Flood Control District of Maricopa County

Upper New River/Skunk Creek
Technical Addendum

November 2009

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INTRODUCTION

The Flood Control District of Maricopa County (District) provides flood hazard identification, prevention, regulation and remediation to reduce the risk of injury, loss of life and property damage from flooding in the County. The purpose of this comprehensive Flood Response Plan (FRP) is to ultimately reduce the potential for property damage and loss of life resulting from floods on identified hazardous watercourses in the Upper New River and Skunk Creek watersheds.

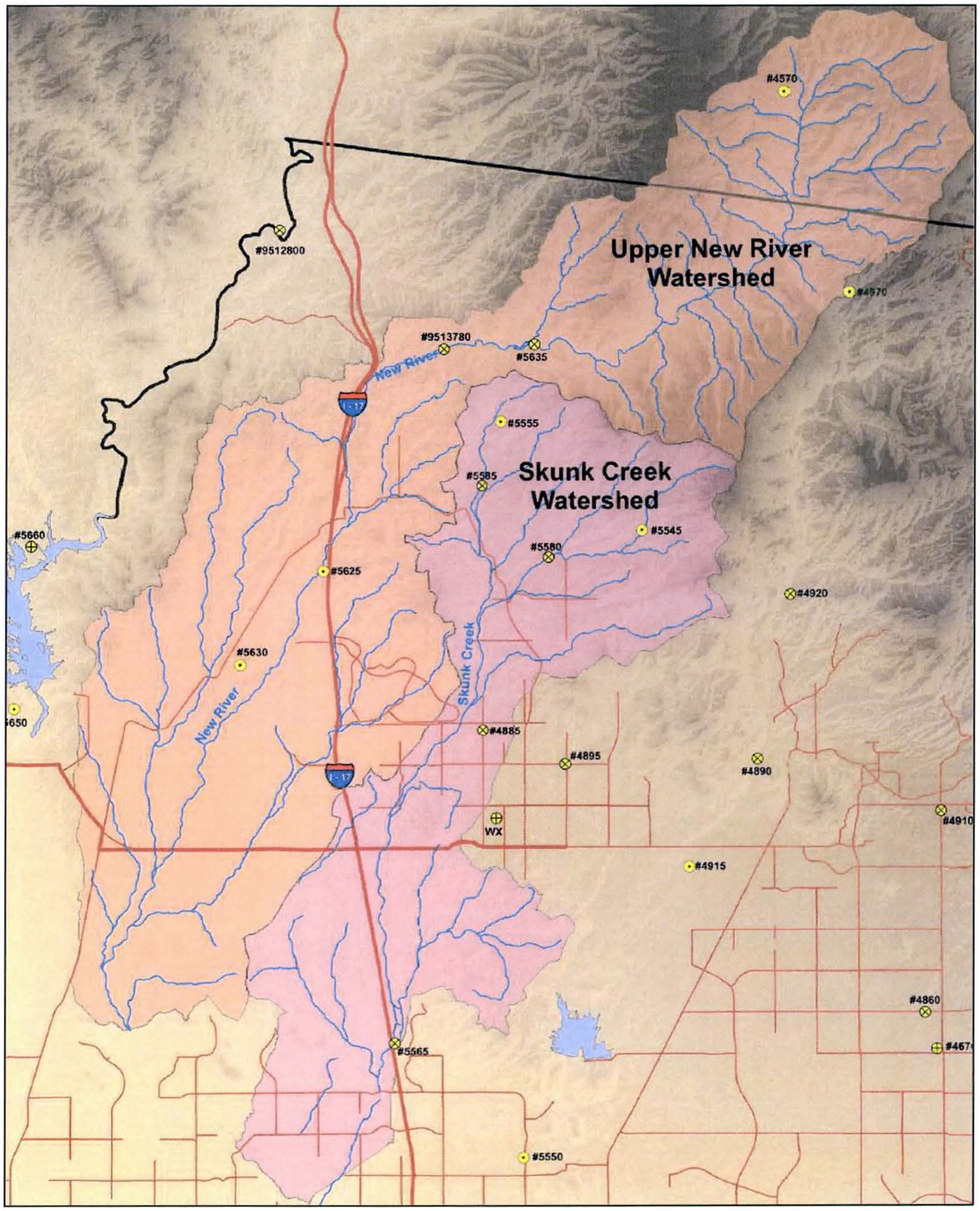


Figure 1: Location Map

Project Need

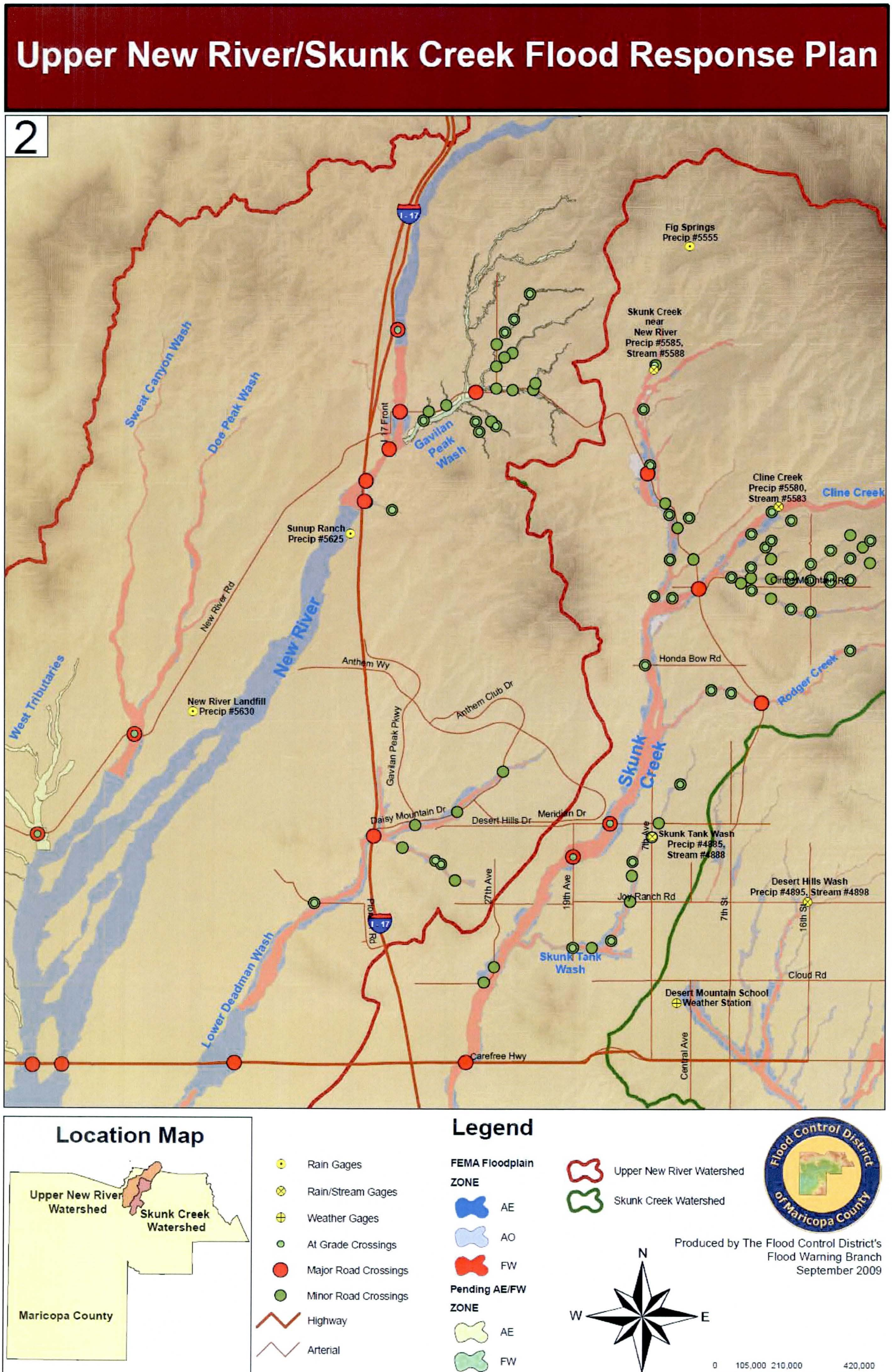
The New River area has transformed from what used to be a vast, nearly empty desert, to a bustling bedroom community of Phoenix. This area has been always been prone to flooding and due to increased urbanization over the past decades the flooding now has the potential to affect a great number of people. On August 10, 2005 there was a fatality on Old Stage Road which is a low flow crossing New River North of I-17. The article was printed in the Arizona Republic and was titled "1 Dead, 1 Lost in Flash Flood." Due to these and other flooding problems located within the watershed the District contracted with Stantec, Inc. to produce the "Upper New River Area Drainage Master Plan" (ADMP) which was finished in June 2008.

The Skunk Creek FRP, originally prepared by Tetra Tech, Inc, was developed for Skunk Creek and its tributaries. This FRP was developed in conjunction with the Skunk Creek Watercourse Master Plan, August 2001. In 2005, JE Fuller completed an Adobe Dam/Desert Hills FRP. Since 2005, Skunk Creek has continued to experience urbanization. The District saw a need to update and expand these two previous plans.

Project Description

The Upper New River/Skunk Creek FRP was created to identify the flood hazards and ultimately reduce the risk of injury, life and property damage to the residents and the communities within the Upper New River and Skunk Creek watersheds. A successful FRP is a result of the preparedness and coordination of all participants. By using the most recent hydrology and hydraulics available for these watersheds along with the most recent studies and GIS data, the most up to date and current information has been provided in this FRP.

Figure 2: Upper New River/Skunk Creek FRP Map



FLOOD DETECTION

The Flood Control District of Maricopa County (District) provides early warning to agencies and responders through weather monitoring and an elaborate ALERT gage network. The District's ALERT gage network provides real-time data for rainfall, streamflow, water levels, and weather information 24 hours a day 365 days a year. All of this information is easily accessible via the District's website:

http://www.fcd.maricopa.gov/Rainfall/rainfall.aspx

Weather Monitoring

The District's in-house meteorologist monitors satellite data, radar data, National Weather Service (NWS) products and other tools to develop rainfall forecasts for the County. If requested, the forecasts are made available to local jurisdictions by fax or email notification. The forecasts are used as an early "heads up" for flood threat within the County.

In addition to the email, fax and telephone notifications for an impending flood threat, the District's meteorologist prepares and posts a Daily Weather Outlook each afternoon for the subsequent 24 hours, covering all zones including the New River/Cave Creek Zone. According to the District's Standard Operating Procedure, if meteorological conditions warrant, the following messages are delivered for individual zones:

District Meteorological Services Program (MSP) Standard Operating Procedure:

Message 1 Developing weather conditions my lead to flooding and/or destructive winds. Lead times will generally be 1 to 3 hours in advance of the expected event. The alert will normally include the zones to be affected, the time frame of the expected event, and the type of areas that will be impacted- such as roads, washes, or streams.

Message 2 Developing weather event my lead to flash flooding. This message is similar to NWS Flood Watch. Lead time will generally be 1 to 2 hours in advance of the expected event.

Message 3 Flash flooding is imminent or occurring. This message is similar to a NWS Flood Warning. Lead time will generally be less than an hour. The magnitude of flooding is variable – a Message 3 does not necessarily signify major flooding.

Message 4 ALL CLEAR. Event no longer poses a threat and previous messages have expired or have been cancelled.

Weather Outlook The daily outlook will be disseminated to all clients Monday through Friday (daily during monsoon season), between 1:00 pm and

1:30 pm. In addition, from about October 1 to July 1, a preliminary Outlook is issued around 8:00 am Monday thru Friday. Outlooks include synopsis of expected weather conditions for the remainder of the day, the coming night and the following morning. Expected weather trends for the following 2-3 days and expected wind conditions will also normally be included in the synopsis portion of the Outlook if time and space permits. The Outlook also includes the expected hours the bulk of the rain will fall, the probability of rain during this time and the amount of rain expected during this period.

Track Forecast At times the depiction of expected thunderstorm movement may best be shown by a graphic, including location of the primary thunderstorms of concern, and a 1-hour forecast track of these storms.

Message 1, 2 & 3 Update This message will update the existing Alert, Watch or Warning.

Quantitative Precipitation Forecast (QPF) This graphical product may be issued when the forecaster believes he has a good grasp as to how much rain will fall, where it will fall and when it will fall (valid time).

ALERT Gage Network Monitoring

The District monitors a sophisticated network of automatic rain gages, stream gages, and weather stations in and around Maricopa County. The network uses ALERT (Automated Local Evaluation in Real Time) technology to detect and monitor rainfall and runoff during storms. Monitoring of the system is continuous (24/7) by using threshold alarm features available onsite or by remote notification and access.

Flood Control District of Maricopa County (FCDMC) Gages

A complete list of ALERT gages located within the Upper New River/Skunk Creek FRP with their specific alarm values are listed below in Table 2.

Gage Name	Location	Owner	ID #	Type	Alarm Threshold
Cooks Mesa	10 miles E of Black Canyon City	MCFCD	5640	Precip.	1.0 in / 2 hrs
New River Fire	5 miles NE of New River	MCFCD	5635	Precip.	1.0 in / 2 hrs
			5638	Stream	2.9 ft, 2815 cfs
New River nr Rock Springs	3.5 miles NE of New River	USGS	9513780	Precip. Stream	N/A
Sunup Ranch	1 mile SSW of New River	MCFCD	5625	Precip.	1.25 in / 1 hr
New River Landfill	4 miles ENE of New Waddell Dam	MCFCD	5630	Precip.	1.25 in / 1 hr

Fig Springs	3.5 miles E of New River	MCFCD	5555	Precip.	0.75 in / 1 hr
Skunk Creek nr New River	Skunk Creek at Fig Springs Rd., 3.5 miles E of New River	MCFCD	5585	Precip.	0.75 in / 1 hr
			5588	Stream	2.5 ft, 400 cfs
Upper Cline Creek	8 miles E of New River	MCFCD	5545	Precip.	0.75 ft / 1 hr
Cline Creek	4 miles E of New River	MCFCD	5580	Precip.	0.75 ft / 1 hr
			5583	Stream	2.28 ft, 470 cfs
Skunk Tank Wash	0.2 miles S of 7^{th} Ave and Desert Hills Dr.	MCFCD	4885	Precip.	0.75 in / 1 hr
			4888	Stream	5.0 ft, 152 cfs

Table 1: ALERT gages within the Upper New River/Skunk Creek FRP

The District has created an interactive flood response map for the Upper New River/Skunk Creek FRP. This interactive map provides real-time data, graphical summaries, data reports and access to the pages from the Upper New River/Skunk Creek FRP. You can access this custom interactive map by directly going to:

http://156.42.96.39/cgi-bin/submapNRSC/?NRSC

You can also go to the Flood Control District's website, www.fcd.mariocpa.gov, and then go to Rainfall & Weather, Custom Products & Reports, Online Flood Response Plans and click on the Upper New River & Skunk Creek FRP Map.

Other Data Sources

Many additional data sources are available online that help provide additional information about the weather and flooding conditions in Maricopa County and throughout Arizona. The District is a partner with Arizona Flood Warning System (http://www.afws.org). The Arizona Flood Warning System's website provides additional weather data including watershed conditions, US Geological Survey (USGS) streamgage data, and ALERT data from areas outside of Maricopa County, including Yavapai County. In addition, Yavapai County's Flood Control District operates its own ALERT data collection network and posts real-time data on its web site http://www.co.yavapai.az.us/FloodALERT.aspx. NWS issues meteorological and hydrological forecast and warnings to the public and to local jurisdictions (http://www.wrh.noaa.gov/psr). The Colorado Basin River Forecast Center (CBRFC) in Salt Lake City, Utah, prepares forecasts using computer-based river forecast models (http://www.cbrfc.noaa.gov). USGS also operates an elaborate network of rain and stream gages (http://water.usgs.gov/.

Location

The Upper New River/Skunk Creek area is roughly bounded by Carefree Highway to the south, the Town of Cave Creek and Tonto National Forest to the east, Yavapai County to the north and west and by the cities of Peoria and Phoenix to the southwest. This area consists of the Upper New River and the Skunk Creek watersheds.

The main watercourse in the Upper New River watershed is New River. Gavilan Peak Wash, Upper Deadman Wash, Sweat Canyon/Doe Peak, West Tributaries and Lower Deadman Wash area all headwaters to New River. Kelly Road Wash, Coyote Pass Wash, Table Mountain Wash, Photo View Wash, River Creek, Soda Springs Wash, White Spur Wash, Rough Rider Wash, Lazy G Wash, Twin Peaks Wash and Sharman Wash are all headwaters to Gavilan Peak Wash. All the watercourses located within the Upper New River watershed are identified in Table 3.

Table 2: Upper New River Watercourses

Watercourse	Portion Included in FRP
New River	Headwaters to Carefree Highway
Sweat Canyon	Headwaters to New River
Doe Peak	Headwaters to New River
West Tributaries	Headwaters to New River
Lower Deadman Wash	Headwaters to New River
Upper Deadman Wash	Headwaters to New River
Gavilan Peak Wash	Headwaters to New River
Kelley Road Wash	Headwaters to Gavilan Peak Wash
Coyote Pass Wash	Headwaters to Gavilan Peak Wash
Table Mountain Wash	Headwaters to Gavilan Peak Wash
Photo View Wash	Headwaters to Gavilan Peak Wash
River Creek	Headwaters to Gavilan Peak Wash
Soda Springs Wash	Headwaters to Gavilan Peak Wash
White Spur Wash	Headwaters to Gavilan Peak Wash
Rough Rider Wash	Headwaters to Gavilan Peak Wash
Lazy G Wash	Headwaters to Gavilan Peak Wash
Twin Peaks Wash	Headwaters to Gavilan Peak Wash
Sharman Wash	Headwaters to Gavilan Peak Wash

The main watercourse in the Skunk Creek watershed is Skunk Creek. Cline Creek, Rodger Creek and Skunk Tank Wash all are headwaters to Skunk Creek. Tributaries to Skunk Creek include; Tributary 6B, Tributary 6C, Tributary 10A, Tributary 10B, Tributary 12, Cline Creek, Rodger Creek, Skunk Tank Wash. Cline Creeks Tributaries include; Tributary C8, X1, X2, X3, X4A, X4B, and C6. Skunk Tank Wash has one tributary which is Valley Wash. All the watercourses located within the Skunk Creek watershed are identified in Table 4.

Table 3: Skunk Creek Watercourses

Watercourse	Portion Included in FRP
Skunk Creek	Headwaters to Carefree Highway
Tributary 6B	Headwaters to Skunk Creek
Tributary 6C	Headwaters to Skunk Creek
Tributary 10A	Headwaters to Skunk Creek
Tributary 10B	Headwaters to Skunk Creek
Tributary 12	Headwaters to Skunk Creek
Rodger Creek	Headwaters to Skunk Creek
Cline Creek	Headwaters to Skunk Creek
Tributary C8	Headwaters to Cline Creek
Tributary X1	Headwaters to Cline Creek
Tributary X2	Headwaters to Cline Creek
Tributary X3	Headwaters to Cline Creek
Tributary X4A	Headwaters to Cline Creek
Tributary X4B	Headwaters to Cline Creek
Tributary C6	Headwaters to Cline Creek
Skunk Tank Wash	Headwaters to Skunk Creek
Valley Wash	Headwaters to Skunk Tank Wash

The following maps show where all the ALERT gages, streams gages and tributaries are located within the Upper New River and Skunk Creek watersheds.

Figure 3: Gages, Streams and Tributaries North of New River Fire Gage

Upper New River Watershed - Above New River Fire Gage
Gages, Streams and Tributaries

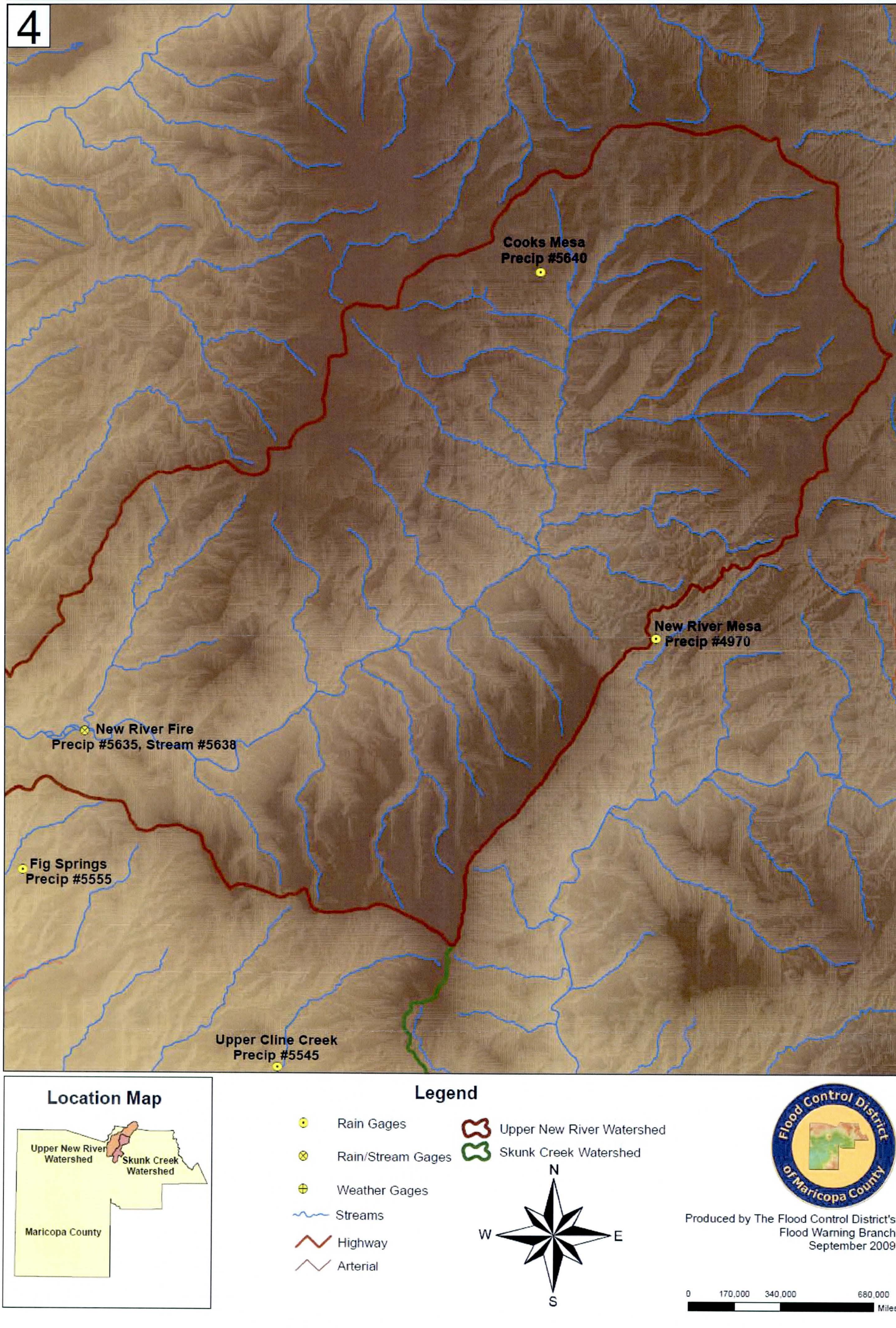


Figure 4: Gages, Streams and Tributaries South of New River Fire Gage

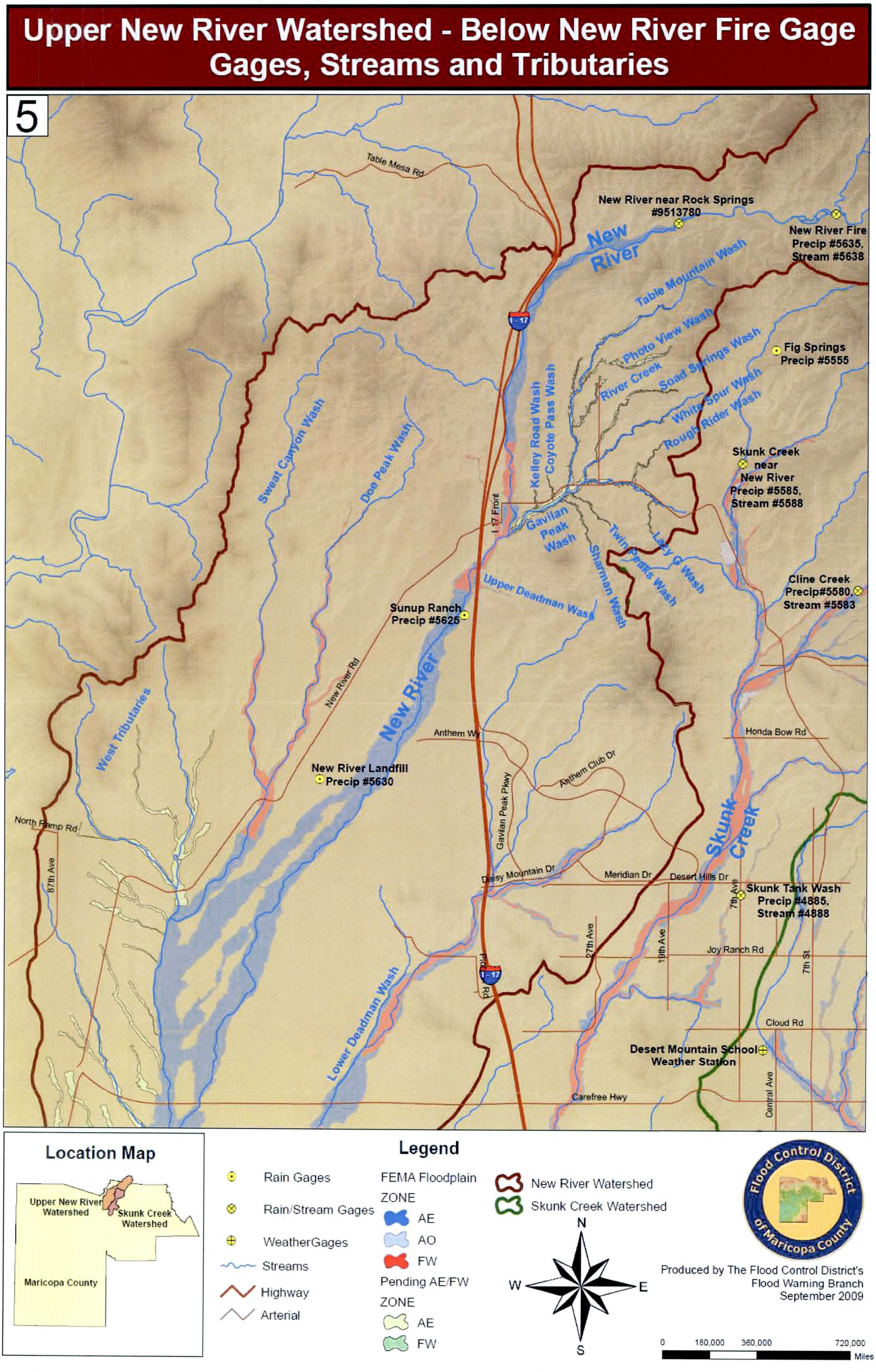
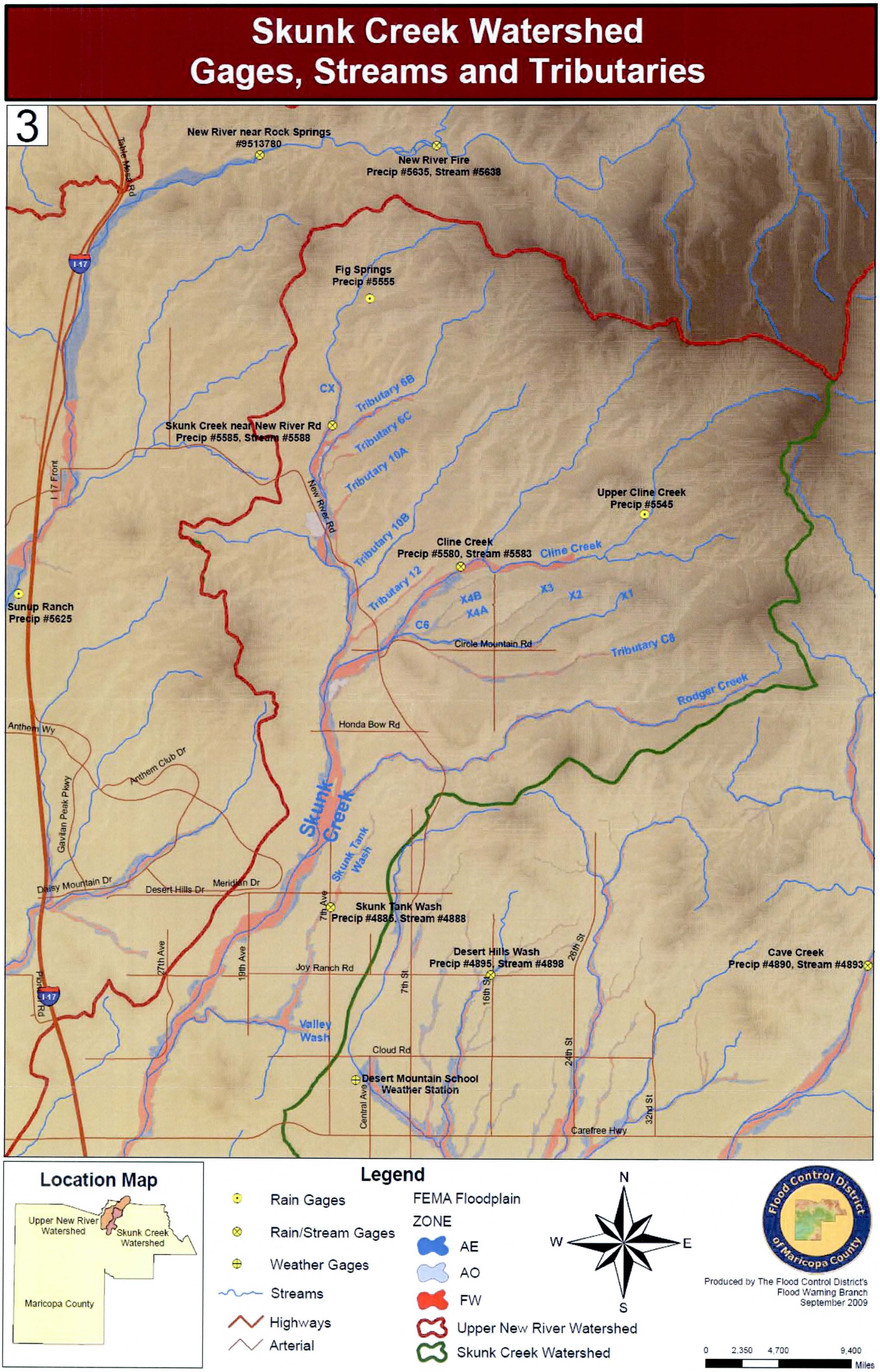


Figure 5: Skunk Creek - Gages, Streams and Tributaries



Available Lead Times

Early flood detection is one of the most important aspects to being able to provide an early warning to communities and their residents. When a threshold value has been met at a sensor the ALERT software sets off an alarm. The alarm alerts an operator to a hazardous condition. By monitoring the streamgages the District is able to estimate travel times from when the water is at the gage to when it will reach a particular road crossing. Certain road crossings are more vulnerable to flooding and need to be barricaded during an event to prevent injury, property damage or loss of life.

New River

New River flows in a southwest direction starting from the most northeastern part of the Upper New River watershed. The travel times have been estimated from the New River Fire streamgage to Table Mesa Road, Old Stage Road, New River Road, and to I-17. These travel times were estimated using rating data and HEC-RAS data completed for the New River Fire streamgage by the District's Flood Warning Branch.

Table 4: Travel Times for New River

New River Fire Streamgage to Table Mesa Road
2.2 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
500	4.75	0.62	41
3,000	8.61	3.08	22
5,000	10.42	4.44	19
10,000	12.28	6.74	16
20,000	15.94	9.44	12
40,000	20.00	13.20	10

New River Fire Streamgage to Old Stage Road
6.7 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
500	4.75	0.62	124
3,000	8.61	3.08	68
5,000	10.42	4.44	57
10,000	12.28	6.74	48
20,000	15.94	9.44	37
40,000	20.00	13.20	29

New River Fire Streamgage to New River Road
7.88 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
500	4.75	0.62	146
3,000	8.61	3.08	81
5,000	10.42	4.44	67
10,000	12.28	6.74	56
20,000	15.94	9.44	44
40,000	20.00	13.20	35

New River Fire Streamgage to I-17
8.9 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
500	4.75	0.62	164
3,000	8.61	3.08	91
5,000	10.42	4.44	75
10,000	12.28	6.74	64
20,000	15.94	9.44	49
40,000	20.00	13.20	39

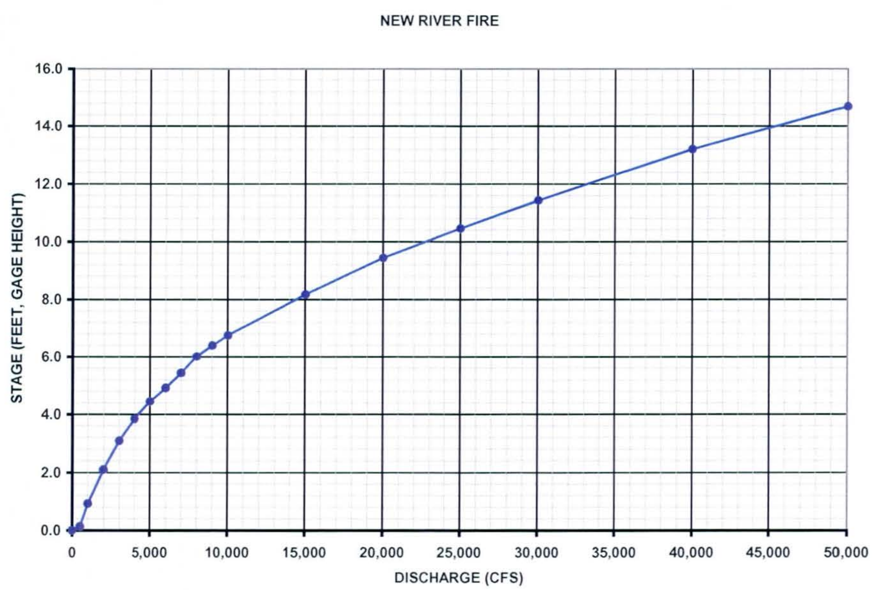


Figure 6: Rating Curve for New River Fire #5638 - Provided by FCDMC

Skunk Creek

Skunk Creek flows in a southerly direction starting from the northern most part of the Skunk Creek watershed. These travel times have been estimated from the Skunk Creek near New River streamgage to the New River Road crossing and from the New River Road crossing to the confluence of Skunk Creek and Cline Creek.

The travel times provided in Table 6 were estimated using rating data and HEC-RAS data completed for the Skunk Creek near New River streamgage by the District's Flood Warning Branch. These travel times are just accounting for the streamflow that will pass by this gage only. There are four additional small tributaries that converge with Skunk Creek before New River Road. These stream names are Tributary 10A, Tributary 6C, Tributary 6B, and Tributary CX. Due to these additional tributaries and the water they may potentially carry, the travel times may drastically increase in the event of a large storm event.

Table 5: Travel Times for Skunk Creek

Skunk Creek near New River Streamgage to New River Road
1.4 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
300	4.88	2.11	25
655	6.94	3.24	18
950	8.57	3.89	14
1500	10.86	4.55	11
2500	11.63	5.21	10

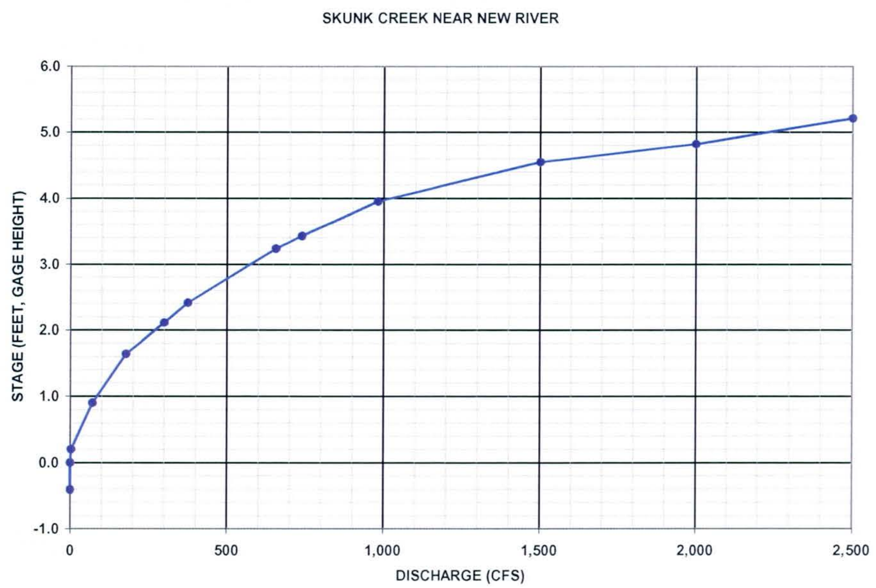


Figure 7: Rating Curve for Skunk Creek near New River #5588- Provided by FCDMC

The travel times provided in Table 7 were estimated using the Adobe Dam/Desert Hills ADMP 100-year flow at the same location of the Skunk Creek near New River gage which is RS: 27.164. The 100-year flow has an estimated at 4,899 cubic feet per second (cfs) with a velocity of 4.38 ft/sec. From New River Road to the confluence of Cline Creek for the 100-year flow was estimated at 7,840 cubic feet per second (cfs) with a velocity of 5.1 ft/sec. This would be including the flows from Tributary 10A, Tributary 6C, Tributary 6B, Tributary CX, Tributary 10B and Tributary 12.

Table 6: Travel Times for Skunk Creek (Adobe Dam/Desert Hills ADMP)

Skunk Creek near New River Streamgage to New River Road
1.4 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
4,899	4.38	N/A (>5.21 ft)	28

New River Road to the confluence of Cline Creek
2.14 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
7,840	5.1	N/A	37

Cline Creek

Cline Creek flows in a westerly direction from the east side of the Skunk Creek watershed until it reaches Skunk Creek. At Skunk Creek the flow returns to a southerly direction to Carefree Highway. The travel times provided in Table 8 were estimated from the Cline Creek streamgage to New River Road using rating data and HEC-RAS data completed for the Cline Creek streamgage by the District's Flood Warning Branch. These travel times are just accounting for the streamflow that will pass by this gage only. There are two additional tributaries that converge with Cline Creek before New River Road. These streams names are Tributary C-8 and Tributary C-6 (which includes X4B, X4A, X3, X2 and X1). Due to these additional tributaries and the water they may potentially carry, the travel times may drastically increase in the event of a large storm event.

