Gresham Smith

South Fulton Wastewater Capacity Study

February 2021

Fulton County Department of Public Works

Version 06

Gresham Smith Project No. 43819.04

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Georgia

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Acronyms/Abbreviations

CoA	City of Atlanta
DDR	Design Development Report
DPW	Department of Public Works
DWM	Department of Watershed Management
EPA	Environmental Protection Agency
EPD	Environmental Protection Division
GIS	Geographic Information System
NPDES	National Pollutant Discharge Elimination System
PDR	Preliminary Design Report
RFP	request for proposal
CCWRF	Camp Creek Water Reclamation Facility
WRC	Water Reclamation Center
WRF	Water Reclamation Facility
WTP	Water Treatment Plant

Definition of Units

ac	acre
cfs	cubic feet per second
ft	feet
gpd	Gallons per day
gpm	gallons per minute
in	inch
mgd	Million gallons per day
sf	square feet

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1. Executive Summary

Fulton County Department of Public Works commissioned the South Fulton Wastewater Capacity Study to evaluate infrastructure needs in the South Fulton service area through a planning horizon of year 2050 - 2059. The study area focused on the sanitary sewer network managed by Fulton County within the cities of Chattahoochee Hills, College Park, East Point, Fairburn, Palmetto, South Fulton, and Union City, as well as portions of Tyrone and Atlanta. Gresham Smith solicited input from each of these cities to understand their future flow projections – both quantity of flow, and where the cities expect it to originate.

Based on the Cities input, Gresham Smith updated the County's wastewater collection system hydraulic model to capture growth scenarios for the milestone years of 2020, 2030, 2040, and 2050. Infrastructure needs were then assessed for each milestone year according to available hydraulic capacity in the system.

Gravity sewers were examined based on percent full, in which pipes exceeding 75% depth were prioritized for upsizing. Pump stations were evaluated to ensure adequate firm pumping capacity (i.e. capacity with the largest pump out of service) for maximum influent flow conditions. New facilities including new pump stations, force mains, and gravity sewers were extended to growth areas within the cities of Chattahoochee Hills and South Fulton, for areas managed by Fulton County.

Across the planning horizon, the Study projects a total of 122,500 LF of new gravity pipe, and forecasts 34,600 LF of existing gravity pipe requires upsizing due to lack of hydraulic capacity. Additionally, 92,700 LF of new force main is proposed, three existing pump stations are upsized and eight new pump stations are proposed. The Study developed planning level capital improvements budgets for each of the recommended project types, escalated to the respective planning year, as summarized in Table 1-1.

Table 1-1 CIP Summary Costs

Project Type	2020 – 2029	2030 – 2039[1]	2040 – 2049[1]	2050 – 2059[1]
Upsized Gravity Sewer	$-	$20,755,000	$49,530,000	$36,735,000
New Gravity Sewer	$16,720,000	$109,630,000	$18,975,000	$-
New Force Main	$68,120,000	$6,160,000	$-	$-
New Pump Station	$4,975,000	$865,000	$1,350,000	$-
Upsized Pump Station	$655,000	$190,000	$810,000	$1,015,000
Camp Creek WRF Expansion[2, 3]	$25,000,000	$225,000,000	$-	$-
Total	$115,470,000	$362,600,000	$70,665,000	$37,750,000

[1] Costs escalated 5% per year, and not compounded annually.
[2] Phasing of expansion to be considered in preliminary engineering.
[3] Refer to Section 8.7 for basis of WRF expansion costs.

The results from the Capacity Study culminate to recommend expansion of the Camp Creek Water Reclamation Facility from 24 MGD to 48 MGD, with a design phase forecast to begin in 2025 followed by construction beginning in 2027. The expansion requires concept development that was outside the scope of this Study, and therefore these costs are not reflected in the table above.

The recommendations of this Study are flexible and can be adapted based on where growth occurs (particularly as pertains to Chattahoochee Hills and South Fulton) and whether it occurs at the anticipated pace. Accompanying recommendations are provided for targeted flow monitoring, pump station capacity verification, and model input data refinement. The ultimate objective of this Study is to provide Fulton County Department of Public Works with a capital and financial planning tool, as well as an updated calibrated hydraulic model, which serves as a guide to the County's growth and funding decisions in South Fulton for several decades in response to city stakeholder and ratepayer needs.

2. Introduction

Cities within the South Fulton service area currently predict that development will accelerate therefore Fulton County Department of Public Works commissioned this Capacity Study to evaluate infrastructure needs in South Fulton specifically through a planning horizon of 2050 - 2059.

This evaluation will address the following objectives:

- Develop wastewater flow forecasts for each of the South Fulton cities;
- Assess pipe capacities to determine, on a hydraulic basis, which pipes require upsizing;
- Assess pump station capacities to ensure adequate firm capacity through the planning horizon;
- Identify increased capacity needs at the Camp Creek Water Reclamation Facility (CCWRF)
- Provide planning level capital costs for recommended infrastructure improvements.

The Study will also update the County's existing hydraulic model encompassing the South Fulton service area, which is based on gravity sewers 12" in diameter and greater. The study area is limited to South Fulton which includes the sanitary sewer network managed by Fulton County within the cities of Chattahoochee Hills, College Park, East Point, Fairburn, Union City, Palmetto, and South Fulton, as well as portions of Tyrone and Atlanta. The planning horizon encompasses four milestone years: 2020(current day), 2030, 2040, and 2050.

A map of the South Fulton service area with existing sewers, based on the County's GIS database, is captured in Figure 2-1.

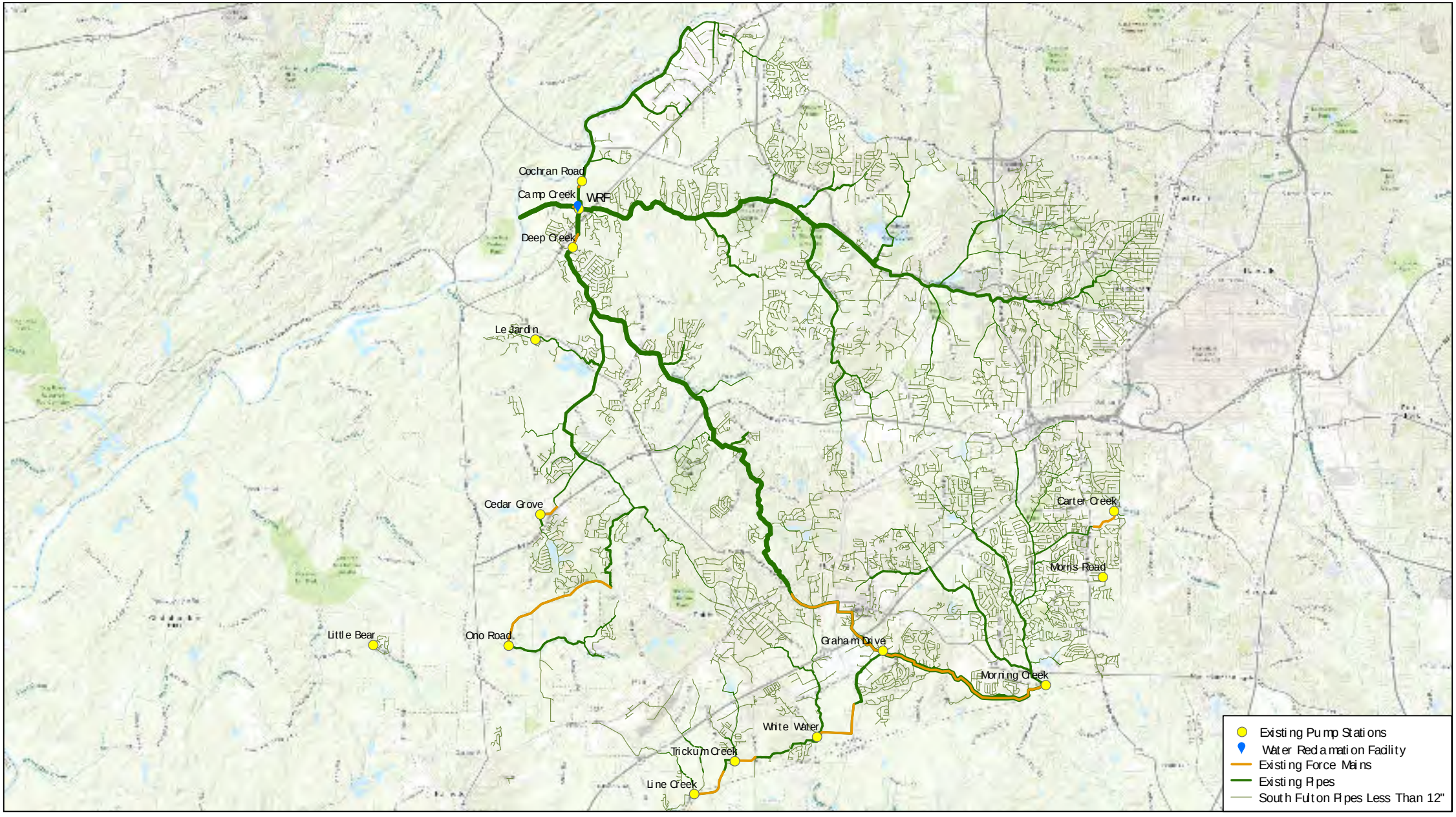

Figure 2-1 Existing Collection System

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3. Project Summary

The South Fulton collection system is comprised of several basins: Utoy Creek, Wilson Creek, City of East Point, City of College Park, Camp Creek, Morning Creek, Deep Creek, Tuggle Creek, Pea Creek, Little Bear Creek, White Water Creek, Line Creek, Pine Mill Creek, White Oak Creek, and Cedar Creek. The original 2007 hydraulic model was loaded with "subcatchments" across these basins to estimate dry weather and wet weather flows with a model storm.

This evaluation originally set out to model extreme wet weather flows. However, upon further discussion with Fulton County, it was determined to be more reasonable to examine historical average flows. Therefore, historical meter data from the full year of 2019 was averaged, to capture both dry and wet weather flow conditions. These average flow values were then escalated out to year 2050 based on input from the individual cities, and flows were geocoded into the model based on actual growth area projections for each city to best represent disaggregation of flows.

A combination of permanent billing meters and portable meters were used to validate the geocoded flows and calibrate the model. Gresham Smith conducted stakeholder meetings with each of the South Fulton cities, on the County's behalf to obtain flow projection data.

3.1 Project Background

Several historical documents were reviewed as part of this Capacity Evaluation.

3.1.1 Previous Studies, DDRs, Reports

This Study includes a review of historical studies and Design Development Reports (DDRs). Below is a summary of Metropolitan North Georgia Wastewater Plans, Fulton County Master Plans and previous Collection System Models. A summary of Comprehensive Plans from each City included in the Model is provided in Section 3.3.

3.1.1.1 Metropolitan North Georgia Wastewater Plan

The Metropolitan North Georgia Water Planning District ("Metro Water District" or "District") was established by the Georgia General Assembly in 2001 (O.C.G.A. §12-5-572) with the purpose of serving as a water planning organization, with guidance to establish policy and plans. In 2003 JJ&G prepared the first edition of the *Metropolitan North Georgia Water Planning Districts (District) Long-Term Wastewater Management Plan* (WW Plan). By Law (Senate Bill 130) the WW Plan is to be reviewed annually by the District and updated every 5-years to provide 30-yr. wastewater projections and plan for the Metro Atlanta area.

In 2003, the District oversaw 233 wastewater treatment facilities (103 facilities were publicly owned) with a total capacity of 723 MGD, while 21% of the wastewater generation in the District was treated through septic tank systems. The 2003 WW Plan included the proposed construction of 6 new wastewater treatment facilities, expansion of 39 existing facilities, and retiring 61 existing facilities, for an estimated 345 MGD of additional treatment capacity needed by 2030. The Camp Creek WRF expansion from 11.0 MGD to 24.0 MGD was, completed in 2005. Previous study efforts in 2009 and 2017 have identified increased needs at Camp Creek

WRF. Expansion of Camp Creek WRF to 24.0 MGD was expected to provide capacity requirements through 2035.

3.1.1.2 Fulton County Master Planning

Fulton County revised their 1999 *Water and Wastewater Master Plan* in 2007 through the assistance of JJ&G. The report projected wastewater flows for basins in the County not served by City of Atlanta to increase from current condition of 55 MGD to 80 MGD in 2025. In 2006, peak month flow rates at Camp Creek WRF were 66% of the facilities permitted capacity. To meet wastewater capacity requirements the County had developed approximately twenty agreements with neighboring jurisdictions, with a total of 7.1 MGD flow allocation for Camp Creek WRF. Utoy Creek and Camp Creek WRFs capacity optimization was proposed with the addition of pump stations to divert up to 5 MGD. The report noted the expansion of Camp Creek WRF was deemed necessary, with an additional 4.0 MGD of treatment capacity requirements by 2035. (Jordan Jones & Gouldng June 2008)

3.1.2 Collection System Model

Black and Veatch developed a Collection System Model ("Model") and master plan for Fulton County Department of Public Works, Water Services Division.

The Model is managed by County staff with ongoing updates and scenarios routinely run. The County is working on importing piping 8" and larger for the micromodel. The macromodel, however had not been updated since development in 2007 and did not include recently constructed pipeline networks and pump stations, as shown in Figure 3-1. Existing but missing sections included the Ono Road pump station and upstream piping, Camp Creek pump station and piping directly adjacent to it, Morris Road pump station, and piping to the City of East Point. Several small segments of piping, mostly in upstream portions of the model, were missing throughout. Furthermore, many pipe segments in the model were missing actual invert data and were inferred. Lastly, there were discrepancies between pump station data in the model and pump station data provided by Veolia (County operations staff) for individual pump capacities, pump on and off levels, and wet well invert levels.

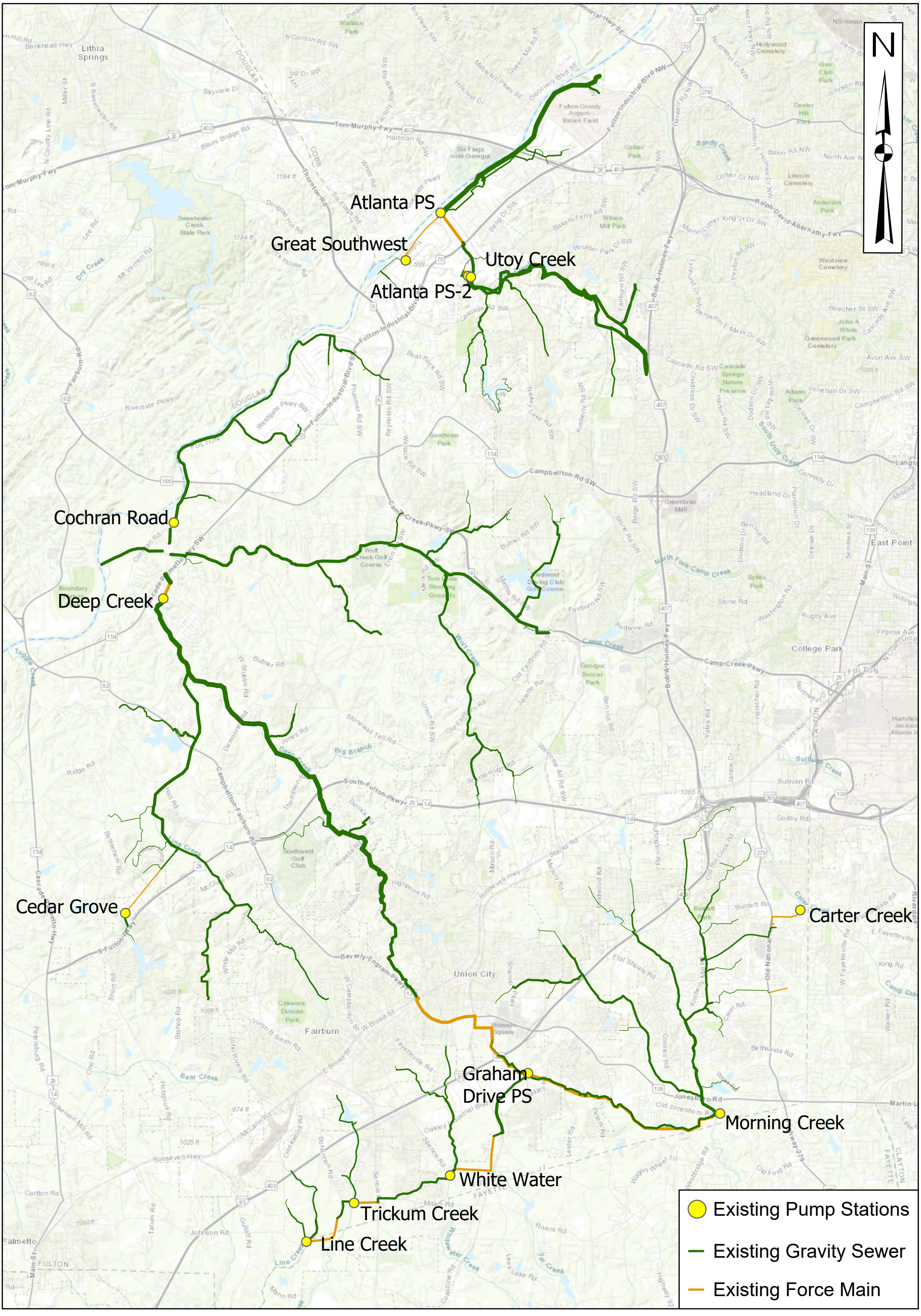

Figure 3-1 2007 Model

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3.2 Scope of Work

The core objective of this evaluation is to provide Fulton County with a CIP budget for decades following 2020, 2030, 2040, and 2050 that will enable the County to keep pace with growth and development in South Fulton.

