FEMA Guidance for Modeling and Mapping the Impact of Dams and Dam-Like Structures on FEMA RiskMAP Products

E.G. Beadenkopf PE, CFM
Presentation Agenda

• Project Objectives
• Challenges Developing this Nationwide Guidance
• Addressing the Challenges
• Overview of the Guidance
• Input and Questions
Project Objectives

• Develop guidance to assist FEMA and Mapping Partners consistently address the influence of dams and structures that function like dams in the preparation flood hazard products

• Lay the groundwork for further alignment of the National Dam Safety Program and RiskMAP

• Wet and dry flood control
• Water supply
• Recreation
• Irrigation
• Flood fighting
• Power generation
• Multi-purpose

Dam

Dam- Like

• High level embankments
• Incidental flood storage
• The existence of limited and unclear flood hazard program guidance
• The desire for new guidance but not new nationwide requirements
• The need for the new guidance to be RiskMAP specific
• The desire for the guidance to also align with the National Dam Safety Program
Project Challenges

• Recent H&H guidance does not address flood structure storage in detail
• 1992 G&S Appendix C sections covering structure storage is not considered by many Mapping Partners to be current policy
Project Challenges

• Very limited detail exists in current/past guidance
  • Lakes/reservoirs can be modeled for flow attenuation
  • Culverts/bridges/ high road embankments can be included
  • No specific details exist by storage structure type and routing preferences for use in the H&H modeling

• Legacy study methods need to be considered as the new guidance methodology is formulated
  • Most 1D models treat dams/roadways as weirs
  • Most 1D models use a steady state discharge. Typically not routed through the structure
  • 2D models typically include structure storage behind roads as channel storage with no controversy
• FEMA Regions want maximum flexibility
  • They support guidance but not mandated requirements and want to make decisions what is hydrologically modeled to account for flood storage on a case-by-case basis

• Hydrologically including structure flood storage in the floodplain mapping of downstream areas understates potential flood hazard
  • FPM decisions will be made assuming the structures stay do not fail, are not modified, and flood storage remains

• New guidance must be compatible with the guidance for RiskMAP non-regulatory products for dams and any TMAC guidance developed per BW12 requirements
Purpose of the Assignment

• The guidance will focus on existing conditions flood hazard products (FIRM’s, FIS’s and FIRM database)
  • Existing physical conditions will be modeled
  • Target the 1% flood and then rout other events

• Potential dam breach mapping will be addressed by RiskMAP non-regulatory products for dams and work resulting from TMAC recommendations

• New products will be needed to effectively communicate the real risk downstream of dams
  • Disclosure of assumptions in the FIS and flood risk reports
  • New non-regulatory product maps for dams
  • Potential use of shaded Zone X to map loss of flood storage at road crossings and some dams similar to the guidance that exists for future conditions hydrology

Addressing the Challenges
Purpose of the Assignment

- FEMA Regions will make modeling decisions
  - Dams, culverts, bridges, high road embankments may be modeled for flood storage
  - Structures will be hydraulically modeled assuming they stay in place
  - A decision matrix will be part of the guidance

Three categories of structures will have modeling guidance

- Dams with a primary function to provide flood control
- Multi purpose dams that include flood control storage
- Dams, roadways, and high embankments that provide incidental flood storage

Addressing the Challenges
General Guidance Flood Control Dams

• Dams with a primary function to provide flood control
  • Typically designed by federal and state agencies and local governments
  • Examples include some dams designed by the NRCS, USACE, USBR and many by local governments
  • Identified as such in the National Inventory of Dams

• Guidance for hydrological routing
  • FEMA will create a rainfall-runoff hydrologic model or leverage an existing model
  • If the 1% flood overtops the dam (without overtopping erosion protection) assume that the dam hydraulically remains in place and do not model downstream flood reduction
  • Include flood reduction that produces a downstream BFE change of 1’ or more
  • Map the upstream 1% flood storage pool as floodway
General Guidance Flood Control Dams

South River #25- Tom’s Branch Augusta County VA
• Multi purpose dams with flood control storage
  • Typically designed by governments and utilities
  • Examples include some dams designed by the NRCS, USACE, USBR, TVA, and water/ power generation utility companies
  • Flood control could be a designed component or incidental

