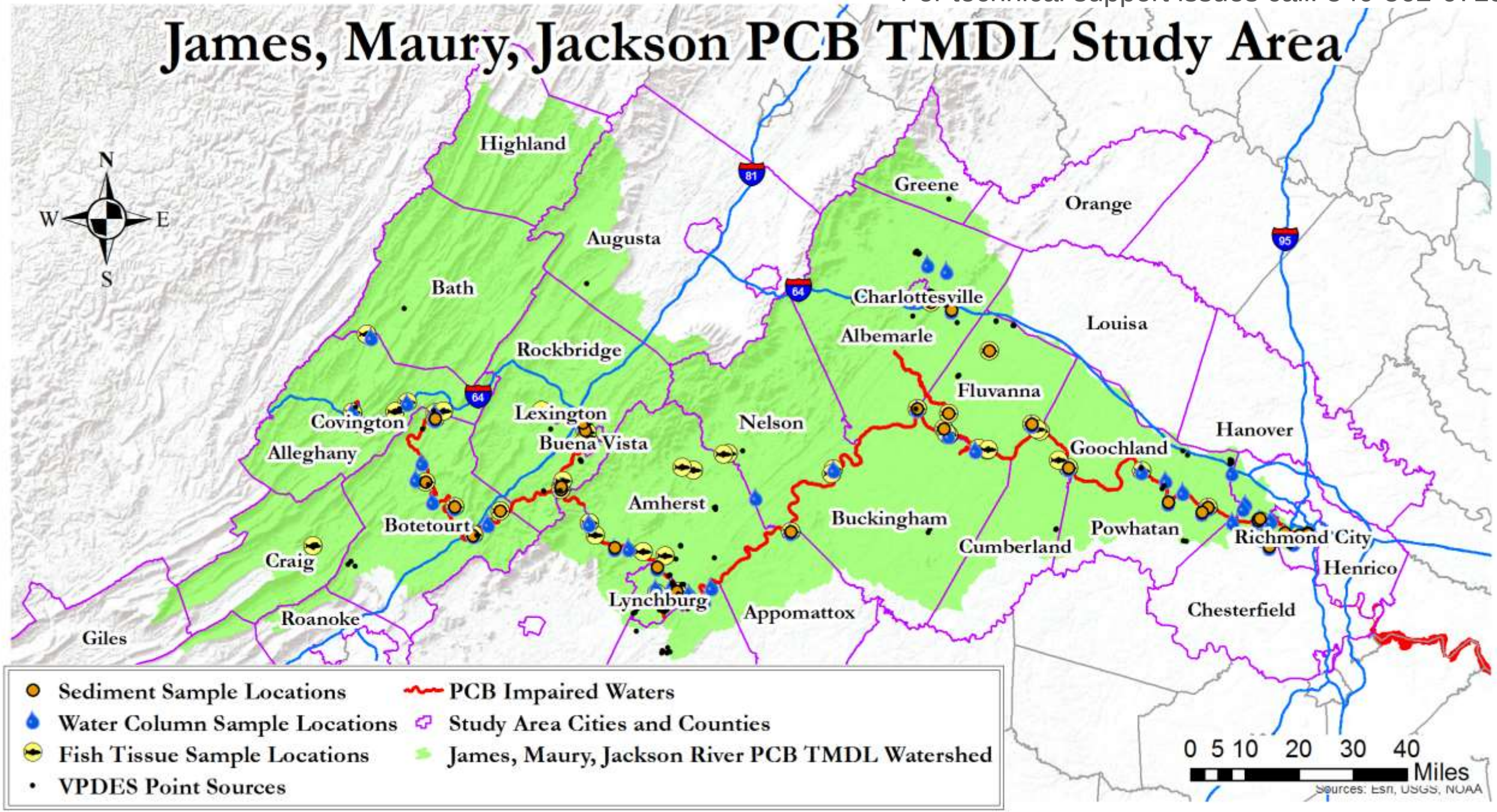
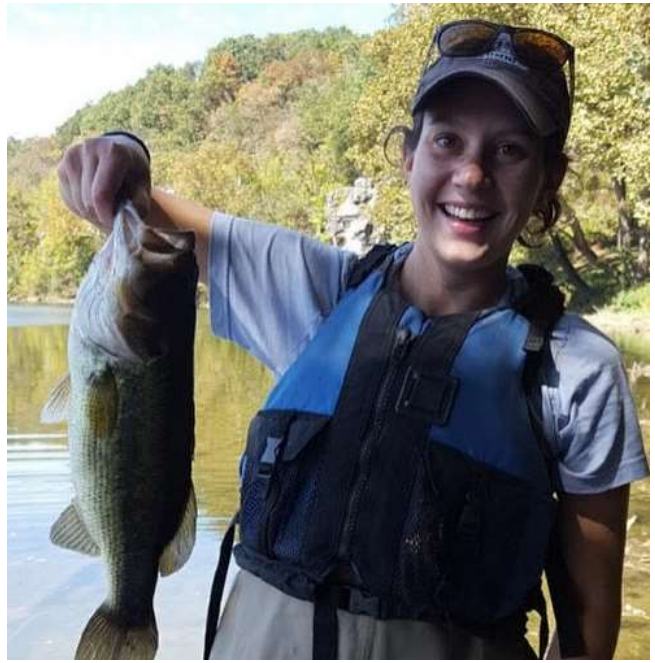


Will Isenberg
DEQ Central Office

Nesha McRae
DEQ Valley Regional Office

Jen Rogers
DEQ Piedmont Regional Office



Lucy Smith
DEQ Blue Ridge Regional Office

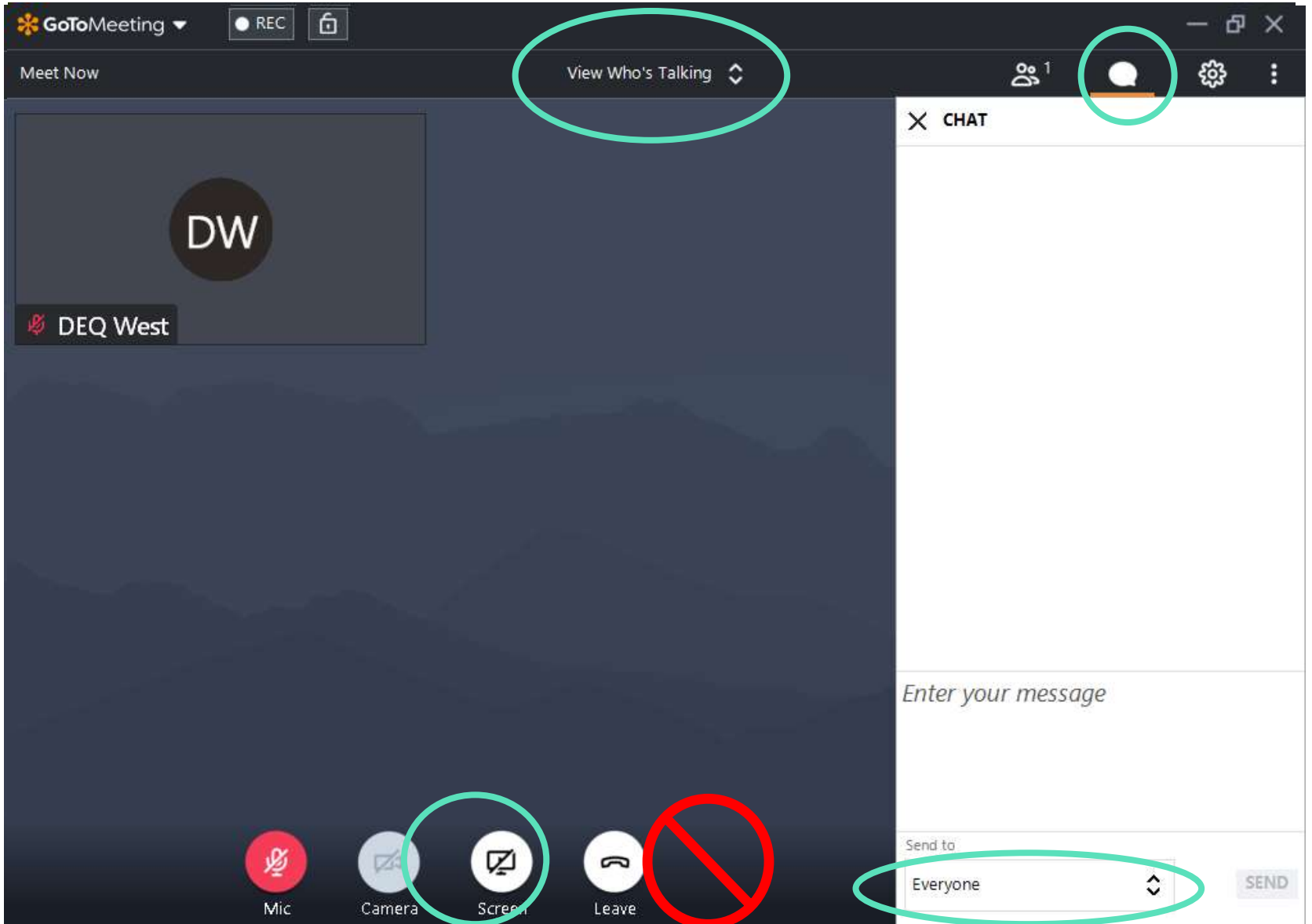
Karen Kline
VT Biological Systems Engineering

Welcome!

Please enter your affiliation in the chat box

DEQ

Getting Familiar with GoToMeeting



For technical support issues call: 540-562-6718

James River, Maury River, Jackson River PCB Cleanup Plan Development

Community Kick Off Meeting

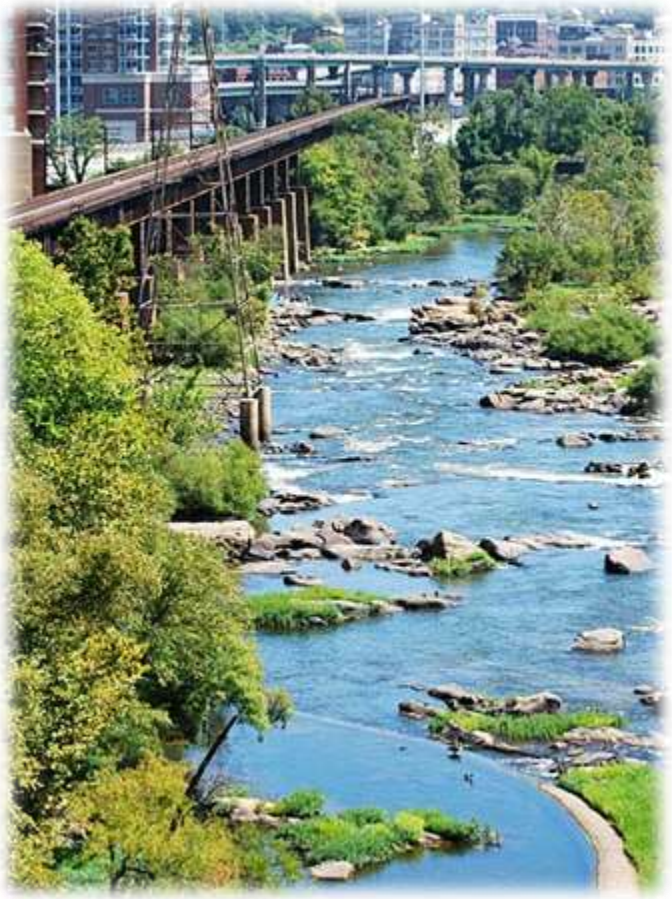
Will Isenberg

Virginia Department of Environmental Quality

January 12, 2021

Meeting Objectives

1. Introduce the TMDL development process
2. Discuss the TAC role and draft shared expectations
3. Introduce the modeling process
4. Introduce the TMDL sources and point source load calculations
5. Discuss and identify TMDL endpoints



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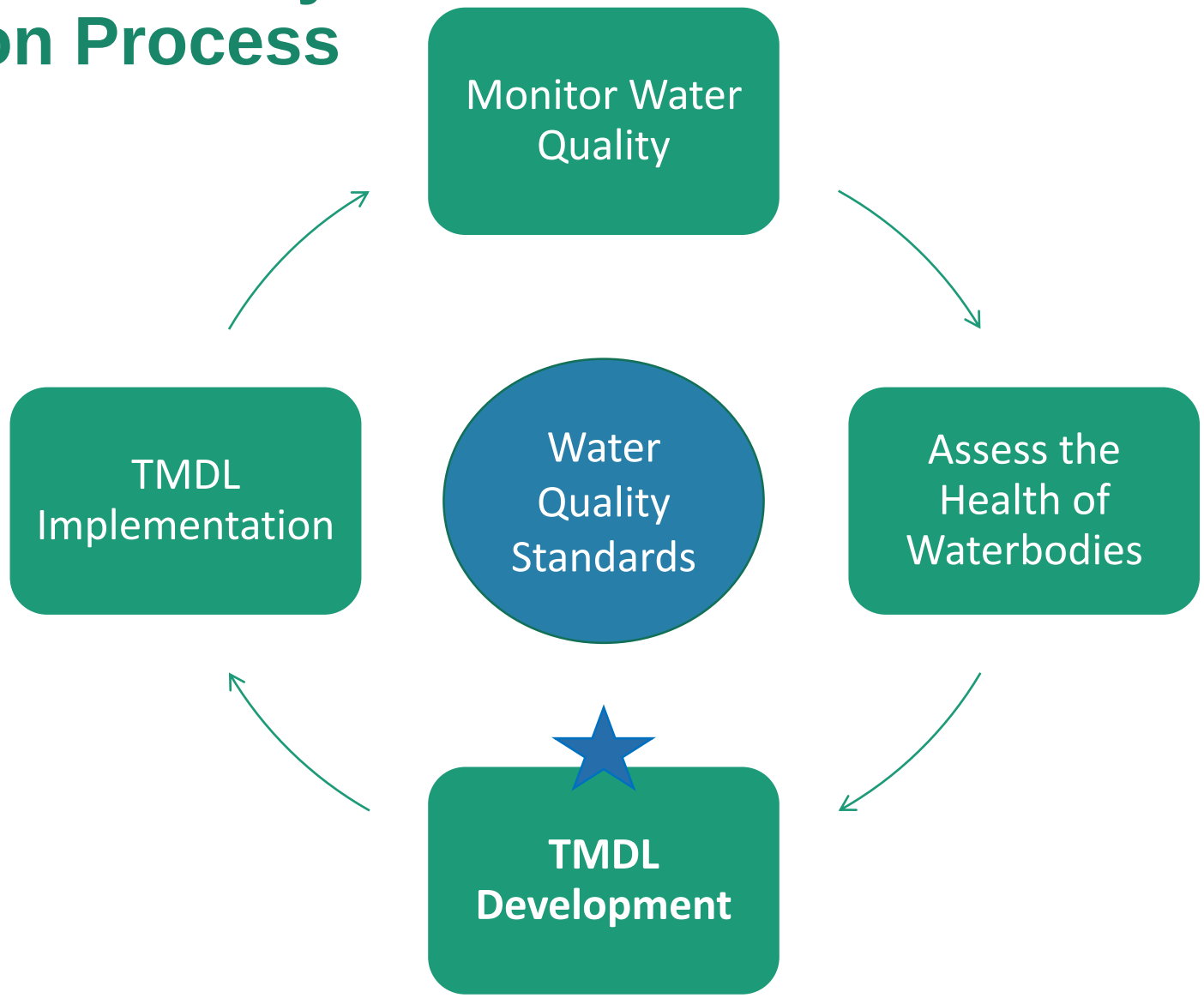
Meeting Outline

