2018-2021 Progress Report on the Action Strategy for the Reservoir Watersheds

Baltimore Reservoir Watershed Management Program
August 2024

The following text provides a progress report on the actions that the members of the Baltimore Reservoir Watershed Protection Committee have agreed to carry out as listed in the 2019 Action Strategy for the Reservoir Watersheds. This Action Strategy was created with the shared goal of protecting the water quality of the region's reservoirs and their tributaries in mind. These reservoirs include the Loch Raven, Liberty, and Prettyboy Reservoirs.

Reservoir and Watershed Assessment

Monitoring

Initiate:

1. The RTG will work to implement the enhanced monitoring plan recommended in the June 2016 report to the Baltimore Metropolitan Council by the Center for Watershed Protection and EA Engineering, Science and Technology. The fundamental goal of the Reservoir Watershed Management Program is to ensure that the three reservoirs (Loch Raven, Liberty and Prettyboy) and their respective watersheds continue to serve as sources of high-quality raw water for the Baltimore Metropolitan water-supply system. Continued monitoring of the reservoirs and their tributaries helps to ensure the quality of the water. The enhanced monitoring plan is a result of the recommendations adopted by the RTG based on an evaluation of the historical monitoring program completed by the U.S. Geological Survey. The data collected and analyzed as a result of this updated monitoring plan will result in the overall improvement of the watershed monitoring and management system of the Baltimore Metropolitan Water Supply System and as such, improved and maintained source water quality. It will also enable the City and its Reservoir Watershed Management Agreement partners to improve watershed planning and management based on more reliable and comparable data that will in turn facilitate the development of improved prediction of trends and the ability to further facilitate compliance with water quality standards and TMDL-based Watershed Implementation Plan requirements.
    - The RTG developed a short paper to restate and summarize the proposal for an enhanced monitoring program including key components, overall benefits, data use potential, approach and funding needs. The proposal was to:
        - *"reinstate a stormwater sampling program; contract with a single water testing laboratory to test samples from fixed interval monitoring, reservoir monitoring, and stormwater monitoring; establish and enable use of stricter detection limits for several of the pollutants assessed in order to provide the Baltimore region with more comprehensive and comparable monitoring data; and, employ independent review of laboratory and monitoring data."*
    - This document was forwarded to the Watershed Protection Committee. Without meeting, feedback was received from some of the members indicating a number of questions outlined in the Appendix to this document, along with responses to those questions.

Continue:

2. Baltimore City will continue to conduct fixed-interval monitoring of tributaries to the three reservoirs. The City will also continue to conduct monitoring at in-lake stations. Concentrations of key pollutants of concern are measured, and estimated annual loadings of sediment and total phosphorus are calculated.

    - The City performs fixed-interval monitoring at 16 tributary stations. This switched from dry weather monitoring as a result of recommendations in a 2011 USGS report. The City also performs monitoring at 12 in-lake stations.

3. Baltimore County will continue to conduct fixed-interval monitoring of tributaries in its portions of the three reservoir watersheds. The County will also continue to conduct biological sampling in the tributaries in its portions of the three reservoir watersheds, including its Randomized Biological Monitoring Program to assess general water quality in the three watersheds. Results are reported annually in Baltimore County's NPDES/MS4 report, submitted to MDE.

    - **Chemical Monitoring**: Baltimore County continued chemical stream monitoring in the reservoir watersheds. As a result of the 2011 USGS report, baseflow monitoring was replaced with trend monitoring. The Trend Program is a fixed-site, fixed-interval chemical monitoring program that will better serve the needs of assessing watershed improvement (or degradation) and provide data for any future modeling. This monitoring program results in 12 samples, annually, from each monitoring station regardless of weather conditions. A total of 18 fixed sites are located in the three reservoir watersheds (Liberty – 3 sites, Prettyboy – 3 sites, and Loch Raven – 12 sites. In addition, chemical synoptic surveys were conducted in support of the Prettyboy Watershed Restoration Action Strategy, and two Loch Raven Reservoir Small Watershed Action Plans (Beaver Dam and Loch Raven East). Results are summarized in the Characterization Report – Chapter 3 for the respective SWAP area. See webpage: www.baltimorecountymd.gov/Agencies/environment/watersheds/swap.html
    - **Biological Monitoring**: The Probabilistic Biological Monitoring Program has been in effect since 2003. This program randomly selects points in streams for macro invertebrate sample collection. It operates on an alternate year basis with the Patapsco/Back River Basin sampled in odd years, and the Gunpowder Basin sampled in even years. This program allows assessment of current stream conditions, as well as trends over time. The data is supplemented with a Reference Site Biological Monitoring Program to serve as controls, and a Sentinel Site Biological Monitoring Program to serve as a fixed site control over time. Most recent random point sampling in the Liberty Reservoir watershed occurred in 2021, while Prettyboy Reservoir and Loch Raven Reservoir 8-digit watersheds were sampled in 2020. Of the seven sites sampled in the Liberty watershed, six BIBI (Benthic Index of Biotic Integrity) scores were in either the "fair" or "good" category, and only one was considered to be degraded. In the Prettyboy Reservoir watershed, all 5 samples had BIBI scores in the "good" category, indicating good stream health. Of the 29 samples taken in the Loch Raven watershed, only 14% were in "very poor" or "poor" condition. BIBI scores from sentinel and reference sites within these watersheds remained stable across recent years.
    - **Trash Monitoring**: In response to a trash impairment listing of the Northwest Branch and Middle Harbor, a Trash Monitoring Program was initiated in October 2010. While there are currently no monitoring sites in any of the reservoir watersheds, the data is related to land use and extrapolated to trash loads for watersheds not currently monitored. The calculated annual trash loads in the reservoir watersheds are 38,761 lbs., 266,591 lbs., and 27,366 lbs, for Prettyboy, Loch Raven, and Liberty reservoir watersheds, respectively.

