James River, Maury River, Jackson River PCB Cleanup Study

Third Technical Advisory Committee Meeting

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Virginia Department of Environmental Quality

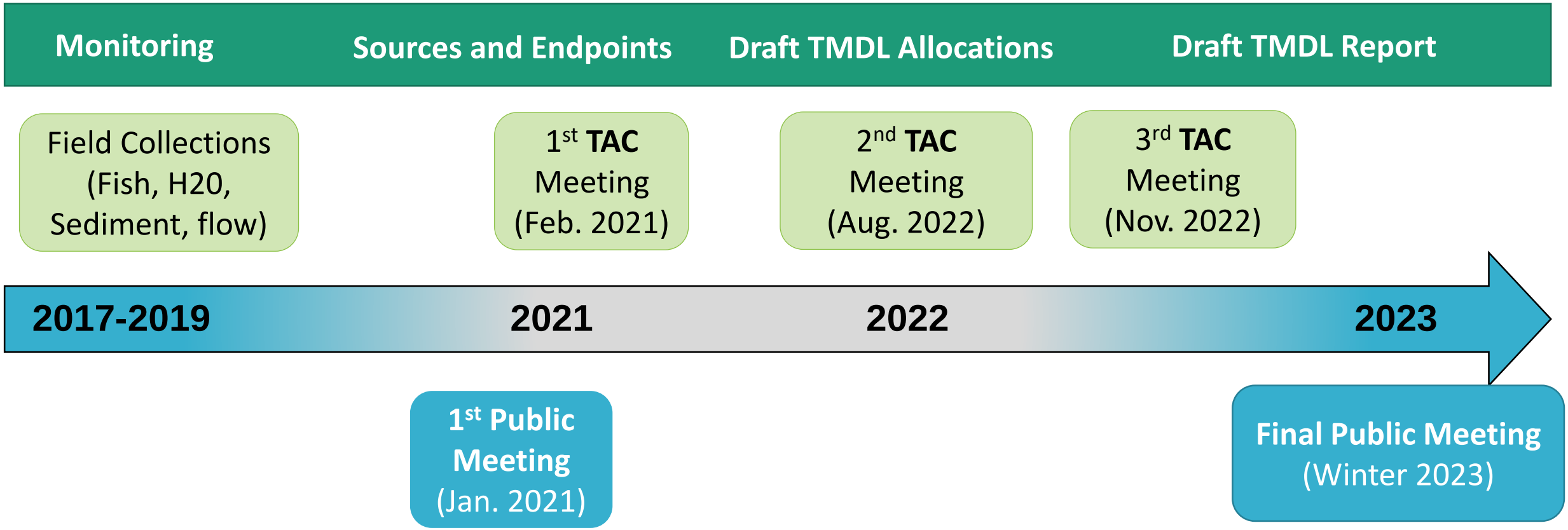
November 2, 2022

Agenda

- Welcome and Introductions
  - Meeting Objectives
- Recap – Aug. 2nd TAC Meeting
- TMDL Endpoint Recommendation
- Allocations Recommendation
- TMDL Implementation
- TMDL Cost Benefit Analysis
- Wrap-up & Next Steps

DEQ

TMDL Study Timeline

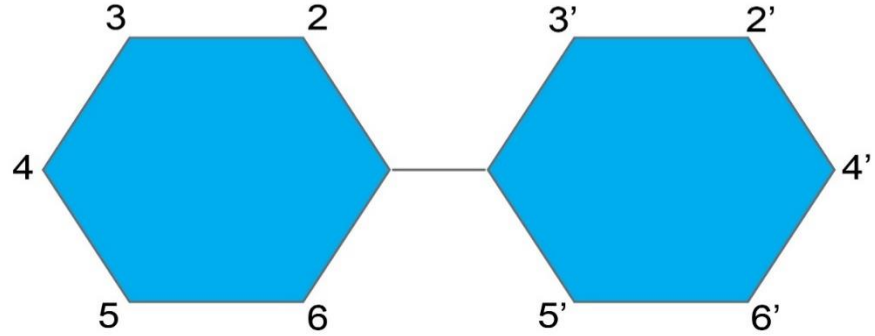


DEQ

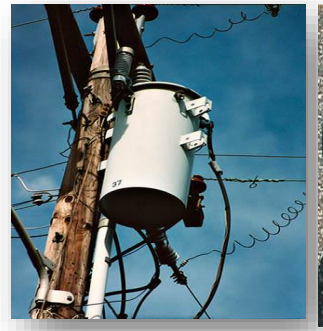
Polychlorinated Biphenyls: PCBs

- Biphenyl molecule (1-10 chlorine atoms)
- Aroclors (Monsanto) e.g., 1248,1254
- Common uses
  - Transformers, capacitors, hydraulic fluids, circuit breakers, PVC Products, carbonless copy paper, caulking material, paints, etc.
  - Stability enables environmental persistence
- Legacy Contaminant (banned 1977)
- Toxics Substances Control Act (TSCA)
  - Defines non-PCB as < 50 ppm
  - Inadvertent production allowed and common

50 ppm compared to DEQ's WQC - 6.4 X 10^{-7} ppm (0.00000064)



209 distinct PCB Compounds



DEQ

VA Water Quality Criterion (WQC) – Total PCBs

Agency	Fish Tissue Threshold (ppb)	WQC (pg/L)
VDH	100 (Fish Consumption Advisory)	- -
DEQ	18 (Screening Value)	640 Revised update (580)

- DEQ's Water Quality Assessment (Integrated Report)
  - VDH: Consumption Advisory = impairment
  - DEQ: If 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 Water Quality Assessment Guidance Manual

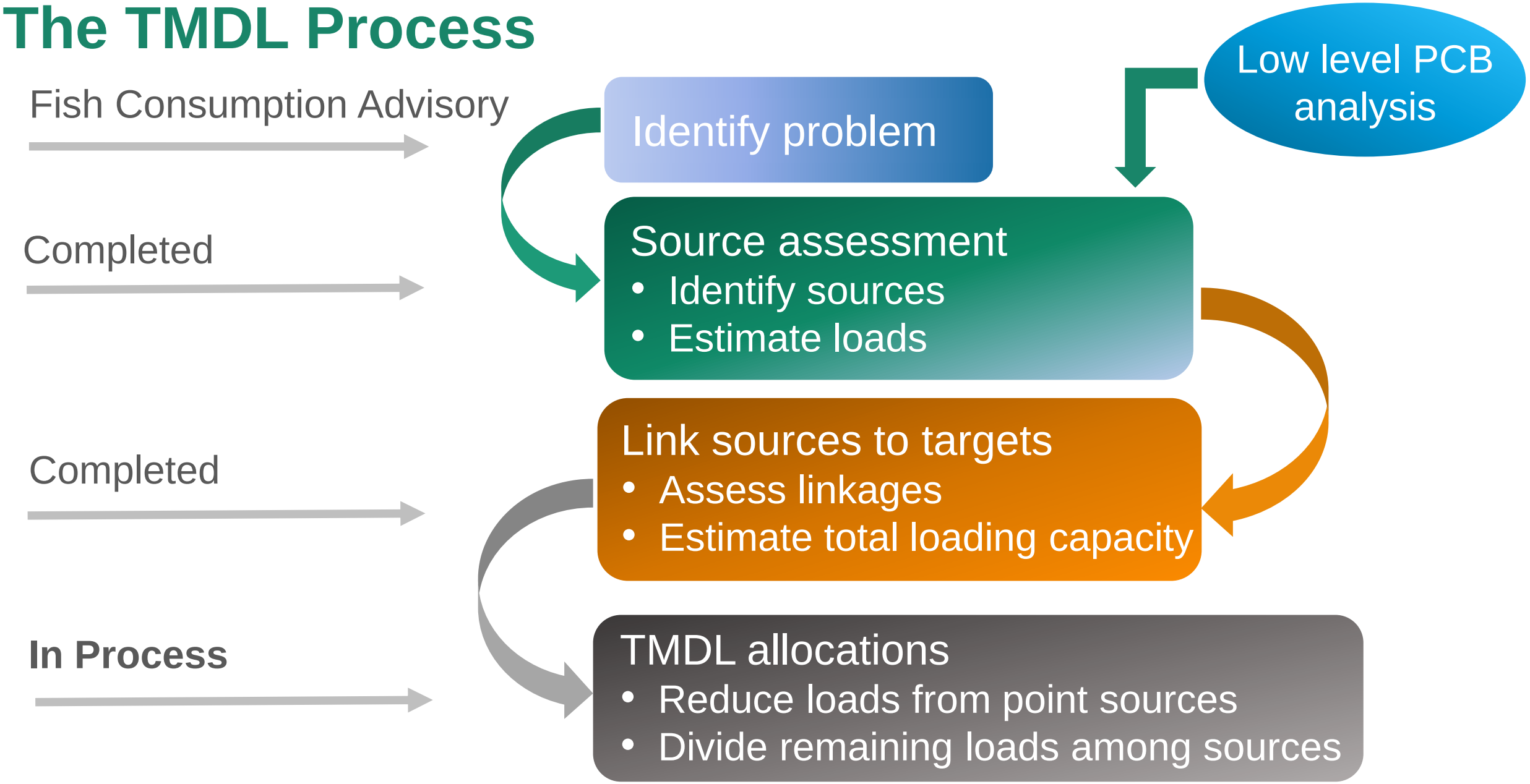
PCB Water Quality Criterion (Total PCBs)
Triennial Review

