

A LITTLE ROOM FOR THE RIVER PLEASE !!!

The case of Prairie Creek in Lebanon, Boone County, Indiana

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The Need for Assessment

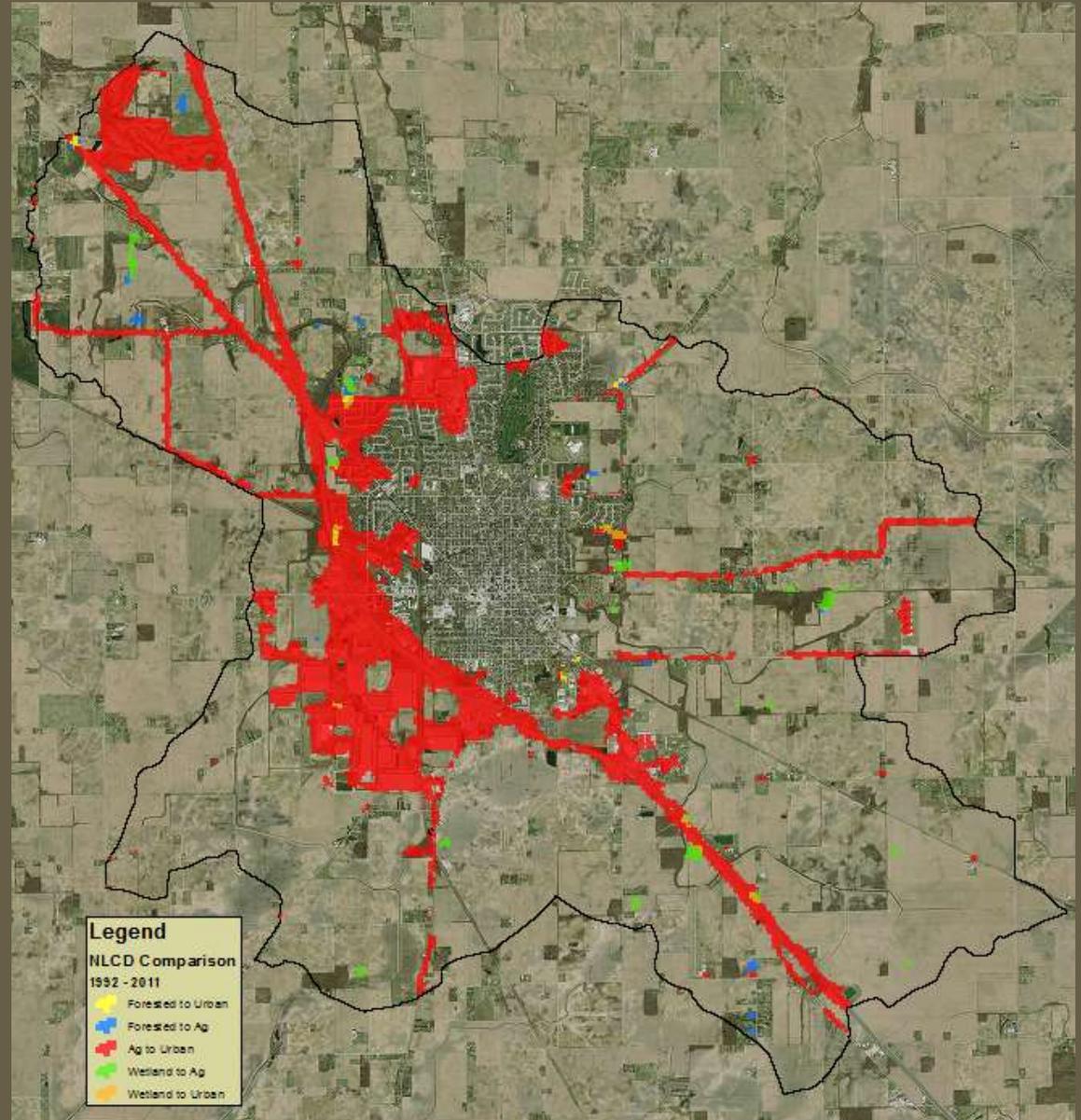
- Increased flooding and streambank erosion
- Homes, garages, and sheds are too close to the stream and at risk of severe damage, both from flooding and streambank erosion
- Multiple streambank stabilization measures along the river, most experiencing failure
- Wondering whether incremental fixes along the stream are exacerbating problems elsewhere
- Lack of adequate funding to address the multitude of existing and likely future streambank failures
- Perceived problems with existing trees along the banks

The Scope

- Data Gathering
- Analysis of Existing Data
- Desktop and Field Stream Assessment
- Recommended Strategies
- Report and Presentation

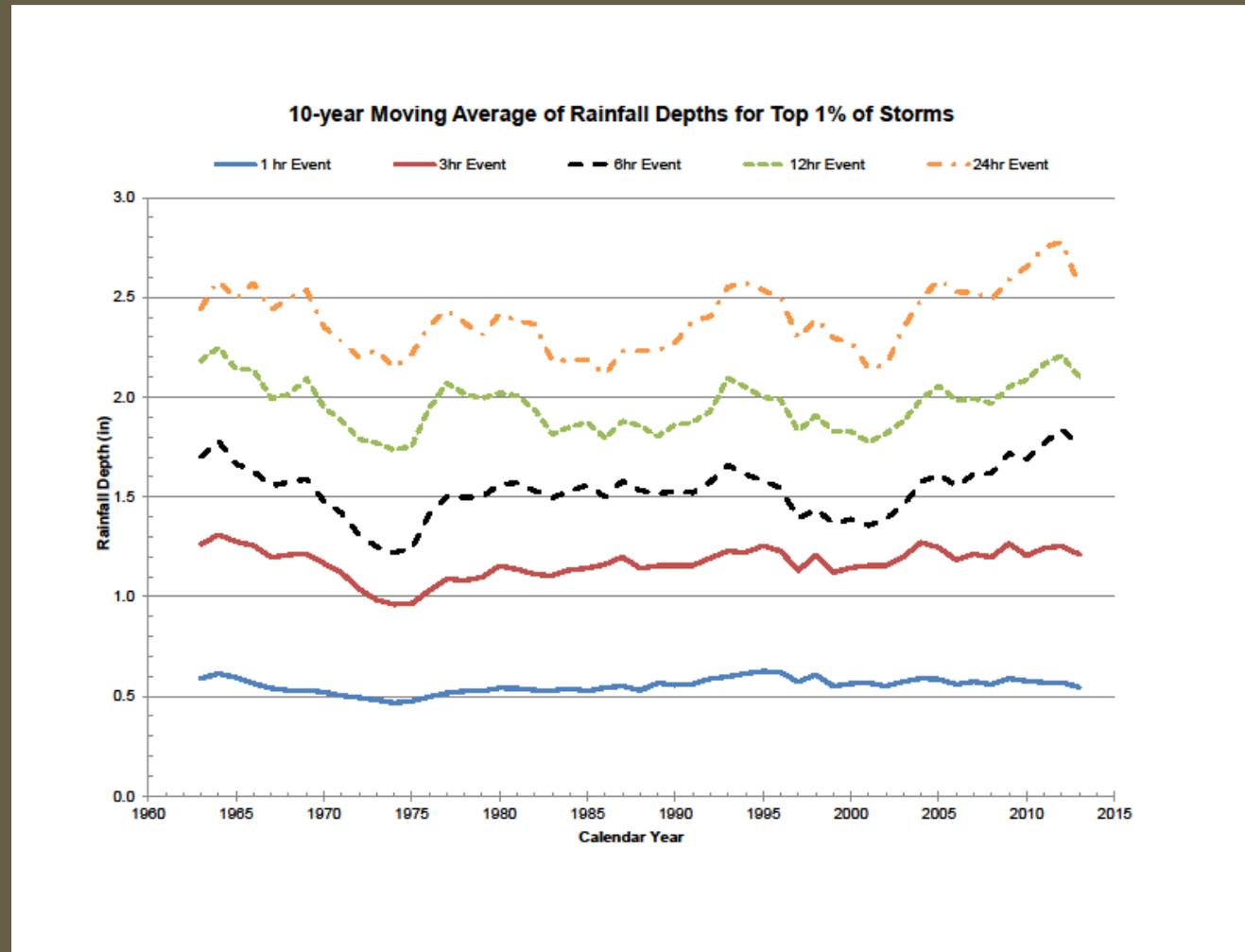
Changes in Land Use

- Percentage of urban areas in the watershed doubled from 1992 to 2011
- Most of the growth in Sanitary Ditch watershed
- Prairie Creek watershed also seeing significant urbanization near Lebanon
- More urban area = more impervious area = more and faster runoff = more erosion



