

Hassayampa River in Wickenburg, 02/14/2005, D. Gardner

Flood Control District of Maricopa County

Stephen D. Waters, Engineering Division, Flood Warning Branch

Storm Report : February 2005



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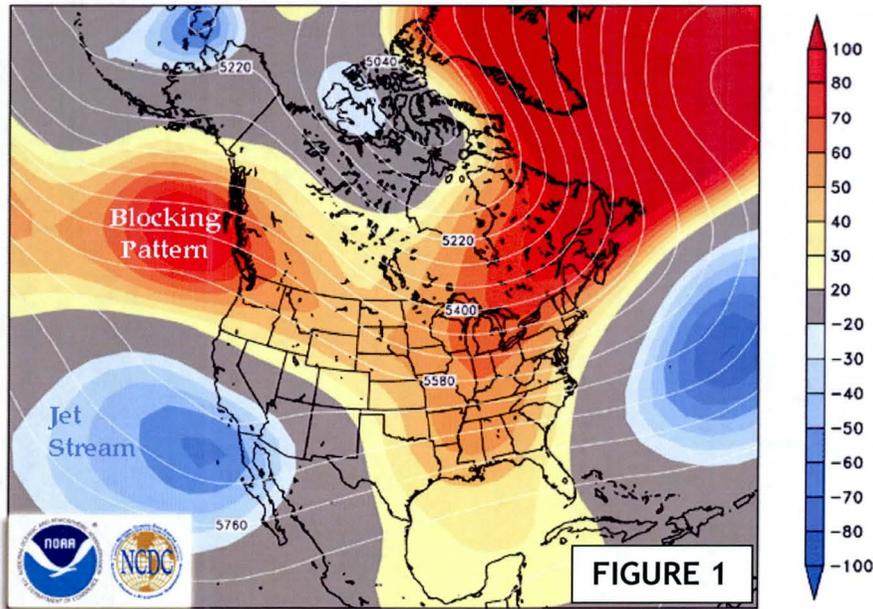
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A special thank you to members of the NWS, USGS, and NRCS for supplying several of the above figures.

METEOROLOGY

The fall and winter months leading up to February 2005 were well above normal in terms of rainfall. A persistent blocking pattern (Figure 1) had set up off the coast of British Columbia, causing a split in the jet stream. The polar jet was forced over Alaska, while the pacific jet entered the United States over southern California and Arizona. Storms forming in the gulf of Alaska were forced southward, where their counter-clockwise circulation gathered-up large amounts of moisture from the tropical Pacific. This phenomenon is often referred to as the “Pineapple Express” (Figure 2). Contributing to this effect were a weak El Niño in the east-central Pacific, and a relatively strong episode of a tropical disturbance known as the Madden-Julian Oscillation (MJO). From early January 2005, the MJO over the central Pacific gradually shifted eastward toward the west coast of the US, allowing passing storms to tap deep tropical moisture.

500 Millibar Heights and Anomalies (in meters)
(From NCEP Reanalysis)



February 2005

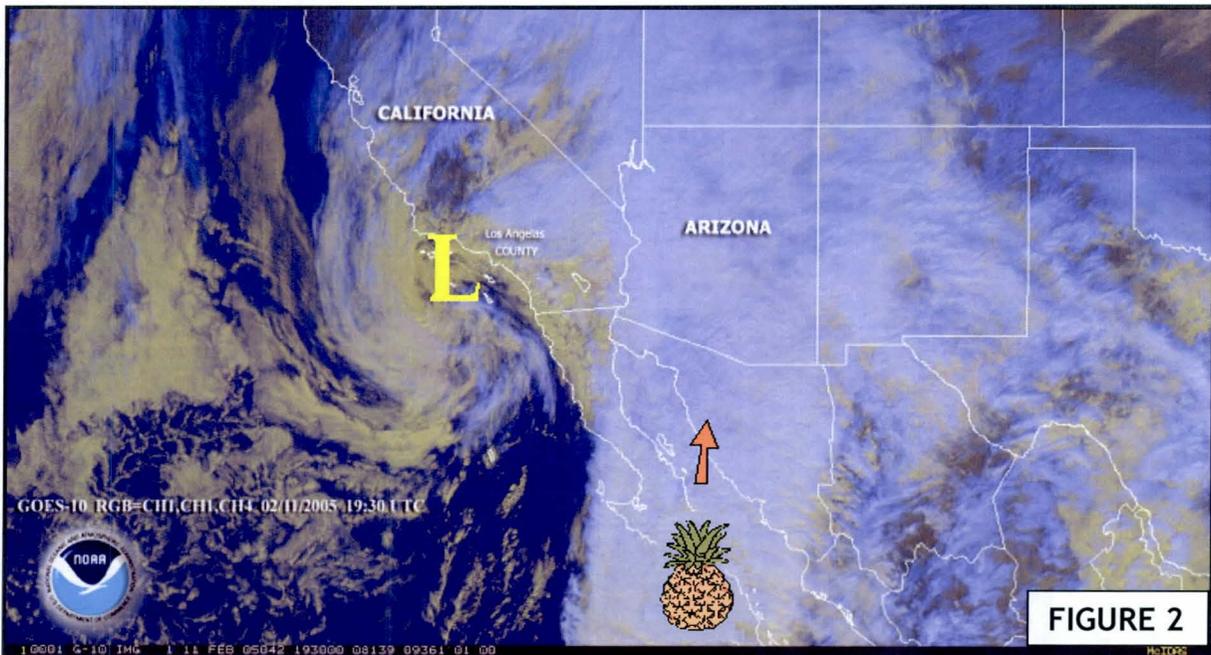


Table 1 - Climatological Report for February 2005 (From NWS Phoenix WFO)

CXUS55 KPSR 021845 CCC
CLMPHX

MONTHLY CLIMATOLOGICAL REPORT...CORRECTION
NATIONAL WEATHER SERVICE PHOENIX AZ
1145 AM MST TUE MAR 2 2005

PHOENIX WEATHER STATISTICS FOR FEBRUARY 2005

...FEBRUARY 2005 HAD 3.01 INCHES OF RAIN MAKING IT THE 5TH WETTEST
FEBRUARY ON RECORD. THE WETTEST FEBRUARY ON RECORD WAS IN 1905 WHEN
4.64 INCHES FELL. OTHER HIGHER AMOUNTS IN FEBRUARY WERE 3.71 INCHES
IN 1931...3.18 INCHES IN 1935 AND 3.15 INCHES IN 2003

AVERAGE MAXIMUM TEMPERATURE	67.0	NORMAL	71.4
AVERAGE MINIMUM TEMPERATURE	51.4	NORMAL	48.4
AVERAGE MONTHLY TEMPERATURE	59.2	NORMAL	59.9
DEPARTURE FROM NORMAL	MINUS 0.7	DEGREES	

HIGHEST AVERAGE MONTHLY TEMPERATURE	66.0	IN 1991
LOWEST AVERAGE MONTHLY TEMPERATURE	48.6	IN 1939

HIGHEST TEMPERATURE THIS MONTH	72	ON THE 9TH...16TH AND 17TH
LOWEST TEMPERATURE THIS MONTH	46	ON THE 8TH

RECORD HIGH TEMPERATURE FOR MONTH	92	ON THE 27TH IN 1986 AND THE 25TH IN 1921
-----------------------------------	----	---

RECORD LOW TEMPERATURE FOR MONTH	24	ON THE 8TH IN 1933 AND THE 7TH IN 1899
----------------------------------	----	---

NUMBER OF DAYS WITH MINIMUM TEMPERATURE 50 OR LOWER	11
NUMBER OF DAYS WITH MINIMUM TEMPERATURE 55 OR HIGHER	5
NUMBER OF DAYS WITH MAXIMUM TEMPERATURE 60 OR LOWER	2
NUMBER OF DAYS WITH MAXIMUM TEMPERATURE 70 OR HIGHER	5

COOLING DEGREE DAYS BASE 65	0	NORMAL	15	SEASONAL TOTAL	4
HEATING DEGREE DAYS BASE 65	156	NORMAL	169	SEASONAL TOTAL	798

TOTAL MONTHLY PRECIPITATION	3.01	INCHES
NORMAL MONTHLY PRECIPITATION	0.77	INCHES
DEPARTURE FROM NORMAL	PLUS 2.24	INCHES

GREATEST PRECIPITATION IN 24 HOURS	1.05	INCHES ON THE 18-19
PRECIPITATION YEAR TO DATE	4.86	INCHES
DEPARTURE FROM NORMAL YEAR TO DATE	PLUS 3.26	INCHES

GREATEST MONTHLY PRECIPITATION	4.64	INCHES IN 1905
LEAST MONTHLY PRECIPITATION	0.00	INCHES IN 2002 AND 3 PREVIOUS YEARS

NUMBER OF THUNDERSTORM DAYS	1	NORMAL	1
NUMBER OF MEASURABLE RAIN DAYS	11	NORMAL	4
PERCENT OF POSSIBLE SUNSHINE	56	NORMAL	80

AVERAGE WIND SPEED 6.0 MPH NORMAL 5.9 MPH
 HIGHEST PEAK GUST 33 MPH FROM THE WEST ON THE 23RD
 AND FROM THE EAST ON THE 2ND

HIGHEST BAROMETRIC SEA LEVEL PRESSURE 30.20 INCHES ON THE 2ND
 LOWEST BAROMETRIC SEA LEVEL PRESSURE 29.74 INCHES ON THE 5TH

