

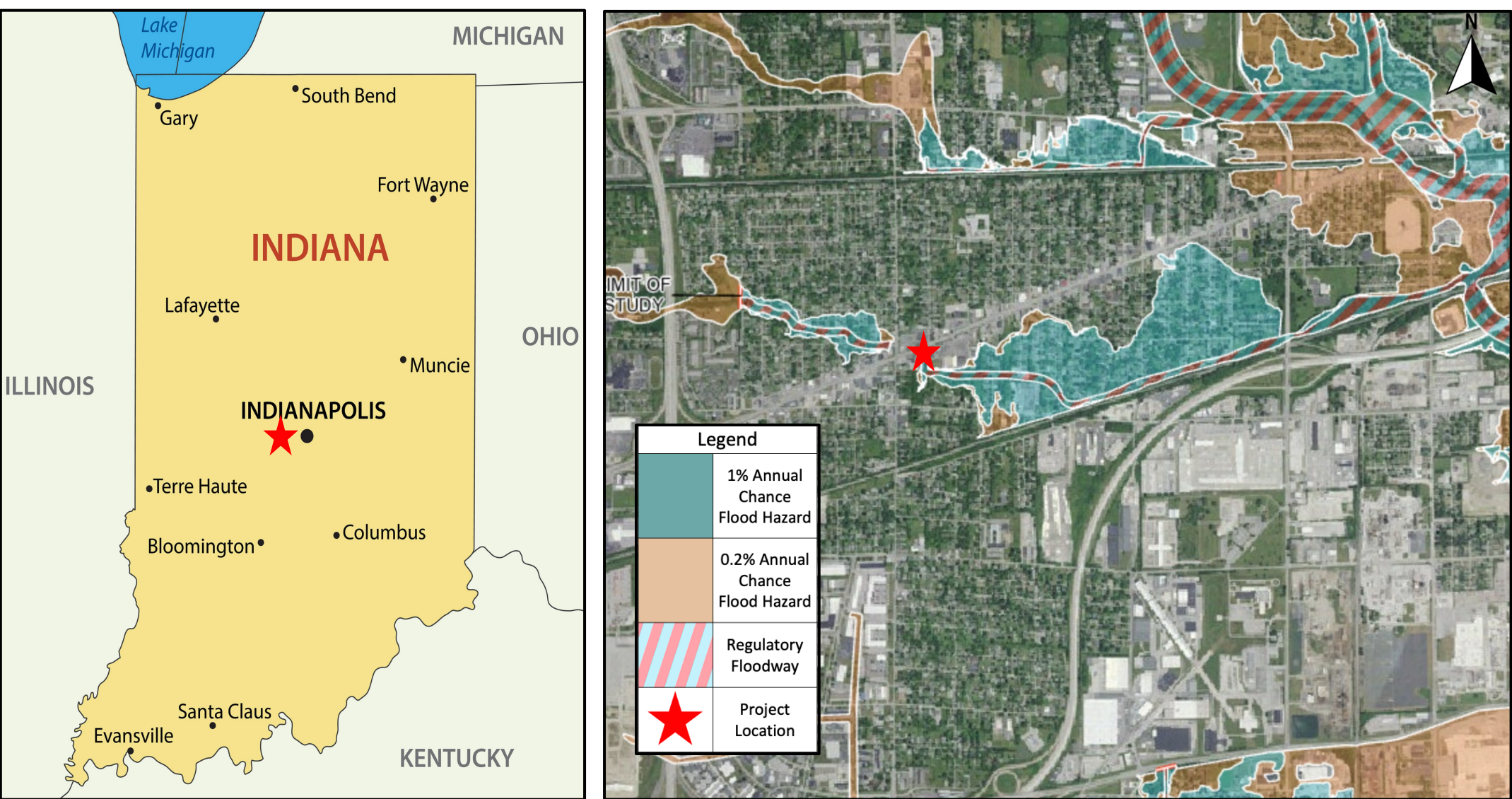
1. AT A GLANCE

On the west side of Indianapolis, Indiana, the residential drainage channel Neeld Ditch traverses from its source at Krannert Park to its outlet at Eagle Creek. Due to urban development and long outdated infrastructure, this area is prone to extensive flooding. This issue has led to the desire for reduction of the 100-year floodplain elevation.

