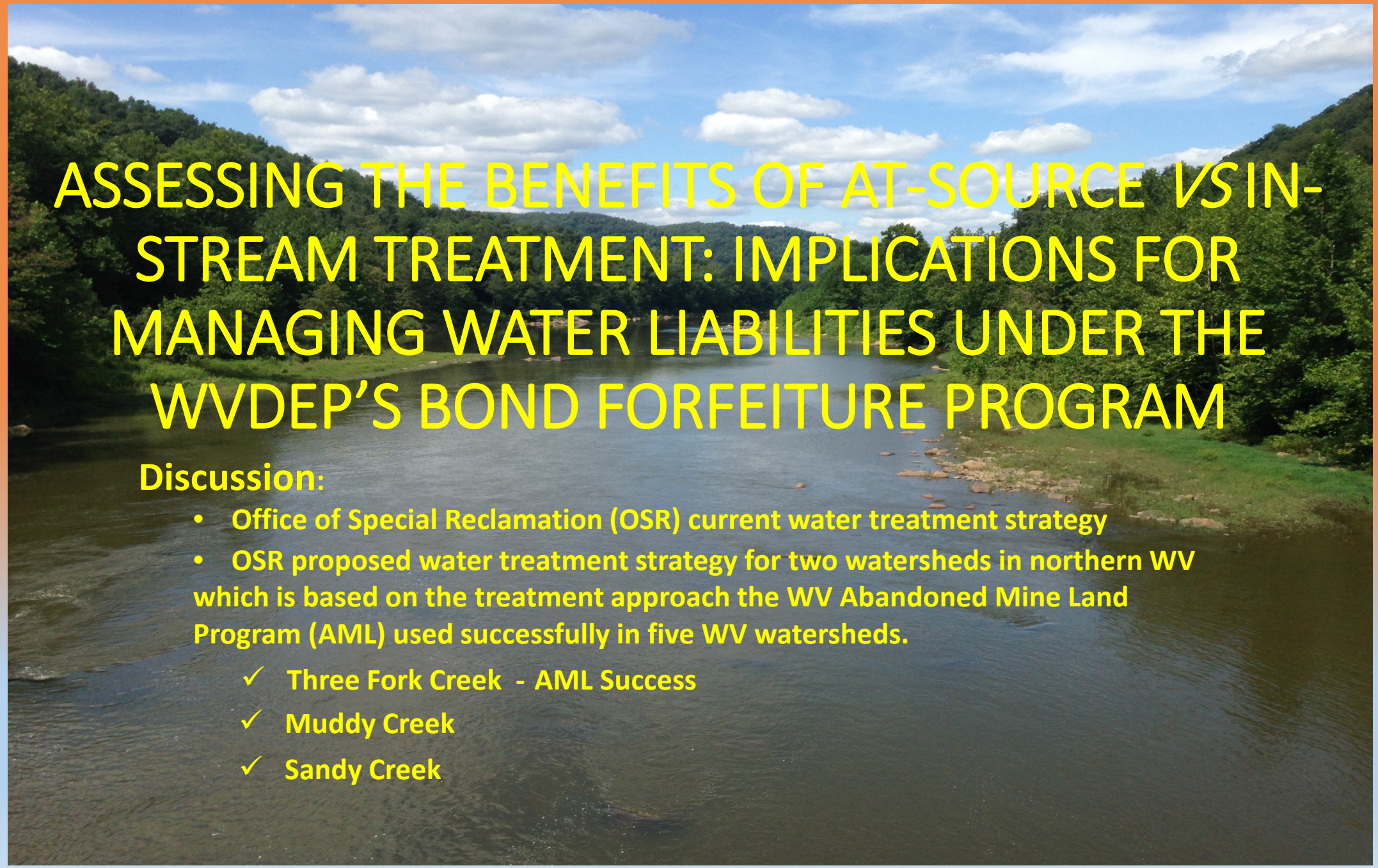
ASSESSING THE BENEFITS OF AT-SOURCE *VS* IN-STREAM TREATMENT: IMPLICATIONS FOR MANAGING WATER LIABILITIES UNDER THE WVDEP'S BOND FORFEITURE PROGRAM

Presented by: Mike Sheehan, WVDEP
and Paul Ziemkiewicz, WVU/WRI

at the

2017 Joint Conference of the
American Society of Mining and Reclamation
&
Appalachian Regional Reforestation Initiative
April 10, 2017

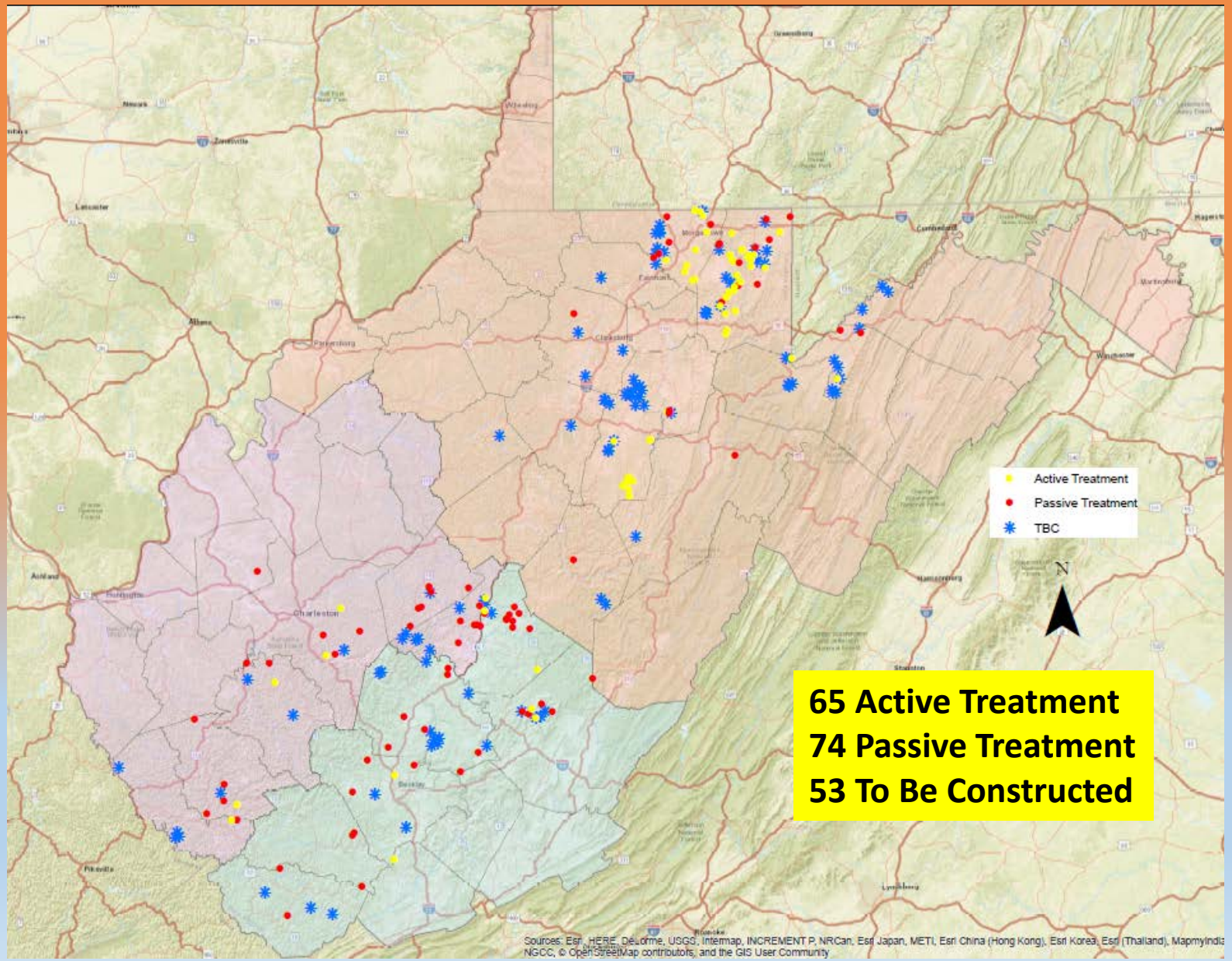


ASSESSING THE BENEFITS OF AT-SOURCE *VS* IN-STREAM TREATMENT: IMPLICATIONS FOR MANAGING WATER LIABILITIES UNDER THE WVDEP'S BOND FORFEITURE PROGRAM

Discussion:

- **Office of Special Reclamation (OSR) current water treatment strategy**
- **OSR proposed water treatment strategy for two watersheds in northern WV which is based on the treatment approach the WV Abandoned Mine Land Program (AML) used successfully in five WV watersheds.**
  - ✓ **Three Fork Creek - AML Success**
  - ✓ **Muddy Creek**
  - ✓ **Sandy Creek**

