



227 West Trade Street
Suite 1400
Charlotte, NC 28202

Phone 704 • 373 • 1199
Fax 704 • 373 • 1113

www.raftelis.com

November 7, 2017

Mr. John Eller
County Manager
Davie County
123 South Main St.
Mocksville, NC 27028

Dear Mr. Eller:

Raftelis Financial Consultants, Inc. (“RFC”) has completed its assignment to develop cost-justified wastewater system development fees for Eastern Davie Sewer District for consideration by Davie County (“County”). This letter documents the results of the analysis which is based on a cost justified and industry standard approach for establishing system development fees and is also consistent with the methods for establishing such fee as set forth in North Carolina general statute 162A Article 8 “System Development Fees”. Raftelis is a qualified, financial professional firm that has provided rate and financial consulting to public water and wastewater utilities since 1993, has edited or contributed content for the Seventh Edition of the American Water Works Association “Principles of Water Rates, Fees and Charges M-1 Manual” (a manual that is used by the water industry to set rates, including system development fees), and has calculated system development fees for utilities in North Carolina and across the country since 1993.

Background

System development fees are defined as one-time charges assessed against new development as a way to recover a proportional share of the costs of capital facilities constructed to provide service capacity for new customers connecting to the water and wastewater utility systems. Typically, the cost basis for setting system development fees is based on the major system components, or core system assets, that are necessary to serve, and that provide benefit to, all customers. These components typically include reservoirs, water treatment plants, storage tanks, major water transmission lines, wastewater treatment plants, and major wastewater interceptors.

In general, RFC recommends that system development fees should be developed to be consistent with the common legal consideration in setting system development fees in the water/wastewater industry – the Rational Nexus Test. The Rational Nexus test requires that: 1) the need for capacity is a result of new development; 2) the costs are identified to accommodate new development; and

3) the appropriate apportionment of that cost to new development in relation to the benefit the new development reasonably receives¹.

There are three approaches for calculating water and wastewater development fees that are recognized in the industry as cost-justified² and meet the requirement of the Rational Nexus standard applied by the courts, as described below.

Buy-In Approach

The Buy-In Methodology is most appropriate in cases where the existing system assets provide adequate capacity to provide service to new customers. This approach calculates a fee based upon the proportional cost of each user's share of existing plant capacity. The cost of the facilities is based on fixed assets records and usually includes escalation of the depreciated value of those assets to current dollars. All core assets that provide benefit to the general transmission/collection and treatment systems are included, such as water and wastewater treatment plants, storage, major water transmission mains and wastewater interceptors, and pump/lift stations.

Incremental Cost Approach

The second method used to calculate water and wastewater capital facilities fees is the Marginal/Incremental Cost Methodology. This method focuses on the cost of adding additional facilities to serve new customers. It is most appropriate in a situation where existing facilities do not have adequate capacity to provide service to new customers, and the cost for new capacity can be tied to an approved capital improvement plan (CIP).

Combined Approach

A combined approach, which is a combination of the Buy-In and Marginal Incremental approaches, can also be used when the existing assets provide some capacity to accommodate new customers, but where the capital improvement plan also identifies significant capital investment to add additional infrastructure to address future growth and capacity needs.

Calculation of System development fees

To perform the update of the system development fee calculation, RFC requested and was provided with the following data from County staff:

- Five-year capital improvement plan
- Opinion of probably project cost dated October 11, 2017
- State revolving fund loan information
- Capacity in existing and future sewer system
- History of system development fees collected
- Inflow and infiltration factor for wastewater collection system
- History in number of customers added to system

¹ See the AWWA M-1 7th Edition Manual –System Development Charges, Chapter VII.2; pp.324.

² See the AWWA M-1 Manual –System Development Charges, Chapter VII.2; pp.329-330.

