

RUNOFF COEFFICIENTS – MOVING BEYOND IMPERVIOUS COVER

The negative impacts of increased impervious cover (IC) on receiving water bodies have been well documented (CWP 2003, Walsh et al. 2004; Shuster et al. 2005; Bilkovic et al. 2006). Due to widespread acceptance of this relationship, IC has frequently been used in watershed and site design efforts as a chief indicator of stormwater impacts.

More recent research, however, indicates that other land covers, such as disturbed soils and managed turf, also impact stormwater quality (Law et al, 2008). Numerous studies have documented the impact of grading and construction on the compaction of soils, as measured by increase in bulk density, declines in soil permeability, and increases in the runoff coefficient (OCSCD et al, 2001; Pitt et al, 2002; Schueler and Holland, 2000). These areas of compacted pervious cover (lawn or turf) have a much greater hydrologic response to rainfall than forest or pasture.

Further, highly managed turf can contribute to elevated nutrient loads. Typical turf management activities include mowing, active recreational use, and fertilizer and pesticide applications (Robbins and Birkenholtz 2003). An analysis of Virginia-specific data from the National Stormwater Quality Database (Pitt et al. 2004) found that runoff from monitoring sites with relatively low IC residential land uses contained significantly higher nutrient concentrations than sites with higher IC non-residential uses (CWP & VA DCR, 2007). This suggests that residential areas with relatively low IC can have disturbed and intensively managed pervious areas that contribute to elevated nutrient levels.

The failure to account for the altered characteristics of disturbed urban soils and managed turf can result in an underestimation of stormwater runoff and pollutant loads generated from urban pervious areas. Therefore, the computation and compliance system for nutrients should take into account impervious cover as well as other land cover types.

The runoff coefficients provided in **Table 4** were derived from research by Pitt et al (2005), Lichter and Lindsey (1994), Schueler (2001a), Schueler, (2001b), Legg et al (1996), Pitt et al (1999), Schueler (1987) and Capiella et al (2005). As shown in this table, the effect of grading, site disturbance, and soil compaction greatly increases the runoff coefficient compared to forested areas.

Table 4. Site Cover Runoff Coefficients (Rv)	
Soil Condition	Runoff Coefficient
Forest Cover	0.02 to 0.05*
Disturbed Soils/Managed Turf	0.15 to 0.25*
Impervious Cover	0.95
*Range dependent on original Hydrologic Soil Group (HSG) Forest A: 0.02 B: 0.03 C: 0.04 D: 0.05 Disturbed Soils A: 0.15 B: 0.20 C: 0.22 D: 0.25	

The advantage of a computation system for nutrients that takes into account a range of land covers is that site stormwater designs will have a higher likelihood of treating all relevant land uses that contribute nutrients to waterways. In addition, such a system can incorporate site design incentives, such as maintaining or restoring forest cover, as a means of reducing site compliance requirements.

Source: *Technical Memorandum: The Runoff Reduction Method*. Center for Watershed Protection & Chesapeake Stormwater Network. April 18, 2008. Page 13