Changes in Very Heavy Precipitation

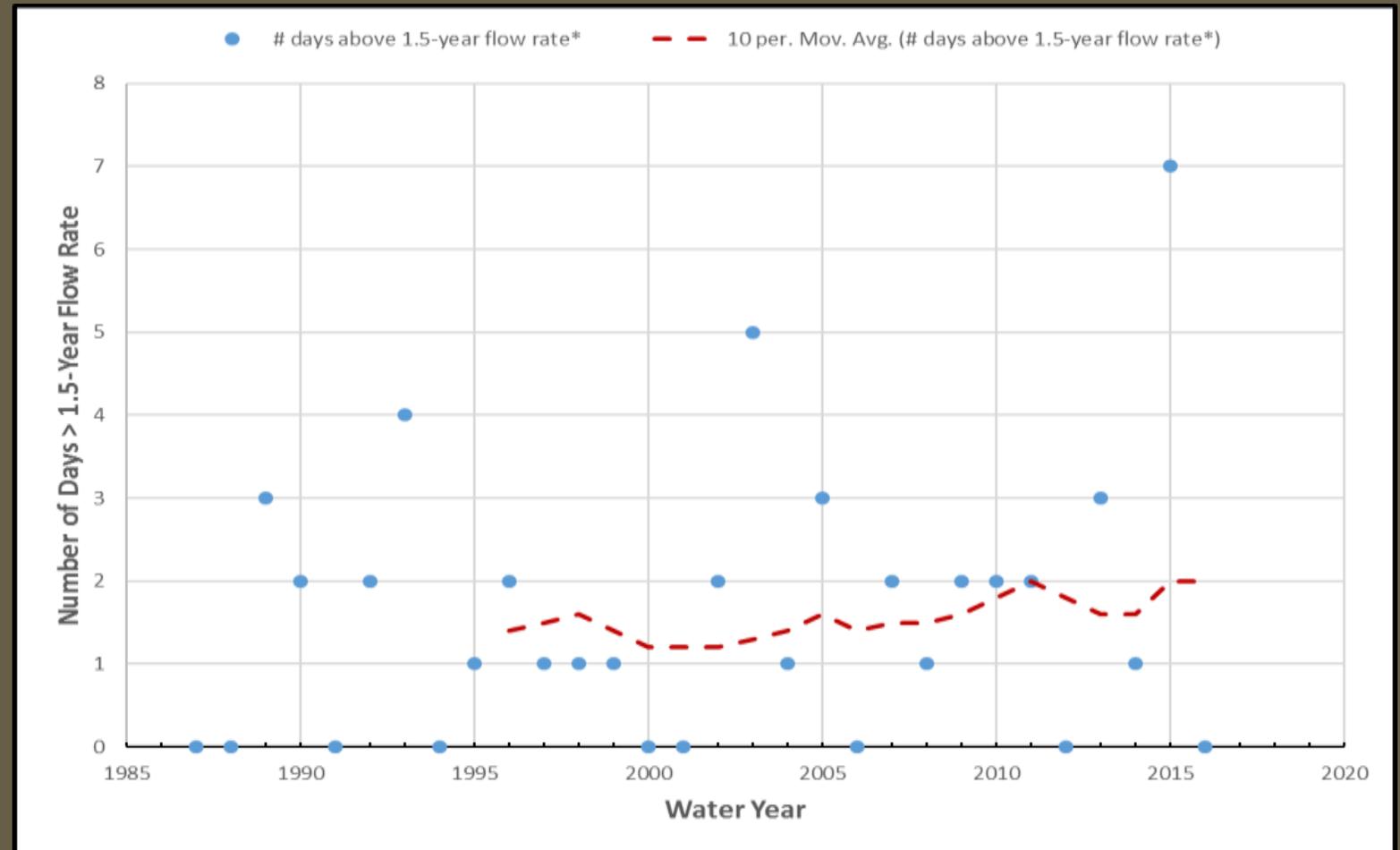
- Significant increase in heavy precipitation, especially for the 24-hour duration, since 1970s
- More intense and larger heavy rainfall = more and faster runoff = more erosion



Rainfall Depth Exceeded by Top 1% of Events by Duration (10-year Moving Average) at Indianapolis International Airport

Changes in Channel Forming Events

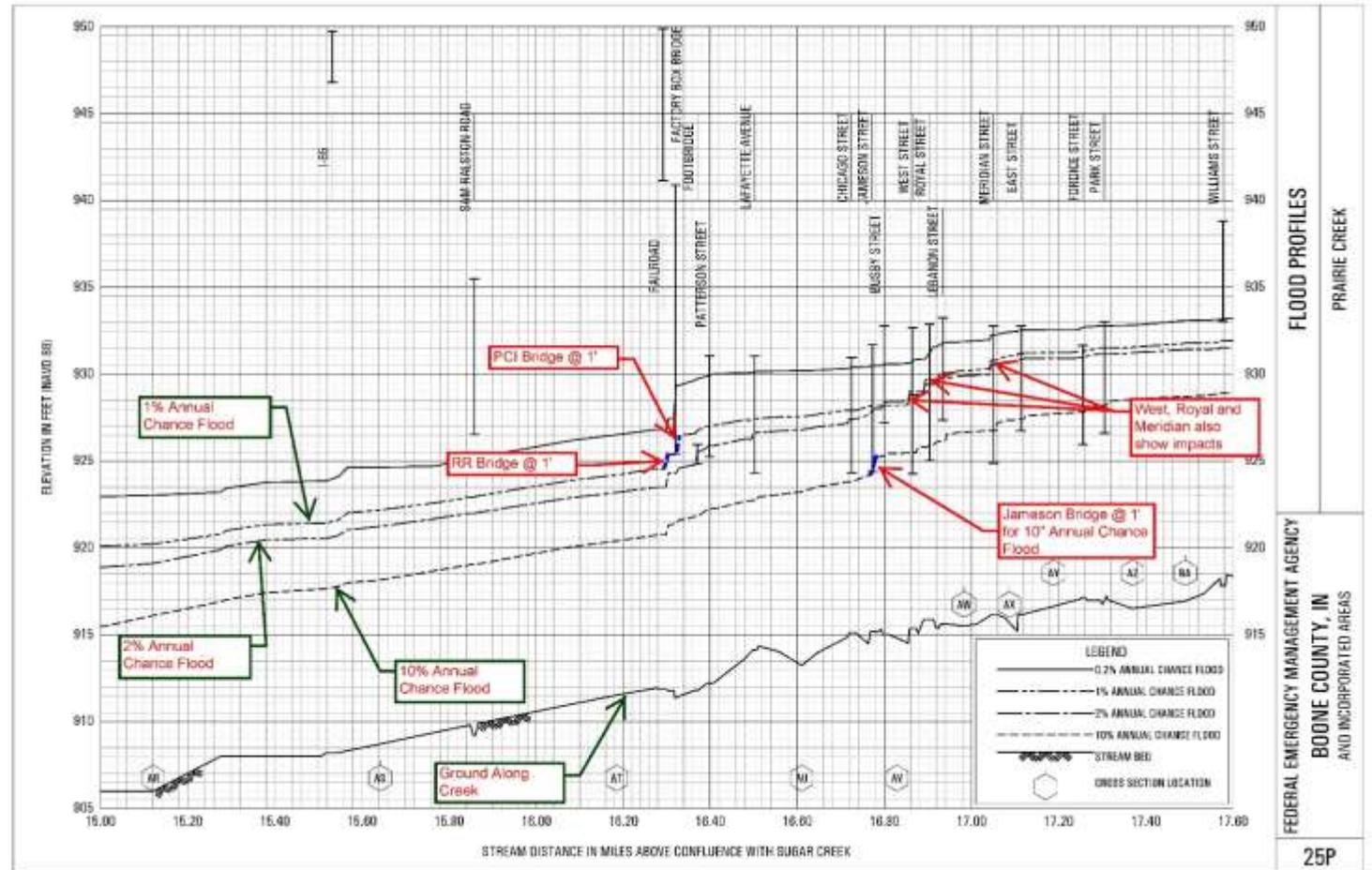
- Channel forming event (bankfull flow) is typically represented by 1.5-year discharge
- Gradual increase in average number of days at or above 1.5-year discharge at the gage
- Increase in number of bankfull flows = more erosion