4. Baltimore County will continue to conduct bacteria monitoring on an as-needed basis, based upon TMDL requirements.

    - A bacteria monitoring program was initiated in June of 2010 in response to the development of bacteria Total Maximum Daily Load (TMDL) in 6 of Baltimore County watersheds. This program is conducted in cooperation with Baltimore City and Carroll County. Sites are selected based on the original sites monitored by MDE used for the development of the bacteria TMDLs. As of 2021, bacteria samples are not taken at Liberty Reservoir since suspending these sites after 2016. As of 2016, four Liberty Reservoir sites were sampled ten times, and a fifth site was sampled only 9 times. Three of 5 sites in the Liberty Reservoir watershed exceeded the 126 geometric mean standard of 126 Most Probable Number (MPN) (average of nine or ten samples). However, comparing the results to the single sample "infrequently used full body contact recreation" standard of 576 MPN during low flows in the seasonal period, only three of the 18 samples collected exceeded the standard. For the Prettyboy Reservoir watershed, in 2021 two of the 3 sites sampled exceeded the 126 MPN geometric mean standard (average of 16 samples). Four samples out of a total of 18 samples taken during the seasonal period exceeded 576 MPN for low flow conditions. In calendar year 2021, all six sampling locations in the Loch Raven Reservoir watershed exceeded the 126 MPN standard (mean of 16 samples at each site). A seventh site (LOC-7) was suspended in 2018 for reporting geometric means below the 126 MPN standard for seven years. Six of 38 samples during seasonal low flow periods exceeded the 576 MPN standard. Baltimore County also completed, in 2016, a two-year Subwatershed Prioritization Program. This program was intended to systematically sample and identify sources of fecal bacteria upstream of trend points. A total of 14 sites in the Liberty watershed, 16 in the Prettyboy Watershed, and 45 in the Loch Raven watershed were sampled under this program. Detailed results are available in Baltimore County's 2016 NPDES report.

5. The signatories will continue to work collaboratively to generate data of sufficient quality and quantity to:
    - Characterize the state, changes, and trends in water quality in the reservoirs and their tributaries through a regular sampling, analysis, and reporting monitoring program to ensure maintenance of high quality raw drinking water supply;
    - Characterize the state, changes, and trends in water quality in the reservoirs and their tributaries through a regular sampling, analysis and reporting monitoring program to support management activities to track progress and compliance towards TMDLs;
    - Identify emerging water quality issues affecting the quality of the raw or finished water supply;
    - Improve the application and development of models simulating water quality response in the reservoirs, effectiveness of management practices (e.g. BMPs), or other scenarios as defined by the RTG; and,
    - Create readily available data sets, or future data, needed for special studies, on an as needed basis.
        - See response to #1 on Page 1.

Reservoir Modeling and Predictive Analysis

Continue:

1. Baltimore City, in cooperation with other Reservoir Program signatories, will investigate the principal sources of the "precursors" (organic substances present in the raw water) of the disinfection byproducts (DBPs) which have been detected at various points in the metropolitan water system. The research would include a study of the relationship between sub-watershed land cover, total organic carbon/dissolved carbon in the tributaries and the reservoirs, and DBP precursors in the raw water.
    - No activity is being pursued on this initiative.
2. Baltimore and Carroll Counties and Baltimore City will update the water availability analysis in Water Resource Elements (WREs) as needed. State law requires that a WRE be developed and adopted by counties and municipalities as a component of the local Comprehensive Plan. The WREs include a "water supply availability analysis" that compares current and future demands for public water in each area with the known and planned sources of water (wells, stream withdrawals, reservoirs, etc.). All counties have developed their WREs.
    - Comprehensive plans are required by State law to be updated every 10 years. In January 2022, Maryland Department of Planning released its online 2022 Proposed Water Resources Element (WRE) Guidance Update. The update encourages the integration of climate change considerations, particularly flooding risks, into the drinking water, wastewater and stormwater assessments of the WRE.
    - The Carroll County Master Plan was last updated in 2015, which included an update to the WRE chapter. An update to the Master Plan is scheduled to begin in 2025. Carroll County is in the process of hiring a consultant to update the technical background information in 2023. This includes incorporating climate change impacts and adaptions, as well as updates to reflect changes to the regulatory framework for receiving waters and an update to the water balance assessment. The WRE document will be updated in 2024 to be available to inform Planning staff analysis and recommendations during the Master Plan update process.
3. The Maryland Department of the Environment (MDE) will continue to implement Total Maximum Daily Load (TMDL's) addressing pollutants in the region's reservoirs through the Municipal Separate Storm Sewer System (MS4) permitting process and NPDES permits for wastewater treatment plants. Nutrient load reductions are calculated in the applicable county(s) MS4 report.
    - The EPA has approved the following TMDLs[1] for the Prettyboy, Loch Raven, and Liberty reservoirs.
        - Fecal bacteria in tributaries only (2009)
            - Loch Raven (2009)
            - Prettyboy (2009)
            - Liberty Reservoir (2009)
        - Methylmercury in fish tissue (2004)
            - Loch Raven (2004)

[1] https://mde.maryland.gov/programs/water/TMDL/Pages/sumittals_a-l.aspx

        - Prettyboy (2004)

    - Phosphorus and sediment
        - Loch Raven and Prettyboy (2007)
        - Liberty Reservoir (2014)

- The EPA has approved the following water quality analysis (WQAs)[2] for heavy metals (2003).
    - Loch Raven (2003)
    - Prettyboy (2003)
- The EPA has approved WQAs for chromium and lead (2003). [3]
- The EPA has approved the WQA for Mercury in Fish Tissue for the Liberty Reservoir (2014) [4] thus lifting the previous TMDL.
- TMDL restoration plans are implemented through MS4 permits.

