



# REPORT ANNOUNCEMENT

SUSQUEHANNA RIVER BASIN COMMISSION

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

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The purpose of this report is to present basic information on annual and seasonal loads and yields of nutrients and suspended sediment (SS) measured during calendar year 2004 at SRBC's six long-term monitoring sites. Included in the report are several data comparisons aimed at removing the effects of flow in order to determine if improvements are occurring. This includes comparisons of 2004 values of total nitrogen (TN), total phosphorous (TP), and SS with the initial 5-year baseline data and with the full program baselines and trends in flow-adjusted concentrations (FACs) for the period 1985 through 2004.

### Long-Term Nutrient Monitoring Sites

Data were collected from three sites on the Susquehanna River and three sites on major tributaries in the basin during 2004. These six sites, selected for long-term monitoring of nutrient and SS transport in the basin, are:

1. Susquehanna River at Towanda, Pa.
2. Susquehanna River at Danville, Pa.
3. Susquehanna River at Marietta, Pa.
4. West Branch Susquehanna River at Lewisburg, Pa.
5. Juniata River at Newport, Pa.
6. Conestoga River at Conestoga, Pa.

### Enhanced Nutrient Monitoring Sites

In October 2004, SRBC began sampling at 13 additional sites within the Susquehanna River Basin as part of the Chesapeake Bay Program's non-tidal water quality monitoring network. All samples were analyzed for various species of TN and TP, total organic carbon (TOC), and SS. Site locations are listed in the 2004 report along with summary statistics.

### Sample Collection and Analysis

Samples were collected at each of the sites to measure nutrient and SS concentrations during base flow and stormflow periods. Base flow samples were collected monthly by hand with depth-integrating samplers. Additionally, a monthly random sample was collected during the middle of each month, regardless of flow. Stormflow samples were collected daily from the start of the storm to the time when the flow receded to near its prestorm rate. These samples were collected by hand with depth-integrating samplers at all but the Conestoga River site, which is equipped with an automatic pumping sampler.

### Precipitation

Precipitation data are summarized for the 2004 Susquehanna River Watersheds above Towanda, Danville, and Marietta, Pa., and the West Branch Susquehanna, Juniata, and Conestoga River Watersheds. Precipitation for 2004 was above average for all sites. Highest departure from the long-term mean (LTM) was recorded at Newport with 14.3 inches above the LTM.

### Water Discharge

Mean water discharges for calendar year 2004 are listed, along with the long-term annual mean discharge and percent of long-term annual mean discharge for each site. The annual mean water discharge was above normal for all sites in 2004. Streamflow ranged from 127.7 percent of the LTM at Danville to 157.9 percent at Conestoga.

### Annual Nutrient and Suspended-Sediment Loads and Yields

Nutrient and SS loads were computed for each site for calendar year 2004. Loads were computed for total and dissolved ammonia, total and dissolved nitrite plus nitrate, total and dissolved nitrogen, total and dissolved organic nitrogen, dissolved orthophosphate (DOP), total and dissolved phosphorus, and SS.

The greatest loads of TN, TP, and SS were measured at Marietta, which represents the site with the greatest annual flow. The smallest loads of TN, TP, and SS were

at Conestoga, which represents the site with the lowest annual flow. The annual yields, in pounds per acre per year, of TN, TP, and SS were greatest from the Conestoga River at Conestoga, which has high agricultural and urban concentrations. Lewisburg, which has a mostly forested watershed, had the lowest yields for TP and SS during 2004.

The 2004 loads for TN, total and dissolved ammonia, dissolved nitrogen (TNH<sub>3</sub> and DNH<sub>3</sub>), and dissolved nitrate plus nitrite (DNO<sub>23</sub>) were all lower than the LTM<sub>s</sub> at Towanda, Danville, Lewisburg, and Conestoga. Newport and Marietta showed increases in 2004 as compared to the LTM<sub>s</sub> for all parameters except total and dissolved organic nitrogen. The 2004 values of TOC were lower than the LTM at Newport and Conestoga. There were increases in SS for 2004 as compared to the LTM<sub>s</sub> at all sites except Lewisburg (79 percent forested watershed). Additionally, there were increases at all six sites in TP and DOP as compared to the LTM.

### **Seasonal Water Discharges and Nutrient and Suspended-Sediment Loads**

Seasonal mean water discharges for calendar year 2004 were highest during the summer months due to high flows from Tropical Storm Ivan. This caused all parameters to be highest during the summer months at Conestoga. This was the only site where TN matched the high flow season. For Towanda, Danville, and Lewisburg, the high TN season was winter, which was the second highest flow season for these sites. DN was also highest during winter at these sites, as well as at Newport. DNO<sub>23</sub> followed this same trend. Another interesting point is that at Marietta, the highest season for TN, DN, TNH<sub>3</sub>, DNH<sub>3</sub>, total nitrate plus nitrite, and DNO<sub>23</sub> was fall, which was the lowest flow season. TOC, TP, and SS were all highest during the highest flow months.

### **Comparison of the 2004 Loads and Yields of Total Nitrogen, Total Phosphorus and Suspended Sediment with the Baselines**

The annual fluctuations of nutrient and SS loads and water discharge make it difficult to determine whether the changes were related to land use, nutrient availability, or simply annual water discharge. To make that determination, data during the initial 5-year sampling period were used to create a linear relationship between water discharge ratios (annual discharge/long-term discharge) and annual yields. A second linear relationship was created using the entire dataset for each

site. The 2004 yields and discharge ratios were then plotted on graphs to see where improvements may have occurred.

Comparison with the initial 5-year baselines showed improvements in TN at Towanda, Danville, Lewisburg, and Conestoga. Towanda and Danville also showed improvements when compared to the full program baselines. Lewisburg showed improvements in SS yields for both comparisons. Newport showed slight increases in TN and TP for both comparisons while showing no change in SS yields. Marietta showed increases in TP and SS when compared to the initial 5-year baseline but showed no significant deviations from the predicted values for the full program baseline.

### **Discharge, Nutrient, and Suspended-Sediment Trends**

Trends for monthly mean flow and FAC were computed for the period January 1985 through December 2004 for flow, SS, TOC, and several forms of nitrogen and phosphorus. Flow-adjusted trends represent the trends after the affects of flow have been removed, and they indicate that changes have occurred in the processes that deliver constituents to the stream system. This is the concentration that relates to the effects of nutrient-reduction activities and other actions taking place in the watershed.

In 2004, there were no changes in trends for flow at any of the six long-term sites. The trends for TN, TP, and SS decreased at all sites except Marietta, which had no significant trends for TP. The trends for Towanda and Danville decreased for all parameters except for DOP, which increased at Towanda, Danville, Newport, and Marietta.

This report is available on the Susquehanna River Basin Commission website at:

<http://www.srbc.net/techreport241.htm>

It also is available on compact disc.

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