Floodway Design

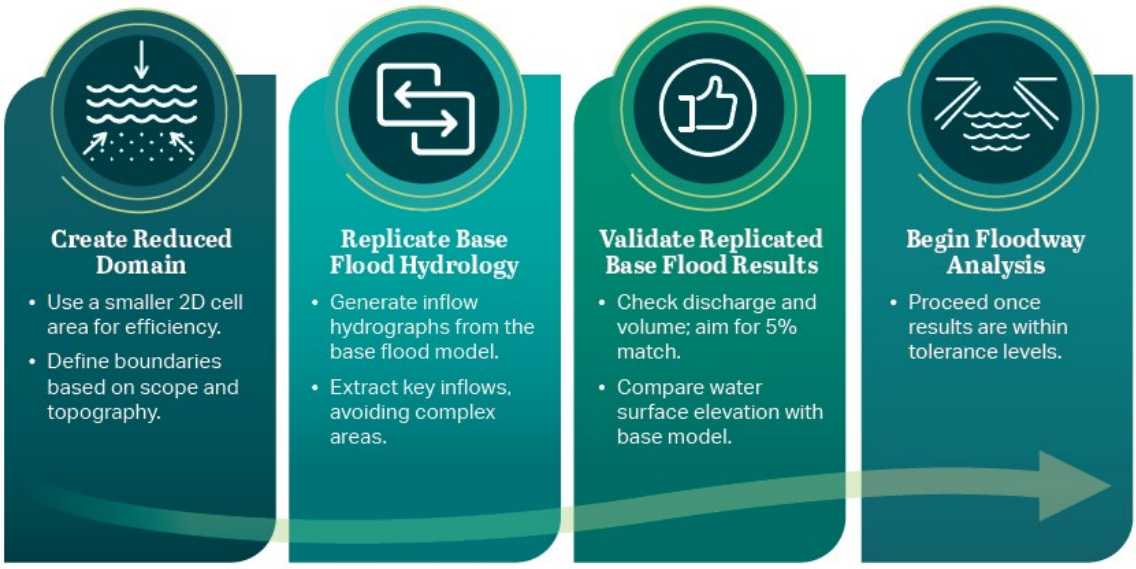
This approach is what is used by Iowa DNR contractors in order to create appropriate floodways, developed to FEMA guidelines and standards.

It includes creating single reach analysis, using a reduced domain approach that converts the pluvial inflow sourced data to fluvial inflow source coupled with the raised terrain method within HEC-RAS. This text is from a proposal submitted by AECOM where floodways were created for study areas in Iowa.

This process can be broken up into two major pieces: 1. Pre-Floodway Analysis and 2. Floodway Analysis.

Pre-Floodway Analysis

Figure 5. Pre-Floodway Analysis



1. **Create Reduced Domain**
    - For 2D floodway analyses the reduced domain approach helps by introducing model efficiencies since there are fewer 2D cells. This allows for more iterations during the encroachment process. The modeler begins by reducing the model domain to at least the scoped extents. This boundary may be fined tuned due to topographic restraints and extraction of data.

2. **Replicate Base Flood Hydrology**
    - The first major component to the single reach floodway analysis approach involves replication of the base flood hydrology as illustrated in Figure 3. Next a series of inflow hydrographs are extracted from the rain on grid base flood model through a series of profiles lines. The profile lines will capture the upstream inflow and any major lateral inflows while avoiding complex locations such as confluences and eddy pools.

3. **Validate Replicated Base Flood Results**
    - Next a series of validation lines are added at incremental locations to the model to check it's results against the base model. It is imperative to match the base flood data as close as possible. This requires checking both discharge and volume at

the incremental locations. FEMA suggests a match of 5% or better. A secondary check involves the comparison of the base flood water-surface elevation results to reduced domain model with fluvial inflow sourced hydrology. If deficiencies are found during the validation phase additional flow/volume will be added as a series of inline hydrographs to account for the difference.

