Article 21

Technical Note #72 from Watershed Protection Techniques 2(2): 358-360

Habitat and Biological Impairment In Delaware Headwater Streams

As part of a comprehensive watershed management demonstration study, John Maxted and his colleagues at Delaware's Department of Natural Resources and Environmental Control (DNREC) examined the effects of urban stormwater runoff on non-tidal headwater streams in Delaware's Coastal Plain and Piedmont ecoregions using a variety of biological and physical habitat assessments. Maxted and his colleagues selected headwater streams for three primary reasons. First, headwater streams are arguably the narrowest window receiving urban stormwater runoff and are not usually exposed to impacts from other sources (i.e., industrial or sewage treatment plant discharges). Second, the biological and physical habitat characteristics of headwater streams are reasonably well understood and amply documented in the literature. Third, most non-tidal waterway systems are made up of headwater streams. So targeted protection and restoration of these sensitive water resources will, by default, provide a level of protection to downstream and watershed resources.

Biological and habitat monitoring methods were selected over more traditional chemical monitoring due to the intermittent and varied nature of stormwater runoff. Unlike steady-state flows, used in the analysis of point-source discharges, stormwater events range in frequency, duration, and magnitude and produce varied, and often statistically random, responses of pollutant concentrations. Furthermore, although the states and U.S. EPA have developed pollutant concentration criteria for many pollutants, there are no criteria for many of the most common stormwater pollutants. Therefore, chemical constituent monitoring may yield results of little practical use due to the absence of a standard. In fact, Delaware's 1994 305(b) Report indicated that 87% of the State's non-tidal streams supported the designated life uses based on chemical measures (primarily dissolved oxygen exceedance criteria); whereas if biological and habitat assessments were included, just the opposite was true, and only 13% of the state's non-tidal waters supported designated life uses. This same phenomena was observed by Ohio EPA in 1991 where approximately 50% of that State's waters were identified as impaired when using biological assessments versus approximately 3% when using chemical monitoring alone (Rankin, 1991).

Biological monitoring was conducted using macroinvertebrates as indicators of stream system quality at 42 Coastal Plain sites and 38 Piedmont sites. Macroinvertebrates have varying life stages from a few months to several years, are relatively immobile, and are therefore good tools for assessing both long term and short term impacts in streams. The following three biological measurements were conducted to quantify

Table 1: Macroinvertebrate Community Measurements Used by Delaware Dept of Natural Resource and Environmental Control (Shaver *et al.*, 1995)

Metric Name	Description	Type
Taxa richness	Total # of unique taxa	Richness
EPT richness*	Total # of EPT taxa	Richness/tolerance
% EPT abundance	% of sample that are EPTs	Tolerance/composition
% dominant taxon	Largest % of a single taxon	Composition
%Chironomidae**	% of sample from this group	Tolerance
Biotic index	Composite tolerance by taxon	Tolerance

* EPT consists of the orders ephemeroptera (mayflies), plecoptera (stoneflies), and trichoptera (caddisflies) (considered among the most pollutant sensitive macroinvertebrate species)

** Chironomidae consists of the family of midges (considered among the most pollutant tolerant macroinvertebrate species)