

Coosa-North Georgia Supplemental Document: Water Stewardship Act and Water Conservation Measures

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Introduction

As part of the water planning process, the Georgia Environmental Protection Division (GAEPD) carried out a modeling and analysis exercise to determine if the readily available water resources could support current and future water needs based on the forecasted water demands for each Water Planning Region. The planning contractors and the regional councils were then tasked with developing and selecting a series of management practices (MP's) that would close the gaps found on the resource assessments. This TM summarizes the MPs applied to the nodes of interest in the Coosa-North Georgia (CNG) Region to address the resource availability gaps. For modeling purposes, the conservation measures were only applied to the municipal water demands to account for the implementation of the requirements established by the Water Stewardship Act (WSA) and additional conservation measures in cases where the gaps were persistent.

GAEPD and the Surface Water Availability Resource Assessment Team performed analysis of current and future resource assessments for the CNG Water Planning region with projected 2050 water use conditions, specifically the Tennessee River Basin and the Alabama-Coosa-Tallapoosa (ACT) River Basins. The future water use values (including municipal, industrial, thermal energy, and agricultural) were provided by the water planning contractors between May and September 2010. The results of additional modeling scenarios, which included water conservation estimates and additional MPs to address gaps were provided in February 2011.

Process

The planning process flowchart shown in Figure 1 places Gap Analysis as the basis for selecting suitable MPs for each Water Planning Region. The resource assessment analyses and water demand forecasts were used to provide a baseline assessment of the readily available water sources and their ability to provide sufficient water now and into the future. The modeling process was used to identify gaps at the Planning Nodes and to also model possible alternatives to close those gaps applying water conservation measures and MPs.

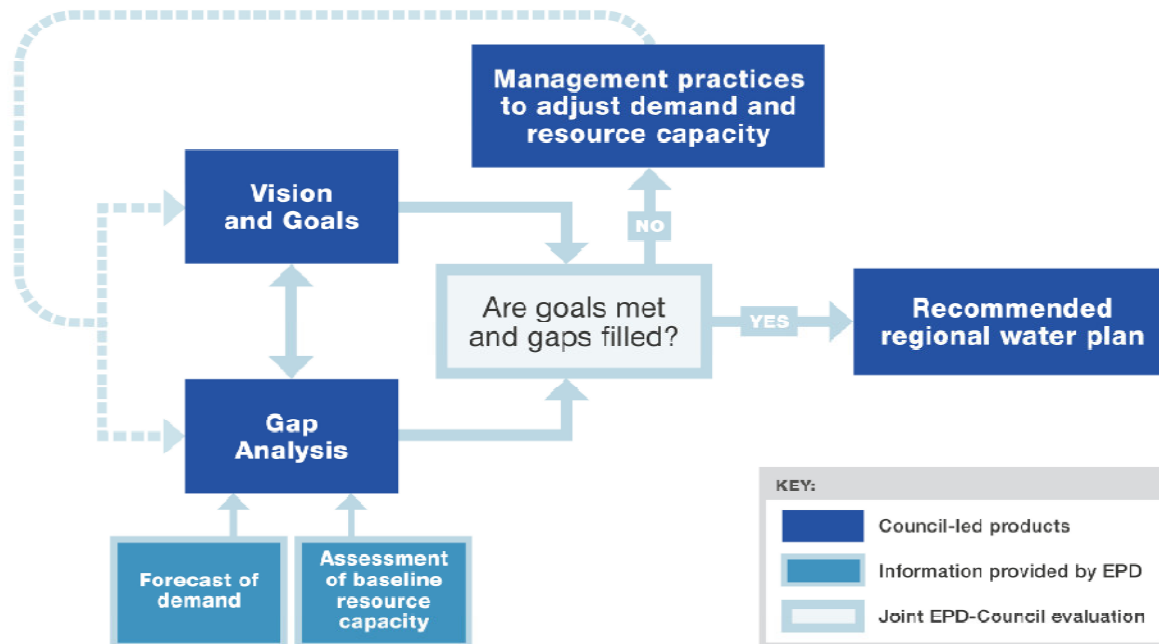


FIGURE 1
 Planning Process Flowchart
 Source: GAEPD, 2009

Figure 2 shows a schematic of a typical baseline modeling scenario in which the total forecasted water demand tends to increase throughout the planning horizon while the resource capacity stays constant unless additional storage or significant water transfers take place. Under those circumstances, the water demand is expected to surpass the available resources and the implementation of water management measures will be necessary to close the gap by reducing water demand or increasing the capacity of the available resources.

