Anacostia River Toxics TMDL

Pre-TMDL Informational Meeting

September 25, 2018

Presentation Overview

- Welcome and Purpose
- Total Maximum Daily Load Program
- Anacostia River Toxics History
- Existing Impairments and Data
- TMDL Endpoints
- Modeling Approach
- Verification and Allocation Points

What is a Total Maximum Daily Load?

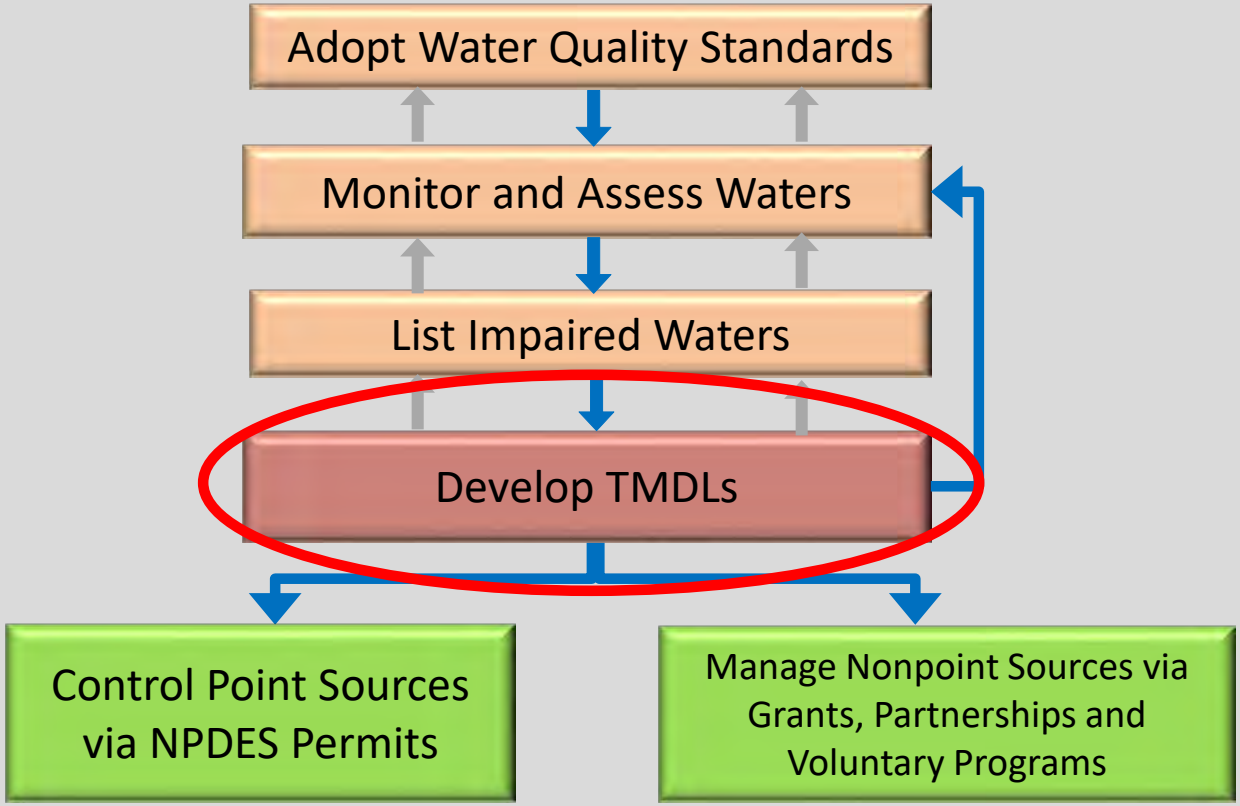
- Required under the Clean Water Act, Section 303(d).
- The maximum amount of pollutant allowed to enter a waterbody so that the waterbody will meet water quality standards (WQS) for that pollutant.
- Allocated among all pollutant sources.
- TMDL = WLA + LA + MOS
  - WLA = Wasteload Allocation to point sources.
  - LA = Load Allocation to nonpoint sources.
  - MOS = Margin of Safety.

What Waterbodies Require a TMDL?

- Waters that do not meet water WQS after all technology-based controls and/or other required pollutant controls are in place.

