Article 10

Technical Note #59 from Watershed Protection Techniques. 2(1): 284-287

Dry Weather Flow in Urban Streams

Not only does impervious cover lead to greater flooding during storms, but it is also believed to cause water levels in urban streams to decline during dry periods. An increase in impervious cover prevents rainwater from infiltrating into the soil. Consequently, the water table beneath is not resupplied, the water having been flushed away downstream rather than infiltrating through pervious surfaces to the water table.

If impervious cover significantly diminishes groundwater recharge, then not only do we have to deal with flooding and eroding of urban streams, but also the possibility that these same streams could experience severe decreases in water level in dry weather, with serious implications for habitat quality, especially for migrant species. Permanent streams may become intermittent and intermittent streams may disappear altogether.

While flood damage can be mitigated by stormwater detention practices, the problem of reduced dry-weather flows can only be approached from a whole-watershed perspective.

Imperviousness/Low-Flow Relationship: Difficult to Detect

The widely held belief that imperviousness decreases dry weather flows is based on principles of groundwater hydrology. However, a cause-and-effect relationship has yet to be directly observed. According to hydrological and geological principles, stream water levels depend on the level of the water table beneath the stream, and a rise or drop in the water table depends mainly on the amount of precipitation received from the surface. Therefore, groundwater recharge and stream water level are expected to decrease correspondingly with a reduction of pervious area above ground.

Attempts to detect the effect of imperviousness on low flow are constrained by the following:

1. The need for long-term, reliable hydrological records of an area that underwent steady development. USGS gauging stations are more apt to be found on large river systems where the effects of imperviousness on low flow is less obvious. Data for smaller streams are more recent and often collected less regularly.
2. The lack of a proven method for factoring out "scale effects" is needed in large, unevenly developed urban areas where many human and natural factors are at work.
3. The added confusion of storm drains and sanitary sewers, which intercept subsurface drainage and divert storm runoff that would otherwise infiltrate the soil.

This article describes two different studies that employed a similar approach of using historical data from gaging stations and comparing urbanized and rural streams.

Long Island: Urbanization Linked to Lowered Base Flows

The population of Nassau and Suffolk counties in Long Island has more than doubled since the 1940s Simmons and Reynolds, 1982). Development has occurred as an eastward wave across the island. The paving of land was accompanied by construction of recharge basins where possible; storm sewers were built in southern Nassau and Suffolk counties. Sanitary sewer lines were constructed over time as the population and housing density increased. Treated effluent is discharged into the ocean; therefore, there is a net loss of water from the system. In Long Island, the supply of water to streams is 95% from groundwater in rural areas, 84% from groundwater in semi-urban areas (impervious cover, no sewers), and only 20% from groundwater in urbanized areas (impervious cover plus stormwater and sanitary sewers).

If the remaining 80% of the water supply to an urbanized stream is from precipitation alone, then base flow would be severely decreased in dry periods. However, there is the possibility that some water is being returned to suburban streams from lawn watering.

Reduction of base flow in highly urbanized areas compared with less urban areas was clearly shown in Long Island (Figure 1). Though there were some years of drought, variation in rainfall could not account for the general downward trend in base flow. Urbanization clearly has an effect on lowered base flow. However, impervious cover is not the only component of urbanization. Residential wells are drawing a great deal of water that is not being returned to the system. This