Mountain Run PCB Study:

Final Public TMDL Meeting

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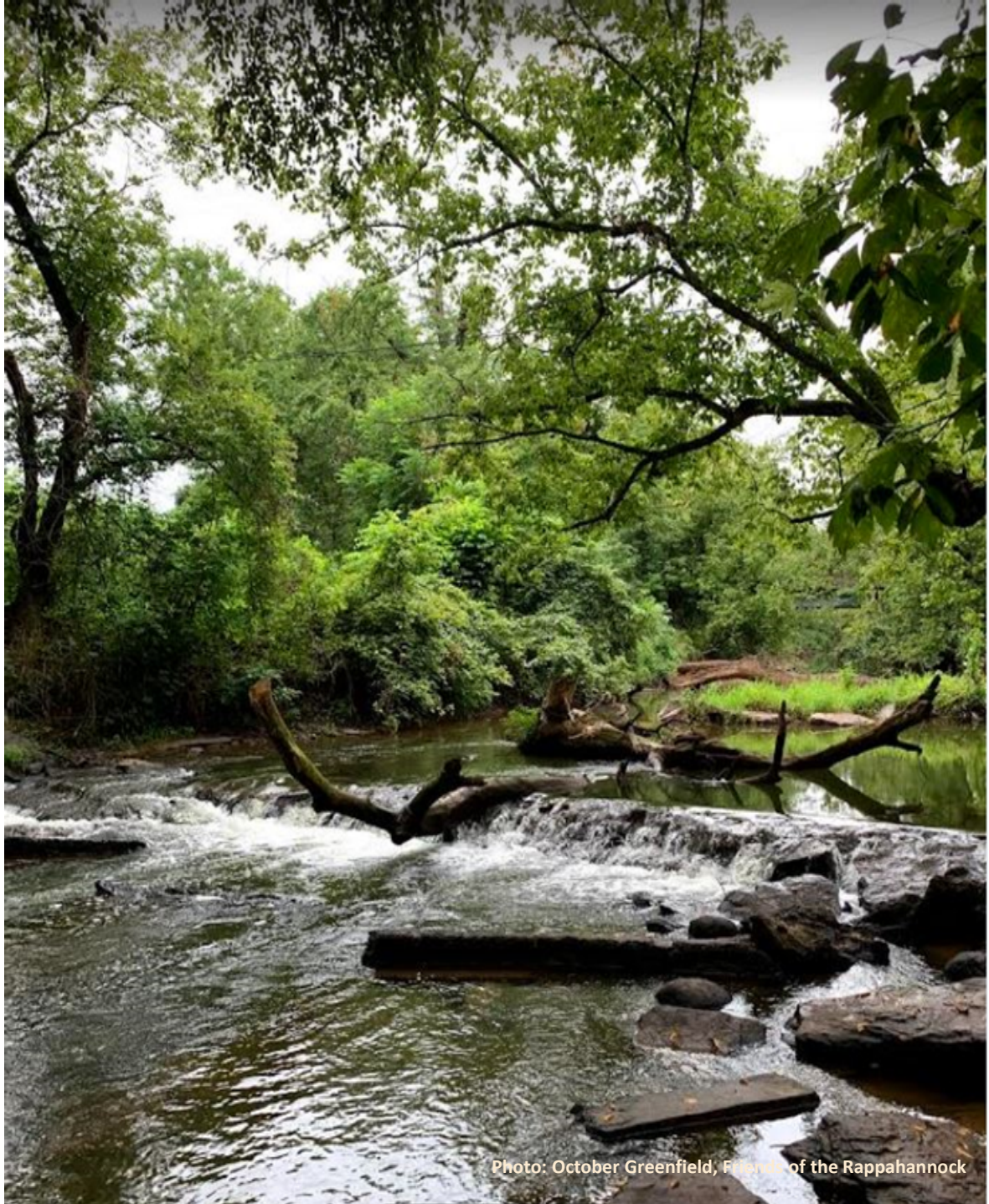
Virginia Department of Environmental Quality

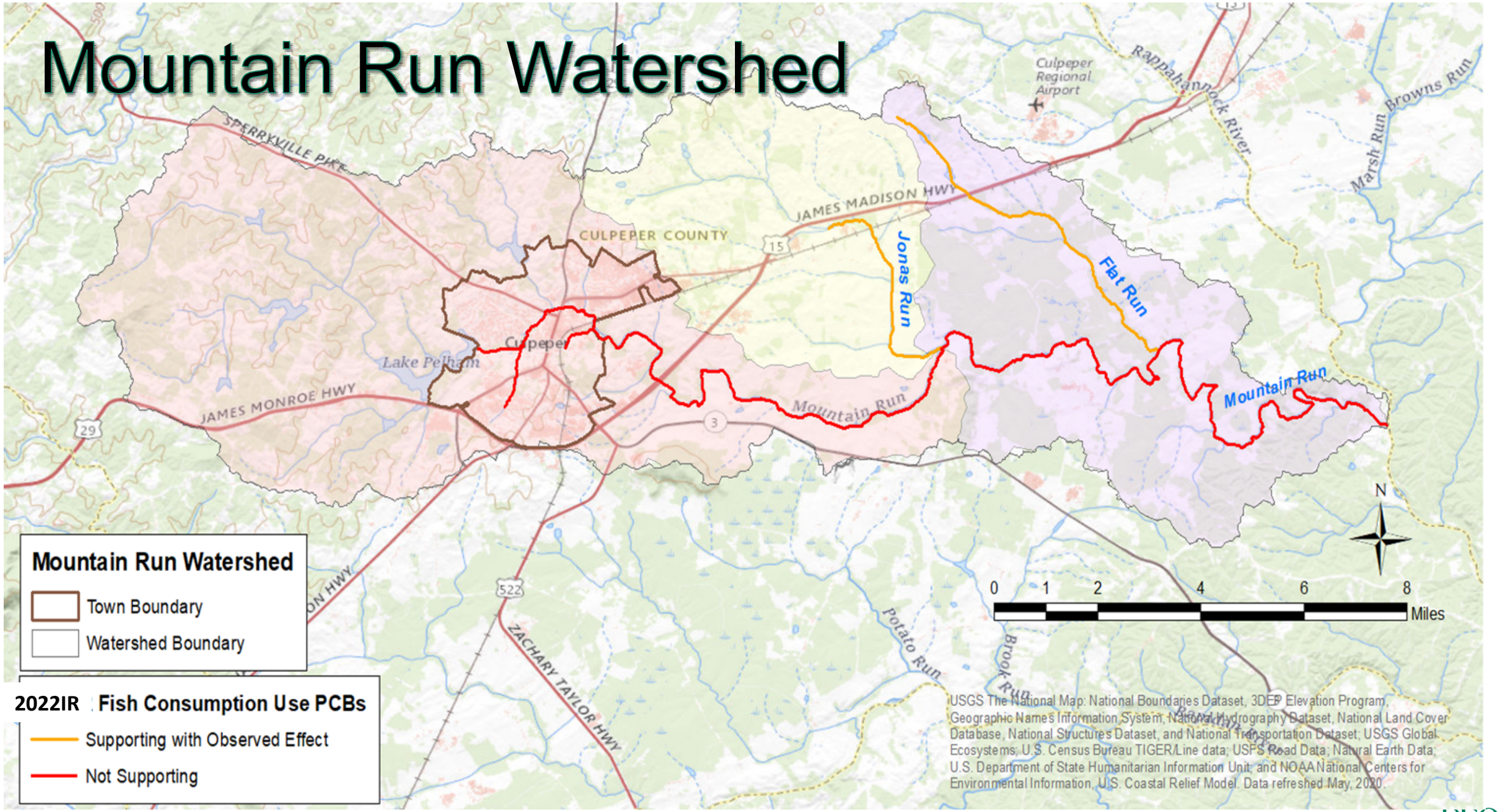
September 6, 2023

Agenda

- **Welcome and Introductions**
  - Meeting Objectives
- **PCB Background and TMDL Development**
- **Mountain Run PCB TMDL Overview**
  - Monitoring
  - Source Assessment
  - TMDL Endpoint/Model/ Allocations
  - TMDL Implementation
- **Next Steps**
  - Public Comment



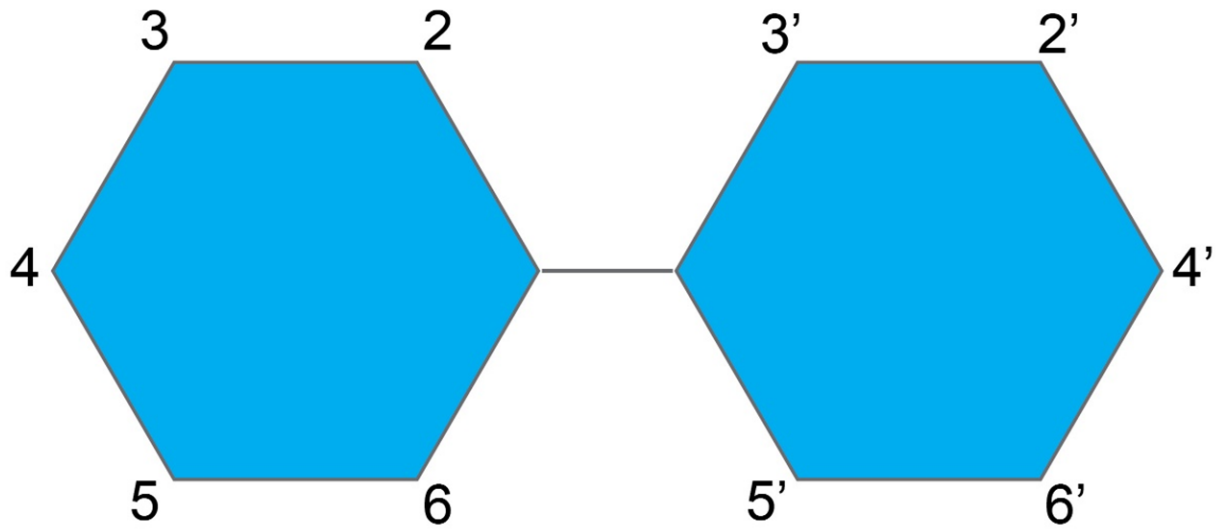
Mountain Run Watershed



DEQ

Background: PCBs

- Biphenyl molecule (1-10 chlorine atoms)
- 209 distinct PCB Compounds
- Regulated by DEQ as Total PCB (tPCB) = 209 compounds summed



- Referred to as PCB Aroclors (Monsanto tradename) = mixture of PCB compounds

Background: PCBs

Over 1.5 Billion lbs. manufactured in the U.S. until 1977

Legacy contaminant

Very stable and heat resistant

Persistent in the environment

Common uses

Transformers, circuit breakers, PVC products, caulking material, paints…

Toxics Substances Control Act (TSCA)

- 1976 Law regulates PCBs
  - Bans manufacture, processing, use and distribution
  - Non-PCB Transformer defined as containing < 50 ppm PCB
  - Inadvertent manufacture of PCBs – products up to 50 ppm allowed to leave site as long as annual average is < 25 ppm
    - ***Unintentional*** by-products of manufacturing processes