RECORDS BROKEN OR EQUALLED DURING THE MONTH

DATE	TYPE	NEW RECORD	OLD RECORD	YEAR/YEARS
11	PRECIP	0.77 INCHES	0.54 INCHES	1915
19	PRECIP	0.93 INCHES	0.64 INCHES	1915

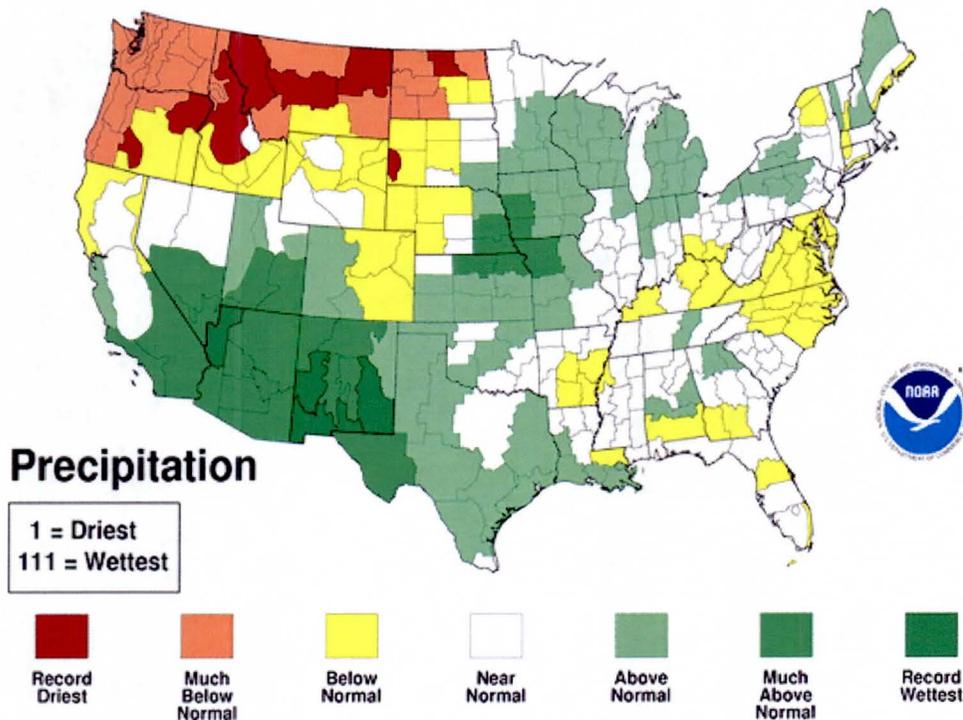
WFO PHOENIX AZ

Please note that this information is preliminary and unofficial.
 Official and certified climatological data can be accessed at:
National Climatic Data Center

Feb 2005 Divisional Ranks

FIGURE 3

National Climatic Data Center/NESDIS/NOAA



PRECIPITATION

Summary Statistics:

Total FCDMC Automated Rain Gages Installed: 284

Overall Percent Operational Automated Rain Gages for the Month: 99.68%

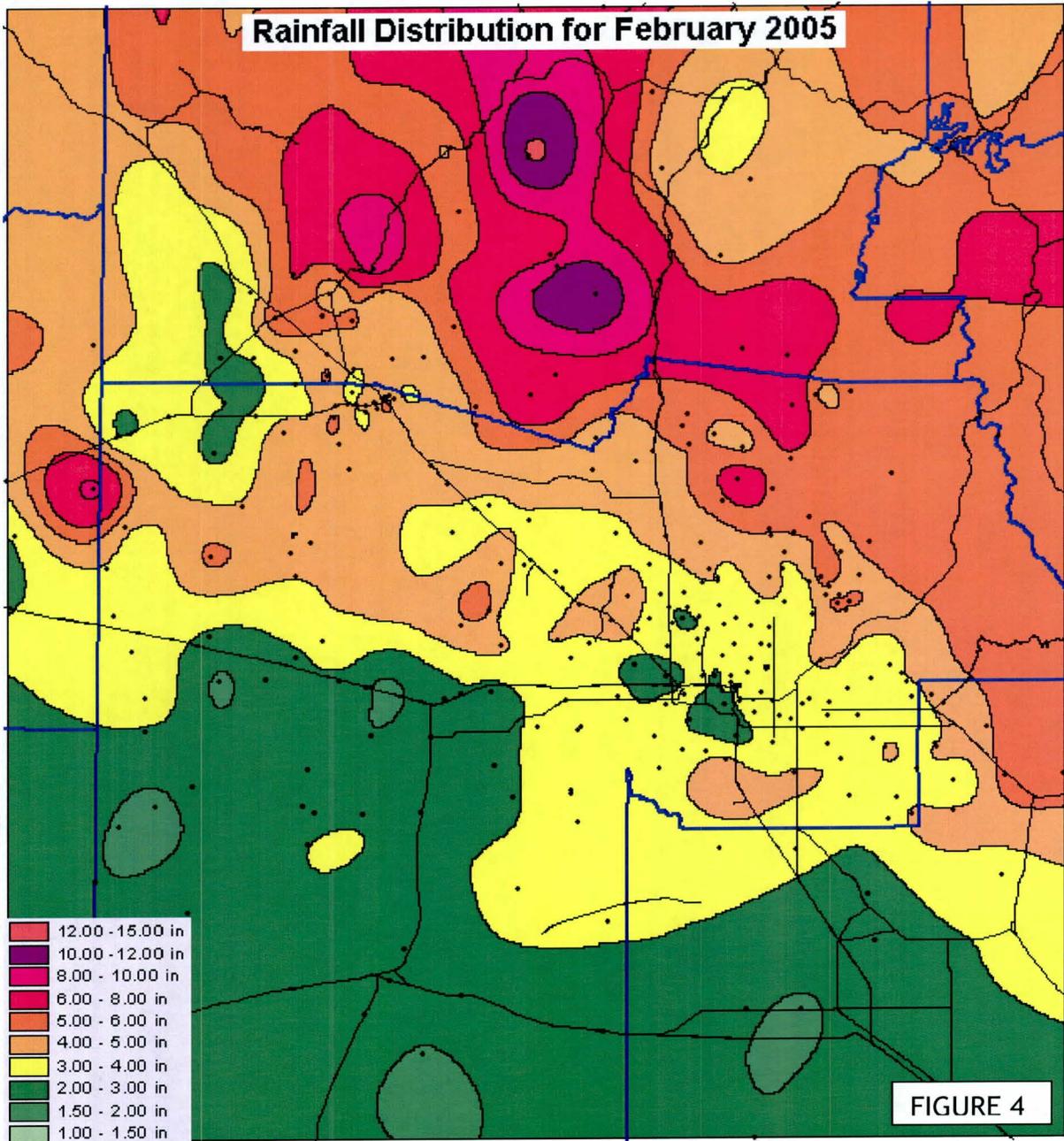


Figure 4 above was created with Arcview 3.2 and Spatial Analyst, using edited rainfall data from Flood Control District automated rain stations (black dots). Daily-total data for all stations for the month can be downloaded from the FCDMC website at: <http://156.42.96.39/alert/Rain/pcp0205.pdf>

Precipitation for the month of February, 2005 can be broken into three distinct storm periods. First, a minor storm brushed the northern parts of the County on Feb. 6th and 7th. The heaviest storm drenched central Arizona on the 10th through the 12th. Finally, a procession of storms affected the entire State from the 17th through the 24th, with slight breaks on the 21st and 22nd. Most ALERT stations recorded rainfall on at least 10 of the 28 days in February - many of the northern stations recorded rainfall on 14 or more days. Figure 5 below shows that, for all of Arizona, 2005 is second only to 1980 as the wettest February since records have been kept.

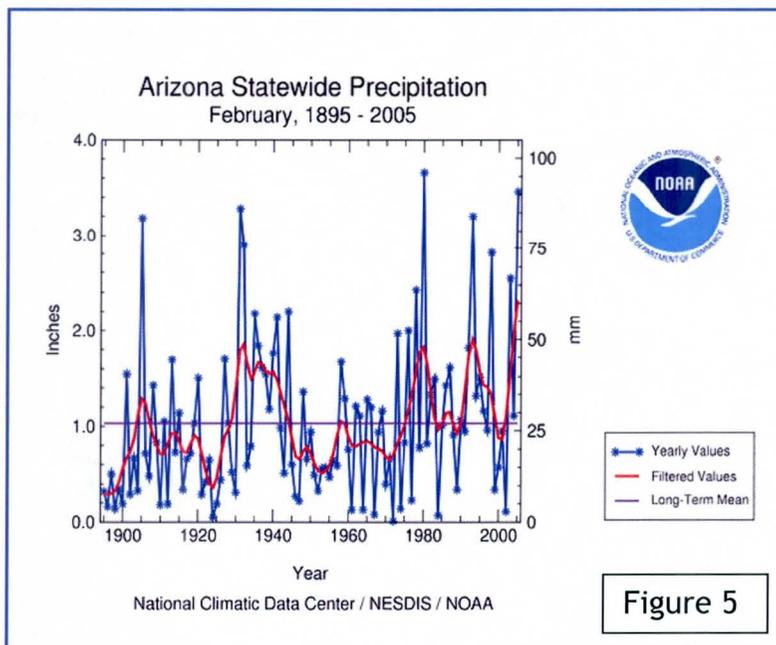


Figure 5

In Figure 6 below, the vertical green bars on the right show the number and magnitude of wet months since August of 2004. It is a striking contrast to the previous below normal (drought) months shown in red.

