CHRISTOPHER B. BURKE ENGINEERING, LLC

Pigeon Creek Corridor Flood Risk Management Plan

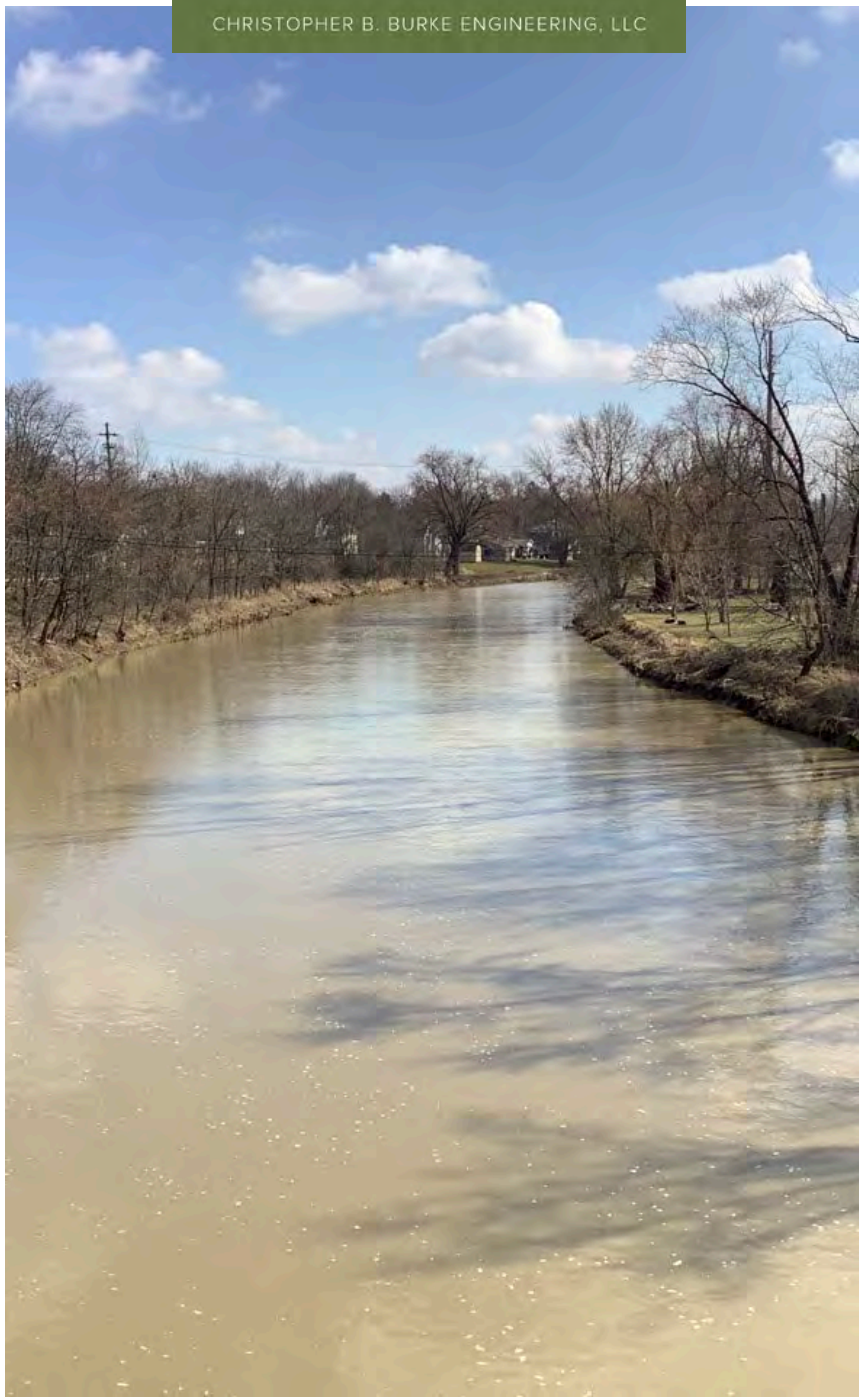
Evansville, IN – Vanderburgh Co. Commissioners

Ian Hahus & Bob Barr

May 9, 2023

Discussion Overview

- Motivation for Study
- Geology
- Hydrology
- Field Assessment
- Project Locations & Conceptual Solutions
- Conclusions
- Recommendations



Project Motivation

- Supported by Vanderburgh County Surveyor's Office and County Commissioners
- Better understand flooding and channel stability of Pigeon Creek in Vanderburgh County
  - Causes and potential solutions for flooding
  - Presence and transport of large woody debris
  - Identify potential to increase recreational opportunities
- Explore opportunities for cooperation with upstream counties

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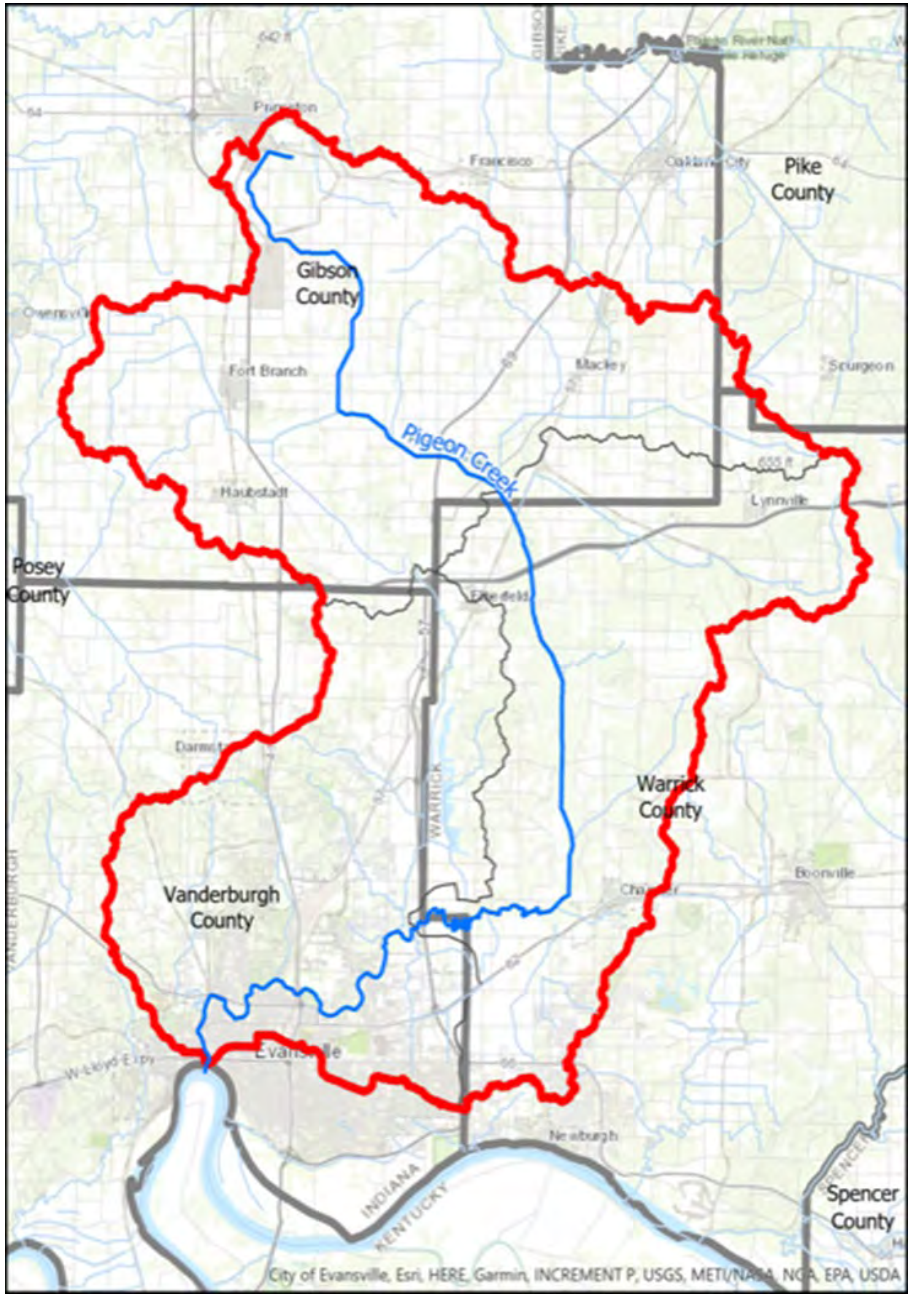
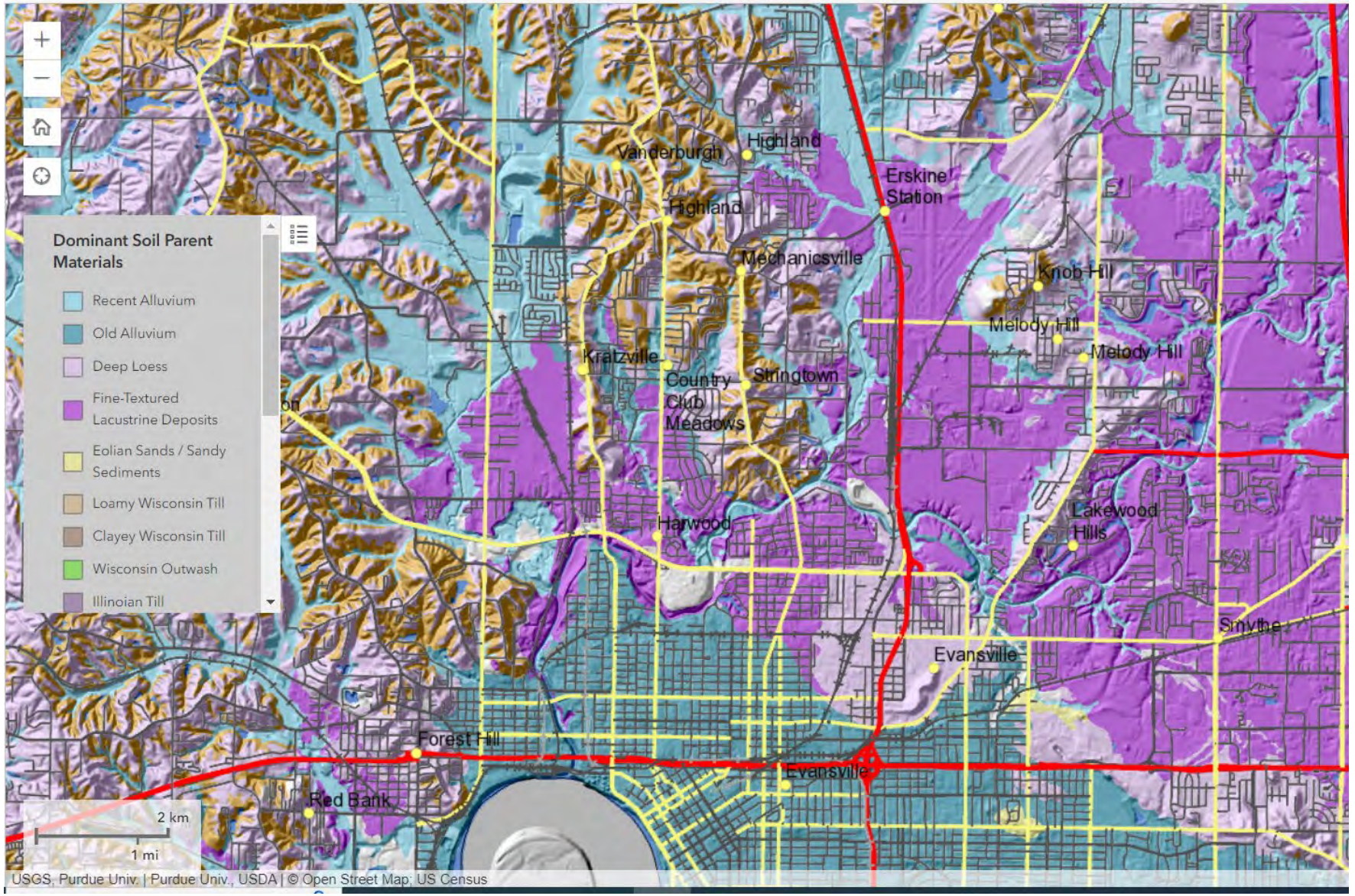
DRAINAGE BASIN and GEOLOGY



