Environmental Issues

Photo courtesy of J. Willoughby, 2005, ICPRB

West Virginia Water Resources Training Workshops

Presented by the Interstate Commission on the Potomac River Basin

Sponsored by the West Virginia Department of Environmental Protection

With funding from the American Reinvestment & Recovery Act

Introduction

- Environmental Flows
  - Definition
  - Concepts
  - Tools
- Water Quality
  - Clean Water Act
    - Impairments
    - Total Maximum Daily Loads (TMDLs)

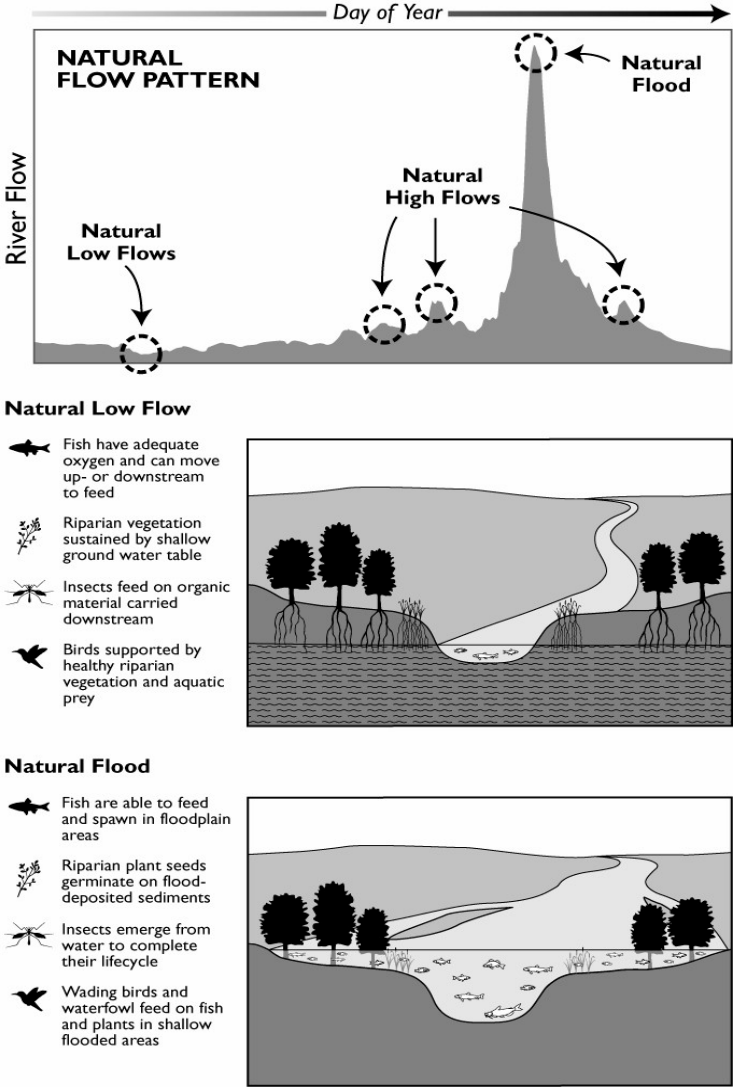
Environmental flows

Photo courtesy of
J. Willoughby, ICPRB

> Environmental flows can be defined as the quality, quantity and timing of water flows required to maintain the components, functions, processes, and resilience of aquatic ecosystems that provide multiple goods and services to people.

(Cummins et al., 2010)

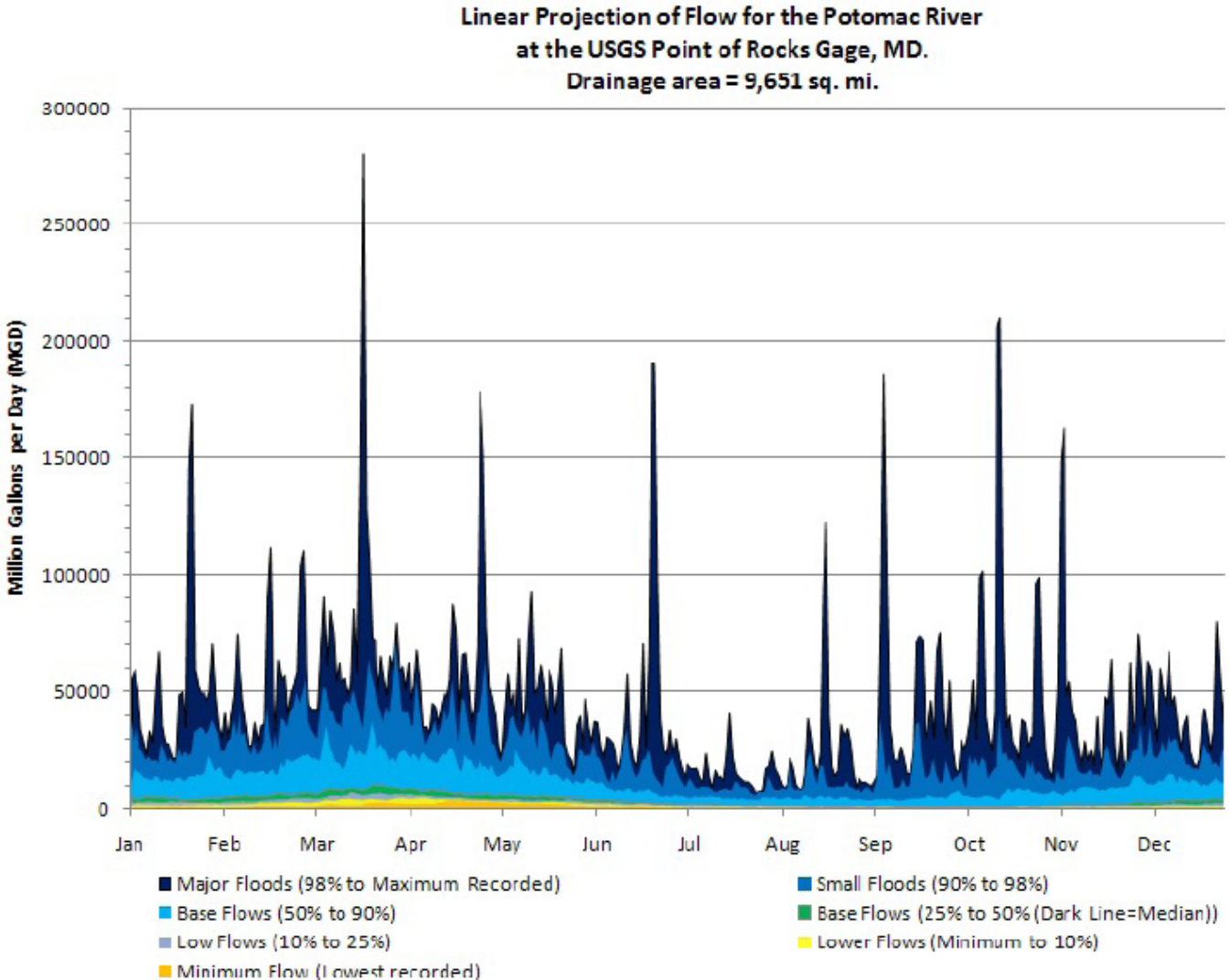
Environmental flows (cont'd)