Table 7: Travel Times for Cline Creek

Cline Creek Streamgage to New River Road
1.5 Miles Downstream

Discharge (cfs)	Velocity (ft/sec)	Gage Height (feet)	Time (minutes)
300	6.10	2.30	22
750	7.34	3.65	18
2,000	9.61	6.36	14
5,000	13.01	8.79	10
8,000	15.49	N/A	9

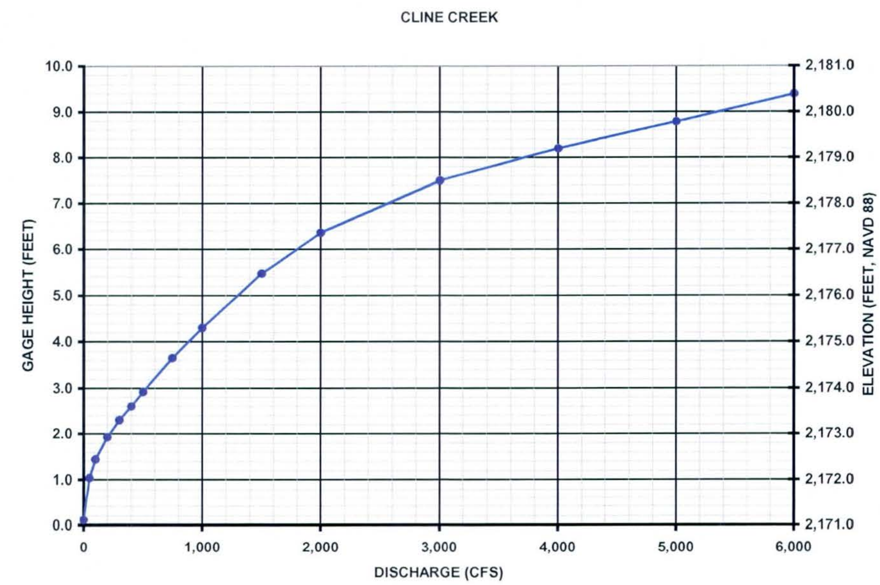


Figure 8: Rating Curve for Cline Creek #5583 - Provided by FCDMC

FLOOD VULNERABILITY

Many roadways, local and collector road crossings and structures within the Upper New River and Skunk Creek watersheds are vulnerable to flooding. In this FRP the roads are classified as major roadways and minor roadways. Both watersheds have particular road crossings that are vulnerable to dangerous flooding. This section will provide a complete list of all roads that cross or are within the FEMA 100-year floodplain. It is important to know the location of all the roadways within the FRP. At any point in a storm event a watercourse could become impassable and an alternative route may need to be taken by emergency vehicles to access a particular crossing or structure. Some of the crossings have flood structures like bridges and culverts, but there are also some at-grade crossings that pose a very big danger to motorists (an at-grade crossing is defined as a point on the roadway that is periodically inundated by moving floodwaters). These at-grade crossings need to be barricaded in a timely manner to prevent motorists from trying to cross flooded rivers, streams and washes.

Along with roadway crossings, the Upper New River and the Skunk Creek watersheds have many structures that are located within designated floodways and floodplains. When there is a potential for a flood event these structures, especially the occupied structures, need to be monitored and potentially people might need to need to be evacuated from their homes. These structures were identified by using the most up-to-date aerial photos from the District and the most recent floodplain delineation studies from FEMA.

Several flooding scenarios were evaluated for potential flood threat:

- Major roadway crossings
- Minor street crossings
- Floodway residents - Occupied structures located within the 100-year floodway
- Floodplain residents - Occupied structures located within the 100-year floodplains

Upper New River/Skunk Creek FRP
Major and Minor Road Crossings

Major Roadway Crossings

Major roadway crossings are defined as road crossings that have a combination of being highly travelled, have a high discharge (cubic feet per second) value or have a high velocity (feet per second) value. Old Stage Road, New River Road, Desert Hills Drive, 19th Avenue, Carefree Highway and I-17 all traverse either New River or Skunk Creek. High flows in these watercourses can make particular crossings very dangerous during a flood event. Locations of major roadways that are vulnerable to flooding are identified in Table 9.

Table 8: Major Roadway Crossings

Road Crossing	Stream Name	Type of Crossing	Discharge
Old Stage Road	New River	Asphalt Dip	Q100 = 29,000 cfs
New River Road	New River at West Tributaries	Asphalt Dip	Q100 = 13,400 cfs
	New River at Sweat Canyon/Doe Peak	Asphalt Dip	Q100 = 14,100 cfs
	New River at I-17 Bridge	Bridge	Q100 = 29,000 cfs
	New River at Black Canyon Highway	Bridge	Q100 = 29,000 cfs
	New River at New River Road	Bridge	Q100 = 28,800 cfs
	Gavilan Peak Wash at New River Road (west crossing)	Box Culvert	Q100 = 4,649 cfs
	Skunk Creek at New River Road	Bridge	Q2 =1,463 cfs, Q10 = 4,063 cfs, Q100 = 7,840 cfs
	Cline Creek at New River Road	Bridge	Q100 = 16,700 cfs
	Rodger Creek at New River Road	Culverts	Q2 = 1,699 cfs, Q10 = 3,310 cfs, Q100 = 6,500 cfs
Desert Hills Drive	Skunk Creek Between 11th Ave & 17th Ave	Asphalt Dip	Q2 = 4,900 cfs, Q10 = 14,000 cfs, Q100 = 26,500 cfs
19th Avenue	Skunk Creek	Asphalt Dip	Q2 = 4,900cfs, Q10 = 14,000 cfs, Q100 = 26,500 cfs
Carefree Highway	New River West	Bridge	Q100 = 18,030 cfs
	New River East	Bridge	Q100 = 8,000 cfs
	Skunk Creek	Bridge	Q2 = 4,872 cfs, Q10 = 13,837 cfs, Q100 = 27,283 cfs
	Lower Deadman Wash	Culvert	Q100 = 9,510 cfs
I-17	New River	Bridge	Q100 = 29,000 cfs
	Upper Deadman Wash	Box Culvert	Q100 = 4,800 cfs
	Lower Deadman Wash	Bridge	Q100 = 9,700 cfs

Local and Collector Street Road Crossings

Minor roadway crossings are defined as road crossings that have a decreased level of traffic compared to a major roadway. These roads can still have high discharge (cubic feet per second) values and high velocity (feet per second) values. Road crossings that have culverts may still be flooded if the culvert is blocked with sediment or debris and/or the flow is of a discharge higher than the culvert can convey. Locations of minor roadways that have at-grade crossings that are vulnerable to flooding are identified in Table 10.

Table 9: Minor Roadway Crossings

Stream Name	Road Crossing	Type of Crossing	Discharge
Skunk Creek	Fig Springs Road	Dip	Q100 = 4,899 cfs
	Wolftrap Road	Dip	Q100 = 7,174 cfs
	7th Avenue	Dip	Q100 = 7,174 cfs
	Zorrillo Drive	Dip	Q100 = 8,8818 cfs
	Shangri La Lane	Asphalt Dip	Q100 = ~9,000 cfs
	Circle Mountain Road	Dip	Q100 = ~9,500 cfs
	Honda Bow Road	Asphalt Dip	Q100 = ~23,250 cfs
	Cloud Road	Culverts	Q100 = ~28,500 cfs
	27th Avenue	Culverts	Q100 = ~28,500 cfs
Skunk Creek Tributary 10A	New River Road	Culverts	Q2 = 499 cfs, Q10 = 1,230 cfs, Q100 = 2,255 cfs
Skunk Creek Tributary 10B	Venado Dr	Dip	N/A
	New River Road	Culverts	Q2 = 182 cfs, Q10 = 640 cfs, Q100 = 1,820 cfs
Skunk Creek Tributary 12	New River Road	Culverts	Q2 = 499 cfs, Q10 = 1,230 cfs, Q100 = 2,255 cfs
Cline Creek	3rd Avenue	Dip	Q100 = 13,747 cfs
	10th Street	Dip	Q100 = 10,883 cfs
	12th Street	Asphalt Dip	Q100 = 10,883 cfs
	14th Street	Dip	Q100 = 10,883 cfs
Cline Creek Tributary C6	10th Street	Culverts	Q100 = 1,430 cfs
	12th Street	Box Culvert	Q100 = 1,430 cfs
	14th Street	Asphalt Dip	Q100 = 1,430 cfs
	16th Street	Asphalt Dip	Q100 = 1,430 cfs
	18th Street	Asphalt Dip	Q100 = 1,430 cfs
Cline Creek Tributary X4B	Johnson Road	Dip	N/A
	12th Street	Asphalt Dip	N/A
Cline Creek Tributary X4A	12th Street	Culverts	N/A
Cline Creek	10th Street	Dip	N/A

Tributary X4A, X4B			
Cline Creek Tributary X3	14th Street	Asphalt Dip	N/A
	16th Street	Asphalt Dip	N/A
	18th Street	Dip	N/A
	20th Street	Culvert	N/A
Cline Creek Tributary X2	18th Street	Asphalt Dip	N/A
	20th Street	Asphalt Dip	N/A
	Gaffney Road	Culvert	N/A
	22nd Street	Dip	N/A
Cline Creek Tributary X1	20th Street	Asphalt Dip	Q100 = 708 cfs
	22nd Street	Culvert	Q100 = 708 cfs
Cline Creek Tributary C8	Circle Mountain Road	Box Culvert	Q2 = 228 cfs, Q10 = 780 cfs, Q100 = 2,280 cfs
	7th Street	Dip	Q100 = 2,280 cfs
	10th Street	Dip	Q100 = 2,280 cfs
	12th Street	Culverts	Q100 = 2,280 cfs
	14th Street	Asphalt Dip	Q100 = 2,280 cfs
	16th Street	Asphalt Dip	Q2 = 228 cfs, Q10 = 800 cfs, Q100 = 2,280 cfs
Rodger Creek	3rd Street	Dip	Q100 = 5,450 cfs
	7th Street	Dip	Q100 = 5,450 cfs
	20th Street	Dip	Q100 = 5,450 cfs
Skunk Tank Wash	19th Avenue	Dip	Q100 = ~2,500 cfs
	17th Avenue	Culvert	Q100 = 2,110 cfs
	15th Avenue	Dip	Q100 = 2,110 cfs
	Maddock Road	Asphalt Dip	Q100 = 2,110 cfs
	Joy Ranch Road	Culverts	Q2 = 211 cfs, Q10 = 740 cfs, Q100 = 2,110 cfs
	11th Avenue	Culverts	Q100 = 2,110 cfs
	Irivne Road	Asphalt Dip	Q100 = 1,880 cfs
	7th Avenue	Culverts	Q2 = 157 cfs, Q10 = 550 cfs, Q100 = 1,570 cfs
	Desert Hills Drive	Culverts	Q2 = 142 cfs, Q10= 497 cfs, Q100 = 1,420 cfs
	Saddle Mountain Road	Dip	Q100 = 1,420 cfs
Gavilan Peak Wash	Meander Road	Dip	Q100 = 8,683 cfs
	27th Avenue	Culverts	Q100 = 2,346 cfs
	New River Road (east crossing)	Box Culvert	Q100 = 4,649 cfs Q100 = 2,221 cfs

Coyote Pass Wash	New River Road	Culvert	Q100 = 267 cfs
Rough Rider Wash	23rd Ave	Culverts	Q100 = 948 cfs
	New River Road	Culverts	Q100 = 948 cfs
Sharman Wash	Wander Lane	Dip	Q100=796cfs
	Twin Peaks Lane	Dip	Q100=796cfs
Soda Springs Wash	27th Avenue	Culverts	Q100 = 1,482 cfs
	26th Avenue	Dip	Q100 = 1,365 cfs
	White Spar Road	Dip	Q100 = 1,394 cfs
	Estrella Road	Dip	Q100 = 1,096 cfs
Twin Peaks Wash	27th Avenue	Dip	Q100 = 470 cfs
	Twin Peaks Lane	Culvert	Q100 = 470 cfs
White Spur Wash	Mingus Road	Box Culvert	Q100 = 1,162 cfs
	Rough Rider Road	Culverts	Q100 = 1,162 cfs
	27th Avenue	Culverts	Q100 = 1,162 cfs
New River	Table Mesa Road	Dip	N/A
Upper Deadman	Jenny Lin Road	Dip	Q100 = 4,800 cfs
	Frontage Road	Box Culvert	Q100 = 4,800 cfs
Lower Deadman	Sheriffs Pistol Range Road	Dip	N/A
	Pioneer Road	Dip	N/A
	Gavilan Peak Parkway (North)	Bridge	N/A
	Gavilan Peak Parkway (South)	Bridge	Q100 = 1,661 cfs
	Irvine Road	Dip	Q100 = 1,661 cfs
	33rd Avenue	Dip	Q100 = 1,661 cfs
	31st Avenue	Culvert	Q100 = 1,661 cfs
	Daisy Mountain Drive (West)	Box Culvert	N/A
	Daisy Mountain Drive (East)	Box Culvert	N/A

At-Grade Road Crossings

An at-grade road crossing is defined as a point on a roadway that is periodically inundated by moving floodwaters. These crossings will be more likely to need barricades than crossings with flood structures like bridges and/or culverts. Barricades need to be set up to divert motorists from attempting to cross flooded rivers, streams and washes during a flood event.

Table 10: Major Road Crossing with At-Grade Crossings

Watercourse	Road Crossing
New River	New River Road at West Tributaries
New River	New River Road at Sweat Canyon/Doe Peak
New River	Old Stage Road
Skunk Creek	Desert Hills Drive
Skunk Creek	19^{th} Avenue

Table 11: Minor Road Crossings with At-Grade Crossings

Watercourse	Road Crossing
Skunk Creek	Fig Springs Road
	Wolftrap Road
	7^{th} Avenue
	Zorrillo Drive
	Shangri La Lane
	Circle Mountain Road
	Honda Bow Road
SC Trib. 10B	Venado Dr
Cline Creek	3^{rd} Avenue
	10^{th} Street
	12^{th} Street
	14^{th} Street
CC Trib. C6	14^{th} Street
	16^{th} Street
	18^{th} Street
CC Trib. X4B	Johnson Road
	12^{th} Street
CC Trib. X4A, X4B	10^{th} Street
CC Trib. X3	14^{th} Street
	16^{th} Street
	18^{th} Street
CC Trib. X2	18^{th} Street
	20^{th} Street
	22^{nd} Street
CC Trib. X1	20^{th} Street
CC Trib. C8	7^{th} Street
	10^{th} Street

	14^{th} Street
	16^{th} Street
Rodger Creek	3^{rd} Street
	7^{th} Street
	20^{th} Street
Skunk Tank Wash	19^{th} Avenue
	15^{th} Avenue
	Maddock Road
	Irivne Road
	Saddle Mountain Road
Gavilan Peak Wash	Meander Road
Sharman Wash	Wander Lane
	Twin Peaks Lane
Soda Springs Wash	26^{th} Avenue
	White Spar Road
	Estrella Road
Twin Peaks Wash	27th Avenue
New River	Table Mesa Road
Upper Deadman	Jenny Lin Road
Lower Deadman	Sheriffs Pistol Range Road
	Pioneer Road
	Irvine Road
	33^{rd} Avenue

Structures within the FEMA Floodways and 100-yr Floodplains

As previously noted, the Upper New River and Skunk Creek watersheds have many structures that are located within designated floodways and floodplains. The structures were located using the most up-to-date aerial photos and the most recent floodplain delineation studies from FEMA; both of which are available through the District's GIS database. The tables below provide a detailed list of the types of flood hazards present on particular parcels throughout the two watersheds. The structure types range from; Single Family Residential Structures (SFR), Mobile Homes (Mobile), Commercial Buildings (Commercial Blgd), Detached Garages (Garage), Horse Barns (Barn) and Sheds.

Floodways

A floodway is defined as the channel of a river or other watercourse, and portions of the adjacent floodplain, that must remain open to permit passage of the base flood without cumulatively increasing the water surface elevation more than a designated height. This is usually where the low flow area of the stream is located and receives the flows with the highest discharge and velocity values. Within the Upper New River/Skunk Creek FRP there are a total of 29 occupied structures in the floodway. Here is a list of the number of occupied structures and watercourses that they are located on:

- 9 structures are in the Skunk Creek and Skunk Creek Tributaries
- 8 structures are in the Cline Creek and Cline Creek Tributaries
- 4 structures are in Lower Deadman Wash
- 3 structures are in Gavilan Peak Wash
- 3 structures are in Skunk Tank Wash
- 2 structures are in Rodger Creek

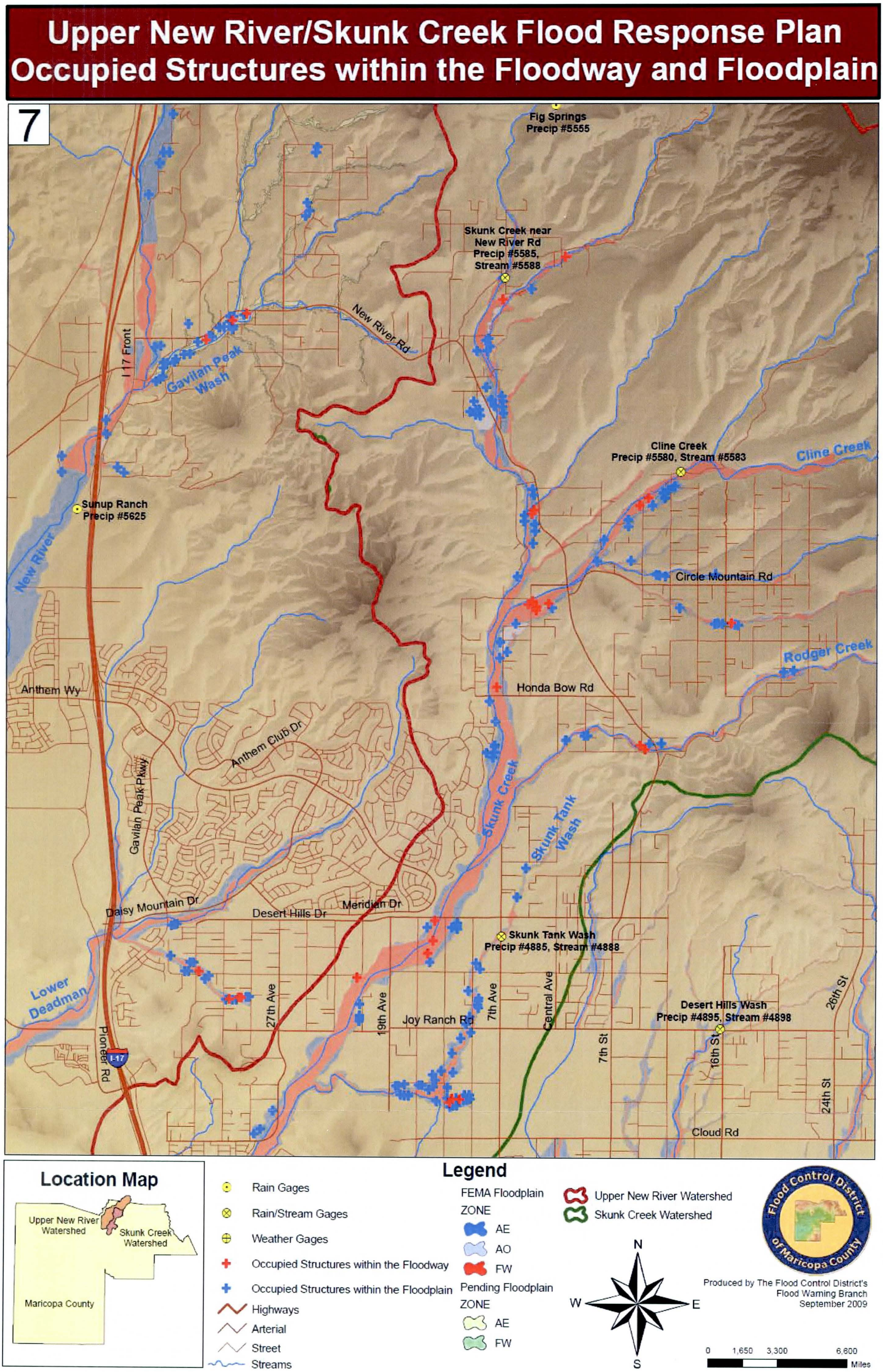
Floodplains

A floodplain is defined as any land area susceptible to being inundated by flood waters from any source. Within the Upper New River/Skunk Creek FRP there are a total of 181 homes in the floodplain. That total excludes the homes already accounted for in the floodway totals. Here is list of the number of occupied structures and watercourses they are located on:

- 53 structures within the Skunk Creek and Skunk Creeks Tributaries
- 40 structures within Skunk Tank Wash and Skunk Tank Wash Tributaries
- 28 structures within the Gavilan Peak Wash and Gavilan Peak Wash Tributaries
- 22 structure within the Cline Creek and Cline Creeks Tributaries
- 15 structures within Lower Deadman Wash
- 13 structures within New River
- 8 structures within Rodger Creek
- 2 structures within Upper Deadman Wash

If you include the total number of homes located within the floodways and the floodplains there are a total of 210 occupied structures that are at risk of being flooded during a 100-year storm event.

Figure 10: Occupied Structures within the Floodway and Floodplain



Upper New River Watershed

The structures within the Upper New River watersheds floodways and floodplains were located by using the most up to date aerial photos and the most recent floodplain delineation studies from FEMA which are available through the District's GIS database. The structures located within Gavilan Peak Wash where identified using a floodplain delineation study completed by PBS&J, "Gavilan Peak Floodplain Delineation Study, FCD Contract 2007-C036", which was submitted on July 7, 2008 to FEMA. This is the most current study available for Gavilan Peak Wash but FEMA has not given the final approval on the study yet. For a list of the all the structures located within Upper New River watersheds' floodways and floodplains refer to Table 13 and Table 14.

Table 12: Upper New River Watershed - Structures in the Floodway

APN #	Stream Name	Owner	Address	Structure
202-11-071E	Gavilan Peak	Loraine & Ervin Brazzel	2929 W New River Rd	SFR
202-11-025D	Gavilan Peak	Ethel & Robert Philpott	47549 N 33rd Ave	SFR
203-35-010J	Lower Deadman	Thomas Walker	3034 W Tamar Rd	SFR
203-35-002J	Lower Deadman	Vicki Watts	38214 N 29th Ave	SFR
203-14-018S	Lower Deadman	Jeffery Haupricht	3211 W Desert Hills Dr	SFR & Garage
203-35-002M	Lower Deadman	Sherry & Michael Moe	38220 N 29th Ave	SFR & Garage
202-11-066E	Gavilan Peak	Sally & George Hemming	3057 W New River Rd	Mobile
202-26-005	Gavilan Peak	Lisa & Mark Willingham	49201 N 27th Ave	Garage
202-10-973D	Gavilan Peak	Ronald Marx	2306 W New River Rd	Garage
202-12-003B	Gavilan Peak	Elmoretta & Jay Mathews	1275 Lan 17 Worland, WY	Barn
202-11-071G	Gavilan Peak	Gerald Manning	2900 W New River Rd	Shed
202-11-027A	Gavilan Peak	Blair Milner	3303 W New River Rd	Shed
202-26-089	Gavilan Peak	Marie & Kendall Pendergast	2502 W White Spar Rd	Shed
203-35-002P	Lower Deadman	Wilson & Diane Phillip	38208 N 29th Ave	Shed

Table 13: New River Watershed - Structures in the Floodplain

APN #	Stream Name	Owner	Address	Structure
202-06-027G	New River	Don McAdams	51011 N 35th Ave	SFR
202-06-015L	New River	Cline Preston	50437 N 36th Ave	SFR
202-06-015M	New River	Daniel & Chana O'Neil	52019 N 36th Ave	SFR
202-12-014D	New River	Rene Faires	PO BOX 1170 BCC	SFR
202-11-021G	Gavilan Peak	Paul Aratico	3205 W New River Rd	SFR
202-11-023B	Gavilan Peak	Roberta & Roy Wise	46740 N Wagon Wheel	SFR
202-11-020E	Gavilan Peak	Linda & Scott Miller	46741 N 32nd Ave	SFR
202-11-068K	Gavilan Peak	Emily & Michael Wuollet	47846 N 31st Ave	SFR
202-11-068J	Gavilan Peak	Raymond Johnson	47840 N 31st Ave	SFR
202-11-066H	Gavilan Peak	Arnold & Troy Kennedy	16202 N 36th Ave	SFR
202-11-071C	Gavilan Peak	Gareth Braxton-Johnson	2923 W New River Rd	SFR

202-13-011E	Gavilan Peak	Helen & Ralph McCannon	47049 N Kelly Rd	SFR
202-13-003B	Gavilan Peak	Maria & Kenneth Goracke	47627 E Kelly Rd	SFR
202-13-003C	Gavilan Peak	Linda Creley	46834 N Meander Rd	SFR
202-13-003D	Gavilan Peak	Charity & Thomas Holder	3535 W Wander Ln	SFR
202-12-001B	Gavilan Peak	Tracey Vrooman	47433 N Kelly Rd	SFR
202-12-003B	Gavilan Peak	Elmoretta & Jay Mathews	1275 Lan 17 Worland, WY	SFR
202-11-009F	Gavilan Peak	Elvira & Enrique Alvarez	47428 N Meander Rd	SFR
202-11-009G	Gavilan Peak	Elvira & Enrique Alvarez	47428 N Meander Rd	SFR
202-11-008A	Gavilan Peak	Stephanie & Mark Vadovich	47445 N Meander Rd	SFR
202-11-028B	Gavilan Peak	Nikki Sands	3325 W Twin Peak Ln	SFR
202-11-027A	Gavilan Peak	Blair Milner	3303 W New River Rd	SFR
202-26-028	Gavilan Peak	Lori & David Denhan	2511 E White Spar	SFR
202-06-101	Gavilan Peak	Krystal & Shawn Krebs	2431 W Photoview Dr	SFR
202-06-102A	Gavilan Peak	Harry Kuntz	2445 W Phototview Dr	SFR
202-13-005D	New River	Frances Perkins	46219 N Black Canyon Hwy	SFR
202-13-051B	Upper Deadman	Pamela & Joseph Airdo	45835 N 39th Ave	SFR
203-14-022B	Lower Deadman	Tamara & Wesley Brown	3412 W Mesquite St	SFR
203-14-022C	Lower Deadman	Marsha & Jerald Bohstedt	3436 W Mesquite St	SFR
203-14-022D	Lower Deadman	Kathleen & Jeffery Newfield	3440 W Mesquite St	SFR
203-14-020C	Lower Deadman	Odette & Darr Colburn	3445 W Valley View Dr	SFR
203-14-011S	Lower Deadman	Jeffery & Lisa May Geiser	3330 W Irvine Rd	SFR
203-14-011Y	Lower Deadman	Sondra Lynn Kirtley	3321 W Jordan Ln	SFR
203-14-011W	Lower Deadman	Melanie Reynolds	3307 W Jordan Ln	SFR
203-35-010H	Lower Deadman	Jaime Olivas	3046 W Tamar Rd	SFR
203-35-010K	Lower Deadman	Jazwin & Iain Kenny	3022 W Tamar Rd	SFR
203-35-002P	Lower Deadman	Wilson & Diane Phillip	38208 N 29th Ave	SFR
202-26-029	Gavilan Peak	Rhonda & Leland Armantrout	49630 N 25th Ave	SFR & Garage
203-14-011M	Lower Deadman	Richard Geiser	3348 E Irvine Rd	SFR & Garage
202-06-017	New River	Wayne & Linda Wiekhorst	52013 N 36th Ave	SFR & Shed
202-06-032	New River	Joyce Ann	49819 N 37th Ave	SFR & Shed
202-12-019A	New River	Frances & Leon Gee	3547 W New River Rd	SFR & Sheds
202-13-054B	Upper Deadman	Jangula & Donn Pfeiffer	3812 W Jenny Lin Rd	SFR & Shed
203-35-002N	Lower Deadman	Turnaround Ranch	38202 N 29th Ave	SFR & Shed
202-13-065A	New River	Carol Bond	46231 N Black Canyon Hwy	Mobiles
202-13-006Z	New River	Rene Faires	PO BOX 1170 BCC	Mobiles
202-11-066D	Gavilan Peak	Connie & Donald Arbuckle	3059 W New River Rd	Mobile
202-11-066F	Gavilan Peak	Joan & John Schifeling	3055 W New River Rd	Mobile
202-11-004B	Gavilan Peak	Mary Jane & Paul Litz	48056 N Coyote Pass Rd	Mobile
202-11-021F	Gavilan Peak	Lopez & Jorge Rios	20904 W Tip Toe Mine Rd	Mobile

202-26-089	Gavilan Peak	Marie & Kendall Pendergast	2502 W White Spar Rd	Mobile
203-36-014Q	Lower Deadman	Shannon & Jason Smith	3221 W Irvine Rd	Mobile
203-36-014M	Lower Deadman	Jennifer & Johathan Jones	3205 W Irvine Rd	Mobile
203-35-010L	Lower Deadman	Evelyn Schulz	3010 W Tamar Rd	Mobile
202-13-005F	New River	Hallie & Brain Curtis	21602 N 21st Ave	Mobile & Sheds
202-11-029D	Gavilan Peak	Assembly of God	2009 N 7th Street	Church
202-13-063A	New River	Roy Mills	8400 E Long Mesa Bldg	Commercial Bldg
202-13-062A	New River	2Bar M LLC	8400 E Long Mesa Bldg	Commercial Bldg
202-26-014	Gavilan Peak	Rebecca & Steven Hall	49202 N 26th Ave	Garage
202-26-013	Gavilan Peak	Foxtail Dove Trust	49220 N 26th Ave	Garage
202-26-025	Gavilan Peak	Ethel Francis Sedlacek	4940 N 26th Ave	Garage
202-26-031	Gavilan Peak	Shehi Geralee Newbanks	49420 N 25th Ace	Garage
202-26-072	Gavilan Peak	Melanie & Thomas Dunlap	49014 N 24th Ave	Garage
202-26-071	Gavilan Peak	Patricia & Jeffery Bromley	49030 N 24th Ave	Garage
203-35-002M	Lower Deadman	Sherry & Michael Moe	38220 N 29th Ave	Garage
202-12-008A	New River	Reda & George Howard	48109 N Black Canyon Hwy	Garage
202-26-070	Gavilan Peak	Steve Smith	49044 N 24th Ave	Barn
202-06-077K	Gavilan Peak	Jody Sanders	50426 N 27th Ave	Barn
202-11-023E	Gavilan Peak	Roberta & Roy Wise	46740 N Wagon Wheel	Shed
202-11-018B	Gavilan Peak	John & Linda Lefco	3121 W New River Rd	Shed
202-11-018C	Gavilan Peak	Debra & Jeffery Bitton	3105 W New River Rd	Shed
202-11-014B	Gavilan Peak	Mary Jane & Paul Litz	48056 N Coyote Pass Rd	Sheds
202-11-068Q	Gavilan Peak	Kristen & Brent Taylor	47808 N 30th Ave	Shed
202-26-003B	Gavilan Peak	Beverly Jame Coley	49029 N 27th Ave	Shed
202-26-024	Gavilan Peak	Linda Woodman	49225 N 26th Ave	Shed
202-26-027	Gavilan Peak	Sean Suto	2537 W White Spar Rd	Shed
202-06-046A	Gavilan Peak	Keith Postlethwait	50419 n 27th Ave	Shed
202-06-010R	Gavilan Peak	Sandra & Eugene Schill	2335 W Estrella Rd	Shed
203-36-014J	Lower Deadman	Sandy & Marshall Scott	38521 N 33rd Ave	Shed
203-36-013B	Lower Deadman	Arlene & Victor Hicks	38212 N 31st Ave	Shed
203-35-002J	Lower Deadman	Vicki Watts	38214 N 29th Ave	Shed
202-06-002P	New River	Cline Preston	50437 N 36th Ave	Shed
202-06-005W	New River	Connie Jordan	50045 N 36th Ave	Shed
202-06-005X	New River	Marie & Charles Jordan	50211 N 36th Ave	Shed

Skunk Creek Watershed

The structures within the Skunk Creek watershed were located by using the most up to date aerial photos from District and the most recent floodplain delineation studies from FEMA which are available through District's GIS database. For a list of the all the structures located within Skunk Creek watersheds' floodways and floodplains refer to Table 15 and Table 16.

Table 14: Skunk Creek Watershed - Structures in the Floodway

APN #	Stream Name	Owner	Address	Structure
202-09-009C	King Wells	Joyce & Jack McGee	48224 N 7th Ave	SFR
202-21-036M	Cline Creek	Myers & Michelle Lynch	43841 N 3rd Ave	SFR
202-21-036F	Cline Creek	Melanie & Brent Cotton	43817 N 3rd Ave	SFR
202-21-033B	Cline Creek	Wilda Justson	43909 N Central Ave	SFR
202-20-076P	Cline Creek C8	Laura & Gerald Nelson	43637 N 12th St	SFR
211-70-046	Rodger Creek	Norma & James Mosley	41806 N New River Rd	SFR
211-50-015A	Skunk Creek	Anthony Guinta	1537 W Desert Hills Dr	SFR
211-51-035K	ST-Valley Wash	Didomizio & Anthony Jenson	1215 W Dolores Rd	SFR
211-70-007H	Rodger Creek	Tracey Smith-Tudor	41822 N 10th St	SFR & Garage
202-21-147A	Skunk Creek 10B	Michael Wright	15208 N 28th Ave	SFR & Shed
202-21-036L	Cline Creek	Maureen & Jeffery Miller	43829 N 3rd Ave	SFR & Shed
202-20-017L	Cline Creek	Agripina Joseph	45236 N 10th St	SFR & Shed
202-21-024B	Skunk Creek	Colt Bruegman	42745 N 7th Ave	SFR & Sheds
211-50-022	Skunk Creek	Diana Walters	39030 N 15th Ave	SFR & Shed
203-32-010E	Skunk Creek	Patricia Stiles	2111 W Irvine Rd	SFR & Shed
202-08-005K	King Wells	Sheri & Brian Lasher	4144 New River Stage	Mobile
211-51-050G	ST-Valley Wash	First Trust Com	1407 W Dolores Rd	Mobile
211-51-050E	ST-Valley Wash	Maria & Bob Beastrom	1313 W Dolores Rd	Mobile
202-21-148	Skunk Creek 10B	Karen & Dennis Robinson	45016 N New River Rd	Mobile & Sheds
202-21-180	Cline Creek	Charles Selleys	43850 N 3rd Ave	Mobile & Sheds
202-20-450	Cline Creek	Desert Island LLC	45409 N 10th St	Mobile & Sheds
211-50-016J	Skunk Creek	Rose & Willis Harper	HCL Box 651	Mobile & Sheds
202-21-168	Skunk Creek	Claudia & Clyton Roler	43024 N 7th Ave	Sheds
211-50-007C	Skunk Creek	Matthew Hodge	39205 N 15th Ave	Sheds
211-51-048E	Skunk Tank Wash	Maura Isaacs	1525 W Maddock Rd	Sheds
202-16-003L	Skunk Creek	Sandra Mathews	47207 N New River Rd	Shed
202-16-003M	Skunk Creek	Andrea & Victor Karns	47205 N New River Rd	Shed
202-16-009C	Skunk Creek	Brenda & Randolph Anthens	47119 N New River Rd	Shed
202-16-025	Skunk Creek	Margaret & Anthony Pirri	46636 N New River Rd	Shed
202-21-068	Skunk Creek	Siegreled Schmueckle	45327 N 6th St	Shed
202-21-036D	Cline Creek	Roberta & Richard Goreia	43819 N 3rd Ave	Shed

202-20-289B	Cline Creek X3-2-1	Loralea & Dan Daniel	2016 E Circle Mtn Rd	Shed
202-21-006M	Cline Creek C8	David Jordan	44404 N 7th St	Shed
202-20-494	Cline Creek C8	Loyd & Phyllis Deffner	44013 N 11th St	Shed
202-20-076G	Cline Creek C8	Jackie Inge	43611 N 16th St	Shed
211-70-005M	Rodger Creek	Teresa & Todd Witte	42017 N 7th St	Shed
203-32-003G	Skunk Creek	Arline Damen	PMP 331	Shed
211-51-002C	Skunk Tank Wash	Chris & Gwendolyn Steinle	36806 N 18th Ave	Shed
211-51-003G	Skunk Tank Wash	Katherine & Raymond Johnson	1739 W Maddock Rd	Shed
211-51-049E	Skunk Tank Wash	Kerry & Johnny Watkins	36640 N 15th Ave	Shed
211-51-049H	Skunk Tank Wash	Terry Edwin Wilson	1510 W Carriage Dr	Shed
211-51-035H	ST-Valley Wash	Grace & Debra Hilb	1121 W Dolores Rd	Shed
211-51-029	Skunk Tank Wash	Margarel &Traven Hale	37419 N 15th Ave	Shed
211-50-038G	Skunk Tank Wash	Louise Ross	38017 N 11th Ave	Shed
211-50-038K	Skunk Tank Wash	Tambra & Lawrence Hayes	38017 N 11th Ave	Shed
211-50-001L	Skunk Tank Wash	Jewel & Paul Tomasello	38211 N 11th Ave	Shed
211-73-135	Skunk Tank Wash	Linda & Keith Pafflatn	520 W Desert Hills Dr	Shed
211-51-035M	ST-Valley Wash	Jennifer & Michael Smyser	1113 W Dolores Rd	Shed

Table 15: Skunk Creek Watershed - Structures in the Floodplain

APN #	Stream Name	Owner	Address	Structure
202-09-006J	Skunk Creek	Dena & William Hennessy	48606 N 7th Ave	SFR
202-09-031D	Skunk Creek	Kathleen Jardine	916 W Wolf Trap Rd	SFR
202-09-018K	Skunk Creek	Lee Underwood	1256 W New River Rd	SFR
202-16-012W	Skunk Creek	Sandra Sutton	46610 N New River Rd	SFR
202-16-012X	Skunk Creek	Angela & Ben Currey	46631 N 11th Ave	SFR
202-21-145B	Skunk Creek	Donita & Clayton Carter	45602 N New River Rd	SFR
202-21-149	Skunk Creek	Karen & Dennis Robinson	45016 N New River Rd	SFR
202-21-006N	Cline Creek	Sondra & Joseph Hess	530 E Circle Mtn Rd	SFR
202-20-017K	Cline Creek	Marilyn & Wallace Goldsmith	45003 N 7th Ave	SFR
202-20-019T	Cline Creek	Amy Lou Little	45326 N 11th St	SFR
202-20-366	Cline Creek	Tracy & Michael Ewen	45607 N 12th St	SFR
202-20-011U	Cline Creek X4A-B	Camila & Mark Herrell	808 E Wild Field Dr	SFR
202-20-630B	Cline Creek X3-2-1	Terry & Jay Sprague	44321 N 11th St	SFR
202-20-640A	Cline Creek X3-2-1	Paul Proctor	44236 N 12th St	SFR
202-20-040K	Cline Creek X3-2-1	Kim Wallis	44245 N 15th St	SFR
202-20-021H	Cline Creek C8	Leroy & Jacquelyn Henery	43013 N 11th St	SFR
202-20-027N	Cline Creek C8	Donna & Cass Robertson	43618 N 16th St	SFR
202-20-027P	Cline Creek C8	Kathryn Shannon	43410 N 16th St	SFR
202-20-027L	Cline Creek C8	Christy & Jason Sartin	43626 N 16th St	SFR