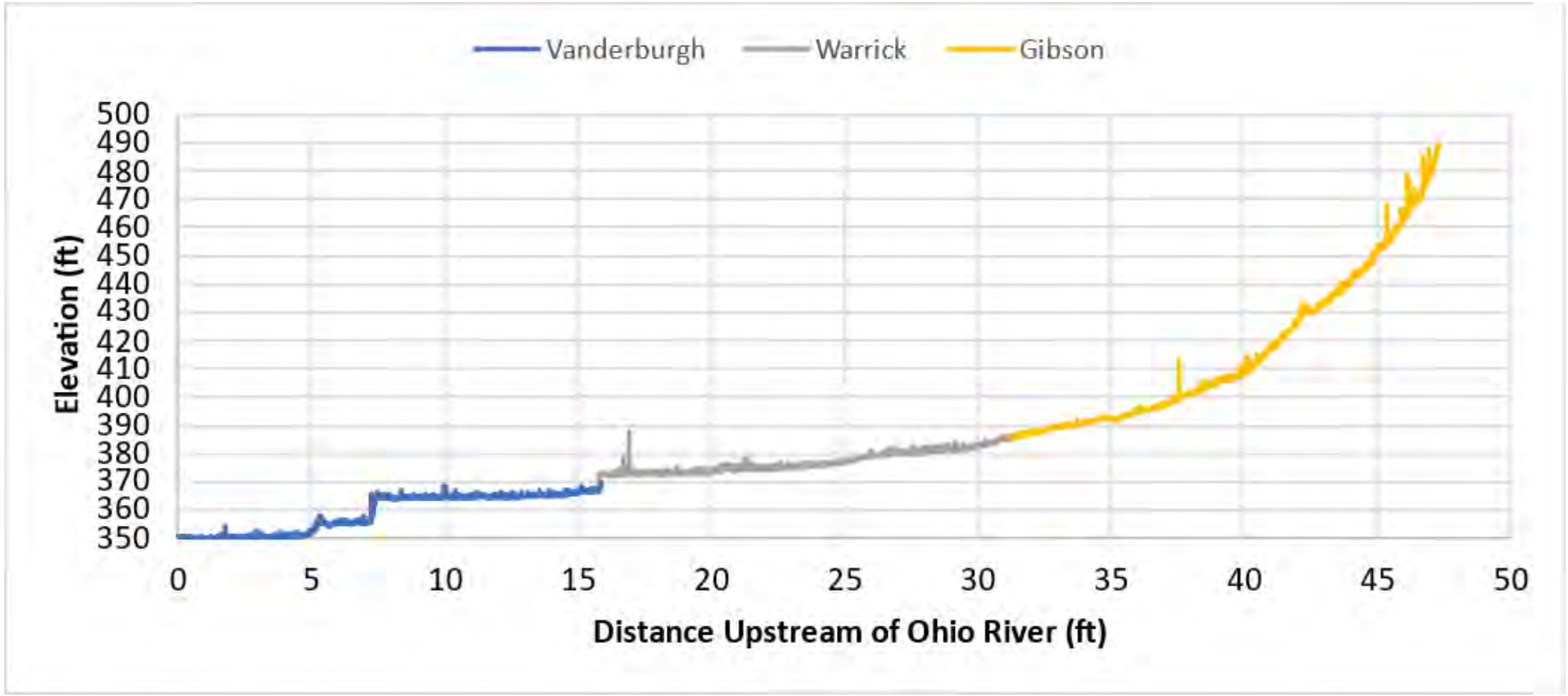
Study Area Summary

1. ***Study Reach:*** *16 mi in Vanderburgh County*
2. ***Drainage Area:*** *370 mi² (90 mi² in V'burgh)*



Surficial Geology

River in silty alluvium and silty lake deposits in Vanderburgh County



Longitudinal profile of Pigeon Creek watershed

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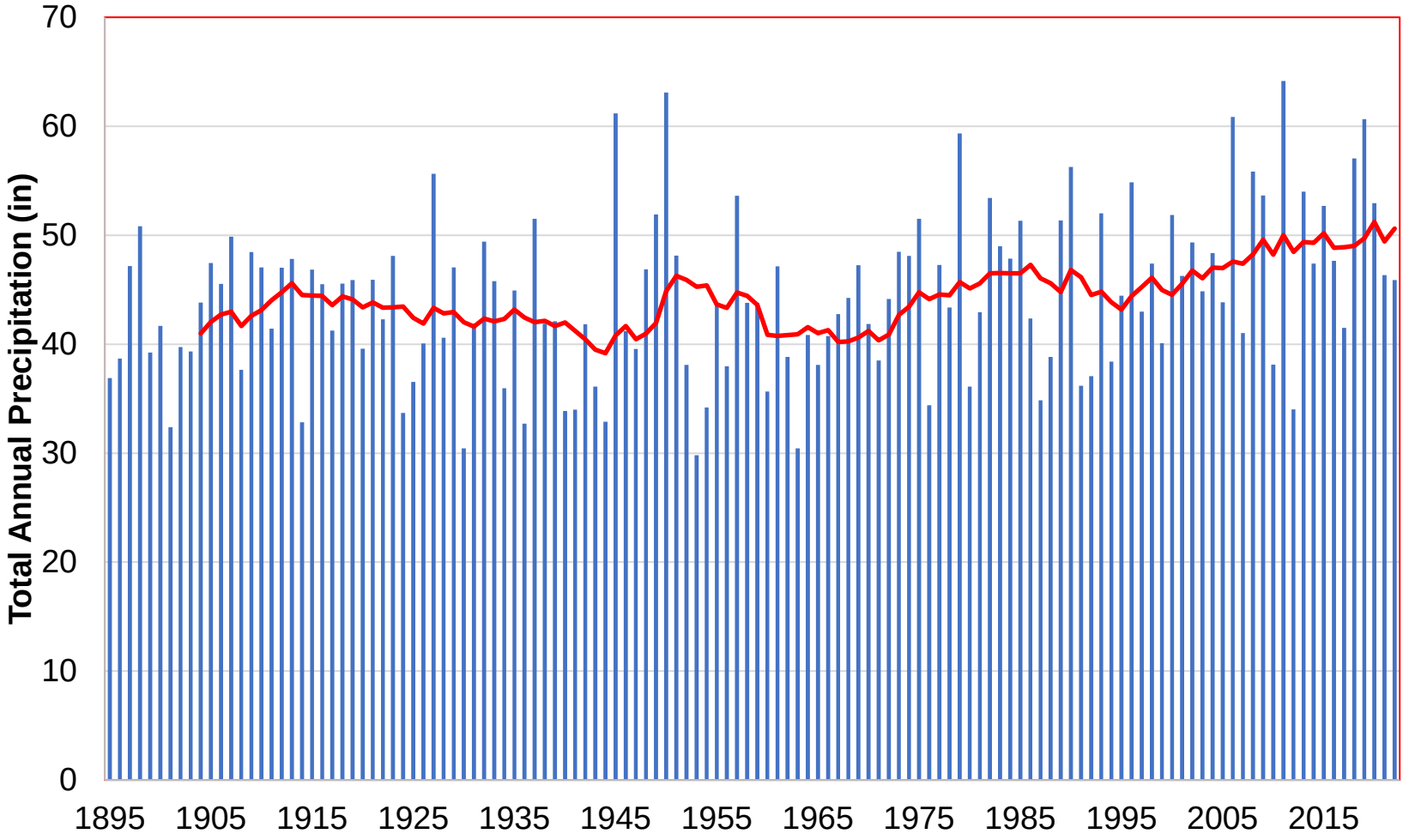
- HYDROLOGY - RAINFALL and RUNOFF ANALYSIS

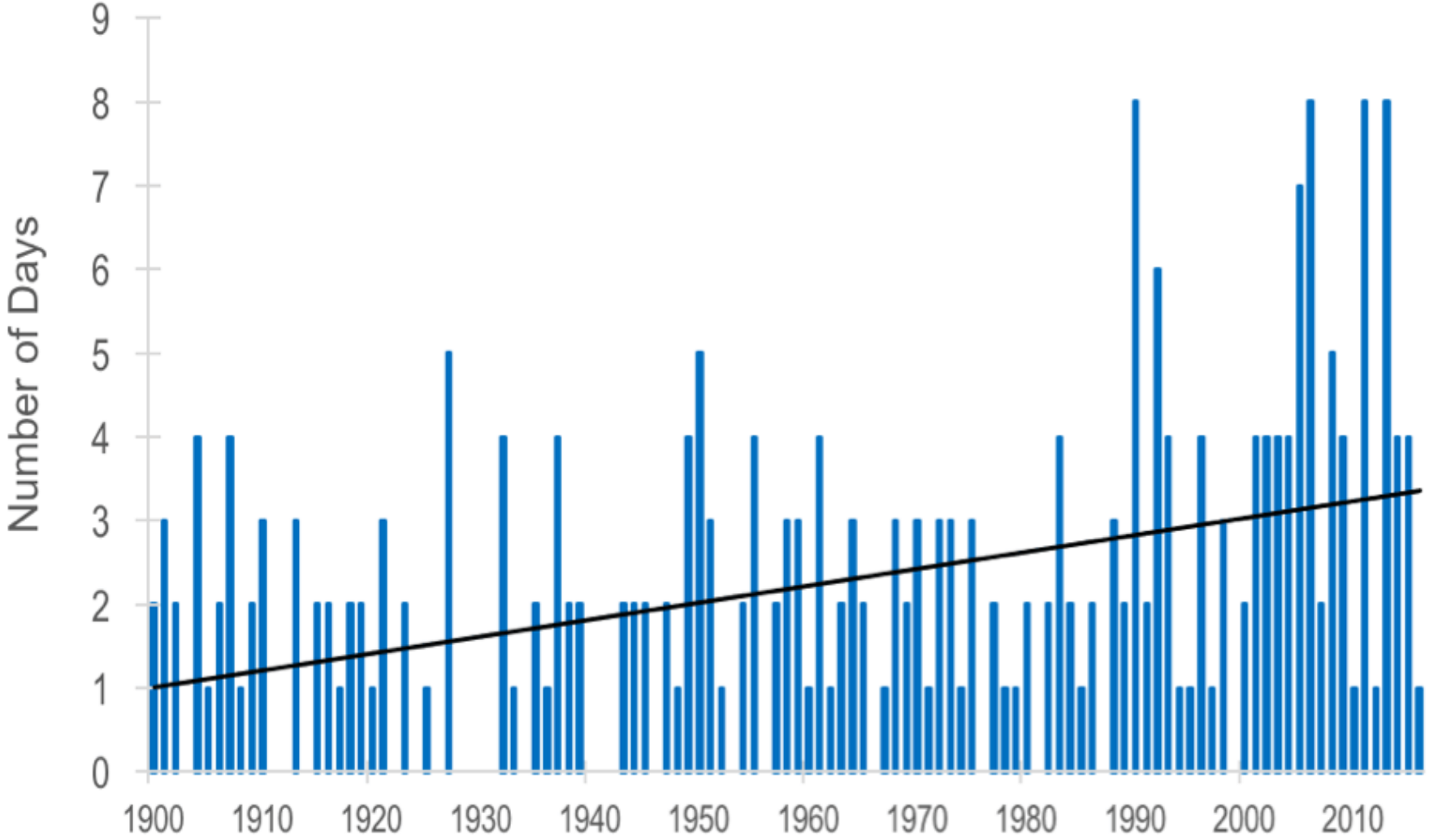
Annual Precipitation Depth, SW Indiana
Climate at a Glance, NOAA



Rainfall Trends

1. *1" increase every 16 years over full record*
2. *1" increase every 6 years since 1960*
3. *Note recent lack of "dry" years*