- Welcome and introductions
- The James, Maury, Jackson PCB TMDL project and process
- The TAC Process
  - Overview of the role of the TAC
  - Developing shared expectations
- Presentation on Modeling from VT-BSE
- Overview of sources and point source load calculations
- TMDL endpoints
- Next steps

DEQ

Project Background

DEQ's Water Quality Restoration Process



VA Water Quality Criterion – Total PCBs

Agency	Fish Tissue Threshold (ppb)	WQC (ppq)
VDH	100 (Fish Consumption Advisory)	- -
DEQ	18 (Screening Value)*	640

- DEQ's Water Quality Assessment (Integrated Report)
  - VDH - Consumption Advisory = impairment
  - DEQ - two or more fish samples exceed screening value at a site or two water samples exceed criterion at a site = impairment

*From DEQ's 2022 Draft Water Quality Assessment Guidance Manual

Problem Identification

VDH Fish Consumption Advisories*

Affected Water Body Boundaries	Affected Localities	Listing Year	Species	Advisory description
Upper James River from the head of the James near Iron Gate to Balcony Falls Dam downstream of Glasgow	Botetourt County and Rockbridge County	2020	Carp	≤2 meals/month
Maury River from Buena Vista at Rt. 60 16 miles to James River	Rockbridge County and Buena Vista City	2004	Redbreast Sunfish, Rock Bass, Yellow Bullhead Catfish, Carp	≤2 meals/month
James River from Big Island Dam to I-95 James River Bridge in Richmond.	Amherst County, Bedford County, Lynchburg City, Campbell County, Appomattox County, Nelson County, Buckingham County, Albemarle County, Fluvanna County, Cumberland County, Goochland County, Powhatan County, Henrico County, Chesterfield County, Richmond City	2004	Gizzard Shad, Carp, American Eel, Flathead Catfish, Quillback Carpsucker	≤2 meals/month

http://www.vdh.virginia.gov/environmental-health/public-health-toxicology/fish-consumption-advisory/

***Does not affect swimming**

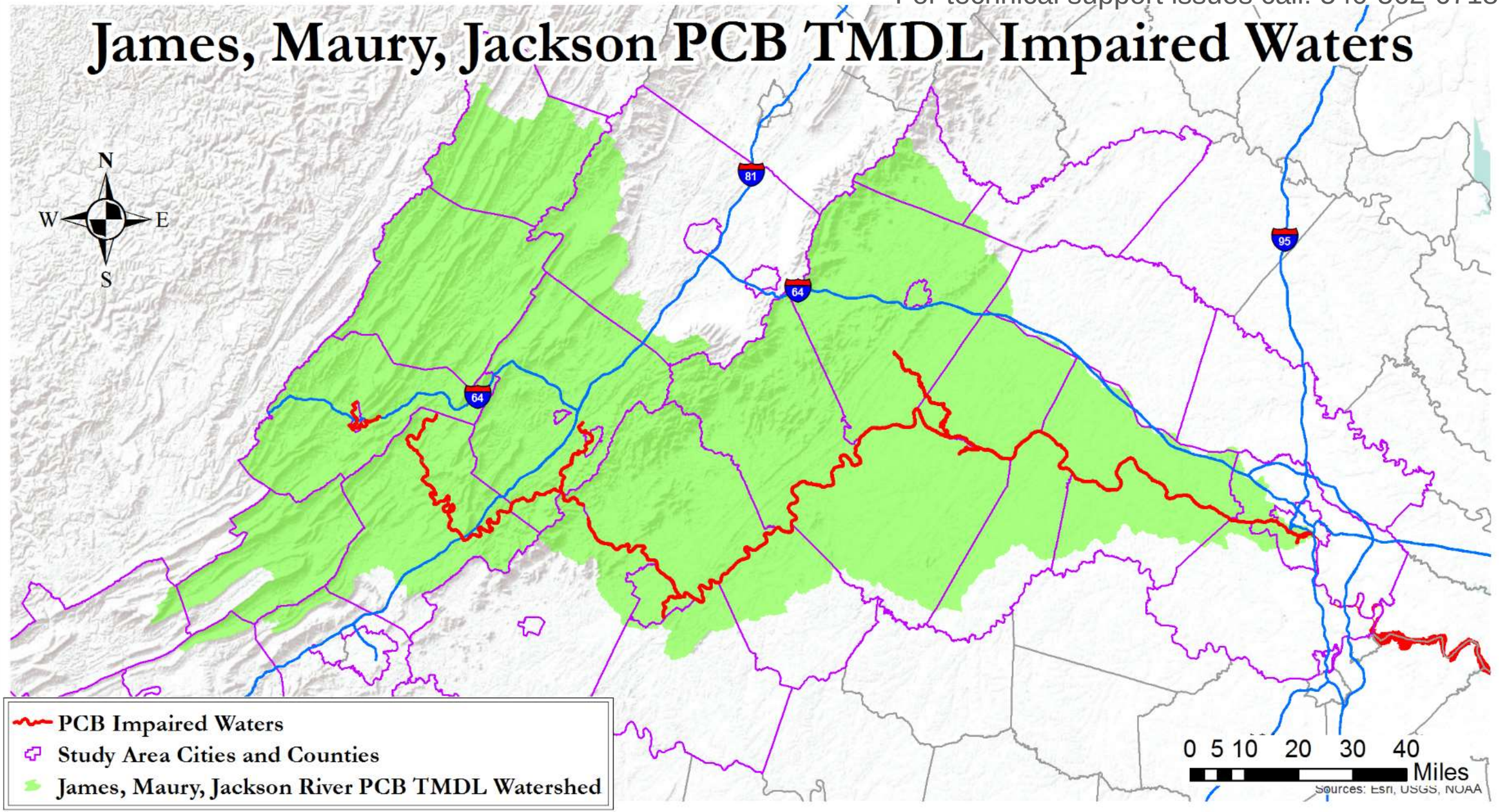
Problem Identification

Additional PCB Impairments Identified by DEQ*

Affected Water Body	Affected Localities	Listing Year	Length
Reedy Creek	City of Richmond	2020	1.08 mi
Fishing Creek	City of Lynchburg	2020	6.32 mi
Slate River	Buckingham County	2008	3.88 mi
Hardware River	Fluvanna and Albemarle counties	2008	23.24 mi
Jackson River	City of Covington and Alleghany County	2008	12.63 mi

***Does not affect swimming**

James, Maury, Jackson PCB TMDL Impaired Waters



Background: PCBs

- Very stable and heat resistant
  - Persistent in environment
- 209 distinct PCB Compounds
  - Regulated as total PCBs (tPCB)
- Deliberate manufacture banned in the 1970s
  - Inadvertent production allowed and common
- Fish consumption significant exposure pathway
  - Possible impacts - carcinogenic, immunotoxic, hepatotoxin (liver), reproduction and development, nervous system

So What is a TMDL?

Technically, a Total Maximum Daily Load is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards.

TMDL = WLA + LA + MOS

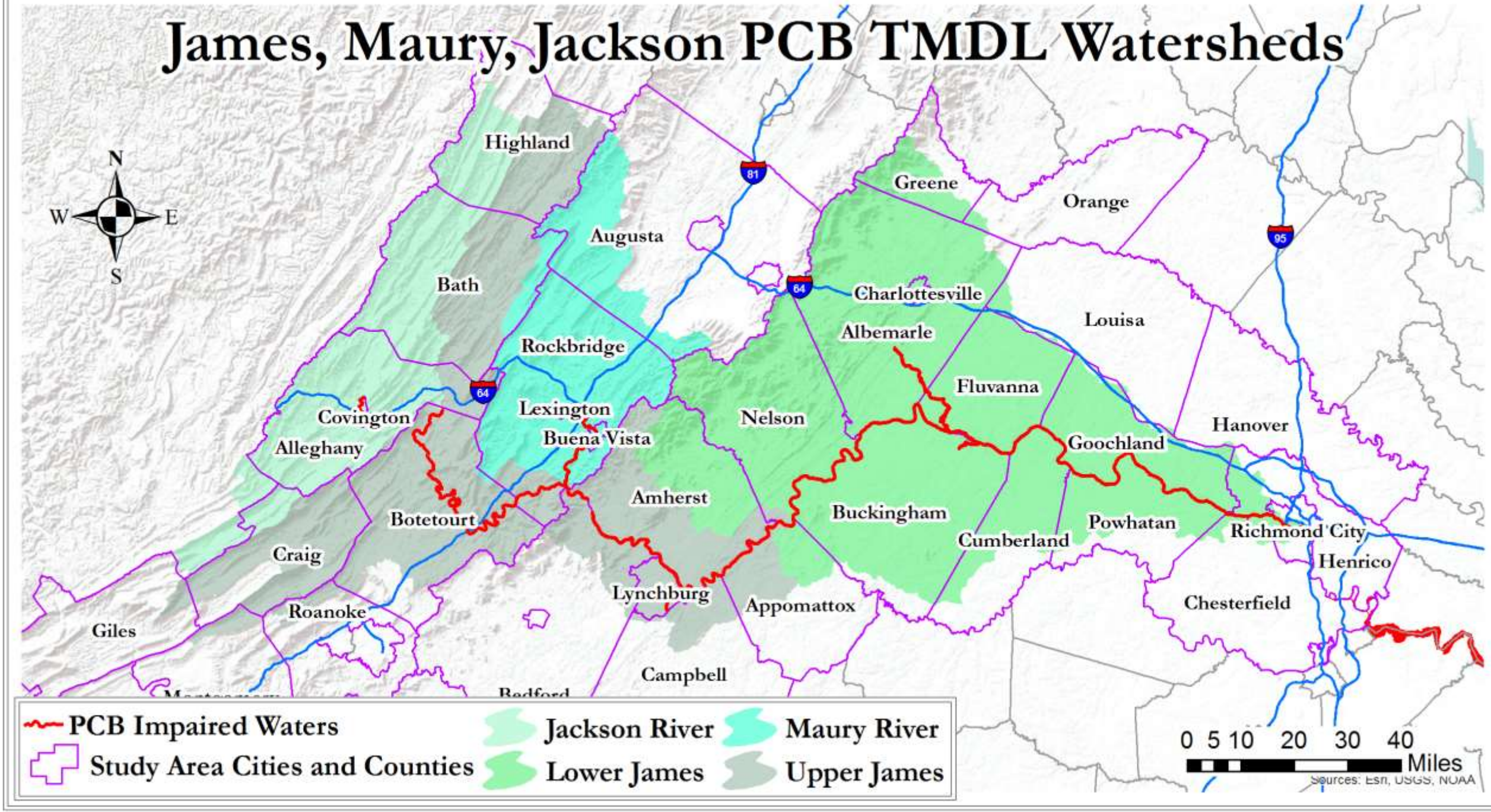
WLA: Wasteload Allocation (permits)

LA: Load Allocation (runoff)

