HOW TO SUSTAIN WATER RESOURCES THROUGH EFFECTIVE WATERSHED MANAGEMENT: IN DEFENSE OF WATERSHEDS

Tracy Carluccio and Maya K. van Rossum, Delaware Riverkeeper Network

Tracy Carluccio, Special Projects Director, Delaware Riverkeeper Network
P.O. Box 326, Washington Crossing, PA 18929
(215) 369-1188, tracy@delawareriverkeeper.org

Everything we do on the land results in changes to the watershed. As communities grow, the landscape is transformed; our waterways bear testimony to these actions. In natural forests and meadows, rainwater is absorbed into vegetated soils, feeding plant life, recharging aquifers and wetlands and maintaining stream base flow and waterway health. After development, rainwater rushes off impervious surfaces such as parking lots, roads, rooftops, hard-packed and chemically treated turf lawns, playing fields, golf courses and unstable farm fields into detention basins and storm systems that dump it, untreated, directly into streams, wetlands, lakes, and rivers.

These man-made changes to the land and the generally accepted and applied practices for handling the resulting stormwater runoff carry a host of harmful environmental and ecological impacts. But the impact of our present day land change and development approaches carry a very large hidden payload that is not being recognized by those who are responsible for our nation's water security—the steady decline of our water resources. As a result of how we handle stormwater runoff and attempt to control the inevitable resulting cycle of flood and drought, surface waters and aquifers are running dry and water quality is being dangerously compromised, diminishing available water supply.

National water security is compromised by:

- ✓ Diminished water supply
- ✓ Degraded water quality
- ✓ Destruction of natural systems

Diminished water supply

One of the most far-reaching impacts of changes in land use is the disruption of the hydrologic cycle. Under natural conditions, a proportionately small part of rainfall runs off the land. Most of the precipitation is captured and gently released into the natural environment over time, thereby sustaining environmental health and equilibrium. In large storms a portion may run off the undeveloped land and eventually follow a natural path to the local stream. But the greatest portion of the rainfall in an undeveloped watershed is absorbed into the land where it is stored, taken up by the roots of vegetation, or recharged to the aquifer below. Water that returns to the sky as evapo-transpiration from vegetation, the land, and waterways returns again later as rainfall. This is the constantly renewing process of the natural hydrologic cycle.

This past year, drought gripped the Mid-Atlantic States and many other parts of the nation. The drought of 2002 impacted well levels and surface water supplies and lowered stream flows. Agriculture was damaged, farmers reaped the poorest corn crop in years and water for livestock became critical (Bergstrom 2002). Drought emergencies were declared in many States, halting water allocations for new developments, limiting such activities as washing cars, watering lawns and athletic fields -- hurting local economies and curbing public use. Worst of all, water was rationed to the brink of panic in some areas. Early this year, low water tables and aquifers in New Jersey, central Virginia and the northern tip of Maine were still a concern (Bergstrom 2002).

Rainfall deficit is just one factor, albeit a critical one, that is leading States such as New Jersey and Maryland into chronic water shortage crises. Poor water resource management and protection, personified in the outdated structural stormwater control practices that dominate our approach to managing the hydrologic cycle, exacerbate drought conditions.

When land is developed, the loss of natural vegetation and the imposition of impervious surfaces such as buildings, roadways, parking lots and turf lawnscapes prevent rainfall infiltration into the soil. Rainfall is no longer a replenishing resource; it is lost as stormwater runoff. One recent study demonstrated that a typical suburban-density development with the typical 23% impervious cover would deprive groundwater aquifers of over 40 million gallons of recharge per square mile annually (Cahill 1993). When considered on a watershed basis, conventional development results in dramatic groundwater losses.

Structural solutions focused on detaining rainfall and discharging it directly to the local creek, wetlands or other waterway, bypass the natural hydrologic cycle. Dams and detention basins, two of the most common modern stormwater management approaches, only focus on the peak flow of runoff. Detention basins are designed to collect and hold stormwater for a period of time and

The loss of groundwater that results from the peak rate/detention basin approach also negatively impacts drinking water supplies because wells will run dry if the static underground water level drops below the well intake and there will be less water stored in the underground aquifer upon which the wells can draw. As recharge decreases, the aquifer is eventually drawn down and, when stressed, may never recover to pre-stressed levels.