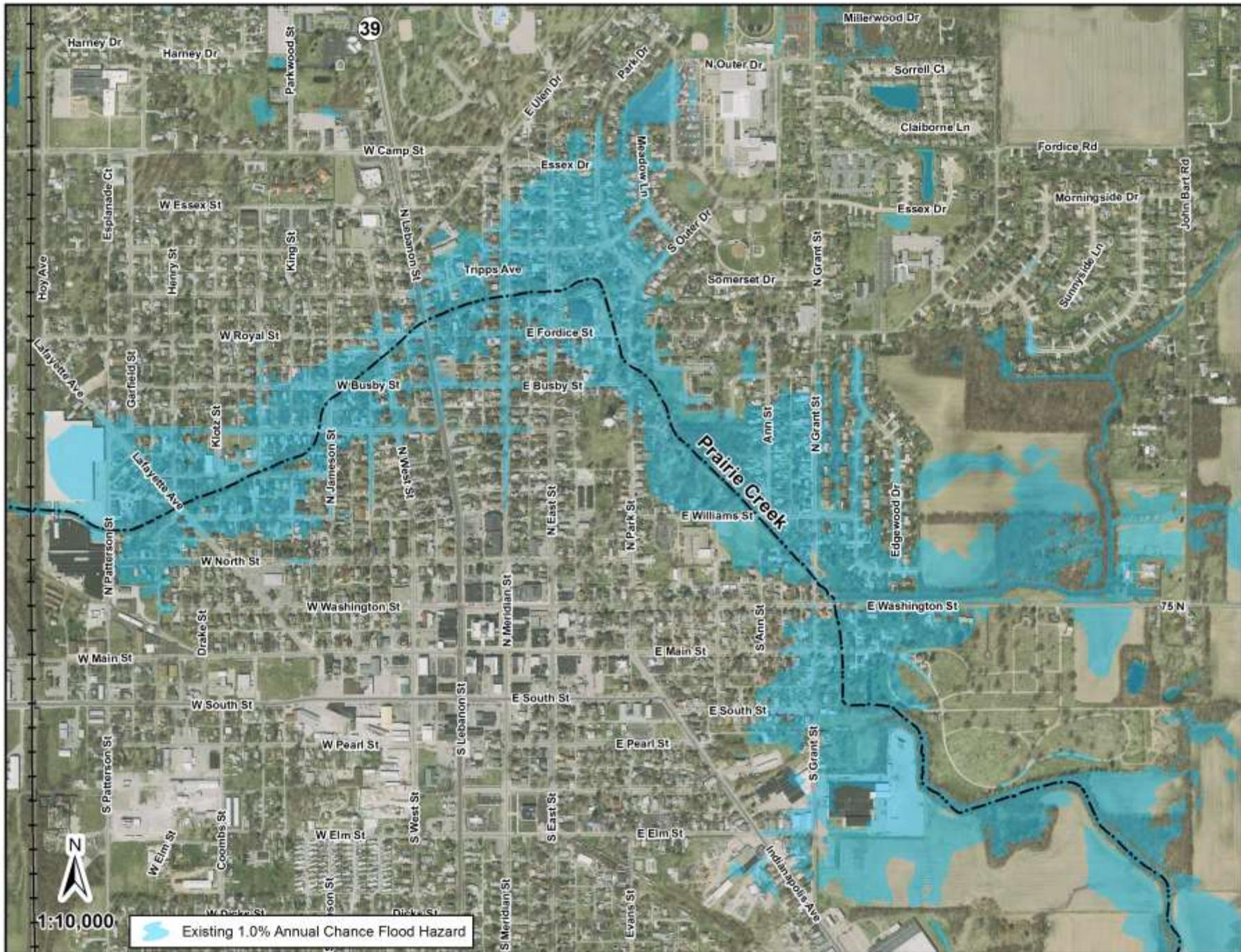
Frequency of 1.5-Year Discharge at USGS Gage near Lebanon, IN

Flow Restrictions

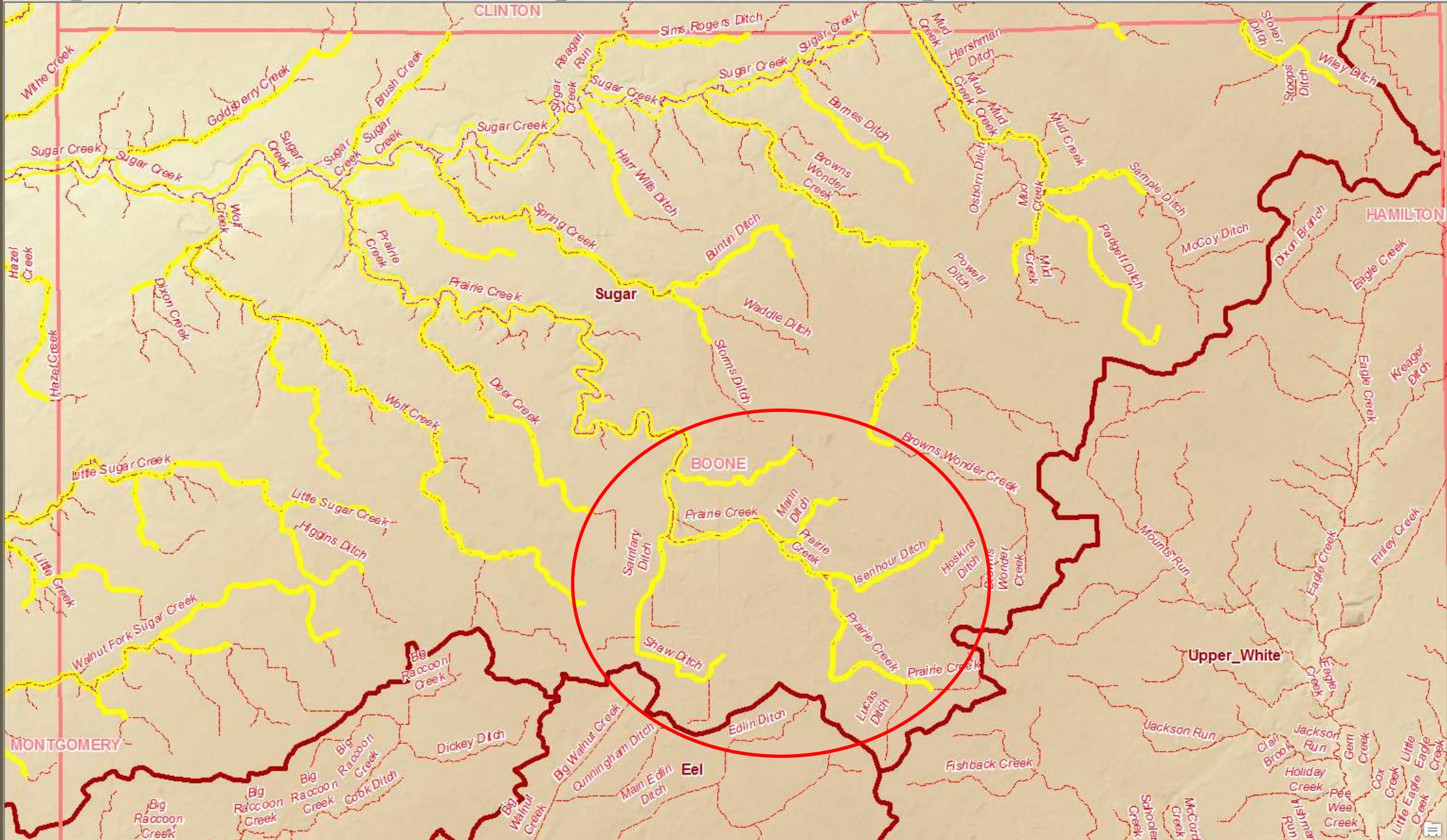
- 15 Bridges within a 1.5-mile reach
- Most all bridges appear inadequate to convey flood flows without a surcharge
- More flow restrictions = more disturbance = more erosion and higher flood levels