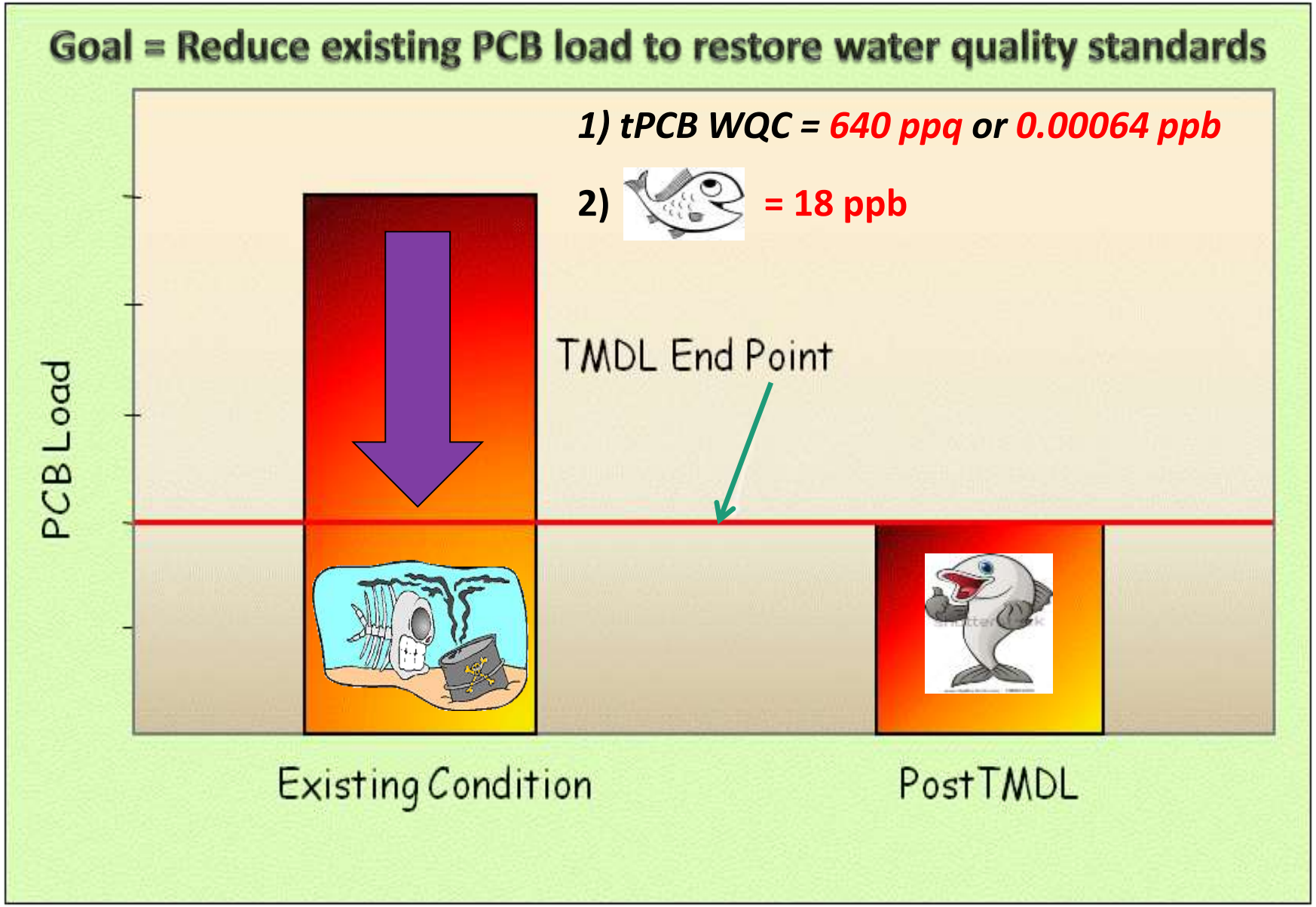
MOS: Margin of Safety

Practically, Total Maximum Daily Loads are a process that we use to clean up our waterways

DEQ


James, Maury, Jackson PCB TMDL Watersheds
N
W
E
S
Highland
Augusta
Bath
Rockbridge
Greene
Orange
Charlottesville
Albemarle
Louisa
Fluvanna
Nelson
Hanover
Goochland
Lexington
Buena Vista
Covington
Alleghany
Amherst
Botetourt
Buckingham
Powhatan
Cumberland
Richmond City
Henrico
Craig
Lynchburg
Appomattox
Chesterfield
Roanoke
Giles
Campbell
Bedford
81
64
95
PCB Impaired Waters
Study Area Cities and Counties
Jackson River
Lower James
Maury River
Upper James
0 5 10 20 30 40
Miles
Sources: Esri, USGS, NOAA

An Example TMDL



The TMDL Development Process

For technical support issues call:
540-562-6718

Completed → **Identify Problem**
- Fish Consumption Advisory
- Watershed Monitoring

Low Level PCB Analysis

Under Way → **Develop Numeric Targets**

Under Way → **Source Assessment**
- Identify sources
- Estimate source loading

To be Completed → **Models the watershed**
- Existing condition
- Estimate total loading capacity

To be Completed → **TMDL Allocations**
- Reduce loads from point sources
- Divide remaining loads among sources

TMDL = WLA + LA + MOS

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Virginia Department of Environmental Quality

DEQ TMDL Sampling Approach

2017 – 2019

- Source identification
- TMDL model support
  - Calibration/validation
- 2017 – 2019 fish tissue, water column, sediment, flow
  - Fish tissue (n = 93)
  - Water column samples: High and Base Flow (n = 157)
  - Sediment samples (n = 26)

Questions?

The Technical Advisory Committee (TAC)

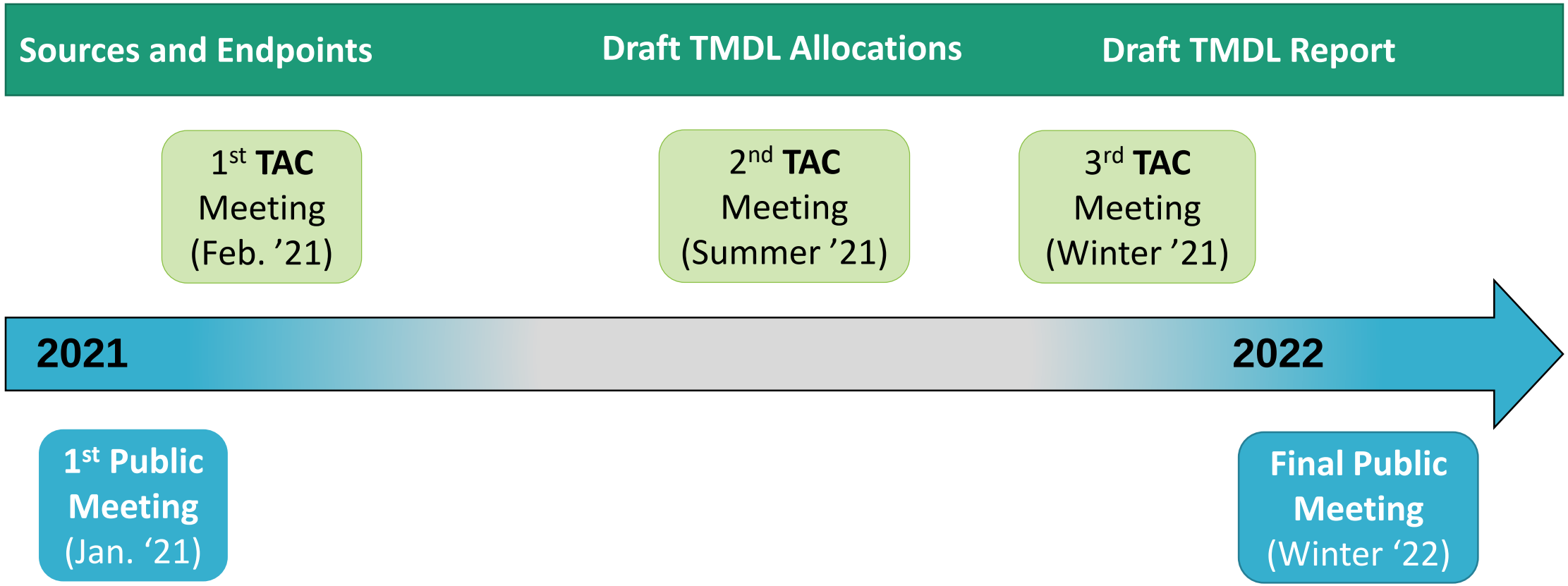
Role of Technical Advisory Committee Members

- To play an **advisory** role on technical aspects of the TMDL in order to keep the TMDL:
  - Protective of Water Quality Standards
  - Realistic
    - Reflective of local conditions
  - Reasonable

- Examples of things TAC members **have** influence over:
  - TMDL watershed endpoint concentrations protective of Water Quality Standards
  - Allocations of the TMDL to the different sources
  - Identification of missing sources
  - Some other model assumptions

- Examples of things TAC members **do not have** influence over
  - The Water Quality Standards (as those are already set)
  - The type of model being used (it is already set)
  - The study area (it is based on the existing impairments)

Anticipated TAC Meeting Timeline



Developing TAC Shared Expectations

- Why are we doing this?
  - Unspoken expectations into words
  - Accommodate and value everyone's participation
  - Provide a guide to decision making

- Next steps after today's meeting
  - Summarize what was heard
  - Share a compilation of expectations
  - Finalize it at the next meeting

DEQ

Summary of Survey Response Expectations

For everyone: Treat everyone with respect and as equals

For DEQ and VTBSE:

- Be transparent, communicate clearly, listen carefully
- Ensure protection of water quality
- Consider impacts to all stakeholders
- Use good practices/science
- Keep to meeting schedule
- Don’t let a few voices dominate
- Prepwork to a minimum

For TAC Members:

- Be prepared and informed
- Assume good intentions
- Be open minded
- Stay on task
- Participate actively
- Commit adequate time
- Be reasonably accepting of the scientific process

Additional Expectations

1. How would you like us to make decisions?
2. What is your primary reason for participating on the TAC?
3. **What expectations do you have for DEQ and VT-BSE (the modelers)?**
4. **What expectations do you have for fellow TAC members?**
5. **What expectations do you have for TAC meetings in general?**
6. What concerns do you have for this process?
7. What information do you need to help you participate in the TAC?
8. Beyond verbal dialogue, are there other ways you prefer to express your thoughts?
9. What other (if any at all) expectations do you have?

Gauging Support on Developing Expectations

- What do you like most?
- What concerns you?
- What are you not sure about?

DEQ

Next Steps for Our Shared Expectations

1. DEQ will summarize feedback received in survey and today
   - Accepting additional feedback through **March 10**

2. DEQ will share a compilation of our expectations prior to the next meeting

3. We will finalize our shared expectations at the next meeting

DEQ

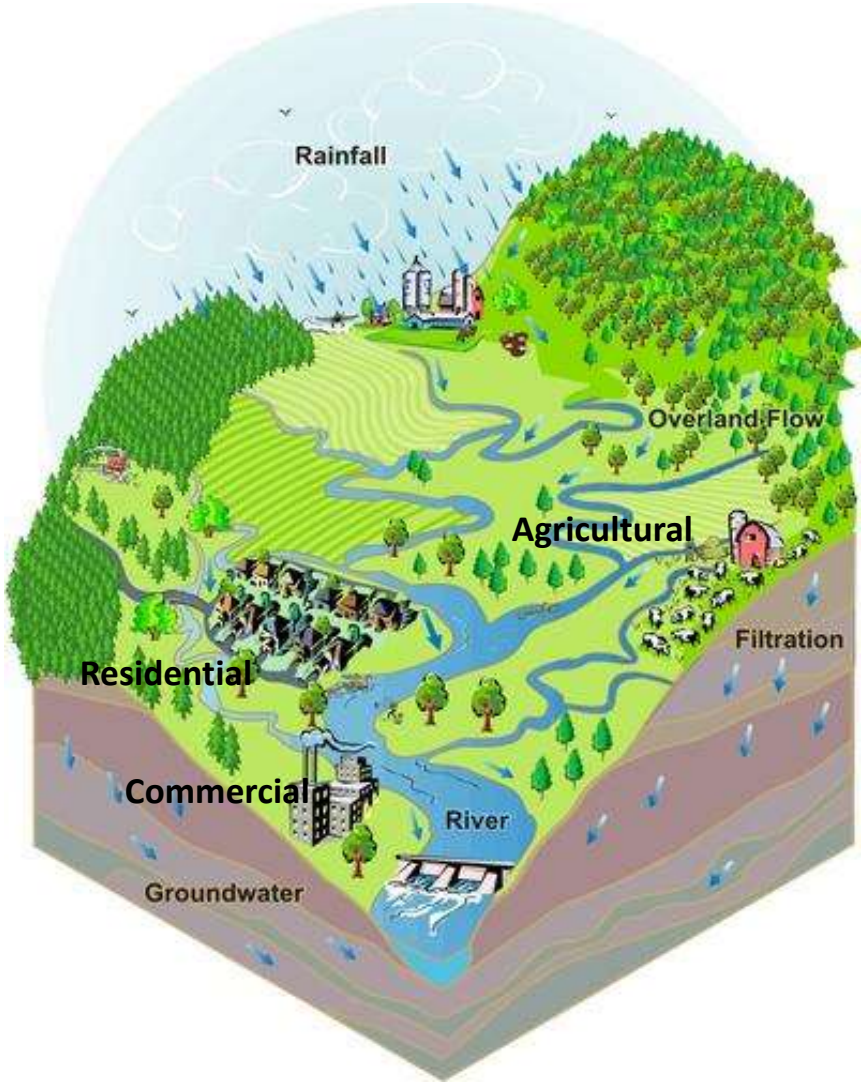
Modeling PCBs

James River PCB TMDL TAC Meeting

February 24, 2021

What is a model?