- Ecological integrity depends on maintaining quantity of flows and flow variability
  - Need right amount of water at right time
  - High/low flow indicators such as:
    - 7Q10: the lowest stream flow for seven consecutive days that would be expected to occur once in ten years
  - Influences: impoundments, withdrawals…

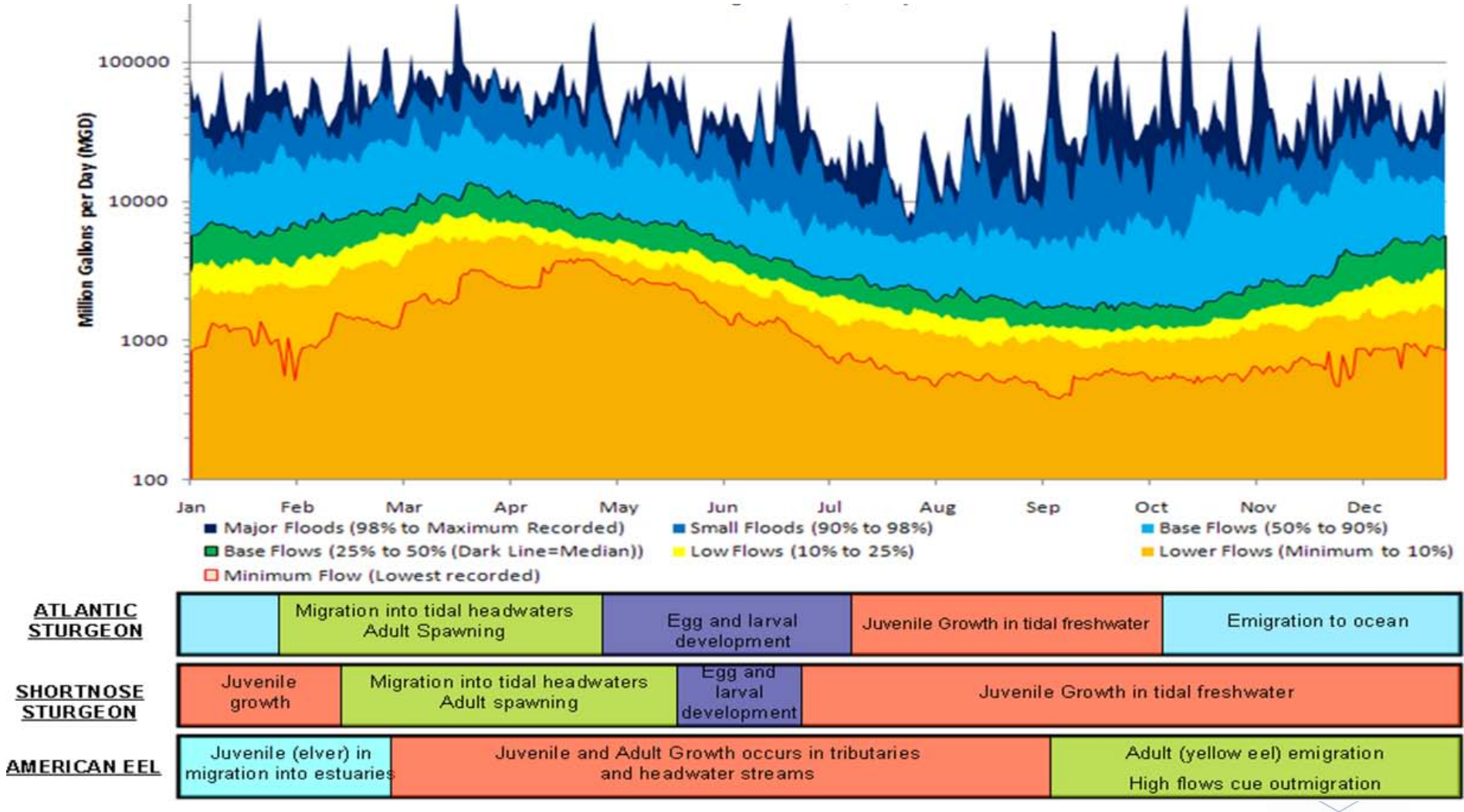
Figure: (Richter, 2004)

Environmental flows (cont'd)



