Water and Wastewater Forecasting Technical Memorandum

Altamaha Regional Water Planning Council

Little Ocmulgee State Park

Supplemental Material
Initial Recommended Altamaha Regional Water Plan

May 2011

CDM

Little Ocmulgee State Park photo courtesy of the Georgia Department of Industry, Trade & Tourism

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1. Introduction

This report summarizes the results and methods that were used to complete water and wastewater forecasts for the Altamaha Regional Water Planning Council. These forecasts and related elements of water resource planning are being conducted pursuant to a framework plan that is known as the Georgia Comprehensive State-wide Water Management Plan (CSWMP). For more information and to review the CSWMP please visit:

http://www.gawaterplanning.org/pages/technical_guidance/state_water_plan.php

Section 14 of the CSWMP empowers each of the Regional Water Planning Councils to prepare plans for the long-term water resource management needs in their respective regions. A map showing the boundaries of the Regional Councils is shown in **Figure 1** (color shading depicts discrete surface water drainage basins).

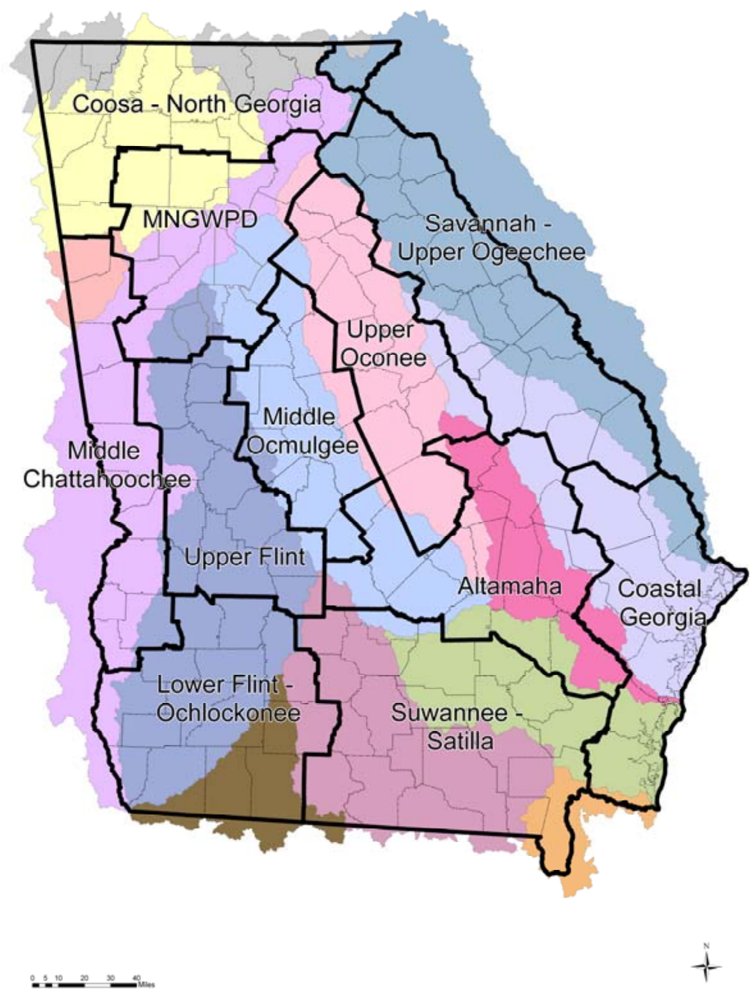


Figure 1: Georgia State-wide Water Planning Regions

At the heart of the state planning process is recognition of the importance to wisely and comprehensively manage Georgia's water resource to benefit current and future generations.

To accomplish this goal, there is a commitment to:

- Develop resource assessments to evaluate current and future resource conditions
- Develop regional forecasts of water supply and assimilative capacity demands through the year 2050
- Employ a planning process that focuses on regional planning by tasking local regional water planning councils with the development of Regional Water Plans
- Employ an iterative process of developing and improving planning over time, rather than developing a one-time plan. The regional plans will be updated at 3-5 year intervals.

Information regarding the other elements of water resource planning in the above list will be developed and described in the recommended Regional Water Plans, which are scheduled to be submitted to the Georgia Environment Protection Division (EPD) in April 2011. These plans will undergo formal public comments and then the Director of EPD will either: adopt the plan; advise the Regional Water Planning Council as to additional measures that should be taken to allow the plan to be adopted; or adopt the recommended plan with conditions.

The remainder of this report will focus on bullet 2 from the above list -- the quantification of current water uses and conditions and forecasts of future water resource needs.

The Georgia water planning process examines and forecasts four major demand sectors:

Municipal – this sector includes domestic, commercial, and lower water use industries

Industrial – this sector includes higher water use industries

Agricultural – this sector includes major crops such as cotton, corn, peanuts, soybean, pecans, specialty crops, and nursery and horticulture; a snapshot of major livestock water use and golf course water use

Energy – this sector includes thermoelectric power generation

Each of the above water demands and forecasts was undertaken concurrently by different expert teams. This report will provide detailed information on the municipal and industrial water and wastewater forecast and will provide references and brief summaries for the agricultural and energy forecasts.

Forecasting water demand involves two critical components: rate of water use and the number of water users. As described in more detail below for municipal water, the average per capita use is multiplied by the number of people using the water. For industrial water, the average water demand per employee is multiplied by the number of employees. In both cases, determining the appropriate water use rate and estimating the number of users are fundamental elements.

During the regional planning process, the majority of Council members identified some level of concern with the forecast process. The two primary concerns were:

- Ensuring accurate data
- Ensuring that data is not used to establish regional or local mandates

Central to these concerns is the fact that a goal of state and regional planning is the development of consistent and comparable sets of data. This means that one must rely on select data sets (common year for data inputs and comprehensive coverage of the state) that in many cases have broader coverage of the state, but may not be as precise as local provider level data. During development of the regional plan, there was a concerted effort to strike a balance between broad coverage and local data by using consistent data collection on a regional basis modified as appropriate with local provider input. These data and resulting forecasts are not applicable between regions or between providers within the region.

2. General Forecasting Methodology and Purpose

The process used to produce forecasts of municipal water/wastewater needs from population projections and industrial water/wastewater needs from employment projections is described below. The methodology described provides a means of maintaining consistency in the forecasting efforts in each of the planning regions, while still allowing for the incorporation of some regional variation. Beginning in 2010, Councils developed water and wastewater demand forecasts at 10 year increments through the year 2050 for the region to:

1) understand the changes the region may experience; and

2) identify future needs and any "gaps" that may exist between the capabilities of the available water resources, as articulated by the resource assessments, and the future regional water needs.

The methodology to forecast water and wastewater demands is based primarily on the assumption that there will be a continuation of existing trends and practices. It does not make a determination regarding the efficiency or inefficiency of forecasted demands, only that they are expected to occur given current trends. Initial forecasting does not take into account management practices, including water conservation (other than passive conservation as described in more detail below) that may be adopted by Regional Water Planning Councils to reduce the expected magnitude of demand. Additionally, this forecasting effort does not change EPD requirements related to individual permitting decisions, but represents a forecast for regional water planning.

It is also important to note that the parameters identified in forecasts should not be used as performance standards or for water resource allocation. These parameters are provided to evaluate future needs, trends, and to help make informed decisions on how to meet future needs within the capacity of available resources.

2.1. Forecasting Categories

The basic methodology for forecasting water demand is to estimate demand separately for each major water use sector (municipal, industrial, agricultural, and thermoelectric power). For each sector, water demand will be estimated using a 'driver' multiplied by the rate of use approach. The driver is defined as a countable unit of water use, which can be projected in future years, such as number of people, number of employees in a business, unit of production, etc. The rate of use is defined as the quantity of water used by the driving unit per unit of time, such as gallons per person (capita) per day (GPCD).

2.2 Rate of Water Use

A per unit rate of water use, or water use factor, can be developed for most water use sectors given historical water use data and a defined demographic unit. Projection of future water demand then requires having projected values of the defined demographic unit. With this approach, the water use factor of each sector can be assumed to either remain constant into the future, decrease over time due to increases in water use efficiency, or increase over time due to more intensive water use.

While trends in future water use are uncertain, reasonable assumptions can be made that provide the foundation for estimating trends in the future. Scenarios can be developed that consider demands under potential alternative conditions. For municipal water and wastewater demand forecasts, population projections will provide the basis for estimates of future growth. For industrial water and wastewater demand forecasts, employment projections will provide the basis for estimates of future growth.

2.3 Population and Employment Projections

Population projections were prepared by the Governor's Office of Planning and Budget (OPB), the state agency responsible for demographic data, with assistance from the Applied Demography Program at the University of Georgia's (UGA's) Carl Vinson Institute of Government. Population projections were developed for each county in the state. The population projections reflect a single 'most likely' growth scenario. Projecting population involves many variables. Therefore, it is important to continually update projections as new information becomes available.

The Regional Water Planning Councils were provided with the opportunity to evaluate preliminary water use forecasts to determine if there was a need to develop an alternative forecast scenario(s) to reflect either higher or lower regional water use.. All scenario(s) identified by the Councils will be evaluated in order to produce a set of forecasts of regional municipal water and wastewater demand.

Table 1 shows OPB's population projections by county for the Altamaha Region in 10 year increments through 2050.

Industry-specific employment projections were prepared by UGA for Georgia EPD. These employment forecasts are utilized to forecast industrial water demand for the major water using industries in Georgia. Because the distribution of industrial demand may not directly follow population growth, the location of these industrial demands will not use population projection data by county. Regional industrial water demand forecasts will be driven by regional employment projections by industry category.

Table 1: Population Projections by County

County	PROJECTED POPULATION					Projected Population Increase 2010 to 2050	Percent Increase 2010 to 2050
	2010[1]	2020[1]	2030[1]	2040[2]	2050[2]		
Appling County	18,437	20,766	23,043	25,335	27,782	9,345	51%
Bleckley County	13,001	14,501	15,820	17,104	18,322	5,321	41%
Candler County	11,074	14,216	18,241	23,201	29,306	18,232	165%
Dodge County	20,458	22,367	24,218	25,048	25,775	5,317	26%
Emanuel County	23,141	24,623	26,424	28,315	30,401	7,260	31%
Evans County	12,004	14,052	16,103	18,128	20,146	8,142	68%
Jeff Davis County	13,676	14,422	15,079	15,592	16,041	2,365	17%
Johnson County	9,698	10,272	10,849	11,431	11,948	2,250	23%
Montgomery County	9,172	10,611	11,961	12,866	13,737	4,565	50%
Tattnall County	24,230	28,706	33,706	39,135	45,100	20,870	86%
Telfair County	13,529	14,360	15,241	15,984	16,734	3,205	24%
Toombs County	28,858	32,189	35,059	38,619	43,195	14,337	50%
Treutlen County	7,189	7,973	8,811	9,195	9,255	2,066	29%
Wayne County	30,275	34,061	37,861	41,637	45,387	15,112	50%
Wheeler County	7,039	7,869	8,652	9,361	10,011	2,972	42%
Wilcox County	8,878	9,655	10,350	10,921	11,425	2,547	29%
Total Altamaha Region	**250,659**	**280,643**	**311,418**	**341,872**	**374,565**	**123,906**	**49%**

[1] Source: Georgia 2030 Population Projections, Governor's Office of Planning and Budget, March 2010

[2] Data based on the 2010 – 2030 projections extrapolated to 2040 and 2050.

2.4 Data Sources

Several data sources were used in developing municipal and industrial water and wastewater demand forecasts. In general, the data came from two categories: permitted water withdrawals/discharges and demographic data.

The two primary sources of base year water use data are the 2009 USGS report, *Water Use in Georgia by County for 2005; and Water-Use Trends, 1980-2005* by Fanning and Trent, and Georgia EPD water withdrawal and discharge permit databases. The USGS report contains 2005 water use data for each county in Georgia by category and source. The report also provides county level information on total population and population served by public water suppliers. Permitted water withdrawal data was received from Georgia EPD in August 2009 in the form of two Microsoft Access databases, one containing records for surface water withdrawal and wastewater discharge permits and another containing records for groundwater withdrawal permits.

As the forecasting process progressed, additional data sources became available that helped to fill in data gaps and improve specific forecasting parameters. A database of all permitted land application and point source wastewater dischargers in the State of Georgia was made available to the planning contractors to supplement information that was otherwise unavailable in the EPD wastewater discharge permit database. This data allowed for a better understanding of the regional ratio of wastewater discharged by land application or point source returns. In addition, Georgia EPD provided the planning contractors with discharge monitoring report (DMR) compliance spreadsheet data upon request in order to identify permits and flow data for wastewater facilities absent from both the EPD wastewater discharge permit database and the supplemental wastewater permit database mentioned above.

Demographic data utilized in developing the municipal and industrial water and wastewater demand forecasts included information pertaining to county population and population served by public water suppliers, housing stock estimates by county, and existing septic systems within a county. County population and population served by public water suppliers was available in the USGS report by Fanning and Trent. County population was cross-checked with U.S. Census Bureau data. The Georgia Drinking Water System Survey (DWSS) provided data on the population served by individual public water suppliers. This data was cross-checked with the USGS estimates of population served. The DWSS also contributed to the development of supplier-specific per capita water use rates. Public supplier per capita use rates for each county were weighted by the supplier’s population served to calculate a county-specific municipal water use rate. Further discussion of the development of county water use rates can be found in Section 3.2 of this report.

3. Municipal Water Forecasting

For this state planning effort, municipal water includes uses for residential, commercial, and non-major water using industrial purposes. This water may be self-supplied by the user (such as individual wells) or publicly-supplied (which includes all public and private providers with 15 or more taps or that serve at least 25 people).

Residential water use is defined as water used for normal household purposes. This category includes water used for drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, watering lawns and gardens, residential car washing and swimming pools. Commercial uses include water used by hotels, restaurants, retail stores, office buildings and institutions, both civilian and military. This category also includes water for hospitals, schools, fire fighting, and recreational water uses such as water parks, as well as water losses in the treatment and distribution of water. Demands for major water-using industries are projected separately utilizing a different methodology as described in Section 5.

3.1 Methodology

The municipal water forecasts are determined by multiplying the baseline per capita water use rate by the population served. Since the per capita rate for public water systems is different than those served by self-supply, the demands are calculated separately and then added together.

The self-supplied residential per capita water use rate of 75 gallons per capita per day (GPCD) was derived by USGS (Fanning & Trent, 2009) and was recommended for use to forecast future self-supplied residential water demand unless region specific factors necessitate modification of this value.

The publicly-supplied water use rate is also expressed as GPCD and is determined by dividing the water supplier's daily average water withdrawal rate by the population served by that provider:

GPCD= [Publicly Supplied Water Withdrawal (gallons per day) / Population Served by Public Supplier]

This publicly-supplied water use rate is typically higher than the self-supply rate since public supply includes commercial water use as described above. It should also be pointed out that public supply withdrawal quantities include non-revenue water (NRW), which will be included in the per capita water use rate for each county. NRW includes losses during the treatment and distribution of water. The term "Unaccounted-for Water" was commonly used in previous years; however, NRW is the current term recommended by the American Water Works Association. NRW includes water losses and usage that is authorized but does not generate revenues.

The formulas used to calculate future self-supplied and publicly-supplied residential water demand are shown below:

*Future Self-Supplied Demand = 75 GPCD * Projected Self-Supplied County Population*

*Future Publicly-Supplied Municipal Demand = 2005 Per Capita Municipal Water Use Rate * (Projected County Population – Projected Self-Supplied County Population)*

Total Municipal Water Demand = Future Self-Supplied Demand + Future Publicly-Supplied Demand

Table 2 shows the division between the publicly-supplied and self-supplied populations by county for the Altamaha planning region.

3.2 Publicly-Supplied Water Use Rates

3.2.1 Data Sources

Three primary sources of data were used to calculate initial publicly-supplied per capita water demand rates by county:

- The U.S. Geological Survey (USGS) 2009 report entitled *Water Use in Georgia by County for 2005 and Water-Use Trends for 1980-2005* by Fanning and Trent. For each county in the state, this document shows the 2005 county population, public supply water demand, and population served by all public suppliers in the county. This report was the sole data set used to calculate the initial estimates for county publicly-supplied per capita demand rates. Please note that the USGS data include all public-supply water for each county, not just the major suppliers they list by name. USGS defines public supply as any public or private system that provides water to at least 25 people or a minimum of 15 hookups or water connections.

- The Georgia Environmental Protection Division (EPD) water withdrawal permit database 1997-2007. This database contains withdrawal totals for each surface water and groundwater withdrawal permit in the state. Municipal withdrawal permits in the database were used to cross-reference and confirm or identify discrepancies with USGS withdrawal estimates for major public suppliers. Discrepancies among the two data sources were noted as issues for follow up with major public suppliers.

- The EPD Drinking Water System Survey 2006-2009 (DWSS) is a database of self-reported public water supplier data including population served estimates. Population served totals for major public suppliers in this database were used along with USGS data to calculate GPCD values for major public suppliers. It is important to note that this data set is more likely to have subjective estimates of population and therefore the results should be used with caution.

Table 2: Division of Population by Water Supply Category in 2005

County	2005 County Population[1]	Population Served by Public Supply[1,2]	Percent of County Population Publicly-Supplied[3]	Percent of County Population Self-Supplied[3]
Appling	17,954	6,660	37%	63%
Bleckley	12,141	5,380	44%	56%
Candler	10,321	4,380	42%	58%
Dodge	19,574	7,330	37%	63%
Emanuel	22,108	11,990	54%	46%
Evans	11,443	5,880	51%	49%
Jeff Davis	13,083	6,240	48%	52%
Johnson[5]	9,538	4,000	42%	58%
Montgomery	8,909	5,430	61%	39%
Tattnall[4]	23,211	9,270	40%	60%
Telfair	13,205	9,070	69%	31%
Toombs	27,274	18,190	67%	33%
Treutlen	6,753	3,130	46%	54%
Wayne	28,390	12,200	43%	57%
Wheeler	6,706	2,200	33%	67%
Wilcox	8,721	4,950	57%	43%
REGIONAL TOTALS	**239,331**	**116,300**	**49%**	**51%**

Notes:

[1]Data for 2005 from USGS 2009 report called Water Use in Georgia by County for 2005

[2]USGS defines public supply as any public or private water system that provides water to at least 25 people or if there are a minimum of 15 hookups or water connections.

