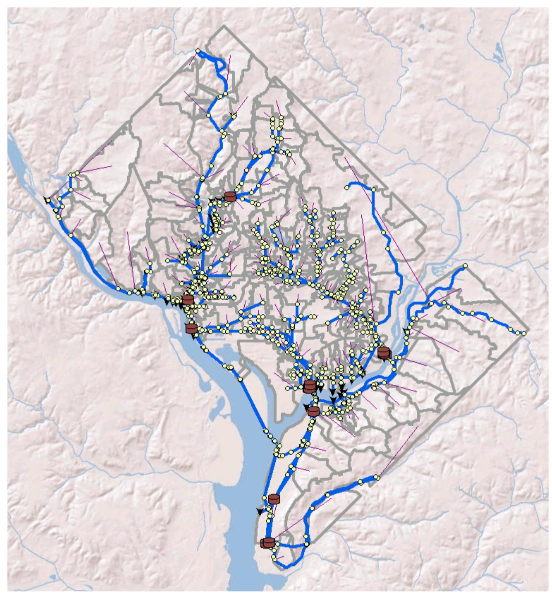

Consolidated Total Maximum Daily Load (TMDL) Implementation Plan Methodology

Prepared for:
District Department of the Environment

Final

June 17, 2014

DISTRICT DEPARTMENT OF THE ENVIRONMENT

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The following organization, under contract to the District Department of the Environment (DDOE), prepared this report:

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Final Total Maximum Daily Load (TMDL) Implementation Plan Methodology

This *Final Consolidated Total Maximum Daily Load (TMDL) Implementation Plan Methodology* document (the "Methodology document") is being submitted to the District Department of the Environment (DDOE) under this cover. The Methodology document is the final update from the *Draft Consolidated Total Maximum Daily Load (TMDL) Implementation Plan Methodology* document, which was submitted to stakeholders on January 30, 2014. DDOE received comments on the draft Methodology document from several stakeholders, including the Interstate Commission on the Potomac River Basin (ICPRB), the National Resources Defense Council (NRDC), and DC Water. Comments from ICPRB were technical in nature and clarifications were made in the text of the document to address ICPRB comments, particularly to the discussions of modeling and data management issues throughout Section 4. Comments from DC Water provided suggestions on how best to address TMDLs for toxic and organic contaminants and did not require changes in the document. Comments from NRDC were addressed by revising text. A summary of NRDC's comments and the changes made to the document in response to those comments follows below:

- NRDC commented on the Methodology's draft description of legal requirements – particularly the evaluation of the Maximum Extent Practicable (MEP), which they deemed were incorrect and should be revised. The text summarizing the role of MEP in the Methodology document was removed because it had no impact on DDOE's approach for meeting MS4 WLAs as they are described in the TMDLs. However, this change should not be construed as DDOE agreement with NRDC's comments, analysis, and interpretation of the MEP concept and its applicability to MS4 discharges.
- In another comment, NRDC requested the Methodology document provide more detail regarding the calculation of pollutant load reductions. However, ICPRB's comments suggested that perhaps the text was too detailed and could potentially restrict the flexibility for the methodology to address unforeseen issues as they came up – such as a potential lack of available data for calculating pollutant load reductions. Therefore, the level of detail on the calculation of pollutant load reductions was retained from the draft Methodology document.
- NRDC had two comments requesting additional discussion in the text: one comment requesting that the Methodology should describe whether non-water quality considerations, such as environmental justice, might be included as selection factors for BMP planning; and another comment requesting that the Methodology should describe a plan for seeking additional sources of implementation funding if the current funding strategy proves inadequate. The first comment was addressed by adding more discussion of non-water quality considerations to the text concerning BMP selection factors in Section 4. The second comment was addressed by revising Section 8 to clarify that the Plan will be based on existing levels of funding, and will include an analysis of estimated total implementation costs, as well as costs associated with accelerating the implementation schedule.

Several of NRDC's comments were addressed with clarifications to the text, including a comment that the Implementation Plan should address TMDL WLAs recommended for withdrawal, unless appropriately withdrawn prior to the Plans' finalization; and a comment to include outfall monitoring among the potential monitoring strategies.

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1. Introduction

The District Department of Environment (DDOE) is required to develop a Consolidated Total Maximum Daily Load (TMDL) Implementation Plan (IP), as established in the District's Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit (U. S. EPA 2011 and U. S. EPA 2012). The IP will define and organize a multi-year process centered on reducing pollutant loads originating within the District MS4. The level of pollutant control will be based on past TMDL studies performed to protect impaired water bodies in the District. The IP will include a summary of the regulatory compliance strategy to satisfy TMDL-related permit requirements, a summary of data and methods used to develop the IP, specific prioritized recommendations for stormwater control measures, a schedule for implementation and attainment of Waste Load Allocations (WLAs), and a method for tracking progress. Substantial public involvement will be sought in plan development.

This document describes the methodology and approach to develop the IP.

1.1 Overview of Methodology Document

The Methodology document is organized with Sections corresponding to Sections that will be included in the final IP. While most of the Methodology document describes the processes and methods to develop the IP, some Sections also describe data gathering, interpretation of regulations, and research already conducted or underway.

The key components of each of the Sections are outlined below. Further details are provided in the Sections themselves.

MS4 NPDES Permit Requirement for Development of IP and Monitoring Program (Section 2)

This Section describes the interpretation of Clean Water Act (CWA) regulations and District's MS4 permit requirements. It also presents a Regulatory Compliance Strategy for the IP. The examination of the MS4 NPDES requirements conducted in this Section involves intensive review of the CWA and associated rules included in the Code of Federal Regulations (CFR). In particular, it includes a detailed evaluation of the relationship between MS4 permit requirements and Wasteload Allocations (WLAs) specified for MS4 discharges in existing TMDLs. In addition, potential strategies for addressing individual WLAs are discussed.

Review of TMDL Inventory and 303(d) Listing Process (Section 3)

This Section provides a plan for developing a comprehensive summary of TMDLs and MS4 WLAs in the District. Developing this comprehensive summary involves thorough investigation of all of the existing TMDL studies, and formation of a plan to reconcile and resolve situations where multiple and/or overlapping TMDLs exist for the same waterbodies and pollutants. The process to review the rationale and supporting water quality and other aquatic data used to list the water bodies as impaired and requiring TMDLs is described. The process to assess the current condition of water bodies in the District with existing data is also described.

Implementation Actions (Section 4)

This Section summarizes the planned research and analysis, and the process to develop and implement needed controls for meeting MS4 WLAs. The approach is described for building a modeling framework to organize the TMDL requirements and implementation actions and to generate pollutant loading and stormwater control scenarios. This approach explains how the modeling framework will be developed based upon existing TMDL models, GIS coverages, inventories of current best management practices (BMPs), BMP performance, costs, and other data sources. The plan for implementation actions will outline a process for development of measureable goals and milestones (covered in more detail in Section 5) to gauge implementation progress. It will also address the design of a comprehensive monitoring program to support the IP. Use of the TMDL Inventory, a Literature Review and a QAPP to support the development of implementation actions is also described.

Measurable Goals and Milestones (Section 5)

This Section describes the process and information that will be used to establish measurable goals and milestones for the IP. The process includes considerations related to ongoing progress on pollutant load reduction, development and re-development forecasts for the District, costs, budget projections, and other information or programs that influence the pace of implementation. Implementation of needed controls may span several decades. Therefore, this Section also describes the use of modeling and monitoring analyses to help inform DDOE's need to assess progress and, if needed, to make adjustments.

Stakeholder Involvement and Public Participation (Section 6)

The participation of stakeholders in the development of the IP, and their support of the final plan, is essential to the plan's success. This Section reports on those stakeholders, their roles and responsibilities as part of the Stakeholder Group, and their involvement in formulation of the IP. In addition, the process for seeking out and facilitating the involvement of additional individuals and organizations that are not formally included in the Stakeholder Group, but interested in and affected by TMDL implementation, is also described.

Integration with Other Watershed Planning Efforts (Section 7)

This Section describes how the IP will relate to other watershed planning efforts in the District. This includes the process and methods for incorporating existing TMDL and watershed implementation plans and Chesapeake Bay Watershed Implementation Plans (WIPs) into the IP. Opportunities for integration and coordination with other local programs and initiatives will be summarized and any specific action items identified.

Potential Funding Sources (Section 8)

This Section investigates and summarizes the approach that will be used to identify funding sources available to support TMDL implementation. These sources include existing programs like the District Stormwater Fees well as potential funding sources from federal programs, grants, and support from foundations. The impact of private investment on stormwater management resulting from the 2013 Stormwater Rule will also be assessed and incorporated into the funding/implementation analysis This Section will then discuss the methods that will be used to analyze the potential funding available against the full cost of TMDL implementation. The Section will also include a discussion of the link between the available funding and the schedule for implementing the IP.

1.2 Important Considerations

Several important considerations are offered below that directly affect the trajectory and ultimate success of the IP. While addressed in various parts of the Methodology document, they are highlighted here due to their overall importance to the process.

1.2.1 Funding

Achieving the necessary amount of BMP implementation to meet load reduction goals is likely to require funding from both public and private sources and investment on both public and private lands. It is expected that revenue from the District's stormwater fee alone will not be able to fund implementation at a sufficient level. Therefore, successful implementation of stormwater management on a broad scale will likely rely on development and redevelopment over time that adheres to the District's Stormwater Management Regulations (DDOE, 2013), and project work directly undertaken by other District and federal agencies on property they own and are responsible for within the District's MS4 area.

1.2.2 Participation by Federal Partners

Because the federal government is such a large landowner in the District, participation by federal partners will be critical to the success of load reduction strategies. There are several drivers that will spur participation by federal agencies in achieving load reductions. In addition to improvements made by federal agencies in response to the District's Stormwater Management Regulations, federal properties are subject to the stormwater requirements of the 2007 Energy Independence and Security Act (EISA). Section 438 of that legislation establishes strict stormwater runoff volume requirements for federal development and redevelopment projects. The intent of Section 438 is to require federal agencies to maintain or restore stormwater runoff to the maximum extent technically feasible when developing or redeveloping applicable facilities. Implementation of EISA Section 438 at federal properties will also help to reduce pollutant loads and aid the District in meeting its WLAs.

1.2.3 Adaptive Management

The IP will take a necessary adaptive approach with the intent to maximize benefits and account for costs where possible. This flexibility will allow the program to be adjusted as needed at fixed intervals, such as at planned benchmarks, where the pace of implementation and the performance of BMPs and other practices can be assessed.

A related consideration is that green infrastructure technology is emerging as a preferred option for reducing runoff and pollutant loads in urban settings. This is largely due to the fact that green infrastructure provides benefits beyond stormwater management by improving air quality, reducing the urban heat island effect, and adding aesthetic amenities. It is expected that better information on the installation and maintenance costs and the performance of individual green infrastructure practices will improve over time as this method for controlling stormwater matures. Consequently, the use of green infrastructure is a good fit into an adaptive management approach.

1.2.4 Water Quality Standards

The IP will be designed to comply with the requirements stated in the District MS4 NPDES permit. However, compliance with these requirements does not ensure water quality standards will be met in all of the impaired waters in the District. All three major water bodies in the District – the Potomac and Anacostia rivers and Rock Creek – have upstream watersheds largely in other jurisdictions. More specifically, less than 15 percent of the Anacostia River and Rock Creek watersheds and less than one percent of the Potomac River watershed are in the District. Additionally, there is a substantial amount of direct drainage to these water bodies that lies outside of the permitted MS4 system. TMDL requirements to reduce pollutant loads from sources other than the District's MS4 are not covered under the District MS4 permit.

2. Background on Permit Requirements and Regulatory Compliance Strategy for IP

This Section summarizes the regulatory framework underpinning the District's MS4 permit requirements to develop a Consolidated TMDL IP (IP), as well as the regulatory compliance strategy the District will implement to meet this specific provision of the permit. The information in this Section will be included in the final IP and will serve as the basis for demonstrating compliance with the District's MS4 permit requirements.

The permit language indicates models shall be used to assess and demonstrate attainment of the WLAs, and that both modeling and monitoring shall be used for demonstrating progress during implementation. As described more fully in Section 4, a modeling tool will be developed and applied to assess and describe attainment of WLAs under the permit requirements. Furthermore, a revised monitoring framework will also be developed to ensure that monitoring can be used to demonstrate progress towards meeting WLAs and that this monitoring is coordinated across all DDOE departments. Section 4.10.3 of the permit also notes that there is potential for the WLA to no longer be applicable, for instance, if there are data to demonstrate that the waterbody may be de-listed or if the TMDL is withdrawn for some reason. If these types of situations are encountered, DDOE may resolve them outside of the implementation plan framework. These topics are presented in more detail below, following a brief background on regulatory requirements.

2.1 Specific TMDL-Related Requirements in the District's MS4 Permit

In addition to the District's permit requirements related to the standard stormwater management program elements, the permit also includes several major requirements relevant to TMDLs and TMDL implementation. The requirements in the permit are set out in a number of different Sections, but are summarized in the Section 1.4, Discharge Limitations. This Section states that:

> The permittee must manage, implement and enforce a stormwater management program (SWMP) in accordance with the Clean Water Act and corresponding stormwater NPDES regulations, 40 CFR Part 122, to meet the following requirements:
>
> 1.4.1 Effectively prohibit pollutants . . . to comply with existing District of Columbia Water Quality Standards (DCWQS);
>
> 1.4.2 Attain applicable wasteload allocations (WLAs) for each established or approved Total Maximum Daily Load (TMDL) for each receiving waterbody, consistent with 33 USC 1342(p)(3)(B)(iii); 40 CFR Part 122.44(k)(2) and (3); and
>
> 1.4.3 Compliance with all other performance standards and provisions contained in Parts 2 through 8 of this permit shall constitute adequate progress toward compliance with DCWQS and WLAs for this permit term.

Permit Section 4.10.3, IP, provides further clarification of the requirements related to TMDLs. It states:

> For all TMDL waste load allocations assigned to District MS4 discharges, the permittee shall develop, public notice and submit to EPA for review and approval an Implementation Plan . . .

Together, these Sections describe the requirements and methods for meeting the TMDL implementation components of the permit.

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2.2 Regulatory Compliance Strategy

Section 4.10.3 of the permit includes instructions for the content of the IP and provides direction on how to demonstrate compliance with the permit requirements. Specifically, the IP must include:

1. A schedule for attainment of the WLAs (final date and interim milestones as necessary; it should also be noted that the schedule will be designed to achieve the WLAs as soon as possible)
2. Demonstration using models for how each applicable WLA will be attained
3. Narrative explaining schedules and controls used in the IP
4. Requirement to follow elements 1-3 above until the TMDL is withdrawn, reissued or waterbody is de-listed
5. Requirement to post the IP on the District website.

As presented earlier, the permit language states that models shall be used to assess and demonstrate attainment of the WLAs, and that modeling and monitoring during implementation shall be used for demonstrating progress. As described more fully in Section 4, a modeling tool will be developed and applied to assess and describe attainment of WLAs under the permit requirements. Furthermore, a revised monitoring framework will also be developed to ensure that monitoring required under the permit is adequate to document progress in attaining WLAs.

Because the IP will be designed to achieve compliance by reducing pollutants through the use of BMPs, the methods used to develop the original WLAs will be a key source of information for defining compliance. Generally, when WLAs are developed, the agency in charge of the process includes information related to the water quality standards (WQS), the assessment that led to the listing of the water, and the assumptions and calculations used to establish the WLA. Therefore, review of the documentation in the TMDLs will be necessary to understand the assumptions that were part of the WLA development and to identify an appropriate compliance endpoint (e.g., source control, load reduction) for that WLA. Information regarding the listing of the waterbody will also be important in cases where it is appropriate to consider de-listing the waterbody. Data includes:

- MS4 discharge points and corresponding WLAs;
- Pollutants to be controlled and level of control established in the WLA for the pollutant;
- BMP information;
- Correlation of pollutants and BMPs in place, as well as an assessment of the level of additional controls needed for achieving the needed pollutant reductions.

The following bulletized list summarizes the permit requirements relative to TMDL implementation and the actions necessary to meet these requirements that are critical to the Regulatory Compliance Strategy.

- The permit requires development of an IP to address TMDL WLAs.
- Data used to develop the TMDL and the MS4 WLA will inform both the modeling and strategy to achieve the WLA and could lead to strategies focusing on implementation of source controls, BMPs to reduce loads, or additional data evaluation to support potential de-listing of the waterbody.
- The IP, through the modeling, will identify controls (i.e., BMPs) necessary to achieve required load reductions.
- Models and monitoring data will be used to determine the effect of BMPs in reducing pollutants.

- Information from the monitoring and application of models will inform the need to adjust BMPs and overall implementation of the plan, using an iterative approach as described in the EPA policies.

The information outlined in the preceding Sections will be used to develop specific strategies to address each MS4 WLA. The methodology by which each of these individual strategies will be developed is discussed in the next Section.

2.3 Specific Strategies to Address Each MS4 WLA

Once the modeling assessment has been developed, the IP will include specific individual strategies to address each MS4 WLA. The individual strategies will be based on a number of factors, including:

- The type of pollutant/impairment;
- The quality and applicability of the data and methods used to list the waterbody as impaired, develop the TMDL, and allocate loads to specific sources, including the MS4;
- Information on expected TMDL implementation from the original TMDL document;
- Current water quality or stream condition data;
- Current levels of BMP (structural, non-structural, and programmatic) implementation in the watershed;
- Current watershed restoration or other improvements in the watershed, as described in existing watershed restoration or IP documents; and
- Other relevant data.

Two primary strategies will comprise the main approach toward meeting individual MS4 WLAs:

- Documenting source control as an adequate means of achieving the required pollutant reduction; and,
- Quantifying pollutant load reduction through modeling of BMP implementation.

As stated earlier, there may be instances where data are insufficient or no longer support an existing TMDL or WLA. In these cases, it may be appropriate to re-evaluate the applicability and/or technical basis for the TMDL itself. It is envisioned that the TMDL evaluation would be documented within the implementation planning process, but resolved outside of this framework, through other programs within DDOE. Possible approaches in such instances could include refining the use of the waterbody, or de-listing of the TMDL if warranted. Therefore, although some TMDLs may be re-evaluated through this type of analysis – either in the near term or in the future – and potentially replaced, withdrawn, or otherwise modified, the IP will address all current MS4 WLAs and will include a schedule and plan for achieving each one.

In order to properly evaluate the types of source control and BMPs to be selected, the relevant information will be evaluated and a specific strategy to address each MS4 WLA will be proposed. The steps involved in this evaluation will include:

- Compile and review all information on the impairment. Evaluate the quality of the supporting data that were used to list the waterbody as impaired, including water quality or other data used to define the impairment and any data on potential pollutant sources.

- Evaluate current water quality and other data to determine if the impairment still exists. If the impairment is not supported by current data, the waterbody may be a candidate for de-listing for that pollutant.
- Base the strategy for addressing the MS4 WLA on the implementation expectations in the original TMDL document. For example, some MS4 WLAs may be implemented by focusing on source control. This may be the case for MS4 WLAs for certain toxic pollutants (such as PCBs) where MS4 WLAs are impractical to measure and where the TMDL has identified source control as the primary method for TMDL implementation. The original TMDL will be reviewed to identify the sources of the pollutant and the recommended implementation activities. In addition, any subsequent IPs or other restoration plans that focus on the same pollutant or pollutant source will also be reviewed.
- Determine if BMPs implemented to date have already achieved the load reduction necessary to meet the WLA. For example, the District has already developed several TMDL and watershed implementation plans and has begun implementing BMPs in some watersheds. Therefore, MS4 WLAs may already have been achieved in some impaired water bodies. More current monitoring data may also be available to confirm this. Even if WLAs have not been achieved through the previous implementation of BMPs, the load reductions achieved by these BMPs can be credited towards the total load reduction needed to meet the WLA, thereby reducing the amount of additional BMPs needed to meet the WLA.
- Apply the modeling framework with the most updated information on load reductions by BMP type to develop a strategy to implement additional BMPs in the MS4 areas of a given watershed. Compare the modeled load reductions through the implementation of BMPs MS4 WLA.
- Use an adaptive management strategy with an iterative approach focused on cost performance and benefits that leads to an optimal strategy for each MS4 WLA.

The IP will describe how the implementation methods for each MS4 WLA will be determined, what data will be used to make the determination as to how the MS4 WLA will be implemented, how the determination will be made, and how the implementation will be tracked.

In summary, the permit requirements and their relationship to the CWA and TMDLs were thoroughly reviewed and interpreted. A Regulatory Compliance Strategy was developed that is responsive to federal regulations and EPA guidance. The approach that will be taken to develop a specific strategy for each MS4 WLA was described.

