Prioritization Strategy for Monitoring Maryland's Lakes

Last Updated: 9/25/24

Table of Contents

List of Tables

Acknowledgements

Background:

Maryland's lakes are valuable natural resources that provide numerous recreational and ecological benefits such as bathing beaches, fishing and boating opportunities, freshwater aquatic life habitat, and drinking water to Maryland citizens. Section 314 of the federal Clean Water Act (CWA) established the Clean Lakes program, which was designed to identify publicly owned lakes, assess their water quality condition, implement in-lake and watershed restoration activities and develop programs to protect restored conditions.

The Clean Lakes program originally had dedicated funding to perform the necessary monitoring, but these funds were discontinued in 1995. As a result, lake projects must now be funded through the §319 Nonpoint Source Program or other funding sources (e.g., Section 106 Monitoring Initiative) where lake projects must compete with other projects for limited funds. Due to the limited funding and other high priorities, Maryland has not implemented any ongoing state-scale lake monitoring efforts for aquatic life indicators such as those that are in place for rivers/streams and the Chesapeake Bay. Currently, the only ongoing monitoring that occurs in lakes is to assess human health endpoints with regards to the safety of consuming fish (e.g., the Maryland Department of the Environment (MDE) collects fish tissue to determine polychlorinated biphenyl (PCB) and mercury content) as well as the safety of drinking water sources (e.g., as required by drinking water utilities).

Previously, Maryland has conducted a statewide assessment of trophic conditions in 1991-1993. For this project, each of the State's 60 significant (> 5 acres surface area), publicly-owned lakes were assessed and classified by their overall level of productivity or "trophic condition". In addition, Maryland has participated in EPA's National Lake Surveys which included monitoring sites in Maryland in 2007, 2012, and 2017. For these National Lake Surveys, EPA randomly selected lakes in each state to be sampled using a nationally-consistent set of protocols (stratified by state, EPA Region and ecological region). Lakes were intensively sampled a single time during the late summer with water, sediment and biological samples being sent to national labs for analysis. MDE has also conducted targeted sampling for specific lakes including an intensive study on Deep Creek Lake, TMDL studies on various impaired lakes, a special study in 2015 on eutrophication, acid mine drainage (AMD) monitoring in Deep Creek Lake and Jennings Randolph Reservoir following MD Bureau of Mines remediation projects, and ad-hoc fish kill sampling.

In 2009, MDE updated "The State of Maryland's Comprehensive Water Monitoring Strategy" and included plans for increased lake monitoring in the coming years. Since then, MDE and the Maryland Department of Natural Resources (MDDNR) have recognized the need for continued lake monitoring and have taken steps to fill this need.

Working in collaboration, the two agencies are partnering to address known sampling gaps and to coordinate sampling protocols. One of the primary goals of this partnership is to monitor and assess all significant (> 5 acres surface area), publicly-owned lakes in Maryland for impacts due to nutrients. An excess of nutrients or eutrophication in lakes can lead to nuisance algal blooms, decreased dissolved oxygen levels, and may require additional treatment for use as a drinking water supply. This causes impacts to public health, the health of aquatic organisms, and can

limit recreational activities on the lake. Eutrophication is one of the major sources of impairments to Maryland's lakes so the initial focus of this lake monitoring prioritization scheme will be on nutrients and its associated effects on designated use attainment.

To inform current and future lake monitoring efforts, MDE and MDDNR have jointly developed a prioritization list to identify an order in which lakes will be sampled. MDE plans to sample 3-5 lakes per year according to the list and MDDNR will assist with other targeted sampling of State-owned Lakes. This document describes the rationale used to develop the lake sampling prioritization list.

Prioritization of Lakes for State Monitoring Efforts:

MDE and MDDNR discussed a variety of factors that are important in Maryland's management of lakes and incorporated them into a scoring system that creates a numeric prioritization for each lake. In general, the factors reflect a risk to a particular use, such as drinking water or swimming, how recently a lake was sampled, or if a TMDL has been completed.

