Washington DC's MS4 TMDLs for Metals and Toxics:
Challenges in Modeling for TMDL Tracking, Planning, and Implementation Purposes

Anouk Savineau, LimnoTech

CWEA Spring Conference

June 8, 2016

Overview

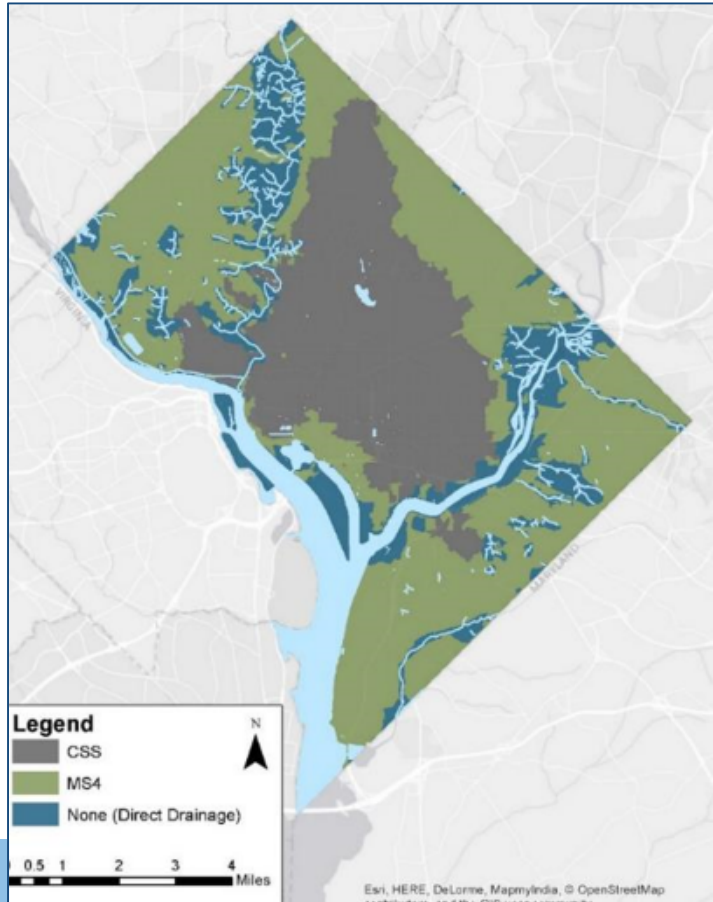
- DC's TMDLs and MS4 Permit
- Metals and Toxics Modeling
- The Implementation Plan Modeling Tool
- Implementing DC's TMDLs

DC’s TMDLs and MS4 Permit

The District's Stormwater Landscape

Conveyance	Total Area
Municipal Separate Storm Sewer System (MS4)	19,750 acres
Direct Drainage	7,230 acres
Combined Sewer System (CSS)*	12,220 acres

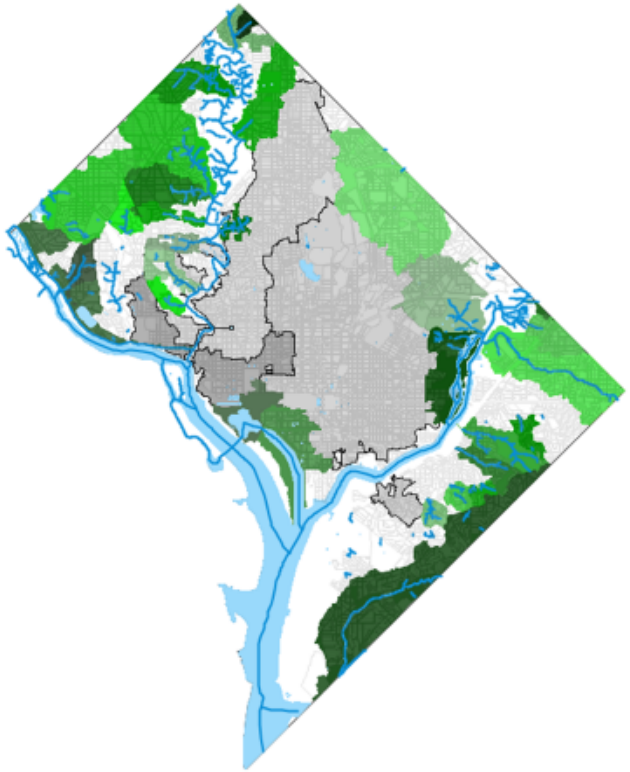
*Runoff entering the Combined Sewer System is treated at the Blue Plains Treatment Plant.