3.3 Basis of Design

3.3.1 South Fulton City Coordination

Gresham Smith performed one-day workshops with each South Fulton city to discuss comprehensive plans, development forecasts and wastewater flow data to update the existing model. Development projections, population projections and wastewater flow estimation documentation were provided by DPW Stakeholders and reviewed for model preparation.

3.3.2 Wastewater System Inventory

South Fulton includes one treatment facility – CCWRF – and 18 pump stations, 9 pump stations of which were included in the 2007 model, and 13 existing and 8 new pump stations were included the updated model. The remainder of the existing pump stations service lines less than 12 inches, which were not included in this assessment. The following linear feet of pipe are in the South Fulton system according to the 2007 model, as detailed in Table 3-1.

Table 3-1 Summary of Piping in 2007 Model

Diameter (in)	Length of Piping (ft)
8	6,400
10	1,800
12	123,200
14	2,400
15	52,800
16	13,700
18	71,500
20	1,400
21	23,700
24	155,100
27	6,000
30	24,500

Diameter (in)	Length of Piping (ft)
33	4,900
36	53,900
42	55,500
48	75,700
54	200
60	19,200
66	900
72	36,600
Total	**729,400**

The 2007 model includes a portion of the South Fulton sewer system which drains to Utoy Creek Water Reclamation Center (UCWRC). These values include all piping in the 2007 model, those that drain to CCWRF and UCWRC as well as both gravity sewer and force main.

Chattahoochee Hills is not currently sewered and therefore was not included in the existing model. Some areas of the City of South Fulton were also not sewered. Chattahoochee Hills may ultimately be served and maintained by Fulton County, and therefore the model was updated to reflect sewering Chattahoochee Hills by making sewer available through a regional pump station in the case of Chattahoochee Hills. Fulton County currently manages the entire sewer system for the City of South Fulton therefore sewer was extended in the model to be available for service taps for the other South Fulton cities. Linear infrastructure will be developed and owned by those respective cities, so no new pipes were illustrated in those jurisdictions.

Proposed pump stations were created based on proposed development in Chattahoochee Hills and added to the model. The Foxhall development was proposed providing connections through Little Bear, which is currently a wastewater package plant owned and operated by Fulton County proposed to be converted to a pump station. Similar pump stations were placed to serve Bouckaert Town Center, Serenbe Farms, Wilkerson Mill Hamlet, and Friendship Village.

Proposed piping in the City of South Fulton was served primarily by gravity sewer. Manholes for gravity sewer segments were positioned approximately every 400-ft, connecting the developments, proposed pump stations, and existing pump stations. Proposed force mains (increasing topography) and gravity sewers (decreasing topography) were identified and added to the model and are shown in Figure 3-2 according to build-out conditions in 2050.

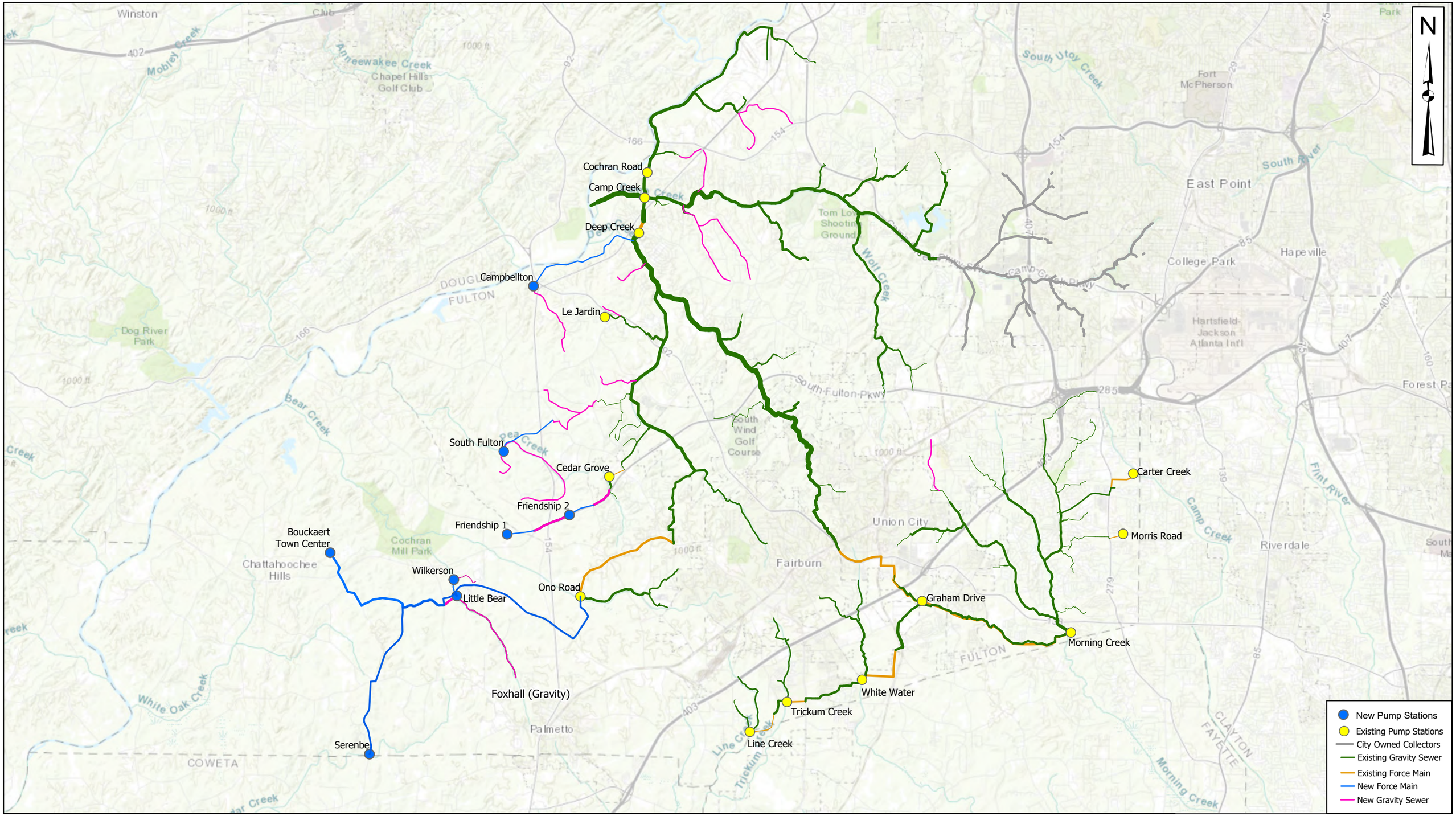

Figure 3-2 Updated Model for 2050 Build-out Conditions

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3.3.3 General Criteria for Upsizing Pumps

To determine which pump stations require upsizing, this Study evaluated the cumulative flow and maximum flow entering each pump station. If either the cumulative or maximum flow value was greater than the firm capacity of the pump station, the pump station was upsized in the model. Pump stations were upsized by increasing the firm capacity of the pumps to match the 2050 planning year firm capacity with the cumulative and maximum flow entering the pump station. For existing pump stations, the final pump station capacity at year 2050 was determined and pumps were upsized one at a time as capacity was reached in each planning year.

Additionally, this Study examined maximum force main velocities. All existing force main velocities were projected not to exceed 10 feet per second therefore, no force main upsizes were recommended. New pump stations were originally sized for planning year 2050 conditions. For new pump stations with two pumps, the pumps were modeled for 2050 conditions in 2020. For pump stations with three pumps, two pumps were input for the year 2020 and the third pump was added in 2040 to meet 2050 conditions. All new force mains were sized to experience velocities between 2 and 10 feet per second for each planning year.

3.3.4 Fulton County Intergovernmental Agreements

The cities within South Fulton County that maintain their own sewer system but tie into the greater Fulton System have formal agreements for allotted flow into Camp Creek WRF, known as Intergovernmental Agreements (IGA). Table 3-2 shows the flow allocations based on current IGAs. Figure 3-3 shows the boundaries of each City in South Fulton.

Table 3-2 Individual City Flow Allocations

City	Flow Allocation (MGD)	2019 Average (MGD)	% of Flow Allocation
Chattahoochee Hills[1]	-	0	-
College Park	2.23	1.31	58.7%
Fairburn	1.50	1.09	72.7%
Palmetto	1.00	0.75	75.0%
Union City	3.00	1.97	65.7%
Atlanta[2]	3.60	2.42	67.2%
East Point	1.80	0.90	50.0%
Tyrone	0.40	0.15	37.5%
Fulton County Direct Customers[1]	-	(7.36)	-
Total (MGD)	**13.53**	**8.59[3]**	**63.5%**

[1] These areas do not have an IGA or flow monitoring. Includes City of South Fulton and Fulton Industrial Boulevard.
[2] City of Atlanta flow allocation for peak wet weather is 9.00 MGD
[3] Doesn't include flow from Fulton County Direct Customers, only allocated flow.

IGA sewer capacity allocations will need to be renegotiated and increased for each contributing city based on their flow projections (planning year, and amount) and in coordination with the capacity increases at the Camp Creek WRF.

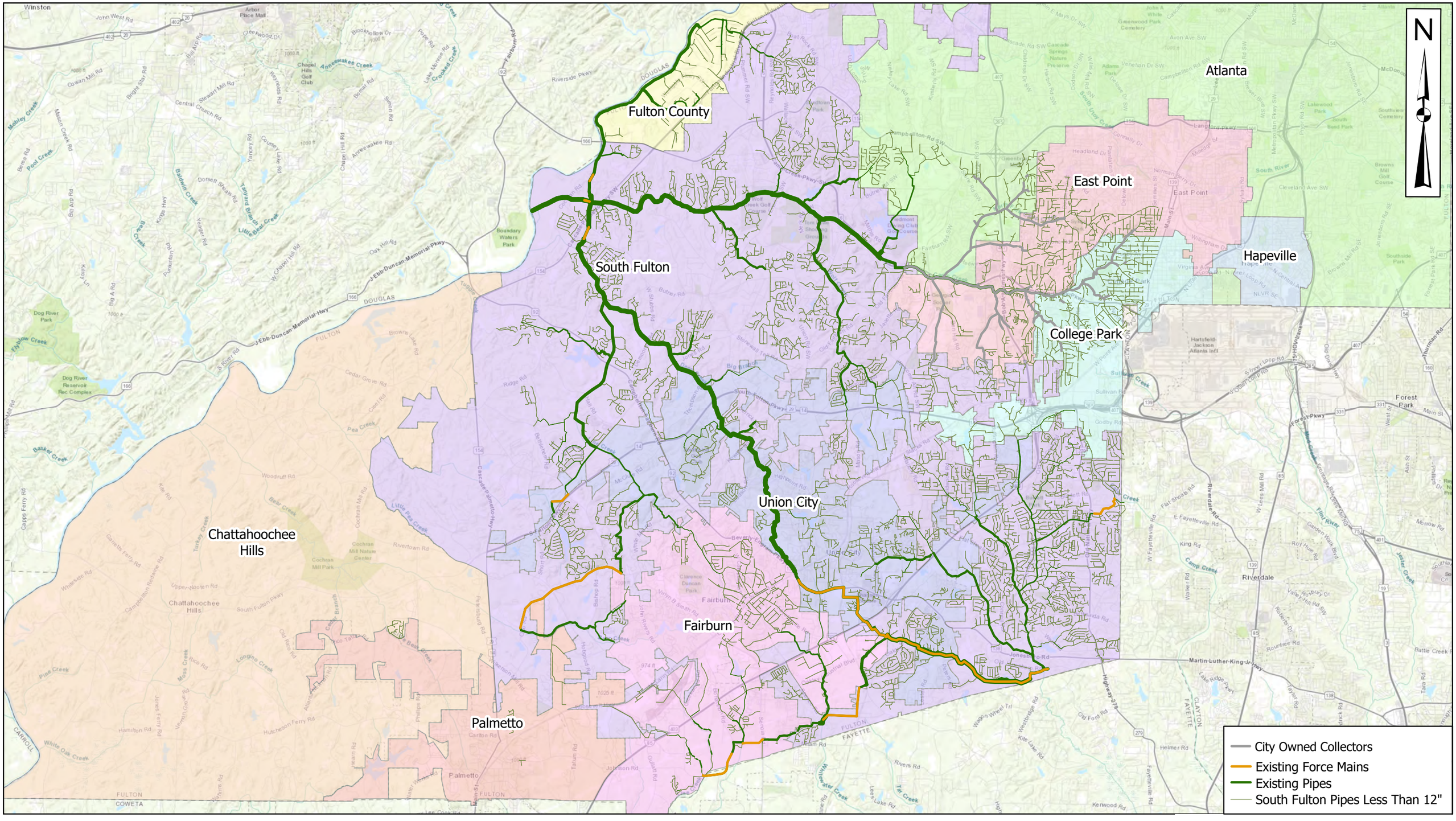

Figure 3-3 City Boundaries

3.3.5 Fulton County Billing

For South Fulton areas with currently existing Intergovernmental Agreements (IGAs), Fulton County bills these cities based on flow data from billing meters. Figure 3-4 shows the location of the meters used for billing. Refer to Figure 3-5 for locations of calibration meters. In some cases, the billed meters do not account for all flow entering the South Fulton system from each City. As part of the modeling effort, this Study identified several areas where flow may be entering the system unbilled. Using a combination of historical data from additional meter locations and building counts, projections for areas lacking flow data were developed and added to the Model. Table 3-3 lists the meter IDs used for billing for each city along with any additional meters used to account for all flow entering the South Fulton system.

