Response to Comments

Synopsis Reports on Draft Water Resource Assessments: Surface Water Availability, Groundwater Availability, Surface Water Quality (Assimilative Capacity)

December 20, 2010
Responses added May 5, 2011 (see page 65 on)

Introduction

This document provides responses to comments received on Synopsis Reports summarizing results of the draft Current Water Resource Assessments. As described in the State Water Plan, the Water Resource Assessments are evaluations of the capacity of water resources to meet demands for water supply and wastewater discharge without unreasonable impacts. The Current Water Resource Assessments evaluate surface water availability, groundwater availability, and assimilative capacity of surface waters under current conditions.

For more information on the regional planning process and the purpose and use of the resource assessments, please see EPD's Regional Planning Guidance, available for download at http://www.georgiawaterplanning.org/pages/technical_guidance/regional_planning_guidance.php.

The Synopsis Reports provide an overview of the methods used for the resource assessment and a summary of the results for current conditions. Detailed technical reports have been or are being completed for each draft Water Resource Assessment. These reports provide background information on methods, data, and modeling techniques. Background data sets, such as the list of facilities used in the current assessments, are also available. To receive any of the technical reports completed to date or other available background data, please contact Suzanne Desmond at suzanne.desmond@dnr.state.ga.us or 404-463-1425.

Since the release of the draft Current Water Resource Assessments earlier this year, the assessment tools and analyses have been refined based on input from regional water planning council members, newly available data, and the comments summarized in this document. Tools have also been used to assist the regional water planning councils with evaluating the capacity of resources to meet demands for water and wastewater projected in their regions through 2050.

Detailed information on the use of the resource assessments by each Water Planning Councils, as well as other information the regional water planning councils are using to develop their recommended regional water plans can be found on Council websites available at http://www.georgiawaterplanning.org.

Results of the assessments and the management practices recommended to meet current and future water demands will be summarized in each of the ten recommended regional water plans, scheduled to be released for public review and comment in May 2011.

Date: 12/20/2010; Responses added 5/5/2011

This document focuses on comments on the draft Current Water Resource Assessments. Responses to comments from the following parties are presented in order in the following pages:

- Georgia Department of Community Affairs (James R. Frederick)
- Cobb County Water System (Stephen D. McCullers)
- Cobb-Marietta Water Authority (Glen M. Page)
- Metropolitan North Georgia Water Planning District (Pat Stevens)
- Georgia DNR - Wildlife Resources Division (John Biagi, Mike Harris)
- West Point Lake Coalition and LaGrange-Troup County Chamber of Commerce (Dick Timmerberg)
- Riverkeepers and Georgia River Network (Sally Bethea)
- United States Department of Interior – Fish and Wildlife Service (Sandra Tucker)
- Florida Department of Environmental Protection (Janet Llewellyn and Watershed Assessment and Watershed Monitoring Sections)
- Georgia Power (Tanya Blalock)
- The Georgia Water Alliance
- Les Ager – Pulaski County
- The Nature Conservancy (Mary Davis)
- R Johnston
- Emery & Garrett Groundwater, Inc. (James Emery)

May 5, 2011: Responses to comments from the Suwannee River Water Management District (David Still) and St. Johns River Water Management District (Harold Wilkening) have been added at the end of the document.

Georgia Department of Community Affairs (James R. Frederick)

1. Sources of water (surface water, aquifers, groundwater recharge areas, et. al) should be protected from hazardous water and toxic substances…and from excessive withdrawals that compromise the long-term sustainability of the human communities and natural systems of our state.

Protection of source waters (surface and groundwater) is an important goal of the State Water Plan and the regional plans being prepared following the State Water Plan. The resource assessments provide modeling tools and metrics with which to evaluate a mix of management practices, including water withdrawals, and determine if the practices are within the sustainable capacity of the resource.

While source water protection is not directly addressed by the resource assessment modeling, consideration of this topic may be addressed by the regional Water Planning Councils in their vision and goals statements as well as by the management practices they recommend. The assessments focus on determining resource capacity, as one of the building blocks for the regional plans. Regional Water Planning Councils are using the assessments to develop recommended plans that address resource management practices. The regional water plans are intended to work in concert with the programs that are currently in place to protect source waters.

Date: 12/20/2010; Responses added 5/5/2011

2. Recommend that EPD actively involve itself in the efforts undertaken by each Regional Commission pursuant to DCA's Rules for Regional Planning. Collaborative approach could meaningfully strengthen the state's position in managing these crucial assets

EPD has worked with the Regional Commissions to inventory local comprehensive plans and compile the water management practices detailed in each of these plans for review and use by each regional Water Planning Council. Regional Commission staff have also participated in Council meetings and Regional Commissions are likely to be identified as implementing parties for specific management practices in some regions. As the regional water plans are finalized in 2011, an MOA between each Council, EPD and DCA specifies steps to coordinate provisions of regional water plans and local comprehensive plans. Looking forward, EPD expects to continue the on-going active involvement with DCA and Regional Commissions in their coordinated planning roles.

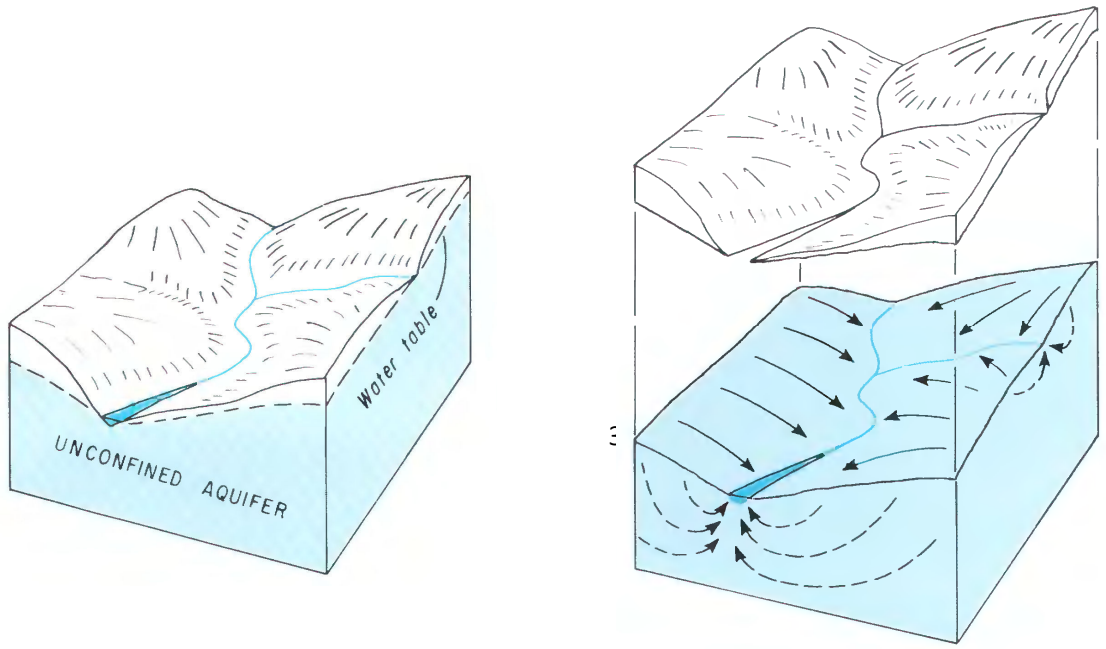
Cobb County Water System (Stephen D. McCullers)

Groundwater Assessment Comments

1. The assumption of the method is that surface watershed and groundwater basin cover the same area making them appropriate for unconfined surficial aquifers. This assumption is questionable in the Piedmont where the surficial aquifer is fractured rock that is highly variable in location and productivity. Because of this location variability it is unlikely that a contiguous shared geographical watershed/groundwater basin is possible at least as defined by area recharge.

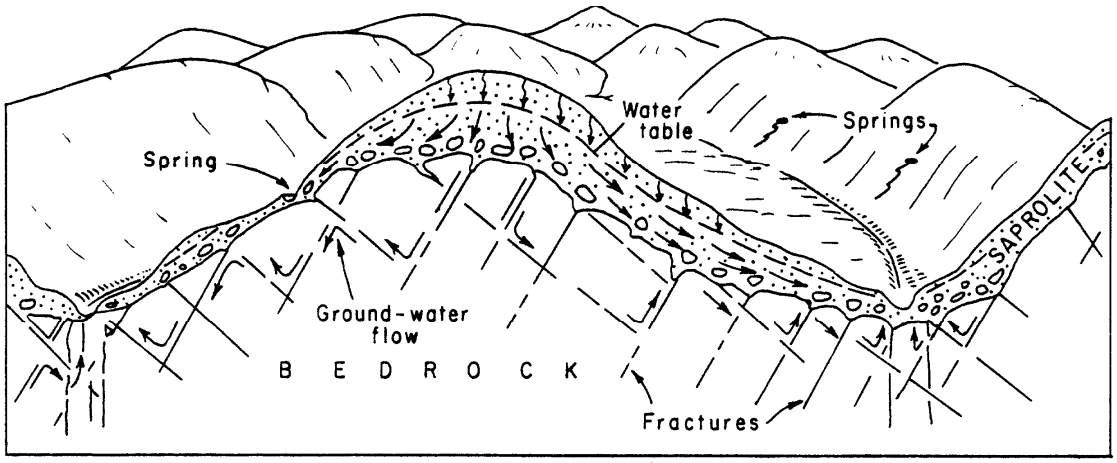
In U.S. Geologic Survey (USGS) Circular 538, *Ground Water of the Piedmont and Blue Ridge Provinces in the Southeastern States* (1967), H.E. LeGrand wrote that the water table in the Piedmont has a hill and valley relation that approximately conforms with surface topography, although the water table is somewhat flatter. Groundwater, like surface water, has the tendency to drain away from the hills to the valleys, and the natural movement of groundwater is relatively short and is almost everywhere restricted to the zone underlying the gross topographic slope extending from a particular land-surface divide to the adjacent streams.

Groundwater movement in the Piedmont, with the surface watershed and groundwater basin covering the same area, was illustrated in a figure from USGS Water-Supply Paper 2220, *Basic Ground-Water Hydrology* (Heath, R.C., 1983), where the figure on the right was a vertical expansion of the figure on the



left to distinguish the unsaturated zone from the saturated zone below the water table, and arrows indicated the directions of groundwater movement from topographically high areas toward streams.

A figure from USGS Water-Resources Investigations Open-File Report 80-44, *Basic Elements of Ground-Water Hydrology with Reference to Conditions in North Carolina* (Heath, R.C., 1980) illustrated how, even with fractured rock that is highly variable in location, directions of groundwater movement remain from topographically high areas toward streams:



Based on the information published by LeGrand and Heath the assumption that a surface watershed and groundwater basin cover the same area would not be questionable in the Piedmont and it is likely that a contiguous shared geographical watershed/groundwater basin is possible even with location variability of water-bearing fractures.

2. The majority of the geology within the Piedmont is granite bedrock and is itself impermeable except where cracks and fissures are present. There is no mention of current accounting for the level of impermeable surface as inputs in the model process. These affects would have to be considered when estimating the potential yield from these sources.

The effects of the level of impermeable surface on sustainable yield of the crystalline rock aquifer were noted on page S-14 of the Synopsis where it was stated that the water budgets developed for the Water Plan did not consider decreased stream baseflows resulting from future increases in impermeable cover. It was also noted that because of the way stream baseflow was used as a metric in the water budgets to determine sustainable yields, increases in impermeable cover and subsequent decreases in stream baseflows would result in lower sustainable yields. The ranges of sustainable yield in the Synopsis were based on current stream baseflows, which reflect current impermeable cover within the watershed. Because sustainable yields were directly related to stream baseflows, future sustainable yields could be adjusted to reflect decreased stream baseflows resulting from increased impermeable surface.

3. With the reductions in streamflows experienced during the 2007-2009 drought, a benchmark of a 40% reduction in flows would potentially have a significant impact on surface water flows and impoundments

at dry times. A benchmark of 40% reduction in base streamflow for an area primarily dependent upon surface water is unacceptable risky for meeting both human and ecological demands on those streams.

Table S-3 in the Synopsis presented a more restrictive use of the streamflow metric in the Piedmont to estimate sustainable yield of the crystalline rock aquifer, which is similar to an approach applied in the New Jersey Highlands. In this case, the streamflow reduction categories were further reduced, allowing only 20% of the difference between the mean September flow and the streamflow threshold to calculate groundwater availability. The concern about reductions in streamflows was reflected on page S-18 of the Synopsis where it was recommended that the lower-end of the sustainable yield range (i.e., the 20% of the difference between the mean September flow and the streamflow threshold to calculate groundwater availability) be used for planning purposes.

4. The groundwater availability from crystalline rock aquifer is highly variable. In order for groundwater to be a considered supply it must be in a usable location for a utility and be reliable. The dependency on fluctuating water tables for the crystalline rock aquifer recharge makes the location, reliability, and sufficiency a potentially undependable source.

The concern about useable locations and reliability of groundwater supplies from the crystalline rock aquifer was recognized on page S-18 of the Synopsis where it was noted that it might be difficult to find sufficient water-bearing fractures in the crystalline rock aquifer to develop the full range of sustainable yield and recommended that the lower-end of the sustainable yield range be used for planning purposes.

5. The impact of a potential 40% reduction in base streamflow at the headwaters of the river basin is going to be far more significant than a 40% reduction further down the basin where streamflow is greater and less constrained.

The sustainable yield metric of no more than 40 percent reduction in groundwater contributions to base streamflow was applied to the reaches of the streams within the crystalline rock aquifer study basins. In the Piedmont and Blue Ridge provinces, baseflow contribution per length of stream reach may be relatively consistent so that the impact of a potential 40 percent reduction in groundwater contributions to base streamflow in a headwaters reach of a stream would be no different than the impact of a potential 40 percent reduction in downstream reaches of a stream.

<u>*Surface Water* Availability *Comments*</u>
6. Unimpaired flows rather than observed flows were applied in this study

The unimpaired flow method (UIF) is consistent with best professional practice and provides a reasonable basis for long term analyses of water availability because it portrays hydrological conditions that are not altered by withdrawals, discharges, consumptive water use, and change of timing resulting from reservoir regulations. If the observed flow time series was used as the basis for a long term analysis, then the hydrological conditions between one period cannot be compared to another, simply because there might have been different types and magnitudes of alterations from anthropogenic activities.

7. The methodology employed in this study prioritizes water uses over satisfying flow regimes. [This] is the exact opposite of the actual operation of Federal Projects. Some instream flow targets are adjusted back slightly to a level designated in the operating plans of the affected Federal Projects. These alterations in flow regime targets are triggered by composite storage benchmarks. Instream flow regimes are not abandoned in the management of Federal Projects. This was clearly evidenced during the 2007-2009 drought.

Meeting water supply needs rather than satisfying flow regimes was chosen as a modeling approach to analyze the differences between available resources and the sum of off-stream and instream needs. When a resource is not able to meet both, there is a shortage. EPD's technical team chose to express a shortage as the extent of flow regime violations while attempting to meet all water supply (off-stream) needs. This is not an EPD policy. Rather, it is just a way of accounting the shortage in available resources. Had we chosen to meet stream flow protection first and account for the shortage in water supply or a mixture of the two, we would have arrived at the same magnitude and frequency of total demand and flow regime gaps.

The various flow requirements at Chattahoochee, Florida have been incorporated in our model and serve as part of the flow regime used in the surface water resource assessments.

8. Storage that is not allocated for water supply cannot be assumed as available for meeting a demand when access to that supply will be unavailable for that demand. In a gap analysis, it seems unreasonable to assume "no gap" because storage exists that by law can't be used to meet the assumed purpose.

The surface water assessment makes no assumptions as to whether storage is allocated to current or future water uses in federal or non-federal reservoirs, given that any such assumptions would require interpretation of water and storage rights conveyed by law, judicial rulings, federal agencies and/or private reservoir owners – well outside the scope of this study. Consequently the surface water assessment identifies only hydrologic shortages, i.e. when streamflow and/or storage have been physically depleted to the point that water withdrawals cannot be supported. No assertion is made as to whether physical availability of storage implies authorization for use of storage for water supply (i.e. whether the fact that storage 'can' be used means that it 'may' be used).

For the assessment of availability under current conditions, however, using remaining physical storage to gauge whether there is a gap between available resources and the total needs (off-stream and instream) was based on the understanding that (1) current water supply use from federal and private reservoirs is mostly sanctioned and authorized by the reservoir owners, and (2) at places downstream of these reservoirs where a flow requirement exist, the water supply needs upstream of that control point are almost always met. To date, the water needs of all existing users have been met by the operation of these reservoirs. This is the basis of the assumed legitimacy of current water use from federal and private reservoirs.

9. The July 2009 federal court ruling on use of Lake Lanier cannot be ignored in a true resource gap analysis. At a minimum the decision should have been modeled along with the current conditions modeled.

While conducting the State Water Plan work, much of the Surface Water Resource Assessment team has been involved in the discussions, negotiations, and associated technical work among the states; in that way, EPD has not ignored the effect of the Magnuson ruling.

That said, the implications of the July 2009 federal court ruling are still the subject of litigation. Consequently, the Revised Interim Operations Plan (RIOP) implemented in 2008 forms the basis of ACF Basin modeling. The RIOP will also provide the basis for future water availability assessments unless an updated ACF Water Control Manual is ready before those assessments are completed.

The July 2009 Magnuson ruling dealt mainly with whether water supply from or supported by Lake Lanier is legal. The ruling did not specify how the Army Corps of Engineers should operate the reservoir system in the ACF Basin. The ruling left a great degree of uncertainty regarding how the Corps should operate Lanier and the other ACF projects.

Assuming no change in the IOP operation, the effect of the ruling on water availability, in simple terms, is that almost all of withdrawals from Lanier and a big portion of the withdrawals from the upper Chattahoochee River should be considered gaps. Modeling results would not assist in further clarifying this self-evident scenario.

The July 2010 ruling from Judge Magnuson suggests that the IOP operation should continue until a new Water Control Plan becomes available. In his ruling, Judge Magnuson stated that any Water Control Plan that did not consider water supply of the metro Atlanta area would be a useless practice, indicating that the Corps' new Environmental Impact Statement will have to take into consideration current and future metro water supply needs. This adds to the uncertainty of how the Corps might operate Lanier and the rest of the ACF system.

When the potential operations are so uncertain and so many assumptions can be made, the number of potential modeling scenarios becomes unmanageable.

10. "Use all water availability to meet demands and allow any shortfall expressed as not meeting instream flow requirements." This is not how these systems are operated. They are actually operated to meet the downstream flow targets at various levels triggered by benchmarks of composite storage. Water use curtailments will be required if those targets are not being met. Especially those targets associated with ESA requirements.

As described in the response to Comment 7 from the Cobb County Water System above, this accounting is an analytical tool used to evaluate differences between available water and the sum of offstream and instream needs. It does not reflect an EPD policy and is not intended to reflect how the systems actually operate.

11. Water efficiency and conservation are priority practices as outlined in the State Water Plan. Assessments that potentially fail to acknowledge the potential gaps in available supply, by modeling idealized conditions, may result in a failure to consider any conservation or efficiency practices when preparing regional plans.

The resource assessments are intended to determine the extent to which gaps exist between demands on a water source and the sustainable supply of water. The 'current assessments' compare current demands with water supplies as currently developed within geographic areas, and 'future assessments' compare expected future demands (i.e., forecasted demands) with water supply capacities in their current state.

The current resource assessments are not designed to be an evaluation of management practices beyond those already in place. They are designed to depict current conditions and, because they incorporate current water use, they reflect the water efficiency and conservation practices currently in use. And, for some of the nodes, results do indicate gaps in available supply.

The assessments provide the baseline required for regional Water Planning Councils to identify and evaluate a suite of future management practices, including water conservation. Water conservation is indeed a priority practice in the State Water Plan. All Councils are considering water conservation practices among the suite of future practices to be evaluated with the resource assessment tools and selected for inclusion in their regional plans.

Water Quality Assessment

12. This synopsis report is just a synopsis. It is difficult to determine if there is a problem or where a problem may occur. For example, if you look at Figure 3-2, one would assume that there is basically no problem with capacity in the Chattahoochee River Watershed and in regards to DO in the issuance of NPDES permits.

The synopsis presents a summary of the results of the current assessments that are being used by the regional Water Planning Councils. EPD staff and consultants under contract with EPD are working with the Councils to help them interpret and understand the results presented in the synopsis, as well as draw on other information on water quality conditions in their regions (e.g., the 303(d)/305(b) list of impaired waters; local information on causes of water quality problems). While an important part of their work, the current resource assessments are not the only sources of information in use by the Councils.

For the Chattahoochee basin specifically, additional assimilative capacity models (watershed, lake and river) are being developed and the results are expected to be available late in 2010. This modeling is funded through a different source, so the results will be available later than modeling supported by state water planning funds.

13. Figure 1-1 indicates that the RIV 1 model was used on the Savannah River but this model is not discussed with the other models.

EPD RIV-1 is a one-dimensional (cross-sectionally averaged) hydrodynamic and water quality model. It consists of two parts, a hydrodynamic code (EPD RIV-1H) and a water quality code (EPD RIV-1Q). EPD RIV-1H predicts flows, depths, velocities, water surface elevations, and other hydraulic characteristics. The hydrodynamic model solves St. Venant equations, as the governing flow equations, using the widely accepted four-point implicit finite difference numerical scheme. EPD RIV-1Q predicts variations in each

of ten state variables: temperature, carbonaceous biochemical oxygen demand (CBOD), organic nitrogen, ammonia, nitrate, dissolved oxygen, organic phosphorus, orthophosphate, and algae.

14. There is mention of REV 1 model. Is this the same as RIV 1?

REV 1 indicates the revision of the modeling report.

15. Figure 3-4 indicates that there is zero dissolved oxygen capacity available in Carters Lake, a portion of Lake Allatoona, and Lake Acworth.

The figure is incorrect and will be corrected in any future use. There is sufficient dissolved oxygen in Carters Lake, Lake Allatoona and Lake Acworth. Carter's Lake and portions of Lake Allatoona are impaired for chlorophyll-a, which means that, in these lakes, there is no remaining capacity to assimilate nutrients. Lake Acworth has nutrient assimilative capacity.

16. Table 4-2 appears to miss a model prediction in 2004 for station 14302001.

The standard for Etowah River upstream from Sweetwater Creek (Station 14302001) is 12 ug/l. Due to significant figures, a growing season average of chlorophyll-a up to 12.49 ug/l is considered to be equivalent to 12 ug/l.

17. In the discussion on lake results, there are no data tables on actual nitrogen loadings presented.

Comment noted. GAEPD does not measure nitrogen loadings. Total nitrogen concentration measurements can be found in annual reports for those lakes with standards.

18. In discussion on reaeration, there appears to be an error under the equation. 1 cfs probably should be 10 cfs.

The commenter is correct; the formula will be corrected in future publications.

19. On Critical Conditions, it states that data was "adjusted, as needed". What exactly does this mean as it indicates that field data is not reliable?

The point sources that did not have dissolved oxygen or ammonia limits in their permits were adjusted as needed based on concentrations used during calibration.

20. On Natural Conditions, "all other model parameters remained the same unless background levels of CBOD and NBOD were abnormally high in the calibration model then these parameters were reduced to typical background levels." Is it possible that the background levels are normally higher than typical?

Yes, in some areas of the State, observed data indicate that background CBOD and NBOD levels are high, and this information was used in the calibration of the models. In the Natural Conditions models, based on a review of all available data, these levels may have been reduced to typical background levels.

21. Would suggest not using SOD in Figures A-3 and A-4 as SOD is referenced earlier as Sediment Oxygen Demand.

Comment noted. Figures A-2 through A-4 should read Atlanta Hartsfield Airport Summary of the Day Station 090451.

22. In Section B-1 thru B-6, it is recommended that the detailed results be relabeled

Comment noted.

23. Fire B-13 and B-13 (B-13.3 and B-13.4) are the same but the detailed results are very different. An explanation would be helpful.

Figure B-13.3 is the available assimilative capacity whereas figure B-13.4 is the actual modeled dissolved oxygen under current conditions.

24. In the detailed results in Section B.1 thru B.6, it is not possible to determine if the problems are the result of point source, non-point source discharges, or natural conditions.

Comment noted.

25. Section B.7 shows widely different assimilative capacity for dissolved oxygen in Brunswick harbor for the years 2001 thru 2007, yet there is no rationale given for the difference. Without an explanation, how is it possible for this information to be used in the allocation of resources?

The difference in the dissolved oxygen values is due to different flow conditions based on wet and dry years. The lowest flows were in 2002 and 2007 when the assimilative capacity was most limited. As noted above, EPD staff ad consultants under contract with EPD are working with Water Planning Councils to help them interpret and understand the results presented in the synopsis. It should also be noted that resources will not be directly allocated through this planning process. The regional water plans will guide permitting, once adopted, and multiple sources of information will be considered when permit applications are be evaluated.

26. Section C.1 presents the Watershed Results for nitrogen and phosphorus from the LSPC model in pounds per acre per year for the watershed. However, point source discharges are not shown so it is not possible to determine if problems are due to point or non-point sources.

Comment noted.

27. There is a limit of 38,000 lbs/yr of phosphorus loading from Noonday Creek at North Rope Mill Road. We do not believe that North Rope Mill Road actually crosses Noonday Creek.

North Rope Mill Road does not actually cross Noonday Creek; however, it dead-ends into Noonday Creek.

28. We do not believe that the results of the water quality assessment are sufficient for the water planning councils to begin their work.

EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the results of the current assessments as presented in the synopsis. As they develop their draft plans, Councils are also drawing in other sources of information on water quality conditions in their regions (e.g., the 303(d)/305(b) list of impaired waters; local information on causes of water quality problems).

Cobb-Marietta Water Authority (Glen M. Page)

Staff at the Cobb-Marietta Water Authority worked with Cobb County Water System staff to review the draft current resource assessments, and the letter from Mr. Page presented the same comments as submitted by Cobb County Water System. See responses to comments from Cobb County Water System immediately above.

Metropolitan North Georgia Water Planning District (Pat Stevens)

Groundwater Assessment

1. Our understanding of water budget techniques is that if all remains constant the surface water flow could potentially be reduced at all times by as much as 15.8 cfs in the crystalline rock aquifer. During critical periods the flow in the study watershed would be reduced to 4.2 cfs by subtraction from the 20 cfs 7Q10 flow (Table S-3).