The District's MS4 TMDLs

500+ MS4 WLAs in 45 regulated drainage areas for 22 pollutants

"Conventional"	Metals	Toxic Organics
TN	Arsenic	Chlordane
TP	Copper	Heptachlor Epoxide
TSS	Lead	Dieldrin
BOD	Mercury	DDD, DDE, DDT
Bacteria	Zinc	PAH1, PAH2, PAH3
Oil and Grease		PCBs
Trash		



Challenges with Metals and Toxics

- Many impairments based on little data
- Many legacy pollutants that are no longer manufactured
- Few BMPs designed specifically to remove these pollutants

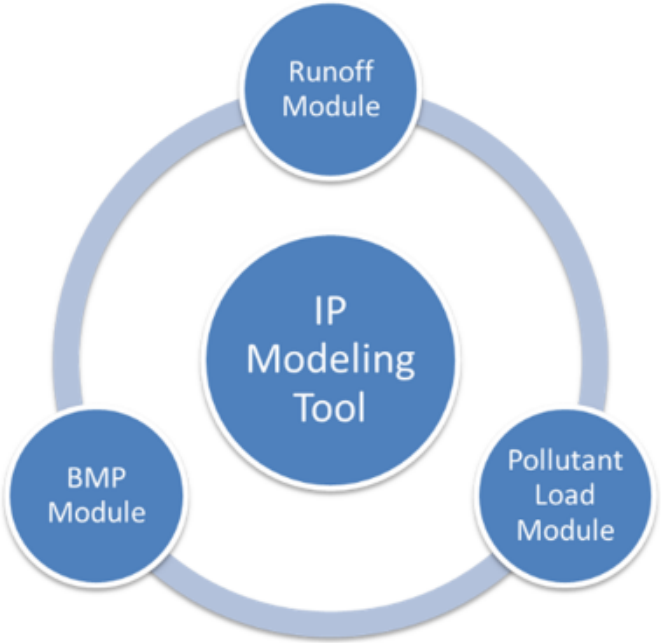
The District's MS4 Permit Requirements

- Create a consolidated TMDL Implementation Plan (IP) for all MS4 WLAs
- Show schedule for attainment of all 500+ WLAs
- Demonstrate through modeling how attainment will be achieved
- Provide narrative for schedule and controls

Metals and Toxics Modeling

Implementation Plan Modeling Approach

- Runoff and pollutant calculations based on Revised Simple Method
- Runoff is a function of precipitation, area, and the runoff coefficient
- Pollutant load is a function of EMC and runoff
- BMP pollutant removal is a function of BMP volume and load efficiency



Challenges in Modeling Metals and Toxics

- Developing appropriate EMCs
- Assigning appropriate BMP load reduction efficiencies

Developing Appropriate EMCs

- Toxic organics monitored at MS4 outfalls but:
  - Detection limits too high
  - Changes in labs and methods over time
  - Too many non detects to establish EMC
- Had to rely on literature
  - Some uncertainty of applicability to DC MS4 system

Assigning BMP Load Reduction Efficiencies

Two options investigated:

1. Pollutant Percent Removal
2. Runoff Reduction Method Removal

1. Pollutant Percent Removal

- Traditional method of assigning BMP load reduction “efficiency”
    - Literature review
    - Sediment partition coefficient