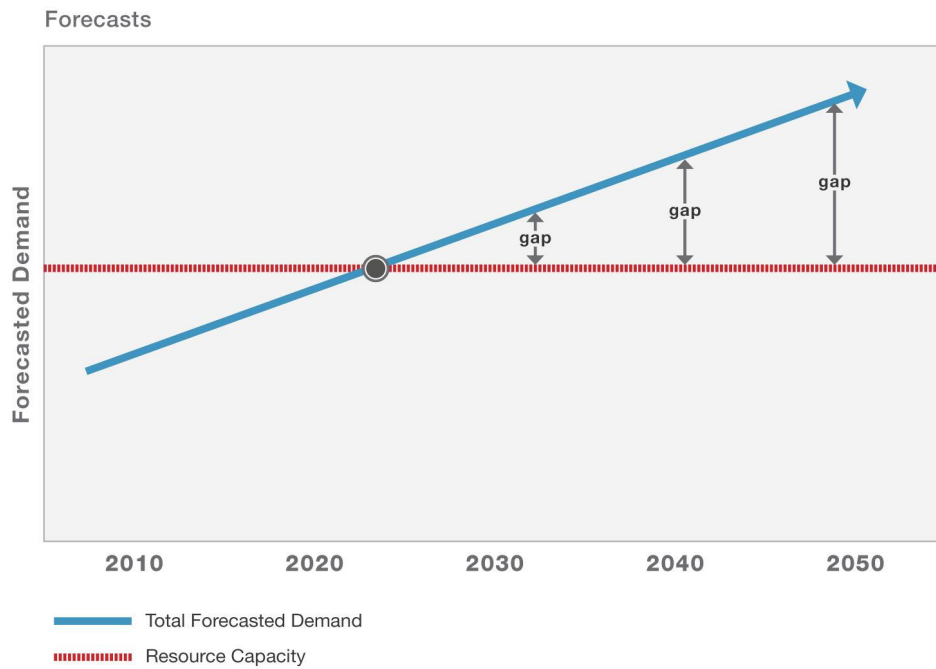


FIGURE 2
 Typical Baseline Modeling Scenario
 Source: GAEPD, 2009

Figure 3 shows an example of how the implementation of water conservation practices, such as WSA requirements, drought triggers, and other Tier 4 practices might reduce the water needs along the planning horizon. Reduction in water demand will extend the time at which the gaps start appear and also reduces the quantity of the gap.

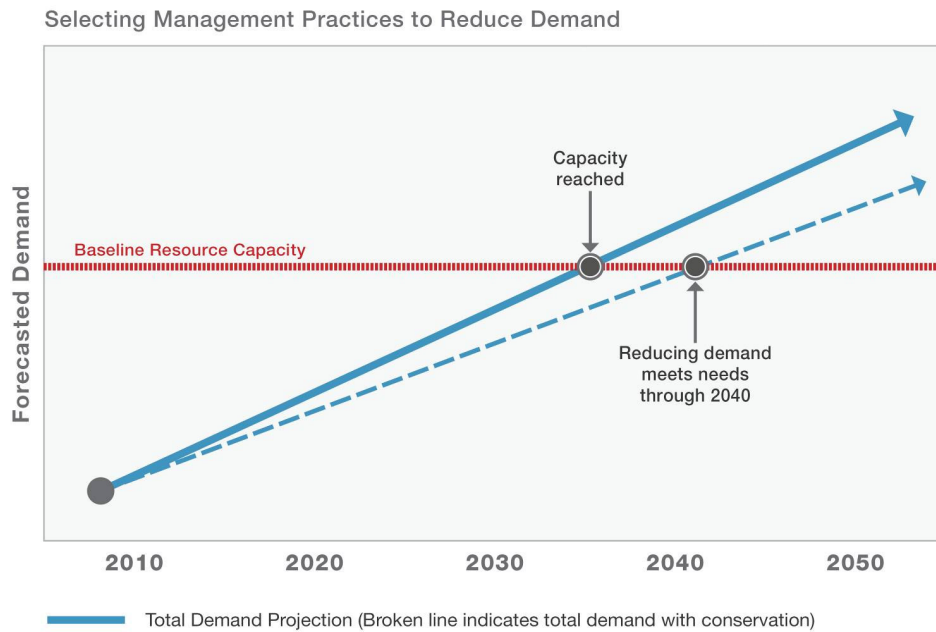


FIGURE 3
 Schematic of Water Demand Reduction with the Application of Water Conservation Practices
 Source: GAEPD, 2009

If the resource assessment model showed persistent gaps within the planning node, additional MPs were applied in addition to the WSA requirements, drought triggers, and the Tier 4 practices. Figure 4 shows how addition of storage capacity would increase the baseline resource capacity and a combination of water conservation practices and water MPs would minimize or close any gaps identified in the future.

