10335080 Humboldt River Tributary near Rye Patch, Nevada

(Miscellaneous ungaged site in the Humboldt River basin, USGS Nevada Water Science Center)

Review of peak discharge for flood of May 31, 1973

Location: This flood was located about 20 mi northeast of Lovelock, Nev., at 40.4196 N and 118.2573 W.

Published peak discharge: The published peak discharge for this flood is 8,870 ft^3/s and was rated fair. The peak discharge should be downgraded to estimate. The discharge published in Moosburner (1978), written in cooperation with the Nevada State Highway Department, is 8,940 ft^3/s and is thought to be a typographical error. The original hand-calculated discharge was 8,960 ft^3/s, but minor errors discovered in review reduced the discharge to 8,870 ft^3/s.

Drainage area: The drainage area, as originally planimetered from the 1:24,500-scale Oreana and Unionville quadrangle maps, is 0.85 mi^2.

Data for storm causing flood: The storm was reported by Patrick Glancy (USGS retired) to be an area-wide storm with intense inner cells that produced high runoff from several basins draining the west-facing slopes of the Humbolt Range. This is a sparsely populated area, and precipitation data may be available only at Rye Patch Reservoir, about 25 mi north of the slope-area measurement site. Precipitation data were not available for this review. Historical photographs taken after the May 31, 1973, flood and during 2003 review and described herein are provided in figures A106–A118.

Method of peak discharge determination: A four-section slope-area measurement was run on June 6, 1973, at a site selected by Howard Matthai and Lynn Harmsen (USGS). The reach is straight, high-gradient, and all flow was confined to one channel. The high-water profiles are well defined by an appropriate number of high-water marks, but wash and debris lines were fair to poor. Sheet flow over the length of the canyon, described as "side hill wash," reduced the quality of many high-water marks. Fall through the reach is almost 30 ft in the 400 ft length from sections 1 to 4. The bed consists of sand, gravel, and cobbles with scattered large boulders. Bedrock is exposed at section 3 and may underlay the entire reach with only a thin veneer of erodible sediment. Flow is reported to have extended about 0.25 mi across the flat outflow plain causing closure of Interstate Highway 80. The outflow plain is littered with huge boulders (Volkswagen size) that are evidence of past major floods.

The cross sections are nearly trapezoidal, fairly uniform in size and shape, and correctly located. There is no evidence of significant downcutting in the reach. The exposed bedrock indicates that the channel is fairly stable. Sections 1–3 were not subdivided. Section 4 was subdivided on the basis of shape because of a small shallow area on the left bank. A Manning's roughness coefficient of 0.032 was used for the entire reach with the exception of the small shallow subarea at section 4. A value of 0.065 was used for this subsection. These values seem reasonable based on depth of flow, bed-material size, and the lack of any significant bank irregularities. Main channel velocities were calculated to be just over 30 ft/s and Froude numbers ranged from 2.2 to 2.8, which appear unreasonably high.

Slides taken by Patrick Glancy (USGS retired) documenting this flood show extensive erosion scars in the upstream part of the basin. The flood transported a large amount of sediment through the reach after this flood as evidenced by extensive fresh deposits of sediment on the shallower gradient receiving river downstream of the mouth of the canyon.

A slope-area measurement for runoff from the same storm was made about 1 mi south at Rocky Canyon near Oreana, Nev. The reach at that site was poor, and the runoff profiles were erratic with evidence of several feet of extremely high elevation. The discharge was 14,400 ft^3/s from the 4.05 mi^2 drainage basin with a unit runoff of 3,550 $(ft^3/s)/mi^2$. A slope-area analysis in the same basin, 1.1 mi upstream of the mouth of Rocky Canyon, yielded a peak discharge of 683 ft^3/s from a 3.02-mi^2 drainage basin. The unit discharge at this site was 228 $(ft^3/s)/mi^2$. These two indirect measurements demonstrate the wide range in unit runoff in a small area as a result of storms with high-intensity cells.

Possible sources of error: The most probable source of error is selection of roughness coefficients for steep-gradient streams with movable beds. The roughness coefficients used are consistent with verified values for streams with similar bed material and gentler slopes. The drainage area is small so any error in location or drainage boundary will have a significant effect on unit discharge. The 30-ft/s velocities and high Froude numbers (2.2–2.8) are a concern, but with steep slopes and shallow depths (about 6 ft), they may be realistic. These values are comparable to those computed for other steep-gradient streams in arid and semiarid regions. The stream moved a lot of sediment, but there is no evidence that this was a debris flow, although there may have been hyperconcentrated flow.

Recommendations of what could have been done differently: This slope-area measurement is correctly done, and the reach is about as good as any in this environment. A second indirect measurement could have been made farther up the canyon or in one of the tributary canyons to verify the high unit discharge, particularly when the slope area in Rocky Canyon produced a much smaller unit runoff. Precipitation data may have been helpful in adding validity to the runoff, but there may not have been much data available.

Site visit and review: The site was visited on July 30, 2003, by John Costa (USGS Office of Surface Water), Patrick Glancy (USGS retired), Kerry Garcia (USGS Nevada Water Science Center), and Gary Gallino (USGS retired). The site was approximately located by Kerry Garcia and Bob Burrows (Nevada Water Science Center) about a week earlier and saved valuable field time. The original cross-section stakes and hubs were found, and GPS readings of latitude and longitude were taken to positively locate the reach. These readings will be used with the most recent topographic map to check the drainage area. The reach appears to have changed very little when compared to slides taken shortly after the flood. Extensive side-hill erosion scars are evident in the upstream part of the basin and are visible in stereo slides taken by Patrick Glancy documenting the flood.

Recommendations: The original peak discharge of 8,870 ft^3/s should be accepted as published and the rating should be downgraded to "estimate" because of the unusually high Froude numbers.

The published value of 8,940 ft^3/s (Moosburner, 1978) is a typographical error and should be corrected.

Figure A106. View looking downstream of range marker 1 (painted white spot on rock), Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A107. View looking downstream of hill near left end of cross section 3, Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A108. View looking downstream through slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A109. View looking upstream at right bank through cross section 3, Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A110. View looking upstream of hilltop near left end of cross section 3, Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A111. View looking upstream through cross section1 overbank flow area, Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A112. View looking upstream through slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, June 1973.

Figure A113. View looking downstream through slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, July 30, 2003.

Figure A114. View looking downstream through slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, July 30, 2003. Rock with painted registered mark shown on left.

Figure A115. Original registered mark (white paint on rock) found 30 years later, Humboldt River Tributary near Rye Patch, Nevada, July 30, 2003.

Figure A116. View looking downstream of top of slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, July 30, 2003. People standing at cross sections.

Figure A117. View looking upstream through slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, July 30, 2003.

Figure A118. View of left bank near top of slope-area reach, Humboldt River Tributary near Rye Patch, Nevada, July 30, 2003.