DESIGNING FOR FLOODPLAIN CONNECTIVITY AND RIPARIAN WETLAND SUCCESS:

A HOLISTIC MODELING BASED APPROACH FOR BIG RIVERS WMA WETLAND AND STREAM MITIGATION PROJECT, STURGIS, KENTUCKY

Session G

Blair Borries and Jessie Boles

KENTUCKY DEPT. OF FISH & WILDLIFE RESOURCES

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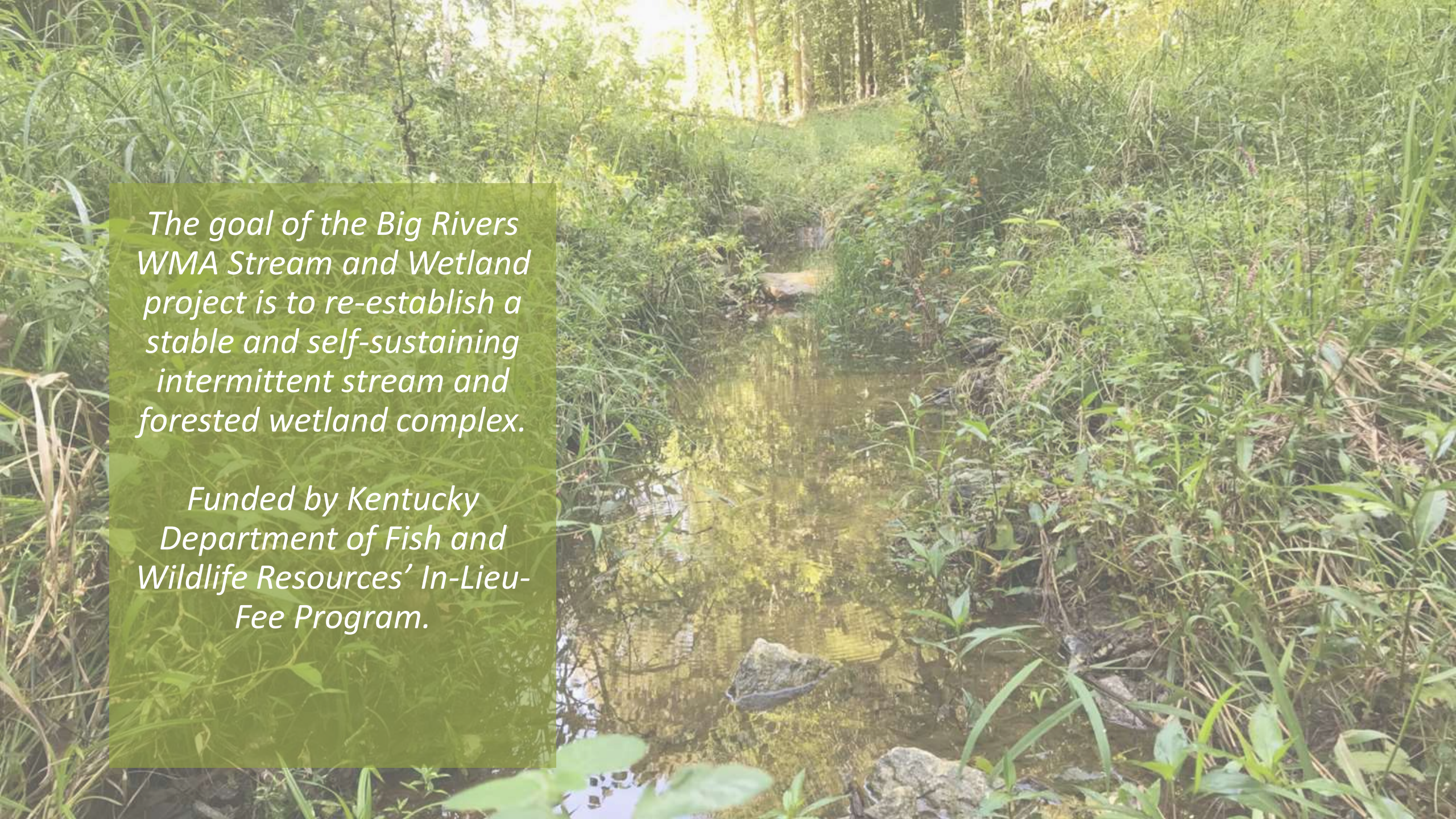
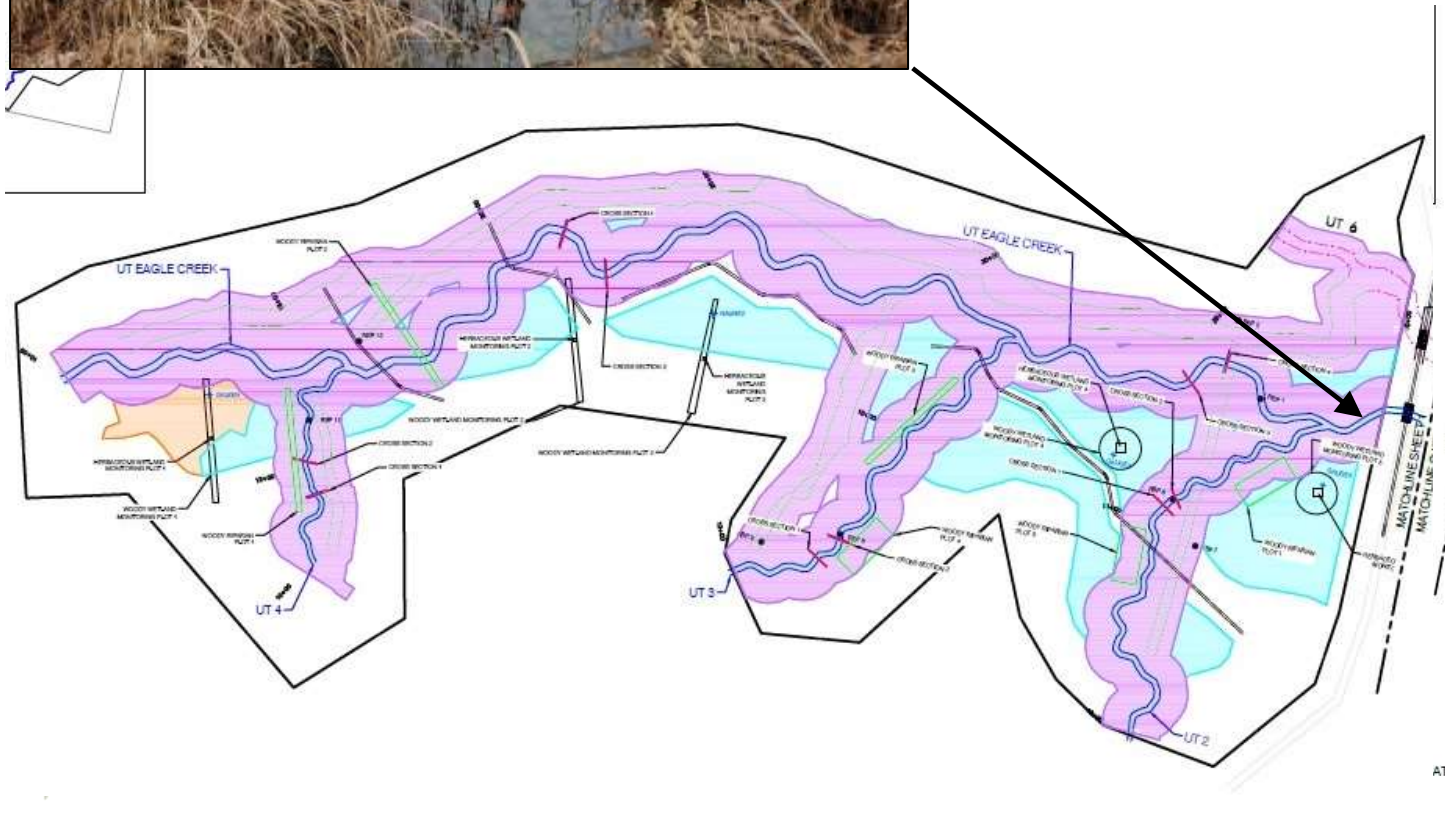
First National STREAM RESTORATION Conference