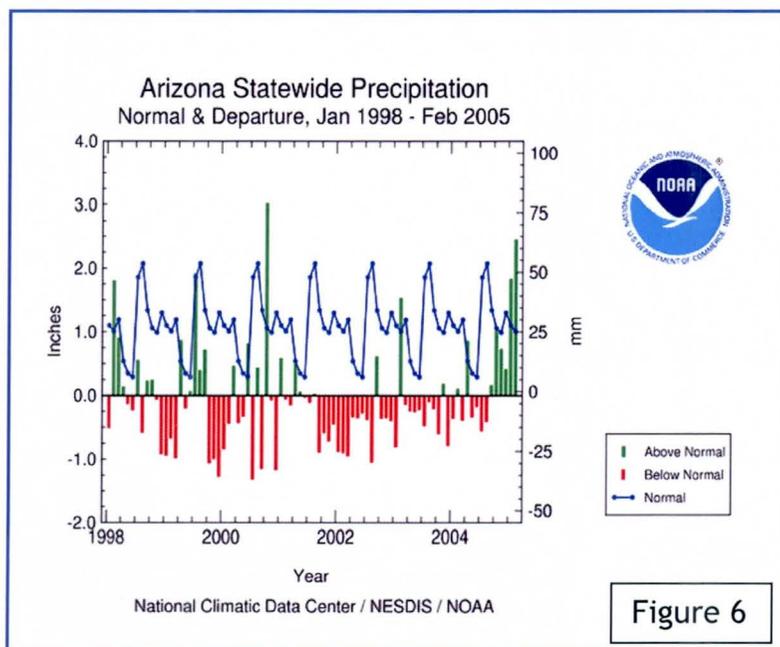


Figure 6

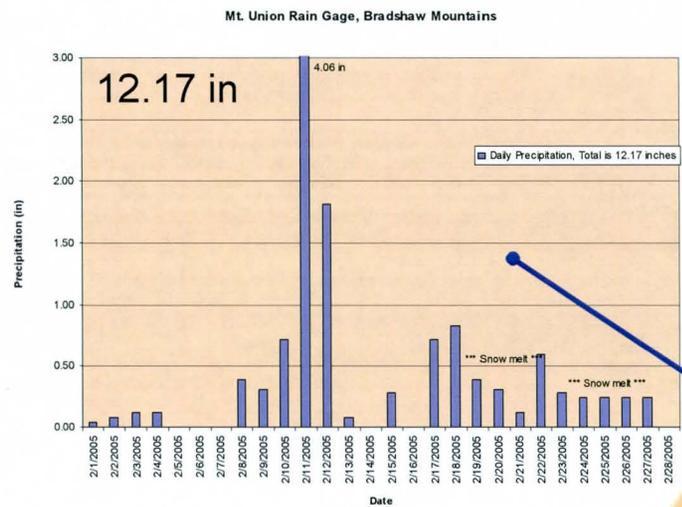


Figure 7

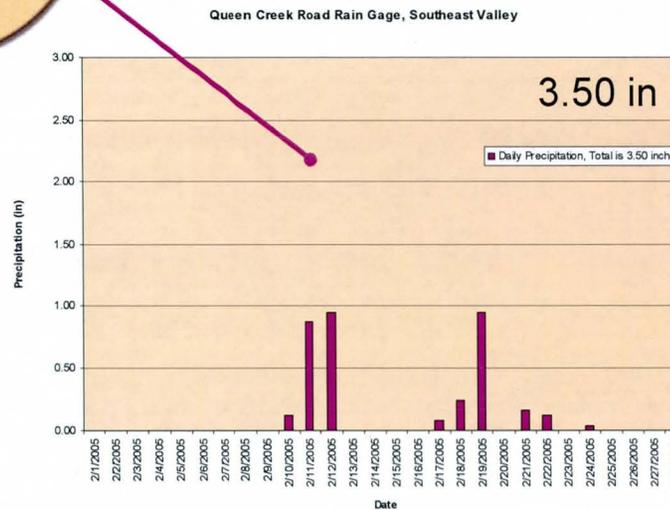
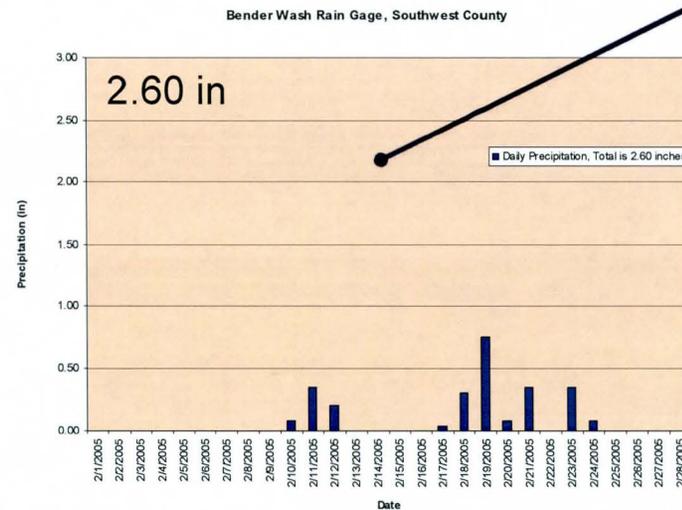
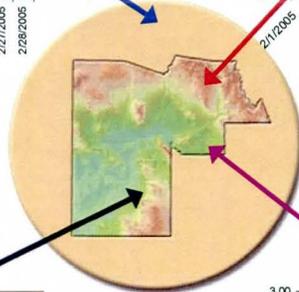
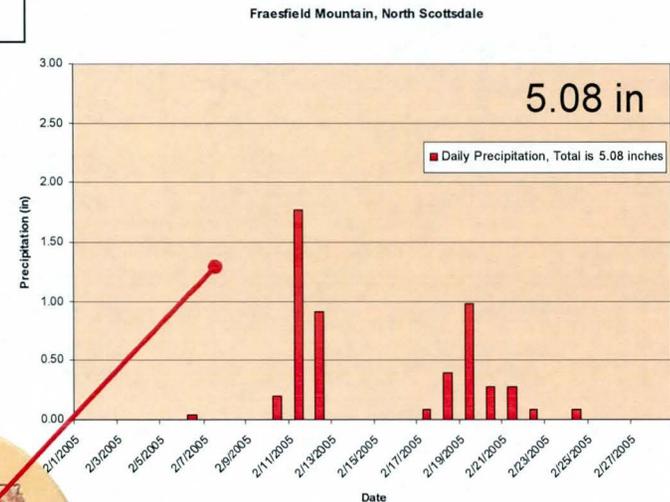
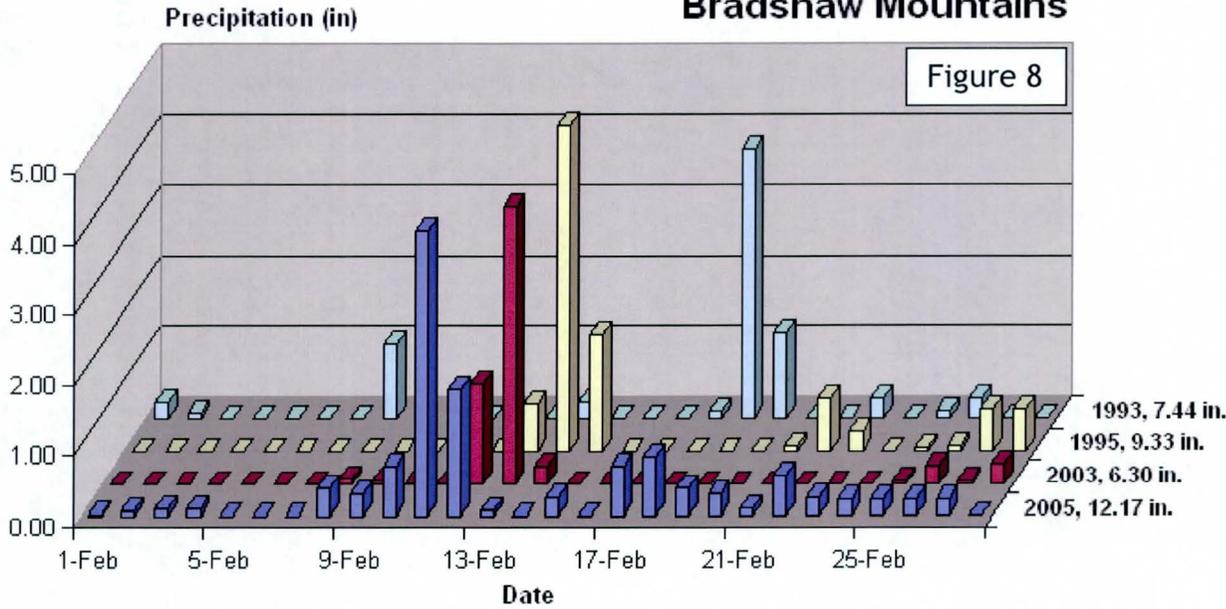
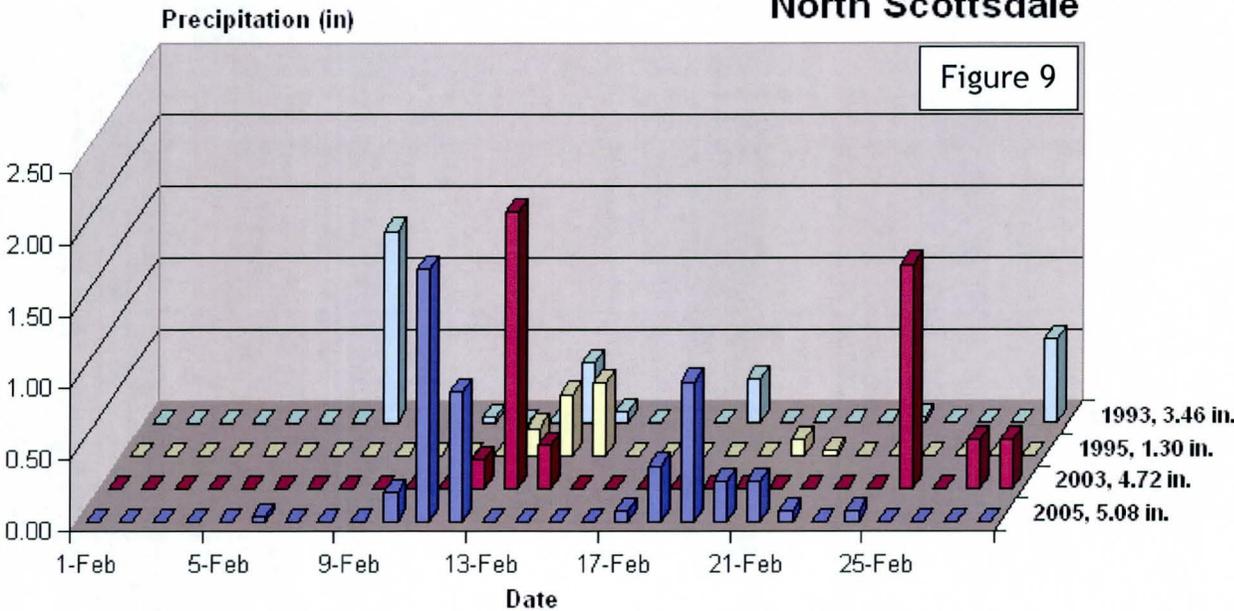


