

West Fork White River Stream Restoration Project Update



Watershed Conservation Resource Center

Arkansas Game and Fish Commission, Beaver Water District, Northwest Arkansas Land Trust, Arkansas Natural Resources Commission, Environmental Protection Agency

Project Goal

Demonstrate an rural stream restoration using a natural channel design approach



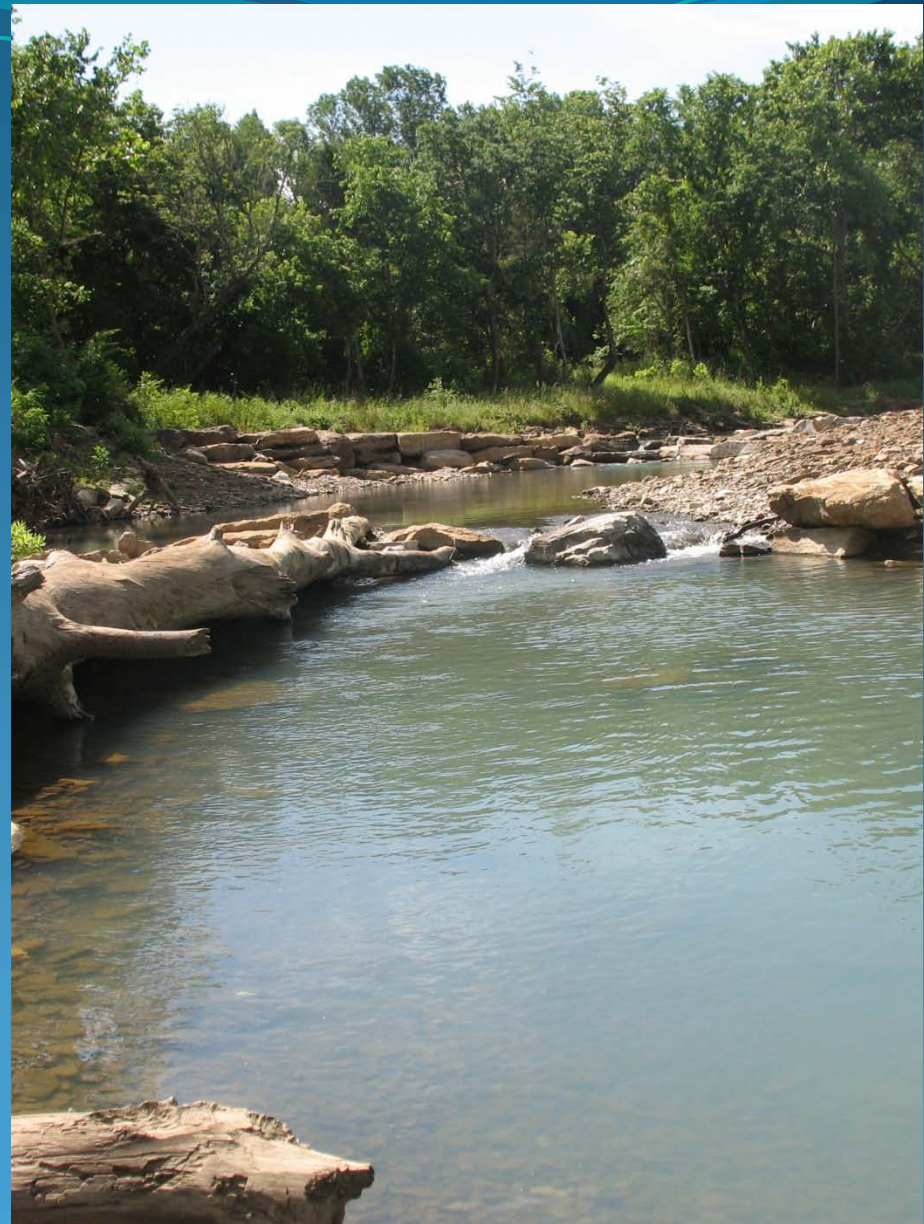
Project Partners

- Arkansas Game and Fish Commission
- Beaver Water District
- Northwest Arkansas Land Trust
- Elk River Construction
- Arkansas Natural Resources Commission
- US EPA, Region VI
- Watershed Conservation Resource Center



