

CRH SSD
APRIL 1992

CENTRAL REGION TECHNICAL ATTACHMENT 92-09

AN UNUSUAL FLOOD ALONG THE WHITE RIVER IN SOUTHERN INDIANA

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1. Background

The people of Spencer in Owen County, as well as many others in Indiana, suffered during the late December 1990 and early January 1991 flooding. Flooding was made worse by very cold temperatures that followed a heavy rain event. Ice up to 12 inches thick occurred along portions of the White River's broad flood plain. Long-time river residents stated that the last similar occurrence they could remember was the January 1930 flood. The very cold temperatures also caused a river phenomenon unusual along rivers in southern Indiana.

2. Antecedent Conditions

The weather in Owen County had been wet and mild in early and middle December. Lowland flooding had occurred along the White River during the third week of the month. A strong polar outbreak dropped the temperature to zero (0° F) on the day before Christmas. (Figure 1). The cold air caused the ground to freeze and allowed the river to return to half bankfull (Figure 2).

Snow of about six inches blanketed Owen County on December 27. This snow and the snow just before Christmas brought the water equivalent of the snow pack to 3/4 to 1 inch. Conditions were ideal for a flood. All that was needed was a rapid thaw and generous amounts of rain.

3. The Flood Event

Snow in Owen County melted overnight on the 28th as temperatures soared into the 50s (Figure 1). Rain moved into Owen County by the afternoon of the 29th. When the rain ended, the cooperative observer at Spencer measured slightly over three inches by the afternoon of the 30th. Other locations immediately upstream of Owen County had received slightly more than four inches of rain.

Almost all of the melted snow and rain ran directly into the streams and the White River of Owen County. The hydrograph (Figure 2) shows a meteoric rise beginning around noon on the 29th and

culminating with a sharp crest on New Year's Eve. That crest at Spencer was the highest since the record flood of March 1913.

4. The Ice Effect

During this large flood event in Owen County, the temperature had changed from nearly tropical to nearly arctic (Figure 1). The temperature had plunged from a high of 60° F on the 29th to a low of 7° F on the 31st. Very cold air remained through January 4.

Warm temperatures had lasted about two days. The underlying ground had little time to warm and quickly refroze. Floodwaters were only slightly above freezing. The very cold air thus caused a great deal of ice formation along the slow moving portion of the White River flood plain.

A close look at the enlarged hydrograph (Figure 3) reveals the effect of ice on the river beginning late on December 31 and continuing until midday on January 4. A sawtooth/wavy trace is evident as the ice forced the water upwards. Although some ice may have been affecting the well house, the local river observer reported this effect to our office on January 4, stating that the river was "surging". Because the river was so high, local residents observed this for more than two days. Overall, this phenomenon lasted for three days. Naturally, such a strange movement caused concern to flooded residents. Some thought the river was going to rise again and cause more flooding.

5. The Explanation

In slow moving water along rivers in the cold climates ice that forms expands and decreases the water carrying capacity of the stream. Because liquid water is incompressible, the depth increases as a result of reduced cross sectional area. During the flood event of Owen County, the cold conditions caused this effect to occur in southern Indiana when water velocities slowed near and after crest passage.

Typically, there are two crests on the White River in Owen County. The first occurs from local waters in west central and central Indiana. A second crest arrives about 2 1/2 days later from water in east central Indiana and/or another storm passage. Although a second crest is not indicated on the hydrograph in Figure 3, a slowed recession is shown on the 2nd and 3rd.

6. The Ice Effect Ends

As the air temperature warmed on January 4 (Figure 1) the ice formation ceased. At the same time the upstream water from east central Indiana passed. The river dropped nearly as fast as it rose (Figure 2). This brought an end to a phenomenon most common on slow-moving rivers in cold climates. It was very unusual for southern Indiana.

7. Acknowledgements

The author wishes to thank the U.S. Geological Survey for stage data for the White River at Spencer, the National Climatic Data Center for temperature data at Spencer and the cooperative weather observer of Spencer, Shelly Edwards, who first noticed this phenomenon.

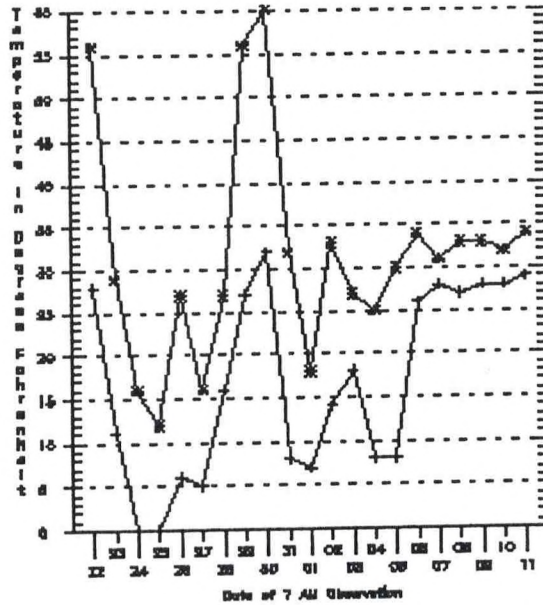


Figure 1. Daily maximum and minimum temperatures at Spencer, IN from December 22, 1990 - January 11, 1991.

