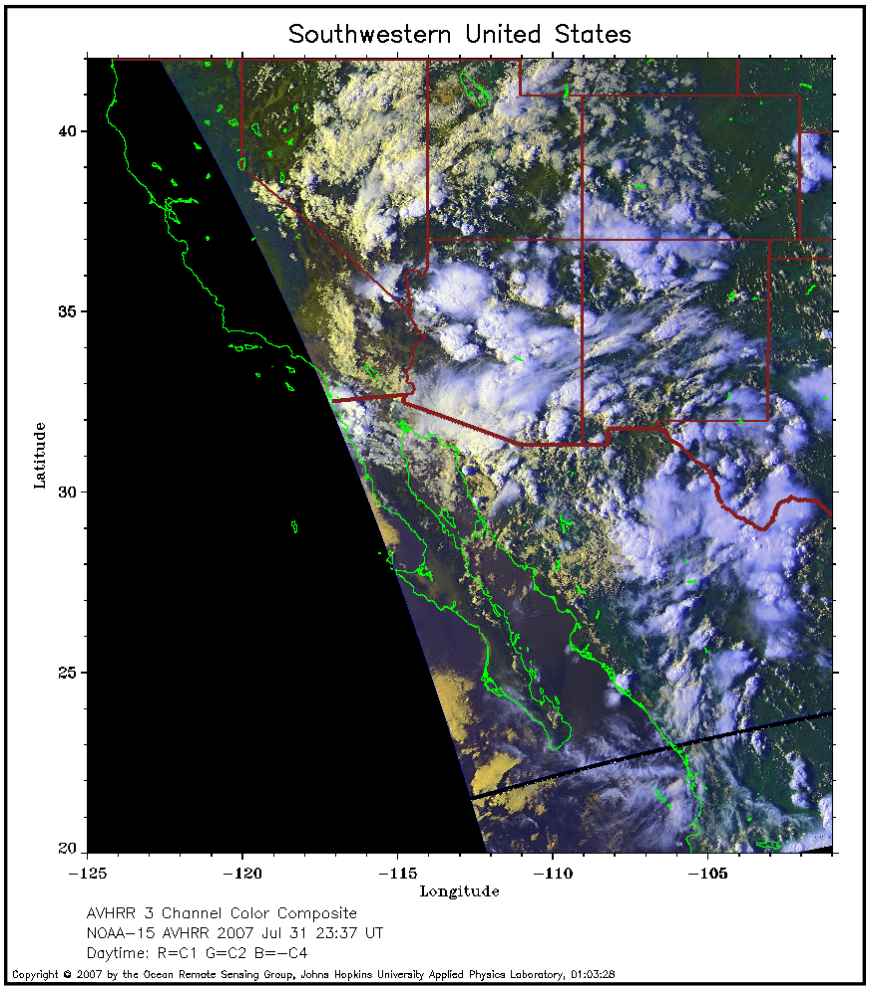


Storm Report : July 31, 2007
Northeast Maricopa County, AZ

Stephen D. Waters, Engineering Division, Flood Warning Branch

TABLE OF CONTENTS

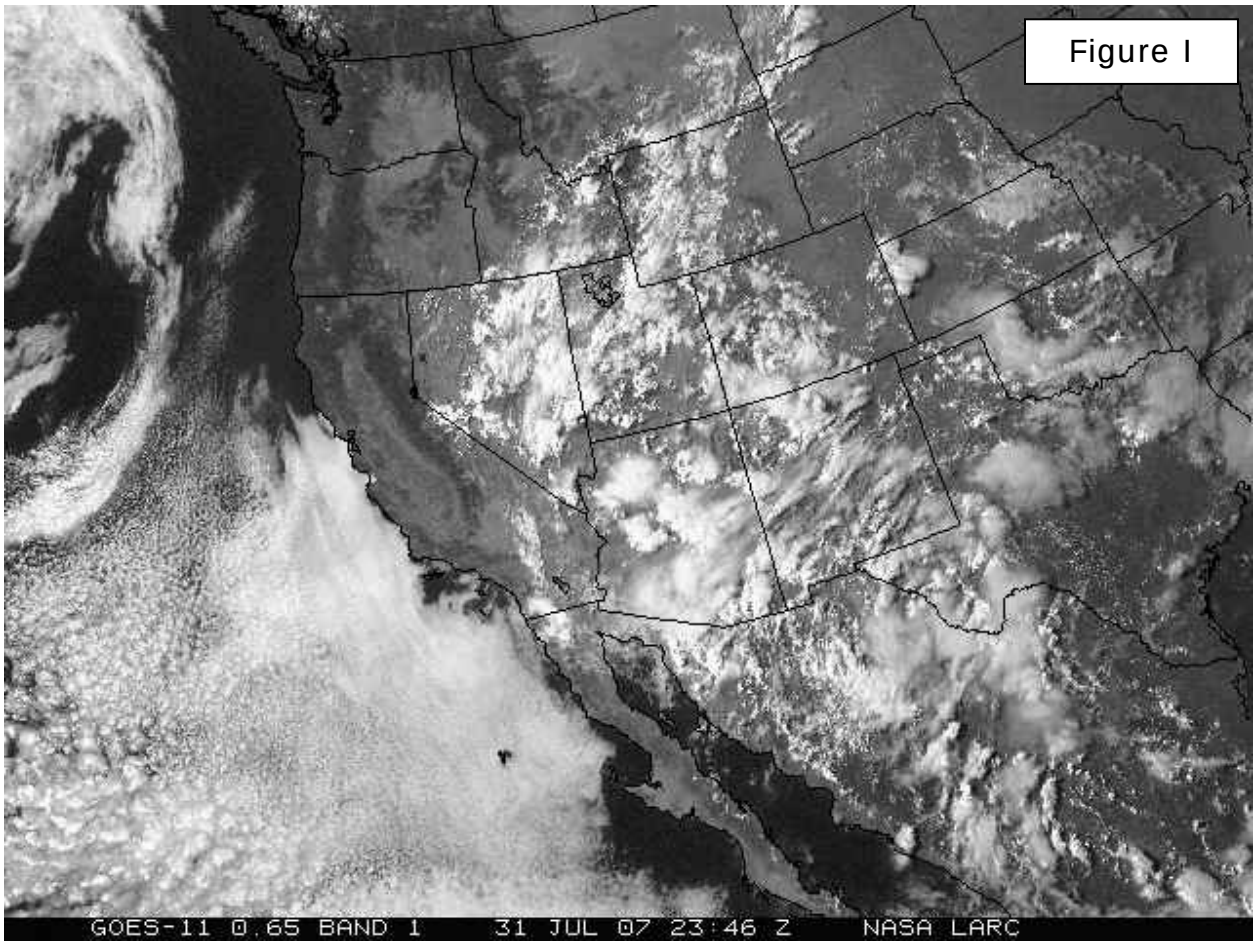
TABLES

FIGURES

A special thank you to members of the NWS, USGS and Johns Hopkins University for supplying several of the above figures.

METEOROLOGY

July 31, 2007 began as a relatively cloudless day, but signs in the atmosphere were pointing to the potential for unusual storms. Mid-level steering winds were out of the northeast, favoring propagation of mountain storms off the Mogollon Rim into the central deserts. The 5:00 AM KSRP sounding showed that moisture values were high – 1.96 inches of precipitable water, a mean RH of 68% and a surface dewpoint of 65 degrees. Instability values were only moderate (CAPE of 378 J/kg), but appear from later soundings to have increased as the day went on. Figure I below is a visible satellite photo from 7/31/07 at 4:46 PM MST, and clearly shows the line of storms coming off the Rim toward the Phoenix area.