Criteria	Existing Criterion	Revised Criterion
Water	640 pg/L (pg/L)	580 pg/L
Fish Tissue Threshold	18 ng/g (ppb)	18 ng/g
Duration and Frequency	No reference, 0% exceedance	Footnote: Human health criteria based on the assumption of average amount of exposure on a long term basis

Triennial Review Approval Timeline

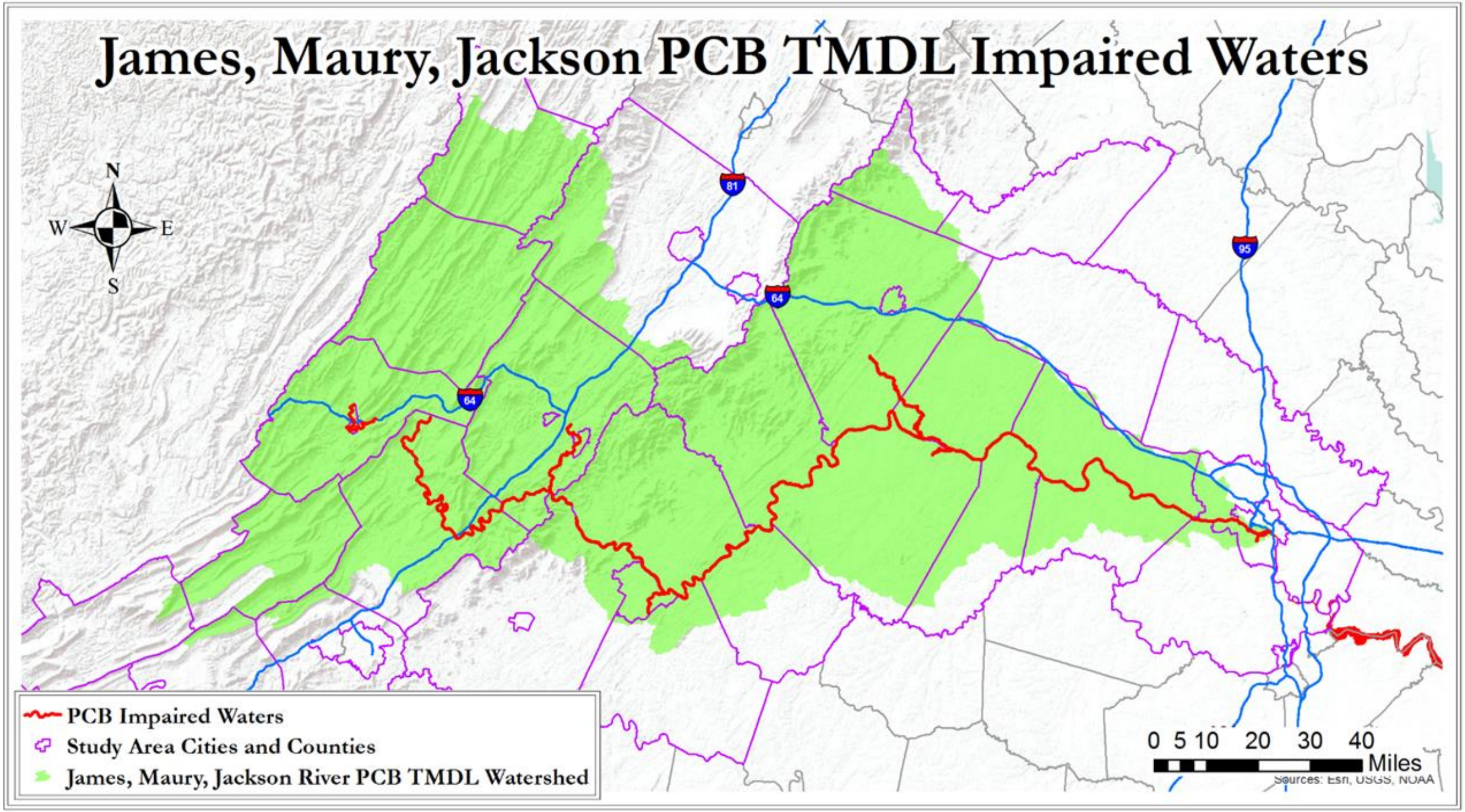
DEQ

The TMDL Process



TMDL = Sum of WLA + Sum of LA + MOS

DEQ


James, Maury, Jackson PCB TMDL Impaired Waters
N
W
E
S
81
64
64
95
PCB Impaired Waters
Study Area Cities and Counties
James, Maury, Jackson River PCB TMDL Watershed
0 5 10 20 30 40
Miles
Sources: Esri, USGS, NOAA

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
Jackson River	City of Covington and Alleghany County	2008	12.63 mi
Hardware River	Fluvanna and Albemarle counties	*2022 (revised)* 2008	*(now) 7.21 mi* (was) 23.24 mi
Slate River	Buckingham County	2008	3.88 mi
Fishing Creek	City of Lynchburg	2020	6.32 mi
Reedy Creek	City of Richmond	2020	1.08 mi

***Does not affect swimming**

TMDL Source Categories

Waste Load Allocation (WLA)

- Permitted Facilities
  - Municipal WWTPs (26)
  - Combined Sewer Overflows (2)
  - Industrial facilities(73)
    - Two permit types
  - Regulated Stormwater (11)
    - MS4s

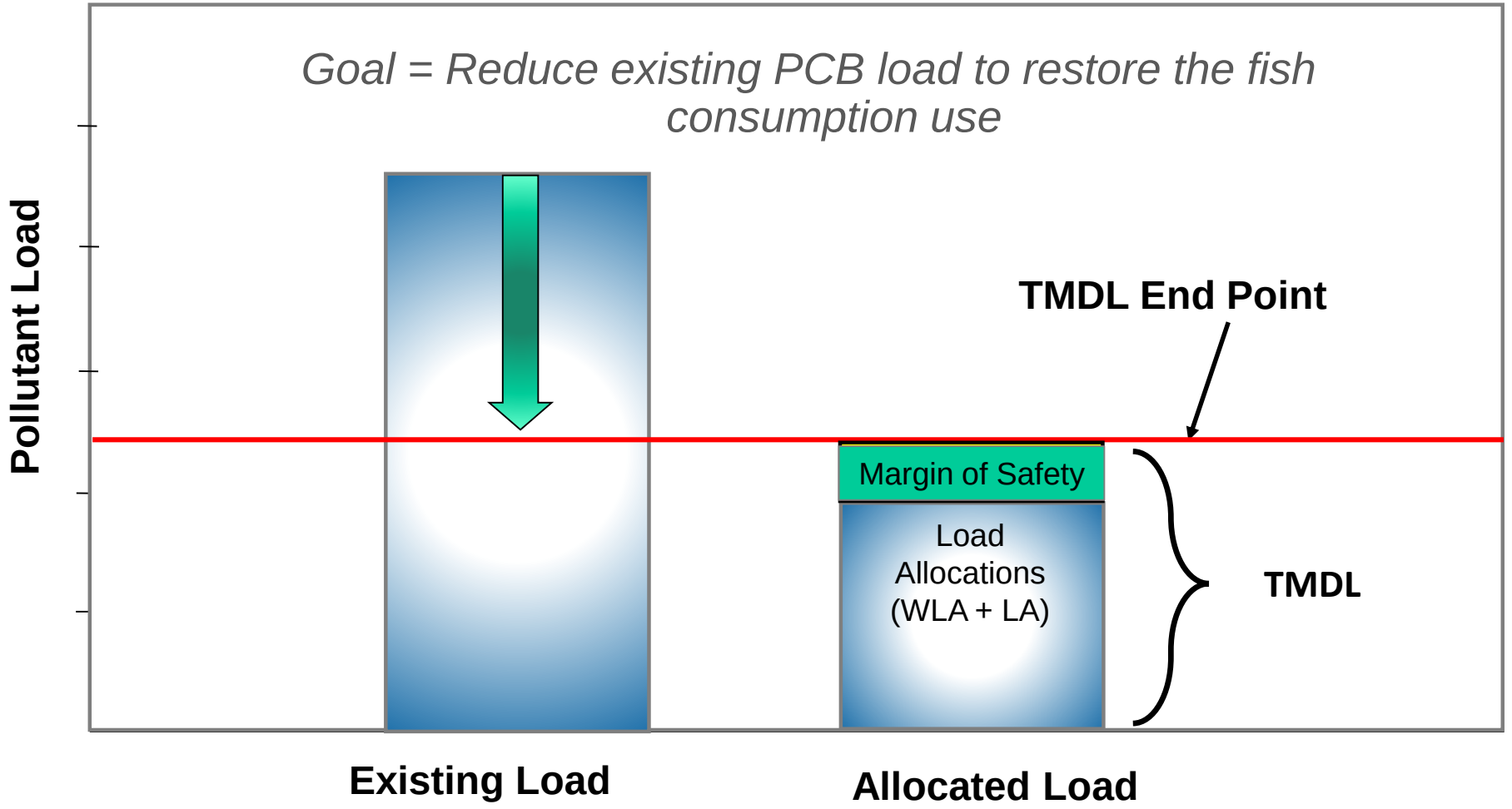
Load Allocation (LA)

