SUMMARY

Bimonthly and stormflow samples were collected during 2002 from the Susquehanna River at Towanda, Danville, and Marietta, the West Branch Susquehanna River at Lewisburg, the Juniata River at Newport, and the Conestoga River at Conestoga, Pennsylvania. Collected samples were analyzed for various nitrogen and phosphorus species and SS.

Precipitation for 2002 was above average at all sites except Lewisburg, ranging from 4.25 inches above average at Towanda to 0.58 inches below average at Lewisburg. Precipitation amounts were highest during the spring followed by fall at all sites except Conestoga and Newport, which recorded highest amounts during fall followed by spring. This contradicts the long-term means that show the summer season as having the highest amounts for all sites except Newport. Although precipitation was at or above the long-term mean for all sites, the annual water discharge values for the southern four sites were below their respective long-term mean values, while Towanda and Danville discharges were slightly above average. Discharge values ranged from 103.2 percent of the long-term mean at Danville to 57 percent of the long-term mean at Conestoga.

Load and yield values for 2002 were lower than the respective long-term means values for TN, TP, and SS at all sites except for Marietta, which recorded higher 2002 values for loads and yields of TP. Although these results look meaningful, they only attain meaning when compared with the corresponding discharge values. 2002 percentage of long-term means of loads for TN, TP, and SS showed varied results when compared with the 2002 percentage of long-term means for discharge. TN percentage of long-term mean values showed improvements when compared to the long-term means of discharge at all sites except Newport. This indicated that, over the entire history of the program, improvements in TN loads have been made at these sites. Using the same comparison of long-term percentages of discharge and constituent, TP showed improving conditions at Towanda, Danville, and Lewisburg, while showing degrading conditions at Newport, Marietta, and Conestoga. SS improvements were shown at all sites except Newport. The largest improvements for SS were shown at Towanda, Danville, and Lewisburg, which support the reductions in TP shown for 2002.

Another way to attain meaning out of these load values is to compare them to a year of similar water discharge. Throughout the history of this program, the year that corresponds most to 2002 with regard to flow was 1992. 2002 flows ranged from 91.6 percent of the 1992 flows at Conestoga to 98.5 percent of 1992 flows at Danville. Regarding the well established rule that higher flows result in higher constituent loads, TN, TP, and SS loads for 2002 should be lower than the loads for 1992. This was observed to be the case for TN at all sites. The only other constituents to follow this rule were TP at Lewisburg and SS at Danville. TP at Marietta and Conestoga actually recorded 2002 values that were 155 percent of the 1992 values. This dramatic difference also was apparent for SS at these two sites. The 2002 SS values were 182 percent of the 1992 value at Marietta and 267 percent of the 1992 value at Conestoga. Comparison of 1992 and 2002 loads indicated that, although TN improvements were basin wide over this 10-year period, TP and SS improvements were not.

Analyzing the seasonal loads presents a good method of determining where the effects of flow were most apparent. Discharge for 2002 was highest during the spring season for all sites except Conestoga, which recorded significantly higher flows during the fall months, resulting in all constituents having highest load values during fall, as well. The most consistent pattern among the other sites was that TNH3, DNH3, and DOP seemed to be less dependent on flow. For all sites, except Conestoga, the highest seasons for these three constituents did not correspond with the highest flow season. Newport also showed variations with TN, DN, TNOx, and DNOx, but these can be attributed to a small flow difference between the spring and fall seasons.

When dividing the annual mean water discharge by the long-term mean discharge, a value termed the water-discharge ratio is obtained. This value is equivalent to the percentage of long-

term mean discharge referenced earlier. This value can then be used to plot the yield for a given year versus the water-discharge ratio. In order to extract meaning from this value, it must be compared to a previous record of data. To accomplish this, the initial five years for each site were used to develop a best-fit linear regression line, which was then used to form a baseline relationship between annual loads and discharge. By plotting a year's yield value along this line, any improvements or degradations can be revealed. When the 2002 values were compared to their respective baselines, most parameters showed improvements. TP for Conestoga and Marietta was the exception. Yield values for both sites plotted above the baseline values, indicating that phosphorus yields in these two watersheds are degrading.

Trend analysis of water quality parameters and flow data for all six sites were completed for the period 1985 to 2002. Trends results were reported for flow adjusted concentrations, flow weighted concentrations, monthly load, and flow. Significant improving trends were apparent for all three analytical methods for the parameters listed in Table 28. Degrading trends in DOP for all three analyses were found at all sites except Conestoga and Lewisburg. Degrading trends also were apparent for DON at Marietta. Decreasing trends for flow at Lewisburg and Conestoga also appeared. This is the first time during the entire history of the program that decreasing trends in flow were detected. These trends developed due to the multiple-year drought in the basin, which also may be the cause of many of the improving nutrient and SS trends shown for 2002.

The sediment and nutrient monitoring sites on the Susquehanna River will be one of the first places where water quality improvements will be observed due to Pennsylvania's restoration efforts. Because of the threat of a regulatory TMDL cited previously in this report, it will be extremely important to document this progress. Because of the delay time, it is almost certain that observable water quality improvements in the Bay will occur after improvements in the Susquehanna, and that biological responses in the Bay due to improved water quality will occur even later.