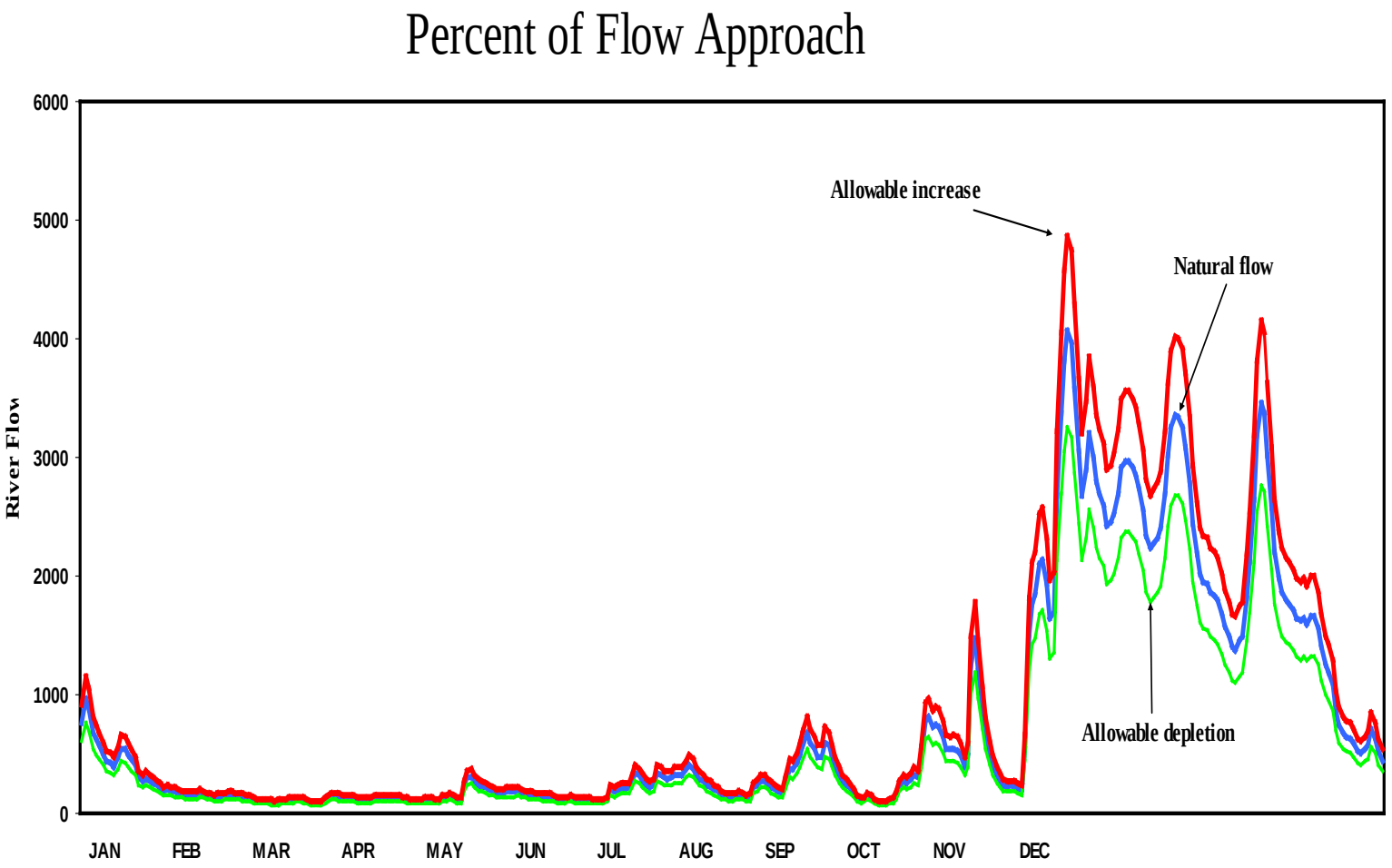
(Cummins et al., 2010)

Environmental flows (cont'd)



(Cummins et al., 2010)

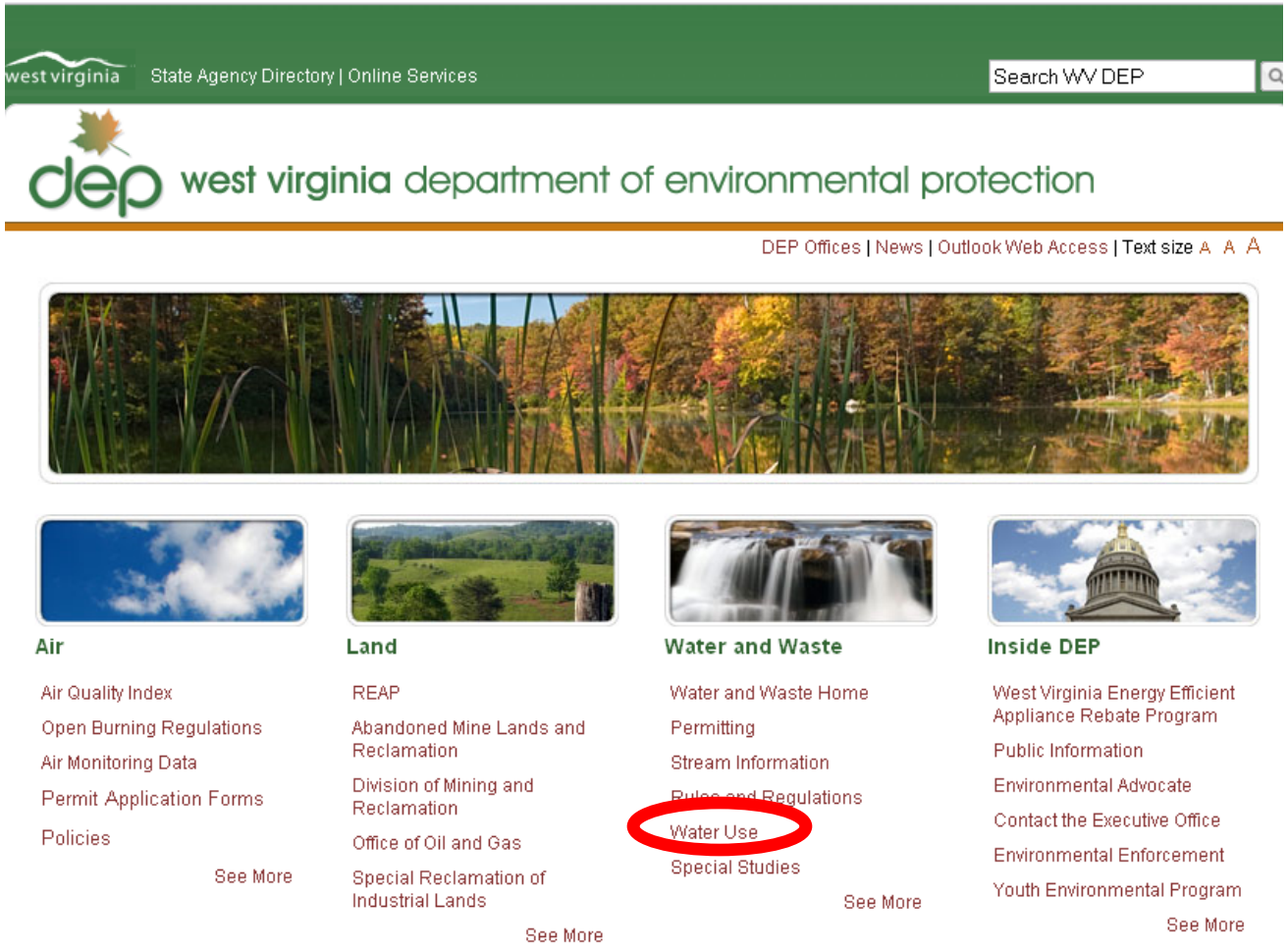
Environmental flows (cont'd)



