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Memorandum

To: Regional Water Planning Council Members

*From: Cliff Lewis, Acting Assistant Branch Chief,
Ochlockonee/Suwannee/Satilla/St. Mary's' Basins*

Date: 09/11/09

Subject: Agricultural Forecasting Meetings Q&A Summary

This memorandum summarizes the questions and answers from the Agricultural Forecasting meetings held in Perry on August 17 and Athens on August 18, 2009. Cliff Lewis and Dr. Jim Hook with the University of Georgia (UGA) College of Agricultural and Environmental Sciences, the head of the UGA team who prepared the forecasts of agricultural irrigation water demand for the Environmental Protection Division (EPD), facilitated the meetings.

Question: Why do we need an annual average irrigation demand?

Jim Hook: If you look at industrial and municipal water demands, they are all calculated on an average daily basis in million gallons per day (MGD). We need to generate the same information for agriculture to be consistent with the other demand forecasts and resource assessments. We are also presenting the agricultural demands by county and by month, and can adjust the format to make it the most useful for your Councils' needs.

Comment: In January irrigation demands are zero. It does us no good to see an average daily value for January.

Jim Hook: That is true. This is why we are also breaking the demand numbers down by month.

Question: Where are urban agriculture demands (e.g., golf courses, retail nurseries, athletic fields, and home lawns) picked up in the forecasts?

Jim Hook: These demands will be included in the municipal and industrial forecasts.

Question: Are Georgia future crop projections lower than the USDA national model numbers?

Jim Hook: Yes. The numbers are close in the short term but get farther apart in the long-term (by 2050). These differences are due to the crop variety in Georgia that is unique to this region and therefore Georgia agriculture does not necessarily follow national trends. Some marketing and economic models predict that some crops will simply not be as economically feasible in the future in Georgia.

Question: Are these Georgia predictions based on commodity group feedback?

Jim Hook: Yes.

Question: Can you explain how you estimated irrigated acres?

Jim Hook: Three sources were used in estimating irrigated acres within each county: data from the metering program, EPD's permit database (including pending permits), and visual observations of pivot systems

Question: Were all irrigation sites visited by someone?

Jim Hook: Some sites were visited by Soil and Water Contractors, some were visited by EPD personnel, and some were identified by satellite imagery without being visited.

Question: Can you expand on the explanation of the use of satellite imagery?

Jim Hook: In 2007 we got a good, high-resolution overflight of the State. This imagery, combined with available imagery from Google Earth, allowed us to see down to a level of detail of identifying truss rods on pivot systems or actually seeing water spray. The estimate of irrigated acres is based on 2007-2008 baseline of actual acres irrigated.

Question: Is the commodity table in your report predicting fewer peanut acres grown in Georgia in the future?

Jim Hook: Yes, that is what the models predict. Even though the USDA model shows steady peanut production in the future, Georgia price models say this crop will be less competitive in the future.

Question: Are you projecting cotton to go up from 26,000 acres to 34,000 acres by 2050?

Jim Hook: Yes, this is based on expected profitability. In this case the USDA and Georgia models agree.

Question: In well-to-pond systems, is the source accounted for as 30% surface water and 70% groundwater?

Jim Hook: That is correct. These numbers were the averages based on a total of 45 well-to-pond sites that were monitored.

Question: Will there be variation by location and type of crop?

Jim Hook: By location, yes. In some cases the well capacity may be small and a well-to-pond system will allow the farmer to pump into the pond at a low rate and then have the water available for higher-rate irrigation usage from the pond without having to upgrade to a larger well/pump.

Question: Where does livestock water come into play?

Jim Hook: Agricultural water use has many component parts, some of them quite large (e.g., irrigation of major crops), others comparatively small (e.g., livestock watering). The forecasts we have developed seek to estimate the largest of such uses, so livestock water use is not part of these agricultural projections. In some areas these smaller dispersed agricultural water uses, when combined, could

become notable. You should therefore encourage your regional water planning council to consider these in developing the region's water plan.

Comment: Poultry and livestock can put a significant demand on groundwater.

