherfordton provided the following additional financial and billing related information:

a. Rutherfordton's sewer billing are conducted by Broad River Water Authority (BRWA) and sewer bills are based on water usage.

b. The Town of Rutherfordton Financial Planning Model prepared by Jacobs Engineering Group, Inc. and dated April 26th, 2011. It should be noted that Rutherfordton has not followed the recommended rate increases recommended by the model or funded a preliminary Capital Improvement Plan (CIP) detailed in the model.
c. Broad River Water Authority (BRWA) bills for Rutherfordton's sewer fees with sewer bills based on water usage.
d. Allied Dye Casting uses a separate wastewater flow meter. BRW reads meter and bills.
e. Rutherfordton works with BRW for adjustments related to leaks.
f. Customers call either BRWA or Rutherfordton for billing related issues. Time spend by Rutherfordton staff related to sewer billing issues is minimal.
g. The Town maintains a budget for sewer system repairs. However, as noted above, the Town does not fund its "capital replacement" fund and/or CIP.

11.2.5 Spindale

The Town of Spindale provided a copy of their rate structure and excerpts from the FY 2012 / 2013 audit. Summarized rate information is presented in further detail in section 10.1 of this chapter and a copy of Spindale's rates are attached in Appendix 10.13. A copy of the excerpts from Spindale's FY 2012 / 2013 audit are attached in Appendix 10.14. Attached in Appendix 10.15, please find information pertaining to water usage in Spindale during FY 2012 / 2013 used in the Financial Model.

In addition, the Town of Forest City provided the following additional financial information:

a. Spindale's sewer billing are conducted by Broad River Water Authority (BRWA) and sewer bills are based on water usage.
b. The Town of Spindale has a number of NCDENR SRF loans for it's sewer system including the following:
    i. 2011 Sewer Rehabilitation Project – approx. 7,000 LF.
    ii. Oakland Community - $273,000 or 34,000 per year until 2021-22.
    iii. Second loan $290,000 or 37,000 per year to 2019-20.
    iv. Oakland sewer - $308,000 total – $62-63,000/year until 2018-19.
    v. Force main project – $400,000 - $40,000 /year until 2022-23.
    vi. Federal stimulus - $600,000 @ 0% interest.
c. The Town of Spindale's existing debt service is at approximately 40% of their total revenue and is approaching the LGC limit.
d. The Town has applied for and received a funding commitment for an NCDENR SRF loan for the rehabilitation of their WWTP. The funding commitment is for a $5 million SRF loan with $4 million at 0% interest and $1 million in principal forgiveness.
e. WWTP rehab includes:
f. Aeration basin reconfiguration into 2 smaller basins.
g. Relining aeration basin with concrete.
h. New blower aeration system with diffusers in the basin.
i. Removal of sludge accumulation in existing aeration basin. Town is now getting estimate for Southern Soil Builders.
j. New gate valves.
k. Design is forthcoming.
l. Time is of concern as Town's back-out date for accepting the loan and incurring the debt is approaching.

m. The Town maintains is funding a Capital Improvement Plan (CIP) for their sewer system as well as an Asset Management Plan (AMP). The Town has used the AMP to schedule and set sewer rehabilitation funding priorities.
n. Spindale has concerns about transfer of assets.
o. Spindale believes that placing the sewer system under 3rd party control would allow for there to be less concern about rate increases (i.e. removing politics from the rate setting process) and that a 3rd party entity would be less likely to rely on "Band-Aid" fixes.
p. Spindale's sewer system in 1995/1996 was funded 80% by industry. In 2009/2010 the ratio reversed with public now funding 80%.
q. Spindale historically transferred significant sewer system revenues to the general fund to keep taxes low.
r. Spindale is more willing to raise consumption charges before adjusting their base charge because of it's impact on small and/or low income users.
s. Issues perceived by Spindale with consolidation includes lack of control related to rate setting, lack of control associated with growth, ownership of the sewer collection systems, the true costs of sewer system collection and treatment, economic viability, long term benefits, and the division of excess available sewer capacity amongst the project stakeholders.

11.3 Rate Structures:

11.3.1 Cliffside

The primary rate structure for the Cliffside Sanitary District is as follows:

Table 11.1 Cliffside Sanitary District Sewer Rates

Minimum Charge, includes 1st 1,000 gallons	$26.00
Next 19,000 gallons, per 1,000	$5.05
Next 980,000 gallons, per 1,000	$4.50
Next 9,000,000 gallons, per 1,000	$1.90
All over 19,000,000 gallons, per 1,000	$1.60

In addition, the Cliffside Sanitary District has two (2) additional rate classes for large customers within the District. Additional information pertaining to Cliffside's rates is contained in Appendix 11.1. Additional financial information pertaining to Cliffside is contained in Appendix 11.2. And, sewer usage data pertaining to Cliffside is contained in Appendix 11.3.

11.3.2 Forest City

The primary rate structure for the Town of Forest City is as follows:

Table 11.2 Cliffside Sanitary District Sewer Rates

Minimum Charge, includes 1st 1,000 gallons	$26.00
Next 19,000 gallons, per 1,000	$5.05
Next 980,000 gallons, per 1,000	$4.50
Next 9,000,000 gallons, per 1,000	$1.90
All over 19,000,000 gallons, per 1,000	$1.60

Forest City has numerous rate classes. Additional information pertaining to Forest City's rates is contained in Appendix 11.4. Additional financial information pertaining to Forest City is contained in Appendix 11.5. And, sewer usage data pertaining to Forest City is contained in Appendix 11.6.