PRECIPITATION

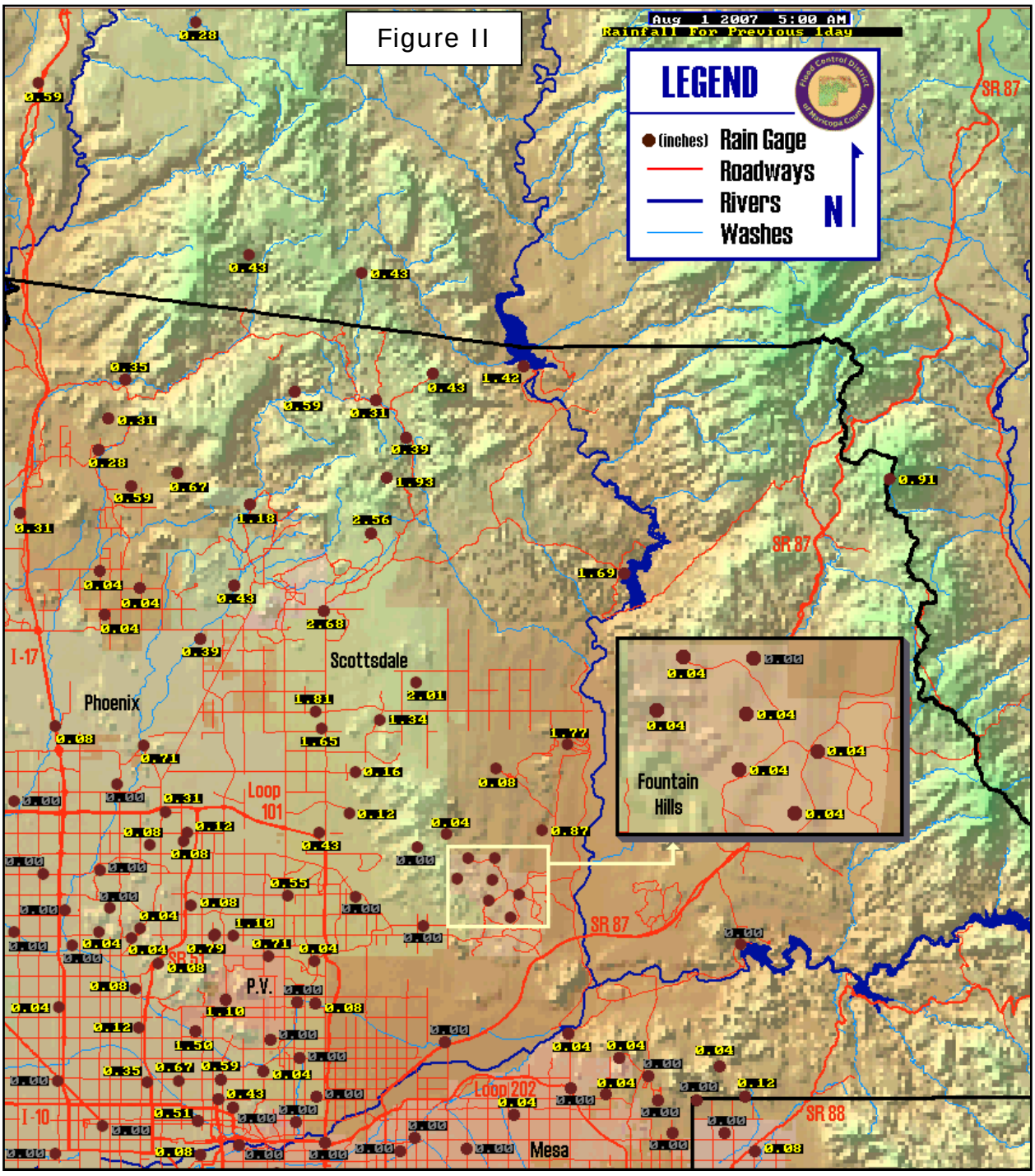


Figure II – 24 hour precipitation values in the northeast County ending 08/01/2007 at 05:00 MST. All readings are in inches and are from automated Flood Control District rain gages.

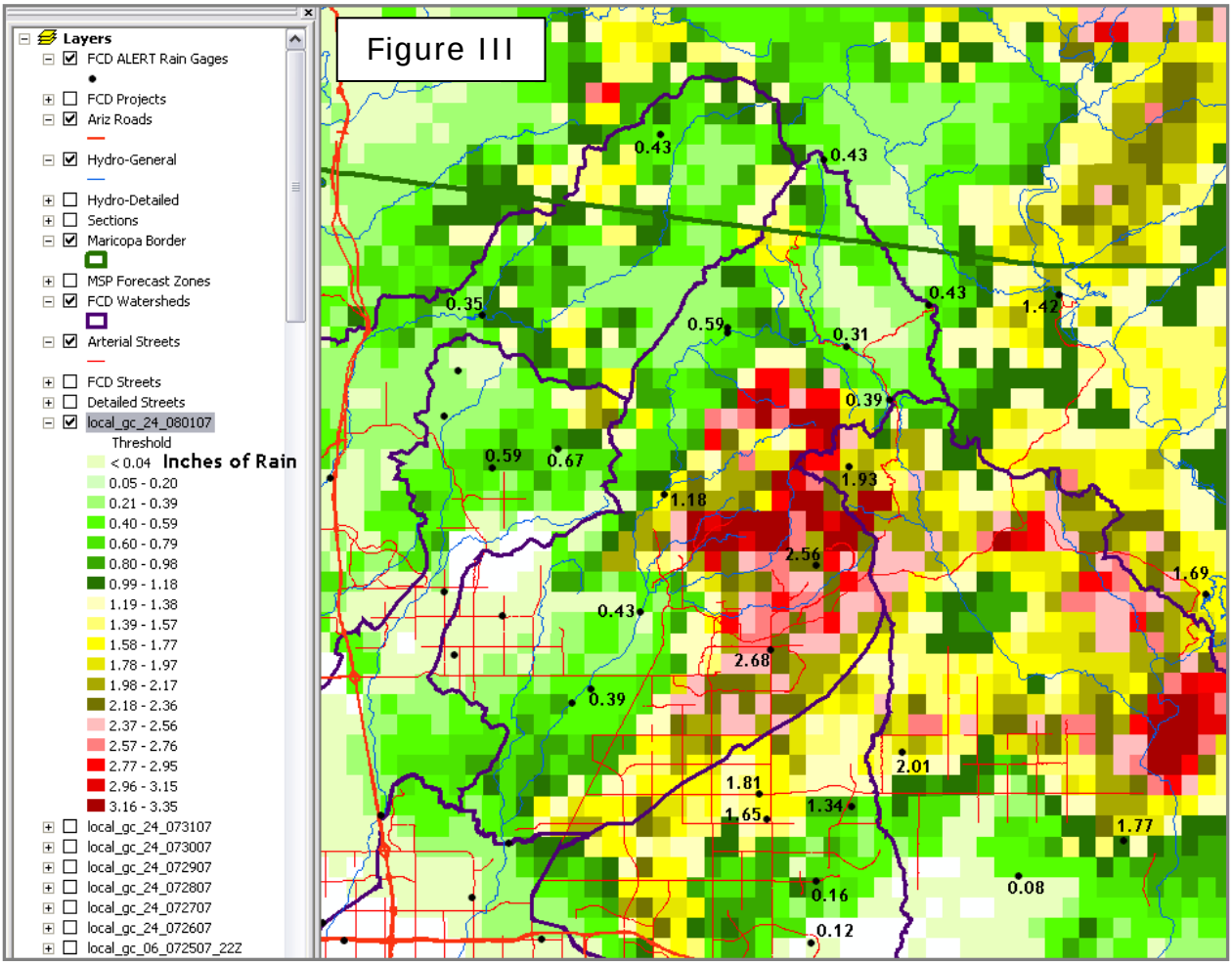


Figure III – this map was generated using GIS and a gridded rainfall product provided by our weather vendor. The colored cells are approximately 1 km on a side and represent an average rainfall depth for that area. The depths are accumulated for the 24-hour period prior to 8/01/2007 at 5:00 AM MST. The cells are derived from an algorithm that accumulates the weather radar returns, then adjusts them using the raingage readings which are shown on this map in black next to the gage locations (black dots).