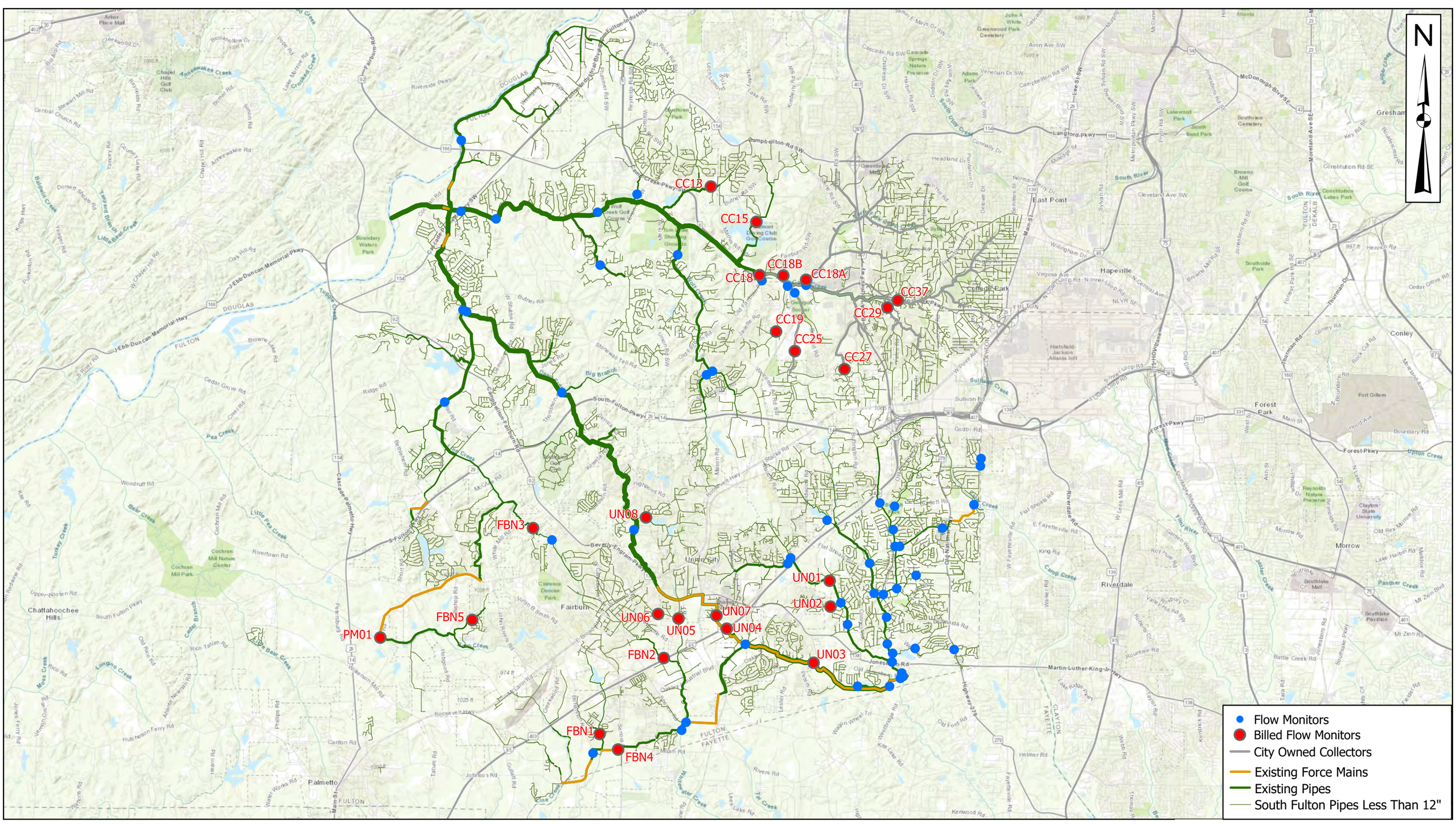

Figure 3-4 Billing Meters in South Fulton

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Table 3-3 Billing Meters for Each City

City	Billed Meter ID	Additional Meter ID[1]
Chattahoochee Hills[2]	-	-
College Park[3]	CC29[4]	MC59[5]
	CC37[4]	
Fairburn	FBN1	LC01
	FBN2	WW70
	FBN3	WW62
	FBN5	Unmetered Warehouses[6]
Palmetto[7]	PM01	
Union City[3]	UN01	MC59[5]
	UN02	Unmetered Housing[9]
	UN03	South Fulton Parkway[10]
	UN04	GDPS
	UN04	
	UN06[8]	
	UN07[8]	
	UN08	
South Fulton[11]	-	-
Atlanta	CC18A[4]	
	CC18B[4]	
	CC15	
	CC13	

City	Billed Meter ID	Additional Meter ID[1]
East Point[3]	CC18	
	CC18A[4]	
	CC18B[4]	
	CC19	
	CC25[12]	
	CC27[12]	
	CC29[4]	
	CC37[4]	
Tyrone	FBN4	
Fulton Industrial Boulevard (FIB)[13]	-	WW68
	-	FIB Warehouses[14]

[1] Meter ID listed for any additional meters used to account for full originating from each city. 2019 average flows were used to project future planning years. Additional sources other than flow meters identified in footnotes.
[2]No billed meters currently exist for City of Chattahoochee Hills as developments are proposed for 2020.
[3] Cross flows from other cities subtracted or added in the billing process.
[4] Duplicate Meter within the system, added in one city and subtracted from another for billing purposes
[5] MC59 flow is split between College Park and Union City based on manhole count
[6] Unmetered warehouses determined by area calculation and typical flows by Gresham Smith
[7] Fulton County began subtracting flow from meters FBN5 and PM02 from PM01 in late 2019. Since PM02 did not have flow collected for the entirety of 2019, these meters were not used in the projections for Palmetto.
[8] Meter UN06 and UN07 subtracted from billing to Union City but not added elsewhere for billing.
[9] Unmetered housing flow data provided by Fulton County
[10] South Fulton Parkway flow data and projections provided by Union City
[11] South Fulton is a direct customer and not billed through use of billed meters
[12] CC25 and CC27 subtracted from East Point but not added elsewhere because they capture flow originating from City of South Fulton
[13] FIB is a direct customer and not billed through the use of billed meters
[14] FIB warehouse data provided by Fulton County
Highlighted meters are subtracted from the City's billing

3.3.6 Base Flow Loading – City Wastewater Flow Projections

Updated wastewater flow projections were prepared for each South Fulton city contributing flow to Camp Creek WRF for each decade from 2020 to 2050. The current and future flow projections were redistributed per city in the model to update inflow conditions for 2020 base flow loading.

The following outlines summary descriptions on how future flow projections were distributed in each city:

3.3.6.1 City of Chattahoochee Hills

Chattahoochee Hills was officially charted in 2007, with a population of 2,804 persons in 2016. The *City of Chattahoochee Hills Comprehensive Plan Update 2016* expresses the goal of its citizens to maintain and embrace the rural character of the city. Regulations are poised for land preservation, clustering development in towns, villages, and hamlets. Developments are to be designed to provide suburban environment while maintaining much of the natural rural landscape, and commercial development to be designed to maintain integration with surrounding land use. Chattahoochee Hills land uses of Hamlet Developments include Mixed-Use, Residential and Special Districts with dense pedestrian oriented housing nodes. In 2007, the City had a population growth rate of 1.9%, with 1350 residential homes, with approximately 100 units vacant. Population was expected to grow steadily from 2,804 persons in 2016 to a projected population of 3,131 persons in 2020 according to the Atlanta Regional Commission. Chattahoochee Hills's own projections for future growth are substantially escalated from these historical real and projected rates. Key developments within Chattahoochee Hills in addition to other hamlets include Bouckaert, Serenbe, Friendship, Wilkerson, and Campbellton; it may also include Foxhall, which for the purposes of this report was carried as a Palmetto development.

The City of Chattahoochee Hills was established in 2007 and was not included in the model previously, as it is unsewered. Pump stations were created in the model for Chattahoochee Hills developments and applied flow according to each developments' pump station according to each milestone year with projections as provided by the City of Chattahoochee Hills.

Summary of Model base flow loading include:

- Development projections provided by the City for each decade, developments include: Bouckaert, Serenbe, Friendship, Wilkerson, Foxhall, Campbellton, and other Hamlet developments.
- A pump station was added to the model for planned developments, as necessary, and flow applied to the upstream node of the pump station according to milestone decade. Due to uncertainty of location for other Hamlets, those flow projections were split evenly between each development.

The proposed Bouckaert development is routed into the Little Bear pump station and ultimately into the Ono Road pump station. This Study evaluated the option to route Bouckaert along a northern route to the Cedar Grove pump station, but this is not cost-effective because of elevation changes that would require several repumping stages. Alternatively, Friendship Village was routed to Cedar Grove pump station to relieve a portion of the additional flow contributions through the Ono Road pump station.

3.3.6.2 City of College Park

The City of College Park prides itself on being a diverse and forward-thinking community, with goals including community engagement and future success. In 2014, the Comprehensive plan listed a population of 11,796 persons with a 2.51 household size. The city had 5,926 residential housing units with a negative 0.5% change from 2010 to 2014. Housing vacancy increased to 25.3% in 2014. Of the City's 5,769.1 acres, 1,346.1 acreage was undeveloped in 2014 (The Collaborative Firm, LLC 2016). The City is working hard to promote development, employment opportunities and strong sense of community which is reflected in its development plan. Airport City, one of the largest proposed developments, includes an additional 3,000 acres of undeveloped land, proposed to be developed over the next decades, with completion projected for 2050. Others are Wally Park,

Folia Group, the Felderworth property, Gateway Center, and 368 acres of undeveloped land at Interstate 85/285.

Fulton County currently collects College Park flows at two billed meter locations, CC29 and CC37. Additionally, a portion of College Park flows are collected at meter MC59, which are not billed.

Summary of Model base flow loading include:

- Development projections provided by the City for each decade to be applied to billed meter CC29, and include: Airport City development, Wally Park, Folia Group, Felderworth Property, Gateway Center, and I-85/285 acreage.
- The flow contributing to meter CC37 was kept constant until 2050 and additional flows were added to CC37, as this basin is expected to capture the growth area.
- All flow for CC29 and CC37 was applied at manhole ID SMCC1813340 due to lack of invert data for piping upstream of manhole ID SMCC1813340.
- MC59 captures from College Park and Union City. Flow at MC59 was dividedly evenly between College Park and Union based on the number of manholes.
- Manholes were categorized based on corresponding downstream meter MC59.

$$Wastewater\ flow\ for\ each\ manhole, MC59\ =\ [Calculated\ 2020\ flows, MC59]\ /\ \#\ of\ manholes$$

3.3.6.3 Fairburn

The City of Fairburn has a diverse and growing population which holds the vision to be an economically thriving community and destination including its parks and natural attractions and historical downtown, as expressed in its *City of Fairburn Comprehensive Plan 2015-2025*. Fairburn population was 12,950 in 2010 showing a 137% increase from 2000, with an estimated population of 13,720 in 2012. In 2010 the City was composed of 11,000 acres. Greenspace accounts for 32% of the total area of the City, and agricultural land accounts for 9%. Nearly 5% of the total land area includes developments which have not been completed, representing possible assets for repurposing by the City (The Collaborative Firm, LLC 2015). Today the City projects moderate growth with an estimated population of 15,882 persons in 2020, and nearly doubled to 30,252 persons by 2050.

Fairburn provided flow projections for each of the milestone planning years based on typical gpd residential, commercial, and industrial demands.

Fulton County currently collects Fairburn flows at four billed meter locations, FBN1, FBN2, FBN3, and FBN5. Additional flows are captured at meters LC01, WW70, WW62, and an unmetered warehouse count.

Summary of Model base flow loading include:

- Development projections provided by the City for each decade, developments include: Approximately 900-units of single family and multi-family residential developments (3,623 acres), commercial (712 acres), industrial and office institutional developments (2,672 acres).
- Percentage of total flow to each flow meter was determined by assessment of historical flow meter data for meters FBN1, FBN2, FBN3, and FBN5.
- Total average daily flow projections were divided for each flow meter using historical percentages for meters FBN1, FBN2, FBN3, and FBN5.
- Historical data was used to determine projections for meters LC01, WW70, and WW62.

- Manholes were categorized based on corresponding downstream meters identified for Fairburn.

$$Wastewater\ flow\ for\ each\ manhole, Billed\ Meter\ A = [2020\ Average\ daily\ flow\ *\ \%\ for\ billed\ meter\ A]\ /\ \#\ of\ manholes, Billed\ Meter\ A$$

- Unmetered warehouses projections were based on area of warehouses and typical warehouse flows. The total flow was distributed to the manholes in the vicinity of the warehouses.

3.3.6.4 Palmetto

The City of Palmetto was established in 1833, originally Johnson's Store, and nearly 100 years later became part of Fulton County. The City prides itself of being a small historic town and strives for a future attracting small business, quality of life and innovation. The City was losing population until the 2000s, with a 40% population growth between 2000 and 2013 with 4,770 persons. The City of Palmetto 2017 Compressive Plan Update includes initiatives for families and small business, centered around sustainability and safety (Atlanta Regional Commision 2017).

Palmetto is expecting near built-out conditions by 2050. Near term growth projections were based on actual proposed developments in permitting or planning phases. 2040 and 2050 projections were based on otherwise undeveloped land tracts remaining in the City.

Summary of Model base flow loading include:

- Development projections were provided by the City for each decade, with developments including: Palmetto Oaks, Carlton Point, Princeton Village, DaVita Dialysis, Palmetto Industrial, Riverchase, Townhome East, Brent Scarborough's, Commercial Park, EMC expansion, Townhomes West, Princeton Village expansion, Industrial Part, Cotton Mill renovation, Main Street developments, North Village, and commercial and office developments.
- All flows from the City discharge into Fulton County at one manhole located near the Ono Road Pump Station, SMLB0120421. All projections loaded into the model were therefore assigned to one manhole location for Palmetto.

3.3.6.5 Union City

The City of Union City was charted in 1908, and in 2006 acquired 5,300 acres of property to the west of the City, for a total area of 10,827 acres. The *2015 Union City Comprehensive Plan Update* includes proposed development of residential, commercial and industrial centers to enhance future growth of the City. From 2000 to 2015 population had increased by 74% to 20,260 persons. Housing was projected to increase to 9,714 units in 2020 with approximately 10% vacancy rate. The TAD financing initiative provides additional development opportunities for the mall site and 4,000 acres along the South Fulton Parkway, including the Atlanta Metro Studios and Colliers Internationals developments in late 2014. The City proposed growth to strengthen the community through future development, reinvestment, and a strong economic base (MACTEC 2015).

Fulton County currently collects Union City flows at 8 billed meter locations. Flows from meters UN01, UN02, UN03, UN04, UN05, and UN08 are summed and flows from meters UN06 and UN07 are subtracted from billing to Union City. Additional flows are captured at meters MC59, GDPS, South Fulton Parkway and an unmetered house count.

Summary of Model base flow loading include:

- Development projections were provided by the City for each decade according to billing meter; projections for all flow meters (except UNO6) spanned years 2030, 2040 and 2050. Additionally, development of the S. Fulton Parkway was included for each decade.
    - Determined UN06 by applying a 3% growth rate from historical flow meter data (2019 avg).
- 2020 projections were determined for each flow meter by applying a 3% growth rate backward from 2030 numbers.
- Historical data was used to determine projections for meters MC59 and GDPS. MC59 captures from College Park and Union City. Flow at MC59 was dividedly evenly between College Park and Union based on the number of manholes.
- Manholes were categorized based on corresponding downstream meters identified for Union City.

$$Wastewater\ flow\ for\ each\ manhole, Billed\ Meter\ A = [\ 2020\ flow\ to\ Billed\ Meter\ A] \ /\ \#\ of\ manholes, Billed\ Meter\ A$$

- Unmetered house projections were provided by Fulton County and based on house count and typical household flows. The total flow was distributed to the manholes in the vicinity of the houses.
- SF Parkway area projections were provided by Union City and were divided into six (6) branches.

$$Wastewater\ flow\ for\ each\ manhole, Branch\ 1 = [\ (SF\ Parkway\ Flow)/\ 6\ or\ "Branch\ 1"] \ /\ \#\ of\ manholes\ in\ each\ branch$$

3.3.6.6 South Fulton

The majority of unincorporated South Fulton County was incorporated as the City of South Fulton in 2017. This City has experienced an increase in population and development over recent years as shown in the *2016 Fulton County Comprehensive Plan*. South Fulton population increased to 87,478 persons in 2010 with an estimated population increase of 40.83%. Estimated population in 2035 is projected to reach over 130,000 persons, with growth rate of peaking at 11.14% by 2020 and decreasing to 7.15% by 2035. In 2015, Unincorporated South Fulton County housing increased with 723 permits in 2015, with a vacancy rate of 14.32%. South Fulton proposes development through agriculture, industrial, commercial and residential with focus on building strong communities (Fulton County 2016).