A list of the prioritization factors and the priority points assigned to each are provided in table 1 below. A lake can receive points for more than one factor and the final score will be cumulative of any of the factors that apply. MDE plans to assess 3-5 lakes per calendar year and intends for the sampling schedule to follow this list starting with the highest priority lakes. The prioritization list will be a living document and will continue to change as new information becomes available or as lakes are monitored and have TMDLs established. MDE reserves the right to select alternate lakes from the list as needs and priorities change.

Table 1: Factors and associated points for the prioritization of lake monitoring locations in Maryland.

Priority Factor	Points Assigned
Drinking water reservoir	5
Harmful Algal Bloom (HAB) advisory issued in the past 10 years	3
Environmental Justice (EJ) Score	1 or 3
Beach	1
Public access	1
Year last assessed for nutrients	-5 to 7
TMDL already developed for nutrients	-3
Other factors	-3 to3

Priority Factors:

Each of the priority factors are described in more detail below.

1. **Drinking water reservoir.** Several of Maryland's lakes were constructed for the purpose of and are used as a drinking water supply. Drinking water protection is a major health priority for Maryland with the goal to ensure sustainable water quality and quantity for all public water systems. Lakes that are drinking water reservoirs are given higher priority since there is a direct link to public health and the need for additional treatment could lead to increased fees for ratepayers of varying socioeconomic status.

   For this prioritization ranking factor, MDE will only assign prioritization points to the lake if there is a drinking water intake actually in the reservoir or within a mile of the reservoir. Therefore, some of Maryland's lakes that are assigned the drinking water use designation(-P) in Code of Maryland Regulations 26.08.02.08 will not be assigned prioritization points under this factor because they are not directly upstream of a drinking water intake. This was done to recognize the added importance of lakes that are used directly as a water supply.

   Lakes that have a drinking water intake within a mile of the reservoir will receive 5 priority points to capture the importance drinking water reservoirs have both on public water supply but also other uses such as aquatic life, canoeing, etc.

2. **Harmful Algal Bloom (HAB) advisory issued in the past 10 years.** Some of Maryland's lakes have a history of harmful algal blooms that can negatively impact aquatic life as well as pose a risk to human health. MDE utilizes Enzyme Linked Immuno Sorbent Assay equipment (ELISA) to quickly assess public health threats associated with several algal toxins and specifically microcystin.

   Based on the ELISA method, any lake that has had an elevated microcystin level (8 µg/L and above) and a HAB advisory issued in the past 10 years will receive 3 priority points for sampling. Lakes with HAB blooms are given a ranking of 3 priority points so as to recognize a significant public health risk but are ranked slightly lower than drinking water reservoirs since citizens are not generally directly consuming the water. Any drinking water reservoir that also has a HAB bloom will receive points for both factors and will be ranked as an even higher priority.

3. **Environmental Justice (EJ).**

   MD's lakes are used for drinking water, recreation, fishing, etc., across the State, and there are many human health implications that could disproportionally affect overburdened or underserved communities. MDE strives to implement programs that reduce existing environmental inequities and that avoid the creation of new inequities in communities who are overburdened or underserved that may have Environmental Justice

(EJ) concerns. MDE developed an [EJ Screening Tool](#) to enable users to better understand and locate environmental stressors and potential disparities in communities.

To calculate an EJ Score, MDE uses four indicators to screen locations and communities based on census and health data:
1. Pollution burden exposure
2. Pollution burden environmental effects
3. Sensitive populations
4. Socioeconomic/Demographic indicators

A final EJ score is calculated for each census tract and with higher scores denoting a higher percentage of all four indicators listed above. Then a final EJ percentile is developed to compare communities to each other and to the rest of MD. The EJ percentile results are split into quartiles with the 4th quartile, 75th to 100th percentiles, representing the census tracts in MD that have the highest EJ scores and therefore are the most at risk.
- 0 -24.9th percentile- 1st quartile
- 25- 49.9th percentile- 2nd quartile
- 50-74.9th percentile- 3rd quartile
- 75- 100th percentile- 4th quartile

A desktop GIS analysis was conducted using MDE's EJ Screen Tool and each lake was assigned the highest EJ percentile score in the surrounding census tracts. Any lake with a surrounding census tract in the 4th quartile will receive 3 priority points. Any lake with a surrounding census tract in the 3rd quartile will receive 1 priority point. Lakes with surrounding census tracts in the 1st or 2nd quartile will not receive any additional points.