A computational representation of a watershed used to simulate pollutant fate and transport.



http://prairierivers.org/what-is-a-watershed/

Model Process

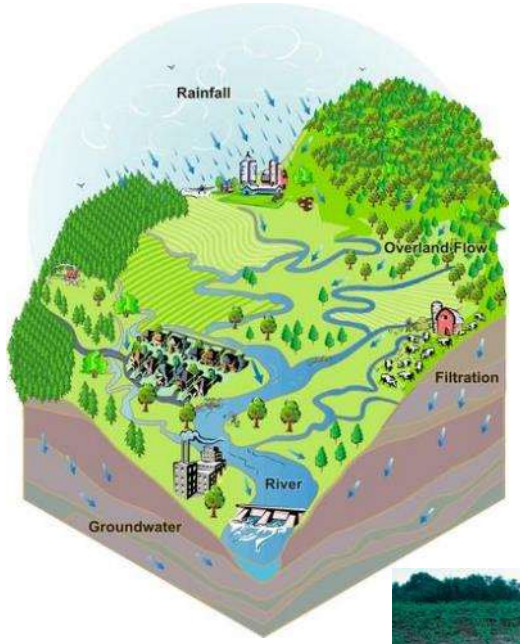
- PCB model consists of

  3 major components:

  1. Hydrology
  2. Sediment
  3. PCB fate and transport

- Results calibrated against observed data:

  1. USGS stream flow data
  2. Suspended sediment concentration data
  3. PCB concentration data



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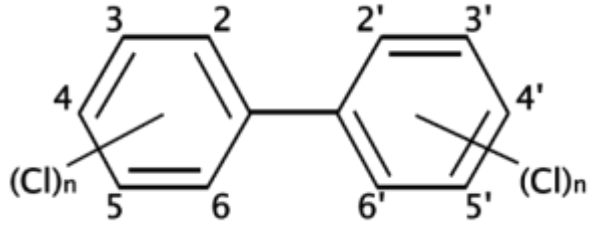
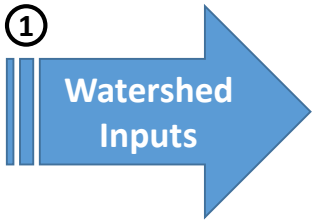


https://upload.wikimedia.org/wikipedia/commons/thumb/4/49/Polychlorinated_biphenyl_structure.svg/2000px-Polychlorinated_biphenyl_structure.svg.png

How is the model used?

1. Watershed inputs are used to develop model.



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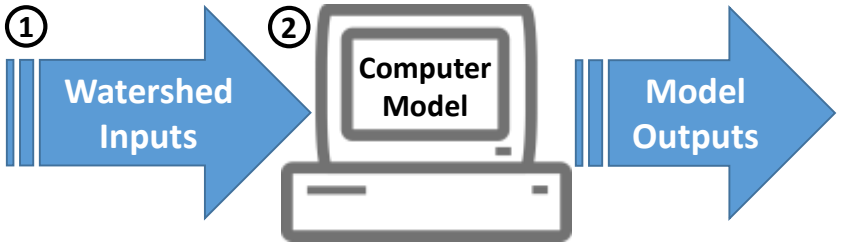

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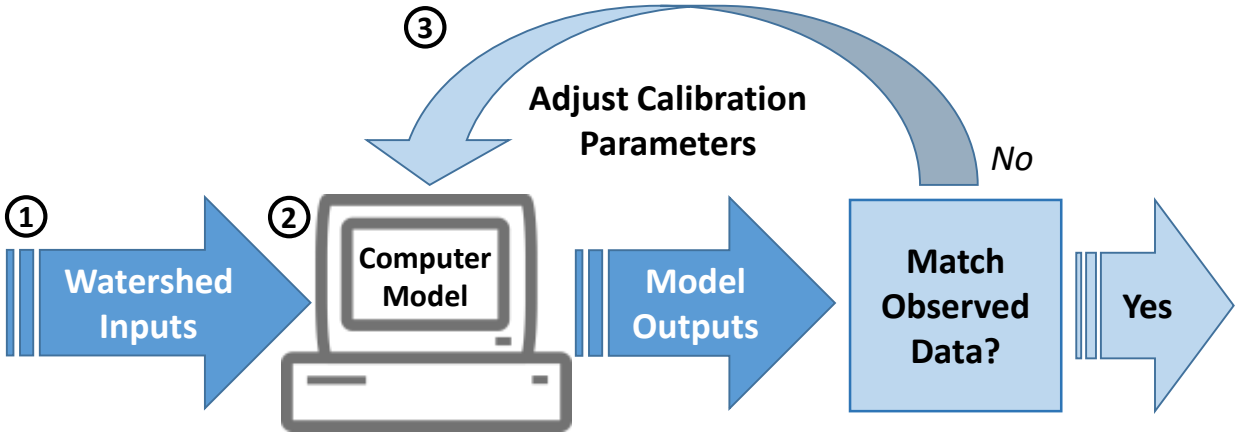

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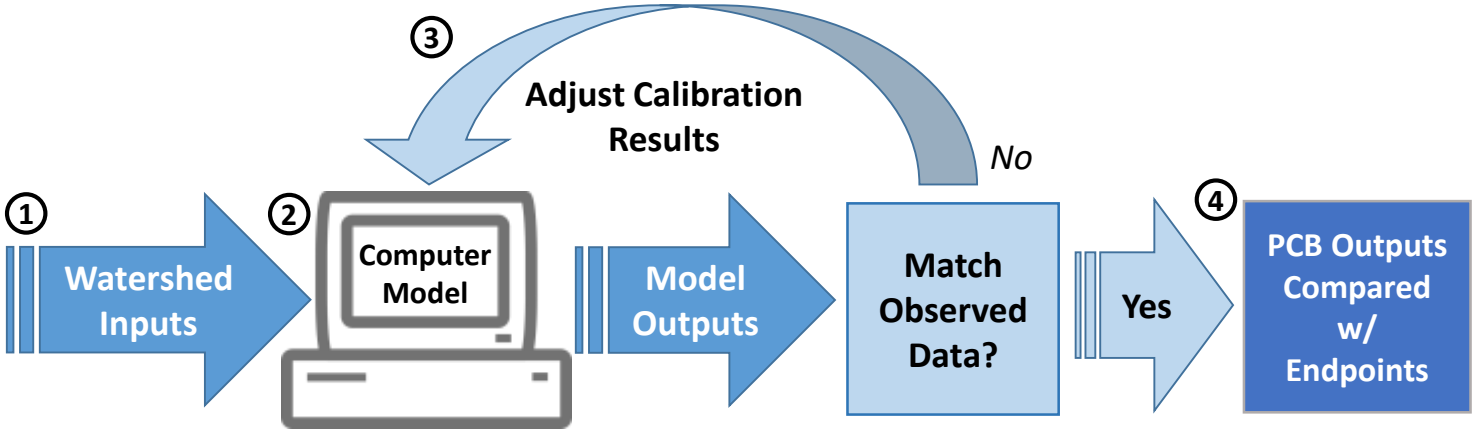

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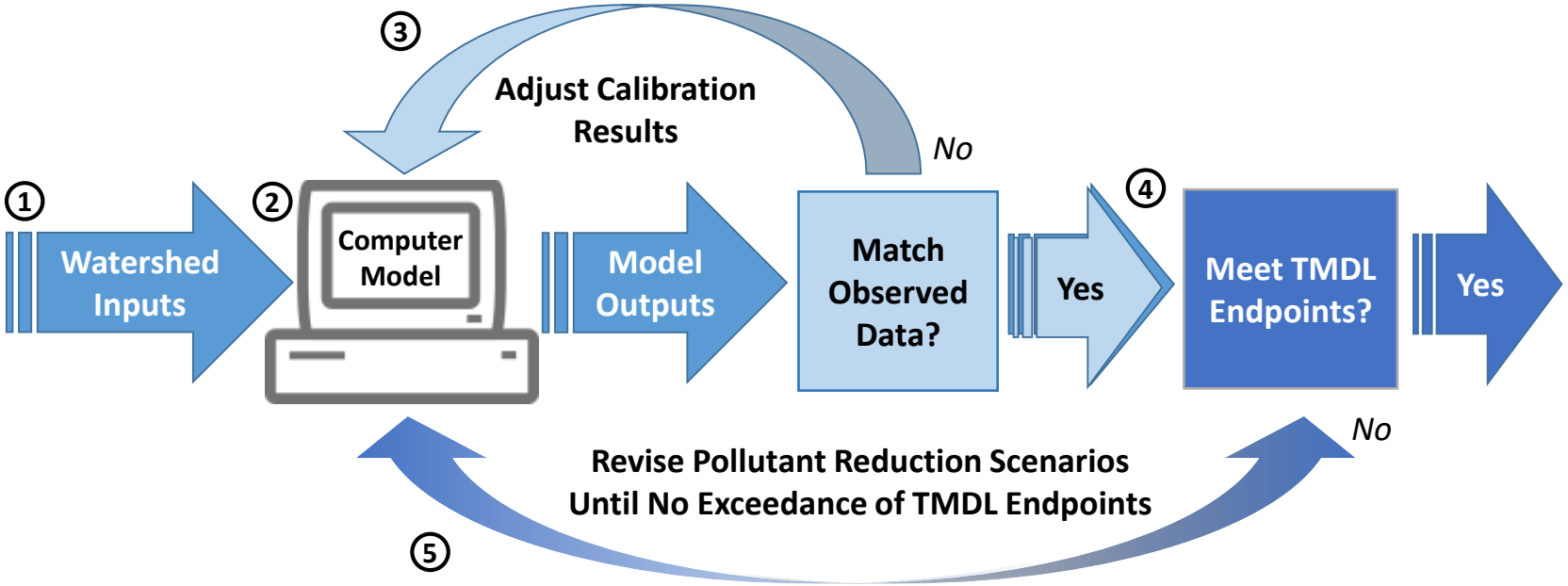

5. Model allows evaluation of multiple pollution reduction scenarios.

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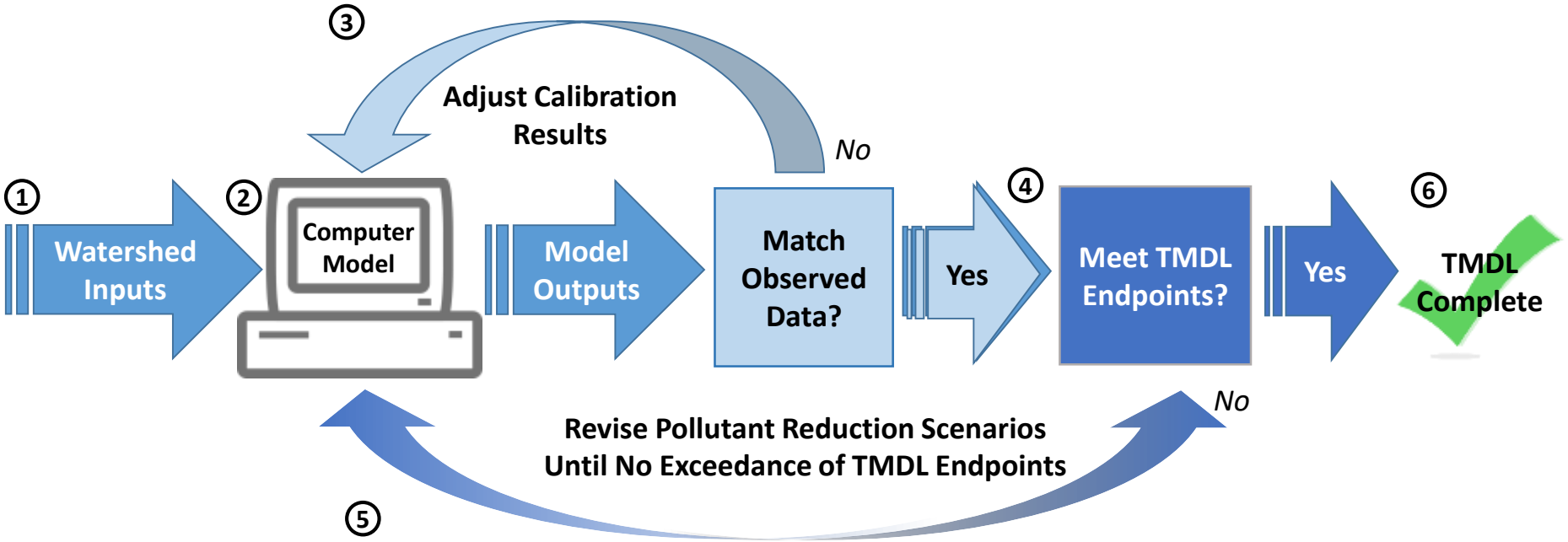


5. Model allows evaluation of multiple pollution reduction scenarios.
6. Stakeholders select acceptable reduction scenario to achieve TMDL.