[3]Calculated values. Population data is used only to derive percent publicly-supplied and self-supplied. Population data is not used for defining existing conditions.

[4] Revised county population based upon US Census data, USGS value was incorrect

[5] Revised population served by public supply based upon data from City of Wrightsville.

3.2.2 Refinement Methodology

The initial calculation of county per capita municipal demand rates using USGS data revealed which counties had data that produced unusually high or low GPCD values. The 75 to 175 GPCD range appeared to be a 'typical' water use (most water use across the state fits into this range) and counties falling outside of this range were identified for potential follow up and outreach. The first adjustment made to the USGS GPCD rates was based upon feedback received by EPD following their information and outreach efforts in September and October of 2009 (Municipal Ad Hoc meetings in Columbus and Augusta).

The next step involved comparing GPCD values derived from the USGS 2005 water use data to weighted county GPCD values. The weighted county GPCD estimates were calculated from the EPD Drinking Water System Survey population served data and the USGS public supply withdrawal data for major public suppliers. The resulting GPCD values for major suppliers were then weighted by population served to derive the weighted county GPCD estimates. In some cases, the two GPCD values were close while some were quite different. When the differences were more than 20 percent, these public suppliers were flagged for follow up.

As an added element of the analysis, an estimate of the percent of the total county population served by each of the county's major public suppliers was made by dividing DWSS supplier population served numbers by the USGS total county population value. A county-wide percent of population served by major suppliers was calculated for each county. For many of the rural counties, the USGS-identified 'major suppliers' only supply a small portion of the overall county population. This analysis allowed a determination of whether the population served by 'major suppliers' represented a significant portion of the overall county population and, thus the degree to which a weighted county GPCD may accurately represent the overall county publicly-supplied per capita water use.

The initial calculations of county GPCDs were shared with members of the Altamaha Council Water and Wastewater Forecasting Ad Hoc subcommittees. Participants reviewed the data, and were asked for concurrence with those counties where additional follow up was recommended, any recommendations based upon verifiable local information, and lists of other water suppliers that should be contacted.

Based on this input, ultimately three criteria were used as guidance in determining which individual water supplier would be contacted:

1. Large water suppliers in each region in terms of population served.

2. GPCD value derived from USGS 2005 data was not within 20 percent of the GPCD value derived with population from the EPD Drinking Water System Survey Database.

3. County water use values were outside the 'normal' range of 75 to 175 GPCD.

A questionnaire was developed and used to conduct outreach phone calls. The questionnaire was designed to gather information pertaining to the verification of population served estimates, water withdrawal rates, water sold and/or purchased wholesale, and identification of large industrial or agricultural uses of publicly-supplied water.

Overall, the outreach effort was successful with seventy-five percent of suppliers responding to information requests. Critical information provided by suppliers resulted in adjustments to the calculated GPCD water use rates. Some municipal systems were called, but contact with appropriate personnel was not accomplished.

The feedback received as a result of the outreach effort was documented and tracked in an Excel spreadsheet. Data received allowed for adjustments to the GPCD for individual municipalities. Adjustments to individual municipal water system GPCDs, in turn, had an effect on the respective weighted county GPCDs.

Note that total county population numbers were not revised based upon information gathered from individual municipal water systems.

3.2.3 Results

The publicly-supplied water use rates for each county within the Altamaha Regions are shown on **Table 3**. The major public suppliers identified by the USGS 2009 report are listed. Column C shows the original USGS County GPCD calculated from base year 2005 data listed in the USGS report. After the Municipal Ad Hoc Committee meetings in Augusta and Columbus, adjustments were made to the USGS GPCD based upon information provided by EPD and feedback they received from individual suppliers. Column D shows the USGS County GPCD after these initial adjustments were made.

Column E shows the major public supplier GPCD calculated using population served from the EPD Drinking Water System Survey (2006-2009). Column F shows the population-weighted County GPCD. Column G shows the adjusted major supplier GPCD after incorporating feedback from outreach to individual suppliers. These adjusted individual supplier data were then used to recalculate the population-weighted county GPCD as shown in Column H. Finally, the recommended County GPCD is listed in Column I. The recommended county GPCD is based upon a review and rounding of prior calculations and adjustments.

Table 3: Municipal GPCD Development by County

A County	*B* Major Public Suppliers Listed by USGS[1]	*C* Original USGS County GPCD[1]	*D* USGS County GPCD After First Adjustment[2]	*E* Major Public Supplier GPCD[3]	*F* Population-Weighted County GPCD[3]	*G* Adjusted Major Public Supplier GPCD[4]	*H* Adjusted Population-Weighted County GPCD[4]	*I* Recom-mended County GPCD
Appling	City of Baxley City of Surrency	139.6	139.6	165 52	150.5			140
Bleckley	City of Cochran	39.0	115.0	139	139.1			115
Candler	City of Metter Town of Pulaski	105.0	105.0	92 71	91.0			105
Dodge	Town of Chauncey Town of Chester City of Eastman Town of Rhine	98.2	98.2	75 75 107 59	97.0	211.4	173.5	174
Emanuel	City of Adrian Town of Garfield Town of Nunez Town of Oak Park Town of Stillmore Town of Summertown City of Swainsboro City of Twin City	169.3	169.3	74 77 52 86 81 73 205 148	169.2			169
Evans	City of Bellville City of Claxton City of Daisy City of Hagan	95.2	95.2	38 103 60 57	83.1			95
Jeff Davis	City of Denton City of Hazlehurst	70.5	70.5	93 36	38.0	203.8	195.1	195
Johnson	Town of Kite Scott Water and Sewer City of Wrightsville	177.5	177.5	80 126 198	183.8	123.3	120.9	121
Montgomery	Town of Ailey Town of Alston City of Mt. Vernon Village of Tarrytown Town of Uvalda	88.4	88.4	48 59 97 77 78	84.6	157.3	112.2	112
Tattnall	City of Cobbtown City of Collins	120.8	120.8	88 49	118.0			121

A County	B Major Public Suppliers Listed by USGS[1]	C Original USGS County GPCD[1]	D USGS County GPCD After First Adjustment[2]	E Major Public Supplier GPCD[3]	F Population-Weighted County GPCD[3]	G Adjusted Major Public Supplier GPCD[4]	H Adjusted Population-Weighted County GPCD[4]	I Recom-mended County GPCD
	City of Glennville City of Manassas City of Reidsville			155 68 88				
Telfair	City of Helena Town of Jacksonville City of Lumber City City of McRae Town of Milan City of Scotland	140.0	140.0	137 103 137 143 73 69	129.9			140
Toombs	City of Lyons City of Santa Claus City of Vidalia	146.8	146.8	166 150 130	140.7			147
Treutlen	City of Soperton	127.8	127.8	115	115.5			128
Wayne	City of Jesup Town of Odum City of Screven	171.3	171.3	200 144 89	186.7			171
Wheeler	City of Alamo City of Glenwood	140.9	140.9	144 138	140.8			141
Wilcox	City of Abbeville Town of Pineview City of Pitts City of Rochelle Town of Seville	139.4	139.4	138 139 117 142 128	137.0			139

Maximum Altamaha Region County GPCD	195
Minimum Altamaha Region County GPCD	95
Population-Weighted Altamaha Regional GPCD	140

Sources:

1. USGS Water Use in Georgia by County for 2005

2. First Adjustments to USGS County GPCD:

Bleckley County - *From EPD questionnaire completed by Jody Sapp, City of Cochran population served was 5,680 and average withdrawal rate was 0.79 MGD in FY 2009. From EPD withdrawal database, Middle Georgia College average withdrawal rate in 2005 was 0.07 MGD. From EPD DWSS, Middle Georgia College population served was 1,800. Adjusted USGS County GPCD includes revised City of Cochran data plus additional Middle Georgia College data.*

3. Georgia EPD Drinking Water System Survey

4. Feedback from outreach to public suppliers

Yellow	*Contacted for more information due to discrepancy between USGS and EPD Survey values OR abnormally high or low values*
Light blue	*One of top suppliers in region based upon population served*
Green	*One of top suppliers flagged for follow up due to data discrepancies or anomalies*

Figure 2 shows the recommended municipal water use rates by county geographically.

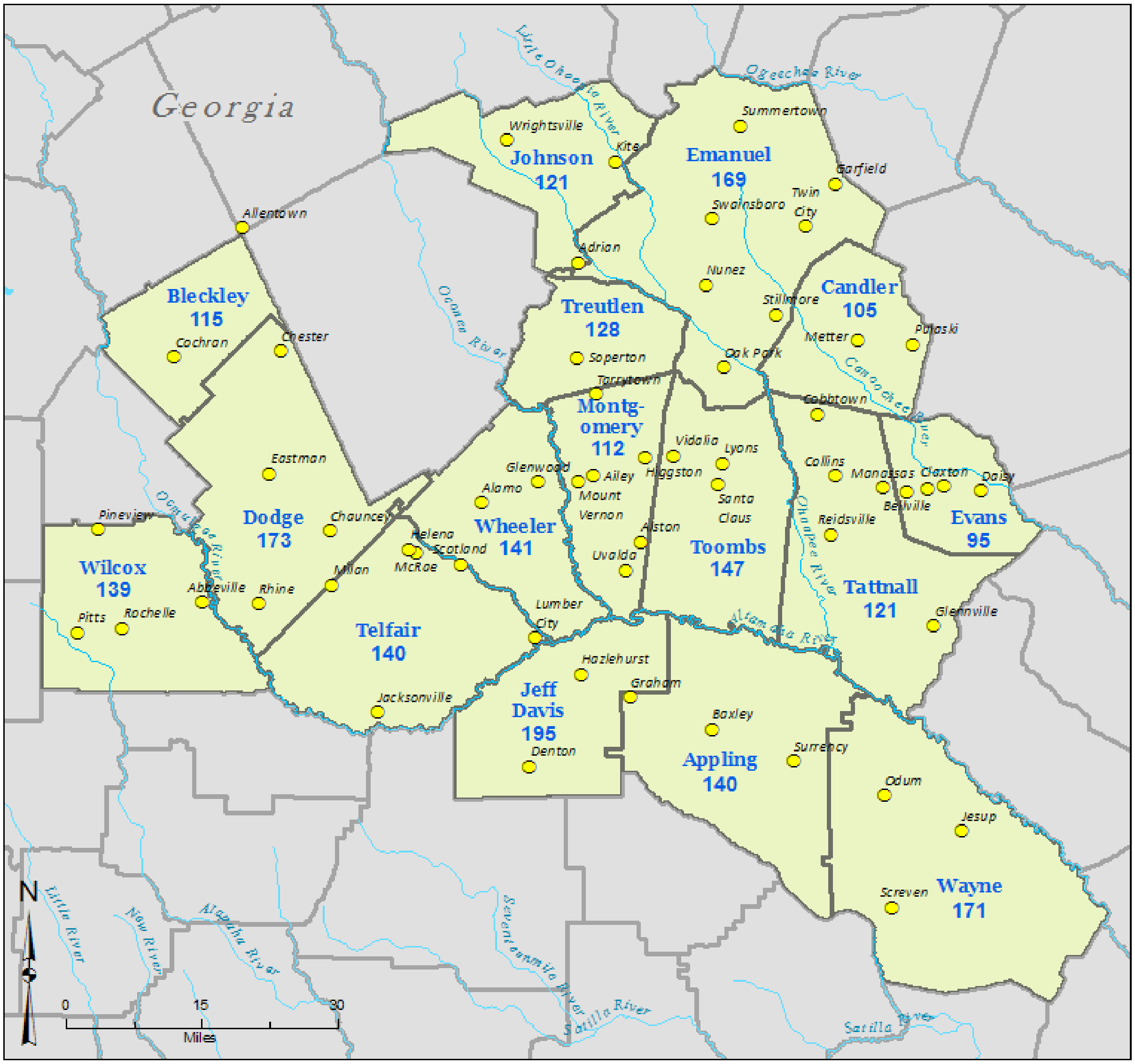


Figure 2: Municipal Water Use Forecasting – GPCD Numbers by County

In many counties, additional follow up was not necessary because the USGS County GPCD and population-weighted GPCD values were within 20 percent of each other, and individual major supplier water use rates were within expected ranges. For example in the Altamaha region, Telfair County's USGS water use rate was calculated as 140.0 GPCD. The population-weighted county water use rate was found to be 129.9 GPCD. These two county GPCD values are within 8 percent of each other. The six individual major suppliers for Telfair County have water use rates ranging from 69 to

143 GPCD. These individual supplier numbers are within reasonable per capita values. Therefore, no additional information was needed and the USGS County GPCD value is recommended as the County GPCD in the forecast model.

When choosing between USGS and population-weighted GPCD without additional supplier feedback, the USGS value is chosen because the population-weighted GPCD value is calculated using the EPD Drinking Water System Survey population served data for years 2006-2009 rather than the 2005 base year. Also, as previously mentioned, the EPD DWSS data appears to have a higher degree of uncertainty.

For more details regarding the publicly-supplied municipal GPCD calculations including population served data and specific feedback data received from each provider, refer to the detailed tables in **Appendix A**.

Regional publicly-supplied municipal water use rates were also calculated from the recommended county water use rates. This data is presented in **Table 4**.

Table 4: Regional Municipal Water Use Rates

Region	Category	Water Use Rate (GPCD)
Altamaha	Maximum publicly-supplied county rate	195
	Minimum publicly-supplied county rate	95
	Population weighted regional average	140
	Self-supplied	75

The Altamaha Regional Council recommended publicly-supplied county water use rates for the baseline municipal forecast.

3.2.4 Additional Considerations

It is recognized that in many parts of Georgia transient populations due to visitation or non-residential status at university, training/educational facilities, military installations, or seasonal tourism can have a significant effect on water use rates. However, the water use by transient population is likely already included in the current and historical water withdrawals. Therefore, the calculation of the per capita water use rates for each county includes water use from any such transient populations. The population projections provided by OPB do not include information about significant changes in transient populations into the future. For forecasting purposes, the basic assumption is that initially the ratio of population captured by US Census to transient population will remain the same over the forecast period. Council was asked if changes are appropriate and for this round of planning Council agreed to this assumption but also recognized that if a major shift occurred such as a shift in military populations, this assumption may need to be revisited.

3.3 Self-Supplied Water Use Rates

There are many residents that supply their own water, typically through private wells located on their own property. Generally these households are in more rural areas and their wells are typically not metered. Based upon a survey conducted in Athens, Georgia in 1983, the USGS 2009 report estimates self-supply per capita water use in Georgia as 75 GPCD. The Altamaha Council chose to use this rate for their self-supplied water needs forecast.

3.4 Plumbing Code Efficiency Adjustments

Since 1994, the national plumbing codes have mandated lower maximum flush rates for toilets available in the United States (US), which has resulted in significant reductions in water use in Georgia and nationwide, and will continue to do so over the 40-year planning period for this forecasting. The National Energy Policy Act of 1992 (NEP Act) reduced the maximum flush volume for toilets from 3.5 gallons per flush to 1.6 gallons per flush (also called Ultra Low Flow Toilet, or ULFT) for all toilets available in the US starting in 1994. Furthermore, Georgia state code, Title 8, Section 8-2-3 states that after April 1, 1992, all residential buildings of all types shall not be constructed with a toilet that uses more than 1.6 gallons of water per flush. In addition to affecting new construction, when an older, high flush-toilet is replaced after 1992 due to remodel or replacement, it was replaced with an ULFT. This replacement of older fixtures lowers the water use rate over time.

Georgia Senate Bill 370, passed in March of 2010, mandates that on or before July 1, 2012, the Georgia Department of Community Affairs shall amend applicable state minimum standard codes to require the installation of high-efficiency plumbing fixtures in all new construction permitted on or after July 1, 2012. This legislation requires that any new buildings or any alterations made to existing buildings shall include the replacement of a malfunctioning, unserviceable, or obsolete toilet with a 1.28 per gallon flush High Efficiency Toilet (HET).

To account for increased efficiency of indoor plumbing fixtures resulting from replacement of old fixtures and construction of new homes required to install 1.28 gallons per flush HETs, the municipal water demand forecast model uses an adjusted county per capita water demand rate for each forecast year for both publicly-supplied and self-supplied categories. The estimated adjustment to per capita water demand is based upon the anticipated rate of replacement of higher flush volume toilets with HETs. The effect of the adjustment for increased efficiency in toilets is commonly referred to as passive conservation.

The calculation of the per capita water use rate using current (2005) withdrawal data described in the previous section already reflects the effect of the plumbing codes over the 13-year period of 1992-2005. However, an estimate needs to be made for the effect of the plumbing code requirement due to toilet replacement over the period of 2010-2050. This section describes the methodology for estimating the reduction of the water use rate due to the effect of the plumbing code on the publicly-supplied municipal water demand projections for the planning horizon of 2010 through 2050.

Methodology

The steps to estimate this reduction due to the plumbing code are described below. A sample calculation is provided in **Appendix B**.

Step 1. Estimate the current mix of toilets for each county by flush volume based on the US Census Age of Housing Units information. This estimate is based on the following timeline for different flush volume toilets in the Georgia.

Toilets installed prior to 1980 use an average of 5 gallons per flush

Toilets installed between 1980 and 1994 use an average of 3.5 gallons per flush

Toilets installed after 1992 use 1.6 gallons per flush (ULFT)

Step 2. Estimate the water savings that will occur when these higher volume per flush toilets are replaced with HETs based on an estimate of the natural replacement rate of the current mix of toilets by county throughout the 40-year planning period. The recommended replacement rate value 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 (Metropolitan North Georgia Water Planning District).

The replacement of higher volume per flush toilets with HETs creates a changing mix of the number of toilets in each flush volume category mentioned in Step 1 for each county. The number of 1.28 gallon per flush toilets increases annually, replacing the toilets in the other volume per flush categories equally throughout the 40-year planning period. Based on the changing ratio of toilets by flush volume category, the total water saved as a result of the replacement of higher volume per flush toilets is calculated as the difference between the water demand of the base year mix of toilets and the water demand of the mix of toilets following the replacement.

Step 3. Apply the plumbing code adjustment as a reduction to the calculated per capita water use rate for each county over the planning period. The annual water savings calculated in Step 2 is converted into a per capita savings based upon the county population to determine the gallons per capita per day reduced as a result of replacement with HETs.

This adjustment to the water use rate is made before the wastewater forecasting is performed. See Appendix B for example calculations.

