

# AGRICULTURAL WATER DEMAND FORECAST

## Development of the contract and procedures

In summer of 2008, leaders of the Georgia Environmental Protection Division, Georgia Soil and Water Conservation Commission and Georgia Department of Agriculture turned to the State's largest agricultural research institution to participate in the State Water Plans. Because of their experienced and recognized teams in economic forecasting, agricultural irrigation, and environmental modeling, the UGA College of Agricultural and Environmental Sciences was asked to develop estimates of future water needs for agricultural irrigation. These estimates, the agencies specified, would be the amounts required to sustain the important irrigated agriculture sector of Georgia's economy. The agencies agreed to share all of their data on permitting and metering of agricultural water to the extent that that data could aid water use projections.

In their request the agencies identified a forecast horizon of 2011 through 2050. That would coincide with forecasts being made for municipal, industrial, power, and other water users. They also asked for specificity as to location of future water withdrawals - counties within Water Planning Regions and watersheds within sub-basins. Because water use for agricultural irrigation is seasonal, they requested a breakdown by months of the year. Finally, the agencies asked that withdrawals be identified by source - groundwater or surface water.

The College assembled a team with engineers, economists, and agronomists to analyze the problem and define the boundaries of the forecast. They established the key assumptions that would guide and limit the analyses, and they determined potential sources of data.

The UGA team's initial assessment showed that the most robust analyses could be made for the five major crops that made up 85% of irrigated area in the state - corn, cotton, peanut, soybean, and pecan. For these crops, there were long records of water use, production area, costs and prices received. Well-tested models exist for seasonal growth and water use of these crops. Econometric models have been developed for them at national, regional, and state levels, and USDA tracks and forecasts production of these crops annually. Data and forecasts on fresh and processed vegetables were also available, although these were more generic than for other crops.

Following this assessment, UGA proposed a scope for the forecast. EPD reviewed the proposed forecast approach and basic assumptions. It was agreed that forecasts would be made based on data and trends in data observed for Georgia in past years. A contract was drawn by October, 2008, with deliverables set for December, 2008, and March, 2009, and completion by June, 2009.

As the statewide planning progressed during 2009, EPD recognized that, in addition to Water Planning Regions, withdrawal forecasts would also need to tie in with its assessments of available surface and groundwater resources. Many of these were tied to physical surface and groundwater borders. For surface water assessments, the state had been divided into 91 Local Drainage Areas (LDA). Many of these have water outflow past a stream gauging station with a long historical flow record. The

state's groundwater resources had been divided into 24 aquifers. All of the aquifers contained monitoring wells that tracked water levels for many areas of the aquifers' extent.

EPD executed a separate contract with the UGA team to break down the forecasted agricultural withdrawals along these new physical boundaries and more specific water sources. Deliverables for this contract were in October, 2009 and June, 2010.

For accessibility, UGA and the state agencies agreed that all data used in the forecasts, the modeling procedures and assumptions, and the withdrawal forecasts would be made available to all interested parties and the general public by means of the internet. Currently the forecasts and data, known as Agricultural Water Demand, are hosted on UGA computers at NESPAL.

## **Public Involvement**

Throughout the process, the research team sought feedback from the state planners and the agriculture industry. In February, before the earliest forecasts were made, agricultural commodity leaders, independent economists, and county agents were invited to assemble at Macon State University to provide feedback. The team presented the data gathered, assumptions being made, and the modeling approach and early results then in use for each of the three tasks. There was a good discussion on how any crop forecasts could be made that far into the future, but all agreed that tying it to past trends and growth was at least a defensible approach.

A few weeks later, also at Macon State, the team presented the preliminary forecast and thoroughly discussed the input data and models with the state agency representatives and water planners. Planners discussed their preferences for data format and requested that all data be presented in million gallons per day units to be consistent with other water withdrawal forecasts in preparation. On March 31, 2009, the first full set of water withdrawal data, based upon the five major crops, was posted onto the website. Web pages detailed initial drafts of the procedures and data sets in use. County-by-county data and forecasts were posted for each Water Planning Region.

During the next two months, commodity groups, county agents, water planners and many others examined the forecasts, underlying data, and forecasting assumptions, particularly as it applied to their county, region, or commodity. A number of issues were raised. To facilitate the airing of these concerns and to enable agency planners and modeling team to respond, elected leaders and commodity group leaders called a meeting at the Forestry Commission Headquarters in Macon in early June, 2009.

