MARYLAND DEPARTMENT OF NATURAL RESOURCES

Tidewater Ecosystem Assessment

Potomac River
Water Quality and Habitat Assessment
Overall Condition 2010-2012

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 is 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, phosphorus and sediment loadings increased. 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, 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 and maybe decreased in Catoctin Creek and Monocacy River. 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 and nitrogen levels may have decreased at the upstream main river station. Nitrogen and phosphorus levels also decreased in Seneca Creek. However, phosphorus levels may have increased and sediment levels increased in the Anacostia River. Sediment loadings measured at the fall line increased.

Water and habitat quality in the tidal portions of the middle Potomac was fair to poor due to high nitrogen levels and poor water clarity. Piscataway Creek had fair water quality. Nitrogen levels decreased throughout the Middle Potomac, and phosphorus levels decreased in most areas. Overall, phosphorus levels were good but sediment levels in shallow waters and algal densities in the main river were too high. Summer dissolved oxygen levels were good.

Underwater grass beds in the tidal fresh main river and in Piscataway Creek have decreased in the last several years. Underwater grass beds covered more than the area required to meet restoration goals from 2005-2010, but decreased to approximately 40% of the restoration goal area in 2012. Bottom animal populations were 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 and habitat quality in the open tidal waters of the Lower Potomac was fair due to moderate nutrient levels but high algal densities and poor water clarity. Mattawoman Creek had good water quality. Nitrogen levels decreased throughout the Lower Potomac and phosphorus levels decreased in the upstream areas and in Mattawoman Creek. Sediment levels increased in the middle portion of the main river but decreased at the two downstream stations and in Mattawoman Creek. Algal densities and water clarity degraded in the main river but improved in Mattawoman Creek. Summer bottom dissolved oxygen in the Lower Potomac upper portion was fair to good, but in the lower portion summer bottom dissolved oxygen was almost always below 3 mg/l and very often less than 1 mg/l.

Underwater grass beds in the Lower Potomac have decreased in the last several years, especially in the lower portion of the river. In 2005, underwater grass beds in Maryland waters covered 80% of the area required to meet restoration goals in the middle portion of the Lower Potomac, but decreased to approximately 40% of the restoration goal area in 2012. In the lower portion of the river, underwater grass beds in Maryland waters covered 40% of the area required to meet restoration goals in 2005, but decreased to approximately 10% of the restoration goal area in

2012. Underwater grass beds in Mattawoman Creek covered areas close to or above restoration goals in recent years but decreased to 70% of the goal in 2012.

More than half of the habitat for bottom animals was degraded. The degraded locations were 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 were 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. Dissolved nitrogen levels below the level for nitrogen limitation 'Meet' criteria, otherwise 'Fail' criteria. Summer bottom dissolved oxygen levels above 3 mg/l 'Meet' criteria, otherwise 'Fail' criteria. Annual trends for 1999-2012 ether 'Increase' or 'Decrease' if significant at $p \leq 0.01$ or 'Maybe Increase' or 'Maybe Decrease' at $0.01 < p < 0.05$; 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. Data is from the long-term monitoring program (2010-2012). Gray boxes indicate there is no data to evaluate that component.

		Water Quality			Habitat Quality		
	Station	Nitrogen	Phosphorus	Sediment	Algal	Water Clarity	Summer
Middle Potomac	Upper Piscataway	FAIL DECREASING	FAIL	MEET	MEET		
	Lower Piscataway	FAIL DECREASING	MEET DECREASING	FAIL	FAIL	FAIL	
	Mouth of Piscataway	FAIL DECREASING	MEET DECREASING	MEET	FAIL	FAIL	MEET IMPROVING
	Mouth of Dogue Creek	FAIL DECREASING	MEET DECREASING	MEET	FAIL	FAIL	MEET
Lower Potomac	Upper Mattawoman	FAIL Maybe Decreasing	MEET	MEET	MEET		
	Lower Mattawoman	FAIL DECREASING	MEET DECREASING	MEET DECREASING	MEET DECREASING	FAIL INCREASING	
	Indian Head	FAIL DECREASING	MEET DECREASING	FAIL	MEET Maybe Decreasing	FAIL	MEET DECREASING
	Between Possom Pt and Moss Pt	FAIL DECREASING	FAIL DECREASING	FAIL	MEET	FAIL	MEET
	Smith Point	FAIL DECREASING	FAIL	MEET INCREASING	MEET INCREASING	FAIL Maybe Decreasing	MEET
	Maryland Point	FAIL DECREASING	FAIL	FAIL INCREASING	MEET INCREASING	FAIL Maybe Decreasing	MEET Maybe Decreasing
	Morgantown	FAIL DECREASING	FAIL	MEET Maybe Increasing	MEET Maybe Increasing	FAIL	MEET
	Ragged Point	MEET	MEET	MEET DECREASING	FAIL	MEET	FAIL
	Point Lookout	MEET Maybe Decreasing	MEET	MEET Maybe Decreasing	MEET Maybe Increasing	MEET DECREASING	FAIL

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

The Middle Potomac and Lower Potomac River basins are in the 'High Urban, Low Agriculture' land use category, with Middle Potomac being among the most urbanized areas in Maryland. Nitrogen, phosphorus and sediment levels are higher in the Middle Potomac than in the Lower Potomac portion of the river (Figure 1). Algal densities are similar in both parts of the river, and water clarity is much better in the Lower Potomac than in the Middle Potomac portion.