The net amount of groundwater available for use in the Piedmont study basin was given as a range of 0 to 15.8 cfs based on 20 percent of the mean September flow minus the Tennant threshold. In Table S-4 on the following page of the Synopsis, which compared groundwater sustainability measures to net groundwater consumption, the net groundwater available in the Piedmont study basin was 3.2 cfs based on 20 percent of the mean September flow minus the Tennant threshold. With this consumption, the flow in the study watershed would be reduced to 16.8 cfs by subtraction from the 20 cfs 7Q10 flow, a reduction in the streamflow of 16 percent during critical periods. As noted in the response to comment 3 of the Cobb County Water System, page S-18 of the Synopsis recommended that the lower-end of the sustainable yield range be used for planning purposes.

2. We request that Groundwater Availability Assessment more clearly state something to the effect that "groundwater should not be relied on as a primary source of drinking water in the Piedmont."

It would be incorrect for the Synopsis to have included such a statement, given that groundwater from the crystalline rock aquifer is already used as a primary source of drinking water in some parts of the Piedmont and Blue Ridge provinces. Presentations on groundwater availability made at the Water Planning Council Joint Meetings during January and February 2010 noted that, while the low ends of the ranges of sustainable yield in the Piedmont and Blue Ridge study basins (those recommended for planning purposes) were higher than current groundwater use in the study basins, the sustainable yield of groundwater was not sufficient to replace all surface water use in the study basins.

The extent to which groundwater will be relied upon to meet future demands in different parts of the Piedmont is a recommendation to come from the Water Planning Councils in their recommended regional plans. Councils - with assistance provided by planning contractors and EPD staff - will use the Groundwater Availability Assessment as one element of input as they deliberate on their water supply choices. Councils are currently evaluating different mixes of management practice, including groundwater withdrawal.

3. It is recommended that any request for ground water withdrawal for community water supplies should evaluate the impacts of the requested withdrawal with the cumulative impacts of all groundwater withdrawals in the watershed and planning area on the surface water and ecological resources.

The Georgia Environmental Protection Division (EPD) rules at Chapter 391-3-2, Groundwater Use, address this comment. The rules at Chapter 391-3-2-.04 (1), (2), and (3) already require applicants for a groundwater withdrawal permit to furnish the Georgia EPD with sufficient documented evidence to evaluate the effects of the described water use upon the water resources of the area. The rules at Chapter 392-3-2-.04 (5) state that sufficient documented evidence shall include, but not be limited to, any present or anticipate unreasonable adverse effects or potential unreasonable adverse effects on other water uses or users. The rules at Chapter 391-3-2-.05 (1) 9h) state that in considering permit applications, the Georgia EPD shall consider diversion from or reduction of flows in other watercourses or aquifers.

Surface Water Availability Assessment

4. We understand that the models used for the surface water assessment were intended for broad scale regional planning purposes as opposed to individual permitting decisions. We are not completely clear as to how these results will be used in the ensuing "Future Assessment (Planning)" phase of the plan.

The results obtained from the surface water assessments reflect the impact of consumption (i.e., surface water withdrawals minus discharges to surface waters) - within a local drainage area - on stream flows at discrete locations called planning nodes. Determination of the impacts of consumption on flows at a planning node requires the same modeling approach for current conditions (i.e., current assessments) and future conditions (i.e., future assessments). What is different is that current assessments evaluate the impacts on planning node flows of current consumption, while future assessments evaluate the impact on flows of expected future consumption. In evaluating the impact of expected future consumption on planning node flows, there is the opportunity to determine impacts without new management practices, as well as WITH new management practices.

Flow metrics are used to determine whether sufficient water is available to meet current or expected future consumption above the planning nodes as well as desired instream flows at the planning node. If not, then corrective measures (i.e., management practices) are required to ensure that consumptive use and instream metrics can both be met.

Future assessment planning is therefore the act of determining the extent to which satisfying future expected consumption and flow metrics will or will not require additional management practices within the drainage area above a planning node.

5. The next steps in the surface water assessment planning process should take into account existing permits and future needs. In growing communities the orderly protection of public health requires water supply reservoirs, permits and major infrastructure to be in place many years before the date the actual need occurs. There is a tremendous lead time and huge public investment involved in preparing for adequate water supply. Water systems in the metro Water District have invested heavily in the infrastructure to withdraw, treat and distribute drinking water at the permit limits.

Assessment of water availability for future needs is currently underway. We have completed the Initial Future Assessment using projected water use through 2050, and will provide further assessments with management practices as requested by the Water Planning Councils.

Existing permits reflect planning and investment to meet future needs and information on existing permits has been compiled as the first step in meeting forecasted demand. Information on projects that are in the pipeline is also being compiled to supplement that on existing permits. Water Councils are using this information along with forecasted demands and the results of the Future Assessments as they develop their management practices.

However, the Surface Water Resource Assessment Team did not run a "Permit Limit" scenario because this scenario is not directly related to the available resources or water needs at specific time horizons. First, the water available to meet off-stream and instream needs is not determined by permits. Second, most permit holders' current water use is far different from there permit levels and because these permit have different expiration dates, a simple sum of all the permitted amounts does not tell whether this limit will be reached on a certain time horizon. Finally, forecasts of future water use amounts also do not reflect permit limits either, at least not on an aggregated basis.

The more appropriate approach, as we envisioned, would be to run the future scenarios with various forecast horizons and see if available resources can meet future water needs plus instream flow thresholds. The permit limit value can then be compared to the corresponding water needs at these forecast scenarios to see how far existing permits can carry the water users.

See also response to comment 9 from the Georgia Water Alliance.

<u>*Current Assimilative Capacity Assessment*</u>

6. Results indicate that a stretch of the Chattahoochee River from Buford Dam to just downstream of Suwannee Creek has minimal or no assimilative capacity. Since there are no wastewater treatment facilities (WTF) that discharge treated wastewater into this stretch of river, the low dissolved oxygen (DO) must be the result of historically low DO in the water released from Buford Dam/Lake Lanier. It is our understanding that the Corps of Engineers completed a project in 2006 that provided venting of the waters being released through the Buford Dam turbines. The venting should result in an increase in the DO to approximately 6.0 mg/1, though we are unsure if more recent DO data have been collected on this stretch of the river. Does this planning document reflect the increase in the DO concentrations as a result of the turbine venting project?

The planning document does not reflect the increase in dissolved oxygen concentrations as a result of the turbine venting project. GAEPD does not yet have data on that. If dissolved oxygen data are collected or become available, the models will be updated with the new information.

Georgia DNR - Wildlife Resources Division (John Biagi, Mike Harris)

Groundwater Available Assessment Comments
1. Type of 7Q10 should be specified whenever mentioned.

The type of 7Q10 will be specified in resource assessment reports from here on.

2. Effects of groundwater withdrawals on stream flows in regard to aquatic organisms are not clearly addressed.

Groundwater withdrawals were constrained to limit potential impacts on stream flows and instream or other uses of surface water. The metrics used to constrain decreases in groundwater contribution to baseflow, and thereby limit potential effects on stream flows, were derived from the Tennant Method. The Tennant Method was chosen because, at this level of water resource planning, there is a need for a sufficiently simple method that can make use of readily available streamflow statistics. The Tennant Method relies on percentages of mean annual flow in order to recommend seasonally adjusted instream flows that have some hydrologic relevance to maintenance of healthy aquatic conditions. The method has become popular because it is an easy to apply standard that can be used with limited and readily available data and is therefore practical for the level of planning being completed for the State Water Plan.

The Tennant Method uses percentages of mean annual flow to recommend seasonal instream flows to maintain healthy aquatic conditions. In this method, streamflows of 60% of mean annual flow from April to September and 40% of mean annual flow from October to March are generally associated with outstanding aquatic habitat conditions.

The Tennant Method was further modified to provide an indication of sustainable yield considering only the baseflow component of streamflow. This was done to provide an upper limit to groundwater withdrawals that would leave sufficient water in the stream during the period of lowest flows to support opportunities for instream and other surface water uses. Baseflows are lower than the mean annual discharge so that the Tennant Method metrics used in the groundwater assessment were more constraining than if the Tennant Method had been applied directly using percentages of mean annual discharges. Accordingly, in the Groundwater Availability Assessment, simulated groundwater withdrawals were generally increased until groundwater contributions to baseflow were reduced by no more than 40 percent (the metric was modified slightly for the Paleozoic and crystalline rock aquifers).

3. Dougherty Plain Model was calibrated to October 1999. Although this period of the drought did represent the lowest stream baseflow, it also correlated with the end of the growing season and thus

groundwater withdrawal rates may have been lower than typical withdrawal rates. As a result, sustainable yields may be exceeded and not reflected in the model.

The Dougherty Plain model was calibrated by the USGS as part of the March 2006 Georgia EPD *Flint River Regional Water Development and Conservation Plan*. The modeling conducted by the USGS included steady-state calibration to October 1999 conditions.

According to USGS Scientific Investigations Report (SIR) 2006-5234, *Simulated Effects of Seasonal Ground-Water Pumpage for Irrigation On Hydrologic Conditions In the Lower Apalachicola-Chattahoochee-Flint River Basin, Southwestern Georgia and Parts of Alabama and Florida, 1999-2002* (Jones, L.E. and L.J. Torak, 2006), October is a month of low (if not lowest) stream baseflow. Because the sustainable yield of the Upper Floridan aquifer in the Dougherty Plain was dictated by the constraint on reduction of groundwater contributions to stream baseflow, the range of sustainable yield was done for a month of low stream baseflow (i.e., October) when the amount of recharge available from reduction of groundwater contributions to stream baseflow, and therefore the range of sustainable yield, would be lowest.

The range of sustainable yield using October 1999 baseflows was 237 to 328 million gallons per day (mgd). An additional simulation was performed using March 2001 streamflow, the month of highest streamflow in USGS Cir 2006-5234. These scenarios resulted in a range of sustainable yield of 262 to 347 mgd, slightly higher than the range determined using the October 1999 stream baseflows.

The range of sustainable yield determined for a growing-season month with larger irrigation withdrawals and stream baseflows larger than those during October 1999, but smaller than those during March 2001, would be between the ranges of 237 to 328 mgd and 262 to 347 mgd. The ranges of sustainable yield determined by the simulations apply throughout the year, not just during the months of October and March. Therefore it is likely that groundwater withdrawals will exceed the ranges of sustainable yield during the growing season.

4. It is important to take into account the highly connected nature of the Upper Floridan Aquifer to streams and rivers in the Lower Flint River Basin. For instance, some springs in the lower Flint temporarily lose function as thermal refuges for striped bass as warmer river water enters these cool-water groundwater inflows. While aquifers are known to recharge from rivers, it appears that smaller streams also recharge the aquifer under increased withdrawal scenarios, exacerbating the drying of these sensitive streams and threatening the persistence of aquatic species.

The high degree of interconnection between the Upper Floridan aquifer and streams and rivers in the lower Flint River basin was built into the USGS model used to determine the range of sustainable yield of the Upper Floridan aquifer in the Dougherty Plain. No adjustments were needed or made to the USGS model to simulate interactions between the aquifer and surface waters.

Smaller streams can recharge the aquifer under increased groundwater withdrawal scenarios. The sustainable yield modeling was done in a way that constrained the reduction of groundwater

contributions to stream baseflow. The models were never run beyond the point of constrained baseflow contributions to the point that streams actually contributed water to the aquifer. Streams in the simulations had reduced baseflows, but even with increased simulated groundwater withdrawals, gaining streams never became losing streams in the simulations.

Groundwater withdrawals were increased in sustainable yield simulations until groundwater contributions to baseflow in any stream segment in the model domain were reduced by 40 percent. This occurred to a segment of Muckaloochee Creek in the northern portion of the Dougherty Plain at which point simulated increases in groundwater withdrawals were stopped. The reductions in groundwater contributions to stream baseflows elsewhere in the Dougherty Plain were less than 40 percent. Therefore the simulations did not induce recharge from smaller sensitive streams and greatly constrained reductions of groundwater contributions to baseflows of such streams.

Surface Water Availability Assessment Comments

5. The type of 7Q10 should be specified whenever mentioned

All of the 7Q10's in Surface Water Resource Assessments are monthly 7Q10s of unimpaired flows. The type of 7Q10 will be specified in resource assessment reports from here on.

6. Spelling of Ochlockonee should be standardized

GAEPD uses the spelling of Ochlockonee, not Ochloconee. We will make sure that the spelling of this word is consistent.

7. Is the number of planning nodes sufficient for Water Planning Council to address stream flows in smaller rivers and streams? Our concern is that the planning areas are too large to adequately address questions of water availability. In addition, in systems that are mostly regulated the unregulated portions of those systems will function in entirely different ways that are not likely to be addressed under the current planning node strategy.

The number of nodes and their locations are constrained by the existing USGS gages and the period of record at these gages. As a result, all Basic Nodes and Planning Nodes are located on the main stem of major rivers or major tributaries. Flow data (both observed and unimpaired) at the Planning Nodes provide a good basis for analyzing flows from the local drainage area that contributes to each node. However, the analysis is limited to the locations where such flow data have been compiled. It does not allow Councils to address stream flows in smaller rivers and streams. This is a limitation in the analysis and one area where refinements will be considered as the assessment tool is revised in the future.

8. Although this resource assessment and the Groundwater Availability resource assessment both indicate that the effects of surface water and groundwater on each other are taken into account, it is unclear in either document how that occurs. Could you include demonstrations/examples showing how that takes place?

For the groundwater assessment, as noted in the responses to comments 2 and 4 from the Georgia Department of Natural Resources Wildlife Resources Division, modeling of the ranges of sustainable

yield of prioritized aquifers was done in a way that constrained reduction of groundwater contributions to stream baseflows due to increased simulated groundwater withdrawals. Simulated increases in groundwater withdrawals were stopped when groundwater contributions to the baseflow of any stream segment in the model domain was reduced by 40 percent. Therefore, in the sustainable yield simulations, reduction of groundwater contributions to the baseflow of many, if not most, stream segments in the model domain was less than 40 percent. A similar approach was used to determine the range of sustainable yield for the Paleozoic rock aquifer in northwestern Georgia although the constraint on reduction of groundwater contributions to stream baseflow was even smaller than 40 percent.

There are different levels of groundwater and surface water interactions at different places around the state. The most prominent interaction between the two is in the Dougherty Plain, where the Upper Floridan Aquifer outcrops and the main stem Flint River and its major tributaries cut through the aquifer. For the surface water assessment, we have a groundwater model developed by USGS capturing the interaction. Groundwater discharge into the streams as well as the reduction of such discharge resulting from groundwater pumping can be computed, and its results are fed into our surface water model to reflect its impact on surface water stream flows.

To the east of the Dougherty Plain, the Upper Floridan Aquifer is buried deep, and the interaction between surface stream and the aquifer is minimal.

In the Piedmont area, the total amount of potential M&I groundwater use is very small. We summed all of the permitted groundwater withdrawal amounts. We also summed the long-term average of surface water stream flow in the entire Piedmont area. The former is less than 0.5% of the latter. Because permitted parties currently withdraw at levels lower than their permitted levels, the actual effect of groundwater pumping on surface water flow would be even lower than this. We concluded that this effect is negligible in surface water resource assessment for the Piedmont area.

For the Blue Ridge Mountain area, before this round of Groundwater Resource Assessment, we did not have any information quantifying interactions between groundwater and surface water streams. We will incorporate the results of this round of Groundwater Resource Assessment into the next round of surface water availability resource assessment.

9. Regarding regulated and semi-regulated notes the meaning of the following statement is unclear: "in the absence of such requirements at any node, there is no required flow regime". Do you then revert to "unimpaired flow", monthly 7Q10, or some other metric?

In many of the regulated basins, the operating parties have a responsibility to either make specific minimum releases from the projects or to maintain a certain minimum flow at a downstream node. Where they exist, these provisions were used as flow regime requirements at the project and downstream nodes. For example, the Army Corps of Engineers is required to make a release from Lake Lanier to sustain a 750 cfs minimum flow at Chattahoochee River at Atlanta. Also, the Corps is required by its Operation Manual to release 675 cfs through its service unit at West Point.

However, these requirements do not cover all of the nodes in the regulated basins. At places where an explicit requirement does not exist, we did not apply any flow regime metric.

10. [In Table 1] Consider separating the Ochlockonee and Suwannee basins from the Satilla and St. Marys basins. Topography, stream morphology, hydrology, geology, and land use are significantly different in the Gulf slope versus Atlantic slope systems.

Even though the OSSS Study Basin incorporates the Ochlockonee River, Suwannee River, St. Mary's River, and the Satilla River, the models used to assess surface water resource were constructed separately for each river basin. The assessment of surface water availability in these basins is independent of each other.

11. There is a body of primary literature documenting the effects of changing land use on runoff and stream flow. Perhaps it could be examined and used to remove that important human influence from your unimpaired flows.

There are two reasons why the effects of land use change have not been addressed in development of unimpaired flows. First of all, land use change such as development or urbanization is likely to remain in place for the foreseeable future. The effects of such change on hydrologic responses are likely to continue to take place as well. The net effect of any land use adjustment would be to remove the differential between "land use in force under the forecast scenarios" and "historical land use" from observed flows. This differential may be difficult to determine and may not be significant.

Second, if we were to remove the effects of development on hydrologic responses, a reliable quantification of such effects would have to exist. We welcome stakeholder input to help us identify such methodology for consideration as we refine the resource assessments in the next round of regional planning.

12. It appears there are planning nodes outside the state's boundary. Are neighboring states supplying adequate water demand data to be used at these nodes?

We have received water use data from the State of South Carolina. We have obtained water use data for the State of Alabama from the Army Corps of Engineers. We do not have water use data from other neighboring states.

Some of the Planning Nodes are outside the boundary of the State of Georgia simply because they are the closest gage to the state line. Keowee is a special case. We placed it as a Planning Node because of a significant amount of inter-basin transfer that is taking place from this sub-basin.

13. The following statement is difficult to understand: "agricultural water use data aggregate direct surface and effective surface withdrawals from groundwater pumping."

Some farmers practice agricultural irrigation using surface water. The amount of diversion is a direct withdrawal from the surface water sources. Others pump groundwater for agricultural irrigation. Such pumping reduces groundwater levels and consequently the amount of groundwater discharged into the

streams. We call this "effective surface withdrawals" or "surface water effects." The sum of the direct surface withdrawal and effective surface withdrawals is the total effect of agricultural irrigation on surface water flows.

14. The description of the River Basin Planning Tool indicates that it can be run for different levels of "instream flow protection reliability." This might be more directly stated so that Water Planning Councils members clearly understand that the models can be run for a broad range of flow protection scenarios.

Point taken. We will reword this in the updated Surface Water Resource Assessment Report.

15. Regarding the non run-of-river reservoirs, it is unclear how you are modeling current conditions if "the operational plans for these non-run-of-river reservoirs are not known to this study."

We have received additional information regarding the operation of these reservoirs, and have incorporated this additional information into the Resource Assessment models. Most of these projects are operated to provide minimum releases at sites. The minimum releases can change from month to month.

16. The Augusta Diversion Dam was omitted from the description of the Savannah basin, and should be covered.

We will have the description incorporated into the updated Surface Water Resource Assessment Report.

17. Modeling indicates that rivers will go dry at the planning nodes under current demands. Can management practices selected by the Water Planning Councils include more stringent requirements for water conservation during low flow periods?

Yes, various water conservation practices are among the suite of management practices being considered by the Water Planning Councils. For areas where a gap between demands and resource capacities are identified, the Councils will identify water conservation practices for evaluation. Planning contractors will assist the Councils in evaluating the water savings and costs of the water conservation practices. Councils will then select a portfolio of conservation practices that, if necessary, can be combined with other quantity management practices to close gaps between demand and resource. The goal is to bridge the gap between available resource and the total off-stream and instream needs. It is conceivable that a Council's recommended regional plan may include more stringent water conservation provisions during low flow periods as one of the practices in the Council's suite of management practices.

<u>*Surface Water Quality Assessment Comments*</u>
18. The type of 7Q10 should be specified whenever mentioned

The 7Q10 used in the steady-state models is typically an annual number, unless there are seasonal or monthly limits, and then the monthly 7Q10 is used.

19. The spelling of Ochloconee should be standardized

GAEPD uses the spelling of Ochlockonee, not Ochloconee. We will make sure that the spelling of this word is consistent.

20. To what area does the "coastal fishing dissolved oxygen standard" apply? How will you determine if "the biological community is not adversely affected"?

The coastal fishing DO standard is applicable from Seaboard Coastline RR Bridge (Mile 27.4) to Fort Pulaski (Mile 0). The allowable dissolved oxygen deficit greater than 0.1 mg/l will be determined by comparing results from the natural Savannah Harbor WASP model to the results of the recruitment model for the biological community expected in Savannah Harbor.

21. [In the table on p. 4 of the Synopsis], does the sum of river miles across a row equal the total river miles for that river basin? Or does the sum only represent the river miles assessed? It would be helpful to know the total river miles in each river basin.

The sum of the river miles across a row is the total number of river miles modeled for that basin.

22. If six lakes in Georgia have lake standards why are results only available for Lakes Jackson and Allatoona?

Results were only available for Lake Jackson and Lake Allatoona in March 2010. Current assimilative capacity models are being developed for lakes Lanier, West Point, and Walter F. George, and the results are expected be available late in 2010. The Carter's Lake model will be developed in 2011.

23. It would be helpful to know what the lake standards are as the nutrient results are summarized. Nutrient standards for Lake Jackson seem high. If so, using Lake Jackson's standards as surrogates for Lakes Oconee and Sinclair may allow nutrient loadings in those reservoirs to be higher than their actual assimilative capacity.

The lake criteria are presented in the result tables. Lake criteria will be developed for lakes Oconee and Sinclair as part of Georgia's Nutrient Criteria Development Plan.

24. Who developed the GAEst, LSPC and EFDC models?

The GAEst, LSPC and EFDC models were developed by Tetra Tech under contract to EPD.

25. Figures indicate that dissolved oxygen assimilative capacity analyses occurred relatively less frequently in the Tennessee basin, the lower Chattahoochee basin, and the upper Savannah basin. Is that an accurate assessment and if so, why where those areas sampled with less intensity?

Dosag and GaEst models were developed for those waterbodies that currently have wastewater treatment plant discharges on them. The results for the Tennessee, lower Chattahoochee and upper Savannah basins do not reflect less intense sampling. Those basins simply have fewer waterbodies that currently receive wastewater treatment plant discharges. For future discharges, modeling tools will be expanded to include additional stream segments as necessary.

26. Nutrient values for Lakes Oconee and Sinclair are being compared to standards for Lake Jackson. It may be more appropriate in Tables 4-12 through 4-19 to replace "N/A" with some indication of the Lake Jackson standards.

Water quality benchmarks were needed for each of the lakes. Results for lakes Oconee and Sinclair were therefore compared to water quality criteria established for Lake Jackson because these lakes are all in the same ecoregion and have similar land use characteristics. However, since lakes Oconee and Sinclair do not have criteria, the columns listed in the tables 4-12 through 4-19 should read N/A.

27. GA Dosag model allows the user to choose whether to use the depth variable or not for each branch. However, both Sediment Oxygen Demand calculations and the Dobbins-O'Conner reaeration equation require a reach depth user chooses not be use the depth variable is unclear how the fixed reach depth is determined.

If a fixed reach depth is selected, typically a 1.0 ft depth is chosen based on best professional judgment.

28. [It is] unclear how the default values of 2 mg/L. for DO and 17.4 mg/L for NH3 were selected in cases where NPDES permits did not contain DO or NH3 limits.

These are the default values typically used for secondary treatment plants.

29. Description and assumptions presented for the Natural Conditions Model need to be explained further in order to clarify the appropriateness of the model.

The Natural Conditions Model is the Critical Conditions Model with point source discharges removed. In a few cases, adjustments need to be made to model parameters such as CBOD, NBOD, and SOD.

30. Were channel geometry characteristics for the LSPC model collected in the field? These are difficult measurements to collect correctly and would not likely be useful if derived remotely.

Channel geometry characteristics were not measured in the field. These values were determined using Rosen stream metrics.

31. [In] Appendix B, it appears that the last two figures for B-13 are the same section of the Satilla River with different results.

Figure B-13.3 is the available assimilative capacity whereas figure B-13.4 is the actual modeled dissolved oxygen under current conditions.

West Point Lake Coalition and LaGrange-Troup County Chamber of Commerce (Dick Timmerberg)

1. The planning process has totally ignored the importance of tourism to the state of Georgia. Tourism is the #2 industry in the state and the reservoirs are a major contributing factor to the overall tourism economic impact. It is incomprehensible that the state would proceed with water planning and totally ignore recreation, the need for water to maintain lake elevations, and the economic impact of the federal reservoirs to the state's overall prosperity.

The metrics being employed by EPD to determine the sustainable capacities of Georgia's water resources do not currently include consideration of reservoir levels - at various reservoirs - required or desired to support various intensities of water related recreational activities. These types of analyses are beyond the scope of the current resource assessment process. However, in accordance with the Regional Water Planning Guidance, members of regional Water Planning Councils are encouraged to provide information related to reservoir-level influences on tourism and other factors for Council consideration. The surface water modeling tools being employed by EPD in support of Councils' planning activities are capable of responding to a range of reservoir level questions that members may wish to investigate, but EPD does not anticipate adding these type of metrics to its baseline assessment of surface water systems during the current round of regional water planning. Economic valuation of water in alternative uses is outside the scope of the resource assessment, but may be considered by the planning councils during the evaluation of both the Councils vision and goals for the region as well as their recommended water management strategies.

2. The Planning Process continues with no mention of studies to determine the impact on the environment or the ecosystems in the ACF Basin as a result of the state's modeling plan.

The Army Corps of Engineers operation of the ACF Basin as well as its environmental and ecological effects have been documented numerous times during the past few years. This information can be found in the Corps Environmental Assessment for the Revised Interim Operation Plan and the Environmental Assessment granting the State of Georgia's request for reduced flow at Chattahoochee River at Atlanta under extreme drought conditions. The state's modeling of the Corps operation of the ACF system is a reflection of the Corps' current operation, whose environmental effects have been analyzed clearly in these documents.

3. The Planning Process has failed to factor in and respect the congressionally mandated authorizations for the federal reservoirs on the ACF System in spite of Judge Magnuson's ruling. Judge Magnuson stated the congressional authorizations should be honored early throughout the planning process and should NOT be ignored.