- Contaminated Sites
  - Rail Yards/spurs
  - Electric Utility Transformer Pads
  - Brownfields Sites
  - DEQ Voluntary Remediation Program
- Spill sites

- Nonregulated Surface Load
  - Stormwater
  - Small Tributaries
  - Unidentified contaminated sites
  - Unspecified permitted facilities
- Atmospheric Deposition
- Streambed Sediment

DEQ

Total Maximum Daily Load (TMDL)



For restoration the waterbody must meet two thresholds: 1) Numeric WQC [*or site specific value*] and 2) fish tissue threshold. Must also consider revised criterion.

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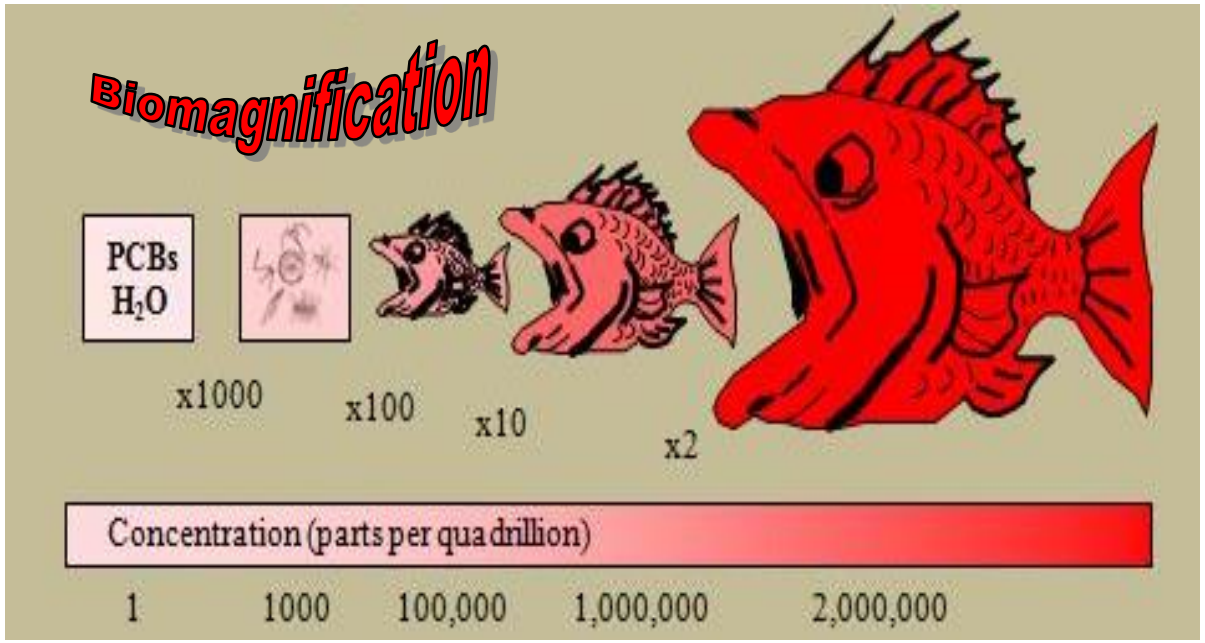
TMDL Endpoints

Site Specific TMDL Endpoint

- PCB WQC derived from a single exposure pathway to fish
  - Bioconcentration/exposure via dissolved PCBs
- PCBs bioaccumulate at a low conc. (pg/L)
  - Water, food, sediment
- PCBs biomagnify
- Narrative Water Quality Standard (accounts for toxic pollutants that bioaccumulate)



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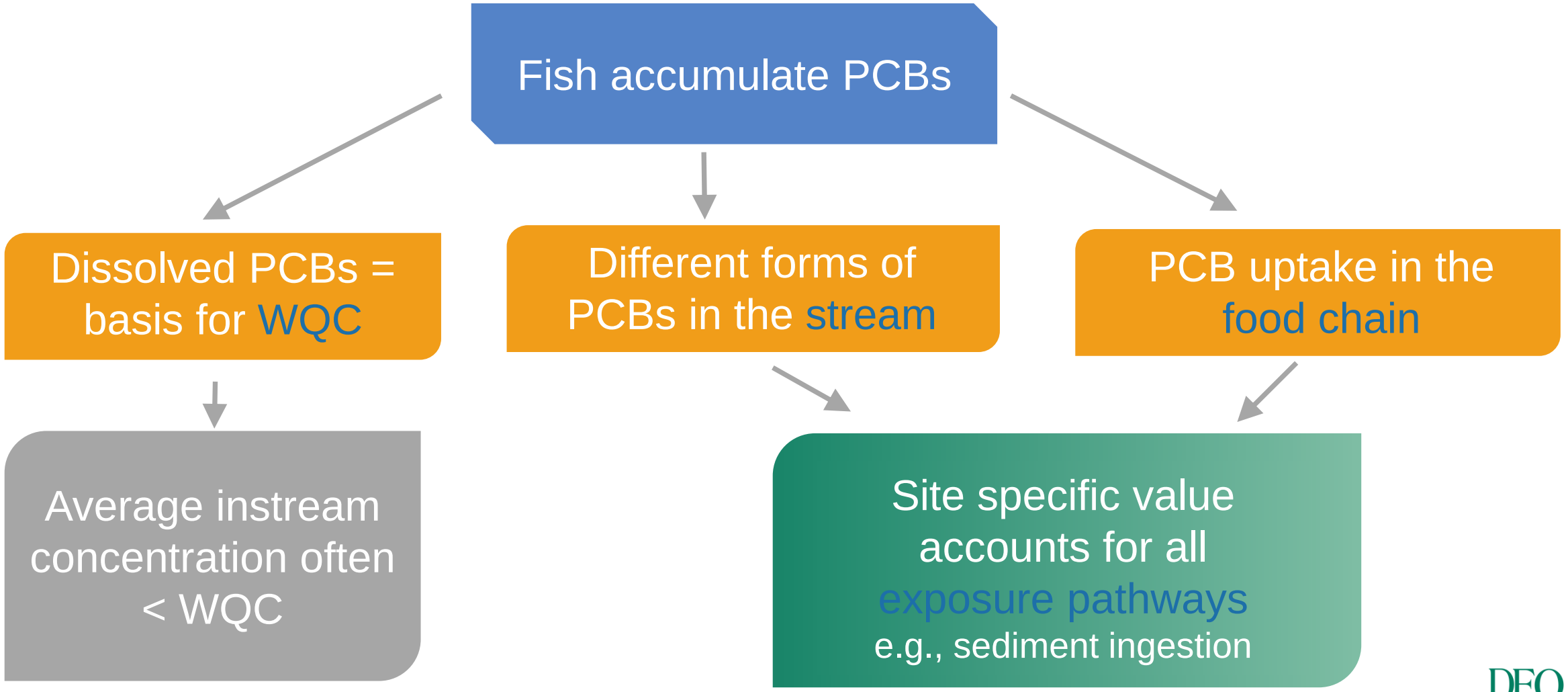
Factors to Consider for a Site-Specific Endpoint