The East Davie Sewer District is currently comprised of pumping stations and force mains that connect to the Winston-Salem/Forsyth City County Utility system (CCUC), which combined provides a capacity of 0.75 million gallons per day (MGD). However, the County is obtaining a permit to construct a new pump station and transmission mains that will allow the County to receive sewer flow from Bermuda Run (which is currently treating sewer at a package plant owned by the development and then transport both East Davie sewer flow and Bermuda Run sewer flow to CCUC). This infrastructure will provide a total capacity of 2 MGD. At the time of this study, Davie County was in the process of obtaining a permit and a state revolving fund loan to fund the project. Since the project costs are reflected in the County's approved capital improvement plan, and since the project will provide expanded capacity to this service area over the next 20 years, the Incremental Approach was used to calculate the system development fees.

Using the Incremental Approach, Raftelis used the costs identified in the County's adopted 2017 capital improvement plan, but modified to reflect the most recent opinion of probable costs for the Eastern Davie sewer project, estimated at \$17,625,200. This project will be funded with a state revolving fund loan with a term of 20 years and an estimated interest rate of 1.5%. The aggregate project costs must be reduced by a revenue credit, according to section 162A-207 "Minimum requirements" of Article 8. The revenue credit is applied to ensure that new customers are not paying twice for the capacity received (the system development fee and then again to pay debt service issued for the project that provided capacity). The revenue credit was calculated by taking the net present value of the new customer debt-service payments that will be included in future monthly charges³, which was calculated to be approximately \$4.9 million over the 20-year planning horizon (which also reflects the term of the bond issued to fund the project). Since the net present value calculation is slightly higher than the minimum credit of 25% of the total project costs (as required per 162A-207), the net present value of revenues of \$4.9 million was subtracted from the aggregate project costs to derive the net project costs of approximately \$12.7 million. The net project costs are then divided by the total capacity to be provided by the system which is 2.0 MGD to derive a cost per gallon per day (GPD) for wastewater capacity, as shown in Exhibit 1.

³ See the AWWA M-1 7th Edition Manual –System Development Charges, Chapter VII2; pp.340-341.

Exhibit 1 – Cost per GPD of Core Utility Assets

	Wastewater
Total Project Costs	\$17,625,200
Less: Credit	-(\$4,944,598)
Adjusted Cost of Capacity	\$12,680,602
Total Capacity (gallons per day)	2,000,000
Cost Per Gallon per Day	\$6.34

The cost per gallon per day becomes the basic building block or starting point for determining the *maximum cost justified level* of the wastewater system development fees. Fees for different types of customers are based on this cost of capacity multiplied by the amount of capacity needed to serve each type or class of customer.

The next step is to define the level of demand associated with a typical, or average, residential customer, often referred to as an Equivalent Residential Unit, or ERU. The level of demand associated with a typical residential customer is built up based on a number of factors or assumptions, as shown in Exhibit 2.

Exhibit 2: Wastewater Demand per Single-Family ERU

	Wastewater
Usage per ERU	
Gallons per day per ERU	300
Inflow & Infiltration Factor	1.10
Adjusted GPD per ERU	330

Additional information in support of each of these factors or assumptions is provided below:

- **GPD per ERU** –For planning purposes and for calculating committed capacity at wastewater treatment plants, the state guidelines were used which specify expected average wastewater

usage of 240 GPD⁴ for a 2-bedroom single-family home and 360 GPD for a 3-bedroom home, the average of which results in an ERU of 300 GPD.

- **Inflow/Infiltration Factor** – This factor represents the portion of flows being returned to the water reclamation plants that is attributable to inflow and infiltration (I&I) that occurs in the wastewater collection system. Plant assets and wastewater collection lines must be sized to meet the level of actual flows delivered to the plants. This factor was estimated by County staff and was determined by comparing wastewater flow sent to the treatment plant with billable wastewater flow. The factor provided is below I&I factors typically experienced by other utilities.

Assessment Methodology

The analysis provides a maximum cost justified level of system development fees that can be assessed by the County. For single-family residential customers, the calculation of the system development fee is based on the cost per gallon per day multiplied times the number of gallons per day required to serve each ERU, as shown below in Exhibit 3.