It remains unclear how Judge Magnuson's July 2009 ruling is interpreted in terms of operation of Lanier and other ACF federal projects. The Army Corps of Engineers interpreted Congressional authorization to develop its operation plan, and that is what Georgia's modeling team used in the Resource Assessment process. Also see response to Comment 9 by Cobb County Water System.

4. The Planning Process is void of any analysis of stakeholders' wants vs. needs. Major stakeholders needs have to be determined and then validated. Once all the needs are verified, the state must ascertain that each need is based on the respective stakeholder being a good steward of the water resource.

The regional Water Planning Councils are an important vehicle for incorporating stakeholders' wants and/or needs. Stakeholders who serve on Water Planning Council will continue to provide this perspective as regional water plans are developed and finalized. There are also ongoing provisions for

public input in development of regional water plans. The Resource Assessment team remains ready to analyze any requested scenarios for future water use selected by the Water Planning Councils.

5. There has yet to be a resource assessment for the Chattahoochee River presented to the Middle Chattahoochee Planning Council.

Results of Surface Water Resource Assessment have been presented at multiple meetings and are also posted online. A number of additional model runs and material were made available specifically to the Middle Chattahoochee Council.

For the Water Quality Resource Assessment, models of dissolved oxygen (Georgia Dosag) are available for the Chattahoochee River basin. Additional assimilative capacity models (watershed, lake and river) are being developed for the Chattahoochee River basin, and the results are expected to be available late in 2010.

6. The state Planning Process continues to move ahead although critical information is missing and the foundation of the planning process is both flawed and shaky! The Corps of Engineers is currently developing a comprehensive Revised Water Control Plan; yet there has been no indication that the state is coordinating with the Corps of Engineers. The state Planning Process should be based on the Corps Revised Water Control Plan.

The Army Corps of Engineers' updated Water Control Plan (WCP) is expected to be available in June 2012. The final shape of the WCP will also depend on the results of negotiation amongst the three states and/or litigation. Such uncertainty has already impeded water planning and waiting for all the critical information would result in more years of delay. If we plan now, using the best available information and reasonable assumptions, we will be in a stronger position to assess and incorporate new "critical information" when it finally arrives.

Per Judge Magnuson's July 2010 ruling, it seems rather clear that the Revised Interim Operation Plan will serve as the very basis for the Army Corps of Engineers' update of its Water Control Manual.

7. The state Planning Process fails to utilize all available storage in the ACF System. Federal reservoirs are nearly drained during times of drought while the storage in Georgia Power reservoirs is untouched.

The Army Corps of Engineers does not have the authorization to use storage in ACF reservoirs other than Lanier, West Point, Walter F. George, and Jim Woodruff. While there is storage in Georgia Power's private reservoirs, the operation of these projects complies with Federal Energy Regulatory Commission (FERC) regulations. Therefore, uses of Georgia Power's storage that are not in compliance with FERC regulations are not viable alternatives.

It should be noted that Georgia Power's storage in the ACF Basin is fairly small in comparison to the total federal storage. Even if such storage was available for the Corps' basin-wide operation, the beneficial effects of such addition would likely be very small.

8. All reservoirs and lakes on the Chattahoochee should managed in a balanced manner, fair and equitable to all stakeholders, and based on percent of conservation storage remaining.

See response to the comment immediately above. The conservation zones in the ACF basin were designed to provide maximum amount of flexibility by keeping more water stored in the upper most project during times of extreme drought. The draft current resource assessments reflect the Army Corps of Engineers current operating practices. Alternative operating practices may be considered by the planning councils during the evaluation of both the Council's vision and goals for the region as well as their recommended water management strategies.

9. Water quantity is being studied and defined in a vacuum. Water quantity studies should be done concurrently with water quality studies as water quantity and water quality are intertwined and cannot be separated.

The surface water availability assessment will be reviewed once the additional water quality models are completed (scheduled for completion late in 2010). If necessary, the surface water availability assessment will be revised.

Riverkeepers and Georgia River Network (Sally Bethea)

1. We are very concerned that the draft assessments are not accompanied by the technical and scientific documents needed to fully evaluate them, thereby making it difficult for us and the public to conduct a thorough review.

All of the technical reports completed to date are available by request to Suzanne Desmond at suzanne.desmond@dnr.state.ga.us or 404-463-1425. Technical reports are still in process for the current groundwater availability assessments. These reports will be made available to interested parties when they are complete. We can also arrange a conference call or work session with the resource assessment managers to provide information not included in the technical documentation that is currently available.

We will continue to take comments on the resource assessments. The June 30 deadline was simply the date that we removed the web-based comment tool and began compiling a summary comment and response document. Comments will be incorporated as the resource assessments are refined and applied to support development of regional water plans in this or subsequent rounds of planning.

2. We note a lack of integration among all three assessments. Lack of integration is significant – for example, the ground water availability assessments assume we have sufficient groundwater supplies largely premised on the assumption that surface water supplies for the purpose of recharge are unlimited. Similarly, the surface water availability assessments effectively assume that drawdown of groundwater will not impact surface water supplies even though the science presented to the water planning councils explicitly shows that this is not the case. Water quality assessments essentially ignore the impacts that reduced surface water and ground water availability may have on water quality.

a. Groundwater assessment seems to assume unlimited surface water for recharge

Most of the aquifers modeled for ranges of sustainable yield are confined aquifers with one or more confining units separating the aquifers from surface water bodies. Because of the confining units the aquifers are not in direct hydraulic connection with surface water, and pumping of the confined aquifers would not directly induce recharge from surface waters.

For modeled aquifers in direct hydraulic connection with surface water, such as the Upper Floridan aquifer in the Dougherty Plain of southwestern Georgia and the Paleozoic rock aquifer in northwestern Georgia, the sustainable yield models did not allow for unlimited recharge from surface water. The amount of surface water available for aquifer recharge was constrained so that surface water recharge to groundwater would have limited, if any, impact on opportunities for surface water use.

Recharge from surface water was constrained to a percentage of the groundwater discharge to stream base flow. This was smaller, and therefore more conservative, than constraining recharge from surface water to the same percentage of total stream flow. For instance, the range of sustainable yield for the Upper Floridan aquifer in the Dougherty Plain was constrained to a percentage of the stream base flow contribution for a month of low, if not lowest, stream flow (October).

While the groundwater model for the Upper Floridan aquifer in the Dougherty Plain was able to determine how groundwater withdrawals would affect stream baseflows, the groundwater model was not intended to look at how groundwater withdrawals would affect any potential current gaps in streamflows. The assessment of groundwater availability for the aquifer therefore recognized that more groundwater could be available from the aquifer in portions of the Dougherty Plain, except in areas where groundwater withdrawals would greatly impact streamflows, and that the availability of additional groundwater from the aquifer in the Dougherty Plain would be constrained by the results of the surface water assessment and gap analysis.

b. Surface water assessments assume no impact of groundwater drawdown on surface water supplies.

We assume that “surface water supplies” means “surface water flows.” For SW GA, where the groundwater-surface water flux is substantial, the surface water availability assessment does incorporate the impacts of groundwater drawdown on surface water flows. This includes the Flint River and its major tributaries. This was done based on prior work by USGS and others that demonstrated a significant groundwater impact on surface water flows in this area.

In other parts of the state, the effects of groundwater drawdown on surface water flows were not included because of the lack of evidence indicating impacts at the scale of these assessments. At finer scales, there may be localized impacts of groundwater drawdown but, when flows and groundwater withdrawals are aggregated to the scale of the planning nodes, groundwater withdrawals are so small that the impacts are not significant.

This conclusion is based, in part, on a mass balance evaluation done for the Piedmont physiographic province. When surface water outflow from the Piedmont are totaled and compared with the total permitted M&I groundwater withdrawals in the Piedmont, the groundwater withdrawals are less than 0.5% of the surface water flow. That is, even if there was a one-to-one relationship between

groundwater withdrawals and impacts on surface water flow, the total impact across the Piedmont would be less than 0.5%, an amount that is not significant in this assessment.

c. Assessment essentially Ignore the impacts of reduced surface water and groundwater availability on water quality and long-term decline in low flows caused by human activities.

The GA DOSAG and GA ESTUARY modeling was done under critical conditions assuming high temperatures that typically occur in the summer and low flows (7Q10s) that typically occur in either September or October. These models were used to determine the assimilative capacity as it relates to instream dissolved oxygen (DO) levels. The 7Q10s used in the models were either USGS published values and/or calculated values using available USGS gage data, which takes into account any long-term decline in flows caused by human activities. In general, using 7Q10 as low flows assumed that water withdrawals protect instream 7Q10s.

The watershed (LSPC) and lake or estuary (EFDC) modeling was done using 10 years of meteorological data from 1997-2007, which included both wet, normal, and drought years. These models were used to determine nutrient assimilative capacity and lake chlorophyll a concentrations. These models included actual water withdrawals that occurred during modeled time period and thus revealed the impact that reduced surface water may have on nutrient and chlorophyll levels.

As surface and groundwater models are used to evaluate future scenarios for water consumption, assessment of availability will be coordinated with water quality modelers to evaluate potential impacts on water quality.

<u>*Deficiencies of Surface Water Availability Assessments*</u>

3. The presumed use Lake Lanier to meet water supply needs in spite of the recent federal judicial decision to simply do not mirror legal reality. We strongly recommend that EPD rerun these assessments assuming no use of Lake Lanier for water supply, as well as assuming lesser reliance on Lanier compared to that which is currently used, to account for such uncertainties.

The draft current baseline resource assessments are not designed to be an evaluation of alternatives; they are designed to depict current conditions. For reservoirs and other surface waters, the results provide an assessment of what happens if current water use is applied across a variety of hydrologic conditions.

As such, the assessments provide the baseline required for Council identification and evaluation of alternatives. Alternatives could include those suggested in the comment. Councils are currently identifying the alternative scenarios (including, potentially, the scenario suggested by the commenter) they would EPD to model using the surface water assessment tools.

4. The surface water availability assessments for the Flint River contain gross inaccuracies. Due to the importance of various aquifer inputs to the system, the choice of gauging stations for baseline assessments is critical. Choosing to site a gauge downstream of the fall line sets an artificially high baseline for the base flow. There is an available gauge situated immediately upstream of the fall line (at Carsonville), and it was not used. The justification for this was that the time series at Carsonville is not

equivalent to the gauge further downstream. The error introduced by copious aquifer inputs to base flow far outweighs that introduced by using a shorter time series.

While the Carsonville gage is a reasonable alternative to the Montezuma gage, the Montezuma gage is preferable because the USCOE used it in their development of unimpaired flows, which allowed this work to incorporate existing data.

We used the Montezuma gage as a planning node because its drainage includes all of the major water users in the upper part of the basin, including suburban counties in the metro Atlanta area.

Groundwater inflow at the Montezuma gage is limited to that from the crystalline rock and Cretaceous aquifers. Highly productive aquifers, like the Upper Floridan, outcrop downstream of the gage. However, even if there is significant groundwater inflow, that is part of the natural flow in the river system and as such, it should be included in the analysis.

EPD continues to search literature for additional information on groundwater inflow to surface water here and in other parts of the state. Future refinements of the assessments tools will be based, in part, on relevant literature results.

5. Surface water availability assessments for the Altamaha, the Chattahoochee, and the Savannah contain assumptions addressing management of reservoirs that while physically possible, are not culturally and economically, and therefore politically viable. It is assumed that reservoirs such as Jackson, Thurmond, Hartwell, West Point are fully drawn down to "conservation pool" levels modeling of flow/volume availability should have presented a suite of reservoir pool usage for council members to consider.

The draft current baseline resource assessments are not designed to be an evaluation of alternatives; they are designed to depict current conditions. For reservoirs and other surface waters, the results provide an assessment of what happens if current water use is applied across a variety of hydrologic conditions.

As such, the assessments provide the baseline required for Council identification and evaluation of alternatives. Alternatives could include those suggested in the comment. Councils are currently identifying the alternatives they would like to evaluate using the surface water assessment models.

6. The assessments assume that water supply is unlimited as long as the surface water flows do not drop below what are effectively already stressed, low flow conditions. The assessments admit that water for water supply was prioritized over satisfying flow regime and that water use would be curtailed only when flows were insufficient to meet water use. This indicates that the health of the natural system was ignored.

Assessments were designed to evaluate availability of surface water for consumptive or off-stream use and for instream use. Flow regime metrics for each planning node were derived from state policy or from federal policy and operations.

Models were run to apply current water demand across a range of hydrologic conditions. Results estimate the shortfall, if any, below the flow metrics that serve as basic indicators of availability of water for instream use. These metrics are, essentially, indicators of risk or potential for adverse impacts.

While the metrics and models reflect sound professional judgment and are supported by the best available information, results that show a shortfall do not necessarily mean that undue adverse impacts are occurring or can be demonstrated with existing information.

The assessments consider the health of the system by providing a type of "warning" indicators about a system's capacity to meet offstream and instream needs during low flow conditions (as reflected in the DNR Board policy and/or federal operating requirements for Corps of Engineers' and power company reservoirs). These indicators will help target future monitoring, research and evaluation, and management practices. In this round of regional planning, regional councils are working to identify management practices to restore resource capacity in the areas where the assessments indicate shortfalls. They will also identify the information needed to better understand the characteristics of any shortfalls or gaps, the factors that contribute to them, and likely or potential impacts.

EPD as well as the Councils will explore ways to get this information and improve our understanding of the indicators, their meaning, and their relationship to adverse impacts on the ground. For EPD, this may include the following:

- Reviewing the current monitoring network and working with our partners to identify opportunities for targeted monitoring of certain resources;
- Continuing to enhance our data and information management capacities;
- Supporting implementation of regional plans, once adopted, through coordination and technical assistance; and
- Revising and/or enhancing the assessment models and flow metrics, as resources allow, to better integrate them and increase their value as tools to support future rounds of regional planning.

7. We strongly recommend that EPD fully engage its own Science and Engineering Advisory Panel (SEAP), the U.S. Fish and Wildlife Service (FWS), the National Oceanic and Atmospheric Administration (NOAA), the U. S. Environmental Protection Agency (EPA), the U. S. National Park Service (NPS), and fish and wildlife experts within EPD to identify interim flow targets and hydrological operations protective of these federally-mandated ecological needs.

Point taken. Determining flow targets is not a simple process. Current thinking amongst experts in the field, including those on the SEAP, recognizes that doing so requires both a rigorous scientific foundation and a parallel process to specify the uses and benefits that flow targets should protect. It is not a process for hired experts alone, even if funding were available to pursue this recommendation. The work of the regional councils gives us a starting point as they consider the suite of values associated with water resources in their region.

The Councils are also identifying the information they need on biological resources and the flows that support these resources. EPD and outside experts are providing information to the Councils and we

expect the recommended regional plans to highlight additional information needs. Looking ahead, the assessment results will help us target monitoring and resource evaluation to improve the information base to better understand ecological flow needs in different river systems.

8. The energy forecasts have yet to be completed. Georgia Power will be providing a state-wide analysis. This approach is unacceptable… in order to determine surface availability within each planning district the energy forecasts must be performed at the same scale as other demand forecasts. We strongly urge EPD to secure an independent contractor to perform the necessary district level energy forecasts.

Future energy needs in Georgia will be met by a suite of energy producing technologies (i.e., different fuel types, turbine driving mechanisms, cooling technologies). Some of these require significantly more water as an input than others; some consume more water than others. The mix of the technologies will be influenced by factors well beyond local and state influence. Additional unknowns include national energy policy, when specific technologies will come into play, where additional energy-producing technologies might be located, and how these decisions will influenced by factors such as availability of water supplies, location of load centers, regulatory drivers, etc.

EPD has employed the services of a consultant to assist with forecasting Georgia's future energy needs. This consultant, with input from representatives of power producers and providers in Georgia, has developed future scenarios for energy production and estimated the water needs associated with each technology (per kilowatt hour of energy produced). The results of this work were provided to the regional Water Planning Councils in October 2010.

<u>Deficiencies of Ground Water Availability Assessments</u>
9. The upper and lower ranges of sustainable yield in each of the prioritized aquifers were set arbitrarily. As a consequence, these ground water assessments provide little support for any conclusions drawn concerning subterranean-resource sustainability or the adequacy of resulting surface water flows.

Because ranges of sustainable yields were determined using quantitative methods with pre-established quantitative metrics, sustainable yield ranges were not dependent on individual discretion at the time of modeling and therefore were not set arbitrarily.

Ranges of sustainable yield for prioritized aquifers were determined considering possible long-term effects of increased groundwater withdrawals from the aquifers. Numerical models were used to determine how increased groundwater withdrawals could affect water levels in the pumped and adjacent aquifers, reduction of groundwater discharge to stream baseflows, reduction of aquifer storage, water levels with respect to the tops of confined aquifers, and recovery of water levels after periods of increased groundwater withdrawals such as droughts.

Quantitative metrics were established for each possible effect and ranges of sustainable yield were determined for each modeled aquifer by incrementally simulating increased groundwater withdrawals until a pre-established quantitative sustainable yield metric was reached. Different metrics were reached for different modeled aquifers. The ranges of sustainable yield were dictated by the

configuration of simulated increased groundwater withdrawals. Upper and lower sustainable yields reflected differences in how increased groundwater withdrawals were simulated, ranging in multiple scenarios from uniform increased withdrawals at existing wells to increased withdrawals at existing wells outside of high-use areas plus withdrawals where wells currently do not exist. The former simulations usually resulted in the lower ends of the sustainable yield ranges and the latter simulations usually resulted in the higher ends of the ranges.

10. These models must be rerun with other parameter values, if for no other reason than to perform the rudimentary sensitivity analysis.

The assessment of each prioritized Coastal Plain aquifer included the following tests of sensitivity:

- Multiple runs to calibrate the Coastal Plain regional model to steady state conditions and to test sensitivity of the regional model to various input parameters
- Multiple runs of zoomed-in models of prioritized aquifers to refine calibration and test sensitivity to transient conditions
- Multiple runs of each zoomed-in model to test sensitivities of sustainable yields to simulated groundwater withdrawal scenarios and sustainable yield metrics, and to determine ranges of sustainable yields.

The model of the Paleozoic rock aquifer in northwestern Georgia included multiple runs for model calibrations and for determining sustainable yields for both average and dry climatic conditions. The water budgets for the crystalline rock aquifer in the Piedmont and Blue Ridge provinces included multiple calculations for different stream flow conditions representing a range of climatic conditions.

11. The assessment notes a vertical hydraulic connection between aquifers; however, the modeling fails to consider usage in groundwater layers other than the priority ones that were modeled. The reality is that if conditions require increased pumping in one system, this increase is likely across aquifers. This failure could result in more dramatic aquifer draw downs and impacts on surface water systems than the current models indicate.

It was assumed that "groundwater layers" is a reference to aquifer layers within the models. Groundwater withdrawals in aquifers other than the prioritized aquifer were in included in the model of each prioritized Coastal Plain aquifer in two ways:

- The sustainable yield model for each prioritized aquifer included baseline withdrawals for each aquifer layer in the model, including withdrawals in the portions of Alabama, Florida, and South Carolina within the model boundary

- After sustainable yields were determined for each prioritized aquifer by increasing simulated withdrawals within the prioritized aquifers individually, the regional model was run simulating increased withdrawals in all prioritized aquifers at the same time

Due to the hydraulic connections between aquifers, the latter simulations resulted in a smaller range of sustainable yield than the former simulations.

In the second way that groundwater withdrawals were included in the model, increased groundwater withdrawals were simulated for all prioritized aquifers simultaneously and groundwater usages in prioritized aquifers systems were not held steady. The models of prioritized aquifers included groundwater usage in all aquifer layers, even if the aquifers were not prioritized for determination of sustainable yield.

The model of the Paleozoic rock aquifer in northwestern Georgia included only one layer so that effects of pumping from other aquifers were not included in the model.

12. Modeling is significantly flawed in that it fails to consider new withdrawals permitted by the Georgia Environmental Protection Division since 1999. For example, a new coal fired power plant has been permitted that if built, will consume up to 16 million gallons of water a day under low flow conditions. This failure to model such a significant user and the impact on this already stressed system raises serious questions as to the legitimacy of the findings.

To properly calibrate a groundwater model, simulated groundwater withdrawals must occur at about the same time that water levels used for model calibration were measured. Proper calibration cannot be done without such time synchronicity of withdrawals and water level measurements. The models would have been calibrated incorrectly if models had included new permitted withdrawals that were not yet occurring when water levels used for model calibration were measured, which would have lead to incorrect ranges of sustainable yields.

Because ranges of sustainable yields for the prioritized aquifers were determined by incrementally simulating increased groundwater withdrawals until a pre-established quantitative sustainable yield metric was reached, new permitted groundwater withdrawals can be directly compared to the ranges of sustainable yields to determine if new permitted withdrawals would be sustainable.

As for the new permit for withdrawals from the Cretaceous aquifer near Sandersville, the proposed groundwater withdrawals for Plant Washington were modeled using a site-specific transient numerical model that was carefully calibrated and subsequently used to simulate infrequent and short-duration groundwater withdrawals for cooling water. This modeling was done outside of the sustainable yield modeling done for the State water plan. The Plant Washington modeling indicated that transient short-term groundwater withdrawals would have no lasting effects on water levels in the Cretaceous aquifer, or on the overlying water table that is hydraulically connected to surface waters.

13. The assumptions made on ground water usage are highly flawed and illogical. We believe that any management or permitting decisions made on these models could be determined to be arbitrary and capricious.

Modeling of sustainable yield was done using state-of-the-practice groundwater modeling techniques and current versions of commercially available, non-proprietary computer software. Data on groundwater usage used for calibration of the models were obtained from multiple State and Federal agencies that routinely publish documents on groundwater use in Georgia, and from private contractors engaged to implement the State water plan.

The models were not arbitrary in that the modeling was not based on or determined by individual preference or convenience but rather on scientific necessity and the intrinsic geologic and hydrogeologic natures of the modeled aquifers. The models were not capricious in that modeling was not done impulsively, but instead in accordance with the state-of-the-practice for model calibration followed by determination of sustainable yields using pre-established quantitative sustainable yield metrics. Because the models were neither arbitrary nor capricious, reasonable management decisions made on the basis of the models will not be arbitrary or capricious.

Deficiencies of Assimilative Capacity Assessments

14. Unexplained delay in completing the assimilative capacity assessment for Lake Lanier and the Chattahoochee River. We find this omission to be a glaring one

The Lanier watershed and lake modeling is being funded by State Lake TMDL funds and the work is being done under separate schedule. EPD and their consultant have met with the Upper Chattahoochee Riverkeeper (UCR) to discuss the modeling being done and the model data needs. The UCR provided additional lake data. Recently, the models have been calibrated and the results were presented to UCR in July 2010. The modeling necessary to complete the TMDL is scheduled for completion late in 2010.

The funding for the Chattahoochee and Flint rivers (RIV-1), watershed, and lake modeling was not made available until November 2009 and the baseline resource assessment will be available late in 2010. The Chattahoochee modeling will include all wastewater facilities with permitted discharges greater than 0.1 million gallon per day (MGD) in both Georgia and Alabama. The RIV-1 baseline modeling will use the 1997-2007 dam releases and future assimilative capacity assessments can be performed using a variety of flow regimes.

15. These assessments do not address all of the water quality impacts associated with wastewater and other discharges because the models are limited in scope to dissolved oxygen, chlorophyll a, and nutrients, but ignore other key parameters including fecal coliform, sediment, pesticides, metals, temperature and pH.

As directed by the State Water Plan, the assimilative capacity assessments were designed as a tool to support planning to meet projected wastewater discharges. The major parameters of concern due to point sources are DO and nutrients, and thus these parameters were the ones modeled.

The assessment tools support regional planning and complement EPD's other monitoring and assessment activities. In-stream monitoring has indicated only a few problems due to metals and pesticides. In 2010, EPD began targeted monitoring for these parameters in streams believed to be at greatest risk. All streams are routinely monitored for pH and temperature. In addition, a portion of the streams monitored for fecal coliform and assessed for their fish communities. If water quality violations for any of these parameters are observed, then impaired streams will be placed on the 303(d) list requiring a Total Maximum Daily Load be developed for them.

The assessments tools are expected to be refined for use in future rounds of regional water planning. Refinements in the metrics (e.g., reflecting nutrient standards) and inclusion of other water quality parameters may be considered at that time.

16. These assimilative capacity documents ignore the restorative and anti-degradation requirements of the Clean Water Act. We strongly urge EPD to rerun these assessments assuming instead incremental improvements in water quality. EPD should commit to reducing limits on permits for withdrawals from and discharges to impaired waters until those waters have been adequately restored through the TMDL program or a comparable program.

The assimilative capacity models were designed to provide a baseline to help us better understand current conditions; as such, they had to model the status quo. The baseline model runs allows us to understand where there are current water quality issues and allow the Water Planning Councils to make appropriate management recommendations to address these issues.

The models can also be used to evaluate a variety of future scenarios, including incremental improvements in water quality. The models will be used by the Councils as they plan to meet future wastewater demand, and Councils are currently identifying the alternatives they would like to evaluate using the assimilative capacity assessment models.

<u>Other outstanding issues</u>

17. The projections of future regional population changes have been criticized for inaccuracy in most of the Regional Water Planning Councils. The failure to integrate projections for economic and population growth across the already poorly located boundaries of the regional councils makes the projections very limited utility to this planning process.

The population projections were developed by the Office of Planning and Budget (OPB), which is the Georgia agency statutorily responsible for producing such projections. OPB is the only agency in state government with this statutory responsibility. OPB employed resources available within the University System of Georgia to assist in developing the population projections, a decision that EPD supports.

EPD accepts these projections, without reservation, as a starting point for producing the water and wastewater forecasts that use population as a principal input. While the OPB final projections were not unanimously endorsed by all members of every council, they have proven to be a viable base for development and use of a meaningful set of municipal water and wastewater forecasts. The Office of Planning and Budget continues to accept comments from those who take issue with various aspects of the population projections, and regional water planning is proceeding.

18. Economic projections were rejected and replaced by projections for specific high water consumption industrial sectors.

Economic growth projections are not an element in the water and wastewater demand forecasts. Municipal water and wastewater demand forecasts are largely based upon population projections developed by the Office of Planning and Budget, but the forecasts have no economic projections component.

