

GOES-West Enhanced Visible Image, July 10, 2008 at 6:30 PM MST

Storm Report: July Storms of 2008 in Central Arizona



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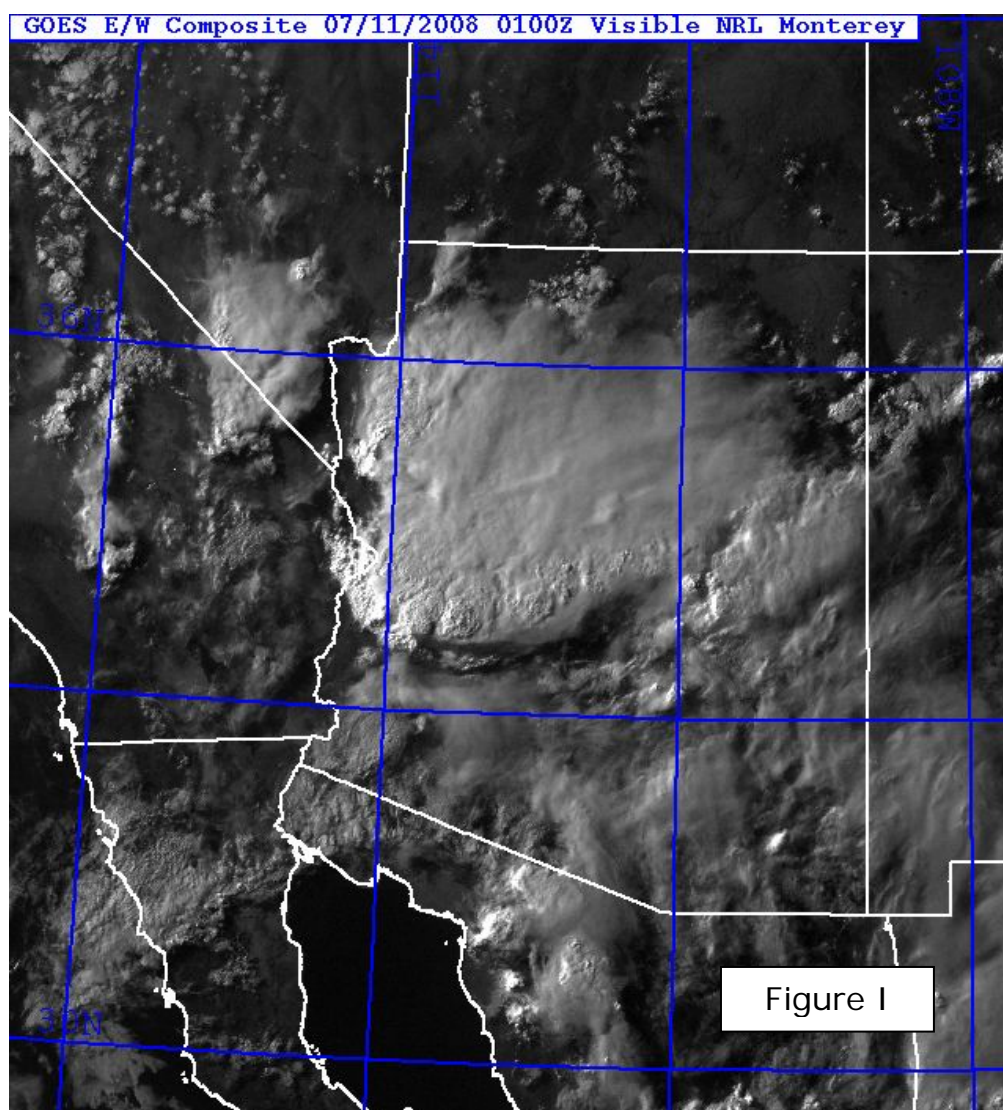
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A special thank you to members of the NWS, USGS, Pinal County Flood Control and the Naval Research Laboratory for supplying data and several of the figures in this report.

Storm of July 10th, 2008

METEOROLOGY

In the days preceding July 10th a low pressure system moved slowly north from the mountains of northern Mexico. This system drew large amounts of moisture from Mexico and the Gulf of California into Arizona, to the point where the Phoenix balloon sounding on the morning of the 10th measured 1.92 inches of precipitable water – a very wet value. The sounding indicated a large degree of atmospheric instability as well. A 65 mph wind gust was reported in Scottsdale near Scottsdale Road and Palm Lane. The highest wind gust measured by an FCD gage was 35 mph at Rackensack Canyon north of Carefree. Storm-steering winds on the 10th were from the northeast at greater than 10 knots.



GOES East/West Visible Image, July 10, 2008 at 6:00 PM MST

PRECIPITATION

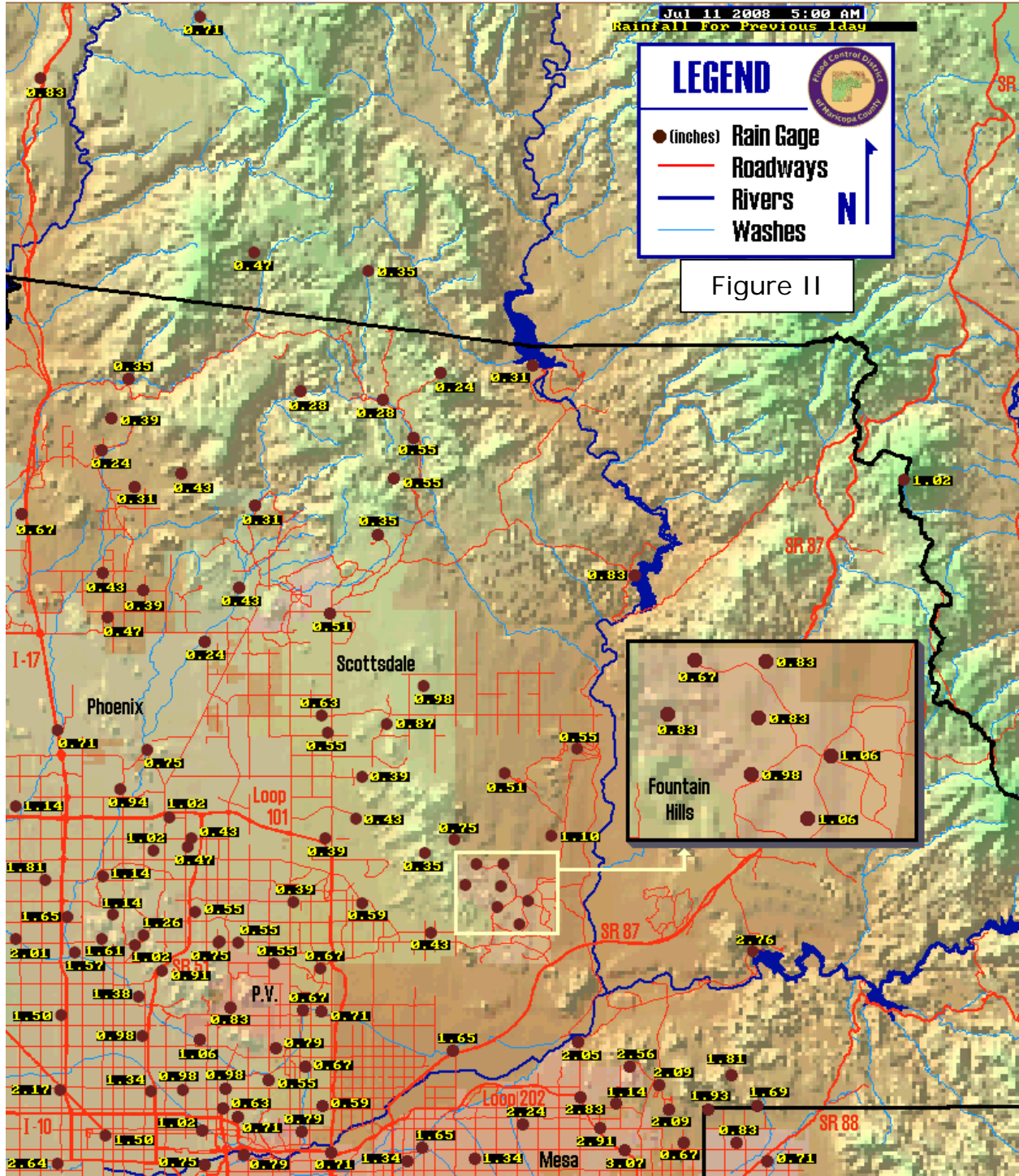


Figure II – 24 hour precipitation values in the northeast County quadrant ending 07/11/2008 at 05:00 MST. All readings are in inches and are from automated Flood Control District rain gages.

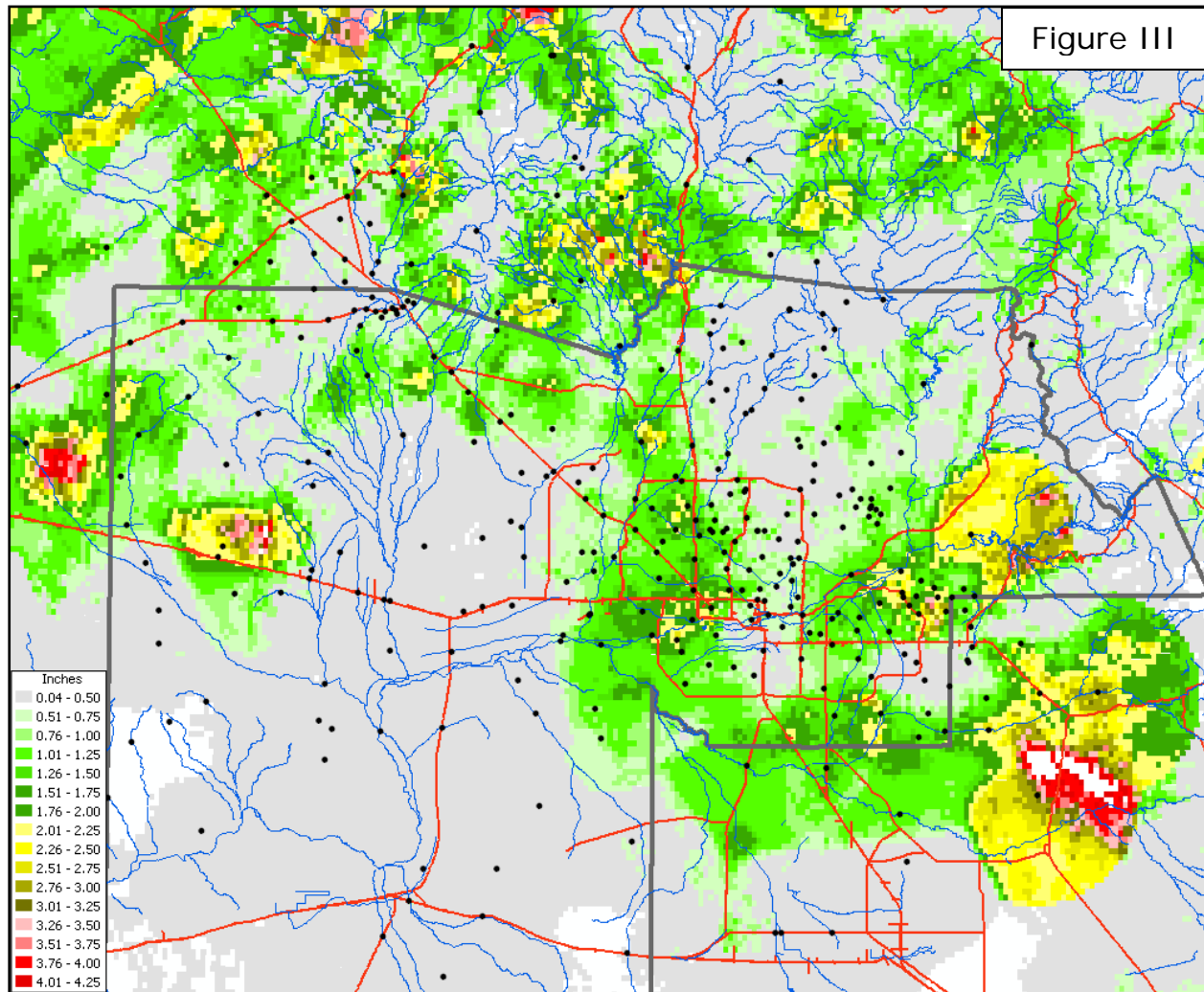


Figure III – This map was generated using GIS and a gridded rainfall product provided by our weather vendor. The colored cells are approximately 1 km on a side and represent an average rainfall depth for that area. The depths are accumulated for the 24-hour period prior to 07/11/2008 at 5:00 AM MST. The cell values are derived from an algorithm that sums the weather radar returns, then adjusts them using the raingage readings. Black dots represent ALERT raingage locations. White pixels within the red area at lower right are values greater than 4.25 inches – see Figure IV for more detail in this area.