202-20-076J	Cline Creek C8	Margarett & Paul Zakos	4634 E Leann Rd	SFR
202-21-043B	Skunk Creek	Bauer Family Trust	43207 N 7th Ave	SFR
202-21-168	Skunk Creek	Claudia & Clayton Roler	43024 N 7th Ave	SFR
211-20-005L	Skunk Creek	Nancy Werring	42505 N 9th Ave	SFR
211-22-005G	Skunk Creek	Valle Del Sol Dev	42203 N 9th Ave	SFR
211-22-394	Skunk Creek	Weide & Gayle Abbott	41821 N La Crosse Trl	SFR
211-22-395	Skunk Creek	Dawn Cirri	41815 N La Crosse Trl	SFR
211-22-397	Skunk Creek	Christy & Thomas Bedharik	41727 N La Crosse Trl	SFR
211-22-398	Skunk Creek	Tracy & Jeff Seman	41708 N La Crosse Trl	SFR
211-22-399	Skunk Creek	Rich Family Trust	909 W Hazelhurst Dr	SFR
211-72-021A	Rodger Creek	Jo Ann & Richard Sanchez	41921 N Central Ave	SFR
211-70-001S	Rodger Creek	Kathy & James Richards	41840 N New River Rd	SFR
211-70-011L	Rodger Creek	Iron Gate Development	1109 E Falling Star Dr	SFR
202-20-094L	Rodger Creek	Carol & Gregory Goguen	42839 N 20th St	SFR
202-20-094E	Rodger Creek	Vicki & Neil Jensen	42849 N 20th St	SFR
211-50-011C	Skunk Creek	Denise & Salvator Canteline	1603 W Desert Hills Dr	SFR
211-50-007A	Skunk Creek	Kathleen McCarthly	1305 W Desert Hills Dr	SFR
211-50-007D	Skunk Creek	Janet & John Chmela	39214 N 13th Ave	SFR
211-50-020H	Skunk Creek	Judy & Tim Glass	1610 W Irvine Rd	SFR
203-32-005J	Skunk Creek	Bonnie Larose	3430 E Libby St	SFR
203-32-003G	Skunk Creek	Arline Damen	PMP 331	SFR
203-32-003F	Skunk Creek	Chiostri & Heath Carlson	37906 N 21st Ave	SFR
211-51-002C	Skunk Tank Wash	Chris & Gwendolyn Steinle	36806 N 18th Ave	SFR
211-51-002K	Skunk Tank Wash	Downey Savings	1815 W Maddock Rd	SFR
211-51-003L	Skunk Tank Wash	Patrick Johnson	1725 W Maddock Rd	SFR
211-51-009K	Skunk Tank Wash	William Jineniet	36913 N 17th Ave	SFR
211-51-009J	Skunk Tank Wash	Nancy Schatzberg	1631 W Maddock Rd	SFR
211-51-009H	Skunk Tank Wash	Jo Long	1615 W Maddock Rd	SFR
211-51-050K	Skunk Tank Wash	Jina & Will Anderson	36617 N 15th Ave	SFR
211-51-050L	Skunk Tank Wash	James Young	36623 N 15th Ave	SFR
211-51-050H	Skunk Tank Wash	Vivian & Mark Struebel	36629 N 15th Ave	SFR
211-51-035J	ST-Valley Wash	Deborah & Brent Wiese	1207 W Dolores Rd	SFR
211-51-035H	ST-Valley Wash	Grace & Debra Hilb	1121 W Dolores Rd	SFR
211-51-035M	ST-Valley Wash	Jennifer & Michael Smyser	1113 W Dolores Rd	SFR
211-51-040E	ST-Valley Wash	Evelyn & Dennis Watkins	1209 W Prime Rose Path	SFR
211-51-053K	Skunk Tank Wash	Nancy & Theodore Brock	1526 W Maddock Rd	SFR
211-51-053E	Skunk Tank Wash	Cheryl & Greg Lachance	1534 W Rambling Rd	SFR
211-51-029	Skunk Tank Wash	Margarel &Traven Hale	37419 N 15th Ave	SFR
211-51-056N	Skunk Tank Wash	Shaw Mary Trust	1111 W Joy Ranch Rd	SFR

211-50-033N	Skunk Tank Wash	Vanessa & Lanny Lauritsen	1126 W Joy Ranch Rd	SFR
211-50-038G	Skunk Tank Wash	Louise Ross	38017 N 11th Ave	SFR
211-50-038K	Skunk Tank Wash	Tambra & Lawrence Hayes	38017 N 11th Ave	SFR
211-50-038J	Skunk Tank Wash	Peter Meola	38119 N 11th Ave	SFR
211-50-001L	Skunk Tank Wash	Jewel & Paul Tomasello	38211 N 11th Ave	SFR
211-50-001Z	Skunk Tank Wash	Peter Breen	38309 N 12th Ave	SFR
211-50-029J	Skunk Tank Wash	Cynthia & Arlen Rowland	4832 W Harmont Dr	SFR
211-50-029E	Skunk Tank Wash	Beth & Joel Rapp	38707 N 11th Ave	SFR
211-73-022E	Skunk Tank Wash	Donald Brown	313 W Saddle Mtn Rd	SFR
203-38-009K	Skunk Creek	Michelle & Williams Sanders	2821 W Long Rifle Rd	SFR
203-38-009G	Skunk Creek	Julie & Tim Muncie	36309 N 29th Ave	SFR
202-08-007F	King Wells	Terry Burnett	48419 N 5th Ave	SFR & Garage
202-16-002A	Skunk Creek	Terry Walker	47015 N New River Rd	SFR & Garage
202-16-025	Skunk Creek	Margaret & Anthony Pirri	46636 N New River Rd	SFR & Garage
202-20-017J	Cline Creek	Meara & David Perrin	45023 N 7th Ave	SFR & Garage
202-20-630A	Cline Creek X3-2-1	Jani & Anthony Johnson	44329 N 11th St	SFR & Garage
211-51-002H	Skunk Tank Wash	Downey Savings	1823 W Maddock Rd	SFR & Garage
211-51-040D	ST-Valley Wash	Taylor Bean Mortgage	1117 W Promise Path	SFR & Garage
211-73-080C	Skunk Tank Wash	Susan & Steven Campbell	39627 N 5th Ave	SFR & Garage
202-09-031A	Skunk Creek	Gagnon Revocable Trust	47608 N 9th Ave	SFR & Sheds
202-09-013K	Skunk Creek	Jacqueline Kincaid	47421 N New River Rd	SFR & Sheds
202-16-004H	Skunk Creek	Stanley Edwards	46827 N 8th Ave	SFR & Sheds
202-16-012M	Skunk Creek	Robert Sherick Jr	46625 N New River Rd	SFR & Shed
202-16-012K	Skunk Creek	Dorothy Nickerson	46609 N New River Rd	SFR & Shed
202-21-146D	Skunk Creek	Mark & Debra Byman	45418 N New River Rd	SFR & Shed
202-21-150	Skunk Creek	Aruna & Prakash Dhond	44833 N Shangri La Ln	SFR & Shed
202-21-191	Cline Creek	Martelley Family	36879 N 38th St	SFR & Sheds
202-20-656	Cline Creek	Lasalle Bank	45446 N 12th St	SFR & Shed
211-50-007E	Skunk Creek	Maya & Jason Johnson	39206 N 13th Ave	SFR & Shed
203-32-005B	Skunk Creek	Mary Hart	38006 N 21st Ave	SFR & Shed
211-51-003G	Skunk Tank Wash	Katherine & Raymond Johnson	1739 W Maddock Rd	SFR & Shed
211-51-048E	Skunk Tank Wash	Maura Isaacs	1525 W Maddock Rd	SFR & Shed
211-51-047A	Skunk Tank Wash	Ronald & Jo Ann Souza	1339 W Maddock Rd	SFR & Shed
211-51-053C	Skunk Tank Wash	Gary Smith	37130 N 15th Ave	SFR & Shed
211-51-059C	Skunk Tank Wash	Joseph Racco	1430 W Maddock Rd	SFR & Shed
211-50-033P	Skunk Tank Wash	Fox Family Trust	1109 W Blue Eagle Ln	SFR & Shed
203-38-001R	Skunk Creek	Betty & Mark Dail	36616 N 27th Ave	SFR & Sheds
202-16-005F	Skunk Creek	Juanita & Mark Wdowiak	46835 N New River Rd	Mobile
202-16-013Y	Skunk Creek	Jeannie & William Forst	29640 N 57th St	Mobile

202-16-013T	Skunk Creek	Laurie & Peter Infante	46225 N 12th Ln	Mobile
202-16-013S	Skunk Creek	Mary & Duncan Maciver	45417 N New River Rd	Mobile
202-21-154	Skunk Creek	Lisa & Robert Albillar	45207 N Zorrillo Dr	Mobile
202-21-153	Skunk Creek	Darcy & Michael Moore	45025 N Zorrillo Dr	Mobile
202-21-131	Skunk Creek	Judy & Tim Glass	1510 W Irvine Rd	Mobile
202-21-033F	Cline Creek	Kim & Steven Miller	43814 N 1st Ave	Mobile
202-20-657A	Cline Creek	Linda Smith	45440 N 12th St	Mobile
202-20-076G	Cline Creek C8	Jackie Inge	43611 N 16th St	Mobile
202-21-176	Skunk Creek	Pingitore Family Trust	43244 N 7th Ave	Mobile
211-50-007C	Skunk Creek	Matthew Hodge	39205 N 15th Ave	Mobile
211-72-020B	Rodger Creek	Victor & Chabolla Frausto	42007 N 3rd St	Mobile
211-51-003H	Skunk Tank Wash	Salvatore Gatto	1747 W Maddock Rd	Mobile
211-51-049E	Skunk Tank Wash	Kerry & Johnny Watkins	36640 N 15th Ave	Mobile
211-51-050F	ST-Valley Wash	David Orchard	1411 W Dolores Rd	Mobile
211-51-050D	ST-Valley Wash	Julie Harding	1307 W Dolores Rd	Mobile
202-20-343	Cline Creek	Kathy Richard	45416 N 12th St	Mobile & Garage
211-51-056L	Skunk Tank Wash	Karen & Douglas Bass	1225 W Joy Ranch Rd	Mobile & Garage
202-09-031C	Skunk Creek	47636 N 9th Ave LLC	1059 W Wolf Trap Rd	Mobile & Sheds
202-16-004J	Skunk Creek	Tayna & Steven Koskella	515 E Carefree Hwy	Mobile & Shed
202-16-006K	Skunk Creek	Jamaria & William Russell	46812 N 11th Ave	Mobile & Shed
202-21-111	Cline Creek	William Cawthon	44807 N 6th St	Mobile & Shed
211-72-028	Rodger Creek	Nicole & Lee Miracle	42010 N 3rd St	Mobile & Shed
202-21-008U	Skunk Creek	Shangri La Ranch	46834 N Shangrila Rd	Commercial
211-72-019A	Rodger Creek	Joan & Lorne Williams	42036 N 7th St	Garage
211-50-015A	Skunk Creek	Anthony Guinta	1537 W Desert Hills Dr	Garage
211-51-047E	Skunk Tank Wash	Scott Hoffman	36805 N 15th Ave	Garage
203-38-001S	Skunk Creek	Ronald Dail	36616 N 27th Ave	Garage
202-07-005Z	Skunk Creek	Sandra & Joseph Yound	49119 N 7th Ave	Shed
202-08-003P	Skunk Creek	Beverly Peebles	48903 N 7th Ave	Shed
202-08-419C	Skunk Creek	Benson & Eric Ballantyne	48625 N Fig Springs Rd	Shed
202-09-013J	Skunk Creek	Jacqueline Kincaid	47421 N New River Rd	Shed
202-16-005E	Skunk Creek	Jacqueline & Ben Brakefield	47002 N New River Rd	Shed
202-21-156	Skunk Creek	Debra & Billy Carson	45419 N Zorrillo Dr	Shed
202-21-148	Skunk Creek 10B	Karen & Dennis Robinson	45016 N New River Rd	Shed
202-21-184	Cline Creek	Jeffery Egley	515 E Carefree Hwy	Shed
202-21-032F	Cline Creek	Carol Gleason	43612 N 3rd Ave	Shed
202-21-032G	Cline Creek	Julie & Randy Norris	43616 N 3rd Ave	Shed
202-21-033B	Cline Creek	Wilda Justson	43909 N Central Ave	Sheds
202-21-114	Cline Creek	Dorothy & Alfred Simpson	415 E Mano Dr	Shed

202-21-110	Cline Creek	Barbara 7 Tim Thompson	44633 N 6th St	Shed
202-20-019S	Cline Creek	Linda Miller	45231 N 10th St	Shed
202-20-011Z	Cline Creek X4A-B	Cain & John Graham	44436 N 10th St	Shed
202-20-576	Cline Creek X4A-B	Joanna Allan	45020 n 12th St	Shed
202-20-015Q	Cline Creek X3-2-1	N/A	1313 E Circle Mtn Rd	Shed
202-20-015W	Cline Creek X3-2-1	Betty & Mel Ingwaldson	44243 N 14th St	Shed
202-20-338A	Cline Creek X3-2-1	Ann & Ralph Cordell	1430 E Circle Mtn Rd	Shed
202-21-174	Skunk Creek	Tom Hutton	582 W Cavalry Rd	Shed
202-21-175B	Skunk Creek	Barbara Molanick	43210 N 7th Ave	Shed
211-70-047	Rodger Creek	Norma & James Mosley	41806 N New River Rd	Shed
211-50-028G	Skunk Creek	Jennifer & Lewie Philles	3901 N 15th Ave	Shed
211-50-022	Skunk Creek	Diana Walters	39030 N 15th Ave	Sheds
203-32-001F	Skunk Creek	Barbara Ferrigno	1922 W Adamanda	Shed
211-51-049H	Skunk Tank Wash	Terry Edwin Willso	1510 W Carriage Dr	Shed
211-51-054D	Skunk Tank Wash	Gina Brian	37204 N 15th Ave	Shed
211-51-056H	Skunk Tank Wash	Pamela & Matthan Tarner	37612 N 12th Ave	Shed

DISSEMINATION OF INFROMATION

Good communication among the participating agencies is critical to the success of the Upper New River/Skunk Creek FRP. The responsibilities of the entities involved are identified below.

Districts Responsibilities

The District monitors rainfall and runoff conditions through its county wide real-time flood detection and data collection network to support its flood control facilities and local jurisdictions within the County. The District is responsible for notifying MCDOT, MCSO, Fire Departments and any other necessary agency of potential or occurring flooding within the Upper New River/Skunk Creek FRP area. The District's in-house meteorologist will develop a daily weather outlook for the New River/Cave Creek Zone along with other messages and alerts that will be sent out by email or fax to the agencies listed above which will provide available weather and flooding information. Notification responsibilities include anticipated heavy storms that are likely to fill the washes and temporarily restrict roadways.

Maricopa County Department of Transportation

The District works closely with MCDOT to ensure that county roads in unincorporated Maricopa County will be monitored and barricaded (if needed) in the event of a flood. The District will contact MCDOT and let them know what road crossings need to be barricaded and the available lead time, if available, that they have to barricade the road. These roads should be barricaded from both sides of the wash. Cars should not pass the "Road Flooded" signs and the signs should not be moved or removed from the road crossing until MCDOT has been able to inspect and clean and/or repair the roadway. MCDOT may need to work closely with MCSO and the Fire Departments while barricading the road crossings.

Maricopa County Sherriff's Office Responsibilities

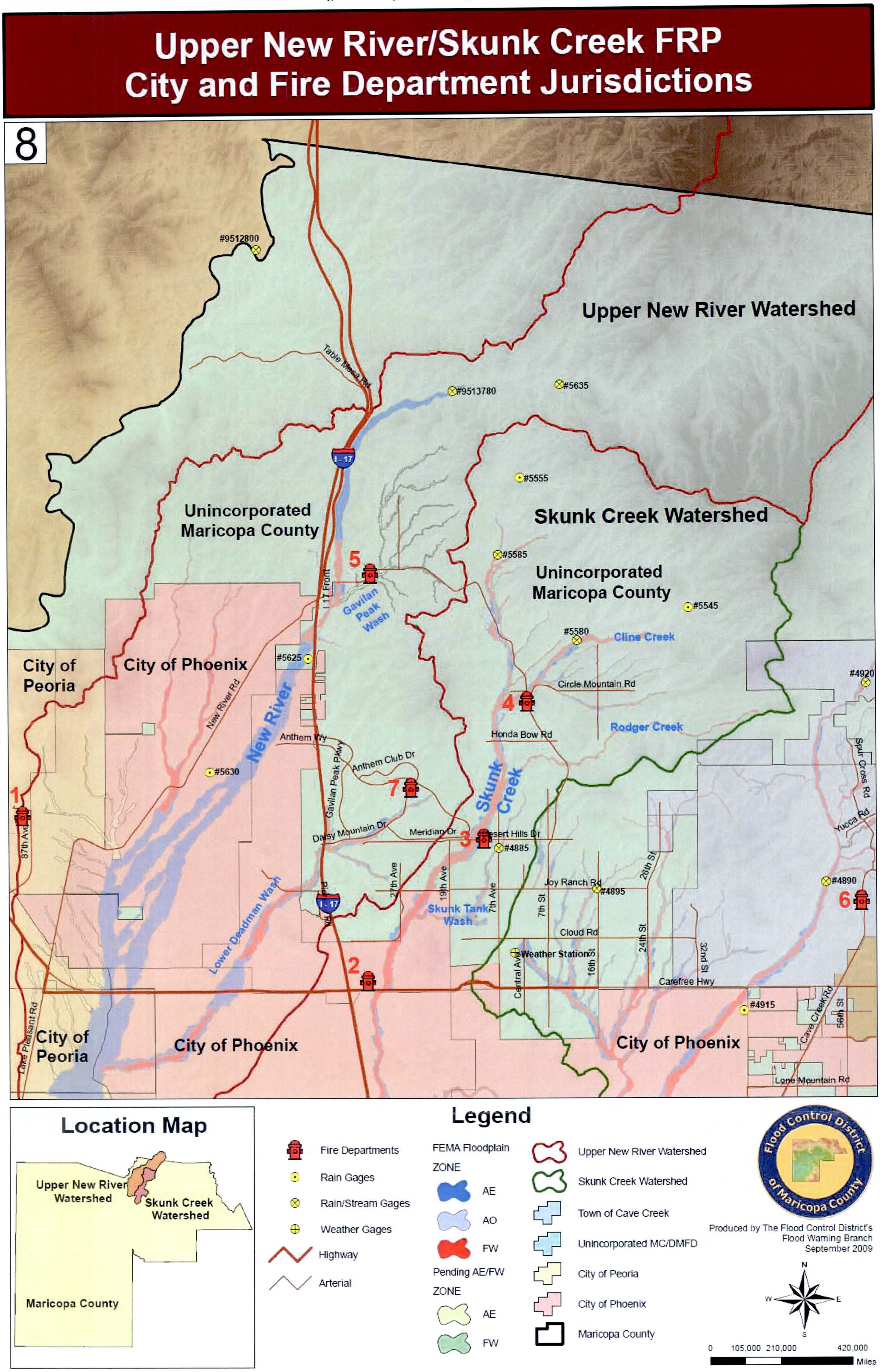
Maricopa County Sherriff's office will assist with responding to a flood emergency. They will work in coordination with MCDOT, Fire Departments and any other necessary agencies to provide emergency services like barricading roads, evacuating homes, and performing rescues.

Fire Departments

The Fire Departments within the Upper New River/Skunk Creek FRP include Daisy Mountain, Rural/Metro, Phoenix and Peoria. The Fire Departments protect and preserve life and property from the impact of fire, disaster, injury and illness by providing fire suppression, fire prevention, and emergency medical services to the citizen within the community. MCSO will work closely with these departments to monitor road crossings and structures in the event of a flood. All these fire departments are in communication and work together in the event of an emergency. The fire stations names and address are provided in Table 17.

Table 16: Fire Stations within or near the Upper New River/Skunk Creek FRP Area

Number on Map	Location	Fire Stations	Address	Cross Streets
1	City of Peoria	Fire Station # 199	40202 N 87th Ave Peoria, AZ	87th Ave & Desert Hills Dr
2	City of Phoenix	Tramonto Fire Station # 56	3210 W Canotia Place Phoenix, AZ	Carefree Highway & I-17
3	Unincorporated Maricopa County	Daisy Mountain Fire Department Station # 145	1120 W Desert Hills Dr Phoenix, AZ	11th Ave & Desert Hills Dr
4	Unincorporated Maricopa County	Daisy Mountain Fire Department Station # 141	43814 N New River Rd Phoenix, AZ	New River Rd & Circle Mountain Rd
5	Unincorporated Maricopa County	Daisy Mountain Fire Department Station #146	3116 W New River Rd Phoenix, AZ	31st Ave & New River Rd
6	City of Cave Creek	Rural Metro Fire Department Station Cave Creek #825	37402 N Cave Creek Rd Cave Creek, AZ	Cave Creek Rd & Blue Ridge Dr
7	Unincorporated Maricopa County	Daisy Mountain Fire Department Station # 142	41104 N Daisy Mtn Dr Anthem, AZ	Daisy Mtn Dr & Anthem Way


Upper New River/Skunk Creek FRP
City and Fire Department Jurisdictions
8
Upper New River Watershed
Skunk Creek Watershed
Unincorporated Maricopa County
Unincorporated Maricopa County
City of Peoria
City of Phoenix
City of Peoria
City of Phoenix
City of Phoenix
New River
Skunk Creek
Gavilan Peak Wash
Cline Creek
Rodger Creek
Skunk Tank Wash
Lower Deadman Wash
Table Mesa Rd
I-17
I-17 Front
New River Rd
Anthem Wy
Anthem Club Dr
Gavilan Peak Pkwy
Daisy Mountain Dr
Meridian Dr
Desert Hills Dr
Circle Mountain Rd
Honda Bow Rd
Joy Ranch Rd
Cloud Rd
Carefree Hwy
Lone Mountain Rd
Cave Creek Rd
Spur Cross Rd
Yucca Rd
87th Ave
Lake Pleasant Rd
27th Ave
19th Ave
7th Ave
Central Ave
7th St
16th St
24th St
28th St
32nd St
56th St
#9512800
#9513780
#5635
#5555
#5585
#5545
#5580
#5625
#5630
#4920
#4885
#4895
#4890
#4915
Weather Station
1
2
3
4
5
6
7
Location Map
Upper New River Watershed
Skunk Creek Watershed
Maricopa County
Legend
Fire Departments
Rain Gages
Rain/Stream Gages
Weather Gages
Highway
Arterial
FEMA Floodplain ZONE
AE
AO
FW
Pending AE/FW ZONE
AE
FW
Upper New River Watershed
Skunk Creek Watershed
Town of Cave Creek
Unincorporated MC/DMFD
City of Peoria
City of Phoenix
Maricopa County
Flood Control District of Maricopa County
Produced by The Flood Control District's
Flood Warning Branch
September 2009
N
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Miles

SPECIFIC TASKS

Emergency response actions are critical when weather conditions are a serious threat to life and property. The specific tasks for the District and the participating agencies have been outlined and are identified below.

Routine Operational Procedures

Flood Control District of Maricopa County. The District shall perform the following non-emergency functions:

a. Review the Upper New River/Skunk Creek FRP annually. If any revisions are made notify all participating agencies of those changes.
b. Participate in annual Flood Exercise Drills.
c. Prepare and incident report for internal use after the flood emergency has ended.
d. Develop and maintain an online flood response plan and interactive map within the Flood Warning Branch's Custom Products and Reports webpage for the Upper New River/Skunk Creek Flood Response Plan. (http://www.fcd.maricopa.gov/Rainfall/products.aspx).
e. Provide public information on what actions residents should take to reduce the risk of injury prior to, during, and after a flood event.

Flood Condition Procedures

Flood Control District of Maricopa County. The District is responsible for the following tasks during a flood threat or actual flood event within the boundaries of the Upper New River/Skunk Creek FRP:

a.) Monitor internal ALERT rainfall and runoff gages within the Upper New River and Skunk Creek watersheds.
b.) Notify the appropriate agencies if any of the following conditions are met:
    i. Adverse condition that could intensify flood hazards in the event of a storm.
    ii. Criteria for MESSAGE 1, 2, 3 have been met.
    iii. Precipitation sensors and/or stream sensors in the vicinity of the Upper New River/Skunk Creek FRP meet or exceed pre-set threshold and rain is expected to continue.
    iv. Storm conditions have subsided and the Upper New River/Skunk Creek drainage system poses no further threat to lives or property within the FRP area.

Maricopa County Sheriffs Office. MCSO is responsible for the following tasks during a flood threat or actual flood event within the boundaries of the Upper New River/Skunk Creek FRP:

a.) If notified by the District that weather conditions may lead to minor flooding (MESSAGE 1), or if basin rain or stage gage alarms have met or exceed pre-set thresholds, perform the following:
    i. Follow the procedures outlined on the flowcharts and maps.

b.) If notified by the District that the National Weather Service has issued a flash flood warning and/or flash flooding is imminent or occurring (MESSAGE 3) for one or more of the identified washes with the FRP area, perform the following:
   i. Follow the procedures outlined on the flowcharts and maps.

Maricopa County Department of Transportation. MCDOT is responsible for the following tasks during a flood threat or actual flood event within the boundaries of the Upper New River/Skunk Creek FRP:

a.) If notified by the District that the National Weather Service has issued a flash flood watch for the area or a developing weather event may lead to a flash flood (MESSAGE 1 or 2) for one or more of the identified washes with the FRP area, perform the following:
   i. Follow the procedures outlined on the flowcharts and maps.

b.) If notified by the District that the National Weather Service has issued a flash flood warning and/or flash flooding is imminent or occurring (MESSAGE 3) for one or more of the identified washes with the FRP area, perform the following:
   i. Follow the procedures outlined on the flowcharts and maps.

Fire Departments. The fire departments are responsible for the following tasks during a flood threat or actual flood event within the boundaries of the Upper New River/Skunk Creek FRP:

a.) If notified by the District that the National Weather Service has issued a flash flood watch for the area or a developing weather event may lead to a flash flood (MESSAGE 1 or 2) for one or more of the identified washes with the FRP area perform the following:
   i. Assist MCDOT and MCSO with road closures and evacuations as needed.

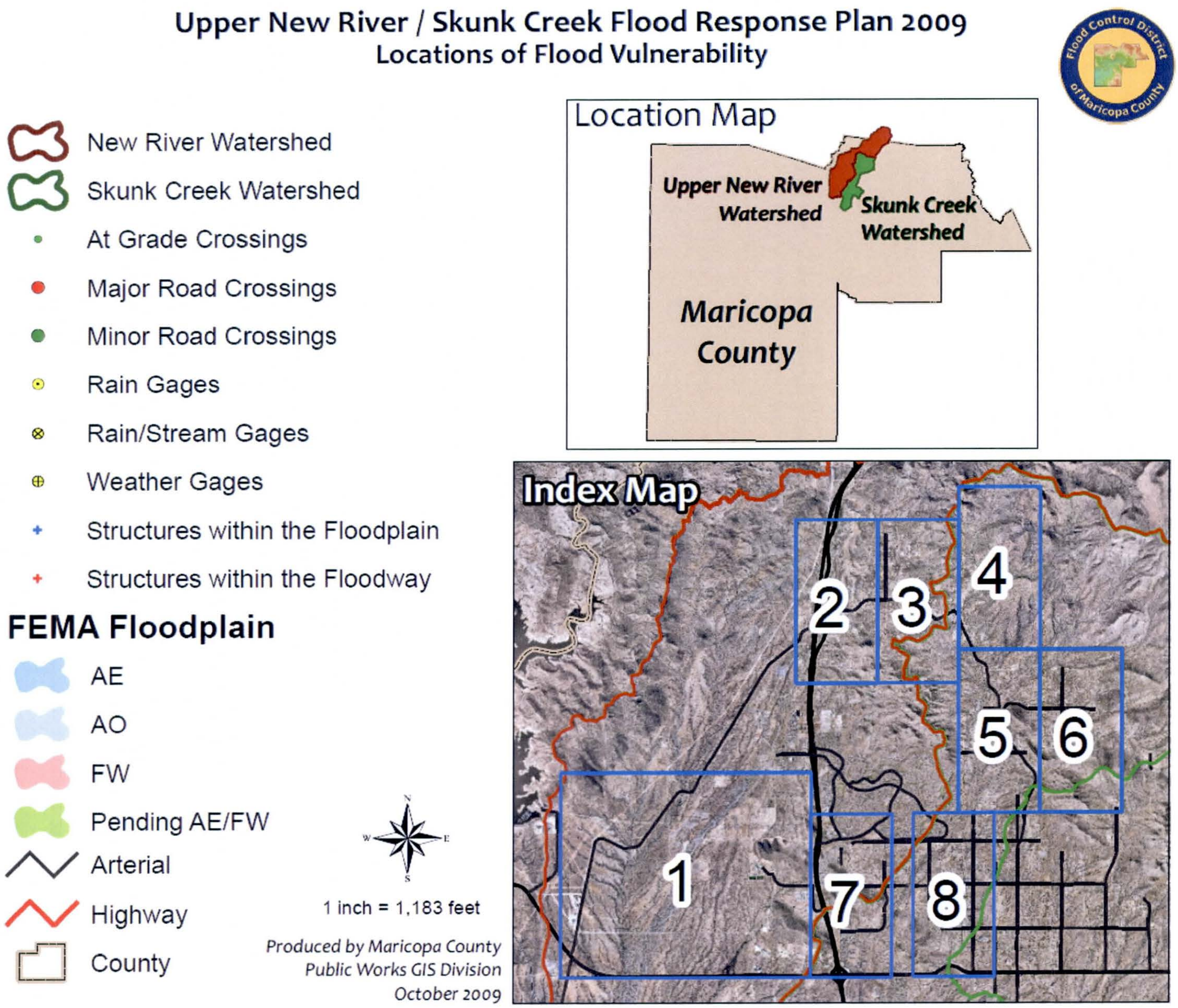
b.) If notified by the District that the National Weather Service has issued a flash flood warning and/or flash flooding is imminent or occurring (MESSAGE 3) for one or more of the identified washes with the FRP area, perform the following:
   i. Assist MCDOT and MCSO with road closures and evacuations as needed.

Arizona Department of Transportation. ADOT is responsible for the following tasks during a flood threat or actual flood event within the boundaries of the Upper New River/Skunk Creek FRP:

a.) If notified by the District that the National Weather Service has issued a flash flood watch for the area or a developing weather event may lead to a flash flood (MESSAGE 1 or 2) for one or more of the identified washes with the FRP area perform the following:
   i. Monitor Carefree Highway (SR74) and Black Canyon Highway (I-17).

b.) If notified by the District that the National Weather Service has issued a flash flood warning and/or flash flooding is imminent or occurring (MESSAGE 3) for one or more of the identified washes within the FRP area, perform the following:
   i. Monitor Carefree Highway (SR74) and Black Canyon Highway (I-17).

Upper New River/Skunk Creek FRP Locations of Flood Vulnerability Map Legend



Maps 5 and 6, from the map above, cover the area of **Cline Creek**.
Maps 3 and 2, from the map above, cover the area of **Gavilan Peak Wash**.
Maps 7 and 1, from the map above, cover the area of **Lower Deadman Wash**.
Map 2, from the map above, covers the area of **Lower New River**.
Maps 4, 5, 8 and 7, from the map above, cover the area of **Skunk Creek**.
Map 8, from the map above, covers the area of **Skunk Tank Wash**.
Map 2, from the map above, covers the area of **Upper New River**.

