Beyond Reclamation and Remediation, Next Steps in a Recovered Watershed



Amy Mackey, Natalie Kruse Daniels, Nora Sullivan, and Maxwell Omane Henneh

Voinovich School of Leadership and Public Service, Ohio University

Watershed Overview

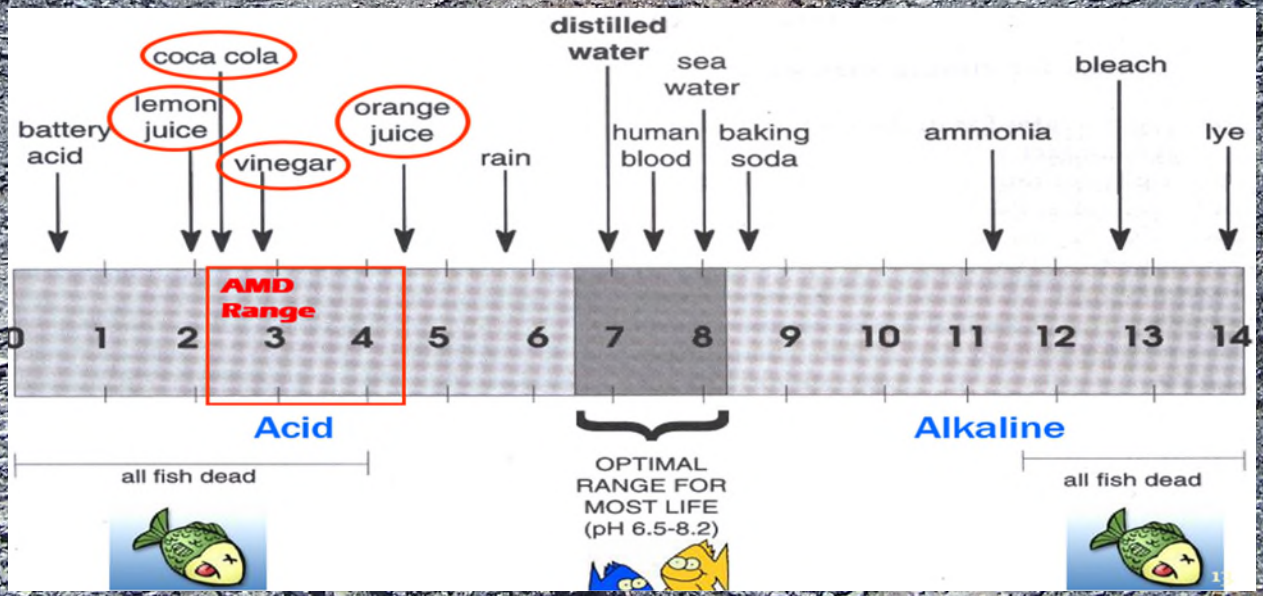
- 683.5 square miles draining to the Ohio River
- 112 miles long (Hocking Hills to Gallipolis)
- 75% forested, rural
- 60,000 acres of public land in the watershed
- Flows through 6 southeast Ohio Counties
  - Hocking (headwaters)
  - Vinton (headwaters)
  - Athens
  - Meigs
  - Jackson
  - Gallia (mouth)

Primary Impairments

- Historic (pre-SMCRA 1976) coal mining is the #1 issue in Raccoon Creek and many other streams in the coal-bearing region of Ohio!
- Low-head dams
- Invasive Species
- Loss of riparian/stream side buffer
- Failing / non-existent home sewage treatment (and municipal sewage treatment)

Pre-law Coal Mining

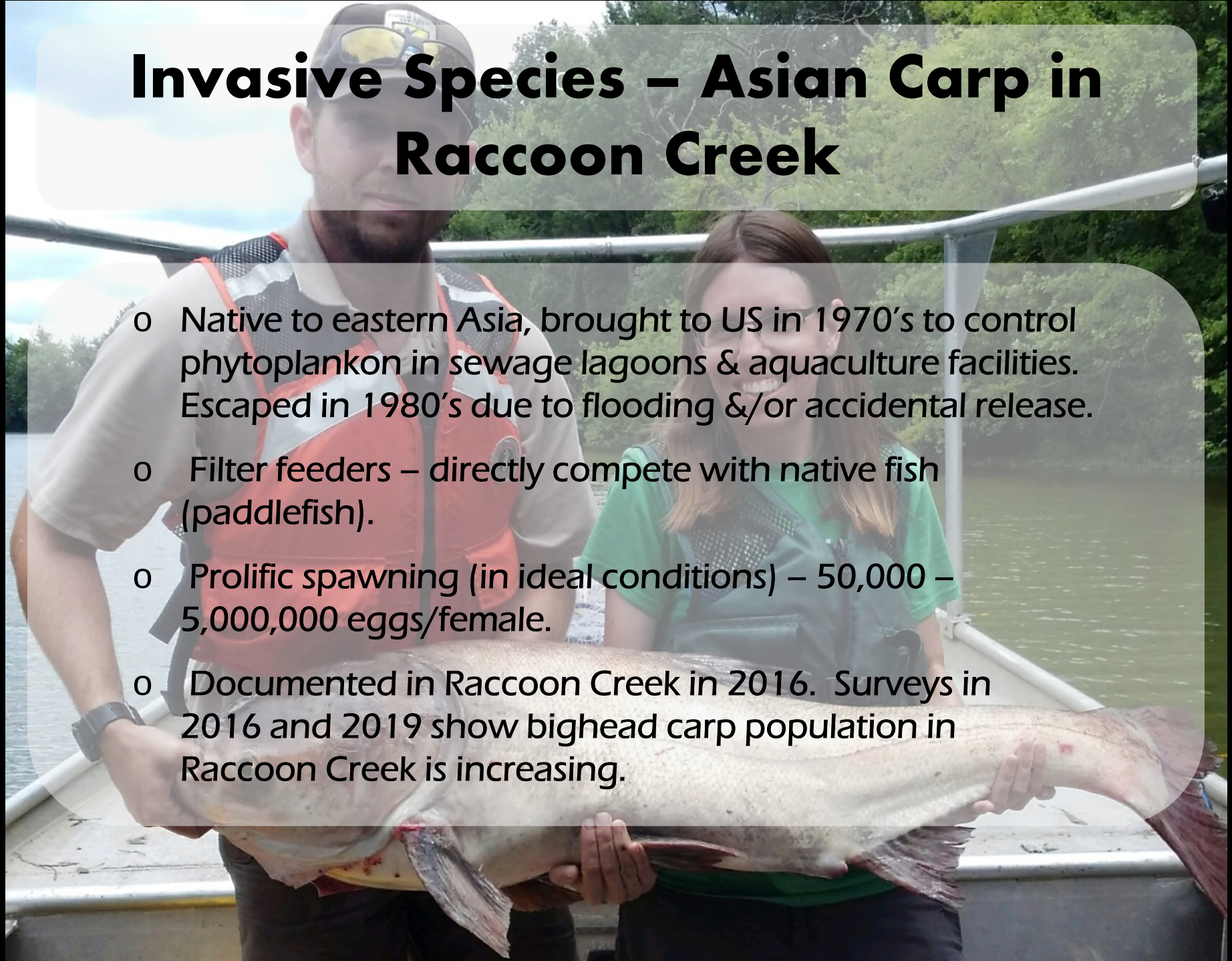
- ACID MINE DRAINAGE (increased acidity and metal concentrations)
- Iron pyrite + water + oxygen = sulfuric acid (AMD)
- 50,000 acres mined, 190 stream miles in Raccoon Creek impacted
- Sedimentation, erosion & habitat degradation
- Lack of species diversity / increase of invasive species