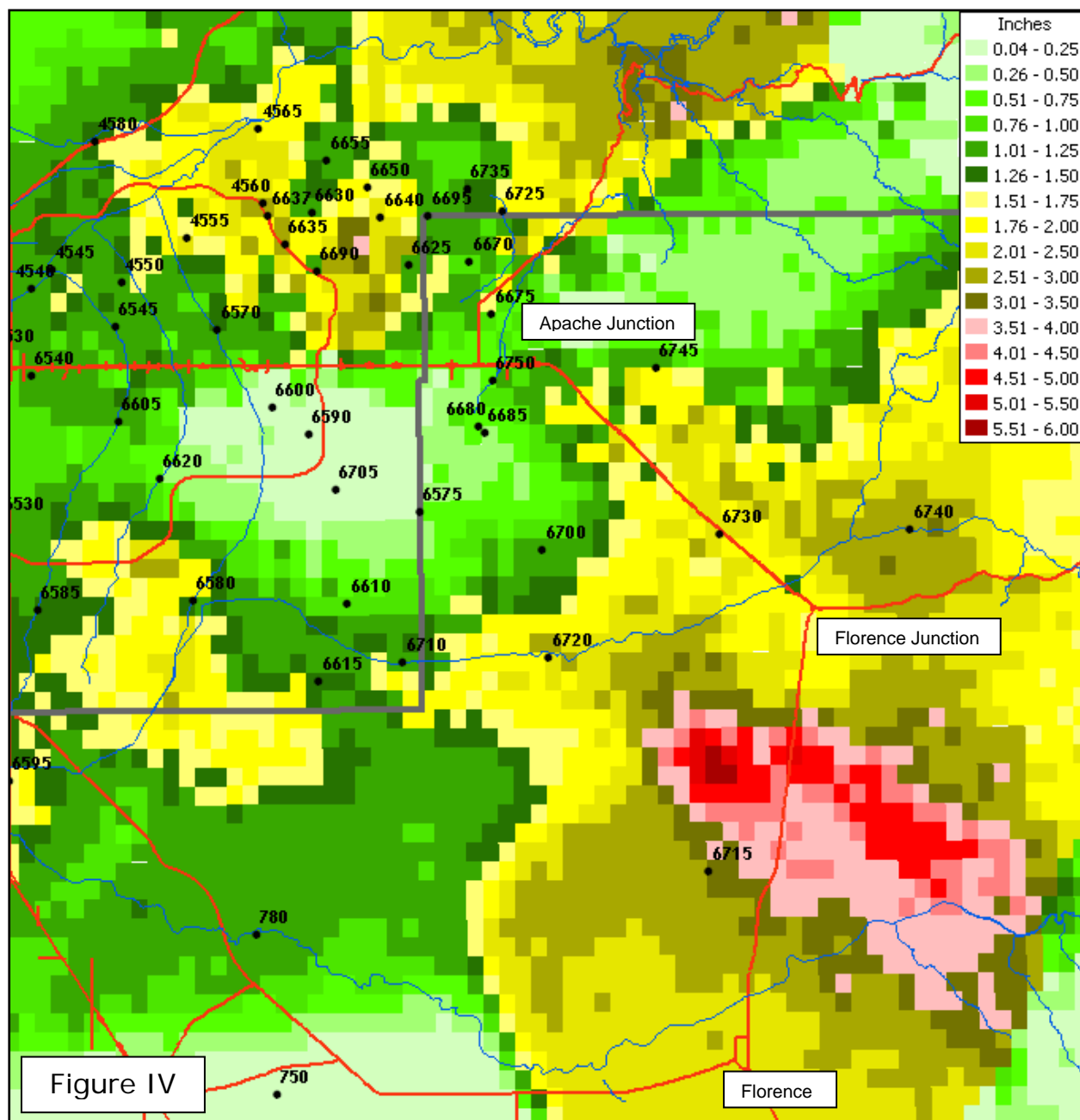


Figure IV – This map was generated using GIS and a gridded rainfall product provided by our weather vendor. The colored cells are approximately 1 km on a side and represent an average rainfall depth for that area. The depths are accumulated for the 24-hour period prior to 07/11/2008 at 5:00 AM MST. The cell values are derived from an algorithm that sums the weather radar returns, then adjusts them using the raingage readings. The black numbers are ALERT raingage ID numbers. ID 6715 is Magma Dam in Pinal County.

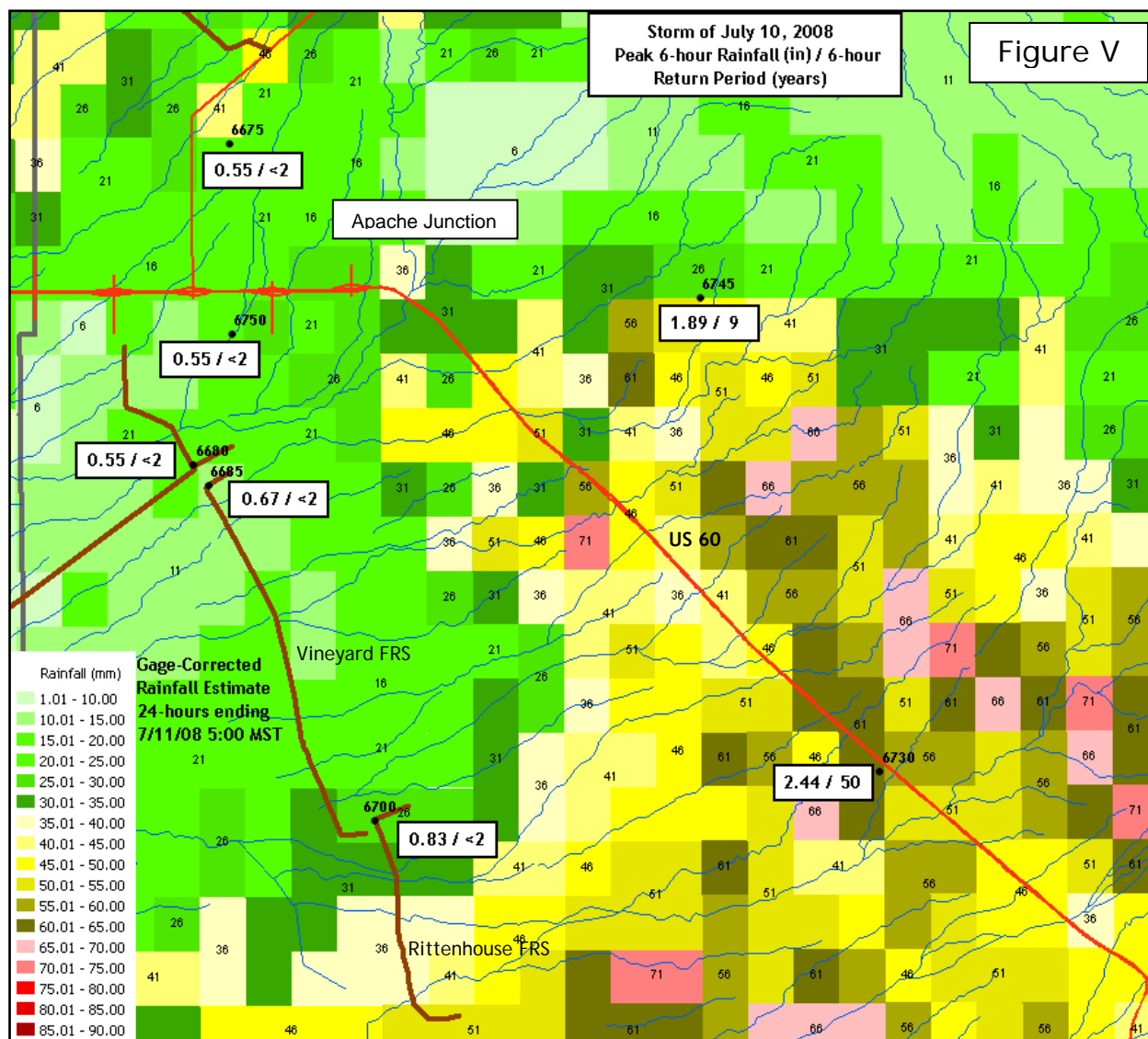


Figure V – This map was generated using GIS and a gridded rainfall product provided by our weather vendor. The colored cells are approximately 1 km on a side and represent an average rainfall depth for that area. The depths are accumulated for the 24-hour period prior to 07/11/2008 at 5:00 AM MST. The cell values are derived from an algorithm that sums the weather radar returns, then adjusts them using the raingage readings. In the white boxes – the value on the left is the 6-hour peak rainfall (inches) recorded by the gage, and the value on the right is the estimated 6-hour return period (years) for that point in space from NOAA Atlas 14 version 4. The two-digit numbers within the grid cells are the estimated average rainfall amounts in millimeters.