OSR Water Treatment Sites



OSR Current Water Treatment Strategies

TYPICAL TREATMENT LAYOUT

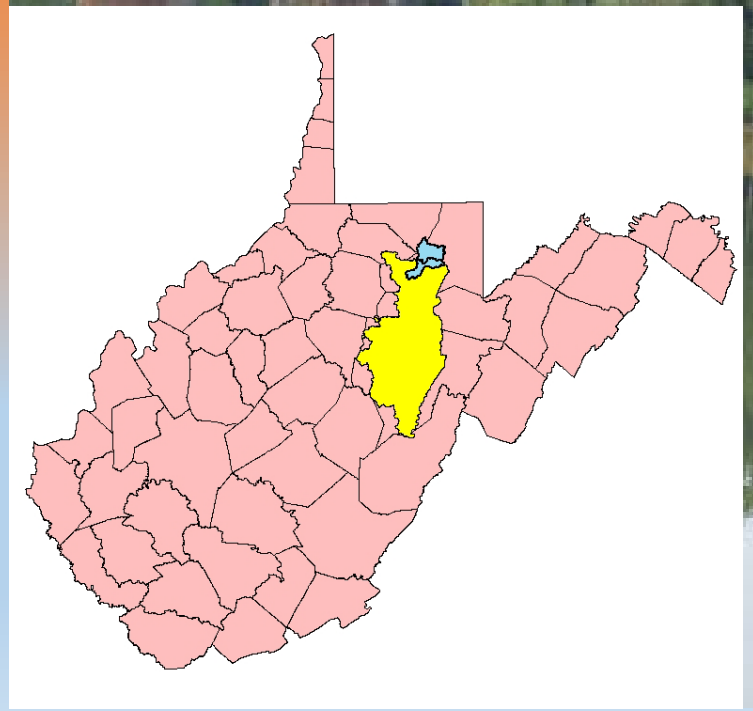
Sludge Management

Sludge Management


Sludge Management w/ Geo Tubes


High Tech
Mixer
Control Building
38 ft Clarifier
Lime Slurry
Geo Tubes

TYGART VALLEY RIVER

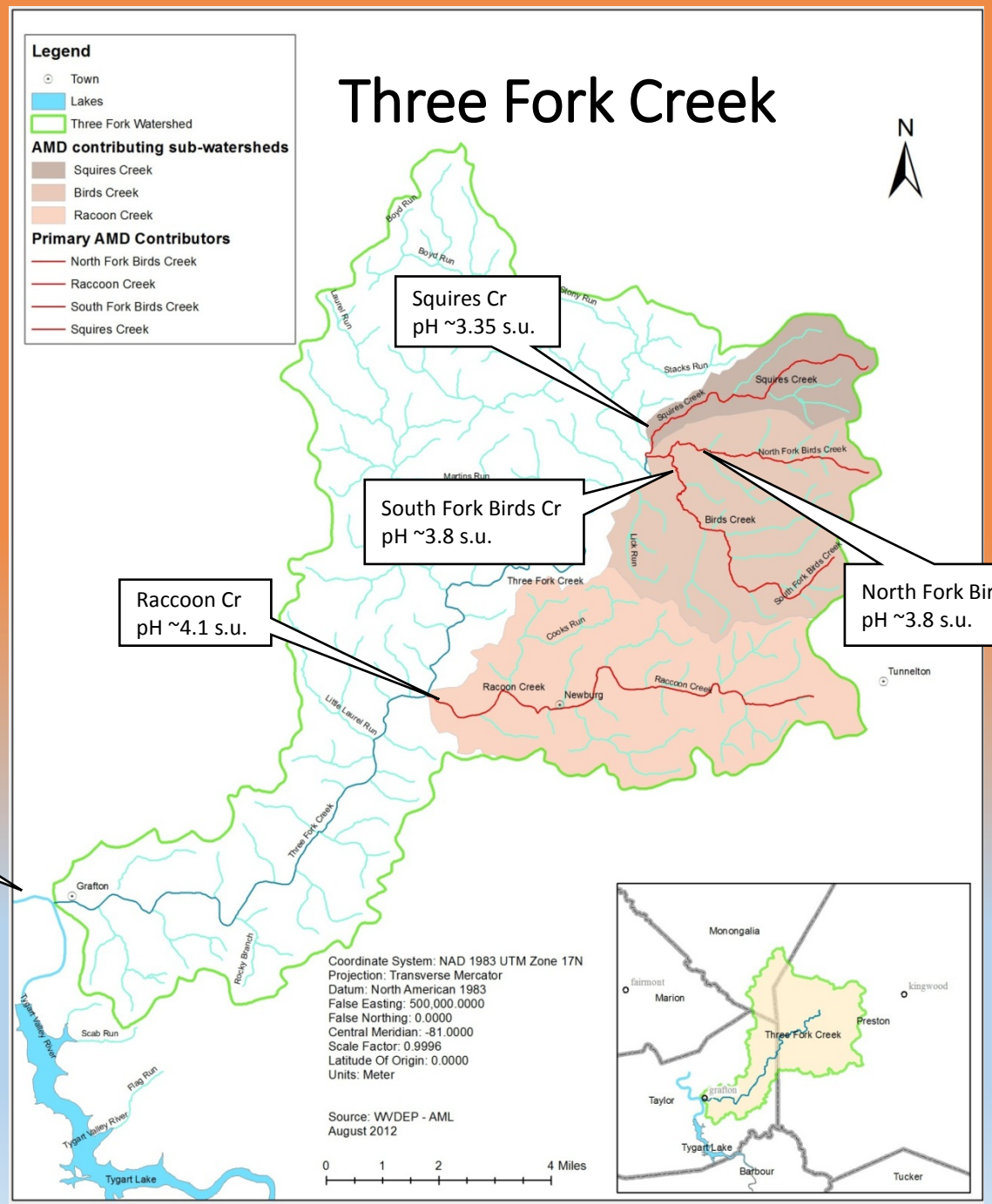



Three Fork Creek
2010
Three Fork Creek Watershed
Restoration Project

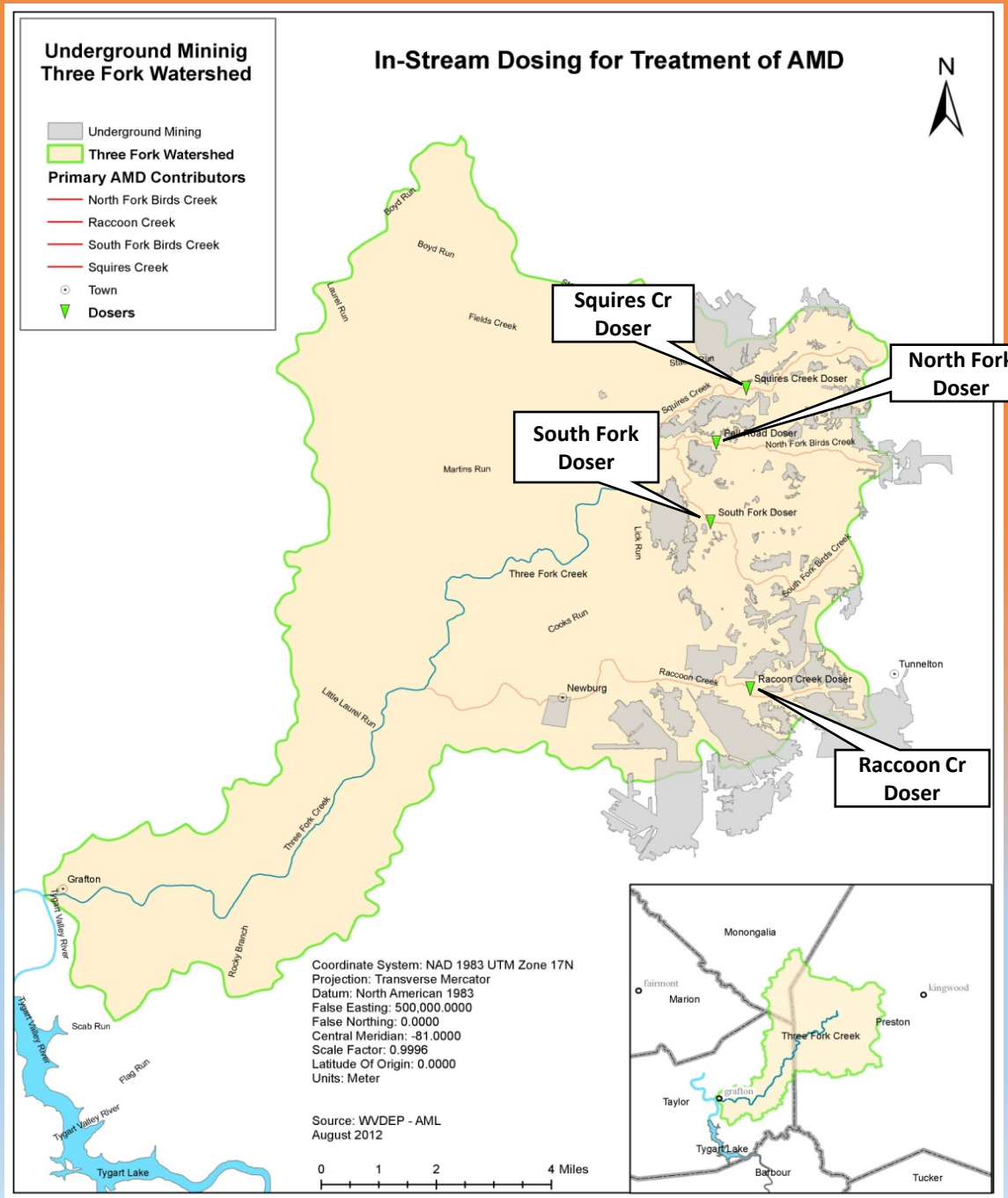
Problem

There are three major contributors of AMD to Three Fork Creek.

- **Squires Creek**
- **Birds Creek**
- **Raccoon Creek**



Three Fork Creek Watershed Restoration Project

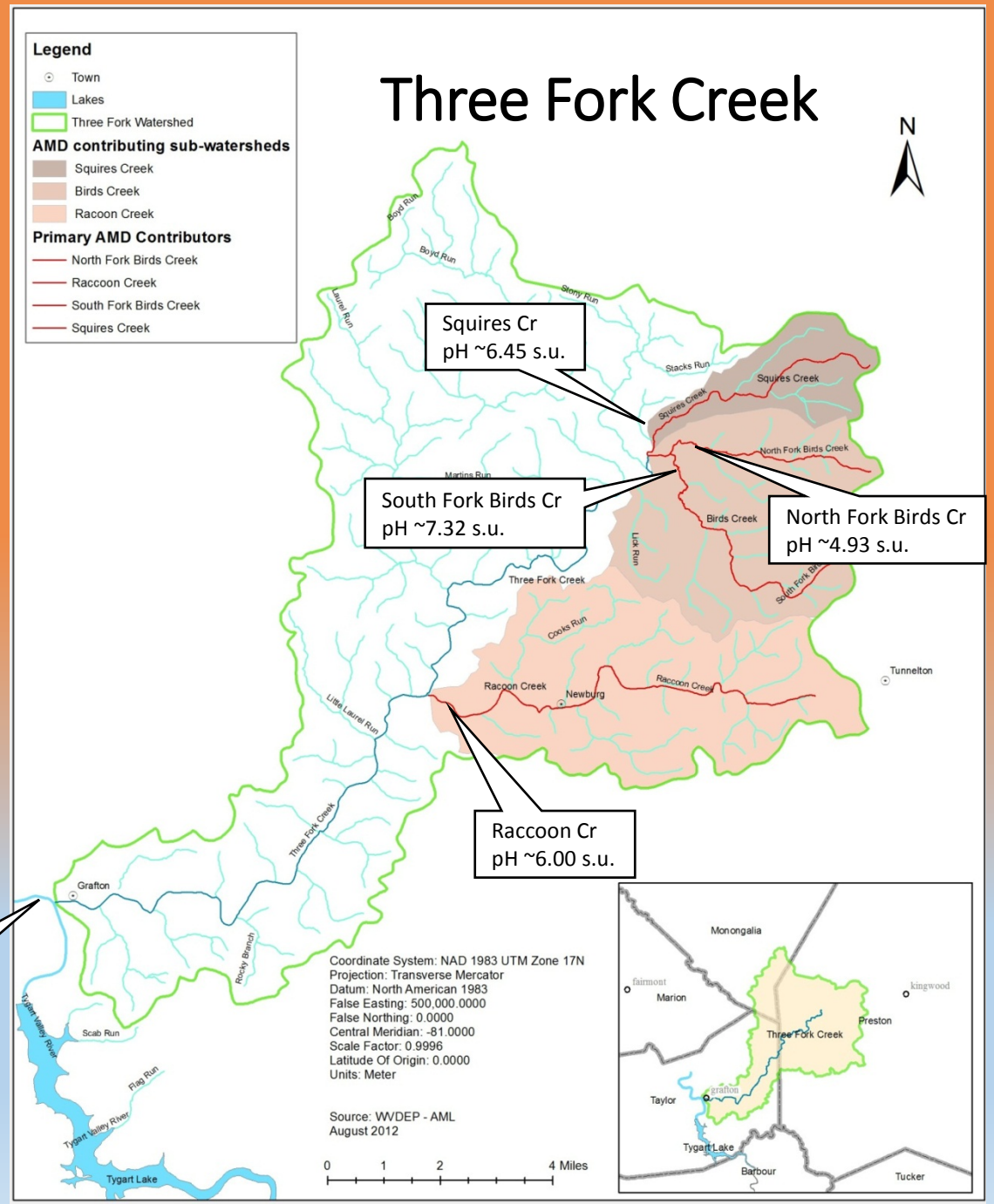


- **Project Start Date: July 19, 2010**
- **In 2010 benthic macro-invertebrate surveys and fish surveys were conducted by the WVDEP Watershed Assessment Branch (WAB) at four locations along the mainstem of Three Fork Creek.**

  ❑ **WAB only identified Eight taxa and three EPT species.**

  ❑ **Results of the fish survey were even more discouraging having only found one fish, a green sunfish caught at 0.4 miles from the confluence with the Tygart Valley River.**

- **4 Lime dosers were installed on the three tributaries**
- **Project Completion Date: April 15, 2011**
- **Initial Construction Cost: $750,491.15**



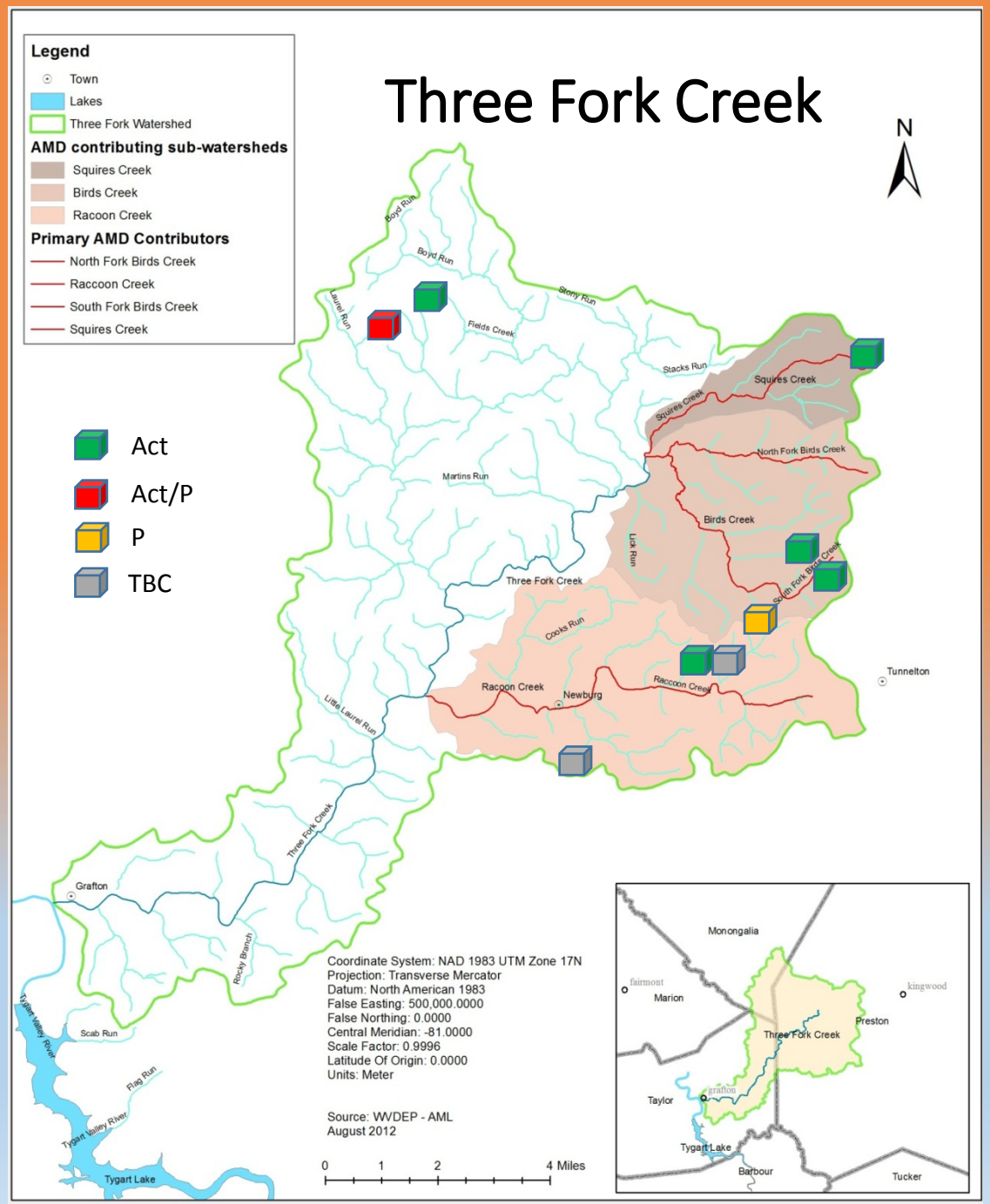
Three Fork Creek Watershed Restoration Project

- **In 2012 benthic macro-invertebrate surveys and fish surveys were conducted by WAB at the same four locations along the mainstem of Three Fork Creek.**
- **Benthic results were impressive, increasing the total taxa to fifteen with eight EPT taxa.**

Results of the fish survey were even more dramatic. Less than two years after the initiation of in-stream treatment 1,605 fish were caught representing 21 species of predator and prey at the same four locations.

- **More importantly they caught young fish, indicating that natural reproduction is taking place in Three Fork.**

1,605!



OSR Treatment Activities in Three Fork Creek

OSR has been treating mine drainage at forfeited mine sites within the Three Forks watershed as early as 2001. OSR has constructed 6 active treatment sites and 3 passive treatment systems at nine bond forfeiture sites within the watershed and there are two more to complete.
And OSR has eleven NPDES outlets.

OSR spent approximately $3 million for the construction of these treatment sites and by 2010 over $1.5 million had been spent in O&M.

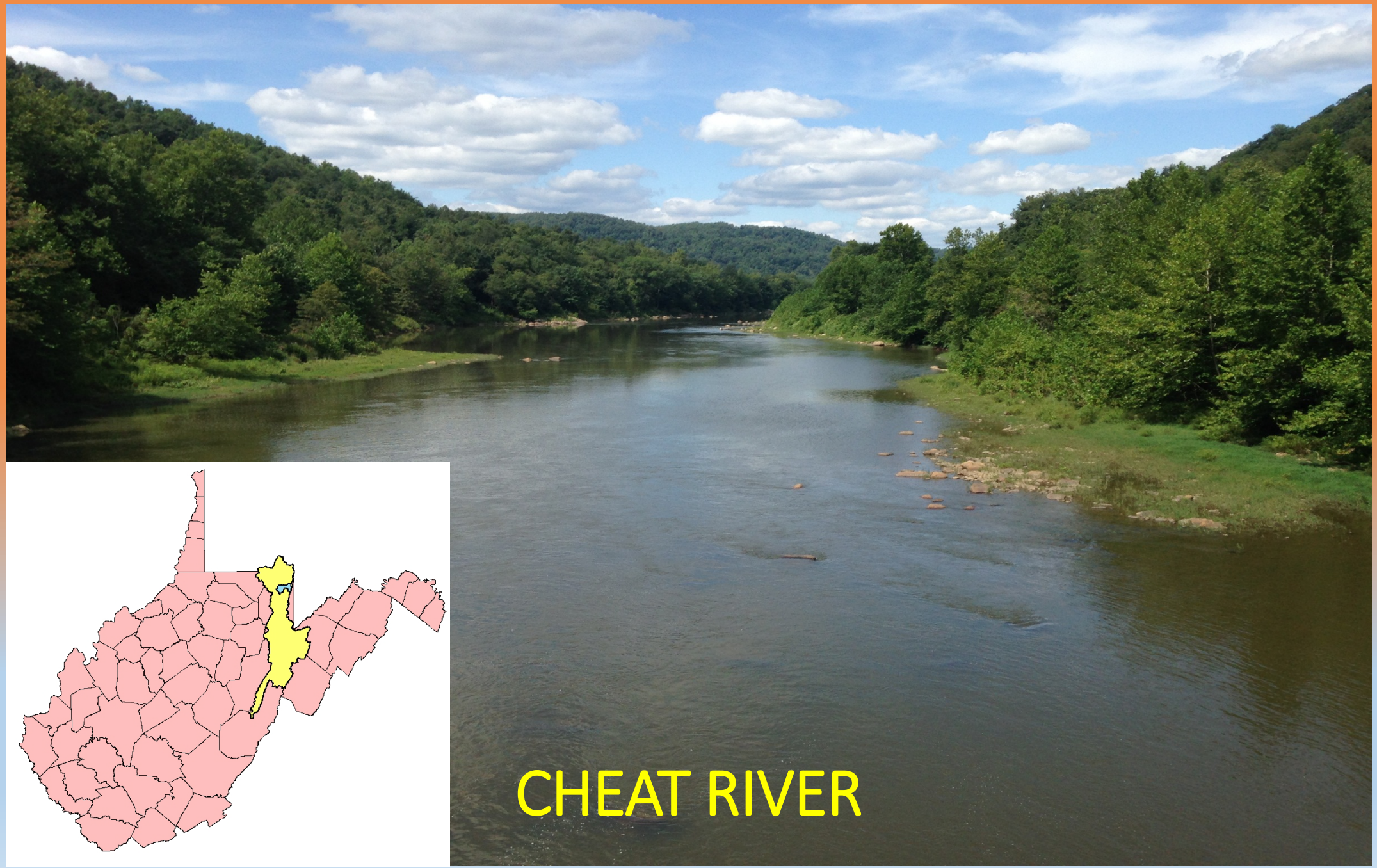
And as the 2010 fish survey indicated there was one fish.