- More than one TMDL may be developed for a given waterbody if multiple pollutants have been identified.

Steps in the Water Quality Management Approach of the Clean Water Act



A TMDL is important because…

- A planning tool to facilitate achieving water quality standards
- Analytic underpinning for watershed decisions
- Can integrate solutions
- Opportunity for innovations

Toxics TMDL Timeline

2003 TMDLs approved for organics and metals (toxics) in the Anacostia

2009 TMDLs were challenged because the loads were not expressed in daily terms

2010 The court vacated EPA's approval but stayed vacatur until 1/31/2020 to allow time for replacement TMDLs to be established

2014 DOEE's ongoing Remedial Investigation (RI) for sediment in the Anacostia led to a large monitoring dataset and complex modeling tools to characterize sources in the watershed

2020 Final TMDLs will be submitted by DOEE/MDE to EPA

Toxics TMDL Revision

- The 2003 TMDLs are currently implemented through NPDES permits and other water control programs
- DOEE, MDE, and EPA agreed to develop the revised TMDLs in cooperation and incorporate additional data and more robust water quality modeling
- The revised TMDL will re-assess sources within the watershed and re-allocate load reductions

Toxics Listing History

Waterbodies	Pollutants	Supporting Data	Notes
DC Anacostia Mainstem	Metals Pesticides PAHs	Fish Tissue	Listed in 1996
DC Anacostia Tributaries	Varies by Tributary: Metals Pesticides and/or PAHs	Water Column	Listed in 1996 based on Mainstem data. Refined based on 2013 data.
MD Anacostia Mainstem	Heptachlor Epoxide	Fish Tissue	Listed in 2012
MD Anacostia Northwest Branch	Heptachlor Epoxide	Water Column	Listed in 2002. Extent of impairment refined in 2010.

- DC listings were established for classes of chemicals and TMDLs were developed for specific pollutants.

Existing Data

- To better understand water quality in the tributaries, EPA hired TetraTech in 2013 to collect water column data in DC
- Based on these data, several tributaries were determined not to be impaired, while impairments in the remaining tributaries were confirmed
- Additional water column and fish tissue data are currently being collected (Summer/Fall 2018) and will be used to inform the TMDL
- Through this effort, toxics TMDLs will be developed for the remaining impaired waters in both the Maryland and D.C. portions of the Anacostia watershed