Point Source Management

Continue:

1. The upgrade of the Hampstead Wastewater Treatment Plant (WWTP) to an enhanced nutrient removal (ENR) process will be completed. Effective October 2017, Carroll County was issued dual (split) discharge permits: one to Piney Run and the other to Deep Run watersheds, with a total permitted discharge of 1.15 MGD. The Piney Run discharge permit (State #16DP0594, NPDES #MD0022446) includes an alternate effluent limit (AEL). This permit can be viewed on MDE's website at http://mes-mde.mde.state.md.us/
    - The ENR Upgrade project was formally considered to be completed on October 1, 2021, when approximately 50% of the treated effluent flow was conveyed to the Deep Run stream channel. The effluent discharge flow continues to be split as evenly as possible between Piney Run and Deep Run.
2. Policy for **new** municipal discharges in the watersheds: MDE, through its NPDES permit program, continues to discourage new discharges exceeding 1,000 gpd, except as needed to correct failing septic systems. In those cases, MDE will encourage land treatment of the plant effluent.
    - Policy continues unchanged; MDE reports that there have not been any applications made for new municipal discharges in the watersheds for at least the last 10 years.
3. MDE, through its NPDES permit program, continues to discourage discharges from package sewage treatment plants intended to serve new residential communities and proposed to discharge in the reservoir watersheds.
    - Policy continues unchanged; MDE reports that there have not been any applications made for new package treatment plant discharges in the watersheds for at least the last 10 years.
4. MDE, through its NPDES permit program, continues to institute a phosphorus limit of 0.3 mg/l effluent concentration from **existing** industrial sources when each permit comes up for renewal.
    - This policy continues unchanged.

[2] https://mde.maryland.gov/programs/water/TMDL/Pages/sumittals_a-l.aspx
[3] https://mde.maryland.gov/programs/water/TMDL/Pages/sumittals_a-l.aspx
[4] https://mde.maryland.gov/programs/water/TMDL/Pages/sumittals_a-l.aspx

- The NPDES discharge permit in effect for the Congoleum WWTP (Liberty watershed) (effective February 2021) contains phosphorus limits of 126 lbs/yr annual maximum, 0.30 mg/L monthly average, and 2.0 mg/L daily maximum. Baltimore City periodically samples the effluent discharges of the Congoleum WWTP.
- Effective October 2017, MDE issued a split discharge for the BTR Hampstead wastewater discharge (State #16DP0022, NPDES #MD0001881) and the Hampstead WWTP (State #16DP0594, NPDES #MD0022446). The effluent from BTR is currently being sent to the Hampstead WWTP for treatment, resulting in a net reduction in load to the Liberty Reservoir watershed. These permits can be viewed on MDE's website at https://mes-mde.mde.state.md.us/WastewaterPermitPortal/.
- MDE continues to require a 0.3 mg/l phosphorus effluent concentration limit from existing industrial sources as each permit comes up for renewal.

5. Policy for **new** industrial discharges: MDE, through its NPDES permit program, discourages significant phosphorus discharges to the reservoir watersheds.
    - Policy continues; MDE reports that there have been no new industrial discharges proposed in the watersheds in recent years.

6. Since phosphorus is the primary nutrient of concern for the reservoirs, Baltimore and Carroll Counties continue to strive to reach phosphorus load goals for the reservoir TMDLs.
    - As of the 2021 reporting year, Baltimore County has achieved 6.9% of its phosphorus reduction goal for Prettyboy, 1.5% for Liberty, and 25.1% for Loch Raven, according to the Chesapeake Bay Model, Phase 5. Note that the model was updated to Phase 6, which includes changes in land use pollutant loading rates and restoration practice pollutant reduction rates; this will shift future calculations.
    - Carroll County remains committed to source water protection and reducing pollutants from runoff to our local waterways. As of the 2021 reporting year, Carroll County has achieved 100% of the phosphorus TMDL in Loch Raven, 49% in Prettyboy, and 31% in Liberty. The planned practices over the next 6 years that have been approved through the County's Community Investment Program (CIP) will achieve 100% of the phosphorus TMDL requirement in Prettyboy and 40% in Liberty.

Reservoir Watershed	Acreage in Carroll County	% of Total MD Acreage
Liberty	87,249	83%
Loch Raven (Piney Run Sub-watershed)	592	<1%
Prettyboy	21,025	45%

Nonpoint Source Management, Land Use and Natural Resource Protection

Agricultural Practices

Continue:

1. The Baltimore County Soil Conservation District (SCD) and the Carroll SCD (also referred to as the "two SCDs") will continue to encourage farm owners/operators in the three reservoir watersheds to utilize their various technical and financial assistance programs for soil conservation practices and

other measures to protect local water quality. This includes both the federal programs (from Natural Resources Conservation Service and Farm Service Agency) and the state assistance programs which are delivered in cooperation with the two SCDs (see items below).

- These efforts are ongoing.

2. The two SCDs will continue to give targeted attention to farms operated in the reservoir watersheds, and will adopt the long-term goal of preparing a "soil conservation and water quality plan" (SCWQ plan) for every farm in the reservoir watersheds.
    - The two SCDs continue to work with farms in these areas to update or develop SCWQ plans.
    - Between 2018 and late June 2022, the Baltimore County SCD prepared 249 new SCWQ plans (covering 1,570 acres) in the Loch Raven, Prettyboy, or Liberty watersheds.
    - Between 2018 and June 2022, the Carroll SCD prepared 95 new SCWQ plans (covering 4,411 acres) in the Liberty, Prettyboy, or Loch Raven watersheds.

3. The two SCDs will continue to follow up on the implementation by farmers in the watersheds of their existing SCWQ plans (i.e., plan maintenance) and to update all SCWQ plans that are 10 or more years old.
    - Between 2018 and June 2022, the Baltimore County SCD updated 10 SCWQ plans in the reservoir watersheds.
    - Between 2018 and June 2022, the Carroll SCD updated 76 SCWQ plans in the reservoir watersheds.
    - Between 2018 and June 2022, the Baltimore County SCD helped farmers plan for and install/apply the following amount of BMPs:

Watershed	BMP Categories	Amount
Loch Raven	Agronomic practices	30
Prettyboy	Agronomic practices	19
Liberty	Agronomic practices	9
Loch Raven	Structural Measures	78
Prettyboy	Structural Measures	32
Liberty	Structural Measures	17

    - Between 2018 and June 2022, the Carroll SCD helped farmers plan for and install/apply the following amount of BMPs:

Watershed	BMP Categories	Amount
Loch Raven	Agronomic practices	1
Prettyboy	Agronomic practices	12
Liberty	Agronomic practices	51
Loch Raven	Structural Measures	7
Prettyboy	Structural Measures	52
Liberty	Structural Measures	74

4. The two SCDs will continue to assist farmers in meeting the requirements of federal (USDA) laws and regulations, which require up-to-date SCWQ plans for all farms that apply for benefits under a variety of federal USDA programs.