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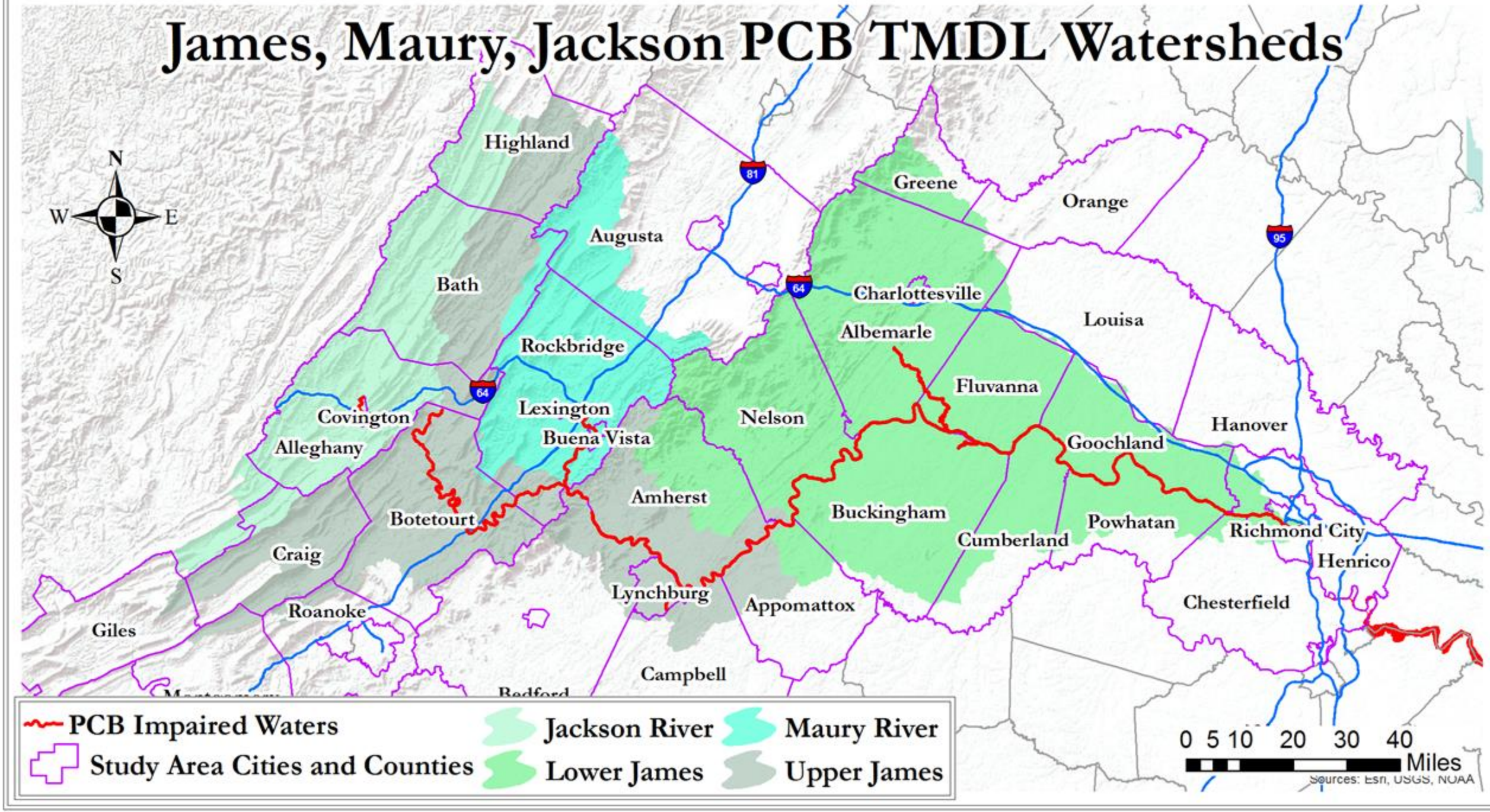
James, Maury, Jackson PCB TMDL Watersheds
N
W
E
S
Highland
Augusta
Bath
Rockbridge
Covington
Alleghany
Lexington
Buena Vista
Botetourt
Craig
Roanoke
Giles
Amherst
Lynchburg
Campbell
Bedford
Appomattox
Nelson
Greene
Orange
Charlottesville
Albemarle
Louisa
Fluvanna
Buckingham
Cumberland
Powhatan
Goochland
Hanover
Richmond City
Henrico
Chesterfield
81
64
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

Bioaccumulation Factor (BAF) Endpoint Selection

- BAFs were calculated for individual fish species in each TMDL watershed
- Three Scenarios Presented:
  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 pg/L*	n/a*	n/a*
Maury River	320 pg/L	300 pg/L	400 pg/L
Upper James River	1,186.8 pg/L*	91 pg/L	120 pg/L
Lower James River	140 pg/L	61 pg/L	52 pg/L

**These cases would default to a TMDL endpoint equal to the criterion = 640 or 580 pg/L*

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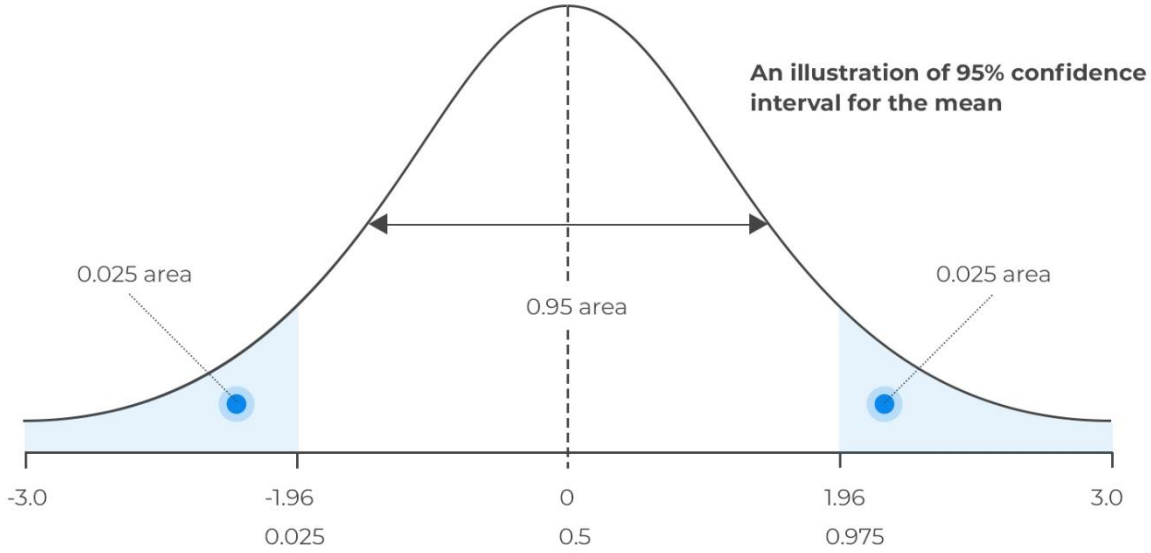
Considering the Revised Water Quality Criterion

Revised Water Quality Criterion:
Interpreting the "*Long term average*" footnote

- Human health criteria
  - Assumes there is an average amount of exposure on a long-term basis
  - Footnote for tPCB included with revised WQC
- Decision process created to assist with the establishment of TMDL based allocations/reductions
  - Utilizes an appropriate statistic of central tendency to compare the modeled output against the TMDL endpoint
    - Arithmetic mean, geometric mean, or median
      - Upper Confidence level (CL), Percentile rank order



Graphic credit: AnalystPrep.com

Revised Water Quality Criterion:
An Example for Interpreting the "*Long term average*" footnote

- Decision process:
  - Is the calibrated modeled output a normal distribution, lognormal distribution, or neither? All modeled output datasets - neither
  - Approach: If the median of the model output is greater than the endpoint:
    - Use the upper 95% CL of the median as the basis for reductions

- Upper James River

Median Model Output Statistic	Existing Conditions PCB concentration (pg/L)
TMDL Endpoint	120
Model Median	156
Upper 95% CL	171

