
NUTRIENTS AND SUSPENDED SEDIMENT TRANSPORTED IN THE SUSQUEHANNA RIVER BASIN, 2009, AND TRENDS, JANUARY 1985 THROUGH DECEMBER 2009

Kevin H. McGonigal
Water Quality Program Specialist

ABSTRACT

Nutrient and suspended-sediment (SS) samples were collected under base flow and stormflow conditions during calendar year 2009 for Group A sites listed in Table 2. Fixed date samples also were collected at these sites as well as 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 2009 was above average at all Group A sites except at Lewisburg, which was 1.84 inches below the long-term mean (LTM). Rainfall amounts above the LTM ranged from 1.39 inches above LTM at Marietta to 2.73 inches above LTM at Conestoga. Winter rainfall amounts were below LTM at all sites including 4.66 inches lower at Conestoga. Spring amounts were above LTM for all sites ranging from 0.57 at Lewisburg to 3.73 at Newport. Although precipitation rates were mostly above LTM values, 2009 flow values were below the LTM at all sites. Highest departures from the LTM were at Newport and Towanda with 85 percent of the LTM. Individual monthly flows were above the LTM for June, August, and October at most sites.

This report utilizes several methods to compare nutrient and SS loads and yields including: (1) comparison with the LTM; (2) comparison with baseline data; and (3) flow-adjusted concentration trend analysis.

Annual loads for all parameters were below the LTM at all sites except for dissolved phosphorus (DP), dissolved orthophosphate (DOP), and TOC. DP and DOP were above the

LTM at Towanda, Danville, and Lewisburg. DOP and TOC were above the LTM at Newport. Conestoga 2009 values were below LTM for all parameters including substantially lower than LTM values for total phosphorus (TP), SS, total organic nitrogen (TON), and dissolved organic nitrogen (DON).

2009 seasonal flows were highest for winter at all sites except Newport and Conestoga. This resulted in the highest load of all parameters being transported during winter at Towanda, Danville, and Lewisburg, with TOC at Lewisburg being the only exception. Flow was lowest during summer at all stations except Conestoga, resulting in lowest loads delivered during the season. Conestoga flows were distinctly different from past years with winter being the lowest flow season.

Lower than predicted yields in total nitrogen (TN), TP, and SS were found in 2009 for all baseline comparisons at all sites, except for TP at Towanda and TP at Danville for the second half baseline comparison. This comparison remained unchanged from 2008. Seasonal yields of TP at Towanda were higher than baseline predictions for all seasons. 2009 annual yields were dramatically lower than baseline predictions at Conestoga for TN, TP, and SS.

All trends for 2009 remained unchanged from 2008 except DON at Conestoga, which changed from a downward trend to no significant trend. TN, TP, and SS trends were improving at all sites except for TP at Towanda, which had no significant trend. Upward trends were found at Towanda and Newport for DOP. The most southern site, Marietta, showed downward trends for all parameters except DOP,

which had no significant trend due to more than 20 percent of the values being below the method detection limit (BMDL). This also occurred for dissolved ammonia nitrogen (DNH₃) at Towanda, Danville, Lewisburg, and Newport. No significant trends were found for flow for the time period.

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. In October 2005, four more sites (three in New York and one in Maryland) were added to the existing network. This project involves monitoring efforts conducted by all six Bay state jurisdictions, 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 2009. Comparisons are made to LTM and to various baselines, including baselines created from the initial five years of data, the first half of the dataset, the second half of the dataset, and those created from the entire dataset for each site. Additionally, seasonal baselines were created using the initial five years

of data from each site. 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 2009 for various forms of nitrogen and phosphorus, SS, TOC, and 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 Chesapeake 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 operations 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.