Low-head Dams

- 6 low-head dams in the watershed, only 4 still in place
  - Northup – disintegrating, minimal or no impact
  - Cora Mill – natural rock shelf
  - Vinton – priority for removal, EWH boundary
  - Wellston – municipal water supply (can not remove)
- Originally installed to operate gristmills, water treatment, municipal water source, road crossing, etc
- Inhibits fish passage
- Human safety risk, "Drowning machine"
- Disrupts stream channel morphology

Invasive Species – Asian Carp in Raccoon Creek

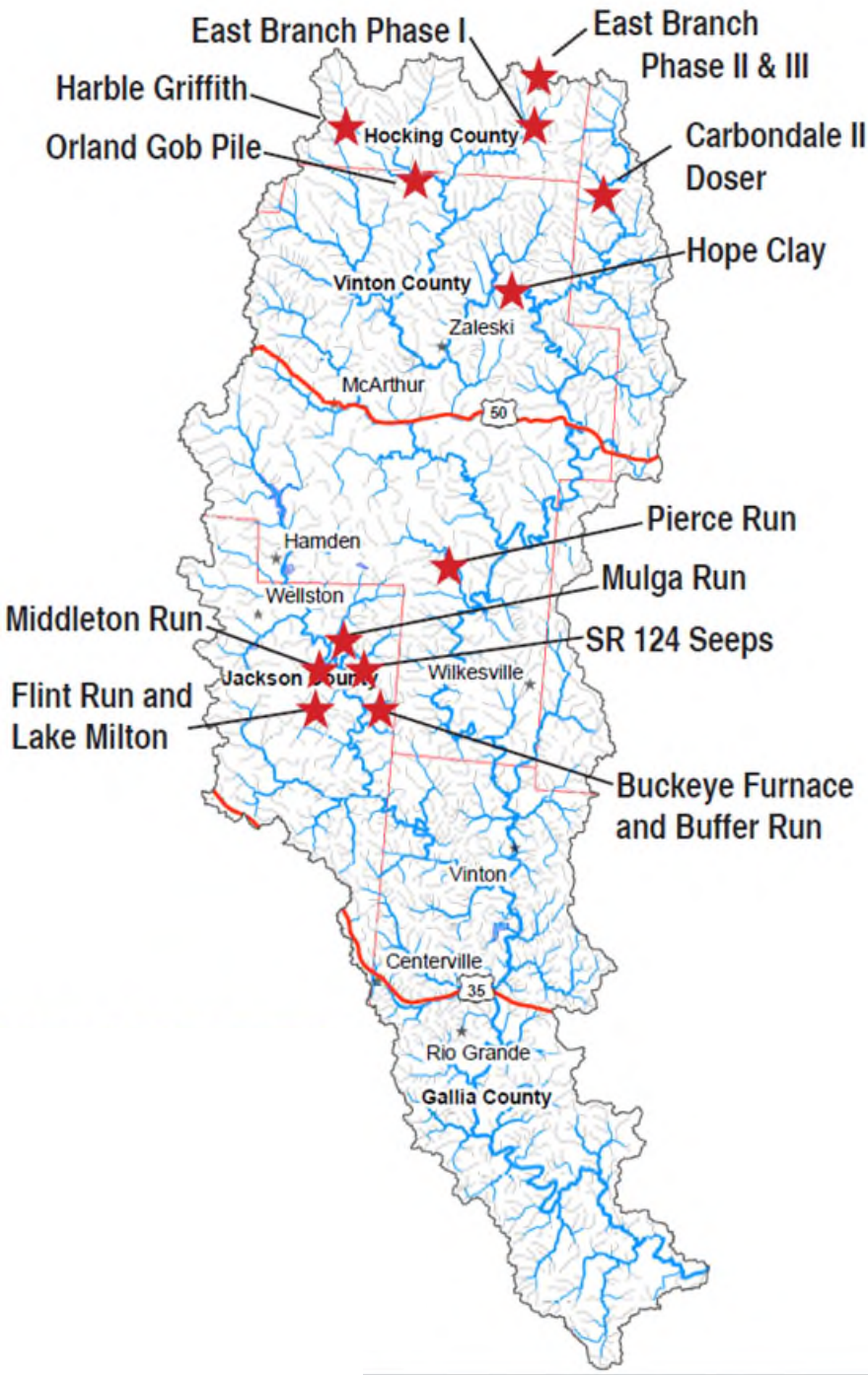


- Native to eastern Asia, brought to US in 1970's to control phytoplankon in sewage lagoons & aquaculture facilities. Escaped in 1980's due to flooding &/or accidental release.
- Filter feeders – directly compete with native fish (paddlefish).
- Prolific spawning (in ideal conditions) – 50,000 – 5,000,000 eggs/female.
- Documented in Raccoon Creek in 2016. Surveys in 2016 and 2019 show bighead carp population in Raccoon Creek is increasing.

What's the Solution??

AMD Reclamation & Treatment Projects

- Since1998....
- Over $15 million (AML fund, EPA 319 grants, OSM Watershed Cooperative Agreement Program)
- 22 reclamation, treatment, and maintenance projects
- Reclamation and treatment projects can only be completed on ABANDONED mine lands: sites that were mined pre-law!
- Raccoon Creek mainstem and Little Raccoon Creek have always been the goal for recovery



Active Treatment – Calcium Oxide Doser

Passive Treatment – Steel Slag Leach Beds

- Vertical flow pond
- Steel slag is an alkaline by-product of the steel industry
- "Super charge" clean water with alkalinity, discharge into AMD
- Difficult to control treatment
- Slag must be replaced every 5-7 years as alkalinity is exhausted

Passive Treatment – Open Limestone Channel

- Used to convey water with minimal erosion
- Does provide some treatment from the limestone
- After time, iron will "armor" the limestone and reduce effectiveness

Passive Treatment – Successive Alkaline Producing System

- Good for acidic, low metal water
- Layers of limestone and compost
- Strip oxygen and raise pH
- Very little maintenance if installed in the right place
- Water flows vertically through system
- May be step one of a "daisy chain" system

