

Fact Sheet: Nashville Flood After Action Report (AAR)

Key Points:

- The AAR is a process to identify the facts of what happened during the event; why they happened; and what needs to be done to improve future performance.
- This AAR reviewed 3 General Areas: Communication, Emergency Management and Water Management, of which 7 issues were identified as sustained and 20 identified for improvement.
- The Corps of Engineers is actively collaborating with the National Weather Service and other agencies. Each agency recognizes its responsibilities to forecast and communicate to the public and to each other, and are working together to improve communication by instituting new procedures during flood events.
- A Post Flood Report has been started that will detail technical hydrologic and meteorological data from the flood that will be used to improve modeling. Pending receipt of funding, the report should be complete in a year.
- The Nashville District projects and facilities have suffered \$51.3M in damages during the May Flood. The Corps is prioritizing resource allocations for repairs with the following criteria: Dam Safety/Life Safety; Infrastructure & Operational Readiness; Public Access & Safe Use; Ancillary Project Purposes; Economic Impact to Community/Region. \$3.7M in emergency funding and \$29.2M in supplemental funds will cover the first two priorities.
- Although this AAR recommends many improvements to communication, coordination, water management and operations, these improvements will not prevent another similar flood event, since much of the rainfall in May fell on uncontrolled tributaries and not on the mainstem of the Cumberland River.
- The preliminary calculation of flood damages prevented during the May Flood is approximately \$432M. These are additional damages that would have occurred if USACE projects were not in place on the Cumberland River.
- As we move forward to improve, we must remember one of the biggest lessons from any flood: Nature has the potential to overwhelm any manmade system regardless of how well it is designed, constructed, or managed.

What Happened:

- In May 2010, portions of the Cumberland and Tennessee River Basins experienced a 36-hour rainfall over twice the forecast amount that produced record flooding. The two-day storm was far greater than a 1,000-year rain event that resulted in large-scale flash flooding along the Cumberland and Lower Tennessee Rivers and tributaries.
- During this two-day event some areas received rainfall amounts that exceeded 17 inches, the highest amount in more than 140 years of record. The Nashville area received more than 13 inches of rain in 36 hours, more than doubling the previous two-day rainfall record set in September 1979.
- Three projects set pools of record and maximum water flow release records: Old Hickory, Cordell Hull and J. Percy Priest. Barkley Dam set a maximum water flow release record. Old Hickory came within 6.6 inches of overtopping the dam. Cordell Hull came within two inches of overtopping the dam.
- Much of the rain fell in areas downstream of the Corps' flood risk management projects; and so were unable to play a major role in reducing flood crests on the Cumberland. Record water flow from the Harpeth and Red Rivers, Mill Creek and numerous other tributaries flowed unchecked into the mainstem, producing the historic crests observed at Nashville, Cheatham Lock and Dam, and Clarksville.
- Although modeling of the weather forecast did not predict mainstem flooding, as a precautionary measure the Nashville District lowered pools levels on April 30 half a foot at Cordell Hull and Old Hickory Lakes, and one foot at Cheatham Lake.
- Daily communications started between the USACE and NWS on Wednesday, April 28, prior to the event, and continued through mid-May.
- There were 13 scheduled coordination calls between USACE and NWS held from April 29 through May 6, when water levels fell below the flood stage at Nashville.
- There were over 80 specifically documented instances of interagency coordination between the NWS Ohio River Forecasting Center (OHRFC), NWS Nashville, USACE LRD and USACE LRN from April 29 and May 3.
- Frequent coordination between LRN and Nashville Division of Water Pollution Control on May 3 resulted in project adjustments and Corps-supplied sandbags that saved the Omohundro Water Plant.
- The Nashville District Water Management Section and Hydropower Operators at Corps dams applied all of their experience and expertise in a dramatic flood fight. Their tireless and in some cases heroic efforts, prevented a five-foot higher crest in downtown Nashville.
- USACE and NWS have coordinated this AAR and the NWS' Service Assessment. The Corps of Engineers will continue to collaborate with the NWS as they complete their assessment.

Summarization of Lessons Learned

- The AAR issues have been grouped from Appendix B by the following categories:
 - Communication (Issues 1 through 5)
 - Emergency Management (Issues 6 through 17)
 - Water Management (Issues 18 through 27)
- Any AAR has two kinds of issues: those that need to be sustained and those needing improvement.
 - This AAR has **7 Sustains**, **20 Improves**

Communication:

1. Issue: **Improve** integration with the United States Geological Survey.
2. Issue: **Improve** internal communications before and during potential flood events.
3. Issue: **Provide** redundant communication systems.
4. Issue: **Improve** risk communication.
5. Issue: **Improve** District recall of personnel.

Emergency Management:

6. Issue: **Sustain** communications between LRN Emergency Management and the Tennessee Emergency Management Agency.
7. Issue: **Sustain** Emergency Management Operations.
8. Issue: **Improve** efficient use of ENGLink.
9. Issue: **Sustain** pre-event coordination.
10. Issue: **Sustain** response phase activities.
11. Issue: **Sustain** recovery phase.
12. Issue: **Improve** logistics response.
13. Issue: **Improve** continuity of operations for the ULA.
14. Issue: **Improve** the Logistics support plan for no-notice events.
15. Issue: **Improve** resourcing of the Logistics Planning and Response Team.
16. Issue: **Improve** logistics personnel ability to use ENGLink.
17. Issue: Develop duty descriptions for logistic team members.

Water Management:

18. Issue: **Improve** awareness of project maintenance status.
19. Issue: **Improve** triggers for activation of Water Management offices.
20. Issue: **Improve** the understanding of technical information between the Corps and the National Weather Service.
21. Issue: **Implement** redundant Water Management Enterprise Architectural (WMEA).
22. Issue: **Improve** communication between the Corps and the National Weather Service.
23. Issue: **Sustain** pre-event water management actions.
24. Issue: **Improve** awareness of the Quantitative Precipitation Forecasts.
25. Issue: **Improve** situational awareness of the National Weather Service published forecasts.
26. Issue: **Improve** long term reliability of rainfall and stream gages.
27. Issue: **Sustain** the ability to operate projects under extreme conditions.

Key AAR Take-Aways:

- The May Flood was an unprecedented extreme event far surpassing the weather forecast or any of the Nashville District's experiences with a major flood.
- Nashville District professionals responded competently, adaptively, and in some cases heroically, preventing the loss of any flood risk management projects.
- The event exposed inadequacies in the Corps' system for flood response, especially in the area of communications for which the Corps is responsible and is taking corrective action.
- Communication and coordination during extreme events must be improved between the Corps and NWS.
- A disconnect on the technical information exchange between Corps and NWS was a contributing factor to problems with flood crest forecasts.
- Water Management did an outstanding job, but technical systems can be improved and a common operating picture between the Corps and NWS can be refined.
- Nature can overwhelm any manmade system regardless of how well designed, constructed and managed.
- Improved procedures were implemented during the August high water event:
 - Improved interagency coordination.
 - Real-time project release information provided by Corps Hydropower Operators directly to NWS staff.
 - Water Management implemented 24/7 operations plan.
 - Increased information to the public through the media.