Figure 7 above shows daily total rainfall for February 2005 at four rain stations around the County. The bottom axis is days of the month from 1-28, and the left axis is daily rainfall from 0.00 to 3.00 inches.

Mt. Union Rain Gage Bradshaw Mountains

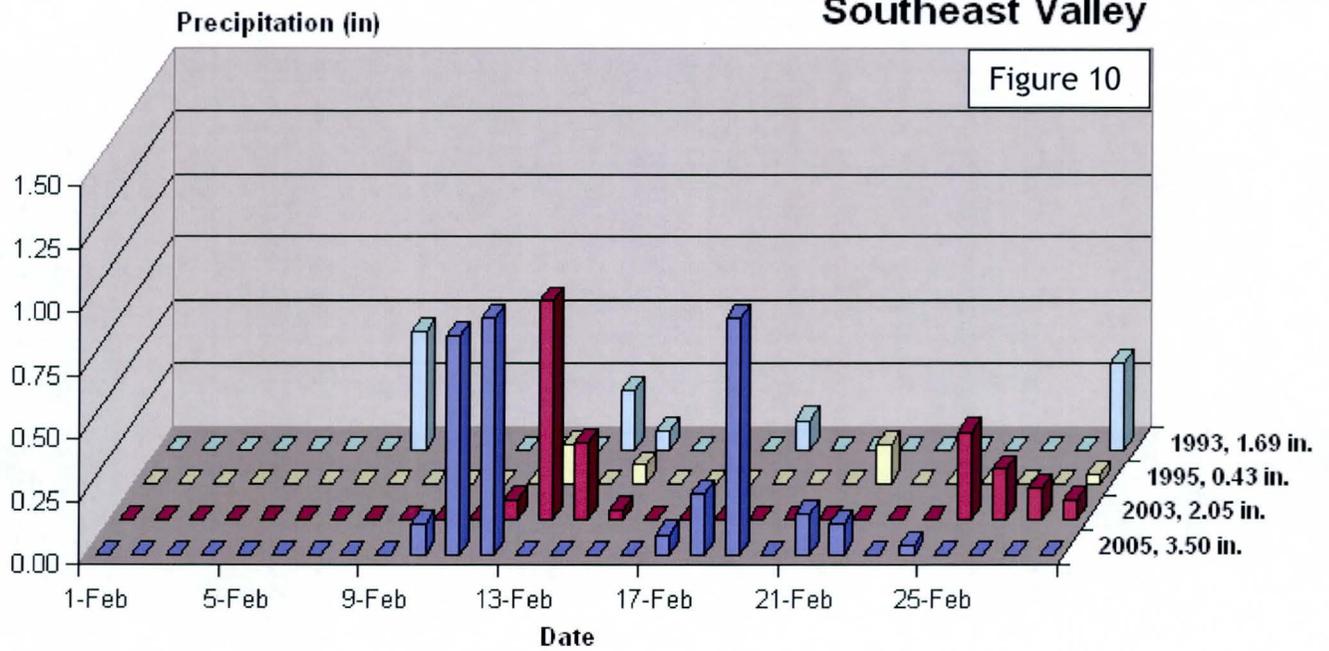


Fraesfield Mountain Rain Gage North Scottsdale

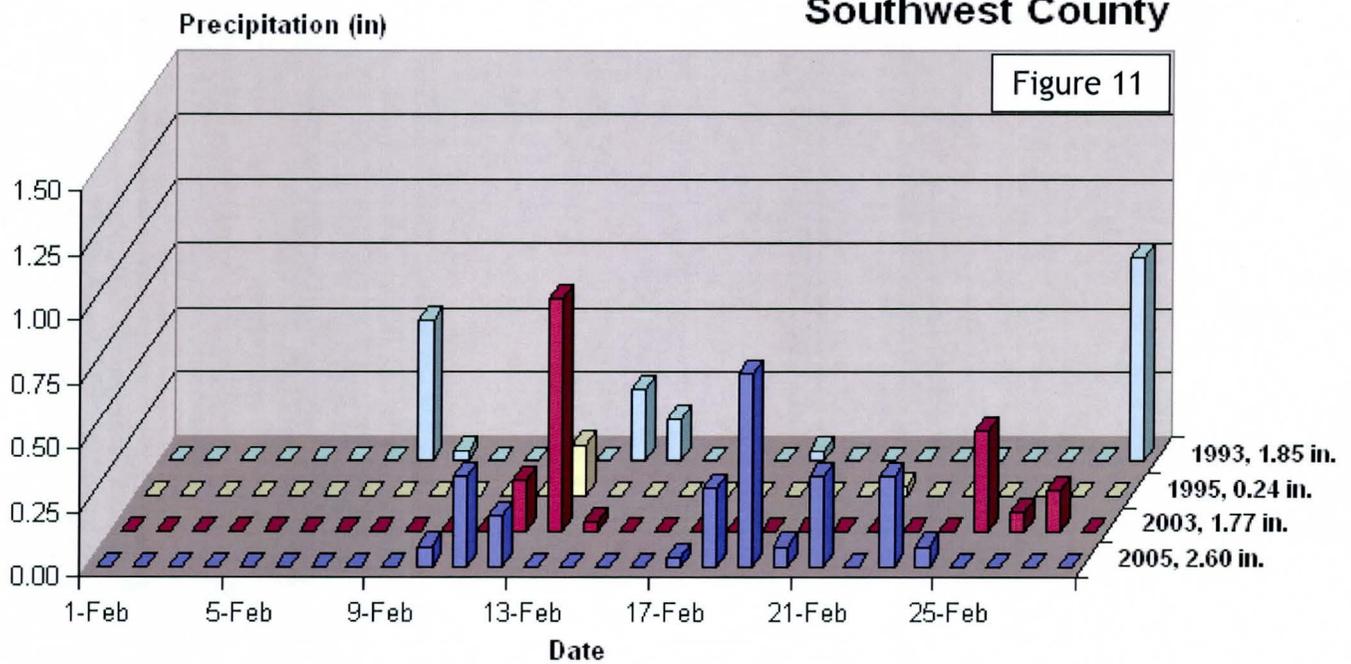


Figures 8 & 9 above, and 10 & 11 below, show daily rainfall values for February 2005 in comparison to three other recent wet Februaries. Note that in all four cases, February 2005 was the wettest, and that in most years the majority of precipitation fell in the 2nd and 3rd weeks of the month.

