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Prepared in cooperation with Nevada Department of Transportation

Peak Streamflow Determinations in Nevada: A Cooperative Program with the USGS and Nevada Department of Transportation

Background

Floods are one of the most costly and frequent natural disasters in Nevada. For example, the 1997 New Year's flood has been estimated to have caused more than $1 billion in damage across northern Nevada (Truckee River Flood Management Authority, 2017). In 2014, more than 2 miles of Interstate 15 in southern Nevada was heavily damaged by the remnants of Hurricane Norbert combined with monsoonal rains (Sutko, 2015). Flooding in Nevada is highly variable in cause and the season of the year. Flooding can be caused by snowmelt, rain on snow (fig. 1), and flash flooding during thunderstorms. Peak streamflow estimates are critical for planning by government agencies; designation of flood zones; and design of infrastructure including culverts, bridges, and roadways. In order to provide accurate estimates of flood frequencies, long-term data collection of peak streamflows would be needed because the accuracy of estimates improves with longer datasets.

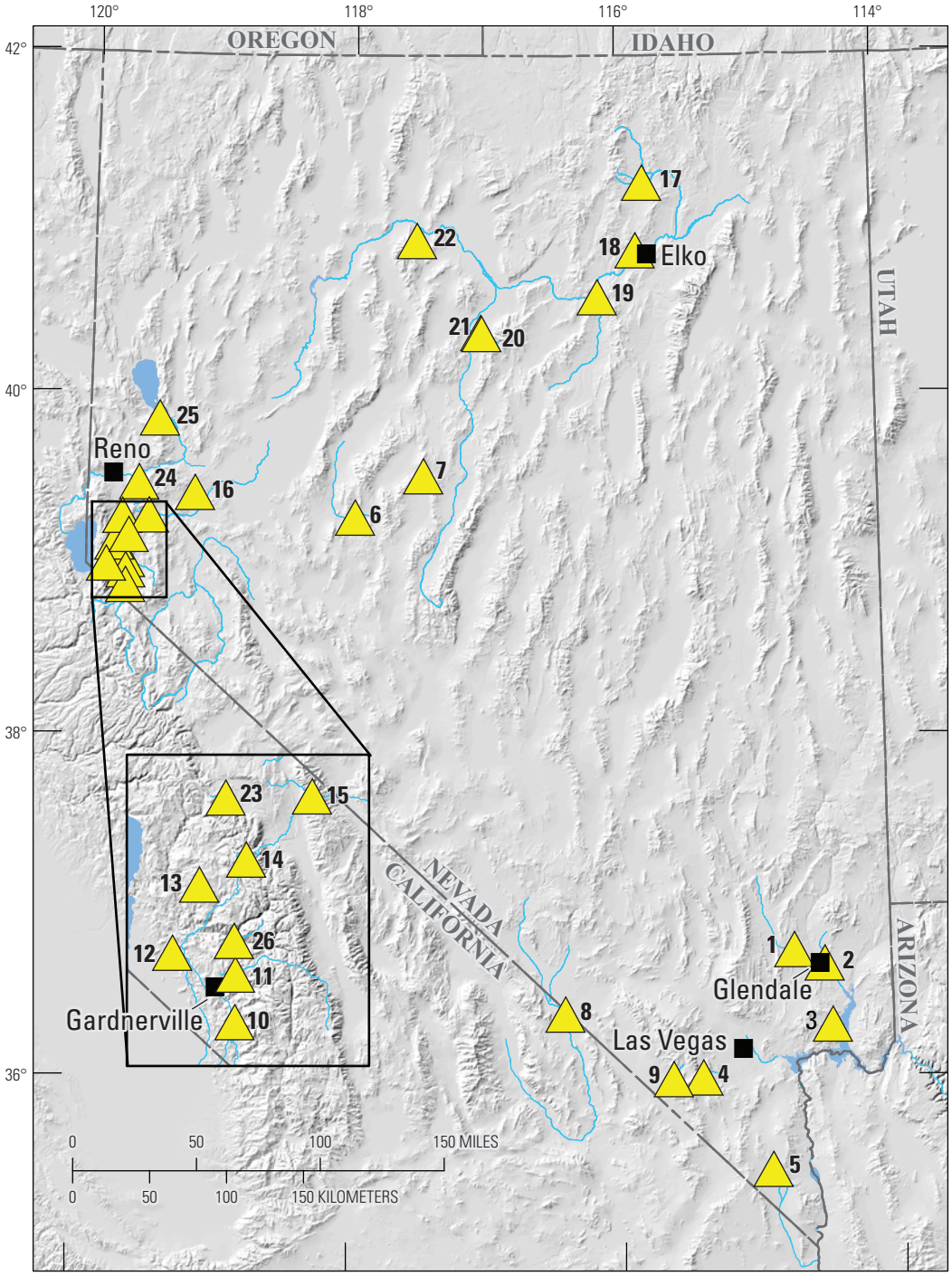
Figure 1. Example of flood event at crest-stage gage at station 10312075 Ramsey Canyon Wash at Hwy 50 at Silver Springs, NV, on February 14, 2019.