3.5 Municipal Water Forecasting Results

Municipal water needs are calculated in ten year increments for the 40 year planning horizon. **Table 5** presents the baseline data for Altamaha showing both publicly-supplied and self-supplied water needs separately and then totaled. For Altamaha all current municipal water needs are met with groundwater.

Table 5: Baseline Municipal Water Needs

Region	Category	Water Use Rate (GPCD)	2010	2020	2030	2040	2050	Percent Increase 2010 - 2050
Altamaha	Publicly-supplied	by county	17.52	19.11	20.63	22.06	23.54	34%
	Self-supplied	75	9.67	10.48	11.24	11.90	12.54	30%
	Total		**27.19**	**29.59**	**31.87**	**33.95**	**36.08**	**33%**

Table 6 shows the forecasted municipal water needs by county in the Altamaha region. These numbers are depicted graphically in **Figures 3** with the 2010 forecast demand shown in blue and the incremental increases in demand for each sequential 10 year period shown in other colors.

Table 6: Altamaha Region Total Municipal Water Demand (MGD), Average Annual Demand (AAD)

COUNTY	2010	2020	2030	2040	2050	Percent Increase 2010- 2050
Appling	1.82	2.00	2.17	2.32	2.47	35%
Bleckley	1.21	1.31	1.38	1.45	1.51	25%
Candler	0.97	1.21	1.51	1.86	2.27	134%
Dodge	2.29	2.44	2.58	2.60	2.61	14%
Emanuel	2.92	3.04	3.18	3.33	3.49	20%
Evans	1.03	1.17	1.30	1.41	1.52	48%
Jeff Davis	1.81	1.87	1.92	1.94	1.96	8%
Johnson	0.91	0.94	0.96	0.99	1.00	9%
Montgomery	0.90	1.01	1.11	1.16	1.21	35%
Tattnall	2.26	2.60	2.96	3.34	3.72	65%
Telfair	1.62	1.68	1.74	1.78	1.81	12%
Toombs	3.55	3.87	4.12	4.43	4.84	37%
Treutlen	0.72	0.77	0.83	0.84	0.82	15%
Wayne	3.52	3.88	4.22	4.54	4.83	37%
Wheeler	0.68	0.74	0.79	0.83	0.86	27%
Wilcox	0.99	1.05	1.10	1.13	1.15	16%
Grand Total	**27.19**	**29.59**	**31.87**	**33.95**	**36.08**	**33%**

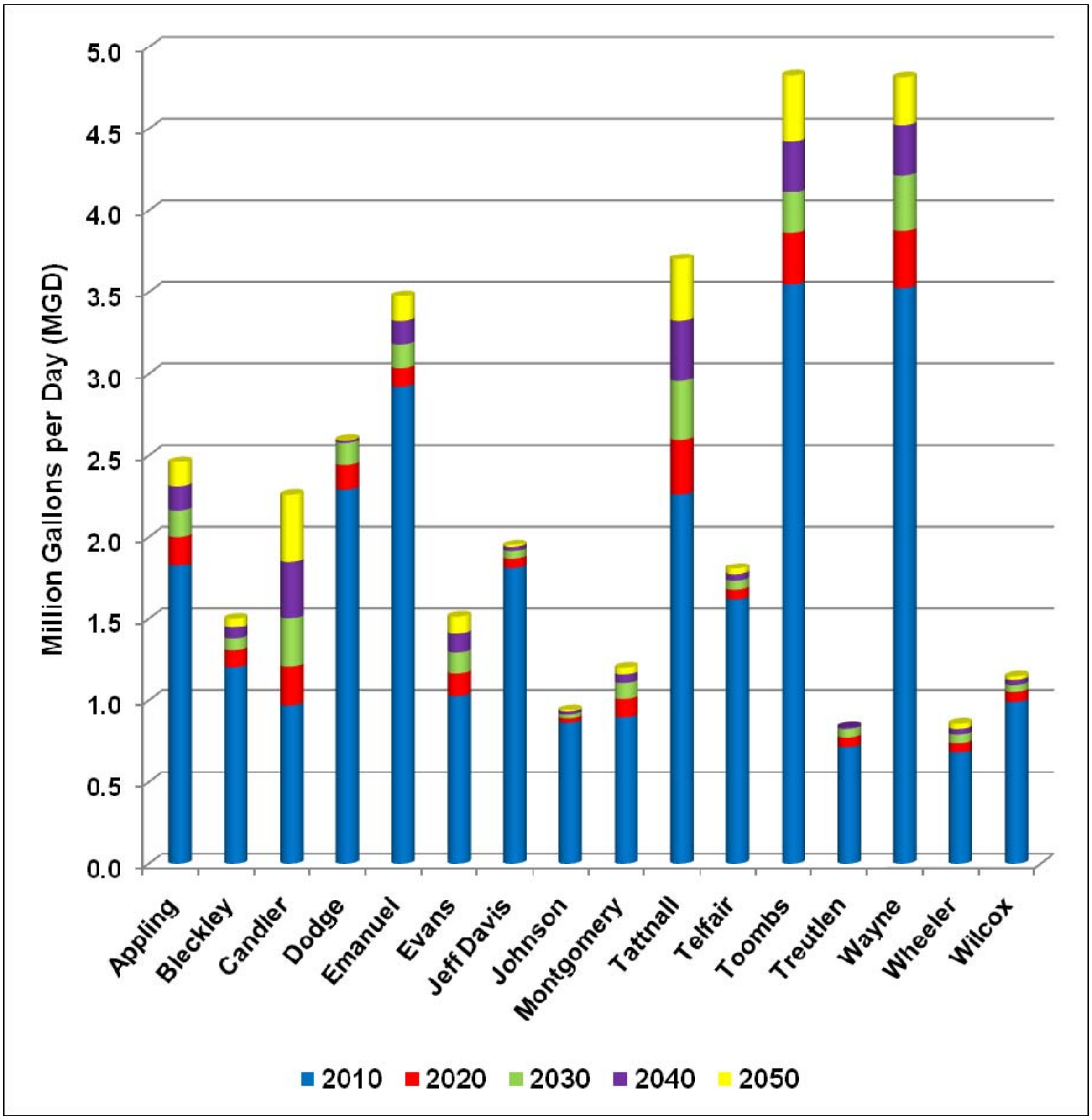


Figure 3: Altamaha Region Municipal Water Demand Forecast 2010 and Incremental Increases to 2050

In the Altamaha region, the largest increase in municipal water demand forecast occurs in Candler County, more than doubling by 2050. Tattnall County has the second largest demand increase. All other counties in the region are forecast to have increases of less than 50% through 2050, with Jeff Davis and Johnson having the smallest increases. Toombs and Wayne Counties are forecast to continue to be the highest users of municipal water in the region due to the population centers in these counties, although their forecast municipal water demand increase is only slightly above average for the region.

The baseline municipal water forecasts include a reduction in the publicly-supplied water use rate over time first shown for 2020 due to passive conservation as described above in Section 3.4. **Table 7** shows the regional Municipal water forecast before and after the adjustments for both the 1992 National Energy Policy Act and the 2010 Georgia Water Stewardship Act. **Table 8** depicts this reduction in terms of municipal flow rate and percent decrease by county within each region.

Table 7: Passive Conservation Adjustments to Municipal Water Forecast (MGD)

Category	2010	2020	2030	2040	2050
Municipal Forecast Before Passive Conservation Adjustment	27.2	30.3	33.5	36.6	40.0
Passive Conservation Reduction from 1992 National Energy Policy Act	0.0	-0.5	-1.0	-1.6	-2.1
Additional Passive Conservation Reduction from 2010 Water Stewardship Act	0.0	-0.2	-0.6	-1.1	-1.8
Total Passive Conservation Savings	0.0	-0.7	-1.6	-2.7	-3.9
Municipal Forecast After Passive Conservation Adjustment	**27.2**	**29.6**	**31.9**	**34.0**	**36.1**

Table 8: Reduction in Base Water Forecast Due to Passive Conservation

	Percent Reduction in Municipal Water Demand					Passive Conservation Demand Reduction (MGD)				
County	**2010**	**2020**	**2030**	**2040**	**2050**	**2010**	**2020**	**2030**	**2040**	**2050**
Appling	0.0%	2.5%	5.0%	7.6%	10.1%	0.00	0.05	0.11	0.19	0.28
Bleckley	0.0%	2.8%	5.6%	8.5%	11.3%	0.00	0.04	0.08	0.13	0.19
Candler	0.0%	2.9%	5.8%	8.7%	11.7%	0.00	0.04	0.09	0.18	0.30
Dodge	0.0%	2.4%	4.8%	7.2%	9.6%	0.00	0.06	0.13	0.20	0.28
Emanuel	0.0%	2.2%	4.5%	6.7%	9.0%	0.00	0.07	0.15	0.24	0.34
Evans	0.0%	2.9%	5.8%	8.7%	11.6%	0.00	0.03	0.08	0.13	0.20
Jeff Davis	0.0%	1.9%	3.9%	5.8%	7.8%	0.00	0.04	0.08	0.12	0.16
Johnson	0.0%	2.8%	5.7%	8.5%	11.4%	0.00	0.03	0.06	0.09	0.13
Montgomery	0.0%	2.5%	5.0%	7.5%	10.0%	0.00	0.03	0.06	0.09	0.13
Tattnall	0.0%	2.9%	5.8%	8.7%	11.6%	0.00	0.08	0.18	0.32	0.49
Telfair	0.0%	2.3%	4.7%	7.0%	9.4%	0.00	0.04	0.09	0.13	0.19
Toombs	0.0%	2.2%	4.4%	6.5%	8.7%	0.00	0.09	0.19	0.31	0.46
Treutlen	0.0%	2.6%	5.3%	8.0%	10.7%	0.00	0.02	0.05	0.07	0.10
Wayne	0.0%	2.1%	4.2%	6.4%	8.5%	0.00	0.08	0.19	0.31	0.45
Wheeler	0.0%	2.7%	5.4%	8.1%	10.8%	0.00	0.02	0.05	0.07	0.10
Wilcox	0.0%	2.4%	4.8%	7.3%	9.7%	0.00	0.03	0.06	0.09	0.12
Total	**0.0%**	**2.4%**	**4.9%**	**7.3%**	**9.8%**	**0.00**	**0.73**	**1.63**	**2.69**	**3.93**

3.6 Geographic Distribution of Municipal Water Needs

There are two main sources of municipal water: surface water and groundwater.

Surface water sources include rivers and streams. The land area surrounding a river or stream is called a watershed or river basin. Any rain that falls into this area flows down into small tributaries which then flow into streams and finally into rivers. For planning purposes, river basins are subdivided into areas called local drainage areas (LDAs). There are location(s) called nodes within each LDA that contain surface water flow measuring gauge(s). Node locations where demands can be compared to available supply are called planning nodes. In this forecast, any water withdrawn in the LDA upstream of the node location or at the node location is summed up at the node for that sub-region.

Groundwater is found in aquifers beneath the earth's surface. An aquifer is a layer of permeable rock, sediment or soil that yields water. Aquifers are sometimes layered on top of one another or they can be located in separate areas horizontally at similar subsurface depths.

Municipal water demand is assigned to a particular watershed or aquifer unit. This assignment is based on the location of current permitted surface water intakes and groundwater wells as well as input from water suppliers.

The forecasted geographic distribution of base year water demand is based upon water withdrawal location and supply source in relationship to the LDA or aquifer unit boundary. For future forecasting purposes, it is assumed that this distribution will remain the same as the base year. Using actual 2005 permitted water withdrawal data from the EPD withdrawal permit database, the ratio of withdrawal by source within a county is calculated. For instance, if 20 percent of the publicly-supplied demand in a county is occurring in Node A, under base scenario conditions, 20 percent of publicly-supplied demands in the county will continue to occur in Node A throughout the planning horizon. The municipal water demand forecast model allows for flexibility of the ratio of publicly-supplied demand by node or aquifer by county. Therefore, the distribution of demand by source within a county can be adjusted at a specific point in time within the forecast horizon.

As part of the planning process, Councils will have the flexibility to assign future water demands (and wastewater returns) to a specific location within an LDA or more detailed geographic location within an aquifer boundary. In making this determination, Councils will likely consider the magnitude and nature of future water needs in relation to available resource capacity.

4. Municipal Wastewater Forecasting

4.1 Methodology

Municipal water demands are the basis for estimating municipal wastewater flows. A portion of water used for residential or commercial purposes flows out of the residence or business as wastewater. This portion of water that returns to the sewer is estimated based on indoor water use because it is not returned directly to the ground through outdoor water uses such as irrigating landscapes or washing vehicles. An indoor water use percentage is multiplied by the estimated publicly-supplied and self-supplied water use to derive estimates of wastewater generated. The percent indoor water use for each county in Georgia was obtained from the Georgia Water Use and Conservation Profiles (CH2M-Hill, March 2008).

Estimates of wastewater generated from publicly-supplied and self-supplied water use are then translated into septic and centralized wastewater flows. U.S. Census data on the percent of households with septic systems in 2005 were obtained by county. For planning purposes, it is assumed that 100 percent of the wastewater generated from self-supplied water use is disposed of via septic system. Therefore, the percent septic value for wastewater generated from self-supplied domestic water use is assumed to be 100 percent. Using Georgia Health Department data on the number of septic systems by county in 2001 and 2007, the average annual addition of septic systems by county from 2002 to 2007 was calculated. Using the average annual addition of septic systems by county, the 2005 number of septic systems by county was interpolated. U.S. Census estimates of county population divided by housing stock allowed for the calculation of the county average number of persons per household. Dividing the USGS 2005 estimate of the self-supplied county population by the U.S. Census estimate of the 2005 persons per household resulted in an estimate of the number of self-supplied households by county in 2005. Subtracting the estimate of the number of self-supplied homes in 2005 from the estimate of the total number of septic systems in 2005 by county yielded the estimate of the number of municipally supplied households on septic in 2005. Dividing the number of municipally supplied households on septic by the U.S. Census estimate of the number of municipally supplied households by county provided an estimate of the percent of municipally supplied households on septic systems in 2005.

The formula for estimating county septic flow from both publicly-supplied municipal water use (PS) and self-supplied residential (SS) water use is as follows:

Septic MGD = [(PS MGD) x (% indoor) x (% septic)] +[((SS MGD) x (% indoor) x (% septic)]

Estimates of wastewater flows to centralized wastewater treatment facilities are derived from the portion of wastewater flow that is not septic. In addition, a percent of flow is added to account for infiltration and inflow (I/I) that occurs in the wastewater collection system before reaching the treatment facility.

I&I is a term used to describe the ways that groundwater and stormwater enter into dedicated wastewater or sanitary sewer systems. Inflow is stormwater that enters into sanitary sewer systems at points of direct connection to the systems while infiltration is groundwater that enters sanitary sewer systems through cracks and/or leaks in the sanitary sewer pipes. Since I&I can vary between regions, an average I&I percentage can be determined for each water planning region based on input from water utilities. A 20 percent I/I was used as a reasonable generalization after consultation with EPD and other experts. Thus, the formula for estimating the centralized wastewater flow is as follows:

> *Centralized MGD = [((PS MGD) x (% indoor) x (1 - % septic)) + ((SS MGD) x (% indoor) x (1 - % septic))] x (1 +% I/I)*

Wastewater effluent flow from centralized treatment facilities is either discharged as a point source to a receiving water body or delivered to a land application system (LAS). Information obtained from existing EPD permit data as well as feedback from municipal suppliers was used to determine the ratio of point discharge to LAS for each county. **Figure 4** shows the simplified progression from municipal wastewater generation to ultimate discharge. Municipal wastewater parameters by county are shown in **Table 9**.

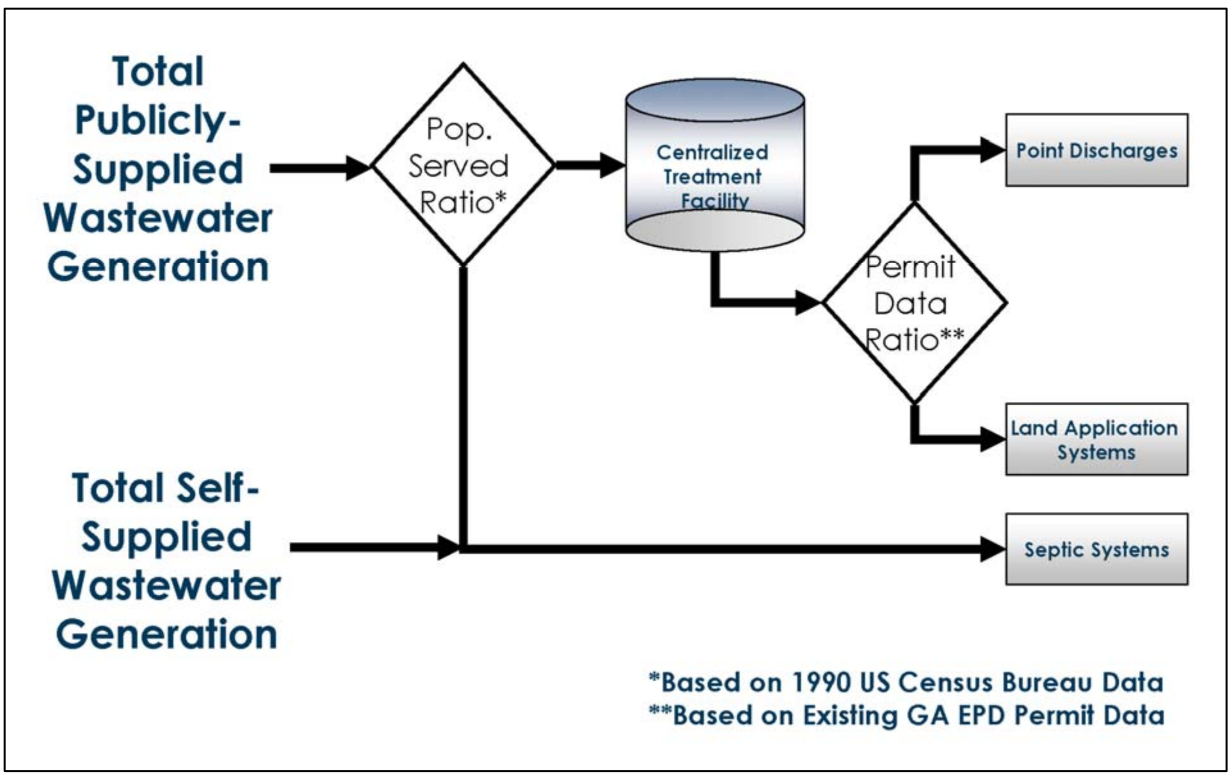


Figure 4: Municipal Wastewater Forecasting Flow Diagram

Table 9: Altamaha Region Wastewater Forecast Parameters

County	Publicly - Supplied Water						Self - Supplied Water	
	Percent Average Indoor Water Use[1]	Percent Inflow and Infiltration	Percent of Households to Septic[2]	Percent of Households to Centralized WW	Centralized WW		Percent Average Indoor Water Use[1]	Percent Septic
					Percent Point Source Discharge[3]	**Percent LAS**		
Appling[4]	82%	20%	37%	63%	80%	20%	82%	100%
Bleckley[4]	77%	20%	22%	78%	100%	0%	77%	100%
Candler[4]	82%	20%	50%	50%	0%	100%	82%	100%
Dodge[4]	88%	20%	44%	56%	83%	17%	88%	100%
Emanuel	82%	20%	47%	53%	77%	23%	82%	100%
Evans	77%	20%	35%	65%	100%	0%	77%	100%
Jeff Davis	77%	20%	40%	60%	100%	0%	77%	100%
Johnson	82%	40%	70%	30%	100%	0%	82%	100%
Montgomery	84%	20%	52%	48%	90%	10%	84%	100%
Tattnall	88%	20%	23%	77%	71%	29%	88%	100%
Telfair	87%	20%	40%	60%	49%	51%	87%	100%
Toombs[4]	82%	20%	27%	73%	49%	51%	82%	100%
Treutlen	88%	20%	37%	63%	100%	0%	88%	100%
Wayne[4]	82%	48%	53%	47%	95%	5%	82%	100%
Wheeler	85%	20%	58%	42%	100%	0%	85%	100%
Wilcox	87%	20%	42%	58%	100%	0%	87%	100%

Notes:

[1]Data from Georgia Water Use and Conservation Profiles (2008).