Industrial water and wastewater demand forecasts were completed for the largest industrial water users industries in Georgia. These forecasts were developed in conjunction with representatives of those industries. One of the inputs considered in developing these forecasts was the expected rate of growth of the workforce in each of the major water using industries; however, other inputs were considered as well. In some instances, this expected rate of growth was used as a surrogate for the rate at which water needs - for a particular industry - would grow through 2050. In other instances, different information and data were used. 'Economic growth projections' per se were not developed or used in this exercise, nor elsewhere in generating water needs forecasts used in regional water planning.

19. Failure to provide regional analysis of the largest single continuous user of water, thermoelectric power production, is particularly unhelpful in assisting the regional councils to develop management plans; Councils must speculate on the effects on local water supplies.

The councils will not 'speculate' relative to the impact of some large water user not defined in the forecasts (thermoelectric power production or otherwise). Such speculation is counter-productive to regional water planning and EPD is encouraging councils to avoid such approaches.

Energy forecasts, developed with a rational and defensible method, were provided to the councils for their use in October 2010. In instances where information is incomplete, the councils will proceed with regional water planning with that caveat.

Plans will be reviewed and revised on a five-year cycle, which allows incorporation of new information on resource conditions as well as current and projected water use.

20. Economic investments that looks at regional and local population, income and public sector investment, and which shows the relationships of these factors to previous rates of growth would be very useful to the councils in the development of their management plans. The lack of any economic information on water dependent outdoor recreation, such as fishing, boating, even hunting and "eco-tourism" is a significant omission in the information with which the councils must work.

These types of analysis are beyond the scope of the resource assessments and EPD does not anticipate undertaking them during the regional water planning process.

21. Use of the Office of Planning and Budget for development of statistical information remains puzzling Why was OPB chosen to develop population and economic forecasts when other academic and private sector providers could have made the required projections?

See response to comment 17 above.

United States Department of Interior – Fish and Wildlife Service (Sandra Tucker)

1. The assessment reports are of minimal use [as a tool for the planning councils]. Reports are not related to each other and the results are not placed in useful context. For example, surface water assessment gives a clear impression that much more water could be withdrawn; however, there is no discussion of potential impacts to assimilative capacity if the maximum sustainable yields are withdrawn.

The synopses of the current resource assessments are not intended to be a primary tool for the planning councils; they are simply a summary of results from the draft current resource assessments. EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the results of the resource assessments for their region, individually and in concert. And, when the Councils identify suites of management practices for evaluation with the assessment tools, each suite will be reviewed for potential impacts on surface water availability, groundwater availability, and assimilative capacity. If there are potential impacts, this information will be provided to the Planning Councils along with the results of specific assessment model runs.

2. There is no guidance on critical aspects of water management such as an unacceptable quantity of water withdrawal, potential impacts to downstream neighbors, potential impacts from upstream neighbors, disadvantages of withdrawing certain quantities from certain sources and/or under certain seasonal conditions, or benefits of leaving water for instream purposes. Alarmingly, there is no mention of water conservation. Our concern is that the reports are likely to convince the basin councils that water availability is not problematic and, therefore, planning for water use that sustains human and natural communities is not a priority need.

In the Surface Water Availability Resource Assessment process, the assessment team incorporated as flow regimes both the DNR Board's Interim Instream Flow Policy as well as minimum flow requirements by the Army Corps of Engineers, Tennessee Valley Authority, and Georgia Power Company. These flow regimes set thresholds limiting both quantity and timing of water removal. If the flow regimes are not met, there are gaps between available resources and total off-stream and instream needs. These gaps are to be bridged by incorporating management practices. Management practices include water conservation as a priority practice and EPD has provided guidance on evaluation of water conservation practices to the planning contractors that are assisting the Water Planning Councils in development of their recommended regional water plans.

EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the assessment results and understand the implications of the management practices under consideration, including some of the specific points noted in the comment. As the Councils' work progresses over the remainder of this calendar year, interim products will be reviewed to determine if the concern noted in this comment is, indeed, becoming evident. The draft plans to be completed by the Councils in January 2011 will be available for public review and comment, providing another opportunity to evaluate the degree to which planning for water use that sustains human and natural communities has been accomplished.

3. Fundamental purpose of the assessments is not clear based on information in and associated with the reports.

The basic purpose of the assessments is described in EPD's Regional Planning Guidance released in July 2009, which is available at www.georgiawaterplanning.org/pages/technical_guidance/regional_planning_guidance.php.

4. The level of impacts that is acceptable to EPD seems to be any amount that does not preclude future use of a particular water source and does not violate current water quality standards. From the Service's perspective, such policy will facilitate violation of the Clean Water Act and the Endangered Species Act because water withdrawals will not be designed to protect instream flows for native fish, mussels and other aquatic organisms.

The metrics used in the assessments of surface water availability and water quality were based on current state and federal policies. These metrics define thresholds of unacceptable impact and include an instream flow metric and water quality standards adopted by the DNR Board. The DNR Board may opt to revise these policies in the future and the assessment approach would be adjusted accordingly.

We expect to refine the resource assessments for use in future rounds of regional water planning and the metrics that define unacceptable impacts are among the components we expect to review for refinement as revisions are considered. We welcome further input on science-based stream flow thresholds that could be used in next round of planning and resource assessment.

Finally, regional water plans will be implemented, in part, through EPD permitting. Permitting is subject to a variety of factors that include coordination with appropriate agencies related to the impacts of permit decisions. The regional water plans guide permitting, but are not intended to be and will not be, the sole source of information that EPD uses in permitting decisions.

5. An important aspect not addressed is monitoring of use and impacts. Water users should be required to document the amount of water they use and water quality parameters in the water bodies affected by the water withdrawals.

Entities that hold water withdrawal permits do monitor and report their water use amounts. The dischargers also report water quality parameters in their return flow.

6. The [surface water availability] assessment is an estimate of all the water could be withdrawn with no precautions regarding protection of instream resources or the impacts associated with withdrawals

As stated in response to Comment 2 by US Fish and Wildlife, the assessment includes explicit clear flow metrics to assess whether there is enough available resource to meet both off-stream and instream needs. The flow metrics were established per existing policies to protect instream flow. Withdrawals that cause flow regime violations are considered gaps that need to be bridged by management practices, which are currently being considered by the Water Planning Councils.

7. When preparing the assessment, a decision was made to not be protective of instream resources in lieu of acknowledging the full capacity of available water. The Service finds this statement confounding because managing water use at full capacity will thwart efforts by EPD to protect and prevent degradation of aquatic resources. The assessment provides no discussion of the disadvantages of ignoring the value of maintaining instream flows.

See responses to comment 7 from the Cobb County Water System and comment 2 from the U.S. Fish and Wildlife Service above.

8. Not clear how water needs were estimated. Water conservation does not appear to have been incorporated. Finally, the assessment articulates a water shortage where river reaches are not impounded while with rare exception, impoundments satisfy all projected water needs. The information as portrayed provides a not-so-subtle message that a basin's water availability concerns can be simply met by building a reservoir. Reservoirs can be solutions for water management issues, they are destructive to natural systems and have other disadvantages that should be considered during any water planning efforts.

In the Current Resource Assessment, water needs are those that have been recorded in recent years (2002 through 2007). The Future Resource Assessments include forecasted water demand. Forecasted demands do reflect a basic level of conservation that will occur due to legislation and policies already in place (e.g., passive conservation due to requirements for low flow plumbing fixtures in new construction). However, conservation beyond what is already reflected by the forecast data is an important management practice tool and EPD has provided guidance on evaluation of water conservation practices to the planning contractors that are assisting the Water Planning Councils in development of their recommended regional water plans.

Regarding impoundments, storage in a river basin does provide flexibility in management of limited water resources. Especially at drought times, when most of the gaps in surface water availability occur, a storage project provides both reliable water supply as well as minimum flow protection. However, reservoirs are expensive and have environmental impacts due to changes in flow regimes and alteration of stream and wetland habitat as well as other impacts on instream and downstream uses. If a council identifies new or expanded storage among the suite of management practices it wishes to see implemented to help close a resource gap, that practice can only be implemented when it has satisfactorily completed the battery of federal and state requirements needed to obtain the necessary permits. Inclusion of a practice in a region's water plan is no guarantee the practice has undergone the sort of scrutiny required to ensure it is fully implementable.

9. [Groundwater] assessment is independent of the surface water availability assessment; there appears to be no recognition that withdrawing surface water to extremes and withdrawing ground water to extremes would not be sustainable.

As noted in the responses to comments 2 and 4 from the Georgia Department of Natural Resources Wildlife Resources Division, modeling of the ranges of sustainable yield of prioritized aquifers was done in a way that constrained reduction of groundwater contributions to stream baseflows. Simulated increases in groundwater withdrawals were stopped when groundwater contributions to the baseflow of any stream segment in the model domain was reduced by 40 percent. Therefore, in the sustainable yield simulations reduction of groundwater contributions to the baseflow of many, if not most, stream segments in the model domain was less than 40 percent. A similar approach was used to determine the range of sustainable yield for the Paleozoic rock aquifer in northwestern Georgia although the constraint on reduction of groundwater contributions to stream baseflow was even smaller than 40 percent.

10. A key assumption in the ground water assessment is that reducing aquifers by 30 feet or surface water by 40% below current conditions is acceptable. There is no explanation of how this number was

derived, why it is acceptable or the disadvantages of reducing an aquifer level by such a large depth. Reduction of current flows by 40% is a significant alteration of instream flows. During low flow years, such a reduction will exacerbate drought conditions and contribute to death and injury of listed species such as freshwater mussels of the Flint basin.

The maximum water level drawdown in the pumped aquifer of 30 feet between pumping wells was selected because, in the experience of Georgia EPD, water supply wells are typically constructed in a manner that would allow a water level drop of 30 feet or so before the well couldn't operate. When regional water levels drop in the range of 30 feet, Georgia EPD becomes aware of some wells going dry. Water level drawdowns of 10 or 50 feet could also have been selected as sustainable yield metrics, but such drawdowns could have resulted in sustainable yields that were unrealistically low or high, respectively.

As noted in the response to comment 2 of the Georgia Department of Natural Resources Wildlife Resources Division, potential effects of groundwater withdrawals on aquatic organisms were addressed by adapting the Tennant Method to constrain decreases in groundwater contributions to baseflow during groundwater withdrawals. As specified by the Tennant Method, streamflows of 60% of mean annual flow from April to September and 40% of mean annual flow from October to March are generally associated with outstanding aquatic habitat conditions. Accordingly, in the Groundwater Availability Assessment, decreases in groundwater contributions were generally limited to 40% of baseflow in a model cell in order to maintain surface water flows (the metric was modified slightly for the Paleozoic and crystalline rock aquifers).

Considering only the baseflow component of streamflow is a further modification of the Tennant Method. In this way, an attempt was made to provide an upper limit to groundwater withdrawals that would leave sufficient water in the stream during the period of lowest flows to support opportunities for surface water uses. These flows are lower than the mean annual discharge so that the Tennant Method metrics used in the groundwater assessment to constrain recharge from streams during groundwater withdrawals was more constraining than if the Tennant Method had been applied directly using percentages of mean annual discharges.

In the sustainable yield models, simulated groundwater withdrawals were increased until groundwater contributions to baseflow in a stream segment were reduced by no more than 40 percent. Simulated increased groundwater withdrawals were stopped when groundwater contributions to the baseflow of any stream segment in the model domain were reduced by 40 percent. Therefore, in the sustainable yield simulations, reduction of groundwater contributions to the baseflow of many, if not most, stream segments in the model domain was less than 40 percent.

11. On page S-25, the report states that pulling large quantities of water from the Upper Floridan aquifer is not problematic because surface waters will recharge the aquifer. It is factual, particularly, in the lower Flint basin, surface and ground water sources are often closely connected, but the report does not make the connection in a manner that recognizes that surface and ground water sources being used at the same time can be quickly over-allocated.

As noted in the response to comment 3 of the Georgia Department of Natural Resources Wildlife Resources Division, the sustainable yield of the Upper Floridan aquifer in the lower Flint River basin of the Dougherty Plain was constrained by stream baseflows during October 1999 and March 2001. The ranges of sustainable yield determined by the simulations apply throughout the year, not just during the months of October and March. Therefore, it is likely that groundwater withdrawals will exceed the ranges of sustainable yield during the growing season.

It was stated on page S-25 that because there is a significant degree of connection between the Upper Floridan aquifer and the rivers in this part of Georgia, excessive drawdown of the aquifer did not appear to be a major concern because the rivers would recharge the aquifer under increased groundwater withdrawal scenarios. The report then went on to explain that while excessive drawdown would not occur, reduction of stream baseflow constrained the range of sustainable yield, again because of the degree of connection between the Upper Floridan aquifer and rivers. In other words, for the Upper Floridan aquifer in the Dougherty Plain, the range of sustainable yield for the aquifer was dictated by the reduction in groundwater contributions to stream baseflow and not by dropping groundwater levels.

12. The limits this document suggests as appropriate for ground water withdrawals are those that preclude surface water use.

The ranges of sustainable yield presented in the document for prioritized aquifers were constrained in manners described in responses to preceding comments to maintain opportunities for surface water use. Again, we anticipate refining the resource assessments to support future rounds of regional water planning and welcome additional information on this and other topics to inform future revisions.

13. The [water quality] assessment is independent of the surface water availability assessment in that assimilative capacity will be considerably compromised where surface water is withdrawn to extreme lows. Conclusion that the streams and rivers have extra assimilative capacity is contrary to the State's 303(d) list for certain basins, and does not account for dry years when the average flows that permitted discharges are based on are not present.

Wasteload allocations are typically developed using annual 7Q10 and high temperatures, and these factors were incorporated in the assessment of surface water quality. The surface water availability assessment uses specific flow metrics to identify the frequency at which the instream flow regime is not met under different demand scenarios. For unregulated streams, the instream flow regime is either the monthly 7Q10 or inflow, whichever is less; these flows will be greater than or close to the annual 7Q10 used in the assessment of surface water quality. For regulated streams, flow metrics were based on reservoir operations and federal flow targets, some of which were adopted for water quality protection purposes.

We expect to refine the assessments to support future rounds of regional water planning. Ways to better integrate the assessments, in methodology and/or expression and use of results, is among the refinements we expect to consider.

Regarding the 303(d) list, the majority of streams are currently listed for bacteria and/or biota impairments. Neither of these parameters was evaluated as part of the assimilative capacity resource assessment. The water quality assessment was an evaluation of the ability of streams to absorb additional oxygen demanding constituents and nutrients without unacceptable degradation of water quality. The regional Water Planning Councils are using both the 303(d) list and the water quality assessment as they consider the water quality management practices to be included in their regional plans.

14. The draft assessment reports are unlikely to be of use to the basin councils as the documents are currently written. If the councils base their decisions on these documents, it is likely that water quality and at-risk species will not be protected.

EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the resource assessment results presented in the synopses. Councils are also drawing on a range of other information on resources in their regions as they identify the management practices recommended to meet future demand within resource capacities. Criteria for selection of management practices are expected include protection of natural resources consistent with the Councils' vision and goals.

Looking ahead, the assessment results will help us target monitoring and resource evaluation to improve the information base to better understand conditions in different river systems. And, the regional water plans will be used in conjunction with other programs and tools already in use to meet the goals of the protecting water quality and at-risk species. This includes EPD's permitting programs. Permitting is subject to a variety of factors that include coordination with appropriate agencies related to the impacts of permit decisions. The regional water plans guide permitting, but are not intended to be and will not be, the sole source of information that EPD uses in permitting decisions.

Florida Department of Environmental Protection (Janet Llewellyn and Watershed Assessment and Watershed Monitoring Sections)

1. Based on our initial review, we are very concerned that the aquatic ecosystems of our shared streams and rivers are not being provided protection.

Further discussions are scheduled between Georgia and Florida water management agencies to give full exposition to the nature of this concern, and to determine the extent to which Georgia's water quality and quantity metrics support water management aspirations Florida may have for streams flowing from Georgia as well as shared groundwater resources. We look forward to receiving more detailed comments on this and related concerns.

2. Groundwater withdrawals in Florida are not being considered when evaluating existing and proposed conditions.

The regional Coastal Plain model used to develop the sub-regional models of prioritized aquifers for determination of ranges of sustainable yield included Georgia and portions of Alabama, Florida, and South Carolina. The regional model included groundwater withdrawals from about 3,500 wells located in Florida with a groundwater withdrawal of 287 mgd of the total 1,167 mgd groundwater withdrawal included in the regional model. The regional model was used to simulate potentiometric surface contours that were compared to measured groundwater levels in Alabama, Florida, Georgia, and South Carolina and the model was calibrated to measured groundwater levels in all of these states. The sub-regional model of the Upper Floridan aquifer in south-central Georgia and the eastern coastal plain included groundwater withdrawals from many wells in the Northwest, St. Johns, and Suwannee River Water Management Districts of Florida. The sustainable yield simulations completed to date included baseline groundwater withdrawals in Florida and simulated increased groundwater withdrawals in Georgia. Because the regional and sub-regional models already include wells located in Florida, simulations could be done in the future to simulate increased groundwater withdrawals in both Georgia and Florida.

3. Reviewed Georgia's "Synopsis Report Current Assimilative Capacity" to compare Georgia's assessment information with Florida DEP's impairment assessments and EPA's proposed numeric nutrient criteria [for Florida waters]… Information indicates that Georgia may be contributing to impairments in some of these tributaries… Information indicates that Georgia may be causing or contributing to possible nutrient impairments in Florida.

We appreciate the data assessment included in the comment; however, evaluation of the impairment status of the major tributaries flowing from Georgia into Florida goes beyond the scope of the resource assessments conducted for statewide water planning. We recognize that United States Environmental Protection Agency (US EPA) finalized the numeric nutrient criteria for Florida's free flowing waters on November 15, 2010, and the new standards will become effective in 15 months. The issue that Georgia may be contributing to impairments in some of Florida's streams will addressed when these streams have been listed as impaired and the potential source has been identified.

May 5, 2011 Note: Responses to comments from the Suwannee River Water Management District (David Still) and St. Johns River Water Management District (Harold Wilkening) have been added at the end of the document.

Georgia Power (Tanya Blalock)

General Comments
1. The reports are highly technical in nature and do not lend themselves to layman interpretation. This likely renders the reports less useful to policymakers and other professional who may lack the expertise to interpret and apply the reports in the manner required by the State Water Plan.

The subject matter is highly technical in nature. The resource assessment teams tried to use less technical terms in the synopsis reports. The team will make an effort to revise the language in the future reports to make it easier for people to understand the results.

EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and apply the resource assessment results presented in the synopsis reports. EPD staff and planning consultants are also working with the Councils to draw on other information on resources in their regions as they complete the regional planning tasks laid out in the State Water Plan.

2. The reports' supporting documents, which are intended to be highly technical and help explain the synopsis reports, are not all available for review at this time. Georgia Power therefore reserves the right to comment further on the reports after it has had an opportunity to review the supporting technical documents.

The technical reports that further document the resource assessments are being made available as they are completed. We welcome further comments as the remaining technical reports are completed and reviewed by interested parties.

3. Georgia Power anticipates that EPD will issue subsequent report iterations and Final reports that reflect stakeholder input. Subsequent steps for the reports are less clear, as the reports do not explain how they will be managed over time; in particular, how they are to be amended, at what frequency and by whom. Georgia Power respectfully requests that EPD clarify and map out these next steps and include a description of them in the Final versions of the reports.

While we do not plan to revise the synopses themselves, the resource assessments have been refined in light of new information and in response to comments received from the Water Planning Councils and from other members of the public.

None of the comments received to date indicated a need for significant changes in the assessments or in the assessment tools, and the Water Planning Councils are using the refined current assessments and the assessments tools as they develop their recommended regional plans. This process is documented in the meeting summaries and presentations that detail the information being considered by each Council (see www.georgiawaterplanning.org).

4. Georgia Power asks that the reports themselves specifically address the interrelatedness of the three resources assessed – surface water availability, assimilative capacity, and groundwater. It is critical that these water resources be considered holistically when planning water management. While in some instances the reports referenced the other resources, there is no detailed discussion of direct impacts.

For specific responses on inter-connections between the three resource assessments, see responses to comment 2 by the Riverkeepers and Georgia River Network and responses to comment 8 by Georgia Department of Natural Resources Wildlife Resources Division.

More generally, the assessment reports are not intended to be the primary tool for the planning councils; they are simply a summary of results from the draft current resource assessments. EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the results of the resource assessments for their region, individually and in concert. And, when the Councils identify suites of management practices for evaluation with the assessment tools, each suite will be reviewed for potential impacts on surface water availability, groundwater

availability, and assimilative capacity. If there are potential impacts, this information will be provided to the Planning Councils along with the results of specific assessment model runs.

We expect to refine the assessments to support future rounds of regional water planning. Ways to better integrate the assessments, in methodology and/or expression and use of results, are among the refinements we expect to consider.

Surface Water Availability Assessment Comments

5. Georgia Power's hydropower reservoirs are non-federal projects developed with private funding, owned and operated by Georgia Power. They are regulated and licensed by the Federal Energy Regulatory Commission (FERC) under the Federal Power Act (FPA) and are subject to a host of other statutory and regulatory requirements. Any changes to hydropower project to operate for water supply would impact the balancing of all benefits and would require FERC approval. Attempts to impose water supply obligations would interfere with FERC licensed activities, could negate Georgia Power's investment in storage capacity and could impose upon consumers the cost of more expensive replacement sources of power. As such, Georgia Power reservoirs should not be considered water supply sources for state water planning purposes.

We understand the purposes and constraints in the Georgia Power reservoirs. That is why the analysis only included the amount of water supply currently honored by Georgia Power and permitted by the state. In the Surface Water Availability Current Resource Assessment, the water supply needs put on the Georgia Power reservoirs are the same as what Georgia Power has experienced in the recent years. No additional amounts were used in the modeling of current conditions. Also, when the Resource Assessment team conducted Future Resource Assessment using 2050 projected water needs, it specifically added language in the Technical Memorandum stating that any planned increase in withdrawal from the storage reservoirs is considered potential gaps unless and until it is recognized and authorized by the reservoirs' owners.

6. The report never explains what it means by "substantially altering the flow regime."

Flow regime metrics were established as thresholds for unacceptable alteration of the flow regime. For unregulated nodes, the flow regime is defined as monthly 7Q10 or natural inflow whichever is lower. For regulated nodes (gage at a dam or immediately downstream of a dam where incremental flow between the dam and the gage is negligible), the flow regime is defined as operations per regulating manuals. For example, the flow regime at Chattahoochee River at Atlanta is defined as the minimum flow requirement of 750 cfs. At West Point dam, the flow regime is defined as the minimum release requirement of 675 cfs. Violations of these thresholds are considered altering the flow regime in a substantial way.

7. The report does not explain what it means by "effects of reservoir regulation."

The effects of reservoir regulation include replenishment of storage and augmentation of low flow. The former causes release from the storage project to be less than unimpaired flows, while the latter is the exact opposite.

8. [First paragraph under Flow Regimes] needs to be clarified. The report does not explain how the potential flow regimes were refined by EPD and the report should explain the inferences that are predicated on the assumptions expressed.

EPD's Resource Assessment team obtained gage data from USGS and operations data from Georgia Power. Based on these data, we were able to derive the minimum monthly average release (minimum for each month among all of the monthly average values) from the Georgia Power storage projects. We assumed that Georgia Power has always met requirements set forth by FERC and what was observed constitute a good representation of the FERC requirements.

9. The report's assumption that certain water is available when for all practical purposes it is unavailable may result in underestimating a basin's potential shortfall.

This is a way of accounting whether the available resource can meet both off-stream and instream needs. In other words, even when a potential gap is expressed only as a flow regime violation, the gap really reflects the resource's inability to meet both instream and off stream needs. The approach reflects a technical methodology, rather than an EPD policy. See response to Comment 2 by Cobb County Water System for further discussion.

10. In this context, assuming zero shortfalls in water allocation/availability when no storage is present is very misleading to the layman reader. This assumption could lead to serious overestimation of water availability. Georgia Power reservoir storage should not be assumed to be available for state water planning purposes.

In the assessments of current conditions, when existing water supply needs are met from a certain storage reservoir, when the release requirements at this reservoir are met, and when there is usable storage left in this reservoir even through the most critical period, we do not see a shortfall between available resource and the total needs. Given that the existing water supply needs from the Georgia Power reservoirs are both authorized by Georgia Power and permitted by Georgia EPD, we have no reason to question the legitimacy of such water supply needs.

See also response to Georgia Power Company's comment 5 above.

11. The report does not simply explain the methods and procedures [for the current gap analysis] and how they were used in the context of developing the draft assessment.

The section titled "Water Availability Measures" on Page 3 of the Synopsis Report explains the methods and procedures. We will make an effort to clarify this in the final Resource Assessment Report.

12. The report does not explain what is meant by substantially altering [the flow regime and the opportunities for instream and offstream use supported by the flow regime].

See response to comment 6 from Georgia Power Company above.

13. The recognition that certain human influences "are not readily quantifiable" should not preclude some attempt to take them into account. In particular, eliminating from consideration the impact of

changing land uses on stormwater runoff and streamflow may result in an unrealistic picture of water use in the state. It may also result in disproportionately attributing impacts to the human influences that are included in the assessment: reservoirs, water withdrawals and wastewater returns, and some groundwater pumping. At a minimum, the assessment should include a more robust discussion of why the impact of changing land uses on stormwater runoff and streamflow "are not readily quantifiable."

See response to Comment 11 by Georgia DNR, Wildlife Resources Division.

14. The assessments of future conditions have not been adequately discussed. What is the status of the assessments of future conditions and how will the regional councils' future assessments be coordinated in a consistent manner with them and the synopsis assessment? A detailed road map of this organic assessment process would be very helpful.

The resource assessments are intended to determine the extent to which gaps exist between demands on the waters of a source, and the sustainable supply of water. The 'current assessments' compare current demands with water supplies as currently developed within geographic areas, and 'future assessments' compare expected future demands (i.e., forecasted demands) with water supply capacities in their current state. Subsequent to the release of the current assessments during the spring of 2010, EPD completed - and distributed to the Councils - water needs forecasts through 2050 for municipal, industrial, and agricultural water use sectors. These forecasts have since been paired with the results of the current assessments to determine if the 'do nothing' option (i.e., no additional water management practices) will result in future gaps at planning nodes within affected river basins. In instances where the 'do nothing' option indicates the creation of gaps, the Councils are investigating suites of additional management practices that might bridge gaps between forecasted demand and resource capacity. This is the essence of the future assessment process.

15. Average demand shortage, average at-site flow requirement short fall, minimum reservoir storage average basin-wide flow requirements shortfall. These terms have not been fully explained/defined.