The Program

Since 1961, the United States Geological Survey (USGS), in a cooperative program with the Nevada Department of Transportation (NDOT), has collected annual peak streamflow data at selected gage sites across the state of Nevada (fig. 2). The purpose of this project has been to characterize annual peak streamflows at the selected gage sites for use in flood frequency analysis. The USGS collects annual peak streamflow data through this project at 26 locations in Nevada. The peak streamflow data are collected through a network of crest-stage gages (CSGs) maintained across the state by the USGS.

A crest-stage gage (fig. 3) is a device that records peak stage between site visits. Crest-stage gages used by the USGS in Nevada typically consist of a 2-inch pipe with vented caps on the top and bottom of the pipe; contained within the pipe is a measuring stick with granulated cork on the bottom. As the flow rises during a flood, the cork contained within the pipe floats on the water surface. As the flow recedes, the cork adheres to the stick and a mark is left on the stick, thereby recording the peak stage of the flood (fig. 3). Lower subsequent peaks also can leave a mark on the stick if enough cork remains in the pipe.

Crest-stage gages are routinely visited every 6 weeks to be inspected, serviced, and for measurements to be obtained at the site using current meters or other methods. Gages also are visited during times of flooding or shortly thereafter to obtain either direct or indirect streamflow measurements. Indirect measurements of streamflow are taken by using surveys of channel geometry, the water surface during the flood peak, and any structures (such as culverts or bridges) to model and estimate the peak streamflow. The peak annual streamflow for gage sites are entered in a publicly available database called the National Water Information System (NWIS), which can be accessed at http://nwis.waterdata.usgs.gov/usa/nwis/peak.



Base from U.S. Geological Survey and U.S. Census Bureau data digital data, 2015.
Shaded-relief base from 3DEP 10-meter digital elevation model, 2016.
Universal Transverse Mercator projection, Zone 11
World Geodetic System datum of 1984

Figure 2. Crest-stage gage sites in the network (see "table 1" for the gage-site numbers).