[2] Estimate derived from a combination of 1990 U.S. Census data, 2002 and 2007 GA Health Department estimates of septic systems, USGS estimate of self-supplied population, U.S. Census population estimates, and U.S. Census housing unit estimates

[3] Data from Georgia EPD Returns Permit Database (1990 - 2007) for base year 2005.

[4] Percent point source discharge and percent LAS values were derived from additional Discharge Monitoring Reports provided by EPD. See Appendix C for detailed calculation tables.

4.2 Municipal Wastewater Forecast Results

Municipal wastewater estimates are calculated in ten year increments for the 40 year planning horizon. **Table 10** shows the wastewater estimates broken down by disposal system.

Table 10: Municipal Wastewater Forecast by Region

Region	Disposal System	2010	2020	2030	2040	2050	Percent Increase 2010 – 2050
Altamaha	Centralized Treatment - Point Source	8.08	8.67	9.23	9.81	10.38	28%
	Centralized Treatment - Land Application	2.80	3.12	3.45	3.83	4.27	53%
	Septic Systems	13.93	15.13	16.27	17.28	18.29	31%
	Total	**24.82**	**26.92**	**28.95**	**30.92**	**32.94**	**33%**

Figure 5 depicts the proportion of wastewater flow by septic and centralized systems in the Altamaha region. **Figure 6** shows the proportion of centralized wastewater that is discharged via point source or land application systems in the region.

4.3 Geographic Distribution of Municipal Wastewater Flows

The geographical representation of wastewater generation is determined using existing EPD permit information and input from water utilities. Wastewater discharges and land application volumes are assigned to a watershed based on current distribution of sources from existing EPD permit information. During the selection of management practices by Water Planning Councils, this initial assignment of future wastewater generation locations may be adjusted.

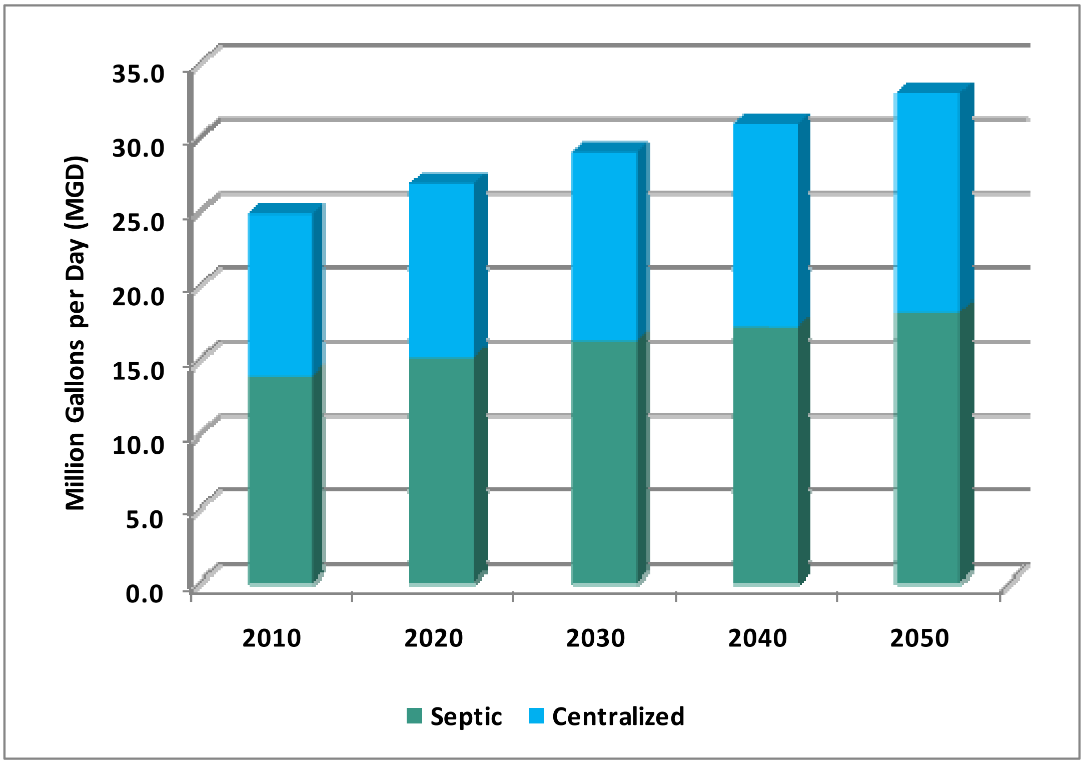


Figure 5: Altamaha Total Municipal Wastewater Discharge, 2010-2050

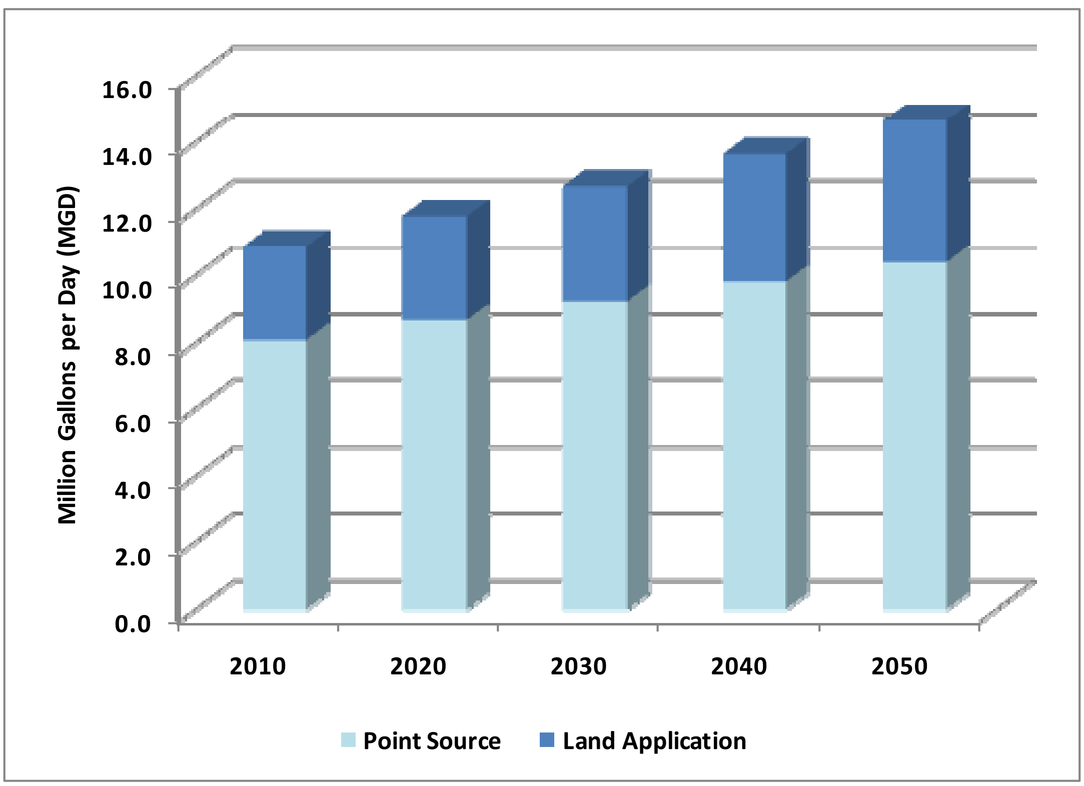


Figure 6: Altamaha Centralized Wastewater Discharge by Type, 2010-2050

5. Industrial Forecasting

Estimates of industrial water demands for major industrial water-using sectors are determined in each watershed and aquifer unit within the Water Planning Regions. The major water-using industries are shown in **Table 11**. Note that some data sources, such as USGS references, use the older Standard Industrial Classification (SIC) codes to categorize businesses and industries, while other sources use the newer North American Industrial Classification System (NAICS) codes. Both the SIC and NAICS codes are shown in Table 10 for the industries of interest. Other water-using industries in a given region may also be included in this estimation of industrial water use for each region. These demands outside the big 15 categories would be included in the 'Other and Unidentified' industrial category. There are many industries in the 'Other' category that are projected to have significant increases in employment over the planning horizon. These industries include: wholesale trade, retail trade, educational services, healthcare, general warehousing and food services.

Industrial water use for the major water using industries is primarily self-supplied water (that is, these industrial water users have water withdrawal permits). However, major industries that obtain water from municipal water systems are included to the extent that these industrial uses were identified and excluded from the municipal water use estimates as described in Section 3. Also, water use for non-major water using industries will be estimated as part of the municipal water use estimates described in Section 3.

Table 11: Industrial Categories and Codes

Industry	SIC Code	NAICS Code	Industry	SIC Code	NAICS Code
Apparel	23	315	Paper	26	322
Automobile	37	336	Petroleum and Coal Products	29	324
Chemicals	28	325	Primary Metals	33	331
Electrical Equipment	36	335	Plastic and Rubber	30	326
Fabricated Metal Products	34	332	Nonmetallic Mineral Products (includes Kaolin)	32	327
Food – Food Manufacturing	20	311	Textile Mills	22	313
Food - Beverage and Tobacco	20	312	Textile Product Mills (includes Carpet)	22	314
Mining	14	212			

5.1 Water Forecast Methodology

Industries require water for processes, sanitation, cooling, and other purposes, in addition to domestic (employee) water use. Some industries, such as poultry processors operate under strict USDA (U.S. Department of Agriculture) guidelines that require water use to maintain sanitary conditions within the facilities. Water need (i.e., the total water requirements of an industry, or the water withdrawals) is directly linked to production. However, in many instances historical production data and estimates of future production are proprietary information. Industry employment data are readily available, and employment is linked to production, and thus indirectly linked to water requirements.

Thus, by assuming that water use per production unit, and production per employee remain the same over the forecast period, future water needs can be estimated by future employment as follows:

> *Future Water Need by Industry = (Water Need / Employment) x Future Employment*

Since the future employment is the current employment times a rate of growth, the formula can be further simplified as:

> *Future Water Need by Industry = Current Water Need x Employment Growth Rate*

Employment projections by industry were prepared for EPD by the University of Georgia. Based upon the employment projections, the average annual growth rates for each of the major water using sectors were determined by planning region for the major industrial sectors at 5-year increments. Employment projections for the largest industrial water users in the Altamaha, Coastal Georgia and Suwannee-Satilla regions show declining trends and modest growth. In situations where there was a projected decline in an industry's employment, the forecast model applies a zero percent average annual growth rate to the base year demand. This approach was chosen instead of applying a negative rate which would have produced a decreasing water demand. Therefore, when an industry's employment is projected to decline or experience minor growth, the current water need remains roughly the same in future years.

The current industrial water use for each category was identified using the 2005 EPD industrial permit database to determine the actual withdrawal amounts for that base year. The 2009 USGS report listings of large industrial water users were also used. Data was collected by performing a query of the EPD database by specific region and industry. Permit location was used to determine the watershed/aquifer unit assignment within the basin. In addition, any large industrial water use extracted from municipal water use is included in the industrial water use if the industrial sector and corresponding employment is known. The water use information is summed for a given industry within a given watershed/aquifer unit to generate the demand on the resource.

As part of the forecast development, EPD conducted outreach meetings with industry stakeholders. Due to proprietary constraints and the complexities of manufacturing processes (e.g., different water requirements for different types of products), industries were unable to provide either water use per product or projections of future product production. Production related water use information was obtained from the Georgia carpet industry and is being incorporated into the water demand forecast for this industry.

EPD's industrial water withdrawal data covers industries that are self-supplied and have permits allowing them to withdraw over 100,000 gallons per day. Industries that are self-supplied, but withdraw less than 100,000 gallons per day are not required to have EPD permits and their actual withdrawals are not tracked by EPD. This category of industrial water use is not expected to be significant for overall forecasting. However, it is recognized that this sector of demand is underrepresented in the current methodology.

Industries that are supplied by municipal water systems are also not directly tracked by EPD. However, the water use for many of these industries was captured during outreach to municipal systems as part of the refinement process used to develop municipal water rates. If a municipal system reported large industrial water use customers, the average daily industrial water rate was subtracted from municipal calculations and added to the industrial forecast as a withdrawal from the same source as the municipal withdrawal. In some cases, the industry category was known and the industrial water use was added to the base year water use in the industrial model for that specific category. In other cases, the type of industry was unknown so the water use was added to an "All other or unidentified" industrial use category for that region.

The intent of the industrial water forecast is to capture water demands and trends among major water users. As noted in the description of the municipal publicly-supplied water demand, there is some publicly-supplied industrial water use represented within the municipal GPCD water use. The industrial water use model reflects large (greater than 100,000 gallons per day) self-supplied industrial water users, plus any indentified municipally supplied industrial large water users that are removed from the municipal GPCD calculations. This method avoids any double counting of industrial water use. However, small (less than 100,000 gallons per day) self-supplied industrial water use may be under-represented.

Beyond the baseline industrial forecast as described above, an alternate scenario can be developed to capture projections of industrial water demand within a planning region or watershed/aquifer unit based on credible and defensible information regarding the geographical distribution of future industrial development within the region. This information is unique for each water planning region and is based upon input provided by representatives from the major water using industries, regional commissions or development authorities and the subsequent direction of each regional water planning council.

5.2 Geographical Distribution of Industrial Water Demand

Industrial water demands are distributed by source node and county throughout the region based upon the base year geographic distribution of industrial water withdrawals by industry category. Under baseline conditions, it is assumed that the geographic distribution will not deviate from the base year throughout the planning horizon. The industrial water demand forecast model allows for flexibility of the ratio of forecasted demands by node for each industrial category within a region. Therefore, the distribution of industrial demands by source within a region can be adjusted.

5.3 Wastewater Forecast Methodology

As with the industrial water demand estimates, the industrial wastewater flow estimates are calculated on a regional basis by industry. Industrial wastewater flow is estimated from a wastewater to water ratio developed for each industrial category. For example in the apparel category, for every gallon of water used, there will be 0.6 gallons of wastewater produced. For the paper category, for every gallon of water used, there will be 1.0 gallon of wastewater produced. In some categories, this approach estimates that more wastewater will be produced than the gallons of water used. This occurs when wastewater treatment tanks and ponds are located outside and collect precipitation. This rainwater adds to the total wastewater effluent discharged or land-applied. Stone and gravel quarries also have to discharge rainwater that accumulates in the operational pits, and this flow adds to the permitted discharge. Thus, some industries have a wastewater to water use ratio greater than 1.0.

Data on the ratio of wastewater to water use are limited. Data had to be matched by industry type by permit holder between discharge information and water use information. Few industrial discharge permit holders could be identified by industry type and matched with water use data at the facility level. Thus, the wastewater to water ratios were determined from a limited number of matches between actual water use and actual wastewater discharge identified by an industrial permit holder for the state. These ratios can be adjusted to reflect more localized data by region.

Outreach to industrial stakeholders allowed for industry representatives to offer a stakeholder-approved statewide industry wastewater to water ratio. Two such industries did provide industry-specific statewide recommendations for wastewater to water ratios that were incorporated into the forecast models. The paper industry recommended a wastewater to water ratio of 100 percent and the food manufacturing industry recommended a wastewater to water ratio of 95 percent. If available data allowed for a region-specific industry wastewater to water ratio to be calculated, that ratio was incorporated into the forecast model. For example, one facility in the Altamaha planning region accounts for 100 percent of the paper industry demands in that region. Available water withdrawal and wastewater discharge permit data made it possible to calculate an average annual wastewater to water discharge ratio for that facility using data from 1997 through 2007. It was determined that the average annual wastewater to water ratio for that facility is 102 percent. This ratio was incorporated into the industrial wastewater forecast model.

Once the industrial wastewater flows are estimated, the flows are separated between point discharges and land application. The percent of permitted point discharges to total discharges for each industry was determined statewide from the EPD's wastewater discharge database. Again, the data was limited because not all industrial discharge permits are identified by industry type. Furthermore, within a particular industry, the number of permits with land application systems is limited. Therefore, the proportion of land application to point discharge (i.e., the percent discharge) can be revised based upon Council input for a specific industry or region. The formulas for estimating point discharge and land application flows by industry and region are as follows:

Point Discharge MGD = (Ind MGD) x (ww/w) x (%point discharge)

Land Application MGD = (Ind MGD) x (ww/w) x (1 - %point discharge)

5.4 Geographic Distribution of Industrial Wastewater

Once the industrial wastewater flows are calculated by category for the entire region, the next step is to determine where the flows discharge back into the river basin and how much flow is returned at each location. As discussed in previous sections, each river basin is divided into smaller regions called local drainage areas or LDAs. Distinct points within the LDAs called nodes have surface water gauges to monitor flow rate and elevation. In this forecast, any wastewater discharged into the LDA upstream of the node location or at the node location is summed up at the node for that sub-region. For industrial wastewater forecasting, it is important to know how much flow is going to each node within the region.