Exhibit 3 – Calculated Maximum Single-Family Residential capacity fee’s

Single-Family	Wastewater
Calculated Cost per GPD	\$6.34
GPD per ERU	330
Total Calculated Capacity Fee per ERU	\$2,092
Existing Capacity Fee per GPD	\$13.00

For non-residential customers with larger meters, the fees for the smallest residential meter can be used and then scaled up by the flow ratios for each meter size, as specified in the AWWA M-1 Manual⁵, the results of which are shown in Exhibit 4. This method provides a straight forward approach that is simpler to administer and reasonably equitable for most new customers. However, the level of flows assigned to a 5/8” meter, based on the ERU concept, is well below the actual flow capacity of that meter size. As a result, since larger meters are scaled up from this starting point, there is a potential to understate the flow for customers with larger meters. The County could consider adopting a policy that allows more flexibility in determining system development fees for larger meters. For example, for customers requesting a 3” meter or greater, the County could request an engineering analysis of expected sewer flow. The expected average sewer flow (including any I&I) would be multiplied by the cost of wastewater capacity (\$6.34) to determine a wastewater system development fee.

⁴ Source: NCAC 02T.0114

⁵ See the AWWA M-1 Manual – Appendix B- Equivalent Meter Ratios; pp.326

Exhibit 4 shows the resulting maximum cost justified system development fees by meter size for meters ranging from 3/4 inches to 12 inches. For these calculations, the system development fees have been rounded to the nearest dollar. However, the County may want to consider adopting a policy to allow for greater flexibility in calculating system development fees for larger meters.

Exhibit 4 – Calculated Maximum System development fees

Meter Size	Maximum Cost Justified System Development Fee If Assessed by Meter Size
¾”	\$ 2,092
1”	\$ 3,487
1 ½”	\$ 6,974
2”	\$ 11,159
3”	\$ 22,318
4”	\$ 34,872
6”	\$ 69,743
8”	\$ 111,589
10”	\$ 167,384
12”	\$ 369,640

The County may elect to charge a cost per gallon that is less than the maximum cost justified cost documented in this report. If the County elects to charge a fee that is less, all customers must be treated equally, meaning the same reduced cost per gallon per day must be used for all customers.

Please contact me at your convenience if you have any questions regarding this report. We appreciate the opportunity to assist Davie County with this important engagement.

Very truly yours,
RAFTELIS FINANCIAL CONSULTANTS, INC.



Elaine Conti
 Senior Manager

Appendix

Supporting Schedules From the System Development Fee Model

**Davie County, NC
Supporting Schedules**

**Davie County
System Development Fee Study
Marginal-Incremental Calculation
Sewer**

DRAFT

Capital Improvements for Capacity Added Projects (1)	\$ 17,625,200	
Less: NPV of Expected Revenues (2)		\$ (4,944,598)
% of credit		28.1%
Credit must be no less than 25% of aggregate capital improvements (2)		\$ (4,406,300)
Adjustment (2)	\$ (4,944,598)	
Net Capital Costs	\$ 12,680,602	
Total Capacity Added (GPD) (replaces old system so add 2 MGD) (3)	2,000,000	
Cost Per Gallon	\$ 6.34	
 Cost of Capacity Added (GPD)	 \$ 6.34	

Single-Family Residential

ERU - gallons per day (4)	300
I&I factor (5)	1.10
Adjusted gallons per day (with I&I factor)	330
 Calculated Sewer Capacity Fee per ERU	 \$ 2,092

If Assess Fee by Meter Size

Meter Size	Flow	Ratio
3/4	30	1.0
1	50	1.7
2	100	3.3
2	160	5.3
3	320	10.7
4	500	16.7
6	1000	33.3
8	1600	53.3
10	2400	80.0
12	5300	176.7

Capacity Fee
\$ 2,092
\$ 3,487
\$ 6,974
\$ 11,159
\$ 22,318
\$ 34,872
\$ 69,743
\$ 111,589
\$ 167,384
\$ 369,640

Notes:

- (1) East Davie sewer project costs were obtained from the "Opinion of Probable Cost" provided on October 11, 2017 . Costs include the Yadkin River Pump Station which is being replaced but the total capacity of the system of 2 MGD is being used, as opposed to the incremental capacity added which is 1.25 MGD.
- (2) Present value or revenues from new customers added is compared to the 25% minimum credit. The greater of the two values is applied as a credit.
- (3) Capital improvement will add 1.25 MGD of capacity and replace existing capacity of 0.75 MGD.
The total capacity of the project is 2.0 MGD.
- (4) Gallons per day are based on the NCAC 02T.0114 flow rates for residential customers as shown below:
Wastewater permitted capacity design flow rates

120 gallons per day per bedroom	120
240 gallons per day for 2 bedrooms	240
360 gallons per day for 3 bedrooms	360
Estimated gallons per day per household - average of 2 and 3 bedrooms	300
- (5) The I&I factor was estimated by County staff.