• Guidance for hydrological routing
  • FEMA will create a rainfall-runoff hydrologic model or leverage an existing model
  • If the 1% flood overtops the dam (without overtopping erosion protection) assume that the dam hydraulically remains in place and do not model downstream flood reduction
  • Include flood reduction that produces a downstream BFE change of 1’ or more
  • Map the upstream 1% flood storage pool as floodway
  • For gated or human controlled outlet works, the operational plan rules will be used or worst case assumptions if no plan exists
General Guidance Multi-purpose Dams

T. Nelson Elliot Dam- Lake Manassas Prince William VA

Water supply reservoir providing incidental flood storage includes manual controls in the principal spillway to increase lake level for water supply.
General Guidance Dam-like Structures

• Dams, roadways, and high embankments that provide incidental flood storage
  • Typically operated by states and private owners and generically include state/local roadways and privately owned and operated recreational dams
  • Most significant flood reduction occurs in small watersheds where available flood storage volume is a large percentage of runoff volume
• Guidance for hydrological routing
  • FEMA will create a rainfall-runoff hydrologic model or leverage an existing model
  • If the 1% flood overtops the dam (without overtopping erosion protection) assume that the dam hydraulically remains in place and do not model downstream flood reduction
  • Include flood reduction that produces a downstream BFE change of 1’ or more
• Map the upstream 1% flood storage pool as floodway
• Guidance will be provided on the size of the contribution watershed and storage volume whether to model flood storage
General Guidance Dam-like Structures

• Dams, roadways, and high embankments guidance for hydrological routing (continued)
  • The embankment stability must be reasonably assured
    • Massive embankments e.g. Interstate Highways
    • Documented historical performance
    • Stable outlet pipes e.g. concrete pipes with headwall and outlet protection and seepage control
    • Storage depth and duration not high or long enough to produce seepage
  • The 1% flood storage pool is contained in the floodway
  • Agreement by community to not increase capacity of the outlet works
Purpose of the Assignment

General Guidance Aides Dam-like Structures

Roadway Embankment Design Criteria

1. HW - TW > 10 ft.
2. HW / D > 2
(Based on 100-Year Storm Event)

- No Special Design Required
- Use Watertight Pipe and Filter Diaphragm

Design as a Dam

* Use HW when TW is below the inlet invert elevation.
General Guidance Aides

<table>
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<th>REDUCTION IN MAXIMUM RATE DUE TO STORAGE</th>
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Aligning RiskMAP and the NDSP

- NDSP considerations for the guidance
  - Dams are not hazards but instead are infrastructure subject to internal and external stress or loads
  - Understanding the dam function and performance to the loads is critical to the decision whether and how to model and map flood reduction
    - Does the dam have a unconditional state NDSP operations & maintenance permit?
    - Do dam safety inspection reports identify maintenance issues or structural deficiencies?
    - Is it appropriate to assume the dam will not fail and will provide flood reduction?
Purpose of the Assignment

- Flood hazard mapping is a fundamental component of the NDSP
  - Preparedness planning
  - Risk assessments
  - Mitigation actions
  - Residual risk management
  - Emergency response during events
  - Post flood resiliency planning and recovery

- The guidance document will include additional sections to align RiskMAP with the NDSP
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- Regulatory flood hazard product guidance
- Recommendations for additional non-regulatory products for dams
- Pre-disaster preparedness modeling guidance for EM
- Disaster support dam breach modeling, mapping and risk prioritization
- Guidance for post disaster advisory dam breach recovery maps
The guidance is in progress and an initial draft for review by FEMA HQ staff is planned in 2018. A more thorough review by FEMA Regions and Mapping Partners will then take place leading to release of the guidance in 2019.

We want your input!

• Send me an e-mail and I will provide a questionnaire
• Or send us any thoughts including your preferences for policy and technical methodology to:

  james.demby@fema.dhs.gov
  and
  edward.beadenkopf@atkinsglobal.com
Questions

Pine Run Floodwater Retarding Structure,
Montgomery County, PA.