11.3.3 Lake Lure

The primary rate structure for the Town of Lake Lure is as follows:

Table 11.3 Town of Lake Lure Sewer Rates

	Inside	Outside
Minimum Charge, Residential	$21.00	$42.00
Minimum Charge, Commercial	$23.50	$47.60
0 – 5,000 gallons, per 1,000	$3.68	$7.35
5,001 to 20,000 gallons, per 1,000	$3.94	$7.88
Usage over 20,001 gallons, per 1,000	$4.47	$8.93

Additional information pertaining to Lake Lure's rates is contained in Appendix 11.7. Additional financial information pertaining to Lake Lure is contained in Appendix 11.8. And, sewer usage data pertaining to Lake Lure is contained in Appendix 11.9.

11.3.4 Rutherfordton

The rate structure for the Town of Rutherfordton is as follows:

Table 11.4 Town of Rutherfordton Sewer Rates

	Inside	Outside
Minimum Charge, includes 1st 1,000 gallons	$12.09	$36.27
Next 499,000 gallons, per 1,000	$4.70	$14.11
Next 500,000 gallons, per 1,000	$4.08	$12.24
Next 9,000,000 gallons, per 1,000	$2.62	$7.86
All over 10,000,000 gallons, per 1,000	$1.17	$3.52

Additional information pertaining to Rutherfordton's rates is contained in Appendix 11.10. Additional financial information pertaining to Rutherfordton is contained in Appendix 11.11. And, sewer usage data pertaining to Rutherfordton is contained in Appendix 11.12.

11.3.5 Spindale

The rate structure for the Town of Spindale is as follows:

Table 11.5 Town of Spindale Sewer Rates

	Inside	**Outside**
Residential, Min. Charge, includes 1st 1,000 gallons	$12.00	$24.00
Residential, Per 1,000 gallons	$5.69	$11.38
Commercial, Min. Charge, includes 1st 1,000 gallons	$16.00	$32.00
Commercial, Per 1,000 gallons	$5.69	$11.38
Industrial, Min. Charge, includes 1st 1,000 gallons	$16.00	$32.00
Industrial, Per 1,000 gallons	$4.02	$5.99

Additional information pertaining to Spindale's rates is contained in Appendix 11.13. Additional financial information pertaining to Spindale is contained in Appendix 11.14. And, sewer usage data pertaining to Spindale is contained in Appendix 11.15.

11.3.6 General Rate Discussion and Conclusions

Rate setting should be conducted with the following goals and objectives:

a. Maintaining simplicity, certainty, convenience, feasibility, and freedom from controversy;
b. Yielding total revenue in a stable and predictable manner;
c. Minimizing unexpected changes to customers;
d. Promoting conservation, discouraging wasteful use of water, and promoting justified uses;
e. Promoting fairness and equity;
f. Avoiding discrimination; and,
g. Complying with all applicable laws.

As part of the financial, WK Dickson compared the Project Stakeholder's existing rate structures to "Industry Standards" as well as average sewer rates in the State of North Carolina in 2014. Water and sewer rates continue to rise in North Carolina and South Carolina as well as the rest of the country due to aging water and wastewater systems as well as more stringent water and wastewater treatment requirements. It is not unusual to see rates outside of a given municipality's / utility's limits higher than those rates charged to customers within the municipality's / utility's limits.

However, proposed legislation could require municipalities in North Carolina that have an outside rate which are significantly higher than their inside rate to reduce or justify these higher rates on such things as customer base, additional operation and maintenance costs, etc. in accordance with industry standards. The majority of water and wastewater systems have minimum monthly charges. Uniform rate structures are considered to be the most common.

Trends seen in the water and wastewater industry include the following:

a. The use of declining rate structures is decreasing due to conservation efforts and the fact that they are complex in nature.
b. Loan and grant agencies look poorly upon declining rate structures, discourage their use, and may not fund loans or grants with those entities that have declining rate structures.
c. The use of inclining or inverted rate structures is increasing in an effort to promote water conservation.
d. Customer rates tend to be lower as the size of a given water or wastewater system increases due to the ability to spread fixed costs over a larger customer base
e. Expenditures on water and wastewater operation and maintenance (O&M) programs is increasing as systems age and the value of these beneficial programs are realized.
f. Most water and wastewater systems have some form of mandatory use policy.
g. Water and sewer rates vary considerable between systems located in close proximity with one another due to such things as system age and systems that have taken a proactive instead of reactive approach towards such things as capital improvements and operation & maintenance.

Federal guidelines recommend that water and sewer usage fees fairly distribute the cost of operating and maintaining water systems and sewer systems to all users. Three costs are associated with maintaining water systems and sewer systems: (1) Fixed; (2) Variable; and (3) Surcharge.

Fixed costs are incurred to maintain water distribution, water treatment, wastewater collection, and wastewater treatment systems properly. Fixed costs do not increase or decrease with the quantity of water consumed or the quantity of wastewater received. The minimum monthly water charge and the minimum monthly sewer charge to customers should cover the water and sewer systems fixed costs respectively.

Variable costs are those costs that vary with the quantity of water consumed or the quantity of wastewater received. Variable costs include such things as the power for pumping, water and wastewater treatment chemicals, providing aeration, and treating wastewater at the wastewater treatment plant. The cost per volume of water consumed or wastewater received over the minimum respective system user fee must cover these costs.