Days w/Extreme Precipitation, Indiana
IN CCIA, 2018

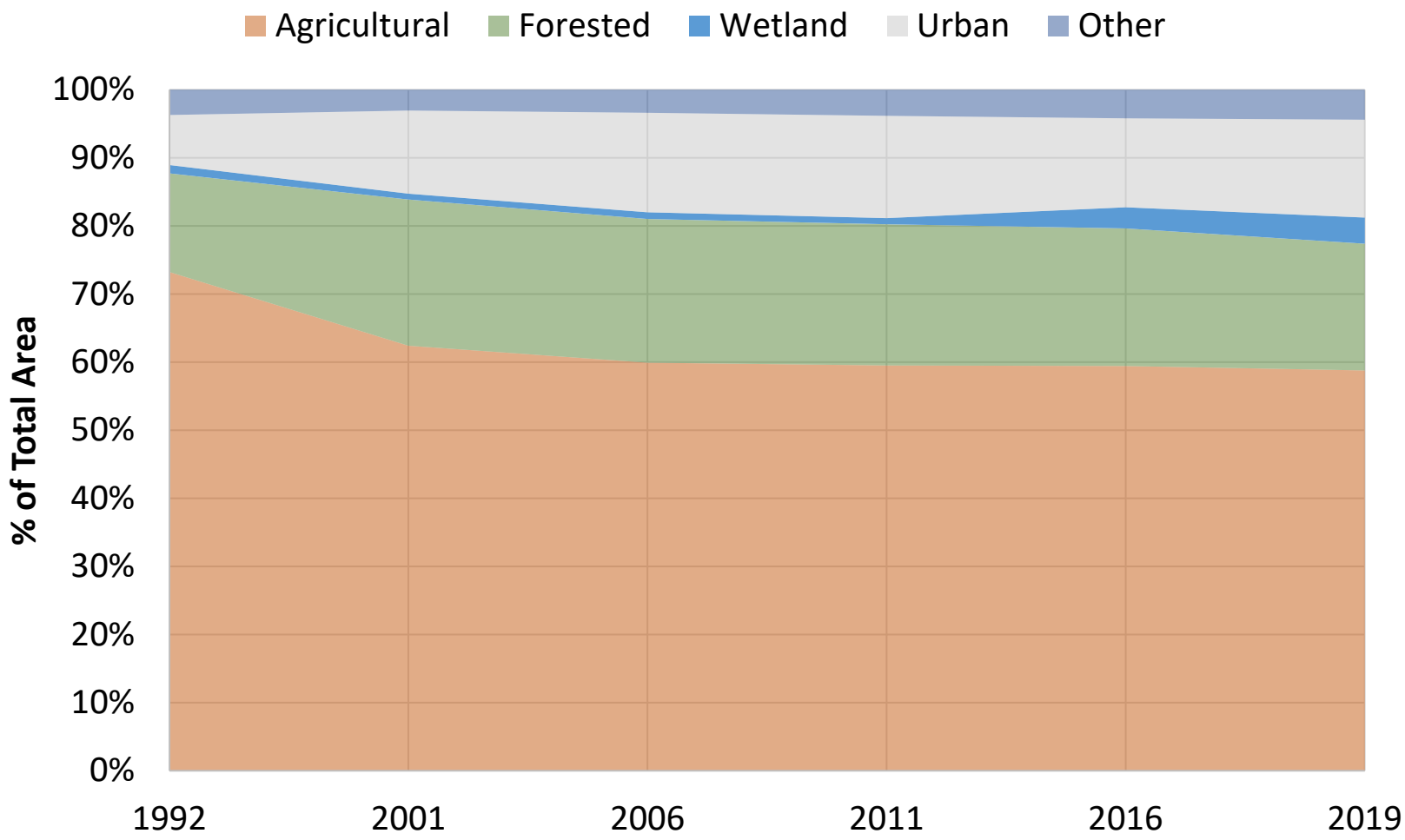


Extreme Rainfall

1. *Number of days exceeding 99th percentile increasing from 1 to 3/yr*

-> Increased potential for dramatic changes to channel stability

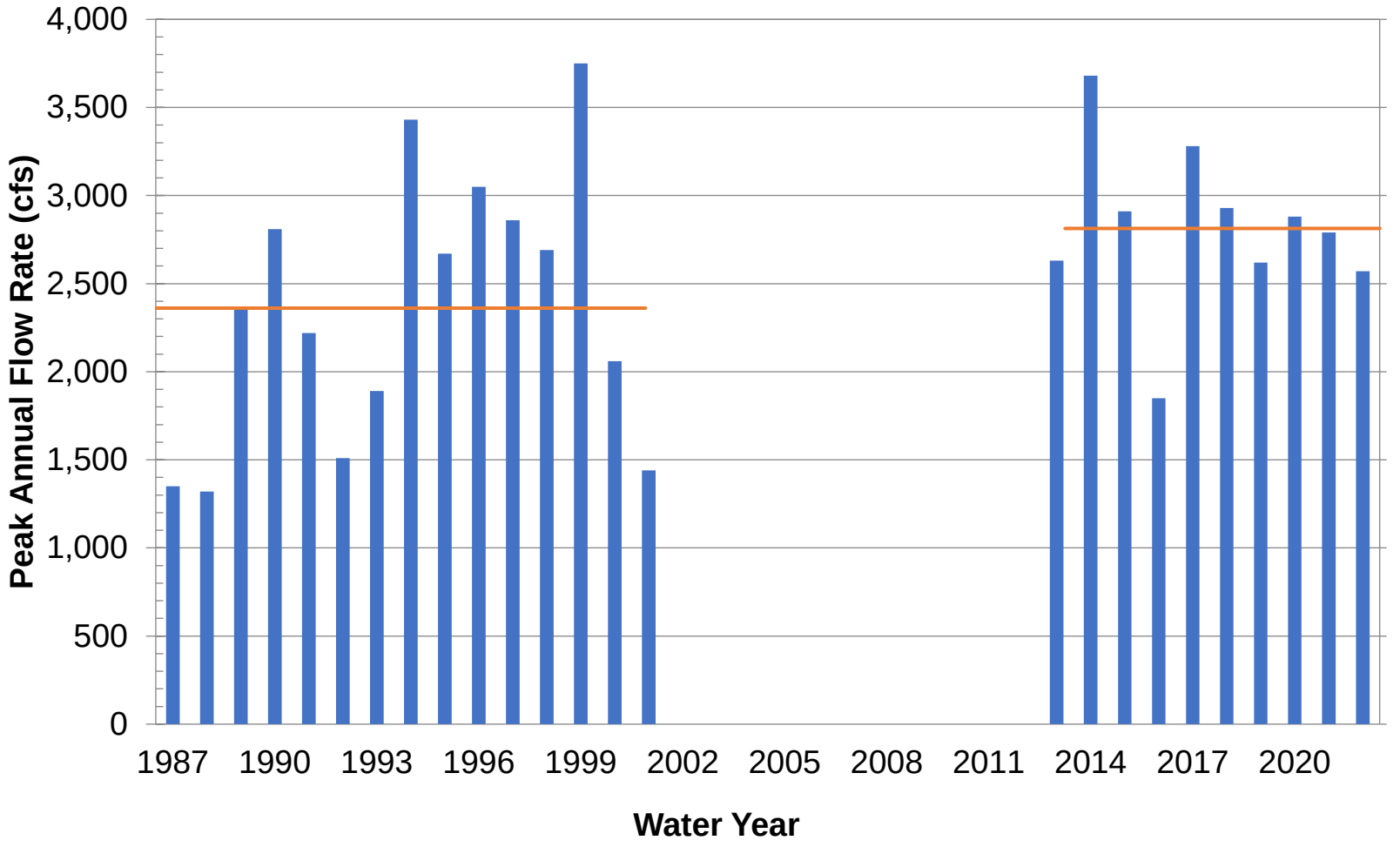
Landuse Change 1992-2019
National Land Cover Dataset



Landuse Trends

1. *Watershed is 60% Agricultural*
2. *Remaining area is Urban, Forested*
3. *Largely stable composition since 2006*

Stream Gage Analysis – Peak Flow
PC near Fort Branch, IN (USGS Gage 03322011)



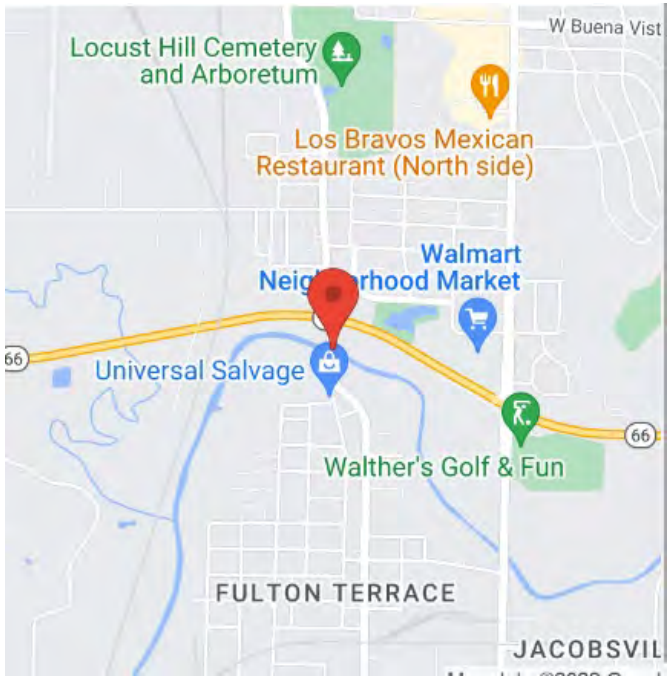
Peak Flow Trends

1. *Peak annual flowrate average increasing from 2,350 to 2,820 cfs*
2. *Approx. 20% increase over past 35 years*