Literature Review: Many Data Gaps

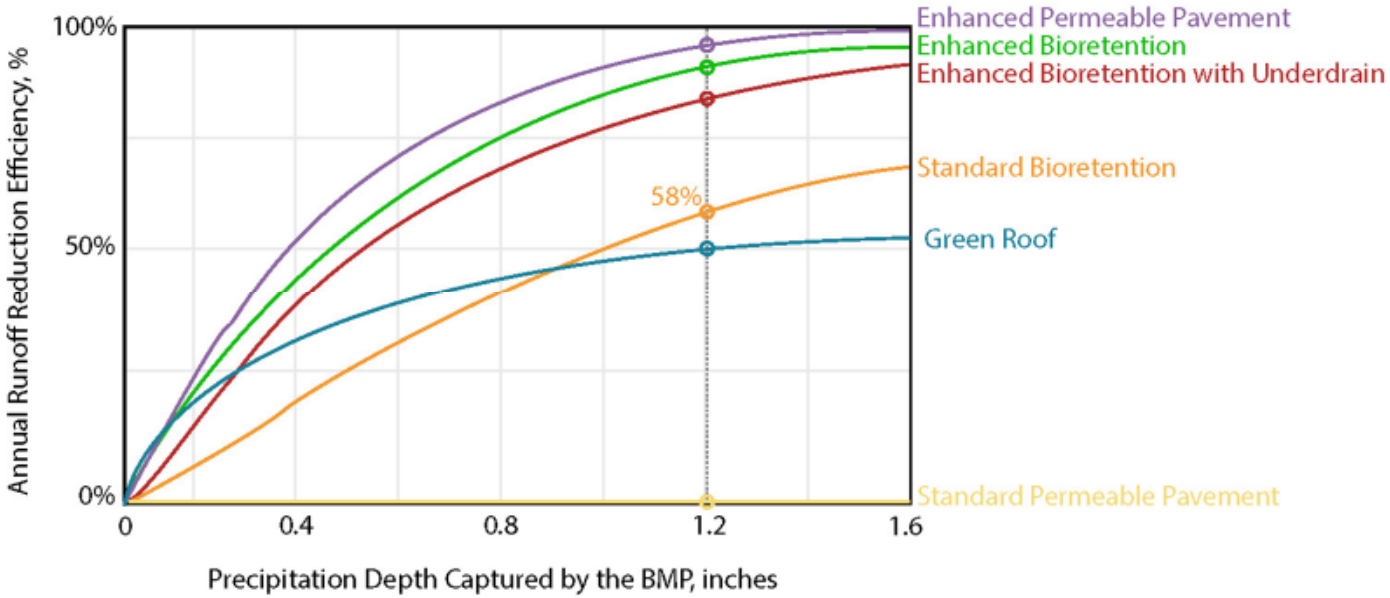
	Green Roofs	Rain Water Harvesting	Impervious Surface Disconnect	Permeable Pavement	Bio retention	Filtering Systems	Infiltration	Open Channel	Ponds	Wetland	Storage Practices	Proprietary Practices	Trees
Arsenic													
Chlordane													
Copper	X				X						X		
DDD													
DDE													
DDT													
Dieldrin													
Bacteria	X	X	X	X	X	X		X	X	X	X	X	X
Hep.Epox.													
Lead	X			X	X						X		
Mercury													
Oil/Grease													
PAH1													
PAH2													
PAH3													
TPCB													
Trash													
TSS	X	X	X	X	X	X	X	X	X	X	X	X	X
Zinc	X			X	X						X		

Sediment Partition Coefficient

- Method to link non-traditional pollutants to TSS
  - Works well with metals and organics because they tend to bind to TSS
- Calculate removal efficiency as follows:
  - Use partition coefficients to calculate the fraction of the total concentration of metals/toxics in particle-bound form
  - Percent removal efficiency of metals/toxics = removal efficiency of TSS multiplied by fraction of metals/toxics in particle bound form

2. Runoff Reduction Efficiency

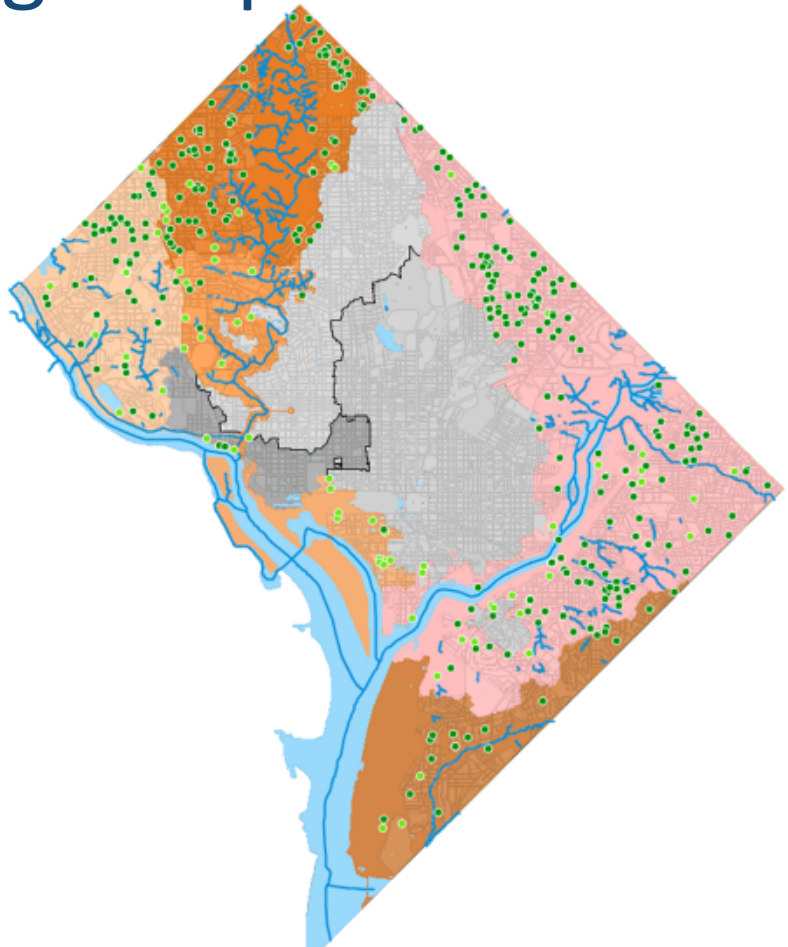
- Newer approach for use with retention based BMPs
- Determine the runoff reduction efficiency based on BMP design parameters, then apply EMC to the runoff reduced to calculate equivalent load reduced.