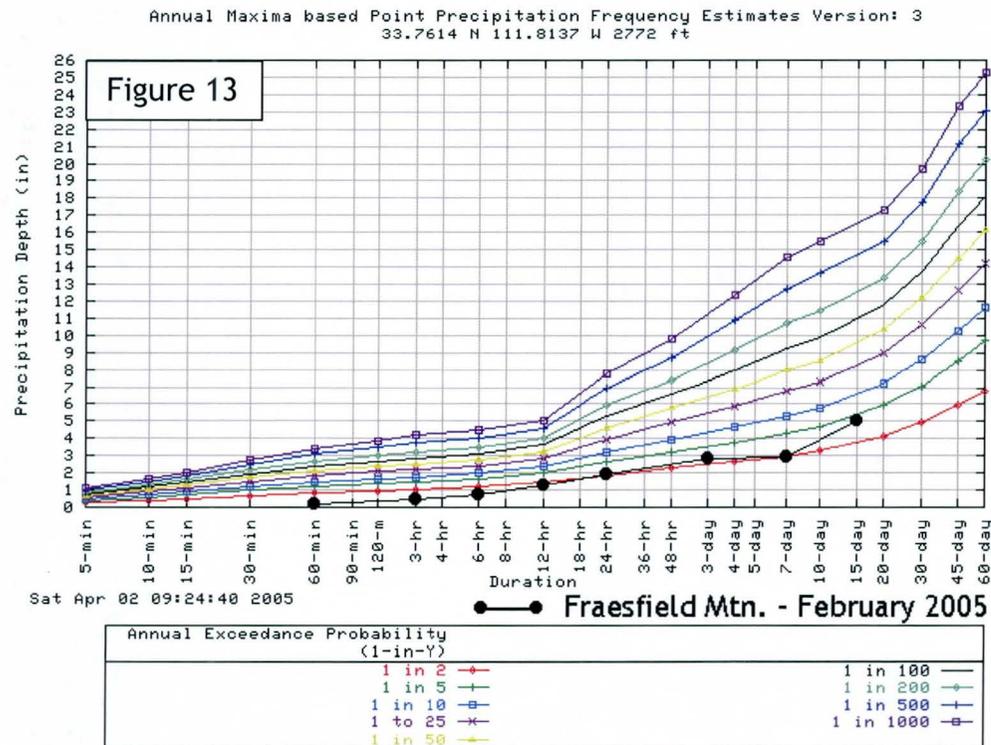
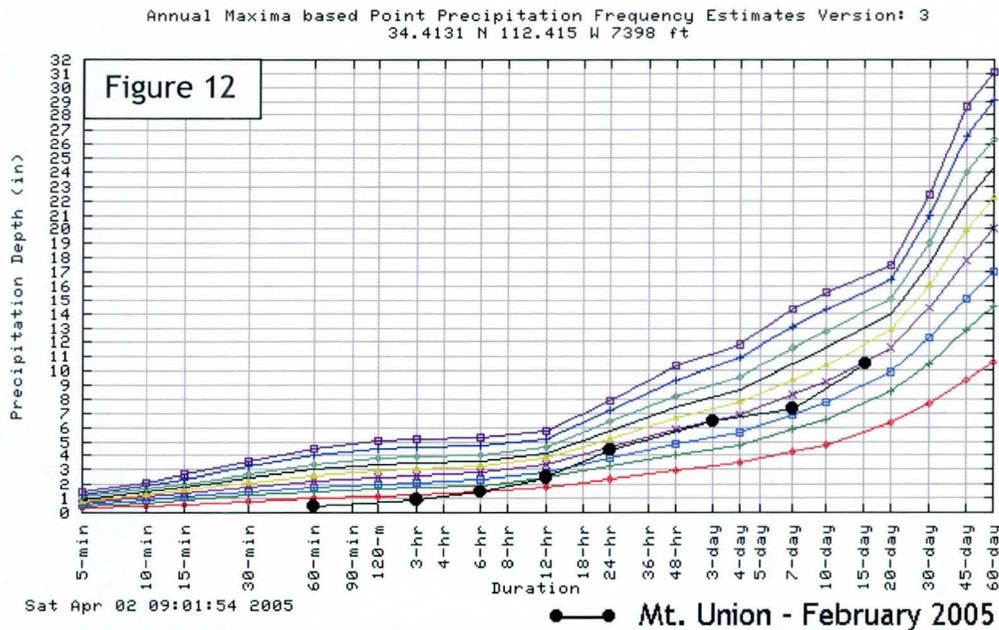
Queen Creek Road Rain Gage Southeast Valley

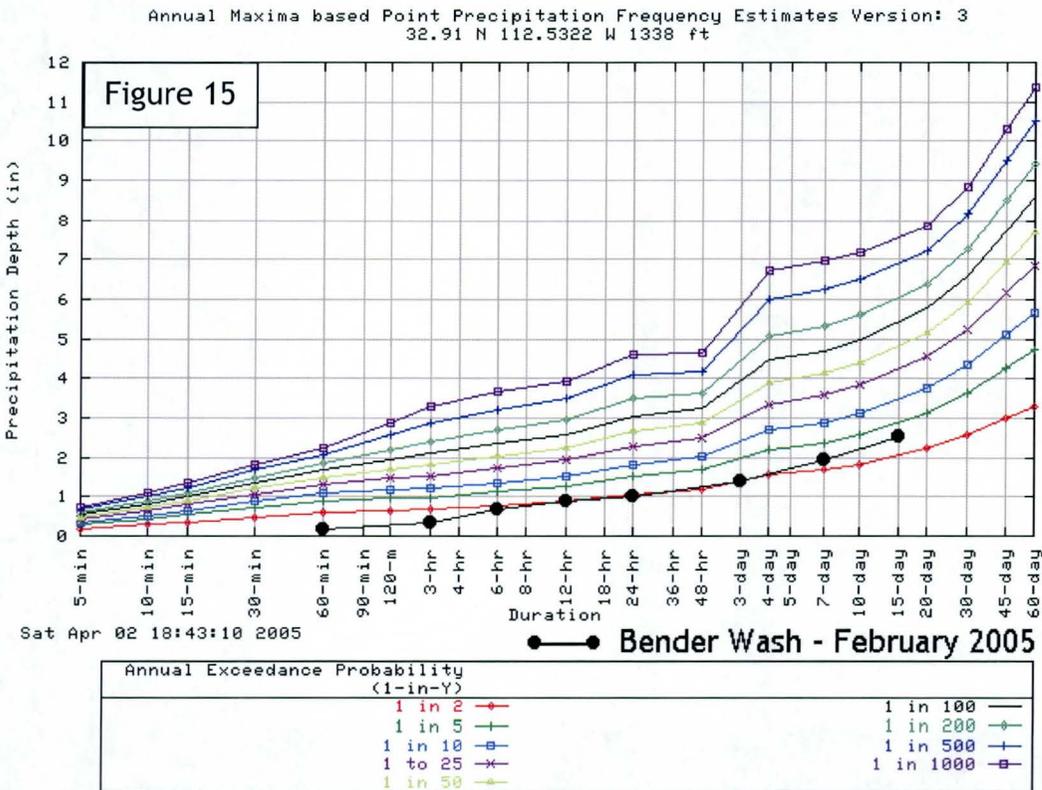
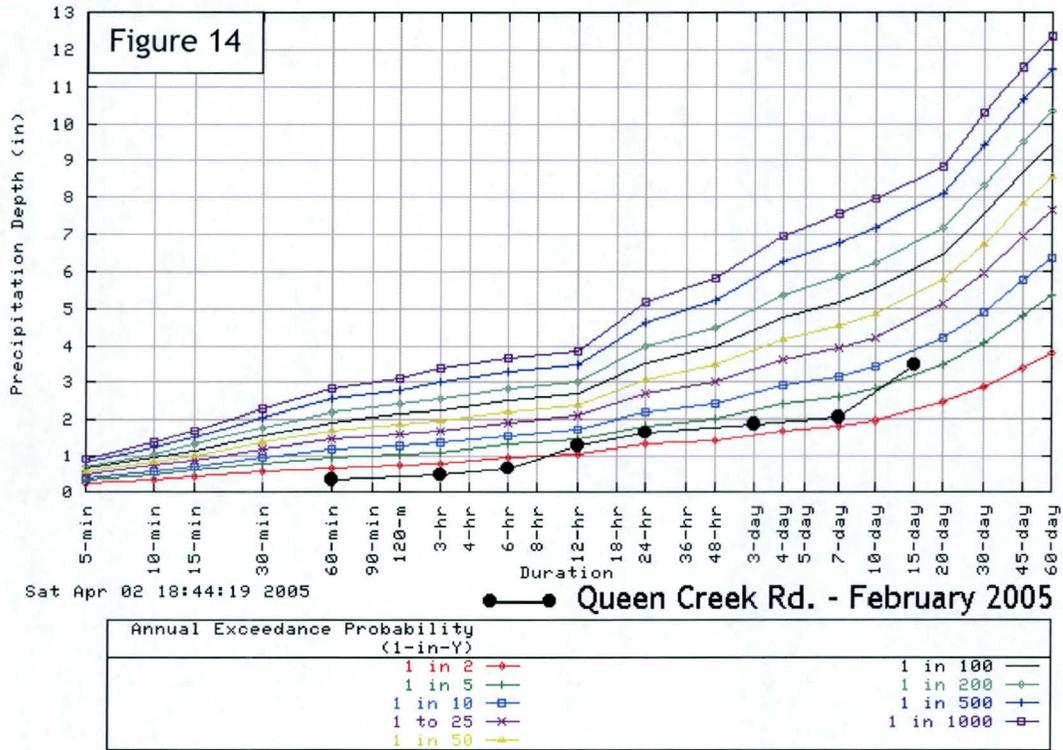


Bender Wash Rain Gage Southwest County



How did the precipitation events of February 2005 measure up in terms of return frequency? Take a look at Figures 12 - 15 below - graphs of recorded point rainfall plotted against frequency data at the same point from NOAA Atlas 14. Looking again at our four representative gages, Mt. Union, in the Bradshaw Mountains north of Phoenix, approximates a 25-year event for durations past 1 day. The other three gages, all within Maricopa County, are plot around the 2 and 5-year events for the same durations.





