Jacobs

Fulton County Water Distribution System Master Plan

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Fulton County Public Works Department
Georgia

FULTON COUNTY

November 2024

Fulton County Water Distribution System Master Plan

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01	10/25/24	Draft Master Plan	Brian Skeens		Jennifer Henke	
02	11/25/24	Final Master Plan	Brian Skeens			

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Executive Summary

This Master Plan for the North Fulton County, Georgia, water distribution system outlines capital improvements needed to maintain service levels for Alpharetta, Johns Creek, Milton, and Roswell through 2050. These improvements include water main extensions, pump stations, storage tanks, and new pressure zones and are phased starting with immediate recommendations, 2030, 2035, 2040, and 2050.

To understand the expected growth and developments through 2050, a series of meetings was held with each city served by the North Fulton water distribution system. During these meetings, the community development and planning departments provided information on current and planned projects. Additionally, population projections from the Atlanta Regional Commission were used to provide growth information by census tract for Fulton County through 2050. A water demand forecast was then developed for each city.

The combined water demand projections indicate an expected increase of approximately 9.1 million gallons per day (MGD) by 2050. Table ES-1 presents historical data and the proposed forecast for North Fulton. This report includes both the 1.5 peaking factor (the historical average since 2007) and the 1.75 peaking factor (a recent maximum experienced on July 3, 2024) to illustrate the range of peak demands experienced by the North Fulton system.

Table ES-1. Historical and Proposed Future Annual Average and Maximum Day Water Demand for North Fulton

Year	Historical Water Demand[a] (AADD-MGD)	2024 Water Demand Forecast[b,c] (AADD-MGD)	2024 Water Demand Forecast[d] (MDD-MGD)	2024 Water Demand Forecast[e] (MDD-MGD)
2010	26.44	NA	NA	NA
2017	21.8	NA	NA	NA
2018	26.3	NA	NA	NA
2019[f]	28.2	NA	NA	NA
2020	26.2	NA	NA	NA
2021[g]	26.8	NA	NA	NA
2025	NA	28.4	42.5	49.6
2030	NA	30.4	45.5	53.1
2035	NA	31.6	47.4	55.3
2040	NA	33.1	49.6	57.9
2045	NA	34.5	51.8	60.5
2050	NA	36.0	54.0	63.0

[a] Historical water demand calculated using billing records and water supplied data.
[b] Future water demand includes 10 percent non-revenue water.
[c] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 to 2050.
[d] Calculated using a peaking factor (peak day factor) of 1.5 based on the historical average.
[e] Calculated using a peaking factor (peak day factor) of 1.75 based on highest demand of 47.9 MGD registered on July 3, 2024.

[f] Water demand data for the year 2019 reflect an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that year.
[g] Billing- and water-supplied data for 2021 were used as the baseline for the 2024 demand forecast.
AADD-MGD = annual average daily demand in million gallons per day
MDD-MGD = maximum day demand in million gallons per day
NA = Not Available

The hydraulic model used in this Master Plan was rebuilt and calibrated for Fulton County by Stantec in 2022 and 2023. Jacobs was asked to evaluate and validate the calibrated water distribution model for use in future system capacity planning as part of this Master Plan project. Jacobs reviewed the calibrated model, and the calibration reports provided with the hydraulic model. The evaluation found discrepancies between the pump station flow rates and suction/discharge pressures in the model results compared to SCADA data. These discrepancies are suspected to be due to pump curve issues in the model. To address these concerns, Jacobs made several adjustments, including modifying the pump curves, updating the model controls, accounting for an unknown large water user and a known closed valve, and other adjustments. These changes appear to have significantly reduced or eliminated the previous concerns with the model. The pump station suction/discharge pressures, pump flow rates, and tank levels in the revised model more closely align with SCADA data than the observations in the previous calibration report. These changes significantly improve the confidence level in the model performance for use in this Master Plan.

To evaluate improvements in the water distribution system, a standard for customer service levels and hydraulic performance must be established. Primarily, this consists of minimum pressures and available fire flow, but it also includes industry best practice for potable water service. The County's operational Level of Service for minimum pressure is 35 psi; however, for the modeling in this Master Plan, a minimum pressure of 40 psi was used. This provides a buffer to account for potential uncertainties and adds a "factor of safety" to the recommendations related to minimum pressure. The minimum pressure criteria is 40 pounds per square inch (psi) under maximum day demand conditions. The minimum fire flow is 1,500 gallons per minute (gpm) for residential and 3,000 gpm for commercial on the average hour under maximum day conditions, while maintaining 20 psi pressure. Using these Level of Service criteria, the hydraulic model is run to identify areas where the system does not meet these standards. Both under existing water demands and future demands. Once these system deficiencies are identified, projects are identified for the Fulton County Capital Improvement Plan (CIP).

Jacobs conducted additional analyses that were included in the final CIP. These included a system storage analysis, a pressure zone analysis, water loss control review, interconnections analysis, and a valve criticality analysis, summarized as follows:

Storage Analysis – Based on a robust evaluation of system storage considering requirements for equalization, fire protection, and emergency storage, Fulton County has a 2050 storage deficit of 6.7 million gallons (MG), excluding the clearwells at the Tom Lowe Water Treatment Plant.

Pressure Zone Analysis – The objective was to identify areas where zones could be created to lower the pressure in areas with lower ground elevation, providing multiple benefits to the system: stabilizing pressure through pressure-reducing valves, reducing background leakage, and lowering pipe stress and risk of failure in these areas. Six pressure zones were recommended to be implemented.

Water Loss Control Review – Involved a review of water loss trends and analysis of real loss components. The analysis showed a large portion of the existing real loss is background leakage, so only a small annual investment in leak detection is recommended. For apparent losses, a customer meter testing program is recommended, to meet the Metro North Georgia Water Planning District requirement, and to address the high annual cost of apparent losses, which is trending up.

Interconnections Analysis – Findings showed Fulton County could only get water from Forsyth County in an emergency without investing in additional infrastructure to raise the pressure. However, there are potential for significant amounts of emergency water supply from Gwinnett, Cobb, and Cherokee Counties and the City of Atlanta with the use of a booster pump station at the interconnection points.

The hydraulic model was used to develop projects to address the deficiencies such as low pressure, fire flow availability, customer demands, and operational efficiency. Based on the timing of the growth in demand, the projects are phased by current year recommendations, 2030, 2035, 2040, and 2050.

- Current phase: 8,708 feet of water main, $6,813,000
- 2030 phase: 16,906 feet of water main, 2 pump stations, and 1 storage tank, $72,261,000
- 2035 phase, 500 feet of water main and the creation of 6 new pressure zones, $24,288,000
- 2040 phase: 9,838 feet of water main (optional deferral from the 2030 phase), $30,842,000
- 2050 phase: 163,809 feet of water main (including one project listed twice with different sizes due to peaking factor) and 2 storage tanks, $181,709,000

Table ES-2 lists the capital improvements by phase for the years 2025 through 2050.

Table ES-2. Capital Improvement Plan Project Descriptions

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (inches)	Planning-Level Cost Estimate ($)[b]	Length (feet)
101[a]†	2025	Low Pressure	Crossing Pipe Connection at Kimball Bridge Road/Webb Bridge Road	Water Main	Both	-	30"	$102,000	4
102†	2025	Low Pressure	Crossing Pipe Connection at Webb Bridge Road/Maid Marion Close	Water Main	Both	-	30"	$195,000	7
103[a]†	2025	Low Pressure	Crossing Pipe Connection at Freemanville Road/Quarterpath Lane	Water Main	Both	-	24"	$101,000	22
104	2025	Low Pressure	Woodstock Road Extension	Water Main	Both	-	8"	$128,000	40
105†	2025	Low Pressure/ Fire Flow	Providence Road Extension	Water Main	Both	-	8"	$741,000	956
106†	2025	Low Pressure/ Fire Flow	Hopewell Road Parallel Line	Water Main	Both	1	12"	$3,936,000	5,096
107	2025	Low Pressure/ Fire Flow	Hamby Road Extension	Water Main	Both	2	8"	$1,610,000	2,583
201-A†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Buice Road (Phase A)	Transmission Main	1.75	Yes	54"	$8,812,000	2,816
201-B†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Buice Road (Phase B)	Transmission Main	1.75	Yes	54"	$6,111,000	1,960
201-C†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase C)	Transmission Main	1.75	Yes	54"	$7,269,000	2,309
201-D†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase D)	Transmission Main	1.75	Yes	54"	$8,650,000	2,753

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (inches)	Planning-Level Cost Estimate ($)[b]	Length (feet)
202	2030	Alpharetta Tank	Alpharetta Tank Pump Station (75 HP pumps)	Pump Station	Both	1	16"	$12,380,000	2,014
203	2030	Low Pressure (Maid Marion)	Maid Marion In-line Booster Station and High Pressure Zone (5 HP pumps)	Pump Station	Both	3	8"	$4,898,000	267
204	2030	Low Pressure	Crossing Pipe Connection at Webb Bridge Road/Strath Drive	Water Main	Both	-	30"	$143,000	4
205	2030	Low Pressure	Crossing Pipe Connection at Webb Bridge Road/N Point Pkwy	Water Main	Both	-	30"	$150,000	11
206	2030	Low Pressure	Crossing Pipe Connection at Mansell Road/ Alpharetta Hwy	Water Main	Both	-	20"	$193,000	52
207	2030	Low Pressure	Crossing Pipe Connection at Bethany Road just north of Mayfield Road	Water Main	Both	-	16"	$144,000	9
208	2030	Low Pressure	Crossing Pipe Connection at Abbotts Bridge Road/Abbotts Way	Water Main	Both	-	30"	$159,000	19
209	2030	Low Pressure	Crossing Pipe Connection at Crabapple Road just north of Strickland Road	Water Main	Both	-	16"	$151,000	24
210	2030	Low Pressure	Crossing Pipe Connection at W Crossville Road/Woodstock Road	Water Main	Both	-	24"	$203,000	60
211	2030	Low Pressure	Crossing Pipe Connection at Providence Road/Freemanville Road	Water Main	Both	-	24"	$278,000	127
212	2030	Low Pressure/ALCON customer	Medlock Bridge Road/Johns Creek Pkwy Parallel Line	Water Main	Both	2	30"	$7,120,000	4,481

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (inches)	Planning-Level Cost Estimate ($)[b]	Length (feet)
213	2030	Emergency Storage/ALCON	New 3 MG Elevated Storage Tank at ALCON	Tank	Both	4	N/A	$15,600,000	N/A
301†	2035	Low Pressure/Water Age	Complete 42" Transmission Main under GA 400 along Kimball Bridge Road	Transmission Main	1.75	Yes	42"	$3,768,000	500
302	2035	Emergency Interconnection	Rogers Bridge Pump Station - Gwinnett Interconnection (450 HP pumps)	Pump Station	Both	7	N/A	$11,151,000	N/A
303	2035	High Pressure	Pine Grove Low Pressure Zone	Pressure Reducing Valve	Both	6	N/A	$2,082,000	N/A
304	2035	High Pressure	Shakerag Low Pressure Zone	Pressure Reducing Valve	Both	2	N/A	$1,041,000	N/A
305	2035	High Pressure	Horseshoe Bend Low Pressure Zone	Pressure Reducing Valve	Both	3	N/A	$1,041,000	N/A
306	2035	High Pressure	Martin Landing Low Pressure Zone	Pressure Reducing Valve	Both	1	N/A	$2,082,000	N/A
307	2035	High Pressure	Atlanta Athletic Club Low Pressure Zone	Pressure Reducing Valve	Both	4	N/A	$2,082,000	N/A
401-A†	2040	Low Pressure/ Water Age	Complete 54" Transmission Main along Buice Road (Phase A)	Transmission Main	1.5	Yes	54"	$4,815,000	1,769
401-B†	2040	Low Pressure/Water Age	Complete 54" Transmission Main along Buice Road (Phase B)	Transmission Main	1.5	Yes	54"	$6,111,000	1,960
401-C†	2040	Low Pressure/Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase C)	Transmission Main	1.5	Yes	54"	$7,269,000	2,309
401-D†	2040	Low Pressure/Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase D)	Transmission Main	1.5	Yes	54"	$8,650,000	2,753

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (inches)	Planning-Level Cost Estimate ($)[b]	Length (feet)
501-A†	2050	Low Pressure/Water Age	Complete 36-42" Transmission Main along Kimball Bridge Road	Transmission Main	1.75	Yes	36-42"	$4,815,000	1,769
501-B†	2050	Low Pressure/Water Age	Complete 36-42" Transmission Main along Kimball Bridge Road	Transmission Main	1.5	Yes	36-42"	$6,155,000	2,269
502	2050	Low Pressure	Jones Bridge Road Parallel Line	Water Main	Both	1	24"	$6,949,000	5,196
503	2050	Fire Flow	Fox Road and Greatwood Manor Parallel Line; Extension on Shirley Bridge	Water Main	Both	11	10-12"	$4,062,000	4,653
504	2050	Fire Flow	Old Cedar Lane/Kensington Farms Drive and Triple Crown Drive/Seabiscuit Parallel Line	Water Main	Both	10	12"	$9,015,000	11,852
505	2050	Fire Flow	Freemanville Road/Hipworth Road/ Conagree Ct/ Mayfield Road/ Harrington Dr Parallel Line; Bethany Road crossing pipe connection	Water Main	Both	3	12"	$14,349,000	18,898
506	2050	Fire Flow	Providence Road and Birmingham Hwy Parallel Line	Water Main	Both	2	24"	$19,594,000	14,773
507	2050	Fire Flow	Hwy 9N/Creek Club Dr, Five Acres Road/Woodlake Dr, Belleterre Dr, Francis Road/Autumn Close Parallel Line and crossing pipe connections on Hwy 9N	Water Main	Both	5	12"	$16,508,000	21,728
508	2050	Fire Flow	Manor Bridge Road/Manor Club Dr/ Belford Drive, Watsons Bend/Manor Club Drive Parallel Line	Water Main	Both	12	10-12"	$11,989,000	14,279

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (inches)	Planning-Level Cost Estimate ($)[b]	Length (feet)
509	2050	Fire Flow	Scott Road/Holcomb Bridge Road Parallel Line	Water Main	Both	4	16"	$9,201,000	9,237
510	2050	Fire Flow	Eves Road Parallel Line	Water Main	Both	9	12"	$2,933,000	3,812
511	2050	Fire Flow	Bell Road/McGinnis Ferry Road/Rogers Circle Parallel Line	Water Main	Both	6	12-16"	$23,680,000	22,874
512	2050	Fire Flow	Woodstock Road/Jones Road/Lake Charles Drive and Bowen Road/Stroup Road Parallel Line	Water Main	Both	8	12-16"	$23,194,000	21,390
513	2050	Fire Flow	Mountain Park Road and Highland Colony Drive Parallel Line	Water Main	Both	7	12"	$8,457,000	11,079
514	2050	Emergency Storage	2 MG Storage Tank at existing Jones Bridge tank site	Storage Tank	Both	14	N/A	$10,404,000	N/A
515	2050	Emergency Storage	2 MG Storage Tank at the existing Bethany tank site	Storage Tank	Both	13	N/A	$10,404,000	N/A

[a] Ongoing project with construction cost estimate per email from Timothy Mullen (August 8, 2024)
[b] Cost estimate is total project cost and includes 40% contingency except for ongoing projects.

†This project will improve minimum pressures at subdivisions where low pressure have been reported in the summer by customers.

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Acronyms and Abbreviations

AADD	annual average daily demand
ADD	average day demand
AFCWRC	Atlanta Fulton County Water Resources Commission
ARC	Atlanta Regional Commission
AWWA	American Water Works Association
CIP	Capital Improvement Plan
CMI	Customer Metering Inaccuracy
County	North Fulton County
DEM	digital elevation model
District	Metropolitan North Georgia Water Planning District
EPA	U.S. Environmental Protection Agency
fps	foot (feet) per second
GA EPD	Georgia Environmental Protection Division
GEFA	Georgia Environmental Finance Authority
GIS	geographic information system
GPAD	gallon(s) per account per day
GPCD	gallon(s) per capita per day
gpm	gallon(s) per minute
HGL	hydraulic grade line
HP	horsepower
HSP	high service pump
IRT	Interconnection Reliability Target
MDD	maximum day demand
MG	million gallon(s)
MGD	million gallon(s) per day
MNGWPD	Metro North Georgia Water Planning District
MSL	mean sea level

PF	peaking factor
PHD	peak hour demand
PRV	pressure-reducing valve
psi	pound(s) per square inch
RLCA	real loss component analysis
RPM	revolution(s) per minute
SCADA	Supervisory Control and Data Acquisition
TDH	total dynamic head
VSP	variable speed pump
WTP	water treatment plant

1. Introduction and Background

The North Fulton County (County) water distribution system provides water to the cities of Alpharetta, Johns Creek, Milton, and Roswell, Georgia. It serves approximately 80,000 customers and purchases finished water from the Atlanta Fulton County Water Resources Commission's Tom Lowe Water Treatment Plant (WTP). The County's water distribution system includes 1,100 miles of mostly ductile-iron pipe ranging in size up to 54 inches in diameter. A small portion of Roswell is served by a water treatment plant that it owns and operates.

The County uses a water distribution hydraulic model to aid in understanding water system operations, identifying deficiencies, and developing system improvements through Master Plans. The most current overall Master Plan was developed in 2007 and primarily addressed the major system components (transmission system). Some of the 2007 recommendations have been constructed and some are ongoing as part of the Capital Improvement Plan (CIP).

Continuing its commitment to understanding the water system and strategic future planning, the County selected Jacobs to create an updated Master Plan for the Water Distribution System. One goal of the Master Plan to be developed under this contract is to update the CIP based on current water demand projections as determined from updated population projections and per capita water use values. Additionally, a current Water System Master Plan is a regulatory requirement of the Metropolitan North Georgia Water Planning District (District), and this is intended to meet that requirement.

This report contains the following sections for tasks outlined in the scope of services:

- Section 1: Introduction and Background
- Section 2: Water Demand Projections
- Section 3: Model Review
- Section 4: Water System Analysis
- Section 5: Additional Analyses
- Section 6: Capital Improvement Plan

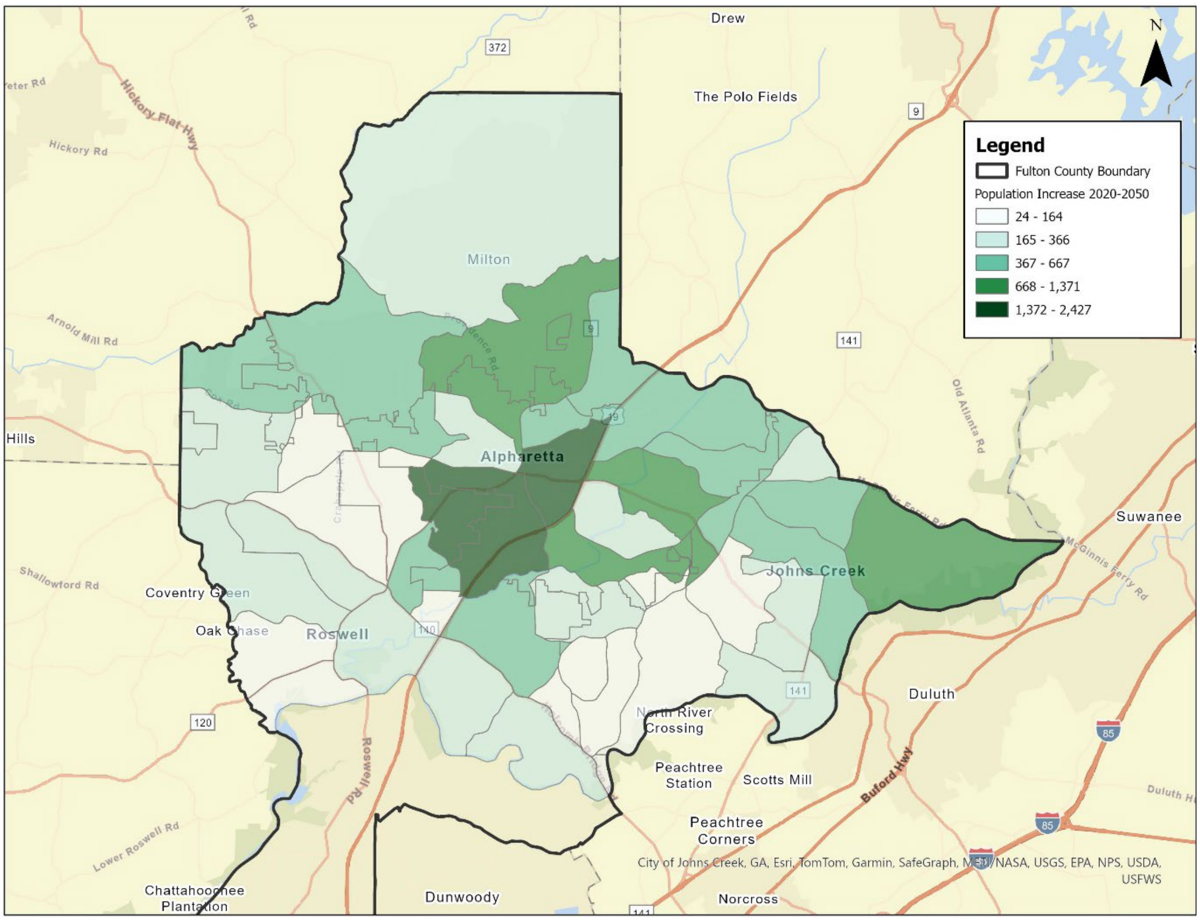
Additional information is provided in the following appendices to this report:

- Appendix A: Overall Water Demand Projections
- Appendix B: Alpharetta Water Demand Projections
- Appendix C: Johns Creek Water Demand Projections
- Appendix D: Milton Water Demand Projections
- Appendix E: Roswell Water Demand Projections
- Appendix F: Model Development Technical Memorandum
- Appendix G: Existing System Deficiencies
- Appendix H: CIP Map Book
- Appendix I: Impact of Transportation Projects on CIPs
- Appendix J: Model Intergovernmental Agreement
- Appendix K: Hydraulic Model Scenario Descriptions

2. Water Demand Projections

Fulton County provides potable water to the cities in North Fulton, including Alpharetta, Johns Creek, Milton, and Roswell. As part of the Fulton County Water Distribution System Master Plan, Fulton County staff and Jacobs met with representatives from each city to discuss future developments and expected growth to develop city-specific water demand projections. Members of the community development and public works departments were extremely helpful in supplying land use information. Historical billing data from Fulton County and population projections broken down by census tract through 2050 from the Atlanta Regional Commission (ARC) were also used to project growth and demand. In February 2024, the ARC adopted the Series 17 population and employment forecast from 2020 to 2050. Figure 2-1 shows the expected population growth for North Fulton per census tract based on the ARC projection.

Figure 2-1. ARC Series 17 Projected Population Increase 2020 to 2050



The water demand projections calculated for Fulton County's *Water and Wastewater Master Plan 2007 Update* (2007 Fulton County Master Plan; JJG 2008) and the newly calculated water demands for North Fulton are shown in Table 2-1. The updated demands are significantly lower based on population projections, data provided by the cities on new development and redevelopment projects, current and future land use planning policies, existing per capita water uses extracted through historical billing data and conservation from more water-efficient fixtures expected in the future. The historical demand and baseline data used for the current demand forecast is approximately 60 percent of the estimated water demand developed for the 2007 Fulton County Master Plan.

Table 2-1. Historical and Projected Annual Average Day Demand for North Fulton

Year	2007 Water Demand Forecast[a] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005[b]	33.2	NA
2010[b]	38.4	NA
2020[b]	44.0	26.2
2021[b,c]	44.3	26.8
2025	45.5	28.4
2030	47.0	30.4
2035	48.5	31.6
2040	NA	33.1
2045	NA	34.5
2050	NA	36.8

[a] Water demand forecast as shown in the 2007 Fulton County Master Plan.
[b] Historical water demand shown under the 2024 Water Demand Forecast was calculated using billing records and water supplied data.
[c] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

AADD-MGD = annual average daily demand in million gallons per day.
NA = Not Available.

2.1 Population Projections and Future Development Forecast

Two methods were used to determine future water demand. The first method relies on existing and future development data provided by the cities within the study area being built or permitted as of February 2024. The second method uses the projected population growth for North Fulton to distribute the growth throughout the planning period (2021 to 2050). Both methods produced similar water demand forecasts, but applying a conservative approach, the highest forecast was used in each city to calculate a water demand forecast that is expected to increase approximately 9.1 million gallons per day (MGD) by 2050.

The Jacobs and Fulton County teams met with officials from the cities of Alpharetta, John Creek, Milton, and Roswell to discuss the *Fulton County Water Distribution System Master Plan.* The information presented and shared during and after the meetings was summarized in an overall technical memorandums (TMs) describing the methodology used to calculate future demand projections using information on current and future development (Appendix A). City-specific TMs present the information shared during the team meetings (Appendices B through E). Following the meetings with city officials, the Jacobs team leveraged data from multiple sources, including comprehensive plans, permitting reviews and approvals, land use maps, and geographic information system (GIS) data to compile a list of projects that have been approved or proposed for each jurisdiction. In some cases, the city provided insight on their built-out plans that were also considered for this analysis.

The multifamily residential use per account was similar across all cities and future demands for multifamily residential projects was calculated using 1,100 gallons per account per day (GPAD) for all cities. Similarly, the commercial use per account was similar across all cities, and future demand for commercial projects was calculated using 3,300 GPAD for all cities. The average residential use per account for Alpharetta, Johns Creek, and Roswell is 180 GPAD. Milton's residential use per account is 260 GPAD; hence, a higher per account use needed to be applied for Milton to accurately estimate future water demand. The billing data show that Johns Creek is the only city with significant industrial demand with an average 73,000 GPAD; however, industrial use was extracted completely and projected separately using the customers' expansion plans and sewer capacity applications. Table 2-2 lists the water use per account for each customer type that was calculated using billing data.

Table 2-2. Per Account Water Use (GPAD) Based on 2021 Billing Records

Jurisdiction	Water Use Customer Type (GPAD)			
	Residential	Multifamily Residential	Commercial	Industrial[a]
Alpharetta	180	1,100	3,300	-
Johns Creek	180	1,100	3,300	73,000
Milton	260	1,100	3,300	-
Roswell	180	1,100	3,300	-

Notes:

[a] Significant existing and future industrial water use was only observed in Johns Creek.

The projections considered the type of development and the number of units and/or acres specified in development plans or permit applications. Johns Creek provided information on build-out plans, which were incorporated into the future water demand calculations. Because few plans had specific completion dates, the future demand calculated using this approach lacked temporal distribution but provided important site-specific information. Table 2-3 shows the expected water demand increase for each city based on their development and redevelopment plans as well as future land use plans. The numbers in bold show the highest forecast between the development-based and population-based demands for Alpharetta and Johns Creek. The highest forecast per city was selected to calculate the final water demand forecast summarized in Section 2.2.

Table 2-3. Expected Future Water Demand Increase for North Fulton Using Development-based Forecast

Jurisdiction	Additional Future Water Demand (AADD-MGD)[a]
Alpharetta	2.8
Johns Creek	3.0
Milton	0.5
Roswell[b]	1.4
North Fulton	**7.7**

Notes:
[a] Future water demand includes 10 percent non-revenue water.
[b] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 to 2050.

Population projections are an essential part of the water demand projection calculations because they significantly influence the residential water demand forecast. The 2020 Census calculated Fulton County's population at 1,066,710, with a 15.9 % estimated growth since 2010 (Census 2021). For this analysis, existing population data were gathered from the U.S. Census for each city in North Fulton. The latest Series 17 population projections were developed by the ARC (2024) and are broken down by census tract and city boundary. Figure 2-2 shows North Fulton's historical population and projected increase through 2050 as published by ARC in 2024, as well as the population projections used in the 2007 Fulton County Master Plan. The most recent population data show a higher population at the time the 2020 Census took place, but the projections show a more moderate growth rate from 2020 to 2050.

Figure 2-2. Population Trend for North Fulton

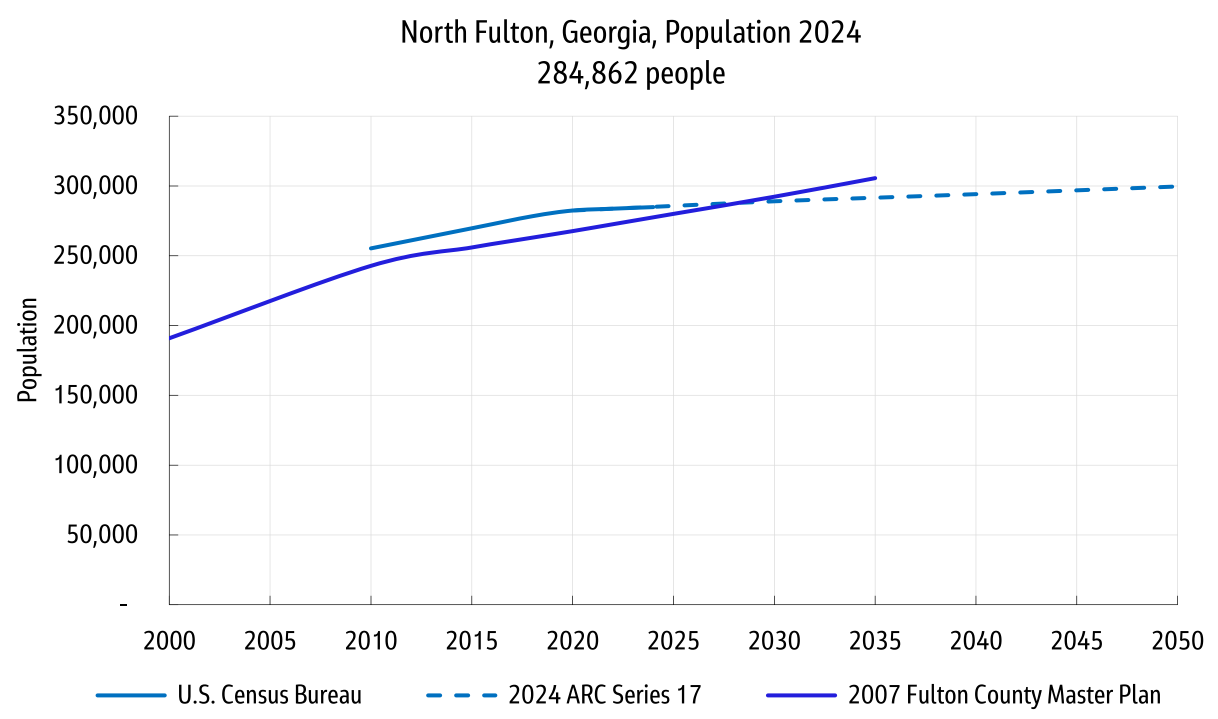


Table 2-4 summarizes the historical population and population projections for each city in North Fulton and the total for the study area. Currently, Roswell is the most populous city, followed by Johns Creek. Alpharetta is expected to have the highest growth in the future with a 12 percent increase in population between 2020 and 2050. The study area is expected to grow 6 percent in the same 30-year period.

Table 2-4. Historical and Projected Population Projections for North Fulton

Jurisdiction	Population					2020 to 2050 Growth Rate
	2010[a]	2020[a]	2030	2040	2050	
Alpharetta	57,551	65,818	69,742	72,064	73,721	12%
Johns Creek	76,728	82,453	83,344	84,988	85,674	4%
Milton	32,661	41,290	42,574	43,202	44,220	7%
Roswell[b]	88,346	92,833	93,375	93,881	96,018	3%
North Fulton	255,286	282,394	289,017	294,135	299,633	6%

Notes:
[a] Population as reported by the U.S. Census Bureau
[b] Population for City of Roswell includes areas served by Roswell Water Utility and Fulton County.

Population data by census tract and 2021 billing data were used to develop a temporal distribution that would project future water use through 2050. The billing data were used to establish the baseline year and to develop a per capita value for each city. Table 2-5 shows the per capita water use for each city. The per capita water use for Johns Creek was calculated using commercial and residential use only. The industrial use was extracted completely and projected separately using the customers' expansion plans and sewer capacity applications. Alpharetta, Johns Creek, and Roswell have similar per capita uses; hence, those three cities were combined to create an average per capita of 126 gallons per capita per day (GPCD).

Milton showed a higher per capita of 133 GPCD, which was applied in the forecast. In this projection, the per capita usage increases over time due to the expected increase in industrial use, the increase of wholesale water supplied to the City of Roswell, the use of a constant non-revenue water of 10 percent, and exclusion of passive conservation.

Table 2-5. Per Capita Water Use (GPCD) Based on 2021 Billing Records

Jurisdiction	Water Use per Person (GPCD)
Alpharetta	126
Johns Creek	126
Milton	133
Roswell	126
North Fulton[a]	128

Notes:
[a] Average per capita for North Fulton

The water demand forecast was calculated by establishing a baseline water use and calculating the future demand for the expected population increase between 2021 and 2050. The baseline water use was set by splitting the 2021 billing data for each census tract and then disaggregated by city. The baseline was calibrated so the addition of the demands for each census tract equaled the total water used in 2021, including losses. The next step was to calculate the increase in number of people for each census tract using the Series 17 ARC population projections. Finally, the future demand was calculated for the new population using the per capita in Table 2-5 and then added to the baseline. Table 2-6 shows the expected water demand increase for each city based on population growth per census tract. The numbers in bold show the highest forecast between the development-based and population-based demands for Milton and Roswell. The highest forecast per city was selected to calculate the final water demand forecast.

Table 2-6. Expected Future Water Demand Increase for North Fulton by 2050 Using Population-based Forecast

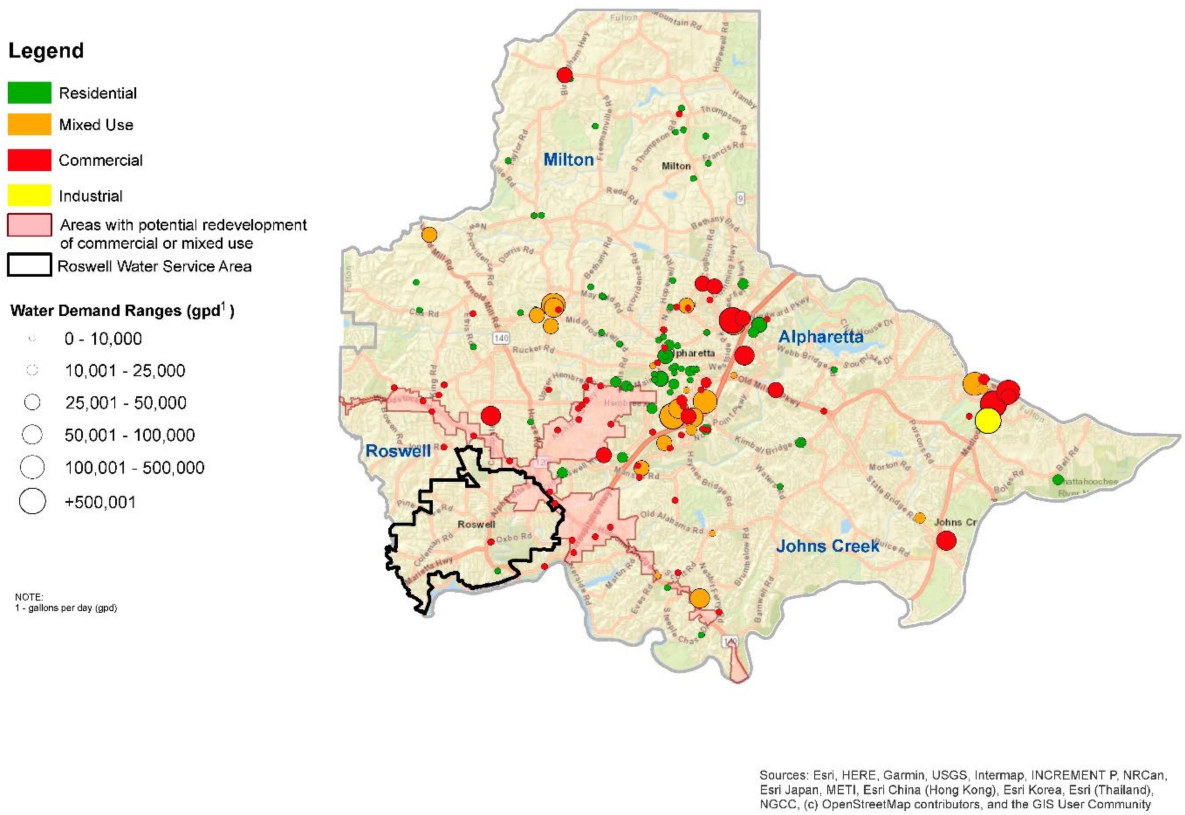
Jurisdiction	Additional Future Water Demand (AADD-MGD)[a]
Alpharetta	2.0
Johns Creek	2.6
Milton	0.9
Roswell[b]	2.4
North Fulton	**7.9**

Notes:
[a] Future water demand includes 10 percent non-revenue water.
[b] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.

2.2 Water Demand Projection Results

The water demand forecast was used to model scenarios for the water distribution system hydraulic model and determine if additional infrastructure is needed to provide adequate water service and fire protection through 2050. The forecast considered factors such as available land for development, current land use and comprehensive land planning policies by the city, existing per capita water uses extracted through historical billing data, and anticipated conservation efforts through the adoption of more water-efficient fixtures. The major water users are industrial and commercial facilities as well as mixed-use developments that are expected to expand or open as soon as 2025. Figure 2-3 shows the development areas and future growth for North Fulton based on the information provided by the cities and their available planning documents.

Figure 2-3. Future Growth Areas for North Fulton



The methods evaluated during the forecasting exercise resulted in similar water demand projections. Although water demand calculations based on growth beyond developments are not all known and lacked temporal distribution, the demand projections calculated from population projections were comparable in scale and provided a growth rate through 2050. Adopting a conservative approach, the water demand curve was developed using the highest increase in demand between the two methods. Table 2-7 summarizes the future water demand for Alpharetta, Johns Creek, Milton, and Roswell.

Table 2-7. Future Annual Average Water Demand for the Cities Served by North Fulton

Year	2024 Water Demand Forecast[a] (AADD-MGD)			
	Alpharetta[b]	Johns Creek[b]	Milton[c]	Roswell[c,d]
2025	7.0	10.2	3.9	7.3
2030	7.6	11.3	3.9	7.5
2035	8.2	11.7	4.0	7.8
2040	8.6	12.3	4.1	8.1

Year	2024 Water Demand Forecast[a] (AADD-MGD)			
	Alpharetta[b]	Johns Creek[b]	Milton[c]	Roswell[c,d]
2045	9.0	12.5	4.2	8.8
2050	9.4	12.7	4.4	9.5

Notes:
[a] Future water demand includes 10 percent non-revenue water.
[b] Future water demand calculated using development-based approach.
[c] Future water demand calculated using population-based approach.
[d] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.

The combined water demand projections resulted in an expected increase of approximately 9.1 MGD by 2050. Table 2-8 and Figure 2-4 show the historical data and the proposed forecast for North Fulton. The current demand forecast shows a lower demand projection than the one developed for the 2007 Fulton County Master Plan but follows the most current historical demand and baseline data. The 1.5 peaking factor is the recent historical average (since 2007), and the 1.75 peaking factor is a recent maximum last experienced on July 3, 2024. They are both shown in this report for context and to illustrate the range of peak demands that the North Fulton system experiences.

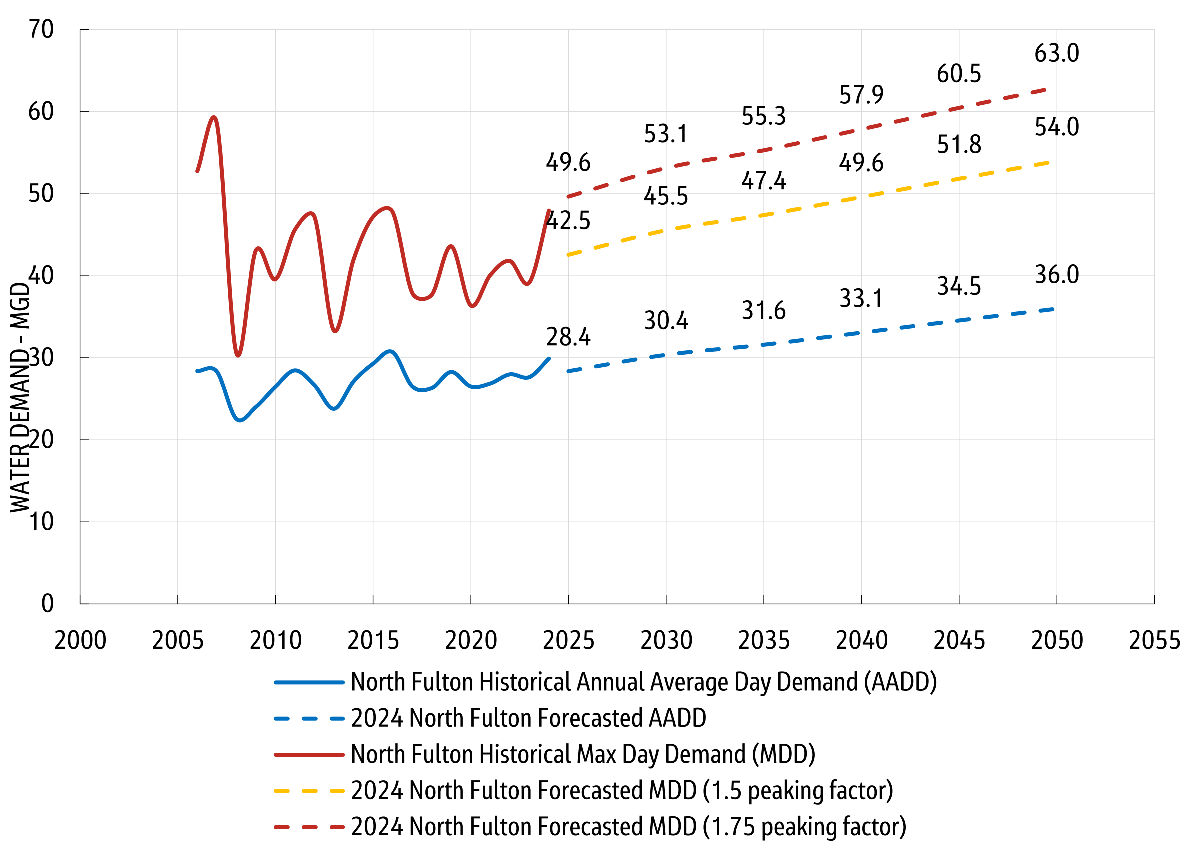
Table 2-8. Historical and Proposed Future Annual Average and Max Day Water Demand for North Fulton

Year	Historical Water Demand[a] (AADD-MGD)	2007 Water Demand Forecast[b] (AADD-MGD)	2024 Water Demand Forecast[c,d] (AADD-MGD)	2024 Water Demand Forecast[e] (MDD-MGD)	2024 Water Demand Forecast[f] (MDD-MGD)
2005	NA	33.2	NA	NA	NA
2010	26.44	38.4	NA	NA	NA
2017	21.8	NA	NA	NA	NA
2018	26.3	NA	NA	NA	NA
2019[g]	28.2	NA	NA	NA	NA
2020	26.2	44.0	NA	NA	NA
2021[h]	26.8	44.3	NA	NA	NA
2025	NA	45.5	28.4	42.5	49.6
2030	NA	47.0	30.4	45.5	53.1
2035	NA	48.5	31.6	47.4	55.3
2040	NA	NA	33.1	49.6	57.9
2045	NA	NA	34.5	51.8	60.5
2050	NA	NA	36.0	54.0	63.0

Notes:
[a] Historical water demand calculated using billing records and water supplied data.
[b] Water demand forecast as show in the 2007 Fulton County Master Plan.
[c] Future water demand includes 10 percent non-revenue water.
[d] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand

within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.
[e] Calculated using a peaking factor (peak day factor) of 1.5 based on the historical average.
[f] Calculated using a peaking factor (peak day factor) of 1.75 based on highest demand of 47.9 MGD registered on July 3, 2024.
[g] Water demand data for the year 2019 reflect an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that year.
[h] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.
AADD-MGD = annual average daily demand in million gallons per day
NA = Not Available

Figure 2-4. Historical and Proposed Future Annual Average and Max Day Water Demand for North Fulton



2.2.1 Future Demand Allocation to Hydraulic Model

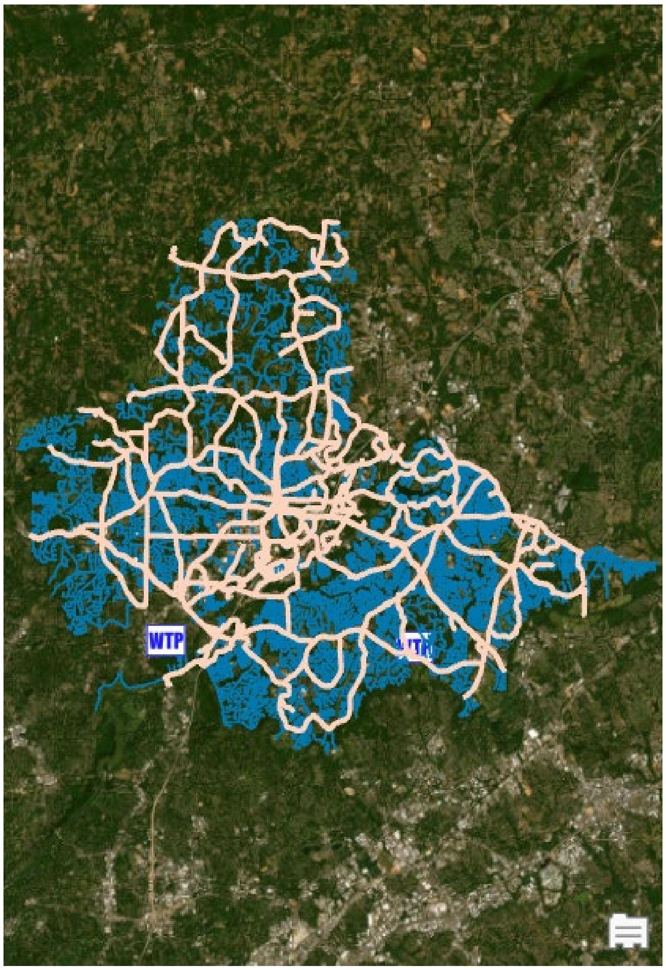
Existing water demands in the calibrated hydraulic model were allocated based on geocoded water billing data.

The projected water demands (as shown in Table 2-7) for 2030, 2040, and 2050 were allocated to the corresponding scenarios in the hydraulic model. For the 2035 scenario, an average of the 2030 and 2040 demands was used in the model. The projected water demands were also defined spatially by census tracts for each city service area.

To load future demands for different scenarios, and to avoid allocating future demand growth to areas with existing developments, specific growth area pipes were developed as shown on Figure 2-5. A subdivision with full, 100 percent build-out would not see additional demand due to future growth estimates, but the main line supplying water to that subdivision would see demand increase from future growth.

Thiessen polygons were generated from the nodes connected to future demand pipes to proportionally allocate by area demand growth from the census tract city service areas. Each Thiessen polygon defines an area of influence around its sample node, so that any location inside the polygon is closer to that node than any of the other sample nodes. This is the industry standard methodology for water distribution demand loading.

Figure 2-5. Future Growth Pipes



3. Model Review

Fulton County engaged Stantec to rebuild and calibrate a hydraulic model of their water distribution system in 2022[1] and 2023.[2] The model was rebuilt using a combination of GIS and record drawings and subsequently calibrated using field data collected in November 2022.

The County requested that Jacobs evaluate and validate the 2022 calibrated water distribution model for use in future system capacity planning as part of this Master Plan project. Jacobs reviewed the calibrated model and the calibration report of the hydraulic model and noted discrepancies between the pump station flow rates and suction/discharge pressures in the model results compared to SCADA data. The discrepancies were suspected to be due to pump curve issues in the model. Additionally, there were concerns regarding the impact of a large pressure drop in the northwestern part of the system, as captured in the iHydrant data. This was speculated to be related to unknown user and/or closed valves in that area. These issues were investigated further as explained in the following subsection.

3.1 Model Validation and Updates

The original calibrated hydraulic model was reviewed in detail with regard to connectivity, loaded demands, diurnal curves, pump curves, C-factors, fire flow tests, tank levels, pump station suction/discharge pressures, pump station flows, and iHydrant pressures during both average day demand (ADD) and maximum day demand (MDD) scenarios. As part of the main project effort, pipe connectivity review tools in InfoWater Pro were used to assess connectivity issues in the model. Most of these issues were resolved with GIS data; some areas were prioritized and resolved in coordination with County staff.

The model validation results presented in this section are for the MDD scenario (Figure 3-1), where the comparison results are shown between the original calibrated model on the left and the revised model on the right. The comparison was set up for 2 days – June 21 and 22, 2022 (same period as the original calibration). The comparison spreadsheet is included in Appendix F of this report.

3.1.1 Unknown User Demand/Potential Closed Valves Issue

Analysis of the iHydrant pressure monitoring data showed a significant drop in static pressures when compared to the model pressures during summer months. The largest pressure drop was seen in iHydrant 18 (530 Hickory Mill Lane) data, as shown on Figure 3-1. This issue was attributed to a combination of an unknown heavy demand and potential closed valves near iHydrant 18 (530 Hickory Mill Lane). Since heavy usage is seen mostly in summer months, the pressure drop was likely due to outdoor water usage. For iHydrant 18 (530 Hickory Mill Lane), the pressure drop was higher in the summer of 2022 compared to the summer of 2023 when it was more intermittent (Figure 3-2).

The proximity of the valves to iHydrant 18 (530 Hickory Mill Lane). also suggested the valves might be closed at the intersection of Birmingham Road and Freemanville Road between the 12-inch and 24-inch lines. Field investigations confirmed that closed valves existed, as suspected, in this area.

The location of the unknown user is suspected to be somewhere between Birmingham Road and Wood Road as highlighted on Figure 3-2. For the purposes of model validation, a demand of 800 gallons per minute (gpm) was loaded close to a Country Club with a diurnal pattern that matched the pressure drop

[1] Water Model Recalibration Phase 1 Report. Stantec. August 26, 2022.

[2] Water Model Field Test and Calibration Phase 2 Report. Stantec. May 22, 2023.

that was seen in the iHydrant data. The diurnal pattern was developed where there is a constant demand at around 50 percent and the total demand increases steadily starting from 1:00 a.m., peaking at 6:00 a.m., and dropping back to the constant demand around 11:00 a.m. with a higher peak on the second day as shown on Figure 3-3.

The comparison results of the monitored iHydrant data for the revised model are shown on Figure 3-4 through Figure 3-10. Overall, these results seemed to match well.

Figure 3-1. iHydrant 18 Pressures Comparison

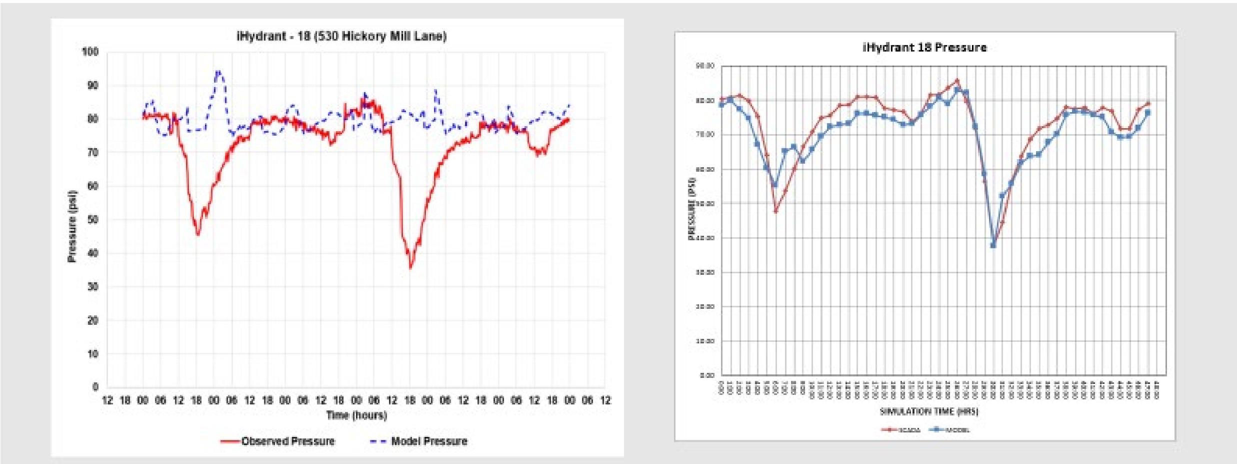


Figure 3-2. iHydrant 18 Pressures in 2022 – 23 and Potential Locations of Unknown Use

Figure 3-3. Unknown User Diurnal Pattern

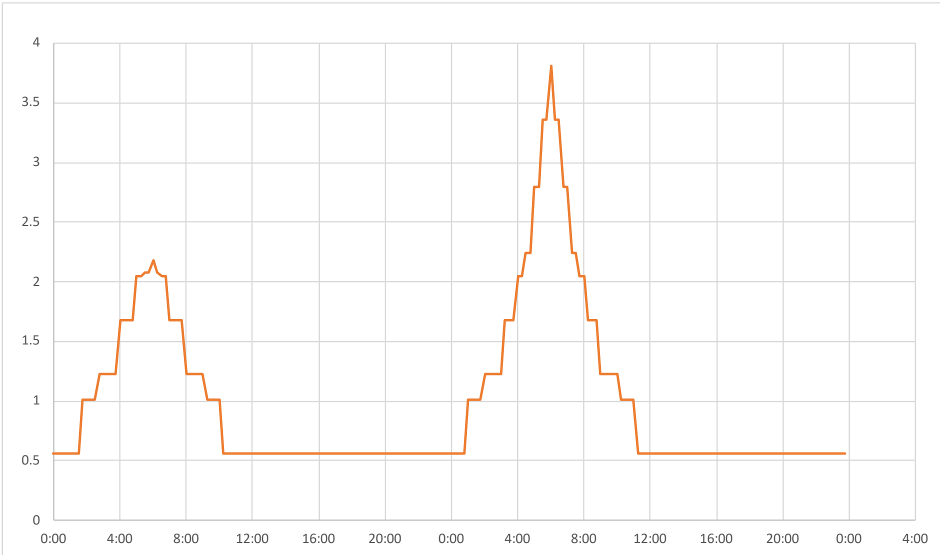


Figure 3-4. iHydrant 25 Pressures Comparison

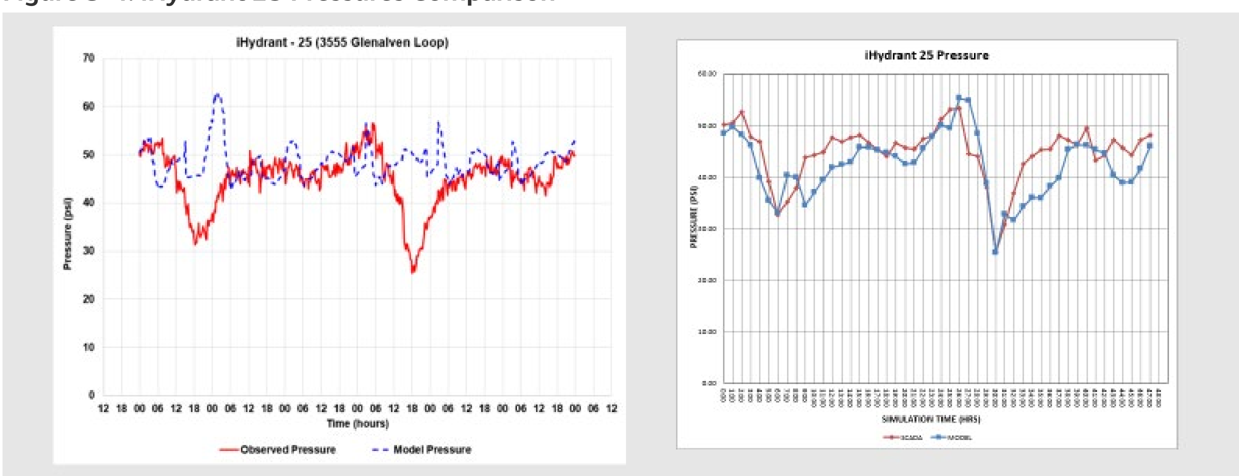


Figure 3-5. iHydrant 17 Pressures Comparison

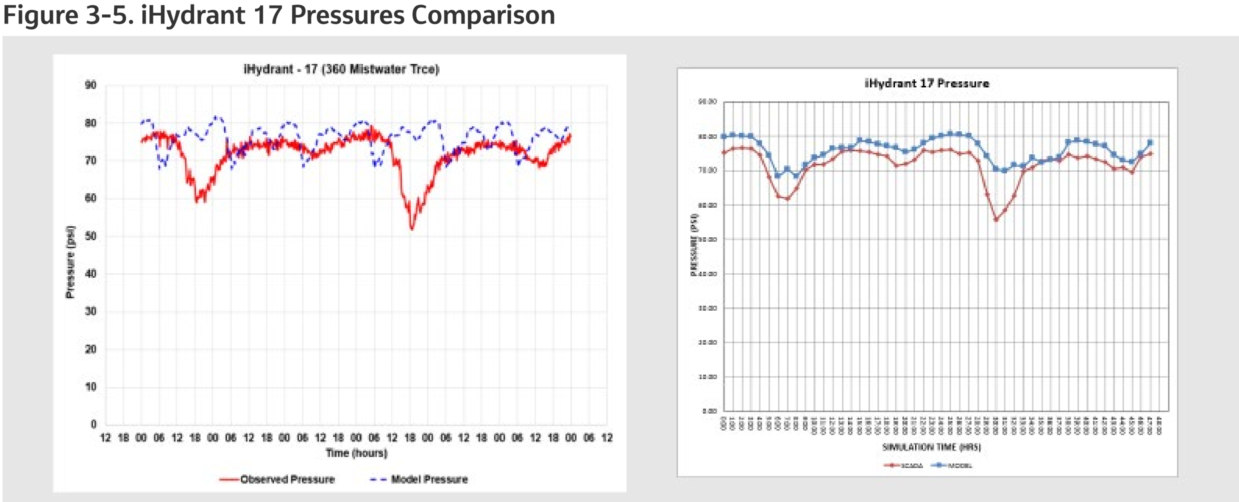


Figure 3-6. iHydrant 16 Pressures Comparison

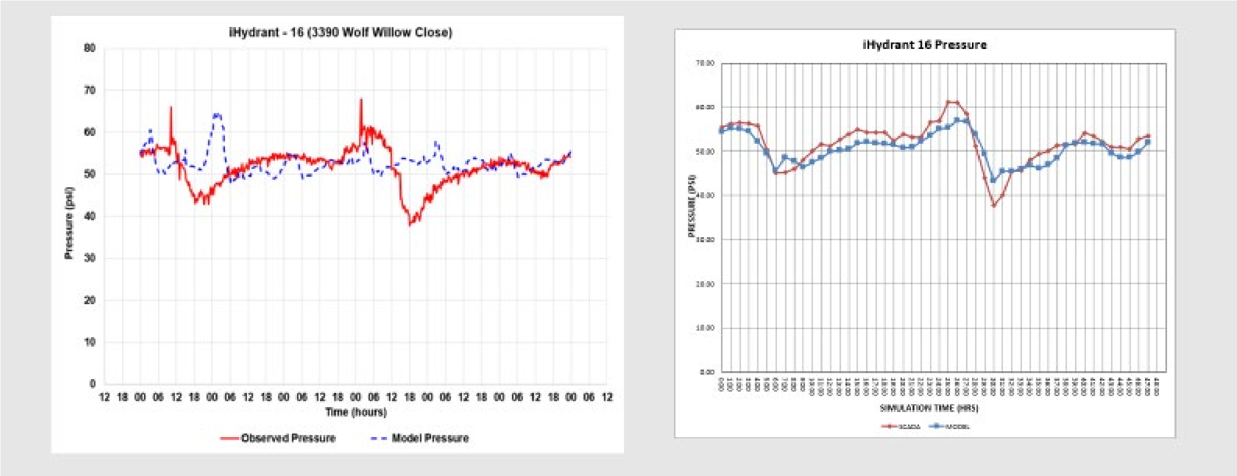


Figure 3-7. iHydrant 11 Pressures Comparison

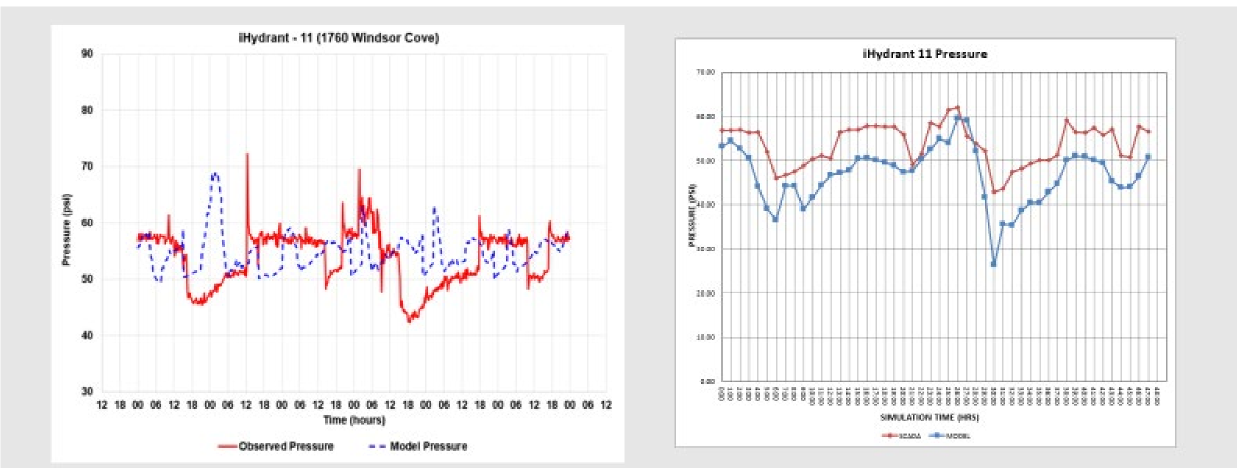


Figure 3-8. iHydrant 13 Pressures Comparison

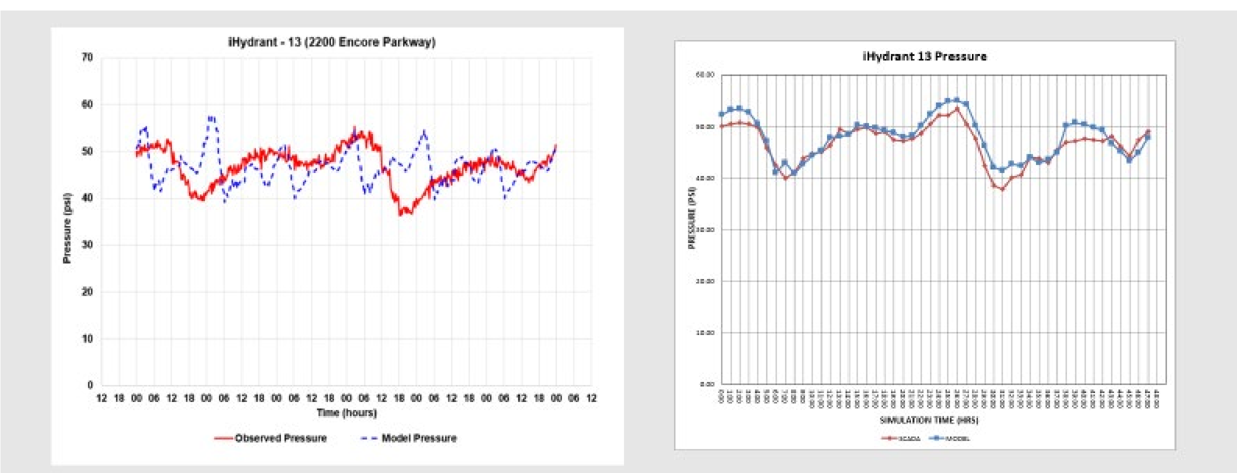


Figure 3-9. iHydrant 7 Pressures Comparison

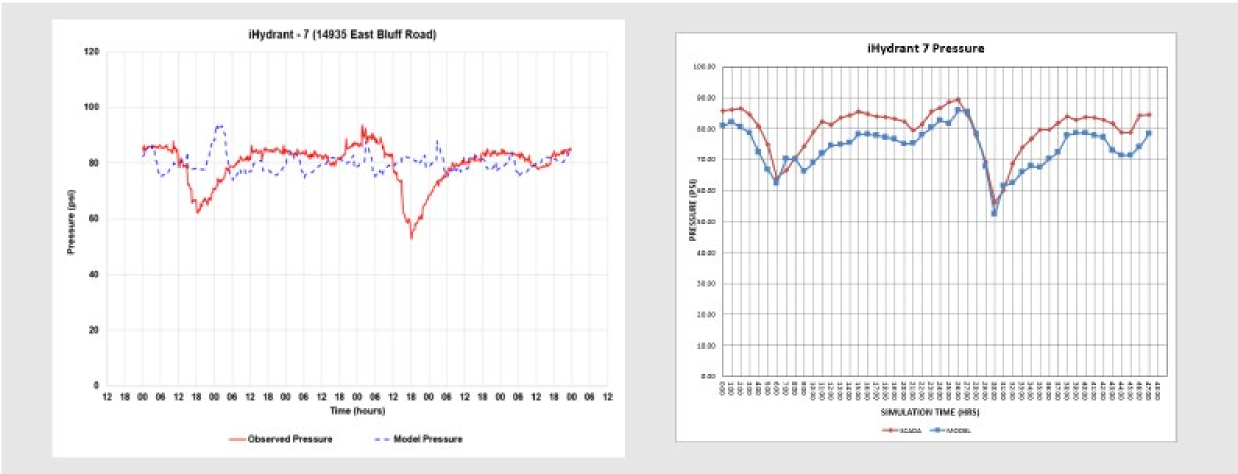
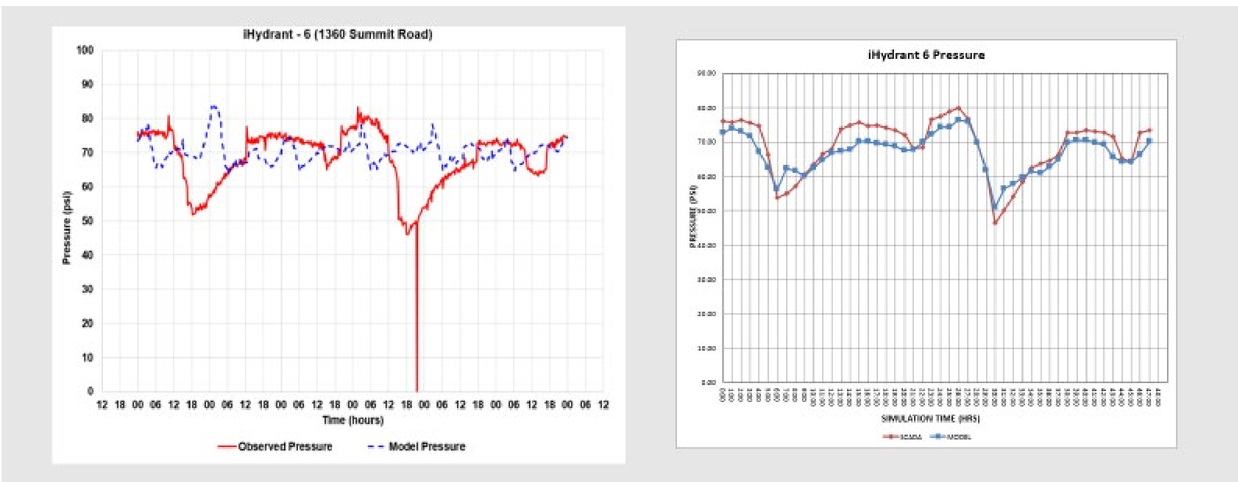


Figure 3-10. iHydrant 6 Pressures Comparison



3.1.2 Pump Station and Tank Updates

The pump curves used in the 2022 calibrated model for the Pritchard Road, Providence Road, and Mansell Road pump stations were based on field testing performed in November 2022. In many cases, the field test results were different from the SCADA data and had a significant impact on model calibration. The manufacturer's pump curves for these pump stations together with the field tests results were compared to find the best fit for the SCADA data. The final pump curves used in the model were digitized from the original manufacturer's pump curves and were adjusted based on the SCADA data, as necessary. The pump digitizer spreadsheet is included in Appendix F of this report. The methodology for the pump curve updates is explained in the sections below for each pump station.

3.1.3 Pritchard Road Pump Station and Pritchard Tank

The primary concern for this station was the large difference observed between the suction and discharge pressures, which was about 30 pounds per square inch (psi) according to the previous calibration report. Additionally, the flow difference between the SCADA and the model was over 3,000 gpm. To address these concerns, the SCADA data and pump curves were reviewed.

For the Pritchard Road pump station, the field test data for both Pumps 1 and 2 showed a flow rate of about 1,040 gpm and a TDH of about 120 feet when running at full speed and with shutoff head near 165 to 170 feet, which was higher than the manufacturer's pump curves' shutoff head. The full speed field test data showed reduced performance from the manufacturer's pump curve; the pump curve was then adjusted to better fit the full speed field data for Pumps 1 and 2, as shown on Figure 3-11 and Figure 3-12.

Uncertainty regarding the quality of the SCADA Pritchard data appears to have resulted in the primary differences in the flow and pressure between the model and SCADA results observed in the prior calibration results. Upon closer inspection, the flow and pressure SCADA results for the Pritchard Road pump station appear to be unreliable and unrealistic.

The suction and discharge pressures from SCADA differed significantly from the model, as shown on Figure 3-13. However, photos taken during field visits and published in the original calibration report clearly show the gauge suction and discharge pressure at the station. The gauges identified the suction pressure as about 18 psi and the discharge pressure as about 67 psi. These values matched well with the model results.

Flow results for this station, however, were more difficult to verify. SCADA pump station flow rate would routinely peak at about 4,000 gpm (with no change in suction/discharge pressures), which was not realistic but would periodically drop for short periods to flows in the more realistic 1,200 to 1,300 gpm range. These flows were comparable to the model results, which were in the 1,250 gpm range. Since the model flows also resulted in a close match of the tank filling and draining, the flow range of 1,200-gpm range had to be correct, and the SCADA flows in the 4,000-gpm range must be incorrect.

The Pritchard Road pump station is primarily used to fill the Pritchard Tank. The trend of the Pritchard Tank levels in the revised model vs. SCADA (Figure 3-14) confirms that the Pritchard Road pump station flow is closer to the model predictions.

It is recommended that the SCADA pressure and flow data for this pump station be checked due to the issues found in suction/discharge pressures and the discharge flow rate. The model results are now considered reasonable for both pressures and flows after the pump curve adjustments. Pressures now fall within the 5-psi tolerance for suction and discharge values, and flows closely align with real flows, as evidenced by the closely matched tank filling and draining at Pritchard Tank. The differences in suction and discharge pressures at the Pritchard pump station are now resolved, but the high flow data being reported by SCADA still need to be investigated.

Figure 3-11. Pritchard Road Pump Station: Original Field-tested Curve vs. Adjusted Pump Curve

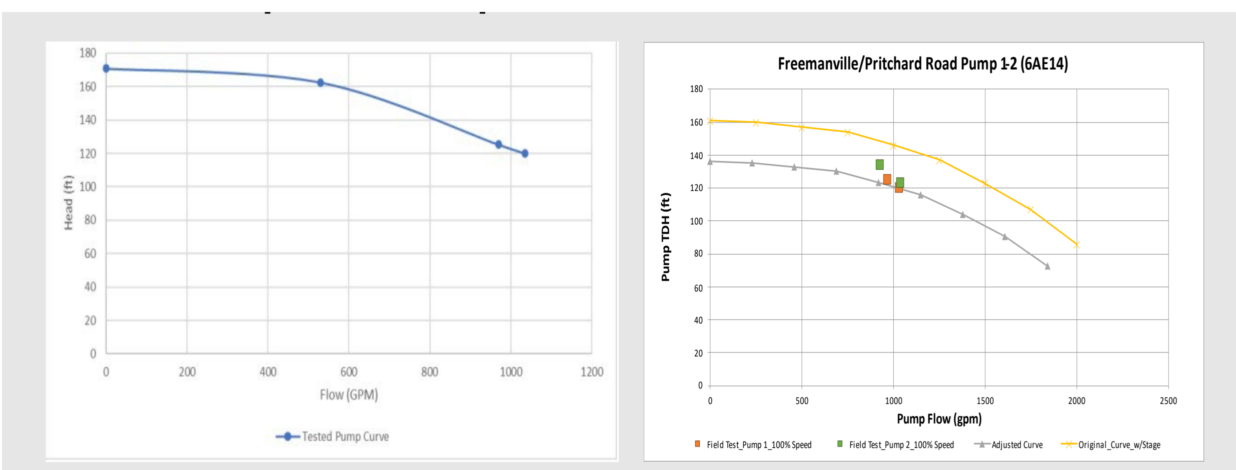


Figure 3-12. Pritchard Road Pump Station: Pump Flow Rate Comparison

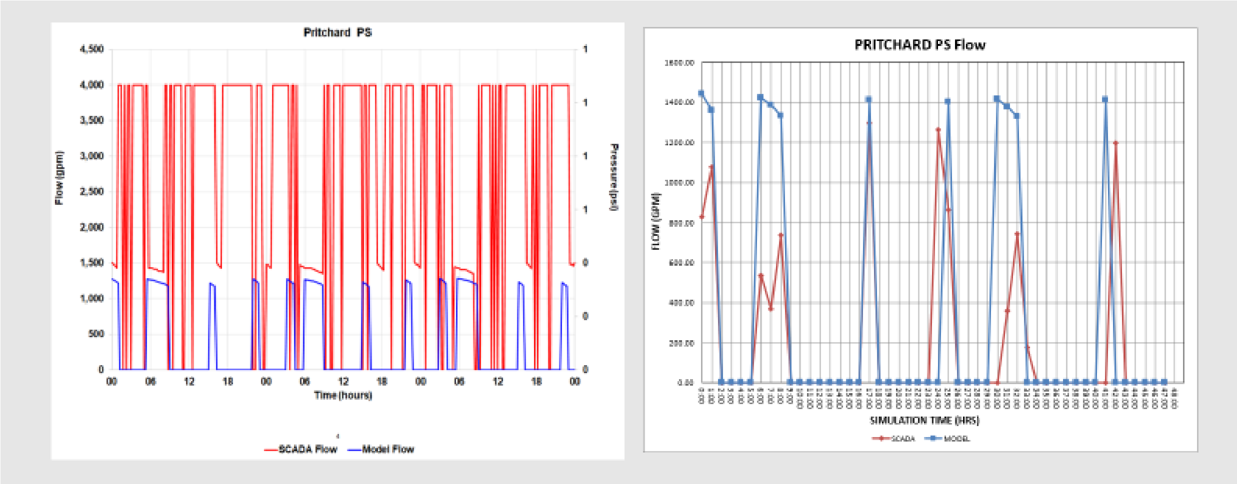


Figure 3-13. Pritchard Road Pump Station: Suction and Discharge Pressure Comparison

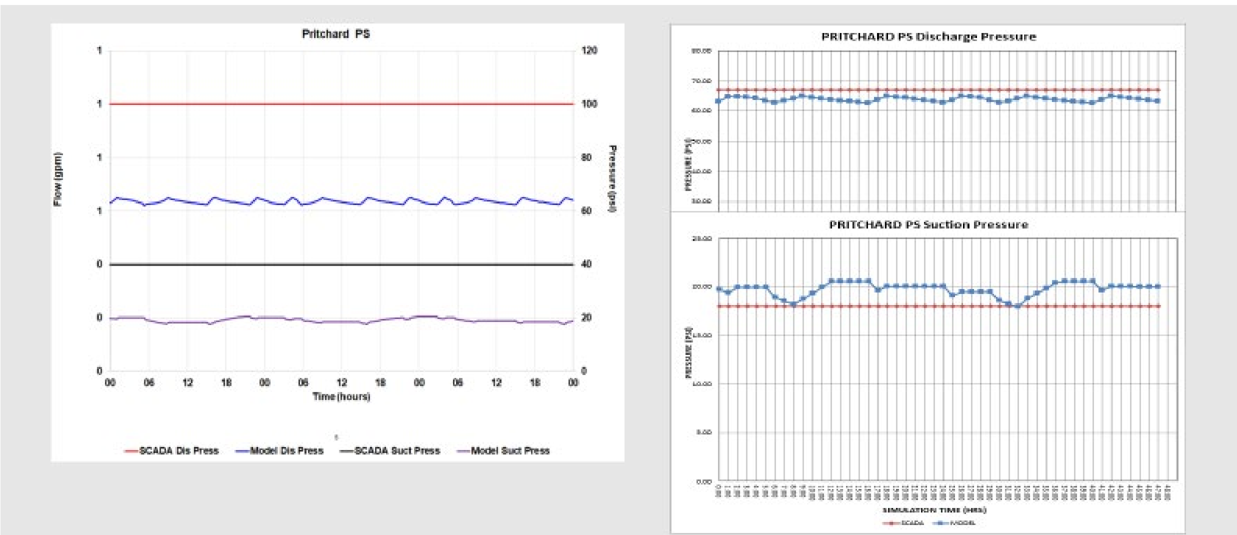
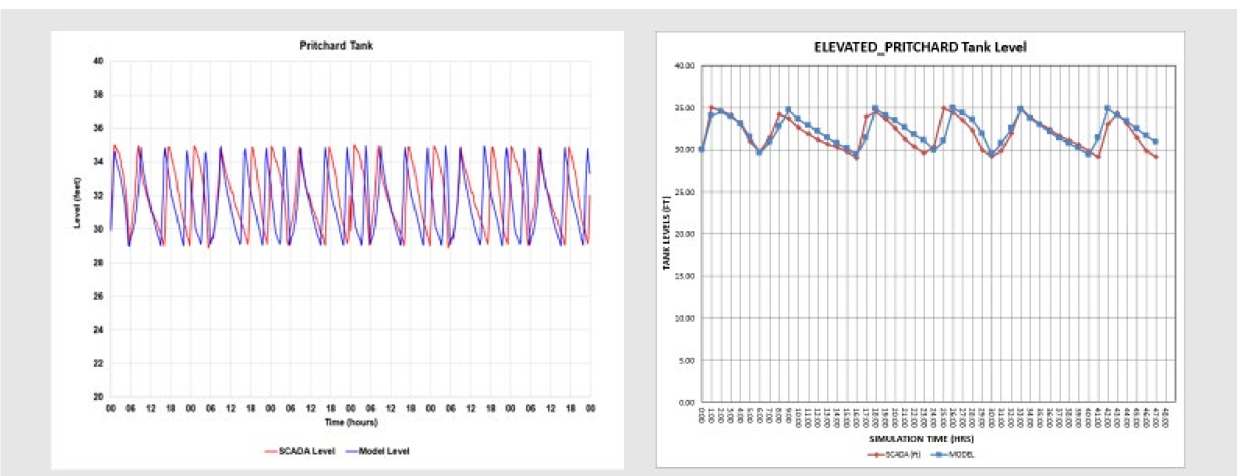


Figure 3-14. Pritchard Tank Level Comparison



3.1.4 Providence Road Pump Station and Freemanville Tank

The primary concern with the Providence Road facility was the 15- to 20- psi difference in the suction pressures and the large 2,000 gpm flow differences between the model and the SCADA data, as observed in the calibration report. These differences are believed to be the result of pump curves that did not incorporate the unidentified large water user in the downstream zone or the identified large close valve previously identified at the corner of Freemanville and Birmingham Roads. The inclusion of updated pump curves and the large water user and closed valve were identified as likely to improve the model's calibration results.

The Providence Road pump station field test data showed a flow rate of 3,000 gpm and TDH of 52 feet with Pump 1 running at full speed, and a flow rate of 2,780 gpm and TDH of 43 feet with Pump 3 running at full speed. The field test data for Pump 1 was very close to the manufacturer's pump curve, but the field test for Pump 3 showed reduced performance. The pump speed that was tested was also higher, at 1,185 revolutions per minute (RPM), than the manufacturer's pump curve test speed of 1,160 RPM. The model results were found to best fit the SCADA data when the Providence Road pump curve was adjusted to be slightly greater than the original pump curve (at roughly 102% speed), which is slightly higher than what was predicted by the field test data shown on Figure 3-15. This curve was needed to get the higher flow rates observed in the SCADA data and is believed to be justified even though it is slightly larger than the original manufacturer's curve as some curves provided may represent trimmed curves while pumps may be delivered without trimmed impellers. Whatever the case, the actual station flows are clearly higher than what is being predicted and a slight adjustment like this is reasonable to assume given the flows observed in SCADA.

The SCADA data show the pump station flow rates were above 4,000 gpm in certain cases. Although the SCADA data did not show how many pumps were running, it was apparent that two pumps were running together. The pump controls at this pump station were revised from a variable speed pump (VSP) to level-based controls based on the Freemanville Tank levels. The predicted flow rate in the revised model is close to 10% of the SCADA flow rate as shown on Figure 3-16.

The calibrated model suction pressures were trending higher compared to the SCADA data while the discharge pressures were fairly close. The revised model suction and discharge pressures trend quite closely to the SCADA data, as shown on Figure 317, except for the early hours where the discharge pressures are higher. It is believed this is caused by the model tank control valve failing to open which causes the model pressures to rise when the valve is closed. Similar behavior was also observed in the iHydrant data in the actual system as well and was therefore left closed in the model. Close operational control of the Providence pump station should be matched to ensure that when a second pump is turned on that the Freemanville Tank altitude valve is allowed to fill to avoid higher pressures in the discharge zone. It is unknown if current operations currently are checking for this, but this should be added to the system operation to avoid this potential higher pressurization from occurring in the real system.

The Freemanville Tank altitude valve was adjusted based on SCADA data such that it opens when the tank level drops below 40 feet instead of 42.5 feet. The revised model compares well with the SCADA data for the Freemanville Tank as shown on Figure 3-18.

Conclusions: The tank operations are vastly improved with these changes to the system. The pump curve significantly improved the Providence Road operations for both flow and pressure and getting the model and SCADA values closer than were observed previously. The adjustment of operational controls and adjustment of the operations of the Providence Road pump station to non-variable speed control also greatly improved model operations and model stability. Suction pressures and discharge flows are now much more closely matching what was observed in the SCADA data. Adding the large unknown user demand with its diurnal curve also improved the pressure and flows in this area as well as did the inclusion of the closed valve at the corner of Freemanville and Birmingham Roads. That the tank level at Freemanville Tank now much more closely matches the actual operation level confirms and appears to validate these changes and increases the confidence in the model significantly.

Figure 3-15. Providence Road Pump Station: Original Field-tested Curve vs Adjusted Pump Curve

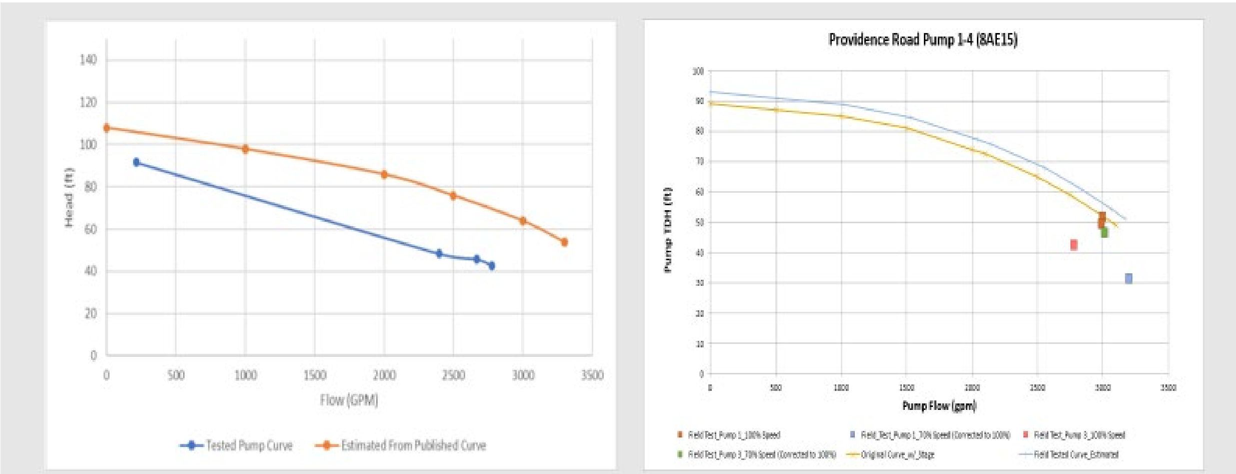


Figure 3-16. Providence Road Pump Station: Pump Flow Rate Comparison

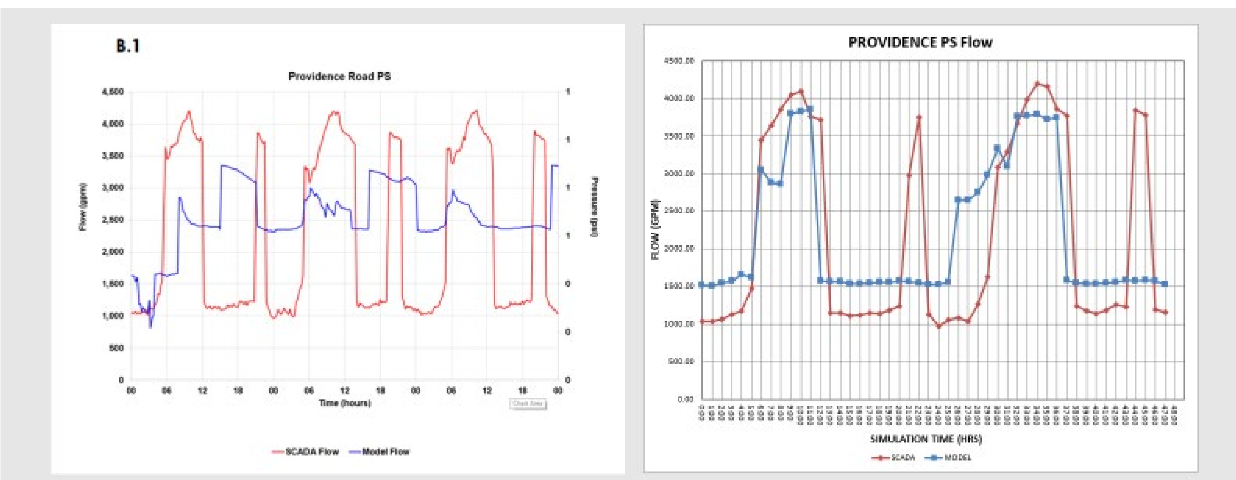


Figure 3-17. Providence Road Pump Station: Suction and Discharge Pressure Comparison

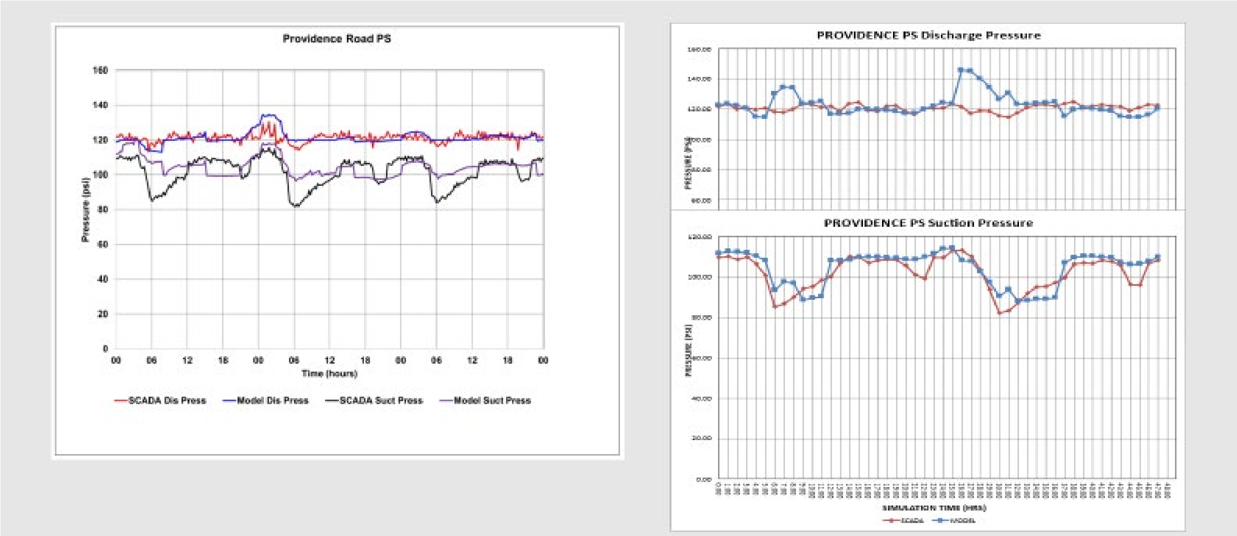
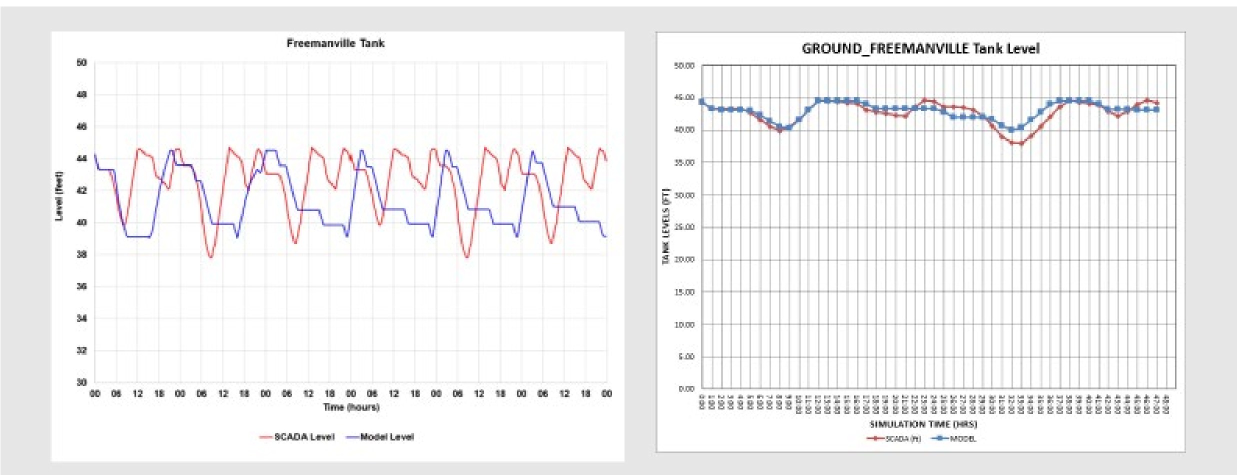


Figure 3-18. Freemanville Tank Level Comparison



3.1.5 Mansell Road Pump Station and Hembree Tank

The primary concerns for the Mansell pump station were the roughly 1,500 gpm difference in pump station flows and the 15 to 20 psi differences in suction pressure that were observed in the original calibration report. It was believed that these differences were due to the pump curves at the Mansell station as well as the low flows seen at the Providence pump station. Improvements to these facilities' pump curves and controls would likely improve these concerns in the model.

The Mansell Road pump station field test data showed a flow rate of 5,150 gpm and a TDH of 15 feet for Pump 1 (at 95% speed), a flow rate of 5,250 gpm and TDH of 15 feet for Pump 2 (at 95% speed), and a flow rate of 4,950 gpm and TDH of 12 feet for Pump 3 (at 94% speed). The pump speed that was tested was also higher (where 100% speed was 1,185 RPM) compared to the manufacturer's pump curve test speed of 1,160 RPM, as shown on Figure 3-19. As with the Providence Road pump curves, to match the flows observed in SCADA, a pump curve similar to the original manufacturer's pump curve was necessary to get model flows close to SCADA flows, even though the field test data indicated that a slight reduction in the curve may have been warranted.

SCADA data indicated that the pump station flow rates were close to 7,000 gpm. Although the SCADA data did not show how many pumps were running, it was apparent that all three pumps were running together. The pump controls at this pump station were revised from a VSP to level-based controls based on the Hembree tank levels. The predicted flow rate in the revised model is close to 10% of the SCADA flow rate (Figure 3-20). Even with this full, 100% speed curve, model flows were still under predicting the flows observed in the SCADA system.

In contrast, the calibrated model suction pressures trended higher compared to the SCADA data while the discharge pressures were fairly close but higher when the pumps were operating. The revised model suction and discharge pressures overall trend does follow quite closely to the SCADA data (Figure 3-21).

However, the differences in flow (lower) and suction pressure (lower), and discharge pressure (higher) when pumping is interesting as it does indicate that there is something still somewhat off here, but the model is still reasonably close overall. This is also a location where the SCADA sensors should also be verified against field gauge data to ensure good accuracy of the data. If there is any inaccuracy in the SCADA data at this location here, that could also explain the differences, but without more information it is difficult to explain the differences further. But even as is, this is still reasonable for the planning purposes of the model but should be revisited should additional information become available.

The Hembree tank altitude valve, which receives water from this pump station, was adjusted based on SCADA data such that it opens when the tank level drops below 33.8 feet instead of 32.0 feet and closes at 34.0 feet instead of 34.2 feet. The revised model aligns with the SCADA data for the Hembree tank (Figure 3-22).

While refining the pump curves and controls for this facility improved flow differences, some uncertainty remains regarding suction pressures. While the changes reduced the differences observed from what was seen in the original calibration report to lesser values, there is still some uncertainties that appear to be occurring that cannot be fully explained. However, results are now much more closely matching to the SCADA data and tank level trending is much more closely matching that the model is more than acceptable for planning purposes of the Master Plan.

Figure 3-19. Mansell Road Pump Station: Original Field-tested and Adjusted Pump Curve

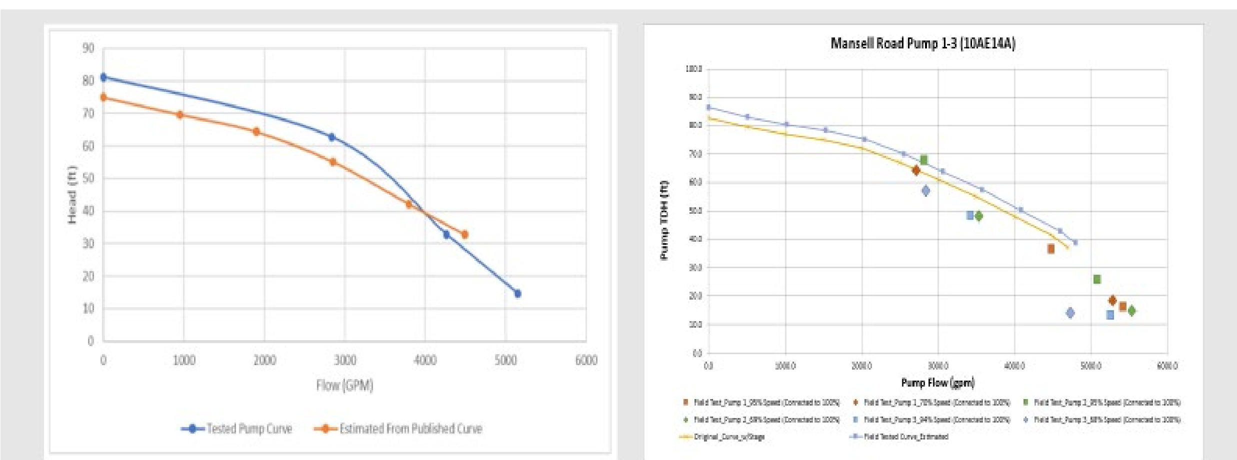


Figure 3-20. Mansell Road Pump Station: Pump Flow Rate Comparison

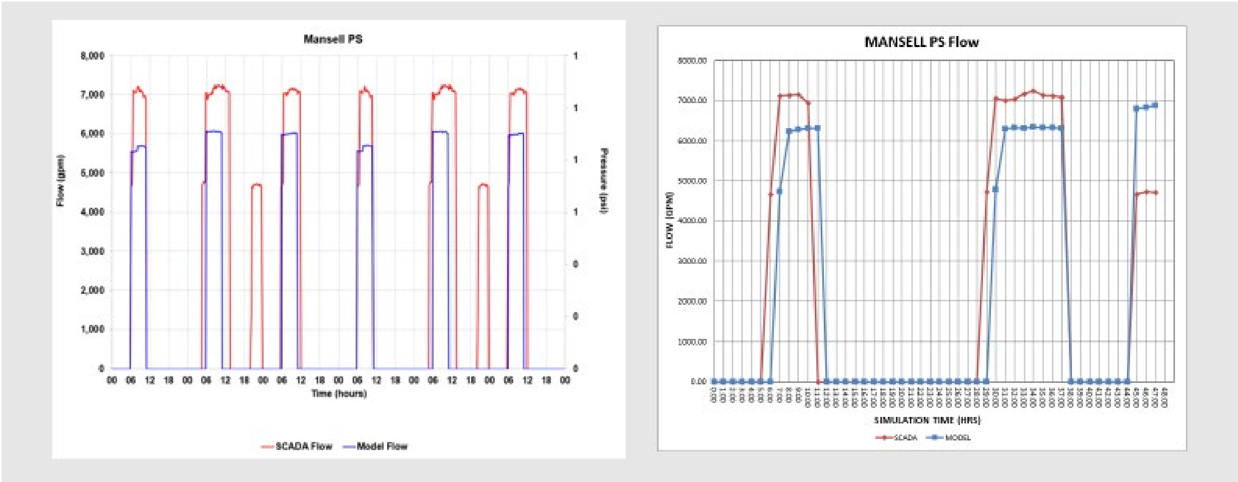


Figure 3-21. Mansell Road Pump Station: Suction and Discharge Pressure Comparison

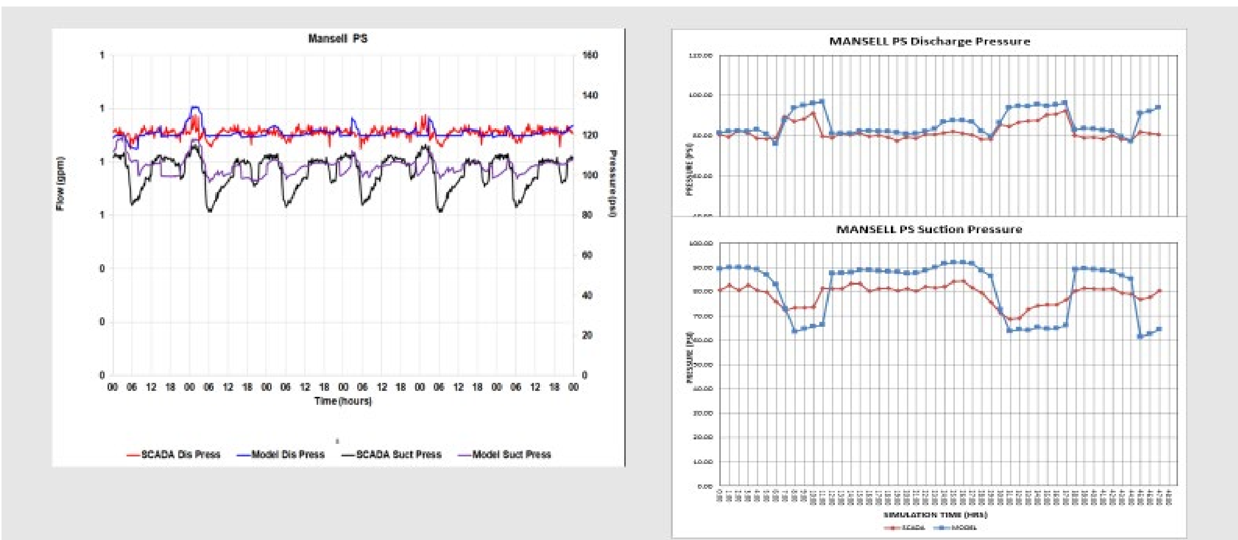
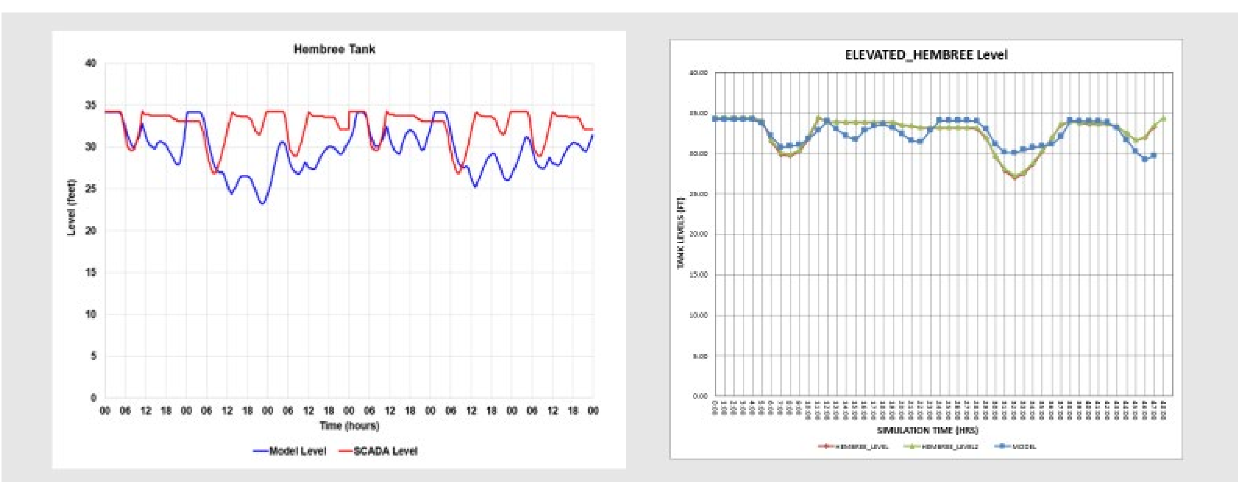


Figure 3-22. Hembree Tank Level Comparison



3.1.6 Other Tank Updates

When reviewing elevated storage tanks in the model, the levels did not match up with SCADA. The current model used tank levels that calculated tank levels from the ground, whereas the SCADA measured tank level from the bottom of the Tank storage level. This difference makes it difficult to compare model and tank "levels" easily from the SCADA to the model. Because of this, the model tank bottom levels were adjusted to match what was used in the SCADA to make the SCADA comparisons easier to read.

Additionally, for the Freemanville and Hackett tanks, the tank volume to depth curves looked to be upside down in the calibrated model. Based on photos of the storage tanks, the volume change had to taper at the bottom and not at the top of the tanks. These curves were corrected as shown on Figure 3-23.

The Hackett and Bethany tanks' altitude valve controls were also adjusted in the calibrated model to match the operations observed in the SCADA data. They were adjusted based on SCADA data such that the altitude valves open when the tank levels drop below 30.5 feet and 31.0 feet for Hackett and Bethany tanks, respectively, and close at 40.0 feet for both tanks. The revised model tank levels compare well with the SCADA data as shown on Figure 3-24 and Figure 3-25.

Figure 3-23. Pritchard Tank Volume Curve Comparison

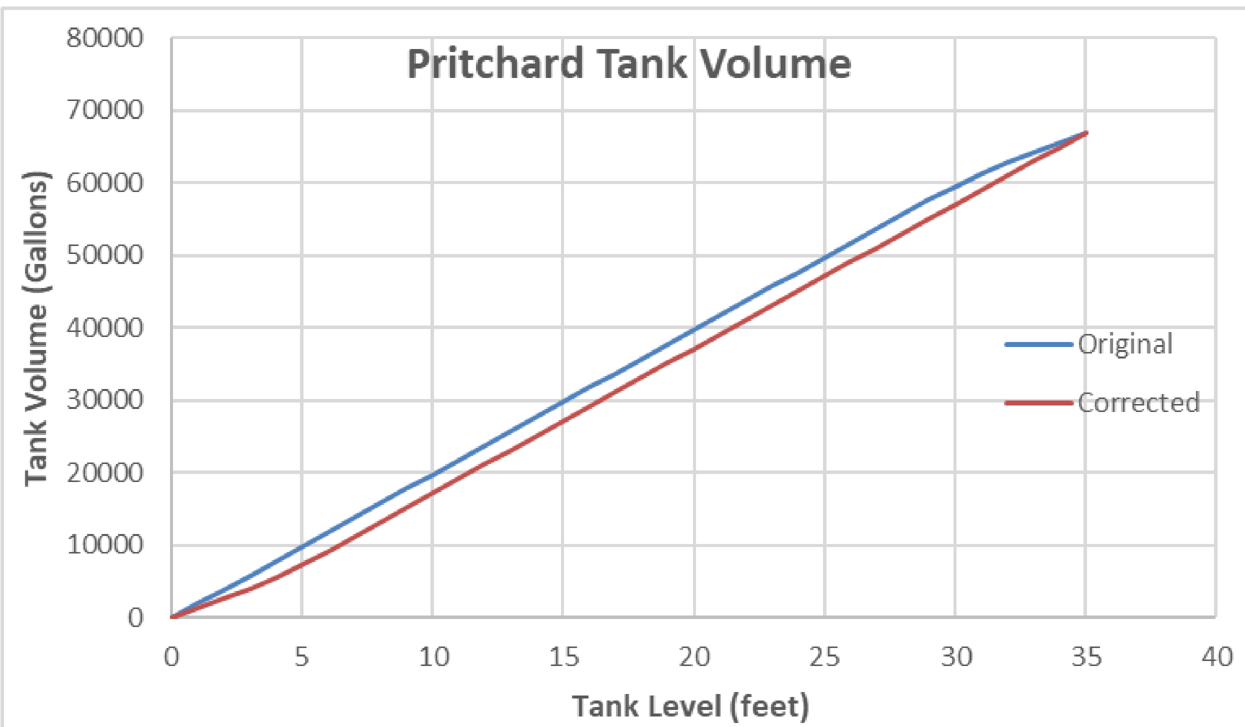


Figure 3-24. Hackett Tank Level Comparison

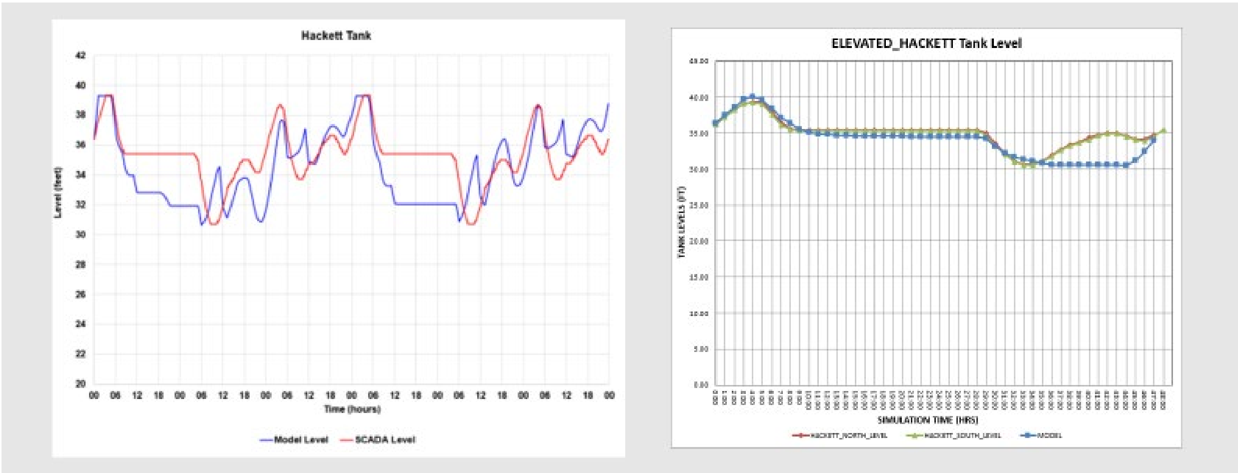
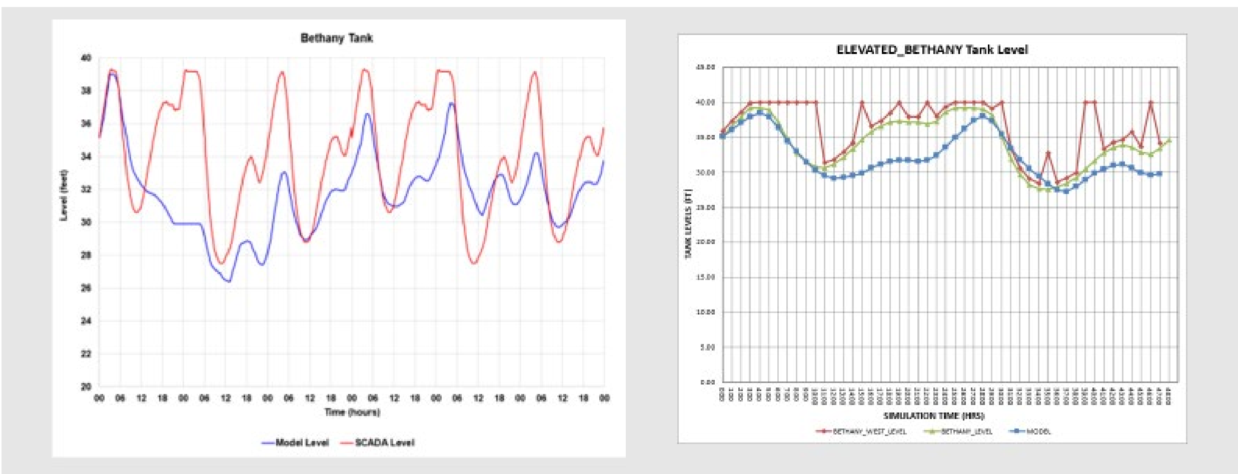


Figure 3-25. Bethany Tank Level Comparison



3.2 Summary

This model validation exercise was conducted as part of the Fulton County Water Distribution Master Plan project to identify areas for improvement and incorporate any changes before future system capacity planning.

With the changes made to the pump curves, the updates to the model controls, the inclusion of the unknown large water user, and known closed valve, the previously identified concerns appear to have been significantly reduced or eliminated from the model. The pump station suction/discharge pressures, pump flow rates, and tank levels in the revised model more closely reflect the SCADA data compared to the previous calibration report. Additional improvements to the model tank curves were identified during this exercise, which allowed for easier comparison of model vs. SCADA tank levels. In addition, two tank volume vs. tank level curves were revised when input errors were found in the previous model. Pump station controls, altitude valve controls, tank levels, and tank volume curves are now more accurately configured in the revised model. These changes appear to now allow the model tank levels significantly better tracking than previously observed. These changes significantly improve the confidence level in the model performance for use in Master Planning purposes.

It is recommended that the SCADA equipment for the Pritchard pump station and the Mansell pump station be checked for issues with suction and discharge pressures and pump flow rates.

The validation exercise also helped identify a significant low-pressure issue near iHydrant 18, which was attributed to a combination of a large unknown user and potential closed valve in the system. Field investigations in this area seemed to corroborate that closed valves might exist as seen at the intersection of Birmingham Road and Freemanville Road between the 12-inch and 24-inch lines. The location of the unknown user is suspected to be somewhere between Birmingham Road and Wood Road. It is recommended that field investigations continue to help identify the location of the unknown user as well as check for other closed valves in the system. For the purposes of future capacity planning, it is recommended that the closed valve that was found at the intersection of Birmingham and Freemanville Roads be opened.

Through this validation exercise one operational recommendation was identified. At the Providence pump station when a second pump is turned on, the Freemanville Tank altitude valve should be allowed to fill to avoid higher pressures in the discharge zone. This will help avoid potentially damaging high pressures from occurring in the system. Overall, this model validation and update exercise helped improve the confidence in the water distribution model for Fulton County. All previously identified concerns appear to have been resolved. Calibration efforts near the Mansell pump station may be warranted in the future to further improve the model, but the current model appears sufficient for master planning purposes without significant flow or pressure concerns previously identified.

4. Water System Analysis

The water system analysis identifies the following under existing and future conditions:

- Areas of constant concern, such as chronically low pressure, high pressure, or high velocity
- System capacity and capability to deliver peak flows
- Available fire flows
- Areas of high average water age

Water system operating standards help ensure an adequate level of water service to all customers. The recommendations applied to the Fulton County water distribution system are from design guidelines published by the American Water Works Association (AWWA) Manuals of Water Supply Practice and input from County personnel. These standards are customized to the County's needs in a tailored Level of Service.

When the system does not meet this Level of Service under the specified conditions, deficiencies are identified. This aids in the identification of improvements to the system, both operational and capital, to overcome these deficiencies and meet the County Level of Service.

Jacobs performed analysis using an extended period simulation of 3 to 168 days using diurnal demand patterns to fluctuate demands hourly. This method allows for a more robust approach in that it evaluates various simulation periods under a defined demand set based on the analysis being performed. Simulations for maximum system response were under maximum day demands, and simulations for minimum or average system response were under average day demands.

4.1 Level of Service

The performance criteria of a water system is defined as the Level of Service a water system delivers water to the customer, as well as other defined criteria in the water distribution system. The following Levels of Service were developed in consultation with the County to evaluate the performance of the water system using the hydraulic model (Table 4-1). The County's operational Level of Service for minimum pressure at the customer connection is 35 psi; however, for the modeling in this Master Plan, a minimum pressure of 40 psi was used at the customer connection or node in the model. This provides a buffer to account for any potential uncertainties or minor losses and adds a "factor of safety" to the recommendations related to minimum pressure.

Table 4-1. Level of Service Criteria

Evaluation Criteria	Value	Units	Evaluation Demand Conditions
System Pressure			
Minimum Pressure	40	psi	PHD
Minimum Pressure, Fire Flow Conditions	20	psi	MDD
Pipeline Velocity			
Maximum Pipeline Velocity for Pipes < 12 inches	5	fps	PHD
Maximum Pipeline Velocity for Pipes > 12 inches	4	fps	PHD
Maximum Pipeline Velocity during a Fire Flow Event	10 to 15	fps	MDD
Pipeline Head Loss			

Evaluation Criteria	Value	Units	Evaluation Demand Conditions
Maximum Pipeline Head Loss for pipes < 16 inches	10	ft/1,000 ft	PHD
Maximum Pipeline Head Loss for pipes > 16 inches	4	ft/1,000 ft	PHD
Water Quality			
Water Age	72 to 96	hours	ADD
Fire Flow Availability			
Residential	1,500	gpm	MDD
Commercial	3,000	gpm	MDD
For New Pressure Zone Evaluations			
Maximum Pressure	100	psi	ADD
Minimum Pressure	40	psi	PHD
Target Pressure Range (static)	50 to 100	psi	-

fps = foot (feet) per second
PHD = peak hour demand

4.2 Current System Deficiencies

The model was run under current demand conditions and compared to the Level of Service to identify deficiencies in the current system. Pressures vary due to changes in ground elevation, water demands, and location relative to water supply sources. Ground elevations within the Fulton County water system vary from 857 feet mean sea level (MSL) to 1,264 feet MSL. This difference is about 407 feet MSL and therefore it is not feasible to limit pressures everywhere within the desired range of 35 psi to 100 psi with the elevation variation of this magnitude. The average pressure across all junctions in the model is about 98 psi with a range of 15 to 198 psi. Most of the high pressure areas are close to the Chattahoochee River toward the south of the county where the elevations are lower. The overall system average pressures are shown on Figure 4-1.

Figure 4-2 illustrates the existing system under MDD, highlighting areas with a minimum pressure below 40 psi. As previously discussed, this is partly attributed to the large unknown demand in the vicinity of iHydrant 18 (530 Hickory Mill Lane), where 2022 data show that the static pressures dropped significantly during the summer months. Figure 4-3 shows the tank level turnover during the MDD scenario. Most of the tanks turn over at least 20%, while Bethany and Alpharetta tanks turn over almost 40%.

Figure 4-4 shows the maximum head losses in the system in feet per thousand feet of main during MDD. Figure 4-5 shows the maximum velocities in feet per second (fps) in the mains during MDD.

According to the Level of Service criteria established in Section 4.1, there are only a few areas where the criteria are exceeded for both high head losses and maximum velocities; some of these exceedances are attributed to the assumption of the unknown user demand mentioned herein. The current system deficiencies are also presented in Appendix G.