4. **Beach.** A few of Maryland's lakes have public bathing beaches which attract both local and out of state visitors. Bathing beach water quality is a human health priority for the State since beaches provide opportunities for direct contact with the water and swimming can result in the accidental ingestion of water. MDE works with local health departments to coordinate water quality monitoring and public health notifications for beaches throughout the State.

   Any lake with a designated public bathing beach will receive 1 priority point. Bathing beaches were assigned a lower priority ranking than the previously mentioned ranking factors since Maryland's Beaches Program already has in place monitoring protocols for several public health risks at beaches (e.g. bacteria, HABs).

5. **Public access.** Many of Maryland's largest lakes are publicly-owned and provide public access for a range of activities such as fishing, hiking, canoeing, etc. Public access

is used as a prioritization factor in lake sampling since these lakes will serve the greatest number of Maryland's citizens.

Any lake that has public access will receive 1 priority point. Public access has also been assigned a lower priority ranking than some other factors in recognition that all surface waters are State-owned. Though lakes with public access will receive priority over those without, the State will still consider lakes without public access when determining monitoring priorities. In those cases, other factors may provide compelling reasons for monitoring these lakes ahead of those lakes with public access.

6. **Year last assessed for nutrients.** One of the primary objectives for developing this monitoring prioritization is to ensure that all significant, publicly-owned lakes are comprehensively monitored for nutrients so as to guide future management approaches. Therefore, a higher priority ranking will be given to lakes that have never been assessed for nutrients on the Integrated Report, followed by lakes that were assessed the longest time ago. A lower priority will be given to lakes that have been most recently assessed (for nutrients) since their status has not likely changed over the shorter time period. Points are assigned to a lake according to how recently it has been sampled for nutrients.

   Scoring is assigned as follows:
   a. Unassessed for nutrients: 7 priority points
   b. Last sampled 18-20 years ago: 5 priority points
   c. Last sampled 15-17 years ago: 3 priority points
   d. Last sampled 12-14 years ago: 1 priority point
   e. Last sampled 10-11 years ago: 0 priority points
   f. Last sampled 7-9 years ago: -1 priority point
   g. Last sampled 4-6 years ago: -3 priority points
   h. Last sampled 1-3 years ago: -5 priority points

   Lakes that have not been assessed for nutrients will receive 7 priority points, the highest ranking of any factor, to reflect the need to have a baseline assessment. Without this assessment, the status of these lakes is largely undocumented and therefore can't be appropriately managed or protected. These lakes are the highest priority for monitoring so that water quality can be assessed to inform TMDL development and future restorative actions (if necessary). Lakes that were sampled 18-20 years ago are assigned 5 priority points, to recognize the long temporal gap in monitoring during which water quality changes may have occurred since the original assessment effort. The list continues with a step down in priority points (3 to 1) for each 3 year block since the last sampling (15-17 years and 12-14 years).

   Lakes that have been assessed 10-11 years ago will receive 0 priority points since 10 year old assessments are considered the halfway point for this prioritization and so as to emphasize the State's goal of addressing unassessed lakes first. For lakes that were more

recently assessed, points are subtracted from the ranking score since the assessments for these lakes most likely reflect current water quality.

7. **TMDL already developed for nutrients.** If a lake is sampled for nutrients and is found to be impaired, a Total Maximum Daily Load (TMDL) will be established to guide efforts to help the lake meet the intended water quality standard. A TMDL establishes the maximum amount of an impairing substance or stressor that a waterbody can assimilate and still meet Water Quality Standards (WQS) and allocates that load among pollution contributors.

   A lake with a nutrient TMDL in place will have 3 priority points subtracted in recognition of the comprehensive water quality monitoring, assessment, and modeling effort that the lake has already received.