Surcharge costs are those costs required to treat wastewater that has a higher strength than domestic waste. Higher BOD, suspended solids, and ammonia-nitrogen levels require greater treatment capacity and effort. Therefore, the greater treatment capacity and operation and maintenance costs are recovered through surcharges on industrial users.

According to the North Carolina Environmental Finance Center, the median price for 5,000 gallons/month across all of the utilities they surveyed in 2014 was $30.01 for water and $36.15 for wastewater, using "inside" residential rates, in 2014. This indicates that half of the 384 water rate structures in their sample charge more than $30.01 for water for 5,000 gallons/month, and half of 319 wastewater rate structures charge more than $36.15 for wastewater. However, larger utilities may be charging lower rates because they are able to spread their costs across a large customer base. The actual average bill for a North Carolinian for 5,000 gallons is likely to be higher, however, since a substantial portion of the citizens are paying "outside" rates that are greater than "inside" rates. According to their 2014 Rate Dashboard, a 5,000 gallons per month sewer bill for similar sized utilities across the state is approximately $38.00.

11.3.7 Rate Comparison

Table 11.6 Sewer Rate Comparison for a 5,000 gallon per month Residential Customer

Stakeholder		Base	Per 1,000	3,000	5,000	10,000
Cliffside		$26.00	$5.05	$36.10	$46.20	$71.45
Lake Lure	Inside	$21.00	$3.68	$32.04	$39.40	$57.80
	Outside	$42.00	$7.35	$64.05	$78.75	$115.50
Forest City	Inside	$14.95	$3.71	$14.95	$22.37	$40.92
	Outside	$27.15	$6.97	$27.15	$41.09	$75.94
Rutherfordton	Inside	$12.09	$4.70	$21.49	$30.89	$54.39
	Outside	$36.27	$14.11	$64.49	$92.71	$163.26
Spindale	Inside	$16.00	$5.69	$27.38	$38.76	$67.21
	Outside	$32.00	$11.38	$54.76	$77.52	$134.42
Average				$38.05	$51.97	$86.77
Average Inside				$26.39	$35.52	$58.35
Average Outside				$52.61	$72.52	$122.28

When comparing rates and rate structures between the Project Stakeholders, the following was noted:

a. Cliffside Sanitary District, Forest City, and Rutherfordton have declining rate block structures.
b. Spindale has a flat rate structure.
c. Lake Lure has an inclining rate block structure.
d. Rutherfordton's outside rates are over double the inside rates.
e. Forest City's outside rates are less than double the inside rates.
f. Lake Lure's and Spindale's outside rates are approximately double the inside rates.

11.4 Opinions of Probable Cost:

For the purposes of this study, WK Dickson evaluated the possible consolidation of sewer collection and treatment systems, including the abandonment of inefficient WWTP's for and between the Project Stakeholders. This evaluation identified improvements most likely required for consolidation (including necessary upgrades to the receiving system) along with opinions of probable cost.

WK Dickson has also prepared opinions of probable cost associated with WWTP abandonment and provided a recommendation as to how to make efficient use of the existing WWTP NPDES permits. The following alternatives were explored:

a. Lake Lure to Rutherfordton
b. Rutherfordton to Spindale
c. Spindale to Rutherfordton
d. Spindale to Forest City
e. Spindale and Rutherfordton to Forest City
f. Cliffside Sanitary District to Forest City (Second Broad River WWTP)
g. Cliffside Sanitary District to Forest City (Riverstone WWTP)
h. Cliffside Sanitary District to Forest City (Dan River WWTP)

As part of this analysis, WK Dickson inspected each WWTP to collect information related to this task. A summary of the information pertaining to the Project Stakeholders WWTP's is presented in Chapter 2. The inspections included a meeting with the operations staff to evaluate the current treatment operations, equipment with regard to apparent operational condition, reliability, possible equipment repairs or upgrades, equipment replacement schedules and the capability of the plants to accept wastewater flows from consolidation.

Table 11.7 County / Joint Municipalities Opinions of Probable Cost

	Alternative	Probable Cost
A.	Lake Lure to Rutherfordton WWTP	$9,901,000
B.	Cost to Upgrade Lake Lure WWTP	$7,014,000
C.	Rutherfordton WWTP Upgrades to Handle Lake Lure & Equestrian Center	$304,000
D.	Rutherfordton to Spindale WWTP	$5,171,000
E.	Upgrades to Spindale WWTP to Handle Rutherfordton & Lake Lure	$11,205,000
F.	Spindale to Rutherfordton WWTP	$8,292,000
G.	Spindale to Forest City Second Broad River WWTP	$5,628,000
H.	Spindale and Rutherfordton to Forest City WWTP	$8,294,000
I.	Cliffside to Forest City Second Broad River WWTP	$5,423,000
J.	Cliffside to Riverstone WWTP	$4,799,000
K.	Cliffside to Forest City DRG WWTP w/o Riverstone WWTP	$6,226,000
L.	Cliffside to Forest City DRG WWTP with Riverstone WWTP	$6,509,000
M.	Forest City Second Broad River WWTP Upgrades to Handle Cliffside, Rutherfordton, and Spindale WWTP	$13,960,000
N.	Upgrades to Forest City Riverstone WWTP to Handle Cliffside	$889,000
O.	Upgrades to Forest City DRG WWTP to Handle Cliffside and Riverstone	$1,348,000
P.	Rutherford County Airport to Spindale	$1,551,000
Q.	Area North of Rutherfordton / Hwy 221 to Rutherfordton	$1,551,000
R.	Sewer Service to Ellenboro Henrietta Rd Interchange at Hwy 74 via FM to Ellenboro	$2,231,000
S.	Sewer Service to Ellenboro Henrietta Rd Interchange at Hwy 74 via FM to Henrietta	$1,979,000
T.	Service to Industrial Area on HWY 221 near Harris Elementary via PS & FM to Spindale Torrington PS on Hwy 221	$1,914,000
U.	Service to Industrial Area on Hwy 221 near Harris Elementary via PS & FM to Riverstone Blvd Gravity Sewer to Riverstone WWTP	$2,145,000
V.	Hwy. 221 / US 74 Interchange PS Upgrade - Spindale	$150,000