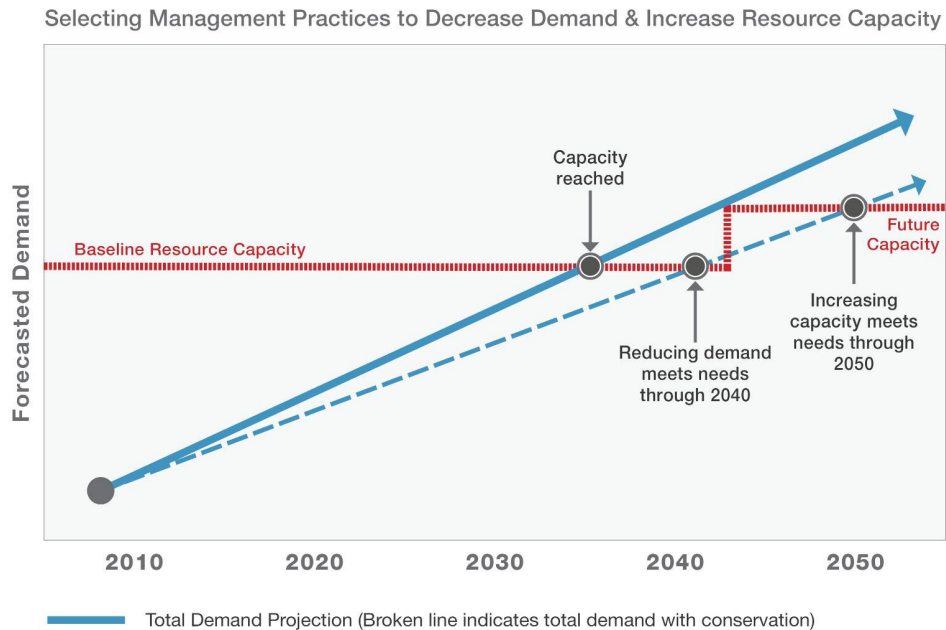


FIGURE 4
 Schematic of Water Demand Reduction with the Application of Water Conservation Practices and Increase in Resource Capacity to Close Water Demand Gaps
 Source: GAEPD, 2009

Resource Assessment Background

The Baseline Surface Water Quantity Resource Assessment estimates the ability of surface water resources to meet current municipal, industrial, agricultural, and thermoelectric power water needs, as well as the needs of in-stream and downstream users. For each region, nodes are the finest spatial resolution in the planning models. Water withdrawal and discharge values do not reflect any individual facilities, existing or planned, but all components have been aggregated per node.

For the baseline model, it was assumed no MPs had been implemented beyond those reflected in the Current Resource Assessments or by the 2050 Water Demand Forecasts. The amount of storage for each node remained the same as in the Current Resource Assessments and all the storage volume was aggregated at the node level. The storage information incorporated in the model did not reflect the site or size of any single reservoir. Figure 5 shows the Tennessee River Basin divided into 7 Basic Nodes and its corresponding Local Drainage Areas.