(Richter, 2004)

Environmental flows (cont'd)

West Virginia Water Withdrawal Guidance Tool (www.dep.wv.gov)



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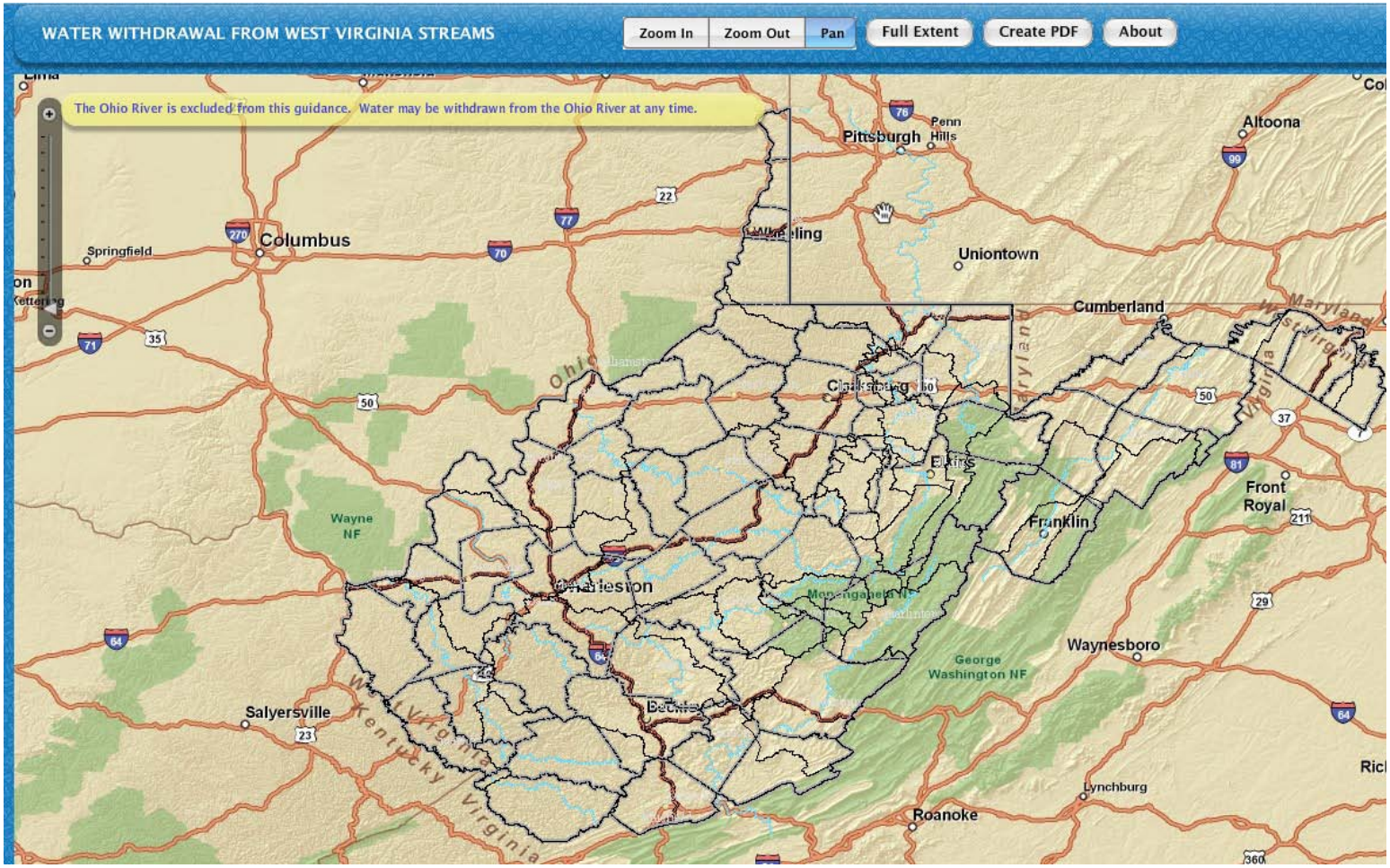
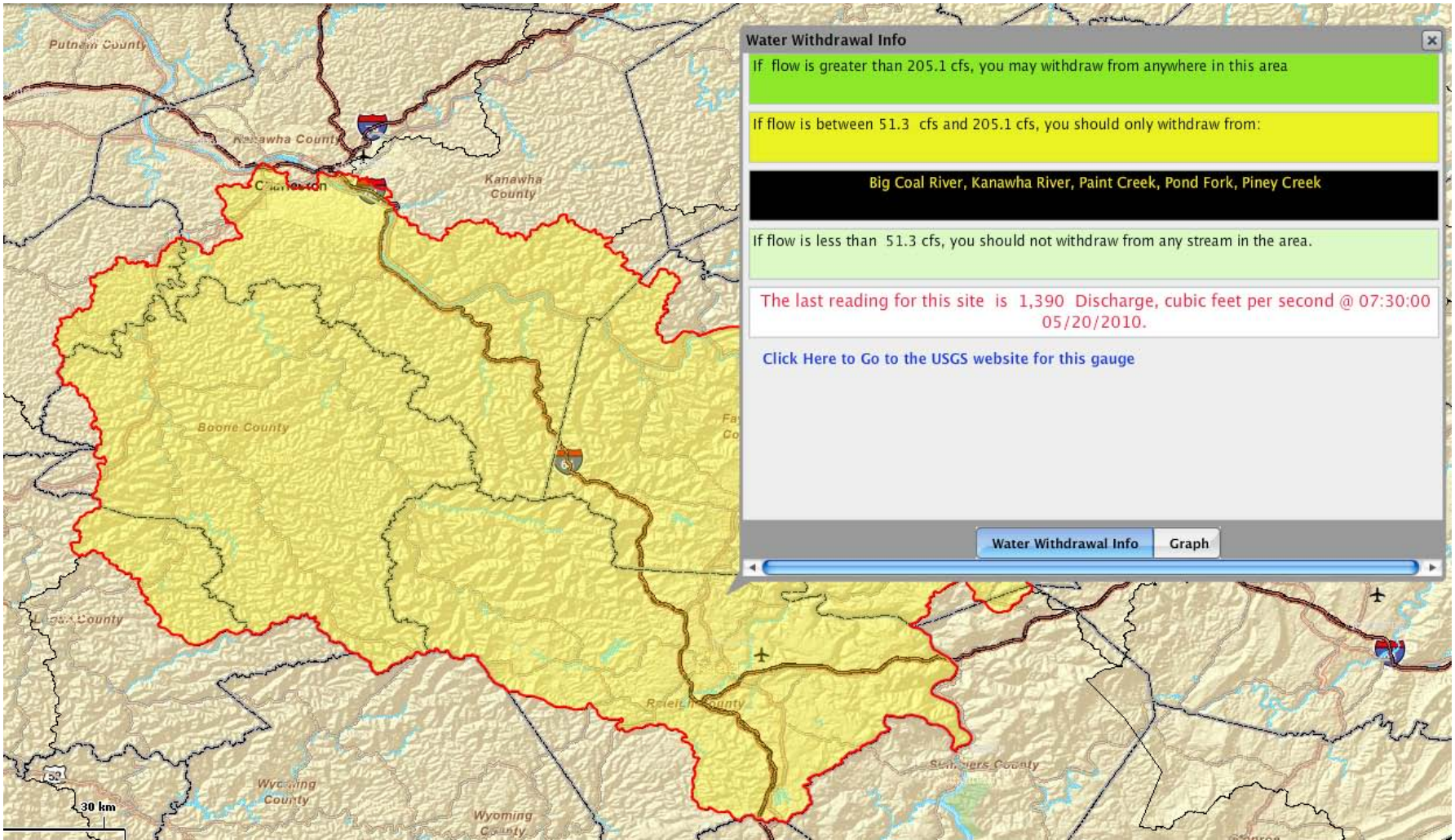
West Virginia Water Withdrawal Guidance Tool



