Flood Plain Delineation of Indiana Streams

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Problem Statement:

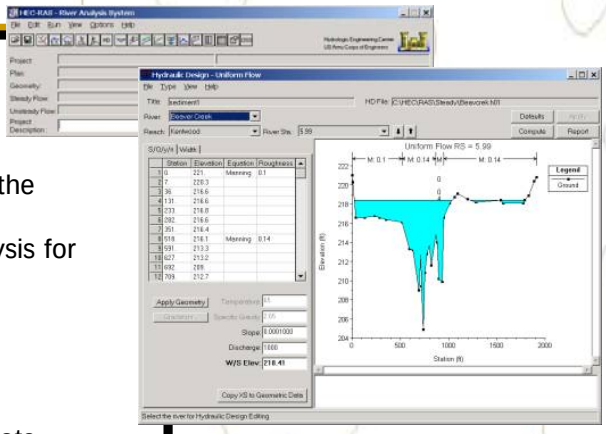
Flooding due to recent development in rural areas of Indiana has heightened public concerns and requires the development of flood plain mapping in previously unmapped areas.

Objectives:

- Create a hydraulic based model
- Delineate areas most prone to flooding
- Design a flood control structure to reduce area of impact
- Determine the economic feasibility of proposed design
- Recommend the next course of action

Resources

Hec-Ras



Why use Hec-Ras?

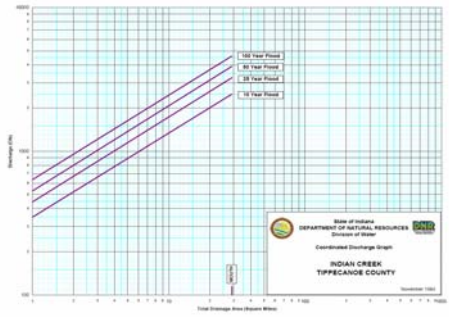
- Hec-Ras is a free program developed by the Army Corp of Engineers.
- Performs one dimensional hydraulic analysis for steady and unsteady river systems.
- Energy loss is calculated using Manning's Equation.

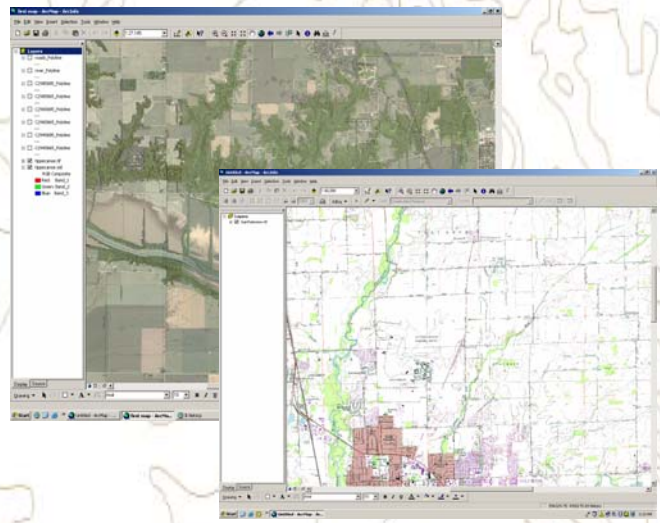
Inputs

- Flow Data
  - Drainage area
  - Discharge
- Cross Section Data
  - Manning's "n"
  - Station/Elevation
- Bridge Information
  - Height
  - Restrictions

Outputs

- Cross Section Plots
- Rating Curves
- Detailed Tabular Output at a Specific Cross Section
  - Water Surface Elevation
  - Flow area of channel
  - Total Discharge





ArcGIS

A complete, single, integrated system for geographic data creation, management, integration, and analysis.

ArcMap
ArcToolbox
ArcCatalog

ArcMap gives you the power to:

Visualize
Create
Present

Methods

- Analyze topographic data to determine representative cross sections
- Determine 100 year flow data from government resources
- Obtain bridge data from Highway Department
- Insert data into Hec-Ras
- Based on output, design flood control structure

Acknowledgments:

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Case Studies

Haw Creek

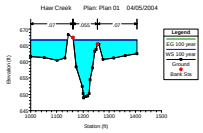
Site Characteristics

- Approximately a 5 mile reach between Columbus and Hope, IN.
- Located in Township 10 N, Range 6 E, Bartholomew County
- Connects Columbus FIS and Hope FIS models

Design Criteria

- Significant flooding in the area between the 450 North Road Bridge and the 550 North Road bridge has caused loss in farmland.
- To reduce flooding in this area, a levee will be constructed and the channel will be excavated to contain the flow in the channel in this area.
- The effects of this design must also not increase flooding at other locations along the stream.
- Several cross section dimensions were modified to achieve the desired results. A representative cross section (cross section number 7) is pictured below.