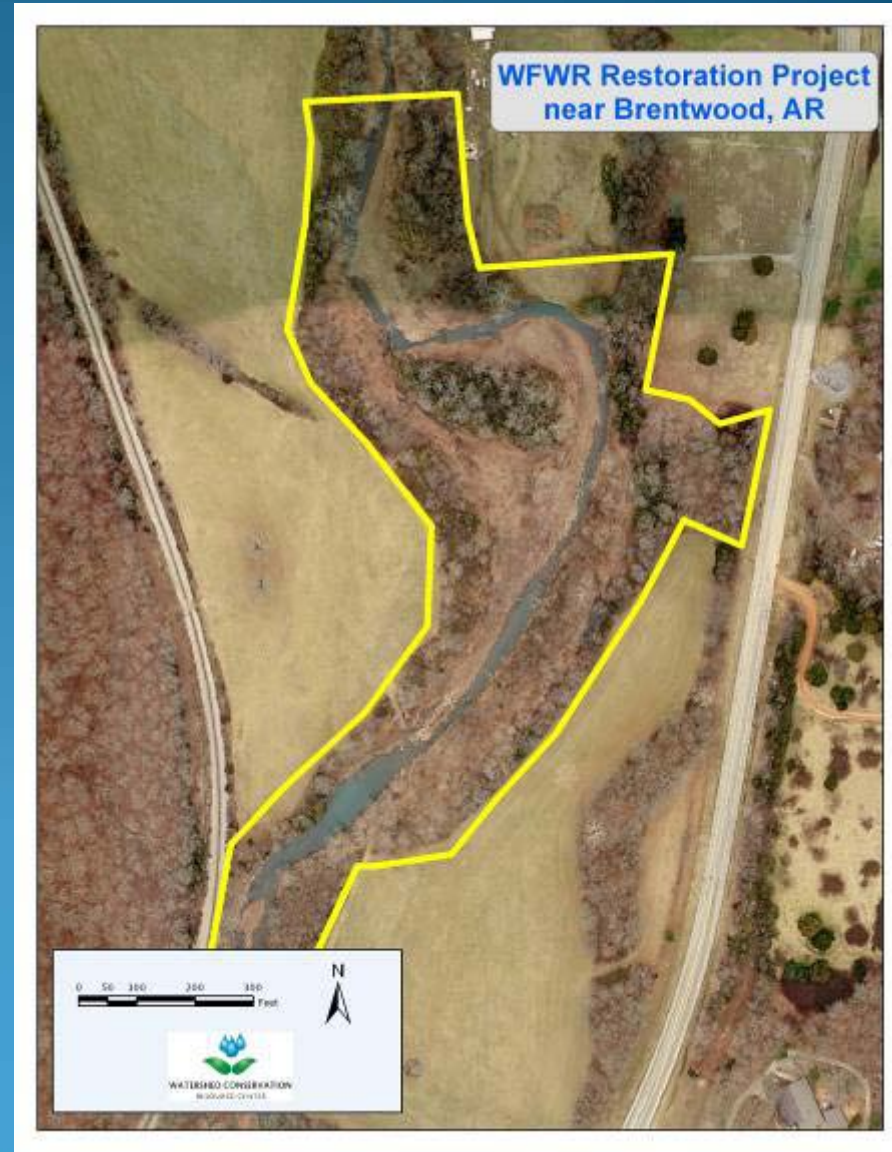
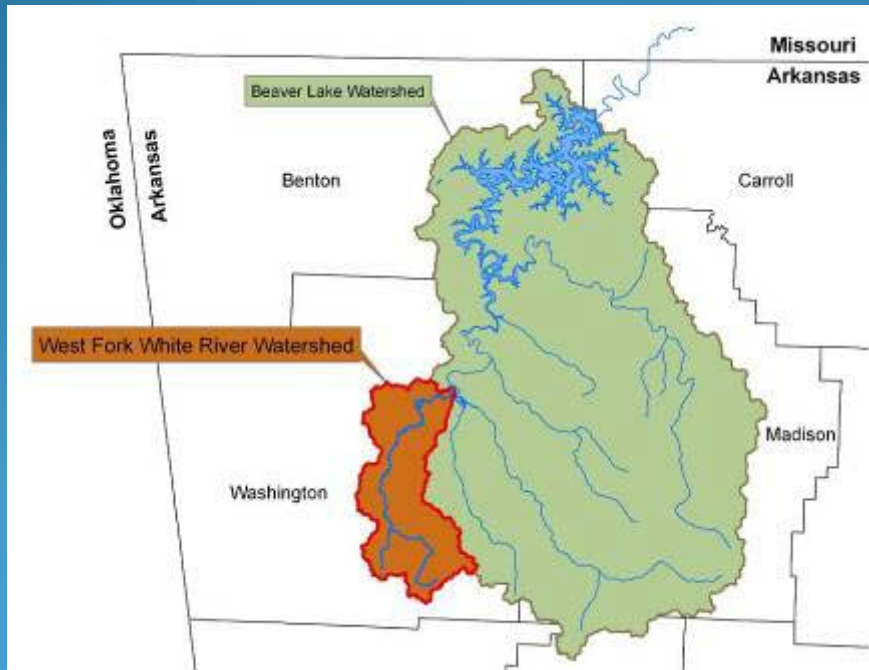
Project Objectives

- Utilize reference or stable stream reaches to assist in restoration design
- Reduce streambank erosion
- Quantify sediment reduction
- Improve aquatic habitat
- Increase pollutant removal potential
- Improve local ecology
- Transfer technology

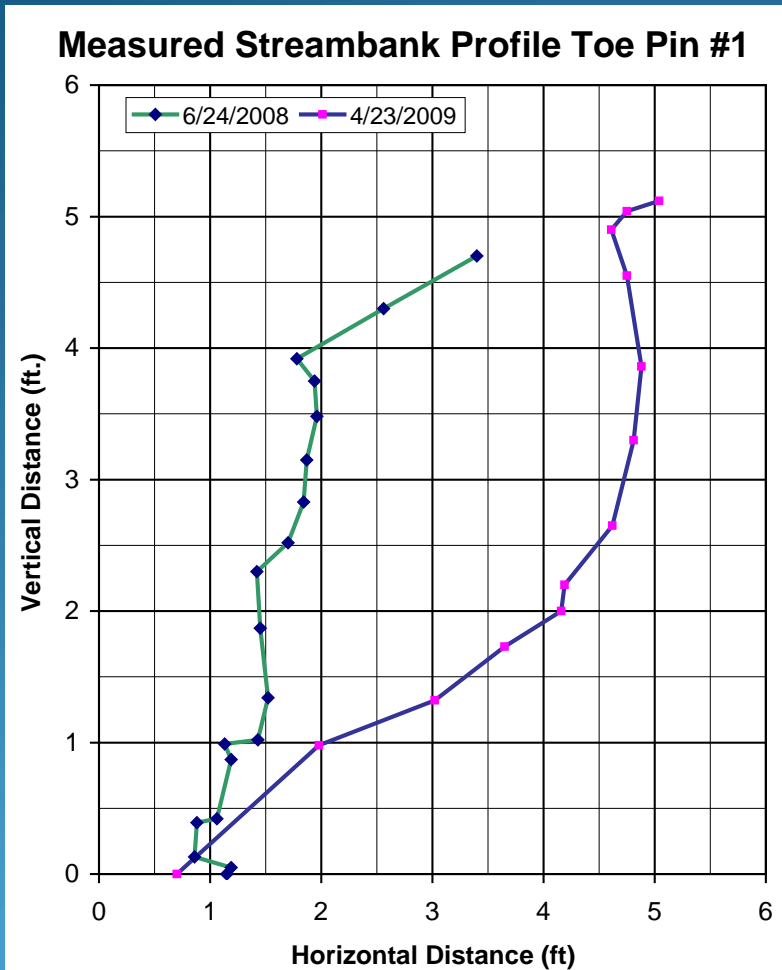


WFWR near Brentwood, AR

- Drainage Area 18 mi²
- Rural Watershed
 - Forest
 - Pasture
- ~1,800' of Stream Channel
- Rosgen C4/1-Type Stream
- 3 Landowners



Pre-Restoration Site Monitoring Streambank Erosion Analysis



Average $\Delta H = 1.72'$ (Toe Pin #1)