Jim Hook: Water use in the poultry processing industry will be considered in development of the industrial water and wastewater forecasts. Livestock water use is comparatively small and rather dispersed in most areas, but you should encourage your regional water council to consider its implications in developing the region's water plan..

Question: So poultry production is not included in these projections?

Jim Hook: That is correct.

Comment: Is that because these operations do not use more than 100,000 gallons per day?

Jim Hook: It has actually more to do with the fact that water use in the poultry processing industry is being addressed in the industrial water and wastewater forecasts.

Comment: In some counties in southwest Georgia, dairy farms use a lot of water.

Jim Hook: That's a good point. We need to make sure we're not overlooking these key uses in the water plan. EPD doesn't know how much water some of these operations use so it is important that each Water Council incorporate these additional uses into their plans.

Question: You mentioned that a "dry year" would use more water than 75% of other years. Do you have a worst-case scenario?

Jim Hook: We have a 95% projection in the report, but you shouldn't consider really dry years for developing every year demands.

Question: Can you point out where in the report the numbers are given in acre-inches?

Jim Hook: The numbers are only presented in MGD in the report.

Question: What are the inches shown in the report tables?

Jim Hook: These are inches of water that you would put on that crop to irrigate for each month.

Question: How did you arrive at those numbers?

Jim Hook: We used crop models that were calibrated in Georgia. The models included corn, cotton, soybeans, peanuts, and pecans.

Question: Have you incorporated the Commission's meter data into the projections?

Jim Hook: The Commission's metering program was not designed to collect data that would tie water use data to specific crops and specific counties, therefore we could not use the Commission's metering data to forecast water needs for specific crops.. The metering process in Georgia is still developing. To that, the mapped locations of irrigation wells and pumps, combined with the mapping of irrigated lands

was the primary source of data used in the Ag Water Demand forecast. The current acreage figures and mapped locations provide the baseline for the entire Ag Demand Forecast.

Additional Information: EPD compared estimated acreage and irrigation volumes for groundwater and surface water from EPD water estimation tool developed in the 2004 National Environmentally Sound Agricultural Production Laboratory (NESPAL) Ag Water Pumping Study, and determined an estimated water use. EPD then compared those results with actual 2007 Georgia Soil and Water Commission (GASWCC) irrigated acreage and irrigation volumes and the corresponding water use. EPD's comparison showed that the results from the estimation tool EPD has are within 4% (Surface water) and 12% (Groundwater) of actual GASWCC data. These results positively show the validity of both methods for determining water use.

Question: Did anybody take agricultural metering data in Lower Flint?

Cliff Lewis: EPD did look at these numbers. They were within 8% of model results. We have to start somewhere with the best available data we have.

Question: Will EPD follow up as numbers become available?

Cliff Lewis: Yes, these models will be updated every few years and we will have better and better data available to incorporate, as time goes on.

Question: Have you considered that minor crops and water uses less than 100,000 gallons per day might add up?

Jim Hook: Many of these minor uses (e.g., retail nurseries) are supplied from municipal sources. For those, their use will be captured in the municipal 'per capita water use'.

Comment: At some point we have to include livestock, poultry, and minor irrigation that might not get credited as water uses in our region.

Jim Hook: That's a good point. You need to take this message to your Water Council and make sure they include these uses in their Regional Plan. Also keep in mind that some permitted uses do capture some of these small uses.

Question: Can you confirm that Dr. Couch says that these forecasts will not be used to cap agricultural water use?

Cliff Lewis: It is true that the ag forecasts will NOT be used to cap agricultural water use. These forecasts, and likewise those for municipal, industrial, and energy water needs, are all being developed to assist with producing effective plans for how we will sustainably meet ALL of Georgia's future water needs. .

Comment: I still don't understand average MGD numbers for agricultural water use.

Cliff Lewis: This conforms to other planning efforts. Tell us what format you want to see the numbers in for your council's planning efforts and we will provide them, such as acre-inches.

Comment: When we look at supply, we don't care about October to March for Agriculture.

