



BACKGROUND

Dam owners, operators, regulators, city officials, emergency managers, and other stakeholders can take many proactive actions to either save a dam or minimize loss of life and property damage from a potential dam incident. The pertinent actions will depend on the situation that is unfolding. This Fact Sheet includes some examples of proactive actions that were taken during Hurricane Matthew to prepare for the event, prevent dam failure, and facilitate response efforts.

Federal emergencies or disasters are sometimes declared prior to an event actually occurring, such as for a major hurricane expected to make landfall and cause a lot of damage or casualties. When this happens, some resources otherwise unavailable might be proactively utilized to assist with response efforts.

Declaration of a Federal disaster is not needed for outside resources to be mobilized. For instance, outside resources can be mobilized through emergency management assistance compacts (EMACs) or memorandums of

understanding (MOUs) between counties or other local governments.

State and local officials can also issue mandatory or voluntary evacuation orders, when prudent and appropriate, to proactively save lives, such as for inundation zones for dam incidents that trigger Emergency Action Plan (EAP) or Emergency Operations Plan (EOP) activation for an evacuation. States can also declare a disaster and must do so prior to requesting a Federal disaster declaration.

Purpose and Intended Audience

This Fact Sheet shares examples of proactive actions taken in response to individual dam emergencies that occurred during Hurricane Matthew in 2016 so stakeholders can better understand actions they might take to reduce risks related to dam emergencies.

The intended target audience for this Fact Sheet includes federal, state, territory, and local officials; tribal leaders; county and city engineers, planners, and emergency managers; dam owners and operators; building and property owners near or potentially affected by a dam failure; and other interested stakeholders.

CONDUCT DAM INSPECTIONS

Before a major storm event, the dam owner should consider inspecting spillway gates, outlet structures, and other appurtenant structures. Where available, cameras and remote monitoring instruments should be



activated (if not auto-activated) and tested to ensure they operate as intended. Dams with a Notice of Deficiency (NOD) should receive particular attention.

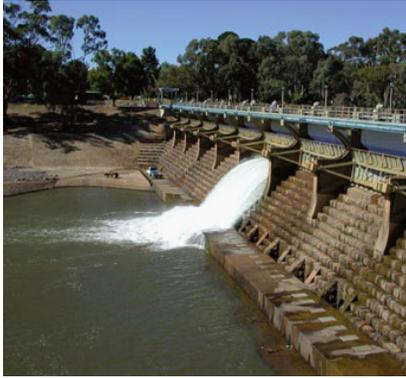
Examples of Actions Taken

Before Hurricane Matthew, the North Carolina Department of Environmental Quality Division of Energy, Mineral, and Land Resources (NC DEQ DEMLR) reviewed existing hydrologic and hydraulic studies on

dams with a NOD to determine how much rain it would take to overtop these dams. This information was used to develop a priority list of concerns before the hurricane. Prior to and during the initial stages of Hurricane Matthew,

12 two-person dam inspection teams proactively inspected North Carolina's dams of concern until road conditions became unsafe (FEMA, 2017).

DRAW DOWN THE RESERVOIR



Dam owners/operators should consider reducing the volume of the reservoir a few days in advance of an incoming storm if it can be done without flooding downstream properties. Drawing down the reservoir can be accomplished by opening gates, valves, or bottom drains or installing pumps or other measures.

Examples of Actions Taken

As the regulator for Woodlake Dam, the NC DEQ DEMLR required its owners to lower the dam's reservoir level by approximately 5 feet before Hurricane Matthew.

Because of NC DEQ DEMLR's concerns of imminent failure, the agency coordinated with the FEMA Incident Management

Assistance Team (IMAT) on potential pump operations to reduce the reservoir level. The FEMA IMAT provided NC DEQ DEMLR information on a host of potential emergency protective measures that could be taken to help save the dam, including pump sizes and quantities available, along with a "Go List" of contractors with the capability to provide timely pump delivery. NC DEQ DEMLR ordered eight pumps. The local fire and transportation departments provided logistical support for the pump contractor, enabling rapid installation and operation of the pumps.

The dam owner was successful in lowering the reservoir levels using the eight pumps and the dam's two large bottom drains. To reduce the chance of slope instability or failure from lowering the reservoir level too quickly, the reservoir level was lowered no more than 2 feet per day, per NC DEQ DEMLR instructions to the dam owner and its engineer. Additional details on the coordination and actions taken at Woodlake Dam are provided in FEMA P-1090 (2017).

OBTAIN SUPPORT FROM OTHER ENTITIES



It is often advantageous for dam owners and regulators to seek support from other local, state, and federal agencies or other entities. Other agencies and entities can supply technical and physical support.

Examples of Actions Taken

National Guard: Wilson County, NC, requested help from the National Guard

through the state emergency operations center (EOC) the night before Hurricane Matthew made landfall. Two Humvees with two teams were deployed to the County, and the National Guard assisted with evacuations.