The City of South Fulton used a combination of flow projections based on developments in permitting, and based on population projections.

Summary of Model base flow loading include:

- Development projections provided by South Fulton for the decade of 2020-2030 only, developments include: Morning Creek Forest, Regency, Home2Suites, Towne Place, Bluffs at Camp Creek, Jones Rd subdivision, Renaissance at South Park, Stonewall Tell Tract, Oakley station, Bethsaida Ponte, Halpern's expansion, Oakhurst, Camp Creek Village, Creekside at Oxford Park, Wyncreek Estates and Jones Hall subdivision.
- Population projections were used to estimate flow contributions in 2030, 2040 and 2050. It was estimated that in 2020, 2030, 2040 and 2050 the populations will be 101,486; 121,303; 146,418; and 178,483 persons respectively.

- Manholes were categorized by which council district they are located in, and flows were divided equally per district.

$$District\ Council\ A\ flow\ =\ total\ flow/\ \#\ of\ districts$$

$$Wastewater\ flow\ for\ each\ manhole, District\ Council\ A = [\ District\ Council\ A\ flow] / \#\ of\ manholes, District\ Council\ A$$

3.3.6.7 Atlanta

Atlanta customers are served by South Fulton on the lower southern side of the County. 2019 average flows are approximately 2,420,000 gpd. Atlanta requested a build-out capacity in 2050 of 3,800,000 gpd.

Fulton County currently collects Atlanta flows at four billed meter locations, CC18A, CC18B, CC15, and CC13.

Summary of Model base flow loading include:

- For 2020, flows were escalated at 3% from the 2019 average. For all other milestone years, a straight-line projection was used to arrive at 3,800,000 gpd in 2050.
- The historical flow from each billed flow meter for the City of Atlanta was analyzed to determine the percentage of total flow for each billed meter.

$$\%\ of\ flow =\ billed\ meter\ /\ total\ flow$$

- All manholes upstream were categorized by each billed meter.
- The projected flow for Atlanta was divided by percentage of flow into the billed meter and number of contributing manholes for the billed meter.

$$Wastewater\ flow\ for\ each\ manhole, Billed\ Meter\ A = (2020\ projections\ *\ \%\ of\ flow)\ /\ \#\ of\ manholes\ contributing\ to\ billed\ meter\ A$$

- Meters CC18A and CC18B overlap with East Point flow meters used for billing. The projections for Atlanta were used for East Point, to be conservative, as these values were higher.
    - All flow for CC18B and CC18A was applied at manhole ID SMCC1813340 due to lack of invert data for piping upstream of manhole ID SMCC1813340.

3.3.6.8 East Point

The City of East Point did not participate in the initial stakeholder workshop to develop flow projections, therefore a straight-line flow projection was used to double their flows over the current period through 2050. Notably, East Point had the most substantial inflow and infiltration (I/I) of any South Fulton city, with a demonstrated wet weather peaking factor of 2.47 based on comparison of December 2018 (peak) flows to 2019 average data.

Fulton County currently collects East Point flows at 8 billed meter locations. Flows from meter CC18 are subtracted from upstream meters CC18A, CC18B, CC19, CC25, CC27, CC29, and CC37 for East Point billing.

Summary of Model base flow loading include:

- Current (2019 average) flows from East Point were 900,000 gpd. A flow projection of 1,800,000 gpd was set for 2050, with a straight-line interpolation for 2020, 2030, and 2040.
- Total average daily flow projections and 2019 average numbers were broken out by each flow meter and cross flows were used to determine flow numbers at each flow meter for 2020, 2030, 2040, and 2050 that would total the average daily flow for each decade.
    - Cross flow projections added to CC18 minus all subtracted flow meters.
- Note: Meters CC18A and CC18B overlap with Atlanta, and CC29 and CC37 overlap with College Park flow meters used for billing.
    - The numbers from CC18A and CC18B were used from Atlanta and CC29 and CC37 numbers were used from College Park.
- All East Point flow was applied at manhole ID SMCC1813340 due to lack of invert data for piping upstream of manhole ID SMCC1813340.

3.3.6.9 Tyrone

Tyrone is a minor contributor to the South Fulton sewer system, averaging 150,000 gpd in 2019. Tyrone demonstrated a comparable wet weather peaking factor to East Point, at 2.67, but overall this is applied to a much lower flow contribution.

Summary of Model base flow loading include:

- A 2050 predicted flow of 1,150,000 gpd was programmed for Tyrone, and a straight-line flow projection was used over the period from 2030 to 2050. For 2020, a 3% growth rate was applied.
- The City of Tyrone feeds into Fulton county at one manhole location, SMWW7009390, therefore all flows applied to the Model discharge at the identified manhole location.

3.3.6.10 Summary of Flow Projections

Table 3-4 below summarizes the projected daily flows from each city for each milestone year, in gpd on an average basis. The averages capture a range of dry and wet weather flow data.

Table 3-4 Projected Average Daily Sewer Demand (ADDF), Gallons per day

City	2019 Average (GPD)	2020-2029 (GPD)	2030-2039 (GPD)	2040-2049 (GPD)	2050-2059 (GPD)
Chattahoochee Hills	0	1,587,000	2,152,000	6,694,000	11,034,000
College Park	1,310,000	1,349,000	3,068,000	6,865,000	9,510,000
Fairburn	1,090,000	1,123,000	2,031,000	2,683,000	3,349,000
Palmetto	750,000	773,000	1,176,000	3,049,000	3,164,000
Union City	1,970,000	2,306,000	2,839,000	4,726,000	6,830,000
Atlanta	2,420,000	2,493,000	2,910,000	3,355,000	3,800,000

City	2019 Average (GPD)	2020-2029 (GPD)	2030-2039 (GPD)	2040-2049 (GPD)	2050-2059 (GPD)
East Point	900,000	1,369,000	1,846,000	2,619,000	3,345,000
Tyrone	150,000	155,000	483,000	817,000	1,150,000
Fulton Direct Customers[1]	7,360,000	12,018,000	14,512,000	17,872,000	22,230,000
Total ADDF	**15,950,000**	**23,173,000**	**31,017,000**	**48,680,000**	**64,412,000**

[1] The breakdown for the City of South Fulton and Fulton County direct customers is shown in Table 3-5.

Table 3-4 was sent to each of the stakeholder cities following the flow projection workshops and data assimilation, for confirmation of the plan and flow loadings moving forward into this Study. No further comments were received on the finalized flow projections.

Table 3-5 below details the projected average daily sewer demand for each milestone year for the City of South Fulton and other direct customers which are not billed through a current IGA.

Table 3-5 Projected ADDF for City of South Fulton and Direct Customers

Area	2020 (GPD)	2030 (GPD)	2040 (GPD)	2050 (GPD)
Fulton Industrial Boulevard[1]	911,000	938,000	942,000	923,000
Unmetered Housing in Union City[2]	430,000	578,000	777,000	1,044,000
Meter MC59[3]	400,000	537,000	722,000	970,000
Meter GDPS[4]	1,700,000	2,285,000	3,071,000	4,128,000
Meter LC01[5]	247,000	332,000	446,000	599,000
Meter WW70[5]	302,000	405,000	545,000	732,000
Meter WW62[5]	84,000	112,000	151,000	203,000
Fairburn Warehouses[6]	373,000	486,000	653,000	878,000
City of South Fulton[7]	7,571,000	8,839,000	10,565,000	12,753,000
Total ADDF	**12,018,000**	**14,512,000**	**17,872,000**	**22,230,000**

[1] Estimated based on sum of typical flows for total area of warehouses, commercial use buildings, office buildings, and homes in this area. Area estimates provided by Fulton County. Flow projections estimated by typical flows of each development type.

[2] Estimated by house count. Flow projections provided by Fulton County.
[3] Meter MC59 captures flow from College Park and Union City but is not used for billing. Projections estimated at a 3% growth rate from 2019 average flow.
[4] Meter GDPS captures flow from Union City but is not used for billing. Projections estimated at a 3% growth rate from 2019 average flow.
[5] Meters LC01, WW70, and WW62 capture flow from Fairburn but are not used for billing. Projections estimated at a 3% growth rate from 2019 average flow.
[6] Estimated by total warehouse area and typical warehouse flows.
[7] City of South Fulton provided estimated flow projections.

3.3.7 Geocoding of Milestone Year Flows

3.3.7.1 AADF calibration

Historical data was reviewed for all flow meters (Figure 3-5). Yearly average flow conditions were calculated and added to the projected development wastewater flow projection for all "near term development" (to be completed by 2020), to represent the updated 2020 wastewater flow. This approach allows immediate CIP funding and planning methods to be conservative for near-term growth. The updated (i.e. calculated) 2020 wastewater flow projections were used for model calibration and compared to historical 2019 wastewater flow yearly average data. As shown in the table of Appendix A, historical 2019 values correlate positively with the 2020 flow of the node ID in the model that corresponds to the meter ID in the South Fulton system. The percent difference of the total ADDF between the average 2019 value and the calculated 2020 value is 37%. This average is largely due to meters which capture flow from new development in 2020-2029, such as DC04, not included in the 2019 average. Aside from differences from new development and projection calculations, as noted in the footnotes of Appendix A, most flow monitors experience a percent difference of 2-6%.

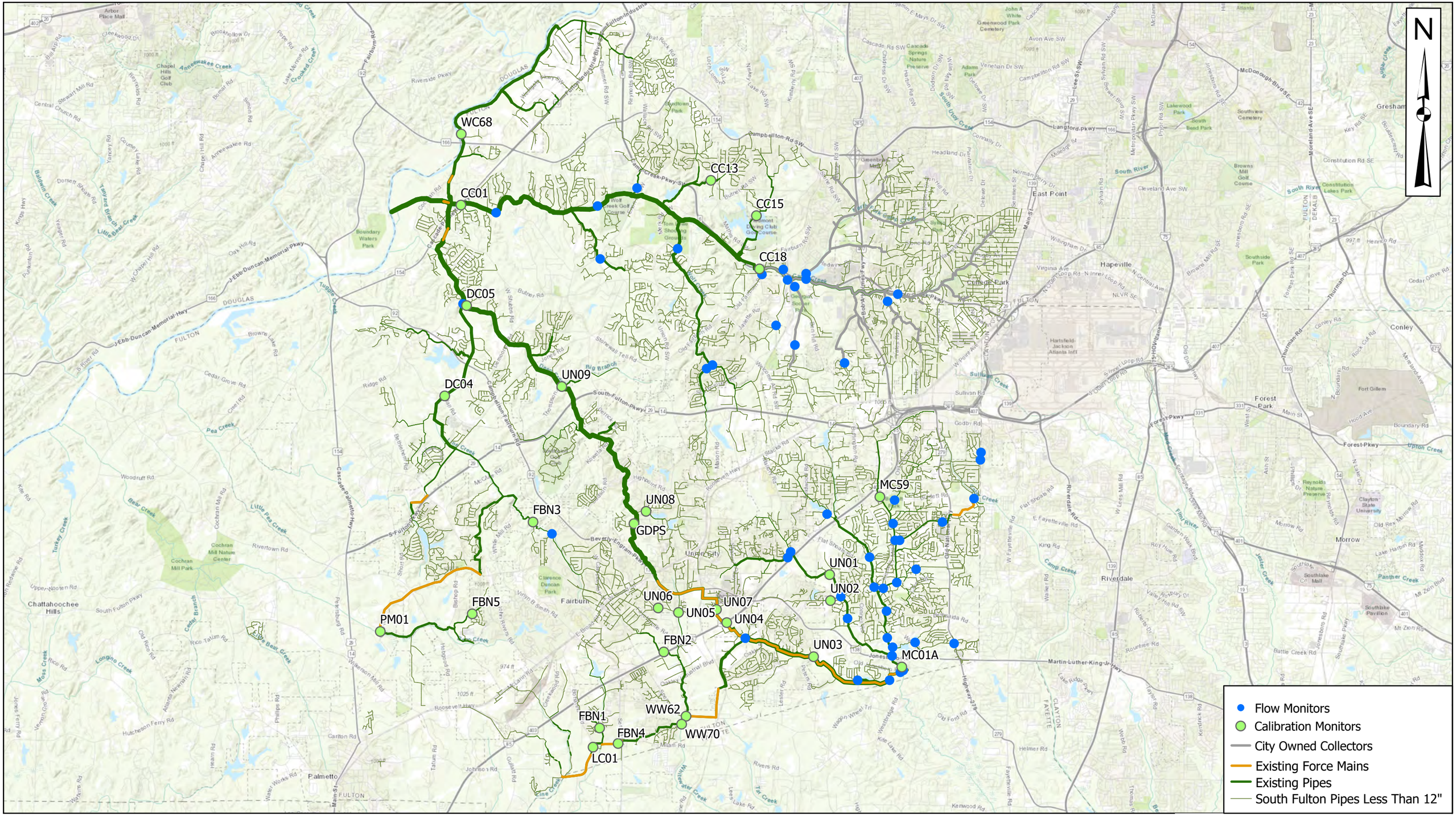

Figure 3-5 Meters Used for Calibration in South Fulton

3.3.7.2 Wet Weather Simulation

A wet weather peaking factor of 1.25 was proposed based on the observed peaking factors from each of the South Fulton cities, and in consideration of future I/I programs that might mitigate the wet weather contribution. However, using average flows (constituting data from both dry and wet weather) proved to generate a CIP in alignment with Fulton County's historical funding allocations. Additionally, flow projections are expected to be conservative, given that; it should be considered that water supply must be developed to facilitate all the projected developments. Therefore, average flows are employed with the understanding that any areas seeing expedited growth from projections might require expedited implementation of their CIP initiatives. For specific CIP projects, the County will conduct detailed analysis using the micromodel.

4. Basis for Capacity Improvements

The objective of capacity improvements is to not exceed the hydraulic capacities of the pipes, pump stations, or treatment plants in any of the milestone planning years (2020, 2030, 2040, 2050).

4.1 Flow Scenario Selections (Design Criteria)

To initiate CIP planning and modeling, the 2020 model was first calibrated, and then the 2050 model was developed as a modification to the 2020 model. Updates from 2020 to 2050 modeling included:

- Addition of pump stations, force mains, and gravity sewers to the City of Chattahoochee Hills developments
- Extension of gravity sewers and a pump station and force main through the City of South Fulton
- Upsizing of pipes that exceed percent full or other sizing criteria
- Upsizing of pump stations that exceed firm capacity or other criteria

The summation of 2050 CIP improvements was estimated and then segmented out by milestone planning year according to priority (based on timing of future growth projected).

4.2 Percent Full Evaluation (>50%, >75%)

Through discussions with Fulton County, it was decided to first examine pipes that peak at more than 75% full, and then to address pipes peaking at more than 50% full, subject to the reasonableness of the resulting CIP.

The pipe full capacity, which can be derived from the ICM model, is based on the Manning's equation but is only meant to be an approximation. Original attempt to analyze pipes used the following query:

(sim.max_ds_flow/capacity) > 0.75)

However, ICM recommends use of the St. Venant equations to determine the results of the percent full analysis; the Manning's equation assumes that the pipe is infinitely long, which can be a skewing approximation and not show surcharging conditions. The St. Venant approach requires the following query:

(sim.max_ds_depth/(conduit_height/12)>0.75) which is based on d/D, or surcharge states.

Table 4-1 summarizes pipe segments exceeding 75% by the planning year of when exceedance occurred. Appendix B includes the detailed table of each pipe segment exceeding 75% full. Appendix C includes figures of each pipe segment identified for upsizing.

