GEORGIA
WATER PLANNING

Upper Oconee Regional Water Planning Council

WATER & WASTEWATER FORECASTING TECHNICAL MEMORANDUM

Supplemental Material | Upper Oconee Regional Water Plan

APRIL 2024

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Section 1
Introduction

Municipal and Industrial Water and Wastewater Forecasts were originally developed for the Upper Oconee Regional Water Planning Council as part of the Georgia Comprehensive Statewide Water Management Plan (CSWMP) in 2011. Agricultural and Energy water needs were also identified and forecasted during the 2011 planning process. As part of the first 5-year review and revision of that plan, all of these forecasts, with the exception of the Industrial water and wastewater forecasts were updated in 2017. In support of the 2023 plan update, the Agricultural, Energy, Municipal, and Industrial water and wastewater forecasts have been updated. This Technical Memorandum describes how the forecasts have been updated to account for changes in population and water use that have occurred since the 2017 forecasts were produced. Throughout this report, the prior Regional Planning process that occurred in 2009 – 2011 is referred to as "Round 1" and the 2017 update is referred to as "Round 2". Thus, the current (2023) update is referred to as "Round 3". The basic approach to updating the forecasts starts with the same methodology used in developing the Round 2 forecasts, which are described in various Technical Memoranda, which were included as supplemental materials to the 2017 Upper Oconee Regional Water Plan[1]. The purpose of this Technical Memorandum is to describe where modifications to the Round 2 forecast methodology were made and to provide the revised forecast values.

1.1 General Methodology

The basic methodology for forecasting water demand is to estimate demand separately for each major water use sector. For each sector, water demand is estimated using a 'driver' multiplied by the 'rate of use'. The driver is defined as a countable unit that can be projected in future years, such as number of people, acres irrigated or megawatts of power. 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 per day, gallons per day per acre, or gallons per megawatt produced.

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

- **Municipal** – this sector includes domestic, commercial, and low 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

[1] See "Upper Oconee Regional Water Plan," dated June 2017 (available at https://waterplanning.georgia.gov/upper-oconee-regional-water-plan);

"Upper Oconee Water and Wastewater Forecasting Technical Memorandum", dated March 2017 (available at https://waterplanning.georgia.gov/upper-oconee-region-technical-information);

- **Energy -** this sector includes thermoelectric power generation

1.2 Population Update

State and County population projections are provided by the Governor's Office of Planning and Budget (OPB). These projections are used consistently throughout the state for multiple purposes such as transportation planning and allocation of education funds. The Georgia Environmental Protection Division (EPD) is required to use these population projections in statewide water planning. The 2010 Census statewide population count was lower than had been projected for 2010 in the Round 1 projections, although this trend of lower population than projected does not hold true for all counties. The Round 1 forecast had the State's population growing at an annual rate of 1.83% while the current updated forecast grows at an annual rate of only 0.83 percent as shown in **Figure 1-1**.

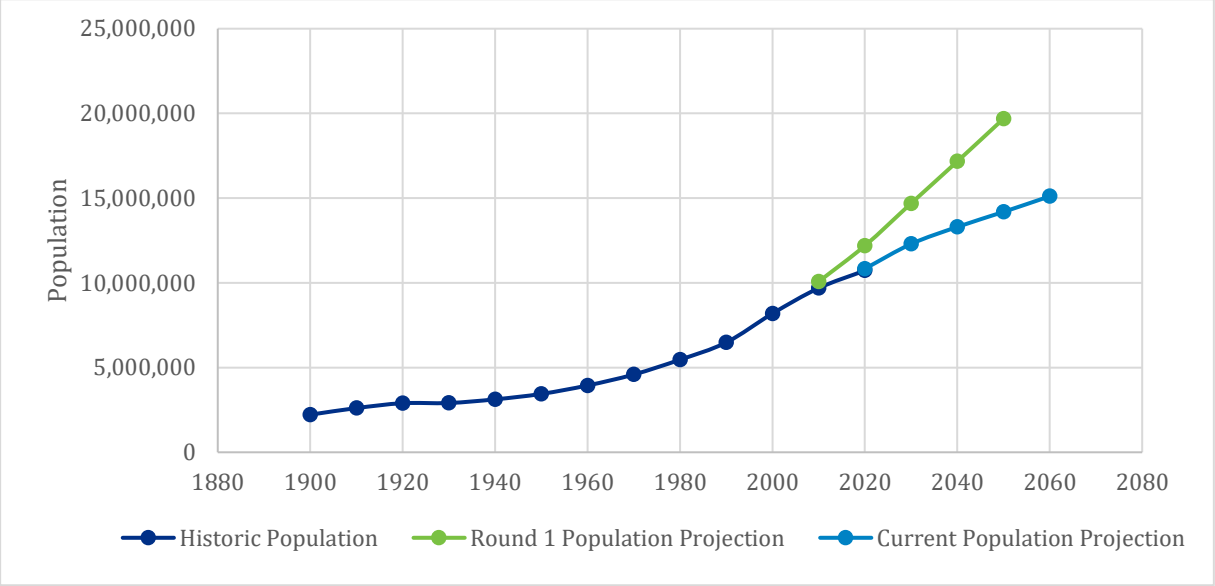

Figure 1-1
Georgia's Historic Population and Growth Projections

While the statewide trend shows a lower population in 2020 and beyond than previously projected, each county had its own individual trend. For the region as a whole, the OPB 2019 population projections are 2.4 percent higher than the OPB 2015 projections. Although, the new growth rate is slightly higher than in Round 2, the new projected population in 2050 is 31 percent less than the Round 1 estimate as shown in **Figure 1-2**. The new population projections (OPB, 2019) by county are shown in **Table 1-1**.

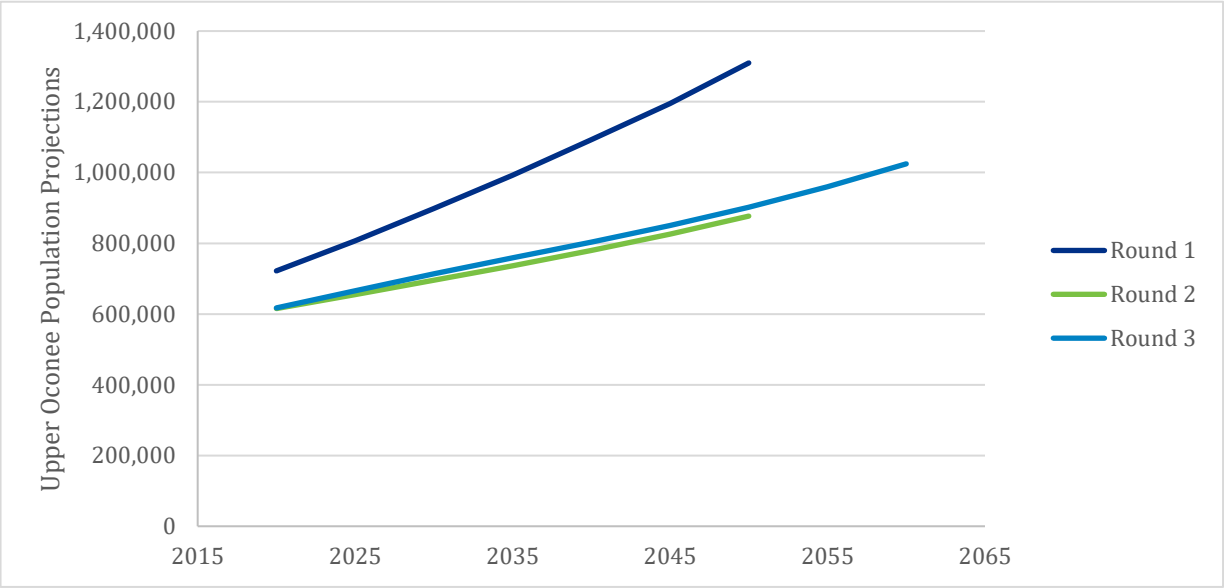

Figure 1-2
Upper Oconee Population Projections

Table 1-1 Population Projections by County

County	2020	2025	2030	2035	2040	2045	2050	2055	2060
Baldwin	44,428	44,033	43,637	42,429	41,221	39,673	38,125	36,966	35,806
Barrow	86,383	101,650	116,916	133,311	149,706	169,546	189,385	214,663	239,941
Clarke	129,779	137,942	146,104	152,472	158,840	163,856	168,872	174,972	181,071
Greene	18,717	20,632	22,546	23,526	24,505	25,760	27,014	28,998	30,982
Hancock	8,193	7,915	7,637	7,321	7,004	6,781	6,557	6,520	6,482
Jackson	74,700	85,097	95,493	105,291	115,088	125,858	136,627	148,718	160,808
Laurens	47,296	47,351	47,405	47,185	46,964	46,477	45,989	45,591	45,193
Morgan	19,138	19,948	20,757	21,598	22,438	23,322	24,206	25,267	26,328
Oconee	41,737	47,332	52,926	58,246	63,566	69,313	75,060	81,260	87,460
Putnam	21,885	22,097	22,308	22,325	22,341	22,410	22,478	22,844	23,209
Walton	95,814	102,497	109,179	116,900	124,621	133,307	141,993	152,323	162,652
Washington	20,302	20,156	20,009	19,731	19,452	19,024	18,595	18,331	18,066
Wilkinson	8,919	8,640	8,361	8,076	7,791	7,443	7,095	6,880	6,665
Total	**617,291**	**665,285**	**713,278**	**758,408**	**803,537**	**852,767**	**901,996**	**963,330**	**1,024,663**

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Section 2
Municipal Water Forecasting

This section describes the methodology and results of municipal water demand forecasts for the Upper Oconee Planning Region.

