
NUTRIENTS AND SUSPENDED SEDIMENT TRANSPORTED IN THE SUSQUEHANNA RIVER BASIN, 2004, AND TRENDS, JANUARY 1985 THROUGH DECEMBER 2004

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ABSTRACT

Nutrient and suspended-sediment (SS) samples were collected under base flow and stormflow conditions during calendar year 2004 for Group A sites listed in Table 2. Fixed date samples also were collected at these sites. Additionally, fixed date samples were collected during the fourth quarter of 2004 at Group B sites listed in Table 2. All samples were analyzed for nitrogen and phosphorus species, total organic carbon (TOC), and SS.

Precipitation for 2004 was above average for all Group A sites. Highest departures from the long-term precipitation averages were recorded at Newport with 14.3 inches above the long-term mean (LTM). Highest departure from LTM in discharge was 157.9 percent above LTM at Conestoga. Lowest departure from the mean was at Towanda for rainfall, 9.16 inches above LTM and at Danville for flow at 127.7 percent of the LTM. Precipitation and flows were above LTM largely due to high flows caused by Tropical Storm Ivan in September.

This report utilizes four methods to analyze nutrient and SS loads and yields: (1) comparison with the LTM; (2) comparison with initial 5-year baseline yields; (3) comparison with baseline data from the beginning of program through 2004 (full program baseline); and (4) flow adjusted trend analysis through 2004.

Comparison with the LTM showed increases in flow, total phosphorus (TP), and SS for all sites except for SS at Lewisburg. Increases in total nitrogen (TN) were shown at Newport and Marietta when compared to the LTMs. Baseline comparisons showed increases in TN at Newport, increases in TP at all sites except Conestoga, and

increases in SS at all sites except Conestoga and Lewisburg, when compared to the initial 5-year baselines. When compared to the full program baseline, Newport showed increases in all three parameters, Marietta and Danville showed increases in TP, and all sites except Conestoga and Lewisburg showed increases in SS. Trends in flow-adjusted concentrations (FACs) were found to be decreasing for TN, TP, and SS at all sites except for TP at Marietta, which showed no significant trends. No significant trends were found for flow.

INTRODUCTION

Nutrients and SS entering the Chesapeake Bay (Bay) from the Susquehanna River Basin contribute to nutrient enrichment problems in the Bay (USEPA, 1982). The Pennsylvania Department of Environmental Protection (PADEP) Bureau of Laboratories, the U.S. Environmental Protection Agency (USEPA), the U.S. Geological Survey (USGS), and the Susquehanna River Basin Commission (SRBC) conducted a 5-year intensive study at 12 sites from 1985-89 to quantify nutrient and SS transported to the Bay via the Susquehanna River Basin. In 1990, the number of sampling sites was reduced to five long-term monitoring stations. An additional site was included in 1994.

In October 2004, 13 additional sites, (two in New York and 11 in Pennsylvania), were added as part of the Chesapeake Bay Program's Non-tidal Water Quality Monitoring Network. This project involves effort conducted by all six Bay state jurisdictions, the USEPA, USGS, and SRBC to create a uniform non-tidal monitoring network for the entire Bay watershed.

Purpose of Report

The purpose of this report is to present basic information on annual and seasonal loads and yields of nutrients and SS measured during calendar year 2004. Comparisons are made to LTM, similar flow years, baseline data calculated from the 1985-89 study, and baseline data calculated from the entire duration of the program. Seasonal and annual variations in loads are discussed, as well as the results of flow adjusted trend analyses for the period January 1985 through December 2004 for various forms of nitrogen and phosphorus, SS, TOC, and water discharge.

DESCRIPTION OF THE SUSQUEHANNA RIVER BASIN

The Susquehanna River (Figure 1) drains an area of 27,510 square miles (Susquehanna River Basin Study Coordination Committee, 1970), and is the largest tributary to the Bay. The Susquehanna River originates in the Appalachian Plateau of southcentral New York, flows into the Valley and Ridge and Piedmont Provinces of Pennsylvania and Maryland, and joins the Bay at Havre de Grace, Md. The climate in the Susquehanna River Basin varies considerably from the low lands adjacent to the Bay in Maryland to the high elevations, above 2,000 feet, of the northern headwaters in central New York State. The annual mean temperature ranges from 53° F (degrees Fahrenheit) near the Pennsylvania-Maryland border to 45° F in the northern part of the basin. Annual precipitation in the basin averages 39.15 inches and is fairly well distributed throughout the year.

Land use in the Susquehanna River Basin, shown in Table 1, is predominantly rural with woodland accounting for 69 percent; agriculture, 21 percent; and urban, 7 percent. Woodland occupies the higher elevations of the northern and western parts of the basin and much of the mountain and ridge land in the Juniata and Lower Susquehanna Subbasins. Woods and grasslands occupy areas in the lower part of the basin that are unsuitable for cultivation because the slopes are too steep, the soils are too stony, or the soils are poorly drained. The Lower Susquehanna

Subbasin contains the highest density of agriculture within the watershed. However, extensive areas are cultivated along the river valleys in southern New York and along the West Branch Susquehanna River from Northumberland, Pa., to Lock Haven, Pa., including the Bald Eagle Creek Valley.

Major urban areas in the Lower Susquehanna Subbasin include York, Lancaster, Harrisburg, and Sunbury, Pa. Most of the urban areas in the northern part of the basin are located along river valleys, and they include Binghamton, Elmira, and Corning, N.Y. Urban areas in the Middle Susquehanna include Scranton and Wilkes-Barre, Pa. The major urban areas in the West Branch Susquehanna Subbasin are Williamsport, Renovo, and Clearfield. Lewistown and Altoona are the major urban areas within the Juniata Subbasin.

NUTRIENT MONITORING SITES

Data were collected from five sites on the Susquehanna River, three sites on the West Branch Susquehanna River, and 11 from smaller tributaries in the basin. These 19 sites, selected for long-term monitoring of nutrient and SS transport in the basin are listed in Table 2, and their general locations are shown in Figure 2. In October 2005, four additional sites will be added to the existing monitoring network, three in New York and one in Maryland.

SAMPLE COLLECTION AND ANALYSIS

Samples were collected to measure nutrient and SS concentrations during various flows in 2004. For Group A sites, two samples were collected per month: one near the twelfth of the month and one during monthly base flow conditions. Additionally, at least four high flow events were sampled, targeting one per season. When possible, a second high flow event was sampled in accordance with spring planting in the basin. During high flow sampling events, samples were collected daily during the rise and fall of the hydrograph. The goal was to gather a minimum of three samples on the rise and three samples on the fall, with one sample as close to peak flow as possible. Sampling continued until flows returned to pre-storm levels.