Figure 4-1. Existing System ADD – Average Pressures

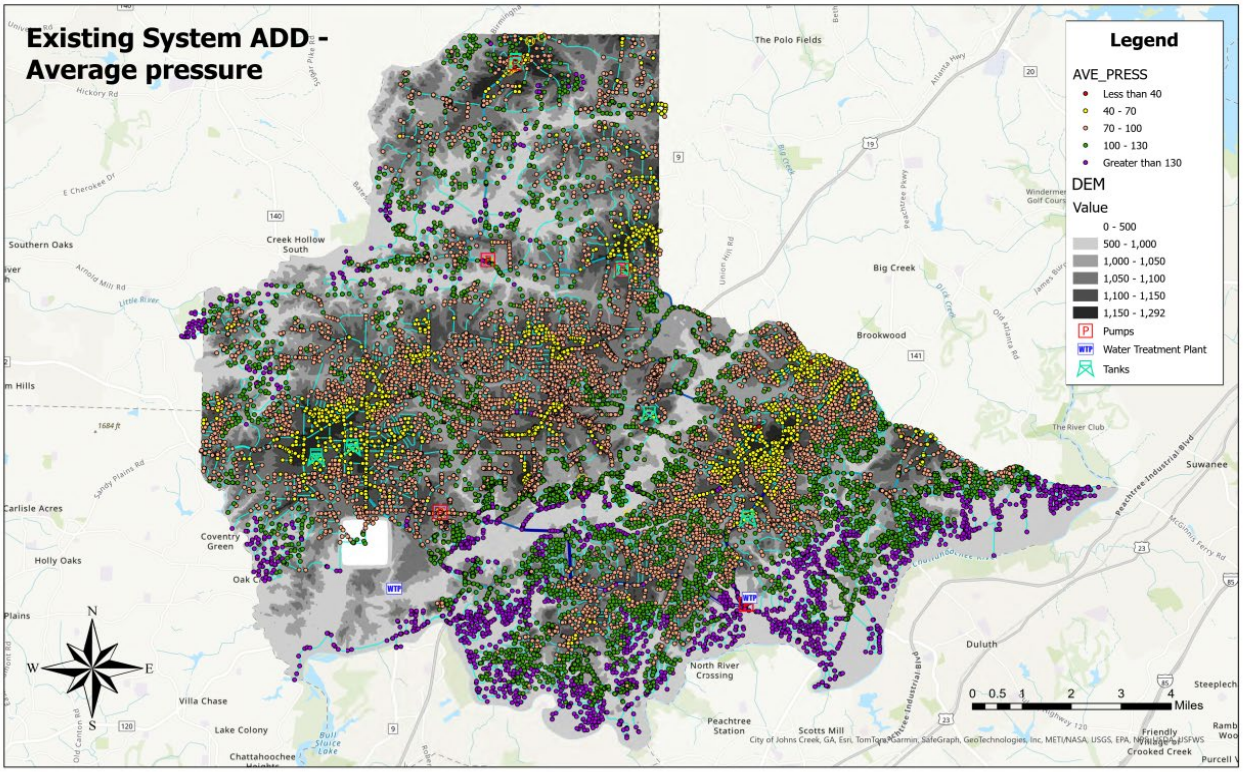


Figure 4-2. Existing System MDD – Minimum Pressure < 40 psi (with unknown user node shown)

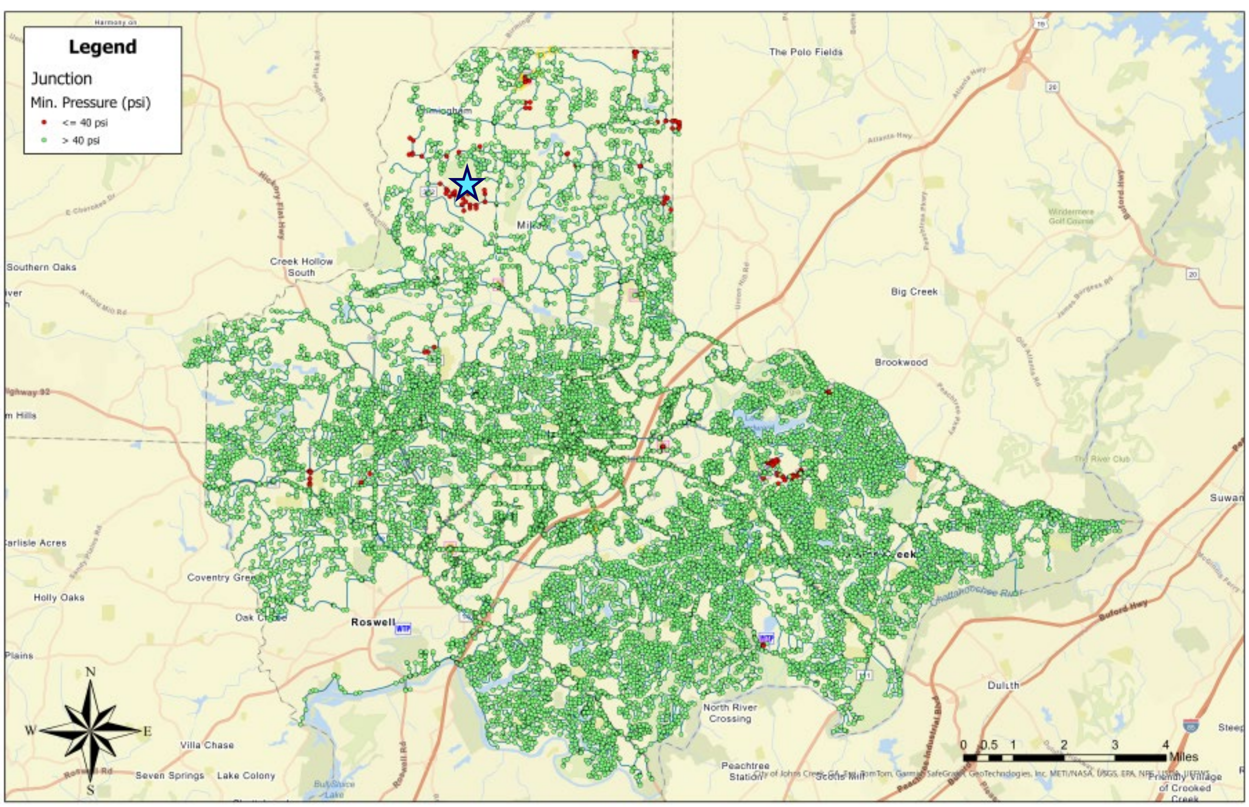


Figure 4-3. Existing System MDD – Tank Levels

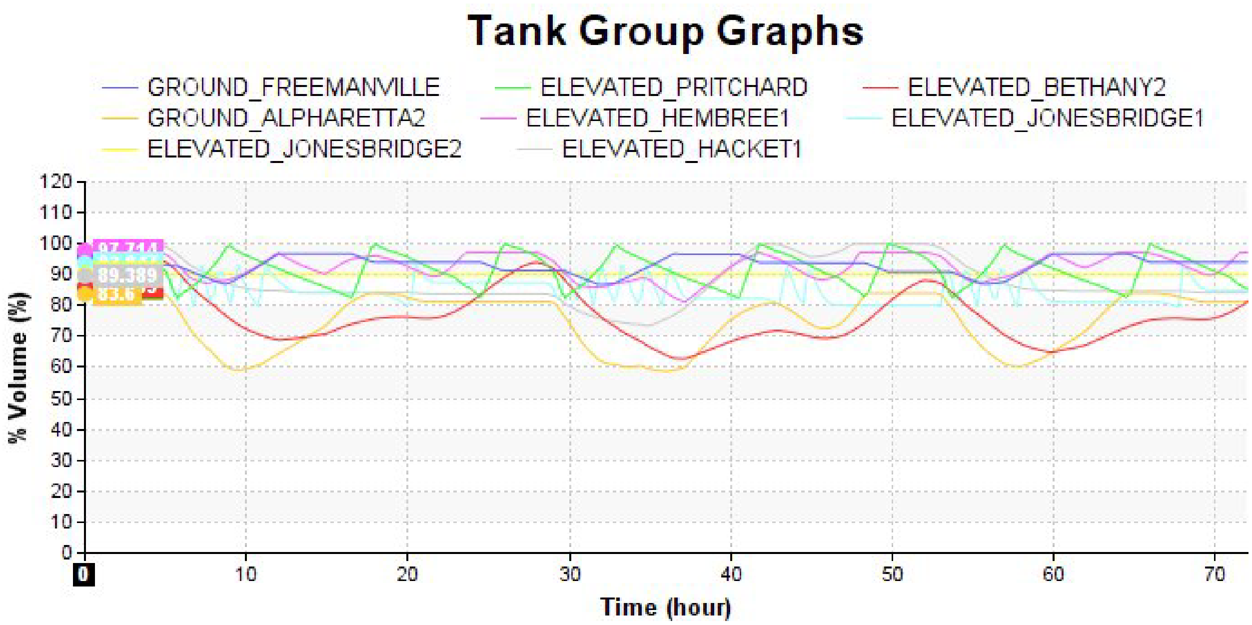


Figure 4-4. Existing System MDD – Maximum Head Losses

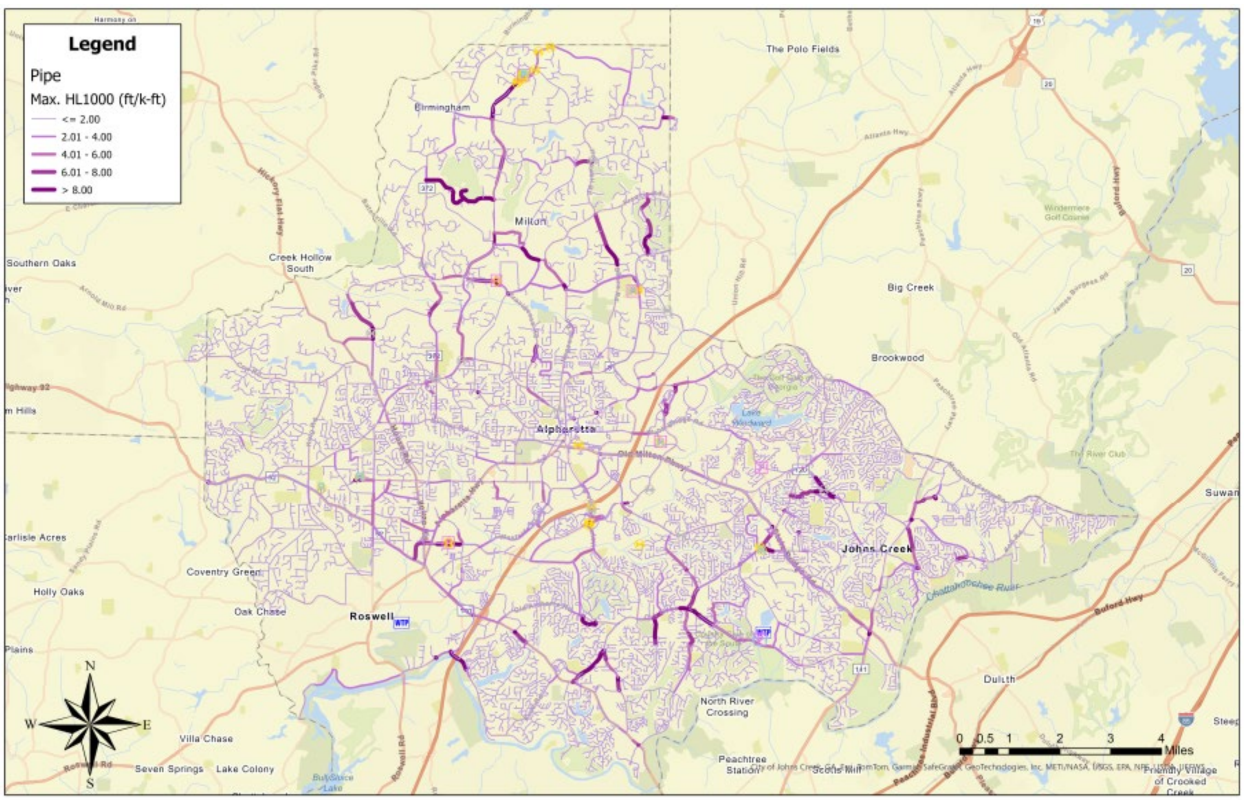
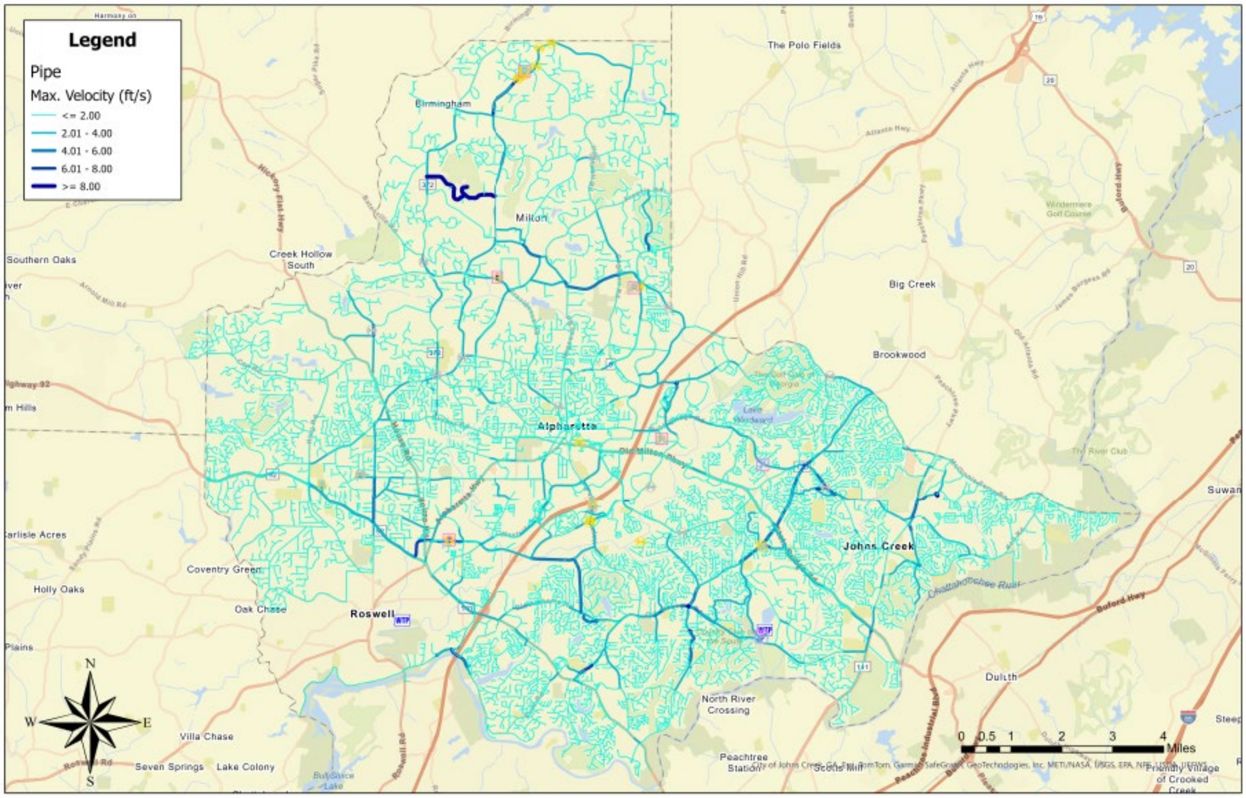
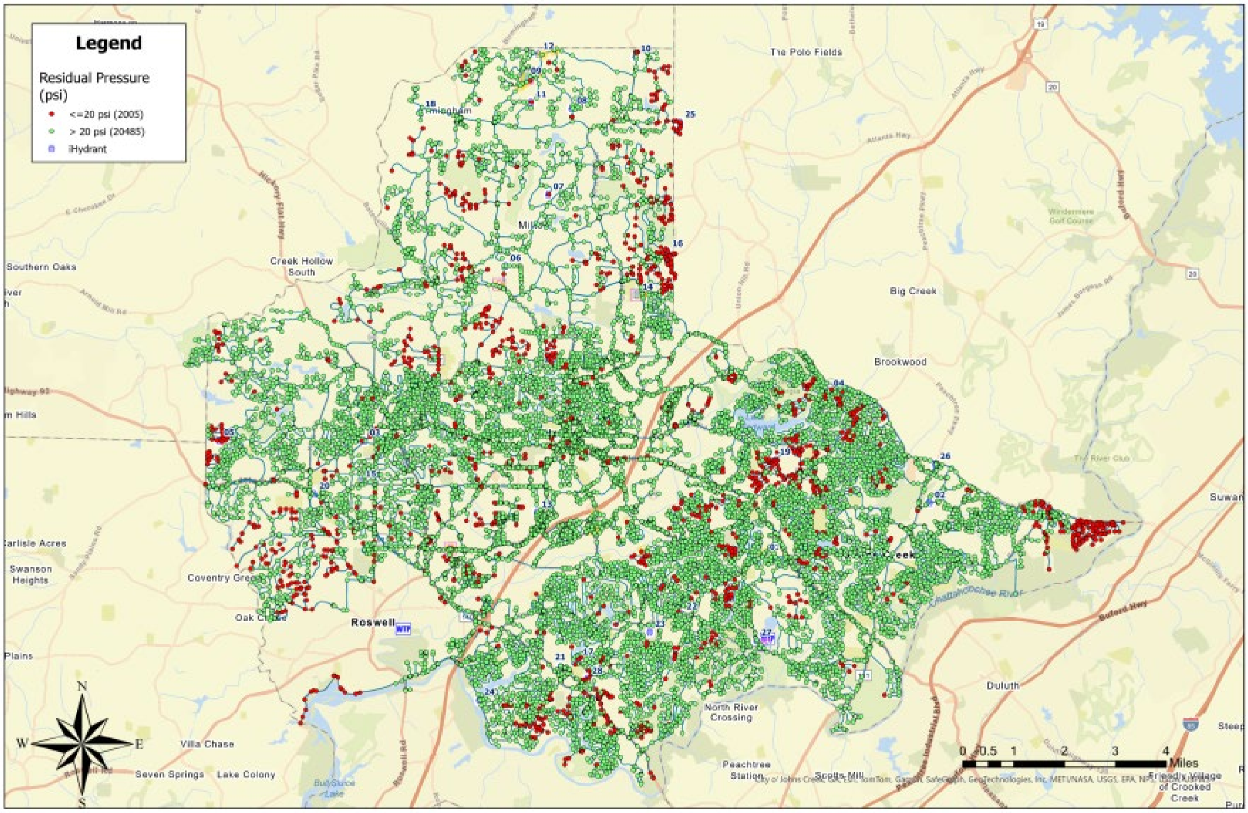


Figure 4-5. Existing System MDD – Maximum Velocities



A fire flow analysis was performed using the MDD scenario where AWWA recommends that fire flow be evaluated at the average hour of the MDD rather than the peak hour. The likelihood of a large fire occurring at the peak hour of the maximum day is small, and planning for this condition could result in the overdesign of system components. Fire flow demand was loaded into the model based on the land use codes associated with the tax parcel data in GIS. Any model junctions that were within commercially zoned parcels were loaded with a fire flow demand of 3,000 gpm. Junctions within residentially zoned parcels were loaded with a fire flow demand of 1,500 gpm. The system's capacity for delivering fire flow to an area via the water mains rather than through an individual hydrant is the metric commonly used by ISO for evaluating system performance. This method more accurately represents the available fire flow in the system up to the hydrant's location. Individual hydrant components were not modeled. The results of the fire flow analysis under MDD are shown on Figure 4-6, where junctions with residual pressures below 20 psi during a fire flow condition are highlighted in red.

Figure 4-6. Existing System MDD – Fire Flow



4.2.1 Water Quality Analysis

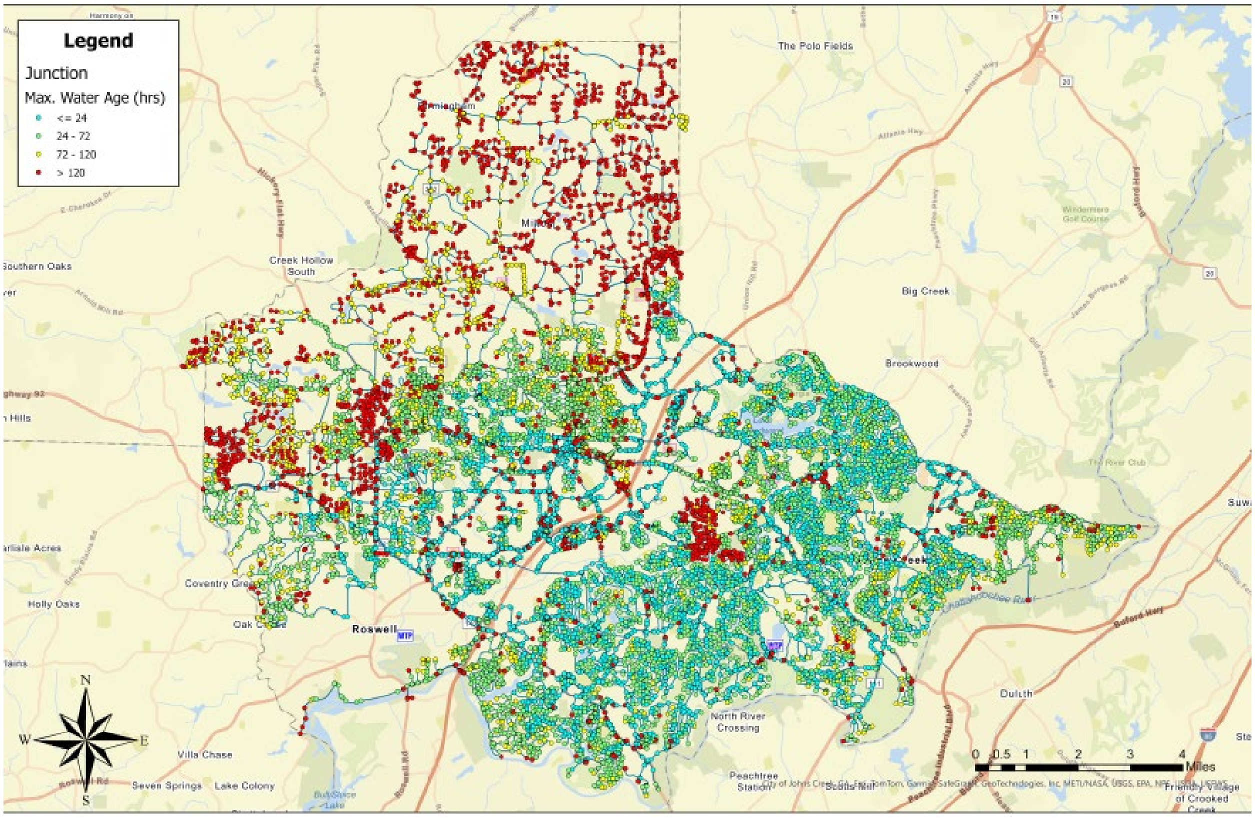
As water travels through the distribution system, it undergoes various chemical, physical, and aesthetic changes, which affect water quality. These changes depend on the finished water quality, water age, water flow rate, pipe materials, and deposited materials (such as sand, iron, and manganese). The water quality analysis evaluated water age and pipe velocities to identify areas that could be more susceptible to deterioration of finished water quality. The water quality analysis consisted of an extended analysis period of 30 days. The extended analysis is required because water models initialize water age at 0 hours and increases until a repeated pattern of water age is stabilized based on a daily diurnal of water patterns and system operations. The results of the water age analysis were based on average water age and average pipe velocity for the final 3 days of the 30-day simulation. The water age evaluation was performed under ADD.

4.2.1.1 Water Age

Water age is defined by measuring the time the water spends in the distribution system—the number of days it takes to travel from the WTP to the customer. As water demand increases, the amount of time any given volume of water resides in the system decreases. Analyzing water age provides information on the operation of the distribution system, the movement of water within the piping network, and the adequacy of the fill and drain process in storage tank operations. Water age provides a better understanding of water quality issues and helps to identify improvements. Several indicators may suggest high water age, including aesthetic considerations that consumers may identify and the results of distribution system monitoring efforts. Other than water age, indicators of poor water quality include insufficient source water treatment and pipe materials, and the condition or age of the distribution system.

The water age analysis indicates that there are certain areas, mostly in the City of Milton, where the maximum water age is more than 5 days, as shown on Figure 4-7. This is largely attributed to the WTP's location in the southeastern portion of the county and the increased travel times to get to the northwestern portion of the county. The higher water age area near Kimball Bridge Road is due to the area being isolated from the system. The water age here is improved with the completion of the transmission main.

Figure 4-7. Existing System Water Age (ADD)



4.2.1.2 Chlorine Residual Sampling

For chlorine analysis, Fulton County provided chlorine results from 679 addresses sampled multiple times between January 2022 and December 2023. In the original dataset, location codes were provided alongside addresses, and some addresses were assigned multiple location codes. For the purpose of this analysis, such data were consolidated and regarded as one location.

Drinking water chlorine sample locations and Tax Parcel shapefiles provided by Fulton County were used as initial reference points for geolocating the 679 addresses. The addresses used for the chlorine sampling were spatially joined to matching addresses in the drinking water chlorine sample locations shapefile. Next, the remaining addresses were manually compared to, matched with, and spatially joined to addresses in the Tax Parcel shapefile. Finally, the remaining addresses were geolocated based on their physical address. If an address could not be located using these methods, it was manually compared to the remaining 678 addresses. If there was a matching address with a different suite or building number, the two were consolidated. However, five addresses from the chlorine residuals file could not be geolocated.

The minimum, average, and maximum chlorine residuals were calculated for the sampling locations and are illustrated on Figures 4-8 to 4-10. There is no apparent relationship between high water age and low chlorine residual on the Figures. It is also noted that if there were more chlorine sampling locations in the northwest portion of the County, it may be helpful to correlate with the higher water age areas shown by the hydraulic model.

Figure 4-8. Minimum Chlorine at Sampling Locations

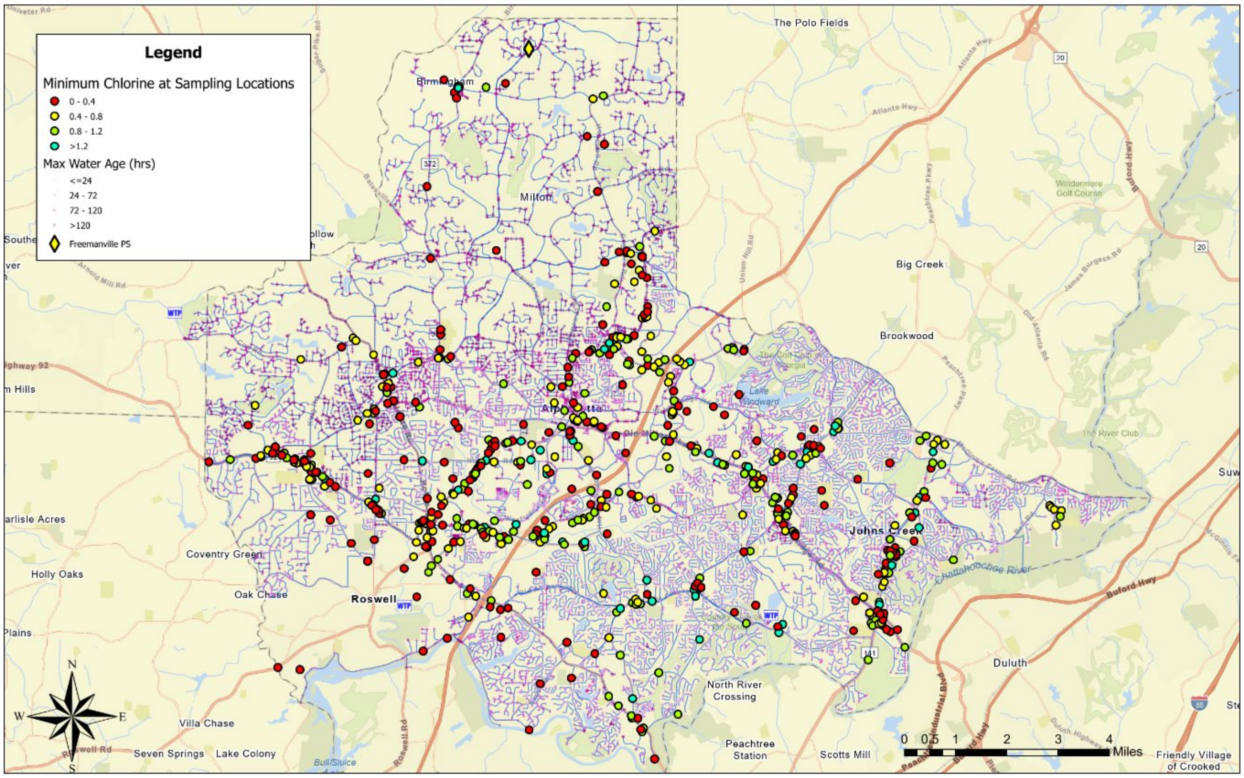


Figure 4-9. Average Chlorine at Sampling Locations

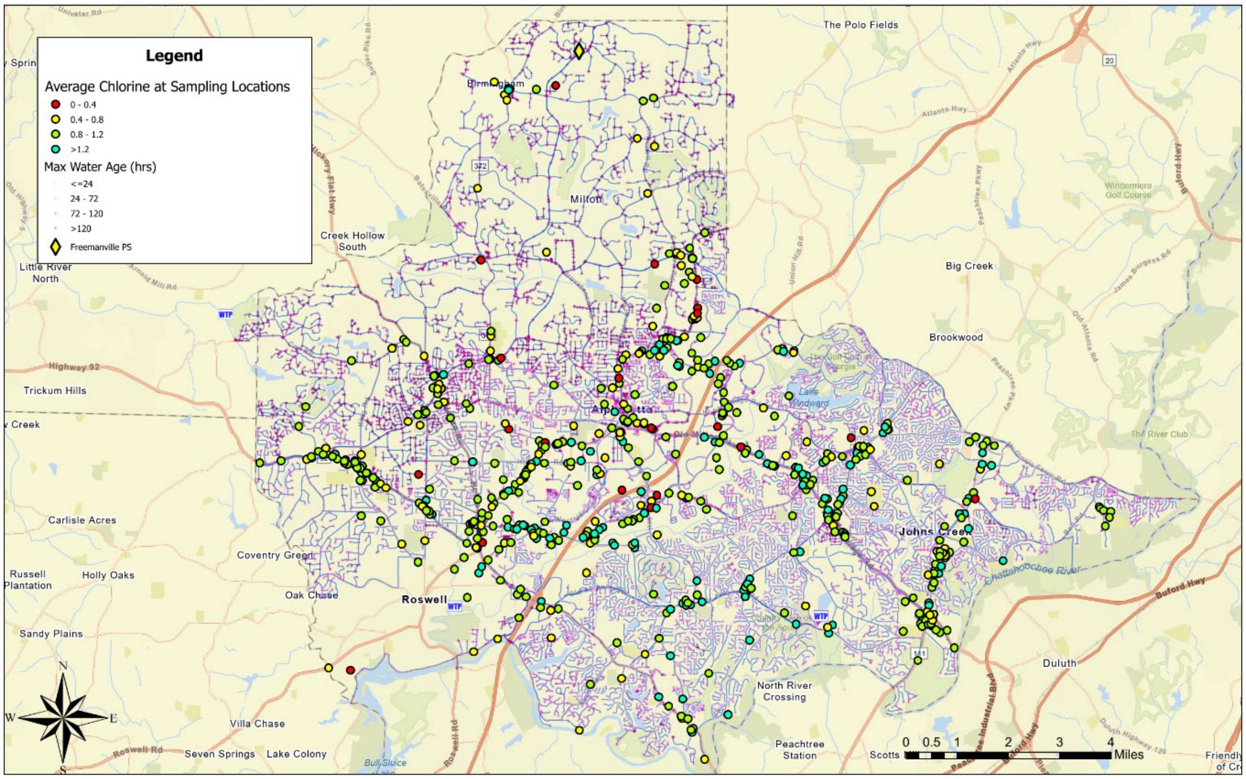
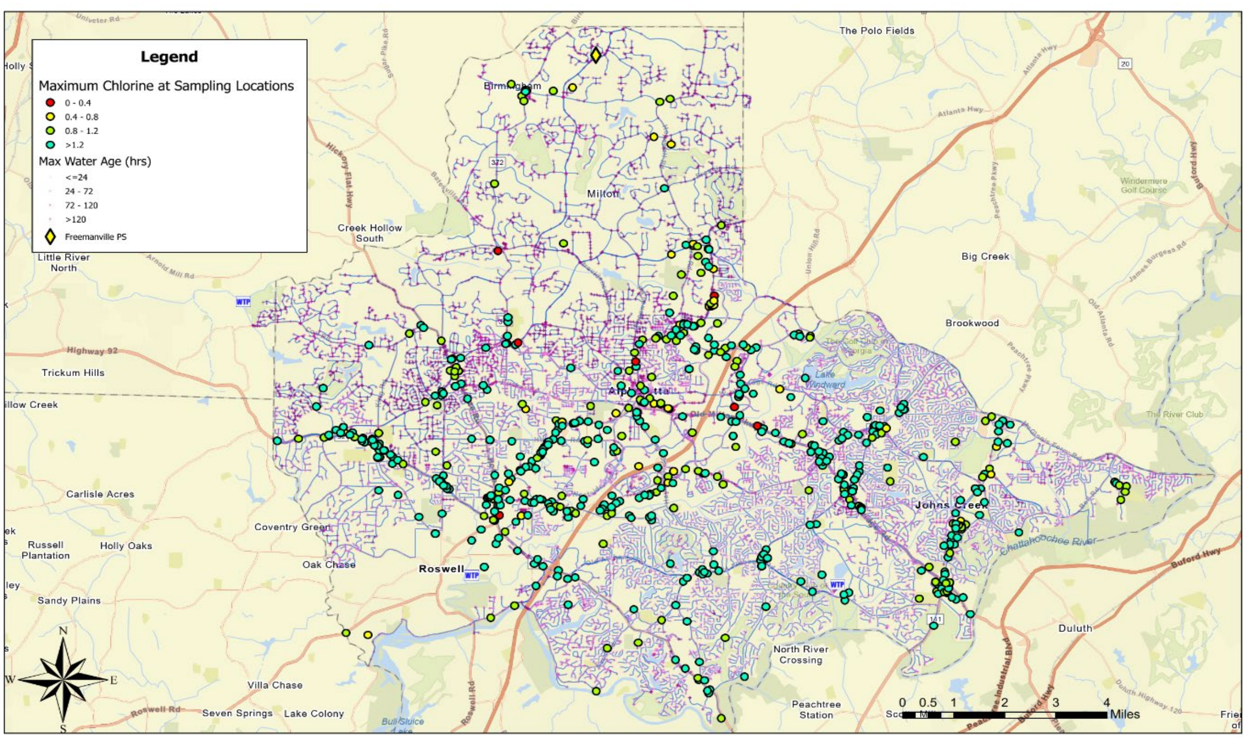


Figure 4-10. Maximum Chlorine at Sampling Locations



4.3 2050 System Deficiencies

The areas with minimum pressures less than 40 psi are shown on Figure 4-11, and the tank levels are shown on Figure 4-12. The Alpharetta and Bethany tanks drain almost completely, while the Hembree and Hackett tanks also have trouble filling. A fire flow analysis similar to the existing system's was repeated under 2050 demand conditions, but the results indicated that the impact was insignificant. This is logical because fire flow demands are usually much higher than domestic demands in the system. The junctions with areas of less than 20 psi residual pressures to meet the total demand are shown on Figure 4-13.

Figure 4-11. 2050 MDD – Minimum Pressure < 40 psi

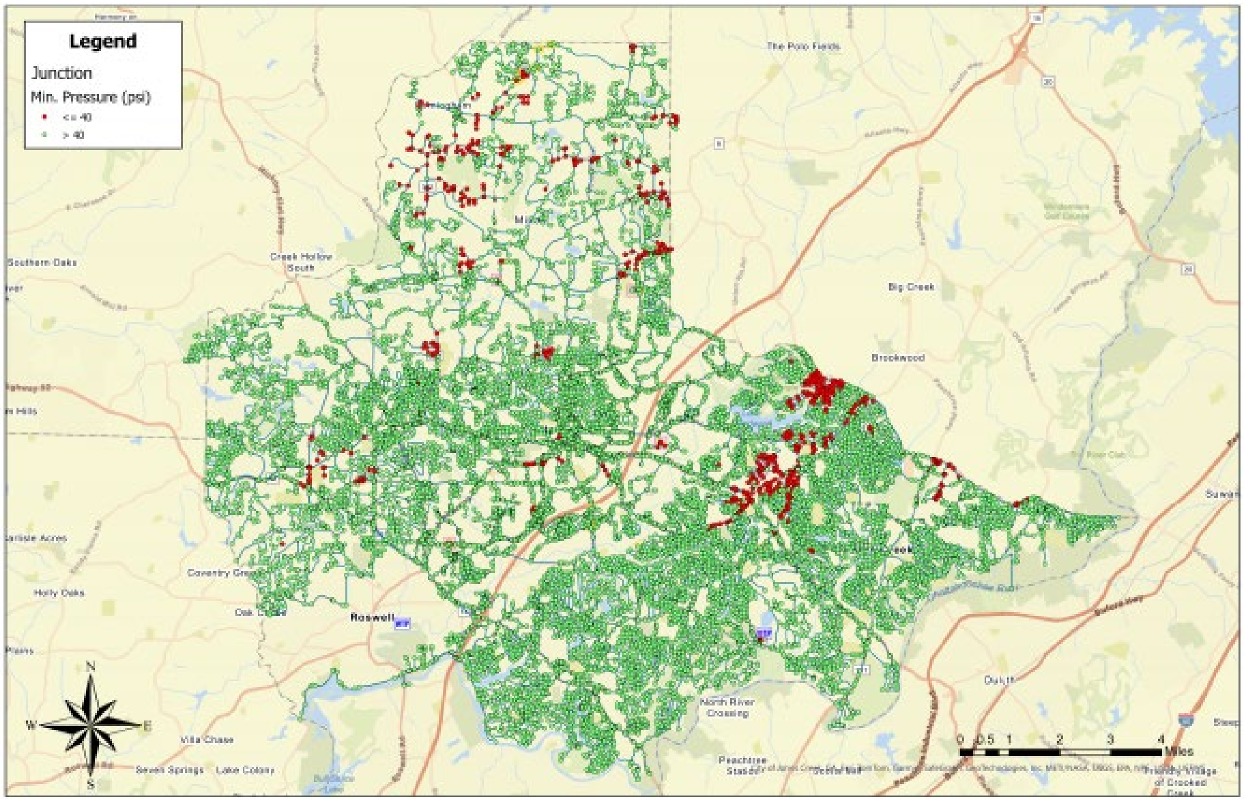


Figure 4-12. 2050 MDD – Tank Levels

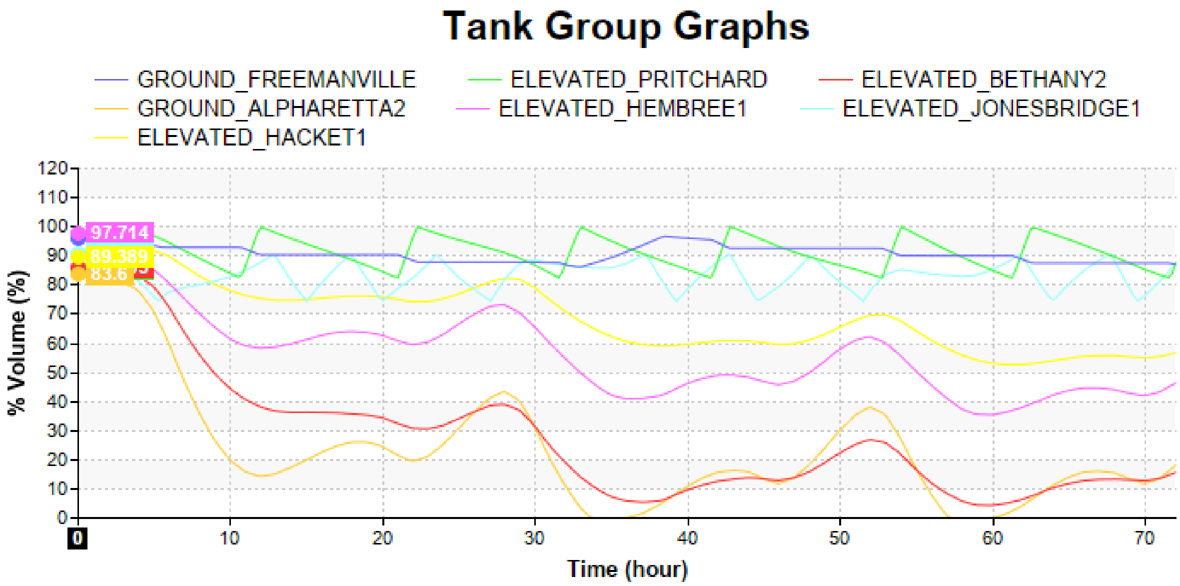
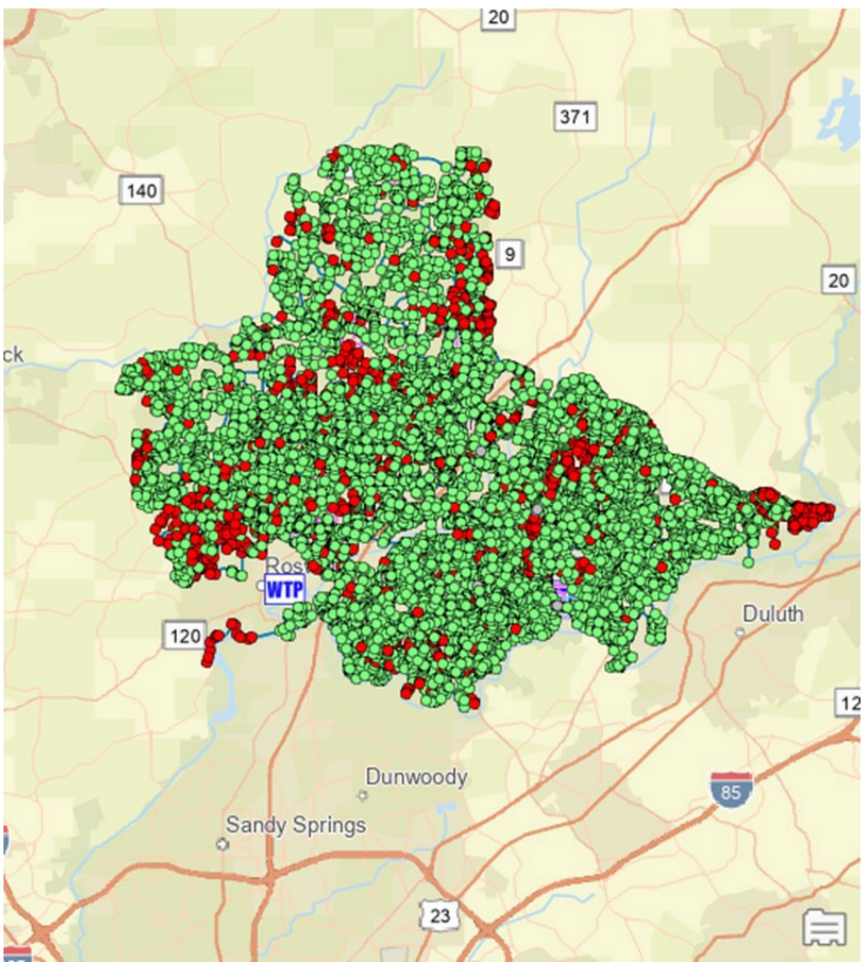


Figure 4-13. 2050 MDD – Fire Flow



5. Additional Analyses

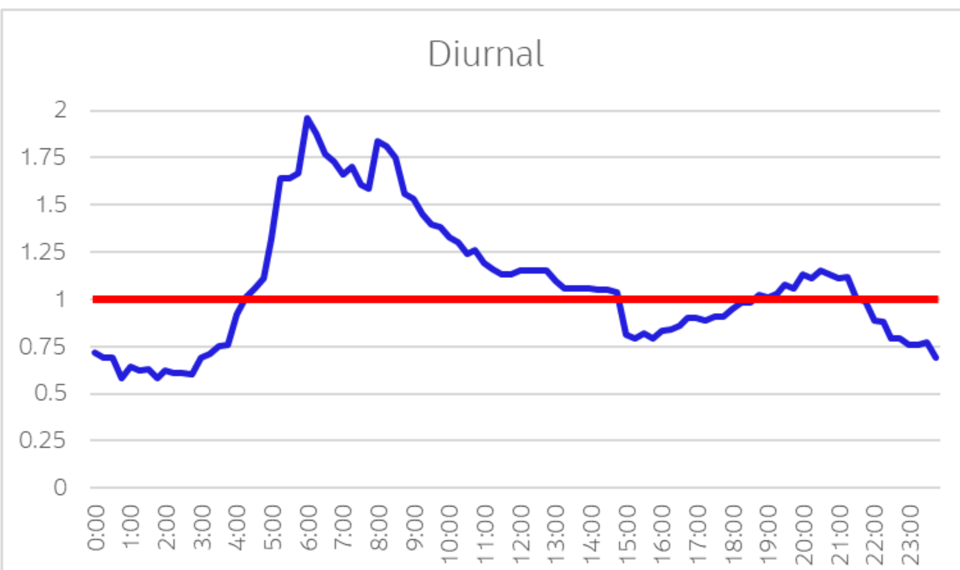
In addition to analysis of system deficiencies, additional analyses were performed that inform the capital improvements plan. These include analysis of required storage in the system, new pressure zones, water loss, interconnections, and valve criticality analysis.

5.1 Storage Analysis

Water system storage is needed to provide equalization, fire protection, and emergency supply to the distribution system. Each of these types of supply requirements should be calculated separately, and there are guidelines for each. Equalization storage provides supply to meet the fluctuating customer demands throughout the day. Fire protection storage should be adequate to supply water for fighting one large fire. Emergency storage should be calculated using a vulnerability analysis in accordance with AWWA Manual M19 or other state guidance.

To determine the amount of required equalization storage in the Fulton County system, the diurnal curve was evaluated (Figure 5-1). The area under the curve above the number 1 is totaled, and that percentage of the day is multiplied by the MDD to determine the volume of equalization storage required. For Fulton County, that number is 17.54% multiplied by the MDD. For this analysis, the MDD used was 47.9 MGD (from 2024) for existing analysis and 63 MGD (using a 1.75 peaking factor for 2050 analysis) from the projected demands.

Figure 5-1. Diurnal Curve



To calculate the fire protection storage, the amount of water needed to fight a large fire is used. In this case, a design fire of 3,000 gpm for 4 hours was used for conservative purposes. This equals 0.72 million gallons (MG) of water.

For emergency storage in Georgia, the Georgia Environmental Protection Division (GA EPD) recommends storage equal to an average day of demand. However, for most large systems, this is generally more than is necessary and can cause water quality issues due to excessive water age, and a more detailed study like this one is recommended. The 2011 Georgia Environmental Finance Authority (GEFA) Water System Interconnection, Redundancy and Reliability Act Emergency Supply Plan identified two Interconnection

Reliability Targets (IRTs), which were 35% and 65% of ADD. In other states, the general guidance for emergency storage is 50% of ADD. For this analysis, the ADD used was the average of the previous 5 years, 27.44 MGD, for existing analysis, and the projected ADD of 36.00 MGD for the 2050 analysis. For the purpose of this study, the GEFA IRT of 65% was used for emergency supply requirements.

Storage needs are determined by comparing the required emergency volume with the available storage separately from the sum of the required equalizing and fire volumes with the available storage. This is because it is not reasonable to assume storage is required for emergency and fire and equalization at the same time, but equalization and fire at the same time is required.

$$\text{Storage Deficit} = \text{Existing Storage} - \text{Emergency Storage}$$

$$\text{Storage Deficit} = \text{Existing Storage} - (\text{Equalizing Storage} + \text{Fire Storage})$$

The amount of available storage in the Fulton County main distribution system is 16.2 MG. The Pritchard Mountain zone contains 0.5 MG and can be counted in the analysis because in an emergency it could be drained into the main zone (Table 5-1). The clearwells at the Tom Lowe WTP are pumped into the distribution system and normally would not be included in distribution storage, but because backup generators are capable of supplying full power to the high service pump station, it is appropriate to include the clearwells in the calculation. The clearwells at the Tom Lowe WTP total 23.6 MG, of which one-half is allocated to Fulton County, which results in 11.8 MG of clearwell storage available at the Tom Lowe WTP. However, Fulton County has requested that the storage analysis be calculated both with and without the Tom Lowe WTP clearwells.

Table 5-1. Distribution Storage Tanks

Tank Name	Capacity
Alpharetta 1	1.00
Alpharetta 2	0.50
Bethany 1	2.00
Bethany 2	2.00
Freemanville	4.00
Hackett 1	2.00
Hackett 2	2.00
Hembree 1	0.20
Hembree 2	1.00
Jones Bridge 1	0.50
Jones Bridge 2	1.00
Pritchard Mountain	0.50
Total	**16.70**

The storage analysis is performed for current (existing) and future (2050) conditions to determine if additional storage is required. Of course, hydraulic modeling may also determine if there are localized needs for storage outside of this overall analysis. Because the main zone for Fulton County is very large and spread out, there may be high demand users that cause a need for storage in a localized area that is different from this overall system analysis. If this analysis reveals a storage deficit, hydraulic modeling will be used to identify potential storage sites that could maximize equalization and prevent excessive water age.

In Table 5-2, the Existing Storage Analysis results are shown with and without the Tom Lowe WTP clearwells. The analysis indicates that when the Tom Lowe WTP clearwells are included, there is no storage deficit. When the Tom Lowe WTP clearwells are not included, there is a 1.13 MG deficit. Not shown, if 50% of the ADD is used as the emergency storage criteria rather than 65%, the storage deficit drops to zero.

Table 5-2. Existing Storage Analysis

Existing Storage Requirements			
Equalizing Storage			
	% from Diurnal Curve	17.54%	
	Maximum Day - MGD	47.9	From 2024
	Storage Needed - MG	8.40	
Fire Storage			
	Design Fire Flow - gpm	3,000	
	AWWA Duration - hours	4	
	Storage Needed - MG	0.72	
Emergency Storage			
	% to meet State Regulations	65%	GEFA IRT
	5-year Average Day - MGD	27.44	
	Storage Needed - MG	17.83	
Existing System Storage - MG			
	Total Floating Storage - MG	16.70	
Existing Repumped Storage - MG			
	Tom Lowe AFCWRC Clearwells	11.80	Fulton portion only
Total Repumped Storage - MG		11.80	Including WTP clearwells
Total Repumped Storage - MG		0.00	Not including WTP clearwells
Total Storage - MG		28.50	Including WTP clearwells
Total Storage - MG		16.70	Not including WTP clearwells
Total Needed for Emergency - MG		17.83	
Total Existing Storage - MG		16.70	Not including WTP Clearwells
Total Storage Deficit - MG		1.13	
Total Existing Storage - MG		28.50	Including WTP clearwell
Total Storage Deficit - MG		--	
Needed for Equalizing and Fire - MG		9.12	
Total Existing Dist. Storage - MG		16.70	Not including WTP clearwells
Distribution Storage Deficit - MG		--	
Total Existing Dist. Storage - MG		28.50	Including WTP clearwells
Distribution Storage Deficit - MG		--	

AFCWRC = Atlanta Fulton County Water Resources Commission

Table 5-3 shows the 2050 Storage Analysis results with and without the Tom Lowe WTP clearwells. When the Tom Lowe WTP clearwells are included, there is no storage deficit. When the Tom Lowe WTP clearwells are not included, there is a 6.7 MG deficit. Not shown, if 50% of the ADD is used as the emergency storage criteria rather than 65%, the storage deficit drops to 1.3 MG.

Table 5-3. 2050 Storage Analysis

2050 Storage Requirements			
Equalizing Storage			
	% from Diurnal Curve	17.54%	
	Maximum Day - MGD	63	Using 1.75 PF (most conservative)
	Storage Needed - MG	11.05	
Fire Storage			
	Design Fire Flow - gpm	3,000	
	AWWA Duration - hours	4	
	Storage Needed - MG	0.72	
Emergency Storage			
	% to Meet State Regulations	65%	GEFA IRT
	2050 Average Day - MGD	36.00	
	Storage Needed - MG	23.40	
Existing System Storage - MG			
	Total Floating Storage - MG	16.70	
Existing Repumped Storage - MG			
	Tom Lowe AFCWRC Clearwells	11.80	Fulton portion only
Total Repumped Storage - MG		11.80	Including WTP clearwells
Total Repumped Storage - MG		0.00	Not including WTP clearwells
Total Storage - MG		28.50	Including WTP clearwells
Total Storage - MG		16.70	Not including WTP clearwells
Total Needed for Emergency - MG		23.40	
Total Existing Storage - MG		16.70	Not including WTP clearwells
Total Storage Deficit - MG		6.70	
Total Existing Storage - MG		28.50	Including WTP clearwell
Total Storage Deficit - MG		--	
Needed for Equalizing and Fire - MG		11.77	
Total Existing Dist. Storage - MG		16.70	Not including WTP clearwells
Distribution Storage Deficit - MG		--	
Total Existing Dist. Storage - MG		28.50	Including WTP clearwells
Distribution Storage Deficit - MG		--	

Hydraulic modeling will be performed to identify one or more locations in the distribution system for approximately 1.13 MG of storage under existing demands. This will depend on the ability to utilize the tank appropriately for equalization, so water quality is not compromised. For the 2030 and 2050 scenarios, additional storage will be evaluated up to 6.7 MG and will be included in the capital projects listing. These locations will be evaluated in a similar manner to ensure that the tank storage fluctuates throughout the day for optimal water quality.

5.2 Pressure Zone Review

The North Fulton County water distribution system currently operates with two zones – the Main Zone and the Pritchard Mountain zone. A pressure zone evaluation was conducted for the water distribution system to understand if the system would benefit from creating new pressure zones. This was evaluated based on the junction pressures during ADD and the minimum pressures during MDD while overlaying the ground elevations in the form of a digital elevation model (DEM) as shown on Figure 5-2 and Figure 5-3. The areas experiencing over 130 psi are circled in blue on Figure 5-2; these areas were further evaluated to determine if they could be isolated to create low pressure zones. The evaluations are described further in Section 6.4.1 Pressure Zone Recommendations. Similarly, the area experiencing less than 40 psi during MDD is circled in red on Figure 5-3. This area was evaluated during the future CIP scenarios to determine if it would benefit from the creation of a higher-pressure zone.

Figure 5-2. Existing System Average Pressures

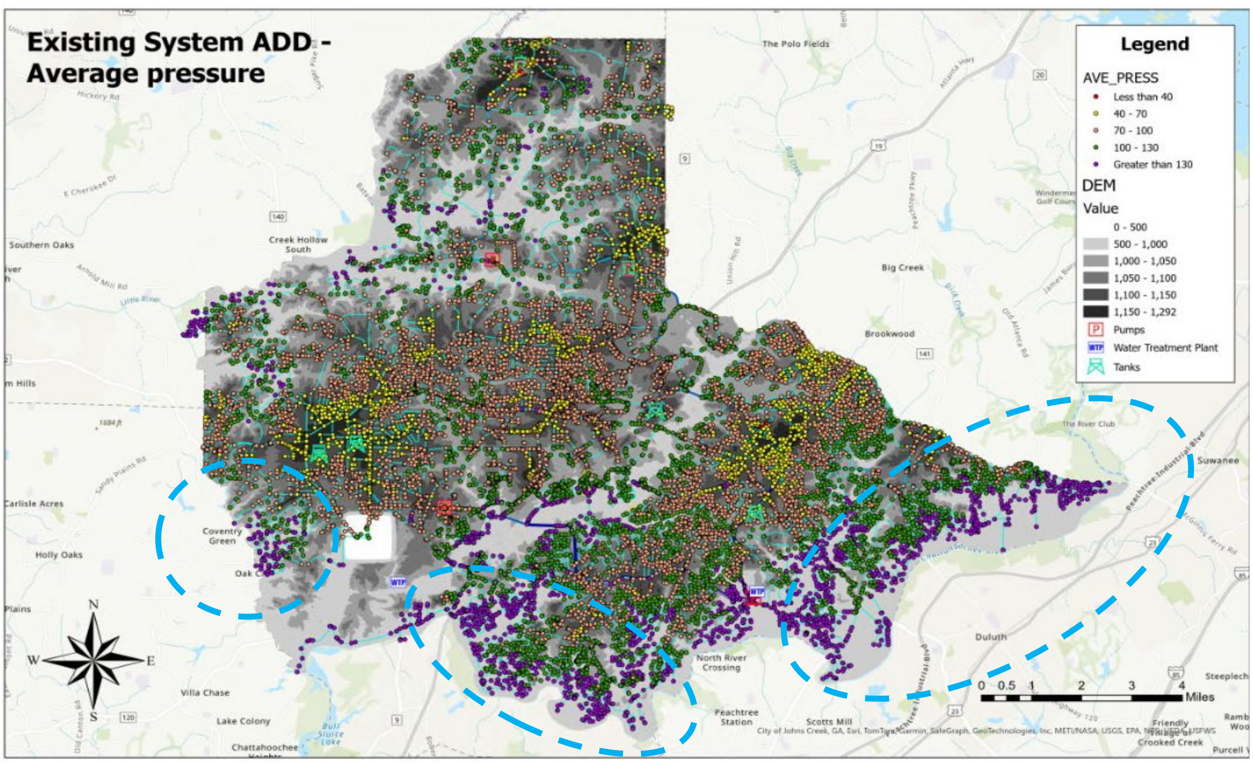
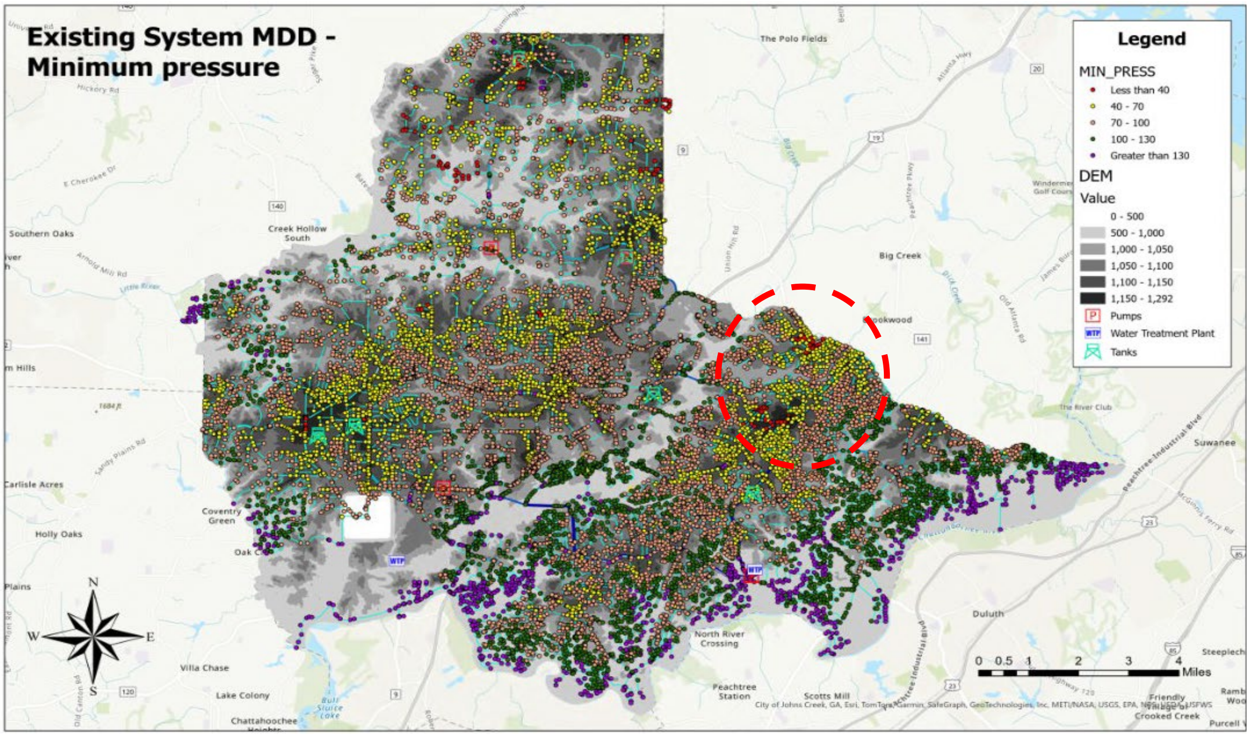


Figure 5-3. Existing System Minimum Pressures (MDD)



5.3 Water Loss Control Review

This task assessed the benefits of increasing water loss reduction efforts. It involved a review of previous water loss audits and the assessment of the cost effectiveness of water loss reduction activities. A real loss component analysis was also included to determine the amount of background leakage that is occurring and how much is potentially recoverable.

County water loss audits from 2016 through 2023 that were provided to GA EPD were compiled using the AWWA Compiler Tool. It should be noted that starting in 2021, Fulton County advanced from using Version 5 to Version 6 of the AWWA Free Water Audit Software. With this change, some defaults in the software changed, which caused some of the outputs to change. Therefore, trending between different versions of the software should be done with this in mind. Figure 5-4 shows an increasing trend in real losses between 2019 and 2022, with a slight dip in 2023. Figure 5-5 shows an increasing trend in the cost of apparent losses from 2017 through 2023. The cost of apparent losses in 2023 was more than $900,000.

Figure 5-4. Real Water Losses (MG)

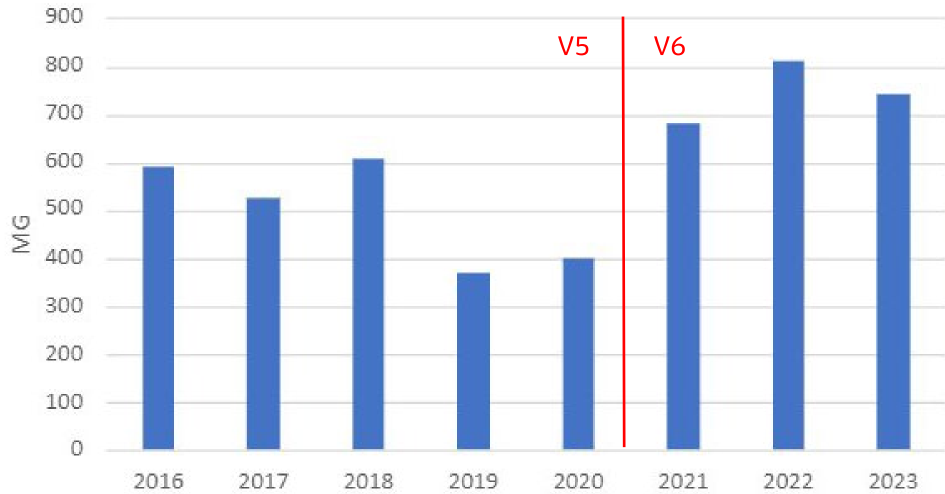
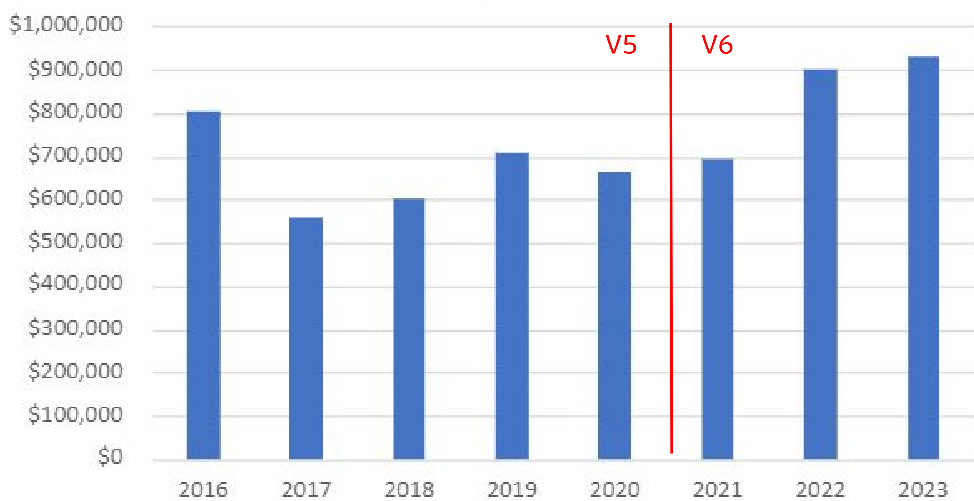


Figure 5-5. Cost of Apparent Water Losses



5.3.1 Compliance with MNGWPD Requirements

The Metro North Georgia Water Planning District (MNGWPD) has an Action Item (WSWC-15) related to Water Loss with several requirements. One of the requirements is to reduce real losses below 35 gallons/connection/day by 2028. As shown on Figure 5-6, these real losses reached a peak of 30 gallons/connection/day in 2022. The County must remain below 35 gallons/connection/day until 2028 and beyond to remain in compliance. The Action Item also requires systems to have a data grade of 7 on Water Imported in the water audit software. The County met this requirement in 2023. In addition, systems must have a data grade of 6 on Customer Metering Inaccuracies (CMI); however, the County only had a data grade of 3 in 2023 in the water audit software on CMI. The County should take action to increase this data grade by conducting a proactive, small customer meter testing program.

Figure 5-6. Real Water Losses (gallons/connection/day)

5.3.2 Real Loss Component Analysis

The water loss audit does not break down real losses into its component parts, and the types of real loss reduction activities are based on the types of real losses that are occurring. The Water Research Foundation created a Real Loss Component Analysis (RLCA) Model in 2015 (Project 4372a) that can be used as a companion to the AWWA Free Water Audit Software to break down existing real losses into the component parts and evaluate some real loss reduction practices.

The three types of real losses are background leakage, unreported leakage and reported leakage. Background leakage is unreported and undetectable using traditional acoustic equipment. It is reduced through pressure reduction and pipe replacement and rehabilitation. Unreported leakage often does not surface but is detectable using traditional acoustic and other leak detection equipment. Reported leakage surfaces and is identified by the public or county workers to be repaired.

The primary inputs to the RLCA are water loss audits and history of water main failures in the distribution system. According to the 2022 Work Orders that were collected from the County, 45 main breaks were reported, 18 service line breaks occurred, and there were 330 appurtenance failures that year. When input into the RLCA model, it compares to literature and other systems. Figure 5-7 shows that Fulton County has a much lower mains failure frequency than the two references cited. Figure 5-8 shows that Fulton County has a much lower service line failure frequency than the two references cited. Figure 5-9 shows the work order failures that were provided for 2022.

Figure 5-7. 2022 Mains Failure Frequency Comparison

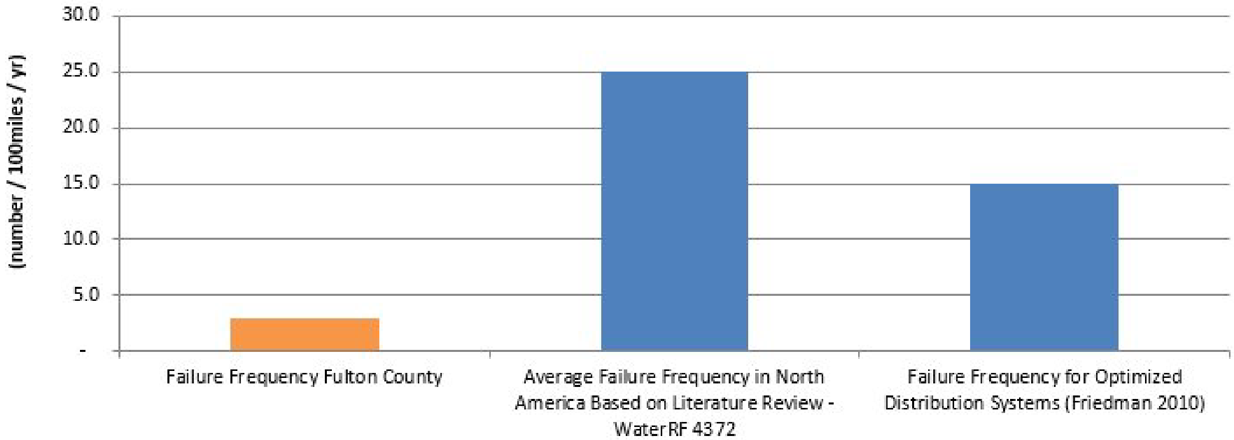


Figure 5-8. 2022 Service Connection Failure Frequency Comparison

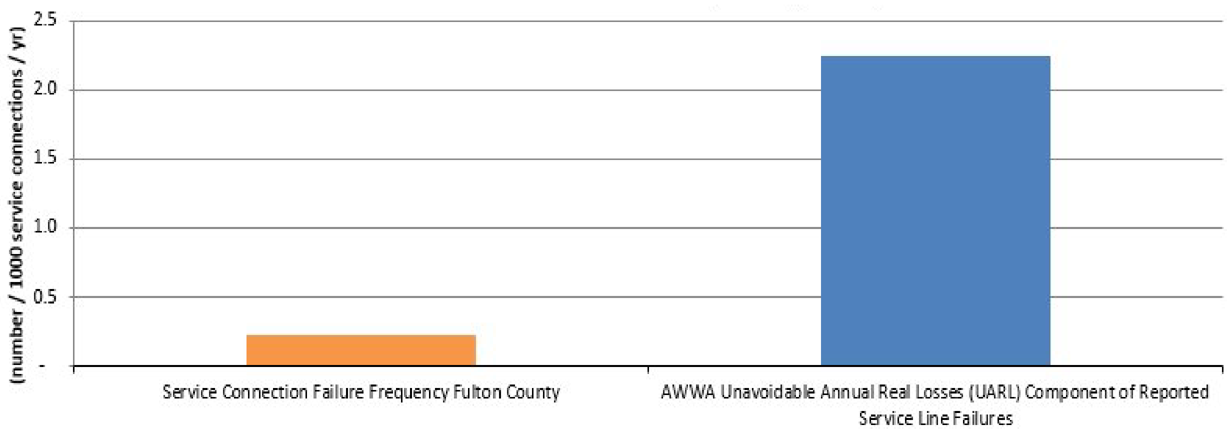
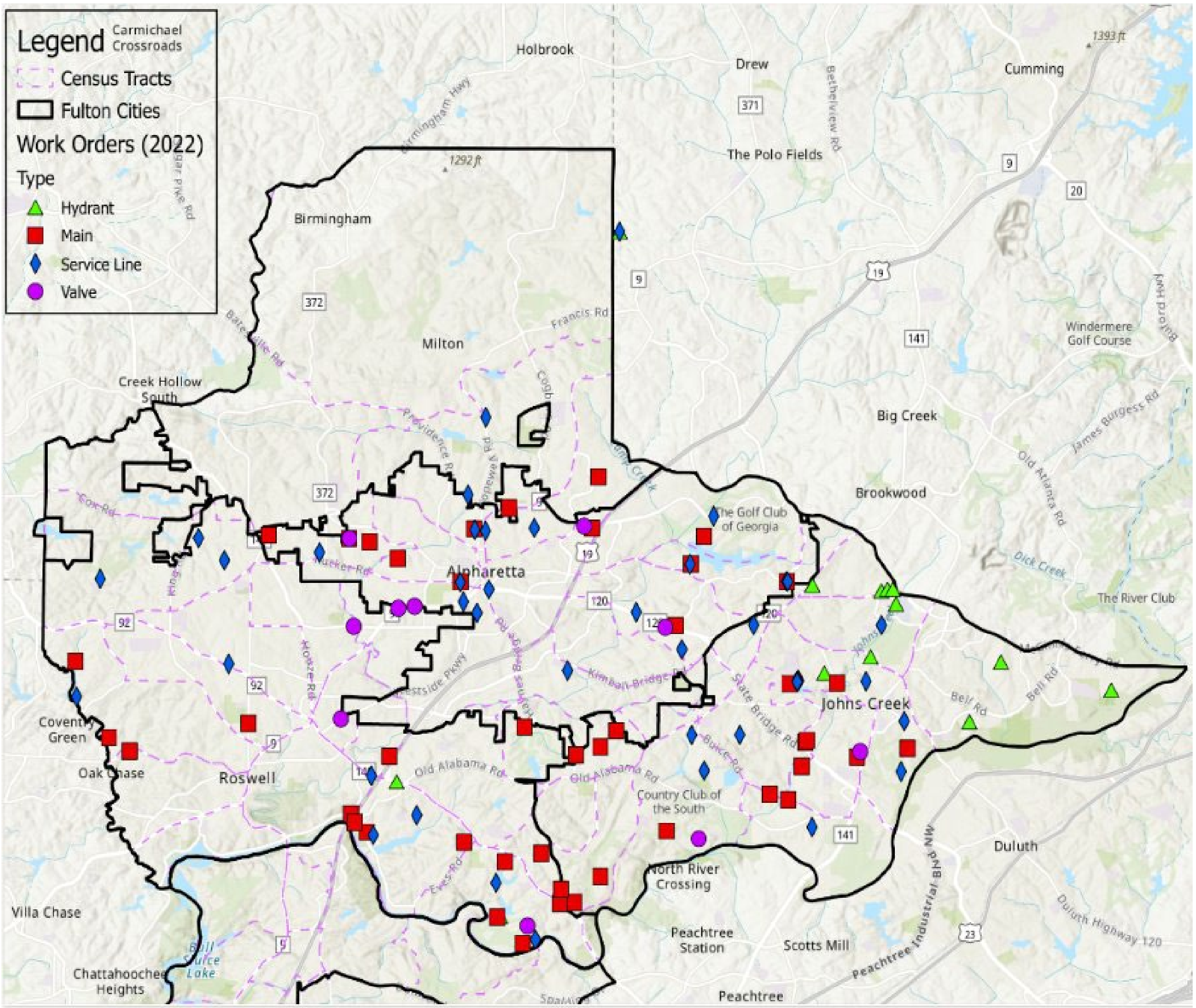


Figure 5-9. 2022 Breaks and Failures



The analysis in the RLCA breaks down the reported real loss from the water loss audit using information about the system age, and characteristics such as density of system connections. Figure 5-10 shows that the real loss is 61% background leakage and 32% hidden losses. According to this analysis, of the real losses, nearly two-thirds of the existing leakage cannot be found using traditional leak detection technologies. Figure 5-11 shows that of the 2022 Real Loss volume, only 16% (132.44/811.13) is potentially recoverable through proactive leak detection. The remaining leakage which is estimated by the analysis to be background leakage, can only be reduced through pressure reduction or pipeline replacement or rehabilitation.

Figure 5-10. RLCA Results for 2022 – Real Loss Components

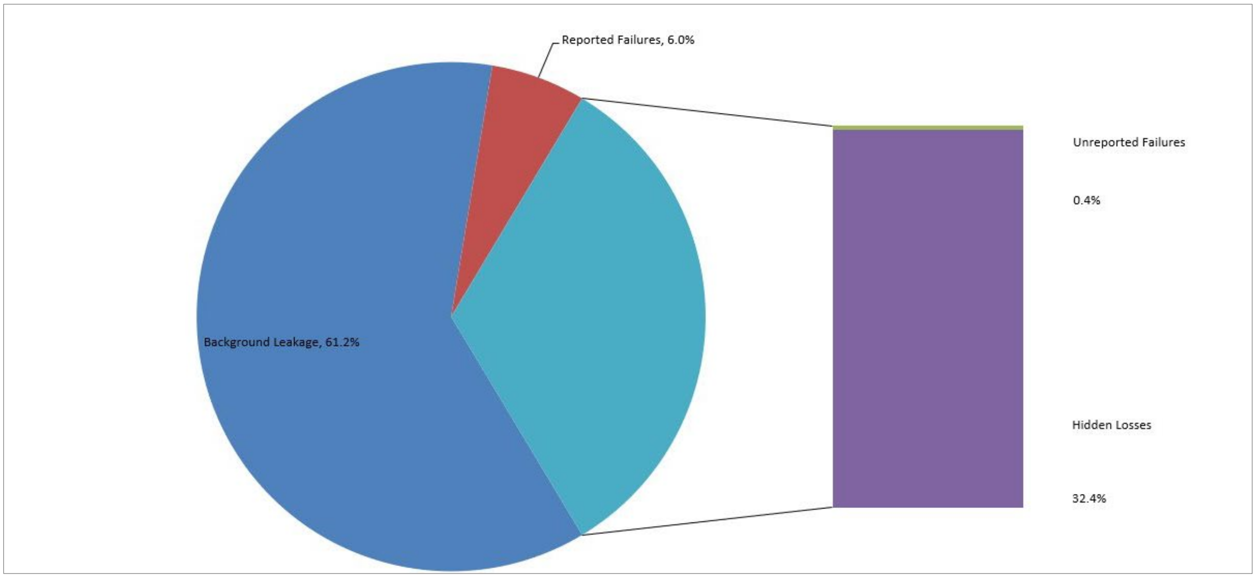
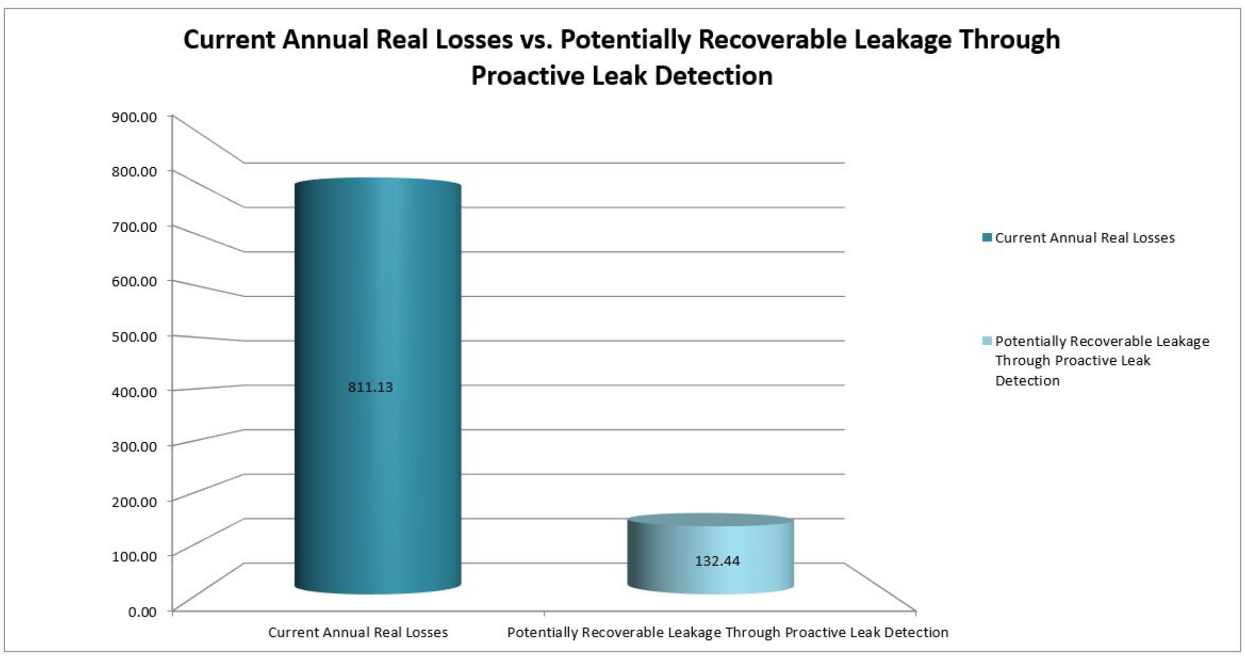


Figure 5-11. RLCA: Recoverable Leakage through Proactive Leak Detection



The RLCA model has a simple tool to evaluate the cost-effective budget for leak detection based on the cost of leak detection and the cost to produce water. Figure 5-12 indicates that the economic amount of performing leak detection on the County's system is 13% of the distribution system per year. That equates to an approximate annual leak detection budget of $70,000, assuming a leak detection survey cost of $350 per mile.

Figure 5-12. RLCA: Analysis of Recoverable Leakage through Proactive Leak Detection

	Variable Cost of Real Losses		
CV	Variable Production cost (applied to Real Losses):	0.54	$/per kgal
		536.86	$/MG
CI	Cost of comprehensive leak detection survey (excluding leak repair cost)	350.00	$/per mile
		540,715	$/for entire system
RR	Average Rate of Rise of Unreported Leakage	0.06	kgal/mile of mains/day in a year
		0.09	MG/day in a year
	CI/CV	651.9	kgal/mile
EIF	Economic Intervention Frequency [0.789 * (CI/CV)/RR] ^0.5	92.6	months
		2,816.3	days
	Economic Intervention Frequency - Average Leak Run Time	1,408.1	days
	Economic Percentage of System to be Surveyed per Year	13	%
ABI	Average Annual Budget for Intervention (Proactive Leak Detection)	70,078	$/year
EUL	Economic Unreported Real Losses	130,534	kgal/year
		130.5	MG/year
	Economic Infrastructure Leakage Index (ILI)	0.9	
PRL	Potentially Recoverable Leakage (CARL-CRL-EUL-TBL-UL)	132.4	MG/year

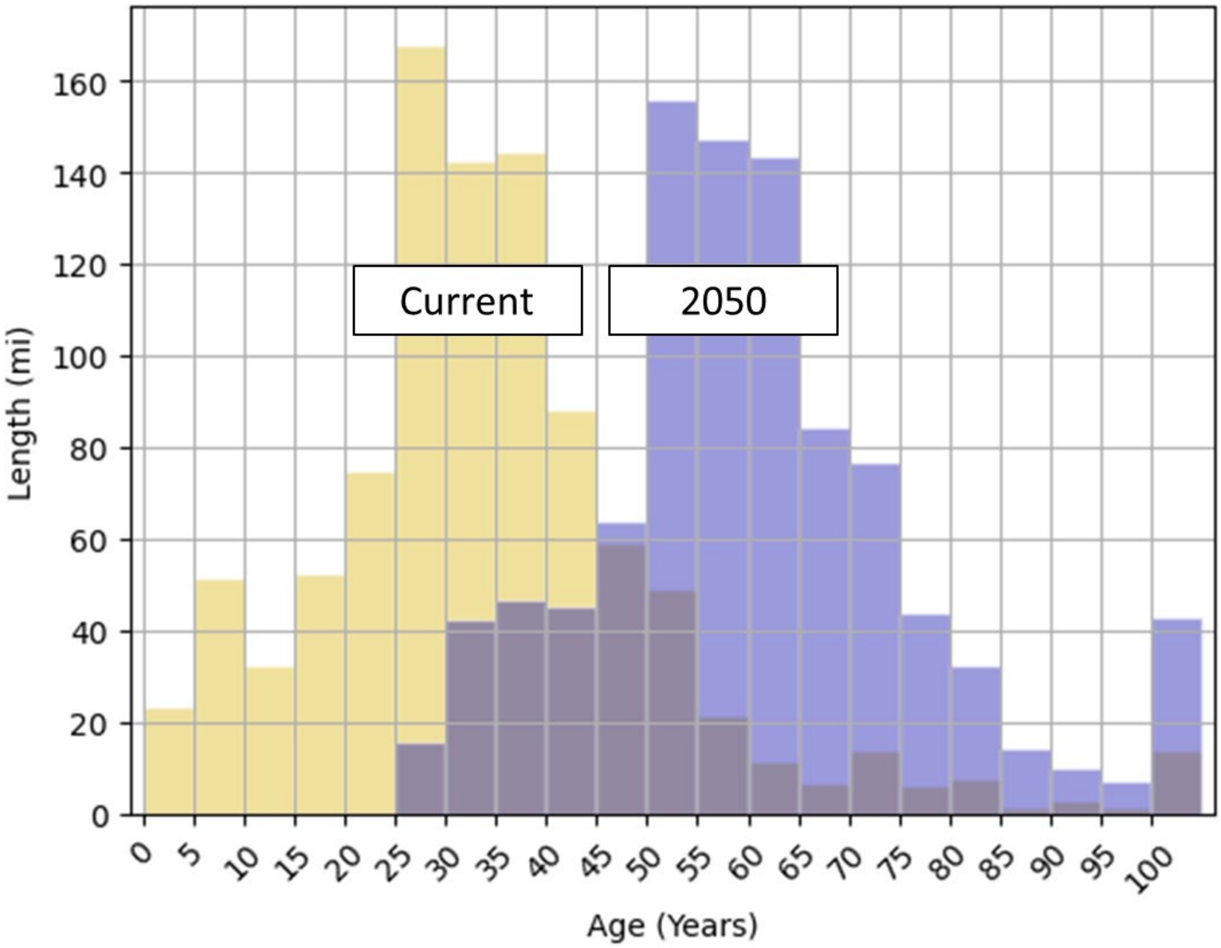
Another leak detection activity that the RLCA evaluates is pressure management for the entire system. Based on an average operating pressure of 98.1 psi, if the pressure is lowered by 5 psi, and it costs $250,000 to implement this pressure reduction, there would be a reduction in leakage of 45.5 MG per year. This would equate to approximately a 10-year payback, as shown on Figure 5-13.

Figure 5-13. RLCA: Analysis of Recoverable Leakage through Pressure Management

Pressure Management Opportunities			
	Existing Pressure Management Policy		
Current Average System Pressure	98.1	PSI	
Total Annual Real Losses	811.1	MG/Yr	
Value of Real Losses	435,463	$/year	
FAVAD N1 Value Used for Calculation of Real Loss Reduction Due to Reduction of Average System Pressure	Use Default N1		1.0
	Use System Specific N1		1.1
Enter % of rigid pipes and service connections in system	95%		
ILI	1.1		
	Alternative Pressure Management Policy		
Assumed Reduction in Average System Pressure	5.0	PSI	
Assumed % Reduction in Average System Pressure	5%		
Real Loss Volume Saved Through Alternative Pressure Management Policy	45.5	MG/Yr	
Value of Real Loss Volume Saved Through Alternative Pressure Management Policy	24,420	$/Year	
Enter Estimated Cost of Implementing Alternative Pressure Management Policy	250,000	$	
Simple Payback Period for Implementing Alternative Pressure Management Policy	10.2	Years	

These RLCA results are based on the fact that the County's pipe system is mostly ductile-iron and relatively young (less than 50 years old). Figure 5-14 indicates that most pipe lengths are in the 25- to 35-year age range. However, by 2050, the majority of pipes will be in the 50 to 65 age group, with many older. To maintain low water losses and low failure frequency, the County will need to establish a robust asset management program for the water distribution assets. The mains in Figure 5-14 that are older than 100 years are actually unknown or based on the ages of structures, not actually older than 100 years.

Figure 5-14. Water Main Ages



5.3.3 Water Loss Recommendations

Based on the review of the water loss analysis, the annual cost and volume of water losses are high – and trending higher in recent years. However, a deeper analysis of the real losses demonstrates that a large portion are not recoverable using traditional leak detection technology. Therefore, it is recommended that only a small budget be allocated to real loss reduction activities at this time, as demonstrated above. In the longer term, an asset management program should be implemented to replace and rehabilitate the inventory of water mains in the future as they get older. This RLCA should be repeated in approximately 5 years as the infrastructure ages. For the apparent losses, a customer meter testing program should be implemented to raise the data grade in the audit and meet the MNGWPD requirement, as well as address the increasing apparent losses through meter replacement, and consider an Advanced Metering Infrastructure (AMI) program.

5.4 Interconnections Analysis

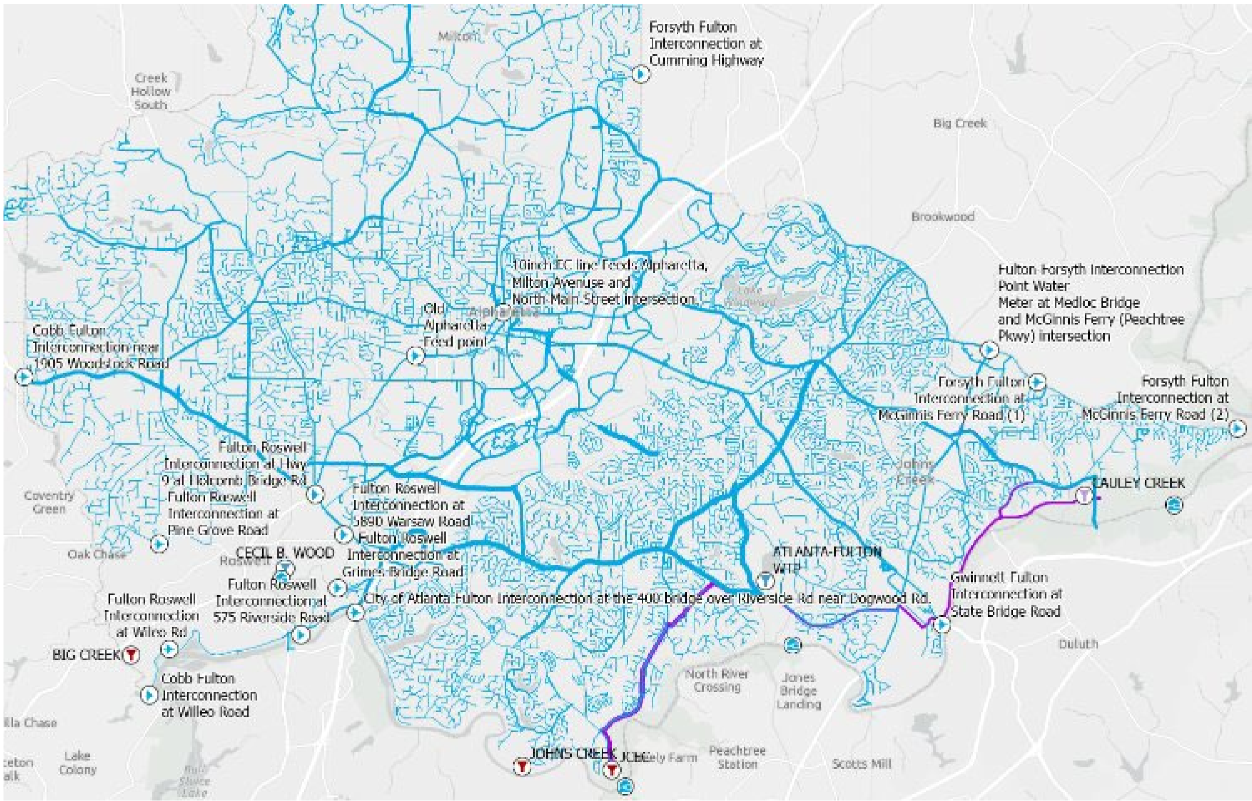
This task is to inventory the existing interconnections and use the hydraulic model to understand the flow capacity available to Fulton County during an emergency. There are potential additional interconnections that have either been disconnected or could be established as new. They are listed in Table 5-4. The County has existing interconnections with Forsyth County, the City of Atlanta, and the City of Roswell. The connections with Forsyth County are to multiple pressure zones in their system, so emergency supply must be drawn from a specific connection. The connections with Roswell are mostly to provide them water; they do not produce enough water to adequately supply the County in an emergency. The County previously studied an interconnection with Gwinnett County and has a plan to install a pump station for an emergency supply location. This will be summarized below and was not evaluated again as part of this plan.

Fulton County may consider two new interconnections for emergency supplies. One is with Cobb County, which is a previous interconnection that has been disconnected because of water quality incompatibility. However, Cobb County-Marietta Water Authority is changing its corrosion control to conform to the rest of the region, so Fulton could potentially re-establish a connection with them in the future. The second connection is with Cherokee County to the north of Fulton County. A connection with Cherokee County could be an advantage in an emergency since it is the farthest away from the Tom Lowe WTP and provides redundancy in the event of a WTP failure. A map of the County's interconnections is provided on Figure 5-15.

Table 5-4. Interconnections Inventory

Name	Address	Fulton Pipe	Other System Pipe	Gravity or Pumped	Status N.O. – Normally Open N.C. – Normally Closed
Atlanta	Riverside Road @ GA 400 bridge overpass	24	42/48	Gravity	N.C.
Forsyth #1	Cumming Highway	8	10	Gravity	N.C.
Forsyth #2	Medlock/Peachtree Parkway	12	24?	Gravity	N.C.
Forsyth #3	6985 McGinnis Ferry	12	10	Gravity	N.C.
Forsyth #4	McGinnis Ferry Road at River Walk Landing	8	8	Gravity	N.C.
Roswell #1	10489 Alpharetta Hwy (at Holcomb Bridge)	8	8	Gravity	N.O.
Roswell #2	9120 Willeo	8	8	Gravity	N.C.
Roswell #3	575 Riverside and Atlanta Street	12" to 6" meter	8	Gravity	N.C.
Roswell #4	890 Warsaw	8	8	Gravity	N.C.
Roswell #5	Grimes Bridge	8	8	Gravity	N.C.
Roswell #6	800 Pine Grove Road	8	6	Gravity	N.O.
Roswell #7	Wavetree Address - 155 Spring Hollow Court	8	8	Gravity	N.C.
Gwinnett	Rogers Bridge Road	30	24	Pumped	New
Cobb	County line on Highway 92	16	Unknown	Gravity	N/A
Cherokee	Hickory Flat Road			Gravity	N/A

Figure 5-15. Interconnections Locations



Each of the existing interconnections and potential new interconnections was evaluated using the hydraulic model to determine the capacity available during an emergency. A fixed-head reservoir was placed at the pressure of the neighboring system and then the amount of water that can be supplied or procured via that connection was evaluated. This was done for the City of Atlanta, Forsyth County, Cobb County, Cherokee County, and the City of Roswell systems. The results are presented below.

The hydraulic grade line (HGL) at the Atlanta side of the interconnection is 1,225 feet while the HGL at the Fulton side of the interconnection is approximately 1,324 feet during ADD; therefore, Fulton County cannot receive any flow from the City of Atlanta without any proposed improvements but can supply flow to the City of Atlanta, if needed. The location of the interconnection as well as the impact of supplying 21 MGD to the City of Atlanta are shown on Figure 5-16. Modeling scenarios were run to determine the pumping capacity (head) required to get 2 MGD, 5 MGD, and 10 MGD using the interconnection. These are presented in Table 5-5. The County has an existing Dogwood pump station that is out of service that was used previously to pump water from Atlanta to Fulton County. The County may decide to refurbish/replace the pumps at the Dogwood pump station to meet these required pumping capacities, if desired.

Figure 5-16. City of Atlanta Interconnection Location and Fulton Impact with 21 MGD Supply to Atlanta

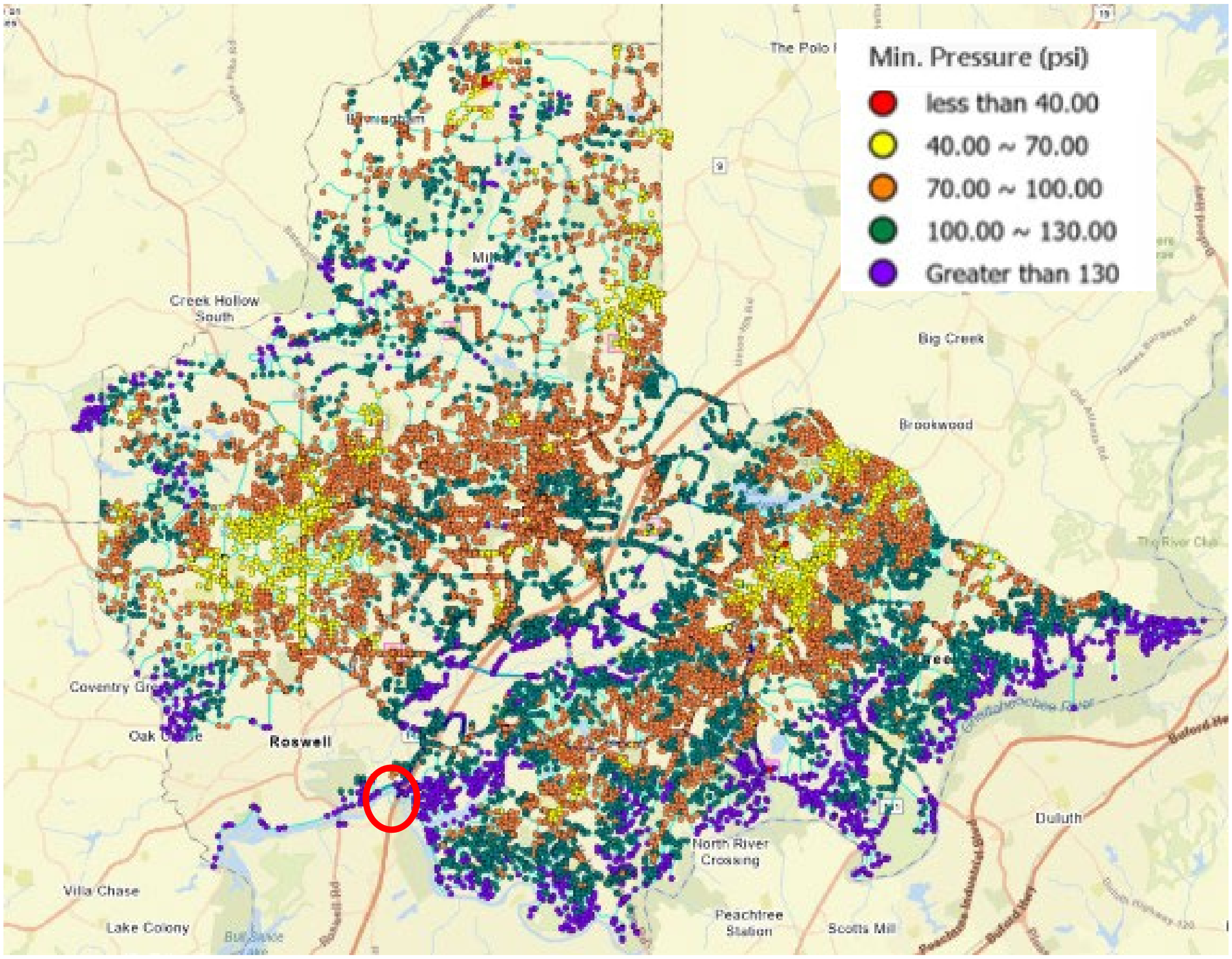


Table 5-5. City of Atlanta Interconnection Pumping Requirements

HGL Needed (ft)	Required Flow (gpm)	Required Flow (MGD)	Modeled Flow (gpm)	Modeled Flow (MGD)
1,375	1,389	2	1,338	2
1,410	3,472	5	3,448	5
1,465	6,945	10	7,075	10

The HGL at the Forsyth County side of the interconnection is 1,421 feet while the HGL at the Fulton side of the interconnection is approximately 1,310 feet during ADD; therefore, Fulton County can receive flow from Forsyth County without any proposed improvements during an emergency. The location of the interconnection as well as the supply of approximately 15 MGD from Forsyth County are shown on Figure 5-17. The Forsyth interconnection could supply a flow of 16 MGD if only high service pump (HSP) 5 was running at a maximum speed of 80%. This was run as another emergency scenario with only one pump running and the impact on the distribution system is shown on Figure 5-18. If the WTP were completely offline (that is, all the HSPs were off), the interconnection could supply up to 19.5 MGD. The impact on the distribution system pressures is shown on Figure 5-19. Note that this evaluation does not consider if Forsyth County's distribution system could feasibly supply these flows but only evaluates the capacity on Fulton County's side during an emergency.

Figure 5-17. Forsyth County Interconnection – 15 MGD Supply to Fulton County (Normal Operation)

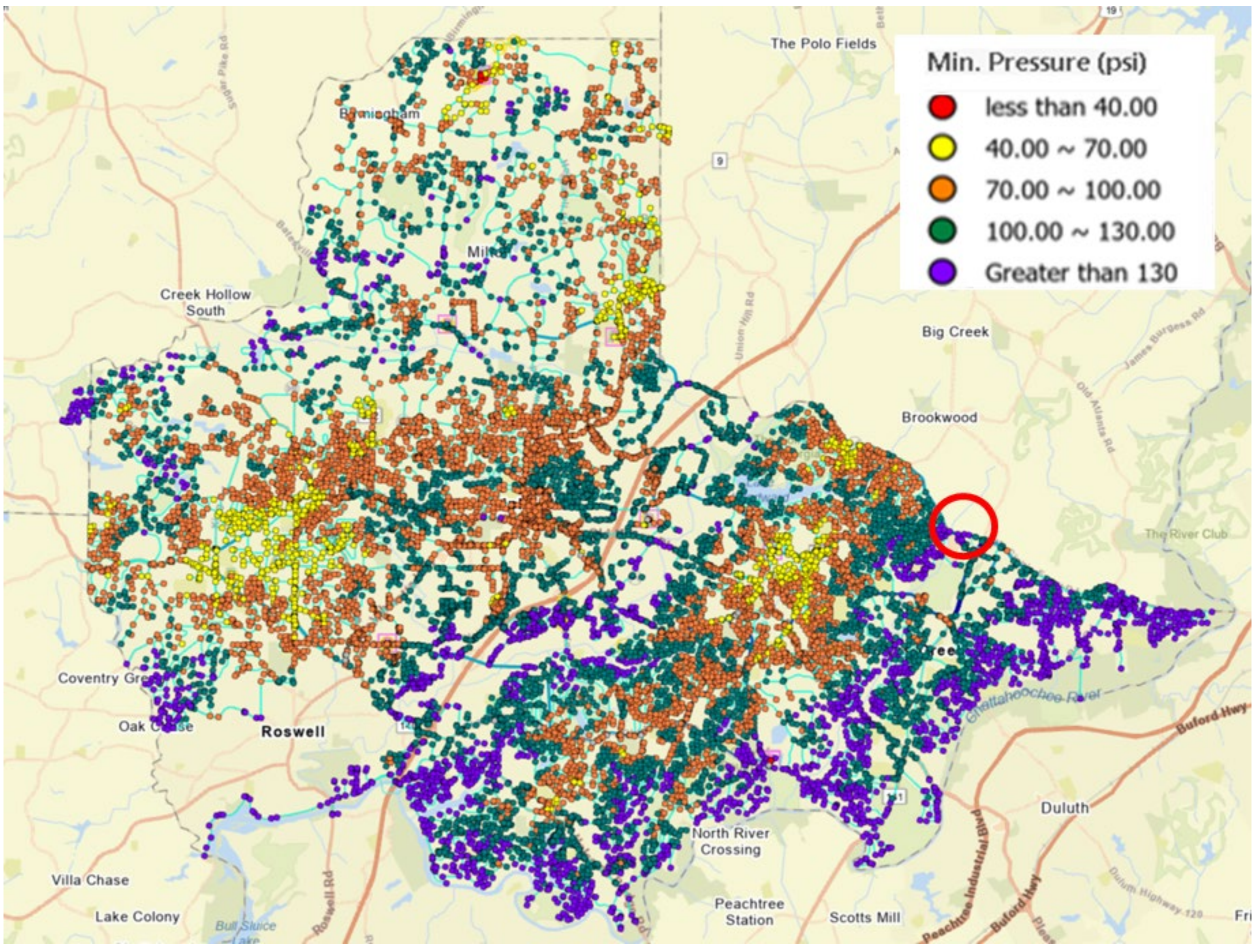


Figure 5-18. Forsyth County Interconnection – 16 MGD Supply to Fulton County (with Only HSP 5 Running at Reduced Speed)

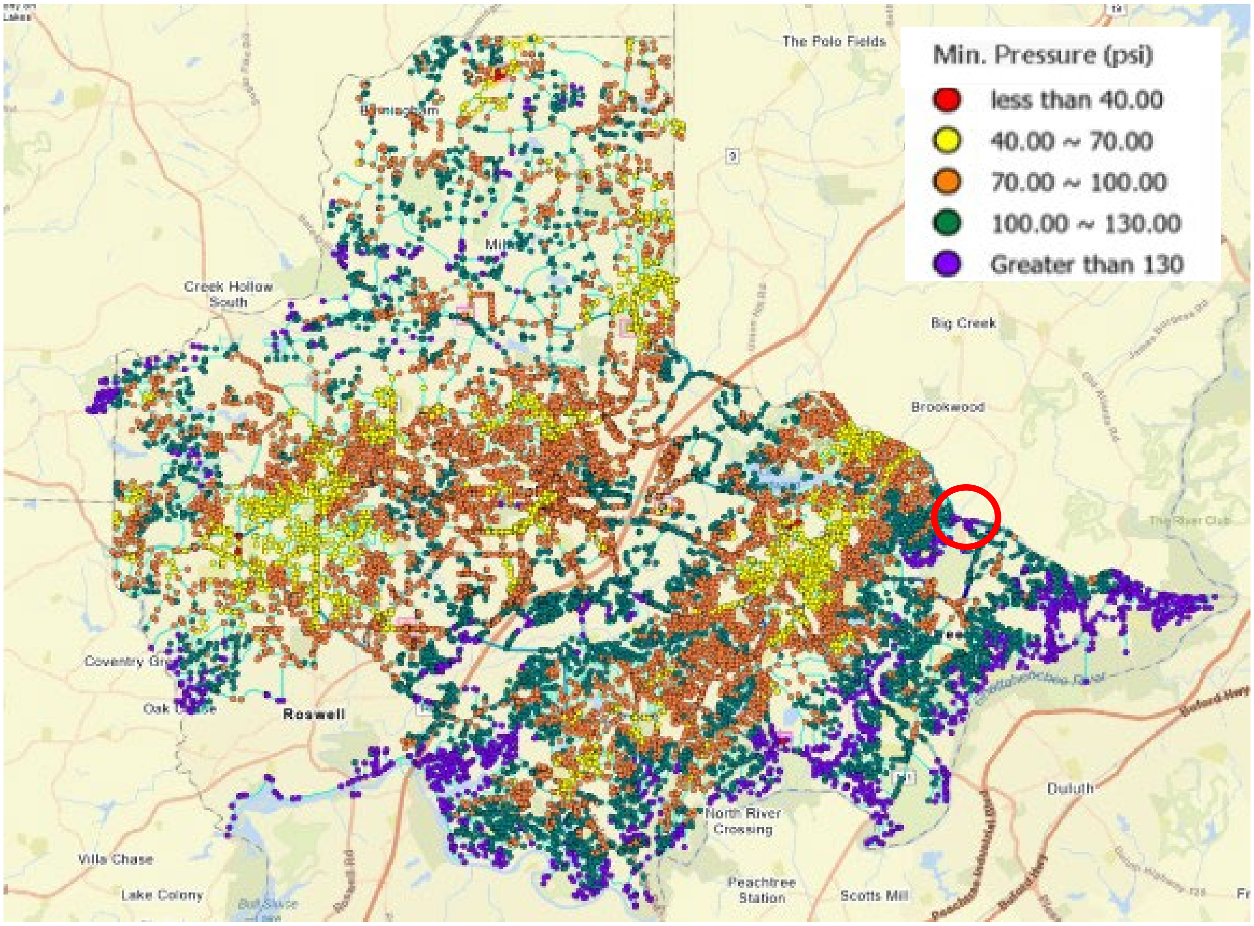
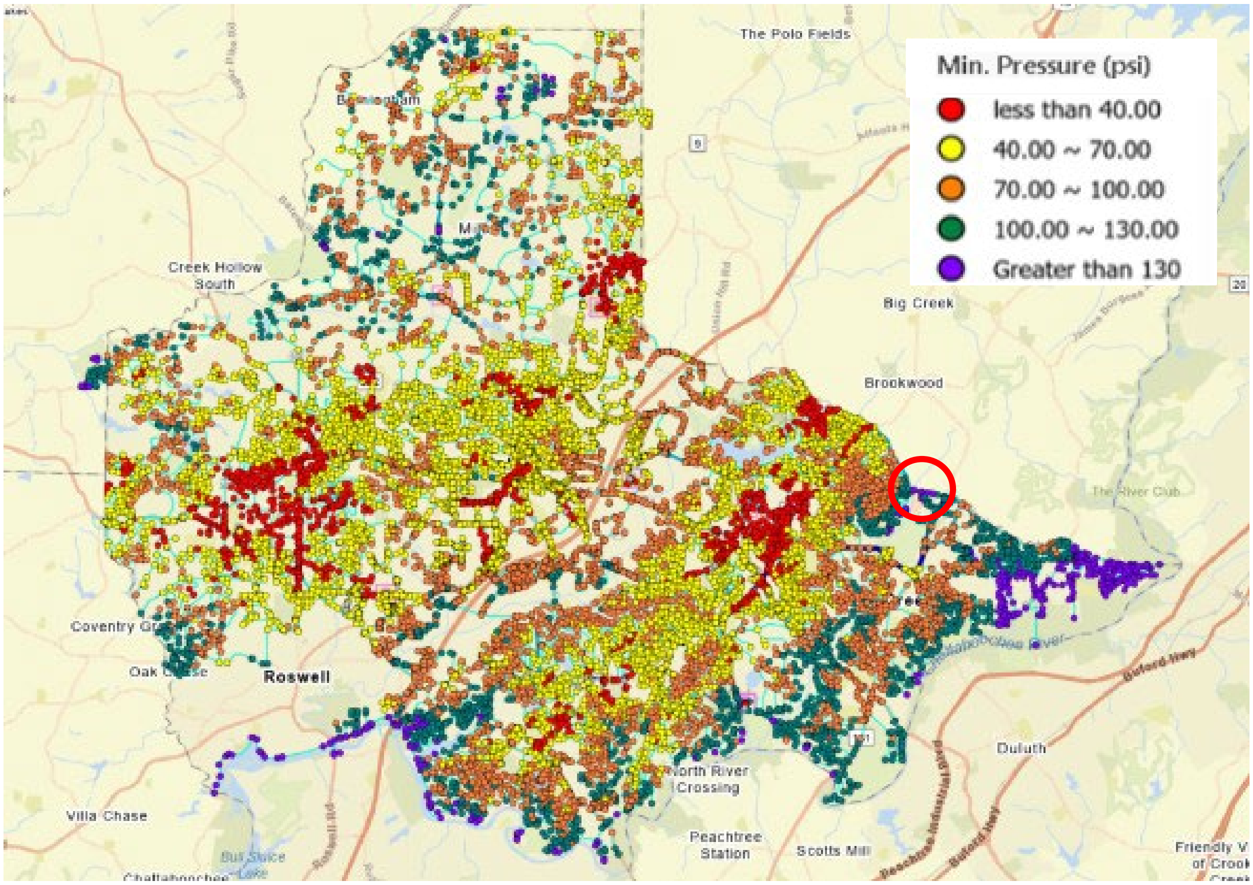


Figure 5-19. Forsyth County Interconnection – 19 MGD Supply to Fulton (with Tom Lowe WTP Offline)



The HGL at the Cobb County side of the interconnection is 1,270 feet while the HGL at the Fulton side of the interconnection is approximately 1,300 feet during ADD; therefore, Fulton County cannot receive any flow from Cobb County without any proposed improvements but can supply flow to Cobb County, if needed. The location of the interconnection as well as the impact of supplying 4.2 MGD to Cobb County are shown on Figure 5-20. A few different modeling scenarios were run to determine the pumping capacity (head) required to get 2 MGD, 5 MGD, and 10 MGD using the interconnection. These are presented in Table 5-6. The County has an existing Woodstock pump station that is out of service that was used previously to pump water from Cobb County to Fulton County. Fulton County may decide to refurbish/replace these pumps at the Woodstock pump station to meet these required pumping capacities, if desired.

Figure 5-20. Cobb County Interconnection Location and Fulton Impact with 4.2 MGD Supply to Cobb

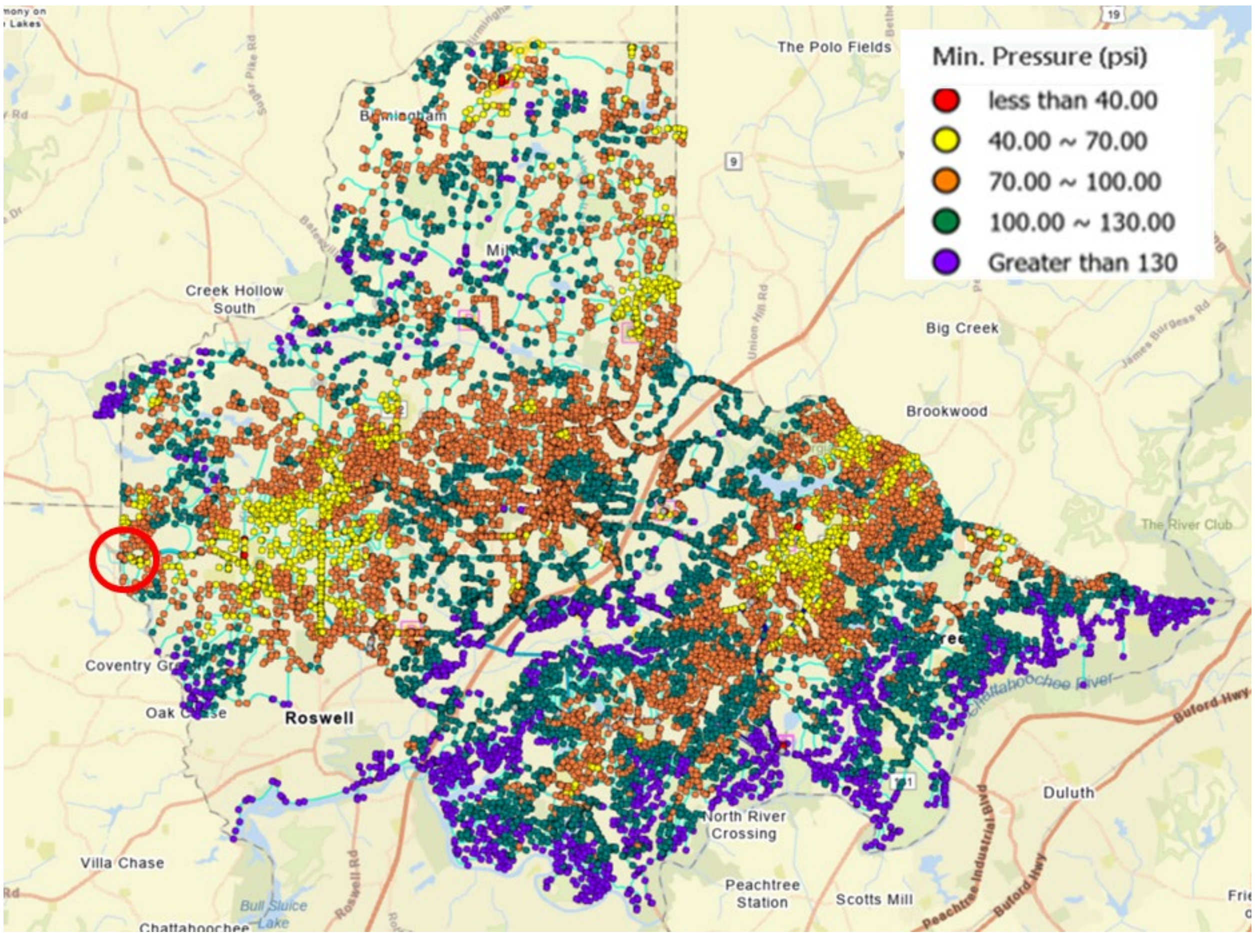


Table 5-6. Cobb County Interconnection Pumping Requirements

HGL Needed (ft)	Required Flow (gpm)	Required Flow (MGD)	Modeled Flow (gpm)	Modeled Flow (MGD)
1,375	1,389	2	1,310	2
1,430	3,472	5	3,475	5
1,535	6,945	10	6,926	10

The HGL at the Cherokee County side of the interconnection is 1,270 feet while the HGL at the Fulton side of the interconnection is approximately 1,301 feet during ADD; therefore, Fulton County cannot receive any flow from Cherokee County without any proposed improvements but can supply flow to Cherokee County, if needed. The location of the interconnection as well as the impact of supplying 1.6 MGD to the Cherokee County are shown on Figure 5-21. A few different modeling scenarios were run to determine the pumping capacity (head) required to get 2 MGD, 5 MGD, and 10 MGD using the interconnection. These are presented in Table 5-7.

Figure 5-21. Cherokee County Interconnection Location and Fulton Impact with 1.6 MGD Supply

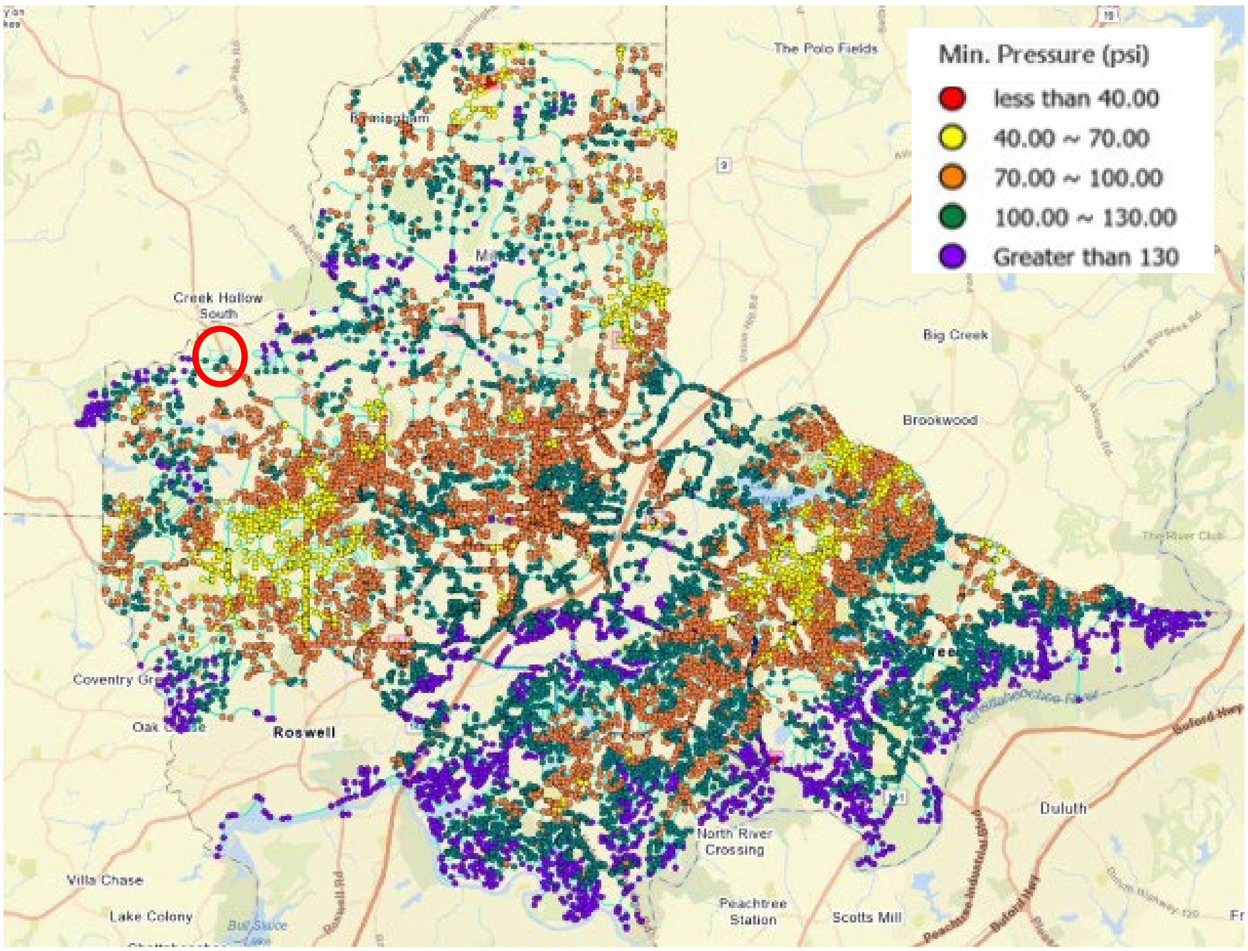
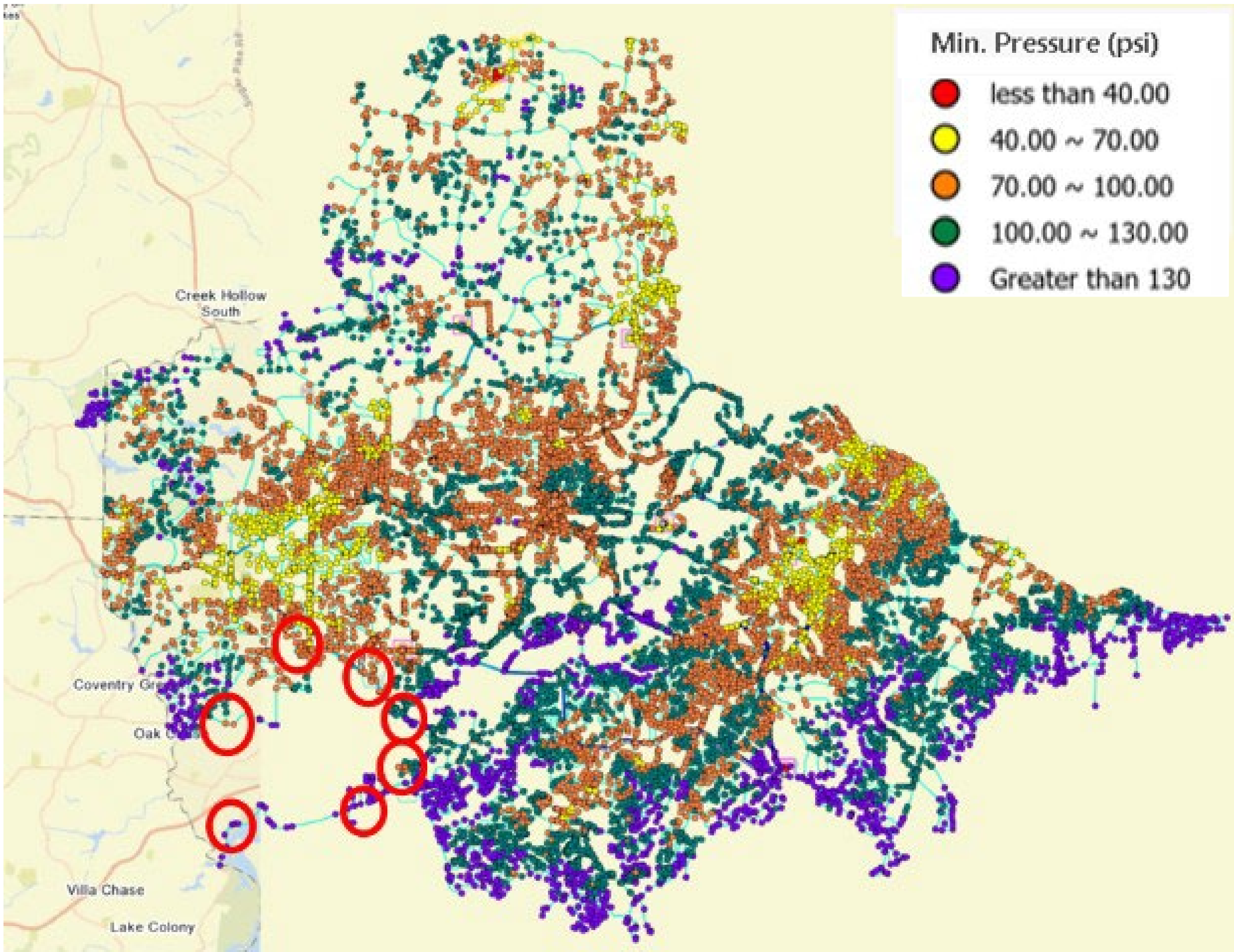


Table 5-7. Cherokee County Interconnection Pumping Requirements

HGL Needed (ft)	Required Flow (gpm)	Required Flow (MGD)	Modeled Flow (gpm)	Modeled Flow (MGD)
1,440	1,389	2	1,441	2
1,630	3,472	5	3,204	5
2,465	6,945	10	7,084	10

The City of Roswell has seven interconnections with Fulton County, as shown on Figure 5-22. The HGL at the Roswell side of the interconnections is 1,290 feet while the HGL at the Fulton County side of the interconnection varies from 1,318 to 1,360 feet during ADD. Only the Pine Grove location could be used to get a supply of about 1 MGD from the City of Roswell while at the other locations, Fulton County could supply 0.3 to 2.5 MGD if needed depending on the location.

Figure 5-22. City of Roswell Interconnection Locations and Fulton Impact with 2.2 MGD Supply to Roswell



5.4.1 Gwinnett County Interconnection

Fulton County is planning for a modified interconnection with Gwinnett County at Rogers Bridge Road. In 2019, Stantec produced a report[3] that described an evaluation of 14 scenarios in the hydraulic model of Gwinnett County Emergency Supply. The report concluded that a pump station would be needed to provide up to 20 MGD if the Tom Lowe WTP were out of service, and that three 18-inch-diameter pipes would be sufficient for crossing the river.

Emails provided by Fulton County indicate that Gwinnett County has a 30-inch McCrometer V-Cone meter that could be used to measure the flow through the interconnection.

[3] Stantec Consulting Services. 2019. *Technical Memorandum: North Fulton County Hydraulic Model Evaluation of Gwinnett County Emergency Supply*. July 1.

Fulton County has already begun implementing this interconnection, including the installation of the three 18-inch pipes across the river, and has purchased property for the installation of the booster pump station.

5.4.2 Intergovernmental Agreements

It is important for both parties in a water sharing arrangement to have an intergovernmental agreement in place. The 2011 GEFA Water System Interconnection, Redundancy and Reliability Act Emergency Supply Plan[4] contains a section describing the topics that should be addressed during the drafting of the intergovernmental agreement and also includes a model agreement. That section and the model agreement from that plan are included as Appendix H.

5.5 Valve Criticality Analysis

Valve criticality analysis was performed for all valves along the transmission mains that are greater than 30 inches in the system using InfoWater Pro's Criticality Assessment Manager. The original model was built using GIS where the in-line valves were imported into the model as junctions. These were used in this analysis to assess each main valve and the impact to facilities caused upstream and downstream of the main valve when the valve is closed. Failure criteria include reverse flow, pressure below 20 psi, and flow velocity greater than 5 feet per second. Example results for valve criticality analysis on two primary transmission corridors are provided as follows: Figure 5-23 shows the flow reversals affected by the valves on the 42-inch transmission main on Old Alabama Road and how the affected area increases as the valve locations get closer to the Tom Lowe WTP; provides examples of flow reversal pipes affected by a valve on the 36-inch transmission main on Jones Bridge Road, velocity violations caused by the same valve, and upstream pressure violations caused by a valve next to Mansell Road.

A vulnerability analysis was also conducted to assess critical pipes and valves within the distribution system. These indicate that if main breaks or valve closures were to occur on these mains, then there could be consequences such as pressure violations in the system. Many of these critical mains are the transmission mains from the WTP or other mains from facilities like tanks and booster pump stations. The critical pipes in the system are shown on Figure 5-24.

[4] CH2M HILL. 2011. *GEFA Water System Interconnection, Redundancy and Reliability Act Emergency Supply Plan*. September.