Figure 12: Lower Deadman Wash FRP Map 1

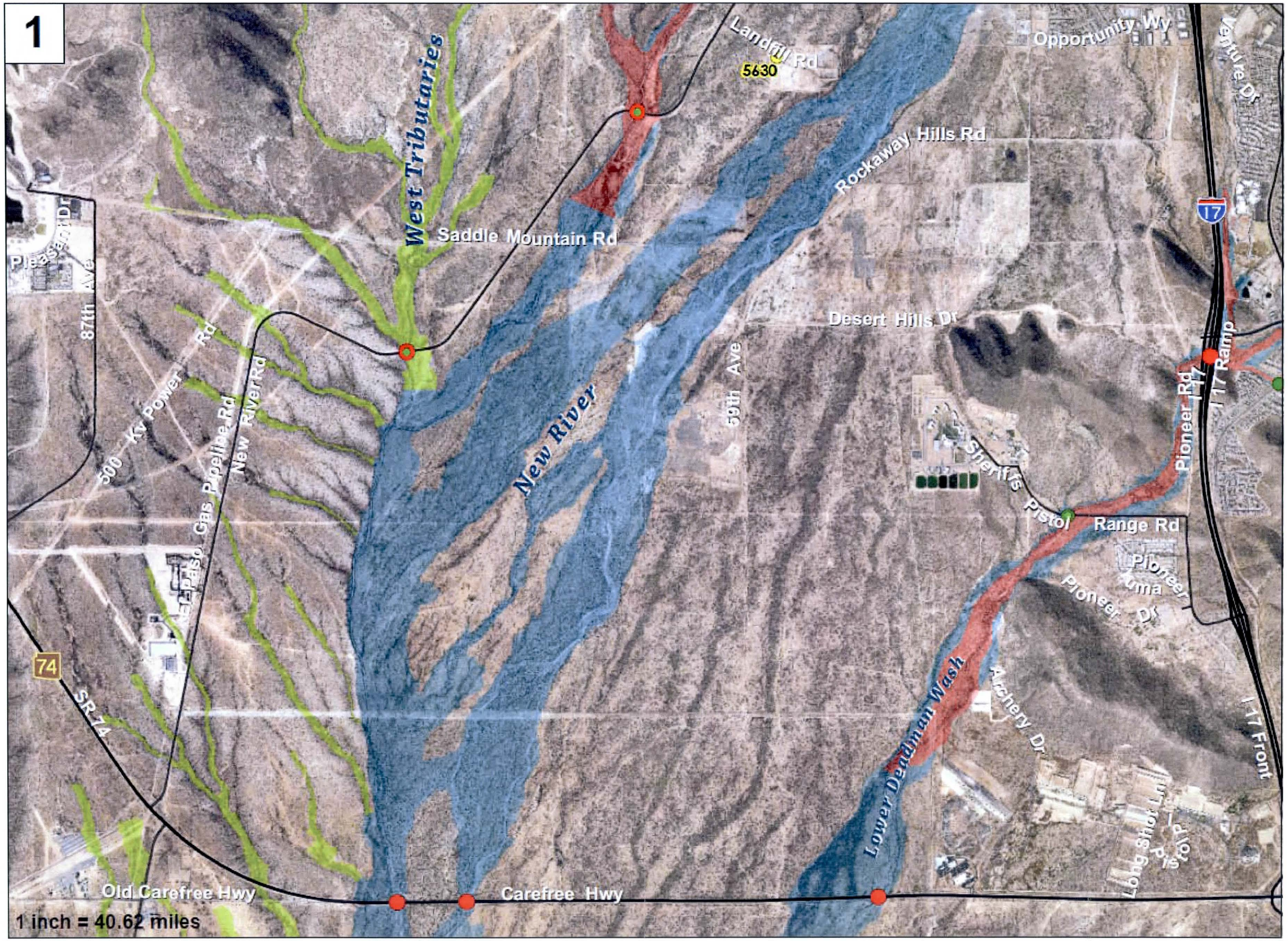


Figure 13: Gavilan Peak Wash and Tributaries FRP Field Map 2

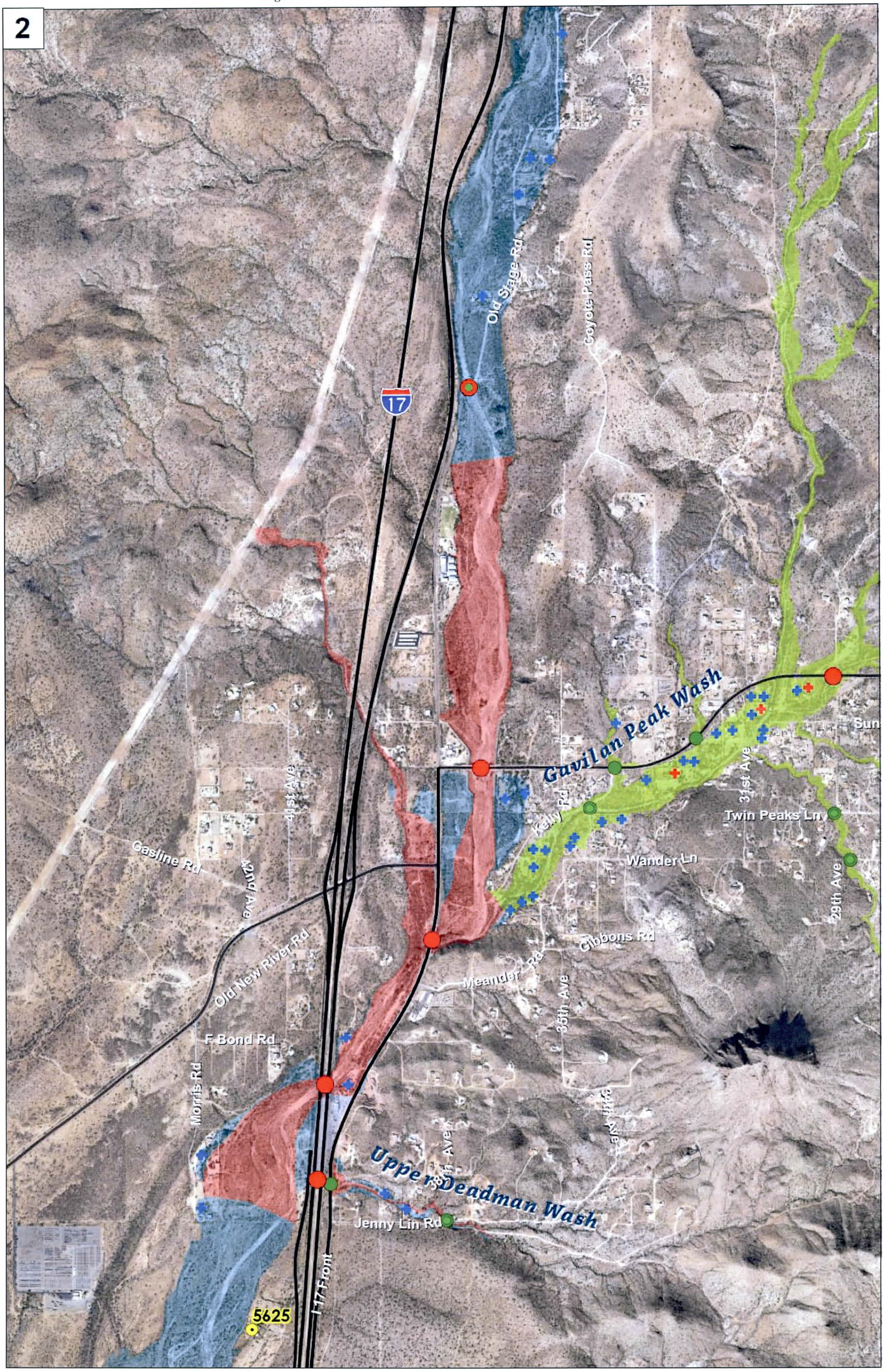


Figure 14: Gavilan Peak Wash and Tributaries FRP Field Map 3

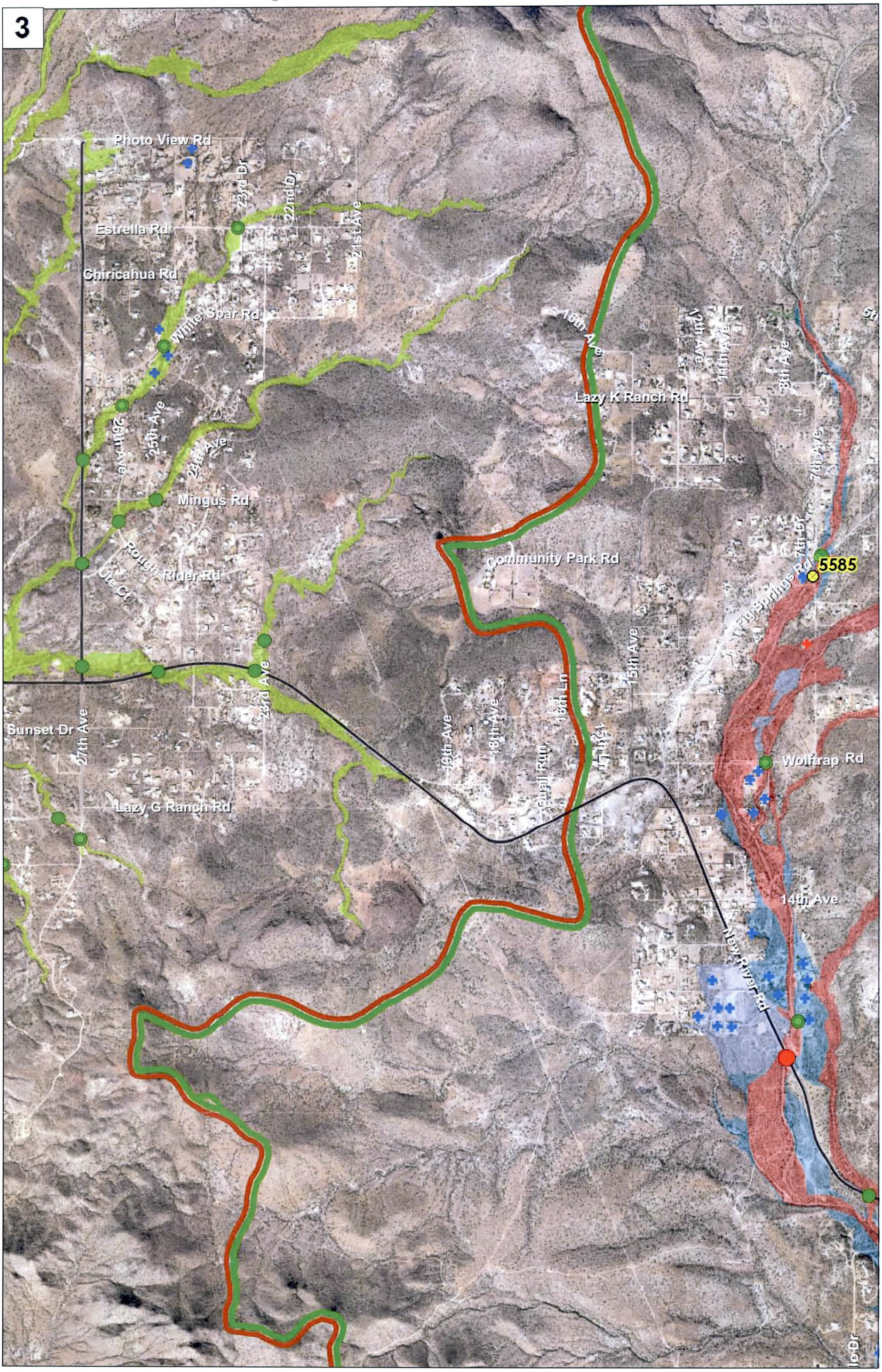


Figure 15: Skunk Creek FRP Field Map 4

Figure 16: Cline Creek and Rodger Creek FRP Field Map 5

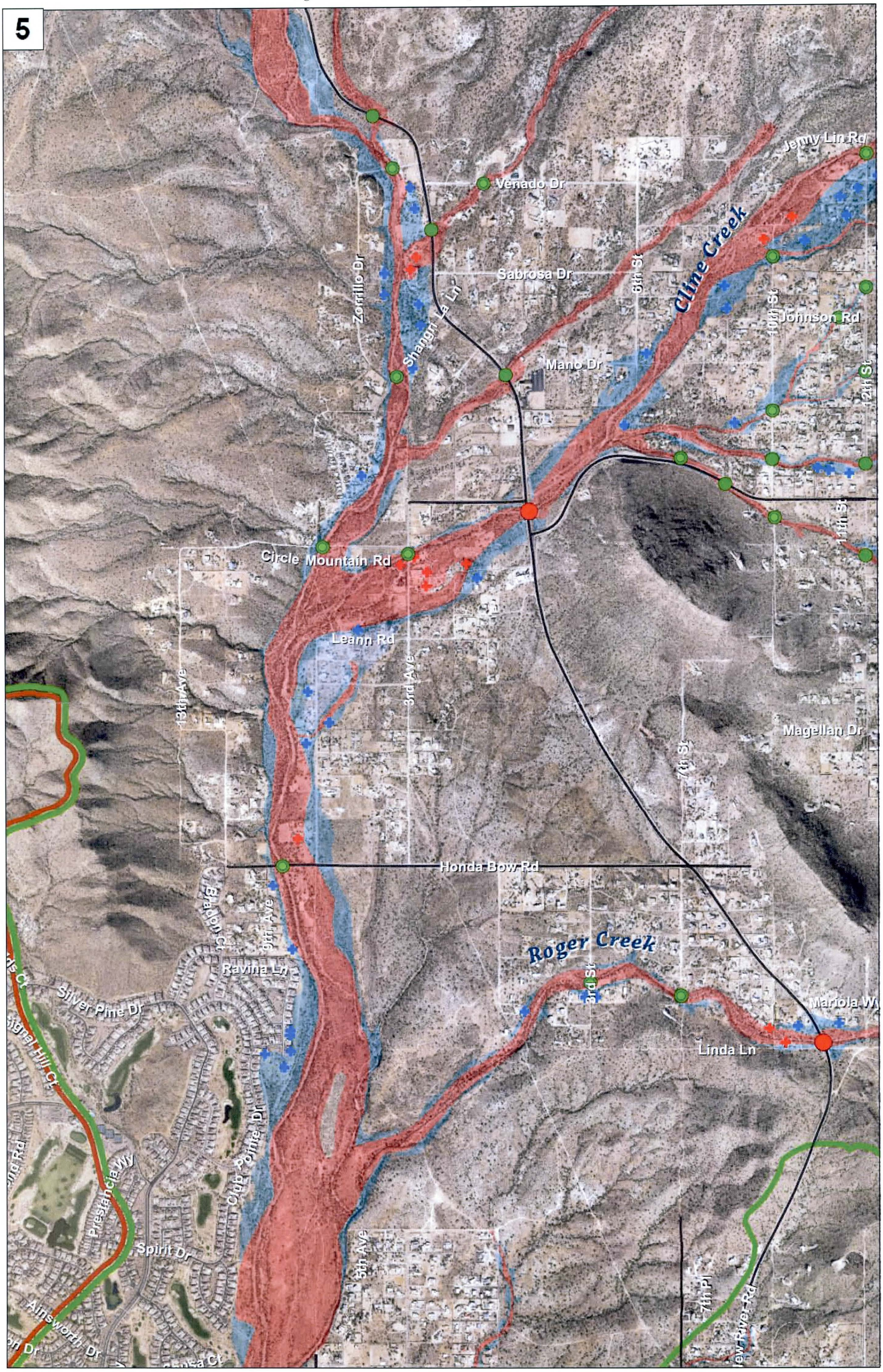


Figure 17: Cline Creek and Rodger Creek FRP Field Map 6

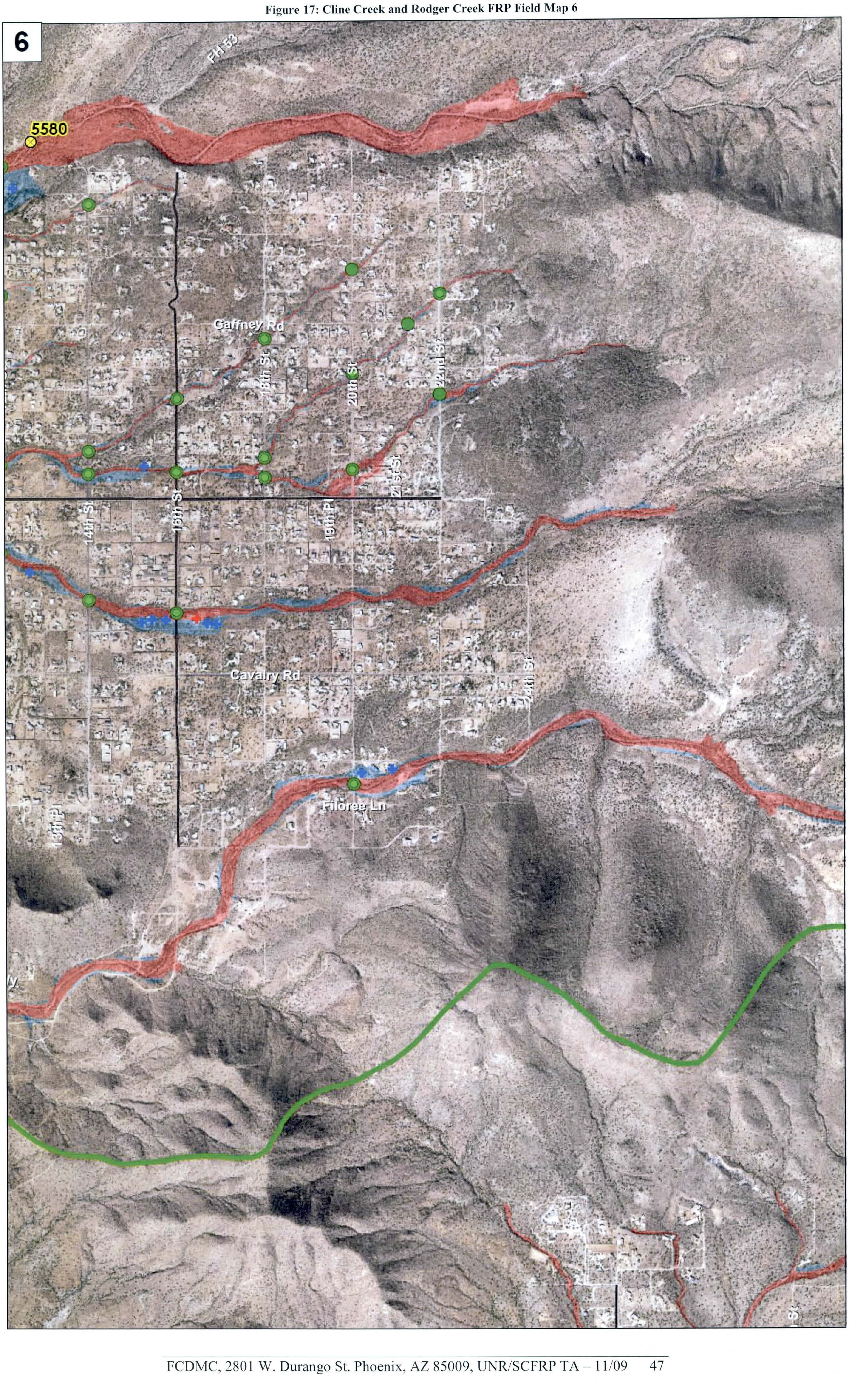


Figure 18: Lower Deadman Wash FRP Field Map 7

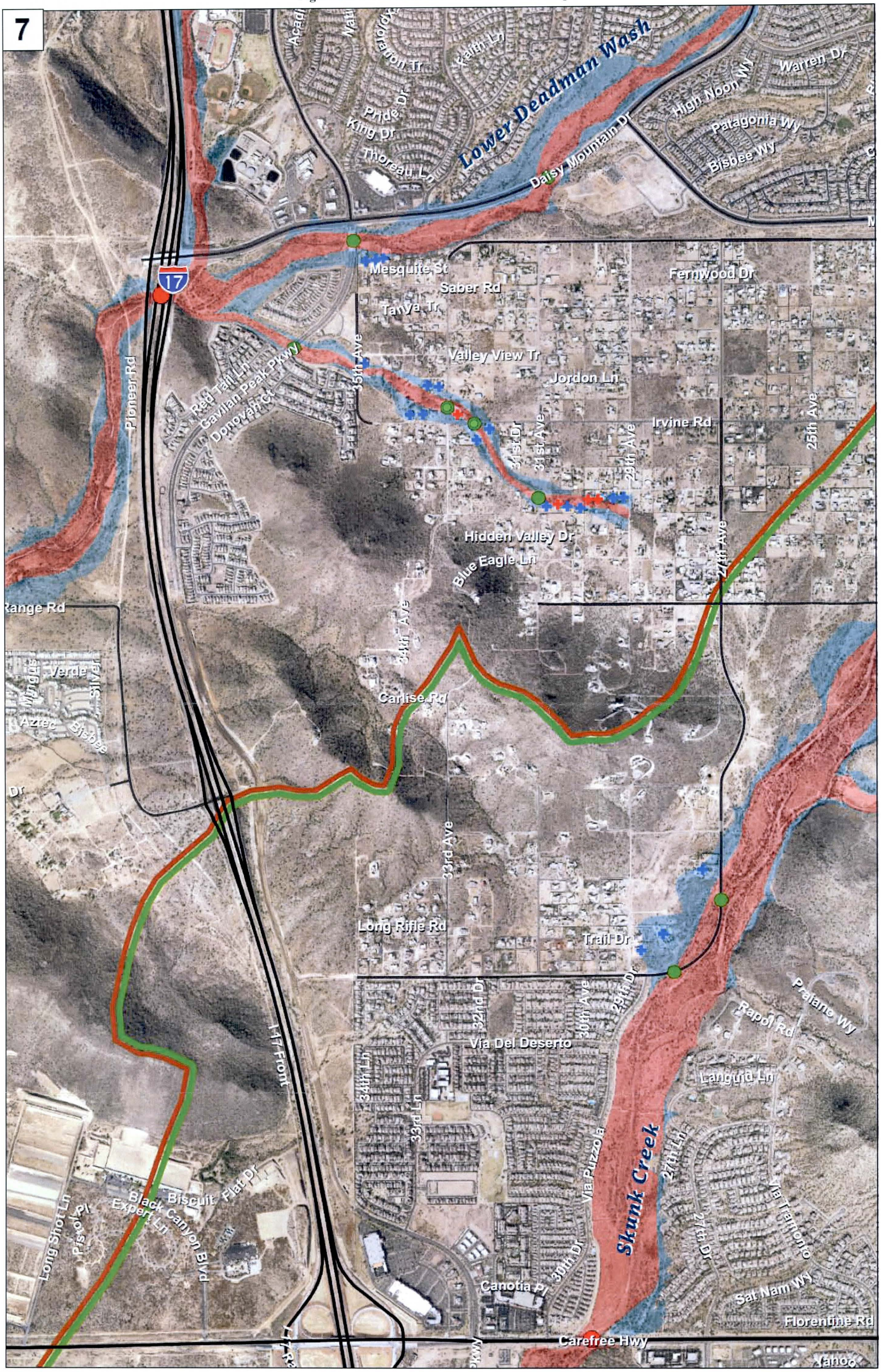
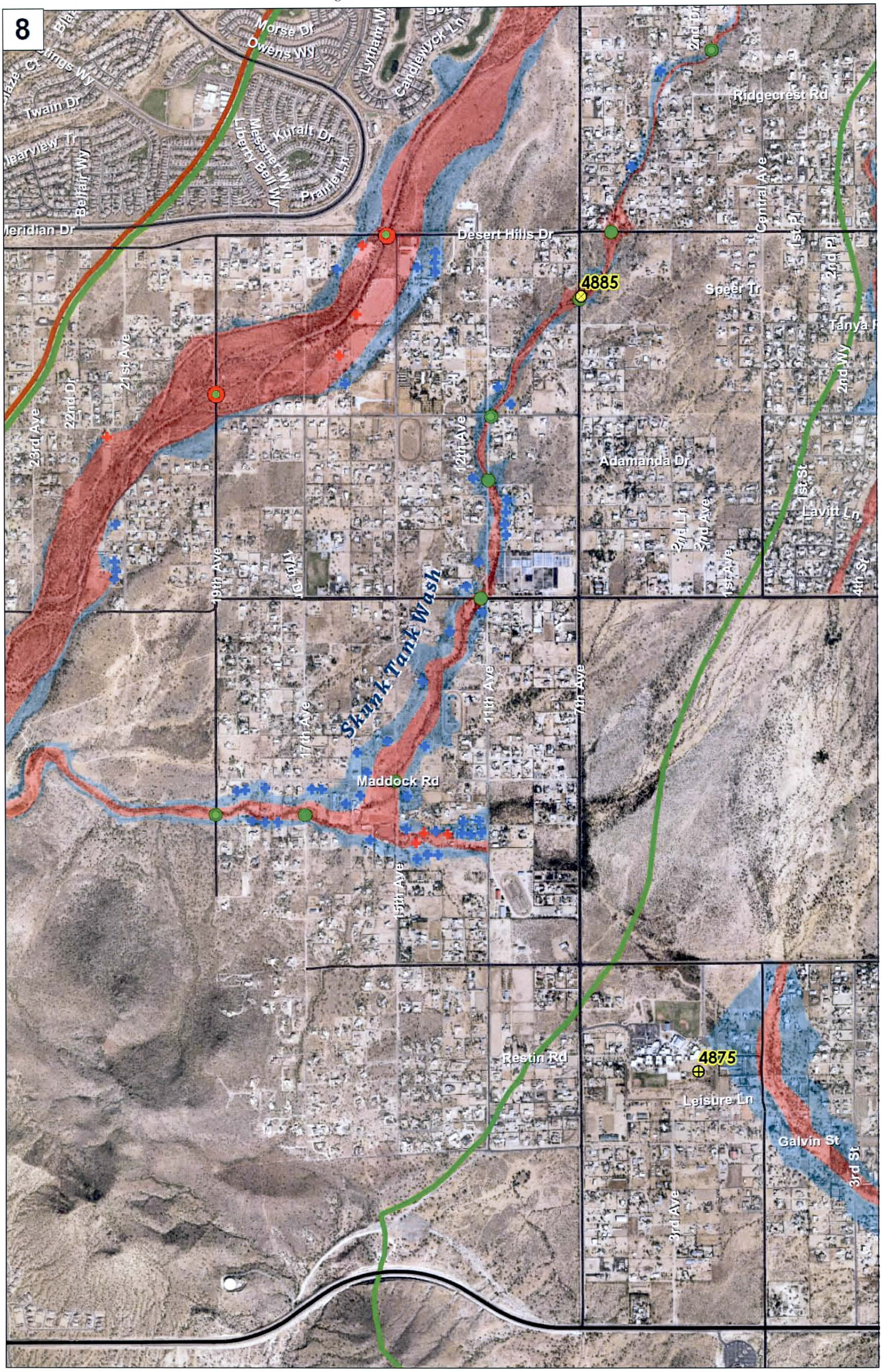


Figure 19: Skunk Creek FRP Field Map 8



Cline Creek and Rodger Creek

East of New River Road

(Refer to Flood Response Plan Field Maps 5 and 6)

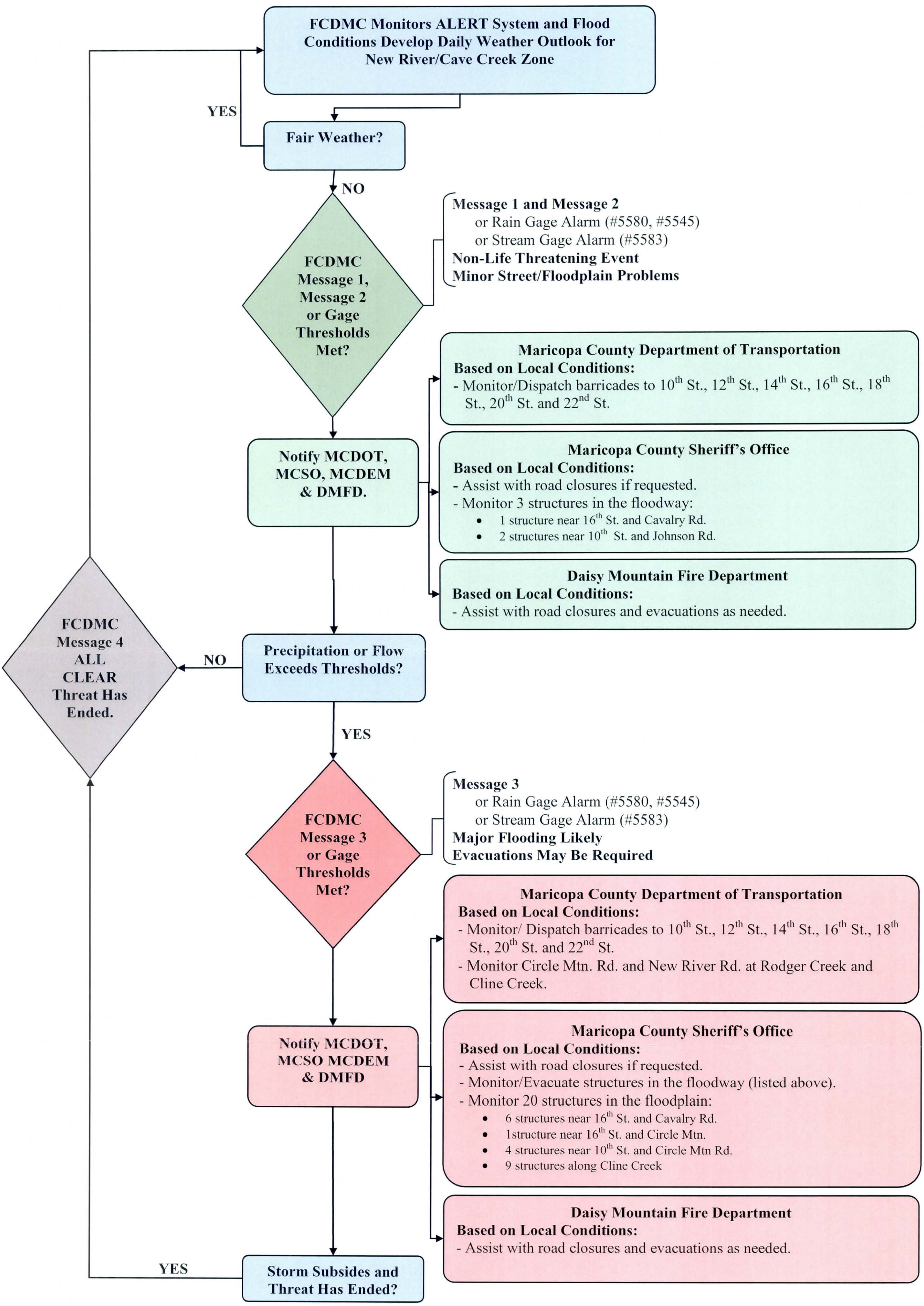


Figure 20: Cline Creek and Rodger Creek Flowchart

Cline Creek and Rodger Creek

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)

Table 17: Notification Data for Cline Creek and Rodger Creek

Gavilan Peak Wash and Tributaries

Headwaters to New River
(Refer to Flood Response Plan Field Maps 3 and 2)

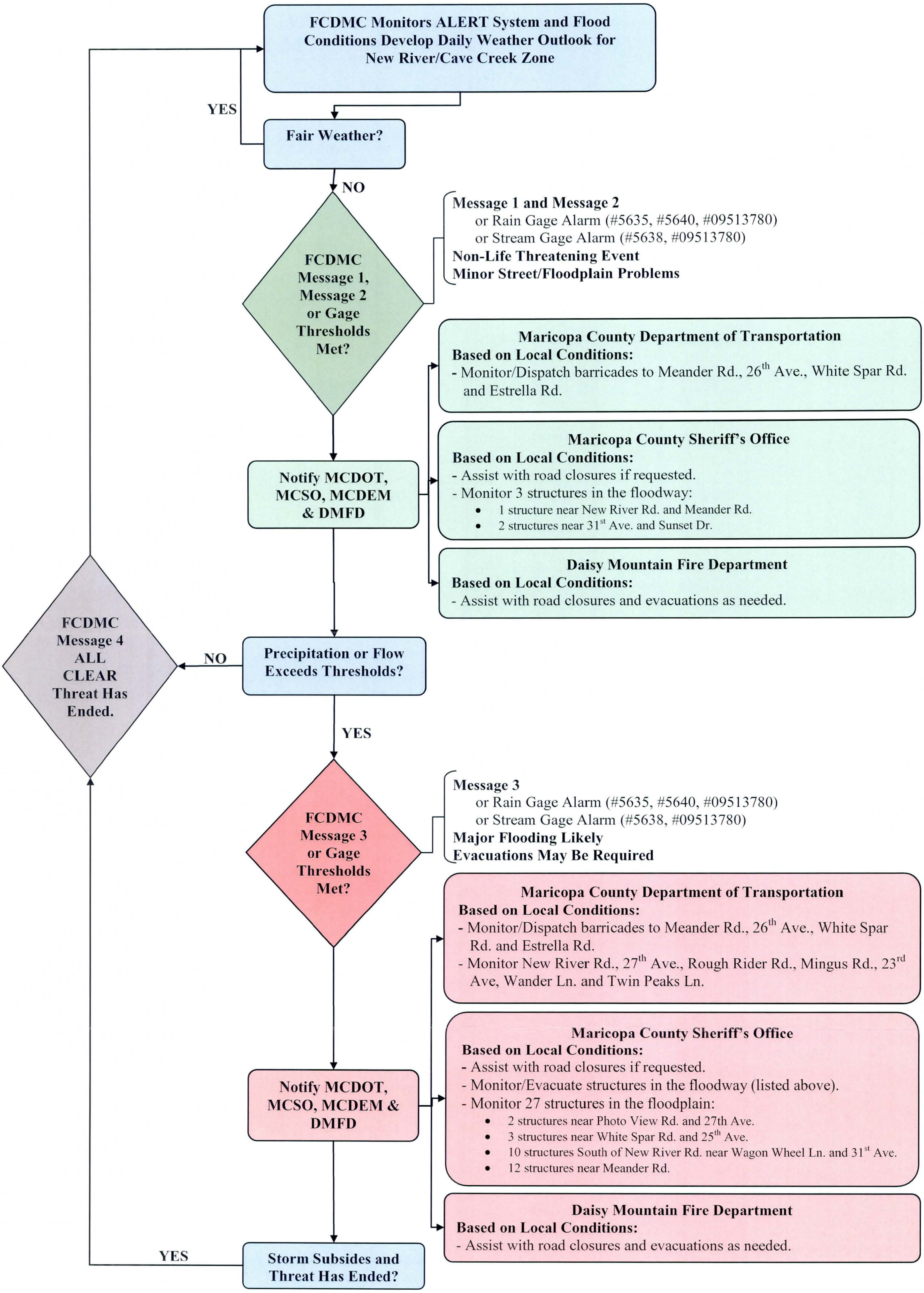


Figure 21: Gavilan Peak Wash and Tributaries Flowchart

Gavilan Peak Wash and Tributaries

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)

Table 18: Notification Data for Gavilan Peak Wash and Tributaries

Lower Deadman Wash

Headwaters to New River

(Refer to Flood Response Plan Field Maps 7 and 1)

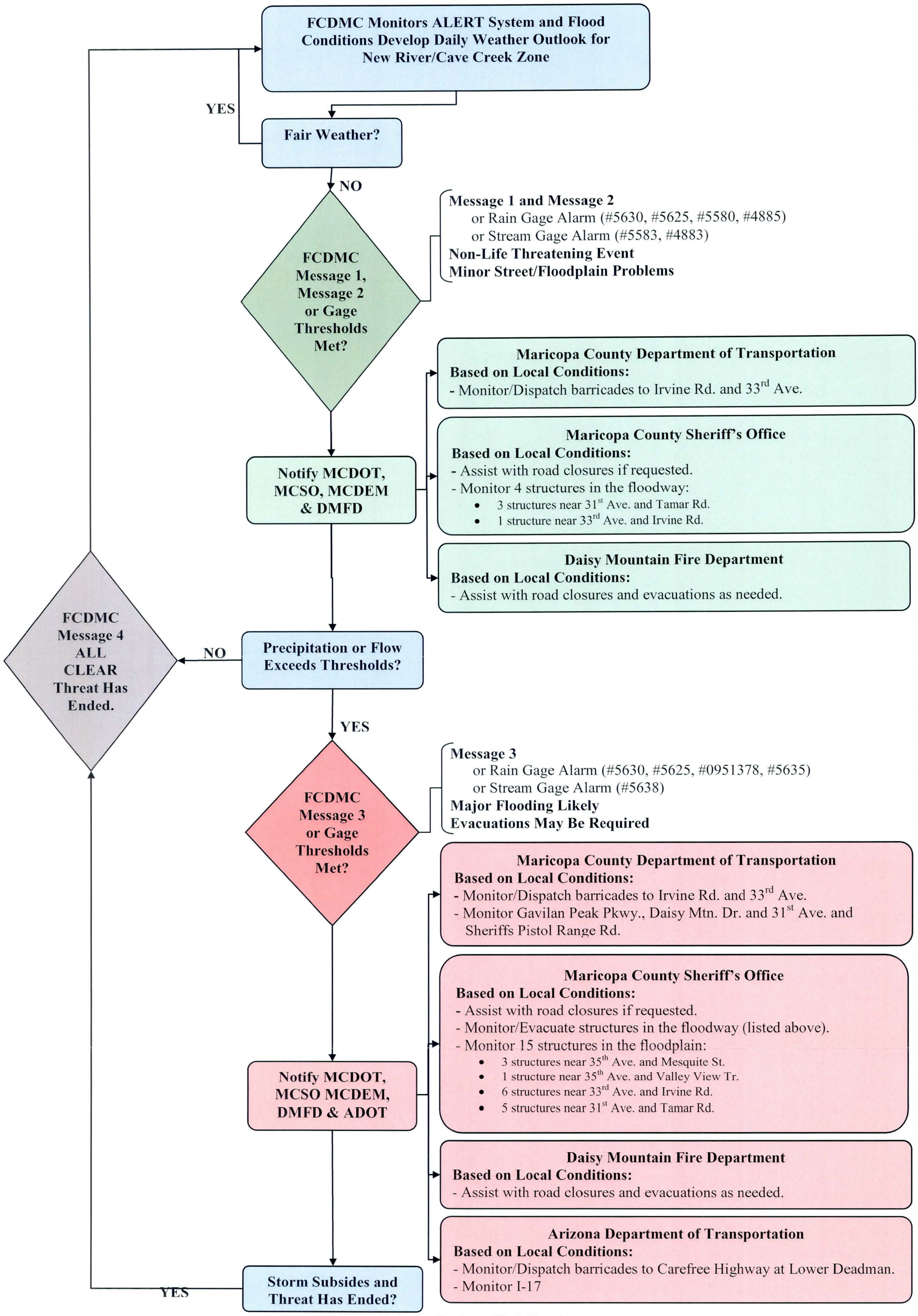


Figure 22: Lower Deadman Wash Flowchart

Lower Deadman Wash

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)
ADOT	Highway Division District 1 Engineer	602-255-7381

Table 19: Notification Data for Lower Deadman Wash

Lower New River, Doe Peak Wash, Sweat Canyon Wash and the West Tributaries

Headwaters to New River

(Refer to Flood Response Plan Field Map 1)

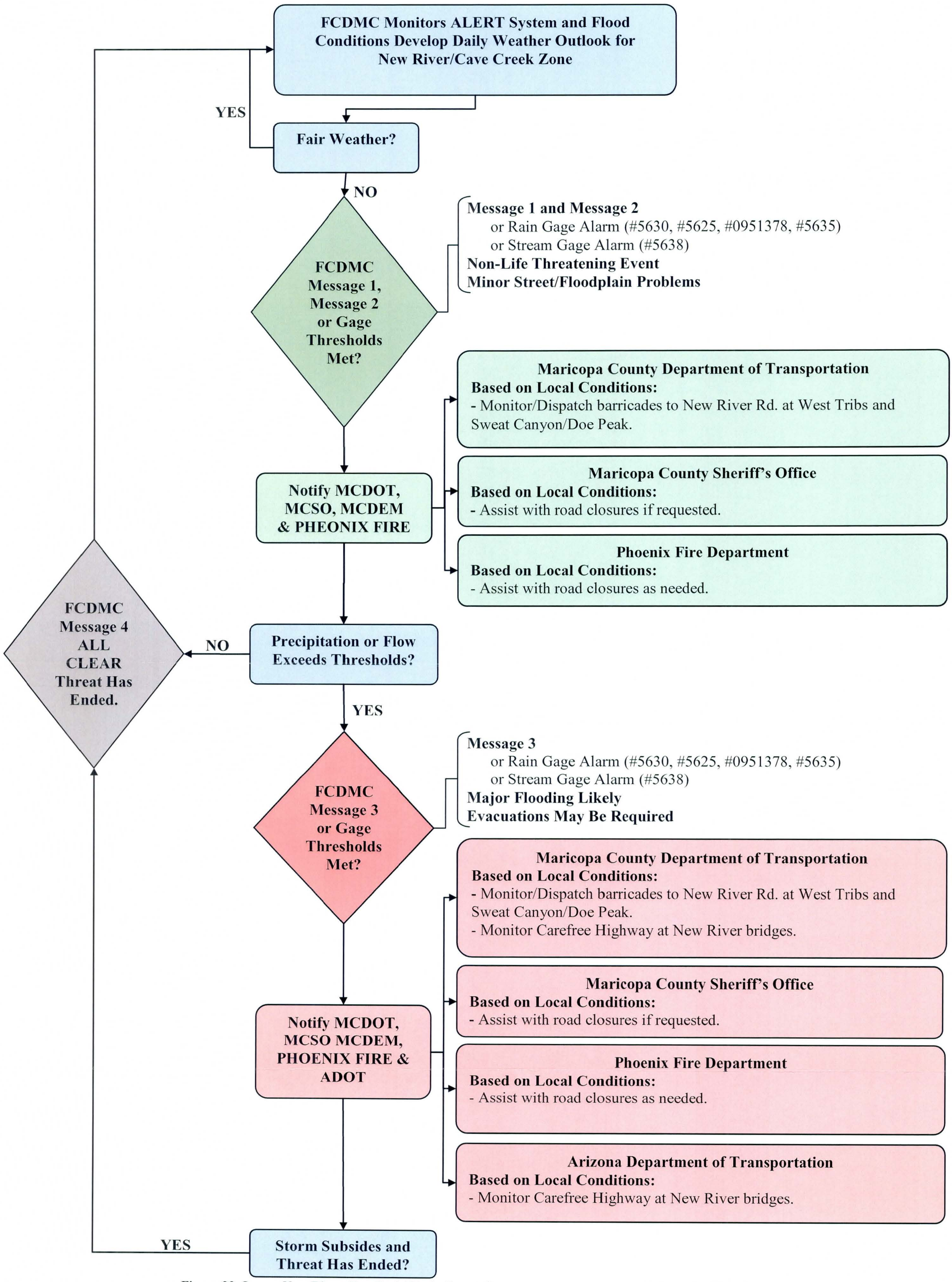


Figure 23: Lower New River, Doe Peak Wash, Sweat Canyon Wash and the West Tributaries Flowchart

Lower New River, Doe Peak Wash, Sweat Canyon Wash and the West Tributaries

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Phoenix Fire Department	Phoenix Fire Alarm 24/7	602-262-6595
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)
ADOT	Highway Division District 1 Engineer	602-255-7381

Table 20: Notification Data for Lower New River, Doe Peak Wash, Sweat Canyon Wash and the West Tributaries

Skunk Creek

This also includes all floodway/floodplain area west of New River Road.
(Refer to Flood Response Plan Field Maps 4, 5, 8 and 7)

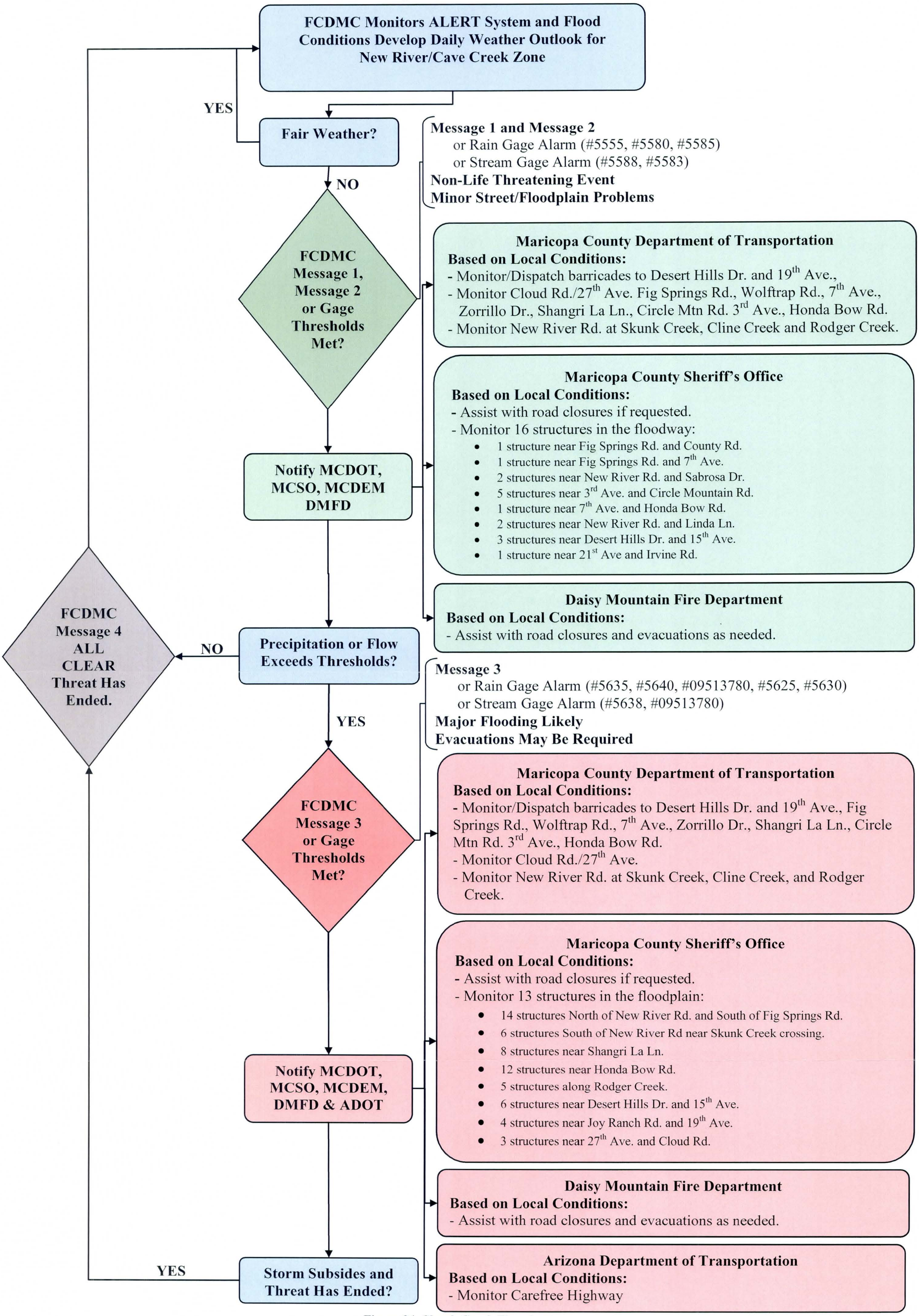


Figure 24: Skunk Creek Flowchart

Skunk Creek

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)
ADOT	Highway Division District 1 Engineer	602-255-7381

Table 21: Notification Data for Skunk Creek

Skunk Tank Wash

Headwaters to Skunk Creek
(Refer to Flood Response Plan Field Map 8)