The terms in question are defined as follows. A clearer explanation will be provided in the final Resource Assessment Report.

- Average demand shortage – the volume of shortage in meeting demand divided by the total number of days when shortage takes place.
- Average at-site flow shortage – the volume of shortage in meeting release requirements at the dam divided by the total number of days when shortage takes place
- Minimum reservoir storage – lowest reservoir storage reached in model results.
- Average basin-wide flow requirement shortfall – the volume of shortage in meeting a basin-wide flow requirement (as opposed to at-site requirement) divided by the total number of days when shortage takes place.

16. The report should include a description of non-federal/private power reservoir purposes: our reservoirs generate steady base load or peaking power while providing recreation; fish, aquatic and wildlife resources and habitat; endangered species habitat; shoreline and land management; cultural resource protection and other benefits.

Response: We will add this to the final Resource Assessment Report.

17. Disregarding the 2009 [Magnuson] ruling in this context is misleading to the reader as it assumes reservoir storage may be available for water supply in the future underestimating a basin's potential shortfall.

See response to comment 9 from Cobb County Water System.

18. "…federal reservoirs operate for multiple purposes, including flood control, water supply, hydropower, navigation , water quality, recreation, and aquatic habitat and species protection." This statement describes the function of federal reservoirs in general, not just in the ACF basin, and should be included in Section 5.3 Flow Regulation by Federal Reservoirs.

Point taken. We will revise the section in the final Resource Assessment Report.

Synopsis Report Surface Water Assimilative Capacity Assessment
19. The report never explains what constitutes unacceptable degradation of water quality. How does the assessment recognize acceptable degradation?

As described on p. 3 of the Current Assimilative Capacity Synopsis report, the Surface Water Quality (Assimilative Capacity) Resource Assessment was used to determine the capacity of Georgia's surface waters to absorb pollutants without unacceptable degradation of water quality. Assimilative capacity is defined as the amount of contaminant load that can be discharged to a specific waterbody without exceeding water quality standards or criteria. The relevant water quality standards were used in the assessments as thresholds that define unacceptable degradation of water quality.

20. The document does not explain why particular parameters [dissolved oxygen, nutrients, and chlorophyll-a] are focused on the exclusion of others.

As directed by the State Water Plan, the assimilative capacity assessments were designed as a tool to support planning to meet projected wastewater discharges. The major parameters of concern due to point sources are dissolved oxygen and nutrients, and thus these parameters were the ones modeled.

21. The report does not provide additional information on if or when results for the other four lakes (for which there are lake-specific standards) will be available.

Current assimilative capacity models are being developed for lakes Lanier, West Point, and Walter F. George, and the results are expected to be available late in 2010. The Carter's Lake model will be developed in 2011.

22. "1992 Georgia Lake Law" not official name of the statute, was enacted in 1990 not 1992.

Comment noted. O.C.G.A. § 12-5-23.1, TITLE 12. CONSERVATION AND NATURAL RESOURCES CHAPTER 5. WATER RESOURCES ARTICLE 2. CONTROL OF WATER POLLUTION AND SURFACE-WATER USE was enacted in 1990.

23. The table shows different categories including the following: none or exceeded, limited, moderate, good, very good. No explanation is provided for the different category cut-off points or how they were established.

The category cutoffs for the dissolved oxygen results were selected on best professional judgment. The cutoffs were explained during several Joint Council Meetings in January and February 2010. The presentations from these meetings are posted on the Georgia Water Planning website (www.georgiawaterplanning.org).

24. EFDC models were developed for lakes Allatoona, Jackson, Oconee and Sinclair. The report does not explain why these lakes were chosen. There are no lake-specific standards for Lake Oconee and Lake Sinclair. However, the report compares the results from Lake Oconee and Lake Sinclair to the standards for Lake Jackson without any explanation. This can be very misleading without specific qualifications.

EFDC models were completed for lakes Allatoona, Jackson, Oconee and Sinclair based on available resources. Current assimilative capacity models are being developed for lakes Lanier, West Point, and Walter F. George, and results are expected to be available late in 2010. The Carter's Lake model will be developed in 2011. As further resources become available, models will be developed for lakes in the Tennessee and Savannah River basins.

Water quality benchmarks were needed for each of the lakes. Results for lakes Oconee and Sinclair were therefore compared to water quality criteria established for Lake Jackson because these lakes are all in the same ecoregion and have similar land use characteristics. As part of the Georgia nutrient criteria development plan, criteria will be proposed for lakes and reservoirs by 2012.

25. The report does not explain how it determines that .5 mg/L above the standard constitutes good to very good assimilative capacity. Again, the report does not explain how it has determined that .5 mg/L or less available dissolved oxygen constitutes moderate to no assimilative capacity.

The category cutoffs for the dissolved oxygen results were selected on best professional judgment.

26. The report does not explain what it means by "downstream effects will still need to be evaluated."

Certain parameters such as NBOD and CBOD degrade over time at given rates thus affecting the dissolved oxygen levels available downstream. Discharge of additional wastewater to a segment with available assimilative capacity may cause water quality violations in downstream segments and modeling is required to assess the potential for downstream impacts.

26. The Lake Sinclair, the Lake Oconee conclusion seems premature given that Lake Sinclair and Oconee do not have a chlorophyll-a standard.

Water quality benchmarks were needed for each of the lakes. Results for lakes Oconee and Sinclair were therefore compared to water quality criteria established for Lake Jackson because these lakes are all in the same ecoregion and have similar land use characteristics. As part of the Georgia nutrient criteria development plan, criteria will be proposed for lakes and reservoirs by 2012.

27. A scale that presents dissolved oxygen results. The report provides no scientific explanation for these categorical conclusions.

The category cutoffs for the dissolved oxygen results were selected on best professional judgment.

28. Table 4-7 shows the calibrated model growing season average chlorophyll levels for Lake Jackson. However, there are no such locations and years. Language should be struck or clarified regarding tables 4-9 and 4-10.

The Lake Jackson specific criteria for chlorophyll a, as stated in Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(17)(c) are:

(i) Chlorophyll a: For the months of April through October, the average of monthly mid-channel photic zone composite samples shall not exceed 20 ug/L at a location approximately 2 miles downstream of the confluence of the South and Yellow Rivers at the junction of Butts, Newton and Jasper Counties more than once in a five-year period.

The location identified above is considered Mid-Lake. Table 4-7 provides model results at locations where GAEPD collects monthly samples during the growing season, Mid-Lake (Stations 04350051 and 04220111), and forebay (Station 04500001). Results at the forebay were provided as supplementary information.

29. No lake specific standards for Lake Sinclair. However, the results for chlorophyll-a, total nitrogen, and the total phosphorus loadings are compared to the stands for Lake Jackson. No specific explanation is provided for this comparison.

Water quality benchmarks were needed for each of the lakes. Results for lakes Oconee and Sinclair were therefore compared to water quality criteria established for Lake Jackson because these lakes are all in the same ecoregion and have similar land use characteristics. As part of the Georgia nutrient criteria development plan, criteria will be proposed for lakes and reservoirs by 2012.

30. Provides a description of the dissolved oxygen results scale. No scientific basis is provided for the various categories.

The category cutoffs for the dissolved oxygen results were selected on best professional judgment.

<u>Synopsis Report Groundwater Availability Assessment</u>
31. The report states that "Sustainable yield simulations did not include increased withdrawals from the portions of aquifers in Alabama, Florida, and South Carolina." In order to be as realistic as possible, the simulations should include some level of increased withdrawal from those states (similar to the consideration of withdrawals in Alabama and Florida made on page S-26).

As noted in the response to comment 1 of the Florida Department of Environmental Protection, the regional Coastal Plain model used to develop the sub-regional models of prioritized aquifers for determination of ranges of sustainable yield included Georgia and portions of Alabama, Florida, and South Carolina. The regional model included groundwater withdrawals from wells located in all of these

states and the sub-regional models used to determine ranges of sustainable yield included groundwater withdrawals from wells in these states. The sustainable yield simulations completed to date included baseline groundwater withdrawals in states other than Georgia and simulated increased groundwater withdrawals in Georgia. Because the regional and sub-regional models already include wells in other states, simulations could be done in the future to simulate increased groundwater withdrawals in Georgia and other states.

32. The report states that one of the selected sustainable yield criteria of allowable groundwater drawdown from current conditions is "streamflow reductions from current conditions of 40 percent or less." The report does not explain why this percentage is an appropriate starting point for the analysis for streamflow reductions.

As noted in responses to comment 2 of the Georgia Department of Natural Resources Wildlife Resources Division, potential effects of groundwater withdrawals on aquatic organisms were addressed by adapting the Tennant Method to constrain recharge from streams during groundwater withdrawals. The Tennant Method was chosen because at this level of water resource planning there is a need for a sufficiently simple method that can make use of readily available streamflow statistics and the method has become popular because it is an easy to apply standard that can be used with limited and readily available data.

33. One of the criteria on which Georgia aquifers were prioritized was "acceptability of impacts due to increased groundwater withdrawals." The report does not define "acceptability" or specify what impacts would be considered acceptable.

Unacceptable impacts were considered to be things such as:

- Large decreases in stream baseflows during times of groundwater withdrawals
- Dropping groundwater levels that did not reach a new base level
- Formation of sinkholes
- Ground surface subsidence
- Creation or acceleration of salt water intrusion

Unacceptable impacts were identified through a review of how aquifers in Georgia have historically responded to groundwater withdrawals.

34. The report states that "the overarching concept to be evaluated is whether an increase in recharge…or a decrease in discharge causes unwanted results." Report does not define "unwanted results" or what would constitute "unwanted results."

Sustainable yield criteria were listed starting on page S-8 of the report in the section titled "Sustainable Yield Approach". The criteria included:

- Drawdowns of groundwater levels in the pumped aquifer do not exceed 30 feet between pumping wells

- Recharge from surface water sources were constrained to a percentage of groundwater contributions to stream baseflow in order to maintain opportunities for surface water use
- Reduction in aquifer storage does not go beyond a new base level
- Groundwater levels are not lowered below the top of a confined aquifer
- The ability of the aquifer to recover to baseline groundwater levels between periods of higher pumping during droughts is not exceeded

An unwanted result would have been a simulated exceedence of any of the listed criteria.

35. The report states that "metrics were selected to constrain recharge from surface water sources in order to maintain opportunities for surface water use." Report does not define "surface water use" or explain whether it includes uses other than surface water withdrawals.

As noted in the responses to comments 2 and 4 from the Georgia Department of Natural Resources Wildlife Resources Division, modeling of the ranges of sustainable yield of prioritized aquifers was done in a way that constrained reduction of groundwater contributions to stream baseflows due to increased simulated groundwater withdrawals. Simulated increased groundwater withdrawals were stopped when groundwater contributions to the baseflow of any stream segment in the model domain was reduced by 40 percent. Therefore, in the sustainable yield simulations, reduction of groundwater contributions to the baseflow of many, if not most, stream segments in the model domain was less than 40 percent. A similar approach was used to determine the range of sustainable yield for the Paleozoic rock aquifer in northwestern Georgia although the constraint on reduction of groundwater contributions to stream baseflow was even smaller than 40 percent.

The Tennant Method was further modified to provide an indication of sustainable yield considering only the baseflow component of streamflow. In this way, an attempt was made to provide an upper limit to groundwater withdrawals that would leave sufficient water in the stream during the period of lowest flows to support opportunities for surface water uses – instream and/or offstream uses. Baseflows are lower than the mean annual discharge so that the Tennant Method metrics used in the groundwater assessment to constrain recharge from streams during groundwater withdrawals was more constraining than if the Tennant Method had been applied directly using percentages of mean annual discharges.

36. In describing the Dougherty Plain modeling approach, the report states that "the critical sustainability metric in the Dougherty Plain area was the potential impact to base flows of the river system because there is a significant degree of connection between the Upper Floridan aquifer and the rivers in this part of Georgia, excessive drawdown of the aquifer does not appear to be a major concern because the rivers would recharge the aquifer under increased withdrawal scenarios." The report should include more comprehensive consideration of the potential effects of groundwater withdrawals throughout Georgia on surface water quantity and quality, and how those effects would impact those resources.

As noted in the response to comment 4 from the Georgia Department of Natural Resources Wildlife Resources Division, the high degree of interconnection between the Upper Floridan aquifer and streams and rivers in the lower Flint River basin was built into the USGS model used to determine the range of sustainable yield of the Upper Floridan aquifer in the Dougherty Plain. The sustainable yield modeling

was completed in a way that constrained the reduction of groundwater contributions to stream baseflow. Groundwater withdrawals were increased in sustainable yield simulations until groundwater contributions to baseflow in any stream segment in the model domain were reduced by 40 percent.

As noted in the response to comment 11 of the United States Department of Interior Fish and Wildlife Service, because there is a significant degree of connection between the Upper Floridan aquifer and the rivers in this part of Georgia, excessive drawdown of the aquifer did not appear to be a major concern because the rivers would recharge the aquifer under increased groundwater withdrawal scenarios. The report then went on to explain that while excessive drawdown would not occur, reduction of stream baseflow constrained the range of sustainable yield, again because of the degree of connection between the Upper Floridan aquifer and rivers. In other words, for the Upper Floridan aquifer in the Dougherty Plain, the range of sustainable yield for the aquifer was dictated by the reduction in groundwater contributions to stream baseflow and not by dropping groundwater levels.

See also response to comment 8 from the Georgia Department of Natural Resources Wildlife Resources Division.

The Georgia Water Alliance

Water Resources Assessments
Data and Assumptions
1. Assumptions and data used in running the models have not been clearly delineated to allow for technical review by peers of the results generated by the models.

Many of the technical reports that document the assumptions and data used in the draft current resource assessments are now available. The remaining reports will be made available when they are completed. The models used in Surface Water Availability Resource Assessment are also available upon request for peer review, as are the assumptions and input data. The Resource Assessment team has provided such data as requested by Planning Contractors to help them interpret modeling results to the Water Planning Councils.

For information on the technical reports or to request specific reports or models, please contact Suzanne Desmond at suzanne.desmond@dnr.state.ga.us or 404-463-1425. We welcome further comments as the technical reports are completed and reviewed by interested parties.

2. How and why was consumptive use determined and handled for wastewater land application sites, agricultural applications, and septic tanks? This issue is not clearly discussed, defined or supported with technical basis.

All existing LAS, septic systems, and agricultural irrigation are considered to be 100% consumptive for the surface water resource assessment purposes. We do not presently have scientifically defensible information indicating otherwise. To the extent there are return flows from these uses, however, they would have been captured in the measured streamflows that are the basis of the current surface water resource assessments. For the assessments of future conditions, EPD's Return Flows Guidance

Date: 12/20/2010; Responses added 5/5/2011

Document provides region-specific information on expected differences in return flows from LAS and septic systems, which, if applicable, may be included in analysis of future water use scenarios.

3. How were daily withdrawals and returns aggregated and applied on a daily basis across the ~70 years of record? Were monthly municipal and industrial withdrawals/returns applied to the entire flow period based on average monthly withdrawals/returns or actual daily flow? Was the highest withdrawal day used? These issues are not obvious and require additional explanation.

The Water Use Inventory and Unimpaired Flows Reports describe methods, procedures, and assumptions for treatment of water withdrawals and wastewater discharges in derivation of unimpaired flows. These reports are available upon request to Suzanne Desmond at suzanne.desmond@dnr.state.ga.us or 404-463-1425.

During the unimpaired flow (UIF) development process, all of the existing monthly M&I withdrawals and returns as well as agricultural irrigation use were derived on a monthly time step. The M&I water use data that we applied date back 10 to 15 years. For the period before such data became available, we applied a procedure called hindcasting. We started from the most recent year with complete data, and scaled back the withdrawals and returns using decadal water use trends provided by USGS. This way, we were able to obtain a monthly water use time series all the way back to 1939. These data were then used to derive the unimpaired flow data.

During the Resource Assessment modeling process, we used the M&I data from 2002 to 2007, and used the maximum amount of monthly consumptive use for current conditions. In the Current Resource Assessment, we repeated this set of demand data in the model for each of the 69 years of hydrology. This tests the availability of water for both off-stream needs and instream needs under various hydrologic conditions.

4. How were the data sets on industrial, municipal, agricultural and energy demands, developed over the course of the last two years for the Regional Water Councils, incorporated into the modeling? Section 7 of the Surface Water Resource Assessment indicates data from 2002 to 2007 was used for the modeling and this six year data set has not been presented to or reviewed with the Regional Water Councils for accuracy or applicability. Incidentally, Section 3 indicates that data going back 10 to 20 years where available was used for the modeling.

Forecasted demands were not used in the Current Resource Assessment. As described in the Synopsis Report and in the response to the comment immediately above, water use data from 2002 to 2007 was used to represent current conditions. Forecasted demands are being incorporated in model runs for assessment of future conditions, given current management practices. Forecasted demands will also be used in additional model runs, as requested by the Councils to evaluate management practices.

5. How was the unimpaired flow regime determined for years prior to the availability of withdrawal and return records? How were data gaps filled during early periods of record and is the data relevant? Explanation of the technical analysis and policy rationale for flow regime targets being based on synthesized "unimpaired" monthly 7Q10 flows and select historic low flow years, and how this

synthesized unimpaired strategy compares with monthly 7Q10 flows based on the last 20 years or so of actual record and application of the non-depletable flow strategy for withdrawals would be helpful.

See response to comment 3 by Georgia Water Alliance for the first question.

Data gaps in observed flows were filled with hydrologic methods using data from nearby gages' data.

The use of unimpaired flow as the basis for assessing the availability of water to meet offstream and instream needs is a common practice nationally, largely because it provides an unbiased baseline for analysis and comparison of planning alternatives and because it separates existing water uses from natural flow. Without the use of unimpaired flows, incremental changes in water uses would have to be evaluated, as opposed to total forecasted water uses, which would greatly complicate the formulation and evaluation of alternative management practices. The current water use assessments effectively reconstitute historical conditions in any case. Another significant problem with the use of historical flows in areas experiencing significant growth (e.g., Atlanta) is the masking of hydroclimate cycles and trends.

See also response to comment 6 by Cobb County Water System.

6. The Draft Unimpaired Flow Data Report has not been put on the website for general review.

The Unimpaired Flows Report is too large for distribution via the web but is available by request to Suzanne Desmond at suzanne.desmond@dnr.state.ga.us or 404-463-1425.

7. Not clear in the Surface Water Resource Assessment why some reservoirs were not modeled or included in the analysis, other than the statement that operational rules were not readily available for the particular reservoir.

See response to comment 15 by Georgia DNR, Wildlife Resources Division.

8. Recommendation. Complete data sets, assumptions and policy decisions need to be provided with both technical and non-technical formats before draft plans are created. A clear and transparent process will allow for adequate peer review and ensure the outcomes are technically sound.

The Resource Assessment models as well as input data are available upon request to the Planning Contractors and the Water Planning Councils as well as the general public, and have been provided as requested. In addition, EPD staff and planning consultants under contract with EPD are working with the Councils to help them understand assumptions, interpret and apply the resource assessment results presented in the Synopsis Reports as well as subsequent analyses. Information on the Councils' work can be found in the meeting summaries and presentations on the statewide water planning website [http://www.georgiawaterplanning.org/]. Furthermore, all Council meetings provide opportunity for public comments consistent with the Council's public involvement plans.

Current Demand vs. Permitted Limits

9. Modeling current demand fails to account for the significant financial investment in infrastructure necessary to support, maintain and utilize permitted capacity. By basing the demand forecasts on actual historic numbers and comparing those numbers to the availability of the resource, you run the risk of penalizing water suppliers, industries or other entities which have already invested in water infrastructure to meet current and future demands.

Techniques for forecasting future demand and the techniques for the resource assessments are intended to produce, to the greatest extent practical, an objective expression of expected demands and the response of the water resources to those demands, respectively. Attaching 'value' to quantities previously placed in permits is necessarily an 'outside the model' exercise and is not directly related to the forecasts and the resource assessments per se.

For a description of how existing permits are being incorporated in Council development of their regional plans, see response to comment 5 by Metro North Georgia Planning District.

10. It is also not clear how the impact of peak demands have been included in the evaluation or "gap analysis" of demand versus resource availability.

All demand data have been compiled on monthly basis. The municipal and industrial demands used in the Resource Assessment models have intra-annual monthly pattern that reflect the maximum amounts of monthly consumptive water use during the 2002-2007 period. Agricultural water use data have been compiled on monthly time steps as well, reflecting the seasonal pattern observed by recent studies.

11. Unless you take away the permitted capacity, thereby penalizing those entities who have made significant investments, you underestimate the current stress on the water resources in the gap analysis by not accounting for additional water that an entity is already permitted to withdraw and supply. Recommendation. The starting point for the water quantity and water quality resource assessments needs to be based on permitted capacity for municipal and industrial water and wastewater systems -- unless actual recent historic demands exceed that permitted capacity, in which case the larger of the two numbers should serve as the starting point. Future potential growth should then be added to those permitted capacity numbers moving forward.

See response to Comment 5 by Metro North Georgia Planning District and response to comment 9 by Georgia Water Alliance.

<u>Correlation between Inputs and Results</u>
12. Presentation of the results and what they mean in simple terms is lacking for all of the resource assessments.

EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the resource assessment results. Information on this work can be found in the meeting summaries and presentations on the statewide water planning website at www.georgiawaterplanning.org.

13. Regional Water Councils will have a hard time extracting the meaning of the results when it comes to identifying real management strategies without some simple, high-level summaries of what the actual impacts are expected to be.

EPD staff and consultants under contract with EPD are working with the Councils to help them interpret and understand the results of the resource assessments as well as potential impacts and implications of the management practices being considered by each Council.

14. Recommendation. Develop and publish summary documents in practical terms.

The planning contractors working with the Water Planning Councils have produced some distillations on the assessment results; see the presentations and meeting summaries posted on the State Water Planning website [http://www.georgiawaterplanning.org/]. As stated above, the Councils are using this information to develop recommended regional water plans. We expect those plans to be presented in practical terms and include summaries of the resource assessment results, as suggested in this comment.

15. These reports should also specifically address the interrelatedness of the three resources assessed - surface water availability, assimilative capacity, and groundwater. Doing so will be instrumental in ensuring a sustainable approach to managing the state's water resources.

The assessment reports are not intended to be the primary tool for the planning councils; they are simply a summary of results from the draft current resource assessments. EPD staff and planning consultants under contract with EPD are working with the Councils to help them interpret and understand the results of the resource assessments for their region, individually and in concert. And, when the Councils identify suites of management practices for evaluation with the assessment tools, each suite will be reviewed for potential impacts on surface water availability, groundwater availability, and assimilative capacity. If there are potential impacts, this information will be provided to the Planning Councils along with the results of specific assessment model runs.

For specific responses on inter-connections between the three resource assessments, see responses to comment 2 by the Riverkeepers and Georgia River Network and responses to comment 8 by Georgia Department of Natural Resources Wildlife Resources Division.

16. …We remain very concerned about the lack of clarity on EPD's proposed use of unimpaired flows… The Alliance remains very concerned that use of unimpaired flows in the water resource assessment will become an EPD permitting requirement replacing the 2001 DNR policy on instream flow protection which utilizes real streamflow data. Suggested action: The final water resource assessment should contain a clear discussion on the use of unimpaired flows and the use of the assessment. This discussion should definitely state that the assessment is for general planning purposes only and is not to be used for permitting decisions. Also, the discussion should verify that the 2001 DNR policy, using real streamflows, is operative until such time it is changed by the DNR Board.

Unimpaired flows were developed for nodes located at USGS gages with long-term records. As a result, all Basic Nodes and Planning Nodes are located on the main stem of major rivers or major tributaries. Flow data (both observed and unimpaired) at the Planning Nodes provide a good basis for analyzing flows from the local drainage area that contributes to each node. However, the analysis is limited to the locations where such flow data have been compiled and does not address streamflows in smaller rivers and streams.

The unimpaired flow method (UIF) is consistent with best professional practice and provides a reasonable basis for long term analyses of water availability because it portrays hydrological conditions that are not altered by withdrawals, discharges, consumptive water use, and change of timing resulting from reservoir regulations. If the observed flow time series was used as the basis for a long term analysis, then the hydrological conditions between one period cannot be compared to another, simply because there might have been different types and magnitudes of alterations from anthropogenic activities.

The Surface Water Availability Assessment was designed to evaluate resource capacity for planning purposes. The results are being used by the Councils to develop recommended regional water plans and it is those plans, once adopted, that will have a direct link to EPD's permitting decisions.

As directed by the Comprehensive State-wide Water Planning Act of 2004 and the 2008 State Water Plan, adopted regional plans will guide EPD permitting. Permitting, however, is subject to a variety of factors. While the regional water plans will guide permitting, they are not intended to be, and will not be, the sole source of information that EPD uses in permitting decisions.

While we do not plan to revise the synopses of the current resource assessments themselves, in future documentation of the assessments, we will continue on-going efforts to communicate the purpose of the resource assessments and the role of regional plans in guiding permitting.

Les Ager – Pulaski County

1. Surface Water Availability Assessment did not adequately define the need for instream flow for the purpose of wildlife conservation and recreation. The interim policy in use by EPD has no apparent biological rationale and has not been studied. Research conducted and reported by DNR, WRD in 1995 (A recommended method to protect instream flows in Georgia, Evans & England) recommended a different instream flow based on the available literature and work in the state. Flawed logic to use instream flows for a sub-basin node as an indicator of ecological conditions upstream of that node. I suggest that EPD use one of the alternative methods indicated in the DNR, WRD in 1995 (A recommended method to protect instream flows in Georgia, Evans & England) report to account for instream flow needs rather than an unverified antiquated method with no ecological basis.

The metrics used in the assessments of surface water availability are based on current state and federal policies. For unregulated nodes, the instream flow metric is one of the options provided in the Board's 2001 Interim Instream Flow Policy, which was adopted after consideration of information based on the 1995 Evans and England report and other sources.

The metrics are used for evaluation of the resource capacity at each Planning Node and the analysis is limited to those locations. The purpose of the metric is also limited in that they are not intended to be indicators of ecological conditions upstream of a Planning Node.

In accordance with the Regional Planning Guidance, regional Water Planning Councils may request additional modeling with other metrics or flow regimes that exceed those used in the Current Resource

Assessment. Councils may consider other options under the Interim Instream Flow Policy as well as metrics/regimes described in the 1995 Evans and England report.

