

Export of Phosphorus from Great Swamp to Passaic River

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The Passaic River at Millington Gorge in Northern New Jersey is the outlet of the Great Swamp watershed in Morris and Somerset Counties, and also serves as the headwater boundary of the flow and water quality model developed for the Non-Tidal Passaic River Basin Nutrient TMDL Study. Because the headwater boundary exhibits relatively high phosphorus concentrations, this study was performed in order to better characterize the export of phosphorus from the Great Swamp to the Passaic River by quantifying the phosphorus loads entering and exiting the swamp. Several high quality datasets were compiled within a single database to provide a characterization of the phosphorus conditions throughout the Great Swamp watershed.

Total phosphorus concentrations at the inlets to the Great Swamp vary by growing season and general flow condition, and total phosphorus concentrations at the Great Swamp outlet (Passaic River at Millington Gorge) vary on a seasonal basis. Furthermore, the relationships between flows at the inlets to the Great Swamp as a percentage of outlet flow and the outlet flow itself turn out to be very strong when described using a power function for each inlet. As a result, powerful empirical tools were developed to calculate both flow rates and total phosphorus concentrations at the inlets and outlet of the Great Swamp. Phosphorus loads in and out of Great Swamp were calculated on a daily time scale over a seven-year period from 1999 through 2005.

Both the hydrology and phosphorus concentrations at the inlets and outlet of the Great Swamp were empirically modeled with a reasonable degree of accuracy. As a result, the study provided a seasonally varying boundary condition for phosphorus concentration at the Passaic River headwater (the outlet of Great Swamp) that was used to enhance the TMDL study. In addition, the study characterized the phosphorus loads from the two major treatment plants in the context of all the other loads into the Great Swamp as well as the load exported out of the Great swamp into the Passaic River, providing the technical basis to recommend total phosphorus effluent limits for these facilities.