Agriculture Water Demand Forecast for the Upper Oconee Region

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Introduction

This document summarizes the methodology and results of the agricultural water demand forecasts for the Upper Oconee Region. There are two primary categories of agricultural water demand and they are crop irrigation and non-crop irrigation. A uniform statewide methodology was used in the formulation of the crop irrigation portion of the water demand forecasts. These crop irrigation water demand forecasts were developed by water source for each county in the region for the planning period between 2011 and 2050. For the non-crop agricultural users, an effort was made to quantify current water demands according to the following major categories: livestock, nurseries, and golf courses. The future water demand for these non-crop agricultural uses was not forecast due to lack of available information.

Crop Irrigation Water Demands

Agricultural water demands were prepared by the National Environmentally Sound Production Agriculture Laboratory (NESPAL), which is a unit of the University of Georgia's (UGA) College of Agricultural and Environmental Sciences. NESPAL was contracted by Georgia Environmental Protection Division (GAEPD) and the Georgia Environmental Facilities Authority (038952-01 and 038950-01) to prepare forecasts of irrigation water demand for the agricultural sector in the state. The projections cover row and orchard crops as well as most vegetable and specialty crops that cover more than 95% of Georgia's irrigated land. The purpose of this supplement is to summarize the foresting results for the Upper Oconee water planning region, more detailed information can be found in the NESPAL website at:

http://www.nespal.org/SIRP/waterinfo/State/AWD/AgWaterDemand.htm

Agricultural irrigation water demand was projected for groundwater and for surface water sources for the years 2011, 2020, 2030, 2040, and 2050. Each year's projection included a wet year, a normal year, and a dry year to simulate a range of weather conditions. Irrigated areas for each crop were projected from the baseline of year 2008 acres using economic models. Water withdrawal quantities were computed as the product of the projected irrigated area for a crop (acres), the predicted monthly irrigation application depth (inches),

and the proportion of irrigation water derived from a source (fraction). While fields irrigated by wells only were assigned as 100 percent groundwater, the proportion of a county's water obtained from surface water sources was reduced to 70 percent of the estimated amount. This adjustment was applied in recognition of the observed irrigation patterns since they are limited by water available in streams or rainfall that refills ponds. The final monthly withdrawals (acre-inches) by crop were summed for each county and/or drainage area. To be consistent with other water planning efforts the data was converted to million gallons per day (MGD).

To address the potential climate extremes in the forecasts completed by NESPAL, a range of agricultural irrigation demand scenarios were considered, including the 10th, 25th, 50th, 75th, and 90th percentiles. The 50th percentile value represents the average rainfall conditions and the median water demand, while the 75th percentile represents the dry year conditions when higher irrigation demands are expected. For planning purposes it was decided that gap analyses will be performed using the 75th percentile values for each region since they represent a more conservative water use scenario than the median value. The agricultural water demand forecast for the Upper Oconee region is summarized in Table 1.

TABLE 1
Total Agricultural Water Demand for 2011 and 2050 (MGD) for the 75th Percentile Scenario[a]
Agriculture Water Use Forecast for the Upper Oconee Region

County	Total 2011	Total 2050
Baldwin	0	0
Barrow	0	0
Clarke	0.37	0.43
Greene	0.30	0.35
Hancock	0.59	0.61
Jackson	0.11	0.13
Laurens	7.10	7.30
Morgan	0.03	0.03
Oconee	4.24	4.73
Putnam	0.29	0.28
Walton	2.31	2.65
Washington	7.37	7.79
Wilkinson	0.05	0.06

[a] The 75th percentile values for each region represent the dry year conditions when higher irrigation demands are expected. The 75th percentile scenario was selected for forecasting purposes.

Crop Irrigation Water Demand Projection Methodology

The current irrigated areas were measured using 2007-2008 aerial imagery and visible irrigated field areas were delineated and labeled by location using standard GIS tools. The proportion of existing irrigated area of each major rotation crop was taken from the 2008 UGA Cooperative Extension Irrigation Survey and it was ensured that the irrigated crop types were consistent with those observed in 2008. The projected growth rate for each year for each crop was based on the arithmetic average of projections from three economics based models. The models predicted the total Georgia production area for each crop based on United States, Southeast Regional, and Georgia data. Five major crops - corn, cotton, peanut, soybean, and pecan - were included in these three models because they make up 85% of Georgia's irrigated crop area.