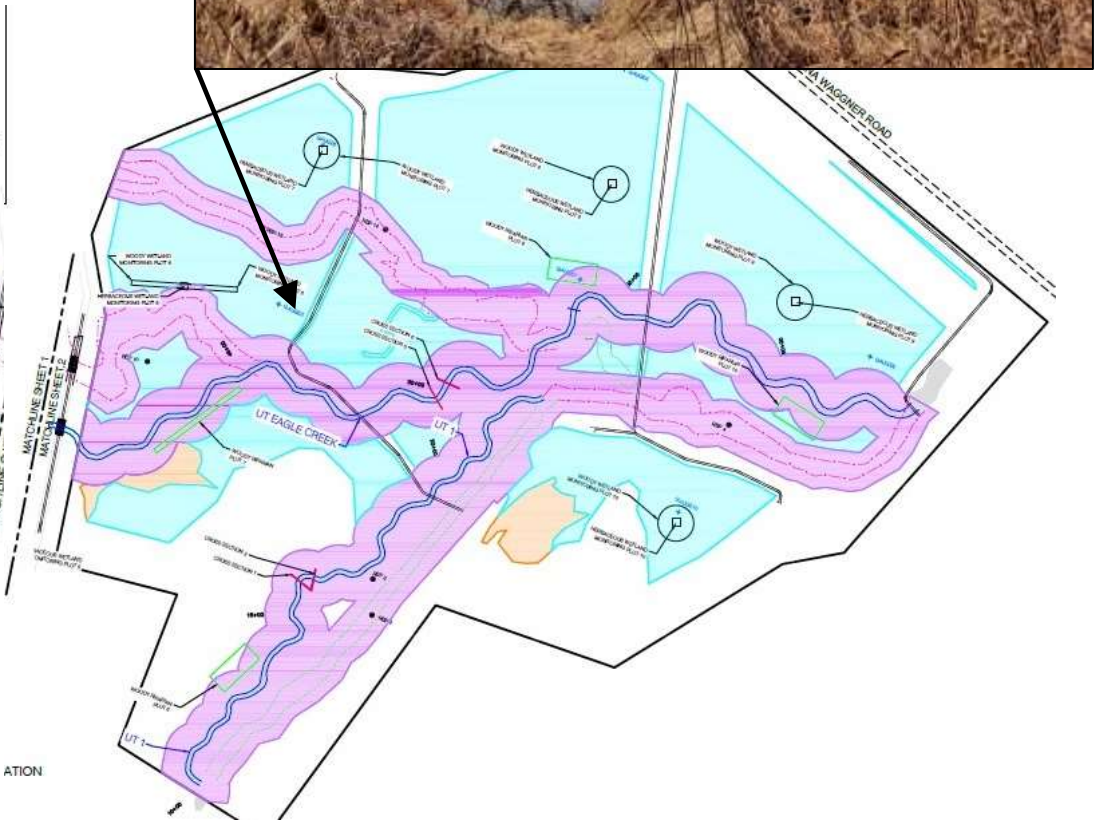


The goal of the Big Rivers WMA Stream and Wetland project is to re-establish a stable and self-sustaining intermittent stream and forested wetland complex.

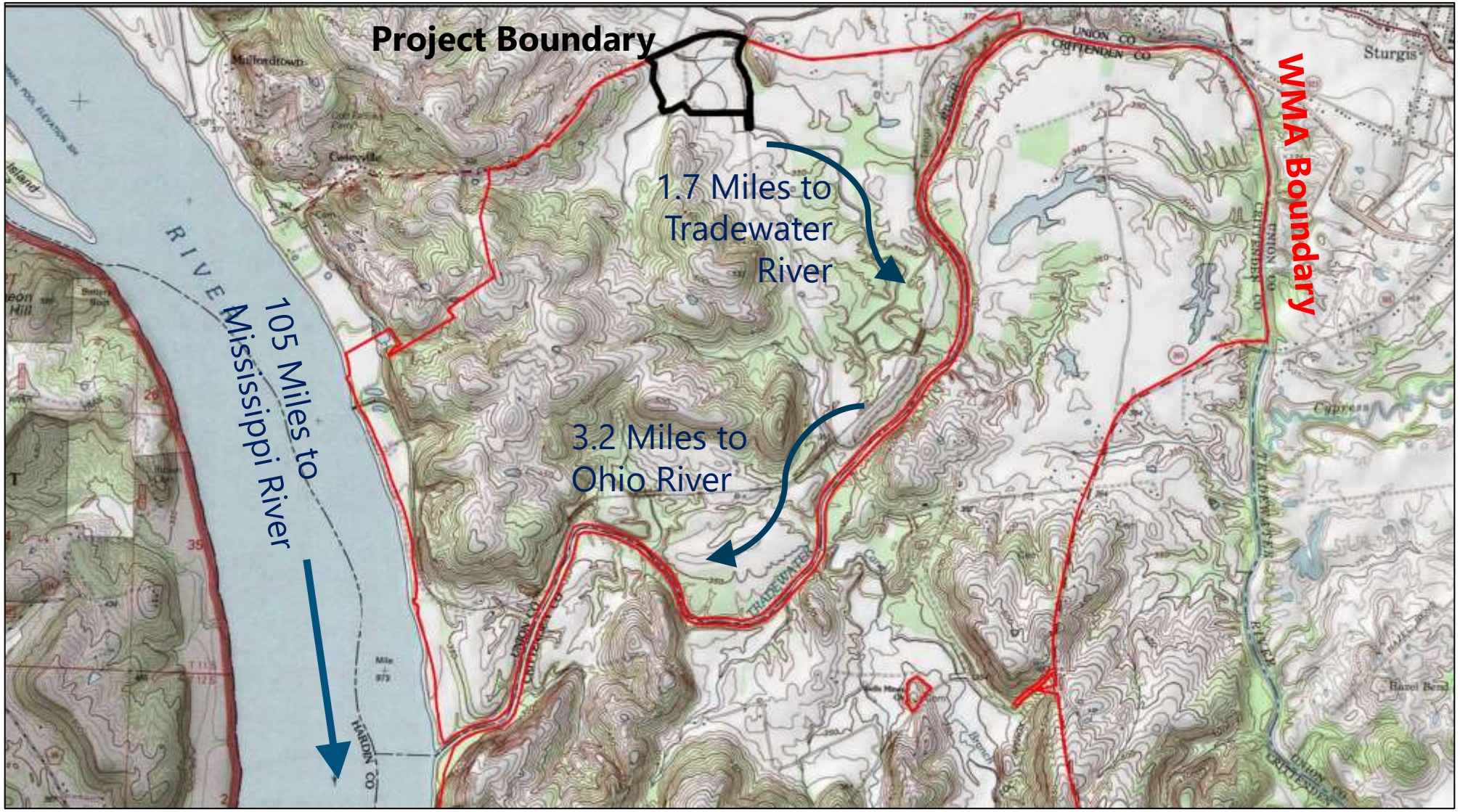
Funded by Kentucky Department of Fish and Wildlife Resources' In-Lieu-Fee Program.