TABLE 1

DeviceID	6690	6715	6635	4560	6740	4700
StatType	rain	rain	rain	rain	rain	rain
DataType	precip	precip	precip	precip	precip	precip
Units	in	in	in	in	in	in
07/11/08						
0500	0.00	0.04	0.00	0.00	0.00	0.00
0445	0.00	0.00	0.00	0.00	0.00	0.00
0430	0.00	0.04	0.00	0.00	0.00	0.00
0415	0.00	0.00	0.00	0.00	0.00	0.00
0400	0.00	0.00	0.00	0.00	0.00	0.00
0345	0.00	0.00	0.00	0.00	0.00	0.00
0330	0.00	0.00	0.00	0.00	0.00	0.00
0315	0.00	0.00	0.00	0.00	0.00	0.00
0300	0.00	0.04	0.00	0.00	0.00	0.00
0245	0.04	0.00	0.04	0.00	0.00	0.00
0230	0.00	0.00	0.00	0.04	0.00	0.00
0215	0.04	0.00	0.00	0.00	0.04	0.00
0200	0.00	0.00	0.04	0.00	0.00	0.04
0145	0.00	0.04	0.00	0.04	0.00	0.00
0130	0.04	0.00	0.04	0.04	0.12	0.04
0115	0.04	0.00	0.04	0.08	0.00	0.04
0100	0.04	0.16	0.04	0.04	0.04	0.04
0045	0.00	0.16	0.08	0.00	0.04	0.00
0030	0.04	0.75	0.00	0.00	0.00	0.04
0015	0.00	0.43	0.00	0.00	0.00	0.04
07/10/08						
2400	0.00	0.24	0.00	0.00	0.08	0.04
2345	0.00	0.47	0.00	0.00	0.47	0.00
2330	0.00	0.08	0.00	0.00	0.16	0.00
2315	0.00	0.04	0.00	0.00	0.20	0.00
2300	0.04	0.00	0.00	0.00	0.51	0.00
2245	0.04	0.08	0.00	0.00	0.43	0.00
2230	0.00	0.39	0.00	0.04	0.12	0.00
2215	0.04	0.00	0.08	0.04	0.08	0.00
2200	0.00	0.00	0.00	0.04	0.00	0.04
2145	0.00	0.00	0.00	0.04	0.08	0.00
2130	0.00	0.00	0.00	0.00	0.35	0.08
2115	0.00	0.00	0.00	0.00	0.08	0.35
2100	0.04	0.00	0.12	0.31	0.00	0.31
2045	0.43	0.00	0.31	0.59	0.00	0.39
2030	0.16	0.00	0.16	0.16	0.00	0.91
2015	0.35	0.00	0.28	0.31	0.00	0.28
2000	0.71	0.00	0.51	0.59	0.00	0.00
1945	0.59	0.00	1.06	0.47	0.00	0.00
1930	0.43	0.00	0.12	0.00	0.00	0.00
1915	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS:	3.07	2.95	2.91	2.83	2.80	2.64

Device ID 6690 is Spookhill Brown
 6715 is Magma FRS
 6635 is Spookhill McKellips
 4560 is Spookhill FRS
 6740 is Whitlow Ranch Dam
 4700 is Durango Complex

Table 1 above presents 15-minute rainfall values for the six highest storm-rainfall totals at FCD ALERT raingages. The bulk of the rainfall in the Spookhill area fell between 7:30 PM and 9:00 PM, while further east at Magma and Whitlow Ranch Dams it rained hardest between 10:30 PM and 12:30 AM.

Table 2 below is the [NOAA Atlas 14](#) Point Precipitation Frequency Estimate Table at the latitude/longitude of the **Spookhill McKellips** (6635) raingage. The red lines list the recorded values from Spookhill McKellips, **Spookhill Brown** (6690) and **Spookhill FRS** (4560) from 7/10/2008. These three stations are close enough in space and elevation that one frequency table can be applied to all. The blue lines are the interpolated return periods for each rainfall amount in years. AEP is "Annual Exceedance Probability".

Precipitation Frequency Estimates (inches) 33.4511N 111.6678W																		
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	0.22	0.34	0.42	0.57	0.71	0.80	0.85	1.01	1.15	1.43	1.53	1.92	2.14	2.34	2.92	3.42	4.03	4.51
5	0.33	0.50	0.62	0.83	1.03	1.15	1.20	1.39	1.57	1.98	2.15	2.74	3.07	3.34	4.16	4.87	5.73	6.40
10	0.40	0.61	0.76	1.02	1.26	1.39	1.45	1.66	1.86	2.36	2.58	3.33	3.74	4.06	5.01	5.86	6.87	7.64
25	0.50	0.75	0.93	1.26	1.56	1.70	1.78	2.01	2.23	2.87	3.14	4.14	4.66	5.04	6.12	7.15	8.32	9.19
50	0.57	0.86	1.07	1.44	1.78	1.94	2.04	2.28	2.50	3.26	3.59	4.79	5.40	5.82	6.96	8.14	9.41	10.34
100	0.64	0.97	1.21	1.63	2.01	2.19	2.31	2.56	2.78	3.67	4.04	5.47	6.19	6.65	7.82	9.14	10.51	11.48
200	0.71	1.09	1.35	1.81	2.24	2.43	2.59	2.84	3.07	4.09	4.52	6.21	7.03	7.52	8.69	10.16	11.63	12.61
500	0.81	1.24	1.53	2.07	2.56	2.77	2.98	3.24	3.45	4.66	5.17	7.24	8.23	8.76	9.89	11.56	13.12	14.12
1000	0.89	1.35	1.68	2.26	2.79	3.02	3.29	3.55	3.75	5.12	5.68	8.09	9.21	9.76	10.82	12.65	14.29	15.27
6635	0.43	0.83	1.10	1.61	2.13	2.56	2.64	2.83	2.91	2.91								
≈AEP	13	41	58	93	144	284	225	195	136	27								
6690	0.31	0.59	0.75	1.38	2.20	2.72	2.76	2.95	3.07	3.07								
≈AEP	4	9	10	40	177	437	298	257	200	36								
4560	0.35	0.67	0.83	1.18	1.73	2.44	2.60	2.76	2.83	2.83								
≈AEP	6	15	15	18	43	206	205	164	113	23								

Table 3 below is the [NOAA Atlas 14](#) Point Precipitation Frequency Estimate Table at the latitude/longitude of the **Whitlow Ranch Dam** raingage (6740). The red line lists the recorded rainfall values from 7/10/2008. The blue line is the interpolated return period for each rainfall amount in years. AEP is "Annual Exceedance Probability".

Precipitation Frequency Estimates (inches) 33.2991N 111.2759W																		
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	0.27	0.41	0.51	0.68	0.84	0.96	1.00	1.19	1.42	1.76	1.94	2.34	2.63	2.89	3.63	4.32	5.13	5.86
5	0.39	0.59	0.74	0.99	1.23	1.37	1.41	1.63	1.92	2.41	2.70	3.27	3.70	4.03	5.08	6.01	7.12	8.07
10	0.47	0.72	0.89	1.20	1.49	1.65	1.70	1.94	2.27	2.87	3.23	3.94	4.48	4.86	6.08	7.18	8.45	9.53
25	0.58	0.88	1.10	1.47	1.82	2.01	2.08	2.34	2.71	3.48	3.93	4.85	5.55	6.00	7.39	8.71	10.17	11.37
50	0.66	1.01	1.25	1.68	2.08	2.29	2.37	2.65	3.04	3.95	4.48	5.58	6.43	6.91	8.40	9.89	11.46	12.73
100	0.74	1.13	1.40	1.89	2.33	2.57	2.67	2.96	3.38	4.43	5.04	6.36	7.37	7.88	9.43	11.11	12.76	14.08
200	0.82	1.25	1.55	2.09	2.59	2.85	2.99	3.29	3.72	4.93	5.63	7.18	8.39	8.91	10.50	12.35	14.07	15.42
500	0.93	1.42	1.76	2.37	2.93	3.22	3.42	3.72	4.17	5.62	6.43	8.34	9.85	10.38	11.96	14.06	15.83	17.20
1000	1.01	1.54	1.91	2.58	3.19	3.52	3.78	4.07	4.52	6.17	7.08	9.29	11.06	11.57	13.11	15.39	17.19	18.55
6740	0.16	0.31	0.43	0.83	1.30	2.01	2.52	2.76	2.80	2.80								
≈AEP	<2	<2	<2	3	8	25	71	64	30	9								

Table 4 below is the [NOAA Atlas 14](#) Point Precipitation Frequency Estimate Table at the latitude/longitude of the [Durango Complex](#) raingage (4700). The red line lists the recorded rainfall values from 7/10/2008. The blue line is the interpolated return period for each rainfall amount in years. AEP is "Annual Exceedance Probability".

Precipitation Frequency Estimates (inches) 33.4266N 112.1186W																		
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	0.23	0.35	0.43	0.58	0.72	0.81	0.86	1.02	1.14	1.31	1.40	1.53	1.69	1.83	2.24	2.62	3.04	3.38
5	0.34	0.51	0.63	0.85	1.06	1.17	1.23	1.42	1.58	1.83	1.98	2.19	2.41	2.61	3.19	3.73	4.33	4.80
10	0.41	0.62	0.77	1.04	1.29	1.42	1.48	1.70	1.87	2.20	2.39	2.65	2.92	3.16	3.83	4.47	5.17	5.71
25	0.51	0.77	0.95	1.29	1.59	1.75	1.83	2.06	2.25	2.68	2.95	3.28	3.62	3.90	4.65	5.43	6.22	6.85
50	0.58	0.88	1.09	1.47	1.82	1.99	2.10	2.34	2.53	3.05	3.38	3.78	4.17	4.49	5.27	6.16	7.01	7.68
100	0.65	0.99	1.23	1.65	2.04	2.24	2.38	2.63	2.82	3.44	3.83	4.31	4.75	5.10	5.90	6.89	7.78	8.49
200	0.72	1.10	1.37	1.84	2.28	2.49	2.67	2.92	3.11	3.84	4.30	4.87	5.36	5.74	6.53	7.62	8.54	9.28
500	0.82	1.25	1.55	2.09	2.58	2.83	3.06	3.31	3.50	4.40	4.95	5.66	6.22	6.64	7.37	8.61	9.54	10.30
1000	0.90	1.36	1.69	2.28	2.82	3.09	3.39	3.62	3.81	4.83	5.48	6.30	6.91	7.35	8.02	9.37	10.29	11.05
4700	0.39	0.75	1.02	1.42	2.17	2.32	2.32	2.60	2.64	2.64								
≈AEP	8	22	35	41	146	125	86	93	65	23								

Table 5 below is the [NOAA Atlas 14](#) Point Precipitation Frequency Estimate Table at the latitude/longitude of a point between three raingages: [Magma FRS](#) (6715, owned by FCDMC), **Magma Cattle Company** (711, approx. 7 miles SE of Florence Jct.) and **Magma 79** (721, approx. 4 miles S of Florence Jct.), both of which are owned by Pinal County Flood Control. These three stations are close enough in space and elevation that one frequency table can be applied to all, and are all in the watershed contributing to Magma FRS. The blue lines are the interpolated return periods for each rainfall amount in years.