2.2 Methodology

The county level municipal water demand includes both public-supplied (i.e., utility) water demand and self-supplied (i.e., private well) water demand. The self-supplied water is associated with groundwater use, while the public-supply water is associated with either surface water or groundwater use as indicated by active permit data. Each county has an average weighted per capita water use value that was derived from an analysis of all reporting utilities within each county. In Round 1, 2005 utility data was used to determine the gpcd average for each county. In Round 2, the Round 1 gpcd values were adjusted based on the utility level data over the most recent four years. In Round 3, the county gpcd averages were based on utility water loss audits and then vetted through the regional councils. The following sections describe updates to the previous methodology used to produce the revised forecasts.

2.1.1 Percent Change in Gallons per Capita per Day

The Georgia EPD compiled and reviewed water loss audit data reported annually for water systems serving populations of 3,300 or more as mandated by the Georgia Water Stewardship Act (2011). The water supplied input value from the audit information was then divided by the population served from EPA's Safe Drinking Water Information System (SDWIS) database to calculate the total per capita water use of a system. A weighted average for counties with more than one system was developed using water loss audit data from 2015 to 2018. To account for treatment loss, three percent was added to counties that have a surface water treatment plant as these systems typically have an in-plant water use that offsets the water produced.

If no data were available to Georgia EPD, withdrawal information was divided by the population served value provided by the SDWIS database to calculate the per capita water use. Of the counties with available data, roughly one-half had a decrease in GPCD while the other half showed an increase in GPCD. Note that a decrease in GPCD could be due to conservation and water loss control efforts during this time period, or other factors such as an increase in population with less increase in water use, or a drop in water use (e.g., loss of industrial customer) with the same population. **Table 2-1** shows the updated relative to the Round 2 GPCD for each county in the region.

The self-supplied value of 75 GPCD for each county remains unchanged from Round 1.

Table 2-1 Per Capita Demand Values by County, GPCD

County	Round 2 Per Capita	Updated Per Capita	% Change
Baldwin	137	146	6.6%
Barrow	153	99	-35.3%
Clarke	167	93	-44.3%
Greene	160	160	0.0%
Hancock	120	192	60.0%
Jackson	110	129	17.3%
Laurens	153	166	8.5%
Morgan	163	220	35.0%
Oconee	136	125	-8.1%
Putnam	129	95	-26.4%
Walton	142	108	-23.9%
Washington	191	219	14.7%
Wilkinson	135	65	-51.9%

2.1.2 Plumbing Code Adjustment Factor

In Rounds 1 and 2, the GPCD for each county was reduced over time due to the effects of plumbing codes based upon the age of housing stock in each county. Over time, as new houses are built with more efficient water fixtures, the county average GPCD will decrease. Previously, a reduction (adjustment) was calculated for each county starting with zero in 2010 (the base year in Round 1) and increasing over time. For the current update, the plumbing code adjustment was extrapolated from the 2017 Regional Water Plan plumbing code adjustment . The revised plumbing code adjustment was then applied to both public-supplied and self-supplied water demand. **Table 2-2** shows the municipal public-supplied GPCD value over time for each county.

Table 2-2 Adjusted Public-Supplied GPCD

County	2020	2025	2030	2035	2040	2045	2050	2055	2060
Baldwin	146.3	145.1	143.9	142.6	141.4	140.2	138.9	137.7	136.5
Barrow	99.2	98.4	97.5	96.7	95.9	95.0	94.2	93.4	92.5
Clarke	93.2	92.0	90.8	89.7	88.5	87.3	86.1	84.9	83.7
Greene	160.0	159.0	158.0	156.9	155.9	154.8	153.8	152.7	151.7
Hancock	191.8	190.5	189.2	187.9	186.7	185.4	184.1	182.8	181.5
Jackson	129.2	128.3	127.4	126.5	125.6	124.7	123.8	122.8	121.9
Laurens	166.1	164.8	163.5	162.3	161.0	159.7	158.4	157.2	155.9
Morgan	219.8	218.7	217.6	216.5	215.4	214.3	213.2	212.1	211.0
Oconee	124.5	123.6	122.7	121.8	120.9	120.0	119.1	118.1	117.2
Putnam	95.0	94.0	93.1	92.1	91.1	90.2	89.2	88.3	87.3
Walton	107.9	107.0	106.2	105.4	104.5	103.7	102.8	102.0	101.1
Washington	219.0	217.7	216.4	215.0	213.7	212.4	211.1	209.7	208.4
Wilkinson	64.6	63.3	62.0	60.7	59.4	58.1	56.8	55.5	54.2

2.3 Municipal Water Forecasting Results

Table 2-3 shows the forecasted municipal water demand in millions of gallons per day (MGD) (public-supplied and self-supplied) by county in the Upper Oconee Region. The total regional demand is shown graphically in **Figure 2-1** along with a comparison of the Round 1 and Round 2 estimates. Region-wide the current municipal forecast is lower than in Round 1 and Round 2 due to the combination of lower population projections and generally lower per capita water use values.

Table 2-3 Average Annual Municipal Water Demand Forecast by County (MGD)

County	2020	2025	2030	2035	2040	2045	2050	2055	2060	% Change
Baldwin	6.41	6.30	6.19	5.96	5.74	5.48	5.21	5.01	4.81	-25.1%
Barrow	8.68	10.19	11.60	13.10	14.57	16.33	18.04	20.21	22.34	157.3%
Clarke	11.59	12.22	12.86	13.35	13.83	14.13	14.42	14.74	15.05	29.9%
Greene	2.69	2.95	3.20	3.31	3.42	3.57	3.72	3.96	4.20	55.8%
Hancock	1.53	1.46	1.40	1.34	1.27	1.22	1.17	1.15	1.14	-25.4%
Jackson	9.12	10.31	11.47	12.55	13.61	14.77	15.91	17.18	18.42	102.1%
Laurens	5.84	5.79	5.73	5.64	5.56	5.44	5.32	5.22	5.11	-12.4%
Morgan	2.69	2.78	2.87	2.97	3.06	3.15	3.24	3.36	3.47	28.9%
Oconee	4.63	5.21	5.78	6.30	6.82	7.37	7.91	8.49	9.06	95.5%
Putnam	2.08	2.08	2.08	2.06	2.04	2.02	2.01	2.02	2.03	-2.8%
Walton	9.66	10.25	10.82	11.49	12.14	12.87	13.59	14.44	15.28	58.1%
Washington	3.28	3.23	3.18	3.11	3.04	2.94	2.85	2.79	2.72	-16.8%
Wilkinson	1.01	0.98	0.95	0.92	0.90	0.87	0.83	0.81	0.79	-21.9%
Total	**69.22**	**73.75**	**78.14**	**82.11**	**85.99**	**90.16**	**94.23**	**99.38**	**104.42**	**50.9%**

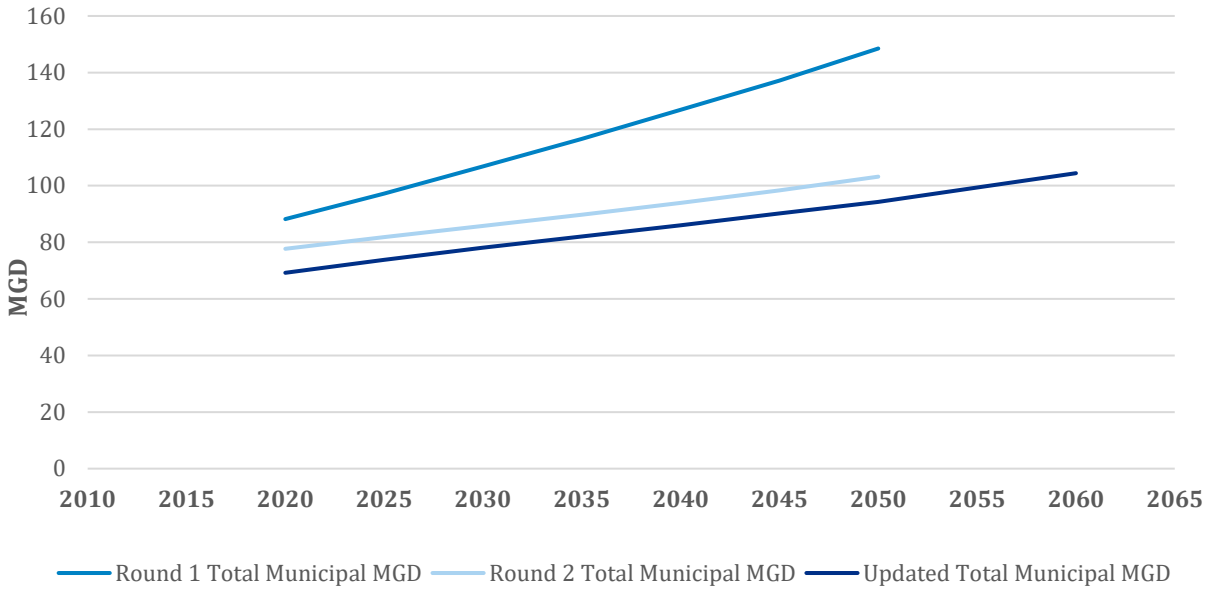


Figure 2-1
Forecasted Municipal Water Demand for Upper Oconee Planning Council

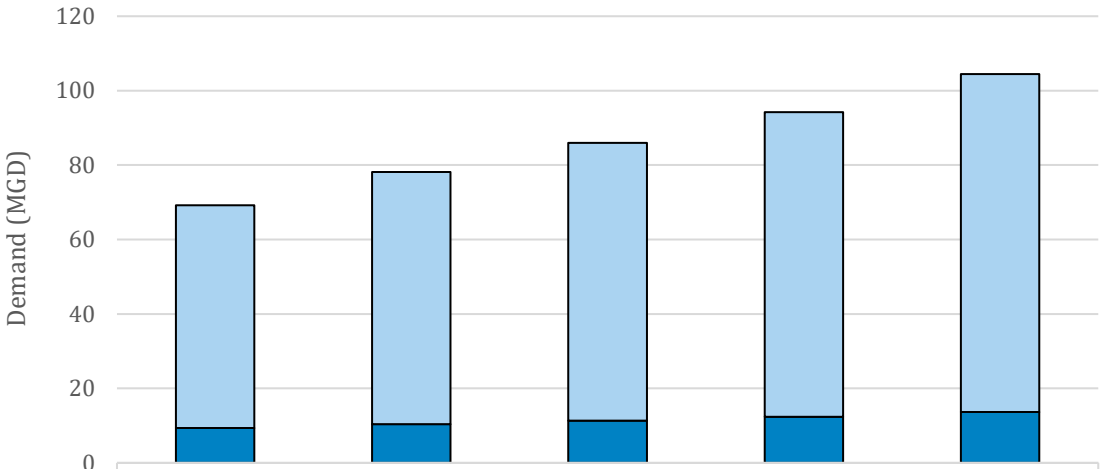
2.4 Municipal Water Forecast Allocations