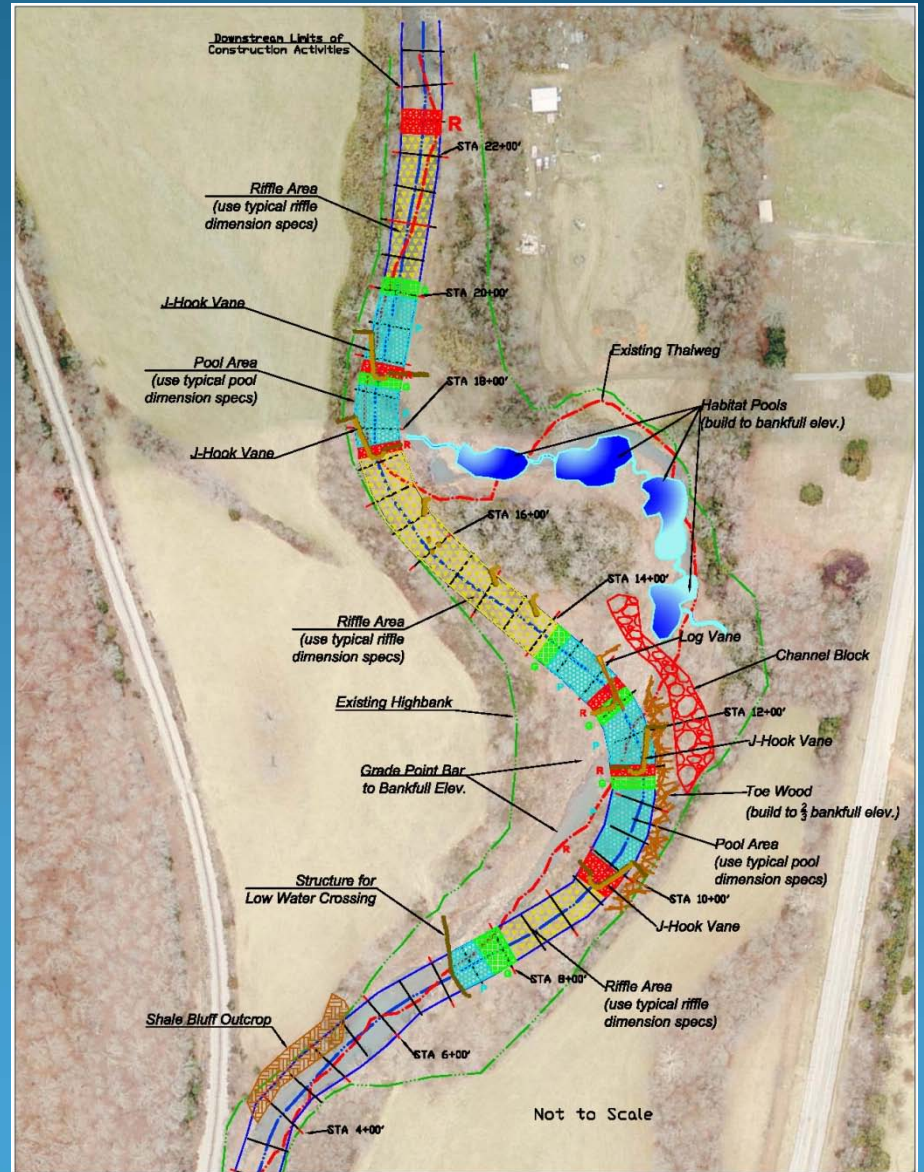
Pre-Restoration Site Monitoring Streambank Erosion Analysis

Estimated vs. Measured Erosion Rates

Toe Pin Site	Estimated Erosion Rate (ft/yr)	Measured Erosion Rate (ft/yr)	Estimated Sediment Load (ton/yr)	Measured Sediment Load (ton/yr)
#1	0.89	1.80	59	119
#2	0.49	0.44	20	18
#3 ^a	14.78	21.1 ^a	793	1250 ^b
#4 ^a	3.22	2.93 ^a	177	261 ^b
#5	0.35	0.01	11	0
#6	0.11	0.46	17	69
#7	0.57	1.73	79	240
Total			1,157	1,958
^a Determined using total station survey data (monitoring period 06/24/08 to 01/12/09) ^b Estimated by scaling based on ratio of the number of hours where bankfull discharge occurred during shortened monitoring period (202 days) to the period for the other toe pins (303 days)				

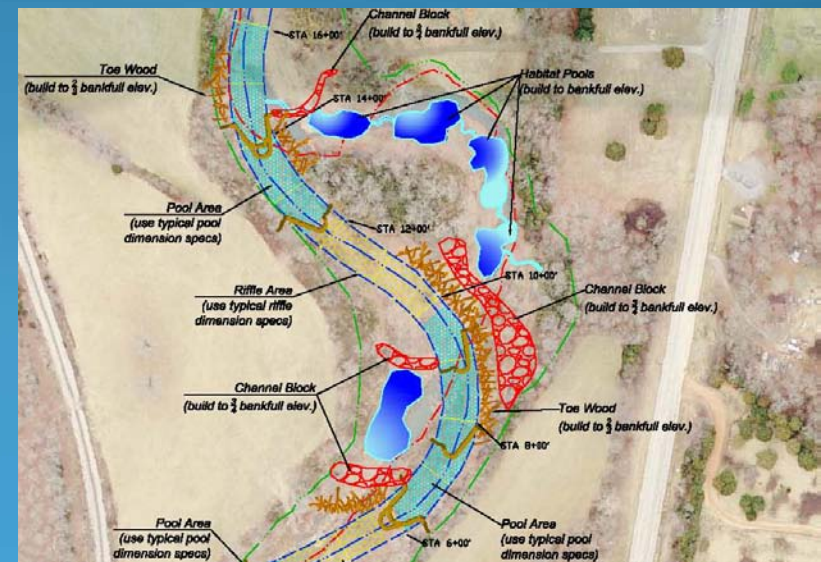
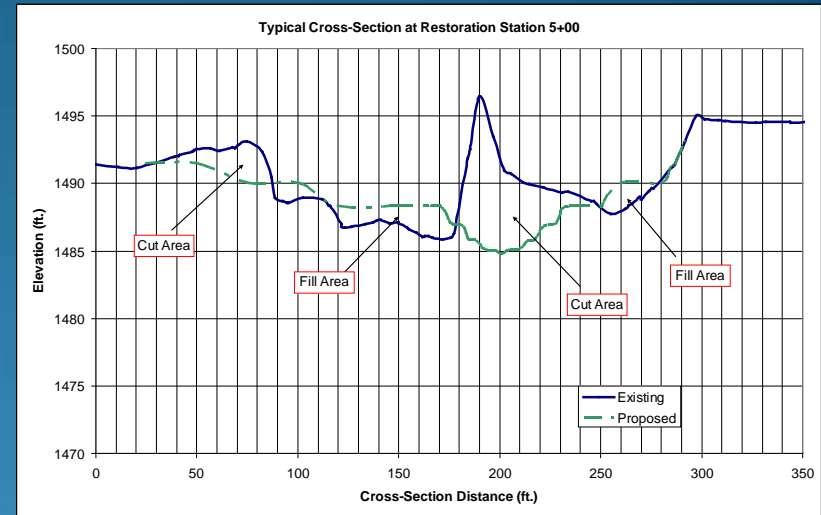
There were only 22 hours where bankfull discharge or greater occurred at the WFWR gage station during the monitoring period. The average number of hours per year at the gage is approximately 48