Table 4-1 Summary of Pipe Segments Exceeding 75% Full

Year Identified	Drainage Basin	Diameter (In)	Length over 75% Full (LF)
2030	Camp Creek	36	200
	Deep Creek	18	2,600
		24	800
2040	Camp Creek	36	500
		48	5,100
	Deep Creek	18	400
		24	5,400
	Morning Creek	24	1,300
2050	Camp Creek	12	300
		48	3,600
	Deep Creek	8	300
		12	1,700
		24	5,200
		30	300
		36	5,200
		72	1,200
	Pea Creek	12	400
Total Length (LF)			***34,500***

Several pipes shown on the 75% d/D listing were flagged due to having very flat slopes, such that even upsizing by three sizes did not eliminate the percent full conditions. These pipes were evaluated on a velocity basis, narrowing the list down to pipes with flow velocities less than 2 feet per second (fps). If at the time of the diurnal peak, the pipe flows at more than 2 fps, then solids suspension considerations are thought to be satisfied. The flat-sloped pipes were also evaluated on the basis of HGL of the pipe versus the manhole rim elevation; if this distance is maintained at a minimum of 4 feet, then the risk of backwater conditions on service connections (which are typically within 2 feet) are thought to be mitigated. These two follow-on analyses for refined design criteria reduced the number of flat pipes triggered for upgrade.

Other causes of pipe capacities over 75% full were caused by backflow, either from pump stations without adequate equalization in the wet well (as discussed in Section 4.3.3) or connection with larger collector piping in the system where water level was higher than the identified pipe invert. Issues caused by pump stations were addressed in the model but should verified in the field as discussed. Lastly, a few segments were identified as >75% full because of a positive slope from inferred pipe inverts in the model. Positive slopes cause backward flow in the model and a pooling effect at one end of a pipe segment, leading to a full pipe capacity. This Study also recommends these pipe segments be field verified. Appendix D includes a table of all pipes over 75% capacity, where upsizing does not reduce pipe full capacity under 75% due to specific conditions described above.

4.2.1 Low Velocity Sewers

A Model scenario was run to identify pipes with peak velocities less than 2 fps, a threshold which might be a concern for settling. The majority of the pipes identified with this condition were smaller diameter pipes on the extremities of the Model, not in collectors which are generally the segments of concern for blockages. In numerous cases this effect is expected to be a result of the disaggregation of flows, in which there is often only one manhole upstream of the subject pipe segment contributing flow. The analysis also does not account for a storm surge, which may flush sediment from the pipeline.

Analysis of low velocity conditions should be completed at a design level, not at a modeling level, as the size and slope of each pipe segment is confirmed against projected flow loadings.

Additionally, it should be considered that any collection system problems due to low velocities would have presented themselves by now in the form of increased maintenance and surcharging conditions. If an area benefits from increased cleaning frequency, in the form of reduced surcharging and overflows, then clearly the conditions for solids deposition are real. We recommend addressing existing areas of concern through a targeted increased maintenance and cleaning program, and to obviate the need for heightened maintenance on new pipes through a low-velocity analysis in detailed design.

4.3 Existing Pump Station Evaluations

Fulton County provided a pump station data sheet for use in updating the 2007 model inputs. This is included in Appendix E. There are 18 existing pump stations in South Fulton. The data sheet contains total station capacity and firm capacity for each. Design criteria to trigger upsizing of a pump station includes:

- Inflow more than firm capacity
- Water Surface Elevation within 4 feet of grade
- Force main velocities exceeding 10 fps

Several existing pump stations had a water surface elevation of more than 10 feet below ground level. This Study recommends checking the wet well floor levels to confirm accurate wet well capacities and water surface elevations in the model.

Fulton County provided Gresham Smith a data sheet for existing pump stations managed by Veolia in South Fulton. Table 4-2 presents the firm and total capacities of existing pump stations. The table includes the

capacities as stated by Veolia, the capacities in the original 2007 model, and any edits made to the existing pump stations in the updated model.

Table 4-2 Existing Pump Station Firm and Total Capacities

Existing Pump Station	Total Capacity (MGD)	Firm Capacity (MGD)	Total Capacity (MGD)	Firm Capacity (MGD)	Total Capacity (MGD)	Firm Capacity (MGD)
	Veolia Data[1]		2007 Model[2]		Model edits[3]	
Morning Creek	28.00	21.00	25.92	19.44	-[5]	-[5]
Cochran Road	11.53	5.76	12.10	6.05	11.52[6]	5.76[6]
Deep Creek	46.69	40.20	102.40	89.60	46.66[6]	40.18[6]
White Water	4.54	3.03	16.20	10.80	-[5]	-[5]
Line Creek	6.72	3.36	13.68	6.84	-[5]	-[5]
Cater Creek	5.00	2.50	2.00	1.00	-[5]	-[5]
Graham Drive	23.30	17.50	41.47	31.10	-[5]	-[5]
Cedar Grove	8.07	4.03	7.20	3.60	4.36[6]	2.20[7]
Trickum Creek	9.04	4.52	11.20	5.60	-[5]	-[5]
Ono Road	8.07	4.03	-[4]	-[4]	8.06	4.03
Camp Creek	27.67	24.21	-[4]	-[4]	27.65	24.19
Le Jardin	0.20	0.10	-[4]	-[4]	-[7]	-[7]
Morris Road	8.65	4.32	-[4]	-[4]	0.02[6]	0.01[6]

[1] Values from pump spreadsheet sourced from Veolia
[2] Values sourced from 2007 Model
[3] Changes made in model to pump station capacities
[4] Pump station did not exist in 2007 Model
[5] No change made in pump station from 2007 Model
[6] Pump station capacities edited because head loss conditions caused issues with effluent flow
[7] La Jardin pump station was not added but it's flows were modeled

Table 4-3 below presents projected flows entering each pump station in the updated model for each planning year, including cumulative and maximum flows. Cells shaded in red are proposed pump stations for new development in City of Chattahoochee Hills and City of South Fulton. Cumulative flow is the accumulated volume at the downstream end of the pipe upstream of the pump station over a 24-hour period. Maximum flow measures the maximum instantaneous flow during a simulation of 24 hours. Pump stations were upsized based

on the maximum influent flow. These values can be referenced for planning purposes to determine when pump stations should be triggered for upsizing.

Table 4-3 Influent Flow Projections

Pump Station (PS)	Flow Entering PS (MGD)	Year 2020	Year 2030	Year 2040	Year 2050
Morning Creek	Cumulative	4.845	5.811	7.274	9.184
	Max	4.883	5.843	7.299	9.202
Cochran Road	Cumulative	1.535	1.934	2.131	2.359
	Max	1.535	1.934	2.131	2.359
Deep Creek	Cumulative	13.895	18.554	30.155	40.879
	Max	13.993	18.694	30.246	41.179
White Water	Cumulative	1.737	2.868	3.981	5.241
	Max	1.893	2.999	4.208	5.258
Line Creek	Cumulative	0.217	0.291	0.391	0.526
	Max	0.217	0.291	0.391	0.526
Cater Creek	Cumulative	0.026	0.030	0.036	0.043
	Max	0.026	0.030	0.036	0.043
Graham Drive	Cumulative	7.207	9.469	12.316	15.833
	Max	12.222	13.903	15.028	16.846
Cedar Grove	Cumulative	0.330	0.435	1.295	2.196
	Max	0.335	0.439	1.295	2.210
Trickum Creek	Cumulative	0.838	1.353	1.798	2.305
	Max	1.053	1.538	1.951	2.442
Ono Road	Cumulative	1.442	3.064	8.370	11.844
	Max	5.331	6.501	12.003	12.162
Camp Creek	Cumulative	23.071	30.926	48.572	64.284
	Max	23.184	31.089	48.964	64.715

Pump Station (PS)	Flow Entering PS (MGD)	Year 2020	Year 2030	Year 2040	Year 2050
Le Jardin	Cumulative	0.003	0.003	0.003	0.004
	Max	-[1]	-[1]	-[1]	-[1]
Morris Road	Cumulative	0.006	0.007	0.009	0.011
	Max	-[1]	-[1]	-[1]	-[1]
Bouckaert Town Center	Cumulative	0.929	1.260	3.795	6.373
	Max	-[1]	-[1]	-[1]	-[1]
Serenbe	Cumulative	0.306	0.414	1.132	1.703
	Max	-[1]	-[1]	-[1]	-[1]
Friendship 1	Cumulative	0.296	0.402	1.220	2.082
	Max	-[1]	-[1]	-[1]	-[1]
Friendship 2	Cumulative	0.296	0.402	1.220	2.082
	Max	0.312	0.412	1.221	2.137
Wilkerson	Cumulative	0.035	0.048	0.192	0.359
	Max	0.035	0.048	0.192	0.359
Campbellton	Cumulative	0.020	0.057	0.068	0.083
	Max	-[2]	0.057	0.068	0.083
Little Bear	Cumulative	1.270	1.722	6.686	10.000
	Max	1.610	2.052	6.853	10.100
South Fulton	Cumulative	-[3]	0.122	0.146	0.177
	Max	-[3]	0.122	0.146	0.177

[1] No piping exists upstream of this pump station in the model, therefore no value is given for a maximum flow.
[2] No piping exists upstream of this pump station in the model in the 2020 planning year.
[3] This pump station is proposed to be built in the planning year 2030.
Pump stations shaded in red are proposed pump stations, they do not exist in the current South Fulton system.

Due to discrepancies in data between the capacities provided by Veolia and data received from the original 2007 model, this Study recommends additional validation in actual firm and total station capacities of existing pump stations. This Study recommends upsizing Camp Creek, Deep Creek, and Ono Road pump stations

because projected influent flows, from Table 4-3, are larger than the smallest firm capacity noted on Table 4-2. White Water pump station exceeds the firm capacity noted from Veolia, but this Study recommends additional validation for the actual capacity before upsizing.

Table 4-4 presents velocities of each force main in the updated model by planning year. This Study evaluated each existing and new force main for upsizing purposes. Since each force main remained under 10 feet per second, this Study does not recommend upsizing any force mains.

Table 4-4 Force Main Velocities Across Planning Period

Pump Station	FM Velocity (ft/s) Year 2020	FM Velocity (ft/s) Year 2030	FM Velocity (ft/s) Year 2040	FM Velocity (ft/s) Year 2050
Morning Creek	3.01	3.01	3.01	3.01
Cochran Road	6.38	6.38	6.38	6.38
Deep Creek[1]	2.86 2.98	2.86 2.98	4.47 5.39	5.34 6.67
White Water	1.38[2]	2.47	2.47	3.25
Line Creek	4.38	4.38	4.38	4.37
Cater Creek[3]	1.11	1.11	1.11	1.11
Graham Drive	4.20	4.21	4.90	5.32
Cedar Grove	9.74	9.74	9.74	9.74
Trickum Creek	3.00	3.01	3.01	3.02
Ono Road	2.34	2.34	4.69	4.69
Camp Creek[1]	2.29 2.02	2.97 2.56	4.45 3.77	5.43 4.57
Le Jardin[4]	-	-	-	-
Morris Road[3]	0.05	0.05	0.05	0.05
Bouckaert Town Center	2.44	2.44	2.44	4.88
Serenbe	2.23	2.23	2.23	4.46
Friendship 1	2.40	2.40	4.81	4.81

Pump Station	FM Velocity (ft/s) Year 2020	FM Velocity (ft/s) Year 2030	FM Velocity (ft/s) Year 2040	FM Velocity (ft/s) Year 2050
Friendship 2	2.40	2.40	4.81	4.81
Wilkerson	2.83	2.83	2.83	2.83
Campbellton	2.68	2.68	2.68	2.68
Little Bear	2.01	2.01	4.02	4.02
South Fulton	-[5]	3.32	3.32	3.32

[1] These pump stations have two effluent force mains
[2] White Water pump station capacity requires verification. Pump station capacity in the model is input as 10 MGD, while County data from Veolia indicates the actual capacity is 3 MGD, as noted in Table 4-2.
[3] Station appears to exhibit low force main velocities which could cause settling. Verification of station capacity and pump station scouring is recommended. The firm capacity in the model is less than the firm capacity as stated by the County spreadsheet, Table 4-2.
[4] Only influent flows were modeled for Le Jardin pump station
[5] South Fulton pump station does not have a value for year 2020 because it is proposed to be built in year 2030
Force mains highlighted in green are proposed, they do not exist in the current South Fulton system.

4.3.2 Modeling Assumptions

The following pump stations had inputs which differed in the original model from the pump station spreadsheet provided by the County, as noted in

Table 4-3. Any changes or assumptions made by Gresham Smith are noted. Any discrepancies noted should be verified by Fulton County.

1. Morning Creek
    a. Firm and total capacity in the original model are less than the capacities in the pump station spreadsheet. Cumulative and max flow entering the pump station in the model do not surpass the model firm capacity, therefore no changes were made.
2. Cochran Road
    a. The firm and total capacity in the original model was more than the capacities in the pump station spreadsheet. The capacities in the model were edited to reflect the values from the pump station spreadsheet because head loss conditions caused issues with effluent flow for the capacities noted in the 2007 model.
3. Deep Creek
    a. The firm and total capacity in the original model was more than the capacities in the pump station spreadsheet. The capacities in the model were edited to reflect the values from the pump station spreadsheet, per request of the County.

4. White Water
    a. The firm and total capacity in the original model was more than the capacities in the pump station spreadsheet. Additional validation is recommended to confirm capacity because influent flow exceeds the firm capacity stated in the Veolia spreadsheet.
5. Line Creek
    a. Firm and total capacity in the original model exceeds the capacities noted in the pump station spreadsheet. Cumulative and max flow entering the pump station in the model do not surpass the spreadsheet firm capacity, therefore no changes were made.
6. Cater Creek
    a. Firm and total capacity in the original model are less than the capacities in the pump station spreadsheet. Cumulative and max flow entering the pump station in the model do not surpass the model firm capacity, therefore no changes were made.
    b. Flows entering Cater Creek pump station may be low in comparison to actual flow because of the method used in the model to distribute flow per manhole.
7. Graham Drive
    a. Firm and total capacity in the original model are more than the capacities in the pump station spreadsheet. Cumulative and max flow entering the pump station in the model do not surpass the spreadsheet firm capacity, therefore no changes were made.
8. Cedar Grove
    a. Firm and total capacity in the original model are less than the capacities in the pump station spreadsheet. Cumulative and max flow entering the pump station in the model do not surpass the model firm capacity.
    b. The pump station in the model was edited to reflect the projected incoming flow because the original model experienced issues with head loss conditions which limited effluent flow.
9. Trickum Creek
    a. Firm and total capacity in the original model are more than the capacities in the pump station spreadsheet. Cumulative and max flow entering the pump station in the model do not surpass the spreadsheet firm capacity, therefore no changes were made.

The following list of the existing pump stations were not included in the original 2007 model but were added by this Study. Gresham Smith modeled these pump stations based on the capacities in the pump station spreadsheet from Veolia.

1. Ono Road
2. Camp Creek
3. Morris Road
    a. Flows entering Morris Road pump station may be low in comparison to actual flow because of the method used in the model to distribute flow per manhole.

The following pump stations were added to the model as part of new developments in City of Chattahoochee Hills and City of South Fulton.

1. Bouckaert Town Center
2. Serenbe
3. Friendship 1
4. Friendship 2
5. Wilkerson Mill
6. Campbellton
7. Little Bear
8. South Fulton

The following pump stations currently exist in the South Fulton system but were not added to the model because they are in areas of piping which are less than 12 inches and therefore not included in the scope of this modeling effort. Although these smaller pump stations were outside the area of piping that was modeling, wastewater flow from these areas were accounted for in the Subcatchment files.

1. Albania Drive
2. Asbury Park
3. Great Southwest
4. Little Bear Creek
5. Stonewall
6. Le Jardin
    a. La Jardin pump station was not added but the flow was modeled.
    b. Flow exiting Le Jardin pump station may be low in comparison to actual flow because of the method used in the model to distribute flow per manhole.

4.3.3 Pump Station Equalization Capacity

Several pump stations in the original 2007 model appeared to lack equalization capacity based on model inputs. Field verification of wetwell dimensions is recommended to ensure adequate minimum sizing, followed by model updating.

