

Dam Failure Inundation Mapping - Items for Submittal (revised 8-4-2014)

Ohio Administrative Code Rule 1501:21-3-02 requires that a registered professional engineer perform detailed investigations and analyses of dams, which would include dam failure inundation mapping. The following provides a basic guideline for the content of a dam failure inundation mapping report.

Dam Hydrology and Hydraulics

- Provide the working hydrology and hydraulics for the dam and how it performs during various flood events.

Dam Failure Analysis – Provide a narrative of the analysis that includes the following.

- Discuss the selection of breach parameters (time to failure, breach width, breach side slopes, pool elevation for failure initiation) or other determination of flows downstream of the dam. [Ref. 1]
- Consider three failure scenarios: (1) sunny day, (2) 100-year (or possibly 25%PMF), and (3) PMF. If any of these are omitted, justification should be provided.
- Discuss the sensitivity of parameters. [Ref. 11]
- Discuss the termination point of the model. [Refs. 2, 3, 11]
- Discuss how cross sections were obtained.

Hydraulic Model of the Inundation Area – Provide the electronic models and work maps.

Work Map(s)

- Provide a map that shows the names, locations, and orientation of all the cross sections in the model. Make sure the cross section names match those in the model.
- Show the full extent of the valley that was modeled.
- This map is provided for review purposes. It does not need to be included in the EAP.

Flood Modeling

- Describe the flood model (hand calculations, HEC-1, HEC-RAS, or other suitable model).
- Provide digital copy of the computer files. Make sure that each run is labeled appropriately. Do not include any unused or “scratch” runs.
- Discuss modeling procedure and content. [Refs. 4, 5 & 6]

Inundation Maps – Provide the inundation maps and the spatial files of the inundation areas, dam location, and lake area

- The maps must show all three failure scenarios unless otherwise approved.
- Clarity – it is crucial that the map can be easily read. The inundation area should be plotted on the most recent aerial imagery. Structures such as homes and other buildings must be identifiable. The roads must be identifiable and labeled. [Refs. 3, Ch. 6, & Ref. 7]
- Label the dam location and shade the lake area. [Ref. 11]
- Include a north arrow, scale, and legend. The legend should at least describe the failure scenarios and travel (and/or arrival) time.
- Verify that content of hazard area is current; this will likely require a field visit.
- Show several cross sections and the distance downstream, time of arrival, water elevation, and time to peak for each. It is not necessary to show every cross section. It is preferable to only include cross sections at significant locations such as at homes, road crossings, etc.
- Briefly discuss the scenario and note that the map is an approximation.
- Also note why the mapping ends at the chosen location. [Ref. 11]

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References

1. Prediction of Embankment Dam Breach Parameters (DSO-98-004), USBR
2. Downstream Hazard Classification Guidelines (ACER Technical Memorandum No. 11), USBR
3. Engineering Guidelines for the Evaluation of Hydropower Projects, Chapters 2 & 6, FEMA
4. Guidelines and Specifications for Study Contractors (Flood Insurance Study), FEMA 37
5. EM 1110-2-1416 River Hydraulics, USACE
6. HEC-RAS Hydraulic Reference Manual & HEC-RAS Users Manual, USACE
7. Emergency Action Planning for Dams, FEMA P-64, FEMA
8. Technical Release 60 – Earth Dams and Reservoirs, NRCS
9. Technical Release 66 – Simplified Dam-Breach Routing Procedures, NRCS
10. National Weather Service Simplified Dam Break Model
11. Federal Guidelines for Inundation mapping of Flood Risks Associated with Dam Incidents and Failures, FEMA P-946

* All references are available via the web.

Comments

- * It is recommended that the investigating engineer discuss the project with Division of Soil and Water Resources engineers prior to beginning.
- * In dam failure modeling, it is always important to keep the final use of the inundation mapping in mind.
- * Simplified methods could be acceptable if the hazard area is easily defined (isolated house or short reach). Using these methods may result in a less costly option for dam owners while still providing appropriate information for emergency personnel.
- * If isolated homes, note addresses and telephone numbers; if several homes, coordinate with county emergency management agency for documentation.
- * Contributing drainage area should be considered in the extent of the analysis for flood scenarios. As a general rule, uncertainty in the analysis rises considerably when ratio of dam drainage area to other contributing drainage areas is about 10 to 1.
- * The scale of the map must be such that homes, buildings, roads, and other features are easily identifiable. These maps are used to identify hazard and to plan evacuations therefore the hazard must be easily seen.

Common Pitfalls

- * Not including the river channel in the cross sections
- * Cross sections not reflective of overall river corridor or oriented incorrectly
- * Not modeling ineffective flow areas
- * Misplacing the failure flood peak (having the breach form significantly before or after a storm peak) or choosing a time interval that skips the peak
- * Ignoring or improperly modeling bridges (all crossing should be discussed or modeled)
- * Over-hatching or shading the inundation area on map to where the background map cannot be read.
- * Not investigating all three failure scenarios.
- * Not considering the sensitivity in dam breach parameters, and therefore under- or over-estimating peak dam failure flows.