-> Increase in flood elevations and impacts

FIELD ASSESSMENT

Vanderburgh County – Levee Authority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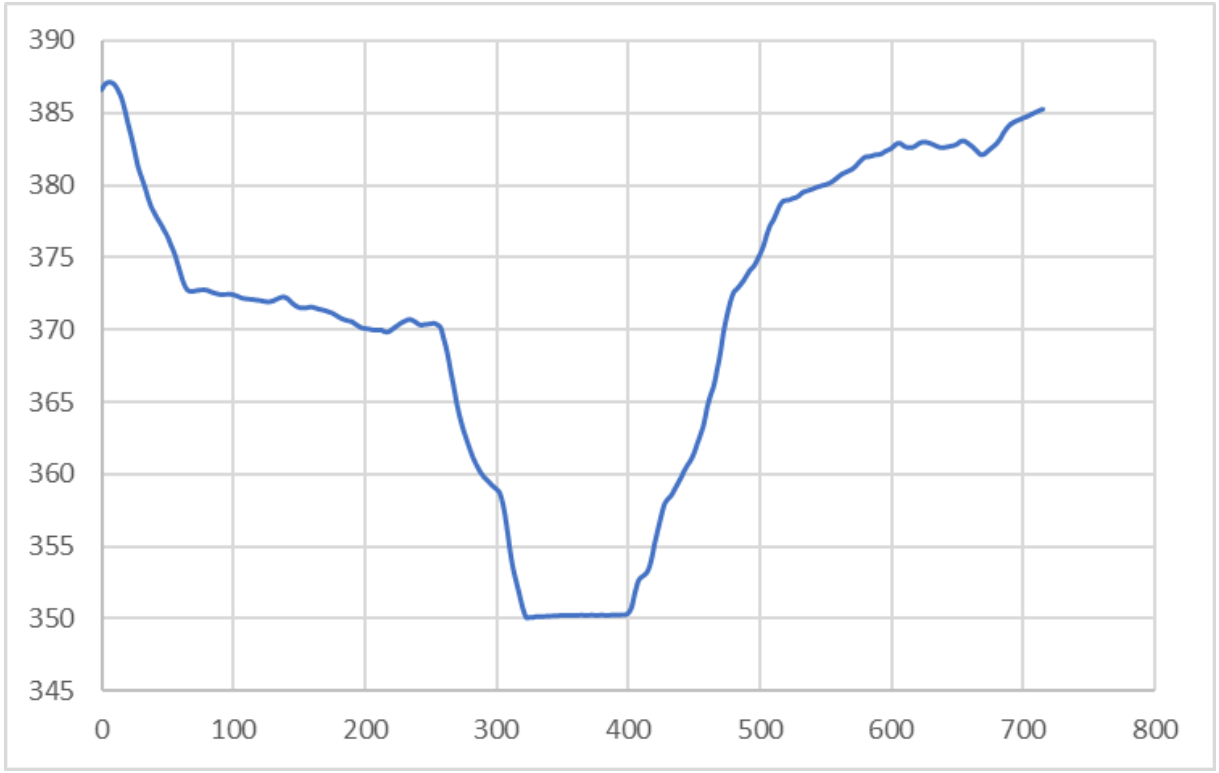
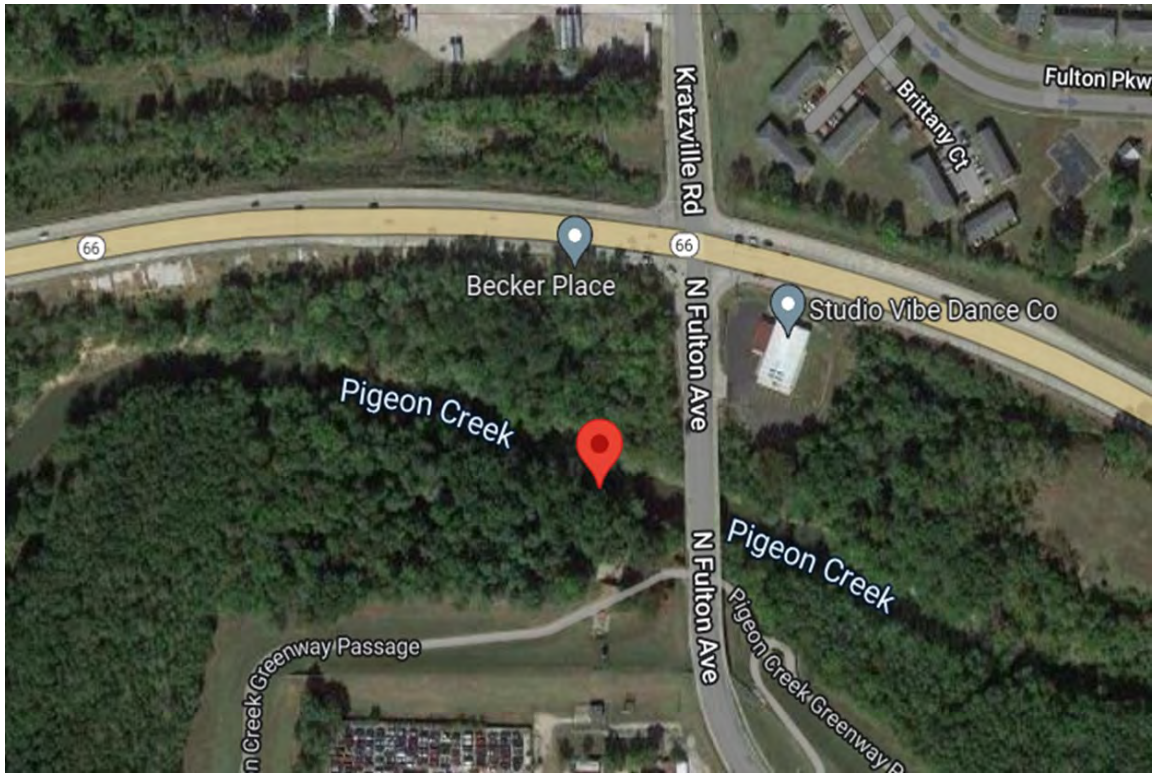
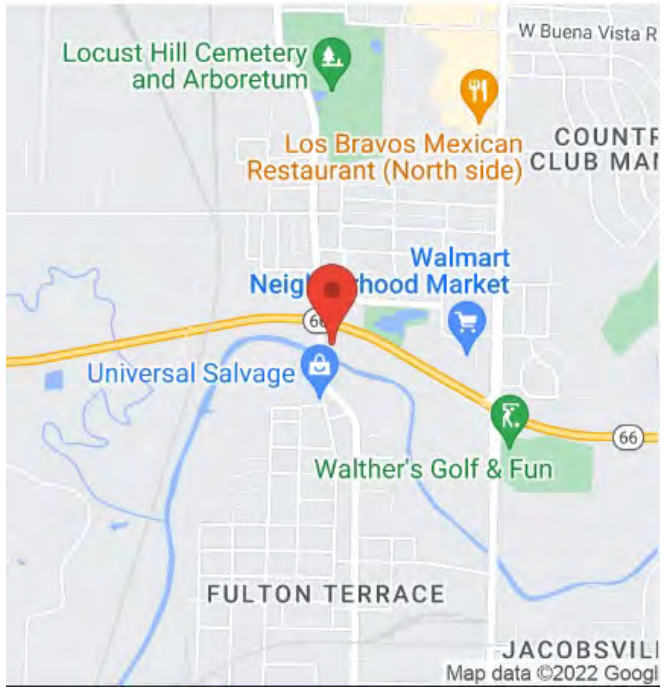
Locust Hill Cemetery and Arboretum
Los Bravos Mexican Restaurant (North side)
Walmart
Universal Salvage
66
66
Walther's Golf & Fun
FULTON TERRACE
JACOBSVIL





38.0027, -87.5830
XS cut from top of levee to roadway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Locust Hill Cemetery and Arboretum
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COUNTR
CLUB MAI
Walmart
Neigh hood Market
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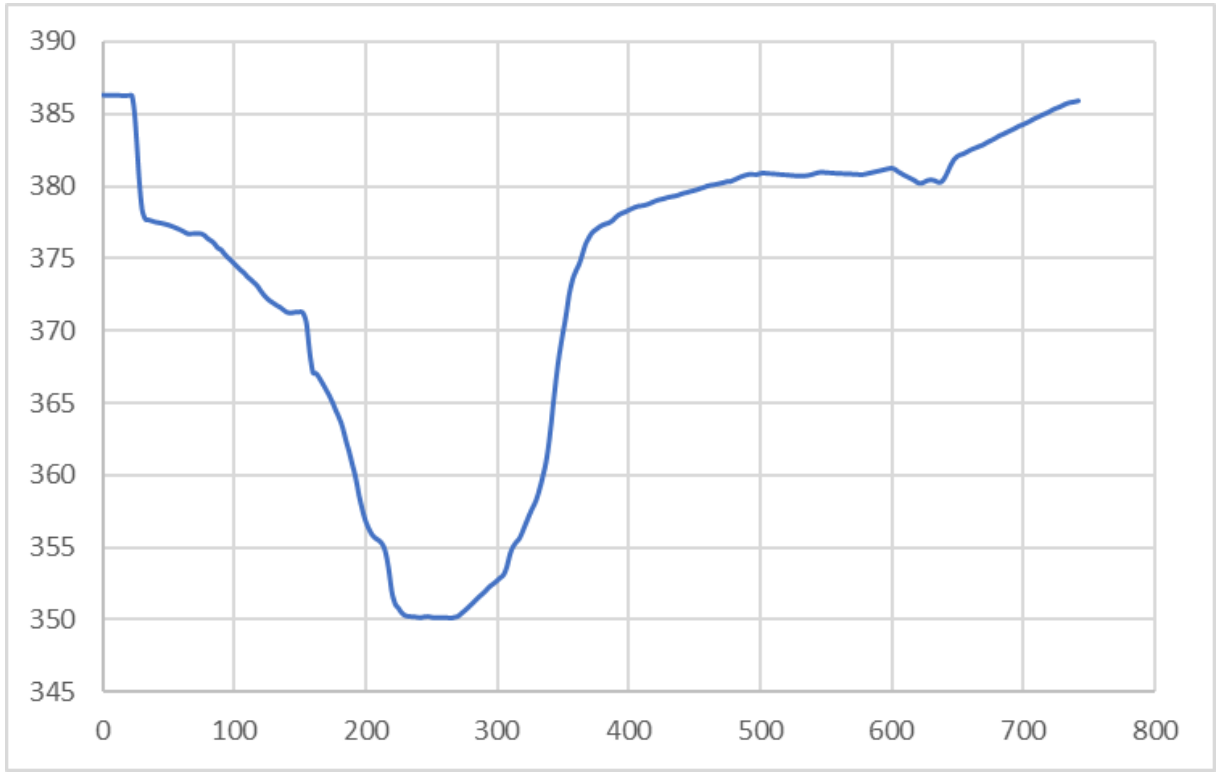
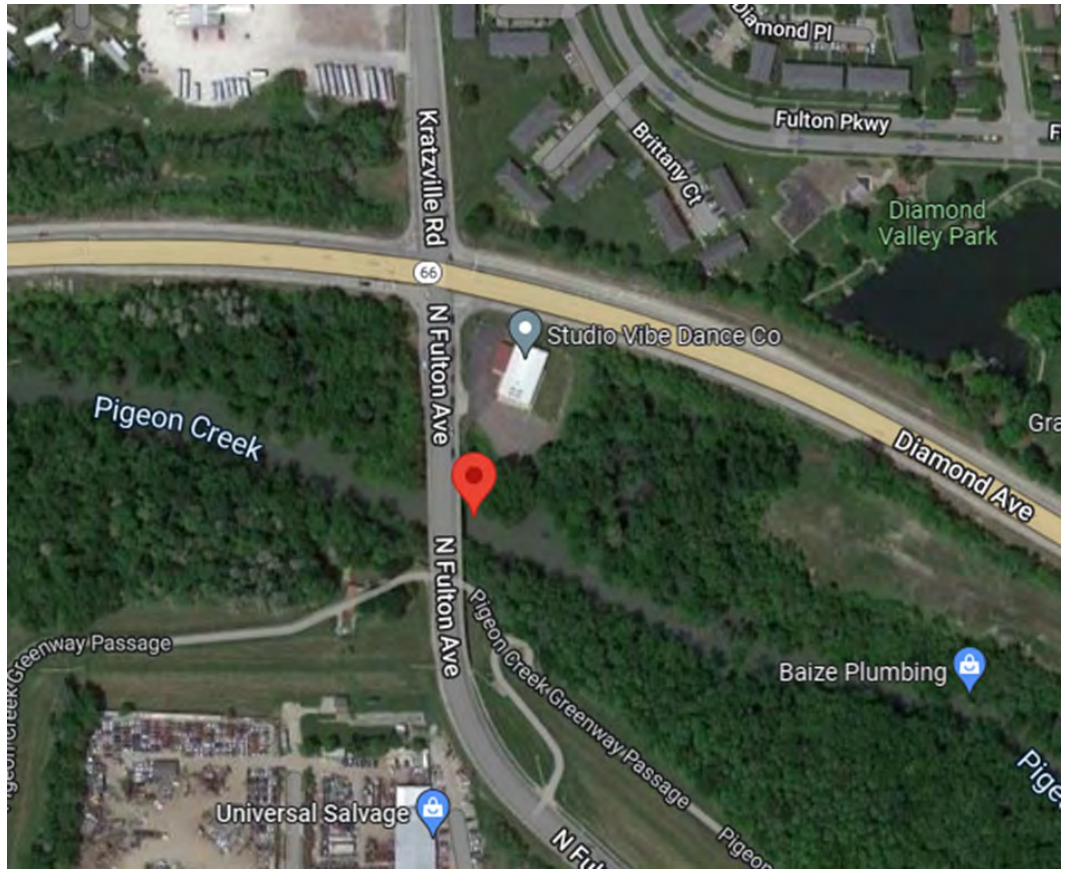
Walther's Golf & Fun
FULTON TERRACE
JACOBSVILL
Map data ©2022 Googl