Copies of the detailed opinions of probable costs and other relevant information may be found in Appendices 11.16 to 11.38.

In addition, based on information available through Forest City and Spindale's Asset Management Plans and Lake Lure's Comprehensive Sewer Study as well as other capital needs identified by WK Dickson, please find on the following page Table 11.8 Other Rutherford County Opinions of Probable Cost.

Table 11.8 Other Rutherford County Opinions of Probable Cost

	Additional Capital Needs	Probable Cost
A.	Forest City Central Business District Sewer Rehab (Post Bid)	$944,197
B.	Forest City Mill Street Area Sewer Rehabilitation	$928,000
C.	Forest City WWTP Large Aeration Basin & Digester Improvements	$1,711,000
D.	Spindale – Rehabilitation of Trunk Line A3	$968,000
E.	Spindale – Rehabilitation of Trunk Line A2	$1,449,000
F.	Spindale – Rehabilitation of Oak Street PS – Southern Trunk Line	$641,000
G.	Spindale – Rehabilitation of Oak Street PS – Southern Trunk Line	$410,000
H.	Rutherfordton – Sewer Outfall to the Second Broad River	$8,003,000
I.	Cliffside to Forest City Second Broad River WWTP	$5,423,000
J.	Sewer Operation & Maintenance Programs	$200,000
K.	Cliffside Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$262,000
L.	Forest City Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$435,000
M.	Lake Lure Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$452,000
N.	Rutherfordton Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$379,000
O.	Spindale Continuing Sewer Assessment / Sanitary Sewer Evaluation Study	$364,000
P.	Upgrading the Rutherfordton WWTP from 3 MGD to 6 MGD	$15,000,000

Copies of the detailed opinions of probable costs and other relevant information may be found in Appendices 11.39 to 11.52.

As a result of these opinions of probable costs, the following should be noted:

a. The cost to upgrade the Rutherfordton WWTP and transfer wastewater flow from Spindale to Rutherfordton is $8,292,000 + $15,000,000 = $23,292,000.
b. The cost to upgrade the Spindale WWTP and transfer flow from Rutherfordton to Spindale $5,171,000 + $11,205,000 = $16,376,000.
c. The cost to upgrade the Forest City WWTP and transfer wastewater flow from Spindale and Rutherfordton to Forest City is $8,294,000 + $5,171,000 + $13,960,000 = $27,425,000.

11.5 Financial Model:

In an effort to construct a high level initial financial model, WK Dickson compiled information on sewer usage, sewer rates, sewer revenues, and sewer expenses from the Project Stakeholders. This data was then compiled in a series of Microsoft Excel spreadsheets for manipulation and assessment along with Opinions of Probable Cost for three consolidation scenarios. The scenarios modeled included the following:

a. The consolidation of Lake Lure, Rutherfordton and Spindale
b. The consolidation of Cliffside Sanitary District, Lake Lure, Rutherfordton, and Spindale with Forest City
c. The consolidation of Cliffside Sanitary District with Forest City

The appendices include the following tables:

a. Appendix 11.53 – Table A.11.1 – Revenues & Expenses - All Project Stakeholders

b. Appendix 11.54 – Table A.11.2 – Revenue Projections - Consolidation of Lake Lure, Rutherfordton & Spindale
c. Appendix 11.55 – Table A.11.3 – Capital Improvements & Net Income - Consolidation of Lake Lure, Rutherfordton & Spindale
d. Appendix 11.56 – Table A.11.4 – Revenue Projections - Consolidation of Cliffside Sanitary District, Lake Lure, Rutherfordton, and Spindale with Forest City
e. Appendix 11.57 – Table A.11.5 – Capital Improvements & Net Income - Consolidation of Cliffside Sanitary District, Lake Lure, Rutherfordton, and Spindale with Forest City
f. Appendix 11.58 – Table A.11.6 – Revenue Projections - Consolidation of Cliffside Sanitary District with Forest City
g. Appendix 11.59 – Table A.11.7 – Capital Improvements & Net Income - Cliffside Sanitary District with Forest City

For the purposes of constructing the financial model, the following assumptions were made:

a. Sewer customer data and sewer usage data were used as the primary data set for developing the scenarios.
b. Due to the complexities of the project stakeholders rate structures (i.e. declining block rate structures, increasing rate block structures, various classes, etc.), sewer revenues for FY 2012 / FY 2013 do not match sewer revenues generated as documented in the financial information supplied by the project stakeholders without significant adjustment to the rates or the development of a more complex model.
c. However, for the purposed of the model, all project stakeholders rate structures were converted to a flat rate structure and revenue generated was estimated based on sewer customers and sewer usage which negates the need for the development of a more complex model with all project stakeholders differing rate structures.
d. Consolidation would result in a conservative savings of only 20%.
e. The interest rate used for capital project financing in the model was 3%.
f. Operation and maintenance programmatic development and sanitary sewer system assessments would be conducted by the final management entity in lieu of be prepared by a consulting engineer (i.e. these costs were not included in the scenarios).
g. All of the options assumed a 2% operating cost increase every year.
h. None of the options included the revenue generated from proposed tax increment financing districts, grants, existing available capital, or principal forgiveness.