Environmental flows (cont'd)

West Virginia Water Withdrawal Guidance Tool



Environmental flows (cont'd)

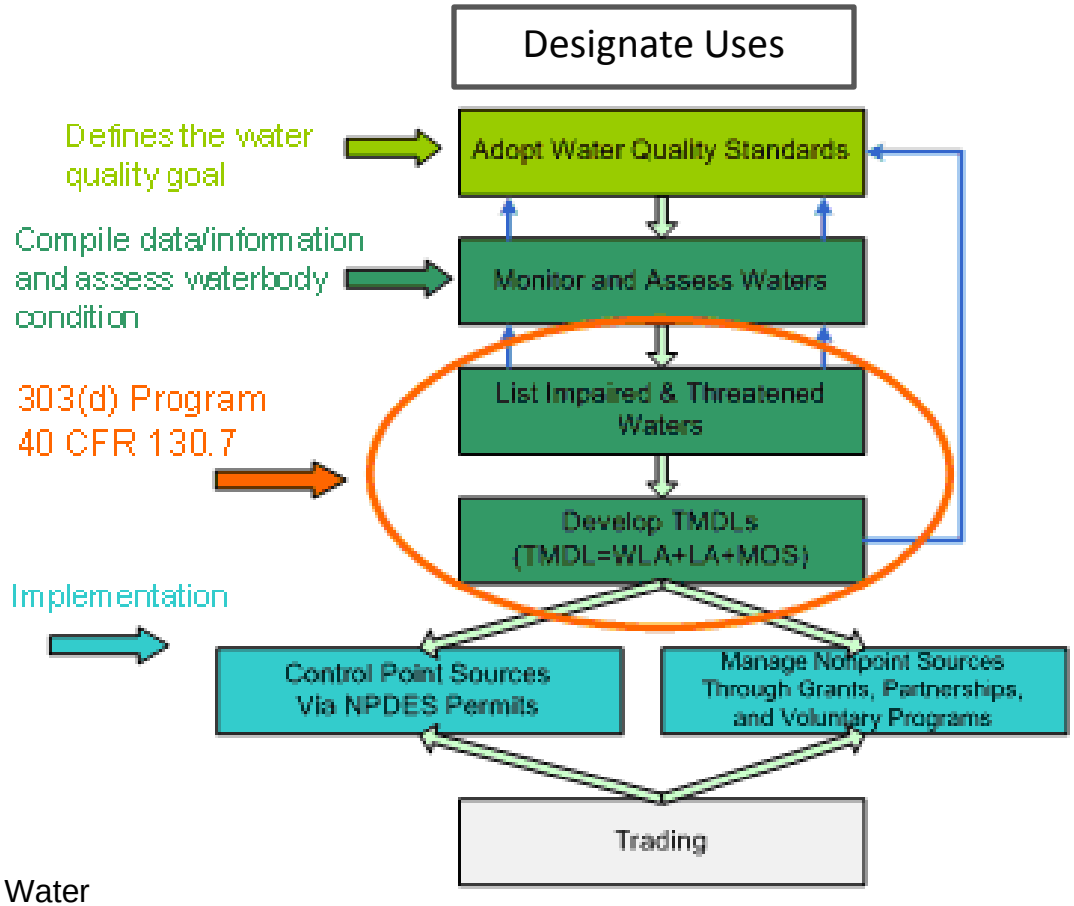
- Water use thresholds determined using the Tennant method, developed in 1976