Passive Treatment - Wetlands

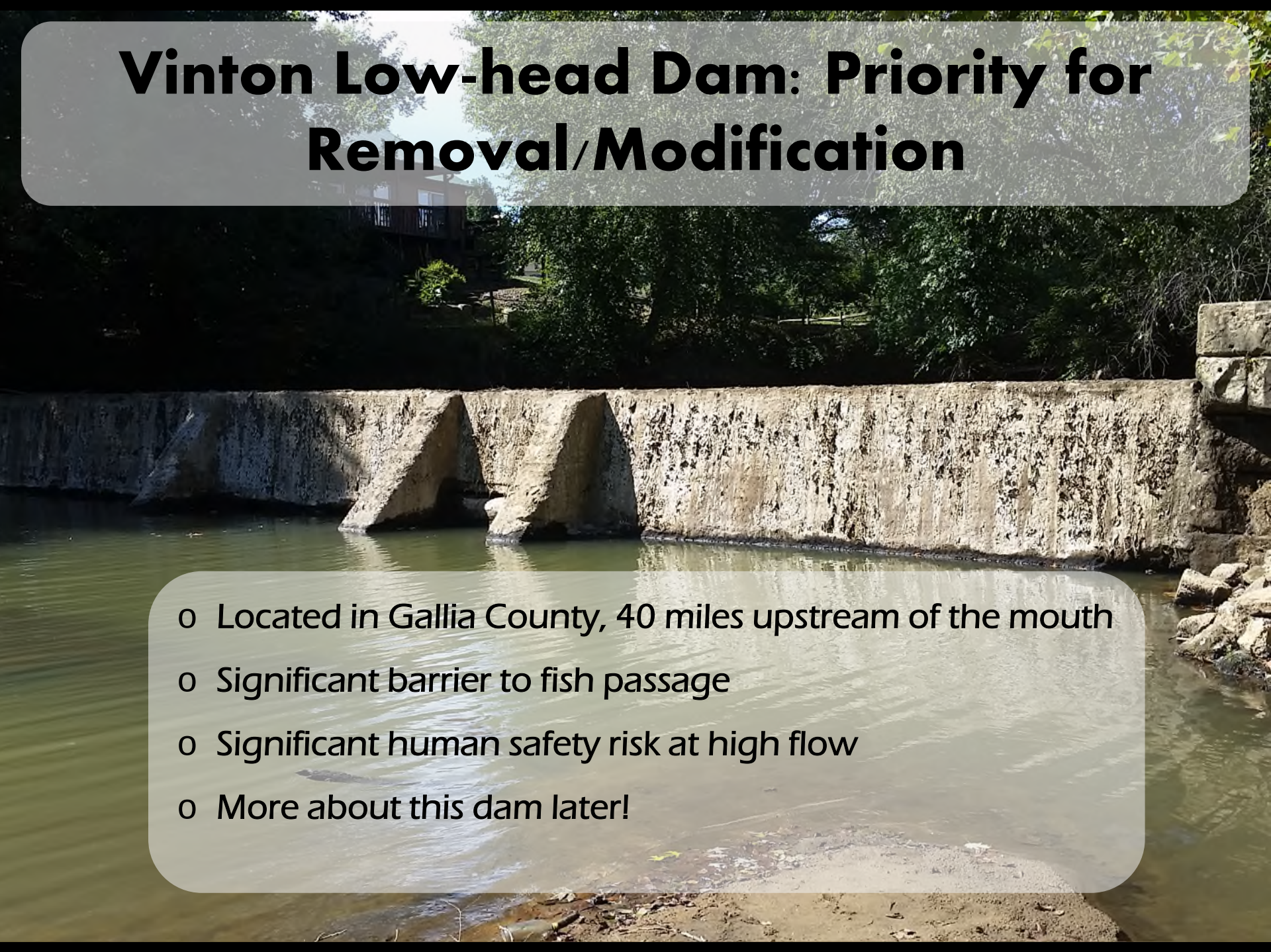
- Precipitate metals below treatment projects
- Ideally all treatments would have a downstream wetland
- Minimal or no maintenance once established
- Usually consist of limestone berms in existing low-quality wetlands

Reclamation / Source Control

Low-head Dam Removal Projects

- Sandy Run low-head dam removed summer 2019.
- Zaleski State Forest Property, just upstream of Lake Hope
- Small dam, only 40 ft long and ~3' high, but served as a barrier to fish passage
- 12 species of fish downstream, only 4 species upstream
- Created un-natural pool devoid of habitat features
- OEPA 319 Grant funded removal.

Vinton Low-head Dam: Priority for Removal/Modification



- Located in Gallia County, 40 miles upstream of the mouth
- Significant barrier to fish passage
- Significant human safety risk at high flow
- More about this dam later!

Bighead Carp Tagging and Removal

- USFWS, ODNR DOW, OU Voinovich School, WVU, WVDNR, KYF&W cooperative effort
- Ultrasonic, uniquely coded tags surgically implanted to detect movement, dam passage and survival, to understand tributary use, to determine yearly survival, to help direct removal efforts (downstream of RC Byrd Pool)
- Gill nets set across Raccoon Creek to capture and remove adult fish. Successful in 2016 and 2019. Study results show increasing density.
- Much more work needs to be done!!!

Recovery & Successes

On the road to recovery…

- Over 20 years
- Over $15 million dollars
- 21 reclamation, treatment, and maintenance projects (with more on the way)
- Monitoring, monitoring, and more monitoring
- Countless partners, staff, volunteers, students….

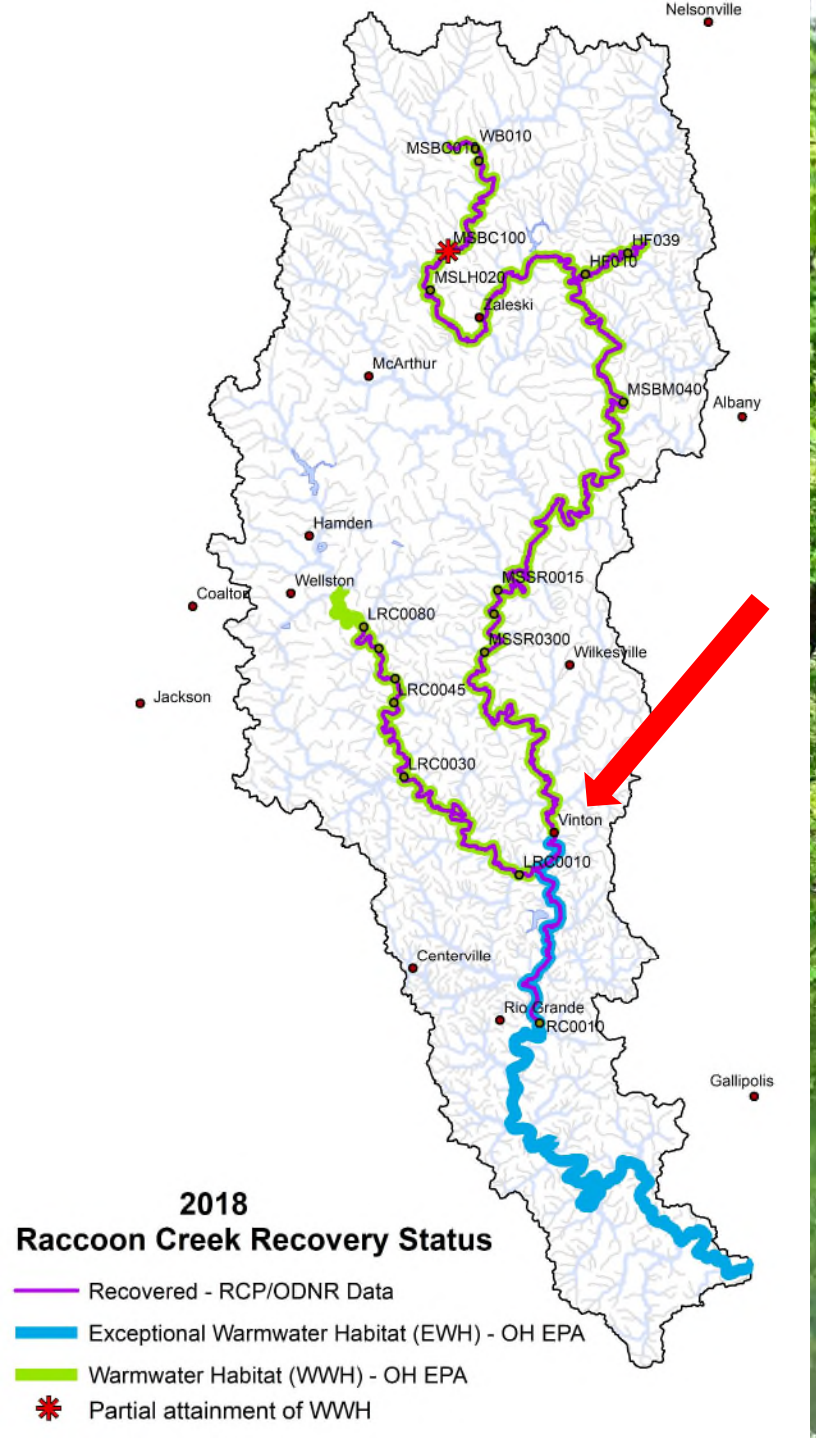
Is it working???


