

AMD Remediation at the Watershed vs Point-Source Scales: Costs and Benefits

West Virginia Mine Drainage Task Force Symposium
Charleston, WV
April 16, 2025



Definitions

regulated discharges

- point-source (NPDES)
- post-law (SMCRA Title V)
- WVDEP Office of Special Reclamation (OSR) Bond Forfeiture (BF) sites
- active discharges

unregulated discharges

- nonpoint-source
- pre-law (SMCRA Title IV)
- WVDEP Office of Abandoned Mine Lands and Reclamation (AML) sites

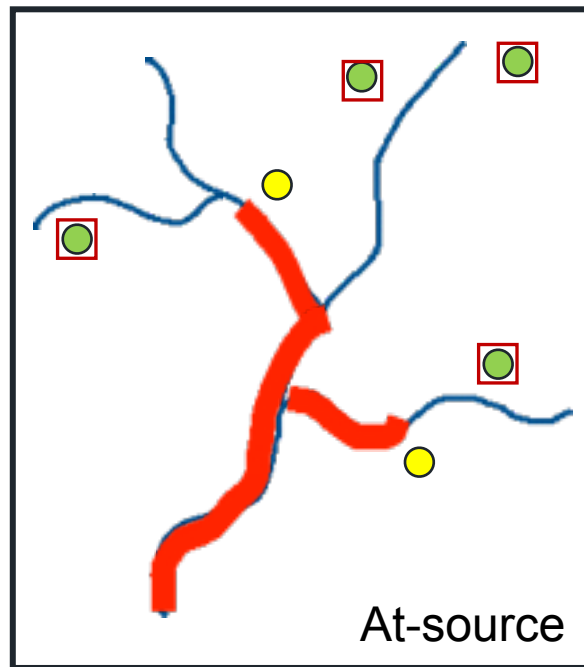
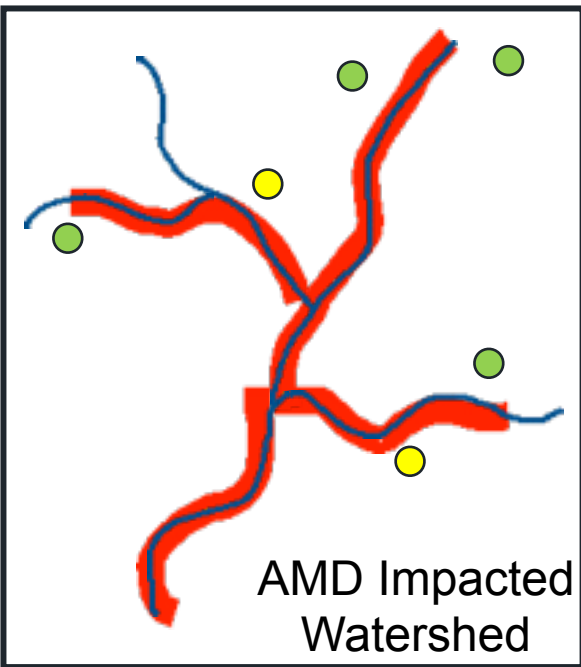
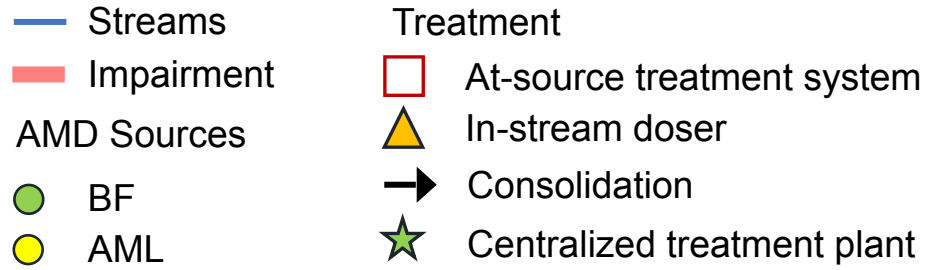
point-source approach

At-source treatment of regulated discharges ONLY

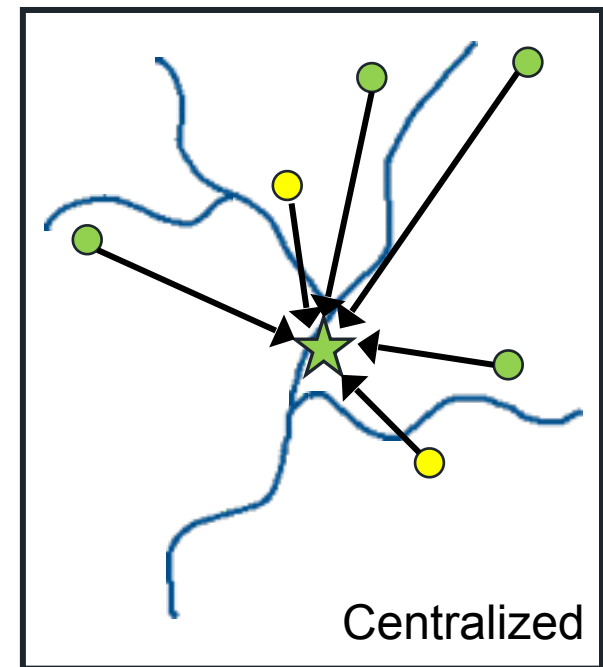
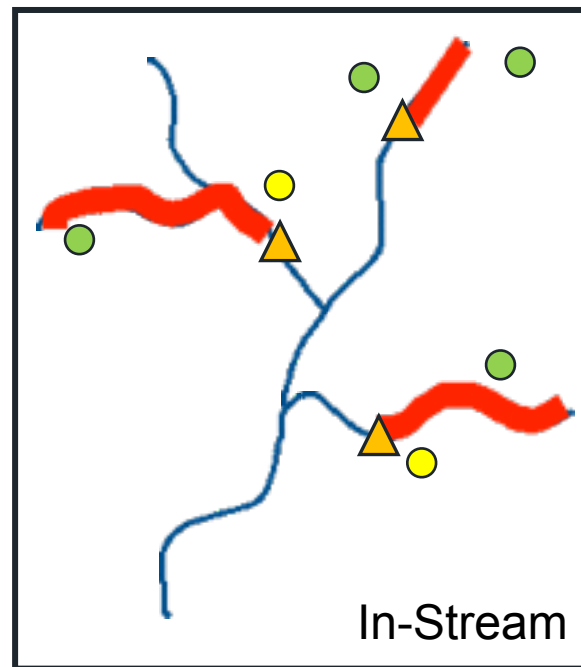
watershed approach

At-source AND/OR in-stream AND/OR centralized treatment of regulated AND unregulated discharges