Past Example



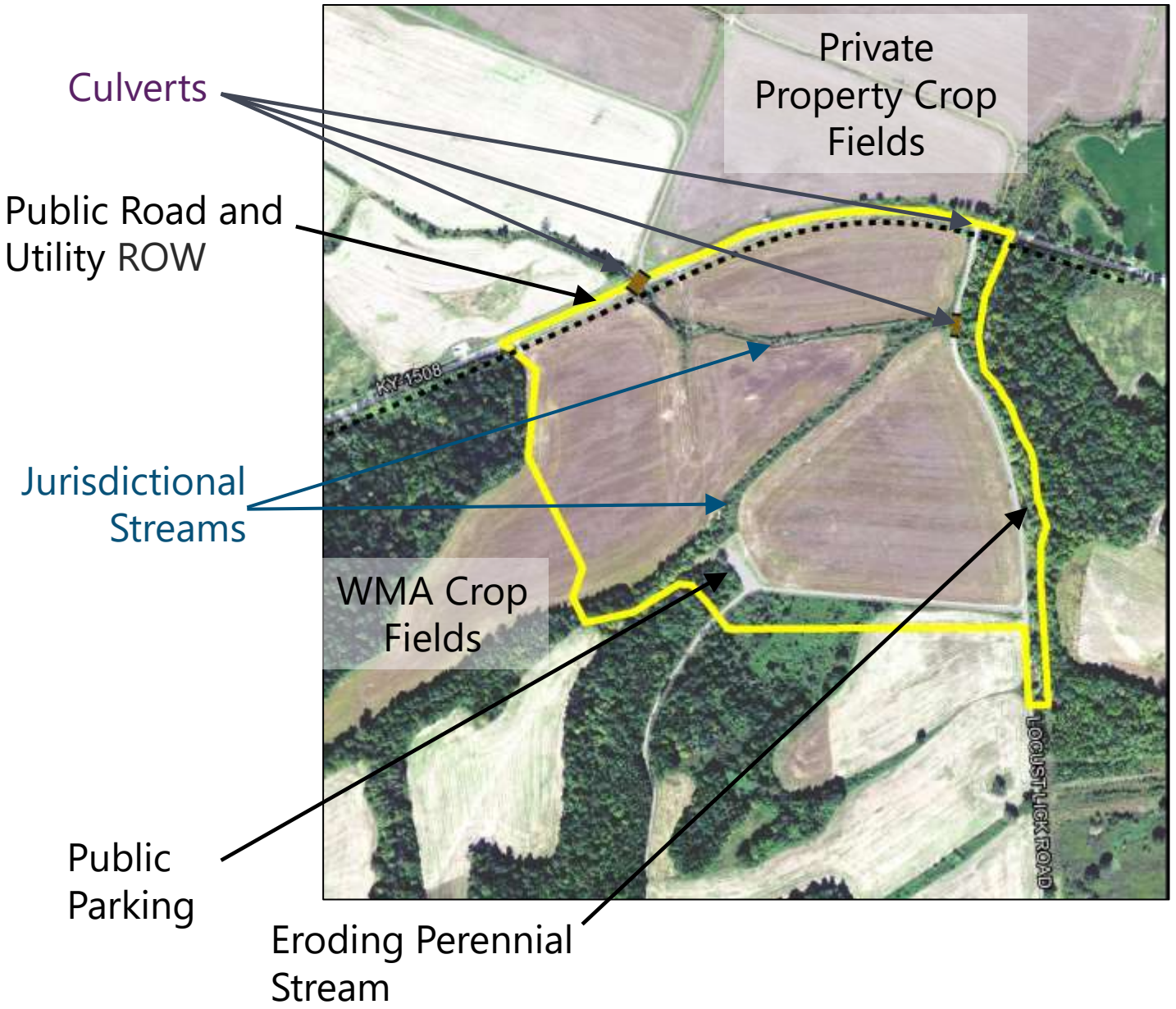


Project Location



Site Constraints and Needs

- Maintain drainage for upgradient crop fields, public roadway and utilities
- Maintain access to public parking area
- Replace any jurisdictional stream length filled during blocking of drainage features
- Prevent eroding perennial stream from destabilizing proposed wetlands



Site Constraints and Needs

What are the characteristics of the ecological reference sites?