Flood Profiles through Lebanon, IN



Stream System Assessment

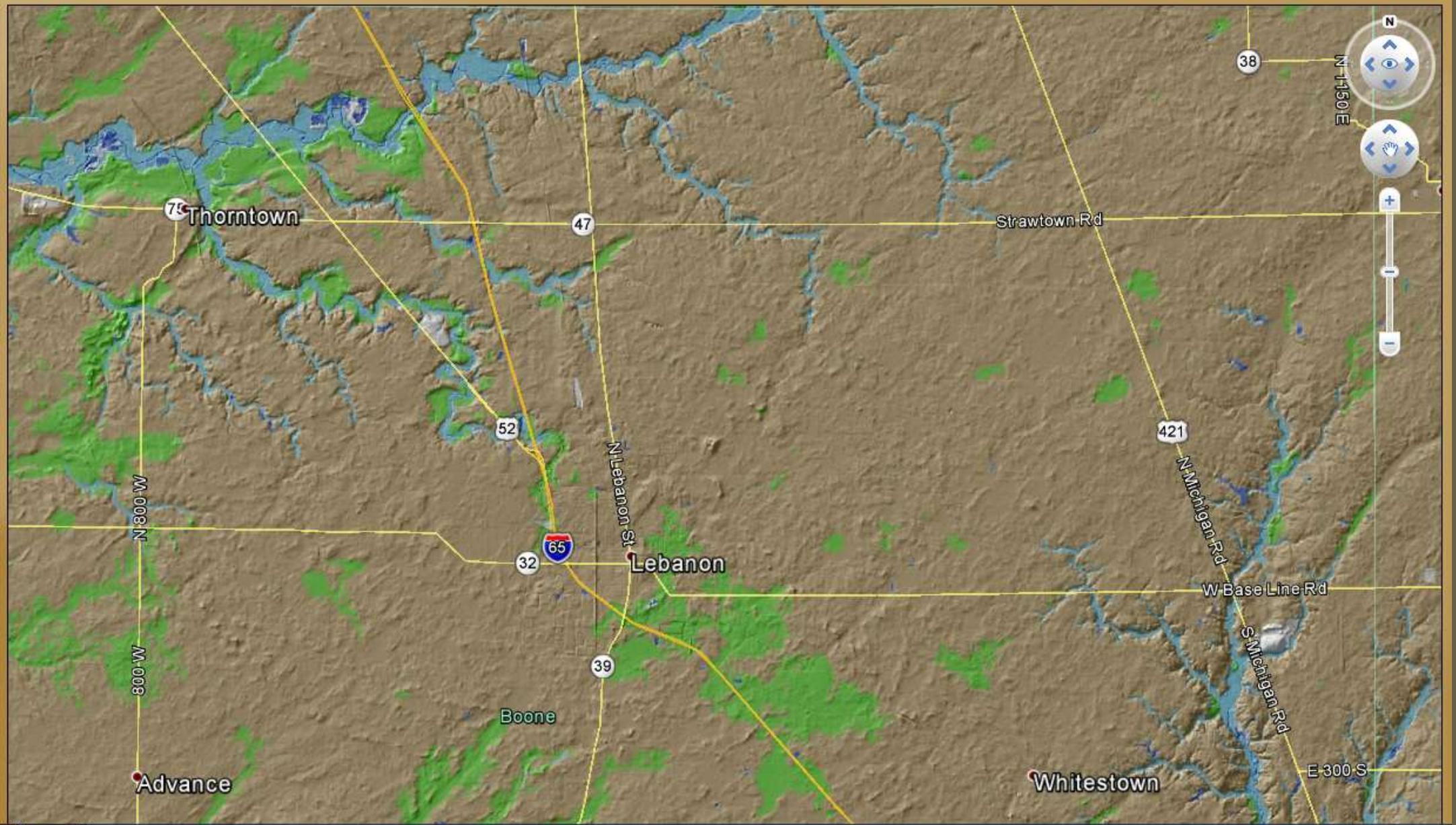


Prairie Creek headwaters, Boone County, Ind.