The financial model for the consolidation of Lake Lure, Rutherfordton and Spindale resulted in the following:

a. A base rate for a 5,000 gallon per month customer of $44.00 the 1st year with rate increases of 10% the first five (5) years, 5% the next ten (10) years, and 2% the remaining 5 years with a final base rate in year 20 for a 5,000 gallon per month customer of approximately $115.
b. Capital improvements funded and their time frame for completion included the following:
    i. FY 2018 / 2019 – Lake Lure to Rutherfordton for Treatment
    ii. FY 2021 / 2022 – Spindale WWTP Upgrades
    iii. FY 2026 / 2027 – Rutherfordton to Spindale for Treatment
    iv. FY 2027 / 2028 – Airport Area to Spindale
    v. FY 2028 / 2029 – Area North of Rutherfordton / Hwy 221 to Rutherfordton

vi. FY 2029 / 2030 – Industrial Area on Hwy 221 near Harris Elementary to Spindale

The financial model for the consolidation of Cliffside Sanitary District, Lake Lure, Rutherfordton, and Spindale with Forest City resulted in the following:

a. A base rate for a 5,000 gallon per month customer of $44.00 the 1st year with rate increases of 10% the first five (5) years, 5% the next ten (10) years, and 2% the remaining 5 years with a final base rate in year 20 for a 5,000 gallon per month customer of approximately $100.
b. Capital improvements funded and their time frame for completion included the following:
   i. FY 2016 / 2017 – Lake Lure to Rutherfordton for Treatment
   ii. FY 2017 / 2018 – Spindale & Rutherfordton to Forest City for Treatment
   iii. FY 2018 / 2019 – Cliffside to Forest City for Treatment
   iv. FY 2021 / 2022 – Airport Area to Spindale
   v. FY 2023 / 2024 – Upgrades to the Forest City WWTP
   vi. FY 2023 / 2024 – Area North of Rutherfordton / Hwy 221 to Rutherfordton
   vii. FY 2024 / 2025 – Industrial Area on Hwy 221 near Harris Elementary to Spindale
   viii. FY 2025 / 2026 – Ellenboro Henrietta Road Interchange to Henrietta

The financial model for the consolidation of Cliffside Sanitary District with Forest City resulted in the following:

a. A base rate for a 5,000 gallon per month customer of $35.00 the 1st year with rate increases the next five (5) years at 5%, the next year at 10%, the next five (5) years at 3%, and the remaining eight (8) years at 2% with a final base rate in year 20 for a 5,000 gallon per month customer of approximately $67.
b. Capital improvements funded and their time frame for completion included the following:
   i. FY 2021 / 2022 – Cliffside to Forest City for Treatment
   ii. FY 2026 / 2027 – Ellenboro Henrietta Road Interchange to Henrietta

11.6 Legislative Actions & Issues:

According to the NC League of Municipalities, Despite clear statutory authority to make policy decisions related to the control and operation of municipally-owned water and sewer utilities outside of the city limits, legislation filed both North Carolina's last session and in the 2012 Short Session generated a number of bills to micromanage the affairs of water and sewer utilities across the State. Despite what is considered to be clear statutory authority to make policy decisions related to the control and operation of municipally-owned water and sewer utilities outside of the municipal limits and disregarding the investments made by municipal tax payers and system rate payers, these bills have the potential to damage the economic vitality of large public enterprises.

Some bills of note that are currently pending include:

a. House Bill 488 - Regionalization of Public Utilities is legislation that would transfer the City of Asheville's water system to a regional metropolitan sewerage district. The bill is written as a statewide bill but includes provisions intended to limit its application to the City of Asheville.

b. Senate Bill 472 - Kinston Public Enterprises is legislation that eliminates the authority of the city to charge differential rates for water customers outside of the city limits, and required the city to make its services available to all property owners outside of the city limits under the same rules as in-city property owners. The bill has the potential to jeopardize the fiscal viability of the Kinston water and sewer systems.

11.7 Findings:

After reviewing the financial analysis and utility financial model as well as debriefing with the respective Project Stakeholders, the following observations were noted:

a. All project stakeholders assume that the full cost of service is currently being charged to their rate payers.
b. A more regionalized approach will benefit rate paying customers through operations and maintenance efficiencies and economies of scale that can be recognized through the shared use of labor, equipment, purchasing agreements, and capital resources.
c. These savings and efficiencies can be passed on to the ratepayer in the form of reduced rates, or the provision of greater rate stability.
d. Cliffside Sanitary District, Forest City, and Rutherfordton have declining rate block structures.
e. Spindale has a flat rate structure.
f. Lake Lure has an inclining rate block structure.
g. Rutherfordton's outside rates are over double the inside rates.
h. Forest City's outside rates are less than double the inside rates.
i. Lake Lure's and Spindale's outside rates are approximately double the inside rates.
j. Rutherfordton currently maintains minimal reserves.
k. Rutherfordton has not adjusted rates in accordance with their 2011 Financial Model
l. It is assumed this means Rutherfordton has not kept up with the capital improvements planned in the CIP contained in the Financial Model.
m. Decreasing rate block structures are not looked upon favorably by loan and grant agencies.
n. Outside rates that are significantly higher than inside rates are not looked upon favorably by loan and grant agencies as well as the legislature.
o. The cost to upgrade the Rutherfordton WWTP and transfer wastewater flow from Spindale to Rutherfordton is $8,292,000 + $15,000,000 = $23,292,000.
p. The cost to upgrade the Spindale WWTP and transfer flow from Rutherfordton to Spindale $5,171,000 + $11,205,000 = $16,376,000.
q. The cost to upgrade the Forest City WWTP and transfer wastewater flow from Spindale and Rutherfordton to Forest City is $8,294,000 + $5,171,000 + $13,960,000 = $27,425,000.
r. In order to make one (1) of the three (3) forms of consolidation viable, capital costs for the projects need to be offset with a combination of grants and/or low interest loans and additional forms of financing such as Tax Increment Financing Districts.
s. If Lake Lure upgrades their WWTP on their own without any financial assistance at an estimated project cost of $7,014,000 and an interest rate of 3%, it has been estimated that Lake Lure would have to raise rates 200%.
t. If Lake Lure connects to Rutherfordton for wastewater treatment on their own without any financial assistance at an estimated project cost of $9,901,000 and an interest rate of 3%, it has been estimated that Lake Lure would have to raise rates 240%.

u. If Rutherfordton upgrades their WWTP on their own without any financial assistance at an estimated project cost of $4,000,000 ($1,000,000 grant already secured) and an interest rate of 3%, it has been estimated that Rutherfordton would have to raise rates 130%.

v. If Rutherfordton upgrades their WWTP on their own without any financial assistance at an estimated project cost of $5,000,000 and an interest rate of 3%, it has been estimated that Rutherfordton would have to raise rates 135%.

w. If Rutherfordton upgrades their WWTP on their own without any financial assistance at an estimated project cost of $11,200,000 and an interest rate of 3%, it has been estimated that Rutherfordton would have to raise rates 180%.

x. Assuming a conservative 20% savings in overall operating and management costs, 2% increases in operating and management costs per year, a 3% interest rate, and conversion to a flat rate structure, three financial model scenarios were developed:
    a. Scenario 1 - Consolidating Lake Lure, Rutherfordton and Spindale;
    ii. Scenario 2 - Consolidating Cliffside, Lake Lure, Rutherfordton and Spindale with Forest City; and,
    iii. Scenario 3 - Consolidating Cliffside with Forest City.

y. The three financial model scenarios have been compiled to include the necessary capital projects to show a potential time line for rate increases and the capital projects as well as the projected rate increases.

z. Scenario 1 - Consolidating Lake Lure, Rutherfordton and Spindale - would result in a base rate for a 5,000 gallon per month customer of $44.00 the 1st year with rate increases of 10% the first five (5) years, 5% the next ten (10) years, and 2% the remaining 5 years with a final base rate in year 20 for a 5,000 gallon per month customer of approximately $115.

aa. Scenario 2 - Consolidating Cliffside, Lake Lure, Rutherfordton and Spindale with Forest City - would result in a base rate for a 5,000 gallon per month customer of $44.00 the 1st year with rate increases of 10% the first five (5) years, 5% the next ten (10) years, and 2% the remaining 5 years with a final base rate in year 20 for a 5,000 gallon per month customer of approximately $100.

bb. Scenario 3 - Consolidating Cliffside with Forest City - would result in a base rate for a 5,000 gallon per month customer of $35.00 the 1st year with rate increases the next five (5) years at 5%, the next year at 10%, the next five (5) years at 3%, and the remaining eight (8) years at 2% with a final base rate in year 20 for a 5,000 gallon per month customer of approximately $67.

11.8 Recommendations:

As a result of the financial analysis and utility financial model conducted, we recommend the following:

a. Decreasing rate block structures are not looked upon favorably by loan and grant agencies. Cliffside Sanitary District, Forest City, and Rutherfordton should eliminate their declining rate structures due to conservation efforts and the fact that they are complex in nature and change to either a flat block rate structure or inclining block rate.

b. Outside rates that are significantly higher than inside rates are not looked upon favorably by loan and grant agencies as well as the legislature. Lake Lure,

Rutherfordton, and Spindale should consider lowering their outside rates to less than double their inside rates.

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Section 12 – Case Studies

12.1 Summary:

As part of this project, WK Dickson has provided four (4) case studies. These include the Yadkin Valley Sewer Authority (YVSA), the Westpoint-Stevens / Scotland Co. / Lumbar River Council of Governments, the Water & Sewer Authority of Cabarrus County (WSACC), and the Cape Fear Public Utility Authority (CFPUA).

12.2 Yadkin Valley Sewer Authority:

For years, the Towns of Elkin, Jonesville and Ronda, North Carolina discussed and evaluated the potential for consolidating wastewater facilities to ease the ever increasing burden and rising costs of operating a sanitary sewer system. These discussions progressed until a resolution by the towns was adopted on April 19th, 2006 to establish the Yadkin Valley Sewer Authority—with a mission of providing adequate, efficient and cost-effective sewer service to the three towns of Elkin, Jonesville and Ronda.

The Yadkin Valley Sewer Authority is unique in that it not only joins three separate towns cooperating on a single project but also joins their three counties—Surry, Wilkes and Yadkin. The Authority will allow Elkin, Jonesville and Ronda to consolidate their wastewater into one central treatment facility and have only one site for discharging treated water into the Yadkin River. The Authority will operate under one joint discharge permit, eliminating not only the need for two other permits, but two other discharge sites.