As noted above, the municipal water demand for each county is the summation of the public- supplied and self-supplied water demand estimates for each county. This ratio of the public-supplied and self-supplied county population was derived from 2015 United States Geological Survey (USGS) estimates and were vetted through the regional council and stakeholder review process. The percent of the population that is public-supplied and self-supplied varies from Round 2. The change in the self-supplied ratio in combination with the change in county population resulted in a 3 percent decrease in self-supplied water demand from Round 2. **Figure 2-2** shows the split between self-supply versus public-supply water demand for the region.

As in the prior forecasts, it is assumed that all self-supplied (i.e., domestic residential) water use is from groundwater. The allocation of public-supplied municipal water among surface water and groundwater sources was determined in Rounds 1 and 2 by an analysis of surface water and groundwater permitted water withdrawals for municipal use by county. The percent of county public-supply municipal water from surface water and groundwater used to allocate the current county public-supply water demand by sources was obtained from 2019 permitted withdrawals. The allocation of public-supply water demand by aquifer (for the groundwater models) and surface water basin was also obtained from 2019 permitted withdrawals. The allocation of the self-supplied water demand by aquifer was based on assignment of major aquifers to counties.

Thus, the current county municipal water demand forecasts are allocated among surface water basins and groundwater aquifers for analysis with other components of the state water plan update. For the Upper Oconee Region, the majority of municipal water is from

surface water (75 percent), as shown in **Figure 2-3**.



	2020	2030	2040	2050	2060
Public Supply	59.9	67.7	74.6	81.8	90.8
Self-Supply	9.4	10.4	11.4	12.4	13.7

Figure 2-2
Self-Supply Versus Public-Supply of Municipal Water Demand

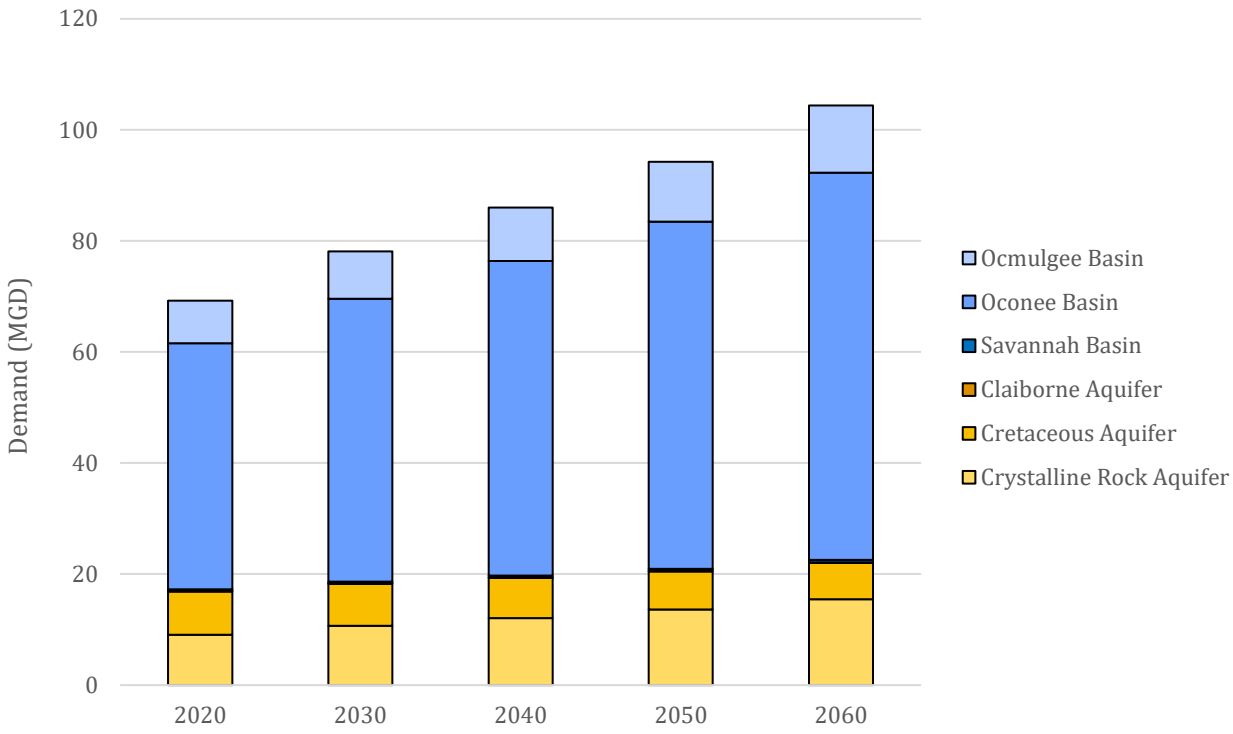


Figure 2-3
Municipal Water Demand for Upper Oconee Planning Council by Aquifer and Basin (MGD)

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Section 3
Municipal Wastewater Forecasting

This section describes the methodology and results of the current municipal wastewater demand forecasts for the Upper Oconee Planning Region.

3.1 Methodology

Within the previous analyses (i.e., Round 1, Round 2), the municipal water demand served as the basis for estimating the municipal wastewater flows for each county with a portion of the water demand assumed to be indoor use that entered the centralized wastewater treatment system or septic system. While self- supplied water demand was assumed to go to a septic system, public-supplied water in each county had a proportion going to septic and a portion to centralized treatment based on existing Georgia EPD permit data. Unlike the previous forecasts, a percentage was then added to centralized flows for inflow and infiltration (I/I) as I/I is accounted for in the reported discharge data. The centralized flow estimate was then allocated between point discharge (NPDES) and land application systems (LAS) based on reported discharges.

For the current update, the Georgia EPD provided an analysis of 2019 NPDES permitted discharges by county and a recommended methodology for the municipal wastewater forecast.

- The percent of county total wastewater flow that is septic was estimated based on Georgia Department of Public Health estimates of septic systems installed by county or based on percentage of septic households from 1990 census data.
- Future septic flow by county is estimated using the estimated 2019 septic flow from EPD multiplied by the percent change in county population from 2019 to each planning year (2020, 2030, 2040, 2050, and 2060).
- The sum of annual average 2019 NPDES point discharges by county are increased/decreased over time with the rate of change in the new county population projections to derive the new point discharge forecast for the county. The percent of county that is septic/centralized remained constant over time.
- Industrial flows larger than 0.2 MGD that are treated at the municipal wastewater facilities were removed from updated industrial wastewater data and added to the 2060 municipal wastewater forecast.
- The sum of annual average 2015 - 2019 land application system (LAS) flows by county are combined with any 2015 - 2019 subsurface flows (if any), and increased/decreased over time with the rate of change in the new county population projections to derive the new LAS + subsurface forecast for the county.

- The current LAS + subsurface flow forecast for the county is allocated among watershed basins based on the permit locations of the 2015 - 2019 (LAS and subsurface) flows in the county.
- County centralized flow is the sum of the point source discharges and LAS and subsurface discharges.
- County total wastewater flow is the sum of the centralized and septic flows.

3.2 Results

Table 3-1 shows the forecasted municipal wastewater generated per county in the Upper Oconee region. The total regional wastewater forecast is shown graphically in **Figure 3-1** separated between septic treatment and centralized treatment that is discharged via a point source or land application. **Figure 3-2** gives a snapshot of how the regional wastewater was discharged per watershed in 2020.