One suicidal green sunfish caught not even a half mile from the confluence of the Tygart Valley River.

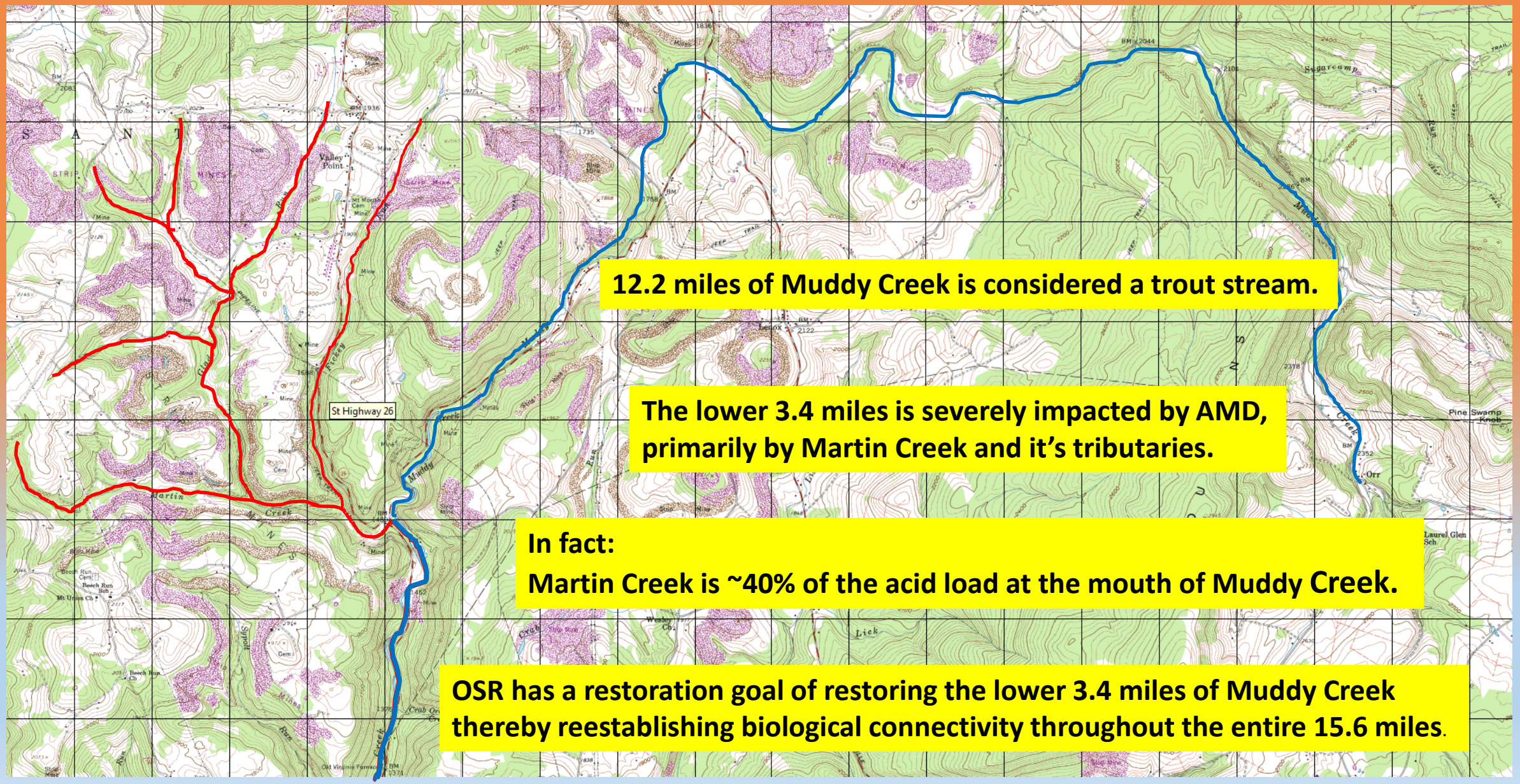

Three Fork Creek
2010


Three Fork Creek
2012


Three Fork Creek
2012


CHEAT RIVER

MUDDY CREEK



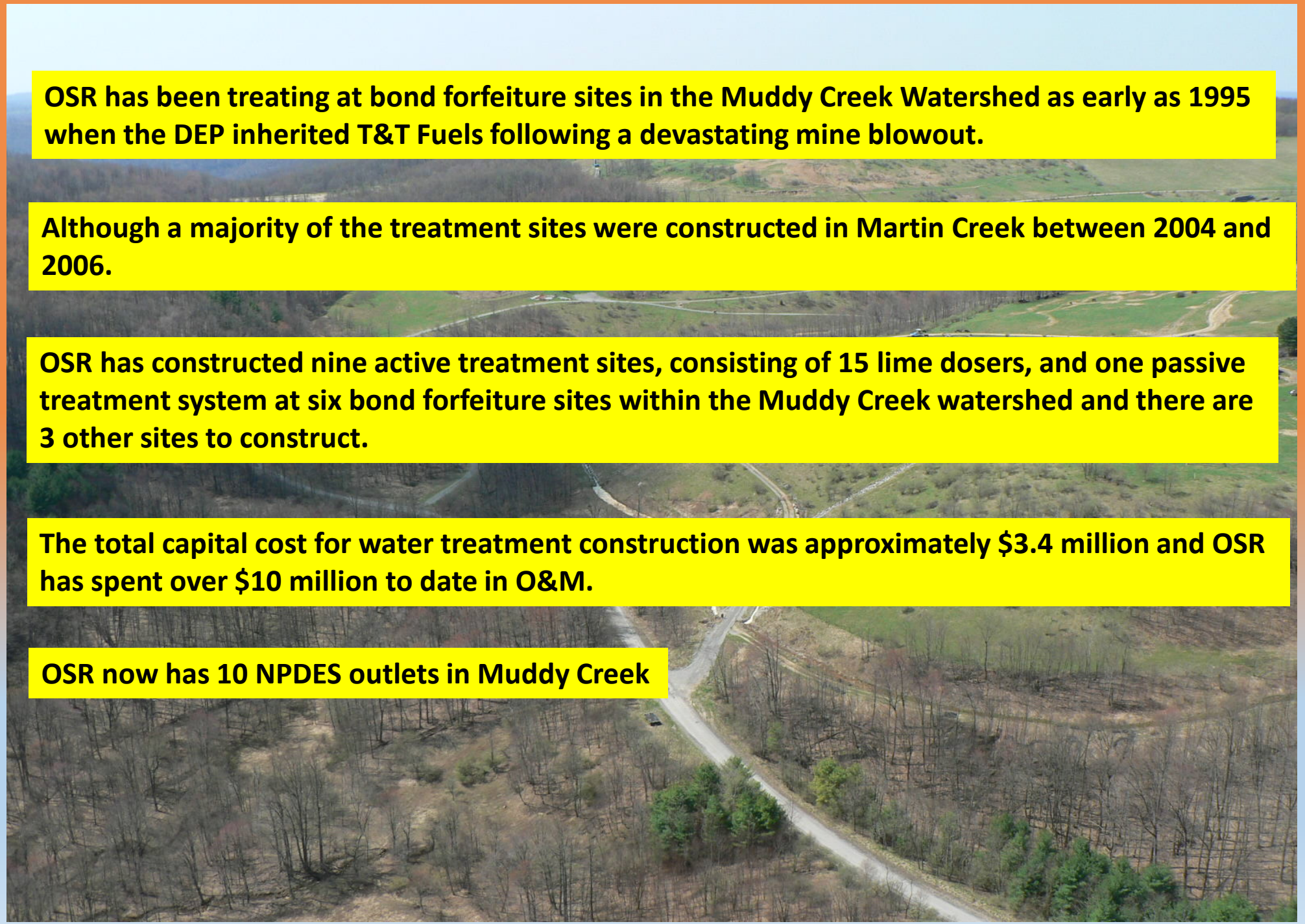
12.2 miles of Muddy Creek is considered a trout stream.

The lower 3.4 miles is severely impacted by AMD, primarily by Martin Creek and it's tributaries.

In fact:
Martin Creek is ~40% of the acid load at the mouth of Muddy Creek.

OSR has a restoration goal of restoring the lower 3.4 miles of Muddy Creek thereby reestablishing biological connectivity throughout the entire 15.6 miles.


Martin Cr
Muddy Cr
Muddy Cr



OSR has been treating at bond forfeiture sites in the Muddy Creek Watershed as early as 1995 when the DEP inherited T&T Fuels following a devastating mine blowout.

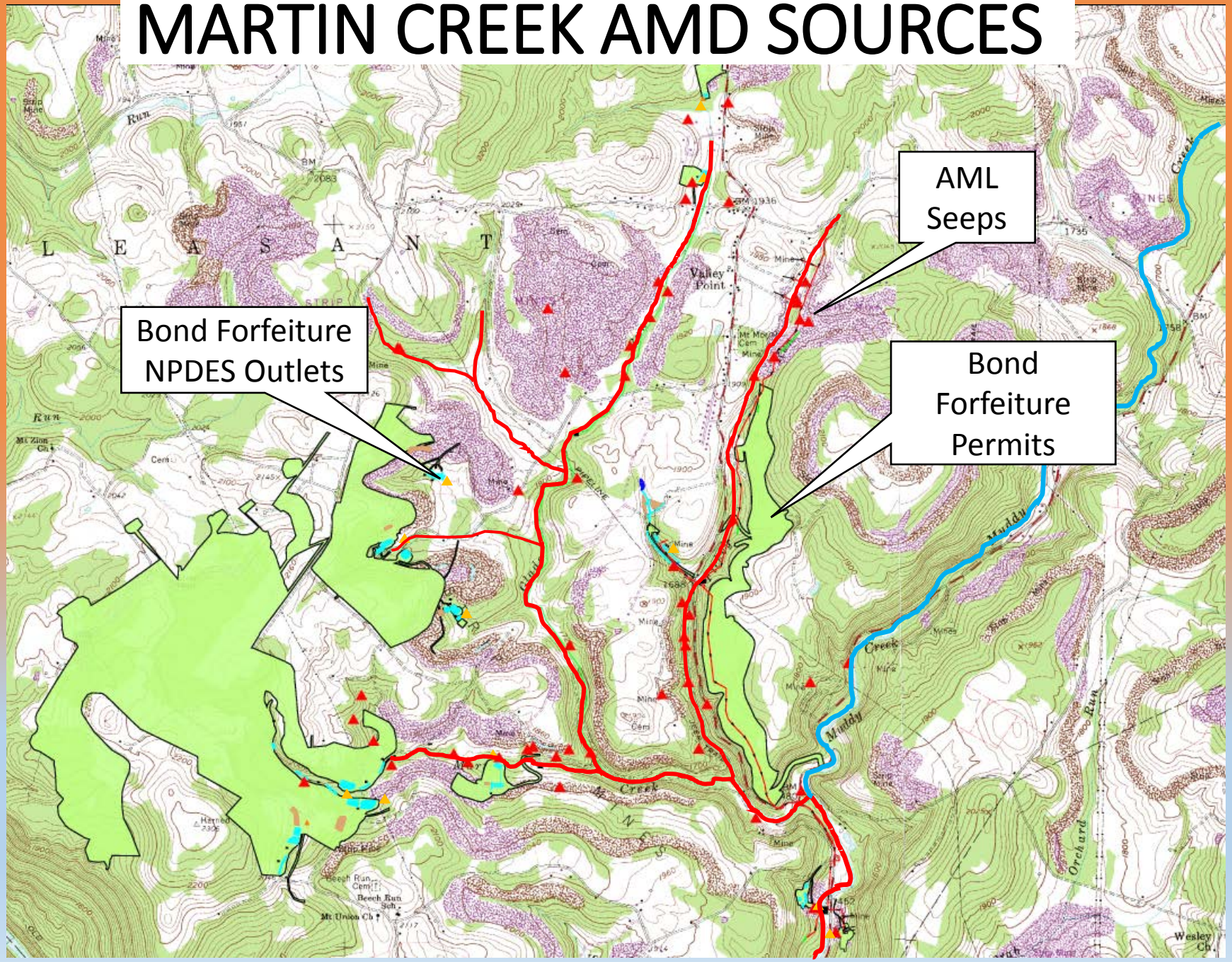
Although a majority of the treatment sites were constructed in Martin Creek between 2004 and 2006.

OSR has constructed nine active treatment sites, consisting of 15 lime dosers, and one passive treatment system at six bond forfeiture sites within the Muddy Creek watershed and there are 3 other sites to construct.