The Yadkin Valley Sewer Authority has and had a high poverty rate. The Authority is located in three counties - Yadkin, Surry and Wilkes. Yadkin County is a Tier 2 economically distressed county, while Surry County and Wilkes County are Tier 1 economically distressed counties.

The Towns of Elkin, Jonesville and Ronda created the Yadkin Valley Sewer Authority to consolidate three existing wastewater treatment plant systems: Elkin (1.8 million gallons per day); Jonesville (0.4 million gallons per day); and East Wilkes High School (0.0105 million gallons per day) at the Town of Elkin's wastewater treatment plant.

The original project was to upgrade the Elkin wastewater treatment plant from 1.8 to 2.5 million gallons per day to facilitate the consolidation and will eliminate two existing NPDES discharges (for East Wilkes High School [Town of Ronda] and Town of Jonesville); however, due to a reduction in billable flows for Elkin and Jonesville resulting from closures of Vaughan Bassett Manufacturing and Blythe Distribution along with overall customer conservation measures, the YVSA Board unanimously approved to reduce the scope of work from the proposed 2.5 million gallons per day expansion to modifying the current 1.8 million gallons per day facility. These improvements allowed for the transfer of flows from the Town of Jonesville and the elimination of the Jonesville NPDES permit.

Wastewater treatment plants initialing in the analysis included the 4 mgd CMI WWTP, the 1.8 mgd Elkin WWTP, and the 0.4 mgd Jonesville WWTP.

As a result of job losses and excess wastewater treatment plant capacity in the early 2000's as well

as one failing wastewater treatment plant, the project stakeholders elected to explore regionalization. As a result of the exploration, numerous roadblocks were determined and included the following:

a. Towns of Jonesville and Arlington
b. Issues associated with the CMI WWTP
c. Personality issues between Towns

As a result, collaboration amongst the project stakeholders halted.

In the mid 2000's, a chain of events began to occur which precipitated the formation of the Authority. These included the following:

a. Ronda received $3 million Unsewered Communities Grant from NC Rural Center
b. The CWMTF provides $1 million to Elkin for improvements to take Ronda flow
c. Elkin provides a $1 million match which allows 100,000 gallon capacity to Ronda

The YVSA board composition ended up as follows:

a. 5 - member Board – Elected officials
b. Elkin -2 members, 1 and 2 year terms
c. Jonesville - 2 members, 1 and 2 year terms
d. Ronda - 1 member, 3 year term
e. 3-year staggered terms

Steps to forming the YVSA included the following:

a. Procedure for Creation
b. Resolution of Intent
c. Articles of Incorporation
d. Publish notice of public hearing
e. Hold public hearing
f. Adopt resolutions
g. File resolutions and proof of public hearing notice to Secretary of State
h. Secretary of State issues certificate of incorporation
i. Authority becomes public body

12.2 Westpoint-Stevens / Scotland Co. / Lumbar River Council of Governments:

In late 2003, the LRCOG and a number of partners completed a comprehensive study of ground water resources in a seven county area within the Southern Coastal Plain (SCP). This study looked at a number of issues including water quality, consumption, hydrogeology and future availability. One of the most important issues studied was ground water availability and future alternative sources. Excessive pumping of the aquifers in the Central Coastal Plain resulted in ground water use restrictions, inside the Central Coastal Plain Capacity Use Area, and concern was being expressed by the Division of Water Resources and Environmental Management Commission about a similar scenario developing in the SCP. A subsequent study completed in 2006 of possible alternative sources in the western portion of the SCP showed few options other than the Lumber River.

In 2007, the Westpoint-Stevens / Westpoint Home manufacturing facility near the Town of Wagram in Scotland County closed. Part of the facility included the surface water intake/treatment plant and wastewater treatment plant. Shortly after the closing of the WestPoint Stevens (WPS) facility, Scotland County and the City of Laurinburg requested the LRCOG assist in facilitating a joint meeting with neighboring governments in Robeson and Hoke County to discuss interest in using the water and wastewater plants as regional public utilities. With Scotland County as the lead government, the LRCOG was successful in obtaining two grants to examine the condition of the plants and their respective permits. Along with local funds, the Clean Water Management Trust Fund (wastewater plant) and Rural Economic Development Center (water plant) provided these additional resources. In January 2009, the Wooten Company completed these studies concluding that both utilities were feasible for rehabilitation / renovation; and that the accompanying permits were in force and very valuable documents that should be kept in play for the future.

At this time Hoke County and the City of Raeford began pursuing alternative wastewater options and left the consortium. The remaining members then approached several governments in neighboring Moore County about their interest. Along with these new members, the consortium came together to continue the examination of the plants and the viability of possible interconnections and transmission costs.

The entities involved in this study ate located in the counties of Scotland, Robeson and Moore and include the following: City of Laurinburg, Scotland County, Laurinburg-Maxton Airport Commission, Town of Maxton, Town of Red Springs, Robeson County, Town of Pinebluff, Town of Aberdeen, Town of Pinebluff, Town of Southern Pines, Village of Pinehurst and Moore County. The Campbell Soup Company, located outside the Town of Maxton in Robeson County, also expressed an interest in the facility for possible wastewater treatment.