Precipitation Frequency Estimates (inches) 33.1692N 111.3267W																	
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	
2	0.25	0.37	0.46	0.62	0.77	0.87	0.91	1.09	1.26	1.54	1.69	1.97	2.19	2.40	2.99	3.52	
5	0.36	0.55	0.68	0.91	1.13	1.26	1.30	1.50	1.72	2.13	2.37	2.78	3.09	3.38	4.22	4.96	
10	0.44	0.66	0.82	1.11	1.37	1.52	1.56	1.78	2.03	2.54	2.85	3.36	3.75	4.09	5.06	5.94	
25	0.54	0.82	1.01	1.36	1.69	1.86	1.92	2.15	2.43	3.09	3.48	4.15	4.64	5.05	6.15	7.21	
50	0.61	0.93	1.16	1.56	1.93	2.12	2.19	2.44	2.73	3.51	3.97	4.78	5.36	5.81	6.98	8.18	
100	0.69	1.05	1.30	1.75	2.17	2.38	2.48	2.73	3.03	3.95	4.48	5.45	6.13	6.61	7.82	9.16	
200	0.77	1.17	1.45	1.95	2.41	2.64	2.77	3.03	3.34	4.40	5.02	6.15	6.94	7.45	8.67	10.16	
500	0.87	1.33	1.64	2.21	2.74	3.00	3.19	3.45	3.75	5.02	5.75	7.15	8.10	8.65	9.84	11.52	
1000	0.95	1.45	1.79	2.41	2.99	3.27	3.52	3.78	4.07	5.52	6.34	7.96	9.04	9.61	10.74	12.57	
6715	0.28	0.55	0.79	1.22	1.89	2.28	2.80	2.87	2.95	2.95							
≈AEP	3	5	9	15	45	77	214	138	83	20							
711	0.35	0.51	0.67	1.06	1.65	2.72	3.82	4.17	4.21	4.21							
≈AEP	5	4	5	8	22	245	>1000	>1000	>1000	149							
721	0.35	0.59	0.79	1.26	1.73	3.27	3.74	4.13	4.49	4.69							
≈AEP	5	6	9	17	28	1000	>1000	>1000	>1000	307							

RUNOFF

There were two big runoff stories in this event:

The first was at Spookhill FRS and the new Spookhill levee along the section of Loop 202 that was scheduled to open on July 15th. The runoff facilities functioned well under the extreme rainfall, but numerous areas of bank erosion were noted and repaired. FCD ALERT stations at McDowell, McKellips and Brown Roads were moved after the event, from the sides of the box culverts to their tops, because erosion was severe enough to nearly topple the standpipes.

The second story occurred at Magma FRS in Pinal County, where “off the scale” rainfall intensities (see bottom of page 9) filled the dam to 45% of its spillway capacity. This was a good test of the Emergency Action Plan that had recently been developed for the dam, as there were concerns regarding the dam’s structural integrity from recent inspections. About 2 hours into the fill event the District’s pressure transducer, which was mounted on the upstream side of the dam’s principal outlet, was broken from its mounts by the high-velocity inflow. However, the gage did its job as responders were notified to visually monitor the dam.

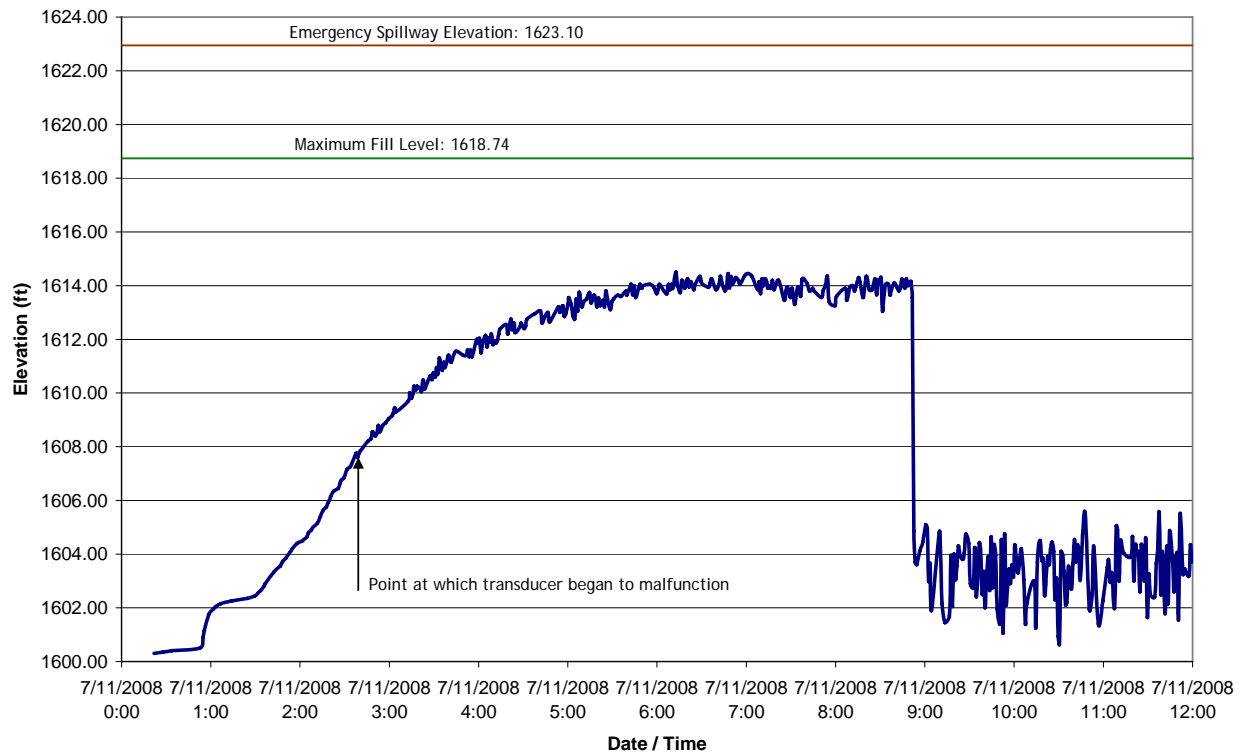
Selected Impoundment Stations (Table 6)

Structure Name	ID	Peak Stage (ft)	Peak Outflow (cfs)	Peak Storage (ac-ft)	Peak Capacity (% full)	Date-Time
Magma FRS	6718	18.74	167	2,470	45	Unknown
Rittenhouse FRS	6703	10.06	106	403	10	7/11-06:56
Spookhill FRS	4563	8.90	58	209	10	7/10-23:10
Vineyard FRS	6688	0.73	5	29	<1	7/11-09:26
Whitlow Ranch Dam	6739	11.14	250	13	<1	7/11-01:12

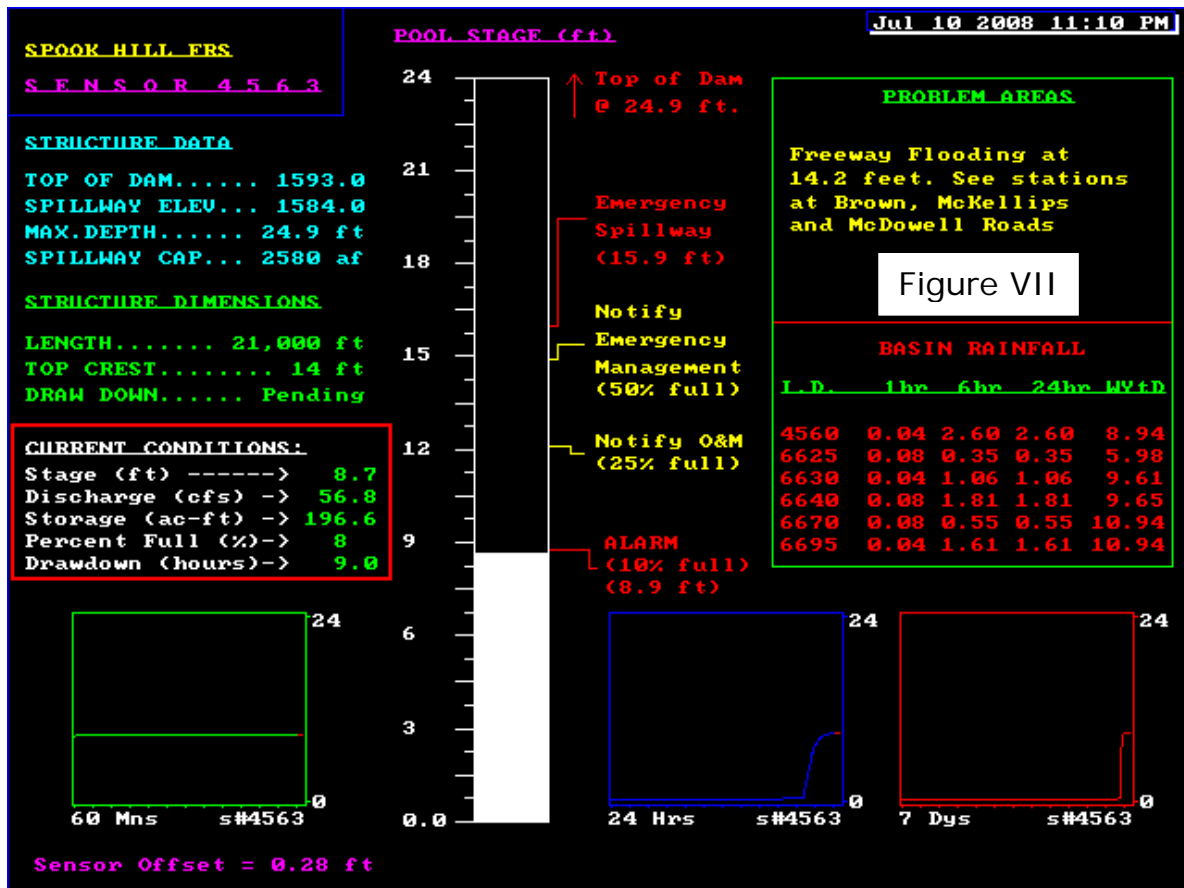
Vineyard FRS is included above because of what *didn't* happen there. Looking at the rainfall values in Figure V one might assume that Vineyard (& Powerline too) would experience a significant impoundment. This shows the ability of these watersheds to absorb large amounts of water after being dry for several months. On 7/13/2008 a rainfall event of much lesser magnitude, falling on a wet watershed, caused a ponding elevation of 1.3 feet at Vineyard FRS.