Photo: onekindplanet.org

50 ppm compared to DEQ's WQC of 0.00000058 ppm

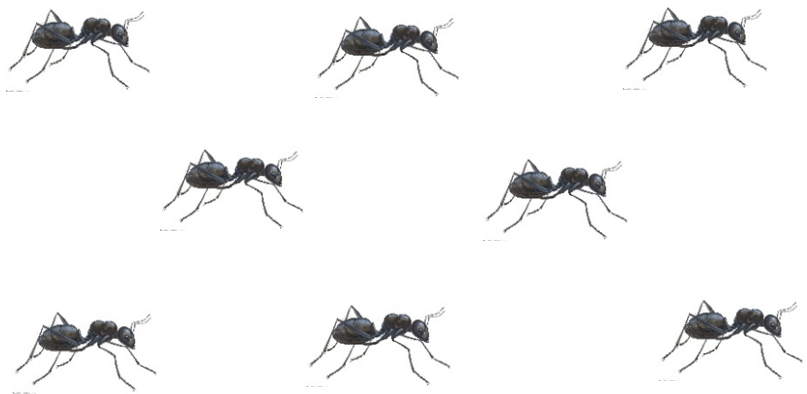


Photo: Britannica.com

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VA Water Quality Criterion – Total PCBs

Agency	Fish Tissue Threshold (ppb)	WQC (pg/l)
VDH	100 (Fish Consumption Advisory)	- -
DEQ	18 (Tissue Value)	580

- 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 2024 Water Quality Assessment Guidance Manual

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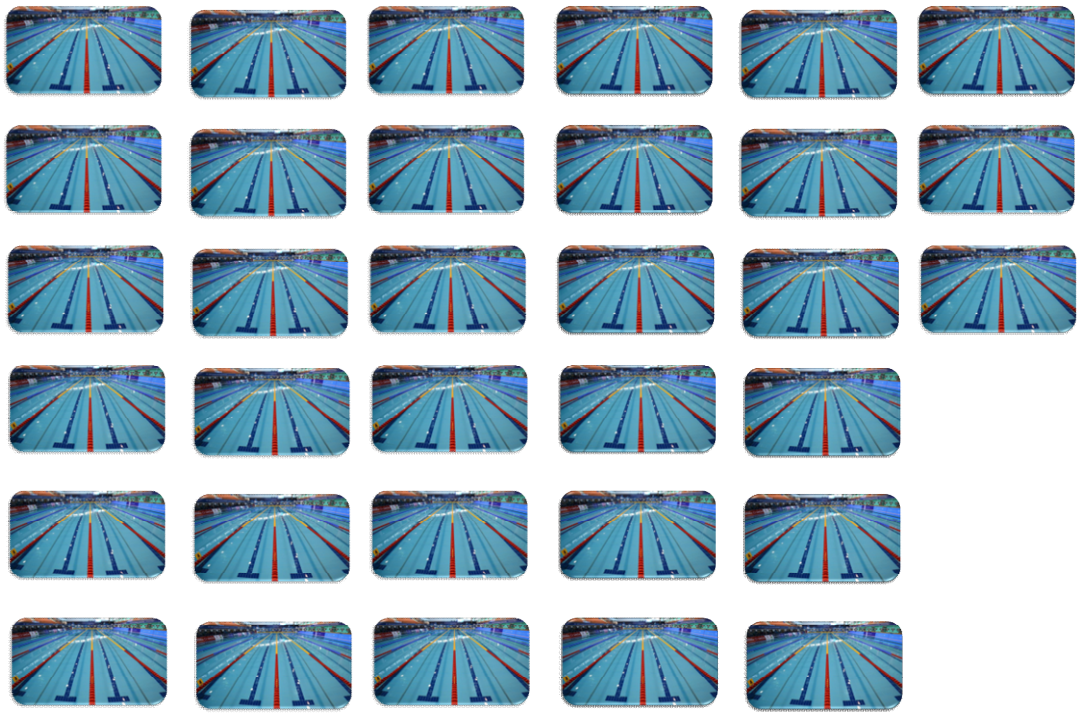
Virginia Department of Environmental Quality

Virginia's PCB Water Quality Criterion =

Concentration of PCBs in the water that is low enough to ensure that fish are safe to eat

580 pg/L

One drop in 33 Olympic-sized swimming pools



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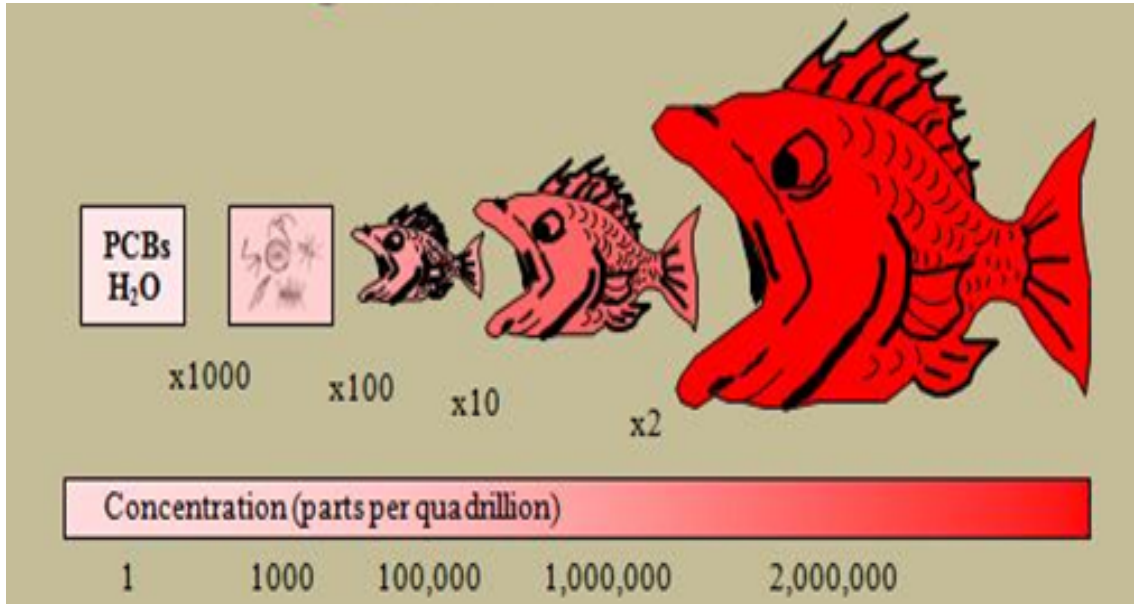
Why PCBs Continue to be an Issue

- Human health concern
  - Fish consumption significant exposure pathway
  - Suspected carcinogen
  - Immunotoxicity, hepatotoxicity (liver)
  - Affects reproduction and development
- Persistent, bioaccumulates at a low conc. (pg/L) & biomagnifies
- Confirmed on-going releases



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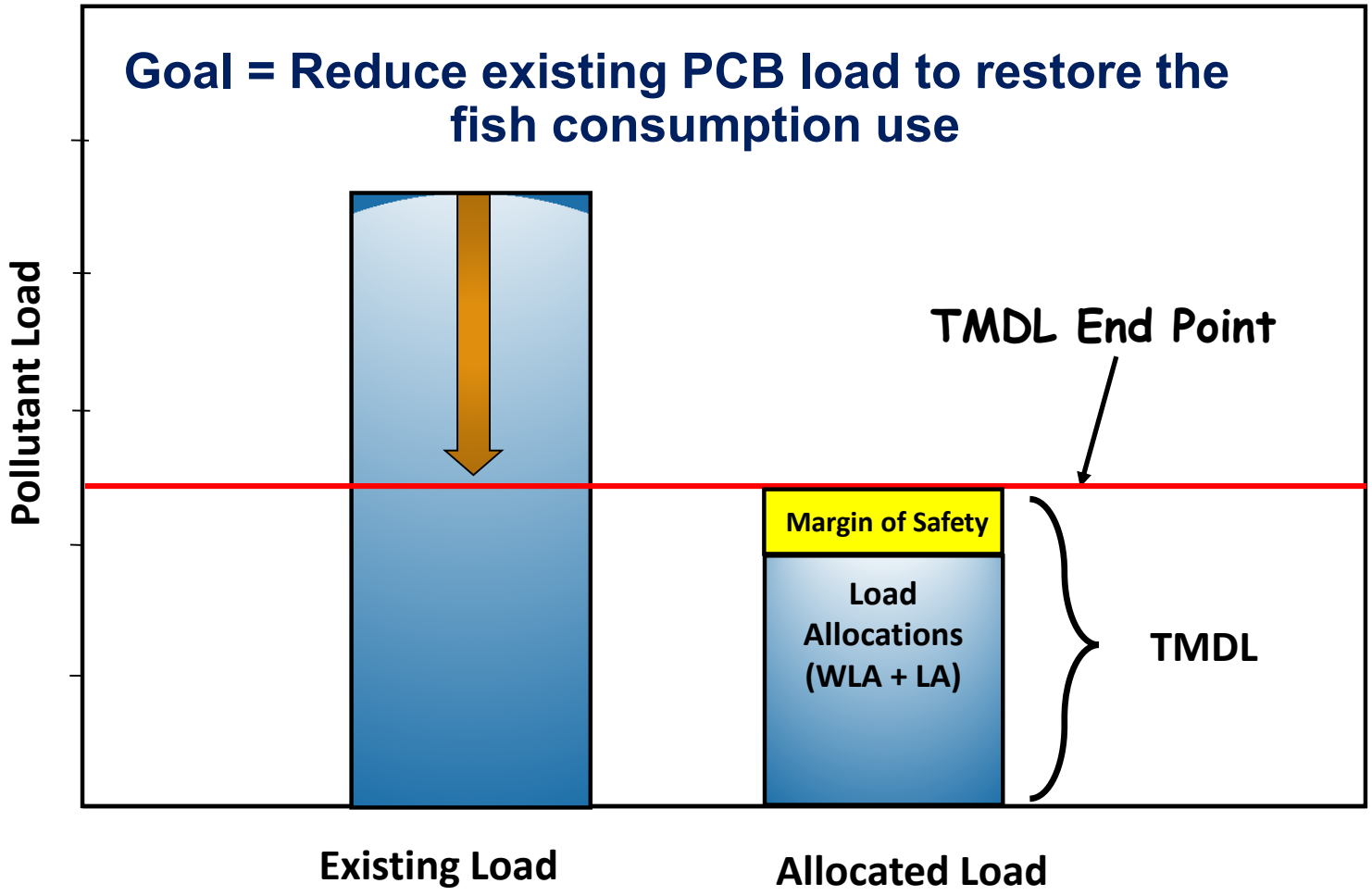
Total Maximum Daily Load (TMDL)

- Pollution Budget
- Addresses different pollution categories
- PCB TMDL - Multi-media approach
  - Air, Land, Water

TMDL = WLA + LA + MOS

Where:

WLA = Waste Load Allocation
LA = Load Allocation
MOS = Margin of Safety



To be restored the waterbody must meet two thresholds: 1) Numeric WQC [*or site specific value*] and 2) fish tissue threshold

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The TMDL Process

Fish Consumption Advisory

Photo: https://www.thefisherman.com/article/inshore-american-eel-life-history-profile/

Low level PCB analysis

Identify problem

Source assessment
- Identify sources
- Estimate loads

Link sources to targets
- Assess linkages
- Estimate total load

TMDL allocations
- Reduce loads from point sources
- Divide remaining loads among sources

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Mountain Run PCB Impairment & TMDL Study Timeline

- *1999 & 2001*: DEQ monitors fish tissue
- *2004*: VA Department of Health issues fish consumption advisory for the American Eel (≤ 2 meals/month)
- *2006*: 19.9-mile segment placed on VA's impaired waters list
- *2006 & 2013*: DEQ completes additional fish tissue monitoring
- *2013-2018*: DEQ completes water and sediment monitoring to prepare for PCB study
- 2020: Impaired segment increased to 24.53-miles due to water concentrations
- 2021: DEQ Initiated TMDL Study

Photo: https://www.cfr.msstate.edu/wildlife/fisheries/pdf/AmericanEel.pdf


Photo: https://www.google.com/maps/place/Yowell+Meadow+Park/@38.4756743,-77.9990059

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VDH Fish Consumption Advisory

River basin	Waterbody	Section	Locality	Contaminants	Fish species	Advisory description
Rappahannock	Mountain Run	From rt. 15/29 bridge 19 miles to confluence with Rappahannock River	Culpeper	PCBs	American Eel	≤ 2 meals/month

Does not affect swimming

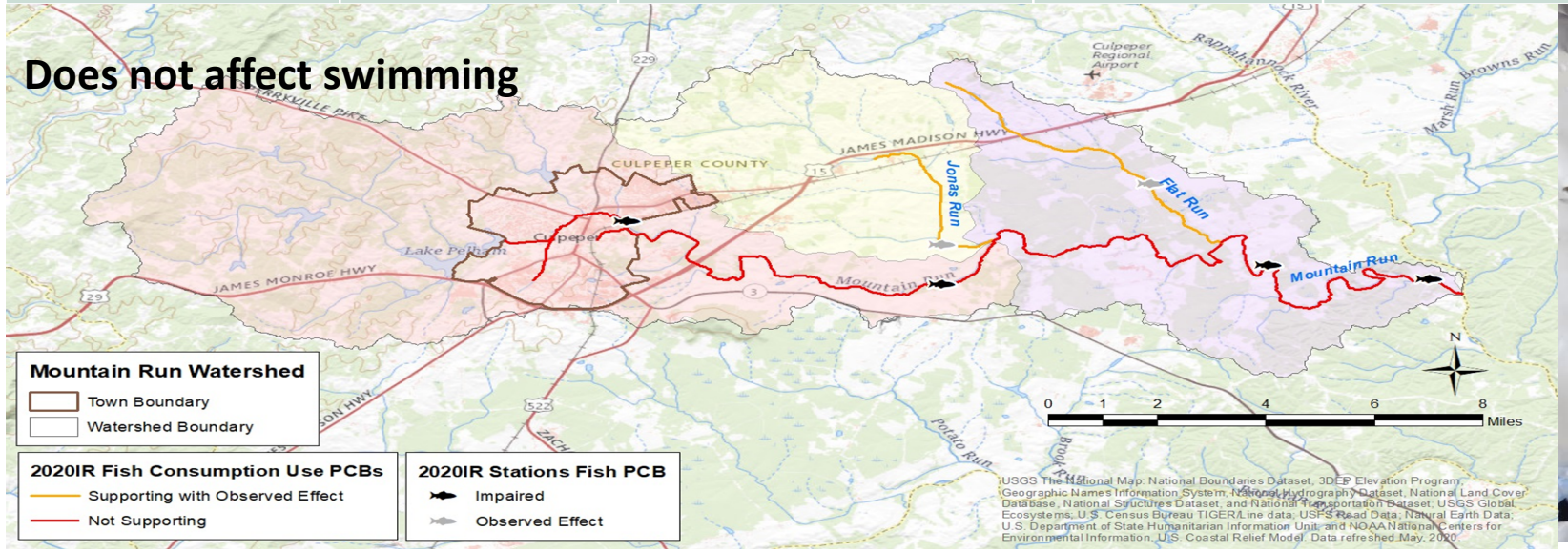

Photo: Rick Browder, VADEQ

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

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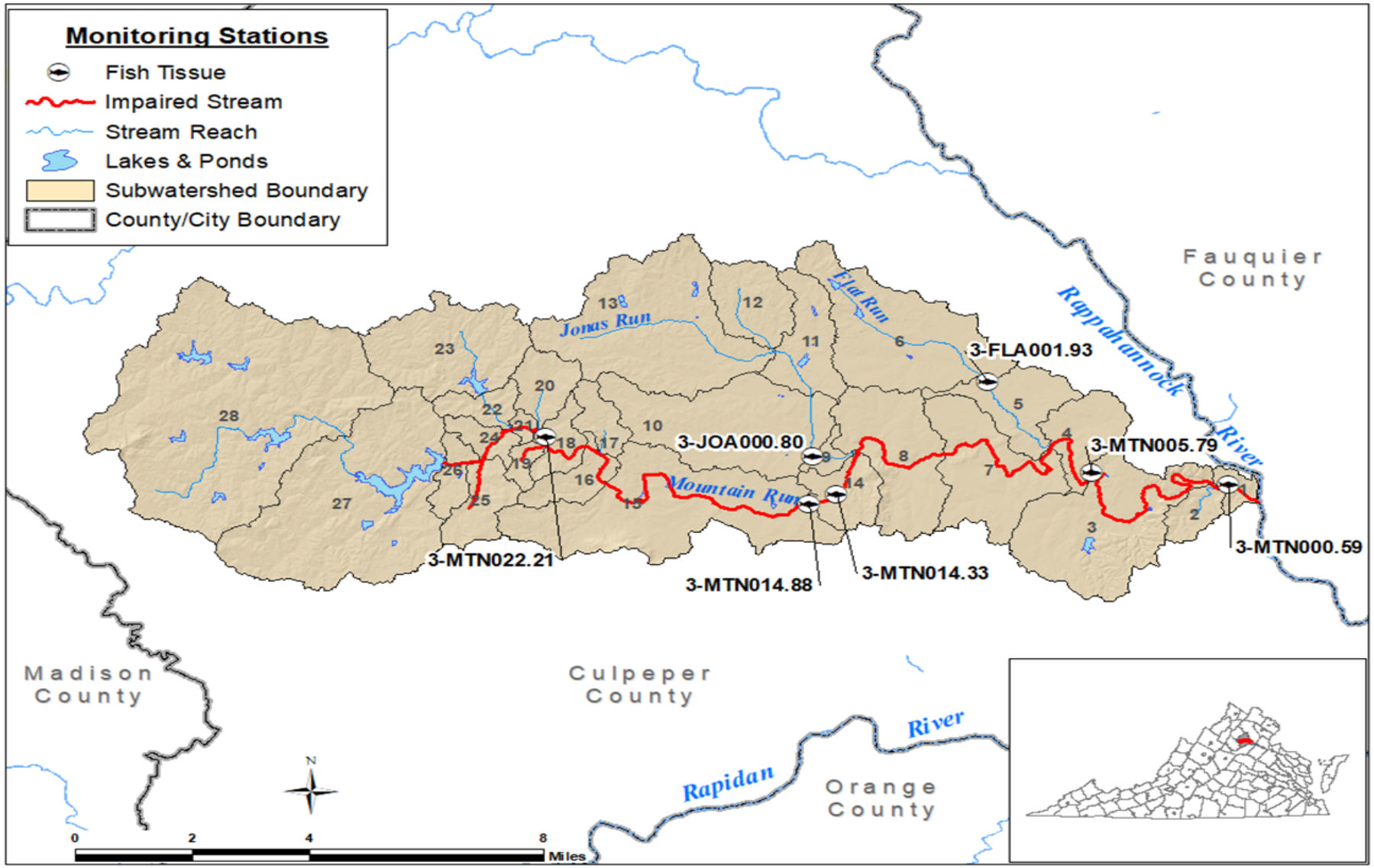
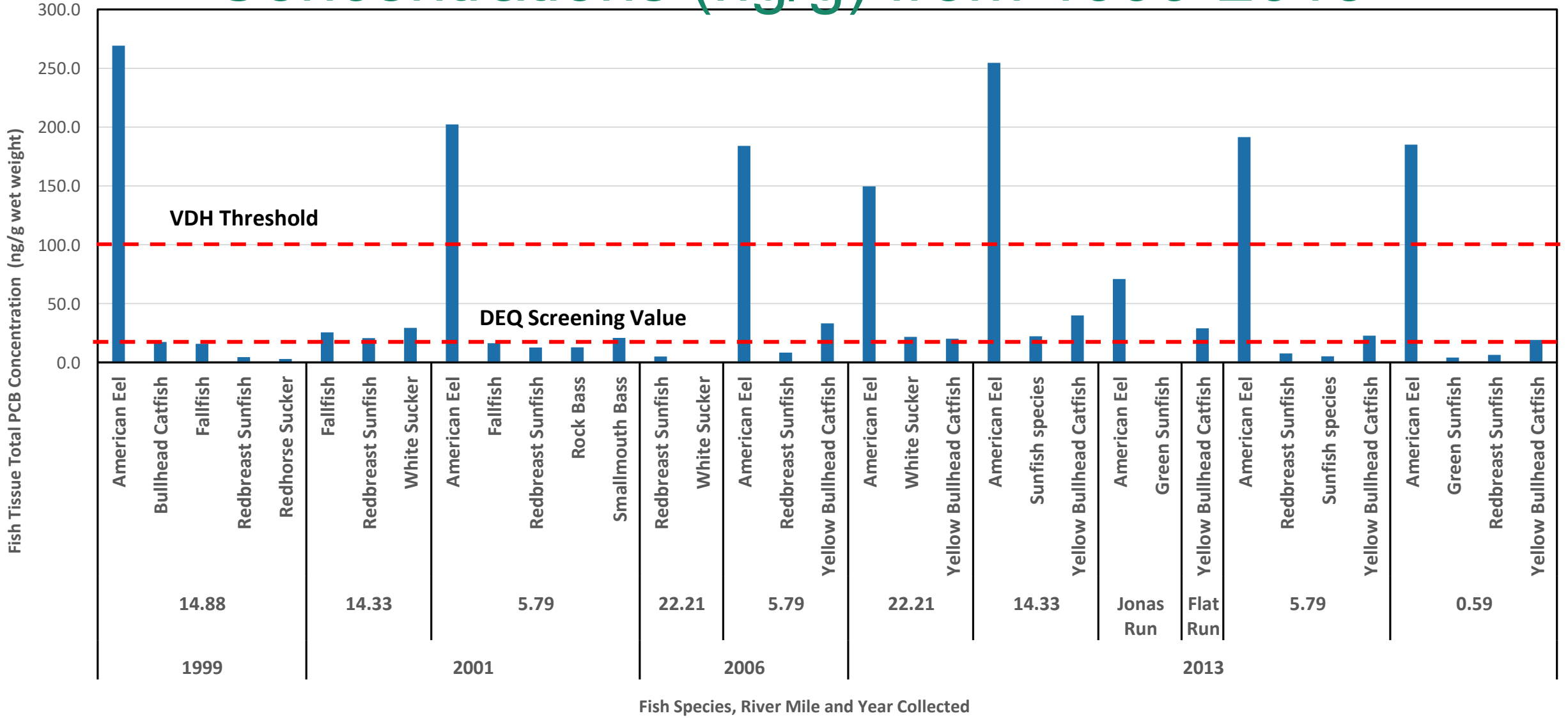
Fish Tissue Sampling Locations (1999 – 2013)