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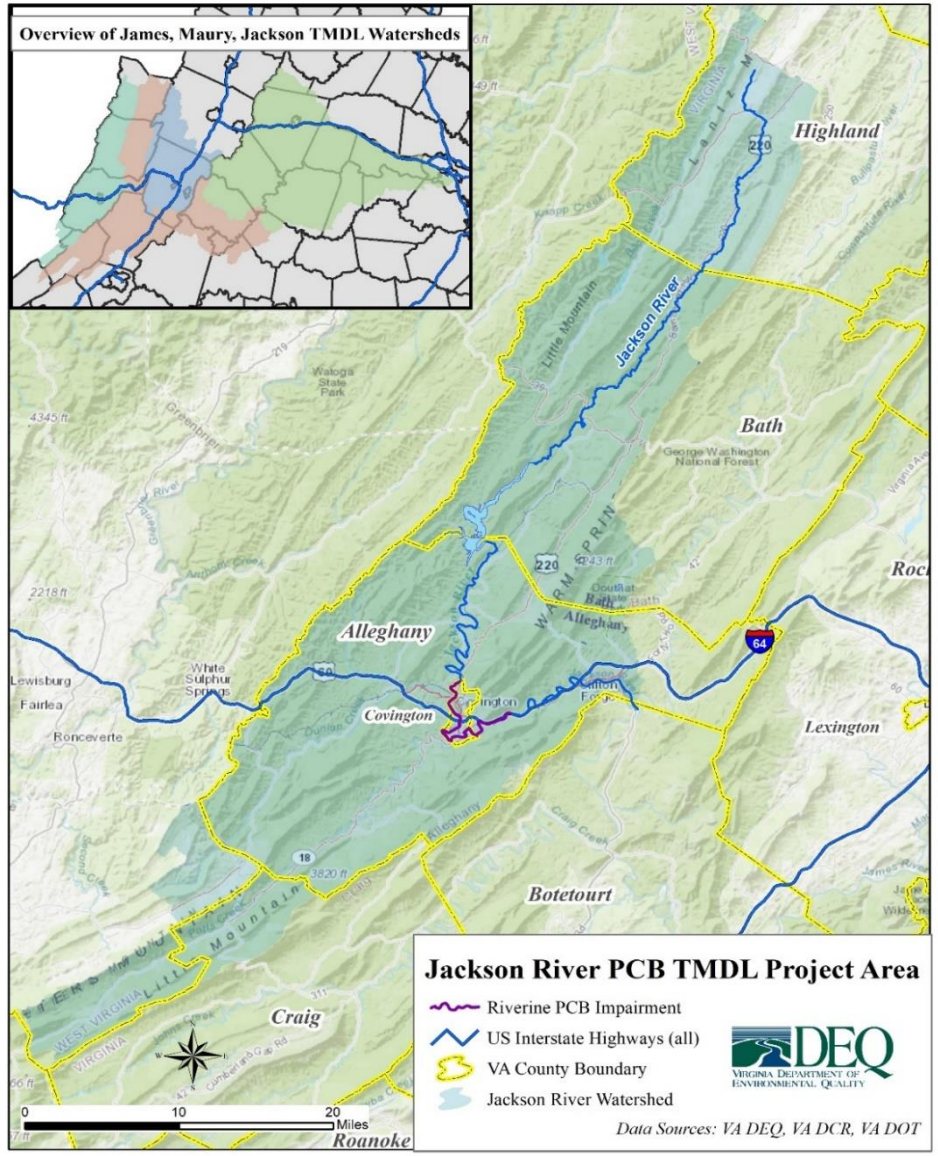
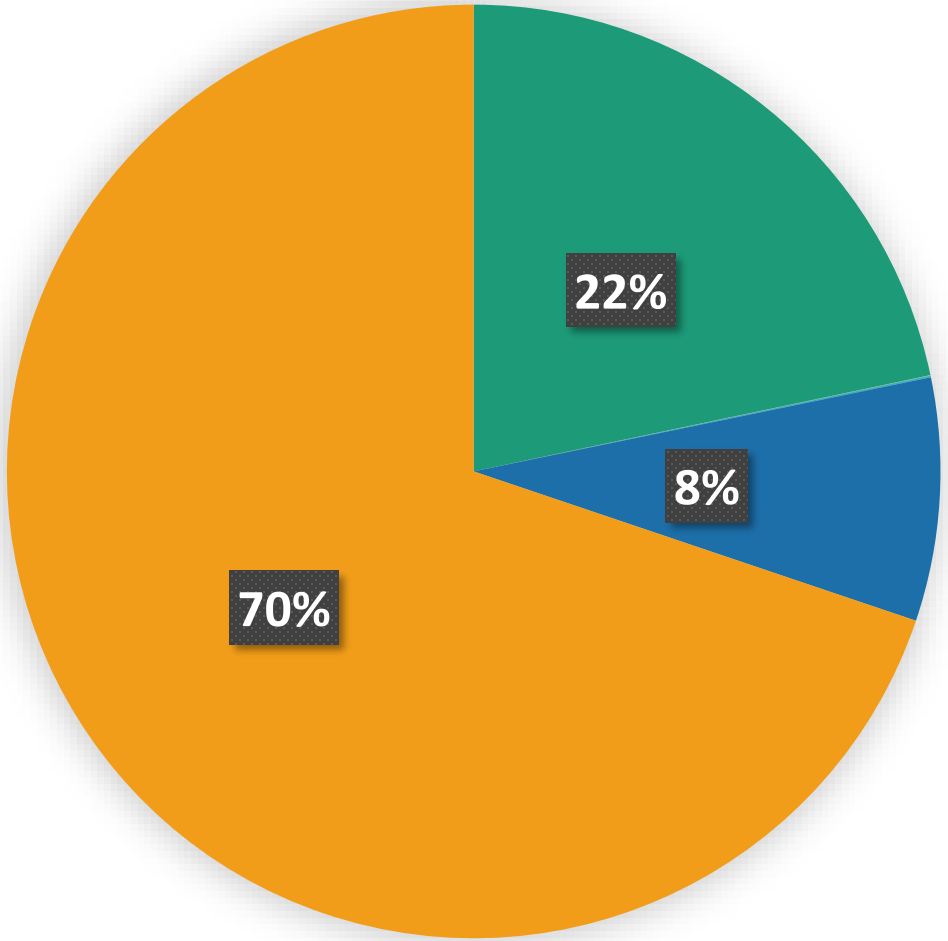
PCB Allocations

Annual Relative Contributions to PCB Concentrations at the Jackson River Outlet



- Streambed Sediment
- Atmospheric Deposition <1%
- Known Contaminated Sites <1%
- Permitted
- Spills <1%
- Nonregulated Surface Load (Stormwater)



Jackson River PCB Allocations
EXISTING Water Quality Criterion

- Scenario 3 Recommended

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Jackson River	640	-	51	-	-	86	0	100

Allocations based on meeting ≤ 10% instream exceedance rate and 0% Exceedance of current WQC (640 pg/L).

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Jackson River PCB Allocations

REVISED Water Quality Criterion

- Recommended scenario 3 includes:
  - Use of the revised numeric WQC (580 pg/L) as the TMDL Endpoint
  - Application of tPCB WQS footnote - “Long Term Average”

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Jackson River	580	-	56	-	-	19	0	100

Reduction are based on the daily simulated PCB concentration closest to the upper 95% CL that is greater than the endpoint but no greater than the 90th percentile of the model output dataset (i.e., 87th percentile).

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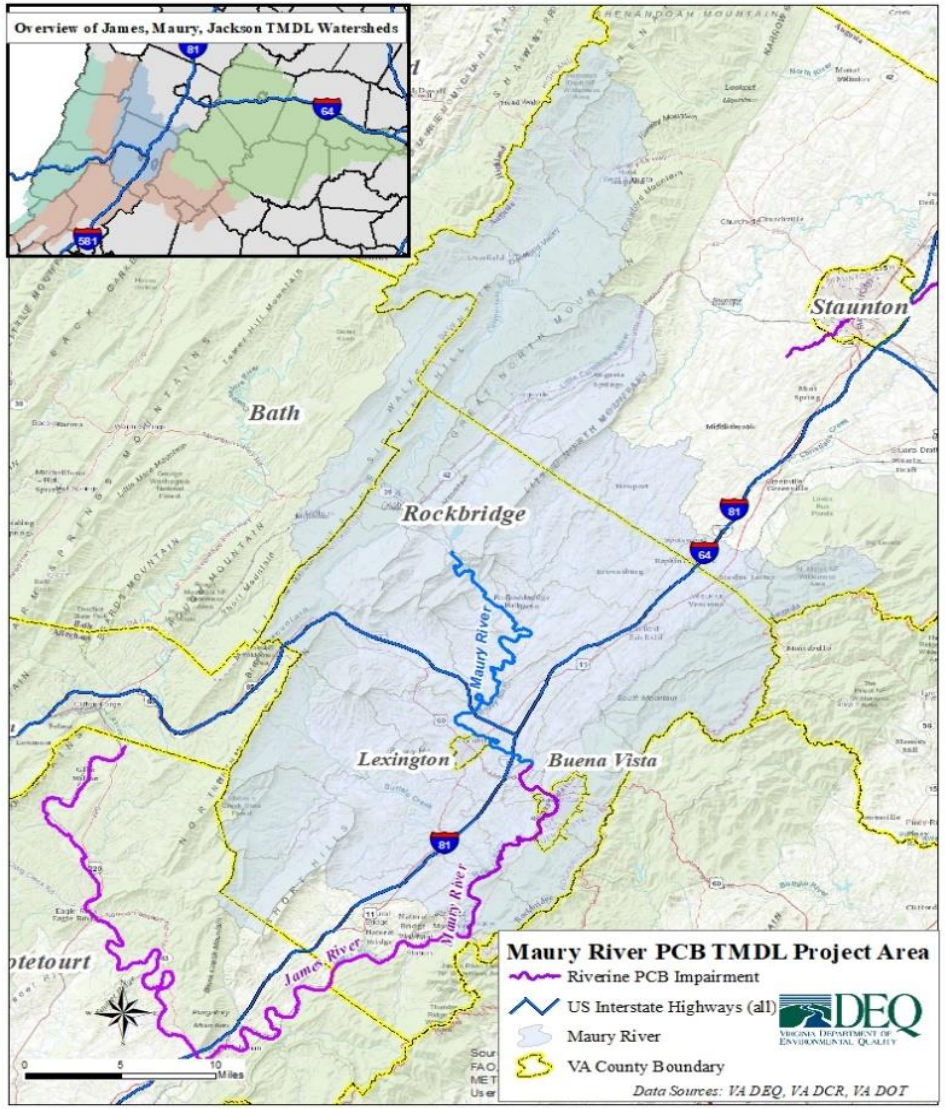
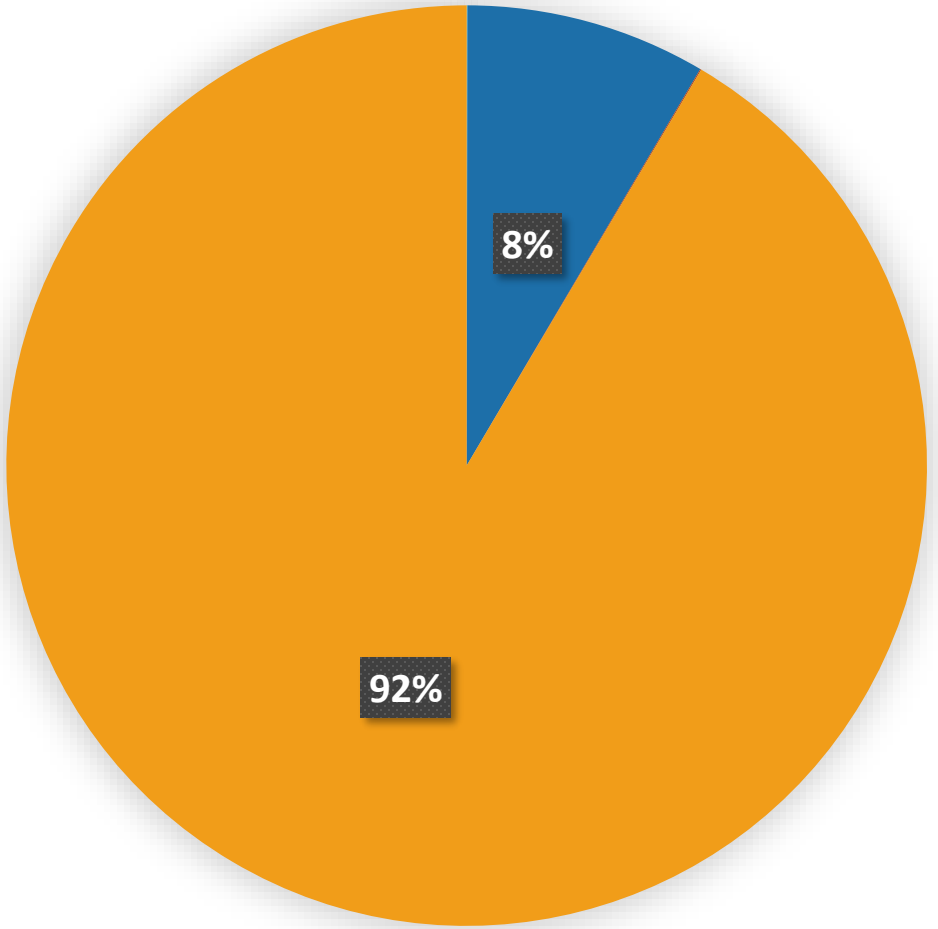
Annual Relative Contributions to PCB Concentrations at the Maury River Outlet