The Nature Conservancy (Mary Davis)

Surface Water Availability Assessment

1. The implementation of the plan is based on an outdated instream flow policy that allows excessive water withdrawals and the endangerment of Georgia's natural wealth. The importance of natural flow regimes to the ecological integrity of rivers has been established in the scientific community for decades. Georgia's interim instream flow guidelines are based on protection of thresholds of flow. As demands for water supply grow under this policy, the natural variability of flows is reduced water levels become 'flat-lined'. Instream flow policies need to be scientifically based and protective of the state resources that are put in the trust of the state as stewards. Over-allocation of water is a threat to Georgia's resources that can be avoided. We strongly urged you to protect Georgia's rich aquatic resources by taking two steps:

1. *Direct Georgia Wildlife Resources Division to begin revising the interim instream flow guidelines by developing the studies about how the ecology of our streams and rivers are harmed with altered flows and*

2. *Direct EPD to work with the Regional Water Management Councils to allocate water resources as conservatively as possible in anticipation of the new instream flow policy and improved protection of the state's aquatic resources.*

The first recommendation is beyond the scope of regional water planning and EPD authority. The regional water plans, however, are expected to identify information needs and this topic may be among those identified. EPD will coordinate with WRD and other agencies with water management responsibilities to support implementation of the adopted regional plans.

The DNR Board may opt to revise the policies that determine the metrics used in the current resource assessments, including the Interim Instream Flow Policy; if that happens, the approach to the resource assessments would be adjusted accordingly.

Regional water plans will be reviewed and revised on a five-year cycle, which will allow incorporation of revised resource assessments as well as new information on resource conditions and current and projected water use.

Groundwater Availability Assessment

1. Our concerns about the groundwater assessments lie in the metrics to assess sustainable yield. These metrics result in the perception that groundwater resources have not already been seriously depleted. Drawdowns of groundwater levels in the pumped aquifer do not exceed 30 feet between pumping wells... This metric does not account for the fact that the safe yield of many aquifers has already been exceeded...The reason for the 30 foot threshold is not explained and seems arbitrary. Please give the source of this metric.

Groundwater levels in areas of Georgia have been lowered as a result of groundwater withdrawals. However, lowered groundwater levels by themselves are not sufficient to fully indicate that groundwater resources have been depleted. Consideration must also be given to what, if any, unwanted results have been caused by lowered groundwater levels, such as reduction of stream flows, creation of sinkholes, or salt-water intrusion.

As noted in the response to comment 2 of the United States Department of Interior Fish and Wildlife Service, a maximum water level drawdown of 30 feet in the pumped aquifer between pumping wells was selected because in the experience of Georgia EPD water supply wells are typically constructed in a manner that would allow a water level drop of 30 feet or so before the well couldn't operate, and that when regional water levels drop in the range of 30 feet Georgia EPD becomes aware of some wells going dry. Water level drawdowns of 10 or 50 feet could also have been selected as sustainable yield metrics, but such drawdowns could have resulted in sustainable yields that were unrealistically low or high, respectively.

2. Recharge from surface water sources were constrained to 40 percent of baseflow in order to maintain opportunities for surface water use, modified to 10 percent of baseflow in the Paleozoic rock aquifer and 40 percent of streamflow in the crystalline rock aquifer...It is not clear how the 10 and 40% of streamflow thresholds were determined... A better metric than an absolute amount of recharge would be an increase of no more than 10% of current recharge levels due to groundwater withdrawals.

As noted in the response to comment 2 from the Georgia Department of Natural Resources Wildlife Resources Division, the Tennant Method was adapted to constrain decreases in groundwater contributions to streamflow during groundwater withdrawals. The Tennant Method uses percentages of mean annual flow to recommend seasonal instream flows to maintain healthy aquatic conditions. In this method, streamflows of 60% of mean annual flow from April to September and 40% of mean annual flow from October to March are generally associated with outstanding aquatic habitat conditions. This was the source of the 40% metric.

The metric of 10 percent for the Paleozoic aquifer was set conservatively low because allowing a higher percentage would not have maintained opportunities for surface water use, and because the accuracy of the qualitatively calibrated model was not known. The 50 percent metric was selected for the crystalline rock aquifer in the Piedmont and Blue Ridge study basins based on the Tennant Method metric for excellent aquatic habitat conditions.

It is possible that using a metric of 10 percent of current recharge levels due to groundwater withdrawals, regardless of the source of the recharge, could have resulted in higher ranges of sustainable yield.

3. Reduction in aquifer storage does not go beyond a new base level...A better metric would allow for recovery of currently lowered base levels.

The purpose of the groundwater availability assessment was to determine ranges of sustainable yield of prioritized aquifers beyond current use and therefore sustainable yield metrics were measured from

current conditions. The purpose of the assessment was not to determine ranges of sustainable yield from pre-development conditions and therefore decreased groundwater withdrawals were not simulated.

4. Groundwater levels are not lowered below the top of a confined aquifer...It is not clear why the top of a confined aquifer was chosen as a threshold. Many confined aquifers are the source of springs. Does this threshold allow for springflow?

The top of a confined aquifer was chosen because lowering the groundwater level below the top of a confined aquifer would create unconfined aquifer conditions, resulting in decreased aquifer transmissivity and decreased well yield. Springs emanate from unconfined aquifers, not from confined aquifers that are isolated from the ground surface and surface waters by confining units.

5. The ability of the aquifers to recover in many parts of the state are already exceeded. The results of the assessments do not reflect this. The results show that groundwater is not limited, with the exception of the coast and Flint basin.

Groundwater levels have been lowered in Georgia as a result of aquifer development. In most aquifers, groundwater levels have been lowered to new base levels where recharge from other sources has been induced. Otherwise groundwater levels would continue to decline with no increase in groundwater withdrawals, which is not the case for most aquifers in the State. This condition was reflected in the models used to determine ranges of sustainable yield of prioritized aquifers.

R Johnston

1. The report describes results of an evaluation of groundwater sustainability by providing tables and maps listing results of model simulations and water budget analysis. Unfortunately, it does not provide any details on the uncertainty of the analysis or calibration of models. It is presented as, "trust me" here's the results. This evaluation has significant ramifications for the development of water resources in Georgia and deserves to be evaluated fully by the public. A panel of five experts of varying technical expertise looked at the results is insufficient; independent review is critical.

The report referred to in the comment was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. A full report of the groundwater modeling to determine ranges of sustainable yield of the prioritized aquifers is being prepared and will be made available to all interested parties when it is complete. We welcome further comment when the technical reports are available and have been reviewed by interested parties.

2. Drawdown "not exceed 30 feet between pumping wells"-Does this mean that drawdown cannot exceed 30 feet at any location in the model domain? The criteria states that limiting to 30 feet would "decrease the potential for creating sinkholes" and could "minimize effects of increased withdrawals on other wells." What type of effects on other wells? Why was 30 feet selected as a basis for this criteria (seems arbitrary)?

As noted in the response to comment 10 by the United States Department of Interior Fish and Wildlife Service, the maximum water level drawdown of 30 feet in the pumped aquifer between pumping wells was selected because in the experience of Georgia EPD water supply wells are typically constructed in a manner that would allow a water level drop of 30 feet or so before the well couldn't operate, and that when regional water levels drop in the range of 30 feet Georgia EPD becomes aware of some wells going dry. Water level drawdowns of 10 or 50 feet could also have been selected as sustainable yield metrics, but such drawdowns could have resulted in sustainable yields that were unrealistically low or high, respectively.

3. Changing an aquifer from confined to unconfined conditions- This is a reasonable criteria which can be evaluated by a model. On page S-21, the criteria states, "Avoid drawing water table down to within 10 feet of the top of a confined aquifer to avoid creating unconfined aquifer conditions." In reality this is a potentiometric surface and not a water table. Was this criteria of 10 feet applied for the other model evaluations in other parts of the state?

Yes.

4. Minimize impacts to streamflow- "Tennant method" is given as the basis for the amount of allowable streamflow reduction, but no supporting argument is given as to why EPD believes this is a reasonable level for protection of streams.

As noted in the responses to comments 2 and 4 from the Georgia Department of Natural Resources Wildlife Resources Division, modeling of the ranges of sustainable yield of prioritized aquifers was done in a way that constrained reduction of groundwater contributions to stream baseflows due to increased simulated groundwater withdrawals. Simulated increased groundwater withdrawals were stopped when groundwater contributions to the baseflow of any stream segment in the model domain was reduced by 40 percent. Therefore, in the sustainable yield simulations reduction of groundwater contributions to the baseflow of many, if not most, stream segments in the model domain was less than 40 percent. A similar approach was used to determine the range of sustainable yield for the Paleozoic rock aquifer in northwestern Georgia although the constraint on reduction of groundwater contributions to stream baseflow was even smaller than 40 percent.

5. There are no criteria listed for saltwater intrusion. This is a critical factor in the coastal area.

Sustainable yield modeling, conducted under the State Water Plan for the purposes of regional water planning, was not done for aquifers where salt-water intrusion is occurring or could occur in the future. Aquifers affected by salt-water intrusion have been modeled and are being managed through other EPD initiatives, and some of the information on those initiatives is being provided to the Coastal Water Planning Council for use in development of their recommended regional plan.

6. The most glaring omission is the lack of discussion regarding model development and subsequent calibration.

As noted in the response to comment 1 above, the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. A full

report of the groundwater modeling to determine ranges of sustainable yield of the prioritized aquifers is being prepared and will be made available to all interested parties when it is complete. We welcome further comment when the technical reports are available and have been reviewed by interested parties.

7. There is mention of "hypothetical groundwater withdrawals" from "uniformly distributed wells." Does this mean that pumpage was applied into each model cell for the various scenarios? If not, how were locations selected and where were they placed?

Hypothetical groundwater withdrawals were applied to model cells where there are currently no existing wells to explore the ranges of sustainable yield of prioritized aquifers.

8. Northwestern Georgia Model: No details provided of model development...The streamflow evaluation criteria for this area is different than for the Piedmont-Blue Ridge, but no reason is given for this difference.

As noted in the response to comment 1 above, the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. A full report of the groundwater modeling to determine ranges of sustainable yield of the prioritized aquifers is being prepared.

The first bullet under Section 4.1 on page S-19 of the Synopsis stated that the allowable percentage of 10 percent was set conservatively low because allowing a higher percentage would not have maintained opportunities for surface water use, and because the accuracy of the qualitatively calibrated model was not known.

9. Coastal Plain Modeling: Transient simulation is mentioned, but details of model development are never described...Documentation is inadequate to evaluate the quality of the model simulation. For many of the drawdown maps, it appears that drawdown extends to the model boundary. This is a limitation that affects model results and needs to be described adequately.

As noted in the response to comment 1 above, the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. A full report of the groundwater modeling to determine ranges of sustainable yield of the prioritized aquifers is being prepared. The modeling included both regional and sub-regional modeling of Coastal Plain aquifers where the boundary of the regional model extended well beyond the boundaries of the sub-regional models. Boundary conditions for the sub-regional models were projected from regional model simulations.

10. A water budget equation is mentioned, but never shown.

As noted in the response to comment 1 above, the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. In keeping with this purpose, the water budget equation is described qualitatively on p. S-13. The full

report of the groundwater modeling, in preparation, will provide more details on the water budget equation.

11. How was baseflow determined?

As noted in the response to comment 1 above the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. The full report of the groundwater modeling, in preparation, will describe determination of stream baseflows.

12. In Table S-3, column "c", net groundwater consumption is mentioned, but how this value was estimated is never described.

Net groundwater consumption was listed in column "c" of table S-4. As noted in the response to comment 1 above the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. A full report of the groundwater modeling to determine ranges of sustainable yield of the prioritized aquifers, including determination of net groundwater consumption, is being prepared.

James Emery – Emery & Garrett Groundwater, Inc

1. We do believe that this study grossly underestimates the availability of groundwater resources in fractured bedrock aquifers that underlie north Georgia. Our investigations...indicated that as much as 100 million gallons per day or more could be developed from just the ten counties surrounding Atlanta.

The ranges of sustainable yield of the crystalline rock aquifer in the Piedmont and Blue Ridge study basins were determined using methods described in the Synopsis and in the full report of groundwater modeling that is being prepared. The methods used to determine ranges of sustainable yield were consistent with methods used to determine sustainable yields of other fractured crystalline rock aquifers in the southeastern United States.

The ten counties surrounding Atlanta have a total area of about 3,021 square miles. Table S-4 in the Synopsis listed the sustainable yield range for the crystalline rock aquifer in the Piedmont study basin, normalized to the area of the basin, as 0.049 to 0.010 million gallons per day per square mile (mgd/mi^2). If the crystalline rock aquifer in the ten counties surrounding Atlanta has a relationship to stream baseflow similar to that in the Piedmont study basin, the sustainable yield of the crystalline rock aquifer in the ten counties surrounding Atlanta would be 148 to 30 mgd. Section 3.2 of the Synopsis explained why it was recommended that the lower-end of the sustainable yield range be used for planning purposes.

2. The Assessment appears to treat (recharge from surface water) as a variable for different types of aquifers, presenting different percentages of different streamflows...This is confusing and suggests that the modelers were modifying fundamental metrics to arrive at preconceived notions of how much water

is available in each aquifer type. If there is a reasonable justification for modifying the metric for different aquifer types, then it should be clearly explained in the text.

The reasons for using different stream recharge metric were explained in the Synopsis:

- Use of a modified Tennant Method for modeling of the Coastal Plain prioritized aquifer was explained in the second paragraph of Section 2.1.3
- Use of the 50 percent streamflow metric in the Piedmont and Blue Ridge study basins of the crystalline rock aquifer was explained in the fourth paragraph of Section 3.2
- Use of the 10 percent streamflow metric in the Paleozoic rock aquifer was explained in the first bullet of Section 4.2

3. "Metrics were selected to constrain recharge from surface water sources in order to maintain opportunities for surface water use." This statement suggests a subjective judgment was made regarding the need to maintain surface water flows at the expense of groundwater.

As noted in the response to comment 2 of the Georgia Department of Natural Resources Wildlife Resources Division, potential effects of groundwater withdrawals on surface waters were addressed by using the Tennant Method to constrain decreases in groundwater contributions to baseflow during groundwater withdrawals. In the Tennant Method, streamflows of 30 percent of mean annual discharge during October to March and 50 percent of mean annual discharge during April to September are associated with excellent aquatic habitat conditions. Determining ranges of sustainable yield where water budgets violated the Tennant Method metric for excellent aquatic habitat conditions would have been an irresponsible non-recognition of the interaction between groundwater and surface water within the Piedmont and Blue Ridge provinces and potential impacts of groundwater use on instream and other uses of surface waters.

4. We question why the EPD would not use actual baseflow data (one of the few data sets that provide reality to the model), rather than relying on synthetic data. There should be a discussion of how the actual and synthetic data compare.

As noted in the response to comment 1 above, the report was a synopsis of results of the groundwater availability assessment and was not intended to be a full report of the sustainable yield modeling. A full report of the groundwater modeling to determine ranges of sustainable yield of the prioritized aquifers, including determination of stream baseflows, is being prepared. Synthetic data were used based on available actual data to extrapolate results to the entire basins. There was no other means to achieve this, and this is the accepted approach to assessing baseflow in a watershed.

5. In Section 3.2 of the Assessment, the text describes an "even more stringent or conservative estimate of sustainable yield, allowing only 20% of the difference between the mean September flow and the Tennant reduction category"...There is no justification for arbitrarily allowing only one-fifth of the available water to be considered.

As noted in the response to comment 3 of the Cobb County Water System, a more restrictive streamflow metric was used similar to an approach applied in the New Jersey Highlands to estimate

sustainable yields of crystalline rock aquifers. In this case, the streamflow reduction categories were further reduced, allowing only 20% of the difference between the mean September flow and the streamflow threshold to calculate groundwater availability.

6. The discussion goes on to say that the 50% mid-level streamflow was chosen as the "criterion to estimate the net amount of groundwater available." But this criterion was chosen because the "40% streamflow reduction amount in the Piedmont Basin resulted in a situation in which current consumption already exceeded the sustainable yield." The authors did not consider that reasonable "given the negative net groundwater consumption in the basin," so they arbitrarily made the criterion the 50% mid-level streamflow, presumably because it allowed for a preconceived volume of groundwater to be made available. There needs to be a more objective appraisal for the calculation of available groundwater and surface water resources.

The 50 percent metric was selected based on the Tennant Method metric for maintenance of excellent aquatic habitat conditions. Assessments of groundwater and surface water availability are expected to be refined to support future rounds of regional water planning and refinements in metrics are among those we expect to be considered.

Suwannee River Water Management District (David Still)

Groundwater Availability Assessment

Comment 1 in Letter: There is a need to include current and projected Florida groundwater demands into the Regional Georgia EPD Groundwater model, and Sub-Regional Upper Floridan Aquifer Model...it is desirable to also include current and projected demands from Alabama and South Carolina...

Response: The regional and sub-regional groundwater models currently include withdrawals in Florida, Alabama, and South Carolina. During simulations to determine ranges of sustainable yield of the prioritized aquifers, simulated withdrawals in Georgia were increased while simulated withdrawals in Florida, Alabama, and South Carolina were kept at their baseline rates. Increased simulated withdrawals in Florida, Alabama, and South Carolina may be included in future model runs.

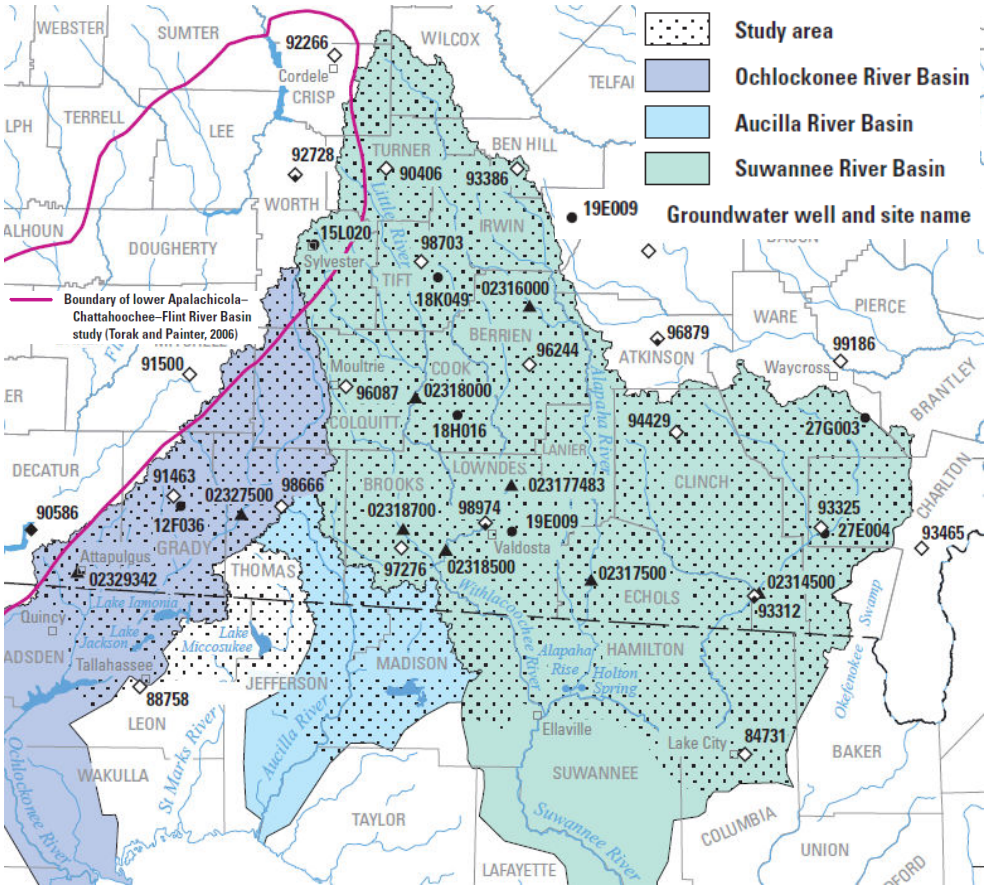
Comment 2 in Letter: The potentiometric surface of the Upper Floridan aquifer has declined 10 to 20 feet in north Florida over the last 50 to 60 years. We feel strongly that the District, GA EPD, and the St. Johns River Water Management District should work together to identify the causes of the decline, and to suggest and implement strategies to prevent further degradation of the groundwater resource...

Response: The Georgia Environmental Protection Division (EPD) agrees with the suggestion made in the comment. Georgia EPD has long been interested in Upper Floridan aquifer water levels in the southern portion of the State adjacent to Florida. During September 2006 Georgia EPD funded the U.S. Geological Survey (USGS) Georgia Water Science center to conduct a study of the geohydrology of the Aucilla-Suwannee-Ochlockonee river basin in south-central Georgia and adjacent parts of Florida. The study was published in 2010 as USGS Scientific Investigations Report (SIR) 2010-5072.

Seven USGS monitoring well are located in the study area, with some located north of the Gulf Trough, within the trough, and south and east of the trough (Figure 1). SIR 2010-5072 included hydrographs for the wells (Figure 2) that indicated different water-level trends:

- Well 15L020 in Worth County with a water level decline of about 20 feet between 1972 and 2008
- Well 18K049 in Tift County with a water level decline of about 30 feet between 1978 and 2008
- Well 18H016 in Cook County with a water level decline of about 17 feet between 1965 and 2008
- Well 27G003 in Ware County with a water level decline of about 7 feet between 1982 and 2008
- Well 19E009in Lowndes County with essentially no long-term trend of declining or rising water levels between 1957 and 2008
- Well 27E004 in Charlton County with essentially no long-term trend of declining or rising water levels between 1978 and 2008
- Well 12F036 in Grady County showed an increase in water levels, which was attributed to moving a municipal well field away from the monitoring well; the water level in the well during 2008 was just about the same as it was during 1964

Figure 1



The different water level trends demonstrated by the well hydrographs included in SIR 2010-5072 indicated that there is no consistent trend of water levels in the Upper Floridan aquifer in the Aucilla-Suwannee-Ochlockonee river basin in south-central Georgia. This should be considered if work is done to identify the causes of water level declines and to develop strategies to prevent degradation of the groundwater resource.

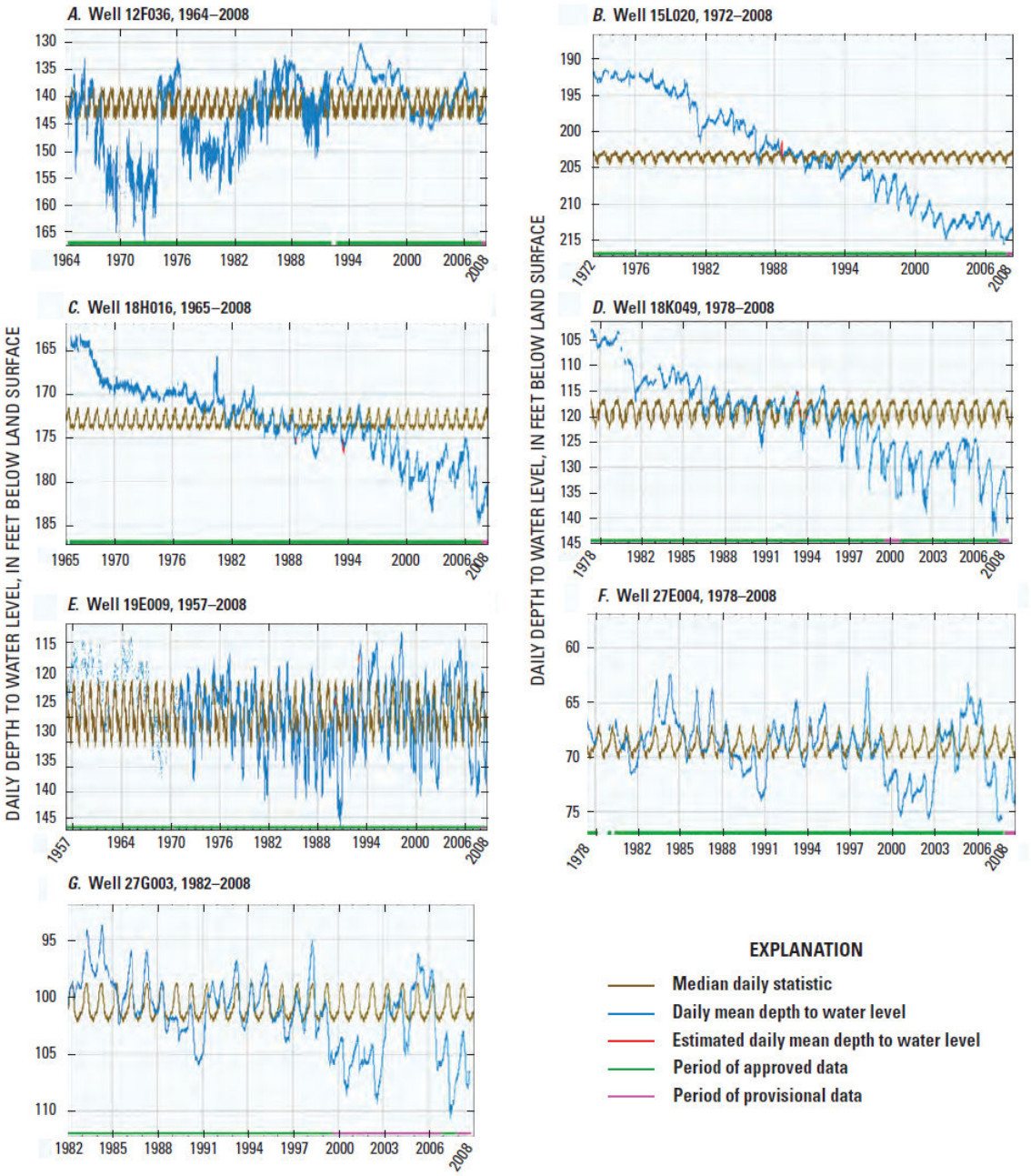
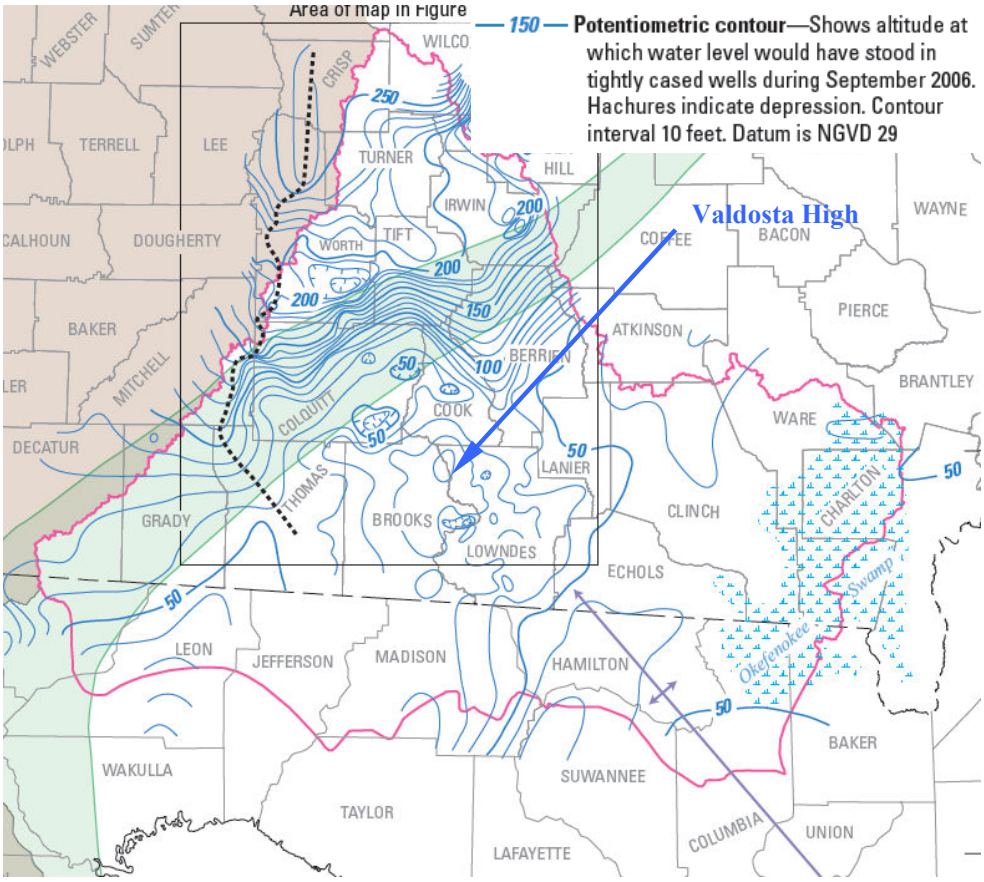


Figure 2

General Comment in Attachment: ...Given that the vicinity of Valdosta, Georgia, is a recharge area for the UFA, and that groundwater in the UFA flows from the recharge area into the northern portion of our District, we are concerned that the ranges of sustainable yields cited for the UFA...in the Groundwater Assessment may further exacerbate projected impacts to water resources in our District.