Table 3-1 Total Wastewater Generated in Upper Oconee Planning Region by County (MGD)

County	2020	2030	2040	2050	2060	% Change 2020 to 2060
Baldwin	4.95	4.86	4.59	4.25	3.99	-19.4%
Barrow	6.06	8.20	10.49	13.28	16.82	177.8%
Clarke	16.77	18.96	20.70	22.13	23.81	42.0%
Greene	1.42	1.71	1.86	2.05	2.35	65.5%
Hancock	0.87	0.81	0.74	0.70	0.69	-20.9%
Jackson	9.15	11.69	14.09	16.73	19.69	115.3%
Laurens	5.36	5.38	5.33	5.22	5.13	-4.4%
Morgan	1.39	1.51	1.63	1.76	1.91	37.6%
Oconee	4.16	5.27	6.33	7.47	8.71	109.6%
Putnam	1.45	1.47	1.48	1.49	1.53	6.0%
Walton	7.29	8.30	9.48	10.80	12.37	69.8%
Washington	2.29	2.25	2.19	2.09	2.03	-11.0%
Wilkinson	0.54	0.50	0.47	0.43	0.40	-25.3%
Total	**61.67**	**70.92**	**79.38**	**88.38**	**99.43**	**61.2%**

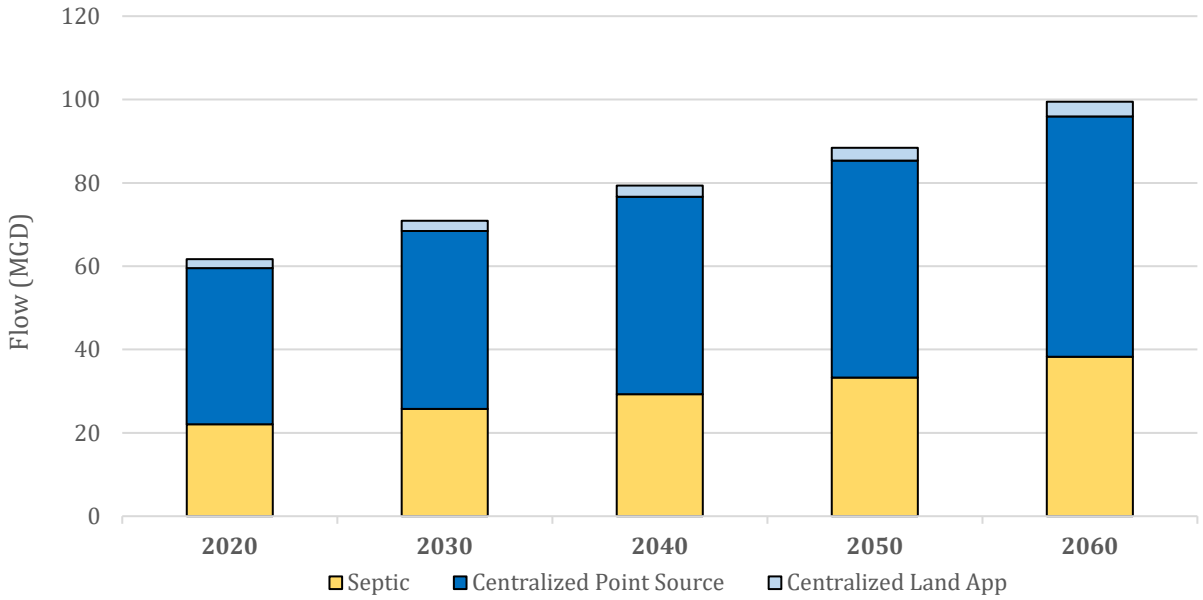

Figure 3-1
Total Wastewater Generated Upper Oconee Planning Region by Type

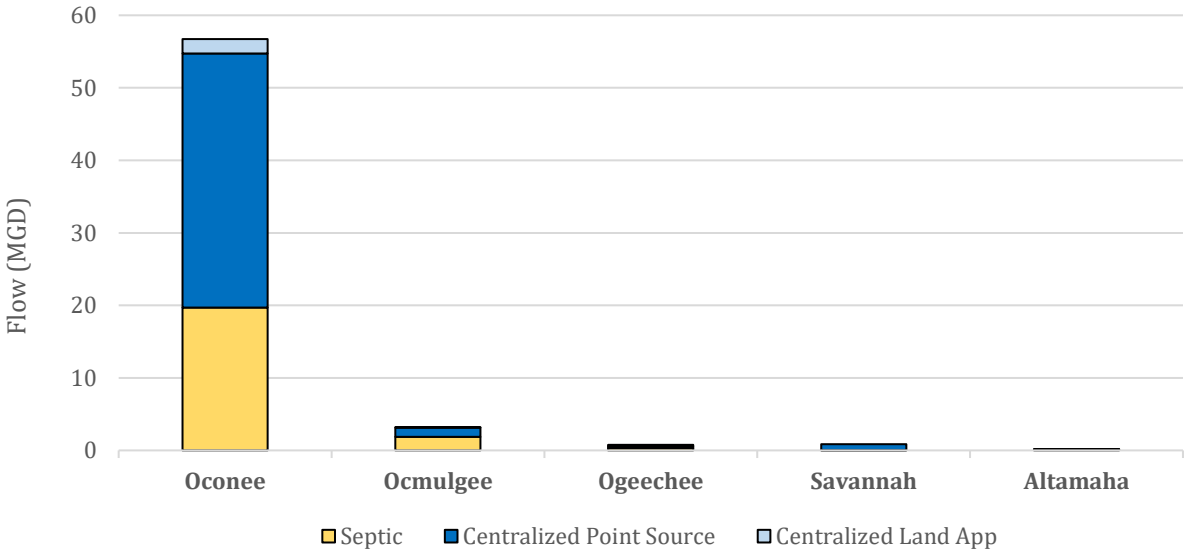

Figure 3-2
2020 Snapshot of Wastewater Discharge Type by Watershed

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Section 4
Industrial Forecasting

This section describes the methodology and results of industrial water and wastewater demand forecasts for the Upper Oconee Planning Region.

4.1 Methodology

The original industrial water and wastewater forecast methodology was based on employment projections per industry with the 2010 water use multiplied by the expected employment growth rate into the future for that type of industry. The industrial wastewater flow was then estimated from a wastewater to water ratio developed for each industrial category. The original forecast was not updated during the 2017 forecast revision process.

In support of the current update, EPD identified industrial representatives throughout the State of Georgia to form an industrial water demand forecast stakeholder advisory group to represent the state's thirteen largest industrial water use sectors. It was then determined that employment projections were not a valid basis for estimating future water requirements of industries as water requirements are a function of production of which automation has reduced the number of employees per unit of production. Separate industrial sub-sector groups were subsequently formed to examine trends in water use for food processing, paper and forest products, mining, and manufacturing. The sub-sector advisory groups worked independently to review a variety of considerations for estimating future water demand and determined a variety of common and sector-specific conclusions.

Data was confidentially collected within the sub-sectors through trade association surveys and merged with EPD withdrawal data. The basis of projected water use for the majority of industrial facilities used the 10-year average water withdrawals from 2010 to 2019, however, there were some instances where data was limited to a 5-year average from 2015 or 2019 or reported water use for 2019.

It should be noted that information was shared between the industrial forecast team and the municipal forecast team to adjust for large industries supplied by municipal water systems. As a result, the municipal forecast excludes large industrial users from the municipal water use per capita and municipal water demand calculations.

4.2 Results

Table 4-1 shows the current (Round 3) industrial water demand by county as well as the percent increase in demand between 2020 and 2060. **Table 4-2** shows the same water demand broken down by industry with the majority of water demand occurring in the mining and paper industrial classification category. Currently, 64 percent of the industrial water demand in the region comes from groundwater and the percentage is projected to remain the same in the future.

Table 4-3 provides the forecast of industrial wastewater generated per county while **Table 4-4** gives the wastewater demand by discharge method. Data from stormwater discharge permits are not included in the analysis because stormwater is accounted for in the resource assessment from precipitation data. The majority of industrial wastewater in the Planning Region is discharged via permitted point sources for the industrial facilities.

Table 4-1 Industrial Water Demand Forecast by County (MGD)

County	2020	2030	2040	2050	2060	% Change 2020 to 2060
Baldwin	0.36	0.36	0.36	0.36	0.36	0%
Barrow	0.65	1.03	1.24	1.36	1.43	120%
Clarke	1.39	1.70	2.05	2.26	2.37	71%
Greene	0.00	0.00	0.00	0.00	0.00	0%
Hancock	0.00	0.00	0.00	0.00	0.00	0%
Jackson	0.57	0.83	1.00	1.10	1.16	104%
Laurens	12.71	12.71	12.71	12.71	12.71	0%
Morgan	0.18	0.18	0.18	0.18	0.18	0%
Oconee	0.00	0.00	0.00	0.00	0.00	0%
Putnam	0.07	0.07	0.07	0.07	0.07	0%
Walton	0.00	0.00	0.00	0.00	0.00	0%
Washington	12.53	12.53	12.53	12.53	12.53	0%
Wilkinson	9.06	9.06	9.06	9.06	9.06	0%
Total	**37.52**	**38.47**	**39.20**	**39.63**	**39.87**	**6.3%**

Table 4-2 Industrial Water Demand Forecast by Industry (MGD)

Industry	2020	2030	2040	2050	2060
Food	2.61	3.56	4.30	4.72	4.96
Manufacturing	0.35	0.35	0.35	0.35	0.35
Mining	21.69	21.69	21.69	21.69	21.69
Paper	12.87	12.87	12.87	12.87	12.87
TOTAL	**37.52**	**38.47**	**62.53**	**39.63**	**39.87**

Table 4-3 Industrial Wastewater Generation Forecast by County (MGD)

County	2020	2030	2040	2050	2060	% Change 2020 to 2060
Baldwin	0.00	0.00	0.00	0.00	0.00	0%
Barrow	0.43	0.67	0.81	0.89	0.94	120%
Clarke	2.40	2.70	3.04	3.24	3.36	40%
Greene	0.00	0.00	0.00	0.00	0.00	0%
Hancock	0.53	0.53	0.53	0.53	0.53	0%
Jackson	0.56	0.82	0.99	1.09	1.15	105%
Laurens	11.26	11.27	11.29	11.29	11.30	0%
Morgan	0.00	0.00	0.00	0.00	0.00	0%
Oconee	0.00	0.00	0.00	0.00	0.00	0%
Putnam	0.00	0.00	0.00	0.00	0.00	0%
Walton	0.00	0.00	0.00	0.00	0.00	0%
Washington	11.77	11.77	11.77	11.77	11.77	0%
Wilkinson	3.41	3.41	3.41	3.41	3.41	0%
Total	**30.36**	**31.17**	**31.84**	**32.22**	**32.44**	**6.9%**

Note: Stormwater discharges from mining are not included.

