

AN APPRAISAL OF THE CONSUMPTIVE WITHDRAWAL LIMIT FOR THE UPPER CHATTAHOOCHEE BASIN

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Abstract. In the Allocation Formula negotiations and in the Metro Atlanta Water Resources Plan reference is made to a 705 MGD average annual consumptive withdrawal limit for the Chattahoochee Basin above Peachtree Creek. Setting such a limit is a serious task because it defines the acceptable depletion level for municipalities and industries to plan their future growth. In this paper several questions relating to this consumptive withdrawal limit will be discussed including: 1) In what temporal context should such a demand limit be provided, 2) What is the relationship between a consumptive withdrawal limit for the Upper Chattahoochee basin and the water available in the basin or the “yield” of the basin, and 3) Accounting for regulated and unregulated reaches in yield calculations. Defining the limits of consumptive withdrawals should 1) be based on an analysis of the safe yield of the upper Chattahoochee Basin, 2) accommodate for seasonal variations in flow, withdrawals and returns and 3) should be based on conservative assumptions.

INTRODUCTION

In the ACF Allocation Formula negotiations and associated litigations and in the water supply and conservation management plan developed for Metropolitan Atlanta (Jordan, Jones and Goulding, 2003), Georgia and Metropolitan Atlanta interests have stated that 705 million gallons per day (MGD) is the limit of average annual daily surface withdrawals from the Chattahoochee basin above Peachtree Creek. In this paper this limit is assumed to be on total withdrawals not net withdrawals, although there is some ambiguity in the Metro Atlanta Water Supply Plan whether this value is intended to be a net or gross value. The Plan provides for a 58% rate for return of water withdrawals which would result in an annual average consumptive use of about 300 MGD.

In spite of the major social and economic implications associated with defining a consumptive withdrawal limit, there have been no documents released comparing this withdrawal limit to the water available in the upper

Chattahoochee basin. Concerns associated with defining such a limit include: 1) resultant elevations at federal storage reservoirs in the Chattahoochee basin including Lake Lanier and West Point Lake, 2) impacts of this level of withdrawal on the economy, recreational use of the water resources and the environment of both the upper Chattahoochee basin and locations downstream and 3) impacts on allowable waste water discharges by public and private entities into the river. As Figure 1 shows, forecasted flows at the Atlanta gage would change significantly from historical flows with this increased level of withdrawals when simulated flows are compared with historically observed flows for the period of 1998 to 2001 for the Chattahoochee River at Atlanta.

SOME ISSUES ASSOCIATED WITH COMPARING THE 705 MGD WITHDRAWAL LIMIT TO STREAM FLOW

Comparing the 705 MGD withdrawal limit to stream flow is not as simple as one would initially expect. Many questions need to be considered such as: How much water should be available for withdrawals and how much should

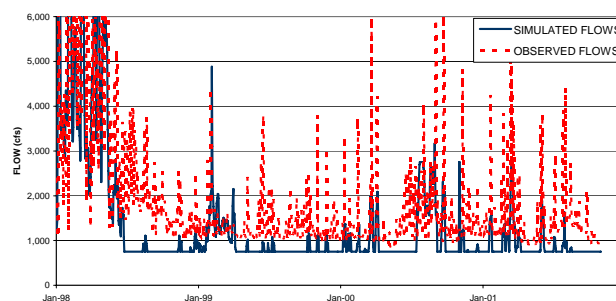


Figure 1. Comparison of historically observed flows and modeled flows with 705 MGD withdrawn for the Chattahoochee River at Atlanta (1998-2001).

be reserved for other uses, including instream uses such as providing water to sustain the aquatic ecosystem? In what temporal context should the comparison be made? And, how conservative should the assumptions be that are integrated into such an analysis?

Safe Yield versus Critical Yield

In making a comparison between stream flow and withdrawal, the comparison can be made from the perspective of the critical yield or the safe yield. The “critical yield” may be defined as “the volume of water passing a defined point that can be sustained throughout the critical drought period” and the “safe yield” as “the amount of water available for withdrawal without impairing the long-term social utility of the water source, including the maintenance of the protected biological, chemical, and physical integrity of the source”. The distinction between these two yields is that the critical yield represents the water that is physically available whereas the safe yield considers the volume of water that is restricted from use considering economic, environmental, social and political constraints, or in other words, the social utility of the water, not just the water that is physically available for consumption (Dellapenna, 1997).