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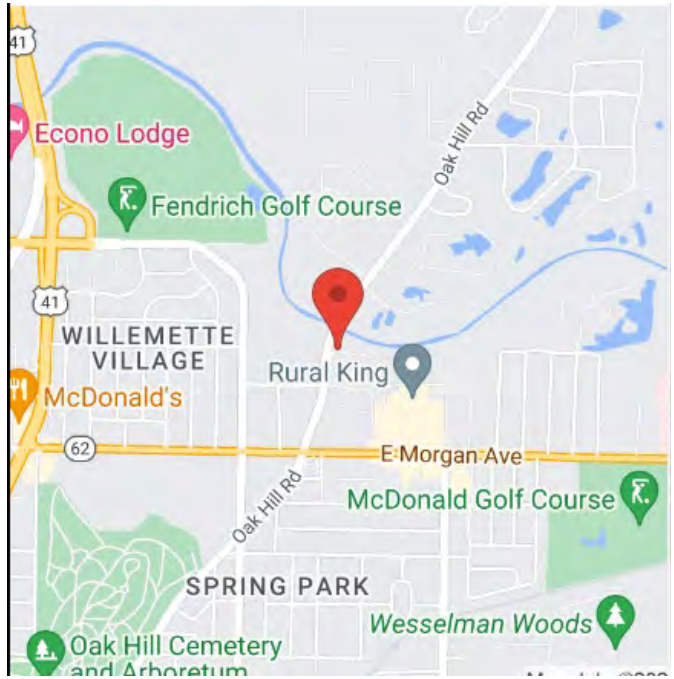
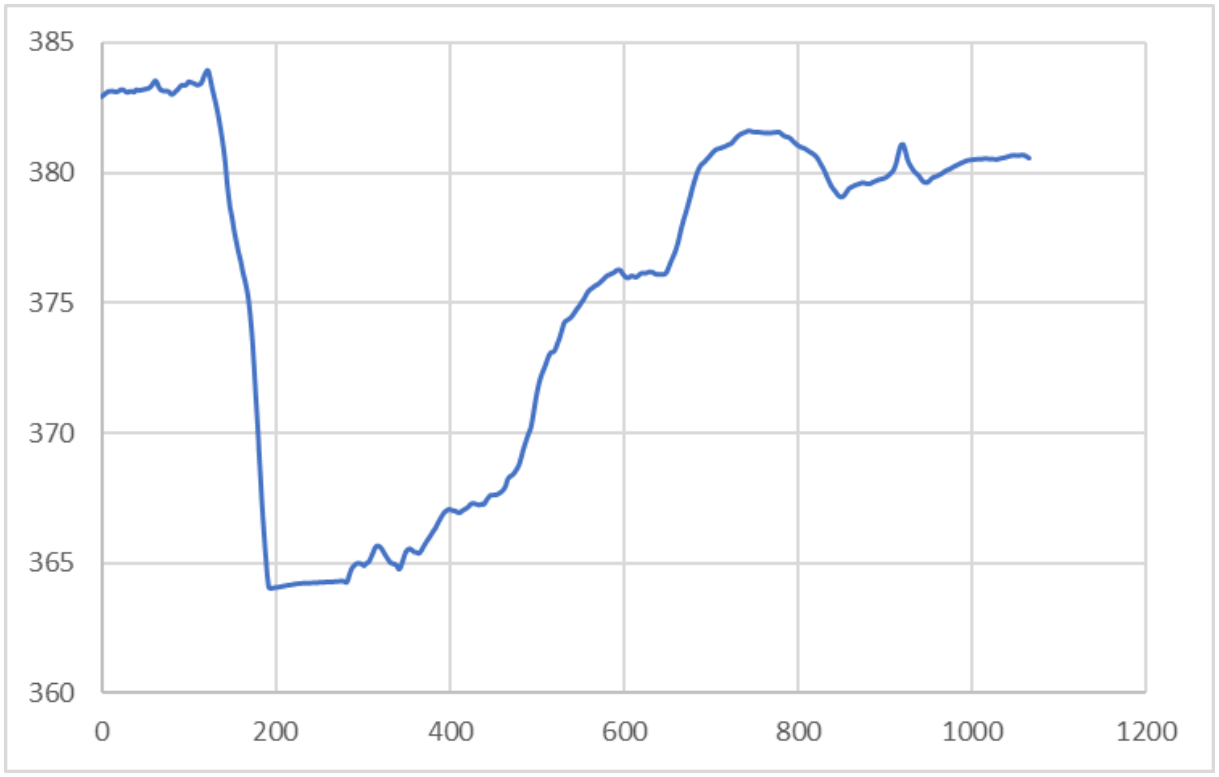
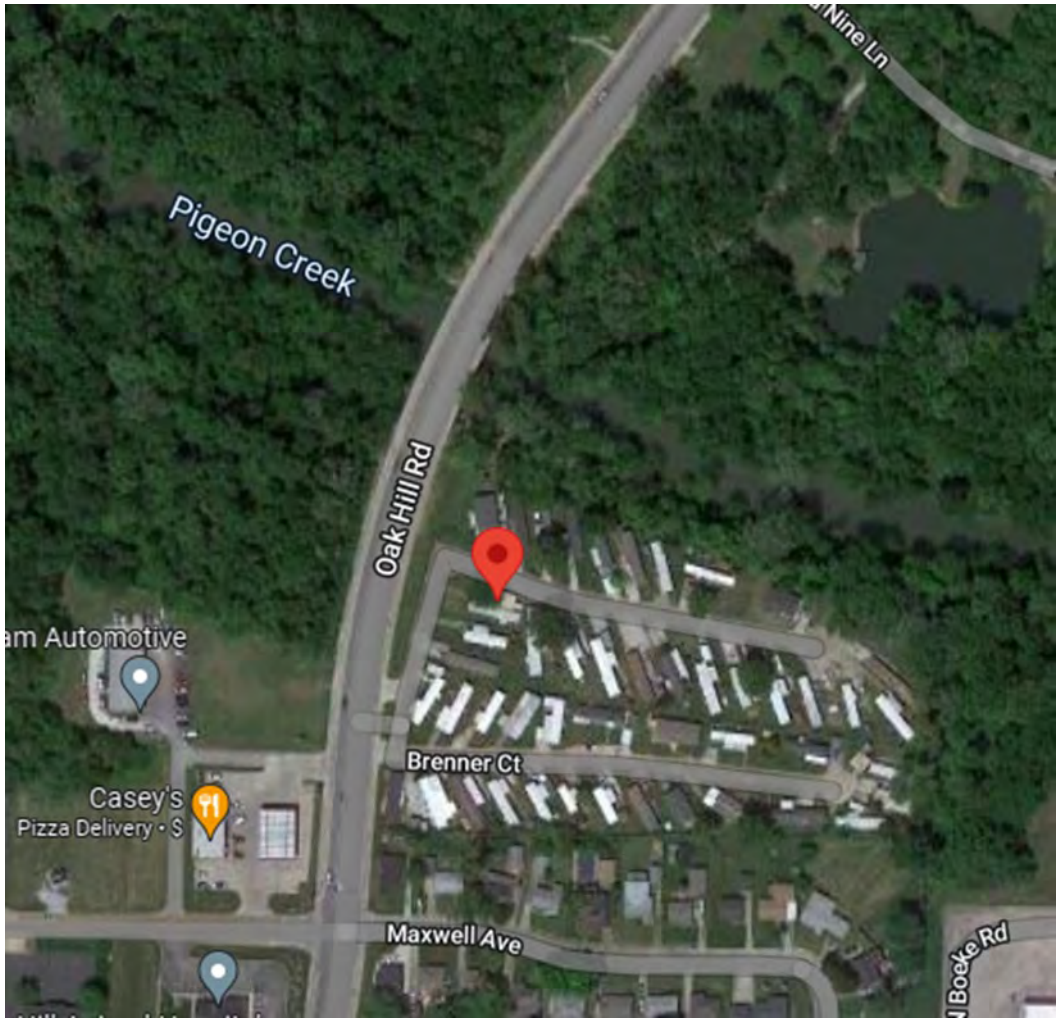