After extensive site analysis and prototyping, the team implemented a combination solution of a step-pool sequence, two-stage ditch, and three-sided culvert. To demonstrate hydraulic improvement, a two-dimensional steady flow simulation on the modeling software HEC-RAS showed a reduction of the 100-year floodplain elevation by up to 2.65 ft.



Neeld Ditch Flooding (Carroll, 2015)



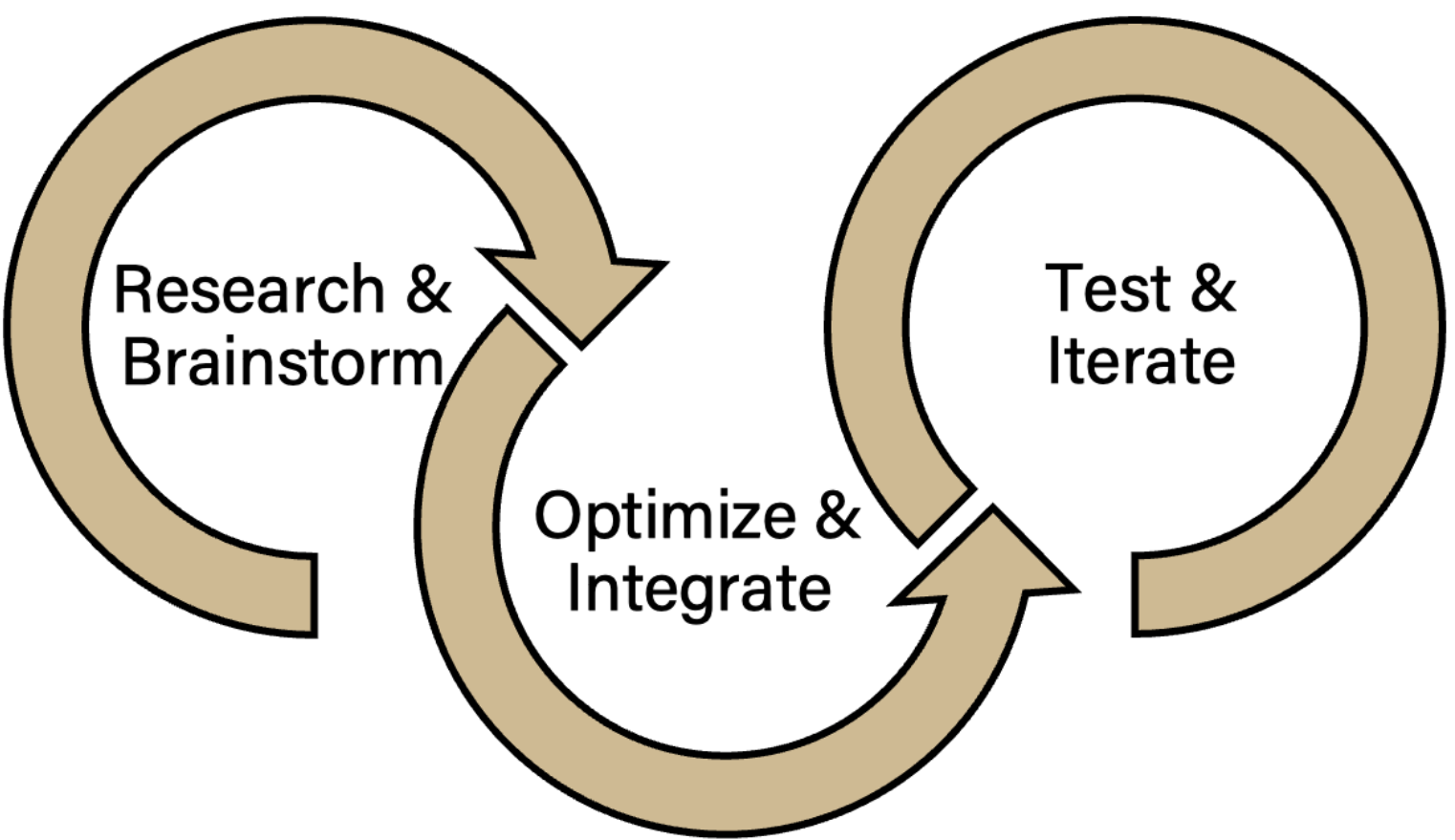
Indianapolis Flooding (FEMA, 2025)

