MARYLAND DEPARTMENT OF NATURAL RESOURCES

Tidewater Ecosystem Assessment

Potomac River
Water Quality and Habitat Assessment
Overall Condition 2011-2013

Healthy rivers and bays support a diverse population of aquatic life as well as recreational uses, such as swimming and fishing. To be healthy, rivers and bays need to have good water and habitat quality. High levels of nutrients and sediment lead to poor water quality. Poor water quality reduces habitat quality, including water clarity (how much light can get to the bottom) and the amount of dissolved oxygen in the water. In turn, habitat quality affects where plants and animals can live. The Maryland Department of Natural Resources (DNR) is responsible for monitoring water and habitat quality in the Chesapeake Bay and rivers, as well as the health of aquatic plants and animals. DNR staff use this information to answer common questions like "How healthy is my river?", "How does my river compare to other rivers?", "What needs to be done to make my river healthy?" and "What has already been done to improve water and habitat quality in my river?"

How healthy is the Potomac River?

The Potomac River is divided into three basins: the Upper Potomac, Middle Potomac and Lower Potomac.

Upper Potomac

The Potomac River in the Upper Potomac basin is all non-tidal. Land use in Maryland is approximately 75% forest in the western half of the basin, and a mix of agriculture, forest and urban in the eastern half of the basin. Human population density is low to moderate.

Nutrient loadings and conditions differ between the western and eastern portion of the basin. In the western portion of the basin, sediment loadings increased but nitrogen loadings decreased. Nitrogen levels in the river and streams decreased, and phosphorus levels have decreased in some main river locations. Sediment levels have increased at the two upstream main river stations and in Savage River and Georges Creek, but decreased in the most downstream main river station.

In the eastern portion of the basin, sediment loadings increased but nitrogen and phosphorus loadings decreased. Nitrogen levels increased in Conococheague Creek and Antietam Creek but decreased in the lower Monocacy River and in the main river at Point of Rocks. Phosphorus levels decreased throughout the basin, and sediment levels decreased in Conococheague Creek and Antietam Creek. While decreased nutrients indicate improvement overall, they do not necessarily indicate healthy stream habitat. Non-tidal river habitat is influenced by many issues beyond nutrient and sediment conditions (for example, acid mine drainage, pollutants, impervious surfaces, etc.). Also, newer concerns include algal blooms in this farthest upstream region of the Potomac River and the occurrence of invasive species such as *Didymo*.

Middle Potomac

In the Middle Potomac basin, the river extends from downstream of the Monocacy River to downstream of Piscataway Creek. Land use in Maryland is 56% urban and 27% forest, and impervious surfaces covered between 10->20% of the sub-watersheds. Human population density in Maryland is high to very high.

Phosphorous levels in the non-tidal main river decreased. Nitrogen and phosphorus levels also decreased in Seneca Creek. However, sediment levels increased in the Anacostia River. Sediment loadings measured at the fall line increased, but nitrogen loadings decreased.

Water and habitat quality in the tidal portions of the middle Potomac is fair to poor due to high nitrogen levels and poor water clarity. Piscataway Creek has poor water quality. Nitrogen levels decreased throughout the Middle Potomac, and phosphorus levels decreased in most areas. Overall, phosphorus levels are good but water clarity is poor. Summer dissolved oxygen levels are good.

Underwater grass beds covered approximately 55% of the restoration goal area in Piscataway Creek and approximately 65% of the restoration goal area in the main river during this period. Bottom animal populations are unhealthy at the long-term station and conditions have degraded.

Lower Potomac

In the Lower Potomac basin the river extends from downstream of Piscataway Creek to the mouth of the river at Point Lookout. Mattawoman Creek is a major tributary from the Maryland side of the river. Land use in Maryland is 51% forest, 24% urban and 19% agriculture, and impervious surfaces covered 4% of the watershed overall Human population density in Maryland is generally moderate.

