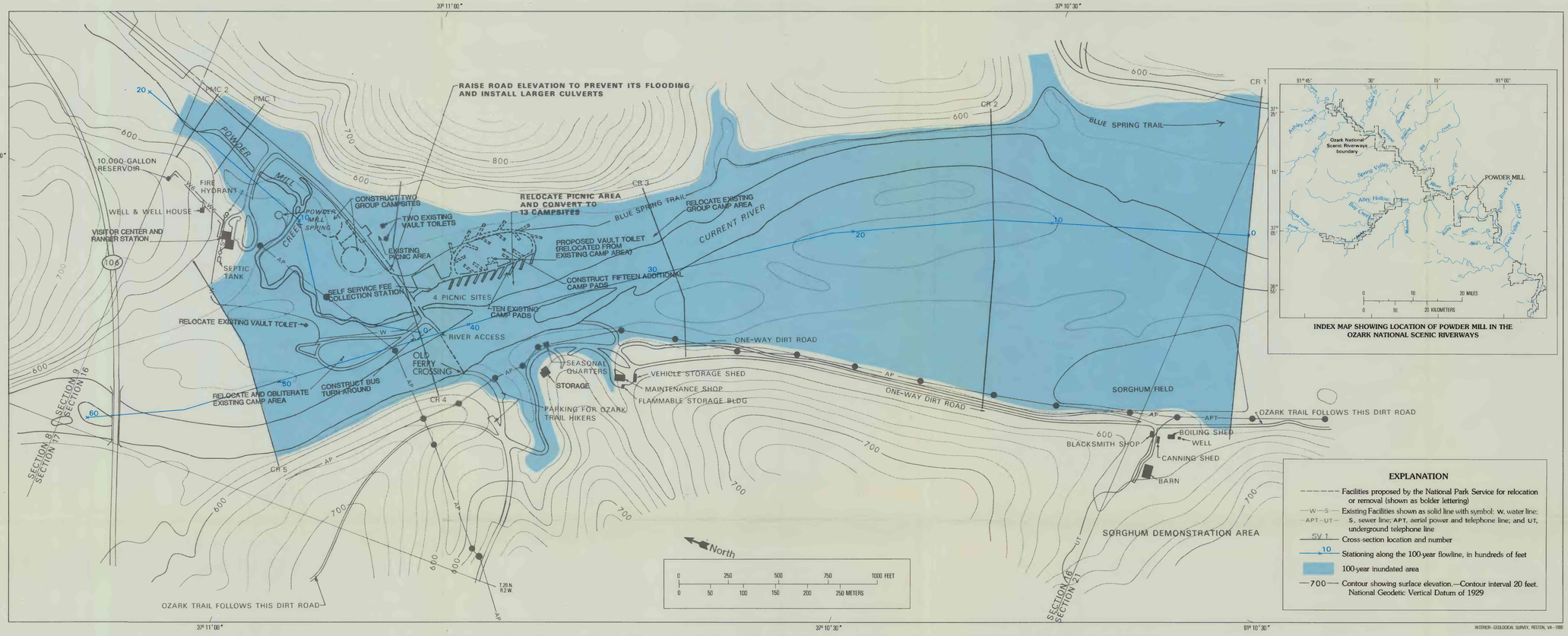


Figure 11. Location of existing and proposed Powder Mill developments during 1986, valley cross sections, and delineation of the area inundated by the 100-year flood discharge.

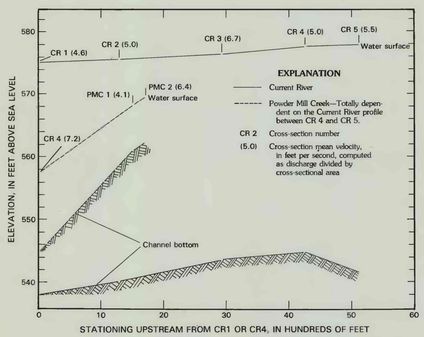


Figure 12. Water-surface profile for the 100-year flood discharge on Powder Mill Creek and the Current River.