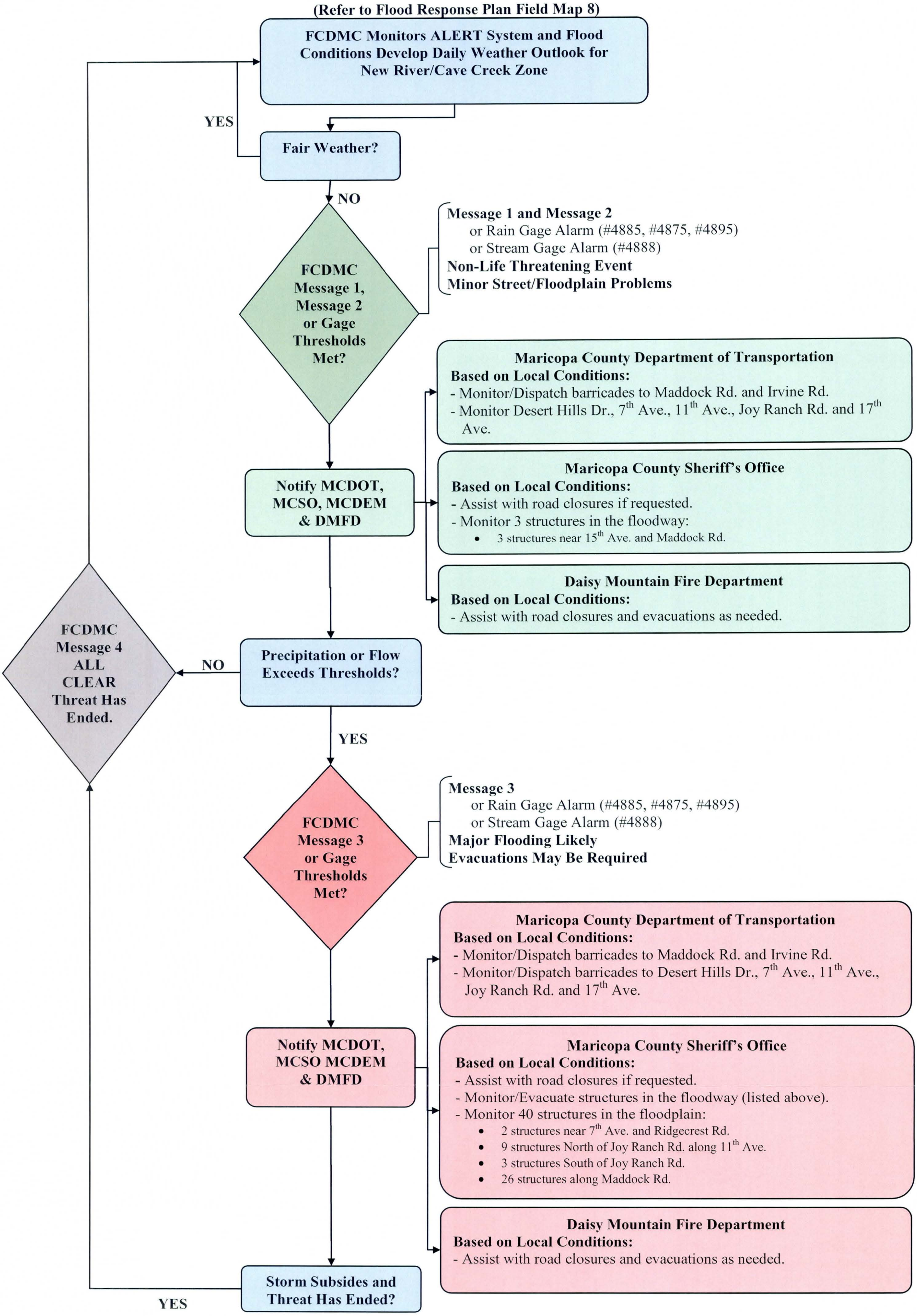


Figure 25: Skunk Tank Wash Flowchart

Skunk Tank Wash

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)

Table 22: Notification Data for Skunk Tank Wash

Upper New River and Upper Deadman Wash

(Refer to Flood Response Plan Field Map Figure 2)

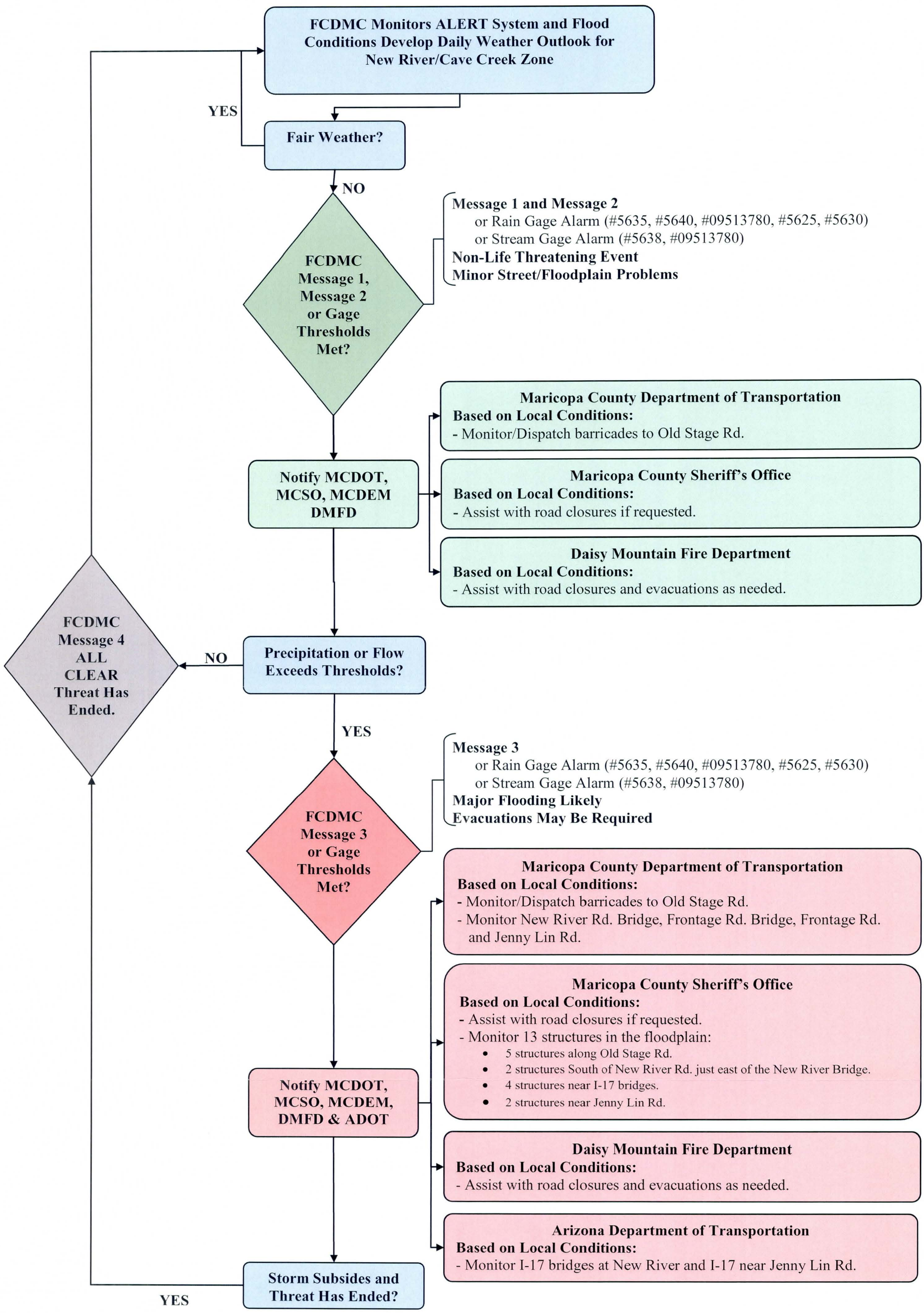


Figure 26: Upper New River and Deadman Wash Flowchart

Upper New River and Upper Deadman Wash

Notification Data

Organization	Name/Title	Contact Information
MCDOT	24/7 Dispatch 24/7 Barricade Crew	602-506-6063 602-506-4636
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
MCDEM	Duty Officer	602-273-1411 (office) 602-725-7181 (cell)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
National Weather Service (NWS) Phoenix	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)
ADOT	Highway Division District 1 Engineer	602-255-7381

Table 23: Notification Data for Upper New River and Upper Deadman Wash

Post-Flood Procedures

Once the storm subsides and the storm threat has ended it is important for the following agencies to take these necessary steps.

Flood Control District of Maricopa County. The Flood Control District of Maricopa County is responsible for following these post-flood actions:

a. Notify agencies of the "ALL CLEAR" status after a flood treat or flood emergency has ended.
b. Follow the existing procedures of post-event inspections of any District structures, appurtenances, and gaging equipment.
c. Prepare an internal after-action report on the flood event.

Maricopa County Department of Transportation. Maricopa County Department of Transportation is responsible for following these post-flood actions:

a. Follow the existing procedure of post-event inspections of any County road crossing, bridge, or any other structure that is MCDOT's responsibility.
b. Following the event evaluate MCDOT's travel time to the wash to place the barricades and how long the barricades were up before road was inspected and the signs were taken down.

Maricopa County Sheriffs Office. Maricopa County Sheriffs Office is responsible for following these post-flood actions:

a. Provide assistance to Maricopa County Department of Emergency Management (MCDEM), Maricopa County Department of Transportation (MCDOT), Peoria Fire Department, Phoenix Fire Department, Daisy Mountain Fire Department, and/or Rural Metro Fire Department if needed.

TRAINING, EXERCISES, AND FRP UPDATES

A successful FRP is a result of the preparedness and coordination of all its participants. The following tasks should be performed routinely to ensure that the Upper New River/Skunk Creek FRP is effective in the event of a real emergency.

Training

An initial training session with the agencies involved is recommended. Training would include an overview of the FRP which would cover flood detection, flood threat recognition, dissemination of information, emergency response actions and post flood actions. This overview would also include specific notification protocols, geographic coverage (watercourses included within the drainage area), locations of concern and an overview of any maps or custom products that were created for this FRP.

Exercises

Representatives from the District, MCDEM, MCDOT, MCSO and the Fire Departments should attend and/or conduct periodic emergency management and response training. It is recommended that a table top exercise be conducted annually prior to the start of monsoon season. In addition it is recommended that all agencies meet after the monsoon season has ended to review procedures and identify any necessary improvements to the Upper New River/Skunk Creek FRP.

FRP Updates

The Upper New River/Skunk Creek FRP is reviewed annually by the District and MCDEM and modifications should be made accordingly, which includes notification data. The District should also review its Standard Operating Procedure and make any appropriate updates.

FUTURE IMPROVEMENTS

Future enhancements should be evaluated for changes that would affect the Upper New River/Skunk Creek FRP.

ALERT Gage Network

The Flood Control District of Maricopa County operates a 24-hour rain, stream and weather gage network which provides "real-time" information to the County and many other agencies about rainfall, floods and weather conditions in Maricopa County. This network operates in the National Weather Service ALERT (Automated Local Evaluation in Real Time) format and is commonly referred to as an ALERT system. The Upper New River watershed currently has 4 ALERT stations. Three are precipitation gages and one is a stream and precipitation gage. There is also a USGS station which provides rainfall and stream flow information. The Skunk Creek watershed currently has 5

ALERT stations. Two are precipitation gages and three are precipitation and stream flow gages.

Early detection of a storm event and closely monitoring a storm are the best ways to reduce the risk of injury, loss of life and property damage from flooding. To improve the usefulness of warnings it is recommended that additional precipitation, stream, crest, and staff gages be installed. Actual locations of gages will be dependent on land ownership and availability, site access, vulnerability to vandalism, absence of obstructions and an accessible radio path.

Although some stream gage sites have limited ability to enhance lead time, they remain an important component in the FRP because they can provide information on an impending flooding. Crest gages are used to gather data from streams and washes that are subject to infrequent, but severe flooding. A crest gage is a cost-effective way of gathering peak flow data which can be used in emergency planning, emergency design and hydrologic analysis. A staff gage can also be installed near a roadway crossing to provide an estimate of the amount of water flowing over the road. Staff gages along roads in the Upper New River and Skunk Creek watershed would be subject to a high sediment load that might deposit on the roadways. In order for the staff gages to read properly during an event, the sediment deposited would need to be removed prior to the barricades being removed from the roadway after a flow event. Once inspected and cleared of debris they would be able to display water level accurately during the next storm event. If these aren't cleared of debris the staff gages would not give accurate measurements and may cause local residents to become overly confident and cross rivers, streams and washes when the condition are in fact unsafe. Potential locations of future gages are described below. See Figure 9 in Attachment B for a map summarizing the proposed gage and flasher locations.

New River

The New River Fire streamgage was installed in July 2005 after the Cave Creek Complex fire in the Upper New River watershed. The USGS streamgage is downstream of the New River Fire station and has data dating back to the early 1960's. New River has been subject to fairly frequent large flows. Although not a high traffic road, Old Stage Road is flooded frequently and there has even been a fatality in 2005. At the banks of New River at Old Stage Road a flashing flood warning road sign could be installed. This sign would be activated by the New River Fire streamgage and a status sensor would also be installed. The sign would first flash yellow lights telling residents to "PROCEED WITH CAUTION WHEN FLASHING". When the river reached a certain threshold, set by District, then a second set of the lights would start flashing red and the sign would display "DO NOT CROSS WHEN FLASHING". This location may also be suitable for a stage gage. It is important that there is an early response to this particular crossing because residents north of Old Stage Road lose access to their homes when New River is flowing.

Figure 27: Flashing Road Sign at Delaney Wash and Salome Hwy in Maricopa County

New River also crosses New River Road at Sweat Canyon/Doe Peak Wash and West Tributaries Wash. Both of these areas are at-grade asphalt dips and can carry 100-year flows of 13,000-14,000 cubic feet per second (cfs). Currently there are no ALERT stations located in either sub-basin. To predict what the precipitation and stream flows might be on theses washes the Sunup Ranch, New River Landfill, Lake Pleasant, and Lake Pleasant North gages can be monitored. Both of these crossings would be a good location for a staff gage.

When driving north on New River Road before reaching the West Tributaries wash crossing there is a "Do Not Cross When Flooded" road sign. When driving south on New River Road there is not a sign before the wash crossing. A sign should be installed prior to the wash crossing on New River Road to warn drivers of the potential flood hazard. This would be the responsibility of MCDOT.

Gavilan Peak Wash

Additional gages are needed to better predict rainfall and streamflow in Gavilan Peak Wash and its tributaries. Currently Gavilan Peak is a pending floodplain and doesn't have any gages within the sub-basin. The Gavilan Peak Floodplain Delineation Study was completed by PBS&J for the District and was submitted to FEMA in July 2008. This study identifies the existing floodplains and floodways within the sub-basin and was used in this FRP analysis but the final approval from FEMA has not been granted yet. This area previously was not classified as a floodplain or floodway and therefore didn't have any flood related building code restrictions. This area has been experiencing rapid urbanization in the last decade which has resulted in structures and residents to be subject to increased danger during a flood event.

In order to increase warning time for these residents it is suggested that a rain gage and stream gage be installed. The rain gage could be installed along 27th Avenue and Estrella Road and the stream gage could be installed at New River Road and Gavilan Peak Wash. Due to the area and the multiple tributaries within the sub-basin, a location that would provide greater lead time was unable to be found. Ideally the stream gage would be further upstream, but by using the rain data from the upstream rain gage and by setting the alarm thresholds on the stream gage at a relatively low level, the District would be able to monitor the rainfall and stream flow within the sub-basin much better. This would allow more accurate warning for residents and more efficient monitoring of the at-grade crossing at Meander Road which is subject to 100-year flows greater than 8,000 cubic feet per second (cfs).

Lower Deadman Wash

Lower Deadman Wash currently doesn't have any stream gages and the closest rain gages are New River Landfill, Sunup Ranch, Cline Creek, Skunk Tank Wash, and Desert Mountain School Weather Station. The major roadway crossing for this wash is at Carefree Highway where 100-yr flows can exceed 9,000 cubic feet per second (cfs). There is a culvert that carries minor flows underneath the highway but when the flow exceeds the capacity of this culvert the roadway will be inundated with water. This road is maintained by Arizona Department of Transportation (ADOT); therefore, a flashing flood warning sign or a staff gage would cause too much liability for the District. This location needs to be closely monitored during a storm event and barricaded when necessary. Because this is a state highway and a very highly travelled road it is also very important to take the "Do Not Cross When Flooded" sign down when the threat has ended in a timely manner.

Skunk Creek

The Skunk Creek watershed currently has five rain gages: Fig Springs, Skunk Creek near New River Road, Cline Creek, Upper Cline Creek and Skunk Tank Wash and there are three stream gages: Skunk Creek near New River Road, Cline Creek and Skunk Tank Wash. There are many minor roadways and major roadways that experience flows during a storm event but the two major roadways of greatest concern are Desert Hills Drive and 19th Avenue. Desert Hills Drive is an at-grade road crossing that is subject to 100-year flows of 27,000 cubic feet per second (cfs). Because of the high discharge and high velocity flows at this location, it would be an ideal spot for a flood warning sign (as described above in the New River section). There are two stream gages north of this road crossing, Skunk Creek near New River Road and Cline Creek, but they are too far away to provide accurate warning. A stream gage and status senor could be installed just north of Desert Hills Drive and the flashing lights would be activated by this new gage. With the flood warning sign in place it could alert residents to cross the wash with caution or to not cross the wash at all. This would reduce the amount of flood related emergencies at this major roadway crossing. 19th Avenue is also subject to 100-year flows of 27,000 cubic feet per second (cfs) but experiences less vehicle traffic. A new stream gage just north of Desert Hills Drive and flood warning sign on Desert Hills Drive would also benefit the 19th Avenue road crossing. The flows could be monitored from the new gage just north of Desert Hills Drive which is a lot closer than the Skunk Creek near New River Road and Cline Creek stream gages and 19th Avenue can be barricaded accordingly.

Staff Gages

There is one staff gage currently in the Upper New River Skunk Creek FRP which is located at Fig Springs Road north of the Skunk Creek near New River gage. Other recommended areas include:

- New River Road
  - Old Stage Road (if no flashing sign)
  - Meander Road
  - New River Road at Sweat Canyon/Doe Peak crossing
  - New River Road at West Tributaries crossing
- Skunk Creek
  - Honda Bow Road
  - 19th Avenue
  - Desert Hills Drive (if no flashing sign)

Public Education

It is critical that the residents within the Upper New River/Skunk Creek FRP be educated and reminded of the inherent flood hazards around them. New residents may be unfamiliar and current residents may not have experienced a severe flash flood. It is important to let residents know if there may be potential for a flood event so they can avoid driving which will eliminate vehicle traffic and loss of access on the roadways. The District broadcasts commercials and advertisements that are seen throughout the Maricopa County area to help educate and make residents aware of the inherent danger of flooding. The District's website is a public website which has all the ALERT gage data and Custom Products made specifically for the Upper New River/Skunk Creek FRP available 24/7. The District encourages participating agencies to observe and monitor the ALERT gage data in the event of a flood.

The District has provided the Upper New River/Skunk Creek FRP, a wall map and field maps to the agencies involved. This will enable emergency response teams to become more familiar with the areas of concern for both of the watersheds and in return the community will benefit. The local fire departments and sheriffs' office also can continue to educate the local residents on the dangers of flooding.

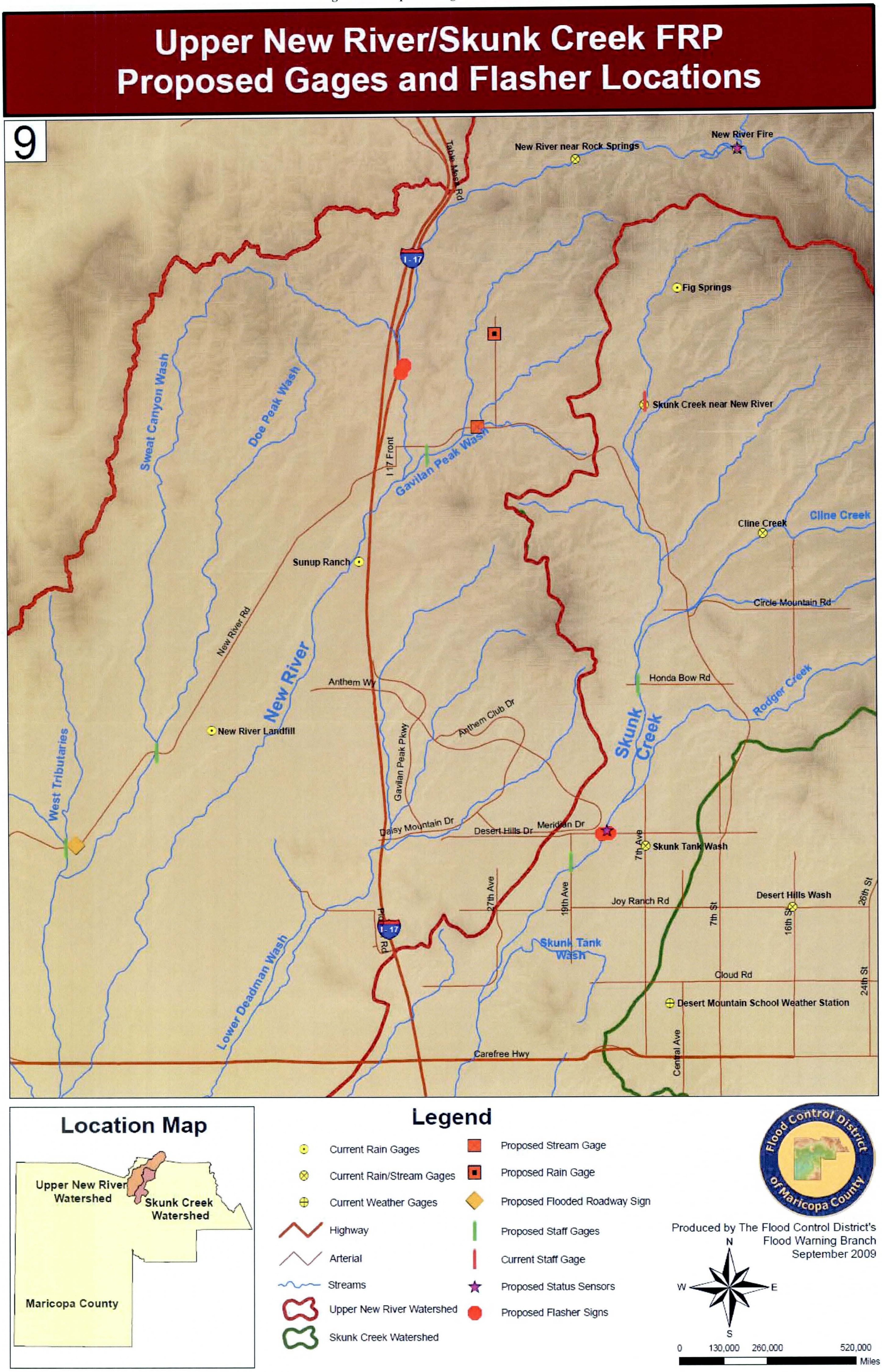
Notification Updates

The majority of the Upper New River/Skunk Creek FRP lies in unincorporated Maricopa County which means the District is responsible for making initial notifications. MCDEM only notifies other agencies and not individual residents. The responsibility to notify individual residents is that of NWS, MCSO, and the local Fire Departments.

Coordination with Participants

Coordination between all agencies is the most important aspect of the Upper New River/Skunk Creek FRP. The better the coordination and communication between all agencies, the more the residents within the FRP area will benefit.

Figure 28: Proposed Gage and Flasher Locations



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U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA) 500 C Street SW, Washington, D.C. 20472. Summary of Databases in HAZUS-MH, http://www.fema.gov/plan/prevent/hazus/hz_database.shtm.

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"Flash Flood Sweeps 7-year-old Girl to Death in Arizona; Driver Dies near Phoenix", Associated Press: Phoenix Metro Area (AZ), August 10, 2005.

"Friends Stunned After Flash Flood Claims Life of Longtime Rodeo Booster", The Arizona Republic, Brent Whiting, Aug. 11, 2005 12:00 AM.

ATTACHMENT A
Notification Data

Upper New River/Skunk Creek Flood Response Plan
Notification Data

Organization	Name/Title	Contact Information
National Weather Service (NWS)	24/7 Weather Forecaster Meteorological Information for Emergency Responders Only	602-275-7004 602-275-7003
Flood Control District of Maricopa County	ALERT Room Hydrologist on Call Steve Waters Jim Perfrement	602-506-8701 or 602-272-0132 602-390-7804 (cell) 480-345-0771 (home) 602-450-1141 (pager) 602-971-4663 (home) 602-450-7127 (pager)
MCDEM	Duty Officer	602-273-1441 (office) 602-725-7181 (cell)
MCDOT	24/7 Barricade Crew	602-506-4636 (office) 602-506-6063 (cell)
MCSO	24/7 Dispatch	602-876-1011 602-876-1062 (office)
Daisy Mountain Fire Department (DMFD)	Phoenix Fire Alarm 24/7 - DMFD On-Duty Fire Marshal DMFD Administration Phil Dyer – Captain/Fire Marshal	602-262-6595 623-465-5501 (cell) 623-465-7400 (office) 602-909-2441 (cell)
Rural Metro Fire Department (RMFD)	RMFD Administration John Kraetz – Chief	480-994-3886 (office) 480-575-1372 (office) 602-616-6363 (cell)
Phoenix Fire	24/7 Dispatch Phoenix Fire Alarm	602-495-5555 602-262-6595
Deer Valley Unified School District (DVUSD)	Nick Portonova, Director of Transportation Dr. Kent Davis, Associate Superintendent	602-467-5090 (office) 623-512-0926 (cell) 623-445-4951
ADOT	Bill Tait, Emergency Manager Coordinator	602-680-8937 (cell)
Arizona Department of Public Safety (ADPS)	Switchboard	602-223-2000

ATTACHMENT B
Selected Photos of ALERT Gages and Vulnerable Locations

Selected Photos of ALERT Gages and Roadway Crossings

Figure 29: Cooks Mesa #5640

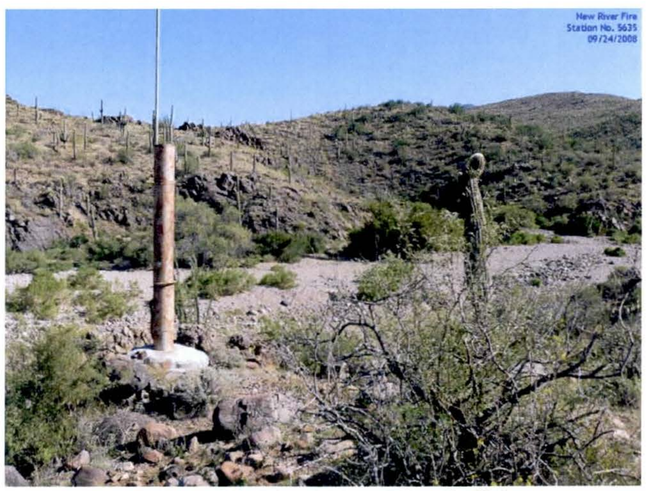


Figure 30: New River Fire #5635

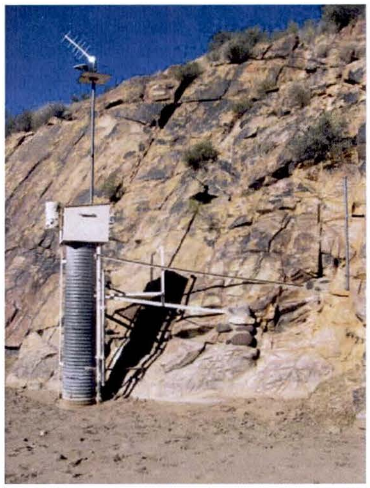


Figure 31: New River near Rock Springs (USGS) #09513780

Figure 32: Sunup Ranch #5625

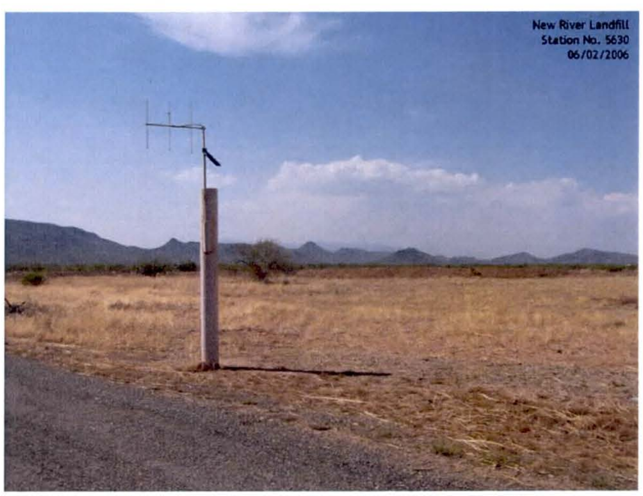


Figure 33: New River Landfill #5630

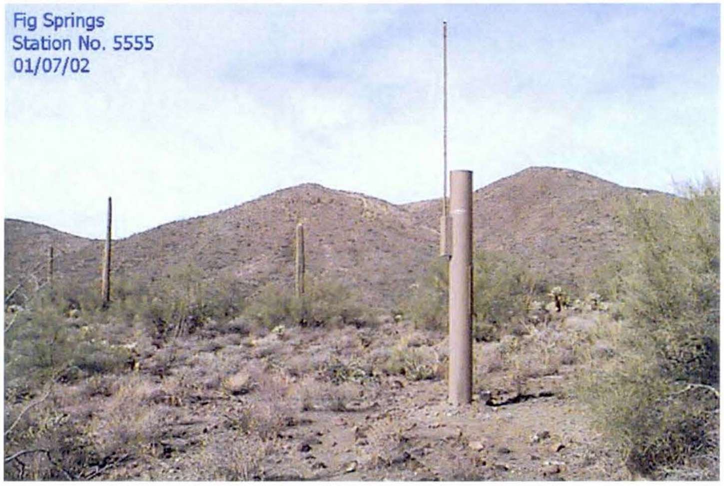


Figure 34: Fig Springs #5555


Figure 35: Skunk Creek near New River Road #5585

Figure 36: Upper Cline Creek #5545

Figure 37: Cline Creek #5580

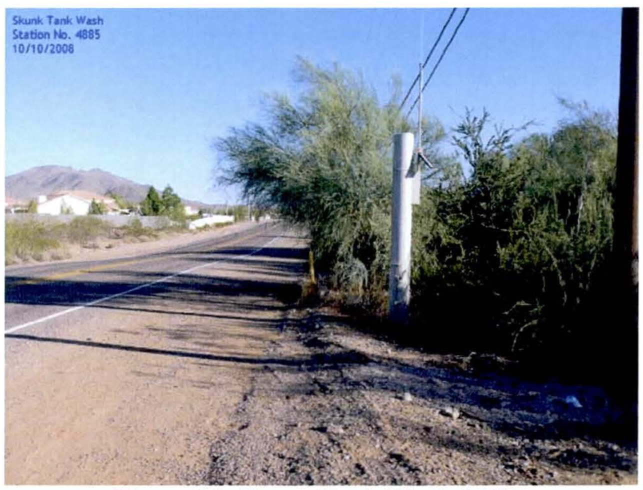


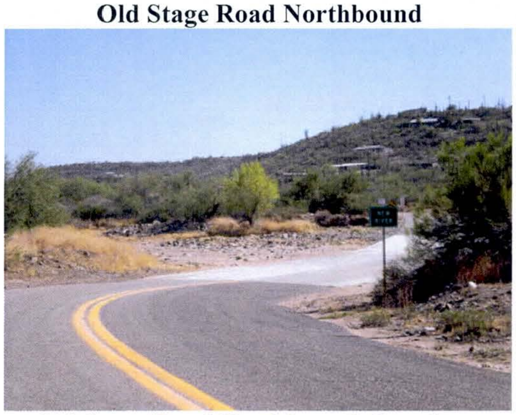
Figure 38: Skunk Tank Wash #4885

At-Grade Major Roadway Crossings
Within the Upper New River/Skunk Creek FRP

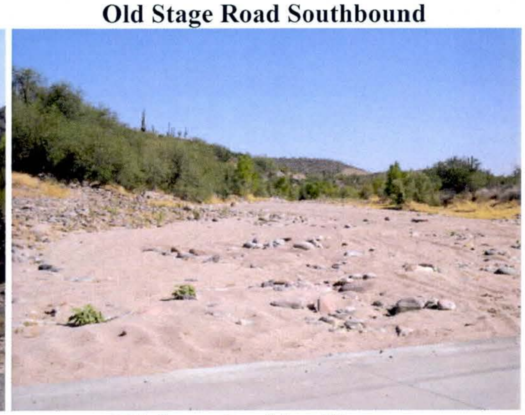
New River at Old Stage Road

Old Stage Road Northbound

Old Stage Road Southbound



Old Stage Road Northbound Crossing



Old Stage Looking Upstream

West Tributaries at New River Road

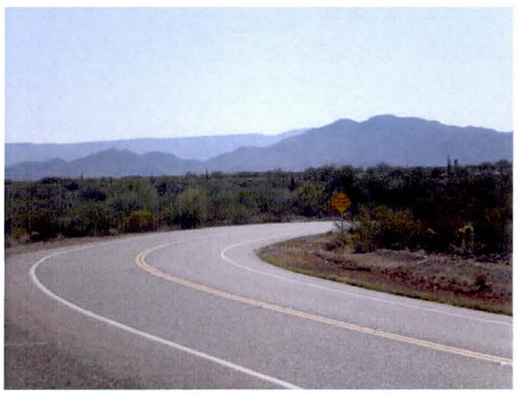
New River Road Northbound

New River Road Southbound

West Tributaries Looking Upstream

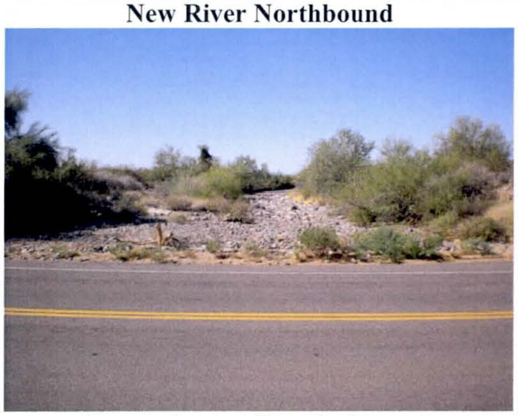
West Tributaries Looking Downstream

Sweat Canyon/Doe Peak at New River Road

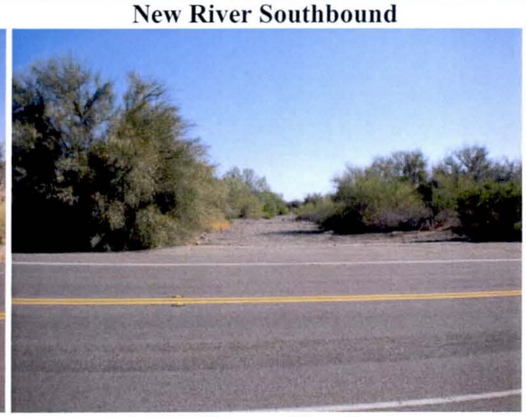


New River Northbound

New River Southbound



Sweat Canyon/Doe Peak
Looking Upstream

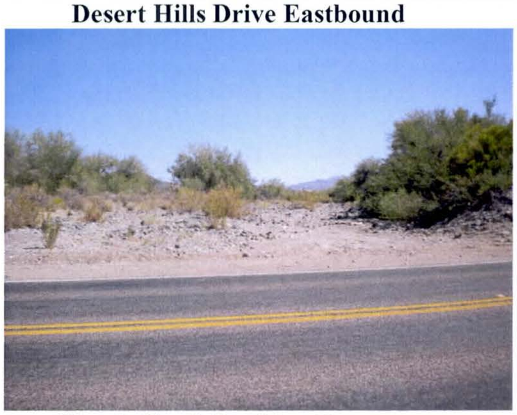


Sweat Canyon/Doe Peak
Looking Downstream

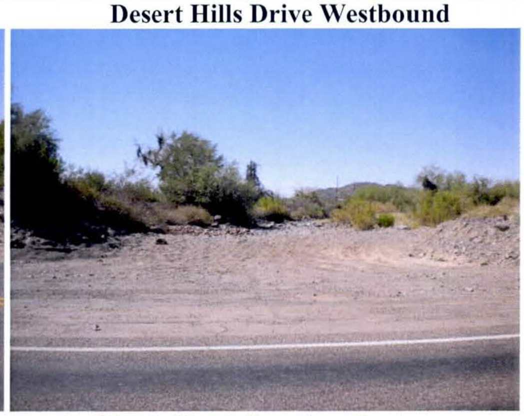
Skunk Creek at Desert Hills Drive

Desert Hills Drive Eastbound

Desert Hills Drive Westbound



Skunk Creek Looking Downstream



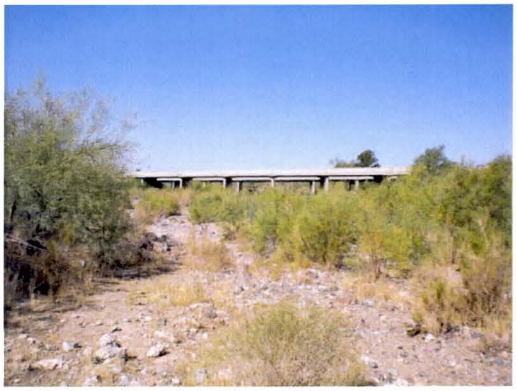
Skunk Creek Looking Upstream

Skunk Creek at 19th Avenue

19th Avenue Southbound

19th Avenue Northbound

New River at I-17 Bridge



North of I-17 Bridge (N & S Bound) Facing South

New River at New River Road Bridge

North of Bridge Facing South

Gavilan Peak Wash at New River Road

Gavilan Peak at West Road Crossing

Gavilan Peak at East Road Crossing

Skunk Creek at New River Road

Eastside of Bridge

Cline Creek at New River Road

Eastside of Bridge

Rodger Creek at New River Road

Culverts on Westside of New River Road

At-Grade Minor Roadway Crossings
Within the Upper New River and Skunk Creek Watersheds

Gavilan Peak Wash at Meander Road


Meander Road Driving South


Meander Road Looking Upstream

Skunk Creek at Fig Springs Road


Fig Springs Road Driving Northeast

Historic Photos
Upper New River and Skunk Creek Watersheds

At New River Bridge Looking downstream, Sat 10³⁰AM, Feb 14-1931
Bartlett + Bowers.

STORM DATE:	February/14/1931
LOCATION:	New River Bridge & New River, New River, Maricopa County, T7N R2E SEC27
PHOTO DESCRIPTIONS:	At New River Bridge looking downstream, Saturday 10:30am Before passing dams
PHOTO SOURCE:	Various Old Negatives 1926-1972

Skunk Creek at Fig Springs Road

New River Rd at New River

12/31/65 51.

91

STORM DATE: December/29/1965

LOCATION: New River Road (Rd) & New River, New River, Maricopa County, T5N R3E SEC27

PHOTO DESCRIPTIONS: New River & New River Road (Rd)

PHOTO SOURCE: Newspapers Articles and Photographs (1965-1966)

FCD LIBRARY CALL #: Call Number: 007.102

New River Road at New River
12/29/65 40.

88

STORM DATE: December/29/1965
LOCATION: New River Road (Rd) & New River, New River, Maricopa County, T5N R3E SEC27
PHOTO DESCRIPTIONS: New River & New River Road (Rd) with a person watching aimlessly
PHOTO SOURCE: Newspapers Articles and Photographs (1965-1966)
FCD LIBRARY CALL #: Call Number: 007.102

ATTACHMENT C
News Articles

News Articles

Friends stunned after flash flood claims life of longtime rodeo booster

Brent Whiting
The Arizona Republic
Aug. 11, 2005 12:00 AM

He was remembered Wednesday as an avid horseman who worked tirelessly to promote the annual Fiesta Days Rodeo in Cave Creek.

Wayne Wilson, 65, a longtime leader with the Desert Foothills Community Association, the rodeo's organizer, took good care of his horses, friends said.

In fact, Wilson was on his way home from a New River farrier after having the animals shod when he drowned Tuesday in raging floodwaters.

John Deegan, a blacksmith and horse trainer, confirmed that tragedy struck after Wilson had paid a visit.