Figure 5-23. Pipes with Flow Reversal*

As 42" main valves on Old Alabama Road are closed (top); pipes with flow reversal and pipes with velocity violations when 36" main valves on Jones Bridge Road are closed (bottom two from the left) and locations with pressure violations when a valve on Mansell Road is closed (bottom right)

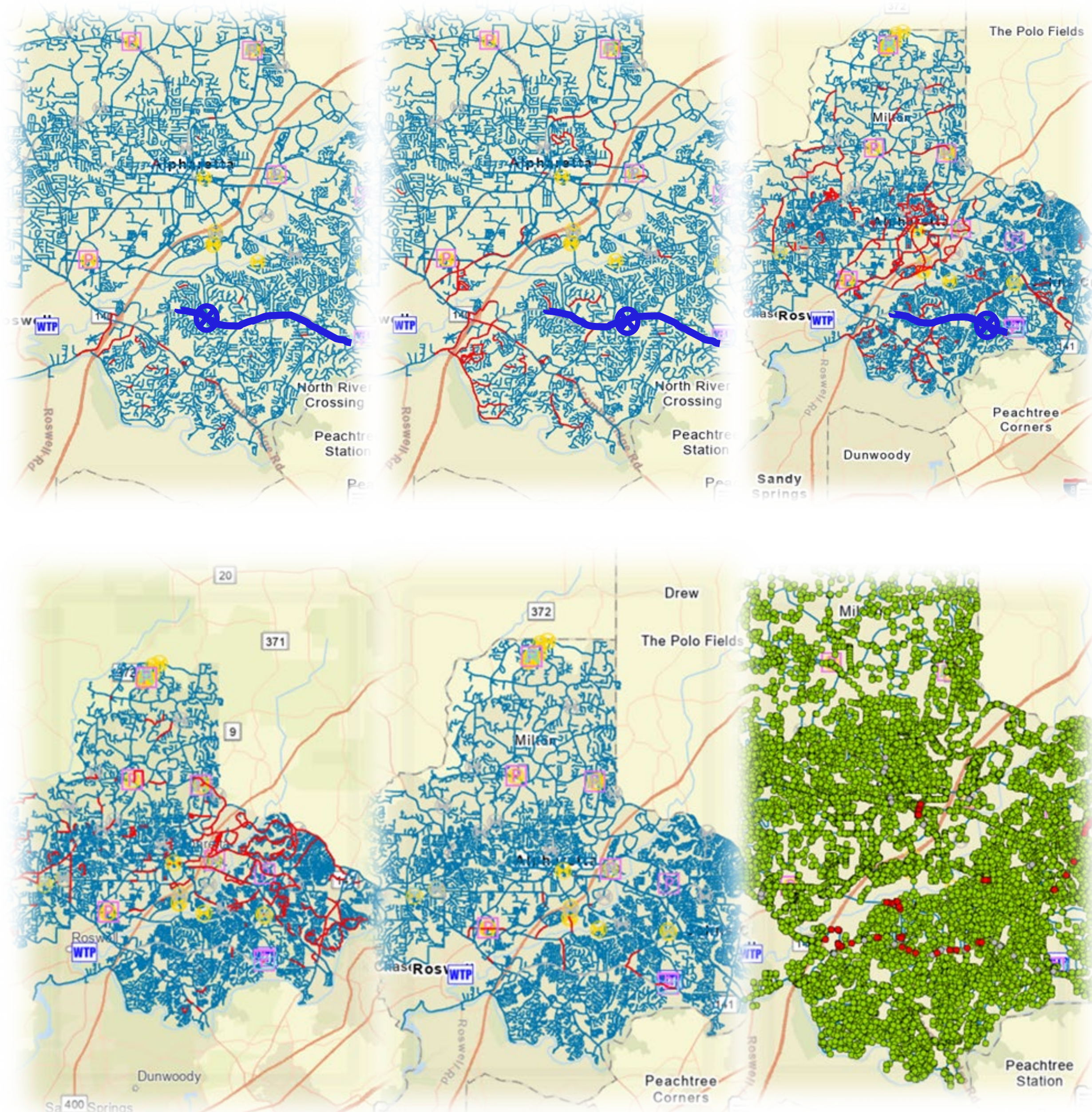
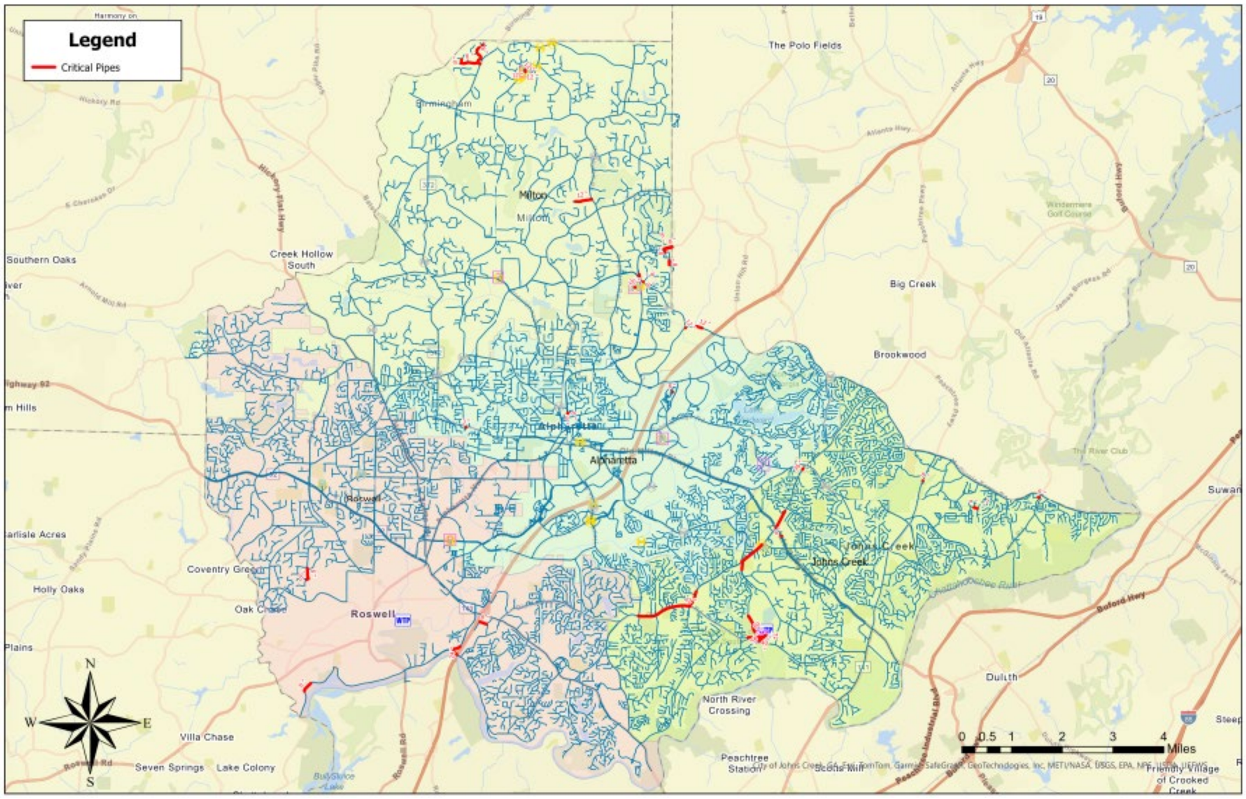


Figure 5-24. Pipe Criticality Analysis



5.6 Climate Resiliency

Planning and preparation by water providers is vital because of the uncertain nature of future climate conditions. The MNGWPD conducted a Utility Climate Resiliency Study in 2015 to address this uncertainty and provide possible future scenarios. The study focused on impacts to water demand, water supply, water quality, and watersheds. Fulton County must continue to address any vulnerabilities in their system due to potential changes in climate and adapt, as necessary.

Water demand was found to be sensitive to climate during the study, with a 1 to 4% increase expected by 2050 due to the influence of climate. Fulton County is preparing for increases in demand by monitoring increasing demands and planning for potential upgrades at the Tom Lowe WTP. The CIP projects developed as a part of this Master Plan also consider future increases in demand.

Water availability and supply is also expected to be impacted by climate uncertainty. Changes to the local climate can affect precipitation, and therefore affect supply. The change could be either an increase or decrease in the amount of precipitation. Drought conditions could cause water supply availability to change. Conservation efforts taken by the County could also help mitigate the impacts of decreased water supplies. Fulton County is an EPA WaterSense Partner, participates in the MNGWPD My Drop Counts program, and provides water conservation kits to its customers.

During times of drought, Fulton County could rely on the raw water reservoirs at the Tom Lowe WTP, clearwell storage, and distribution system storage tanks. In addition, the County could use the existing interconnections with Forsyth County and the City of Atlanta to purchase water, if available. The County is also planning a future interconnection with Gwinnett County for additional capacity. Finally, Fulton County has prepared a Hazard Mitigation Plan, which identifies drought as a recurring concern and identifies basic mitigation measures.

A potential increase in future temperatures could impact source water quality, as higher temperatures would lead to reduced dissolved oxygen and therefore impact the ability to handle pollutants. Temperature increases could also lead to more algal blooms in the lake upstream of the river intake. These issues would need to be handled with changes to the treatment processes used at the water treatment plant. While a potential increase in rainfall could help water supplies, it could also increase the amount of nonpoint source pollutants. Best management practices are adopted by many counties in their Watershed Protection Plans to protect water supplies from potential pollution sources. This will be vital if the ability for water supplies to handle contaminants is impaired.

6. Capital Improvement Plan

CIP solutions were developed as necessary based on several drivers. The main drivers were maintaining minimum pressures above 40 psi, improving operational efficiency, meeting customer demand, improving water age, and maintaining tank levels. Each phase below represents the demand conditions in that year, so if demands increase as predicted, the projects listed for each year should be implemented by that year, as they are needed to meet the water demands in that year.

CIP solution development for this Master Plan began with the existing system scenario based on the deficiencies discussed in Section 4 and were expanded upon for each phase through 2050. The solutions included new piping, pressure zones, pump stations, and operations adjustments. Minimum pipe sizes and extents of upsizing needed to maintain the required level of service are provided in the CIP solutions. When project design starts, pipe sizes and length of new piping can be increased where reasonable and verified in the model.

In the development of capital improvement projects, Jacobs noticed that there were many instances of pipes in the County water system that were close or crossing, but not connected. Some of these are small pipes, which may not have much impact if connected, but others are larger pipes that may have a significant impact when connected. Many of these crossing pipes were evaluated to determine the benefit of making these connections. They were prioritized by diameter of pipe, and proximity to hydraulic deficiency. In many cases, they were very helpful in increasing pressure, and providing additional fire flow. These crossing pipe connections have the potential to make the County water distribution system much more robust, when implemented. They were recommended in the CIP as shown below. Their cost is relatively inexpensive compared to water main extensions, and their benefit is measurable and therefore are priority recommendations.

In the development of the 2050 CIP projects, the MDD peaking factor was discussed and debated with the County. As shown in the water demand projections, a peaking factor of 1.5 reflects the recent historical average since 2007, and the 1.75 peaking factor is a recent maximum last experienced on July 3, 2024. For the transmission main CIP recommendation (Section 6.2), both peaking factors were used to show the County options for the phasing of this project.

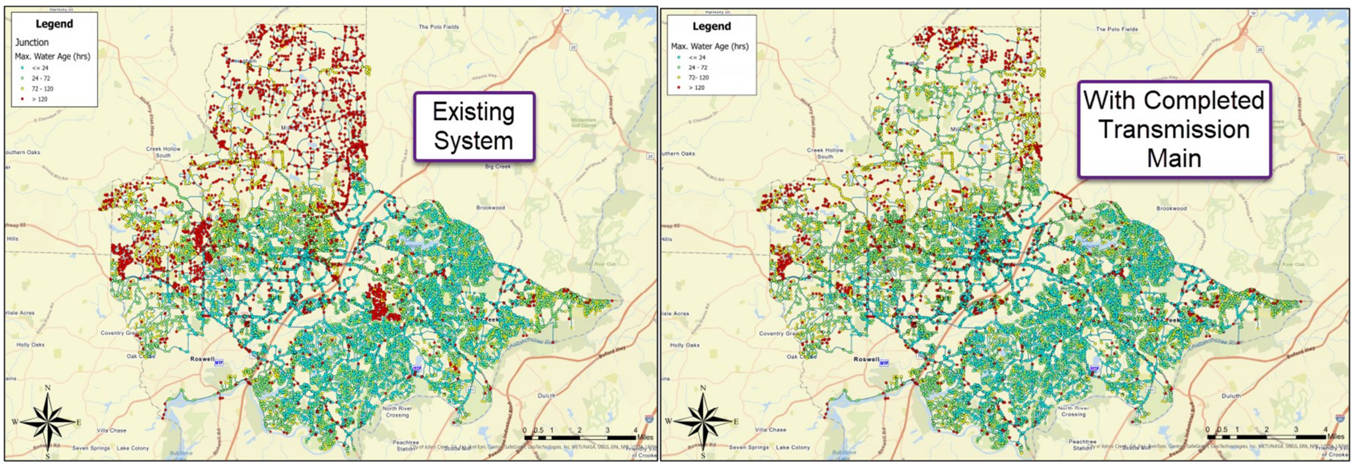
The completion of the transmission main is one of the most beneficial capital improvement projects in this Master Plan. This is based on the hydraulic modeling showing that through the completion of the transmission main with CIP projects 201/401 and 501, deficiencies are significantly reduced toward meeting the levels of service the County has identified. The transmission main helps with reducing low pressure deficiencies in the central and northern portions of the county. The completion of the transmission main also significantly reduces the water age in the northeastern portion of the county, as shown on Figure 6-1. As a result, the county should prioritize the implementation of these transmission main segments in the future.

There are some capital improvement projects that help improve pressure at neighborhoods that have historically experienced low pressure. These neighborhoods and CIP projects include the following list:

- Providence Oaks: 103, 105
- Vickery Crest: 103, 106
- Hayfield: 103, 211, 506
- Maid Marion: 101, 102, 203

To further prioritize the projects within each phase, the projects with costs greater than $1 million were evaluated to determine which ones should be implemented first. This prioritization is based on engineering judgment and the impact each project will have on the system in terms of improving the Level of Service that Fulton County has identified. The transmission main is excluded from this prioritization due to the priority nature of this project. It is a priority project due to the significant benefits of the implementation of this project. The pressure zones were prioritized according to the number of customers in each zone.

Figure 6-1. Transmission Main Water Age Improvements



6.1 CIP Costs

CIP costs were developed using a Jacobs proprietary tool called Replica Parametric Design. This software generates conceptual-level designs and cost estimates for municipal and industrial water and wastewater projects that facilitate sustainable and economical decision-making early in the project. Replica Parametric Design integrates the three main conceptual components of early project planning (facility design criteria and footprints, construction cost estimates, and life cycle cost estimates) to provide a clearer picture of project scope and cost than traditional conceptual estimating techniques. Life cycle costs were not included as part of the CIP costs presented herein but they do include overall project capital costs including adders for additional project costs (like site work or yard piping, if any), contractor markups (which includes a 40% contingency) as well as non-construction costs like permitting, engineering, and services during construction. Costs should be reassessed at the time of project execution.

6.2 Current Recommendations

This section provides the CIP solutions that are recommended to be implemented as soon as they can be funded. They provide immediate improvement to pressure and fire flow and are shown on Figure 6-1. Table 6-1 lists each of the projects in the 2025 phase, along with the driver, description, size, length, and planning level cost estimate. Appendix G includes a map book of the individual CIP projects.

The current recommendations include several crossing pipe connections, and a few line extensions to help with low pressures. Note that crossing pipe connection lengths and costs presented herein are approximate and will need to be reassessed before detailed design and construction.

Figure 6-2. 2025 CIP Projects Overview

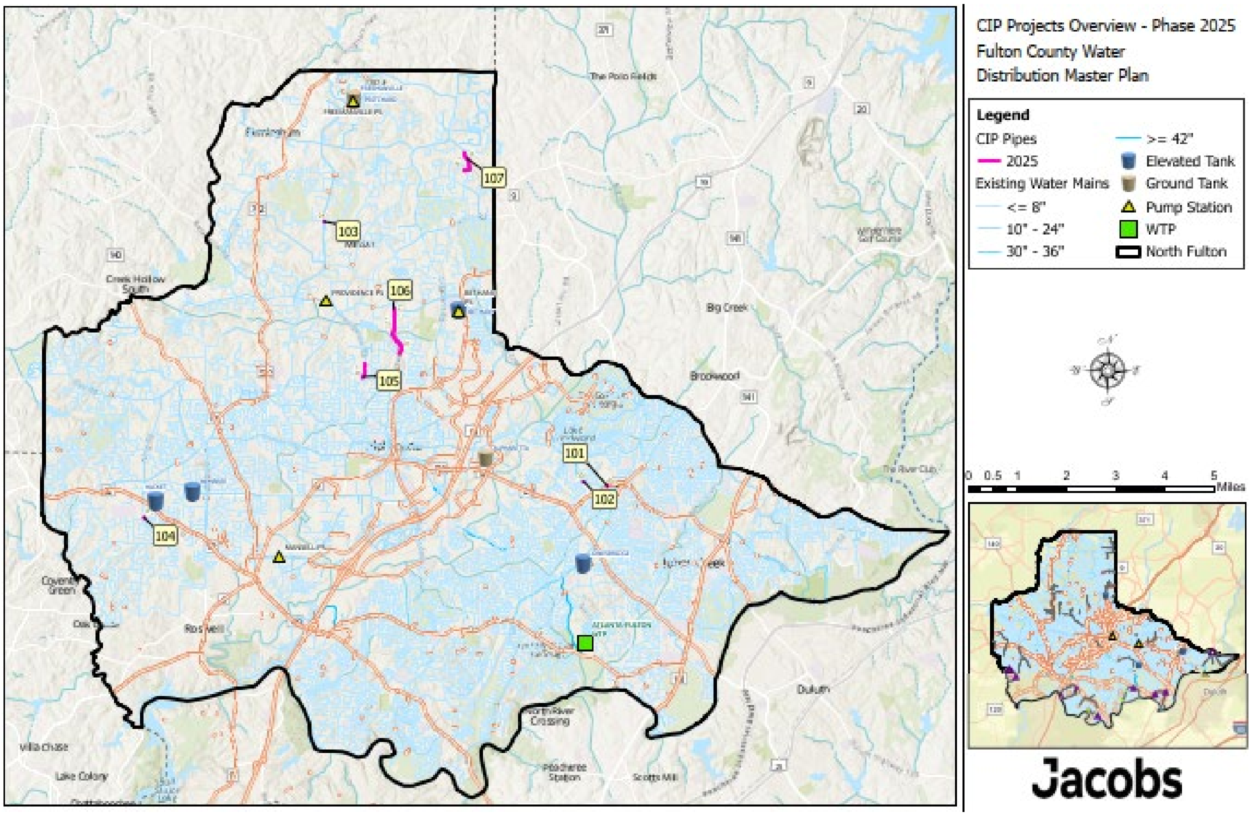


Table 6-1. 2025 CIP Project Descriptions

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[b]	Length (ft)
101[a]†	2025	Low Pressure	Crossing Pipe Connection at Kimball Bridge Road/Webb Bridge Road	Water Main	Both	-	30"	$102,000	4
102†	2025	Low Pressure	Crossing Pipe Connection at Webb Bridge Road/Maid Marion Close	Water Main	Both	-	30"	$195,000	7
103[a]†	2025	Low Pressure	Crossing Pipe Connection at Freemanville Road/Quarterpath Lane	Water Main	Both	-	24"	$101,000	22
104	2025	Low Pressure	Woodstock Road Extension	Water Main	Both	-	8"	$128,000	40
105†	2025	Low Pressure/Fire Flow	Providence Road Extension	Water Main	Both	-	8"	$741,000	956
106†	2025	Low Pressure/Fire Flow	Hopewell Road Parallel Line	Water Main	Both	1	12"	$3,936,000	5,096
107	2025	Low Pressure/Fire Flow	Hamby Road Extension	Water Main	Both	2	8"	$1,610,000	2,583

[a] Ongoing project with construction cost estimate per email from Fulton County's Timothy Mullen (August 8, 2024)
[b] Cost estimate is total project cost and includes 40% contingency except for ongoing projects.
†This project will improve minimum pressures at subdivisions where low pressure have been reported in the summer by customers.

6.2.1 Operational Recommendations

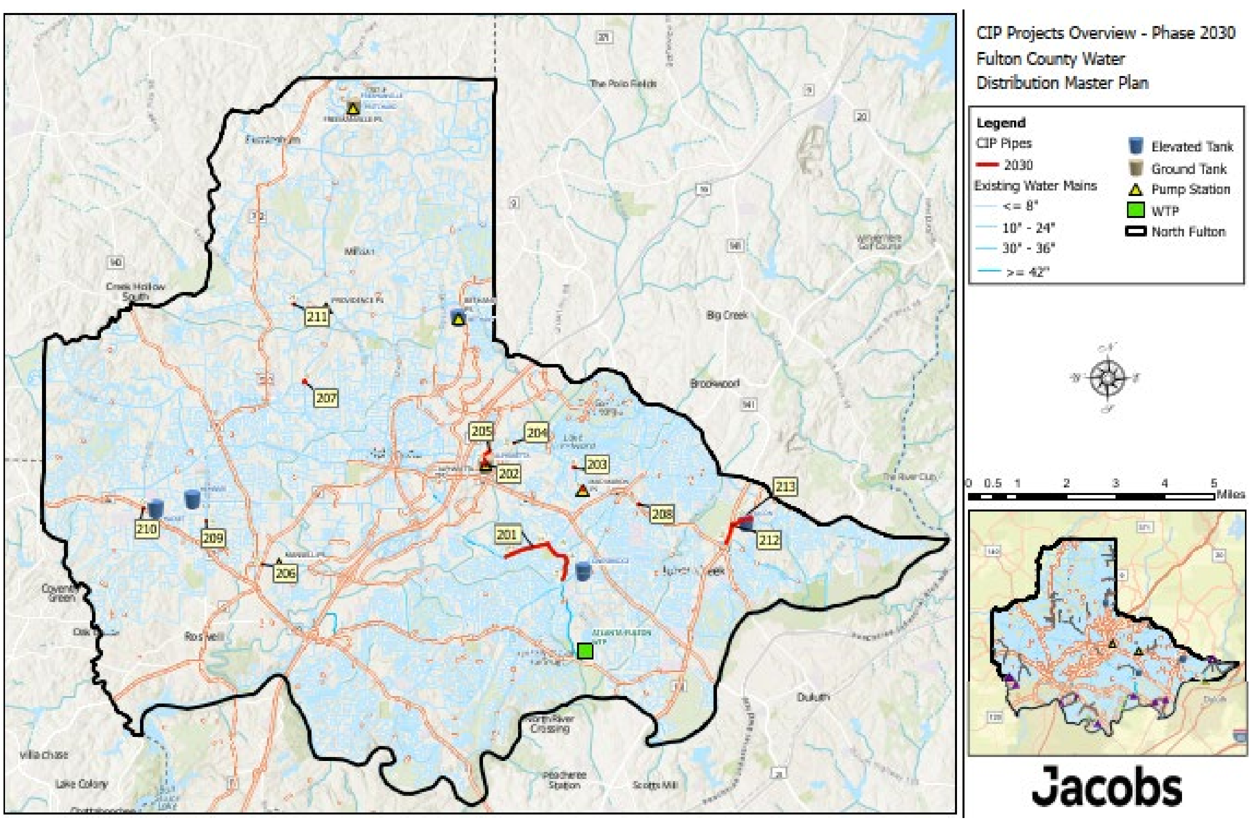
The water distribution system operates based on two main pressure zones – the Main Zone and the Pritchard Mountain Zone. The Main Zone covers most of the county and is supplied by the high service pumps at the Tom Lowe WTP. This zone has an HGL of approximately 1,280 feet. Flow to the Freemanville ground service tank is supplied from the Providence pump station. The Pritchard Mountain pump station then pumps water from the ground Freemanville Tank to the elevated Pritchard Mountain tank. This operates at the Pritchard Mountain Zone at an HGL of around 1,380 feet.

Through the validation exercise, an operational recommendation was identified. At the Providence pump station when a second pump is turned on, the Freemanville Tank altitude valve should be allowed to fill to avoid higher pressures in the discharge zone. This would help avoid potentially damaging high pressures from occurring in the system.

6.3 2030 Recommendations

The 2030 recommendations include some water main and a storage tank for a large customer, eight crossing pipe connections, a segment of the transmission main at the 1.75 peaking factor and two pump stations needed for different reasons. Figure 6-3 shows the locations of these projects and Table 6-2 lists each of the projects in the 2030 phase, along with the driver, description, size, length, and planning level cost estimate.

Figure 6-3. 2030 CIP Projects Overview



The Existing Storage Analysis (Section 5.1) identified a storage deficit of 1.13 MG in the Fulton County system, and the need for additional storage in the near term was discussed with the County. Based on the projected future demand of a large industrial customer (ALCON), the County evaluated the option of an elevated storage tank to serve them. From the 2050 demand, the average water usage was projected to be about 2.5 MG per day. An elevated, 3 MG tank would be able to meet future demands, but the tank could still be used in the short term, as needed.

Table 6-2. 2030 CIP Project Descriptions

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
201-A†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Buice Road (Phase A)	Transmission Main	1.75	Yes	54"	$8,812,000	2,816
201-B†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Buice Road (Phase B)	Transmission Main	1.75	Yes	54"	$6,111,000	1,960
201-C†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase C)	Transmission Main	1.75	Yes	54"	$7,269,000	2,309
201-D†	2030	Low Pressure/Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase D)	Transmission Main	1.75	Yes	54"	$8,650,000	2,753
202	2030	Alpharetta Tank	Alpharetta Tank Pump Station (75 HP pumps)	Pump Station	Both	1	16"	$12,380,000	2,014
203†	2030	Low Pressure (Maid Marion)	Maid Marion In-line Booster Station and High Pressure Zone (5 HP pumps)	Pump Station	Both	3	8"	$4,898,000	267
204	2030	Low Pressure	Crossing Pipe Connection at Webb Bridge Road/Strath Drive	Water Main	Both	-	30"	$143,000	4
205	2030	Low Pressure	Crossing Pipe Connection at Webb Bridge Road/North Point Parkway	Water Main	Both	-	30"	$150,000	11
206	2030	Low Pressure	Crossing Pipe Connection at Mansell Road/ Alpharetta Highway	Water Main	Both	-	20"	$193,000	52
207	2030	Low Pressure	Crossing Pipe Connection at Bethany Road just north of Mayfield Road	Water Main	Both	-	16"	$144,000	9

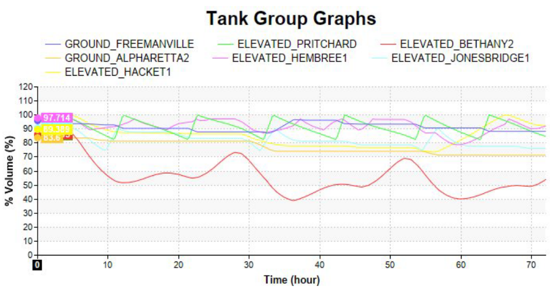
CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
208	2030	Low Pressure	Crossing Pipe Connection at Abbotts Bridge Road/Abbotts Way	Water Main	Both	-	30"	$159,000	19
209	2030	Low Pressure	Crossing Pipe Connection at Crabapple Road just north of Strickland Road	Water Main	Both	-	16"	$151,000	24
210	2030	Low Pressure	Crossing Pipe Connection at W Crossville Road/Woodstock Road	Water Main	Both	-	24"	$203,000	60
211†	2030	Low Pressure	Crossing Pipe Connection at Providence Road/Freemanville Road	Water Main	Both	-	24"	$278,000	127
212	2030	Low Pressure/ALCON customer	Medlock Bridge Road/Johns Creek Pkwy Parallel Line	Water Main	Both	2	30"	$7,120,000	4,481
213	2030	Emergency Storage/ALCON	New 3 MG Elevated Storage Tank at ALCON	Tank	Both	4	N/A	$15,600,000	N/A

[a] Cost estimate is total project cost and includes 40% contingency.

†This project will improve minimum pressures at subdivisions where low pressure have been reported in the summer by customers.

Figure 6-4 below shows the tank levels under the 2030 MDD scenario with all the 2025 CIP projects completed with peaking factors of 1.75 and 1.5. Figure 6-5 shows the improvement to the tank levels when all the 2030 CIP projects are completed with peaking factors of 1.75 and 1.5.)

Figure 6-4. Tank levels at 2030 MDD with 2025 CIP projects completed at a PF of 1.75 (left) and a PF of 1.5 (right)



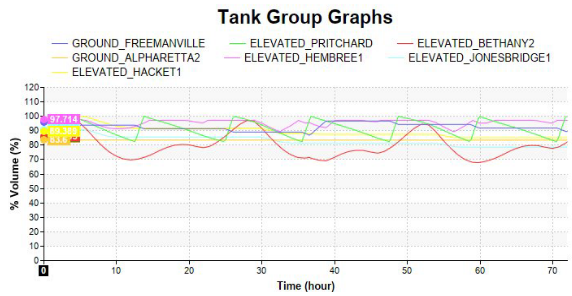
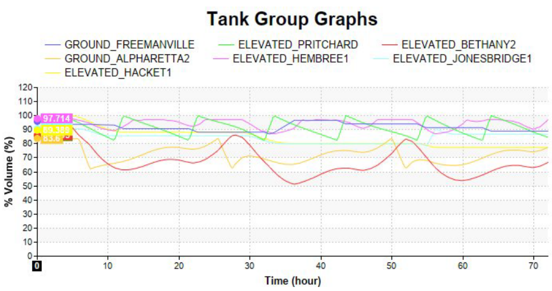
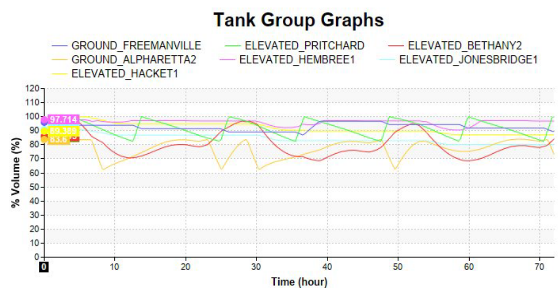


Figure 6-5. Tank levels at 2030 MDD with 2030 CIP projects completed at a PF of 1.75 (left) and a PF of 1.50 (right)





In this phase, due to the benefits of the various crossing pipe connection projects reducing head losses in the system, the Alpharetta tanks do not drain as shown on Figure 6-6. The difference in the HGL between the drain lines between the existing and 2050 scenarios is shown on Figure 6-7. Therefore, to drain the Alpharetta tanks effectively, a pump station is proposed.

This phase also includes the Maid Marion in-line booster station and the creation of a new high-pressure zone. The zone is isolated by closing two valves on the 8-inch main on Webb Bridge Road. This zone helps in alleviating the significant low-pressure issues experienced by the customers in the Maid Marion and Park Glenn subdivisions, which are due to their grade elevations.

Figure 6-6. Alpharetta Tank Levels – Existing System vs. 2050 CIP with No Pump Station

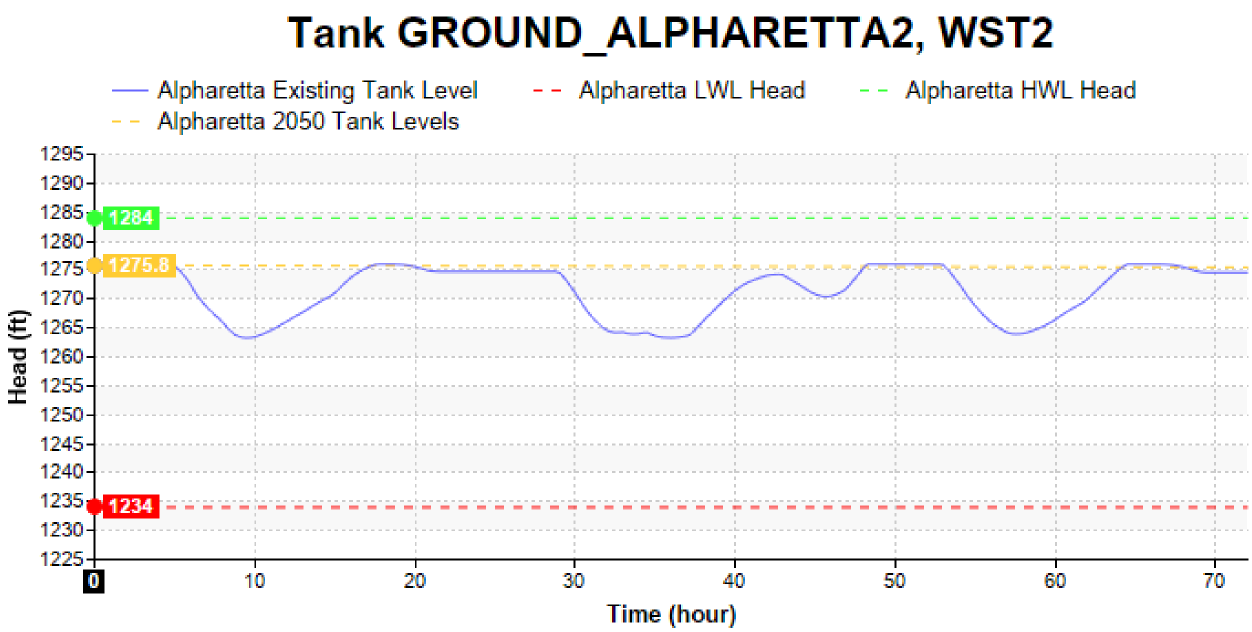
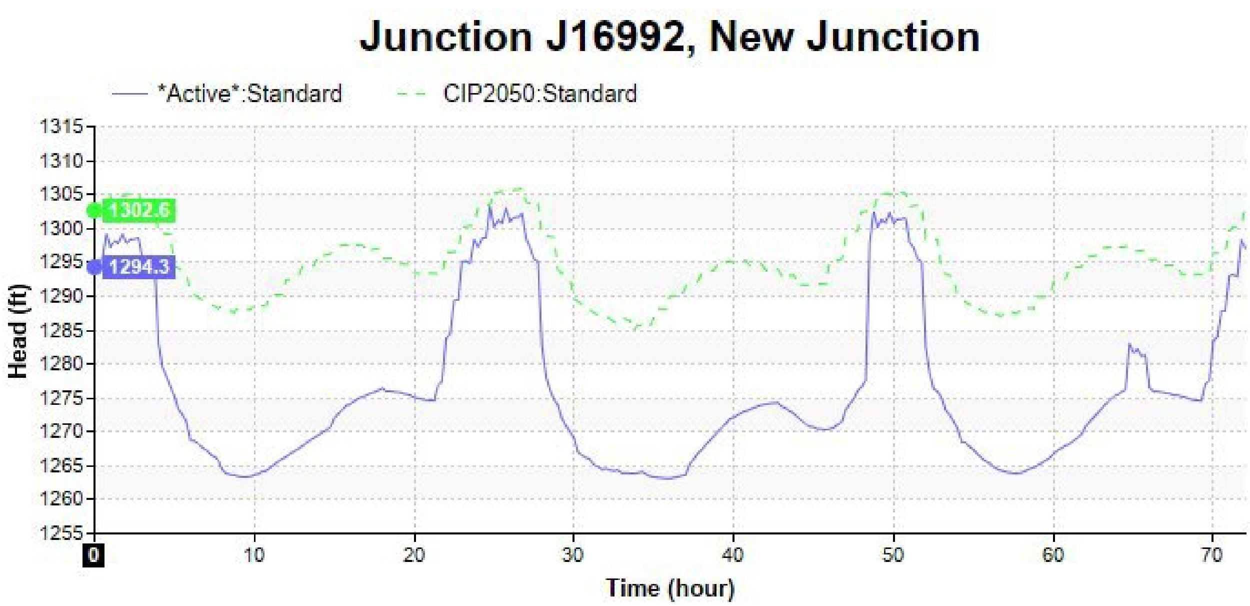


Figure 6-7. HGL Difference between Existing and 2050 Scenario for the Alpharetta Drain Line



6.4 2035 Recommendations

The 2035 recommendation includes a segment of the transmission main at the 1.75 peaking factor. Figure 6-8 shows the locations of this project, and Table 6-3 lists the project in the 2035 phase, along with the driver, description, size, length, and planning level cost estimate.

Figure 6-8. 2035 CIP Projects Overview

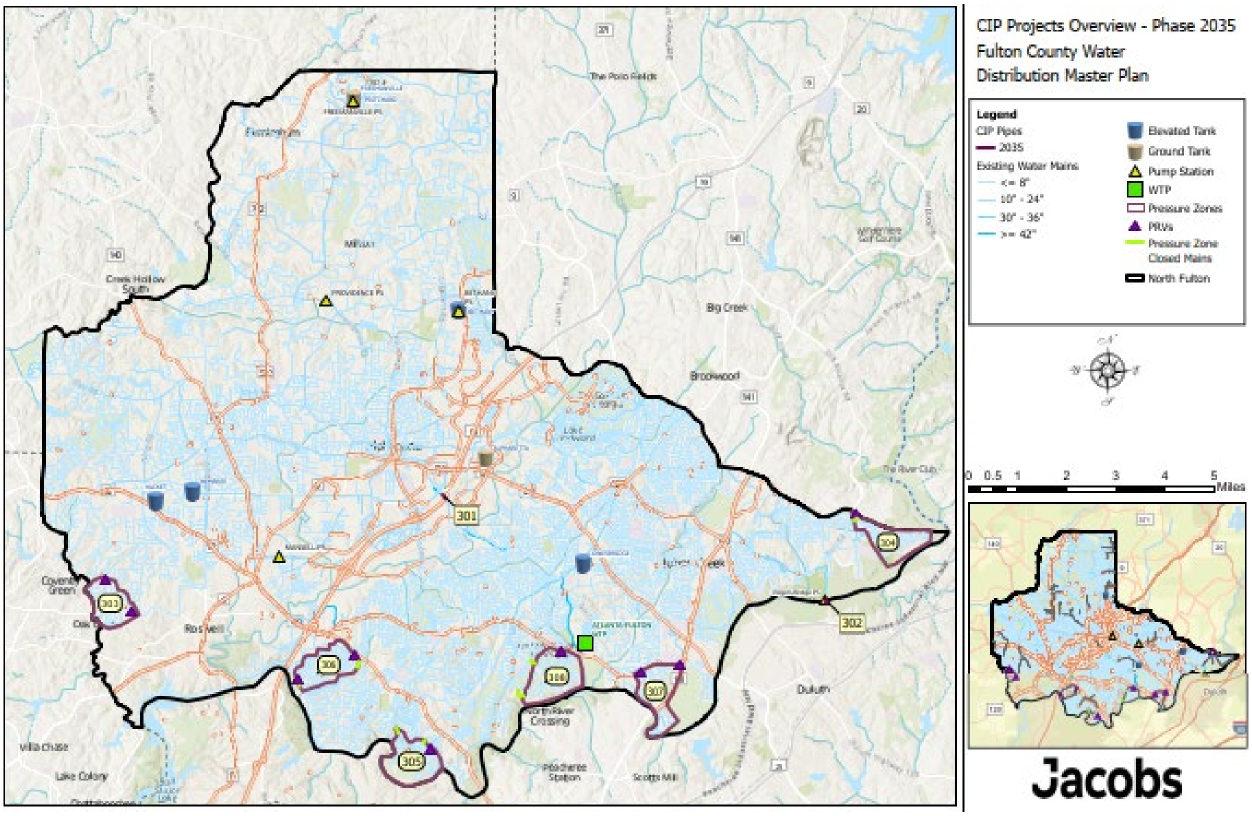


Table 6-3. 2035 CIP Project Descriptions

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
301†	2035	Low Pressure/Water Age	Complete 42" Transmission Main under GA 400 along Kimball Bridge Road	Transmission Main	1.75	Yes	42"	$3,768,000	500
302	2035	Emergency Interconnection	Rogers Bridge Pump Station - Gwinnett Interconnection (450 HP pumps)	Pump Station	Both	7	N/A	$11,151,000	N/A
303	2035	High Pressure	Pine Grove Low Pressure Zone	Pressure Reducing Valve	Both	6	N/A	$2,082,000	N/A

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
304	2035	High Pressure	Shakerag Low Pressure Zone	Pressure Reducing Valve	Both	2	N/A	$1,041,000	N/A
305	2035	High Pressure	Horseshoe Bend Low Pressure Zone	Pressure Reducing Valve	Both	3	N/A	$1,041,000	N/A
306	2035	High Pressure	Martin Landing Low Pressure Zone	Pressure Reducing Valve	Both	1	N/A	$2,082,000	N/A
306	2035	High Pressure	Atlanta Athletic Club Low Pressure Zone	Pressure Reducing Valve	Both	4	N/A	$2,082,000	N/A
307	2035	High Pressure	County Club of the South Low Pressure Zone	Pressure Reducing Valve	Both	5	N/A	$1,041,000	N/A

[a] Cost estimate is total project cost and includes 40% contingency.

†This project will improve minimum pressures at subdivisions where low pressure have been reported in the summer by customers.

Figure 6-9 below shows the tank levels under the 2035 MDD scenario with all the 2030 CIP projects completed with peaking factors of 1.75 and 1.5. Figure 6-10 shows the improvement to the tank levels when all the 2035 CIP projects are completed with peaking factors of 1.75 and 1.5.

Figure 6-9. Tank levels at 2035 MDD with 2030 CIP projects completed at a PF of 1.75 (left) and a PF of 1.5 (right)

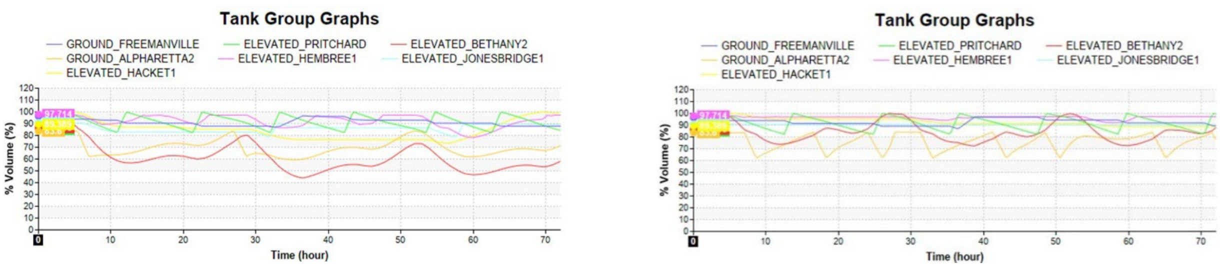
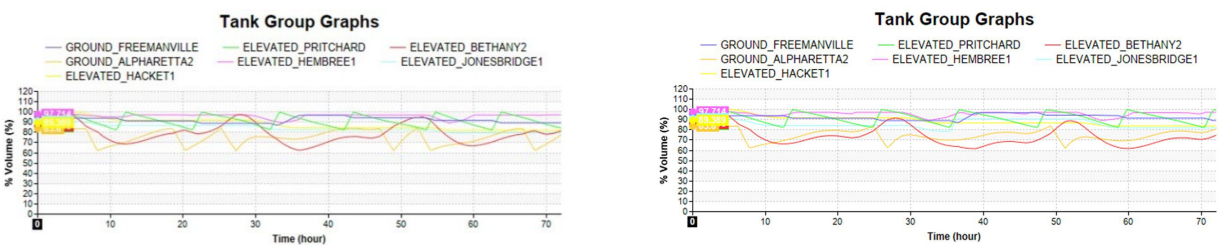


Figure 6-10. Tank levels at 2035 MDD with 2035 CIP projects completed at a PF of 1.75 (left) and a PF of 1.50 (right)



6.4.1 Pressure Zone Recommendations

There are six new proposed pressure zones shown below, and they are recommended to be implemented as soon as they can be funded in the 2030 Phase. They will lower the pressure and will be created by closing valves and installing pressure-reducing valves (PRVs). All pressure zone analysis were conducted using the existing model for ADD and to assess fire flows under MDD. The six new low-pressure zones are as follows:

- Pine Grove Zone
- Shakerag Zone
- Horseshoe Bend Zone
- Martin Landing Zone
- Atlanta Athletic Club Zone
- Country Club of the South Zone

The pressure zone analysis statistics for each zone is tabulated in Table 6-4. This table shows the average pressure before and after, number of PRVs needed, number of customers affected, pressure settings, length of pipe in each zone, maximum pressures before and after, junction residual pressures less than 20 psi during fire flows before and after, and the flow requirement on the low-pressure side. This information is typically used to size and cost PRV stations. The rough order of magnitude costs for a PRV station is around $250,000 to $300,000 but could vary based on several factors.

Table 6-4. Pressure Zone Analysis Statistics

Pressure Zone Analysis Statistics	Pine Grove Zone	Shakerag Zone	Horseshoe Zone	Martin Landing Zone	Atlanta Athletic Club Zone	Country Club of the South Zone
Average pressure (before), psi	137	149	150	162	155	146
Average pressure (after), psi	100	91	101	84	100	88
Number of PRVs	2	1	1	2	2	1
Number of customers (based on tax parcel layer)	443	806	632	1,207	489	485
PRV 1 setting, psi	67	70	80	90	80	90
PRV 2 setting, psi	67	-	-	90	80	-
Length of pipes, feet	34,696	46,891	35,201	56,725	42,196	42,766
Length of pipes, miles	7	9	7	11	8	8
Maximum pressure (Before), psi	155	170	184	184	173	176
Maximum pressure (After), psi	117	113	136	106	119	118
Residual pressure junctions < 20 psi (before)	13	122	17	1	0	62
Residual pressure junctions < 20 psi (after)	12	154	21	21	13	62
Valve size (pipe size) for both pipes	8-inch	8-inch	10-inch	8-inch	12-inch	8-inch
Low pressure side flow requirement (ADD - gpm)	63	95	78	198	90	81

Pine Grove Zone: The location and average pressure in the Pine Grove Pressure Zone with a pressure setting of 67 psi under ADD is shown on Figure 6-11. Fire flow impacts were assessed before and after by examining areas with residual pressures less than 20 psi during MDD as shown on Figure 6-12. The pressure zone statistics are tabulated in the Table 6-4.

Figure 6-11. Pine Grove Low Pressure Zone – Average Pressures (ADD)

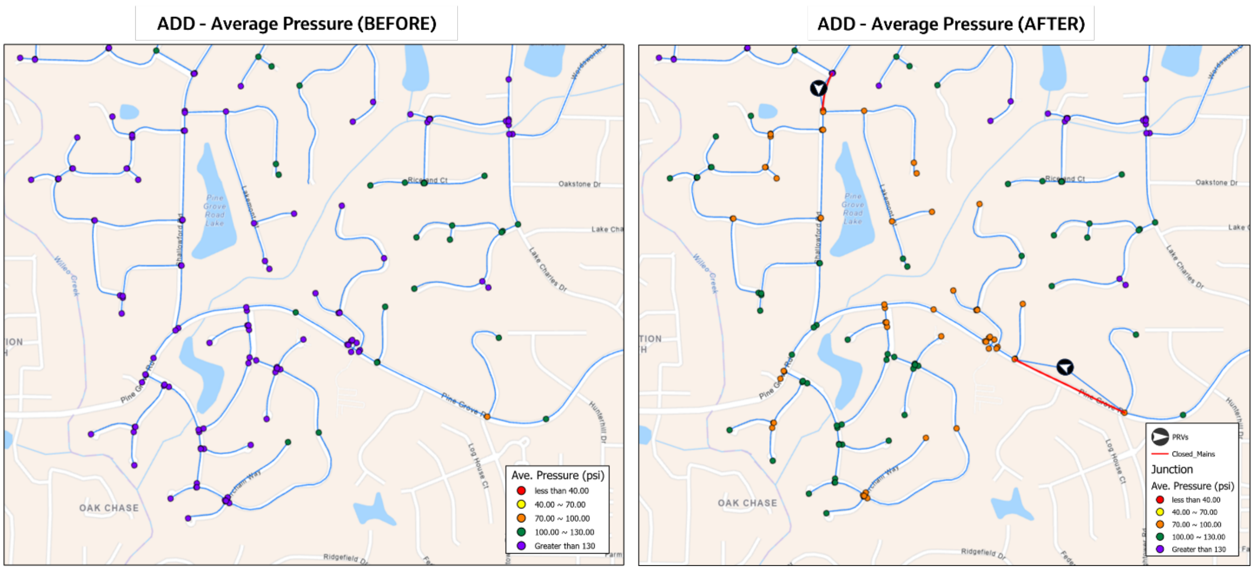
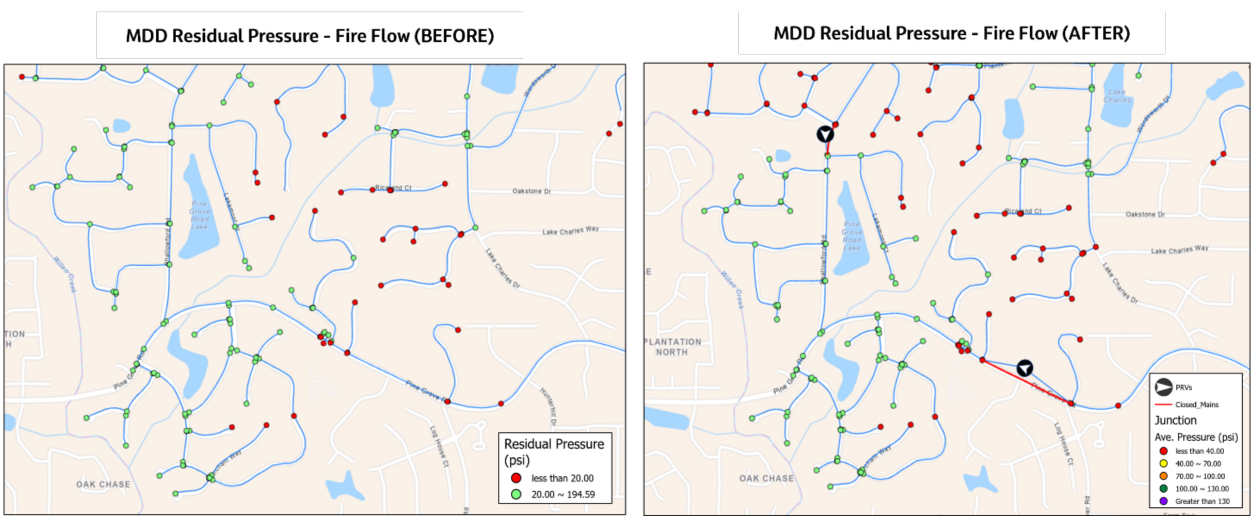


Figure 6-12. Pine Grove Low Pressure Zone – Fire Flow Residual Pressure (MDD)



Shakerag Zone: The location of the Shakerag Pressure Zone and the average before and after pressures with a pressure setting of 70 psi under ADD are shown on Figure 6-13 and Figure 6-14. The PRV is proposed in the main along McGinnis Ferry Road. Fire flow impacts were assessed before and after by examining areas with residual pressures less than 20 psi during MDD, as shown on Figure 6-15. The pressure zone statistics are tabulated in Table 6-4.

Figure 6-13. Shakerag Low Pressure Zone Location

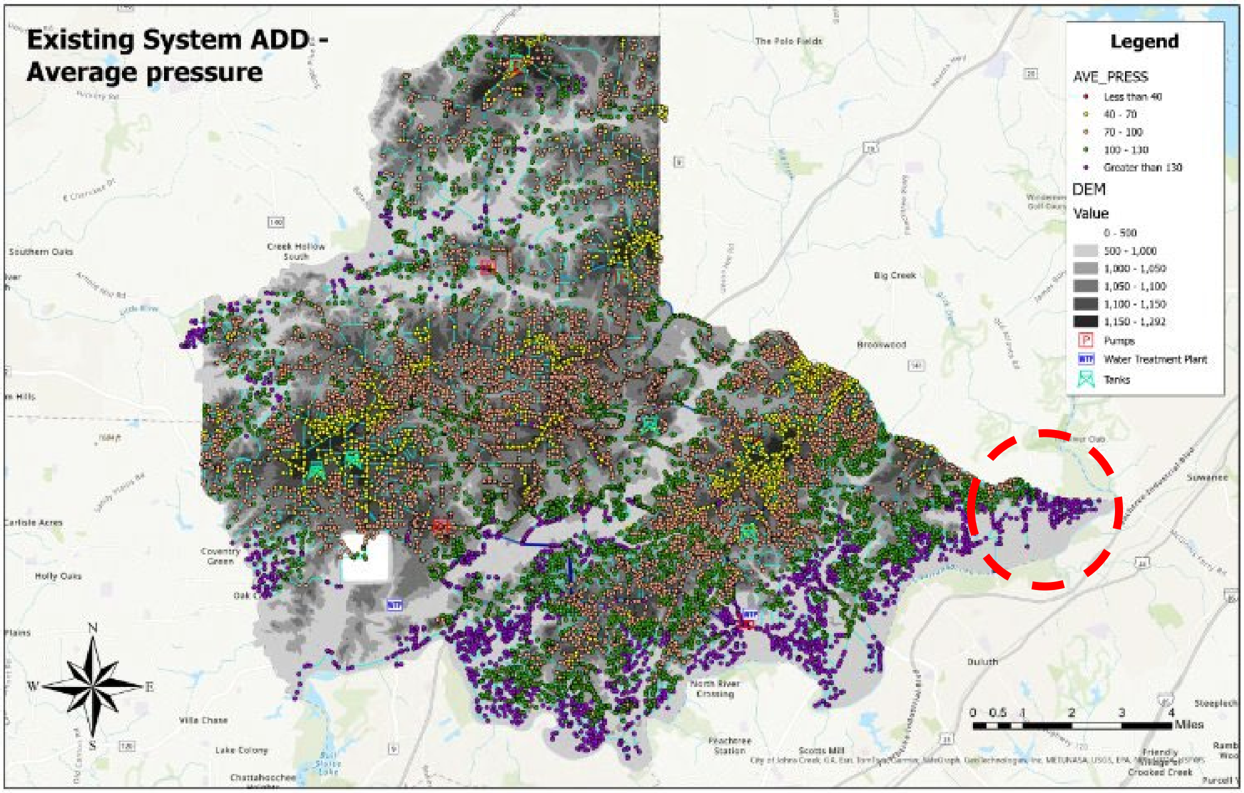


Figure 6-14. Shakerag Low Pressure Zone – Average Pressures (ADD)

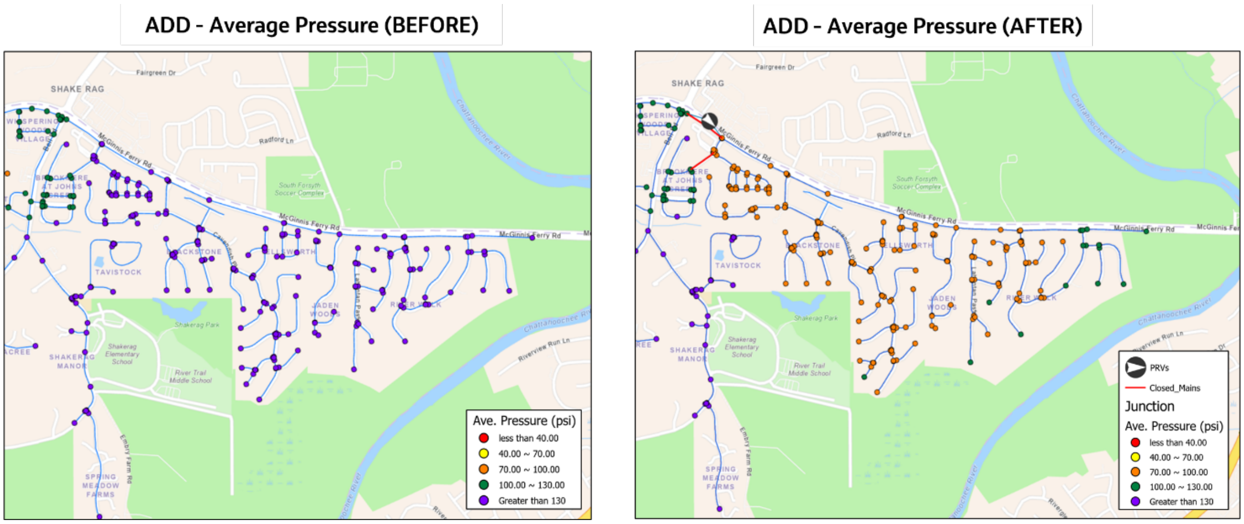
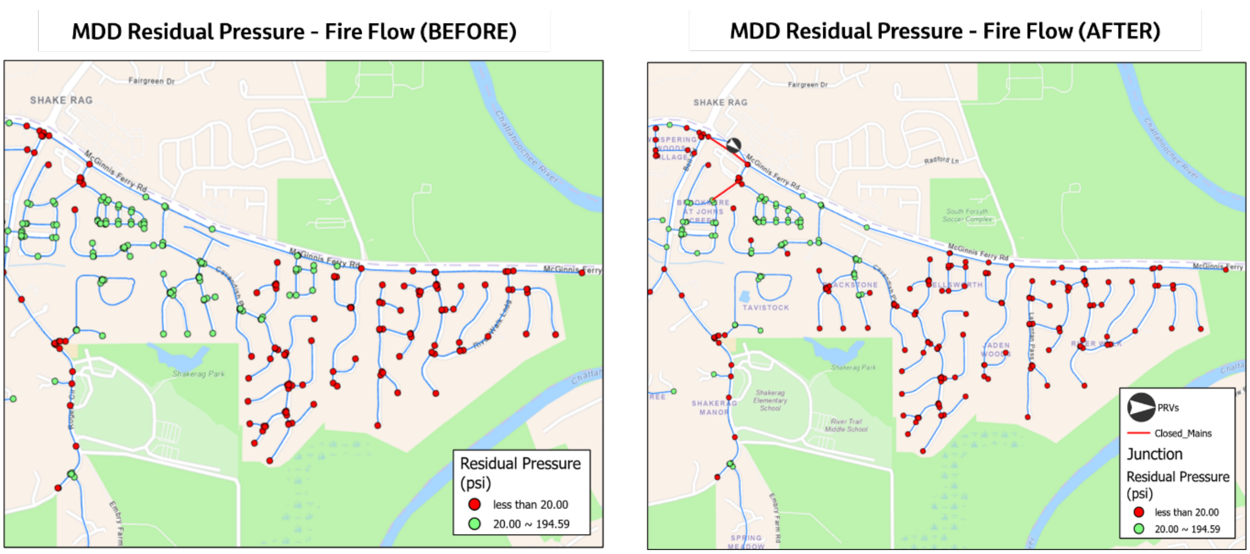


Figure 6-15. Shakerag Low Pressure Zone – Fire Flow Residual Pressure (MDD)



Horseshoe Bend Zone: The location of the Horseshoe Bend Pressure Zone and the average before and after pressures with a pressure setting of 80 psi under ADD are shown on Figure 6-16 and Figure 6-17 The PRV is proposed in the main in the Haven Wood area. Fire flow impacts were assessed before and after by examining areas with residual pressures less than 20 psi during MDD, as shown on Figure 6-18. The impact on available fire flow was not significantly affected by the new zone. The pressure zone statistics are tabulated in Table 6-4.

Figure 6-16. Horseshoe Bend Low Pressure Zone Location

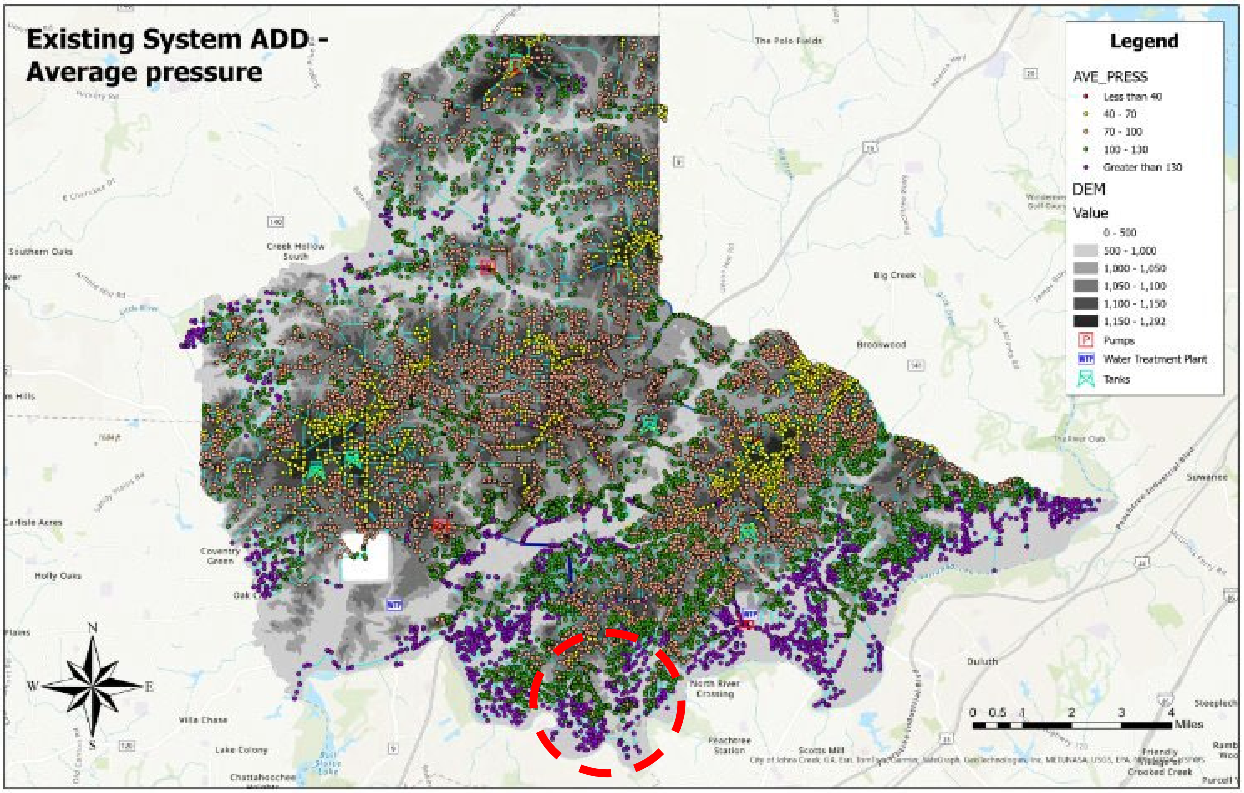


Figure 6-17. Horseshoe Bend Low Pressure Zone – Average Pressures (ADD)

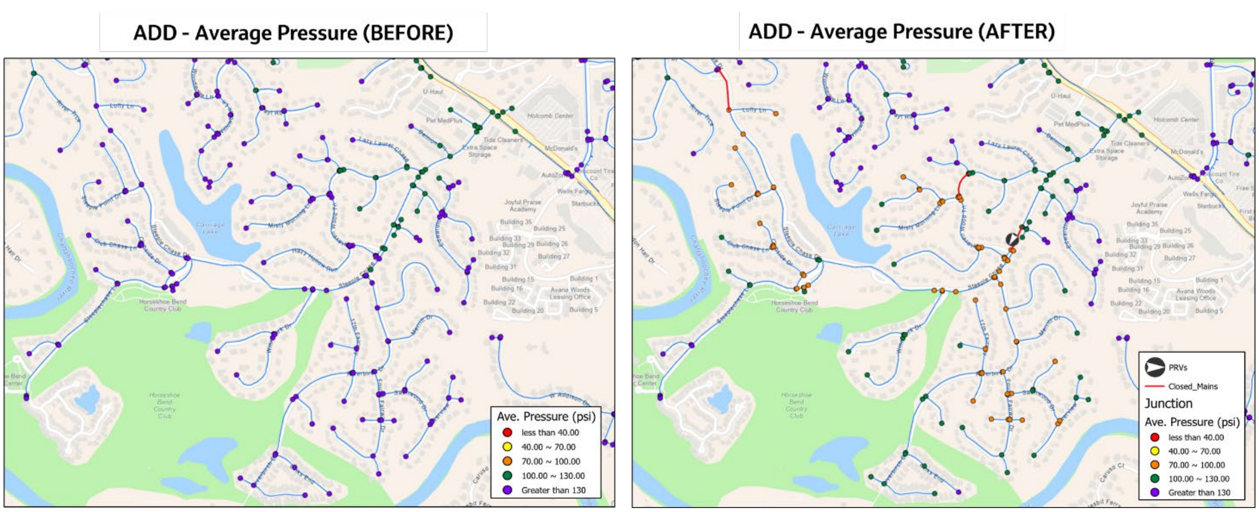
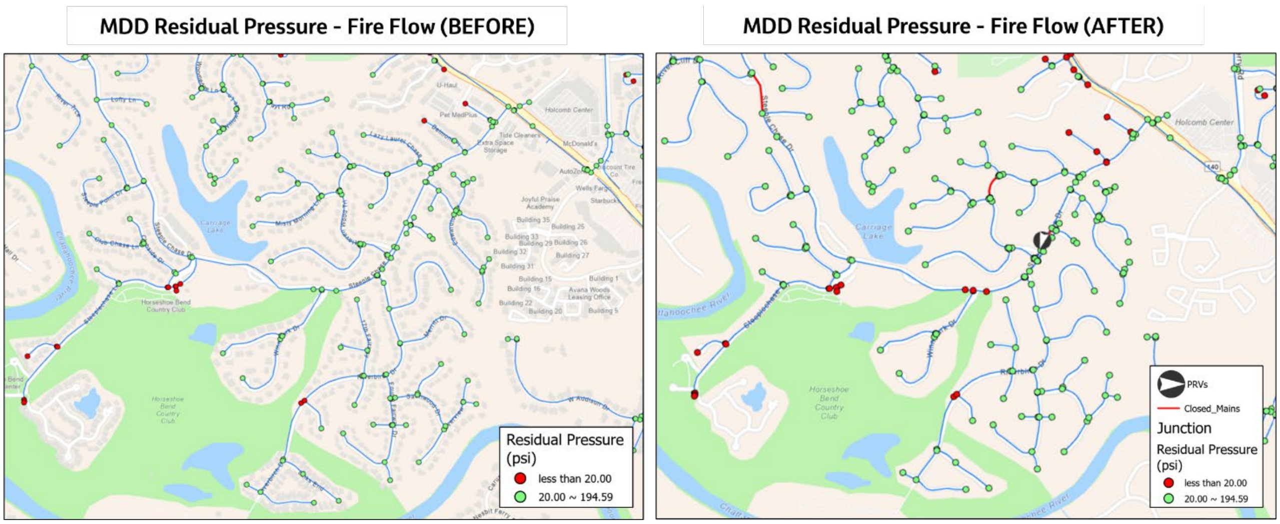


Figure 6-18. Horseshoe Bend Low Pressure Zone – Fire Flow Residual Pressure (MDD)



Martin Landing Zone: The location of the Martin Landing Pressure Zone and the average before and after pressures with a pressure setting of 90 psi under ADD are shown on Figure 6-19 and Figure 6-20. There are two PRVs proposed in the main along Martin Road and along Martin Landing Drive. Fire flow impacts were assessed before and after by examining areas with residual pressures less than 20 psi during MDD, as shown on Figure 6-21. The impact on available fire flow was significantly affected by adding a PRV on Martin Landing Drive. To mitigate this, another PRV on Martin Road was added which had a lesser impact on the available fire flow. The pressure zone statistics are tabulated in Table 6-4.

Figure 6-19. Martin Landing Low Pressure Zone Location

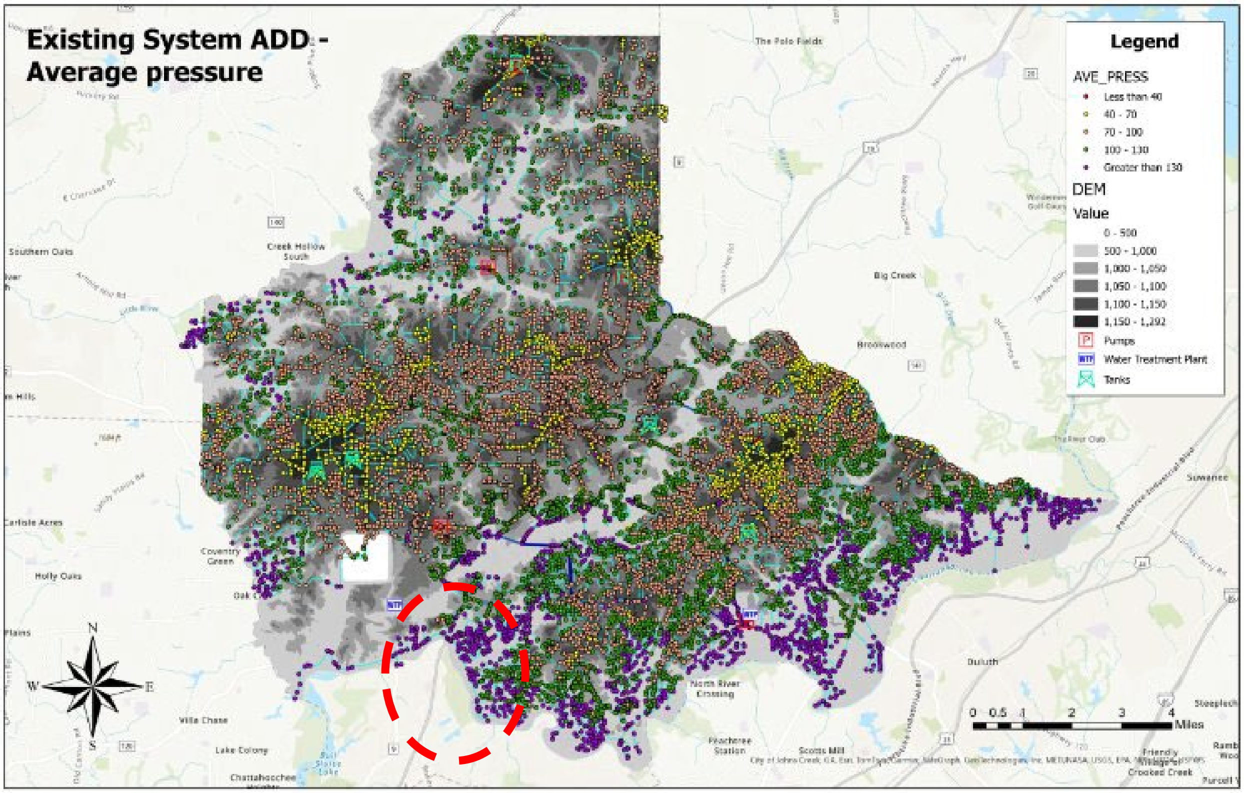
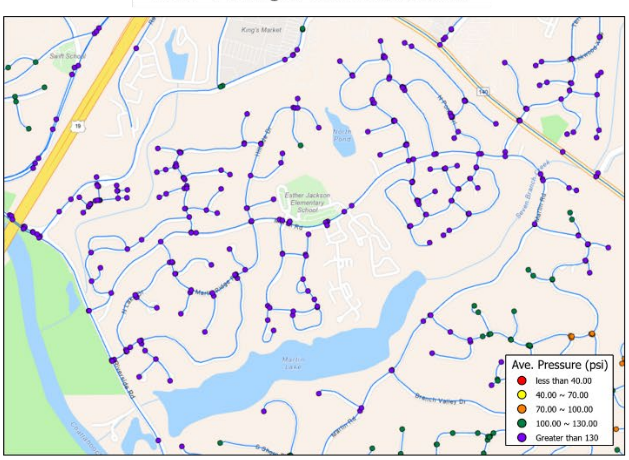


Figure 6-20. Martin Landing Low Pressure Zone – Average Pressures (ADD)

ADD - Average Pressure (BEFORE)



ADD - Average Pressure (AFTER)

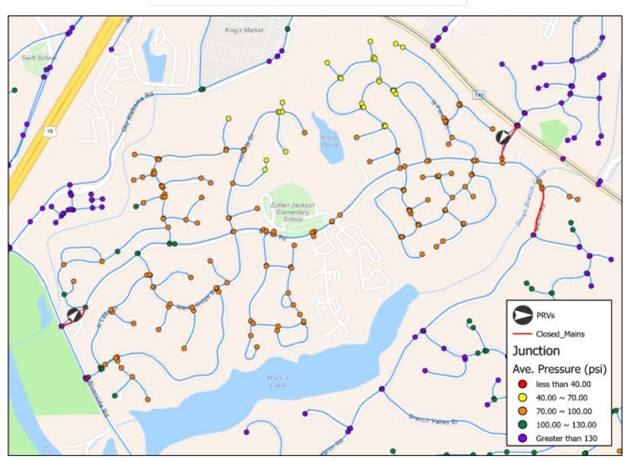
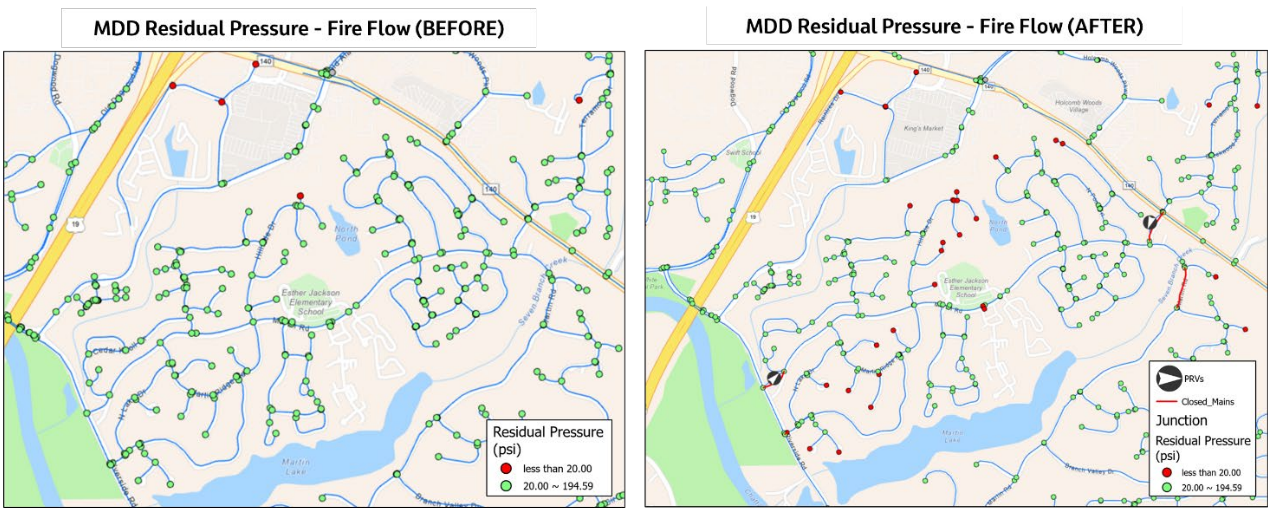


Figure 6-21. Martin Landing Low Pressure Zone – Fire Flow Residual Pressure (MDD)



Atlantic Athletic Zone The location of the Atlantic Athletic Pressure Zone and the average before and after pressures with a pressure setting of 80 psi under ADD are shown on Figures 6-22 and 6-23. Two PRVs are proposed in the main along Old Alabama Road and along Waits Ferry Crossing Road. Fire flow impacts were assessed before and after by examining areas with residual pressures less than 20 psi during MDD as shown on Figure 6-24. The impact on available fire flow was significantly affected by adding a PRV on Old Alabama Road. To mitigate this, another PRV on Waits Ferry Crossing Road was added, which had a smaller impact on the available fire flow. The pressure zone statistics are tabulated in Table 6-4.

Figure 6-22. Atlanta Athletic Club Low Pressure Zone Location

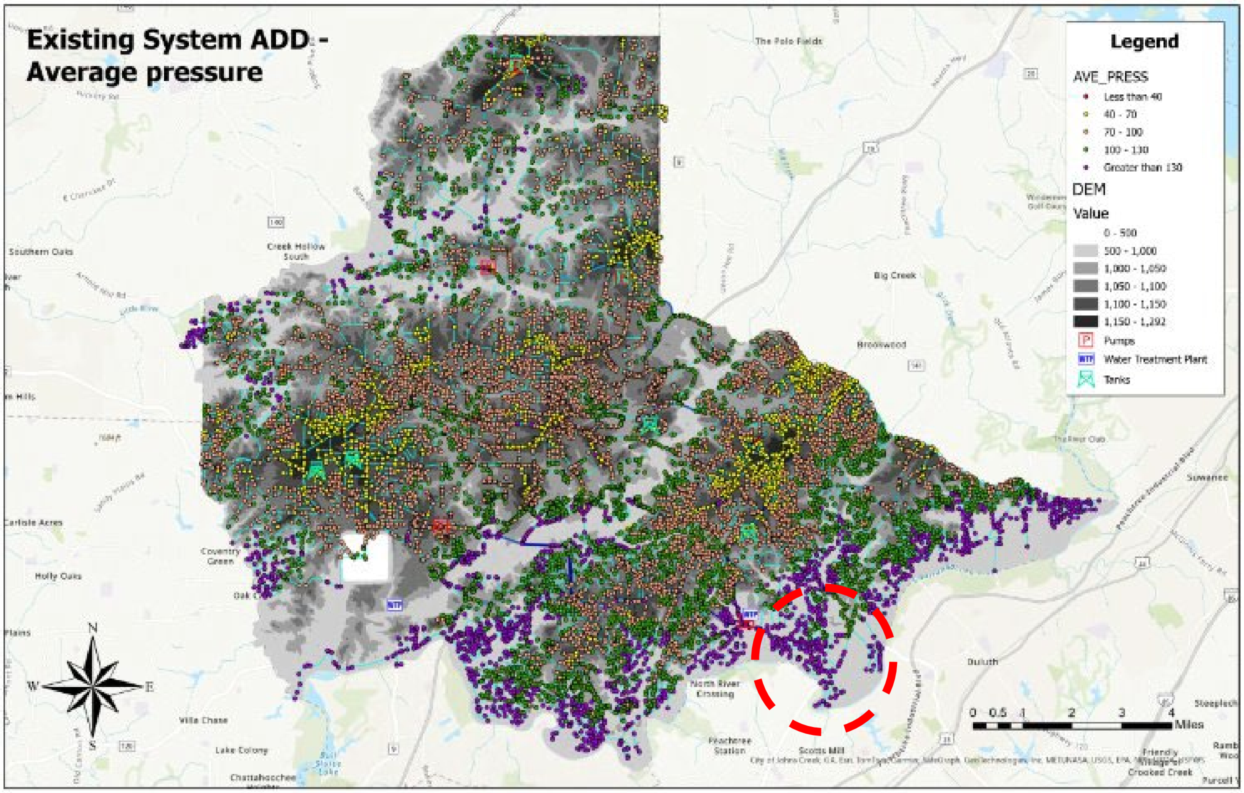
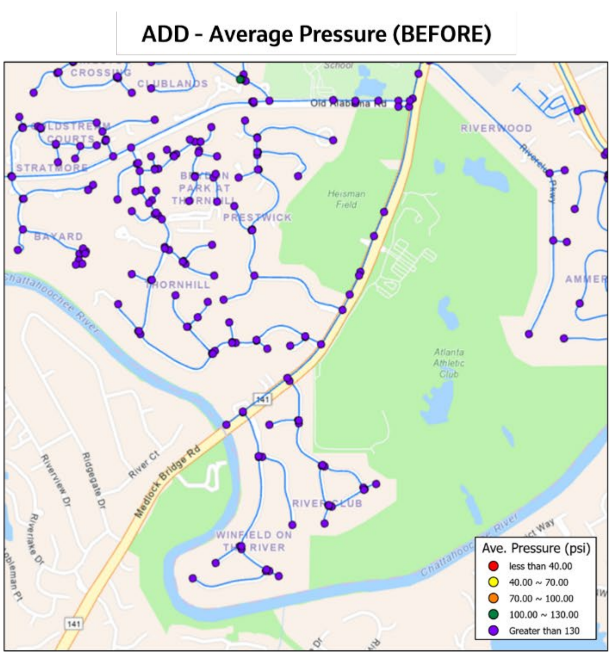


Figure 6-23. Atlanta Athletic Club Low Pressure Zone – Average Pressures (ADD)



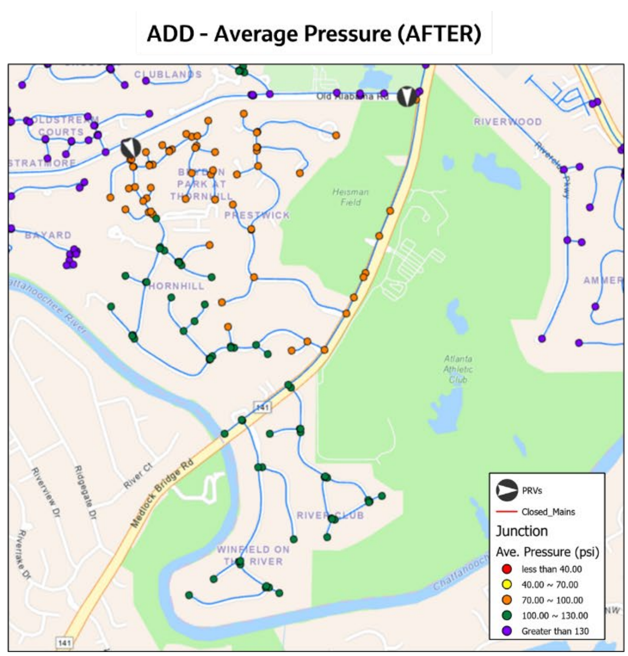
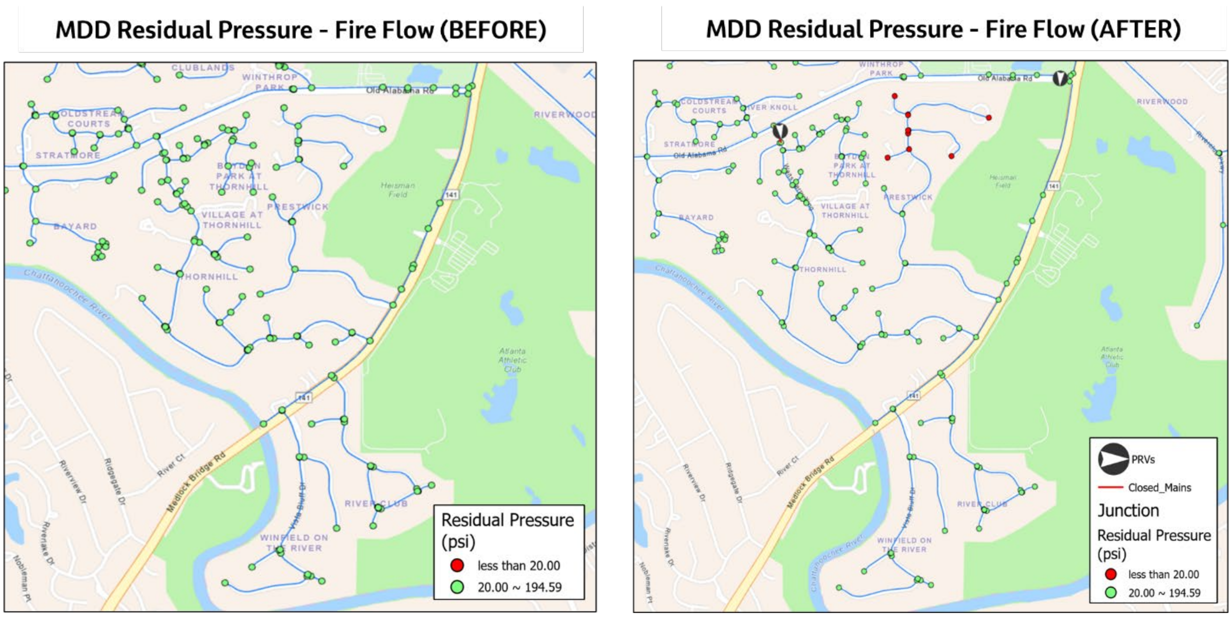


Figure 6-24. Atlanta Athletic Club Low Pressure Zone – Fire Flow Residual Pressure (MDD)



Country Club of the South Zone: The location of the Country Club of the South Pressure Zone and the average before and after pressures with a pressure setting of 90 psi under ADD are shown on Figure 6-25 and Figure 6-26. There are two PRVs proposed in the main along Old Southwick Pass Road. Fire flow impacts were assessed before and after by examining areas with residual pressures less than 20 psi during MDD, as shown on Figure6-27. The impact on available fire flow was not significantly affected by the new zone. The pressure zone statistics are tabulated in Table 6-4.

Figure 6-25. Country Club of the South Low Pressure Zone Location

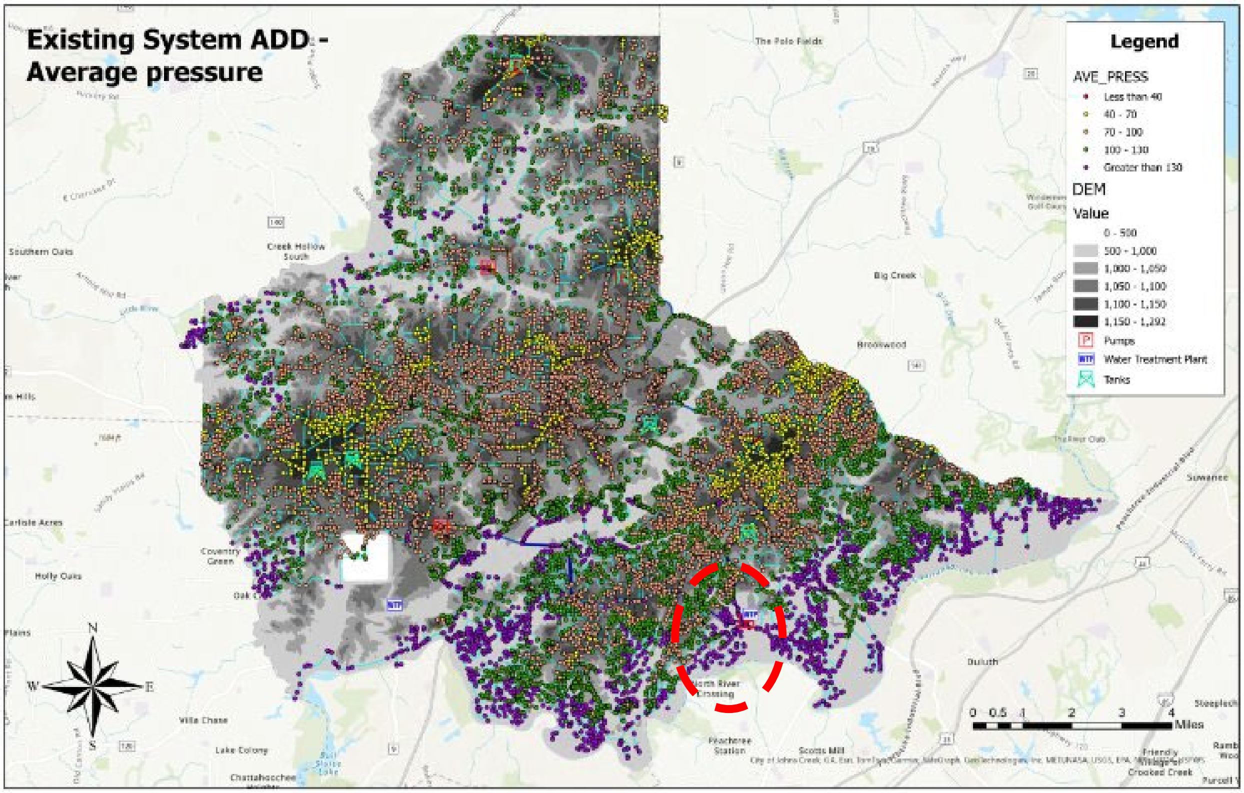


Figure 6-26. Country Club of the South Pressure Zone – Average Pressures (ADD)

ADD - Average Pressure (BEFORE) **ADD - Average Pressure (AFTER)**

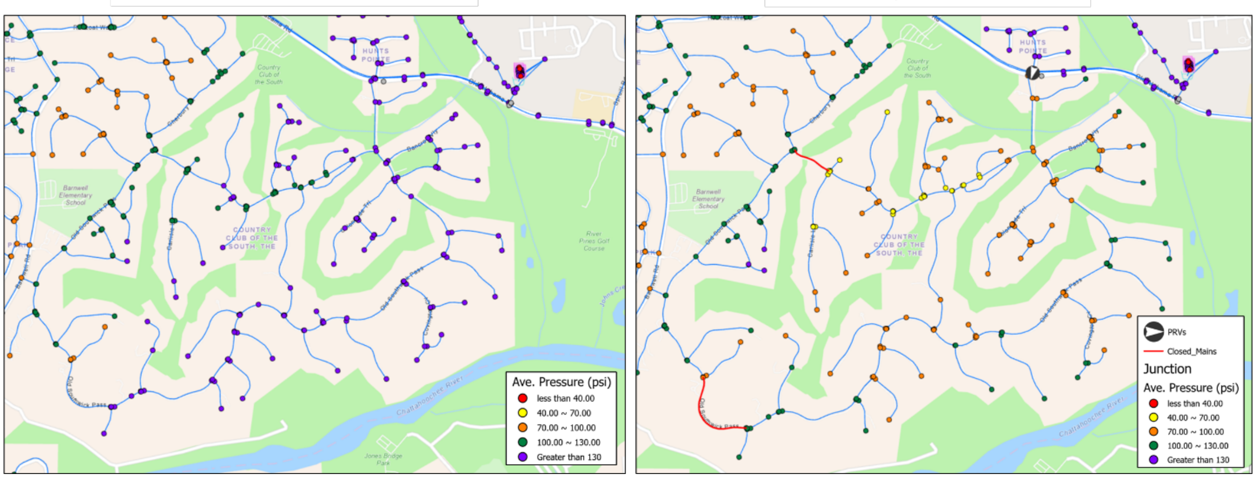
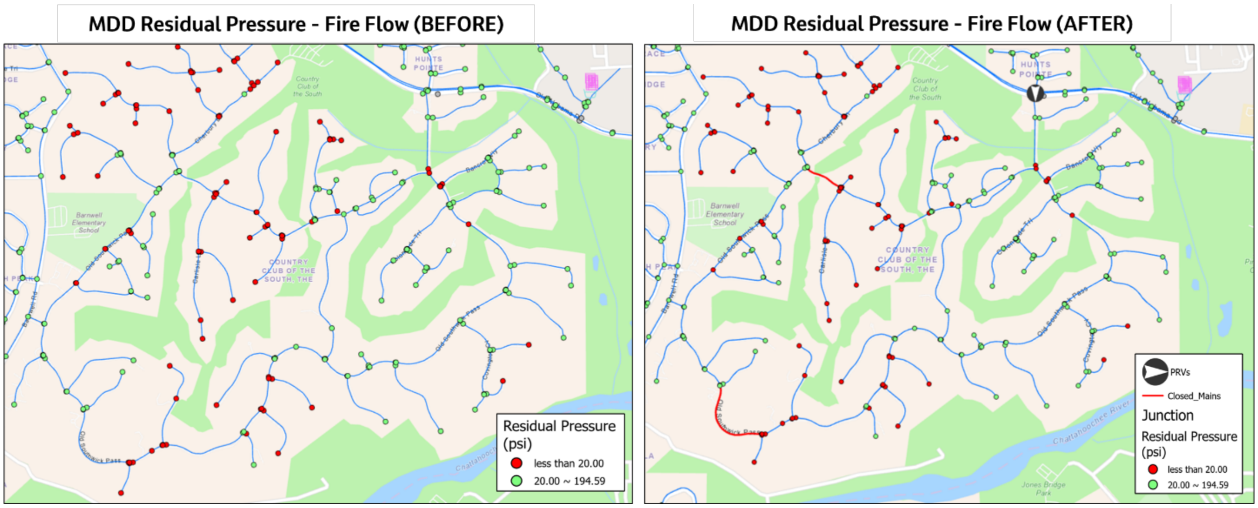


Figure 6-27. Country Club of the South Low Pressure Zone – Fire Flow Residual Pressure (MDD)



6.5 2040 Recommendations

The 2040 recommendation includes a segment of the transmission main at the 1.5 peaking factor. Figure 6-28 shows the locations of this project and Table 6-5 lists the project in the 2040 phase, along with the driver, description, size, length, and planning level cost estimate.

Figure 6-28. 2040 CIP Projects Overview

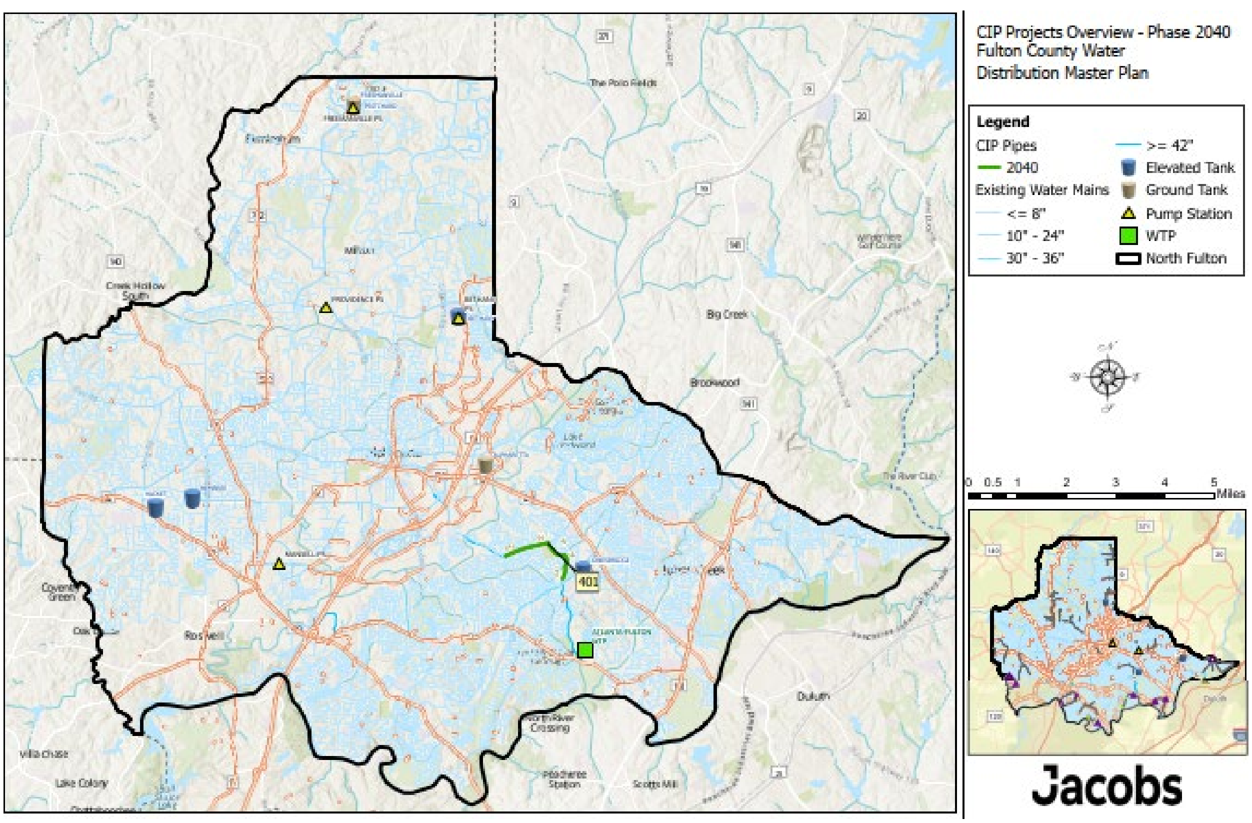


Table 6-5. 2040 CIP Project Descriptions

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
401-A†	2040	Low Pressure/ Water Age	Complete 54" Transmission Main along Buice Road(Phase A)	Transmission Main	1.5	Yes	54"	$8,812,000	2,816
401-B†	2040	Low Pressure/ Water Age	Complete 54" Transmission Main along Buice Road (Phase B)	Transmission Main	1.5	Yes	54"	$6,111,000	1,960
401-C†	2040	Low Pressure/ Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase C)	Transmission Main	1.5	Yes	54"	$7,269,000	2,309
401-D†	2040	Low Pressure/ Water Age	Complete 54" Transmission Main along Kimball Bridge Road (Phase D)	Transmission Main	1.5	Yes	54"	$8,650,000	2,753

[a] Cost estimate is total project cost and includes 40% contingency.
†This project will improve minimum pressures at subdivisions where low pressure have been reported in the summer by customers.

Figure 6-29 shows the tank levels under the 2040 MDD scenario with all the 2035 CIP projects completed with peaking factors of 1.75 and 1.5. Figure 6-30 shows the improvement to the tank levels when all the 2040 CIP projects are completed with peaking factors of 1.75 and 1.5.

Figure 6-29. Tank levels at 2040 MDD with 2035 CIP projects completed at a PF of 1.75 (left) and a PF of 1.5 (right)

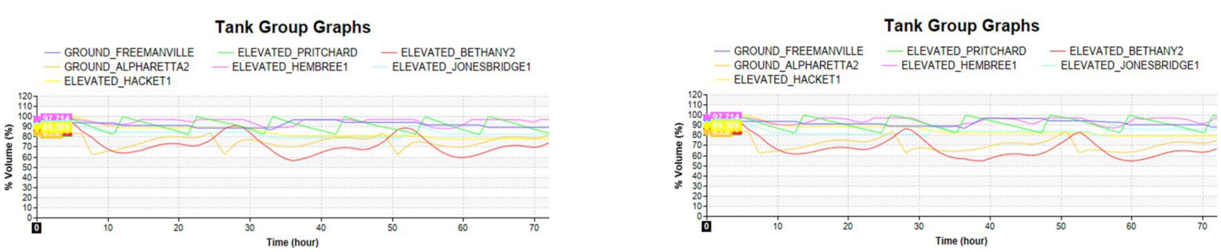
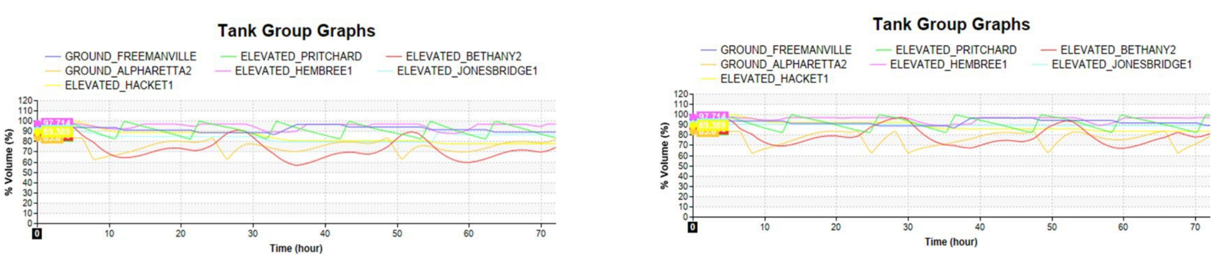


Figure 6-30. Tank levels at 2040 MDD with 2040 CIP projects completed at a PF of 1.75 (left) and a PF of 1.50 (right)



6.6 2050 Recommendations

The 2050 recommendations include water main improvements and two segments of the transmission main at the 1.75 and 1.5 peaking factors.

Figure 6-31 shows the locations of these projects and Table 6-6 lists each of the projects in the 2050 phase, along with the driver, description, size, length, and planning level cost estimate.

From the storage analysis described in Section 5.1, a storage deficit of 6.7 MG was determined for 2050. Since 2030 had a project to serve ALCON with an elevated tank of 3 MG capacity, the remaining storage of 2 MG each is sized at the Jones Bridge and Bethany tanks where Fulton County indicated that there was available space.

Figure 6-31. 2050 CIP Projects Overview

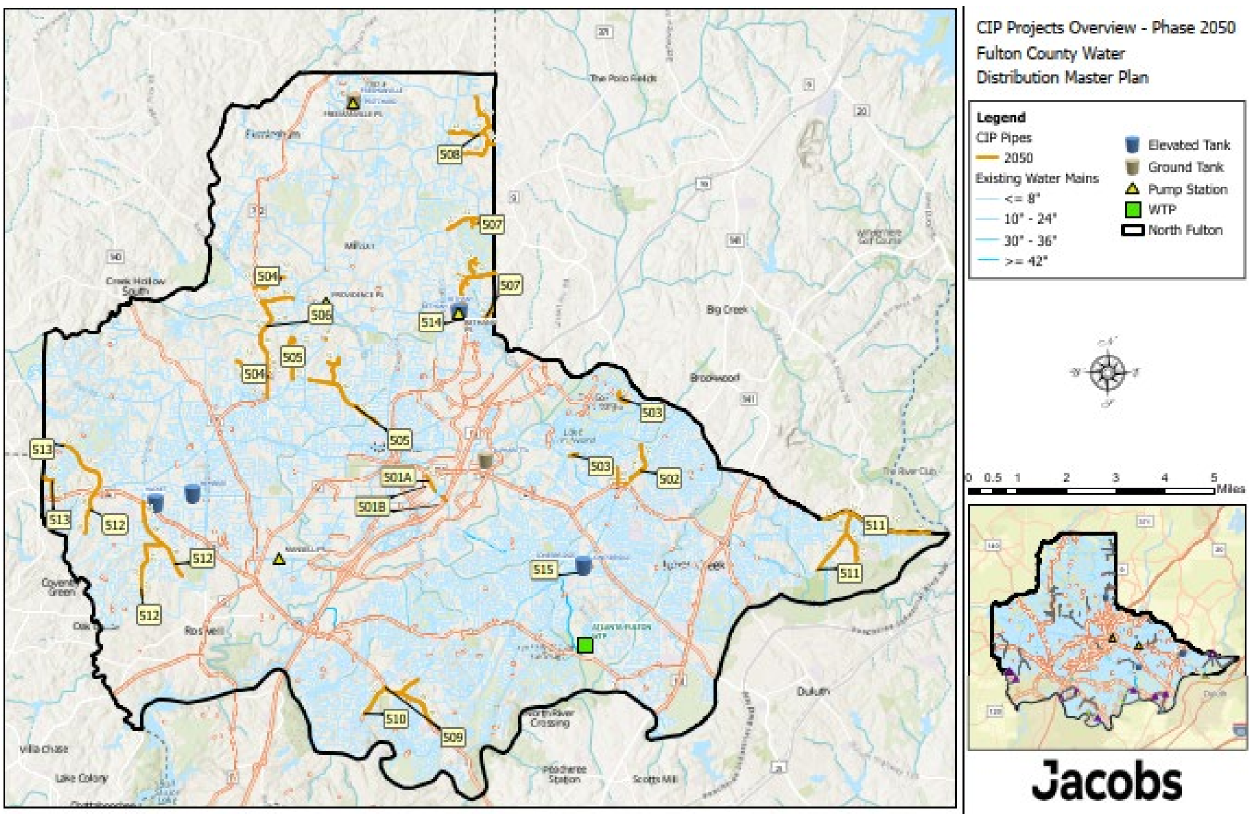


Table 6-6. 2050 CIP Project Descriptions

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
501-A†	2050	Low Pressure/Water Age	Complete 36-42" Transmission Main along Kimball Bridge Road	Transmission Main	1.75	yes	36-42"	$4,815,000	1,769
501-B†	2050	Low Pressure/Water Age	Complete 36-42" Transmission Main along Kimball Bridge Road	Transmission Main	1.5	yes	36-42"	$6,155,000	2,269
502	2050	Low Pressure	Jones Bridge Road Parallel Line	Water Main	Both	1	24"	$6,949,000	5,196
503	2050	Fire Flow	Fox Road and Greatwood Manor Parallel Line; Extension on Shirley Bridge	Water Main	Both	11	10-12"	$4,062,000	4,653
504	2050	Fire Flow	Old Cedar Lane/Kensington Farms Drive and Triple Crown Drive/Seabiscuit Parallel Line	Water Main	Both	10	12"	$9,015,000	11,852
505	2050	Fire Flow	Freemanville Road/Hipworth Road/Conagree Court/ Mayfield Road/Harrington Drive Parallel Line; Bethany Road crossing pipe connection	Water Main	Both	3	12"	$14,349,000	18,898
506	2050	Fire Flow	Providence Road and Birmingham Highway Parallel Line	Water Main	Both	2	24"	$19,594,000	14,773
507	2050	Fire Flow	Hwy 9N/Creek Club Drive, Five Acres Road/Woodlake Drive, Belleterre Drive, Francis Road/ Autumn Close Parallel Line and crossing pipe connections on Hwy 9N	Water Main	Both	5	12"	$16,508,000	21,728
508	2050	Fire Flow	Manor Bridge Road/Manor Club Drive/Belford Drive, Watsons Bend/Manor Club Drive Parallel Line	Water Main	Both	12	10-12"	$11,989,000	14,279
509	2050	Fire Flow	Scott Road/Holcomb Bridge Road Parallel Line	Water Main	Both	4	16"	$9,201,000	9,237

CIP Project #	Phase	Driver	Description	Type	Peaking Factor	Priority	Size (in)	Planning-Level Cost Estimate ($)[a]	Length (ft)
510	2050	Fire Flow	Eves Road Parallel Line	Water Main	Both	9	12"	$2,933,000	3,812
511	2050	Fire Flow	Bell Road/McGinnis Ferry Road/ Rogers Circle Parallel Line	Water Main	Both	6	12-16"	$23,680,000	22,874
512	2050	Fire Flow	Woodstock Road/Jones Road/Lake Charles Drive and Bowen Road/Stroup Road Parallel Line	Water Main	Both	8	12-16"	$23,194,000	21,390
513	2050	Fire Flow	Mountain Park Road and Highland Colony Drive Parallel Line	Water Main	Both	7	12"	$8,457,000	11,079
514	2050	Emergency Storage	2 MG Storage Tank at the existing Jones Bridge tank site	Storage Tank	Both	14	N/A	$10,404,000	N/A
515	2050	Emergency Storage	2 MG Storage Tank at the existing Bethany tank site	Storage Tank	Both	13	N/A	$10,404,000	N/A

[a] Cost estimate is total project cost and includes 40% contingency.
†This project will improve minimum pressures at subdivisions where low pressure have been reported in the summer by customers.

Figure 6-32 shows the tank levels under the 2050 MDD scenario with all the 2040 CIP projects completed with peaking factors of 1.75 and 1.5. Figure 6-33 shows the improvement to the tank levels when all the 2050 CIP projects are completed with peaking factors of 1.75 and 1.5.

Figure 6-32. Tank levels at 2050 MDD with 2040 CIP projects completed at a PF of 1.75 (left) and a PF of 1.5 (right)

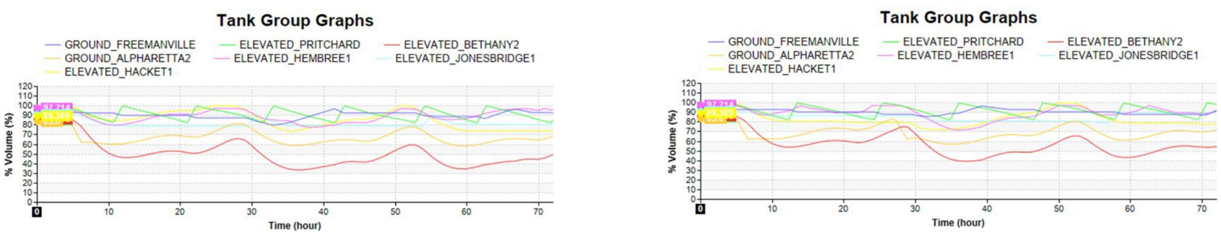
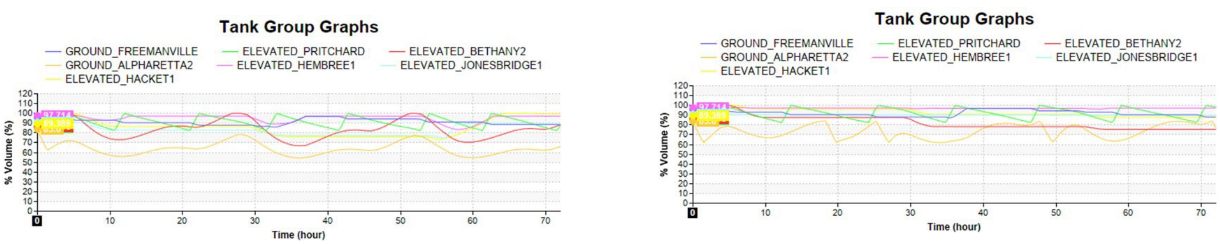
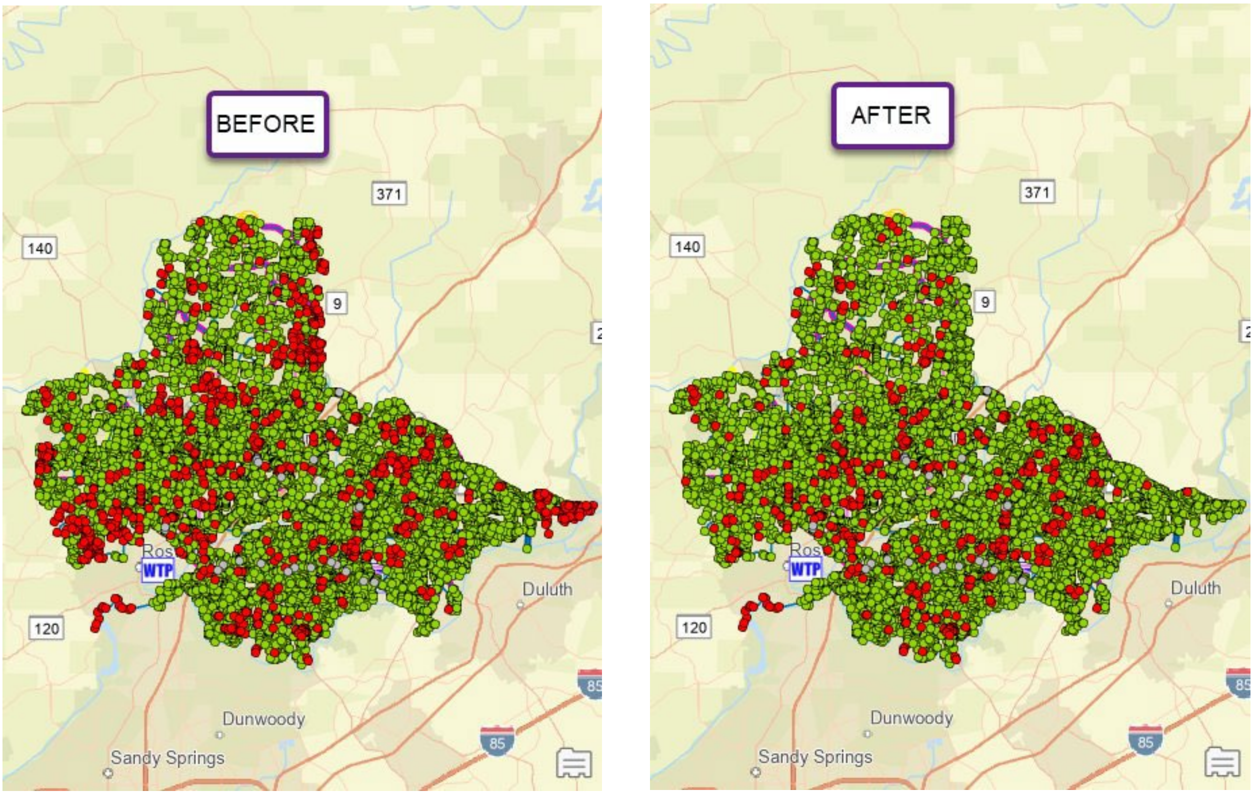


Figure 6-33. Tank levels at 2050 MDD with 2050 CIP projects completed at a PF of 1.75 (left) and a PF of 1.5 (right)



The impact of the many improvements in this 2050 phase targeted to improve fire flows can be seen on Figure 6-34.

Figure 6-34. Fire Flow Based on Junctions with Residual Pressures < 20 psi



7. References

Atlanta Regional Commission. 2024. Population and Employment Forecast. https://atlantaregional.org/atlanta-region/population-employment-forecasts/

CH2M HILL. 2011. *GEFA Water System Interconnection, Redundancy and Reliability Act Emergency Supply Plan*. September.

City of Roswell. 2022. *Roswell Water Utility Master Plan*. January.

Jacobs. 2024a. *Technical Memorandum: Water Demand Projections for North Fulton County – City of Alpharetta.* August 28.

Jacobs. 2024b. *Technical Memorandum: Water Demand Projections for North Fulton County – City of Johns Creek.* August 28.

Jacobs. 2024c. *Technical Memorandum: Water Demand Projections for North Fulton County – City of Milton.* August 28.

Jacobs. 2024d. *Technical Memorandum: Water Demand Projections for North Fulton County – City of Roswell.* August 28.

Jordan, Jones & Goulding (JJG). 2008. *Fulton County Water and Wastewater Master Plan 2007 Update.*

Stantec Consulting Services (Stantec). 2019. *Technical Memorandum: North Fulton County Hydraulic Model Evaluation of Gwinnett County Emergency Supply*. July 1.

Stantec Consulting Services (Stantec). 2022. *Water Model Recalibration Phase 1 Report*. August 26.

Stantec Consulting Services (Stantec). 2023. *Water Model Field Test and Calibration Phase 2 Report*. May 22.

U.S. Census Bureau. 2020. "Total Population." Decennial Census, DEC Demographic and Housing Characteristics, Table P1. https://data.census.gov/table/DECENNIALDHC2020.P1?q=alpharetta. Accessed on March 7, 2024.

U.S. Census Bureau. 2024. Census.gov. https://www.census.gov/.

Appendix A
Overall Water Demand Projections

Water Demand Projections for North Fulton County

Date:	August 26, 2024
Project name:	Fulton County Water Distribution System Master Plan
Project no:	EEXK6102
Client:	Fulton County Government
Prepared by:	Jacobs
Revision no:	4

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Executive Summary

Fulton County serves potable water to the cities in North Fulton, including Alpharetta, Johns Creek, Milton, and Roswell. As part of the Fulton County Water Distribution System Master Plan, water demand projections for each of these cities were developed to appropriately plan for reliable water service to them in the future.

Fulton County staff and Jacobs met with members from the cities to discuss future developments that could be used to develop water demand projections. The community development and public works departments were extremely helpful in supplying information. In addition, historical billing data from Fulton County and population projections broken down by census tract through 2050 from the Atlanta Regional Commission (ARC) were used to project growth and demand. In February 2024, the ARC adopted the most recent Series 17 population and employment forecast from 2020-2050.

The water demand projections calculated for Fulton County's *Water and Wastewater Master Plan 2007 Update* (2007 Fulton County Master Plan, JJG; 2008) and the newly calculated water demands for North Fulton are shown below in Table ES-1. The new demands show a significantly lower demand trend based on population projections, data provided by the cities on new development and redevelopment projects, current and future land use planning policies, existing per capita water uses extracted through historical billing data and conservation from more water-efficient fixtures expected in the future. The historical demand and baseline data used for the current demand forecast is approximately 60 percent of the estimated water demand developed for the 2007 Fulton County Master Plan.

Table ES-1. Historical and Projected Annual Average Day Water Demand for North Fulton

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005[2]	33.2	NA
2010[2]	38.4	NA
2020[2]	44.0	26.2
2021[2,3]	44.3	26.8
2025	45.5	28.2
2030	47.0	30.0
2035	48.5	31.2

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2040	NA	32.5
2045	NA	33.9
2050	NA	35.3

Notes:
AADD-MGD = annual average daily demand in million gallons per day.
NA = Not Available.
[1] Water demand forecast as shown in the 2007 Fulton County Master Plan.
[2] Historical water demand shown under the 2024 Water Demand Forecast was calculated using billing records and water supplied data.
[3] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Additional information about the development of the water demand projection is included in the Technical Memorandum herein.

1. Introduction

Fulton County is located in the north-central portion of the State or Georgia and includes the City of Atlanta. North Fulton is comprised of Johns Creek, Milton, Sandy Springs, Alpharetta, Roswell, and Mountain Park. South Fulton includes College Park, East Point , Fairburn, Hapeville, Palmetto, South Fulton, Chattahoochee Hills, and Union City. Fulton County is not only the largest county in the region with an area of 528.7 square miles but also the most populous county in Georgia. Per the 2020 Census data, Fulton County is the only county in Georgia that has surpassed 1 million people . The main water source for Fulton County is the Chattahoochee River. The County straddles four major river basins- the Chattahoochee, Etowah, Flint, and Ocmulgee River Basins. The Atlanta-Fulton County Water Resources Commission (AFCWRC) and the City of Atlanta fulfill the majority of the water demand. The AFCWRC, a joint venture between the city and county, operates the Tom Lowe Water Treatment Plant (WTP) located in the City of Johns Creek and serve North Fulton County. The City of Atlanta operates two treatment plants located within its City limits and smaller treatment facilities are operated by the cities of East Point, Palmetto, and Roswell. This plan will focus on North Fulton service area that includes the cities of Alpharetta, Johns Creek, Milton, and Roswell.

In an effort to proactively address infrastructure needs, protect the health of the Chattahoochee River, and fulfill regulatory requirements, the county periodically updates their water master plan to evaluate the most current water demand data and prepare for future growth and expanding demands. As part of the *Fulton County Water Distribution System Master Plan*, it is essential to forecast water demand for the municipalities within North Fulton, including Alpharetta, Johns Creek, Milton, and Roswell. This effort not only highlights the availability of the resource but also dives into the operation of the current distribution network and ways to improve water distribution in the future. North Fulton's distribution system is comprised of 12 booster pump stations, 9 elevated storage tanks, 3 ground storage tanks, and approximately 1,100 miles of pipe of multiple materials such as cast iron, copper, ductile iron, galvanized, steel, RCP, and PVC.

Population projections and current use data constitute the basis for this analysis. In addition, city-specific data from their comprehensive master plans and meetings with the community development departments of each city were used to calculate future water demands. This memorandum summarizes methodology used to calculate current and future water needs using the information provided during the city-specific meetings and gathered during the review of the comprehensive master plans and other development plans and maps.

2. Population Projections

Population projections are an essential part of the demand projection calculation because they have a significant impact on the water demand forecast for North Fulton. The 2020 Census calculated Fulton County's population at 1,066,710 people with a 15.9% estimated growth since 2010 (Census, 2021). For this analysis, existing population data was gathered from the U.S. Census for each city within North Fulton. The latest Series 17 population projections were developed by the Atlanta Regional Commission (ARC, 2024) and are broken down by census tract. They were further broken down by city boundary for use in this study. Census tracts that crossed city boundaries were split and the population allocated proportionally based on area.

Figure 1 shows North Fulton's historical population and its projected increase through 2050 as published by the ARC in 2024 as well as the population projections used in the 2007 Fulton County Master Plan. The most recent population data show higher population at the time the 2020 Census took place but the projections show a more moderate growth rate between 2020 and 2050.

Figure 1. Population Trend for North Fulton

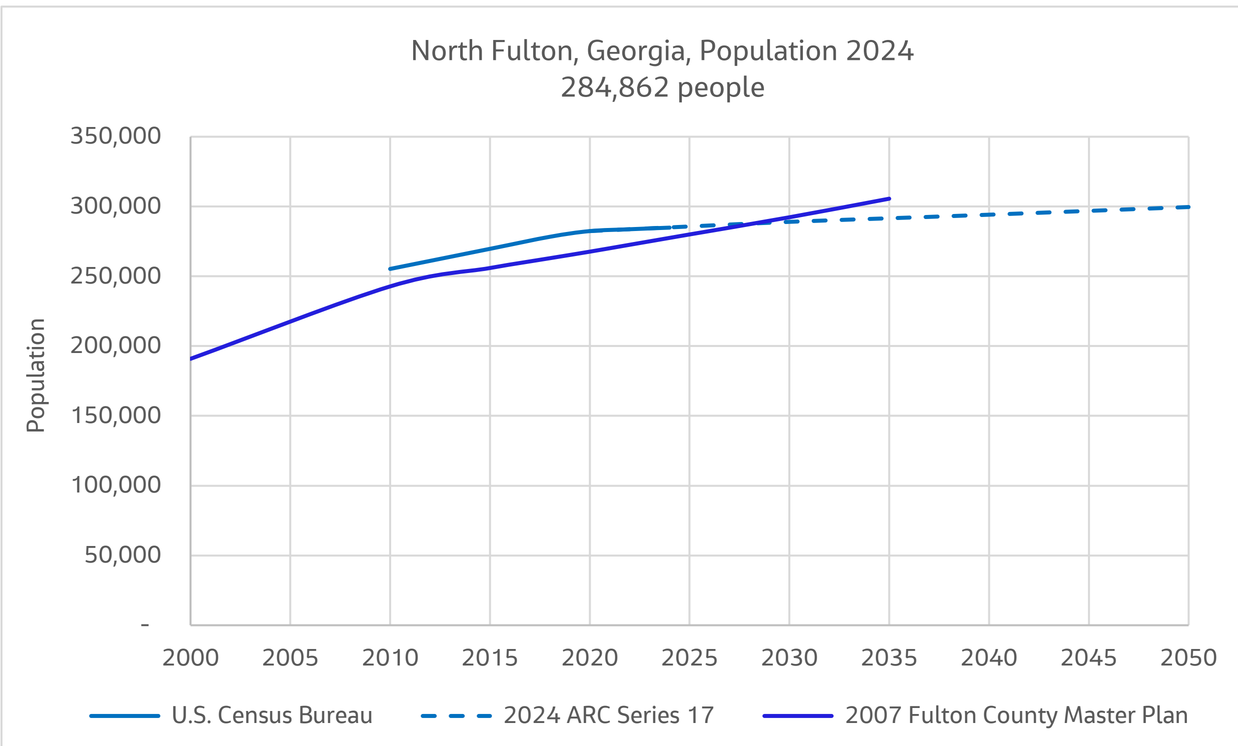


Table 1 summarizes the historical population and population projections for each city within North Fulton and the total for the study area. Currently, the City of Roswell is the most populous city, followed by Johns Creek. The City of Alpharetta is expected to have the highest growth in the future with a 12 percent increase in population between 2020 and 2050. The study area is expected to experience a 6 percent population growth in the same 30-year period.