The water demand created by vegetables, specialty crops, and ornamental nurseries lacked the long-term data needed to make econometric projections. Therefore, projections of irrigated area for these crops were assumed to stay constant within the same areas and future growth rates would equal the aggregate growth rate of the five major crops. Therefore, water demand for vegetable and specialty crops was included with the major crops to produce the total water withdrawal computations.

Predicted monthly irrigation amounts were computed and summarized statistically to represent monthly applications that would be needed to meet normal crop water needs during wet, average, and dry years. For each major crop type, irrigation schedules and monthly totals were computed for the weather conditions that existed during each of the years from 1950 through 2007.

Finally, the proportion of water used for irrigation from a specific source was estimated using the following sources. As part of the Agricultural Water Withdrawal Permitting Program, the GAEPD permits wells, stream-side pumps, and pond pumps but the fields receiving irrigation are not permitted. Therefore, UGA used the data provided by GAEPD and the Georgia Soil and Water Conservation Commission (GSWCC) which has mapped irrigated fields and associating them with the permitted withdrawal points to proportionally assign the water source for each field. Groundwater sources were further broken down by aquifer (or aquifers) based on the available permitted well information. Table 2 shows the agricultural irrigation demand projections for 2011 and 2050 for the Upper Oconee region.

TABLE 2
Total Irrigated Agricultural Water Demand for 2011 and 2050 (MGD) for the 75th Percentile Scenario[a]
Agriculture Water Use Forecast for the Upper Oconee Region

County	Groundwater		Surface Water	
	2011	2050	2011	2050
Baldwin	0	0	0	0
Barrow	0	0	0	0
Clarke	0.373	0.428	0.069	0.079
Greene	0.302	0.347	0	0
Hancock	0.588	0.606	0.139	0.143
Jackson	0.111	0.127	0.026	0.030
Laurens	7.096	7.300	1.333	1.376
Morgan	0.027	0.032	1.537	1.723
Oconee	4.240	4.732	0	0
Putnam	0.288	0.281	0.068	0.066
Walton	2.309	2.654	0.634	0.729
Washington	7.370	7.785	1.464	1.502
Wilkinson	0.050	0.057	0.012	0.013

[a] The 75th percentile values for each region represent the dry year conditions when higher irrigation demands are expected. The 75th percentile scenario was selected for forecasting purposes.

Non-Crop Agricultural Water Demands

State regulations require that farmers who withdraw more than 100,000 gpd from streams and aquifers obtain a permit from the GAEPD. While that limit means that most field irrigation withdrawals require a permit, other agricultural practices such as livestock and other animal-related operations, nurseries, and golf courses might not require permits. Therefore, they following agricultural practices were considered during the forecasting period but future use numbers were not developed due to the lack of reliable forecasting data. On March 24, 2010, the Upper Oconee Water Council agreed to hold the non-crop agricultural water demands constant over the planning period due to the limited data available to estimate future demands.

Livestock and Other Animal Operations

An ad hoc team of experts was pulled together to estimate to estimate animal water use in current farming operations and the aggregate water use in each livestock sector for each county and planning region. Participants included representatives from the Water Councils, The Georgia Farm Bureau, Georgia Cooperative Extension Service, Georgia Milk Producers, Inc., and the Georgia Poultry Federation. Due to the limited data valuable, the ad hoc group

was not able to project this estimate in the future. Table 3 summarizes the results for the livestock and other animal operations water use for the Upper Oconee region.

TABLE 3
Estimated Water Demand for Livestock and Other Animal Operations (MGD)
Agriculture Water Use Forecast for the Upper Oconee Region

County	Beef	Dairy	Goat/Sheep	Horse	Swine	Poultry	Total
Baldwin	0.131	0	0.003	0.002	0	0	0.135
Barrow	0.085	0	0.002	0.000	0	0.083	0.170
Clarke	0.027	0.014	0.001	0.003	0.006	0	0.051
Greene	0.117	0.279	0.001	0.004	0	0.120	0.520
Hancock	0.023	0.022	0	0	0	0	0.044
Jackson	0.450	0	0.004	0.012	0.002	0.474	0.941
Laurens	0.171	0.074	0.001	0.001	0.038	0	0.285
Morgan	0.255	0.650	0.003	0.002	0.006	0.118	1.034
Oconee	0.146	0.019	0.003	0.004	0.001	0.232	0.404
Putnam	0.120	0.722	0.001	0.001	0.002	0	0.845
Walton	0.104	0	0.002	0.012	0.001	0.059	0.179
Washington	0.072	0.082	0.003	0.005	0	0	0.162
Wilkinson	0.023	0	0.003	0.002	0.005	0	0.033