Surface water supplies are also impacted because the loss of base flow to lakes, reservoirs, streams and rivers causes drought conditions sooner and for longer periods of time than normally would occur in times of low rain fall. Drought conditions carry environmental and economic costs because less water is available and is of poorer quality. Economically the lack of water quantity and quality impacts potable water supplies as well as recreational, commercial and industrial users.

While we may not be able to control the weather, we can change how we attempt to manage stormwater. 95% of all rainfall in this region is delivered in storms smaller than 2-year storms (less than 3 inches). Conventional detention basins do not address these smaller storms, passing them through to the stream. Stormwater management approaches (infiltration best management practices, BMPs, and conservation design techniques) can be designed to infiltrate the post development increase in runoff from a 2-year storm. This will restore the bulk of rainfall to the natural hydrologic cycle, realizing the benefits of rainfall-turned-recharge. These same BMP systems can be designed to serve double duty by controlling peak rates of the 100-year storm (Cahill 2002). And because conventional detention systems allow an increased volume of runoff, developing and urban watersheds are experiencing a lot of flood damage, stream channel erosion, and significant pollution from these smaller (2 to 5-year) storms (CH2MHILL 1998), which can be avoided by this prTc -0.002i 0 12 306.96223 4.63982 377.76172 Tm(detenve (infiltratiosiltragy.( )

By contrast, the infiltration/conservation design approach that preserves or attempts to mimic nature utilizes and takes advantage of the physical, chemical and biological powers of soil to trap and transform pollutants before they can enter aquifers, streams, or wetlands. The soil mantle "offers critical pollutant removal functions through physical processing (filtration), biological processing (various types of microbial action), and chemical processing (cation exchange capacity, other reactions)" (Cahill 1989).Vegetation removes different types of pollutants associated with stormwater runoff including sediment, phosphorus, nitrogen, and metals (Ferguson 1994, DNREC 1997, CH2MHILL 1998). Vegetation, particularly communities of native plants, shrubs, and trees, work with the soil to treat pollutants and hold soil in place, which in turn prevents sedimentation and erosion. By allowing natural systems to work, pollution is prevented, protecting water supplies from degradation and loss of their intended use.

<u>Destruction of natural systems</u>

Healthy streams, wetlands, floodplains, and the ecosystems that comprise our watersheds are interrelated as part of the natural world. The conventional structural detention basin and dam approach to stormwater control does not utilize or work with these environmental features; quite the opposite. Streams are devastated by the hydrologic and water quality impacts that result from the conventional detention approach we have employed in traditional land management.

The resulting lack of groundwater infiltration deprives aquifers of the reserves needed to feed the base flow of streams. Reduced stream base flow results in less dilution of pollutants and therefore a greater concentration of pollutants in our stream systems; the stream's assimilative capacity is compromised. The loss of water also stresses aquatic communities and streamside habitats (Cahill 1993). This loss of base flow is why streams in many areas are drying up when rainfall is not plentiful -- and this change in flow regime can eventually destroy the life in and along the stream.

Wetlands, habitats, and riparian life associated with a stream is adapted to a natural flow regime and hydrologic cycle; the detention approach disrupts this but the infiltration/conservation design approach preserves these regimes. The only way to insure intact natural stream systems and the life and high water quality they support is to employ stormwater strategies that work with these features to prevent stormwater runoff, allowing rainfall to fulfill its role in the hydrologic cycle.

Sustaining the security of water resources across our Nation requires a paradigm shift in how we manage the threats that are within our control. One of the greatest of these is the stormwater runoff that results from what we, as humans, do to the land. We understand the changes we need to make and have the tools and knowledge to accomplish them.

REFERENCES

Bergstrom, Bill, 12.2.02. Snow Relieves East Coast Drought, Associated Press.
Cahill Associates, prepared for NJDEP, 1989. *Stormwater Management in the New Jersey Coastal Zone*. Trenton, NJ.
Cahill Associates, 1993. *Stormwater Management Systems, Porous Pavement with Underground Recharge Beds, an Engineering Design Report*, West Chester, PA.
Cahill Associates and Delaware Riverkeeper Network, 2002. 65,4 *Upper and Middle Neshaminy Creekm*

Approach to Reduce Stormwater Impacts from Land Development and Achieve

NY State Department of Environmental Conservation, 1992. *Reducing the Impacts of Stormwater*