2. THE BIGGER PICTURE

Flooding is the United States' most frequent and costly natural disaster, causing billions of dollars in damages and insurance claims. Urban flooding burdens homeowners, displaces residents, threatens public safety, degrades water quality, and endangers historic architecture. Climate change affects flood frequency, intensity, and duration, rendering Federal Emergency Management Agency (FEMA) flood maps outdated.

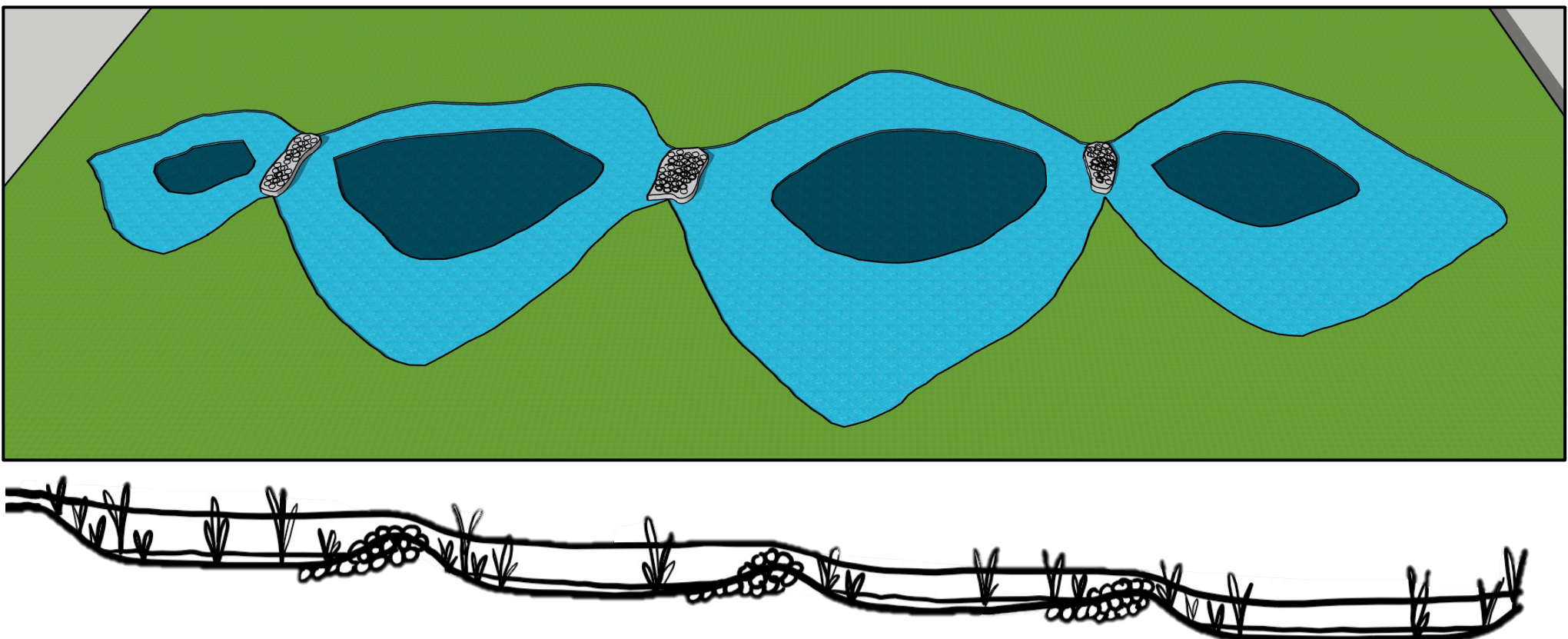
3. DESIGN & SELECTION

Constraints:	Criteria:
1. Spatial Limitations	1. Ecosystem Integration
2. Codes & Standards	2. Durability
3. Drainage & Sediment Control	3. Hydraulic Impact
4. 100-Year Channel Discharge	4. Cost Effectiveness
a. 1600 ft ³ /s	a. Flood reduction relative to cost