Table 1. Historical and Projected Population Projections for North Fulton

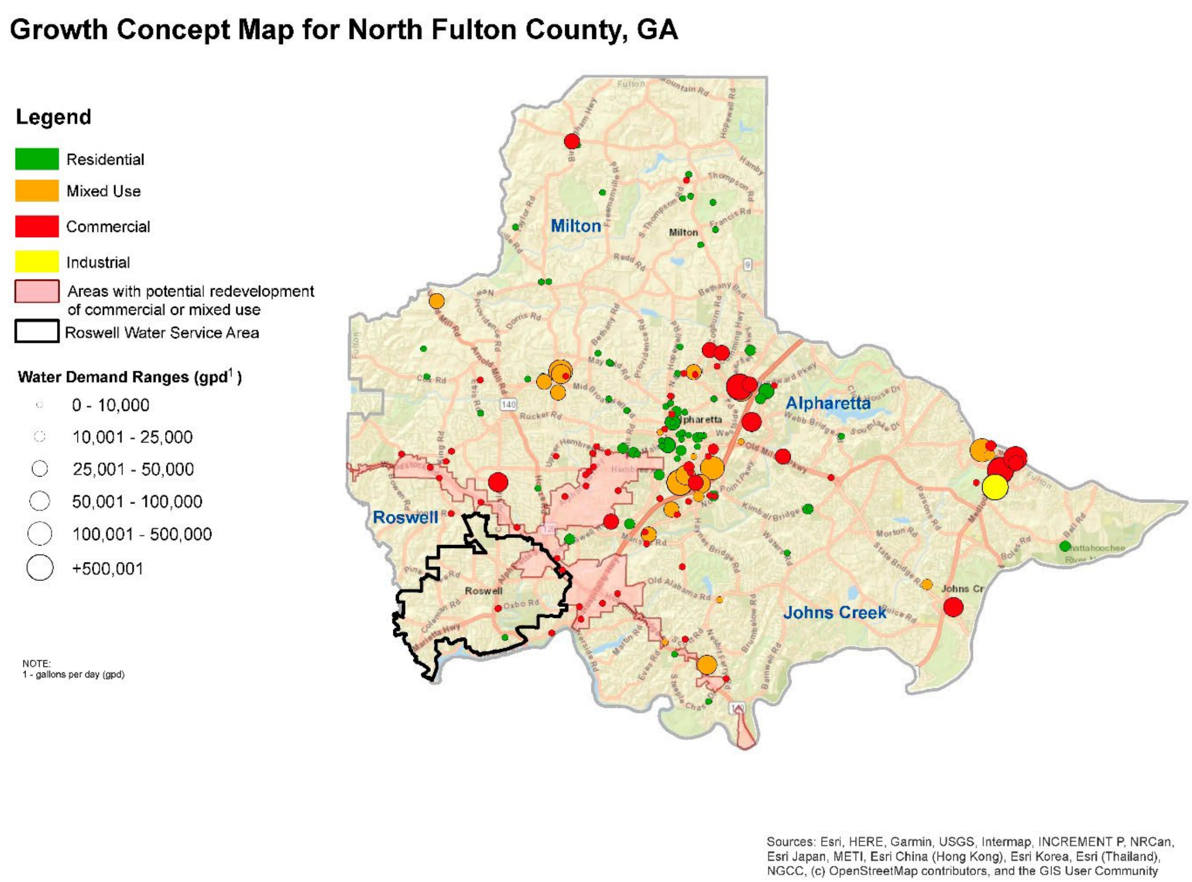
Jurisdiction	Population					2020-2050 Growth Rate
	2010[1]	2020[1]	2030	2040	2050	
Alpharetta	57,551	65,818	69,742	72,064	73,721	12%
Johns Creek	76,728	82,453	83,344	84,988	85,674	4%
Milton	32,661	41,290	42,574	43,202	44,220	7%
Roswell[2]	88,346	92,833	93,375	93,881	96,018	3%
North Fulton	255,286	282,394	289,017	294,135	299,633	6%

Notes:
[1] Population as reported by the U.S. Census Bureau
[2] Population for City of Roswell includes areas served by Roswell Water Utility and Fulton County.

3. Water Demand Forecast

The water demand forecast will be used to in future demand scenarios of Fulton County's water distribution system hydraulic model to determine if additional infrastructure is needed to provide adequate water service and fire protection for future needs through 2050. The water demand forecast used two methods to determine future water demand. The first method relies on existing and future development data provided by the cities within the study area being built or permitted as of February 2024. The second method uses the projected population growth for North Fulton to distribute the growth throughout the planning period (2021-2050). Both methods produced similar water demand forecast but applying a conservative approach, the highest forecast was selected to calculate a water demand forecast that is expected to increase approximately 9.1 million gallons per day (MGD) by 2050. The forecast considered factors such as available land for development, current land use and comprehensive land planning policies by the city, existing per capita water uses extracted through historical billing data, as well as anticipated conservation efforts through the adoption of more water-efficient fixtures. The major water users are industrial and commercial facilities as well as mixed-use developments that are expected to expand or open as soon as 2025. Figure 2 shows the development areas and future growth for North Fulton based on the information provided by the cities and their available planning documents.

Figure 2. Future Growth Areas for North Fulton



3.1 Development-Based Water Demand Forecast

At the end of 2023, representatives from the Jacobs team and Fulton County convened with officials from the City of Alpharetta, John Creek, Milton, and Roswell to discuss the *Fulton County Water Distribution System Master Plan.* The information presented and shared during and after the meetings was summarized in separate documents and is included in Appendix A. This document describes the methodology used to calculate future demand projections using information on current and future development. Following the meetings with city officials, the Jacobs team leveraged data from multiple sources including their comprehensive plans, permitting review and approval, land use maps, and geographic information system data to compile a list of projects that have been approved or proposed for each jurisdiction. In some cases, the city provided insight on their built out plans that were also considered for this analysis.

In order to calculate future water demands in addition to the current demand, the 2021 billing records were summarized per city and separated by customer type. The four customer types used were Residential, Multifamily Residential, Commercial, and Industrial. The purpose of this exercise was to establish a per account water use that can be applied to the various existing and future development projects within each City and calculate the expected increase in water demand based on the type of development .

Table 2 shows the water use per account for each customer type. The multifamily residential use per account was similar across all cities and future demands for multifamily residential projects was calculated using 1,100 gallons per account per day (GPAD) for all cities. Similarly, the commercial use per account was similar across all cities and future demands for commercial projects was calculated using 3,300 GPAD for all cities. The average residential use per account for Alpharetta, Johns Creek, and Roswell is 180 GPAD. City of Milton's residential use per account is 260 GPAD; hence, it was determined that a higher per account use needed to be applied for Milton to correctly estimate their future water demand. The billing data shows that Johns Creek is the only city with significant industrial demand with an average 73,000 GPAD; however, industrial use was extracted completely and projected separately using the customers' expansion plans and sewer capacity applications.

Table 2. Per Account Water Use (GPAD) based on 2021 Billing Records

Jurisdiction	Water Use Customer Type (GPAD)			
	Residential	Multifamily Residential	Commercial	Industrial [1]
Alpharetta	180	1,100	3,300	-
Johns Creek	180	1,100	3,300	73,000
Milton	260	1,100	3,300	-
Roswell	180	1,100	3,300	-

Notes:
[1] Significant existing and future industrial water use was only observed in Johns Creek.

The water demand forecast used the type of development and the number of units and/or acres specified in the plans or permit applications. Johns Creek had information describing build-out plans that was included in their future water demands calculations. Because not many plans had specific completion dates, the future demands calculated using this approach lacked temporal distribution but provided important site-specific information. Table 3 shows the expected water demand increase for each city based on their development and redevelopment plans as well as future land use plans. The numbers in bold show the highest forecast between the development-based and population-based demands for

Alpharetta and Johns Creek. The highest forecast per city was selected to calculate the final water demand forecast summarized in Section 3.3

Table 3. Expected Future Water Demand Increase for North Fulton using Development-Based Forecast

Jurisdiction	Additional Future Water Demand (AADD-MGD)[1]
Alpharetta	**2.8**
Johns Creek	**3.0**
Milton	0.5
Roswell[2]	1.4
North Fulton	**7.7**

Notes:
[1] Future water demand includes 10% Non-Revenue Water (NRW).
[2] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.

3.2 Population-Based Water Demand Forecast

After calculating the future water demands based on city-specific development and redevelopment information, additional work was put into developing a temporal distribution that would project future water use though 2050. For that purpose, the Series 17 ARC population projections by census tract was used as described in Section 2 and the 2021 billing data. The billing data was used to establish the baseline year and to develop a per capita value for each city. The per capita was developed using the billing records for all customer types combined and dividing it by the number customers in each city. The number of customers was calculated using the total number of accounts for each city and multiplying it by the average number of people per household. The average number of people per household for North Fulton is 2.50 as stated in the U.S. Census database.

Table 4 shows the per capita water use for each city. The per capita water use for Johns Creek was calculated using commercial and residential use only. As described in Section 3.1, the industrial use was extracted completely and projected separately using the customers' expansion plans and sewer capacity applications. Alpharetta, Johns Creek, and Roswell have similar per capita uses; hence, those 3 cities were combined to create an average per capita of 126 gallons per capita per day (GPCD). City of Milton presented a higher per capita of 133 GPCD which was applied in the forecast. In this projection, the per capita usage increases over time due to the expected increase in industrial use, the increase of wholesale water supplied to the City of Roswell, the use of a constant non-revenue water of 10%, and exclusion of passive conservation.

Table 4. Per Capita Water Use (GPCD) based on 2021 Billing Records

Jurisdiction	Water Use per Person (GPCD)
Alpharetta	126
Johns Creek	126
Milton	133
Roswell	126

North Fulton [1]	128

Notes:
[1] Average per capita for North Fulton

The water demand forecast was calculated by establishing a baseline water use and calculating the future demand for the expected population increase between 2021 and 2050. The baseline water use was set by splitting the 2021 billing data for each census tract and then disaggregated by city. The baseline was calibrated so the addition of the demands for each census tract equaled the total water used in 2021, including losses. The next step was to calculate the increase in number of people for each census tract using the Series 17 ARC population projections. Finally, the future demand was calculated for the new population using the per capita in Table 4 and then added to the baseline. Table 5 shows the expected water demand increase for each city based on population growth per census tract. The numbers in bold show the highest forecast between the development-based and population-based demands for Milton and Roswell. The highest forecast per city was selected to calculate the final water demand forecast summarized in Section 3.3.

Table 5. Expected Future Water Demand Increase for North Fulton by 2050 using Population-Based Forecast

Jurisdiction	Additional Future Water Demand (AADD-MGD)[1]
Alpharetta	2.0
Johns Creek	2.6
Milton	**0.9**
Roswell [2]	**2.4**
North Fulton	7.9

Notes:
[1] Future water demand includes 10% Non-Revenue Water (NRW).
[2] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.

3.3 Water Demand Forecast Results

The methods presented above resulted in similar water demand forecasts. While water demand calculations based on growth beyond developments are not all known by the cities and lacked temporal distribution, the demands projections calculated using population projections were similar in scale and provided a growth rate through 2050. Adopting a conservative approach, the water demand curve was developed using the highest increase in demand between the two methods. Table 6 summarized the future water demand for Alpharetta Johns Creek, Milton, and Roswell.

Table 6. Future Annual Average Water Demand for the Cities served by North Fulton

Year	2024 Water Demand Forecast [1] (AADD-MGD)			
	Alpharetta [2]	Johns Creek [2]	Milton [3]	Roswell [3,4]
2025	7.0	10.2	3.9	7.3
2030	7.6	11.3	3.9	7.5
2035	8.2	11.7	4.0	7.8
2040	8.6	12.3	4.1	8.1
2045	9.0	12.5	4.2	8.8
2050	9.4	12.7	4.4	9.5

Notes:
[1] Future water demand includes 10% Non-Revenue Water (NRW).
[2] Future water demand calculated using development-based approach.
[3] Future water demand calculated using population-based approach.
[4] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.

The combined water demand projections resulted in an expected increase of approximately 9.1 MGD by 2050. Table 7 and Figure 3 show the historical data and the proposed forecast for North Fulton. The current demand forecast shows a lower demand projection than the one developed for the 2007 Fulton County Master Plan but follows the most current historical demand and baseline data. The 1.5 peaking factor is the recent historical average (since 2007), and the 1.75 peaking factor is a recent maximum last experienced on July 3rd, 2024. They are both shown in this TM for context and to illustrate the range of peak demands that the North Fulton system experiences.

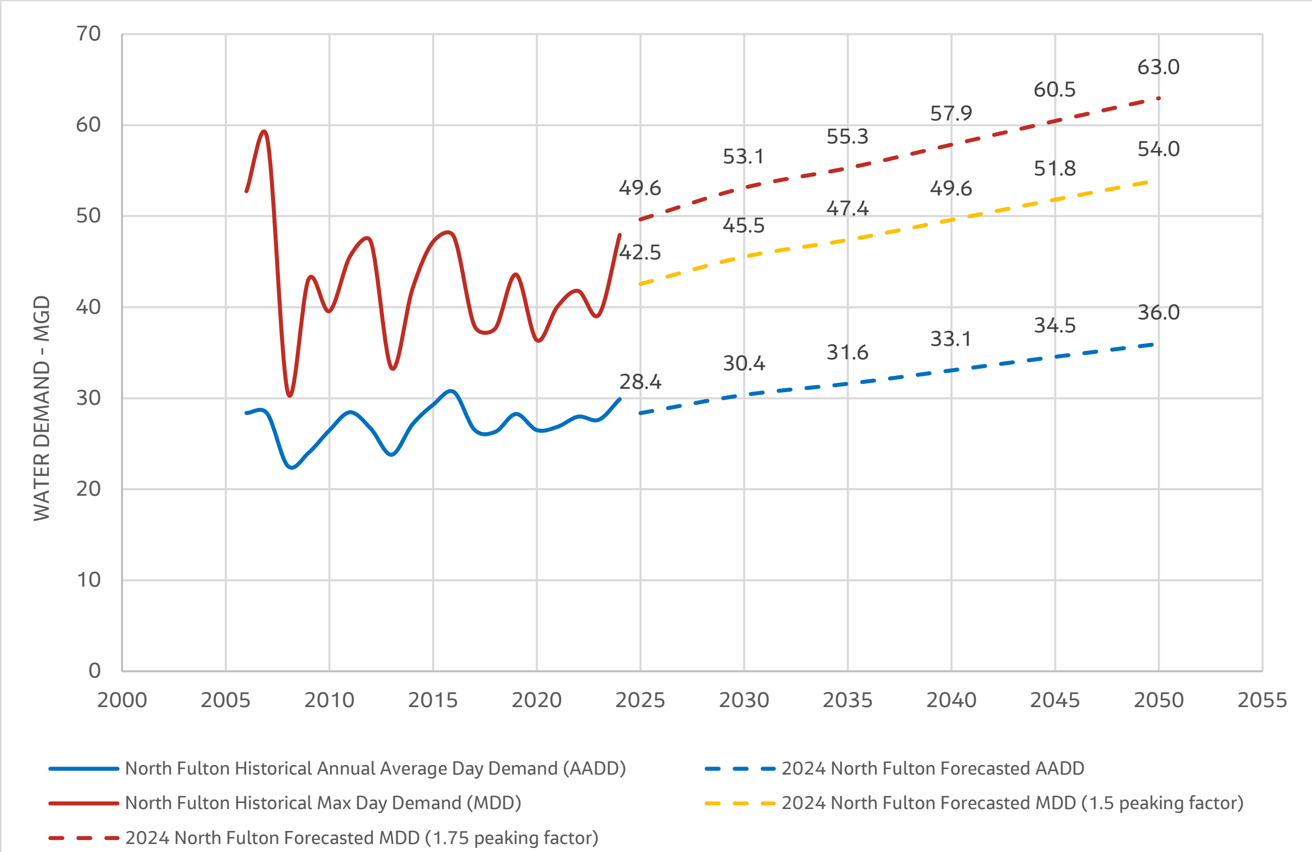
Table 7. Historical and Proposed Future Annual Average and Max Day Water Demand for North Fulton

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast [3,4] (AADD-MGD)	2024 Water Demand Forecast [5] (MDD-MGD)	2024 Water Demand Forecast [6] (MDD-MGD)
2005	NA	33.2	NA	NA	NA
2010	26.44	38.4	NA	NA	NA
2017	21.8	NA	NA	NA	NA
2018	26.3	NA	NA	NA	NA
2019[7]	28.2	NA	NA	NA	NA
2020	26.2	44.0	NA	NA	NA
2021[8]	26.8	44.3	NA	NA	NA
2025	NA	45.5	28.4	42.5	49.6
2030	NA	47.0	30.4	45.5	53.1

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast [3,4] (AADD-MGD)	2024 Water Demand Forecast [5] (MDD-MGD)	2024 Water Demand Forecast [6] (MDD-MGD)
2035	NA	48.5	31.6	47.4	55.3
2040	NA	NA	33.1	49.6	57.9
2045	NA	NA	34.5	51.8	60.5
2050	NA	NA	36.0	54.0	63.0

Notes:
AADD-MGD = annual average daily demand in million gallons per day
NA = Not Available
[1] Historical water demand calculated using billing records and water supplied data.
[2] Water demand forecast as show in the 2007 Fulton County Master Plan.
[3] Future water demand includes 10% Non-Revenue Water (NRW).
[4] Future water demand includes water needs as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.
[5] Calculated using a peaking factor (peak day factor) of 1.5 based on the historical average.
[6] Calculated using a peaking factor (peak day factor) of 1.75 based on highest demand of 47.9 MGD registered on July 3rd, 2024.
[7] Water demand data for the year 2019 reflect an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that year.
[8] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Figure 3. Historical and Proposed Future Annual Average and Max Day Water Demand for North Fulton



4. References

JJG. 2008. W*ater and Wastewater Master Plan 2007 Update*

U.S. Census Bureau. 2020. "TOTAL POPULATION." Decennial Census, DEC Demographic and Housing Characteristics, Table P1. https://data.census.gov/table/DECENNIALDHC2020.P1?q=alpharetta. Accessed on March 7, 2024.

U.S. Census. 2021. Census 2020 Data Confirms that Fulton Remains Georgia’s Most Populous County. https://www.fultoncountyga.gov/news/2021/08/13/census-2020-data-confirms-that-fulton-remains-georgias-most-populous-county#:~:text=42.5%25%20of%20Fulton%20County's%20population,County's%20population%20is%20Hispanic%2FLatino.

U.S. Census Bureau. 2024. Census.gov. https://data.census.gov/profile/Fulton_County,_Georgia?g=050XX00US13121.

Atlanta Regional Commission. 2024. Population and Employment Forecast. https://atlantaregional.org/atlanta-region/population-employment-forecasts/.

Appendix B
Alpharetta Water Demand Projections

Water Demand Projections for North Fulton County – City of Alpharetta

Date: August 28, 2024
Project name: Fulton County Water Distribution System Master Plan
Project no: EEXK6102
Client: Fulton County Government
Revision no: 3
Document no: 240308111745_9a8f45bf

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Executive Summary

Fulton County serves water to the cities in North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. As part of the Fulton County Water Distribution System Master Plan, water demand projections for each of the cities were developed to appropriately plan for reliable water service to them in the future.

Fulton County staff and Jacobs met with members from the cities to discuss future developments that could be used to develop water demand projections. The community development and public works departments were very helpful in supplying information. In addition, historical billing data from Fulton County and population projections broken down by census tract through 2050 from the Atlanta Regional Commission (ARC) were used to project growth and demand. In February 2024, the ARC adopted the most recent Series 17 population and employment forecast from 2020-2050.

The water demand projections calculated Fulton County's *Water and Wastewater Master Plan 2007 Update* (2007 Fulton County Master Plan, JJG; 2008) and the newly calculated water demands for the City of Alpharetta are shown below in Table ES-1. The new demands shows a significantly lower demand trend based on population projections, data provided by the city on new development and redevelopment projects, current and future land use planning policies, existing per capita water uses extracted through historical billing data and conservation from more water-efficient fixtures expected in the future. The historical demand and baseline data used for the current demand forecast is half of the estimated water demand developed for the 2007 Fulton County Master Plan.

Table ES-1. Historical and Projected Annual Average Day Water Demand for the City of Alpharetta

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005[2]	7.6	NA
2010[2]	11.4	NA
2020[2]	14.5	6.5
2021[2,3]	14.7	6.6
2025	15.5	6.9
2030	16.5	7.5
2035	17.4	8.02
2040	NA	8.44

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2045	NA	8.81
2050	NA	9.15

Notes:
AADD-MGD = annual average daily demand in million gallons per day.
NA = Not Available.
[1] Water demand forecast as shown in the 2007 Fulton County Master Plan.
[2] Historical water demand shown under the 2024 Water Demand Forecast was calculated using billing records and water supplied data.
[3] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Additional information about the development of the Alpharetta water demand projection is included in the Technical Memorandum herein.

1. Introduction

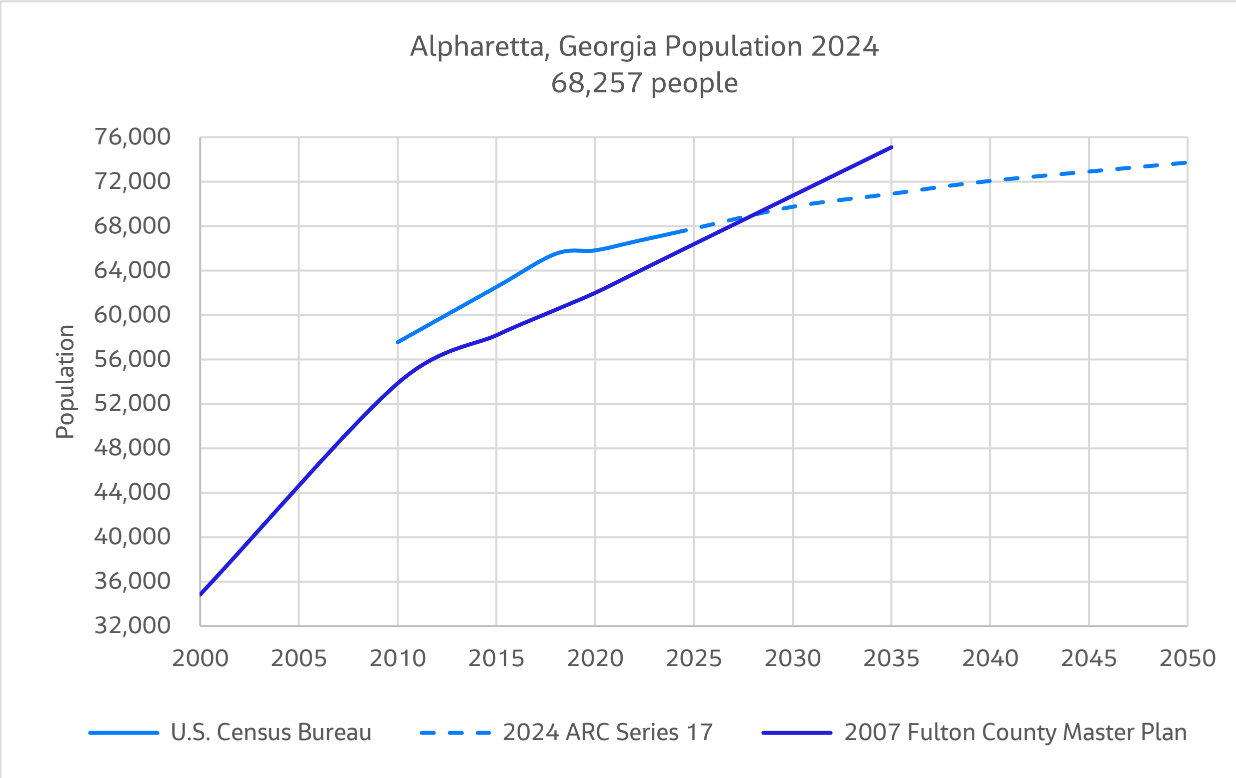
As part of the *Fulton County Water Distribution System Master Plan*, it is essential to forecast water demand for the municipalities within North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. To determine the future water demands for the cities, meetings were held with the community development departments of each city. This memorandum summarizes the outcomes of the meeting with the City of Alpharetta, integrating research and insights from the city planning departments and various other sources to formulate water demand projections.

Founded in the 1830s and occupying a land area of approximately 27 square miles, Alpharetta, Georgia, is one of the 14 incorporated municipalities within Fulton County and one of the fastest growing communities in the South (City of Alpharetta 2021). It is in northern Fulton County, Georgia, approximately 25 miles north of the City of Atlanta. Alpharetta contains many single-family neighborhoods and continues to be a leading destination for corporate locations, high-tech services, and retail trade.

Alpharetta is mostly developed and still has substantial potential for growth in terms of redevelopment. A majority of Alpharetta’s commercial land is professional office space, with most of its residential land consisting of single-family detached residential dwellings. One of the most significant changes in the last 10 years has been the emergence of mixed-use centers in locations such as Avalon, Northwinds Summit, and TPA/Lakeview.

According to the 2020 U.S. Census Bureau data, Alpharetta was home to approximately 65,818 individuals residing in 26,089 housing units. By 2024, the population is expected to increase to 67,388, reflecting a growth rate of 2.4 percent since the latest census (ARC, 2024). Forecasts from the City of Alpharetta's *Horizon 2040 Comprehensive Plan* suggest continued expansion, with the population projected to reach 83,034 by 2040. These projections were compared to those outlined in the 2007 Fulton County Master Plan, which estimated Alpharetta's population at 66,379 in 2025 and 75,094 in 2035. Notably, the U.S. Census data revealed a higher and more realistic population figure compared to the projections in the 2007 Fulton County Master Plan. Figure 1 shows Alpharetta’s historical population growth and its projected population increase as published by the ARC in 2024.

Figure 1. Population Trend for the of City of Alpharetta



Source: U.S. Census Bureau, Series 17 Population Forecast from 2020-2050 (ARC, 2024) and 2007 Fulton County Master Plan

Alpharetta residents rely on the Tom Lowe Atlanta-Fulton County Water Treatment Plant for their water supply. Alpharetta's distribution system is comprised of 283 miles of pipe of multiple materials such as cast iron, copper, ductile iron, and PVC. There are two ground tanks within city limits located off Preston Ridge Road. As per projections outlined in the 2007 Fulton County Master Plan, water demand for Alpharetta was expected to reach 14.5 million gallons per day (MGD) by 2020 and 17.4 MGD by 2035, as shown in Table 1. These estimates were based on population projections, with per capita water usage rates set at 81.3 gallons per capita per day (GPCD) for residential purposes and 53.6 GPCD for non-residential purposes, as stipulated in the 2007 Fulton County Master Plan.

Table 1. Previous Water Demand Projections of Cities within Fulton County (MGD)

Jurisdiction	Water Demand (MGD)				
	2005	2010	2020	2030	2035
Alpharetta	7.6	11.4	14.5	16.4	17.4
Johns Creek	9.2	9.5	10.3	10.6	10.7
Milton	3.8	4.6	5.7	6.2	6.5
Roswell	12.6	12.9	13.5	13.7	13.9

Source: 2007 Fulton County Master Plan

Despite the population growth in Alpharetta, billing records show that water demand for the city did not reach the expected water demand levels stated in the 2007 Fulton County Master Plan. Moreover, demand remained below 7 MGD throughout the period of record (2017-2021) with the highest water demand recorded in 2019. The high demand of 6.94 MGD for 2019 was attributed to lower precipitation levels experienced during that year. Billing records show a combined per capita water usage rates of 100 GPCD. This reduction may be attributed to a lower population growth, advancements in water-saving technologies, the adoption of efficient water use practices, the implementation of water conservation programs, and shifts in climate and weather patterns.

2. Meeting Summary

On November 14, 2023, representatives from the Jacobs team and Fulton County convened with officials from the City of Alpharetta to discuss the *Fulton County Water Distribution System Master Plan.* Attachment 1 shows the meeting presentation and sign-in sheet. This plan emphasizes the municipalities in North Fulton County, outside of Atlanta's service area, including Alpharetta, Johns Creek, Milton, and Roswell. The primary objective of these discussions was to evaluate the future requirements of Alpharetta for the *Fulton County Water Distribution System Master Plan*.

Currently, Alpharetta has established a daily water demand of 6.56 MGD and a peak reaching 10.36 MGD. The majority of Alpharetta's residential areas comprise single-family detached homes, while commercial areas are predominantly occupied by professional offices. Potable water for Alpharetta residents is sourced from the Tom Lowe Atlanta-Fulton County Water Treatment Plant.

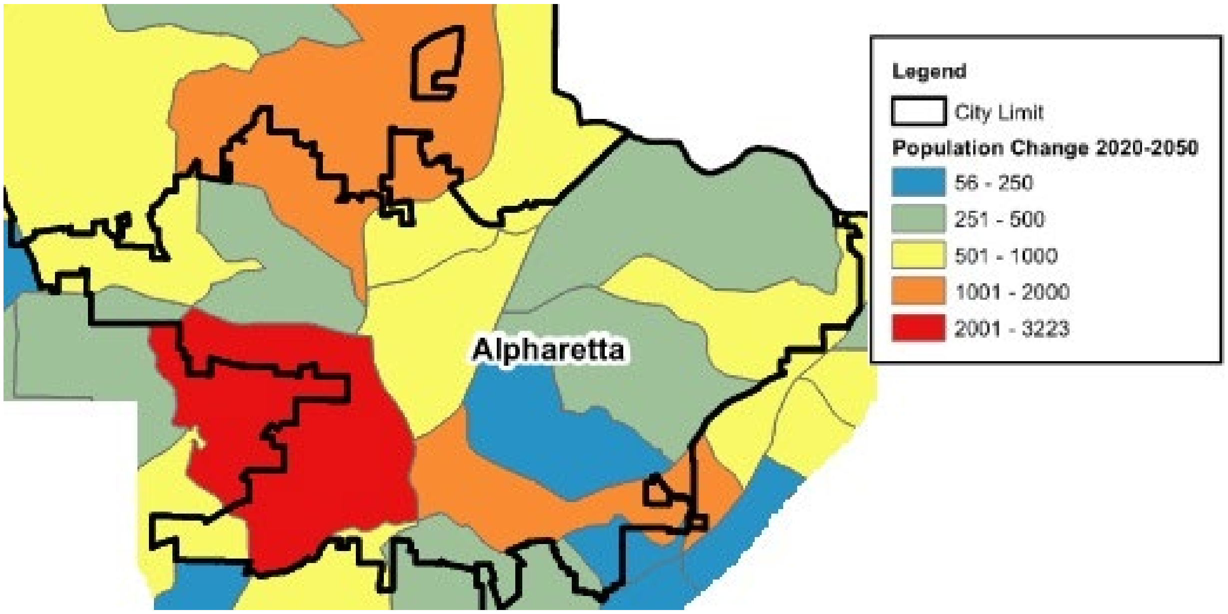
Alpharetta's development landscape primarily centers around redevelopment, with downtown Alpharetta spearheading initiatives to incorporate more housing and dining options into its urban fabric. Much of the remaining undeveloped land within the city poses challenges for construction or is in areas prone to significant flood risk.

Anticipating a surge in development proposals, City of Alpharetta officials foresee a proliferation of mixed-use complexes featuring amenities such as sports and entertainment venues, restaurants, office spaces, green areas, and residential units. Prominent locations earmarked for mixed-use growth include North Point Parkway, Windward Parkway, Westside Parkway, and Brookside Parkway. Ongoing mixed-use construction projects include Alpha Loop, Lakeview Park, 116 and 126 North Main Street, and Northwinds Summit.

Several residential developments are either under way or anticipated, including The Gathering comprising 179 rental units and townhomes, Continuum with 250 homes, Firefly with 48 townhomes, and The Foundry with 113 single-family homes. Moreover, forthcoming developments in manufacturing, special event centers, and data centers are expected to drive significant demand for water resources.

Alpharetta officials anticipate a growth trajectory surpassing that depicted on the U.S. Census Tract maps, with the 2022 Census reporting a total population of 67,267 residents. Growth metrics for the city are readily accessible through the City of Alpharetta's website, with permit statuses tracked via the city's GIS system for proposed, approved, and under construction projects. Figure 2 depicts the population projections per census tract for North Fulton County with a focus on Alpharetta.

Figure 2. Population Projections per Census Tract for North Fulton County



Source: Fulton County Water Distribution System Master Plan

3. Future Developments

Future developments for the City of Alpharetta have been determined through a comprehensive analysis leveraging data from multiple sources, including the City of Alpharetta *Horizon 2040 Comprehensive Plan*, geographic information system data, land use maps, and input from the city's Community Development Department.

Alpharetta maintains its position as a premier destination for corporate headquarters, high-tech services, and retail trade, boasting nearly 700 technology companies operating within the city limits. One of the most notable shifts in the past decade has been the rise of mixed-use centers. Alpharetta is committed to furthering growth and development in both residential and commercial sectors, aiming to attract fresh investments and businesses to the area.

Enhancements in transportation infrastructure also are under way, with the Georgia Department of Transportation expanding express lanes on Georgia State Route 400 (GA 400) and plans from the Metropolitan Atlanta Rapid Transit Authority (MARTA) to establish a Bus Rapid Transit (BRT) line along GA 400, featuring designated stops for both Windward and North Point Districts in Alpharetta. These initiatives are expected to improve transportation accessibility and mobility in the region.

Table 2 presents an overview of current and projected developments, detailing their respective locations, descriptions, water demand, and anticipated completion years. The table organizes projected developments alphabetically based on their approximate geographical locations, facilitating easy reference.

Table 2. Ongoing and Future Development Plans as Proposed to the City of Alpharetta

Location	Name (Address)	Description	Water Demand (gallons/day)	Timing
Alpharetta Highway	Village Park – Phase 2 (11940 Alpharetta Highway)	Building enhancement; Construction of 91 assisted living units	17,480	Under construction
Amber Park Drive	Parkway 400 (11740/11760 Amber Park Drive)	Construction of 120,000 square feet (SF) of office space	19,800	Approved
Anglin Walk	Manning on the Square (215 Anglin Walk)	58 single-family homes on 11.7 acres	11,540	Under construction
Ashbury Drive	700 Hudson Way	New gated townhome community with 128 units	24,140	Under construction
Cotton Creek	Foamworks (11725 Cotton Creek Entry)	Construction of a car wash	50,000	Under construction
Cumming Street	133 Cumming Street	3 single-family homes on 1.76 acres	540	Under construction
Cumming Street	The 1858	11 single-family homes on 1.7 acres	1,980	Under construction
Davis Drive	Iveybrooke Townhomes (10800 Davis Drive)	Construction of 85 townhomes on 8.6 acres	16,400	Approved
Devore Road	Sedgwick Residential (130 Devore Road)	Construction of a single-family detached dwelling unit	180	Approved
Fanfare Way	Fulton Science Academy Sports Field (3035 Fanfare Way)	Construction of athletic fields (4 tennis courts and 1 soccer field)	3,300	Approved
Gardner Drive	Alpha Loop (6000 Gardner Drive)	Construction of multi-use trail and park system	1,100	Under construction
Haynes Bridge Road	Alcovy Estates (11681 Haynes Bridge Road)	Construction of 10 single-family detached homes, 4 semi-detached homes, and 5 townhomes on 2.84 acres	3,420	Approved
Haynes Bridge Road	Eddie V's (11405 Haynes Bridge Road)	Construction seafood restaurant	3,300	Proposed
Haynes Bridge Road	The Atley (Haynes Bridge Road)	122-unit townhomes and stacked condominiums	23,060	Under construction

Location	Name (Address)	Description	Water Demand (gallons/day)	Timing
Haynes Bridge Road	The Gathering (11470 Haynes Bridge Road)	Construction of a mixed-use development with 144 townhomes, 37 single-family detached homes, and 41,900 SF of retail and restaurant space on 24.8 acres	52,150	Under construction
Hembree Road	Firefly (3000 Hembree Road)	Construction of 58 (1,862–2,025 SF) townhomes	11,540	Under construction
Kimball Bridge Road	Garren	Construction of gymnasium	3,300	Under construction
Kimball Bridge Road	Kimball Bridge Condos	Construction of 8 condominium units	1,440	Approved
Kimball Bridge Road	Ocee Place	Construction of 2 single-family detached homes on 2.5 acres	360	Approved
Kimball Bridge Road	Toll Brothers (Kimball Bridge Crossing)	Construction of 43 single-family detached homes on 22.7 acres	8,840	Under construction
Lakeview Parkway	Lakeview Park TPA	Construction of a 62-acre mixed-use development with 630,000 SF of office space, 32,000 SF of retail and restaurant space, 60 townhomes, and 255 apartments.	547,250	Under construction
Mansell Road	Verzachi Bar and Restaurant (2375 Mansell Road)	A restaurant and bar	3,300	Approved
Marietta Street	Chapman Medical and Office	Construction of a 4,000 SF medical building	3,300	Approved
Mayfield Road	Hudson Park	Construction of 17 single-family detached homes on 2.41 acres	3,060	Approved
Mayfield Road	KJ Luxury Homes	Construction of 7 single-family detached homes on 5.6 acres	1,260	Approved
Mayfield Road	Marigold at Mayfield Road	Construction of a subdivision with 10 single-family homes	1,800	Under construction
Mid Broadwell Road	Mid Broadwell Parc (1460 Mid Broadwell Road)	Construction of 5 single-family detached homes	900	Approved
Mid Broadwell Road	Mid Broadwell Residential	Construction of 23 single-family detached homes, 20 townhomes	7,740	Approved
North Main Street	100 N Main Street	Construction of a 30,000 SF office building	3,300	Under construction

Location	Name (Address)	Description	Water Demand (gallons/day)	Timing
North Main Street	116 and 126 N Main Street	Two 4-story mixed-used building on 1.43 acres (32,000 SF of office, 4,000 SF of retail, 8,000 SF of restaurant space, and 4 condominiums)	5,120	Approved
North Main Street	Alpha at Main (236 and 244 N Main Street)	11 single-family detached homes	1,980	Approved
North Main Street	Custom Pools ATL (711 North Main Street)	Construction of a 3,000 SF office building	3,300	Under construction
North Main Street	Mamita's Cantina and Tacos (312 N Main Street)	Construction of a 2-story, 4,000 SF building for a restaurant and office on 0.59 acre	3,300	Proposed
North Main Street	North Main Street Townhomes (0 State Highway)	Construction of 16 townhomes on 2.28 acres	2,880	Approved
North Main Street	Pavlova	Conditional use of an existing building for a restaurant, bakery, and coffee shop	3,300	Approved
North Point	Adora Childcare (5750 North Point Parkway)	Addition to an existing building for a childcare establishment	3,300	Under construction
North Point	Brixmor - Mansell Crossing (North Point Parkway)	Construction of 3 buildings (16,600 SF) for restaurant and retail	29,700	Approved
North Point	Cooper's Hawk (7665 North Point Parkway)	A winery and restaurant	3,300	Approved
North Point	Ecco Park (Olmstead Way)	Construction of 159 condominium units on 9.2 acres	29,720	Under construction
North Point	Encore Commons (North Point Parkway)	Construction of 5 retail spaces and 2 restaurants	50,000	Approved
North Point	Maru Japanese Restaurant (North Point Drive)	Construction of a restaurant	3,300	Under construction
North Point	Pickle and Social (North Point Drive)	Construction of an indoor and outdoor pickleball facility, 14,000 SF restaurant with rooftop, 24,000 SF medical	13,200	Approved

Location	Name (Address)	Description	Water Demand (gallons/day)	Timing
		office, and 5,000 SF professional office on 6.25 acres		
North Point	Pinecone (5760 North Point Parkway)	Construction of 90 single-family detached homes	17,300	Under construction
North Point	Terra Nova Spa (5755 North Point Parkway)	Conditional use of an existing building for a spa business	3,300	Approved
North Point	The Golf Sanctuary (380 North Point Circle)	Conditional use of an existing building for a restaurant and indoor recreational facility	3,300	Proposed
North Point	Windward Point Townhomes (315 and 425 North Point Parkway)	Construction of 100 townhomes	18,000	Under construction
Northwinds Parkway	The Bailey/ Northwinds	Construction of a 156,400 SF wellness center, 53,000 SF of office space, 100-room boutique hotel, 24,700 SF of retail and restaurant space on 4.7 acres	200,000	Approved
Old Milton Parkway	2325 Old Milton Parkway Tract	Construction of 24 townhomes on 4.9 acres	4,320	Approved
Old Milton Parkway	Bridge Road Holdings (3190 Old Milton Parkway)	Construction of 21,500 SF of professional, medical, and dental offices	3,300	Approved
Old Roswell Road	Julio Jones Kia (Old Roswell Road)	Kia car dealership	3,300	Under construction
Rainwater Drive	Roberts Properties (11556 Rainwater Drive)	Construction of a 39,000 SF office building	13,200	Approved
Roswell Street	Roswell St. Corridor (75 and 91 Roswell Street)	Construction of a 3-story building to include a restaurant and office space.	9,900	Approved
South Main Street	Maxwell	Construction of 138 detached and attached townhomes and condominiums	25,940	Under construction
South Main Street	Mayfair on Main (217 S Main Street)	Construction of a 24-unit townhome development	4,320	Under construction
South Main Street	South of Wills Park	Construction of 55 townhomes on 5.5 acres	11,000	Approved
South Main Street	Wills Overlook	Construction of 16 townhomes on 2.24 acres	2,880	Approved

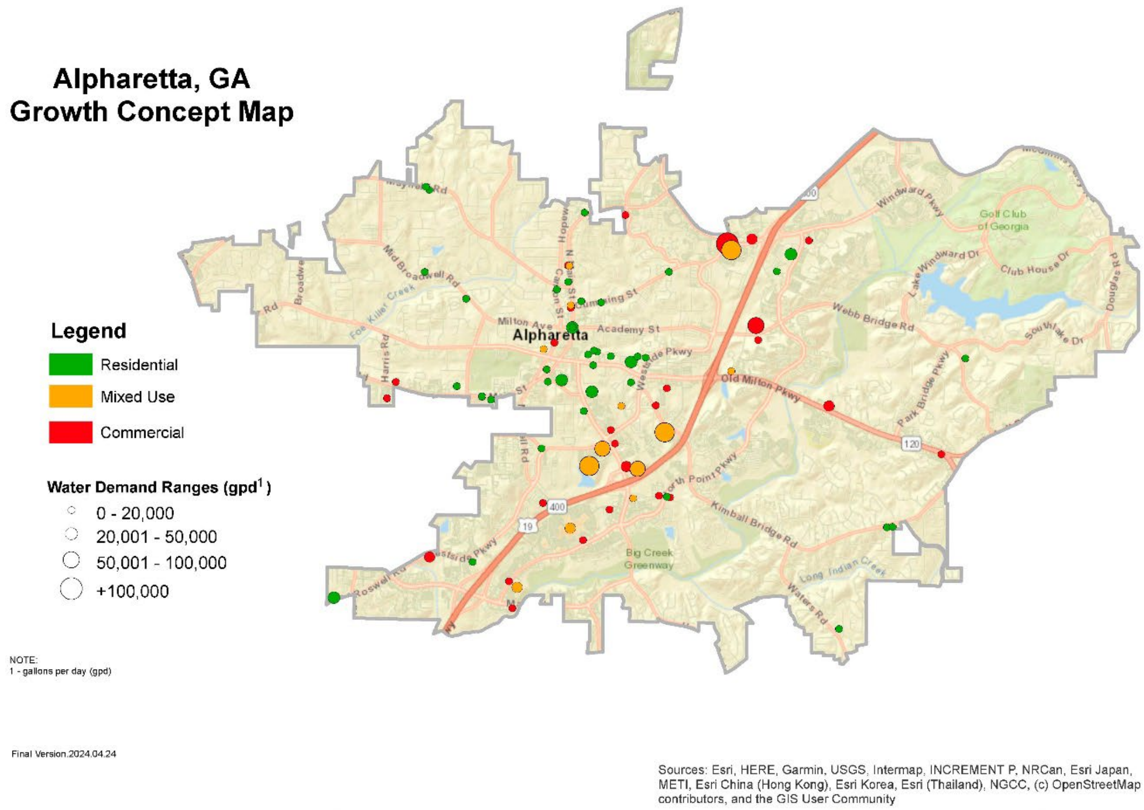
Location	Name (Address)	Description	Water Demand (gallons/day)	Timing
State Bridge Road	Fifth Third Bank (4303 State Bridge Road)	Construction of a banking center	3,300	Proposed
Summit Place	AC Hotel at Northwinds (2000 Summit Place)	Construction of 140-room hotel facility	28,500	Approved
Summit Place	Northwinds Summit	Construction of 5 office buildings totaling 1.2 million SF (30,000 to 50,000 SF of retail and restaurant space, 140-room hotel, 130 apartment units, 32 stacked flat condominium units)	54,360	Under construction
Thompson Street	296 and 304 Thompson Street	Construction of a 17-unit subdivision (11 single-family detached homes and 6 townhomes)	3,060	Approved
Thompson Street	31 and 51 Thompson Street	Construction of 17 single-family detached homes and 5 townhomes on 2.23 acres	3,960	Approved
Thompson Street	82 and 92 Thompson Street	Construction of a 5-unit condominium building on 1.13 acres	900	Under construction
Thompson Street	Alcovy	10 single-family homes	1,800	Under construction
Thompson Street	Chiswick Park (332 Thompson Street)	Construction of 44 new townhomes on 5.8 acres	9,020	Under construction
Thompson Street	The Foundry	113 homes (25 single-family homes and 88 townhomes)	21,440	Under construction
Thompson Street	Towns of Thompson (165 Thompson Street)	48 townhome units on 3.27 acres	9,740	Under construction
Upper Hembree Road	Spirit of God Church	Construction of a church on 2.9 acres	3,300	Approved
Upper Hembree Road	Upper Hembree Healthcare (1180 Upper Hembree Road)	Construction of 5,200 SF of medical office building	3,300	Approved
Waters Road	Waters Road Tract	Construction of 3 single-family detached homes on 1.5 acres	540	Approved
Webb Bridge Road	Fairfield Inn (3225 Webb Bridge Road)	Construction of a 5-story, 78,000 SF hotel with 166 guest rooms	36,480	Under construction

Location	Name (Address)	Description	Water Demand (gallons/day)	Timing
Webb Bridge Road	Stack Data Center (3200 Webb Bridge Road)	Construction of a 2-story 131,720-SF data center on 6.5 acres	100,000	Approved
Webb Bridge Road	The Bridges (4430 Webb Bridge Road)	Construction of 6 single-family detached homes on 8.1 acres	1,080	Under construction
Weyhill Court	Weyhill	9 single-family homes on 3.1 acres	1,620	Under construction
Windward Parkway	5555 Windward Parkway	Enhancement of an existing structure	668,200	Under construction
Windward Parkway	Calibar Car Wash (5570 Windward Parkway)	Construction of a car wash	50,000	Under construction
Windward Parkway	Continuum (5555 Windward Parkway)	Mixed-use development with 1,545,899 SF office space, 77,600 SF of retail and restaurant space, 82 townhome units, 488 rental units, 218 hotel rooms, parks, and greenspace on 51.9 acres	207,840	Approved
Windward Parkway	Windward Park Pod 66 Master Plan (Zephyr Way)	Construction of 100 townhomes and 130 condominium units	42,500	Approved

4. City-Specific Water Demand Forecast

The water demand forecast for the City of Alpharetta will be used to update the Fulton County's water distribution system hydraulic model and will determine if additional infrastructure is needed to provide adequate water service and fire protection to meet future needs out to 2050. Based on the data provided by the city and the new development and redevelopment projects being built or permitted as of February 2024, water demand is expected to increase approximately 2.8 MGD in the future. The projection considers factors such as available land for development, current land use and comprehensive land planning policies by the city, existing per capita water uses extracted through historical billing data, as well as anticipated conservation efforts through the adoption of more water-efficient fixtures. The major water users are athletic facilities and mixed-use developments that are expected to expand or open new facilities as soon as 2025. Figure 3 shows the development areas and future growth for the City of Alpharetta based on the information provided by the city and available planning documents.

Figure 3. Future Growth Areas for the City of Alpharetta



Water demand calculations based on growth beyond developments are not all known by the city; therefore, additional demands projections were also calculated using ARC population projections and the most current billing data. These water demand projections resulted in an expected increase of approximately 2.0 MGD by 2050. Adopting a conservative approach, the demand curve was developed using higher increase in demand as calculated using future development plans. Table 3 and Figure 4 show the historical data and the proposed forecast for the City of Alpharetta. The current demand forecast shows a lower demand projection that follows the most current historical demand and baseline data used for the current demand forecast is half of the estimated water demand developed for the 2007 Fulton County Master Plan.

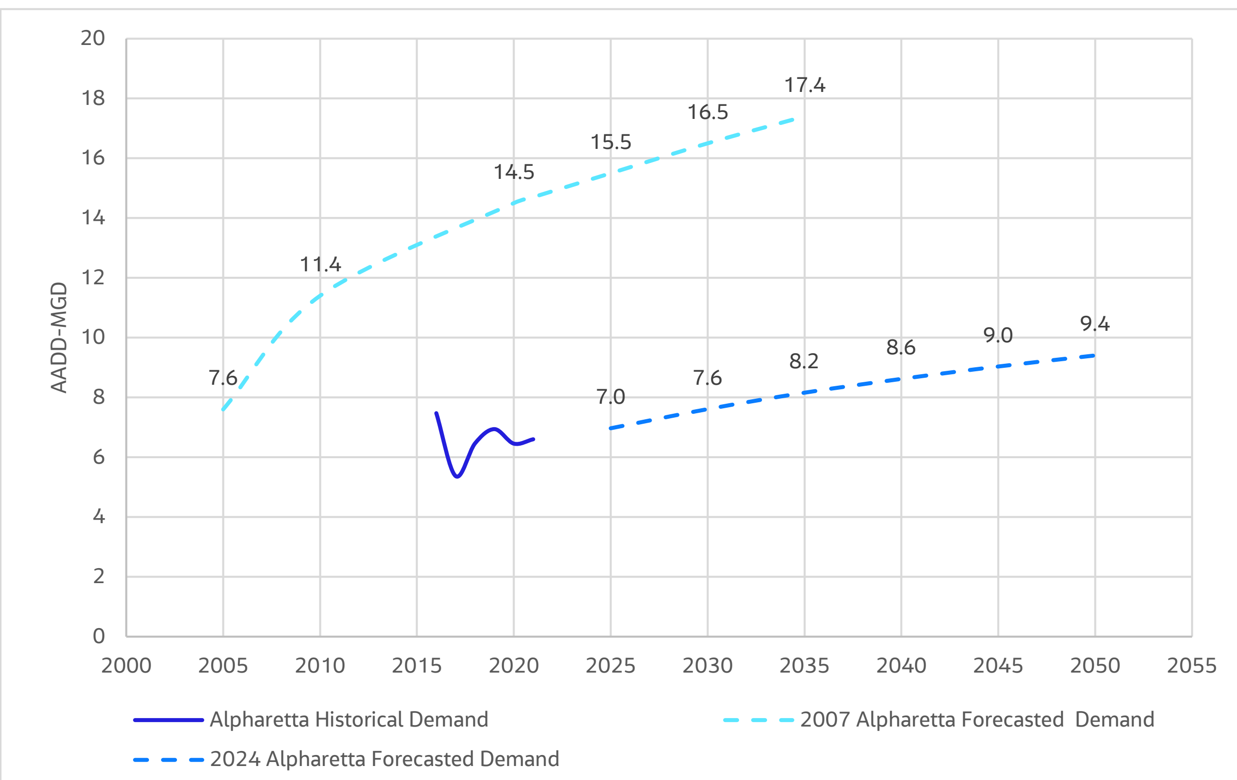
Table 3. Historical and Proposed Future Annual Average Water Demand for the City of Alpharetta

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005	NA	7.6	NA
2010	NA	11.4	NA
2017	5.37	NA	NA
2018	6.47	NA	NA

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2019[3]	6.94	NA	NA
2020	6.46	14.5	NA
2021[4]	6.60	14.7	NA
2025	NA	15.5	7.0
2030	NA	16.5	7.6
2035	NA	17.4	8.2
2040	NA	NA	8.6
2045	NA	NA	9.0
2050	NA	NA	9.4

Notes:
AADD-MGD = annual average daily demand in million gallons per day
NA = Not Available
[1] Historical water demand calculated using billing records and water supplied data.
[2] Water demand forecast as show in the 2007 Fulton County Master Plan.
[3] Water demand data for the year 2019 reflect an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that year.
[4] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Figure 4. Historical and Proposed Future Annual Average Water Demand for the City of Alpharetta



5. References

City of Alpharetta. 2021. *Horizon 2040 Comprehensive Plan*. October.

JJG. 2008. W*ater and Wastewater Master Plan 2007 Update*

U.S. Census Bureau. 2020. "TOTAL POPULATION." Decennial Census, DEC Demographic and Housing Characteristics, Table P1. https://data.census.gov/table/DECENNIALDHC2020.P1?q=alpharetta. Accessed on March 7, 2024.

U.S. Census Bureau. 2024. Census.gov. https://www.census.gov/.

Atlanta Regional Commission. 2024. Population and Employment Forecast. https://atlantaregional.org/atlanta-region/population-employment-forecasts/.

Attachment 1
Meeting Presentation and Meeting Sign-in Sheet

Appendix C
Johns Creek Water Demand Projections

Water Demand Projections for North Fulton County – City of Johns Creek

Date: August 28, 2024
Project name: Fulton County Water Distribution System Master Plan
Project no: EEXK6102
Client: Fulton County Government
Revision no: 1
Document no: 240308112636_4d3a2796

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Executive Summary

Fulton County serves water to the cities in North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. As part of the Fulton County Water Distribution System Master Plan, water demand projections for each of the cities were developed to appropriately plan for reliable water service to them in the future.

Fulton County staff and Jacobs met with members from the cities to discuss future developments that could be used to develop water demand projections. The community development and public works departments were very helpful in supplying information. In addition, historical billing data from Fulton County and population projections broken down by census tract through 2050 from the Atlanta Regional Commission (ARC) were used to project growth and demand. In February 2024, the ARC adopted the most recent Series 17 population and employment forecast from 2020-2050.

The water demand projections, as outlined in the Fulton County's *Water and Wastewater Master Plan 2007 Update* (2007 Fulton County Master Plan JJG; 2008), and the newly calculated water demands for the City of Johns Creek, are presented in Table ES-1. The 2024 Water Demand Forecast is relatively aligned with the 2007 Water Demand Forecast in the 2007 Fulton County Master Plan. Throughout the comparable years spanning from 2020 to 2035, the water demands show a consistent trend remaining within a 10 percent margin of each other. The 2024 water demand forecast is estimated based on population projections, data provided by the city on new development and redevelopment projects, current and future land use planning policies, existing per capita water uses extracted through historical billing data and conservation from more water-efficient fixtures expected in the future.

Table ES-1. Projected Future Annual Average Water Demand for the City of Johns Creek

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005[2]	9.2	NA
2010[2]	9.5	NA
2020[2]	10.3	9.5
2021[2,3]	10.3	9.7
2025	10.5	10.2
2030	10.6	11.3
2035	10.7	11.7
2040	NA	12.3

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2045	NA	12.5
2050	NA	12.7

Notes:
AADD-MGD = annual average daily demand in million gallons per day.
NA = Not Available.
[1] Water demand forecast as shown in the 2007 Fulton County Master Plan
[2] Historical water demand shown under the 2024 Water Demand Forecast was calculated using billing records and water supplied data.
[3] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

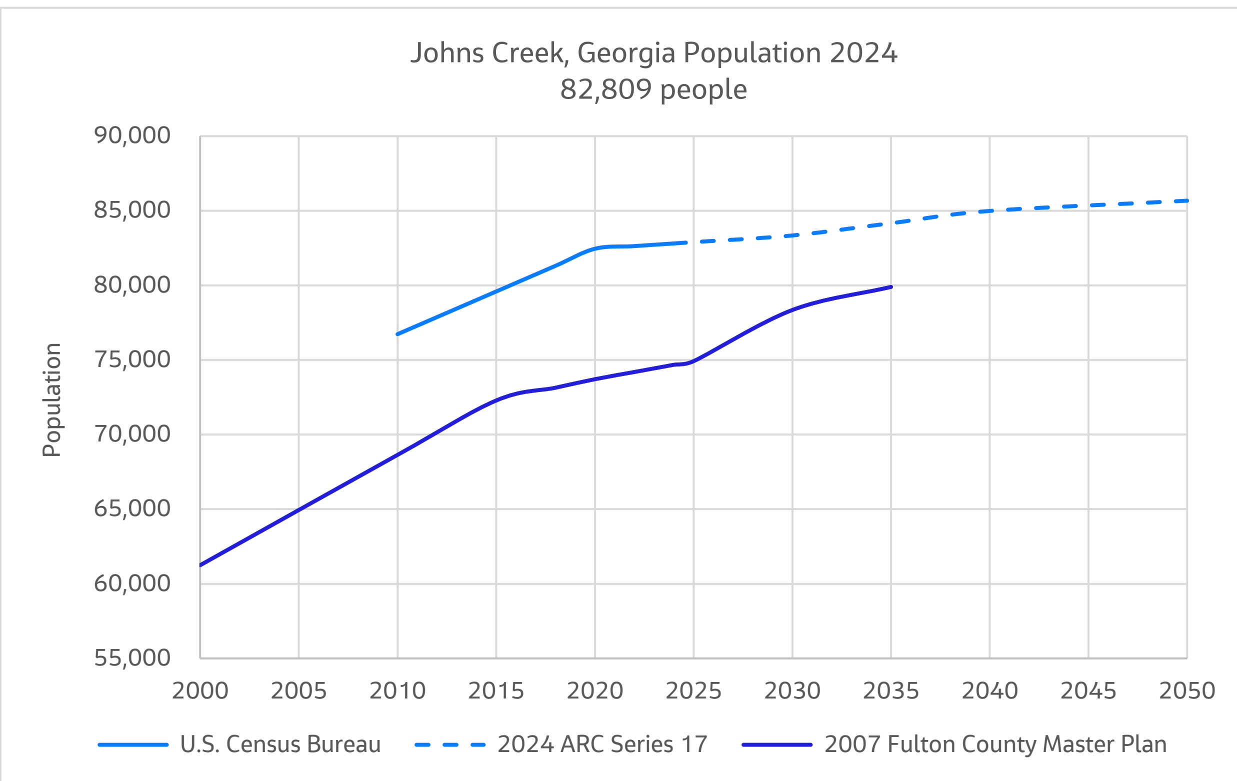
Additional information about the development of the Johns Creek water demand projection is included in the Technical Memorandum herein.

1. Introduction

As part of the *Fulton County Water Distribution System Master Plan*, it is essential to forecast water demand for the municipalities within North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. To determine the future water demands for the cities, meetings were held with the community development departments of each city. This memorandum summarizes the outcomes of the meeting with the City of Johns Creek, integrating research and insights from the city planning departments and various other sources to formulate water demand projections.

The City of Johns Creek, established in December 2006, is segmented into eight distinct community areas: Autrey Mill, Johns Creek North, Medlock, Newtown, Ocee, River Estates, Shakerag, and Technology Park. Spanning an area of 31.3 square miles. According to the 2020 U.S. Census Bureau data, Johns Creek was home to approximately 82,453 individuals residing in 28,177 households. By 2024, the population is expected to increase to 82,809 reflecting a slight decline in growth rate of 0.7 percent since the latest census (ARC, 2024). Notably, new residential developments have declined significantly, with emphasis shifting predominantly toward single-family homes and the revitalization of specific commercial areas. The ARC population projections were compared to those outlined in the 2007 Fulton County Master Plan, which estimated Johns Creek population at 74,920 in 2025 and 79,896 in 2035, which are noticeably lower than both the U.S Census and ARC data, as shown on Figure 1. Both the U.S. Census Bureau and the ARC data present a more realistic population data compared to the projections in the 2007 Fulton County Master Plan. Figure 1 shows Johns Creek's historical population growth and its projected population increase as published by the ARC in 2024.

Figure 1. Population Trend for the City of Johns Creek



Source: U.S. Census Bureau, Series 17 Population Forecast from 2020-2050 (ARC, 2024) and 2007 Fulton County Master Plan

The residents of the City of Johns Creek receive water from the Atlanta-Fulton County Water Treatment Plant (nine high service pumps), located within city limits. Johns Creek's distribution system is comprised of 326 miles of pipe of multiple materials such as cast iron, copper, ductile iron, galvanized, steel and PVC. There are two elevated tanks located off Jones Bridge Road. Per the population projections outlined in 2007 Fulton County Master Plan, the water demand for Johns Creek was forecasted to reach 10.3 million gallons per day (MGD) by the year 2020, with a slight increase to 10.7 MGD by 2035 as shown in Table 1. These projections were formulated based on population estimates. The per capita water usage rates were delineated as 81.3 gallons per capita per day (GPCD) for residential purposes and 53.6 GPCD for non-residential purposes, per the 2007 Fulton County Master Plan.

Table 1. Previous Water Demand Projections of Cities within Fulton County (MGD).

Jurisdiction	2005	2010	2020	2030	2035
Alpharetta	7.6	11.4	14.5	16.4	17.4
Johns Creek	9.2	9.5	10.3	10.6	10.7
Milton	3.8	4.6	5.7	6.2	6.5
Roswell	12.6	12.9	13.5	13.7	13.9

Source: 2007 Fulton County Master Plan

Billing records show that water demand for the city was close to reaching the expected water demand levels stated in the 2007 Fulton County Master Plan. Demand shows an average 9.3 MGD throughout the period of record (2017-2021) with the highest water demand recorded in 2019. The high demand of 10.2 MGD for 2019 was attributed to lower precipitation levels experienced during that year. Billing records show a combined per capita water usage rates of 109 GPCD. Demand is expected to continue its steady growth trend with periodic increases in industrial demands from research and development companies as well as data centers.

2. Meeting Summary

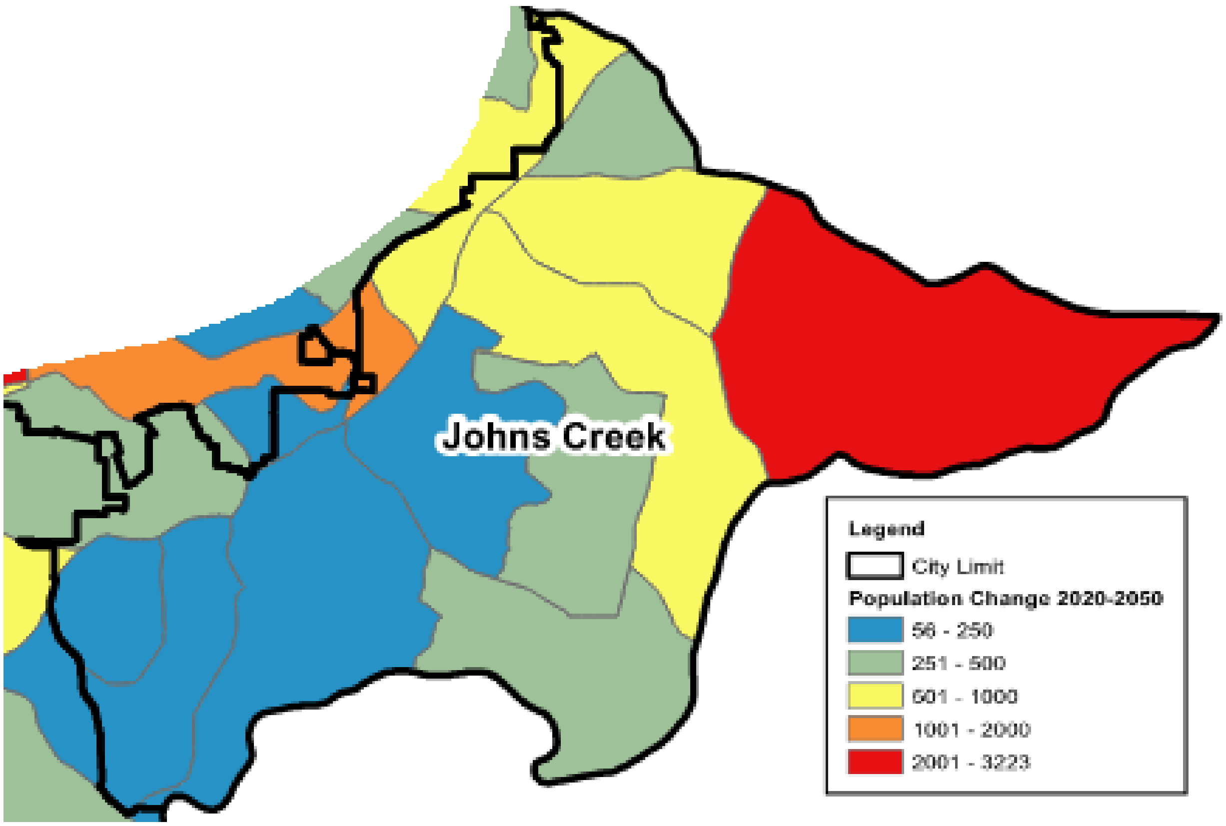
On November 13, 2023, representatives from the Jacobs team and Fulton County convened with officials from the City of Johns Creek to discuss the *Fulton County Water Distribution System Master Plan*. Attachment 1 shows the meeting presentation and sign-in sheet. This plan emphasizes the municipalities in North Fulton County outside of the City of Atlanta's service area, including Johns Creek, Alpharetta, Milton, and Roswell. The primary objective of these discussions was to evaluate the future requirements of the City of Johns Creek for the *Fulton County Water Distribution System Master Plan*.

Currently, Johns Creek has established a daily water demand of 10.58 MGD, peaking at 14.06 MGD, the highest usage among all North Fulton County cities. Potable water needs for Johns Creek residents are met through the Tom Lowe Atlanta-Fulton County Water Treatment Plant. Most residential developments in Johns Creek adhere to a 1-unit-per-acre zoning requirement. There are ongoing initiatives to decrease residential density and designate specific areas for commercial redevelopment. Anticipated growth peaks are expected in the northwestern quadrant of the city, with vertical expansion yet to be zoned. The Town Center area, serving as the commercial hub, is zoned for 30 units per acre, with plans spanning the next three decades. Notable concentrations of commercial development are situated in the Medlock Bridge Road and State Bridge Road areas.

City officials highlighted that future redevelopment focuses on major intersection areas. Details of the redevelopments and action plans are documented comprehensively in the Community Work Program section of the *Johns Creek 2018 Comprehensive Plan* (City of Johns Creek 2018). This section delineates priority capital projects for land use, economic development, transportation, parks and recreation, and community facilities over the forthcoming 5 to 10-year period, as outlined in Section 3.

During the meeting, it was stated that Alcon, a prominent eye care manufacturing company with a facility in Johns Creek, is expanding its manufacturing operations. Alcon has requested permits for additional sewer capacity, initially from 1 MGD to 1.7 MGD, with eventual plans to reach 2 MGD. Regarding the potential necessity of water tanks as an upgrade to the existing water distribution system to accommodate future demand, Johns Creek authorities emphasized that if such tanks are deemed necessary, careful consideration of their location and aesthetics will be crucial to community satisfaction. Figure 2 depicts the population projections per census tract for North Fulton County with a focus on Johns Creek.

Figure 2. Population Projections per Census Tract for North Fulton County

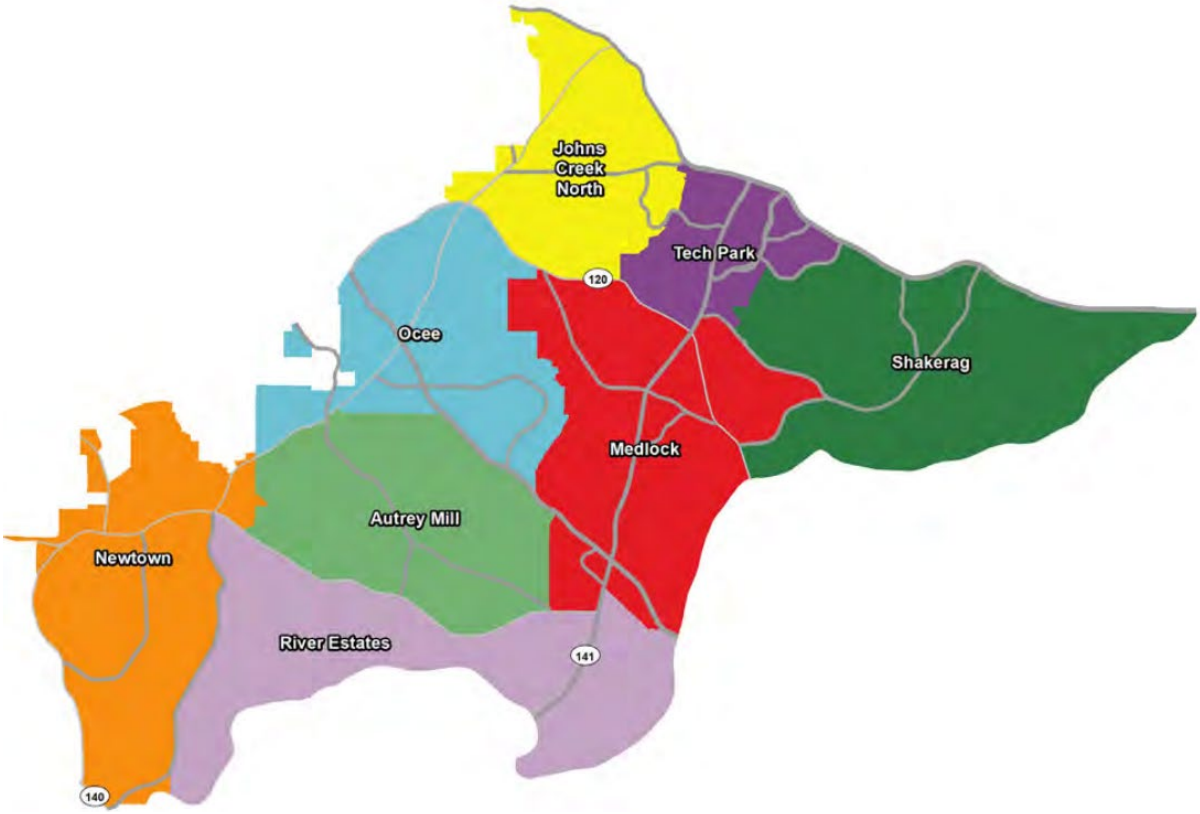


Source: Fulton County Water Distribution System Master Plan

3. Future Developments

The future development plans for Johns Creek have been determined through a thorough analysis incorporating data from various sources such as the *Johns Creek 2018 Comprehensive Plan*, geographic information system data, land use maps, and the Johns Creek Community Development Department. Each of the city's eight distinct community areas presents unique characteristics, influencing their respective development goals in terms of land use, density, and zoning. Figure 3 illustrates the geographical locations of each of Johns Creek community areas.

Figure 3. Johns Creek Community Areas



Source: Johns Creek 2018 Comprehensive Plan

Six of these community areas—Autrey Mill, Johns Creek North, Ocee, River Estates, Newtown, and Shakerag—are primarily focused on fostering low-density, single-family housing. Conversely, Medlock and Technology Park prioritize commercial and mixed-use developments, with Technology Park particularly emphasizing high-density office and institutional spaces, including corporate offices, and supporting amenities like food and retail establishments. The specifics of development vary by community area and are described in the following sections.

3.1 Autrey Mill

This community area is characterized by large-scale single-family residential properties, comprising 78.3 percent of the total land. Commercial and multi-family residential developments are limited, with only 0.2 percent and 1 percent of the land allocated, respectively. With 63.4 acres of undeveloped land, future plans focus on single-family residential units with a density of 1 unit per acre, allowing for an additional 34 residential units based on zoning requirements and available land.

3.2 Johns Creek North

The Johns Creek North community area is dominated by single-family residential land use covering 87.4 percent of the area. Commercial and multi-family residential developments occupy smaller percentages. With 3.2 acres of undeveloped land, future residential infill projects are restricted to single-family detached homes at a density of 3 units per acre, enabling the addition of 155 residential units based on zoning and land availability.

3.3 Medlock

Medlock is primarily characterized by large-scale residential subdivisions alongside commercial retail spaces, housing approximately 20 percent of the city's population. Single-family residential land use accounts for 62.1 percent, with commercial office and retail spaces comprising 4.6 percent. New residential infill developments are capped at a maximum of 2 units per acre for single-family detached homes, with no mixed-use projects based on existing traffic congestion. The buildout analysis suggests a capacity for 156 additional residential units.

3.4 Ocee

Ocee is predominantly single-family residential covering 78.6 percent of the area, with commercial and retail spaces occupying smaller proportions. New low-intensity mixed-use developments are planned at a rate of 8 residential units per acre, alongside single-family detached units limited to 3 units per acre for infill housing projects. The buildout analysis indicates a potential for 362 additional residential units.

3.5 River Estates

River Estates mainly consists of single-family residential and recreational spaces, with golfing facilities being a prominent feature. New infill housing developments are restricted to single-family detached homes at a density of 1 unit per acre, with a capacity for 92 additional residential units based on the analysis of available land.

3.6 Shakerag

Shakerag is predominantly single-family residential at approximately 58 percent of total land, with significant portions dedicated to recreational (18.9 percent) and agricultural (6.5 percent) uses. New developments, including commercial and mixed-use projects, are limited, with infill housing projects focused on single-family detached homes at a density of 1 unit per acre. There are approximately 342 acres of undeveloped land (11.3 percent) left in this area. The buildout analysis suggests a capacity for 606 additional residential units, although substantial development is not anticipated in the next decade.

3.7 Newtown

Characterized by single-family residential properties as the primary land use, Newtown also has smaller allocations for commercial office, retail, and multi-family residential spaces. Plans include transforming existing shopping centers into low-intensity mixed-use areas that incorporate local retail, office spaces, residential units, and entertainment venues. New infill housing developments are limited to 3 units per acre for single-family detached homes, with mixed-use projects capped at 8 residential units per acre. The buildout analysis shows a capacity for 615 additional residential units.

3.8 Technology Park

Focused on office and industrial spaces, Technology Park has commercial offices as the primary land use covering 26 percent of the area. Residential spaces, both single-family and multi-family, comprise a smaller percentage. New residential infill developments are limited to single-family detached units at a density of 3 units per acre, with a capacity for 75 additional residential units based on available land.

Table 2 below provides details of known developments, including location, description of housing or commercial units, water demand, and projected timing. The table organizes the projected developments by Community Areas in alphabetical order.

Table 2. Ongoing and Future Development Plans for the City of Johns Creek

Name	Location	Description	Water Demand (gallons/day)	Timing
Autrey Mill	**Autrey Mill**	Large-scale single-family housing developments, 1 dwelling per acre. Buildout capacity is 34 dwelling units. No pending developments currently.	9,420	Buildout, not permitted or planned
Johns Creek North	**Johns Creek North**	Single-family housing developments, 3 dwellings per acre. Buildout capacity is 155 dwelling units. No pending developments currently.	34,500	Buildout, not permitted or planned
Medlock	**Medlock**	Large-scale housing developments with commercial office and retail spaces. Buildout capacity is 156 dwelling units. No pending developments currently.	64,380	Buildout, not permitted or planned
Newtown	**Newtown**	Single-family housing developments with low commercial office, retail, and multi-family dwellings. Buildout capacity for 615 dwelling units. No pending developments currently.	127,200	Buildout, not permitted or planned
Mt. Pisgah Christian School	Newtown	Potential 123,362 SF expansion of the school (academic buildings, performing arts theater, indoor pool).	7,700	NA
Ocee	**Ocee**	Single-family housing developments with low commercial and retail spaces. Buildout capacity is 362 dwelling units. No pending developments currently.	76,160	Buildout, not permitted or planned
Medlock Crossing Shopping Center	Ocee	A 21-acre shopping center revitalization project that proposes a mixed-use retail center anchored by Regal Cinema. Potential for mixed-use development up to 12 to 14 dwelling units/acre.	57,320	Assuming completion within 5 to 10 years (by 2035)
River Estates	**River Estates**	Single-family housing developments with recreational spaces. Buildout capacity is 92 dwelling units. No pending developments currently.	22,060	Buildout, not permitted or planned
Shakerag	**Shakerag**	Low-density, single family housing development with 1 dwelling unit/acre requirement. Buildout capacity is 606 dwelling units. No pending dwelling developments currently.	110,180	Buildout, not permitted or planned
Cauley Creek Park	Shakerag	A 203-acre multipurpose park consisting of lighted grass and synthetic turf playing fields, playgrounds, parking, park office, sports courts (pickle ball, volleyball, basketball), a 5-kilometer rubberized trail, pedestrian bridges, and river overlooks. The park opened to the public in July 2023. City is in the process of determining a project to introduce commercial space (for	16,500	Completed July 2023

Name	Location	Description	Water Demand (gallons/day)	Timing
		example, restaurants) to the southern portion of the park.		
Technology Park	**Technology Park**	High-density, multi housing, 30 dwelling units/acre. Approximately 11.2 acres of undeveloped land. Buildout is 75 dwelling units.	14,600	Buildout, not permitted or planned
Alcon	Technology Park	Requested additional sewer capacity for permitting reasons going from 1 MGD to 1.7 MGD, and eventually will request 2 MGD.	1,200,000	NA
Boston Scientific	Technology Park	A $62.5 million medical device manufacturing and distribution facility to be located at 11350 Johns Creek Pkwy. It is expected to employ approximately 340 people. Sewer capacity request states 30.07 gpm water demand.	43,301	Fall 2024
Emory Johns Creek Hospital	Technology Park	Hospital and medical offices, proposed expansion adds 1 million SF to existing facility. Proposed expansion of hospital and medical office buildings adds 337,922 SF in 0 to 10 years, and 742,380 SF in 10 to 20 years.	165,000	337,922 SF by 2034 742,380 SF by 2044
Hospital Pkwy	Technology Park	75+ condominiums. Pending rezoning. Council will review rezoning request in April/May 2024.	14,600	NA
Johns Creek Town Center	Technology Park	A 192-acre business park area surrounding City Hall with a phased redevelopment to include a new 40-acre mixed-use retail district, Creekside Park (a park that features pedestrian pathway systems, lakefront amphitheater, a boardwalk, fountains, and a community playground).	1,320,000	Ongoing through approximately 2034
Medley	Technology Park	A $350 million development plan of unique residential (141 townhomes and 750 multi-family units), retail space (200,000 SF), office space (110,000 SF), and entertainment offerings.	214,280	2026
Standard Club Golf Course	Technology Park	Building a 3,600 SF Mizuno Golf Fitting and Training Facility.	3,300	Assuming completion within 5 years (by 2030)
The Terraces at Johns Creek	Technology Park	Development of a shopping center that will be approximately 69,200 SF spread across 4 buildings.	13,200	Fall 2025
Wards Crossing Townhomes	Medlock	Development of 128 residential units (104 townhomes and 24 single-family detached homes).	24,140	2025

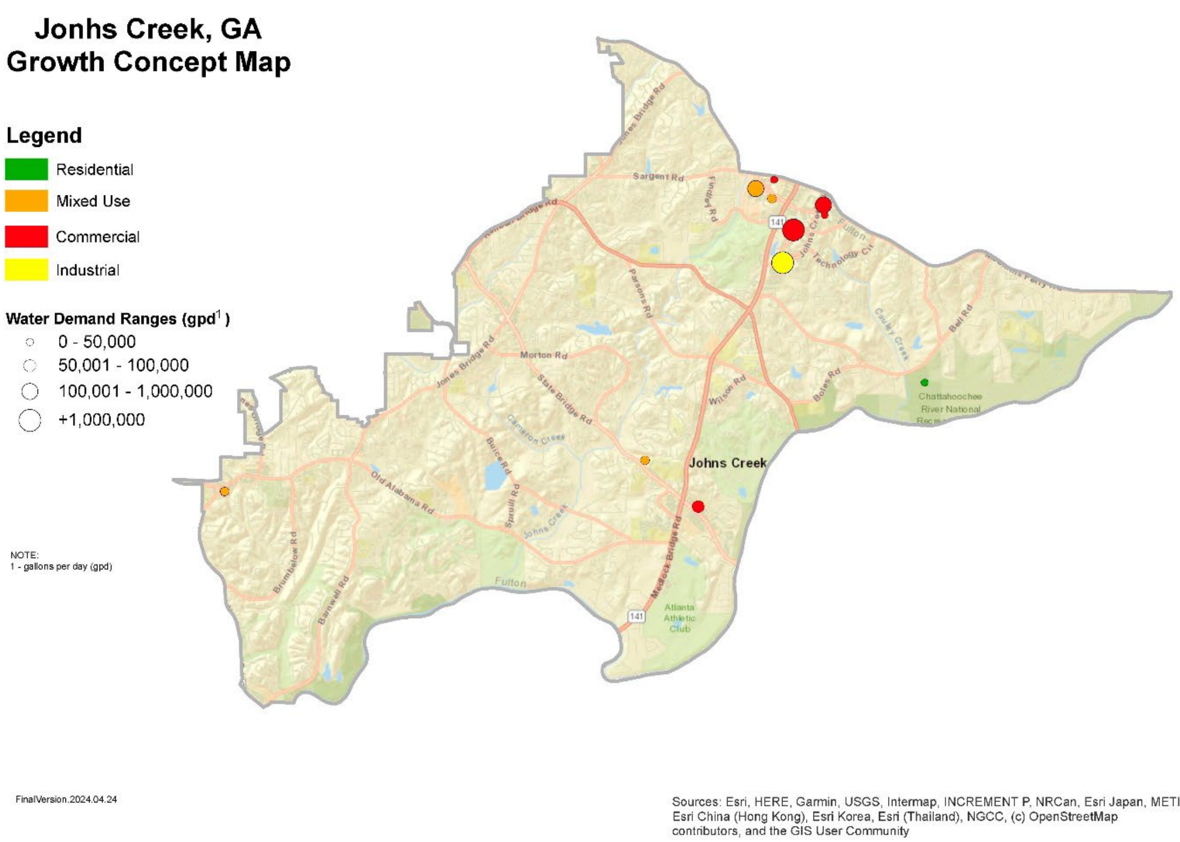
Notes:
NA = not available
SF = square foot (feet)

4. City-Specific Water Demand Forecast

The water demand forecast for the City of Johns Creek will be used to update the Fulton County's water distribution system hydraulic model and assessing the need for additional infrastructure to ensure sufficient water service and fire protection to meet future needs out to 2050. Based on the data provided by the city alongside ongoing new development and redevelopment projects being built or permitted as of February 2024, it is projected that water demand will rise by approximately 3.0 MGD in the near future. The projection considers factors such as available land for development, current land use and comprehensive land planning policies by the city, existing per capita water uses extracted through historical billing data, as well as anticipated conservation efforts through the adoption of more water-efficient fixtures.

Furthermore, the forecast accounts for significant water consumers like Alcon, a pharmaceutical and medical device manufacturing facility, and the anticipated growth of mixed-use developments concentrated in the Technology Park area that are expected to expand or open new facilities. To accommodate uncertainties surrounding future growth beyond current developments, additional projections were calculated using ARC population estimates and the most current billing data. These supplementary projections indicate a potential increase of approximately 2.6 MGD by 2050. Figure 4 shows the development areas and future growth for the City of Johns Creek based on the information provided by the city and available planning documents.

Figure 4. Future Growth Areas for the City of Johns Creek



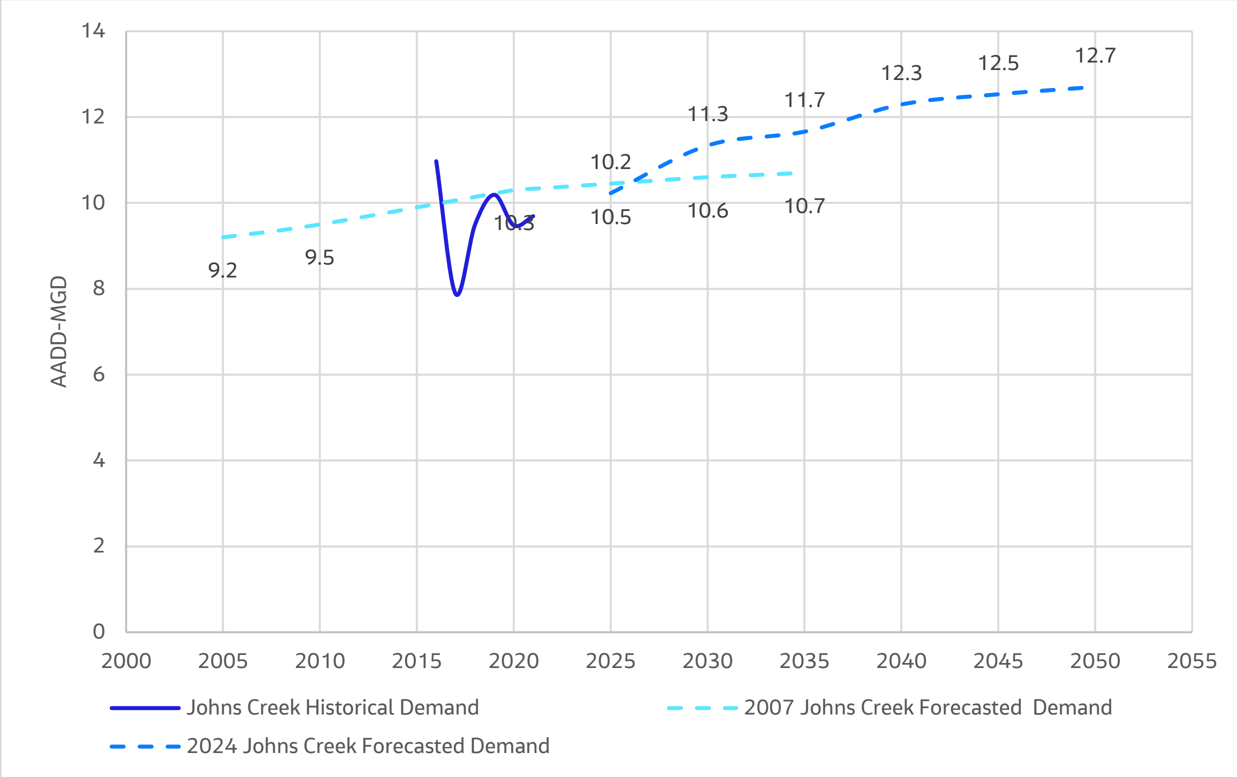
Adopting a conservative approach, the demand curve was developed using the higher demand as calculated using future development plans. Notably, the current demand forecast reflects a more conservative estimate, aligning closely with recent historical data, and within 10 percent of the 2007 water demand forecast. Detailed historical data and the proposed forecast for the City of Johns Creek are presented in Table 3 and Figure 5, showing a comprehensive view of past trends and future projections to inform strategic planning and infrastructure development decisions.

Table 3. Historical and Proposed Future Annual Average Water Demand for the City of Johns Creek

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005	NA	9.2	NA
2010	NA	9.5	NA
2017	7.88	NA	NA
2018	9.49	NA	NA
2019[3]	10.19	NA	NA
2020	9.48	10.3	9.5
2021[4]	9.69	10.3	9.7
2025	NA	10.5	10.2
2030	NA	10.6	11.3
2035	NA	10.7	11.7
2040	NA	NA	12.3
2045	NA	NA	12.5
2050	NA	NA	12.7

Notes:
AADD-MGD = annual average daily demand in million gallons per day
NA = Not Available
[1] Historical water demand calculated using billing records and water supplied data.
[2] Water demand forecast as show in the Water and Wastewater Master Plan 2007 Update (JJG, 2008)
[3] Water demand data for the year 2019 reflect an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that year.
[4] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Figure 5. Historical and Proposed Future Annual Average Water Demand for the City of Johns Creek



5. References

City of Johns Creek. 2018. *Johns Creek 2018 Comprehensive Plan.* October.

JJG. 2008. *Water and Wastewater Master Plan 2007 Update*.

U.S. Census Bureau. 2020. "TOTAL POPULATION." Decennial Census, DEC Demographic and Housing Characteristics, Table P1. https://data.census.gov/table/DECENNIALDHC2020.P1?q=alpharetta. Accessed on March 7, 2024.

Atlanta Regional Commission. 2024. Population and Employment Forecast. https://atlantaregional.org/atlanta-region/population-employment-forecasts/

Attachment 1
Meeting Presentation and Meeting Sign-in Sheet

Appendix D
Milton Water Demand Projections

Water Demand Projections for North Fulton County – City of Milton

Date:	September 10, 2024
Project name:	Fulton County Water Distribution System Master Plan
Project no:	EEXK6102
Client:	Fulton County Government
Revision no:	3
Document no:	240311085349_1ac289e1

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Executive Summary

Fulton County serves water to the cities in North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. As part of the Fulton County Water Distribution System Master Plan, water demand projections for each of the cities were developed to appropriately plan for reliable water service to them in the future.

Fulton County staff and Jacobs met with members from the cities to discuss future developments that could be used to develop water demand projections. The community development and public works departments were very helpful in supplying information. In addition, historical billing data from Fulton County and population projections broken down by census tract through 2050 from the Atlanta Regional Commission (ARC) were used to project growth and demand. In February 2024, the ARC adopted the most recent Series 17 population and employment forecast from 2020-2050.

The water demand projections calculated Fulton County's Water and Wastewater Master Plan 2007 Updated (2007 Fulton County Master Plan, JJG; 2008) and the newly calculated water demands for the City of Milton are shown below in Table ES-1. The new demands show a lower demand trend based on population projections, data provided by the city on new development and redevelopment projects, current and future land use planning policies, existing per capita water uses extracted through historical billing data and conservation from more water-efficient fixtures expected in the future. The historical demand and baseline data used for the current demand forecast is also lower than estimated water demand developed for the 2007 Fulton County Master Plan.

Table ES-1. Historical and Projected Annual Average Day Water Demand for the City of Milton

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005 [2]	3.8	NA
2010 [2]	4.6	NA
2020 [2]	5.7	3.4
2021 [2,3]	5.8	3.5
2025	6.0	3.9
2030	6.2	3.9
2035	6.5	4.0
2040	NA	4.1
2045	NA	4.2

Year	2007 Water Demand Forecast [1] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2050	NA	4.4

Notes:
AADD-MGD = annual average daily demand in million gallon(s) per day.
NA = Not Available
[1] Water demand forecast as shown in the 2007 Fulton County Master Plan.
[2] Historical water demand shown under the 2024 Water Demand Forecast was calculated using billing records and water supplied data.
[3] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

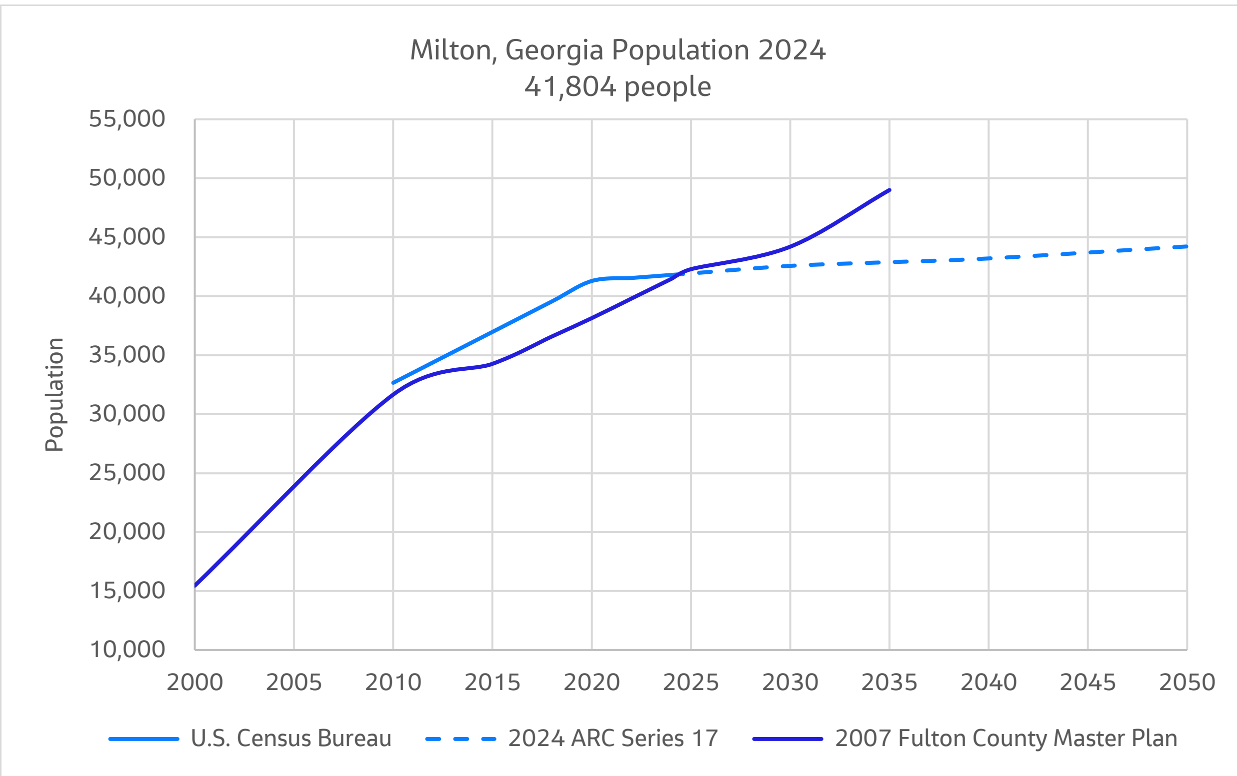
Additional information about the development of the Milton water demand projection is included in the Technical Memorandum herein.

1. Introduction

As part of the *Fulton County Water Distribution System Master Plan* (Fulton County 2008), it is essential to forecast water demand for the municipalities within North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. To determine the future water demands for the cities, meetings were held with the community development departments of each city. This memo summarizes the findings of those meetings, research, and information from planning departments and various sources to develop water demand projections.

The present-day City of Milton, Georgia, was formerly a part of the Cherokee Nation. With fewer than 4,000 residents, Milton County was formed in 1857 from portions of northeastern Cobbs, southwestern Forsyth, and southeastern Cherokee counties. Fulton County annexed Milton County on January 1, 1932. This region has continued to expand and prosper. The City of Milton was incorporated in 2006. Its traditional mix of small-town living and easy access to nearby cities has made it a desirable location, so it has grown since its establishment. In 2024, the population is 41,804 with the anticipation of strong population growth in the future. Figure 1 shows Milton's historical population growth and its projected population increase as published by the ARC in 2024.

Figure 1. Population Trend for the City of Milton



Source: U.S. Census Bureau, Series 17 Population Forecast from 2020-2050 (ARC, 2024) and 2007 Fulton County Master Plan.

Milton residents rely on the Tom Lowe Atlanta-Fulton County Water Treatment Plant for their water supply. Milton's distribution system is comprised of 228 miles of pipe of multiple materials such as cast iron, copper, and ductile iron. There are booster pump stations off Bethany Road (2 pumps), Freemanville Road (4 pumps), Providence Road (2 pumps), an elevated tank and a ground tank off Freemanville Road, and two elevated tanks off Bethany Road. Crabapple, Milton Lakes, Deerfield, and Bethany are some of the

Milton character areas served by the Fulton County wastewater treatment plant. Septic systems are used for all other sewer services in Milton.

As shown on Figure 1 and in Table 1, the City of Milton has consistent growth overall with its projected population and water demand. In the 2007 Fulton County Master Plan, the water demand for Milton was forecasted to reach 5.7 million gallons per day (MGD) by 2020, with a slight increase to 6.5 MGD by 2035 as shown in Table 1. These estimates were based on population projections, with per capita water usage rates set at 81.3 gallons per capita per day (GPCD) for residential purposes and 53.6 GPCD for non-residential purposes, as stipulated in the 2007 Fulton County Master Plan.

Table 1. Previous Water Demand Projections of Cities within Fulton County (MGD)

Jurisdiction	Water Demand (MGD)				
	2005	2010	2020	2030	2035
Milton	3.8	4.6	5.7	6.2	6.5
Alpharetta	7.6	11.4	14.5	16.4	17.4
Johns Creek	9.2	9.5	10.3	10.6	10.7
Roswell	12.6	12.9	13.5	13.7	13.9

Source: 2007 Fulton County Master Plan

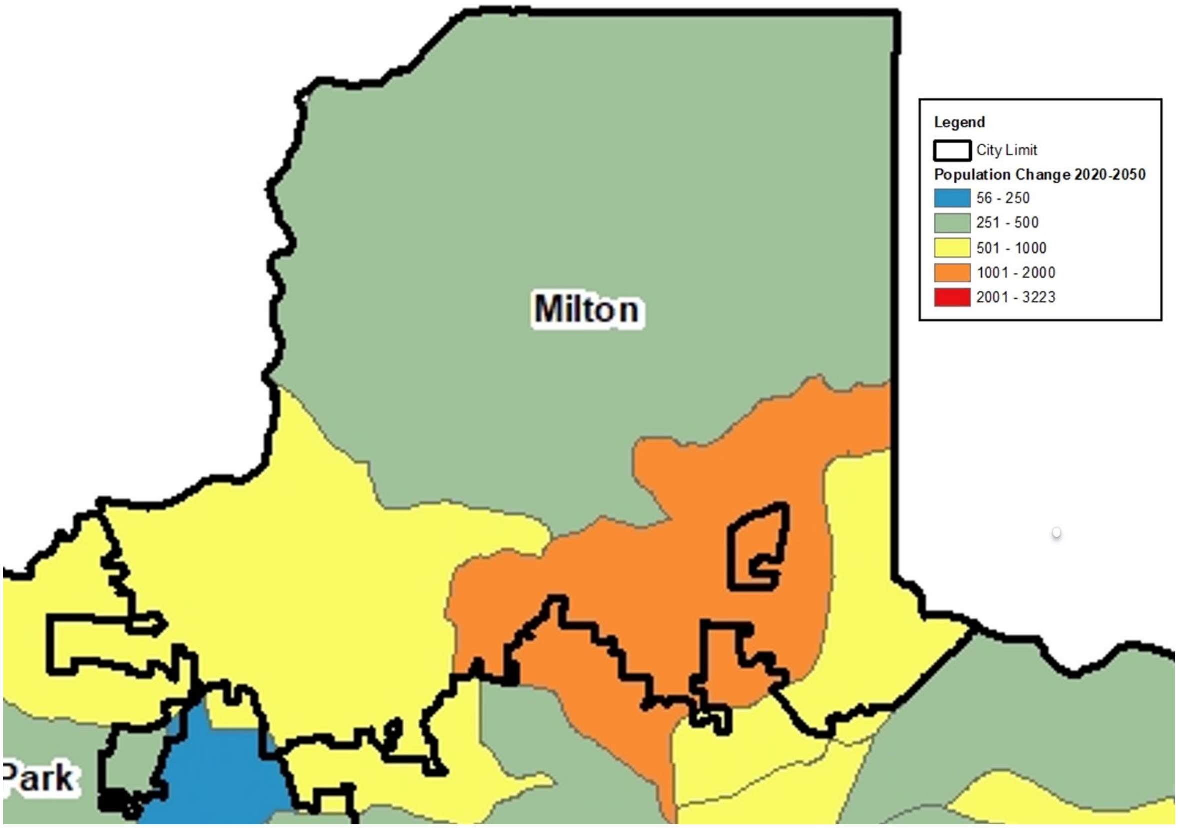
Despite the population growth in Milton, billing records show that water demand for the city did not reach the expected water demand levels stated in the 2007 Fulton County Master Plan. Moreover, demand remained below 4 MGD throughout the period of record (2017-2021). The high demand of 3.6 MGD for 2019 was attributed to lower precipitation levels experienced during that year. Billing records show a combined per capita water usage rate of 91 GPCD. This reduction may be attributed to lower population growth, advancements in water-saving technologies, the adoption of efficient water use practices, the implementation of water conservation programs, and shifts in climate and weather patterns.

2. Meeting Summary

On December 12, 2023, representatives from the Jacobs team and Fulton County convened with officials from the City of Milton to discuss the *Fulton County Water Distribution System Master Plan*. Attachment 1 shows the meeting presentation and sign-in sheet. This plan emphasizes the municipalities in North Fulton County, outside of Atlanta's service area, including Milton, Alpharetta, Johns Creek, and Roswell. The primary objective of these discussions was to evaluate the future requirements of Milton for the *Fulton County Water Distribution System Master Plan*.

Currently, Milton has established a daily water demand of 2.79 MGD and a peak reaching 6.29 MGD. Milton anticipates higher growth than what the census tract maps reflect. The green area on Figure 2 shows the Central Milton census tract area, which is expected to remain a low-density development region with large lots. In this area of low-density development, septic tanks supply most of the sewer services. Milton describes the orange area on Figure 2 as Sweetapple/Arnold Mill, which is experiencing growth, and the yellow Deerfield character area as mostly built out. According to Milton staff, the primary expansion growth corridor in the yellow Deerfield character area is near Georgia State Highway 9 (GA 9).

Figure 2. Population Projections per Census Tract for North Fulton County



Source: Fulton County Water Distribution System Master Plan

An urban growth boundary (UGB) has been established around the sewage area. Within specific geographic areas, the UGB is used for limiting dense urbanization. Overall, the City of Milton is expected to reach its maximum building capacity by 2040. Milton aims to maintain its rural characteristics while offering access to urban conveniences.

Milton staff stressed the importance of the existing elevated water storage tanks, which need maintenance. Staff would like to know the maintenance schedule for these tanks. Fulton County staff members indicated they would contact the tank maintenance group for more information. For water distribution system planning, Fulton County has mentioned that there may be a need for additional water storage tanks to maintain the necessary water pressure. Milton staff expressed concern about the possibility of the additional tanks and their locations. If additional tanks are required to meet the water demands, Milton staff would request more public outreach assistance from the county.

Milton would prefer that the *Fulton County Water Distribution System Master Plan* take into consideration the long-term objectives of the city, which include the following:

- For new developments, it is recommended to have a looped water distribution system. The looped water system will minimize water quality issues normally associated with dead-end mains.
- For new developments, master meters will not be used.
- For general usage, water conservation is encouraged.

3. Future Developments

Since 2006, the City of Milton has created citywide initiatives to preserve its small town quality and to focus its future development on supporting this quality of life. The Fulton County/Jacobs team reviewed various relevant information, including the *2040 Milton Comprehensive Plan* (City of Milton 2021b) and the city's vast interactive GIS data.

Milton delineated eight character areas, each of which has distinctive characteristics and aspirations for the future. Figure 3 illustrates Milton's character areas and the availability of the Fulton County sewer area within Milton. These character areas are described in the following sections.

3.1 Arnold Mill

This area is the southwest gateway to Milton from the City of Roswell and Cherokee County. The primary land use in Arnold Mill is rural and low-density residential. Arnold Mill plans to develop its public recreation space. Fulton County provides sewage to the part of Arnold Mill adjacent to Crabapple.

3.2 Bethany

Bethany has the eastern boundary with Forsyth County, while the remaining boundaries are encircled by the character areas of Deerfield and Central Milton. This character area contains approximately 10 subdivisions built between 1978 and 2016. Bethany plans to continue its dominant land use of residential properties of similar types and styles. All of Bethany uses sewer services from Fulton County.

3.3 Birmingham

This region lies in the northwestern part of Milton, bordering Cherokee County to the west. It is the most northern part of Fulton County and mostly comprises rural areas with forests and horse farms. Septic systems are in use throughout Birmingham.

3.4 Central Milton

The largest of all the character areas is Central Milton. Numerous upscale home communities provide expansive lots exceeding 1 acre, some of which feature exclusive recreational amenities such as tennis courts, golf courses, and swimming pools. Large woodlands and other nature preserves controlled by the city are among the many green spaces in Central Milton. When new development areas are integrated, Central Milton intends to preserve the rural, low-density residential land uses throughout the city. Septic systems are in use throughout Central Milton.

3.5 Crabapple

Crabapple boasts a unique rural village core with the highest concentration of historical preservation. Crabapple Road is home to several residential complexes, new commercial buildings, and transportation upgrades. Crabapple plans to continue to promote a pedestrian-oriented community. Fulton County provides sewage to the lower portion of Crabapple.

3.6 Deerfield

The mix of residential, commercial, and office uses at higher densities sets this character area apart. Deerfield intends to keep redeveloping and building in its available space in a mix of higher-density combinations that complement neighboring projects in Forsyth County and Alpharetta. All of Deerfield receives sewer services from Fulton County.

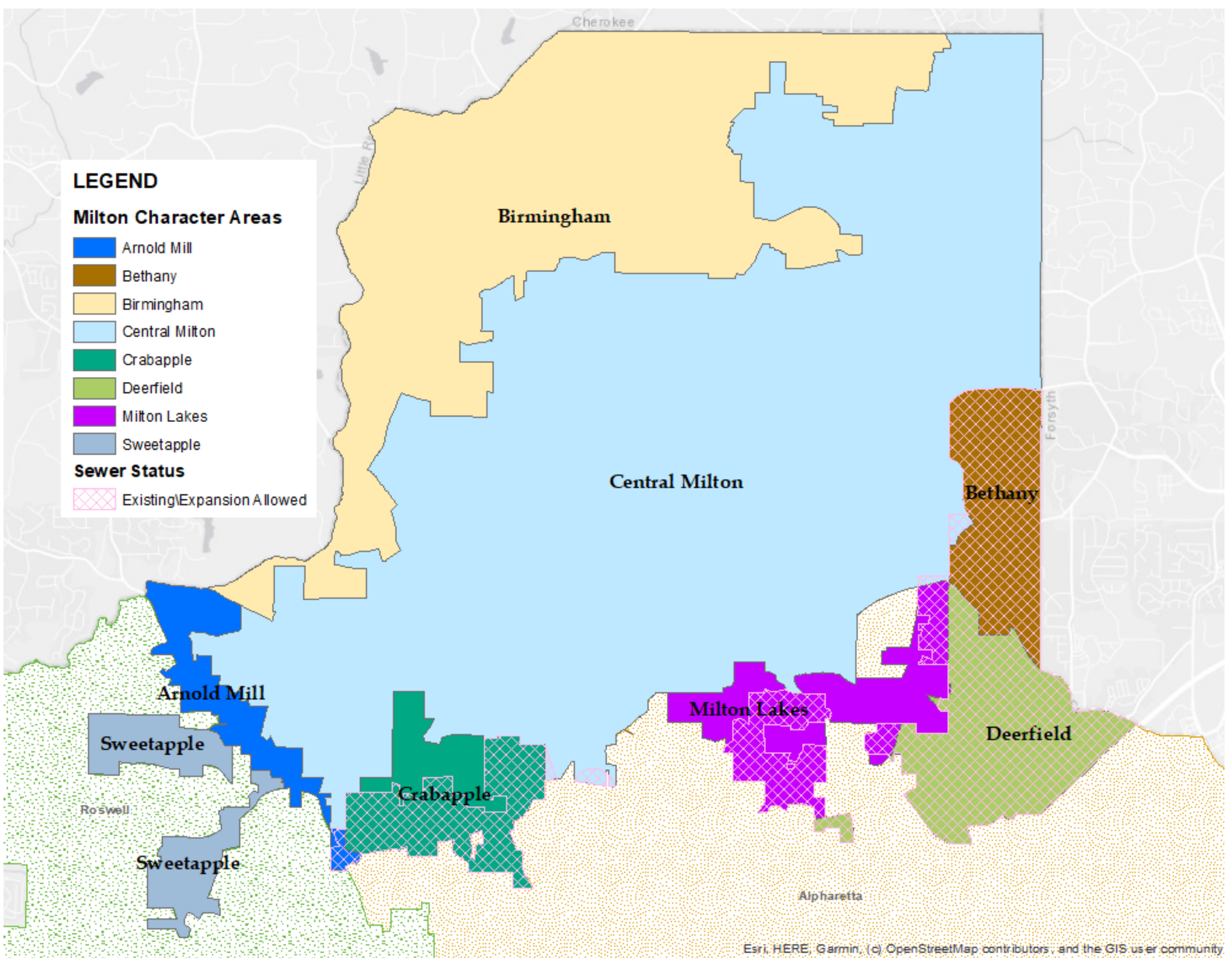
3.7 Milton Lakes

This area is bordered by the City of Alpharetta, the Deerfield character area, and the Central Milton character area. It has a blend of low-density residential and medium-density residential neighborhoods. The *2040 Comprehensive Plan* (City of Milton 2021b) recommends that Milton Lakes minimize redevelopment of this area into a higher-density multi-family residential area. Milton Lakes' sewage is serviced by septic systems or the Fulton County Wastewater Plant.

3.8 Sweetapple

This region is divided into two sections and bound on three sides by Roswell. It is in the southwest corner of Milton. It features woodlands, pastures, and horse farms. It is considered the most rural of Milton's character areas. Sweetapple plans to continue its typical agricultural and rural-residential pattern of development. Septic systems are in use throughout Sweetapple.

Figure 3. City of Milton Character Areas and Sewer Status with Fulton County



Source: Milton On-Demand GIS Data

In Table 2, each of the developments are listed, along with the location of the development (address), description (number of housing units, commercial description), water demand, and timing (expected completion year). The table lists active and potential development projects in Milton, arranged alphabetically by location (Character Area) and development name, respectively.

Table 2. Ongoing and Future Development Plans for the City of Milton

Name	Location (Character Area/Description)	Description	Water Demand (gallons/day)	Timing
Chadwick Village	Arnold Mill - Arnold Mill Rd	Mixed-use gas station with convenience store and other retail space	28,000	Current Project
Birmingham Crossroads Office Building	Birmingham -Birmingham Hwy/ Birmingham Rd	Medical office building	28,000	Current Project
Crossroads at Birmingham	Birmingham	New neighborhood, 35 single-family lots	10,200	Current Project
Little River Estates	Birmingham -11040 Taylor Rd (near Little River Farms)	15 single-family lots, 27.49 acres	3,900	Current Project
Claxton Subdivision	Central Milton – Hopewell Rd	12 single-family lots, 17.27 acres	3,120	Current Project
Deerhaven Preserve Subdivision	Central Milton -Freemanville Rd	Gated neighborhood, 9 single-family lots, 25 acres, with 2.84 acres for conservation	3,440	Current Project
Heatherton Subdivision	Central Milton - Mayfield Rd	New neighborhood, 21 single-family lots, 33.99 acres	6,560	Current Project
The Homestead at Milton	Central Milton - Hopewell Rd	32 single-family lots, each lot is 3.04 to 10.33 acres, 172.8 acres	9,420	Current Project
Lyndon Creek	Central Milton - Cogburn Rd	11 single-family lots, 14 acres	2,860	Current Project
Oaks at Francis	Central Milton - Francis Rd (Old Field)	7 single-family lots, minimum lot size > 1 acre, 10.2 acres	1,820	Current Project
Providence Point	Central Milton - New Providence Rd and Birmingham Hwy	5 single-family lots, 6.56 acres	1,300	Current Project
Whisper Woods	Central Milton - New Providence Rd and Birmingham Hwy	5 single-family lots, 11 acres	1,300	Current Project
Thompson Estates	Central Milton	7 single-family lots, 23.119 acres	1,820	Current Project
Thompson Oaks	Central Milton - Thompson Rd (adjacent to Fire Station #42)	16 single-family lots, 20.52 acres	4,160	Current Project

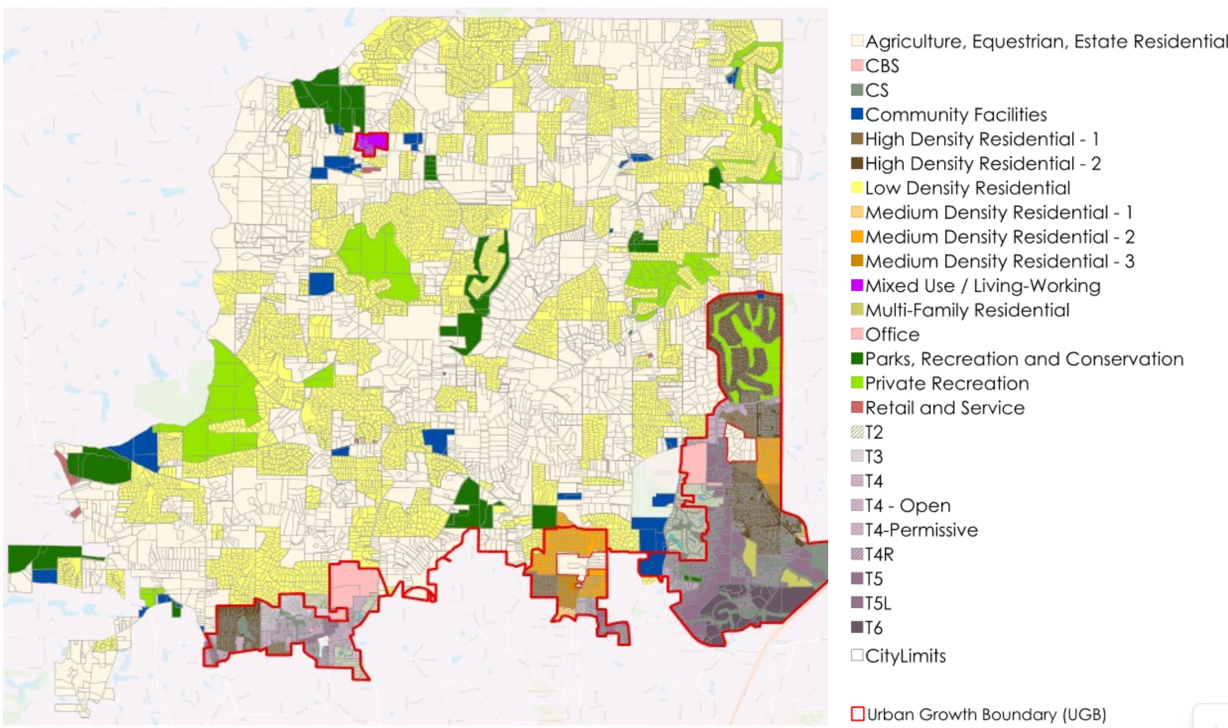
Name	Location (Character Area/Description)	Description	Water Demand (gallons/day)	Timing
Braeburn Townhomes	Crabapple - Heritage Walk	9 single-family lots, summer 2023 – remaining 3 units under construction	2,340	Current Project
Echo at Crabapple	Crabapple	23 single-family lots, 4.88 acres	5,980	Current Project
Market District Crabapple	Crabapple	Mixed use – restaurant, office, retail, and residential spaces, 2 buildings completed in 2022, 2 buildings under construction	112,000	Current Project
Milton Pointe at Broadwell	Crabapple - Southern part of Crabapple	New mixed use with condominiums, restaurants, and retail	28,000	Current Project
Milton Towns	Crabapple - Branyan Trl	14 single-family lots, townhomes	3,640	Current Project
Stone House Tap	Crabapple	Reuse of Crabapple Stone House to a new restaurant	28,000	Current Project
Town Center East	Crabapple - Mayfield Rd	Mixed use: retail, office, and commercial business uses, 4story building with a proposed second building	56,000	Current Project
Daycare Facility	Deerfield - Webb Rd	Childcare facility, 6,342 square feet	28,000	Current Project
Deerfield Dentistry	Deerfield	2-story dental office, 8,147 square feet, with tenant space	28,000	Current Project
Henderson Mixed-Use Development	Deerfield	Retail/commercial tenants on the first floor, office space on the second floor	28,000	Current Project
Millstone Parc	Deerfield - Webb Rd and Deerfield Pkwy	9 stacked flats/ duplexes, 1.401 acres	18,000	Current Project
Crescent Ridge	Milton Lakes - Hopewell Rd	11 single-family lots, 9.045 acres	2,860	Current Project
The Ridge at Sweetapple	Sweetapple - Ebenezer Rd	19 single-family lots, 25.3 acres	4,940	Current Project

The planned and ongoing developments illustrated in Table 2 should be considered short-term projects because they are active developments. From the Community Development Online GIS data, the interactive map illustrates approximately 29 development projects.

3.9 Current and Future Land Use

In addition to the character area map, Milton also uses a UGB as a growth management strategy to recognize denser urbanization within designated areas of the city, such as Crabapple and Deerfield/GA 9. Milton and Fulton County agreed in the early 2000s to limit the number of sewer connections in Milton's rural areas. With this agreement and its usage of the UGB, Milton created a future land use map that designates more than 90 percent of Milton as low-density residential areas. Figure 4 illustrates the location of the UGB, which corresponds with the area where an existing sewer or the expansion of a sewer is allowed.

Figure 4. City of Milton's Urban Growth Boundary



Source: Milton website Community Development

Milton has an on-demand GIS data view for its land use for the periods of 2023, 2035, and 2040. Along with the UGB, the intended future development pattern and density in these character areas are reflected in the future land use. These data were also referenced in the *2040 Comprehensive Plan* (City of Milton 2021b). From these data, tabular attributes were created to illustrate the land use composition for each period. Currently, the top three land use categories are agriculture/ equestrian, low-density residential, and forest/undeveloped areas. Milton intends to keep the city's rural character while promoting growth, and this is reflected in the composition of land uses.

Table 3 illustrates the estimated number of acres and percentage of each future land use for 2040. In order of highest to lowest percentage of land used, the top three land use categories are agriculture/ equestrian/estate residential, low-density residential, and private recreation areas. The percentages shown below represent the city's intention to continue maintaining low residential density to enhance the natural resources and rural character, to support the "live-work-play" model, and to maintain recreation space to improve the previously mentioned items within the designated character area.

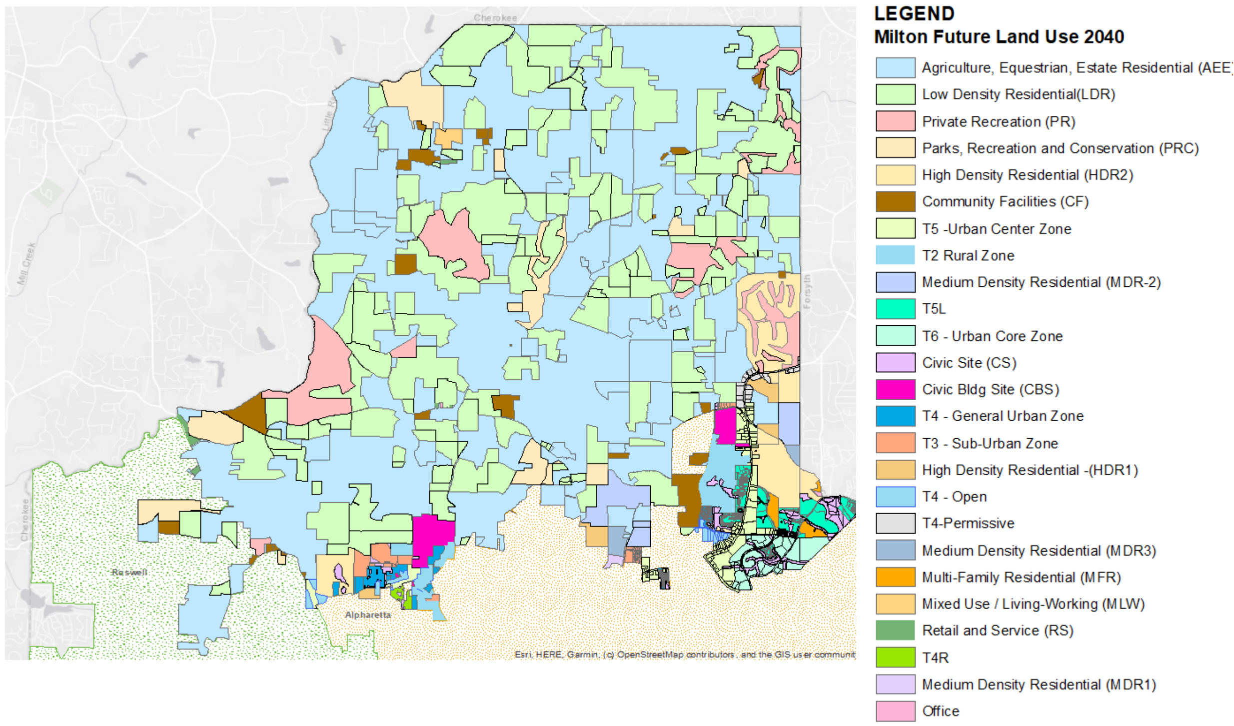
Table 3. City of Milton Land Use 2040

Land Use Categories	Area in Acres	Percent by Acre
Agriculture, Equestrian, Estate Residential (AEE)	11,877	47.03%
Low-Density Residential (LDR)	7,492	29.67%
Private Recreation (PR)	1,185	4.69%
Parks, Recreation and Conservation (PRC)	834	3.30%
High-Density Residential (HDR-2)	768	3.04%
Community Facilities (CF)	458	1.81%
T5 - Urban Center Zone	353	1.40%
T2 - Rural Zone	284	1.13%
Medium-Density Residential (MDR-2)	281	1.11%
T5L	276	1.09%
T6 - Urban Core Zone	234	0.93%
Civic Site (CS)	220	0.87%
Civic Building Site (CBS)	217	0.86%
T4 General Urban Zone	130	0.52%
T3 Sub-Urban Zone	126	0.50%
High-Density Residential (HDR-1)	120	0.48%
T4 Open	104	0.41%
T4 Permissive	66	0.26%
Medium-Density Residential (MDR-3)	65	0.26%
Multi-Family Residential (MFR)	54	0.21%
Mixed Use / Living-Working (MLW)	40	0.16%
Retail and Service (RS)	29	0.11%
T4R	21	0.08%
Medium-Density Residential (MDR-1)	15	0.06%
Office (O)	4	0.02%
TOTAL	**25,254**	**100.00%**

Source: Calculated using Milton Land Use GIS Data

Figure 5 illustrates Milton's land use for 2040. The allocation of agricultural and equestrian land use was broadened to include residential estates. The Estate Residential category is a large residential estate with at least 3-acre lots on gravel roads. To further reflect the area's development pattern, several land categories for residential density on different lot sizes were introduced. Milton preserves its city's rural character while promoting growth in designated areas within the specified character area.

