

## VIRGINIA GROUND WATER CONDITIONS

**Importance of Ground Water:** Approximately 80% of Virginians rely on ground water as the source of at least a portion of their daily water needs. About 79% of the community public water supplies in the Commonwealth are dependent on ground water supplies. In 38 of Virginia's 95 counties all public water supply systems are totally dependent on ground water. Virtually all residences, commercial, industrial and agricultural operations not served by public water supplies are reliant on ground water for the supply of domestic and process water. In 60 of Virginia's 95 counties, private domestic wells serve the daily needs of the majority of the citizens. In 10 of Virginia's 95 counties, private domestic wells serve the needs of more than 85% of the population. In addition ground water is used extensively for commercial, industrial and agricultural operations. These operations often rely solely on ground water supplies and are major contributors to the economy of broad regions of the Commonwealth. Ground water discharge to surface waters is a significant component in maintaining wetlands and surface water flows.

**Availability and Use:** Ground water is usually available in quantities and qualities necessary to support individual domestic users and small to moderate commercial and industrial users throughout the Commonwealth. Ground water is available in large quantities in the Coastal Plain physiographic province, which is characterized by thick unconsolidated sedimentary deposits. In this province large capacity wells are generally constructed in deep confined aquifers and are capable of yielding millions of gallons of ground water per day (up to 3000 gpm). Ground water is available in moderate quantities (10 - 200 gpm) in the Piedmont and Blue Ridge physiographic provinces which are characterized by igneous and metamorphic rocks with ground water occurring primarily in secondary fractures. Yields in these provinces will generally support light commercial and industrial uses with adequately sited well fields. Yields in the Blue Ridge province are generally more limited due to steep slopes and very shallow soil cover. Ground water is available in varying quantities within the

Valley and Ridge physiographic province, which is characterized by alternating bands of shale and carbonate deposits. In carbonate areas with significant karst development very large ground water yields (up to 1000 gpm with numerous large springs discharging more than 3000 gpm) are available from wells that intersect solution cavities. In areas characterized by shale deposits yields are significantly lower (50 -200 gpm). Ground water is available in small to moderate amounts (10 - 50 gpm) in the Cumberland Plateau physiographic province which is characterized by relatively horizontal formations of sandstones, shales and coal beds.

**Ground Water Quality:** Ground water quality is generally acceptable for most uses throughout the Commonwealth. There are several areas where naturally occurring constituents may limit the use of ground water without treatment. In the Coastal Plain province there are areas where naturally occurring chloride and fluoride levels exceed potable levels. These high chloride areas raise the concern of salt-water movement due to large Coastal Plain withdrawals. Ground water in the Piedmont and Blue Ridge provinces is generally of good quality but there are areas of naturally occurring high iron, acidity, and other dissolved minerals. In the carbonate portions of the Valley and Ridge province ground water quality is characterized by naturally occurring high levels of hardness while the shale areas commonly contain high sulphate, iron and total dissolved solids. The Cumberland Plateau province is characterized by ground water with elevated iron, sulphate, manganese, acidity and total dissolved solids. In this province water quality is often the limiting factor for ground water use with acceptable water quality generally occurring within 300 feet of the land surface. Generally Virginia does not have large areas where ground water quality has been degraded by anthropogenic sources. The largest single source of site specific ground water contamination cases in the Commonwealth is leaking underground storage tanks. In addition, several areas of the Commonwealth, especially areas of karst terrain, have elevated nitrate levels

due to agricultural activities or on site sewage disposal systems.

**Cost of Contamination:** There is not a comprehensive estimate of ground water contamination costs for Virginia. An example of the magnitude of costs associated with ground water contamination can be obtained from a review of the underground storage tank program. Between 1990 and 1998 the Virginia Department of Environmental Quality has reimbursed tank owners \$67 million for remediation of ground water contamination. These reimbursement costs do not include financial responsibilities borne by the tank owners or costs associated with remediation activities where responsible parties can not be identified. A comprehensive analysis of the cost of ground water contamination that includes remediation related to waste management sites, replacement of public water supply wells that have been adversely affected, etc. would result in an enormous cost.

**Major ground water initiatives:** In 1985 Virginia established the Ground Water Protection Steering Committee. This Committee is composed of representatives from nine state and one federal agency who implement programs that have the potential to impact ground water quality. The Committee developed the Ground Water Protection Strategy for Virginia in 1987 and continues as a mechanism to stimulate, strengthen and coordinate ground water protection activities in the Commonwealth. Virginia has a strong Petroleum Storage Tank Program that has identified approximately 12,000 releases from underground and aboveground storage tanks and has completed corrective

action at over 9,400 sites (1998 data). The Virginia Ground Water Management Act of 1992 mandates the regulation of large ground water withdrawals in certain portions of the Commonwealth to prevent adverse impacts due to over utilization of the resource. While Virginia has elected not to apply for an EPA approved Well Head Protection Program, significant efforts have been and continue to be expended encouraging local governments and water suppliers to voluntarily participate in well head protection activities. Virginia has completed a generic Pesticides in Ground Water Management Plan and has conducted a pesticide disposal program for farmers, pesticide dealers, and pest control firms in every locality in the Commonwealth.

**Ground Water Challenges:** The most significant challenge to all ground water protection activities in Virginia is lack of sufficient resources. Basic ground water resource characterization activities are required to describe the occurrence of ground water in the Commonwealth. A meaningful state-wide ambient ground water monitoring program is needed to determine the existing state of the quality of the ground water resource and to gauge the effects of all ground water protection efforts. Specific ground water research efforts are needed to gauge the impacts of various land use activities on ground water quality, such as the ground water impact of agricultural activities. While the Commonwealth is encouraged by the increased funding in the Safe Drinking Water Act for Source Water Protection Programs, there is a pressing need to fund ground water protection efforts outside of areas served by public drinking water systems.