Magma FRS - ID 6718

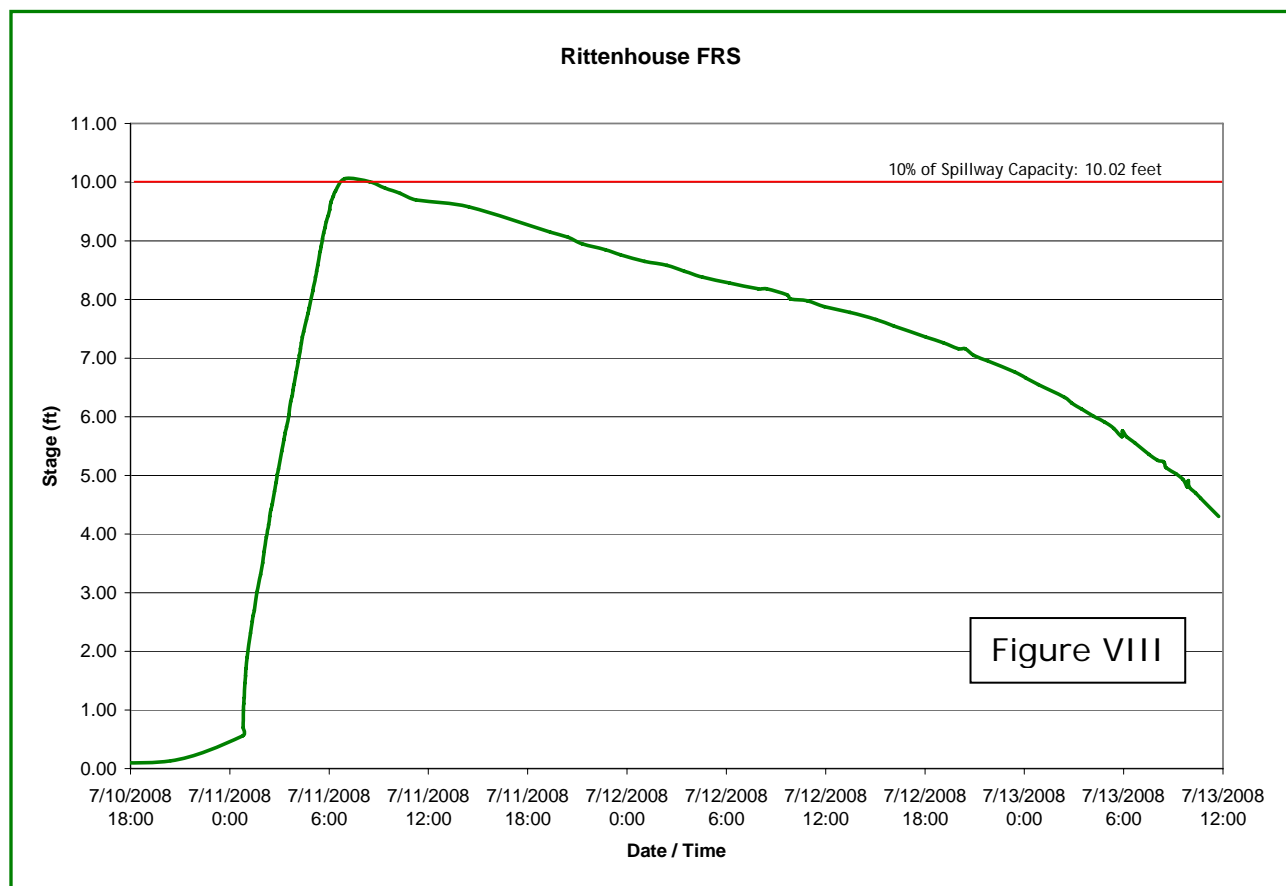
Figure VI



Magma FRS – Inflow Hydrograph



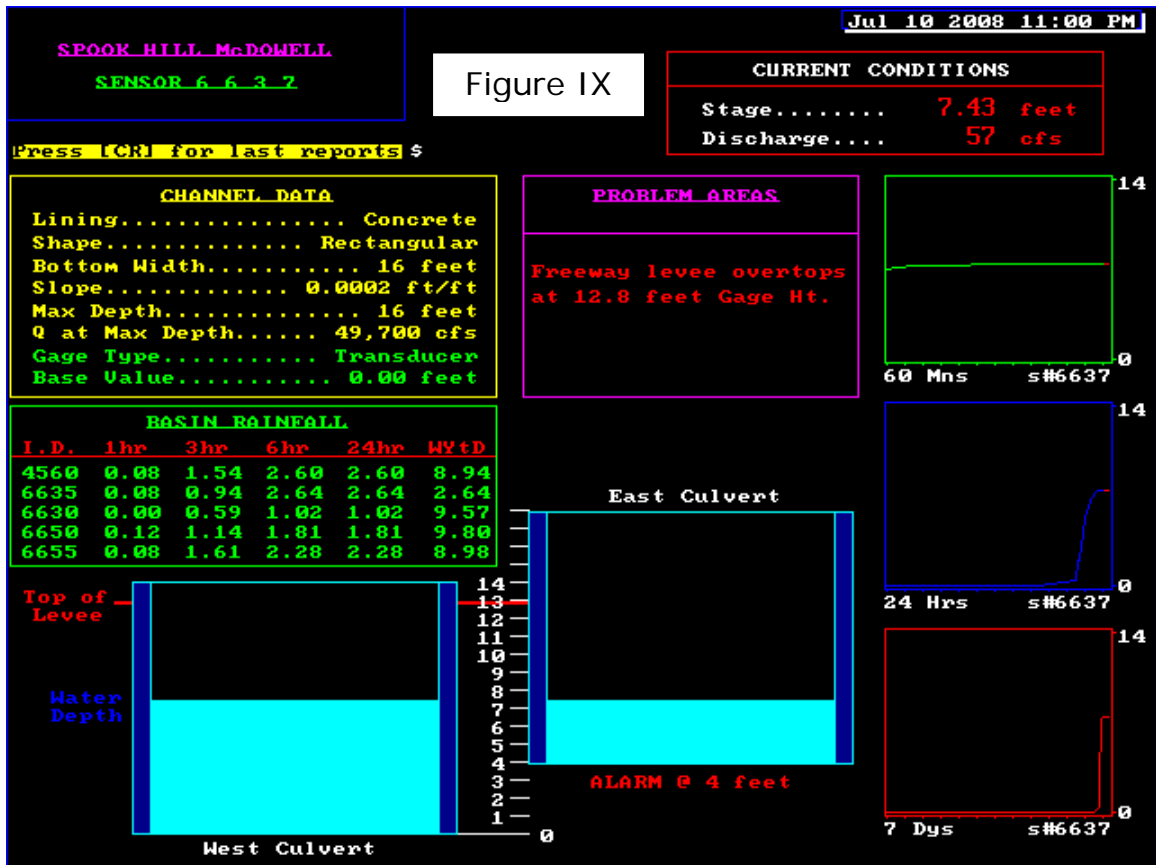
Spookhill FRS near 10% of spillway capacity – 07/10/2008 @ 11:10 PM MST



Rittenhouse FRS – Inflow Hydrograph

Selected Stream Stations (Table 7)

Water-level Sensor Name	ID	Peak Discharge (cfs)	Peak Stage (ft)	Date-Time
ACDC @ 43rd Ave.	4823	2,344	3.85	7/10-21:48
ACDC @ 67th Ave.	5523	1,627	5.50	7/10-22:34
EMF @ Broadway	6573	1,402	2.78	7/10-22:44
Granite Reef	4568	751	1.75	7/10-22:02
Granite Reef Wash	4728	39	3.00	7/11-02:09
Guadalupe Channel	6603	739	2.45	7/10-20:35
Indian Bend Wash @ Shea	4693	589	1.88	7/10-22:24
New River @ Glendale	5508	3,216	1.33	7/11-01:14
Spookhill Brown	6693	58	5.42	7/10-21:13
Spookhill McDowell	6637	57	7.43	7/10-22:29
Spookhill McKellips	6638	58	6.60	7/10-22:44

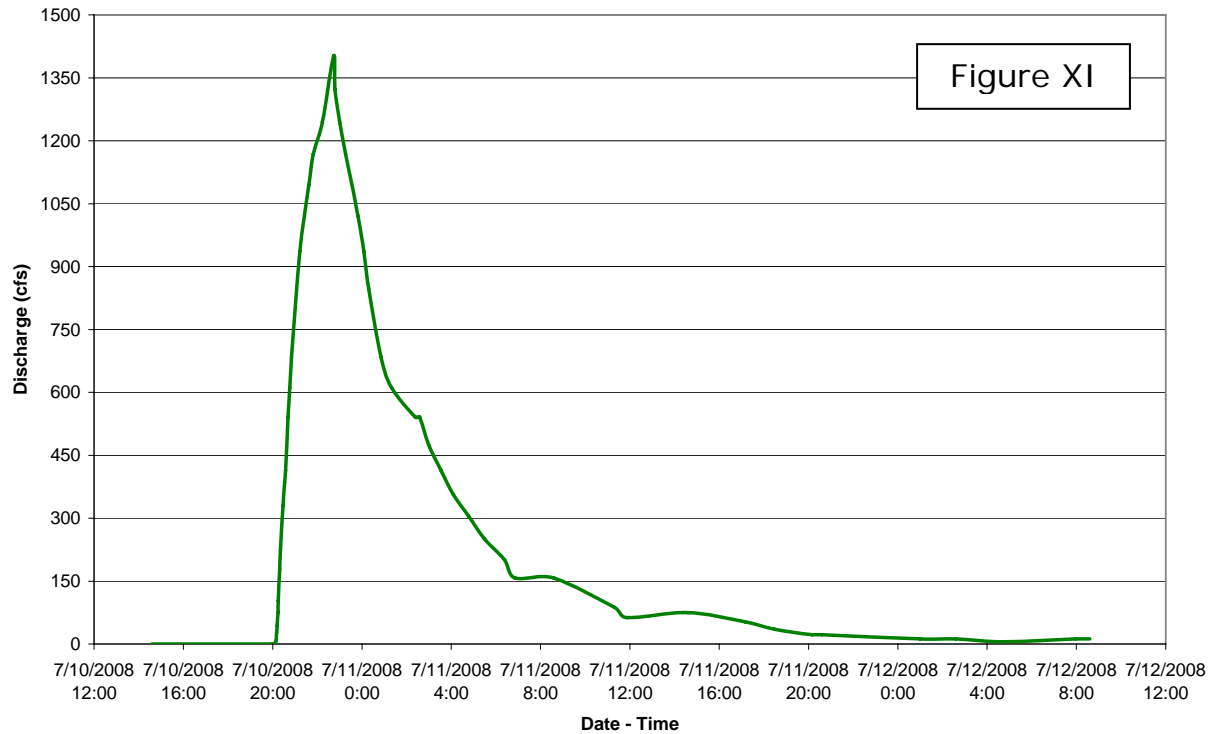


Spookhill at McDowell Stream Gage near its peak, 07/10/2008 @ 11:00 PM MST

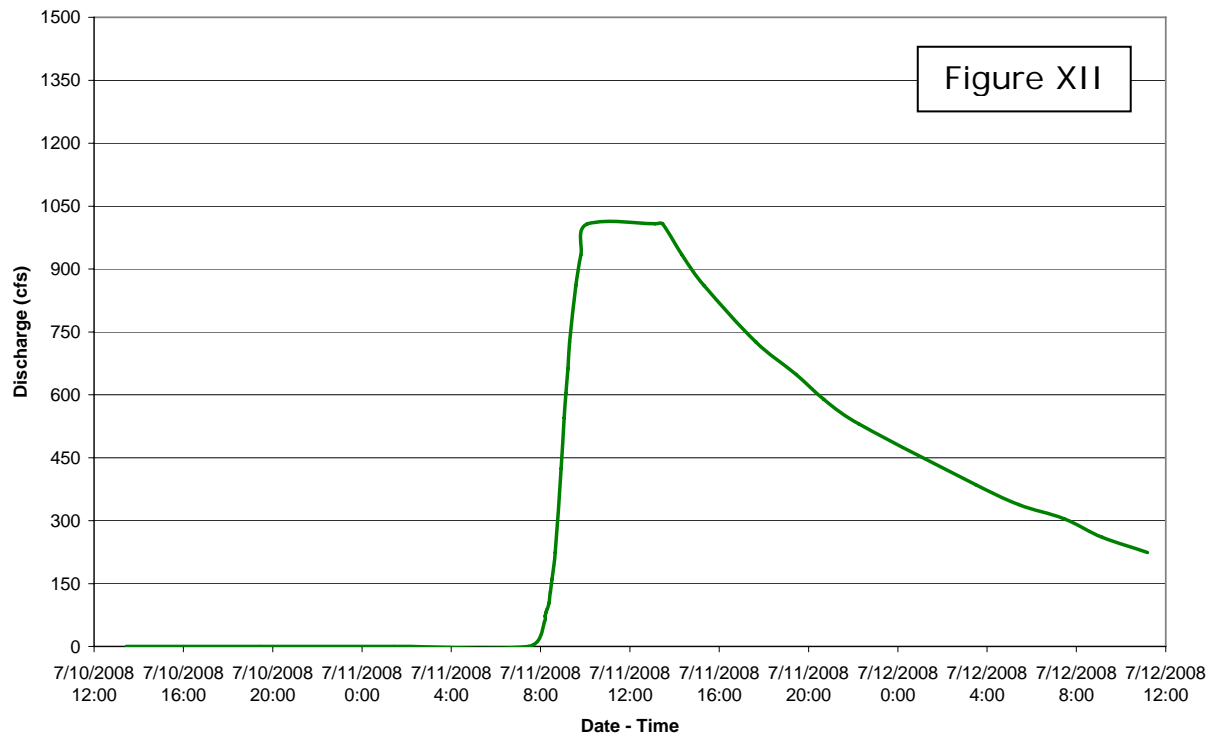


These partially submerged culverts are on the upstream side of the Spookhill Levee, and pass water from south to north beneath McDowell Road. The new section of the Loop 202 freeway is off the photo to the left. The water surface appears brown because of all the floating straw washed down from recent landscaping.