Figure 5. City of Milton Land Use 2040

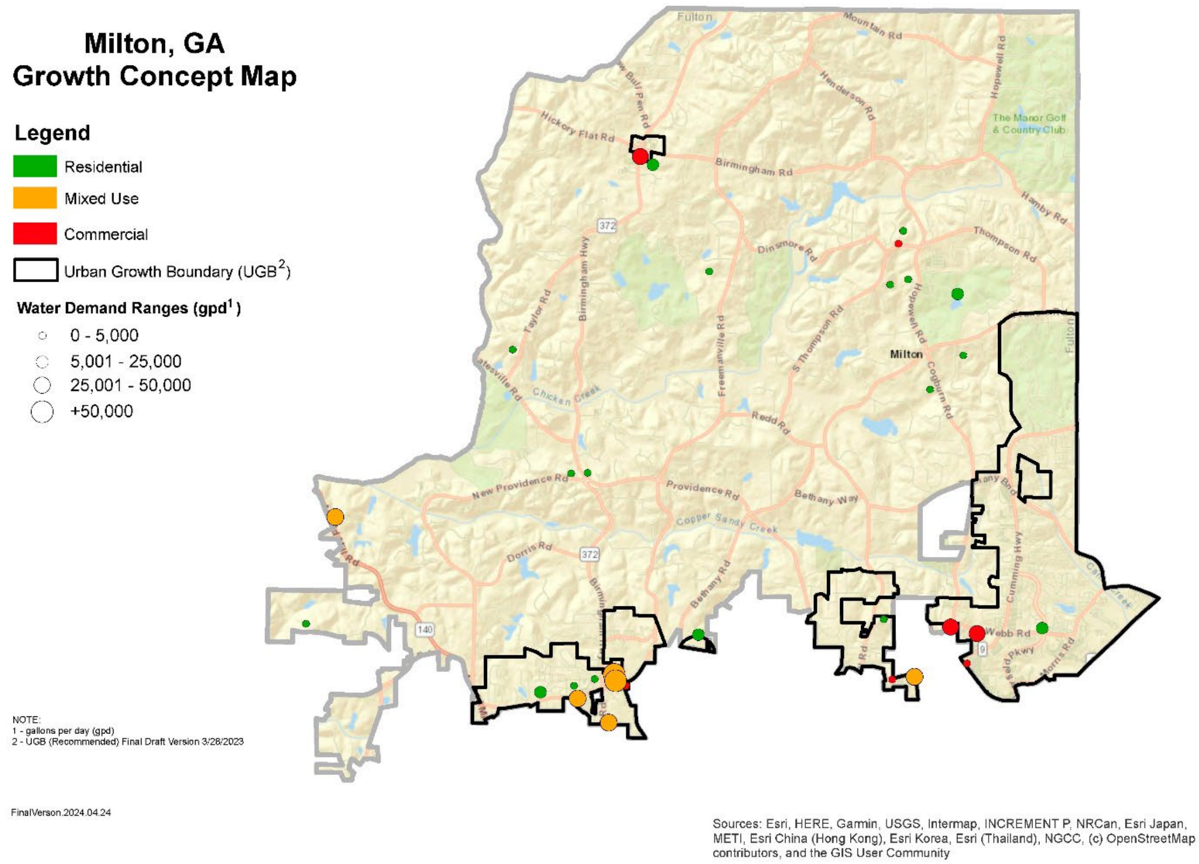


Source: Milton On-Demand GIS Data

4. City-Specific Water Demand Forecast

The water demand forecast for the City of Milton will be used to update the Fulton County's water distribution system hydraulic model and determine if additional infrastructure is needed to provide adequate water service and fire protection to meet future needs out to 2050. Based on the data provided by the city and the new development and redevelopment projects being built or permitted as of February 2024, water demand is expected to increase approximately 0.5 MGD in the future. The projection considers factors such as available land for development, current land use and comprehensive land planning policies by the city, existing per capita water uses extracted through historical billing data, as well as anticipated conservation efforts through the adoption of more water-efficient fixtures. While single-family residential areas may expect the most development, new commercial businesses are the biggest users of water. Figure 6 shows the development areas and future growth for the City of Milton based on the information provided by the city and available planning documents.

Figure 6. Future Growth Areas for the City of Milton



Water demand calculations based on growth beyond developments are not all known by the city; therefore, additional demands were also calculated using ARC population projections and the most current billing data. These water demand results in an expected increase of approximately 0.9 MGD by 2050. Adopting a conservative approach, the demand curve was developed using higher increase in demand as calculated using future development plans. Table 4 and Figure 7 show the historical data and the proposed forecast for the City of Milton. The current demand forecast shows a lower demand projection that follows the most current historical demand and baseline data used for the current demand forecast is less than half of the estimated water demand developed for the 2007 Fulton County Master Plan.

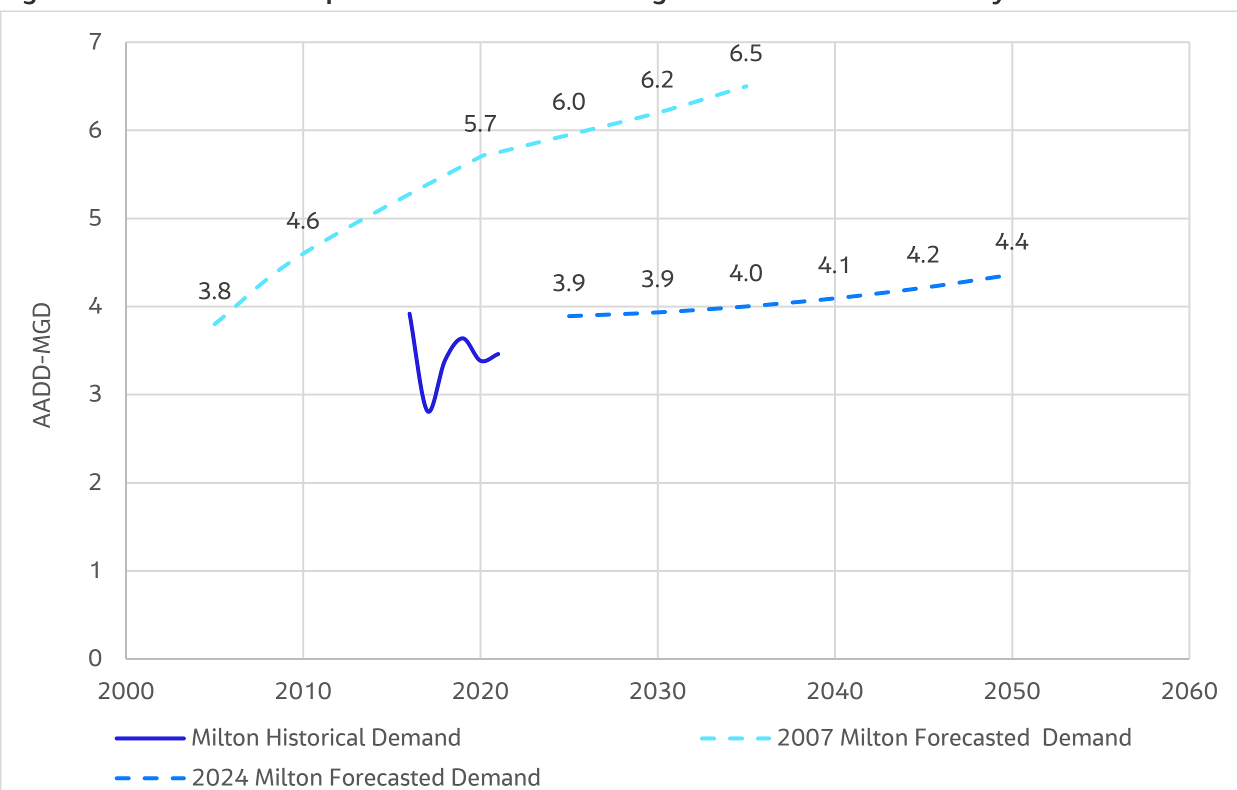
Table 4. Historical and Proposed Future Annual Average Water Demand for the City of Milton

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2005	NA	3.8	NA
2010	NA	4.6	NA
2017	2.82	NA	NA
2018	3.39	NA	NA

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Water Demand Forecast (AADD-MGD)
2019[3]	3.64	NA	NA
2020	3.38	5.7	NA
2021[4]	3.46	5.8	NA
2025	NA	6.0	3.9
2030	NA	6.2	3.9
2035	NA	6.5	4.0
2040	NA	NA	4.1
2045	NA	NA	4.2
2050	NA	NA	4.4

Notes:
AADD-MGD = annual average daily demand in million gallon(s) per day.
NA = Not Available
[1] Historical water demand calculated using billing records and water supplied data.
[2] Water demand forecast as show in the 2007 Fulton County Master Plan.
[3] Water demand data for the year 2019 reflects an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that year.
[4] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Figure 7. Historical and Proposed Future Annual Average Water Demand for the City of Milton



5. References

City of Milton. N.d. Milton, GA | Home. https://www.miltonga.gov/.

City of Milton. N.d. Milton on demand. https://ondemand-miltonga.hub.arcgis.com/.

City of Milton. 2019. *City of Milton Comprehensive Parks & Recreation Master Plan*. March.

City of Milton. 2021a. *Milton Strategic Plan, 2021-2025*. March.

City of Milton. 2021b. *Milton Comprehensive Plan 2040*. October.

City of Milton. 2022. *City of Milton Crabapple Area Personal Transportation Vehicle (PTV) Plan*.

City of Milton. 2023a. *Milton Final Draft Urban Growth Boundary (UGB) Map*. May.

City of Milton. 2023b. *Comprehensive Transportation Plan*. December.

City of Milton. 2024. Milton, GA, Private Development. ArcGIS StoryMaps. https://storymaps.arcgis.com/stories/90c2a451e1e4495ab3e7c20e43d6c2ea.

City of Milton Community Development. N.d. Community Development | Milton, GA. https://www.miltonga.gov/government/community-development.

City of Milton Community Development. N.d. Urban Growth Boundaries | Milton, GA. https://www.miltonga.gov/government/community-development/zoning/urban-growth-boundaries.

JJG. 2008. W*ater and Wastewater Master Plan 2007 Update*

Milton Historical Society. N.d. *History of Milton*. https://www.miltonhistoricalsociety-georgia.org/history-of-milton.html.

U.S. Census Bureau. 2024. Census.gov. https://www.census.gov/.

https://worldpopulationreview.com/hAtlanta Regional Commission. 2024. Population and Employment Forecast. https://atlantaregional.org/atlanta-region/population-employment-forecasts/

Attachment 1
Meeting Presentation and Meeting Sign-in Sheet

Appendix E
Roswell Water Demand Projections

Water Demand Projections for North Fulton County – City of Roswell

Date: September 10, 2024
Project name: Fulton County Water Distribution System Master Plan
Project no: EEXK6102
Client: Fulton County Government
Revision no: 3
Document no: 240311082933_48bc3f14

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Executive Summary

Fulton County serves water to the cities in North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. As part of the Fulton County Water Distribution System Master Plan, water demand projections for each of the cities were developed to appropriately plan for reliable water service to them in the future.

Fulton County staff and Jacobs met with members from the cities to discuss future developments that could be used to develop water demand projections. The community development and public works departments were very helpful in supplying information. In addition, historical billing data from Fulton County and population projections broken down by census tract through 2050 from the Atlanta Regional Commission (ARC) were used to project growth and demand. In February 2024, the ARC adopted the most recent Series 17 population and employment forecast from 2020-2050.

The water demand projections calculated Fulton County's *Water and Wastewater Master Plan 2007 Update* (2007 Fulton County Master Plan, JJG; 2008) and the newly calculated water demands City of Roswell are shown below in Table ES-1. The new demands show a significantly lower demand trend based on population projections, data provided by the city on new development and redevelopment projects, current and future land use planning policies, existing per capita water uses extracted through historical billing data and conservation from more water-efficient fixtures expected in the future. The historical demand and baseline data used for the current demand forecast is approximately half of the estimated water demand developed for the 2007 Fulton County Master Plan.

Table ES-1. Historical and Projected Annual Average Day Water Demand for the City of Roswell

Year	2007 Water Demand Forecast[1] (AADD-MGD)	2024 Fulton County Water Demand Forecast (AADD-MGD)[2]
2005[3]	12.6	NA
2010[3]	12.9	NA
2020[3]	13.5	6.9
2021[3,4]	13.5	7.1
2025	13.6	7.3
2030	13.7	7.5
2035	13.9	7.8
2040	NA	8.1

2045	NA	8.8
2050	NA	9.5

Notes:
AADD-MGD = annual average daily demand in million gallons per day.
NA = Not Available
[1] Water demand forecast as show in the 2007 Fulton County Master Plan.
[2] Includes the water demands as indicated in the Roswell Water Utility Master Plan, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.
[3] Historical water demand shown under the 2024 Water Demand Forecast was calculated using billing records and water supplied data.
[4] Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Additional information about the development of the Roswell water demand projection is included in the Technical Memorandum herein.

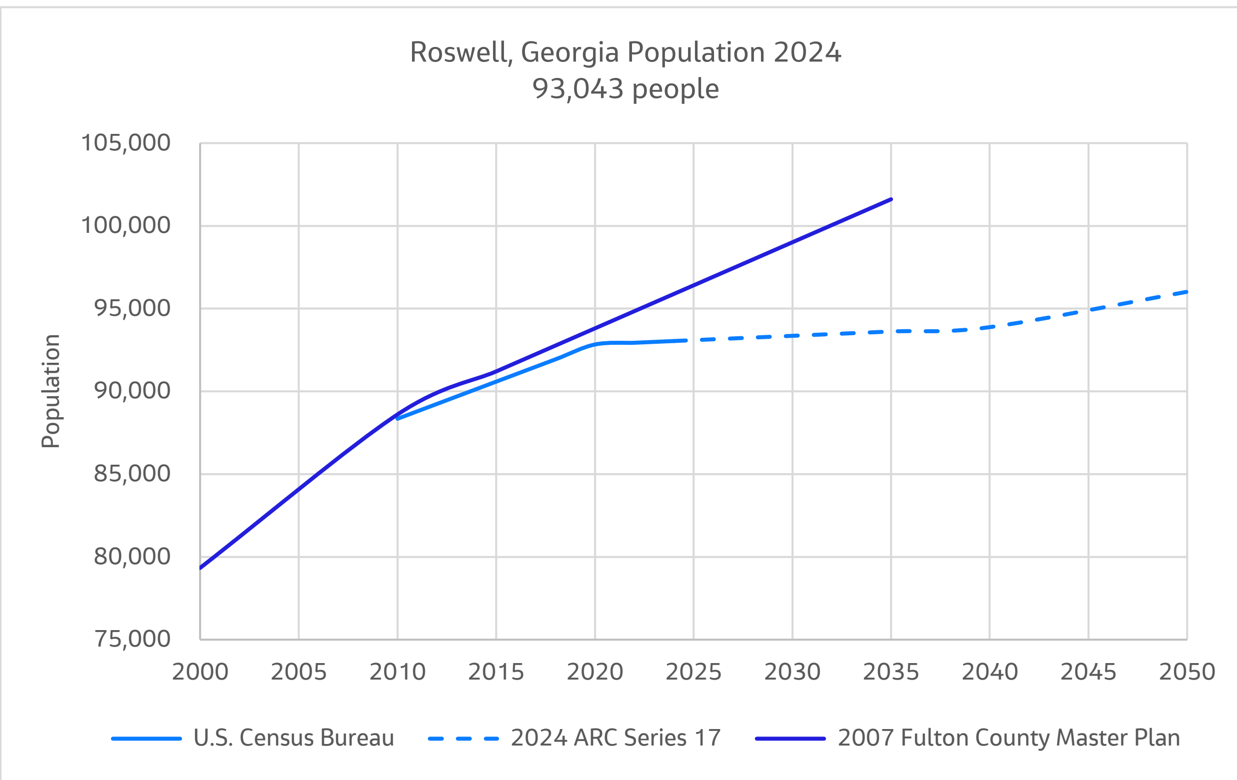
1. Introduction

As part of the *Fulton County Water Distribution System Master Plan*, it is essential to forecast water demand for the municipalities within North Fulton County, including Alpharetta, Johns Creek, Milton, and Roswell. To determine the future water demands for the cities, meetings were held with the community development departments of each city. This memorandum summarizes the outcomes of the meeting with the City of Roswell, integrating research and insights from the city planning departments and various sources to develop water demand projections.

In 1828, Roswell King traveled to the Cherokee Nation's "gold country" to investigate business opportunities. In his travels, he came upon the confluence of the Chattahoochee River and Big Creek, and he saw the business potential of harnessing the waterpower of these sources. Roswell King moved to the area in 1836 and established the Roswell Manufacturing Company, a mill to make textiles, using the power of the local rivers. Roswell officially became a city on February 16, 1854 (Roswell Historical Society Library and Archives).

According to the 2020 U.S. Census Bureau data, City of Roswell was home to approximately 92,833 individuals. Today, Roswell extends north from the Chattahoochee River, encompassing historic homes, a downtown, and green spaces laid over the rolling hills of north-central Georgia. Roswell is the eighth largest city in Georgia and has a population in 2024 of 93,043. Figure 1 illustrates the historical population growth and its projected population increase as published by the ARC in 2024.

Figure 1. Population Trend for the City of Roswell



Source: U.S. Census Bureau, Series 17 Population Forecast from 2020-2050 (ARC, 2024) and 2007 Fulton County Master Plan

Roswell Water Utility operates the Roswell Water Treatment Plant (WTP) and maintains its distribution mains within the south-central portion of the city. Fulton County provides water from the Tom Lowe Atlanta-Fulton County Water Treatment Plant for the remainder of the city. The portion of Fulton's distribution system within the city limits of Roswell is comprised of 336 miles of pipe of multiple materials such as cast iron, copper, ductile iron, galvanized iron, PVC, RCP, and steel. There is one booster pump station (three pumps) on Mansell Road, two elevated tanks on Hembree Road and two elevated tanks on Hackett Road.

Per the population projections outlined in 2007 Fulton County Master Plan, the water demand for Roswell was forecasted to reach 13.5 million gallons per day (MGD) by the year 2020, with a slight increase to 13.9 MGD by 2035 as shown in Table 1. These estimates were based on population projections, with per capita water usage rates set at 81.3 gallons per capita per day (GPCD) for residential purposes and 53.6 GPCD for non-residential purposes, as stipulated in the 2007 Fulton County Master Plan.

Table 1. Previous Water Demand Projections of Cities within Fulton County (MGD)

Jurisdiction	Water Demand (MGD)				
	2005	2010	2020	2030	2035
Roswell	12.6	12.9	13.5	13.7	13.9
Alpharetta	7.6	11.4	14.5	16.4	17.4
Johns Creek	9.2	9.5	10.3	10.6	10.7
Milton	3.8	4.6	5.7	6.2	6.5

Source: 2007 Fulton County Master Plan

2. Meeting Summary

On December 4, 2023, representatives from the Jacobs team and Fulton County team convened with officials from the City of Roswell to discuss the *Fulton County Water Distribution System Master Plan*. Attachment 1 shows the meeting presentation and sign-in sheet. This plan emphasizes the municipalities in North Fulton County outside of Atlanta's service area, including Roswell, Alpharetta, Johns Creek, and Milton. The primary objective of these discussions was to evaluate the future requirements of Roswell for the *Fulton County Water Distribution System Master Plan*.

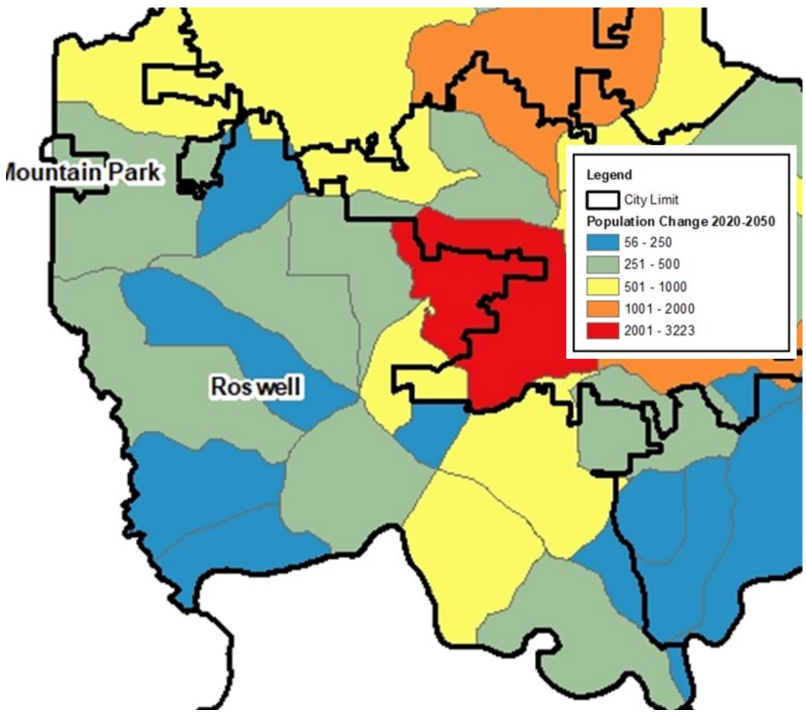
Unlike other North Fulton County municipalities, Roswell operates and maintains the Roswell WTP to service a portion of its water demand needs. In addition to the plant, Roswell Water Utility operates and maintains 89 miles of distribution waterline mains and three elevated storage tanks within the Roswell water distribution system. Roswell Water Utility maintains six interconnections with the Fulton County water distribution system. Of the six interconnections, Roswell Water Utility primarily uses two interconnections, GA 9 Interconnect and Pine Grove Road Interconnect. The other four interconnections located at Warsaw Road (removed and replaced with new Wavetree interconnection), Riverside Road, Willeo Road, and Grimes Bridge Road are valved off and serve as emergency backup water supplies for the Roswell Water Utility service area. Fulton County is responsible for maintaining and testing the interconnect meters and Roswell is responsible for maintaining and testing the backflow prevention valves. Fulton County provides water service to those customers not served by the Roswell Water Utility.

According to Fulton’s historical water usage data, Roswell has a current water demand of 7.2 MGD and a peak of 10.7 MGD. Roswell staff believes that the peak demand may have occurred in June and July with outdoor water usage. This demand excludes what the City of Roswell provides from its treatment plant and distribution system.

The Atlanta Regional Commission (ARC) has developed a series of population and employment forecasts within 21 counties up to the year 2050. Population projections per census tract for Roswell are presented in Figure 2. ARC population projections indicated an average of 2 percent to 3 percent population growth per year in Roswell. City of Roswell staff believes that its population growth projection will be closer to 3 percent. While reviewing the ARC population projection map, there is a red-highlighted census tract that indicates a large population change of 2,001 to 3,223. The red census tract on the map seems unexpected to Roswell staff since it represents a more industrial area. In January 2022, Roswell completed the *Roswell Water Utility Master Plan,* which anticipated a 3 percent population growth.

Fulton County and Jacobs team asked if the Roswell staff used the traffic analysis zone (TAZ) U.S. Census Bureau projections. Roswell staff could not confirm the use of TAZ projections; however, they noted that the city does have the City of Roswell *Transportation Master Plan 2023 Update*. The next update to this document is anticipated to occur in 2028. Roswell staff mentioned that in the northwest area of the city, the Grand Reserve subdivision (near the intersection of Grand Litchfield Drive and Arnold Miller Road) anticipated more growth.

Figure 2. Population Projections per Census Tract for North Fulton County



Source: Fulton County Water Distribution System Master Plan

Roswell expects high-density growth to occur in the economic development pod areas only. There are four economic development areas or pods that were identified and discussed. The four pods were described as follows:

- **Roswell Downtown:** This is an older area with more redevelopment and there is a mixed use of residential and commercial.
- **The Mountain Park area:** This is in the northwest part of the city and is described as having single-family units with septic tanks only.
- **The southwest area of the city:** This part of the city is considered built out.
- **The Alpharetta Highway and Holcomb Bridge Road intersection:** These areas are expected to redevelop into new use, adaptive mixed-use and commercial infill.

The Fulton County and Jacobs team later found out the economic development pods had been merged into one development region.

Roswell has considered several redevelopment areas for mixed-use development of residential and commercial uses. The industrial area will have a townhouse development, but there will be a height restriction in these redevelopment areas that typically is three stories. Multi-family units with commercial mixes also have height restrictions that typically are four to five stories. The historic district has a height restriction of three stories, with some exceptions for four-story buildings. The Old Roswell Road area near Harlow has an eight-story limit. Hotels near the intersection of State Road 400 (GA 400) and Holcomb Bridge are restricted to heights of nine to ten stories with permitting. They indicated that the southwest area of the city is mostly built out. Kimberly Clark is one of the major employers in Roswell and the corporation is headquartered in a seven-story building. Adjacent buildings in the area have a maximum height of three stories.

The Fulton County and Jacobs team inquired if Roswell had a fire flow requirement for its emergency demand such as a pressure of 150 pounds per square inch. The fire flow requirement is a standard set to maintain a minimum sufficient water flow and pressure to fire hydrants. Roswell indicated that the Roswell Fire Department input will be recommended. The team will contact the Roswell Fire Department to better understand the fire flow requirement.

Roswell inquired if an additional water storage tank would be considered for future planning. Fulton County staff did respond that the option of an additional water storage tank to ensure water demands are met is a possibility.

3. Future Developments

The City of Rowell has several resources provided on its website, from various city plans such as the *Roswell Water Utility Master Plan* and the *2040 Comprehensive Plan*, as well as the interactive GIS viewer that shows both intended future land use and currently planned developments. Roswell delineated thirteen character areas with distinctive characteristics and aspirations for the future. Figure 3 illustrates Roswell's character areas. These character areas are described in the following sections:

3.1 Estate Residential

This area will continue to share an estate lot pattern; the low-density character of this area also preserves large acres of open space. Much of this area is not currently served by sewer and therefore has limited future development potential at any density greater than that currently existing. Specific land uses in this area are comprised of primarily single-family residential.

3.2 Suburban Residential

This character area continues to foster stable, established suburban neighborhoods. Existing single-family neighborhoods are preserved and protected in their current state, as are pockets of existing other housing types that occur on scattered sites, some within master planned neighborhoods. Suburban Residential areas often reflect a large lot and/or natural environment. Infill and redevelopment opportunities are limited and should be sensitive to scale and character when implemented.

3.3 Neighborhood Residential

Neighborhood Residential areas are established, traditional suburban-oriented neighborhoods often in a subdivision setting, some within large master planned neighborhoods. Neighborhood Residential areas often reflect medium to large lots. Opportunities for infill and redevelopment are limited but should be realized with a commitment to preserving the existing scale and character. All new development is limited to single-family housing with a density and character matching the character area's overall existing patterns.

3.4 Active Neighborhood

Active Neighborhoods areas accommodate small-lot single family and multi-family areas near commercial areas and major roadways. Opportunities for infill and redevelopment are often limited and should be realized while respecting the existing scale and character.

3.5 Neighborhood Serving Area

Neighborhood Serving Area continues to provide commercial uses for nearby existing neighborhoods in a manner that is compatible with their scale and character. It provides for an assortment of retail, restaurant, and services uses within compact, walkable locations centered on key intersections. Within these areas, Roswell will carefully manage transitions of use between them and the adjacent neighborhoods through the controls required by the Unified Development Code (UDC).

3.6 Commercial Mixed-Use

Holcomb Bridge Road west of GA-400 and areas surrounding the GA-400 node will become a mixed-use village paired with open space. New development in the western portion of the character area will create a mixed-use, pedestrian friendly corridor and activity center that builds a better sense of community.

3.7 Major Activity Area

Roswell will capitalize on this major regional access point to provide maximum economic benefit to the city. The perception of this area will change as Roswell invests in streetscape and new road improvements, and investors redevelop underutilized sites with a mix of uses characterized by high quality building materials. The Big Creek Parkway with a bridge connection across GA 400 north of Holcomb Bridge Road is anticipated to begin construction within a few years. Likewise, various conversations involving heavy rail transit or BRT from MARTA have identified this area as a likely location. Therefore, future development should be sensitive to and compatible to the possibility of the area eventually emerging as a Transit Oriented Development.

3.8 Historic Area/Downtown

The Historic District includes Canton Street, Oak Street, Mimosa Boulevard, Atlanta Street, and other areas. This area will continue to serve as a destination point. As change occurs around the Historic District, the area will need to continue to be protected and additional threatened historic sites should be protected and added to the district. The Groveway Community will implement design initiatives to create a community that includes pocket parks; mixed residential and retail uses; and a strong connection visually and aesthetically to Canton Street. The Historic District Master Plan will be a guiding document for this area.

3.9 Industrial / Flex

This cluster of industrial and heavy commercial development will continue to function as an office and business distribution district. The uses in the area will be flexible however, allowing transitions to new uses as economic demand changes. These new uses may include mixed residential and office development. This area is not located along a major gateway to the city and is also not located adjacent to Roswell’s cultural or recreational assets. Therefore, it is ideally situated to continue functioning as an employment center within the city limits with an additional mix of uses.

3.10 Highway 9

A gateway will be established at the City boundary along the Alpharetta Highway/SR 9 corridor to announce arrival into Roswell. Existing big-box developments will have evolved either into a new use or enhanced with additional amenities to keep viable beyond the typical 20-year life cycle. A regulatory framework that encourages flexibility of uses for these existing structures will generate economic value for Roswell. The vacant or underutilized strip centers will achieve adaptive mixed-use and commercial infill.

3.11 Parkway Village

This corridor has a historic character. Any transportation project that is implemented along this corridor will preserve the existing character of the corridor. Vehicular and pedestrian interparcel access between adjacent parcels has been achieved. The single-family residences located along the corridor will be incrementally converted to office/professional use.

3.12 Holcomb Bridge Road

This area will be regulated by an overlay district which will protect the established single-family neighborhoods to the north and south of the corridor. The overlay will include signage or a similar element that is also found in the Parkway Village Character Area portion of the corridor. This corridor will be traversed by multi-use trails which connect the Big Creek Park, the Chattahoochee River, and the adjacent single-family neighborhoods. The development along the corridor will be a mix of uses to allow for residential to integrate with retail and commercial. A gateway will be established at the eastern end of the character area to create a sense of arrival.

3.13 Conservation / Greenspace

This character area includes a portion of the Chattahoochee River National Recreation Area. This undeveloped and protected parkland is bounded on the west by Big Creek, which flows from the character area south to the Chattahoochee River. This area will continue to serve as a major recreational area for Roswell and the region. Further opportunities to provide access to the park via walking or cycling should be explored. This park serves as a major piece of the interconnected trail system envisioned for Roswell.

In Table 2, each of the planned and ongoing developments are listed, along with the character area of the city in which they are located, the location of the development (address), description (number of housing units, commercial description), water demand, and timing (expected completion year). Table 2 identifies developments from the Roswell Community Development online viewer. The viewer illustrates developments in four categories: Pending, Approved, Under Construction, and Denied. The expected completion year (Timing column) is not stated on the viewer. The table lists active and potential development projects in Roswell, arranged alphabetically by location (Character Area) and development name, respectively.

Table 2. Ongoing and Future Development Plans for the City of Roswell

Name	Location (Character Area, Address)	Description	Water Demand (gallons/day)	Timing	Notes
Alstead Shops	Commercial Mixed Use. – 2000 Holcomb Bridge Rd	Holcomb Bridge Rd west of GA 400 and surrounding area	2,200	Under Construction	NA

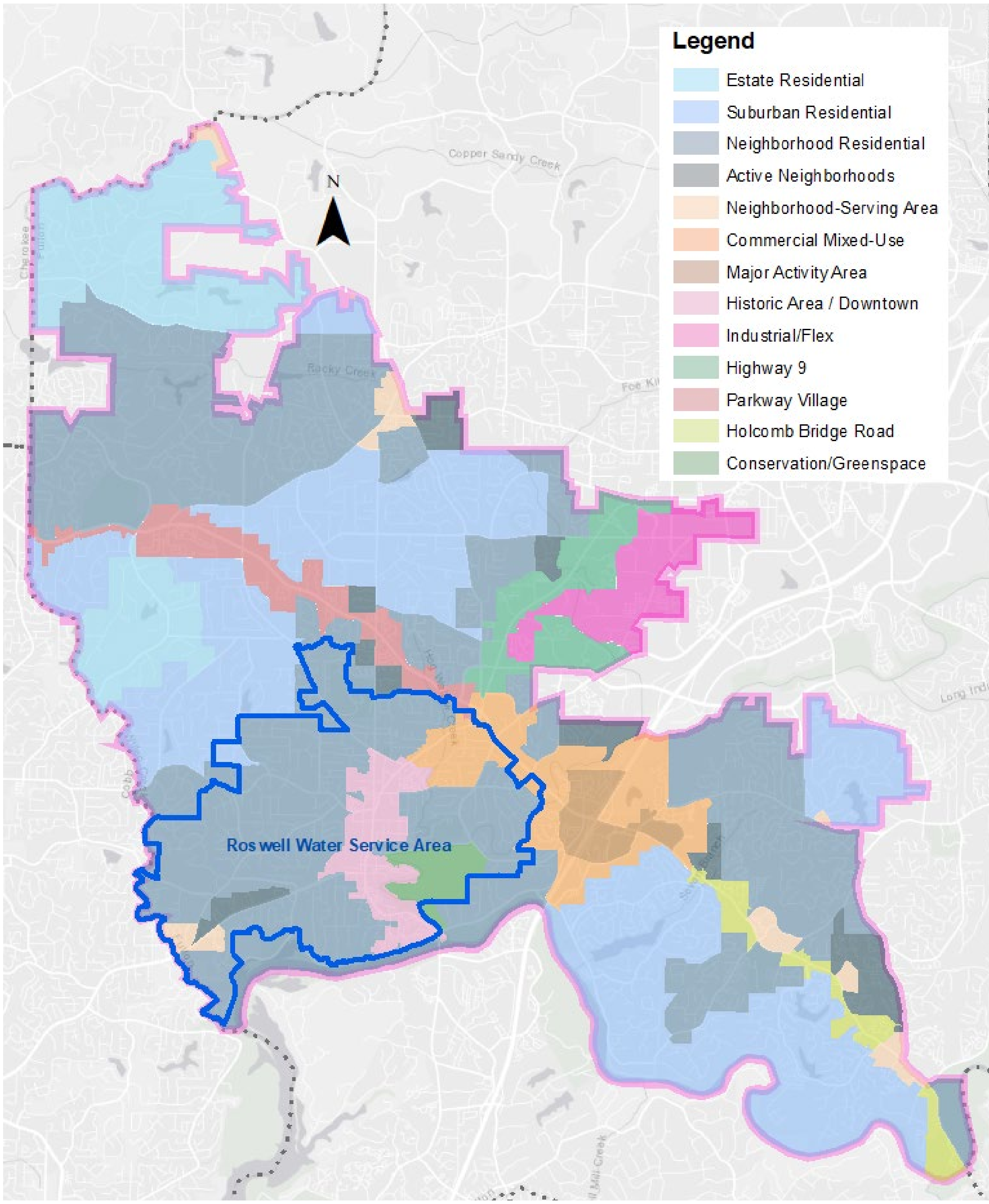
Name	Location (Character Area, Address)	Description	Water Demand (gallons/day)	Timing	Notes
		Retail shopping – 11,200 SF, 60 parking spaces. Mixed-use pedestrian. Redeveloped.			
East Village Redevelopment	Commercial Mixed Use. - 2600 Holcomb Bridge Rd	350 apartments, 76 townhomes, 6,000 SF commercial. Mixed-use pedestrian. Redeveloped.	90,000	Under Construction	NA
Etris Grove	Suburban Residential Central and southwest cluster – 12155 Etris Rd	27-lot single-family neighborhood. Infill and redevelopment should be limited with sensitivity to scale.	5,960	Under Construction	There are five zones in this area matching the height of the neighborhood.
Ferncroft	Estate Residential Northwest area – 845 Cox Rd	24 Estate Lots. The pattern is low density, with 1 dwelling unit/ acre requirement. Preserves large acres of open space.	5,420	Under Construction	Currently, it is not served by sewer.
Maison Subdivision	Active Neighborhood. 11310 Houze Rd	7-lot single-family and multi-family residential near commercial areas and major roadways.	2,360	Under Construction	NA
Parkside Estates	Neighborhood Residential. Various designated larger areas – 9050 Fouts Rd	45-lot single-family homes and townhomes. Infill and redevelopment should be limited. Typically, it is medium to large lots.	9,200	Under Construction	NA
Roswell Community Mosque	Neighborhood Serving – 13170 Crabapple Rd	Commercial use (Place of Worship) for nearby neighborhoods. 3 buildings 48,000 SF, 174 parking spaces	59,400	Pending	NA
Roswell Water Utility	**6 interconnections with Fulton County Water**	**Roswell Water Utility to purchase water from Fulton County Water to supplement demands.**	**20,000–1,240,000**	**2024–2050**	**Refer to Section 3.15 for more details.**

Source: Roswell GIS Development Projects Map Viewer

The Community Development Online GIS data illustrates 65 development projects on March 6, 2024. Of these, 30 percent of the development projects were within the Roswell Water Utility service area, and the rest will be served by Fulton County water distribution.

Figure 3 illustrates the Roswell Water Utility service area with its various character areas, which are identified in the *2040 Comprehensive Plan*. The Roswell Water Utility serves the area that is outlined in blue. The Fulton County water service area provides water to the remainder of the city that is not served by the Roswell Water Utility. Roswell has adopted UDC regulations and guidelines. Roswell will use the design-based provisions of the UDC in the character areas identified in the *2040 Comprehensive Plan*. Roswell manages transitions of use between character areas and the adjacent neighborhoods through the controls required by the UDC.

Figure 2. Roswell Character Areas with the Roswell Water Service Area Boundary

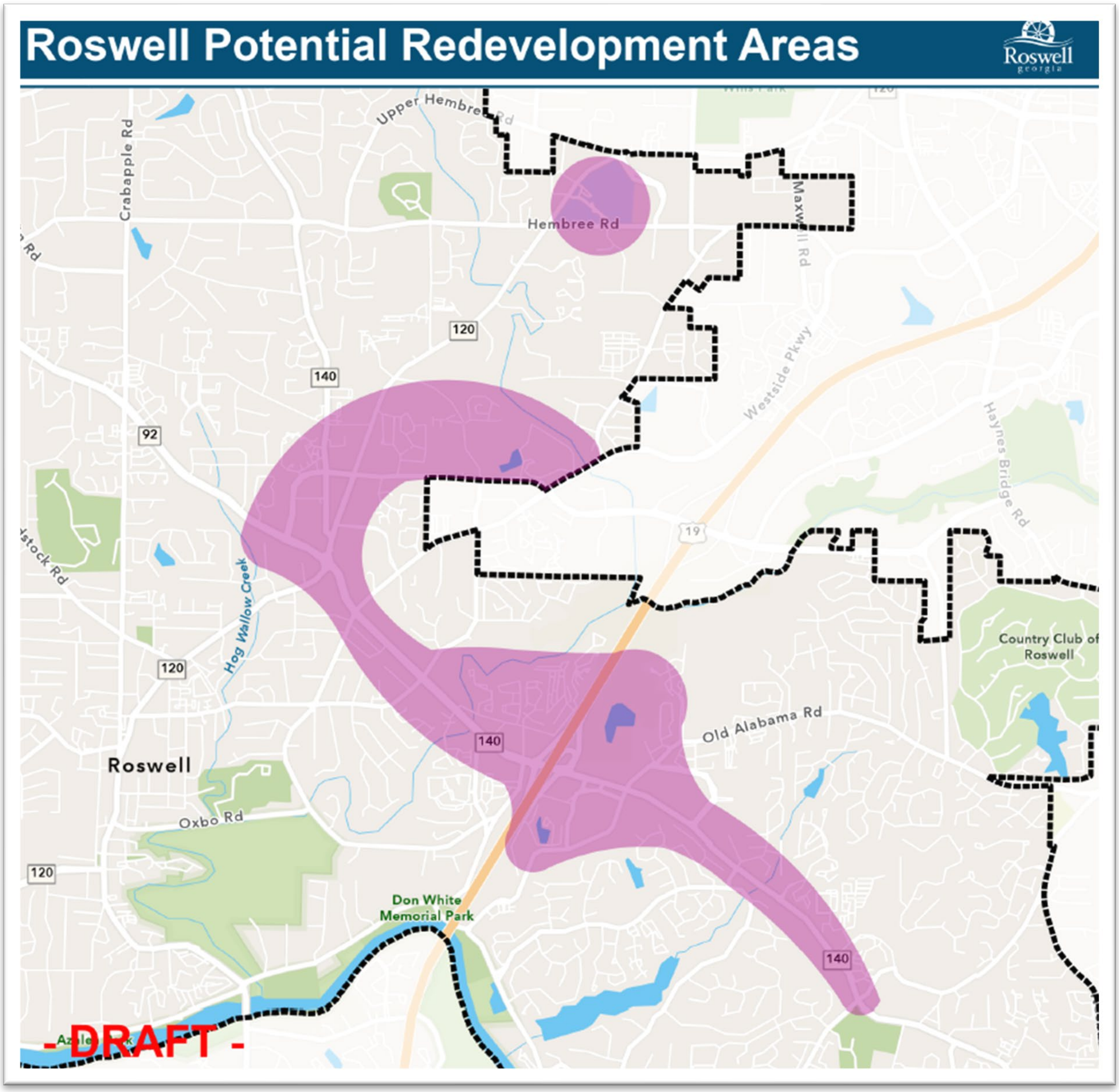


Source: 2040 Comprehensive Plan

3.14 Redevelopment Areas

Using the *Strategic Economic Development Plan*, the City of Roswell pursued preserving and advancing the local economy. The city will encourage redevelopment in several concentrated areas. Roswell also has used the *Urban Redevelopment Plan* to commit public investment within these redevelopment areas. From the Livable Centers Initiative studies, the city will undertake projects based on the study results of an action plan consisting of transportation, regulations, and housing projects. The draft map of potential redevelopment areas (Figure 4) shows these locations.

Figure 3. Draft Map of Roswell Potential Redevelopment Areas



Source: Roswell GIS Department

These potential redevelopment areas are along Holcomb Bridge Road (GA 140) and near North Fulton Medical Center. Since most of the redeveloped area is outside the Roswell Water Utility service area and will be served by Fulton County water distribution lines, it is recommended the water service to these areas be evaluated. Table 3 illustrates the estimated land use areas to be redeveloped based on the preceding map and GIS data. The proposed redevelopment's total area is approximately 1,373 acres.

Table 3. Redevelopment Land Use Composition

Land Use	Redevelopment Percent Area by Land Use	Redevelopment Area (Acres)	Percent Area by Land Use
Neighborhood-serving Area	18%	77	6%
Holcomb Bridge Road	30%	115	8%
Major Activity Area	100%	349	25%
Commercial Mixed-Use	18%	346	25%
Highway 9	61%	485	35%
TOTALS		**1,373**	**100%**

Source: Calculated by Roswell Future Land Use GIS Data

3.15 Roswell Water Utility Master Plan and North Fulton County Water Distribution

Water demands in the system are dependent on the population and number of customers served and their associated water use. Roswell Water Utility developed the *Roswell Water Utility Master Plan* in 2022. Roswell Water Utility operates the Roswell WTP (3.3 MGD) and maintains distribution mains within the south-central portion of Roswell. The capacity of the treatment plant is limited by the Georgia Environmental Protection Division water withdrawal permit (Permit Number 060-1209-01; effective date October 28, 2021; expiration date October 28, 2031) and limits withdrawal from Big Creek to a monthly average of 2.8 MGD.

Roswell Water Utility also operates a groundwater well system that is permitted to withdraw a monthly average rate of 0.167 MGD from a well located at 9400 Willeo Road (Permit Number #060-0007). The groundwater is pumped from the well to the Michael J. Leonard Groundwater Treatment Plant (Permit Number #1210009) located at 485 Willeo Road. The treated groundwater then is blended into the distribution system via a connection at Willeo Road and GA 120. The groundwater is currently used as needed.

Roswell Water Utility implemented a successful and aggressive water conservation rate structure in 2015 and continues other incentives to encourage customers to conserve water. Average annual indoor residential per capita water consumption declined from 75 GPCD in 2015 to 55 GPCD in 2020.

In the *2040 Comprehensive Plan*, all of the historic district and 42 percent of the neighborhood residential character areas are indicated as being served by Roswell Water Utility (along with a small percentage from adjacent character areas near the Roswell Water Service Area). However, the *Roswell Water Utility Master Plan* developed historical and projected water demands for the Roswell water system. Table 4 illustrates the projected growth of water demand for Roswell and the projected demand to be purchased from Fulton County.

Table 4. Roswell Utility Water System Demand Projections

Year	Monthly Average Daily Demand (MGD)	Monthly System Peak Demand (MGD)	Demand Reduction from Water Conservation	Monthly Average Daily Finished Water Production from WTP (MGD)	Monthly Average Daily Withdrawal from Big Creek (MGD)	Monthly Average Daily Well Production (MGD)	Monthly Average Daily Purchase from Fulton County (MGD)
2017	1.47	1.63	--	1.46	1.48	0.00	0.01
2018	1.53	1.70	--	1.52	1.54	0.00	0.01
2019	1.73	2.18	--	1.69	1.74	0.00	0.04
2020	1.79	2.07	0.1%	1.76	1.79	0.00	0.03
2021	1.84	2.21	0.1%	1.82	1.86	As Needed	0.02
2022	1.90	2.27	0.1%	1.88	1.91	As Needed	0.02
2023	1.95	2.34	0.1%	1.93	1.97	As Needed	0.02
2024	2.01	2.41	0.1%	1.99	2.02	As Needed	0.02
2025	2.07	2.48	0.1%	2.05	2.08	As Needed	0.02
2026	2.12	2.55	0.1%	2.10	2.14	As Needed	0.02
2027	2.19	2.62	0.1%	2.17	2.21	As Needed	0.02
2028	2.25	2.70	0.1%	2.23	2.27	As Needed	0.02
2029	2.32	2.78	0.1%	2.30	2.34	As Needed	0.02
2030	2.37	2.85	0.5%	2.35	2.40	As Needed	0.02
2040	3.14	3.77	0.5%	2.75	2.80	0.17	0.22
2050	4.16	4.99	0.5%	2.75	2.80	0.17	1.24
2060	5.51	6.61	0.5%	2.75	2.80	0.17	2.59
2070	7.29	8.75		2.75	2.80	0.17	4.37

Source: Roswell Water Utility Master Plan, 2022. Appendix F – Water Conservation Plan. Table 8-Roswell Water System Demand Projections.

Roswell is projecting limited use of the Fulton County Water Distribution System through 2030; emergency use only from the six interconnections. After 2030, Roswell is projecting the need to use Fulton County to balance water demands in its service area, 0.22 MGD in 2040 to 1.24 MGD in 2050.

In Section 2.6 of the *Roswell Water Utility Master Plan*, Roswell identified several customers within the city's water system boundary that are currently being served by Fulton County because of low pressures in the city's system, which leads to lost revenue by the city. Roswell is evaluating the cost of upgrades to tie these customers to the city's water system:

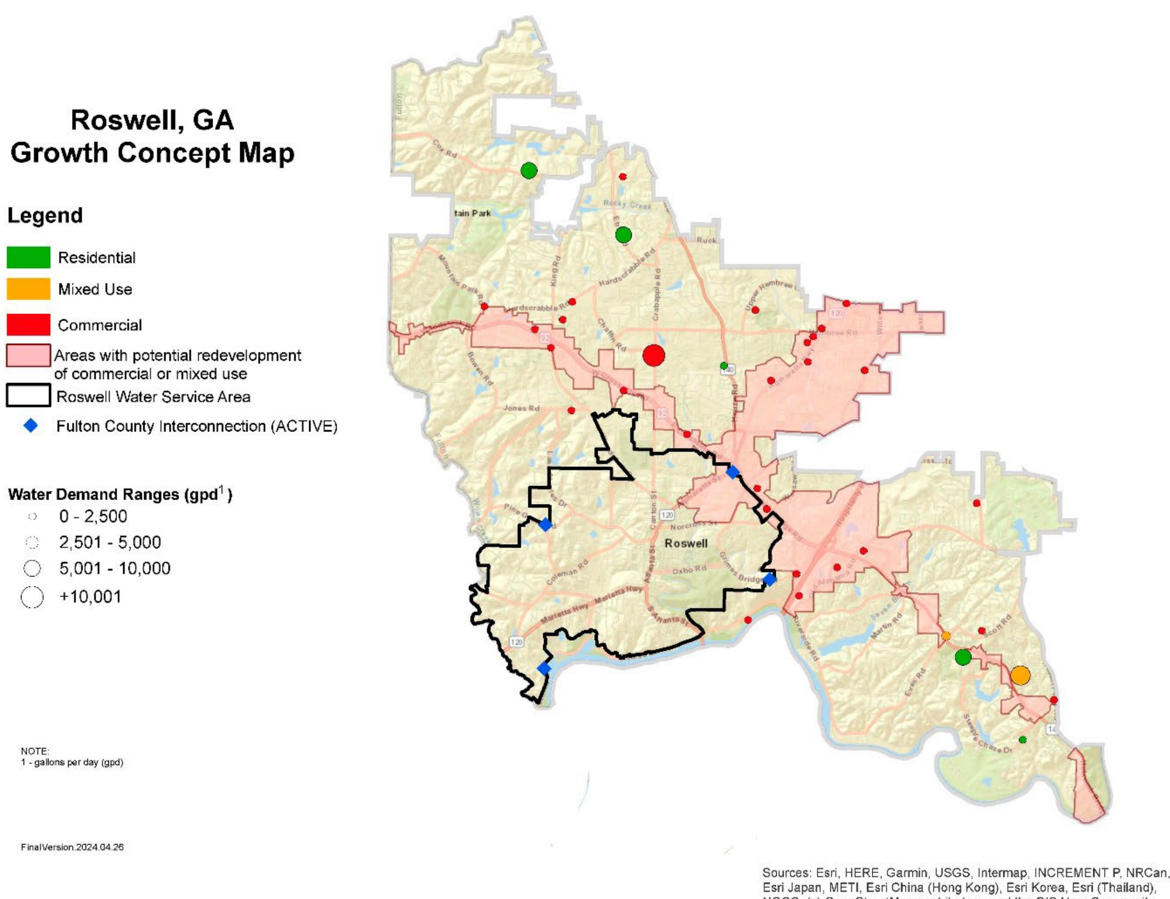
- Swaybranch Drive between Marketplace Road and Warsaw Road
- Wavetree Drive

- Woodstock Road, including Amber Place, Legacy Oaks, Oak Lane, new Fulton County School, Park Bridge Lane, Broadmeadow Cove, and Kiveton Park area
- Park East

4 City-Specific Water Demand Forecast

The water demand forecast for the City of Roswell will be used to update the Fulton County's water distribution system hydraulic model and will determine if additional infrastructure is needed to provide adequate water service and fire protection to meet future needs out to 2050. Based on the data provided by the city and the projects being built or permitted as of February 2024, water demand is expected to increase approximately 1.4 MGD. The projection considers factors such as available land for development, current land use and comprehensive land planning policies by the city, existing per capita water uses extracted through historical billing data, as well as anticipated conservation efforts through the adoption of more water-efficient fixtures. The major water users for the city seem to be commercial and mixed-use development or redevelopment. Figure 5 shows the development areas and future growth for the City of Roswell based on the information provided by the city and available planning documents.

Figure 5. Future Growth Areas for the City of Roswell



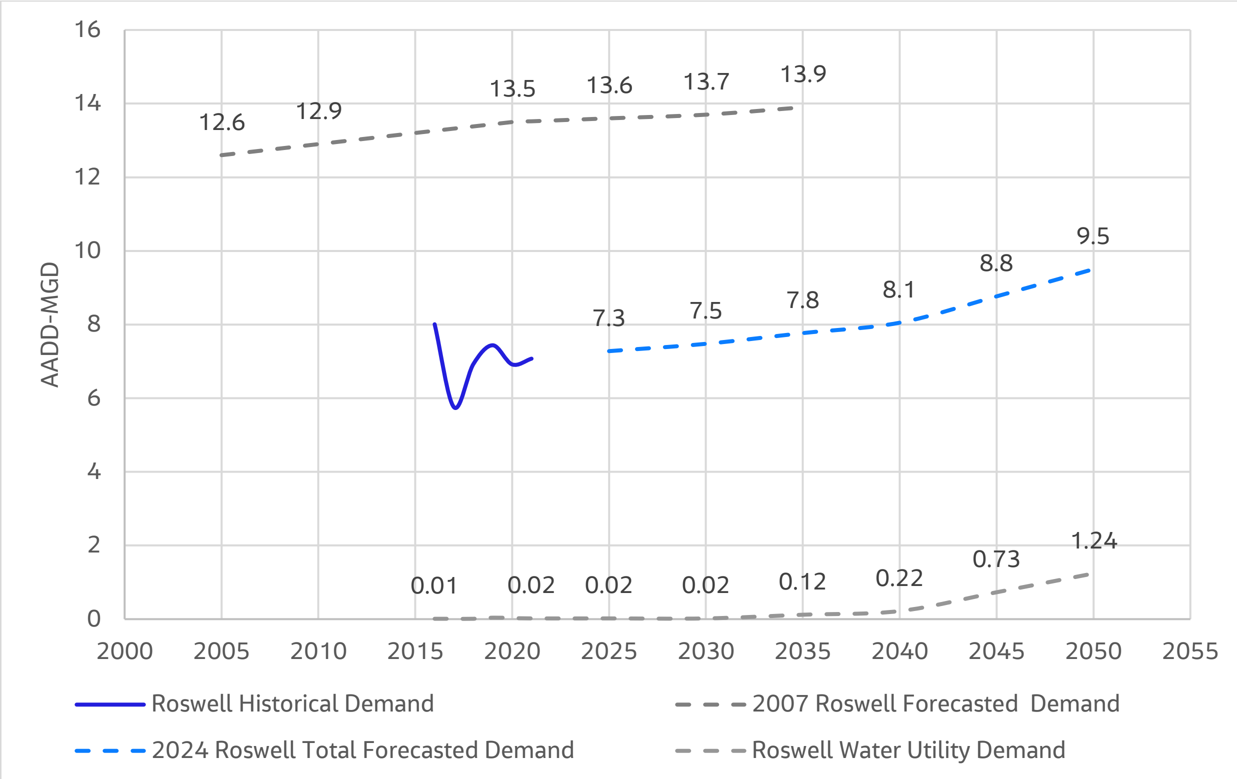
Water demand calculations based on growth beyond developments are not all known by the city; therefore, additional demands projections were also calculated using the ARC population projections and the most current billing data. These water demand projections resulted in an expected increase of approximately 2.4 MGD by 2050. The demands includes additional water sales to the City of Roswell through their interconnection points for sales inside their service area. Adopting a conservative approach, the demand curve was developed using the highest increase in demand as calculated using future development plans. Table 5 and Figure 6 show the historical data and the proposed forecast for the City of Roswell served by Fulton County considering steady growth and redevelopment. The current demand forecast shows a lower demand projection that follows the most current historical demand. The baseline data used for the current demand forecast is half of the estimated water demand developed for the 2007 Fulton County Master Plan.

Table 5. Historical and Proposed Future Annual Average Water Demand for the City of Roswell

Year	Historical Water Demand [1] (AADD-MGD)	2007 Water Demand Forecast [2] (AADD-MGD)	2024 Fulton County Service Area Water Demand Forecast (AADD-MGD)	Roswell Water Utility Interconnections Water Demand (AADD-MGD) [3]	2024 Total Fulton County Water Demand Forecast (AADD-MGD)
2005	NA	12.6	NA	NA	NA
2010	NA	12.9	NA	NA	NA
2017	5.8	NA	NA	NA	NA
2018	6.9	NA	NA	NA	NA
2019 [4]	7.4	NA	NA	NA	NA
2020	6.9	13.5	NA	NA	NA
2021 [5]	7.1	13.5	NA	NA	NA
2025	NA	13.6	7.3	0.02	7.3
2030	NA	13.7	7.5	0.02	7.5
2035	NA	13.9	7.6	0.12	7.8
2040	NA	NA	7.8	0.22	8.1
2045	NA	NA	8.0	0.73	8.8
2050	NA	NA	8.3	1.24	9.5

Notes:
AADD-MGD = annual average daily demand in million gallon(s) per day
NA = Not Available
[1] Historical water demand calculated using billing records and water supplied data.
[2] Water demand forecast as show in the 2007 Fulton County Master Plan.
[3] As indicated in the *Roswell Water Utility Master Plan*, 2022, Table 8—Roswell Water System Demand Projections (Appendix F—Water Conservation Plan), there is an increase in the water purchase from Fulton County to serve the Roswell Water service area to fulfill its demand within its water service areas. As a result, the water demand that Fulton County has directly served and the water demand that Roswell Water Utility has acquired for its water service area combine to provide the county's projected future annual average water demand for 2017 - 2050.
[4] Water demand data for the year 2019 reflects an anomalous higher rate of water consumption that may be attributable to the lower precipitation levels experienced during that period.
5 Billing and water supplied data for 2021 were used as the baseline for the 2024 demand forecast.

Figure 6. Historical and Proposed Future Annual Average Water Demand for the City of Roswell



5. References

Atlanta Regional Commission (ARC). 2024. *Series 17 Forecast Data, covering 2020-2050.* Adopted in February 2024. https://atlantaregional.org/atlanta-region/population-employment-forecasts/

City of Roswell. N.d. Home page. https://www.roswellgov.com/.

City of Roswell. N.d. ARCGIS data. https://data-roswellga.opendata.arcgis.com/.

City of Roswell. 2012. *Strategic Economic Development Plan*. April.

City of Roswell. 2012. *Historic Gateway Master Plan*. June.

City of Roswell. 2013. *Roswell Urban Redevelopment Plan*. November.

City of Roswell. 2021. *2040 Comprehensive Plan*. October.

City of Roswell. 2021. *Strategic Plan 2021 to 2025*.

City of Roswell. 2022. *Roswell Water Utility Master Plan*. January.

City of Roswell. 2023. *Transportation Master Plan*. December.

City of Roswell Community Development Department. N.d. Community Development website. https://experience.arcgis.com/experience/599169ff48124fe7becb643a5b8d3d41/page/Home/.

Fulton County. 2008. *Water and Wastewater Master Plan 2007 Update*.

JJG. 2008. W*ater and Wastewater Master Plan 2007 Update*Roswell Historical Society Library and Archives. N.d. Roswell Historical. https://www.roswellhistoricalsociety.org/.

Roswell Potential Redevelopment Map (DRAFT) provided by Roswell GIS Department

U.S. Census Bureau. 2024. Census.gov. https://www.census.gov/.

Atlanta Regional Commission. 2024. Population and Employment Forecast. https://atlantaregional.org/atlanta-region/population-employment-forecasts/

Attachment 1
Meeting Presentation and Meeting Sign-in Sheet

Appendix F
Model Development Technical Memorandum

Water Distribution Model Validation

Date:	May 9, 2024
Project name:	Fulton County Master Plan
Project no:	EEXK6102
Attention:	Anna Skipper
Client:	Fulton County Department of Public Works
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Document no:	1
Revision no:	0

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Introduction

Fulton County Department of Public Works (County) requested that Jacobs Engineering (Jacobs) evaluate and validate the 2022 calibrated water distribution model for use in future system capacity planning as part of the Fulton County Water Distribution Master Plan project. Jacobs reviewed the calibrated model and the calibration report of the hydraulic model. The main concerns were regarding the discrepancies found between the pump station flowrates and suction/discharge pressures between model results and SCADA. It was suspected that these were due to pump curve issues in the model. There were also concerns regarding the impact of a large pressure drop in the northwest part of the system which was seen in the iHydrant data. This was speculated to be an issue about an unknown user and/or closed valves in that area. These were investigated further as explained in the model validation and updates section below..

Model Validation and Updates

The original calibrated hydraulic model was reviewed in detail with regard to connectivity, loaded demands, diurnal curves, pump curves, C-factors, fire flow tests, tank levels, pump station suction/discharge pressures, pump station flows, and iHydrant pressures during both average day demand (ADD) and maximum day demand (MDD) scenarios. As part of the main project effort, pipe connectivity review tools in InfoWater Pro were used to assess connectivity issues in the model. Most of these were resolved with GIS data and some areas were prioritized and were resolved in coordination with County staff.

The model validation results presented in this section are for the MDD scenario, where the comparison results are shown between the original calibrated model on the left and the revised model on the right. The comparison was set up for two days -June 21st and 22nd, 2022 (same period as the original calibration). The comparison spreadsheet is included as an appendix to this report.

1. Unknown User Demand/Potential Closed Valves Issue

Upon analysis of the iHydrant pressure monitoring data, most of them showed a significant drop in static pressures when compared to the model pressures during summer months. The largest pressure drop was seen in iHydrant 18 data as shown in Figure 1. This issue was attributed to a combination of an unknown large demand and potential closed valves close to iHydrant 18. Since the large usage was seen mostly in summer months it is likely due to outdoor water usage. For iHydrant 18, the pressure drop was higher in the summer of 2022 compared to the summer of 2023 where it was more intermittent as shown in **Figure 2**.

The proximity to iHydrant 18 also suggested that valves might be closed on the intersection of Birmingham Road and Freemanville Road between the 12" and 24" lines. Field investigations seem to corroborate that closed valves existed as suspected in this area.

The location of the unknown user is suspected to be somewhere between Birmingham Road and Wood Road as highlighted in **Figure 2**. For the purposes of model validation, a demand of 800 gpm was loaded close to the White Column Country Club with a diurnal pattern that matched the pressure drop that was seen in the iHydrant data. The diurnal pattern was developed where there is a constant demand at around 50% and the total demand increases steadily starting from 1:00 AM, peaking at 6:00 AM, and dropping back to the constant demand around 11:00 AM with a higher peak on the 2nd day as shown in Figure 3.

The comparison results of the monitored iHydrant data for the revised model are shown in Figures 4-10. Overall, these results seemed to match quite well.

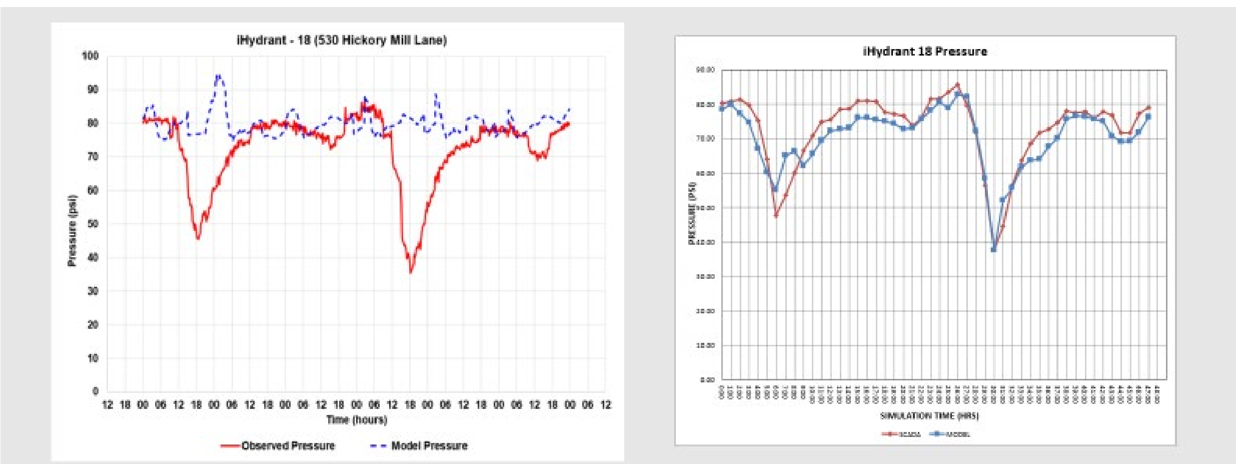


Figure 1 – iHydrant 18 Pressures Comparison

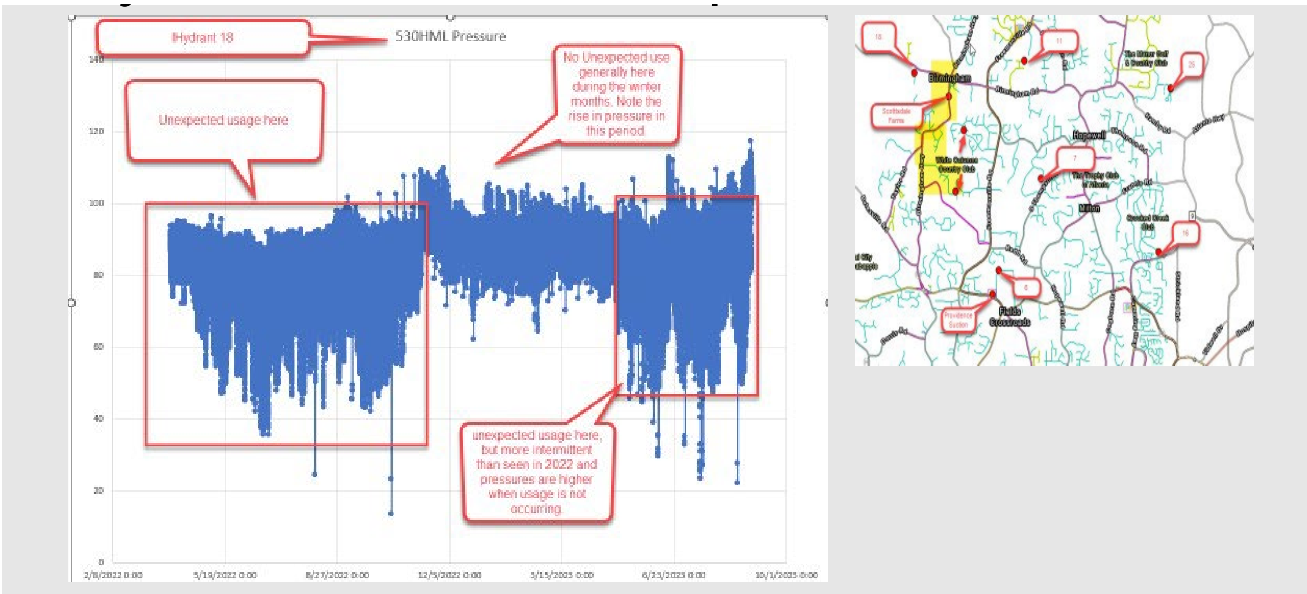


Figure 2 – iHydrant 18 Pressures in 2022-23 and Potential locations of unknown use.

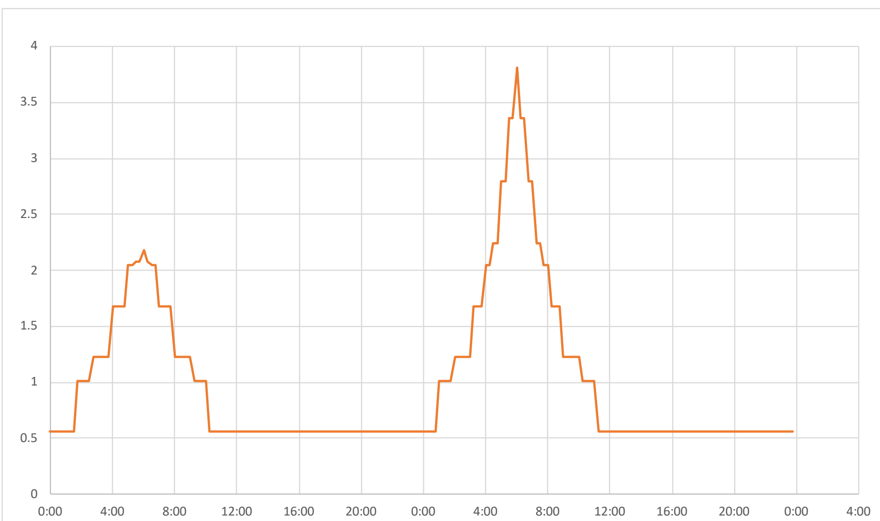


Figure 3 – Unknown User Diurnal Pattern

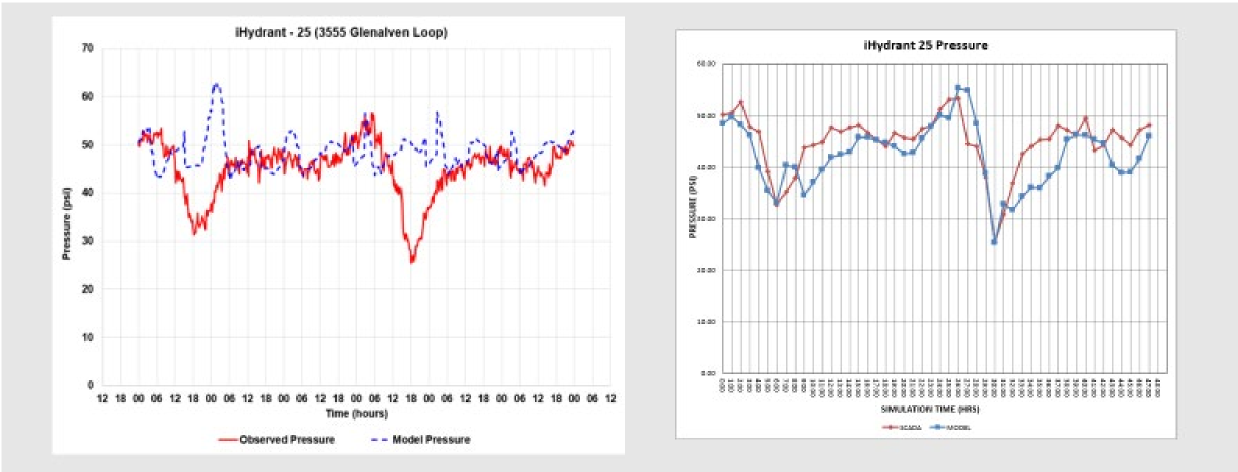


Figure 4 – iHydrant 25 Pressures Comparison

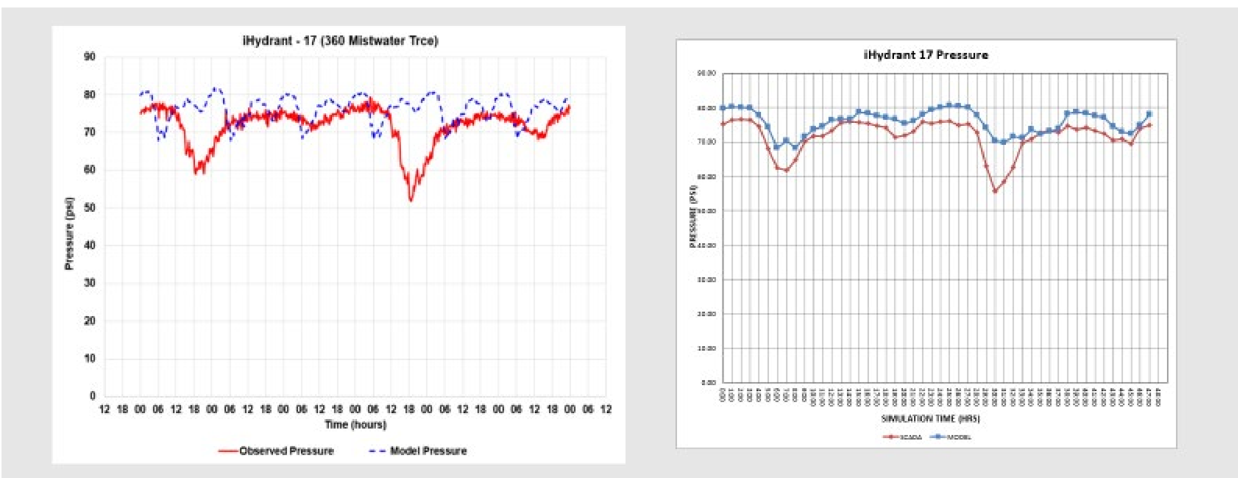


Figure 5 – iHydrant 17 Pressures Comparison

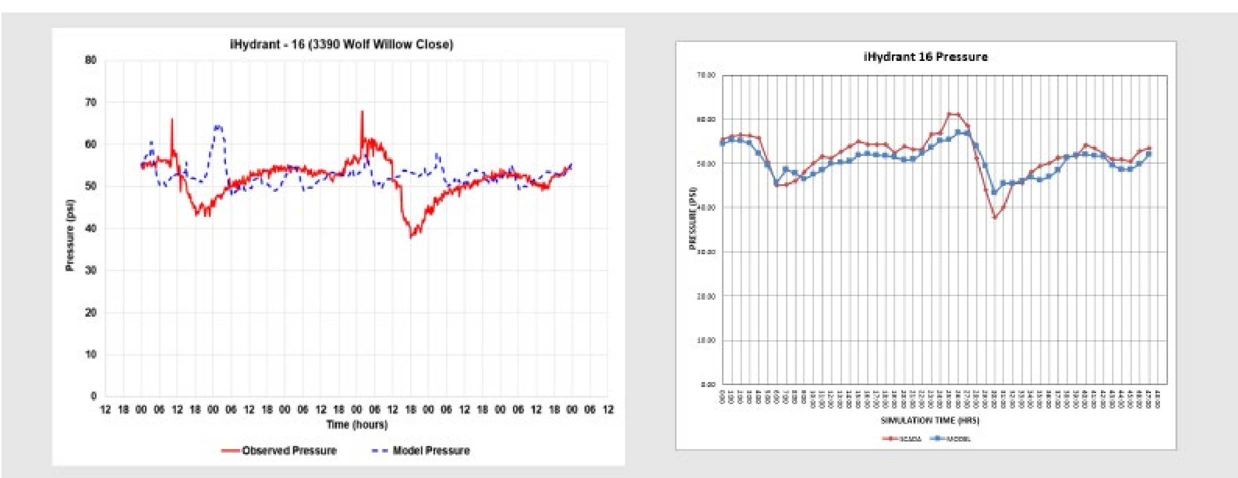


Figure 6 – iHydrant 16 Pressures Comparison

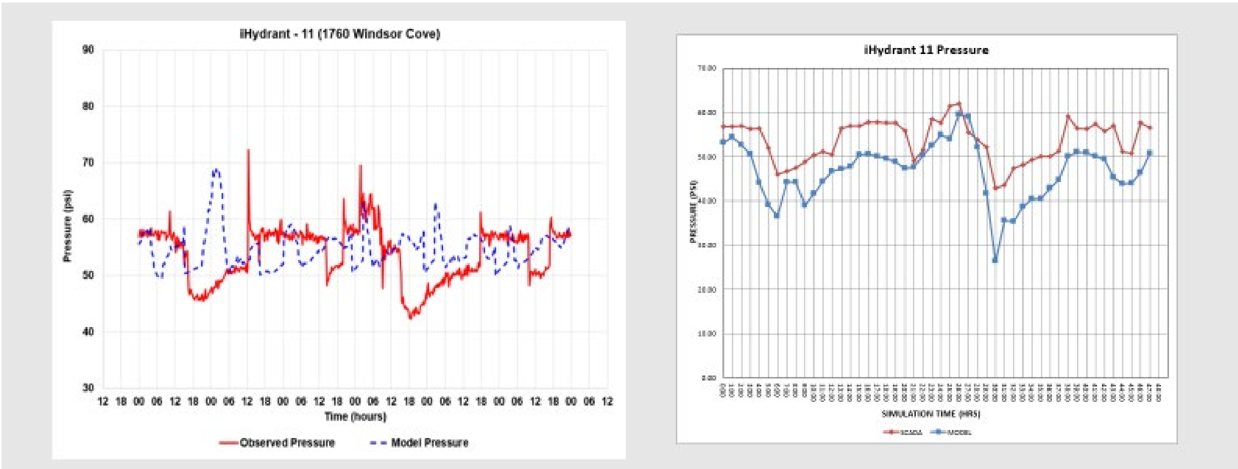


Figure 7 – iHydrant 11 Pressures Comparison

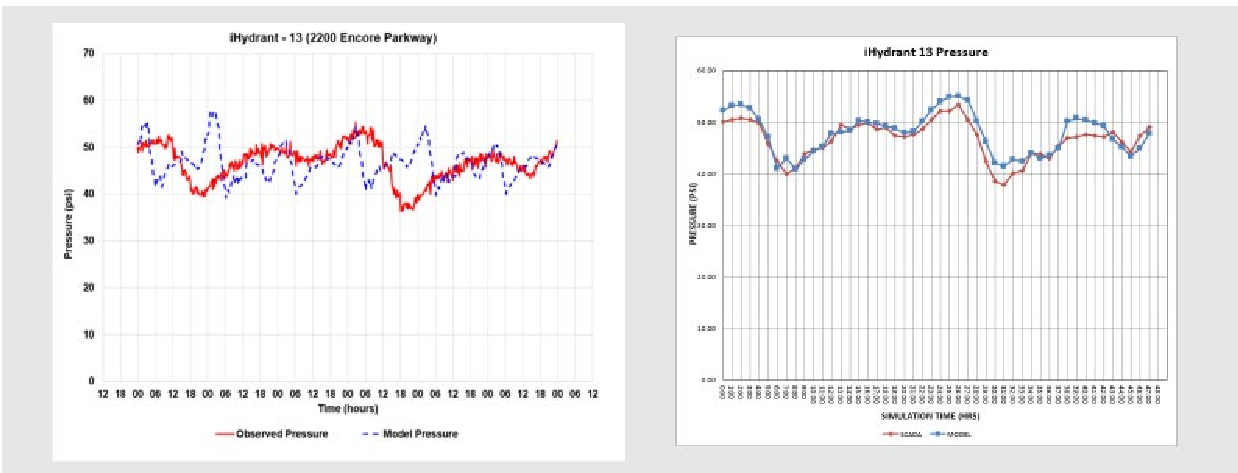


Figure 8 – iHydrant 13 Pressures Comparison

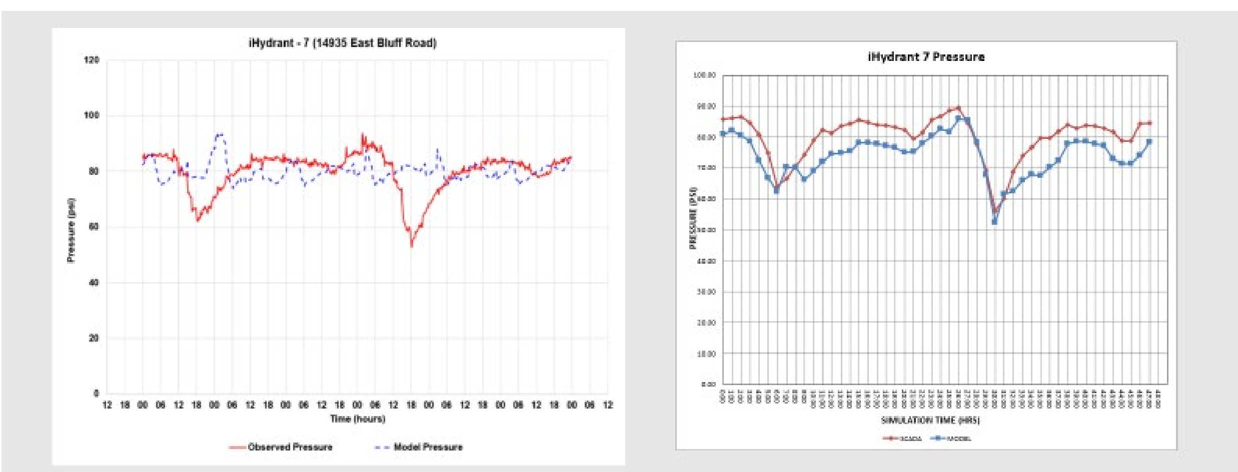


Figure 9 – iHydrant 7 Pressures Comparison

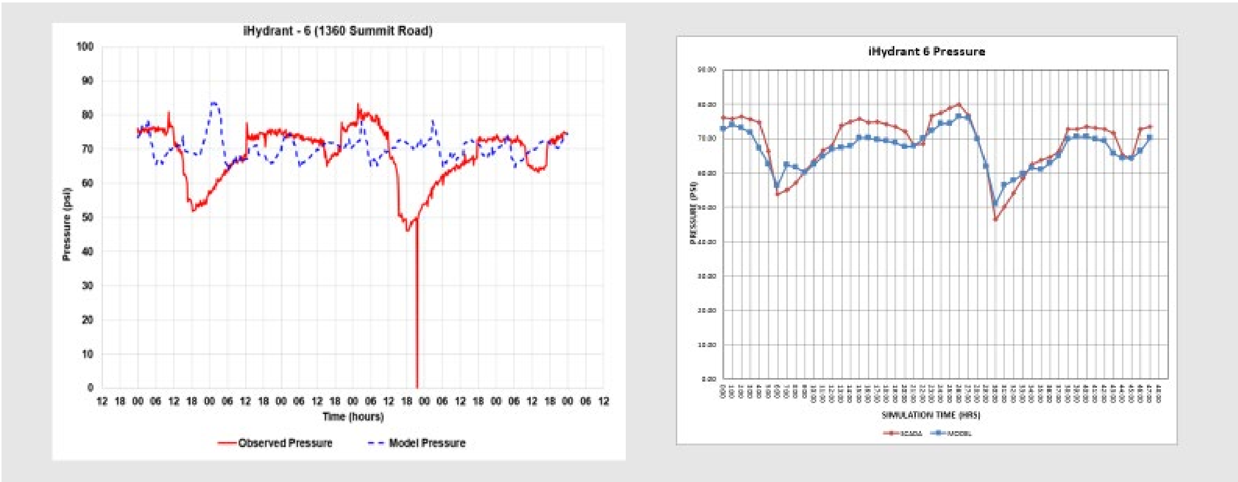


Figure 10 – iHydrant 6 Pressures Comparison

2. Pump Station and Tank Updates

The pump curves used in the 2022 calibrated model for the Pritchard Road, Providence Road, and Mansell Road pump stations were based on field testing performed in November 2022. In many cases, the field tests results were different from the SCADA data and had a significant impact on model calibration. The manufacturer's pump curves for these pump stations together with the field tests results were compared and used to find the best fit for the SCADA data. The final pump curves used in the model were digitized from the original manufacturer's pump curves and were adjusted based on the SCADA data as necessary. This pump digitizer spreadsheet is included in an appendix to this report. The methodology behind the pump curve updates is explained in the sections below for each pump station.

2.1 Pritchard Road Pump Station and Pritchard Tank

The primary concern for this station was the large differences observed between the suction and discharge pressures of roughly 30 psi seen in the previous calibration report as well as flow differences between the SCADA and the model of over 3000 gpm. To resolve these concerns a review of the SCADA data and the pump curves was completed.

For the Pritchard Road pump station, the field test data for both pumps 1 and 2 showed a flowrate of about 1040 gpm and a TDH of about 120 feet when running at full speed while the shut-off head being close to 165-170 feet which was higher than the manufacturer's pump curves' shutoff head. The full speed field test data showed reduced performance from the manufacturer's pump curve; the pump curve was then adjusted to better fit the full speed field data for pumps 1 and 2 as shown in Figure 11.

Uncertainty regarding the quality of the SCADA Pritchard data was identified which appears to have resulted in the primary differences in the flow and pressure differences between the model and SCADA results observed in the prior Calibration results. Upon closer inspection the flow and pressure SCADA results for the Pritchard station appears to be unreliable and unrealistic

The suction and discharge pressures from SCADA differed significantly from the model as shown in Figure 13. However, from photos taken during field visits that were published in the original calibration report show clearly what the gauge suction and discharge pressure was at the station. These gauges identify the suction pressure as about 18 psi, and the discharge pressure as about 67 psi, and these values matched well with the model results.

Flow results for this station though were a bit more difficult to verify. SCADA pump station flowrate would routinely peak at about 4000 gpm (with no change in suction/discharge pressures) which was not realistic but would periodically drop for short periods to flows in the 1200 to 1300 gpm range. These flows were more realistic and were comparable to the model results which were in the 1250 gpm range. Since the model flows also resulted in a close match of the Tank filling and draining the flow range of 1200 gpm range had to be correct, and the SCADA flows in the 4000-gpm range must be incorrect.

The Pritchard Road Pump station is primarily used to fill the Pritchard Tank. The trend of the Pritchard Tank levels in the revised model versus SCADA as shown in Figure 14 further validates that the Pritchard Road Pump Station flow is closer to the model predictions.

It is recommended that the SCADA pressure and flow data for this pump station be checked due to the issues found in suction/discharge pressures as well as the discharge flowrate. In conclusion, we are confident that the model results are now reasonable for both pressures and flows after the pump curve adjustments. Pressures are now falling within the 5-psi tolerance for the suction and discharge pressures and the flows are much closer to the likely real flows because the Tank filling and draining at Pritchard Tank is so closely matching. While there is still some uncertainty of the actual Pritchard pump station flows to compare to, the previous concerns regarding the differences in suction and discharge pressures and station flows are no longer a concern.

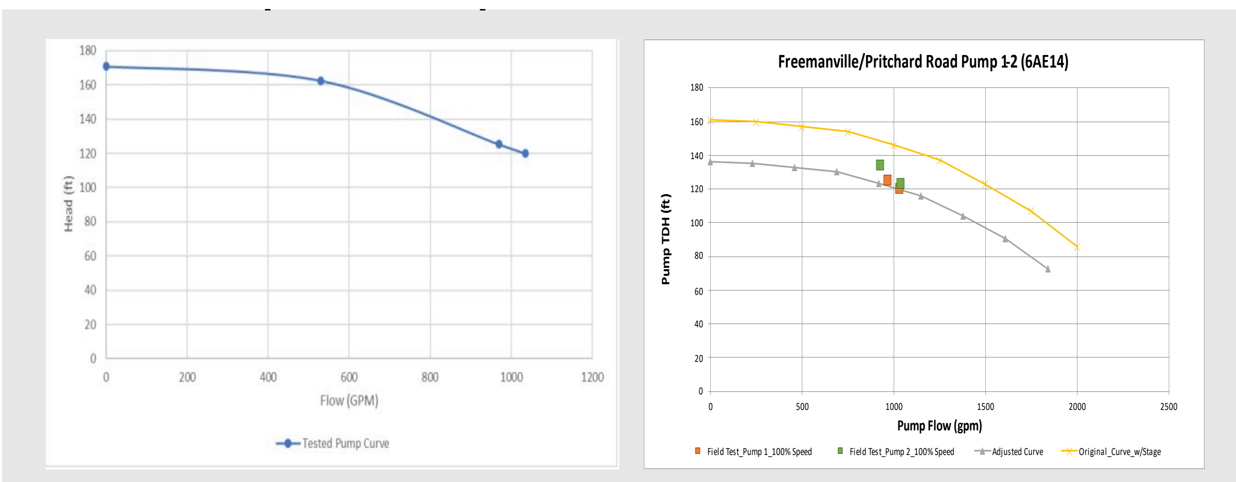


Figure 11 – Pritchard Road Pump Station: Original Field-Tested Curve vs Adjusted Pump Curve

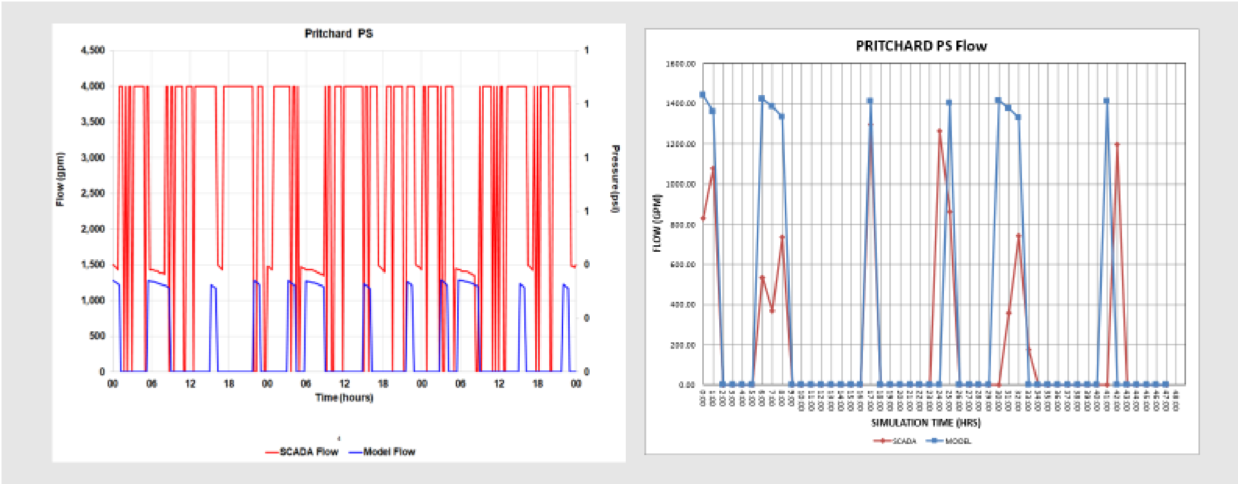


Figure 12 – Pritchard Road Pump Station: Pump Flowrate Comparison

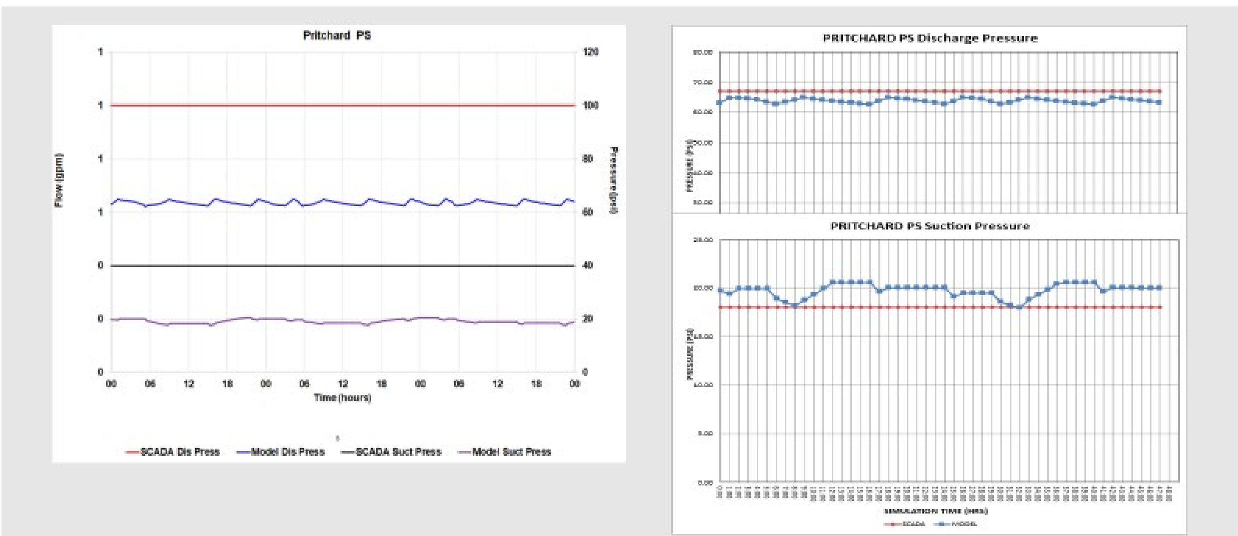


Figure 13 – Pritchard Road Pump Station: Suction and Discharge Pressure Comparison

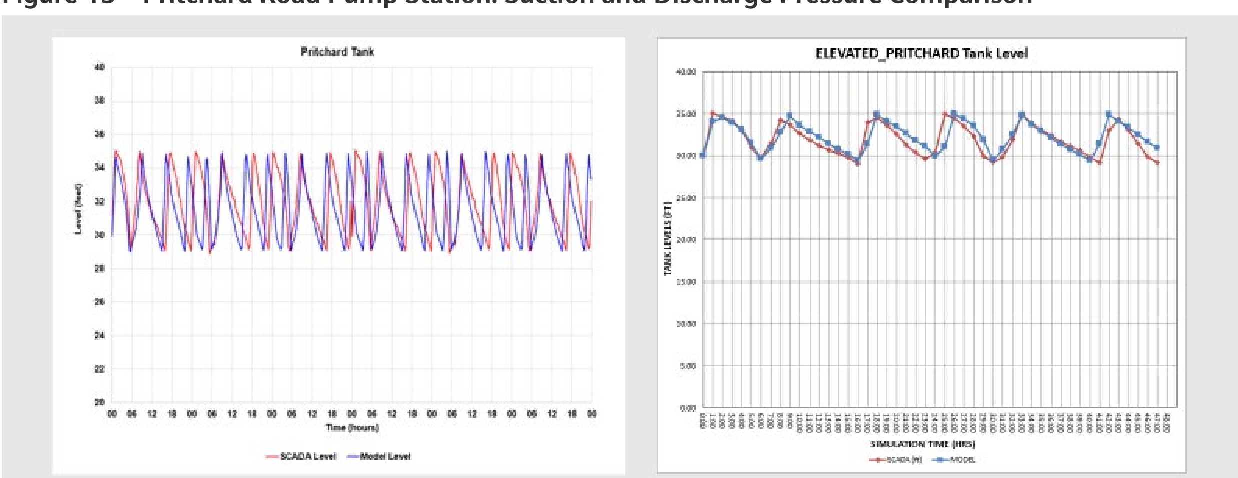


Figure 14 – Pritchard Tank Level Comparison

2.2 Providence Road Pump Station and Freemanville Tank

The primary concern for the Providence facility was the 15-20 psi differences in the suction pressure and the large 2000 gpm flow differences observed in the calibration report between the model and the SCADA data. It is believed that these differences were due to the pump curves used at the Providence Road Pump station and the lack of the use of the unidentified large unknown water user in the downstream zone as well as the identified large close valve previously identified at the corner of Freemanville and Birmingham Roads. The inclusion of updated pump curves and the larger water user and closed valve were identified as likely to improve the calibration results in the model.

For the Providence Road pump station, the field test data showed a flowrate of 3000 gpm and TDH of 52 feet when the Pump 1 was running at full speed and a flowrate of 2780 gpm and TDH of 43 feet when the Pump 3 was running at full speed. The field test data for Pump 1 was very close to the manufacturer's pump curve but the field test for Pump 3 showed reduced performance. The pump speed that was tested was also higher at 1185 RPM compared to the manufacturer's pump curve test speed of 1160 RPM. The model results were found to best fit the SCADA data when the Providence Road pump curve was adjusted to be slightly greater than the original pump curve (at roughly 102% speed) which is slightly higher than what was predicted by the field test data shown in Figure 15. This curve though was needed to get the higher flow rates observed in the SCADA data and is believed to be justified even though it is slightly larger than the original manufactures curve as some curves provided may represent trimmed curves while pumps may be delivered without trimmed impellers. Whatever the case, the actual station flows are clearly higher than what is being predicted and a slight adjustment like this is reasonable to assume given the flows observed in SCADA.

From the SCADA data, the pump station flowrates were above 4000 gpm in certain cases. Although the SCADA data did not show how many pumps were running, it was apparent that two pumps were running together. The pump controls at this pump station were revised from a variable speed pump (VSP) to level-based controls based on the Freemanville Tank levels. The predicted flowrate in the revised model is close to 10% of the SCADA flowrate as shown in Figure 16.

The calibrated model suction pressures were trending higher compared to the SCADA data while the discharge pressures were fairly close. The revised model suction and discharge pressures trend quite closely to the SCADA data as shown in Figure 17 except for the early hours where the discharge pressures are higher. It is believed this is caused by the model Tank control valve failing to open which causes the model pressures to rise when the valve is closed. Similar behavior was also observed in the iHydrant data in the actual system as well and was therefore left in the model. Close operational control of the Providence Pump station should be matched to ensure that when a second pump is turned on that the Freemanville Tank Altitude valve is allowed to fill to avoid higher pressures in the discharge zone. It is unknown if current operations currently are checking for this at this time, but this should be added to the system operation to avoid this potential higher pressurization from occurring in the real system.

The Freemanville Tank altitude valve was adjusted based on SCADA data such that it opens when the tank level drops below 40 feet instead of 42.5 feet. The revised model compares well with the SCADA data for the Freemanville Tank as shown in Figure 18.

Conclusions: The Tank operations are vastly improved with these changes to the system. The pump curve significantly improved the Providence Road operations for both flow and pressure and getting the model and SCADA values closer than were observed previously. The adjustment of operational controls and adjustment of the operations of the Providence Road Pump Station to non-Variable Speed Control also greatly improved model operations and model stability. Suction Pressures and discharge flows are now much more closely matching what was observed in the SCADA data. Adding the large unknown user demand with its diurnal curve also improved the pressure and flows in this area as well as did the inclusion of the closed valve at the corner of Freemanville and Birmingham Roads. That the Tank Level at Freemanville Tank now much more closely matches the actual operation level confirms and appears to validate these changes and increases the confidence in the model significantly.

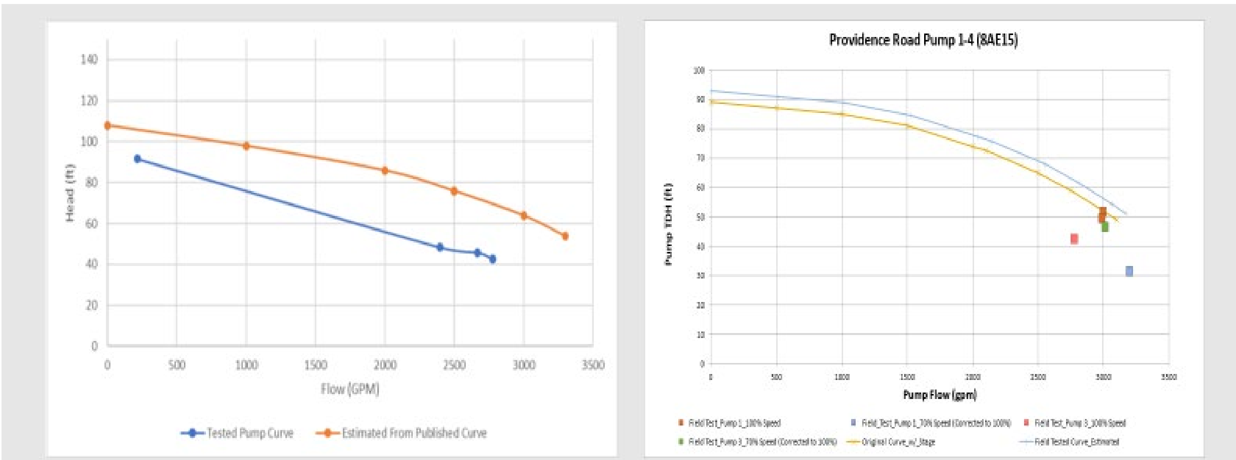


Figure 15 – Providence Road Pump Station: Original Field-Tested Curve vs Adjusted Pump Curve

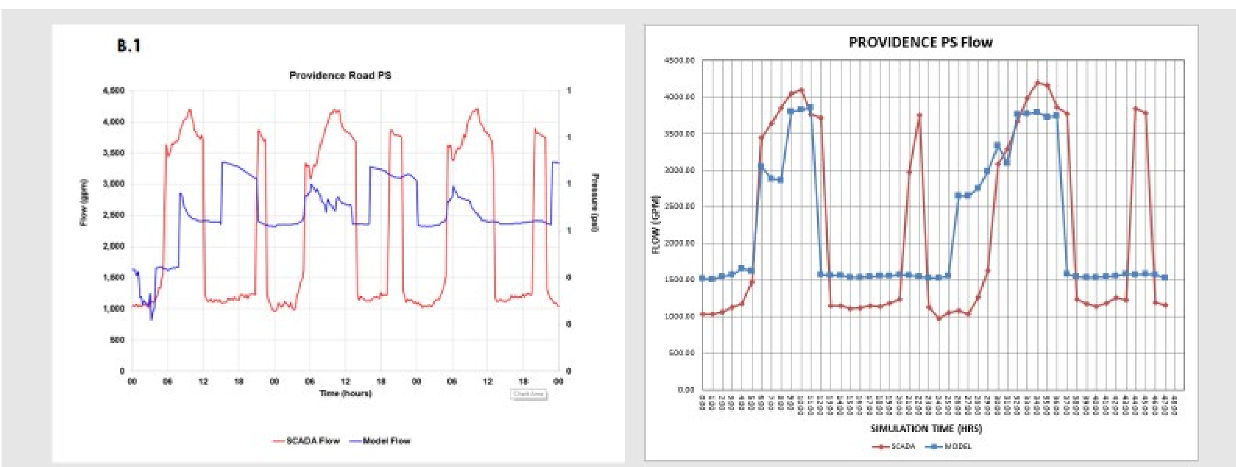


Figure 16 – Providence Road Pump Station: Pump Flowrate Comparison

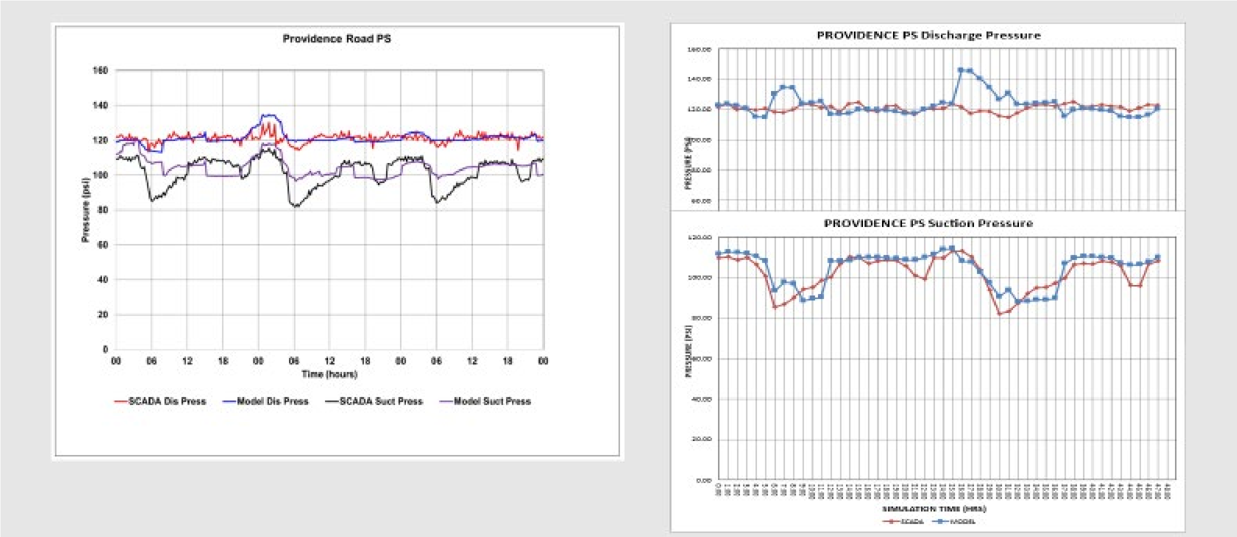


Figure 17 – Providence Road Pump Station: Suction and Discharge Pressure Comparison

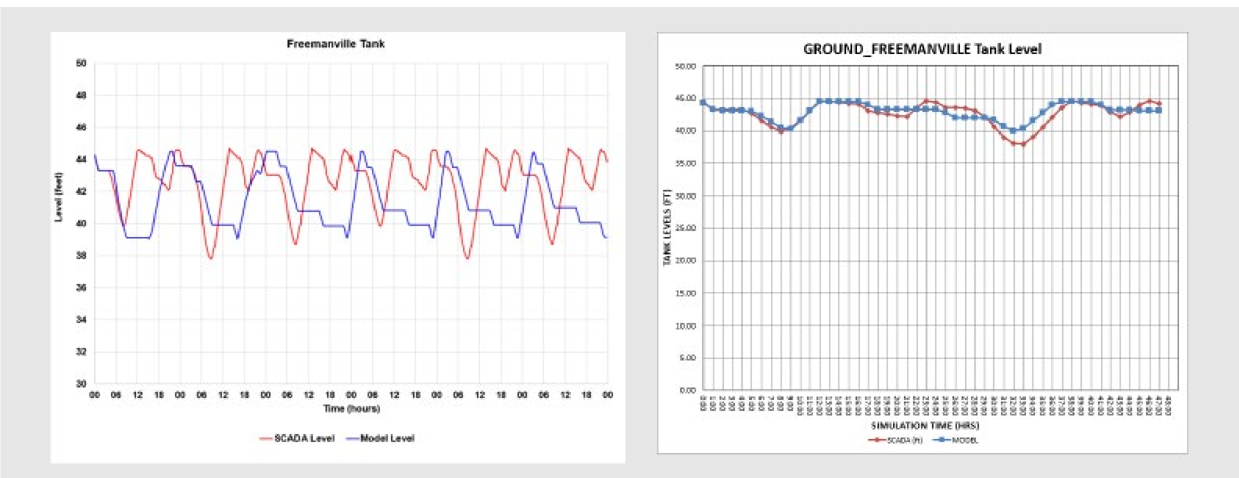


Figure 18 – Freemanville Tank Level Comparison

2.3 Mansell Road Pump Station and Hembree Tank

The primary concerns for the Mansell Pump station were the roughly 1500 gpm difference in pump station flows and the 15-20 psi differences in suction pressure that were observed in the original calibration report. It was believed that these differences were due to the pump curves at the Mansell station as well as the low flows seen at the Providence Pump station. Improvements to these facilities pump curves and controls were thought would likely improve these concerns in the model.

For the Mansell Road pump station, the field test data showed a flowrate of 5150 gpm and a TDH of 15 feet for Pump 1 (at 95% speed), a flowrate of 5250 gpm and TDH of 15 feet for Pump 2 (at 95% speed), and flowrate of 4950 gpm and TDH of 12 feet for Pump 3 (at 94% speed). The pump speed that was tested was also higher (where 100% speed was 1185 RPM) compared to the manufacturer's pump curve test speed of 1160 RPM as shown in Figure 19. Similar to the Providence Road Pump Curves it, was found that to match the flows observed in SCADA, a pump curve close to the original manufacturer's pump curve, was necessary to get model flows close to what was observed in SCADA even though the field test data potentially identified a possibly slight reduction in the curve may have been warranted.

From the SCADA data, the pump station flowrates were close to 7000 gpm. Although the SCADA data did not show how many pumps were running, it was apparent that all three pumps were running together. The pump controls at this pump station were revised from a variable speed pump (VSP) to level-based controls based on the Hembree Tank levels. The predicted flowrate in the revised model is close to 10% of the SCADA flowrate as shown in Figure 20. So even using this full, 100% speed curve, model flows were still under predicting the flows observed in the SCADA system.

In contrast, the calibrated model suction pressures were trending higher compared to the SCADA data while the discharge pressures were fairly close, but higher when the pumps were operating. The revised model suction and discharge pressures overall trend does follow quite closely to the SCADA data as shown in Figure 21.
However, the differences in flow (lower) and suction pressure (lower), and discharge pressure (higher) when pumping is interesting as it does indicate that there is something still somewhat off here, but the model is still reasonably close overall. This is also a location where the SCADA sensors should also be verified against field gauge data to ensure good accuracy of the data. If there is any inaccuracy in the SCADA data at this location here, that could also explain the differences, but without more information it is difficult to explain the differences further. But even as is, this is still reasonable for the planning purposes of the model but should be revisited should additional information become available.

The Hembree Tank altitude valve which receives water from this pump station was adjusted based on SCADA data such that it opens when the tank level drops below 33.8 feet instead of 32.0 feet and closes at 34.0 feet instead of 34.2 feet. The revised model compares well with the SCADA data for the Hembree Tank as shown in Figure 22.

Conclusions: While improving the pump curves for this facility and controls did improve the flow differences at this facility, there is still some uncertainty at the suction pressures at this facility. While the changes did reduce the differences observed from what was seen in the original calibration report to lesser values, there is still some uncertainties that appear to be occurring that cannot be fully explained. However, results are now much more closely matching to the SCADA data and Tank level trending is much more closely matching that the model is more than acceptable for planning purposes of the Master Plan.

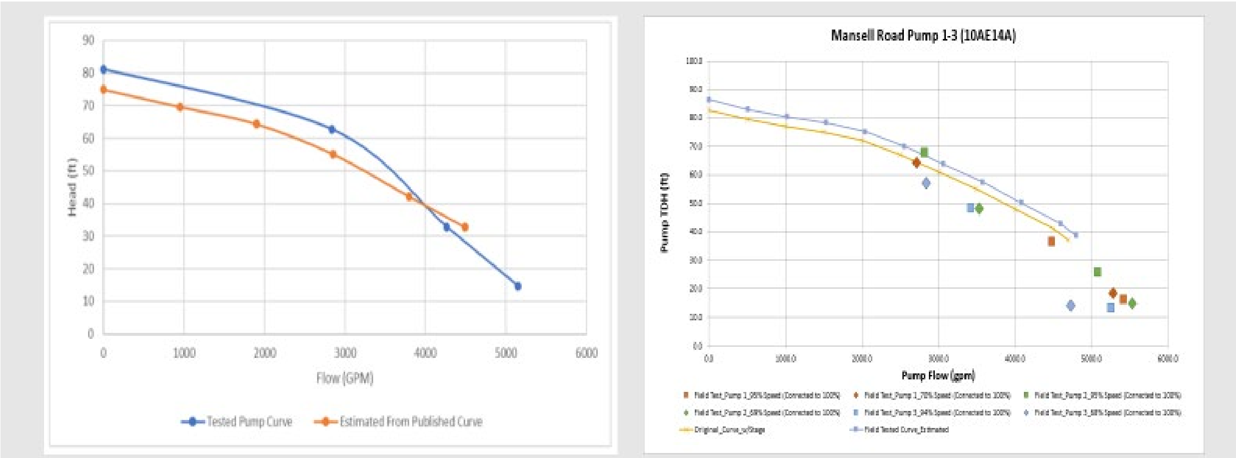


Figure 19 – Mansell Road Pump Station: Original Field-Tested and Adjusted Pump Curve

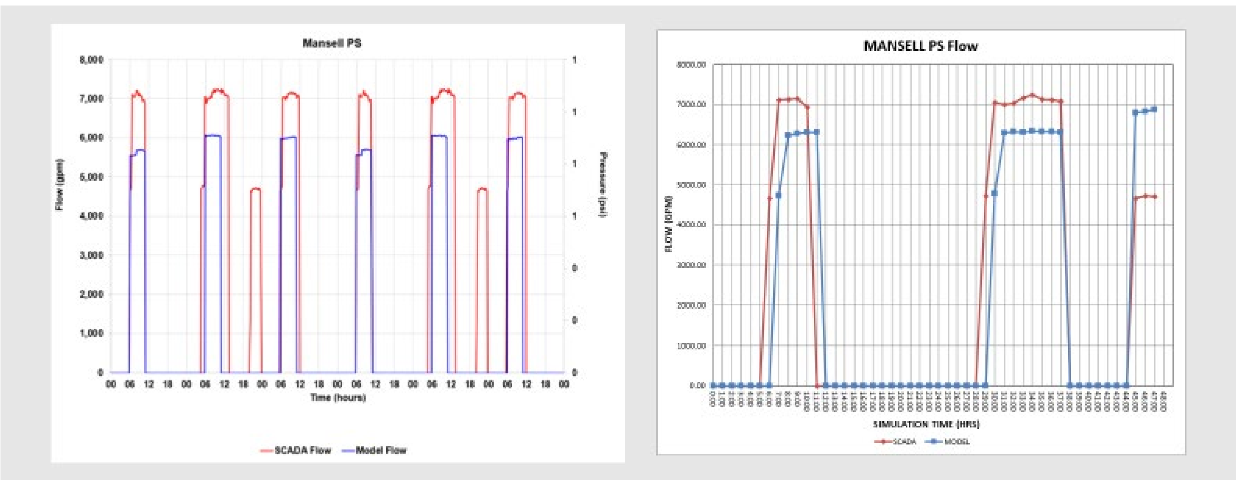


Figure 20 – Mansell Road Pump Station: Pump Flowrate Comparison

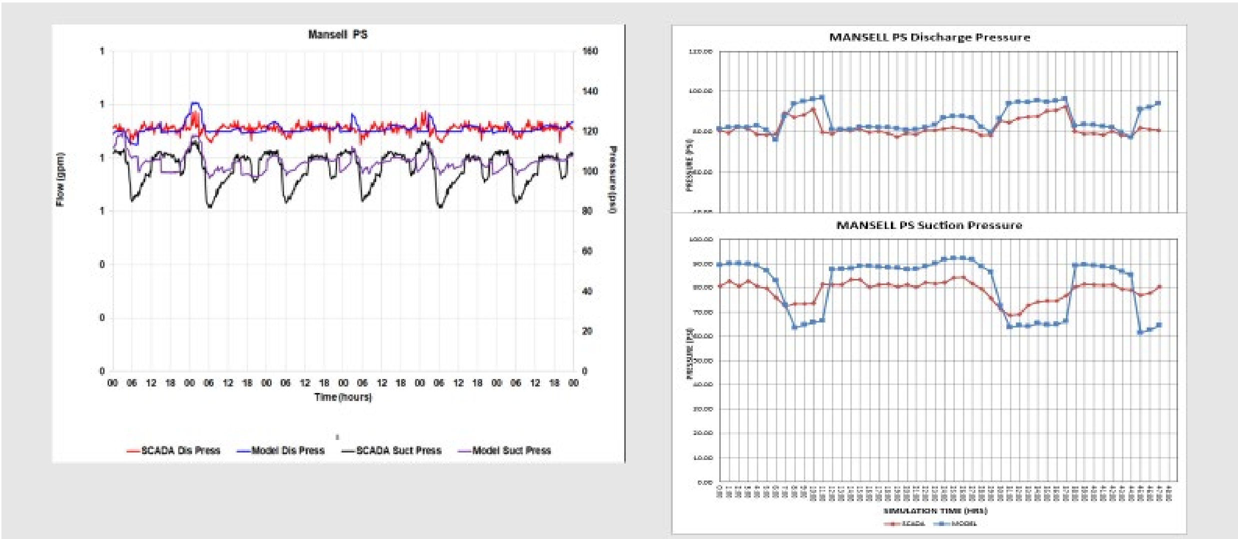


Figure 21 – Mansell Road Pump Station: Suction and Discharge Pressure Comparison

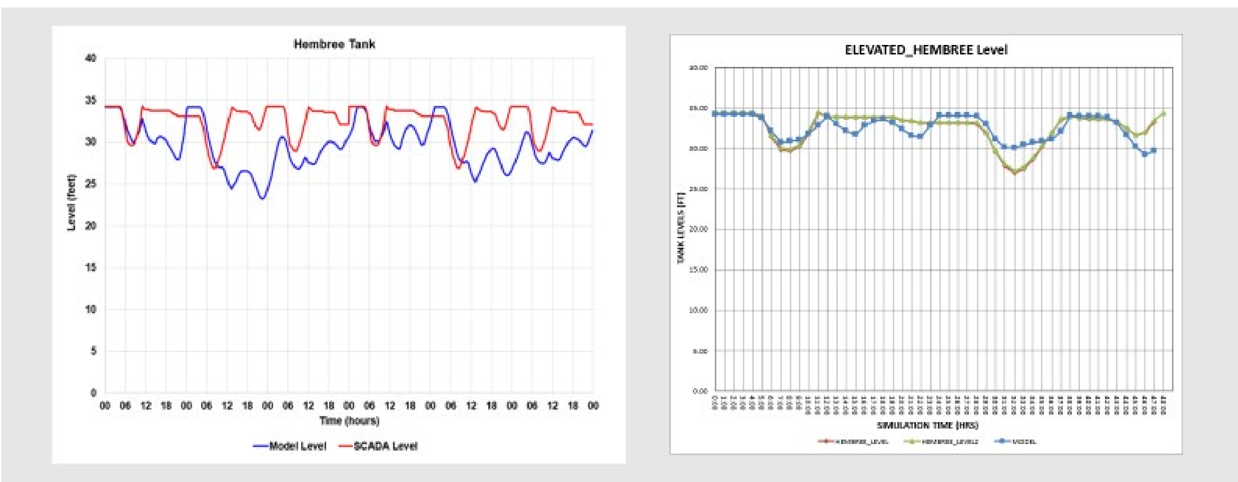


Figure 22 – Hembree Tank Level Comparison

3. Other Tank Updates

When reviewing elevated storage tanks (EST) in the model, the levels did not match up with SCADA. The currently model used Tank levels that calculated Tank levels from the ground whereas the SCADA measured tank level from the bottom the Tank storage level. This difference makes it very difficult to compare model and tank "levels" easily from the SCADA to the model and so the model Tank bottom levels were adjusted to match what was used in the SCADA to make the SCADA comparisons easier to read.

Additionally, for the Freemanville and Hackett tanks, the tank volume to depth curves looked to be upside down in the calibrated model. Based on photos of the storage tanks, the volume change had to taper at the bottom and not at the top of the tanks. These curves were corrected as shown in Figure 23.

The Hackett and Bethany tanks’ altitude valve controls were also adjusted in the calibrated model to match the operations observed in the SCADA data. They were adjusted based on SCADA data such that the altitude valves open when the tank levels drop below 30.5 feet and 31.0 feet for Hackett and Bethany tanks respectively, and close at 40.0 feet for both tanks. The revised model tank levels mostly compare well with the SCADA data as shown in figures 14 and 15.

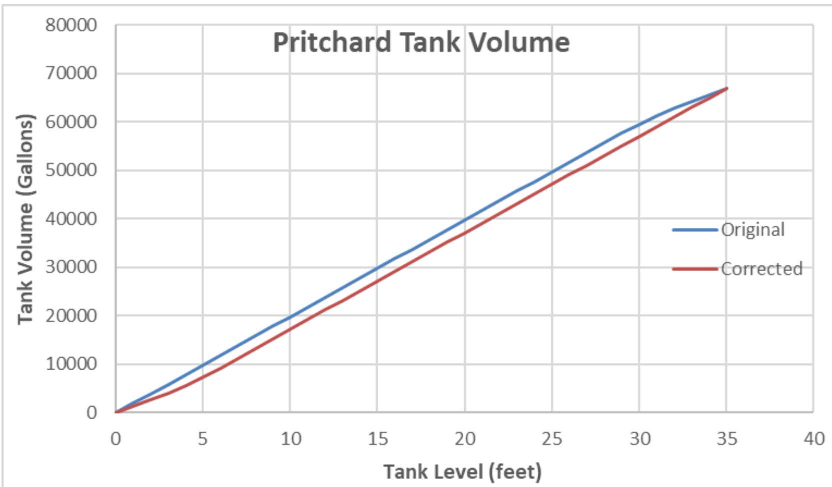


Figure 23 – Pritchard Tank Volume Curve Comparison

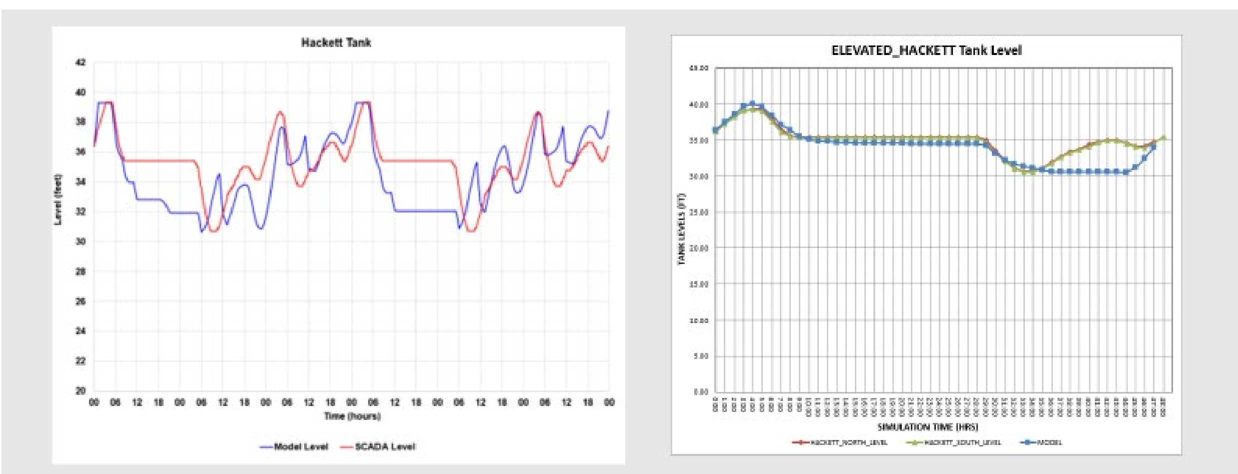


Figure 24 – Hackett Tank Level Comparison

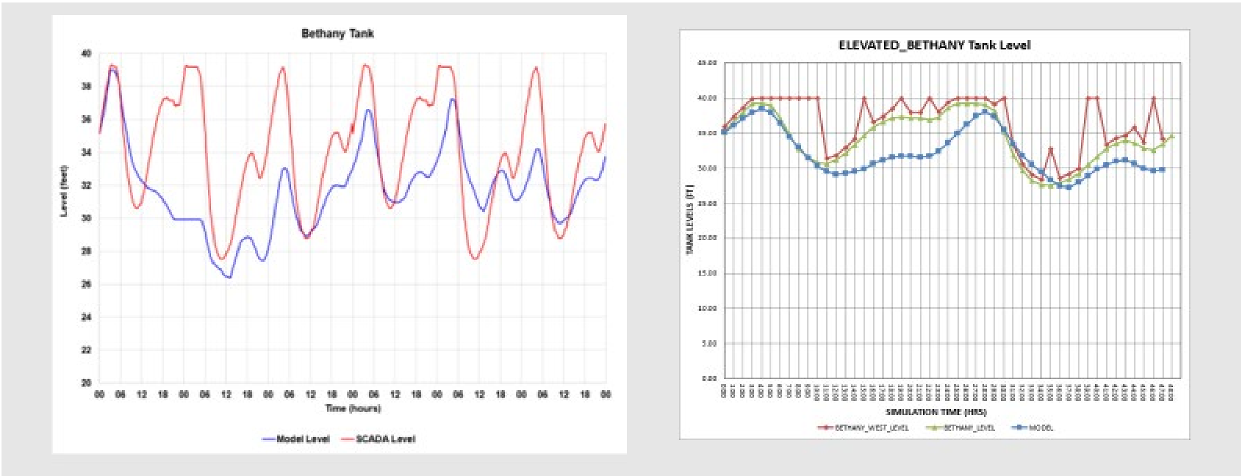


Figure 25 – Bethany Tank Level Comparison

Summary

This model validation exercise was conducted as part of the Fulton County Water Distribution Master Plan project to identify areas of improvement and incorporate any changes before future system capacity planning.

With the changes made to the pump curves, the updates to the model controls, the inclusion of the unknown large water user, and known closed valve the previously identified concerns appear to have been significantly reduced and or eliminated from the model. The pump station suction/discharge pressures, pump flowrates, and tank levels in the revised model seem to match significantly closer with SCADA data than what was observed in the previous calibration report. Additional improvements to the Model Tank curves were also identified during this exercise which allowed for easier comparison of Model vs. SCADA tank levels as well as two Tank Volume vs Tank Level Curves were fixed when curves were found to have been inputted incorrectly in the previous model. Pump station controls, altitude valve controls, tank levels, and tank volume curves are also now set up better in the revised model. These changes appear to have now allowed the model tank levels to now have a significantly better tank level tracking that was previously observed in the previous calibration reports. These changes significantly improve the confidence level in the model performance for use in the Master Planning purposes.

