
MAKING STORMPRINT BETTER

A Critical Step in Restoring the Chesapeake Bay Through Expanded Citizen Involvement in Stormwater BMP Maintenance

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Summary

[StormPrint](#) serves as the primary means by which Maryland watershed advocates and other citizens can learn of the stormwater Best Management Practices (BMPs) present in their area. Examples of these BMPs include ponds, filters, and bioretention (Rain Garden) facilities.

Since the 1970s, more than 32,000 stormwater BMPs have been installed in Maryland. These facilities reduce the following negative effects of growth: flooding, stream channel erosion, runoff pollution, and the loss of groundwater recharge which reduces dry-weather inflow to wells, wetlands, streams and other waters.

The waters closest to 70% of all Maryland homes are affected by stormwater runoff from developed areas. Therefore, maintaining existing BMPs in good working order is essential to preserving the health of the waters nearest most Maryland homes. By providing easy access to facility location, type and other information, StormPrint is critical to citizen efforts to support BMP inspection and maintenance programs.

While the Maryland Department of the Environment (MDE) is to be commended for making StormPrint available, the usefulness of this resource is limited by an apparent high degree of inaccuracy. Based upon a study of 175 BMPs located in the ten Maryland Phase I, MS4 jurisdictions¹, only 60% of these BMPs were accurately located or correctly labeled by StormPrint.

This unacceptably high degree of inaccuracy has severe implications for efforts to identify and correct the sources of pollution degrading the Chesapeake Bay and other Maryland waters. This is because the same inaccurate data appears to serve as the basis for both StormPrint and the models used to prepare MS4 permits, Total Maximum Daily Loads (TMDL) and Watershed Implementation Plans (WIP).

StormPrint inaccuracies also hamper the ability of watershed advocates to augment government efforts to inspect and maintain BMPs. Two factors are about to cause inspection requirements to greatly expand. Under the new Environmental Site Design requirements there will be many more BMPs per site, most of which will require an annual inspection instead of the current once every three-year inspection.

It is doubtful whether government will ever have the funds needed to inspect all of these BMPs. A dramatic increase in public involvement is the only scenario which might allow us to prevent the 33% to 100% BMP failure rate seen in areas with inadequate inspection resources. An experiment underway in the Severn River watershed has shown that it is realistic to believe citizens can effectively augment government efforts to maintain BMPs in good working order. An accurate and expanded StormPrint is essential to this form truly full public participation.

¹ MS4 is the Municipal Separate Storm Sewer System. The ten [Maryland Phase I MS4 jurisdictions](#) are: Anne Arundel County, Baltimore City, Baltimore County, Carroll County, Charles County, Frederick County, Harford County, Howard County, Montgomery County and Prince George's County. For further detail visit:

Introduction

In 1979, the author published one of the first scientific research papers documenting the relationship between watershed development and aquatic resource health.² Even since then I have been actively engaged in improving stormwater management in Maryland.

From the start it was obvious that the effectiveness of stormwater management would hinge on the level of public support. Without active public support stormwater budgets would become easy targets for those seeking to divert funds to more visible (and popular) programs. Public support would also be critical to helping agencies resist pressure from the regulated community to relax aquatic resource protection standards.

The lack of easy access to information on the location, type and condition of BMPs has always been a hindrance to greater public involvement in stormwater management. Therefore I was delighted when MDE first posted some of this information online via StormPrint. However, when I checked out the BMPs serving my community in Baltimore County I saw a disturbing number of errors.

The facility serving my home was labeled as a porous pavement parking lot but is actually an extended-detention dry pond. I then compared StormPrint accuracy in other parts of the State by looking up BMPs I'd encountered while helping citizens with a variety of threats to neighborhoods and the environment. I found StormPrint accuracy to be very good in some areas, but quite poor in others.

Of course I informed MDE of these inaccuracies but never received a reasonable response to my questions regarding corrective action. This prompted me to initiate this study to determine if the problems I perceived were real and, if so, to hopefully help generate the public support MDE needs to improve this valuable resource.

How This Study Was Conducted

This study was conducted by first printing our excerpts of StormPrint maps for each of the ten Maryland Phase I, MS4 jurisdictions. The maps included residential and commercial areas along with institutional and other land uses. Both a street map and an aerial map was printed for each survey area. The BMP type for each facility was then noted by hand since StormPrint does not presently allow printing this information on the map. Underground BMPs were the only facilities generally not included in the study.³

An attempt was made to locate each BMP in the field. A total of 161 StormPrint BMP locations were visited. Some BMPs were found as much as 600 feet from the location given by StormPrint. Of the 161 BMPs, 76% were found.