    - These efforts are ongoing.

5. The two SCDs will continue to assist farmers in meeting the requirements of Maryland laws and regulations, including:

    a) Maryland Agricultural Land Preservation Program requirements that participants develop and implement a SCWQ plan. The same plan requirements apply for the local land preservation programs and for Rural Legacy designation;

    b) Maryland water-quality and sediment-control requirements, which utilize SCWQ plans to address pollution concerns;

    c) Maryland state discharge permits for confined animal feeding operations, which require SCWQ plan components as part of a Comprehensive Nutrient Management Plan for such operations; and

    d) The Maryland Water Quality Improvement Act, which requires farmers to implement animal waste management measures as part of a complete nutrient management plan.

    - These efforts by the SCDs are ongoing.

6. The two SCDs will continue to encourage farm owners and operators in the reservoir watersheds to use the Maryland Agricultural Cost-Share program (MACS) to help offset the costs of best management practice (BMP) implementation.

    - These efforts continue.

7. The two SCDs will continue to provide information and assistance to farm owners and operators in the watersheds to help them utilize the Low-Interest Loan Agricultural Conservation Program to cover the cost of implementing conservation measures.

    - These efforts continue.

8. The two SCDs will continue to promote and support farmer participation in USDA financial assistance programs that provide funding or other incentives for the application of eligible BMPs on farms or for the removal of highly erodible areas from crop production.

    - The two SCDs continue to encourage farms to use these programs.

9. The two SCDs will continue to encourage and assist agricultural producers to comply with the requirements of their “nutrient management plans”, including the implementation of those soil-conservation, water-quality, and animal-waste-management BMPs which support the appropriate management of nutrient inputs to croplands.

    - Efforts continue.
    - The Maryland Water Quality Improvement Act of 1998 requires all farms that make $2500 or more annually (or have 8 or more animal units) to have and implement a nutrient management plan. Beginning July 2005, all such plans were required to address nitrogen and phosphorus as limiting nutrients, in accordance with the regulatory guidelines.

10. In support of the Maryland Water Quality Improvement Act of 1998, as well as the Reservoir Watershed Management Program, the Maryland Department of Agriculture (MDA) will continue to:

    a) Provide comprehensive educational programs developed for nutrient consultants, as well as operation-specific training and certification for farmers, nutrient applicators, and fertilizer users in urban/suburban areas;

    b) Offer related assistance to farmers through the MACS cost-share program;

    c) Support technical assistance provided through the SCDs and county Extension offices;

    d) Enforce the Act and its regulations, including taking action against noncompliant farms;

    e) Compile information and generate reports at the county and state levels on operator/farmer compliance with nutrient management plan requirements; and

    f) With the development of an advanced database system, may generate nutrient plan implementation reports at both the county and watershed levels.

    - MDA continues to carry out these functions and policies.

11. The signatories will work together to evaluate the pollution potential from horse operations located in the reservoir watersheds. The two SCDs will expand outreach and assistance to those operations.

    - During 2006, staff members reviewed literature on the water-quality impacts of sizeable horse operations. In general, the adverse effects of horse wastes and horse farms have not been studied as extensively as have the effects of cow, steer and swine operations.
    - MDA has compiled data on the horse populations in each reservoir watershed, drawing solely upon MDA's "nutrient management plan" database. In comparison with other data (the 2002 Maryland Equine Census), the MDA numbers seem to be missing significant numbers of horses. This needs to be pursued further.
    - At the end of 2007, the Baltimore County SCD and Carroll SCD was working with horse operations in the Loch Raven, Prettyboy and Liberty watersheds; projects included stream fencing, tree buffers and pasture management. The Small Equine project ended in approximately 2014. The project provided cost share for small equine operations, which are too small to qualify for the regular cost-share program.

12. MDA and the two SCDs will continue to target assistance to farmers with on-site problems having the potential to cause water pollution. Where polluting conditions are suspected to exist on a farm, the particular SCD will work with MDA and with MDE to follow the enforcement protocol developed pursuant to a Memorandum of Understanding among MDA, MDE, and the State Soil Conservation Committee.

    - Policy continues.

13. MDE will continue to inspect each site (often a farm) proposed for sewage biosolids application, and may issue a permit which specifies the allowed application rate, taking the sludge nutrient content into consideration. An MDE inspector also visits the site/farm at the time the biosolids are being applied, to verify that permit conditions are being met.

    - This regulatory program continues.

14. The Carroll SCD and the Baltimore County SCD will continue to report their agricultural pollution reduction programs to MDA through a central reporting system.

- Reduction programs continue to be reported through the MDA central reporting system, Conservation Tracker. Conservation plans and best management practices (BMPs) are assigned reduction credits.

Sediment Control and Stormwater Infrastructure

Continue:

1. Baltimore and Carroll Counties will continue to implement state-mandated stormwater management regulations for all new development (including residential, commercial and institutional.) The current county regulations, amended to adhere to MDE's year 2000 regulations and supporting Design Manual, provide for enhanced water quality protection and onsite groundwater recharge, as compared to the older local regulations. (The counties and the State Highway Administration are also subject to the state law, in connection with all new or reconstructed road projects.)

    - Baltimore and Carroll Counties continue to maintain delegation with their stormwater and sediment control programs, as required by the NPDES MS4 permits.