Coordination with EOC: NC DEQ DEMLR, working with the NC EOC, coordinated to obtain various resources from the North Carolina National Guard, North Carolina Department of Public Safety, North Carolina Department of Transportation, and the FEMA IMAT to help with ongoing dam-related events. Furthermore, dams with hydrologic and hydraulic studies on file and a NOD were prioritized for post-storm Civil Air Patrol flights.

A DEMLR staff engineer was on board each aircraft to assist in identifying dams of interest and assessing those dams and their surrounding areas for situational awareness and monitoring (FEMA, 2017.)

State Incident Management Teams: Dillon County, SC, requested and received assistance from an Incident Management Team (IMT) from the South Carolina Forestry Commission. Dillon County made the request for assistance through the state EOC. The IMT assisted the County in setting up incident command and in monitoring of rivers and lakes during Hurricane Matthew.

PROCURE AND STOCKPILE MATERIALS



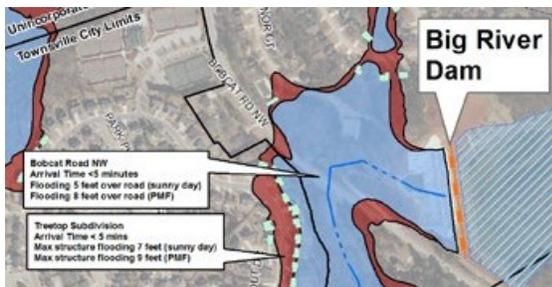
Dam owners should identify borrow sources for sand, gravel, and riprap material or have them stockpiled at the dam site. In some cases, dam owners may want to stockpile sandbags in advance of a storm event. These

materials may be required for remedial actions should seepage or erosion conditions arise.

Examples of Actions Taken

Wilson County, NC, reported that the state delivered sand bags, which were placed at the base of Lake Wilson Dam. County personnel believe the sand bags alleviated erosion of the earthen portion of the dam during and following Hurricane Matthew.

UPDATE HAZARD MODELS AND INUNDATION MAPS



Communities should consider updating their hazard models to facilitate response. The updated models can equip emergency personnel with more accurate information and help them prioritize their activities based on criticality ratings.

Examples of Actions Taken

The Wake County EOC had access to printed dam inundation zones at the time Hurricane Mathew made landfall. The mass notification system in use at that time was activated, but the areas used for mass notification were approximated based on the printed inundation zone maps.

Based on lessons learned from that event, Wake County loaded dam breach inundation

zone geospatial maps into its new mass notification system the following March (2017). In April 2017, Wake County experienced another threatened dam failure (Lewis Dam). Following the Lewis Dam event, areas used for mass notification were expanded to include all area within a land parcel, even if only a portion was in the inundation zone.

REFERENCES AND RESOURCES

References

FEMA (Federal Emergency Management Agency). 2017. *Hurricane Matthew in North Carolina Dam Risk Management Assessment Report*. FEMA P-1090.
<https://www.fema.gov/media-library/assets/documents/131866>

Resources

FEMA. 2015. *Federal Guidelines for Dam Safety Risk Management*. FEMA P-1025.
<https://www.fema.gov/media-library-data/1423661058965-58dfcecc8d8d18b7e9b2a79ce1e83c96/FEMAP-1025.pdf>

North Carolina Department of Environment and Natural Resources. 1985 (revised 2007). *Dam Operation, Maintenance, and Inspection Manual*.
https://files.nc.gov/ncdeq/Energy%20Mineral%20and%20Land%20Resources/Land%20Quality/Dam%20Safety/Dam_Operation_Maintenance_and_Inspection_Manual_rev_2006.pdf

Useful Websites

FEMA Incident Management Assistance Teams (IMATs): <https://www.fema.gov/incident-management-assistance-teams> FEMA IMATs; Meeting the Challenge video: <https://www.fema.gov/media-library/assets/videos/80254>

North Carolina Dam Safety Program: <https://deq.nc.gov/about/divisions/energy-mineral-land-resources/energy-mineral-land-permits/dam-safety>

North Carolina Department of Public Safety, Emergency Management: <https://www.ncdps.gov/our-organization/emergency-management>

North Carolina National Guard: <http://nc.ng.mil> South Carolina Dam Safety Program: <http://www.scdhec.gov/Environment/WaterQuality/DamsReservoirs/DamsOverview>

South Carolina Emergency Management Division: <http://www.scemd.org>

South Carolina Forestry Commission Incident Management Team: <https://www.state.sc.us/forest/scimt.htm>

Other Fact Sheets in this Dam Safety Series

Fact Sheet 1: Use of Emerging Technologies

Fact Sheet 2: Notification Methods

Fact Sheet 3: Benefits of Pre-Event Exercises and Training

Fact Sheet 5: Benefits of Post-Event Data Collection for Dams

The National Dam Safety Program is a partnership of the states, federal agencies, and other stakeholders that encourages and promotes the establishment and maintenance of effective federal and state dam safety programs to reduce the risks to human life, property, and the environment from dam-related hazards.

Visit the National Dam Safety Program website at <https://www.fema.gov/national-dam-safety-program> or scan this QR code.



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