The first source of information is normally wastewater discharge permits which contain specific information on geographic location of the discharge point, discharge method (point source or land application), and discharge volume. However, for industrial water users, there is limited wastewater discharge permit data. This is because many industries included in the forecast have permits for water withdrawals, but do not necessarily have permits for wastewater discharges. In many cases, a facility without an EPD discharge permit sends its wastewater to a municipal Publicly Owned Treatment Works (POTW) for treatment. In the absence of permit data, another method was developed for determining the node location and the proportion of industrial wastewater flow at each node.

The first step involves identifying all facilities within the region included in the base year industrial water demand forecast and their respective industry categories. All facilities included in the industrial water demand forecast were cross-referenced with the EPD wastewater discharge database to determine if the facility is permitted to discharge its own wastewater and, if so, the node of discharge. For those facilities permitted to discharge wastewater, either on site or for pre-treatment prior to sending to a municipal wastewater treatment facility, the reported node of return was used in the forecast calculations.

For those not permitted to discharge wastewater, the node of discharge was determined based on the location of the facility's surface water intake or groundwater well. For surface water sources, the wastewater is returned to the same node from which the surface water was withdrawn. For ground water sources, the wastewater is returned to the node representing the drainage area where the groundwater well is located. The EPD withdrawal database includes geographic coordinates for all surface water and groundwater withdrawal permits. These coordinate points were brought into a GIS along with a polygon layer of the nodes. Using this data, the node of the intake or well was determined and assumed to be the same as the node of discharge. For facilities identified as receiving their water supply from municipal providers, the node of discharge was assumed to be the same as the node of withdrawal of the municipality supplying the water.

Once wastewater location is determined, the next step is figuring out what proportion of the flow from each category is returned at each node. Because there is limited data regarding exact wastewater flow volumes by industrial facility, the volume percentages are based upon withdrawal volumes within the node during the base year. For example, if the total water withdrawn in the 2005 base year for paper in the Altamaha region is 100 MGD with 20 MGD coming from node A and 80 MGD coming from node B, then 20% of the forecasted paper wastewater flow is returned to node A and 80% of the paper wastewater flow is returned to node B. Thus the ratio of wastewater discharged to a particular node by a particular industry is calculated by dividing the category's withdrawal in the node by the category's withdrawal in the region during the base year.

Since the industrial wastewater forecast model assumes all facilities within an industrial category exhibit the same wastewater to water ratio, using withdrawal volumes does not significantly over or under estimate the distribution of industrial wastewater to any one particular node within a region.

For each node, the ratio of wastewater discharged to point source and land application was calculated for each industrial category. The EPD wastewater discharge database is used to determine an industrial facility's method of discharge. Base year withdrawals for point source discharge industrial facilities are divided by total withdrawals by facilities of the same category and in the same node to derive a percent point source ratio for each category within each node. If a facility's method of discharge could not be identified in the EPD database, it is assumed that the discharge is point source. These percent point source ratios were input into the industrial wastewater demand forecast model to distribute the forecasted flows within a node by discharge method.

In many counties, a portion of the forecasted industrial wastewater generated by self-supplied facilities is treated by a municipal POTW prior to discharge. The industrial wastewater treated by municipal POTWs, therefore, is identified and separated from the industrial wastewater forecast in order to accurately depict total municipally-discharged and total industrially-discharged wastewater.

To determine the amount of industrial wastewater being sent to municipal POTWs, it is first necessary to identify which self-supplied industrial facilities have EPD wastewater discharge permits and which do not. Those self-supplied industrial facilities without EPD discharge permits are assumed to send their wastewater to a municipal POTW. Within each county, all self-supplied industrial facilities were identified by industrial category. In each county, the ratio of base year withdrawals by facilities with permits to the total withdrawals for each industrial category determines the percent of the forecasted wastewater sent to municipal POTWs for that category in that county. This ratio is applied to the county's forecasted industrial category flows to derive the forecasted industrial flows sent to municipal POTWs. These flows are further separated by method of discharge based upon the method of discharge for the municipal POTW determined to be the most likely destination of the industrial wastewater. As discussed above, the node of discharge is assumed to be the same as the node of withdrawal for self-supplied industrial facilities. For the purposes of this analysis, it is also assumed that a self-supplied industrial facility without an EPD discharge permit sends its wastewater to the nearest municipal POTW.

5.5 Industrial Forecast Results

Industrial water and wastewater forecasts are calculated by category in ten year increments for the 40 year planning horizon. **Table 12** shows the regional industrial water demand by county and the percent increase in demand from 2010 to 2050.

Table 13 shows the industrial water demand by category for the Altamaha region. **Figure 7** graphically depicts the industrial demand by category for the region.

Industrial water demand is supplied by either surface water or groundwater. **Figure 8** shows the proportion by source for the Altamaha region for both 2010 and 2050.

The industrial wastewater flow forecast totals by county and region are shown in **Table 14**. These totals include the industrial flows to municipal POTWs. **Table 15** shows the forecasted regional wastewater flows by method and location of discharge. The table identifies the industrial point source and LAS flow volumes by permitted industrial facilities as well municipal POTWs.

Table 12 Industrial Water Demand Forecast (MGD)

County	2010	2020	2030	2040	2050	Percent Increase 2010 - 2050
Appling	0.00	0.00	0.00	0.00	0.00	0%
Bleckley	0.00	0.00	0.00	0.00	0.00	0%
Candler	0.00	0.00	0.00	0.00	0.00	0%
Dodge	0.00	0.00	0.00	0.00	0.00	0%
Emanuel	1.07	1.07	1.08	1.09	1.12	5%
Evans	1.68	1.68	1.69	1.72	1.76	5%
Jeff Davis	0.35	0.38	0.39	0.40	0.41	16%
Johnson	0.00	0.00	0.00	0.00	0.00	0%
Montgomery	0.00	0.00	0.00	0.00	0.00	0%
Tattnall	0.02	0.02	0.02	0.02	0.02	17%
Telfair	0.09	0.10	0.11	0.11	0.12	29%
Toombs	0.00	0.00	0.00	0.00	0.00	0%
Treutlen	0.00	0.00	0.00	0.00	0.00	0%
Wayne	59.06	63.90	65.96	67.48	69.16	17%
Wheeler	0.00	0.00	0.00	0.00	0.00	0%
Wilcox	0.00	0.00	0.00	0.00	0.00	0%
Regional Total	**62.28**	**67.16**	**69.24**	**70.83**	**72.60**	**17%**

Table 13: Altamaha Industrial Water Demand Forecast (MGD)

NAICS	Industry	2010	2020	2030	2040	2050
0	Other Industrial	0.09	0.10	0.11	0.11	0.12
311	Food - Food Manufacturing	2.75	2.75	2.77	2.82	2.88
313	Textiles - Textile Mills	0.35	0.38	0.39	0.40	0.41
322	Paper	59.08	63.92	65.98	67.51	69.19
	TOTAL	**62.28**	**67.16**	**69.24**	**70.83**	**72.60**

Note: *The following categories have zero forecast water demand in the Altamaha Region: Mining, Food - Beverage and Tobacco, Textile Product Mills, Apparel, Petroleum, Chemicals, Rubber, Stone and Clay, Primary Metals, Fabricated Metal Products, Electrical Machinery, and Automotive Manufacturing*

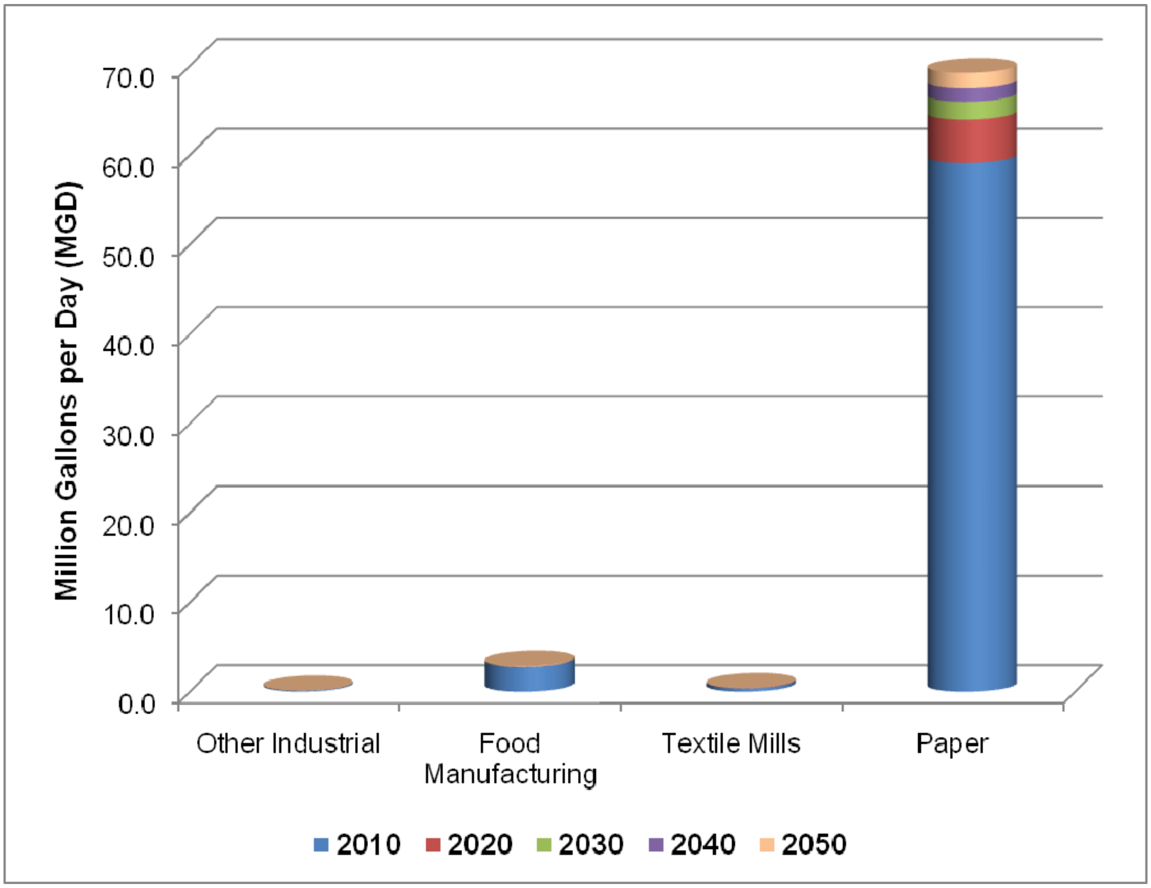


Figure 7: Altamaha Industrial Water Demand by Category

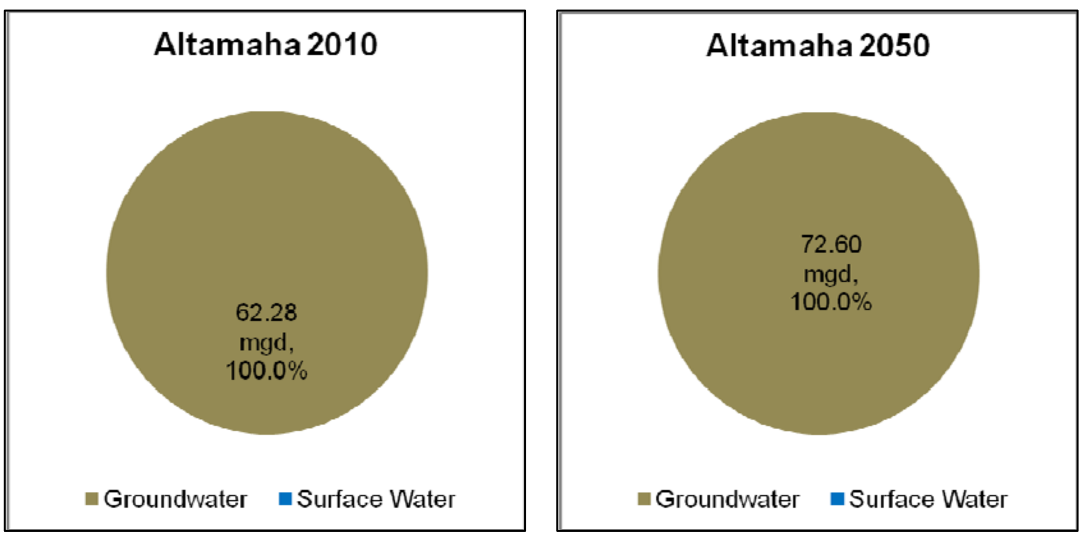


Figure 8: Industrial Water Demand by Source

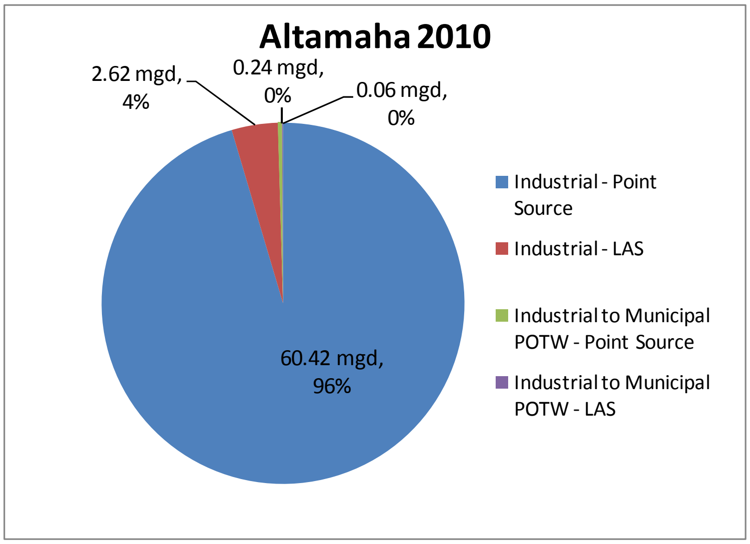
Table 14: Industrial Wastewater Demand Forecast (MGD)

County	2010	2020	2030	2040	2050	Percent Increase 2010 - 2050
Appling	0.00	0.00	0.00	0.00	0.00	0%
Bleckley	0.00	0.00	0.00	0.00	0.00	0%
Candler	0.00	0.00	0.00	0.00	0.00	0%
Dodge	0.00	0.00	0.00	0.00	0.00	0%
Emanuel	1.02	1.02	1.02	1.04	1.06	5%
Evans	1.60	1.60	1.61	1.64	1.68	5%
Jeff Davis	0.21	0.23	0.24	0.24	0.25	16%
Johnson	0.00	0.00	0.00	0.00	0.00	0%
Montgomery	0.00	0.00	0.00	0.00	0.00	0%
Tattnall	0.02	0.02	0.02	0.02	0.02	17%
Telfair	0.06	0.06	0.06	0.07	0.07	29%
Toombs	0.00	0.00	0.00	0.00	0.00	0%
Treutlen	0.00	0.00	0.00	0.00	0.00	0%
Wayne	60.42	65.37	67.48	69.04	70.75	17%
Wheeler	0.00	0.00	0.00	0.00	0.00	0%
Wilcox	0.00	0.00	0.00	0.00	0.00	0%
Regional Total	**63.33**	**68.30**	**70.43**	**72.05**	**73.84**	**17%**

Table 15: Industrial Wastewater Demand Forecast by Discharge Method (MGD)

Discharge Method	2010	2020	2030	2040	2050
Industrial – Point Source	60.42	65.37	67.48	69.04	70.75
Industrial – LAS	2.62	2.62	2.63	2.68	2.74
Total Industrial Discharge	**63.04**	**67.99**	**70.11**	**71.71**	**73.49**
Industrial to Municipal POTW – Point Source	0.24	0.25	0.26	0.27	0.27
Industrial to Municipal POTW – LAS	0.06	0.06	0.06	0.07	0.07
Total Industrial to Municipal POTW	**0.29**	**0.32**	**0.32**	**0.33**	**0.35**

Figure 9 shows the industrial wastewater flow by discharge method for 2010 and 2050.



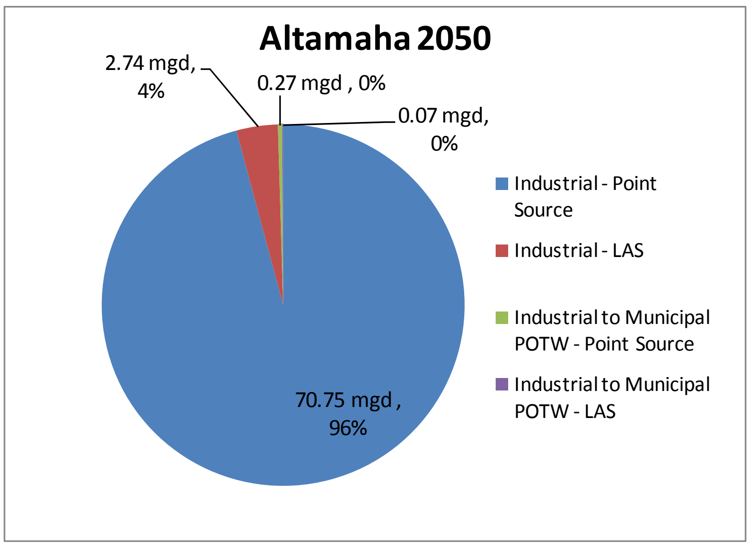


Figure 9: Industrial Wastewater Flow by Discharge Method

6. Agricultural Water Forecasting

The methodology and results of the agricultural forecasts were developed by the University of Georgia. Full documentation of this work is available at http://www.nespal.org/sirp/waterinfo/State/awd/agwaterdemand.htm. A summary of the information is presented below.

6.1 Crop Area

Total current irrigated crop acreage was measured from 2007 and 2008 aerial photos, overlain with Georgia Soil and Water Conservation Commission (GSWCC) or EPD-identified irrigation systems plus additional, visible irrigation systems identified by UGA.

This total irrigated acreage was proportioned by crop type based upon the 2008 UGA Cooperative Extension Irrigation Survey. Projected crop growth rates were based upon the average of projections from three economic models (nation-wide, southeast regional, and Georgia data).

Crop area for specialty and vegetable crops, which comprise 15% of Georgia agriculture, is not available from major crop data. UGA assumed those crops would continue to grow in areas where they have been in production in the past, with growth rates equal to the aggregate growth rate of the state's five major crops (corn, cotton, peanuts, soybeans, and pecans).

