

## DELAWARE GROUND WATER CONDITIONS

**Importance of Ground Water:** Fresh water is derived from both surface water-streams and reservoirs, and ground water supplies any of the 13 major aquifers. Ground water pumped from these aquifers is critically important to both the environmental and the economic health of the state. Total ground-water withdrawals for all freshwater uses totaled 100 million gallons per day (USGS, 1995). These uses include public, commercial domestic, industrial, irrigation, livestock, and thermo-electric. Of the 582 public water systems in Delaware, all but three (3) rely entirely on ground-water aquifers as their sole source of drinking water.

The relative use of ground water varies both regionally and over time. For instance New Castle County utilizes both ground water supplies and surface-water supplies while Kent and Sussex counties rely exclusively on ground water supplies. Use in the southern part of the state varies seasonally because of the summer tourist industry and intensive irrigation needed for crop production.

Ground water as base flow to streams is extremely important to the surface water environment. It is estimated that fresh water flow into streams is as much as 80% ground water discharge (baseflow). During periods of little rainfall this amount is essentially 100%. In watersheds with extensive ground-water pumpage, stream flow is reduced due to low, ring of the water table. The Delaware Water Allocations program requires permits for all water users that exceed 50,000 gallons per day. Minimum pass by standards have been adopted for streams in the Piedmont Province of Delaware to allow for both ecological concerns and for other downstream users. Pumpage from certain aquifers has also been limited where safe limits have been reached. The City of Dover has had to develop a new more vulnerable well field in order to obtain more water supply.

### **Where are Ground Water Supplies found?**

Delaware has approximately thirteen (13) major aquifers statewide. But as one moves from north to south only a limited number of aquifers are actually available at any one locale. Usage is limited by aquifer productivity, ground water quality, and transmission costs. The entire Delmarva peninsula is bound I to the east by the Delaware Bay and Atlantic Ocean, to the west by the Chesapeake Bay, and to the north by both the

C&D Canal and by the Fall Line. Thus salt water is found both on the flanks and at the same depth. This essentially leaves a fresh water lense for use.

Most of Delaware south of the Piedmont Province is overlain by the Columbia formation containing the Columbia aquifer. Most confined aquifers do subcrop beneath the Columbia aquifer where they are the most vulnerable to contamination. All water entering these confined aquifers must pass through (recharge) from the Columbia Aquifer. This aquifer thickens as one moves from the fall line, towards the south and is used by domestic well owners as well as many others.

### **How good is Ground Water Quality?**

Generally Delaware's ground water is of high quality although localized problems exist. These include both natural (e.g. iron, manganese, chloride) and anthropogenic (e.g. point sources such as leaking underground storage tanks and non-point sources such as septic systems or fertilizer application). The most vulnerable aquifer is the Columbia or water table aquifer and the subcrop areas of confined aquifers. The more critical sources of contaminants include hazardous waste sites, septic systems, leaking petroleum underground storage tanks, agricultural application of fertilizers, and animal feedlot operations. In the more densely populated north of the state the major ground water quality concerns stem from industrial activities and urban sprawl; whereas in the south nutrient enrichment (primarily nitrates) is the major concern. One study in southern Delaware demonstrated that 20% of the wells had nitrate levels at or exceeding the 10 mg/l drinking water standard for nitrate. Statewide there are over 500 underground storage tank sites with documented releases to ground water. Over 50% of these are found in the more densely populated north. The ground water contaminants with a relatively high priority include petroleum compounds (e.g. benzene, toluene, ethylbenze, xylenes), volatile organics (e.g. tiichloroethylene), nitrates, bacteria, and salinity.<sup>1</sup>

**Costs of Contamination:** The costs associated with contaminated ground water are extensive and spread across society. These include such costs as

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<sup>1</sup> Sources: 1998 Delaware Watersheds Assessment Report (305(b)); Delaware Source Water Assessment Plan (February 1998) - Draft

remediation of sources of ground-water contaminants, institutional controls on ground-water use, added well construction or replacement costs, and drinking water treatment costs. Delaware is currently involved in addressing the poultry litter problem, a critical non-point source problem. Development and implementation costs will be extensive. Ground water withdrawals have been limited to assure that contaminant plumes are not drawn into drinking water wells, which represents a loss of resource use. Many public water systems must treat for contaminants such as benzene, trichlorethylene, nitrate, pesticides, and bacteria.