Wetlands in the Interior River Valleys and Hills Level III Ecoregion fall within the **riverine HGM wetland class** with a **bottomland hardwood forest** vegetation community

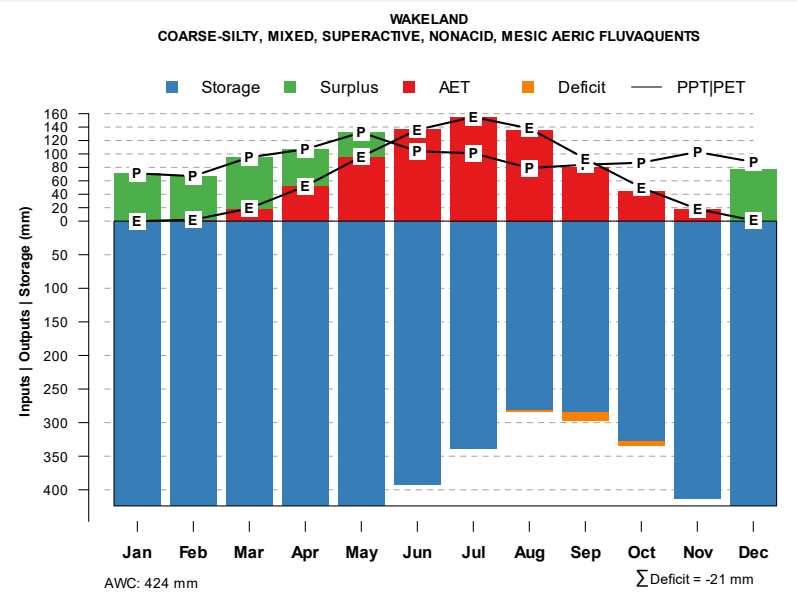
- **Lacks significant groundwater hydrology contributions**
- **Dominant source of hydrology is overbank flow from stream channels**
- Interflow, **overland flow, and precipitation are secondary sources**
- Found within the **active floodplain of low gradient streams**

Analysis Used to Determine Existing Hydrology

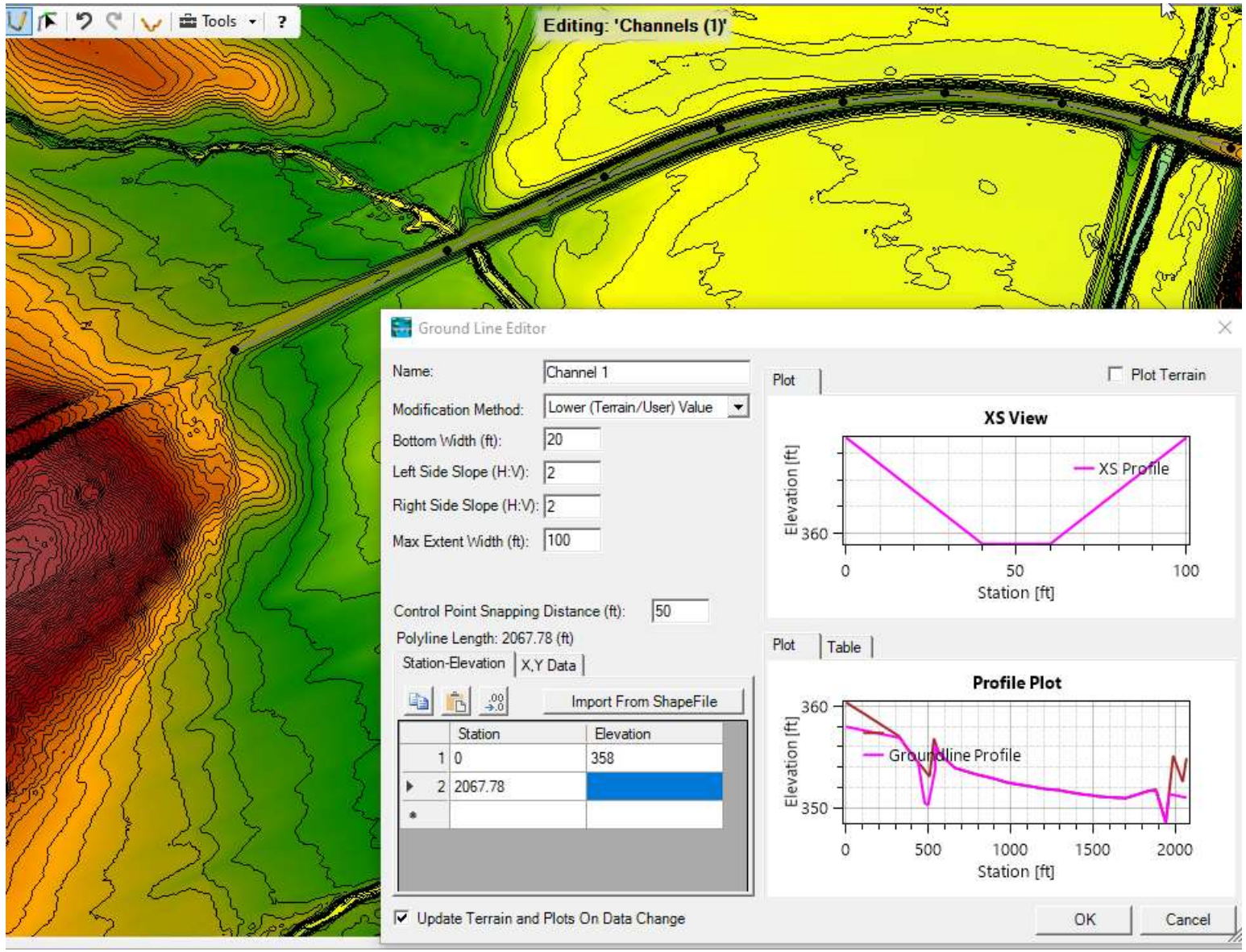
Soil Survey Geographic Database is an abundant source of **data on hydrologic conditions of soils** on the site

Confirm mapped soil data with **on-site soil sampling**

If possible do **deep soil pits** with a hand auger, gouge auger, or backhoe!



What about historic hydrology?