Treatment Alternatives for AMD-impacted watersheds

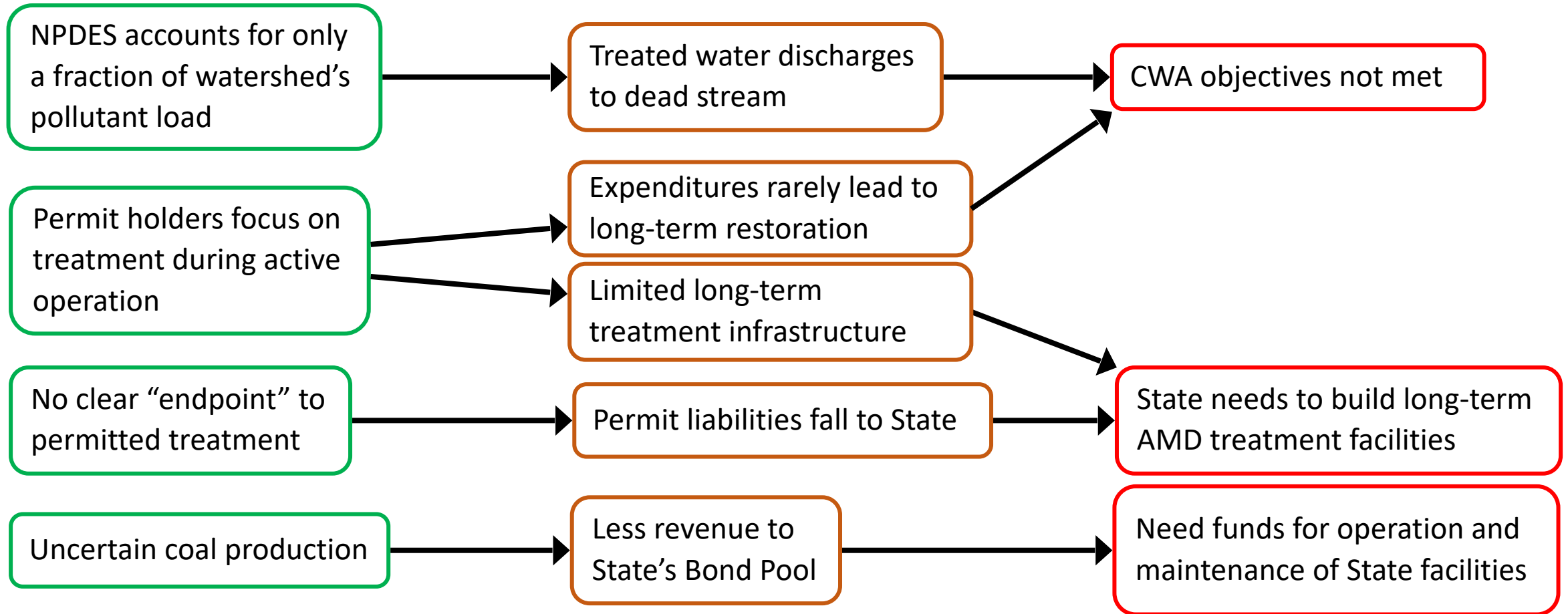


Point-Source Approach



Watershed Approach

Short-falls of the “point source” approach



Evaluating the “watershed” approach

Requirements

Identify and quantify ~90% of sources in watershed

Classify point vs non-point sources

Required treatment of point sources

Voluntary treatment of non-point sources

Document cost/benefit

Reduce load to meet TMDL/
designated use

Challenges

Regulatory (TMDL vs NPDES)

Jurisdiction (AML vs OSR vs active)

Financing (AML vs OSR vs private)

Higher initial capital cost

Benefits

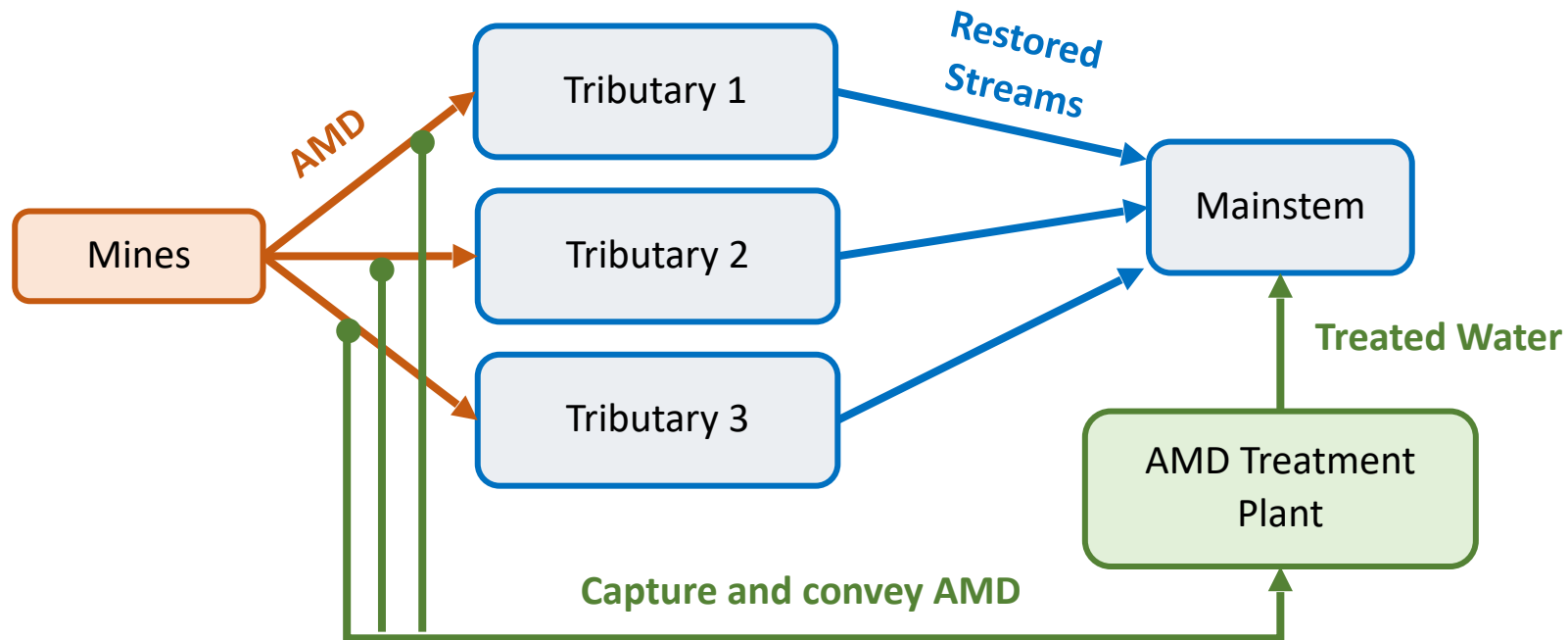
Accounts for ALL pollutant sources in watershed