Polis, 2015



King's 1852 Map of Indiana, Purdue/NRCS ISEE <http://isee.purdue.edu/>

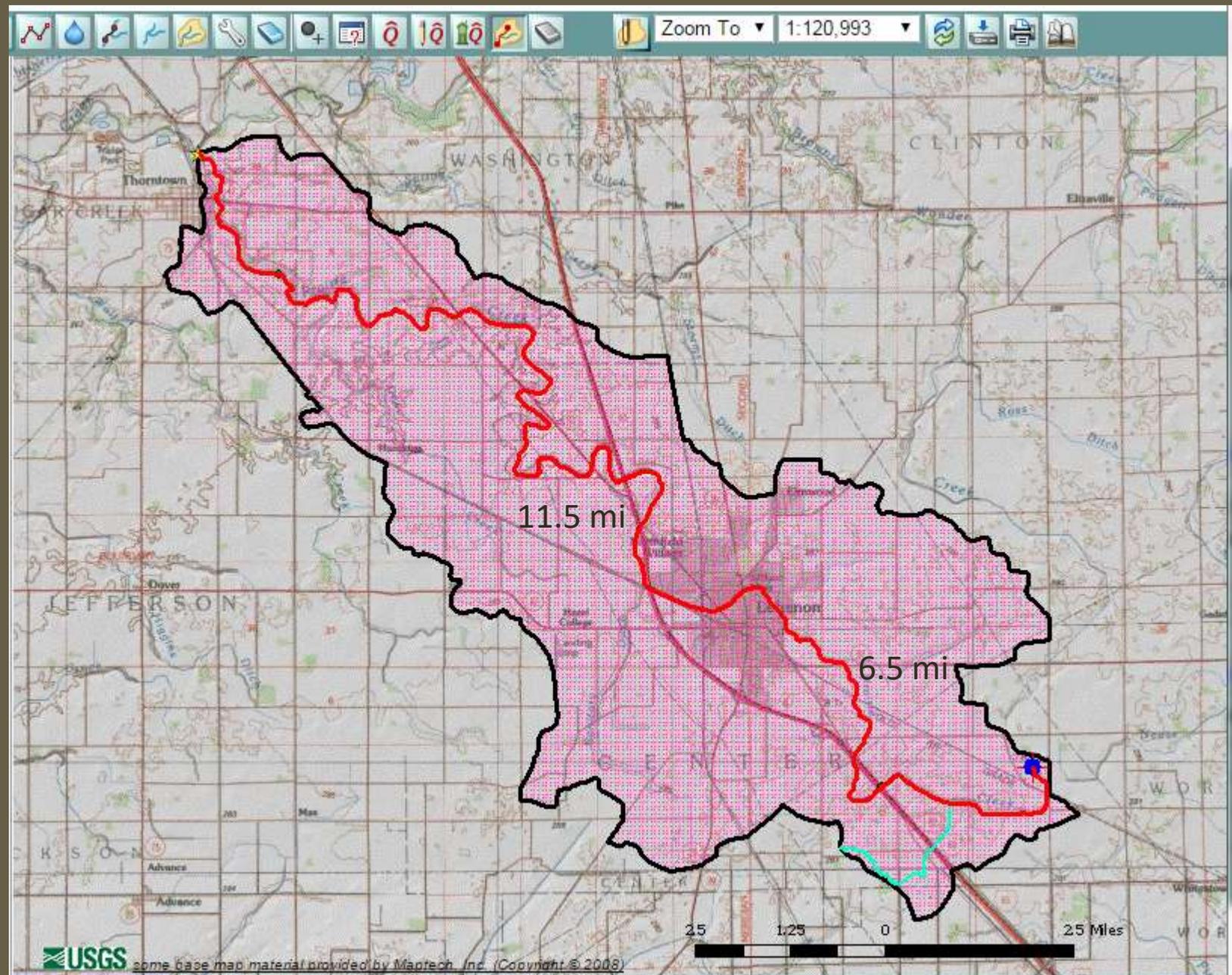


Dominant Soil Parent Materials, Prairie Creek Watershed, Boone County, Ind. Purdue/NRCS ISEE, <http://isee.purdue.edu>

DA = 49.3 mi²

s = .001 ft/ft

rm = 24.0



Prairie Creek at Sugar Creek, near Thorntown, Ind.

USGS StreamStats

Here the natural drainage is very poorly developed ... the innumerable lines shown on the map are mostly artificial waterways. The larger ones are dredge ditches 10-15 feet deep straightening the former illdefined [sp] and obstructed course of natural channels while the smaller ones are outlets for depressions that had little or no connection with each other or with the creeks.

Soil Survey of Boone County, 1912, W.E. Tharp and E.J. Quinn

Select on a tool on the toolbar. If the icon remains depressed, click on the map to perform the desired action.

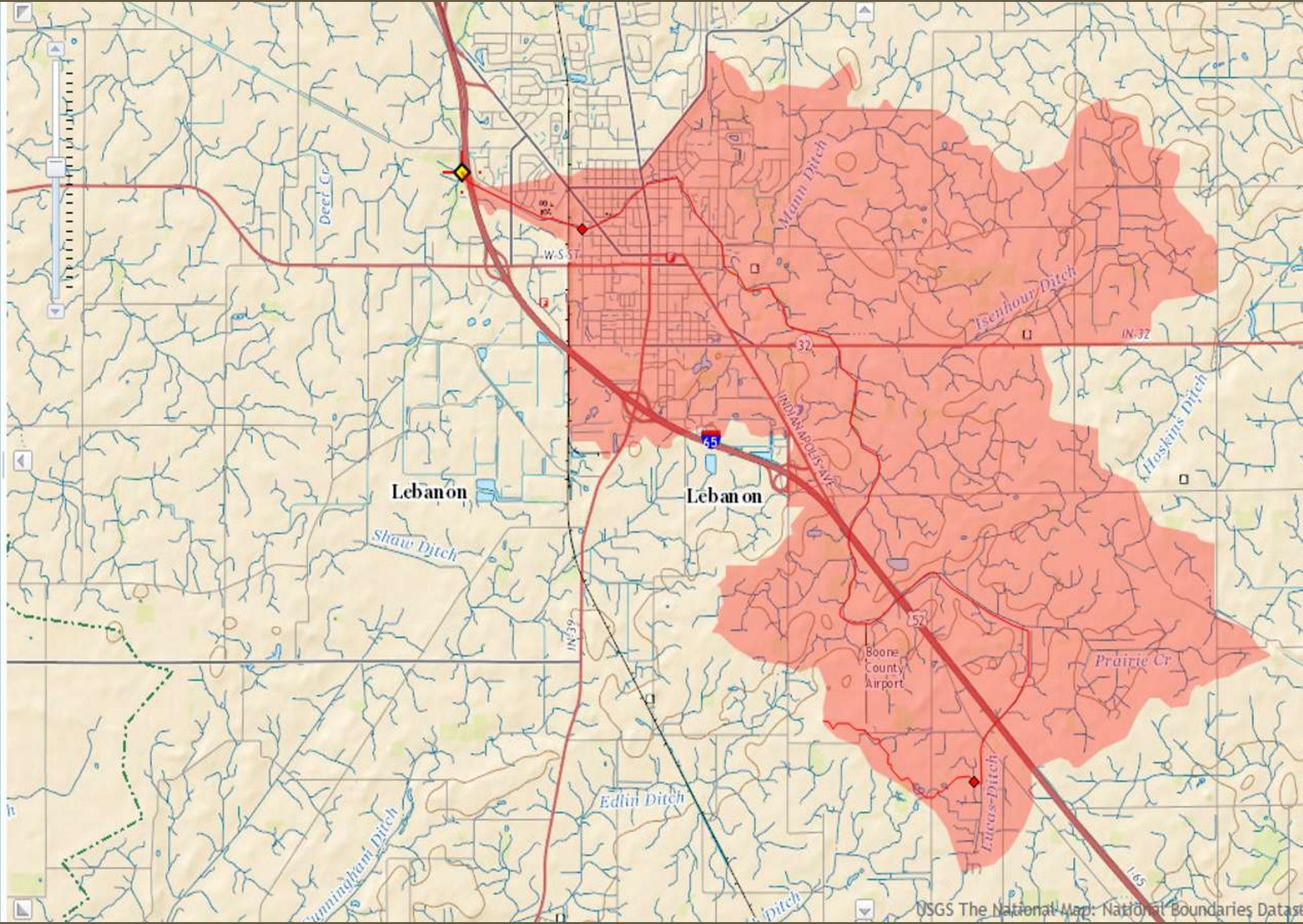
IN Map Layers

- Streamgages
- Coordinated Stream Reaches
- Area of limited functionality
- Indiana
- Stream Grid
- Study Area Bndys

- Base Layers
 - Imagery
 - Street Map
 - World Topo
 - USA Topo
 - Canadian Topo
 - TNM Topo