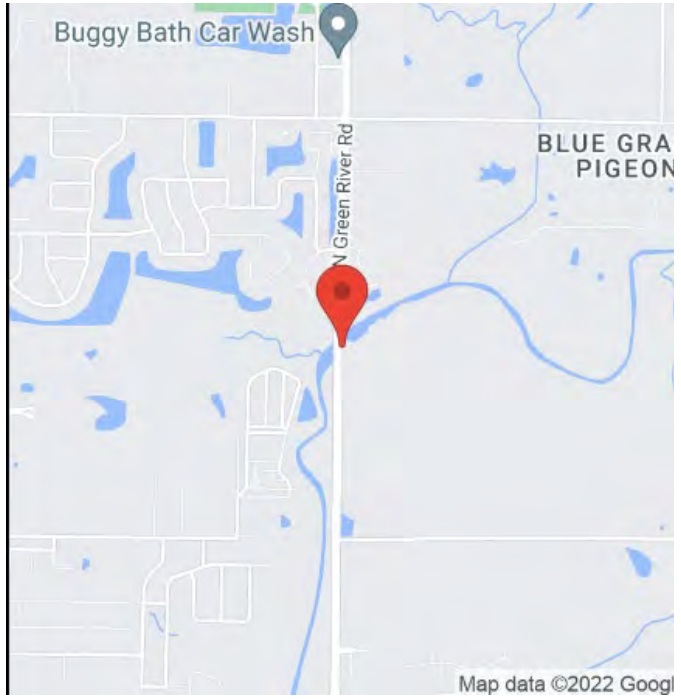
37.9952,-87.5248





37.9952,-87.5248

Vanderburgh County – Warrick County, “natural” reach



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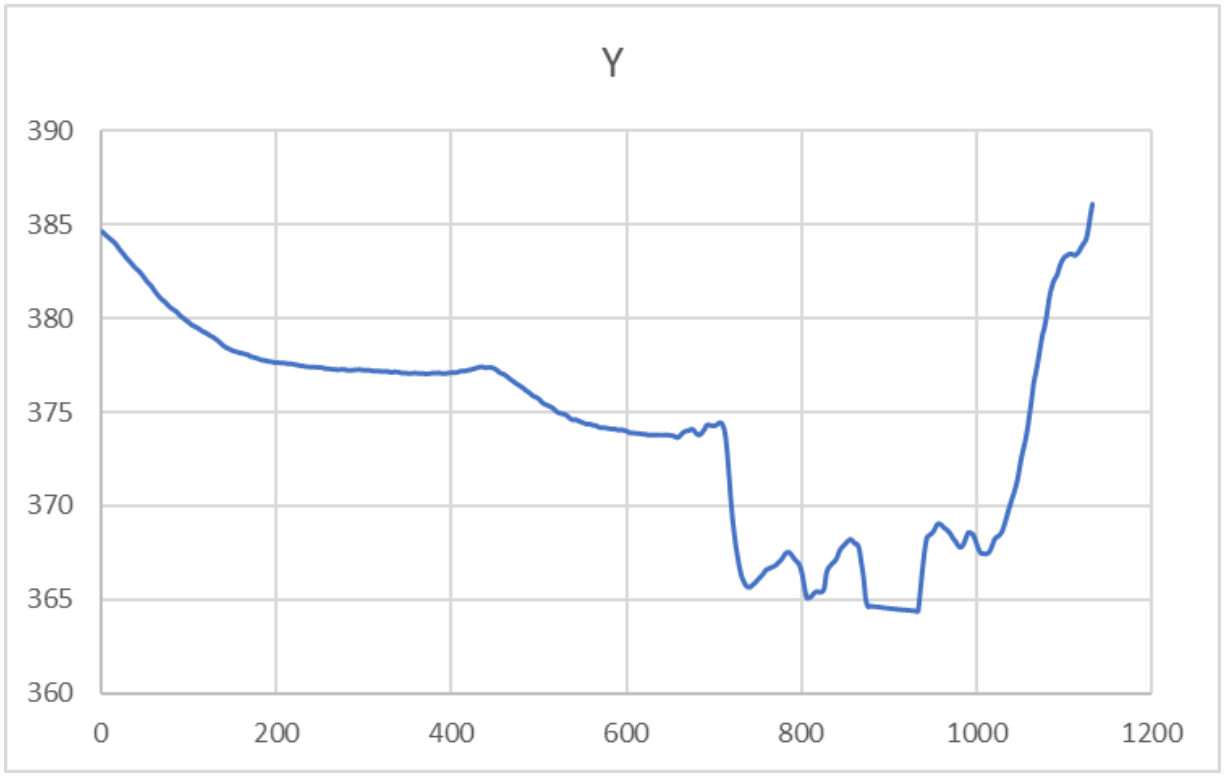
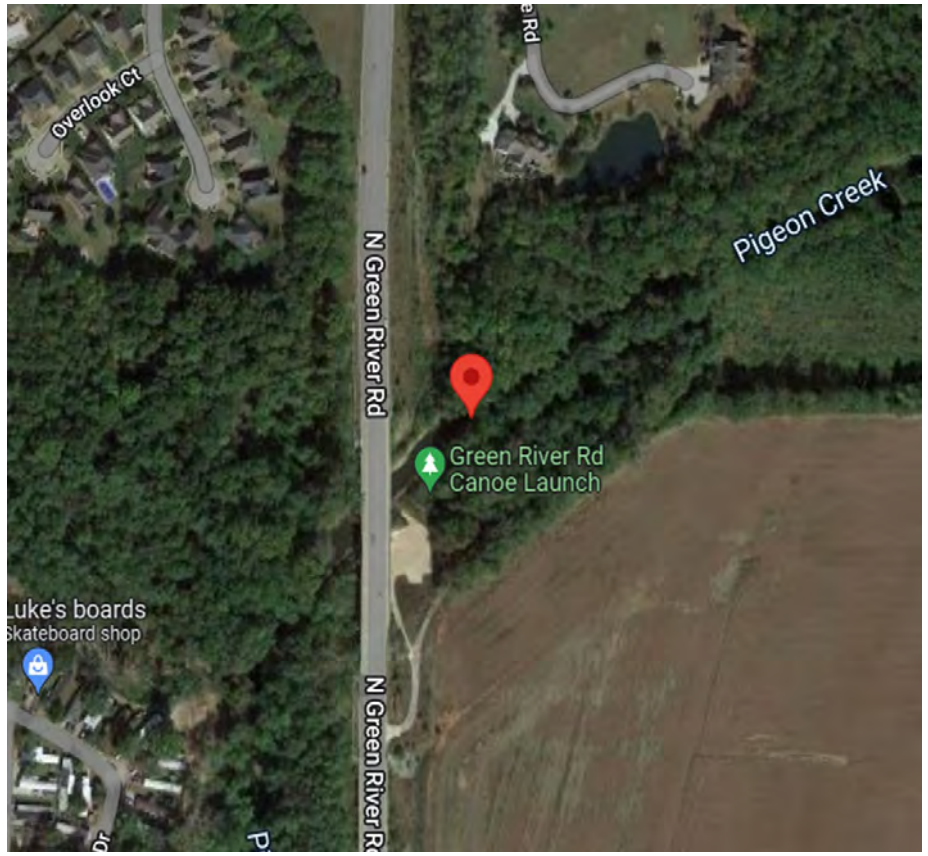
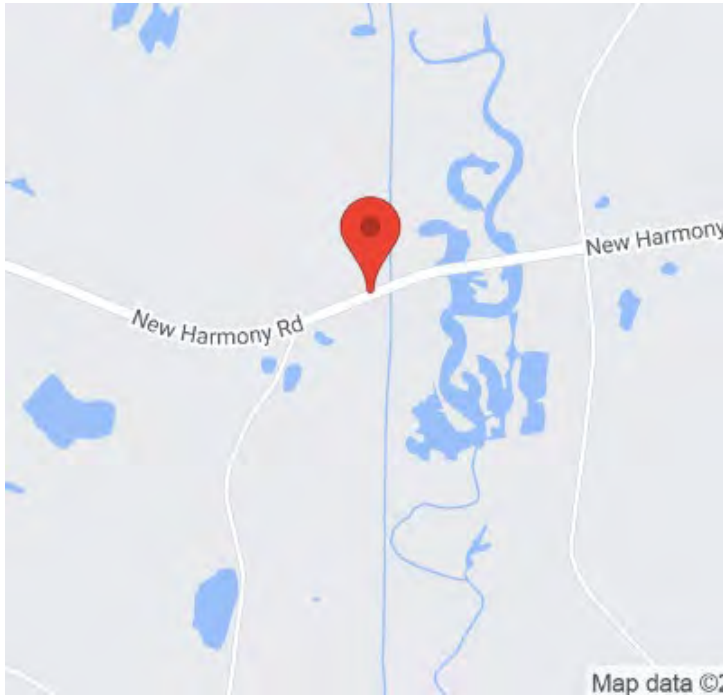




38.0276, -87.4915

Warrick County - channelized



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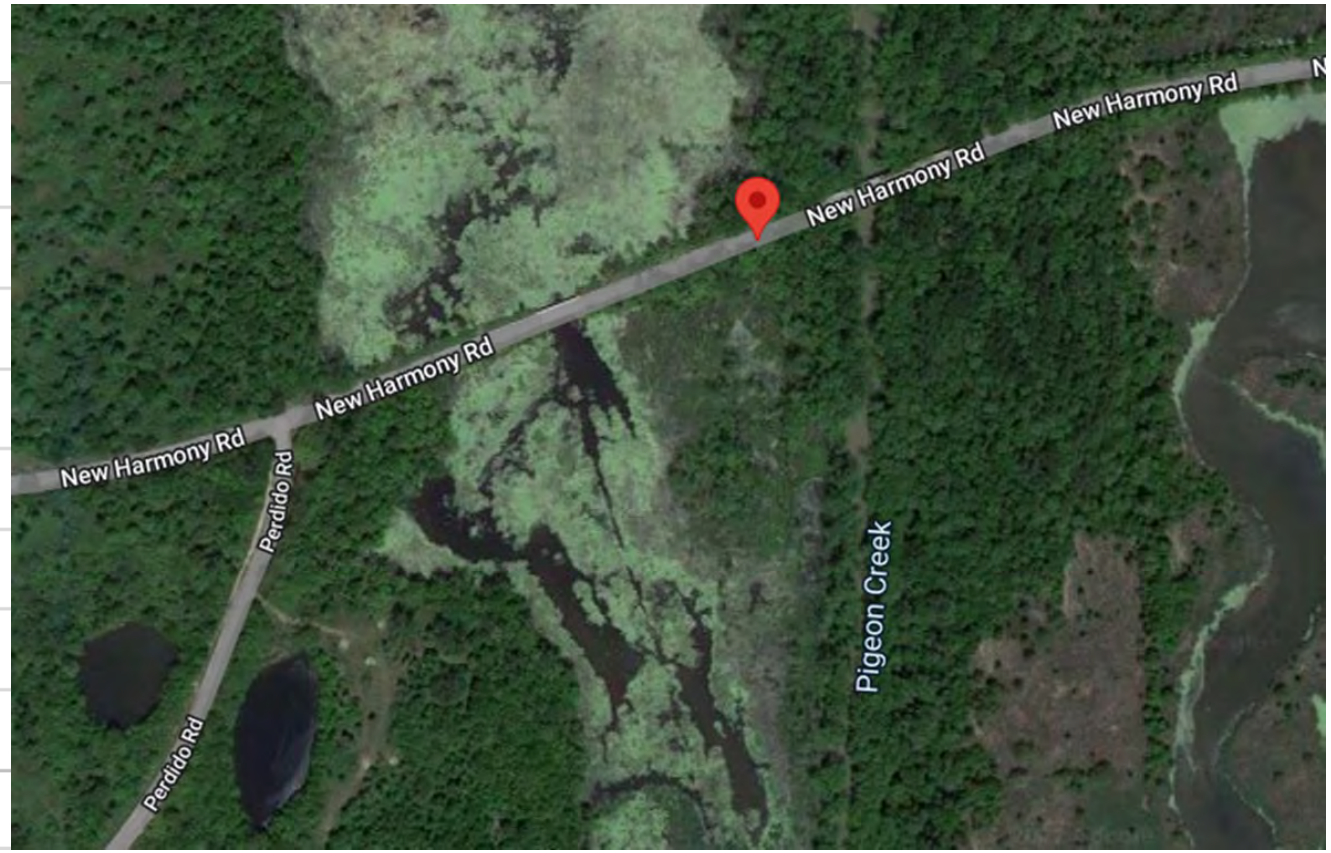
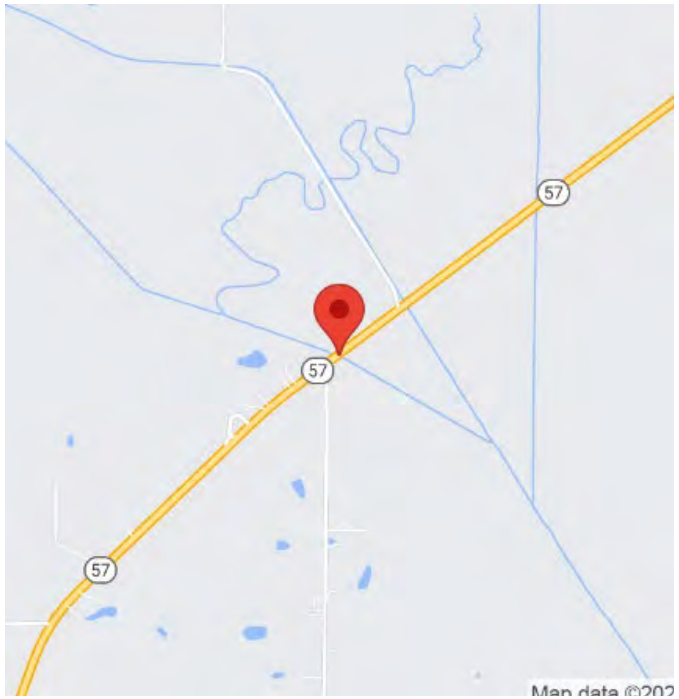


38.0962,-87.4000

Gibson County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PREVIOUS SOLUTIONS

Previous Solutions

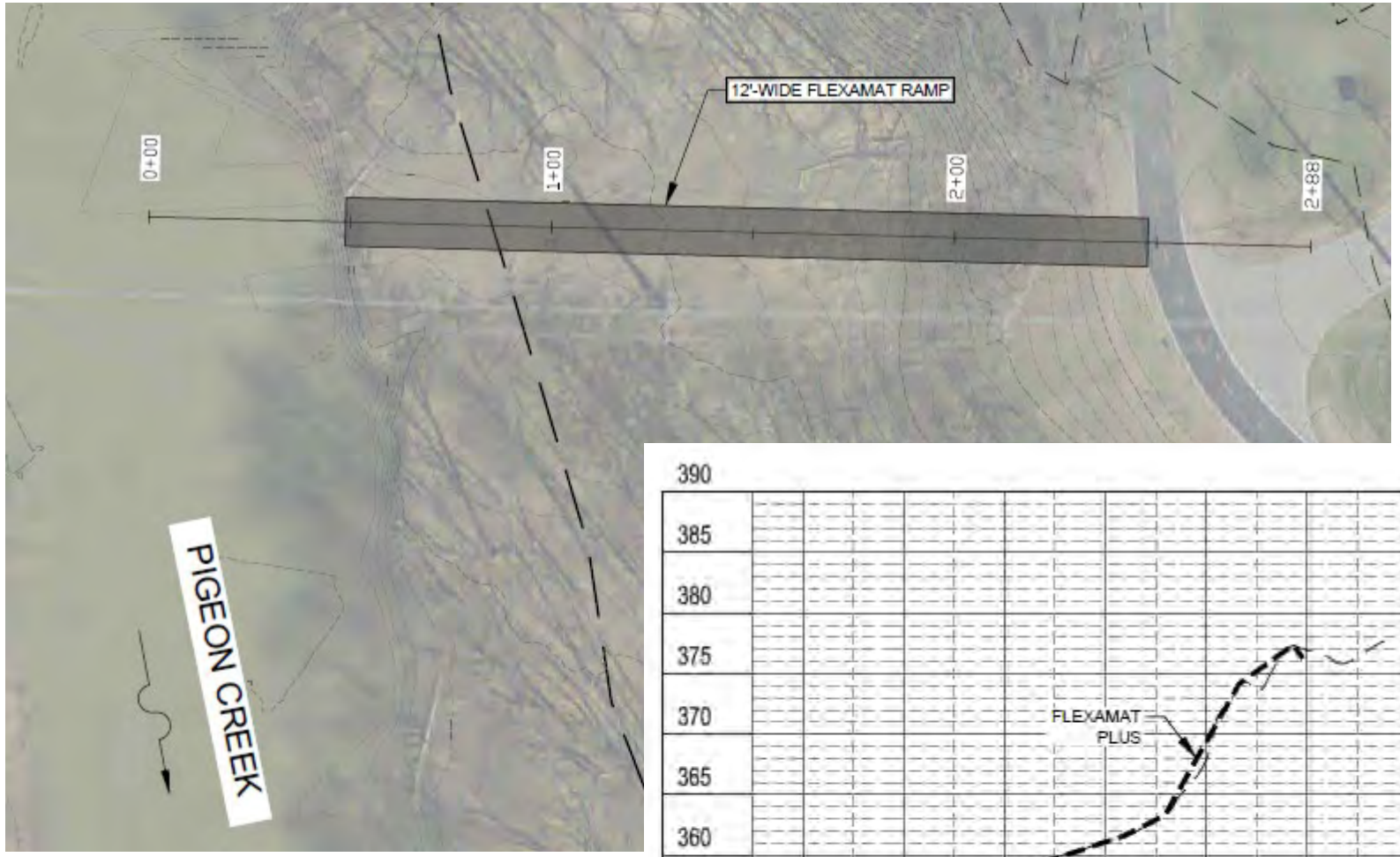
- Regulated Drain
  - 40,000 parcels in V'burgh
  - Joint Drainage Board
- Dredging of Pigeon Creek
  - Limited benefit for most of County
- Realignment of Pigeon Creek
  - Much deeper and more developed than Warrick
- Flood Flow Bypass Channel near I-69
  - Additional storage, but conveyance benefits expected to be minimal

