

RECORDING FLOODS AND FLOOD DAMAGE

Walter Hofmann, U.S. Geological Survey

●RATHER THAN try to cover the whole gamut of both federal and state agency responsibilities for recording floods and flood damage, I will limit this paper to the activities that are the responsibility of the U.S. Geological Survey. The fact is the Geological Survey has very little responsibility for the flood damage side of recording

As part of its basic mission, the Geological Survey has the responsibility for recording the stage, discharge, and areal extent of floods. This information provides hydrologic data for many purposes. Typical uses of hydrologic data on floods are for flood-frequency analysis, economic design of structures in and adjacent to the riverine system, land use planning and management (particularly management of the floodplain), emergency planning and evacuation, and flood warning systems. In addition, in recent years, special data needs have developed for the operation of the National Flood Insurance program. Information also is needed for post-flood rebuilding and zoning, and to an extent for damage and loss assessment.

Major floods are documented by collecting data in the field and then by reporting the data so that they are available to those who need the information. I would like to discuss these two activities separately.

The criterion for the data to be collected is that they must describe the stage and magnitude of the flood at the gauged points and at miscellaneous sites that may be of specific interest to action agencies, federal, state, and local, insofar as resources permit. Also the areal extent of the flooding should be delineated through field surveys and photogrammetrically.

At gauge sites, we operate a continuous water stage record and make periodic discharge measurements, generally a relatively inexpensive procedure. However, during extreme floods, collecting records of stage and discharge can be extremely difficult. In the Hurricane Agnes floods, we lost several of the gauging stations in the area.

In addition to gauges washing out, many become inaccessible because of flooding. The bridges and roads leading to the gauge wash out, and we cannot get there in time to measure the peak discharge with a current meter. This in turn requires indirect measurements of the peak discharge, and these are expensive. They not only are expensive and time-consuming, but require experienced people to make the surveys. For the Agnes floods we detailed about 45 or 50 people from various parts of the United States who had this expertise for periods up to 3 months. For the Rapid City flood we made 19 indirect measurements and for the Agnes floods about 320. The added cost for the additional measurements and other data collection activities was about \$0.5 million. This does not include the cost of replacing destroyed gauging stations.

Whereas the U.S. Army Corps of Engineers had \$50 million for their Agnes flood activities, the Geological Survey was not so fortunate. Our reserves for special flood activities at the beginning of the fiscal year were \$75,000. The last of the reserve was allocated for earlier floods; so, when Agnes hit, there had to be a major reprogramming and redirection of funds from the remainder of our program. This was not sufficient to do everything that we wanted to do, but I think the essential work was accomplished. We did have financial support from the Corps of Engineers for some of the things they were primarily interested in. We also obtained support from the states for the replacement of gauging stations that were in the cooperative program.

To record the areal extent of flooding, we relied principally on aerial photography. It is a fairly standard procedure that, during major floods, our district offices contract with a local aerial photography firm to fly the river as close to flood stage as possible to give us a photographic record of the extent of flooding during the peak. This works

out well if the weather permits, but frequently during a flood situation there is cloud cover, rain, and heavy winds, which limit both flying and adequate photography.

We obtained aerial photography for the Rapid City flood, but this area was not flown until 2 days after the peak. The peak for this flood was quite rapid, and the photography was of little value in delineating the inundated area. Therefore, field surveys were necessary. We did get good photographic coverage for Hurricane Agnes floods in Virginia, Maryland, and southern Pennsylvania. Very little was obtained in northern Pennsylvania and New York because of weather conditions.

Another constraint on flying is the problem of air traffic. For example, we could not fly along the Potomac River in the vicinity of National Airport. Thus, the photographic coverage of the Potomac only went as far downstream as Key Bridge.

The preceding are some of the factors involved in the collection of data. Probably as important or even more important is the dissemination of the information and data collected. To do a better job, we tried to get some input from the users of our information at the time of the Hurricane Agnes floods. Geological Survey staff members went to Richmond, Harrisburg, and a few other places to talk to planners and managers to see what type of information would be most helpful to them. We did not get much response, so we are continuing to do what we have done in the past with some modifications. However, I think this group could be a real help to us by suggesting the type and timeliness of their information and data needs and also by suggesting what we could do to get our information out better and faster. There is considerable cost involved in the collection and dissemination of data, so we want to be as efficient as possible in furnishing the data needed.

In the past for major floods, we have published the information in the Water Supply Paper (WSP) series. These reports include a description of the flood, information on the meteorology, some analysis of flood-frequency relations, some comparison with previous floods, and a tabulation of stage and discharge at various time intervals covering the flood peak. The problem with the WSP publication is that it is not available until a considerable time after the event. This serves the important need for historical documentation. However, we do like to get out some quick releases at the state level; these provide the magnitude of peak stages and discharges. These are usually released 2 to 3 weeks after the event and are available at district offices.

To depict the areal extent of the flooding, we have recently attempted to produce photo mosaics based on aerial photography. These are available 3 to 4 weeks after an event and can be purchased as photocopy or as an ozalid print. For the Agnes flood our coverage of various rivers was quite good. (In the last year there has been a real effort to better coordinate the operations of the National Weather Service, NOAA, and the Geological Survey, Water Resources Division, in terms of flood activities. Some inter-agency committees have been formed. We have established an individual in each to serve as flood coordinator so the activities of each agency will be better coordinated.)

For the Rapid City flood we are preparing a joint report with NOAA to include the meteorological information, the magnitude and frequency of floods, and all the stream flow data in one report. Also we are publishing a Hydrologic Atlas that shows the areal extent of flooding. A joint report also is planned for the Agnes floods. This is still in the planning stage, but we are requesting our districts to assemble the information that will be included in this report.

As I said the areal extent of the Agnes floods has been reported and I doubt whether we can do much more. We have several sets of uncontrolled photo mosaics for the James, Potomac, and Susquehanna Rivers and some tributaries. The scale of these mosaics ranges from 1:5,000 to 1:12,000; these were completed in 1 month and made available to the public as they were completed. In addition to these photo maps, we prepared some flood inundation maps, directly on quadrangle sheets, based on field surveys. These will be published as hydrologic atlases.

In conclusion, I would like to reiterate that we could do a better job of providing the information you need if we had a better understanding of what those needs are, in terms of both the type of data and the timeliness of the data need. Our present program was developed in response to user comments and needs, but we always welcome additional comments and suggestions.