Current Listings

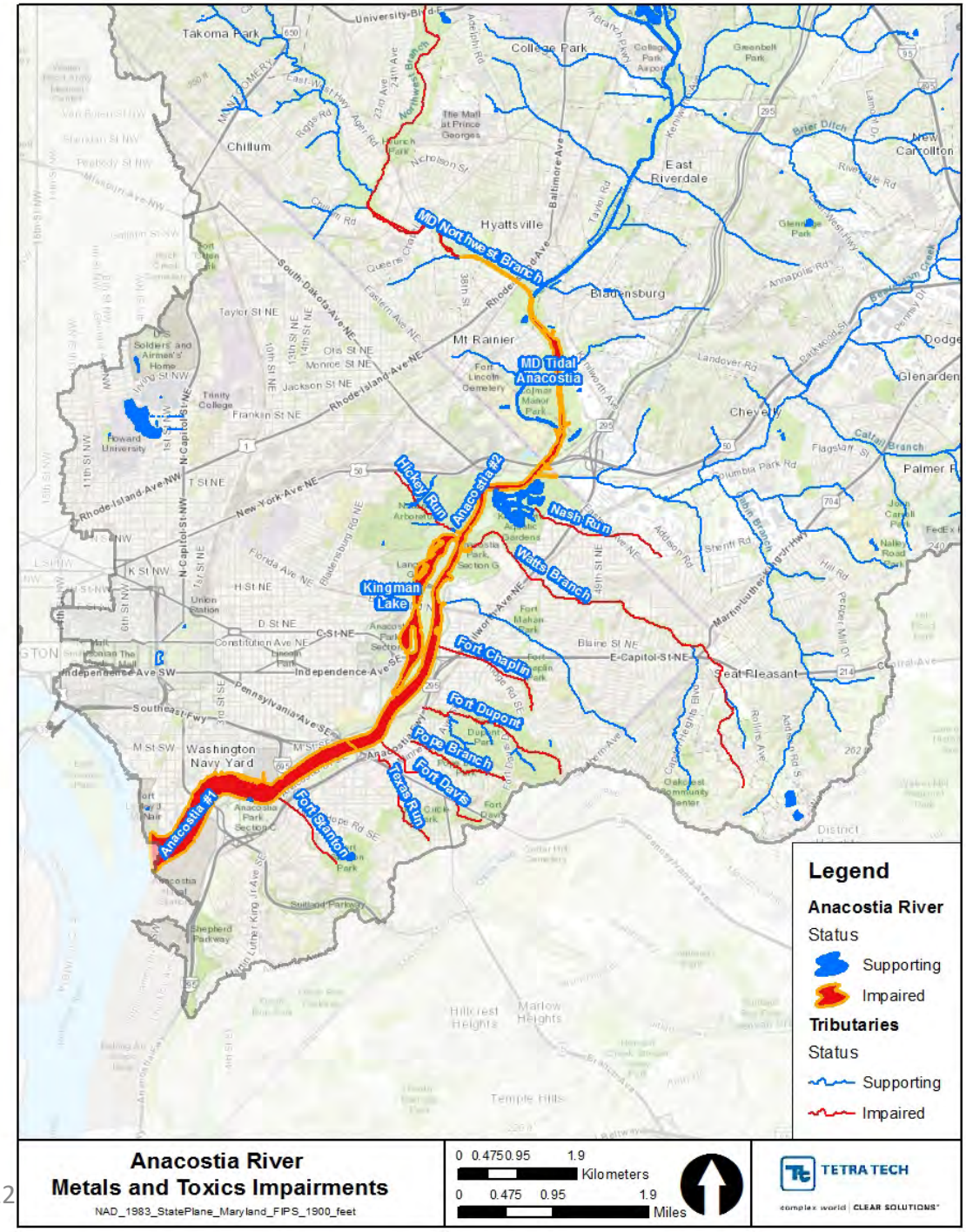
Waterbody	Arsenic	Copper	Zinc	4,4 DDD	4,4 DDE	4,4 DDT	Chlordane	Dieldrin	Heptachlor Epoxide	PAHs	Jurisdiction
Anacostia Mainstem #1	●	●	●	●	●	●	●	●	●	●	DC
Anacostia Mainstem #2	●	●	●	●	●	●	●	●	●	●	DC
Kingman Lake	●					●	●			●	DC
Nash Run	●						●	●	●	●	DC
Popes Branch					●		●		●	●	DC
Watts Branch							●	●			DC
Hickey Run					●		●			●	DC
Fort Dupont	●										DC
Fort Chaplin	●										DC
Fort Davis	●										DC
Fort Stanton	●									●	DC
Texas Run	●			●	●	●	●	●	●	●	DC
MD Tidal Anacostia Mainstem									●		MD
MD Northwest Branch									●		MD
Total Segments	9	2	2	3	5	4	8	5	7	8	14

Metals

Organochlorine pesticides

1-6 ring Polycyclic Aromatic Hydrocarbons (PAHs)

Current listings are based on water column measurements, except for those collected on the Anacostia mainstem, which are also informed by fish tissue data


Takoma Park
College Park
Chillum
Hyattsville
East Riverdale
New Carrollton
Bladensburg
Mt Rainier
Cheverly
Palmer P
Glenarden
Dodge
Washington Navy Yard
Seat Pleasant
Hillcrest Heights
Marlow Heights
Temple Hills
MD Northwest Branch
MD Tidal Anacostia
Anacostia #2
Hickey Run
Nash Run
Watts Branch
Kingman Lake
Fort Chaplin
Fort Dupont
Pope Branch
Fort Davis
Texas Run
Fort Stanton
Anacostia #1
Legend
Anacostia River
Status
Supporting
Impaired
Tributaries
Status
Supporting
Impaired
Anacostia River
Metals and Toxics Impairments
NAD_1983_StatePlane_Maryland_FIPS_1900_feet
0 0.475 0.95 1.9
Kilometers
0 0.475 0.95 1.9
Miles
TETRA TECH
complex world | CLEAR SOLUTIONS™

TMDL Endpoints

- TMDL Endpoint: At what pollutant concentration will water quality be met?