Response: Figure 24 in SIR 2010-5072 showed a recharge area in the vicinity of Valdosta (Figure 3 below). This recharge area is commonly referred to as the "Valdosta High".

Figure 3



The Valdosta High was recreated in the simulation of current withdrawals using the sub-regional model of the Upper Floridan aquifer in south-central Georgia (Figure 4). The Valdosta High persisted with a simulated increase of 507 million gallons per day (mgd) of withdrawals from the Upper Floridan aquifer in south-central Georgia above the current withdrawals (Figure 5). This was the high-end of the modeled sustainable yield range for this prioritized aquifer.

The drawdown in the area of the Valdosta High with the simulated increased withdrawal of 507 mgd was only about 4 feet (Figure 6). The simulated increased withdrawal included withdrawals from existing wells and from hypothetical new wells, many of which were located near the Valdosta High (Figure 7).

The simulated range of sustainable yield for the Upper Floridan aquifer in south-central Georgia did not eliminate the recharge area in the vicinity of Valdosta, nor its groundwater movement into northern Florida. Therefore, increasing groundwater withdrawals to the range of sustainable yield for the Upper Floridan aquifer in south-central Georgia may not exacerbate impacts to water resources in the manner described in the comment.

Figure 4

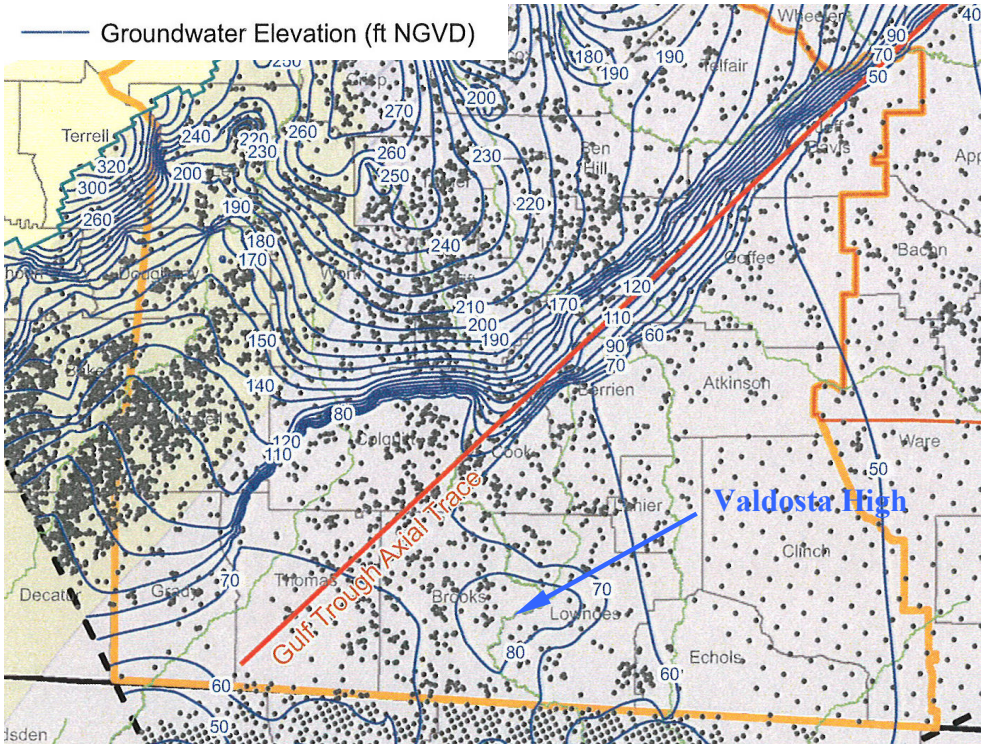


Figure 5

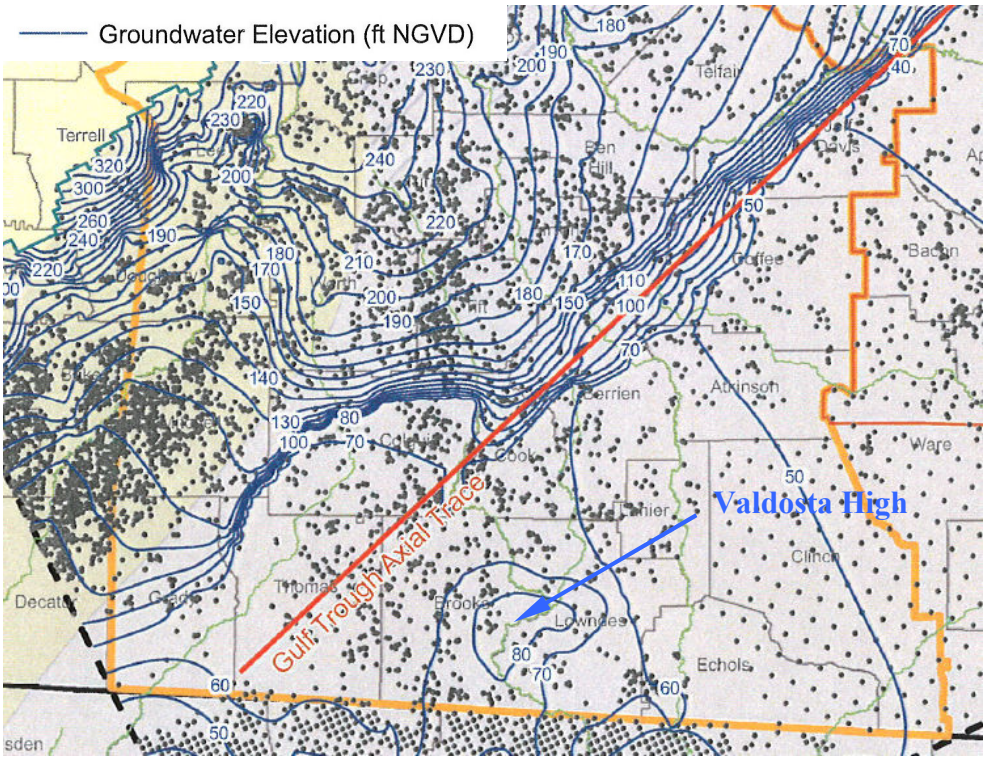


Figure 6

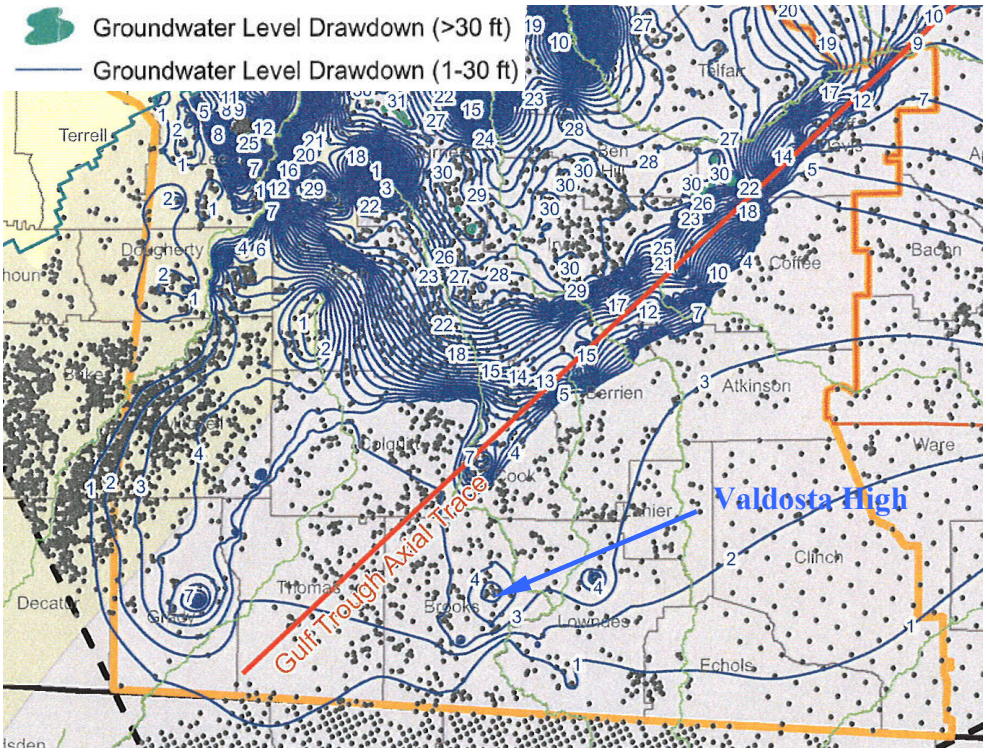
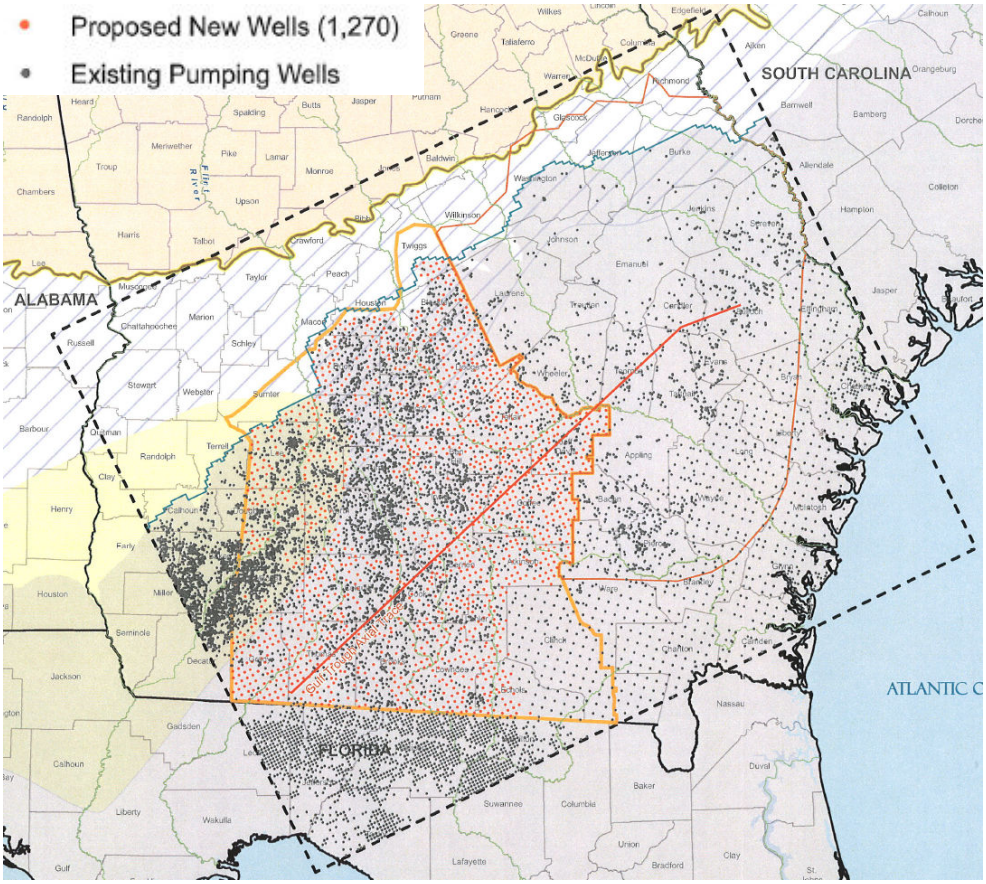


Figure 7



Comment 1 in Attachment: Regarding the sentence 'A report was also produced providing more detailed information on each modeling effort... ...We respectfully request that the GEPD provide the District a copy of the report.

Response: The report is being finalized and will be provided to the Suwannee River Water Management District as soon as it is completed.

Comment 2 in Attachment: Regarding the sentence 'Sustainable yields were determined using numerical modeling simulations with various combinations of withdrawals from existing wells and, where applicable, from hypothetical new wells'...It would be helpful to understand the basis for selection of the various combinations of withdrawals from existing wells and hypothetical wells...

Response: Ranges of sustainable yield were simulated by uniformly increasing simulated withdrawals from existing wells until a sustainable yield metric was exceeded. These simulations usually resulted in the low end of the sustainable yield range. Withdrawals from concentrated areas of existing withdrawals were then held constant and simulated withdrawals were uniformly increased at the remaining existing wells until a sustainable yield metric was exceeded. Where portions of the modeled aquifer had few, if any, existing wells, additional hypothetical wells were added with simulated withdrawals uniformly increased until a sustainable yield metric was exceeded. These latter simulations usually resulted in the high end of the sustainable yield range.

Hypothetical new wells were added in a spatially uniform manner to model nodes where there were few, if any, existing wells. An example of locations of hypothetical new wells is in Figure 8 for the Upper Floridan aquifer in south-central Georgia. Details of how hypothetical wells were included in the model of each prioritized aquifer will be in the report that is being finalized.

Comment 3 in Attachment: Why didn't the sustainable yield simulations in the regional Coastal Plain model domain include increased withdrawals from outside Georgia for withdrawals in the UFA?...

Please refer to the response to Comment 1 in the letter of 28 October 2010. Because the modeling was done for the Georgia State water plan, increased withdrawals were not simulated in states other than Georgia. As noted in the response to Comment 1 in the letter of 28 October 2010, increased simulated withdrawals in states other than Georgia can be included in future model runs.

To clarify, the regional Coastal Plain model was used for model calibration. Ranges of sustainable yield were determined using the sub-regional model for each prioritized aquifer.

Comment 4 in Attachment: Why were baseline withdrawals estimated on actual current withdrawals and not permitted capacities?...

Response: The models were calibrated against water levels measured in monitoring wells in Georgia, Florida, Alabama, and South Carolina. The measured water levels used as calibration targets reflected actual withdrawals, not permitted withdrawals. This necessitated the use of actual estimated withdrawals at the times that water levels were measured. Permitted withdrawals are often very different than actual withdrawals, particularly for agricultural withdrawal permits. Therefore, if

calibration had been done against measured water levels using permitted withdrawals, models would not have been calibrated correctly.

Comment 5 in Attachment: ...how can the sustainable yield be modeled/predicted for aquifer 'withdrawing separately' (see Table S-1)?

Response: It was noted on page S-45 of the Synopsis that increased withdrawals occur at the same time in more than one Coastal Plain aquifer, and that simulations that increased withdrawals in all of the prioritized aquifers were therefore completed to assess the potential impact of combined withdrawals on the overall ranges of sustainable yield. Results of these simulations were summarized in Tables S-7 and S-8.

It was noted on page S-63 that the results of the analysis showed that if withdrawals in each prioritized aquifer were increased simultaneously, the total sustainable yield of prioritized Coastal Plain aquifers was lower than individual aquifers. This was attributed to hydraulic interference between well pumping on a larger scale that limited the aquifer yield before exceeding sustainable yield metrics.

Comment 6 in Attachment: Please comment and provide detail on how the criteria for assessment of sustainable yield were developed...

Response: Details of sustainable yield criteria were provided in Section 2.1 of the Synopsis starting on page S-8. Additional information on sustainable yield metrics will be in the report that is being finalized.

Comment 7 in Attachment: ...Section 1.2 presents the criteria that were used to designate prioritized aquifers, including; 1) existing evidence of adverse impacts due to withdrawals from the aquifer and 2) forecasts suggesting significant increases in demands placed on the aquifer. Given these two criteria, is a modeled estimate of sustainable yield for the UFA sufficient to adequately predict future impacts to water availability and natural systems both within Georgia and into north Florida? Also, please explain how the predicted impacts in the UFA due to increased withdrawals are 'acceptable.'

Response: The modeled estimates for the ranges of sustainable yield for the Upper Floridan aquifer in south-central Georgia and the eastern Coastal Plain were sufficient to adequately predict future impacts to water availability and natural systems within Georgia. Because the modeling was done for the Georgia State water plan, possible future impacts in Florida were not specifically simulated.

As shown in Figure 7, the simulated drawdown with an Upper Floridan aquifer withdrawal increase of 507 mgd above the current withdrawals was less than one foot over most of the Georgia-Florida border of the south-central Georgia portion of the aquifer. A drawdown of less than one foot may have limited impact on water availability and natural systems in northern Florida.

Drawdowns in the Upper Floridan aquifer, and reductions in groundwater contributions to stream baseflows, simulated with increased withdrawals were considered to be acceptable if the simulated drawdowns and simulated reductions in groundwater contributions to stream baseflows did not exceed pre-established sustainable yield metrics.

Comment 8 in Attachment: ...It is unclear how productive each of these aquifers is...We agree with the conclusion of this paragraph that the cumulative effect of simultaneous withdrawals from these aquifers...could result in drawdowns of more than 30 feet and more than 40 percent recharge from streamflow.

Response: Productivity of modeled aquifers was demonstrated by the simulated withdrawals that could be achieved before sustainable yield metrics were exceeded. Simultaneous withdrawals from the aquifers were addressed in the response to Comment 5. It was noted on page S-63 of the Synopsis that results of simulations of simultaneous withdrawals showed that if withdrawals in each prioritized aquifer were increased simultaneously, the total sustainable yield of prioritized Coastal Plain aquifers was lower than individual aquifers due to hydraulic interference between well pumping on a larger scale that limited the aquifer yield before exceeding sustainable yield metrics. These metrics included exceeding 30 feet of drawdown between pumping wells or a 40 percent reduction in groundwater contributions to stream baseflows.

Comment 9 in Attachment: Is it valid to increase withdrawals only in areas where there are relatively little current withdrawals? Is it possible that there are minor current withdrawals in those areas because there is little to no current or projected demand in those areas?

Response: Simulated withdrawals were increased both in areas where there are existing wells, and in areas with there are few, if any, existing wells. Please refer to the response to Comment 2. Modeling was done to estimate ranges of sustainable yield of prioritized aquifers independent of where current groundwater withdrawals occur, or could occur in the future. The modeling was done this way to give the regional water planning councils information on the possible availability of groundwater resources even if such resources are not currently being used.

Comment 10 in Attachment: If the current withdrawals were increased from existing wells throughout the UFA Model domain (including Florida), arguably the drawdown would increase both spatially and in depth over what's depicted in the figures...Our preliminary analysis indicates that the increased drawdown is impacting our waters resources, including river flows, lake levels, and spring flows.

Response: As noted in the response to Comment 1 in the letter of 28 October 2010, during simulations to determine ranges of sustainable yield of the modeled aquifers simulated withdrawals in Georgia were increased while simulated withdrawals in other states were kept at their baseline rates. Increased simulated withdrawals in Florida can be included in future model runs to identify potential impacts. As noted in the response to Comment 7, because the modeling was done for the Georgia State water plan, possible future impacts in Florida were not specifically simulated.

As noted in the response to Comment 7, the simulated drawdown with an Upper Floridan aquifer withdrawal increase of 507 mgd above the current withdrawals was less than one foot over most of the Georgia-Florida border of the south-central Georgia portion of the Upper Floridan aquifer, and a drawdown of less than one foot may have limited impact on water availability and natural systems in northern Florida. It is possible that withdrawals in Florida are contributing to the increased drawdowns that are impacting water resources.

Comment 11 in Attachment: The District concurs...with GEPD's simulation of the potential impacts of combined withdrawals in all prioritized aquifers on the overall range of sustainable yields. Of particular interest related to this combined withdrawal simulation is Figures S-19a and S-20a. Drawdown influences are projected to occur in the UFA extending into Florida. Of special concern is that for the maximum sustainable yield increase over baseline withdrawals (Figure S-20a), drawdown is predicted to extend into northeast Florida and within the District in the area that is currently of special concern to us due to regional pumpage of the UFA...

Response: Figure S-19a, with an increased withdrawal of 400 mgd from all aquifers simultaneously above the baseline withdrawal, showed a simulated drawdown of less than one foot over most of the Georgia-Florida border, except in southeastern Georgia where a simulated drawdown of one foot extended into northeastern Florida. Figure S-20a did show simulated drawdowns of one, two, and three feet extending into central and northeastern Florida for an increased withdrawal of 563 mgd from all aquifers simultaneously above the baseline withdrawal. This simulated drawdown in central and northeastern Florida will be considered if and when future withdrawals in Georgia are considered to the high end of the range of sustainable yield with all aquifers withdrawing simultaneously.

Comment 12 in Attachment: The predicted drawdown in (descending order) the Claiborne, Clayton, Providence, and Eutaw Midville aquifers extends well into our District...We are not currently aware of the lateral facies changes and how these aquifers (if at all) extend into Florida, and if so, how they may be hydraulically connected to the UFA. Please provide more information.

Response: The report that is being finalized will include more information on the horizontal and vertical extents of modeled aquifers, and on the hydraulic properties of aquifers and virtual confining units that dictated simulated hydraulic connections with the Upper Floridan aquifer.

Surface Water Availability Assessment

General Comment in Attachment: …the fact that groundwater is the major sole supply source in the region does not preclude significant impacts to surface water sources from groundwater withdrawals. To the contrary, the available information indicates that current and projected groundwater pumpage (both within and beyond the District boundaries) in the northeastern portion of our District will affect both instream flow regulations in Florida and the District's statutory requirement to provide reasonable and beneficial use of water to our constituents. This is addressed further in our comments on the Groundwater Assessment.

Response: See responses to the Unimpaired Flows comments below as well as comments on the Groundwater Availability Assessment above.

Unimpaired Flows Comments in Attachment: …We support this concept and look forward to further review of the methods, procedures, and assumptions for unimpaired flow development… Was a trend analysis conducted in the available flow records prior to development of the Unimpaired Flows to determine the degree to which anthropogenic effects existed (i.e., were the flows stationary in time)? Additionally, are the final Unimpaired Flows themselves stationary? … Significant reductions in groundwater levels have been documented in south-central Georgia. How was the determination made that these reduced levels don't impact overlying surface water resources, other than in the ACF basin,

and thus did not require incorporation in the development of unimpaired flows in other basins such as the OSSS?

Response: Derivation of unimpaired flows is described in detail in the *Unimpaired Flows Data Report* (available for download at ftp://ftpx.dnr.state.ga.us/../Public/; see folder titled *March 2010 Resource Assessments*).

Generally, the Unimpaired Flow data were developed by correcting recorded gage flow with consumptive water use and the flow regulation by operation of large storage reservoirs such as those operated by the Army Corps of Engineers.

Quality control procedures employed at each stage of unimpaired flow development and described in the *Unimpaired Flow Data Report* include the following:

- Double-mass analysis of mean areal precipitation (MAP) time series and MAP extensions (ACF Basin)
- Adjustment of daily potential evapotranspiration (PET) time series using the Hamon PET (ACF Basin)
- Determination of regional pre-reservoir runoff coefficients based on analysis of MAP and unregulated streamflow data (ACF Basin)
- Visual inspection and adjustment of reservoir elevation time series to correct unrealistically rapid changes in storage (ACF Basin)
- Visual inspection and comparison of local unimpaired flow time series plots (ACF and OSSS Basins)
- Single-mass comparison of average local unimpaired flow volumes (ACF and OSSS Basins)
- Double-mass curves and consistency plots, in which individual nodes were grouped and differences between accumulated unimpaired flow for individual nodes compared with average accumulated unimpaired flow for the group (ACF and OSSS Basins)
- Adjustments to remove negative local incremental unimpaired flows (ACF and OSSS Basins)

These quality control procedures were intended to ensure that derived unimpaired flow time series reflected natural hydrologic variability to the maximum practicable extent. The question of stationarity of unimpaired flows requires paleohydrologic investigations beyond the scope of surface water availability assessment.

For these water resource assessments, evaluation of surface water and groundwater interactions has focused on the effect of groundwater pumping on surface water flow in streams that are hydraulically-connected to the groundwater aquifers prioritized for development of sustainable yield. In the lower ACF basin, the Upper Floridan Aquifer is either exposed at the surface or buried by very shallow overburden. The major rivers channel cut into the aquifers and have direct connections to the aquifer. In the Georgia's portion of the OSSS basins, however, most of the Upper Floridan aquifer is confined. In the modeling conducted to date, there is no evidence of groundwater pumping from the prioritized aquifers affecting surface water stream flow in this area.