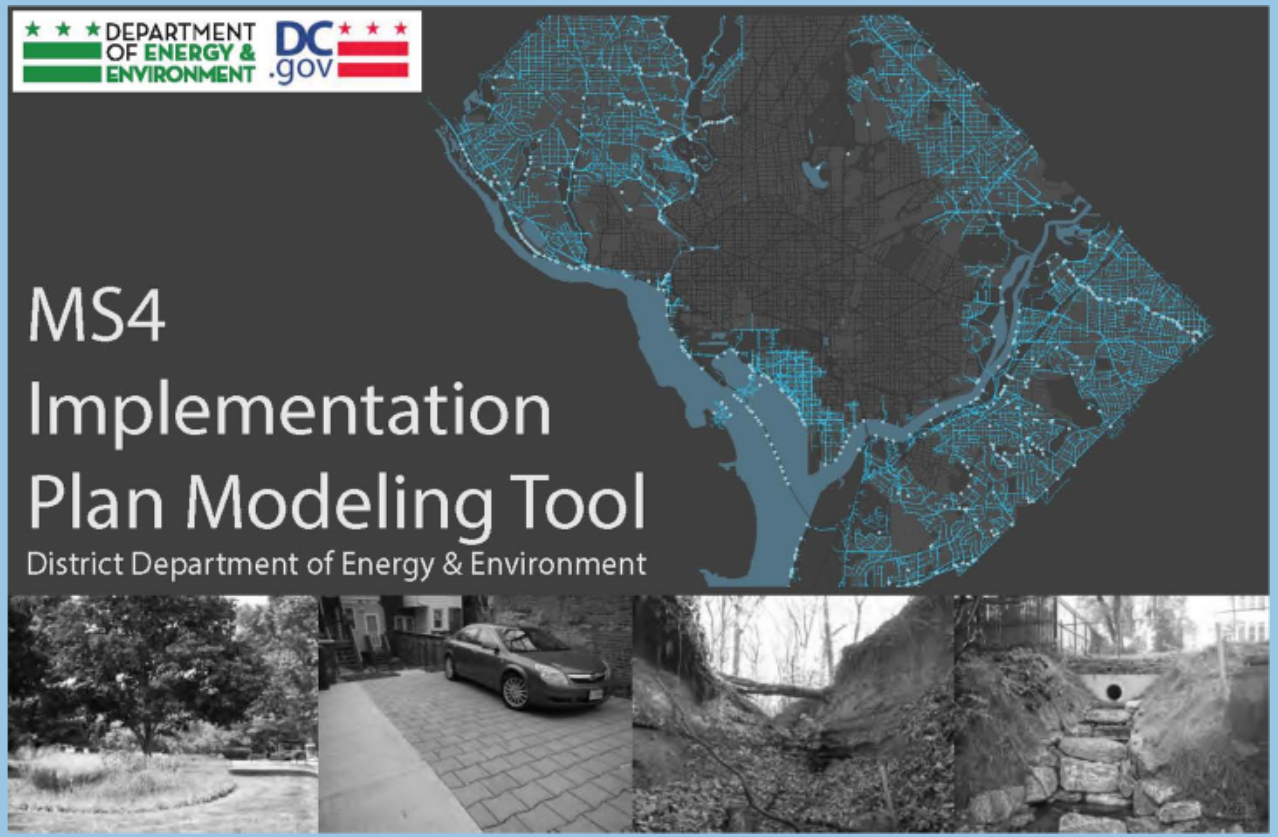
BMP Type	Efficiency at 1.2" Design
Enhanced Permeable Pavement	92%
Enhanced Bioretention	90%
Enhanced Bioretention with Underdrain	83%
Standard Bioretention	58%
Green Roof	50%
Standard Permeable Pavement	0%

Metals and Toxics Modeling Recap

- Calculate loads based on best estimates of EMCs
- Assign an efficiency for each BMP based on design specifications
- Credit efficiency towards meeting appropriate WLA based on its geographic location
- Automate process using the database-driven Implementation Plan Modeling Tool