Wilson was killed when a flash flood came roaring down New River along an Interstate 17 frontage road, about a mile north of New River Road, authorities said.

He was behind the wheel of a pickup truck, pulling a horse trailer, when both were swept away in the torrent, according to Maricopa County sheriff's deputies. The two horses were safely rescued.

Wilson, board chairman of the Desert Foothills group, was devoted to horses and community work, according to associates trying to cope with his sudden death.

"I'm shocked," said Paul Rerich, a Cave Creek merchant. "He was the backbone of the Desert Foothills Community Association. He loved his Western lifestyle."

Linda Reese, president of the non-profit association, said Wilson was a positive force in Cave Creek for many years.

"His death is going to leave a big hole in our community and in our hearts," she said. "I'm still in shock and devastated."

Relatives could not be reached for comment.

Rusty Reed, operations manager for the Desert Foothills group, said Wilson, a retiree, played an important role with the rodeo for 20 years.

Wilson was responsible for many improvements at the 10-acre Cave Creek Memorial Arena rodeo grounds, 31210 N. 28th Ave., Reed said.

"He was a nice man with everyone," Reed said. "He helped build the community association from the ground up."

Two neighbors, Michael and Susan Dowell, described Wilson as a close friend and an upstanding citizen.

"We can't say enough good about him," Michael Dowell said. "The community really lost somebody who worked hard to make it better."

Flash flood sweeps 7-year-old girl to death in Arizona; driver dies near Phoenix

Associated Press: Phoenix Metro Area (AZ)
August 10, 2005

A 7-year-old girl died in a flash flood that ripped her out of the grasp of a would-be rescuer as her family fled to high ground.

The body of Marissa Reyes was found early Wednesday, about 1 1/2 miles from the spot where the rushing water separated her from her family, authorities reported.

Reyes, three of her family members and a ranch worker fled from the family's home Tuesday when they saw high water rushing down a nearby creek following thunderstorms, said Sgt. Kip Rustenburg of the Maricopa County Sheriff's Office.

The ranch worker grabbed a tree for support with one hand and held onto Reyes with his other hand, but the water ripped Marissa from his grasp.

The ranch worker and Marissa's relatives, including a 1-year-old, made it to safety in the area 10 miles northeast of Cave Creek, Rustenburg said.

Elsewhere in central Arizona, a man died when he tried to drive his pickup truck across a flooded river bed near New River, north of Phoenix, said Lt. Paul Chagolla of the Maricopa County Sheriff's Office.

Lightning damaged 12 homes in Mesa, on Phoenix's east side, where more than 2 inches of rain was measured in some areas. There were no injuries.
Index Terms: U.S. Domestic
Dateline: PHOENIX

Record Number: D8BT1T6O1

1 DEAD, 1 LOST IN FLASH FLOODS

Arizona Republic - Phoenix, Ariz.

Author: Brent Whiting; Ofelia Madrid; Mark Shaffer; Shawn McKinnon; Rachel Stults; Carl Holcombe; Corinne Purtill; Tina Shah; Art Thomason; Jack Gillum
Date: Aug 10, 2005

One man died and a 7-year-old girl was swept away by floodwaters after a powerful thunderstorm swept through the Valley Tuesday.

Marissa Reyes slipped away from a ranch worker's hand as he clung to a tree when a wall of water smashed through a wash near Cave Creek, authorities said. Officers were still searching for the girl late Tuesday.

"The mother, who was still in the house, heard her daughter scream," said Sgt. Kip Rustenburg, a spokeswoman with the Maricopa County Sheriff's Office. "When she looked out the window, she saw her daughter swept out of his grip."

In New River, a 65-year-old man died when an apparent flash flood came roaring down the river along an Interstate 17 frontage road and swept him up. The man was identified as Wayne R. Wilson.

In all, the rains dumped more than two inches in other parts of the Valley, including Mesa, where at least 30 homes were flooded. The storms created chaos for many Valley residents, flooding roadways, shattering windows and blowing out power meters.

There's another chance of showers and thunderstorms tonight.

Valerie Meyers, a meteorologist with the National Weather Service, said the Valley has experienced scattered rain for 11 consecutive days.

"The ground is very saturated," she said. "Otherwise we wouldn't have the flooding problems that we've been having."

Late Tuesday, authorities stopped searching for Marissa on the ground and were attempting to find her by using helicopters near Seven Springs, a recreational area north of Cave Creek.

Officials said they would continue the ground search early this morning if they could not find her.

However, authorities feared the worst.

The incident happened about 5:40 p.m. after her family evacuated their Sears Kaye Ranch home. Marissa's grandfather saw the first wave of water coming through the wash and told everybody to get out of the house. He grabbed a 1-year-old baby, and the ranch hand grabbed Marissa.

But Marissa slipped away during a second wave of water. Rustenburg said the three adults and the 1-year-old were able to safely reach higher ground.

The ranch house is situated in a wash, which was flowing with water 15 feet high on Tuesday evening, Rustenburg said.

"The water was so strong that it carried a full-sized Cadillac past them," Rustenburg said.

The search is taking place in the same area as the Cave Creek Complex fire, which burned 248,231 acres in June and July, making it the largest fire ever recorded in the Sonoran Desert. Officials had predicted flooding because the inferno clogged creek beds with debris and damaged soil that is used to soak up rainwater.

In the New River incident, the river came up very quickly at the low-water crossing, said Capt. Dennis Tyrell, a spokesman for the Daisy Mountain Fire Department.

Wilson got out of the truck to examine the flowing river, then decided to cross it anyway, an awful example of what can happen when taking chances with running water, said Sgt. Paul Chagolla, a Maricopa County sheriff's spokesman.

Wilson remained buckled in his seat belt as firefighters removed his body from his upside-down truck. Two horses were rescued from the trailer.

Jason Lee, 18, a New River resident, said the truck and trailer were swept about 100 yards down the river before coming to rest in the river.

Leah Nordin, another resident, said the river was about 10 feet wide by mid-afternoon Tuesday, but quickly widened to 50 feet when the flash flood struck. Nordin described the crossing as one often used by residents.

Elsewhere, heavy rain forced the closure of several roads in Pinal County and Queen Creek.

Closed roadways included portions of Hunt Highway and Riggs Road in Queen Creek. Roger Ball, a spokesman with the Maricopa County Department of Transportation, said morning commuters should plan for extra drive time.

"You can always expect flooding in roadways when there are heavy rains," he said.

In Mesa, more than two inches of rain were reported at some locations, turning streets to rivers and flooding 30 homes in the 600 block of North Oracle Drive, firefighters said.

In addition, a lightning strike near Seventh and Ashbrook avenues damaged 13 homes, said Mary Cameli, a deputy Mesa fire chief.

The bolts broke windows, drywall and blew out power meters, cable wire and circuit breakers, Cameli said. Another home had a hole in the roof and a melted rain gutter.

Witnesses told firefighters that they saw "an incredible flash of light and then their homes began to shake," Cameli said. There were no reported injuries.

Mesa Firefighter Joe Boardman described the spectacular thunderstorm as a "once in a lifetime thing."

Barbara Murdoch said she was in the bathroom when there was a bang, almost loud enough to cause a concussion, causing wall hangings to drop and windows to blow out.

Her father got knocked off the bed, Murdoch said.

Jeff Kloosterman was standing with his garage open when he heard a "sonic boom."

"I first heard it, then saw it, and then everything started flying toward us," he said. "I ran the other way."

Earlier Tuesday in the Ahwatukee Foothills, postal carriers had water up to their ankles as they made deliveries and described a wall of water coming down the streets as they returned from making their rounds.

"They came in pretty soaked," postal clerk Amy Saiki said. "It came down really hard and really fast out of nowhere."

Rural/Metro Fire Department had to rescue two motorists from vehicles trapped in floodwaters in northern Pinal County, spokeswoman Alison Cooper said.

Just south of Queen Creek, a man was rescued from a small pickup truck. A woman was rescued from a car at Bell Road and Hunt Highway.

Travelers at Sky Harbor International Airport faced half-hour to 90-minute delays in departures because of the storms.

Phoenix typically gets 2.65 inches total during July, August and September.

Tuesday marked the 11th day that the airport measured at least a trace or more of precipitation, which is approaching the record.

In January 1993, the airport recorded a trace or more for 14 consecutive days. During those 14 days, a total of 5.12 inches fell.

For summer months, Tuesday broke the record: In July 1921, the airport measured a trace or more for 10 consecutive days. The total for that stretch was just 0.38 of an inch.

CAPTION: 1) Azia Gavin, 25, and Trevor Franco, 24, wade through floodwaters Tuesday at Citrus Highlands Apartments in Mesa.

CAPTION: 2) A truck and horse trailer are overturned in a flooded streambed near New River, north of Phoenix. The driver drowned.

CAPTION: 3) Akenaton Ochoa uses a bucket to empty water out of his flooded Ford Taurus on Tuesday afternoon in Mesa.

CAPTION: 4) Mesa residents wade Tuesday in floodwaters near Oracle and Williams.

CAPTION: 5 & 6) Monsoon 2005

CAPTION: Area of rescue

ATTACHMENT D

HAZUS-MH MR3 (v1.3)

Hazards U.S. Multi-Hazard (HAZUS-MH MR3 (v1.3))

Estimating economic losses is essential to decision-making at all levels of government, providing a basis for developing mitigation plans and polices, emergency preparedness, and response and recovery planning. Hazards U.S. Multi-Hazard is a powerful risk assessment software program used for analyzing potential losses from earthquakes, hurricane winds, and floods. HAZUS-MH uses state-of-the-art Geographic Information Systems (GIS) software to map and display hazard data and the results of damage and economic loss estimated for building and infrastructure. It also estimates the impact of earthquakes, hurricane winds, and floods on populations. This software was developed by Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS).

Flood Model

The HAZUS-MH Flood Model allows planners and other practitioners to carry out a wide range of flood hazard analyses, including:

- Studies of specific return intervals of floods (e.g., 100-year return interval).
- Studies of discharge frequencies, including analysis of discharges from specific streams and the exposure to buildings and population from the resultant flooding.
- Studies of annualized losses from flooding.
- Quick Look assessments, which allows the user to quickly evaluate potential flooding from specific flood depths at specific locations.
- What if scenarios, allow users to evaluate the consequences of specific actions, such as the introduction of flow regulation devices, acquisition of flood-prone properties, and other mitigation measures.

The flood loss estimation methodology consists of two modules that carry out basic analytical processes: flood hazard analysis and flood loss estimation analysis. The flood hazard analysis module uses characteristics, such as frequency, discharge, and ground elevation to estimate flood depth, flood elevation, and flow velocity. The flood loss estimation module calculates physical damage and economic loss from the results of the hazard analysis.

Flood Model Results

Once a successful region has been created and scenarios within an area have been analyzed a model output will consist of:

- General Building Stock Damage Results – By Amount of Damage from occupancy, building type (sqft) and by count.
- By Dollar Losses – Full replacement value and depreciated replacement value, building, content, and inventory losses, cost of relocation, wage and income losses, rental income loss, direct employee output losses and employment loss (days).

- Essential Facilities – Building and content losses, functionality assessment, restoration time to 100% functionality.
- Lifeline Losses (for selected components) – Losses to structures and equipment, functionality assessment.
- Vehicle Losses
- Agriculture Losses
- Shelter Requirements
- Indirect Economic Losses – Income and employment impact with and without aid by market sector, Agriculture, mining, construction, manufacturing, transpiration, trade, services, government, and miscellaneous.

HAZUS-MH Upper New River/Skunk Creek FRP Data Requirements

The Upper New River and Skunk Creek FRP project is in Maricopa County, Arizona. The region contains four census tracts; 04013030329, 04013030378, 04013030377 and 04013010100. The digital elevation model (DEM) that was used for this project was provided by the United States Geological Surveys' (USGS) National Map Seamless Server, http://seamless.usgs.gov/index.php. This map server provides free geospatial data that allows downloading of national base layers, as well as other geospatial data layers including places, structures, transportation, boundaries, hydrography, orthoimagery, land cover and elevation. The north most latitude, east most longitude, south most latitude and west most longitude were taken from the study region which defined the extent of the DEM that we needed for our project. The DEM used for this analysis was the National Elevation Data (NED) of 1 arc second (approximately 30 meters).

The Flood Information Tool (FIT), which is an ArcGIS extension, is used to process the data. The software extension needs some user supplied flood hazard data to run the analysis. For a riverine study area the FIT requires three different types of input data which include:

1.) A digital elevation model (DEM) which describes the terrain elevations and establishes cell size of all output girds.
2.) Flood elevation lines which contain populated fields for flood elevations and discharges for one or more return periods
3.) Floodplain boundaries which define the centerline of flow and act as a guide for determining the floodplain width.

For the Upper New River and Skunk Creek FRP the five areas within the FRP where FIT models were created and ran were Old Stage road at New River Road, New River Road (north of bridge), New River Road Bridge, Sweat Canyon/Doe Peak and Desert Hills Drive. The digital elevation models used in the FIT models are from the District's database and have a 10 foot resolution.

The flood elevation lines were from the District's database. The xs_fema.shp file was used which shows all the FEMA cross sections. Where there was not a defined floodway but still a treat of flooding (like on Old Stage Road north of the New River bridge) the FEMA NFIP flood profiles, summary of discharges, and floodway data were used to get the flood elevations for a 100-year storm event.

The floodplain boundaries that were used were also from the District's database. The femafloodplain.shp file was used which shows all of the FEMA floodplains. There is a pending floodplain in the Gavilan Peak Wash sub-basin which does have a shape file but was not used in the analysis because the shape file will not be finalized and added to the FEMA floodplain shape file until the project has been officially finalized by FEMA.

Once the correct information for the specific project is opened within ArcView, the user picks the appropriate floodplain boundary to run the analysis. Once that analysis is completed a backwater analysis can be done on any specific area within the chosen floodplain boundary.

After getting the results for each individual FIT model, the results were input into the HAZUS-MH Flood Model for Upper New River and Skunk Creek FRP.

HAZUS requires the user to input specific user data for a region. The DEM for the region is added to the project as the base topography. The results from all five of the FIT models are added as well as the five depth elevation grids created from the FIT analysis.

Upper New River and Skunk Creek Flood Response Plan Region

The Upper New River and Skunk Creek Flood Response Plan area was defined in HAZUS as one study region. Within this region two scenarios were created - the Upper New River and Deadman Wash scenario and the Skunk Creek and Tributaries scenario.

The stream network that was developed for the region (both scenarios) was defined as any watercourse that had drainage of 0.25 square miles or more. The smallest stream network allowed by HAZUS is 0.25 square mile. The most detailed stream network was used in this region to make sure watercourses like Gavilan Peak Wash, which is a pending floodplain, was identified. Once the stream network was defined the hydrologic analysis can be run and the floodplains can be delineated for areas up to 10 square miles.

Prior to running the final analysis on the two scenarios, some of the inventory data was revised to make the default data more accurate. The latitude and longitude for the New River Elementary School was revised and the ID is now US00001. There are four new fire stations added to the inventory data. These include City of Peoria #199 ID US00001, City of Phoenix #56 ID US00002, Daisy Mountain #141 ID US00003 and Daisy Mountain #142 ID US00004. Some of the default HAZUS bridge data needed to be deleted because the latitude and longitude where incorrect. These bridges included; AZ002602, AZ002583, AZ002598, AZ002596, AZ002594, AZ002592, AZ002581 and AZ007275. Some of the default HAZUS bridge latitude and longitude data needed to be revised. The HAZUS file was deleted and a new file was created using all the same data except with the exception of the revised longitude and latitude data. These revised bridge files include; AZ07291 to US00001, AZ007274 to US00002, AZ001248 to US00003, AZ001250 to US00004, AZ001246 to US00005, AZ001247 to US00006, AZ001252 to US00007, AZ001254 to US00008, AZ002712 to US00009, AZ000159 to US00010, AZ000764 to US00011 and AZ001244 to US00012. The analysis did not include any bridges along Carefree Highway (SR74) because they were out of the study region due to the location of the census tracts. The Flood Event Summary Report was run before and after the revisions were made to the inventory data. After careful review, it was concluded that these minor revisions did not make any difference in the final analysis.

Results for Upper New River Watershed

The Upper New River and Deadman scenario was created for the Upper New River watershed. The river reaches included within this scenario are New River, Gavilan Peak Wash and Tributaries, Upper Deadman, Sweat Canyon/Doe Peak, West Tributaries and Lower Deadman. Of all the defined river reaches within the Upper New River watershed that had 0.25 miles square miles of drainage or more, 106 where analyzed. The max recommended amount of reaches to be analyzed within one study region is 150. The 106 reaches that were chosen were the main stream reaches or upstream of an area with road crossings or structures in danger in the event of a flood. After the hydrology was completed for the 106 river reaches, floodplains were delineated for the 10 year, 50 year, 100 year, 200 year and 500 year return periods. The results and totals in this summary are based on the 100 year flood results generated by HAZUS (the Flood Event Reports and the Quick Assessment Reports for all the return periods analyzed are included in Appendix E. The Inventory Summary Reports are also included in Appendix E).

Results for Skunk Creek Watershed

The Skunk Creek and Tributaries scenario was created for the Skunk Creek watershed. The river reaches included within this scenario are Skunk Creek, Tributary 6B, Tributary 6C, Tributary 10A, Tributary 10B Tributary 12, Cline Creek, Tributary C6, Tributary X4B, Tributary X4A, Tributary X3, Tributary X2, Tributary X1, Tributary C8, Rodger Creek, Skunk Tank Wash and Valley Wash. Out of these river reaches all 110 were analyzed and a floodplain delineation was created. The return periods analyzed were 10 year, 50 year, 100 year, 200 year and 500 year. The results and totals in this summary are based on the 100 year flood results generated by HAZUS (the Flood Event Reports and the Quick Assessment Reports for all the return periods analyzed are included in Appendix E. The Inventory Summary Reports are also included in Appendix E).

General Description of Upper New River/Skunk Creek FRP Study Region

The Upper New River and Skunk Creek FRP region included four census tracts which covered the Upper New River and Skunk Creek watersheds. The geographical size of the region is 1,226 square miles and this area contains 977 census blocks. There are over 6,000 households and a total population of 17,221 people (2000 Census).

Study Region for Upper New River/Skunk Creek Flood Response Plan

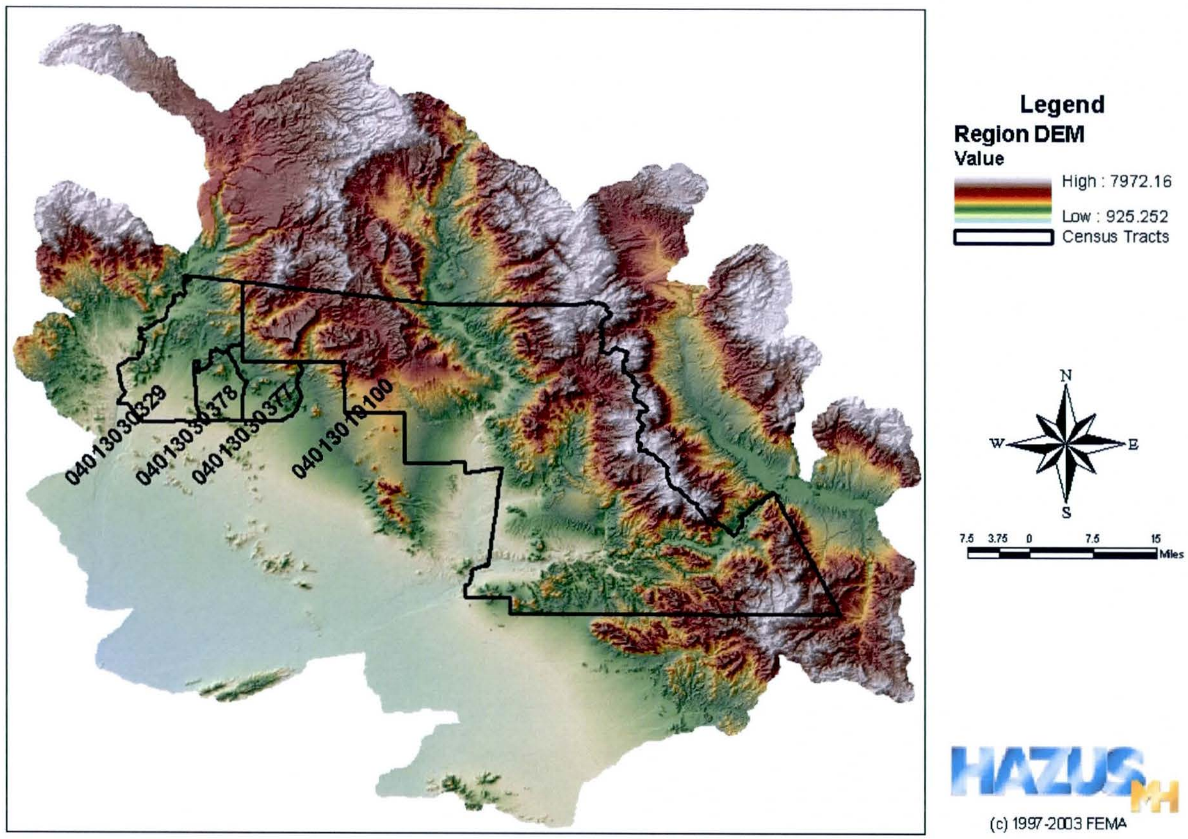


Figure 39: Study Region for the Upper New River/Skunk Creek Flood Response Plan

Upper New River/Skunk Creek FRP Study Region Building Inventory

HAZUS estimates that within the Upper New River and Skunk Creek FRP region there are 9,163 buildings with a total building replacement value (excluding contents) of 1,891 million dollars. Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing. Table 25 shows the relative distribution of the value with respect to general occupancies by the Study Region. There are no hospitals, 3 schools, 6 fire stations, no police stations, and no emergency operation centers within this study region.

Table 24: Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	1,890,570	100.0%

Upper New River and Deadman Wash Study Case/Scenario

Total estimates for the Upper New River and Deadman Study Case/Scenario are shown in below:

Upper New River and Deadman Wash: 100-Year Flood Event

- Total economic loss 15.22 million dollars
  - Residential 6.51 million dollars
  - Commercial 4.90 million dollars
  - Industrial 0.79 million dollars
  - Other 3.01 million dollars
- 31 buildings moderately damaged
- 2 buildings completely destroyed
- 1,444 tons of debris will be generated
- 132 households displaced
- 184 people in need of shelter

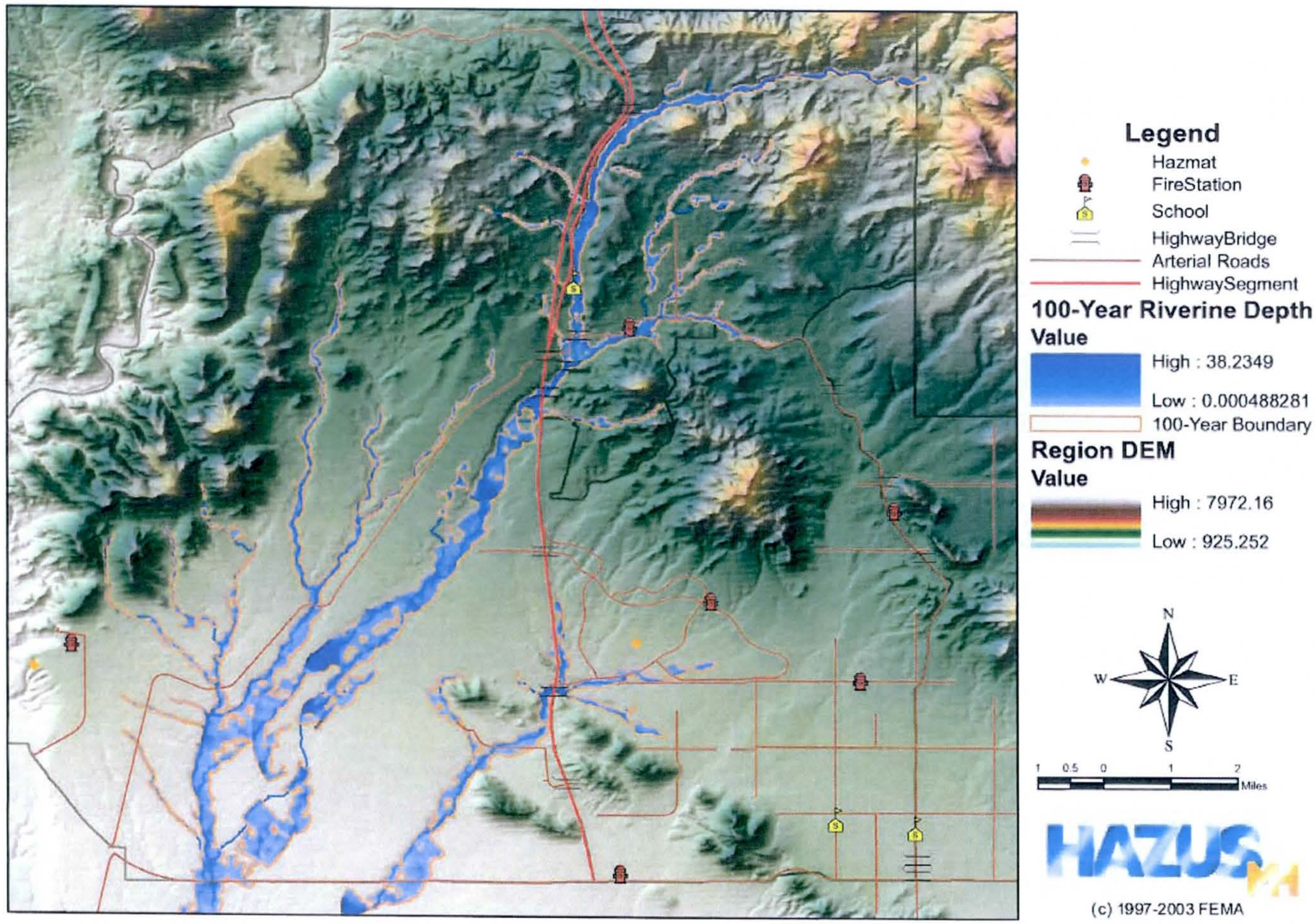


Figure 40: Upper New River and Deadman Wash: 100- Year Flood Event

Upper New River and Deadman Wash Study Case/Scenario Building Damage

In a 100-year flood event HAZUS estimates that 31 buildings will be at least moderately damaged. This is over 35% of the total number of buildings in this study case. There are an estimated 2 buildings that will be completely destroyed. Table 26 shows the relative distribution of the value with respect to general occupancies by the Study Case/Scenario. Table 27 summarizes the expected damage by general occupancy for the buildings in the Study Case/Scenario. Table 28 summarizes the expected damage by general building type. Table 29 summarizes the expected damage to essential facilities.

Table 25: Building Exposure by Occupancy Type for UNR/DW Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	268,322	78.4%
Commercial	54,178	15.8%
Industrial	8,550	2.5%
Agricultural	1,613	0.5%
Religion	3,272	1.0%
Government	3,187	0.9%
Education	3,058	0.9%
Total	**342,180**	**100.0%**

Table 26: Expected Building Damage by Occupancy for UNR/DW Scenario

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	6.45	17	54.84	5	16.13	5	16.13	2	6.45
Total	**0**		**2**		**17**		**5**		**5**		**2**	

Table 27: Expected Building Damage by Building Type for UNR/DW Scenario

Building Type	1-10 Count	1-10 (%)	11-20 Count	11-20 (%)	21-30 Count	21-30 (%)	31-40 Count	31-40 (%)	41-50 Count	41-50 (%)	Substantially Count	Substantially (%)
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	100.00
Masonry	0	0.00	0	0.00	7	87.50	0	0.00	1	12.50	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	9.52	10	47.62	5	23.81	4	19.05	0	0.00

Table 28: Expected Damage to Essential Facilities for UNR/DW Scenario

		Number of Facilities		
Classification	**Total**	**At Least Moderate**	**At Least Substantial**	**Loss of Use**
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	1	0	0

Upper New River and Deadman Wash Study Case/Scenario Induced Flood Damage

HAZUS estimates that a total of 1,444 tons of debris will be generated. Of that total amount dry wall, insulation, etc. comprised 51% and wood, brick, etc. comprises of 22% of the total. This debris will require 58 truckloads (@25tons/truck) to remove the debris generated by the flood.

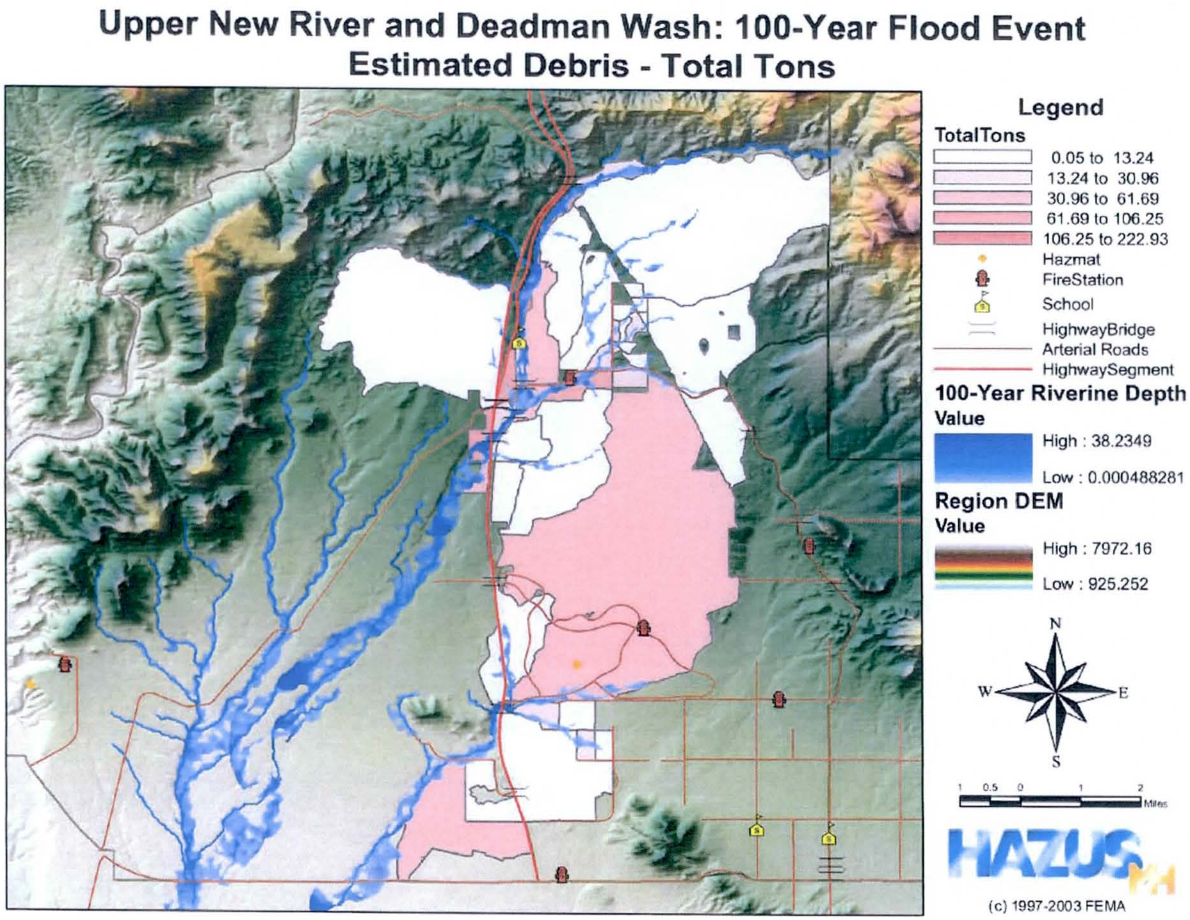


Figure 41: HAZUS Upper New River Debris Total Tons

Upper New River and Deadman Wash Study Case/Scenario Social Impacts

HAZUS estimates 132 households will be displaced due to the flood. Displacement included households evacuated from within or very near the inundated area. Of these, 184 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

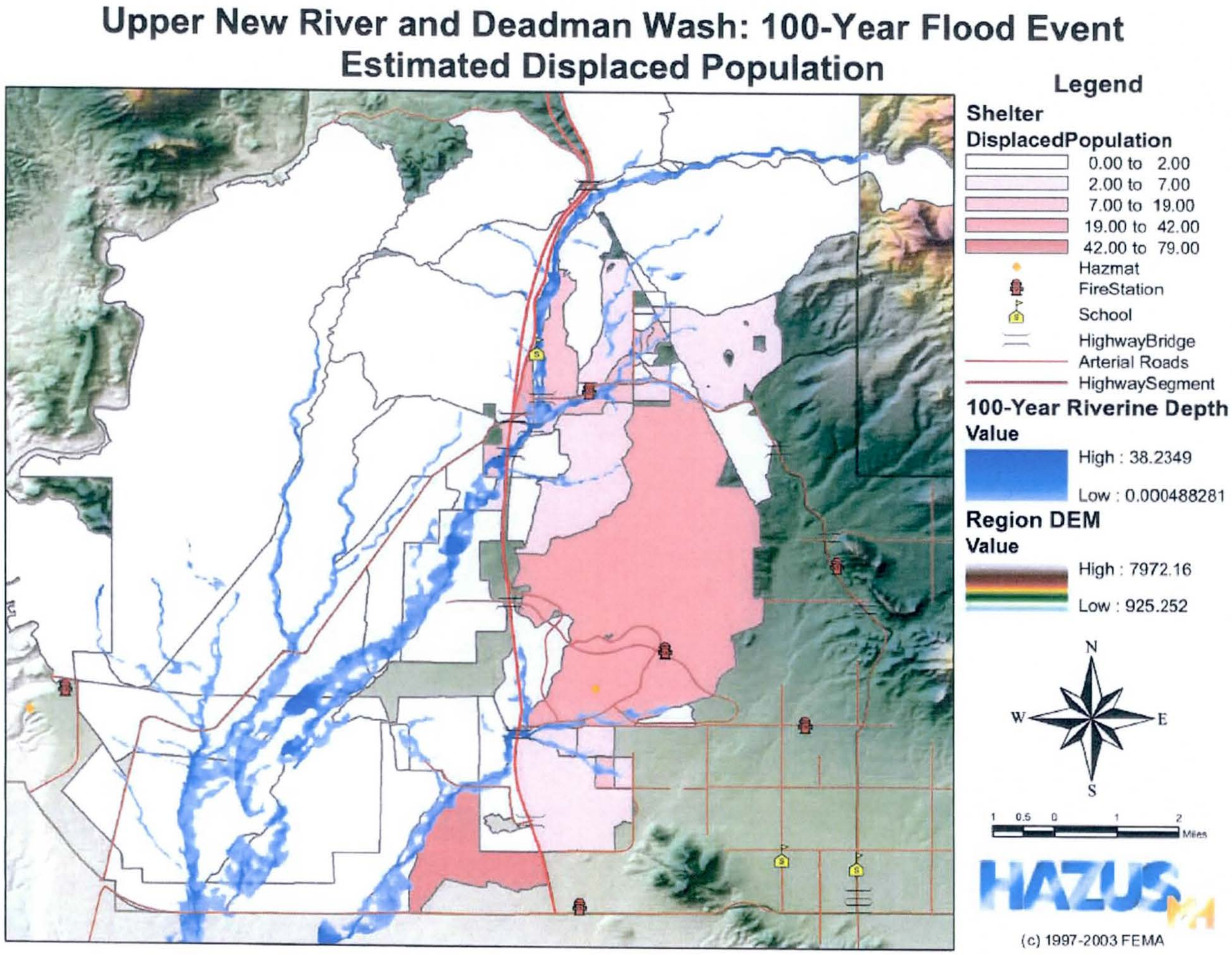


Figure 42: HAZUS Upper New River Displaced Population

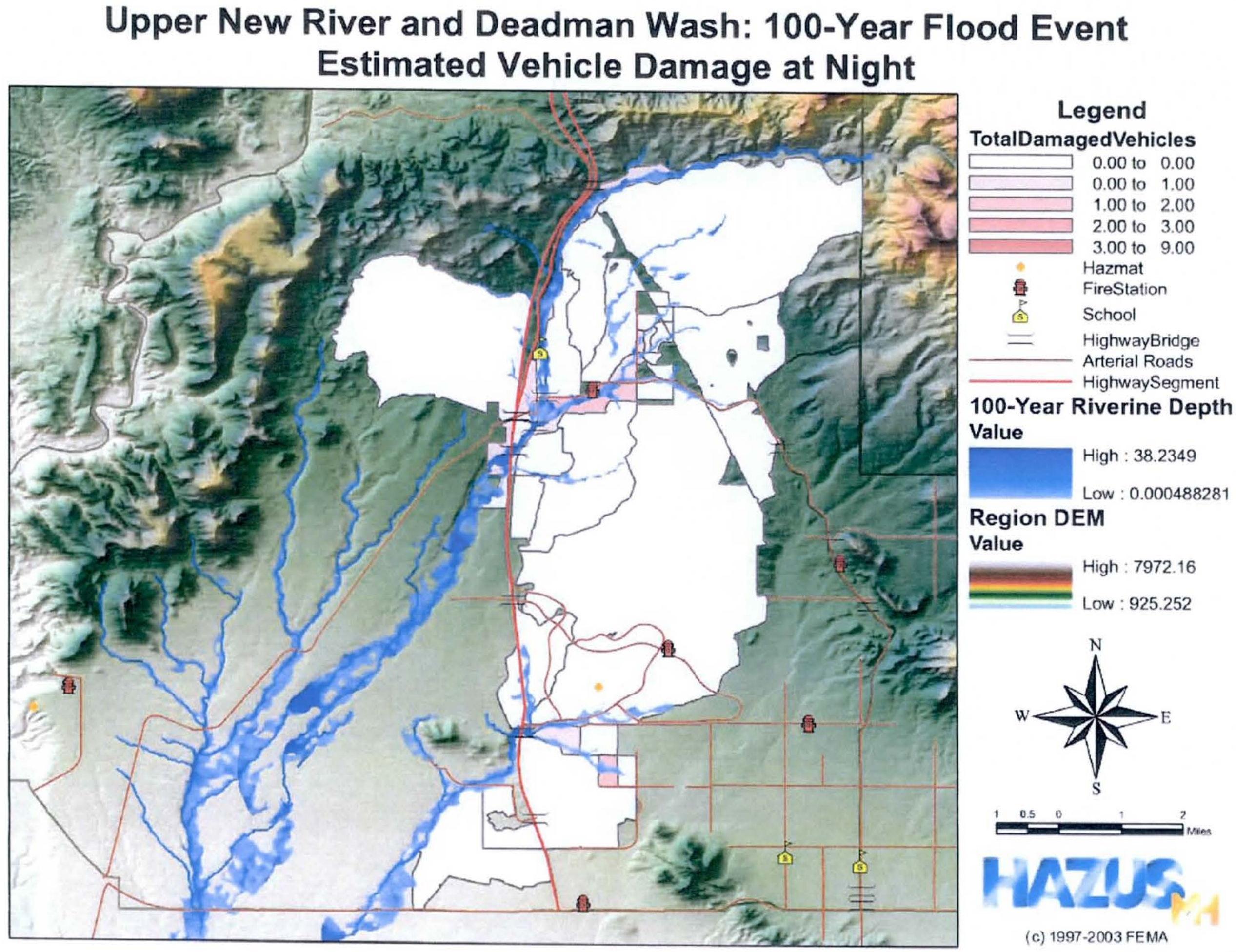


Figure 43: HAZUS Upper New River Vehicles Damaged at Night

Upper New River and Deadman Wash Study Case/Scenario Economic Loss

The total economic loss estimated for the flood is 15.22 million dollars. The total building-related losses were 14.92 million dollars. 2% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.8% of the total loss. Table 30 provides a summary of the losses associated with building damage.

