

# Groundwater Consumption Contributing to Loss of Low Stream Baseflow in Some Wake County Drainage Basins

by Jeri Gray

Groundwater is important to Wake County's economic life. About 141,000 county residents rely on groundwater for household use. Groundwater withdrawals in the county total nearly 14 million gallons per day. The number of people relying on groundwater is about 21% of the county's population and is more than the population of Cary.

The Wake County Comprehensive Groundwater Investigation is now entering its 8<sup>th</sup> month, and much information is available to begin answering the important question of whether current use of groundwater is sustainable and whether more groundwater can be withdrawn in the future to meet the demands of population growth.

At the last meeting of the **Groundwater Study Advisory Committee**, the county's study consultant (Camp, Dresser & McKee) presented results of their "water balance" calculations for each of 14 major drainage basins in Wake County. A water balance accounts for all the water flows into and out of a basin. Water balance calculations show that groundwater consumption is low compared to the annual AVERAGE baseflow of streams (which is a surrogate for groundwater recharge). That suggests that current consumption is not depleting the groundwater system on a long-term basis.

However, the question of sustainability is not simply whether, on average, groundwater recharge is occurring at a rate that replenishes withdrawals. The question of sustainability also asks whether the timing and the location of groundwater consumption is affecting the ecology of streams in a way that

will damage their resilience. Information collected for the Wake groundwater study also addresses this question.

### Groundwater and stream flows

On average, groundwater discharging from stream banks into stream channels accounts for 45 percent of flow in Wake County streams (the range is 34 to 55 percent). During long periods when there is no rain, streams



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are kept flowing only by groundwater. When groundwater is the only source of water, stream flow will decrease as groundwater levels drop, and when groundwater levels drop below the level of streambeds, streams go dry. For purposes of assessing stream conditions, scientists refer to a specific flow level termed "7Q10" which is based on historic records of flow measurement (or determined by other methods). 7Q10 is the lowest seven consecutive day streamflow that recurs every ten years (statistically speaking). In Wake County streams, 7Q10 flows are very low—a trickle compared to

7Q10 flows in most other places-- indicating that streams in Wake County are quite vulnerable to dry conditions and drought.

Data presented to the Groundwater Study Advisory Committee indicates that in some Wake County drainage basins, streams are drying up more quickly and staying dry longer during periods of drought because groundwater is being withdrawn by residents and not returned to the subsurface.

Calculations show that in drainage basins designated as Swift Creek, Middle Creek, Crabtree Creek, Kenneth Creek and Beaver Dam, net groundwater consumption is contributing to the loss of baseflow during relatively infrequent and short dry periods. In Upper Falls Lake, Jordan Lake, Harris Lake and Black Creek drainage basins, net groundwater consumption is probably extending the period during which streams are dry.

The negative effects of groundwater consumption on stream flow in these basins may be infrequent and of short duration, but the effects of changes to the natural flow regime on stream

ecology could be significant. Streams have evolved to specific rhythms of hydrologic variability, and disruption of this natural variability damages the ability of streams to recover from dry periods and droughts with a healthy aquatic community intact.

It has become clear that on the question of groundwater sustainability – as with other resources – Wake County faces a decision about balancing the demands of growth against the needs of the environment.