² Urbanization and stream quality impairment. [Water Resources Bulletin](#) 15(4):948-963.

³ According to the 2010 Maryland Urban BMP Database, only 6% of all BMPs are underground.

Of the 161 BMPs, 65% were correctly labeled as to type. The incorrect type can make a big difference in assumptions made about pollutant retention effectiveness. For example, an extended-detention dry pond near the author's home was labeled as porous pavement by StormPrint. These two facilities can remove 20% and 50%, respectively, of the nitrogen delivered in runoff from impervious surfaces.⁴ An incorrectly labeled BMP is also more difficult to find and evaluate.

A total of 14 BMPs were found which were not shown on the StormPrint maps. These BMPs were encountered while driving within the area covered by each map. These facilities brought the total number of BMPs evaluated to 175.

Following are links to documentation (maps and photos) for the BMPs evaluated in each of the ten jurisdictions.

- Anne Arundel County: <http://ceds.org/audit/AACODocumentation.pdf>
- Baltimore City: <http://ceds.org/audit/BaltoCityDocumentation.pdf>
- Baltimore County: <http://ceds.org/audit/BaltoCODocumentation.pdf>
- Carroll County: <http://ceds.org/audit/CarrollCODocumentation.pdf>
- Charles County: <http://ceds.org/audit/CharlesCODocumentation.pdf>
- Frederick County: <http://ceds.org/audit/FrederickCODocumentation.pdf>
- Harford County: <http://ceds.org/audit/HarfordCODocumentation.pdf>
- Howard County: <http://ceds.org/audit/HowardCODocumentation.pdf>
- Montgomery County: <http://ceds.org/audit/MontgomeryCODocumentation.pdf>
- Prince George's County: <http://ceds.org/audit/PrinceGeorgesCODocumentation.pdf>

An Excel file containing the results overall and for each jurisdiction is posted at: <http://ceds.org/audit/StormPrintAccuracy.xls>.

Results & Discussion

Table 1, on the next page, shows that of the ten MS4 jurisdictions StormPrint was 100% accurate in Frederick, Howard and Prince George's counties. Accuracy was poorest in Baltimore City and Baltimore County - 13% and 19%, respectively. The results were sent to inspection officials in each jurisdiction along with a request to verify the findings. Only two jurisdictions provided corrections: Charles and Harford counties. There were only a few actual errors. Of course the findings were corrected.

⁴ *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated*, published by MDE, June 2011: http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/NPDES%20Draft%20Guidance%206_14.pdf

Table 1: StormPrint Accuracy: A Survey of Stormwater BMPs in the Ten Maryland MS4 Phase I Jurisdictions

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StormPrint: <http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/stormprint/Pages/index.aspx>

JURISDICTION	NUMBER OF STORMPRINT BMPs EVALUATED	AVERAGE DISTANCE (feet) BMP WAS FROM STORMPRINT LOCATION	NUMBER OF STORMPRINT BMPs FOUND	PERCENT OF STORMPRINT BMPs FOUND	NUMBER OF BMPs CORRECTLY LABELED BY STORMPRINT	PERCENT OF BMPs CORRECTLY LABELED BY STORMPRINT	NUMBER OF BMPs FOUND WHICH WERE NOT SHOWN ON STORMPRINT	TOTAL NUMBER OF BMPs EVALUATED	PERCENT OF TOTAL BMPs ACCURATELY SHOWN BY STORMPRINT
Anne Arundel County	18	16	10	56%	8	44%	0	18	44%
Baltimore City	15	0	5	33%	2	13%	1	16	13%
Baltimore County	24	123	10	42%	5	21%	2	26	19%
Carroll County	13	0	12	92%	11	85%	0	13	85%
Charles County	17	59	14	82%	12	71%	4	21	57%
Frederick County	10	43	10	100%	10	100%	0	10	100%
Harford County	23	0	22	96%	20	87%	7	30	67%
Howard County	15	0	15	100%	15	100%	0	15	100%
Montgomery County	16	120	15	94%	12	75%	0	16	75%
Prince George's County	10	0	10	100%	10	100%	0	10	100%
Total	161		123		105		14	175	
Average	16	36		76%		65%			60%

StormPrint is the primary means by which watershed advocates and other members of the general public can learn of stormwater Best Management Practices (BMPs) in their area. These BMPs include ponds, rain gardens, bioretention facilities, and other measures designed to remove pollutants entrained in runoff from rooftops, streets, driveways, parking lots and other impervious surfaces. Highly-effective BMPs remove a large percentage of the pollutants and also reduce the volume of runoff by releasing it into underlying soils. Recent surveys have found that a large percentage of Maryland's 32,000+ existing stormwater BMPs are no longer functioning due to inadequate maintenance. Up to a third of existing impervious area in many urban and older suburban watersheds drains to existing BMPs. If all were working properly the streams and creeks draining these watersheds would be far healthier. StormPrint is the starting point for advocates seeking to assess the condition of BMPs in their watershed. But there appears to be wide variations in the accuracy of StormPrint from jurisdiction to jurisdiction.