In five cases, pump stations were input into the model with a wetwell floor (bottom) level that was equal to the invert into the pump station. Thus, even minor flow accumulation in the wetwell resulted in surcharging upstream. Accordingly, the pump on/off setpoints at these stations were set above the invert in level.

The influent piping appeared to be correct based on continuity of slopes upstream, depths below grade, and available invert data. Gresham Smith revised the wetwell and pump on/off characteristics to accommodate the influent elevations and flows. This entailed lowering the wetwell floor level at the following stations:

1. Cochran Road
2. Deep Creek
3. Line Creek

4. Cater Creek
5. Trickum Creek

The model assumes a wetwell diameter in the absence of an input. For all five of these stations, wetwell depth, wetwell diameter, and pump on/off elevations require confirmation. If surcharging into the upstream sewer persists after confirmation modeling, wetwell upsizing may be required.

The following pump stations had adequate equalization but pump on/off setpoints were above the invert in level, again resulting in surcharging upstream. Gresham Smith lowered the pump on/off setpoints in the model.

1. White Water
2. Graham Drive

These setpoints should be verified as well, and may need to be adjusted to the modeled conditions to prevent surcharging.

4.4 New Infrastructure (Sewer Service Extensions)

Fulton County owns and maintains sewer infrastructure throughout South Fulton, and therefore sewer system extensions was included in the model capacity evaluation and CIP planning.

In Chattahoochee Hills, a new pump station was added at the low point in the region for each of six developments (Campbellton Village, Friendship Village, Bouckaert Town Center, Wilkerson Mill, Serenbe, and Little Bear). Two pump stations were required to serve Friendship Village, with an extent of gravity piping in between. Based on the projected 2050 flow from each development and total dynamic head (TDH) estimations according to static differentials and friction losses, a conceptual pumping scenario was devised to meet 2050 demands. This evaluation aimed to maintain the specific speed of the selected pump within a range of 1,000 to 5,000 rpm. Specific speed for each pump scenario was calculated as:

$$Ns, \text{specific speed} = N, \text{impeller rotational speed} * (\text{Flow, gpm})^{1/2} / (\text{Head, feet})^{3/4}$$

The resulting build-out pump flows and number of pumps per station are outlined accordingly in Section 5.

Force main velocities under both near-term (2020 growth) projections and 2050 projections were also considered. FM sizing is required to maintain velocities of 2 to 10 feet per second as illustrated in Table 4-4.

Within the City of South Fulton, gravity sewers were extended in the model to reach into areas that are currently un-served according to the GIS database. It was observed that there are very few, isolated low points within the South Fulton service area, and that generally the South Fulton extensions appear serviceable by gravity. These pipes were added into the model as 8" diameter and then simulated with 2050 flows. Pipes that exceeded the d/D threshold of 75% were then upsized as required to maintain capacity long term, as shown in Table 4-1.

5. Projected Model Scenario Development

Gresham Smith developed the Model for each planning year by distributing flows as documented in Section 3, with minor reallocations, where needed, to satisfy the calibration process. Pump stations and pipelines were evaluated according to the Section 4 methodology and upsized to meet capacity demands. Pipes segments within the same geographical vicinity, but that were identified for upsizing at different years, were all upsized at the earliest year identified for logistical purposes. Based on the projected Model Scenarios, this section details the recommendations for new and upsized piping and pumps.

Gresham Smith upsized pump stations in the updated model as influent flow surpassed the pump station firm capacity, by milestone year. Proposed pump stations were added for new developments, which need a pump station built as well as pump additions. Each proposed pump station starts with two pumps at the planning year it is proposed for and an additional pump is added if needed to account for influent flows at year 2050. All pump stations identified exceeded the design criteria and the following recommendations, detailed in the following sections, bring these pump stations back into design criteria range.

5.1 Planning Year 2020 – 2029

The 2020 model was developed as an update to the 2007 model from a previous study. It is revised for hydraulic stability and connectivity, correcting several erroneous inverts with flags to note where assumptions are made. It includes pump stations for all six hamlets projected for Chattahoochee Hills, plus the Foxhall Village. Some minor extensions to gravity sewer in the City of South Fulton are also incorporated. Pump station data obtained from Fulton County's recent assessments were used to update pump station input conditions.

The 2020 model was calibrated using historical flow metering data. Specifically, because the 2020 projections are leveraged from 2019 averages in general, meters with a full calendar year of 2019 data were selected for calibration.

An exhibit of the 2020 - 2029 model is included hereafter.

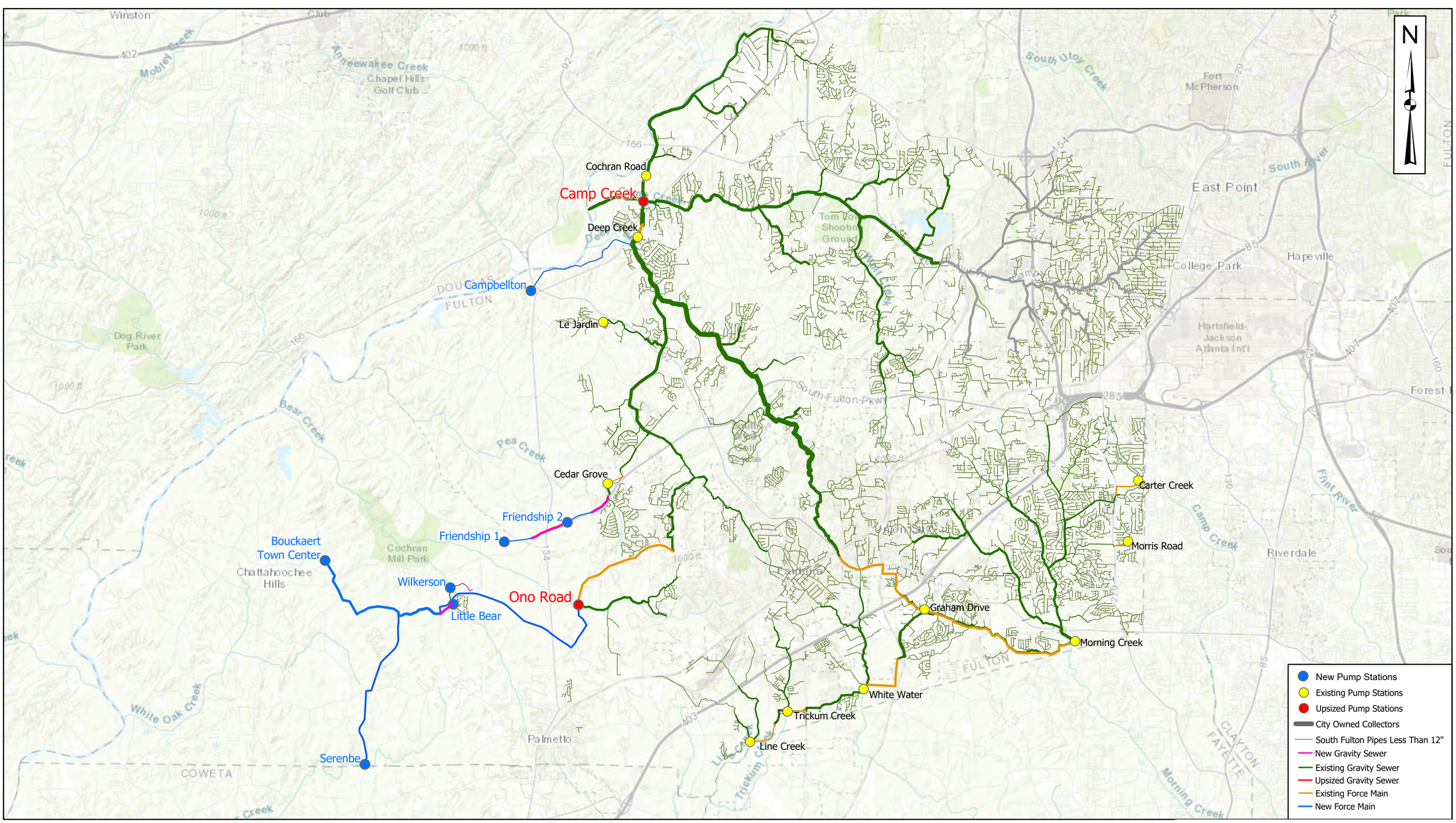

Figure 5-1 2020-2029 Model

Gresham Smith

FULTON COUNTY

5.1.1 Pipe Recommendations

Table 5-2 summarizes the pipe segments to be added to the South Fulton system in order to accommodate new developments in Chattahoochee Hills. No existing pipe segments were flagged for upsizing in planning year 2020. A detailed list of pipe IDs and flow factors for new pipes in 2020 is included in Appendix F. Figures of all new piping are included in Appendix G.

Table 5-1 New Chattahoochee Hills Pipes in 2020

Drainage Basin	Diameter (In)	Length over 75% Full (LF)
Little Bear Creek	8	3,000
	18	700
	30	2,000
Pea Creek	21	6,400
Total		*12,100*

5.1.2 Pump Recommendations

Table 5-2 details each new or upsized pump for existing and proposed pump stations, needed based on proposed influent flows for planning year 2020. Cells shaded in purple identify the proposed pump stations.

Table 5-2 Recommended Pump Station Improvements in 2020

Pump Station	# of Pumps	Upsize or New	Size (MGD) per pump	Power (HP) per pump	Existing Firm/ Total Capacity	Firm/Total Capacity After Improvements	New FM Size (in) / Length (ft)
Ono Road	2	Upsize	6.02	127.60	4.03/8.06	6.02 / 12.04	-
Camp Creek	3	Upsize	9.29	42.64	24.19/27.65	35.85 / 45.14	-
Bouckaert Town Center	2	New	3.80	50.85	-	3.80 / 7.59	21 /19,000
Serenbe	2	New	1.13	22.52	-	1.13 / 2.26	12 /25,300
Friendship 1	2	New	1.22	12.28	-	1.22 / 2.44	16 / 2,800

Pump Station	# of Pumps	Upsize or New	Size (MGD) per pump	Power (HP) per pump	Existing Firm/ Total Capacity	Firm/Total Capacity After Improvements	New FM Size (in) / Length (ft)
Friendship 2	2	New	1.22	12.28	-	1.22 / 2.44	16 / 2,800
Wilkerson	2	New	0.36	2.60	-	0.36 / 0.72	6 / 1,900
Campbellton	2	New	0.61	2.20	-	0.61 / 1.21	8 / 13,500
Little Bear	2	New	5.16	50.17	-	5.16 / 10.32	27 /20,600

Cells shaded in purple are proposed pump stations, they do not exist in the current South Fulton system.

5.2 Planning Year 2030 – 2039

The 2030 model was developed by prioritizing pump station and pipeline improvements projected for the 2050 scenario, plus extending priority pipes in the City of South Fulton.

An exhibit of the 2030 model is included hereafter.

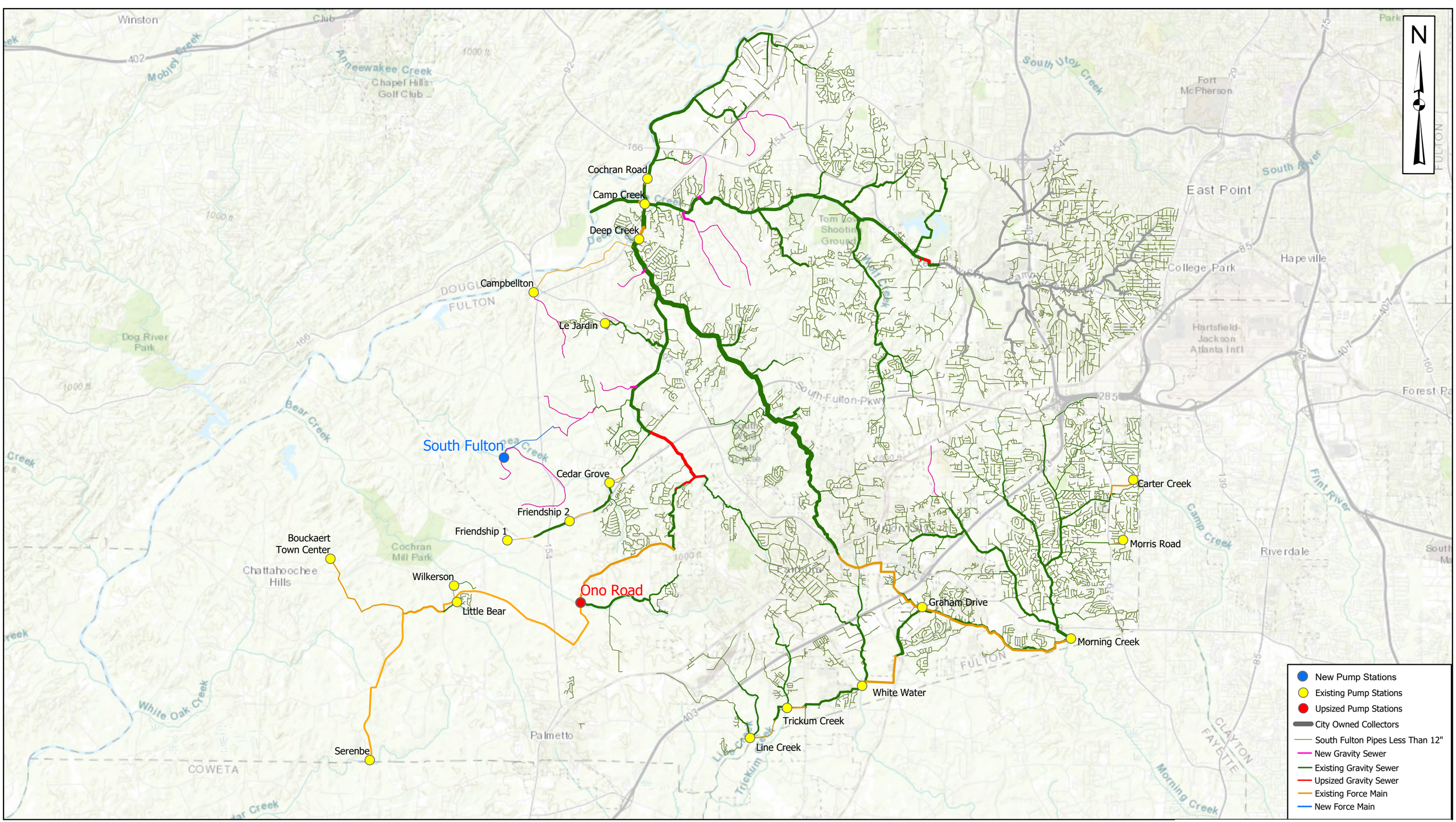

Figure 5-2 2030-2039 Model

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FULTON COUNTY

5.2.3 Pipe Recommendations

Table 5-3 summarizes pipe segments which exceeded 75% capacity, per the criteria stated in Section 4.1, and were upsized in the 2030 version of the model. A detailed list of pipe IDs and flow factors for upsized pipes in 2030 is included in Appendix H. Figures of all upsized pipe segments in Appendix C.

Table 5-3 Upsized Pipes in 2030

Drainage Basin	Original Diameter (In)	Length over 75% Full (LF)
Camp Creek	12	300
	36	700
Deep Creek	18	3,000
	24	6,900
Total		*10,900*

Table 5-4 summarizes the new pipe segments to be added to the City of South Fulton system in order to accommodate growth. A detailed list of pipe IDs and flow factors for new pipes in 2030 is included in Appendix H. Figures of all new piping are included in Appendix G.

Table 5-4 New Pipes in 2030

Drainage Basin	Diameter (In)	Length over 75% Full (LF)
Camp Creek	8	24,300
	12	1,000
	18	700
	21	1,500
Deep Creek	8	25,200
	21	1,100
Morning Creek	8	1,600
Pea Creek	8	20,200
Tuggle Creek	8	8,700

Drainage Basin	Diameter (In)	Length over 75% Full (LF)
Wilson Creek	8	11,900
	12	400
Total		*99,600*

5.2.4 Pump Recommendations

Table 5-5 details each new or upsized pump for existing and proposed pump stations, needed based on proposed influent flows for planning year 2030. Cells shaded in purple identify the proposed pump stations.