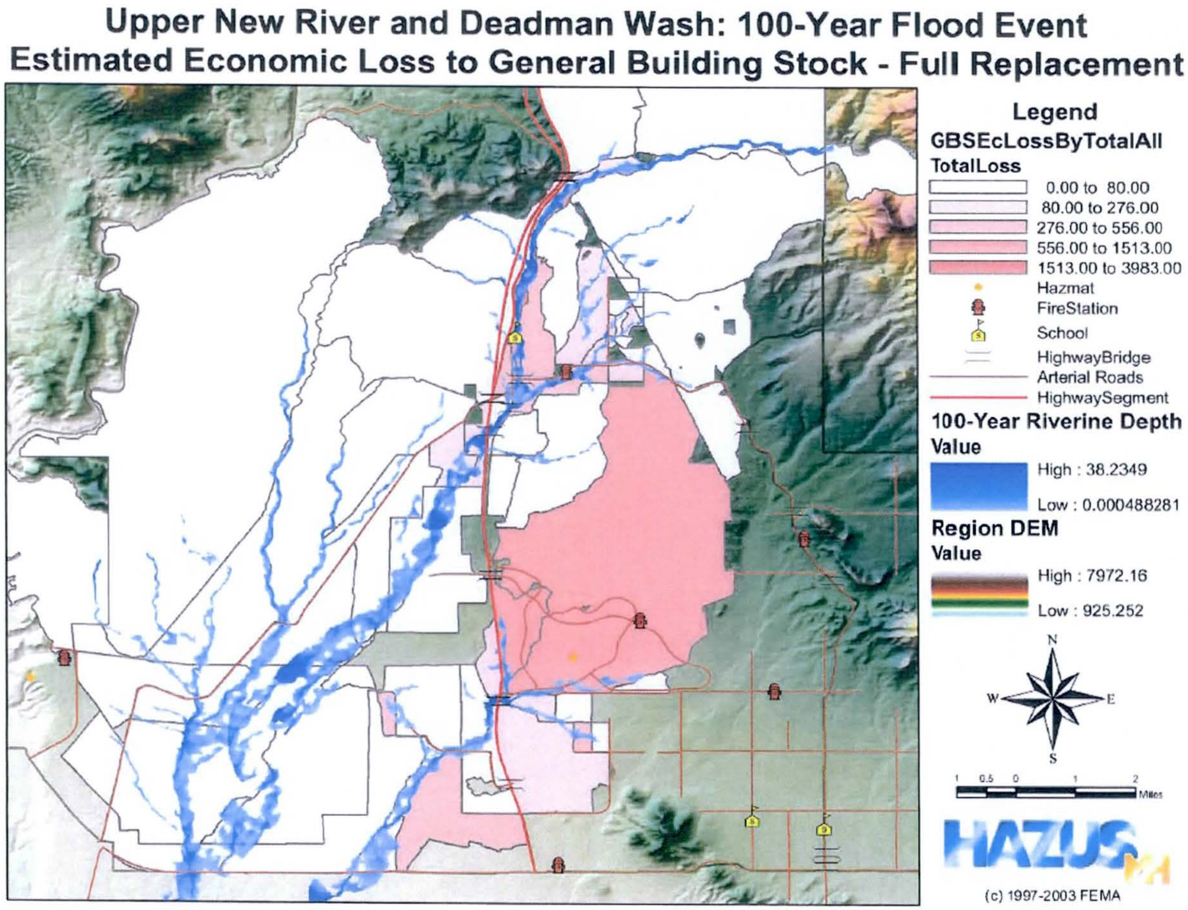


Figure 44: HAZUS Upper New River Economic Loss to GBS

Table 29: Building-Related Economic Loss Estimates (Millions of Dollars) for UNR/DW Scenario

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.92	1.39	0.22	0.51	6.04
	Content	2.58	3.38	0.47	2.21	8.65
	Inventory	0.00	0.07	0.11	0.05	0.23
	Subtotal	**6.51**	**4.85**	**0.79**	**2.77**	**14.92**
Business Interruption						
	Income	0.00	0.03	0.00	0.02	0.05
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.21	0.23
	Subtotal	**0.01**	**0.06**	**0.00**	**0.23**	**0.30**
ALL	**Total**	**6.51**	**4.90**	**0.79**	**3.01**	**15.22**

Depth of Floodwaters at Road Crossings in the Upper New River and Deadman Wash Study Case/Scenario

The following tables show estimates of the depth of the flood water at four particular at-grade road crossings within the Upper New River and Deadman Wash scenario. The depths were derived using the ArcView GIS riverine depth raster file created by HAZUS during the floodplain delineation analysis.

Table 30: HAZUS New River Floodwater Depths at At-Grade Crossings

New River @ Sweat Canyon/Doe Peak			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	6.2	3.5	177
50	9.81	7.14	178
100	11.33	3.7	693
200	9.9	2.7	950
500	10.5	3.4	1035

New River @ Old Stage Road			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	4.4	3.7	410
50	8.5	5.96	532
100	9.9	7.9	535
200	9.3	5.91	655
500	11.98	7.8	756

New River @ West Tributaries			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	7.38	4.19	174
50	8.08	5.23	350
100	8.3	4.96	430
200	9.1	5.68	437
500	10.9	5.9	607

Gavilan Peak Wash @ Meander Road			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	1.9	1.1	188
50	3.3	2.65	550
100	4.8	3.75	707
200	5.7	4.24	712
500	8	5.5	964

Totals for Skunk Creek and Tributaries Study Case/Scenario

- Total economic loss 25.43 million dollars
  - Residential 14.64 million dollars
  - Commercial 6.62 million dollars
  - Industrial 2.14 million dollars
  - Other 2.03 million dollars
- 56 buildings moderately damaged
- 0 buildings completely destroyed
- 1,547 tons of debris will be generated
- 258 households displaced
- 261 people in need of shelter

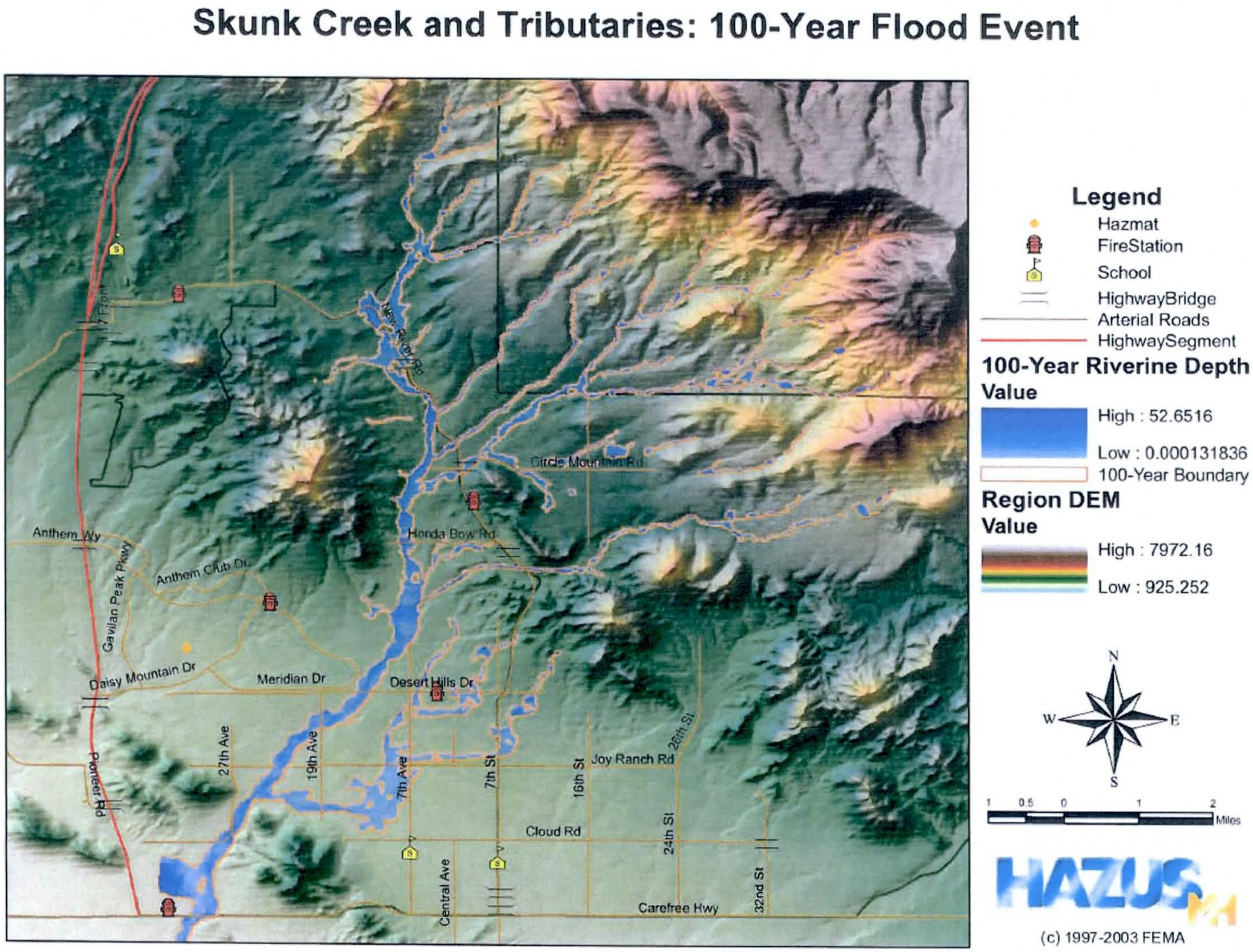


Figure 45: Skunk Creek and Tributaries: 100-Year Flood Event

Skunk Creek and Tributaries Study Case/Scenario Building Damage

In a 100-year flood event HAZUS estimates that 56 buildings will be at least moderately damaged. This is over 31% of the total number of buildings in this study case. There are an estimated 0 buildings that will be completely destroyed. Table 32 summarizes the expected damage by general occupancy for the buildings in the region. Table 33 summarizes the expected damage by general building type. Table 34 summarizes the expected damage to essential facilities. Table 35 summarized the expected damage to essential facilities.

Table 31: Building Exposure by Occupancy Type for SC Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	429,004	84.5%
Commercial	56,293	11.1%
Industrial	12,274	2.4%
Agricultural	4,531	0.9%
Religion	3,549	0.7%
Government	663	0.1%
Education	1,678	0.3%
Total	**507,992**	**100.0%**

Table 32: Expected Building Damage by Occupancy for SC Scenario

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	3.47	37	66.07	5	8.93	12	21.43	0	0.00
Total	**0**		**2**		**37**		**5**		**12**		**0**	

Table 33: Expected Building Damage by Building Type for SC Scenario

Building Type	1-10 Count	1-10 (%)	11-20 Count	11-20 (%)	21-30 Count	21-30 (%)	31-40 Count	31-40 (%)	41-50 Count	41-50 (%)	Substantially Count	Substantially (%)
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	9	75.00	1	8.33	2	16.67	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	4.55	28	63.64	4	9.09	10	22.73	0	0.00

Table 34: Expected Damage to Essential Facilities for SC Scenario

		Number of Facilities		
Classification	**Total**	**At Least Moderate**	**At Least Substantial**	**Loss of Use**
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	0	0	0

Skunk Creek and Tributaries Scenario Induced Flood Damage

HAZUS estimates that a total of 1,547 tons of debris will be generated. Of that total amount dry wall, insulation, etc. comprised 65% and wood, brick, etc. comprises of 15% of the total. This debris will require 62 truckloads (@25tons/truck) to remove the debris generated by the flood.

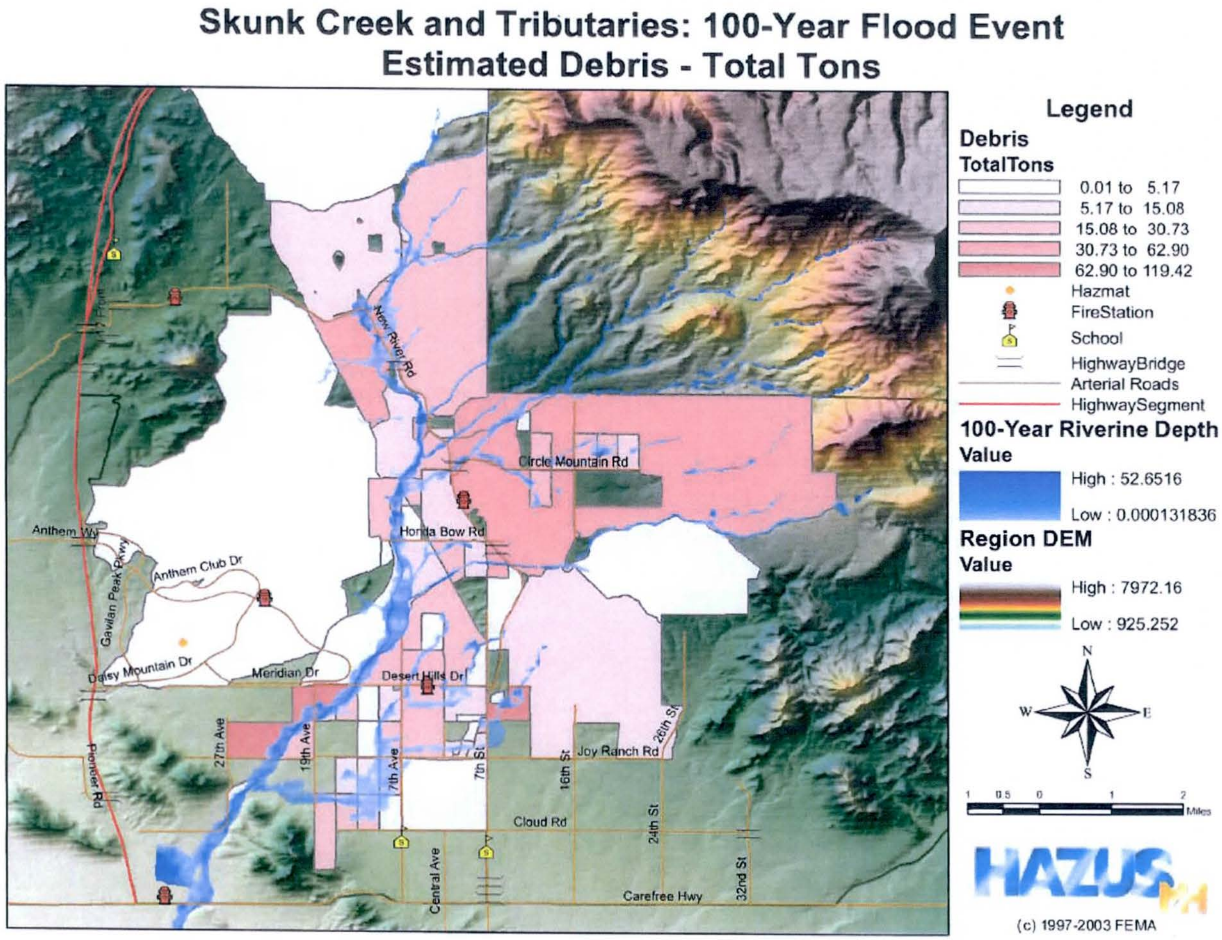


Figure 46: HAZUS Skunk Creek Debris Total Tons

Social Impacts

HAZUS estimates 258 households will be displaced due to the flood. Displacement included households evacuated from within or very near the inundated area. Of these, 261 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

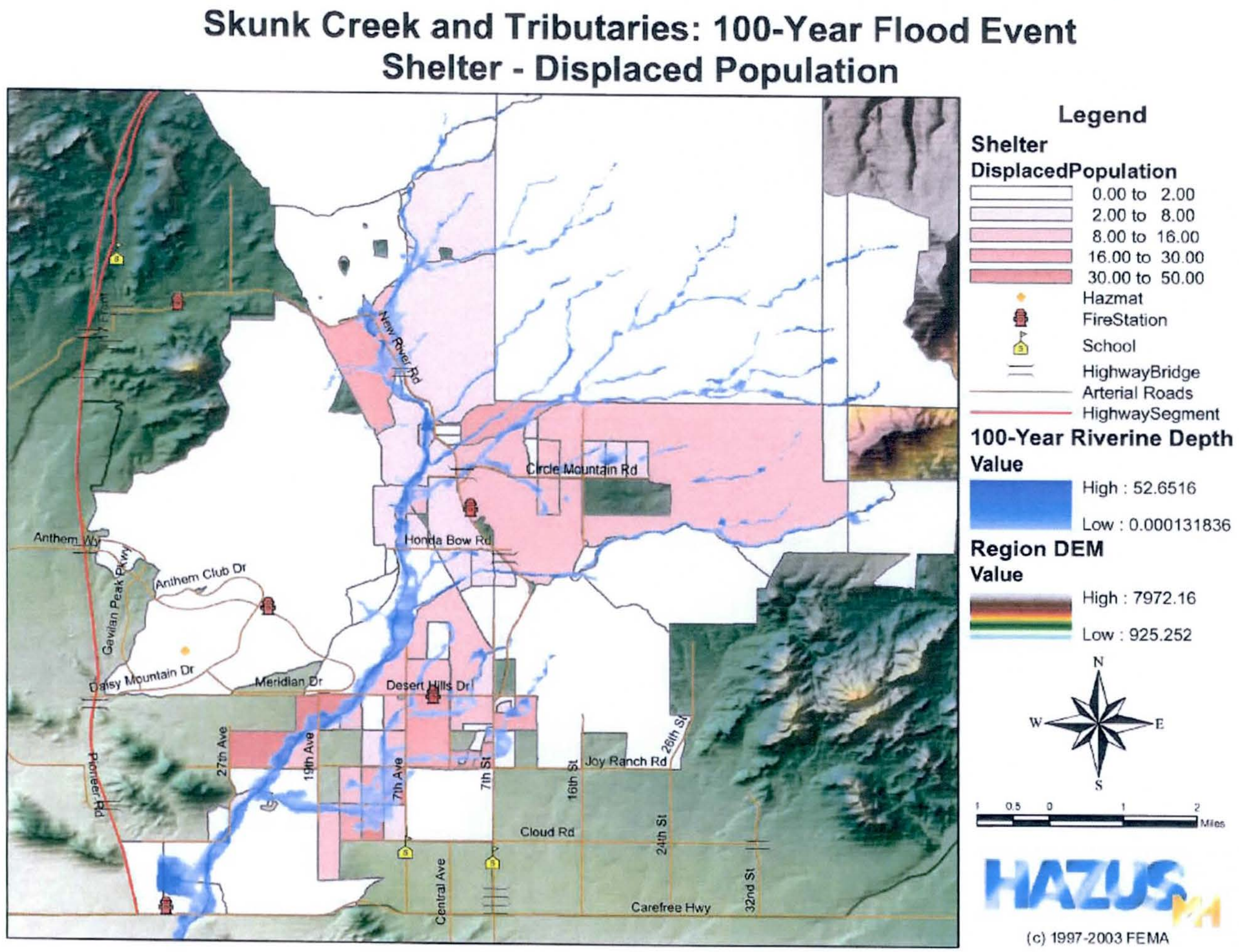


Figure 47: HAZUS Skunk Creek Displaced Population

Skunk Creek and Tributaries: 100-Year Flood Event
Estimated Vehicle Damage at Night

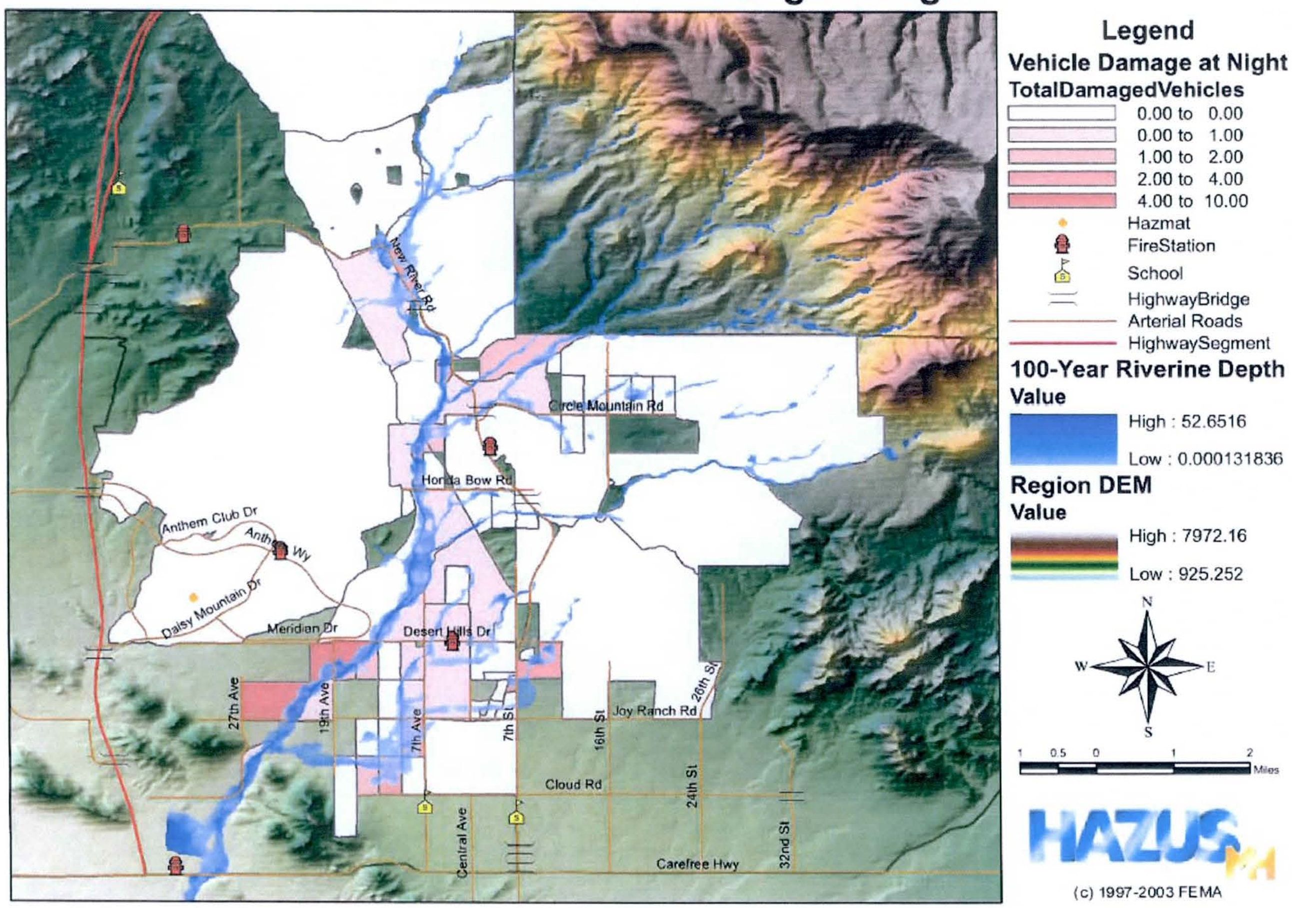


Figure 48: HAZUS Skunk Creek Vehicle Damage at Night

Skunk Creek and Tributaries Study Case/Scenario Economic Loss

The total economic loss estimated for the flood is 25.43 million dollars. The total building-related losses were 25.30 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 57.58% of the total loss. Table 36 provides a summary of the losses associated with building damage.

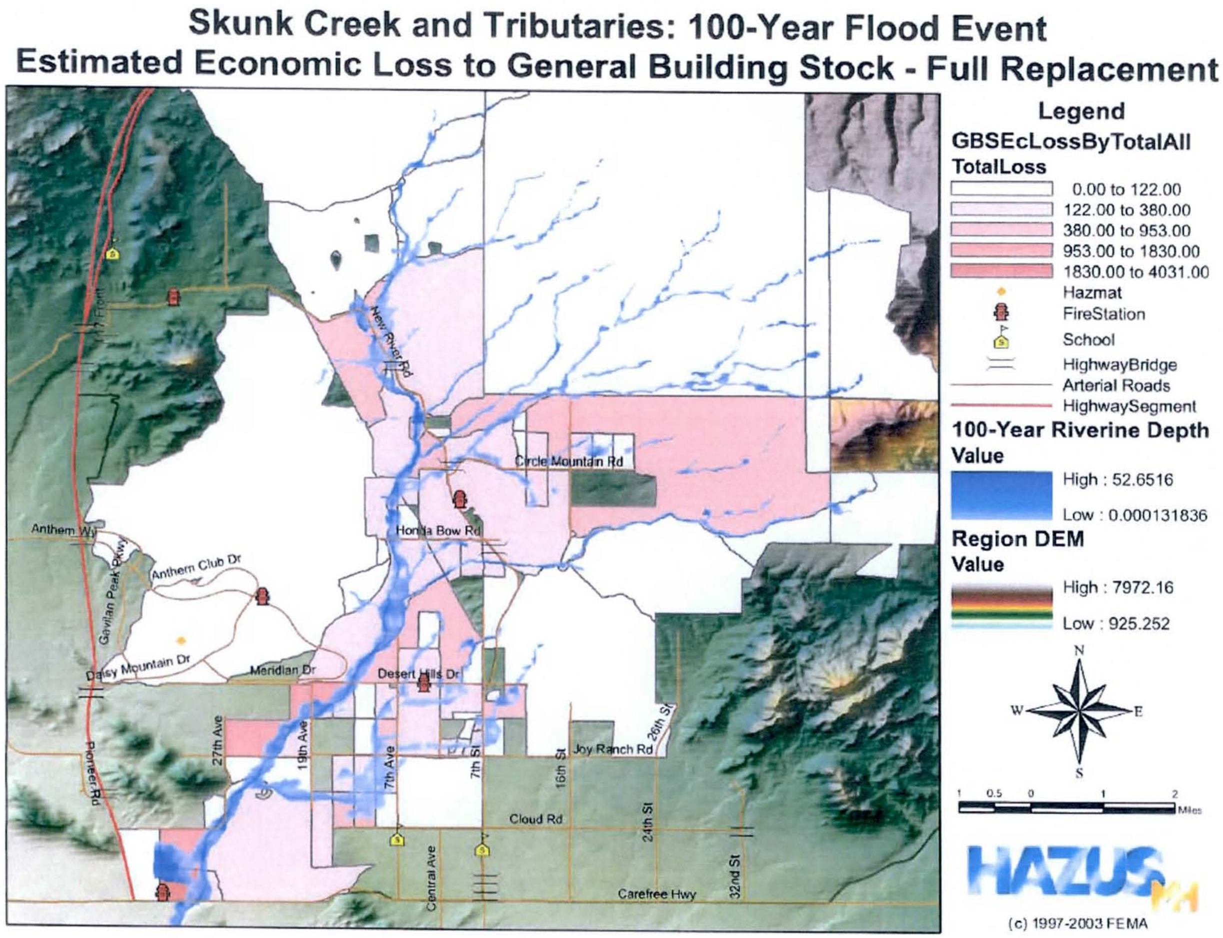


Figure 49: HAZUS Skunk Creek Economic Loss GBS

Table 35: Building-Related Economic Loss Estimates (Millions of Dollars) for SC Scenario

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	9.07	1.90	0.75	0.36	12.08
	Content	5.55	4.50	1.17	1.49	12.70
	Inventory	0.00	0.17	0.22	0.13	0.52
	Subtotal	**14.62**	**6.56**	**2.14**	**1.98**	**25.30**
Business Interruption						
	Income	0.00	0.03	0.00	0.01	0.04
	Relocation	0.02	0.00	0.00	0.00	0.03
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.04	0.06
	Subtotal	**0.02**	**0.06**	**0.00**	**0.05**	**0.13**
ALL	**Total**	**14.64**	**6.62**	**2.14**	**2.03**	**25.43**

Depth of Floodwaters at Road Crossings in the Skunk Creek and Tributaries Case Study/Scenario

The following tables show estimates of the depth of the flood water at seven particular at-grade road crossings within the Skunk Creek and Tributaries scenario. The depths were derived using the ArcView GIS riverine depth raster file created by HAZUS during the floodplain delineation analysis.

Table 36: HAZUS Skunk Creek Floodwater Depth at At-Grade Crossings

Skunk Creek @ Fig Springs Road			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	2.55	1.93	490
50	3.3	1.96	860
100	4.1	2.82	960
200	4.3	2.99	985

500	5.7	4.59	1075

Skunk Creek @ Zorrillo Drive			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	4.7	3.57	205
50	7.9	6.13	173
100	9.8	5.45	372
200	8.1	5.15	260
500	11.8	8.15	265

Skunk Creek @ Shangri La Lane			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	4.9	3.30	316
50	6.5	4.03	560
100	8.3	5.08	620
200	14.9	10.86	771
500	17.98	9.36	1682

Cline Creek @ 3rd Avenue			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	2.8	2.00	169
50	3.8	2.78	765
100	4.1	2.12	847
200	4.7	2.87	938
500	4.9	3.41	767

Skunk Creek @ Honda Bow Road			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	9.6	6.60	595
50	11.9	6.03	938

100	11.8	6.13	1025
200	11.5	6.14	1025
500	15.2	7.23	1280

Skunk Creek @ Desert Hills Drive			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	4.65	2.86	682
50	7.3	4.82	768
100	7.9	5.07	935
200	7.8	4.60	1104
500	10.1	5.31	1530

Skunk Creek @ 19th Avenue			
Return Period	Greatest Depth (ft)	Average Depth (ft)	Width of Floodplain at Crossing (ft)
10	5.7	3.21	940
50	6.0	4.23	1111
100	6.8	4.87	1193
200	7.8	4.99	1447
500	9.0	4.98	2035

Total Results for the Upper New River and Skunk Creek FRP 100-Year Event

Since the Upper New River and Skunk Creek FRP covered two watersheds two case studies/scenarios needed to be created. The results from both scenarios need to be combined for the correct estimations for the Upper New River and Skunk Creek FRP losses.

When combining the results of both scenarios the building-related economic loss estimated for residential buildings is 21.15 million dollars, for commercial buildings is 11.52 million dollars, for industrial buildings is 2.93 million dollars, and for other buildings is 5.04 million dollars. This leaves the Upper New River and Skunk Creek FRP area with a total economic loss is estimated at 40.65 million dollars.

An estimated total of 87 buildings will be moderately damaged and 2 buildings will be completely destroyed, 2,991 tons of debris will be generated, 390 households will be displaced and 445 people will be in need of shelter.

Impacts of a Flood Warning System

With an effective flood warning system damage and losses throughout a community can be reduced. HAZUS-MH can estimate what percentage of losses can be avoided with an effective flood warning system. The Flood Model within HAZUS-MH uses the Day curve developed by the United States Army Corps of Engineers (USACE). This curve attempts to quantity the maximum level of damage reduction achievable based on the amount of time a flood warning has been available. The Day curve indicates a maximum loss reduction of 35% of total damage (e.g. structural, content and business inventory losses), and assumes a public response rate of 100%. The Flood Model also provides and input parameter to allow the user to account for the potential reduction of vehicle losses due to warning with a loss reduction up to 100%. The following figure (Figure 55) is a Day curve based on a scenario of riverine flooding in residential areas.

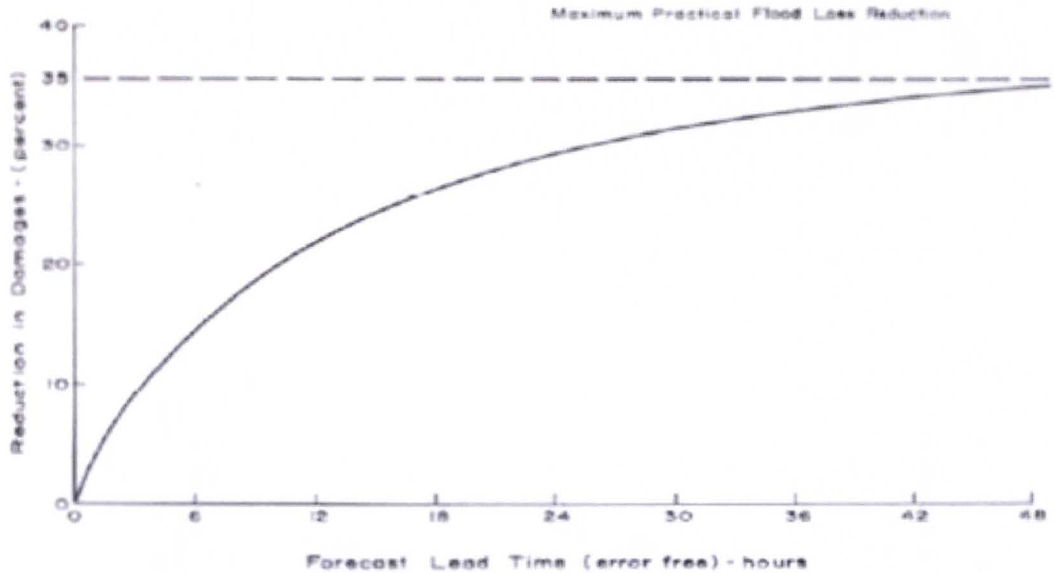


Figure 50: Day Curve for Residential Areas (Source: USACE, New York District, 1984)

The values selected for the Upper New River/Skunk Creek FRP HAZUS-MH Flood Warning were chosen assuming that the FRP plan was used and executed by the involved agencies in a timely manner. The reduction in damage to the structures, contents and business loss is estimated a 22% which accounts for a 12 hour forecast lead time. The amount of vehicles removed from the floodplains was estimated at 100%.

With an effective flood warning system the economic benefit would result in a savings of $12,012,833.00. This would be a 27.48% reduction and further illustrates the importance of an effective flood warning system.

For the Upper New River/Skunk Creek FRP area (both the New River and Deadman Wash Study Case/Scenario and Skunk Creek and Tributaries Study Case/Scenario) the direct economic loss was estimated at $40,646,000.00. With a 22% reduction in damage to the structures, contents and business the loss would be reduced to $31,703,880.00. The expected economic loss for vehicles (both night and day time) was estimated at $3,070,713.00. With a 100% reduction in vehicle loss that number would be reduced to 0%. An effective flood warning could reduce the total economic loss and vehicle loss from $43,716,713.00 to $31,703,880.00 for this FRP area. Figure 56 summarizes the total economic savings from a flood warning system within the Upper New River/Skunk Creek FRP.

Table 37: Total Economic Savings from a Flood Warning System within the Upper New River/Skunk Creek FRP

	Building Loss and Business Interruption	Vehicle Damage Day	Vehicle Damage Night	Total Building Loss, Business Loss and Vehicle Loss)
No Flood Warning				
Upper New River and Deadman Wash	$25,430,000.00	$266,168.00	$572,604.00	
Skunk Creek and Tributaries	$15,216,000.00	$768,106.00	$1,463,835.00	
Total	**$40,646,000.00**	**$1,034,274.00**	**$2,036,439.00**	**$43,716,713.00**
With Flood Warning				
Upper New River and Deadman Wash	$19,835,400.00	$0.00	$0.00	
Skunk Creek and Tributaries	$11,868,480.00	$0.00	$0.00	
Total	**$31,703,880.00**	**$0.00**	**$0.00**	**$31,703,880.00**
Total Economic Savings from a Flood Warning System	**$8,942,120.00**	**$1,034,274.00**	**$2,036,439.00**	**$12,012,833.00**

Upper New River and Skunk Creek FRP Study Region Inventory Summary Reports

The Upper New River and Skunk Creek FRP Region consisted of four census tracts in which the Upper New River watershed and the Skunk Creek watershed were located within. These are the Region Inventory Summary Report results estimated by HAZUS for the Upper New River and Deadman Wash and Skunk Creek and Tributaries scenarios.

Building Stock Exposure by Building Type (all values in thousands of dollars)

Wood	1,010,913
Steel	96,640
Concrete	53,759
Masonry	697,994
Manufactured Housing	31,254
Total	1,890,560

Building Stock Exposure by General Occupancy (all values are in thousands of dollars)

Residential	1,599,311
Commercial	226,104
Industrial	33,045
Agriculture	10,127
Religion	10,647
Government	4,522
Education	6,814
Total	1,890,570

Transportation System Dollar Exposure (all values in thousands of dollars)

Highway	834,160.95
Railway	119.70
Light Rail	0.00
Bus Facility	0.00
Ports	0.00
Ferries	0.00
Airport	34,703.50
Total	868,984.15

Utility System Dollar Exposure (all values in thousands of dollars)

Total	0.00

Vehicle Dollar Exposure (Day) (all values in dollars)

Cars	25,413,966
Light Trucks	10,687,331
Heavy Trucks	19,783,488
Total	55,884,785

Vehicle Dollar Exposure (Night) (all values in dollars)

Cars	55,811,081
Light Trucks	23,470,225
Heavy Trucks	43,446,107
Total	122,727,413

Upper New River and Deadman Case Study/Scenario Inventory Summary Reports

The Upper New River and Deadman scenario inventory summary reports are below. These totals reflect HAZUS estimations of inventory within the Upper New River watershed.

Building Damage by Building Type (all values are in thousands of square feet)

All Types with No Damage	55.0
All Types with 1-10% Damage	13.0
All Types with 11-20% Damage	49.0
All Types with 21-30% Damage	59.0
All Types with 31-40% Damage	22.0
All Types with 41-50% Damage	21.0
All Types with Substantial Damage	11.0

Building Damage By General Occupancy (all values are in thousands of square feet)

All Types with No Damage	72.22
All Types with 1-10% Damage	17.19
All Types with 11-20% Damage	60.21
All Types with 21-30% Damage	66.75
All Types with 31-40% Damage	32.19
All Types with 41-50% Damage	28.94
All Types with Substantial Damage	26.43
Total Square Footage	303.93

Building Damage By General Occupancy Post-FIRM

None

Building Damage By General Occupancy Pre-FIRM (all values are in thousands of square feet)

All Types with No Damage	72.22
All Types with 1-10% Damage	17.19
All Types with 11-20% Damage	60.21
All Types with 21-30% Damage	66.75
All Types with 31-40% Damage	32.19
All Types with 41-50% Damage	28.94
All Types with Substantial Damage	26.43
Total Square Footage	303.93

Building Damage Count By General Building Type (number of buildings)

All Types with No Damage	24
All Types with 1-10% Damage	0
All Types with 11-20% Damage	2
All Types with 21-30% Damage	17
All Types with 31-40% Damage	5
All Types with 41-50% Damage	5

All Types with Substantial Damage	2
Total	55

Building Damage Count By General Occupancy

All Types with No Damage	24
All Types with 1-10% Damage	0
All Types with 11-20% Damage	2
All Types with 21-30% Damage	17
All Types with 31-40% Damage	5
All Types with 41-50% Damage	5
All Types with Substantial Damage	2
Total	55

Building Damage Count by General Occupancy Post-Firm

None

Building Damage Count by General Occupancy Pre-Firm

All Types with No Damage	24
All Types with 1-10% Damage	0
All Types with 11-20% Damage	2
All Types with 21-30% Damage	17
All Types with 31-40% Damage	5
All Types with 41-50% Damage	5
All Types with Substantial Damage	2
Total	55

Emergency Operation Center Damage and Functionality

None

Fire Station Facilities Damage and Functionality

None

Care Facilities (Hospital) Damage and Functionality

None

Police Station Facilities Damage and Functionality

None

School Damage and Functionality (dollar values are in thousands)

Count of Schools	1
Total Building Damage	149.08
Total Content Damage	465.80
Non-Functional Schools	0
Average Restoration Time	900 (hours)

Highway Bridge Damage and Functionality
None

Light Rail Bridge Damage and Functionality
None

Potable Water System Facility Damage
None

Railroad Damage and Functionality
None

Waste Water Facility Damage
None

Debris Summary Report (all values are in tons)

Finishes	731
Structures	314
Foundations	399
Total	1,444

Direct Economic Annualized Losses for Buildings (all values are in thousands of dollars)

Cost Building Damage	6,040
Cost Contents Damage	8,646
Inventory Loss	234
Building Loss Ratio %	1.8
Relocation Loss	12
Capital Related Loss	47
Wages Losses	234
Rental Income Loss	3
Total Loss	15,216

Depreciated Direct Economic Losses for Buildings (all values are in thousands of dollars)

Cost Building Damage	4,512
Cost Contents Damage	6,501
Total Loss	11,013

Direct Economic Loss for Agriculture Products
None

Direct Economic Losses for Buildings (all values are in thousands of dollars)

Cost Building Damage	6,040
Cost Contents Damage	8,646
Inventory Loss	234

Building Loss Ratio %	1.8
Relocation Loss	12
Capital Related Loss	47
Wages Losses	234
Rental Income Loss	3
Total Loss	15,216

Direct Economic Loss for Transportation (all values are in thousands of dollars)

Total	0.00

Direct Economic Losses for Utilities (all values are in thousands of dollars)

Total	0.00

Direct Economic Losses for Vehicles (Day) (all values are in dollars)

Cars	169,593
Light Trucks	54,201
Heavy Trucks	42,374
Total Loss	266,168

Direct Economic Losses for Vehicles (Night) (all values are in dollars)

Cars	371,396
Light Trucks	116,636
Heavy Trucks	84,572
Total Loss	572,604

Income and Employment Impact (with outside aid)

None

Income and Employment Impact (without outside aid)

None

Shelter Summary Report

# of Displaced People	396
# of People Needing Short Term Shelter	184

Skunk Creek and Tributaries Case Study/Scenario Inventory Summary Reports

The Skunk Creek and Tributaries scenario inventory summary reports are below. These totals reflect HAZUS estimations of inventory within the Skunk Creek watershed.