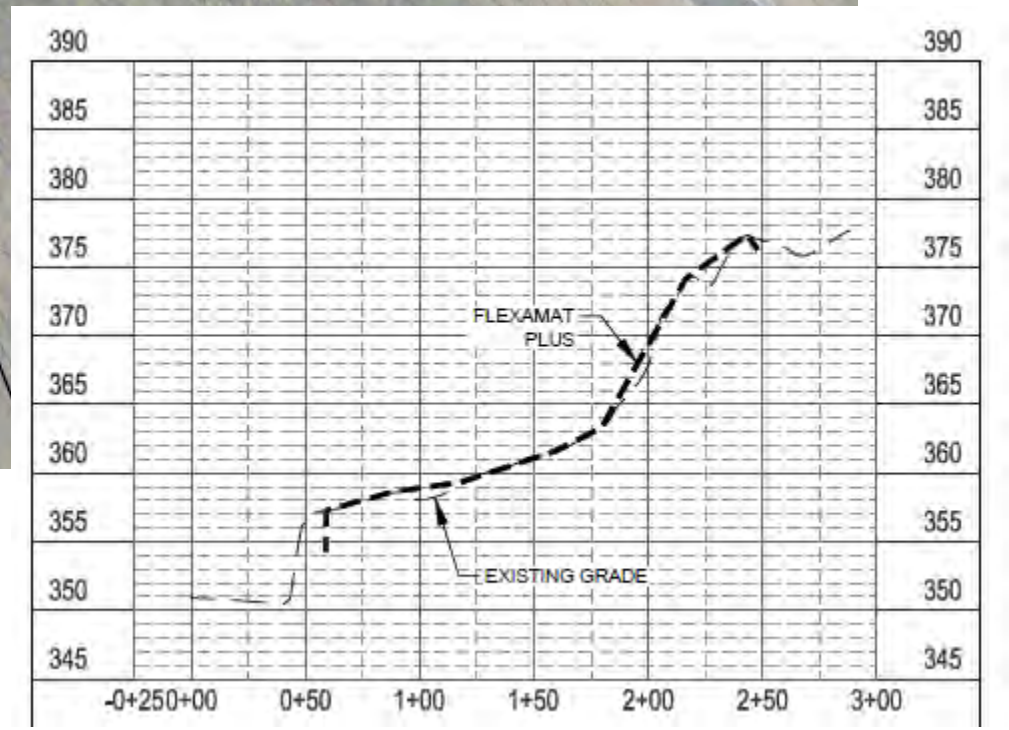
PROJECT AREA IDENTIFICATION

Location	Description
Lamasco Park	Adjacent to existing parking lot and greenway trail; amid City-owned land; gentle slope from greenway trail to creek

Location	Description
N Baker Ave	Existing access over levee; existing dirt/gravel path to creek; woody debris prevalent

PROPOSED SOLUTIONS





Recreational Access

1. *Take advantage of existing parking*
2. *Extend "Blue Trail" from 6 to 10 miles*
3. *Integrate pedestrian and canoe/kayak activities*

-> Minor surface grading

-> Install concrete block mat

-> Seed disturbed areas

Logjam Removal Access

1. *Take advantage of existing levee access*
2. *Clearing of existing wooded corridor minimal*

-> Minor surface grading

-> Install concrete block mat

-> Seed disturbed areas

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CONCLUSIONS

Summary of Assessment Findings

1. **The entire reach of Pigeon Creek in Vanderburgh County is generally stable:** The reach has a very healthy wooded corridor. Channel has been widened and leveed to provide protection and flood storage for Pigeon Creek and Ohio River backwater.
2. **Pigeon Creek has been heavily modified in Warrick and Gibson Counties:** Warrick County has straightened most of their reach of Pigeon Creek. The wooded riparian corridor have been removed in Gibson County.
3. **Precipitation and flow rates continue to increase:** Higher peak flow rates and more frequent bankfull discharges have resulted in more frequent saturation of the soils, which can lead to instability in silty deposits.
4. **Coordination with Warrick and Gibson counties is needed to address systemic stressors on the stream:** The highly developed nature of the stream corridor through Vanderburgh make stream modifications and increased storage opportunities much more challenging. Storing water upstream can alleviate flooding in and near Evansville.

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RECOMMENDATIONS

Coordinate Efforts with Upstream Counties

Multiple approaches can be taken, depending on management goals:

- Joint Drainage Board with Warrick County
  - Address woody debris and flooding near County Line
  - Ind. Code § 36-9-27-14
- Watershed Development Commission with Warrick and Gibson
  - Address straightening and loss of floodplain storage in upper watershed, leading to faster, more severe flooding in Vanderburgh
  - HEA 1639 signed by Governor last week!
  - Ind. Code § 14-30.5-1-2

Adopt Flood-Conscious Development Plans

Resiliency maps identify developed areas that are currently at risk, undeveloped areas that would be at risk, and undeveloped areas with lesser risks where future development may be promoted

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Promote Soil Health Practices

Increase soil moisture holding capacity and decrease sediment contributions from agricultural lands by:

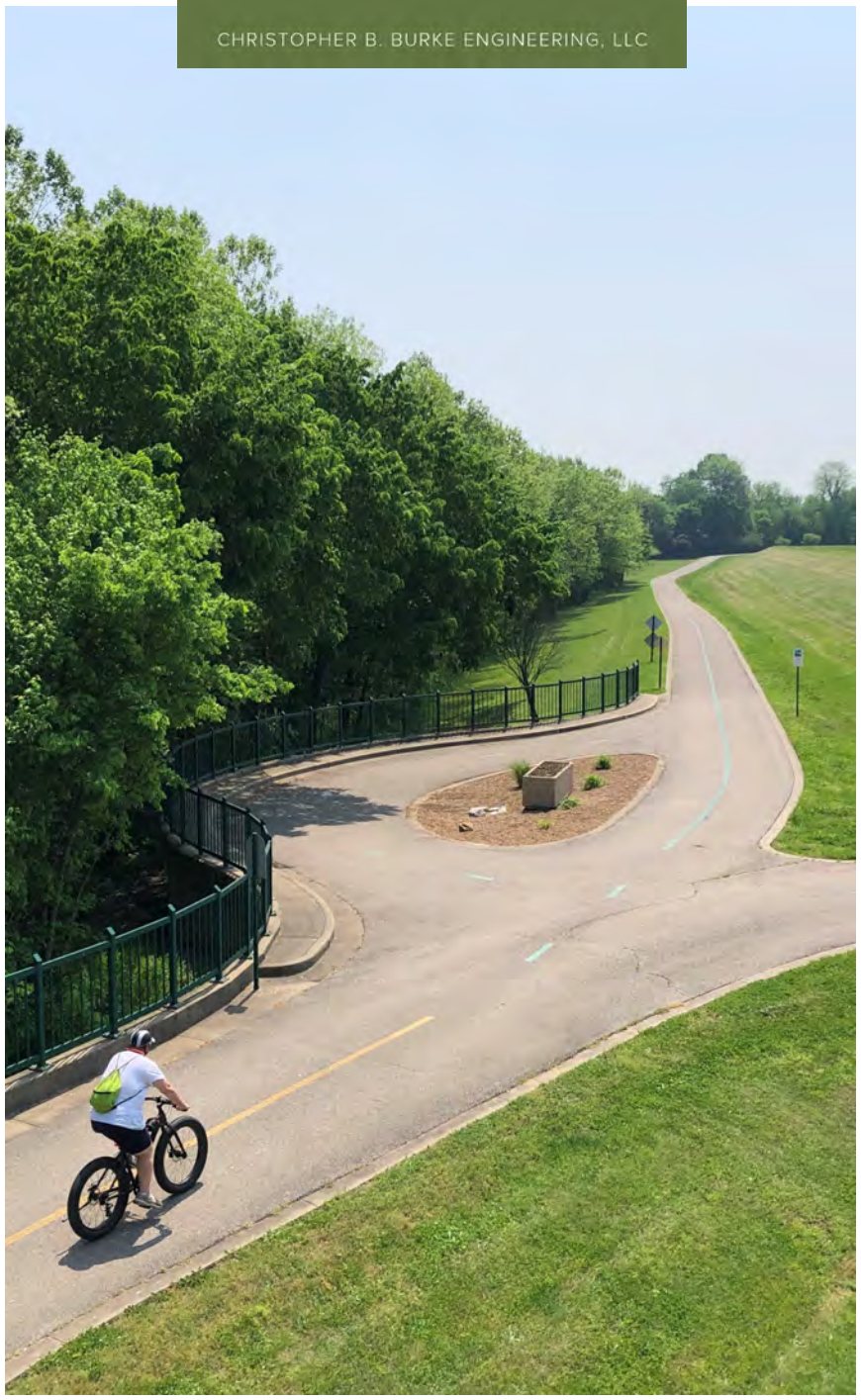
- Soil health improvement practices (such as cover crops)
- Filter strips along drainage ditch tributaries and Pigeon Creek itself

With Cover Crop

Without Cover Crop

Next Steps

1. Discuss findings with Burke, as needed
2. Determine which proposed solution(s) are to be implemented and seek funding
3. Coordinate with partner counties in the watershed to address systemic issues along the stream



Questions?