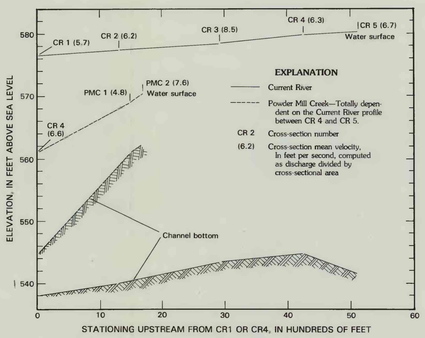


Figure 13. Water-surface profile for the 500-year flood discharge on Powder Mill Creek and the Current River

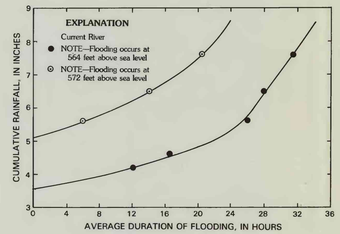


Figure 14. Relation between duration of flooding at the sorghum field and cumulative rainfall throughout Current River Basin.

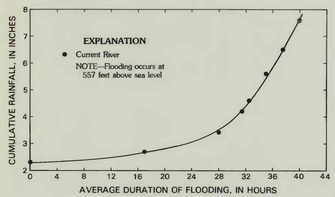


Figure 15. Relation between duration of flooding at the old ferry crossing and cumulative rainfall throughout Current River basin.

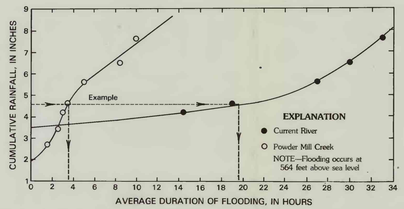


Figure 16. Relation between duration of flooding at Powder Mill Spring and cumulative rainfall throughout Powder Mill Creek and Current River basin.

POWDER MILL

The Ozark National Scenic Riverways development of Powder Mill is located at Powder Mill Spring and near the Current River old ferry crossing downstream of State Highway 106 (fig. 11).

During the peak season (summer months), two popular visitor attractions are blacksmithing demonstrations and making sorghum molasses, both examples of practices used in the past. Other attractions include single-family and group campsites which are partially located on the first terrace (low elevation) of the Current River valley section. This area is prone to flash flooding from both Powder Mill Creek and the Current River (fig. 11). A detailed flood analysis at Powder Mill, in conjunction with the study-area hydrologic analysis (sheet 1), will assist the National Park Service in evaluating all flood-hazards associated with existing or proposed developments.

FLOOD ANALYSIS

The Current river drainage area is 1,340 mi² (including Powder Mill Creek) with 5.2 mi² of area drained by Powder Mill Creek. The 100- and 500-year flood discharges are 5,600 ft³/s and 8,000 ft³/s for Powder Mill Creek; and 115,000 ft³/s and 160,000 ft³/s for Current River (figs. 2–3, sheet 1). Five valley cross-sections (CR1–CR5) on the Current River and two valley cross-sections (PMC1–PMC2) on Powder Mill Creek were field surveyed at intervals that are as uniform in channel geometry and valley cross section roughness as practical. The Current River sections are referred to a zero station measured from the most downstream Current River valley cross-section number CR1; whereas, the Powder Mill Creek sections are referred to a zero station measured from the Current River valley cross-section number CR4 (fig. 11). These data were used in the step-backwater method (Shearman, 1976) to compute the 100- and 500-year water-surface profiles, as shown in figures 12 and 13. Elevations computed for the 100-year water-surface profile on Powder Mill Creek are significantly less than those computed for the Current River (fig. 12; therefore, only the Current River water-surface profile was necessary to delineate the flooded area on Powder Mill Creek and Current River shown on figure 11.