- Water column criteria (to protect aquatic life and/or human consumption of fish) are available for all of the TMDL pollutants

- Fish tissue listing thresholds are also available and are protective of human consumption of fish

TMDL Endpoints

- In 2015, EPA updated nationally recommended criteria for the pesticides and PAHs. Both DOEE and MDE plan to adopt these criteria.

- All applicable criteria and/or listing thresholds (water column, fish tissue, sediment) were reviewed for use as TMDL endpoints

- The final TMDLs will be protective of all applicable Water Quality Standards

MD's Approach

- For listings based on fish tissue data, MD develops fish tissue based (1) water column and (2) sediment endpoints using a site-specific Bioaccumulation factor (BAF) and MDE's fish tissue listing threshold.
- Translates a fish tissue listing threshold into water column and sediment TMDL endpoints.
- Can be thought of as the ratio of fish contamination to sediment and water contamination
- Requires paired fish tissue, sediment, and water column data
- The fish tissue based water column endpoint will be compared to the applicable water column criteria and the most stringent will be chosen.

Pollutant Group	Pollutant		Chronic Aquatic Life (µg/L)	Acute Aquatic Life (µg/L)	Human Health (µg/L)	Fish Tissue (mg/kg)
Metals (µg/L)	Arsenic, dissolved		150	340	0.14	
	Copper, dissolved		8.96	13.44		
	Zinc, dissolved		118.14	117.18	26000	
Organochlorine Pesticides (µg/L)	DDT	4,4 DDD	0.001	1.1	0.00012	
		4,4 DDE	0.001	1.1	0.000018	
		4,4 DDT	0.001	1.1	0.00003	
	Chlordane		0.0043	2.4	0.00032	
	Dieldrin		0.056	0.24	0.0000012	
	Heptachlor Epoxide		0.0038	0.52	0.000032	0.00934
PAH1 (2 + 3 ring) (µg/L)	acenaphthene		50		90	
	acenapthylene					
	anthracene				400	
	fluorene				70	
	napthalene		600			
PAH2 (4 ring) (µg/L)	benzo[a]anthracene				0.0013	
	chrysene				0.13	
	fluoranthene		400		20	
	pyrene				30	
PAH3 (5 + 6 ring) (µg/L)	benzo[a]pyrene				0.00013	
	benzo[b]fluoranthene				0.0013	
	benzo[g,h,i]perylene					
	benzo[k]fluoranthene				0.013	
	dibenzo[a,h]anthracene				0.00013	
	indeno[1,2,3-c,d]pyrene				0.0013	

Yellow represent criteria that will likely drive TMDL endpoints as they are the most stringent.

TMDL Endpoints

- Likely TMDL endpoints are the most stringent
- DDT degradants grouped
- PAHs grouped into 3 groups based on ring structure

Modeling Approach

- Environmental simulation models are simplified mathematical representations of complex real-world systems
- Models use known interrelationships among variables to predict change in response to a varying forcing function (e.g. weather, tides)
- Ability of a model to represent real-world conditions should be demonstrated (calibration, validation)

Modeling Approach

- A linked watershed/receiving water model is best suited to capture critical Anacostia River characteristics
  - Will be able to represent the linkage between watershed sources, legacy river bed contamination, and impact of Potomac River
  - The sources of contaminants can be characterized using site-specific data
    - Levels in surface soils, interflow, groundwater, and dry and wet atmospheric deposition are directly applicable in the modeling environment
  - Allows for simulation of comprehensive TMDL scenarios (i.e. what sources must be reduced to achieve WQS)

Modeling Approach

- A linked watershed/receiving water model of the Anacostia has been developed as part of the RI
  - LSPC watershed model
  - EFDC receiving water model
- The RI model system has been calibrated and validated for simulation of:
  - Hydrology
  - Hydrodynamics
  - Sediment loading and transport
  - Loading of select priority pollutants
- The RI model system will serve as a starting point for the development of the Anacostia River Toxics TMDL model

Modeling Approach

- The TMDL model system will be able to:
  - Simulate existing water quality conditions in the Anacostia River and its tributaries
  - Simulate existing sediment quality conditions in the tidal Anacostia River
  - Represent upland watershed pollutant sources and pathways
  - Represent instream pollutant sources and pathways
  - Link pollutant sources and water quality and sediment quality response
  - Simulate TMDL management scenarios where source controls results in meeting selected TMDL endpoints