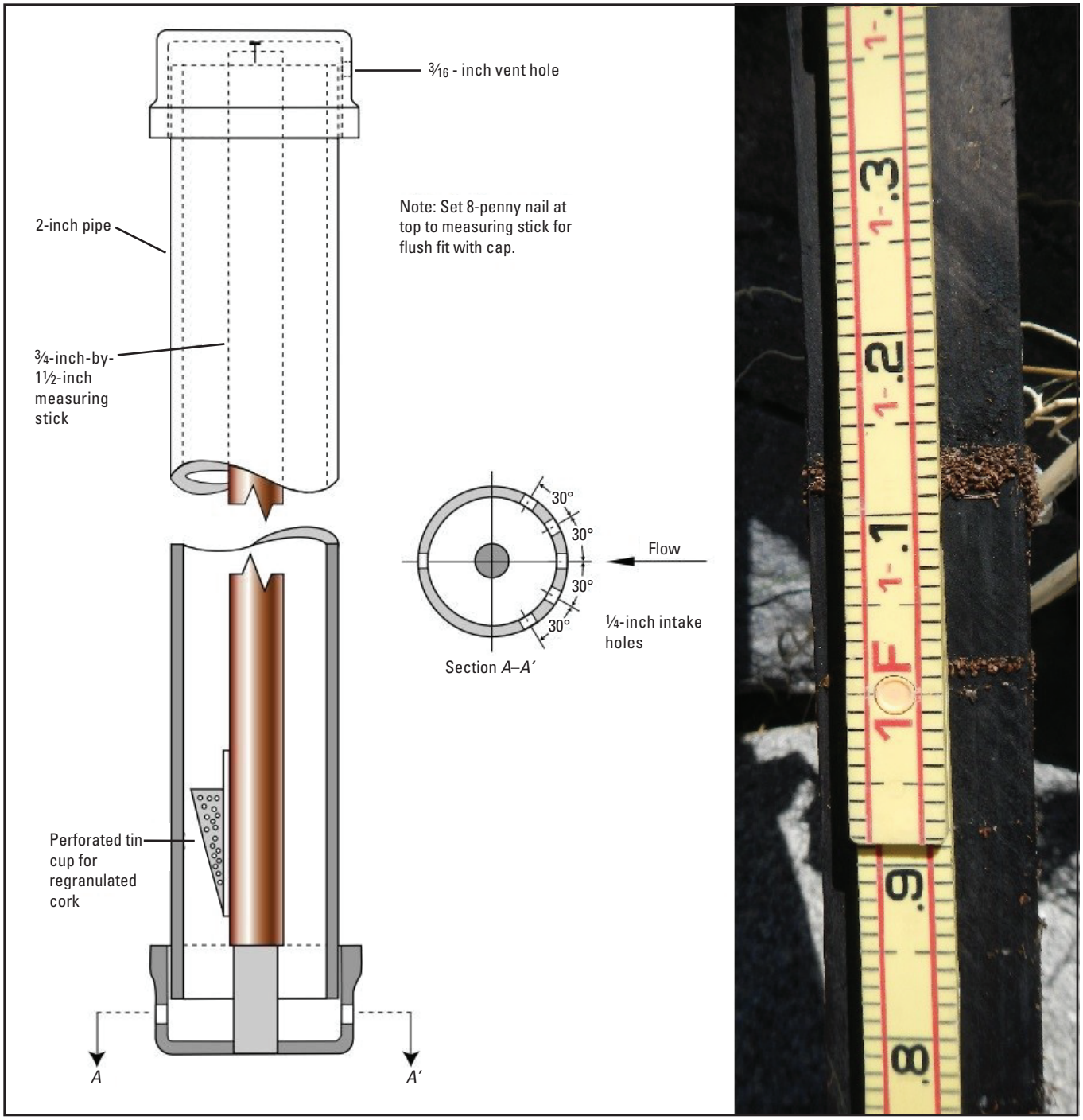


Figure 3. Details of crest-stage gage (CSG) design from Sauer and Turnipseed (2010) and an example of marks left on a CSG stick after multiple peak flows.

Summary

The annual peak streamflow collected, through this cooperative program with the U.S. Geological Survey (USGS) and the Nevada Department of Transportation (NDOT), at these 26 sites represents 832 peak flow events (table 1; U.S. Geological Survey, 2020). The drainage areas of these sites range in size from 0.62 to 1,542 square miles (mi^2). The largest recorded peaks ranged from 56 to 12,000 cubic feet per second (ft^3/s); these flow events can be used to determine estimates of flood frequency and size. In an effort to minimize flood risk and damage, these estimates of flood frequency and size can be used to design structures to withstand flood damage, designate flood zones, guide management decisions, and direct future planning.

Table 1. Largest recorded peak streamflow through water year 2020 and associated drainage area at gage sites in Nevada in cooperation with the Nevada Department of Transportation (NDOT).

[ID, identification; mi^2, square mile; mm/dd/yyyy, month/day/year; ft^3/s, cubic foot per second]

Map ID	Station ID	Name	Water year established)	Drainage area (mi^2)	Date	Magnitude (ft^3/s)
1	09415851	Muddy Wash near Moapa, NV	2012	7.8	09/26/2014	2,800
2	09418990	Weiser Wash near Glendale, NV	1966	43	09/08/2014	12,000
3	09419570	Echo Wash at Northshore Rd near Echo Bay, NV	1990	106	08/15/1990	6,000
4	09419680	Cottonwood Valley near Blue Diamond, NV	1961	18.3	01/25/1969	1,100
5	09423300	Piute Wash tributary at Searchlight, NV	1967	3.4	08/13/1982	400
6	10244360	Dixie Creek Valley Tributary near Eastgate, NV	1961	11	08/1961	1,480
7	10249417	Smith Creek Valley Tributary near Austin, NV	1968	0.62	07/1984	130
8	10251259	Amargosa River at Hwy 127 near California – Neavada state line	1993	1,542	09/22/2007	660
9	10251980	Lovell Wash near Blue Diamond, NV	1965	52.8	01/25/1969	4,150
10	10309035	Indian Creek above mouth, near Gardnerville, NV	1986	25.4	02/19/1986	2,100
11	10309075	Buckeye Creek at East Valley Road, near Minden, NV	1992	73.8	07/14/1992	3,000
12	10310410	Genoa Canyon Creek at Genoa, NV	1997	2.24	01/01/1997	150
13	10310600	Voltaire Canyon near Carson City, NV	1979	1	01/02/1997	118
14	10311450	Brunswick Canyon near New Empire, NV	1966	12.7	01/08/2017	730
15	10311725	Six Mile Canyon at Hwy 50 near Dayton, NV	1986	17.29	01/09/2017	663
16	10312075	Ramsey Canyon Wash at Hwy 50 at Silver Springs, NV	2016	44.67	01/09/2017	669
17	10317460	Gance Creek at Hwy 225 near Tuscarora, NV	1980	20.2	04/30/2006	109
18	10318850	East Adobe Creek near Elko, NV	1971	6	07/27/1971	424
19	10322980	Cole Creek near Palisade, NV	1962	11.4	06/1983	1,090
20	10326825	Mill Creek near Battle Mountain, NV	2006	Indeterminate	04/15/2009	56
21	10326826	Mill Creek N. Channel near Battle Mountain, NV	2011	Indeterminate	09/02/2013	56
22	10328000	Pole Creek near Golconda, NV	1961	10.7	08/05/1961	4,000
23	103448600	Jumbo Wash near New Washoe City, NV	1986	4.86	07/22/1986	1,230
24	10350100	Long Valley Creek near Happy Valley, NV	1956	82.6	02/19/1986	5,400
25	10351850	Pyramid Lake Tributary near Nixon, NV	1968	1.94	01/08/2017	1,220
26	1030909087	Johnson Wash at Fremont Dr near Minden, NV	1991	10.4	07/22/1994	1,400

- Kurtiss Schmidt

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For more information

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ISSN 2327-6916 (print)
ISSN 2327-6932 (online)
https://doi.org/10.3133/fs20213015