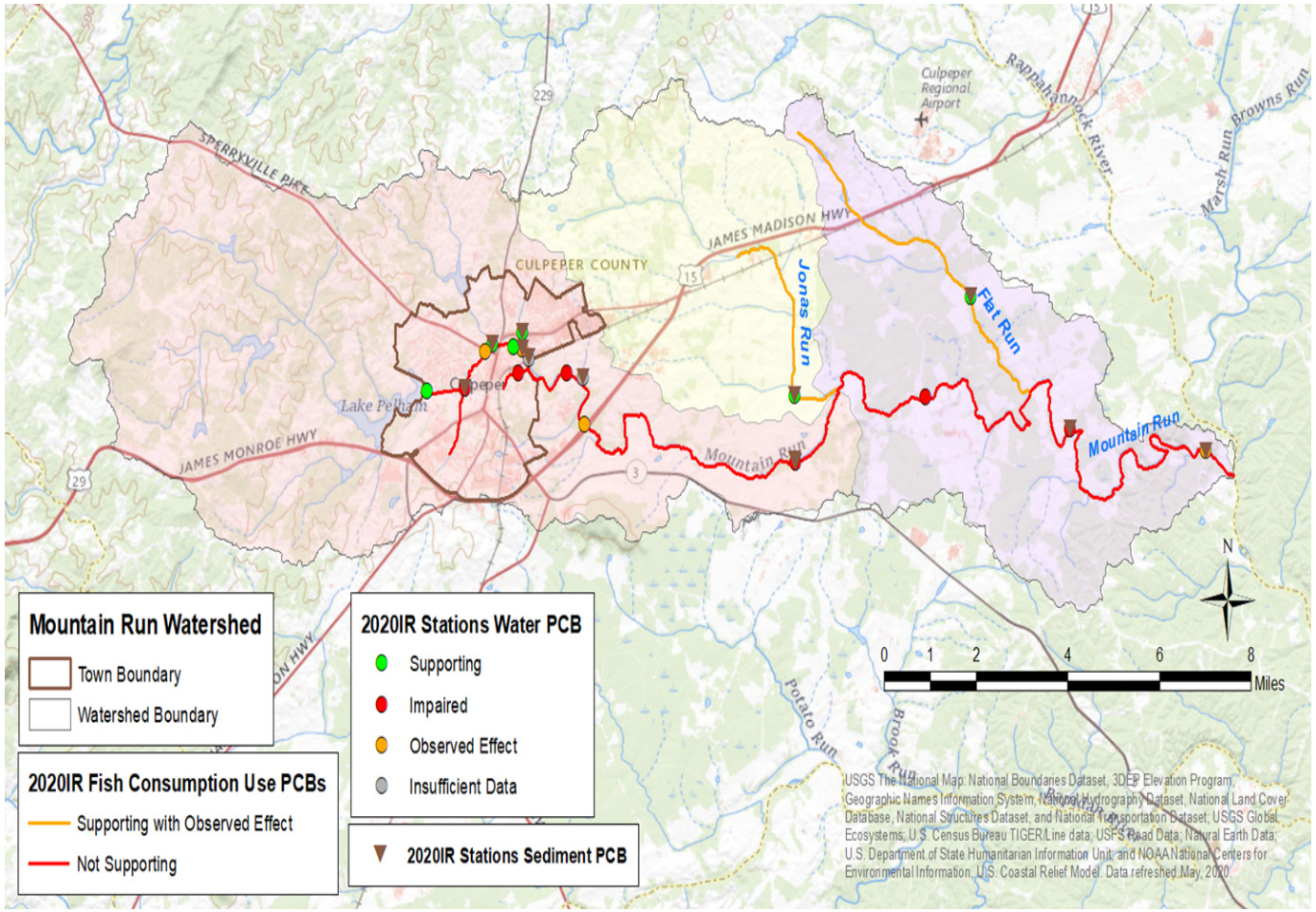


Mountain Run Fish Tissue PCB Concentrations (ng/g) from 1999-2013



DEQ TMDL Sampling Approach

2013 – 2015, 2018



- 2013 – 2021 water column & sediment samples
  - Water column grab samples: High and Base Flow (n = 65)
  - Sediment samples as needed
- Source identification
- TMDL model support
  - Calibration/validation

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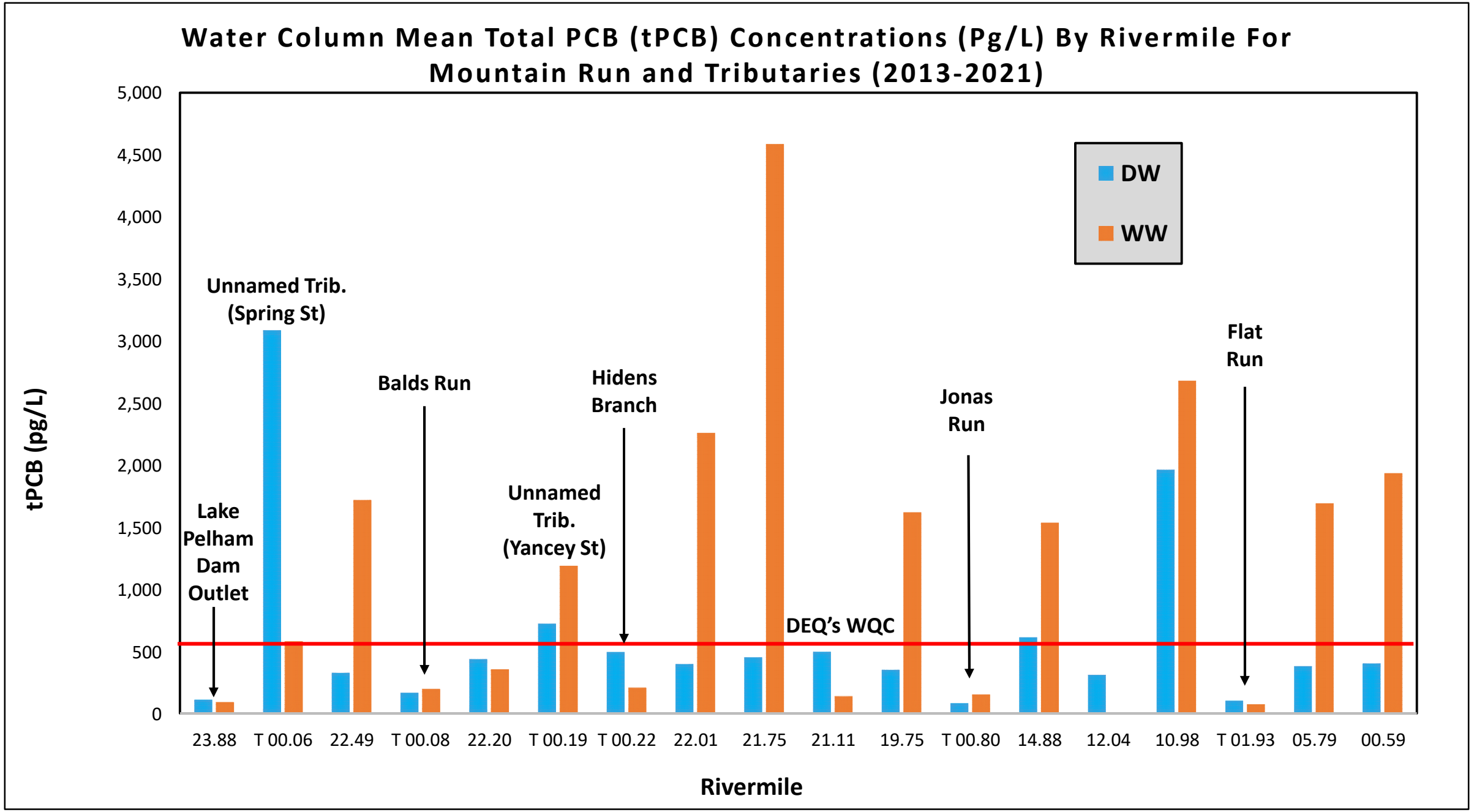
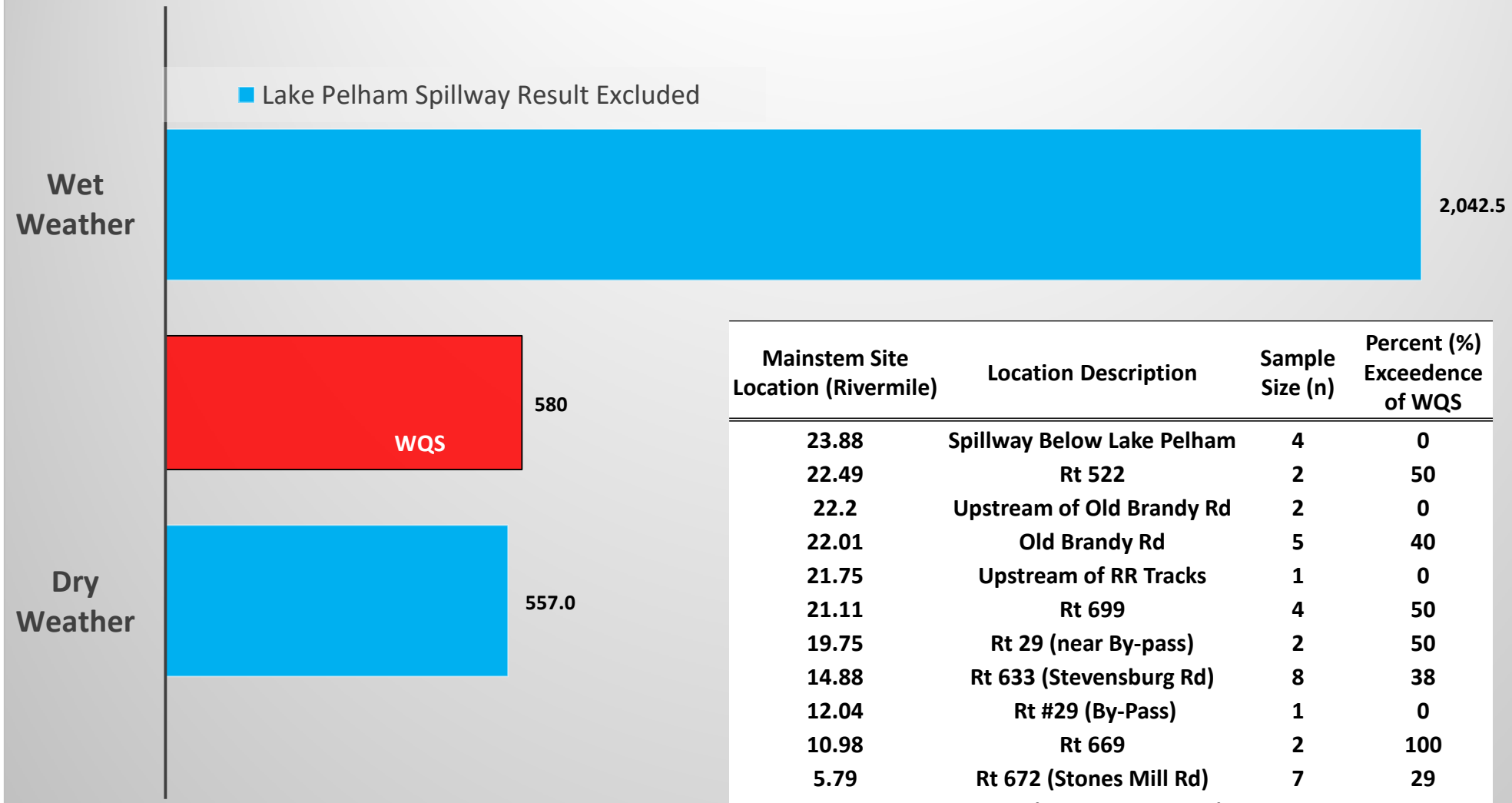
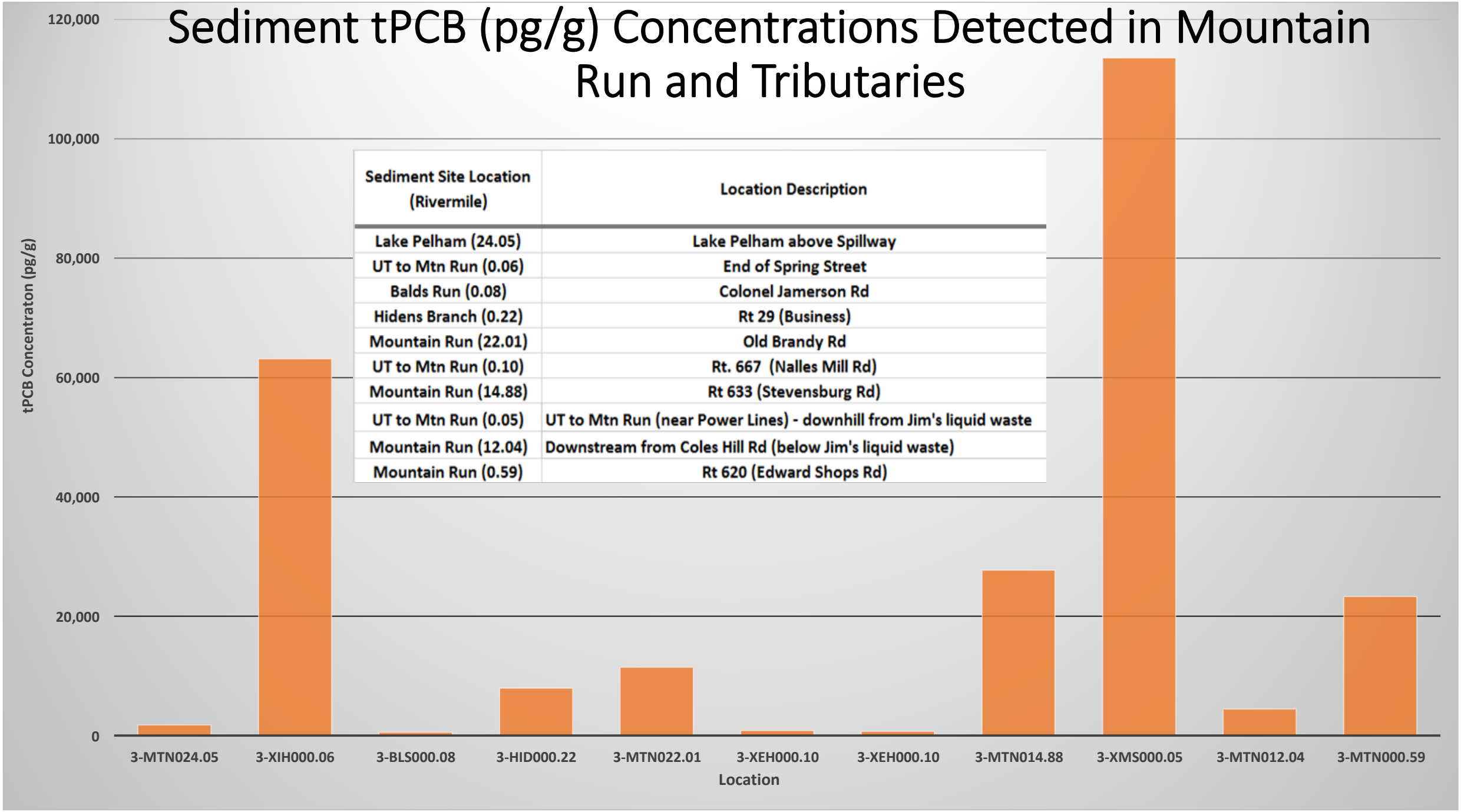