2.4 Daily Expressions of WLAs

The District has several TMDLs that include a daily expression of the TMDL in addition to the more common determination of TMDLs that are expressed as an annual or seasonal load. In general, annual and seasonal expressions of a TMDL are considered to be closely tied to the achievement of water quality standards. This is particularly true for those pollutants that exert their effect on water quality over the longer term. Annual or seasonal expressions of WLAs take into consideration the assimilative capacity of water bodies and a variety of environmental conditions through the use of models. These models account for seasonal differences in stream flow and temperature, and the discharge of intermittent sources of pollutants like stormwater that are triggered by rainfall. In contrast, the daily expression of TMDLs tends to have less bearing on the actual load or load reduction required to achieve WQS or support a designated use.

Where they exist, the daily expression of TMDLs as maximum daily loads and their linkage to WQS will be carefully examined in the development of the IP. It is anticipated that the load reduction practices and requirements implemented to achieve annual or seasonal WLAs will result in achievement of the maximum daily load. Therefore, the focus of the IP will be directed toward annual or seasonal WLAs, and it will be assumed that the annual or seasonal WLAs are, in most cases, better aligned with regulatory compliance.

3. Review of TMDLs and the 303(d) Listing Process

This Section of the IP will provide a comprehensive summary and inventory of current TMDLs in the District and the history of TMDL development. Much of the information for this Section of the IP will be taken from the research and analysis done for this Methodology document that is summarized below, plus additional research and analysis conducted during the course of the project.

The goal of this Section of the IP will be to:

- Establish a common understanding of the inventory of MS4 WLAs that must be implemented;
- Summarize the TMDLs and MS4 WLAs and describe how the inventory was developed and QA/QC'ed; and
- Review the process and supporting data used to develop impairment listings and TMDLs.

The review and analysis undertaken to produce this summary and inventory will be very helpful in the evaluation of potential methods for implementing TMDLs (e.g., quantifying pollutant load reduction, source control, etc.) to be discussed in Section 4.

This review of TMDLs and the 303(d) listing process summarizes the information needed to develop the IP and will summarize:

- The amount and breadth of supporting data used to list waterbodies as impaired;
- The quality of this supporting data and its geographic distribution relative to the waterbodies listed as impaired (i.e., were actual data used for all impaired waterbodies, or were some waterbodies assumed to be impaired because downstream waterbodies were impaired);
- The baseline loads used for the TMDL and how they were derived;
- The development of the MS4 WLA and any stormwater or direct drainage load allocations (LAs);
- The expectations for load reduction (in terms of expected percent reduction and/or pounds of pollutant reduced); and
- Potential approaches for achieving the MS4 WLA (e.g., source control, pollutant reduction through BMPs; other).

Note that <u>all</u> current TMDLs will be addressed during this analysis – even those currently being re-evaluated by EPA Region 3 and any TMDLs pending withdrawal.

As part of the development of this Methodology document, a preliminary evaluation of the District's TMDL development process was undertaken, an inventory of TMDL and MS4 WLAs (the TMDL inventory) was compiled. A summary of the findings produced thus far is provided in the sub-Sections below. This information will be used to initiate internal discussions regarding potential methods to address individual MS4 WLAs. This information will also be incorporated into the IP as it is finalized.

In order to provide a logical framework for a discussion of the preliminary evaluation and a description of the steps that will be necessary to finalize the data compilation and analysis in the IP, this Section has been organized as follows:

- The 303(d) Listing Process for Waterbodies in the District;
- TMDL Development for Impaired Waterbodies in the District;

- TMDL Inventory;
- Collection of Additional Data Literature Review and Quality Assurance Project Plan (QAPP); and
- Summary of Additional Work to Be Completed for the Consolidated TMDL IP.

Each sub-Section includes a discussion of the data compilation and evaluation completed to date, plus a discussion of next steps to finalize the data and analysis for use in the IP. The last sub-Section summarizes the next steps identified in association with the preceding sub-Sections as a series of Action Items.

3.1 The 303(d) Listing Process for Waterbodies in the District

Section 303 of the CWA requires states (in this case, the District is considered a state) to periodically assess whether waters are attaining water quality standards and to provide a list (the 303(d) list) to EPA detailing the locations of nonattainment and the suspected reasons for impairments. As part of its compliance with these requirements, DDOE has developed either separate 303(d) lists or "Integrated Reports" (IRs) that combine the CWA Section 305(b) requirements to report on general water quality conditions in the District with the 303(d) requirements to identify impaired waterbodies. The District developed its first 303(d) list in 1998. An update was prepared in 2002, and revised reports have been prepared every two years since then. The most recent IR was prepared in 2012 and is titled *Integrated Report to EPA and US Congress regarding DC's Water Quality-2012* is (DDOE 2012). DDOE's IRs contain background information on the District waters and water pollution control programs, surface water assessments, and public health related assessments. The IR also includes discussion of methods by which the data generated by these monitoring programs are used to assess the District's surface waters.

DDOE uses a variety of methods to assess its waters, including:

- Ambient water quality monitoring data;
- Biological data from stream monitoring;
- MS4 monitoring data;
- Fish tissue contamination data; and
- Previous assessments.

DDOE assesses all use classes for each waterbody, including:

- Primary and secondary contact recreation ([Classes A and B][1];
- Protection and propagation of fish shellfish and wildlife [Class C];
- Protection of human health related to consumption of fish and shellfish [Class D]; and
- Navigation [Class E] for each waterbody.

In general, all waters in the District are designated for each use type. WQS are established to protect these uses. According to the District's IR, the District applies national criteria in its WQS where possible to determine use support of its waterbodies. This helps to ensure consistency and comparability between District water quality and national water quality. However, a modified version of the criteria established by EPA had to be used in certain use support decisions because the District does not collect the data as

[1] Technically, only lakes have been assessed for primary contact. According to p. 63 of the 2012 IR, due to the 2005 change in WQS from fecal coliform to E. coli, there is insufficient data to determine use support for primary contact (swimming) for both "Rivers and Streams" and "Estuaries." In addition, the secondary contact use for streams in the District of Columbia was not assessed; there are no criteria in the 2010 WQS to determine use support.

specified in the national criteria. For example, the majority of monitoring stations in the District are only sampled once per month, and thus in many cases the District collected monitoring data less frequently than indicated by EPA criteria. Therefore, the criteria for determining primary and secondary contact recreation (Class A and B) as well as aquatic life use determinations (Class C) using physical/chemical data had to be modified to accommodate the sampling frequency.

In some cases, the District used biological/habitat data, instead of chemical/physical standards, to make to make aquatic life use (Class C) decisions. When streams with both conventional pollutant data and biological data are evaluated, the biological data are the overriding factor in aquatic life use decisions. Aquatic life use support is based on the relationship between the observed stream biological conditions compared to the reference stream condition, producing a percent of reference stream biological condition. This scale rates "impaired" at 0-79%, and "non-impaired at 80-100%" of the reference condition.

Fish consumption use determinations (Class D) are based on known fish consumption advisories in effect during the assessment period. Fish tissue data used to issue advisories are collected at stations on the Anacostia and Potomac Rivers. If no barrier for fish movement exists, it is assumed that fish move freely to the smaller streams and other waterbodies.

Impairments (and hence 303(d) listings) are determined based on the frequency that WQS are exceeded. For example, the 2006 IR states

> The percentage of time a selected standard is out of compliance at a monitoring station or group of monitoring stations over a selected span of time determines whether a waterbody supports a particular use. For the 2006 reporting cycle, physical, chemical, and bacterial data collected from January 2001 to December 2005 were used to make many of the use support decisions. Biological data collected during 2002-2003 was also used.

The 2006 IR also states that data used to list waterbodies "must have been collected in the actual waterbody that is being assessed (p. 59)." However, this may not have been the case with many of the listings for organic compounds that were based on fish tissue advisories, because, as was stated above, "fish tissue contamination data used to issue advisories are collected at stations on the Anacostia and Potomac Rivers. If no barrier for fish movement exists, it is assumed that fish move freely to the smaller streams and other waterbodies." Thus, any contamination detected in fish in the mainstem of the Potomac and the Anacostia can be associated with the upstream tributaries even though that pollutant may never have been measured in that waterbody. The 2012 IR acknowledges this and other issues with the original TMDLs and states that:

> Many of these existing District's TMDLs were established based on limited data and narrow modeling options available at the time. Most of these TMDLs need to be revised by taking into account new available data and improved understanding of the natural environmental processes. Revising these TMDL will provide an opportunity to develop more sophisticated water quality models with enhanced prediction capabilities, and consequent upon that, an improved implementation plan for better protection of the environment.

As part of the development of the IP, all of the original 303(d) listing data and original impairment determinations will be reviewed, along with determining whether impairments were actually measured for particular waterbodies, or whether certain waterbodies were listed for certain pollutants (and TMDLs and MS4 WLAs were developed for these pollutants) based on fish tissue sampling from the stations on the Anacostia and Potomac rivers. In cases where TMDLs and MS4 WLAs were developed for pollutants that were not actually measured in the water bodies, current water quality and/or fish tissue data will be reviewed to determine if it is reasonable to conclude that WLAs have been met and de-listing is appropriate.

3.2 TMDL Development for Impaired Waterbodies in the District

A total of 26 TMDL studies have been developed for impaired waters in the District - 15 for waterbodies in the Anacostia watershed, six (6) for waterbodies in the Potomac watershed, three (3) for waterbodies in the Rock Creek watershed, and two (2) that encompass impaired waters in both the Anacostia and the Potomac watersheds. Altogether, these TMDL studies provide allocations for 23 different pollutants in 45 different waterbody segments. The TMDL studies include 381 individual MS4 WLAs. A summary of these TMDL studies is provided in Table 3-1. Maps of each of the waterbody segments with a TMDL will be generated and provided in the final IP.

The first TMDL studies in the District were completed in 1998 (District Final Hickey Run TMDL Water Quality Management Plan to Control Oil and Grease, PCB, and Chlordane) by the District Department of Health (DOH) Environmental Health Administration. This agency continued to develop TMDLs in the District through 2004, by which time the vast majority of District TMDLs had been completed (21 of 26 TMDL studies were completed by DOH between 1998 and 2004). Additional TMDL studies for TSS, nutrients and BOD, and trash in the Anacostia River watershed were completed jointly by DDOE and the Maryland Department of the Environment (MDE) between 2007 and 2010. In 2007, the Interstate Commission on the Potomac River Basin (ICPRB) released the Tidal Potomac and Anacostia PCB TMDL on behalf of DDOE, MDE, and the Virginia Department of Environmental Quality. U.S. EPA Region 3 also finalized the Chesapeake Bay TMDL in 2010.

The large number of TMDL studies completed over a 12 year period by the five different agencies cited above, along with differences in available datasets, modeling approaches, and documentation necessarily complicates the task of developing a consolidated approach to implementing the TMDLs and MS4 WLAs. In addition, refinements over time in mapping the MS4 system have led to improved MS4 coverages and sewershed delineations relative to those used in earlier TMDL studies. These factors also confirm decisions will be needed to develop a uniform baseline for consistent modeling of current progress and future scenarios. This Methodology document discusses the way and approach that will be used to do so.

Additionally, most of the District's TMDLs were developed between 2003 and 2004, the timeframe when U.S. EPA was clarifying its regulatory requirements for establishing WLAs for stormwater discharges in TMDLs[2]. Consequently, many of the older TMDL studies did not differentiate between stormwater loads from the MS4 system and areas that drained directly to the waterbodies (direct drainage areas). As a result, many of the TMDL study documents have combined allocations for point source MS4 and nonpoint source direct drainage areas. In many cases, in its review of these District TMDLs, EPA used the original modeling documentation to divide MS4 WLAs from direct drainage LAs. The net result is that some TMDL studies present MS4 WLAs, while other MS4 WLAs are identified only in EPA's Decision Rationale documents.

In some cases, more than one TMDL was developed for the same pollutant(s) in the same waterbodies. For example, the District DOH completed a TMDL for TSS for the District portions of the Anacostia River in 2002. Subsequently, a TSS TMDL for the entire Anacostia River watershed was developed by DDOE and MDE in 2007. The 2007 TMDL document states that the watershed-wide TMDLs developed in that document replace the 2002 District TSS TMDLs. Likewise, the TMDL for BOD for the Anacostia River (DC DOH, 2001) included MS4 WLAs for total nitrogen and total phosphorus for the Upper and Lower Anacostia River in the District, but this TMDL and its MS4 WLAs were replaced by the TMDL for BOD

[2]Memorandum *Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs*, from Robert H. Wayland, III, Director, Office of Wetlands, Oceans and Watersheds, and James A. Hanlon, Director, Office of Wastewater Management, to Water Division Directors, Regions 1 - 10, dated November 22, 2002.

and nutrients developed by DDOE and MDE for the Anacostia River basin in 2008. In addition, the District's Phase II WIP for the Chesapeake Bay TMDL established MS4 WLAs for total nitrogen, total phosphorus, and sediment for the District including MS4 WLAs for segments that overlap the Anacostia River. Thus, the District has two different sets of requirements for TSS, TN and TP within the same watershed. These overlaps need to be reconciled in order to effectively consolidate implementation planning.

These complicating factors pertaining to individual TMDLs and MS4 WLAs will be identified and summarized in more detail within the IP.

Table 3-1 Summary of TMDLs and MS4 WLAs in the District

				Pollutant Category							
Major Basin	**TMDL Name**	**Year Approved**	**Number of MS4 WLAS**	**Metals**	**Organics**	**Nutrients**	**Sediment**	**Bacteria**	**Pesticides**	**PCBs**	**Other (Oil and Grease, BOD, Trash)**
Anacostia	District Final Hickey Run TMDL Water Quality Management Plan to Control Oil and Grease, PCB, and Chlordane	1998	3		X						X
Anacostia	TMDL Upper Anacostia River Lower Anacostia River District BOD	2001	0			X					X
Anacostia	Total Maximum Daily Loads: Upper Anacostia River, Lower Anacostia River, District; Total Suspended Solids	2002	2				X				
Anacostia	District Final TMDL for Fecal Coliform Bacteria in Upper Anacostia River, Lower Anacostia River, Watts Branch, Fort Dupont Creek, Fort Chaplin Tributary, Fort Davis Tributary, Fort Stanton Tributary, Hickey Run, Nash Run, Popes Branch, Texas Avenue Tributary	2003	12					X			
Anacostia	District TMDL for Organics and Metals in the Anacostia River and Tributaries	2003	125	X	X				X	X	

Table 3-1 Summary of TMDLs and MS4 WLAs in the District cont.

				Pollutant Category							
Major Basin	**TMDL Name**	**Year Approved**	**Number of MS4 WLAS**	**Metals**	**Organics**	**Nutrients**	**Sediment**	**Bacteria**	**Pesticides**	**PCBs**	**Other (Oil and Grease, BOD, Trash)**
Anacostia	District Final TMDL for Oil and Grease in the Anacostia River	2003	2								X
Anacostia	District Draft TMDL for Biochemical Oxygen Demand in Fort Davis Tributary	2003	1								X
Anacostia	District Final TMDL for Fecal Coliform Bacteria in Kingman Lake	2003	1					X			
Anacostia	District Final TMDL for Organics and Metals in Kingman Lake	2003	14	X	X				X	X	
Anacostia	District Final TMDL for TSS, Oil &Grease, BOD in Kingman Lake	2003	3				X				X
Anacostia	District Final TMDL for Total Suspended Solids in Watts Branch	2003	2				X				
Anacostia	TMDL of Sediment/Total Suspended Solids for the Anacostia River Basin, Montgomery and Prince George's Counties, MD and the District	2007	5				X				

Table 3-1 Summary of TMDLs and MS4 WLAs in the District cont.											
				Pollutant Category							
Major Basin	TMDL Name	Year Approved	Number of MS4 WLAS	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)
Anacostia	TMDL of Nutrients/BOD for the Anacostia River Basin, Montgomery and Prince George's Counties, MD and the District	2008	6			X					X
Anacostia	TMDL of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, MD and the District	2010	2								X
Potomac	District TMDL for Organics, Metals and Bacteria in Oxon Run	2004	13	X	X			X	X	X	
Potomac	District Final TMDL for Bacteria in the Chesapeake and Ohio Canal	2004	1					X			
Potomac	District Final TMDL for Fecal Coliform Bacteria in Upper Potomac River, Middle Potomac River, Lower Potomac River, Battery Kemble Creek, Foundry Branch, and Dalecarlia Tributary	2004	6					X			

Table 3-1 Summary of TMDLs and MS4 WLAs in the District cont.											
				Pollutant Category							
Major Basin	**TMDL Name**	**Year Approved**	**Number of MS4 WLAS**	**Metals**	**Organics**	**Nutrients**	**Sediment**	**Bacteria**	**Pesticides**	**PCBs**	**Other (Oil and Grease, BOD, Trash)**
Potomac	District Final TMDL for Organics and Metals in Battery Kemble Creek, Foundry Branch, and the Dalecarlia Tributary	2004	18	X	X				X	X	
Potomac	District Final TMDL for pH in the Washington Ship Channel	2004	1			X					
Potomac	District Final TMDL for Bacteria in the Tidal Basin and the Washington Ship Channel	2004	2					X			
Potomac	District Final TMDL for Organics in Tidal Basin and Washington Ship Channel	2004	20		X				X	X	
Potomac, Anacostia	TMDL for PCBs for Tidal Portions of the Potomac and Anacostia Rivers in District , MD, and VA	2007	7							X	
Potomac, Anacostia	Chesapeake Bay TMDL for Nitrogen, Phosphorus, and Sediment	2010	12	X							
Rock Creek	District Final TMDL for Fecal Coliform Bacteria in Rock Creek	2004	2					X			

Table 3-1 Summary of TMDLs and MS4 WLAs in the District cont.											
				Pollutant Category							
Major Basin	**TMDL Name**	**Year Approved**	**Number of MS4 WLAS**	**Metals**	**Organics**	**Nutrients**	**Sediment**	**Bacteria**	**Pesticides**	**PCBs**	**Other (Oil and Grease, BOD, Trash)**
Rock Creek	District Final TMDL for Metals in Rock Creek	2004	8	X							
Rock Creek	District Final TMDL for Organics and Metals in Broad Branch, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Pinehurst Branch, Piney Branch, Portal Branch, and Soapstone Creek	2004	114	X	X				X	X	
Totals			**381**								

3.3 TMDL Inventory

A draft spreadsheet summarizing TMDL data relevant to the District has been developed. This spreadsheet is referred to as the "draft TMDL tracking spreadsheet." A draft list of TMDL documents was also compiled by DDOE and included in the Request for Proposal (RFP) for this project. The first step in compiling a comprehensive TMDL inventory is matching the TMDL/MS4 WLA list from DDOE's draft spreadsheet with specific TMDL documents included in the RFP. In this step, every individual MS4 WLA was identified with the specific TMDL document from which it came, and these data were added to the draft TMDL tracking spreadsheet. Individual TMDL documents were then reviewed and a cross-check was made between the draft TMDL tracking spreadsheet and the original source TMDL documents. This cross-checking was an integral part of the QA/QC process for the individual MS4 WLAs. Other information included in the original the draft TMDL tracking spreadsheet was also cross-checked with data from the TMDL documents, including:

- MS4 baseline load;
- Percent reduction of MS4 baseline load required to meet MS4 WLA;
- Stormwater/direct drainage baseline load;
- Stormwater/direct drainage LA;
- Percent reduction of stormwater/direct drainage baseline load required to meet stormwater/direct drainage LA; and
- Expression of the TMDL as a daily load.

In addition, the tracking spreadsheet included other information that is relevant to the IP development process, including:

- Baseline year for modeling;
- Pollutant sources;
- The pollutant loading model used to estimate stormwater runoff and pollution load (including discussion of watershed characteristics such as land use, land ownership, etc.); and
- Water quality model used to assess in-stream water quality conditions.

Each entry in the draft TMDL tracking spreadsheet was checked to ensure that it is indeed a MS4 WLA and not a stormwater or direct drainage LA. For many older TMDLs (particularly TMDLs developed before EPA's clarifying guidance – see footnote 2), stormwater loads were often included in LAs and not assigned MS4 WLAs. In each of these cases, discrepancies regarding MS4 WLAs were documented in the draft TMDL tracking spreadsheet.