Water quality in the Lower Potomac is fair due to moderate nitrogen levels, but nitrogen levels decreased throughout this portion of the river and phosphorus levels decreased in the upper Lower Potomac River. Water quality in Mattawoman Creek is fair to good, and nitrogen, phosphorus and sediment levels have decreased.

Habitat quality is fair to poor in the Lower Potomac due to poor water clarity. Algal densities have also increased in lower Lower Potomac river. Habitat quality in Mattawoman Creek is poor at the lower station but algal densities have decreased. Summer bottom dissolved oxygen in the Lower Potomac upper portion is fair to good, but in the lower portion summer bottom dissolved oxygen is almost always below 3 mg/l and very often less than 1 mg/l.

Underwater grass beds in Maryland waters of the main river covered less than 20% of the restoration goal area during this period. However, underwater grass beds in Mattawoman Creek covered areas close to 90% of the restoration goal during this period. Almost 75% of the habitat for bottom animals is degraded. The degraded locations are mostly within the deep channel of the lower river, where dissolved oxygen is almost always depleted during the summer months. Most of the locations where healthy benthic communities are found were upstream of this area or in shallower portions of the river.

Table 1. Summary of tidal habitat quality and water quality indicators in main river.
Algal densities, water clarity, inorganic phosphorus and sediment either 'Meet' or 'Fail' SAV habitat requirements for 2011-2013. Dissolved nitrogen levels below the level for nitrogen limitation 'Meet' criteria, otherwise 'Fail' criteria. Summer bottom dissolved oxygen levels either 'Meet' or 'Fail' EPA open-water 30 day dissolved oxygen criteria. Annual trends for 1999-2013 either 'Increase' or 'Decrease' if significant at $p \leq 0.01$; blanks indicate no significant trend. Improving trends are in green, degrading trends are in red. Nitrogen trends are for total nitrogen, phosphorus trends are for total phosphorus, water clarity trends are for Secchi depth.

		Water Quality			Habitat Quality		
	Station	Nitrogen	Phosphorus	Sediments	Algal Densities	Water Clarity	Summer Bottom DO
Middle Potomac	Upper Piscataway	Fail Decreasing	Fail	Meet	Meet	Fail	
	Lower Piscataway	Fail Decreasing	Meet Decreasing	Fail	Fail	Fail	
	Main River Mouth of Piscataway	Fail Decreasing	Meet Decreasing	Meet	Fail	Fail	Meet
	Main River Mouth of Dogue Creek	Fail Decreasing	Meet Decreasing	Meet	Meet	Fail	Meet
Lower Potomac upper	Upper Mattawoman	Meet Decreasing	Meet	Meet	Meet		
	Lower Mattawoman	Fail Decreasing	Meet Decreasing	Meet Decreasing	Fail Decreasing	Fail	
	Main River at Indian Head	Fail Decreasing	Meet Decreasing	Meet	Meet	Fail	Meet
	Main River between Possom Pt and Moss Pt	Fail Decreasing	Meet Decreasing	Meet	Fail	Fail	Meet
Lower Potomac lower	Main River, Smith Point	Fail Decreasing	Fail	Fail Increasing	Meet Increasing	Fail	Meet
	Main River, Maryland Point	Fail Decreasing	Fail	Meet Increasing	Meet Increasing	Fail	Meet
	Main River, Morgantown	Fail Decreasing	Fail	Meet	Meet Increasing	Fail	Fail
	Main River off Ragged Point	Meet	Meet	Meet Decreasing	Meet	Meet	Fail
	Mouth of Main River at Point Lookout	Meet Decreasing	Meet	Meet	Meet	Meet Decreasing	Fail

How does the tidal Potomac River compare to other Maryland rivers?

The Potomac River basin as a whole (Upper, Middle and Lower portions combined) is in the 'High Urban, High Agriculture' land use category. Nitrogen levels are moderate compared to other rivers in the 'High Urban' categories and compared to other rivers in the 'High Agriculture' categories (Figure 1). Phosphorus levels are moderate compared to other 'High Urban' rivers, but are lower than most 'High Agriculture' rivers. Sediment and water clarity are moderate compared to other Maryland rivers, and algal densities are lower.