8. **Other factors.** MDE reserves the right to use best professional judgement on additional aspects that may be specific to each lake. As many as 3 priority points can be added or subtracted to capture additional factors that may influence the priority for monitoring a lake. Things such as lake sampling permissions, excessive algal blooms, sampling barriers, other human health issues, dredging operations and circumstances surrounding previous sampling are all factors that may play a role in prioritizing or de-prioritizing a lake for monitoring. When this rating factor is used, an explanation will be given in the rationale column for the reasoning behind the points assigned.

References

Maryland Department of the Environment. (2024). Maryland's Final 2024 Integrated Report of Surface Water Quality. Retrieved from https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Pages/2024IR.aspx

_____. (2024). MDE's Environmental Justice Screening Tool [Webpage]. Retrieved from https://mde.maryland.gov/Environmental_Justice/Pages/EJ-Screening-Tool.aspx

_____. (2009). State of Maryland's Comprehensive Water Monitoring Strategy [PDF file]. Retrieved from https://mde.maryland.gov/programs/Water/TMDL/MD-AWQMS/Documents/Maryland_Monitoring_Strategy2009.pdf

_____. (n.d.). Maryland Beaches Program [Webpage]. Retrieved from https://mde.maryland.gov/programs/Water/Beaches/Pages/index.aspx

_____. (n.d.). Harmful Algal Blooms [Webpage]. Retrieved from https://mde.maryland.gov/programs/Water/HAB/Pages/index.aspx

_____. (n.d.). Water Supply [Webpage]. Retrieved from https://mde.maryland.gov/programs/Water/water_supply/Pages/index.aspx

Revision History

January 2020- First Version of *the Prioritization Strategy for Monitoring Maryland's Lakes* is finalized and published on MDE's website.

September 2021- Revisions made to Appendix A-Lake Monitoring Prioritization List. It was updated to include the most recent sampling dates up through summer 2021.

September 2024- Revisions made to the Prioritization Strategy and Appendix A-Lake Monitoring Prioritization List. Edits, updates, and changes include:

- The Environmental Justice section was added to the prioritization strategy.
- Appendix A was revised to include the scoring for Environmental Justice.
- Appendix A was updated with recent sampling dates, HABs, EJ scores, etc.

Appendix A- Lake Monitoring Prioritization List
Last Updated 9/25/24

Water Body	Drinking Water Reservoirs (5 pts)	HAB Advisory Issued in the past 10 years (3 pts)	Beach (1 pt)	Public Access (1pt)	Year last assessed for nutrients (pts from -5 to +7 depending on year)	EJ Percentile (1-3 pts)	TMDL already developed for nutrients (-3 pts)	Other Factors (-3 to +3)	Rationale for Other Factors	Total Score
Lake Elkhorn	5	3		1	7	3				19
Jennings Randolph Reservoir	5		1	1	7	1				15
Lake Louise	5	3			7					15
Lake Waterford		3		1	7					11
Stansbury Pond				1	7	3				11
Keys Community Pond				1	7	3				11
Lake Merle		3			7					10
Schumaker Pond			1	1	7	1				10
Spahr Quarry		3			7					10
Gilbert Run Lake				1	7	1				9
Youghiogheny River Lake				1	7	1				9
Millington Wildlife Pond				1	7	1				9
Allen Pond				1	7					8
Big Piney Reservoir				1	7					8
Big Pool				1	7					8

Water Body	Drinking Water Reservoirs (5 pts)	HAB Advisory Issued in the past 10 years (3 pts)	Beach (1 pt)	Public Access (1pt)	Year last assessed for nutrients (pts from -5 to +7 depending on year)	EJ Percentile (1-3 pts)	TMDL already developed for nutrients (-3 pts)	Other Factors (-3 to +3)	Rationale for Other Factors	Total Score
Chambers Lake				1	7					8
City Park Lake				1	7					8
Cosca Lake				1	7					8
Coulbourn Pond				1	7					8
Edgewater Village Lake				1	7					8
Lake Roland				1	7					8
Laurel Lake				1	7					8
Little Seneca Lake	5			1	3	1		-2	Meeting WQS for nutrients	8
Mitchell Pond 2				1	7					8
Mitchell Pond 3				1	7					8
Pearce Creek				1	7					8
Pine Lake				1	7					8
Tilghman Lake				1	7					8
Wheatley Lake aka Gilbert Run Lake				1	7					8
La Trappe Creek Pond					7	1				8
Bishopville Pond				1	5	1				7
Loch Raven Reservoir	5			1	3	1	-3			7