Taken together all of these costs clearly demonstrate that costs associated with contaminated ground water are great compared to the costs of preventing contamination of ground water.

**Efforts to Protect Ground Water:** Delaware must address both ground-water quantity and quality concern. Ground water quantity issues remain primarily a state, interstate compact and local concern. Delaware addresses this through the Delaware River Basin Commission, the states water allocation program and drought advisory board, and local efforts which address impervious cover in critical ground-water resource areas. Ground-water quality concerns, on the other hand, involve all those listed above plus numerous federal agencies, particularly the U. S. Environmental Protection Agency.

In partnership with the U. S. EPA, the Delaware Department of Natural Resources and Environmental Control (DNREC) has undertaken numerous ground-water protection efforts. These include the Whole Basin initiative, ground water protection strategy, comprehensive state ground-water protection program, pollution prevention program and non-point source management program. Similarly the Delaware Department of Agriculture has developed the Pesticide Management plan which addresses application of pesticides and ground water protection. Numerous control programs regulate activities associated with the discharge of contaminants into ground water. These include Superfund, RCRA, state hazardous substance sites, UST/LUST, solid waste, UIC, large septic, domestic septic, wastewater spray irrigation, and sludge application programs. The non-point source control program addresses NPS problems largely through non-regulatory best management practices.

Sources of ground water that is used for drinking water are largely addressed as part of the state wellhead protection program, the newly created source water assessment and protection program, the water allocation program and the well permitting program. DNREC also works very closely with other

federal, state, and local agencies on ground water issues. These include the Delaware Geological Survey, U.S. Geological Survey, Delaware Rural Water Association Delaware Division of Public Health, Water Resources Agency/University of Delaware, and local counties and municipalities with wellhead protection ordinances.

**What else is needed?** The Delaware ground-water protection program is funded through a combination of federal, state, and fee-based sources. These sources are either mostly used for very specific aspects of ground water protection (e.g. water well construction fees) or are of short duration (e.g. DWSRF -Source Water Fund). However, longer-term funding for staffing from the CWA-106 and state general funding has allowed for a core ground-water protection program for some time. The major gap remains in more thoroughly characterizing and monitoring Delaware's ground-water resources, as follows:

- ◆ Characterizing the Geologic and Hydrologic Framework of Delaware - this is an ongoing state funded, effort under the Delaware Geological Survey. Detailed geologic mapping is complete for 55% of the state and detailed hydrologic mapping for 45% of the state.
- ◆ Priority Setting for Protection of Ground-Water Resources - The three resource-based priority setting areas are excellent recharge potential areas, source water/wellhead protection areas, and confined aquifer subcrop areas. *Recharge potential mapping* is 80% complete and the entire state will be complete in 2001. *Source water protection areas* have been completed for all community wells in New Castle County. All public supply wells will be completed by 2002 under the source water program funding. Subcrop areas are complete for 55% of Delaware mapping program of the Delaware Geological Survey. No completion date is available.
- ◆ Ambient Ground-Water Monitoring - There is no statewide ambient ground-water monitoring network, There are, however, a patchwork of existing program-specific monitoring networks which could be coordinated to have a statewide network. These include the PWSS Public Water Supply Monitoring, DDA's Pesticide Monitoring Network, Southern New Castle County monitoring network, Coastal Sussex salt-water monitoring network, Potomac aquifer salt-water monitoring network, and program/site specific monitoring. Approximately \$150,000 is needed annually to adequately monitor statewide ground-water quality.
- ◆ Technical Support to Local Governments - Additional resources are needed to provide consistent and adequate support to local governments to provide them with the tools to adequately consider ground-water resource protection in their decision-making. Approximately \$60,000 is needed annually to provide this support to the counties and municipalities.