Modeling Approach

Watershed Model – algorithms applied to watershed characteristics and weather data to simulate:

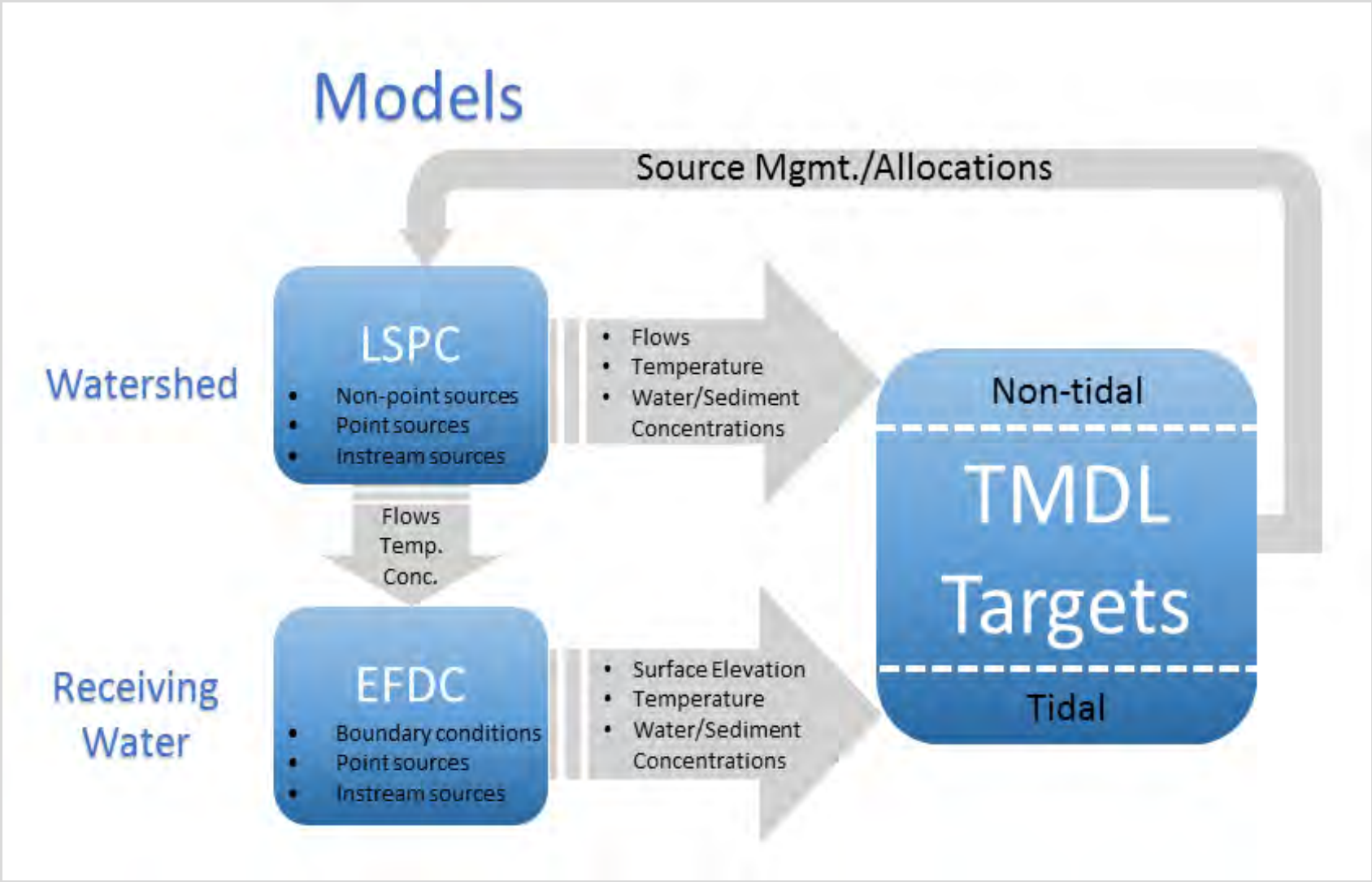
- Land-based processes:
  - Rainfall-runoff
  - Interflow
  - Groundwater flow
  - Flow routing (i.e. time of concentration)
  - Water temperature
  - Pollutant loading (build-up washoff)
- (Simple) instream processes:
  - Hydraulics
  - Pollutant fate and transport