TABLE 1

DeviceID	4910	4930	5940	4920
StatType	rain	rain	rain	rain
DataType	precip	precip	precip	precip
Units	in	in	in	in
07/31/07				
2300	0.00	0.00	0.00	0.00
2245	0.00	0.00	0.00	0.00
2230	0.00	0.04	0.00	0.00
2215	0.00	0.00	0.04	0.04
2200	0.00	0.00	0.00	0.00
2145	0.00	0.00	0.00	0.00
2130	0.00	0.00	0.00	0.00
2115	0.00	0.00	0.00	0.04
2100	0.04	0.04	0.04	0.00
2045	0.04	0.00	0.04	0.00
2030	0.00	0.04	0.04	0.00
2015	0.04	0.08	0.00	0.04
2000	0.00	0.00	0.00	0.00
1945	0.00	0.00	0.08	0.00
1930	0.16	0.08	0.00	0.00
1915	0.43	0.35	0.12	0.24
1900	0.55	0.59	0.43	0.20
1845	0.94	0.63	0.83	0.08
1830	0.47	0.47	0.31	0.24
1815	0.00	0.24	0.00	0.24
1800	0.00	0.00	0.00	0.08
1745	0.00	0.00	0.00	0.00
1730	0.00	0.00	0.00	0.00
1715	0.00	0.00	0.00	0.00
TOTALS:	2.68	2.56	1.93	1.18

Device ID 4910 is Stagecoach Wash
4930 is Carefree Ranch
5940 is Rackensack Canyon
4920 is Cave Cr. at Spur Cross

Table 1 above presents 15-minute rainfall values at four stations in the watersheds east of Cave Creek. These four gages are close to or within the heavy rainfall area in the middle of Figure III. Their Table 1 totals can be matched to those on the map.

Table 2 below is the NOAA Atlas 14 Point Precipitation Frequency Estimate Table at the latitude/longitude of the Stagecoach Wash raingage. The red line lists the recorded values from Stagecoach Wash on 7/31/07. The blue (last) line is the interpolated return period for each rainfall amount in years.

Precipitation Frequency Estimates (inches) 33.8119N 111.8911W																		
AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.28	0.43	0.54	0.72	0.90	1.03	1.10	1.28	1.54	1.74	2.05	2.28	2.63	2.89	3.73	4.47	5.33	5.95
5	0.41	0.63	0.78	1.05	1.30	1.48	1.54	1.76	2.08	2.47	2.92	3.28	3.79	4.16	5.33	6.39	7.61	8.43
10	0.50	0.77	0.95	1.28	1.58	1.79	1.86	2.09	2.46	3.01	3.55	4.03	4.67	5.11	6.48	7.73	9.19	10.13
25	0.62	0.94	1.16	1.57	1.94	2.19	2.28	2.52	2.94	3.74	4.41	5.09	5.92	6.45	8.04	9.50	11.29	12.35
50	0.70	1.07	1.33	1.79	2.21	2.49	2.60	2.85	3.31	4.34	5.10	5.96	6.95	7.57	9.28	10.90	12.92	14.05
100	0.79	1.20	1.49	2.00	2.48	2.80	2.94	3.20	3.68	4.97	5.83	6.91	8.08	8.77	10.59	12.34	14.60	15.78
200	0.87	1.33	1.65	2.22	2.75	3.10	3.29	3.55	4.05	5.65	6.60	7.93	9.33	10.10	11.99	13.83	16.35	17.56
500	0.99	1.50	1.87	2.51	3.11	3.52	3.77	4.01	4.54	6.63	7.70	9.44	11.17	12.04	13.96	15.91	18.77	19.99
1000	1.08	1.64	2.04	2.74	3.40	3.85	4.16	4.38	4.92	7.44	8.59	10.70	12.73	13.68	15.56	17.57	20.70	21.91
4910	0.59	0.94	1.10	1.65	2.44	2.60	2.68											
≈AEP	21	25	21	34	93	68	62											

Table 3 below is the NOAA Atlas 14 Point Precipitation Frequency Estimate Table at the latitude/longitude of the Carefree Ranch raingage. The red line lists the recorded values from Carefree Ranch on 7/31/07. The blue (last) line is the interpolated return period for each rainfall amount in years.

Precipitation Frequency Estimates (inches) 33.8530N 111.8644W																		
AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.30	0.46	0.57	0.76	0.95	1.09	1.16	1.35	1.64	1.96	2.31	2.63	3.04	3.35	4.35	5.20	6.23	7.02
5	0.44	0.67	0.83	1.11	1.38	1.56	1.63	1.85	2.22	2.77	3.30	3.81	4.42	4.85	6.24	7.46	8.94	10.01
10	0.53	0.81	1.00	1.35	1.67	1.88	1.96	2.20	2.62	3.36	4.03	4.69	5.46	5.96	7.59	9.05	10.82	12.05
25	0.65	0.99	1.22	1.65	2.04	2.30	2.40	2.65	3.14	4.17	5.01	5.94	6.93	7.54	9.41	11.16	13.31	14.71
50	0.74	1.12	1.39	1.87	2.32	2.62	2.74	3.00	3.53	4.83	5.80	6.95	8.15	8.84	10.86	12.81	15.26	16.74
100	0.83	1.26	1.56	2.10	2.60	2.94	3.09	3.36	3.92	5.52	6.63	8.06	9.48	10.25	12.39	14.52	17.28	18.83
200	0.91	1.39	1.73	2.32	2.88	3.26	3.46	3.73	4.32	6.25	7.52	9.26	10.94	11.79	14.00	16.30	19.40	20.97
500	1.03	1.57	1.95	2.62	3.25	3.70	3.97	4.21	4.84	7.31	8.78	11.02	13.09	14.04	16.29	18.78	22.34	23.93
1000	1.13	1.72	2.13	2.87	3.55	4.04	4.37	4.59	5.24	8.18	9.80	12.48	14.91	15.93	18.14	20.75	24.71	26.28
4930	0.28	0.47	0.67	1.22	2.05	2.36	2.52											
≈AEP	< 2	2	3	7	25	30	34											