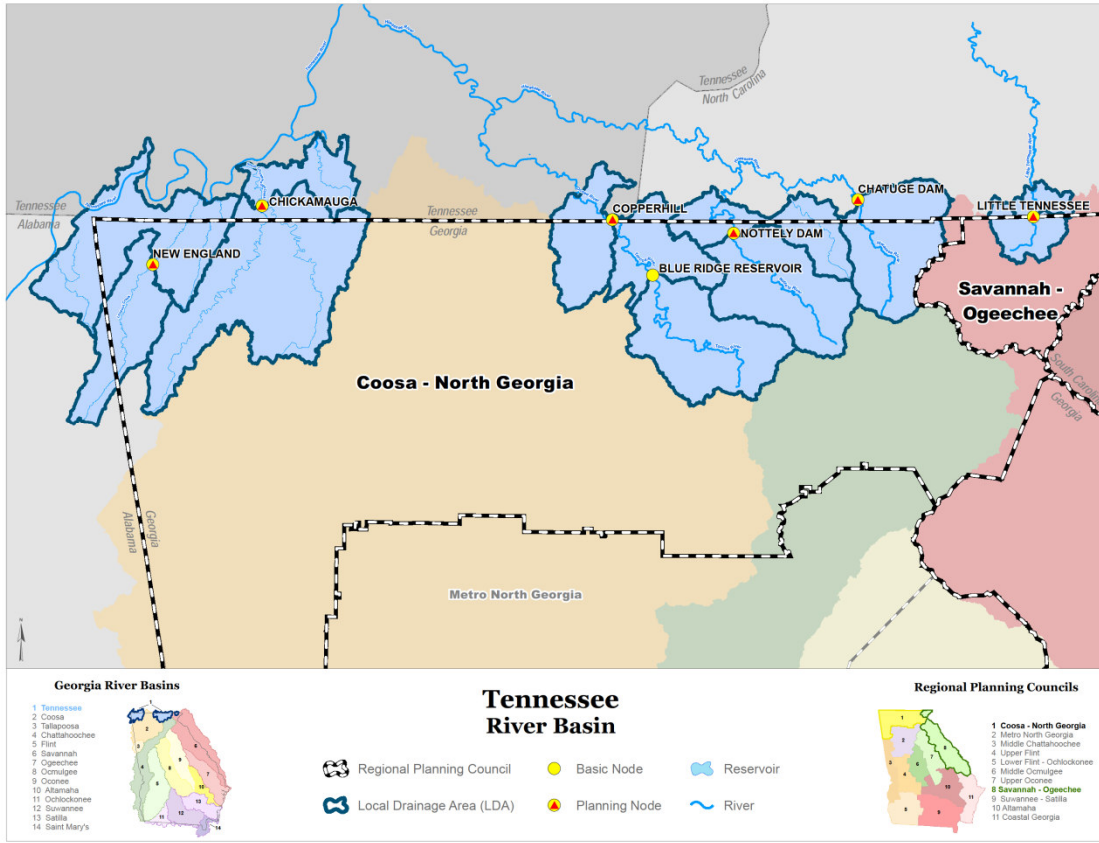


FIGURE 5
 Planning Nodes and Local Drainage Areas within the Tennessee River Basin
 Source: GAEPD, 2009

Figure 6 shows a schematic of the ACT River Basin with its 14 Basic Nodes and corresponding Local Drainage Areas.

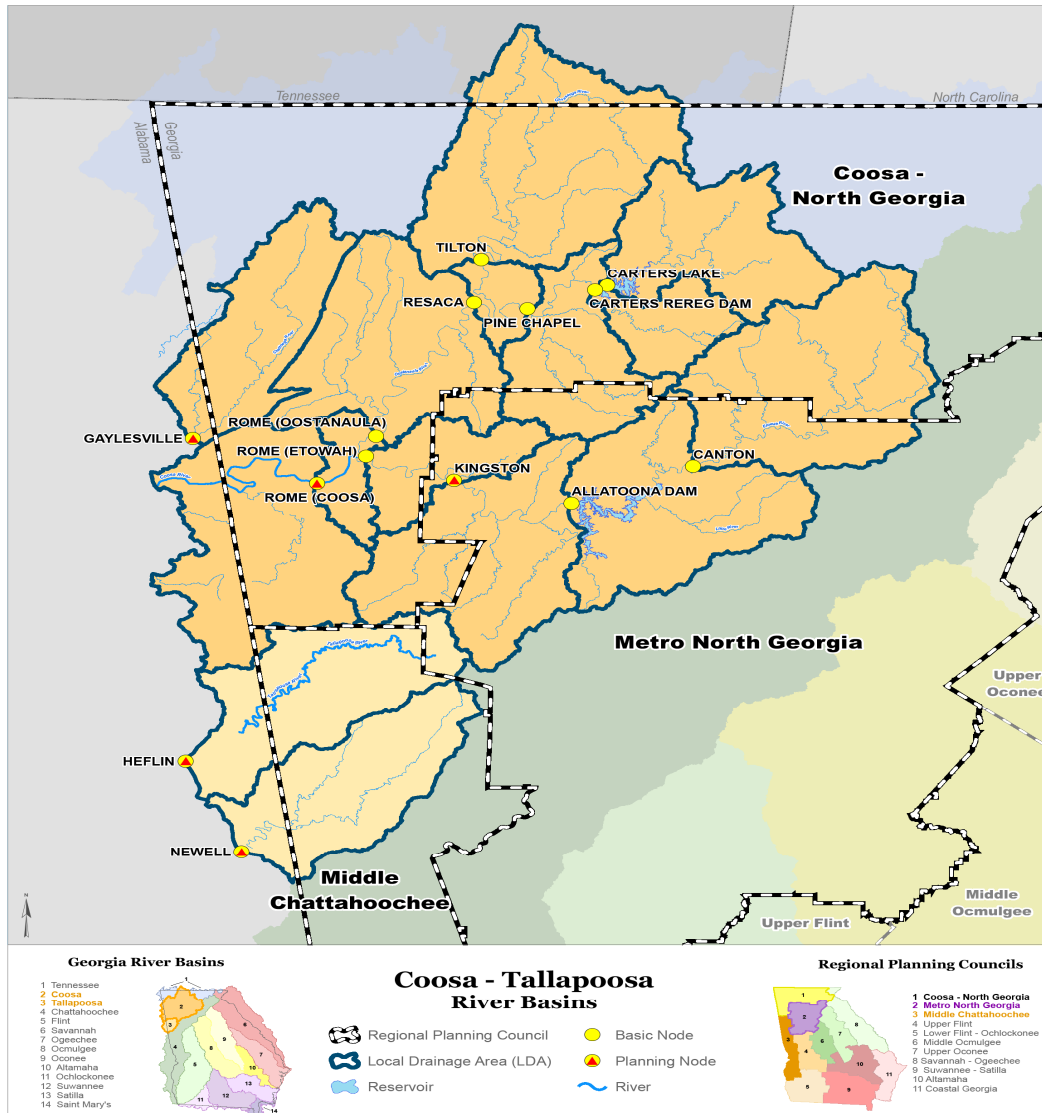


FIGURE 6
 Planning Nodes and Local Drainage Areas within the ACT River Basins
 Source: GAEPD, 2009

Nodes with Gaps

In the Tennessee River Basin, 2 of the nodes within the CNG region showed gaps in the initial surface water availability model results.