Model Inputs

- Watershed Inputs
  - Meteorological Data

https://commons.wikimedia.org/wiki/File:Weather_vane_2748.JPG

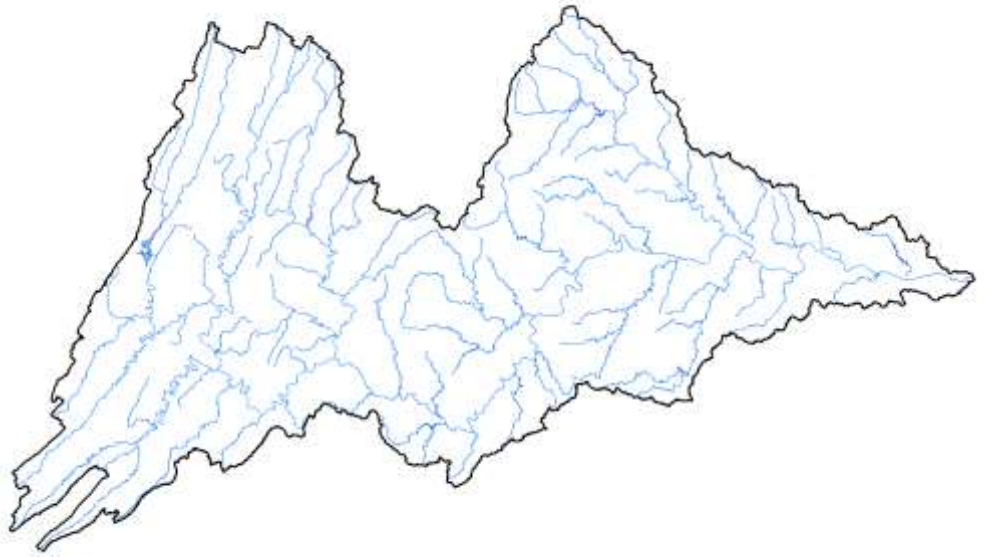
Model Inputs

- Watershed Inputs
  - Meteorological Data
  - Watershed Topography

Topo maps, Digital Elevation Models (DEMs)

Model Inputs

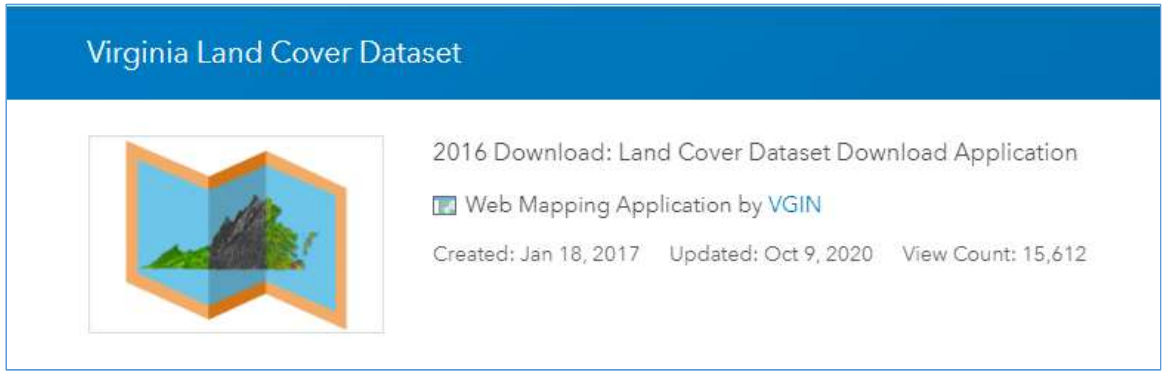
- Watershed Inputs
  - Meteorological Data
  - Watershed Topography
  - Stream Networks



National Hydrography Dataset (NHD)

Model Inputs

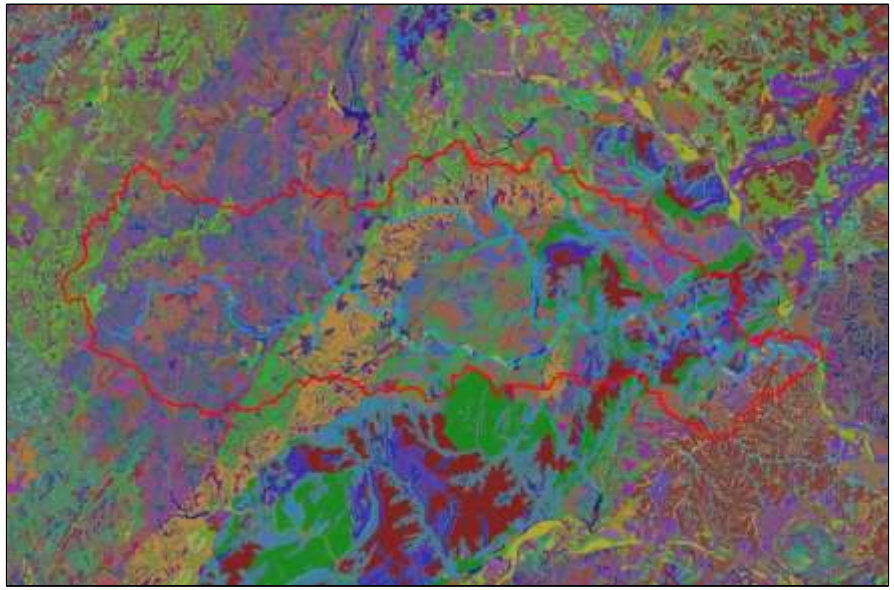
- Watershed Inputs
  - Meteorological Data
  - Watershed Topography
  - Stream Networks
  - Land Use



http://www. https://vgin.maps.arcgis.com/

Model Inputs

- Watershed Inputs
  - Meteorological Data
  - Watershed Topography
  - Stream Networks
  - Land Use
  - Soil Types



SSURGO Data, USDA-NRCS

Potential PCB Sources

Contaminated Sites

- Former Manufacturing Facilities

Former Manufacturing Facility

Contaminated Sites

- Former Manufacturing Facilities
- Rail Yards
- Electrical Substations
- Soils have been exposed to PCBs
  - PCBs attach to the soil particles and wash off during precipitation events
- Modeled as nonpoint sources – diffuse sources (no clearly defined outlet)

Active Rail Yard

Contaminated Sites

- PCB Oil Spills
- Acute events in which PCBs are released into the environment
- May enter stream/river directly or may be spilled onto land surface
- Modeled as single event at specific date and time
- Event details available in Pollution Response Program (PReP) database *(Source: Virginia DEQ)*

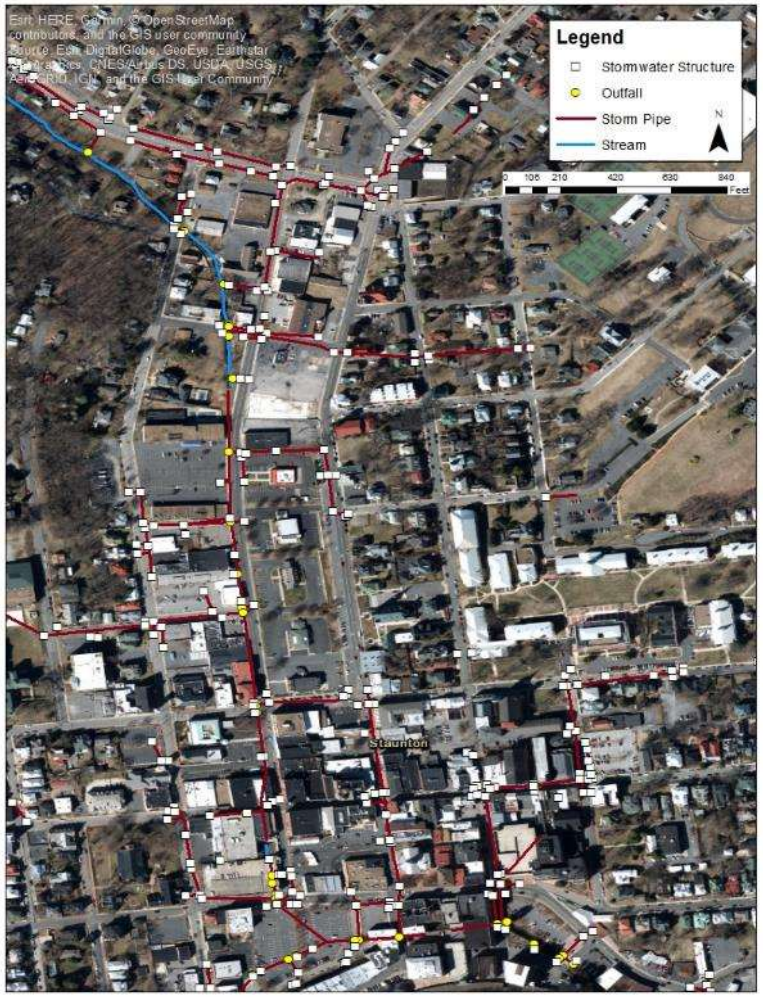
Permitted Sources

- Municipal Wastewater Treatment Plants
- Industrial Stormwater General Permitted Facilities
- Industrial Facilities
- Modeled as point sources – sources with a defined outlet

Wastewater Treatment Plant

Permitted Sources

- Municipal Separate Storm Sewer Systems (MS4s)
- Modeled as surface stormwater runoff from impervious areas to a defined outlet



MS4 Permitted Area

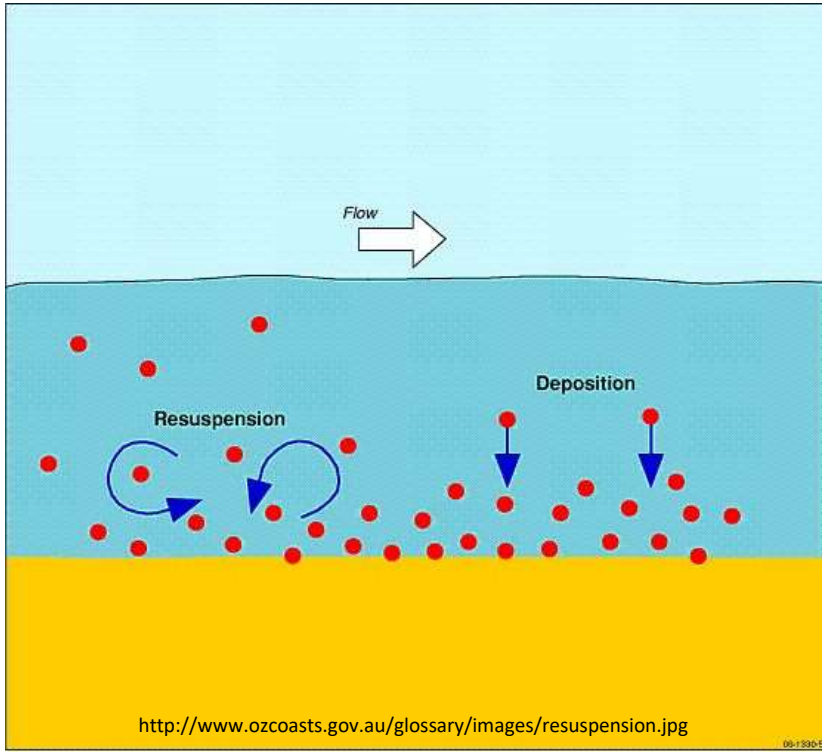
Atmospheric Deposition

- PCBs are present in the atmosphere in small concentrations
- They settle out from the atmosphere and are deposited on the land
- Modeled as a daily load of PCBs, applied to entire watershed surface area at a constant rate (1.6 µg/m^2)
- Considered a legacy source

http://www.pnnl.gov/science/images/highlights/atmospheric/atmosParticleWeightGain_580px.jpg

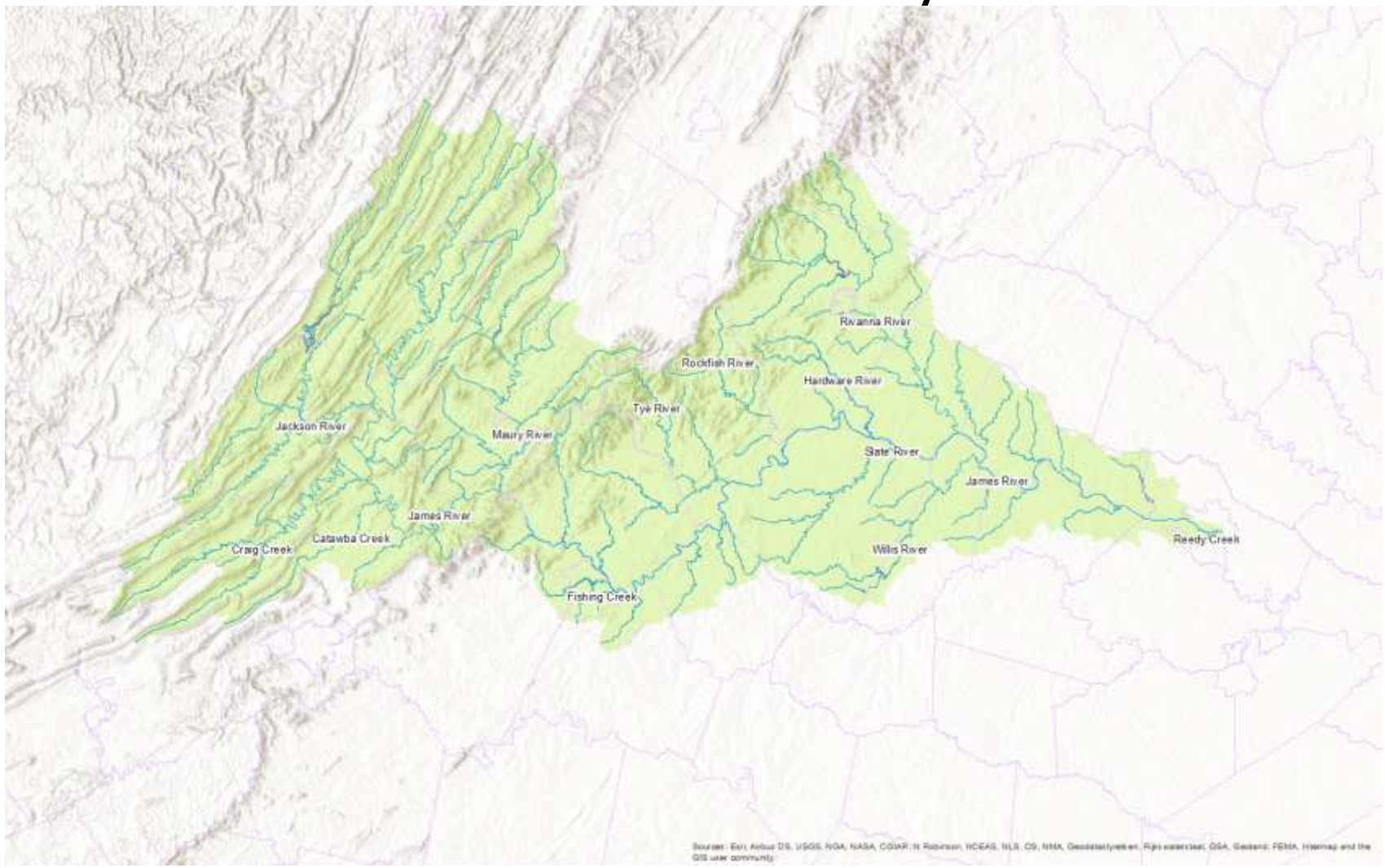
In-Stream Sediment

- PCBs that have attached to sediment and washed off the land surface may settle to the streambed and persist in the environment
- If the sediment is disturbed, the PCBs can be released into the water column
- Modeled as an initial concentration of PCBs attached to in-stream sediment
- Considered a legacy source