2. Baltimore County and Carroll County will strive to reach sediment goals for the reservoir TMDLs.
    - As of the 2021 reporting year, Baltimore County has achieved 2.3% of its sediment reduction goal for Liberty, and has exceeded the target for Loch Raven, according to the Chesapeake Bay Model, Phase 5. Prettyboy does not have a TMDL for sediment. Note that the model was updated to Phase 6, which includes changes in land use pollutant loading rates and restoration practice pollutant reduction rates; this will shift future calculations.
    - The Liberty Watershed is the only reservoir watershed in Carroll County with an approved sediment TMDL for the stormwater wasteload allocation (SW-WLA). As of the 2021 reporting year, through the implementation of various best management practices, Carroll County has achieved 38% of the sediment TMDL requirement in Liberty. The planned practices over the next 6 years that have been approved through the County's CIP will achieve 48% of the sediment TMDL requirement in the Liberty Reservoir Watershed.

3. Baltimore and Carroll Counties will continue to operate their respective programs for the periodic inspection of all existing stormwater management facilities in their jurisdictions. The two counties' programs meet state/federal requirements for stormwater facility approval, inspection and enforcement, as set forth in their federal/state NPDES/MS4 (municipal stormwater) permits, which are issued in Maryland by MDE.
    - Baltimore County and Carroll Counties continue to implement their stormwater programs per the requirements of their NPDES MS4 permit conditions.

4. Baltimore and Carroll Counties will continue their respective maintenance programs for all publicly-owned stormwater management facilities.

    - Baltimore and Carroll Counties continue their respective maintenance programs.

5. Baltimore and Carroll Counties, working in cooperation with their respective SCDs, will continue to operate sediment and erosion control programs county-wide, in order to limit sediment runoff from all new private construction and redevelopment sites. (The SCDs and the county agencies cooperate on sediment-control plan review and approval, while the county agencies do the inspection and enforcement.) Carroll County also enforces the sediment and erosion control regulations in the towns of Hampstead, Manchester and Westminster.

    - Baltimore County programs continue.
    - Carroll County continues to maintain delegation countywide its erosion and sediment control program per State and federal requirements, as required by the NPDES MS4 permits and State law.

6. MDE will continue to enforce sediment and erosion control on state agency construction projects. The Maryland State Highway Administration (SHA) provides sediment control inspection on its own construction projects.

    - Programs continue.

7. MDE will continue to carry out periodic reviews of the respective local sediment/erosion control programs and stormwater management programs.

    - MDE reviews erosion and sediment control programs every two years to ensure compliance with state requirements (known as biennial delegation review). This review process determines if continued inspection authority by the jurisdiction will be granted.
    - Baltimore County continues to receive delegation for sediment and erosion control inspection authority; at the time of this report delegation is in effect through June 2024.
    - MDE reviews Baltimore County's stormwater management program every two to three years, however in 2019 MDE modified their review process. The previous formal review has been replaced with three virtual training sessions and confirmation of attendance.
    - In 2020, MDE reviewed elements of Carroll County's programs, focusing on inspection and enforcement procedures. Based on this review, MDE found the program in compliance with the erosion and sediment control program requirements. MDE reviews Carroll County's programs every two years; the next review will be in fall 2022.

Sewerage System Infrastructure

Continue:

1. Baltimore and Carroll Counties will continue to operate sewage pumping stations located in the Liberty and Loch Raven watersheds in compliance with current state standards for backup systems, including secondary power sources and/or reserve storage capacity, in addition to backup pumps. This greatly reduces the chances of sewage overflows from the public collection systems which are adjacent to the two reservoirs.

    - Operations continue in compliance with the standards.

2. Baltimore and Carroll Counties will continue to reinforce the reservoir protection goals and policies which are contained in their master land-use plans.

    - Reservoir protection policies continue to be included in the master land-use plans.

Septic Systems

Continue:

1. Baltimore County will continue to administer the Bay Restoration Fund (BRF) Grant Program which provides financial assistance for income-eligible residents for septic system upgrades, repairs and public sewer connections.

    - The County continues to administer this program. Through the Bay Restoration Fund Septic System Upgrade Grant Program, Baltimore County Department of Environmental Protection and Sustainability (EPS) provides funding for the installation and the first two years of maintenance for onsite sewage disposal systems (OSDS) that employ the best available technology for nitrogen reduction (BAT). The funding is based on owner's income eligibility and prioritized based on property's proximity to the Chesapeake Bay, whether or not the septic system is failing.
    - Through the same grant program, Baltimore County EPS can fund connections to public sewer and abandonment of existing OSDS for properties in service areas with wastewater treatment plants (WWTP) that are meeting enhanced nutrient removal criteria (ENR) or Biological Nutrient Removal (BNR). As of 2022, both Patapsco and Back River WWTPs have been upgraded to meet ENR technology. Baltimore County is working to identify properties that will meet the grant criteria and encourage property owners to participate.
    - Both of these efforts will serve to reduce the impact of nitrogen to streams, reservoirs and the Chesapeake Bay and meet the targeted goals in the Watershed Implementation Plans.

2. Baltimore and Carroll Counties will continue to promote the proper operation and maintenance of septic systems by homeowners.

    - Baltimore County continues promotion through the development-approval process and by providing an online brochure, available at: http://resources.baltimorecountymd.gov/Documents/Environment/groundwatermanagement/osdsmaintguide2011.pdf
    - The Carroll County Health Department is responsible for the review and permitting of private septic systems. The Bureau of Environmental Health continues to provide detailed information on the operation and proper maintenance for an on-site sewage disposal system through their website, as well as manuals that are available at the Department's headquarters.

Urban Nutrient Management

Continue:

1. MDA will continue to operate a statewide training and certification program for commercial lawn care companies, which results in reduced nutrient application through the proper use of lawn fertilizers and pesticides.

    - MDA continues to train and certify commercial applicators. For information on Maryland's Lawn Fertilizer Law, view the MDA web page at https://mda.maryland.gov/Pages/fertilizer.aspx.

2. Baltimore County will continue to conduct programs involving street-sweeping, stormdrain-inlet cleaning, and storm pipe cleaning in its urbanized areas, in support of source control objectives by reducing pollutant inputs.

    - These programs continue to take place. By summer 2023, DPWT is expected have 2 new air regenerating sweepers. These will be used in the critical bay areas. Both these sweepers will greatly improve nutrient management compared to the current mechanical (broom) sweepers.