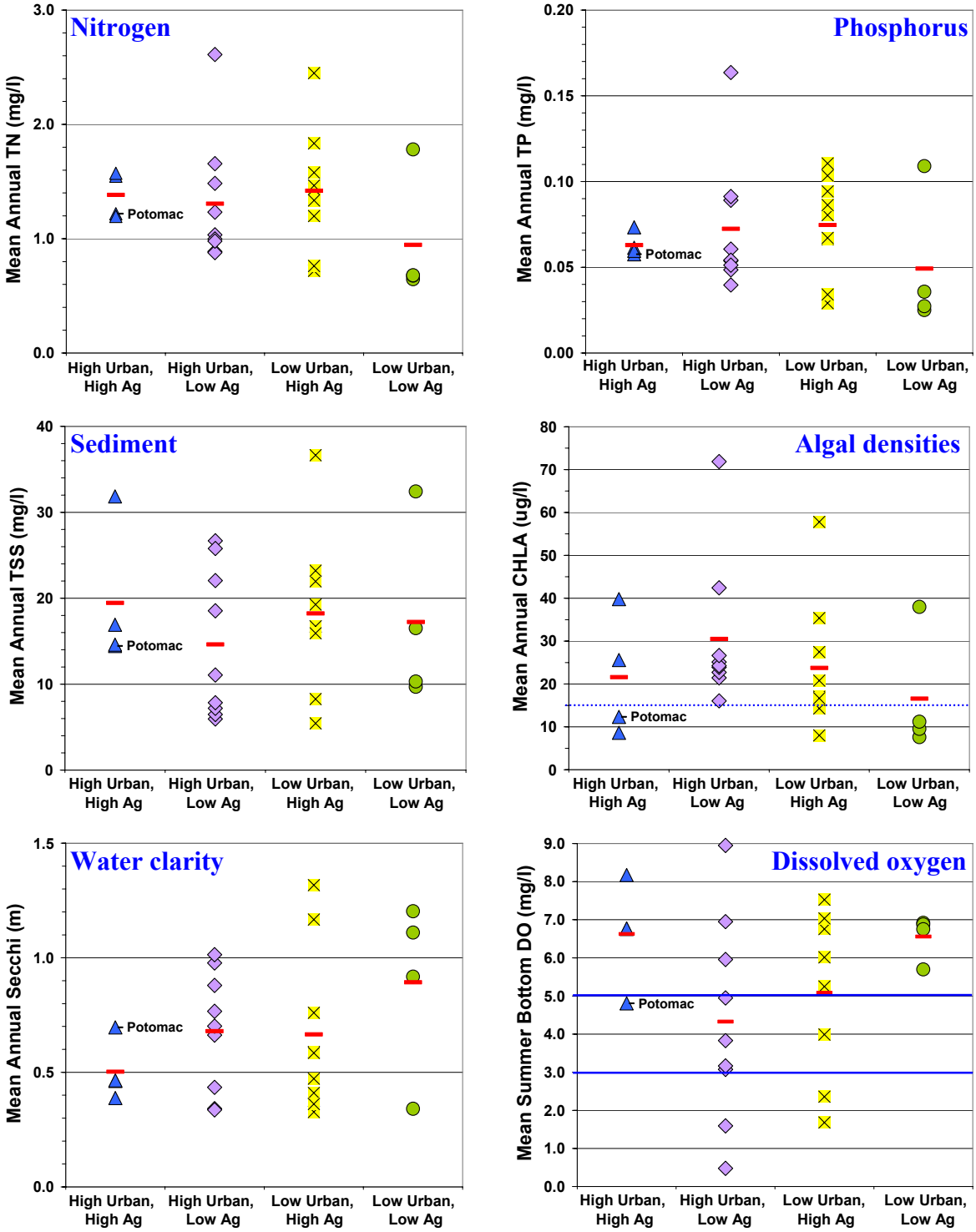

Figure 1. Comparison of the tidal Potomac to similar systems.
The mean annual concentration or depth (bottom dissolved oxygen is only summer) for 2011-2013 data. Total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), chlorophyll *a* (CHLA), Secchi depth and summer bottom dissolved oxygen (DO). Red bars indicate the mean of all systems within a category. Reference lines are included on the CHLA and summer bottom DO graphs.