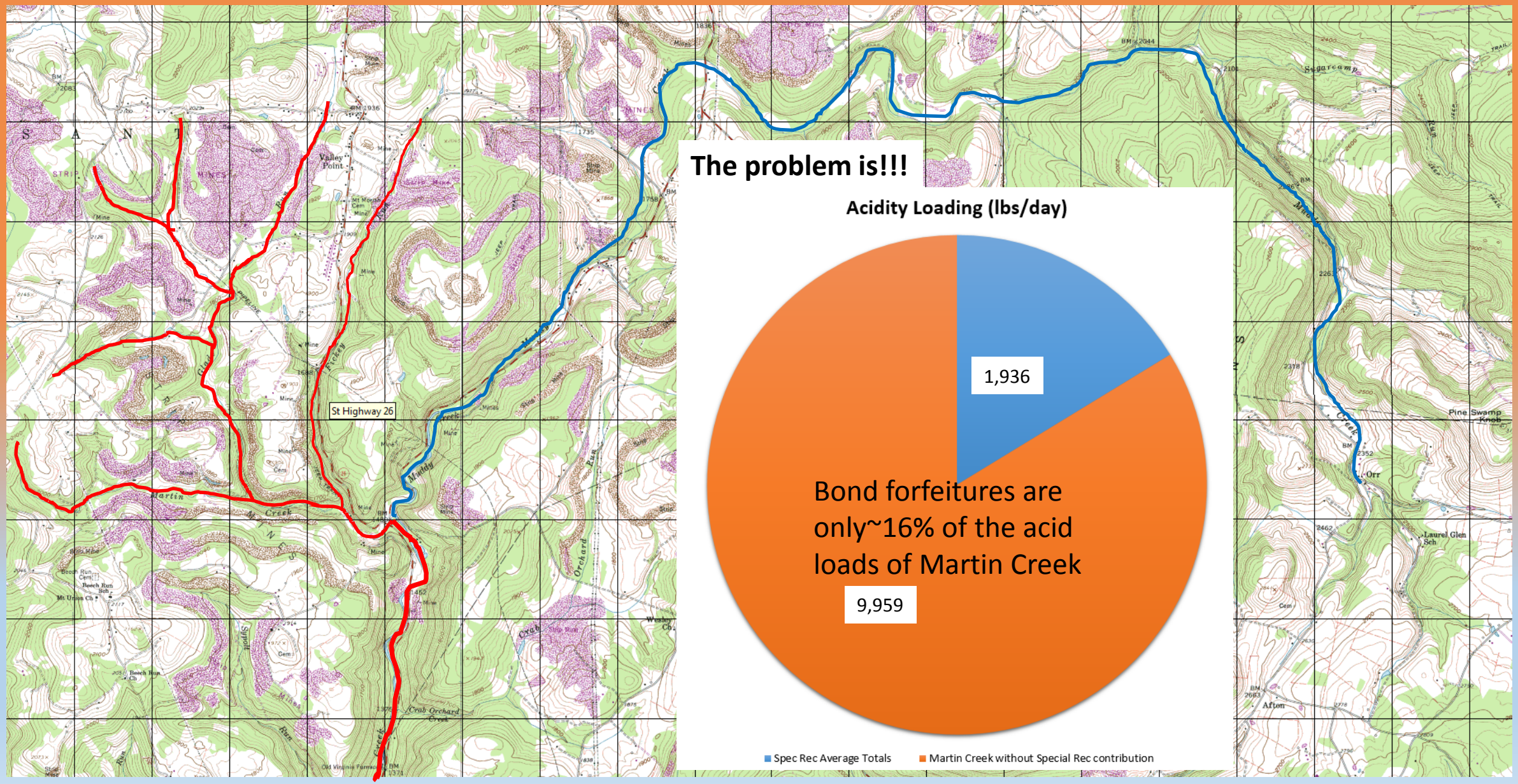
The total capital cost for water treatment construction was approximately $3.4 million and OSR has spent over $10 million to date in O&M.

OSR now has 10 NPDES outlets in Muddy Creek

MARTIN CREEK AMD SOURCES

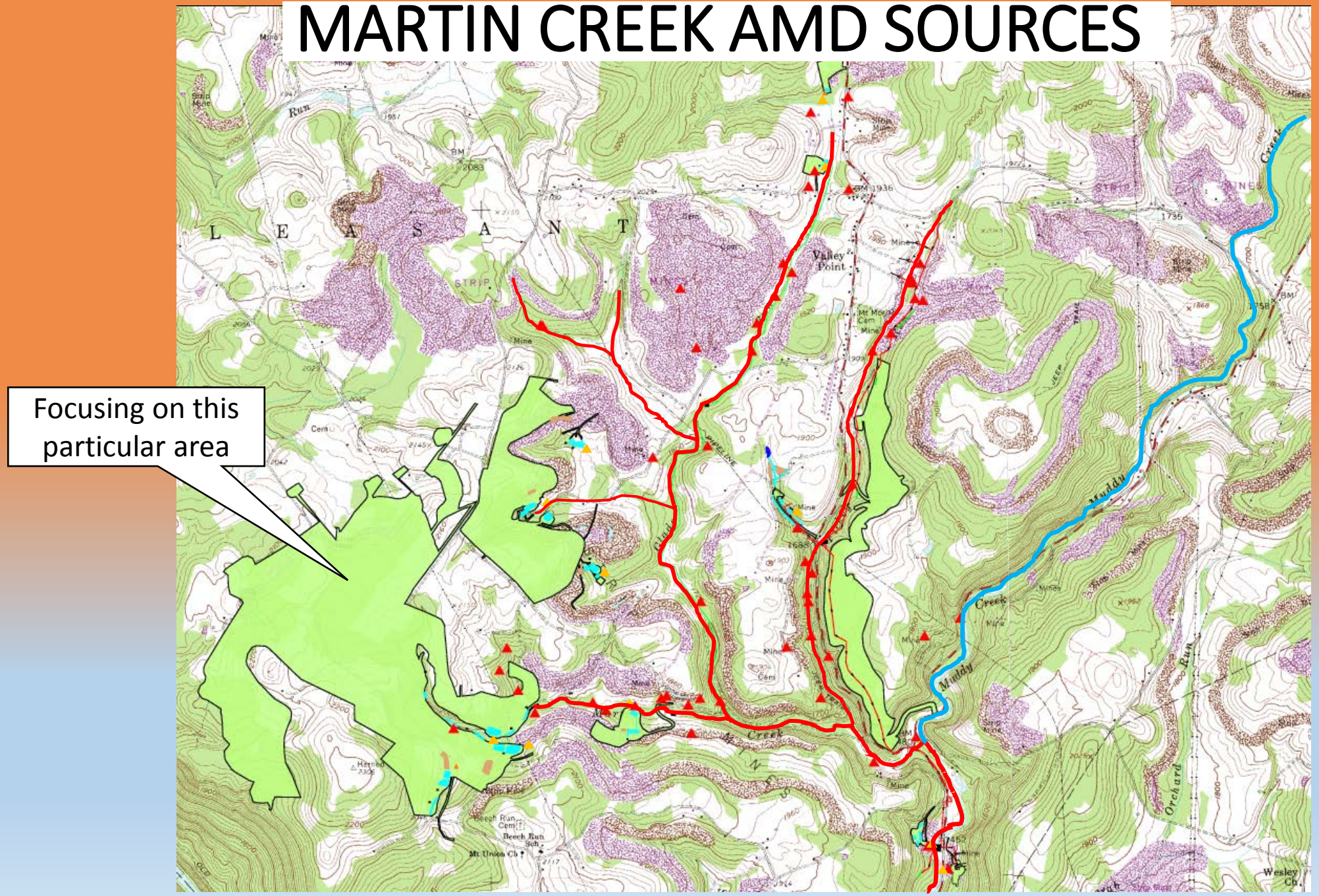


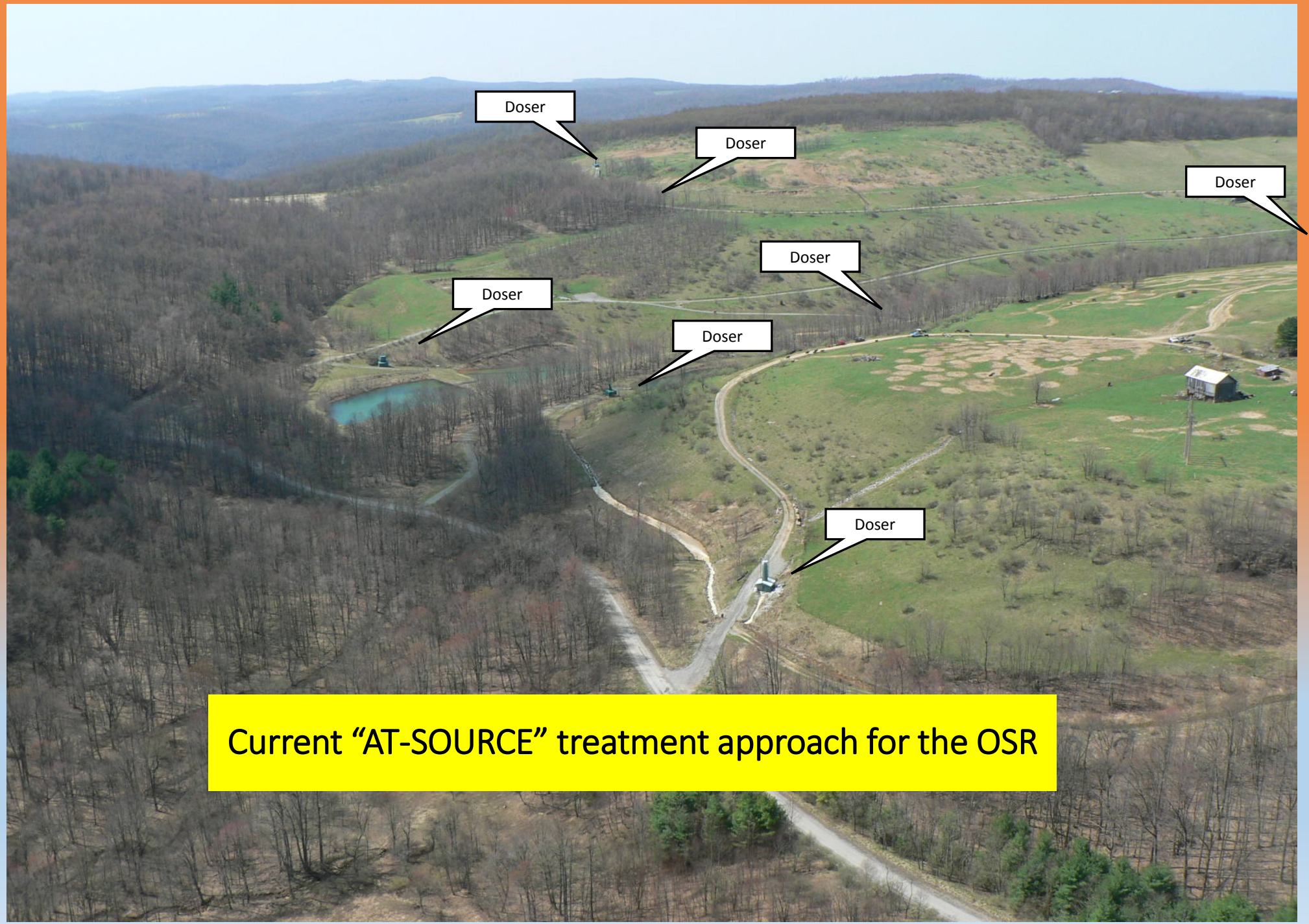
MUDDY CREEK



The problem is!!!