12.3 Water & Sewer Authority of Cabarrus County:

The Water and Sewer Authority of Cabarrus County (WSACC) was established in 1992 by Cabarrus County and the Cities of Concord and Kannapolis and the Towns of Harrisburg and Mount Pleasant for the purposes of planning, constructing, owning, operating and maintaining water and sewer facilities throughout Cabarrus County. WSACC is an independent, incorporated, public body funded by user fees with no taxing authority supporting five jurisdictions in North Carolina.

The authority is comprised of nine members: two members appointed by the Board of County Commissioners; two members appointed by the City of Concord; two members appointed by the City of Kannapolis; one member appointed by the Town of Harrisburg; one member appointed by the Town of Mount Pleasant; and one at-large member appointed by the Board of County Commissioners, at the recommendation of the municipalities. The Board Members serve at the pleasure of their respective Jurisdictions and are appointed on a rotating 3 year basis. Each entity has a say in how the Authority operates through their perspective board appointees with no Jurisdiction having a majority alone, so cooperation is required from multiple jurisdictions to change operations or approve capital expenditures.

WSACC is the primary planning agent for water and sewer facilities, provides wholesale wastewater transportation and treatment for its organizing jurisdictions, and provides reservoir management for some, or all, of its jurisdictions. WSACC is currently operating two WWTPs, one 28 MGD and one 0.8 MGD, one water treatment facility, four regional pump stations, and sewer

outfalls serving multiple jurisdictions, most of which are greater than 24″ diameter. Each Jurisdiction pays a cost of treatment rate and capital recovery that is the same to all entities: however, each jurisdiction has additional charges which vary based on Inflow and Infiltration surcharges, or capital recovery fees that are unique to each jurisdiction based on reserved capacity or a capital expenditure that only serves or expands capacity for their jurisdiction.

Each of the Participating Jurisdictions owns and operates their own collection and distribution system and sets their utility rates based on their operating costs and the charges they receive from the Authority. Each Jurisdiction also uses their capital funds to expand their individual collection and distribution systems in accordance with their individual needs for growth or expansion.

12.4 Cape Fear Public Utility Authority:

The City of Wilmington's Council and the New Hanover County Commissioners formed a Joint City/County Water and Sewer Advisory Committee to guide the consolidation of the two individual water and sewer utility systems to form a new regional water and sewer authority.

The Advisory Committee met approximately fourteen times. During the course of its work, the Advisory Committee was briefed by the City and County staff, their consultants, and the chairmen of numerous Employee Working Groups that addressed all aspects of the utility consolidation.

The Advisory Committee reviewed presentations on Communications, Capital Improvement Programs, Governance Issues, Water and Sewer Rates and Charges, Organizational Structure, Customer Service, Human Resources and Operations and Maintenance. These presentations addressed the status of the existing City and County utilities including identified "best practices" and recommendations on the formation of the future Authority.

Based on the findings, the Advisory Committee recommended that a consolidated water and sewer authority be formed to serve the citizens of the City of Wilmington and New Hanover County.

The Advisory Committee concluded that there would be many benefits from the consolidation of the City of Wilmington and the New Hanover County utility organizations into a new single regional authority, including:

a. Lower water and wastewater rates over the long term;
b. Improved planning and more effective investment of capital in the combined utility system leading to improved system reliability; and;
c. New and expanded career opportunities for employees in the consolidated authority.

The Advisory Committee also recognized that both the City of Wilmington and New Hanover County were facing significant future capital investments in their water and sewer systems that could total over $400 million in the next 10 to 15 years. These capital expenditures were deemed necessary whether or not consolidation of the water and sewer systems occurred. Some of these expenditures would have been required for infrastructure rehabilitation and other funds were determined to be needed to expand service. The City and the County would have had to significantly increase current water and wastewater rates and connection fees to fund these required improvements.

Based on a preliminary rate study, it was determined that City and County customers would have faced higher water and wastewater rates and fees if the City and County utility systems remained separate and did not consolidate. The reports and analyses indicated that water and sewer rates and fees for City and County customers will be lower over time with the new Authority.

The City and County selected and engaged a project manager for the consolidation of their water and sewer systems individually owned and operated by the City of Wilmington and New Hanover County. The City of Wilmington Council and the New Hanover County Commissioners also elected to form a Joint City/County Water & Sewer Advisory Committee to guide the consolidation of the two individual water and sewer utility systems to form the new water and sewer authority. The members of the Joint City/County Water Sewer Advisory Committee were separately appointed by the City of Wilmington City Council and New Hanover County Commissioners.

As part of its project responsibilities, a very detailed consolidation plan and implementation schedule for the project were developed. This plan and schedule, delivered in the form of eight detailed consolidation reports, and various presentations made to the Joint City/County Water & Sewer Advisory Committee, identified responsibilities, organizational structure, timeline and preliminary utility rates and fees.

As part of the project, the Advisory Committee associated with the project made the recommendations on or about the following:

a. Establishing a Regional Authority
b. Membership of the Authority
c. Articles of Incorporation
d. Authority rates and charges
e. Employee Relations
f. Employee Working Groups
g. Organization Structure of the Authority
h. Future Services of the Authority
i. Authority Operations

Some reports prepared as part of the formation of the CFPUA included the following:

a. Internal Communications Plan
b. External Communications Plan
c. Benefits Assessment Report
d. Integrated Capital Improvement Program
e. Water and Sewer Preliminary Rate Study
f. Organizational Structure Report
g. Employee Working Group Report
h. Governance and Legal Report
i. Human Resources Report

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