

## **The water budget myth and large-scale residential development in Western North Carolina**

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Western North Carolina is home to the beautiful Blue Ridge Mountains and in the past decade has become home to an increasing number of upscale residential communities offering golf, equestrian, and a variety of other recreational opportunities. These communities often consist of hundreds of single-family residences spread over hundreds or thousands of acres and can have a significant impact on local issues including traffic, business development, tax revenue, and environmental quality. As drought conditions persist and an increasing number of communities issue mandatory water restrictions, water supply and wastewater treatment have become increasingly important considerations in the planning and approval process for proposed developments. The term *groundwater sustainability* is now commonly used by developers, planners, elected officials, and local residents in the context of large-scale residential growth; however, it is a term that is often misunderstood and misapplied.

Groundwater pumping is often assumed to be sustainable if the pumping rate is less than the average recharge rate; recharge rates are frequently estimated and used to recommend maximum housing densities and minimum lot sizes. Several papers in the hydrogeologic literature refer to this as the *water budget myth* because average recharge rates actually have little impact on the sustainability of a groundwater resource.

For an aquifer under natural conditions, recharge is the only input to the aquifer and discharge is the only output; water pumped by new groundwater wells must be balanced in the water budget equation by an increase in recharge, a decrease in discharge, or a change in storage. Recharge can rarely be increased, meaning groundwater pumped for new residential developments almost always results in drawdown and/or decreased discharge to surface water. The magnitude of these effects and the time taken to reach a new equilibrium do not depend on the recharge rate, but rather the dynamics of a particular groundwater system.

A practical problem resulting from the perpetuation of the water budget myth is that calculated minimum lot sizes may preclude development designs and water supply options with other desirable attributes. Predicting the impacts of proposed developments and attempting to craft meaningful guidelines for future communities require moving beyond average recharge rates and instead taking an integrated approach to understand and model the entire system.