Once all of the MS4 WLAs in the draft TMDL tracking spreadsheet were identified and cross-checked, the entire TMDL inventory was compared to the EPA Watershed Assessment, Tracking Results System website at http://ofmpub.epa.gov/waters10/text_search.tmdl_search_form. By selecting "DC" under the "State Abbreviation" criterion and leaving all other criteria blank, a list of all unique waterbody/pollutant TMDLs completed for the District was generated. This list was compared against the TMDLs included in the draft TMDL tracking spreadsheet. Several discrepancies were identified, but cross-checking against the original TMDL documents resolved the discrepancies. As a last check, the ATTAINS database was reviewed to ensure that all the TMDLs identified in ATTAINS were included in the draft TMDL tracking spreadsheet. During this exercise, the same discrepancies found with the Watershed Assessment, Tracking Results System data were identified again, so no additional resolution was required.

The comprehensive WLA inventory will be finalized as part of the development of the IP. This finalization is necessary to ensure that DDOE complies with its NPDES requirements (NPDES permit Section 4.10.3) and to attain applicable MS4 WLAs (NPDES permit Section 1.4.2).

3.4 Compilation of Background Information and Data on TMDLs, Literature Review, and Quality Assurance Project Plan (QAPP)

In addition to the final TMDL inventory, other background information and data on the TMDLs will be collected in order to understand the context for developing TMDLs and MS4 WLAs for certain pollutants and certain waterbodies. These activities can help identify the specific ways that individual MS4 WLAs can be implemented. In addition to the pollutant load and water quality models discussed above, information to be compiled includes:

- The impairments (reason for listing);
- The water quality monitoring data used to support listing of impaired waterbodies;
- The relevant watershed characteristics, including land use, land ownership, etc.
- The LAs and WLAs required to meet TMDLs;
- The load reduction assumptions made about CSO, upstream and atmospheric sources; and
- The expectations/plans for implementation of the MS4 WLA and/or stormwater or direct drainage LAs.

Several different approaches will be used to compile the targeted TMDL information and data. These approaches are outlined below:

3.4.1 TMDL Study Reports

All TMDL study reports will be reviewed to collect the information described above. Much of the data discussed above can be taken directly from the TMDL studies, including information on impairments; watershed characteristics; pollutant loading and water quality modeling tools; MS4 WLAs as well as other WLAs and LAs assigned to other sources; expected reductions from the MS4 and these other sources; and expectations for implementation.

3.4.2 TMDL Support Documents

TMDL support documents will be reviewed, including TMDL modeling studies, data collection efforts, watershed investigations, or any other studies supporting TMDL development. In many cases, the TMDL study documents focus on the process of developing the TMDL and setting allocations among the various sources, but do not summarize all investigations that occurred prior. For example, modeling reports and model documentation may provide more detail on the data and tools used to develop load estimates. Review has already begun for many of the available modeling documents in an attempt to understand how various sources were represented in the models (e.g., what MS4 area was used for a specific TMDL), how loads were developed (e.g., what land uses were identified, and how were loads assigned for different land uses), what models were used, etc. These data will be useful in developing a comprehensive model that can be used to support decision making for all TMDLs and MS4 WLAs in the District.

Initial contacts have also been made for numerous sources of TMDL support documents, including various contacts in DDOE and ICPRB. Other sources, which may include MDE, EPA, and other regional agencies will also be contacted as necessary.

3.4.3 Ambient Water Quality and Biological Monitoring Data

Ambient water quality and biological monitoring data used to support impairment listings and the development of the TMDLs will also be collected and compiled. These data may be useful in tracking the sources of the original impairment listings, as well as in identifying potential candidate waterbodies for de-listing. Evaluation of the District's current monitoring program (currently being developed under a parallel effort to the IP) will also help to identify specific monitoring locations that can be used to evaluate MS4 WLA implementation. These topics are discussed in more detail under Section 4, *Implementation Actions to Reduce Pollution Loads*, and Section 5, *Setting Benchmarks and Milestones and Tracking Progress*.

3.4.4 Literature Review

A literature review is currently underway that summarizes relevant available information on a number of topics, including:

- Methods for estimating pollutant concentrations (both wet and dry weather);
- Options for calculating loads;
- Methods for evaluating load reductions from BMPs, including both "efficiency" calculations, and more retention-oriented methods. The literature review will also summarize the types of BMPs that are typically used to control specific types of pollutants. This information will be useful in choosing specific BMP strategies to meet individual TMDLs and MS4 WLAs. Both structural and non-structural BMPs will be discussed;
- Costs for BMP implementation, including capital and operations and maintenance (O&M) costs;
- IPs developed for other states or jurisdictions.

Sources used for the literature review will include:

- Previous work performed within District and included in the MS4 Annual Reports;
- The Urban Stormwater Workgroup established to evaluate BMPs for the Chesapeake Bay TMDL;
- The International Stormwater BMP database;
- Work completed by the Low Impact Development Center, the Center for Watershed Protection, and other groups; and
- Previous literature reviews performed for similar projects.

Sources used for evaluating costs for the literature review will include:

- *Costs of Stormwater Management Practices in Maryland Counties* (King and Hagan, draft final Report, October 11, 2011); and
- Pending report from EPA's Chesapeake Bay Program on the costs of BMPs.

The literature review will evaluate both what has already been done in the District, and elsewhere. This will allow comparisons to support decisions on what data to use and how to model loads and load reductions, how to evaluate costs, and what other types of data could be included in the final IP to make it more successful.

3.4.5 QAPP

A Quality Assurance Project Plan (QAPP) has been prepared to document the quality assurance procedures and processes that will be undertaken to ensure the quality of the data and analytical methods used in the project. The QAPP will focus on the use of secondary data, and include discussions and procedures for identifying metadata on the data used for the project (e.g., identifying any QA/QC procedures used in collecting the original data) and documenting the data sources, the intended use of the original data, and any caveats to the original data collection. The QAPP will also focus on procedures to document and validate pollutant loading calculations, including establishing baseline pollutant loads and pollutant load reductions, as well as BMP pollutant removal efficiencies and the effectiveness of non-structural BMPs in reducing pollutant loads. This will be important in establishing load reduction strategies that meet the project objectives. It will be important to establish and assess data quality objectives for these data prior to using any of these types of data in the modeling.

The additional data that are collected will be compiled into a database. It will also be linked to a geodatabase to facilitate spatial analysis, such as evaluation of overlapping TMDLs and the identification of water quality and biological data associated with specific watersheds and TMDLs.

The role of the QAPP in ensuring the overall quality of the IP is described in Section 4.2.

3.5 Summary of Additional Work to be Completed for the Consolidated TMDL IP

The preliminary evaluation carried out thus far has allowed the formation of initial strategies for developing the IP. The review of TMDLs and the 303(d) listing process will continue to compile, review, and assess important data and reports to support development of the IP. Additional work will include:

- Compile relevant ambient water quality MS4 monitoring and biological monitoring data that were used to support impairment listings and the development of the TMDLs;
- Review all of the original 303(d) listing data and original impairment determinations;
- Review current water quality data to determine if appropriate to conclude that WLA has been met for certain impairments;
- Complete review of all TMDL support documents;
- Reconcile multiple documents/sources of MS4 WLAs;
- Reconcile WLA requirements stemming from multiple TMDLs for the same waterbodies and pollutants (e.g., Anacostia nutrients and sediment TMDLs from 2001, 2007, and Chesapeake Bay TMDL);
- Develop a comprehensive inventory that includes all of the MS4 WLAs for the District that are to be addressed in the IP;
- Complete the Literature Review; and
- Complete the QAPP.

4. Implementation Actions to Comply with Requirements to Address MS4 WLAs

This Section of the IP will address all of the data collection and analysis, implementation actions, and management measures required to:

1. Collect relevant data on TMDLs, MS4 WLAs, watersheds, pollutant sources, loads, BMPs, and existing TMDL or watershed implementation plans;
2. Develop strategies to address each individual MS4 WLA based on the data collected in #1, above;
3. Identify implementation plans, management strategies, or compliance methods to address each MS4 WLA; and
4. Develop and implement a plan to track progress in addressing MS4 WLAs.

4.1 Data Collection

Section 4 of this document summarizes the data collection methods that will be used to collect information on existing TMDLs. These data collection efforts will be supplemented with additional efforts to collect data on current conditions and to simulate pollutant loading under those current conditions. The additional data collection will focus on the following:

4.1.1 TMDL Watersheds

Because TMDLs and MS4 WLAs are associated with specific watersheds, each TMDL watershed must be delineated to identify its boundaries and determine where the TMDL and MS4 WLA are applicable. This task is particularly important because there are 45 different waterbody segments with TMDLs and MS4 WLAs that range from very large (e.g., Chesapeake Bay segment-sheds; segments on the Anacostia and Potomac mainstems) to the very small (individual tributaries to the Anacostia and Rock Creek; and small water bodies such as the C&O Canal, the Washington Ship Channel, the Tidal Basin, and Kingman Lake). It is important to understand where TMDLs and MS4 WLAs apply, where TMDLs may overlap (e.g., the Chesapeake Bay TMDL for nutrients and sediment applies to segment-sheds covering the entire District, so any TMDL watershed in the District also lies within a segment-shed for the Bay TMDL); what TMDL watersheds existing and planned BMPs lie in and thus which TMDLs and MS4 WLAs can receive load reduction credit for those BMPs, etc. Maps, descriptions in TMDL study documents and modeling documents, GIS files, and other sources as available will be used to replicate the TMDL watersheds from the original TMDL study documents. The DDOE Study Team has already reached out to the ICPRB, which conducted much of the modeling for the various Anacostia TMDLs, to identify potential sources of data.

TMDL watersheds are in the process of being delineated based on an updated delineation of MS4 sewersheds. It will be important to understand the MS4 drainage area contributing to each TMDL waterbody to ensure that there are no discrepancies between the MS4 area and the TMDL areas identified in the original TMDL study. Any such discrepancies will be documented. Resolution of the discrepancies and any resulting impacts on TMDL and MS4 implementation will need to be addressed in the final IP (e.g., if there are major differences between the area of the MS4 that was used to develop the MS4 WLA at the time the original TMDL was done and the current understanding of the MS4, how can the WLA be achieved?), and comparison of current and historical MS4 area datasets can help in this resolution.

This exercise will also be useful in identifying non-MS4 and direct drainage areas for the TMDLs. In addition, this exercise can help to distinguish MS4 and direct drainage components of the stormwater loads when they are not well differentiated in the TMDL itself (see discussion of evaluation of point source MS4 WLAs vs. nonpoint source direct drainage LAs under the "TMDL Inventory" in Section 3.3).

4.1.2 Watershed and Pollutant Data

Many different types of data related to potential pollution sources will be collected for every watershed for which there is a TMDL and a MS4 WLA. These data will include information on land ownership, parcels, land use, impervious cover, slopes, soil types, wetlands, watersheds, infrastructure, sewer systems, and results from the Toxic Release Inventory and Hazardous Waste points. These data were downloaded from the District's Office of the Chief Technology Officer (DC OCTO) and represent official data from the District government.

These data will be compiled into a geodatabase to be used during the project. The DDOE Study Team will ensure that all data compiled within the geodatabase conforms to the data quality requirements summarized in the project QAPP.

4.1.3 Existing Best Management Practices (BMPs)

Any structural or non-structural BMPs or programmatic actions that were implemented after a TMDL was finalized may be able to provide credit towards achieving a MS4 WLA. The DDOE Study Team will work with DDOE, other city agencies, non-profits, and other relevant entities or organizations to develop a comprehensive database of structural and non-structural BMPs, management actions, program activities, and other actions that could prevent, control, reduce, or mitigate specific pollutants.

The DDOE Study Team has had multiple discussions regarding existing structural and non-structural BMPs and programmatic activities that can mitigate pollution. Table 4-1 below summarizes the data sources identified for BMPs thus far.

Table 4-1 BMP Data Sources in the District

Data Set Name	Data Set Owner	Description
DDOE Tracking Database	DDOE, Watershed Protection Division, Technical Services Branch	Consists of records of all stormwater BMPs installed as a result of construction projects requiring a permit.
DDOE Green Roof Database	DDOE	Comprehensive compilation of all green roofs in the District. Compiled from multiple sources by DDOE. Considered the definitive source for green roof inventory in the District.
RiverSmart BMPs RiverSmart Homes and RiverSmart Communities)	DDOEDDOE, Watershed Protection Division, Planning and Restoration Branch	Individual green infrastructure and LID practices installed as part of RiverSmart initiative. Many on private land.
GreenSitesPT.shp.	TBD	A point shapefile from the District OCTO website that includes stormwater BMPs
Best Management Practices layer	TBD	A shapefile from the District OCTO website that includes stormwater BMPs

Table 4-1 BMP Data Sources in the District cont.		
Data Set Name	**Data Set Owner**	**Description**
Stream Restoration Projects	DDOE	
Tree Planting Projects	DDOE	
Street Sweeping	DDOE Stormwater Management Division,	
Public Outreach/Education	DDOEDDOE Stormwater Management Division	
Pollution Prevention/Good Housekeeping	Stormwater Management Division, DDOE	This may be useful in source control/source reduction.
Brownfield Restoration	DDOE Hazardous Waste Division	
Underground Storage Tank Management	DDOE Hazardous Waste Division	
Integrated Pest Management	DDOE Stormwater Management Division	Program contains elements of outreach, pesticide control. Could be useful for organics TMDLs.
Trash Management	DDOE Stormwater Management Division,	There are multiple specific activities underway through DDOE to specifically address trash TMDLs.
Illicit Discharge Detection and Elimination		The Center for Watershed Protection has done some research on claiming pollutant reduction credit for implementing IDDE programs.
Gross Solids Removal	The Center for Watershed Protection	Removal of debris, vegetation, organic material over and above trash. The Center for Watershed Protection has done some research on claiming pollutant reduction credit for this type of activity.
District Department of Transportation BMPs	District Department of Transportation	
District Department of Parks and Recreation BMPs	District Department of Parks and Recreation	

A draft database structure is being developed that includes fields for all relevant data necessary to track and claim pollutant reduction credit for these BMPs and programmatic activities, including (as relevant) BMP type and classification (for example, the Chesapeake Bay Program classification for different proprietary BMP types), address, permit number (if applicable) for tracking purposes, drainage area in acres, date constructed, soil type, and contact information, among other data. The draft database will consist of all of the relevant BMP datasets identified in Table 4-1. The database will be reviewed to identify gaps in required data and a strategy to fill the data gaps will be developed. Activities that may be necessary to fill data gaps include review of permits, plans, and as-builts; interviews with stormwater managers; and site visits. Once the data gaps have been filled to the extent possible, the BMP database will be finalized. It should also be noted that the BMP database will be continually refined and updated as necessary. These updates and refinements will help provide feedback to guide adaptive management, particularly in identifying areas where adequate BMP coverage is occurring and/or where progress in BMP coverage is being made.

All data compiled within the BMP database will conform to the data quality requirements summarized in the project QAPP.

The comprehensive BMP database will be linked to a geodatabase such that all BMPs can be displayed and quantified spatially (for additional information on the geodatabase, see Section 4.5.2.a). This will allow analysis of the pollutant control activities that are being conducted in specific locations such that credit can be taken (as appropriate based on the activity and the pollutant) for any and all MS4 WLAs within the geographic area of implementation for that BMP. This will require that every individual BMP or program activity have a quantified drainage area that can be associated with a particular land use and percentage of impervious cover. This may be straightforward for some BMPs and program activities, but not for others. Preliminary research indicates that many structural BMPs have drainage area values reported, but others do not. For the few structural BMPs that do not have a reported drainage area, one will be estimated by consulting plan or as-built drawings or by using a hierarchy of assumptions (e.g., drainage areas will be assigned to a particular portion of the parcel or impervious area depending on the BMP type).

In assessing non-structural BMPs and programmatic activities, the geographic area over which the BMP or activity should be applied may not be obvious. Public outreach and pollution prevention education programs are not necessarily linked with specific sewersheds. However, the geographical extent of these efforts can be mapped in broad terms. For example, is the public outreach effort city-wide or targeted to certain neighborhoods? In the former case, the activity and associated credit would be considered to apply in every individual watershed within the City. In the latter case, the activity and associated credit would be restricted to certain watersheds that overlap with the targeted neighborhoods. The DDOE Study Team will work with the appropriate city agencies or entities to identify the geographic area over which to apply credits from these types of non-structural BMPs and programmatic activities.

4.1.4 Existing Water Quality and Stream Biological Conditions Data

Knowledge of current and historical water quality and stream biological conditions data is helpful in assessing the current condition of a waterbody relative to a previously identified impairment. Where sufficient data are available, the current data will be reviewed alongside the historical data to assess whether the waterbody is still impaired by the pollutant for which the MS4 WLA was developed. This type of comparative analysis will help to determine the strategy for addressing the MS4 WLA in that watershed.

In addition to evaluating current conditions versus historical impairments, identifying existing monitoring locations can help to establish plans for tracking activities to address MS4 WLAs. For example, if water quality or biological monitoring stations already exist in a watershed which has a MS4 WLA, then results from the existing station can be used to track progress for addressing that MS4 WLA.

Another comprehensive database will be developed that compiles all existing water quality and stream condition data. Work is underway to identify water quality and stream condition datasets and data owners within DDOE and from other sources (such as EPA's STORET database). Data sets will include, but are not limited to:

- Wet weather discharge monitoring;
- Dry weather monitoring;
- Trash monitoring;

- Ambient water quality monitoring;
- Fish monitoring;
- Macroinvertebrate monitoring and habitat assessments; and
- Geomorphological monitoring.

Water quality monitoring data (comprised of wet weather discharge monitoring, dry weather screening, and ambient water quality monitoring data) will include the station location, dates and times of collection, parameters sampled, results, methods, and data qualifiers/flags. Data tables for other types of monitoring (trash, fish, macroinvertebrate, habitat, and geomorphological) will contain information relevant and appropriate to those programs, including results relative to benchmarks or any other information relevant to evaluating the results. The District's monitoring requirements will be reviewed, including plans, protocols, and summary reports to ensure that the purpose, methods, results, and previous conclusions made about the state of water quality or stream health in the District are understood. This aids incorporation of historical data into development of strategies for addressing specific MS4 WLAs. Note that the new MS4 permit also requires DDOE to evaluate the District's existing monitoring programs and propose a revised monitoring framework. By integrating these two efforts, a more comprehensive understanding will be achieved regarding the District's monitoring programs and the role they play in addressing MS4 WLAs.

All data compiled within the comprehensive water quality and stream condition database will conform to the data quality requirements summarized in the project QAPP.

Similarly to the BMP database described above, the comprehensive water quality and stream condition database will be linked to a geodatabase such that all water quality and stream condition data can be displayed spatially. This will allow analysis of water quality and stream condition data relative to existing TMDLs and MS4 WLAs in the District. As described above, locating the water quality and stream condition data spatially will allow analysis of current conditions relative to a previously identified impairment that has resulted in a TMDL and an MS4 WLA. This will require that every water quality or stream condition monitoring station be associated with a geographic point or area. This should be straightforward, because water quality and stream condition monitoring stations are already defined in terms of location.

4.1.5 Existing TMDL or Watershed Implementation Plans

Multiple plans that address watershed restoration or TMDL implementation have been developed for District waterbodies. These plans will be reviewed to identify relevant information, such as watershed data, historical discussions on impairments and TMDL development, implementation strategies, implementation tracking and accounting methods, and implementation quantification.

Review is already underway to identify various relevant plans. The list of plans to be reviewed includes, but is not limited to:

- Anacostia River Watershed Implementation Plan (DDOE, 2012)
- Oxon Run Watershed Implementation Plan (DDOE, 2010)
- Rock Creek Watershed Total Maximum Daily Load Waste Load Allocation Implementation Plan (DDOE, 2005)
- Rock Creek Watershed Implementation Plan (DDOE, 2010)
- Chesapeake Bay TMDL Phase I Watershed Implementation Plan for the District of Columbia (DDOE, 2010)

- Chesapeake Bay TMDL Phase II Watershed Implementation Plan for the District of Columbia (DDOE, 2012)
- Anacostia River Watershed Restoration Plan and Report (multiple authors, 2010)
- Anacostia Watershed Trash Reduction Plan (DDOE, 2008)

Note that Section 7 of this document will describe how the Consolidated TMDL Implementation Plan integrates with these existing plans.

4.1.6 Literature Review

As described in Section 3, the Literature Review will include compilation, summary, and analysis of data that will be relevant to developing implementation actions and the overall IP, including information on methods for estimating pollutant concentrations (both wet and dry weather), options for calculating loads, and methods for evaluating load reductions from BMPs. A short summary of these major topics areas and how the data will be used to develop implementation actions and the IP is provided below:

Methods for estimating pollutant concentrations

The Literature Review will include a compilation of data on pollutant concentrations/event mean concentrations (EMCs) that are used as part of the equations to generate pollutant loads. The Literature Review will include summaries of three tiers of EMCs, including:

- EMCs used for TMDLs and TMDL and Watershed Implementation Plans in the District
- EMCs developed for and used in other mid-Atlantic states
- EMCs developed for and used outside the mid-Atlantic states

For EMCs developed for use in the District, information compiled will describe the original sampling locations, the number of samples, the number of storm events, the land uses in the sampling area, and the method for calculating the EMCs (as possible based on the data). These types of information, if available, will help to determine the usefulness, accuracy, and representativeness of the EMCs for the respective waterbodies for which they have been used. For EMCs developed for use outside of the District area, the focus will be on documenting the types of land use and rainfall patterns in the areas where the EMCs were calculated, as these parameters will be most useful in determining the potential applicability of these EMCs to the District.