Table 5-5 Recommended Pump Station Improvements in 2030

Pump Station	# of Pumps	Upsize or New	Size (MGD) per pump	Power (HP) per pump	Existing Firm / Total Capacity	Firm/Total Capacity After Improvements	New FM Size (in) / Length (ft)
Ono Road	1	Upsize	6.02	127.60	6.022/12.04	12.04 / 18.07	-
South Fulton	2	New	0.19	4.26	-	0.19 / 0.37	4 /6,800

Cells shaded in purple are proposed pump stations, they do not exist in the current South Fulton system.

5.3 Planning Year 2040 – 2049

The 2040 model was developed by prioritizing pump station and pipeline improvements projected for the 2050 scenario, plus extending priority pipes in the City of South Fulton. Figures of all new piping are included in Appendix G and upsized pipe segments in Appendix C.

An exhibit of the 2040 model is included hereafter.

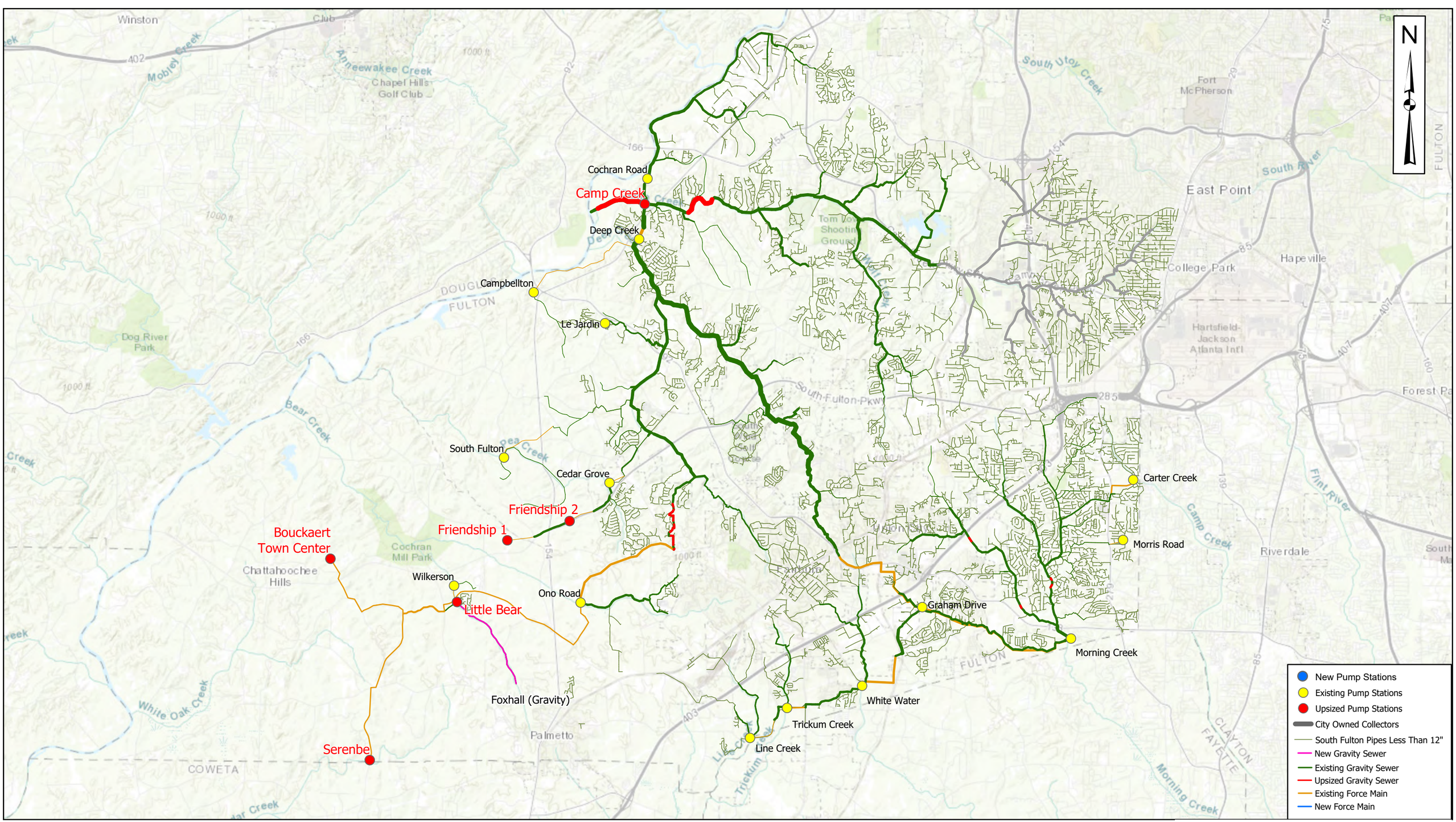

Figure 5-3 2040-2049 Model

Gresham Smith

FULTON COUNTY

5.3.5 Pipe Recommendations

Table 5-6 summarizes pipe segments which exceeded 75% capacity, per the criteria stated in Section 4.1, and were upsized in the 2040 version of the model. A detailed list of pipe IDs and flow factors for upsized and new pipes in 2040 is included in Appendix I. Figures of all upsized pipe segments in Appendix C.

Table 5-6 Upsized Pipes in 2040

Drainage Basin	Original Diameter (In)	Length over 75% Full (LF)
Camp Creek	48	8,700
Deep Creek	24	4,600
Morning Creek	24	1,300
Total		*14,600*

Table 5-7 summarizes the pipe segments to be added to the South Fulton system in order to accommodate Foxhall Development. Figures of all new piping are included in Appendix G.

Table 5-7 New Pipes in 2040

Drainage Basin	Diameter (In)	Length over 75% Full (LF)
Little Bear Creek	18	10,800
Total		*10,800*

5.3.6 Pump Recommendations

Table 5-8 details each new or upsized pump for existing and proposed pump stations, needed based on proposed influent flows for planning year 2040. Cells shaded in purple identify the proposed pump stations.

Table 5-8 Recommended Pump Station Improvements in 2040

Pump Station	Milestone Year	# of Pumps	Upsize or New	Size (MGD) per pump	Power (HP) per pump	Existing Firm/ Total Capacity	Firm/Total Capacity After Improvements
Camp Creek	2040	3	Upsize	9.29	42.64	35.85 / 45.14	53.34 / 62.63
Bouckaert Town Center	2040	1	Upsize	3.80	50.85	3.80 / 7.59	7.59 / 11.39
Serenbe	2040	1	Upsize	1.13	22.52	1.13 / 2.26	2.26 / 3.40
Friendship 1	2040	1	Upsize	1.22	12.28	1.22 / 2.44	2.44 / 3.66

Pump Station	Milestone Year	# of Pumps	Upsize or New	Size (MGD) per pump	Power (HP) per pump	Existing Firm/ Total Capacity	Firm/Total Capacity After Improvements
Friendship 2	2040	1	Upsize	1.22	12.28	1.22 / 2.44	2.44 / 3.66
Little Bear	2040	1	Upsize	5.16	50.17	5.16 / 10.32	10.32 / 15.48

5.4 Planning Year 2050 – 2059

The 2050 model was developed by projecting out all of the infrastructure improvements – pipe upsizing, pump station upsizing, new pump stations and force mains, new gravity sewers, and expanded treatment infrastructure – needed to meet the capacity demands for milestone year 2050. Figures of all new piping are included in Appendix G and upsized pipe segments in Appendix C.

An exhibit of the 2050 model is included hereafter.

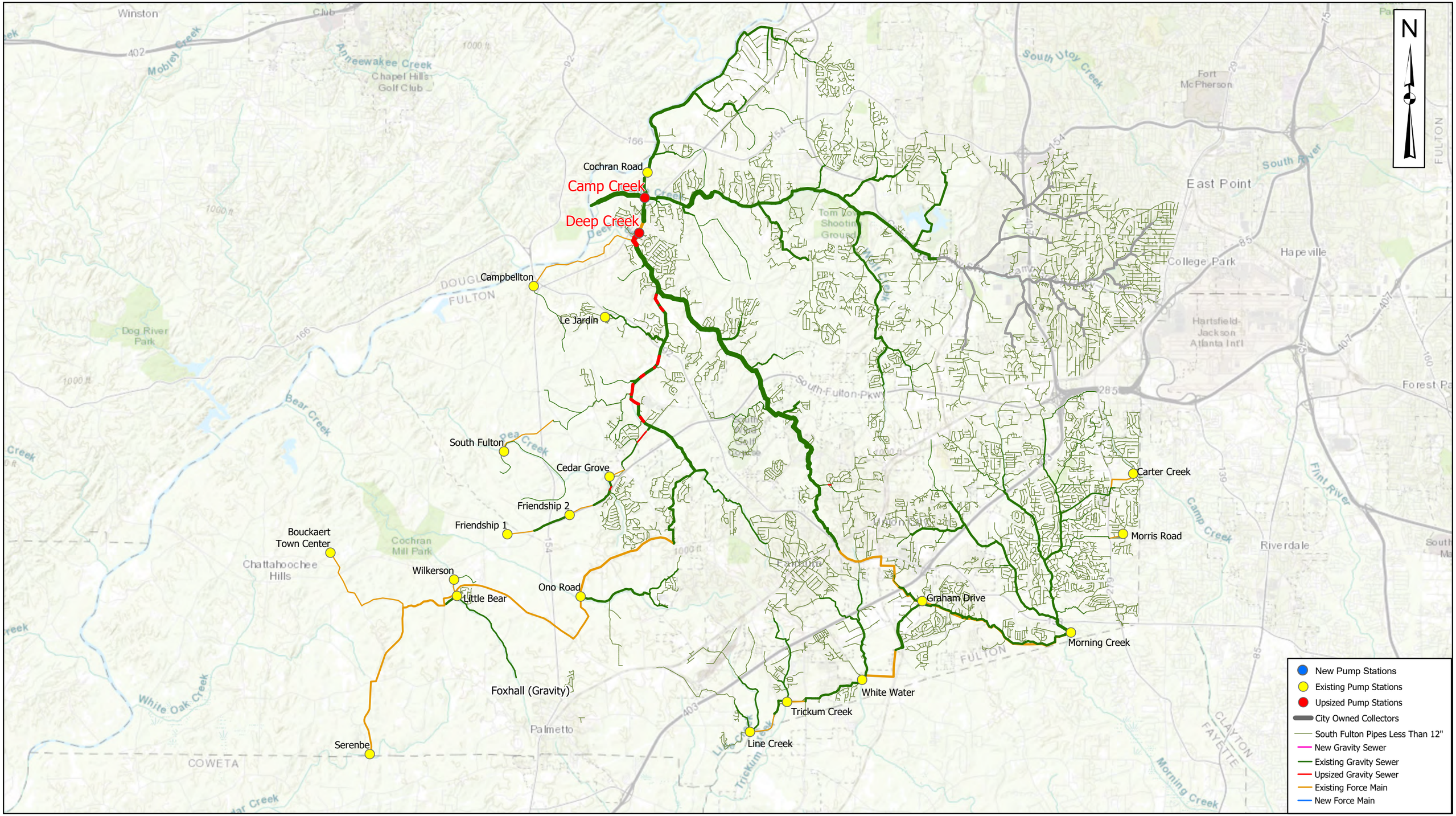

Figure 5-4 2050-2059 Model

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FULTON COUNTY

5.4.7 Pipe Recommendations

Table 5-9 summarizes pipe segments which exceeded 75% capacity, per the criteria stated in Section 4.1, and were upsized in the 2050 version of the model. No new piping for developments is expected for 2050. A detailed list of pipe IDs and flow factors for upsized pipes in 2050 is included in Appendix J. Figures of all upsized piping are included in Appendix C.

Table 5-9 Upsized Pipes in 2050

Drainage Basin	Original Diameter (In)	Length over 75% Full (LF)
Deep Creek	8	300
	12	1,700
	30	300
	36	5,200
	72	1,200
Pea Creek	12	400
Total		*9,100*

5.4.8 Pump Recommendations

Table 5-10 details each new or upsized pump for existing and proposed pump stations, needed based on proposed influent flows for planning year 2040.

Table 5-10 Recommended Pump Station Improvements in 2050

Station	# of Pumps	Upsize or New	Size (MGD) per pump	Power (HP) per pump	Existing Firm/ Total Capacity	Firm/Total Capacity After Improvements
Camp Creek	2	Upsize	9.29	42.64	53.34 / 62.63	65.00 / 74.29
Deep Creek	1	Upsize	5.00	29.46	40.18 / 46.66	41.28 / 47.77

6. Future Modeling Recommendations

Gresham Smith recommends the following details be verified to improve model reliability for future modeling, as identified through this modeling effort.

1. Pump Stations *(Section 4.3, Appendix E)*
    - Due to discrepancies between model inputs and the pump station data provided by Veolia, the following verifications are recommended:
        - Pump Capacities
        - Pump Type/Turndown (pumps modeled as "fixed" with max flows)
        - Pump On/Off Levels
        - Wet Well Capacity (diameter and depth) *(Section 4.3.3)*
    - Pump curves to accurately model pump turn down (i.e. as opposed to "fixed" modeling)
2. Force Mains *(Table 4-4)*
    - Any existing force mains velocities identified with less than 2 fps require additional verification of adequate scouring. This may be able to be achieved by periodically running multiple pumps to generate higher velocities and suspend sediment.
    - Force Main Diameter
    - Force Main Upstream Invert Level (generally assumed ~4' below grade) *(Section 4.3.3)*
    - Force Main Downstream Invert Level (some inferred)
3. Gravity Sewer
    - Inverts for all inferred pipes
        - 158 Pipe segments were imported from GIS
        - 50 Pipe segments were inferred in the model *(Appendix K)*
    - Inverts for pipes experiencing backflow conditions *(Appendix H)*
4. East Point/County Ownership *(Section 3.3.6.8)*
    - Delineation of piping owned by East Point and Fulton County needs to be confirmed
5. Flow Monitoring *(Table 3-3)*
    - There are several areas identified throughout the South Fulton system that are not being measured for flow, and therefore are not billed through the cities current IGAs, as identified in Table 3-3. Additionally, there are also areas that are measured but are not being billed through IGAs, but may be billed directly though South Fulton. While this does not affect the recommendations in this report, options should be considered for inclusion of these areas for billing capture under the IGAs.
6. ICM and GIS Model Consolidation
    - Several piping segments and node IDs vary between the ICM and GIS Models. These discrepancies should be verified and updated to reflect true conditions.
    - Previously inferred inverts in the 2007 model are flagged in the GIS model but not in the ICM model. 824 pipe segments have inferred data in the GIS Model.

As noted in Item 1, several pump station inputs were estimated in this hydraulic modeling effort. For most stations, pump curves were uncertain or unavailable, and therefore fixed flow pumps were modeled (always operating at 100%). Pump on/off levels were also assumed based on available invert/discharge data, and may not be representative of actual wetwell operations. Updated drawdowns conducted at each pump

station are recommended to refine the assumptions applied in the model, and to compare pump station operations to design (or "like new") conditions.

Also as noted in Item 3, several sewers in the model lack invert data from survey or record drawings. In these cases, pipe inverts were inferred based on other nearby invert data or based on grade contours. These assumptions are flagged in the Model for any pipes inferred in this modeling effort, and flagged in the GIS model for inferred inverts from the 2007 Model. It is recommended that elevational data be assimilated and input in the Model for these sewers. Appendix K identifies the pipe segments IDs recommended for upsizing that have inferred invert data which should be verified before upsizing. Invert data is missing on either the upstream end, the downstream end, or both for those segments listed.

7. Camp Creek WRF Future Treatment Capacity

Camp Creek Water Reclamation Facility has a permitted capacity of 24 MGD. In 2019, historical peak average flow occurred of approximately 16 MGD. 2018 maximum daily flow represents the historical high at 21.66 MGD. Based on the flow projections in Table 3-4, it appears that Camp Creek WRF will exceed its rated capacity by year 2030.