The average basin lag for flood-peak discharges within the Powder Mill development is 1.5 hours on Powder Mill Creek (5.2 mi²) and 24 hours on the Current River (1,340 mi²; fig. 4, sheet 1).

Most Powder Mill visitor facilities are situated on the first terrace above the main-channel banks and are subject to flooding from Powder Mill Creek and the Current River. For this reason, a duration-of-flooding analysis at selected locations is an important consideration in the development of a flood-warning system that could provide adequate time to evacuate Powder Mill visitors. Two facilities on the Current River (old ferry crossing and the sorghum demonstration area) and one on Powder Mill Creek (Powder Mill Spring) were selected for analysis (D.C. Stubblefield, National Park Service, oral commun., 1986) using the HEC-1 model (U.S. Army Corps of Engineers, 1982) that transforms excess basin rainfall using duration-frequency data developed by the National Weather Service (Hershfield, 1961) into elevation hydrographs. An elevation-duration curve can be determined for each facility based on these elevation hydrographs. The cumulative rainfall-duration relations (figs. 14–16) give the duration, in hours, that the flood-elevation hydrographs at each facility equal or exceed the ground elevation at which local flooding occurs. The average duration of flooding for each of these three facilities can be estimated by using cumulative rainfall, in inches, and figures 14 to 16.

EXAMPLE

During periods of excessive rainfall within the Ozark National Scenic Riverways, a possible flood-alert situation may develop. The following is an example of the potential flooding within the Powder Mill development:

Description of hypothetical storm

Rainfall began throughout the Current River and Powder Mill Creek basins upstream from the development at Powder Mill on the evening of day 1 about 2100 hours (9 p.m.); the morning of day 2, it had stopped raining by 0700 hours (7 a.m.), with an cumulated rainfall of 4.5 in. It was noted by the National Park Service personnel that the more intense rainfall occurred around 0200 hours (2 a.m.) of day 2.

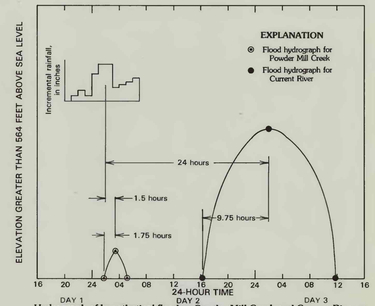
Problem

Assuming this hypothetical rainfall condition, what would be the average potential flooding expected from Powder Mill Creek and Current River at Powder Mill Spring?

Solution

The Powder Mill Creek drainage area is 5.2 mi² and has an average basin lag time of 1.5 hours, whereas the Current River drainage area is 1,340 mi² (including Powder Mill Creek) with an average basin lag time of 24 hours (fig. 4, sheet 1). Using 0200 hours (2 a.m.) as the assumed center of mass of effective rainfall, the expected peak-flood elevation and discharge would occur on day 2 at 0330 hours (3:30 a.m.) on Powder Mill Creek and 0200 hours (2 a.m.) of day 3 on the Current River. From figure 16, the average duration of flooding above 564 ft (elevation above which flood damage may occur) at Powder Mill Spring is 3.5 hours for Powder Mill Creek and 19.5 hours for the Current River.

From these data, the flood hydrographs can be estimated for the Hypothetical 4.5 in. rainfall as shown below.



Hydrograph of hypothetical flood on Powder Mill Creek and Current River at Powder Mill Spring.

Results

The average potential for flooding at Powder Mill Spring would be from 0145 hours (1:45 a.m.) until 0515 hours (5:15 a.m.) of day 2, and again at 1615 hours (4:15 p.m.) on day 2 until 1145 hours (11:45 a.m.) of day 3.

Powder Mill

DELINEATION OF FLOODING WITHIN THE OZARK NATIONAL SCENIC RIVERWAYS IN SOUTHEASTERN MISSOURI—ROUND SPRING AND POWDER MILL

By
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1990