Metropolitan Washington Council of Governments

DRAFT EXECUTIVE SUMMARY
POTOMAC RIVER WATER QUALITY IN THE WASHINGTON REGION

PROGRESS, BUT MORE TO BE DONE

The Metropolitan Washington Council of Government's (COG) assessment of water quality in the Potomac River from 1985 to 2016 shows that the billions of dollars invested by the Washington region's local governments and utilities on advanced wastewater treatment have yielded significant reductions in pollution resulting in water quality improvements. Among the success stories: the amount of nitrogen and phosphorus discharged by wastewater plants in the Washington metropolitan region has declined dramatically since the 1980s and is on track for further reductions. As a result, the number and extent of harmful algal blooms in the upper Potomac estuary has declined significantly. Populations of plants and animals that live in this portion of the river, such as submerged aquatic vegetation and American shad, have also rebounded.

But these improvements do not mean that either the river itself has fully recovered from the poor conditions of previous decades or that further efforts are unnecessary. In this, the river's situation mirrors that of the larger Chesapeake Bay watershed, of which it is an integral part.

The report presents data collected by various entities and compiled by COG to provide a broad overview of water quality conditions in the Potomac River, particularly the portion that flows through the Washington region. It focuses on both the key water quality parameters – dissolved oxygen, water clarity and chlorophyll-a -- and the major pollutants -- nitrogen, phosphorus and sediment -- that are targeted by the Chesapeake Bay Total Maximum Daily Load (TMDL). Almost all of the data in the report is trend data; that is, it shows the direction of change over time, either positive (improving) or negative (degrading) and it is designed to answer the question: are we making progress in our efforts to improve water quality.

There are a number of other water quality issues in the Potomac caused both by these pollutants and other factors. These include harmful algal blooms above the Chain Bridge fall line that release toxins of concern to drinking water providers and toxic man-made chemicals that may cause intersex fish and other problems. These are noted, but not discussed in detail, in the report.

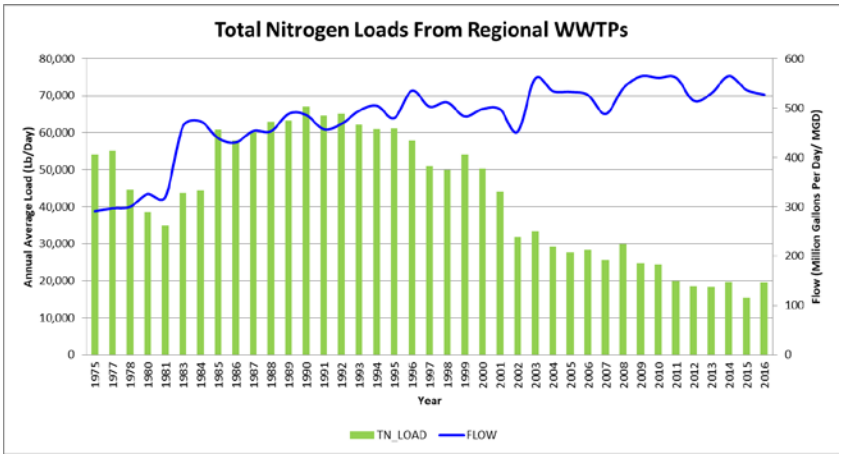
In broad terms, water quality in the Potomac estuary is determined by three major inputs:

- **WWTPs** - discharge from wastewater plants directly to the estuary.
- **Across the Fall Line** - the quality of the water flowing across the main Potomac River fall line at Chain Bridge. The watershed upstream of Chain Bridge has a higher percentage of agriculture than elsewhere in the watershed.
- **Below the Fall Line** - the quality of the water that drains to the river below Chain Bridge. A much larger percentage of the land draining to the river below Chain Bridge compared to above Chain Bridge is urbanized; here the quality of stormwater runoff is a critical factor.

INPUTS TO THE ESTUARY – WASTEWATER

Reductions in wastewater nutrient loadings account for the most significant progress, by far, in the 35-year history of the Chesapeake Bay restoration effort. According to Chesapeake Bay Program (CBP) calculations, the wastewater sector accounts for about 75 percent of total reductions of nitrogen and phosphorus since 1985. The success is derived from a funding partnership among all levels of government. Federal grants helped local governments pay for the original round of phosphorus controls; state and federal funds are helping to pay now for the further nitrogen controls.