- Streambed Sediment <1%
- Atmospheric Deposition <1%
- Known Contaminated Sites <1%
- Permitted
- Spills <1%
- Nonregulated Surface Load (Stormwater)



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Maury River PCB Allocations

EXISTING Water Quality Criterion

- Scenario 3 Recommended

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Maury River	400	-	99.3	-	-	94	0	100

Reductions are based on meeting ≤ 10% instream exceedance rate and 0% Exceedance of current WQC (640 pg/L).

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Maury River PCB Allocations

REVISED Water Quality Criterion

- Recommended scenario 3 includes:
  - Site specific BAF (400 pg/L) selected as the TMDL Endpoint
  - Application of footnote - “Long Term Average”

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Maury River	400	-	99.3	-	-	0	0	100

Reductions are based on the daily simulated PCB concentration closest to the upper 95% CL that is greater than the endpoint but no greater than the 90th percentile of the model output dataset (i.e., 86.8th percentile).

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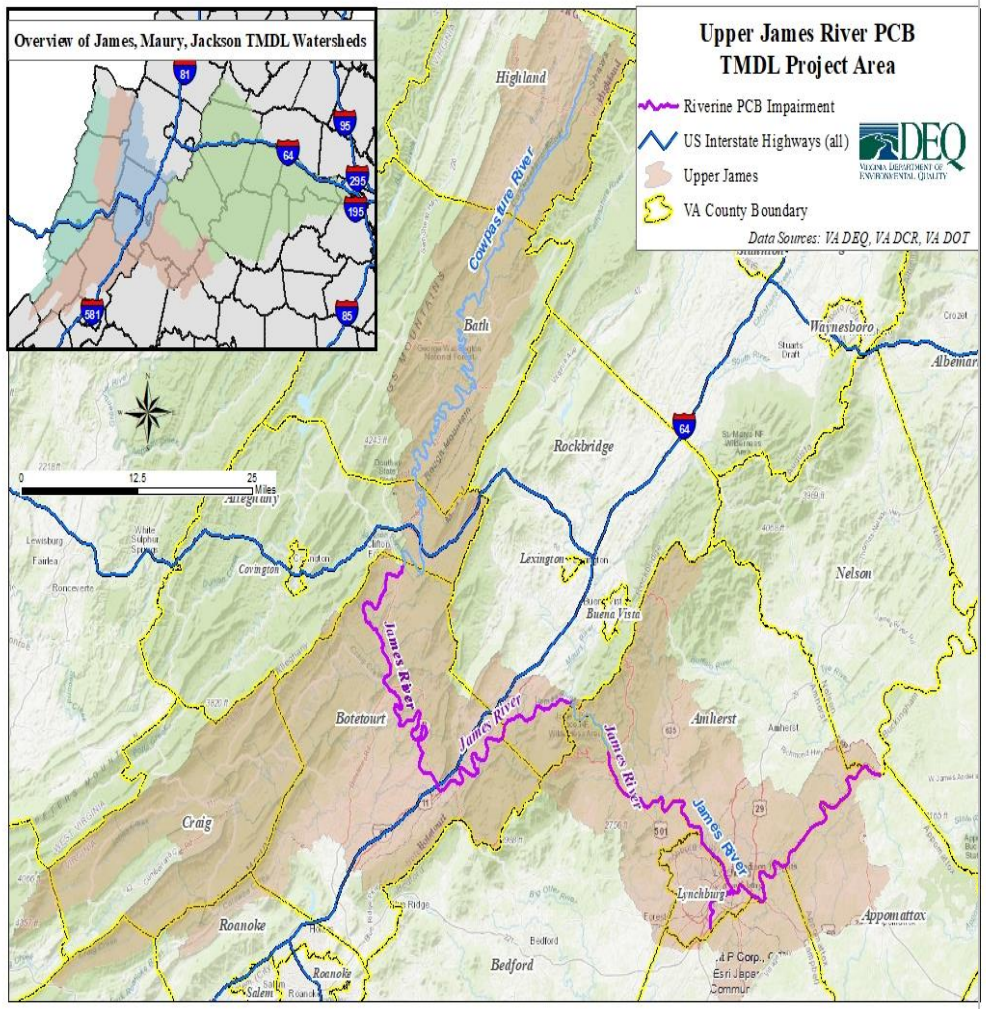
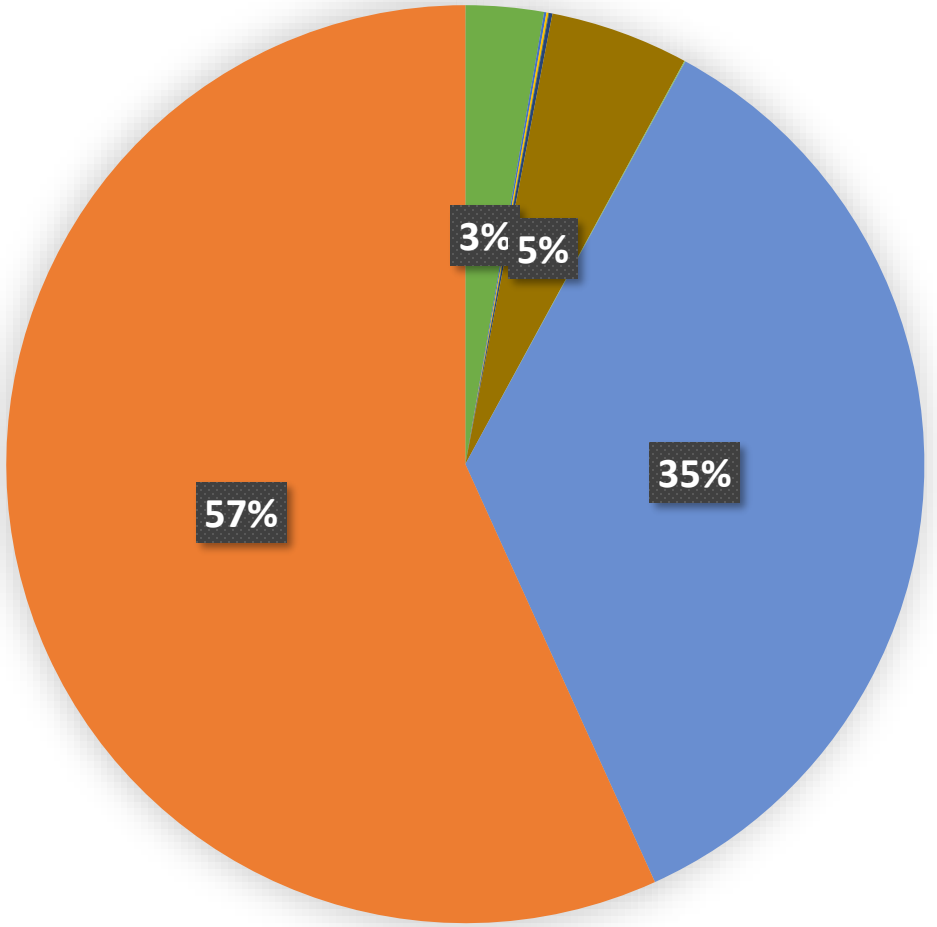
Annual Relative Contributions to PCB Concentrations at the Upper James River Outlet