- The Tennant method
  - assumes that some percentage of the mean flow is needed to maintain a healthy stream environment
  - environmental quality of different flows determined by the quality of the physical habitat provided (stream width, depth, and velocity)

(Jowett, 1997)

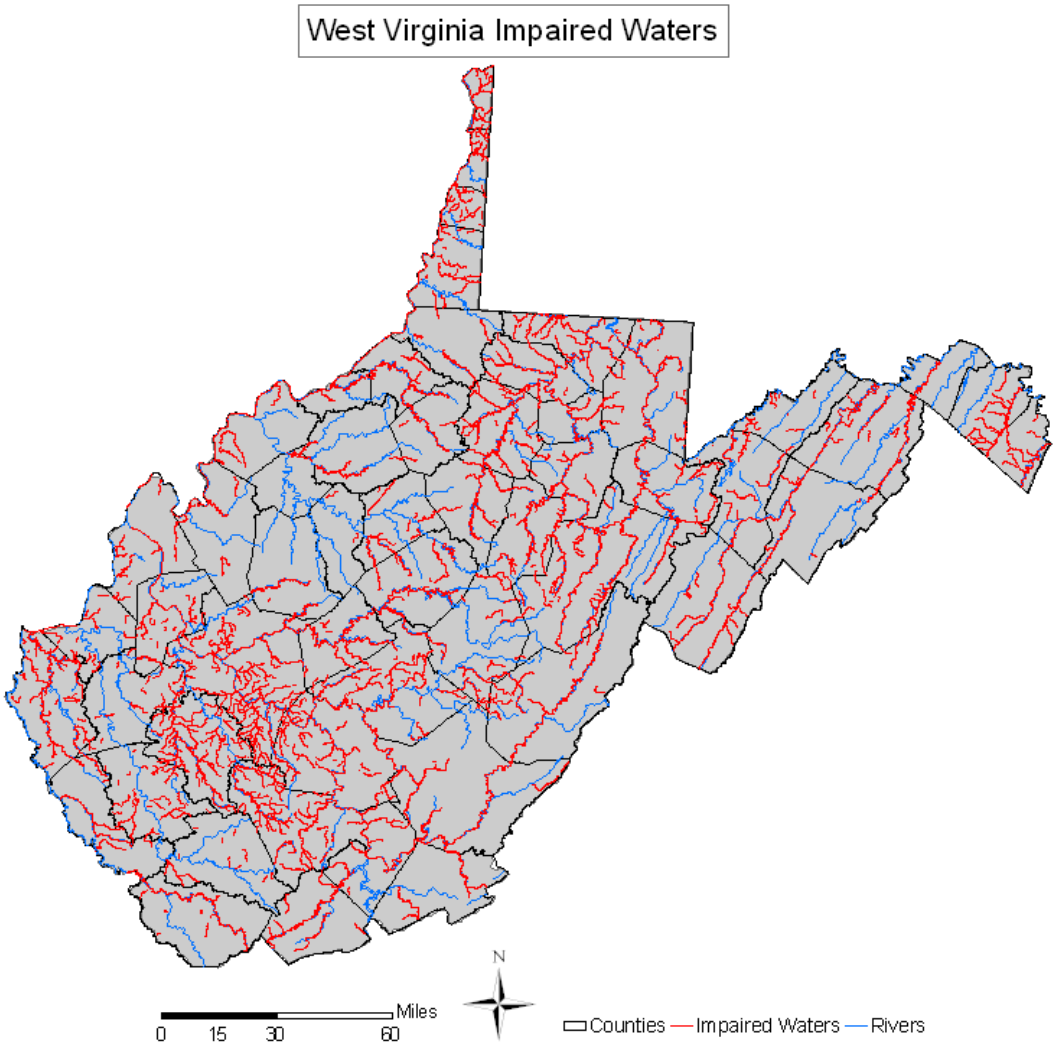
Water quality

- US Clean Water Act (1972) Goal: "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters“



Source: EPA Office of Water

Water quality (cont'd)



57% of WV rivers and streams assessed

Of those, 56% are impaired

Water quality (cont'd)