0 0.5 1mi
Scale: 1 : 72,224

Latitude: 39.99139
Longitude: -86.35038 SS

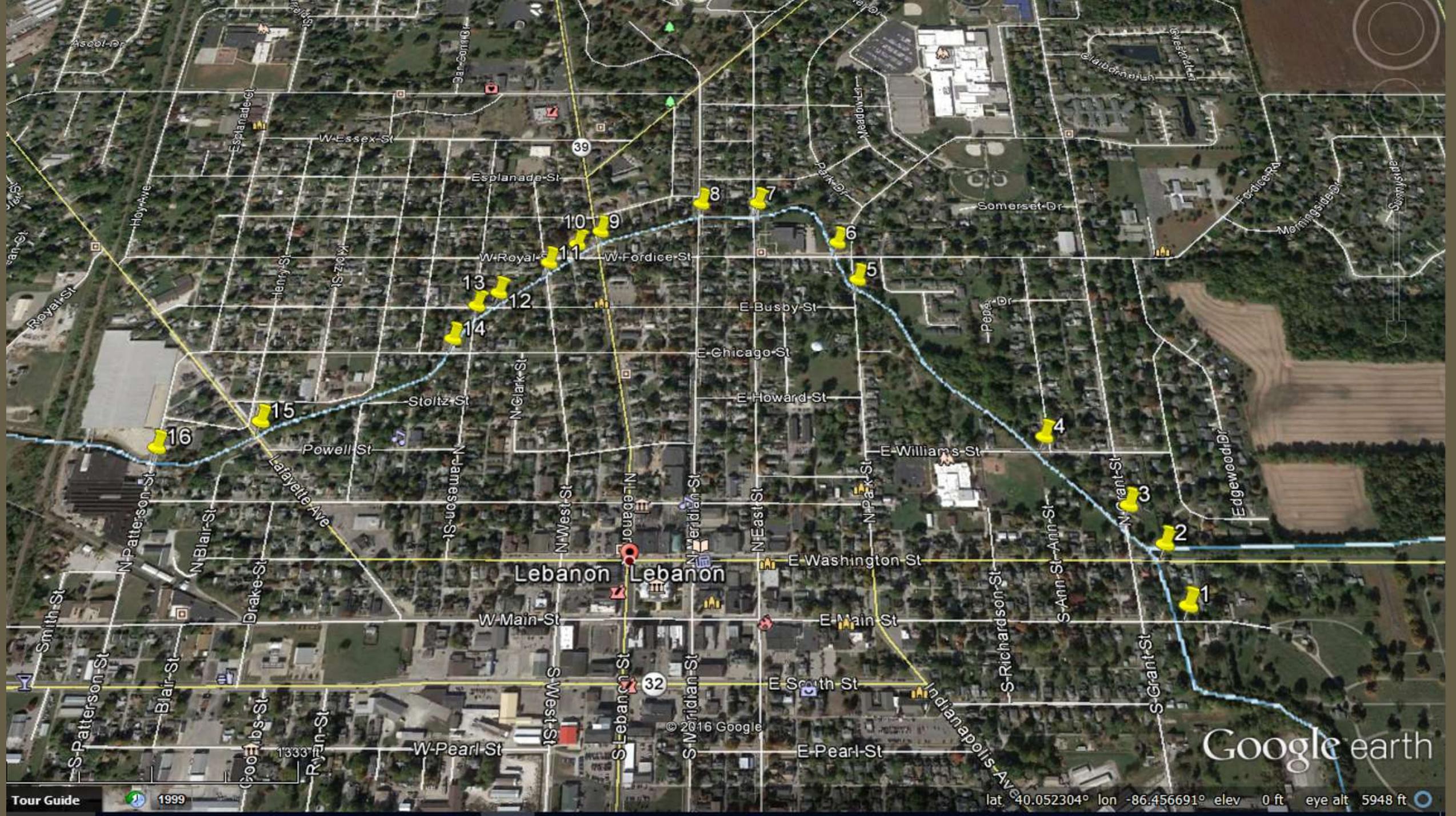




Prairie Creek at CR 100 S, channel dimensions 65 ft, 12ft, 9ft ($A = 347 \text{ ft}^2$), note developing floodplain
(Predicted W 39.2, D2.3, $A = 90$)



Prairie Creek looking downstream near Grant and E. Main, Lebanon
Channel dimensions are 32 ft x12 ft x 9 ft ($A=198 \text{ ft}^2$), predicted floodprone depth approx. 5 ft



Lebanon Lebanon

Google earth



Looking upstream from the N. Grant Street Bridge. The confluence with Mann Ditch (flowing in on the left, yellow arrow) can be seen in the upper center of the image.



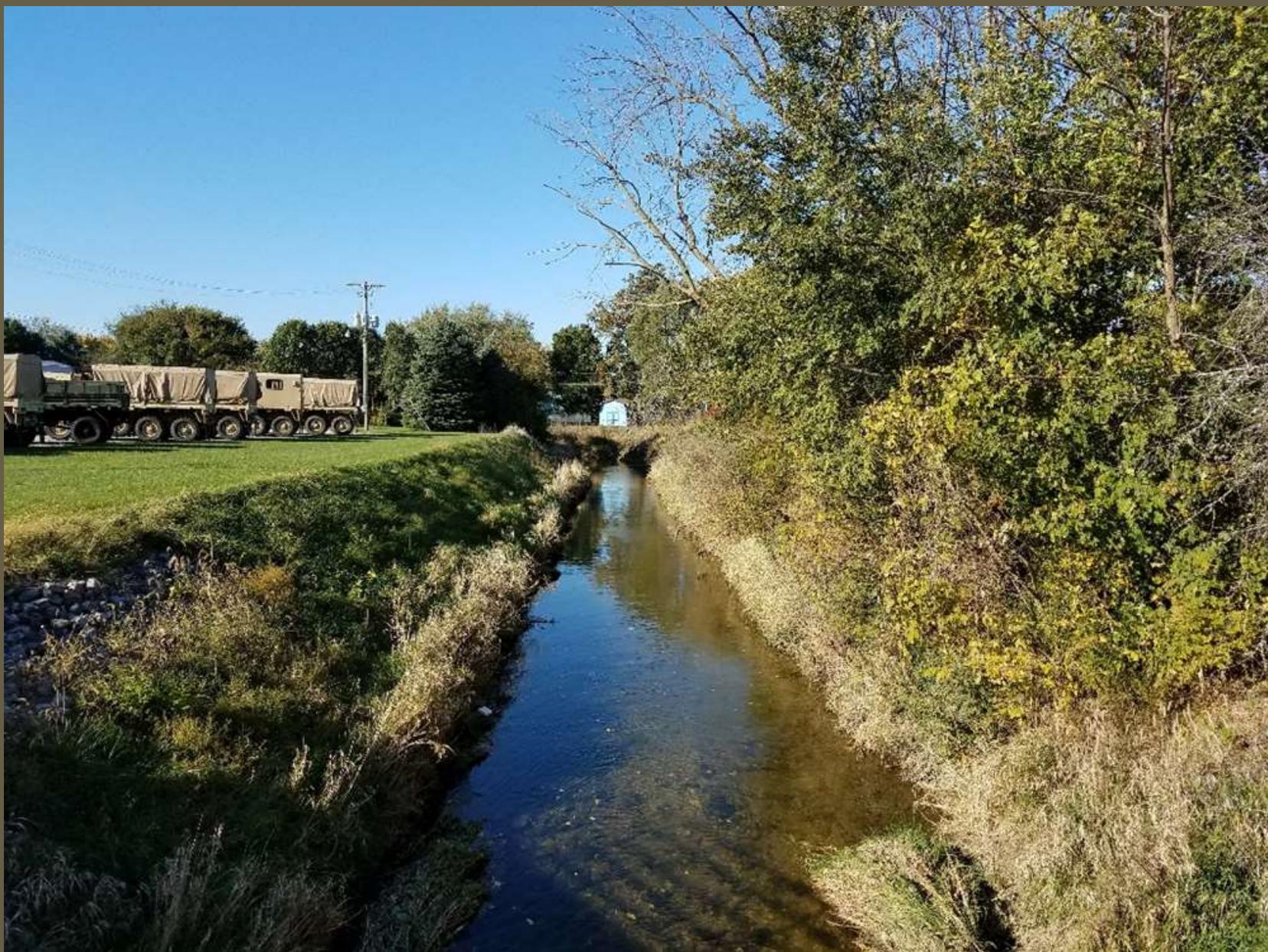
Looking downstream from the Grant Street Bridge. Note stable floodplain bench developing on the inside of the bend.



Downstream from N Park Street. The right bank in this image is higher than the left bank. A till contact is indicated by the yellow line. The soil above is a silty loam, and easily eroded.



View of the Park Street Bridge taken from north side of bridge. Rock on left bank extends to top of bank. Note debris in the pipes



Downstream from E. Fordice Street. The entire Fordice to East Street reach has been armored with gabions. The left bank in the foreground shows the development of a small bench. Vegetation on the left bank is minimal. The right bank is steeper and more protected by the extensive woody vegetation.



Left bank looking upstream from the Meridian Street Bridge. The scour line is visible along the left bank. Note the gabion baskets at the upstream end.