- Jackson and Maury Rivers
- Streambed Sediment <1%
- Atmospheric Deposition <1%
- Known Contaminated Sites <1%
- CSO <1%
- Permitted
- Spills <1%
- Surface Load - Nonregulated
- Surface Load - Regulated



Upper James River PCB Allocations
EXISTING Water Quality Criterion

- Scenario 3 Recommended

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Upper James River	120	85	99	68	90	90	0	100

Reductions are based on meeting ≤ 10% instream exceedance rate and 0% Exceedance of current WQC (640 pg/L).

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Upper James River PCB Allocations

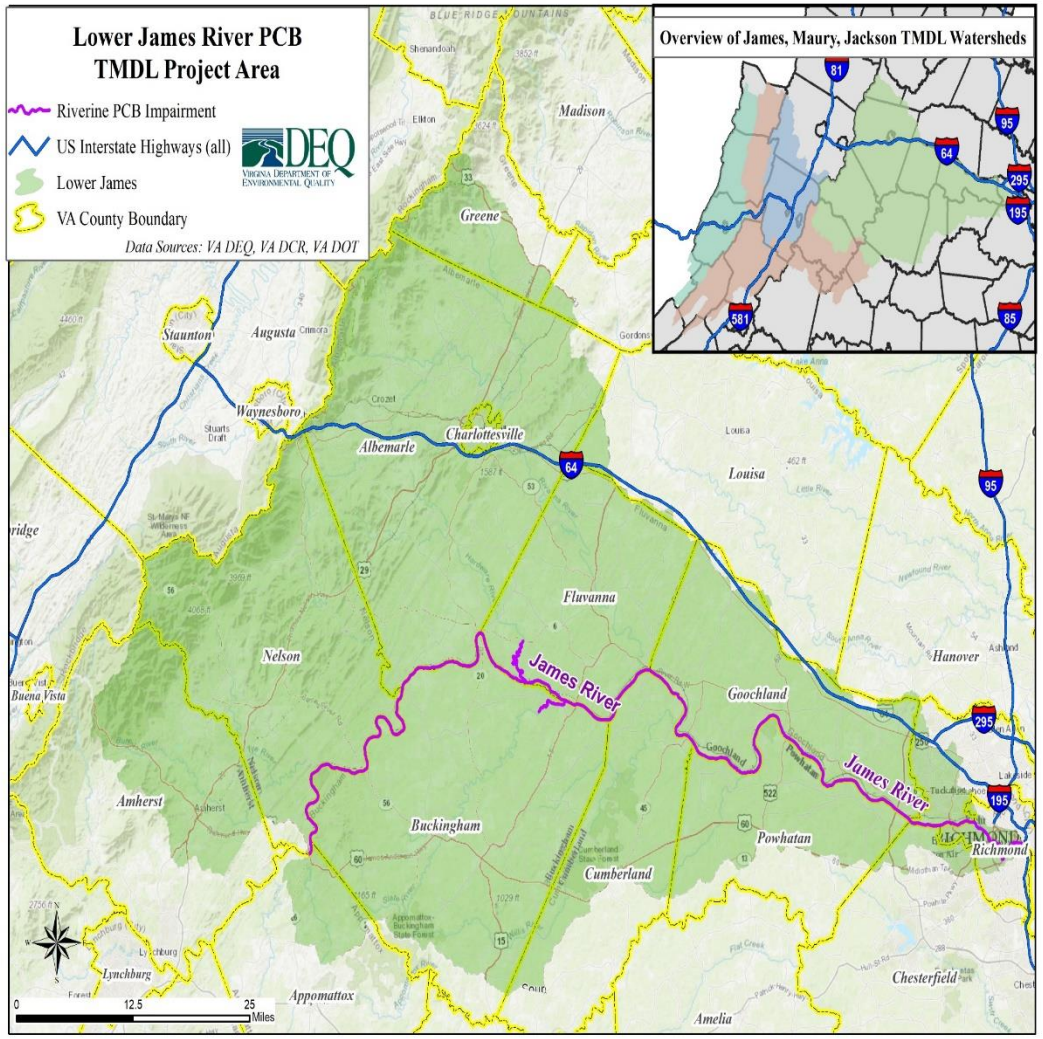
REVISED Water Quality Criterion

- Recommended scenario 3 includes:
  - Site specific BAF (120 pg/L) selected as the TMDL Endpoint
  - Application of footnote - “Long Term Average”

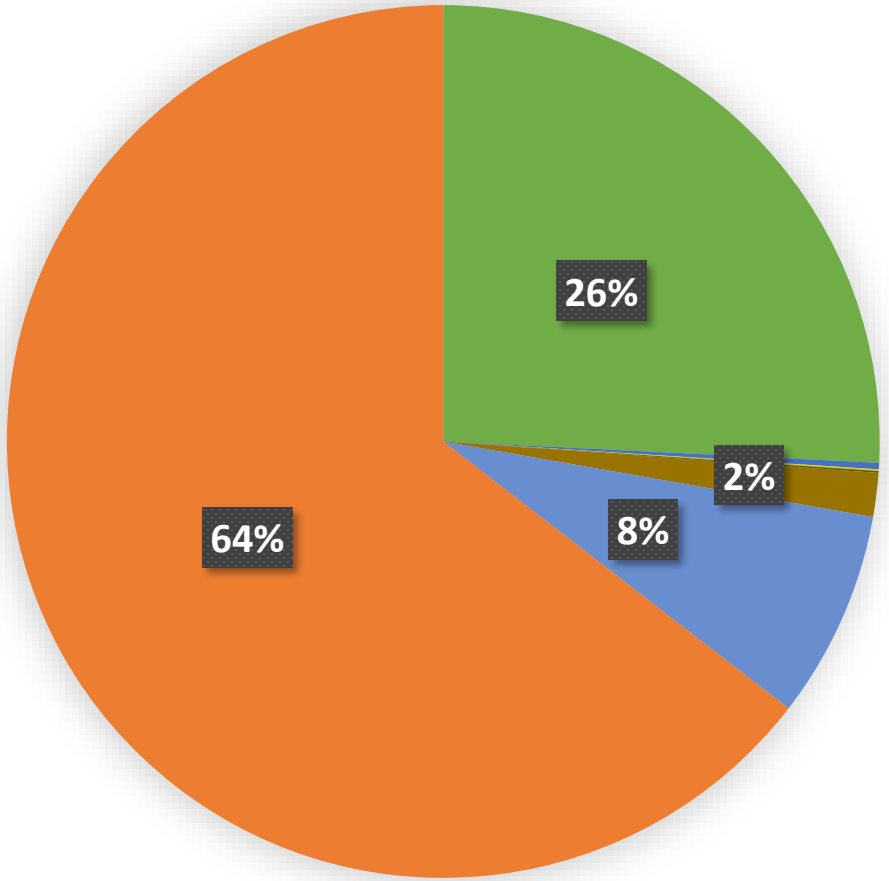
Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Upper James River	120	12	99	68	25	25	0	100

Reductions are based on the upper 95% CL.

Annual Relative Contributions to PCB Concentrations at the Lower James River Outlet



- Upper James River
- Streambed Sediment <1%
- Atmospheric Deposition <1%
- Known Contaminated Sites <1%
- CSO <1%
- Permitted
- Spills <1%
- Surface Load - Nonregulated
- Surface Load - Regulated



Lower James River PCB Allocations
EXISTING Water Quality Criterion

- Scenario 3 Recommended

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Lower James River	52	90	98	92	98	98	0	100

Reductions are based on meeting ≤ 10% instream exceedance rate and 0% Exceedance of current WQC (640 pg/L).

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Lower James River PCB Allocations
REVISED Water Quality Criterion

- Recommended scenario 3 includes:
  - Site specific BAF (52 pg/L) selected as the TMDL Endpoint
  - Application of footnote - “Long Term Average”

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Lower James River	52	27	98	92	35	35	0	100

Reductions are based on the upper 95% CL.