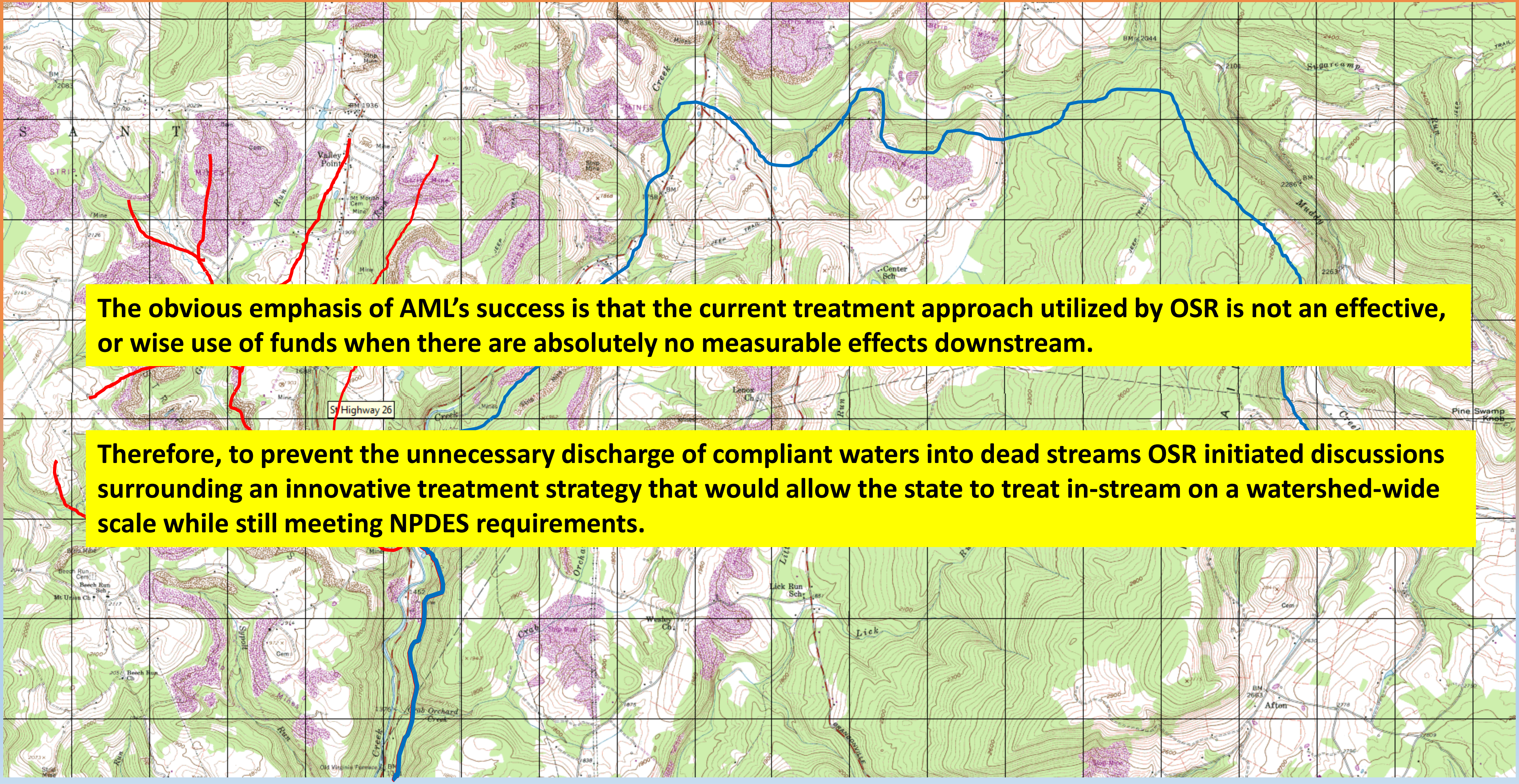
MARTIN CREEK AMD SOURCES





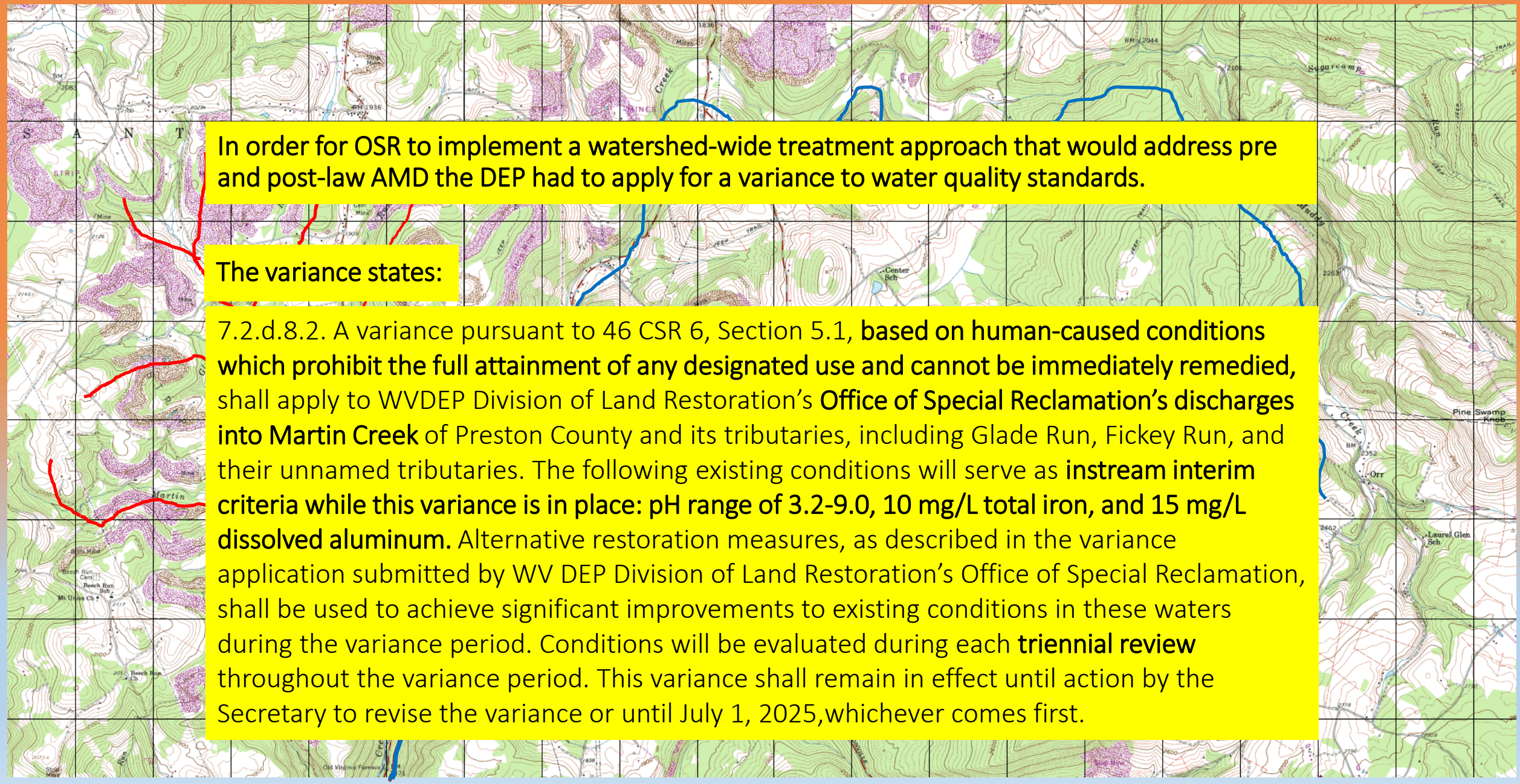
Current “AT-SOURCE” treatment approach for the OSR


Without an alternative treatment approach OSR is scheduled to spend an additional $1.6 million to retrofit 7 existing treatment sites and construct 2 new sites within Martin Creek and it's tributaries.
AND MUDDY CREEK IS STILL DEAD!



The obvious emphasis of AML's success is that the current treatment approach utilized by OSR is not an effective, or wise use of funds when there are absolutely no measurable effects downstream.

Therefore, to prevent the unnecessary discharge of compliant waters into dead streams OSR initiated discussions surrounding an innovative treatment strategy that would allow the state to treat in-stream on a watershed-wide scale while still meeting NPDES requirements.



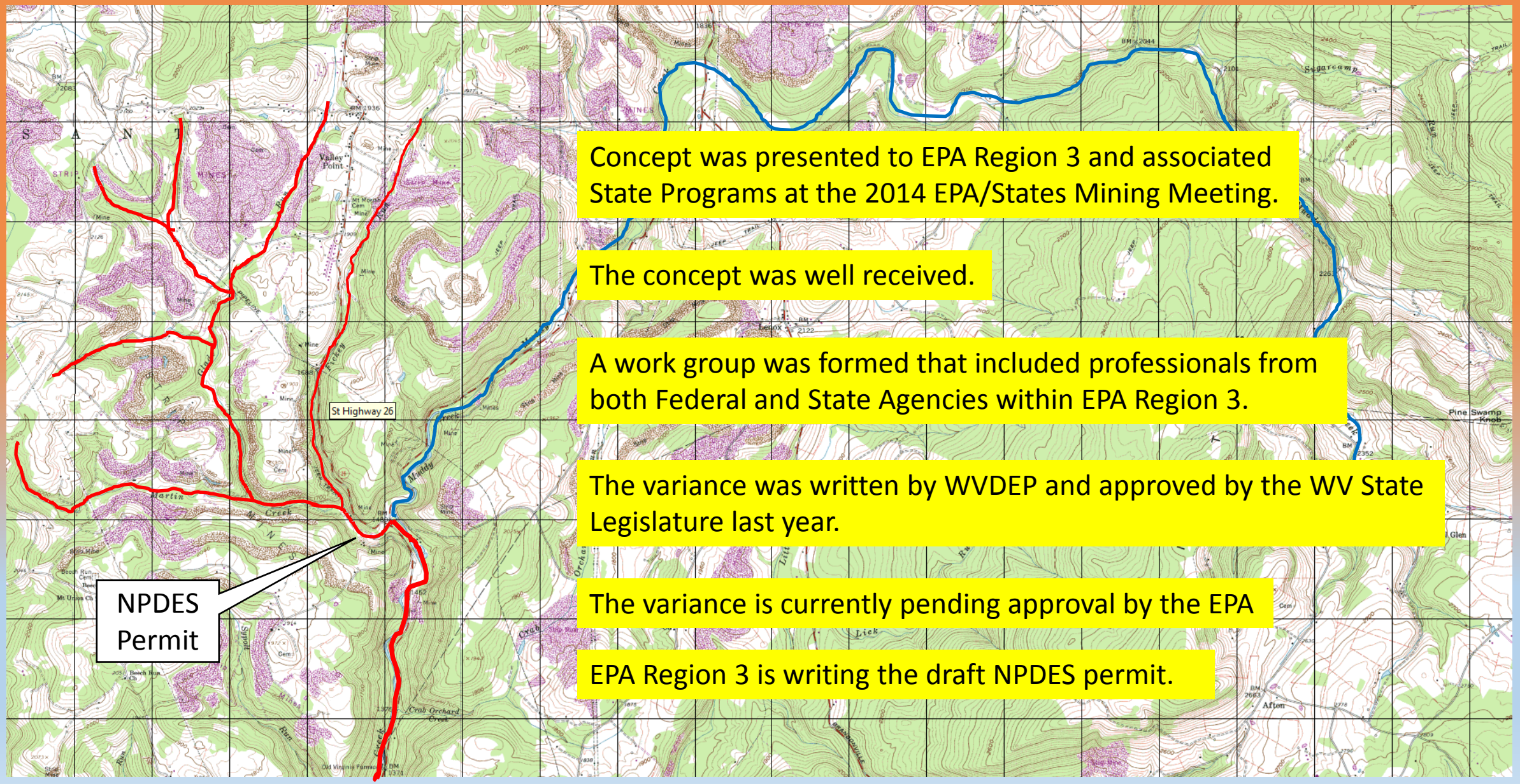
In order for OSR to implement a watershed-wide treatment approach that would address pre and post-law AMD the DEP had to apply for a variance to water quality standards.

The variance states:

7.2.d.8.2. A variance pursuant to 46 CSR 6, Section 5.1, **based on human-caused conditions which prohibit the full attainment of any designated use and cannot be immediately remedied,** shall apply to WVDEP Division of Land Restoration's **Office of Special Reclamation's discharges into Martin Creek** of Preston County and its tributaries, including Glade Run, Fickey Run, and their unnamed tributaries. The following existing conditions will serve as **instream interim criteria while this variance is in place: pH range of 3.2-9.0, 10 mg/L total iron, and 15 mg/L dissolved aluminum.** Alternative restoration measures, as described in the variance application submitted by WV DEP Division of Land Restoration's Office of Special Reclamation, shall be used to achieve significant improvements to existing conditions in these waters during the variance period. Conditions will be evaluated during each **triennial review** throughout the variance period. This variance shall remain in effect until action by the Secretary to revise the variance or until July 1, 2025,whichever comes first.

IN-STREAM PERMITTING

IN-STREAM NPDES PERMIT



Concept was presented to EPA Region 3 and associated State Programs at the 2014 EPA/States Mining Meeting.

The concept was well received.

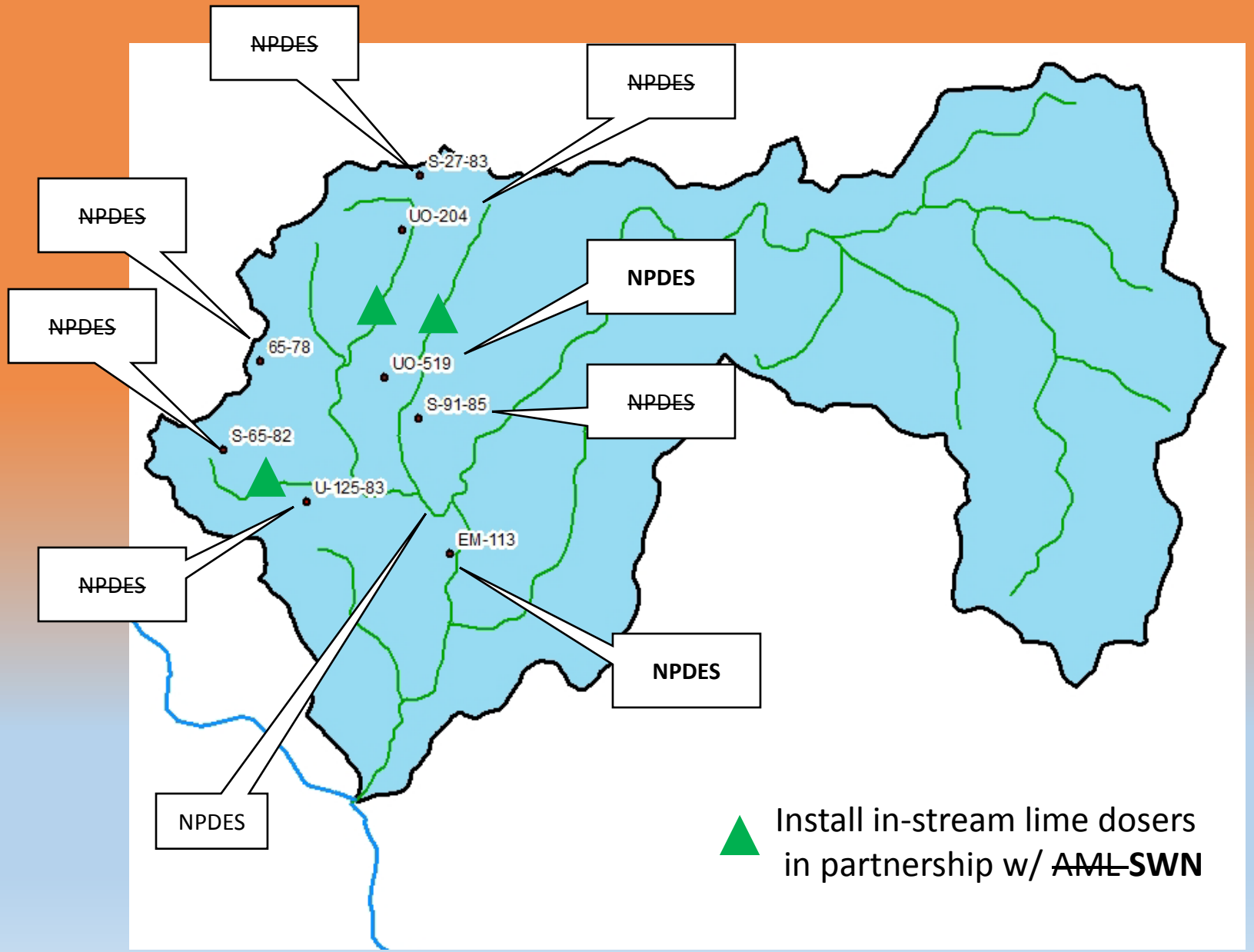
A work group was formed that included professionals from both Federal and State Agencies within EPA Region 3.

The variance was written by WVDEP and approved by the WV State Legislature last year.

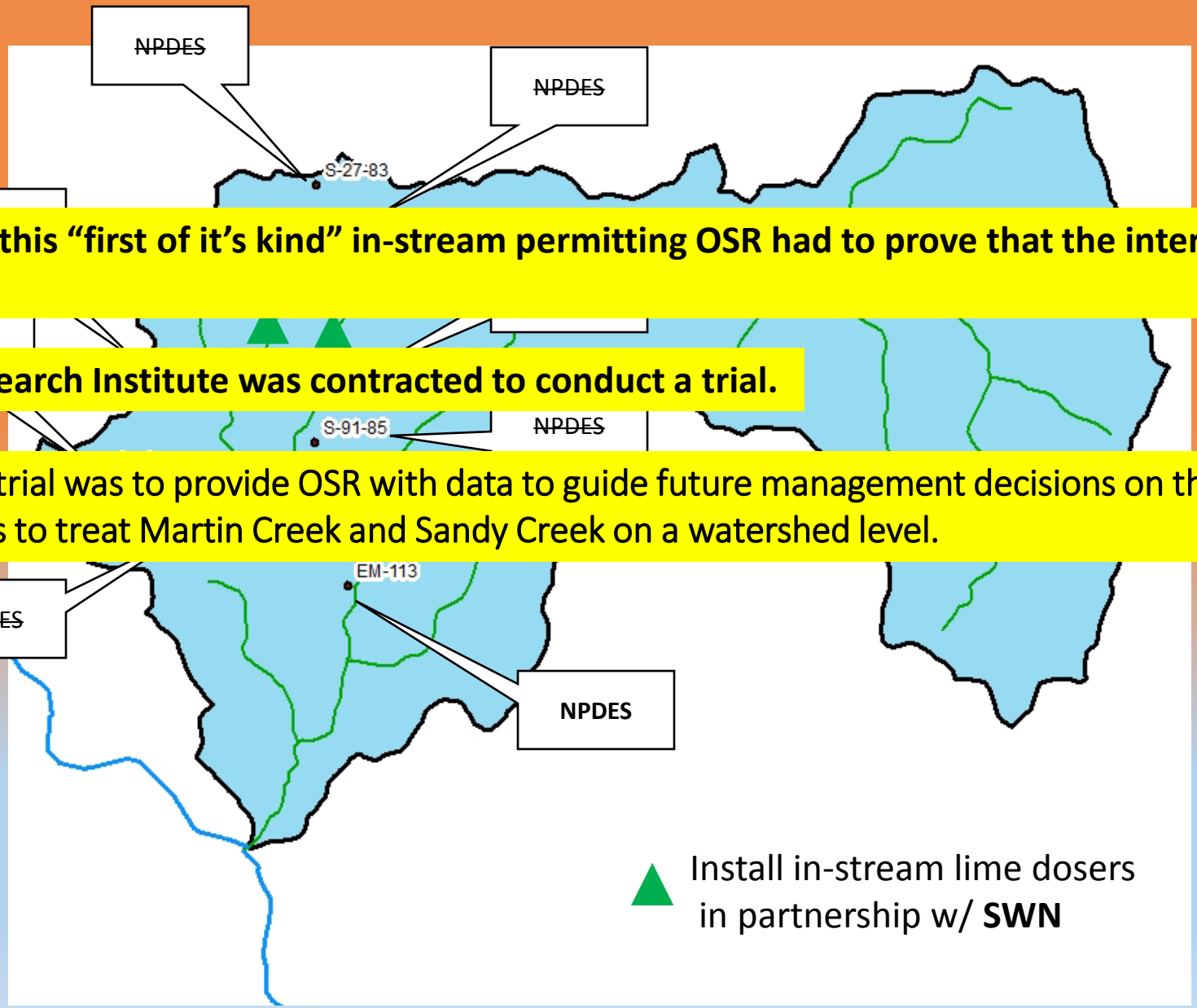
The variance is currently pending approval by the EPA

EPA Region 3 is writing the draft NPDES permit.