This survey was initiated to determine if this appearance was accurate. Because of limited resources, the survey was limited to the ten MS4 Phase I jurisdictions. Within each jurisdiction maps showing two to three clusters of BMPs were downloaded from StormPrint. The type of each BMP was noted on the maps by hand. A visit was then made to each to answer the following question: Could a typical watershed volunteer or staff person find the BMP using the information provided by StormPrint? Once a BMP was found then the distance between the actual location and that shown by StormPrint was noted. Also noted was whether the actual BMP type was the same as that given in StormPrint. Finally, a number of BMPs not shown on StormPrint were encountered while driving the map areas. These BMPs were noted as well.

The table above shows considerable inaccuracy in a number of jurisdictions. While this limits the usefulness of StormPrint as a tool for finding BMPs, there's an even greater concern. StormPrint is based upon the same data used to develop estimates of pollutant loads for TMDLs and WIPs. Given the overall 41% error rate, this could cause TMDL-WIP estimates to be off by a considerable margin.

StormPrint is based upon data provided by local jurisdictions to MDE. This same data serves as the basis for projections of urban-suburban pollution loads used in the Chesapeake Bay Model and for other planning efforts, such as MS4 permits, Total Maximum Daily Loads (TMDL) and Watershed Implementation Plans (WIP). If StormPrint and modeling input data is the same, then the 40% error rate could cause the accuracy of load estimates to be off by a considerable margin.

MDE and the Chesapeake Bay Program are aware of the inaccuracies in not only stormwater BMP databases but that for other pollution sources as well. In fact, the Bay Program has convened a [Best Management Practices Verification Committee](#) to address this issue. However, a looming crisis with regard to inspection resources increases the urgency of making StormPrint better.

Stormwater BMP inspection responsibilities are about to vastly outstrip the resources of most local governments and that of state-federal agencies. There are at least 32,000 stormwater BMPs present in Maryland.⁵ Most were built prior to the adoption of Environmental Site Design (ESD) requirements in 2009. A typical pre-ESD development site would have two or three stormwater BMPs. With ESD the number of BMPs per site is typically one or two dozen!

Presently, MDE requires an inspection of stormwater BMPs once every three years.⁶ Chesapeake Bay Program guidance calls for verifying the function of stormwater filtering BMPs annually in order to claim credit for pollutant removal.⁷ Most ESD practices are filtering BMPs.

So we have two factors converging that are about to explode the number of BMPs requiring an inspection.

One full-time inspector can evaluate about a thousand stormwater BMPs in a year.⁸ Table 2, on the next page, shows the results of a CEDS survey of stormwater BMP inspection capabilities and workloads in the ten Maryland Phase I, MS4 jurisdictions. Note that we are awaiting a response from Baltimore City and Prince George's County. Of the remaining eight jurisdictions, five are meeting the once every three year inspection requirement, one is partially meeting the requirement and two are falling short. Only one is inspecting facilities annually.

⁵ MDE used to make the Maryland Urban BMP Database available to the public. The last database provided to CEDS (in 2010) showed about 32,000 BMPs in Maryland. MDE refused requests in 2012 to provide an updated file.

⁶ Code Of Maryland Regulations (COMAR) [26.17.02.11A](#)

⁷ See page 6-51, in [Chesapeake Bay Phase 5.3 Community Watershed Model](#).

⁸ Personal communication with Mr. John Peacock, Chief of Anne Arundel County Environmental Programs and Infrastructure Inspections.

Table 2: Phase I MS4 Jurisdiction Stormwater Inspection Capabilities & Workloads

Jurisdiction	Number of Inspectors	Number of BMPs	BMPs Per Inspector	BMPs Inspected Annually	BMP Inspection Frequency (Years)
Anne Arundel County	1	11,000	11,000	1,000	11.0
Baltimore City	<i>Awaiting data from jurisdiction</i>				
Baltimore County-Private	3	1,728	576	1,158	1.5
Baltimore County-Public	1	1,153	1,153	135	8.5
Carroll County	4	1,005	251	180	5.6
Charles County	1	1,192	1,192	472	2.5
Frederick County	3	860	287	287	3.0
Harford County	1	1,000	1,000	500	2.0
Howard County	3	3,500		1,000	3.0
Montgomery County	6	4,600	767	5,900	0.8
Prince George's County	<i>Awaiting data from jurisdiction</i>				
Total	23	26,038	16,225	10,632	
Average	3	2,893	2,028	1,181	6.7