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James River Watershed PCB Allocations Summary

EXISTING Water Quality Criterion (Scenario 3)

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted Sources[1]	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Jackson River	640	-	51	-	-	86	0	100
Maury River	400	-	99.3	-	-	94	0	100
Upper James River	120	85	99	68	90	90	0	100
Lower James River	52	90	98	92	98	98	0	100

Reductions are based on meeting ≤ 10% instream exceedance rate and 0% Exceedance of current WQC (640 pg/L).

James River Watershed PCB Allocations Summary

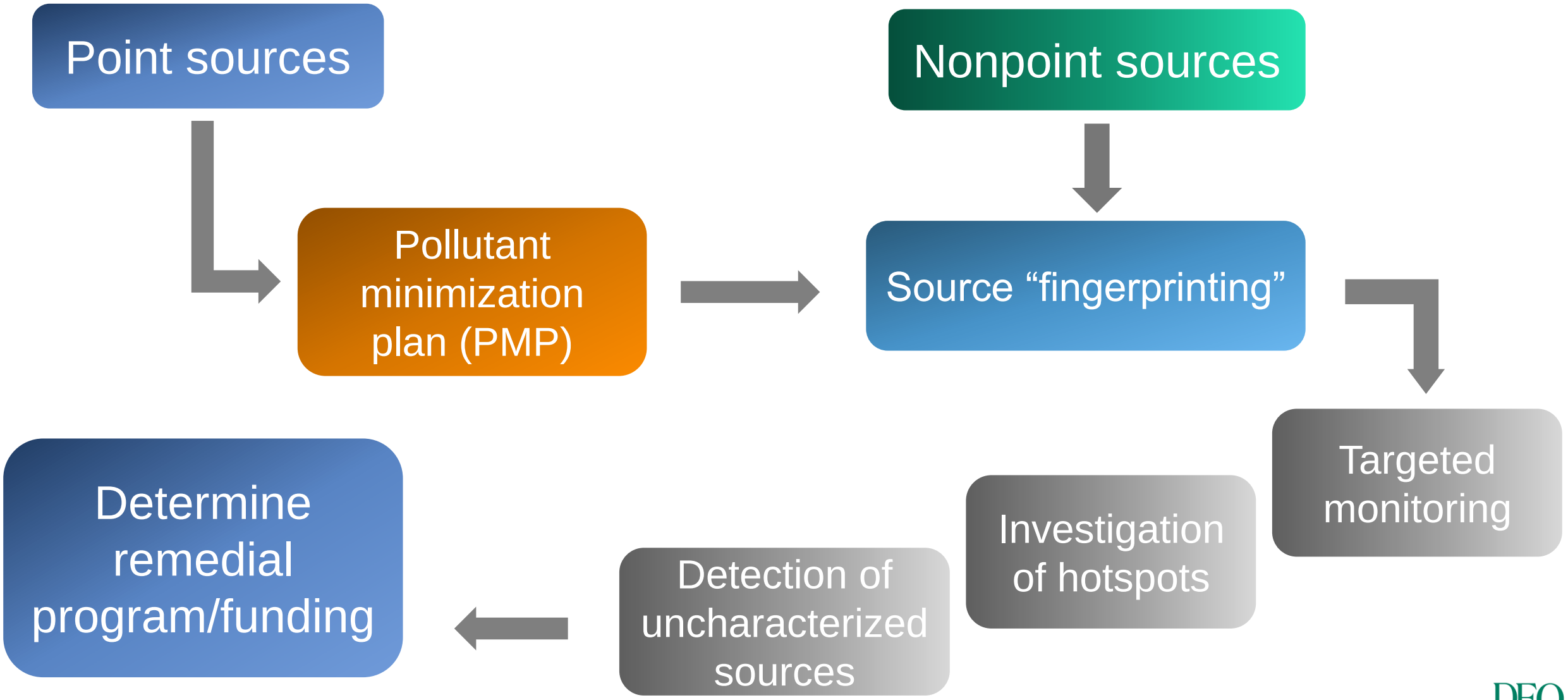
REVISED Water Quality Criterion (Scenario 3)

Impaired Segment	TMDL Endpoint (pg/L)	Required PCB Loading Reductions to Meet TMDL Endpoint, %						
		Upstream Sources	Permitted - Point Sources	CSOs	Surface Sources		Streambed Sediments	Spills
					MS4 Permitted Areas	Non-Regulated Areas		
Jackson River	580	-	56	-	-	19	0	100
Maury River	400	-	99.3	-	-	0	0	100
Upper James River	120	12	99	68	25	25	0	100
Lower James River	52	27	98	92	35	35	0	100

Reductions are based on approach used to apply the long term average.

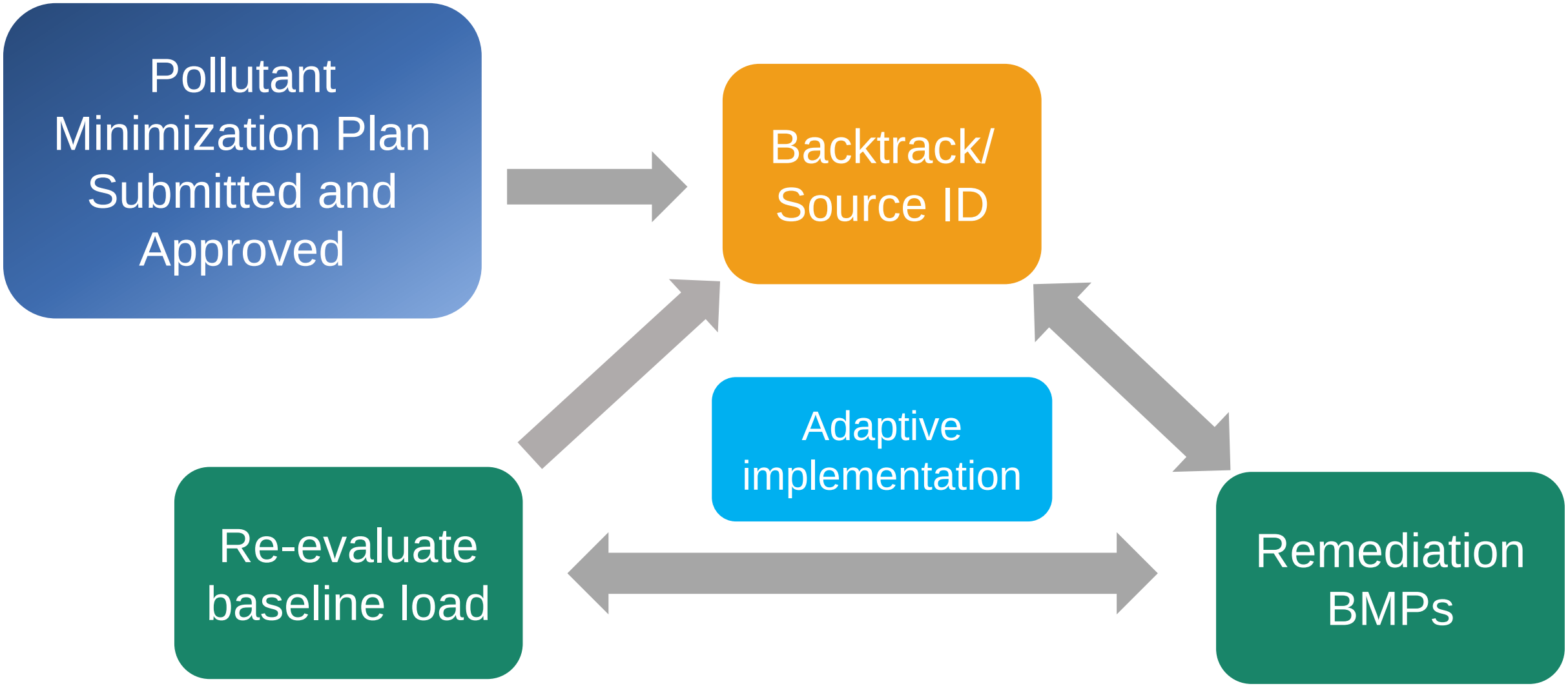
TMDL Implementation

TMDL Implementation Process



DEQ

Developing a Pollutant Minimization Plan for PCBs



Cost/Benefit Analysis

Regulatory Economic Review

- State agencies are required to complete an economic analysis of proposed regulations
- The WLA from the TMDL equation is incorporated into the Water Quality Management Regulation (9 VAC 25-720-60)
- Cost Benefit Analysis
  - Seeking assistance with assembling costs and benefits

Costs

- Pollutant Minimization Plan Development & Implementation
- BMP installation
- PCB Monitoring

Benefits

- Restoration of Fishing Designated Use
- Protect Human Health
- Improved health for aquatic life & wildlife
- Direct economic benefits

Next Steps

- Finalize and share the draft TMDL
  - Winter 2023
- Final Public Meeting

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