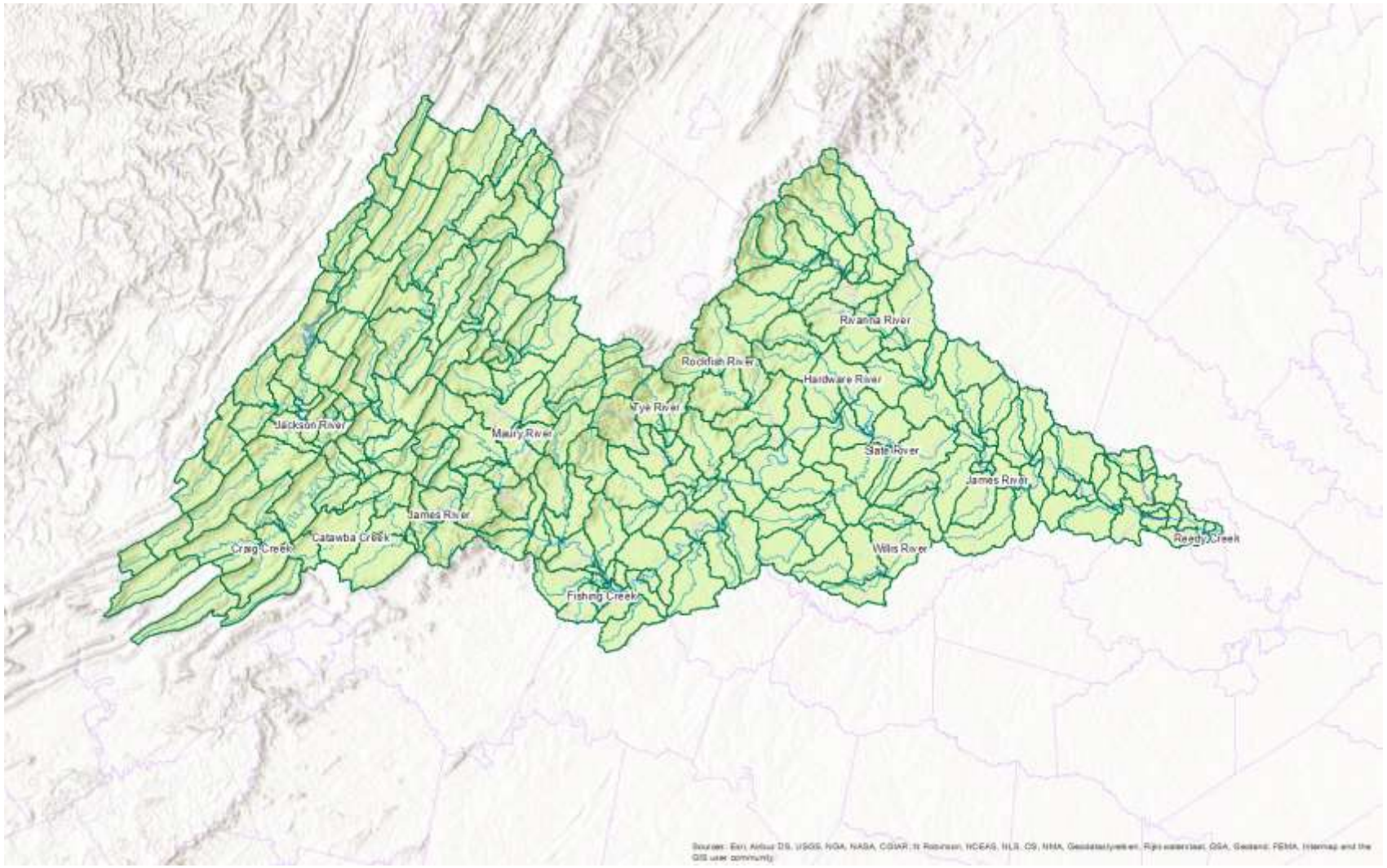


In-stream sediment resuspension and deposition

James River Study Area

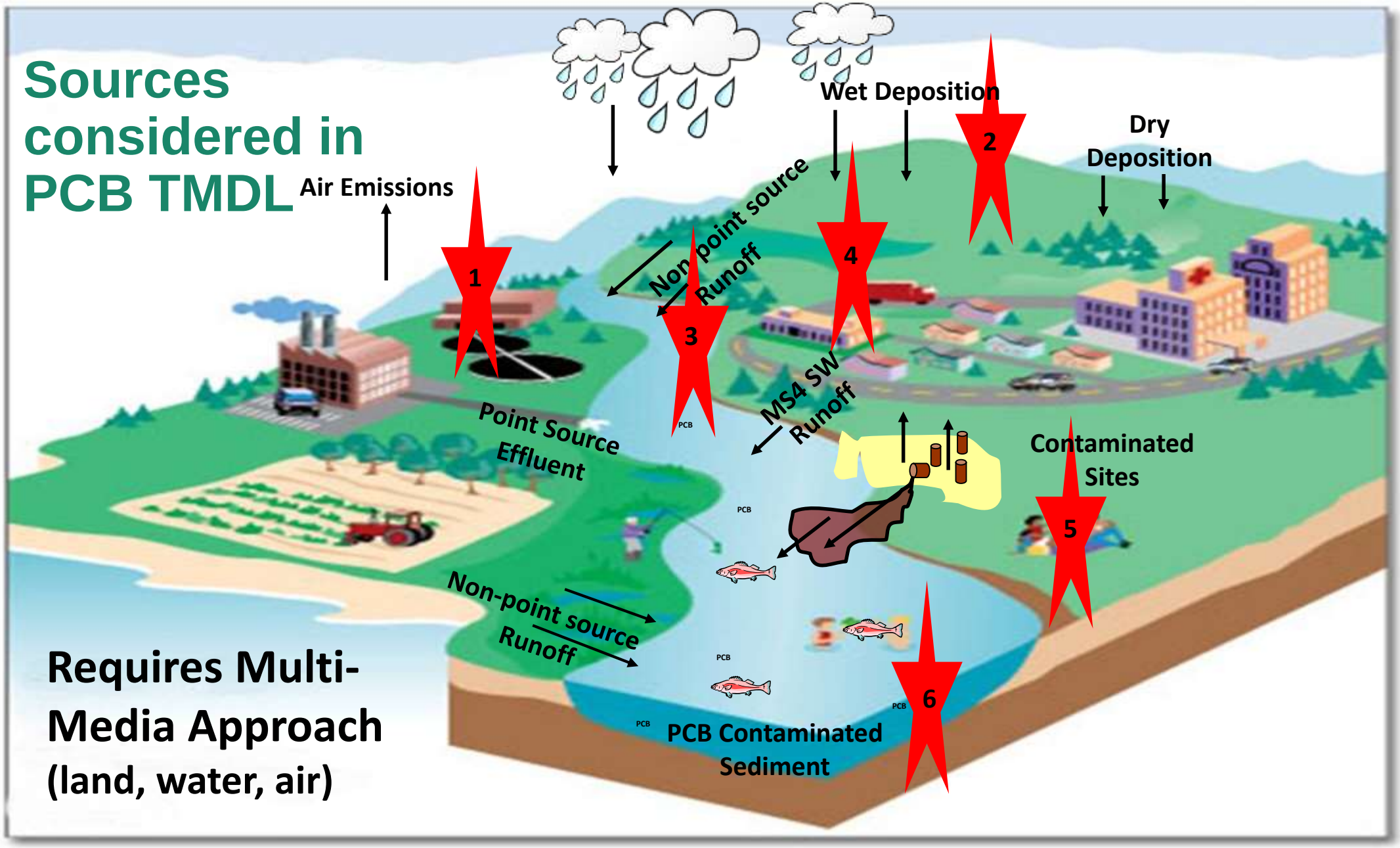


James River Sub-Watersheds



Sources Considered in PCB TMDL Development

Sources considered in PCB TMDL



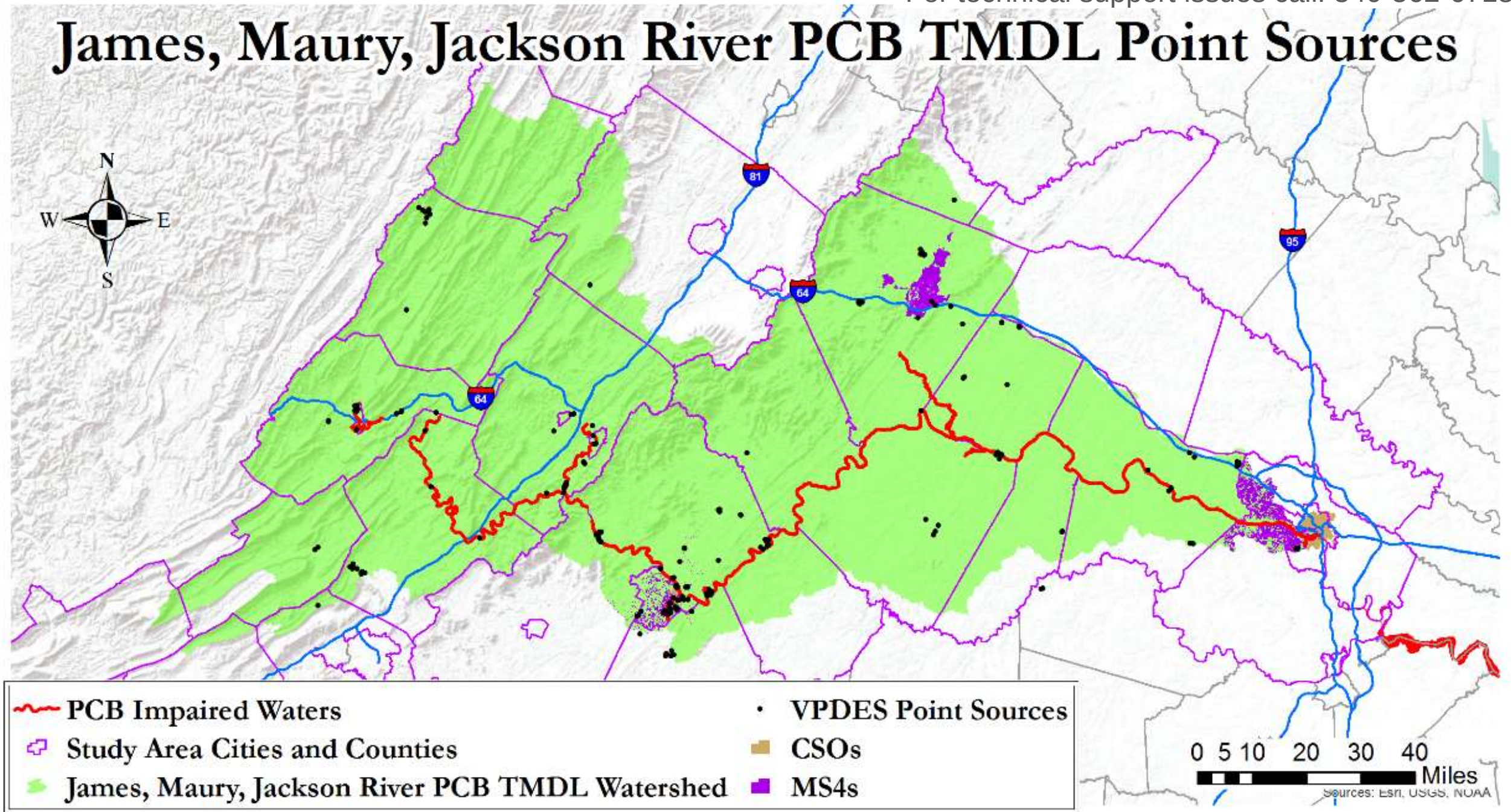
Requires Multi-Media Approach (land, water, air)

TMDL Source Category – Point Sources

- VPDES Permitted facilities
  - Municipal WWTP (n=26)
    - Including two CSSs
  - Industrial sources (n=73)
    - Selected based on Standard Industrial Classification (SIC)
      - Individual Industrial Facilities
      - Industrial Storm Water General Permitted Facilities
  - Municipal Separate Storm Sewer System (MS4; n=11)

For technical support issues call: 540-562-6718

James, Maury, Jackson River PCB TMDL Point Sources



TMDL Source Category - Contaminated Sites

- TSCA (PCB Clean-up Sites)
- RCRA Corrective Action Facilities, CERCLA
- Former Manufacturing Facilities (EPA Emergency Response)
- Brownfields (w/ PCB contamination)*
- Voluntary Remediation Sites*
- Rail Yards/Spurs*
- Miscellaneous spill sites*
- Electric Utility Transformer Pads*

*Exist in study area

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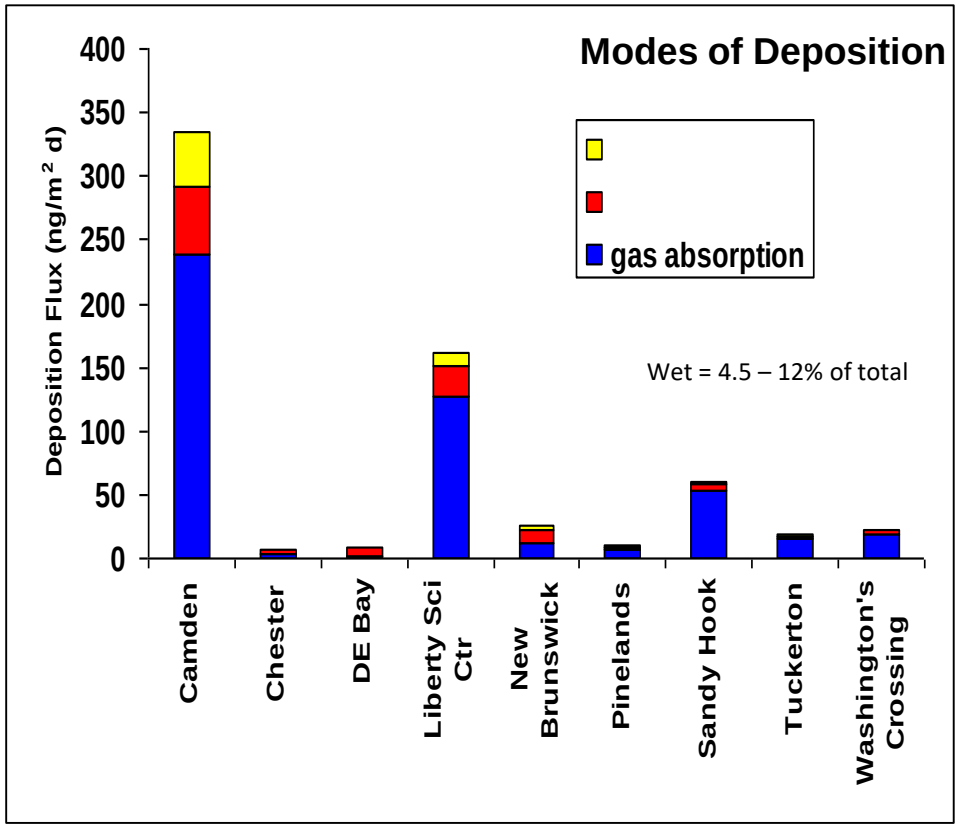
Virginia Department of Environmental Quality