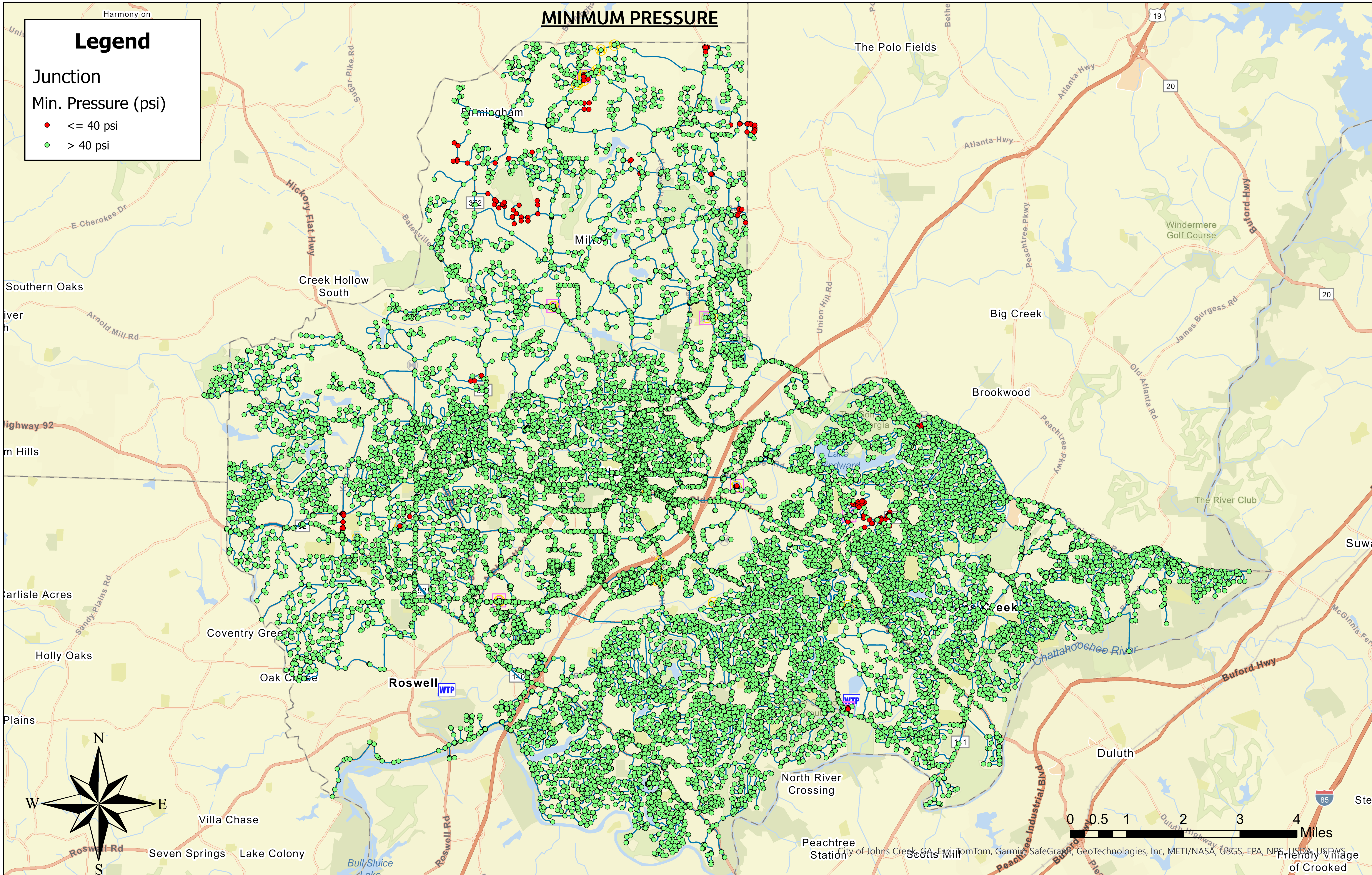
It is recommended that the SCADA equipment for the Pritchard pump station and the Mansell Pump station be checked for issues with regard to suction/discharge pressures as well as pump flowrates.

The validation exercise also helped identify a significant low-pressure issue close to iHydrant 18 which was attributed to a combination of a large unknown user and potential closed valves in the system. Field investigations in this area seemed to corroborate that closed valves might exist as seen on the intersection of Birmingham Road and Freemanville Road between the 12" and 24" lines. The location of the unknown user is suspected to be somewhere between Birmingham Road and Wood Road. It is recommended that field investigations continue to help identify the location of the unknown user as well as check for other closed valves in the system. For the purposes of future capacity planning, it is also recommended that the closed valve that was found in the intersection of Birmingham Road and Freemanville Road be opened.

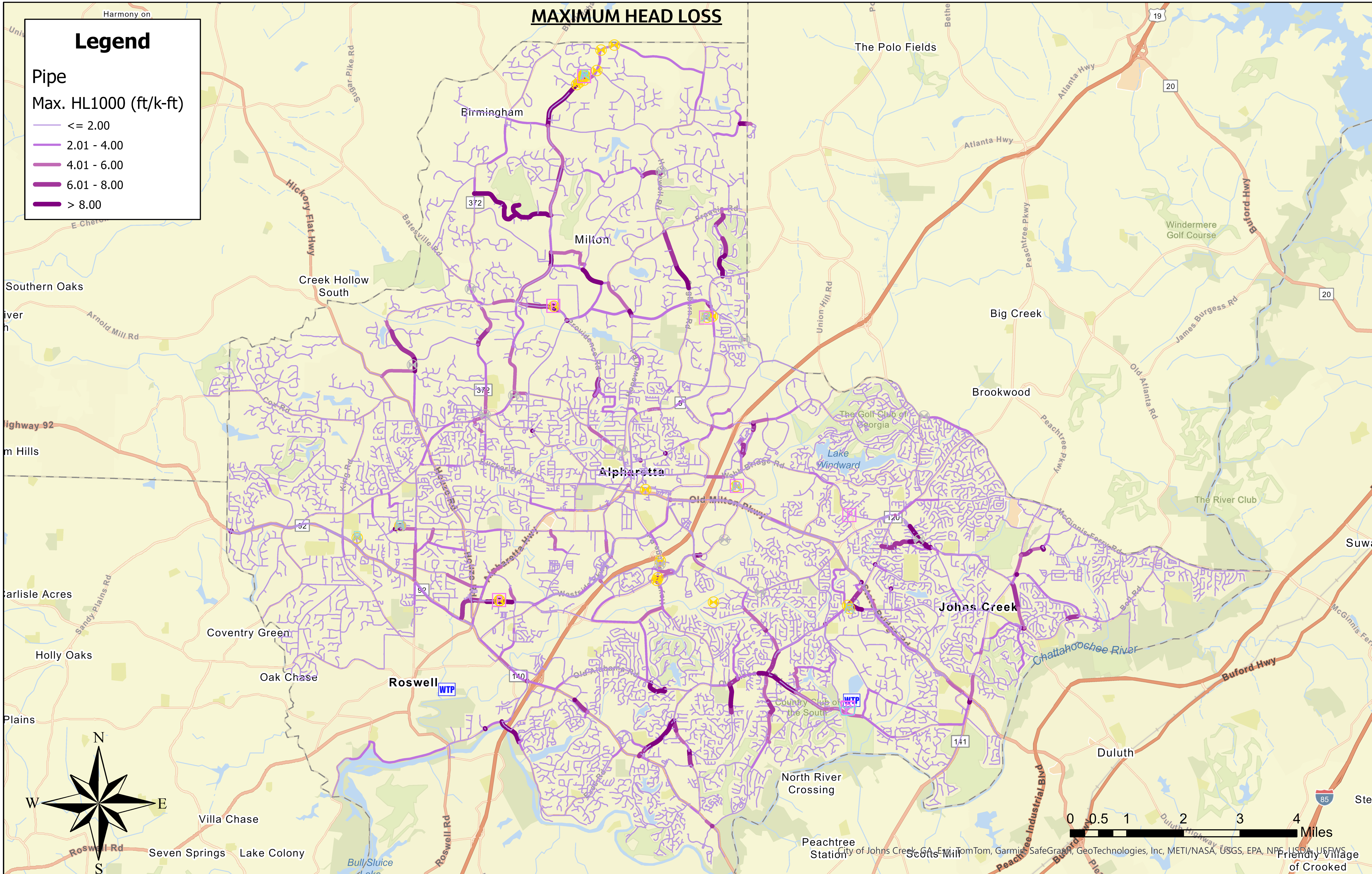
Overall, this model validation and update exercise helped improve the confidence in the water distribution model for Fulton County. All previously identified concerns appear to have been addressed and have now been resolved. Further calibration efforts near the Mansell Pump station may be warranted in the future to further improve the model but the current model appears sufficient for the Master Planning purposes without significant flow or pressure concerns previously identified.

Appendices: Pump Curve Digitizer and SCADA Comparison Spreadsheets

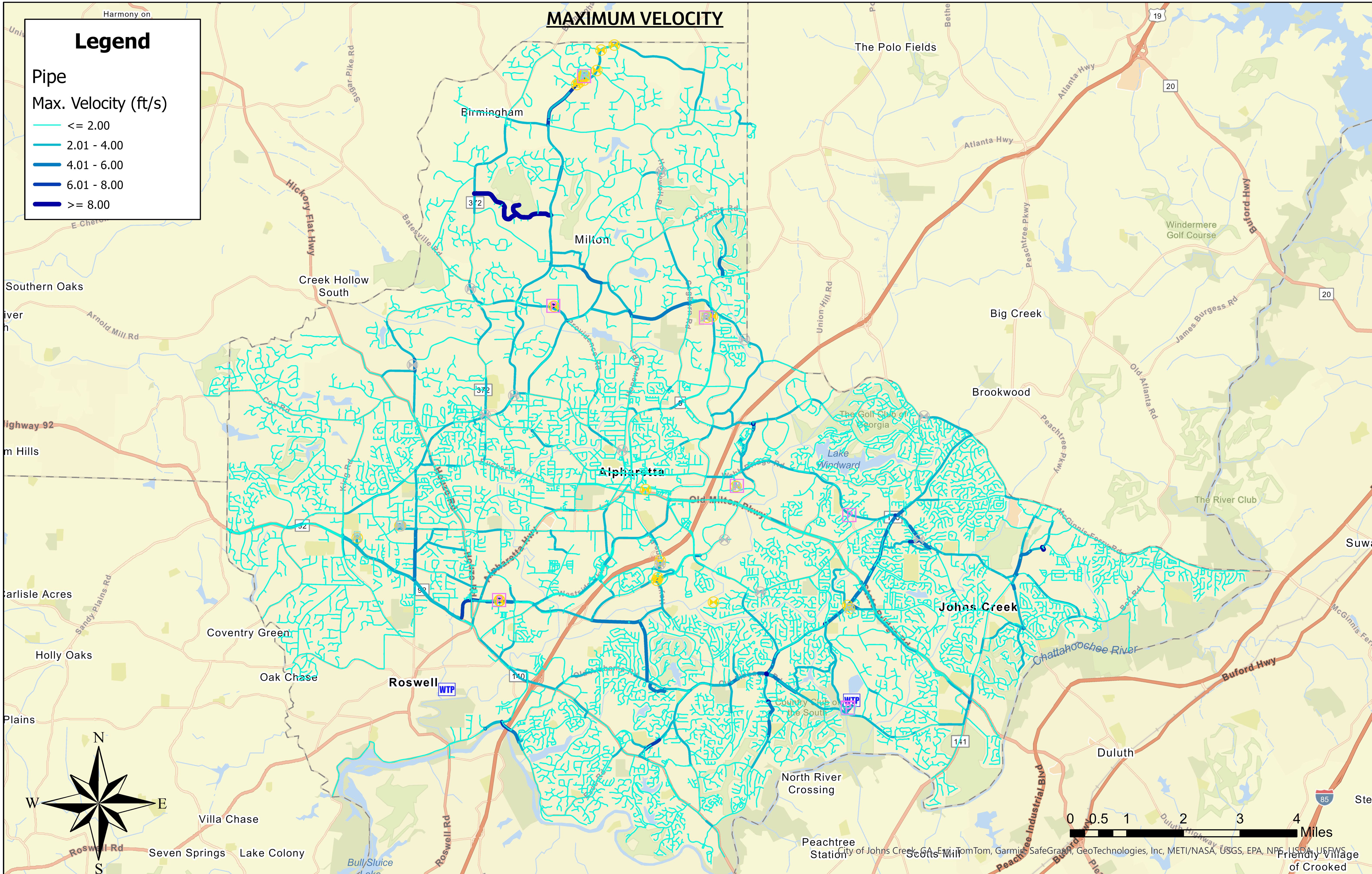
Appendix G
Existing System Deficiencies


MINIMUM PRESSURE
Legend
Junction
Min. Pressure (psi)
<= 40 psi
> 40 psi
The Polo Fields
Big Creek
Brookwood
Windermere Golf Course
The River Club
Creek Hollow South
Southern Oaks
Roswell
Coventry Green
Holly Oaks
Oak Chase
Villa Chase
Seven Springs
Lake Colony
North River Crossing
Peachtree Station
Scotts Mill
Duluth
Chattahoochee River
Buford Hwy
Atlanta Hwy
Hickory Flat Hwy
Arnold Mill Rd
E Cherokee Dr
Roswell Rd
Bull Sluice Lake
0 0.5 1 2 3 4 Miles
City of Johns Creek, GA, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

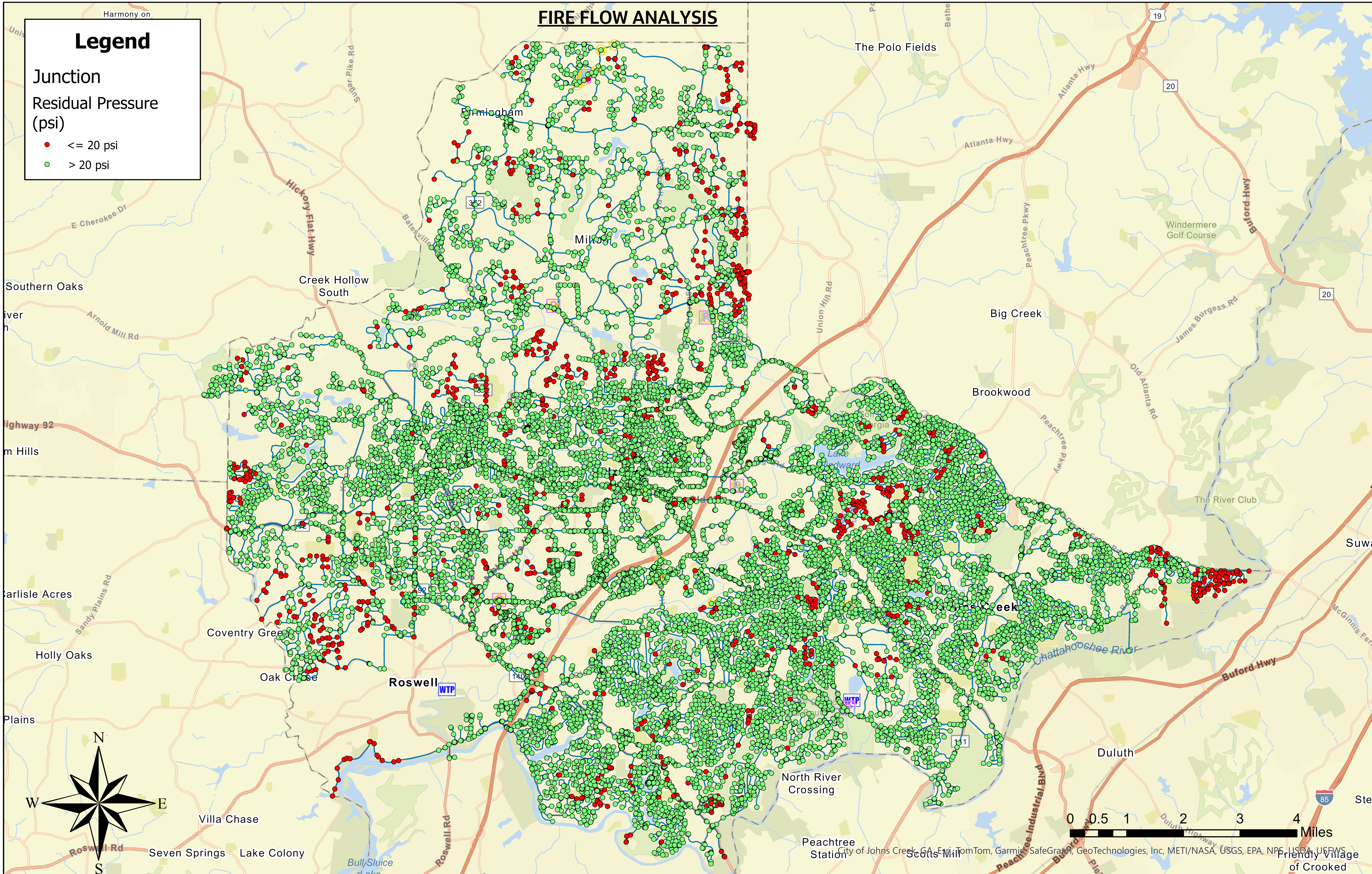
MAXIMUM HEAD LOSS



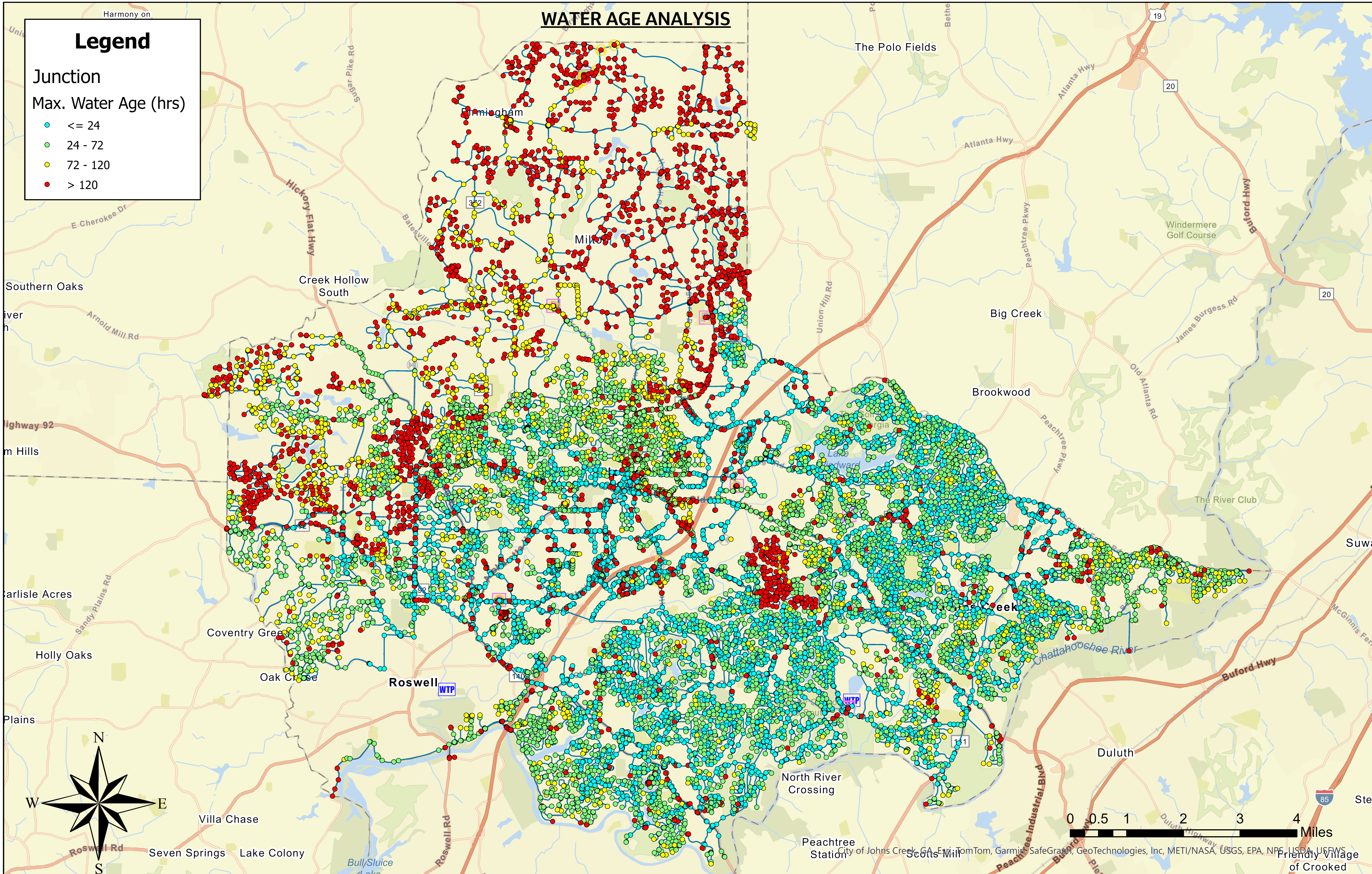
MAXIMUM VELOCITY



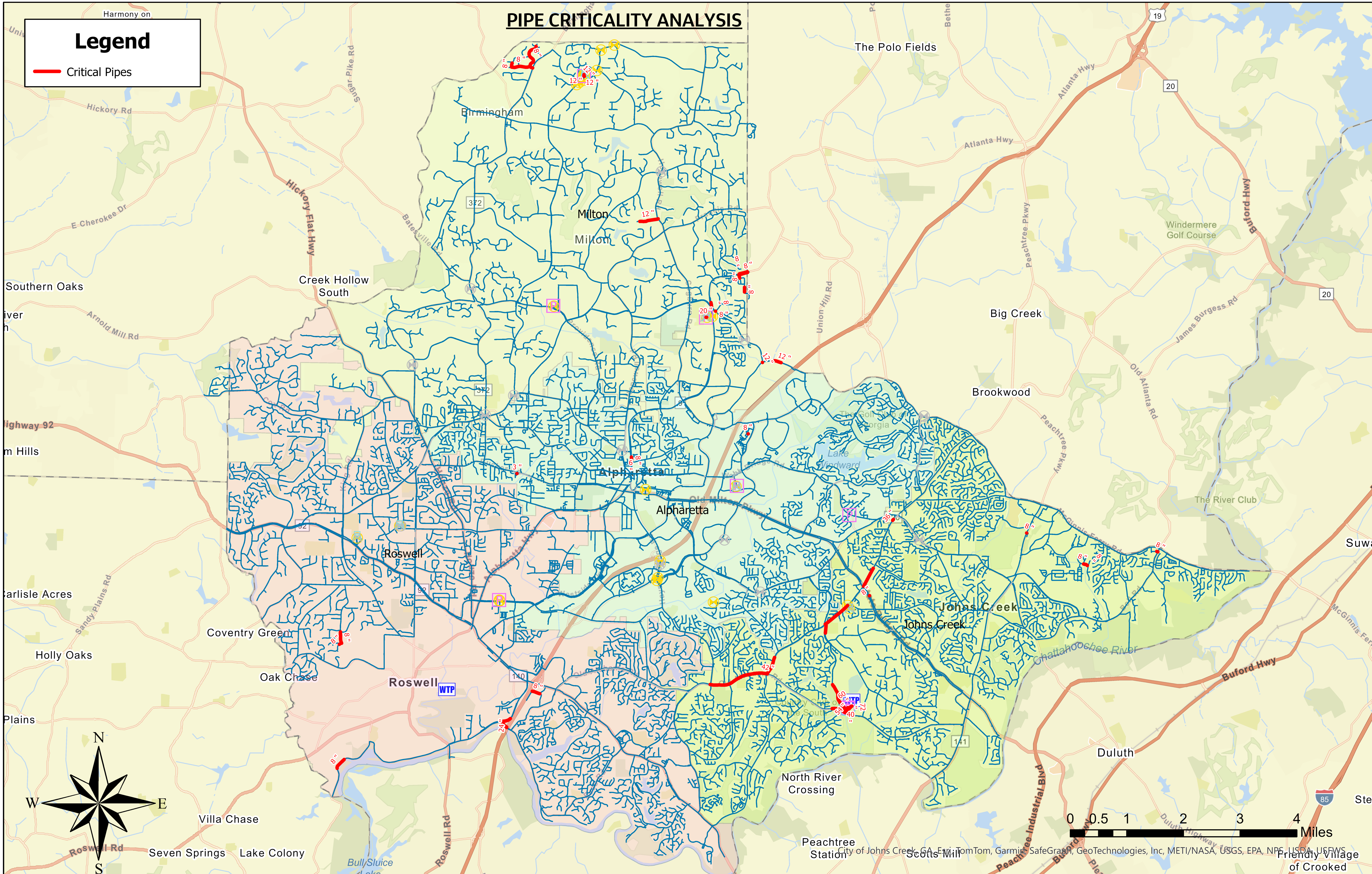
FIRE FLOW ANALYSIS



WATER AGE ANALYSIS

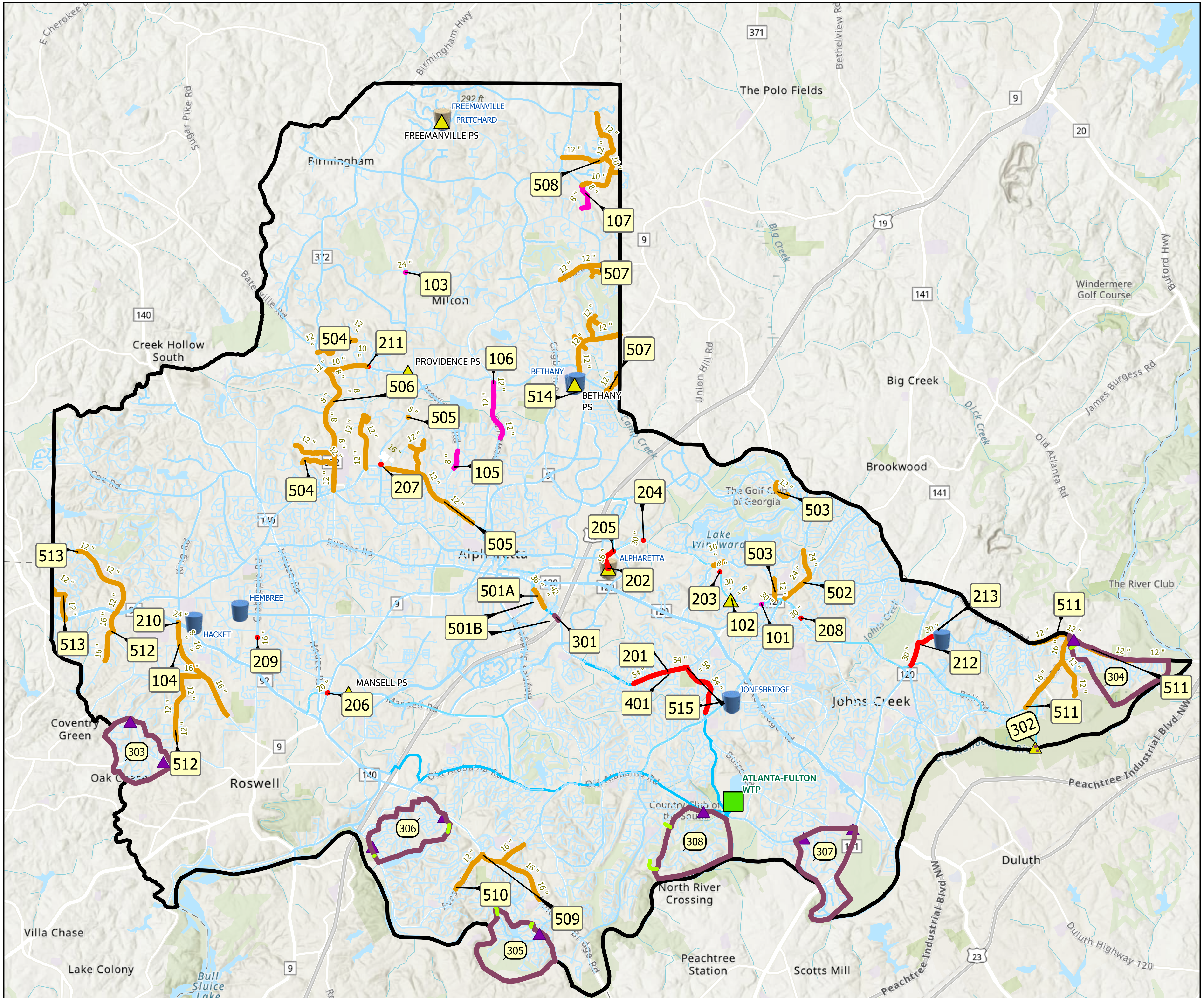


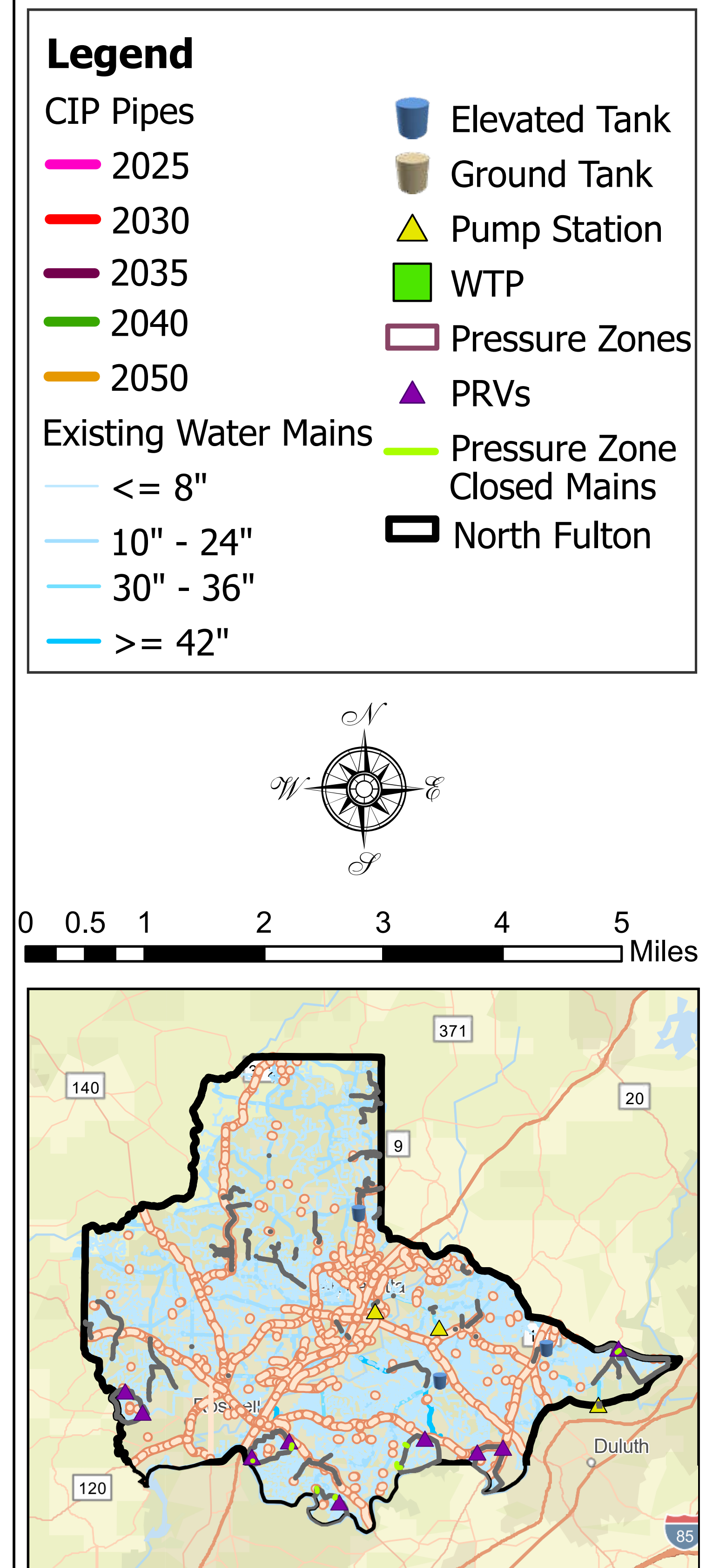
PIPE CRITICALITY ANALYSIS



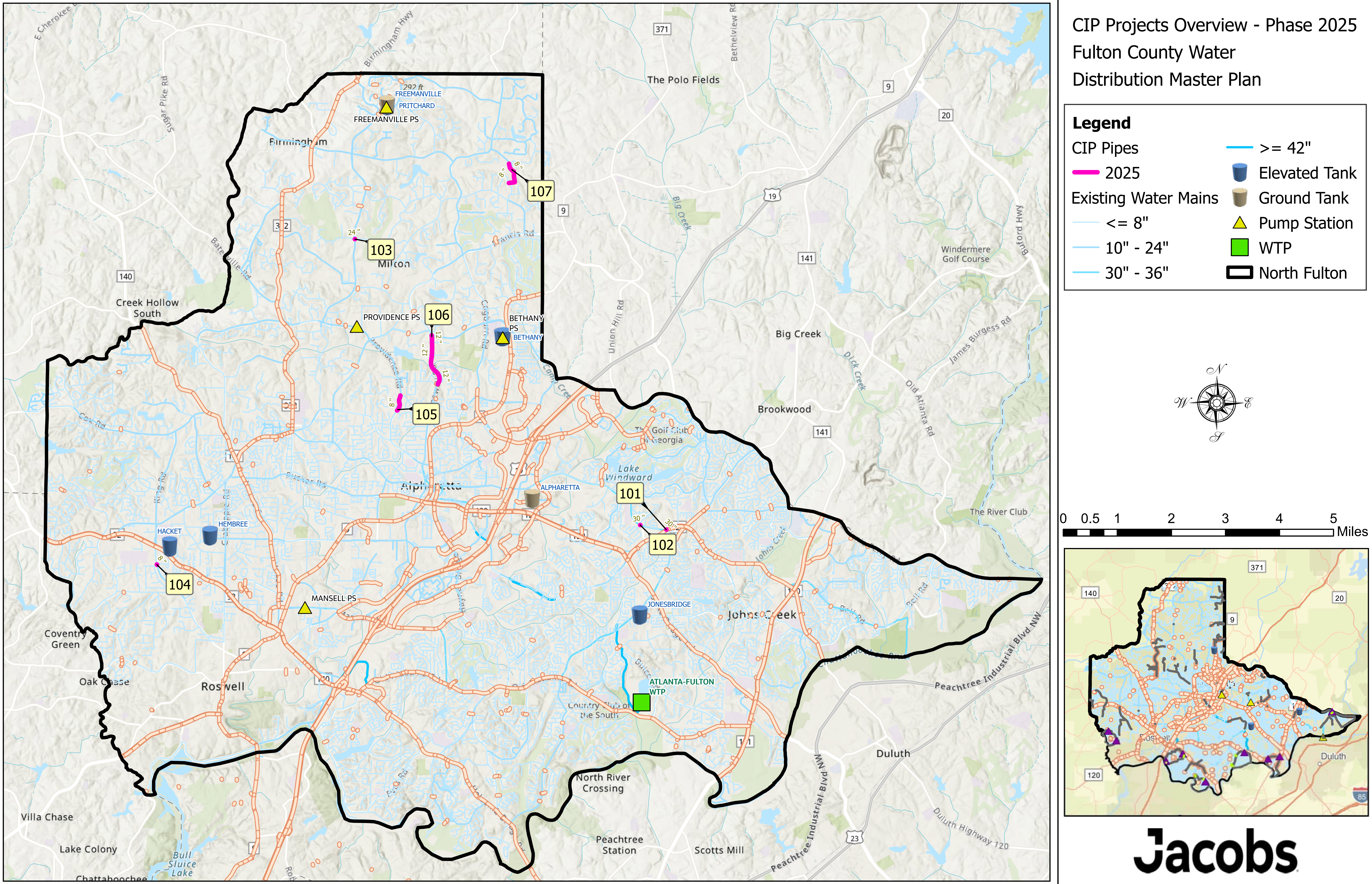
Appendix H
CIP Map Book

CIP Projects Overview
Fulton County Water
Distribution Master Plan



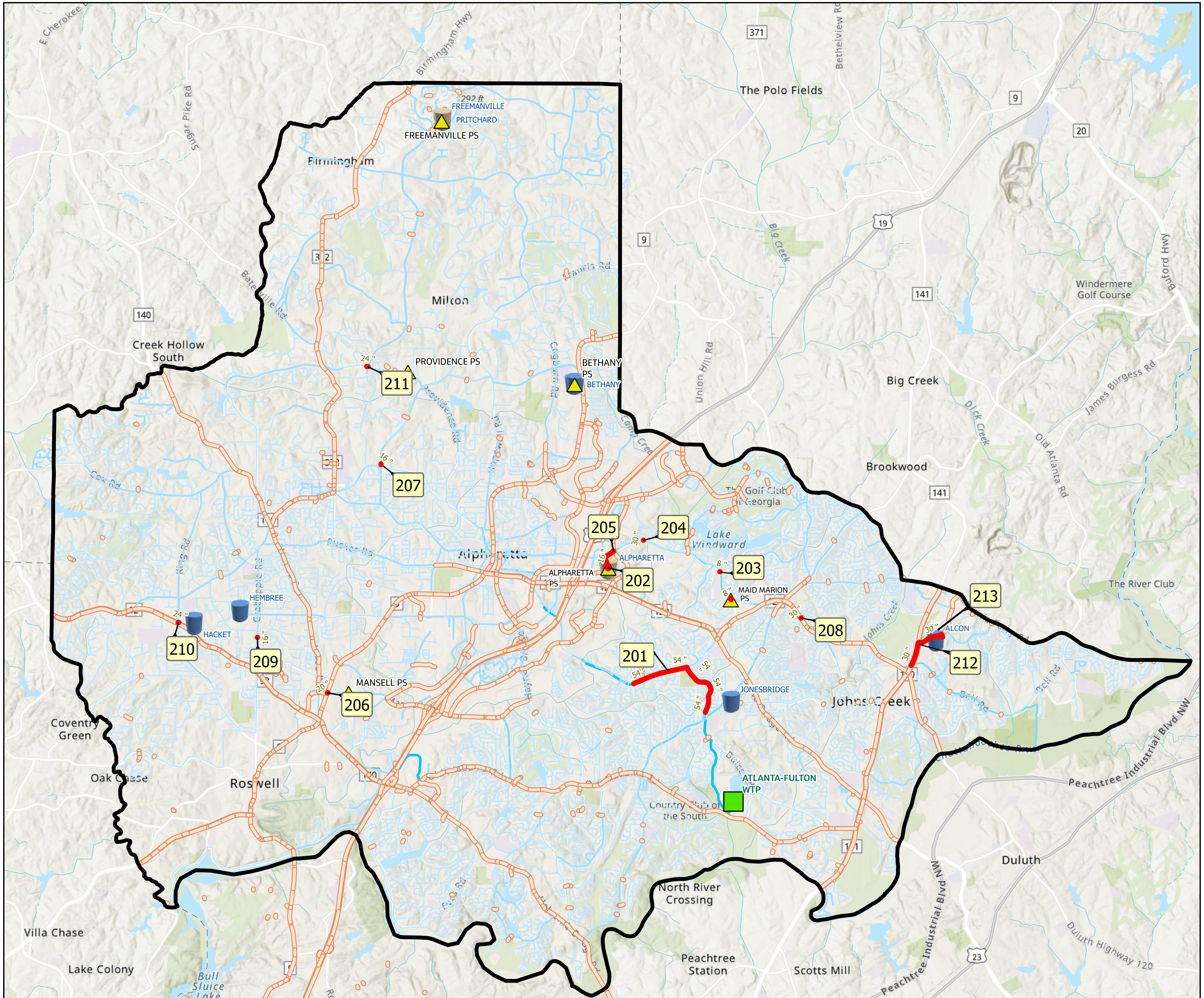


Jacobs



CIP Projects Overview - Phase 2025
Fulton County Water
Distribution Master Plan
Legend
CIP Pipes
2025
Existing Water Mains
<= 8"
10" - 24"
30" - 36"
>= 42"
Elevated Tank
Ground Tank
Pump Station
WTP
North Fulton
0 0.5 1 2 3 4 5 Miles
101
102
103
104
105
106
107
FREEMANVILLE
PRITCHARD
FREEMANVILLE PS
PROVIDENCE PS
BETHANY PS
BETHANY
ALPHARETTA
HACKET
HEMBREE
MANSELL PS
JONESBRIDGE
ATLANTA-FULTON WTP
Birmingham
Milton
Alpharetta
Roswell
Johns Creek
The Polo Fields
Big Creek
Brookwood
Creek Hollow South
Coventry Green
Oak Chase
Villa Chase
Lake Colony
North River Crossing
Peachtree Station
Scotts Mill
Duluth
Windermere Golf Course
The River Club
Jacobs

CIP Projects Overview - Phase 2030
Fulton County Water Distribution Master Plan



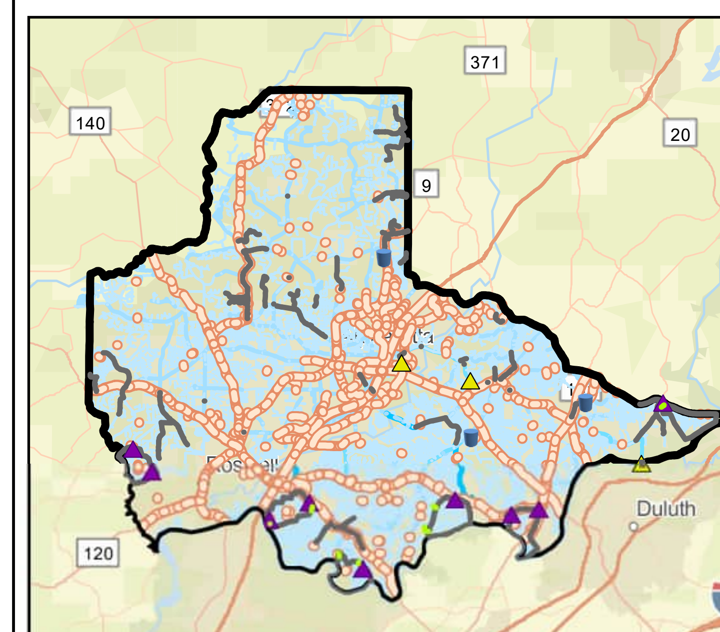
Legend

CIP Pipes
- 2030

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

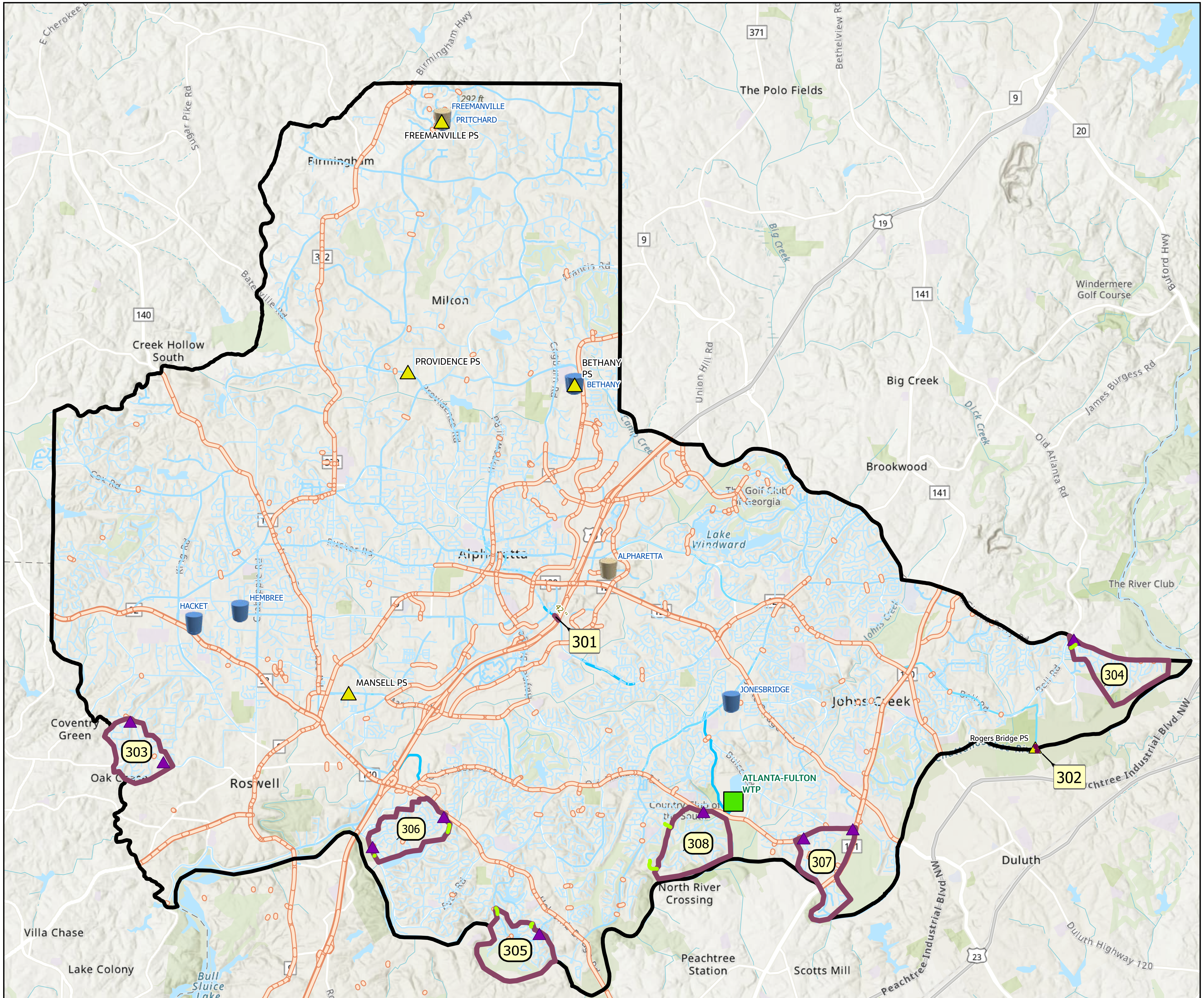
- Elevated Tank
- Ground Tank
- Pump Station
- WTP
- North Fulton

0 0.5 1 2 3 4 5 Miles



Jacobs

CIP Projects Overview - Phase 2035 Fulton County Water Distribution Master Plan



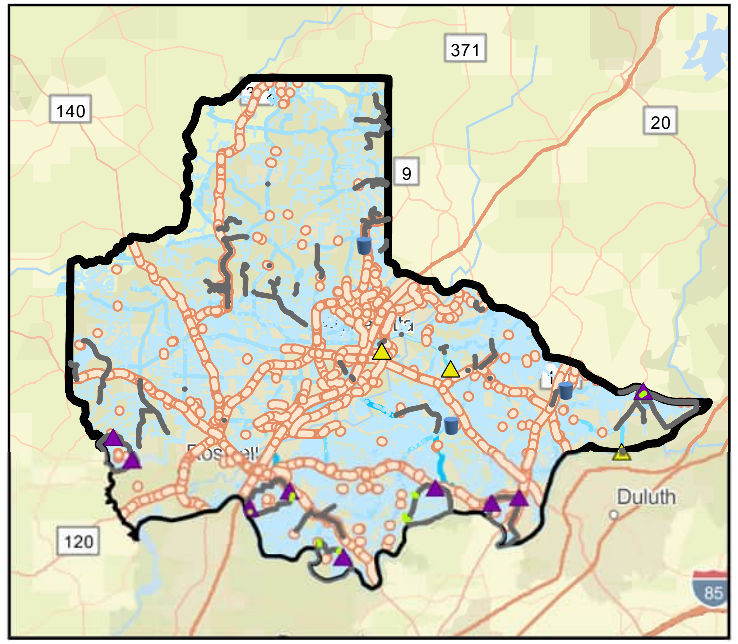
Legend

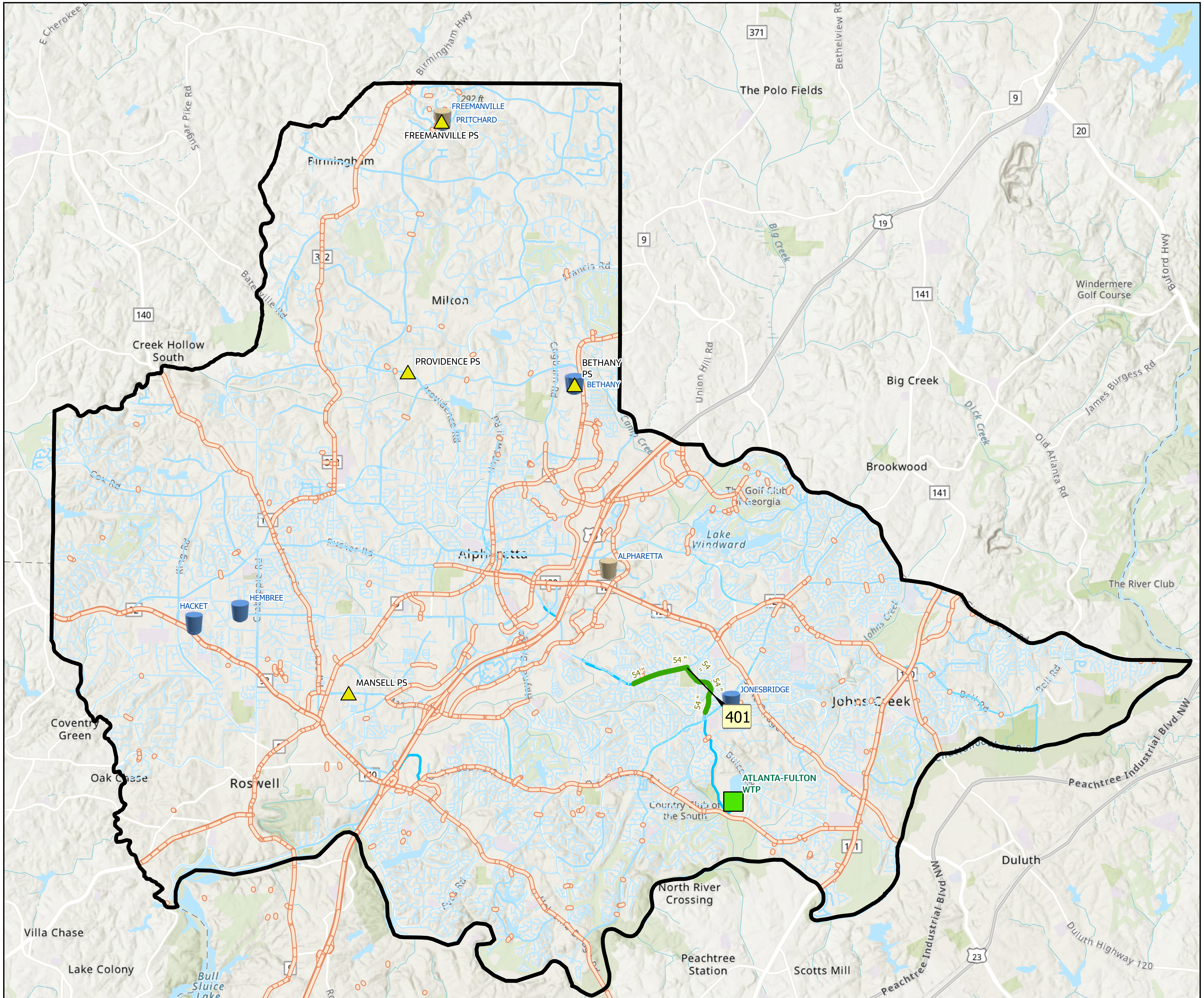
CIP Pipes
- 2035

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- Elevated Tank
- Ground Tank
- Pump Station
- WTP
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains
- North Fulton

0 0.5 1 2 3 4 5 Miles





CIP Projects Overview - Phase 2040 Fulton County Water Distribution Master Plan

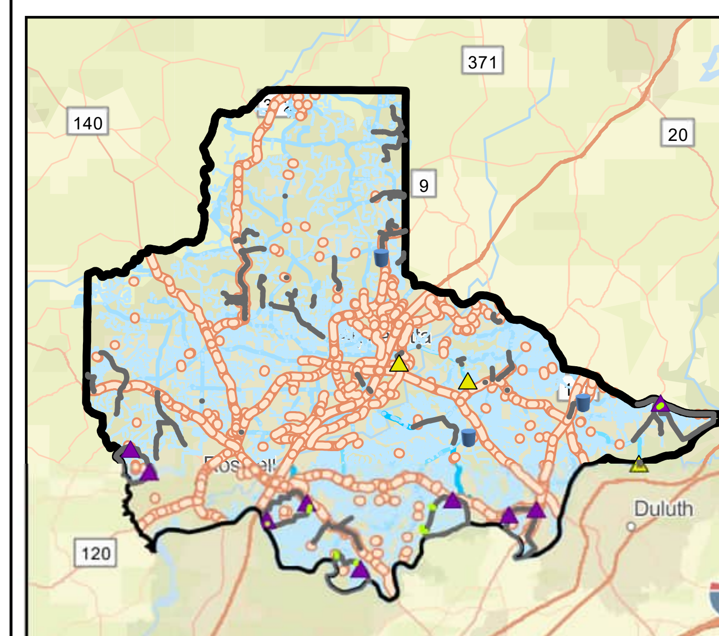
Legend

CIP Pipes
- 2040

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

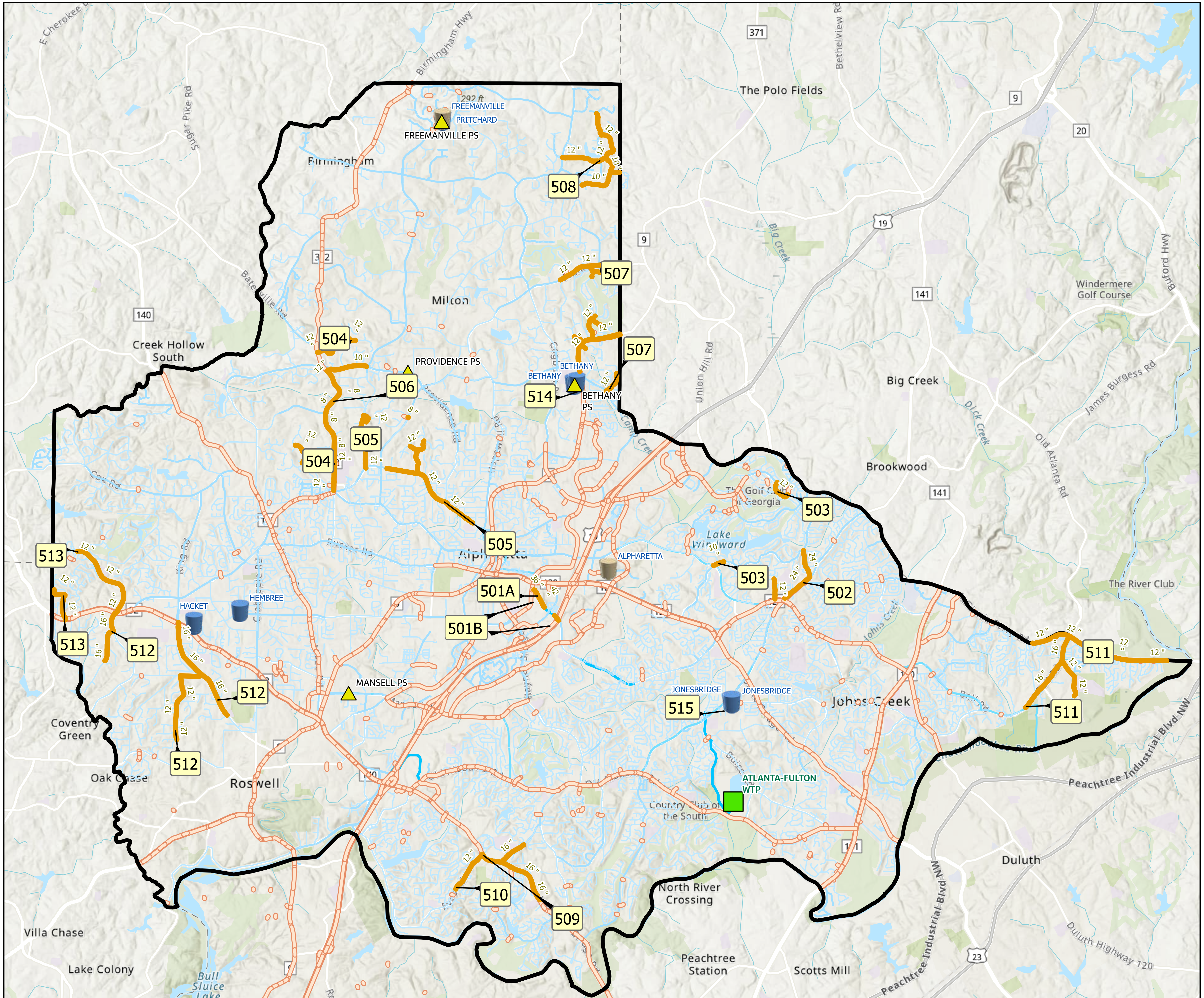
- Elevated Tank
- Ground Tank
- Pump Station
- WTP
- North Fulton

0 0.5 1 2 3 4 5 Miles



Jacobs

CIP Projects Overview - Phase 2050
Fulton County Water
Distribution Master Plan



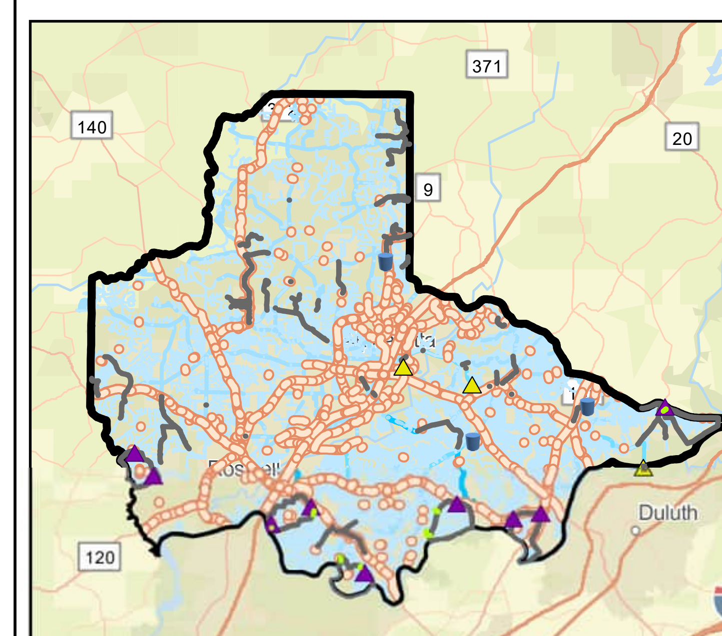
Legend

CIP Pipes
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

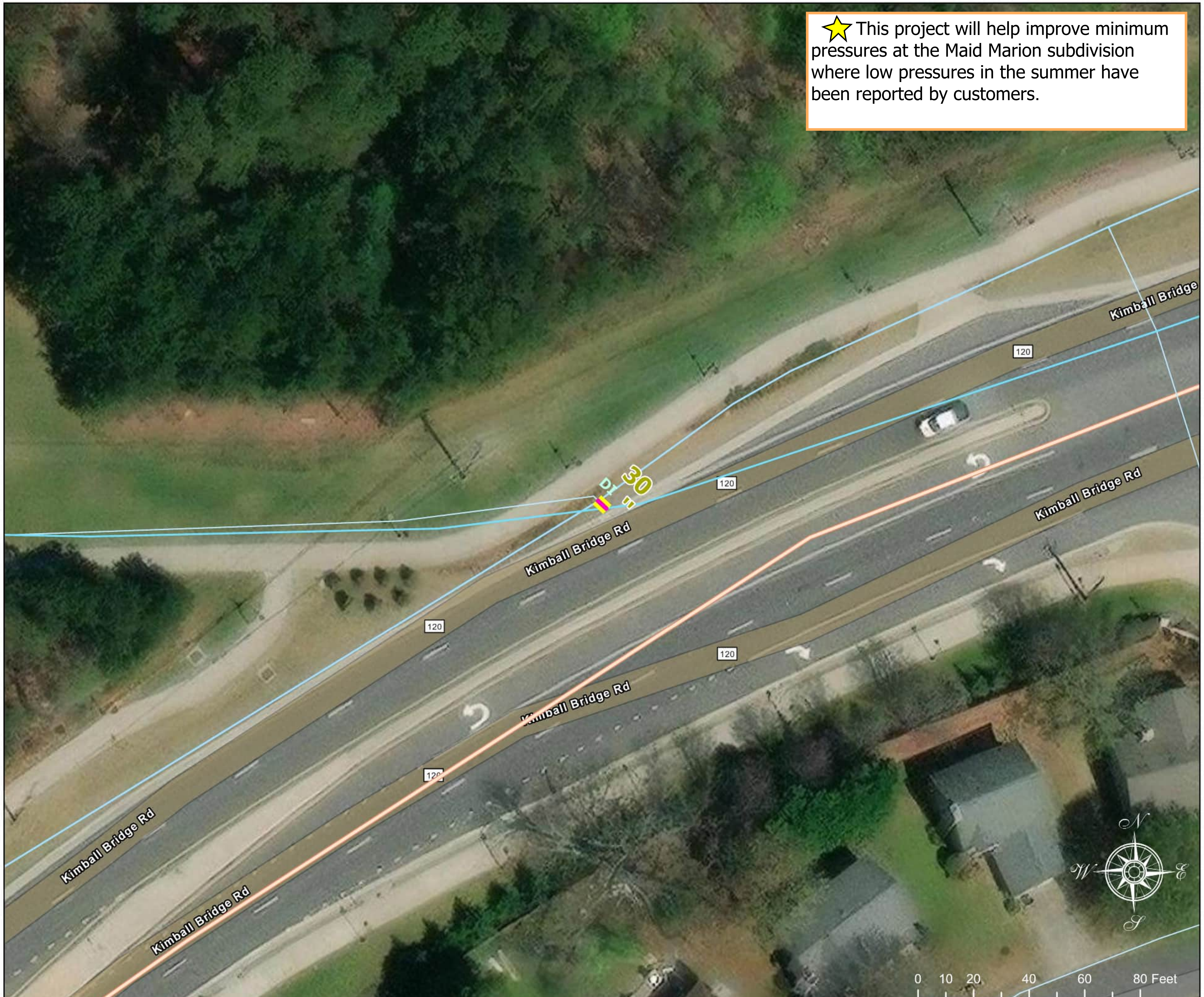
- Elevated Tank
- Ground Tank
- Pump Station
- WTP
- North Fulton

0 0.5 1 2 3 4 5 Miles



Jacobs

CIP Project #101
Kimball Bridge Rd and Webb Bridge Rd Crossing Pipe Connection
Phase: 2025
Fulton County Water Distribution Master Plan



Project Description:

Perform crossing pipe connection of 30" water main to 8" water main at Kimball Bridge Rd and Webb Bridge Rd. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

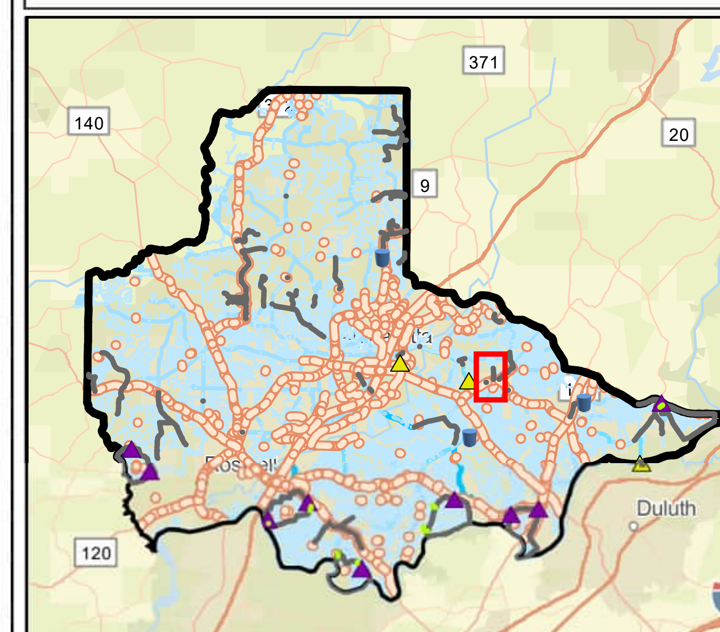
Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Pump Station

WTP

North Fulton

GDOT Road Segments



Jacobs

CIP Project #102
Webb Bridge Rd and Maid Marion Close Crossing Pipe Connection
Phase: 2025
Fulton County Water Distribution Master Plan

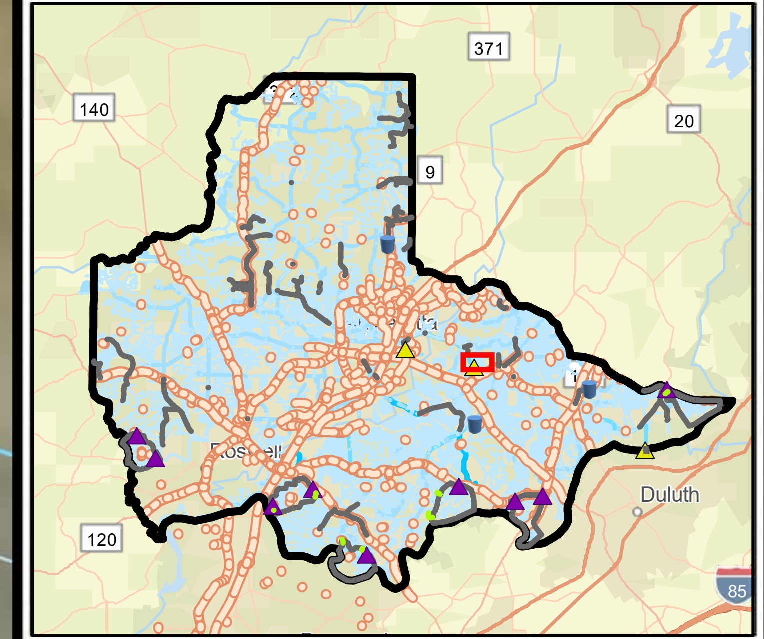
Project Description:

Perform crossing pipe connection of 30" water main to 8" water main at Webb Bridge Rd and Maid Marion Close. Helps in improving minimum pressures in the area.

Legend

Highlighted Project
CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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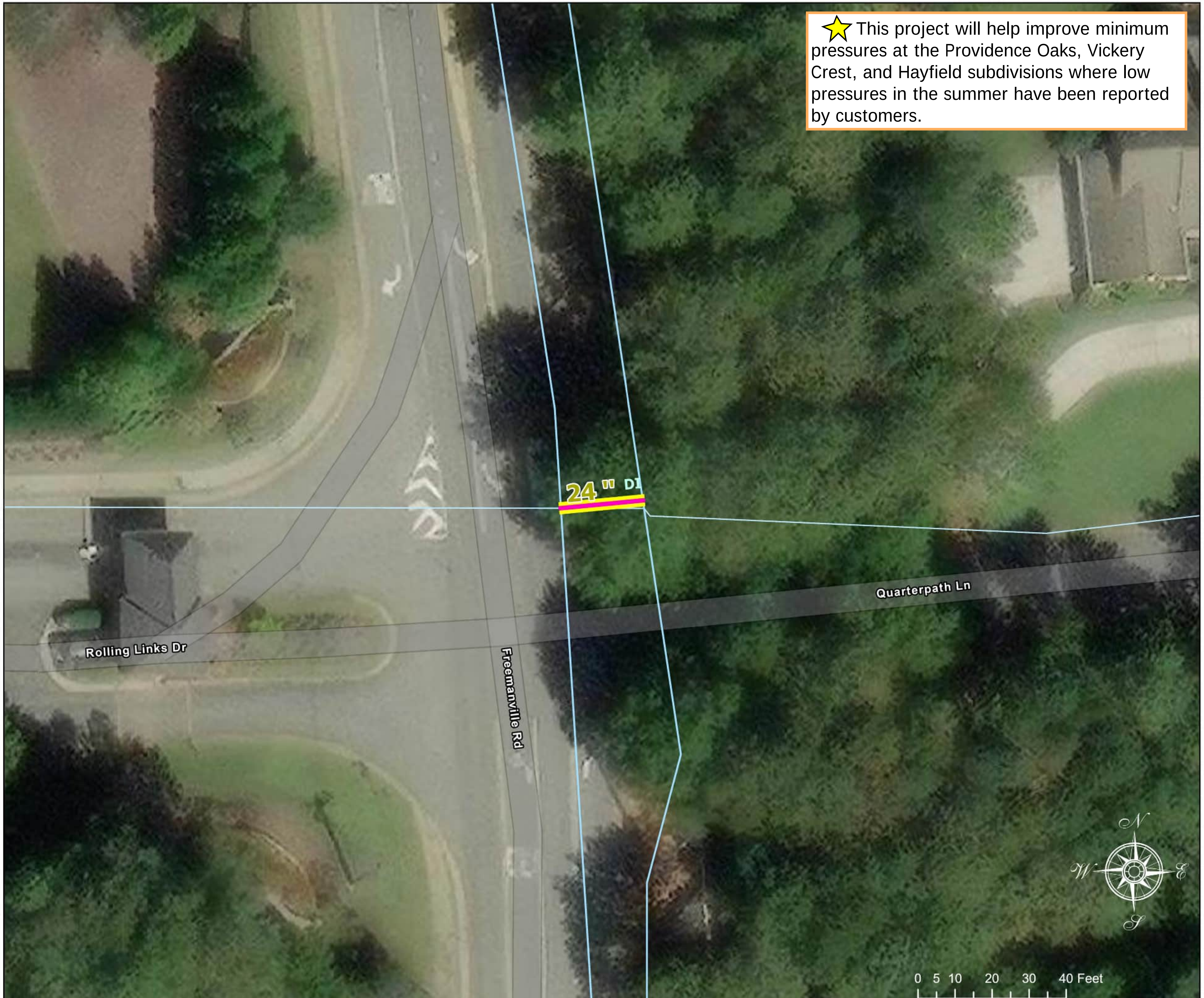


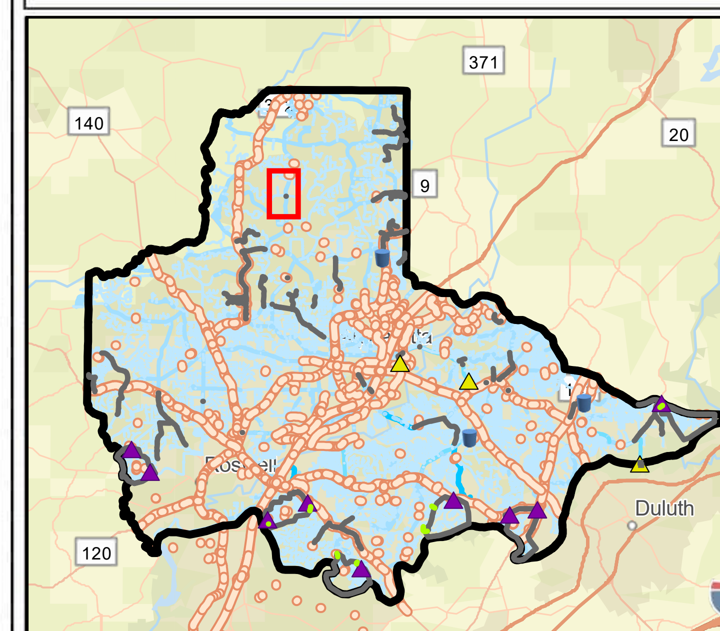
CIP Project #103
Freemanville Rd and Quarterpath Ln
Close Crossing Pipe Connection
Phase: 2025
Fulton County Water Distribution
Master Plan

Project Description:

Perform crossing pipe connection of 24" water main to 8" water main at Freemanville Rd and Quarterpath Ln. Helps in improving minimum pressures around the county.

Legend

Highlighted Project
CIP Pipes
2025
2030
2035
2040
2050
Existing Water Mains
<= 8"
10" - 24"
30" - 36"
>= 42"
Pump Station
WTP
North Fulton
GDOT Road Segments



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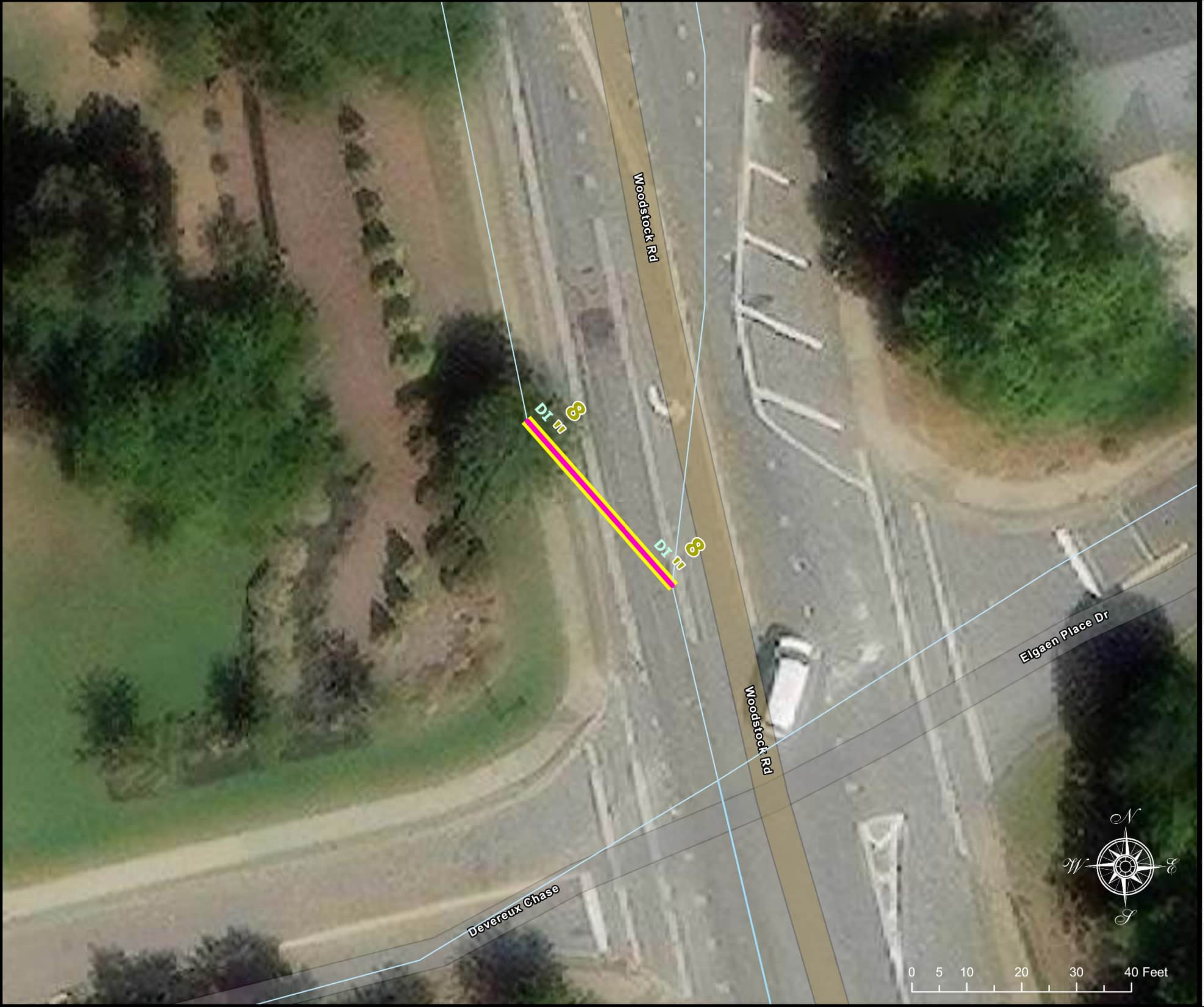


CIP Project #104
Woodstock Rd Extension
Phase: 2025
Fulton County Water Distribution Master Plan

Project Description:

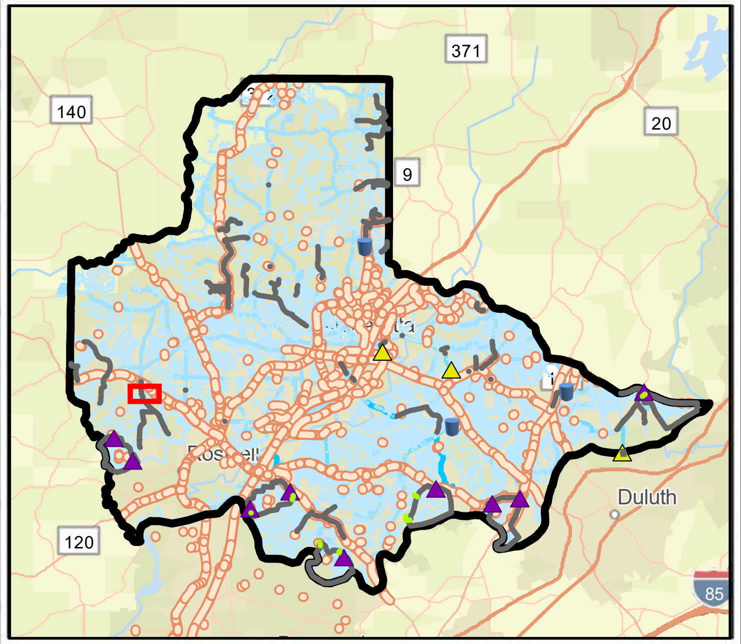
Extend 40 LF of 8" water main along Woodstock Rd. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #105
Providence Rd Extension
Phase: 2025
Fulton County Water Distribution Master Plan

Project Description:

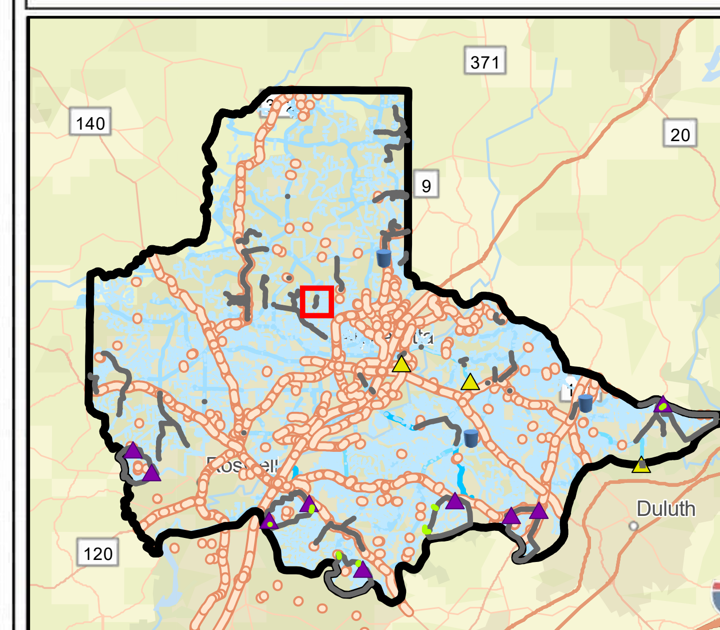
Extend 1,600 LF of 8" water main along Providence Rd. Helps in improving low pressures and fire flows in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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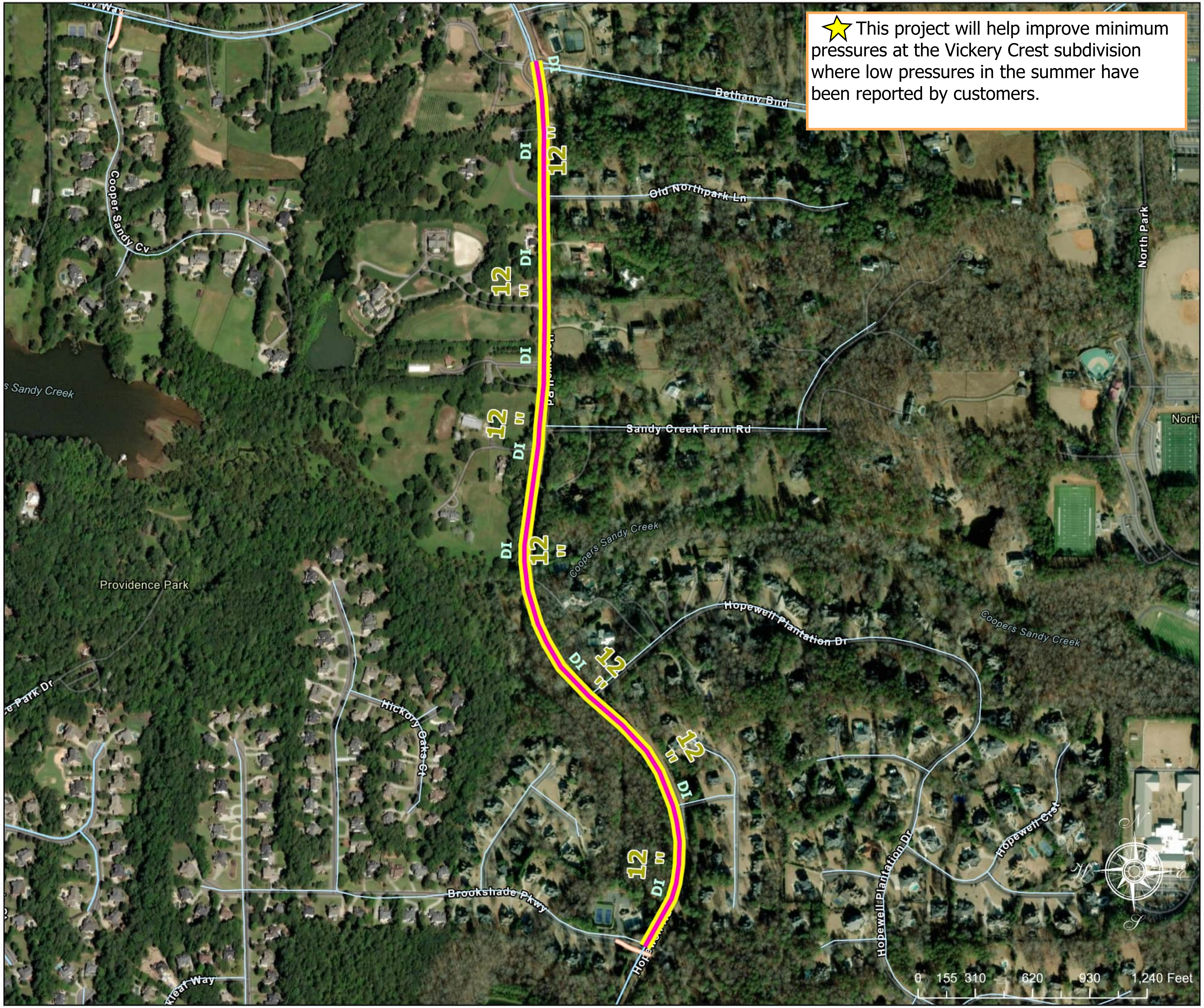


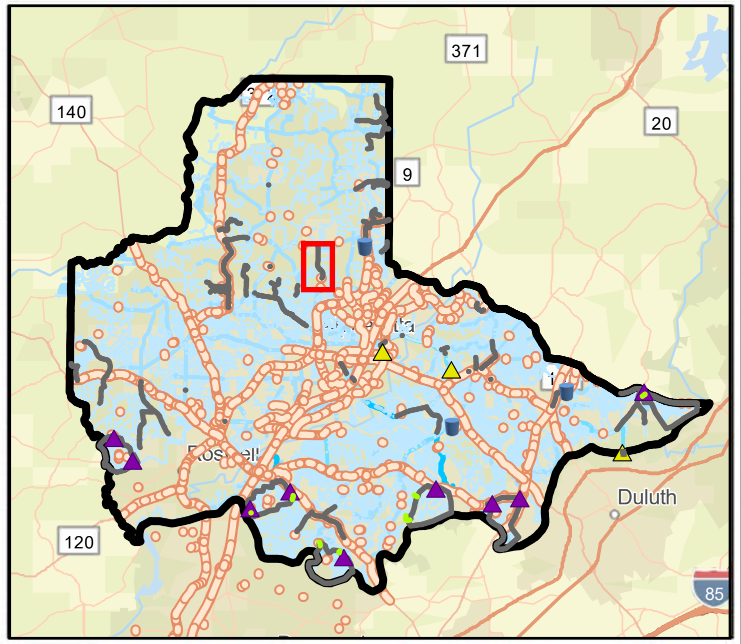
CIP Project #106
Hopewell Rd Parallel Line
Phase: 2025
Fulton County Water Distribution Master Plan

Project Description:

Parallel 5,100 LF of 12" water main along Hopewell Rd. Helps in improving minimum pressures and fire flows in the area.

Legend

Highlighted Project	Existing Water Mains
CIP Pipes	<= 8"
2025	10" - 24"
2030	30" - 36"
2035	>= 42"
2040	Pump Station
2050	WTP
	North Fulton
	GDOT Road Segments



Jacobs

CIP Project #107
Hamby Rd Extension
Phase: 2025
Fulton County Water Distribution Master Plan

Project Description:

Extend 2,600 LF of 8" water main along Hamby Rd. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

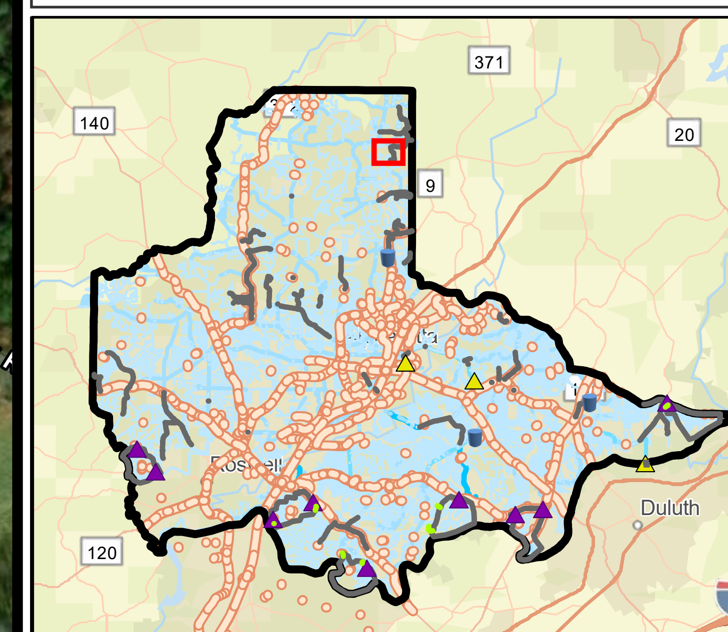
Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Pump Station

WTP

North Fulton

GDOT Road Segments



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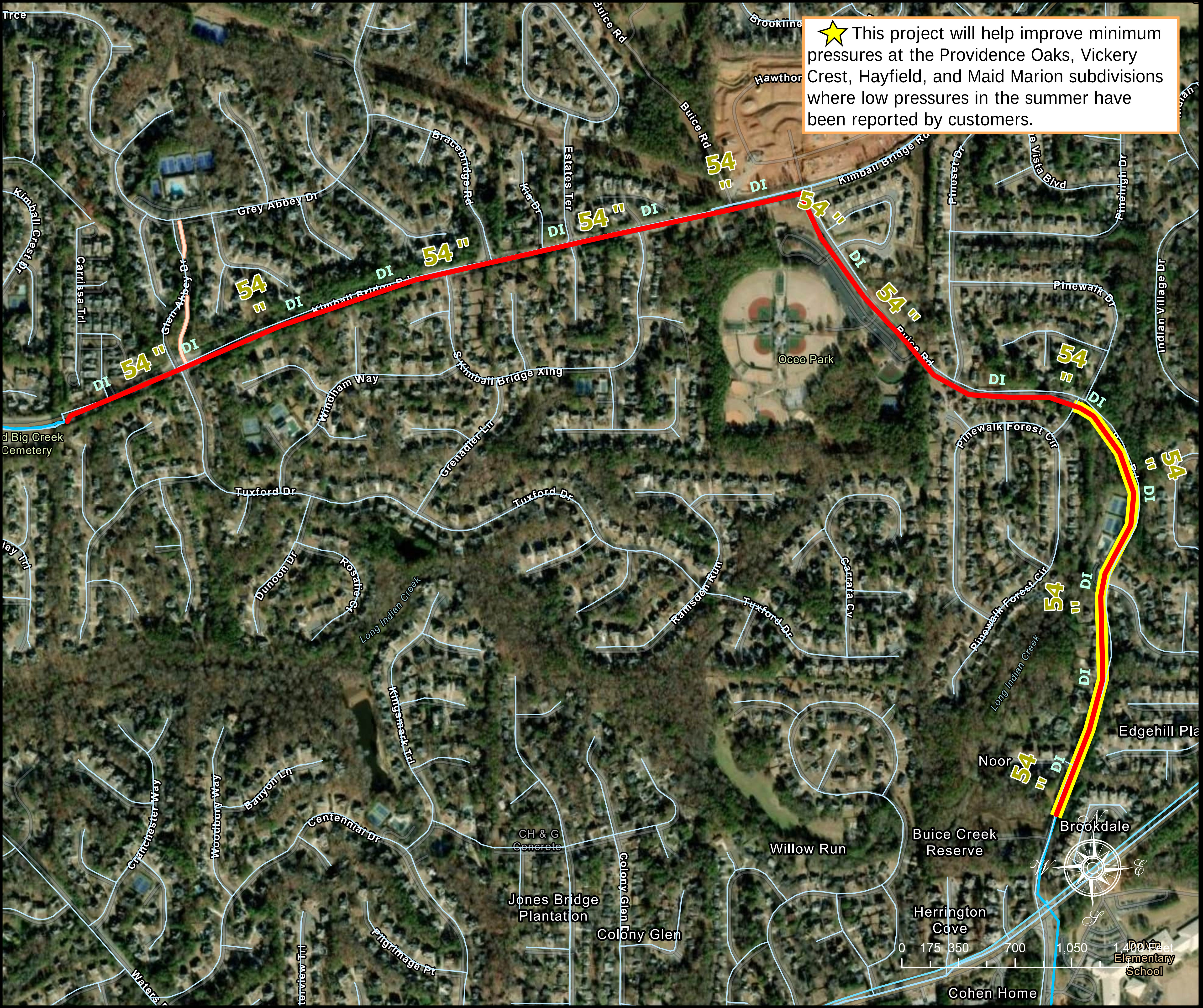


CIP Project #201A
Bruice Rd Transmission Main
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

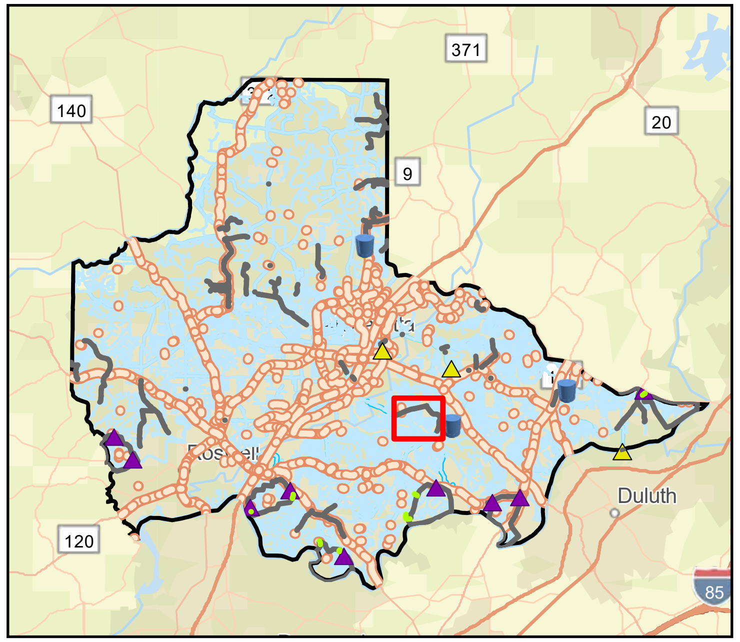
Complete 2,800 LF of 54" transmission main along Buice Rd, starting at Pinewalk Forest Cir. Helps in improving minimum pressures and water age in the county.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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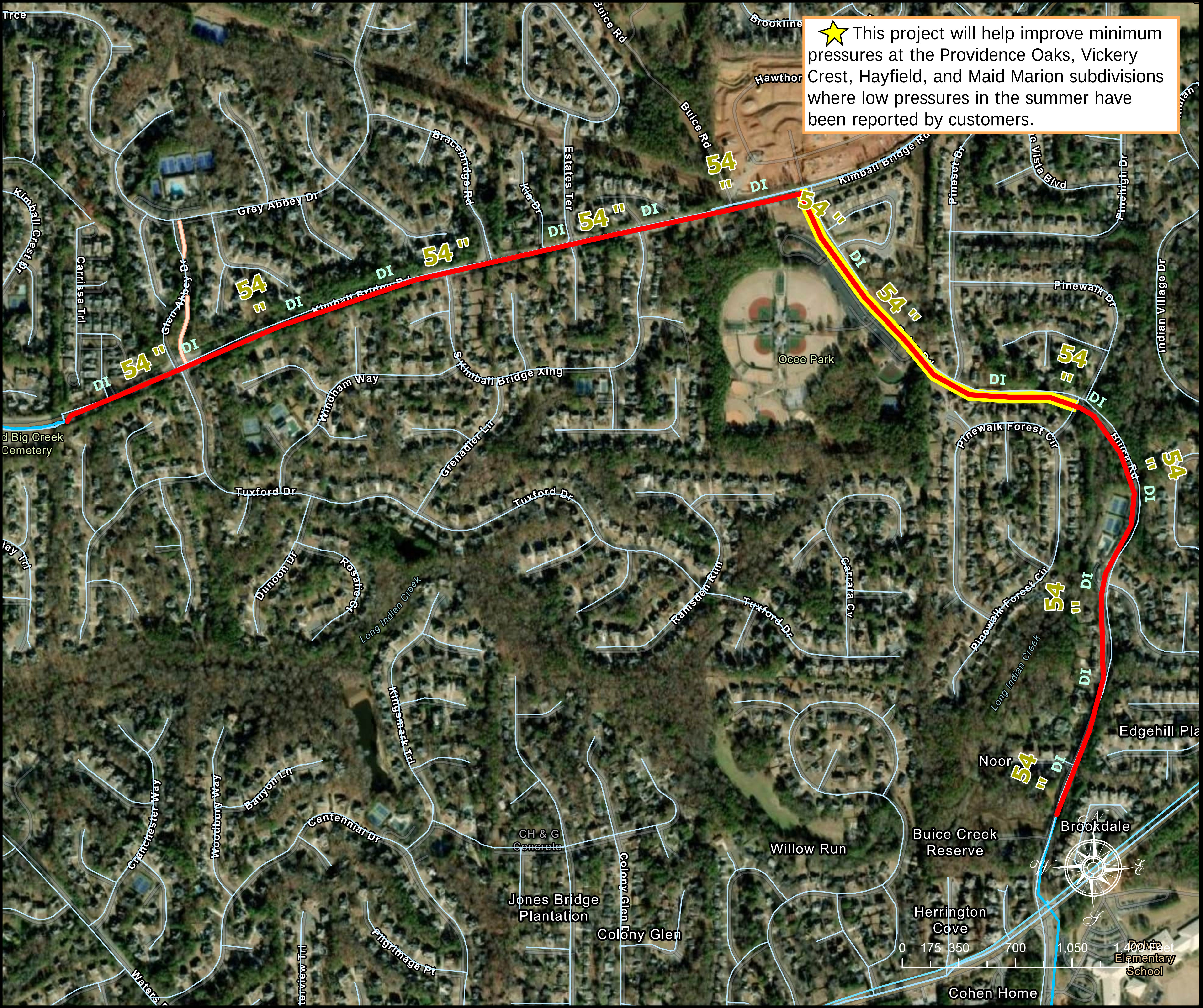


CIP Project #201B
Bruice Rd Transmission Main
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

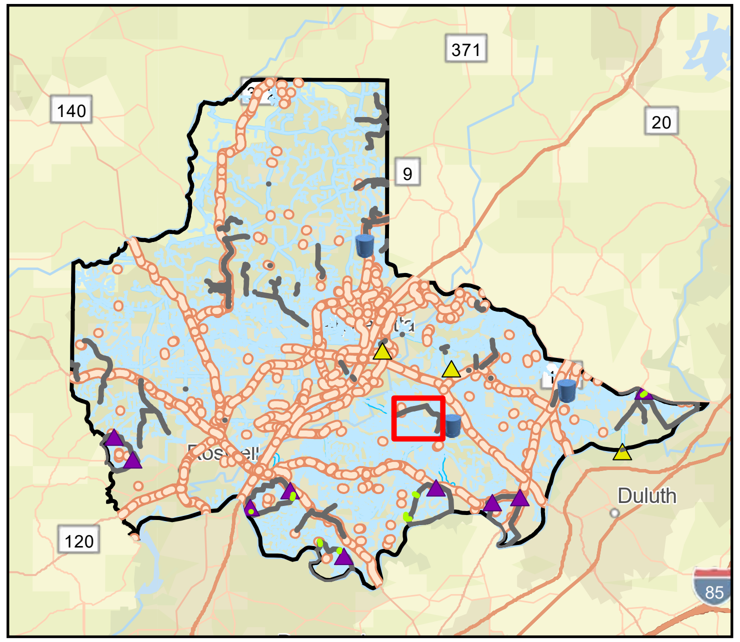
Complete 2,400 LF of 54" transmission main along Buice Rd, ending at Pinewalk Forest Cir. Helps in improving minimum pressures and water age in the county.

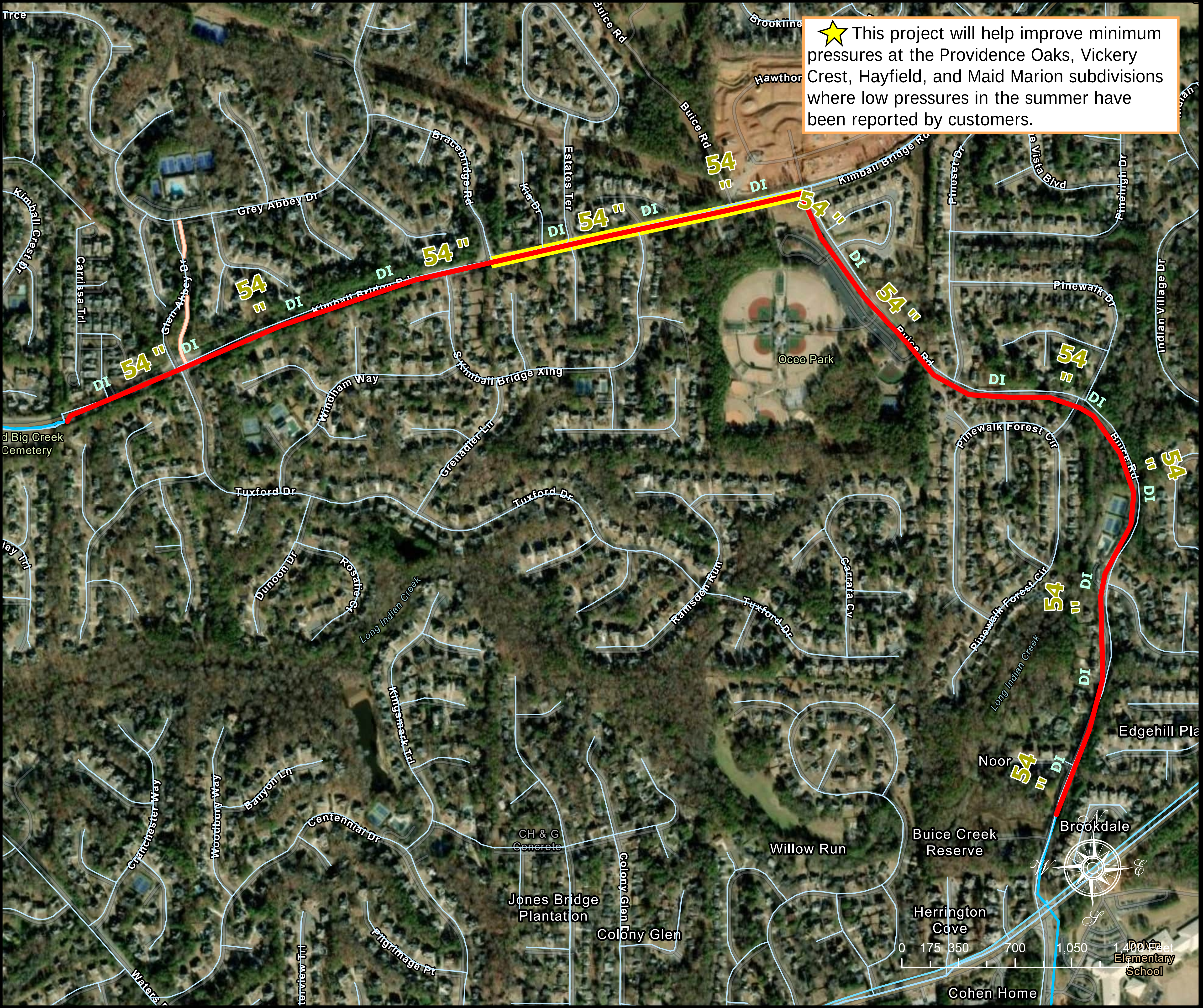
Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments





CIP Project #201C
Bruice Rd Transmission Main
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

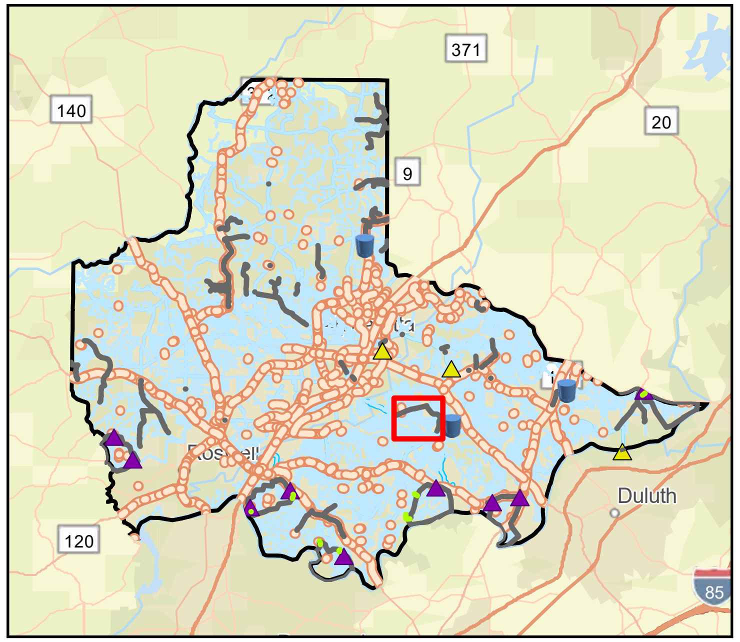
Complete 2,000 LF of 54" transmission main along Kimball Bridge Rd, starting at Bracebridge Rd. Helps in improving minimum pressures and water age in the county.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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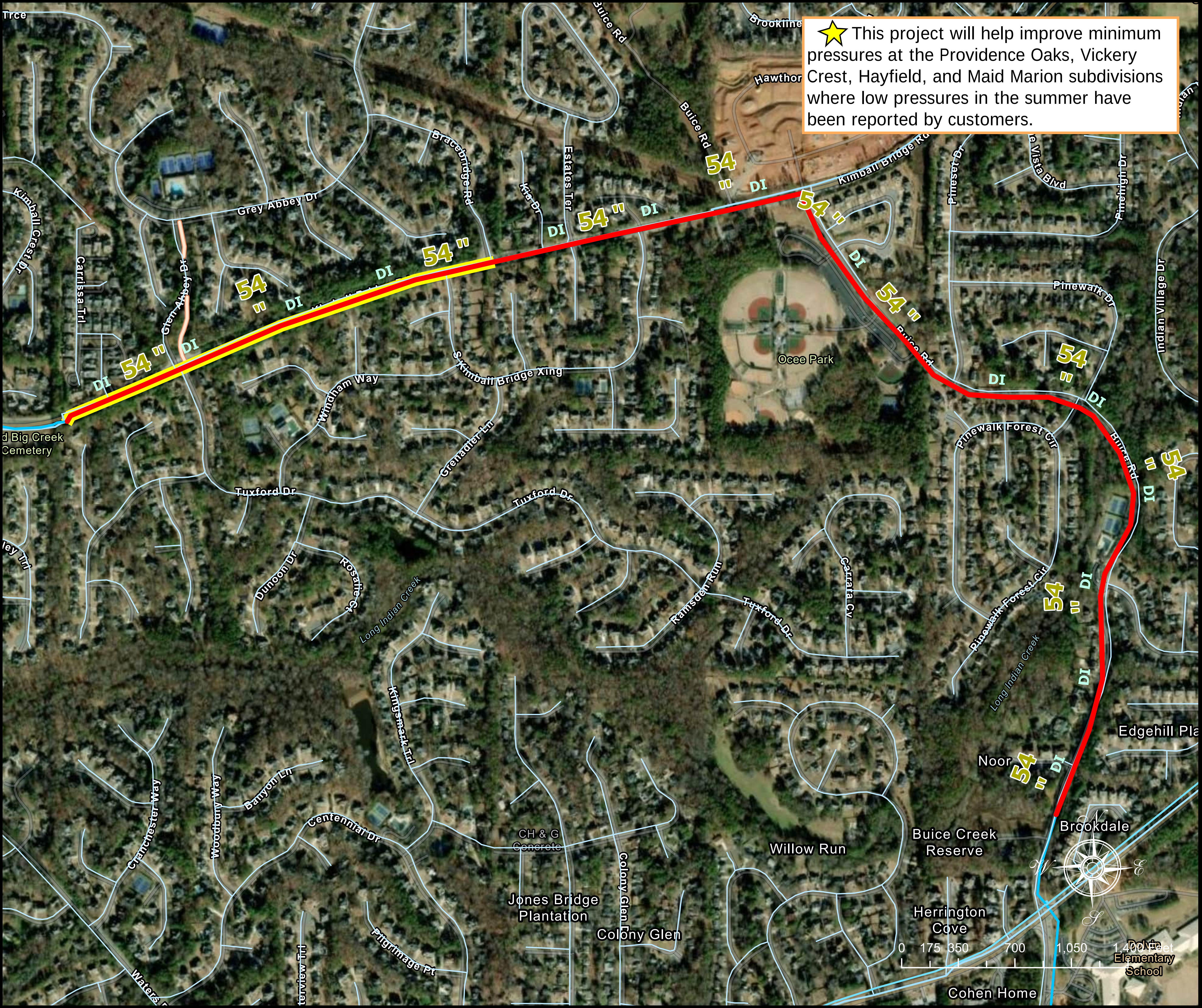


CIP Project #201D
Bruice Rd Transmission Main
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

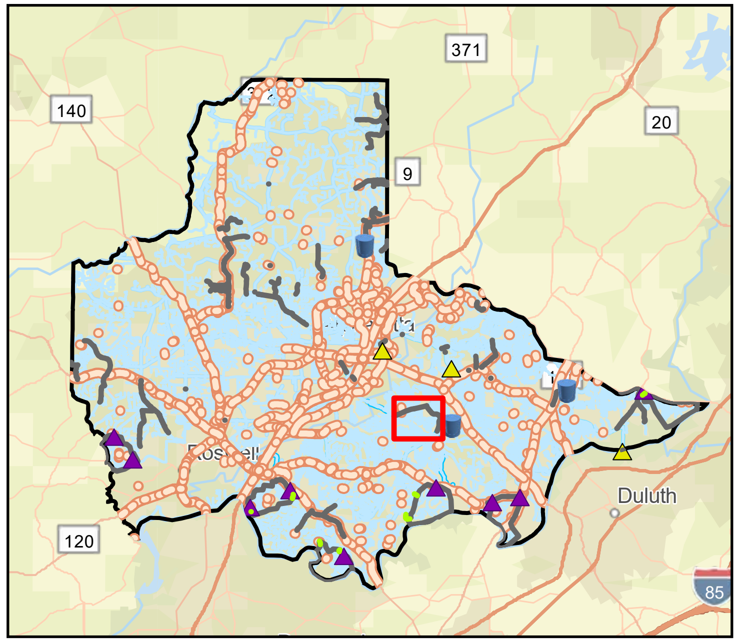
Complete 2,900 LF of 54" transmission main along Kimball Bridge Rd, ending at Bracebridge Rd. Helps in improving minimum pressures and water age in the county.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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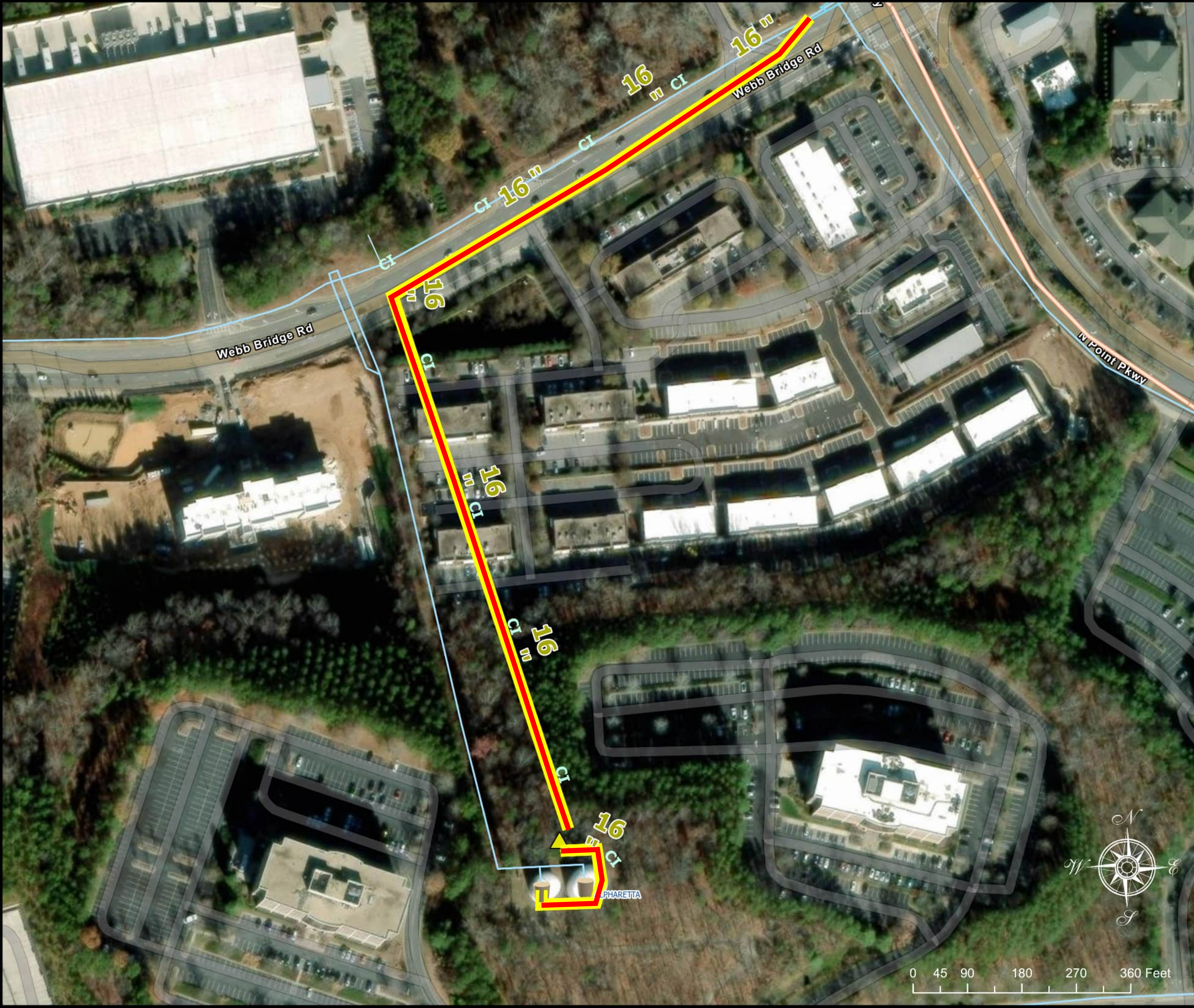


CIP Project #202
Alpharetta Tank Pump Station
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:
New Alpharetta Tank Pump Station, with three pumps of 75 HP each, with 2,100 LF of 16" main along Webb Bridge Road. Helps with draining the Alpharetta Tank.