3. Carroll County will continue to regularly inspect inlets and storm sewers in commercial and industrial areas.

    - This program continues. Information on these inspections is included in the NPDES MS4 annual reports, which can be found at https://www.carrollcountymd.gov/government/directory/land-resource-management/protecting-carroll-county-waters-npdes/annual-reports/.

4. The two counties and Baltimore City will continue to evaluate a variety of urban best management practices under the technical work required by their NPDES/MS4 (municipal stormwater) permits, which are issued by MDE.

    - **Baltimore County**: Baltimore County instituted a long-term study of Scotts Level Branch (in the Gwynns Falls watershed), in an attempt to document overall water quality improvements in the stream as a number of planned urban runoff BMPs are installed there.

      In 2013, Baltimore County initiated a study on the pollutant removal effectiveness of self-converted dry ponds. Many of these older ponds have converted to shallow marsh or forested wetlands and are perhaps providing greater pollutant removal efficiency than the original design that focused on water quantity management only. This data is needed by the county to better target its restoration efforts. Baltimore County is also monitoring a number of restoration projects for effectiveness in restoring the aquatic community.

    - **Carroll County:** As part of Carroll County's NPDES MS4 permit requirement, issued by MDE, BMP effectiveness monitoring has been performed in the Liberty Reservoir Watershed since 2000. With the recently updated monitoring guidelines from MDE, Carroll County is in the process of relocating the established location to begin a new long-term effectiveness study within the Loch Raven Watershed. To further evaluate the effects of stormwater management to the receiving streams on a sub-watershed scale, the County has established a trend monitoring location in each of the Chesapeake Bay River segments, as well as trend monitoring sites for e-coli in each watershed with an EPA approved TMDL for bacteria.

Land-Use Planning and Zoning

Continue:

1. Baltimore County will continue to apply Resource Conservation (RC) zoning in the reservoir watersheds, with allowed residential densities and performance standards that are protective of water quality.

- Baltimore County's zoning policies and practices continue to protect against land conversion in the reservoir watersheds that likely would degrade water quality. Three tables indicating acreage of resource conservation zones in Baltimore County portion of the reservoir watersheds over time is provided below. No new RC acres have been created since 2019.

Table 1. Liberty Reservoir Watershed - Acres Zoned Resource Conservation

Year	Area (in Acres)	Percent of Total
2000	16753.2	95.2%
2004	16753.0	95.2%
2008	16748.1	95.2%
2012	16736.3	95.1%
2016	16736.3	95.1%
2020	16727.1	95.1%

Table 2. Prettyboy Reservoir - Acres Zoned Resource Conservation

Year	Area (in Acres)	Percent of Total
2000	25,472.8	99.7%
2004	25,472.5	99.7%
2008	25,472.5	99.7%
2012	25,472.5	99.7%
2016	25,472.5	99.7%
2020	25,462.7	99.7%

Table 3. Loch Raven Reservoir - Acres Zoned Resource Conservation

Year	Area (in Acres)	Percent of Total
2000	126,685.0	90.8%
2004	126,973.7	91.0%
2008	126,820.9	90.9%
2012	126,815.5	90.9%
2016	126,892.8	90.9%
2020	126,925.3	90.9%

2. Baltimore County will maintain insofar as possible the current limits of extension of the Urban-Rural Demarcation Line (URDL) in the Loch Raven and Liberty watersheds. (The Prettyboy watershed lies well outside of the URDL line.) The URDL essentially represents Baltimore County's urban growth boundary.

    - Policy continues. The URDL boundary has not changed since 2012 and is not expected to change in the future.

3. Baltimore and Carroll Counties will maintain the current extent of conservation and agricultural zoning in the reservoir watersheds, insofar as possible.

- The net acreage of Baltimore County reservoir watershed land protected through Resource Conservation zoning remained at approximately 92.5% following the 2020 Comprehensive Zoning Map Process.
- The current extent of agricultural and conservation zoning in Carroll County has been maintained to date. However, the adopted Land Use Designations on the County comprehensive plans may not maintain this strategy if a comprehensive rezoning is implemented to make the zoning consistent with the Land Use Designations.

4. Baltimore and Carroll Counties will protect the reservoir watersheds by limiting insofar as possible additional urban development zoning within the reservoir watersheds.

    - Baltimore County limits urban development zoning in the reservoir watersheds by maintaining the current extent of agricultural and conservation zoning, as well as maintaining the Urban Rural Demarcation Line (URDL). The URDL was established in the 1960's for efficiency of infrastructure investment and to preserve natural and agricultural areas.
    - The current extent of agricultural and conservation zoning in Carroll County has been maintained to date. However, the adopted Land Use Designations on the County comprehensive plans may not maintain this strategy if a comprehensive rezoning is implemented to make the zoning consistent with the Land Use Designations.

5. The Baltimore County and Carroll County master land-use plans will continue to support the goals of the Reservoir Watershed Management Agreement and the commitments made in this Action Strategy.

    - Policy continues in effect.

Resource Protection and Restoration; Development Guidelines

Continue:

1. Baltimore and Carroll Counties will continue to implement the sensitive-area protection provisions of their development regulations for non-tidal wetlands, steep slopes, floodplains and water courses, forests, water bodies, and natural land areas. These regulations are intended to protect important ecosystem functions and tributary stream quality.

    - Policies continue in effect.

2. Baltimore County will continue to implement a comprehensive forest resource management program in the watersheds, with the goal of ensuring the ecological and economic sustainability of forest resources as a means to help stabilize watershed hydrology and to help protect water quality.

    - Baltimore County EPS has forest management plans for public lands throughout the county, such as the Oregon Ridge Forest Health Plan, and a few on private land.

3. The signatories will continue to encourage the Department of Natural Resources to manage its land holdings in the reservoir watersheds so as to benefit reservoir protection.

    - There is currently no formal coordination between signatories and DNR on management of their land holdings in the reservoir watershed.
    - The primary land in Carroll County owned by DNR is the Morgan Run Environment Area, which is a natural area comprised of 1,930 acres and popular for hiking, equestrian trails, and trout fishing.