What needs to be done to make the Potomac River healthy?

The biggest water quality and habitat issues are moderate to high nutrient levels throughout the river and poor water clarity in the Middle Potomac and upper Lower Potomac River. Agriculture is a major source of nitrogen, phosphorus and sediment loadings from Maryland to all sections of the Potomac, so reductions in loadings from agricultural sources should be a priority. Upgrades to wastewater treatment plants will reduce nitrogen and phosphorus loadings, and these improvements are already in place or planned. Reducing sediment loadings from urban runoff should also be a priority. In heavily urbanized sub-watersheds, retrofitting existing structures with alternatives to conventional building materials and methods should be used to reduce the amount of impervious surfaces and prevent additional degradation of water quality.

By lowering nutrients and sediment levels, water clarity should improve which will improve habitat quality for underwater grasses. Reductions in nutrients will also lead to lower algal densities and further improve habitat quality. Reducing algal densities by reducing nutrients will improve dissolved oxygen conditions.

What has already been done in Maryland to improve water and habitat quality in the Potomac River?

To reduce loadings from agricultural sources, more than 80,750 acres of cover crops have been planted in between growing seasons to absorb excess nutrients and prevent sediment erosion. Fencing on more than 16,000 acres of farmland has been used to keep livestock out of streams and prevent streambank erosion. More than 1,450 containment structures have been built to store animal wastes and allow nutrients to be applied to the land in the most effective manner at the appropriate time. More than 23,600 acres of stream buffers were in place, allowing areas next to streams to remain in a natural state with grasses, trees and wetlands.

Upgrades to all major wastewater treatment plants in the basin in Maryland are in progress and will be completed by 2020. Previous upgrades at the largest facility in the basin, Blue Plains Wastewater treatment plant, have already reduced nitrogen loadings to less than one-third the levels in the early to mid 1990s and also reduced phosphorus loadings to two-thirds the previous levels.

Stormwater retrofits have reduced nitrogen loadings from urban and suburban sources and prevented almost 50,000 pounds of nitrogen from entering streams. Also, almost 600 septic upgrades have been completed.

In addition, Maryland has a number of programs to reduce the impacts of continued development and increasing amounts of impervious surfaces in the Potomac River watershed. Program Open Space projects have conserved more than 10,600 acres of land for outdoor recreation opportunities. Rural Legacy Program projects have protected almost 18,900 acres, with special focus on areas with important cultural sites and natural resources and to ensure large areas of habitat. Maryland Environmental Trust projects have helped individual land owners protect almost 11,900 acres. Maryland Agricultural Land Preservation Program projects have preserved 12,325 acres of agricultural land from development.

For more information
An integrative assessment of the water and habitat quality of the Potomac River for 1985-2012 is available online at **http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm**.

The full report includes:

- Information on land use and human population densities within the basin, including the health of streams and location of Maryland Trust Fund Priority watersheds
- Information on land use in 2010, change in land use since 2000 and percent impervious surfaces in watershed
- Nutrient and sediment loadings information, including breakdown of nitrogen, phosphorus and sediment load by source (agriculture, urban runoff, point source, etc.)
- Loadings information for major wastewater treatment plants including status of upgrades and progress toward loading caps
- Water and habitat quality results for non-tidal streams and tidal waters from long-term monitoring programs
- Shallow-water monitoring results including percent failures of dissolved oxygen, chlorophyll and turbidity thresholds and comparison to long-term monitoring stations
- Phytoplankton information
- Submerged aquatic vegetation coverages
- Benthic program results
- Appendices with station locations, analysis methods and tabular results

Current water and habitat quality information is also available from Maryland DNR's Eyes on the Bay website **www.eyesonthebay.net**

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Chesapeake Bay Program
A Watershed Partnership