IN-STREAM NPDES PERMITTING CONCEPT



IN-STREAM NPDES PERMITTING CONCEPT



Prior to diving into this "first of it's kind" in-stream permitting OSR had to prove that the interim limits could be achieved.

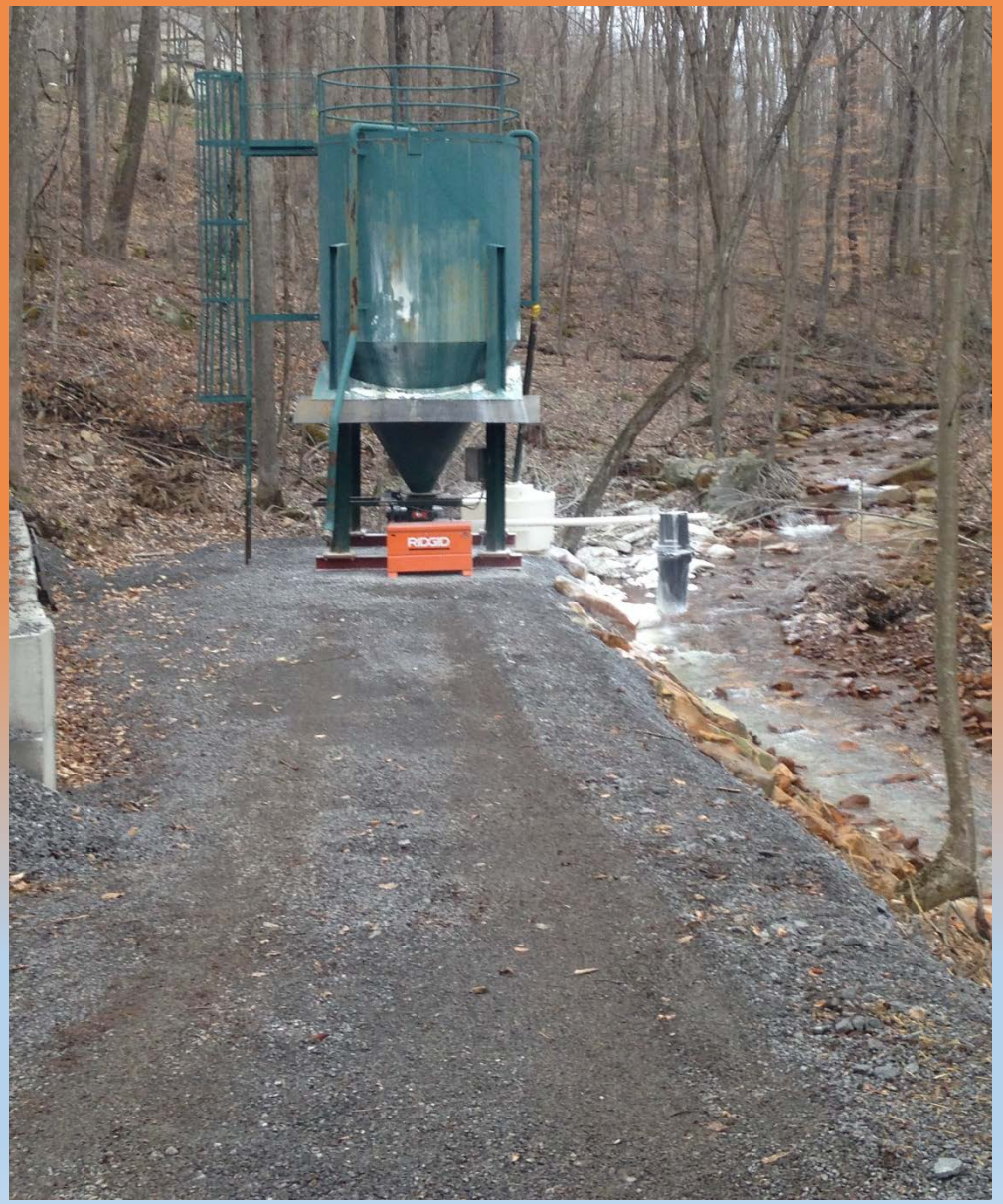
The WV Water Research Institute was contracted to conduct a trial.

The purpose of the trial was to provide OSR with data to guide future management decisions on the placement of dosers to treat Martin Creek and Sandy Creek on a watershed level.

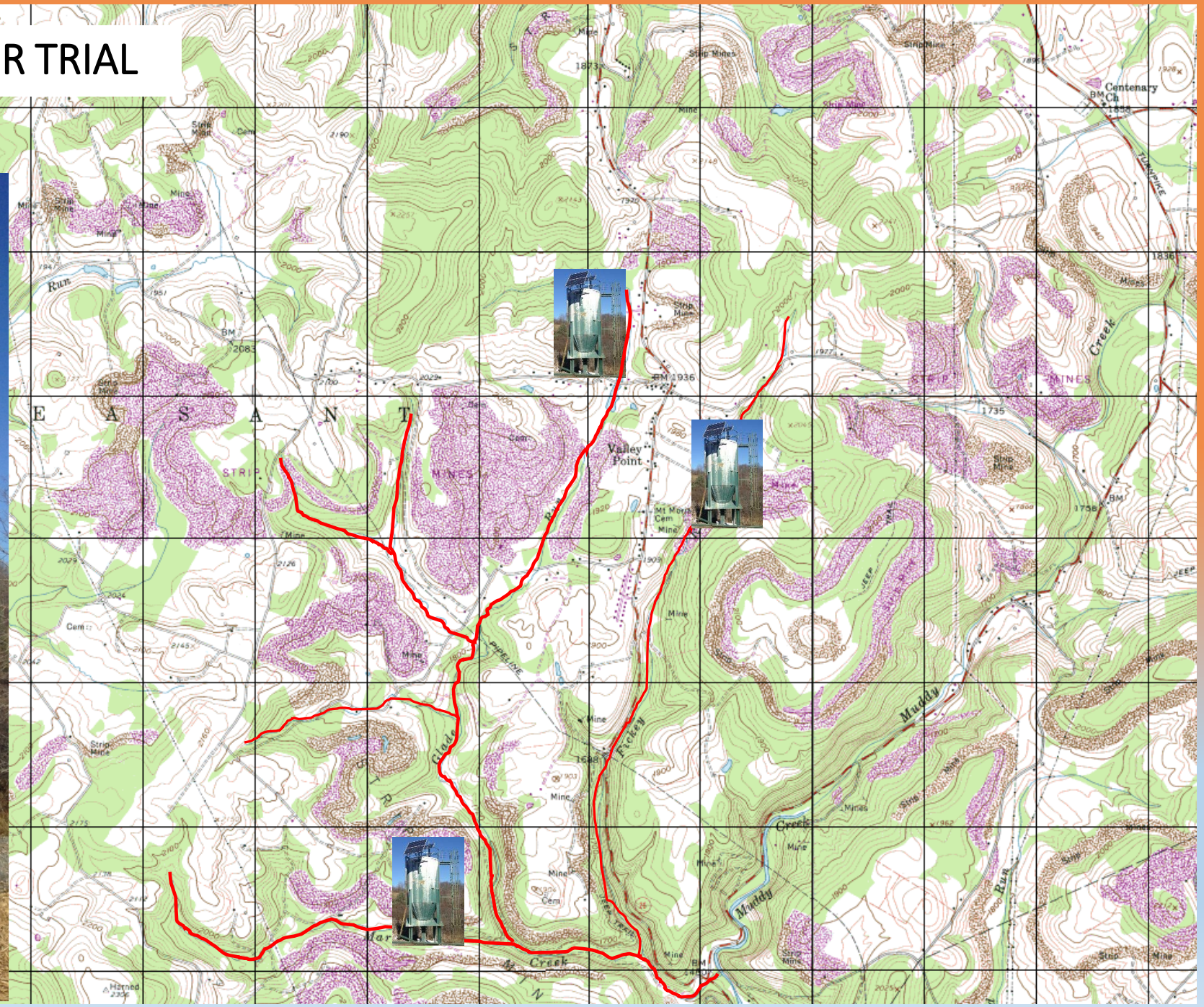
MARTIN CREEK IN-STREAM DOSER TRIAL

Part of the trial was to determine the optimal location for the placement of the dosers.

To accomplish this dosers were modified to enable mobility throughout the watersheds.