EMF @ Broadway Rd.



EMF at Queen Creek Road

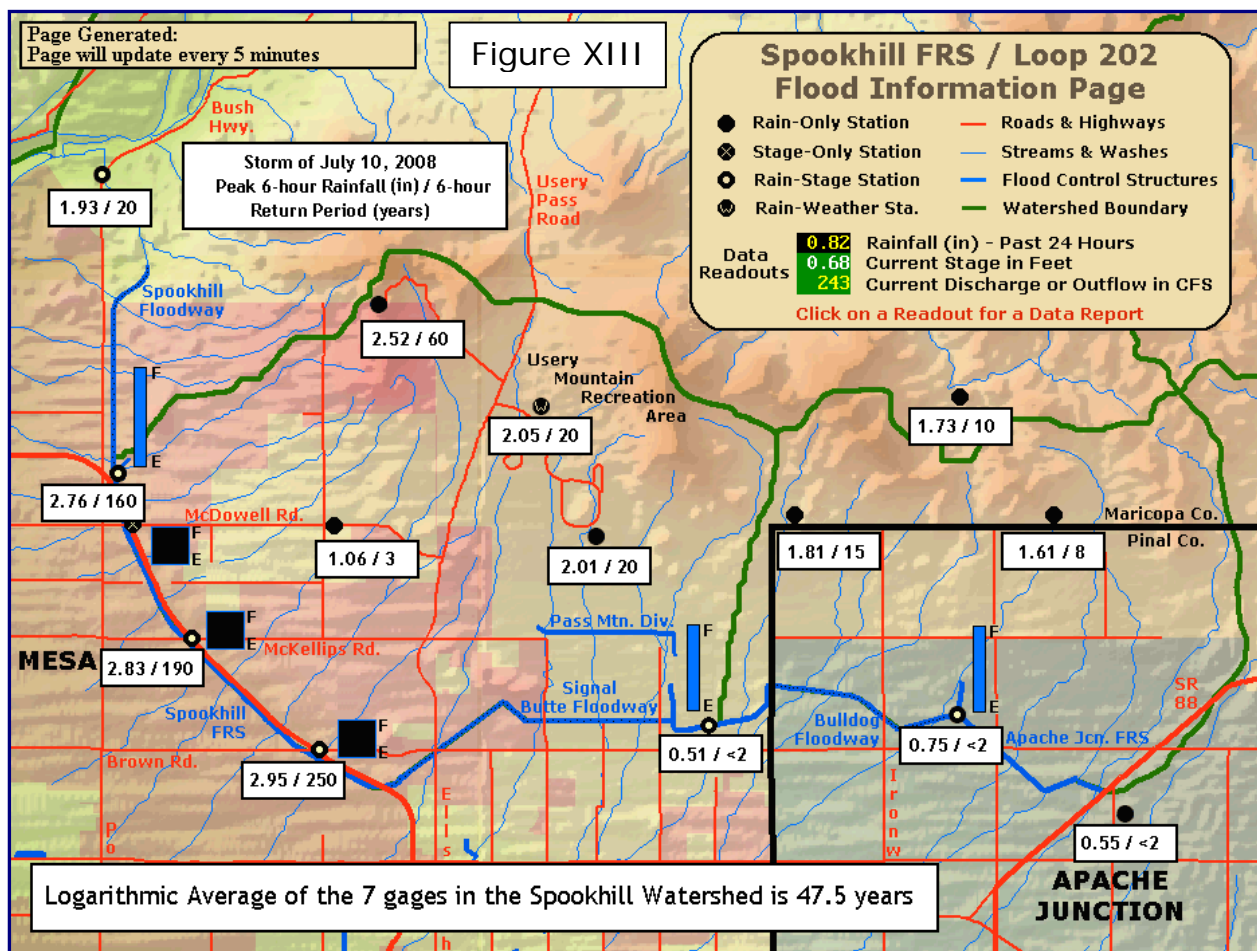


Two hydrographs from gages on the East Maricopa Floodway. The X and Y scales are the same to show the hydrograph translation as it moved downstream from Broadway to Queen Creek Road.

THOUGHTS

The new ADOT levee along the Loop 202 freeway (which opened for traffic on July 15th) was tested by this locally severe event. Rainfall on the structure itself exceeded 150 year return periods, and the logarithmic average of the seven raingages in the watershed directly feeding it was 47.5 years (see Figure XIII below). Luckily, the structure did not receive a large contribution from the watershed feeding Signal Butte and Apache Junction Flood Retarding Structures, and in general runoff was not as abundant as it could have been because this was the first major storm of the season.

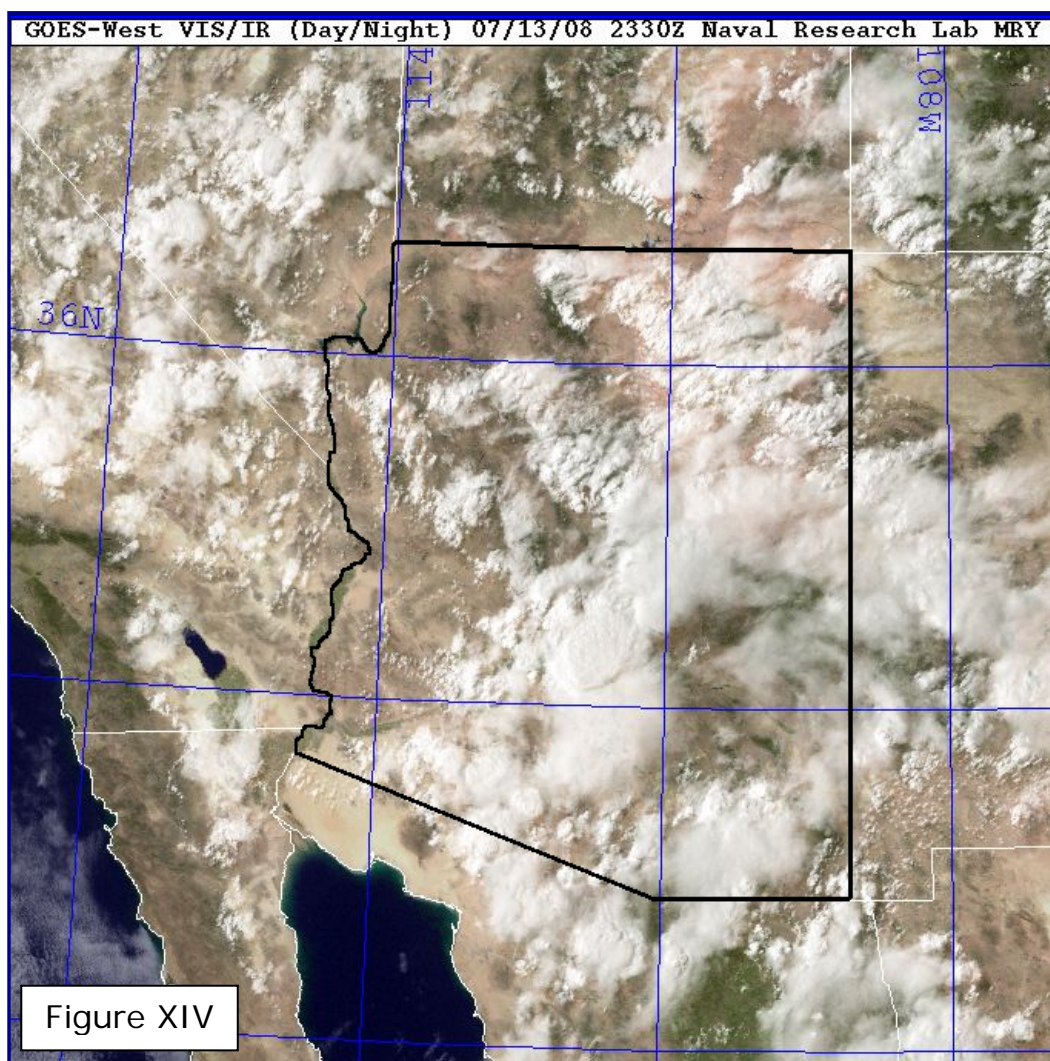
In areas near and including the watershed feeding Magma FRS in Pinal County, approximately 117 square miles received three or more inches of rain from this storm, with *measured* return periods exceeding 1,000 years (see Table 5). This is a very rare storm for central Arizona, and would have caused major damage to infrastructure and transportation had it occurred in the urban area. The fact that the Magma FRS only filled to 45% of its spillway capacity can again, I believe, be attributed to the dry condition of the watershed prior to the storm.



Storm of July 13th, 2008

METEOROLOGY

July 11th and 12th were relatively stable days in our area, but atmospheric moisture remained at elevated levels. On the 11th a complex of storms developed in northern Pima County that dropped more than 4 inches in some areas. Instability returned to the region on the 13th. Storms formed over the mountains to our east and by early evening were pushing outflow gusts into the Valley. The resultant storm that formed over southeast Phoenix and north Tempe dropped more than two inches of rain in a short period of time. The highest wind gust measured by an FCD gage was 36 mph at McMicken Dam in Surprise.