Flow Regime Comments in Attachment: The interim Georgia approach has the benefit of ease of use, especially for a first-cut analysis as presented by the Surface Water Assessment. However, we believe the consensus in the scientific community is that reliance on simple hydrologic/hydraulic measures is ultimately inappropriate… In particular the implementation of the described flow regime does not

appear to provide adequate recognition of the need for medium or high flows… Current methods for instream flow specification incorporate medium and high flows for the continued environmental stability of a river. We would urge Georgia to implement data collection and analysis plans to facilitate refined specification of instream flow requirements using more generally accepted methods.

Response: Flow regime metrics for unregulated planning nodes were derived from the Board of Natural Resources interim instream flow policy. Following the direction of the Board's policy, these metrics focus on the low flow component of the flow regime to define thresholds of unacceptable impact. The DNR Board may opt to revise these policies in the future and the assessment approach would be adjusted accordingly.

Looking ahead, the assessment results will help target monitoring and resource evaluation to improve the information base on conditions in different river systems in Georgia. We also expect to refine the resource assessments in future rounds of regional water planning.[1] The metrics that define unacceptable impact are among the components we expect to review as revisions are considered. We welcome this comment and further input on science-based stream flow thresholds that could be used in the next round of regional planning and resource assessment.

Gap Analysis Comments in Attachment: …The OSSS basin has (proportionally) the greatest number of nodes with shortfalls, the maximum percent duration of shortfall, and a node with the second largest average shortfall rate… Among the OSSS basins the Ochlocknee and Suwannee constitute 75 percent of the total average shortfalls at the planning nodes. Consequently, we hope that additional resources will be prioritized to these systems to better understand them and guide any management responses toward and environmentally sustainable result.

Response: The Surface Water Availability Assessment tools provide a robust framework for evaluation of water management practices developed by the Water Planning Councils, if practices are sufficiently detailed for modeling purposes. The Suwannee-Satilla and Lower Flint-Ochlocknee Water Planning Councils are certainly considering the results highlighted in the comment and will address the shortfalls in their recommended management practices.

As noted in the response to the preceding comment, the results highlighted in this comment will also be a consideration for EPD as we set priorities for our activities in support of regional plan implementation and in preparation for the second round of resource assessment and regional planning.

St. Johns River Water Management District (Harold Wilkening)

Groundwater Availability Assessment

Comment in the Letter of 29 November 2010: "Depending upon the results of the groundwater modeling, we would be concerned about impacts to other water resource related systems, such as wetlands or springs."

Response: Most of the prioritized aquifers modeled for the State water plan are confined aquifers that are not in direct hydraulic connection with surface waters or water tables. Increased groundwater

[1] The State Water Plan requires review and revision of regional water plans every five years.

withdrawals from confined aquifers would not directly affect wetlands or most springs. Exceptions include the Upper Floridan aquifer in the Dougherty Plain of southwestern Georgia, the crystalline rock aquifer in the Piedmont and Blue Ridge provinces, and the Paleozoic rock aquifer of northwestern Georgia. For these aquifers in direct hydraulic connection with surface waters or water tables, reduction of groundwater contributions to stream baseflow was the metric that limited sustainable yield of the aquifer. The constraint on reducing groundwater contributions to baseflow would limit impacts of increased groundwater withdrawals on wetlands and springs.

Comment 1 in Attachment: "Definition of new base level is needed."

Response: One of the metrics used in the sustainable yield modeling was that reduction in aquifer storage does not go beyond a new base level. Simulated increased groundwater withdrawals caused simulated groundwater levels in the aquifer to decline. Dropping water levels increased hydraulic gradients at aquifer boundaries and induced recharge that reduced or stopped groundwater level declines. The sustainable yield metric intended to keep simulated groundwater levels from continuing to decline beyond a level where increased recharge kept groundwater levels from declining further. Other metrics were exceeded in the sustainable yield modeling before the new base level metric was exceeded. The new base level metric never dictated the modeled range of sustainable yield for a prioritized aquifer.

Comment 2 in Attachment: "Clarification needed on the 30 ft drawdown criteria"

Response: The maximum simulated water level drawdown in the pumped aquifer of 30 feet between pumping wells was selected because, in the experience of the Georgia Environmental Protection Division (EPD), water supply wells are typically constructed in a manner that would allow a water level drop of 30 feet or so before the well couldn't operate. When regional water levels drop in the range of 30 feet, Georgia EPD becomes aware of some wells going dry. Water level drawdowns of 10 or 50 feet could also have been selected as sustainable yield metrics, but such drawdowns may have resulted in unrealistically low or high sustainable yields.

Comment 3 in Attachment: "Clarification needed on how and where baseflow/induced recharge was determined."

Response: The MODFLOW river package was used in the sustainable yield models to represent the major rivers and streams in the outcrop areas of the Coastal Plain aquifers. Input data for the river package consisted of the river bottom elevation, the river stage, the river bed sediment thickness, and the hydraulic conductivity of these sediments.

Surface water levels in the Coastal Plain Aquifer System outcrop areas for the 1989-2009 time period were represented as head-dependent boundaries in the upper most aquifer. Only major rivers and streams that are directly connected to modeled aquifers were represented in the model. There were no rivers and streams modeled where aquifers are confined.

River bottom elevations were estimated from available topographic data near each river or stream. River stage data were obtained from the U.S. Geological Survey (USGS) National Water Information System database. The river bottom sediment thickness was estimated to be one foot, and the associated hydraulic conductivity of the sediments was estimated to be approximately one foot per day. The river bed hydraulic conductivity values were adjusted slightly during model calibration. Model river cell stages were assigned using surface water elevation data based on 97 USGS gauging stations.

To assess the contribution of groundwater to major rivers and streams within the outcrop areas and provide the data for calibration of the groundwater flow model, baseflow separation analysis was performed. Baseflow in the modeled area was estimated using the PART computer program developed by the USGS. This program uses stream partitioning to estimate a daily record of baseflow under the streamflow record.

PART was applied to a sufficiently long continuous period of record to give an estimate of the mean rate of groundwater contributions to stream baseflow. An evaluation of the baseflow over the period from 2003 to 2008 was completed and data on mean streamflow, mean baseflow, spatially averaged (normalized) baseflow, and the percent of total streamflow that comes from baseflow were generated for the drainage area of each gauging station.

Comment 4 in Attachment: "Clarification needed on the modification to the Tennant method."

Response: The Tennant method assumes that some percentage of the mean annual flow (Q_{MA}) is needed to maintain a healthy stream environment. The Tennant method is a standard-setting technique that bases its streamflow requirements on the observation that aquatic-habitat conditions are similar in streams carrying the same proportion of the Q_{MA}. To account for seasonal streamflow variability, the Tennant method established different percentages of the Q_{MA} for different seasons. To maintain opportunities for surface water use, the sustainable yield metric was the "outstanding" Tennant category of no more than a 40 percent reduction of Q_{MA} from April through September.

Rivers and streams were represented as sources or sinks in the sustainable yield models. The models were able to simulate groundwater contributions to stream baseflow under existing conditions and reductions in groundwater contributions to baseflow caused by simulated increases in groundwater withdrawals. The groundwater models were not able to simulate actual stream flows that included groundwater contributions to baseflow and surface water runoff. The Tennant method was therefore modified in the sustainable yield modeling by applying the 40 percent criterion to reduction of groundwater discharge to baseflow under equilibrium conditions rather than to reduction of the Q_{MA}.

The baseflow reduction was estimated for the streams and rivers in the outcrop areas from a model-wide water budget for each simulation. Groundwater contribution to baseflow is smaller than the Q_{MA} that includes surface water runoff. Applying the Tennant criterion only to groundwater contributions to baseflow would therefore result in smaller effects on streamflow than applying the criterion to Q_{MA}. Using the modified Tennant method was more conservative than applying the Tennant method directly to the Q_{MA}.

Comment 5 in Attachment: "Clarification needed on streamflow reduction metrics in the Dougherty Plain and Coastal Plain model."

Response: The streamflow reduction metric for the Dougherty Plain and Coastal Plain sustainable yield models was no more than a 40-percent reduction in groundwater contributions to baseflow. This metric constrained the sustainable yield range of the Upper Floridan aquifer in the Dougherty Plain, and constrained the upper end of the sustainable yield range for the modeled Coastal Plain aquifers.

Comment 6 in Attachment: "Clarification needed on the aquifer recovery criteria."

Response: Sustainable yield models simulated long-term water levels resulting from increased groundwater withdrawals. Simulations were also done of additional short-term increased withdrawals such as those during a drought. Three years of drought were simulated with lower recharge and increased withdrawals followed by four years of non-drought precipitation and withdrawals. The aquifer recovery criterion was that water levels simulated for drought periods would rebound to at least 90 percent of pre-drought levels within four years.

Comment 7 in Attachment: "Changing an aquifer from confined to unconfined needs to be qualified."

Response: Simulated increased groundwater withdrawals were restricted to avoid drawing the potentiometric surface of an aquifer down such that portions of the confined aquifer became unconfined (i.e., the potentiometric surface dropped below the top surface of the confined aquifer). Changing an aquifer from confined to unconfined conditions would have decreased the transmissivity of the aquifer and thereby decreased well yields from the aquifer.

Comment 8 in Attachment: "Need to provide a list of assumptions for the determination of sustainable yield for different aquifers."

Response: No assumptions were made in modeling ranges of sustainable yield for the prioritized aquifers. Simulation results were compared to sustainable yield metrics to determine if a simulated increased groundwater withdrawal was within a range of sustainable yield. If the simulated withdrawal exceeded any metric, the simulated withdrawal was considered to be greater than a sustainable yield of the aquifer. If the simulated withdrawal did not exceed a metric, the simulated withdrawal was considered to be less than a sustainable yield of the aquifer. Simulated groundwater withdrawals were incrementally increased until a sustainable yield metric was reached.

Different metrics dictated the range of sustainable yield for different prioritized aquifers:

Prioritized Aquifer	**Metric That Dictated Range of Sustainable Yield**	
	Low End of Range	**High End of Range**
Upper Floridan in the Dougherty Plain	Reduction of Groundwater Contributions to Baseflow	Reduction of Groundwater Contributions to Baseflow

Upper Floridan in South-Central Georgia	30 Feet of Simulated Water Level Drawdown	30 Feet of Simulated Water Level Drawdown and Reduction of Groundwater Contributions to Baseflow
Upper Floridan in South-Central Georgia and the Eastern Coastal Plain	30 Feet of Simulated Water Level Drawdown	30 Feet of Simulated Water Level Drawdown and Reduction of Groundwater Contributions to Baseflow
Claiborne	30 Feet of Simulated Water Level Drawdown	30 Feet of Simulated Water Level Drawdown and Reduction of Groundwater Contributions to Baseflow
Cretaceous Between Macon and Augusta	30 Feet of Simulated Water Level Drawdown	Reduction of Groundwater Contributions to Baseflow
Crystalline Rock	Reduction of Groundwater Contributions to Baseflow	Reduction of Groundwater Contributions to Baseflow
Paleozoic Rock in Northwestern Georgia	Reduction of Groundwater Contributions to Baseflow	Reduction of Groundwater Contributions to Baseflow

Comment 9 in Attachment: "Clarification needed on the benchmark condition."

Response: There is no response because the comment did not indicate what "benchmark condition" refers to.

Comment 10 in Attachment: "Need to include model uncertainty not just spatial uncertainty in the range of sustainable yield."

Response: Sustainable yields were modeled as ranges for each prioritized aquifer, not as single values. Uncertainty would have been evaluated if a single sustainable yield had been modeled for each aquifer. Modeling sustainable yields as ranges precluded the need to evaluate uncertainty.

Comment 11 in Attachment: "Assumption that 'Because there is a significant degree of connection between the Upper Floridan aquifer and the rivers in this part of Georgia, excessive drawdown of the aquifer does not appear to be a major concern because the rivers would recharge the aquifer under increased withdrawal scenarios' may be an issue."

Response: The range of the sustainable yield of the Upper Floridan aquifer in the Dougherty Plain of southwestern Georgia was dictated by the reduction of groundwater contributions to stream baseflows and not by 30 feet of simulated water level drawdown. Because there is a significant degree of connection between the Upper Floridan aquifer and the rivers in this part of Georgia, 30 feet of simulated water level drawdown could not be achieved before simulated groundwater contributions to

baseflow were reduced by 40 percent. Water level drawdowns were always less than 30 feet with a simulated 40 percent reduction of groundwater contributions to baseflow. The assumption cited in the comment was therefore not an issue.

Comment 12 in Attachment: "Drawdown contour maps look like they are affected by the lateral boundary conditions applied to the models used. How do the lateral boundary conditions effect drawdown results, the simulated baseflow reductions, and the estimates of sustainable yield?"

Response: The first step in modeling ranges of sustainable yield was development of a regional groundwater flow model encompassing all of the prioritized Coastal Plain aquifers. The regional model was a portion of the Coastal Plain aquifer system of the eastern United States and therefore boundaries of the regional model were by necessity within the Coastal Plain aquifer system. To minimize effects of boundaries, the regional model extended outside of Georgia into Alabama, Florida, and South Carolina so that areas in Georgia where increased groundwater withdrawals were to be simulated were as far away from regional aquifer boundaries as practicable.

The model was calibrated at the regional level using calibration targets within and outside the State of Georgia. The calibrated regional model was then zoomed-in to sub-regions representing the prioritized aquifers. Boundaries of the sub-regional models were within the boundaries of the regional model. Water level drawdowns and reductions in groundwater contributions to stream baseflows simulated with the sub-regional models were isolated from the boundaries of the regional model which minimized effects of regional model boundaries on modeled of ranges of sustainable yield.

Comment 13 in Attachment: "It appears that withdrawals from the Floridan aquifer system in coastal Georgia and northern Florida that are located within the EPD regional model were not considered in the analysis. This appears to be a significant deficiency in the analysis."

Response: The regional model considered all current groundwater withdrawals for which data were available, or for which withdrawals could be estimated, within the model domain, including states outside Georgia. Floridan aquifer withdrawals in coastal Georgia and northern Florida were included in the regional model. The regional model was calibrated to all of the groundwater withdrawals included in the model domain.

For modeling ranges of sustainable yield, increased withdrawals were simulated for prioritized aquifers in Georgia. Withdrawals in other portions of the model outside the prioritized aquifers were kept at the levels to which the regional model was calibrated.

Projected increases in Florida groundwater withdrawals from the Floridan aquifer system were not know at the time of sustainable yield modeling. The Georgia EPD and USGS are modeling groundwater withdrawals from the Floridan aquifer system in coastal Georgia as part of the Coastal Sound Science Initiative. Not considering withdrawals from the Floridan aquifer system in coastal Georgia and northern Florida did not constitute a significant deficiency in the analysis.

Comment 14 in Attachment: "The aquifer's ability to produce water should not solely be the over-riding factor for determining sustainable yield."

Response: Ranges of sustainable yield were modeled based on sustainable yield metrics affected by aquifer hydraulic properties, sources of aquifer recharge, whether the aquifer was confined or unconfined, and the degree of hydraulic connection between surface water and groundwater. An aquifer's ability to produce water was not a factor dictating sustainable yield. For instance, one of the highest yielding aquifers in Georgia, the Upper Floridan aquifer in the Dougherty Plain of southwestern Georgia, had a relatively low range of modeled sustainable yield due to the interaction of surface water and groundwater in the Dougherty Plain.

Comment 15 in Attachment: "The actual sustainable yield would be less than reported because the constraints used would be affected by 1) pumping in areas within the model domain that were not included in the analysis 2) pumping in those states outside of the model domain that could affect the assigned lateral boundary conditions."

Response: The regional model included current groundwater withdrawals within the model domain, including areas outside the prioritized aquifers and states outside Georgia. The modeled ranges of sustainable yield accounted for effects of all withdrawals within the model domain. The regional model extended outside of Georgia so that areas in Georgia where increased groundwater withdrawals were to be simulated were as far away from regional aquifer boundaries and pumping in those states outside of the model domain as practicable.

Lateral boundary conditions of the regional model were not assigned. Boundary conditions were calibrated to measured water levels in Georgia and in the portions of Alabama, Florida, and South Carolina within the model domain. Calibration of the boundary conditions reflected groundwater withdrawals in those states outside of the model domain.

Comment 16 in Attachment: "How was the Floridan aquifer system conceptualized?"

Response: The Floridan aquifer system was conceptualized consistent with information in the following USGS, Georgia Geologic Survey, St. Johns River Water Management District, and Suwannee River Water Managemernt District documents:

- Birdie, T.R., Burger, P., Huang, C., and Munch, D., 2008. *Northeast Florida Regional Groundwater Flow Model: Model Revision and Expansion*. St. Johns River Water Management District Special Publication SJ2008-SP26.
- Burt, R.A., 1993. *Ground-Water Chemical Evolution and Diagenetic Processes in the Upper Floridan Aquifer, Southern South Carolina and Northeastern Georgia*. U.S. Geological Survey Water Supply Paper 2392.
- Burt, R.A., Belval, D.L., Crouch, M., and Hughes, W.B., 1986. *Geohydrologic Data from Port Royal Sound, Beaufort County, South Carolina*. U.S. Geological Survey Open-File Report 1986-497.

- Bush, P.W. and R.H. Johnston, 1988. *Ground-Water Hydraulics, Regional Flow, and Groundwater Development of the Floridan Aquifer System in Florida and Parts of Georgia, South Carolina and Alabama*. U.S. Geological Survey, Professional Paper 1403-C.
- Bush, P.W., 1988. *Simulation of Saltwater Movement in the Floridan Aquifer System, Hilton Head Island, South Carolina*. U.S. Geological Survey Water Supply Paper 2331.
- Chapman, M.J., 1993. *Ground-Water Quality of the Upper Floridan Aquifer Near an Abandoned Manufactured Gas Plant in Albany, Georgia*. U.S. Geological Survey Water Resources Investigations Report 93-4038.
- Cherry, G.S., 2006. *Simulation of Selected Ground-Water Pumping Scenarios at Fort Stewart and Hunter Army Airfield, Georgia*. U.S. Geological Survey Open File Report 2006-1148.
- Cherry, G.S., 2006. *USGS Georgia Water Science Center and City of Brunswick-Glynn County Cooperative Water Program-Summary of Activities, July 2005 through June 2006*. U.S. Geological Survey Open File Report 2006-1368.
- Cherry, G.S. and Clarke, J.S., 2008. *Ground-Water Conditions and Studies in the Brunswick-Glynn County Area, Georgia, 2007*. U.S. Geological Survey Open File Report 2008-1297.
- Clarke, J.S. and Krause, R.E., 2000. *Design, Revision, and Application of Ground-Water Flow Models for Simulation of Selected Water-Management Scenarios in the Coastal Area of Georgia and Adjacent Parts of South Carolina and Florida*. U.S. Geological Survey Water Resources Investigations Report 00-4084.
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Comment 17 in Attachment: "The lack of information regarding the conceptualization, design and calibration of the groundwater models mentioned in the report makes it impossible to fully understand the results that are presented."

Response: The report was a synopsis of results of the modeling of ranges of sustainable yield for prioritized aquifers. A full report of the modeling is being prepared.

Comment 18 in Attachment: If the aquifers within the regional coastal plain model are connected hydraulically, then determining sustainable yield separately for each aquifer does not have any meaning.

Response: The range of sustainable yield for each prioritized aquifer was modeled separately and then the range of sustainable yield was modeled for withdrawals from all aquifers together. Section 5.5 of the synopsis was titled "Regional Model Combined Prioritized Aquifer Sustainable Yield Adjustment". The first paragraph of this section was "Increased withdrawals occur at the same time in more than one Coastal Plain aquifer. Therefore, groundwater modeling simulations that increased withdrawals in all of the prioritized aquifers were completed to assess the potential impact of combined withdrawals on the overall range of sustainable yields."

Results of the simulations of combined aquifer withdrawals were presented in Table S-8. The total range of modeled sustainable yield of individual prioritized aquifers with aquifer withdrawals modeled individually was 1,166 to 1,433 million gallons per day (mgd) while the range of modeled sustainable yield of individual prioritized aquifers with aquifer withdrawals modeled simultaneously was smaller at 1,066 to 1,229 mgd due to the hydraulic connections between aquifers. The meaning of these simulations was to demonstrate that ranges of sustainable yield of individual aquifers would be smaller if withdrawals occur from all aquifers at the same time.

Comment 19 in Attachment: Georgia has used sustainability metrics that don't appear to relate to specific water resource constraints.

Response: The metrics used to model ranges of sustainable yield for the prioritized aquifers were described in Section 2 of the synopsis and included:

- Drawdowns of groundwater levels in the pumped aquifer do not exceed 30 feet between pumping wells

- Constrain recharge from surface water sources to 40 percent of groundwater contributations to stream baseflow to maintain opportunities for surface water use
- Reduction of aquifer storage does not go beyond a new base level
- Groundwater levels are not lowered below the top of a confined aquifer
- The ability of the aquifer to recover to baseline groundwater levels between periods of higher withdrawals is not exceeded

Each of the sustainable yield metrics was related to a groundwater resource constraint. The metric of constraining recharge from surface water sources to 40 percent of groundwater contributations to stream baseflow was also related to a surface water resource constraint.

Surface Water Availability Assessment

Comments 1-6 in Attachment:

- *The hydrologic regime, based on a monthly 7Q10 statistic, is generally slightly less than flow conditions associated with the 90th percentile of exceedence flows for each month. Such a hydrologic regime tends to "flat line" a river system if the "surplus" water can be extracted or held in reservoirs.*
- *There is no direct relation between 7Q10 and aquatic live protection. According to Annear and others (2002), the 7Q10 should never be used to make instream flow prescriptions for riverine stewardship.*
- *The use of "average" condition criteria or the use of period-of-record duration curve statistics (an averaging process) may result in the loss of biologically relevant information associated with several hydrologic components (e.g., duration, return interval, seasonality and rate of change).*
- *The instream flow protection criteria used for this report are not likely protective of the ecology of river systems. Thus, water availability is likely to be overestimated.*
- *Consumptive use of water, based on the protection criteria (e.g., 7Q10), might allow for the removal of too much water from river reaches in Georgia, resulting in insufficient flows in the downstream portion of these rivers in Florida.*
- *These Florida river systems might not have sufficient flow regimes to protect these systems from "significantly harmful withdrawals" as cited in 373.042 and 373.0421, Florida Statutes. That is, Georgia water use might result in no additional withdrawals from these rivers in Florida or could result in the need for "restoration plans" in the Florida portions of the rivers.*

Response: Flow regime metrics for unregulated planning nodes were derived from the Board of Natural Resources interim instream flow policy. Following the direction of the Board's policy, these metrics focus on the low flow component of the flow regime to define thresholds of unacceptable impact. The DNR Board may opt to revise these policies in the future and the assessment approach would be adjusted accordingly.

Looking ahead, the assessment results will help target monitoring and resource evaluation to improve the information base on conditions in different river systems in Georgia. We also expect to refine the resource assessments in future rounds of regional water planning.[2] The metrics that define

[2] The State Water Plan requires review and revision of regional water plans every five years.

unacceptable impact are among the components we expect to review as revisions are considered. We welcome these comments and further input on science-based stream flow thresholds that could be used in the next round of regional planning and resource assessment.

Comment 7 in Attachment: No water use data are provided. It was mentioned that the data are what is currently available with gaps filled.

Response: Additional information can be found in the *Water Use Data Inventory Report,* available for download at ftp://ftpx.dnr.state.ga.us/../Public/ (see folder titled *March 2010 Resource Assessments*). The water use data itself (recorded municipal and industrial withdrawals and returns and estimated agricultural withdrawals) are available upon request; please contact Suzanne Desmond at suzanne.desmond@dnr.state.ga.us or 404-463-1425.

Comment 8 in Attachment: Clarification needed on Unimpaired Flows method.

Generally, the Unimpaired Flow data were developed by correcting recorded gage flow with consumptive water use and the flow regulation by operation of large storage reservoirs such as those operated by the Army Corps of Engineers. Additional information can be found in the *Unimpaired Flows Data Report*, available for download at ftp://ftpx.dnr.state.ga.us/../Public/ (see folder titled *March 2010 Resource Assessments*).

Comment 9 in Attachment: Clarification needed on the development and use of the Georgia Water Resource Institute River Basin Planning Tool.

Response: EPD has provided the model to staff at the St. Johns River and Suwannee River Water Management Districts and it has been discussed in meetings of staff from the three agencies.

Assimilative Capacity Assessment

Comment 1 in Attachment: Limited information in the report to evaluate the model used.

Response: Additional information can be found in technical reports documenting each of the models used for the assimilative capacity assessment. Those reports are now available for download at ftp://ftpx.dnr.state.ga.us/../Public/ (see folder titled *March 2010 Resource Assessments*).

Comment 2 in Attachment: The use of assimilative capacity in the context of assessing the condition of Georgia's water bodies could be dangerously interpreted as an invitation to allowing increased development and nutrient/DO loading into those water bodies exhibiting good water quality.

Response: As directed by Georgia's State Water Plan, the assimilative capacity assessments were designed as tools to support planning to meet projected demand for wastewater discharge. These tools do not directly assess the condition of Georgia's water bodies. Rather, they supplement the ambient monitoring and assessment done to evaluate the condition of Georgia's water bodies, as shown in the 305(b)/303(d) list.

The models used water quality standards as metrics to evaluate assimilative capacity. While Georgia's nutrient standards at this time are limited to certain lakes, the watershed and lake/estuary models assess nutrient levels and, in the future, will be used to evaluate Georgia's ability to meet Florida's nutrient criteria.

The assessment tools support development of regional water plans, which will in turn guide EPD permitting decisions. The regional plans will be used in conjunction with other programs and tools already in place to protect water quality, including evaluation of NPDES permits and related programs.

Comment 3 in Attachment: The assumption that the number of septic tanks per unit area is constant, regardless of development intensity, is obviously false.

Response: Consideration of septic systems in the watershed models was based on available information on the number of septic systems in each county. The number of septic tanks in each subwatershed was determined through an area weighting method. Each sub-watershed was assigned to a county based on where the outlet of the watershed lies. The area of the sub-watershed to the area of the county was determined, and this ratio was applied to the total number of septic tanks in the county to determine a number for each sub-watershed. For more information, see the watershed modeling reports available for download at ftp://ftpx.dnr.state.ga.us/../Public/ (see folder titled *March 2010 Resource Assessments*).