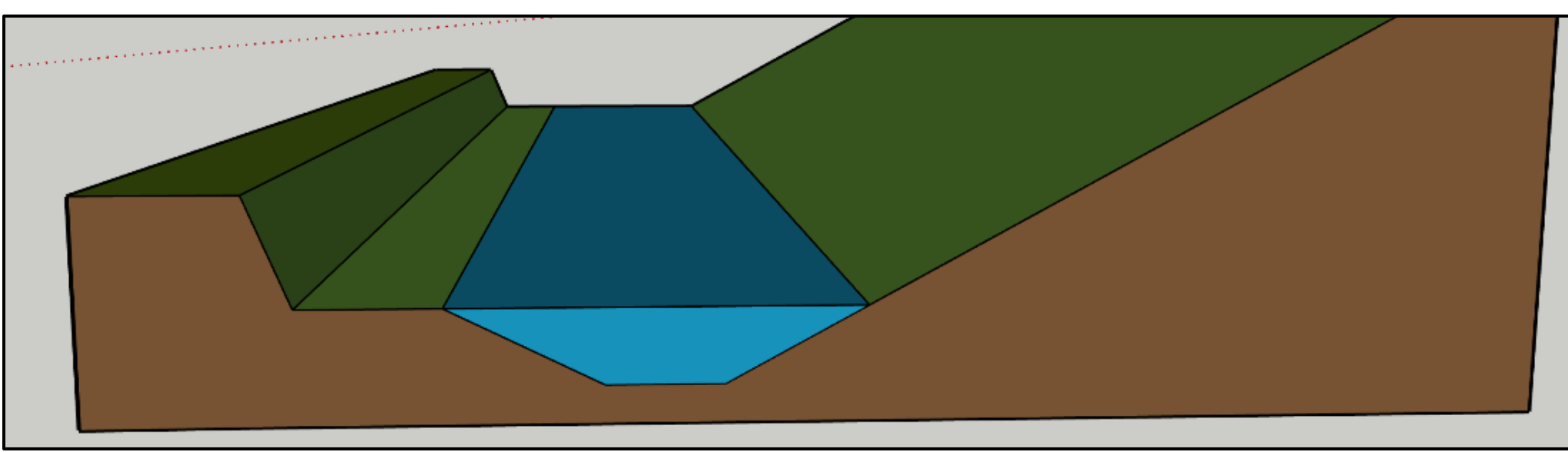


4. COMBINED SOLUTION

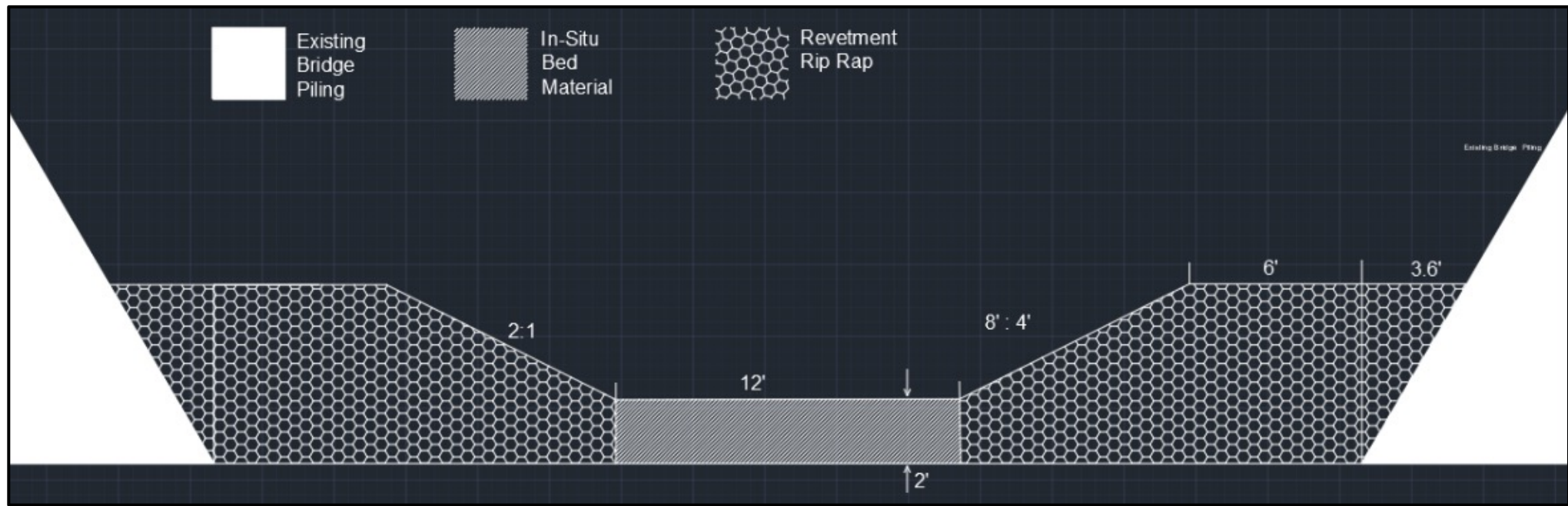
a. STEP-POOL SEQUENCE



b. TWO-STAGE DITCH

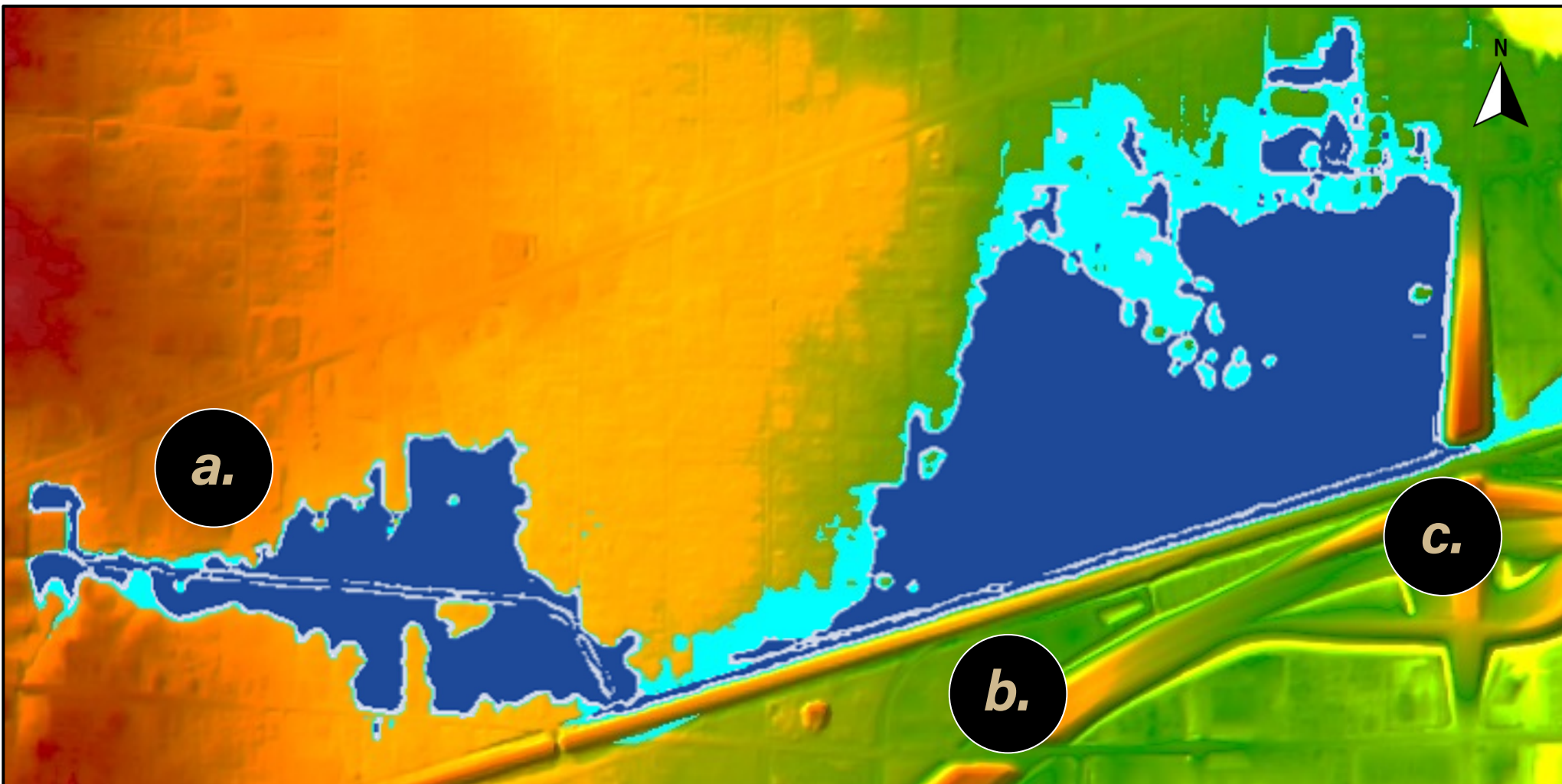


c. THREE-SIDED CULVERT



5. PROTOTYPE RESULTS

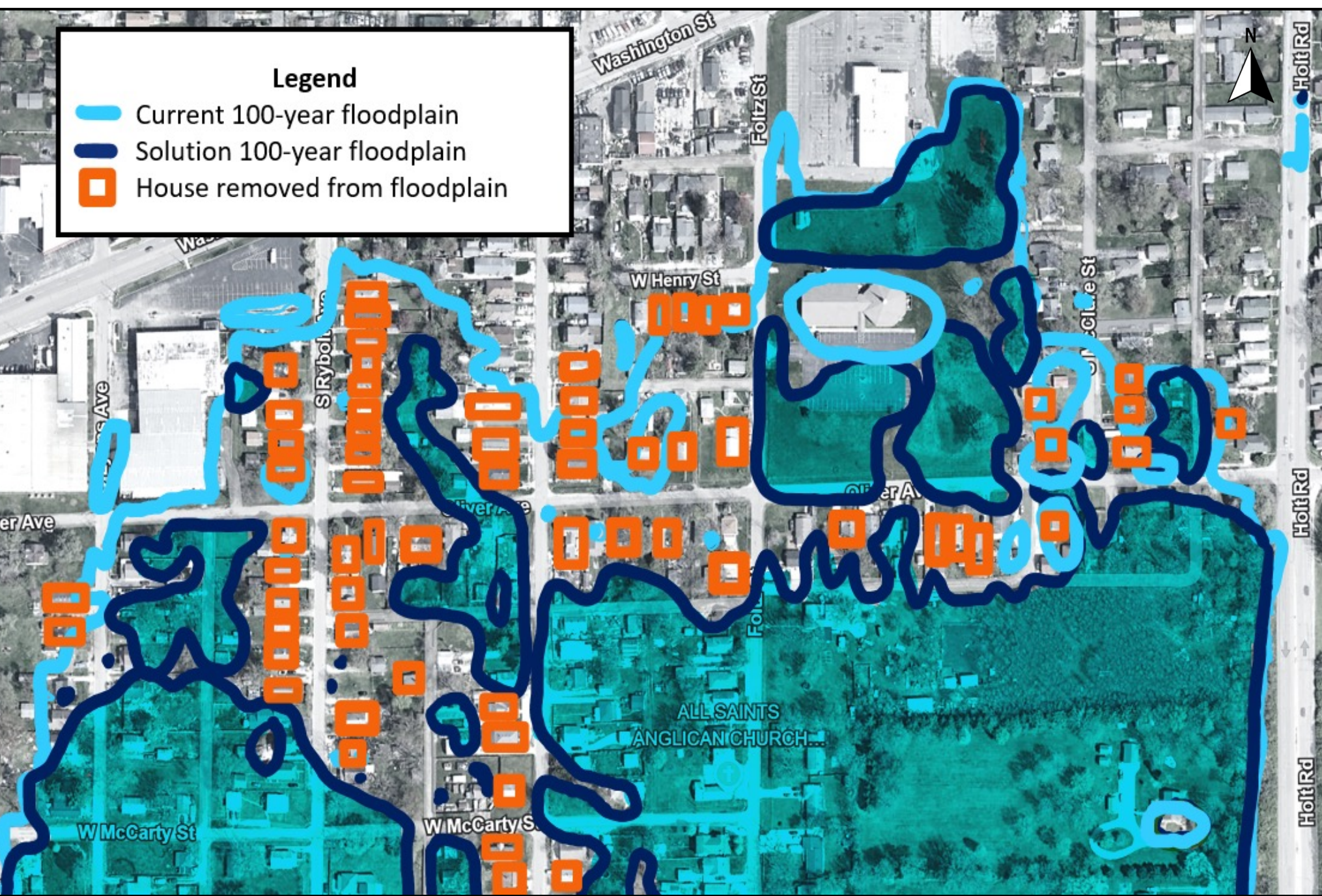
The sponsor provided the team with a HEC-RAS file of Neeld Ditch's current conditions. To demonstrate improvement, the team compared the 100-year flood elevations, areas, and widths of this file with a modified version to include the combination solution.