GOES-West Enhanced Visible Image, July 13, 2008 at 4:30 PM MST

PRECIPITATION

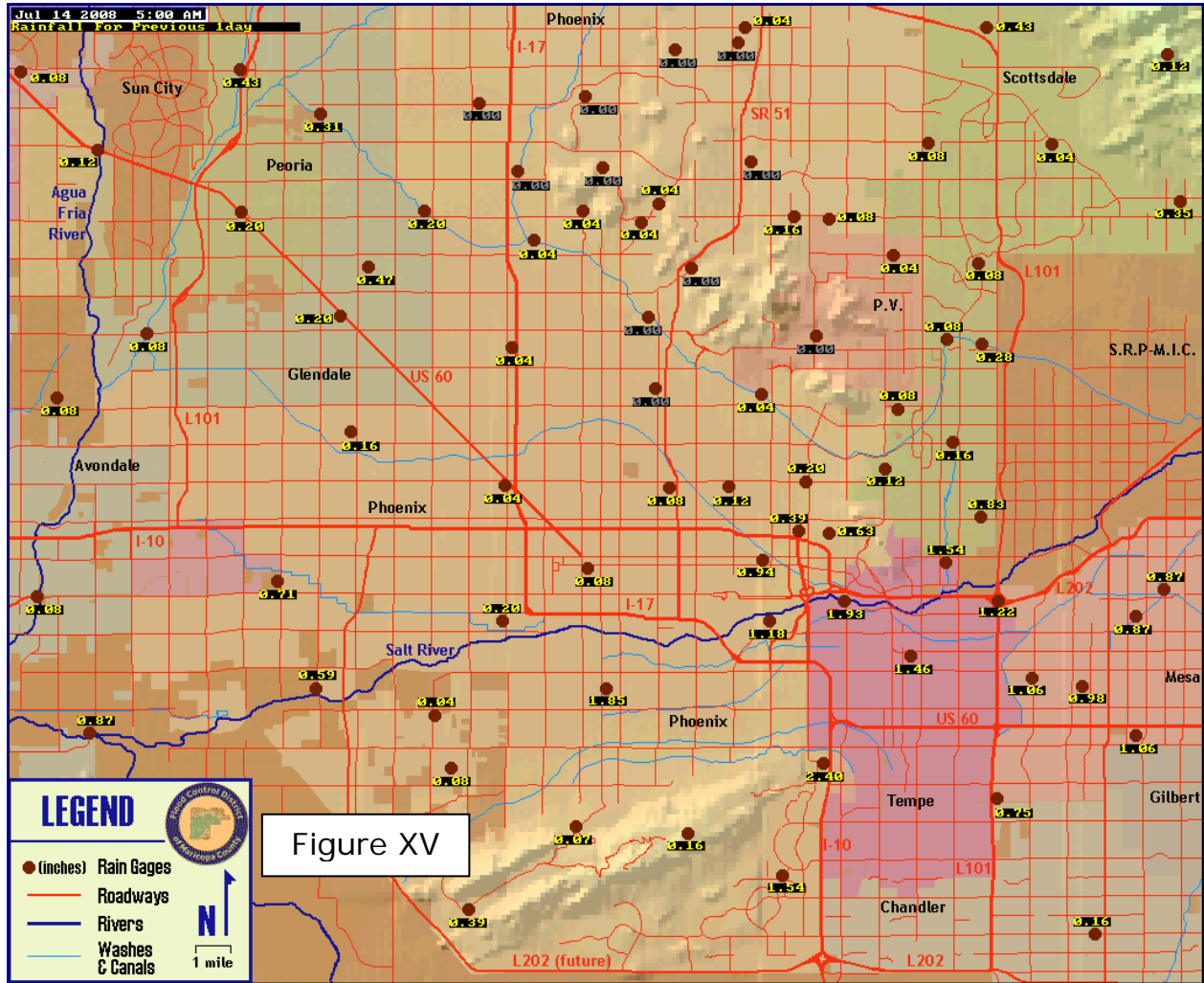


Figure XV – 24 hour precipitation values in the central metro area ending 07/14/2008 at 05:00 MST. All readings are in inches and are from automated Flood Control District raingages.

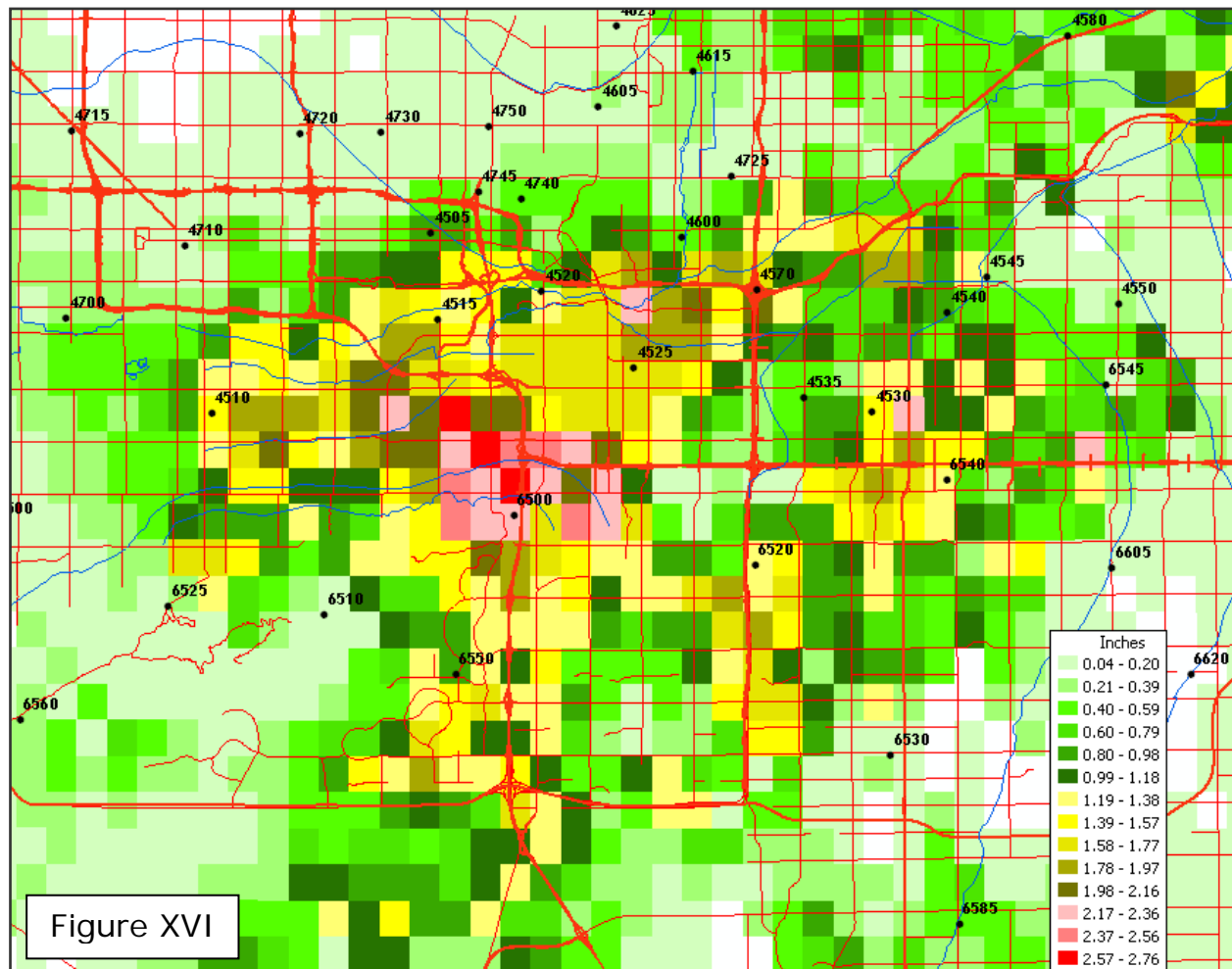


Figure XVI – This map was generated using GIS and a gridded rainfall product provided by our weather vendor. The colored cells are approximately 1 km on a side and represent an average rainfall depth for that area. The depths are accumulated for the 6-hour period prior to 07/13/2008 at 9:00 PM MST. The cell values are derived from an algorithm that sums the weather radar returns, then adjusts them using the raingage readings. The black numbers are ALERT raingage ID numbers. ID 6500, near the center of the red cells, is Guadalupe FRS.

TABLE 8

DeviceID	6500	4520	4510	4600	6550	4525
StatType	rain	rain	rain	rain	rain	rain
DataType	precip	precip	precip	precip	precip	precip
Units	in	in	in	in	in	in
07/13/08						
2000	0.00	0.00	0.00	0.00	0.00	0.00
1945	0.00	0.00	0.00	0.00	0.00	0.00
1930	0.00	0.00	0.00	0.00	0.00	0.00
1915	0.00	0.00	0.00	0.00	0.00	0.00
1900	0.00	0.04	0.04	0.00	0.00	0.00
1845	0.00	0.00	0.00	0.00	0.00	0.00
1830	0.04	0.04	0.00	0.00	0.00	0.00
1815	0.00	0.00	0.04	0.00	0.00	0.00
1800	0.04	0.00	0.00	0.00	0.00	0.00
1745	0.00	0.00	0.08	0.00	0.00	0.00
1730	0.00	0.00	0.00	0.00	0.00	0.00
1715	0.00	0.12	0.00	0.08	0.00	0.00
1700	0.24	0.16	0.20	0.12	0.04	0.16
1645	0.83	0.28	0.94	0.35	0.16	0.24
1630	0.79	0.67	0.55	0.71	0.35	0.51
1615	0.43	0.39	0.00	0.28	0.67	0.55
1600	0.04	0.24	0.00	0.00	0.31	0.00
1545	0.00	0.00	0.00	0.00	0.00	0.00
1530	0.00	0.00	0.00	0.00	0.00	0.00
1515	0.00	0.00	0.00	0.00	0.00	0.00
1500	0.00	0.00	0.00	0.00	0.00	0.00
1445	0.00	0.00	0.00	0.00	0.00	0.00
1430	0.00	0.00	0.00	0.00	0.00	0.00
1415	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS:	2.40	1.93	1.85	1.54	1.54	1.46

Device ID 6500 is Guadalupe FRS
 4520 is Salt River @ Priest Dr.
 4510 is Roeser @ 2nd St.
 4600 is IBW @ McKellips Rd.
 6550 is Ahwatukee
 4525 is ASU South

Table 8 above presents 15-minute rainfall values for the six highest storm-rainfall totals at FCD ALERT raingages. Note that the bulk of the rainfall fell in a one-hour period between 4:00 and 5:00 PM in the afternoon.

Table 9 below is the [NOAA Atlas 14](#) Point Precipitation Frequency Estimate Table at the latitude/longitude of the [Guadalupe FRS](#) raingage (6500). The red line lists the recorded rainfall values from 7/13/2008. The blue line is the interpolated return period for each rainfall amount in years. AEP is "Annual Exceedance Probability".

Precipitation Frequency Estimates (inches) 33.3719N 111.9705W																		
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	0.21	0.32	0.40	0.54	0.67	0.77	0.83	0.97	1.08	1.30	1.41	1.56	1.72	1.87	2.31	2.69	3.14	3.49
5	0.31	0.48	0.59	0.79	0.98	1.12	1.18	1.35	1.49	1.82	2.00	2.23	2.45	2.67	3.29	3.84	4.47	4.97
10	0.38	0.58	0.72	0.97	1.20	1.36	1.42	1.61	1.76	2.18	2.42	2.70	2.98	3.24	3.96	4.61	5.35	5.92
25	0.47	0.72	0.89	1.20	1.48	1.67	1.75	1.96	2.12	2.66	2.97	3.35	3.69	4.00	4.81	5.60	6.45	7.11
50	0.54	0.82	1.02	1.38	1.70	1.90	2.01	2.22	2.38	3.04	3.41	3.86	4.25	4.60	5.46	6.35	7.27	7.97
100	0.61	0.93	1.15	1.55	1.92	2.14	2.28	2.49	2.65	3.42	3.86	4.40	4.85	5.23	6.11	7.11	8.08	8.82
200	0.68	1.04	1.29	1.73	2.14	2.39	2.56	2.77	2.92	3.82	4.33	4.98	5.47	5.89	6.76	7.87	8.89	9.65
500	0.78	1.18	1.46	1.97	2.44	2.71	2.94	3.16	3.29	4.36	4.99	5.79	6.36	6.82	7.65	8.91	9.95	10.74
1000	0.85	1.29	1.60	2.16	2.67	2.97	3.25	3.46	3.58	4.80	5.52	6.45	7.07	7.57	8.33	9.70	10.75	11.54
6500	0.28	0.55	0.83	1.57	2.28	2.36	2.40	2.40										
≈AEP	4	8	21	108	307	184	135	79										

Table 10 below is the [NOAA Atlas 14](#) Point Precipitation Frequency Estimate Table at the latitude/longitude of the [Salt River at Priest Dr.](#) raingage (4520). The red line lists the recorded rainfall values from 7/13/2008. The blue line is the interpolated return period for each rainfall amount in years. AEP is "Annual Exceedance Probability".

