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USING GIS-BASED HYDROLOGIC, HYDRAULIC, AND POLLUTANT LOADING MODELS TO UNDERSTAND NONPOINT SOURCE IMPACTS AND GUIDE RESTORATION INITIATIVES

Thomas Amidon,* Gopi Jaligama[1]

ABSTRACT: The Ramanessin Brook is located in Monmouth County, New Jersey and is designated as impaired due to high total phosphorus concentrations. A study was performed to evaluate the sources of phosphorus in Ramanessin Brook and to assess water quality impacts due to nonpoint sources, specifically instream erosion and stormwater. Hydrologic, hydraulic, and nonpoint source pollutant loading models of the watershed were developed in order to better understand erosion potential and pollutant loading under various flows, and to evaluate the impacts of land use changes. Using the watershed modeling tools developed during the course of the study, several analyses were performed, including: 1) evaluating and mapping glauconitic soil erosion potential; 2) calculating peak flows and total stormwater volumes for individual subwatersheds using pre-developed, existing, and projected build-out land use conditions; 3) calculating shear stress in the stream to understand erosion of sediment under various flow conditions; and 4) evaluating pollutant loading for total suspended solids and total phosphorus in individual subwatersheds.The peak flow and total stormwater volume calculations demonstrate that any changes in watershed land uses that affect runoff have a more significant impact during storms of lower intensities than during storms of higher intensities. In addition, these analyses demonstrate that land use changes that have already occurred have produced a much larger impact on storm runoff than any changes that might result from future development. The pollutant loading and water quality analyses clearly illustrate the importance of erosion of glauconitic soils as a major source of phosphorus and suspended solids in the Ramanessin Brook. This erosion originates both from the watershed and within the stream itself. The study identified sub-watersheds with the most potential for erosion of glauconitic soil, while the shear stress hydraulic analysis also identified which reaches of the stream are most susceptible to instream erosion.The study was used to direct retrofits to areas that can produce the most reduction in peak flow and total volume, areas with the highest potential for glauconitic soil erosion, and stream reaches most vulnerable to instream erosion.

*Senior Project Manager, Omni Environmental LLC, 321 Wall Street, Princeton, NJ 08540 USA, Phone: 609-924-8821 x28, Fax: 609-924-8831, Email: TAmidon@omni-env.com
[1]Project Engineer, Omni Environmental LLC, 321 Wall Street, Princeton, NJ 08540 USA, Phone: 609-924-8821 x43, Fax: 609-924-8831, Email: GJaligama@omni-env.com