Table 4-4 Industrial Wastewater Generation Forecast by Discharge Method (MGD)

Discharge Method	2020	2025	2030	2035	2040	2045	2050	2055	2060
Industrial – Point Source	28.32	28.45	28.50	28.56	28.61	28.65	28.68	28.70	28.72
Industrial – LAS	0.67	0.91	1.01	1.11	1.21	1.27	1.33	1.36	1.40
Industrial to Municipal Publicly Owned Treatment Plant (POTW)	1.37	1.51	1.67	1.84	2.01	2.11	2.21	2.27	2.32
Total Industrial Discharge	**30.36**	**30.87**	**31.17**	**31.51**	**31.84**	**32.04**	**32.22**	**32.33**	**32.44**

Note: Stormwater discharges from mining are not included.

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Section 5
Agricultural Water Forecasting

This section describes the methodology and results of agricultural water demand forecasting for the Upper Oconee Planning Region.

5.1 Methodology

Agricultural water demand forecasts were originally developed, and recently updated, by the Georgia Water Planning & Policy Center at Albany State University (GWPPC), with support from the University of Georgia's (UGA) College of Agricultural and Environmental Sciences. GWPPC was contracted by Georgia EPD to prepare estimates of current and future use of water by the agricultural sector in Georgia. The basic methodology involved estimating the projected irrigated area for each crop type and multiplying that area by the predicted monthly irrigation need in inches per each crop type. The proportion of irrigation water derived from different water source types was also considered. The projections cover row and orchard crops as well as most vegetable and specialty crops accounting for more than 95 percent of Georgia's irrigated land.
Additionally, estimates of current use are made for animal agriculture, horticultural nurseries and greenhouses, as well as golf courses. Golf courses with a water withdrawal permit are included in the estimates of crop irrigation water use, although the acreage is small in comparison to other crops. Some golf courses without withdrawal permits may be included with horticultural nurseries and greenhouses.

Field observations, aerial surveys, and remote sensing were used to identify the 2020 irrigated acres by county. USDA projections, the Southeast Model, Georgia Model and data trends were used by the project team to project crop acreage by county through 2060. The number of irrigated acres has increased from 2015 to 2020 in most counties. Therefore, the projected irrigated crop acreage for 2060 is higher than previous forecasts for most counties. Crop water needs estimates from 2015-2016 were reviewed and updated with data from recent crop metering data. Prior agricultural forecasts assumed that only 70 percent of surface water withdrawals were applied. This assumption was removed for the updated forecast. Estimates were developed for crop irrigation from groundwater and surface water from 2020 to 2060. Water use estimates for animals and horticulture were estimated by county for 2020 and held constant over time. Water use for animals and horticulture is assumed to be groundwater.

To address potential climate extremes, a range of agricultural demand scenarios were considered including wet, normal and dry years. The 75th percentile of water demand was selected to represent dry year conditions when higher irrigation demands are expected. For planning purposes, GWPPC used the 75th percentile values for each Region to represent a more conservative scenario than the median value. It is the 75th percentile demands that are presented in this report.

5.2 Results

Table 5-1 shows the forecasted agricultural water needs by county in the Upper Oconee Region. The region as a whole is expected to see an increase of 21 percent in agricultural water demand by 2060. **Figure 5-1** shows the agricultural demands split by basin for surface water and aquifer for groundwater with the same data also provided in **Table 5-2**. Currently 86 percent of the agricultural demand in the Upper Oconee Region is met from groundwater.

Table 5-1 Upper Oconee Agricultural Demand Forecast by County (MGD)

County	2020	2030	2040	2050	2060	Percent Increase 2020 to 2060
Baldwin	0.18	0.18	0.18	0.18	0.18	0%
Barrow	0.18	0.18	0.18	0.18	0.18	0%
Clarke	0.68	0.68	0.68	0.72	0.68	0%
Greene	0.57	0.57	0.57	0.58	0.57	0%
Hancock	0.19	0.19	0.19	0.19	0.19	1%
Jackson	1.02	1.02	1.02	1.02	1.02	0%
Laurens	12.60	12.91	13.41	14.22	14.61	16%
Morgan	3.06	3.10	3.16	3.23	3.31	8%
Oconee	2.89	2.89	2.89	2.90	2.89	0%
Putnam	2.01	2.01	2.02	2.04	2.05	2%
Walton	2.17	2.17	2.17	2.16	2.17	0%
Washington	15.40	16.42	17.91	19.82	21.71	41%
Wilkinson	0.24	0.25	0.25	0.26	0.27	12%
Total	**41.2**	**42.6**	**44.6**	**47.5**	**49.8**	**21%**

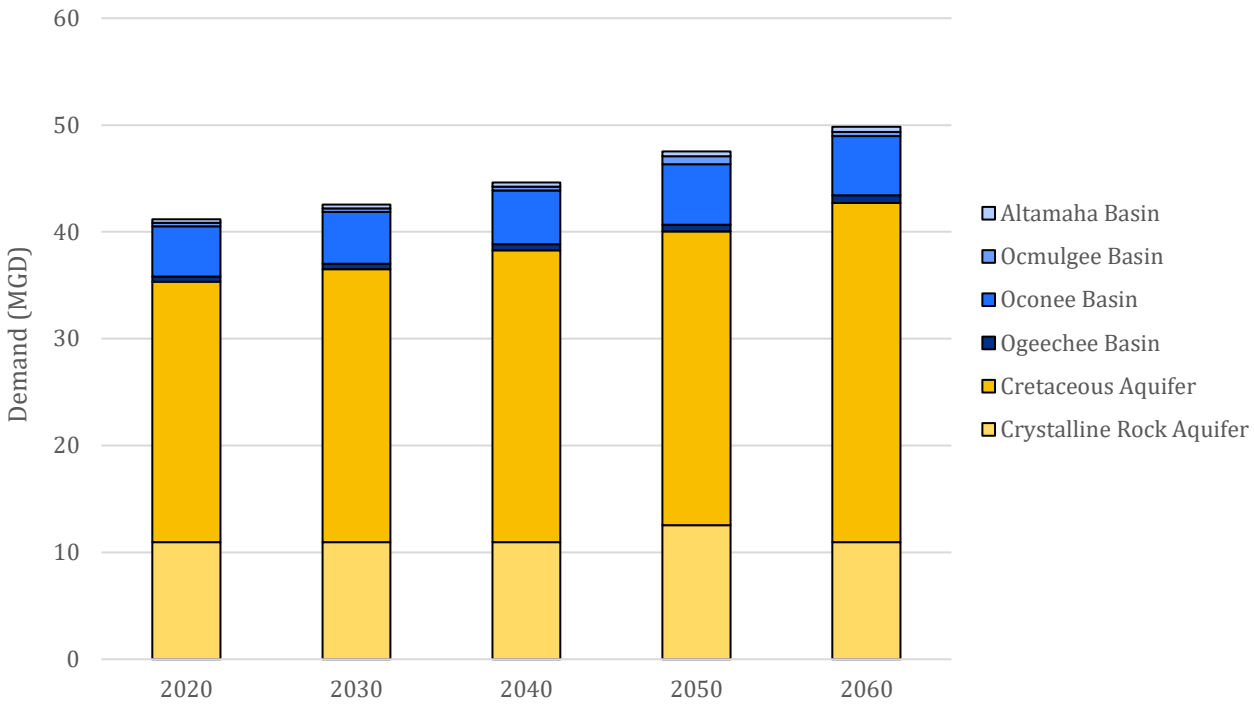

Figure 5-1
Agricultural Water Demand by Source Water Type

Table 5-2 Upper Oconee Agricultural Demand Forecast by Source (MGD)

Source Water Type	Basin/Aquifer	2020	2030	2040	2050	2060	Percent Increase 2020 to 2060
Surface Water	Altamaha	0.3	0.3	0.4	0.4	0.5	49%
	Ocmulgee	0.3	0.4	0.4	0.8	0.4	9%
	Oconee	4.7	4.8	5.0	5.6	5.6	18%
	Ogeechee	0.5	0.5	0.6	0.6	0.7	48%
	Sub Total	**5.8**	**6.0**	**6.3**	**7.5**	**7.1**	**22%**
Groundwater	Cretaceous	24.4	25.6	27.3	27.5	31.8	30%
	Crystalline Rock	11.0	11.0	11.0	12.6	11.0	0%
	Sub Total	**35.3**	**36.5**	**38.3**	**40.0**	**42.7**	**21%**
	Total	**41.2**	**42.6**	**44.6**	**47.5**	**49.8**	**21%**

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Section 6
Energy Water Forecasting

This section describes the methodology and results of energy sector water demand for the Upper Oconee Planning Region.

6.1 Methodology

Demands forecasted in this section are associated with future energy sector utilities (NAICS 22) power generation. Water demands associated with power generation by facilities with other industry codes are captured as part of the municipal and industrial water demand forecasts discussed in previous sections.

The analysis covers both water withdrawal requirements and water consumption associated with energy generation. Information related to water withdrawals is an important consideration in planning for the water needed for energy production. However, water consumption is the more important element when assessing future resources because a large volume of water is typically returned to the environment following the energy production process.