New England Planning Node

Model results showed a very small gap between the current demand and the forecasted demand at this node. An average gap of 2.6 MGD (4 cfs) was observed for 0.1% of the time. A small gap in the flow regime was also observed. For the entire period of record, there is an average gap of 1.9 MGD (3 cfs) in the flow regime for 7% of the time. The gap does not

change throughout the forecasting period but stays constant. No storage facilities were modeled for this node. Table 1 summarizes the gap results for the New England Node.

TABLE 1
2050 Initial and Modified Model Results for the Flow Regime within the New England Node

Scenario	Length of Gap	Average Gap (MGD)	Long-Term Average Flow (MGD)	Maximum Gap (MGD)	Corresponding Flow Regime (MGD)
2050 Forecasted Consumptive Demand	7%	1.9	161	2.6	7.8

Chickamauga Planning Node

Model results showed a small gap between the current demand and the forecasted demand at this node. An average gap of 6.5 MGD (10 cfs) was observed for 0.1% of the time. A small gap in the flow regime was also observed. For the entire period of record, there is an average gap of 11 MGD (16 cfs) in the flow regime for 10% of the time. The model results showed that maximum increase in consumptive use is 12 MGD (18 cfs) and occurs in June. No storage facilities were modeled for this node. Table 2 summarizes the gap results for the Chickamauga Node.

TABLE 2
2050 Initial and Modified Model Results for the Flow Regime within the Chickamauga Node

Scenario	Length of Gap	Average Gap (MGD)	Long-Term Average Flow (MGD)	Maximum Gap (MGD)	Corresponding Flow Regime (MGD)
2050 Forecasted Consumptive Demand	10%	11	437	17	31

It is important to note that wastewater returns for the Chickamauga Node might be underestimated because various municipalities in Walker County (Rossville and Lookout Mountain) and Catoosa County (Ringgold and Fort Oglethorpe) treat their wastewater at the Moccasins Bend Wastewater treatment Plant in Chattanooga, TN which discharges further downstream of this node.

In the ACT River Basin, one of the nodes within the CNG region showed gaps in the initial surface water availability model results.

Gaylesville Planning Node

Model results showed a gap in the flow regime. For the entire period of record, there is an average gap of 9 MGD (14 cfs) in the flow regime for 9% of the time. The model results showed in 2050 the annual average increase of consumptive water use is approximately 8 MGD (12 cfs). During drier months, this increase is even more pronounced. The

consumptive water use in August is 8 MGD (13 cfs) higher under the 2050 conditions than the current levels. Table 3 summarizes the gap results for the Gaylesville Node.

TABLE 3
2050 Initial and Modified Model Results for the Flow Regime within the Gaylesville Node

Scenario	Length of Gap	Average Gap (MGD)	Long-Term Average Flow (MGD)	Maximum Gap (MGD)	Corresponding Flow Regime (MGD)
2050 Forecasted Consumptive Demand	9%	9	414	13	45

The proposed MPs expected to minimize or completely eliminate the water demand and instream gaps at the nodes of interest.

Management Practices

The regional planning guidance describes MPs as any activity that would adjust the water demand and/or wastewater flow or the resource capacity to sustainably meet current and future water needs. The guidance also specified water conservation as a priority MP and each Council were expected to include them in their plan. To assist in the selection process a *Worksheet of Tiered Conservation Practices* was developed by GAEPD to describe various practices and establish a tiered hierarchy from required to voluntary measures.

Water Stewardship Act

The WSA activities are considered Tier 1 water conservation practices because their implementation is required by law. The WSA was signed by the Governor of Georgia in June 2010 and includes incentives for increasing water conservation in addition to required conservation practices¹. Beginning in July 2012, the legislation requires:

1. High efficient water fixtures in all new residential and commercial construction statewide. The maximum flush rate was lowered from 1.6 gpf (gallon per flush) to 1.28 gpf (High Efficiency Toilet or HET) and required that after July 1, 2012, all new residential construction include HETs in addition to the progressive replacement of an older, higher-flush toilets through a plumbing code requirement.
2. The installation of efficient cooling towers in new commercial and industrial construction; and,
3. Sub-metering for all new residential and commercial multi-unit projects that each unit will receive consumption reports and have incentive to practice conservation measures.