Cliff Lewis: You're certainly right to assert that agricultural water use is generally much more pronounced during the period April through September.

Comment: Yes, if we had averages for May to September we can use that.

Cliff Lewis: How about a single record for April to October in acre-inches?

Comment: Yes, that would be usable.

Cliff Lewis: As councils begin planning efforts, it's important that the council tell EPD how you want to see the data for your planning efforts.

Question: What are the other ways you will present these data?

Jim Hook: They will be presented by month, by basin, and by region in MGD.

Comment: It's more important to have it by month than by average annual day.

Jim Hook: We suggest that we present these numbers as PowerPoint presentations at the Council meetings. Jim will attend as many as possible to make the presentations and answer questions.

Question: Did you try to account for different farm bill?

Jim Hook: No, we can't do this because the profitability and cost models would completely change.

Question: Can we get with Cliff to tailor our Council presentations?

Cliff Lewis: Absolutely.

Question: How are we going to set agriculture apart from other water demands? It's different than other demands and we need to think about this. We need to consider "what if" scenarios and maybe develop a straw man, and consider how to develop seasonal-type usage.

Cliff Lewis: Certainly, we might ask for your help with this.

Comment: The agenda times are already set and I don't like that.

Response from another attendee: Call your EPD representative and they will revamp the agenda.

Comment: We don't get this info in time to change our agenda.

Cliff Lewis: How would you like to adjust the agenda or the discussion?

Comment: We need to figure out how to incorporate these numbers into the larger management plan and make the most valuable use out of the 1-hour we have for this discussion in the agenda.

Question: Why is agriculture always the first thing we hit?

Cliff Lewis: The Ag Forecast information became available first, so we are presenting it first.

Comment: We're afraid agriculture is a target for regulation, despite what Dr. Couch says. How do we share water resources in a drought situation? People will say that everyone else is getting restricted, so why not agriculture? We have to expect this and be ready.

Cliff Lewis: That concern is part of a broader picture of water management, and it is also being expressed by a few in the industrial water use community and the municipal water use community. These types of concerns will undoubtedly continue to be voiced, but keep in mind that the regional water councils' planning efforts are being performed under current statutes, current rules and regulations. Those statutes do not give any state agency the leeway to use these plans for anything beyond what's described in the statutes, rules and regulations.

Question: Has the availability study been completed?

Cliff Lewis: No, they are currently under-way and should be presented by the beginning of 2010.

Will there be pre-meetings to present these data as well?

Cliff Lewis: Let your Assistant Branch Chiefs know if you want to see pre-meetings on this material.

Question: Regarding the assumption that water is unlimited in these projections, were there any scenarios that acknowledge that water is limited in some areas?

Jim Hook: No, we assumed that water is available to meet continued growth. We can't assume when and where growth may stop in some areas.

Question: We project that the State will grow at a certain rate. What are ramifications on water use? We have to consider that water is a limited resource.

Jim Hook: The projections are based on facts that we know today. The projections are not 'one time' projections, but will be revisited during future water planning in each region. If actual growth within the State is shown in future years to be significantly different than we have projected, we develop new projections based upon more recent information and data.

The resource assessments will tell us whether current - or future - projections of water needs can be met comfortably within the capabilities of the resource. If the projections cannot be comfortably met, then each region can investigate a number of options for ensuring that the region's future water needs are met.

Comment: This presentation is very good.

Cliff Lewis: These water experts won't all be available forever. We need people to continue to put these data out there. Tell your leaders to continue to support irrigation research.

Question: A price-elasticity model was used in the demand scenarios. Will it apply to supply too?

Jim Hook: We can, but we have to set upper and lower limits.

Question: Will we get resource availability data in pre-meetings?

Cliff Lewis: Let your ABCs know if this is what you want. We are here to support you and your needs.

Question: Will Jim or anyone from agriculture have access to the availability data? We need agricultural representation on the supply forecasting committee (SEAP Panel) (more than one person).

Cliff Lewis: We will check the list for agricultural representation.