Water Column Mean Total PCB (tPCB) Concentrations (Pg/L) By Rivermile For Mountain Run and Tributaries (2013-2021)
tPCB (pg/L)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
DW
WW
Unnamed Trib. (Spring St)
Balds Run
Hidens Branch
Unnamed Trib. (Yancey St)
Jonas Run
Flat Run
Lake Pelham Dam Outlet
DEQ's WQC
23.88
T 00.06
22.49
T 00.08
22.20
T 00.19
T 00.22
22.01
21.75
21.11
19.75
T 00.80
14.88
12.04
10.98
T 01.93
05.79
00.59
Rivermile

Mean Total PCB (pg/L) Water Concentrations in Mountain Run During Wet and Dry Flow Conditions



Mainstem Site Location (Rivermile)	Location Description	Sample Size (n)	Percent (%) Exceedence of WQS
23.88	Spillway Below Lake Pelham	4	0
22.49	Rt 522	2	50
22.2	Upstream of Old Brandy Rd	2	0
22.01	Old Brandy Rd	5	40
21.75	Upstream of RR Tracks	1	0
21.11	Rt 699	4	50
19.75	Rt 29 (near By-pass)	2	50
14.88	Rt 633 (Stevensburg Rd)	8	38
12.04	Rt #29 (By-Pass)	1	0
10.98	Rt 669	2	100
5.79	Rt 672 (Stones Mill Rd)	7	29
0.59	Rt 620 (Edward Shops Rd)	6	17

Sediment tPCB (pg/g) Concentrations Detected in Mountain Run and Tributaries



Sediment Site Location (Rivermile)	Location Description
Lake Pelham (24.05)	Lake Pelham above Spillway
UT to Mtn Run (0.06)	End of Spring Street
Balds Run (0.08)	Colonel Jamerson Rd
Hidens Branch (0.22)	Rt 29 (Business)
Mountain Run (22.01)	Old Brandy Rd
UT to Mtn Run (0.10)	Rt. 667 (Nalles Mill Rd)
Mountain Run (14.88)	Rt 633 (Stevensburg Rd)
UT to Mtn Run (0.05)	UT to Mtn Run (near Power Lines) - downhill from Jim's liquid waste
Mountain Run (12.04)	Downstream from Coles Hill Rd (below Jim's liquid waste)
Mountain Run (0.59)	Rt 620 (Edward Shops Rd)

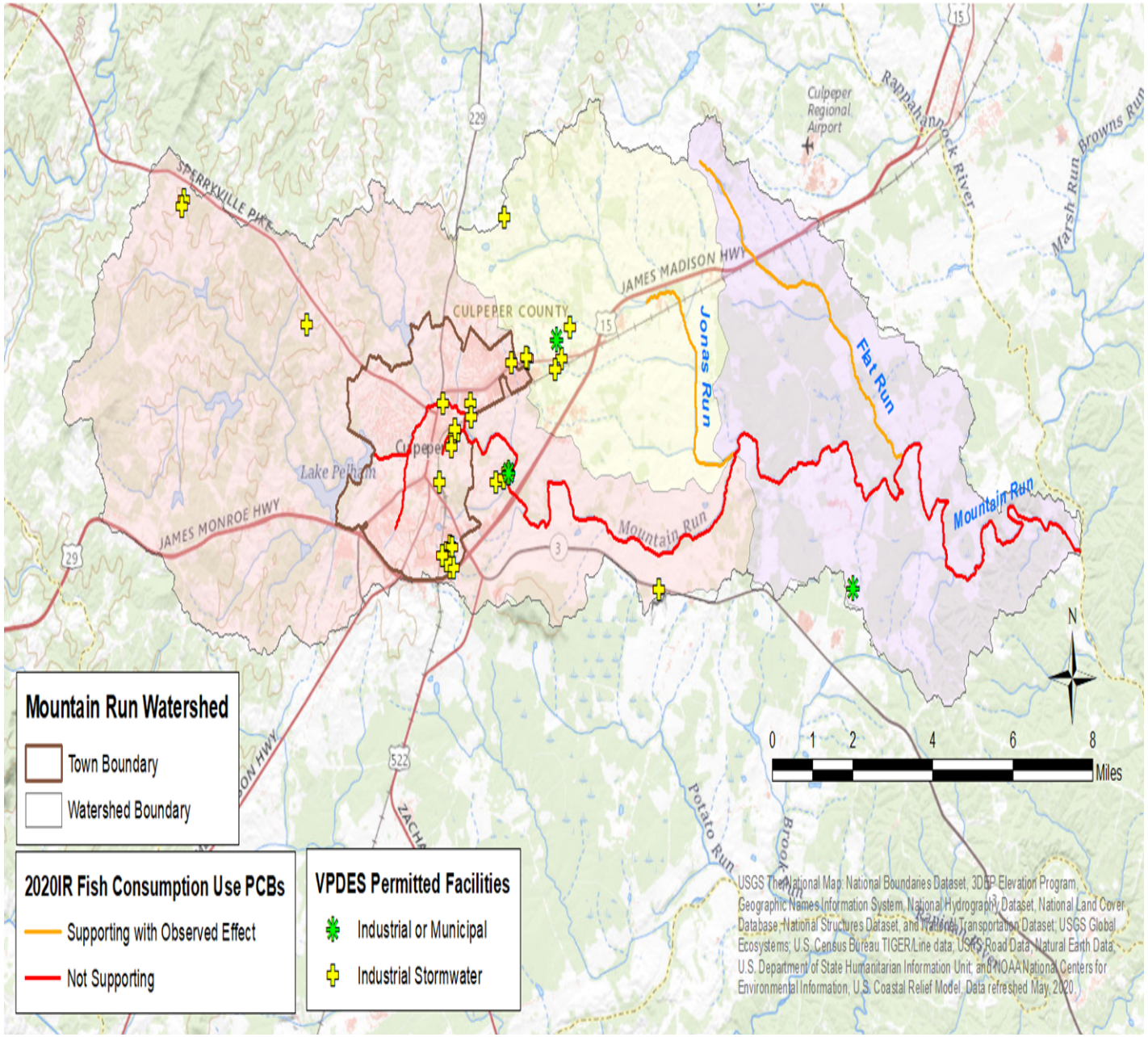
TMDL Source Category Point Sources

Permitted facilities

(1) Municipal WWTP

(7) Industrial Storm Water (General Permits)