For purposes of evaluating a consumptive withdrawal limit, the appropriate comparison would be with the safe yield, not the critical yield. There are many other uses of the water resources of the upper Chattahoochee that will be competing for use of this same water that is sought for municipal supplies. All of these uses need to be considered and understood before determining that a given level of consumptive depletion is acceptable to society over the long term. Included among these other uses are: 1) the water quality flow requirement at Peachtree Creek, 2) maintaining reservoir elevations at Lake Lanier for homeowners and recreational users, 3) fishery resources from the trout fishery below Buford Dam, 4) recreational uses by citizens who utilize the Chattahoochee National Recreation Area, 5) interests holding NPDES permits whose permits could be affected by lower flows, and 6) uses of the Chattahoochee River below Peachtree Creek, including those associated with recreation at West Point Lake, for NPDES discharges, water supply, recreation and other activities.

Although the Metro Atlanta Water Supply Plan uses the term “safe yield”, it defines the safe yield as “the maximum quantity of water, on an annual average daily basis, that is available during a critical drought, typically defined as a drought with an occurrence frequency of once in 50 years” (Jordan, Jones and Goulding, 2003), which is actually the definition of the critical yield, not the safe yield.

The critical yield for the Chattahoochee basin above Peachtree Creek has been calculated by the author to be 1,995 cubic feet per second (cfs) or about 1,290 MGD.

This yield value was calculated using the ACF STELLA model developed during the Comprehensive Study. The model was set so that the entire conservation pool of Lake Lanier was available for release (e.g. the minimum elevation of Lake Lanier was set at 1035 feet) and no demands or returns were removed from the upper basin. This yield value also was calculated assuming Lake Lanier could be managed to provide the exact yield value each day unless the reservoir was spilling water because its elevation exceeded the top of the conservation pool. In the model, the reservoir was not allowed to store water above the rule curve.

If the safe yield were to be calculated for the Chattahoochee Basin above Peachtree Creek as a beginning step the minimum elevation at Lake Lanier should be set in the range between 1051 feet and 1055 feet, depending on what elevation is deemed acceptable by management interests and stakeholders, not at 1035 feet used in the critical yield calculation. Lake Lanier is located in the upper part of the basin and has refill problems when it is drawn down. The reservoir also serves as a major source of drinking water for Metro Atlanta and provides substantial economic benefits to the region from recreational use. Drawing the reservoir down to the bottom of its conservation pool is not considered to be an acceptable option. If the minimum allowable elevation at Lake Lanier were set at 1055 feet instead of 1035 feet, the yield from the upper basin would decline from 1,995 cfs to 1,760 cfs (1,140 MGD) and if the minimum elevation were set at 1051 feet the yield would be 1,835 cfs (1,186 MGD).

Other factors which should be integrated into a safe yield calculation include: 1) what is an acceptable minimum water quality flow at Peachtree Creek, 2) what are acceptable flows to provide acceptable dissolved oxygen levels to sustain the trout fishery below Lake Lanier, 3) what flows are needed to sustain recreational use of the Chattahoochee River National Recreation Area?, 4) what are acceptable impacts on downstream interests such as those at West Point Lake, and 5) what are acceptable impacts on NPDES permit holders which would be affected by reduced flows. Since the critical yield represents the total water available in a worst case scenario, by definition, consideration of these and other factors can only lower the yield from the basin.

The yield from the upper Chattahoochee could be increased by either importing water into the basin from another basin or by diverting water that would have been discharged through Peachtree Creek back to Lake Lanier. Raising the top of the conservation pool at Lake Lanier would not have a major effect on the yield.