Water requirements for thermoelectric power generation facilities are estimated based on future energy demands along with the water requirements and consumption rates in gallons per megawatt-hour (MWh) for different power generating configurations. For a full discussion of the original forecast methodology see the 2010 Technical Memorandum "Statewide Energy Sector Water Demand Forecast" or the "Update of GA Energy Needs & Generating Facilities" Memorandum. The following modifications to the original methodology were incorporated into the current estimates:

- Projections of the statewide energy demand were updated using the new population projections to estimate "High Demand" and "Expected Demand" scenarios. Values of 10 MWh and 11 MWh per capita were assumed for the High Demand and Expected Demand scenarios, respectively.
- The list of existing facilities, facilities under construction, and planned and permitted new facilities was updated and reviewed by the stakeholder advisory group. In addition, some prior facilities were retired from service or converted from one generating configuration to another configuration. It was assumed that all coal-fired generating facilities in Georgia will be retired by 2040.
- The same water withdrawal and consumptive use factors (gallons per MWh) by generating configuration were maintained as previously developed.

  To meet the future energy demand, the energy generation of existing facilities is increased over time to a predetermined maximum sustainable generating capacity based on the generation configuration. As additional capacity is needed in the future,

"new" capacity is added to the most likely to be developed generating configurations, which are assumed to be provided by natural gas and renewable energy. The increase in natural gas generation was assigned geographically to locations in which natural gas generating facilities currently exist.

- The estimated future generating capacity of existing facilities, and associated water requirements, is allocated to regions based on the location of the existing facilities.

6.2 Results

The energy facilities within the Upper Oconee Regional Water Planning Council include AL Sandersville, Doyle, Washington County Power, Walton County Power, MPC Generating and Plant Dahlberg. Each of these facilities use natural gas and require only small amounts of water. The GA Power Plant Harllee Branch has been retired since the previous update. **Table 6-1** shows the projected expected scenario average annual daily withdrawal and consumption at the facilities over the planning horizon which is met via groundwater.

Table 6-1 Upper Oconee Forecasted Energy Sector Demands (MGD)

Demand Type	2020	2030	2040	2050	2060
Withdrawals	0.72	0.72	0.94	1.05	1.15
Consumption	0.63	0.63	0.83	0.92	1.01

In the previous statewide analysis, the generating capacity of the existing and planned facilities was not able to meet the projected statewide power needs through 2050 and additional generating capacity was assumed to be developed beyond 2020. Projections for the need of new energy capacity are less than estimated previously. Under the current energy forecasting effort, it was determined that planned generation levels will be sufficient enough to meet the expected need up to 2036. Because coal-fired generation is expected to decline and be retired by 2040, renewable energy and natural gas-fired facilities will be increased to generate the additional energy required to meet the expected demand. The energy facilities in the Planning Region are assumed to provide steady power generation throughout the planning horizon.

Section 7
Regional Summary

This section summarizes the water and wastewater forecasts within the Region for all the sectors combined.

7.1 Water Demand Summary

The full regional water demand including municipal, industrial, agricultural and energy uses are summarized in the figures and tables of this section. **Figure 7-1** shows the regional water demand per basin for surface water withdrawals and per aquifer for groundwater withdrawals. **Figure 7-2** shows the regional water demand per sector with municipally supplied industrial and energy demand removed to avoid double-counting. **Figure 7-3** shows the sector breakdown by county for 2020. **Table 7-1** provides a breakdown of the demand by sector and source for each county.

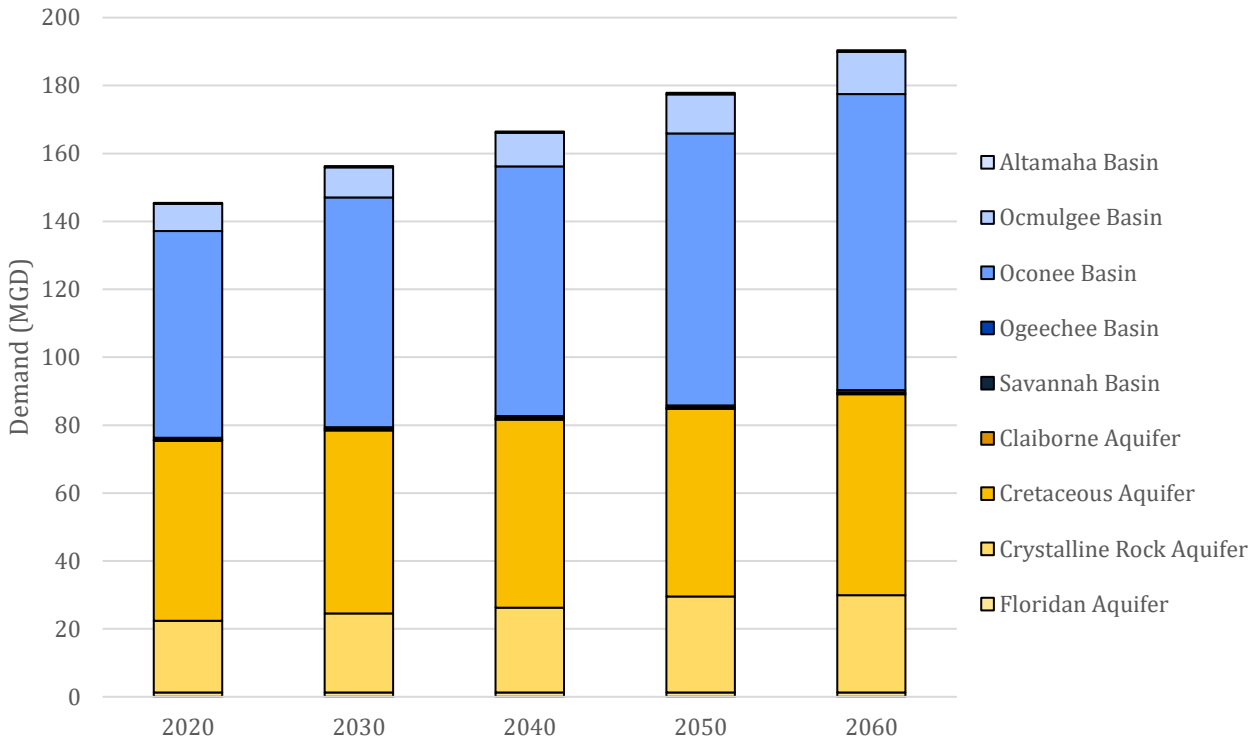

Figure 7-1
Regional Water Demand by Basin and Aquifer
Groundwater demand has been assigned to priority aquifers. Gordon aquifer demands were reclassified as Floridan and Dublin aquifer demands were reclassified as Cretaceous.