Davie County					
System Development Fee Calculation					
Calculation of Revenue Credit					
	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
	Actual	Actual	Actual	Actual	Projected
Number of Sewer Customers	1,284	1,309	1,342	1,355	1,380
Annual historic growth rate '14 - '17 (1)		2.0%	2.5%	1.0%	
Average historic growth rate '14 - '17 (2)				1.8%	
Annual Increase in customers over the course of the year (3)					
Cumulative Increase in customers for calculating revenues (assume half of new customers for entire FY)					
Subtotal: Total Growth in Customers					
Revenues under Existing 2018 Rates (4):					
From Bi-Monthly Sewer Base Charges (include 3 kgal)					
From Volumetric sewer rate per kgal above 3 kgal					
From Bermuda Run wholesale rate in 2021 when they begin to be on new sewer system (5)					
Projected Revenues Available to Cover Annual Debt Service					
Net Present Value of Cumulative Projected Revenues over 20 years (6)					\$ 4,944,598
1.53% Discount Rate - Cost of Debt for SRF Loan					

Davie County								
System Development Fee Calculation								
Calculation of Revenue Credit								
	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected
Number of Sewer Customers	1,405	1,431	1,458	1,484	1,511	1,539	1,567	1,596
Annual historic growth rate '14 - '17 (1)								
Average historic growth rate '14 - '17 (2)								
Annual Increase in customers over the course of the year (3)		26	26	27	27	28	28	29
Cumulative Increase in customers for calculating revenues (assume half of new customers for entire FY)		13	39	65	92	120	148	176
Subtotal: Total Growth in Customers		13	39	65	92	120	148	176
Revenues under Existing 2018 Rates (4):								
From Bi-Monthly Sewer Base Charges (include 3 kgal)			\$ 7,841	\$ 13,180	\$ 18,617	\$ 24,154	\$ 29,793	\$ 35,535
From Volumetric sewer rate per kgal above 3 kgal			\$ 457	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457
From Bermuda Run wholesale rate in 2021 when they begin to be on new sewer system (5)			\$ 116,844	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688
Projected Revenues Available to Cover Annual Debt Service	\$ -	\$ -	\$ 125,142	\$ 247,325	\$ 252,762	\$ 258,299	\$ 263,938	\$ 269,680
Davie County								
System Development Fee Calculation								
Calculation of Revenue Credit								
	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034
	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected
Number of Sewer Customers	1,625	1,655	1,686	1,716	1,748	1,780	1,813	1,846
Annual historic growth rate '14 - '17 (1)								
Average historic growth rate '14 - '17 (2)								
Annual Increase in customers over the course of the year (3)	29	30	30	31	31	32	33	33
Cumulative Increase in customers for calculating revenues (assume half of new customers for entire FY)	205	235	265	296	327	358	391	424
Subtotal: Total Growth in Customers	205	235	265	296	327	358	391	424
Revenues under Existing 2018 Rates (4):								
From Bi-Monthly Sewer Base Charges (include 3 kgal)	\$ 41,382	\$ 47,336	\$ 53,400	\$ 59,574	\$ 65,862	\$ 72,265	\$ 78,786	\$ 85,426
From Volumetric sewer rate per kgal above 3 kgal	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457
From Bermuda Run wholesale rate in 2021 when they begin to be on new sewer system (5)	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688
Projected Revenues Available to Cover Annual Debt Service	\$ 275,527	\$ 281,481	\$ 287,545	\$ 293,719	\$ 300,007	\$ 306,410	\$ 312,931	\$ 319,571

