

UMR FLOOD RISK MANAGEMENT HYDRAULIC MODEL

KEY POINTS

- (1) The newly developed UMR FRM hydraulic model is now available for partner, stakeholder and public use. Its development was facilitated by USACE Rock Island and St. Louis Districts for a 320-mile stretch of the river from Lock and Dam 19 at Keokuk, Iowa (River Mile 364) to Thebes, Illinois (River Mile 44), including all leveed and storage areas in the model geometry.
- (2) Developed and tested collaboratively with State and Federal technical experts using the very latest guidance, expertise, technology and data. Its predictive capacity was validated by running the historic hydrology from four significant flood events: 2008, 2013, 2014 and 2017. Broader application and testing of the model by expanded stakeholder group may identify further refinements in coming months.
- (3) Provides users with a key tool to accurately and realistically predict changes in water movement and depth profiles in response to a variety of “what if” land-use variables. Such information is integral to the risk-informed planning, evaluation and decision-making processes.
- (4) National Levee Database survey data incorporated into this model does not alter the congressionally authorized elevation for individual Federal levee systems or constitute retroactive USACE approval of altered levees.
- (5) This was a model development effort not a traditional USACE study authority which compare alternatives, consequences of courses of action. Since this tool is likely to be used for future studies or evaluations, it was developed in a highly transparent manner with external expert reviews to ensure the greatest degree of trust, credibility and confidence from our partners, stakeholders and public.

WHAT WAS DONE

- Reach 1 UMR FRM hydraulic model was developed from the tailwater of Lock and Dam 19 at Keokuk, Iowa (River Mile 364) to Thebes, Illinois (River Mile 44). The model extends bluff to bluff to include all leveed areas and storage areas in the model geometry.
- The goal of this tool is to provide a common model using the best available data and widely used software (HEC-RAS) that can reasonably recreate a range of events that have occurred or may occur in the future to assess system performance and flood risk management strategies.
- This covers 320 river miles, includes 7 navigation dams, and encompasses parts of two USACE districts (Rock Island and St. Louis). The two districts worked in conjunction to ensure the development of a continuous model that can be used for a number of applications in this geographic region.
- The major tributaries (gaged streams) to the Mississippi River are modeled as separate reaches from the tributary’s confluence with the Mississippi River upstream to the first USGS flow gage. Minor tributaries are input as lateral inflows.
- The model was calibrated and tested using some of the most significant floods in the modeled reach in the recent past: 2008, 2013, 2014 & 2017.

- Documentation was developed to detail model development, calibration, sensitivity analysis, replication of historic flood events and the technical review process.

WHY IS THIS SIGNIFICANT

- Serves as a key tool to evaluate wide variety of “what if” landscape scenarios by producing comparative analysis of water elevation consequences necessary to guide collaborative risk-informed decision making.
- Significant improvement over previous pool based models because of the large geographic extent and continuity across multiple navigation dams.
- Historically a wide variety of very localized hydraulic models have been used to evaluate site specific scenarios in UMR, this new model will serve as a standard tool that has capability to evaluate both regional and localized hydraulic modeling scenarios.
- Employs the very latest technological advancements which include higher resolution terrain data, inclusion of bridges, 2D flow areas, and updated levee survey data.
- Will run unsteady flow hydrographs and will provide a base condition to efficiently and reliably evaluate proposed changes to the system and resulting changes in flood risk.

HOW WAS IT DEVELOPED

- The calibrated existing conditions model was developed using the best available National Levee Database (NLD) data and uses one set of parameters that are representative of four recent significant flood events (2008, 2013, 2014 and 2017).
- The model successfully underwent multi-stage Agency Technical Reviews (ATR) to ensure accuracy and reliability. Reviewers included nationally recognized HEC-RAS experts from USACE Omaha, Tulsa and St. Paul Districts.
- The model is being released with a single geometry file representing the levees at the existing condition as determined by the most recent UMR National Levee Database surveys, completed largely in 2015-17.
- The existing NLD levee elevations used in the model represent the sum of all activities (flood fighting, repairs, dredge material placement, approved and unapproved alterations) that have occurred over time.
- Collaborative effort: multiple USACE sponsored web meetings and conference calls were held with federal and state agencies. Federal and state technical team members included Iowa, Illinois, Missouri, Minnesota, and Wisconsin Department of Natural Resources (DNR); Federal Emergency Management Agency (FEMA); United States Geological Survey (USGS); and National Weather Service (NWS) North Central River Forecast Center (NCRFC).
- Multiple webinars were also held between the USACE and interested Non-governmental stakeholders, including Upper Mississippi River Basin Association (UMRBA); The Upper Mississippi, Illinois and Missouri Rivers Association (UMIMRA) and consultant Klingner and

Associates; Neighbors of the Mississippi River and consultant from Crawford, Murphy & Tilly; American Rivers; and National Wildlife Foundation.

WHO WILL USE IT

- This model has wide appeal and support, which will drive a variety of applications by a diverse array of disciplines, including:
 - Floodplain managers
 - Levee Districts
 - Municipalities
 - Forecasters
 - Planners
 - Decision-makers
 - Ecologists
 - Engineers
- Provides users with a standard hydraulic model platform and answers potential water surface profile impacts caused by changes in the river system.
- Another application may be to explore alternative actions and “what if” scenarios by modifying the existing conditions model and compare them to the “no action” alternative.

CAVEATS

- This model has been developed as a flood risk management tool and is not currently designed or calibrated for sediment transport, water quality, steady state flow modeling, or river training structure analysis. FEMA acknowledges that the UMR model cannot be used to produce an update or replacement of 2004 UMRSFFS study and FEMA’s regulatory products in its current state.
- The UMR Hydraulic Model has the best available information and will be available for public use. Users are strongly encouraged to consult with appropriate flood plain managers at the local, state and federal levels before using the UMR Hydraulic model for project permitting (i.e. no-rise) purposes.
- The hydraulic model was developed and calibrated as a regional model therefore USACE recommends maintaining the model in its entirety. However, one common practice may be to reduce this regional model to a reach of the river that encompasses the specific area of interest. When the model is parsed in this way, an experienced HEC-RAS modeler will need to define the appropriate upstream and downstream boundary locations and conditions.
- National Levee Database survey data incorporated into this model does not alter the congressionally authorized elevation for individual Federal levee systems or constitute retroactive USACE approval of altered levees.