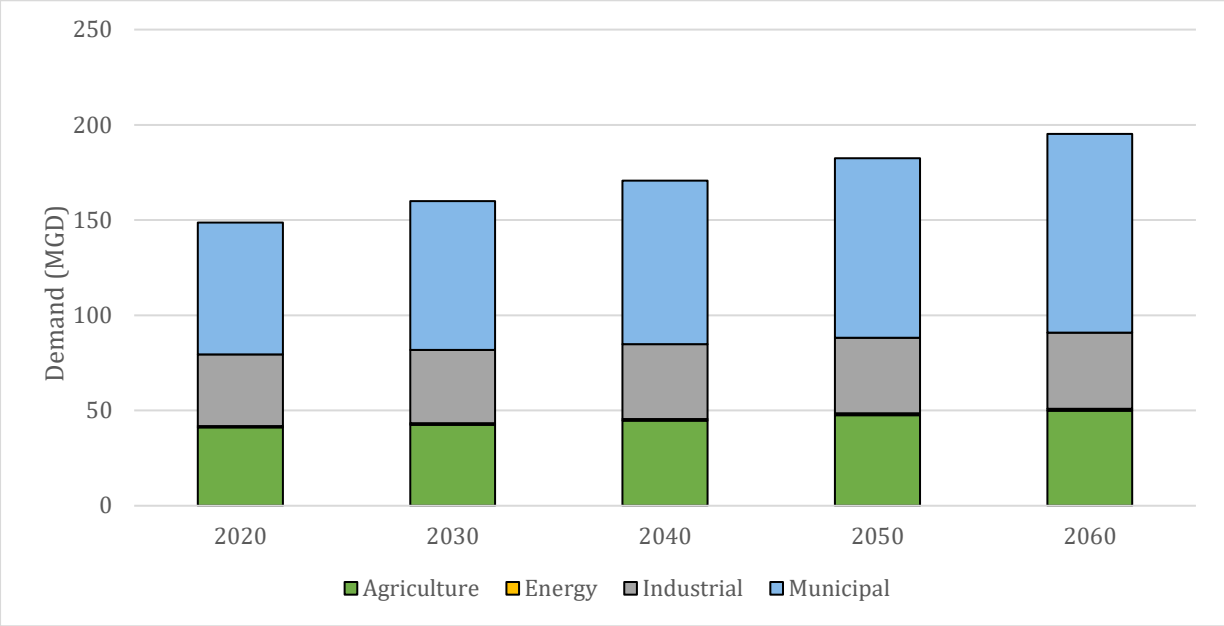

Figure 7-2
Regional Water Demand by Sector

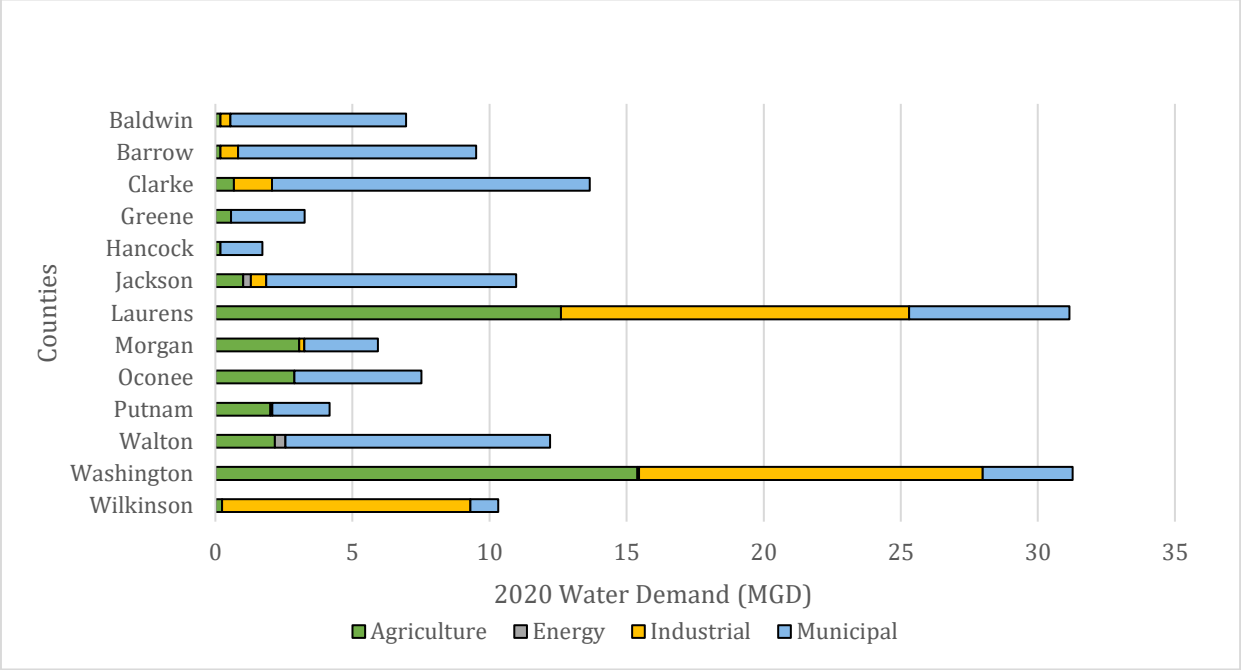

Figure 7-3
County Water Demand by Sector for 2020

Table 7-1 Summary of Water Demand by County (MGD)

County	Sector	2020	2030	2040	2050	2060
Baldwin	GW Agricultural	0.18	0.18	0.18	0.18	0.18
	GW Industrial	0.01	0.01	0.01	0.01	0.01
	GW Municipal Self Supply	0.28	0.27	0.24	0.22	0.20
	Groundwater Total	0.47	0.45	0.43	0.41	0.38
	SW Municipal Public Supply	6.13	5.92	5.50	5.00	4.61
	Total	**6.60**	**6.38**	**5.93**	**5.40**	**4.99**
Barrow	GW Agricultural	0.18	0.18	0.18	0.18	0.18
	GW Industrial	0.43	0.67	0.81	0.89	0.94
	GW Municipal Self Supply	1.04	1.37	1.72	2.12	2.62
	Groundwater Total	1.65	2.23	2.71	3.20	3.74
	SW Municipal Public Supply	7.65	10.23	12.86	15.92	19.72
	Total	**9.29**	**12.46**	**15.57**	**19.11**	**23.46**
Clarke	GW Agricultural	0.62	0.62	0.62	0.70	0.62
	GW Municipal Self Supply	0.10	0.11	0.12	0.12	0.12
	Groundwater Total	0.72	0.73	0.73	0.82	0.74
	SW Agricultural	0.06	0.06	0.06	0.02	0.06
	SW Municipal Public Supply	11.48	12.75	13.71	14.30	14.93
	Surface Water Total	11.54	12.80	13.77	14.32	14.98
	Total	**12.26**	**13.53**	**14.50**	**15.14**	**15.72**
Greene	GW Agricultural	0.57	0.57	0.57	0.58	0.57
	GW Municipal Public Supply	1.29	1.54	1.65	1.79	2.03
	GW Municipal Self Supply	0.29	0.35	0.36	0.39	0.43
	Groundwater Total	2.16	2.45	2.58	2.77	3.03
	SW Municipal Public Supply	1.11	1.31	1.41	1.53	1.73
	Total	**3.26**	**3.76**	**3.99**	**4.30**	**4.77**
Hancock	GW Agricultural	0.18	0.19	0.19	0.18	0.19
	GW Municipal Self Supply	0.06	0.05	0.04	0.04	0.04
	Groundwater Total	0.24	0.24	0.23	0.22	0.22
	SW Agricultural	0.01	0.01	0.01	0.02	0.01
	SW Municipal Public Supply	1.47	1.35	1.22	1.13	1.10
	Surface Water Total	1.48	1.36	1.23	1.15	1.11
	Total	**1.72**	**1.60**	**1.46**	**1.36**	**1.33**

Table 7-1 Summary of Water Demand by County (MGD) (Cont'd)

County	Sector	2020	2030	2040	2050	2060
Jackson	GW Agricultural	0.99	0.99	0.99	1.02	0.99
	GW Energy	0.27	0.27	0.36	0.40	0.44
	GW Industrial	0.55	0.81	0.98	1.08	1.13
	GW Municipal Public Supply	0.81	1.02	1.21	1.42	1.65
	GW Municipal Self Supply	1.04	1.29	1.52	1.76	2.02
	Groundwater Total	3.39	4.12	4.70	5.27	5.79
	SW Agricultural	0.03	0.03	0.03	0.00	0.03
	SW Municipal Public Supply	7.27	9.16	10.88	12.73	14.76
	Surface Water Total	7.30	9.19	10.91	12.73	14.79
	Total	10.69	13.30	15.61	18.00	20.57
Laurens	GW Agricultural	10.38	10.65	11.10	9.62	12.18
	GW Industrial	1.28	1.28	1.28	1.28	1.28
	GW Municipal Public Supply	1.90	1.88	1.83	1.76	1.71
	GW Municipal Self Supply	1.71	1.66	1.58	1.50	1.41
	Groundwater Total	15.27	15.46	15.79	14.16	16.58
	SW Agricultural	2.22	2.26	2.31	4.60	2.44
	SW Industrial	11.43	11.43	11.43	11.43	11.43
	SW Municipal Public Supply	2.22	2.20	2.14	2.06	1.99
	Surface Water Total	15.88	15.88	15.89	18.10	15.86
	Total	31.15	31.35	31.68	32.25	32.44
Morgan	GW Agricultural	2.25	2.25	2.25	2.98	2.25
	GW Industrial	0.05	0.05	0.05	0.05	0.05
	GW Municipal Self Supply	0.81	0.86	0.90	0.94	0.99
	Groundwater Total	3.12	3.16	3.20	3.97	3.29
	SW Agricultural	0.81	0.85	0.91	0.25	1.06
	SW Municipal Public Supply	1.88	2.02	2.16	2.31	2.48
	Surface Water Total	2.69	2.87	3.07	2.56	3.54
	Total	5.80	6.03	6.27	6.52	6.83
Oconee	GW Agricultural	2.70	2.70	2.70	2.83	2.70
	GW Municipal Public Supply	0.06	0.07	0.08	0.10	0.11
	GW Municipal Self Supply	1.01	1.25	1.46	1.69	1.91
	Groundwater Total	3.77	4.02	4.25	4.61	4.72
	SW Agricultural	0.18	0.18	0.18	0.07	0.18
	SW Municipal Public Supply	3.57	4.46	5.27	6.13	7.04
	Surface Water Total	3.75	4.64	5.46	6.21	7.22
	Total	7.52	8.66	9.71	10.81	11.95

Table 7-1 Summary of Water Demand by County (MGD) (Cont'd)

County	Sector	2020	2030	2040	2050	2060
Putnam	GW Agricultural	1.15	1.15	1.15	1.93	1.15
	GW Industrial	0.07	0.07	0.07	0.07	0.07
	GW Municipal Public Supply	0.04	0.04	0.04	0.04	0.04
	GW Municipal Self Supply	0.18	0.18	0.18	0.17	0.17
	Groundwater Total	1.44	1.44	1.43	2.21	1.43
	SW Agricultural	0.86	0.86	0.87	0.12	0.90
	SW Municipal Public Supply	1.86	1.86	1.82	1.80	1.81
	Surface Water Total	2.72	2.72	2.70	1.91	2.72
	Total	4.16	4.16	4.13	4.12	4.15
Walton	GW Agricultural	2.14	2.14	2.14	1.98	2.14
	GW Municipal Self Supply	2.04	2.28	2.54	2.82	3.16
	Groundwater Total	4.18	4.41	4.67	4.80	5.29
	SW Agricultural	0.03	0.03	0.03	0.18	0.03
	SW Municipal Public Supply	7.62	8.55	9.60	10.76	12.12
	Surface Water Total	7.65	8.58	9.63	10.94	12.16
	Total	11.83	12.99	14.31	15.75	17.45
Washington	GW Agricultural	13.81	14.71	16.02	17.68	19.36
	GW Energy	0.06	0.06	0.08	0.09	0.10
	GW Industrial	12.53	12.53	12.53	12.53	12.53
	GW Municipal Public Supply	2.67	2.60	2.49	2.35	2.26
	GW Municipal Self Supply	0.61	0.58	0.54	0.50	0.47
	Groundwater Total	29.68	30.48	31.67	33.15	34.71
	SW Agricultural	1.58	1.71	1.89	2.14	2.35
	Total	31.26	32.19	33.56	35.29	37.06
Wilkinson	GW Agricultural	0.19	0.20	0.20	0.19	0.21
	GW Industrial	8.23	8.23	8.23	8.23	8.23
	GW Municipal Public Supply	0.82	0.78	0.74	0.70	0.67
	GW Municipal Self Supply	0.19	0.17	0.15	0.13	0.12
	Groundwater Total	9.43	9.38	9.33	9.26	9.24
	SW Agricultural	0.05	0.05	0.05	0.07	0.06
	SW Industrial	0.42	0.42	0.42	0.42	0.42
	Surface Water Total	0.47	0.47	0.47	0.49	0.48
	Total	9.90	9.85	9.80	9.75	9.71
Planning Region Total Groundwater Demand		**75.79**	**78.84**	**82.10**	**85.22**	**89.61**
Planning Region Total Surface Water Demand		**69.94**	**77.69**	**84.78**	**93.00**	**101.27**
Planning Region Total Demand		**145.73**	**156.53**	**166.87**	**178.23**	**190.88**

7.2 Wastewater Summary

The full regional wastewater forecasts including municipal and industrial discharges are summarized in the figures and tables of this section. **Figure 7-4** shows the wastewater discharges per basin while **Figure 7-5** shows the forecasted discharge per method. **Table 7-2** provides a summary of the wastewater discharges by discharge type by county.