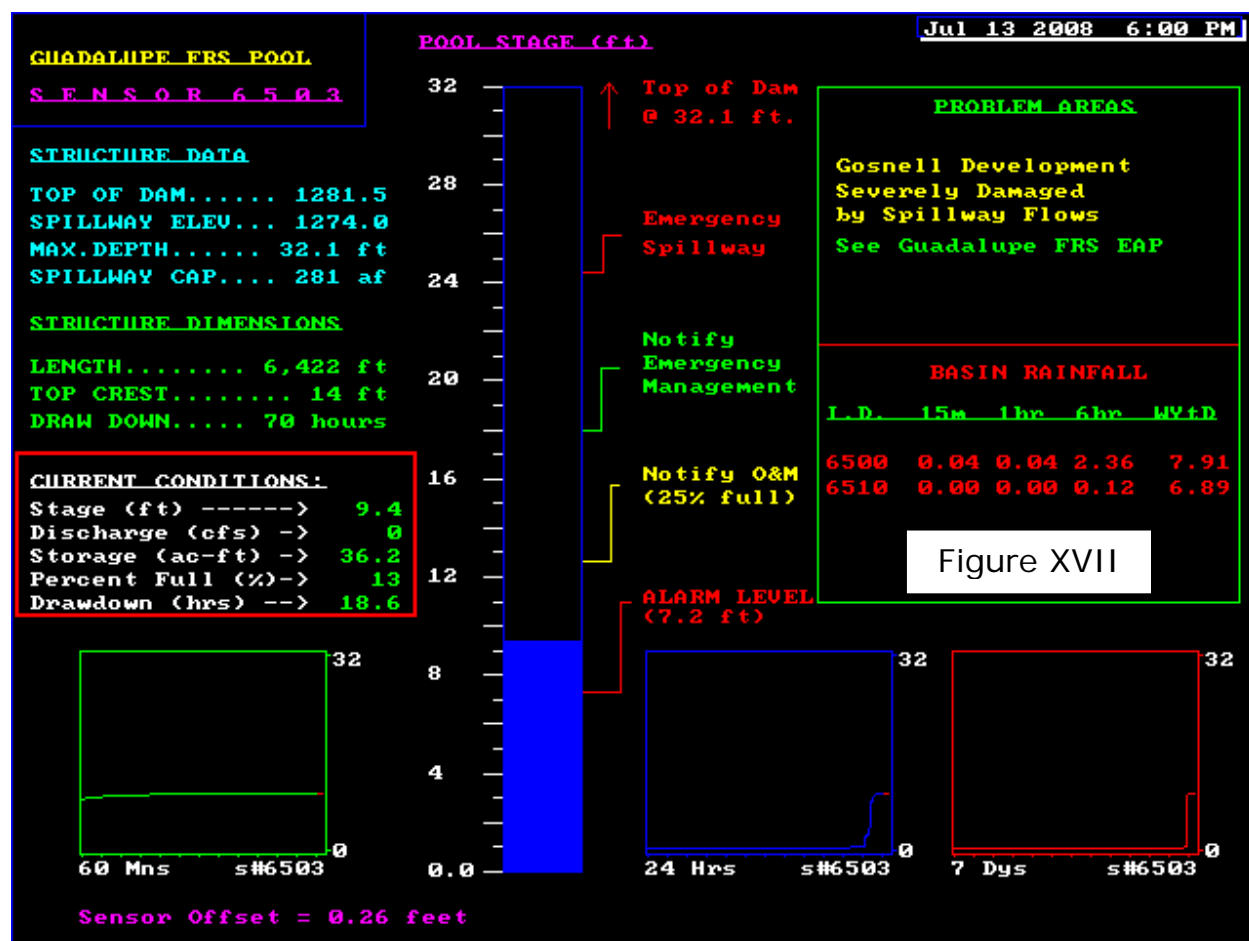
Precipitation Frequency Estimates (inches) 33.4320N 111.9613W																		
AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.21	0.32	0.39	0.53	0.65	0.75	0.80	0.95	1.07	1.29	1.42	1.57	1.73	1.89	2.33	2.72	3.17	3.52
5	0.31	0.47	0.58	0.78	0.96	1.09	1.14	1.33	1.47	1.81	2.01	2.24	2.47	2.69	3.32	3.87	4.51	5.01
10	0.38	0.57	0.71	0.95	1.18	1.32	1.38	1.58	1.74	2.17	2.44	2.72	3.00	3.26	3.99	4.65	5.40	5.97
25	0.46	0.71	0.88	1.18	1.46	1.62	1.70	1.92	2.09	2.65	3.00	3.37	3.72	4.03	4.86	5.66	6.51	7.17
50	0.53	0.81	1.01	1.35	1.68	1.86	1.96	2.19	2.36	3.02	3.44	3.89	4.29	4.64	5.51	6.41	7.34	8.05
100	0.60	0.91	1.13	1.53	1.89	2.09	2.22	2.46	2.63	3.40	3.90	4.44	4.89	5.28	6.16	7.18	8.16	8.90
200	0.67	1.02	1.27	1.71	2.11	2.33	2.49	2.73	2.90	3.80	4.38	5.02	5.52	5.95	6.83	7.95	8.97	9.74
500	0.77	1.17	1.45	1.95	2.41	2.65	2.87	3.11	3.26	4.35	5.05	5.84	6.41	6.88	7.72	9.00	10.05	10.84
1000	0.84	1.28	1.58	2.13	2.64	2.91	3.18	3.41	3.55	4.78	5.59	6.51	7.13	7.63	8.41	9.80	10.86	11.65
4520	0.24	0.43	0.63	1.02	1.61	1.85	1.89	1.93										
≈AEP	3	4	7	13	40	49	42	26										

RUNOFF

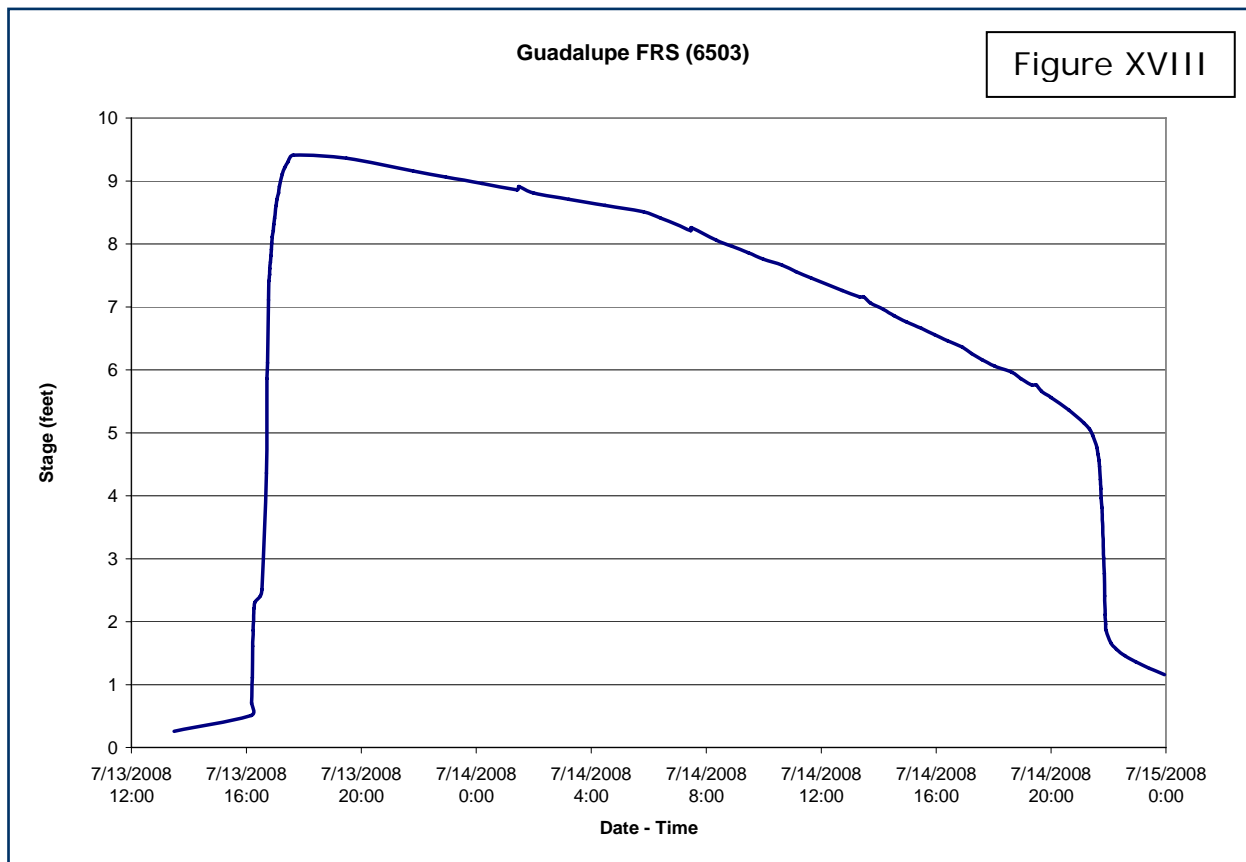
Runoff of consequence was in effect limited to the high-rainfall areas shown in Figure XVI. Because most of this area is urbanized there are few established drainage channels and therefore few stream gages. Two runoff instances stand out – the inflow to Guadalupe FRS, which reached its highest impoundment ever since records were established in 1989, and the Superstition Freeway (US 60) from Priest Drive to Mill Avenue, which was closed for several hours due to ponded water accumulating faster than it could be pumped out.

Selected Impoundment Station (Table 11)

Structure Name	ID	Peak Stage (ft)	Peak Outflow (cfs)	Peak Storage (ac-ft)	Peak Capacity (% full)	Date-Time
Guadalupe FRS	6503	9.41	Gated	36	12.8	7/13-17:38



Guadalupe FRS near its peak, 07/13/2008 @ 6:00 PM MST



Guadalupe FRS – Inflow Hydrograph





Guadalupe Detention Basin in the Town of Guadalupe approximately 1 mile SE of Guadalupe FRS. Although there is not a water-level monitoring station at the basin, this is likely the largest impoundment experienced since its construction in 2003.



This photo of the storm was taken by the author on 07/13/2008 at 4:15 PM. The view is to the east from the Flood Control District office at 2801 W. Durango St., Phoenix.

THOUGHTS

This storm was much smaller in aerial extent than the storm on the 10th, but was significant because of the area that was affected. For reasons of geography, storm patterns, or just chance, the area east of the Salt River Mountains (which includes South Mountain) is infrequently hit by severe storms. As noted on page 22, this storm produced the largest volume of water stored behind Guadalupe FRS since 1989, and is likely the largest storm since 1969 – the storm that originally prompted the construction of the dam. Had this area been wetted sufficiently by the storm on the 10th (see Figure III), or if the core of the storm had been more centered over the watershed, the impoundment would have been much larger.

As shown in the chart below, Monsoon 2008 was the second wettest in central Arizona since 1999. These two storms (July 10th and 13th) were the result of greater than normal moisture being advected into the State from Mexico, and this condition continued into August where urban Phoenix experienced three additional notable storms (7th, 25th and 28th).