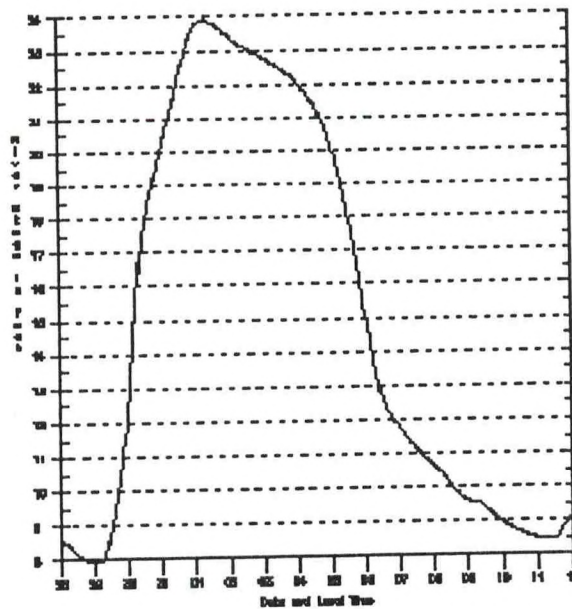


Figure 2. Hydrograph for the White River at Spencer, IN for December 28, 1990 - January 12, 1991.

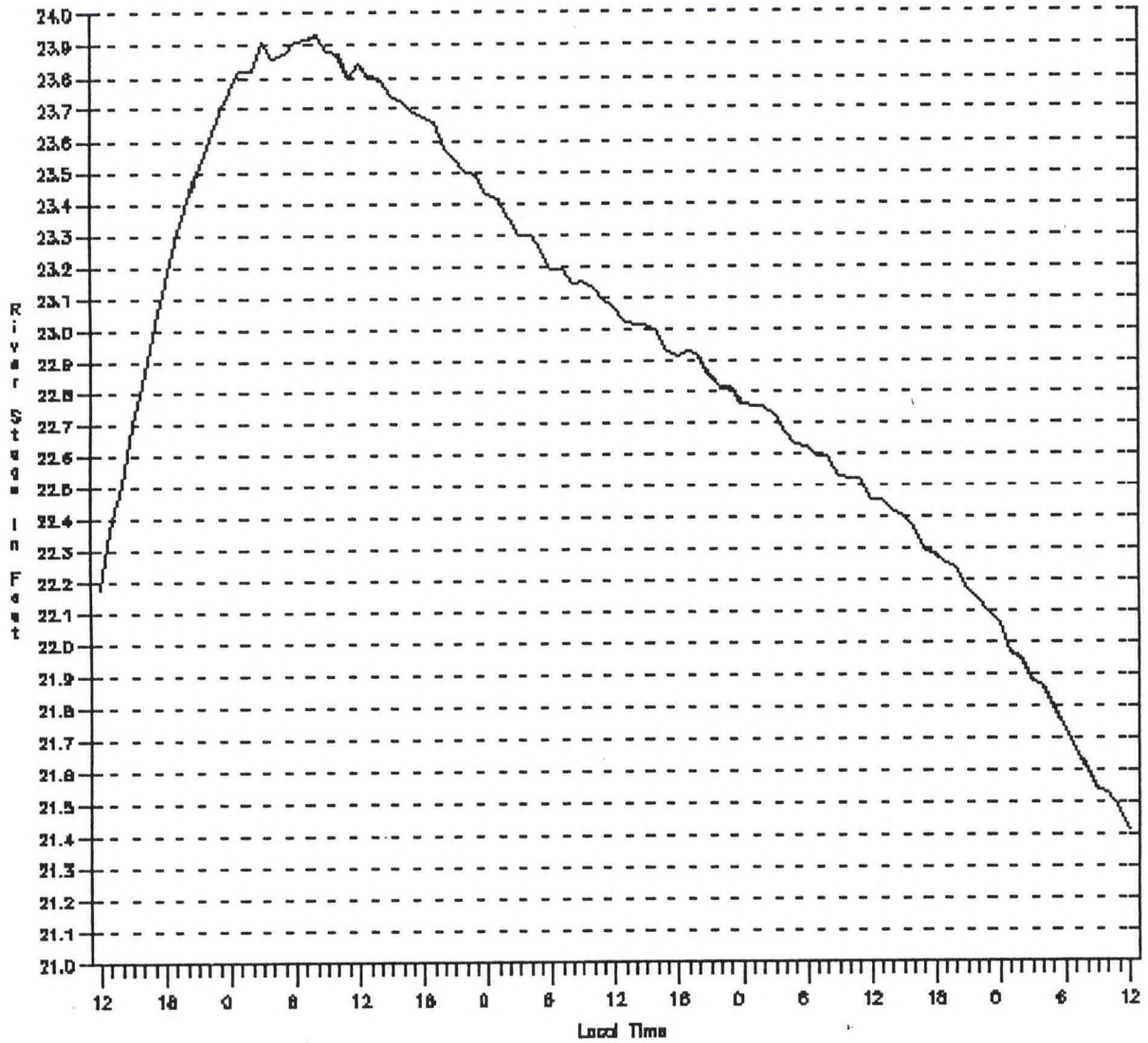


Figure 3. Detailed hydrograph for the White River at Spencer, IN from noon LST, December 31, 1990 to noon LST, January 4, 1991.