RUNOFF

Stagecoach Wash
Runoff Event of July 31, 2007

A large quantity of precipitation fell quickly on the afternoon of July 31, 2007 near Pima Road and Stagecoach Pass causing a large runoff event at the Stagecoach Wash streamgage (4913). The rain gage at the site (4910) recorded nearly 2.7 inches of rain in about 2 hours with the majority (2.5 inches) falling in about 1 hour. The drainage area of the wash (above the gage) is just over one square mile.

Unfortunately, the transducer gage at the site did not properly record the event. It recorded a much smaller peak. Following the event, a large amount of debris was lodged in a bush that was near the pressure transducer housing. The bush appears to have been pushed over toward the transducer. Photographs from May 2007 show the bush much smaller and not near the transducer. Following the event, the transducer was serviced, but no problem was found with its operation. Thus, the reason for the failure is not known. Though the bush seemingly did not cause the failure of the transducer, it was trimmed severely.

High water marks at Pima Road were flagged on August 1, 2007. High water marks and debris at the site indicated that the flow covered Pima Road by just over one foot. A survey of high water marks and the channel itself was done on August 22, 2007. Data from three cross sections were collected in a 970 foot reach upstream from Pima Road, and were used to determine the peak discharge for the event.

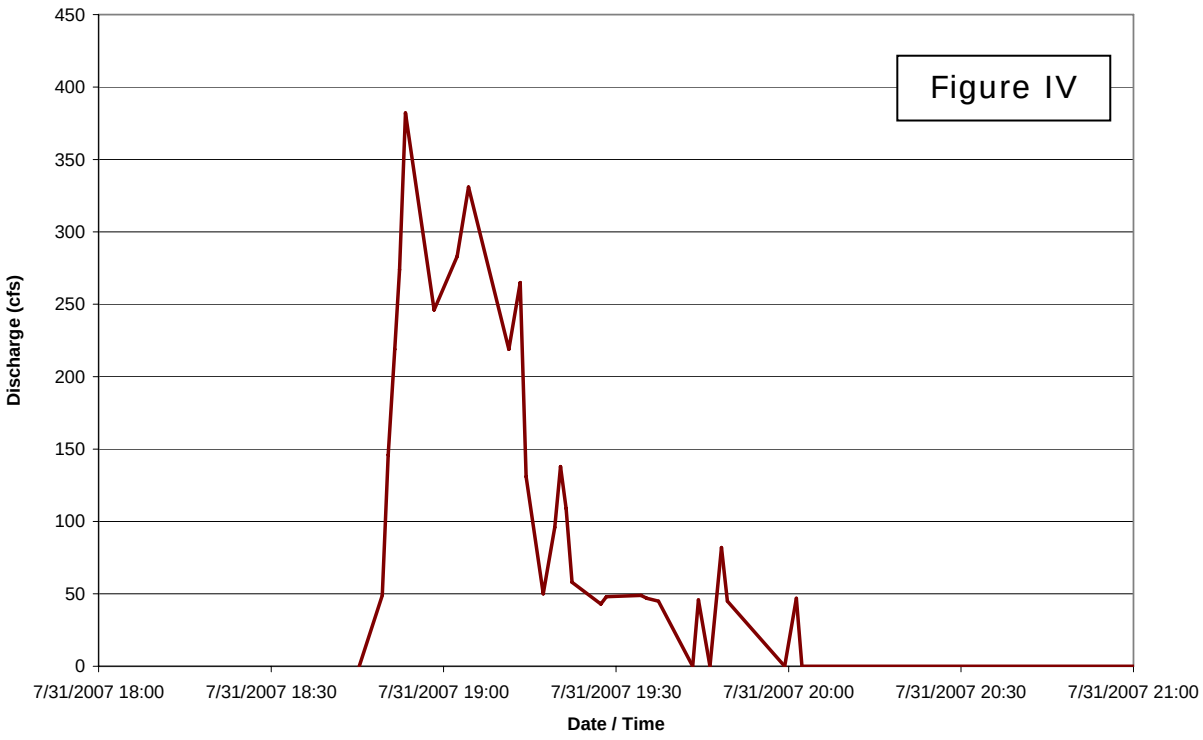
Peak discharge was computed by two methods. First the data were used in a USGS-SAC (Slope Area Computation) model. The peak discharge was computed to be 802 cfs. Second, a simple Manning computation was done based on slope and area of the uppermost cross section. The peak discharge was computed to be 808 cfs. Similar results were expected since both computations are based on the Manning equation. However, the SAC program took all three cross sections into consideration. No other inputs into the wash were noted through this reach to the bridge. Furthermore, because of the significant precipitation at the gage site, the granitic soil was likely saturated when the flow occurred, thus minimizing any losses to the wash itself.