Note: The Council Subcommittee members recognized that “zero” values for livestock in some counties are not accurate but agreed that the overall livestock totals and water demands across the planning region are reasonable for planning purposes.

Nurseries and Greenhouses

Georgia's Green Industry is an important agricultural and commercial sector with great diversity of production practices. It includes producers of turfgrass sod, shrubbery and trees, annual plants particularly flowers and vegetables, and pine trees, which is the crop with the largest acreage in Georgia. Therefore, water needs for production in this sector are somewhat unique and certainly difficult to characterize Even though landscape and lawn irrigation is could be considered a part of this industry sector and accounts for a significant portion of the State's water use and much of its consumption, it was NOT considered part of the Agricultural Water Demand of the Georgia. The lawn and landscape water use was accounted for within other sections of the state water demand analyses.

Water use in nurseries is difficult to quantify due to the ever changing inventory and the variable water needs of each plant depending on their type and size. Therefore, the state and industry came to a consensus in setting some broad categories of water use using a few studies conducted by the Agricultural Water Pumping and Plant Research Plots and surveys conducted by the Cooperative Extension Service Irrigation Surveys and the Green Industry to provide some insight to plant water needs. For in-ground nurseries average annual use is estimated at 31 inches; for container nurseries, 87 inches; and for greenhouses, 121 inches.

Greenhouse water use numbers are larger because the elevated temperatures increase water losses but water use is expected to vary very little from year to year or from dry to wet seasons because they are covered facilities. Although not included in the industry survey, lower management nurseries, like Christmas tree farms, tend to use less water than higher production, in-ground nurseries. Table 4 summarizes the estimated water use by nurseries in the Upper Oconee region.

TABLE 4
Estimated Water Demand for Nurseries (MGD)
Agriculture Water Use Forecast for the Upper Oconee Region

County	Nurseries
Baldwin	0.08
Barrow	0.01
Clarke	2.70
Greene	0.26
Hancock	0.17
Jackson	0.09
Laurens	0.05
Morgan	1.52
Oconee	2.15
Putnam	0.05
Walton	2.01
Washington	0.11
Wilkinson	0.01

Golf Courses

In counties and state water planning regions where there are non-municipality water supplied golf courses, their water needs were estimated with the support of the Georgia Golf Course Superintendents Association (GGCSA), GAEPD, and research on GGCSA Best Management Practices (BMPs). Since State regulations require a permit for users that withdraw more than 100,000 gpd from streams and aquifers, most golf course irrigation systems require permits. Therefore, the golf course water demand data presented in Table 5 includes only golf courses with Agricultural (Farm Use) Permits.

TABLE 5
Estimated Water Demand for Golf Courses with Agricultural (Farm Use) Permits (MGD) for an Average Rainfall Year and a Dry Year.
Agriculture Water Use Forecast for the Upper Oconee Region

County	Average Rainfall Year	Dry Year
Baldwin	0.05	0.11
Barrow	0.50	1.07
Clarke	0.54	1.15
Greene	1.04	2.22
Hancock	0	0
Jackson	0.20	0.42
Laurens	0.15	0.32
Morgan	0.42	0.89
Oconee	0.18	0.39
Putnam	0.10	0.22
Walton	0.30	0.64
Washington	0.04	0.09
Wilkinson	0	0

Water use for golf courses with municipal and industrial permits or municipal supplies were NOT included in the statewide estimates of (farm use) golf course irrigation withdrawals. Similar to the livestock operation estimate, the data does not forecast golf course water use in the future but does provide water use estimates in an average rainfall year and in a dry year. The dry-year estimates were used for forecasting purposes.

Reference

Georgia Agricultural Water Demand Forecasts, 2010. *NESPAL, University of Georgia*. http://www.nespal.org/SIRP/waterinfo/State/AWD/AgWaterDemand.htm