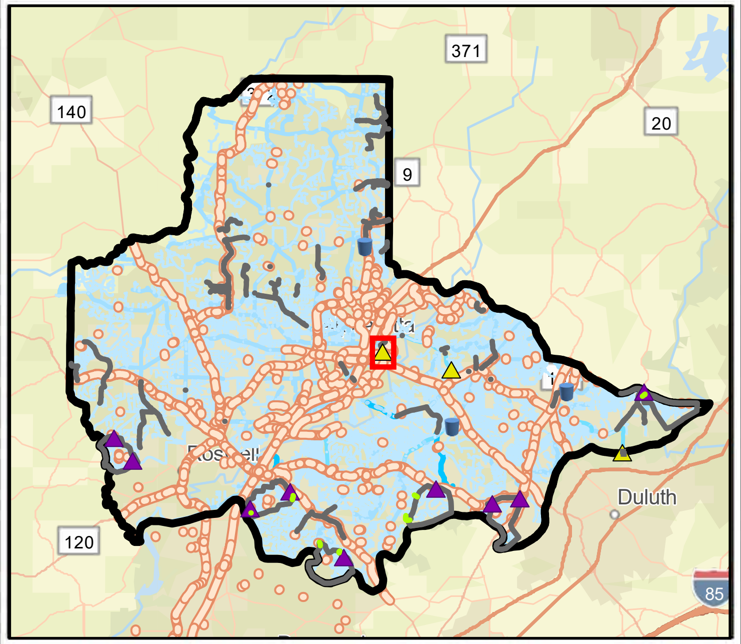
Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Ground Tank
Pump Station
WTP
North Fulton
GDOT Road Segments



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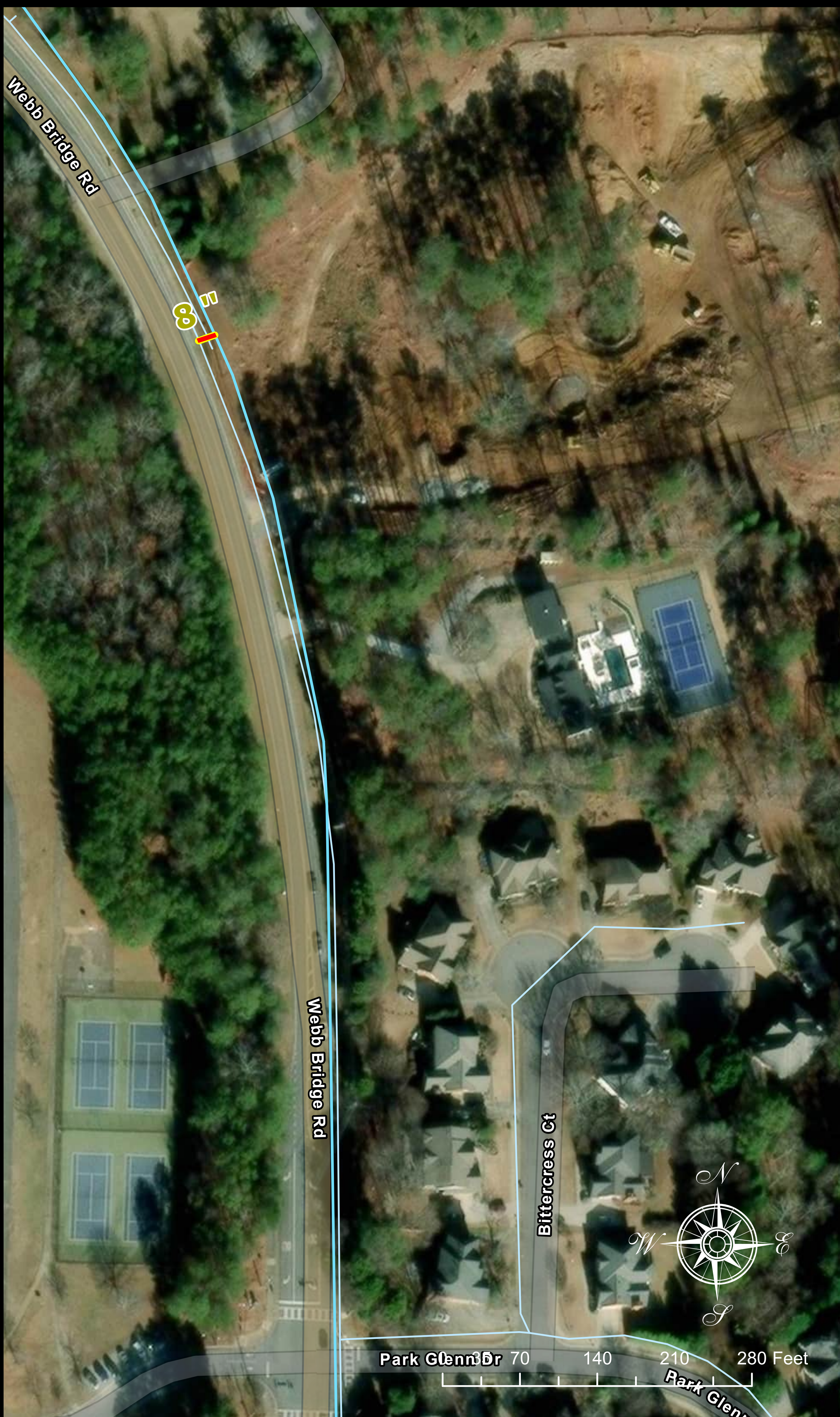
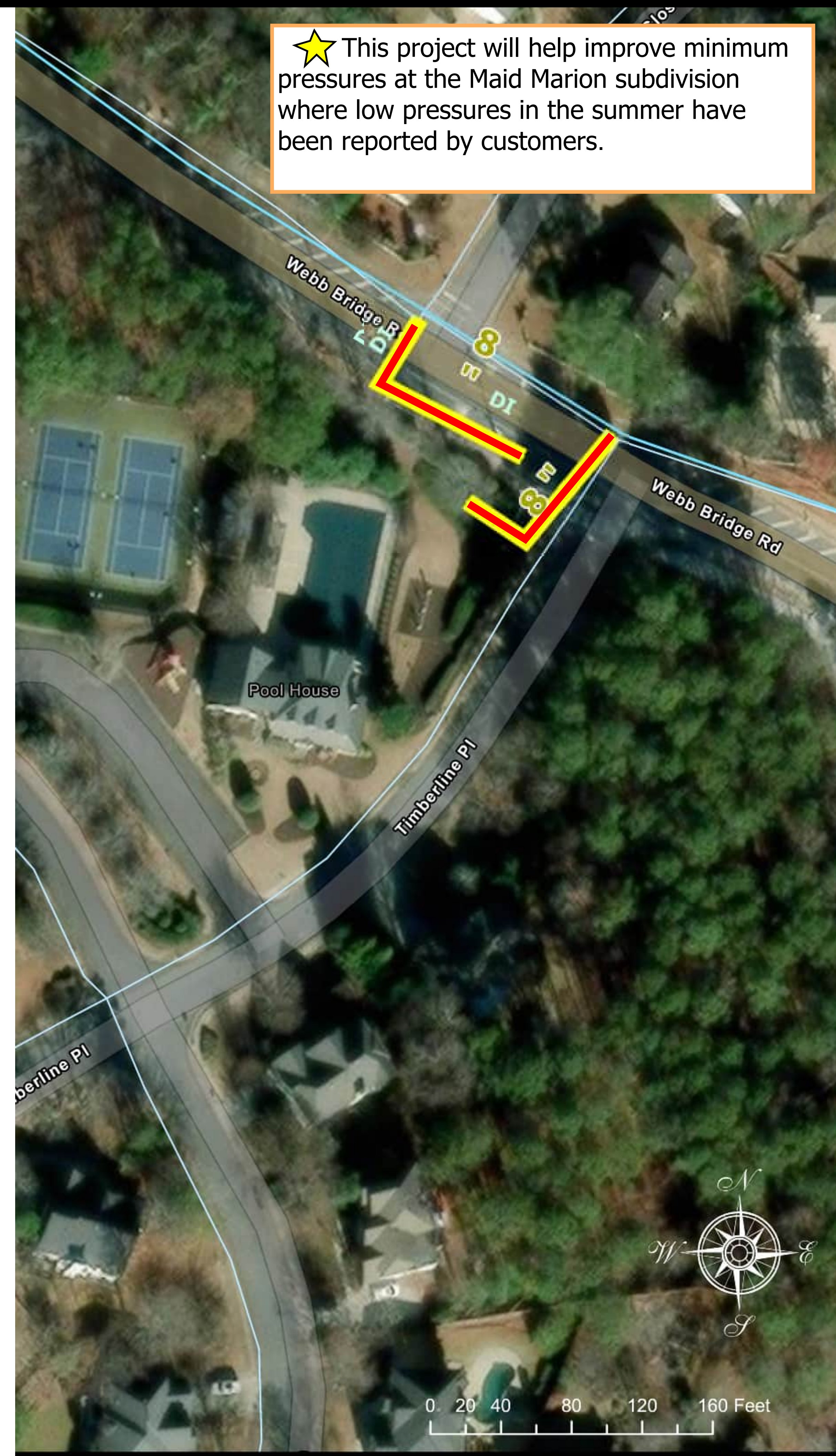




CIP Project #203
Maid Marion In-line Booster Station
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

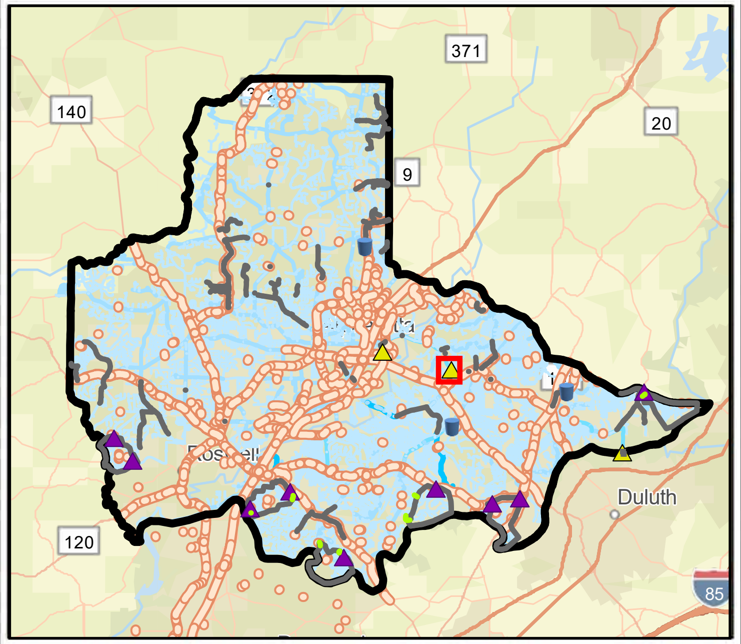
New Maid Marion In-line Booster Station with three pumps of 5 HP each. Perform crossing pipe connection of 300 LF of 8" water main to 30" water main at Webb Bridge Road. Helps with improving minimum pressures in the area by creating a new Maid Marion high pressure zone. Project includes closed valves.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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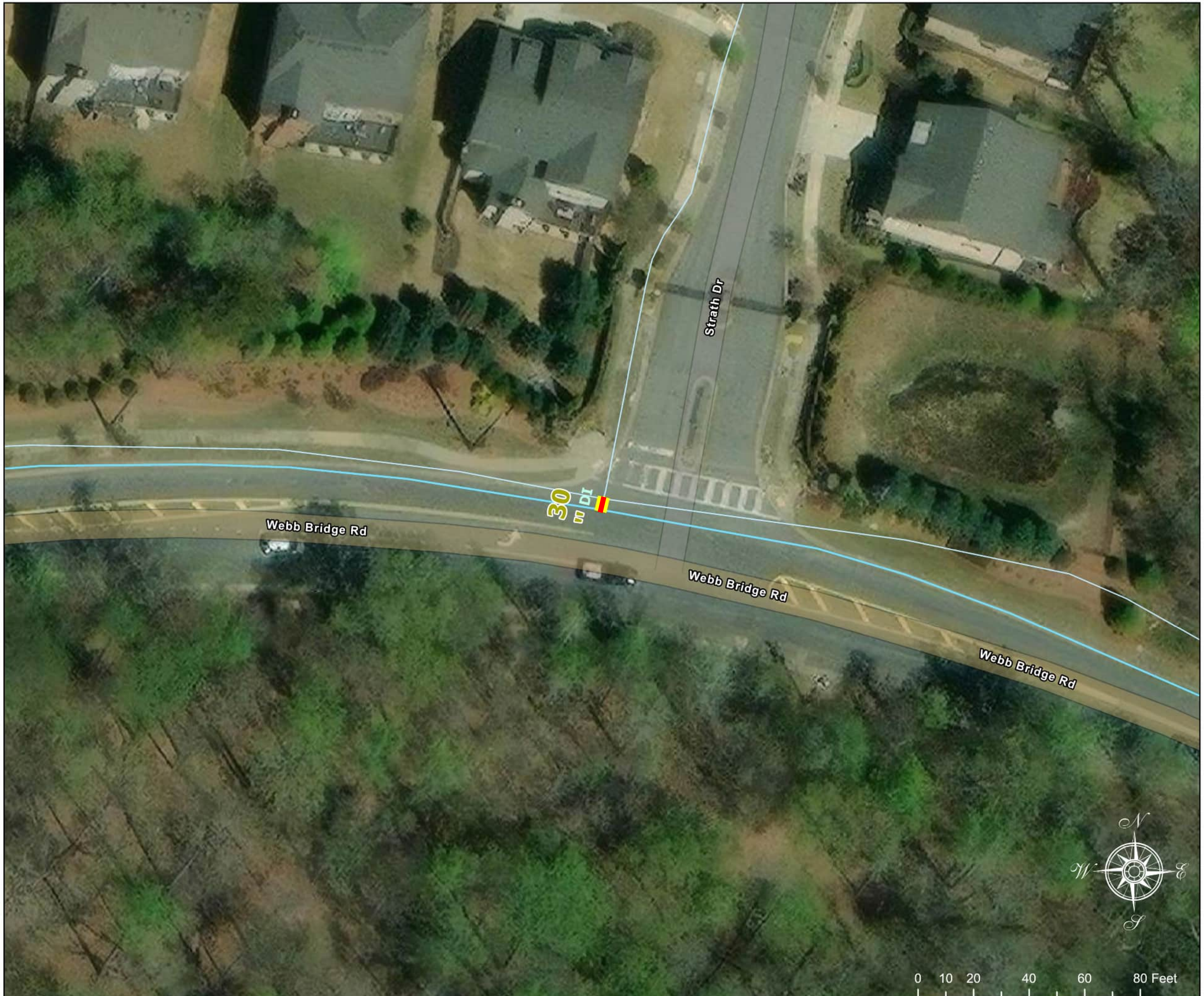


CIP Project #204
Webb Bridge Rd and Strath Dr
Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution
Master Plan

Project Description:

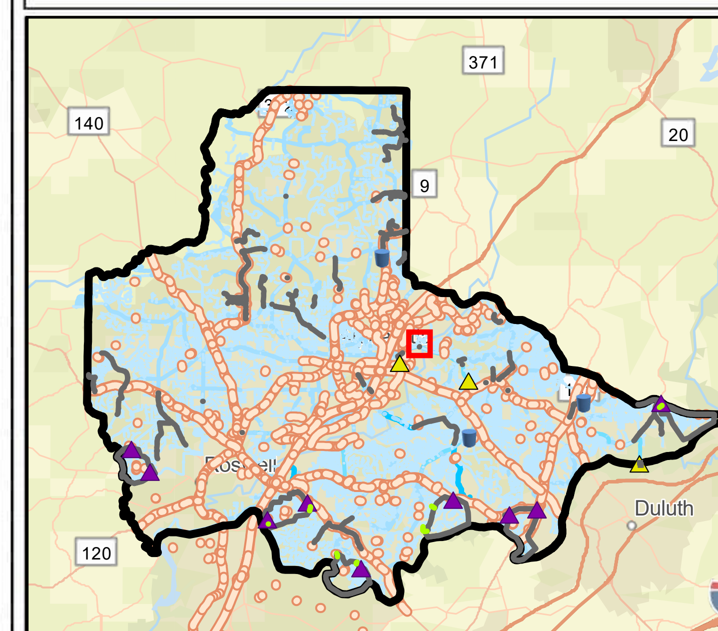
Perform crossing pipe connection of 30" water main to 8" water main at Webb Bridge Rd and Strath Dr. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #205
Webb Bridge Rd and N Point Pkwy Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

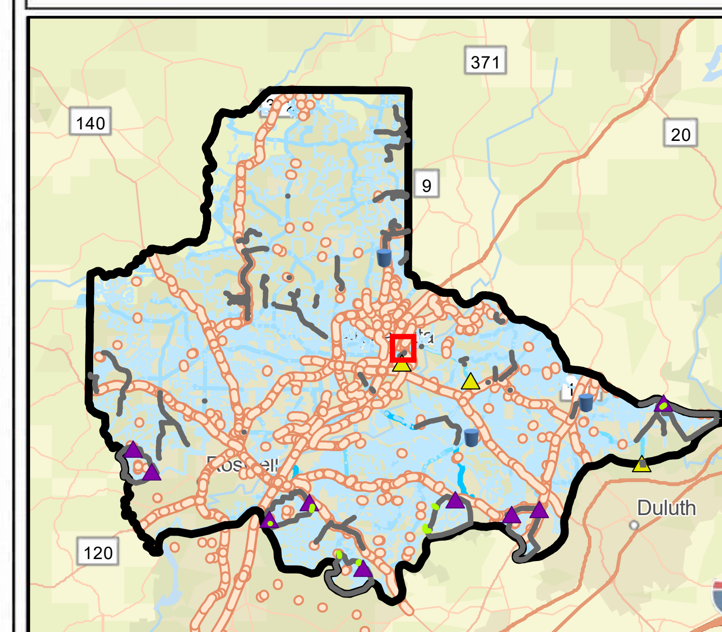
Perform crossing pipe connection of 30" water main to 12" water main at Webb Bridge Rd and N Point Pkwy. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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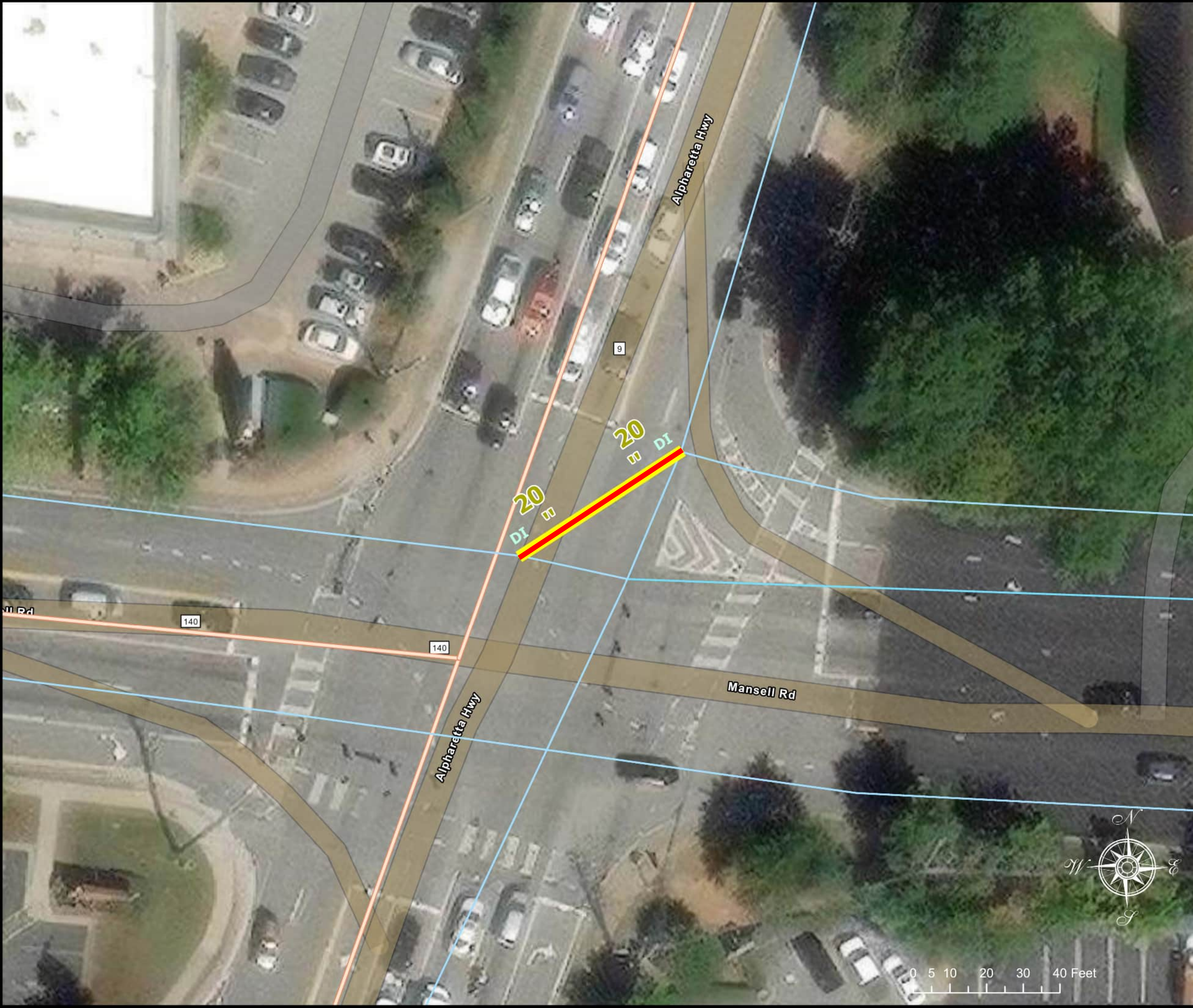


CIP Project #206
Mansell Rd and Alpharetta Hwy
Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution
Master Plan

Project Description:

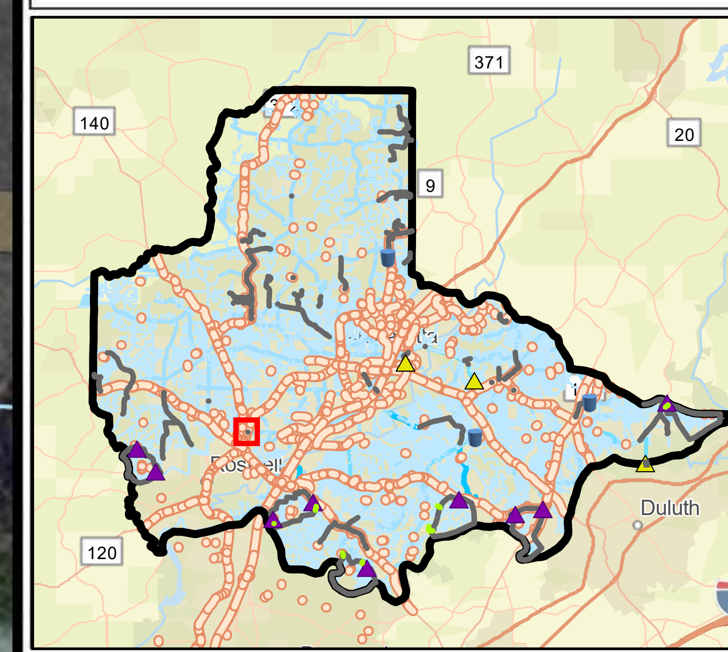
Perform crossing pipe connection of 60 LF of 20" water main to 10" water main at Mansell Rd and Alpharetta Hwy. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #207
Bethany Rd Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution Master Plan

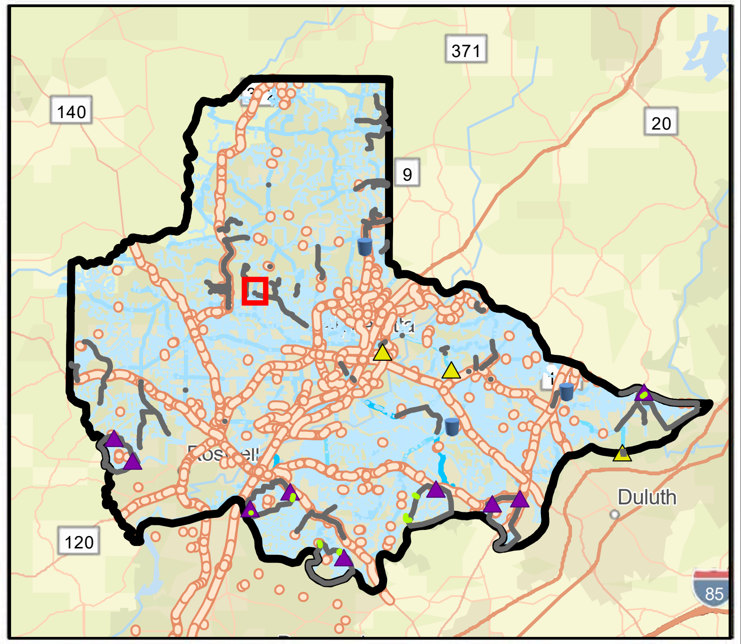
Project Description:

Perform crossing pipe connection of 16" water main to 10" water main at Bethany Rd, just north of Mayfield Rd. Helps in improving minimum pressures in the area.

Legend

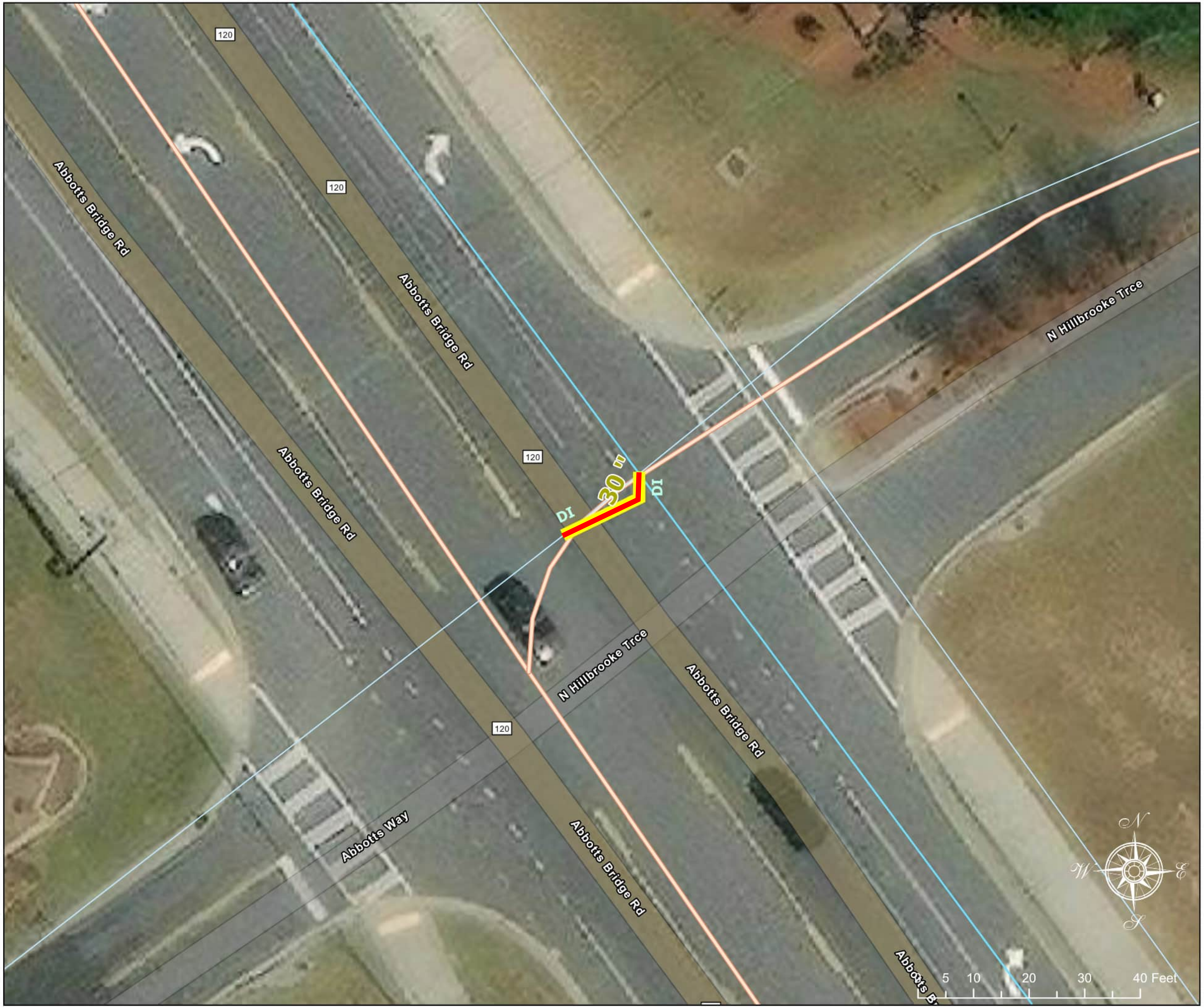
Highlighted Project
CIP Pipes
2025
2030
2035
2040
2050

Existing Water Mains
<= 8"
10" - 24"
30" - 36"
>= 42"
Pump Station
WTP
North Fulton
GDOT Road Segments



Jacobs

CIP Project #208
Abbotts Bridge Rd and Abbotts Way Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution Master Plan



Project Description:

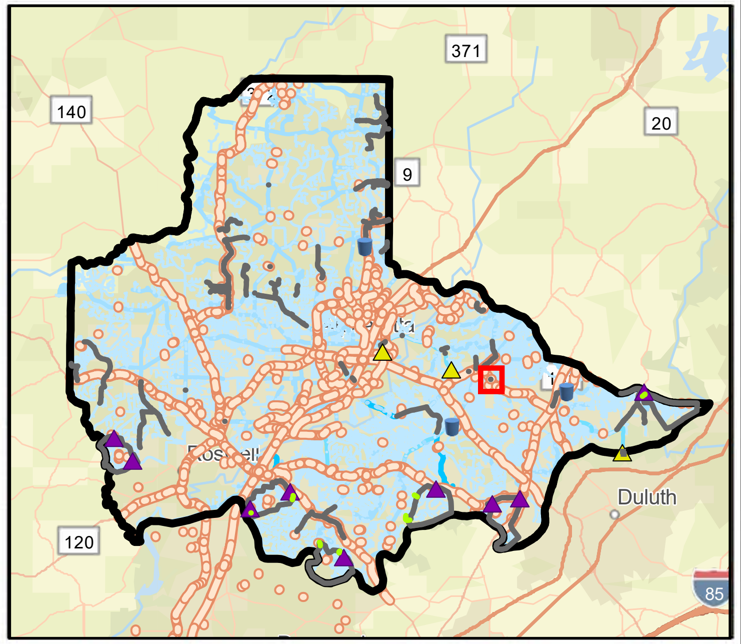
Perform crossing pipe connection of 30" water main to 8" water main at Abbotts Bridge Rd and Abbotts Way. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #209
Crabapple Rd Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

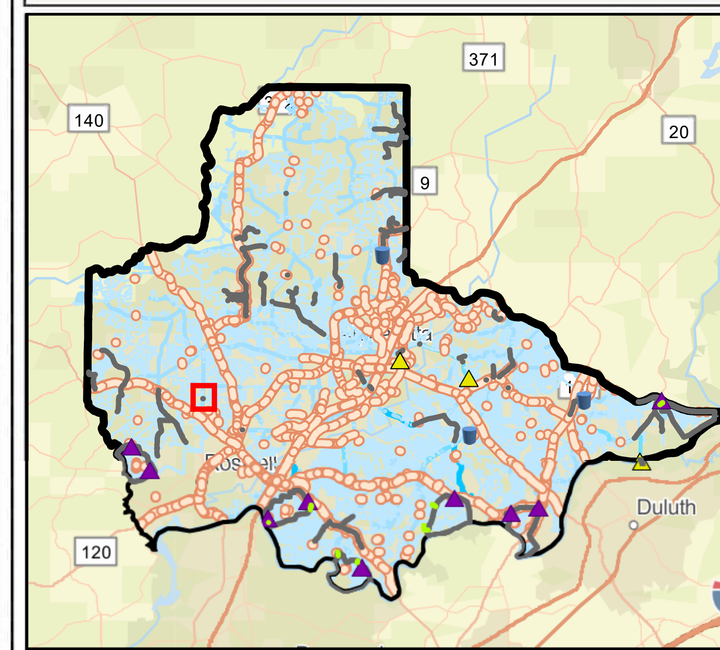
Perform crossing pipe connection of 16" water main to 10" water main at Crabapple Rd, just north of Strickland Rd. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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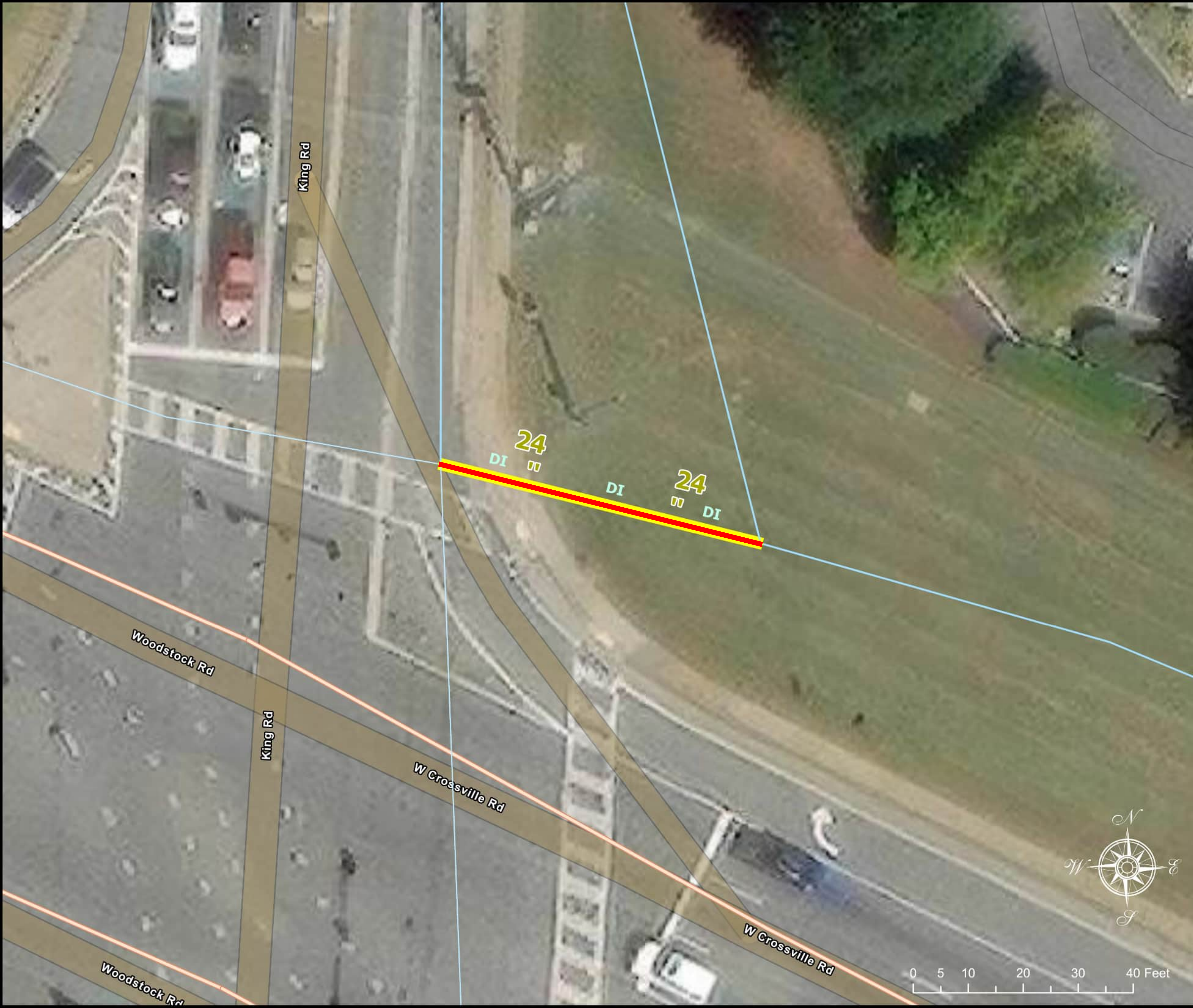


CIP Project #210
W Crossville Rd and Woodstock Rd Crossing Pipe Connection
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

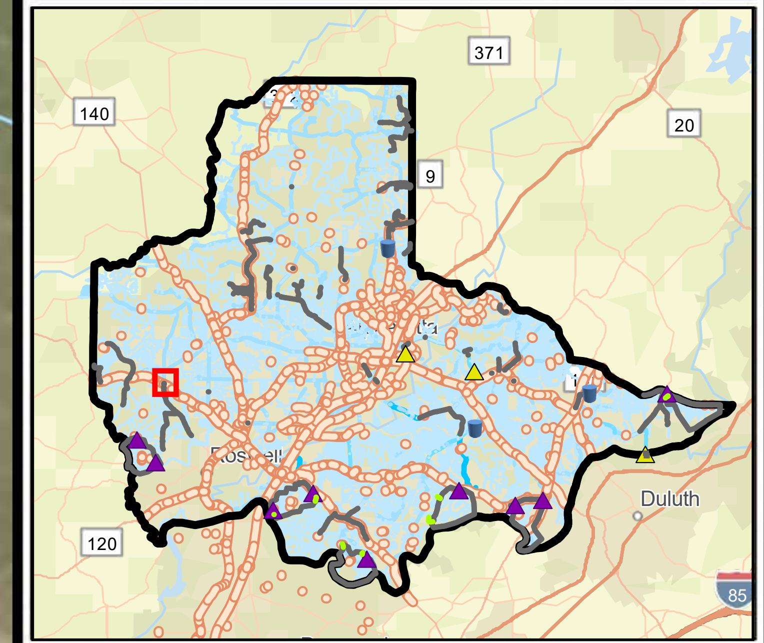
Perform crossing pipe connection of 60 LF of 24" water main to 10" water main at W Crossville Rd and Woodstock Rd. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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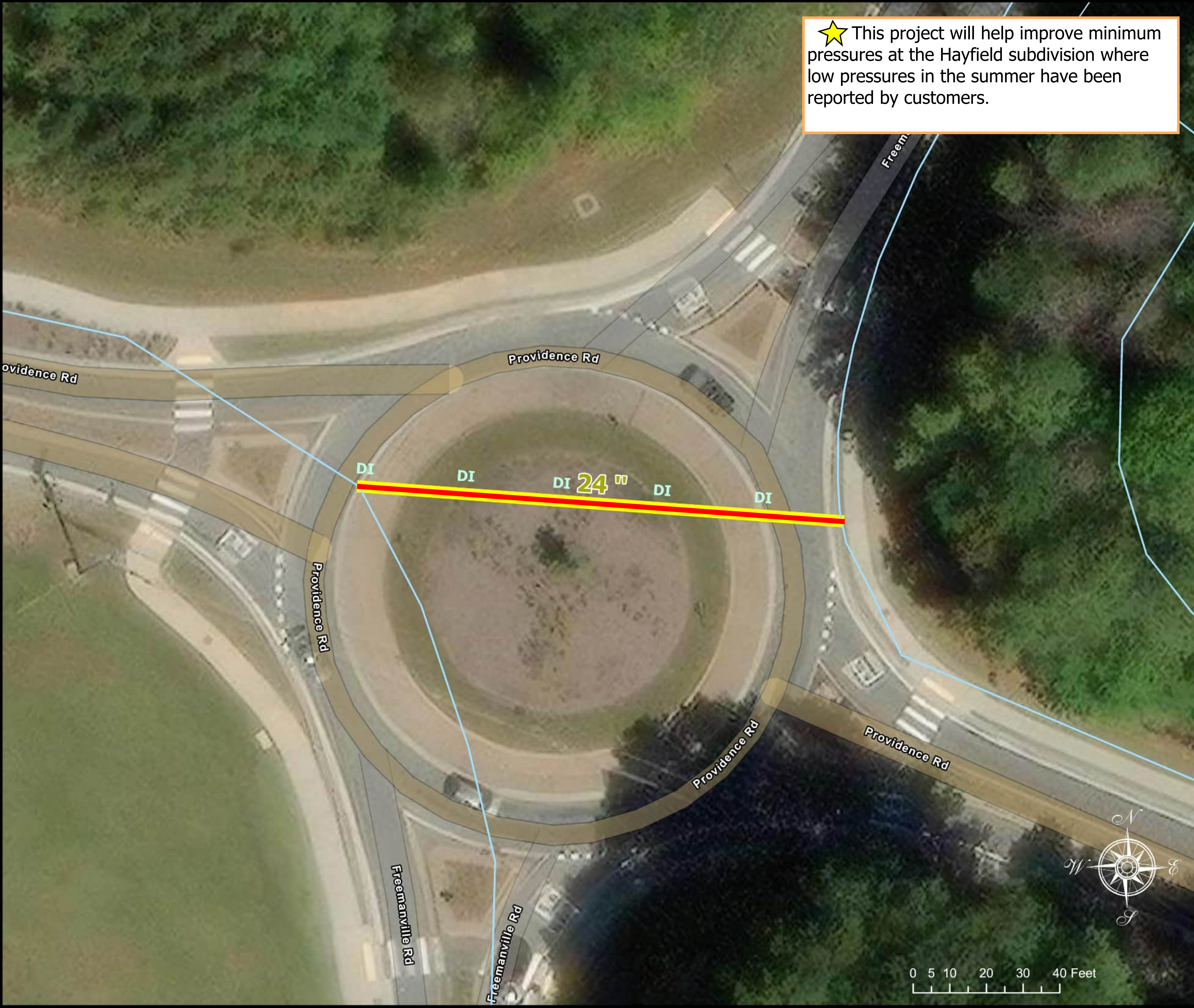


CIP Project #211
Providence Rd and Freemanville Rd Pipe Connection
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

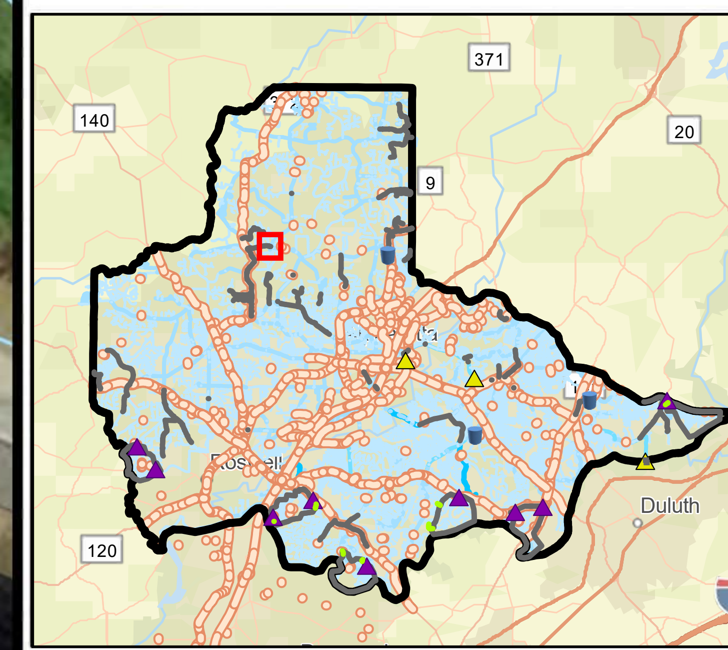
Perform crossing pipe connection of 120 LF of 24" water main to 10" water main at Providence Rd and Freemanville Rd. Helps in improving minimum pressures in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #212
Medlock Bridge Rd Parallel Line
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

Parallel 4,500 LF of 30" water main along Medlock Bridge Rd and Johns Creek Pkwy. Helps in improving minimum pressures in the area. ALCON customer

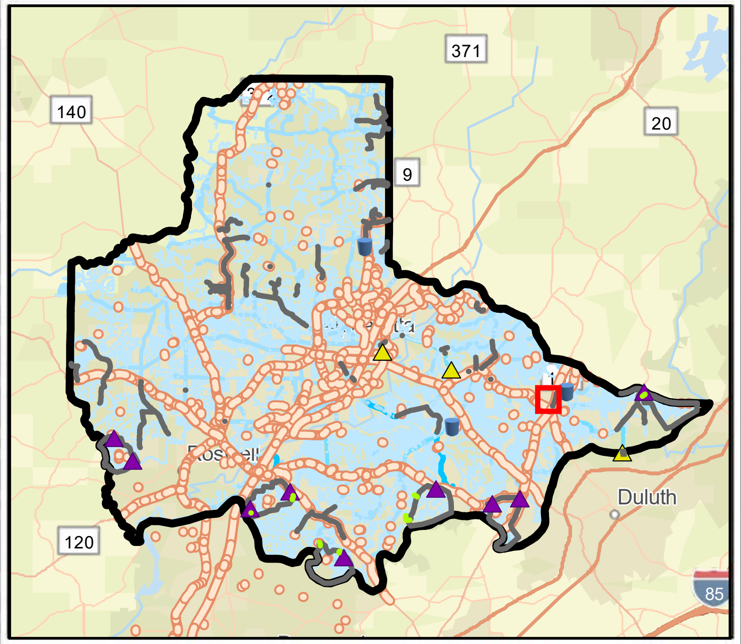
Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Pump Station
WTP
North Fulton
GDOT Road Segments



Jacobs

CIP Project #213
New 3 MG Elevated Tank at ALCON
Phase: 2030
Fulton County Water Distribution Master Plan

Project Description:

New 3 MG elevated storage tank at ALCON. Helps with providing emergency storage.

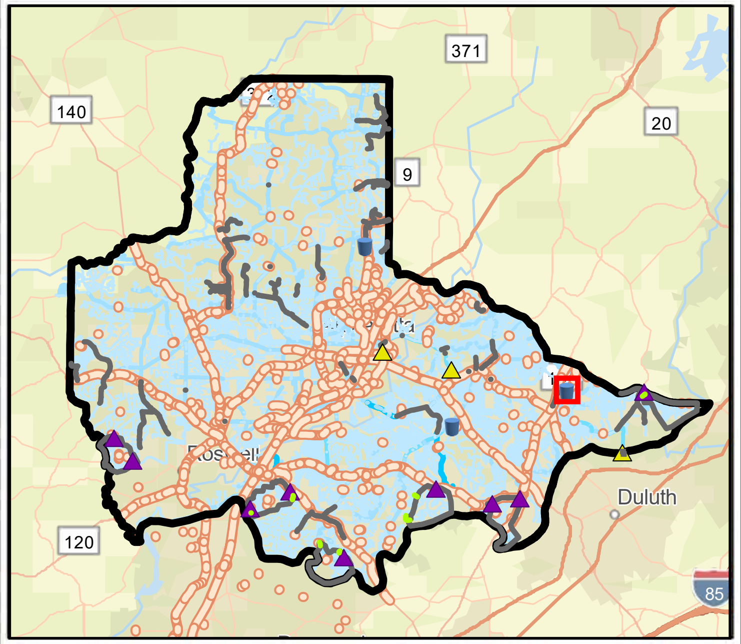
Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Elevated Tank
Pump Station
WTP
North Fulton
GDOT Road Segments



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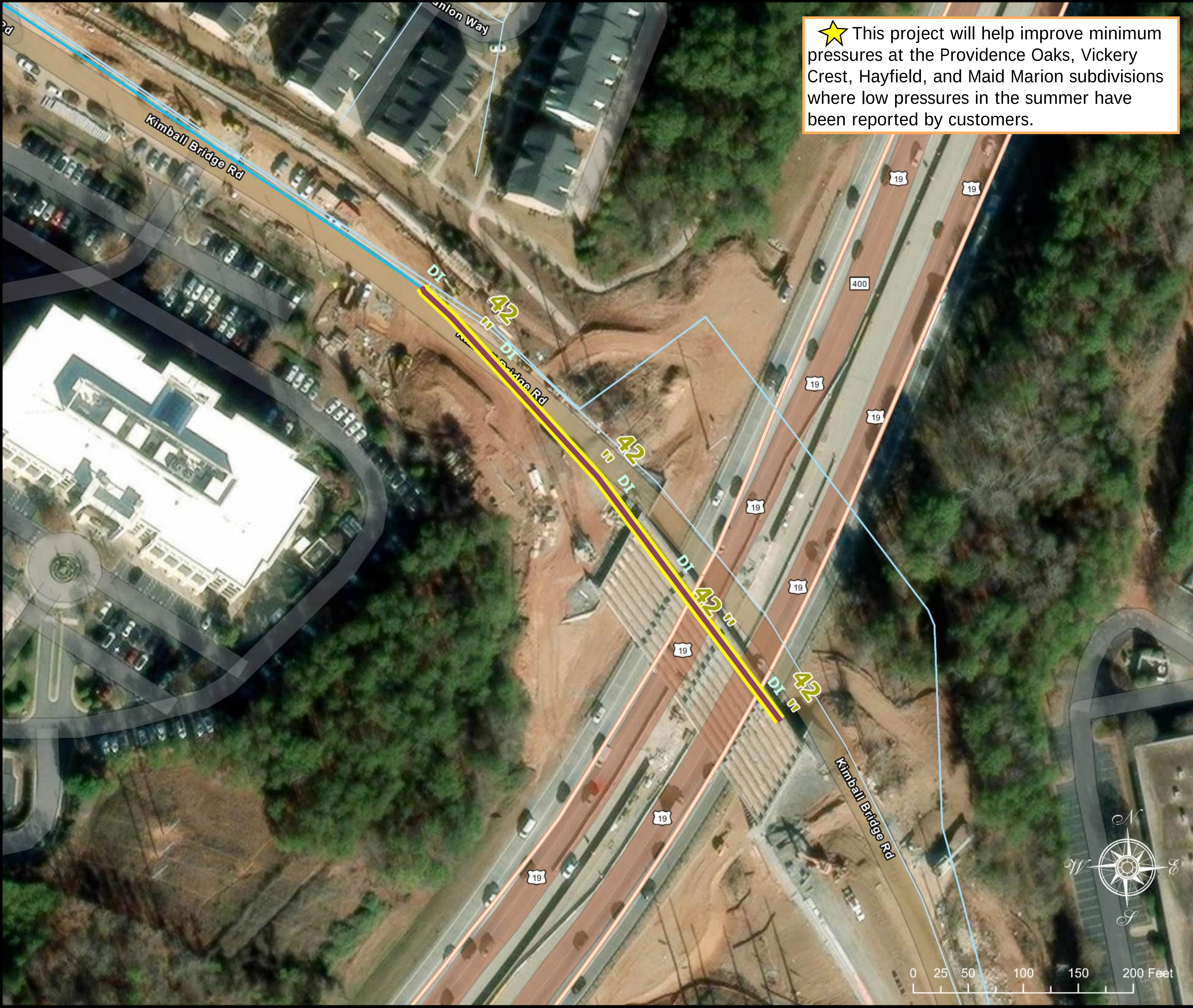


CIP Project #301
Kimball Bridge Rd Transmission Main
Phase: 2035
Fulton County Water Distribution Master Plan

Project Description:

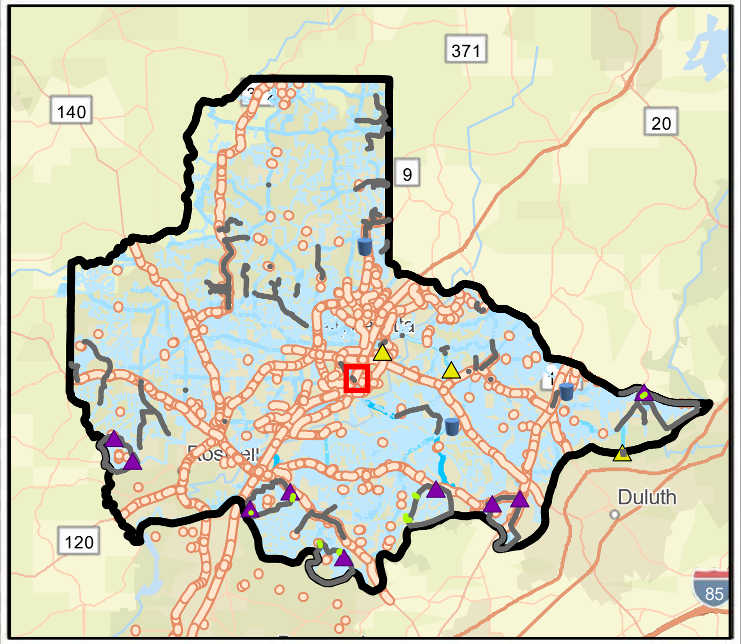
Complete 500 LF of 42" Transmission Main under GA 400 along Kimball Bridge Rd. Helps in improving minimum pressure and water age in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #302
Rogers Bridge Pump Station
Phase: 2035
Fulton County Water Distribution Master Plan

Project Description:

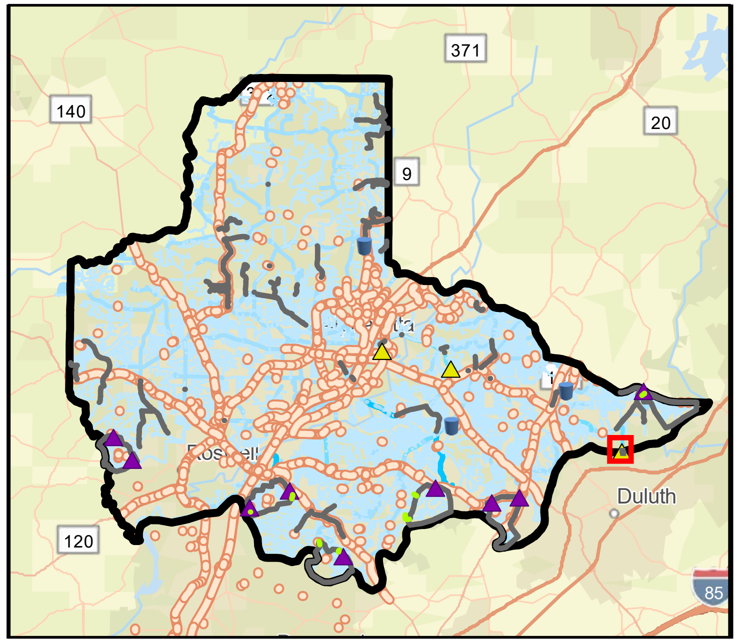
New 20 MGD Pump Station at Rogers Bridge Rd with three 18-inch parallel mains. Includes replacing 18-inch cross connects with 24-inch cross connects. Helps serve as an emergency interconnection with Gwinnett County.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- North Fulton
- GDOT Road Segments



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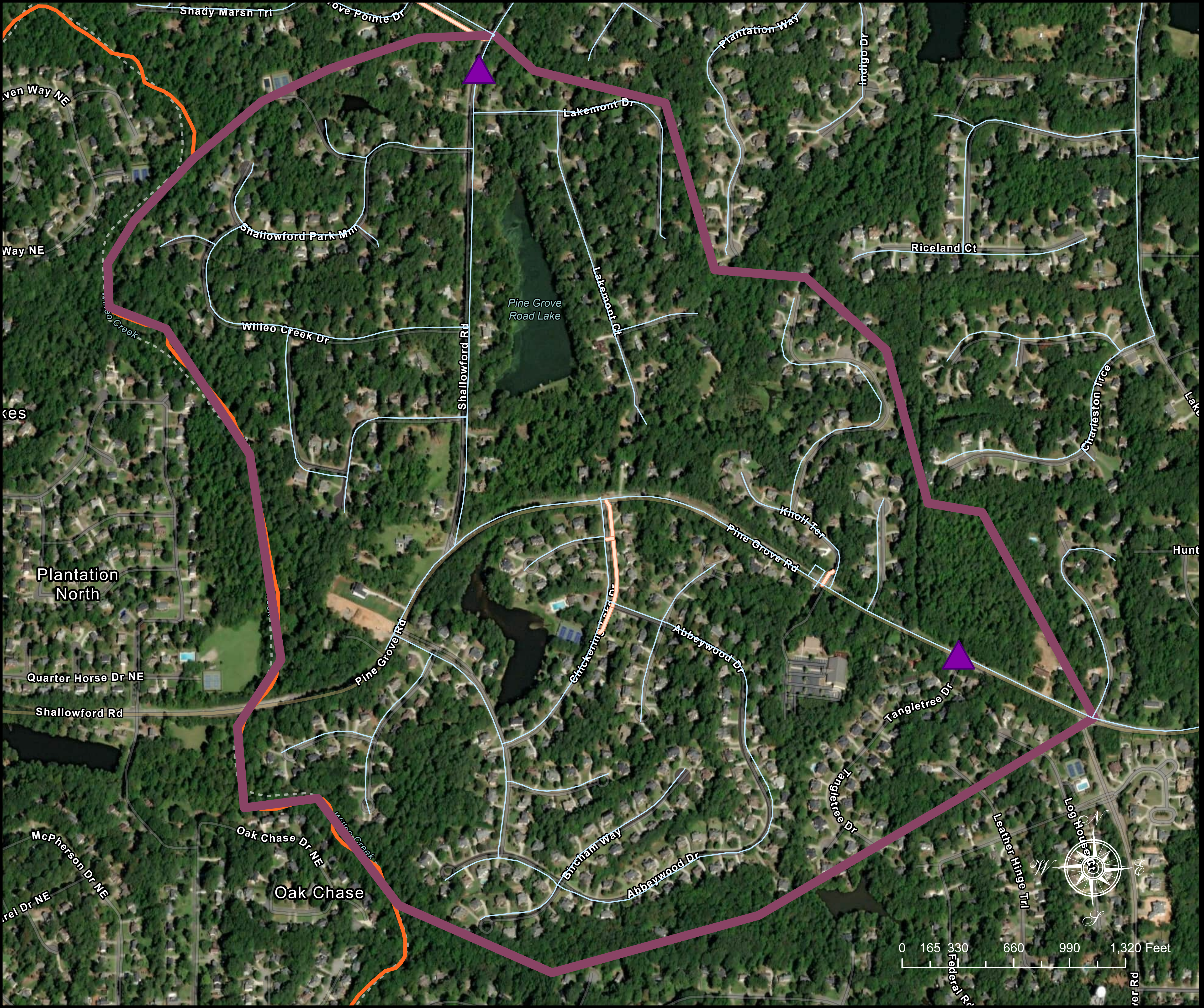


CIP Project #303
Pine Grove Low Pressure Zone
Phase: 2035
Fulton County Water Distribution Master Plan

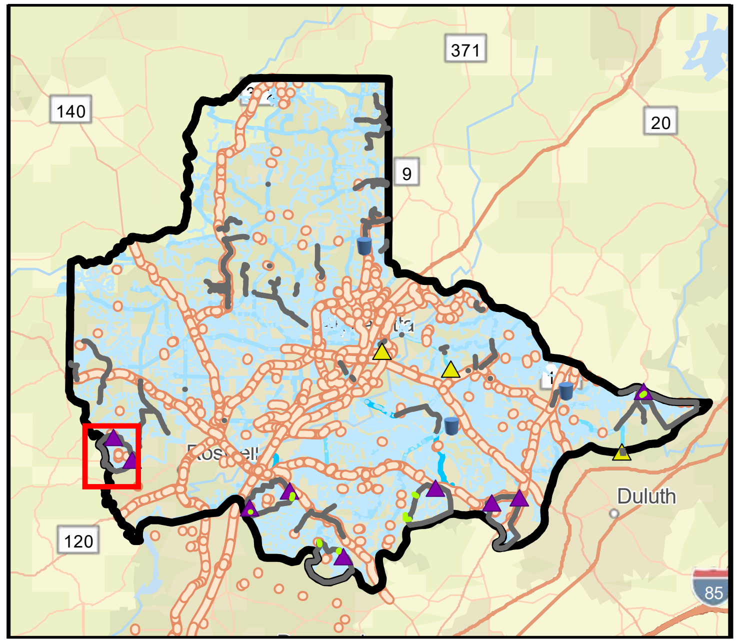
Project Description:

New Pine Grove low pressure zone with two PRVs which reduces the average pressure from 137 psi to 100 psi. This zone covers around 7 miles of water main and impacts about 500 customers.

Legend

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- North Fulton
- GDOT Road Segments
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains



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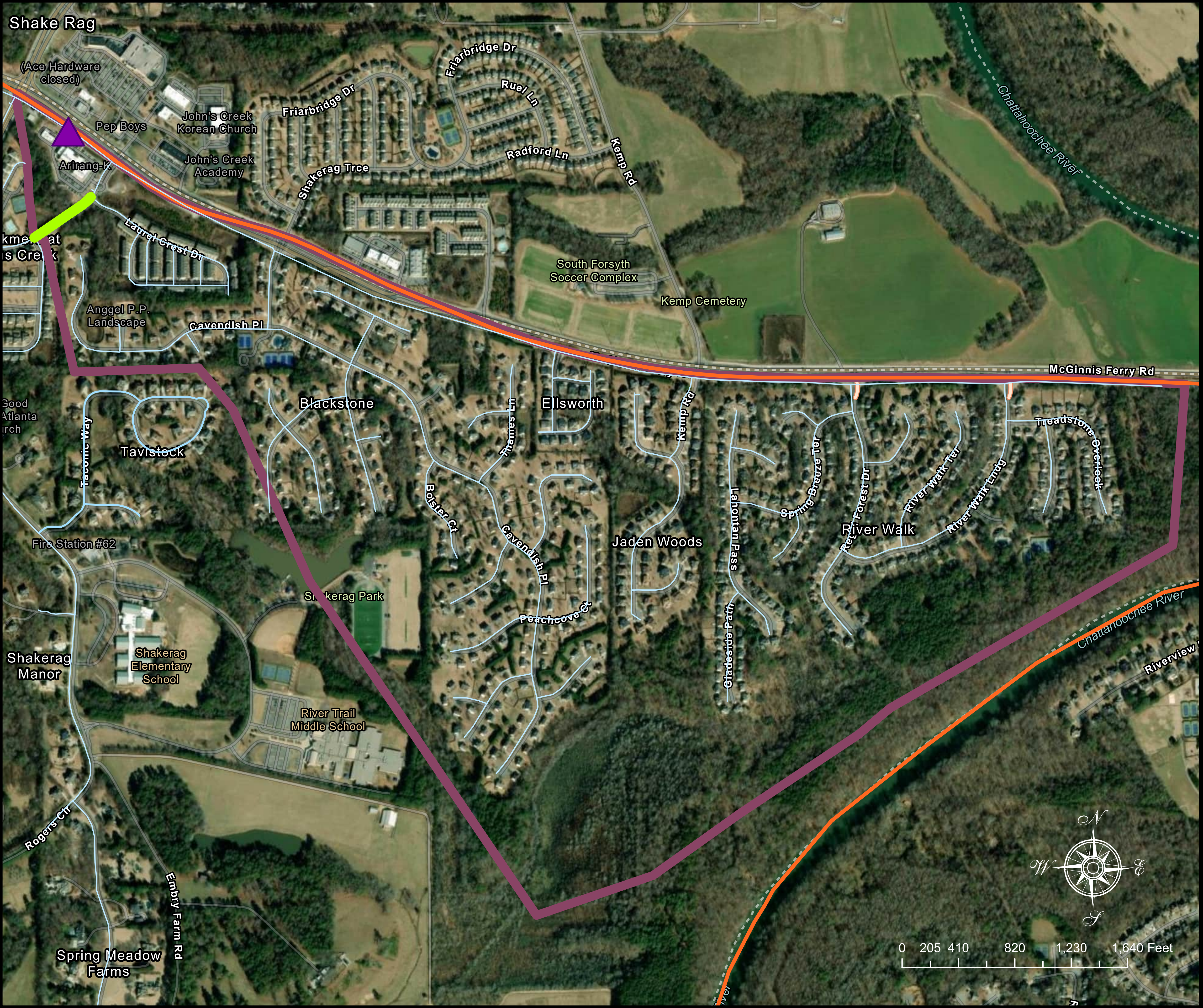


CIP Project #304
Shakerag Low Pressure Zone
Phase: 2035
Fulton County Water Distribution Master Plan

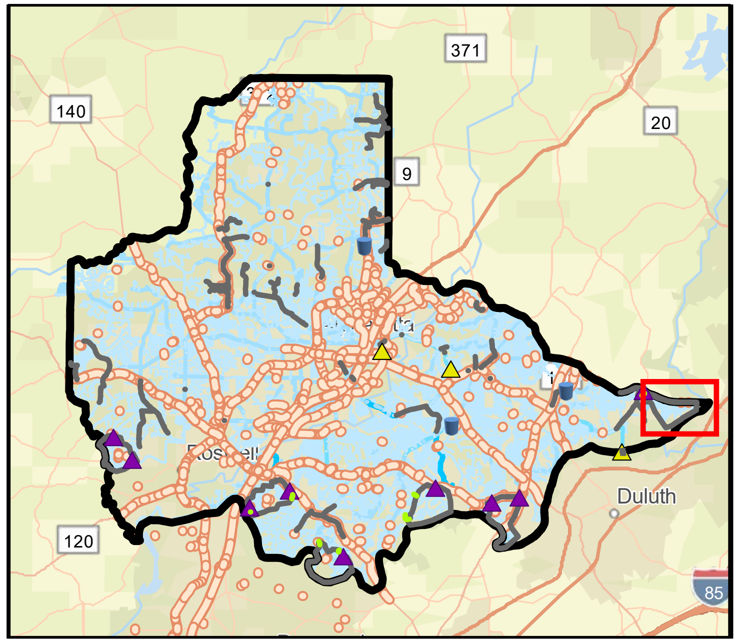
Project Description:

New Shakerag low pressure zone with one PRV and one closed valve which reduces the average pressure from 149 psi to 91 psi. This zone covers around 9 miles of water main and impacts about 850 customers.

Legend

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- North Fulton
- GDOT Road Segments
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains



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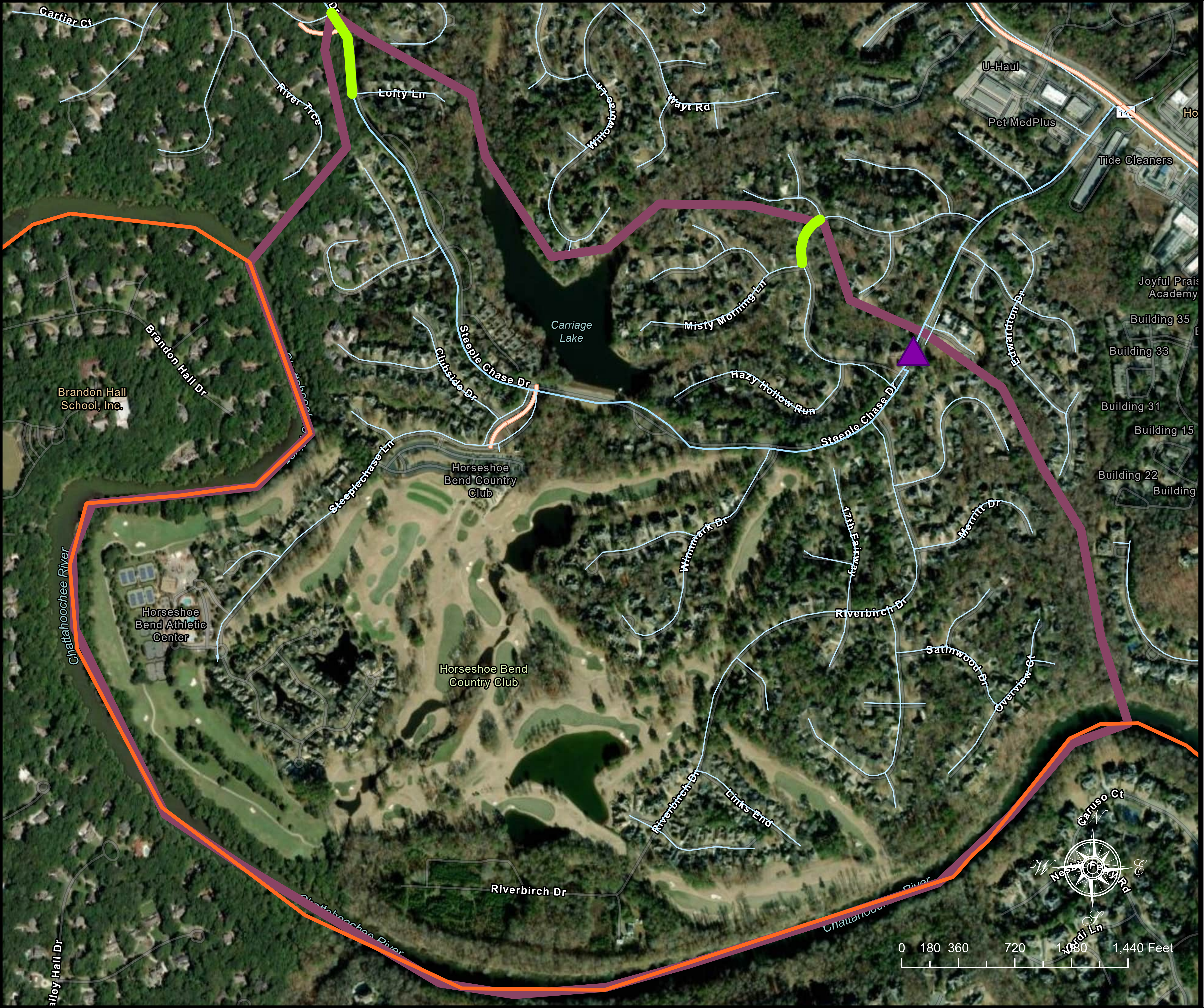


CIP Project #305
Horseshoe Bend Low Pressure Zone
Phase: 2035
Fulton County Water Distribution Master Plan

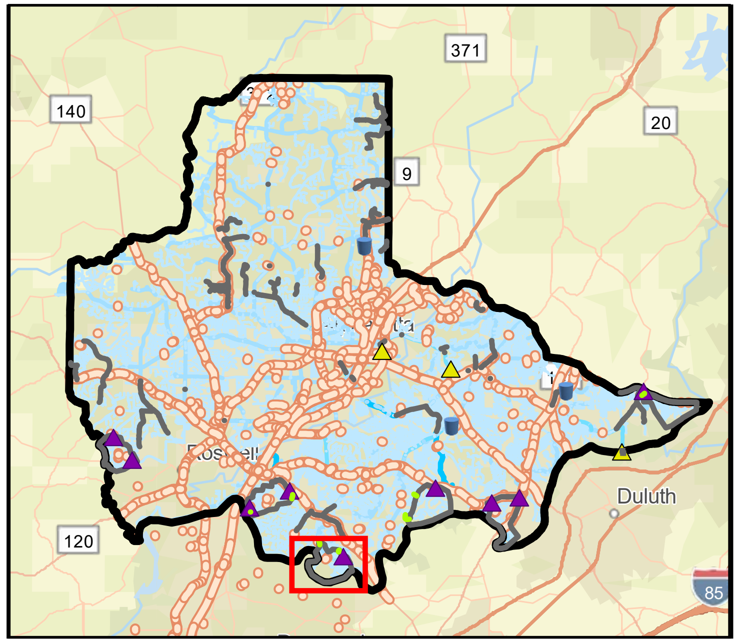
Project Description:

New Horseshoe Bend low pressure zone with one PRV and two closed valves which reduces the average pressure from 150 psi to 101 psi. This zone covers around 7 miles of water main and impacts about 700 customers.

Legend

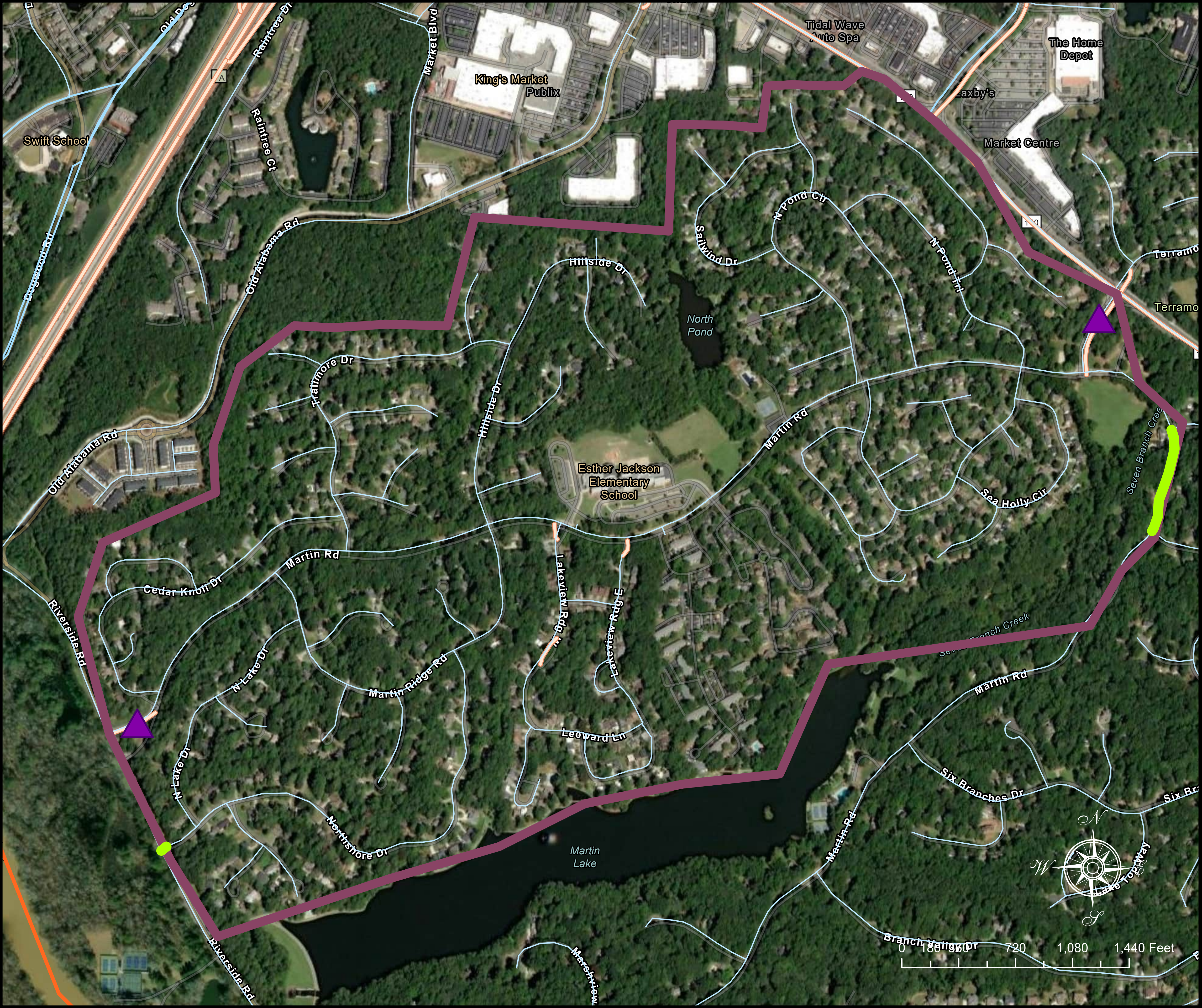
Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- North Fulton
- GDOT Road Segments
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains



Jacobs

CIP Project #306
Martin Lake Low Pressure Zone
Phase: 2035
Fulton County Water Distribution Master Plan



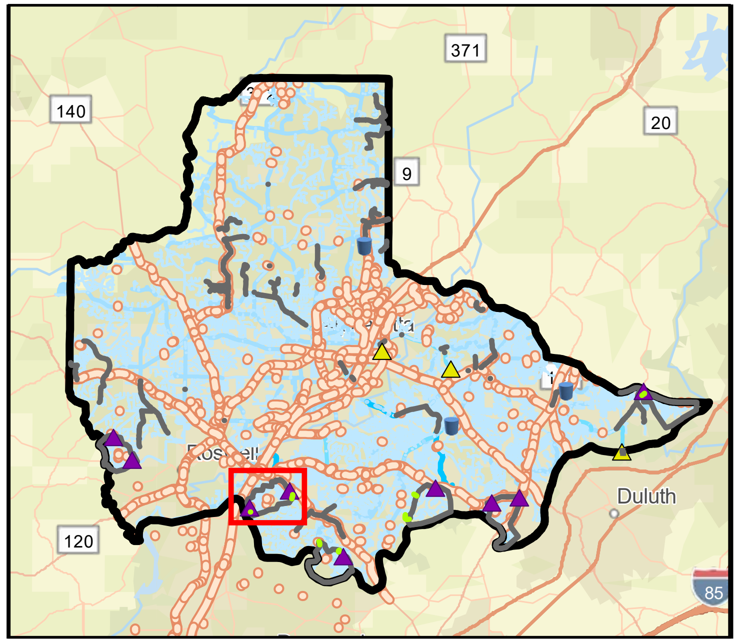
Project Description:

New Martin Lake low pressure zone with two PRVs and two closed mains which reduces the average pressure from 162 psi to 84 psi. This zone covers around 11 miles of water main and impacts about 1,300 customers.

Legend

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- North Fulton
- GDOT Road Segments
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains



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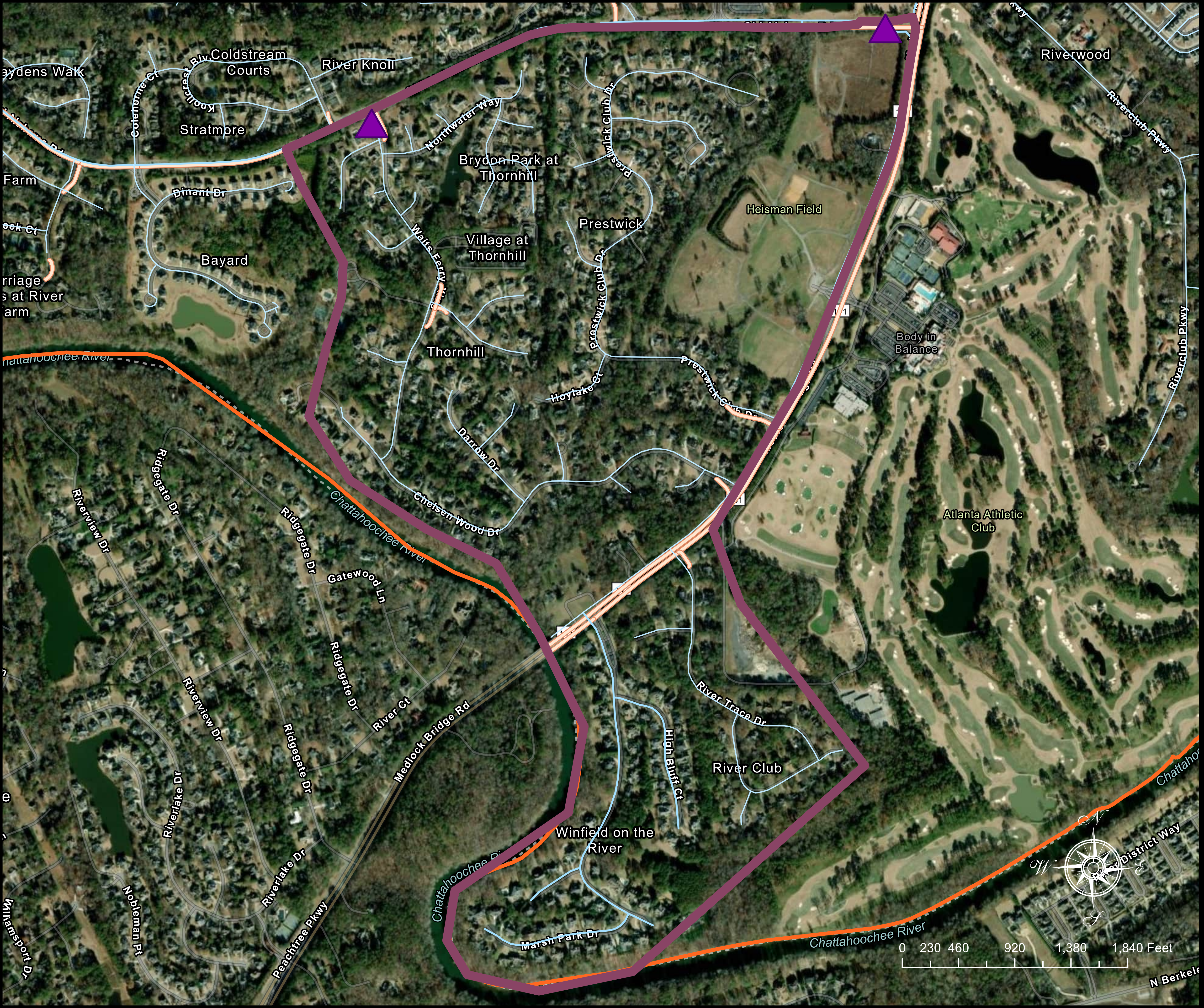


CIP Project #307
Atlanta Athletic Club Low Pressure Zone
Phase: 2035
Fulton County Water Distribution Master Plan

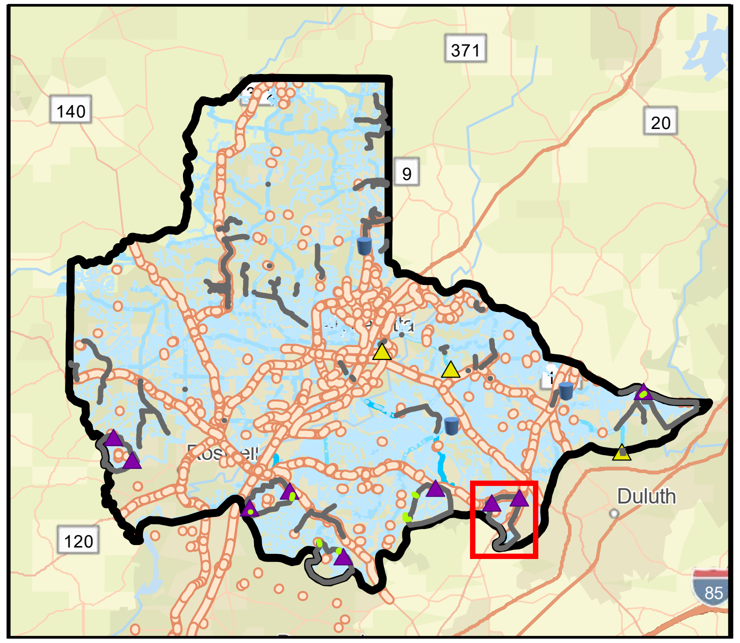
Project Description:

New Atlanta Athletic Club low pressure zone with two PRVs which reduces the average pressure from 155 psi to 100 psi. This zone covers around 8 miles of water main and impacts about 500 customers.

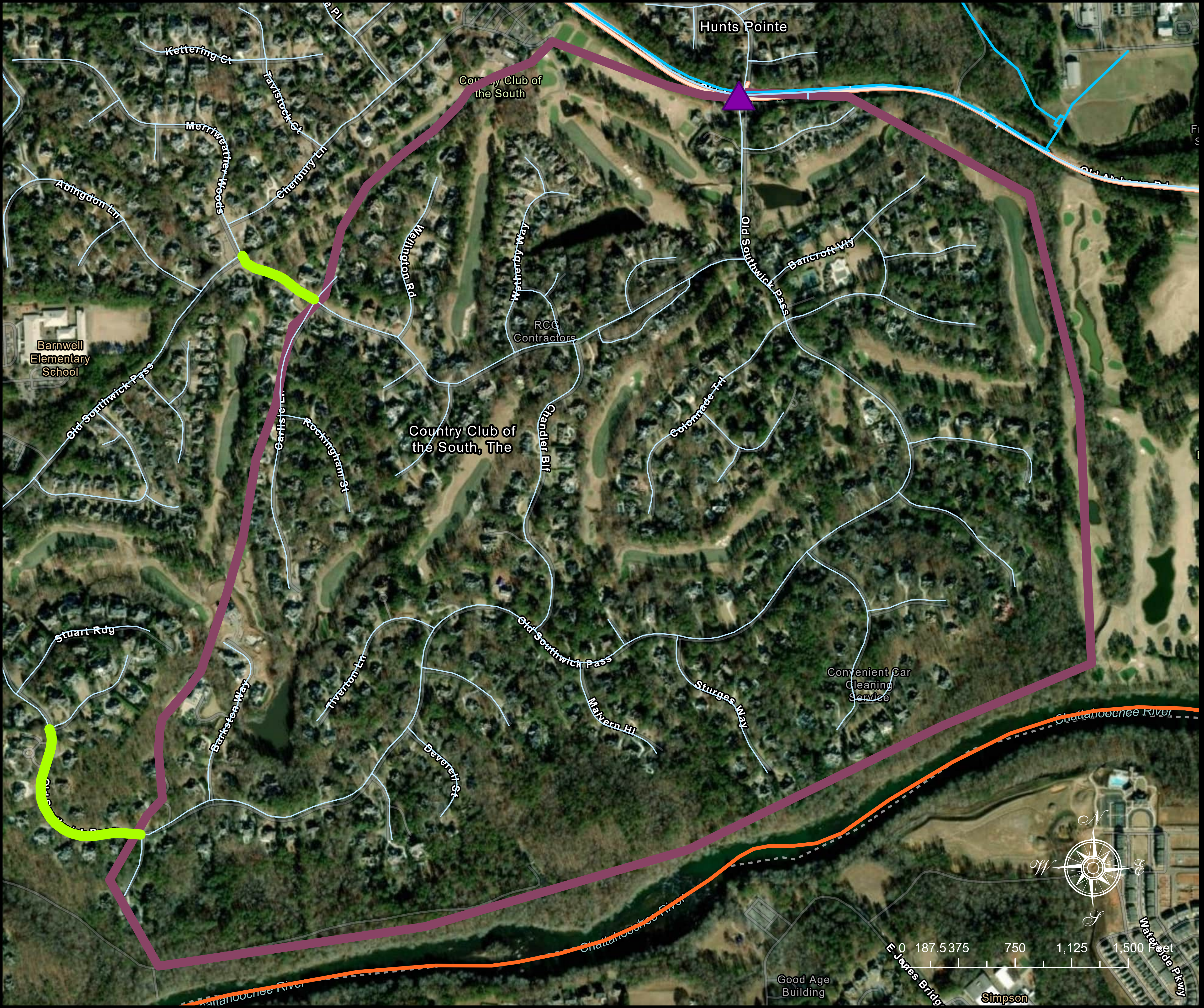
Legend

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- North Fulton
- GDOT Road Segments
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains



Jacobs



CIP Project #308
Country Club of the South Low Pressure Zone
Phase: 2035
Fulton County Water Distribution Master Plan

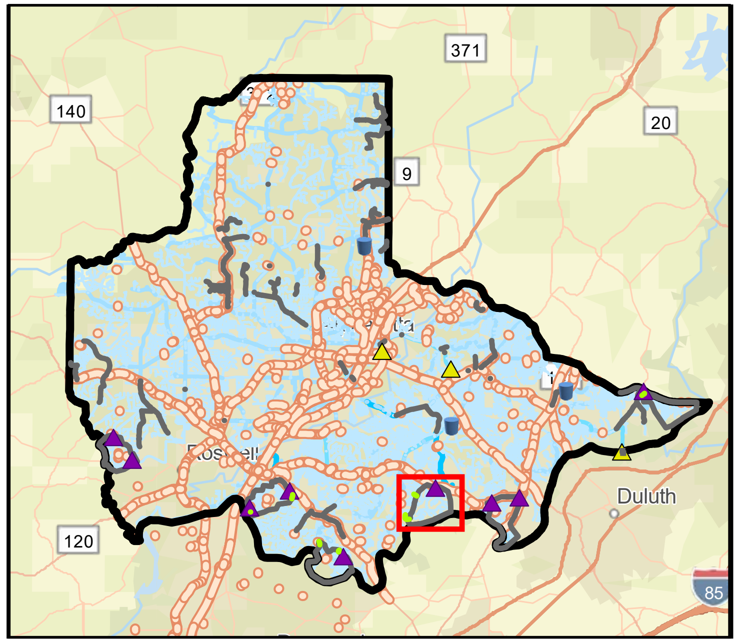
Project Description:

New Country Club of the South low pressure zone with one PRV and two closed valves which reduces the average pressure from 146 psi to 88 psi. This zone covers around 8 miles of water main and impacts about 500 customers.

Legend

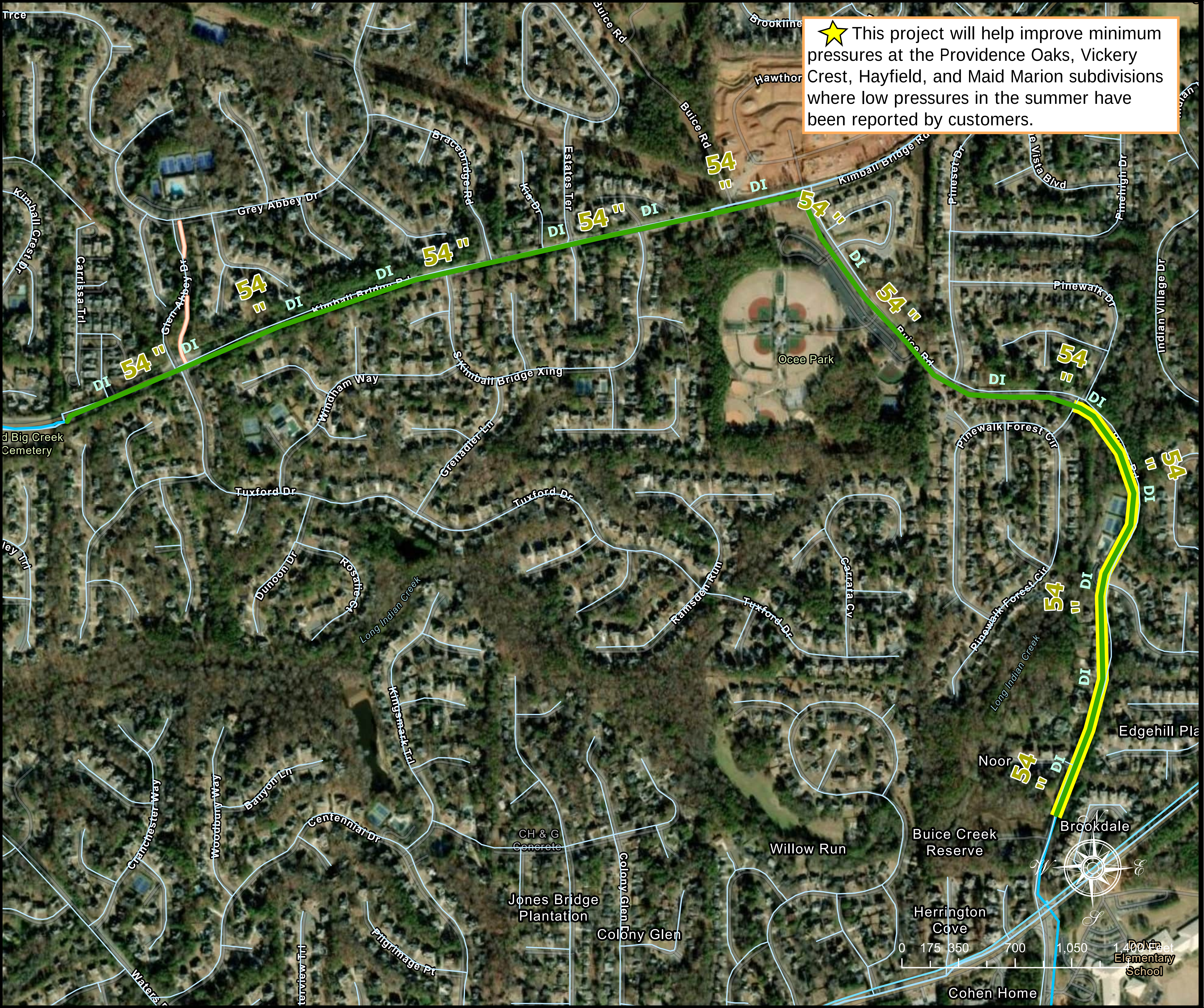
Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

- North Fulton
- GDOT Road Segments
- Pressure Zones
- PRVs
- Pressure Zone Closed Mains



Jacobs

CIP Project #401A
Bruice Rd Transmission Main
Phase: 2040
Fulton County Water Distribution
Master Plan



Project Description:

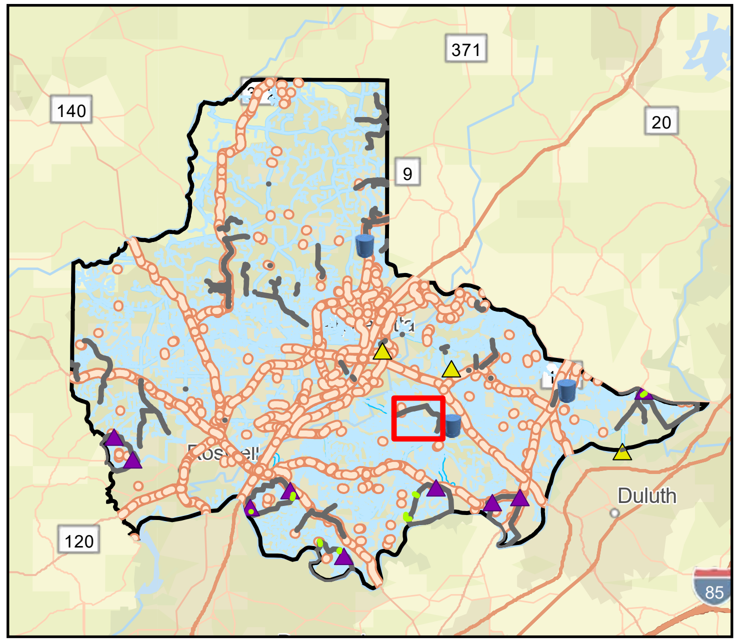
Complete 2,800 LF of 54" transmission main along Buice Rd, starting at Pinewalk Forest Cir. Helps in improving minimum pressures and water age in the county. The project is optional for a peaking factor of 1.5.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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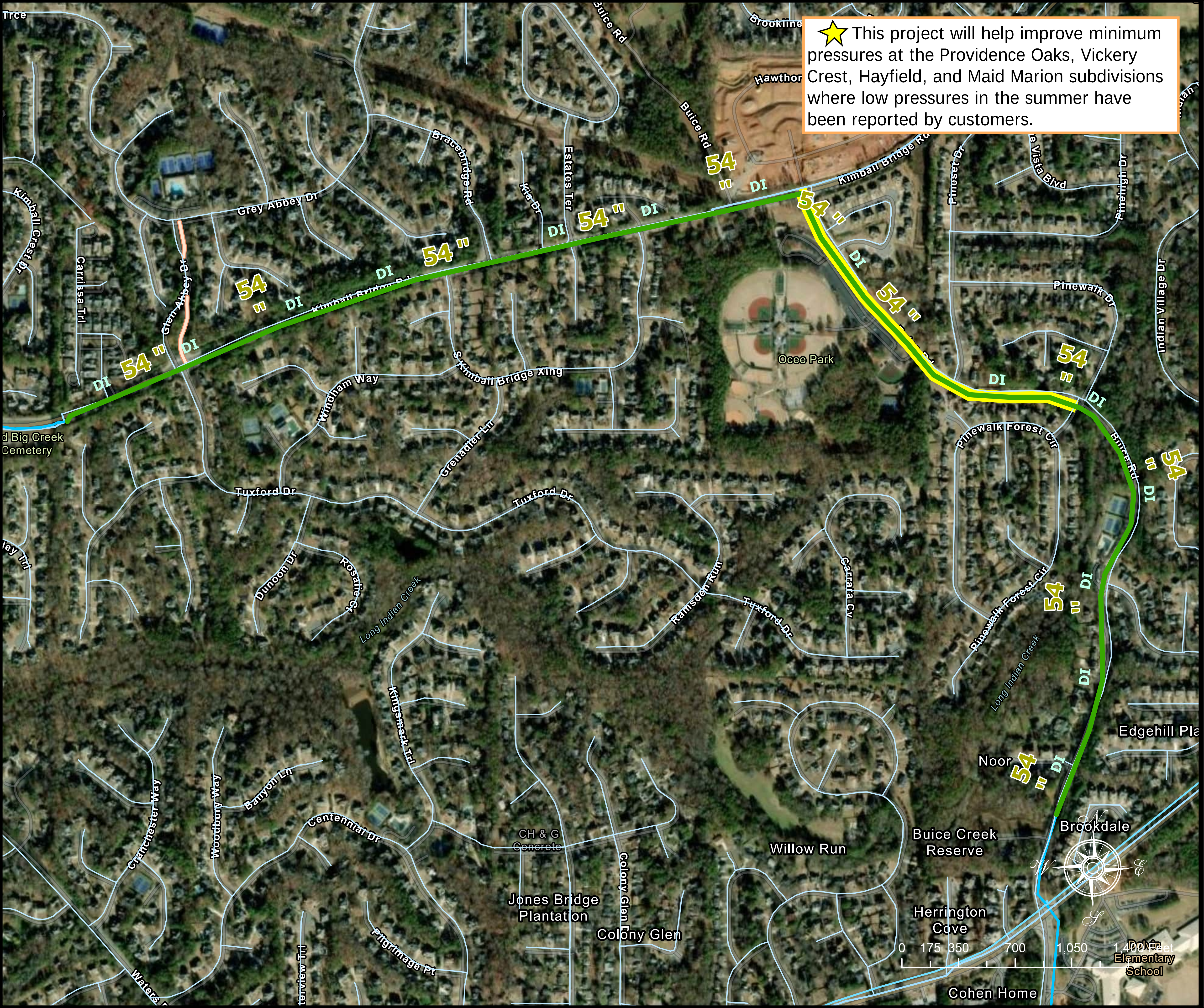


CIP Project #401B
Bruice Rd Transmission Main
Phase: 2040
Fulton County Water Distribution Master Plan

Project Description:

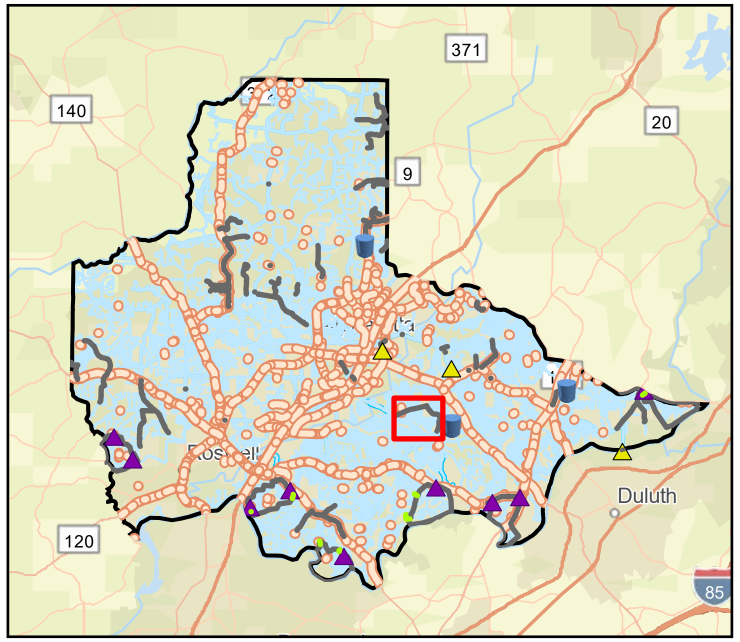
Complete 2,400 LF of 54" transmission main along Buice Rd, ending at Pinewalk Forest Cir. Helps in improving minimum pressures and water age in the county. The project is optional for a peaking factor of 1.5.

Legend

Highlighted Project

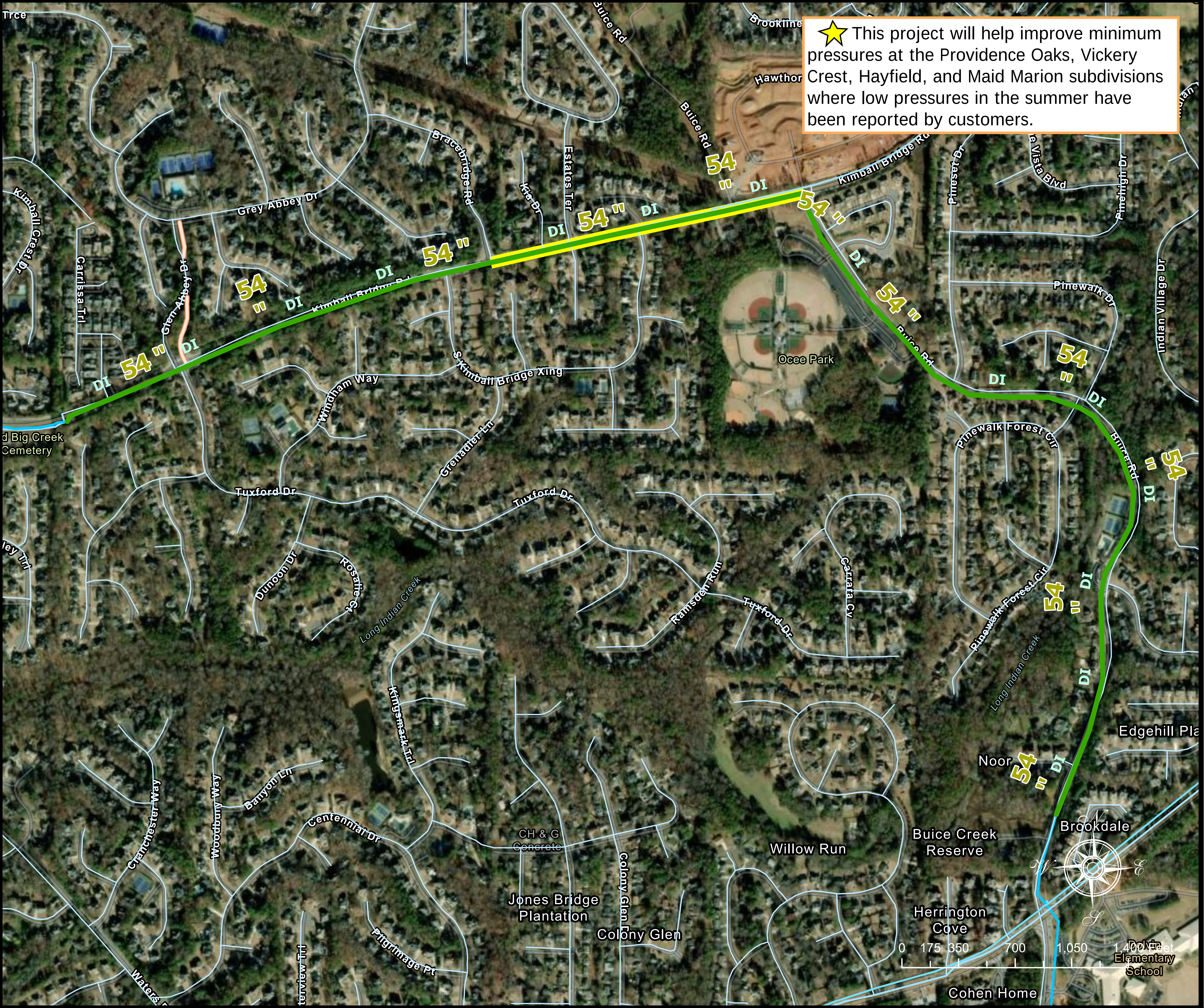
CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #401C
Bruice Rd Transmission Main
Phase: 2040
Fulton County Water Distribution Master Plan



Project Description:

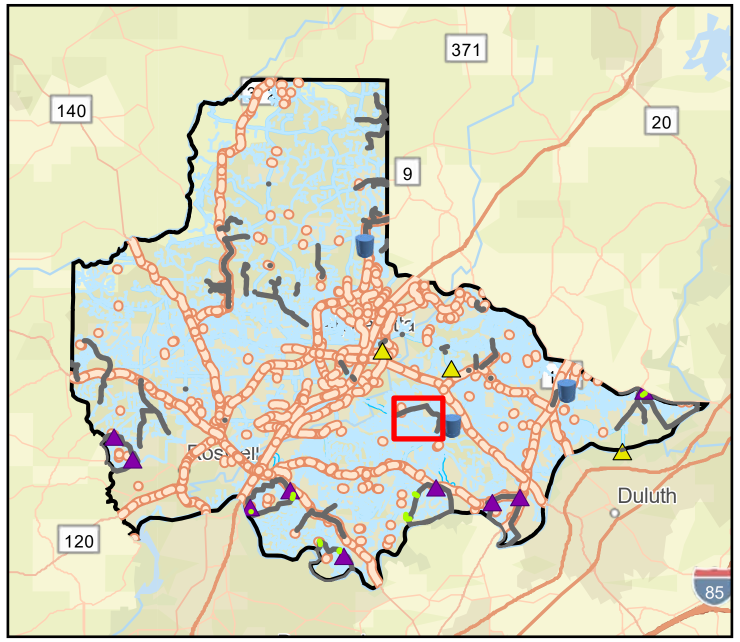
Complete 2,000 LF of 54" transmission main along Kimball Bridge Rd, starting at Bracebridge Rd. Helps in improving minimum pressures and water age in the county. The project is optional for a peaking factor of 1.5.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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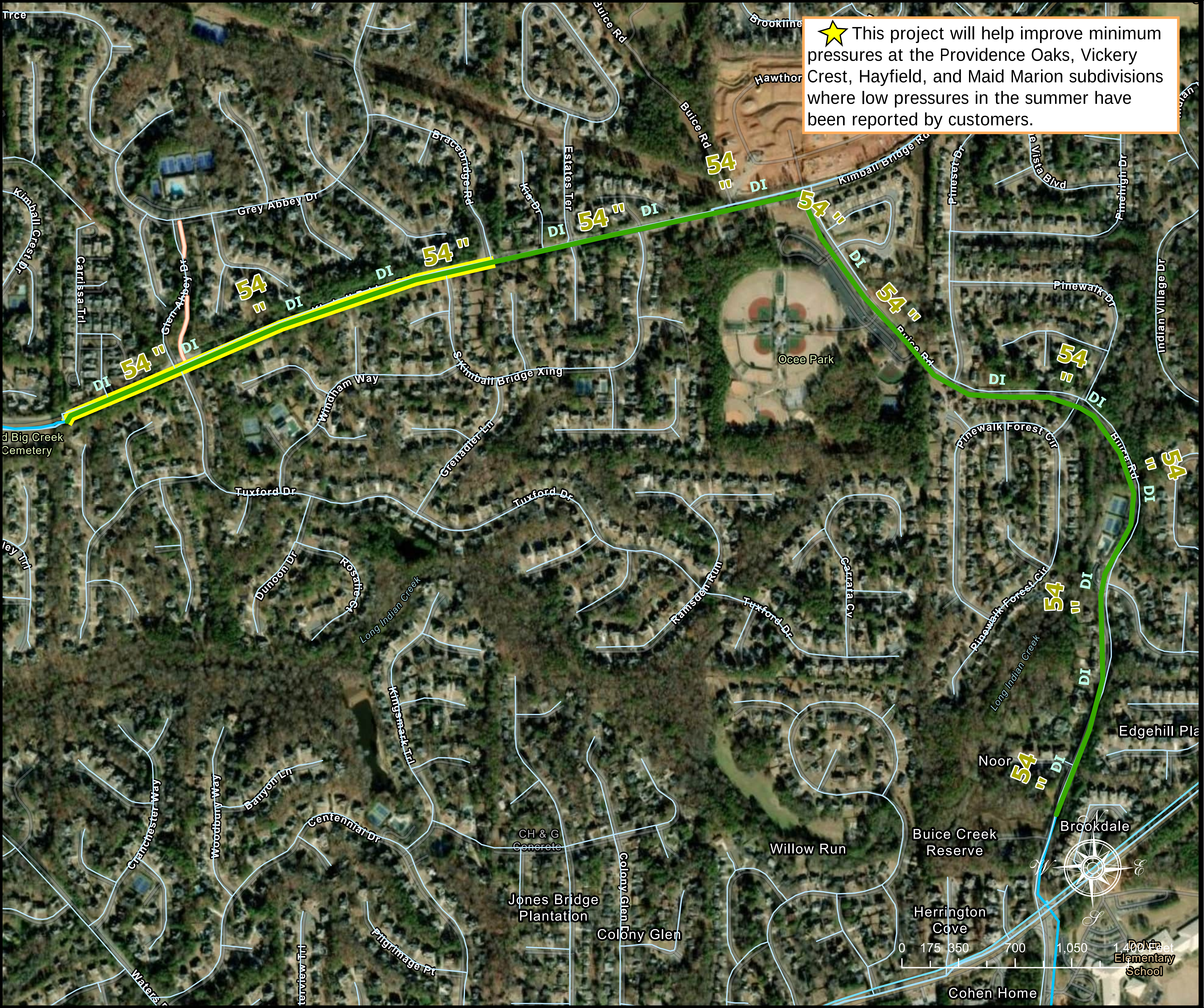


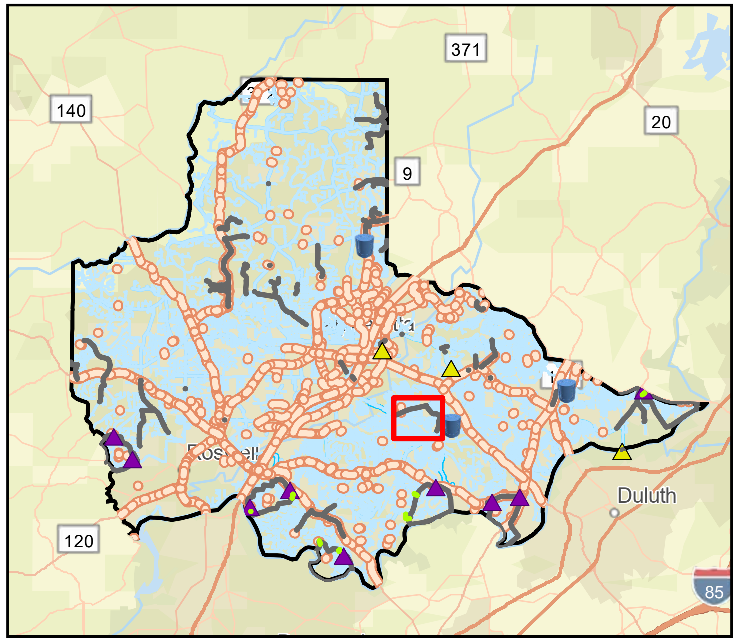
CIP Project #401D
Bruice Rd Transmission Main
Phase: 2040
Fulton County Water Distribution Master Plan

Project Description:

Complete 2,900 LF of 54" transmission main along Kimball Bridge Rd, ending at Bracebridge Rd. Helps in improving minimum pressures and water age in the county.The project is optional for a peaking factor of 1.5.

Legend

Highlighted Project	Existing Water Mains
CIP Pipes	<= 8"
2025	10" - 24"
2030	30" - 36"
2035	>= 42"
2040	Pump Station
2050	WTP
	North Fulton
	GDOT Road Segments



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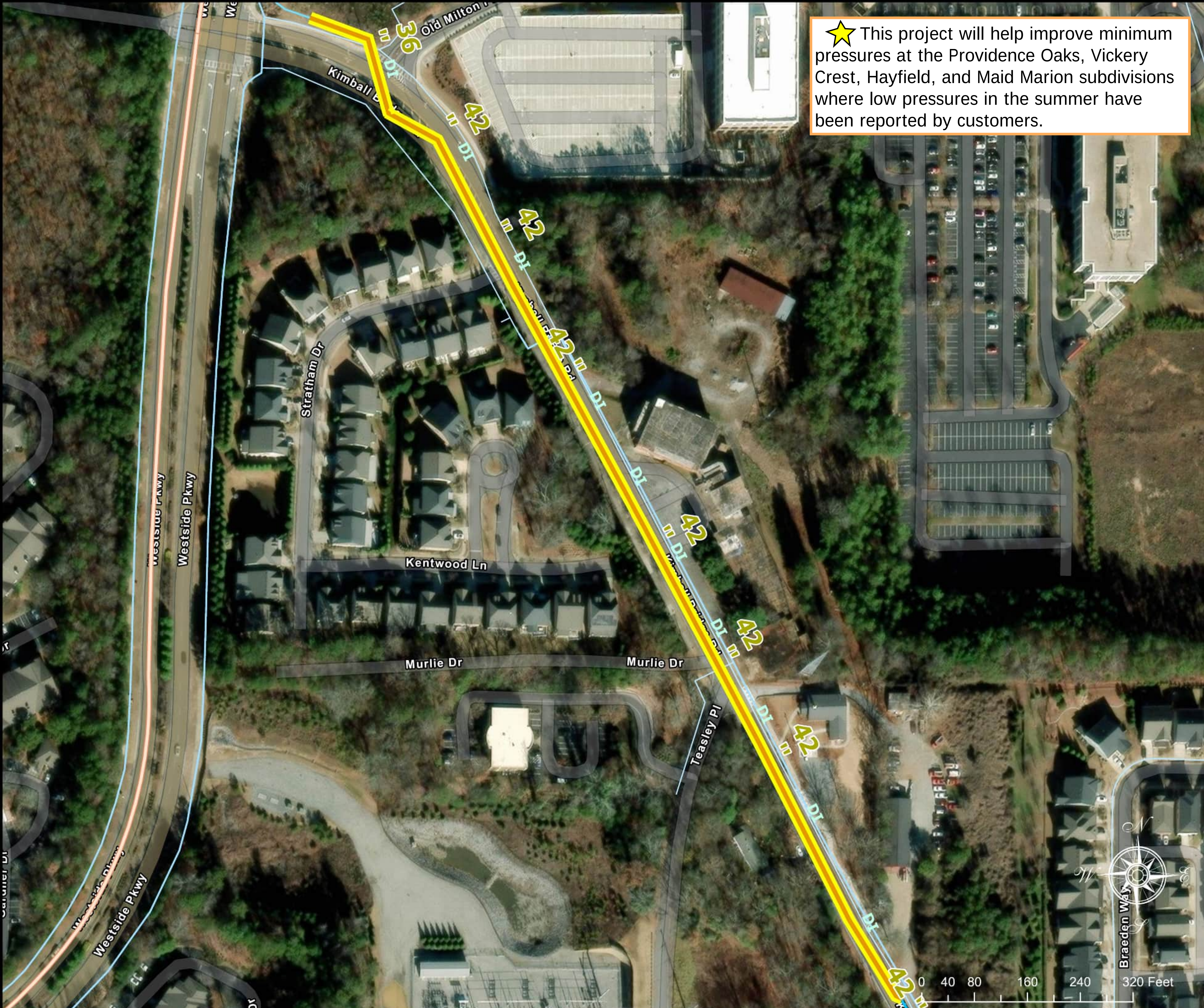


CIP Project #501A
Kimball Bridge Rd Transmission Main
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

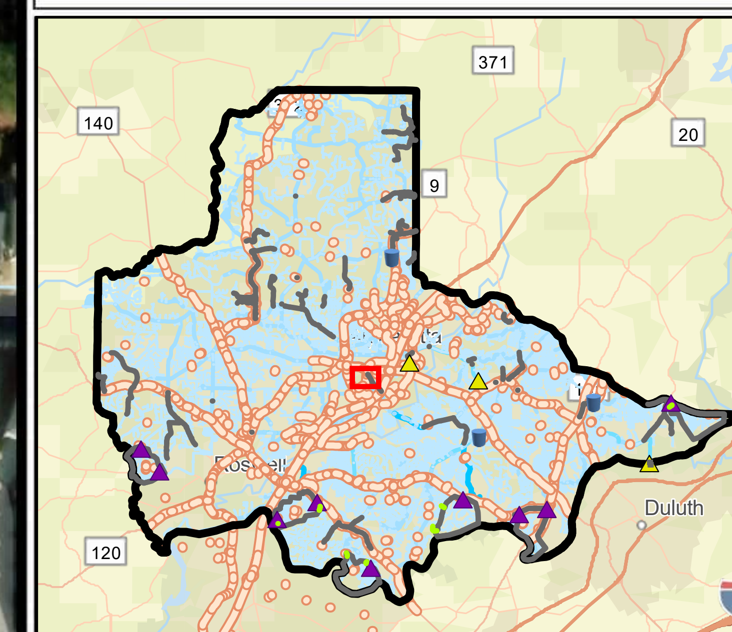
Complete 1,800 LF of 36"-42" Transmission Main under GA 400 along Kimball Bridge Rd. Helps in improving minimum pressure and water age in the county.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #501B
Kimball Bridge Transmission Main
Phase: 2035
Fulton County Water Distribution Master Plan

Project Description:

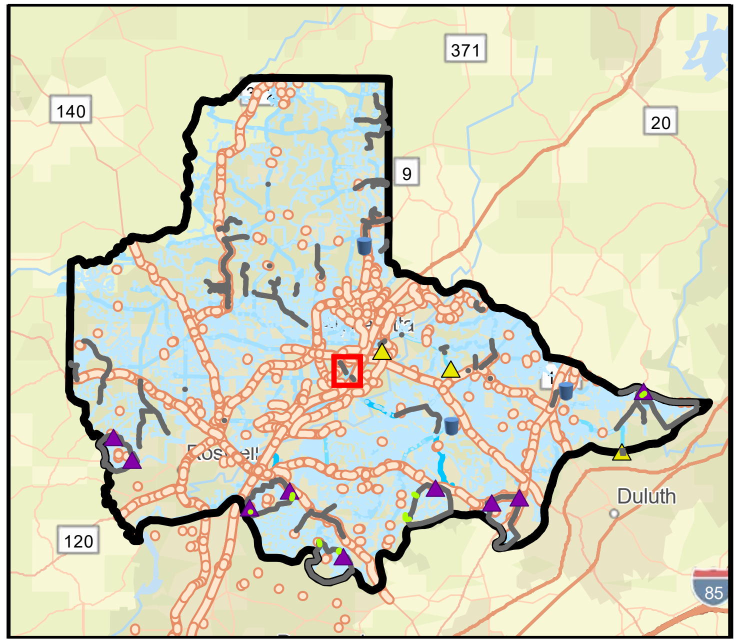
Complete 2,300 LF of 36-42" Transmission Main under GA 400 along Kimball Bridge Rd. Helps in improving minimum pressure and water age in the county. The project is optional for a peaking factor of 1.5.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #502
Jones Bridge Rd Parallel Line
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

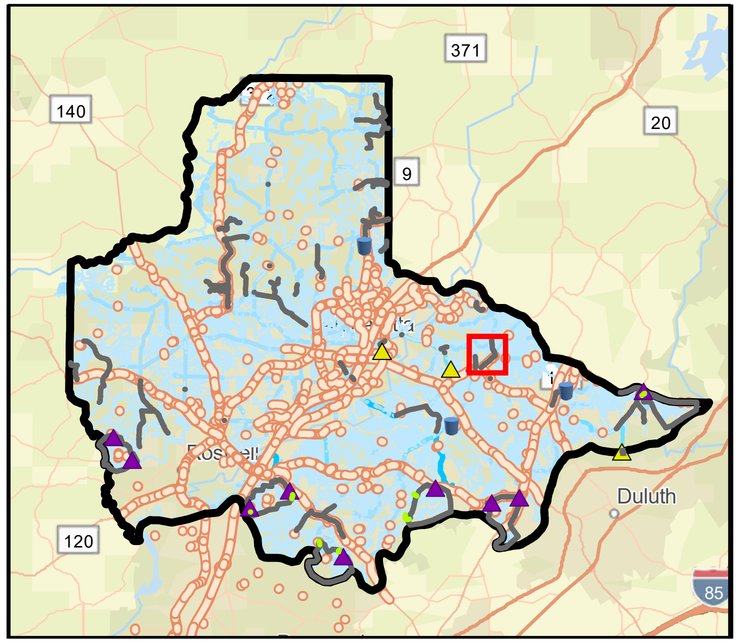
Parallel 5,200 LF of 24" water main along Jones Bridge Rd and Douglas Rd. Helps in improving fire flows in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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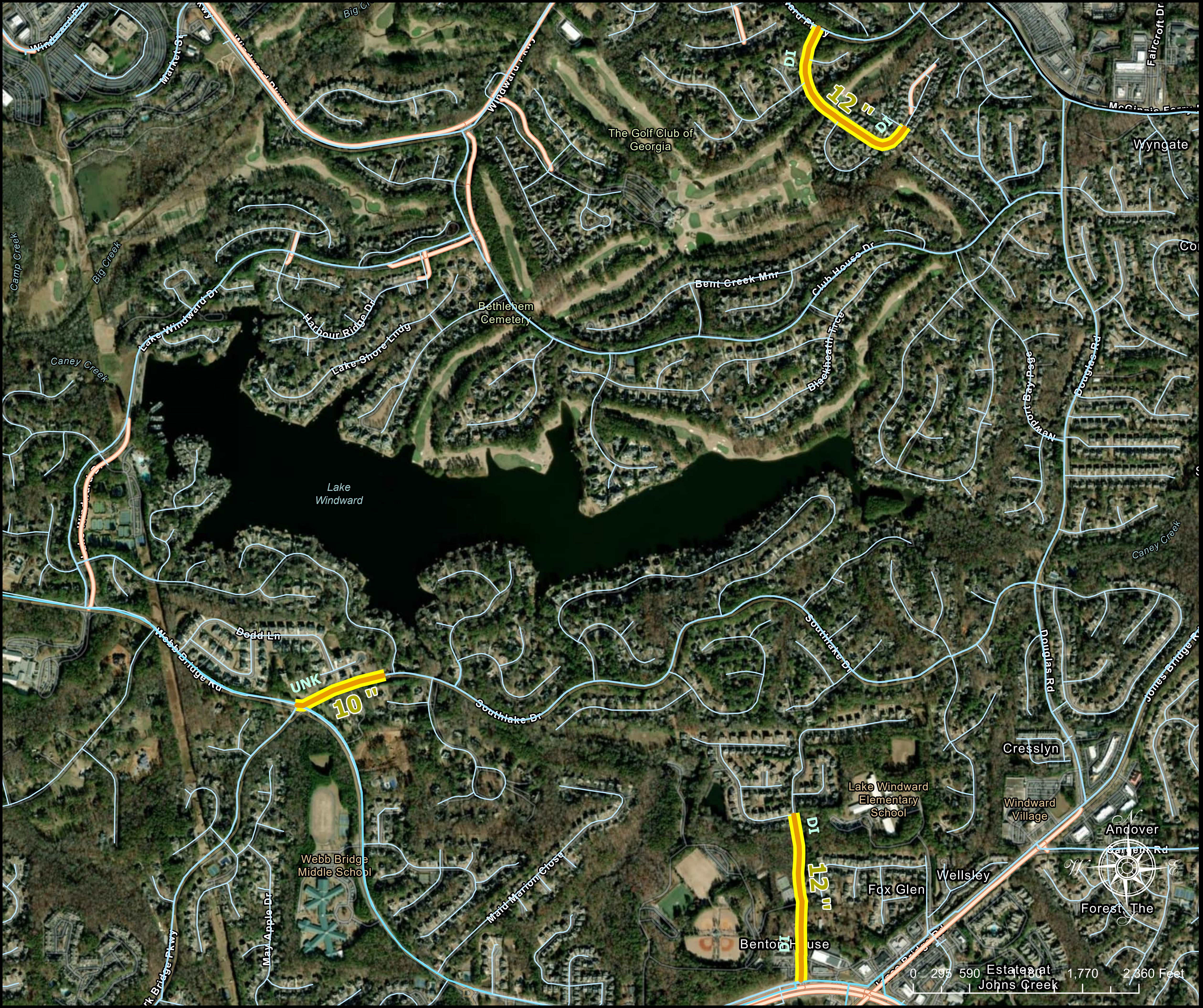


CIP Project #503
Fox Rd and Greatwood Manor Parallel Lines. Shirley Bridge Extension.
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

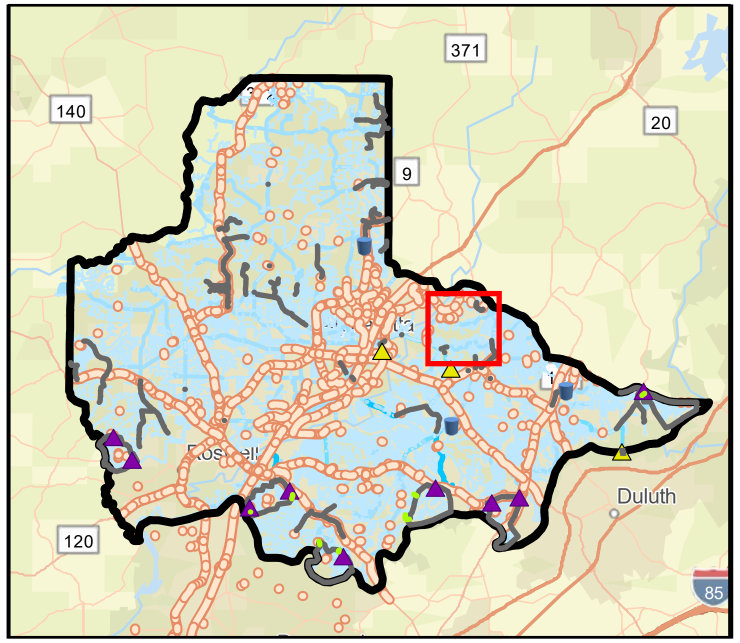
Parallel 1,800 LF of 12" water main along Fox Road. Parallel 2,000 LF of 12" water main along Greatwood Manor. Extend 1,000 LF of 10" water main along Shirley Bridge. Helps in improving fire flows in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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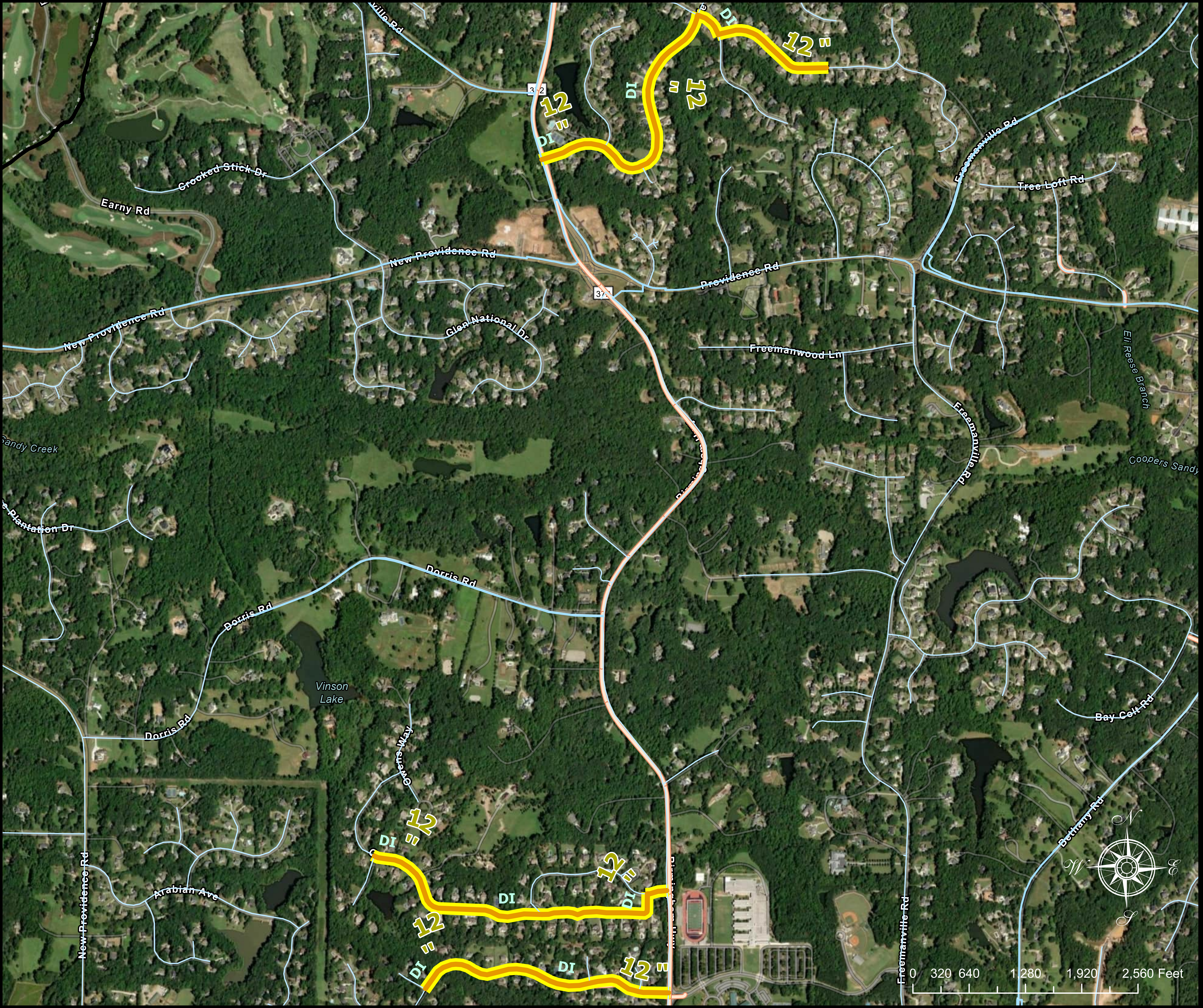


CIP Project #504
Tripe Crown Dr, Old Cedar Ln, and Kensington Farms Dr Parallel Lines
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

Parallel 5,100 LF of 12" water main along Triple Crown Dr and Seabiscuit. Parallel 3,900 LF of 12" water main along Old Cedar Ln. Parallel 3,000 LF of 12" water main along Kensington Farms Dr. Helps in improving fire flows in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

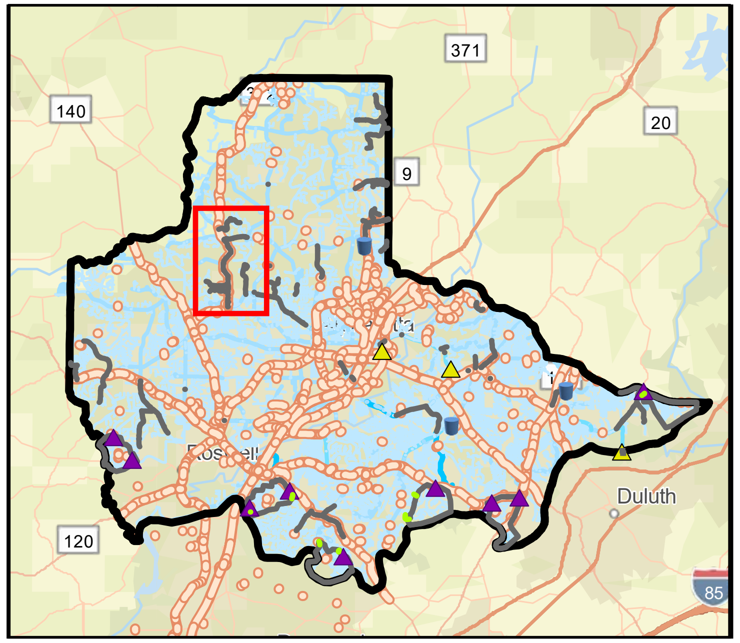
Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Pump Station

WTP

North Fulton

GDOT Road Segments



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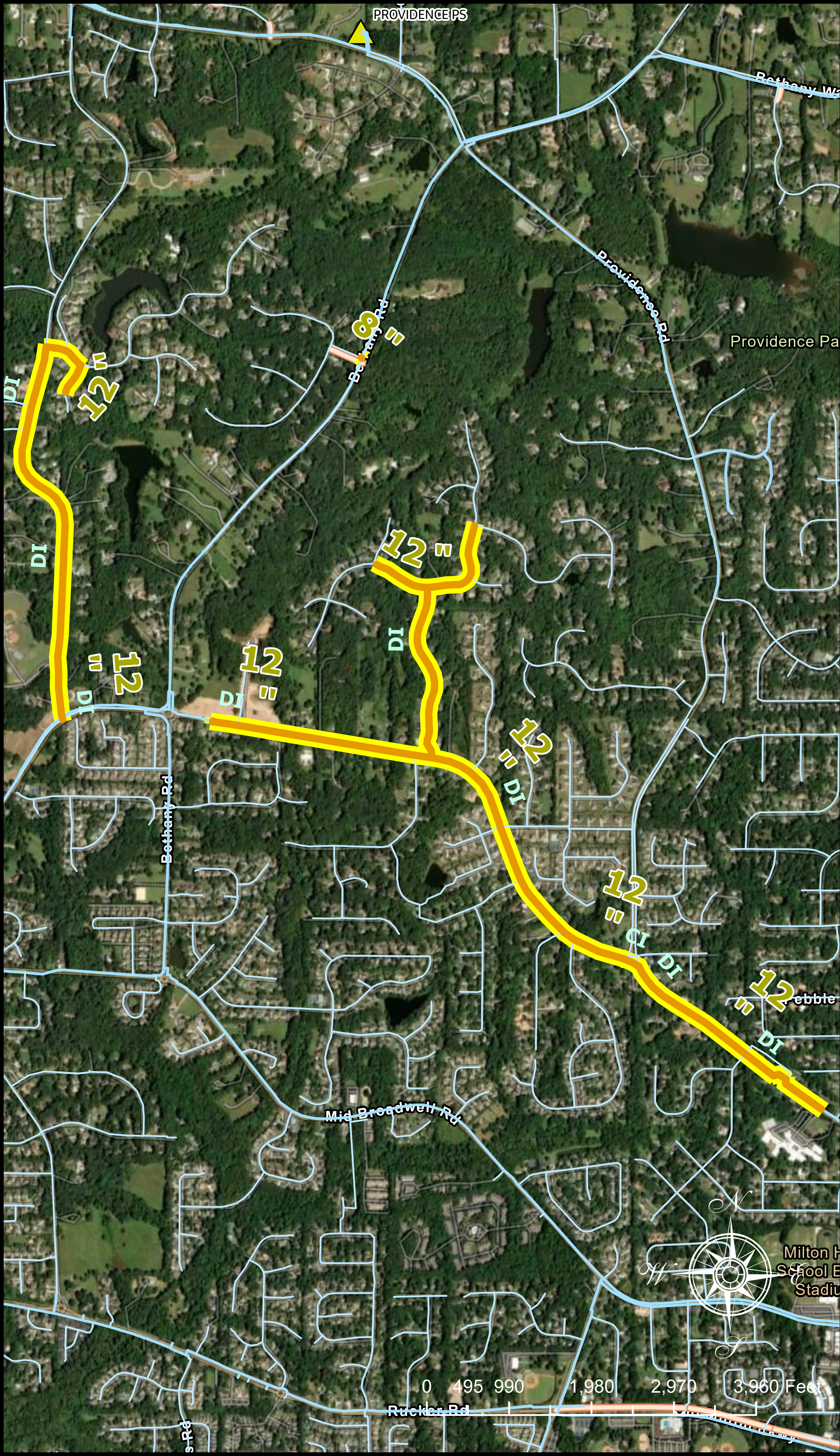


CIP Project #505
Freemanville Rd and Mayfield Dr Parallel Lines. Bethany Rd Cross Connection
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

Parallel 5,600 LF of 12" water main along Freemanville Rd, Hipworth Rd, and Conagree Ct. Parallel 13,300 LF of 12" water main along Mayfield Rd and Harrington Dr. Perform crossing pipe connection of 8" water main on Bethany Rd. Helps in improving fire flows in the area.