4. Begin Floodway Analysis

- Once this process has produced a match within acceptable tolerances then the floodway process can begin.

Floodway Analysis

Figure 6. Floodway Analysis

1. Delineate Floodway

- Analyze Depth x Velocity raster data to identify areas of high hazard within the floodplain. The Australian Rainfall & Runoff (ARR) combined hazard curves – vulnerability thresholds will be utilized in U.S. Customary units to highlight maneuverability and vulnerability to both people and structures. This unique classification symbolization will be leveraged as the basis for the initial delineation of the floodway. It will help ensure that high hazard areas with deep and swift moving water will be included into the floodway corridor. The initial equitable consideration can begin by including the high hazard zones H3 – H6 as these provide the greatest risk to people and structures (See Table 2). Figure 6

graphically illustrates how the ARR Flood Hazard criteria can be used to highlight potential high hazard areas.

Table 2: Hazard Vulnerability Thresholds

Hazard Vulnerability Classification	Description	Classification Limit (D and V in combination) [ft^2/sec]	Limiting Still Water Depth (D) [ft]	Limiting Velocity (V) [ft/sec]
H1	Generally safe for vehicles, people, and buildings.	D*V ≤ 3.2	1.0	6.6
H2	Unsafe for small vehicles.	D*V ≤ 6.5	1.6	6.6
H3	Unsafe for vehicles, children, and the elderly.	D*V ≤ 6.5	3.9	6.6
H4	Unsafe for vehicles and people.	D*V ≤ 10.8	6.6	6.6
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.	D*V ≤ 43.1	13.1	13.1
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.	D*V > 43.1	-	