Options for calculating loads

The Literature Review will include a summary of potential methods for calculating loads that are commonly used in TMDL studies. The Literature Review will summarize the options, the pros and cons of each option, and the types of data needed for each option. The Review will also discuss where these various types of methods have been used, as well as the purpose or goal of each application.

Methods for evaluating load reductions from BMPs

The Literature Review will include a discussion of the potential methods for calculating load reductions from BMPs. Many of the published BMP studies present the information in terms of a percent reduction of the pollutant load by that BMP. For example, if a BMP receives an annual average of 10 lbs of pollutant, but the output of that BMP is 5 lbs of that pollutant, then the BMP efficiency is 5/10 = 50% for that pollutant. Thus, when that BMP is modeled for that pollutant, the pollutant input can be varied and the pollutant output can be modeled based on the BMP's efficiency for that pollutant. The use of BMP efficiencies in this manner provides an ideal way to track implementation of MS4 WLAs because a required load reduction to meet the MS4 WLA can be calculated. For example, if the MS4 WLA is 20 lbs per acre per year, and the baseline load is 30 lbs per acre per year, then the required load reduction is 30 – 20 = 10 lbs per acre per year. Tracking the total load reduction in a watershed through implementation of BMPs and calculation of load reduction from these BMPs based on efficiencies can be a very straightforward way to demonstrate that a permittee is meeting its MS4 WLAs. As an example, the Chesapeake Bay Program (CBP) uses this method for determining load reduction for the Chesapeake Bay TMDL, and DDOE is required to report levels of implementation of different BMPs that receive different load reduction credit based on BMP efficiencies set by the CBP. Therefore, DDOE will have at least one set of MS4 WLAs (MS4 WLAs in the Bay TMDL) where implementation expectations are based on using BMP efficiencies to evaluate achieving the WLA. In the case of the Bay TMDL, DDOE is required to report the levels of BMP implementation. EPA determines whether the WLAs are being met. DDOE can use tools like the Chesapeake Assessment and Scenario Tool (CAST) to forecast whether planned levels of BMP implementation will meet the Bay load targets, or whether additional implementation is needed.

Multiple references will be used to identify BMP efficiencies, including the CAST documentation (which contains BMP efficiencies for nutrient and sediment reduction for various BMPs; the International Stormwater BMP database (http://www.bmpdatabase.org/); previous work performed in association with the District's Watershed Implementation Plans and TMDL Implementation Plans; and other sources. However, in order to be compatible with DDOE's MS4 WLA tracking requirements for reporting for the Bay TMDL, the use of BMP efficiencies approved by the CBP are recommended for nitrogen, phosphorus and sediment.

Another potential method for calculating load reduction is equating load reduction to runoff retention. This method of calculating load reduction may be particularly useful in the District because it aligns with the District's new stormwater regulations and on-site retention requirements for runoff that must be achieved by BMPs. DDOE does not dictate what types of BMPs must be used to achieve this retention requirement – only that the retention be achieved by whatever BMP fits the owner's needs. Thus, if DDOE was able to track or model the amount of retention by individual BMPs it could use this value as a method for calculating pollutant load reduction to meet MS4 WLAs.

The CBP's Expert Panel on Stormwater BMP Performance Standards recently released its "Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards" report (Chesapeake Stormwater Network, October 2012), which includes a protocol whereby the removal rate for each individual development project is determined based on the amount of runoff it treats and the degree of runoff reduction it provides. This document includes curves that provide nutrient and sediment removal percentages based on the amount of runoff depth captured per impervious acre. While these curves are restricted to nitrogen, phosphorus and sediment, the literature will be researched for other information on stormwater retention versus capture of other pollutants to determine if this methodology can be applied to other pollutants.

Non-structural BMPs and programmatic activities will also be investigated and reviewed for pollutant removal credit. The Literature Review will determine appropriate removal efficiencies or other means of establishing pollutant removal credit for these types of BMPs.

The Literature Review will serve as the basis for model inputs and calculations for the parameters and methodologies described above.

4.2 Quality Assurance

A QAPP is being developed to summarize the quality assurance procedures and processes that will be undertaken to ensure the quality of the data and analytical methods used in the development of the IP. The QAPP was previously summarized in Section 3.4.5.

The QAPP will be used to ensure the quality of data used in the development of implementation actions and the IP, including the watershed, pollutant, BMP, water quality, biological and habitat assessment, TMDL implementation, EMC, pollutant load calculation, and BMP efficiency data discussed above, as well as the load and load reduction modeling to be discussed below. The QAPP will focus on identifying metadata (data about data) on the data used for the project (e.g., identifying any QA/QC procedures used in collecting the original data) and documenting the data sources, the intended use of the original data, and any caveats to the original data collection.

To do this, all data sources will the identified and compiled into a project library. The QAPP will summarize relevant data quality information (including, as much as possible, the original source of the data) in all written documents supporting the project. For example, the Literature Review will include discussions of the original sources of data used to generate EMCs (e.g., sampling locations, sampling dates, data qualifiers, calculation methods for EMCs in the District, land uses and weather patterns for EMCs outside the District) and the project library will include the original source data (as available) for all EMCs. For the BMP efficiencies, the Literature Review will include discussions of how the BMP efficiencies were derived, as this will help ensure that the efficiencies are applied correctly in the modeling.

For the modeling, the QAPP will describe quality assurance procedures and checks for the model inputs, results, and application. It will also describe how the model will be calibrated and confirmed. Further discussion of quality assurance procedures for the modeling will be provided in the discussion of the modeling below.

4.3 Development of Specific Strategies to Address Each MS4 WLA

Once the appropriate data are collected and analyzed, strategies will be developed to address each MS4 WLA. The individual strategy developed for each TMDL will be based on a number of factors, including:

- The type of pollutant/impairment;
- The quality and applicability of the supporting data and methods used to list the waterbody as impaired, develop the TMDL, and allocate loads to specific sources, including the MS4;
- Information on expected TMDL implementation from the original TMDL document;
- Current water quality or stream condition monitoring data;
- Current levels of BMP implementation (structural, non-structural, and programmatic) in the watershed;
- Current watershed restoration or TMDL implementation planning in the watershed, as described in existing watershed restoration or TMDL implementation plan documents; and
- Other relevant data.

Among the potential strategies that could be applied to any individual MS4 WLA are:

- Documenting source control as an adequate means of achieving the required pollutant reduction; and,
- Quantifying pollutant load reduction through modeling of BMP implementation.

As stated earlier, there may be instances encountered where data are not available or no longer support an existing TMDL or WLA. In these situations, it may be appropriate to re-evaluate the applicability and/or technical basis for the TMDL itself. However, although some TMDLs may be re-evaluated through this type of analysis – either in the near term or in the future – and potentially replaced, withdrawn, or otherwise modified, the IP will address all current MS4 WLAs and will include a schedule and plan for achieving each one.

For any TMDLs that are re-evaluated based on potentially questionable impairment listings or other issues, it is envisioned that this TMDL evaluation would be documented within the IP process, but resolved outside of this framework, through other programs within DDOE. Possible approaches in such instances could include refining the use of the waterbody, or de-listing of the TMDL if warranted.

The specific strategies to address each MS4 WLA will describe how the implementation methods will be determined, what data will be used to make that determination, how the determination will be made, and how the implementation will be tracked. For example, some MS4 WLAs may be implemented by focusing on source control. Evaluation of this type of implementation will be reserved for MS4 WLAs for certain toxic pollutants (such as PCBs) where MS4 WLAs are impractical to measure and where the TMDL has identified source control as the primary method for TMDL implementation. Original TMDLs will be reviewed to identify the sources of the pollutant and the recommended implementation activities. Reviews will also apply then to any subsequent TMDL Implementation Plans or other restoration plans that focus on the same pollutant or pollutant source. One potential source of restoration plans or activities that may address specific pollutants of interest is DDOE's Hazardous Waste Division. The Hazardous Waste Division will be contacted to identify programs, plans, or activities that identify and/or control pollutants of interest from the land side, because these programs, plans, and activities will be critical in ensuring that pollutants are removed, controlled, or otherwise mitigated such that they minimize the potential for the pollutants to reach the MS4 system in the first place.

As described in Section 2, the *TMDL for PCBs for Tidal Portions of the Potomac and Anacostia Rivers in DC, MD, and VA* provides a good example of this type of implementation because the "TMDL Implementation and Reasonable Assurance" Section of this TMDL study states that the WLAs will be achieved by implementing non-numeric BMPs focusing on PCB source tracking and elimination at the source. Therefore, any TMDLs including such language will be implemented by focusing on source controls as opposed to modeling of load reduction.

4.4 Tracking Existing Loads and Numeric Load Reductions

A loading model will be used to generate loads and account for load reductions for TMDLs and MS4 WLAs where numeric load reductions will be tracked as part of addressing the WLA. The development and implementation of the loading model will be discussed in the next Section. This Section discusses the model inputs necessary to generate and track existing loads and load reductions through BMPs.

4.4.1 Modeling Existing Loads and Numeric Load Reductions

A loading model will be developed and used to generate and track existing loads and load reductions. In order to generate loads and calculate load reductions, the model will rely on a variety of data inputs including precipitation, drainage area, soils, land use, EMCs, and BMP coverages and efficiencies. The modeling and analysis of loads and load reductions will generally follow the steps below. Additional detail on these steps and how the model will function is provided in Section 4.5.

4.4.1.a Baseline Load

Baseline loads reported in the TMDL documentation will be reproduced to the extent possible by the model for each watershed/pollutant combination for which there is a MS4 WLA. This will be the baseline load without BMPs.

4.4.1.b *Existing BMP Implementation Scenarios*

The pollutant removal will be modeled from existing BMPs in the watershed for each watershed/ pollutant combination for which there is a MS4 WLA. The BMPs modeled will include both structural and non-structural BMPs. Based on the initial review of current TMDL and MS4 WLA, the modeling will include any BMPs that were not already included in previous TMDL modeling. Consistent use of DDOE-approved methods for tracking load reduction through BMPs to assign load reductions to each existing BMP will be confirmed.

4.4.1.c *Gap Analysis*

The model will be used to evaluate the existing load reduction from existing BMP implementation compared to the MS4 WLA for each watershed/ pollutant combination and determine if there is a "gap" of reduction that remains to be achieved. This evaluation would be made according to the following set of comparisons:

Baseline WLA –existing BMP load reductions = Load Reduction to Be Achieved.

If Load Reduction to Be Achieved – Load Reduction from Existing BMPs ≤ 0, then there is no "gap" and no additional load reduction needed from implementation of additional BMPs

If Load Reduction to Be Achieved – Load Reduction from Existing BMPs >0, then there is a "gap" and additional load reduction needed from implementation of additional BMPs

4.4.1.d *Future BMP Implementation Scenarios*

If gaps are identified between the load reduction to be achieved for a specific MS4 WLA and the load reduction from existing BMPs, then the future BMP implementation scenarios will be designed to assess the scale of additional implementation needed to close the gap and achieve the amount of additional load reduction needed to meet the MS4 WLA. The future BMP implementation scenarios will account for various factors that could impact BMP implementation, such as the effectiveness of each BMP in achieving load reduction for the specific type of pollutant in question, the BMP efficiency, the availability and feasibility of land for BMPs, land ownership, the availability of incentives for private BMP implementation in that watershed, etc.

4.5 TMDL Implementation Plan Modeling Tool

A modeling tool will also be developed to assist in the successful development and tracking of the IP, and to ensure that pollutant load targets will be met within a defined regulatory time frame. This Section discusses how the modeling tool will be developed.

4.5.1 Identifying the Modeling Tool Requirements

The first step in developing the IP modeling tool is to identify its requirements. The overarching requirements were articulated in the RFP, notably:

- The model will estimate a baseline of current pollutant loads.
- The model will tabulate loads on an annual basis.
- The model will be able to represent the daily expression of the TMDL.
- The model will estimate pollutant load reductions achievable via various BMP implementation scenarios.

Below is a list of items identified by DDOE as requirements of the modeling tool (in no particular order). The model will:

- Calculate and track pollutant loads and reductions spatially and temporally by watershed, catchment (a defined MS4 drainage area), pollutant, or other specification;
- Account for site-specific characteristics of watersheds and catchments such as land use, land cover, soil type, slope, and proximity to waterbodies and storm drains;
- Quantify pollutant load reductions associated with various IP scenarios, including the implementation of the District stormwater management regulations over defined time periods;
- Incorporate spatial changes over time to the District's land use/land cover and BMP implementation and their effect on pollutant loads and reductions;
- Quantify the cost of various implementation scenarios;
- Evaluate progress towards WLA compliance by comparing current and future condition pollutant loads with benchmarks and milestones;
- Screen, rank, and prioritize catchments suitable for specific BMP implementation ("opportunity areas");
- Screen and rank potential BMPs to address pollutants in the opportunity areas;
- Utilize a GIS component to allow spatial visualization of modeling scenarios;
- Be user-friendly and not require expert knowledge of modeling concepts to run the modeling tool and understand the output;
- Be adaptive so that future information can be incorporated into the tool as knowledge and data sources improve; and
- Be linked directly with input data sources (such as the BMP database) to allow for continuous or periodic updates as sources are updated.

Adjustments will be made to the modeling tool requirements as necessary to respond to new needs or to address obstacles during the modeling tool development.

4.5.2 Selecting the Modeling Framework

The modeling framework describes how the modeling tool will be constructed to satisfy all of the requirements needed. The custom-built runoff and pollutant load model will consist of several different interconnected pieces, as shown in Figure 4-1.

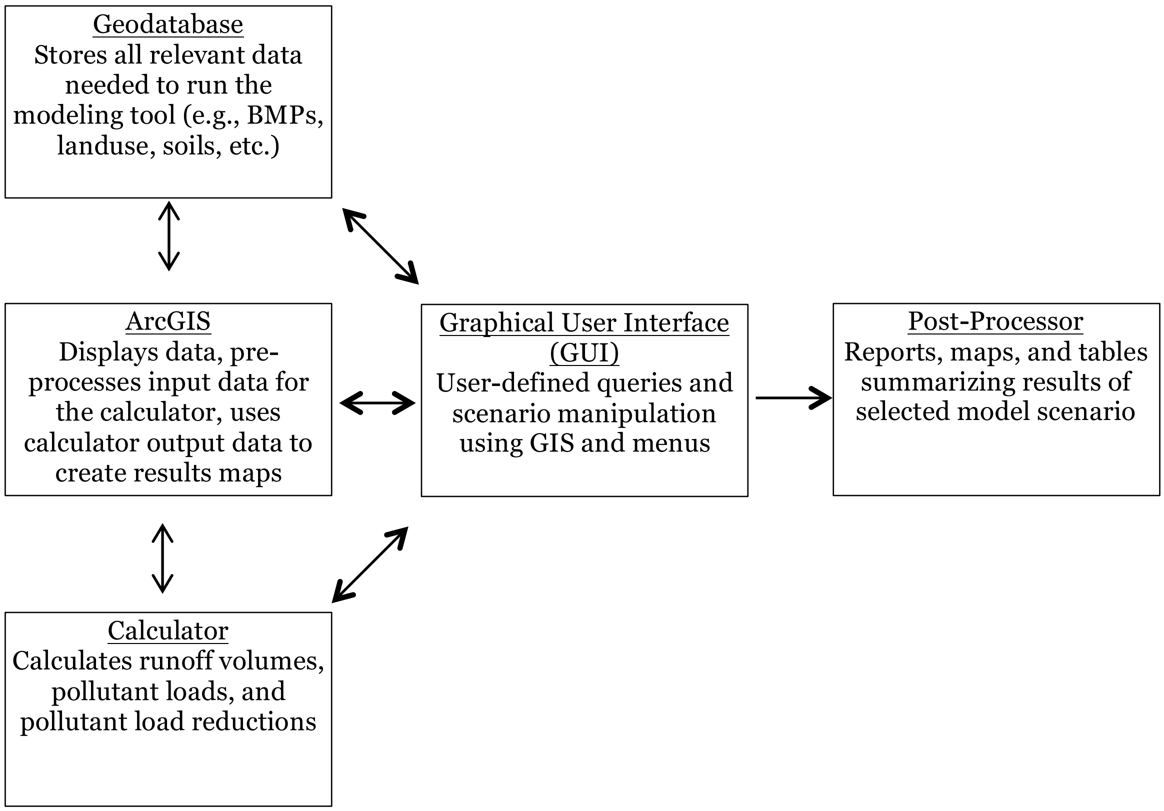

Figure 4-1. Model Framework Diagram

4.5.2.a Geodatabase

The geodatabase will contain all relevant data need to run the calculator and to produce output maps. Examples of relevant data include:

- Landuse/land cover
- Impervious areas
- Ownership parcels
- Soils
- Topography
- BMP data
- Watershed and catchment delineations
- Hydrography
- Rainfall

The development of several of these data sets (such as the BMP data and the watershed and catchment delineations) has been described elsewhere in this document, and these data will be incorporated into the geodatabase when they are completed. The remaining data used to populate the geodatabase will be collected from a variety of local and federal agencies, including DDOE, DC OCTO, the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS), EPA, and others. The assimilation of data into the geodatabase will follow the minimum spatial data standards published by EPA and the Federal Geographic Data Committee (FGDC).

Data acquired for inclusion in the geodatabase will also be verified for accuracy and validity, as described in the QAPP. Data gaps identified during this verification process will be flagged and resolved to the extent possible. The geodatabase will be updated as newer data becomes available.

4.5.2.b ArcGIS

The modeling tool will use ESRI ArcGIS version 10.x for all spatial needs. The geoprocessing and Spatial Analyst tools within ArcGIS will be used to extract relevant input data for the calculator, such as determining area and landuse type per catchment or watershed, calculating slopes and impervious areas, intersecting data layers, and others. ArcGIS will also be used to create maps to display the results from the modeling tool spatially.

4.5.2.c Calculator

The calculator is the engine that will determine runoff volumes, pollutant loads, and load reductions in the MS4 area. The calculator will be tabular, using Excel or Access to execute the runoff volume, pollutant load, and pollutant load reduction calculations, which are explained in more detail in Sections 4.5.3, 4.5.4, and 4.5.5 below. The calculator will be linked to ArcGIS and the geodatabase to access relevant input data that will be used by the runoff and pollutant load equations. The calculator will be accessed by the user through the graphical user interface (GUI), as explained below. The calculator will be able to express loads and load reductions on an annual basis (for TMDLs with annual WLAs) or on a daily basis (for TMDLs with daily WLAs).

4.5.2.d Graphical User Interface

The GUI is where the user can create and run different management scenarios, query the geodatabase, and create maps of results. The GUI is linked to the geodatabase, ArcGIS, and the calculator. The GUI will consist of a series of dropdown menus and data input fields that will allow the user to run management scenarios.

4.5.2.e Post Processor

This will be a collection of tables, reports, and graphs that describe the results of a particular management scenario run. The results will describe, for the selected area, the pollutant load generated, the pollutant load reduced, cost of the scenario, and percent WLA attainment achieved. It will also include some of the defining characteristics of the scenario, such as the year analyzed and BMPs included. The layout and content of the results output can be changed as the project advances.

4.5.3 Dry-and Wet-Weather Flow Calculation Method

Two types of flow contribute to the overall flow of rivers and streams: dry-weather flows and wet-weather flows. Dry-weather flows include river or stream baseflows that are fed by groundwater sources, and which typically vary seasonally. In urban settings, dry-weather flows may also include dry-weather runoff, which are flows that are generated from excessive lawn irrigation, car-washing, street or sidewalk washing, illicit connections, construction activities, and other similar sources. Dry-weather runoff can be variable both in time and space depending on when and where these activities occur, and as such are sometimes hard to quantify. Wet-weather flow, or runoff, occurs during precipitation events and can vary in volume and intensity depending on the precipitation, land cover, and soil characteristics.

Not all TMDLs account for dry-weather contributions, but all account for wet-weather contribution. The potential contribution of dry-weather flows and pollutant loads relative to wet-weather flows and pollutant loads will be analyzed. If the analysis shows that dry-weather flows contribute a significant load to the system, then these flows and loads will be included in the modeling tool.