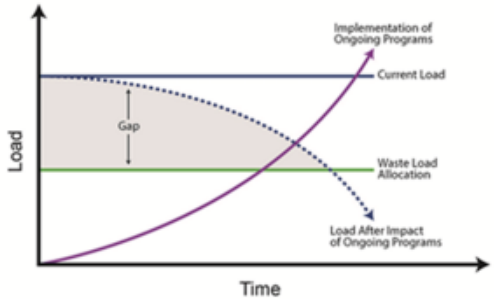


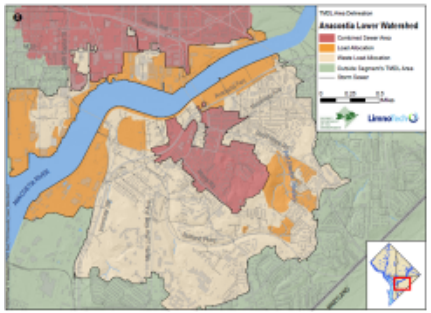
The Implementation Plan Modeling Tool

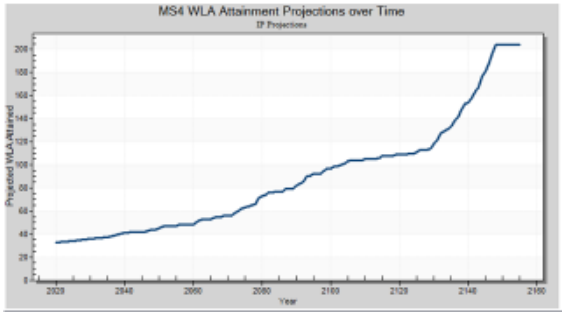


What does the IPMT do?

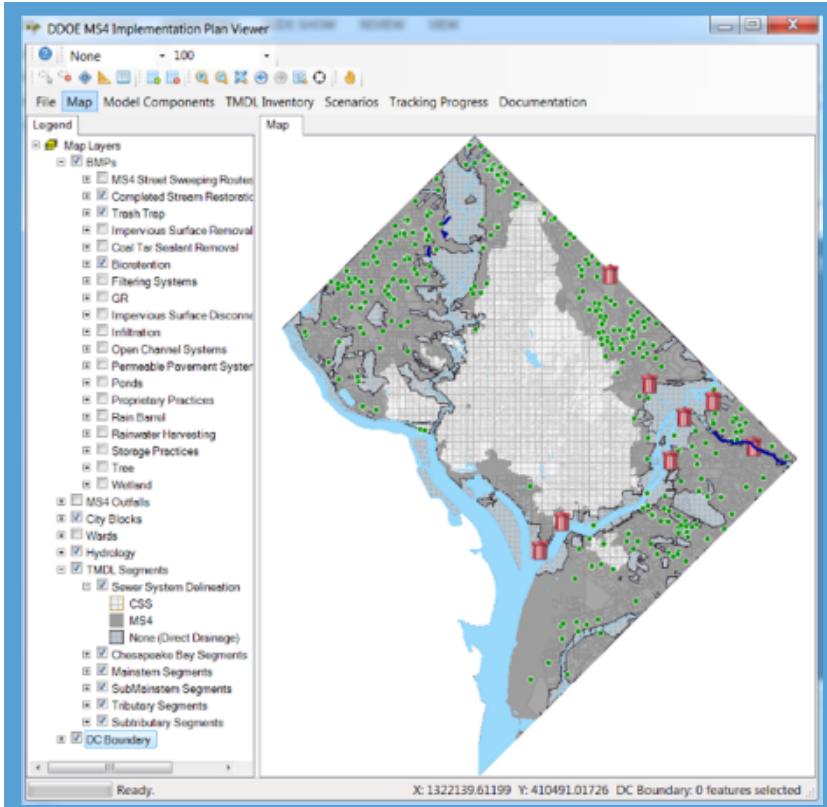
- Presents complex modeling results in an easy-to-use interface
  - Provide a geospatial display of stormwater related inventories
  - Query and display specific TMDL information
  - Display BMP implementation spatially and through a detailed inventory
  - Calculate runoff, pollutant loads, and load reductions
  - Track progress towards WLAs (required by permit)
  - Generate report and graphics