6.2 Irrigation Depth

The agricultural forecast uses a precipitation period of record from 1950 – 2007. Using specific crop computer models, UGA calculated irrigation needs for each major crop type for each day during this period of record for each county. The calculations are based on known and accepted plant growth and water balance calculations for each crop type. The calculations are also based on an assumption of 75% irrigation efficiency, meaning 75% of water pumped by the irrigation system is used by the crop and the other 25% is lost due to spray evaporative loss, canopy loss, wind drift, runoff, and deep percolation. UGA summed the calculated irrigation for each month and used the results to tier all years in the period of record into wet, average, and dry years.

For forecasting purposes, UGA used the general observation from the Agricultural Water Pumping Study that, on average, surface water users applied 70% as much water as groundwater users. This ratio was used this percentage to reduce estimated/forecasted surface water withdrawals. The Agricultural Water Pumping Study sampled a total of 800 randomly chosen irrigation systems and monitored them monthly from 1999 – 2004. The study monitored 45 well-to-pond systems and concluded that 70% of the water reaching the field came from the wells. It also provided a monthly distribution of irrigation depths for specialty crops.

6.3 Irrigation Source

Demands by water source for irrigation were computed using EPD's Agricultural Water Withdrawal Permitting Program (which identifies withdrawal sources) and an EPD/GSWCC field mapping effort that identified the location of withdrawal sources. Based on this information, UGA made the following assumptions related to water source:

- Fields irrigated by wells are sourced 100% from groundwater.
- Fields irrigated by surface water only, including ponds without refill wells, are sourced 100% from surface water.
- Fields irrigated by ponds supplemented by wells (well-to-pond systems) are sourced 70% from groundwater and 30% from surface water. This ratio is based on 45 well-to-pond systems that were monitored from 1999 – 2004.
- No fields were identified as irrigated by direct surface water withdrawal (no pond) with wells as an additional source.
- Calculated irrigation requirements were assumed to be 100% consumptive.

6.4 Agricultural Forecast Results

Agricultural water needs were calculated in ten year increments for the 40 year planning horizon. **Table 16** shows the forecasted agricultural water needs by county in the Altamaha region. These numbers are depicted graphically in **Figure 10**, with the 2010 forecast demand shown in blue and the incremental increases in demand for each sequential 10 year period shown in other colors.

The Altamaha region as a whole is expected to see an increase of 18% in agricultural water demand by 2050. The largest increase in forecasted demand occurs in Toombs County, with a 36% increase by 2050. Tattnall and Evans Counties have the next largest forecasted demand increases at 26% and 22%, respectively. All other counties in the region are forecast to have increases of less than 20% through 2050, with Montgomery and Johnson having the smallest increases at 8% and 2%, respectively.

Table 16: Altamaha Agricultural Demand Forecast (MGD, average annual day)

County	2011	2020	2030	2040	2050	Percent Increase 2010 to 2050
Appling	6.30	6.42	6.59	6.77	6.97	11%
Bleckley	11.24	11.42	11.67	11.94	12.23	9%
Candler	5.27	5.37	5.50	5.64	5.80	10%
Dodge	12.79	13.22	13.75	14.33	14.97	17%
Emanuel	4.70	4.85	5.02	5.22	5.43	15%
Evans	7.15	7.45	7.84	8.27	8.75	22%
Jeff Davis	5.91	6.09	6.31	6.55	6.81	15%
Johnson	1.90	1.90	1.91	1.92	1.93	2%
Montgomery	3.01	3.06	3.12	3.19	3.26	8%
Tattnall	16.42	17.23	18.26	19.41	20.70	26%
Telfair	8.65	8.96	9.34	9.78	10.25	19%
Toombs	11.29	12.07	13.05	14.15	15.39	36%
Treutlen	1.62	1.66	1.72	1.78	1.85	14%
Wayne	3.83	3.91	4.02	4.14	4.27	12%
Wheeler	4.02	4.10	4.22	4.34	4.48	11%
Wilcox	16.42	17.03	17.81	18.68	19.65	20%
Total	**120.54**	**124.75**	**130.13**	**136.10**	**142.72**	**18%**

Includes 2011 livestock water demand carried forward for all forecast years.

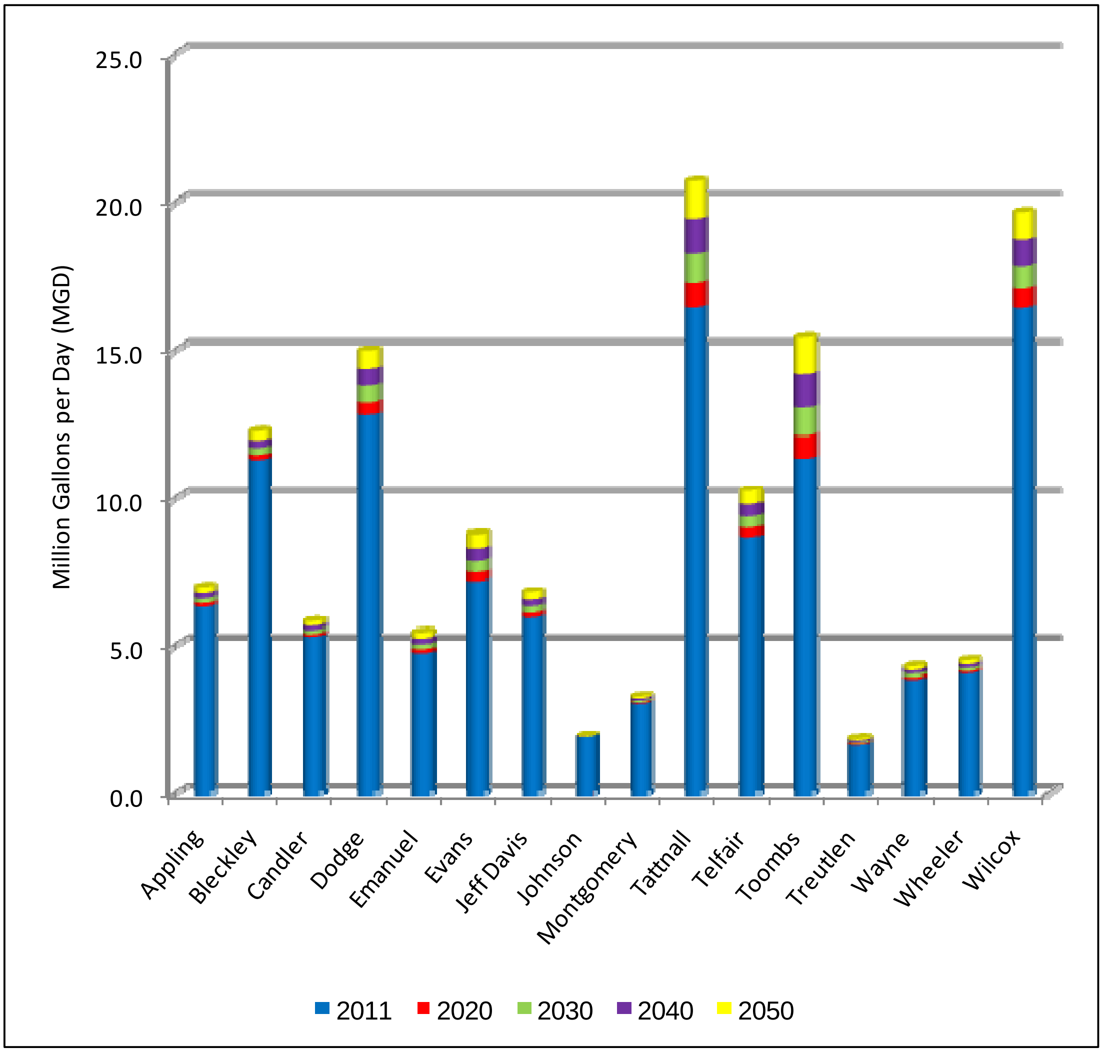


Figure 10: Altamaha 2010 Agricultural Forecast by County with Incremental Increases to 2050

7. Energy Water Forecasting

Evaluating and forecasting water demands for power generation is a critical element to consider in planning for future water needs. This section briefly describes the methods and results of the Georgia statewide energy sector water demand forecast including those demands occurring with the Altamaha Water Planning Region. A detailed and thorough description of the methodology can be found in a technical memorandum called, "Statewide Energy Sector Water Demand Forecast" dated October 29, 2010 (Energy Forecast Tech Memo).

The purpose of the energy sector forecast is to evaluate water withdrawal and water consumption needs to meet the anticipated power needs of Georgia's citizens through 2050. For the purposes of this analysis, forecasted water demands are associated with future energy sector utilities' (NAICS 22) power generation. Power generation water demands associated with facilities with other industry codes are captured as part of the municipal and industrial water demand forecasts. This energy forecast is designed to support statewide water resources planning and is not intended to support future energy planning needs.

7.1 Data Sources and Methodology

There were two primary sources of data used to develop the energy forecast. The Georgia EPD water withdrawal permit database provided information on reported water withdrawals and consumptive use for all permitted thermoelectric facilities. The U.S. Department of Energy, Energy Information Administration compiles facility-level data on generating capacity, monthly and annual power generation, facility cooling system type, fuel type and prime mover.

Using this information, average withdrawal and consumption rates, expressed in gallons per megawatt hour (MWh) were calculated for each of four unique power generation processes requiring water for the production of energy. Each generation process uses a unique combination of fuel type, method of converting energy to electricity (prime mover), and cooling type. These processes are henceforth referred to as power generation combinations. For each power generation combination, the average water rate was multiplied by the estimated power generation for each forecast year:

*Power Generation Combination Demand = Combination Average Gallon per MWh * Estimated Combination Power Generation MWh*

Then, the individual power generation combination withdrawal and consumption values were summed for each forecast year to calculate the total statewide demands. Demands were forecasted for the following power generation combinations identified by fuel source/prime mover/cooling type:

- Natural gas/combined-cycle/cooling tower
- Fossil fuel & biomass/steam turbine/once-through

- Fossil fuel & biomass/steam turbine/cooling tower
- Nuclear/steam turbine/cooling tower

The amount of power generated by combination was calculated by multiplying a combination's available capacity by a combination capacity factor – the percent of capacity utilized:

*Power Generation Combination Production (MWh) = Combination Available Capacity (MWh) * Combination Capacity Factor (%)*

It is recognized that multiple factors can influence a combination's capacity factor from year-to-year making future combination capacity factors difficult to predict. Future combination capacity factors were guided by recent historical trends in combination capacity factors and insights from an energy sector ad hoc group.

7.2 Energy Forecast Results

The ability to transmit power from the location of generation to the location of demand presents some unique challenges in developing the water needs forecast. Consequently, this forecast does not focus specifically on regional demands, but rather is meant to forecast energy sector water demands at the state level. It was possible to identify statewide demands at a regional level based on a set of assumptions applicable to all power generating facilities in the state and according to the location of known and planned power generating facilities confirmed by the Georgia EPD and the energy sector ad hoc group. Information was available for facilities planned to be built or expanded through the year 2017. Details on the specific assumptions and planned facilities can be found in the Energy Forecast Tech Memo.

Table 17 below shows the Altamaha regional energy sector demand forecast for existing and planned facilities through 2050. The numbers shown represent average annual daily flow rates. The forecasted demand associated with these facilities remains steady throughout the planning horizon.

Table 17: Altamaha Existing and Planned Facilities Forecasted Energy Sector Demands, MGD

Region	Demand Type	2010	2020	2030	2040	2050
Altamaha	Withdrawals	51.0	50.5	50.5	50.5	50.5
Altamaha	Consumption	32.7	32.4	32.4	32.4	32.4

An analysis of existing and planned facilities' available generating capacity revealed that these plants would not be able to accommodate projected statewide power needs through 2050. In order to meet the projected statewide power needs through 2050, it was assumed that additional generating capacity will be developed beyond what currently exists and what is known to be planned through 2020. The demands associated with the additional generating capacity assumed to be available beyond 2020 were not distributed regionally due to the many unknowns, data gaps, and challenges associated with speculating on the location of unplanned generating capacity. Therefore, the demands associated with additional power generating capacity not currently available or planned through 2020 are not assigned to a particular region. The forecasted statewide unassigned demands are shown in **Table 18**.

Table 18: Unassigned Forecasted Energy Sector Demands, MGD

Region	Demand Type	2010	2020	2030	2040	2050
No Assigned Region	Withdrawals	-	-	106.1	209.6	313.1
No Assigned Region	Consumption	-	-	57.7	114.0	170.5

The Altamaha Water Planning Council has elected to consider the implications of a portion of the unassigned statewide energy sector water demand occurring within the region. The Council's decision on how to consider future energy water needs in the region was guided by the following three principles:

- Future energy production and water use should be located in areas of sufficient supply and within the capacity of surface water systems
- Reuse and use of water, where possible and feasible, should be part of the water budget for energy production
- Energy development should be in cooperation with local governments to make sure that energy water use does not impact other possible growth sectors and should promote "fairness" in water supply

The Council unanimously decided that a 2,000 megawatt plant construction or expansion was the minimum that would occur in the region given "economy of scale considerations". Current generating capacity in the region is nearly 2,000 megawatts. The water withdrawal associated with that capacity is about 50 MGD while the consumption is about 33 MGD. Therefore, the Council elected to include an additional 50 MGD of energy withdrawals and an additional 33 MGD of consumption in the plan by 2050. Due to the uncertainty of the timing of a plant construction or expansion and for planning purposes, the schedule for incorporating the additional demands is such that half of the anticipated demands are added in 2030 and half are added in 2050.

Using this approach, the additional withdrawal and consumptive demands can be estimated for the forecast years 2030, 2040, and 2050. **Table 19** shows the regional demands associated with existing and planned facilities through 2020 as well as the unassigned demands added to the regional forecast following the approach described above.

Table 19: Altamaha Forecasted Energy Sector Withdrawals and Consumption, MGD

Category	2010	2020	2030*	2040*	2050*
Existing and Planned Facilities Withdrawals	50.5	50.5	50.5	50.5	50.5
Existing and Planned Facilities Consumption	32.7	32.4	32.4	32.4	32.4
Regional Portion of Unassigned Withdrawals	-	-	25.0	25.0	50.0
Regional Portion of Unassigned Consumption	-	-	16.5	16.5	33.3
Total Regional Withdrawals	**50.5**	**50.5**	**75.5**	**75.5**	**100.5**
Total Regional Consumption	**32.7**	**32.4**	**48.9**	**48.9**	**65.4**

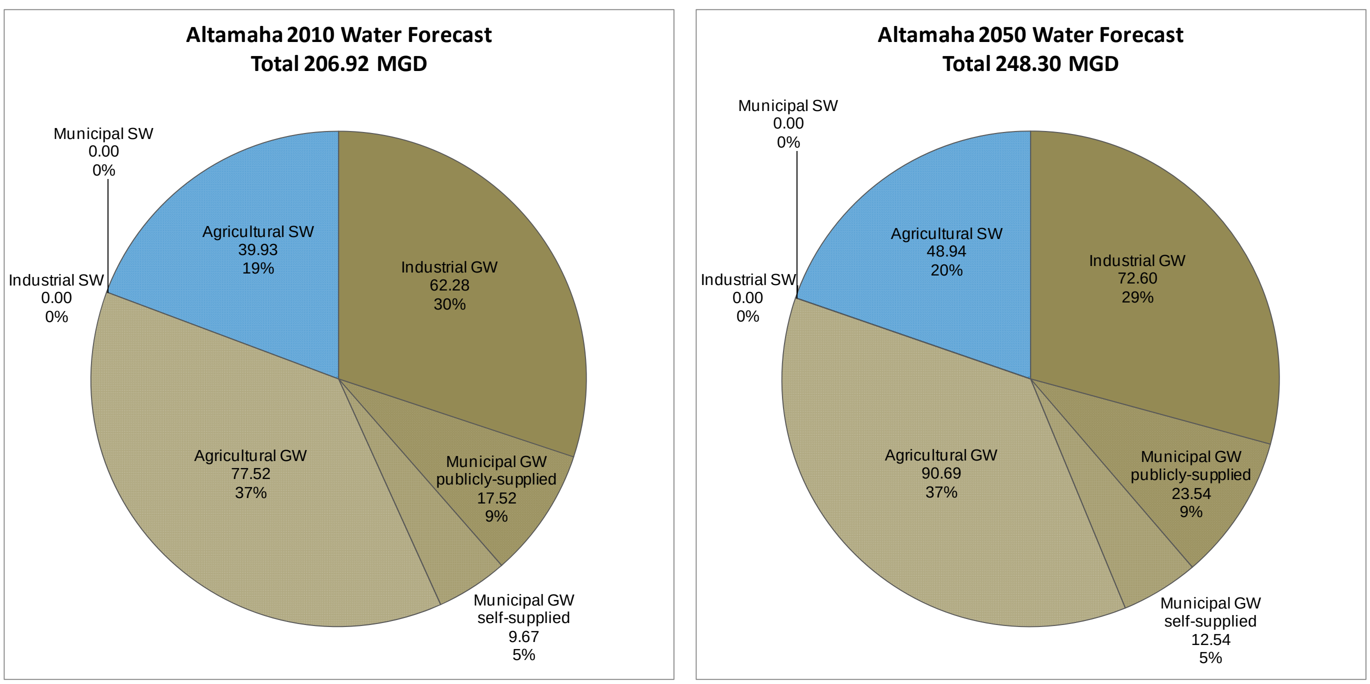
*Includes demands associated with existing and planned facilities and demands associated with a 2,000 MW thermoelectric facility construction/expansion.

8. Regional Summary of Forecasting Results

The results of the water and wastewater forecasts for all 16 counties within the region are summarized in this section. These forecasts have been developed at 10-year increments beginning in 2010 and extending to 2050. The major water and wastewater sectors include: municipal (domestic and commercial), industrial, agricultural, and energy.