Of the eight jurisdictions, Anne Arundel County has the greatest shortfall with regard to stormwater BMP inspections. In 2001, the County had seven full-time inspectors which was then slashed to one for reasons that defy logic. For the past eleven years the County has struggled with but one inspector to cover 11,000+ BMPs. While the County staff are very dedicated and capable, they are simply too few in number. As a result anywhere from a third to 100% (depending on type) of Anne Arundel County stormwater BMPs are failing.⁹

Many of these BMPs could be keeping 20% to 50% of the incoming nitrogen load out of the Bay, but actually trap little.¹⁰ Of the 11,000+ BMPs, 83% are privately maintained. Up to a third of the impervious area in some watersheds drains to existing BMPs. There is no action that would reduce Anne Arundel County pollution loads more quickly or substantially than restoring the inspection resources required to enforce BMP maintenance requirements.

The preceding illustrates what can happen when inspection and enforcement capabilities fail to keep up with BMP numbers. Again, the number of stormwater BMPs is about to mushroom due to Environmental Site Design and the tripling of inspection frequency. It is difficult to fathom how government will ever provide the inspectors needed to evaluate all of these BMPs. Frankly, the only scenario which offers the hope of monitoring all BMPs for maintenance needs is a dramatic increase in public involvement.

Most stormwater BMPs can be evaluated by volunteers with as little as a half-hour of training.¹¹ Trespassing is not needed since most BMPs can be viewed from adjacent public areas. A two-person team of volunteers can evaluate three BMPs per hour.

The [Severn River Association](#) - America's oldest watershed organization - is engaged in an experiment to enlist those who live near stormwater BMPs in monitoring for maintenance needs and in performing routine upkeep like replacing dead vegetation and mulch. An accurate source of up to date stormwater BMP information is essential to engaging the public in this essential activity. Therefore, resolving the accuracy issue and making other improvements to StormPrint is critical if we are to succeed in this latest "new" effort to restore the Chesapeake and the thousands of miles of Maryland waterways degraded by existing and shortly to come growth. Without this and other innovative approaches we may well find ourselves another 20 years into this latest Bay restoration effort with the same result as with past efforts: the Bay even more degraded than it is today.

⁹ The 33% to 100% BMP failure rate is documented in the [Severn River Preliminary Watershed Audit](#), published by Community & Environmental Defense Services, November 2011.

¹⁰ Ibid.

¹¹ For an example of a stormwater BMP citizen monitoring effort visit: ceds.org/raingarden

Suggested Improvements

Besides resolving the inaccuracy of StormPrint, the following improvements should be made:

1. Presently the StormPrint *Print* function only allows printing a map showing BMP locations. It would be helpful to have the ability to print out maps with BMP types and an identifier such as the sequence number (SQX) from the Maryland Urban BMP Database.
2. It should be possible to download a spreadsheet of the BMPs within a watershed, a county, a city or other geographical areas. The spreadsheet should include the following data which already exists in the Maryland Urban BMP Database:
 - Facility identifier known as SQX;
 - Report Source (government unit that generated BMP data);
 - Coordinates like latitude-longitude compatible with commonly used GPS devices;
 - Subbasin (there are 20 six-digit subbasins in Maryland);
 - MDE 8-Digit Subwatershed (138 in Maryland);
 - Structure Type;
 - Year Built;
 - Drainage Area; and
 - Land Use.
3. StormPrint uses three colors to denote BMPs built during various periods. Gray is used for the “undetermined BMP Year” symbol but is hard to see on the aerial photo layer.
4. The Chart and Bookmark options do not seem to work.
5. The StormPrint Search function does not seem to work.
6. The following information should also be made available via StormPrint:
 - Date of last inspection;
 - Facility condition as determined by the most recent inspection; and
 - Date by which any necessary repairs are to be made.

A Single Online Source of All Watershed-Specific Information

Thanks to the leadership of Governor Martin O’Malley, all Marylanders benefit from a number of online environmental information resources including [BayStat](#), the Maryland Environmental Resources Land Information Network ([MERLIN](#)), MDE’s reported [sewer overflows webpage](#), and about a dozen others. Many of those concerned about aquatic resources seek information for a specific waterway or watershed. Presently the user must go from one website to another to gather all that is known about a watershed. And each site has its own quirks that takes time (and

much patience) to learn. It would be extremely helpful if there was one website where the user could enter a watershed name then gain access to all available information.