Modeling Approach

Receiving Water Model – algorithms applied to waterbody characteristics and boundary conditions (watershed input, other stream input, weather, point sources) to simulate detailed instream:

- Water circulation
- Water temperature
- Suspended sediment transport
- Pollutant fate and transport
- Conventional pollutant kinetics and transport

Modeling Approach



Verification & Allocation Points

- To assign TMDL load allocations to an impaired water body, must determine:
  1. Over what spatial domain will simulated Water Quality be compared to TMDL endpoints? – **Verification Points**
  2. At what location(s) will the existing and TMDL pollutant loads be evaluated? – **Allocation Points**
- Anacostia TMDL model system uses two platforms:
  1. LSPC – model domain defined by subwatersheds (SWS)
  2. EFDC – model domain defined by grid cells
- When evaluating Water Quality at a verification point and pollutant loads at an allocation point those organizing units (subwatersheds and grid cells) are where comparisons are made

Verification Points

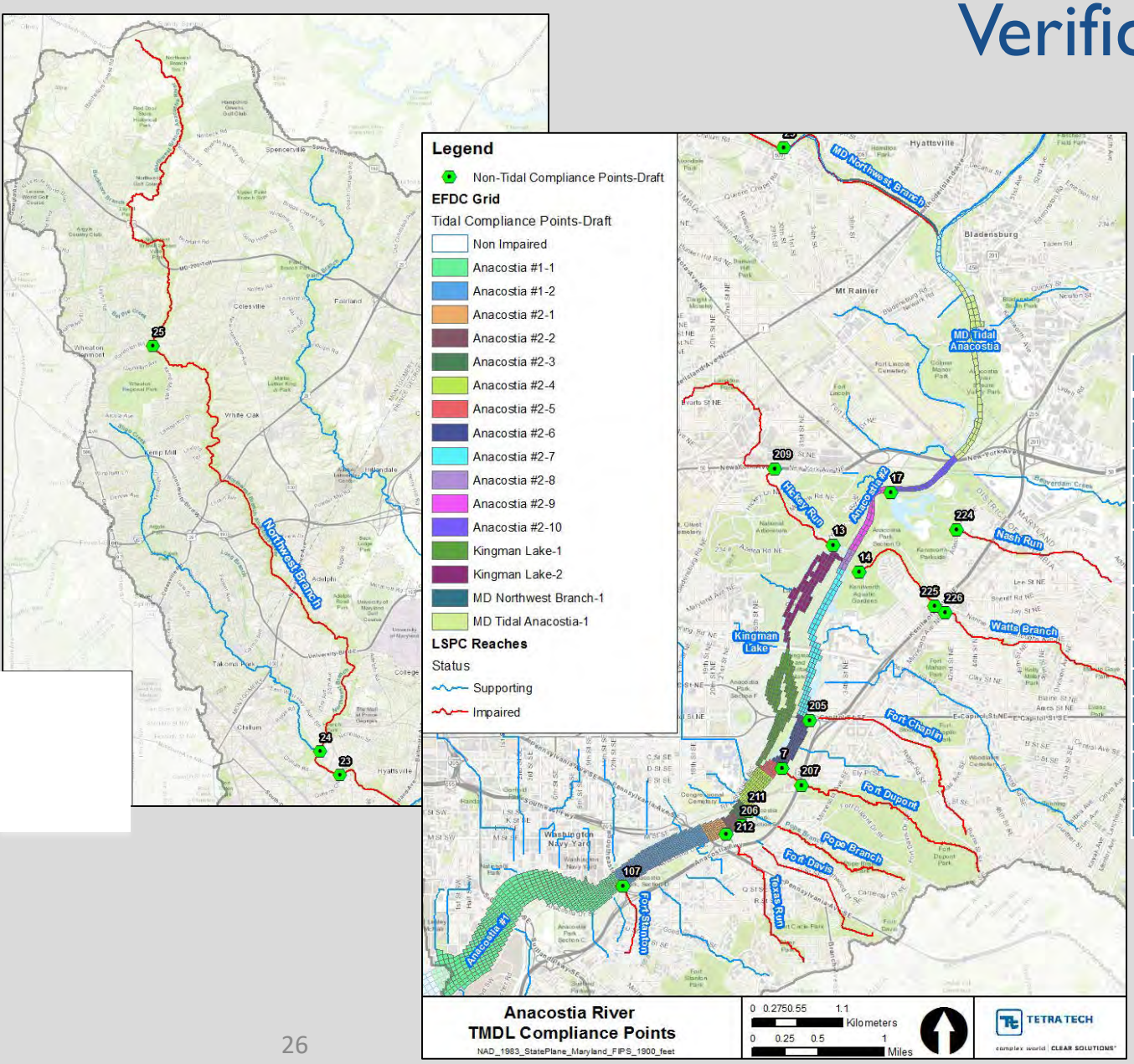
Non-tidal Waters (LSPC)