Restores more stream miles

Lower long-term treatment cost

Centralized AMD Treatment

Consolidates AMD sources to minimize treatment cost and maximize restoration



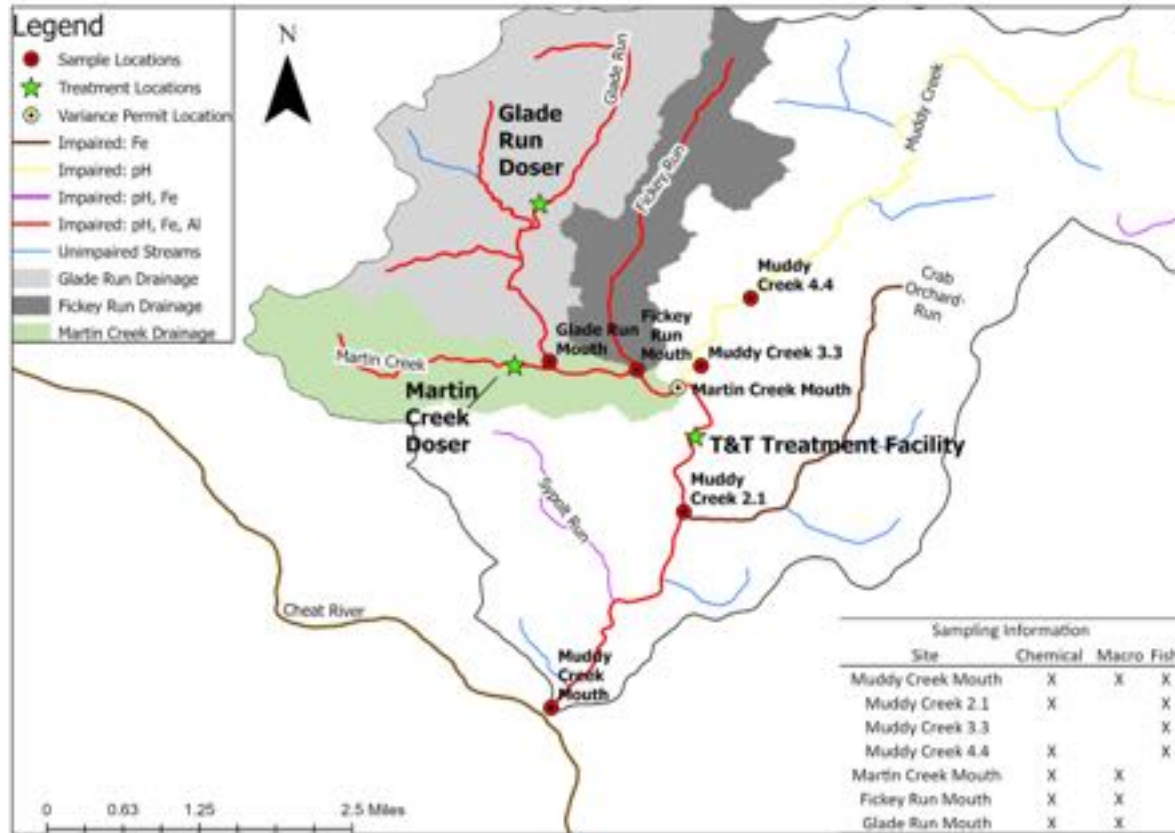
Case Study – Muddy Creek Watershed

Point-Source Approach

- Muddy Ck was responsible for ~50% of acid load to Cheat River
- Multiple OSR treatment sites
- Unregulated discharges (AML) responsible for >90% of pollutant load
- Expensive treatment without desired restoration

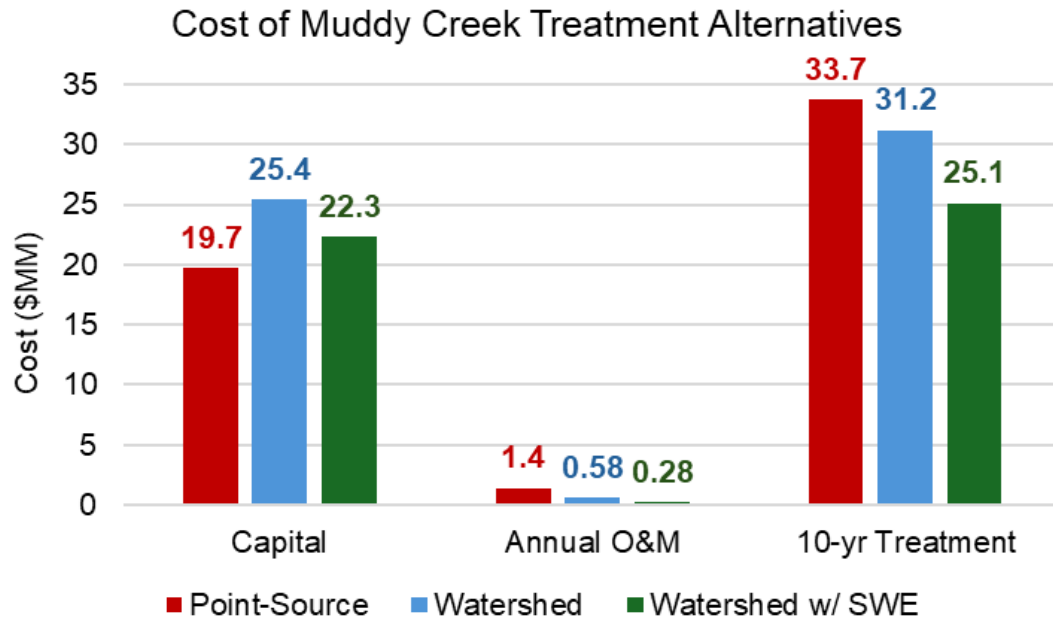
Watershed Approach

- T&T AMD Treatment Plant & in-stream dosers
- Consolidated deep mine AMD into centralized treatment
- Treated headwaters w/ in-stream dosers
- EPA granted in-stream variance
- Lower long-term treatment cost
- Improved restoration outcomes



Case Study – Muddy Creek Watershed

Cost



Restoration



EPA Case Study:

<https://www.epa.gov/system/files/documents/2023-03/muddy-creek-watershed.pdf>

In press: “Evaluation of Watershed-Scale Acid Mine Drainage Treatment in the Muddy Creek Watershed, West Virginia”. Mine Water and the Environment.

- pH ↑ : 4.3 to 7.2
- Fe ↓ : 8.22 to 1.02 mg/L; Al ↓ : 8.10 to 1.37 mg/L
- WVSCI ↑ : 32 to 63
- Fish ↑ : 0 to >130 (mottled sculpin, trout)
- Improved stream length ↑ : 0 to 3.2 (Muddy) + 16 (Cheat)

Case Study – Muddy Creek Watershed

Lessons Learned

Recommendations

Jurisdictional challenges



Prioritize watersheds impacted by AML

Permitting challenges



Developed alternative watershed-based permitting structure

Sacrifice zones for dosers



Use centralized approach to highest degree possible

Maintenance challenges



Pre-treat ferrous iron
Limit hydraulic conveyance
Use mine pools as conveyance
Strategic plant placement