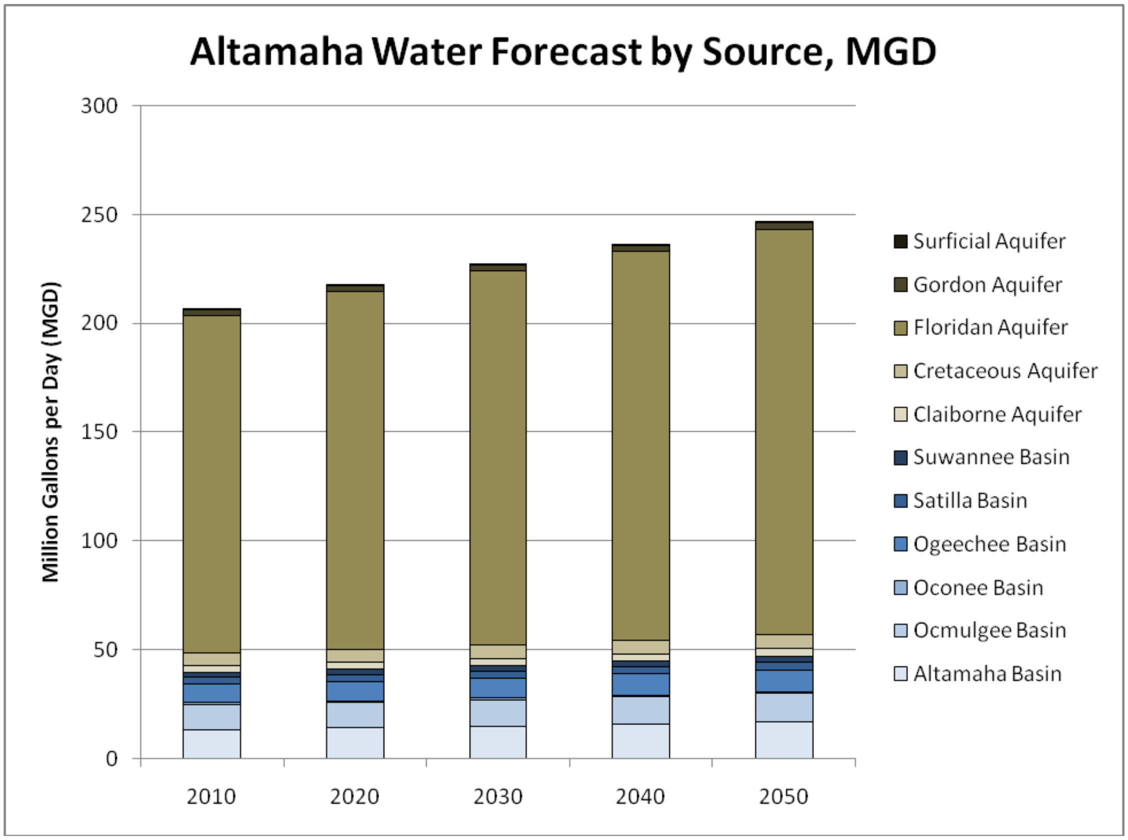
Figure 11 shows the aggregated county water forecasts by supply source for the Altamaha region in 2010 and 2050. **Figure 12** shows the aggregated regional forecast by supply source, identified by river basin for surface water withdrawals and aquifer for groundwater withdrawals. Overall, the regional forecasted water need is expected to increase by approximately 41 million gallons per day (MGD). Note that the agricultural livestock snapshot forecast of 3 MGD is not shown in Figure 11 and 12 because the source of water supply is currently unspecified.

All other water forecasts are associated with water source, either surface water (SW) shown in blue or groundwater (GW) shown in brown. **Table 20** shows the regional groundwater forecast by aquifer and surface water forecast by river basin. **Table 21** summarizes forecasted demands by county, source, and sector.



Note: Energy forecasts are not shown above. The 2010 energy forecast for surface water withdrawal is 50.5MGD with 32.7 MGD consumption. The 2050 energy forecast for surface water withdrawal is 100.5 MGD with 65.4 MGD consumption based upon the minimum threshold for power plant expansion. Water not consumed is returned to the surface water source. Livestock demands are also not shown because source of demand was not identified.

Figure 11: Altamaha Regional Water Forecast by Supply Source



Note: Energy forecasts are not shown in the figure above. Energy sector withdrawals are 51.03 MGD in 2010 and 50.47 MGD in 2020 all of which comes from the Altamaha Basin.

Figure 12: Altamaha Regional Water Forecast by Aquifer and Basin

Table 20: Altamaha Regional Water Demand Forecast by Supply Source

Supply Source		2010	2020	2030	2040	2050	Increase from 2010 to 2050	Percent of Demand by Source
Groundwater	Claiborne Aquifer	2.84	2.95	3.09	3.23	3.38	0.54	2%
	Cretaceous Aquifer	5.69	5.83	6.01	6.19	6.38	0.69	3%
	Floridan Aquifer	155.36	164.82	172.00	178.81	186.19	30.83	93%
	Gordon Aquifer	3.04	3.10	3.17	3.25	3.33	0.30	2%
	Surficial Aquifer	0.06	0.06	0.06	0.06	0.06	0.01	0.03%
	Groundwater Total	166.99	176.76	184.33	191.54	199.35	32.37	
	Groundwater Percent of Total	81%	81%	81%	81%	81%	-	
Surface Water	Altamaha Basin	13.40	14.04	14.85	15.76	16.78	3.38	34-36%
	Ocmulgee Basin	11.43	11.75	12.17	12.63	13.13	1.70	28-29%
	Oconee Basin	0.80	0.81	0.83	0.85	0.87	0.07	2%
	Ogeechee Basin	8.52	8.79	9.14	9.52	9.95	1.43	21%
	Satilla Basin	3.12	3.18	3.27	3.37	3.47	0.36	7-8%
	Suwannee Basin	2.45	2.55	2.66	2.79	2.94	0.49	6%
	Surface Water Total	39.72	41.12	42.92	44.92	47.17	7.42	
	Surface Water Percent of Total	19%	19%	19%	19%	19%	-	
Grand Total		**206.71**	**217.88**	**227.26**	**236.47**	**246.49**	**39.78**	

Note: Energy forecasts are not shown in the table above. Energy sector withdrawals are 51.03 MGD in 2010 and 50.47 MGD in 2020, all of which come from the Altamaha Basin. Basin and aquifer aggregated totals may not equal county-aggregated totals shown in Figure 11 because surface water agricultural irrigation forecasts by source were not disaggregated to the county level. The regional ratio of surface water irrigated acres in each basin was used to calculate the regional crop irrigation forecast by source basin.

Table 21: County Water Demand Forecast by Sector and Source

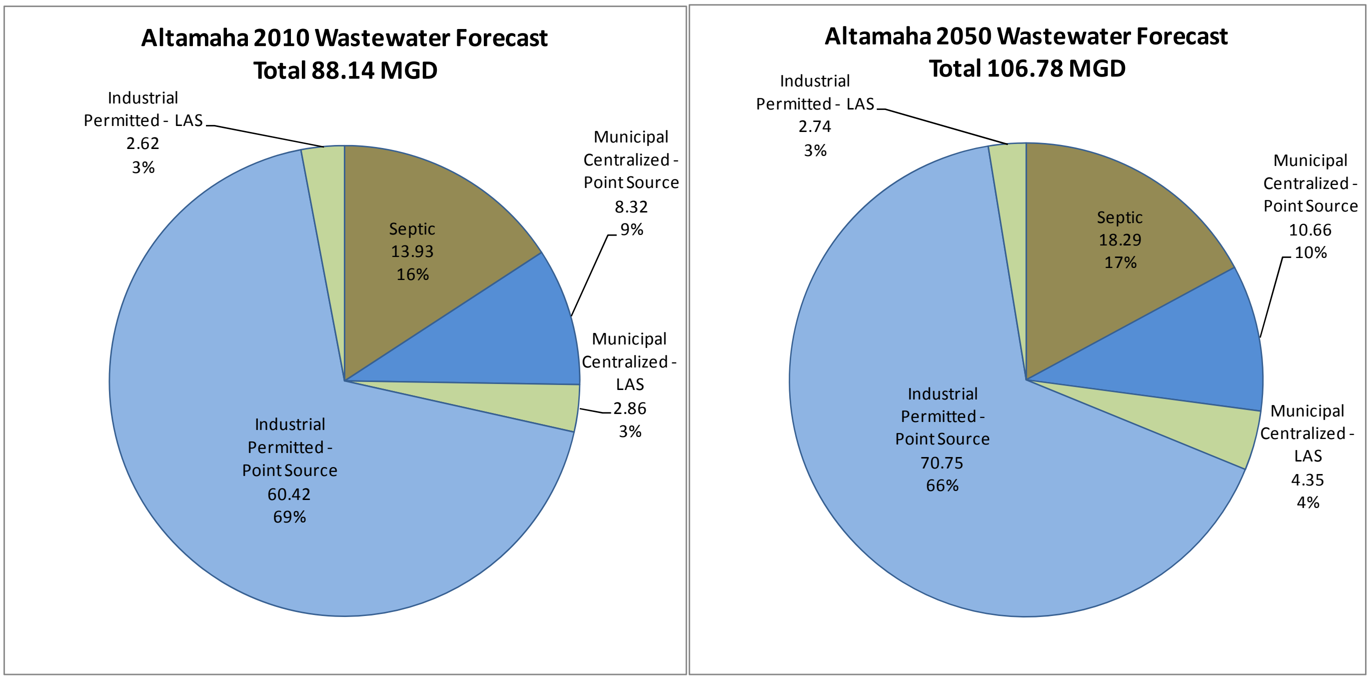
County	Sector	2010	2020	2030	2040	2050	Increase in Water Use from 2010 to 2050
Appling	GW Municipal public-supply	0.96	1.06	1.15	1.24	1.34	0.38
	GW Municipal self-supply	0.87	0.95	1.01	1.08	1.14	0.27
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	4.44	4.54	4.66	4.80	4.95	0.51
	GW Total	6.27	6.54	6.83	7.11	7.42	1.15
	SW Agricultural	1.24	1.27	1.31	1.35	1.40	0.16
	Total	7.50	7.81	8.13	8.47	8.82	1.31
Bleckley	GW Municipal public-supply	0.66	0.72	0.77	0.81	0.85	0.19
	GW Municipal self-supply	0.54	0.58	0.61	0.64	0.66	0.12
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	8.30	8.43	8.62	8.83	9.06	0.76
	GW Total	9.50	9.74	10.01	10.29	10.57	1.07
	SW Agricultural	2.85	2.89	2.95	3.01	3.07	0.22
	Total	12.36	12.63	12.96	13.29	13.64	1.29
Candler	GW Municipal public-supply	0.49	0.62	0.77	0.96	1.18	0.69
	GW Municipal self-supply	0.48	0.59	0.73	0.90	1.09	0.61
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	2.34	2.38	2.44	2.49	2.56	0.22
	GW Total	3.31	3.59	3.94	4.35	4.83	1.52
	SW Agricultural	2.83	2.89	2.97	3.05	3.14	0.30
	Total	6.15	6.48	6.91	7.40	7.97	1.82
Dodge	GW Municipal public-supply	1.33	1.43	1.53	1.55	1.57	0.24
	GW Municipal self-supply	0.96	1.01	1.06	1.05	1.04	0.08
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	9.23	9.53	9.91	10.32	10.77	1.53
	GW Total	11.52	11.98	12.49	12.92	13.37	1.85
	SW Agricultural	3.32	3.45	3.60	3.78	3.97	0.65
	Total	14.84	15.42	16.09	16.70	17.34	2.50

County	Sector	2010	2020	2030	2040	2050	Increase in Water Use from 2010 to 2050
Emanuel	GW Municipal public-supply	2.12	2.22	2.35	2.47	2.60	0.48
	GW Municipal self-supply	0.79	0.81	0.84	0.86	0.89	0.09
	GW Industrial	1.07	1.07	1.08	1.09	1.12	0.05
	GW Agricultural	3.78	3.90	4.05	4.21	4.39	0.60
	GW Total	7.77	8.01	8.31	8.64	9.00	1.23
	SW Agricultural	0.74	0.76	0.79	0.83	0.86	0.12
	Total	8.51	8.77	9.10	9.46	9.86	1.35
Evans	GW Municipal public-supply	0.59	0.67	0.75	0.82	0.88	0.30
	GW Municipal self-supply	0.44	0.50	0.55	0.60	0.64	0.20
	GW Industrial	1.68	1.68	1.69	1.72	1.76	0.08
	GW Agricultural	3.44	3.56	3.72	3.89	4.08	0.65
	GW Total	6.15	6.41	6.71	7.03	7.37	1.22
	SW Agricultural	3.58	3.76	3.99	4.25	4.53	0.95
	Total	9.73	10.17	10.69	11.27	11.90	2.17
Jeff Davis	GW Municipal public-supply	1.27	1.32	1.37	1.39	1.41	0.14
	GW Municipal self-supply	0.54	0.55	0.55	0.55	0.54	0.01
	GW Industrial	0.35	0.38	0.39	0.40	0.41	0.06
	GW Agricultural	3.92	4.04	4.19	4.35	4.52	0.60
	GW Total	6.08	6.29	6.49	6.69	6.88	0.80
	SW Agricultural	1.87	1.93	2.00	2.08	2.17	0.29
	Total	7.95	8.22	8.50	8.77	9.05	1.10
Johnson	GW Municipal public-supply	0.49	0.51	0.53	0.54	0.55	0.06
	GW Municipal self-supply	0.42	0.43	0.44	0.44	0.45	0.02
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	1.40	1.40	1.41	1.42	1.42	0.02
	GW Total	2.32	2.34	2.37	2.40	2.42	0.10
	SW Agricultural	0.36	0.36	0.36	0.36	0.37	0.01
	Total	2.68	2.70	2.73	2.77	2.79	0.11

County	Sector	2010	2020	2030	2040	2050	Increase in Water Use from 2010 to 2050
Montgomery	GW Municipal public-supply	0.63	0.71	0.78	0.82	0.86	0.23
	GW Municipal self-supply	0.27	0.30	0.33	0.34	0.35	0.08
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	2.08	2.11	2.15	2.20	2.26	0.18
	GW Total	2.97	3.12	3.26	3.37	3.47	0.49
	SW Agricultural	0.82	0.83	0.85	0.87	0.89	0.07
	Total	3.79	3.95	4.11	4.23	4.35	0.56
Tattnall	GW Municipal public-supply	1.17	1.35	1.55	1.76	1.98	0.81
	GW Municipal self-supply	1.09	1.25	1.41	1.57	1.74	0.65
	GW Industrial	0.02	0.02	0.02	0.02	0.02	0.00
	GW Agricultural	6.46	6.76	7.14	7.57	8.05	1.59
	GW Total	8.74	9.38	10.13	10.93	11.80	3.06
	SW Agricultural	9.35	9.86	10.51	11.23	12.03	2.68
	Total	18.09	19.24	20.64	22.16	23.83	5.74
Telfair	GW Municipal public-supply	1.30	1.35	1.41	1.45	1.48	0.18
	GW Municipal self-supply	0.32	0.32	0.33	0.33	0.33	0.02
	GW Industrial	0.09	0.10	0.11	0.11	0.12	0.03
	GW Agricultural	6.80	7.04	7.34	7.68	8.05	1.25
	GW Total	8.51	8.82	9.19	9.57	9.98	1.47
	SW Agricultural	1.77	1.83	1.92	2.02	2.12	0.36
	Total	10.28	10.65	11.11	11.58	12.10	1.82
Toombs	GW Municipal public-supply	2.83	3.09	3.31	3.57	3.92	1.09
	GW Municipal self-supply	0.72	0.78	0.81	0.86	0.92	0.20
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	5.39	5.76	6.21	6.72	7.30	1.90
	GW Total	8.94	9.63	10.33	11.16	12.14	3.20
	SW Agricultural	5.80	6.22	6.74	7.33	7.99	2.19
	Total	14.74	15.84	17.07	18.49	20.14	5.39

County	Sector	2010	2020	2030	2040	2050	Increase in Water Use from 2010 to 2050
Treutlen	GW Municipal public-supply	0.43	0.46	0.50	0.51	0.50	0.08
	GW Municipal self-supply	0.29	0.31	0.33	0.33	0.32	0.03
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	1.17	1.21	1.25	1.29	1.34	0.17
	GW Total	1.89	1.98	2.08	2.13	2.17	0.28
	SW Agricultural	0.41	0.42	0.44	0.45	0.47	0.05
	Total	2.30	2.40	2.51	2.58	2.63	0.33
Wayne	GW Municipal public-supply	2.23	2.47	2.71	2.93	3.15	0.92
	GW Municipal self-supply	1.29	1.41	1.51	1.60	1.68	0.39
	GW Industrial	59.06	63.90	65.96	67.48	69.16	10.10
	GW Agricultural	3.32	3.40	3.50	3.61	3.73	0.40
	GW Total	65.91	71.18	73.68	75.63	77.72	11.82
	SW Agricultural	0.38	0.39	0.40	0.41	0.43	0.04
	Total	66.29	71.57	74.08	76.04	78.15	11.86
Wheeler	GW Municipal public-supply	0.33	0.36	0.39	0.41	0.43	0.10
	GW Municipal self-supply	0.35	0.38	0.41	0.42	0.43	0.08
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	2.95	3.00	3.08	3.17	3.27	0.32
	GW Total	3.63	3.74	3.88	4.00	4.13	0.51
	SW Agricultural	0.95	0.97	1.01	1.04	1.08	0.13
	Total	4.58	4.72	4.88	5.04	5.21	0.64
Wilcox	GW Municipal public-supply	0.70	0.75	0.79	0.81	0.83	0.13
	GW Municipal self-supply	0.29	0.30	0.31	0.32	0.32	0.03
	GW Industrial	0.00	0.00	0.00	0.00	0.00	0.00
	GW Agricultural	12.50	12.96	13.55	14.21	14.95	2.45
	GW Total	13.49	14.01	14.65	15.34	16.10	2.61
	SW Agricultural	3.64	3.79	3.98	4.19	4.42	0.78
	Total	17.13	17.80	18.63	19.53	20.52	3.40

Figure 13 shows the aggregated county wastewater forecasts for the Altamaha region in 2010 and 2050. Overall, the regional forecasted wastewater flows are expected to increase by approximately 18.5 million gallons per day (MGD).



Note: Energy forecasts are not shown above. The 2010 energy forecast for returns is 17.8MGD. The 2050 energy forecast for returns is 35.1 MGD based upon the minimum threshold for power plant expansion.