Water Body	Drinking Water Reservoirs (5 pts)	HAB Advisory Issued in the past 10 years (3 pts)	Beach (1 pt)	Public Access (1pt)	Year last assessed for nutrients (pts from -5 to +7 depending on year)	EJ Percentile (1-3 pts)	TMDL already developed for nutrients (-3 pts)	Other Factors (-3 to +3)	Rationale for Other Factors	Total Score
Liberty Reservoir	5			1	0	3	-3			6
Prettyboy Reservoir	5			1	3		-3			6
Lake Bernard Frank				1	5	1		-2	Meeting WQS for nutrients	5
Rocky Gorge Reservoir, AKA Howard Duckett	5			1	-1	3	-3			5
Savage River Reservoir	5	3		1	-5	1				5
Broadford Lake	5		1	1	-1	1	-3			4
Conowingo Reservoir	5			1	-3	1				4
Piney Run Reservoir	5	3		1	-5					4
Big Mill Pond				1	5		-3			3
Hunting Creek Lake	5	3	1	1	-5			-2	Meeting WQS for nutrients	3
Triadelphia Reservoir	5			1	-1	1	-3			3
Atkisson Reservoir				1	1					2
Deep Creek Lake			1	1	1	1		-2	Meeting WQS for nutrients	2
Lake Linganore	5			1	-1		-3			2
Lake Williston		3	1	1	-3					2
Lake Habeeb	5		1	1	-5	1		-2	Meeting WQS for nutrients	1
Smithville Lake		3		1	-3					1

Water Body	Drinking Water Reservoirs (5 pts)	HAB Advisory Issued in the past 10 years (3 pts)	Beach (1 pt)	Public Access (1pt)	Year last assessed for nutrients (pts from -5 to +7 depending on year)	EJ Percentile (1-3 pts)	TMDL already developed for nutrients (-3 pts)	Other Factors (-3 to +3)	Rationale for Other Factors	Total Score
Lake Lariat		3	1		-5	1				0
Tony Tank Lake				1	-1	3	-3			0
Allen Pond				1	-5	3				-1
Cash Lake				1	-5	3				-1
Lake Artemesia				1	-5	3				-1
Lake Kittamaqundi				1	-5	3				-1
Lake Needwood		3		1	-3			-2	Meeting WQS for nutrients	-1
Wilde Lake				1	-5	3				-1
Centennial Lake				1	-1	1	-3			-2
Adkins Pond				1	-1	1	-3			-2
Higgins Mill Pond		3			-5					-2
Johnsons Pond				1	-1	3	-3	-2	Meeting WQS for nutrients	-2
Northwest		3			-5					-2
Clopper Lake		3		1	-5	1	-3			-3
Cunningham Lake			1	1	-3			-2	Meeting WQS for nutrients	-3
Herrington Lake			1	1	-5					-3
Mrytle Grove				1	-3	1		-2	Meeting WQS for nutrients	-3
New Germany Lake			1	1	-5					-3

Water Body	Drinking Water Reservoirs (5 pts)	HAB Advisory Issued in the past 10 years (3 pts)	Beach (1 pt)	Public Access (1pt)	Year last assessed for nutrients (pts from -5 to +7 depending on year)	EJ Percentile (1-3 pts)	TMDL already developed for nutrients (-3 pts)	Other Factors (-3 to +3)	Rationale for Other Factors	Total Score
Tuckahoe				1	-5	1				-3
Blairs Valley Lake				1	-5					-4
Greenbelt Lake				1	-5					-4
Leonard Mill Pond				1	-5					-4
Unicorn Lake				1	-5					-4
Wye Mills Community Lake				1	-5					-4
Greenbriar Lake			1	1	-5			-2	Meeting WQS for nutrients	-5
St Mary's Lake				1	-5	1		-2	Meeting WQS for nutrients	-5
Urieville Lake				1	-5		-3			-7