YES!
You're sayin' there's fish in Raccoon Creek?!


“Dead as a bag of hammers”
EXCEPTIONAL WARM WATER HABITAT!!

BIG NEWS!!!!!

- On August 18th, 2022, Ohio EPA officially approved upgraded Aquatic Life Uses for much of Raccoon Creek
- The headwaters of RC (RM 95.52 to RM 111.0), previously designated Limited Resource Water (the lowest degree of biological integrity) is now recommended and meeting Warmwater Habitat
- RC from the low-head dam in Vinton (RM 40.3) to the backwaters of the Ohio River (RM 8.15) is now recommended and fully meeting *Exceptional Warmwater Habitat (EWH)!*
- As of August 18, 2022, the entire mainstem of Raccoon Creek, from the Ohio River in Gallia County to the confluence of East and West Branch in Vinton County, is recommended Warmwater Habitat or Exceptional Warmwater Habitat



Recovery & Success

- RC Mainstem and LRC = goal for recovery
- Over 100 stream miles now meet or exceed criteria for Warmwater Habitat designation
- Most downstream 40 miles of RC (from confluence to dam at Vinton) meeting criteria for Exceptional Warmwater!
- Projects have resulted in acid load reduction of >2,500 lb/day & metal load reduction of >500 lb/day
- Biological recovery downstream of projects
- 78 species of fish documented in RC

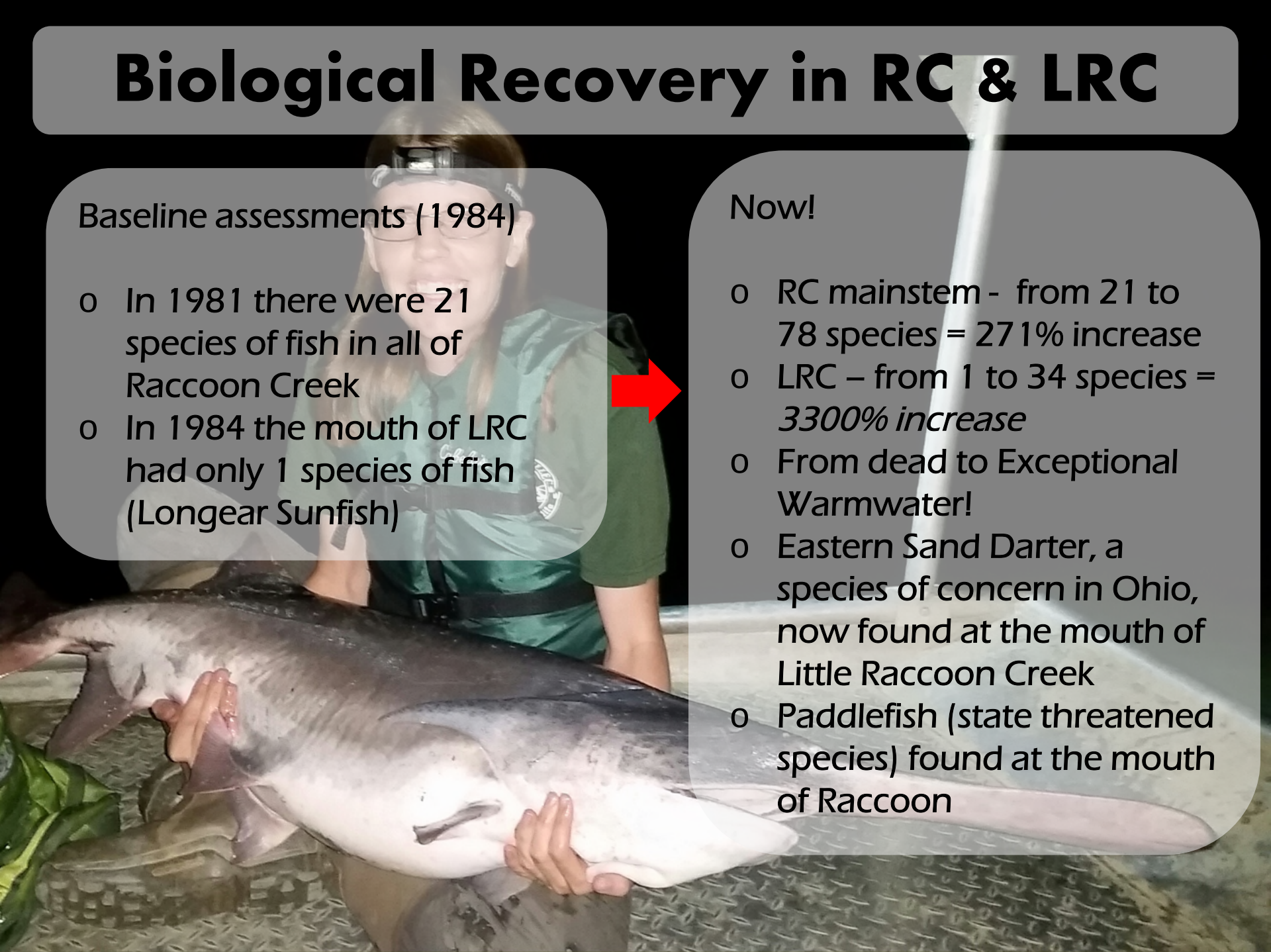
Biological Recovery in RC & LRC

Baseline assessments (1984)

- In 1981 there were 21 species of fish in all of Raccoon Creek
- In 1984 the mouth of LRC had only 1 species of fish (Longear Sunfish)

Now!