Restoration Design



Stream Restoration Design

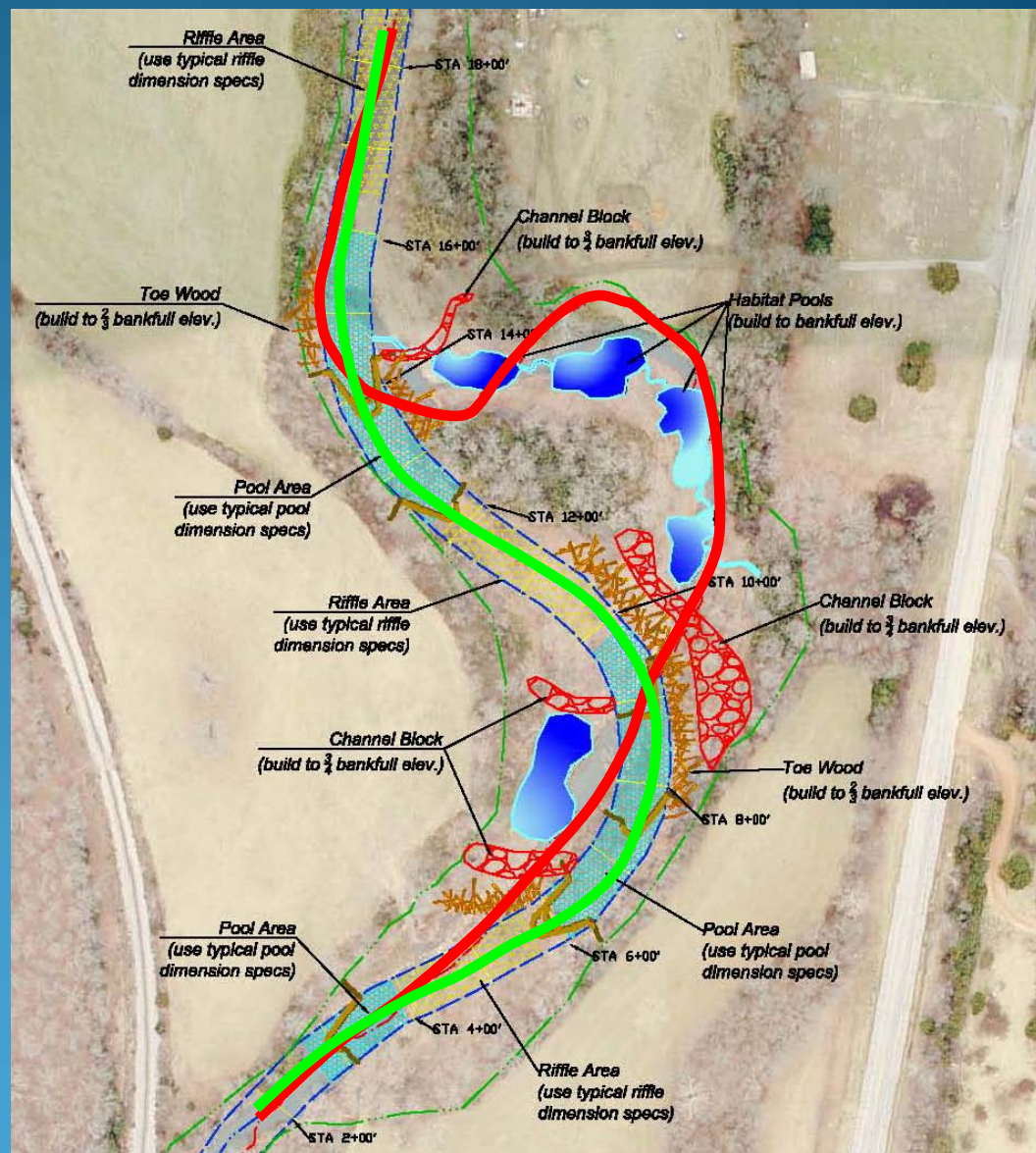
- Detailed Data Evaluation
 - Topographic Survey
 - Geomorphologic Analysis
 - Hydrology Analysis
- 40 Step Engineering Process
 - Dimension, Pattern, Profile
 - Flow Capacity
 - Sediment Transport
- Bankfull Discharge: 725 cfs
- Design Cross Section: 135 ft²
- Bankfull Slope: 0.0064 ft/ft
- Bankfull Shear: 0.84 lb/ft²