The modeling tool will calculate wet-weather runoff flow volume with the application of a standard calculation method such as the Simple Method. The Simple Method is an empirical equation to estimate nutrient loads in stormwater runoff (Schueler, 1987). The Simple Method makes generalized assumptions about the fraction of rainfall that becomes runoff based on land cover and soil characteristics, and is commonly used to compare runoff volumes from different stormwater management scenarios.

$$R = P*Pj*Rv*A/12$$

R = annual runoff volume (acre-ft)

P = annual rainfall (in)

Pj = fraction of storms that produce runoff (typically 0.9)

Rv = Site runoff coefficient

A = site area (acre)

12 = unit conversion factor

The site runoff coefficient is dependent on both the hydrologic soil group (A, B, C, or D) and the site cover condition (forest cover, disturbed soil cover, impervious cover). The Chesapeake Storm Network Technical Bulletin No.9 compiled a matrix of runoff coefficients as shown in the table below (CSN, 2011).

Table 4-2 Runoff Coefficient

Site Cover Condition	Hydrologic Soil Group			
	HSG A	HSG B	HSG C	HSG D
Forest Cover	0.02	0.03	0.04	0.05
Disturbed Soil	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Current land cover and soil characteristics of the MS4 area will be obtained through DC OCTO's GIS files. Historic land cover and soil characteristics used to develop the TMDLs will be obtained from reviewing the TMDL model documentation. The development of future land cover is explained in detail in Section 4.5.8.c.

A specific rainfall period, which may consist of multiple discrete rainfall events, will be needed to drive the runoff model. This could be the years 1988-90 or 1994-1996, which are the basis of the existing TMDL models in the District, or a different year or set of years consistent with other studies such as the Chesapeake Bay TMDL studies. Prior to model application, reviews will be performed on the available rainfall data, precedents such as 1988-90 and 1994-1996, and the needs and issues surrounding the designation of rainfall planning years. A recommendation will be made, and the rainfall period will be finalized and documented.

The runoff calculation could be applied using the total lumped annual rainfall for one or more years, or it could be applied using the multiple discrete rainfall events that make up the total lumped annual rainfall. Final determination of the runoff calculation method will occur following further analysis of available methods, review of the existing TMDL runoff methodology, and discussions with DDOE.

4.5.4 Pollutant Load Calculation Method

Two types of pollutant loads are recognized to exist: dry-weather loads and wet-weather loads. Dry-weather loads are pollutant loads present in stream baseflow or in dry-weather runoff. Wet weather loads are pollutant loads generated by stormwater runoff during precipitation events. As noted earlier, dry weather conditions will not be calculated unless further analysis shows that dry-weather flows contribute a significant load to the system. The wet-weather pollutant loads will be calculated for each area of interest by multiplying the runoff volume by the EMC value for each pollutant of interest. EMC values typically have units of mg/l or MPN/100ml (bacteria).

Load is calculated as:

$$L = R * C * 2.72$$

L = annual load (lbs)

R = runoff (acre-ft)

C = event mean concentration (mg/l)

2.72 = unit conversion factor

Or for bacteria calculations as:

$$L = R * C * 1.23E7$$

L = annual load (MPN)

R = runoff (acre-ft)

C = event mean concentration (MPN/100ml)

1.23E7 = unit conversion factor

Specific EMC values will be assigned to each source, based either on land use data or based on TMDL-specific watershed data, for each pollutant. It is generally understood that EMCs account for distributed ground applications, atmospheric dry deposition, and rain-deposited pollutants, and therefore can be assumed to be comprehensive of all non-point pollutant sources. A literature review will be conducted to ensure that the most recent and relevant studies are used to determine pollutant loads, especially as they apply to the District's urban nature. Recommendations for EMC values will be finalized following discussion with DDOE. The modeling tool will be able to calculate the pollutant loads on a site-specific basis (e.g., catchments or BMP drainage areas) and will also be able to aggregate the pollutant loads on a watershed-wide basis.

4.5.5 Pollutant Load Reduction Method

Pollutant loads can be reduced through structural and non-structural BMP application. Both types of BMPs and their pollutant load reduction efficiencies are described below.

4.5.5.a Structural BMPs

There are two ways of predicting pollutant load reduction methods from structural BMPs. The first is to assign an average percent pollutant load reduction to various classes of BMPs based on published literature values. This average load reduction is applied irrespective of the amount of stormwater volume retained, size of the BMP, age of the BMP, or other BMP-specific or area-specific characteristics. For the past three decades, this has been the conventional way of determining pollutant load reductions from BMPs, especially for BMPs that do not retain stormwater, but rather detain stormwater (flow-through systems).

With the emergence of new BMP practices focused on stormwater retention rather than detention, a new way of determining pollutant load reduction has been developed. This approach utilizes a different set of BMP pollutant removal efficiencies that account for the retention volume provided by each BMP. A series of pollutant load reduction curves will be generated for different classes of BMPs outside of the modeling tool. These curves will be created by routing a continuous rainfall time-series dataset for a representative time period through different sized BMPs and analyzing annual cumulative retention volume.

This is a relatively new approach to calculate BMP efficiencies. It allows more BMP-specific and site-specific characteristics to be taken into account as each class of BMPs offers different storage capabilities and may treat different types of area.

Existing structural BMP data will be reviewed to determine if and which BMPs have attribute data describing the retention volume. If such data exists, the modeling tool will calculate pollutant load reductions based on the retention volume provided and the pollutant reduction curves described above. If no information exists to describe the BMP retention volume, then the pollutant load reductions will be based on average percent efficiencies found in literature.

It should be noted that both approaches to defining BMP efficiency require knowledge of the drainage area contributing to the BMP. Both the size of the drainage area and the land use/land cover included in that drainage area are important characteristics that influence the runoff volume and pollutant load that are treated by the BMP. An initial analysis of the existing BMP data shows that many BMPs do not have this type of information included in their attributes. In such situations, assumptions will have to be made about the drainage area and its composition. The merits of these assumptions will be evaluated.

Particular care will be taken to provide consistency with the Chesapeake Bay TMDL-approved BMP efficiencies for nutrients and sediment to ensure that estimated reductions will be consistent with EPA's accounting. If certain BMPs do not have established performance standards for certain pollutants, then a methodology for estimating those load reductions will be developed. Pollutants that fall under this category include some organics, metals, and pesticides. In these situations, surrogate pollutants with established load reductions may be selected to represent the performance of non-measurable pollutants.

Scalars may be applied to reflect the imperfect nature of field implementation of BMPs. Over time, field-implemented BMPs may not perform as well as literature citations because of lack of maintenance, age of BMP, vandalism, site constraints, or others. The application of scalars is a method for reflecting these imperfections in the model. For example, studies have shown that older BMPs that are not regularly maintained do not remove pollutants as well as new BMPs. A scalar may therefore be applied to older BMPs to assign a lower pollutant reduction than that for newly implemented BMPs.

The model will be able to calculate the pollutant load reductions on a site-specific basis, and also aggregate the pollutant load reductions on a watershed-wide basis. The model will also allow for load reductions to be summarized by absolute values (e.g., lbs/year) or by relative reductions (e.g., percent removal per catchment).

It should be noted that a significant component of BMP implementation in the District will be driven by compliance with the new 2013 Stormwater Rule (officially, the 2013 Rule on Stormwater Management and Soil Erosion and Sediment) during development and re-development projects in the District. The design and volume of retention achieved by these projects will be determined in accordance with the Districts 2013 Stormwater Management Guidebook (SWMG). The SWMG allows for the following stormwater retention practices:

- Green Roofs
    - Extensive green roof
    - Intensive green roof
- Rainwater Harvesting

- Impervious Surface Disconnection
    - Simple disconnection to pervious areas with the compacted cover designation
    - Simple disconnection to conservation areas with the natural cover designation
    - Simple disconnection to a soil compost amended filter path
    - Infiltration by small infiltration practices (dry wells or French drains)
    - Filtration by rain gardens or stormwater planters
- Permeable Pavement Systems
    - Enhanced Permeable Pavement
    - Standard Permeable Pavement
- Bioretention
    - Standard Bioretention
    - Enhanced Bioretention
- Stormwater Infiltration Practices
    - Infiltration trench
    - Infiltration basin
- Open Channel Systems
    - Grass channels
    - Dry swales/bioswales
    - Wet swales
- Ponds
    - Micropool extended detention pond
    - Wet pond
    - Wet extended detention pond
- Wetlands
    - Shallow wetland
    - Extended detention shallow wetland
- Trees
- Proprietary Practices, if specifically approved by DDOE

Installation of these types of practices as part of development and re-development projects – particularly with the scale and frequency of such activities in the District – will improve stormwater management as the District re-develops, thereby helping to meet MS4 WLAs. The model will specifically incorporate projected development and re-development scenarios as part of implementation planning (see Section 4.5.8.c below), and will address the impacts of stormwater retention through compliance with the 2013 Stormwater Rule on pollutant removal.

4.5.5.b Non-Structural BMPs

Non-structural BMPs include practices such as street sweeping, the Anacostia River Clean Up and Protection Act ("Bag Law"), stormdrain stenciling, and public education campaigns. Some of these practices have defined pollutant load reductions. For example, street sweeping is a well-studied practice and can be quantified in terms of pounds of pollutant removed per mile of street swept. Other non-structural practices are not well-defined in terms of their pollutant load reduction efficiency. An approach for estimating pollutant load reductions from stormwater management practices with no established load reduction performance, such as public education campaigns or pet waste management will be developed. Any quantification of load reductions from non-structural BMPs will be focused on the impact within the MS4 area.

4.5.6 Baseline Condition Analysis

Once the modeling tool is constructed and operational, the first step will be to verify the runoff and pollutant load generated under the baseline conditions. The baseline conditions refer to the year and data that were used to develop the TMDLs. These will be TMDL specific. The modeling tool will calculate the runoff and pollutant load for the baseline scenario and those results will be compared with the runoff and pollutant load calculated by the TMDL models. Discrepancies are expected to arise due to differences in model equations, data inputs, and other modeling assumptions. These discrepancies will be explained and, where possible, rectified. The types of rectification solutions include changing data inputs and assumptions or modifying the modeling equations. In situations where the model differences cannot be rectified, a scientifically defensible explanation will be provided.

Since the development of the TMDLs span 12 years (1998-2010), the baseline scenario may be based on a variety of different datasets depending on the waterbody and the pollutant. The modeling team will assess the baseline parameters used to develop the TMDLs and will recommend data sets to be used to represent the baseline conditions. These will be presented to DDOE for review and feedback.

A cursory review of the TMDL model documentation has shown that most TMDLs did not take into account the pollutant removal provided by any existing BMPs. A preliminary review of the BMP data has also shown that very few BMPs were in existence when the majority of TMDLs were developed. It is therefore likely that the baseline condition will exclude the presence of any existing BMPs.

4.5.7 Current Condition Analysis

Following the baseline condition analysis, the modeling tool will be applied to calculate the current condition. This analysis will use current information on landuse, land cover, and BMP data, and a representative annual rainfall year (or multiple years). In addition to calculating the pollutant loads, the current condition analysis will also calculate the pollutant load reduction provided by the structural BMPs that are currently in the ground (as tracked by DDOE), and account for pollutant load reductions provided by non-structural BMPs. An initial analysis of the BMP database shows that the current condition includes thousands of BMPs of various types and efficiencies scattered across the District. The pollutant load reductions offered by these BMPs will be credited to the catchment and watershed in which they are located.

By comparing the results from the current conditions with the results from the baseline conditions, the modeling team will gain a better understanding of the amount and rate of progress towards load compliance that has been achieved across the MS4 area to date, as well as the rate of implementation actions that will be needed in the future to achieve load compliance.

4.5.8 Future Management Scenario Analysis and the Prioritization Tools

The current condition analysis can be used to prioritize catchments to target for BMP implementation. This exercise of prioritizing catchments and identifying BMPs will be used to develop the future management scenarios. The future management scenario analysis will consider plans for future development and redevelopment, and assess the extent to which various TMDL implementation actions associated with growth and development will contribute to compliance with WLAs.

4.5.8.a Identifying and Prioritizing Opportunity Areas

The modeling tool will include a function that will help identify and prioritize opportunity areas for targeted BMP implementation. The identification of opportunity areas will be based on the net pollutant load generated within a catchment. Since pollutant loads will be generated for multiple pollutants, but not all pollutants are of concern in every watershed, a scoring mechanism will be formulated to quantify the relative overall combined pollutant load for each catchment, as well as the relative risk of the catchment to contribute to downstream impairments. This scoring mechanism will identify catchments that are affected by multiple pollutants where BMP implementation may offer the best return on investment. The scoring mechanism could be based on variables such as:

- Relative importance and severity of certain pollutants over others (for example, bacteria may be weighed more heavily than copper in catchments where there is bacteria impairment)
- Runoff coefficients (for example, catchments with a high runoff coefficient may be weighed more heavily than catchments with a low runoff coefficient)
- Ownership (for example, areas that are owned or maintained by District government agencies may be weighed more heavily that areas that are privately owned)

Other factors, such as consideration of environmental justice, also may be considered when determining where BMPs will be placed within the District.

The modeling team will evaluate these and other potential scoring variables, and make a recommendation to DDOE on the scoring mechanism. While this process will be mostly automated, a thorough manual review of the opportunity areas will be required by the user as well to verify the results. The result of the catchment prioritization will be a set of maps and corresponding tables showing the relative scores per catchment.

4.5.8.b BMP Selection and Prioritization

Once opportunity catchments are identified, the modeling tool will screen potential BMPs for implementation using considerations such as:

- Effectiveness at reducing targeted pollutants;
- Ease of implementation (depends on available area, soil type, slope, landuse/land cover); and
- Cost.

These considerations will be evaluated along with others, and the modeling team will provide a recommendation to DDOE on the most useful and applicable BMP screening criteria.

The modeling tool will be able to represent a variety of standard BMPs with known efficiencies, as well as user-defined BMPs. The BMP selection and prioritization exercise will result in a list of BMPs best suited to implement in the priority catchments.

4.5.8.c Addressing Changes in the Urban Landscape

The District's urban landscape is a continually evolving one, shaped by local demographics, public governance, and private development. Future development and redevelopment has important impacts on the IP because development may lead to increases in pollutant loads, but may also result in additional stormwater retention and pollutant load reduction through the application of the District stormwater regulations. The District stormwater regulations require that major land-disturbing projects retain the volume from a 1.2-inch storm event, and major substantial improvement activities must retain the volume from a 0.8-inch storm event.

In order to assess the impact of future changes in the urban landscape, the expected changes in development will be forecasted. The forecast will result in a GIS dataset of the future land cover/landuse and a GIS dataset of areas where stormwater retention practices are expected to occur and the depth of runoff volume that will be retained on-site. These two GIS files will be used as inputs to the modeling tool to calculate the runoff volume and pollutant load generated by the new landuse/land cover, and the runoff volume and pollutant load removed through the additional stormwater retention practices. This assessment will provide an indicator of the rate at which the District stormwater regulations will positively impact the reduction in WLAs.

4.5.9 Methodology for Growth Scenario

4.5.9.a Demographics

The Metropolitan Washington Council of Government (MWCOG) develops the population and employment forecast for the District Metropolitan Region. MWCOG works with Federal and local governments in the region to develop the forecasts for use by the jurisdiction for planning purposes. The regional model is based on local and national economic factors. Forecasts are based on master plans and development projects that are in the pipeline.

The Round 8.2 Cooperative Forecasting, released in July 2013, is the most recent forecast produced by MWCOG. The baseline year is the data from the 2010 census. The data are then forecast in five-year increments for 2015 through 2040 by Transportation Analysis Zone and is available as a GIS coverage.

These data will be used to represent changes in population, the number of households, and employment within the District from 2010-2040.

4.5.9.b Forecasting and modeling of proposed/planned development and redevelopment

A forecast of the proposed and/or planned development and redevelopment in the District over time will be developed. Development/re-development over time will lead to changes in stormwater loads that must be incorporated into the IP. The District's new stormwater regulations are expected to lead to reduced stormwater loads as properties without current stormwater management are required to retain stormwater onsite after development/re-development. In addition, DDOE's program to provide stormwater retention credits (SRCs) is expected to generate a large amount of voluntary implementation of small retention practices around the city; if successful, this program could be a major driver of BMP implementation and could have a large impact on pollutant load reductions.

The creation of the forecast models must be done in collaboration with city planners from the Office of Planning (OP). OP maintains the GIS data for current land use, zoning, future land use from the comprehensive plan, and planned unit developments/large development projects (PUD). It is important to ensure that the forecast models developed are consistent with the city and regional models. DC Water created a model to determine the impervious surface area charge, which all properties are required to pay as part of their water bill. The DDOE Study Team will meet with DC Water to ensure that comparable assumptions are used.

Collaboration will occur with District Department of Transportation's Urban Forestry Administration to include data on tree cover throughout the city, and to review future plans to add more tree cover.

The following assumptions will be used to build the development scenarios:

- Single-family homes (attached and detached) and multi-family condominium buildings will not be redeveloped. These areas are excluded because of the difficulty of assembling and redeveloping areas with several individual owners.
- Auto dependent commercial areas, low-density commercial areas, surface parking lots, and multi-family residential buildings built prior to 1980s have the potential to be redeveloped.
- Vacant properties near metro stations could be assembled to create high-density, mixed-use development.

At the beginning of the project, three development scenarios will be created:

- **Existing condition/Base Case -** To be consistent with the regional forecasting model, 2010 will be the base case. A map of the existing land use, watersheds, and tree cover data will be developed to serve as the base case. The land use will include building footprints, right-of-way, alleys, and tax lots. The base case will also include all stormwater management systems currently installed in the city.
- **Short-term Future Land Use (2020) –** A map built on the base case but including building permit data from Department of Consumer and Regulatory Affairs and PUD data from the Office of the Deputy Mayor for Planning and Economic Development and OP will be created to represent 2020 conditions in the District. This map will include all development projects in the pipeline as well as proposed stormwater management systems and tree cover.
- **Planned build out conditions with current regulations (2040) -** A map will be created to show the 2040 build out conditions in the District. The future land use will be mapped based on data from the Comprehensive Future Land Use Plan, small area plans, and future tree cover. It will be assumed that all land that could be redeveloped is redeveloped based on existing zoning. It will be further assumed that stormwater management systems for properties that are forecast to undergo change in land use or density will meet the current regulations.

These scenarios will show the current impact, immediate future impact, and the future impact under the current regulations. Additional scenarios can be created to model additional years between the short term and the planned build out scenarios.

4.5.10 Evaluating and Comparing Management Scenarios

The modeling tool will be used to assess IP management scenarios that will achieve compliance towards TMDL attainment. A set of metrics against which various scenarios will be measured in order to meet the challenges of how to evaluate and compare different management strategies will be developed. These metrics may include:

- Load reduction achieved for each pollutant modeled;
- Cost of implementation;
- Return on investment;
- Estimated timeline for full implementation of management scenarios; and
- Parties responsible for implementation (for example: District government, private property owners, federal government, etc.).

Some metrics may be weighted more heavily than others. The outcome of the scenario comparison is a ranking of the scenarios indicating the most favorable holistic management scenario.

4.5.10.a Development of Implementation Costs

BMP cost data compiled as part of the Literature Review will be used to develop unit cost estimates for BMP implementation to the levels identified under the Scenario Development task discussed above. Cost estimates will include estimates for both capital costs and for continuing O&M costs. Because O&M is typically presented as an annual cost, an appropriate timeframe will be developed on which to base the total O&M cost to be presented in the cost estimates (i.e., present costs for the years 2017 and 2025, which would require four and 12 years of annual O&M, respectively). Cost estimates will include costs for both structural and non-structural BMP implementation.

Costs will be developed based on multiplying the amount of implementation of different BMP types by the unit costs for those BMP types. As described in the paragraph above, these unit costs will include both capital and O&M costs, and will be inclusive of O&M costs for a specified amount of time. Costs can be broken out to show the capital versus O&M components, if this is requested. For example, if the unit capital cost of a BMP is $10,000 per impervious acre treated, the annual O&M cost is $200 per impervious acre treated, and the timeframe chosen for cost estimating is five years, then the total cost per impervious acre treated over that five year period would be $11,000 ($10,000 + (5 yrs*$200/yr)). If the expected implementation level of this BMP was treating 30 acres of impervious area, then the total expected cost would be $330,000.