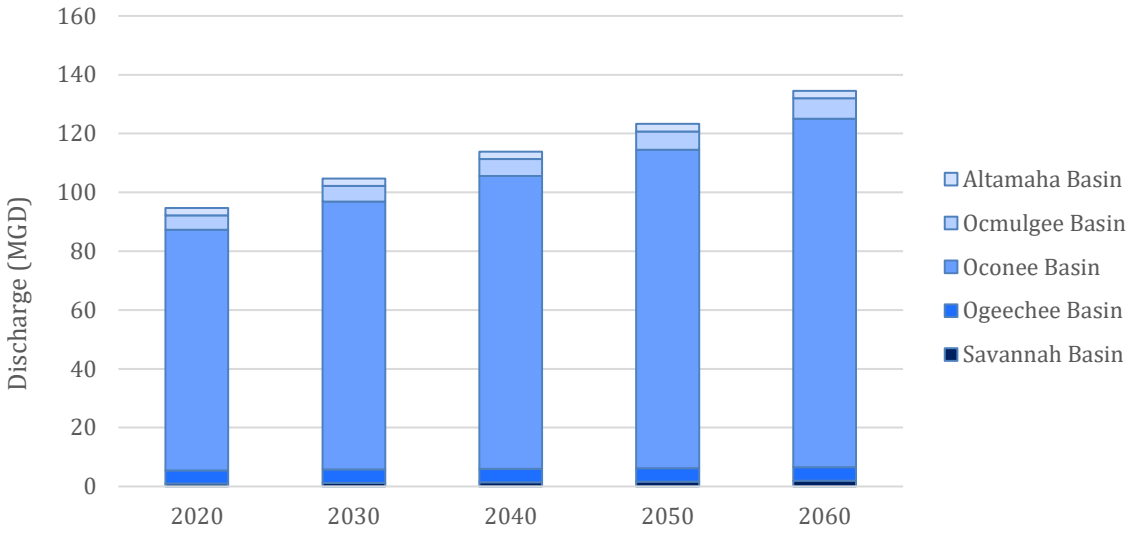

Figure 7-4
Regional Wastewater Discharge by Basin
Note: Stormwater discharges from mining are not included. Industrial discharges to municipal WWTP are not double-counted. Energy discharges are minimal and are also not included in the regional total.

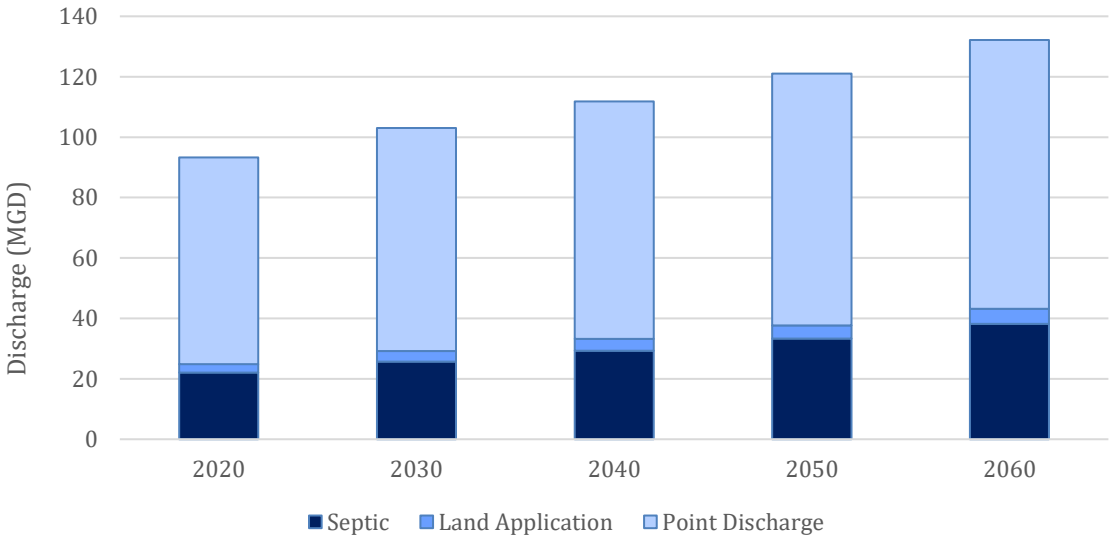

Figure 7-5
Regional Wastewater Discharge by Method
Note: Stormwater discharges from mining are not included. Industrial discharges to municipal WWTP are not double-counted. Energy discharges are minimal and are also not included in the regional total.

Table 7-2 Summary of Regional Wastewater Flows by County (MGD)

County	Discharge Type	2020	2030	2040	2050	2060
Baldwin	Point Discharge	3.22	3.16	2.99	2.76	2.60
	Septic	1.73	1.70	1.60	1.48	1.39
	Total	4.95	4.86	4.59	4.25	3.99
Barrow	Point Discharge	2.06	2.79	3.57	4.52	5.72
	Land Application	0.91	1.32	1.64	1.95	2.27
	Septic	3.51	4.76	6.09	7.70	9.76
	Total	6.48	8.87	11.30	14.17	17.75
Clarke	Point Discharge	16.03	18.01	19.58	20.86	22.38
	Land Application	0.01	0.01	0.01	0.01	0.01
	Septic	1.76	1.98	2.15	2.29	2.45
	Total	17.80	19.99	21.74	23.16	24.84
Greene	Point Discharge	0.27	0.33	0.35	0.39	0.45
	Land Application	0.43	0.51	0.56	0.61	0.71
	Septic	0.72	0.87	0.95	1.05	1.20
	Total	1.42	1.71	1.86	2.05	2.35
Hancock	Point Discharge	0.58	0.57	0.57	0.57	0.57
	Land Application	0.42	0.39	0.36	0.33	0.33
	Septic	0.40	0.38	0.34	0.32	0.32
	Total	1.40	1.34	1.27	1.22	1.21
Jackson	Point Discharge	5.99	7.73	9.32	11.00	12.86
	Land Application	0.39	0.53	0.64	0.74	0.82
	Septic	3.33	4.25	5.12	6.08	7.16
	Total	9.71	12.52	15.09	17.82	20.84
Laurens	Point Discharge	14.83	14.84	14.80	14.73	14.67
	Land Application	0.29	0.30	0.31	0.31	0.31
	Septic	1.51	1.51	1.50	1.47	1.44
	Total	16.63	16.65	16.61	16.51	16.42
Morgan	Point Discharge	0.60	0.65	0.70	0.76	0.83
	Land Application	0.02	0.02	0.02	0.02	0.02
	Septic	0.77	0.84	0.90	0.98	1.06
	Total	1.39	1.51	1.63	1.76	1.91
Oconee	Point Discharge	1.92	2.43	2.92	3.45	4.02
	Land Application	0.06	0.07	0.09	0.11	0.12
	Septic	2.18	2.76	3.31	3.91	4.56
	Total	4.16	5.27	6.33	7.47	8.71

Table 7-2 Summary of Regional Wastewater Flows by County (MGD) (Cont'd)

County	Discharge Type	2020	2030	2040	2050	2060
Putnam	Point Discharge	0.38	0.39	0.39	0.39	0.40
	Land Application	0.12	0.12	0.12	0.13	0.13
	Septic	0.94	0.96	0.96	0.97	1.00
	Total	1.45	1.47	1.48	1.49	1.53
Walton	Point Discharge	3.18	3.62	4.14	4.71	5.40
	Land Application	0.01	0.01	0.02	0.02	0.02
	Septic	4.09	4.67	5.33	6.07	6.95
	Total	7.29	8.30	9.48	10.80	12.37
Washington	Point Discharge	13.15	13.13	13.10	13.04	13.00
	Land Application	0.18	0.18	0.18	0.17	0.16
	Septic	0.72	0.71	0.69	0.66	0.64
	Total	14.06	14.02	13.96	13.86	13.80
Wilkinson	Point Discharge	3.54	3.53	3.53	3.52	3.51
	Septic	0.40	0.38	0.35	0.32	0.30
	Total	3.95	3.91	3.88	3.84	3.81
Total	Point Discharge	65.76	71.19	75.95	80.70	86.40
	Land Application	2.83	3.48	3.95	4.39	4.91
	Septic	22.07	25.76	29.31	33.30	38.24
Grand Total		**90.66**	**100.42**	**109.21**	**118.39**	**129.55**

Note: Stormwater discharges from mining are not included. Industrial discharges to municipal WWTP are not double-counted. Energy discharges are minimal and are also not included in the regional total.

Section 8
References

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