Sludge disposal challenges



Prioritize sludge disposal

Limited baseline data

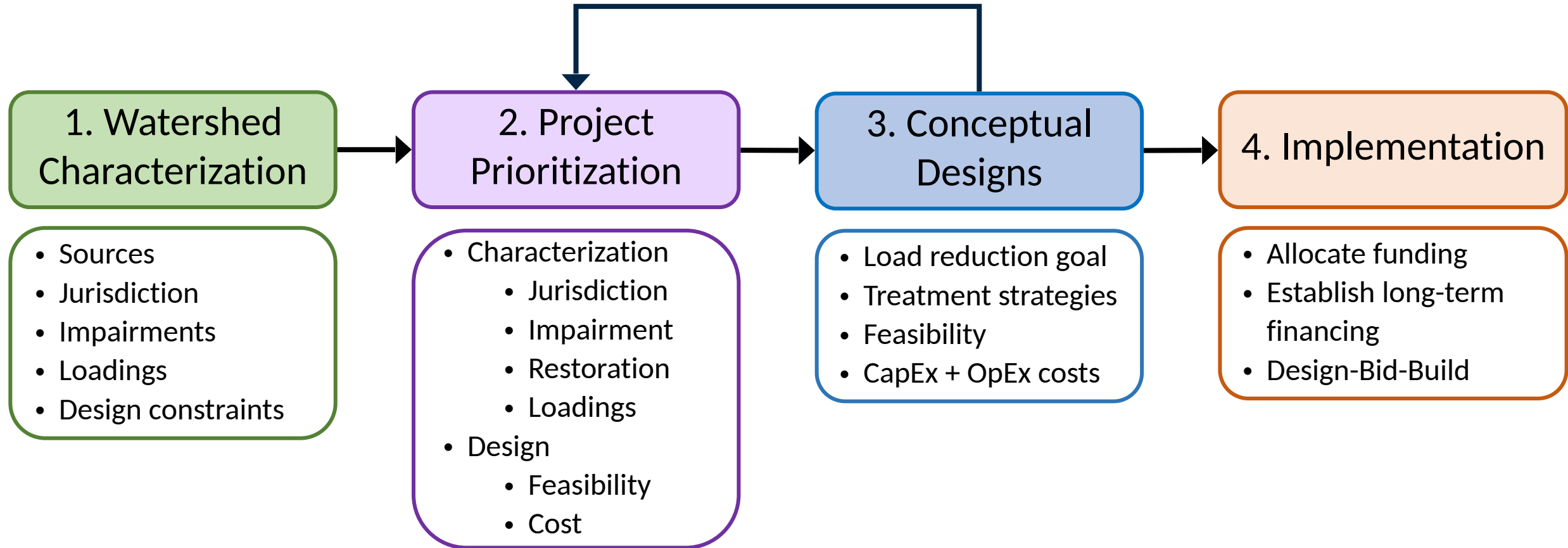


Collect robust data in characterization phase

Evaluating the watershed approach in WV

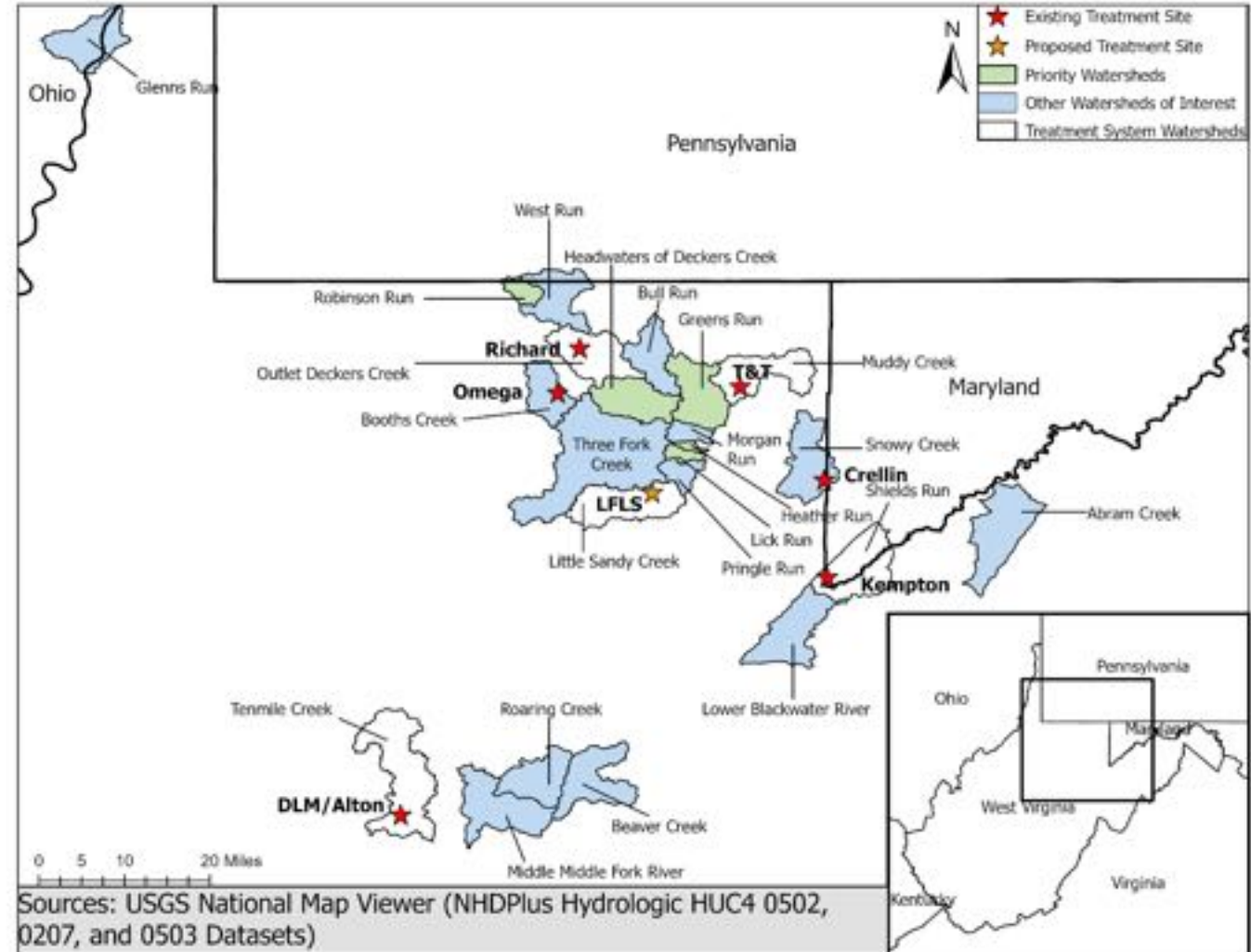
- **Project**: ETD-119 Watershed-Scale Restoration
- **Agency**: WVDEP AML
- **Funding**: Bipartisan Infrastructure Law (BIL)
- **Timeline**: Nov 2023 – Nov 2025
- **Objective**: Evaluate projects for watershed-scale AMD treatment
 - Identify, characterize, and prioritize watersheds
 - Develop conceptual plans for treatment
 - Focus on AMD impacts from AML
 - Collaborate with WVDEP, OSMRE, WVGES, WV watershed groups
 - Inform future use of WVDEP OSR and AML remediation funds