Figure 13: Altamaha Regional Wastewater Forecast by Discharge Method

Appendix A: Development of Publicly–Supplied Water Use Rates (GPCD) by County

Altamaha Municipal GPCD Development by County

				Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]								Information Gathered during Follow Up							
County	Major Public Suppliers Listed by USGS[2]	Original USGS County GPCD[1]	USGS County GPCD After First Adjustment[2]	Population Served By Supplier[3]	Percent of County Population Served by Supplier[1,3]	Public Supply Withdrawals by Supplier[3] (MGD)	Major Public Supplier GPCD	Population-Weighted County GPCD	Population-Weighted GPCD percent above or below adjusted USGS value	Follow Up with Public Supplier?	Reason for Follow Up or Comments	Revised Population Served	Revised Water Withdrawal (MGD)	Wholesale Water Purchase (MGD)	Wholesale Water Sale (MGD)	Major Industrial Water Use (MGD)	Adjusted Major Public Supplier GPCD[4]	Adjusted Population-Weighted County GPCD[4]	Recommended County GPCD
Appling	City of Baxley	139.6	139.6	5,283	29%	0.87	165	150.5	7.8%	no									**140**
	City of Surrency			762	4%	0.04	52			no									
Bleckley	City of Cochran	39	115.0	5,680	47%	0.79	139	139	20.9%	no	One of the largest public suppliers in the region, feedback gathered prior before intial USGS adjustment								**115**
Candler	City of Metter	105.0	105.0	4,776	46%	0.44	92	91.0	-13.4%	no									**105**
	Town of Pulaski			280	3%	0.02	71			no									
Dodge	Town of Chauncey	98.2	98.2	400	2%	0.03	75	97.0	-1.2%	no								173.5	**173**
	Town of Chester			1,072	5%	0.08	75			no									
	City of Eastman			5,440	28%	0.58	107			yes	Inconsistencies in data between USGS and EPD withdrawal database	-	1.15	-	-	-	211.4		
	Town of Rhine			512	3%	0.03	59			no									

County	Major Public Suppliers Listed by USGS[2]	Original USGS County GPCD[1]	USGS County GPCD After First Adjustment[2]	Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]: Population Served By Supplier[3]	Percent of County Population Served by Supplier[1,3]	Public Supply Withdrawals by Supplier[3] (MGD)	Major Public Supplier GPCD	Population-Weighted County GPCD	Population-Weighted GPCD percent above or below adjusted USGS value	Follow Up with Public Supplier?	Reason for Follow Up or Comments	Information Gathered during Follow Up: Revised Population Served	Revised Water Withdrawal (MGD)	Wholesale Water Purchase (MGD)	Wholesale Water Sale (MGD)	Major Industrial Water Use (MGD)	Adjusted Major Public Supplier GPCD[4]	Adjusted Population-Weighted County GPCD[4]	Recommended County GPCD
Emanuel	City of Adrian	169.3	169.3	675	3%	0.05	74	169.2	-0.1%	no									**169**
	Town of Garfield			390	2%	0.03	77			no									
	Town of Nunez			192	1%	0.01	52			no									
	Town of Oak Park			348	2%	0.03	86			no									
	Town of Stillmore			615	3%	0.05	81			no									
	Town of Summertown			275	1%	0.02	73			no									
	City of Swainsboro			7,500	34%	1.54	205			yes	One of the largest public suppliers in the region and calculated GPCD above expected range, information pending								
	City of Twin City			1,825	8%	0.27	148			no									
Evans	City of Bellville	95.2	95.2	800	7%	0.03	38	83.1	-12.8%	no									**95**
	City of Claxton			4,082	36%	0.42	103			no									
	City of Daisy			336	3%	0.02	60			no									
	City of Hagan			1,404	12%	0.08	57			no									
Jeff Davis	City of Denton	70.5	70.5	323	2%	0.03	93	38.0	-46.1%	no								195.1	**195**
	City of Hazlehurst			10,999	84%	0.40	36			yes	Calculated GPCD value well below expected range and not consistent with USGS value	3,787	0.80	-	-	0.03	203.8		

Altamaha Municipal GPCD Development by County

County	Major Public Suppliers Listed by USGS[2]	Original USGS County GPCD[1]	USGS County GPCD After First Adjustment[2]	Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]					Population-Weighted GPCD percent above or below adjusted USGS value	Follow Up with Public Supplier?	Reason for Follow Up or Comments	Information Gathered during Follow Up					Adjusted Major Public Supplier GPCD[4]	Adjusted Population-Weighted County GPCD[4]	Recommended County GPCD
				Population Served By Supplier[3]	Percent of County Population Served by Supplier[1,3]	Public Supply Withdrawals by Supplier[3] (MGD)	Major Public Supplier GPCD	Population-Weighted County GPCD				Revised Population Served	Revised Water Withdrawal (MGD)	Wholesale Water Purchase (MGD)	Wholesale Water Sale (MGD)	Major Industrial Water Use (MGD)			
	Town of Kite			250	3%	0.02	80			no									
Johnson	Scott Water and Sewer	177.5	177.5	159	2%	0.02	126	183.8	3.5%	no								120.9	**121**
	City of Wrightsville			2,475	26%	0.49	198			yes	Calculated GPCD value well above expected range	3,975					123.3		
	Town of Ailey			825	9%	0.04	48			no									
	Town of Alston			169	2%	0.01	59			no									
Montgomery	City of Mt. Vernon	88.4	88.4	3,500	39%	0.34	97	84.6	-4.3%	yes	Member of municipal forecasting subcommittee	2,162					157.3	112.2	**112**
	Village of Tarrytown			130	1%	0.01	77			no									
	Town of Uvalda			765	9%	0.06	78			no									
	City of Cobbtown			567	0%	0.05	88			no									
	City of Collins			814	1%	0.04	49			no									
Tattnall	City of Glennville	120.8	120.8	4,698	4%	0.73	155	118.0	-2.3%	no									**121**
	City of Manassas			146	0%	0.01	68			no									
	City of Reidsville			3,183	2%	0.28	88			no									

Altamaha Municipal GPCD Development by County

				Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]								Information Gathered during Follow Up							
County	Major Public Suppliers Listed by USGS[2]	Original USGS County GPCD[1]	USGS County GPCD After First Adjustment[2]	Population Served By Supplier[3]	Percent of County Population Served by Supplier[1,3]	Public Supply Withdrawals by Supplier[3] (MGD)	Major Public Supplier GPCD	Population-Weighted County GPCD	Population-Weighted GPCD percent above or below adjusted USGS value	Follow Up with Public Supplier?	Reason for Follow Up or Comments	Revised Population Served	Revised Water Withdrawal (MGD)	Wholesale Water Purchase (MGD)	Wholesale Water Sale (MGD)	Major Industrial Water Use (MGD)	Adjusted Major Public Supplier GPCD[4]	Adjusted Population-Weighted County GPCD[4]	Recommended County GPCD
Telfair	City of Helena	140.0	140.0	2,256	17%	0.31	137	129.9	-7.2%	no									**140**
	Town of Jacksonville			195	1%	0.02	103			no									
	City of Lumber City			1,385	10%	0.19	137			no									
	City of McRae			4,550	34%	0.65	143			no									
	Town of Milan			1,100	8%	0.08	73			no									
	City of Scotland			291	2%	0.02	69			no									
Toombs	City of Lyons	146.8	146.8	5,300	19%	0.88	166	140.7	-4.2%	no									**147**
	City of Santa Claus			200	1%	0.03	150			no									
	City of Vidalia			13,050	48%	1.70	130			yes	One of the largest public suppliers in the region, information pending								
Treutlen	City of Soperton	127.8	127.8	3,378	50%	0.39	115	115	-9.7%	no									**128**
Wayne	City of Jesup	171.3	171.3	8,958	32%	1.79	200	186.7	9.0%	yes	One of the largest public suppliers in the region and calculated GPCD above expected range, information pending								**171**
	Town of Odum			417	1%	0.06	144			no									
	City of Screven			1,015	4%	0.09	89			no									

County	Major Public Suppliers Listed by USGS[2]	Original USGS County GPCD[1]	USGS County GPCD After First Adjustment[2]	Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]: Population Served By Supplier[3]	Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]: Percent of County Population Served by Supplier[1,3]	Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]: Public Supply Withdrawals by Supplier[3] (MGD)	Alternate GPCD Derived from EPD Drinking Water System Survey Data[3]: Major Public Supplier GPCD	Population-Weighted County GPCD	Population-Weighted GPCD percent above or below adjusted USGS value	Follow Up with Public Supplier?	Reason for Follow Up or Comments	Information Gathered during Follow Up: Revised Population Served	Information Gathered during Follow Up: Revised Water Withdrawal (MGD)	Information Gathered during Follow Up: Wholesale Water Purchase (MGD)	Information Gathered during Follow Up: Wholesale Water Sale (MGD)	Information Gathered during Follow Up: Major Industrial Water Use (MGD)	Adjusted Major Public Supplier GPCD[4]	Adjusted Population-Weighted County GPCD[4]	Recommended County GPCD
Wheeler	City of Alamo	140.9	140.9	1,040	16%	0.15	144	140.8	-0.1%	no									**141**
	City of Glenwood			1,162	17%	0.16	138			no									
Wilcox	City of Abbeville			2,029	23%	0.28	138			no									
	Town of Pineview			576	7%	0.08	139			no									
	City of Pitts	139.4	139.4	515	6%	0.06	117	137.0	-1.7%	no									**139**
	City of Rochelle			1,760	20%	0.25	142			no									
	Town of Seville			156	2%	0.02	128			no									

Maximum Altamaha Region County GPCD	**195**
Minimum Altamaha Region County GPCD	**95**
Population-Weighted Altamaha Regional GPCD	**140**

Sources:

1. USGS Water Use in Georgia by County for 2005

2. First Adjustments to USGS County GPCD :

Bleckley County - From EPD questionnaire completed by Jody Sapp, City of Cochran population served was 5,680 and average withdrawal rate was 0.79 MGD in FY 2009. From EPD withdrawal database, Middle Georgia College average withdrawal rate in 2005 was 0.07 MGD. From EPD DWSS, Middle Georgia College population served was 1,800. Adjusted USGS County GPCD includes revised City of Cochran data plus additional Middle Georgia College data.

3. Georgia EPD Drinking Water System Survey

4. Feedback from outreach to public suppliers

Yellow	Contact for more information due to discrepancy between USGS and EPD Survey values OR abnormally high or low values
Light blue	One of top suppliers in region based upon population served
Green	One of top suppliers flagged for followup due to data discrepancies or anomalies

Appendix B: Passive Conservation Per Capita Adjustment Calculation

Passive Conservation – Example Calculation of Per Capita Adjustment and Per Capita Adjustments by County

Atkinson County

2000 Housing Units (age of structure)			
	# of units	% of total	gallons/flush
2000-2005	62	2%	1.6
1994-2000	481	15%	1.6
1990-1994	341	11%	3.5
1980-1990	608	19%	3.5
Pre-1980	1,741	54%	5

Source: U.S. Census Bureau

2000 Population	7,609
2005 Population Estimate	7,968

Source: U.S. Census Bureau

2000 Estimate Total Housing Units	3,171
2005 Estimate Total Housing Units	3,233

Source: U.S. Census Bureau

2000 Household Size	2.4

Source: U.S. Census Bureau

Assumptions

ULFT gallons/flush	1.6
HET gallons/flush	1.28
# toilets per house	2 (assumed, can be modified)
# of flushes per day*	5.05 (assumed, can be modified)
Annual replacement rate of toilets (Equates to a 50 year life)	2% (assumed, can be modified)

**Residential End Uses of Water* (American Water Works Association, 1999)

Number of Toilets by Flush/Gallon Category

Gallons/flush	# of toilets	# of toilets calculation
1.6	1,427	= # of structures built between 1994 and 2005 plus half of the structures built from 1990-1994 times # toilets per house =((62+481)+(341/2))* 2
3.5	1,557	= # of structures built between 1980 and 1990 plus half of the structures built from 1990-1994 times # toilets per house =((608)+(341/2))* 2
5	3,482	= # of structures built before 1980 times # toilets per house =1,741*2
Total	6,466	

Annual Water (MG) by Flush/Gallon Toilets

Gallons/flush	Annual Water (MG)	Annual Water (MG) Calculation
1.6	5.2	=2005 population * (# of 1.6 gal/flush toilets)* # flushes per person per day * gal/flush * 365 / 1,000,000 =7,968 * 1,427 * 5.05 * 1.6 * 365 / 1,000,000
3.5	12.4	=2005 population * (# of 3.5 gal/flush toilets)* # flushes per person per day * gal/flush * 365 / 1,000,000 =7,968 * 1,557 * 5.05 * 3.5 * 365 / 1,000,000
5	39.5	=2005 population * (# of 5 gal/flush toilets)* # flushes per person per day * gal/flush * 365 / 1,000,000 =7,968 * 3,482 * 5.05 * 5 * 365 / 1,000,000
Total	57.1	

Toilet Replacement Calculation

	Year 0	Year 5	Replacement Calculation
Gal/Flush	# Toilets	# Toilets	Annual Toilets Replaced = Total # Toilets * 2% 6,466 * 2% = 129.32 Annual Toilets Replaced by Flush/Gal Category = # of Toilets in 2005 – (((Annual Toilets Replaced) * (% of Toilets in 2005 by Flush/Gal Category) * # Years)
1.28	0	647	= 129.32 * 5
1.6	1,427	1,284	= 1,427 – (((129 * (1,427/6,466)) * 5)
3.5	1,557	1,401	= 1,557 – (((129 * (1,557/6,466)) * 5)
5	3,482	3,134	= 3,482 – (((129 * (3,482/6,466)) * 5)
Total	6,466	6,466	

Annual Water Demand Calculation

	Year 0	Year 5	Annual Water Calculation, Year 5
Gal/Flush	Annual Water (MG)	Annual Water (MG)	=2005 population * (# of gal/flush toilets in year 5)* # flushes per person per day * gal/flush * 365 / 1,000,000
1.28	0	1.9	= (7,968 * (647/6,466)) * 5.05 * 1.28 * 365 / 1,000,000
1.6	5.2	4.7	= (7,968 * (1,284/6,466)) * 5.05 * 1.6 * 365 / 1,000,000
3.5	12.4	11.1	= (7,968 * (1,401/6,466)) * 5.05 * 3.5 * 365 / 1,000,000
5	39.5	35.6	= (7,968 * (3,134/6,466)) * 5.05 * 5 * 365 / 1,000,000
Total	57.1	53.3	

Per Capita Adjustment Calculation

= Annual Water (MG) savings from base year / 2005 population * 1,000,000 / 365

= (57.1 – 53.3) / 7,968 * 1,000,000 / 365

= 1.3 gallons per capita per day adjustment

Altamaha Passive Conservation Per Capita Adjustment by County

County	2010	2020	2030	2040	2050
Appling	0.0	2.5	5.0	7.5	10.0
Bleckley	0.0	2.6	5.2	7.8	10.5
Candler	0.0	2.5	5.1	7.7	10.2
Dodge	0.0	2.6	5.3	8.0	10.7
Emanuel	0.0	2.8	5.6	8.5	11.3
Evans	0.0	2.4	4.9	7.4	9.9
Jeff Davis	0.0	2.5	5.1	7.7	10.3
Johnson	0.0	2.7	5.4	8.1	10.8
Montgomery	0.0	2.4	4.8	7.3	9.7
Tattnall	0.0	2.7	5.4	8.1	10.8
Telfair	0.0	2.8	5.6	8.4	11.2
Toombs	0.0	2.7	5.3	8.0	10.7
Treutlen	0.0	2.6	5.3	8.0	10.7
Wayne	0.0	2.4	4.9	7.4	9.9
Wheeler	0.0	2.6	5.2	7.8	10.5
Wilcox	0.0	2.7	5.4	8.1	10.8

Appendix C: Municipal Wastewater – Calculating split between point source and land application systems by county

Municipal Wastewater – Calculating split between point source (PS) and land application systems (LAS) by county

Altamaha Region

County	Permit/ DMR	Facility	LAS	NPDES	Total	% PS
Appling[1]	Permit	Baxley LAS	0.24		1.20	80%
		City of Baxley		0.96		
Bleckley[2]	DMR	Cochran WPCP		1.2	1.20	100%
Dodge	Permit	Chester LAS	0.14		1.34	83%
		Eastman – Roach Branch WPCP		0.60		
		Eastman – South WPCP		0.51		
		Milan LAS	0.09			
Emanuel	Permit	Stillmore WPCP	0.07		2.18	77%
		Swainsboro WPCP		1.47		
		Twin City WPCP		0.21		
	DMR	Twin City LAS[3]	0.20			
		Swainsboro LAS[4]	0.23			
Evans	Permit	Claxton WPCP		0.21	0.21	100%
Jeff Davis	Permit	Hazlehurst – Bully Creek WPCP		0.56	0.56	100%
Montgomery	Permit	Ailey WPCP		0.04	0.33	90%
		Mount Vernon WPCP		0.25		
		Uvalda WPCP	0.03			
Tattnall	Permit	Glennville – Spring Branch WPCP		0.76	1.08	71%
	DMR	Reidsville Sherwood Forest	0.31			
	DMR	Collins Pond		0.02		
Toombs	Permit	Lyons – East Pond No. 1		0.44	2.70	49%
		Lyons – North WPCP No. 2		0.35		
		Santa Claus Pond		0.00		
		Vidalia WPCP		0.52		
	DMR	Vidalia LAS	1.38			
Treutlen	Permit	Soperton WPCP		0.37	0.37	100%

County	Permit/ DMR	Facility	LAS	NPDES	Total	% PS
		Treutlen County Development Authority		0.01		
Wayne	Permit	Jesup WPCP		2.93	3.08	95%
	DMR	Odum LAS	0.05			
		Screven WPCP	0.10			
Wheeler	Permit	Alamo WPCP		0.17	0.29	100%
		Glenwood WPCP		0.12		
Wilcox	Permit	Abbeville WPCP		0.00	0.20	100%
		Rochelle – Northwest WPCP		0.19		
		Rochelle – Southeast WPCP		0.01		

[1] City of Baxley has a dual LAS/NPDES permit. The permit database flows were confirmed by the DMR spreadsheet. The 2005 average of "Plant to Sprayfields" was used as the flow to LAS. The 2005 average of "Plant to River" was used as the flow that is NPDES

[2] Permit database showed City of Cochran flows for 2005 as 0 MGD. DMR showed 2005 flows of 1.20 MGD.

[3] DMR data received for Twin City LAS included 2009 and partial 2010 flows. The flow used is the average annual flow from 2009.

[4] 2005 flow data was not available in the DMR for Swainsboro LAS. 2007 flow was used to determine percent point source.