V. SUMMARY

In 1996, segments of seven rivers within West Virginia's Potomac watershed (Lost River, South Branch of the Potomac, North Fork of the South Branch, South Fork of the South Branch, Mill Creek, Lunice Creek and Anderson Run) were placed on the 303(d) list of impaired water bodies due to fecal coliform bacteria. Out of concern that the listing of these waters was based on insufficient data, in 1998 the West Virginia Department of Agriculture (WVDA) began a water quality sampling program in these watersheds intended to collect additional data that would more accurately establish the condition of these streams.

This comprehensive report has presented WVDA Water Quality Program findings for nutrient and bacteria data collected between July 1998 and June 2004. During this period, over 13,000 samples were collected at 100 sites throughout this region. Eighty three of those sites, with 12,778 total samples, are discussed in this report. Samples were analyzed for fecal coliform bacteria, ammonia-nitrogen, nitrate-nitrogen, and total phosphorus.

The study of water quality in rivers and streams that are primarily impacted by non point sources is very challenging. For parameters that are present in the water column at very low concentrations, such as phosphorus, much of the data provides little in the way of comparative information. At all but a very few sites, at least 25% of the samples had phosphorus concentrations below the detection limit for the analytical method being used, and most sites had medians at or only slightly higher than the method detection limit. For many sites it was only in the upper few percentiles of the data that differences in phosphorus became apparent. Of the sites that had consistently higher phosphorus concentrations, most had point sources as the likely cause. It should be remembered that phosphorus is a limiting resource. It is removed from the water column rapidly because it is in short supply and, even at low concentrations, can have a profound biological effect.

Ammonia, fecal coliform bacteria, and nitrate are delivered to streams more readily that phosphorus (nitrate much more readily). Water quality analyses for these parameters found many differences between sites, with median results by site ranging more than one order of magnitude for all three. Differences were also detected between watersheds. For example, Mill Creek had relatively high ammonia and fecal coliform bacteria concentrations, the Lost River had relatively high nitrate concentrations, while the North Fork of the Potomac's South Branch had distinctly low levels of ammonia, nitrate, and fecal coliform bacteria.

Sampling for bacteria was discontinued at sites in the South and North Fork watersheds during 1999 and 2000, and was discontinuous in the South Branch 1&2 watersheds. However, fecal coliform bacteria concentrations at all sites in the North and South Fork watersheds exceeded 400 cfu/100 ml in substantially less than ten percent of samples collected. In South Branch 1&2, only one site had more than ten percent of samples in excess of 400 cfu/100 ml. The WVDA data therefore generally indicates that the South Fork, North Fork and South Branch 1&2 watersheds are meeting fecal coliform water quality standards.

The primary challenge in analyzing water quality data for trends is to separate the components of variability related to human impacts from natural variability, in particular streamflow and season. During the six year study period discussed in this report, agriculture in the Potomac Highlands region was expanding rapidly, agricultural best management practices were being installed on many farms, the human population was growing (explosively in some areas), and the region experienced extreme drought at the beginning of the study followed by an exceptionally wet period near the end. Any of these factors alone would make interpretation of trends difficult, but the lack of flow data for study sites made interpretation of trend analyses particularly problematic. However, a visual assessment of trends in the

overall data set suggested that hydrology probably played a large role in shaping results of trend analyses, in particular for phosphorus and nitrate-nitrogen.

In research programs carefully designed to measure changes in water quality due to improvements in land management, the typical study design calls for two or more years of baseline data collection followed by three to six years of sampling after implementation of new land use practices (Lombardo et al, 2000). There is a need for patience in measuring changes in water quality in watersheds primarily impacted by non point sources, and the West Virginia Department of Agriculture understands this need. Although program parameters have changed over time, and may need to change further to accommodate shifting needs of information, WVDA water quality programs will continue to collect data to accurately ascertain the condition of rivers and streams throughout West Virginia.