Project Approach

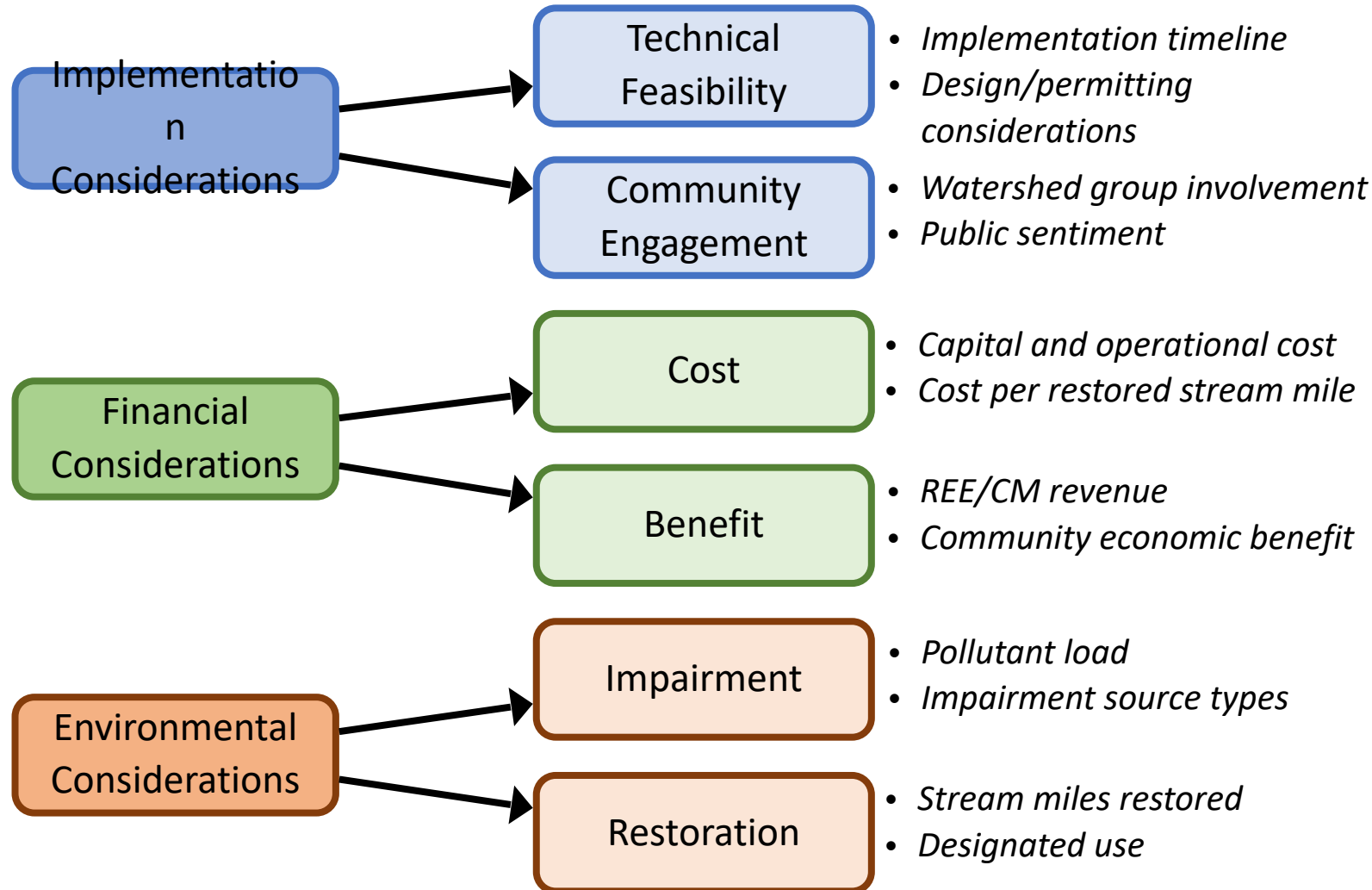


Watershed Characterization

- 19 watersheds (and counting!) across Northern WV
- >800 samples collected to date
- >250 distinct AMD sources
- 7 AMD treatment systems



Project Prioritization



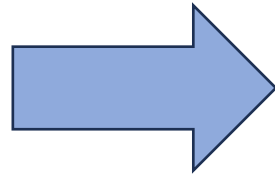
Objective: Rank/prioritize watershed-scale projects

- Develop objective evaluation tool using weighted criteria
- Solicit input from stakeholders and decision-makers
 - State/federal agencies
 - Watershed groups
 - Owner-Operators
- Use to “grade” individual projects

Project Prioritization

Critical Factors

- Jurisdiction
- Restoration impact
- Treatment feasibility
- Community buy-in



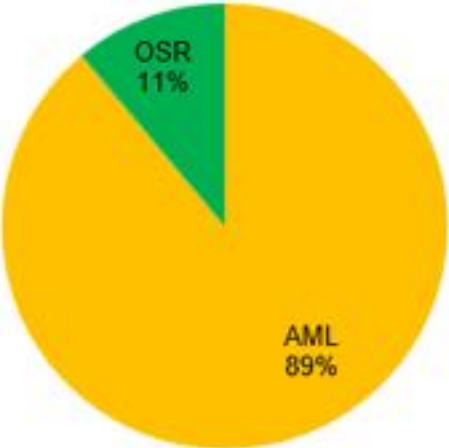
Prioritized Watersheds

1. Greens Run (Cheat)
2. Robinson Run (Mon)
3. Heather/Lick Run (Cheat)
4. Headwaters Deckers Creek (Mon)

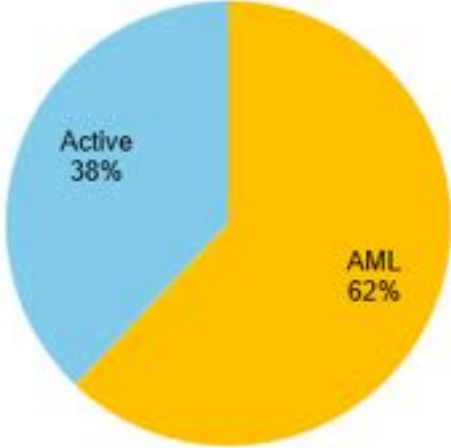
Priority Watersheds

AMD Sources by Jurisdiction

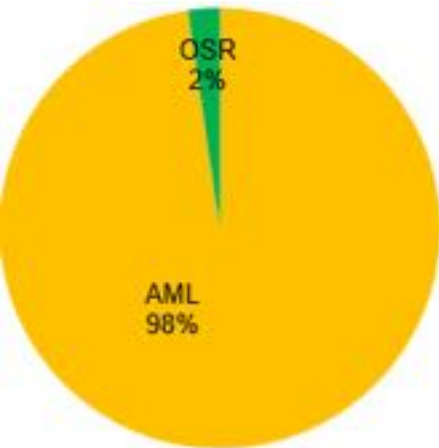
Greens (n=18)



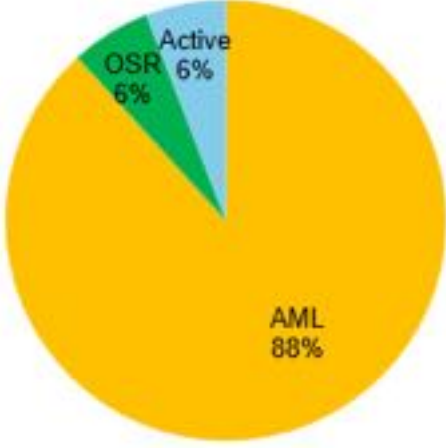
Robinson (n=29)



Heather/Lick (n=43)

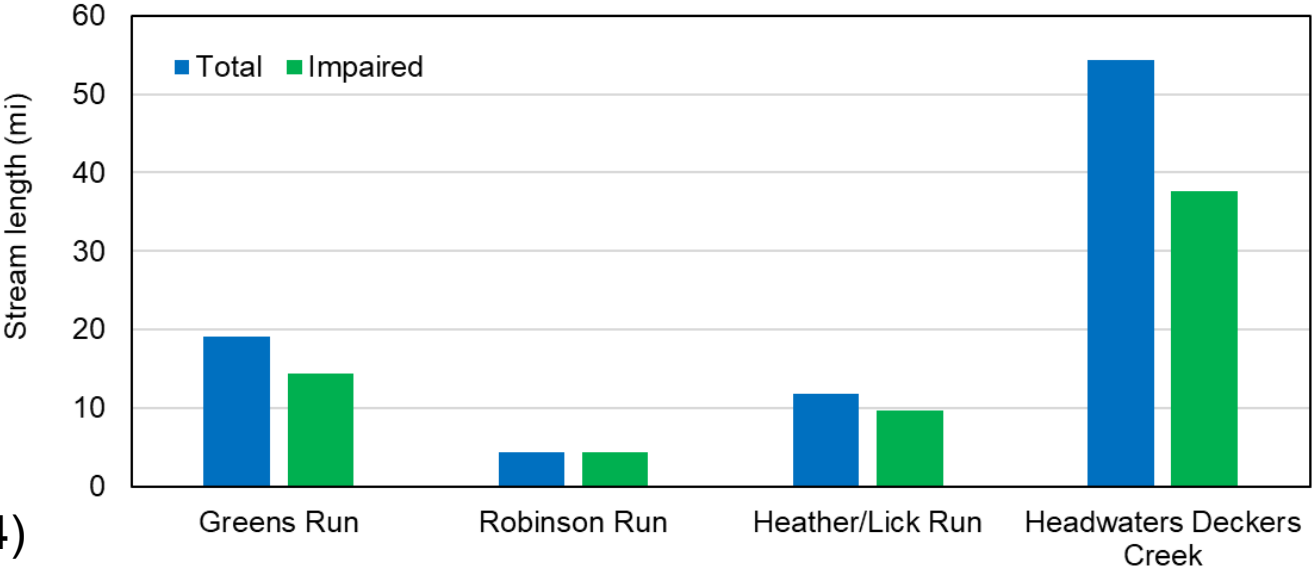


Headwaters Deckers (n=34)