Costs will be compiled and reported in aggregate, as opposed to individually. This is the most sensible option for reporting costs for several reasons. First, these are planning level cost estimates based on generalized unit cost data, and thus they are better used to evaluate the potential magnitude of total expected costs, but not to evaluate the costs of any individual project. Second, the BMP implementation scenarios that are used as the basis for the level of implementation are also done at the planning level, and thus the amount of implementation of any individual BMP type, and also the implementation of any individual BMP, is subject to change depending on conditions on the ground. Finally, the costs for any individual BMP will be highly site-specific, and developing more accurate cost estimates requires actual design plans, which are beyond the scope of this project.

Because the implementation of BMPs will be modeled spatially, costs can also be broken out by individual watershed, MS4 WLA, or any other subcategory, as requested. This may be useful for prioritizing the implementation of BMPs in certain watersheds to meet individual MS4 WLAs, and/or for developing milestones, benchmarks, and the proposed implementation schedule (discussed below).

The DDOE Study Team will also attempt to identify the costs that would be incurred by various types of parties (e.g., private sector, District government, federal sector) based on the modeled implementation scenarios. The assignment of costs will be based on the amount of implementation modeled or expected on lands owned by these different entities. Including this type of analysis in the IP can be helpful in several ways, including:

- Identifying the costs that are expected to be incurred by the District government. It should also be possible to identify the specific District government agency responsible for the land on which BMPs are expected to be implemented (e.g., District Department of Transportation [DDOT], District Parks and Recreation (DPR), etc.). This can allow/encourage initial planning for future capital and O&M budgets, manpower, training, etc.
- Identifying the costs that are expected to be incurred by the private sector. This should allow for a "reality check" in terms of the amount of cost and implementation that is expected to be driven by redevelopment and/or in response to the District's updated stormwater fee structure and stormwater retention credit program.
- Identifying the costs that are expected to be incurred by the federal sector. DDOE has no direct control over the implementation of BMPs on federal land. Nevertheless, analysis of the amount and cost of the implementation of BMPs on federal land which would be necessary to help meet the load reductions in the TMDLs and MS4 WLAs would provide useful information for DDOE on the scale of the effort required by federal agencies. This may be helpful both in discussions with individual agencies where BMPs need to be implemented, and also with EPA Region 3, which is administering the permit and evaluating compliance.
- Evaluating the potential for "fees in lieu of" onsite stormwater retention. DDOE's new stormwater regulations allow the payment of a fee in lieu of meeting the requirements to retain stormwater onsite. Analysis of the expected redevelopment scenarios and the potential use of the fee in lieu of

onsite stormwater retention option can provide DDOE with an idea of the amount of funds generated through the fee that can be used to implement BMPs. This can assist in planning and prioritizing potential future projects.

- Developing a feasible implementation schedule. Total costs and the rate at which funds can be generated to meet these costs are important in setting a realistic schedule for implementation. The analysis of total costs, plus the total amount of implementation as defined by the modeling, will be used to propose a realistic implementation schedule for addressing each TMDL/MS4 WLA, as well as to set benchmarks and milestones for those TMDLs/MS4 WLAs, as appropriate. However, it will be important to remember that the IP will propose a process of adaptive management in addressing individual TMDLs, and thus any schedule will be subject to change as new information, potentially including new cost information, is collected.

4.5.10.b Reconciling Implementation Levels with Implementation Costs

Once cost information is developed, it will be used in conjunction with other information as a basis for developing the IP, including the proposed implementation schedule. However, it is important to recognize the uncertainties inherent in this planning effort, and to be prepared to develop and implement a strategy to reconcile the projected levels of implementation with the projected costs. This will help ensure that the most cost effective, feasible BMP implementation strategy is produced. In other words, it may be that the cost of achieving the load reduction required to meet a specific MS4 WLA is extremely high, while the uncertainty in the modeling is also high. In such cases, return on investment in terms of the proportion of additional dollars spent versus additional load reduction achieved may need to be weighed. This is especially true in light of the uncertainty regarding exactly how much load reduction will be needed to meet the MS4 WLA. Methods such as a "knee of the curve" analysis, whereby the total costs of a solution are graphed against the amount of load reduction that is achieved can help to identify the point where additional dollars spent produce ever decreasing amounts of additional load reduction. Analyses such as these, which are already in use in Combined Sewer Overflow Control Program planning, may help to identify the most cost effective amount of control for a watershed. Such an analysis also helps meet the requirements of identifying controls, which is part of the regulatory compliance strategy to address MS4 WLAs. Situations such as these are ideal candidates for evaluation through adaptive management, wherein monitoring or other data are used to evaluate the watershed and determine if it has met its targets, or if additional controls or other actions must be taken to achieve the targets (in this case, the MS4 WLA).

In order to address any of these types of these issues, should they arise, the modeling team will recommend approaches for addressing each MS4 WLA, using the cost information and modeling data to support the recommendations. The approach for any individual watershed may include an analysis such as the knee of the curve evaluation to assess the most feasible approach for addressing an individual MS4 WLA given the potentially high costs of meeting that WLA, especially given any uncertainties in the data and a diminishing return in terms of additional load reduction per additional dollars spent.

4.5.10.c The Use of Stakeholder Input in Implementation Planning

Stakeholder input is critical to successfully achieving the goals established in the IP. This is especially true in the case of DDOE's IP because third party lawsuits were one of the primary drivers in shaping the requirement to develop the IP in DDOE's MS4 permit. Therefore, it is important that stakeholders be involved in all aspects of the development of the plan.

DDOE has designed and implemented a robust stakeholder and public participation plan as part of the development of the project. The specifics of this plan are discussed in detail in Section 6. It is DDOE's goal to leverage this stakeholder involvement and public participation process to ensure that all stakeholders are aware of the steps being taken to develop the IP. The stakeholder involvement and public participation process is also designed to solicit input from the stakeholders and the public, and to encourage discussion of the data, methods, and processes used to develop the IP. Barring the ability to always reach consensus, DDOE is committed to making its decisions as transparent as possible, and to document and communicate these decisions to the stakeholders as quickly as is feasible.

DDOE has implemented a stakeholder involvement process whereby stakeholders will be briefed on a regular basis on the available data, process, planning, analysis, and proposed decisions that will go into the development of the IP. Input of various types will be obtained from the stakeholders, which may include evaluations of:

- Regulatory compliance strategies;
- Project QA/QC strategies;
- Data completeness;
- Data interpretation/data analysis techniques;
- Modeling techniques and processes (e.g., development of baselines, load calculations, load reduction calculations, etc.);
- Implementation scenarios;
- Implementation schedules/timelines;
- The development and tracking of implementation milestones and benchmarks; and
- Integration with existing/ongoing watershed plans/strategies.

Documentation of all stakeholder input received will be compiled and routinely distributed. These comments and recommendations, along with any other stakeholder input, will be recorded as part of the meeting minutes, and any immediate follow-up actions will be identified. With respect to any written comments received, they will also be compiled and reviewed with DDOE. Written summaries of comments may be provided to the entire group if this appears to be valuable or feasible. Decisions on how to handle stakeholder input will be documented, either by reporting them to the stakeholders at subsequent stakeholder meetings, or by providing a written summary of the input and its resolution to the stakeholders.

In addition to stakeholder input, which is being solicited from specifically-identified stakeholders who have been invited to participate in the process, DDOE also plans to hold public meetings whereby the general public can also participate in the development of the IP. However, unlike the stakeholder involvement process, the public meeting process is designed to be primarily informational. Therefore, the structure of these meetings may differ from the stakeholder meetings. The public meetings are likely to include a "Question and Answer" session designed to answer any general questions that the participants may have.

4.5.10.d Development of the Consolidated Implementation Plan and Schedule

All of the developed information outlined in this document will be used to prepare an IP that meets DDOE's MS4 NPDEs permit requirements. As required by the permit, the IP will include the following for each applicable MS4 WLA:

1. A schedule for attainment of the WLAs (final date and interim milestones as necessary; it should also be noted that the schedule will be designed to achieve the WLAs as soon as possible);
2. Demonstration using models for how each applicable WLA will be attained; and

3. Narrative explaining schedules and controls used in the Plan.

The IP will follow the regulatory compliance strategy outlined in Section 2 of this document in order to address each applicable MS4 WLA and meet permit requirements. As described in Section 1 of this document, the Consolidated TMDL IP will follow the same general outline as this document, and will incorporate all of the information, analyses, and strategies outlined herein.

This Section of the IP will also address coordination with partners or stakeholders whose actions are likely to impact the implementation schedule, benchmarks, or milestones. Because DDOE is not a landholder, it must rely on coordination with those that do own or manage land, or other drivers (such as the new stormwater retention requirements), to ensure that the IP is implemented. DDOE is already coordinating with sister agencies (such as DDOT and DPR) to incorporate stormwater management into these departments' capital planning and O&M programs. In addition, the District's new stormwater regulations are expected to drive a large amount of BMP implementation, as described above. While projections of the amount of BMP implementation driven by the new stormwater regulations are just that - projections - it is reasonable to assume that modeled projections of stormwater BMP implementation can be used to set the implementation schedule. The IP will include benchmarks (and milestones for longer-term implementation), evaluation of the achievement of these benchmarks and milestones, and the ability to make mid-course corrections through adaptive management, which will help ensure that the overall IP stays on schedule despite most of the actual implementation being done by others.

5. Setting Benchmarks and Milestones and Tracking Progress

This Section describes the process for setting benchmarks and milestones and tracking progress towards attaining WLAs. Once recommendations have been developed to address the District's MS4 WLAs, a system must be used to monitor progress towards attainment. Progress can be defined in many ways, including tracking implementation of BMPs or improvements in water quality. However, for the purposes of meeting the District's MS4 permit requirements, progress towards attaining WLAs will be "evaluated against [meeting] all implementation objectives, milestones and benchmarks[3]." This Section of the IP will define those objectives, benchmarks, and milestones, and how they will be used to set implementation goals and a schedule for attaining the WLAs. It will also then describe the actual methods that will be used to track progress in meeting these benchmarks and milestones and in achieving MS4 WLAs.

5.1 Benchmarks and Milestones

Section 4.10.3 of the MS4 permit requires a "specified schedule for attainment of WLAs that includes final attainment dates and, where applicable, interim milestones and numeric benchmarks."

"Benchmarks" are the goals or targets by which DDOE can gauge incremental progress toward meeting TMDL WLAs. In addition, the permit specifies that if attainment of WLAs requires more than one permit cycle, then benchmarks will be used to track progress towards attaining interim "milestones" in the schedule to attaining those WLAs.

> **Benchmarks**
> A "quantifiable goal or target to be used to assess progress toward 'milestones' and WLAs, such as a numeric goal for BMP implementation. Benchmarks are intended as an adaptive management aid and generally are not considered enforceable."
>
> MS4 Permit, Section 9

Benchmarks include the projects, programs, and other efforts implemented on an annual basis to reduce pollutant loads. Benchmarks can include grouped or individual projects as well as broader scale programs or efforts, such as public outreach (e.g., conducting a certain number of stormwater related workshops over the course of the year). Benchmarks will be established on an annual timeframe and used internally to DDOE for tracking short-term progress. Benchmarks also set an updated check on conditions at any time that can be used to compare against projected progress.

Using a benchmark approach allows for more quantified assessments of implementation progress, and helps determine areas within the MS4 where progress is lagging and prioritization of additional implementation efforts may be needed. Cumulatively, the benchmark approach will be used to track progress toward meeting WLAs or, in cases where attainment of WLAs requires more than one permit cycle, then benchmarks will be used to track progress towards attaining interim milestones.

In contrast to benchmarks, which are non-binding, "milestones" are interim numerical targets (e.g., achieve 50 percent load reduction by year 2020) that are used to track WLAs scheduled to be achieved over more than one permit cycle. Milestones will be enforceable per the MS4 permit. A depiction of how

[3] From MS4 permit Section 4.10.4.

milestones and benchmarks can correlate with one another is included in the example presented in Figure 5-1.

> **Milestones**
> "An interim step toward attainment of a WLA that upon incorporation into the permit will become an enforceable limit or requirement to be achieved by a stated date. A milestone should be expressed in numeric terms (i.e., as a volume reduction, pollutant load, specified implementation action or set of actions) when possible and appropriate."
>
> MS4 Permit, Section 9

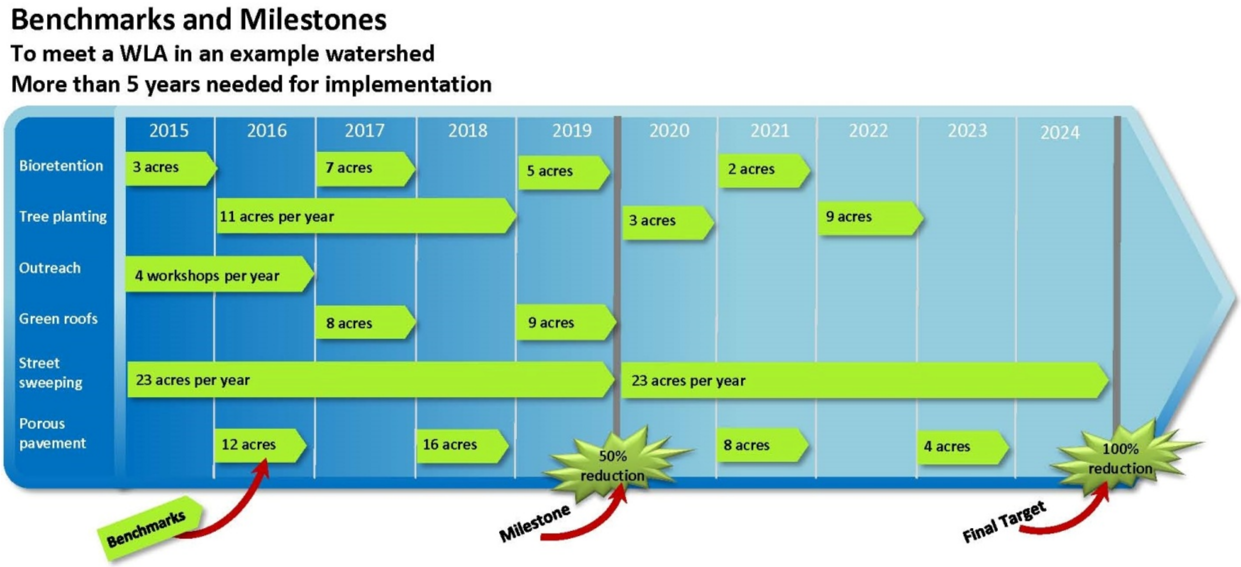

Figure 5-1. Example of schedule established for benchmarks and milestones associated with achieving a WLA over a 10-year period

The Chesapeake Bay TMDL provides a good example of using the milestone approach. The WLAs established in the 2010 Bay TMDL were expected to be achieved by 2025, 15 years after the TMDL was established. However, U.S. EPA set a target of achieving 60 percent of the necessary load reduction by 2017. While the terminology used in the Bay TMDL is different, this percent reduction goal can be is identical to the type of "milestone" that could be set in the IP. In addition, the Bay TMDL also requires the setting of benchmarks every two years (although the Bay TMDL calls these "two year milestones.") These two year milestones are based on the local-level pollutant reduction actions and efforts implemented by the various source sectors in the basin. The CBP describes pollutant reduction efforts in the Bay prior to this approach as "a ladder without rungs – it did not include incremental, short term goals needed for steady progress in reducing pollution[4]."

Benchmarks and milestones can be characterized in various ways and can include tracking the actual implementation of on the ground practices as well as programmatic implementation or enhancements.

For instance, "implementation" benchmarks can be established based on achieving a certain amount of implementation within a specified timeframe (e.g., implement six acres of BMPs or conduct three outreach sessions over the course of a year) or the modeled impact of a certain amount of implementation

[4] Chesapeake Bay Program. 2009. 2011 Milestones for Reducing Nitrogen and Phosphorus

(for example, the implementation of two acres of bioretention equated to six pounds of Nitrogen removal annually, etc.).

Alternately, “programmatic” benchmarks and milestones reflect the actual formation of programs, efforts (e.g., new ordinances), or enhancements to existing water quality programs. This could include development of additional ordinances, expansion of programs that would lead to additional pollutant reductions, or securing additional resources. While programmatic benchmarks and milestones do not include direct control of pollutants, they are important for increasing the resources and developing the capacity for future implementation of such actions.

Because attaining individual WLAs may necessitate pollutant reduction efforts over a number of years, developing appropriate benchmarks, and, if necessary, enforceable milestones, will enable DDOE to track progress toward WLA attainment in an iterative manner and modify its approach if sufficient progress is not made.

5.1.1 Setting Benchmarks and Milestones

While the MS4 permit established that the IP preempts previously developed IPs, this IP will incorporate the processes used and account for actions identified in previous IPs and WIPs that are still deemed appropriate for making continued progress towards meeting WLAs.

DDOE’s previous WIP efforts incorporated an approach for the development of an implementation schedule, benchmarks, and associated milestones that involved prioritizing strategies, individual efforts, and locations for implementation, and also enabled tracking progress toward meeting DDOE’s MS4 permit requirements. This process included the following steps:

1. Identifying projects to achieve pollutant reductions (projects already planned or underway as well as potential or conceptual projects);
2. Grouping projects by location;
3. Scoring projects according to their environmental impact, ability to be implemented, and educational value; and
4. Prioritizing watersheds for restoration based on score and to better see results, incorporate cost efficiencies, and facilitate targeted monitoring.

Once projects have been identified and prioritized, an approximate schedule can be determined which reflects the length of time needed for implementation. The IP will incorporate this information in development of the actual schedule. The baseline and the level of pollutant reduction required to achieve WLAs establishes the bounds within which the strategies for pollutant reduction are developed. The rate of actual implementation, however, may vary considerably from year to year.

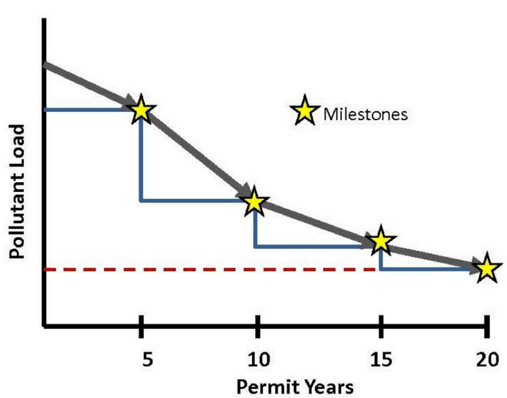

Figure 5-2. Examples of varying rates of implementation to reach milestones (adapted from Oregon DEQ, 2012)

As shown in Figure 5-2, implementation efforts and rates can vary over time. The type of actions or technologies selected will impact the ability to implement efforts at particular rates (i.e., significant early implementation of more readily available actions; later implementation once ordinances or funding have been established). The schedule will

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serve as the framework within which benchmarks (and, if necessary, milestones) will be established.

While every TMDL WLA will vary, DDOE's previous WIP and planning efforts have included dividing watershed work into five year intervals, thus conducting the steps above within the context of establishing five and 10-year load reduction targets. This approach was used in these previous efforts as it meshes closely with the Chesapeake Bay TMDL and MS4 permit cycle timeframes.

An example of implementation schedule development is seen in the Anacostia WIP. In this document, a 30-year schedule was defined based on making progress toward de-listing the Anacostia watershed. Milestones were identified based on "the number of watersheds attaining water quality standards and the percent of the Anacostia attaining water quality standards."

Another example can be seen in the Oxon Run WIP. Table 5-1 demonstrates the types and quantity of projects required to achieve TMDL WLAs for a variety of pollutants[5] in this watershed. In this example, the schedule for implementation (including the "near", "medium", and "far" milestones) is over the next 30 years. Here, milestones are based on area (acres or percent of watershed treated). The near term milestone (e.g., the 5 year milestone) reflects implementation of most of the pollutant reduction practices over 2 percent of the watershed (or approximately 47 acres of treatment). The 15 year milestone includes 10 percent of the watershed being treated by bioretention. Benchmarks (e.g., restoration actions) used to mark progress toward meeting these milestones could include individual projects which can be tracked on a fine water segment scale (e.g., tributary scale). Table 5-2 (also from the Oxon Run WIP) describes benchmarks that will help DDOE evaluate incremental progress toward the milestones summarized in Table 5-1.