- RC mainstem - from 21 to 78 species = 271% increase
- LRC – from 1 to 34 species = *3300% increase*
- From dead to Exceptional Warmwater!
- Eastern Sand Darter, a species of concern in Ohio, now found at the mouth of Little Raccoon Creek
- Paddlefish (state threatened species) found at the mouth of Raccoon



Bonus…Increased Recreational Opportunities!

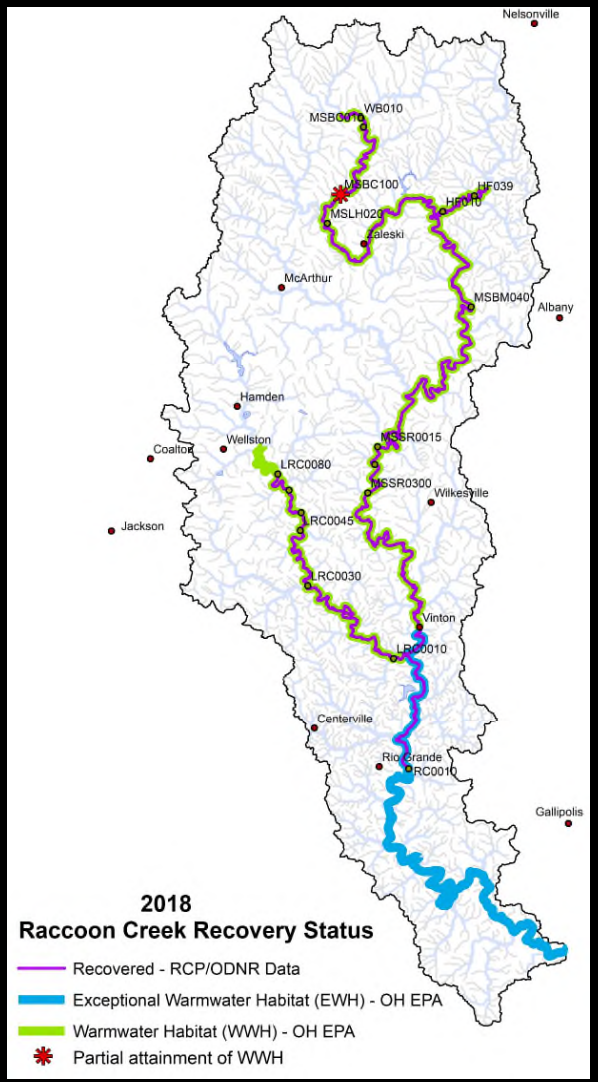
Raccoon Creek - The 1st Scenic River in Southeast Ohio??

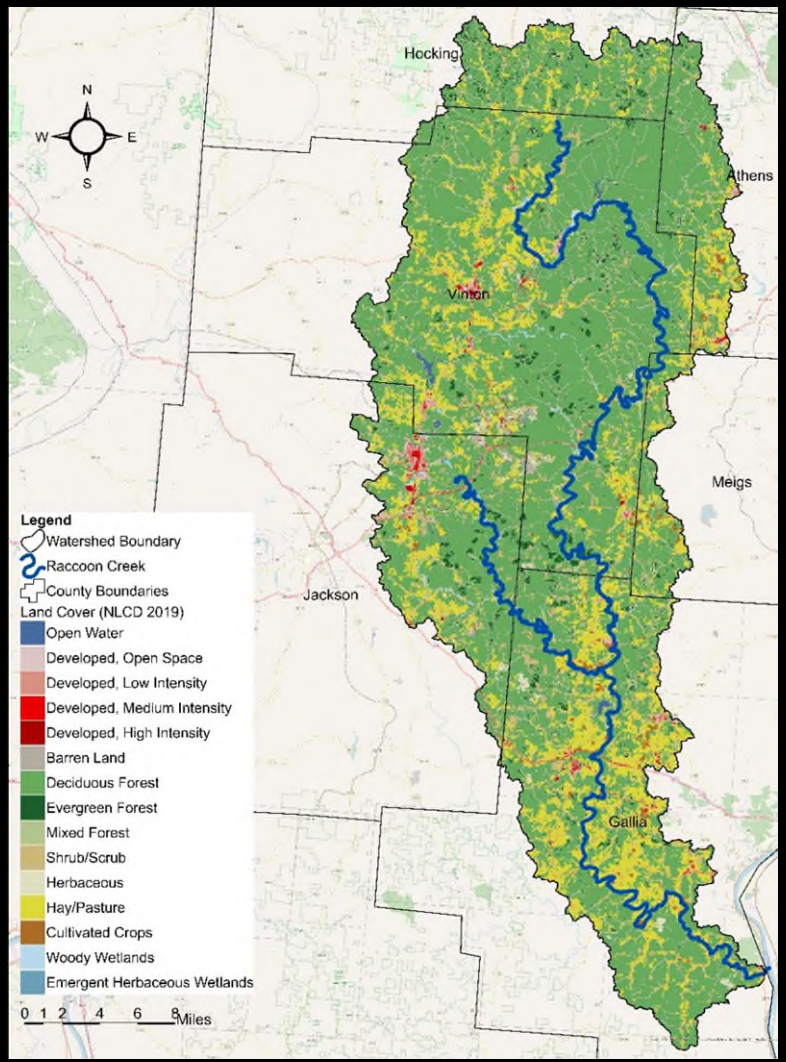
Raccoon Creek - The 1st Scenic River in Southeast Ohio??

RCP is requesting that ODNR designate Raccoon Creek as the first Scenic River in southeast Ohio

- The successful restoration of Raccoon Creek makes the watershed an ideal candidate for designation
- RCP is currently meeting with SWCDs and conservation groups in the watershed to garner support for Scenic River designation and to clarify any confusion about Scenic River designation impacts on private lands
- Raccoon Creek meets or exceeds the designation criteria for Scenic River Status

Raccoon Creek - The 1st Scenic River in Southeast Ohio??