4. Baltimore County will continue to implement its deer management program in which deer surveys and harvest operations are conducted at Oregon Ridge and Cromwell Valley Parks. The goal of the program is to bring the number of deer at the parks to a sustainable population.

    - The County has an on-call contract with the USDA APHIS for Wildlife Management Services. Each year the USDA conducts a survey to determine the deer population at County parks (Cromwell Valley and Oregon Ridge). If surveys indicate an excess in the deer population, night-time sharp shooting is conducted to bring the deer population down to the recommended population densities.

5. Baltimore County will continue to implement its capital improvement program for stream restoration and for upgrading of existing stormwater best management practices to stabilize selected stream channels and to improve water quality in the reservoir watersheds.

    - Restoration program continues.

6. Baltimore and Carroll Counties will continue to apply their regulations for the design, construction and operation of golf courses. These guidelines address water quality and habitat-protection issues, including appropriate nutrient application and pesticide management, as well as the preferred designs for wetlands crossings and guidance on the removal of vegetation.

    - Policies continue in effect.
    - More detail on Baltimore County strategies include the following:
        - Practice integrated pest management on a regular basis to highlight scouting and targeted applications. Scouting is the process of routinely checking crops for pests and disease to inform management decisions.
        - County courses employ 17 certified or trained and registered employees for the application of fertilizer and pesticides.
        - Operate calibrated equipment that is checked to verify output prior to use.
        - Pursue new technologies that introduce lower usage rates of pesticides.
        - Utilize laboratory conducted soil testing for nutrient analysis, and
        - Apply foliar absorbed fertilizers to minimize runoff potential.

    - No changes have been made in Carroll County for golf courses within the reservoir watersheds. However, an interesting example of environmental BMPs is Wakefield Valley Golf Course, which drains west to the Potomac. This golf course is no longer functioning as a golf course. It has been turned over to the City of Westminster, which is implementing long-term environmental plans, such as walking paths and tree plantings. The County has partnered with the City on some of the tree planting projects.

Management of Municipal Watershed Property

Continue:

1. Baltimore City will continue its efforts to maintain diverse and vigorously-growing forest communities on the City-owned watershed properties surrounding the three reservoirs.

    - These efforts continue.

- Baltimore City is working with a consultant on the development of a comprehensive watershed management plan for the source water reservoirs. The project will identify and prioritize watershed and source water management actions to preserve and protect Baltimore City's water resources and serve as a framework to identify and prioritize water resource management needs. The City will update the membership with outcomes of the study as they are available.

2. When and where appropriate, Baltimore City will continue to implement the recommendations of the Comprehensive Forest Conservation Plan for Long-term Watershed Protection on the City of Baltimore's Reservoirs, which was prepared by the state DNR Forest Service in 2003. These recommendations are aimed at improving the health, diversity and sustainability of the forests surrounding the lakes.
    - See response above to point #1.

3. New or expanded recreational or commercial facilities should not be constructed in the City-owned watersheds. Existing facilities should be managed so as to not represent a significant threat to the health of the City-owned forests, nor to the water quality of the reservoirs.
    - The policy continues in effect.

4. Baltimore City will continue to take action to discourage or prevent unauthorized recreational uses of the City-owned watersheds which present a significant threat to public safety, forest health, and/or reservoir water quality.
    - See response above to point #1.

Toxics, Pathogens, Potential Spills, Road Deicing, and Disinfectant Byproduct Precursors

Initiate:

1. The Reservoir Technical Group will promote measures to reduce road salt runoff in the reservoir watersheds in support of the requirements within the NPDES MS4 permits. The RTG will support the Counties' development of their Salt Management Plans (SMPs), with a goal of reversing the trend of higher concentrations of sodium chloride in the waters feeding the reservoirs.
    - Baltimore County DPWT has outfitted all snow removal equipment outside of the Urban Rural Demarcation Line (URDL) with independent salting controls. Just over a quarter of the entire fleet has been replaced and all new vehicle replacements are being equipped with this technology. DPWT also continues to have yearly staff reviews of our Snow Management Plan which includes best practices of salt usage. This information is also now shared with their contractual snow vendors.
    - Carroll County DPW developed a salt management plan. The plan will be reviewed to determine if updates are needed as a result of the new NPDES MS4 permit, for which issuance by MDE of the final permit is anticipated in fall 2022. A public outreach piece for homeowners will also be completed in fall 2022.

2. Reservoir Program signatories will review and comment on the existing arrangements and established procedures for notification of all appropriate agencies in the event of a significant spill or discharge of a hazardous substance in any of the reservoir watersheds.

    - Facilities are required to report storage of established quantities of hazardous materials to the State Emergency Response Commission (SERC) and to their Local Emergency Planning Committee (LEPC) using the MD Tier II Reporting System. Local jurisdictions in Maryland can access this system and use it for planning purposes. Signatory jurisdictions have reviewed the procedures established by the Emergency Planning and Community Right to Know Act (EPCRA) for facilities to report the release of hazardous substances. There is coordination between signatory jurisdictions and Maryland Department of Emergency Management (MDEM), the SERC, and the Nuclear Regulatory Commission (NRC) regarding release notifications.

3. Signatories will review information that is available on prevention of leaks or spills of hazardous materials directly into the reservoir as well.

    - See response above.

4. As required under the America's Water Infrastructure Act, Section 2018 MDE will notify community water suppliers, such as the City of Baltimore, of releases of hazardous substances that may potentially affect their source water. It also requires MDE to provide the City of Baltimore with access to hazardous chemical inventory data for facilities in their source water areas, if requested.

    In order for MDE to provide notice to community water systems that could be affected, the facilities are required to immediately report any release of Extremely Hazardous Substance and Hazardous Substances listed under CERCLA to the State Emergency Response Commission.

    - Requirements continue to apply.

5. As required by law, signatories with water systems serving populations more than 3,300 will update risk assessments and emergency response plans associated with hazardous substances and spills.

    - Baltimore City has sent certification to EPA of the completion of their Risk and Resiliency Assessment and Emergency Response Plan.
    - The public water systems in Carroll County which are located within the reservoir watersheds – Freedom, Hampstead, Manchester, and Westminster – have sent certification to EPA of the completion of their Risk and Resiliency Assessments and Emergency Response Plans.