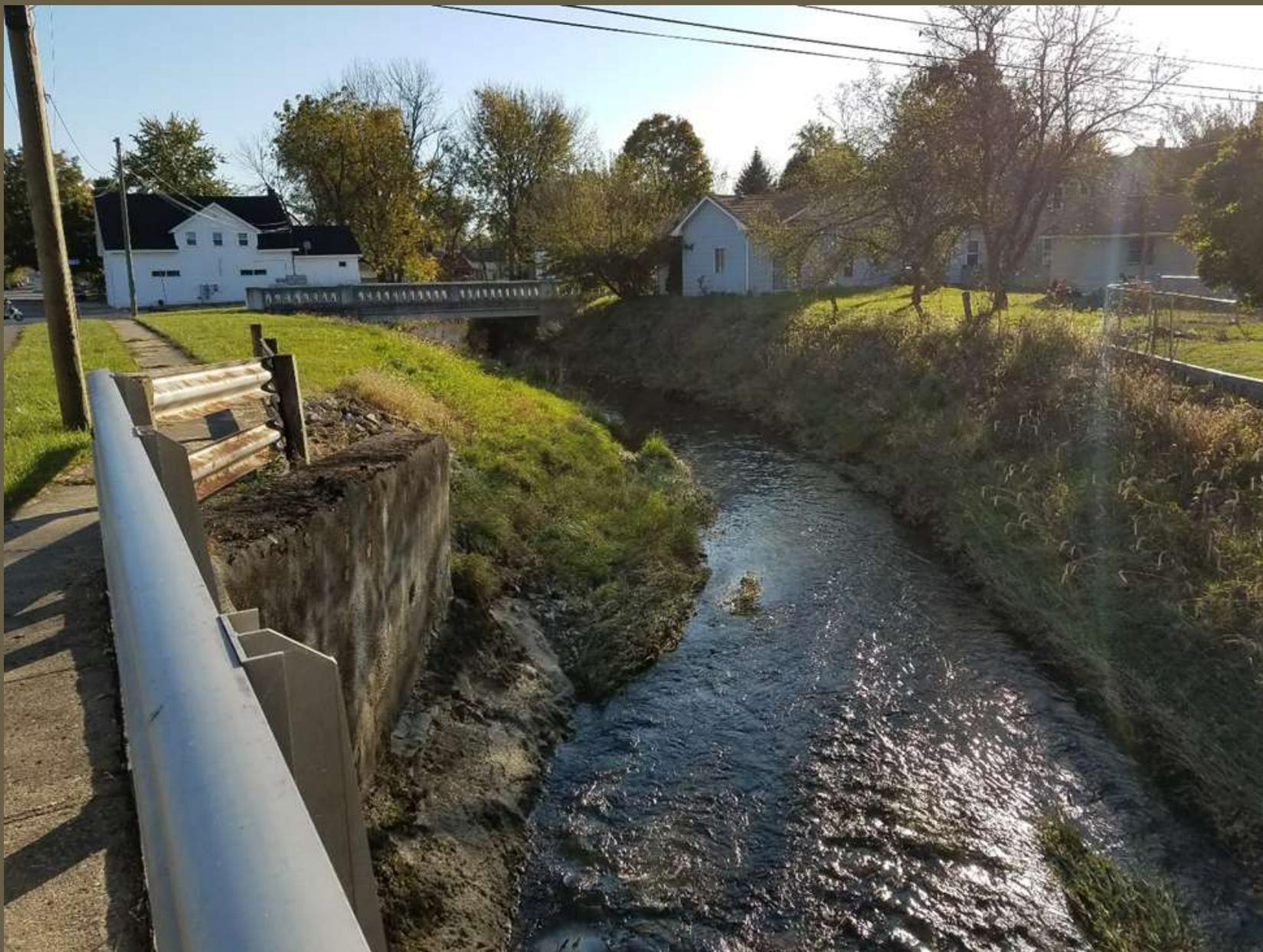
Looking downstream from the Meridian Street Bridge. Note height of banks, as in the upstream reach these banks are 9.5 to 10-feet above the channel bed.



Looking downstream from the Lebanon Street Bridge. Left bank is poured concrete. Right bank shows several different efforts to stabilize the bank and proximity of home



Looking downstream from Busby Street to Jameson. Reach is armored with concrete blocks, poured concrete walls, rubble, large blocks, and wood pallets.



Looking downstream from Jameson Street to Chicago Street. Note the bridge deck on Chicago Street that seems to go halfway across the house. This reach is armored with old rip rap, gabions, and concrete walls.



Looking downstream from Kersey Street to Lafayette Avenue. Notice proximity of road and homes to channel.



Looking downstream from the N. Patterson Street Bridge towards the RR Bridge. Parking lots on both sides of the channel come right to the top of bank. Notice that the box bridge in the background sits on the parking lot and would restrict any flood flows.



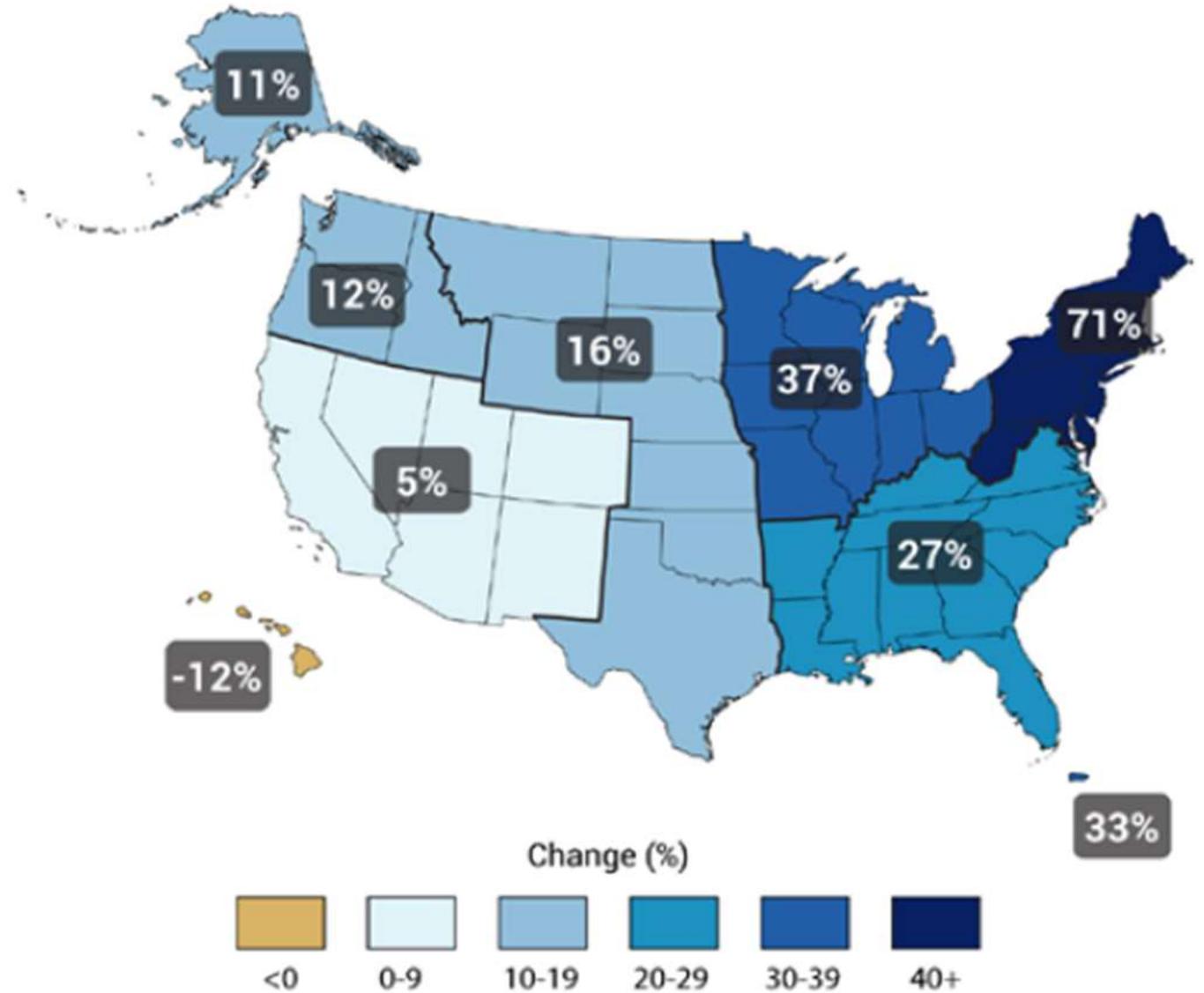
Downstream from RR Bridge, looking downstream from Farm Heritage Trail