The legislation also instructs GAEPD agencies to consider grants and loan programs to develop incentive criteria that would encourage retrofit programs on existing construction and to set standards for water loss and leak detection for all medium and large public water systems. The final piece of the legislation extends the voluntary agriculture monitoring

¹ http://www.georgia.gov/00/press/detail/0,2668,78006749_160096907_160096913,00.html

program to include surface water withdrawals. Extending this program to surface water withdrawals is expected to provide critical data to update the Georgia’s water inventory of sources and uses.

The methodology for estimating water demand projections after applying the plumbing code were calculated as follows:

1. Estimated the number of toilets by flush volume based on the U.S. Census Age of Housing Units information and the following timeline:
 - a. Toilets made prior to 1980 use an average of 5 gpf
 - b. Toilets made between 1980 and 1992 use an average of 3.5 gpf
 - c. Toilets made after 1992 use 1.6 gpf (ULFT)
 - d. Toilets made after 2012 use 1.28 gpf (HET)
2. Estimated the amount of toilet replacement that has already taken place, typically 5 percent.
3. Estimated the natural replacement rate of the remaining toilets installed prior to 2010 over the 40-year planning horizon. This replacement is 2 percent per year, which corresponds to a life of 50 years per toilet, and is consistent with other regional water planning efforts in Georgia.
4. Used the estimated natural replacement rate and estimated the water savings that will occur (i.e., the plumbing code adjustment).
5. Applied the plumbing code adjustment as a reduction to the municipal water demand projections for each county over the planning period.

Table 4 summarizes the water demand projections over the planning period in the nodes of interest after applying the plumbing code adjustment.

TABLE 4
Water Demands in MGD Before and After Applying the Plumbing Code Adjustment in the Nodes of Interest in the CNG Region over the Planning Horizon

Node	Plumbing Code = 1.6 gpf					Plumbing Code = 1.28 gpf				
	2010	2020	2030	2040	2050	2010	2020	2030	2040	2050
New England	2.22	2.54	2.83	2.98	3.09	2.22	2.53	2.82	2.97	3.07
Chickamauga	7.57	9.35	11.45	14.03	17.22	7.57	9.34	11.41	13.95	17.09
Gaylesville	4.63	5.11	5.60	6.02	6.40	4.63	5.10	5.59	5.99	6.37

The methodology for estimating water demand projections after applying cooling tower adjustment for commercial buildings only was calculated cumulatively after applying the plumbing code as follows:

1. Savings were applied only to the new demand, per the WSA.
2. Estimated the percent of the water demand used by commercial buildings; the value used for planning purposes was 20 percent.
3. Estimated the amount water that is used by cooling towers account for approximately 50 percent of the water used by large commercial buildings.

4. Applied the expected water reduction, typically water use in a cooling tower can be reduced by 20 percent by increasing cooling tower cycles².
5. Applied the cooling tower adjustment as a reduction to the municipal water demand projections for each county over the planning period.

Table 5 summarizes the water demand projections expected from the cooling tower adjustment over the planning period in the nodes of interest.

TABLE 5

Water Demands in MGD After Applying the Cooling Tower Adjustment in the Nodes of Interest in the CNG Region over the Planning Horizon

Node	2010	2020	2030	2040	2050
New England	2.22	2.53	2.81	2.97	3.06
Chickamauga	7.57	9.30	11.37	13.90	17.03
Gaylesville	4.63	5.09	5.58	5.99	6.36

Water use reduction on the municipal water demand projections after applying the submetering requirements to new multiunit buildings was calculated as follows:

1. Savings were applied only to the new demand, per the WSA.
2. Estimated the percent of the water demand used by commercial and residential multiunit buildings; the value used for planning purposes was 10 percent.
3. Estimated the expected decrease in water demand, typically the installation and billing of individual units actual water use can reduce water usage by approximately 15percent².
4. Apply the submetering water savings to the municipal water demand projections for each county.

Table 6 summarizes the estimated demand projections after applying the submetering adjustment cumulatively after applying the plumbing code and cooling tower savings over the planning period in the nodes of interest.

TABLE 6

Water Demands in MGD After Applying the Multiunit Submetering Adjustment in Nodes of Interest in the CNG Region over the Planning Horizon

Node	2010	2020	2030	2040	2050
New England	2.22	2.52	2.81	2.96	3.06
Chickamauga	7.57	9.28	11.34	13.86	16.98
Gaylesville	4.63	5.08	5.57	5.98	6.35

² GAEPD. 2010. EPD Guidance for Evaluating Management Practices to Manage Water Demand.

The WSA requirements were applied to the 2050 Future Resource Assessment models when a gap was identified within a planning node. The use of the HET plumbing code adjustment was accounted for in the initial model runs. Table 7 summarizes the model input for the expected water demands and saving for 2050 once the WSA requirements were applied. A potential decrease in water demand of 1 percent could be expected from the application of the WSA requirements.