Continue:

6. MDE, working in cooperation with the Hazardous Waste Facility Siting Board, will enforce the provision in State law which prohibits the siting of any hazardous waste facility that would "adversely affect" a public water supply, such as the reservoirs.

    - This policy continues in effect.

7. Program participants will continue to stay abreast of new developments and new issues relating to potential toxics problems in the reservoirs.

    - This policy continues in effect.

- The signatories to the *2005 Reservoir Watershed Management Agreement* do not have evidence of a toxics problem in the reservoirs at this time. Baltimore City labs routinely screen for some specific toxic compounds in the raw water.

8. MDE will continue to support fish-consumption "advisories" for fish taken from the three reservoirs, based on the potential for bioaccumulation of mercury present in the water column. Much of the source of the mercury is atmospheric deposition, generally from out-of-state.
    - This policy continues in effect.

9. Baltimore City will continue to analyze the raw (untreated) reservoir water for certain pathogens, in compliance with federal EPA requirements (the Long-Term Enhanced Surface Water Treatment Rule.)
    - The City continues to be in compliance with EPA's Long-term 2 Enhanced Surface Water Treatment Rule. This includes daily analysis of the raw water entering the two treatment plants for total coliform bacteria and for fecal coliform or E. Coli bacteria, and monthly analysis of the water for Giardia and Cryptosporidium.

10. Baltimore City will continue to track sodium and chloride levels in both the raw water and the finished water. This will enable the Reservoir Program participants, working through the RTG, to establish a goal for sodium concentration in the lakes, should they choose to do so.
    - Baltimore City continues to sample for sodium and chlorides.

Coordination and Administration of Reservoir Watershed Protection Program

Continue:

1. The six major jurisdictions in the Baltimore region will continue to fund the operation and coordination of the Reservoir Watershed Protection (Management) Program by making annual payments to the Baltimore Metropolitan Council, with each jurisdiction's contribution based in part on the volume of Baltimore City or (raw) reservoir water consumed by that jurisdiction in the previous fiscal year.
    - The jurisdictions have continued to support the regional program.

2. Program participants, working through the Reservoir Technical Group, will prepare a report on progress made in implementing the Action Strategy for the Reservoir Watersheds, at a minimum once every four years.
    - This report covers decisions made and actions taken up to 2021. The previous report covered actions taken in 2016 and 2017.

3. Signatories will send representatives to meetings that will participate in the activities of the program to an extent that is appropriate to the program goals.
    - Signatories continues to send representatives to meetings that participate in program activities.

Public Awareness

Continue:

1. Reservoir Program participants will continue to identify and pursue opportunities for public education programs relating to reservoir protection.
    - Baltimore County has a variety of county-wide outreach and awareness programs focused on waterway health, especially in regard to stream protection, litter, and proper pet waste management.
        - Anti-Litter Efforts and Materials – including info on how to organize a cleanup, Clean Green 15 litter cleanup contest with Baltimore County Public Schools, Name Our Streams Contest, Adopt a Road Program, and Litter-Smart Business Program
        - Pet Waste Awareness - tabling at events and pet-related locations, coordination with Baltimore County Animal Services to provide outreach materials to pet adopters, pet waste station grants to communities.
        - Forest Sustainability Program – tree give aways and tree planting opportunities for residential yards and reforestation; forest and tree resources – compilation of resources; "How to Attract Pollinators" booklet
        - Groundwater Management Educational Resources – info for homeowners on wells and onsite sewage disposal systems (septic)
        - Social Media - The Department of Environmental Protection and Sustainability (EPS) utilizes the Clean Green Baltimore County Facebook page to promote environmental stewardship and watershed association activities.
    - Carroll County implements a public outreach program throughout the county regarding water quality and pollution prevention. Not all efforts are specific to the reservoirs, but water quality outreach in general is also applicable to the reservoirs. The Department of Land & Resource Management hosts a Facebook page, named "Carroll Environment," that can periodically post educational and awareness information related to the reservoirs and their watersheds.
2. Reservoir Program participants will continue to use the Baltimore Metropolitan Council website to disseminate progress reports, technical reports, current information and to promote public awareness about the Reservoir Program and its activities and accomplishments.
    - Important information is being shared on the BMC website through links to local jurisdiction Annual MS4 Reports and outreach material.
3. Reservoir Program signatories will continue to assist and encourage the efforts of local citizens' organizations which are concerned about watershed management issues and reservoir protection.
    - Baltimore County's Watershed Association Restoration, Planning and Implementation Grant provides grant funding to local watershed associations and community organizations. In fiscal year 2022, six grantees were awarded a total of $346,000. Grants fund staff time to plan and implement restoration projects in watersheds. Presently, the Gunpowder Valley Conservancy (GVC) is the only organization operating in reservoir watersheds in Baltimore County, primarily in the Loch Raven Reservoir watershed. With assistance from the County's grant program, GVC installs rain gardens, micro-bioretention practices, and plants acres of trees each year.

Funding Opportunities

Initiate:

1. The RTG will work to both understand the reasons for limitations on grant funding opportunities for best management practices within reservoir watersheds, and to then communicate the need for funding.

    - MDE's current Advancing Stormwater Resiliency in Maryland (A-StoRM) initiative includes the need for watershed management studies to address flooding. Historically, these studies were led by NRCS, since the watershed boundaries spanned more than one jurisdiction. MDE is in the process of determining what should be addressed by these studies and by whom but anticipates a requirement for these studies will be incorporated into regulations and/or stormwater permits at some point in the near future. MDE also anticipates that there may be funding available for conducting these studies and developing associated watershed plans.

2. The RTG will review and pursue opportunities under the 2018 Farm Bill that contains provisions for States to identify local priority areas for drinking water protection and improving water quality.

    - RTG will continue to explore/discuss relevant funding sources as they become available.

3. The RTG will work with MDE to expand eligibility within existing grants and loans programs to include the reservoir areas as priorities.

    - RTG will continue to explore/discuss relevant funding sources as they become available.