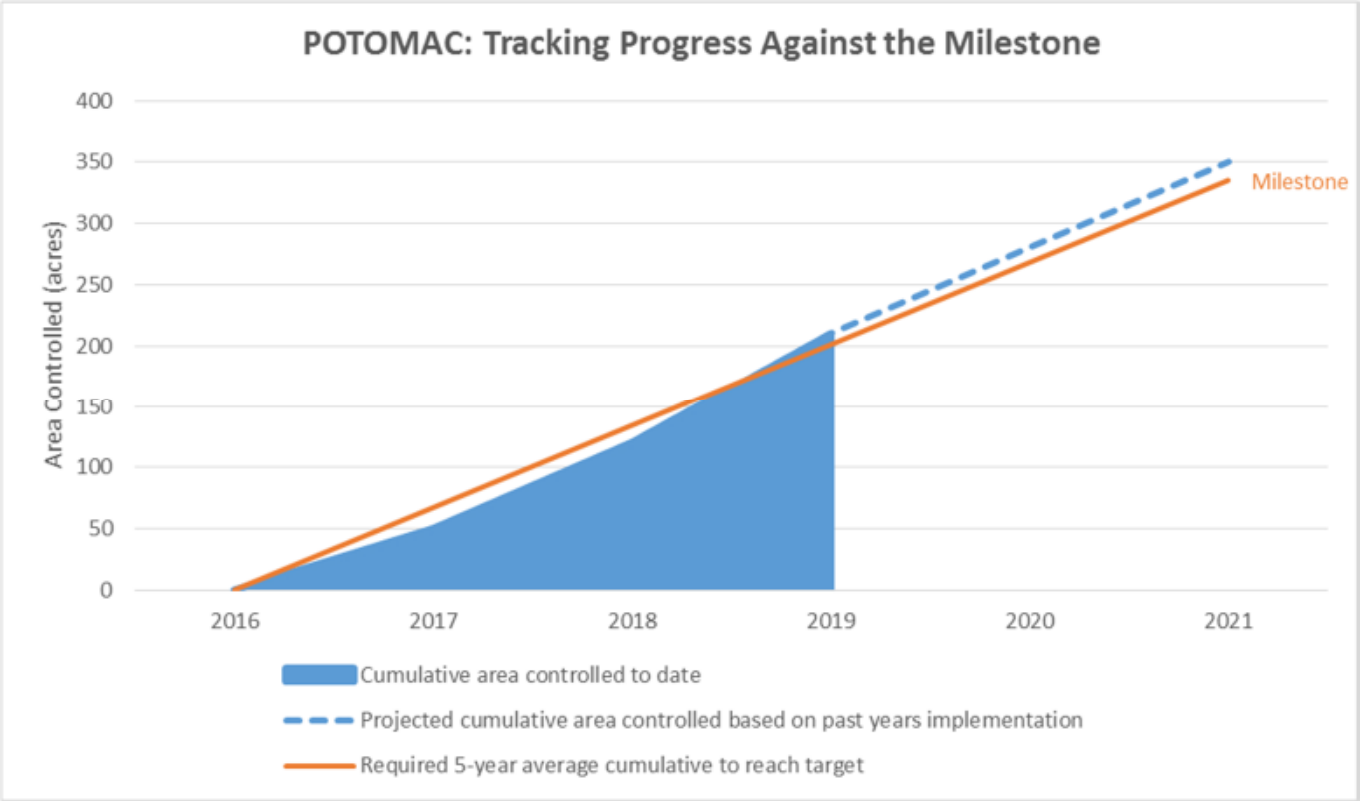
IP Modeling Tool Framework



Graphical User Interface

The GUI displays information from the databases and calculator through maps, graphics, and tables. Mainly menu driven with a strong mapping component. Use the interface to export or import data as desired.