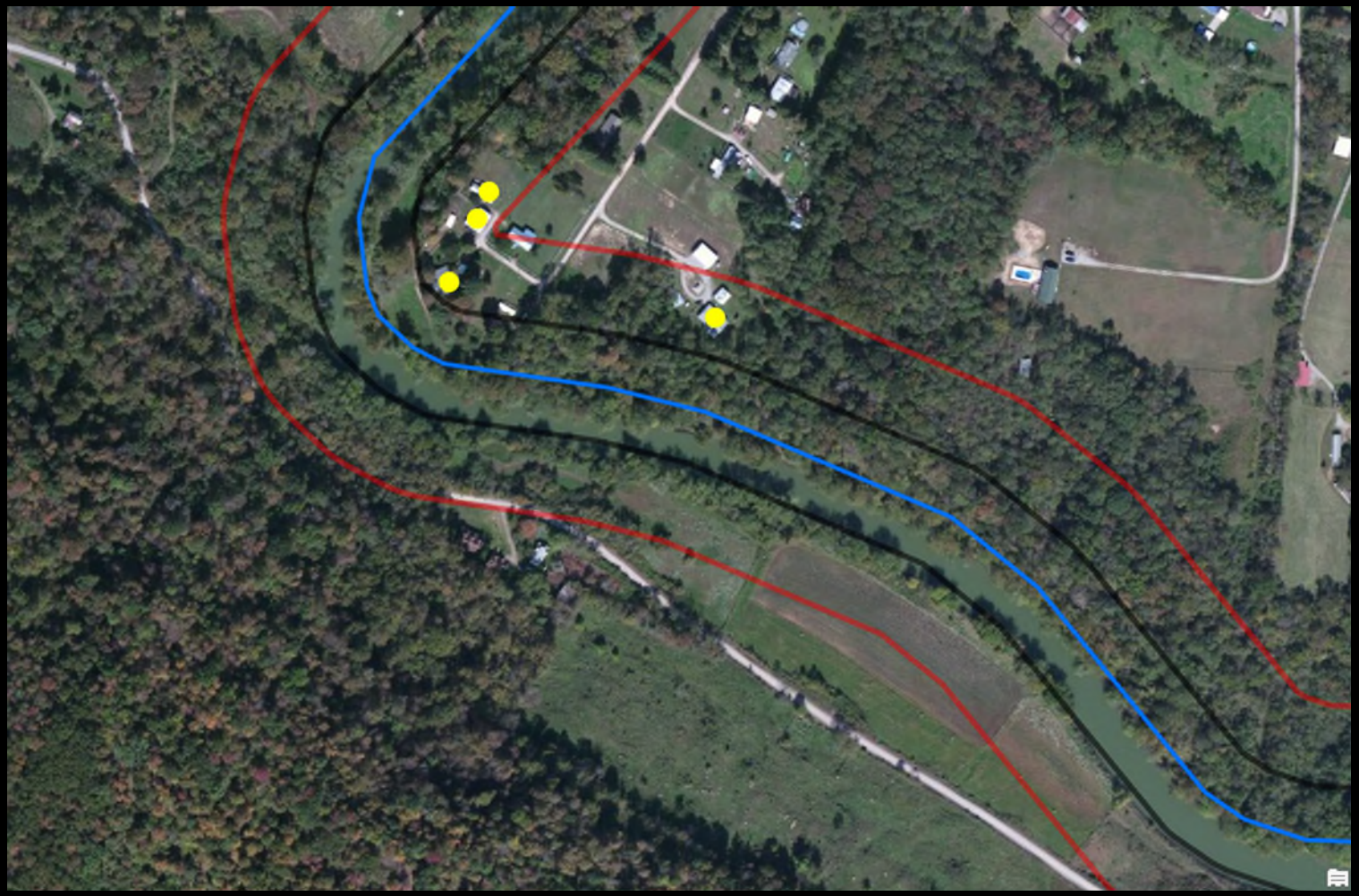




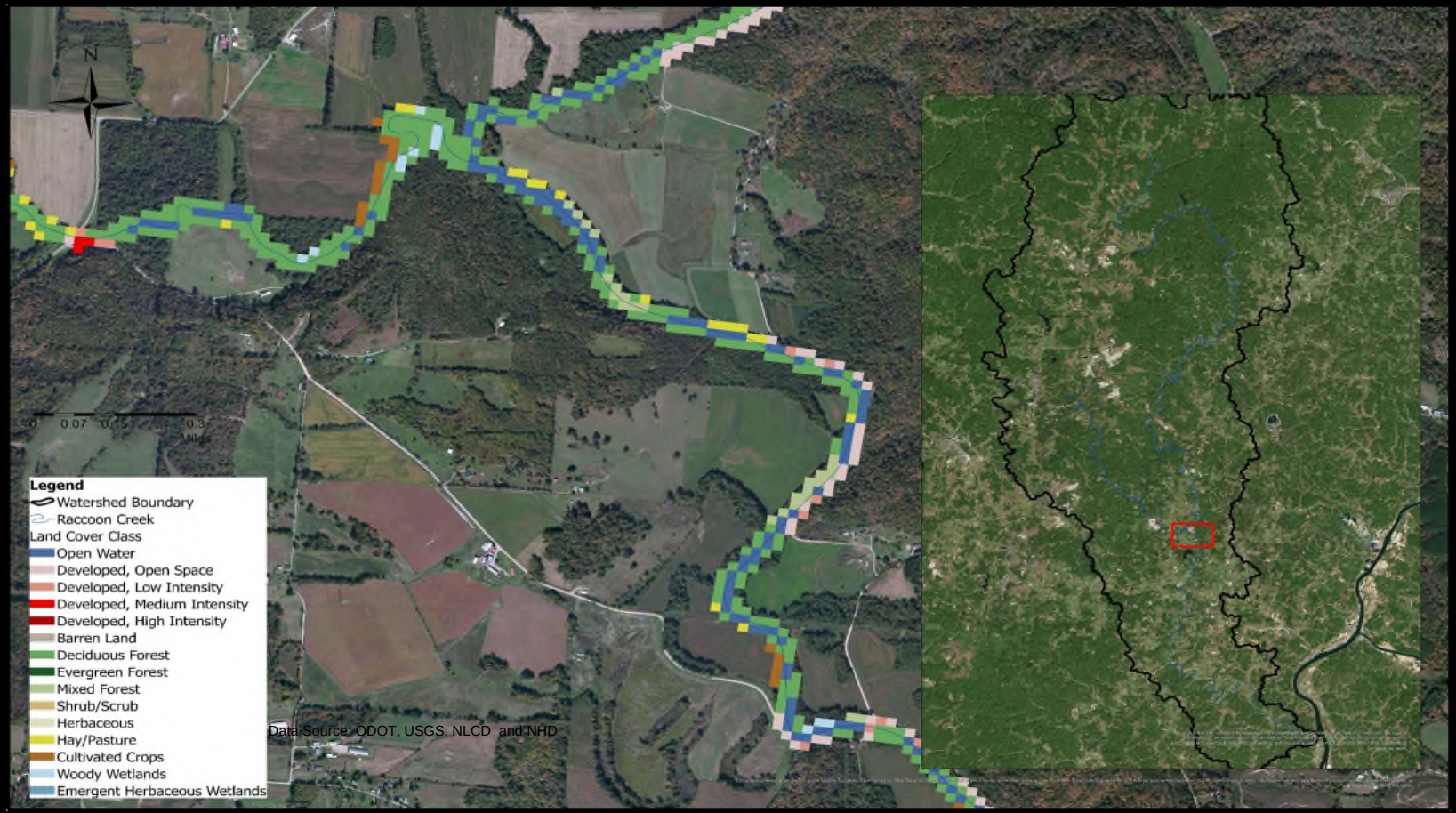
Scenic River Designation

- Wild, Scenic, or Recreational
- Criteria include:
  - Free flowing
  - Roads in 300 ft buffer of stream
  - Road crossings
  - Length of reach
  - Commercial, industrial, and residential development
  - Native forest or wetland riparian corridor