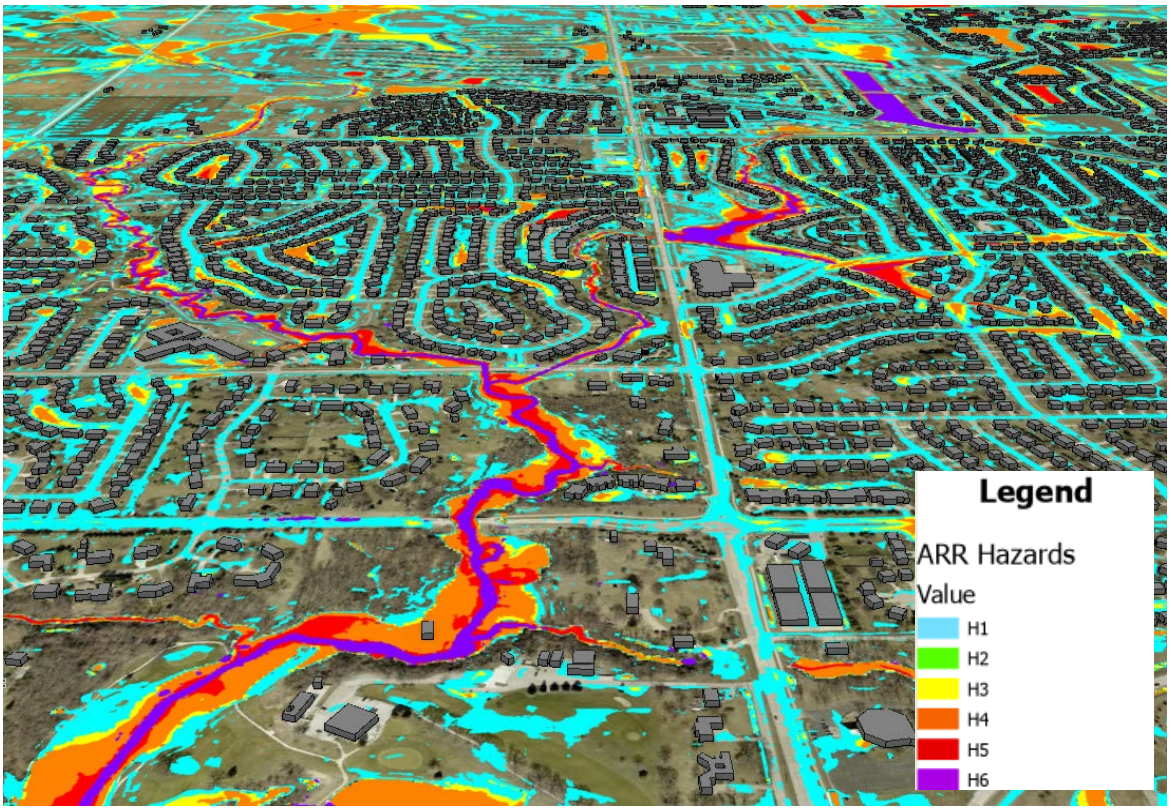


Figure 7. ARR Hazards

2. Artificially Raise Terrain

- Perform initial floodway encroachments based on hazard areas identified in the Depth x Velocity analysis. Once the initial floodway has been delineated using the ARR criteria the raised terrain approach will be utilized. The flood fringe area adjacent to the floodway will take advantage of RAS Mapper's terrain modification tools to create a virtualized raised terrain to simulate 100% fill with no conveyance.
- Ensure that these encroachments equitably distribute risk while maintaining effective floodplain management practices.

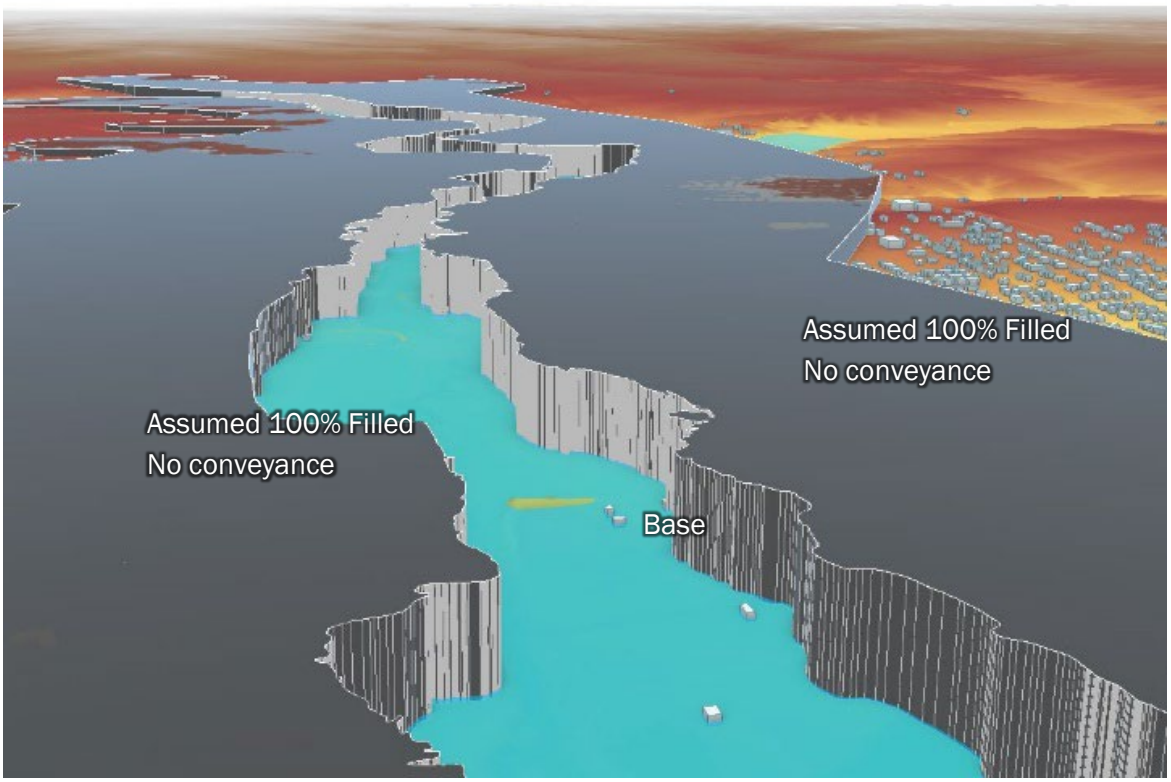


Figure 8. Raise terrain within the model to reflect encroachments

3. **Discharge Base Flood into Floodway**
    - The validated base flood hydrology developed from the pre-floodway analysis process is routed through the floodway model and confined to the limits of the delineated flood. This process routes all flows on the floodway side of the artificially raised terrain.