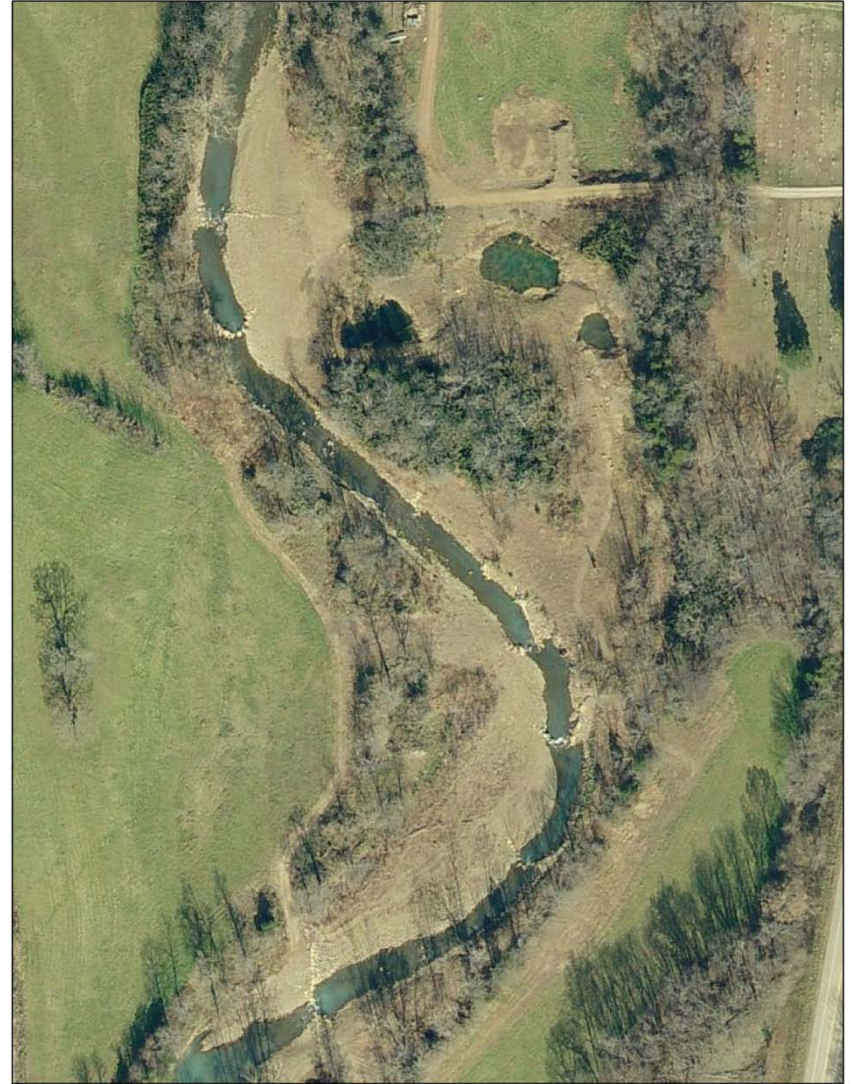
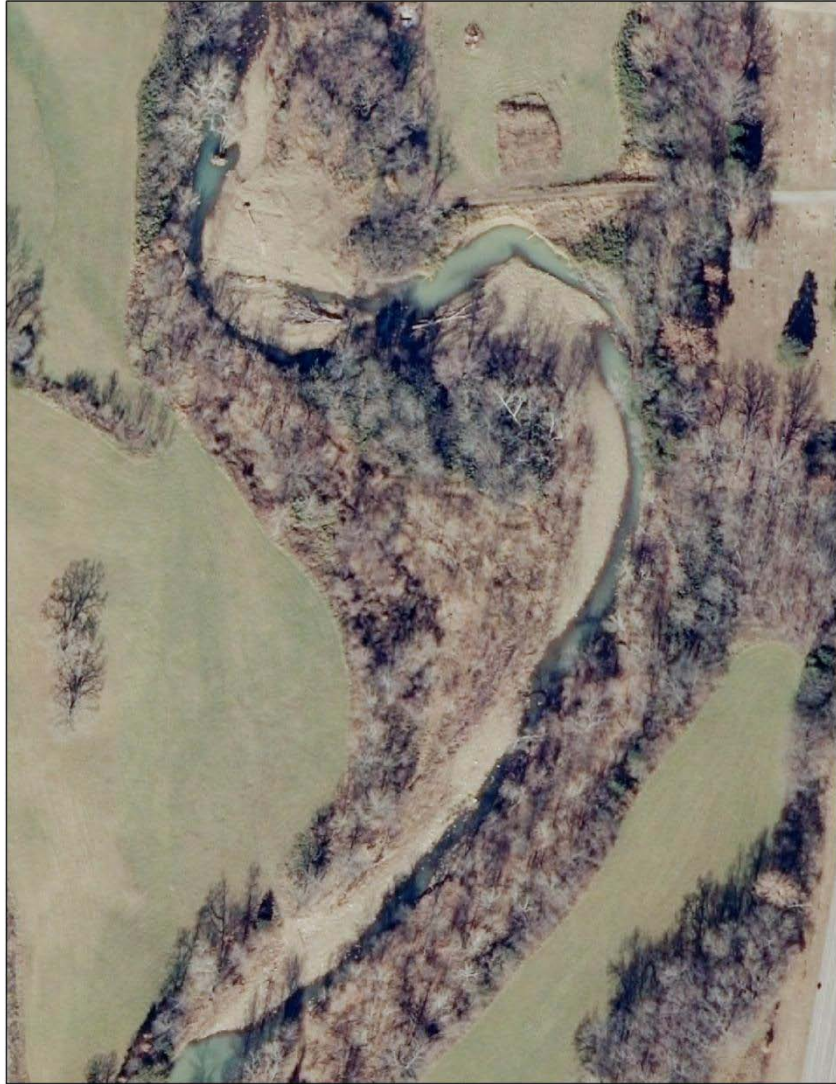
Stream Restoration Design

General Design Approach

1. Eliminate Tight Meander Bend Radii
2. Avoid Old Growth Riparian Areas
3. Maintain Stream Length
4. Create Wetlands



Stream Restoration Design



Revegetation Plan

- Critical Element of the Restoration Design
 - Provides Stability (high and moderate flows)
 - Habitat
 - Forage
 - Aesthetics
- Reused on-site soil and plants
- Purchased plants
- Consult with local specialists
- Several thousand individual plants
- Native Species by Sun/Water needs
 - Inland Sea Oats, Wetland Grass Mix
 - Button Bush, Spice Bush
 - Alder, Witch Hazel, River Birch, Sycamore
- Irrigation throughout 1st summer and during dry periods of 2nd summer



Site Photos Before Restoration (upstream)



Site Photos Before Restoration (upstream)



Site Photos Before Restoration (mid-section)



Site Photos Before Restoration (mid-section)



Site Photos Before Restoration (mid-section)



Site Photos Before Restoration (downstream)



Site Photos Before Restoration (downstream)



Site Photos After Restoration (upstream)



Site Photos After Restoration (upstream)



Site Photos After Restoration (upstream)



Site Photos After Restoration (upstream)



Site Photos After Restoration (upstream)



Site Photos After Restoration (mid-section)



Site Photos After Restoration (mid-section)



Site Photos After Restoration (mid-section)



Site Photos After Restoration (new channel)



Site Photos After Restoration (downstream)