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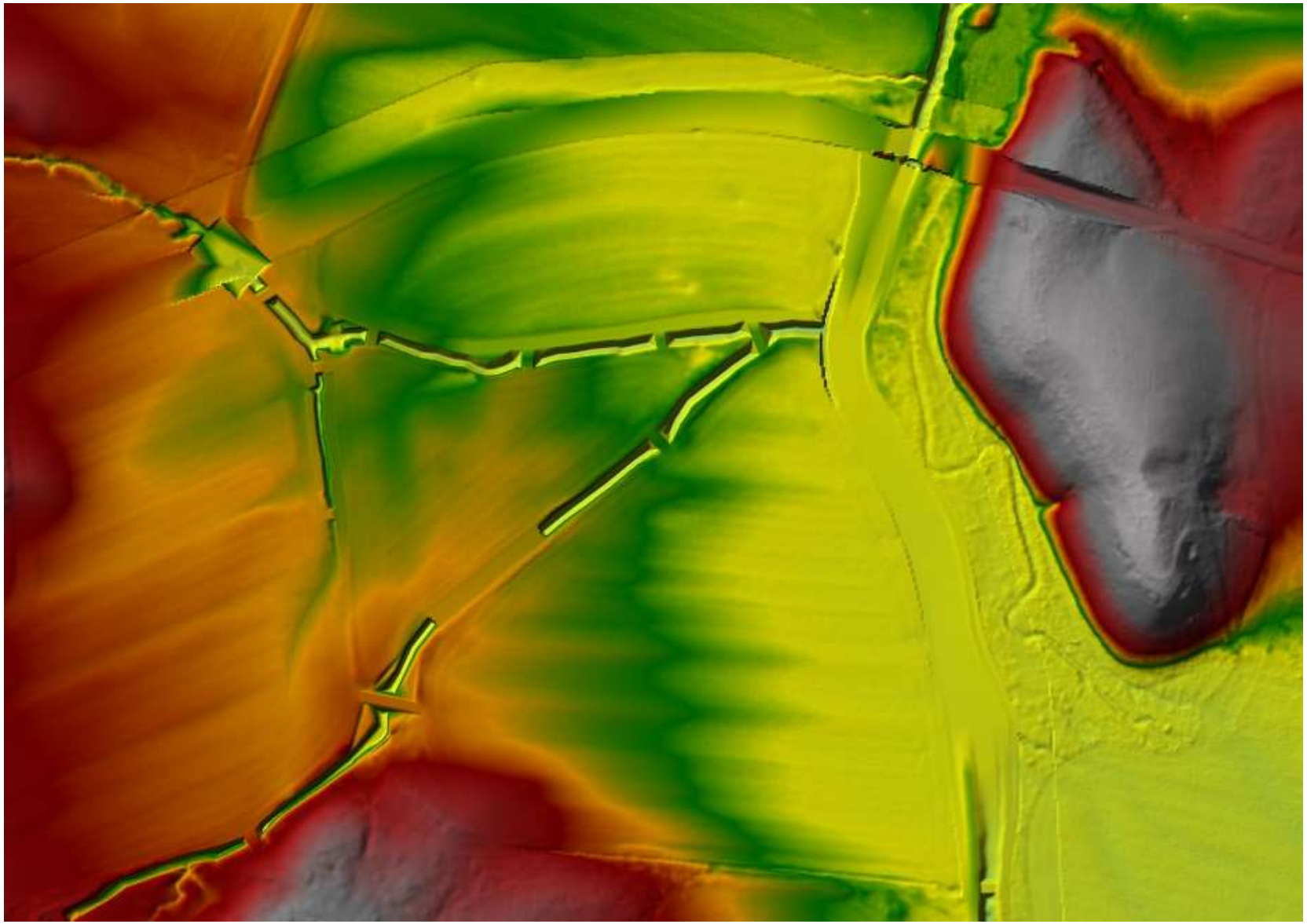

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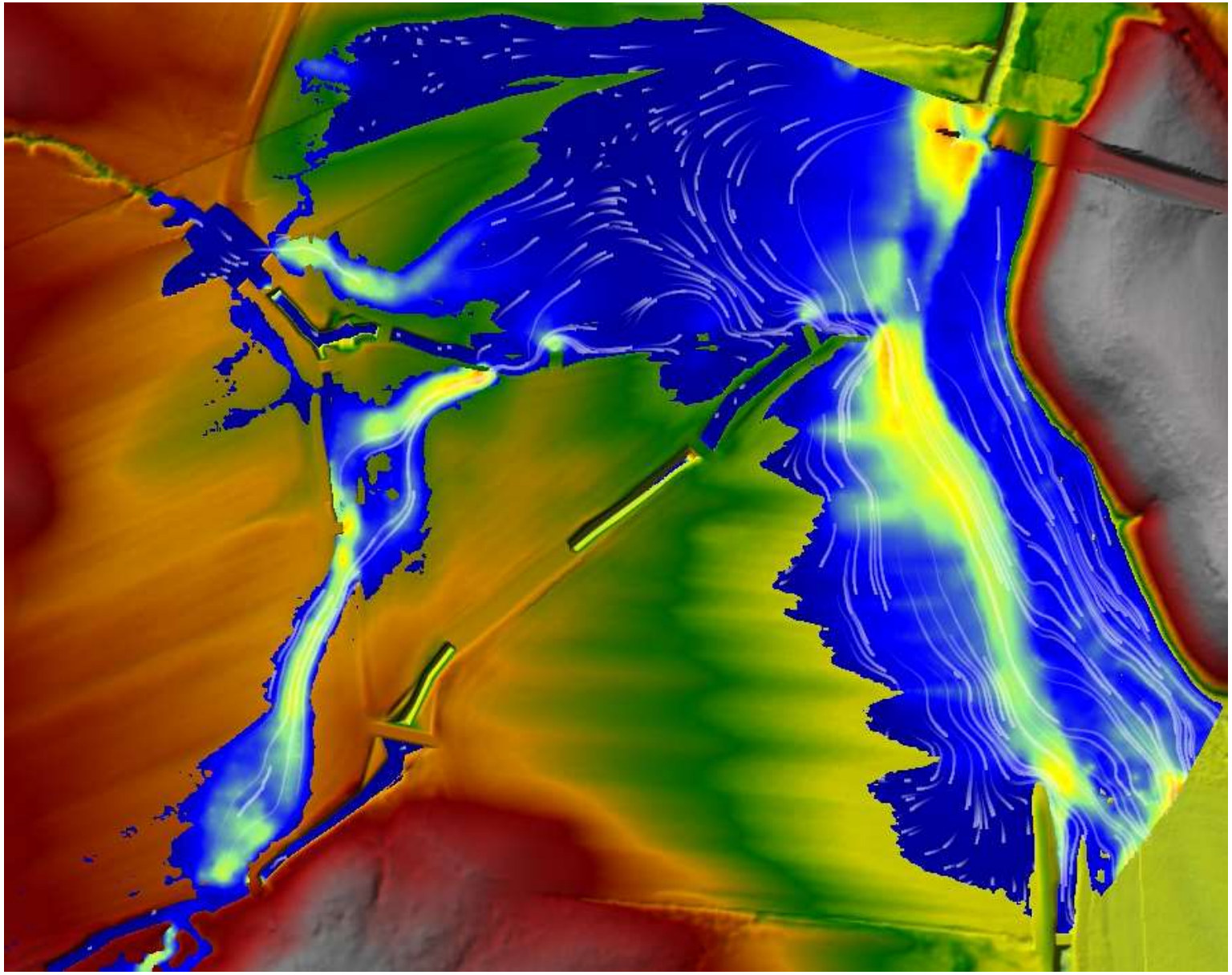

