

CENTRAL REGION TECHNICAL ATTACHMENT 94-13

A STRATEGY FOR UPDATING PREFORMATTED FLASH FLOOD WARNINGS  
AND WATCHES FOR USE DURING DAM BREAK EPISODES

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1. Introduction

Central Region dam failure policy (ROML C-01-91, filed with WSOM Chapter E-20) states that the WSO or WSFO having county warning responsibility should issue flash flood warnings for the areas immediately downstream of the dam break. Additionally, the WSFO is responsible for issuing a flash flood watch, if a dam break is imminent or possible.

Historical records of dam breaks cover a broad span of time from every geographic region of the country. In Michigan, the most recent event of multiple dam breaks occurred on September 10 and 11, 1986. Over those two days, between 8 and 13 inches of rain fell over central lower Michigan. In addition to widespread flooding, 11 dams failed and 19 others were threatened, resulting in the evacuation of 1500 people downstream of these dams.

The National Weather Service plays a vital role in protecting life and property from both floods and flash floods. In Michigan there are over 2260 dams of various sizes constructed from a variety of materials. Many of these dams are nothing more than earthen barriers in remote areas, but a large number meet the criteria that define a significant dam. The ROML C-01-91 defines a dam as hydrologically significant if it is:

- 1) "25 feet or more in height from the natural bed of the stream and has a storage of at least 15 acre-feet, or
- 2) has an impounding capacity of 50 acre feet or more and is at least 6 feet above the natural bed of the stream."

In the event of a dam break, especially a break of a hydrologically significant dam, the actions of the office with county warning responsibility must be swift and accurate.

## 2. Strategy

There are several avenues that field offices can take to be ready to handle a dam break event. Generic work files can be prepared for use, and stored either in AFOS or on the ABT. The information for filling in such files during a dam break may come from several sources including the Catalog of Dams, dam break Rules of Thumb, and Emergency Action Plans.

The Catalog of Dams, which should be available in all offices, includes:

- 1) Name and location of the dam, the river on which the dam is located, and the nearest downstream town.
- 2) Dam height, storage volume, and crest length.
- 3) Reservoir storage area.
- 4) Estimated fail time and breach width.
- 5) Computed peak flow and peak depth.

The Dam Break "Rules of Thumb" can be used for quick estimates of wave height and time of arrival of the flood crest downstream.

- 1) At the dam, the maximum initial height of the flood wave will be no greater than about  $\frac{1}{2}$  the original height of the water behind the dam.
- 2) In general, except right near the dam site, a good average downstream speed of a flood wave is about 3-4 mph.
- 3) The wave height will be reduced by about  $\frac{1}{2}$  for each ten miles of travel downstream.

Emergency Action Plans are a comprehensive plan of action to be followed by public officials and dam officials following a dam break or if a dam break threatens. It contains detailed maps of the area immediately downstream of the dam, a phone tree which guides officials through the notification process, as well as specific information about the dam and reservoir.

In addition, a well developed and reliable spotter network is an invaluable asset as are good working relationships with the various law enforcement officials within the county warning area (CWA). The nearest downstream town(s) which will be affected by the flooding can be determined from detailed topographic maps.

In the most ideal situation there would be complete preformatted watches and warnings for each dam within the CWA requiring only the insertion of expiration and issuance times and the date. In fact, the ROML C-01-91 states that "preformatted warning messages should also be ready for use". Preformatted messages allow the person on duty to fill-in only the pertinent times and



dates, giving them a product which can be disseminated in less than a minute. In Michigan, preformatted warnings and watches have been written for the dams for which Emergency Action Plans (E.A.P.) have been written.

Constructing preformatted watches and warnings began with a basic work file (Figure 1) then verifying and filling in most of the information which would normally have to be looked up in real time. Included in the information is the source of the report, the name of the dam, the location (both the general geographic area and specific county), the name of the associated river, the county FIPS codes, and the downstream communities which may be threatened by the dam break.

A notable omission from the warnings are the computed peak depth and computed travel time of the crest. There are instances where the catalog of dams is not accurate because of the assumptions made in these calculations. It was decided that this type of information can be included in a follow-up statement, after real-time spotter reports are received. The most important thing is to get a basic warning onto the weather wire as quickly as possible.

Superwriter has been used for writing the preformatted messages in Michigan. The purpose of using Superwriter instead of a more sophisticated word processing program was that the files would be compatible with the ABT computers in most offices. Upon completion, these files can be downloaded to the ABT computers, and stored in a special file called "DAMS".

The Emergency Action Plans (E.A.P.) provide a wealth of information including the location of the dam, the name of the river on which the dam is located, and the most likely source of the initial report. The most likely source was assumed to be the agency or person immediately preceding the NWS on the phone tree. County FIPS codes were verified from the severe weather chart at WSFO DTX.