Figure 1: Total Nitrogen Loads from Regional WWTPs



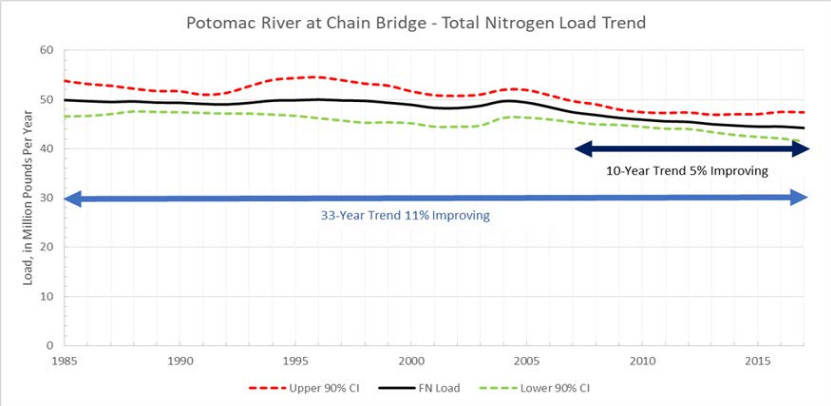
Source: COG

The reduction in nutrient discharges from wastewater treatment plants is all the more impressive because it has been achieved despite increases in wastewater flow (depicted by the blue line in the adjacent chart) to the plants as a result of population and job growth in the region. The improvement in nutrient reduction efforts has given the region a cushion to accommodate future growth without exceeding the Bay TMDL's nutrient caps.

INPUTS TO THE ESTUARY –MONITORING POLLUTION AT CHAIN BRIDGE

The U.S. Geological Survey (USGS) has maintained a Potomac River fall line monitoring station at Chain Bridge since 1985, one of a series of river input monitoring stations that analyze water quality flowing into the Bay from its major tributaries. Data in this section is drawn from the USGS Chain Bridge station and addresses the three major pollutants regulated by the Bay TMDL: total nitrogen, total phosphorus and total sediment.

Figure 2: Total Nitrogen Load Trend at Chain Bridge



Source: USGS

The USGS data shows that nutrient reduction efforts above the Potomac fall line have led to decreasing trends since 1985 for all three of the major pollutants. However, the patterns differ between nitrogen (TN) on the one hand and both phosphorus (TP) and sediment (TS) on the other. The TN load trend has been flat to steadily declining over the 33-year span of the USGS monitoring data. Overall reductions are about 11 percent.

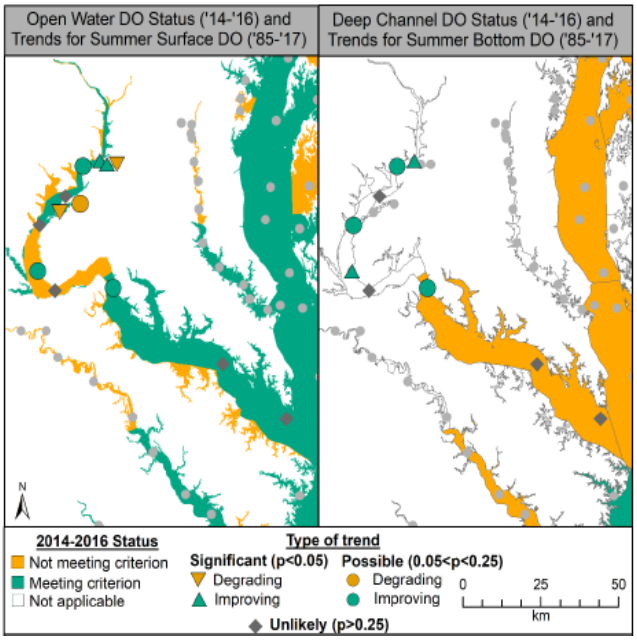
INPUTS TO THE ESTUARY - NONPOINT SOURCE LOADS FROM BELOW THE FALL LINE

Efforts to reduce nutrient and sediment loads from urban landscapes are still in their infancy compared to wastewater nutrient reduction efforts. COG member jurisdictions with Municipal Separate Storm Sewer System (MS4) permits for their stormwater conveyance systems only began to focus on pollutant reductions from BMPs in permit cycles that began between 2005 and 2010. Moreover, controlling pollution across the urban landscape and ramping up the necessary program resources, both financial and otherwise, to accomplish this have been major challenges. Nevertheless, some signs have emerged of progress in reducing nutrient loads from urban stormwater in portions of the COG region.

ESTUARINE WATER QUALITY

Water quality data gathered in the Potomac River estuary and the Chesapeake Bay since 1985 provides a mixed picture of progress, with certain parameters showing signs of improvement while others have degraded. The dissolved oxygen (DO) graph below illustrates the complex nature of charting progress. In general, DO attainment is better in the open water habitat in the Potomac estuary (as shown by the predominance of green in the map on the left) than it is in the segments where deep water or deep channel habitat exists (as shown by the predominance of orange in the map on the right). Similarly, the long-term trend indicators on these maps point to both improving and degrading trends.