Additional information regarding SEAP Panel: The purpose of the SEAP is to advise EPD on scientific matters associated with the resource assessment components of the State Water Plan. As specified on page 14 of the SWP, the panel is a "technical advisory group with expertise in disciplines such as hydrology, biology, engineering, and other fields."

Regional water planning starts with a scientific assessment of the capabilities of Georgia's rivers, lakes and aquifers. The SEAP's role is to ensure that the scientific basis of the assessments is sound and will yield credible results. Its members were selected for their expertise in hydrologic, biologic, and engineering science.

The panel will focus specifically on the resource assessment methods and advice from the SEAP will help EPD improve and validate the resource assessment methods. The panel will not be asked to provide advice on forecasts of water use nor will it address questions specific to any water use sector. Input on those questions has been, and will be, solicited through other channels.

The SEAP is a scientific panel with specific focus, and input from professionals with water-related experience and other stakeholders will be as important as the SEAP's input. The broader water planning effort provides a number of opportunities to incorporate the expertise of water management professionals, including those from different water use sectors. Experts with those stakeholder perspectives will be asked to review the resource assessments.

The full package of information on the resource assessments - methods, supporting factors, and results - will be subject to public notice, review and comment. At that time, all water-related interests will have an opportunity to provide input on the full package.

Comment: It's important where agriculture is a minority that we can ask these questions. This is a good format.

Jim Hook: Agreed, that's why we provided this format.

Q. When will representatives of other (competing) demands be brought in on the discussion of this information?

Cliff Lewis: All pieces will be brought together during the water planning meetings starting in January. Want to bring all participants up to speed regardless of initial familiarity with ag water demand information.

Q. Water withdrawal data is being recorded from as meters are installed. At what point will these numbers be used?

Jim Hook: One part of data was used extensively - irrigated field locations and water source data. The meter data on irrigation application depths was considered incomplete data as the SWCC program is still being implemented. Officially July of 2009 was the target date for installation of meters throughout the state. I'm not sure where they are at this point, but they are not complete. As much as four years of data has been collected in areas of Southwest Georgia, but there is one or two years in the Coastal Watersheds, but the Central Coastal Plain is just beginning data collection. For the forecast we needed consistent data for the entire state. That data should be available in the future, but it is not certain that the data will be reported by specific crop types, one of the necessities for forecasting.

Additional information: The mapping of well and pump locations, combined with the mapping of irrigated lands, was a primary data source used in the forecasts. The current acreage figures and locations provide the basis for the entire forecasting work.

Using the actual 2007 meter results reported to EPD by the Soil and Water Conservation Commission, and extending that statewide, EPD is able to confirm that previous figures used by UGA, and thus by EPD, match meter data closely. This shows that methods previously used by UGA have been verified by data obtained from the meters.

The water use numbers obtained by the SWCC have been used to verify the forecasts, especially those for the 2011 to 2018 period

Q. Has any of the data from the water-metering program been used to check the model or inputs to the model?

Jim Hook: The forecast models were arranged to give information crop by crop. Water meter data is not currently delineated crop by crop. We did use previously observed data from the Ag Water Pumping project, which did have crop-by-crop records by county for 2000 to 2004 to compare predictions by the models for those same years and counties. The model predictions of average irrigation use on farms was acceptable, and the models were not adjusted to fit observed data. Additionally I should note that independent studies conducted on research and farmer fields in Georgia have been collected and used since the 1970's in creating and validating these models. These models were available for the five crops that make up 85% of Georgia's current irrigated acreage.

Cliff Lewis: EPD did comparative analysis in the Lower Flint between the EPD water-use estimation tool developed for EPD in UGA's Ag Water Pumping Study (2004) and the Ga. Soil & Water Commission's water-use data. The results were within 8%. **Clarification:** The groundwater comparison shows that the application rate results between EPD estimates and GASWCC data is 12% and the surface water results were within 4%. (8% was avg. for the two).

Q. Foresee elimination of estimation?

Cliff Lewis: As more data is collected, less estimation would become necessary.