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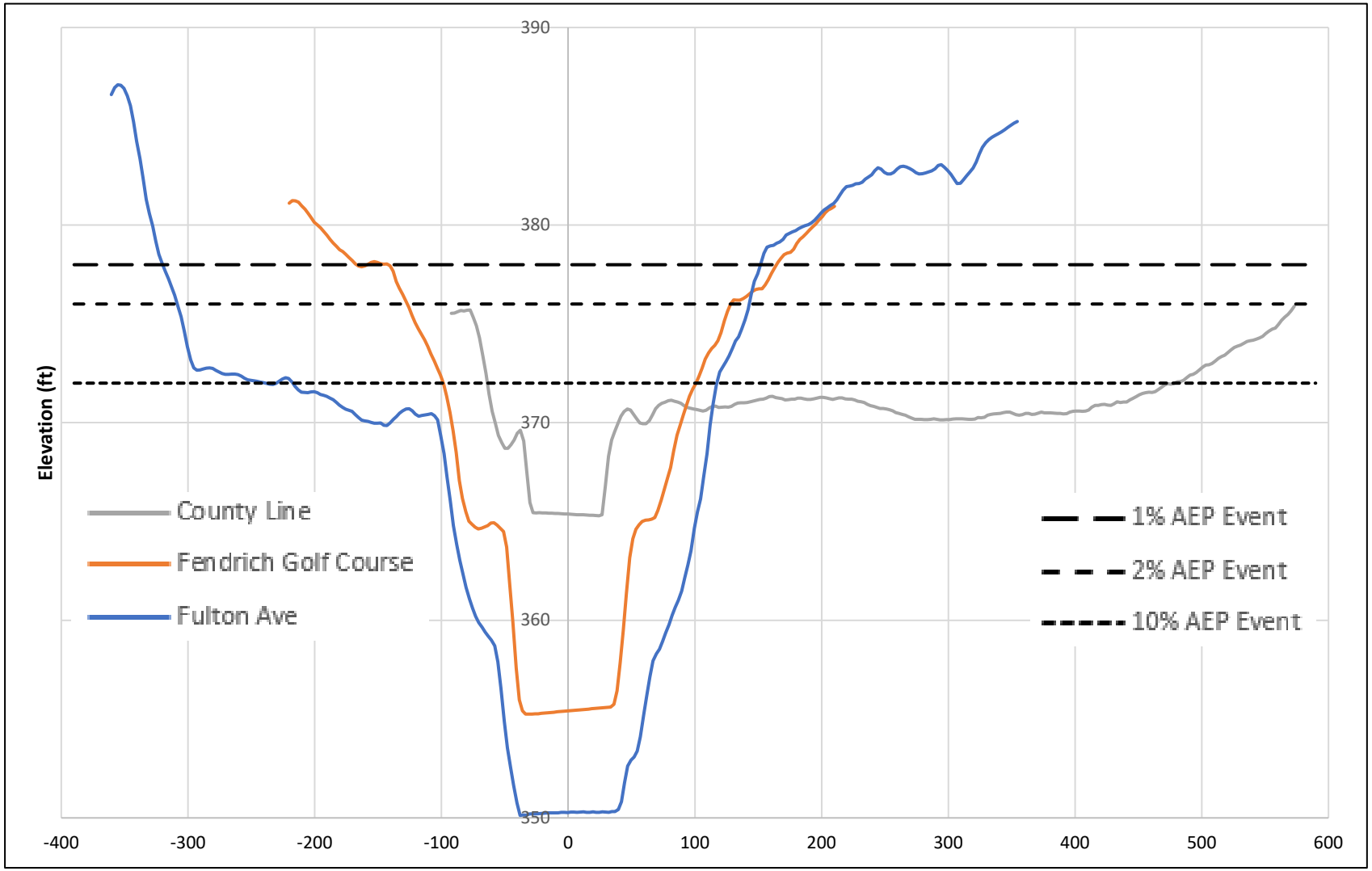
Additional Material

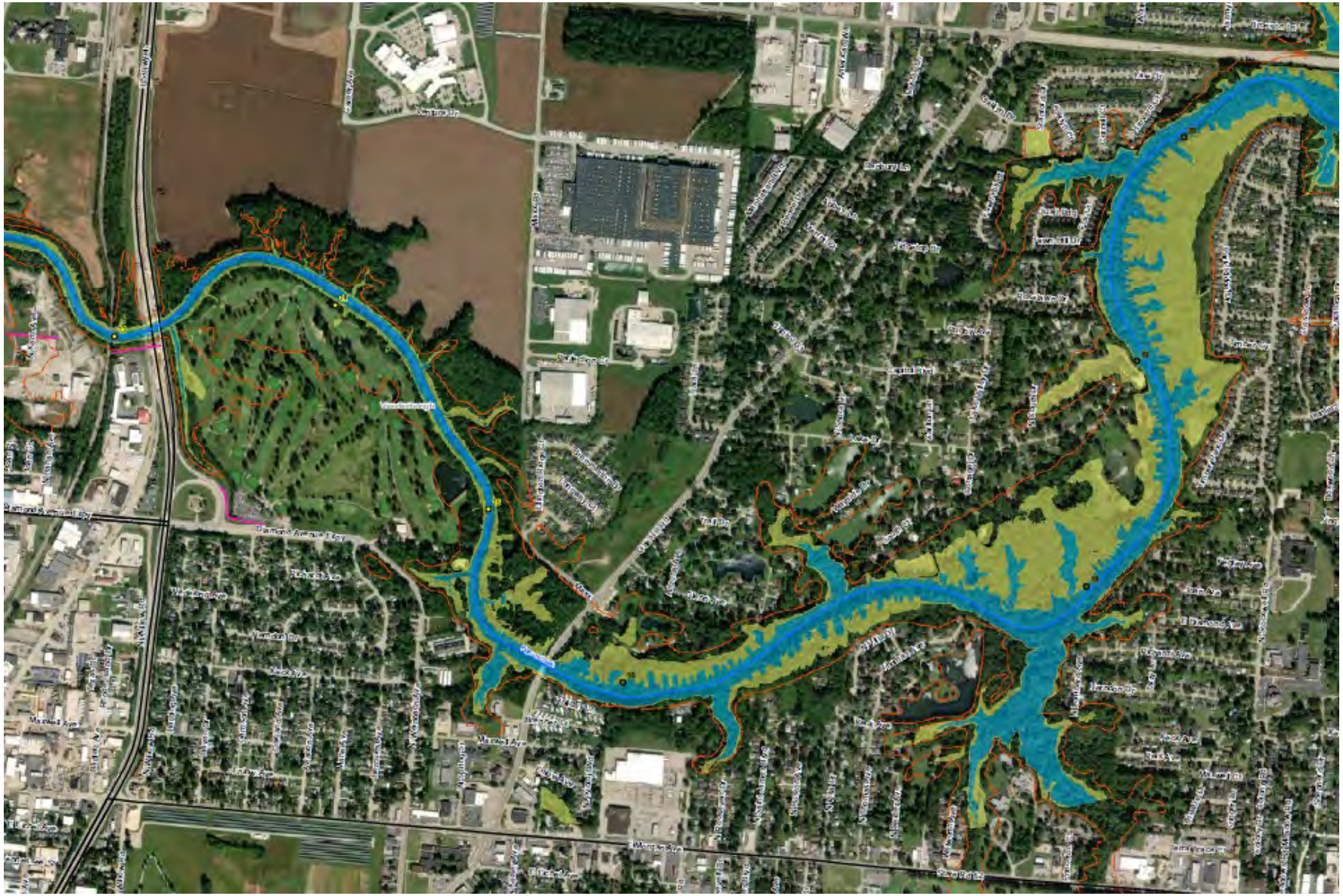
Ohio River Backwater



Notes

1. *Backwater influence extends throughout County*
2. *Flooding is largely contained within wooded corridor d/s of Green River Rd*

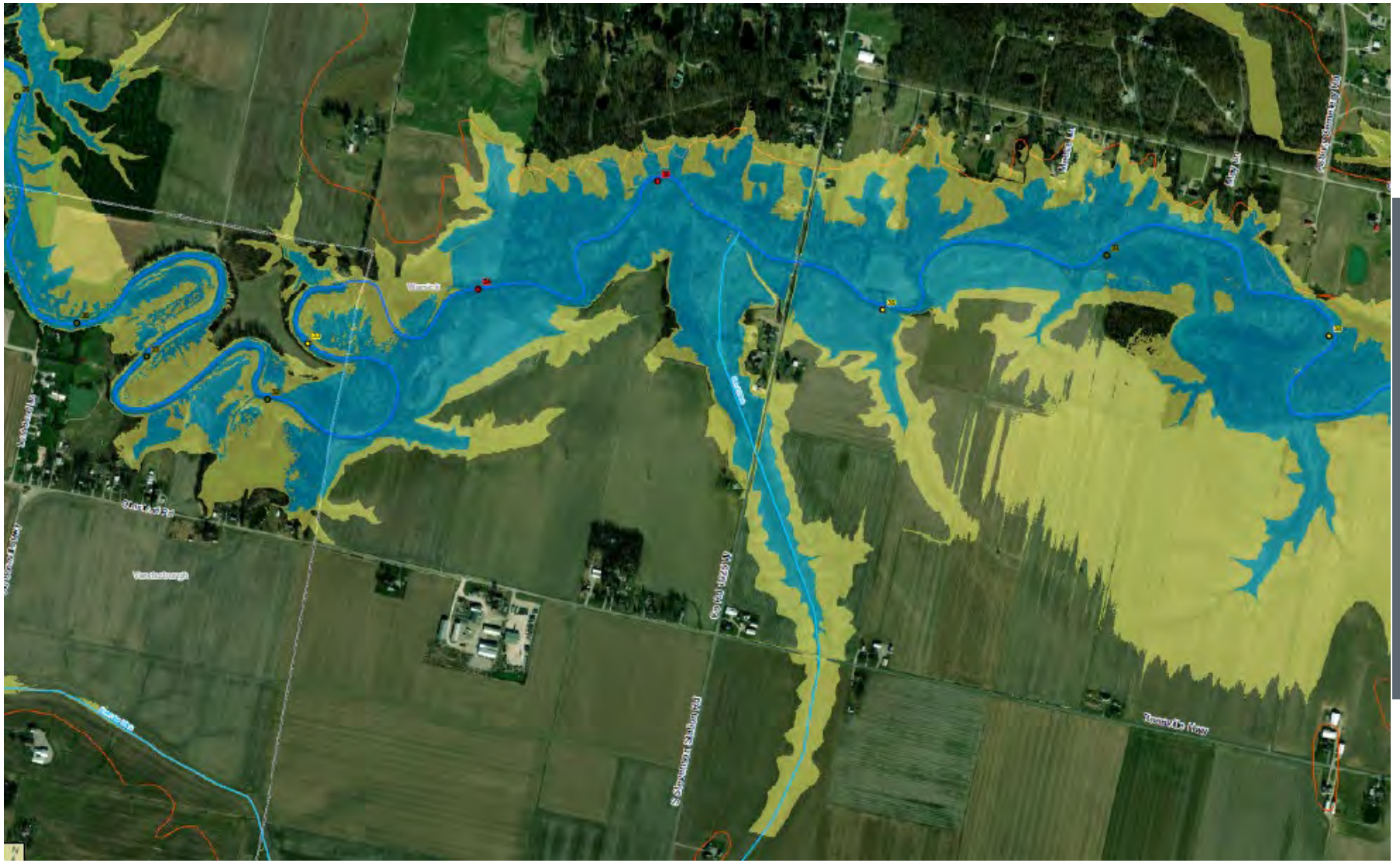
Floodplain Connectivity



Notes

1. *Stream more confined in leveed portion and up to Oak Hill Rd*
2. *Much more storage / stress relief upstream of Oak Hill Rd*

Floodplain Connectivity



Notes

1. *Much more connectivity (flooding) near County Line and into Warrick*
2. *This is expected in highly sinuous stream cutting through historic lakebed material*

Floodplain Connectivity

Notes

1. *Pigeon Creek dramatically straightened through mid-upper Warrick*
2. *Connectivity in Warrick generally good past New Harmony Rd; connectivity greatly reduced N of I-64*

Floodplain Connectivity

Notes

1. *Floodplain connectivity nearly absent at lower stages in Gibson County*

Wetlands / Floodplain Storage

County	Existing Wetlands (ac)	Historic Wetlands (ac)	Hydric Soils (ac)	Percent Lost*
Vanderburgh	1,500	410	15,600	21% [91%]
Warrick	5,560	1,960	18,600	26% [77%]
Pike	10	10	0	50% [0%]
Gibson	3,200	290	34,400	8% [91%]

* First value represents loss relative to historic wetlands, second value in brackets represents hydric soils not currently classified as wetland.

Notes

1. *Majority of existing and recently-lost wetlands occur in Warrick*
2. *Majority of hydric soils in watershed occur in Gibson*