No Regulated Storm Water (MS4)



MS4 – Municipal Separate Storm Sewer System

TMDL Source Category - VPDES Permitted Facilities

Facility Type	PCB Impaired Waterbody	Facility Name	Permit ID
Municipal WWTP			
	Mountain Run	Town of Culpeper WWTP	VA061590
Industrial Stormwater			
	Mountain Run. UT	TE Connectivity - Culpeper Plant	VAR050855
	Mountain Run. UT	Bingham and Taylor Corp	VAR050900
	Mountain Run. UT	Culpeper Municipal Power Plant	VAR051573
	Mountain Run	Wise Services and Recycling LLC	VAR051878
	Jonas Run, UT	Culpeper Recycling	VAR051928
	Mountain Run	Culpeper Towing and Salvage Incorporated	VAR051952
	Jonas Run, UT	AMRF Incorporated	VAR052293
Industrial Individual Permit			
		Not Applicable	

TMDL Source Category

Contaminated Sites

Voluntary Remediation Program (DEQ)

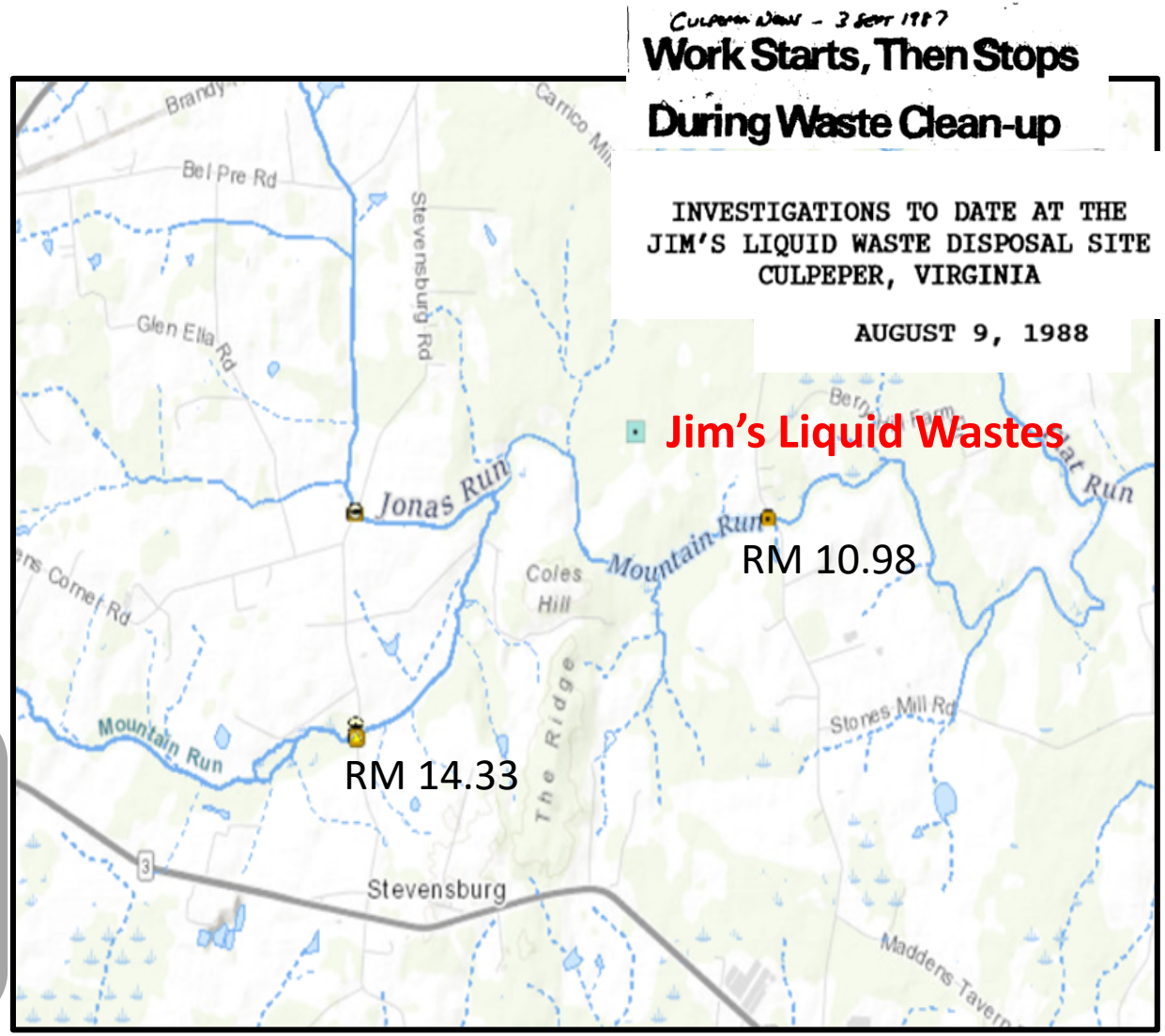
Spill sites

Electric Utility Transformer Pads

*RCRA Corrective Action

Rail Yards/Spurs

*CERCLA



* Screened but non identified as a source

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TMDL Source Categories

Non-regulated Surface Load

- Unregulated stormwater
- Unidentified Contaminated Sites
- Loads from small tributaries
- Atmospheric Deposition
- Unspecified Point Sources

Streambed Sediment

Photo: Bryan Hofmann

Determining a PCB Endpoint: Two Options

Use water quality criterion

*580 pg/L

Default if < site specific value

* Human health criteria are based on the assumption of average amount of exposure on a long-term basis.

Calculate site-specific value

Based on fish tissue samples from impaired stream

Calculate bioaccumulation factor for each species

PCB levels in the stream ⟷ PCB levels in fish tissue

Bioaccumulation Factor Approach (BAF)

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Determining a PCB Endpoint in Mountain Run

Feeding Strategy	Fish Species	Endpoint (pg/L)	Sample Size (n)	Individuals
Predator	American Eel	25.00	11	76
Predator	Fallfish	290.00	2	12
Predator	Rock Bass	580.00	1	10
Benthivore-generalist	Sunfish sp.	250.00	10	89
Predator	Smallmouth Bass	360.00	1	4
Benthivore-generalist	White Sucker	110.00	3	24
Benthivore-generalist	Yellow Bullhead	56.00	7	39

Scenario 1 based on all species	
Summary Statistics	
n	35
min (pg/L)	25.0
max (pg/L)	580.0
mean (pg/L)	240.0
median (pg/L)	250.0
geometric mean (pg/L)	160.0
weighted mean (pg/L) sample size	140.0
weighted mean (pg/L) indivduals; n= 254	160.0

Scenario 2 based on Feeding Strategy	
Summary Statistics	
Scenario 2	Mean (pg/L)
Benthivore-Generalists	140
Predators	310

Scenario based on using Advisory Species	
Scenario	pg/L
American Eel	25
Yellow Bullhead	56

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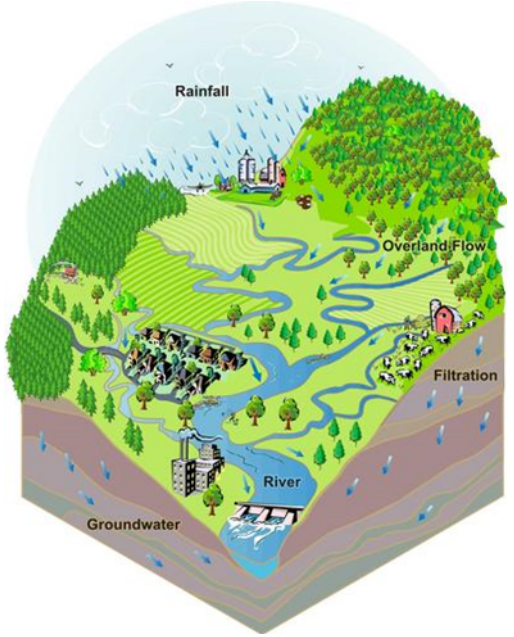
HSPF Model
Process

- PCB model consists of

  3 major components:

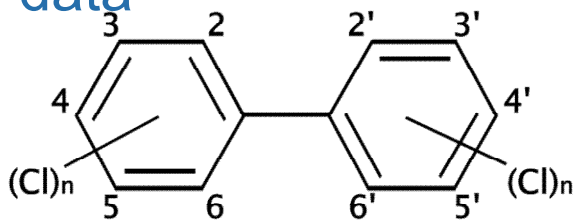
  1. Hydrology
  2. Sediment transport
  3. PCB fate and transport

- Model calibrated using observed data:
  1. Stream gage flow data
  2. Suspended sediment concentration data
  3. PCB concentration data



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

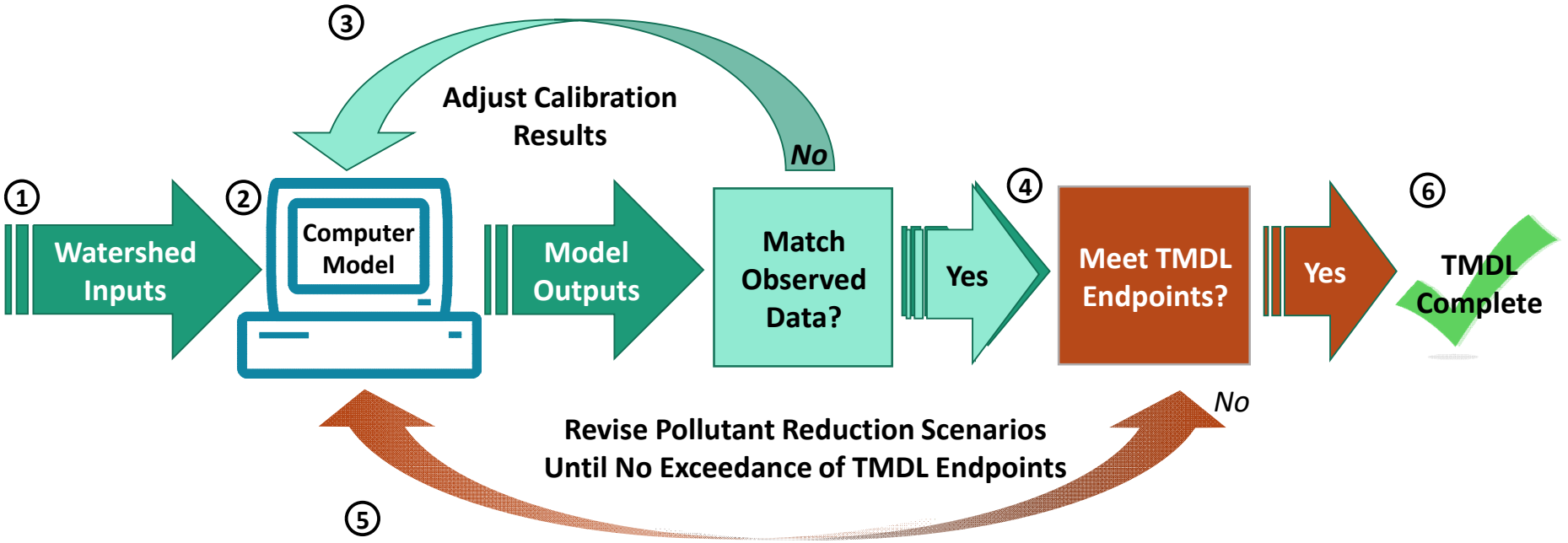
https://photogallery.sc.egov.usda.gov/netpub/server.np