The nitrogen and phosphorus levels in the Middle Potomac portion of the river are moderate relative to other high urban areas, but sediment levels are higher than in most other high urban areas. Summer bottom dissolved oxygen levels in the Middle Potomac are among the best of the high urban areas, but water clarity is among the worst of similar areas.

The nitrogen, phosphorus and sediment levels in the Lower Potomac portion of the river are among the lowest of the high urban areas, and water clarity is the best among similar areas. However, summer bottom dissolved oxygen levels are very poor and among the worst of all tidal waters in Maryland.

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 81,000 acres of cover crops have been planted in between growing seasons to absorb excess nutrients and prevent sediment erosion. Fencing on more than 13,700 acres of farmland has been used to keep livestock out of streams and prevent streambank erosion. More than 1,250 containment structures have been built to store animal wastes to allow nutrients to be applied to the land in the most effective manner at the appropriate time, and more than 22,000 acres of stream buffers were in place, allowing areas next to streams to remain in a natural state with grasses, trees and wetlands.

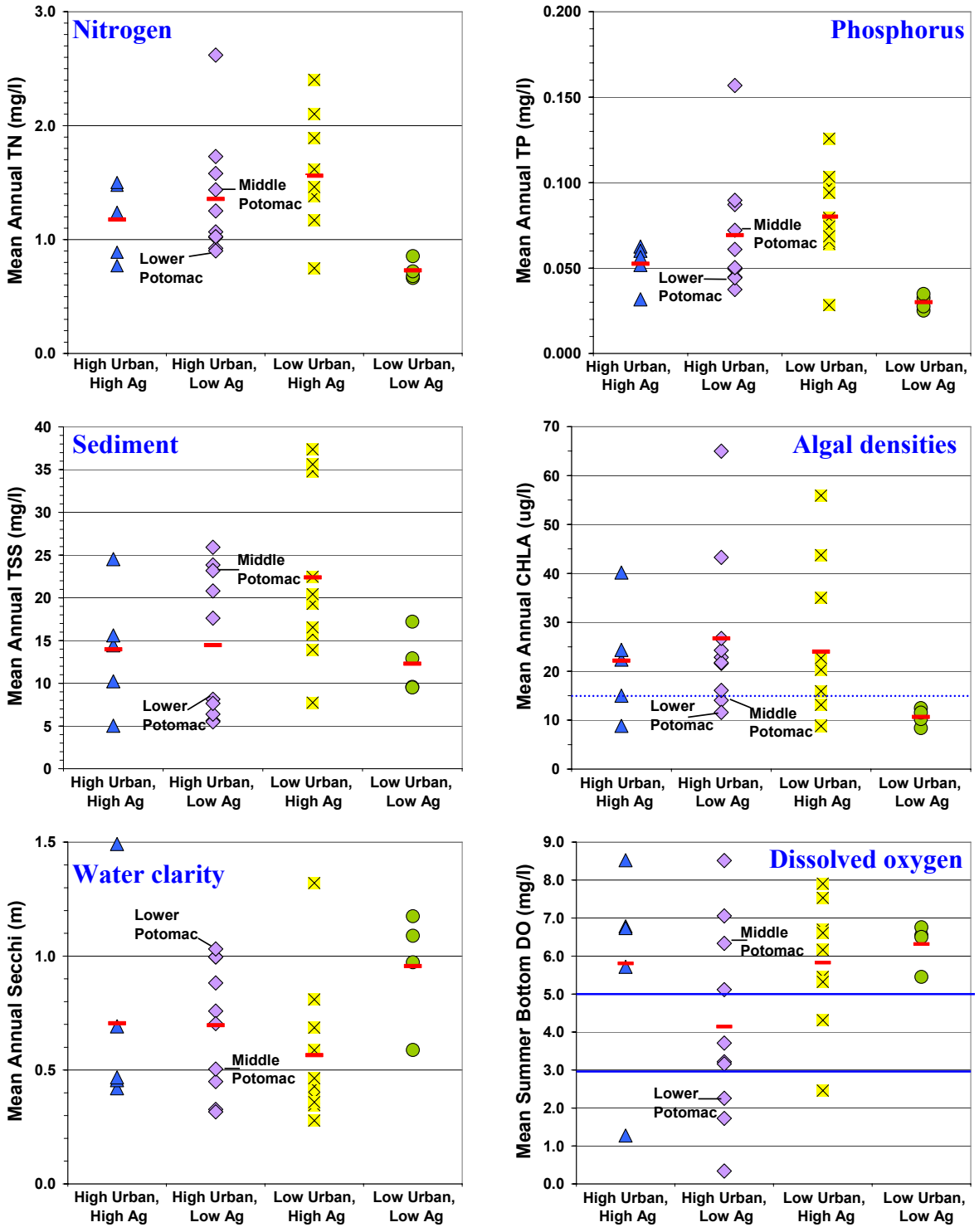

Figure 1. Comparison of the tidal Potomac to similar systems.
The mean annual concentration or depth (bottom dissolved oxygen is only summer) for 2010-2012 data. Total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), chlorophyll *a* (CHLA), Secchi depth and summer bottom dissolved 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.

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 more than 41,000 pounds of nitrogen from entering streams. Also, almost 175 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 10,400 acres of land for outdoor recreation opportunities. Rural Legacy Program projects have protected almost 18,400 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 11,800 acres. Maryland Agricultural Land Preservation Program projects have preserved almost 11,350 acres of agricultural land from development.

For more information

An integrative assessment of the water and habitat quality of the Potomac River is available online at **http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm**.
The full report includes:

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