IP Modeling Tool: Example Applications



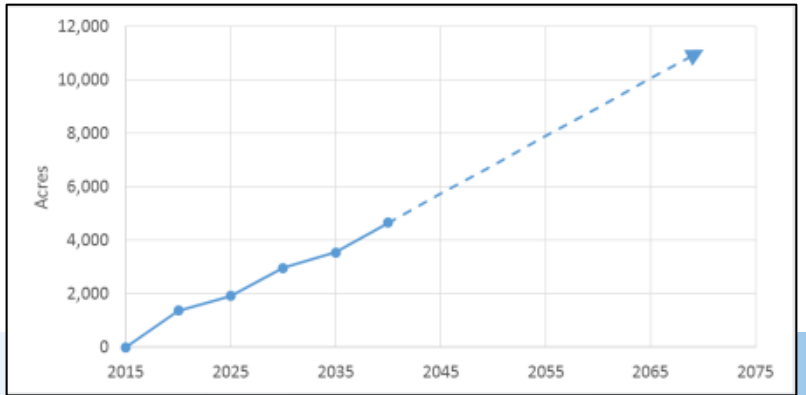
Implementing DC's TMDLs

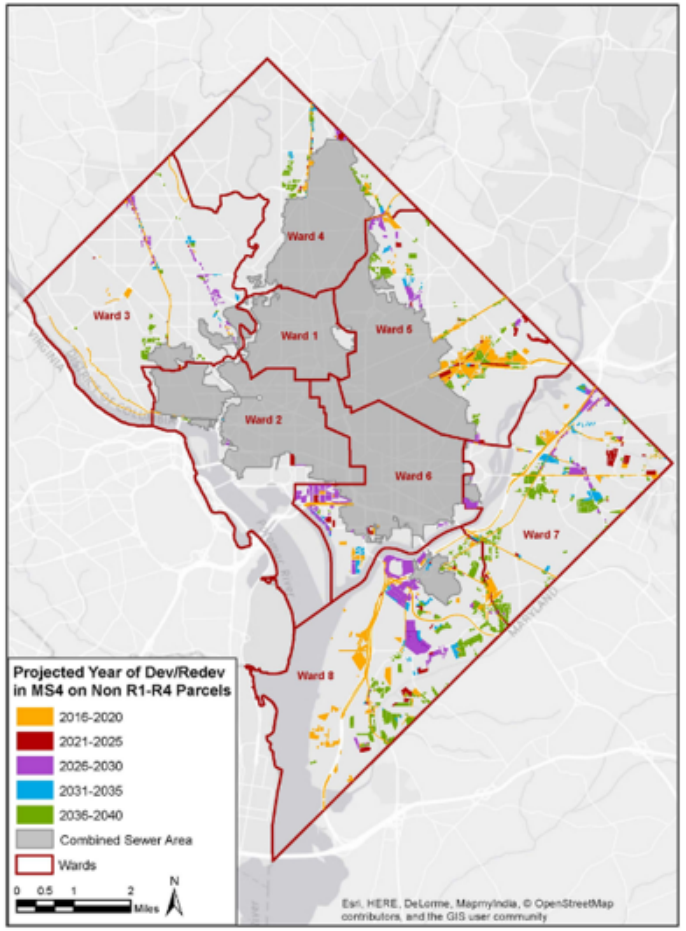
DC's TMDL IP – Strategies for Compliance

- Stormwater regulations
- Direct investment
- Programmatic and source control efforts

Current Programs to Address MS4 TMDLs

Program	Annual Area Projection
Compliance with Stormwater Regulations	187 acres/yr
Direct investment in BMP implementation and programmatic and source control efforts	21 acres/yr
Programmatic and source control efforts	Not area-based



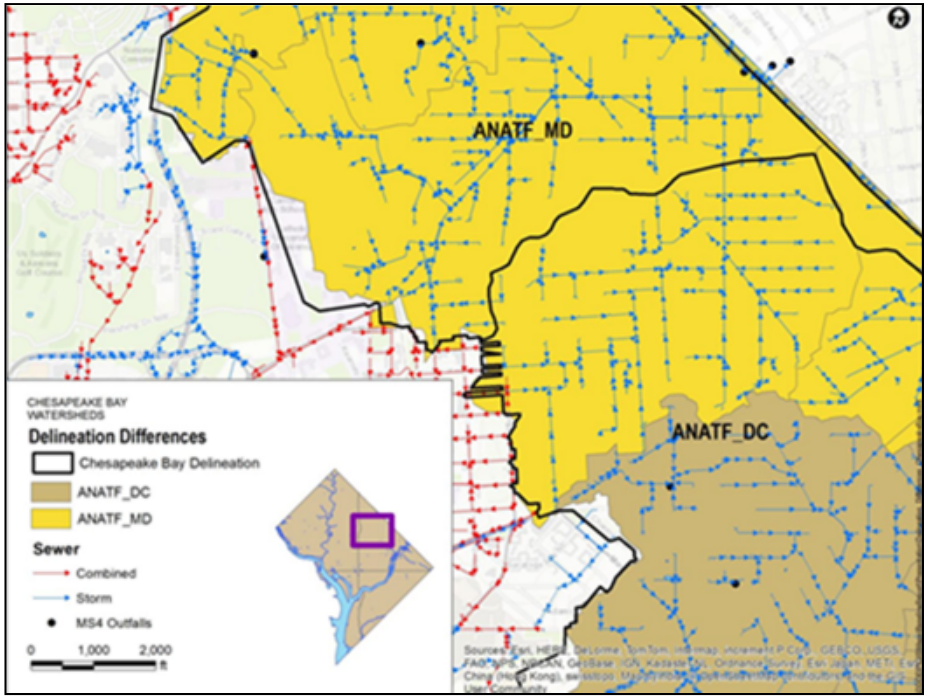


Toxics and Metals Implementation Plan Challenges

- Bay TMDL vs local TMDL
- Achieving metals and toxics reductions with low BMP efficiencies