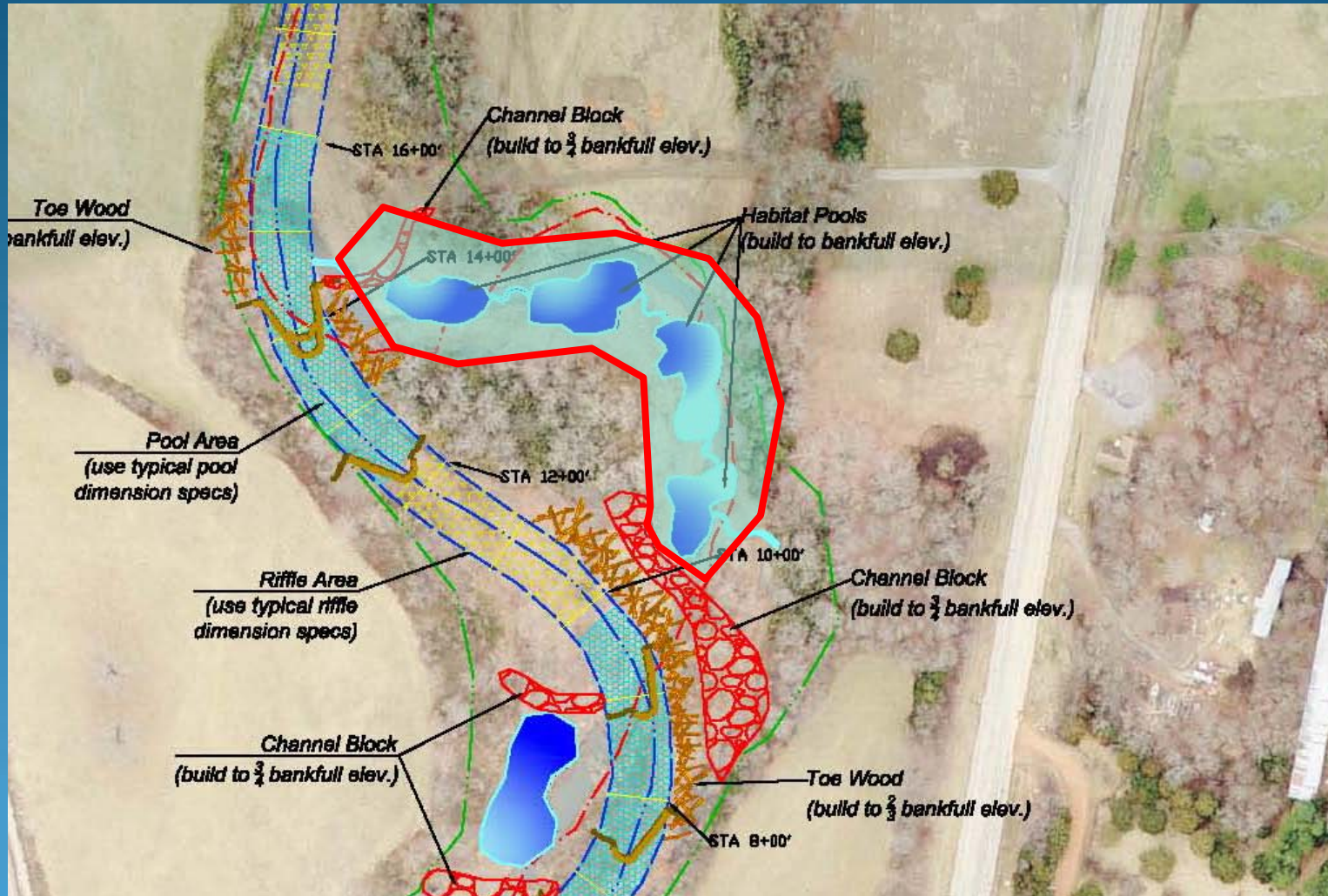
Site Photos After Restoration (downstream)



Site Photos After Restoration (downstream)