Temporal Defining of Consumptive Demand Limit

The 705 MGD limit was provide as an average annual withdrawal. However, from Figures 2 and 3, it is apparent

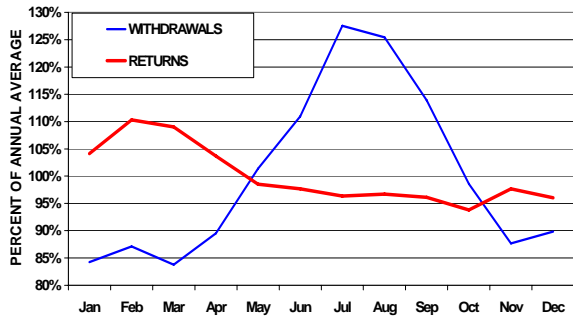


Figure 2. Average monthly ratio of municipal and industrial withdrawals and returns for the Chattahoochee Basin above the Peachtree Creek gage.

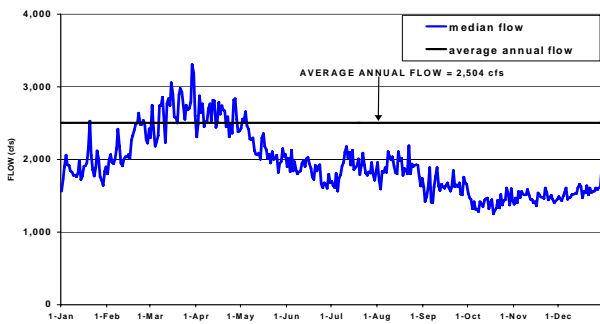


Figure 3. Median daily flow and average annual flow at the Atlanta gage on the Chattahoochee River (1939-2001).

that over the course of the year there is typically considerable variation in the average magnitude of withdrawals, returns and stream flow. When withdrawals are at their peak in the summer months, both returns and stream flow tend to be lower. And, in times of drought these variations become more extreme. The nature and timing of this variability suggests that consumptive withdrawal limits should be on a monthly time scale rather than on an average annual basis or at a minimum, seasonal variations should be considered. To not do so, creates an illusion of sustainability that will not occur in the real world.

Consideration of Regulated and Unregulated Reaches in Yield Calculation

The Chattahoochee Basin above Peachtree Creek can be divided into two distinct sub-areas: 1) the basin above Buford Dam which can be regulated by the Buford Dam and 2) the basin area between the Buford outflow and Peachtree Creek which is not regulated except to a minimal extent by Morgan Falls Dam. There are two approaches for accounting for the total yield above Peachtree Creek. One approach is to calculate the yield for Lake Lanier and for the segment below independently and then sum up the two yields. The other approach is to

calculate the yield in an integrated manner that would allow for Lanier to augment flows in the lower reach to meet the yield. The first approach is one that would be taken by an entity with management responsibility, such as the Corps of Engineers, who would be accountable for any failures to meet the yield. The other approach is one that would be taken by a user of the water resources who wants to justify as high a withdrawal value as possible, such as Metro Atlanta interests, and one who would not be held responsible for any failures to meet the yield once these higher levels of demands are occurring. The reason there are two approaches is because the future climate is unknown, as is the severity of future drought events, and the coincidence of drought events in different portions of the watershed. Deciding which approach is correct would depend on whether one is seeking to guarantee that the yield would never be exceeded or whether one is seeking to justify the maximum volume of withdrawals to support growth.

If Lake Lanier is drawn to an elevation no lower than 1055 feet, then using the yield using first approach would be the sum of the yield from both segments. The yield from the basin above Buford Dam is 1,273 cfs (823 MGD) and the minimum average monthly local inflow for the basin between the Buford outflow and Peachtree Creek was about 250 cfs (162 MGD). Therefore, if the yield were calculated by the first approach it would be 1,523 cfs (985 MGD), whereas if the yield were calculated in an integrated manner it would be 1,760 cfs (1138 MGD).

CONCLUSIONS

Defining a consumptive demand limit for the Chattahoochee Basin above Peachtree Creek is a serious endeavor and the analyses which support such a demand limit should be open to public scrutiny and debate. Defining the limits of consumptive withdrawals should 1) be based on an analysis of the safe yield of the upper Chattahoochee Basin, 2) accommodate for seasonal variations in flow, withdrawals and returns and 3) should be based on conservative assumptions.

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