Bay TMDL vs Local TMDLs

- "Consolidated" approach
  - Bay TMDL WLAs just several of many that must be met
- Differences in:
  - Watershed delineations
  - Pollutant types, EMCs
  - Water quality goals
  - Modeling methods and scale
  - Timelines



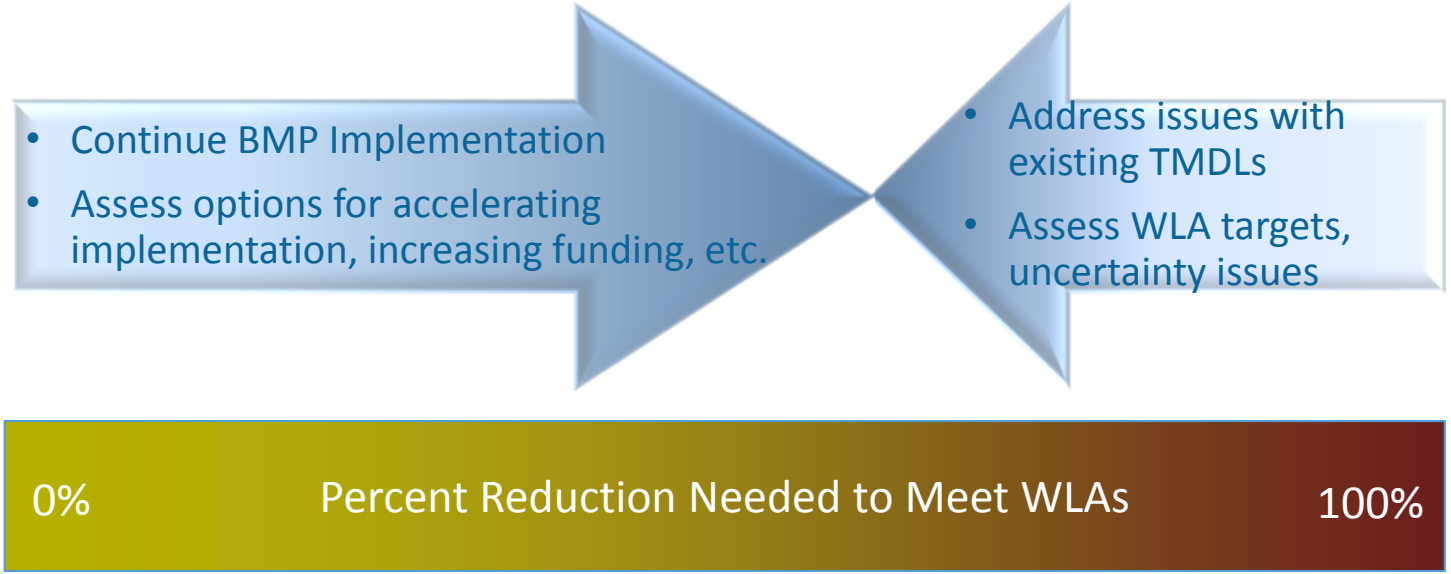
Implementation for Bay and Local TMDLs

- Can't assume meeting Bay TMDL will meet local TMDLs
  - Local pollutants may behave differently than Bay pollutants
  - May need different BMPs to address local TMDLs
- Different reporting timeframes/frameworks

Challenges of meeting metals and toxics WLAs

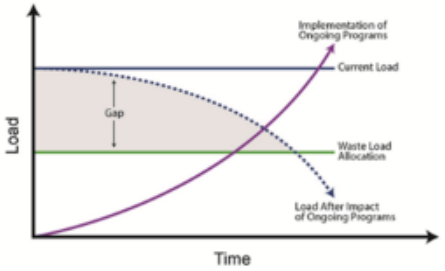
- Many TMDLs require high load reductions
- BMP efficiencies for metals and toxics sometimes not sufficient to meet load reductions
- Will be long process
- Many metals and toxics are legacy pollutants and are ubiquitous in urban environments

How Will the District Address MS4 WLAs in the future? The Two-Pronged Approach



Tracking IP Progress

- Modeling
  - Milestones and benchmarks
  - Ultimate attainment of WLAs
- Monitoring
  - Measures WQ improvements
  - Feedback for model adjustments
- Other programmatic tracking



Anouk Savineau
LimnoTech
(202) 864-6825
asavineau@limno.com

Jonathan Champion
DC Department of Energy and Environment
Stormwater Management Division
(202) 535 1722
jonathan.champion@dc.gov

www.dcstormwaterplan.org