DEQ

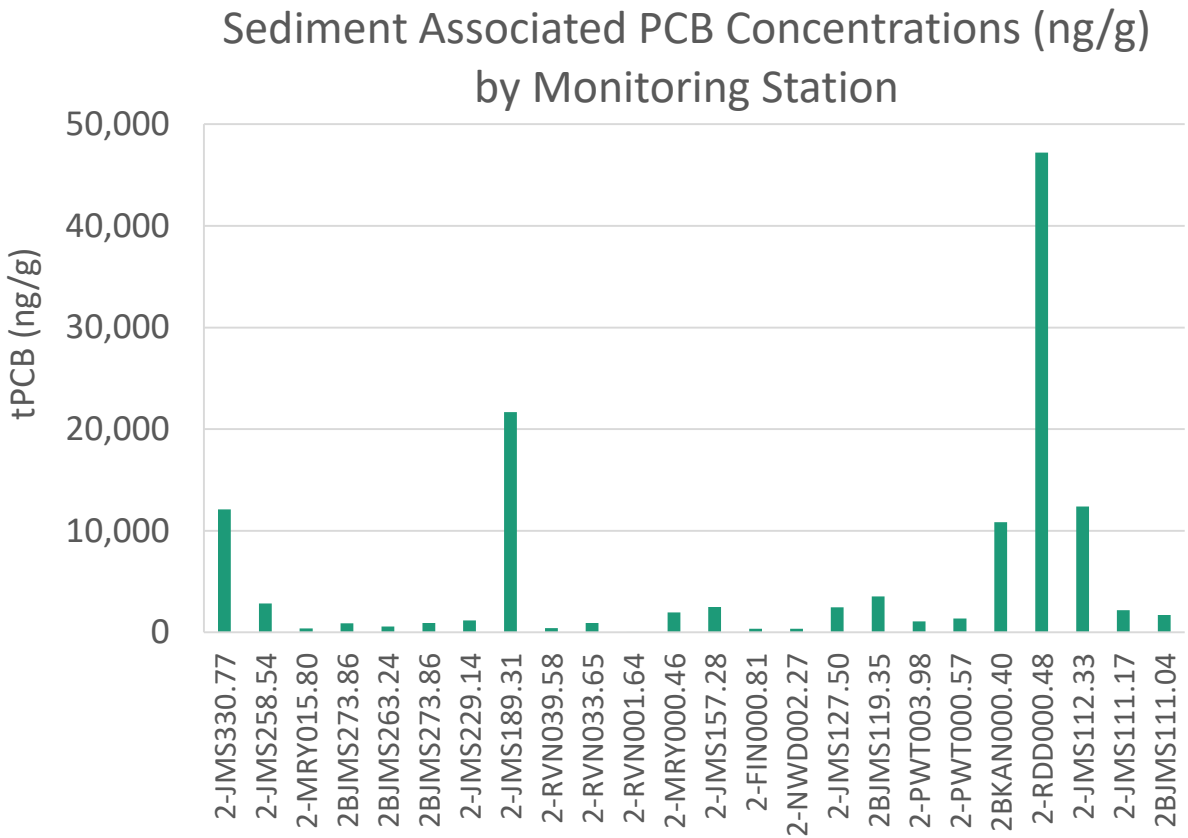
TMDL Source Categories

- Atmospheric Deposition (example)



Rodenburg (Totten), L. A. et al., 2007. Rutgers University

- Contaminated Sediment



DEQ

Permittee Load Calculations

General Approach to Point Source Loads

- Applicable to:
  - Municipal Wastewater Treatment Plants
  - Industrial Stormwater General Permits
  - Industrial Individual Permits

- Existing loads and wasteload allocations (WLAs) are calculated on a spreadsheet outside of the TMDL model
  - Integrated into the TMDL model

- Calculated in a standard fashion for all PCB TMDLs
  - Provides for consistency and certainty
  - Clearly communicates the assumptions of the TMDL WLA

- Load = concentration * flow

PCB Concentration Used for Establishing Point Source Loads

- "Existing Condition" load
  - Permittee generated PCB data when available
    - Corrected in accordance with TMDL GM 14-2004
  - In lieu of available PCB data, default concentration used
    - Derived from statewide PCB data using Standard Industrial Classification (SIC)
- Waste Load Allocation (WLA)
  - Utilize TMDL endpoint PCB concentration

DEQ

Flow Used in Load Calculations

Wastewater Type*		Flow Used in Load Calculations
Municipal		For Existing Load: Monthly Ave Flow (2008-2019)
		For WLA: Design Flow
Industrial Storm Water General Permits (ISWGPs)		Flow calculations based on outfall drainage acreage and impervious acreage
Individual Industrial	Process Water OR Comingled Process Water + Storm Water	For Existing Load: Monthly Ave Flow (2008-2019)
		For WLA: Average of Daily Max Flow (2008-2019)
	Storm Water	Flow calculations based on outfall drainage acreage and impervious acreage

What about Combined Sewer Systems?

- Combined Sewer Systems (CSSs) have Combined Sewer Overflows (CSOs)
  - City of Lynchburg
  - City of Richmond
- Existing Load = flow * concentration
  - Both cities supplemented DEQ data with CSO monitoring data
- WLA = flow * concentration
  - “Flow” will be modeled as it will be based on the CSS’ Long Term Control Plan

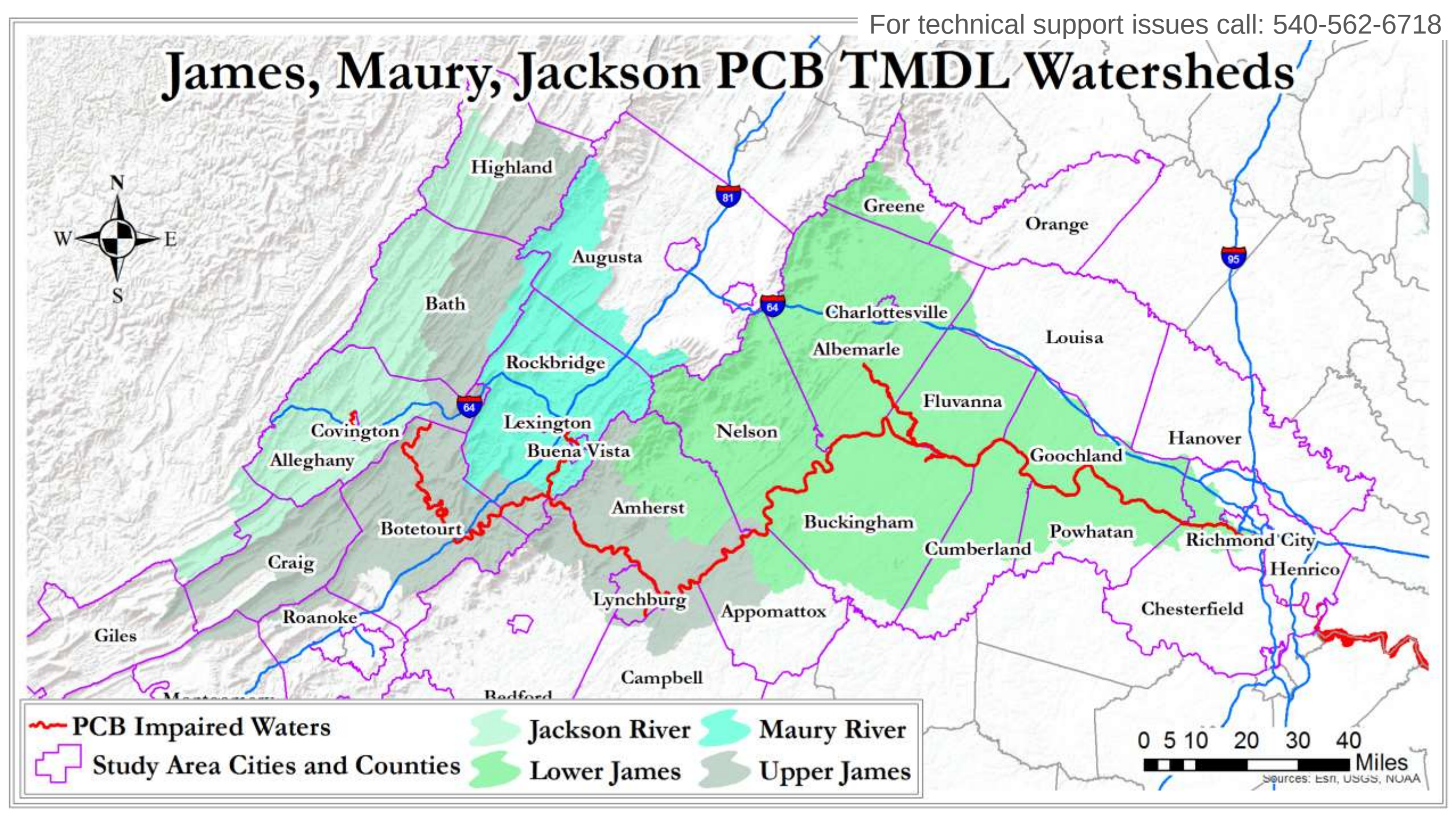
What about MS4s?

- Municipal Separate Storm Sewer Systems (MS4s)
- MS4s will be modeled as nonpoint source runoff
- Existing loads modeled with the watershed
- WLA: Point Source loads are subtracted from the TMDL and then reductions are assigned to MS4s and other sources
  - TMDL Allocations

Questions?

TMDL Endpoints

For technical support issues call: 540-562-6718



State Water Quality Standards Has Two Values

TMDL has two endpoints

	Fish Tissue Threshold (ppb)	WQC (ppq)
VDH	100 (Fish Consumption Advisory)	- -
DEQ	18 (Screening Value)	640

- DEQ's Water Quality Assessment (Integrated Report)
  - VDH - Consumption Advisory = impairment
  - DEQ - two or more fish samples exceed screening value at a site or two water samples exceed criterion at a site = impairment

DEQ

Narrative WQS

9VAC25-260-20. General criteria.

A. State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life.

Specific substances to be controlled include, but are not limited to: floating debris, oil, scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled. Conditions within mixing zones established according to 9VAC25-260-20 B do not violate the provisions of this subsection.

VA Water Quality Criterion

- VA PCB criterion and Fish Screening Values based on EPA guidelines

- Fish Screening Value basis of criterion
  - Water concentration translated using a Bioconcentration Factor (BCF)
    - Lab derived translator developed in the early 80's
    - Assumes fish only obtain PCBs through gills from the water column (ratio of PCB conc. in fish to that in water)
      - **What about other exposure pathways?**

$$\text{Water Quality Criterion} = \frac{RL \times BW}{CSF \times (CR \times BCF)} \qquad \text{Fish Screening Value} = \frac{RL \times BW}{CSF \times CR}$$

Where:

BW = average adult body weight **80 kg** (176 lbs.)
CR = fish consumption rate **0.022 kg/day**.
BCF = bioconcentration factor **31,200** (recommended by EPA WQC, 1980)
RL = acceptable extra risk level for extra cancer risk. In Virginia WQC; 1 additional cancer in 100,000 population, or **0.00001**.
CSF = cancer slope factor **2** (or cancer potency factor) a measure of carcinogenicity **(updated in EPA-IRIS 1997)**

DEQ

PCBs and Water Partitioning

K_{ow} values of PCB homolog groups

Homolog	Midpoint K_{ow}
Mono+Di	47,315
Tri	266,073
Tetra	1,011,579
Penta	3,349,654
Hexa	5,370,318
Hepta	17,179,084
Octa	39,810,717
Nona	82,224,265
Deca	151,356,125