RUNOFF

Water-year 2005 began at the conclusion of six years of below normal rainfall in Arizona. October and November 2004, and January 2005, turned that around in a big way! At the start of Water-year 2005, Roosevelt Lake was at 28% of operating capacity, and the Verde River lakes (Horseshoe and Bartlett) were at 49%. By February 1st, Roosevelt had risen to 48% and the Verde system was at 88%. Through February, Roosevelt gained an additional 34% to 83%, and the Verde system gained 12% to become more than full, and releases from Bartlett became necessary. By April 1st, Roosevelt gained an additional 9% to 92% - it is expected to be full to it's operating pool by the end of the 2005 snowmelt season.

February 11-12, 2005

The most significant storm of the winter season dropped large amounts of precipitation on already wet watersheds. The Hassayampa River peaked during the late morning of February 12 of about 16,000 - 17,000 cfs, which translates to about a 10-year return period. Cave Creek had high flows of nearly 2,000 cfs at the two gages above Cave Buttes Dam. Martinez Creek had a peak runoff of 1,470 cfs. Queen Creek at CAP and Queen Creek at Rittenhouse had runoff from a significant impoundment at Whitlow Ranch Dam. Queen Creek at Rittenhouse had its first runoff event in many years. Also, because of the impoundment at New River Dam, New River at Bell Road showed decent runoff (1,500 cfs) for the first time in several years.

As for impoundments at dams, Whitlow Ranch Dam peaked at about 50 feet which is about 13% full. Rittenhouse FRS had a peak of 12.5 feet which is about 23% full. Cave Buttes Dam had a peak impound of about 31 feet or about 3% full. New River Dam had a peak impoundment of 20.7 feet or which is nearly 5% full.

February 19-23, 2005

This last of the series of moderate rain/runoff events produced average runoff from many of the urban watersheds such as Indian Bend Wash and the ACDC. Cave Creek had runoff in the 250 to 650 cfs range. The Salt River Project continued releases over Granite Reef Dam. Peaks were in excess of 10,000 cfs.

TABLE 2 - SUMMARY OF SELECTED IMPOUNDMENTS AT FCD STATIONS

STATION NAME	ID	PEAK Gage Ht. (feet)	PEAK OUTFLOW (cfs)	PEAK STORAGE (acre-feet)	PEAK CAPACITY (% full)	DATE - TIME
Adobe Dam	5534	4.23	192	44	< 1%	2/13 00:03
Apache Junction FRS	6673	2.65	19	2.0	< 1%	2/19 05:14
Casandro Dam	7133	2.09	11	5.8	4%	2/11 20:40
Cave Buttes Dam (1)	4899	31.0	266	1,480	3%	2/14 14:13
Crossroads Park Basin	6623	2.28	Pumped	17	4%	2/24 05:53
Dreamy Draw Dam	4803	6.72	100	0.0	< 1%	2/18 00:11
East Fork Cave Cr. #1	4648	0.86	8	1.0	2%	2/12 17:42
East Fork Cave Cr. #3	4683	0.25	8	0.0	< 1%	2/12 00:39
East Fork Cave Cr. #4	4658	3.00	52	4.0	5%	2/12 17:58

STATION NAME	ID	PEAK Gage Ht. (feet)	PEAK OUTFLOW (cfs)	PEAK STORAGE (acre-feet)	PEAK CAPACITY (% full)	DATE - TIME
Freestone Basin	6608	7.38	Pumped	27.3	13%	2/20 06:14
G&F Woolsey Peak	5063	4.45	Water Tank	---	---	2/12 06:01
Golden Eagle Park Dam	5978	4.95	354	2	2%	2/11 23:05
New River Dam	5609	20.71	1,578	2,245	5%	2/12 17:49
Phoenix Basin #3	4828	3.60	29	0.70	1%	2/18 00:42
Phoenix Basin #7	4853	1.20	7	0.30	< 1%	2/19 01:04
Powerline FRS	6683	3.22	42	240	5%	2/19 08:26
Reata Pass Dam	4938	3.22	11	Unknown	Unknown	2/19 03:56
Rittenhouse FRS	6703	12.58	120	919	23%	2/12 18:18
Signal Butte FRS	6628	5.70	0	41	2%	2/12 20:48
Spookhill FRS	4563	4.61	34	20.5	1%	2/12 13:08
Stoneridge Dam	5968	1.65	11	0.10	< 1%	2/11 22:39
Sunnycove FRS	5248	9.39	32	7.8	4%	2/12 08:13
Sunset FRS	5233	6.88	22	10.3	12%	2/12 06:52
Vineyard FRS	6688	3.58	67	335	10%	2/12 21:10
Whitlow Ranch Dam	6739	36.01	576	1,789	5%	2/16 10:08

(1) Gage was down prior to 2/16 due to a leak in the orifice line. Peak stage is from an observed high-water mark.

TABLE 3 - SUMMARY OF SELECTED STREAMFLOW READINGS AT FCD STATIONS

STATION	ID	PEAK STAGE (feet)	PEAK RUNOFF (cfs)	DATE - TIME
4 th of July Wash	5043	0.12	19	2/19 23:04
ACDC @ 14 th St.	4813	0.60	25	2/19 01:47
ACDC @ 43 rd Ave.	4823	1.12	202	2/24 04:03
ACDC @ 67 th Ave.	5523	4.10	698	2/19 06:57
Adobe Dam Outlet	5538	2.35	143	2/12 23:39
Agua Fria @ Buckeye Rd.	5403	1.51	140	2/14 04:02
Antelope Creek	7168	2.57	533	2/12 08:24
Berneil Wash	4688	1.02	192	2/19 02:07
Box Wash	5273	1.65	159	2/12 06:28
Bullard Wash	6863	0.41	48	2/24 01:25
Casandro Wash	7093	0.35	14	2/11 21:13
Cave Buttes Dam Outlet	4903	5.38	415	2/14 14:13
Cave Cr. near Cave Cr.	4918	4.68	2,785	2/12 04:21
Cave Cr. @ Spur Cross	4923	9.40	2,963	2/12 02:56
Cave Cr. @ Cactus Basin	4833	10.38	414	2/19 04:26
Centennial @ Wenden	5093	0.45	71	2/13 05:51
Centennial near Aguila	5178	0.32	11	2/12 05:59
Centennial Railroad	5103	3.26	258	2/11 16:39
Cline Creek	5583	0.59	12	2/12 01:26
Colter @ El Mirage	5408	0.47	25	2/19 13:18
Copper Wash	5033	0.69	16	2/19 23:00
Cruff Wash	5078	1.17	53	2/20 00:31
Delaney Wash	5108	2.90	364	2/20 00:39
Dysart @ El Mirage	5422	2.26	167	2/24 02:46
Dysart Drain @ LAFB	5413	0.60	22	2/24 03:37
E.Fork Cave Cr. near 7 th Ave.	4668	1.80	137	2/12 19:33
EMF @ Arizona Ave.	6598	1.43	616	2/19 13:29
EMF @ Broadway Rd.	6573	1.62	504	2/19 04:10