The peak stage for the event was between 5.1 – 5.2 feet gage height, based on surveyed high water marks at Pima Road. The current rating (#1) shows discharges of 690 – 725 cfs for that range of stages. **The peak discharge for the event will be 805 cfs at a stage of 5.10 feet gage height.** The rating will be updated to reflect this new information.

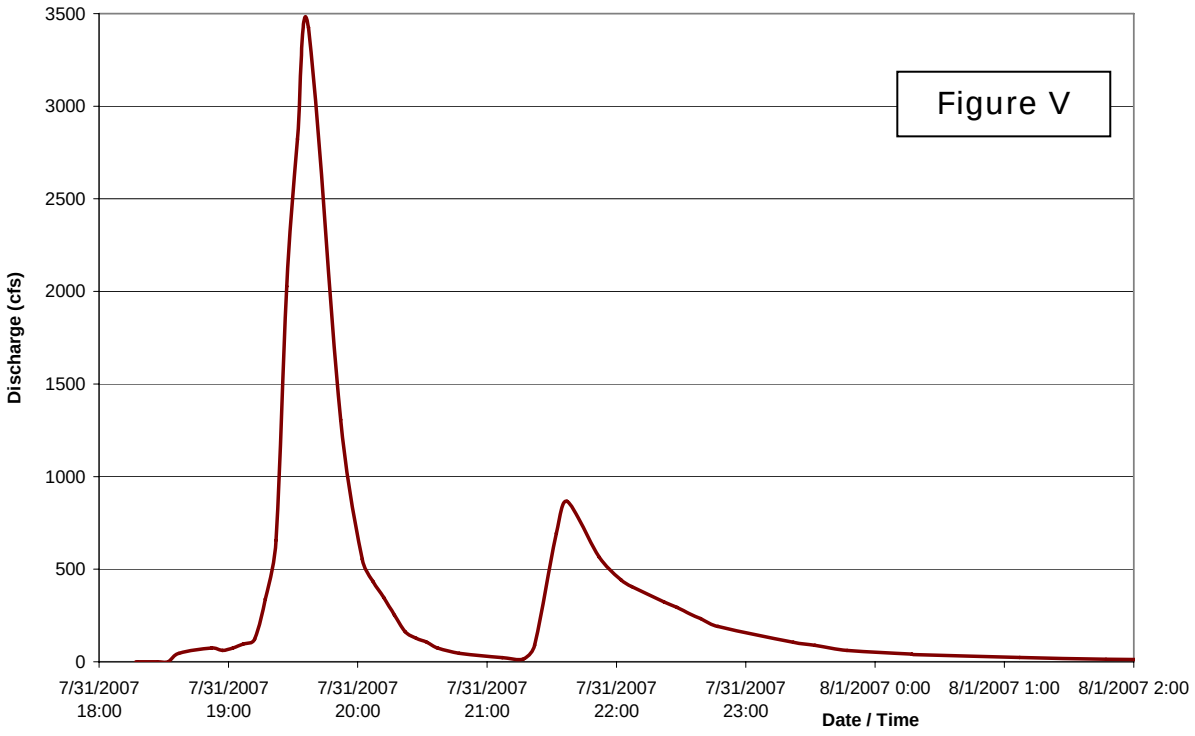
David E. Gardner, Hydrologist
8/23/2007

Selected Hydrographs

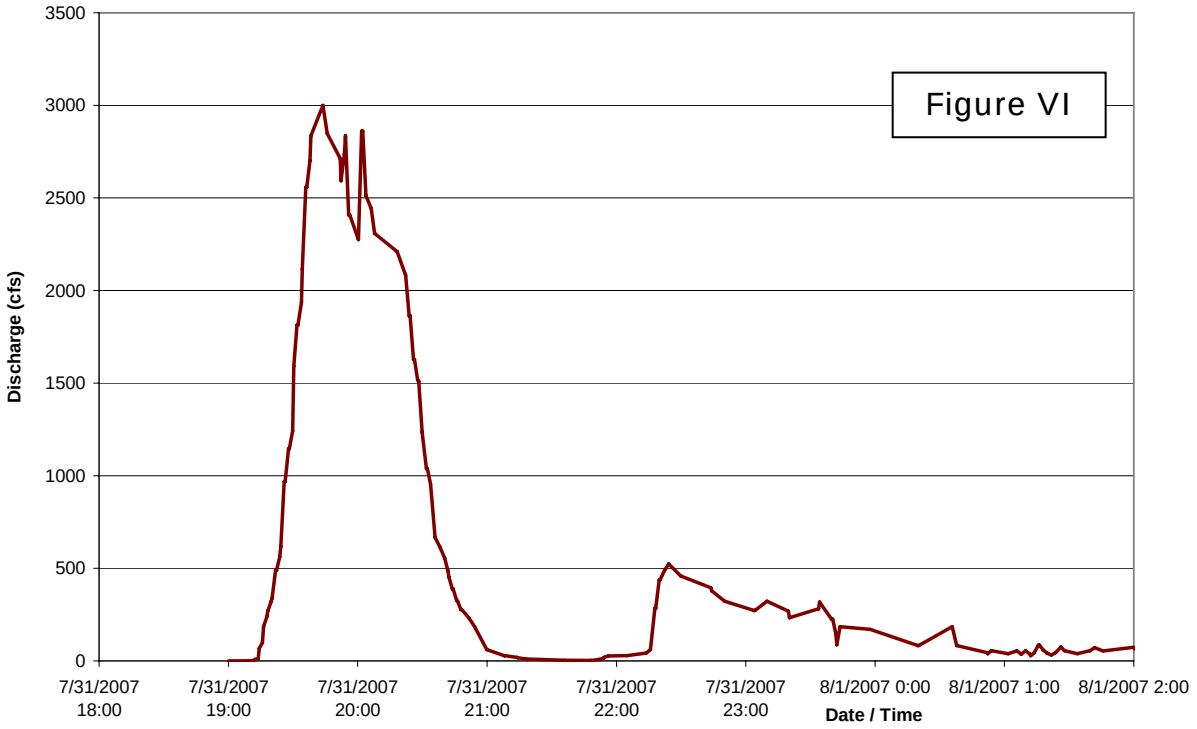
4863 - Rawhide Wash, 1/3 mile west of Pima Road on Dynamite Blvd.