The most important step may also be the most time consuming. It is vital to the success and credibility of this NWS mission that the towns immediately downstream be correctly identified and included. In some cases, the areas downstream are relatively uninhabited, but include state or national park land that can support hiking or camping. This information was taken from the E.A.P.'s and the U.S.G.S. topographical maps of Michigan.

Using this information, warning files can be created, including nearly complete headers (Figure 2). In addition to the above information, a strong call-to-action was inserted. The warnings were then stratified by individual WSOs and copied onto floppy disks. The floppy disks and hard copies of the warnings were distributed to the OIC/MIC of each office on September 15, 1993 at the Michigan state meeting.

FIGURE 1

ZCZC ARBFFWXXX  
ETTAA00 KARB DDTTTT  
MICXXX-DDTTTT-

BULLETIN...IMMEDIATE BROADCAST REQUESTED/EBS ACTIVATION REQUESTED  
FLASH FLOOD WARNING  
NATIONAL WEATHER SERVICE \_\_\_\_\_ MI  
ISSUED BY NATIONAL WEATHER SERVICE DETROIT/PONTIAC MI  
\_\_\_ \_M E\_T \_\_\_ \_ 1993

...DAM FAILURE...AAAA DAM...ON THE BBBB RIVER...

THE NATIONAL WEATHER SERVICE HAS ISSUED A FLASH FLOOD WARNING  
EFFECTIVE UNTIL \_\_\_ \_M E\_T FOR THE PEOPLE IN THE CCCC MICHIGAN  
COUNTY OF DDDD...DOWNSTREAM OF THE AAAA DAM...ON THE BBBB RIVER.

A FLASH FLOOD WARNING MEANS FLOODING IS IMMINENT OR HAS BEEN  
REPORTED. MOVE TO HIGHER GROUND IMMEDIATELY.

AT \_\_\_ \_M THE (SOURCE OF INFORMATION I.E. EEEE) REPORTED THAT  
THE AAAA DAM LOCATED IN DDDD COUNTY...ON THE BBBB RIVER...HAD  
FAILED.

THE NEAREST DOWNSTREAM TOWN IS FFFF LOCATED GGGG MILES FROM THE  
FAILED DAM. PEOPLE IN THE LOW LYING AREAS BELOW AAAA DAM SHOULD  
MOVE TO HIGHER GROUND IMMEDIATELY. DO NOT ATTEMPT TO DRIVE  
ACROSS FLOODED ROADWAYS.

FURTHER STATEMENTS WILL BE ISSUED AS MORE INFORMATION BECOMES  
AVAILABLE.

...NAME/INT...

NNNN



FIGURE 2

ZCZC ARBFFWGRR  
ETTAA00 KARB DDTTTT  
MIC077-DDTTTT-

BULLETIN...IMMEDIATE BROADCAST REQUESTED/EBS ACTIVATION REQUESTED  
FLASH FLOOD WARNING  
NATIONAL WEATHER SERVICE GRAND RAPIDS MI  
ISSUED BY NATIONAL WEATHER SERVICE DETROIT/PONTIAC MI  
\_\_\_ \_M E\_T \_\_\_ \_ 1993

...DAM FAILURE...MORROW DAM...ON THE KALAMAZOO RIVER...

THE NATIONAL WEATHER SERVICE HAS ISSUED A FLASH FLOOD WARNING  
EFFECTIVE UNTIL \_\_\_ \_ E\_T FOR THE PEOPLE IN THE SOUTHWEST LOWER  
MICHIGAN COUNTY OF KALAMAZOO...DOWNSTREAM OF THE MORROW DAM...ON  
THE KALAMAZOO RIVER.

A FLASH FLOOD WARNING MEANS FLOODING IS IMMINENT OR HAS BEEN  
REPORTED. MOVE TO HIGHER GROUND IMMEDIATELY.

AT \_\_\_ \_M (SOURCE OF INFORMATION I.E. KALAMAZOO COUNTY SHERIFF  
DEPARTMENT) REPORTED THAT THE MORROW DAM LOCATED IN KALAMAZOO  
COUNTY...ON THE KALAMAZOO RIVER...HAD FAILED.

THE NEAREST DOWNSTREAM TOWN IS COMSTOCK LOCATED 1 MILE FROM THE  
FAILED DAM. DOWNSTREAM FROM COMSTOCK IS LAKEWOOD...LOCATED 2  
MILES FROM THE FAILED DAM. THE CITY OF KALAMAZOO IS LOCATED  
3 1/2 MILES DOWNSTREAM FROM THE FAILED DAM.