6. EVIDENCE OF SUCCESS

Downstream Location	Existing Water Elevation (ft)	Design Water Elevation (ft)	Water Level Reduction (ft)
Step-Pool Sequence	731.65	729.00	2.65
2-Stage Ditch	722.22	719.79	2.43
3-Sided Culvert	709.44	708.91	0.53

Flood elevations decreased at every measured cross section along the adjusted extent of Neeld Ditch, resulting in a reduction of the 100-year floodplain width by up to 1,200 feet, removing 79 homes from flood zone.



7. KEY INSIGHTS

To convey the team's success, the final deliverable to the sponsor is a traditional hydraulic report. Highlights of the report include:

- The cost of implementing this design:
 - \$21,100 for the step-pools
 - \$67,140 for the 2-stage ditch
 - \$118,649 for three-sided culvert
- A suggested maintenance plan:
 - Periodic inspections of all structures and surfaces
 - Prompt removal of sediment accumulations
 - Regular clearing of undesirable trees and brush
- An expected lifetime of 100 years
- Local Benefits:
 - Reduced insurance: \$1,000 per home per year
 - Higher property values: two percent

Referenced Codes, Standards, and Regulations:

CWA Sec 401, 402, 404; FEMA Flood Maps; INDOT E 723-CCSP-02; Indianapolis/Marion County Ch. 561; Part 654 National Engineering Handbook; NRCS Open Channel Code 582



Special Thanks to:

Instructor Dr. Margaret Gitau; Dr. Dani Winter Lay; Company Sponsor Robert Page, HNTB