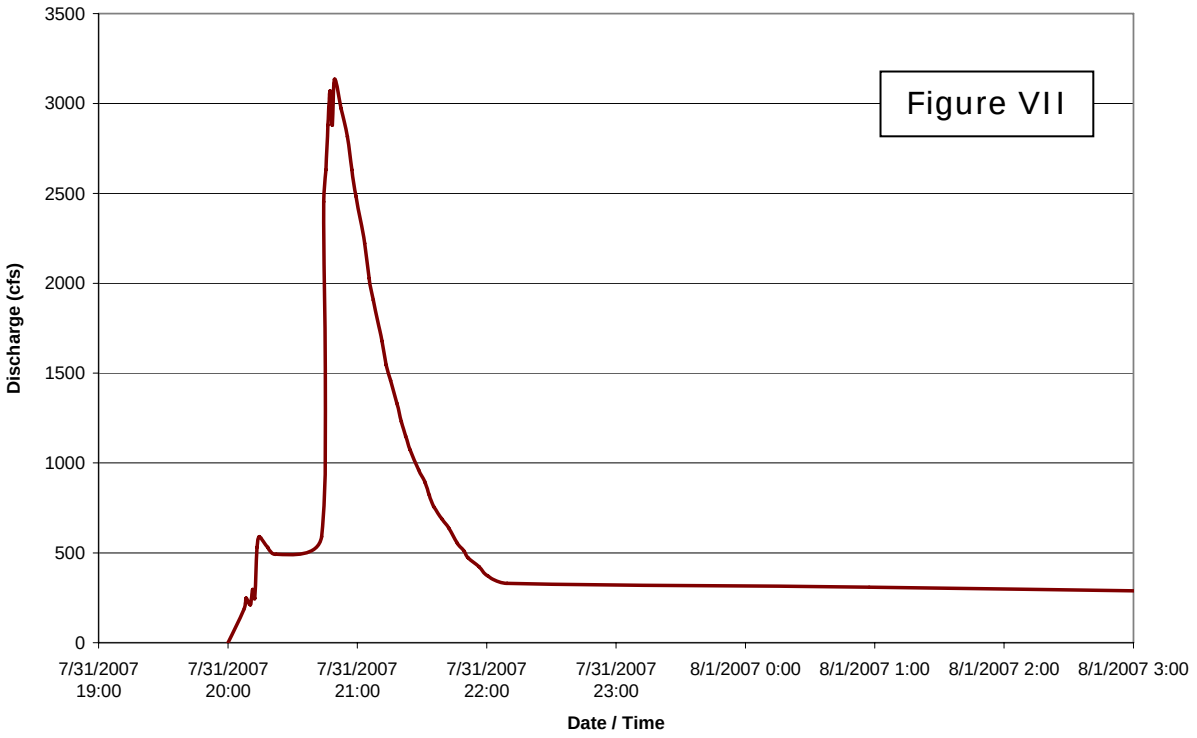
4923 - Cave Creek at Spur Cross



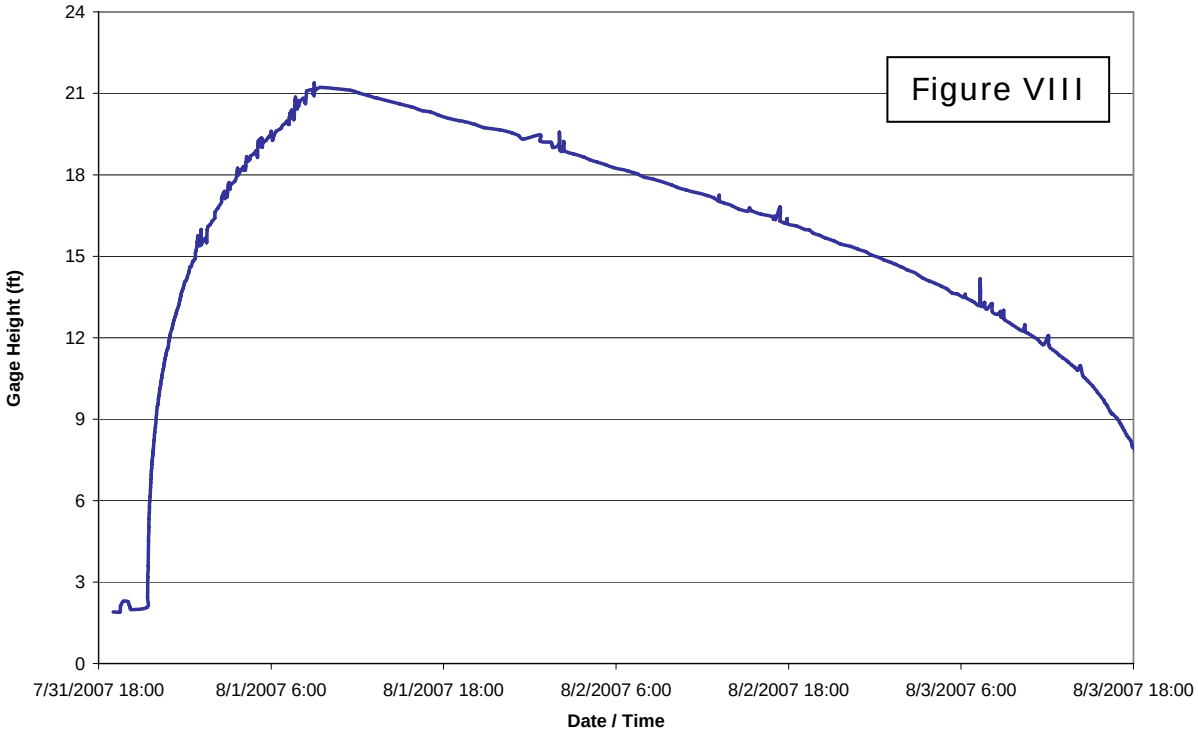
4889 - Cave Creek



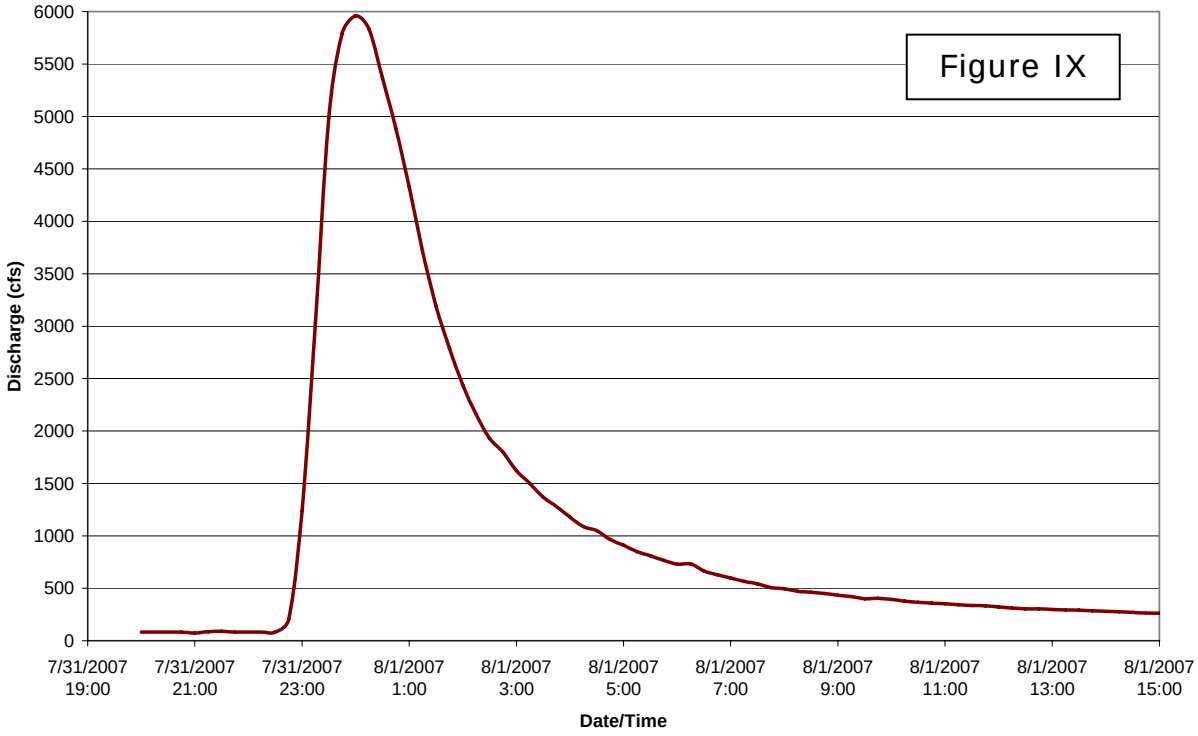
4918 - Cave Cr. near Cave Cr.



4899 - Cave Buttes Dam



09511300 - Verde River near Scottsdale, AZ



THOUGHTS

The highest measured annual exceedance probability was 93 years for the 1 hour period at Stagecoach Wash. However, Figure III and the graphic below show a number of areas with storm-totals of three inches or more. These values are approximately 20% higher than the 2.68 inches measured at Stagecoach Wash. If we multiply the 1-hour value from Stagecoach of 2.44 inches by 1.2 we get 2.93 inches, which equates to a return period of approximately 350 years. So it is quite likely that significant areas of the Willow Springs, Rowe, Grapevine and Cottonwood Creek watersheds experienced a 100-year or greater storm. Galloway, Andora Hills and Stagecoach Wash watersheds received in general less than 100-year rainfall depths.

The high peak flow in Cave Creek was likely do to the contribution from Cottonwood Creek, with a volume contribution from Grapevine/Galloway Washes measured at the Cave Creek gage (4890).