TABLE 7
2050 Water Demands in MGD from the Nodes of Interest in the CNG Region

Node	2050 Water Demand			
	Baseline ^a	Plumbing Code ^b	Cooling Towers ^c	Submetering ^c
New England	3.09	3.07	3.06	3.06
Chickamauga	17.22	17.09	17.03	16.98
Gaylesville	6.40	6.37	6.36	6.35

^a The baseline values represent the water demands previous to the application of the plumbing code (toilets with 1.6 gallons per flush).

^b The plumbing code values represent the water demands for 2050 once the plumbing code was applied (toilets with 1.28 gallons per flush)

^c Cooling towers and submetering was applied only to the municipal water demand values, which also includes commercial, because the expected ground on the municipal water use category was found to be more limited.

Wastewater returns were also estimated for each node to account for the decrease in water use. Wastewater reductions were calculated by multiplying the water demand percent reduction by the forecasted point discharge flows and by the indoor percent use within each node.

Water Conservation

Additional Tier 4 Water Conservation Practices were recommended for the nodes that showed gaps after considering WSA requirements, drought triggers and additional storage. Tier 4 water conservation practices are considered “beyond basic” activities that needed to be considered when gaps were identified. The water conservation practices were only applied to the municipal water demands following the guidance from the Georgia Water Use and Conservation Profiles Study³.

The Georgia Water Use and Conservation Profiles Study selected various communities in Georgia, outside the metro area, and attempted to characterize water use and identify cost-effective conservation measures. The communities were selected based on size, water source, geographic location, and major water use type. Historic water use data was analyzed and then summarized before the water conservation measures were implemented. The water conservation measures were evaluated to 100 percent of market penetration at the end of the implementation period. The savings were calculated based on a 5-year program and assuming a steady increase in implementation annually.

Tier 4 water conservation practices selected for modeling purposes were as follows: spray rinse valves, rains sensors, and the distribution of water conservation kits. These were also

³ CH2M HILL, 2008.

analyzed as part of the Georgia Water Use and Conservation Profiles Study; therefore, the results from the study were extrapolated to calculate the adjustment in water demand per county for the nodes of interest.

Table 8 summarizes the water conservation savings potential for the counties within the node of interest and references the counties selected from the Georgia Water Use and Conservation Profiles Study to serve as guidance. Once the county reductions were estimated, the total demand was aggregated per node.

TABLE 8
Water Conservation Savings Potential (%) for the Counties within the Nodes of Interest

Node	County	Percent Reduction (%)				
		Spray Rinse Valves	Rain Sensors	Conservation Kits	Total Reduction	Indoor Reduction
New England	Dade ^a	1	1	3	5	4
Chickamauga	Catoosa ^b	0	1	2	3	2
	Walker ^b	0	1	2	3	2
	Whitfield ^c	0	1	3	4	3
Gaylesville	Chattooga ^b	0	1	2	3	2
	Walker ^b	0	1	2	3	2

^a Potential saving derived from LaGrange County data.

^b Potential saving derived from Pickens County data.

^c Potential saving derived from Leary County data.

Table 9 shows the result of applying the water conservation practices to municipal water demands.

TABLE 9
Water Demands in MGD after Applying the WSA and Selected Tier 4 Water Conservation Practices

Node	Future Water Demand				
	2010	2020	2030	2040	2050
New England	2.22	2.39	2.67	2.82	2.91
Chickamauga	7.57	8.99	10.99	13.43	16.45
Gaylesville	4.63	4.93	5.40	5.80	6.16

Wastewater returns for both nodes were calculated by multiplying the forecasted wastewater returns per by the water conservation percent reduction, the indoor percent reduction due to the application of water conservation practices, and by the indoor percent water use.

Drought Management Plan

A drought trigger was recommended in addition to the WSA requirements and the Tier 4 water conservation practices for the nodes of interest in the CNG Region. The initial resource assessment model runs did not consider or apply drought reductions.

Various municipalities were contacted to obtain their drought contingency plans. The Drought Contingency Plan provided by City of Rome was selected because its approach offered the most flexible scenarios for the nodes of interest. Drought severity was measured based on the elevation of the water level at the raw water intake. For modeling purposes, drought triggers were trigger limits were extrapolated and applied to all the modeled streams within the node of interest as described in Table 10.