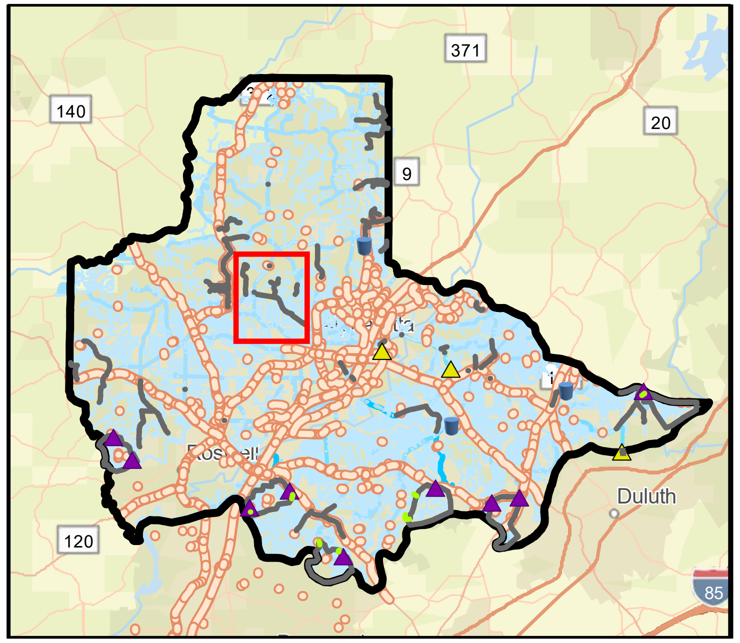
Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Pump Station
WTP
North Fulton
GDOT Road Segments



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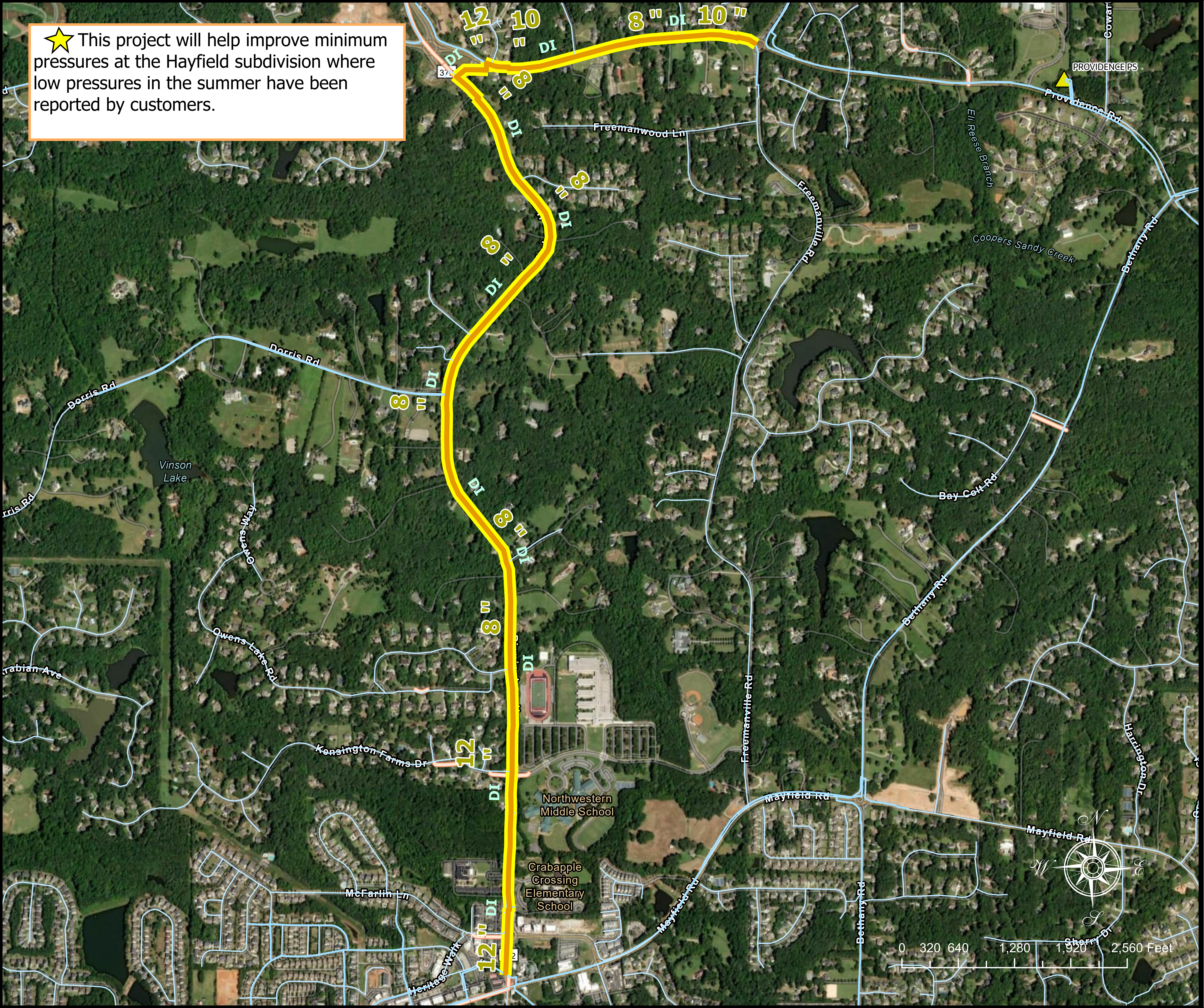


CIP Project #506
Birmingham Hwy Parallel Line
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

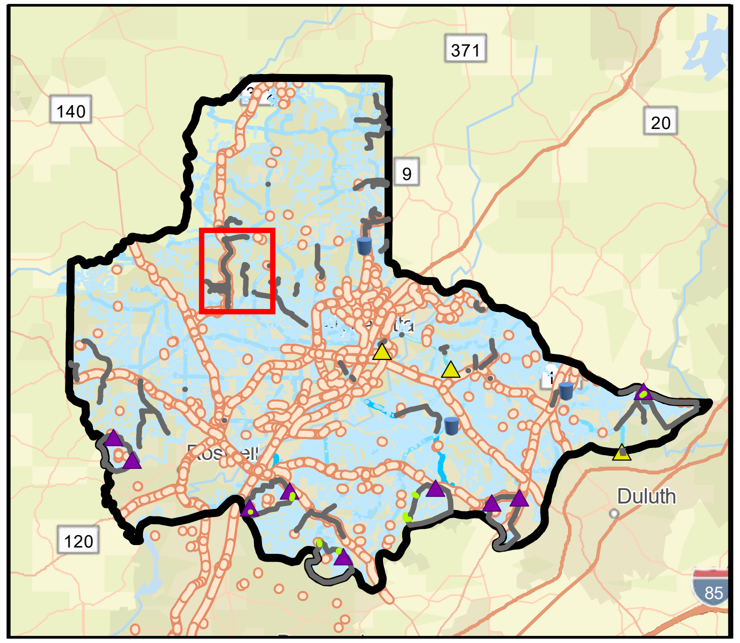
Parallel 14,800 LF of 24" water main along Birmingham Hwy and Providence Rd. Helps in improving fire flows in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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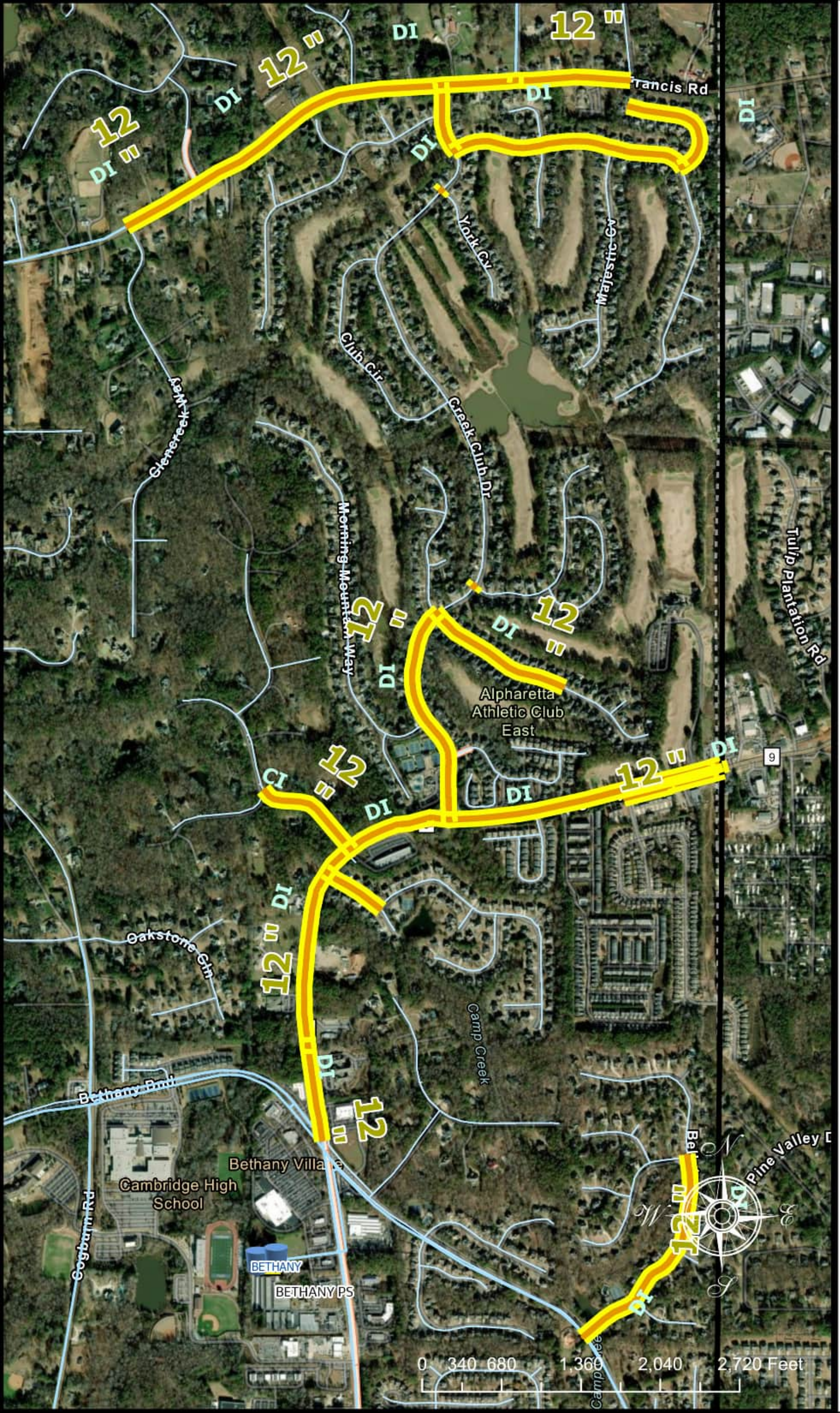
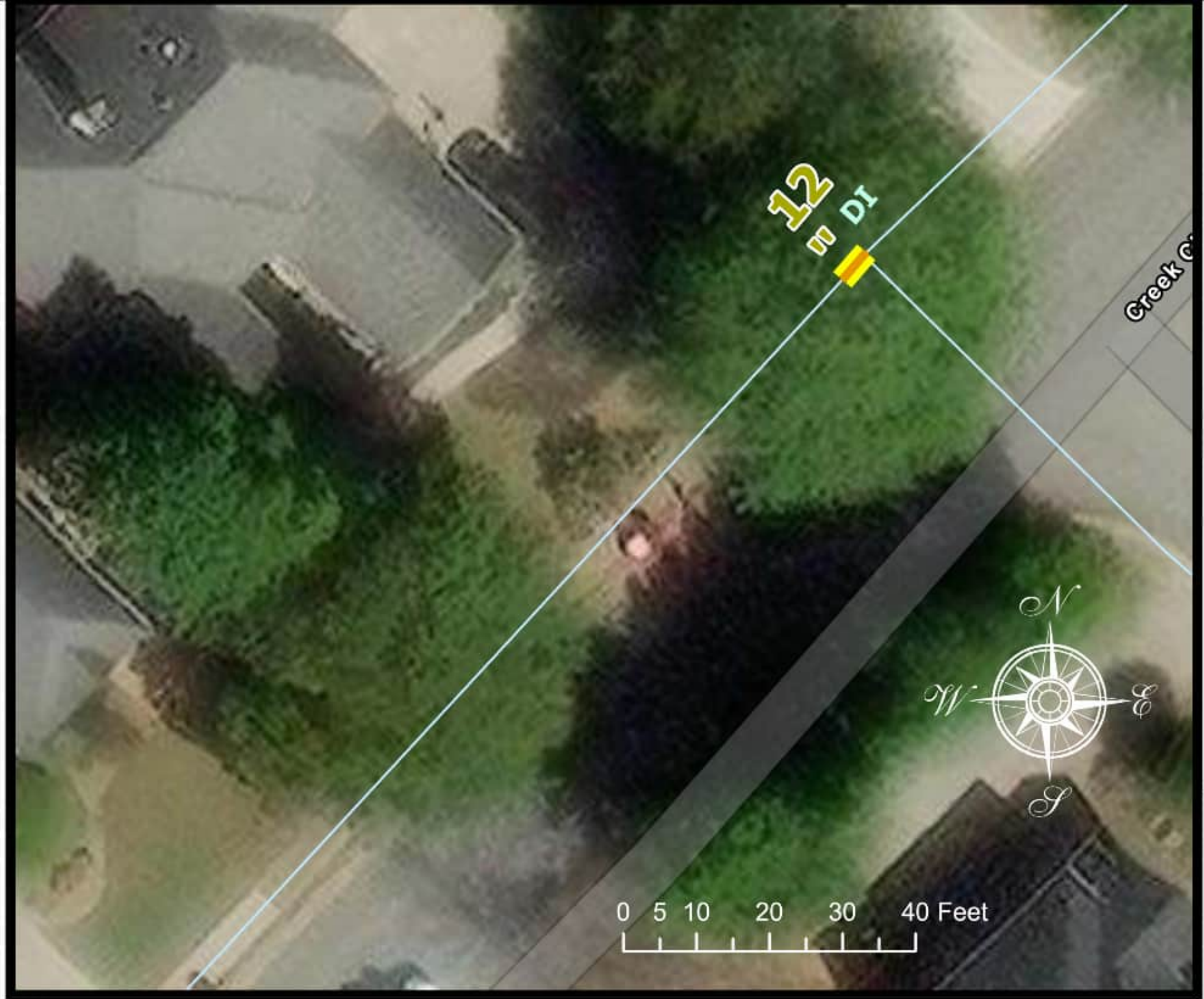
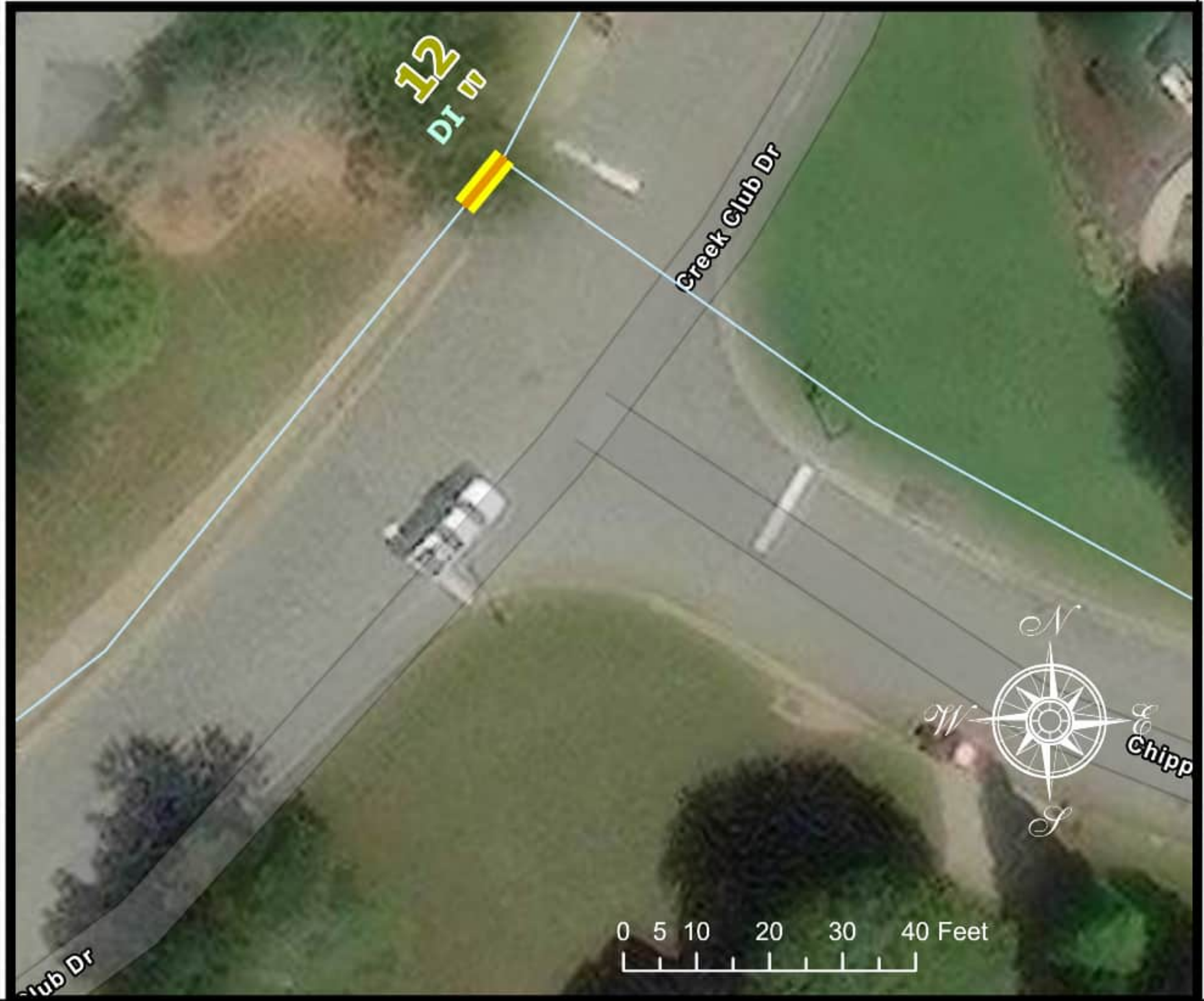






CIP Project #507
Francis Rd, Hwy 9N, and Belleterre Dr Parallel Lines. Creek Club Dr Cross Connections
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

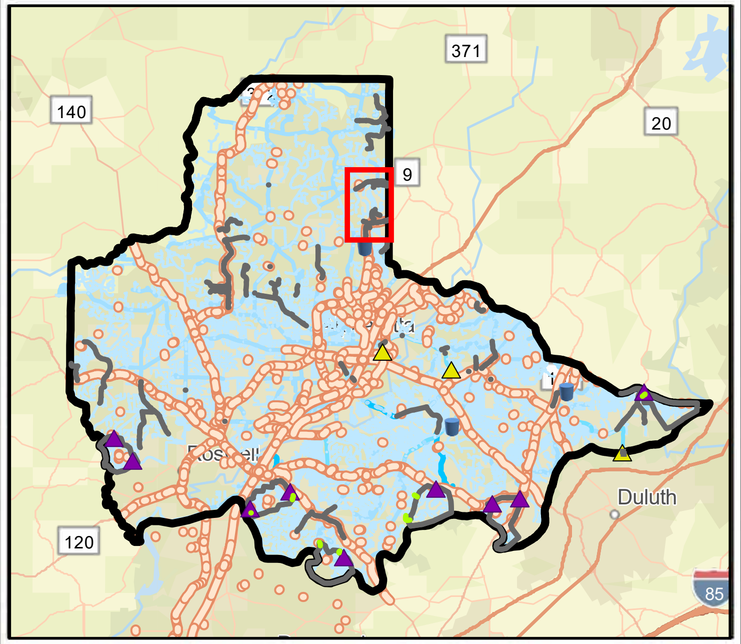
Parallel 8,300 LF of 12" water main along Francis Rd and Autumn Close. Parallel 11,600 LF of 12" water main along Hwy 9N, Creek Club Dr, and Five Acres. Parallel 2,000 LF of 12" water main along Belleterre Dr. Perform crossing pipe connection of 12" water mains on Creek Club Dr. Helps in improving fire flows in the area.

Legend

Highlighted Project
CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"

Elevated Tank
Pump Station
WTP
North Fulton
GDOT Road Segments



Jacobs

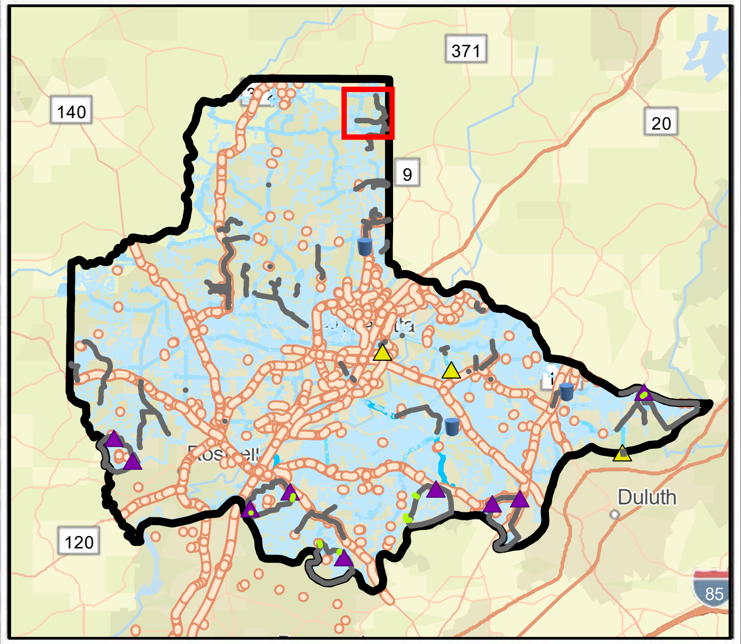
CIP Project #508
Manor Bridge Dr and Watsons Bend Parallel Lines
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

Parallel 8,800 LF of 12" water main along Manor Bridge Dr, Belford Dr, and Manor Club Dr. Parallel 5,500 LF of 10" water main along Watsons Bend and Manor Club Dr. Helps in improving fire flows in the area.

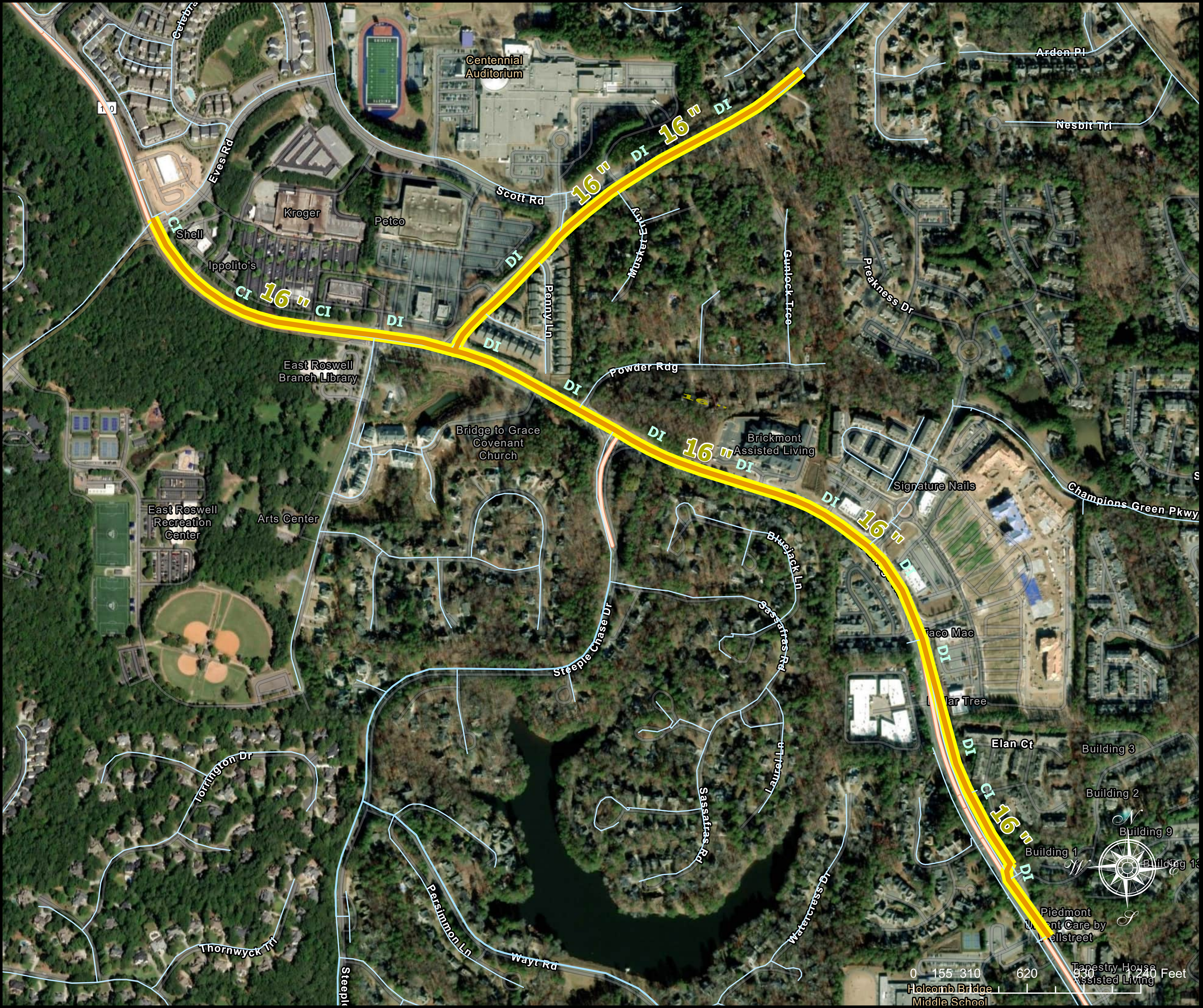
Legend

Highlighted Project	Existing Water Mains
CIP Pipes	<= 8"
2025	10" - 24"
2030	30" - 36"
2035	>= 42"
2040	Pump Station
2050	WTP
	North Fulton
	GDOT Road Segments



Jacobs

CIP Project #509
Holcomb Bridge Rd Parallel Line
Phase: 2050
Fulton County Water Distribution
Master Plan



Project Description:

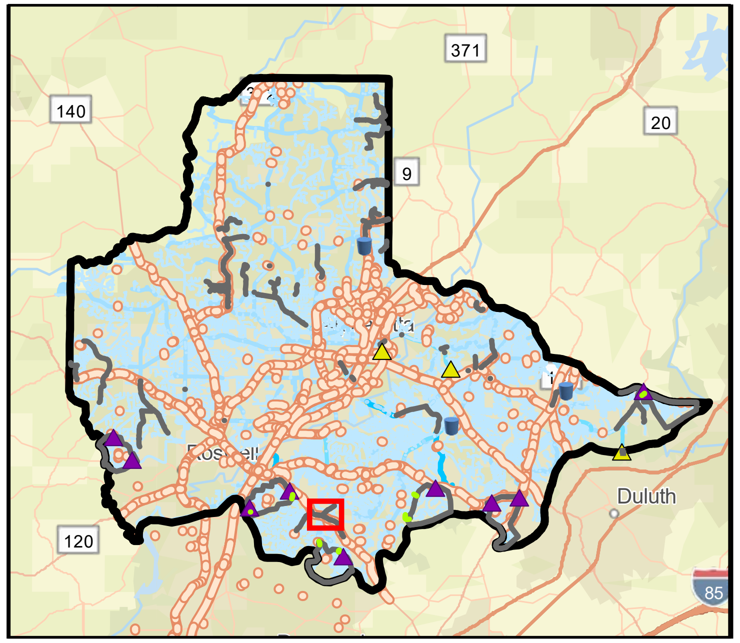
Parallel 9,300 LF of 16" water main along Holcomb Bridge Rd and Scott Rd. Helps in improving fire flows in the area.

Legend

Highlighted Project

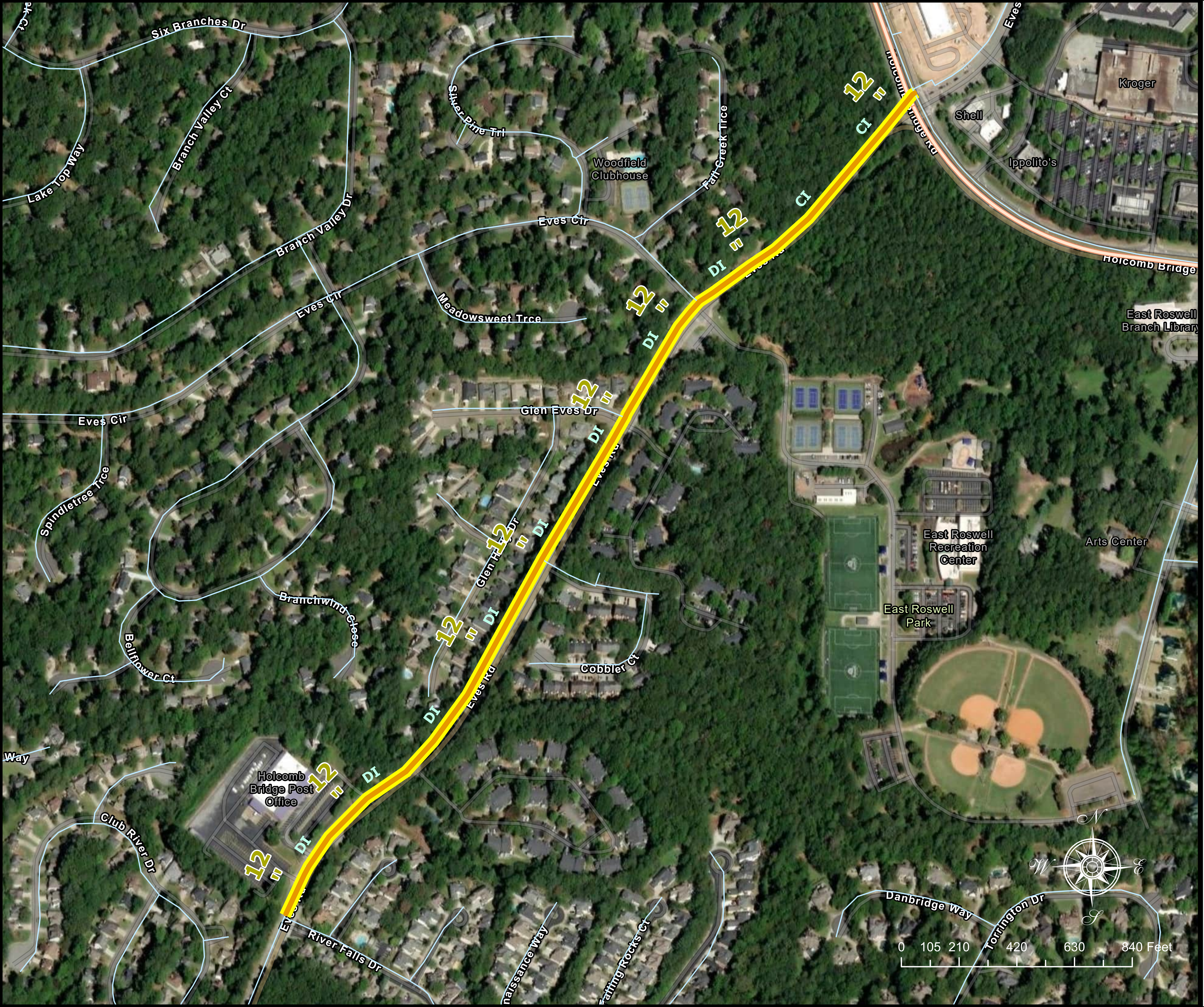
CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



Jacobs

CIP Project #510
Eves Rd Parallel Line
Phase: 2050
Fulton County Water Distribution Master Plan

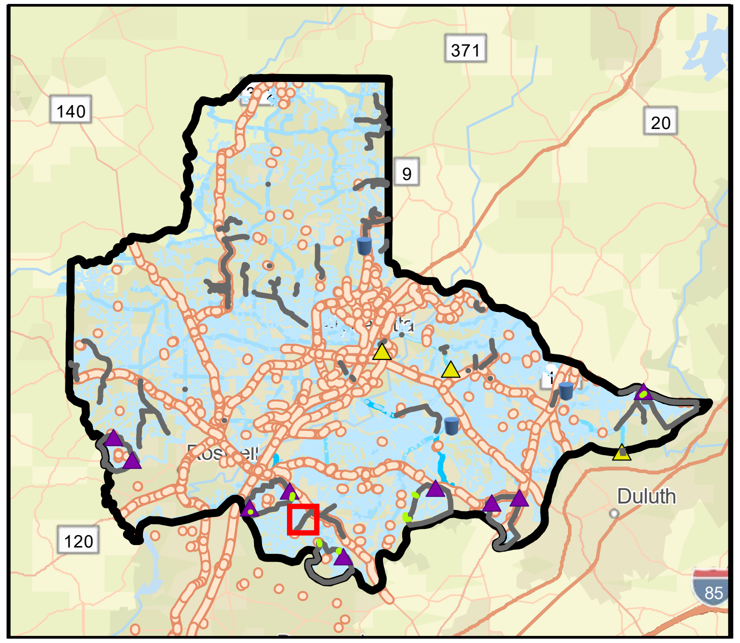


Project Description:

Parallel 3,900 LF of 12" water main along Eves Rd. Helps in improving fire flows in the area.

Legend

- Highlighted Project
- CIP Pipes
  - 2025
  - 2030
  - 2035
  - 2040
  - 2050
- Existing Water Mains
  - <= 8"
  - 10" - 24"
  - 30" - 36"
  - >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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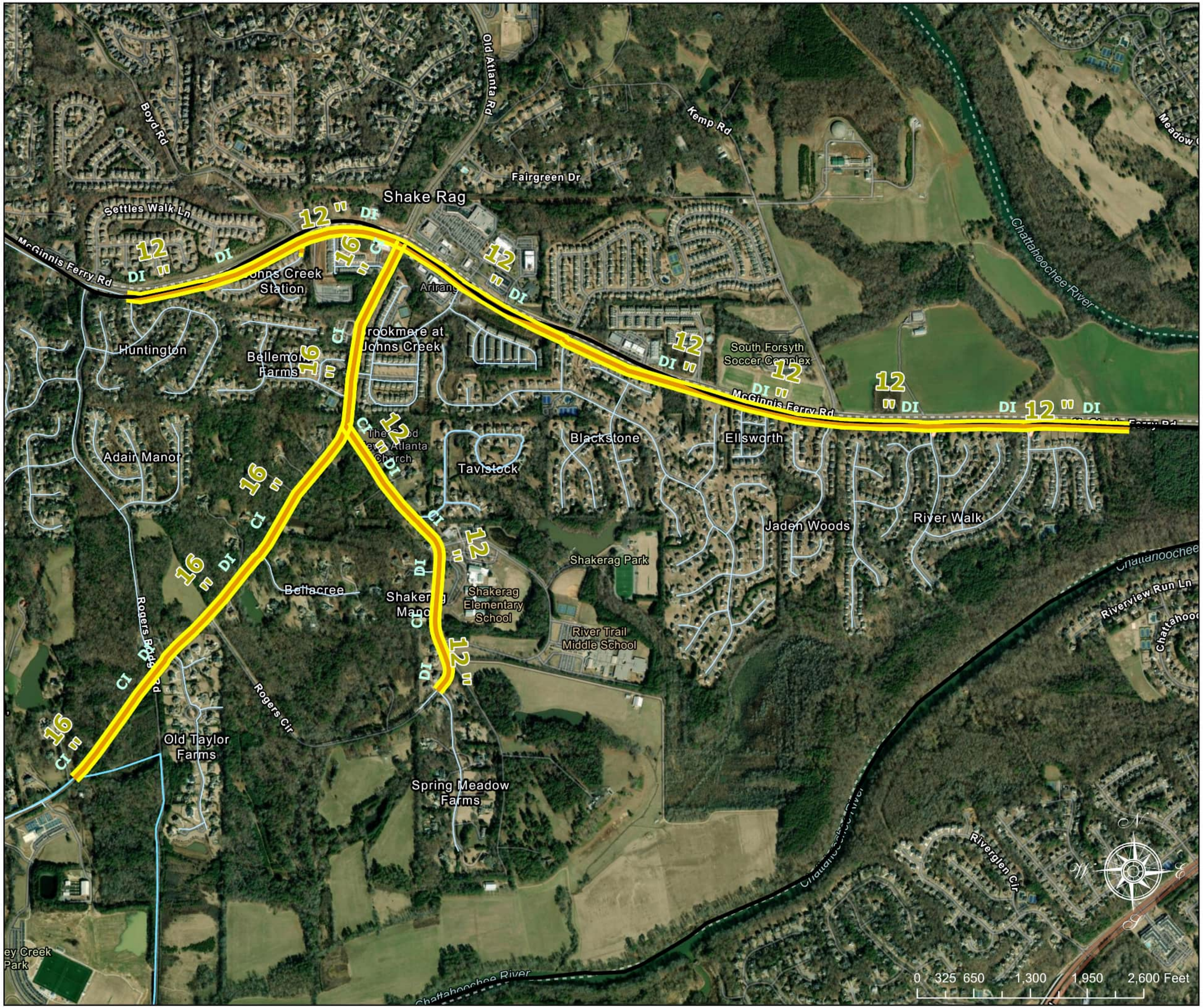
CIP Project #511
Bell Rd, McGinnis Ferry Rd, and Rogers Circle Parallel Lines
Phase: 2050
Fulton County Water Distribution Master Plan

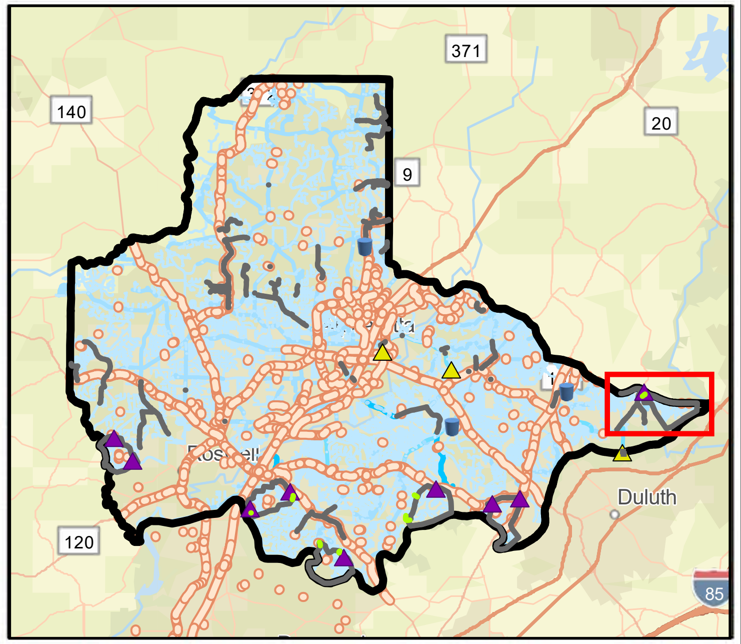


Project Description:

Parallel 7,400 LF of 16" water main along Bell Rd. Parallel 12,200 LF of 12" water main along McGinnis Ferry Rd. Parallel 3,500 LF of 12" water main along Rogers Circle. Helps in improving fire flows in the area.

Legend

- Highlighted Project
- CIP Pipes
  - 2025
  - 2030
  - 2035
  - 2040
  - 2050
- Existing Water Mains
  - <= 8"
  - 10" - 24"
  - 30" - 36"
  - >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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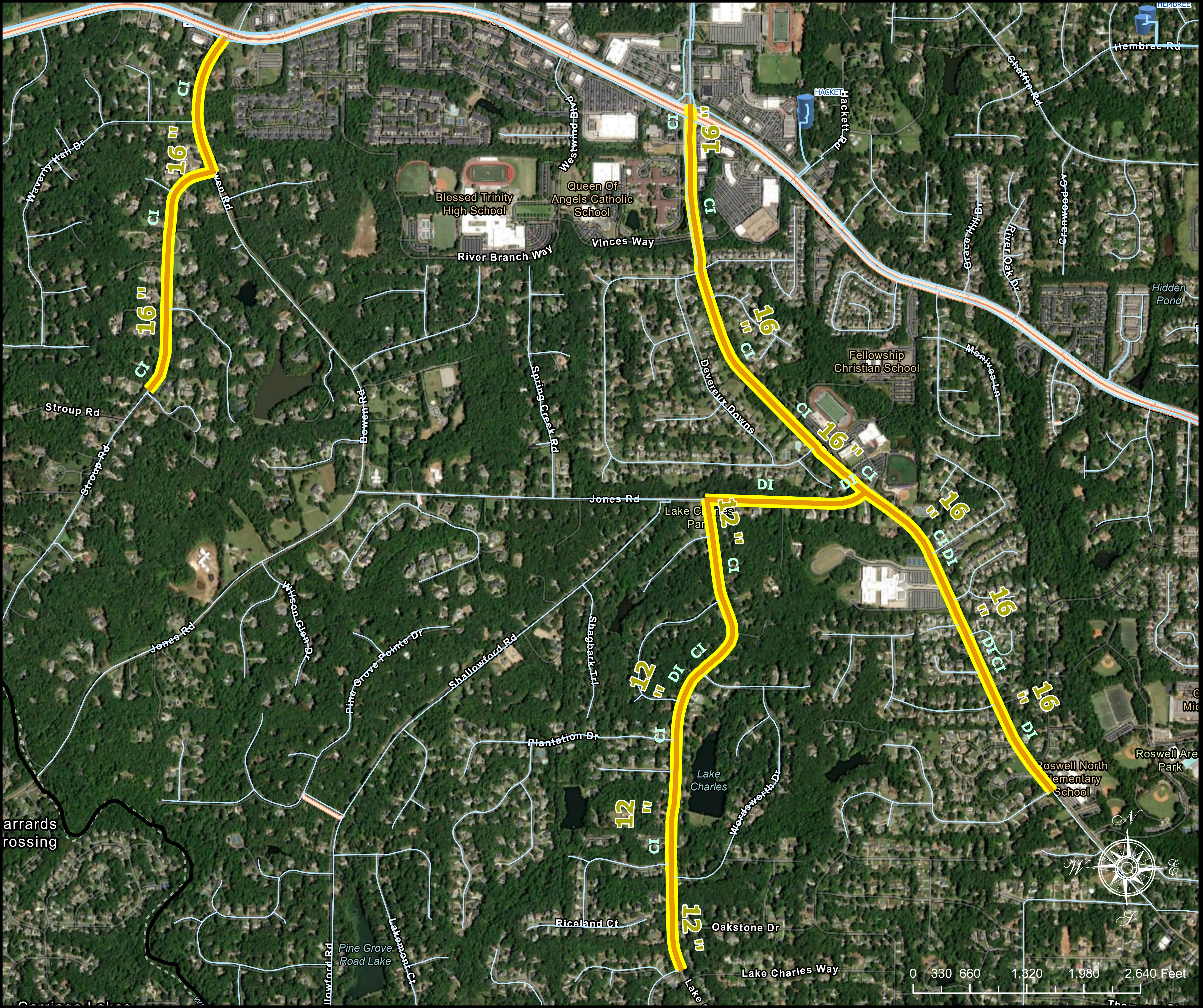


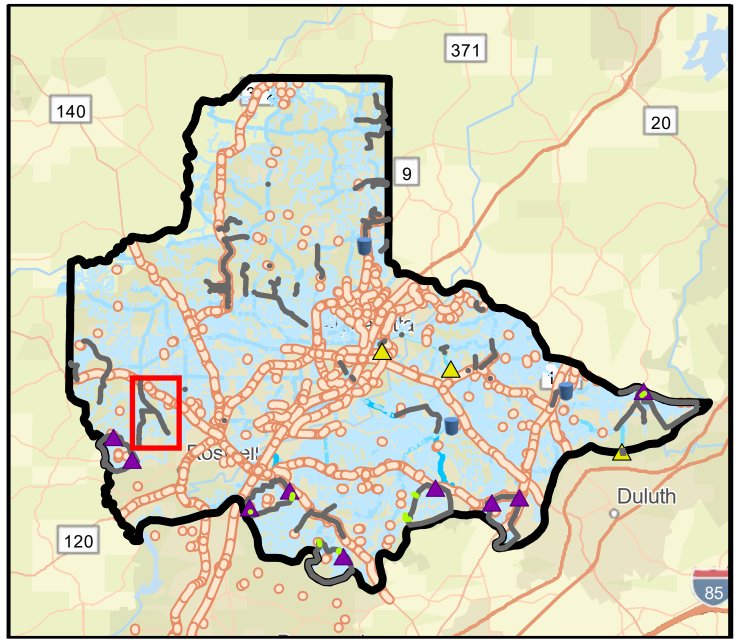
CIP Project #512
Stroup Rd, Woodstock Rd, and Lake Charles Dr Parallel Lines
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

Parallel 4,500 LF of 16" water main along Stroup Rd and Bowen Rd. Parallel 11,300 LF of 16" water main along Woodstock Rd and Jones Rd. Parallel 5,700 LF of 12" water main along Lake Charles Dr. Helps in improving fire flows in the area.

Legend

- Highlighted Project
- CIP Pipes
  - 2025
  - 2030
  - 2035
  - 2040
  - 2050
- Existing Water Mains
  - <= 8"
  - 10" - 24"
  - 30" - 36"
  - >= 42"
- Elevated Tank
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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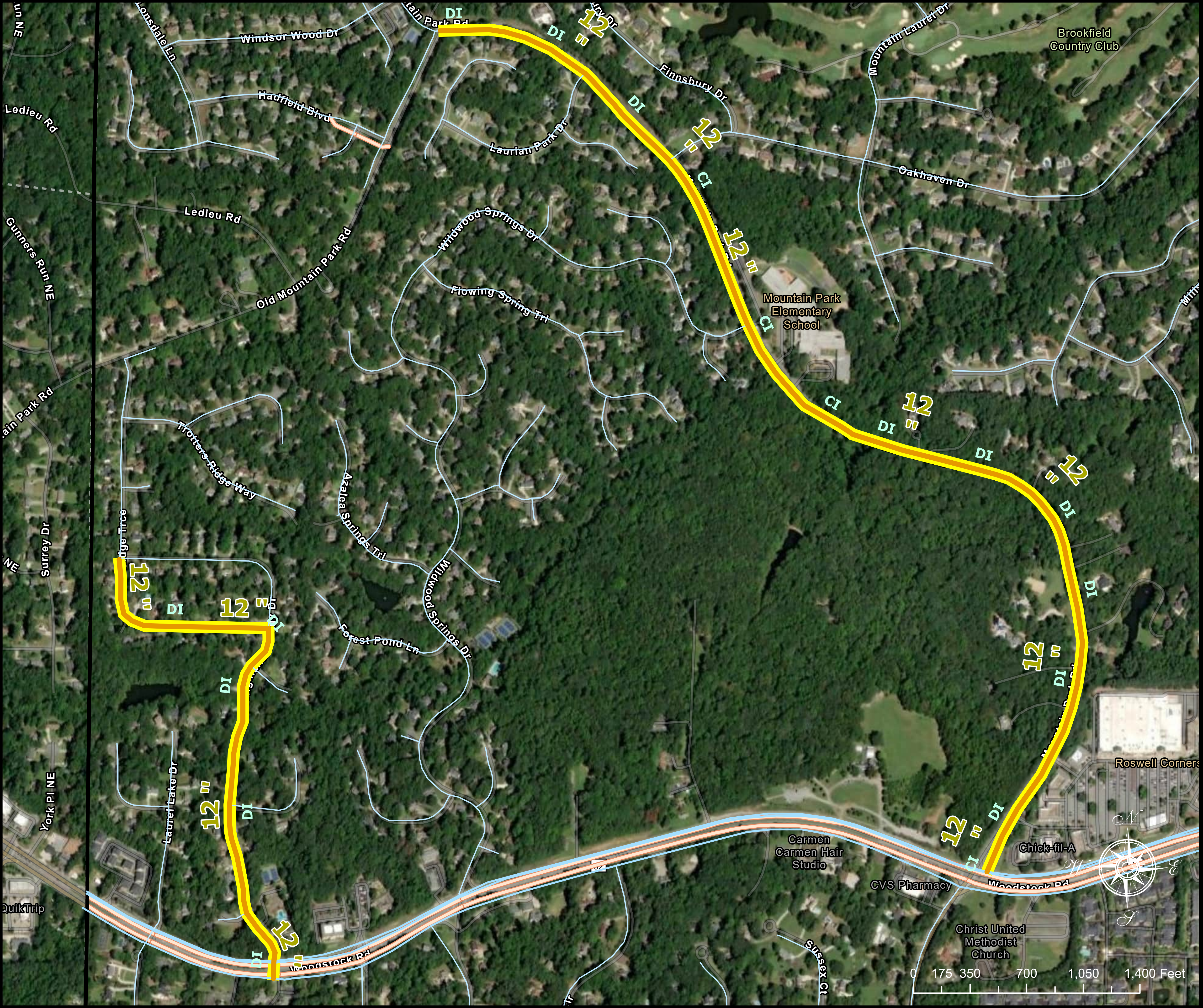


CIP Project #513
Mountain Park Rd and Highland Colony Dr Parallel Lines
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

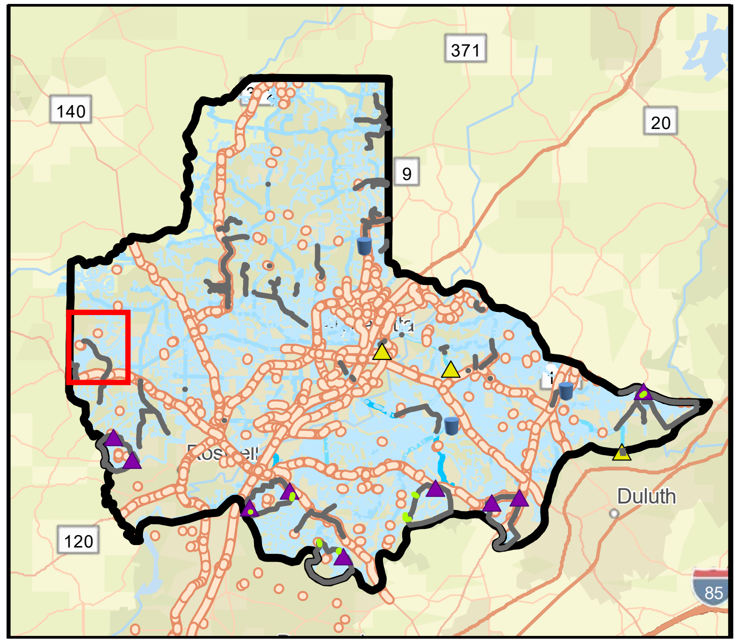
Parallel 7,600 LF of 12" water main along Mountain Park Rd. Parallel 3,600 LF of 12" water main along Highland Colony Dr and Bridle Ridge Trce. Helps in improving fire flows in the area.

Legend

Highlighted Project

CIP Pipes
- 2025
- 2030
- 2035
- 2040
- 2050

Existing Water Mains
- <= 8"
- 10" - 24"
- 30" - 36"
- >= 42"
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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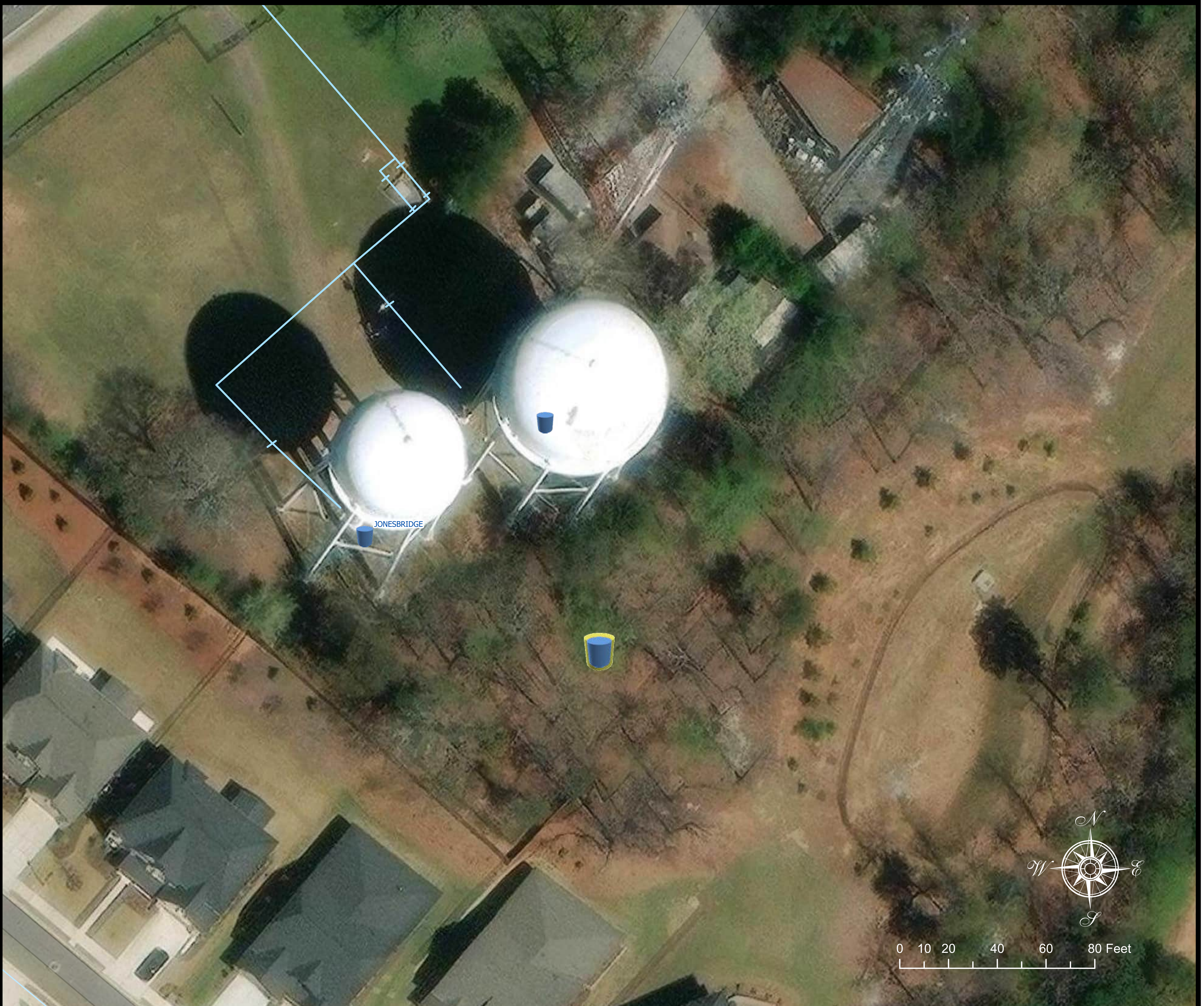


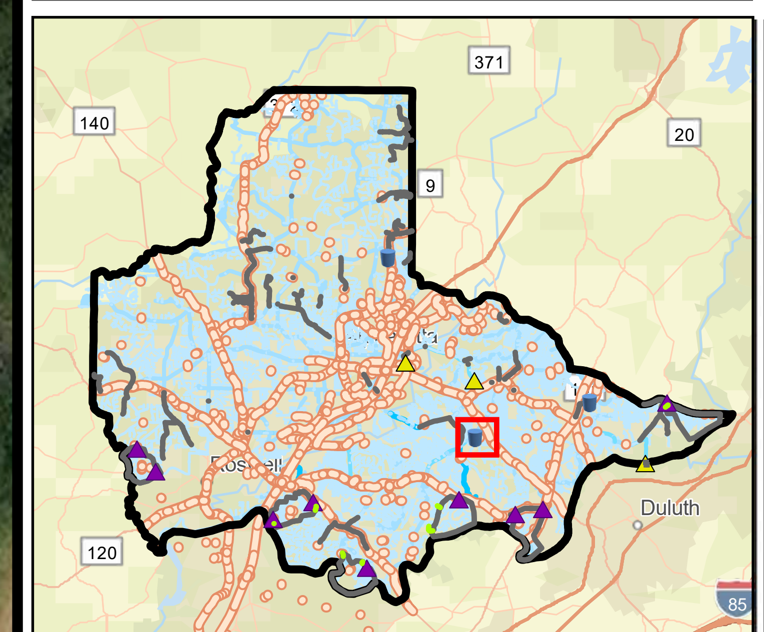
CIP Project #514
New 2 MG Elevated Storage Tank at Jones Bridge
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:

New 2 MG elevated storage tank at existing Jones Bridge Tank site. Helps with providing emergency storage.

Legend

- Highlighted Project
- CIP Pipes
  - 2025
  - 2030
  - 2035
  - 2040
  - 2050
- Existing Water Mains
  - <= 8"
  - 10" - 24"
  - 30" - 36"
  - >= 42"
- Elevated Tank
- Pump Station
- WTP
- North Fulton
- GDOT Road Segments



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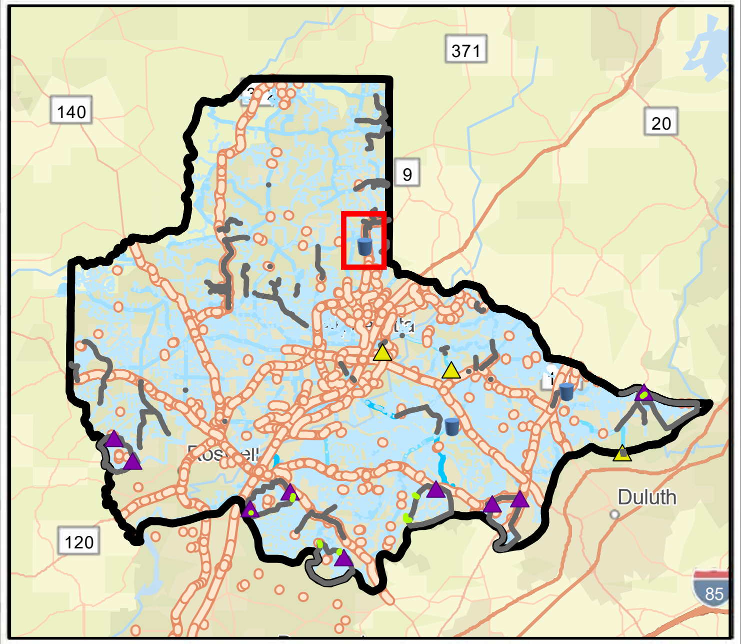
CIP Project #515
New 2 MG Elevated Storage Tank at Bethany
Phase: 2050
Fulton County Water Distribution Master Plan

Project Description:
New 2 MG elevated tank at existing Bethany Tank site. Helps with providing emergency storage.

Legend
Highlighted Project
CIP Pipes
2025
2030
2035
2040
2050
Existing Water Mains
<= 8"
10" - 24"
30" - 36"
>= 42"
Elevated Tank
Pump Station
WTP
North Fulton
GDOT Road Segments



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Appendix I
Impact of Transportation Projects on CIPs

Impact of Planned City and County Transportation Projects on the Master Plan's Capital Improvements Projects

The North Fulton individual city comprehensive plans, the North Fulton's 2010 Transportation Resource Implementation Plan (TRIP), the North Fulton's 2018 Comprehensive Transportation Plan (CTP), and the Atlanta Regional Commission's (ARC) Metropolitan Transportation Plans were compared to the capital improvement projects in the Fulton County Water Distribution Master Plan to assess any interaction of water main improvement projects with planned transportation projects in the area. A determination of impact was assigned based on whether projects were along the same road or if they overlapped at any intersection. Table 1 presents a summary of the impact of planned transportation projects on the capital improvement projects (CIP) recommended as part of this Master Plan. Table 2 presents a summary of the North Fulton's 2010 TRIP recommendations which impact the CIP projects of this Master Plan.

City of Milton

As the City of Milton continues to grow, the community aims to focus on land use that supports rural lifestyles; expanding greenspaces and trails using existing natural features; supporting local businesses by designating areas for commercial development; organizing agritourism; and promoting economic development. Table 3 presents the projects from the Milton's 2023 Comprehensive Transportation Plan and their level of impact with the Master Plan's CIP projects.

An Operations project, R11, aiming for operational and safety improvements along Hopewell Road, is expected to coincide with CIP 106. The city hopes that future projects will result in additional crossing treatments along Hopewell Road, but it is not a current priority.

A Multimodal project, R59, is expected to make improvements along Birmingham Highway which has a minor impact to CIP 506. The improvement aims to extend the two turning lanes along SR 372 and includes multi-use trails on both sides of the road. A sidewalk project, B29, aims to install Rectangular Rapid Flashing Beacon (RFFB) at the roundabouts along SR 372 and Heritage Walk. This project also has a minor impact to CIP 506.

Another Multimodal project, R3, is proposing streetscape enhancements along SR 9 which would impact CIP 507. An Intersection improvement project, I50, is proposed at Thompson Road and Francis Road which also intersects with CIP 507. The city hopes for a future sidewalk to side path conversion along this route but has not designated it as a current priority.

The following CIP projects exist along Milton's designated priority bike networks: CIP 103, CIP 106, CIP 207, CIP 506, and CIP 507. CIP 506 is along the designated sidewalk priority area.

The North Fulton's TRIP project, VH102, which proposes widening SR 9 from 2 to 4 lanes from Academy Street to Hamby Road in Forsyth County and the ARC's Metropolitan Transportation Plan, which highlights a project aiming to widen lanes along SR 9 from Windward Parkway to the Forsyth County line, are both expected to impact CIP 507.

The following projects from North Fulton's 2018 CTP are within the City of Milton:

- Roadway capacity improvements that widen existing roads are expected to overlap with CIP 106 and CIP 507.
- New intersection projects are proposed to intersect with CIP 506.
- Operational projects that work to optimize roadway performance are expected to overlap with CIP 506 and CIP 507. CIP 507 also overlaps with a bicycle and pedestrian improvement project.

City of Johns Creek

Johns Creek's vision for growth includes protecting and preserving the city's residential community; providing recreational and cultural activities; protecting the natural and historical properties; expanding the economic base; strengthening the city's identity; and creating a multi-modal transportation network.

Road widening and capacity improvement projects in the City's Comprehensive Plan are expected to impact some of the CIPs in the City of Johns Creek. The road widening project on Abbotts Bridge Road is expected to impact CIP 101 and CIP 208. The roadway capacity improvement project on Medlock Bridge Road and Jones Bridge Road are expected to impact CIP 212 and CIP 502, respectively. Potential new roundabouts at Bell Road and Rogers Bridge Road and Rogers Circle are expected to impact CIP 511.

An increase in residential units is expected near many of the CIP projects proposed within the City of Johns Creek. These are sometimes in proximity to multiple buildings and are either eligible for the National Register of Historic Places or identified as historically significant by the city.

The following CIP projects exist alongside roads designated as future sidewalk/trailway paths: CIP 101, CIP 208, CIP 212, and CIP 511.

North Fulton's TRIP project, VH112, which proposes capacity improvements to Jones Bridge Road and road widening to 4 lanes from Taylor Road to Douglas Road is alongside CIP 502.

The ARC's Metropolitan Transportation Plan also proposes improvements such as widening along Abbotts Bridge Road (SR 120) and Medlock Bridge Road (SR 141), and operational improvements on Jones Bridge Road.

The following projects from North Fulton's 2018 CTP are within the City of Johns Creek:

- Roadway capacity improvements that widen existing roads are expected to overlap with CIP 101, CIP 208, CIP 212, and CIP 502.
- Roadway widening improvements are expected to overlap with CIP 208, CIP 502, and CIP 503.
- Operational projects that work to optimize roadway performance are expected to overlap with CIP 212, CIP 503, and CIP 511.

City of Roswell

For its future, Roswell aims to promote a well-designed community; sustain, and protect its resources; be responsive to its citizen's concerns; and maintain a safe environment for its inhabitants. Table 4 presents the projects from the Roswell's 2023 Transportation Master Plan and their level of impact with the Master Plan's CIP projects.

Bicycle and pedestrian improvement projects, intersection improvement projects, and traffic calming element projects in the City of Roswell's Transportation Plan are expected to impact some of the CIPs in this Master Plan.

BPD-35 is a proposed multi-use trail along King Road from Woodstock Road to Hardscrabble Road and is expected to be alongside CIP 104, CIP 210, and CIP 512. BPD-08 and BPD-10 are proposed multi-use trails on Crabapple Road from Hembree Road to Houze Way and are expected to be alongside CIP 209. BPD-34 is a proposed sidewalk project on Jones Road from the existing sidewalk to Shallowford Road; this is expected to be alongside CIP 512. BPD-38 is a proposed multi-use trail on Mountain Park Road from Woodstock Road to Mountain Park Elementary School; this is expected to be alongside CIP 513.

INT-05, an intersection improvement project on SR 9 and Mansell Road, is proposed at the location of CIP 206. TCE-11 is a project that will place speed feedback signs along Holcomb Bridge Road. This will have a minor impact to CIP 509. TCE-08 is a proposed project to review the feasibility of traffic calming features on Eves Road and is expected to be alongside CIP 510. TCE-18 is a proposed project to review the feasibility of traffic calming features on Mountain Park Road and is expected to be alongside CIP 513.

The following projects from North Fulton's 2018 CTP are within the City of Roswell:

- Roadway capacity improvements that widen existing roads are expected to overlap with CIP 509.
- Operational projects that work to optimize roadway performance are expected to overlap with CIP 206.

City of Alpharetta

The City of Alpharetta plans to promote and encourage residential housing, improve transportation accessibility and mobility; support economic development; revitalize downtown areas; protect and preserve cultural and historic resources; provide high-quality public services and facilities; coordinate more with adjacent local governments; and promote broadband services.

The GA 400 Westside Greenway multi-use trail from Webb Bridge Road east of GA 400 to the Deerfield Area west of GA 400 is expected to be alongside CIP 202, CIP 204, and CIP 205.

The Kimball Bridge Road multimodal improvements propose to extend the greenway along Kimball Bridge Road from Northwinds Parkway to Big Creek Greenway/Rock Mill Road. This is expected to impact CIP 301, CIP-501A, and CIP 501-B.

North Fulton’s TRIP project, BP105, is expected to occur along the same segments as CIP 101, CIP 102, CIP 203, and CIP 204. The project entails connections from Big Creek Greenway at Webb Bridge Road to Webb Bridge Park and from the future Big Creek Greenway east of Marconi Drive down the powerline easement to the existing trail at Park Bridge Parkway. The connections include grade separation at Webb Bridge Road and grade crossings elsewhere.

The ARC’s Metropolitan Transportation Plan highlights a project to provide MARTA’s High-Capacity Premium Transit Service from the North Springs MARTA station to Windward Parkway. The Plan also highlights a project to provide new Express Lanes along GA 400 from North Springs MARTA station to McFarland Road. These projects are expected to have minor impact to CIP 301 and CIP 501B.

The following projects from North Fulton’s 2018 CTP are within the City of Alpharetta.

- Roadway capacity improvements that widen extending roads are expected to overlap with CIP 101 and CIP 502.
- Operational projects that work to optimize roadway performance are expected to overlap with CIP 102, CIP 202, CIP 203, CIP 204, and CIP 205.
- A street completion project is expected to overlap with CIP 201/401.

Table 1. Impact of Planned Transportation Projects with Master Plan's Proposed Capital Improvement Projects (CIPs)

CIP Project Number	Project Description	2010 North Fulton TRIP Projects (Table 2)[a]	2018 North Fulton CTP Projects[b]	ARC Projects[c]	Projects in Individual City Comprehensive Plans[d]	Impacted City
103	Crossing Pipe Connection at Freemanville Rd/Quarterpath Ln	No	No	No	No but along a priority bike network.	Milton[d] (Table 3 provides in-depth description of projects)
106	Hopewell Rd Parallel Line	No	Yes – Capacity; Maybe – New Intersection	No	Yes – R11; priority bike network; aspirational crossing treatments along Hopewell Road	
207	Crossing Pipe Connection at Bethany Rd just north of Mayfield Rd	No	Maybe – New Intersection, Realignment	No	No but along a priority bike network.	
504	Old Cedar Ln/Kensington Farms Dr and Triple Crown Dr/Seabiscuit Parallel Line	No	Maybe – Operational, New Intersection	No	Maybe – Personal Transportation Vehicle (PTV) permitted on Kensington Farms Dr and Owens Lake Rd (Crabapple PTV Plan)	
505	Freemanville Rd/Hipworth Rd/ Conagree Ct/ Mayfield Rd/ Harrington Dr Parallel Line; Bethany Rd crossing pipe connection	No	Maybe – New Intersection	No	Maybe – Mayfield Road sidewalk project .	
506	Providence Rd and Birmingham Hwy Parallel Line	No	Yes – Operational, New Intersection; Maybe – New location	No	Yes – R59, BP29; priority bike network, sidewalk priority area.	
507	Hwy 9N/Creek Club Dr, Five Acres Rd/Woodlake Dr, Belleteree Dr, Francis Rd/ Autumn Close Parallel Line and crossing pipe connections on Hwy 9N	Yes – VH102	Yes – Capacity, New Lanes, Operational, Bicycle and Ped	SR 9 (Cumming Highway) Widening from Windward Pkwy to Forsyth County Line	Yes – R3, I50; Aspirational conversion of sidewalk to sidepath, priority bike network	
101	Crossing Pipe Connection at Kimball Bridge Rd/Webb Bridge Rd	No	Yes – Road Capacity, Operational (at a point)	No	Yes – Roadway widening on Abbotts Bridge Rd Maybe – Future sidewalk/trailway, Increase in residential units	Johns Creek[e]
208	Crossing Pipe Connection at Abbotts Bridge Rd/Abbotts Way	No	Yes – Road Capacity, Widening	SR 120 (Abbotts Bridge Rd Widening) from Jones Bridge Rd to Sr 141 (Medlock Bridge) – Programmed	Yes – Roadway widening on Abbotts Bridge Rd Maybe – Future sidewalk/trailway	
212	Medlock Bridge Rd/Johns Creek Pkwy Parallel Line	No	Yes – Road Capacity; Lane addition; Operational; New Location; Bike, Pedestrian, and Trail	SR 141 (Medlock Bridge Rd) Widening from Grove Point to McGinnis Ferry RD (Phase 3)	Yes, Roadway Capacity Improvement at Medlock Maybe – Traffic signal improvements, Future sidewalk/trailway, increase in residential units, from commercial office to mixed-use high intensity, Improvements to Creekside Park are near but not on the road segment	
502	Jones Bridge Rd Parallel Line	Yes - VH112	Yes – Road Capacity, Widening	Jones Bridge Rd Operational Improvements from Sargent Rd to Douglas Rd	Yes – Roadway Capacity Improvement on Jones Bridge Rd, Maybe – Increase in residential units	
503	Fox Rd and Greatwood Manor Parallel Line; Extension on Shirley Bridge	No	Maybe – Road Capacity, Widening , Operational	No	Maybe – Increase in residential units	

CIP Project Number	Project Description	2010 North Fulton TRIP Projects (Table 2)[a]	2018 North Fulton CTP Projects[b]	ARC Projects[c]	Projects in Individual City Comprehensive Plans[d]	Impacted City
511	Bell Rd/McGinnis Ferry Rd/ Rogers Circle Parallel Line	No	Yes – Operational, proposed trail Maybe – Road Capacity (at a node) – Forsyth	No	Yes – Potential new roundabouts - Bell Road at Rogers Bridge and Rogers Circle Maybe – Multiple buildings either eligible for National Register of Historical Places or identified as historically significant by the city, large increase in residential units, new bridge or bridge repair, New 2 lane local street off of the intersection of Rogers Bridge Rd and Kemper Dr); Future Sidewalk/Trailway.	
104	Woodstock Rd Extension	No	Maybe – New Location	No	Yes – BPD-35	Roswell[d] (Table 4 provides in-depth description of projects)
206	Crossing Pipe Connection at Mansell Rd/ Alpharetta Hwy	No	Yes – Operational Maybe – New Intersection	No	Yes – INT-05	
209	Crossing Pipe Connection at Crabapple Rd just north of Strickland Rd	No	Maybe – Operational, New Trail, Bike and Ped	No	Yes – BPD-08, BPD-10	
210	Crossing Pipe Connection at W Crossville Rd/Woodstock Rd	No	Maybe – New Location, New intersection, New Trail	No	Yes – BPD-35	
509	Scott Rd/Holcomb Bridge Rd Parallel Line	No	Yes – Capacity Maybe – Operational, New Intersection, New Trail, Bike and Ped	No	Yes – TCE11	
510	Eves Rd Parallel Line	No	Maybe – Operational	No	Yes – TCE-08	
512	Woodstock Rd/Jones Rd/Lake Charles Dr and Bowen Rd/Stroup Rd Parallel Line	No	Maybe – New Location, New Intersection, Bike and Ped	No	Yes – BPD-35, BPD-34	
513	Mountain Park Rd and Highland Colony Dr Parallel Line	No	Maybe – New Location, New Intersection, Bike and Ped	No	Yes – TCE 18, BPD-38	
101	Crossing Pipe Connection at Kimball Bridge Rd/Webb Bridge Rd	Yes – BP105	Yes – Road Capacity, Maybe – Operational (at a point)	No	Maybe – Webb Bridge Road Improvement, Kimball Bridge Road Improvement	Alpharetta[f]
102	Crossing Pipe Connection at Webb Bridge Rd/Maid Marion Close	Yes – BP105	Yes – Operational	No	Maybe – Webb Bridge Road Improvement	
105	Providence Rd Extension	No	No	No	Maybe – Sidewalk Improvements	
201/401	Complete 54" Transmission Main along Buice Rd and Kimball Bridge Rd	No	Yes – Complete Street	No	Maybe – Kimball Bridge Road Improvement	
202	Alpharetta Tank Pump Station (75 HP)	No	Yes – Operational	No	Yes – GA 400 Westside Greenway	
203	Maid Marion In-line Booster Station (5 HP pumps)	Yes – BP105	Yes – Operational	No	No	
204	Crossing Pipe Connection at Webb Bridge Rd/Strath Dr	Yes – BP105	Yes – Operational	No	Yes – GA 400 Westside Greenway Maybe – Webb Bridge Road Improvement	

CIP Project Number	Project Description	2010 North Fulton TRIP Projects (Table 2)[a]	2018 North Fulton CTP Projects[b]	ARC Projects[c]	Projects in Individual City Comprehensive Plans[d]	Impacted City
205	Crossing Pipe Connection at Webb Bridge Rd/N Point Pkwy	No	Yes – Operational	No	Yes – GA 400 Westside Greenway. Maybe – Webb Bridge Road Improvement, North Point Parkway Streetscape Design/Improvements	
301/501B	Complete 42" Transmission Main under GA 400 along Kimball Bridge Rd	No	Yes – SR 400 Express Lanes Maybe – New Bridge, New Trail	Yes MARTA GA 400 High Capacity Premium Transit Service - Phase 1 (From North Springs MARTA station to Windward Pkwy) SR 400 Express Lanes from (From North Springs MARTA station to McFarland Rd)	Yes – Kimball Bridge Multimodal Improvements and Kimball Bridge at North Point Parkway Intersection Maybe – Kimball Bridge Road Improvement	
501A/501B	Complete 36-42" Transmission Main along Kimball Bridge Rd	No	No	No	Yes – Kimball Bridge Multimodal Improvements and Kimball Bridge at North Point Parkway Intersection Maybe – Kimball Bridge Road Improvement	
502	Jones Bridge Rd Parallel Line	No	Yes – Road Capacity, Widening	No	No	
503	Fox Rd and Greatwood Manor Parallel Line; Extension on Shirley Bridge	Maybe - BP105	Maybe – Road Capacity	No	No	
505	Freemanville Rd/Hipworth Rd/ Conagree Ct/Mayfield Rd/ Harrington Dr Parallel Line; Bethany Rd crossing pipe connection	No	Maybe – Intersection	No	No	

[a] North Fulton County Comprehensive Transportation Plan, Transportation Resource Implementation Program, October 2010
[b] North Fulton Comprehensive Transportation Plan, Executive Summary, 2018
[c] ARC Metropolitan Transportation Plan | Fulton County, Georgia - Open Data
[d] Plans used are cited under each city's separate project table.
[e] Johns Creek information: Johns Creek Recreation and Parks Master Plan, 2023; Johns Creek Comprehensive Plan, 2018-2028; Johns Creek Transportation Master Plan, Appendix B, 2008
[f] North Fulton CID Master Plan Update, Blueprint North Fulton 2.0, 2014 ; Alpharetta Comprehensive Plan, Horizon 2040, 2021

Table 2. North Fulton's 2010 TRIP Recommendations[a]

North Fulton's 2005 TRIP Project Number	Project Name	Project Description	Tier[b]
BP105	Johns Creek Connection to Big Creek Greenway	Connections made from Big Creek Greenway at Webb Bridge Road along Webb Bridge Road to Webb Bridge Park and from future Big Creek Greenway east of Marconi Drive down powerline easement to existing trail at Park Bridge Parkway. Grade separation only at Webb Bridge Road. At grade crossings elsewhere.	Tier 1
VH102	Capacity Improvements to SR 9 (Hamby Road to Academy Street)	Widen to 4 lanes from Hamby Road in Forsyth County to Academy Street.	Tier 1
VH112	Capacity Improvements to Jones Bridge Road	Widen to 4 lanes from Taylor Road to Douglas Road.	Tier 1

[a] North Fulton County Comprehensive Transportation Plan, Transportation Resource Implementation Program, October 2010
[b] Tiers: Tier 1: $500 Million, the approximate cost of projects currently in the Envision6 RTP, High Priority

Table 3. Milton's 2023 Comprehensive Transportation Plan Recommendations[a]

Milton Transportation Plan Project ID	Project Name	Project Description	Level[b]
Sidewalk - BP29	SR 372 Ped Crossing RRFBs	Rectangular Rapid Flashing Beacon (RRFB) at roundabouts along SR 372 and Heritage Walk	Level 1, Tier 1
Multimodal - R3	SR 9 Streetscape	Streetscape enhancements along SR 9 (North Main Street/Cumming Highway)	Level 1, Tier 1
Operations - R11	Hopewell Road Corridor Improvements	Concept and preliminary design of operational and/or safety improvements with traffic calming measures along Hopewell Road from Mayfield Road to Redd Road	Level 1, Tier 1
		Right of way acquisition for operational and/or safety improvements with traffic calming measures along Hopewell Road from Mayfield Road to Redd Road	Level 1, Tier 2
Multimodal - R59	SR 372 School Stacking Lane	Northbound right turn lane extension approaching School Drive and southbound left turn lane extension to remove queuing from SR 372 mainline; includes multiuse trails on both sides of the road	Level 1, Tier 1
Intersection - I50	Thompson Road at Francis Road	Intersection improvements at Thompson Road and Francis Road	Level 2, Remaining Projects

[a] City of Mil0on Comprehensive Transportation Plan, Recommendations Report, 2023; Milton 2040 Comprehensive Plan, 2021
[b] Levels and Tiers:
Level 1: TSPLOST II funding, highest priority projects; Tier 1 funding is the highest priority, which is 85% of the expected TSPLOST revenue; Tier 2 equals 100% of the funding.
Level 2: Projects that could be completed if another TSPLOST was passed on the next ballot. These projects would be initiated in the next 6 to 10 years.
Level 3: This funding is an estimate of TSPLOST funding in the next 11 to 20 years if the tax continues to be passed.

Table 4. Roswell Comprehensive Plan Recommendations[a]

Roswell Comprehensive Plan Project ID	Project Name	Project Description	Tier[b]
BPD-08	Multi-use Trail; Crabapple Road; Hembree Road to Strickland Road	This project will fill gaps in sidewalk network and construct multi use path on corridor where feasible.	Tier 2
BPD-10	Multi-use Trail; Crabapple Road; Strickland Road to Houze Way	This project will construct multi use path where feasible	Tier 3
BPD-34	Sidewalks; Jones Road; Existing Sidewalk to Shallowford Road	This project will fill the sidewalk gap along the south side of Jones Road.	Tier 2
BPD-35	Multi-use Trail; King Road; SR 92/Woodstock Rd to Hardscrabble Road	This project will install multi use path on corridor where feasible.	Tier 1
BPD-38	Multi-use Trail; Mountain Park Road; SR-92/Woodstock Rd to Mountain Park Elementary	This project will construct multiuse path where feasible.	Tier 3
INT-05	Alpharetta Hwy (SR 9); Mansell Road	Examine signal timing improvements and add new pedestrian island in NE quadrant where dual right turn lanes exist.	Tier 1
TCE-08	Eves Road; Riverside Road to Holcomb Bridge Road (SR 140)	Review future feasibility for traffic calming features that may include speed feedback signs, median treatments, horizontal deflection, or other improvements.	Tier 2
TCE-11	Holcomb Bridge Road (SR 140); Holcomb Woods Parkway to City Limits	This project will increase the placement of speed feedback signs along Holcomb Bridge Road (SR 140) as part of the Speed Management Program.	Tier 2
TCE-18	Mountain Park Road; Woodstock Road (SR 92) to Old Mountain Park Road	Review future feasibility for traffic calming features that may include speed feedback signs, median treatments, horizontal deflection, or other improvements.	Tier 3

[a] City of Roswell Transportation Master Plan, 2023; City of Roswell Comprehensive Plan, 2040
[b] Tiers:
Tier 1: Capital Improvement Program and Short-Range Projects for Fiscal Years 2024-2028
Tier 2: Mid-Range Projects, Fiscal Year 2029-2039
Tier 3: Long Range Projects, Fiscal Year 2040-2050

Table 4. North Fulton CID Master Plan – Alpharetta Recommendations

North Fulton CID Master Plan Project ID	Project Name	Project Description	Prioritization**
8 - Multimodal Trail	GA 400 West Side Greenway; Windward Pkwy	Complete greenway from Webb Bridge Road East of GA 400 to Webb Road/Deerfield Area West of GA 400	Work Plan
9 - Roadway	Lakeside Parkway/Haynes Bridge Road Accel/Decel Lane; North Point	Reopen slip lane from Lakeview Parkway to Haynes Bridge Road and extend decel lane from GA 400 southbound on-ramp to Lakeview Parkway	Work Plan
11- Multimodal Trail	Kimball Bridge Multimodal Improvements and Kimball Bridge at North Point Parkway Intersection; Old Milton	Extend greenway along Kimball Bridge Road from Northwinds Parkway to Big Creek Greenway/Rock Mill Road	Work Plan
16 - Multimodal Trail	Webb Bridge Multimodal; Greenway Old Milton	Extend greenway along Webb Bridge Road from Westside Parkway to Big Creek Greenway	Out of district

*North Fulton CID Master Plan Update, Blueprint North Fulton 2.0, 2014
**Prioritization
Work Plan: Top Tier appropriate size and scale. CID can undertake these efforts within 7 years
Out of District: CID's ability to pursue these projects is limited by different restraints. Initiatives can be revisited.

Appendix J
Model Intergovernmental Agreement

8.4 Model Intergovernmental Agreement

Intergovernmental agreements for sharing and pricing of water during emergency situations are unique and will vary depending on the type of project and the systems or entities involved. Crafting a successful intergovernmental agreement will involve a number of policy decisions, which also will vary according to the governmental entities involved. However, there are key issues common to all intergovernmental agreements that are integral to the success of these agreements. Addressing these issues of governance and financial and technical issues in the agreement will minimize the potential for legal disagreements between the participating governmental parties.

A Model Intergovernmental Agreement for Emergency Water Interconnection System is provided at the end of this section as Exhibit 8-5. It assumes that the parties will share water in emergency situations via a physical interconnection between their distribution systems. While the type of project may vary, parties can use this Model Intergovernmental Agreement as a tool to facilitate discussion on drafting the specific intergovernmental agreement that best meets their needs.

This section sets out a list of topics that should be addressed by the parties during the drafting of the intergovernmental agreement and addresses the general issues surrounding each topic.

8.4.1 Governance

Generally, the recitals of the agreement between various parties set forth the legal authority permitting the parties to enter into the agreement. Since the intergovernmental agreements at issue deal specifically with the sharing and pricing of water during emergency situations for QWSs in the District, the WSIRRA (O.C.G.A. § 12-5-200, et seq.) should be addressed. As defined by the WSIRRA, "Qualified Water Systems" considered in this study are limited to public water systems that are operated by a city, county or water authority. Therefore, the examples discussed in this section involve only intergovernmental agreements.

Example:

"WHEREAS, the General Assembly finds that it is in the best interests of the state of Georgia for public water systems in the Metropolitan North Georgia Water Planning District to evaluate their withdrawal, treatment, and distribution systems and to take proactive measures to reduce the risk of catastrophic interruptions of water service during emergencies as set forth in O.C.G.A. §12-5-200(2); and,"

City and county governmental entities need statutory authority to enter into contracts. This is because of the general rule that local governments may not enter into a contract that lasts longer that the government's term of office. One council may not bind itself or its successors (O.C.G.A. § 36-30-3(a)). However, the Intergovernmental Contracts Clause found in Article IX, Section III, Paragraph I(a) of the 1983 Georgia Constitution provides an exception to that rule and allows political subdivisions of the state to contract with one another or with other public agencies provided that the contract does not exceed 50 years. This exception does not give authority for these governmental entities to enter into any kind of agreement that they want to. The agreement must be for the provision of services or for the use of facilities or equipment that the parties are authorized by law to undertake. See, City of Decatur vs. DeKalb County, Ga. (2011) (Georgia Supreme Court Case No. S11A0354, decided July 5, 2011). City and county governments are authorized by law to provide services for "[d]evelopment, storage, treatment, purification, and distribution of water", 1983 Georgia Constitution Article IX, Section II, Paragraph III(7). Thus, city and county governments are permitted by law to contract for the provisions of services or for the use of facilities or equipment for the sharing of water.

Examples:

"WHEREAS, Article IX, Section III, Paragraph I(a) of the Georgia Constitution authorizes, among other things, any county, municipality or other political subdivision of the state to contract, for a period not exceeding 50 years, with another county, municipality or political subdivision or with any other public agency, public

corporation or public authority for joint services, for the provision of services, or for the provision or separate use of facilities or equipment, provided that such contract deals with activities, services or facilities which the contracting parties are authorized by law to undertake or to provide; and,"

"*WHEREAS, Article IX, Section II, Paragraph III(7) of the Georgia Constitution authorizes, among other things, any county or municipality to provide for the development, storage, treatment, purification, and distribution of water; and"*

If the "qualified system" contracting party is a local water authority, the recitals of the agreement should set forth the legal authority permitting the local authority to contract. "[T]he term "local authority" means an instrumentality of one or more local governments created to fulfill a specialized public purpose or any other legally created organization that has authority to issue debt for a public purpose independent of a county or municipality, regardless of name; provided, however, that the term "local authority" does not include a state authority. A local authority may have been created by local constitutional amendment, general statute or local law."(O.C.G.A. § 36-80-17(a)).

Example:

"WHEREAS, the Local Water Authority is organized and established under the provisions of [local constitutional amendment, general statute, or local law], for the purpose of constructing and operating a water supply distribution system serving water users within the area described in the plans now on file in the office of the Local Water Authority; and, "

8.4.2 Purpose

The agreement should address why the parties are entering into the agreement, including the spirit and intent of the agreement, which can be set forth in the recitals or as a provision in the agreement.

Examples:

"WHEREAS, the City and County agree that the establishment of a potable water interconnection between the two parties is in the best interest of their respective communities and that to promote the establishment of such a system, all points of connection constructed between the City system and the County system shall be treated as emergency interconnections and constructed so as to allow the flow of water from either system to the other; and"

"WHEREAS, the City and the County desire to enter into an agreement for an emergency water interconnection system, whereby both parties agree to coordinate and cooperate with each other and agree to establish the terms and conditions under which the systems can be physically connected and water made available to each other during times of emergency, as more specifically set forth below. "

"1. Purpose. This is an Agreement for the reciprocal sale and purchase of available potable water by and between the City and County during emergency water conditions for the mutual convenience of the parties. All of the foregoing recitals are true and correct and are made a part of this Agreement as if fully set forth herein."

8.4.3 Definitions

Terms and corresponding definitions should clearly be set out in the agreement. Of particular interest is the definition of "emergency," which should be defined to include those parameters set forth in O.C.G.A. § 12-5-201. Other terms and corresponding definitions may be dictated by the type of project and its financial and technical issues.

Examples:

"2. Definitions. For purpose of this Agreement, the following definitions shall apply:

(a) *"Available Potable Water" shall mean a surplus of potable water not immediately needed by the Selling Party.*

(b) *"Emergency Water Condition" shall mean a shortage of potable water to meet the essential water needs of the Requesting Party's customers that threatens their health, safety and welfare.*

(c) *"Essential Water Needs" shall mean the minimum amount of water needed for residential and commercial means for food processing, drinking, toilet flushing, fire fighting, hospital use, and critical asset use and a portion of the system's unaccounted for water as defined in O.C.G.A. §12-5-201(4).*

(d) *"Requesting Party" shall mean that party which desires to purchase potable water from the other.*

(e) *"Selling Party" shall mean that party which has Available Potable Water to sell to the Requesting Party."*

8.4.4 Procedures

The agreement should address the processes and procedures for parties to follow in a water emergency.

Examples:

"3. *Disruption of Potable Water Supply. Whenever either City or County experiences an Emergency Water Condition and desires to purchase Available Potable Water from the other, the Requesting Party shall notify the Selling Party of the Emergency Water Condition and request Available Potable Water be transferred to the Requesting Party for a limited period, as determined by mutual agreement. The Selling Party shall respond as soon as possible to the request by advising the Requesting Party of the quantity of Available Potable Water.*

4. *Notification of Emergency Water Conditions. The City water system director, by whatever name called, or his on-call designee, and the County water system director, by whatever name called, or his on-call designee, shall immediately notify the other when Emergency Water Conditions develop and request temporary water service from the other. Such notice shall include a description of the emergency and expected duration.*

5. *Utility Staff Responsibilities. In the event that water is needed by City or County, each parties' Utility Department will be responsible for operating all of the valves necessary to permit water to be sold from one to the other; and each utility will be responsible for returning their valves to the original closed position once the temporary water service event is completed."*

8.4.5 Amount to Supply

The agreement should address how much water the parties agree will be supplied in the event of an emergency.

Example:

"6. *Rate of Supply. The Selling Party shall not be required to draw water in excess of any Water Use permits, nor shall the Selling Party be required to provide more than its Available Potable Water; and the Selling Party shall not be liable to the Requesting Party or its customers for any interruptions or water service provided hereunder. The parties shall be obligated to supply water pursuant to this Agreement only to the extent that doing so does not prejudice the ability of the Selling Party to fulfill its obligations to its customers and other entities with contracts with the Selling Party."*

8.4.6 Pricing

The cost allocation concepts discussed in the prior sections give various examples of how allocation of costs associated with interconnections can be addressed by the parties in the agreement. The Model Intergovernmental Agreement presented here uses a volume of use approach to pricing and contemplates a change in rates; however, other approaches to pricing, as described previously, could be instituted with the concurrence of both parties. Setting the cost allocation in the agreement will require a mixture of accounting, business and political skills to arrive at a pricing agreement that meets both business and political criteria.

Example:

"7. Water Supply Charges. Water supplied by either party per this Agreement and distributed through the point(s) of interconnection shall be charged at the then current lowest retail residential water rate, regardless of the number of gallons used, as set forth in the Selling Party's rate ordinance or resolution. The parties will not be required to pay each other impact or connection fees for the carrying out of this Agreement.

If the contracting party is a local water authority, the enabling legislation, i.e., the local constitutional amendment, general statute or local law that created the water authority, should be reviewed to determine what powers the local water authority has. See, City of Jonesboro v. Clayton County Water Authority, 136 Ga. App. 768 (1975) (Enabling Act of water authority gave it power to set rates; however, it did not give it power to arbitrarily revise rates after it had contracted for specific rates). The agreement also should address the requirements of O.C.G.A. § 36-80-17 as to contracts specifying rates, fees or other charges to be charged and collected for water utility services provided by the local authority. This Code Section allows the governing body of any local authority which is authorized to provide electric, natural gas or water utility services to enter into contracts that specify the rates, fees or other charges which will be charged and collected by the local authority for utility services to be provided by the local authority to one or more of its utility customers. However, such contracts are subject to the following conditions and limitations:

"(1) No such contract shall be for a term in excess of 10 years;

(2) Any such contract that is for a term in excess of two years shall include commercially reasonable provisions under which the rates, fees or other charges shall be adjusted with respect to inflationary or deflationary factors affecting the provision of the utility service in question; and,

(3) Any such contract shall include commercially reasonable provisions relieving the local authority from its obligations under the contract in the event that the local authority's ability to comply with the contract is impaired by war, natural disaster, catastrophe or any other emergency creating conditions under which the local authority's compliance with the contract would become impossible or create a substantial financial burden upon the local authority or its taxpayers." (O.C.G.A. § 36-80-17 (b) (1) – (3)).

There is a similar provision authorizing municipalities to execute contracts establishing water rates, which recognizes the power of a local authority providing water utility services to establish rates, where the right or power to specify such rates, fees or charges is otherwise vested by local constitutional amendment, general statute or local law in the governing body of such local authority. However, any such contract is subject to the same three conditions and limitations listed above (O.C.G.A. § 36-30-3(d) (1) – (3)).

Examples:

"(a) Change of Rates. If either City or County proposes any new or amended rate schedule while this Agreement is in effect, provided that any new or amended rate schedule shall be adjusted with respect to inflationary or deflationary factors affecting the provision of the water utility service, notice shall be furnished to the other party prior to the effective date of the new or

amended rate schedule. Thereafter, the new or amended rate schedule shall take effect for purposes of this Agreement beginning in the next billing cycle after the change in rate takes effect. The purpose of this subsection is only to ensure disclosure of rate changes and shall not grant either party a right to appeal any rate increase. The parties hereby agree that, during the Agreement, both parties shall continue to be billed at the lowest retail residential water rate."

"Term. This Agreement shall continue in effect for five (5) years, unless otherwise terminated, as set forth above. Further, this Agreement shall be automatically renewed for five (5) year increments unless either party notifies the other in writing at least one year prior to the termination date. Upon Termination of the Agreement both parties agree to share equally the interconnection removal costs."

"Force Majeure. City and County agree that the Available Potable Water will be continuous during the Emergency Water Condition, except that temporary disruption of service at any time caused by an act of God, fire, strikes, casualties, war, terrorist act, natural disaster, accidents, necessary maintenance work, breakdowns of or injuries to machinery, pumps or pipelines, civil or military authority, insurrections, riot, acts or declarations of government or regulatory agencies other than City or County, or any other cause beyond the control of City or County, shall not constitute a breach of this Agreement; and no party shall be liable to the other or to its customers for any damage resulting from such unavoidable disruption of service."

8.4.7 Project Subject to Intergovernmental Agreement

The project contemplated by the Model Intergovernmental Agreement is a physical interconnection with the parties equally sharing the capital, operating and maintenance costs of the interconnection. As discussed in the prior sections, the available funding and cost allocation options will vary according to the project.

Example:

"8. Physical Interconnection for Emergency Conditions. Within six (6) months of the effective date of this Agreement, City and County shall install equipment that will allow water flow in either direction and will allow an automatic supply to occur to equalize pressure (the "Interconnection"). The parties shall mutually determine the scope of and the plan for maintenance of the Interconnection. The cost of installing and maintaining the Interconnection will be shared equally by the parties. The parties shall mutually develop a protocol for maintenance which includes the manner of and procedure for cost sharing. It is agreed that during normal operating conditions, the Interconnection will be closed and water will be prevented from flowing through the Interconnection."

8.4.8 Meter Maintenance and Ownership Responsibilities

The agreement should have basic language about who will read meters, maintain meters and replace meters, especially if the interconnection will be used on a regular basis to provide water from one system to another. The need for meters on emergency interconnections is not as important, and the use of meters is left to the discretion of the utility systems.

Example:

"9. Metering.

(a) Each party shall install a meter, and each party shall be charged with maintaining, calibrating and reading its meter at its own expense. Annually, or upon written notice by the other party, each shall inspect and test their meter in the presence of a representative of the other party. Copies of these inspections and tests shall be made available from one to the other. No meter

shall be allowed to remain in service that has an error in excess of published American Water Works Association ("AWWA") Standards (or such succeeding standards) at the time of the testing. If a party requests a meter inspection in addition to the annual inspection, and the meter conforms to AWWA standards upon testing, the party requesting the inspection shall pay all inspection and testing costs. In the event that it is determined that the meter is not properly calibrated, then the requesting party shall not be liable for the inspection and testing cost, and the owner of the meter shall immediately take steps to restore the meter to an accurate condition or install a new meter, and credit the requesting party for any overpayment based on all available information as agreed to by the utility staffs of City and County.

(b) The Requesting Party shall read the meter prior to opening the Interconnection. Said meter reading shall be provided to the Selling Party with the notice required in Section 4. When the Interconnection is closed at the end of the Emergency Water Condition, the meter shall be read again by the Requesting Party, which shall immediately notify the Selling Party of the reading."

8.4.9 Water Quality

The agreement should address water quality standards and should include a basic agreement for each party to notify the other in the event of a change in the water treatment process that would affect the quality of water being furnished under the agreement.

Example:

"10. Water Quality. Each party shall provide treated water to the other party at the point of connection to the Interconnection. Treated water must meet the water quality requirements of all applicable regulatory agencies, including the U.S. Environmental Protection Agency and the Environmental Protection Division of the Georgia Department of Natural Resources. Further, if City or County proposes any change(s) to their water treatment process that would affect the water quality chemistry of their finished water while this Agreement is in effect, notice shall be furnished to the other party prior to the effective date of the proposed change(s)."

8.4.10 Termination

The agreement should address early termination of the agreement, both for cause and without cause, and the process for handling disputes arising from early termination of the agreement. The model agreement contemplates the option of resolving any disputes through mediation.

Example:

"11. Early Termination.

(a) Without Cause. If neither party is in breach, either party may terminate this Agreement prior to the expiration of the term by rendering to the other party ninety (90) days notice of early termination.

(b) For Cause. If either party fails to perform each and every obligation of this Agreement, each party reserves the right to immediately discontinue performance of services pursuant to this Agreement, after the party seeking termination has provided written notice of the alleged violation to the breaching party, and the breaching party has failed to cure the breach within thirty (30) days of receipt of notice thereof.

(c) Remedies. Either party to this Agreement, in the event of or act of breach by the other, shall have all remedies available under the laws of the state of Georgia including, but not limited to,

injunction to prevent breach, specific performance to enforce this Agreement, or mediation subject to State law."

8.4.11 Water Conservation Measures

The agreement should address how water conservation measures and restrictions will be handled. The Model Intergovernmental Agreement contemplates a reciprocal approach to this issue.

Example:

"12. Water Conservation. This Agreement shall be subject to all state and federal water conservation regulations. Further, any time that the customers of the Selling Party are under water use restriction and water is being supplied to the Requesting Party, the Requesting Party agrees to impose restrictions at least as strict as those imposed by the Selling Party."

8.4.12 Other Contract Considerations

The agreement may contain other standard contract provisions regarding the enforcement, interpretation and execution of the agreement, as necessary.

EXHIBIT 8-5
Model Intergovernmental Agreement for Emergency Water Interconnection System

MODEL INTERGOVERNMENTAL AGREEMENT FOR EMERGENCY WATER INTERCONNECTION SYSTEM

THIS INTERGOVERNMENTAL AGREEMENT (this "Agreement"), made and entered into as of the ____ day of __________, 20___, by and between CITY OF __________, GEORGIA, a municipal corporation of _________County, Georgia (the "City"), and __________ COUNTY, GEORGIA, a political subdivision of the state of Georgia (the "County").

W I T N E S S E T H:

WHEREAS, City and County each own and operate public water systems in the Metropolitan North Georgia Water Planning District that provide service to their respective customers; and,

WHEREAS, the General Assembly finds that it is in the best interests of the state of Georgia for public water systems in the Metropolitan North Georgia Water Planning District to evaluate their withdrawal, treatment and distribution systems and to take proactive measures to reduce the risk of catastrophic interruptions of water service during emergencies as set forth in O.C.G.A. § 12-5-200(2); and,

WHEREAS, City and County agree that the establishment of a potable water interconnection between the two parties is in the best interest of their respective communities and that to promote the establishment of such a system, all points of connection constructed between the City system and the County system shall be treated as emergency interconnections and constructed so as to allow the flow of water from either system to the other; and,

WHEREAS, Article IX, Section III, Paragraph I(a) of the Georgia Constitution authorizes, among other things, any county, municipality or other political subdivision of the state to contract, for a period not exceeding 50 years, with another county, municipality or political subdivision or with any other public agency, public corporation or public authority for joint services, for the provision of services, or for the provision or separate use of facilities or equipment, provided that such contract deals with activities, services or facilities that the contracting parties are authorized by law to undertake or to provide; and,

WHEREAS, the City and the County desire to enter into an agreement for an emergency water interconnection system, whereby both parties agree to coordinate and cooperate with each other and agree to establish the terms and conditions under which the systems can be physically connected and water made available to the each other during times of emergency, as more specifically set forth below.

NOW, THEREFORE, for and in consideration of the premises and undertakings as hereinafter set forth and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the City and the County DO HEREBY AGREE, as follows:

1. Purpose. This is an Agreement for the reciprocal sale and purchase of available potable water by and between the City and County during emergency water conditions for the mutual convenience of the parties. All of the foregoing recitals are true and correct and are made a part of this Agreement as if fully set forth herein.

2. Definitions. For purpose of this Agreement, the following definitions shall apply:

(a) "Available Potable Water" shall mean a surplus of potable water not immediately needed by the Selling Party.

(b) "Emergency Water Condition" shall mean a shortage of potable water to meet the Essential Water Needs of the Requesting Party's customers that threatens their health, safety and welfare.

(c) "Essential Water Needs" shall mean the minimum amount of water needed for residential and commercial means for food processing, drinking, toilet flushing, fire fighting, hospital use, and critical asset use and a portion of the system's unaccounted for water as defined in O.C.G.A. § 12-5-201(4).

(d) "Requesting Party" shall mean that party which desires to purchase potable water from the other.

(e) "Selling Party" shall mean that party which has Available Potable Water to sell to the Requesting Party.

3. Disruption of Potable Water Supply. Whenever either City or County experiences an Emergency Water Condition and desires to purchase Available Potable Water from the other, the Requesting Party shall notify the Selling Party of the Emergency Water Condition and request Available Potable Water be transferred to the Requesting Party for a limited period, as determined by mutual agreement. The Selling Party shall respond as soon as possible to the request by advising the Requesting Party of the quantity of Available Potable Water.

4. Notification of Emergency Water Conditions. The City water system director, by whatever name called, or his on-call designee, and the County water system director, by whatever name called, or his on-call designee, shall immediately notify the other when Emergency Water Conditions develop and request temporary water service from the other. Such notice shall include a description of the emergency and expected duration.

5. Utility Staff Responsibilities. In the event that water is needed by City or County, each party's Utility Department will be responsible for operating all of the valves necessary to permit water to be sold from one to the other; and each utility will be responsible for returning their valves to the original closed position once the temporary water service event is completed.

6. Rate of Supply. The Selling Party shall not be required to draw water in excess of any Water Use permits, nor shall the Selling Party be required to provide more than its Available Potable Water; and the Selling Party shall not be liable to the Requesting Party or its customers for any interruptions or water service provided hereunder. The parties shall be obligated to supply water pursuant to this Agreement only to the extent that doing so does not prejudice the ability of the Selling Party to fulfill its obligations to its customers and other entities with contracts with the Selling Party.

7. Water Supply Charges. Water supplied by either party per this Agreement and distributed through the point(s) of interconnection shall be charged at the then current lowest retail residential water rate, regardless of the number of gallons used, as set forth in the Selling Party's rate ordinance or resolution. The parties will not be required to pay each other impact or connection fees for the carrying out of this Agreement.

(a) Change of Rates. If either City or County proposes any new or amended rate schedule while this Agreement is in effect, notice shall be furnished to the other party prior to the effective date of the new or amended rate schedule. Thereafter, the new or amended rate schedule shall take effect for purposes of this Agreement beginning in the next billing cycle after the change in rate takes effect. The purpose of this subsection is only to ensure disclosure of rate changes and shall not grant either party a right to appeal any rate increase. The parties hereby agree that, during the Agreement, both parties shall continue to be billed at the lowest retail residential water rate.

8. Physical Interconnection. Within six (6) months of the effective date of this Agreement, City and County shall install equipment that will allow water to flow in either direction and will allow an automatic supply to occur to equalize pressure (the "Interconnection"). The parties shall mutually determine the scope of and the plan for maintenance of the Interconnection. The cost of installing and maintaining the Interconnection will be shared equally by the parties. The parties shall mutually develop a protocol for maintenance which includes the manner of and procedure for cost sharing. It is agreed that during the normal operating conditions, water will be prevented from flowing through the Interconnection.

9. Metering.

(a) Each party shall install a meter, and each party shall be charged with maintaining, calibrating and reading its meter at its own expense. Annually, or upon written notice by the other party, each shall inspect and test their meter in the presence of a representative of the other party. Copies of these inspections and tests shall be made available from one to the other. No meter shall be allowed to remain in service that has an error in excess of published American Water Works Association ("AWWA") Standards (or such succeeding standards) at the time of the testing. If a party requests a meter inspection in addition to the annual inspection, and the meter conforms to AWWA standards upon testing, the party requesting the inspection shall pay all inspection and testing costs. In the event that it is determined that the meter is not properly calibrated, then the requesting party shall not be liable for the inspection and testing costs, and the owner of the meter shall immediately take steps to restore the meter to an accurate condition or install a new meter, and credit the requesting party for any overpayment based on all available information as agreed to by the utility staffs of City and County.

(b) The Requesting Party shall read the meter prior to opening the Interconnection. Said meter reading shall be provided to the Selling Party with the notice required in Section 4. When the Interconnection is closed at the end of the Emergency Water Condition, the meter shall be read again by the Requesting Party, which shall immediately notify the Selling Party of the reading.

10. Water Quality. Each party shall provide treated water to the other party at the point of connection to the Interconnection. Treated water must meet the water quality requirements of all applicable regulatory agencies, including the U.S. Environmental Protection Agency and the Environmental Protection Division of the Georgia Department of Natural Resources. Further, if City or County proposes any change(s) to their water treatment process that would affect the water quality chemistry of their finished water while this Agreement is in effect, notice shall be furnished to the other party prior to the effective date of the proposed change(s).

11. Early Termination.

(a) Without Cause. If neither party is in breach, either party may terminate this Agreement prior to the expiration of the term by rendering to the other party ninety (90) days notice of early termination.

(b) For Cause. If either party fails to perform each and every obligation of this Agreement, each party reserves the right to immediately discontinue performance of services pursuant to this Agreement, after the party seeking termination has provided written notice of the alleged violation to the breaching party, and the breaching party has failed to cure the breach within thirty (30) days of receipt of notice thereof.

(c) Remedies. Either party to this Agreement, in the event of or act of breach by the other, shall have all remedies available under the laws of the state of Georgia including, but not limited to, injunction to prevent breach, specific performance to enforce this Agreement, or mediation subject to state law.

12. Water Conservation. This Agreement shall be subject to all state and federal water conservation regulations. Further, any time that the customers of the Selling Party are under water use restriction and water is being supplied to the Requesting Party, the Requesting Party agrees to impose restrictions at least as strict as those imposed by the Selling Party.

13. Billing. The Selling Party shall bill on or around the thirtieth (30) day of the month for all metered water sold hereunder during the month. Bills not paid within forty-five (45) days of receipt shall be assessed a one and one-half percent (1-1/2%) per month late charge.

14. Term. This Agreement shall continue in effect for five (5) years, unless otherwise terminated, as set forth above. Further, this Agreement shall be automatically renewed for five (5) year increments unless either party notifies the other in writing at least one (1) year prior to the termination date. Upon termination of the Agreement both parties agree to share equally the Interconnection removal costs.

15. Force Majeure. City and County agree that the Available Potable Water will be continuous during the Emergency Water Condition, except that temporary disruption of service at any time caused by an act of God, fire, strikes, casualties, war, terrorist act, natural disaster, accidents, necessary maintenance work, breakdowns of or injuries to machinery, pumps or pipelines, civil or military authority, insurrections, riot, acts or declarations of government or regulatory agencies other than City or County, or any other cause beyond the control of City or County, shall not constitute a breach of this Agreement; and no party shall be liable to the other or to its customers for any damage resulting from such unavoidable disruption of service.

16. Notices. All notices under this Agreement will be in writing and shall be given only by hand delivery for which a receipt is obtained, or certified mail, return receipt requested. Notices will be deemed given when received by the party for whom intended. Notices will be delivered or mailed to the addresses set forth below or as either party may designate in writing:

If to the CITY:	Mayor Street City, Georgia ZIP
with a copy to:	City Attorney Street City, Georgia ZIP
If to the COUNTY:	Chairman, Board of Commissioners Street City, Georgia ZIP
with a copy to:	County Attorney Street City, Georgia ZIP

17. Entire Agreement. This Agreement constitutes the entire Agreement of the parties and may not be changed or modified except by instrument in writing executed by both of the parties hereto. This Agreement shall supersede any other agreement between the parties which may be in conflict.

18. Legal Prohibition. Neither City nor County shall be required to deliver Available Potable Water under the terms of this Agreement if prohibited by any applicable, federal, state, regional or local statute, rule, ordinance, law, administrative order or judicial decree, or in violation of applicable permits.

19. Applicable Law and Venue. The laws of the state of Georgia shall govern the validity, interpretation, construction and performance of this Agreement; and venue for any suit involving this Agreement shall be within County, Georgia.

20. Binding Effect. This Agreement is binding upon and shall inure to the benefit of the successors or assigns of the parties to this Agreement.

21. Indemnity. Each party hereby agrees to save and hold harmless the other from and against any claims made by third parties for damages resulting from the failure of either party to deliver Available Potable Water meeting all state and federal standards. Each party agrees, at its own expense, to maintain general liability insurance coverage or self insure with standard limits for utility operations during the term of this Agreement to cover all such claims by third parties. When receiving water under this Agreement, the Requesting Party acts in the capacity of owner and operator of a public water system and is solely responsible for compliance with all pertinent regulations and the Selling Party will have no responsibility for said water.

22. No Third Party Beneficiaries. The parties' obligations to deliver Available Potable Water shall run only to each other and shall in no event create any obligation to or duty toward any other party or any customer. This Agreement is for the sole and exclusive benefit of the parties, and shall not be construed to confer a benefit or right upon any third party.

23. Assignment. No party may transfer or assign its rights under this Agreement without the written approval from the governing boards of both parties.

24. Further Documents. The parties shall execute such other and further documents as may be deemed necessary by either party to fulfill the intent of the parties to this Agreement.

25. Time of Essence. Time is of the essence of each and every term, provision and covenant of this Agreement.

26. Captions. All captions, headings, Section and subsection numbers and letters and other reference numbers or letters are solely for the purpose of facilitating reference to this Agreement and shall not supplement, limit or otherwise vary in any respect the text of this Agreement.

27. Counterparts. This Agreement may be executed in several counterparts, each of which shall constitute an original and all of which together shall constitute one and the same instrument.

28. Severability. This Agreement is intended to be performed in accordance with, and only to the extent permitted by, all applicable laws, ordinances, rules and regulations. If any provision of the Agreement, or the application thereof to any person or circumstance, shall, for any reason and to any extent be invalid or unenforceable, the remainder of this Agreement and the application of such provision to other

persons or circumstances shall not be affected thereby but rather shall be enforced to the greatest extent permitted by law.

IN WITNESS WHEREOF, the parties hereto, acting by and through their duly authorized officers, have caused this Agreement to be executed under seals as of the day and year first above written.

CITY OF ____________________, GEORGIA

____
Mayor

(SEAL)

ATTEST:

____
City Clerk

COUNTY OF ____________________, GEORGIA

____
Chairman

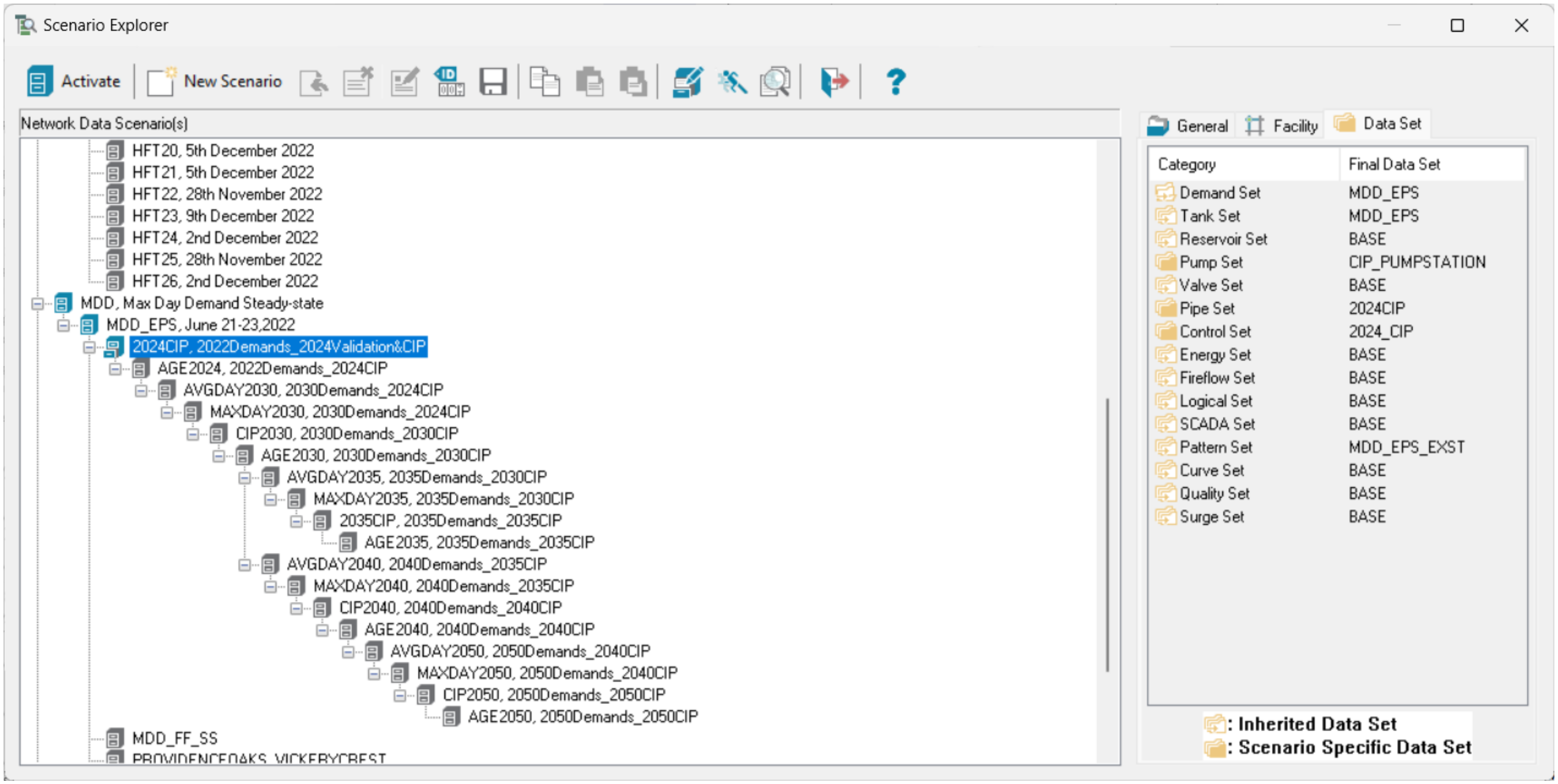
(SEAL)

ATTEST:

____
County Clerk

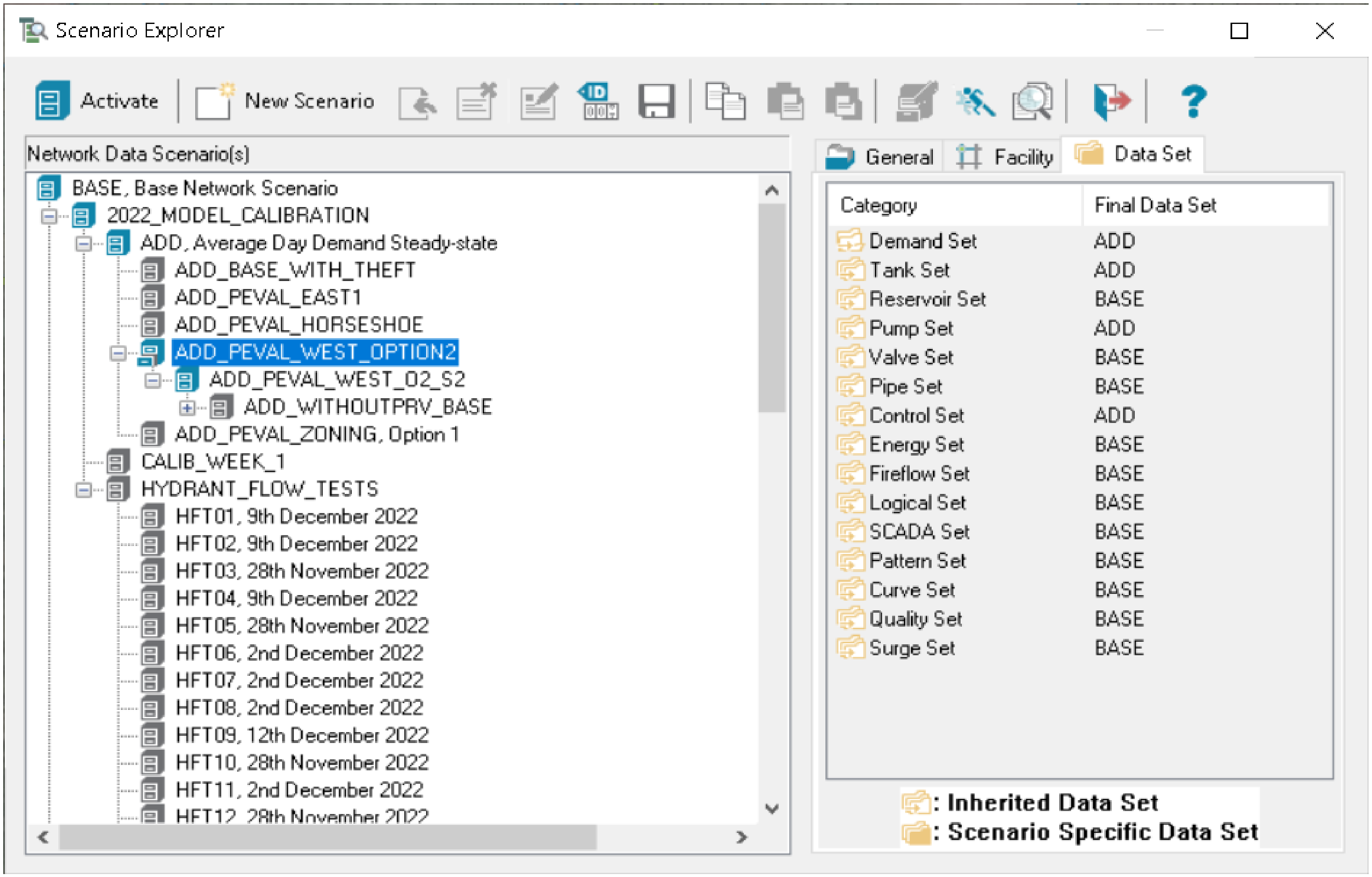
Appendix K
Hydraulic Model Scenario Descriptions

Figure K-1.



Each new model scenario added is shown below the MDD_EPS scenario in the Scenario Explorer in InfoWater Pro. The CIP phasing was done for 2024 (current), 2030, 2035, 2040, and 2050 planning years.

Figure K-2.



Each new pressure zone model was analyzed in the model scenario shown under ADD in InfoWater Pro.