Challenges

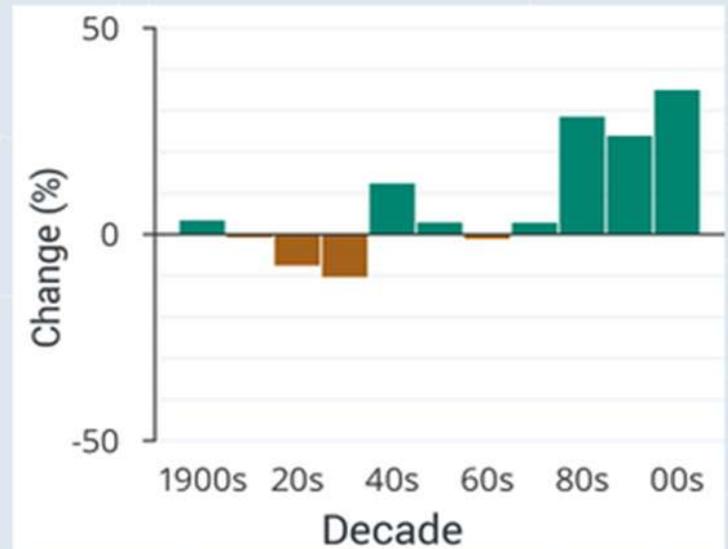
“The likely increase in precipitation in winter and spring, more heavy downpours, and greater evaporation in summer would lead to more Global Climate Change Impacts in the United States periods of both floods and water deficits.”

Global Climate Change Impacts in the United States, 2009

Observed Change in Very Heavy Precipitation



Midwest



Percent changes in the annual amount of precipitation falling in very heavy events, defined as the heaviest 1% of all daily events from 1901 to 2012 for each region. (2014 National Climate Assessment)

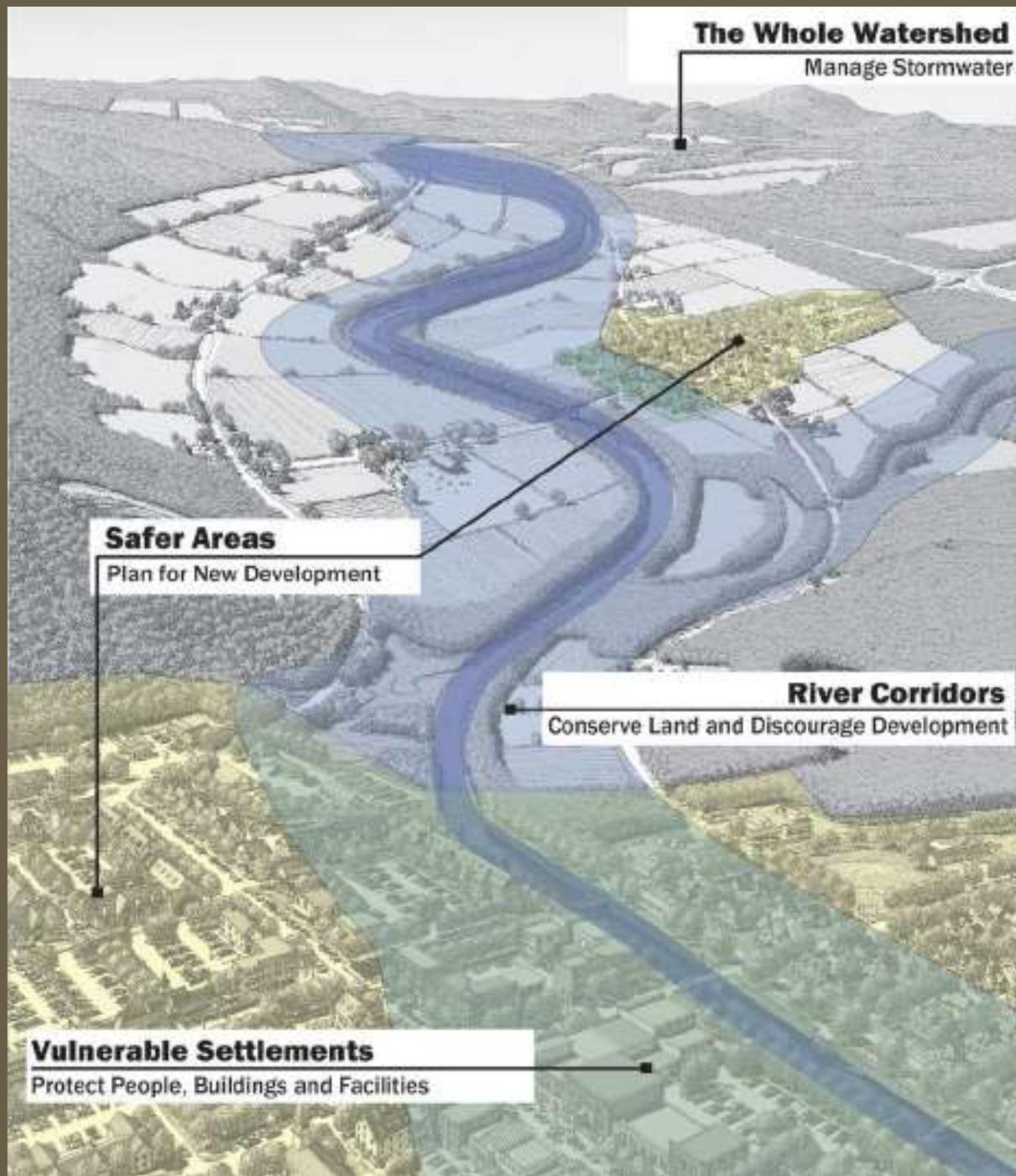
Opportunity



Sanitary Ditch at SR 32, looking downstream



Sanitary Ditch at SR 32, looking upstream



Planning for Flood Recovery and Long-Term Resilience in Vermont, 2014.

“Flood resilience” means measures taken to reduce the vulnerability of communities to damages from flooding and to support long-term recovery after an extreme flood.

Bottom Line

Conclusions

- Current channel instability, an unintended consequence
- Seemingly random bank stabilization efforts have become ineffective or made the problems worse
- There are a few small existing areas that show the potential for a stable stream
- Observed trends in increasing rainfall and runoff in this area suggest that problems will worsen over time
- The continuation of current approach is not sustainable and may lead to even bigger challenges down the road. A new vision is needed!

Recommendations

- Continue strict enforcement of current regulations for this “impacted” stream reach
- Develop a “River Corridor Revitalization Plan” for the Lebanon reach of Prairie Creek
- River Corridor Revitalization Plan would:
 - lay out a long-term vision and a conceptual plan for an aesthetically pleasing and functional open corridor
 - provide specifics for a geomorphically improved Prairie Creek such as laying the banks back and creating an instream floodplain shelf
 - provide layout for a multi-use recreational path and the necessary space for future maintenance of the creek
 - evaluate the effectiveness of an upstream flood control storage
 - determine the conceptual costs and a long-term, socially sensitive strategy for acquiring the necessary properties, consolidating stream crossing and access routes, and relocating utilities

A New Vision for Sustainability and Resilience

A carefully developed “City of Lebanon Prairie Creek River Corridor Revitalization Plan” is considered the essential first step for a successful multi-year challenge that would lead to a more sustainable stream corridor and an asset for Lebanon, while accommodating the growing needs of the landowners in the upstream watershed who rely on the Prairie Creek conveyance capacity as a regulated drain



QUESTIONS?

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