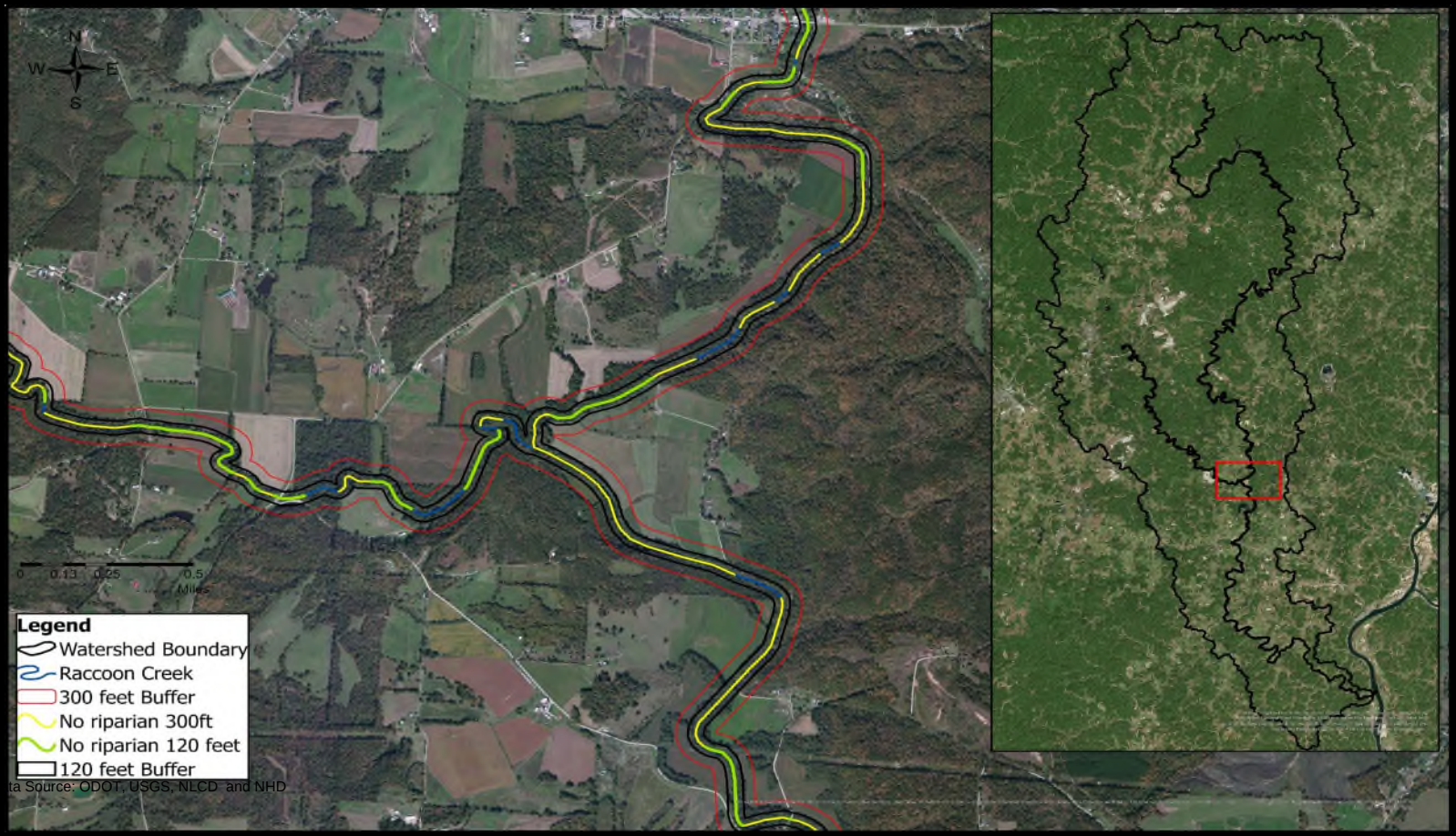
GIS Analysis



Land Cover Class within 120 Raccoon Creek

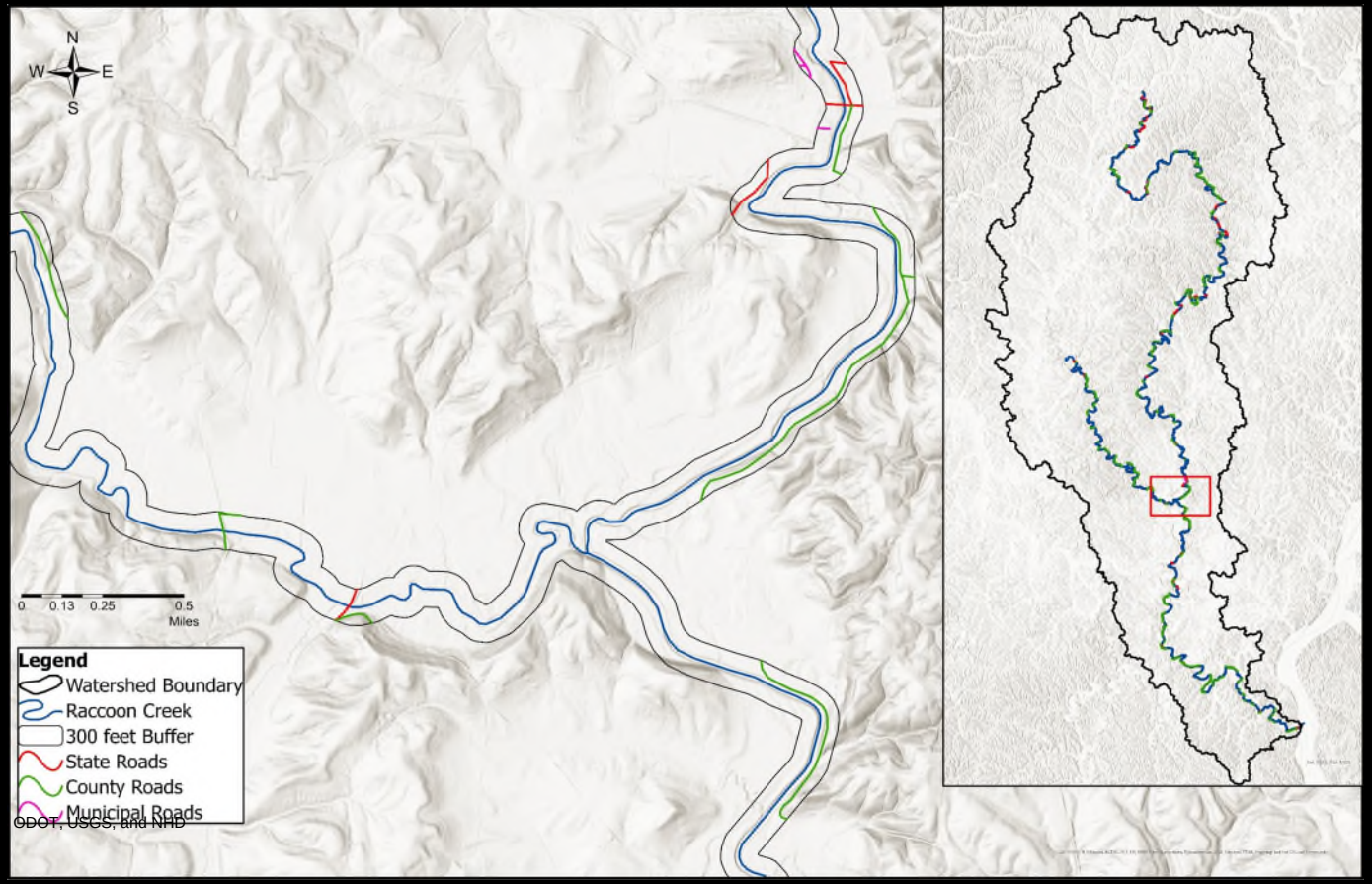


Areas Without Riparian



Roads

Roads within 300 feet of the Little Raccoon Creek and RM 37.5 near Vinton County

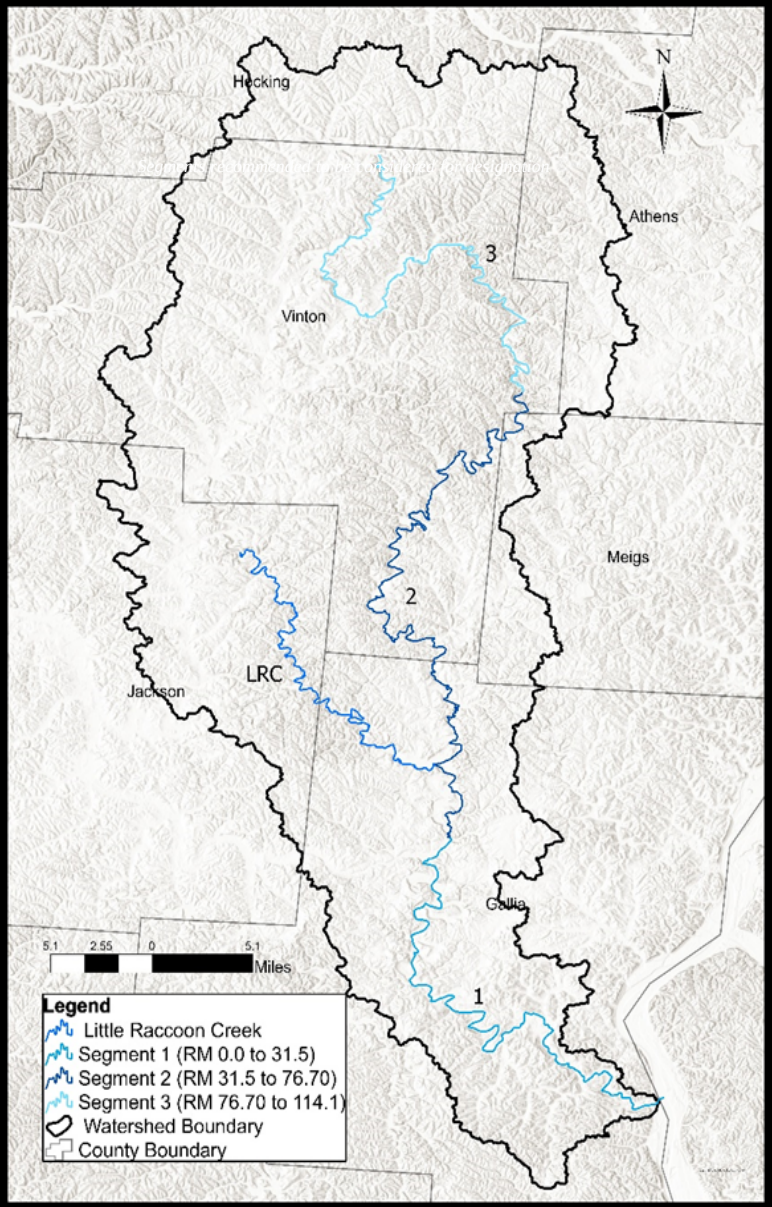


Commercial or Industrial settings

Bridge Crossings

- The different Wild, Scenic, and Recreational River criteria regarding bridge crossings state that there should be no limited access highway crossings within the proposed river segment
- 47 bridge crossings were traced within the 300 feet buffer of Little Raccoon Creek and Raccoon Creek
- Limited access highways SR 32 near Mulga run and US highway 35 (Appalachian Hwy) which passes through Rio Grande at RM 65.2
- Majority of crossings can be found within the Vinton, Gallia and Meigs Counties

River Mile	Road	County
0.4	State Route 7	Gallia
10.3	CR. 20	
9.78	CR.18	
14.3	TR. 394 / Blessing Road	
22.15	SR 141	
23.62	CR. 12 / Cora Mill Road	
27.06	TR. 420 / Garners Ford Bridge	
29.2	SR 588	
29.3	CR. 71	
30.7	U.S. 35	
40.01	SR 160: SR. 325	
	MR132C MR 130E	
44.6	SR. 160	
50.1	T-4 / Covered Bridge	
53.5	T-8 / Minerton Chapel Road	Vinton
54.9	SR. 124	
58.21	T-25 / Clarion Road	
58.6	CR. 9 / Hawk Station Road	
62.8	SR 160 / Main Street	
63.8	CR. 28 / Cotterill Road	
65.15	Copper Road	
66.2	SR 32: SR 32	
67.8	CR. 38A / Eakin Mile Covered Bridge	
68.04	CR. 38B Arbaugh Road	
68.7	SR. 32	
71.25	SR. 32 / Appalachian Hwy	
72.22	CR. 43C / Vales Mills	
75.9	T-1 / Rutherford Road	Vinton/Meigs