Jim Hook: Difficulty is that that data will not be helpful for 'what-if' scenarios. Forecasting tools would still be useful. It will be several years before enough collected data can provide a range representative of what we may expect in future climates. Metering system not designed to provide data crop by crop. Trying to move toward more refined system that could provide data crop by crop.

Brent Dykes, Executive Director of the Ga. Soil and Water Commission:

The Soil & Water Commission is working to complete installation of meters to complete coverage. We are tracking water use by crop and will be able to provide year by year in the future.

Q. Please provide clarification of updating of the projections.

Jim Hook: Direction dependent upon water council decisions. Start with national projection and determine how Georgia involved. 3 yrs, 5 yrs, 10 yrs.

Q. Do we have number of water meters in each county? How does this compare to total number of wells?

Jim Hook: In sites where permitting is not completed, there is usually no water meter. EPD and SWCC rely upon farmers to install meters on new systems and report back to the agencies when they have installed them. Also there are still un-permitted water withdrawals. Some of these fall within state exemptions for withdrawals from off-stream runoff ponds. In our baseline, we assume that irrigation was or will be used on any field with evidence of irrigation equipment, especially center pivots in place. We looked for irrigation systems that were not included in any EPD or SWCC records.

Brent Dykes (GASWCC) Response: 8600 permitted wells without meter installed.

Q. When will Q&A be available?

Cliff Lewis: The goal is next week, but it may take two weeks.

Q. Slide showing future by crop. Showing total increase in commodities by crop based on water withdrawals. How is the increase projected?

Jim Hook: It's the other way around - total increase in water withdrawals based on projected growth in irrigated commodities. Overall growth projection models are developed from historical data, assumptions about US and worldwide consumption, macroeconomics, and many other inputs. These factors are included in the USDA forecast that projects planted acres. We assumed that Georgia would share proportionally in the increase/decrease projected nationally. Additionally we used a regional Southeast and a Georgia model that considers how Southeast and Georgia farmers have traditionally responded to prices in their planting decisions. Finally we assumed the growth in irrigated acres would

continue to proceed proportionally with growth in commodity acres. If corn planted acres increases 5%, irrigated corn acres will increase 5%.

Q. Does the model consider saturation? How many more center pivots can be placed?

Jim Hook: We looked at new land that is not currently irrigated. A close look indicates room to grow irrigation in all counties. Most of this will be accomplished by conversion of non-irrigated cropland (and pastureland), although some forest clearing will occur around those fields to optimize placement of center pivots. Some additional land will be cleared for specialty crops. We are also seeing a great deal of rearranging and expansion around existing irrigated fields, particularly as farmers convert from traveler to center pivot or as they replace worn pivots.

Q. Is the historical trend in installation of center pivot irrigation sustainable? Will the trend line developed over last 15 years hold over the next 15 years?

Jim Hook: We predict a lower rate of growth over this planning horizon than occurred in the past 15 years. These predictions looked at statewide trends in demand and assumed that neither water nor land was limited beyond what is currently in existence.

Past limitations have shaped the current location of irrigation withdrawals. In areas that cannot support ponds and that have minimal access to streams - Southwest Georgia, for example - farmers developed irrigation based on abundant groundwater. In areas with tight rock formation but numerous streams and gently rolling topography, farmers built ponds as a primary irrigation water supply. In areas that have limited access to both groundwater and surface water, farmers did not irrigate. In fact those last locations have largely gone out of agriculture production. Most of the Piedmont and selected areas in the Coastal Plain fall into this category. This is why we had to assume that an area that has adequate soil and water resources, that currently sustains productive and profitable farming, would continue to sustain irrigated agriculture. It is those places that we predict any future growth will occur. We do not assume that any new major surface water supplies will be built for agriculture irrigation, and we do not foresee any new discoveries of groundwater.