MARTIN CREEK IN-STREAM DOSER TRIAL



STREAM IMPACTS ON FICKEY RUN, MARTIN CREEK, AND MUDDY CREEK

Mouth of Fickey Run

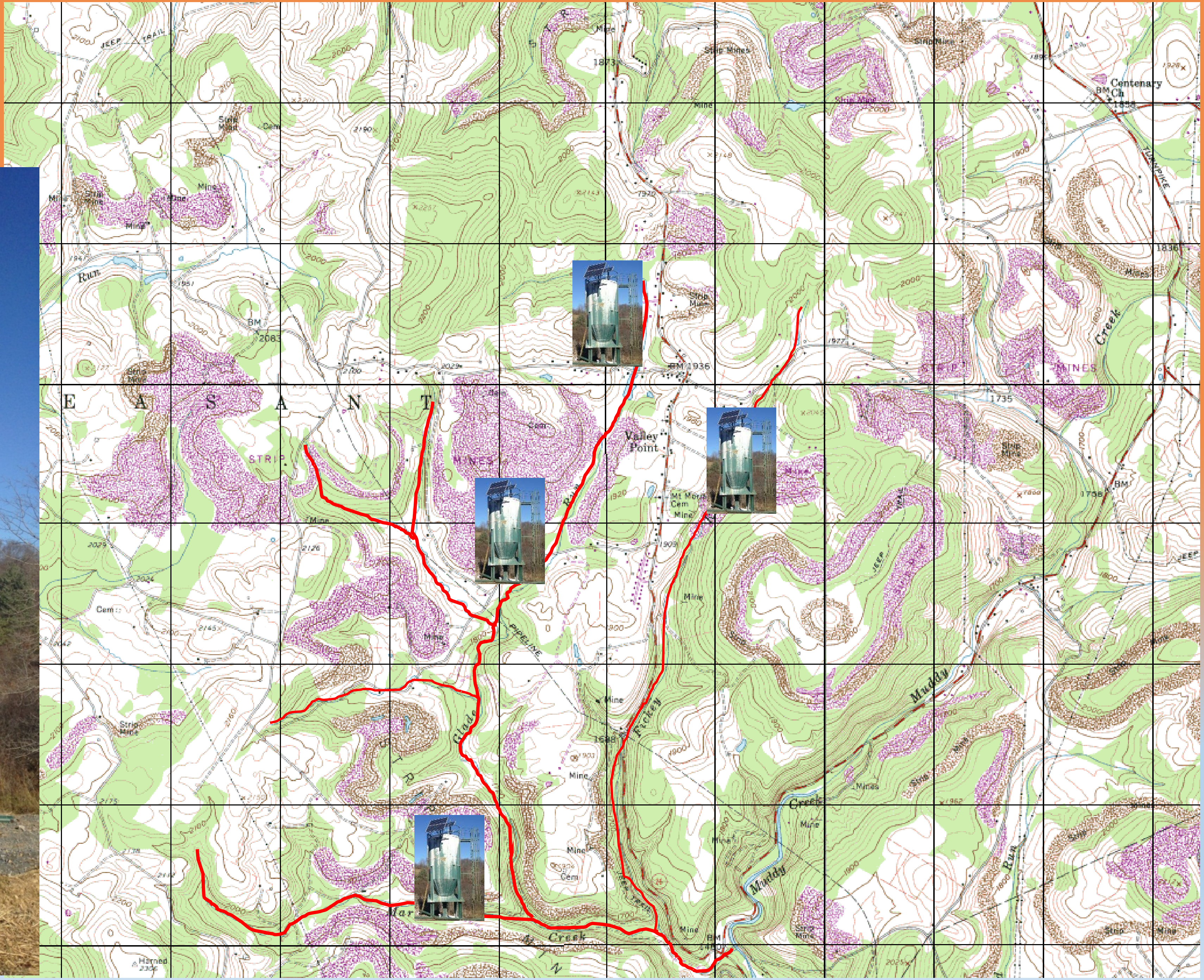
tin Creek and Muddy Creek

STREAM IMPACTS ON FICKEY RUN, MARTIN CREEK, AND MUDDY CREEK

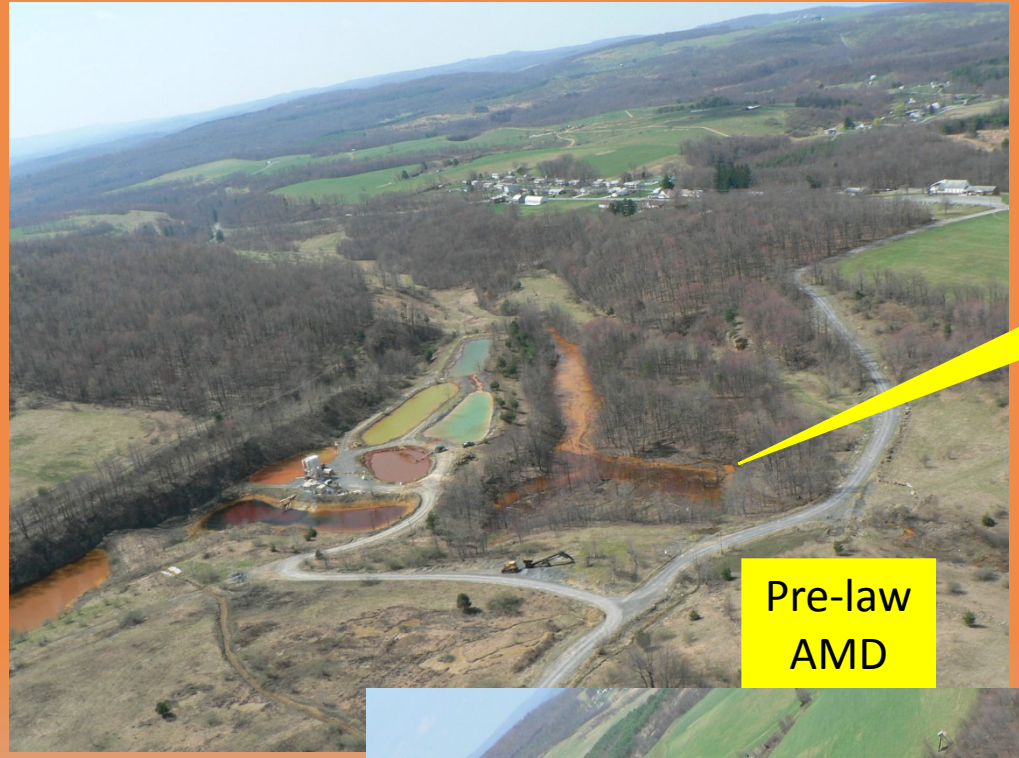
Mouth of Fickey Run

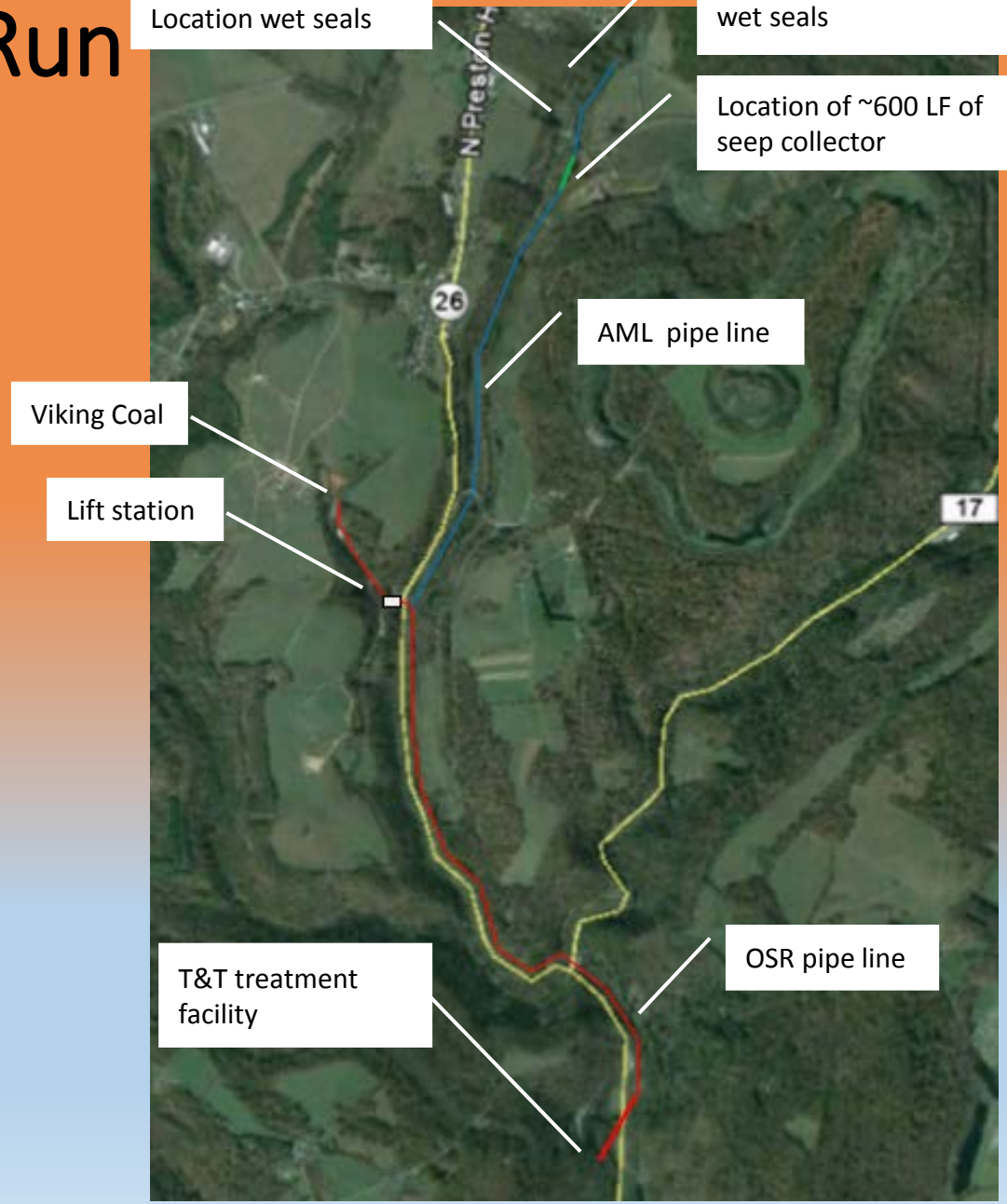
Confluence of Martin Creek and Muddy Creek

PLAN B


Valley Point
STRIP
MINES
Glade
Muddy
Creek
Centenary
Strip Mines
Mine

PLAN B
Fickey Run

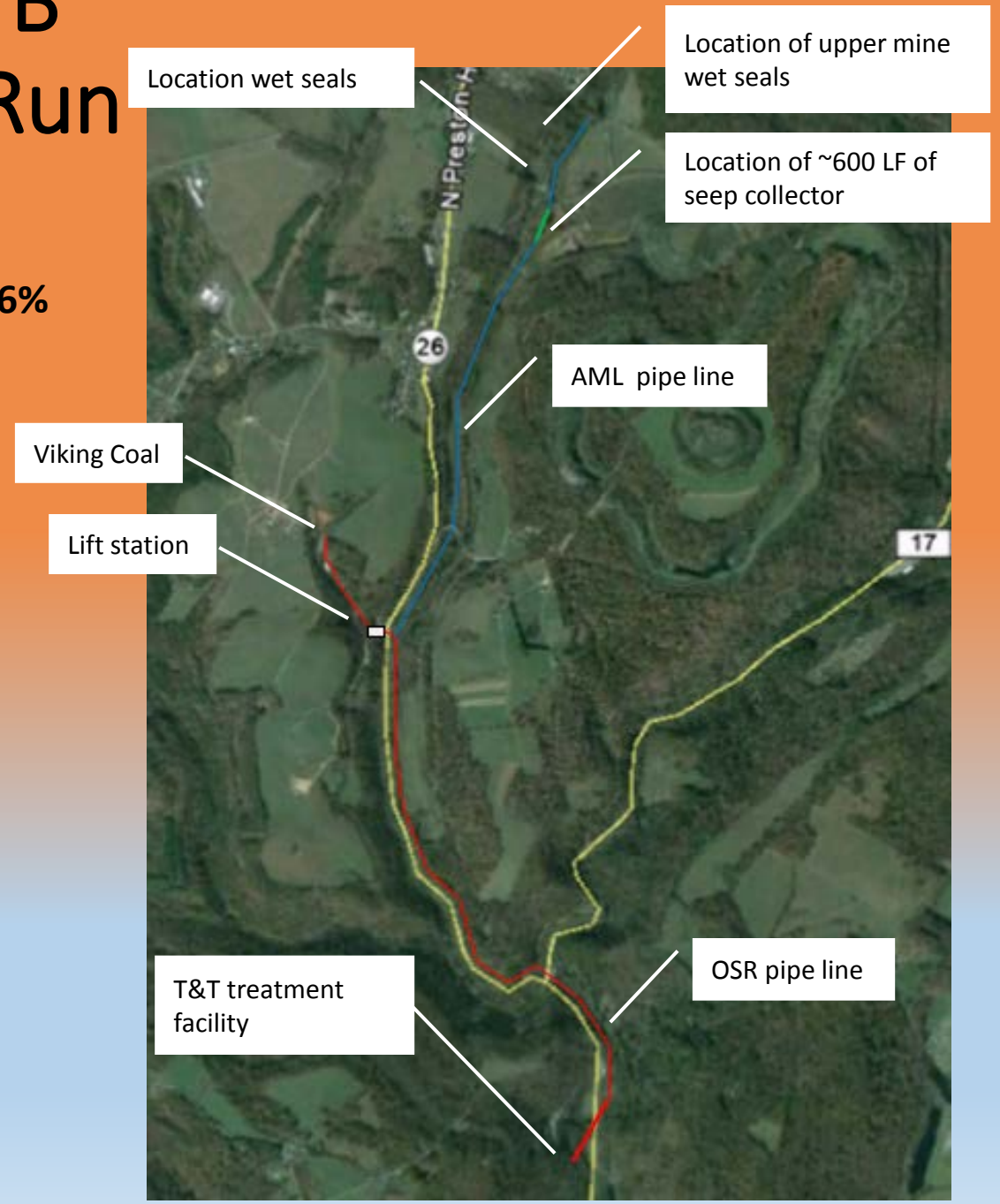




PLAN B
Fickey Run

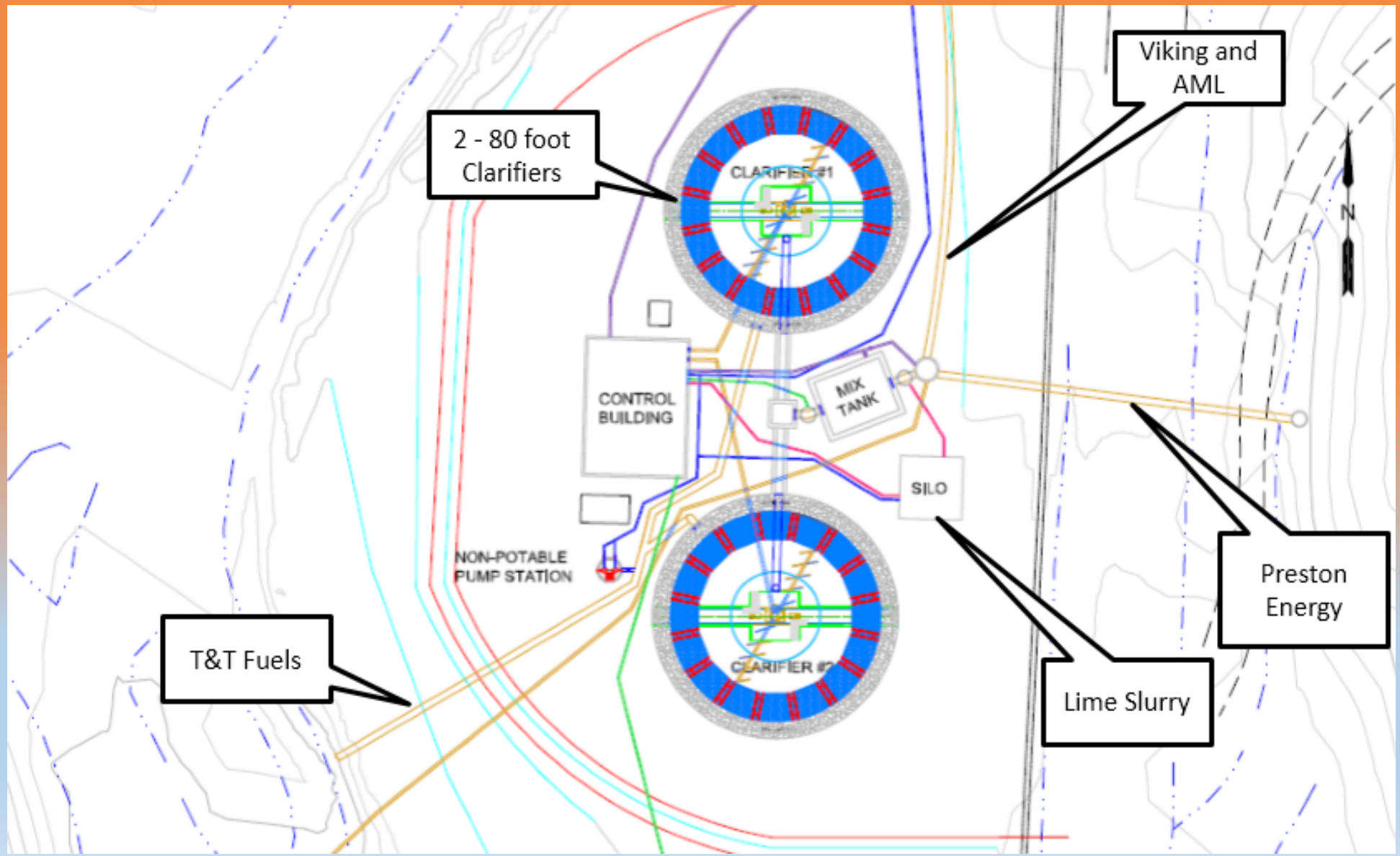
This alternative approach will effectively remove approximately 86% of the acid and metal loads from Fickey Run.

68% of the load reductions would come from pre-law mine discharges that would otherwise go untreated according to current, at-source, treatment methods carried out by OSR to date.