78.9	T-4 / Staneart Hollow Road	
80.1	T-4 / Staneart Hollow Road	
80.61	U.S 50	
83.05	SR 356	
84.01	SR 356	
89.4	T-1 / Buck Lane	
89.9	T-18	
92.3	CR. 3	
96.9	SR. 278	
97.2	T- F3	
98.35	T-F3	
99.6	SR. 677 / Power Plant Road	
102	T-18 /Creek Road	
104.63	SR. 328	
108.1	T-13 / Mine White Road	
109	SR 328	
111.4	SR 328	



Data Source: ODOT, USGS, NLCD and NHD

Findings and Recommendation

- The entire reach meets some specific criteria, if not all, for Wild, Scenic, and Recreational River designation.
- The entire Little Raccoon Creek, which is 25.7 miles, can be considered for Recreational River Designation.
- Segments on the Mainstem to be considered for designation
  - Mouth at RM 0.0 to 31.5 between Adamsville and Harrisburg
  - Harrisburg at RM 31.5 to 76.7 near Bolins Mills
  - Bolins Mills at RM 76.70 to 114.1 at the headwaters near SR 328

Huge thanks to all of our partners!

- Ohio Department of Natural Resources
  - Division of Mineral Resources Management
  - Division of Wildlife
  - Division of Forestry
- Ohio Environmental Protection Agency
- Office of Surface Mining
- Wayne National Forest
- County Soil and Water Conservation Districts
- Schools and Universities
- Department of Agriculture
- Local Landowners
- Mining Companies
- Local non-profits and conservation clubs
- The list goes on and on!!

Questions??

Amy Mackey

mackey@ohio.edu
Raccoon Creek Watershed Coordinator, Energy and the Environment Project Manager

Natalie Kruse

krusen@ohio.edu
Professor, Environmental Studies

Ohio University Voinovich School of Leadership and Public Service