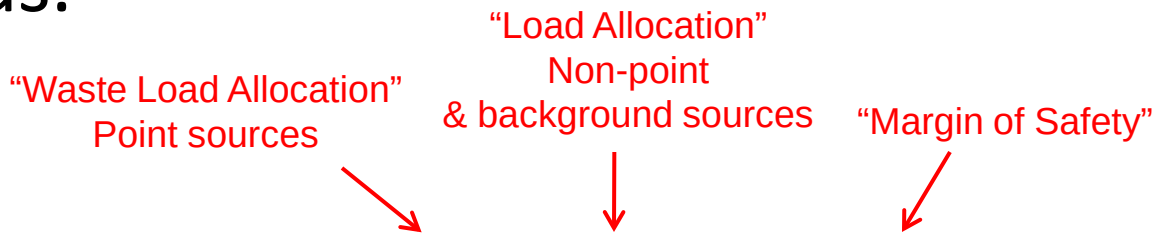
- WV Impairments

	Size of Assessed Waters with Listed Causes of Impairment	
Cause of Impairment Group	**Rivers and Streams (miles)**	**Lakes, reservoirs, and ponds (acres)**
Ammonia	5.4	
Cause unknown - impaired biota	5,152.1	
Dioxins	359.2	
Flow alteration(s)	44.3	
Mercury	669.0	12,018.0
Metals (other than Mercury)	4,455.6	54.0
Nutrients	30.7	100.0
Organic enrichment/Oxygen depletion	23.4	8.0
Pathogens	4,152.8	
pH/Acidity/Caustic conditions	1,378.1	
Polychlorinated Biphenyls (PCBs)	1,056.4	9,198.0
Salinity/Total dissolved solids/Chlorides/Sulfates	21.6	
Sediment		193.0
Temperature	178.7	
Toxic inorganics	0.2	

Water Quality (cont'd)

- A Total Maximum Daily Load (TMDLs) must be developed for each impaired water body

- A TMDL is "a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards."



Water Quality (cont'd)

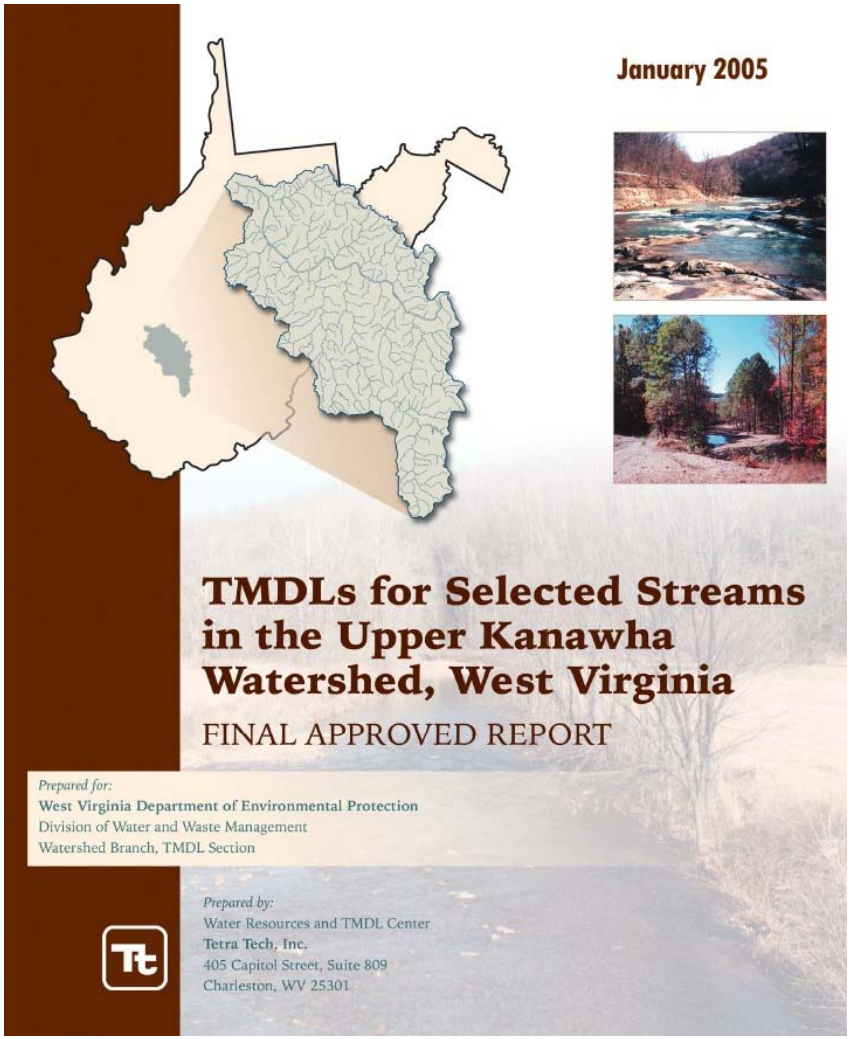
- TMDL process:
  - Identify pollutant of concern
  - Estimate waterbody loading capacity
  - Estimate pollutant loading from all sources (pt and nps)
  - Quantify pollutant reductions needed to meet water quality standards
  - Allocation (+ margin of safety) of pollutant load among the sources to meet water quality standards
  - Public review and comment

Water Quality (cont'd)

- WV TMDLs for selected pollutants
  - Cumulative since October 2005

Pollutant	Number of TMDLs
Iron	716
Aluminum	454
Fecal Coliform	450
Manganese	397
pH	289
Sediment	83
Biological	80
Acid	27
Organic Enrichment	13
Selenium	13
Chloride	7
PCBs	7
Phosphorus	6

TMDL example – Morris Creek, WV



- Located in Kanawha County, 25mi. SE of Charleston
- Listed since 1996 as impaired for metals and pH due to acid mine drainage from abandoned coal mines