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

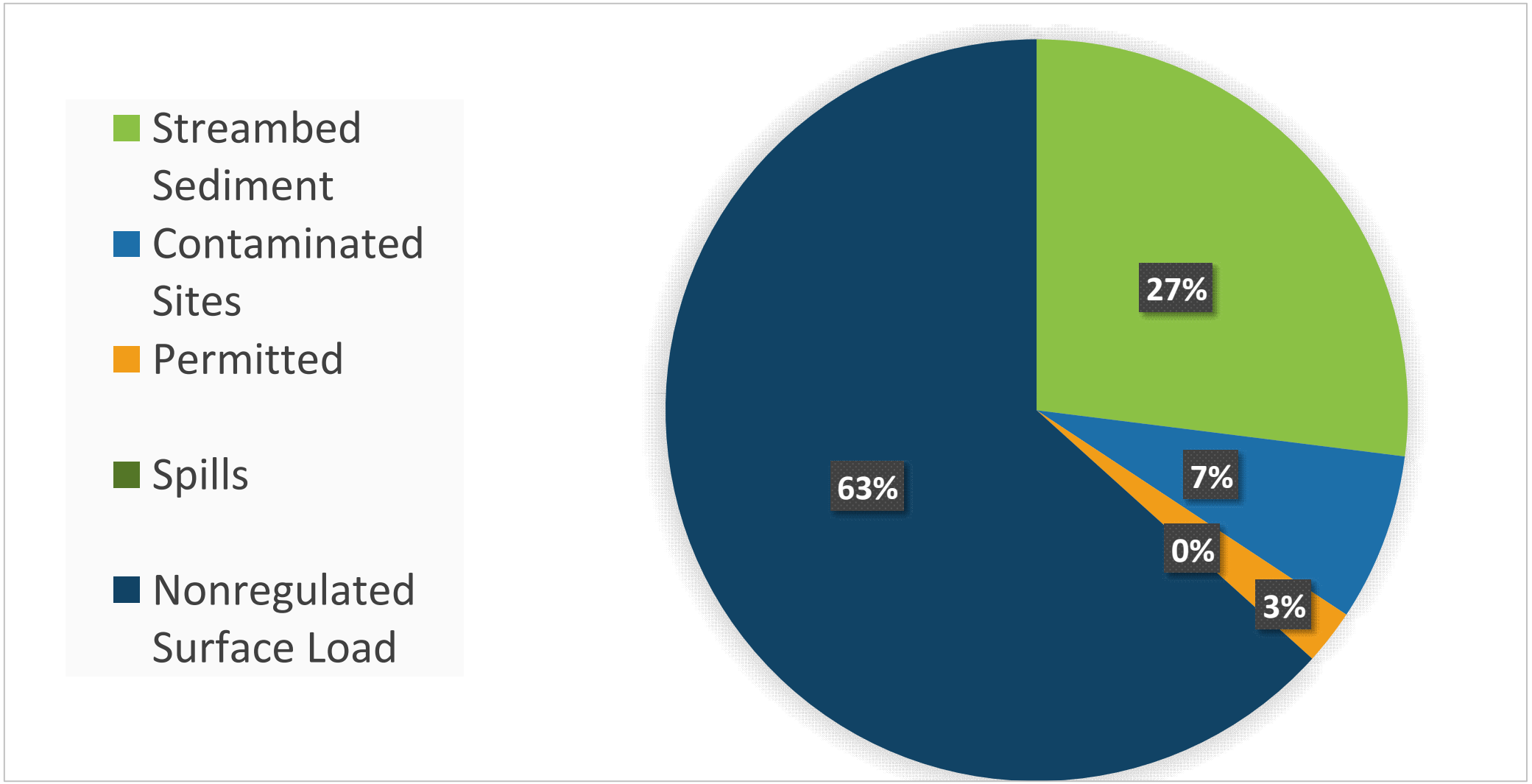
How is the model used?

1. Watershed inputs are used to develop model.
2. Model simulates watershed processes (flow, pollutant fate and transport).
3. Model is calibrated to observed data.
4. Calibrated PCB outputs are compared with TMDL endpoints.



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

Relative Contributions of Different PCB Sources for the Existing Condition in the Mountain Run Watershed



Mountain Run PCB Allocations

- Scenario includes the updated application of the WQC
  - "Long Term Average" included in a footnote
- Use the site-specific BAF derived scenario (#2)
  - TMDL Endpoint = 310 pg/L

Allocation Scenario	Required PCB Loading Reductions to Meet the TMDL Endpoint (%)					Exceedance of 580 pg/L (%)	Daily Mean tPCB conc. (pg/L)	Daily Median tPCB conc. (pg/L)
	Loads from Permitted Sources	Loads from Known Contaminated Sites	Loads from Nonregulated Surface Sources	Loads from Streambed Sediments	Spills			
Existing Conditions	0	0	0	0	0	14	669	329
Allocated Conditions*	-	99	55	0	100	12	440	294

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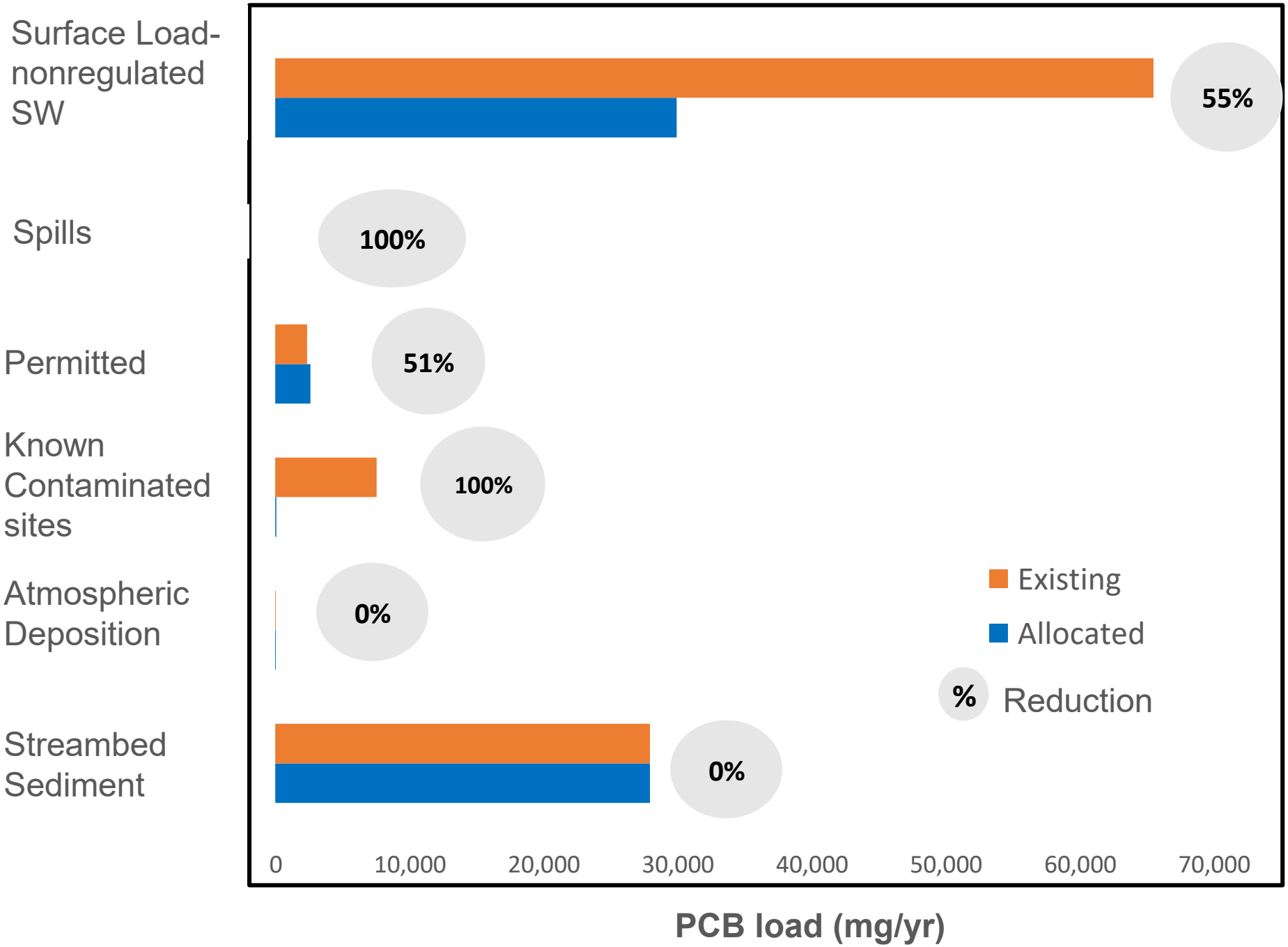
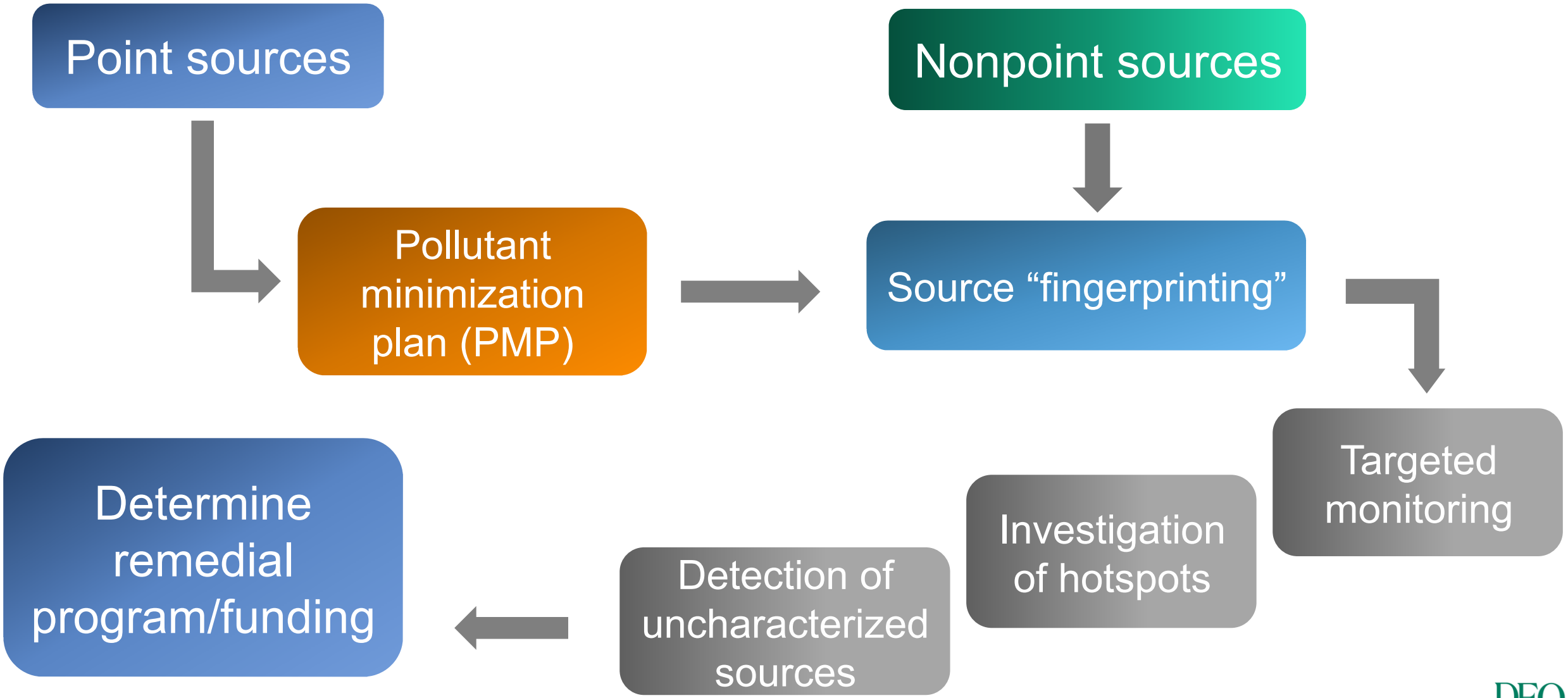
Mountain Run PCB Source Loads