Stream Impairments

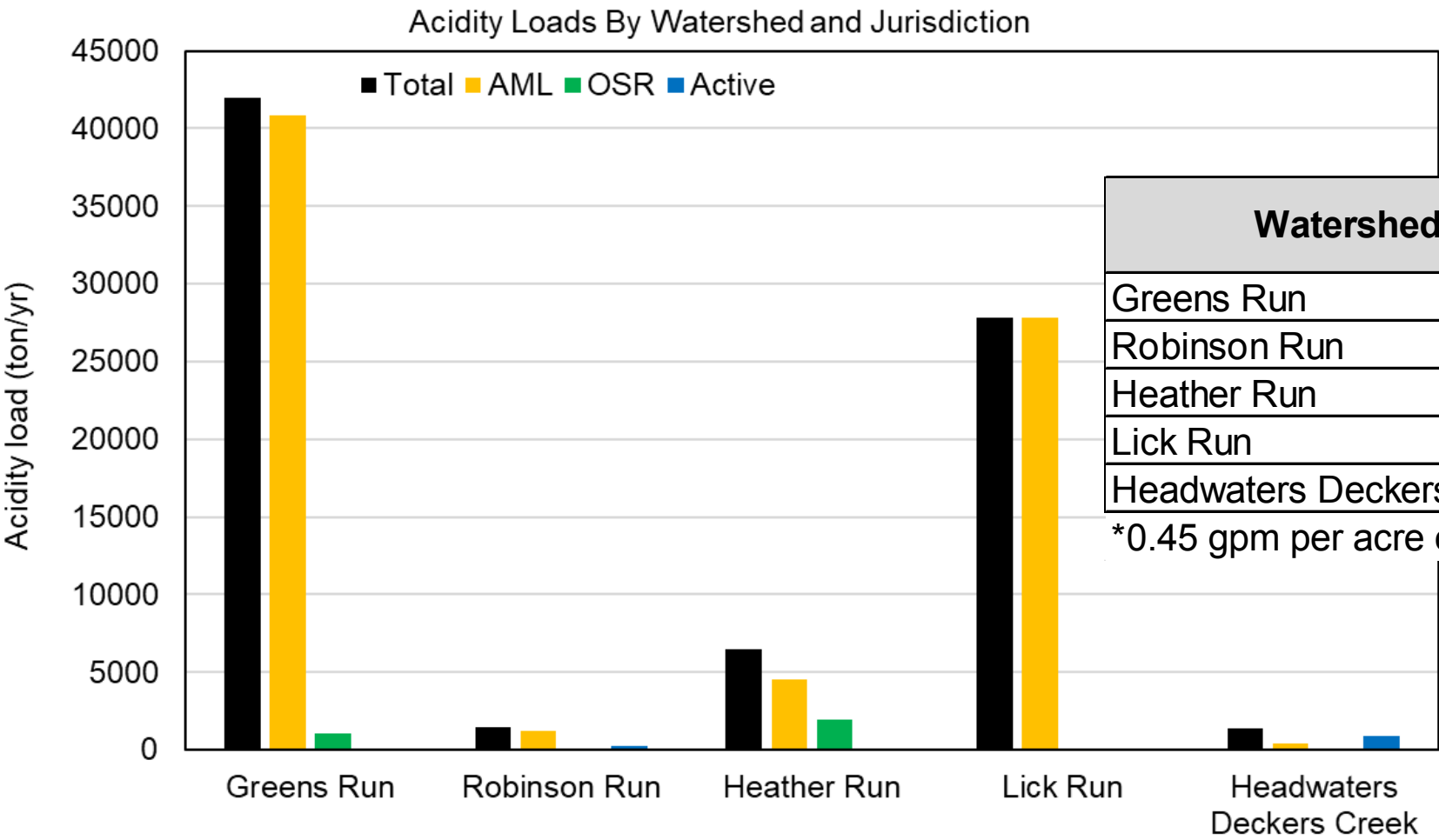
Stream Lengths By Watershed



Watershed	Total Stream miles (mi)	Impaired stream miles (mi)	Percent impaired (%)
Greens Run	19.1	14.4	75
Robinson Run	4.4	4.4	100
Heather/Lick Run	11.8	9.6	81
Headwaters Deckers Creek	54.4	37.7	69
Total		66.1	

Priority Watersheds

Pollutant Loads



Watershed	Mined area (ac)	Flow (gpm)*	pH, avg
Greens Run	878	395	3.14
Robinson Run	5511	2480	3.02
Heather Run	880	396	2.85
Lick Run	1351	608	3.03
Headwaters Deckers Creek	4649	2092	3.37

*0.45 gpm per acre of mined area

Conceptual Designs

- **Monthly sampling to characterize flows and concentrations.**
- **Piezometers to identify and monitor mine pools.**
- **Grouting to eliminate ancillary sources.**
- **Use of mine pools as conveyance and source consolidation.**
- **Capture of primary sources and conveyance to centralized treatment location.**

Greens Run

Centralized Treatment Plant (~\$10M)

North Fork – continue
at-source treatment

Individual sources:

- Eliminate/consolidate (grout)
- Convey to downdip mine
- Convey to downstream collection