4. **Evaluate Surcharges Across Three Main Criteria**
    - **Floodway Cells:** Ensure surcharges at all model cells within the floodway are within the acceptable range of -0.5 to 1.5 feet.
    - **Insurable Structures:** Verify that surcharges at model cells intersecting insurable structures remain between 0 to 1 foot, to minimize flood risk to buildings.
    - **Evaluation Lines:** Confirm that surcharges along evaluation lines are within the range of 0.0 to 1.0 foot, ensuring compliance with FEMA floodway guidelines.

Evaluation Line information will be stored in the S_XS layer and inform the creation of the Floodway Data Tables for each reach.

5. Refine and Adjust

- Based on these evaluations, refine the floodway encroachments as necessary to meet FEMA standards and community requirements.

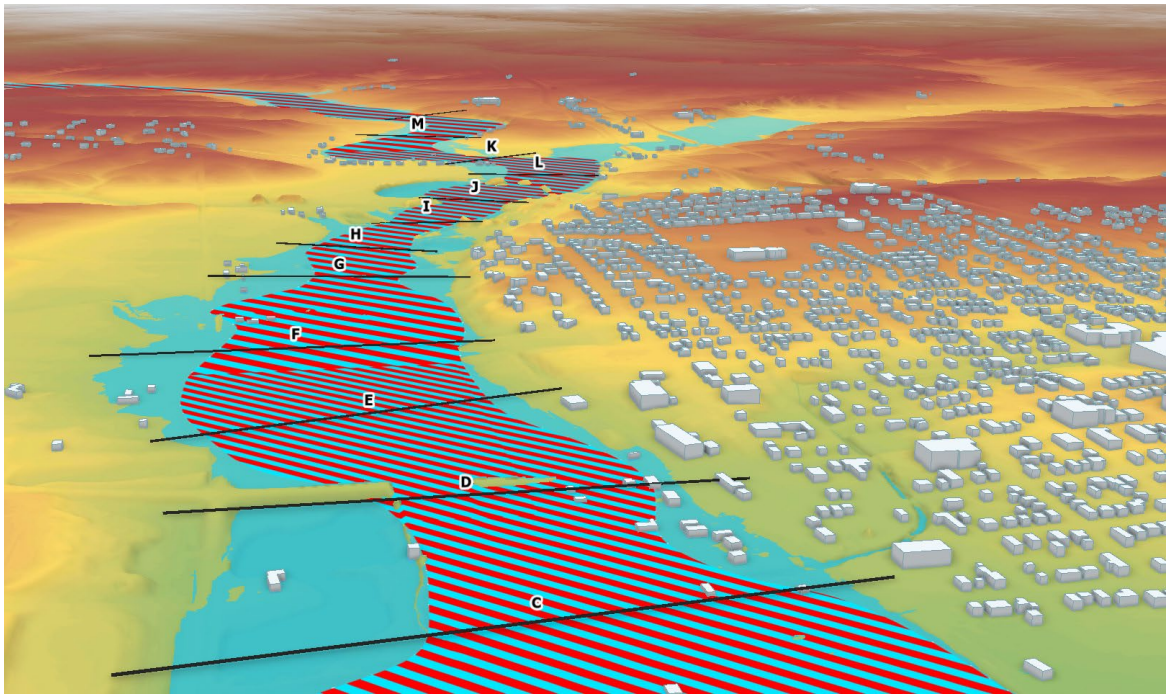


Figure 9. Final floodway delineation with evaluation lines as cross sections