PEOPLE IN LOW LYING AREAS BELOW MORROW DAM SHOULD MOVE TO HIGHER  
GROUND IMMEDIATELY. DO NOT ATTEMPT TO DRIVE ACROSS FLOODED  
ROADWAYS.

FURTHER STATEMENTS WILL BE ISSUED AS MORE INFORMATION BECOMES  
AVAILABLE.

...NAME/INT...

NNNN

For warning purposes, WSFO Detroit/Pontiac is the primary backup for  
the WSOs in Michigan. By adding the line "ISSUED BY NATIONAL  
WEATHER SERVICE DETROIT/PONTIAC MI" to the header, a set of files was  
also created for the WSFO. Having these preformatted warnings are especially  
useful to forecasters who are often not as familiar with the affected area as local  
weather service employees.

In addition to the warnings for the WSFO, a set of watches was written to include all of the above information (Figure 3). This is useful to the WSFO since they have the primary responsibility for flash flood watches within the state of Michigan. When the forecast office receives a call that a dam is weakened, the forecaster on duty need only fill in the expiration time in the UGC code line, the time and date in the header, and the expiration time in the body of the text, and transmit the message.

FIGURE 3

ZCZC ARBFFAARB  
ETTAAOO KARB DDTTTT  
MIC077-DDTTTT-

BULLETIN - IMMEDIATE BROADCAST REQUESTED  
FLASH FLOOD WATCH  
NATIONAL WEATHER SERVICE DETROIT/PONTIAC MI  
\_\_\_ \_M E\_T \_\_\_ \_\_\_ 1993

...A POTENTIALLY HAZARDOUS SITUATION IS DEVELOPING...MORROW  
DAM...ON THE KALAMAZOO RIVER...IS (STRUCTURALLY WEAK/NEAR  
CAPACITY)...

THE NATIONAL WEATHER SERVICE HAS ISSUED A FLASH FLOOD WATCH  
EFFECTIVE UNTIL \_\_\_ \_M E\_T FOR THE PEOPLE IN THE SOUTHWEST LOWER  
MICHIGAN COUNTY OF KALAMAZOO...DOWNSTREAM OF THE MORROW DAM...ON  
THE KALAMAZOO RIVER. A FLASH FLOOD WATCH MEANS RAPIDLY RISING  
WATER OR FLOODING IS POSSIBLE WITHIN THE WATCH AREA.

IT HAS BEEN REPORTED BY THE (SOURCE OF INFORMATION I.E. KALAMAZOO  
COUNTY SHERIFF) THAT THE MORROW DAM LOCATED IN KALAMAZOO  
COUNTY...ON THE KALAMAZOO RIVER...IS (STRUCTURALLY WEAK/NEAR  
CAPACITY). PEOPLE BELOW THE DAM SHOULD BE ALERT TO THE  
POSSIBILITY THAT THE DAM COULD FAIL. DAM SAFETY EXPERTS IN  
COORDINATION WITH THE STATE AND LOCAL EMERGENCY SERVICES ARE  
MONITORING THE DAM AND WILL ISSUE A PUBLIC STATEMENT AS SOON AS  
AN INSPECTION IS COMPLETED.

IN THE MEANTIME...PEOPLE BELOW THE DAM SHOULD BE READY TO  
EVACUATE IMMEDIATELY. THE NEAREST DOWNSTREAM TOWN IS COMSTOCK  
LOCATED 1 MILE DOWNSTREAM OF MORROW DAM. DOWNSTREAM FROM  
COMSTOCK IS LAKEWOOD...LOCATED 2 MILES FROM THE THREATENED DAM. THE  
CITY OF KALAMAZOO IS 3 1/2 MILES FROM THE MORROW DAM.

PLAN NOW SO YOU WILL KNOW WHAT TO DO IN AN EMERGENCY. BY ALL  
MEANS...KEEP INFORMED ON THE STATUS OF THE DAM/S CONDITION BY  
LISTENING TO LOCAL RADIO AND TELEVISION FOR LATER STATEMENTS AND  
POSSIBLE WARNINGS. FOLLOW THE ADVICE OF PUBLIC SAFETY OFFICIALS.

FURTHER STATEMENTS WILL BE ISSUED AS MORE INFORMATION BECOMES  
AVAILABLE.

...NAME/INT...

NNNN

3. Summary

By using 1) a basic watch and warning skeleton, 2) an easy to use word processing program, and 3) information compiled from a number of sources, the offices in Michigan have been able to meet the basic requirements set forth by ROML C-01-91.

4. Acknowledgements

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5. Reference

Regional Operations Manual Letter, 1991: Dam Failure Policy, C-01-91, filed with WSOM Chapter E-20. Central Region National Weather Service, Kansas City, MO