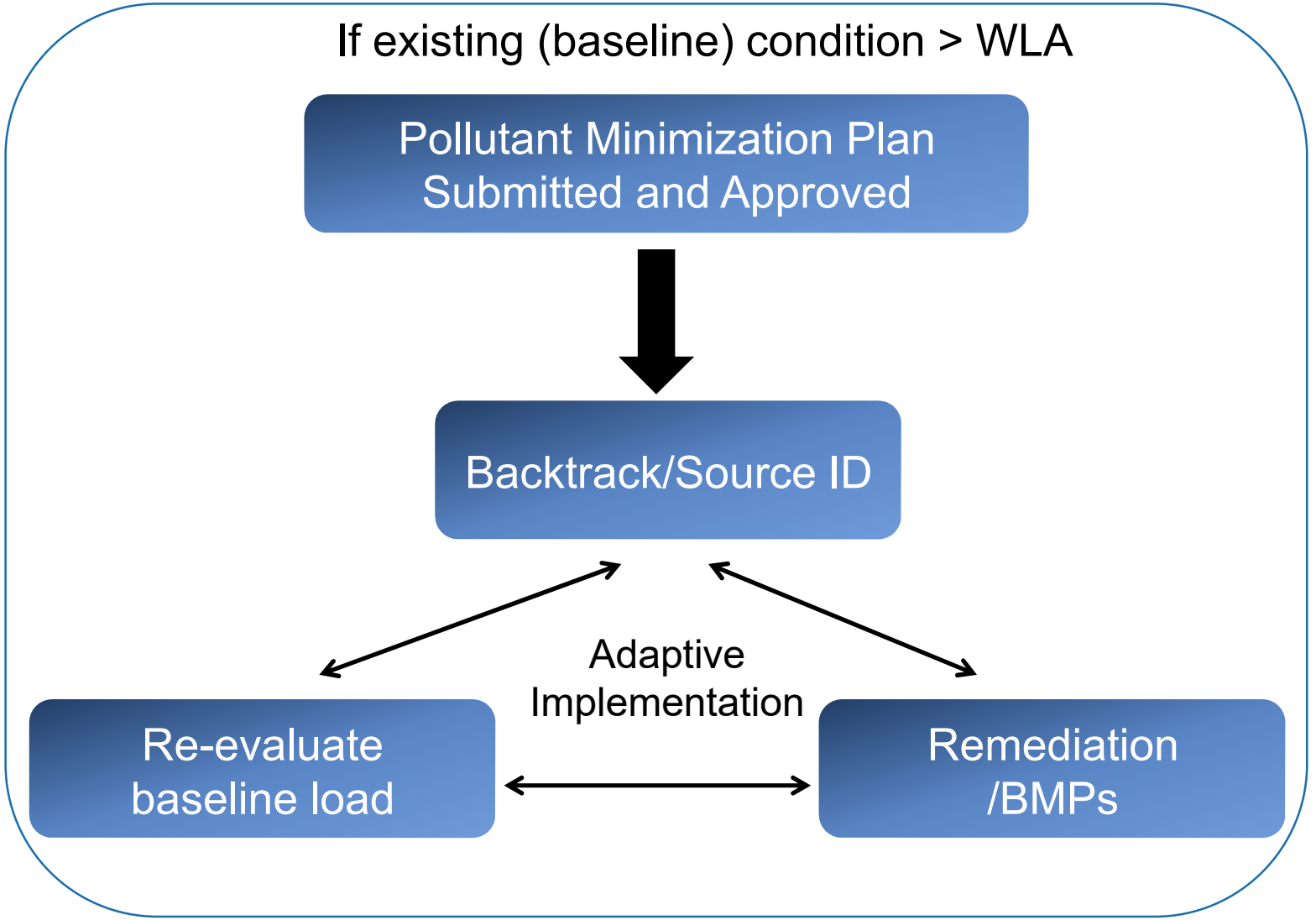
TMDL Endpoint = 310 pg/L



TMDL Implementation Process



VPDES Point Sources
Pollutant Minimization Plan



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Next Steps

- 30-day public comment period
  - (Sept. 6 – Oct. 6, 2023)
- Finalize draft TMDL

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Extra Slides

VDH Threshold

- In 2012 increased fish tissue PCB threshold from 50 ppb to 100 ppb

VDH Changes -
- Increased body weight from 70 kg to 80 kg (176 lbs)
- Changed life expectancy inc. from 70 yrs to 78 yrs & from 30 yrs to 32 yrs a person would live in the same residence
-- Decreased from four meals/month to two

  - Designed to protect public health when contamination has been identified.
  - Risk Assessment calc. designed for known contamination in a finite geographical area (e.g., Superfund site).

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Note: VDH is not required to go through administrative regulatory process to change threshold(s)

For technical support 703-583-3906

PCBs in Municipal Products

Prepared by:

March, 2015

City of Spokane
Wastewater Management Department

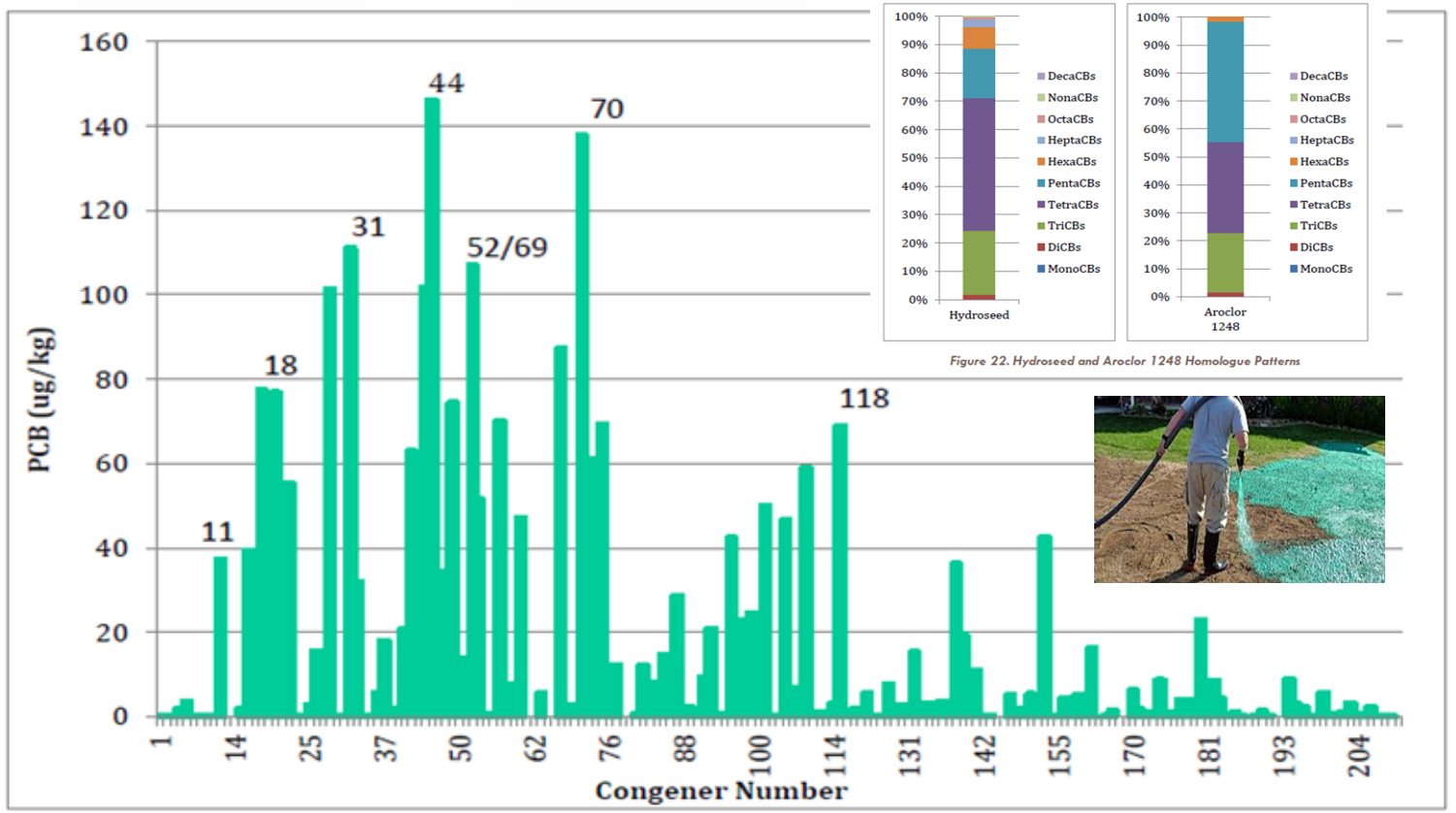

Figure 22. Hydroseed and Aroclor 1248 Homologue Patterns

Figure 21. Hydroseed Congeners

- Examples of other products tested
  - Pennzoil SAE5W-30
  - Valvoline Full Synthetic
  - Road paint

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