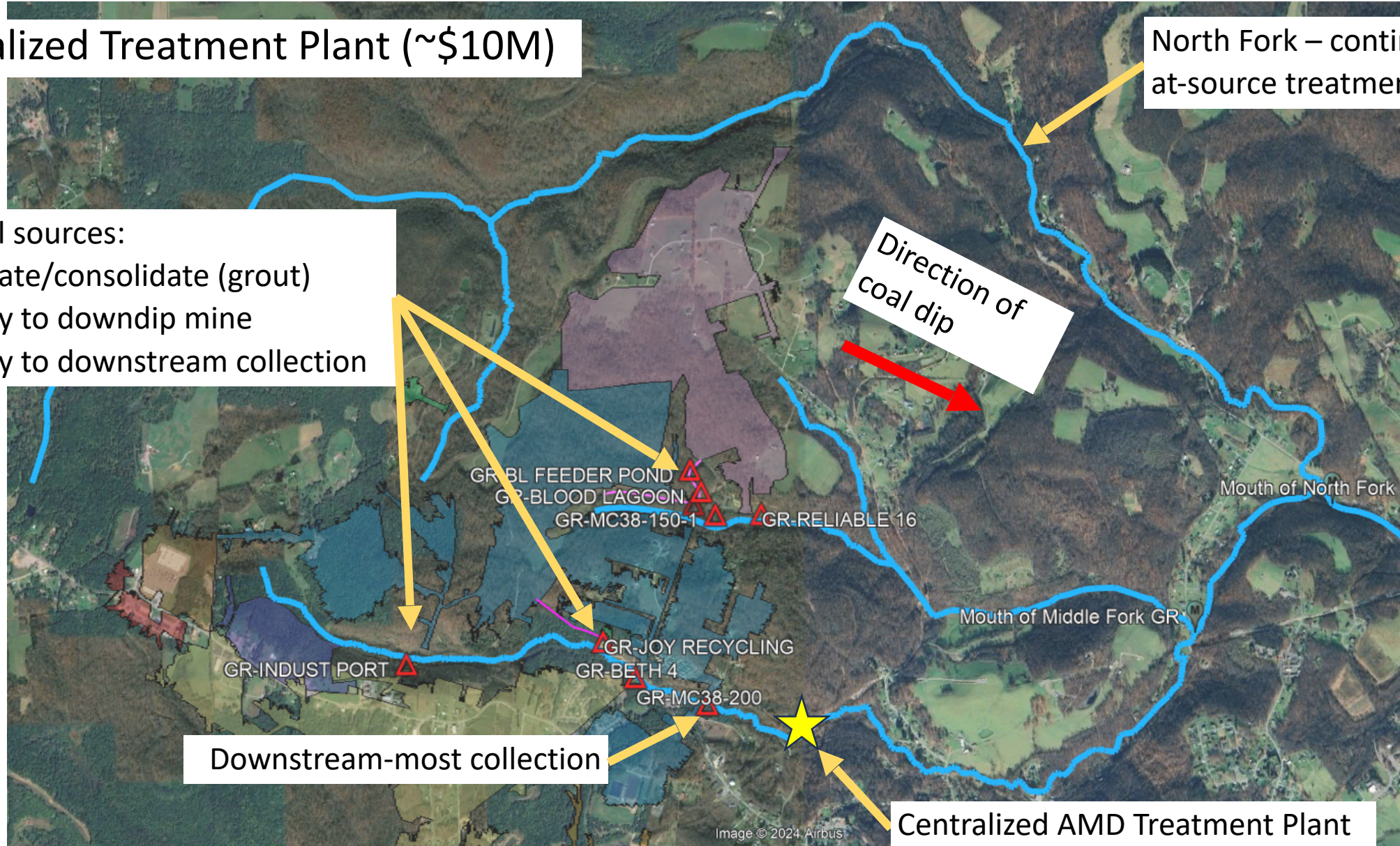
Direction of
coal dip

Mouth of North Fork

Mouth of Middle Fork GR

Downstream-most collection

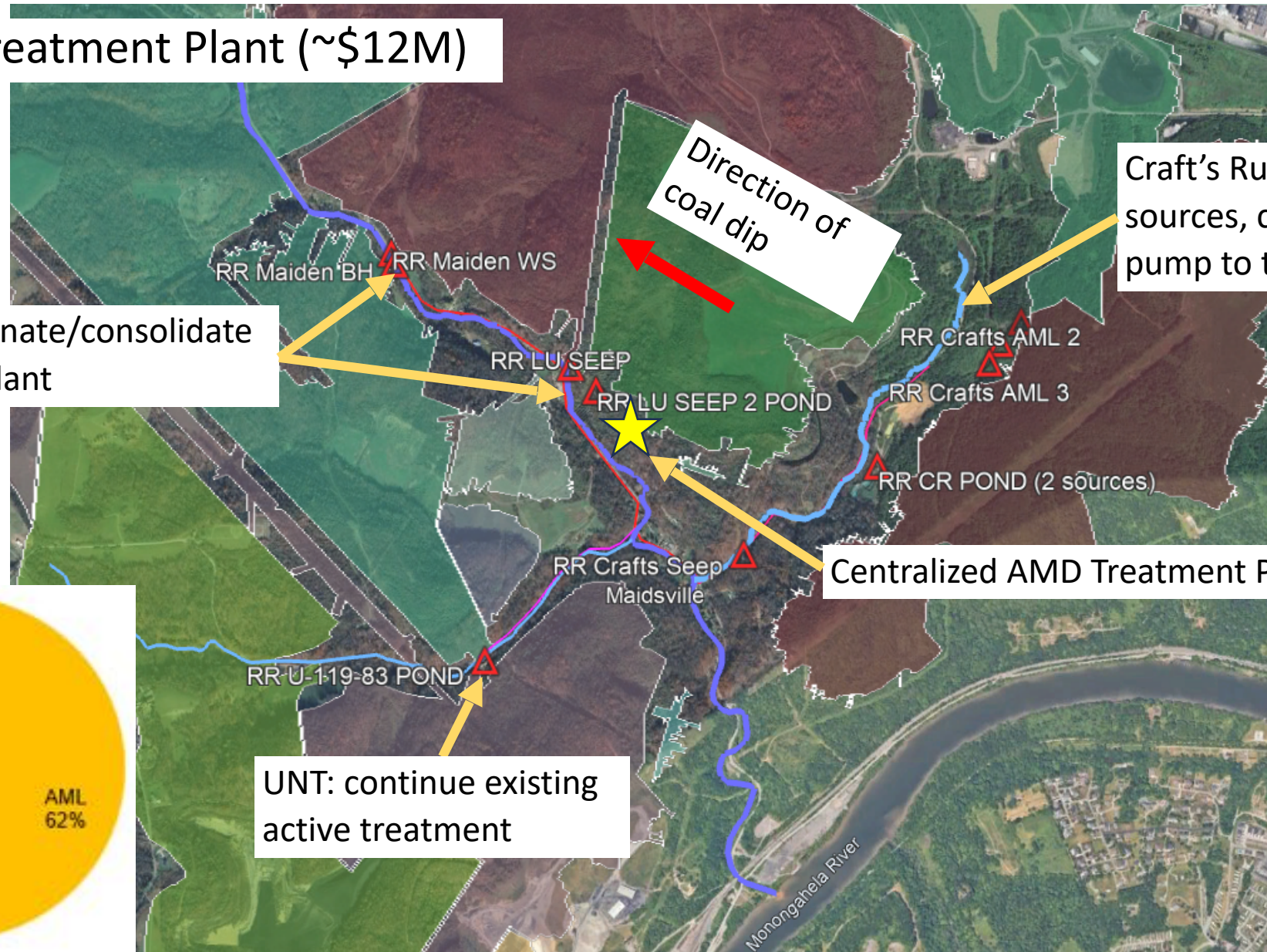
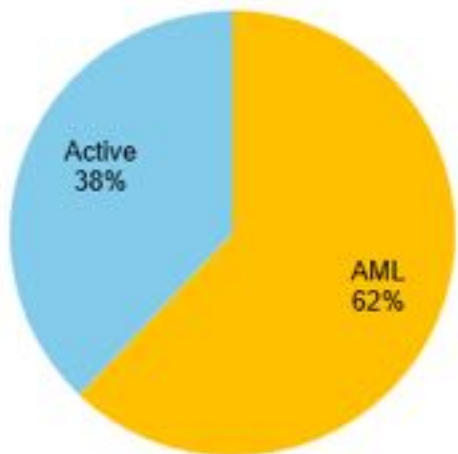
Centralized AMD Treatment Plant



Robinson Run

Centralized Treatment Plant (~\$12M)