TABLE 10
Drought Trigger Limits Based on Water Level Drop at the Raw Water Sources within the Nodes of Interest

Node	County	Raw Water Source	Drought Trigger Variable (MGD) ^a	Reduction in Original Withdrawals
New England	Dade	Lookout Creek	6.5	5%
Chickamauga	Catoosa	Chickamauga Creek	6.5	5%
		Yates Spring	6.5	5%
	Walker	Crawfish Spring	6.5	5%
	Whitfield	Freeman Springs	6.5	5%
Gaylesville	Chattooga	Raccon Creek	6.5	5%
		Lowe Spring	6.5	5%
	Walker	Dry Creek	6.5	5%
		Big Spring	6.5	5%

^a Trigger limit set by a maximum 6.5 MGS (10 cfs) drop in flow from the raw water source's average flow.

Special Cases

The Gaylesville Node had a different approach to modeling because of its location and access to groundwater sources. A model scenario was proposed to switch City of LaFayette's (Walker County) withdrawal from surface water to a groundwater. Table 11 shows the model input for that scenario.

TABLE 11
Waste Demands and Wastewater Flows for Gaylesville Assuming Water Withdrawals for City of LaFayette Come from a Groundwater Source

Node	Future Water Demand				
	2010	2020	2030	2040	2050
Water Demand	3.03	3.33	3.68	4.02	4.37
Wastewater Flow	2.66	2.94	3.22	3.48	3.73

TABLE 11
Waste Demands and Wastewater Flows for Gaylesville Assuming Water Withdrawals for City of LaFayette Come from a Groundwater Source

Node	Future Water Demand				
	2010	2020	2030	2040	2050

Additional Storage

In case the gaps persisted, the addition of planned storage was suggested in addition to the WSA requirements, the Tier 4 water conservation practices, and the drought reductions. Additional storage accounted was to be estimated iteratively during the modeling exercise until the gaps are addressed.

Model Results

The proposed MPs described above were submitted to GAEPD and the Surface Water Availability Resource Assessment Team. The model runs determined that in order to eliminate the gaps under the 2050 demand scenario at the England Node, a combination of WSA requirements, Tier 4 water conservation measures, and the addition of storage capacity were needed. Annual demands were revised as described above and an approximately 933 ac-ft of storage was added to close the gap. Table 12 shows the flow regime results for the initial model run and the model results after the MPs were applied.

TABLE 12
2050 Initial and Modified Model Results for the Flow Regime within the England Node

Scenario	Length of Gap	Average Gap (cfs)	Long-Term Average Flow (cfs)	Maximum Gap (cfs)	Corresponding Flow regime (cfs)
Initial Model	6.9%	3	249	4	12
Modified Model ¹	0%	0	249	0	-

¹This modeling scenario includes the implementation of WSA requirements, Tier 4 water conservation measures, and the addition of storage capacity.

Model runs for the Chickamauga Node determined that in order to eliminate the gaps under the 2050 demand scenario a combination of WSA requirements, Tier 4 water conservation measures, and the addition of storage capacity were needed. Annual demands were revised as described above and an approximately 5,594 ac-ft of storage was added to close the gap. A single, extremely small regime flow gap remained for Chickamauga which required approximately 150 ac-ft of additional storage. Table 13 shows the flow regime results for the initial model run and the model results after the MPs were applied.

TABLE 13
2050 Initial and Modified Model Results for the Flow Regime within the Chickamauga Node

Scenario	Length of Gap	Average Gap (cfs)	Long-Term Average Flow (cfs)	Maximum Gap (cfs)	Corresponding Flow regime (cfs)
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Scenario	Length of Gap	Average Gap (cfs)	Long-Term Average Flow (cfs)	Maximum Gap (cfs)	Corresponding Flow regime (cfs)
Initial Model	9.8%	16	678	27	48
Modified Model ¹	0%	18	678	18	35

¹This modeling scenario includes the implementation of WSA requirements, Tier 4 water conservation measures, and the addition of storage capacity.

Model runs for the Gaylesville Node determined that in order to eliminate the gaps under the 2050 demand scenario a combination of WSA requirements, Tier 4 water conservation measures, and the addition of storage capacity were needed. Annual demands were revised as described above and an approximately 7,287 ac-ft of storage was added to close the gap. Table 14 shows the flow regime results for the initial model run and the model results after the MPs were applied.

TABLE 14
2050 Initial and Modified Model Results for the Flow Regime within the Gaylesville Node

Scenario	Length of Gap	Average Gap (cfs)	Long-Term Average Flow (cfs)	Maximum Gap (cfs)	Corresponding Flow regime (cfs)
Initial Model	9.3%	14	641	20	69
Modified Model ¹	0%	0	641	0	-

¹This modeling scenario includes the implementation of WSA requirements, Tier 4 water conservation measures, and the addition of storage capacity.

Conclusion

The expected water savings described in this TM are appropriate for planning purposes and provide a good estimate of the decrease in water demand over the planning horizon. The MPs and conservation measures were able to reduce water demands by approximately 4 percent and the additional storage eliminated the gaps identified during the initial modeling runs. It is important to note this combination of MPs may not be unique and different mixes of MPs could provide comparable results.