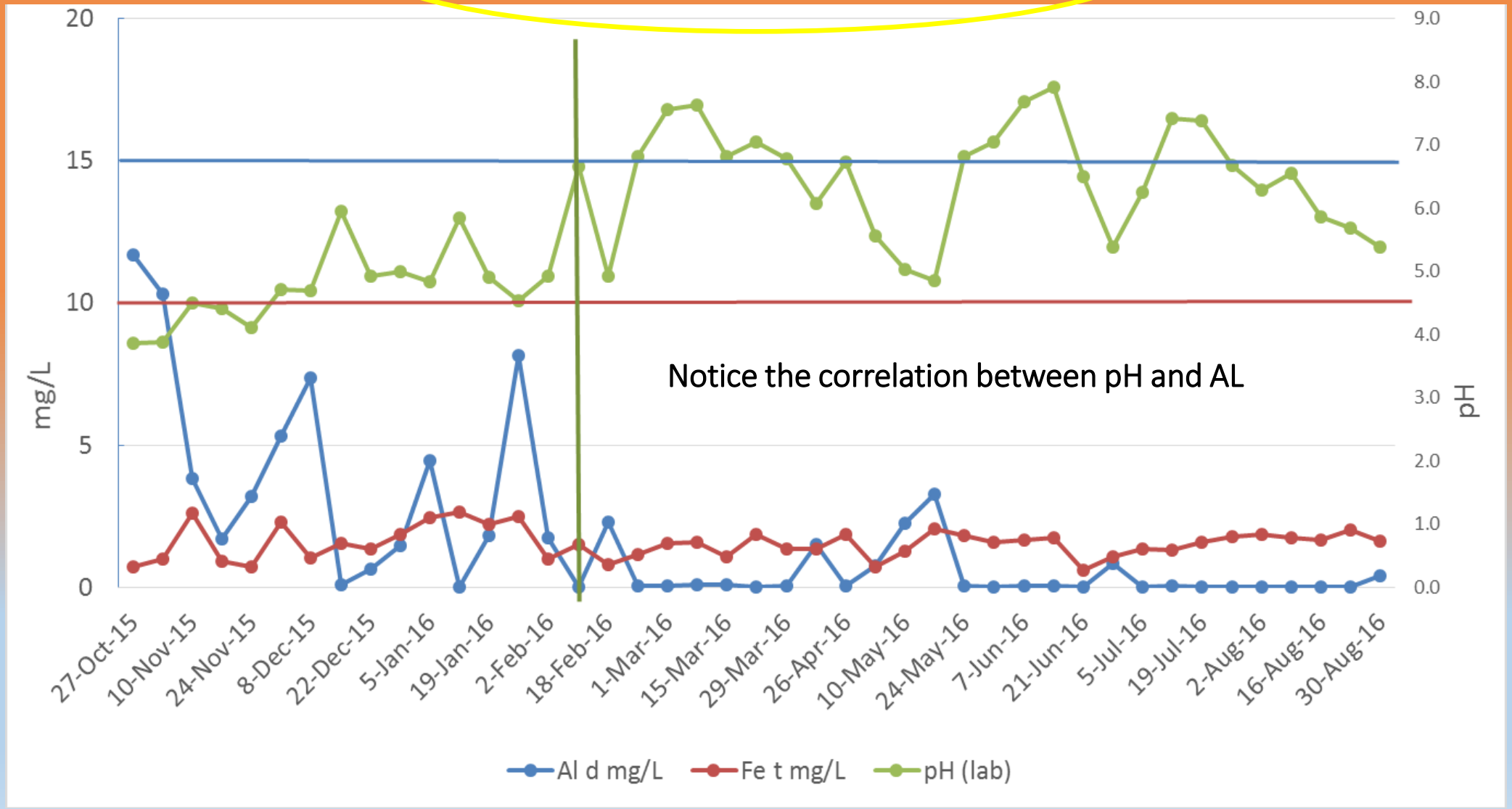
T&T COMBINED TREATMENT FACILITY

T&T COMBINED TREATMENT FACILITY

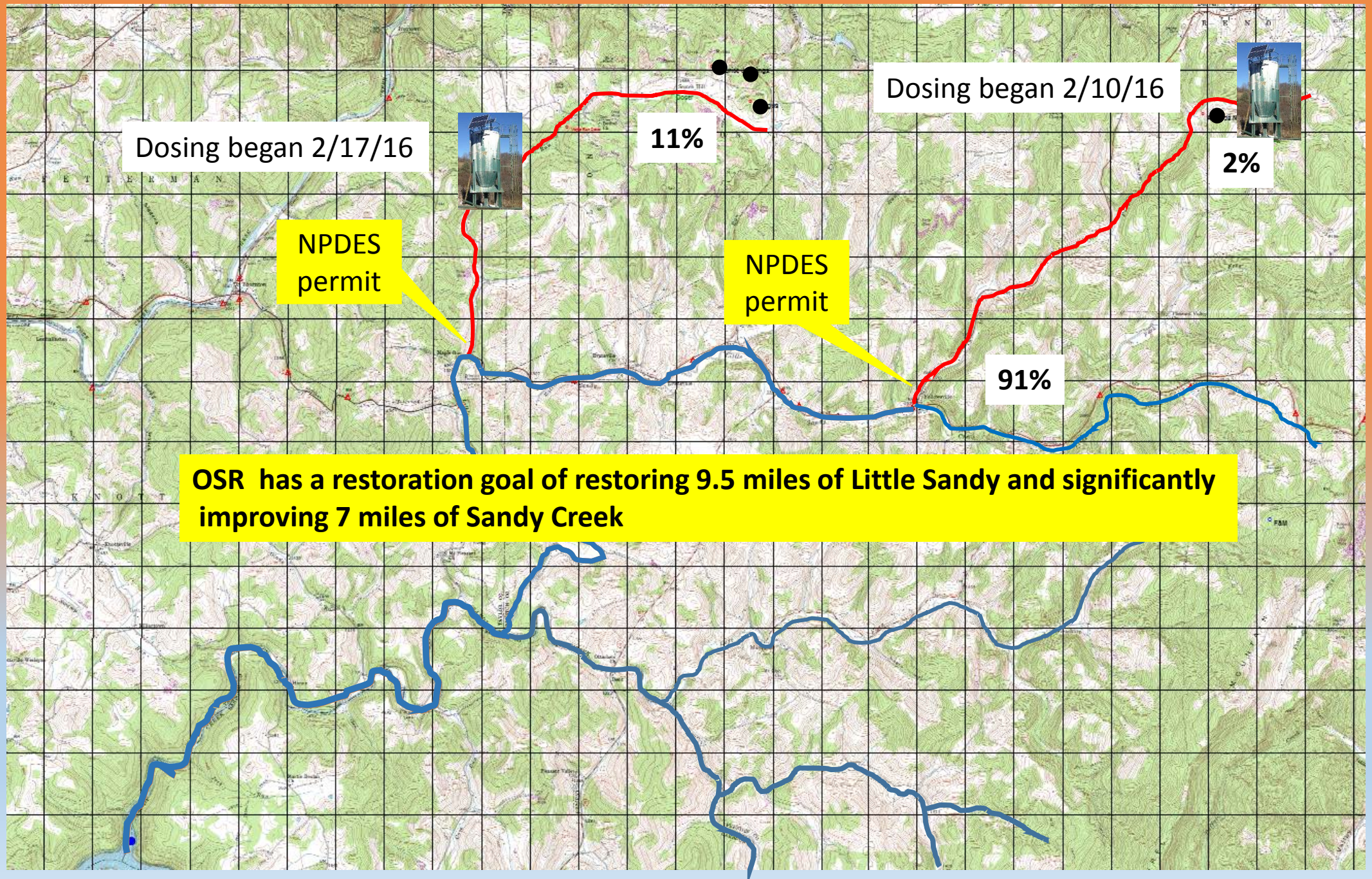


LABORATORY RESULTS

Martin Creek upstream of Fickey Run



SANDY CREEK

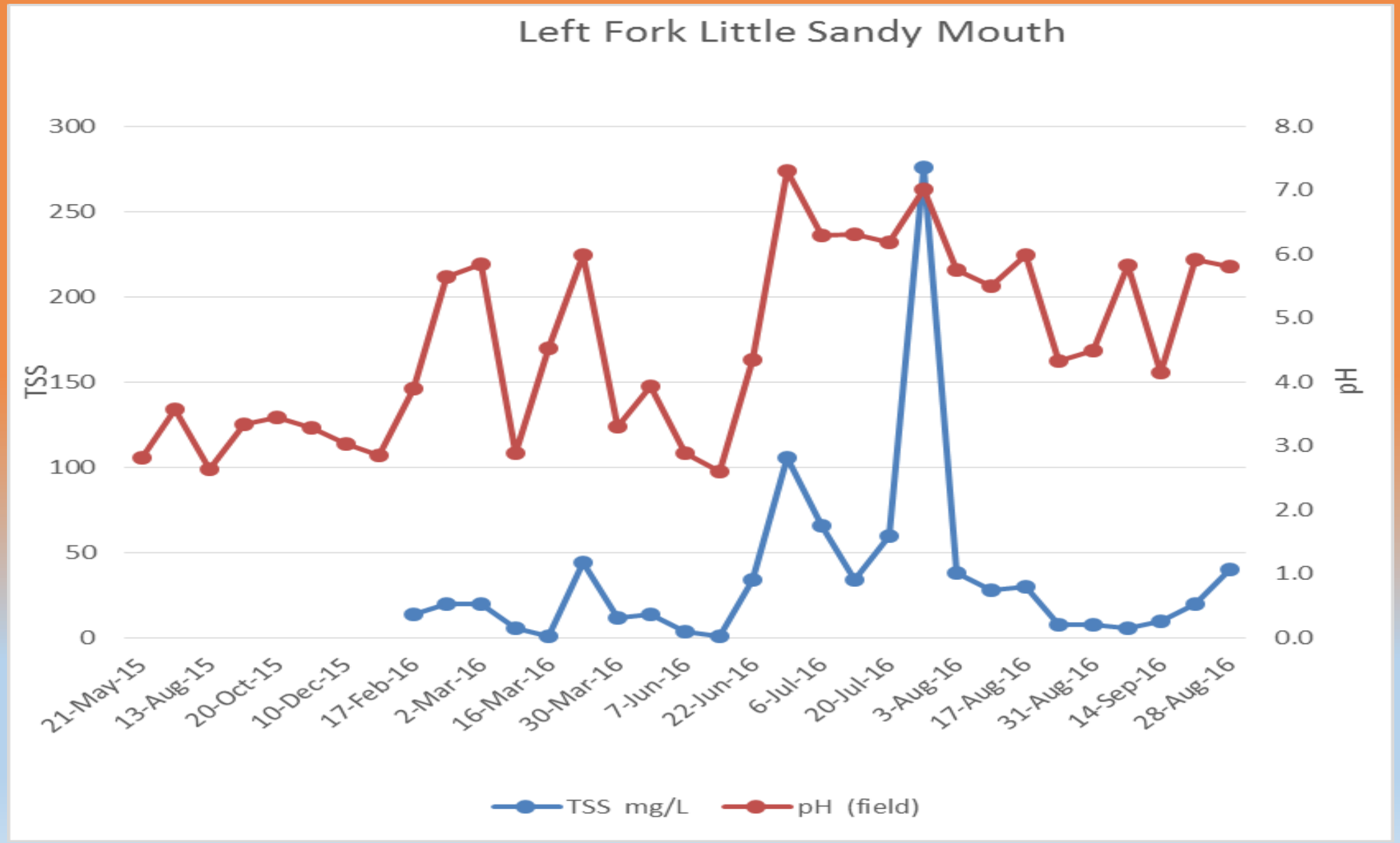

Dosing began 2/17/16
Dosing began 2/10/16
11%
2%
NPDES permit
NPDES permit
91%
OSR has a restoration goal of restoring 9.5 miles of Little Sandy and significantly improving 7 miles of Sandy Creek

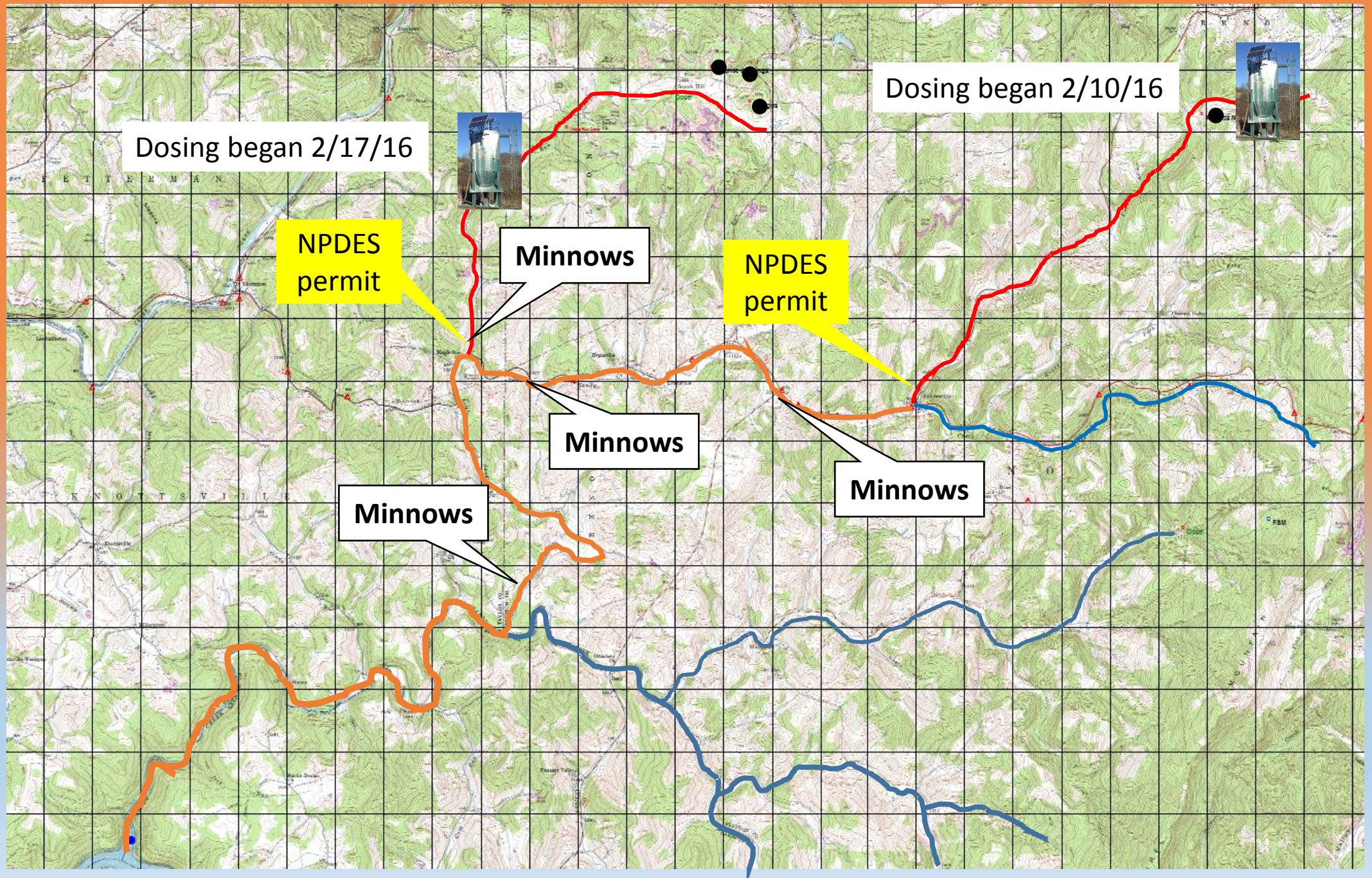
LEFT FORK OF LITTLE SANDY

LITTLE SANDY CREEK

Variance

7.2.d.11.1. A variance pursuant to 46 CSR 6, Section 5.1, based on human-caused conditions which prohibit the full attainment of any designated use and cannot be immediately remedied, **shall apply to WV DEP Division of Land Restoration's Office of Special Reclamation's discharges into Maple Run, Left Fork Little Sandy Creek, and their unnamed tributaries.** The following existing conditions will serve as instream interim criteria while this variance is in place: For **Maple Run, pH range of 3.3-9.0, 2 mg/L total iron, and 12 mg/L dissolved aluminum; for Left Fork Little Sandy Creek, pH range of 2.5-9.0, 14 mg/L total iron, and 33 mg/L dissolved aluminum**. Alternative restoration measures, as described in the variance application submitted by WV DEP Division of Land Restoration's Office of Special Reclamation, shall be used to achieve significant improvements to existing conditions in these waters during the variance period. Conditions will be evaluated and reported upon during each **triennial review** throughout the variance period. This variance shall remain in effect until action by the Secretary to revise the variance or until July 1, 2025, whichever comes first.


Left Fork Little Sandy Mouth
TSS
pH
300
250
200
150
100
50
0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
21-May-15
13-Aug-15
20-Oct-15
10-Dec-15
17-Feb-16
2-Mar-16
16-Mar-16
30-Mar-16
7-Jun-16
22-Jun-16
6-Jul-16
20-Jul-16
3-Aug-16
17-Aug-16
31-Aug-16
14-Sep-16
28-Aug-16
TSS mg/L
pH (field)


Dosing began 2/17/16
Dosing began 2/10/16
NPDES permit
NPDES permit
Minnows
Minnows
Minnows
Minnows