Oxbow Wetland Development



Site Photos: Constructed Wetlands



Site Photos: Constructed Wetlands



Site Photos: Constructed Wetlands



Site Photos: Constructed Wetlands

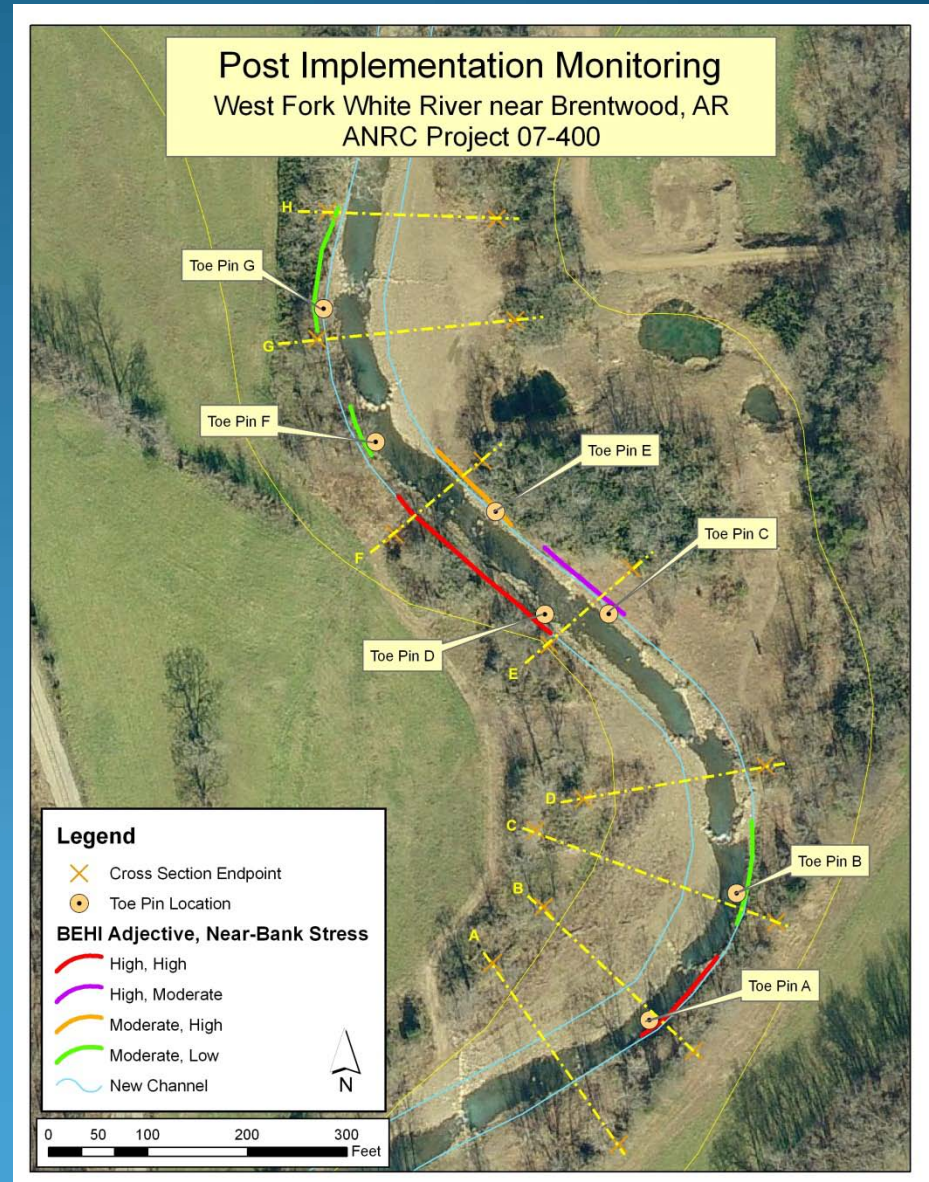


Site Photos: Constructed Wetlands



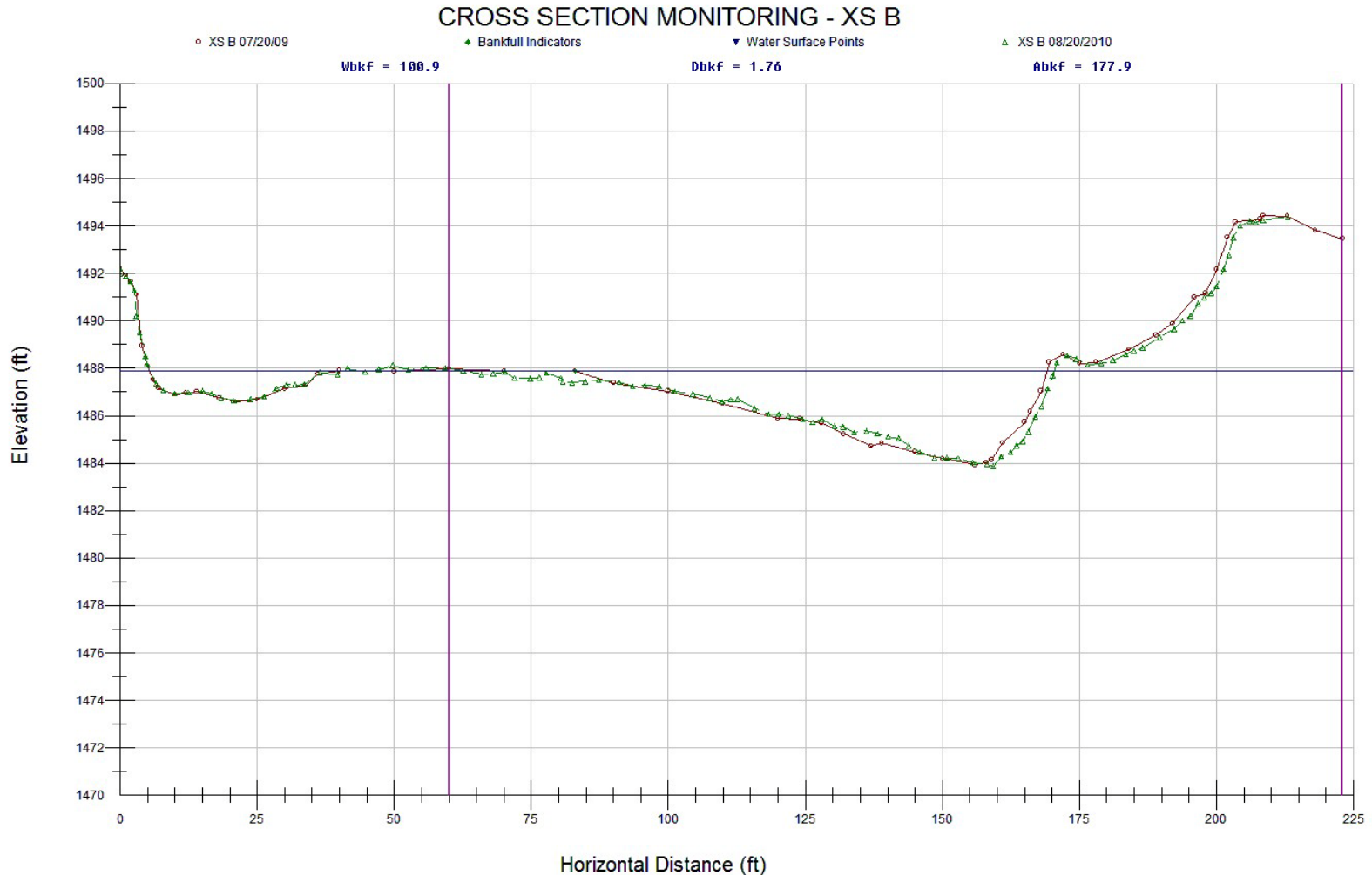
Post-Implementation Monitoring

- Cross-Section Surveys
- BEHI Inventory
- Toe Pins



Cross-Section Surveys

Example of Cross-Section Monitoring



Toe Pin Monitoring

Summary of Toe Pins Measurements

Toe Pin or Bank ID	Measured Erosion Rate ft/yr	Estimated Sediment Loading Rate ton/yr
A	0.46	12.5
B	0.76	21.5
C	0.47	8.1
D	0.88	16.2
E	0.58	15.9
F	0.28	2.7
G	0.12	1.5