More Hydrophobic
i.e., less Dissolved

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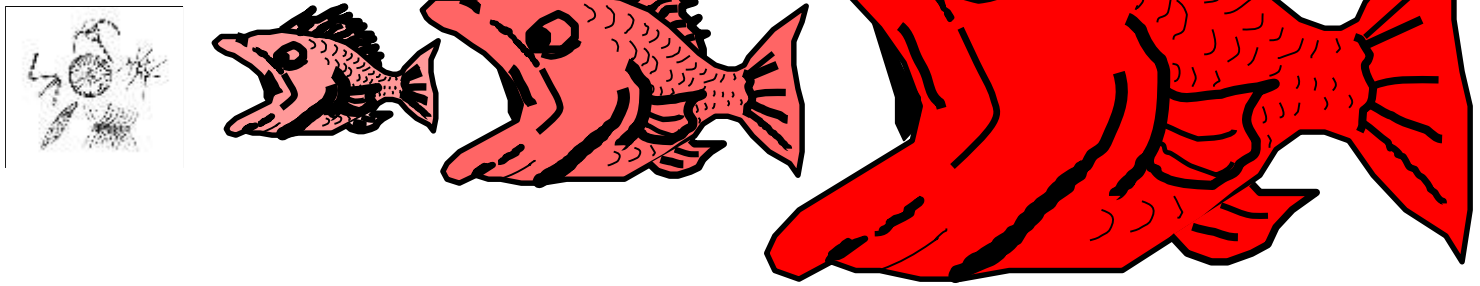
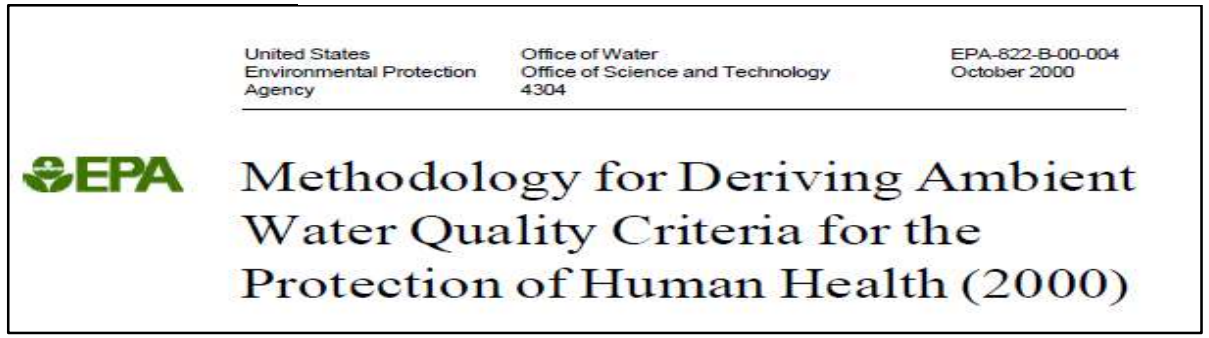
Biomagnification

PCBs
H_2O



Concentration (parts per trillion)				
0.001	1	1,000	10,000	20,000

PCB Endpoints


United States Environmental Protection Agency | Office of Water Office of Science and Technology 4304 | EPA-822-B-00-004 October 2000

EPA

Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)

- Bioaccumulation and Bioconcentration Concepts
  - **Bioaccumulation** refers to *"the uptake and retention of a chemical by an aquatic organism from all surrounding media (e.g., water, food, sediment)."*
  - **Bioconcentration** refers to *"the uptake and retention of a chemical by an aquatic organism from water only."*
- "For some chemicals (e.g., highly persistent and hydrophobic), the magnitude of bioaccumulation by aquatic organisms can be substantially greater than the magnitude of bioconcentration."
- "…EPA encourages States and authorized Tribes to derive BAFs that are specific to certain regions or waterbodies, where appropriate."

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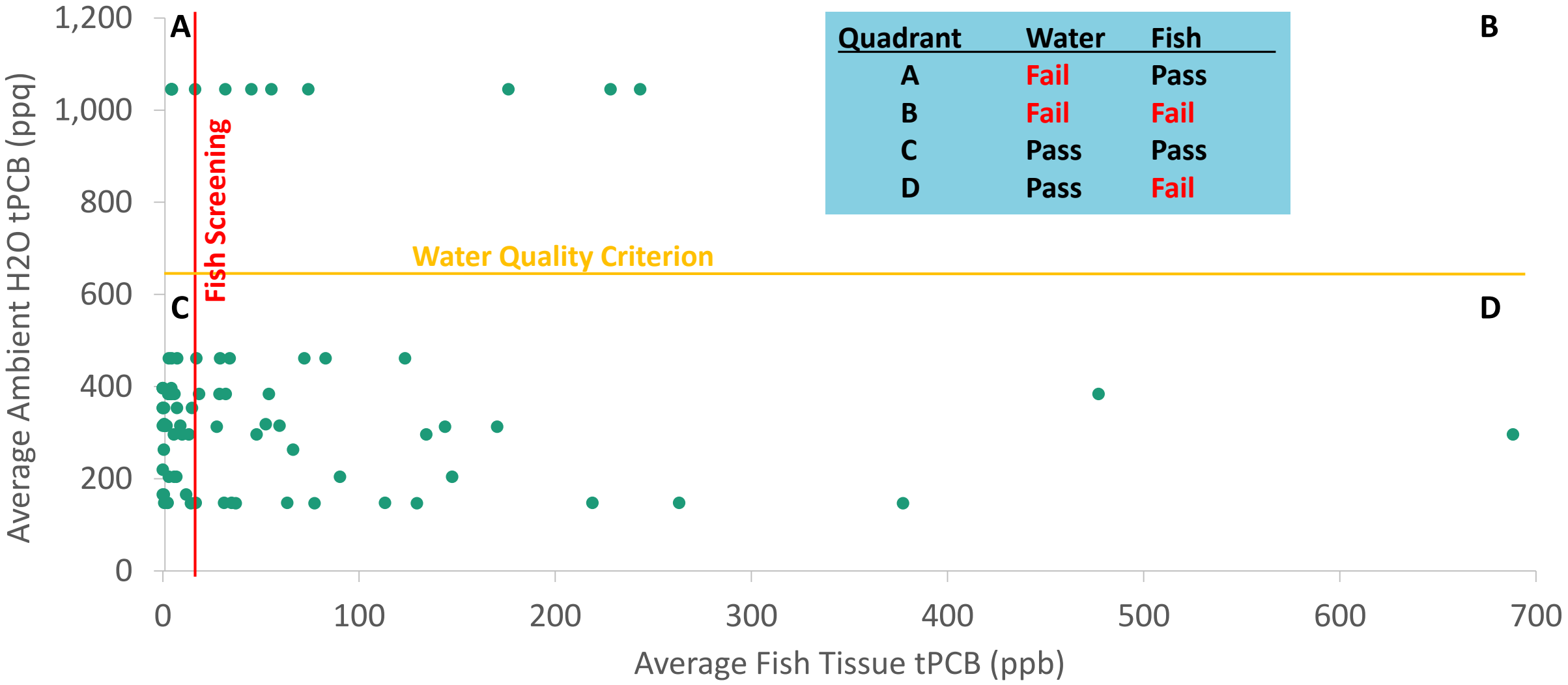
Average Fish Tissue Concentration vs. Average Water Concentrations



Quadrant	Water	Fish
A	Fail	Pass
B	Fail	Fail
C	Pass	Pass
D	Pass	Fail

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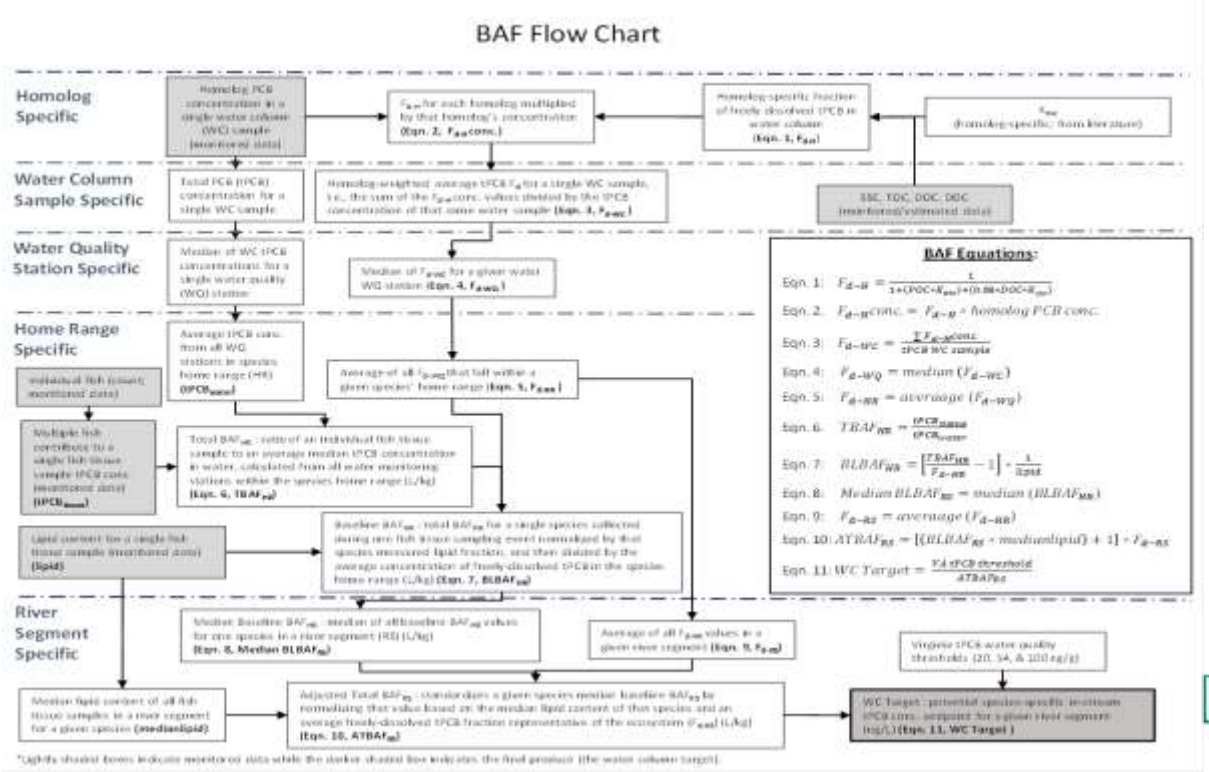
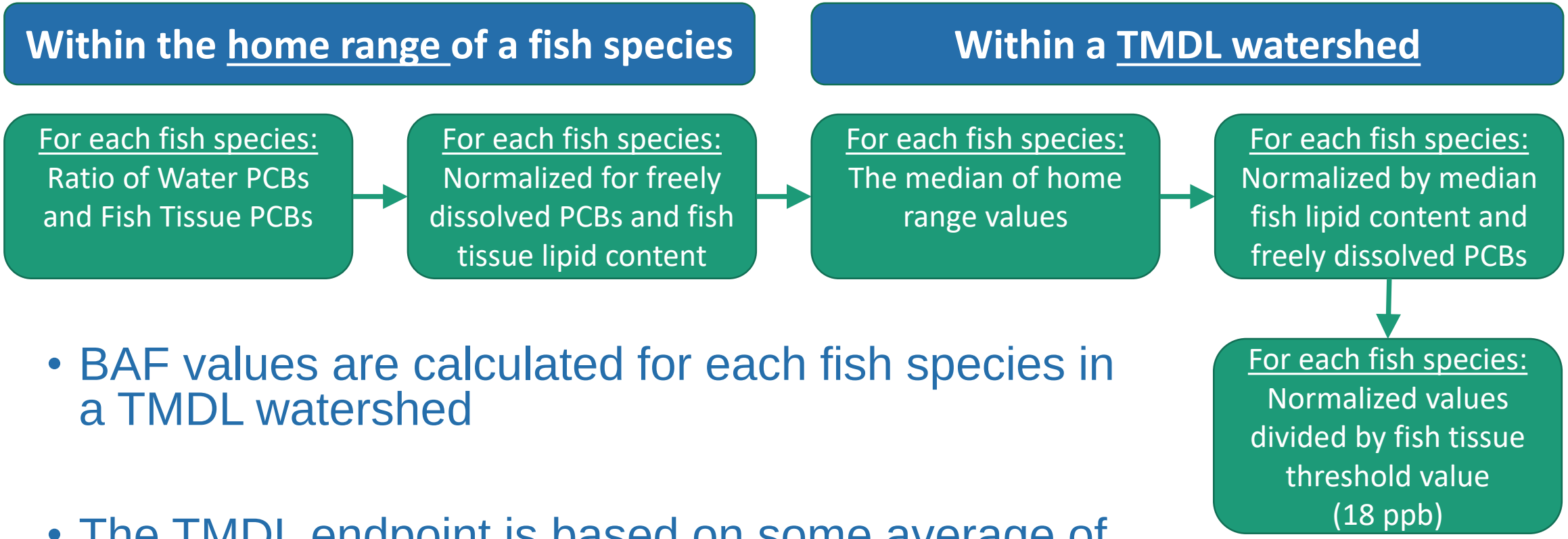
Bioaccumulation Factors (BAFs)

- EPA Method (EPA-822-03-030, 2003)
- Utilize site specific data (i.e., water data) to reflect exposure of fish and their food
  - Pathways of PCB exposure includes through gills, from food, and indirect ingestion of contaminated sediment
- More realistic
- Precedent (PCB TMDLs)
  - Potomac River
  - Roanoke River
  - Levisa Fork
  - New River



VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

BAF Process in a Nutshell



- BAF values are calculated for each fish species in a TMDL watershed
- The TMDL endpoint is based on some average of selected fish species BAF values

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BAF Endpoint Selection

- BAFs are calculated for each fish species in each TMDL watershed

- Three Scenarios Proposed:
  1. Use species of commercial/recreational interest with sample size ≥ 8
  2. Use consumption advisory species regardless of sample size
  3. Use consumption advisory species with a sample size ≥ 8

TMDL Watershed	Scenario 1 Mean	Scenario 2 Mean	Scenario 3 Mean
Jackson River	1024.1 ppq*	n/a*	n/a*
Maury River	321.1 ppq	301.1 ppq	398.1 ppq
Upper James River	1,186.8 ppq*	91.2 ppq	118.3 ppq
Lower James River	139.0 ppq	60.8 ppq	51.7 ppq

*These cases would default to a TMDL endpoint equal to the criterion = 640 ppq

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Next Steps

- Public comment responses
- TAC contact list
- Watershed Modeling
  - Throughout 2021
- Anticipated future TAC meetings
  - TAC 2 - Summer 2021
  - TAC 3 - Winter 2021
- Virtual Meeting Comment Form

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