However, it should be noted that the projections in Table 3-4 are based on annual averages, while the permit conditions are based on monthly averages. December 2018, when 21.66 MGD occurred, can be used as a calibration point to consider worst-case wet weather conditions. The December flows correspond to a peaking factor of 1.4 over average 2018 flows. This is not an unusual peaking factor, as reflected in 2019, which experienced a peaking factor over 1.3.

Applying a 1.4 peaking factor to 2020 average projected flows yields 25,200,000 gpd – an excess of permitted capacity if sustained. Therefore, prioritization of the Camp Creek WRF expansion planning is recommended. It has been Fulton County's experience at the Little River WRF that EPD will accept flow excursions from rated capacity if effluent water quality parameters stay in compliance, and if expansion planning efforts are underway. Fulton County should closely monitor flow increases to Camp Creek WRF over the 2020-2029 planning horizon to ensure that design of the expansion begins well in advance of when the additional capacity is needed.

The demonstrated need for additional capacity at Camp Creek WRF is tempered by three considerations:

1. Chattahoochee Hills flows, in particular, have the potential to be lower than projected. Cities were asked to project near-term growth for milestone year 2020, to capture what is needed in a 5-year CIP. The Chattahoochee Hills flows will not be generated until domestic water is available, the developments are permitted and built, and the sewer system extensions are all in place. Realistically there are several years of buffer until the flows are realized.
2. In December 2018 when the peak of 21.66 MGD was received at Camp Creek WRF, only 16 MGD of the total 24 MGD capacity was on-line. The remaining 8 MGD is currently being rehabilitated to be restored to service. Therefore, Fulton County has 50% additional capacity to be available over what was in place to treat the 2018 peak event.
3. Fulton County's Intergovernmental Agreements (IGAs) with the South Fulton cities allow for management of wet weather peaking factors, which can be used as a moderating mechanism to reduce extreme peaks.

Accordingly, Fulton County should continue to monitor flow increases and PFs at Camp Creek WRF, and should coordinate closely with Chattahoochee Hills on the timing of proposed developments, but entering into detailed design of the Camp Creek WRF improvements by 2025 is expected to provide ample available capacity based on the forecasts in this Study. A design phase over 2025/2026 would be expected to allow construction to begin in 2027. Adequate time must also be budgeted in (or in advance of) this design phase for the EPD Anti-degradation Report preparation and permitting process.

It is tentatively expected that the Camp Creek WRF will be expanded in 8 MGD increments, in keeping with its current train configuration, but this is subject to change in detailed design. An expansion to 48 MGD (three 8-MGD increments) captures the forecasted AADF flows through a typical equipment life planning period of 20

years. Water quality improvements, such as implementing membrane treatment, may also be incorporated into the expansion and could affect the size or phasing of the expansion, based on modularity of treatment units.

8. Capital Improvement Plan

Costs of recommendations identified through Gresham Smith's modeling effort have been estimated by project type and projected milestone planning year to provide Fulton County an estimated Capital Improvement Plan.

8.1 Linear Infrastructure Permitting

For new development within south Fulton County, the linear infrastructure will require permitting. EPD instructs domestic wastewater facilities that wish to extend their sewer lines and/or install a pump station, but that will remain under their current permitted flow limit, should submit plans and specifications to EPD along with the EPD's Sewer Extension Form. EPD will then make a determination if a review of the certified plans and specifications is required.

The extension form requires "project description and design data", lending itself to formatting as a Design Development Report (DDR).

EPD also publishes a list of guidance on PS submittals (https://epd.georgia.gov/document/publication/pump-stations-and-force-mains-submittal-common-problems-listpdf/download).

All new pump stations, force mains, and gravity sewers require submittal of the Sewer Extension Form.

8.2 Camp Creek WRF Improvements

Detailed evaluation of Camp Creek WRF improvements is beyond the scope of this Study. Based on the future flow projections presented in Table 3-4, a rated capacity of 48 MGD at Camp Creek WRF would satisfy demands for the next 20 years (particularly if projections are conservative as expected). While it is recommended that build-out conditions be considered and provisioned in the planning process, design and implementation of the additional 24 MGD is expected to provide ample treatment for the useful life of most systems and equipment. 48 MGD also allows expansion of the plant in increments of 8 MGD, as the existing plant is configured, should the detailed design identify that phasing to be advantageous. A phasing plan can be developed based on when the forecasted flows are actually realized, to appropriately defer expansion costs.

It is unknown at this time what permit levels will be required for the expanded WRF. Accordingly, technology upgrades, such as membrane treatment, may be essential in combination with capacity upgrades.

Camp Creek WRF expansion and improvements require detailed evaluation and are excluded from the scope of the Capital Improvements Plan (CIP) budgetary figures herein.

8.3 Infiltration & Inflow Reduction / Effects of Conservation

Water efficiency and conservation measures implemented by Fulton County and water utilities have led to a decrease in overall water consumption per resident over the past decade. This effect has been so pronounced that water usage has decreased despite continuing population growth. As a result, wastewater flows have decreased as the population has increased. With Fulton County's ongoing initiatives and those of the Metro District, these trends are expected to be sustained to a point of diminishing return.

On the contrary, I/I flows from the South Fulton cities continue to pose a challenge as infrastructure has aged and rehabilitation measures have not kept up with conditions. For example, East Point average 2019 flows were approximately 2,220,000 gpd. At a peaking factor of 2.47, this yields an additional 3,250,000 gpd in wet weather flows. A fraction of this value is enough to sway whether Camp Creek WRF exceeds its capacity allocation as discussed in Section 7.

It is recommended that Fulton County exercise incentives in South Fulton to temper I/I contributions, such as peak rate billing, and to refine these policies as updated IGAs are executed.

8.4 Criteria for Linear Infrastructure Improvements

A CIP was developed for Fulton County based on hydraulic modeling results for the decades beginning in 2020, 2030, 2040, and 2050. Upsized (replacement) sewers and pump stations are recommended where the model indicates that the existing lines/stations have inadequate capacity for the existing or projected flows, based on the following criteria:

- Pipe surcharging during AADF conditions (within 4 ft of grade)
- High force main velocities (>10 fps)
- High d/D flow factor in gravity pipes (>75%)
- Firm pump station capacity less than influent max flow

Additional recommendations were provided for model input verification, specifically as pertains to critical invert data and pump and wetwell characteristics.

8.5 Iterative CIP Process

Once the wastewater hydraulic model was developed for existing (2020) and future (2030, 2040, 2050) conditions, with the loadings summarized in Table 3-4, capital improvements projects were analyzed according to the above criteria to incorporate them into the appropriate planning horizon. The CIP prioritization process was iterative, as each project affects downstream conditions and infrastructure. Each planning period sewer model was run to examine performance of the collection system, after which new/upsized infrastructure was incorporated into the model, and the revised model was re-run to confirm the effectiveness of the proposed project against the evaluation criteria.

8.6 Opinions of Probable Construction Cost (OPCCs)

For each identified project, planning level cost estimates (OPCCs) were compiled. Lump sum factors included demolition, clearing, grading and fine grading, hardscape patching, erosion control and grassing, and traffic control. These items were estimated based on the extent (linear footage) of the project and consideration of aerial maps depicting the nature of the pipeline route. Manholes were budgeted per each at $50,000. Pipe replacement was estimated according to the following per-lineal-foot prices in 2020 dollars:

Table 8-1 Installed Pipe OPCC Basis

Pipe Diameter	Installed Cost per LF
15"	$100
18"	$150
30"	$250
36"	$325
42"	$375
48"	$400
60"	$550
72"	$800
84"	$1,250

New/upsized pipes were modeled as "unknown" type, meaning the model ascribes a typical Manning's "n" value of 0.013 to each; estimates are conservative and based on ductile iron. Upsized (replacement) pipes were assumed to follow the original pipe alignment. New pipes were routed downgradient across contour lines (for gravity sewers) or along existing right-of-way (for force mains). New regional "village" pump stations, in the case of Chattahoochee Hills, were sited at low grade areas within the general drainage basin of each proposed development. Specific pipe alignments and pump station siting will vary and must be determined as part of the design process.

For each OPCC, contractor's overhead and general conditions were added at 30% and profit at 10%. All estimates carry a design contingency of 20%.

Non-construction project costs were excluded from the OPCCs and therefore from the CIP summaries herein. Notably, these include land acquisition, permitting, and engineering.

These OPCCs follow strict guidelines for all quantity take-offs described in the 9th Edition Standard Estimating Practice published by the American Society of Professional Estimators (ASPE). The pricing method is multifaceted and is based on our estimator's experience in the Atlanta market, a quarterly market survey of major sub-contractors, suppliers and venders, along with information that is learned by our estimating staff from trade publications, meetings with local contractors and various other sources. The cost estimates included in this Report are Class 5 estimates based on AACE standards. Thus, the estimate accuracy is anticipated to be -50% to +100% based on this classification.

8.7 CIP by Milestone Period

Across the planning horizon, a total of 122,500 LF of new gravity pipe is proposed, and 34,600 LF of existing gravity pipe is forecast to require upsizing. Additionally, 92,700 LF of new force main is proposed.

Section 5 presents the new/upsized infrastructure, including pump stations, in graphical and tabular format. Each project is then depicted in individual detail in Appendix G for all new piping and Appendix C for upsized pipe segments. The OPCC supporting detail for each project is contained in Appendix L, corresponding to the "layout" number and node IDs captured in Appendix C and G exhibits. A set of layouts numbered 1 through 21 are categorized as *New* infrastructure projects; a set of layouts numbered 1 through 17 are categorized as *Upsize* infrastructure projects. A summary of the improvements slated, according to milestone period and drainage basin, is as follows:

Table 8-2 CIP Summary Costs By Planning Year

Project Type	Drainage Basin	2020 – 2029	2030 – 2039[1]	2040 – 2049[1]	2050 – 2059[1]
Upsized Gravity Sewer	Camp Creek	$-	$3,280,000	$31,935,000	$-
	Deep Creek	$-	$17,475,000	$13,435,000	$35,620,000
	Morning Creek	$-	$-	$4,160,000	$-
	Pea Creek	$-	$-	$-	$1,115,000
Subtotal		$-	$20,755,000	$49,530,000	$36,735,000
New Gravity Sewer	Camp Creek	$-	$31,055,000	$-	$-
	Deep Creek	$-	$29,650,000	$-	$-
	Little Bear Creek	$7,605,000	$-	$18,975,000	$-
	Morning Creek	$-	$1,885,000	$-	$-
	Pea Creek	$9,115,000	$22,225,000	$-	$-
	Tuggle Creek	$-	$9,835,000	$-	$-
	Wilson Creek	$-	$14,980,000	$-	$-
Subtotal		$16,720,000	$109,630,000	$18,975,000	$-
New Force Main	Little Bear Creek	$53,805,000	$-	$-	$-
	Pea Creek	$5,810,000	$6,160,000	$-	$-
	Tuggle Creek	$8,505,000	$-	$-	$-
Subtotal		$68,120,000	$6,160,000	$-	$-

New Pump Station	Little Bear Creek	$2,795,000	$-	$870,000	$-
	Pea Creek	$1,480,000	$865,000	$480,000	$-
	Tuggle Creek	$700,000	$-	$-	$-
Subtotal		$4,975,000	$865,000	$1,350,000	$-
Upsized Pump Station	Camp Creek	$250,000	$190,000	$-	$-
	Deep Creek	$405,000	$-	$810,000	$675,000
	Little Bear Creek	$-	$-	$-	$340,000
Subtotal		$655,000	$190,000	$810,000	$1,015,000
Camp Creek WRF Expansion[2]	Camp Creek	$25,000,000	$225,000,000	$-	$-
Subtotal	Camp Creek	$25,000,000	$225,000,000	$-	$-
Total		$115,470,000	$362,600,000	$70,665,000	$37,750,000

[1] Costs escalated 5% per year, and not compounded annually.
[2] Phasing of expansion to be considered in preliminary engineering.

The dollar values in Table 8-2 have been escalated to the planning year, from 2020 dollars, with an inflation factor of 5% per year, which is *not* compounded annually. Thus, during a ten year period, values are escalated by 50%; i.e. 2020 costs are multiplied by 1.5 to yield 2030 dollars. For example, the 2030 CIP totals to $91,730,000 in 2020 dollars, but is escalated to $137,600,000 in the table values to account for inflation.

The Table 8-2 totals are based on the following linear feet of projects, by type and planning period:

Table 8-3 Projects Forecast, by Planning Year and Type

Project Type	2020 – 2029	2030 – 2039	2040 – 2049	2050 – 2059
Upsized Gravity Sewer (LF)	0	10,800	14,600	9,100
New Gravity Sewer (LF)	12,000	96,600	10,800	0
New Force Main (LF)	85,900	6,800	0	0
New Pump Station	Bouckaert, Campbellton, Friendship 1, Friendship 2, Little Bear, Serenbe, and Wilkerson	South Fulton	Bouckaert, Friendship 1, Friendship 2, Wilkerson and Little Bear	-

Project Type	2020 – 2029	2030 – 2039	2040 – 2049	2050 – 2059
Upsized Pump Station	Ono Road and Camp Creek	Ono Road	Camp Creek	Camp Creek and Deep Creek
Total LF	*97,900*	*114,200*	*25,400*	*9,100*

As shown, near-term improvements are heavily impacted by proposed *New* infrastructure – gravity sewers, force mains, and pump stations. This is primarily due to the substantial growth projected in the City of Chattahoochee Hills over the next decade as well as development for City of South Fulton. If this growth is not realized as quickly as forecast, numerous CIP projects can be shifted to a later planning period.

Expansion and upgrade of the Camp Creek WRF is not shown in Table 8-2 above. Evaluation of treatment technologies, phasing, and preliminary design are required to refine the planning level costs of the Camp Creek expansion, however typical construction costs for similar projects are in the range of $10 million per million gallons of expanded capacity. Therefore, based on an additional 24 MGD of treatment capacity being constructed in 2030 at Camp Creek WRF, a preliminary construction cost value of $250 million has been assigned for planning purposes.

8.8 CIP Prioritization Process

Prior to implementing any CIP project, updated operating conditions and flows should be revisited to confirm that the criteria triggering the upgrade are, in fact, realized. This can be achieved through targeted flow monitoring as an extension of the County's already comprehensive monitoring program. Another useful technology is SmartCover® manhole covers, which can be used to measure surcharge conditions in a manhole that open channel flow meters do not.

Timing for implementation of the New infrastructure – piping and pump stations primarily in Chattahoochee Hills, and gravity sewer in the City of South Fulton – should be confirmed based on the pace of development in these areas. Any implementation of New infrastructure will also affect downstream conditions and may affect the trigger for any of the Upsize projects. The proposed improvements should be reviewed on a regular basis by the County especially as new development comes online and flows through the system indicate steady growth patterns.

8.9 Proposed Rate Study and Camp Creek WRF Expansion Funding

As discussed in Section 8.7, the conceptual design for the Camp Creek WRF expansion has not been developed and was outside the scope of this Evaluation, however a construction cost budget of $250 million have been identified for planning purposes. Costs for this expansion will be refined in a separate study prior to design. Phasing of the project's capacity increase should also be considered, to allow construction to occur over two decades and more in line with actual demand based on new development. Each individual South Fulton City will also receive an increased allocation of the Camp Creek capacity expansion in accordance with the future projected flows documented in this Evaluation. Each City will also be assessed a capital cost for the treatment allocations based on a pro rata basis.

An updated Rate Study for the entire Fulton County system should also be performed to ensure financial coverage of the capital and O&M costs associated with the sanitary sewer upgrades and extensions developed in this Evaluation. This Rate Study is planned to commence by early 2021, allowing the new rate structure to be implemented throughout Fulton County by late 2021, after which the forecasted upgrades will be incorporated into the County's CIP and designed and constructed as development is realized.

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