Figure 3: 2014-2016 oxygen criterion status for Potomac segments along with long-term trends in DO concentrations



Source: Chesapeake Bay Program

Water quality standards are regulatory provisions that describe the desired condition of a water body and the means by which that condition will be protected or achieved. For example, meeting the desired condition for aquatic resources in the deep channel habitat of the mainstem of the Chesapeake Bay and the Potomac River requires dissolved oxygen levels of 1 milligram/liter or higher.

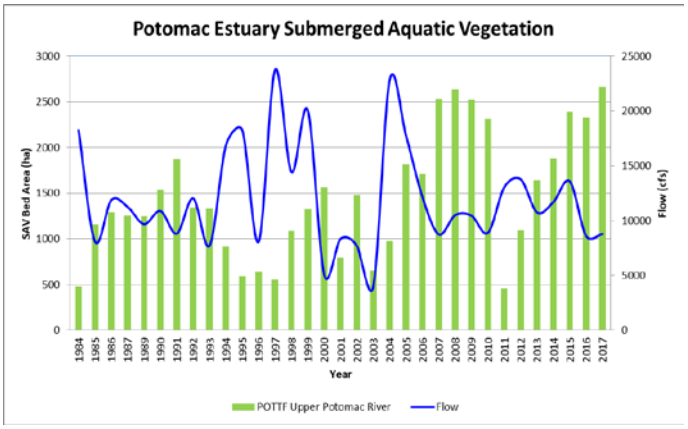
The data in this graph came from the Chesapeake Bay Program's (CBP) tidal monitoring program, under which the Maryland Department of Natural Resources (MDDNR) and Virginia Department of Environmental Quality (VADEQ) in collaboration with the CBP collect water quality samples from the Bay and its tidal tributaries. The data is analyzed and presented in the same way across all the stations, allowing for uniform assessments of the degree to which the water is meeting water quality standards.

There are three official water quality parameters for assessing attainment: dissolved oxygen, water clarity and chlorophyll-a (a measure of algal abundance).

Success Stories – Submerged Aquatic Vegetation (SAV)

Although water quality in the river does not fully meet the water quality goals established under the Clean Water Act, there are success stories where concerted action has led to significant improvements in some conditions and where in recent years the populations of certain species of plants or animals have rebounded from previously low levels. Most of the Potomac's successes, which include more acres of submerged aquatic vegetation (SAV) and increases in the numbers of certain fish species, derive largely from the reductions of nutrients from wastewater plants in the Washington region. These improvements show up most clearly in the freshwater portion of the Potomac estuary, which stretches from the river's fall line at Chain Bridge in Washington, D.C., downriver to the mouth of Mattawoman Creek.

Figure 4: Potomac Estuary SAV (Upper Portion) and Flow at Chain Bridge



Source: Virginia Institute of Marine Science

The amount of SAV growing in the upper estuary fluctuates annually because of changes in weather conditions and other factors, but **overall it has increased significantly in recent years as nutrient levels in the water have decreased.** Fewer nutrients leads to less algal growth, which in turn increases the amount of light that reaches underwater grasses. In addition to greater overall SAV growth, the upper estuary also has seen the diversity of underwater grasses increase in recent years.

Summary

Local governments and utilities in the COG region have made great progress in reducing the amount of nutrients discharged from wastewater plants in the region. As a result, harmful algal blooms have been reduced, submerged aquatic vegetation has returned, and the populations of several fish and waterfowl species have rebounded. There also has been some progress, albeit smaller, in achieving reductions from other nutrient sources in the Potomac watershed. But these reductions are not yet enough to completely achieve water quality standards. Researchers are investigating to what extent nutrient and sediment concentrations must decline further to achieve the standards, but the calculation is not a simple linear relationship. It is complicated by dynamic processes on the land and in the water that are affected by more than just nutrients and sediment. Additional issues such as toxics and chemical contaminants, intersex fish, and climate change also have major impacts on water quality. This complexity underlies some of the mixed signals presented by water quality data in the Potomac estuary, with both improving and degrading trends.

Because wastewater has essentially already achieved state-of-the art levels of nutrient reduction, further progress in improving water quality conditions depends on further efforts to reduce nutrients and sediment from nonpoint sources, such as agriculture and urban runoff. Here, too, there is uncertainty and mixed signals, with many improving trends but some degrading ones as well. Scientists are still interpreting the effects of time lags, for instance, in the flow of nitrate-enhanced groundwater that gradually feeds surface waters and the ability of BMPs to reduce extensive phosphorus reservoirs in certain soils. What is certain is that additional efforts to reduce nutrients and sediment from these nonpoint sources will be needed to achieve the river's long-term water quality goals.