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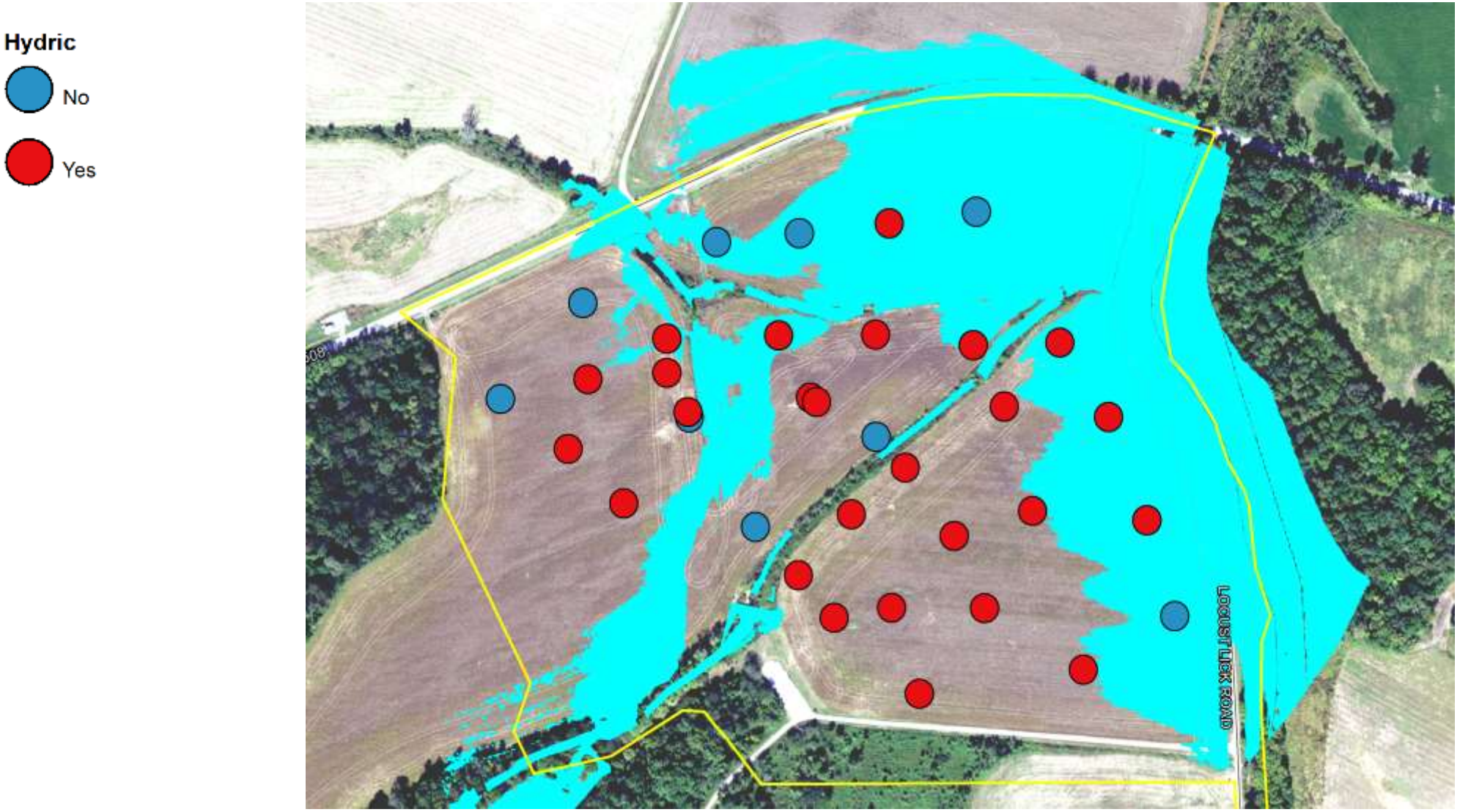
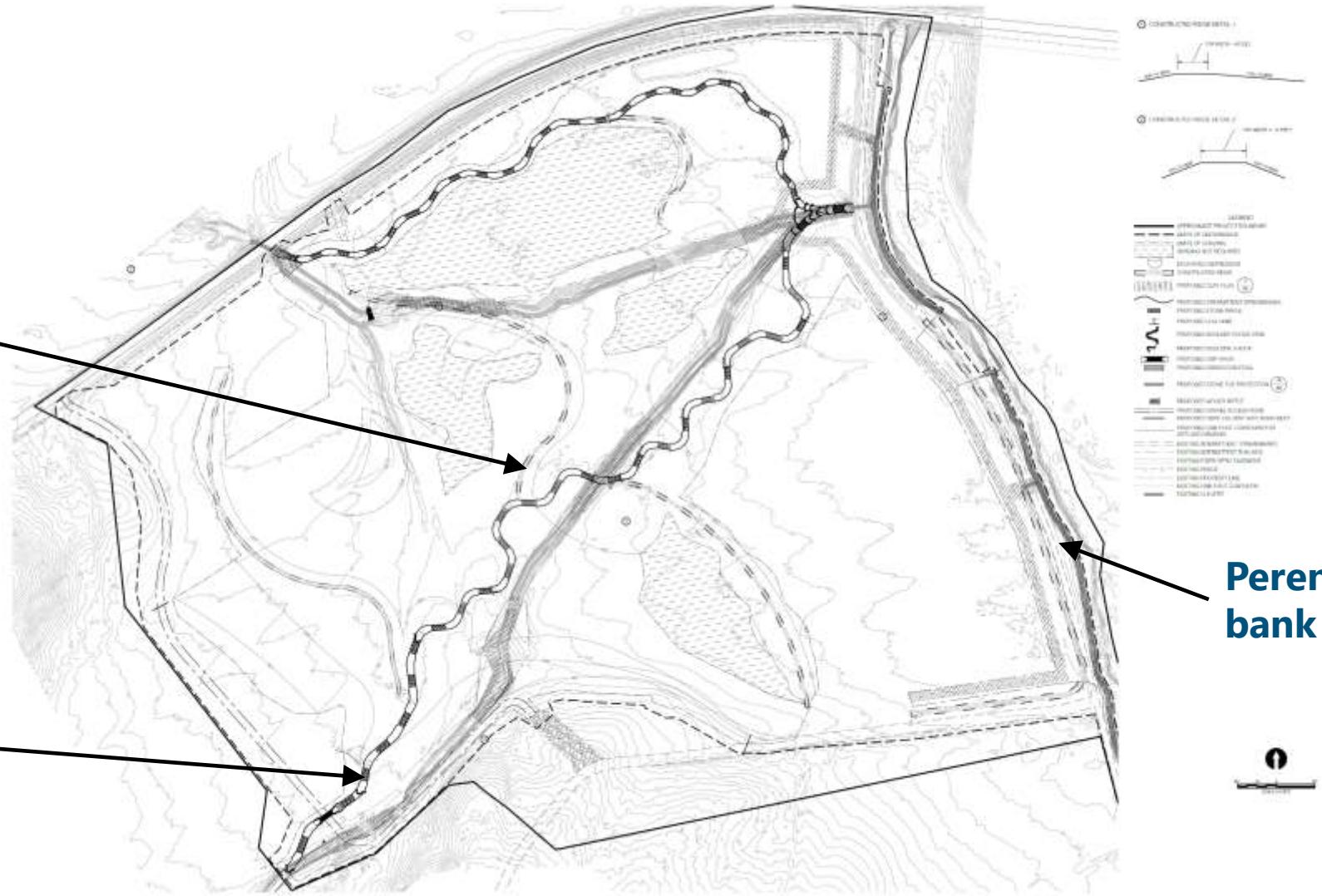