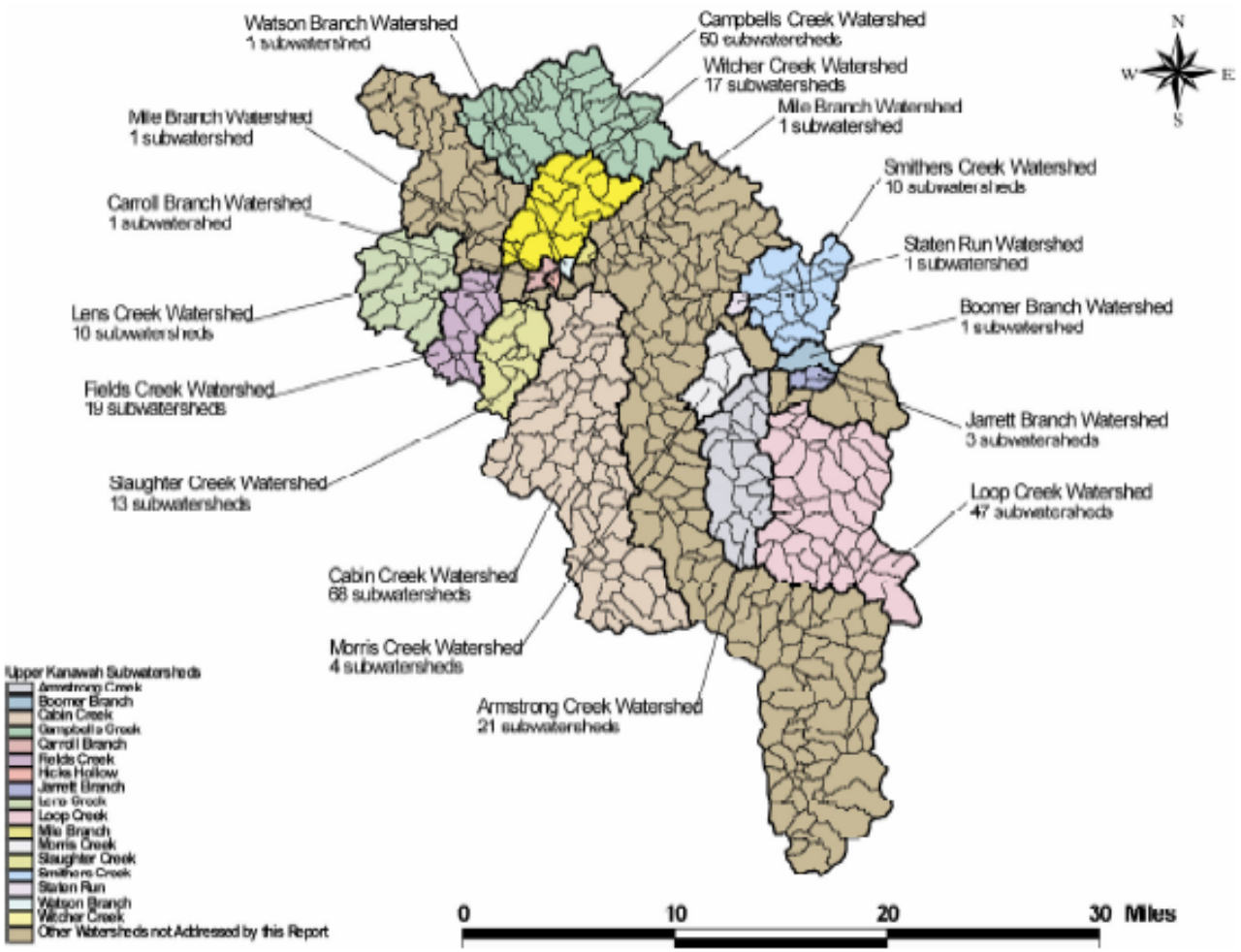
TMDL example – Morris Creek, WV

- Morris Creek designated uses:
  - warm-water fishery
  - drinking water
  - contact recreation

- Morris Creek declared impaired due to lack of aquatic life and deposits of iron and aluminum on the streambed

Acid mine drainage in a tributary to Morris Creek
Source: EPA

TMDL example – Morris Creek, WV



TMDL results for Morris Creek to achieve water quality standards:

- aluminum reduction of 5,900 lbs/yr
- iron reduction of 8,007 lbs/yr
- manganese reduction of 4,444 lbs/yr

Source: TMDLs for selected streams in the Upper Kanawha Watershed Report

TMDL example – Morris Creek, WV

Limestone lined drainage channel
Source: EPA

- Restoration efforts: anaerobic and aerobic wetlands, open limestone channels, and polishing ponds at four sites in the watershed
- Water quality improved immediately after treatment system installation
- Expected to be de-listed in 2010
- Treatment system maintenance ongoing

TMDL example – Morris Creek, WV

Project site	pH level: pre/post treatment	Metal reductions achieved		
		Aluminum (lbs/yr)	Iron (lbs/yr)	Manganese (lbs/yr)
Possum Hollow	3.5/6.7	390.55	47.45	102.2
Blacksnake Hollow	4.4/5.0	84.45	76.65	36.86
Lower Mainstem	4.0/6.3	1,759.3	9,249.1	1,098.65
Upper Mainstem	4.2/5.4	31,006.75	276,483.85	31,119.9
Total Reductions	--	**33,248**	**285,857**	**32,320**
TMDL Allocations	--	5,900	8,007	4,444

Source: EPA

Summary

- Environmental flows
  - Essential to maintaining ecosystem integrity in West Virginia
  - Assessment/protection methods: % of flow, WV water withdrawal guidance tool
  - ICPRB/TNC/CoE 2.5 yr project to quantify environmentally sustainable flows in the Potomac Basin (www.potomacriver.org)

- Water quality
  - Regulated under the US Clean Water Act
  - 57% of WV rivers and streams assessed, 56% of which are impaired
  - TMDLs developed for many impaired waters, with some success stories, but more work remains

References

- Cummins, J., C. Buchanan, H. Moltz, A. Griggs, C. Jones, R. Kraus, N. Hitt, and R.V. Bumgardner. 2010. *Draft* Potomac Large River Ecologically Sustainable Water Management Report. Prepared for The Nature Conservancy.
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- Tennant, D. L. 1976. 'Instream flow regimens for fish, wildlife, recreation, and related environmental resources', in Orsborn, J. F. and Allman, C. H. (Eds), *Proceedings of the Symposium and Speciality Conference on Instream Flow Needs II*. American Fisheries Society, Bethesda, Maryland. Jowett, I.G. 1997. Instream flow methods: A comparison of approaches. Regulated Rivers: Research and Management. 13:115-127.