Robinson Run: eliminate/consolidate (grout), convey to plant

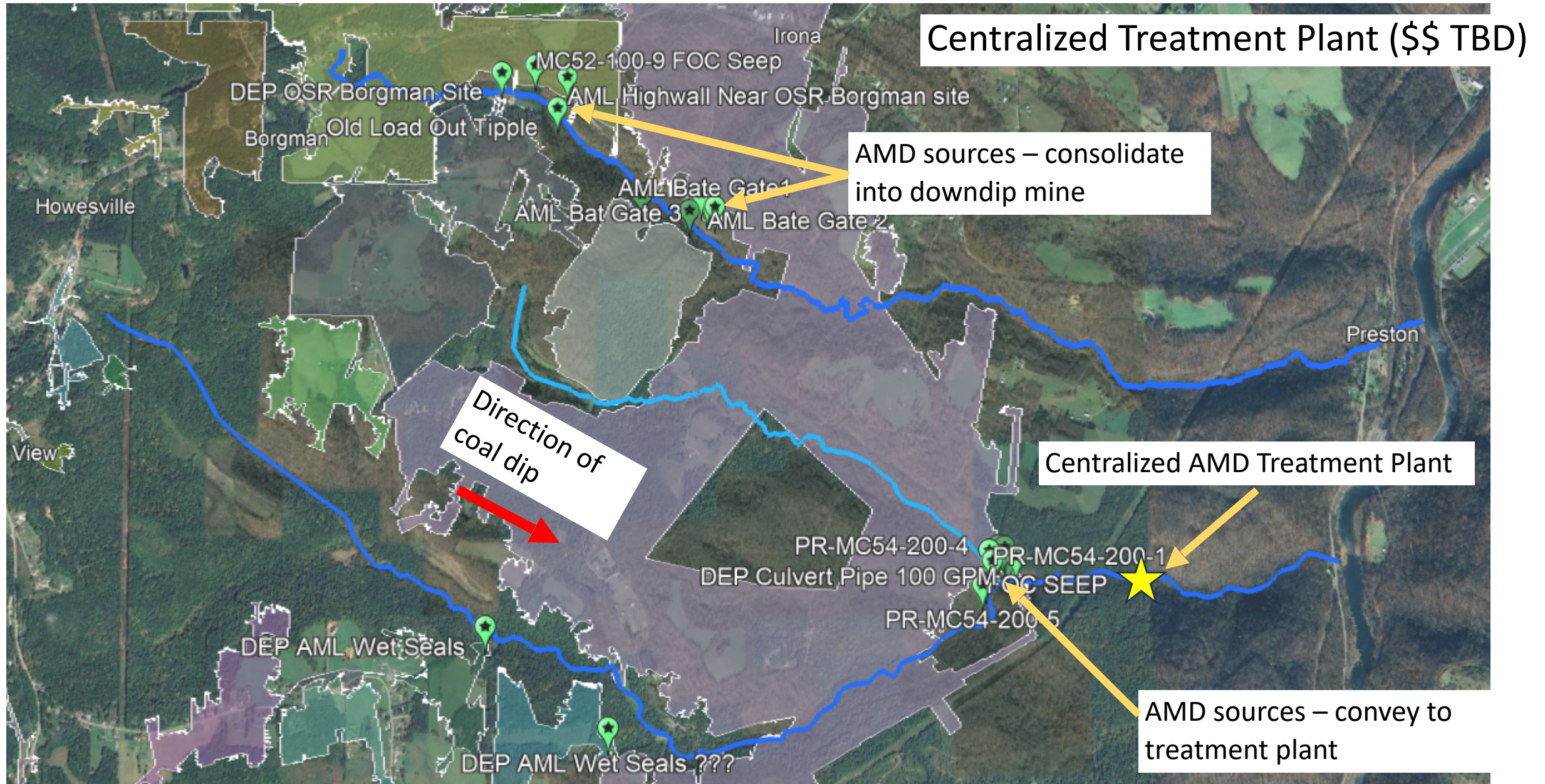


Craft's Run: capture sources, convey, and pump to treatment plant

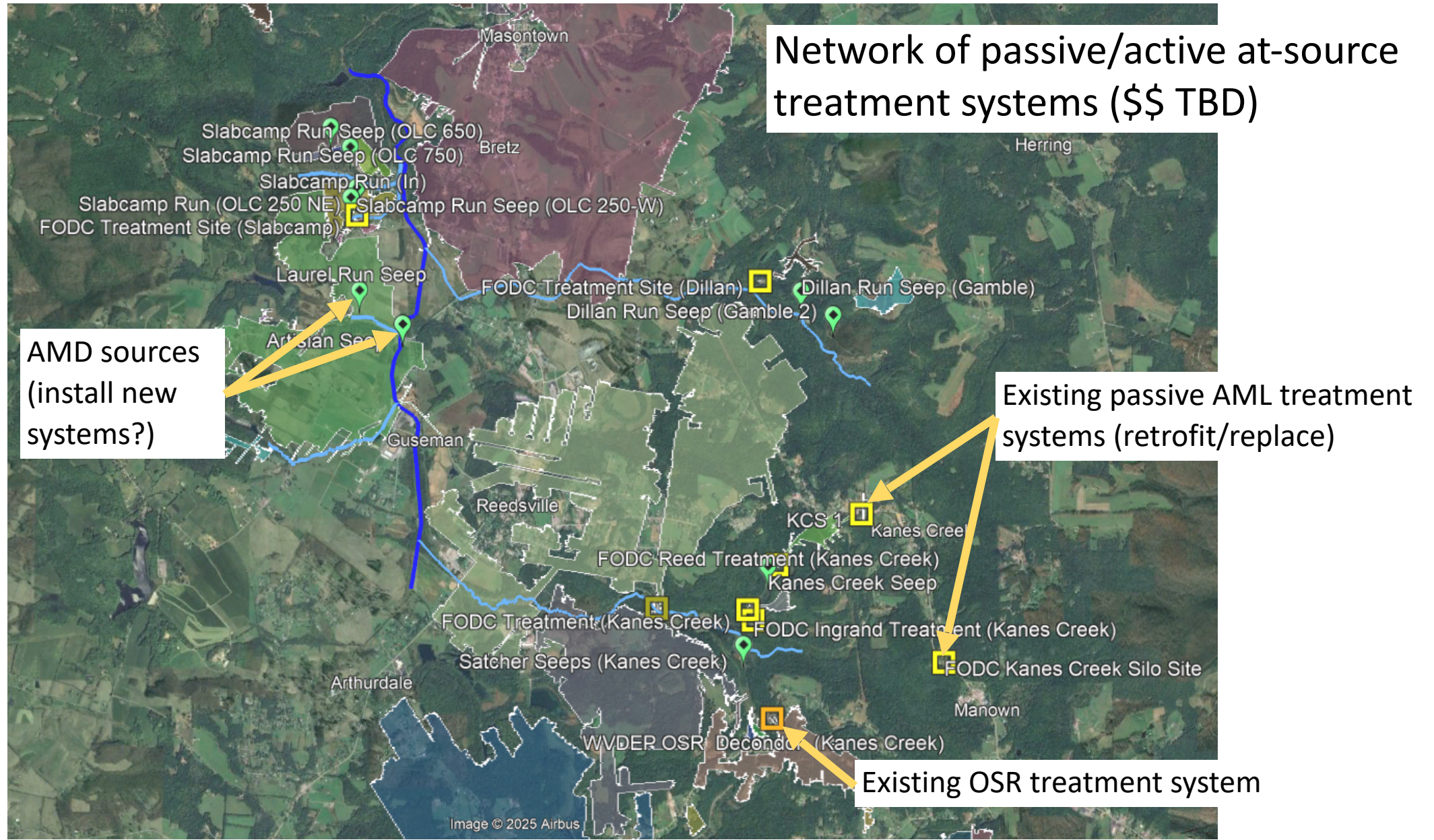
Centralized AMD Treatment Plant

UNT: continue existing active treatment

Heather/Lick Run



Headwaters Deckers Creek



Policy

- **WRDA 2024 - S.4367 signed 1/4/25.**
- **Sec. 1345 – Ohio, Pennsylvania, and West Virginia**
- **Pilot program for federal assistance to treat abandoned mine drainage (1345.b)**
- **\$50MM authorized (1345.i) for 75% of design/construction costs (1345.f.3)**
- **Abandoned mine drainage includes bond forfeiture sites (1345.a.1.B)**
- **Prioritize centralized treatment and number of stream miles (1345.e)**

Not addressed – regulatory consequence of mixing BF and AML treatment

Acknowledgements



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