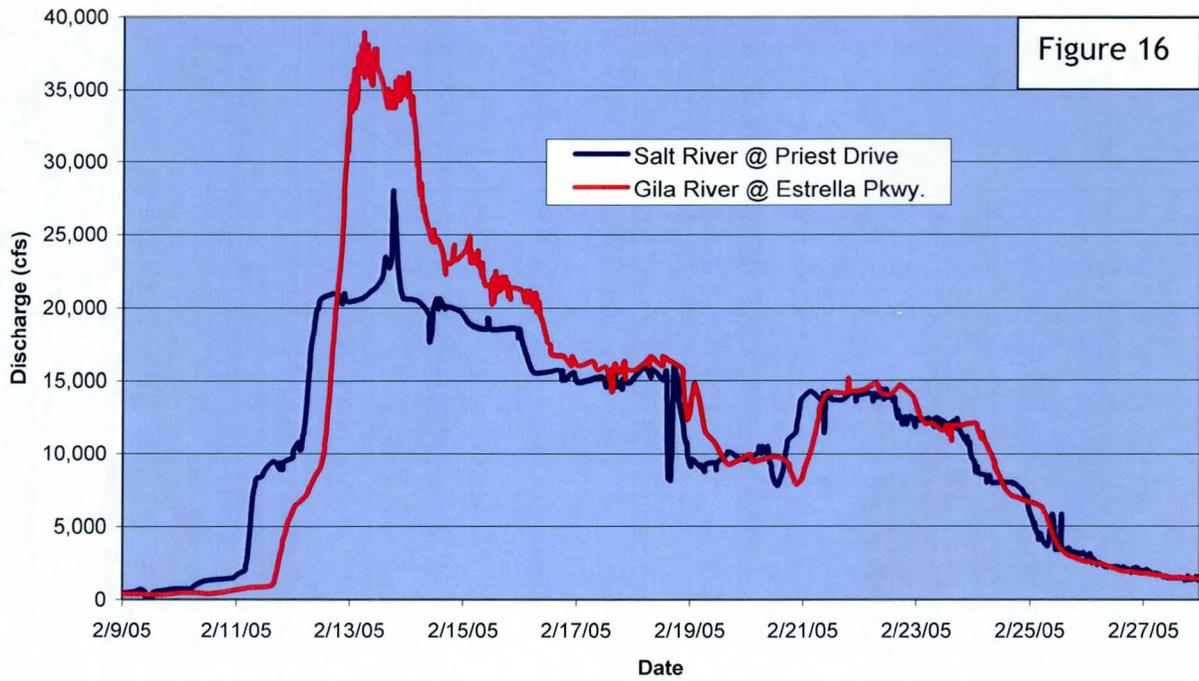
STATION	ID	PEAK STAGE (feet)	PEAK RUNOFF (cfs)	DATE - TIME
EMF @ Queen Creek Rd.	6583	2.95	1,554	2/19 08:30
Flying E Wash	7083	0.85	16	2/12 06:17
Gila @ Estrella Pkwy.	6853	14.00	38,900	2/13 05:18
Gila @ Olberg	0783	2.71	1,902	2/14 04:39
Gila @ 116 th Ave.	6848	9.15	49,394	2/13 02:17
Guadalupe Channel	6603	1.10	191	2/19 03:59
Hassy R. near Morristown	5223	14.05	14,962	2/12 09:49
Hassy R. @ Box Canyon	5308	15.50	15,791	2/12 09:28
Hassy R. @ I-10	5283	4.17	5,775	2/12 19:02
Hassy R. @ Wagoner Rd.	5352	5.62	497	2/12 04:08
IBW @ Indian Bend Rd.	4613	3.15	772	2/19 07:31
IBW @ Indian School Rd.	4618	2.90	422	2/19 07:52
IBW Interceptor	4623	0.60	37	2/19 07:17
IBW @ McDonald Dr.	4628	0.95	596	2/19 08:02
IBW @ McKellips Rd.	4603	2.15	591	2/19 10:19
IBW @ Shea Blvd.	4693	1.58	370	2/19 03:24
IBW @ Sweetwater Ave.	4643	1.65	216	2/12 18:41
Jackrabbit Wash	5218	3.45	1,134	2/11 19:21
Martinez Creek	7013	4.12	1,020	2/12 07:27
McDowell Mountain Rd.	5923	0.30	24	2/11 23:23
McMicken Floodway	5438	0.43	12	2/09 08:48
New River @ Bell Rd.	5598	2.05	1,430	2/12 18:01
New River @ Glendale Ave.	5508	1.48	873	2/12 13:13
New River Dam Outlet	5613	9.11	1,452	2/12 20:52
Old Crosscut @ McDowell Rd.	4748	1.08	172	2/19 01:30
Price Drain @ Loop 202	4573	5.01	311	2/11 21:58
Queen Creek @ CAP	6723	10.15	1,034	2/12 12:01
Queen Cr. @ Rittenhouse Rd.	6707	3.50	475	2/13 02:18
Rainbow Wash	6953	1.12	178	2/23 23:33
Reata Pass Wash	4588	0.53	63	2/19 01:24
Salt River @ Priest Dr.	4523	8.50	28,034	2/13 18:02
Scatter Wash	5543	1.62	472	2/12 17:52
Seven Springs Wash	4963	2.55	137	2/11 18:23
Skunk Cr. near New River	5588	1.14	102	2/18 00:57
Skunk Cr. @ I-17	5568	2.27	504	2/12 18:27
Tiger Wash	5163	7.40	1,822	2/12 05:01
Waterman Wash @ RVR	6833	2.67	169	2/24 04:45
Winters Wash	5118	0.69	29	2/20 01:04

Acronyms and Abbreviations used in Tables 1 & 2 above:

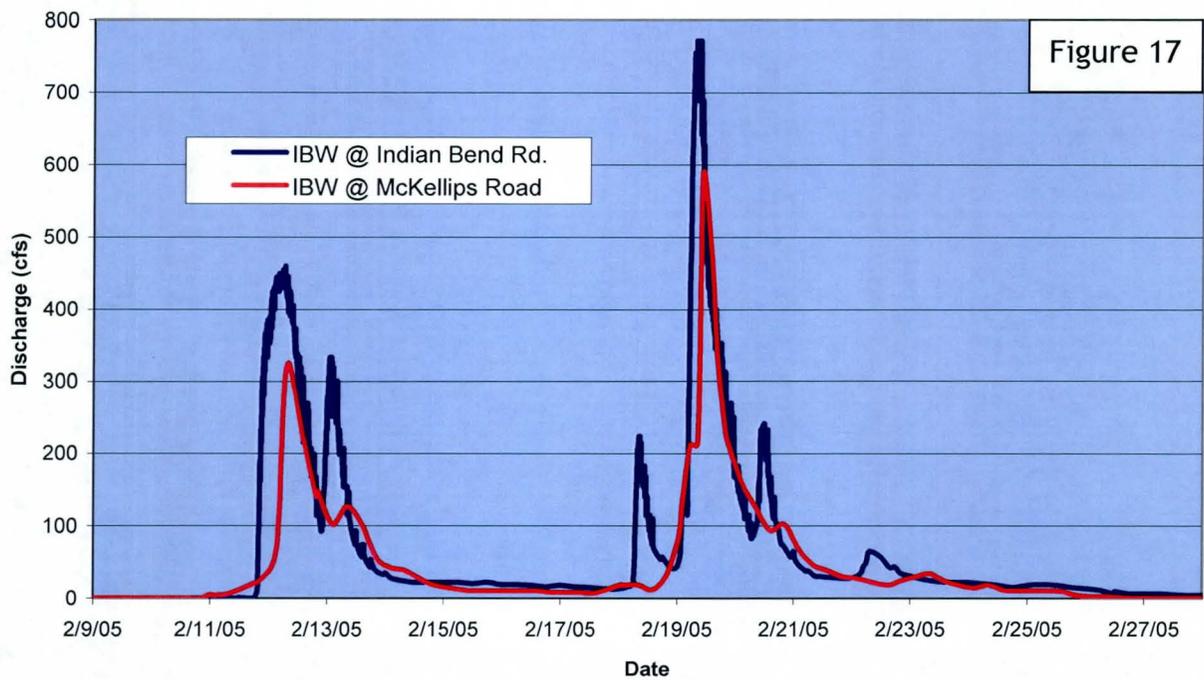
ACDC	Arizona Canal Diversion Channel
CAP	Central AZ Project Canal
EMF	East Maricopa Floodway
FRS	Flood Retarding Structure
G & F	AZ Game and Fish
Gila	Gila River
Hassy	Hassayampa River
IBW	Indian Bend Wash
LAFB	Luke Air Force Base
RVR	Rainbow Valley Road