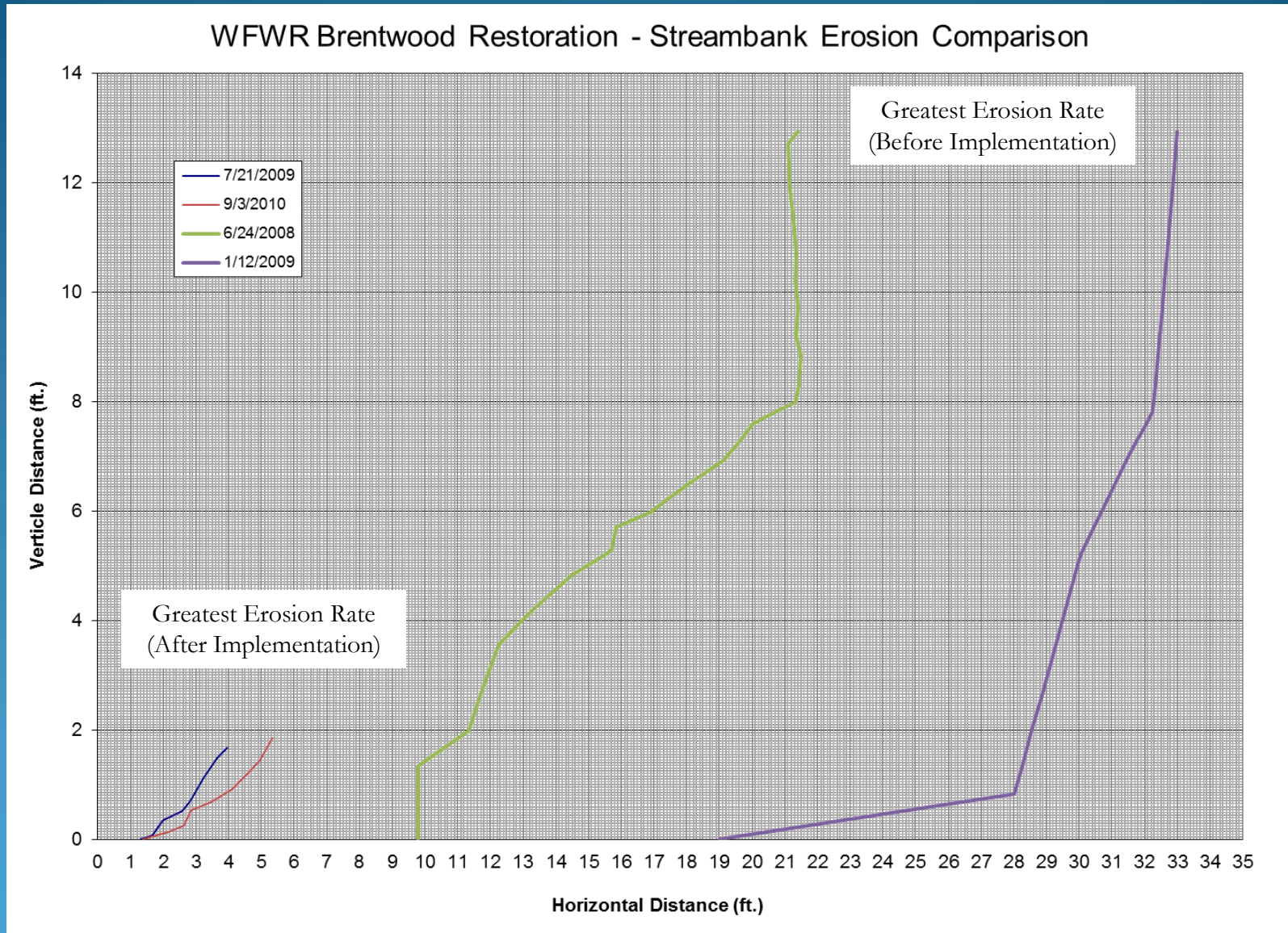
Total	78.4
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Based on data from the WFWR Gage Station, there were 52 hours where bankfull discharge or greater occurred during the monitoring period. The average number of hours at the WFWR gage is 48.

Toe Pin Monitoring

Comparison of Erosion for Before and After Implementation Monitoring

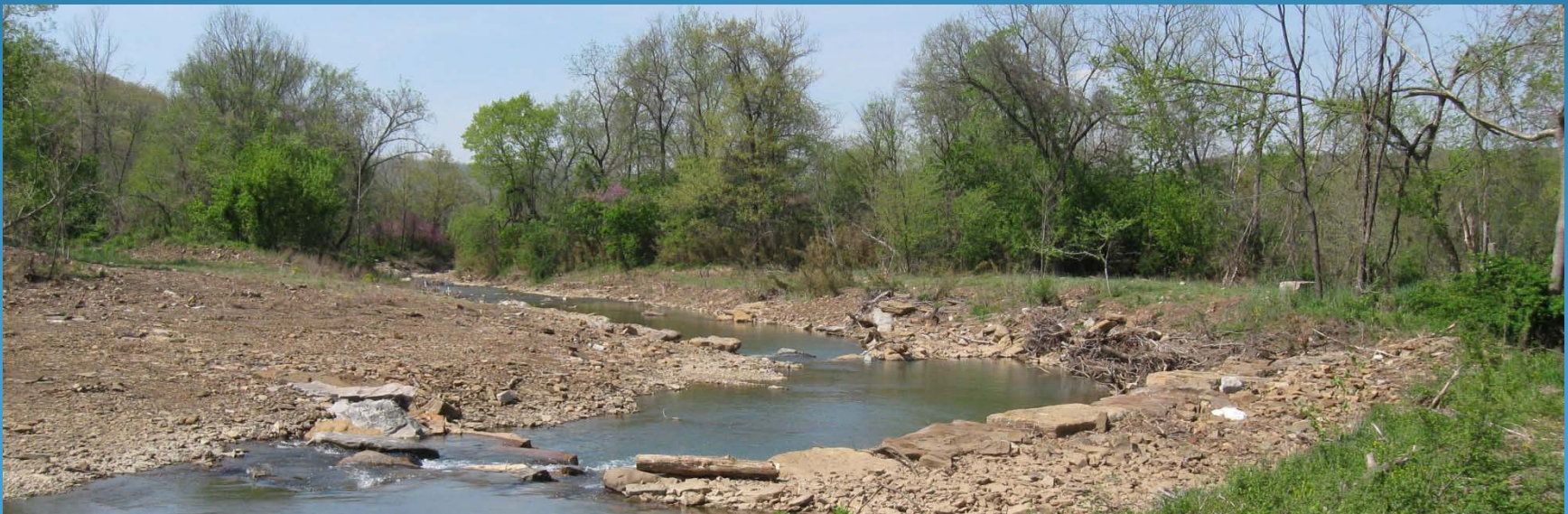


WFWR Steam Restoration

Estimated Annual Loads and Reductions

	Total Sediment	Total P	Total N	Monitored Months	Hours above Bankfull
Before Restoration	1,958 ton/yr	665 (lb/yr)	2,506 (lb/yr)	10	22
After Restoration	78 ton/yr	27 (lb/yr)	100 (lb/yr)	12	52
% Reduction	<96%	<96%	<96%		

Based on hydrology during the pre-construction monitoring, the estimated load prior to restoration would be likely higher during average years and therefor total sediment load reductions would also be greater



Project Benefits & Success

- Stabilized 1,800 feet of channel on WFWR
 - Reduced sediment by at least 1,880 tons/yr
 - Reduced phosphorus by at least 638 lb/yr
 - Reduced nitrogen by at least 2,406 lb/yr
- Improved aquatic habitat
- Improved riparian area
- Established and enhanced native vegetation
- Created one acre of stormwater treatment wetlands
- Stopped loss of property
 - Protected pasture land
 - Protected cemetery land
- Eliminated accelerated streambank erosion
- Provided self-maintaining low-water crossing for primary landowner
- Secured one conservation easement
- Improved the aesthetics and recreation value of the stream

Watershed Conservation Resource Center Thanks to Our Project Partners

- Arkansas Natural Resources Commission
- U.S EPA Region VI
- Arkansas Game and Fish Commission
- Beaver Water District
- Northwest Arkansas Land Trust



Questions?

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