Q. What is the growth projection based on?

Jim Hook: Again, growth projections begin with USDA projections. Here are their assumptions about the macroeconomic conditions:

- U.S. and world economic growth reflect near-term effects of the current economic crisis followed by a transition back to steady economic gains
- Global economy assumed to slow to 1.7-percent growth in 2009 while the U.S. economy declines by 0.5 percent
- The financial crisis and global economic slowdown will constrain U.S. exports in the short to intermediate term
- Global economic growth assumed to rebound to a 3.4-percent average growth rate for 2010-18
- The U.S. economy resumes growth in 2010 at 2.5 percent, followed by average rates near 3 percent over the remainder of the projection period.

They apply their assumptions to trends developed from historical records from data and surveys to project planting and production intentions of the next 10 years. These kinds of projections are updated every year.

We assume that Georgia will respond, in part to these opportunities for increases in production, just as it will feel and national downturn in the economy. Additionally farmers in Georgia are assumed to respond as they have in the past to price signals brought about by these changes in demand.

Q. Can the growth projection be expressed as acreage and can it be provided on a county-by-county basis?

Jim Hook: Yes. This information is available on the website. You can click on links on many pages to dig into more details if you want. By boring down you can learn details on how the projections were developed. Summaries by water planning region and by county are available on the main page near the start of the page.

Presentation - Pulling the Pieces Together

Q. What happens when water table drops, when will the water be turned off?

Cliff Lewis: That is a very broad question and you must remember that what happens today in planning efforts must be considered under the parameters of current statutes. Current competing use complaints in agriculture are assessed on case-by-case investigation.

Q. Why does the rate of increase in projected water withdrawals appear to differ basin to basin?

Jim Hook: They are probably not that different...it may be an illusion based upon the differences in scale on the axis.

Correction, Jim. While the underlying assumptions give the same rates of change over time for the whole state, the rate of growth/decline differs crop-by-crop. So differences in the rates of total water demand for all crops can differ because each region has a different mix of crops.

Q. Average annual demand may not communicate true indication of instantaneous nature of irrigation requirements.

Jim Hook: True. Summaries by shorter periods of time better representation instantaneous changes in the irrigation demand. The models do predict those changes day by day. However I wouldn't want to imply that we can predict the instantaneous daily or even weekly demand that would be expected for, say, July 13. Monthly and annual summaries should be adequate for planning purposes, but even then each projection is made for wet, average, and dry years so that you can plan for contingencies.

Q. Nature of irrigation system could affect rate of irrigation. Projections should show seasonality.

Jim Hook: Yes. Much of the information is crop dependent, and that affects the seasons or time of year when water use will occur. At the county level we addressed this by showing withdrawals by months as well as years. Perhaps it would be better if we also showed cumulative regional data by months as well. Currently those are only shown for annual withdrawals. I'll work on that over the next few months.

Q. Does the model account for lack of water during drought? Does the water run out?

Jim Hook: To an extent. Groundwater is assumed to be there and useable if needed to meet higher demand during droughts. For surface water supplies, we incorporated a reduction in availability of 30% on average, but applied this for average as well as for dry years. That was the difference between water applied by those relying on surface water alone as compared with those using groundwater alone during the 2000 to 2004 seasons on the 800 fields we monitored. But we just don't have enough data to show how much more drought impacted water supplies as compared with normal years. Those depending upon runoff or stream flow are affected in normal as well as drought years.

Q. Does the model account for improvements in irrigation methods?

Jim Hook: We assumed current practices continue. We did not consider changes in technology, crop varieties, improvements in ag science. Not possible to accurately predict future developments in drought resistance for our major commodities, even though we have researchers trying to make that happen.

Q. If a permitted pond goes dry. Can permit holder drill well to meet needs?

Cliff Lewis: Yes, in areas of no restrictions. EPD Ag Permitting program even has a process in which a producer can apply for an expedited Letter of Concurrence to hand to drillers, in emergencies.

Q. Is water demand from proposed new nuclear reactors included in these projections?

Jim Hook: No. Assumptions regarding diversions for power generation or other non-farm uses were not considered. This is what needs to be factored in during the planning efforts for each water planning council as they learn about plans for shifts in water demand.

Q. Does the projection factor in events such as the current meltdown of the economy?

Jim Hook: Yes that was part of the macroeconomic considerations in the USDA planting intentions.