SELECTED HYDROGRAPHS

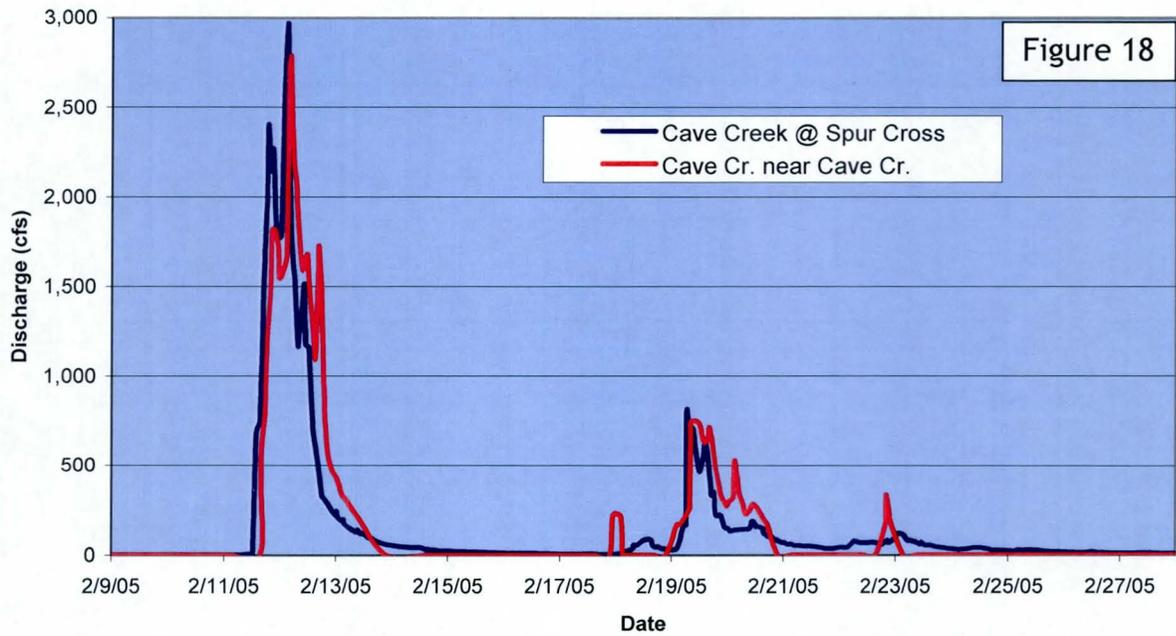
Measured Flows on the Salt/Gila System



Measured Flows along Indian Bend Wash



Measured Flows along Cave Creek



Stage Hydrograph at Rittenhouse FRS

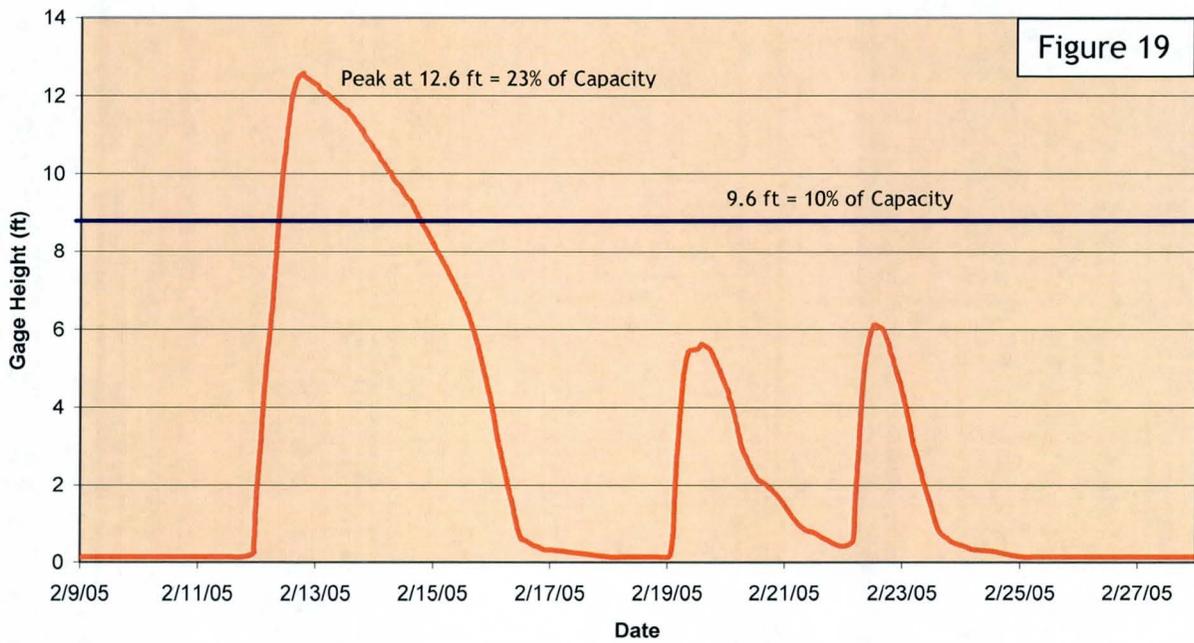


Figure 20 at right shows how the total US precipitation measured in February 2005 compares to previous years. Most of northern and eastern Arizona, which includes the Little Colorado, Gila, Salt, Verde, Agua Fria and Hassayampa watersheds ranks higher than 90% of previous years.

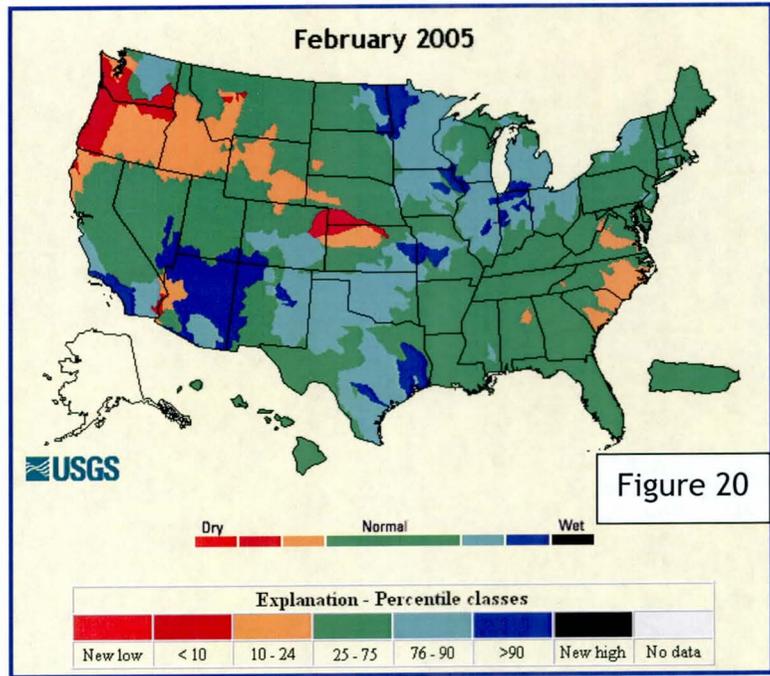
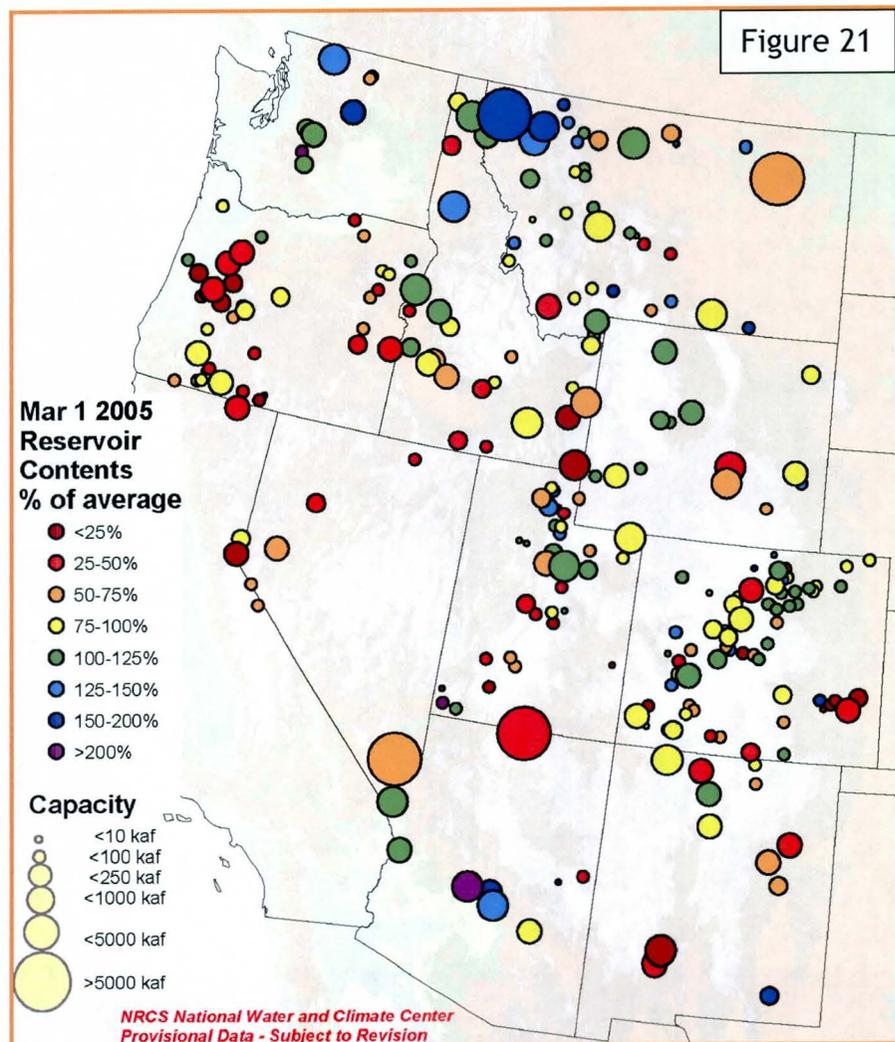


Figure 21 at right shows the rankings of reservoir levels as of 3/01/05 compared to their levels on the same date in previous years. Although it is not clear which dot represents which reservoir in central Arizona, it is clear that the purple, dark blue and blue dots represent greater than average storage levels. This was of course not the case at the beginning of water-year 2005.



FLOOD DAMAGE IN MARICOPA COUNTY

Flood control structures owned and operated by the Flood Control District did not sustain any significant damage during the flooding of February 2005. No ALERT monitoring stations sustained damage due to flooding, although one station was found to have a vandalized solar panel early in the month. It was replaced before the battery went dead.

The following is an excerpt from a 2/28/05 memo from Dennis Cvancara of Maricopa County Emergency Management to Steve Sipple of the National Weather Service:

This year's winter storm flood damage to Maricopa County was generally confined to the Wickenburg area; however, other damage was sustained in other parts of the County. The approach to the Alma School Bridge over the Salt River received substantial damage, forcing road restrictions for several weeks and incurring expensive repair bills. Seven deaths were reported in Arizona due to flooding. Three individuals from Maricopa County died as a result of flooding in Sycamore Creek in Gila County, but no deaths were reported in Maricopa County...

... The next major storm to strike Maricopa County occurred on Thursday, February 10th, when a powerful storm moved in again from the west. The National Weather Service, in anticipation of heavy runoff as warm rains melt(ed) snow in the high country, issued flash-flood watches and urban and small-stream flood warnings. The town of Wickenburg received 1.89 inches of rain swelling the Hassayampa River. The river washed away two mobile homes and two vehicles. Additionally, the Jack Burden Road was washed out and three utility poles were lost, resulting in power outages. Arizona Public Service reported 25 individuals were left without power which was restored the following Monday. Telephone, water and gas service was also restored that day. The Maricopa County Sheriff's Office was credited with rescuing 21 individuals in 11 incidents during the weekend ending February 13th as helicopter crews plucked individuals from vehicles stranded in various washes...

... In summary, the winter storms of late 2004 and early 2005 provided much needed moisture to the Valley and left the water reservoirs full or nearly full, including Roosevelt Lake. Unfortunately, Maricopa County suffered an estimated \$6.5 million in damage during this time period.