Davie County						
System Development Fee Calculation						
Calculation of Revenue Credit						
	FY 2035	FY 2036	FY 2037	FY 2038	FY 2039	FY 2040
	Projected	Projected	Projected	Projected	Projected	Projected
Number of Sewer Customers	1,880	1,914	1,949	1,985	2,021	2,058
Annual historic growth rate '14 - '17 (1)						
Average historic growth rate '14 - '17 (2)						
Annual Increase in customers over the course of the year (3)	34	34	35	36	36	37
Cumulative Increase in customers for calculating revenues (assume half of new customers for entire FY)	457	491	526	562	598	634
Subtotal: Total Growth in Customers	457	491	526	562	598	634
Revenues under Existing 2018 Rates (4):						
From Bi-Monthly Sewer Base Charges (include 3 kgal)	\$ 92,188	\$ 99,074	\$ 106,086	\$ 113,227	\$ 120,499	\$ 127,904
From Volumetric sewer rate per kgal above 3 kgal	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457	\$ 457
From Bermuda Run wholesale rate in 2021 when they begin to be on new sewer system (5)	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688	\$ 233,688
Projected Revenues Available to Cover Annual Debt Service	\$ 326,333	\$ 333,219	\$ 340,231	\$ 347,372	\$ 354,644	\$ 362,049

- (1) Data was obtained from customer count provided by the County.
- (2) Used historic growth to project future growth since we are considering a 20-year planning period to match the term of the loan.
- (3) Customers will be added throughout the fiscal year. Since we are calculating expected revenues for the entire year we assumed half of total customers will generate revenues for the entire year.
- (4) Revenues are based on existing rates for the Eastern Davie sewer system and use current average sewer flow per customer of 4,800 gallons per month. Project will not be completed until September 2020 which means customers can not be added until FY 2021.
- (5) Bermuda Run will become a wholesale customer and connect to the new Eastern Davie sewer system. Wholesale revenues have been calculated assuming the calculated wholesale rate estimated at the time of this analysis and applied to Bermuda Run's estimated sewer flow of 106,000 gallons per day. The wholesale rate is preliminary and is estimated on information obtained as of October 2017.
- (6) Net present value reflects estimated revenues over 20 years and discount rate set at the cost of debt for the SRF loan used to fund the project.

Probable Cost Estimate

Opinion of Probable Project Cost
 East Davie WW Collection System
 Davie County, NC
 HIGHFILL Project No. DAV1502