Although few disagreed with the approach the UGA team had used, several expressed concerns with selected pieces of the baseline data, limitation of projections to major crops, and selection of a national econometric forecast. As farmers and county leaders examined their county's baseline maps, some found omissions of irrigated fields. Others pointed out fields whose use had been labeled 'rotation' when in fact it was a specialty crop. Almost unanimously, farmers felt that the projections must include other major commodities, particularly fruits and vegetables, in addition to the major crops. They understood that the available data for these was more limited, but asked that forecasts include these using the best available data.

Although the economists had examined econometric models for the region and for Georgia, they had recommended and based their forecast on national projections. The USDA updates their 10-year forecasts every year, and this enables near-term forecasting to reflect ever-changing world conditions, as well as expected costs and prices. However, the southeast regional and the Georgia models better reflect the elasticity that operates in this state's markets. Georgia farmers have a unique and wider set of choices in commodities they produce, and their market windows include some not available in the major grain and oilseed producing regions of the country.

A final concern raised, but perhaps never fully understood by commodity and state leaders, was the team's decision to use modeled water use data rather than recently gathered data from Georgia irrigation water meters. After substantial investments in installing and reading the meters, some felt that it should be the preferred source of data for future water use estimates. However, the agencies had requested all projections for irrigation be estimated monthly - information available for only a few sites in metered data. Data was needed for each commodity, but annual crops were not recorded for most metered sites during the fall visits. Additionally, the majority of meter observations were made in 2007 and 2008, by that time. Those were two of the driest years on record, not a suitable baseline for forty-year projections. As years progress and meter observations increase, they will become valuable means of verifying actual irrigation withdrawals, and they will provide input to future projection updates.

After this meeting the team worked to rapidly address these concerns and revise the forecasts. Baseline map revisions that had continued even after the first round of projections was stepped up. Each specific county, or even farm, omission identified by agents and others was added. Incorrectly identified crop uses were relabeled, and all counties, including all North Georgia counties, were rescanned looking for irrigated fields or orchards that may have been overlooked. This new baseline added all previously identified or newly found vegetable, tobacco, apple, peach, blueberry, sod, nursery, or greenhouse irrigation system. Because crop water-use models were unavailable or untested in Georgia for many of these added commodities, water use estimates were based on observations made and reported in the six triennial Irrigation Surveys as reported by the Cooperative Extension Service. Projections of planted acres were revised to be the average of national, SE Regional, and Georgia econometric projections for the original five crops and for fresh and process vegetables. For those commodities that were not projected, future acres were projected based on the average growth rate of all other irrigated commodities. Updated data tables and projections by counties and watersheds was installed on the website on July 29, 2009. This was the data presented to the Water Planning Councils, and shared with state contractors working as planners with State agencies.

Because of the complexity of the data and models used in the Agricultural Demand Forecast, EPD arranged two meetings where agriculture representatives appointed to the Regional Water Planning Councils could examine the data in detail and participate in extended discussions prior to the scheduled September meetings of their councils. These half-day meetings were held at UGA in Athens and the AgriCenter in Perry of August 17 and 18, 2009. The meetings were open to the general public as well.

During mid-September, the UGA team made presentations at each of the ten Regional Water Council Meetings, as part of the agenda's of those councils' third scheduled meetings. The data presented included the statewide summaries as well as their region's specific projected agricultural water needs. This was the first of the water needs projection data of the region. Council members and public was pointed to the Website hosting the July 29 projections.

Public involvement did not end with the publishing of the team's findings on the internet and presentation to the Water Councils. Farmers who produced animals asked that their water needs be considered as Councils proceed. A task force was formed among the animal commodity groups, the Flint River Water Planning and Policy Center and the UGA Cooperative Extension Service to produce estimates of annual water needs on the farm for the production of animals. These estimates were published on the website and linked to the agriculture irrigation water needs forecast. Similarly, golf courses were uncertain how their water needs would be included in Regional Plans. They asked EPD to include an estimate of water needs for golf courses currently permitted with agricultural withdrawal permits. EPD, the Georgia Golf Course Superintendents Association, and UGA's Extension turf specialist prepared the estimate. It too was added to the agricultural forecasts.

Members of the green industry, especially growers of container and in-ground plants in nurseries and greenhouses, did not feel that the estimates for their industry adequately reflected actual water use. The baseline maps had not addressed retail and other small nurseries and greenhouses. The annual water amounts obtained from the County Agents Irrigation Surveys of 1992 to 2008, were much lower than most modern producers felt they should be. Working with UGA Extension Engineers Georgia Green Industry developed a set of annual water needs by production system (greenhouse, container, in-ground), and they asked that the UGA CES Farm Gate Report numbers be used to represent production acres of each. A separate annual use report was prepared and published on the website. Additionally, the updated April 16, 2010, forecasts were modified to include these irrigation amounts and additional baseline acres.