- Selected approach is multiple points at each impaired segment model reach pour point
- Ensures applicable WQS met throughout segment

Tidal Waters (EFDC)

- Two selected approaches:
  1. Large Segments with confluences to other impaired segments – multiple aggregates of cell clusters throughout entire segment
     - Clusters defined by the confluences
     - Accounts for water quality impacts potentially caused by confluence
  2. Segments without confluences to impaired segments – single aggregate of all cells in segment
     - Treats impaired segment as single body composed of all associated cells
     - Appropriate because water quality should be relatively homogenous throughout
- Volume weighted mean used to aggregate cell water quality

Verification Points



Waterbody	Type	SWS ID(s)	Clusters
MD NW Branch	Non-tidal	23, 24, 25	
MD NW Branch	Tidal		1
MD Anacostia	Tidal		1
Nash Run	Non-tidal	17, 224	
Hickey Run	Non-tidal	13, 209	
Watts Branch	Non-tidal	14, 225, 226	
Fort Chaplin	Non-tidal	205	
Fort Dupont	Non-tidal	7, 207	
Kingman Lake	Tidal		2
Popes Branch	Non-tidal	211	
Fort Davis	Non-tidal	206	
Texas Run	Non-tidal	212	
Anacostia #2	Tidal		10
Fort Stanton	Non-tidal	107	
Anacostia #1	Tidal		2

Allocation Points

- Allocation points are defined as the farthest downstream pour point of each impaired segment (tidal and non-tidal)
  - TMDL pollutant loads will be representative of the entire upstream contributing area of an impaired segment
- Non-tidal waterbodies (LSPC)
  - Pour point of the farthest downstream SWS
- Tidal waterbodies (EFDC)
  - Farthest downstream point
  - All watershed model pour points/linkages to the segment grid will be aggregated giving total upstream contributing area
- All impaired waterbodies will have a single existing and TMDL load allocation (i.e. no breakout of sub-segments)

Summary

- Toxics TMDLs for the Anacostia in DC and MD will be finalized by 1/31/2020.

- These TMDLs will replace TMDLs from 2003, which were not expressed as daily loads.

Timeline

- Fall, 2018: Complete monitoring and Model set-up
- Winter, 2019: Run Model, characterize sources, & explore reduction scenarios
- Summer, 2019: Public Notice the draft TMDLs
- Summer, 2019: Host a Public Meeting
- Fall, 2019: Respond to Comments
- January, 2020: Finalize the TMDLs

Additional Information

- EPA's recommended water quality criteria (https://www.epa.gov/wqc/national-recommended-water-quality-criteria)
- DOEE WQS (https://doee.dc.gov/publication/notice-final-rulemaking-dc-water-quality-standards)
- DOEE TMDL Program (https://doee.dc.gov/service/total-maximum-daily-load-tmdl-documents)
- MDE WQS (https://mde.maryland.gov/programs/Water/TMDL/WaterQualityStandards/Pages/index.aspx)
- MDE TMDL Program (https://mde.maryland.gov/programs/water/TMDL/Pages/index.aspx)
- Anacostia Sediment Draft Remedial Investigation (https://doee.dc.gov/release/public-comment-period-remedial-investigation-report-anacostia-river-sediment-project)

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