Table 5-1 Watershed treatment by project type and project phase (taken from the Oxon Run WIP, 2010)

	Near (Projects based on current planning, 0-5 years out)		Medium (through 15 years)		Far (through 30 years)		Cumulative	
BMP	Acres	% of Watershed	Acres	% of Watershed	Acres	% of Watershed	Total Acres	% of Watershed
Tree Boxes	46.94	2%	187.76	8%	422.46	18%	704.10	30%
Porous pavement	46.94	2%	187.76	8%	234.7	10%	469.40	20%
Bioretention	46.94	2%	234.7	10%	422.46	18%	704.10	30%
Vacuum Sweeping	46.94	2%	70.41	3%	117.35	5%	234.70	10%
Constructed Wetland	0	0%	234.7	10%	234.70	10%	469.40	20%

[5] Copper, zinc, arsenic, lead, chlordane, DDT, Heptachlor Epoxide, PAH, TPCB

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Table 5-2 Project List within the Oxon Run Watershed (taken from the Oxon Run WIP, 2010)				
Site Location	**Project Number**	**Project Description**	**Estimated Cost**	**Priority Ranking**
13th Street SE and Valley Avenue SE	OR_LID_103	Bioretention	$51,726	Near Term
915 Valley Avenue SE	OR_LID_105	Bioretention	$55,062	Near Term
601 Mississippi Avenue SE	OR_LID_106	Bioretention	$30,475	Near Term
401 Mississippi Avenue SE	OR_LID_111	Rain Gardens	$168,286	Near Term
2nd Street SE from Wayne Place SE to Xenia Street SE	OR_LID_112	Bioretention	$110,710	Near Term
Wheeler Road SE and Valley Avenue SE	OR_LID_104	Bioretention	$29,289	Near Term

In addition to the implementation measures that will be identified through the modeling scenarios described in Section 4, there are also a number of stormwater measures already included in the District's MS4 permit. Examples include:

- Implement retrofits for stormwater discharges from a minimum of 18,000,000 square feet (approximately 413 acres) (MS4 Permit Section 4.1.5.4)
  - Of this, implement retrofits for 1,500,000 square feet (approximately 34 acres) in the transportation rights-of-way
- Plant a minimum of 4,150 trees annually within the MS4 area (MS4 Permit Section 4.1.6.2)
- Achieve a District-wide urban tree canopy coverage of 40% by 2035 (MS4 Permit Section 4.1.6.2)
- Install a minimum of 350,000 square feet of green roofs on District properties (MS4 Permit Section 4.1.7.2)
- Conduct street sweeping on no less than 641 acres of roadway in the MS4 area (MS4 Permit Section 4.3.6.1)
- Adopt and implement stormwater new retention requirements

Because these are enforceable requirements, they will serve as milestones within the IP. Specific benchmarks can be developed to track annual progress in meeting these milestones.

5.1.2 Incorporation of Benchmarks and Milestones into the Implementation Schedule

For the final IP, benchmarks and milestones will be explicit components of the implementation schedule. They will serve as checks to ensure that adequate progress is being made and that the overall schedule is being maintained. Because adaptive management is such strong component of the implementation, adjustments can be made to the plan or schedule if benchmarks and milestones are not being achieved (e.g., increasing the rate of BMP implementation, adjusting the schedules of other planned implementation activities, etc.).

5.2 Tracking Progress

Once actions to address each applicable MS4 WLA are developed, and appropriate benchmarks and milestones have been set, an approach must be developed to monitor progress. While the primary benchmarks for tracking progress are specific for each WLA, it is also important to track progress in a more collective manner (i.e., progress in implementing the IP as a whole to address all of the individual MS4 WLAs). Tracking progress either in implementing any individual WLA or in implementing the IP as a whole is complex. Approaches will include implementing source control measures and implementing structural and/or non-structural BMPs or other implementation measures to meet the WLA. (As noted previously, in some cases, data are not available or no longer support an existing TMDL or WLA. For these TMDLs, possible approaches could include refining the use of the waterbody, or de-listing of the TMDL if warranted. However, these cases will be handled outside of the IP process.) Similar TMDLs (e.g., individual metals TMDLs for the same tributary) may also be able to be grouped for tracking purposes to streamline reporting and to help evaluate progress at a higher scale (e.g., number of WLAs attained). As a result, there are multiple strategies DDOE will consider and likely ultimately use to track progress toward attaining WLAs, and therefore towards implementing the IP as a whole.

Specific tracking of WLAs progress will be evaluated in a holistic manner, incorporating data from the revised monitoring program, modeling efforts, and other programmatic information (including evaluation of progress against benchmarks and milestones, as discussed above). This holistic approach to tracking progress towards attaining individual WLAs will be important, because directly assessing the District's waters through monitoring efforts will not necessarily provide an accurate representation of DDOE's progress. As mentioned previously, a significant portion of the District's watersheds have sources other than the MS4.

The IP will describe the sources of information and the approaches DDOE will have used to develop a working tracking system. Specific elements that will be components of that tracking system will include:

- **Program implementation** – this method monitors and aggregates the amount of implementation of stormwater measures occurring, including qualitative/non-structural practices (e.g., updates to the District's Stormwater Regulations; outreach; public education) and quantitative/structural practices (e.g., implementation of structural BMPs such as bioretention or green roofs). The assumption with tracking programmatic implementation is that each of these program components has anticipated pollutant reduction benefits that contribute to progress.
- **Modeling** – this method of tracking uses quantitative accounting of the expected impact from the amount of future BMP implementation. This typically includes using modeling to quantify the expected pollutant load reduction from BMPs and other programmatic efforts. The modeling approach could range from a simple spreadsheet approach to the use of more complex modeling tools. (Note: as described in both the program implementation bullet above and the monitoring bullet below, actual levels of implementation will be tracked and water quality improvements will be confirmed. Modeling will be used to supplement these tracking exercises and project progress towards load reductions that can be confirmed through monitoring.)
- **Monitoring** – this method can involve evaluation of watershed load reductions through outfall monitoring or evaluation of receiving waters through ambient water quality monitoring or bio-monitoring. It can also include focused monitoring such as evaluating performance of specific BMPs or source reduction efforts in "hot spot" areas. While tracking progress from monitoring data is a very direct method, other sources of pollutants may also influence monitoring results. Therefore, evaluation of achievement of WLAs through ambient monitoring alone may be difficult.

5.2.1 Tracking Program Implementation

While tracking the level of implementation of various programmatic elements often focuses on tracking completion of BMPs or other pollutant control efforts or programs (e.g., implementation of pollution prevention programs, public education efforts, staff training, etc.), other related information can supplement traditional measures of progress. This can include documentation of:

- Spending on projects and programs to meet WLAs and comparison of efforts achieved versus funds expended;
- Spending on O&M issues (e.g., inspections, etc.) and comparison of O&M issues versus funds expended;
- Information such as budgets, manpower, number of programs, amount of outreach, number of attendees at programs, etc.

Much of this information is already included in the MS4 Annual Report and can be used qualitatively to document progress. Benchmarks will be set for various activities and will be used to track progress.

Methods similar to those described earlier are likely starting points for establishing benchmarks and tracking progress. As discussed previously, benchmarks for tracking progress will vary depending on the project or activity being measured. Benchmarks for tracking structural BMPs (e.g., units installed, area treated, pollutant load reduced) will be evaluated based on completion of scheduled projects. In contrast, benchmarks for non-structural efforts (e.g., public outreach) will be measured by quantifying the implementation effort (e.g., the number of citizens reached with a message or number of pamphlets distributed).

5.2.2 Modeling

For TMDLs and MS4 WLAs where numeric load reductions will be tracked, modeling will be used to generate loads and project load reductions, and BMP implementation will be tracked. Many of the published BMP studies present information in terms of a percent reduction of the pollutant load by that BMP. Using a model to calculate load reductions through the use of BMP efficiencies can be an ideal way to track implementation of MS4 WLAs because the amount of load reduction expected to be achieved can be calculated and compared with the load reduction required to meet the WLA.

U.S. EPA uses this method for determining load reduction for the Chesapeake Bay TMDL. DDOE is required to report levels of implementation of different BMPs that receive different load reduction credit

For Example:
If the implementation scenario calls for installing bioretention to control two acres, and bioretention reduces "pollutant A" by 40%, then the amount of load reduction achieved in the watershed can be calculated.

- *Assume a 10 acre watershed*
- *Bioretention is implemented to control 20% of watershed*
- *Baseline load = 30 lbs of "pollutant A"*
- *20% of 30 lbs of "pollutant A" = 6 lbs pollutant A*
  (baseline amount of pollutant in part of watershed controlled by bioretention)
- *Bioretention reduces "pollutant A" by 40%*
- *6 lbs * 40% reduction = 2.4 lbs reduction*
- *2.4 lbs reduction achieved/10 lbs reduction needed = 24% of required reduction achieved through implementation of bioretention controlling two acres.*

based on BMP efficiencies set by the CBP. Therefore, there will be at least one set of MS4 WLAs (MS4 WLAs in the Chesapeake Bay TMDL) where implementation expectations are based on using BMP efficiencies to evaluate achieving the WLA. The District thus can use tools like the Chesapeake Assessment and Scenario Tool (CAST) to forecast whether planned levels of BMP implementation will meet the Bay load targets, or whether additional implementation is needed. Finally, as described above, implementation is tracked to ensure that projected reductions actually occurred.

Another potential method that will be considered is equating load reduction to runoff retention. This method may be particularly useful in the District because it aligns with District's new stormwater regulations, which focus on retention of specific amounts of runoff that must be achieved by BMPs. DDOE does not dictate what types of BMPs must be used to achieve this retention requirement – only that the retention be achieved by whatever BMP fits the owner's needs. Thus, tracking or modeling the amount of retention by individual BMPs can be used for calculating pollutant load reduction to meet MS4 WLAs.

The CBP's Expert Panel on Stormwater BMP Performance Standards has recently released its "Recommendations of the Expert Panel to Define Removal Rates for the New State Stormwater Performance Standards" report (Chesapeake Stormwater Network, October 2012), which includes a protocol whereby the removal rate for each individual development project is determined based on the amount of runoff it treats and the degree of runoff reduction it provides. This document includes curves that provide nutrient and sediment removal percentages based on the amount of runoff depth captured per impervious acre. While these curves are restricted to nitrogen, phosphorus and sediment, additional research will be performed determine if this methodology can be applied to other pollutants.

At a minimum the following modeling scenarios will be used to track improvement:

- *Current load scenario (year = 2013);*
- *Chesapeake Bay TMDL 60% compliance scenario (year = 2017, will include projected development and necessary BMP installation to meet water quality target); and*
- *Chesapeake Bay TMDL 100% compliance scenario (year = 2025, will include projected development and necessary BMP installation to meet water quality target).*

The proposed model will be able to process data at a fine resolution such as at the parcel level, and also at a more coarse level such as on a watershed basis. The finer resolution will be useful for tracking existing BMP performance and maintenance, whereas the coarser resolution will be useful for tracking compliance towards WLA reductions.

5.2.3 Monitoring

Ambient water quality, biological, and habitat monitoring data are excellent tools to evaluate progress in meeting water quality goals. As part of its new MS4 permit, DDOE is required to develop a revised monitoring framework, and this monitoring "must be adequate to determine WLAs are being attained within specific timeframes…" Thus there will be significant synergy between tracking of progress under the District's IP and its revised monitoring program. The revised monitoring framework will identify gaps and make recommendations for updated or modified monitoring that will supply sufficient data to allow evaluation of attainment of individual WLAs. To accomplish this, data from these revised monitoring efforts will be used to evaluate various measures of success of MS4 WLA implementation. For example, individual BMP performance monitoring can be used to establish the specific load reduction achieved by an individual BMP, which may help to evaluate how much load is actually being reduced in the watershed. Because monitoring the performance of every individual BMP is not practical, other monitoring data, such as biological or ambient stream monitoring, may be used to evaluate overall water quality and stream health.

Monitoring data will be only one component of a tracking strategy. As stated above, connecting DDOE's progress toward meeting WLAs with water quality data will be challenging in the District as there may be multiple point and nonpoint sources of pollutants (including pollutants from upstream) in any given waterbody. As such, monitoring data may be most useful to assess attainment of WLAs directly when there are minimal other pollutant sources into that watershed. However, in cases where there are other pollutant sources in a watershed, monitoring data may be used to show improvements that can be linked to reductions in MS4 loads.

Monitoring data can also be used to possibly reduce the number of actual TMDLs that require implementation. For example, if a water quality or biological monitoring station is located within a watershed with a MS4 WLA, then current data can be assessed to determine whether the waterbody is still impaired by the pollutant for which the MS4 WLA was developed, or if the WLA has already been attained. This type of analysis will help guide the strategy for addressing the MS4 WLA in that watershed. Including this type of analysis in the methodology will also help streamline subsequent modeling efforts by removing those waters that do not warrant additional analysis.

Additionally, monitoring can also be performed to track progress toward meeting water quality goals in waters where load reductions are not modeled or quantified, such as TMDL implementation by source control methods. As with the situations described in the preceding paragraphs, monitoring data may be used to show improvements that can be linked to reductions in MS4 loads.

5.3 Integration of Progress Tracking with Adaptive Management

An adaptive management approach will be a primary component of planning and schedule adjustments during implementation, even more so if tracking confirms actions are not achieving progress. To accomplish this, the tracking framework will include periodic review of the benchmarks, TMDL implementation levels, and water quality and stream health monitoring to determine if progress is adequate. If the review shows that acceptable progress is not being made, corrections can be made through adaptive management.

If benchmarks and milestones are set correctly, then continuing to meet benchmarks and milestones equates to meeting the WLA on the proposed schedule. However, if benchmarks and milestones are not being met, then the IP's adaptive management strategy will be used to make the necessary course corrections.

Adaptive management can also be informed by the monitoring component of the tracking system. If monitoring data are not showing expected improvements, the IP can be modified to increase levels of implementation, accelerate implementation schedules, alter BMP types planned for the watershed, etc. For example, a watershed where BMPs have been implemented, but in which the water quality or biological communities do not show improvement, may need additional implementation efforts. Alternatively, upstream water quality monitoring (e.g., from outside the District's boundaries) may show that the water quality upstream is also not meeting water quality standards, which may explain the lack of improvement despite BMP implementation. In contrast, improved water quality of functioning of biological communities may show that the TMDL implementation has succeeded.

In addition to monitoring data, programmatic data may also be useful in evaluating progress and assessing schedule. For example, much of the information already required in the MS4 Annual Report can be used to evaluate progress towards TMDL implementation. Review of the programmatic data in the MS4 Annual Report can identify areas where actual programmatic implementation levels did not meet expected levels, and where corrective action is needed. As with deficiencies identified through evaluation of monitoring data, adaptive management can be used to modify implementation plans to correct these deficiencies and maintain adequate progress to meet WLAs.

While adaptive management will play a key role in keeping the strategy on track, it should be noted that implementation of a sufficient amount of control to meet MS4 WLAs for some pollutants may take many years. Once controls are implemented, it may take even more time for pollutant reductions to be realized. The tracking approach discussed in this Section will take long-term implementation into account and will be reflected within the tracking of benchmarks and milestones, which were discussed above.

5.4 Setting Milestones and Tracking Progress on a Watershed Basis

Milestones for tracking progress in reducing loads will be set at scales that account for the difficulty and uncertainty of predicting development and/or re-development on smaller scale. Development and re-development are expected to be important drivers for load reductions through the implementation of the new stormwater rules; however the planning and projection of reductions on small scales (such as at the tributary level) can be difficult and uncertain. In contrast, there is typically more confidence and certainty in planning and projecting development and re-development on larger scales, such as on a watershed basis. Therefore, the IP will explore setting milestones at this scale. For example, a milestone may indicate that 300 lbs of load reduction will be achieved within the total area of basins A, B, and C in a watershed. In this scenario, the milestone is more realistic to achieve, because even if less development/re-development (and thus less load reduction) is achieved in basin A, it may be offset by more development/re-development in basins B and C, thereby achieving the overall milestone for pollutant reduction in the watershed.

It may not be possible or desirable in certain cases to set milestones on a watershed basis, but this possibility will be explored on a case-by-case basis as milestones are determined for the IP. Additionally, ultimate attainment of each WLA will continue to be the final milestone for each TMDL, and will also be included in the schedule set forth in the IP.

6. Methodology for Stakeholder Involvement and Public Outreach

6.1 Introduction and benefit of stakeholder outreach and public involvement

DDOE recognizes the benefit of engaging stakeholders and the general public in the development of the IP. It is particularly critical to have buy-in from both groups in order to ensure the success of the IP. Dialogue generated through the engagement of selected stakeholders is mutually beneficial to DDOE and stakeholders because stakeholders have the opportunity to provide feedback, comment on technical or other issues that may arise, and offer potential solutions to address these issues throughout development of the IP. The general public will also be kept informed of the development of the IP through a series of public meetings. Both stakeholders and the general public can add significant value to the development and implementation of the IP because they are familiar with the local water bodies, and have a direct interest in resolving water quality problems within their own communities. By incorporating an engagement process from the beginning of the plan development, it is more likely that DDOE will gain stakeholder and public support and assistance with implementation of the IP.

The engagement strategy focuses on engaging two distinct groups: stakeholders (regulatory agencies, sister agencies, environmental groups, and industry groups) and the general public. This Section will summarize individual strategies to engage both groups.

6.1.1 Vision for Stakeholder and Public Involvement

In developing the IP, DDOE envisions a process that engages the selected Stakeholder Group to ensure that the IP is developed in an open and transparent fashion. This process will encourage stakeholders to leverage their unique experiences and strengths to inform the IP. DDOE also anticipates that the Stakeholder Group can leverage their professional and personal networks to perform outreach on the IP to community groups and the general public. In contrast to the ongoing involvement of the Stakeholder Group, which DDOE intends to engage from the outset of the IP development process, DDOE envisions being more engaged with the general public at certain points throughout the process. The anticipated role of the public will also differ from that of the selected stakeholders. While DDOE will involve the stakeholders directly in the development of the IP, the engagement of the general public will be more informational and will focus on providing updates on the development of the IP. DDOE can also involve the general public in assisting with activities in the watershed during the implementation phase. As part of the public engagement process, it will be important for DDOE to reach out to community groups to elicit the best methods for engaging and educating the public on the importance of the IP.

6.1.2 Key Messages for Stakeholder Involvement and Public Outreach

It is important to frame the message that allows the agency to explain the value of the IP succinctly and in a way that resonates with stakeholders and the general public. Thus the strategy will focus on addressing the following questions and communicating key messages to the stakeholders and the public:

- Why is this project important?
  - The IP will lay out a plan for DDOE to implement activities that will reduce pollutant amounts to specific water bodies in the District, thereby improving water quality.
- What's in it for my group or community?

- Stakeholders and communities in the District have access to water bodies in the District and desire to improve water quality. The quality of water in the watershed is important because it is the habitat for a variety of fish species and other aquatic organisms, animals depend on it for survival, and humans consume fish from these water bodies and use the water bodies for recreation. Reducing pollutant loadings will provide a safe environment for the fish and animals that depend on it for survival and humans who consume fish from these water bodies or otherwise enjoy these waters.

- What's in it for the District?
  - The District will benefit from the IP because progress will be made towards meeting specific designated uses of the water bodies, thus increasing the quality of life for residents and visitors. A potential byproduct, which is not tracked in the IP, is the potential for job creation in implementing specific BMPs such as construction and maintenance of green infrastructure.
- How does each individual contribution impact the whole?
  - If DDOE, the stakeholders, businesses, and residents focus on appreciating the importance of implementing BMPs to reduce pollution from their property, it will directly reduce pollutant loads to the District's water bodies. For example, home owners can ensure that they minimize fertilizer use on their lawns, and can ensure that they do not dump trash or pollutants into storm drains. Pet owners can assist by making sure they clean up after their pet, because pet waste also contributes to impaired waters.

6.2 Focus on Stakeholder Involvement

6.2.1 Composition of Stakeholder Group

The Stakeholder Group is made up individuals that represent a variety of groups with interest in the success of the IP process, including:

- **Federal government -** EPA has regulatory oversight to ensure the District is in compliance with the CWA. As such, the role of EPA Region 3 on the stakeholder committee ensures that DDOE is developing the IP in alignment with regulatory expectations. In addition, the CBP can provide a great deal of useful technical information to the process.
- **Local Government (Sister Agencies)** –local government agencies such as DDOT and DC Water are already implementing measures to reduce pollutants into District water bodies. Their involvement on the stakeholder committee is an opportunity to share best practices and information on pending projects that could affect implementation.
- **Local and National Environmental Organizations –** local and national environmental stakeholders have an interest in the environment and want to ensure that waterbody conditions are improved and protected for the community. Locally-based environmental groups add significant value because they usually have deep ties to the community and can provide District development of a sound IP. These organizations can also further acceptance of the IP by the public through their involvement in its development. The local and national environmental organizations that are currently a part of DDOE's Stakeholder Group for the IP include the Alice Ferguson Foundation, Natural Resources Defense Council, Anacostia Riverkeeper, and Potomac Riverkeeper.

- **Technical Support** – The Center for Watershed Protection and the ICPRB will serve as technical experts on the Stakeholder Group. They will provide feedback and expertise on technical issues and proposed solutions during the IP development.
- **Development Interests** – The District Building Improvement Association represents the real estate development industry. Their input on future growth scenarios and the impact of the IP on growth and development within the District will be valuable throughout the IP development process.