Design



Grading to disrupt crop field furrows

Re-established intermittent stream

Perennial stream bank stabilization

Design Validation: Model Components

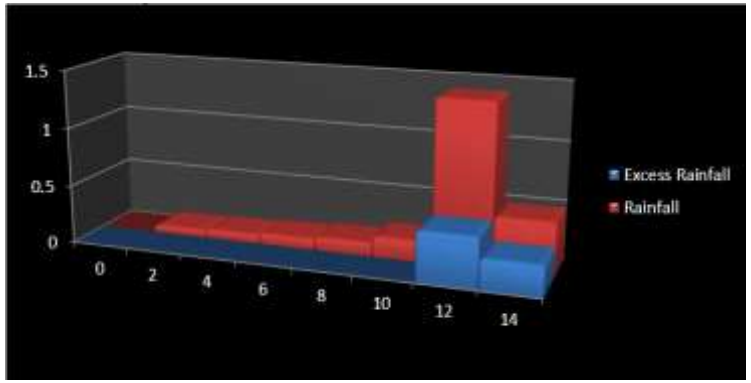
- Stream hydrologic inputs modelled using **conventional watershed models**
- **Rainfall/runoff model** is incorporated to include the secondary hydrology sources
- Profile lines and depth mapping in Ras mapper used to tabulate the **input, output, and storage of wetland areas**
- **Areas remaining ponded** after 24 hours **inform the planting plan**

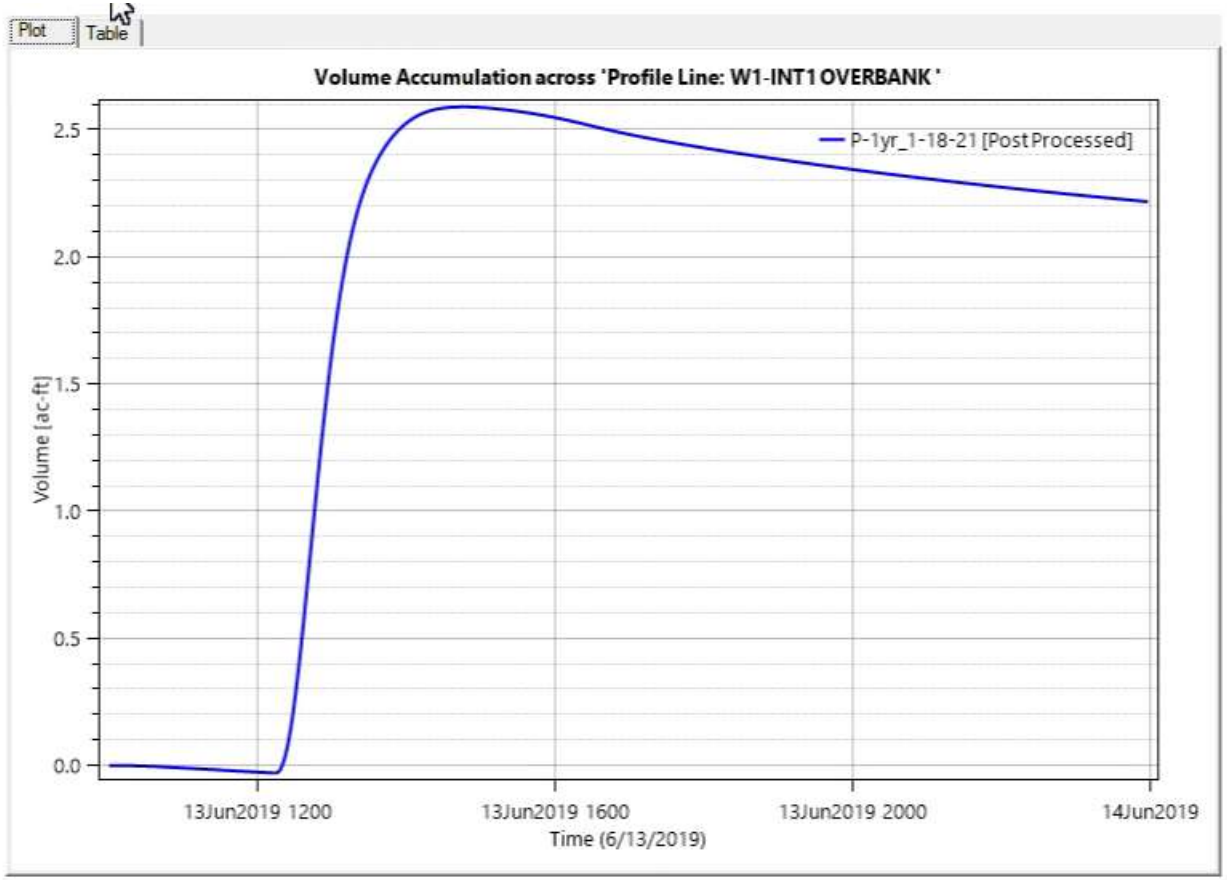
$$S = \frac{1000}{CN} - 10$$

$$I_a \approx 0.2S$$

$$F_a = \frac{S(P - I_a)}{(P - I_a + S)}$$

$$R_S = P_e = P - I_a - F_a$$





Design Validation: Interpreting the Results

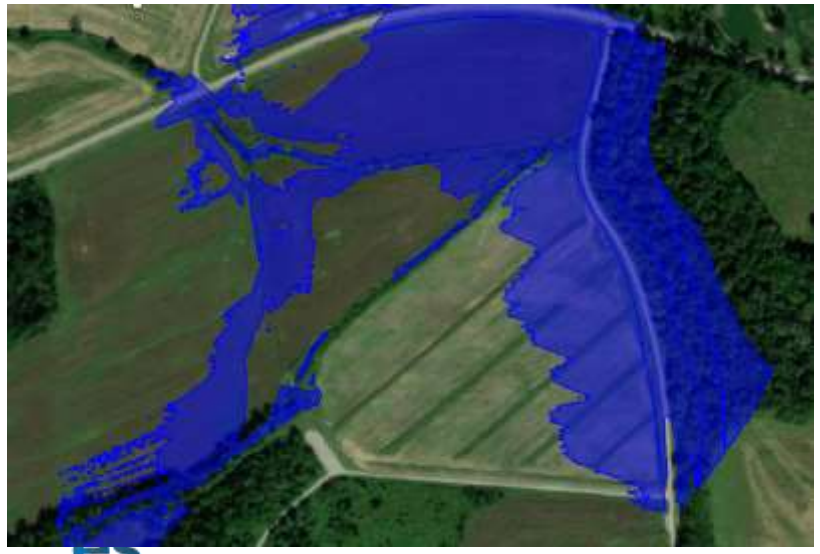
Under historic conditions, the active floodplain occupied a significant portion of the proposed wetland area and the perennial stream floodplain outside these areas