Before



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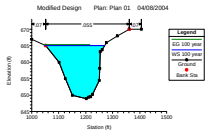


Results

- The flow was contained in the channel in the area of concern.
- The velocity of the channel decreased in the area of modification due to an increase in volume that the new channel holds.
- The land previously in the floodplain can now be used for development purposes without the risk of flooding based on a 100 year storm.

Indian Creek

Area of Study

- Extends from the convergence with the Wabash River 5.75 miles upstream to join existing study
- Township 23 N, Range 5 W, Tippecanoe County, IN

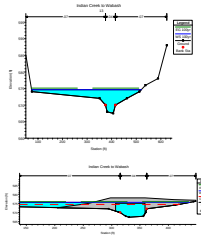
Current Situation

- A residential area with bridge is threatened
- Design must not interfere with housing or local bridge
- Due to steep topography erosion is a concern

Recommendation

- Selective stream bed modifications in the surrounding area can alleviate the flooding problems without interfering with the bridge.
- The addition of vegetation and riprap will help decrease erosion.

Before



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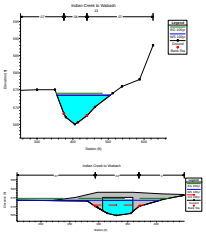


Results

- Local houses and pasture land are no longer in the flood plain
- Bridge is not at full capacity
- Erosion is keep to a minimum

Jordan Creek

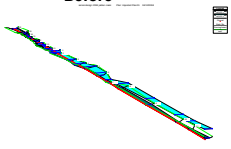
Geographical Data

- 2 mile reach extending south from State Road 26
- Township 23 N, Range5 W, Tippecanoe County, Indiana
- Model acts as a southern continuation of Green Meadows residential development analysis

Design Considerations

- Creek bed experiences a fluctuation in topography along its path, moving from a narrow V-shape to wide, low sloping terrain
- To minimize flooded areas, a levee will be constructed primarily on the eastern side of the creek, and the creek bed will be excavated further
- Reshaping of creek area should not have a negative impact on the local ecosystem, and alleviation of flooding in one area should not encourage flooding or erosion in other areas.

Before



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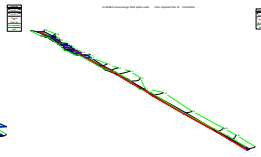
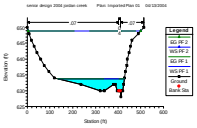
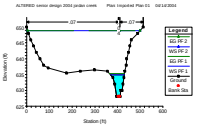






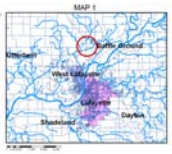
Outcomes:

- Flooding is contained to a minimal area of land
- Land previously in danger of flooding may be used to expand local agricultural practices

Burnett Creek

Location

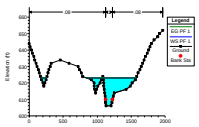
The Site Extends between approximately 3200 and 3500 feet west of State Road 43 and extends 860 and 960 feet south of County Road 600 North, respectively, at the western and eastern borders in the NE1/4, NW1/4, Section 28, T. 24 N., R. 4 W., near Battle Ground, Tippecanoe County, Indiana.



- During a 100 year storm, the river splits after the I-65 overpass.
- By reshaping the channel where the waterway splits, the floodplain will be greatly reduced.
- Soil will be taken upstream, and used in the reshaping of the land. The dig area will be used to increase the channel width, subsequently, decreasing the water elevation upstream.

River Station 3508

Before



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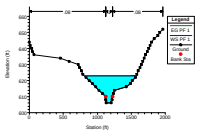

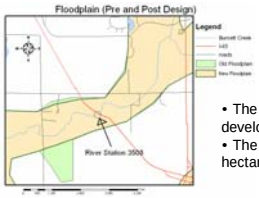

- The areas that can be used for development after design are in green.
- The total land is estimated at 977.3 hectare. (2415 acres)

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