6.2.2 Goals for the Stakeholder Group

The DDOE Study Team has developed mutually agreed upon goals for the Stakeholder Group that will provide opportunity for discussion and consensus building throughout the development of the IP. These goals, which are summarized below, will be instituted as the framework for the stakeholder engagement process. Ensuring the achievement of these goals will drive the purpose, development, and facilitation of all stakeholder meetings:

- Create a method for communicating with key stakeholders on topics and issues relating to the IP and the revised monitoring framework.
- Provide a mechanism for discussing coordination and schedule issues with key stakeholders during implementation of the project.
- Offer an avenue for key stakeholders to present their observations, questions, and concerns to DDOE.
- Provide an open forum for discussion of diverse stakeholder perspectives between the Stakeholder Group and DDOE on topics of mutual interest.
- Ensure adequate time and opportunity for the Stakeholder Group to provide input during project development and implementation.

6.2.3 Strategies for Stakeholder Outreach

As part of the process for engaging stakeholders in development of the IP, the following strategies will be employed:

- Convene facilitated meetings on specific IP related topics with select Stakeholder Groups.
- Provide draft materials to stakeholders for discussion, review and comment.
- Allow opportunities for Stakeholder Groups to present information to the DDOE Study Team regarding their observations and expertise.
- Solicit data from stakeholders who could provide it as a resource.
- Conduct one-on-one listening sessions with members of the Stakeholder Group to understand individual positions.
- Allow stakeholders input on key decision points.

6.3 Focus on Public Outreach

Although DDOE is utilizing a smaller Stakeholder Group during the development of the IP, DDOE will conduct broader engagement to the general public near the implementation phase. Several strategies will be used to meet the goals of broad public involvement. The public outreach process will target homeowners, business and property managers, churches, and community based environmental organizations.

6.3.1 Goals and Strategies of the Public Outreach Process

It will be important to inform the general public about the IP. The following strategies will be used to accomplish this goal:

1. Develop a website that will be used as an information portal during development of the IP. The website will contain meeting minutes from stakeholder meetings, links to draft Sections of the IP and a contact form for people who may have feedback.
2. Send an electronic newsletter to business organizations, homeowner and civic associations and other interested parties informing them of the development of the IP and how it will affect them.
3. Host an interactive informational briefing and invite the general public to participate.
    a. Identify barriers that would prevent public participation in the implementation phase of the IP.
    b. Develop interactive stations that allow residents to map LID activities in their community. Attendees can review information on restoration and water quality activities within the watershed on the map of the watersheds within the District boundaries.
4. Educate and involve the public to implement changes that will ultimately achieve the goals of the IP.
    a. Partner with existing agency programs (i.e. Riversmart Homes) to provide outreach to homeowners and property managers about BMPs.
    b. Host a meeting specifically with representatives from business organizations such as the Business Improvement Districts (BIDs) and smaller business improvement associations to educate them on how they impact pollutant loadings and the purpose of TMDLs. Arrange tours of local BMPs that they can implement onsite to decrease the pollutant loadings to water bodies in the affected area.
    c. Utilize Stakeholder Group organizations and other community based organizations to assist in the public outreach process and with activities in the local watersheds.

6.3.2 Communication Strategy

A two-pronged communication strategy will be implemented. Currently, there is a process for communicating with the Stakeholder Group; however, a strategy to communicate with the general public regarding participation in the IP will also be developed and implemented. Communication with the Stakeholder Group will be via e-mail, in person meetings and website (the development of which is in progress). The following communication vehicles will be used to reach the public for participation in predesigned informational meetings:

- **Website** –DDOE's social media followers will be directed to the IP project website for information about upcoming public meetings.
- **Direct Contact** –direct contact (e-mail or telephone) will be made with environmental and community based organizations, civic/citizen associations and business organizations to invite them to meetings.

- **Community and Agency Listservs-** community and agency listservs will be used to invite target audiences to public meetings.
- **Stakeholder Group Contacts** –Stakeholder Groups will be used to assist with outreach to the communities they serve and their membership.

6.3.3 Meeting Schedule and Involvement Timeline

A stakeholder and public involvement timeline will be developed to highlight meetings and other engagement activities. Setting the meeting schedule at the outset of the process ensures enough time to communicate adequately and provide potential participants with dates far in advance. It also demonstrates that there will be an opportunity for involvement beyond the selected Stakeholder Group. Knowing the timeline and schedule increases the level of consistent involvement from participants. They will have an understanding of the progression of topics related to the IP and be more predisposed to participate.

6.4 Conclusion

An evaluation framework for the stakeholder involvement and public outreach process that measures the effectiveness of this outreach plan will be developed. Some portions of the evaluation framework will include meeting surveys, attendance tracking, and participation. The evaluation will denote areas that need to be improved and methods that worked throughout the engagement process. A final report that details the stakeholder/ public involvement process and feedback as well as the overall evaluation of the process will also be developed. This information will document effective methods for assisting DDOE with outreach during the implementation phase.

7. Integration with Other Watershed Planning Efforts

It is important to recognize that the IP will be developed and implemented in a setting where other plans already exist for many of the same watersheds covered by the IP. The IP will build upon the work already planned and/or underway in these watersheds by integrating these existing watershed planning efforts into the IP, including those for watersheds entirely within the District (e.g., the Hickey Run Watershed Implementation Plan), as well as regional or larger watershed efforts (e.g., Anacostia River Watershed Plan).

Because the IP document is being developed to meet an NPDES permit requirement, it is a legally binding document. Therefore, while it builds upon and/or incorporates other watershed planning efforts, the IP must take precedence over all other planning documents as the principal plan to manage MS4 WLAs in the District. These other watershed planning documents will still remain valuable tools in managing and coordinating overall watershed improvement and stream health for individual watersheds; however, the MS4 component of TMDL and watershed planning must be coordinated through the IP in order to ensure that regulatory requirements are met.

The DDOE Study Team will work to integrate and coordinate the IP with these other plans by assessing and evaluating the following issues with respect to each existing plan:

- Are the objectives of other plans relevant to TMDL implementation or to aspects of the IP, or vice versa, are aspects of the IP relevant to the implementation of these other plans?
- Is it possible to coordinate data collection, sampling, modeling, BMP evaluation, implementation, or tracking?
- Can implementation of source controls or load reduction through the implementation of BMPs done to meet MS4 WLAs in individual watersheds also help to achieve goals of the other watershed plans in the same watershed?
- Can certain BMPs be chosen to maximize load reduction to meet MS4 WLAs in individual watersheds while also enhancing habitat or promoting the health of biological communities (e.g., stream restoration, buffer planting, etc.)?
- Can financial and technical resources be shared and optimized?

Based upon this evaluation, existing watershed and planning documents will be integrated into the IP. A preliminary compilation of existing watershed restoration and implementation plans is provided below:

- Anacostia River Watershed Implementation Plan (DDOE, 2012);
- Oxon Run Watershed Implementation Plan (DDOE, 2010);
- Anacostia River Watershed Restoration Plan and Report (multiple authors, 2010);
- Anacostia Watershed Trash Reduction Plan (DDOE, 2008);
- Hickey Run Watershed Implementation Plan (DDOE, 2005);
- Hickey Run Watershed and Stream Assessment (USFWS, 2005);
- Rock Creek Watershed Total Maximum Daily Load Waste Load Allocation Implementation Plan (DDOE, 2005);
- Rock Creek Watershed Implementation Plan (DDOE, 2010);

- Chesapeake Bay TMDL Phase I Watershed Implementation Plan for the District (DDOE, 2010);
- Chesapeake Bay TMDL Phase II Watershed Implementation Plan for the District (DDOE, 2012);
- DDOT Plans; and
- DC Water's Combined Sewer Overflow Long Term Control Plan.

The DDOE Study Team will meet to discuss these plans, identify other planning documents that should be considered, and develop a specific strategy to coordinate the incorporation of these various plans into the development of the IP. Each one of the identified plans will then be reviewed in detail to collect information such as:

- Types of pollutants/impairments in the watersheds
- Pollutant sources and their specific locations
- Existing sampling data (chemical, biological, physical, habitat) and locations of samples
- Methods used to calculate and track loads or impairments
- EMCs or land use based loading coefficients
- Methods used to track load reduction
- BMPs employed and load reduction efficiencies
- Implementation strategies and schedules
- Priority problem areas
- Proposed projects/restoration areas
- Cost information for proposed projects
- Proposed TMDL implementation strategies, if applicable

Each of these documents will also be evaluated for pertinent information that can be used to develop the IP. For example, the Rock Creek Watershed Total Maximum Daily Load Waste Load Allocation Implementation Plan includes a methodology for assigning load reduction credit to individual BMPs and tracking load reductions from BMP implementation. This information will be summarized in the Literature Review and evaluated for use (either directly or with modifications) in the load reduction modeling.

Similarly, any discussions of implementation strategies, proposed BMPs, or priority problem areas addressed in these watershed plans will be evaluated for use in BMP scenario modeling and in development of the IP. Any previous work that has been done for watershed planning or TMDL implementation will be leveraged so as to take advantage and build upon work and planning already completed or underway in the District. For example, many of the plans cited above already include implementation strategies for specific watersheds. The work that has already gone into preparing these documents included identification of specific BMP types that are feasible and likely to succeed in these watersheds. Similarly, the levels of BMP implementation that are necessary to achieve watershed goals have already been determined. The DDOE Study Team recognizes that the problems identified, the goals for resolving these problems, and the strategies used to achieve these goals may not be in complete alignment with the strategies necessary to achieve a numeric MS4 WLA for a specific pollutant in that watershed.

Many watershed implementation plans are designed to mitigate physical and ecological problems in the watershed, and the proposed solutions focus on habitat and biological community restoration. For example, among the goals of the Anacostia River Watershed Restoration Plan are:

- Reduce peak flow discharge and increase base flows;
- Increase or enhance wetland habitat;
- Improve connectivity of existing wetland habitats and resources;
- Open stream channels to fish migration by removing barriers;
- Connect additional stream lengths to current fish habitat; and
- Increase or enhance habitat and tree canopy.

Similarly, in addition to making recommendations to improve water quality, the Hickey Run Watershed and Stream Assessment focuses on restoring the stream channel and includes many recommendations to enhance stream stability, improve riparian habitat, increase buffer, and reduce impacts of infrastructure. While many of these restoration activities can potentially improve water quality, the impact may not be direct and/or easily tracked for specific load reduction "credit" towards meeting MS4 WLAs.

One potential solution is to tie the achievement of physical and biological goals to improvements in water quality by assigning load reduction credit to these activities. For example, increasing tree canopy can be equated with tree planting, which has been quantified with nutrient and TSS load reduction credit for the Chesapeake Bay TMDL. Likewise increasing or enhancing wetland habitat can be equated with the load reduction credit assigned to wetlands BMPs. Improving connectivity of riparian habitats may also involve planting trees or enhancing wetlands. However, for other restoration activities, such as removing barriers to fish passage and increasing base flows, assigning credit for load reduction may not be as straightforward - or even possible. Therefore, the goals and priorities embedded in each plan will be examined to determine which activities proposed for a certain watershed, or across several watersheds, may be able to be credited towards load reduction to meet MS4 WLAs. In doing this, as much of the work that has already been done in other watershed planning efforts will be used, where this is feasible and useful.

Once the various types of implementation activities have been identified from existing plans, they will be evaluated for inclusion in the IP. Credit toward load reduction will be assigned to qualifying implementation activities. The DDOE Study Team recognizes that other non-qualifying watershed restoration activities that may not receive credit for load reduction will also continue to take place in these watersheds as part of these existing plans, but the activities for which the District can take load reduction credit will be of most value for incorporation into the specific strategies outlined in the IP.

7.1 Integrating Plans Extending beyond District Boundaries

Some watershed planning studies and programs - such as the Anacostia River Watershed Restoration Plan and the Chesapeake Bay TMDL WIP – are at a scale that goes well beyond the boundaries of the District but will still need to be integrated insofar as they apply to the District's MS4. For example, the Anacostia River Watershed Restoration Plan is a joint effort between the District, the U.S. Army Corps of Engineers, the state of Maryland, Prince Georges and Montgomery Counties in Maryland, the Metropolitan Washington Council of Governments, and the Maryland National Capital National Park and Planning Commission. The Plan incorporates federal, state, local, and regional policies, programs, ordinances and projects, and thus the District must coordinate its efforts within a larger set of organizations in order to maximize their effectiveness. Successful implementation of Anacostia River

Watershed Restoration Plan may require integration or coordination of sampling, modeling, BMP implementation, or tracking in order to meet the overall goals of the plan.

Similarly, while the District has developed Chesapeake Bay TMDL Phase I and Phase II WIP documents specifically for the District, and these documents contain District-specific strategies and activities for meeting local goals within the context of the Bay TMDL, meeting the Bay TMDL goals is a region-wide effort, and the District will continue to participate with other jurisdictions in planning, data collection, and data reporting. For example, DDOE staff participate in the Urban Stormwater Workgroup, which, among other tasks, evaluates potential BMPs or BMP types and develops recommendations for credit.

8. Methodology for Funding the IP

The ability to fund the IP is critical to its success, and funding levels are necessarily linked to the schedule for implementing the IP. Therefore, the IP schedule will be established based on known or projected sources and levels of both public and private investment (e.g., funding provided by and available to businesses and community organizations, etc.). Both the potential public funding identified below and the estimated impact of private investment and subsequent improvements will be incorporated into calculations for funding the IP. Furthermore, the IP will also include analyses to project the total value of investment necessary to meet the MS4 WLAs, and the impacts that additional funding may have on the schedule.

8.1 Local Funding

Local funding will provide a meaningful investment in the implementation of the IP. The information below summarizes the major sources of local funding that is envisioned for implementation of the IP. Analysis of the local funding dollars will help determine the gap that must be filled by other sources.

8.1.1 District Grants and Incentives

DDOE offers incentives to homeowners and businesses for implementing stormwater BMPs, which will result in decreased pollution to affected water bodies. The Watershed Protection Division's website provides information on programs that would be applicable to homeowners and businesses to help meet IP goals. These include:

- **RiverSmart Homes -** is an incentive program for homeowners in the District to reduce stormwater pollution.
- **RiverSmart Rooftops -** is available to residential, commercial and institutions to rebate costs of greenroof installation, which can help to decrease stormwater pollution.
- **RiverSmart Schools -** offers schools both teacher training and assistance with installing outdoor classrooms that help reduce stormwater runoff.
- **RiverSmart Communities** - offers incentives, financial and technical assistance to condominiums, co-ops, apartments, locally-owned businesses and houses of worship for property owners to install practices such as rain gardens, BayScaping, pervious pavement, and rain cisterns to control stormwater pollution.
- **RiverSmart Rebates -** offers a series of rebates for trees, rain barrels, rain gardens, and impervious surface removal. Any D.C. single family homeowner is eligible to apply for the rebates.
- **RiverSmart Rewards -** offers a discount of up to 55 percent on the a DDOE Stormwater Fee and is available for new and previously installed BMPs. Eligible BMPs include rain gardens, rain barrels, pervious paving, green roofs, bioretention, and stormwater harvest/reuse systems. Discounts are calculated based on the volume of stormwater retained by BMPs.

8.1.2 Direct Public Investment

The District's direct investment in stormwater management projects utilizing Stormwater Fees, Bag Law revenue, and other local funding sources will be evaluated.

8.2 Federal Funding

The District currently receives several sources of federal funding, and several additional sources of federal funding are also available. These funds are summarized below.

- Clean Water State Revolving Fund (SRF) – The District receives funding from the Clean Water SRF program as a grant to support water quality projects. While it has historically been used primarily to provide funding for point source wastewater projects, communities are beginning to use the SRF program to fund wet weather projects as well. EPA's Fact Sheet entitled "Funding Wet Weather Projects with the Clean Water State Revolving Fund" states that "Communities with Phase I or Phase II NPDES permits may fund … stormwater management facilities such as sediment traps and basins, constructed wetlands, street sweepers and catch basin vacuum vehicles, so long as these projects address problems in a publicly owned system." Typically, 50 percent of the District's SRF grant is allocated toward green infrastructure projects for stormwater management.
- As a signatory to the Chesapeake Bay Program, the DDOE is a recipient of funds from two grant programs. These are:
  - Chesapeake Bay Implementation grant. This grant funds District activities to support Chesapeake Bay Restoration goals.
  - Chesapeake Bay Regulatory and Accountability Program grant. This grant was geared specifically to assisting the District implement the Bay TMDL. It addresses WIP development and reporting, implementation of programs to meet Bay TMDL load reductions, and programs to verify BMP performance.

In addition to the federal grant programs from which DDOE already receives funds, several agencies offer grants to local governments and organizations for efforts related to implementing TMDLs. The following as sources will be used to identify potential federal funding opportunities:

- **Catalog of Federal Funding Sources for Watershed Protection –** This searchable database contains financial assistance sources that are available to fund watershed protection projects. Users can search the database by subject matter using general word based searches of the funding programs. One example of the types of funding that would be applicable for the IP is the Economic Development Authority (EDA.) EDA's Public Works and Development Facilities Program assists distressed communities in attracting new industry; encouraging business expansion; diversifying local economies; and generating long-term, private sector jobs. This grant program can fund sustainable development activities such as the development of stormwater control mechanisms as part of an industrial park, or other eligible projects.
- **EPA's Watershed Funding Website –** This website offers a wealth of information for watershed funding, including links to:
  - Resources for non-profit organizations
  - Resources for state and local governments
  - Sustainable Finance Tools
  - Federal funding programs
  - Funding databases

It should be noted that each of the aforementioned links contains its own webpage with links to multiple additional sources of funding under that topic. For example, the Sustainable Finance Tools leads to a site with tools such as the Financing Alternatives Comparison Tool, Plan2Fund, and Watershed Plan Builder Tool, among others.

- **EPA's Nonpoint Source related funding opportunities** – This website is a hub for information resources and centers that develop tools and conduct research on financing watershed protection projects.

8.3 Private Investment

DDOE expects private investment to play a major role in the implementation of improved stormwater management throughout the District, as future development that is regulated will be required to comply with the new 2013 Stormwater Rule (officially, the 2013 Rule on Stormwater Management and Soil Erosion and Sediment Control). This rule requires major land-disturbing activity to retain the first 1.2" of rainfall on-site or through a combination of on-site and off-site retention, while major substantial improvement activity must retain the first 0.8" of rainfall on-site or through a combination of on-site and off-site retention. DDOE believes these stormwater management regulations will be a critical driver of retrofits as most development in the District involves redevelopment of existing sites without strong stormwater management controls. On average, major land disturbing projects impact approximately 15 million square feet of land per year.

Further, major substantial improvement projects will also result in substantial stormwater retrofits. Collectively, as more public/private sites are retrofitted through regulated development, the District will gradually be transformed into a "spongier" landscape with healthier streams and rivers, and improved water quality.

8.4 Private Foundations and Non-Profit Organizations

There are many private foundations which offer funding to community based organizations for watershed protection. Private foundations that fund watershed protection project will be identified. A preliminary list of potential funding sources is summarized below:

- **Abelard Foundation West** - is a family foundation that provides grant making to organizations that expand community control over economic, social and environmental decisions that affect the community's wellbeing.
- **National Fish and Wildlife Foundation** – NFWF offers several grant programs which could assist the District with implementation of the IP. The Chesapeake Bay Stewardship Fund has two grant programs. The *Chesapeake Bay Small Watersheds Grants Program* supports protection and restoration actions that contribute to restoring healthy waters habitat and living resources of the Chesapeake Bay ecosystem. The *Innovative Nutrient and Sediment Reduction Program* provides grants for sustainable and cost effective strategies for reducing nutrient loads within specific tributaries to the Chesapeake Bay.
- **Multicultural Environmental Development Leadership Initiative (MELDI) –** MELDI is a database developed at the University of Michigan that contains links to all environmental foundations, many of which offer funding for watershed protection. This is a valuable tool to that can be used by community-based stakeholders who plan to apply for grants.

As part of the IP, community-based organizations will be educated about the type of funding opportunities summarized above so that they can facilitate projects in that help meet the goals of the IP.

8.5 Impact of Funding on Implementation Schedule

The Implementation Plan and its schedule for attainment of WLAs will be based on existing levels of funding from the sources described above. This assessment will include an estimate of the total costs of implementation to meet the District's MS4 WLAs consistent with the schedule described in the IP. The District will also examine a number of scenarios for accelerating the implementation schedule (for example, by 10%, 15%, 20% etc.) to determine the increase in implementation costs that would result from such acceleration.

9. References

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