The active floodplain area under current conditions is limited to the existing channels. This channel only appears to overbank during storms larger than a 10-year storm event

Under the proposed design, the active floodplain is greatly expanded suggesting a high likelihood for success in the re-establishment of riparian wetland

Historic Conditions

Active Floodplain = 40% of Proposed Wetland Area



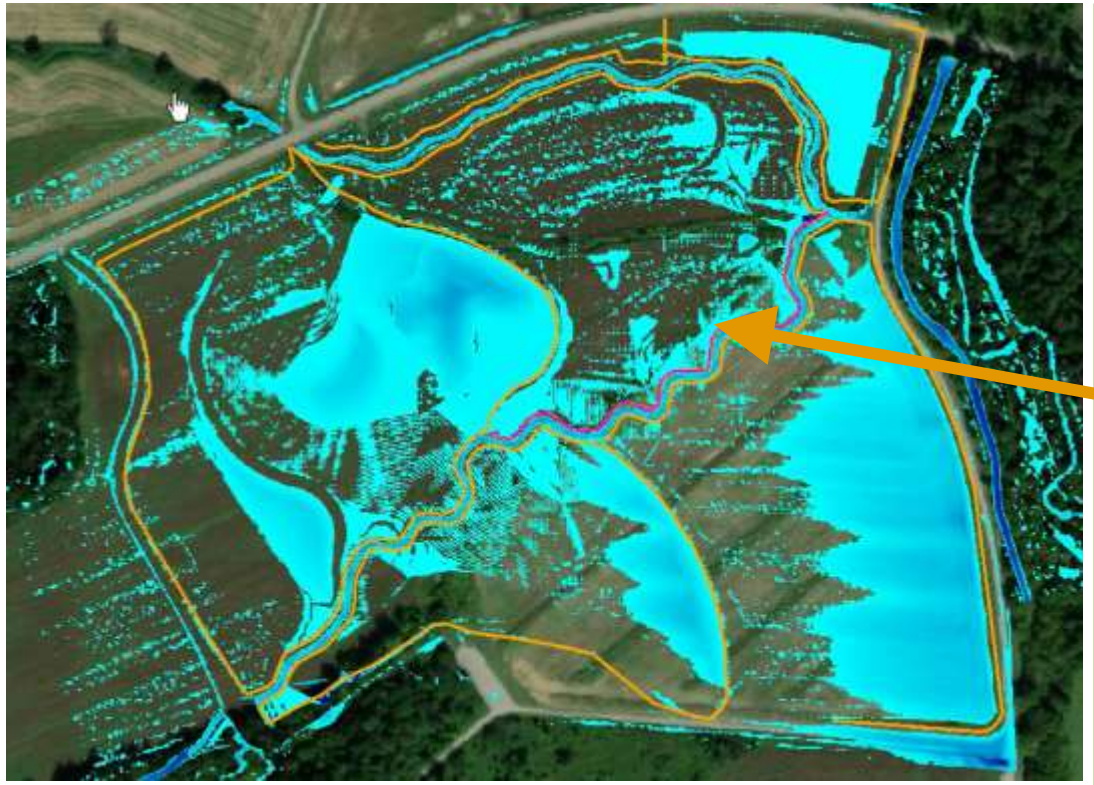
Existing Conditions

Active Floodplain = 2% of Proposed Wetland Area

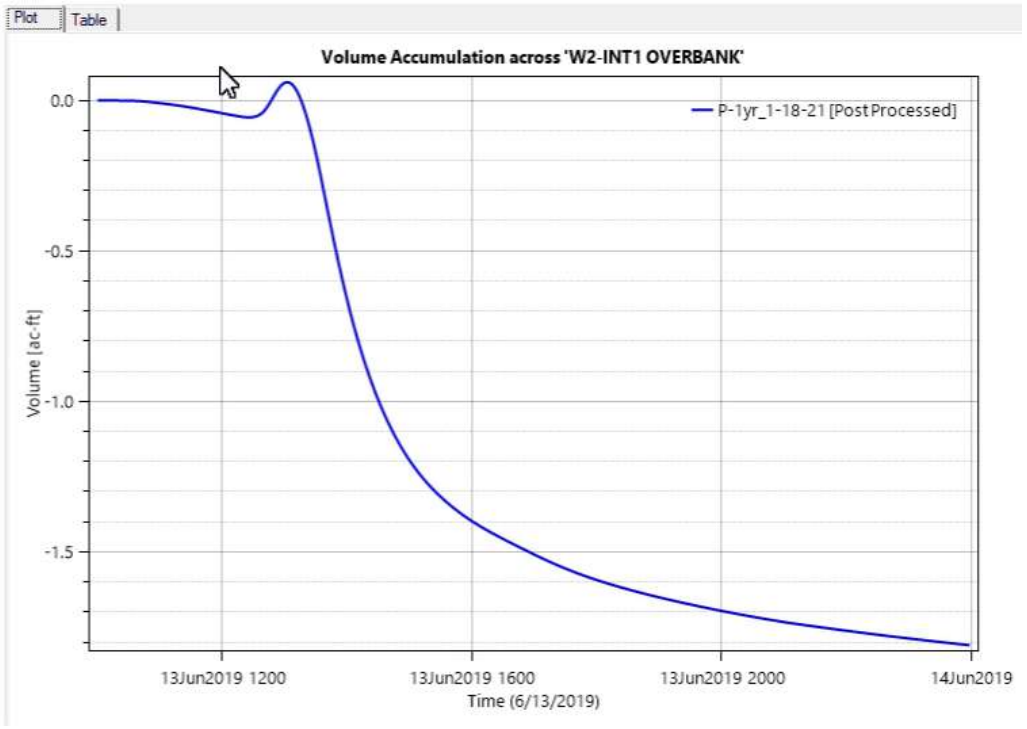
Proposed Conditions

Active Floodplain = 45% of Proposed Wetland Area

Next Steps: Improving the Design based on the Model



- Modeling results show some areas receiving far more inundation than others
- Reference lines along the perimeter of the individual wetland units are useful in identifying water balance across the site



- Above we see volume accumulation across the left streambank adjacent to a wetland unit with very little inundation compared to the rest of the site
- The graph indicates that initially the stream overbanks into the wetland, but this is quickly reversed with most of the water moving back into the stream

Questions & Answers

For more information:

bborries@res.us

res.us

Jessie.boles@ky.gov

https://fw.ky.gov/Fish/Pages/Stream-Team-Program.aspx

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