By: JAA
 10/11/2017

FINAL DESIGN

Item	Quantity	Units	Unit Cost	Extended Total
Mobilization	1	LS	\$ 627,000	\$ 627,000
Yadkin River PS Improvements	1	LS	\$ 266,000	\$ 266,000
Smith Creek PS Demolition	1	LS	\$ 35,000	\$ 35,000
Bermuda Run West PS	1	LS	\$ 1,522,000	\$ 1,522,000
East Davie Transfer PS	1	LS	\$ 2,036,000	\$ 2,036,000
Pipeline Work (Unit Price):				
Clearing and Grubbing	1	LS	\$ 266,000	\$ 266,000
8" PVC Force Main - Non-Restrained	4,170	LF	\$ 37	\$ 154,290
8" PVC Force Main - Restrained	330	LF	\$ 55	\$ 17,985
8" DI Force Main - Non-Restrained	100	LF	\$ 68	\$ 6,800
16" PVC Force Main - Non-Restrained	4,530	LF	\$ 95	\$ 430,350
16" PVC Force Main - Restrained	1,810	LF	\$ 123	\$ 199,030
16" DI Force Main - Non-Restrained	130	LF	\$ 115	\$ 14,950
16" DI Force Main - Restrained	200	LF	\$ 155	\$ 31,000
20" DI Force Main - Non-Restrained	25,990	LF	\$ 135	\$ 3,503,250
20" DI Force Main - Restrained	4,910	LF	\$ 198	\$ 972,180
20" Steel Casing Pipe	220	LF	\$ 320	\$ 70,400
32" Steel Casing Pipe (0.375" Thickness)	490	LF	\$ 500	\$ 245,000
32" Steel Casing Pipe (0.5" Thickness)	130	LF	\$ 550	\$ 71,500
24" HDPE Horizontal Directional Drill	600	LF	\$ 1,000	\$ 600,000
18" PVC Sanitary Sewer:				
8'-8" Depth	2,235	LF	\$ 79	\$ 176,805
8'-10" Depth	540	LF	\$ 81	\$ 43,740
10'-12" Depth	487	LF	\$ 87	\$ 42,400
16'-18" Depth	165	LF	\$ 106	\$ 17,490
8" PVC Gravity Sewer	150	LF	\$ 55	\$ 8,250
36" DIP Gravity Sewer	23	LF	\$ 820	\$ 18,860
5' Dia. Precast Concrete Manhole:				
8'-10" Depth	7	EA	\$ 6,000	\$ 42,000
10'-12" Depth	3	EA	\$ 8,000	\$ 24,000
12'-14" Depth	3	EA	\$ 9,600	\$ 28,800
>14' Depth	1	EA	\$ 10,500	\$ 10,500
6' Dia. Precast Concrete Manhole	2	EA	\$ 12,000	\$ 24,000
3' Dia. Precast Dog House MH	1	EA	\$ 6,000	\$ 6,000
Connect FM to MHs	2	EA	\$ 2,000	\$ 4,000
6' MH Risers and 36" Gravity Sewer Connection	1	LS	\$ 16,000	\$ 16,000
Fittings	34,300	LB	\$ 8.60	\$ 294,980
8" Plug Valve (MJ)	2	EA	\$ 4,500.0	\$ 9,000
20" Plug Valve (FL)	1	EA	\$ 20,000.0	\$ 20,000
6'x6' Valve Vault	1	LS	\$ 13,000.0	\$ 13,000
Air Release Valve Assembly	18	EA	\$ 12,000	\$ 216,000
Retaining Wall Repair	45	LF	\$ 200	\$ 9,000
Brick Wall Repair	15	LF	\$ 500	\$ 7,500
Asphalt Road Repair	118	TON	\$ 220	\$ 25,960
Asphalt Driveway Repair	760	LF	\$ 44	\$ 33,440
Concrete Driveway Repair	230	LF	\$ 145	\$ 33,350
Gravel Driveway Repair	1,000	LF	\$ 32	\$ 32,000
Soil Driveway Repair	75	LF	\$ 32	\$ 2,400
Sidewalk Repair	5	SY	\$ 56	\$ 280
Curb & Gutter Repair	35	LF	\$ 56	\$ 1,960
RCP Stormwater Pipe:				
12" RCP	275	LF	\$ 48	\$ 13,200
15" RCP	75	LF	\$ 50	\$ 3,750
18" RCP	200	LF	\$ 58	\$ 11,600
Fence Gate	3	EA	\$ 2,000	\$ 6,000
Anti-Sleep Collar	20	EA	\$ 1,700	\$ 34,000
Rock Excavation	306	CY	\$ 85	\$ 26,010
Stabilization Stone	1,770	TON	\$ 60	\$ 106,200
Class 1 Rip-Rap	450	TON	\$ 65	\$ 29,250
Select Backfill	3,020	CY	\$ 55	\$ 166,100
Erosion Control Measures	1	LS	\$ 456,000	\$ 456,000
Material Testing Allowance	1	LS	\$ 87,000	\$ 87,000
Bonds & Insurance	1	LS	\$ 251,000	\$ 251,000
Subtotal				\$ 13,442,000
Contingency (10%)				\$ 1,344,200
Property Acquisition (See Note 2)				\$ 168,000
FM and SS Easements (See Note 3 & 4)				\$ 573,000
Professional Services				\$ 2,098,000
Project Budget				\$ 17,625,200

Notes:

- 1 Construction costs based on recent similar projects adjusted to 2016 year costs.
- 2 Cortmatzer property (EDT PS) purchased for \$136,000, assume \$42K per acre for BRW PS.
- 3 The project consists of variable width easements @ \$1/SF.
- 4 Golf course restoration cost included in FM and SS Easement costs. Assumed approximately 30,000 SF of restoration at \$1.00/SF.