Building Damage by Building Type (all values are in thousands of square feet)

All Types with No Damage	184.0
All Types with 1-10% Damage	19.0
All Types with 11-20% Damage	64.0
All Types with 21-30% Damage	124.0
All Types with 31-40% Damage	41.0
All Types with 41-50% Damage	50.0
All Types with Substantial Damage	8.0

Building Damage By General Occupancy (all values are in thousands of square feet)

All Types with No Damage	199.67
All Types with 1-10% Damage	24.06
All Types with 11-20% Damage	92.88
All Types with 21-30% Damage	143.01
All Types with 31-40% Damage	64.17
All Types with 41-50% Damage	65.70
All Types with Substantial Damage	38.33
Total Square Footage	627.81

Building Damage By General Occupancy Post-FIRM

None

Building Damage By General Occupancy Pre-FIRM (all values are in thousands of sqft)

All Types with No Damage	199.67
All Types with 1-10% Damage	24.06
All Types with 11-20% Damage	92.88
All Types with 21-30% Damage	143.01
All Types with 31-40% Damage	64.17
All Types with 41-50% Damage	65.70
All Types with Substantial Damage	38.33
Total Square Footage	627.81

Building Damage Count By General Building Type (number of buildings)

All Types with No Damage	68
All Types with 1-10% Damage	0
All Types with 11-20% Damage	2
All Types with 21-30% Damage	37
All Types with 31-40% Damage	5
All Types with 41-50% Damage	12

All Types with Substantial Damage	0
Total	124

Building Damage Count By General Occupancy

All Types with No Damage	68
All Types with 1-10% Damage	0
All Types with 11-20% Damage	2
All Types with 21-30% Damage	37
All Types with 31-40% Damage	5
All Types with 41-50% Damage	12
All Types with Substantial Damage	0
Total	124

Building Damage Count by General Occupancy Post-Firm

None

Building Damage Count by General Occupancy Pre-Firm

All Types with No Damage	68
All Types with 1-10% Damage	0
All Types with 11-20% Damage	2
All Types with 21-30% Damage	37
All Types with 31-40% Damage	5
All Types with 41-50% Damage	12
All Types with Substantial Damage	0
Total	124

Emergency Operation Center Damage and Functionality

None

Fire Station Facilities Damage and Functionality

None

Care Facilities (Hospital) Damage and Functionality

None

Police Station Facilities Damage and Functionality

None

School Damage and Functionality (dollar values are in thousands)

None

Highway Bridge Damage and Functionality

None

Light Rail Bridge Damage and Functionality

None

Potable Water System Facility Damage

None

Railroad Damage and Functionality

None

Waste Water Facility Damage

None

Debris Summary Report (all values are in tons)

Finishes	1,010
Structures	229
Foundations	307
Total	1,547

Direct Economic Annualized Losses for Buildings (all values are in thousands of dollars)

Cost Building Damage	12,077
Cost Contents Damage	12,704
Inventory Loss	515
Building Loss Ratio %	2.4
Relocation Loss	26
Capital Related Loss	41
Wages Losses	63
Rental Income Loss	4
Total Loss	25,430

Depreciated Direct Economic Losses for Buildings (all values are in thousands of dollars)

Cost Building Damage	10,439
Cost Contents Damage	10,922
Total Loss	21,361

Direct Economic Loss for Agriculture Products

None

Direct Economic Losses for Buildings (all values are in thousands of dollars)

Cost Building Damage	12,077
Cost Contents Damage	12,704
Inventory Loss	515
Building Loss Ratio %	2.4
Relocation Loss	26
Capital Related Loss	41
Wages Losses	63

Rental Income Loss	4
Total Loss	25,430

Direct Economic Loss for Transportation (all values are in thousands of dollars)

Total	0.00

Direct Economic Losses for Utilities (all values are in thousands of dollars)

Total	0.00

Direct Economic Losses for Vehicles (Day) (all values are in dollars)

Cars	511,490
Light Trucks	146,279
Heavy Trucks	110,337
Total Loss	768,106

Direct Economic Losses for Vehicles (Night) (all values are in dollars)

Cars	960,368
Light Trucks	290,362
Heavy Trucks	213,105
Total Loss	1,463,835

Income and Employment Impact (with outside aid)

None

Income and Employment Impact (without outside aid)

None

Shelter Summary Report

# of Displaced People	773
# of People Needing Short Term Shelter	261

Results from Other Return Periods

To see the results of the 10-year, 50-year, 200-year, or 500-year return period for both scenarios refer to the Flood Event Reports and the Quick Assessment Reports in Attachment F. The Inventory Summary Reports for both scenarios are also in Attachment F.

Summary of Databases in HAZUS-MH

HAZUS inventory consists of hazard data, boundary map data and a proxy for the general building stock (GBS) in the continental United States, Hawaii and the US held Territories. Additionally, HAZUS contains national data for essential facilities, high potential loss facilities, selected transportation and lifeline systems, agriculture, and vehicles and demographics.

Flood Model

In the Flood Model, USGS' National Elevation Database (NED) [1] is downloaded for use as topographical data.

Hydrologic calculations, population density, runoff coefficients and soils data are derived from "Compilation of GIS Data Layers for Flash Flood Forecasting" published by the Michigan Technological University for the National Weather Service (date unknown). This document and the "Water-Resources Investigations Report 94-4002"[2] are used for soil permeability. For default hydrologic regions, the source is the "Water-Resources Investigations Report 94-4002." The percentage of basin storage is derived from EPA RF3[3] (reach file 3) data files, and hydrologic region identifiers and regression equation parameters for computation from the "Water-Resources Investigations Report 94-4002." Random variables come from the Tables of K Values found on page 3-1 of USGS' "Guidelines for Determining Flood Flow Frequency", Bulletin #17B of the Hydrology Subcommittee, March, 1982.

Default river reaches and water sheds are derived from National Operational Hydrologic Remote Sensing Center data (developed by Michael Baker), 1998, default stream gage locations from the U.S. Geological Survey WATSTORE Database[4], 1998, and frequency-based discharge data associated with the default reaches from the National Operational Hydrologic Remote Sensing Center and the "Water-Resources Investigations Report 94-4002."

- There is one USGS stream gage located within the Upper New River/Skunk Creek FRP study area which is 09513780 New River near Rock Springs.

Raster data sets include percentage of forest cover derived from the "Compilation of GIS Data Layers for Flash Flood Forecasting" published by the Michigan Technological University for the

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[1] The website address for the NED is http://ned.usgs.gov/.

[2] Jennings, M.E., Thomas, W.O., and Riggs, H.C., 1994. Nationwide Summary of U.S. Geological Survey regional regression equations for estimating magnitude and frequency of floods for ungaged sites, 1993: U.S. Geological Survey Water-Resources Investigations Report 94-4002.

[3] The website address for the EPA RF3 is http://www.epa.gov/waters/doc/rfindex.html.

[4] The WATSTORE Database is no longer and active database. U.S. Geological Survey now uses the National Water Information System (NWIS) as there database. The WEB link to NWIS is http://waterdata.usgs.gov/az/nwis/inventory. The 1998 data book, Water Resources Data, Arizona, Water Year 1998 Water-Data Report AZ-98-1 shows all the sites that were published in the 1998 report and were included in the WATSTORE Database.

National Weather Service (date unknown). High elevation indices, 24 hour precipitation, temperature and average precipitation data, runoff data and additional soil data for types A and D come from the "Water-Resources Investigations Report 94-4002."

Boundary Maps

HAZUS contains GIS boundary maps for the U.S. and the Territories with four GIS map layers: states, counties, census tracts and census blocks. This data set was developed from the 2000 version of Census TIGER/Line® files.[5]

General Building Stock

The key General Building Stock databases in HAZUS include square footage by occupancy, building count by occupancy and general occupancy mapping. For these databases, residential structures are derived from Census 2000 and non-residential structures are derived from Dun & Bradstreet (D&B). Three reports from the Department of Energy (DOE) were used in defining regional variations in characteristics such as number and size of garages, type of foundation, and number of stories. The inventory's baseline floor area is based on a distribution contained in the DOE's Energy Consumption Report.

D&B utilizes the Census Bureau Tiger/line files to geolocate and reference businesses in their database by the reported address. D&B aggregated the data to the Census block level utilizing the assigned block polygon from the geolocation process. The list of documents used to develop the general building stock inventory is as follows:

- Census of Population and Housing, 2000: Summary Tape File 1B Extract on CD-ROM prepared by the Bureau of Census.
- Census of Population and Housing, 2000: Summary Tape File 3 on CD-ROM prepared by the Bureau of Census.
- Dun & Bradstreet, Market Analysis Profile aggregated by Standard Industrial Classification (SIC) Code Clusters, July 2006.
- Department of Energy, Housing Characteristics 1993. Office of Energy Markets and End Use, DOE/EIA-0314 (93), June 1995.
- Department of Energy, A Look at Residential Energy Consumption in 1997, DOE/EIA-0632(97), November 1999.
- Department of Energy, A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures, DOE/EIA-0625(95), October 1998.

[5] The contact information for the Census Bureau is: U.S. Department of Commerce, U.S. Census Bureau, Geography Division. 8903 Presidential Parkway, Room 303 WP I, Upper Marlboro, Maryland, 20772. Telephone (301) 457 -1228/ Email Address: tiger@census.gov. The U.S. Census Bureau website address is http://www.census.gov/geo/www/tiger/index.html.

Essential Facilities

Essential facilities in HAZUS include hospitals, police stations, fire stations, schools and emergency operations centers classified by building structure type and occupancy class.

The police station and fire station datasets were developed from geocoded data from 2001 based on the SIC for the entire United States provided by InfoUSA Inc.[6] The attribute information provided by InfoUSA Inc. for each police station and fire station facility includes name, address, city, zip, state, and geographical coordinates.

The schools data set was developed from the 2000 Public Elementary/Secondary School Universe Survey Data and the Private School Universe Survey Data maintained by the National Center for Education Statistics, U.S. Department of Education.[7] A proprietary geocoding application was used to assign geographical coordinates to each school based on its address. South Carolina schools data from 2004 was provided by the South Carolina Emergency Division [8] (SCEMD).

The care facilities dataset was developed from American Hospital Association (AHA) [9] data from 2000. AHA provided information on hospitals for the entire United States. The attribute information provided by AHA for each medical care facility includes: the number of beds, name, address, city, zip, state, and geographical coordinates. South Carolina hospital data from 2004 was provided by the South Carolina Emergency Division.

The emergency operations centers (EOC) database is a combination of data provided by InfoUSA Inc. and geocoded data provided by FEMA. The InfoUSA Inc data is based on the SIC for the entire United States. The attribute information provided by InfoUSA Inc for each emergency operation center facilities includes: name, address, city, zip, state, function, and geographical coordinates. The data from FEMA includes: contact, name, address, city, zip, state, and telephone number.

High Potential Loss Facilities

High potential loss facilities include dams and nuclear power plants. The dams' dataset is based on the 1999 version of the National Inventory of Dams database, from the U.S. Army Corps of

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[6] The contact information for the InfoUSA, Inc is: InfoUSA, Inc. 5711 S 86th Circle, PO Box 27347, Omaha, NE 68127-0347, (402) 930-3500. The InfoUSA, Inc website address is http://www.infousa.com/.
[7] The contact information for the National Center for Education Statistics: 1990 K Street, NW, Washington, DC 20006, USA, Phone: (202) 502-7300. The NCES, Inc website address is http://nces.ed.gov/
[8] For metadata information on the South Carolina Data, contact South Carolina Emergency Division, 1100 Fish Hatchery Red, West Columbia, SC 29172, Phone: (803) 737-8500.
[9] The contact information for the American Hospital Association is One North Franklin: 27th Floor, Chicago Illinois 60606. Phone: (800)242-2626. The AHA website address is http://www.ahadata.com/ahadata_app/index.jsp.

Engineers (USACE) [10]. The nuclear facilities dataset was developed from 2000 data compiled by the U.S. Nuclear Regulatory Commission (NRC) [11] on nuclear reactors. Military facilities are not available in the current HAZUS default inventory.

Transportation Systems

Transportation systems in HAZUS include highways, railways, light rail, bus, ports, ferries and airports. The inventory data required for these include the geographical location, and classification of system components.

Highway transportation systems consist of roadways, bridges, and tunnels. The highway bridges and tunnels database was developed from the 2001 version of the National Bridge Inventory (NBI) database provided by the Federal Highway Administration, Office of Bridge Technology.[12] Major highway segments were developed with data from the 2000 version of TIGER/Line files, produced by the U.S. Census Bureau.

Railway transportation systems consist of tracks, bridges and tunnels, and stations, fuel, dispatch and maintenance facilities. The railway track segments were developed with data from the National Rail Network database obtained from the Bureau of Transportation Statistics (U.S. Department of Transportation)[13]. Railway system bridges and tunnels were extracted from the 2001 version of the National Bridge Inventory (NBI). The railway facilities database was developed with 1998 data from the Amtrak Stations database and the Intermodal Terminal Facilities, obtained from the Bureau of Transportation Statistics (U.S. Department of Transportation). The Amtrak Stations database is a geographic data set containing Amtrak intercity railroad passenger terminals in the United States. The Intermodal Terminal Facilities data set contains geographic data for trailer-on-flatcar (TOFC) and container-on-flatcar (COFC) highway rail transfer facilities in the United States.

Light railway transportation systems consist of tracks, bridges and tunnels, and stations, fuel, dispatch and maintenance facilities. The light railway database was developed with 2000 data from the Fixed-Guideway Transit and Ferry Network database, obtained from the Bureau of Transportation Statistics (U.S. Department of Transportation).

Bus transportation systems consist of urban stations fuel facilities, dispatch and maintenance facilities. The bus facilities data set was developed from geocoded data from 2001 provided by

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[10] The contact information for USACE is: U.S. Army Corps of Engineers, 7701 Telegraph Road, Alexandria, VA 22315-3864. Phone: (703) 428-6766.

[11] The website address for the NRC is http://www.nrc.gov/reactors/power.html.

[12] The contact information for the NBI is The Federal Highway Administration, 400 7th Street, SW, Washington, DC 20590. The website address of Federal Highway Administration is http://www.fhwa.dot.gov/bridge/bripro.htm.

[13] The contact information for the BTC is: Bureau of Transportation Statistics, 400 7th Street, SW, Room 3103, Washington DC 20590. Phone: (800) 853-1351. The BTC website address is http://www.bts.gov/programs/geographic_information_services/.

InfoUSA Inc. based on the SIC for the entire United States. Attribute information for each bus station facility includes: name, address, city, zip, state, and geographical coordinates.

Port and harbor transportation systems consist of waterfront structures, cranes/cargo handling equipment, warehouses and fuel facilities. The port facilities data set was developed from the 2000 dataset of Port and Waterway Facilities obtained from the U.S. Army Corps of Engineers/CEIWR, Navigation Data Center, Ports and Waterways Division[14].

Ferry transportation systems consist of waterfront structures, passenger terminals, warehouses, fuel facilities, and dispatch and maintenance facilities. The ferry facilities dataset was developed from the Port and Waterway Facilities database obtained from the U.S. Army Corps of Engineers/CEIWR, Navigation Data Center, Ports and Waterways Division.

Airport transportation systems consist of runways, control towers, terminal buildings, parking structures, fuel facilities, and maintenance and hanger facilities. Airport runways and facilities datasets were developed from 1999 data obtained from the Bureau of Transportation Statistics (U.S. Department of Transportation), Federal Aviation Administration. Heliports are not included.

Lifeline Utility Systems

Utility systems include potable water, wastewater, oil, natural gas, electric power, and communication systems. The inventory data required for these include the geographical location and classification of system components.

Potable water systems consist of pipelines, water treatment plants, control vaults, control stations, wells, storage tanks, and pumping stations. Wastewater systems consist of pipelines, wastewater treatment plants, control vaults, control stations, and lift stations. Oil systems consist of pipelines, refineries, control vaults, control stations, and tank farms. Natural gas systems consist of pipelines, control vaults, control stations, and compressor stations. An electric power system consists of generating plants, substations, distribution circuits, and transmission towers.

Each of these datasets was developed from 2001 data obtained through the Environmental Protection Agency[15] (EPA) Envirofacts Data Warehouse Location Reference Tables (LRT) tool based on SIC. The attribute information provided by LRT includes: name, address, city, zip, state, and geographical coordinates. South Carolina potable water, waste water, oil and natural gas pipelines data c2001 were provided by the South Carolina Emergency Division (SCEMD).

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[14] The contact information for the USACE is: Department of the Army Corps of Engineers, CEIWR-NDC-N, 7701 Telegraph Road, Alexandria, Virginia 22315-3868. The USACE website address is http://www.usace.army.mil/Pages/Default.aspx.

[15] The EPA website address is http://www.epa.gov/enviro/html/locational/lrt/ez.html.

The distribution pipelines database for potable water, waste water and natural gas, which is aggregated at the census tract level, was developed based on the assumption that the number of distribution lines is correlated to the number of local streets. This approximation is considered fairly accurate in urban areas, but less so in rural areas because of the use of onsite components such as water wells, septic tanks and propane gas tanks.

Communication systems consist of communications facilities, communications lines, control vaults, switching stations, Radio/TV station, weather station, or other facilities. The communication facilities dataset was developed from the 2001 Broadcast Auxiliary Microwave file obtained from the Federal Communication Commission (FCC)[16].

Hazardous Materials and Agricultural Products

The hazardous materials (Hazmat) facilities dataset is based on the 1999 version of the Environmental Protection Agency (EPA) Toxic Release Inventory database[17].

Agricultural Products

The agriculture products inventory for the Flood Model is based on two National datasets for general distribution of crops by type, average yield, unit price, and harvest price: the National Resources Inventory[18] (NRI) and the National Agriculture Statistical Service[19] (NASS).

Vehicle Data

Parking generation rates are used to associate the number of parked vehicles to square footages of different types of occupancy groups during a flood event. Vehicle distributions are estimated for daytime and nighttime, with daytime assumed to be normal business hours. Occupancy-related data is based on the American Planning Association's "Off-Street Parking Requirements: A National Review of Standards (PAS 432) by David Bergman (1991) and the National Personal Travel Survey[20] (NPTS) - 1995, and related projects of private organizations. Vehicle class estimates are compiled from the National Automobile Dealers Association[21] (NADA), the U.S. Department of Transportation's Truck Size and Weight Study (TSWS) - 2000[22], and the 1995

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[16] The FCC website address is http://wireless.fcc.gov/.

[17] The contact information for EPA is: Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Phone: (202)0260-2090. The EPA Toxics Release Inventory (TRI) Program website address in http://www.epa.gov/triinter/tridata/tri99/.

[18] The website address for the NRI is http://www.nrcs.usda.gov/technical/NRI/. The database represents and average of the 1977, 1982, 1987, 1992 and 1997 data.

[19] The website address for the NASS is http://www.nass.usda.gov/. The data is from 2000.

[20] The website address for the NPTS is http://www.bts.gov/programs/national_household_travel_survey/.

[21] The NADA Data is a comprehensive statistical analysis of the franchised new-vehicle dealership industry conducted by the National Automobile Dealers Association. It is published annually in the August issue of NADA's Automotive Executive magazine. The one used for HASUS was published in 2001. The WEB link for back articles is http://www.autoexecmag.com/current_articles/.

[22] The website address for the TSWS is http://www.fhwa.dot.gov/policy/otps/truck/.

National Personal Transportation Survey (NPTS). The distribution of vehicle age and percentage of trucks versus cars were taken from NADA, with further distribution among trucks by size from TSWS. Dollar valuation of vehicles is based on the 2001 NADA data and the 2001 Ward's Automotive Yearbook[23].

Direct Economic and Social Loss

The datasets for calculating direct economic loss in HAZUS include building, content and inventory valuation by occupancy and repair times, operational valuations (business, personal and rental income and disruption costs) and lifeline valuations at the census block level for the fifty states and the District of Columbia. The building/content inventory valuation dataset was developed by applying RS Means[24] replacement values for typical building floor areas and construction for each specific occupancy. The (Means) County Location Factor data set derived from the 2006 RS Means Square Foot Costs was used to modify the building valuations for each occupancy for major metropolitan areas in addition to a national data set of county specific modifiers from the Means zip-code based data generated by Applied Research Associates. The business loss dataset is based on Dun & Bradstreet (2006), Means Cost Data (regional cost modifiers), income and floor area factors from DOE data and the latest addition of the U.S. County Business Patterns database (e.g., income, employment and output data). ATC13 and ATC25[25] were used for lifeline valuations and R.S. Means for location modifiers for the replacement cost for facilities and the repair costs. Datasets for social loss (displaced households and casualties) in HAZUS are derived from the 2000 Census.

Indirect Economic Data and Demographic Data

HAZUS indirect economic data refers to the post-disaster change in the demand and supply of products, change in employment and change in tax revenues. Data are based on IMPLAN data for the U.S. and the Territories that were acquired from the Minnesota IMPLAN Group, Inc.[26] and compiled in 1997.

The demographics table in HAZUS provides housing and population statistics at the census block level including distributions of income, population, demographics, occupancies, and housing units based on the 2000 U.S. Census. Some employment data is from Dun & Bradstreet.

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[23] The website address for the Ward's Automotive Yearbook is http://wardsauto.com/way.

[24] The contact information for RS Mean's is: RSMeans Company, Inc. Construction Publishers & Consultants, Construction Plaza, 63 Smiths Lane, Kingston, MA 02364-080. Phone: (781) 585-7880. The RS Means website address is http://rsmeans.reedconstructiondata.com/.

[25] The website address for the Applied Technology Council is http://www.atcouncil.org/.

[26] The website address for the IMPLAN is http://www.implan.com.

Specific Model Requirements and Capabilities

HAZUS-MH provides a rough estimate of potential economic losses. It is a dynamic modeling tool that allows the user to ask "what if" questions and is helpful to prepare for the inevitable. It is a very complicated and computer-intensive software program. However HAZUS-MH isn't calibrated to a specific economic situation, and is not a substitute for an engineering-based flood study.

HAZUS-MH's capabilities include: calculating flood depths in both riverine and coastal contexts, modeling losses to the census block level, examining multiple dimensions of loss and analyzing multiple flood recurrence intervals or specific discharge amounts. The general building stock is uses the 2000 Census of Housing data for buildings, Dun & Bradstreet data for non-residential buildings, US Department of Energy for regional differences in square footage, construction types, etc. There are also a limited number of stream gauges within a study area that are used within the analysis.

To determine a riverine flood depth one must create a flow grid from DEM, identify stream reaches from the flow grid, associate each reach with a drainage area, identify stream gauges in the drainage area, approximate the floodplain for each reach, create a set of flood depth cross sections and interpolate from cross sections to grid cells.

HAZUS-MH can define loss estimates. It uses depth-damage curves created from occupancy class, foundation type, and assumed first floor elevation and the depth of flooding throughout the census block. It also uses National Floodplain Insurance Program (NFIP) claims to create depth-damage curves for "typical" construction types and matches up buildings in a block and depth within a block to depth-damage curves to estimate damage.

To set up a study case one must first define the stream reaches. A minimum drainage area and a flow direction is created from the DEM based on the 8-direction pour point model following the steepest slope neighbor. Then, a flow accumulation grid is created. Finally, streams are derived from the flow accumulation grid as those as those grid cells into which than a threshold number of cells drain into. For a 30m terrain grid, a typical threshold value is about 5000 cells.[27]

A study case is then created with a unique name and description. These must have different names because there can be multiple study cases/scenarios within a one regional study area. One then selects the reaches that will be included in the study case. For a riverine flood, hydrologic analysis can be run next. The objective of the hydrologic analysis is to estimate the distribution of water once it lands via precipitation and determine discharge values in streams. In general, this step uses several methods which include analyzing stream gage data to transform historical peak discharges into flood frequency curves, or regression functions determining discharge as a function of other variables, or numerical models [HEC-1, SWMM, MIKE11 etc.] to mimic hydrologic processes. HAZUS-MH implements hydrologic analysis through built-in regression

[27] Riverine Flood Modeling in HAZUS-MH: Overview of the implementation, Subrahmanyam Muthukumar

equations to determine discharge-frequency relationships for each reach and include gage and main stream adjustments. Rainfall-runoff modeling is not implemented. Regression equation parameters include derived variables [catchment area, mean catchment elevation and slope, and channel length] and default data parameters [temperature, precipitation, soil type, forest cover and snowfall]. Where applicable, regression results are adjusted using data from the 11,000 stream gages that accompany HAZUS-MH. The output is a peak discharge table, with discharges computed at each reach's upstream and downstream nodes for return periods of 2, 5, 10, 25, 50, 100, and 500 years. [28]

The hydraulic analysis uses the derived discharge values and stream channel morphology and computes flood elevations at cross-sections which delineates the floodplains. This is done by recurrence intervals, discharge values and by annualized loss. In general, this step is implemented using Manning's equation or by numerical models [HEC-2, HEC-RAS, SWMM, etc.]. Inputs include discharge, cross-section descriptions [channel slope, cross-section geometry and friction factors for inundated areas], and 2-D flow fields, varying Manning's n, bridge geometries, expansion/contraction coefficients and sub-critical/super-critical flow. Outputs include flood elevations at cross-sections, energy head, flood velocity, flood depths and extents. The model is greatly simplified in HAZUS-MH. Inputs include peak discharge, cross-section geometries, 1-D flow field and constant Manning's n for sub-critical flow. Only flood elevations at cross-sections, flood depth and extent grids are generated. The process is iterative. The initial floodplain is estimated by buffering the reaches [buffer distance = $\mathbf{10 * Q^{0.5}}$]. The flow centerline is determined and cross-section lines are placed normal to the flow centerline at intervals of 1000'. Manning's equation is used to determine flood elevations at the cross-sections. A flood surface is determined by interpolating elevations between cross-sections. The DEM is subtracted from the flood surface and the resulting flood conveyance limits are compared with the extents of the depth grid. If necessary, the reach buffers are expanded and the analysis repeated till congruence between conveyance limits and the depth grid is achieved.

Hydraulic analysis may be performed for a single return period, multiple return periods or for a specific discharge – this choice usually dictates the number of reaches that may safely be used in the analysis. Spatial outputs include depth grids by return periods, cross-sections, conveyance boundaries and water elevation points. After the hydraulic analysis, HAZUS-MH allows what-if scenarios including levee-based DEM raising, or regulating flow by modifying the default discharge-frequency curves.

Analysis and loss estimation range from building stock damage to casualties to essential facility damage to debris removal cost. Inventory parameters, damage parameters, restoration parameters and analysis parameters are described below.

Inventory variables consist of the buildings, essential facilities, transportation and utilities, demographics, hazardous materials, agricultural commodities and vehicles aggregated to the block level. HAZUS-MH replacement value functions for the general building stock are

[28] Riverine Flood Modeling in HAZUS-MH: Overview of the implementation, Subrahmanyam Muthukumar

developed from R. S. Means "Square Foot Costs". These functions contain information on the full replacement value as well as the depreciated replacement value. Full replacement value represents the engineering cost to rebuild a structure and is classified by economy, average, custom and luxury structure types. Depreciated value is the remaining value of a structure based on age and is classified by good, average and poor conditions. The depreciated value reflects the insured value of the property. These definitions/functions are based on individual structures, while HAZUS-MH deals with data aggregated to the block level. The true depreciated value of a block will be a combination of the replacement and depreciation cost models.

For single-family structures, depreciated values are computed at the blockgroup level from default curves of depreciation percent against median age and classified by condition. The overall condition for blockgroup structures is determined by the ratio of blockgroup income to county income. In the case of non-single-family structures, depreciated values are based on construction type, use and observed age. Under default conditions, the observed age is assumed similar to residential uses. Depreciation parameters encoded within HAZUS-MH may be modified by the user. Default mapping schemes that convert specific occupancy types into building type with foundation types and first floor heights may be modified by the user. Default agricultural data are provided by National Resources Inventory [NRI] and National Agricultural Statistical Survey [NASS] and compiled into sub-county polygons formed by the intersection of 8-digit HUCs with county boundaries. HAZUS-MH uses the available land use/land cover data and includes default data on crop types, quantities, yields, unit prices and harvest costs after removing non-agricultural areas. All crop types and associated attributes may be modified by the user. The number and type of vehicles are estimated from square footage to vehicle ownership ratios using methods adopted by most MPOs for their transportation planning needs. Vehicles are classified by car, light truck or heavy truck typologies and by age [new/old] and estimated at the block level for day-time and night-time periods.

Damage to inventory categories is based on built-in depth-damage curves. These depth-damage curves relate damage as percent of replacement cost against effective flood depths – effective flood depths are quantified as the height of flood waters above the first floor. Every inventory item is associated with a default depth-damage curve. For the general building stock, each of the 33 specific occupancy classes and their variations by foundation type and building height have associated curves. For bridges, utilities and vehicles, depth-damage curves are derived from historic data and expert opinion. Agricultural depth-damage curves are derived from USACE district curves and other models such as USACE IWR, USACE AGDAM, etc. Agriculture damage curves are associated with additional parameters including flood depth, duration of inundation, flood date relative to crop cycle and crop type. All depth-damage curve values are encoded as tables and may be modified by the user.

As in the other cases, HAZUS-MH has built-in restoration parameters that are based on occupancy restoration timelines. For some inventory items, these curves indicate an assessment of the functionality. All restoration curves have values for the maximum restoration time for 100% operations. Restoration parameters are tabulated and may be modified by the user, but without in-depth domain knowledge, it is safer to use defaults.

HAZUS-MH has an analytical parameter modification interface to alter estimations of debris, shelter requirements, direct and indirect economic losses. Casualty estimation has been deferred.

Estimated weights of debris generated are limited to building-related components [building finishes, structural elements and foundation materials] and does not include vegetation, sediment or building contents. Default debris parameters are listed by specific occupancy classified by foundation type and tabulated for specific flood depth intervals.
Default shelter parameters are based on total population displaced owing to evacuation/flooded roads. Evacuation factors include access restriction heights and additional public safety evacuation buffers. Displaced populations may be weighted by demographic factors including income, age, ethnicity and home ownership, and by utility outages as percent impacted households.
Direct economic loss parameters have been generated only for occupancies with inventory considerations and are based on gross sales data for 2002. Direct economic loss parameters deal with losses caused primarily by business interruption and take into account restoration times for business interruption interval estimation.
Estimates of indirect economic losses are based on simplified models of a synthetic economy classified by type and size. Employment numbers are based on the Bureau of Economic Analysis 2002 figures for counties, and include unemployment rate, level of outside aid/insurance, interest rates on loans and reconstruction costs.
All analysis parameters may be modified by the user. Additionally, all estimated losses may be modified based on flood warning studies conducted by the USACE in the 1960s. Flood warnings include default curves relating damage reduction to flood forecasts. Editable warning parameters for damage reduction include flood warning lead time, warning dissemination and response rates. [29]

The report results are available with maps or tables and every variable calculated can be mapped by census block.

[29] Riverine Flood Modeling in HAZUS-MH: Overview of the implementation, Subrahmanyam Muthukumar

ATTACHMENT E

HAZUS-MH MR3 (v1.3) Flood Event Reports, Inventory Summaries and Quick Assessment Reports

HAZUS-MH MR3 (v1.3) Flood Event Reports, Inventory Summaries and Quick Assessment Reports

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	New River and Deadman Wash
Return Period:	10
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	97
Short Term Shelter (# People)	113

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	3.01
Total Property (Capital Stock) Losses ($ Millions)	7.81
Business Interruptions (Income) Losses ($ Millions)	0.11

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	Skunk Creek
Return Period:	10
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	154
Short Term Shelter (# People)	103

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	6.25
Total Property (Capital Stock) Losses ($ Millions)	9.97
Business Interruptions (Income) Losses ($ Millions)	0.04

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS-MH: Flood Event Report

Region Name:	Upper New River and Skunk Creek FRP
Flood Scenario:	New River and Deadman Wash
Print Date:	Thursday, September 10, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	268,322	78.4%
Commercial	54,178	15.8%
Industrial	8,550	2.5%
Agricultural	1,613	0.5%
Religion	3,272	1.0%
Government	3,187	0.9%
Education	3,058	0.9%
Total	**342,180**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	New River and Deadman Wash
Return Period Analyzed:	10
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 10 buildings will be at least moderately damaged. This is over 29% of the total number of buildings in the study case. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	9	90.00	1	10.00	0	0.00	0	0.00
Total	**0**		**0**		**9**		**1**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	2	00.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	7	87.50	1	12.50	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	1	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 612 tons of debris will be generated. Of the total amount, Finishes comprises 60% of the total, Structure comprises 15% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 24 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 97 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 113 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 7.92 million dollars, which represents 2.31 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 7.81 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 38.09% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	1.77	0.80	0.10	0.25	2.93
	Content	1.24	2.05	0.21	1.26	4.75
	Inventory	0.00	0.04	0.05	0.03	0.13
	Subtotal	**3.01**	**2.89**	**0.37**	**1.54**	**7.81**
Business Interruption						
	Income	0.00	0.02	0.00	0.01	0.03
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.06	0.07
	Subtotal	**0.01**	**0.03**	**0.00**	**0.07**	**0.11**
ALL	**Total**	**3.02**	**2.93**	**0.37**	**1.61**	**7.92**

Appendix A: County Listing for the Region

Arizona
- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

HAZUS-MH: Flood Event Report

Region Name:	Upper New River and Skunk Creek FRP
Flood Scenario:	Skunk Creek
Print Date:	Tuesday, September 15, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	429,004	84.5%
Commercial	56,293	11.1%
Industrial	12,274	2.4%
Agricultural	4,531	0.9%
Religion	3,549	0.7%
Government	663	0.1%
Education	1,678	0.3%
Total	**507,992**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	Skunk Creek
Return Period Analyzed:	10
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 23 buildings will be at least moderately damaged. This is over 29% of the total number of buildings in the study case. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	8.70	19	82.61	2	8.70	0	0.00	0	0.00
Total	**0**		**2**		**19**		**2**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	3	75.00	1	25.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	10.53	16	84.21	1	5.26	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 658 tons of debris will be generated. Of the total amount, Finishes comprises 74% of the total, Structure comprises 9% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 26 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 154 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 103 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 10.01 million dollars, which represents 2.36 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 9.97 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 62.47% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.89	0.60	0.29	0.10	4.88
	Content	2.36	1.60	0.45	0.50	4.91
	Inventory	0.00	0.05	0.09	0.04	0.19
	Subtotal	**6.25**	**2.25**	**0.83**	**0.65**	**9.97**
Business Interruption						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.02	0.02
	Subtotal	**0.01**	**0.02**	**0.00**	**0.02**	**0.04**
ALL	**Total**	**6.26**	**2.27**	**0.83**	**0.66**	**10.01**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	New River and Deadman Wash
Return Period:	50
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	120
Short Term Shelter (# People)	156

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	5.51
Total Property (Capital Stock) Losses ($ Millions)	12.63
Business Interruptions (Income) Losses ($ Millions)	0.20

Disclaimer:

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Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	Skunk Creek
Return Period:	50
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	235
Short Term Shelter (# People)	230

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	11.94
Total Property (Capital Stock) Losses ($ Millions)	21.04
Business Interruptions (Income) Losses ($ Millions)	0.11

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: New River and Deadman Wash

Print Date: Thursday, September 10, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	268,322	78.4%
Commercial	54,178	15.8%
Industrial	8,550	2.5%
Agricultural	1,613	0.5%
Religion	3,272	1.0%
Government	3,187	0.9%
Education	3,058	0.9%
Total	**342,180**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	New River and Deadman Wash
Return Period Analyzed:	50
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 21 buildings will be at least moderately damaged. This is over 39% of the total number of buildings in the study case. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	9.52	15	71.43	1	4.76	2	9.52	1	4.76
Total	**0**		**2**		**15**		**1**		**2**		**1**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	0	0.00	4	00.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	12.50	11	68.75	1	6.25	2	12.50	0	0.00

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	1	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,110 tons of debris will be generated. Of the total amount, Finishes comprises 56% of the total, Structure comprises 18% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 44 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 120 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 156 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 12.83 million dollars, which represents 3.75 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 12.63 million dollars. 2% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.99% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.33	1.19	0.18	0.37	5.08
	Content	2.18	2.97	0.39	1.81	7.35
	Inventory	0.00	0.06	0.09	0.05	0.20
	Subtotal	**5.51**	**4.23**	**0.66**	**2.23**	**12.63**
Business Interruption						
	Income	0.00	0.02	0.00	0.02	0.04
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.13	0.15
	Subtotal	**0.01**	**0.05**	**0.00**	**0.15**	**0.20**
ALL	**Total**	**5.52**	**4.28**	**0.66**	**2.38**	**12.83**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: Skunk Creek

Print Date: Tuesday, September 15, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	429,004	84.5%
Commercial	56,293	11.1%
Industrial	12,274	2.4%
Agricultural	4,531	0.9%
Religion	3,549	0.7%
Government	663	0.1%
Education	1,678	0.3%
Total	**507,992**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	Skunk Creek
Return Period Analyzed:	50
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 44 buildings will be at least moderately damaged. This is over 30% of the total number of buildings in the study case. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	3	6.82	34	77.27	3	6.82	4	9.09	0	0.00
Total	**0**		**3**		**34**		**3**		**4**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	8	80.00	1	10.00	1	10.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	3	8.82	26	76.47	2	5.88	3	8.82	0	0.00

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,181 tons of debris will be generated. Of the total amount, Finishes comprises 73% of the total, Structure comprises 10% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 47 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 235 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 230 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 21.15 million dollars, which represents 4.98 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 21.04 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 56.56% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	7.40	1.56	0.64	0.29	9.89
	Content	4.54	3.91	1.01	1.23	10.69
	Inventory	0.00	0.15	0.19	0.11	0.45
	Subtotal	**11.94**	**5.62**	**1.84**	**1.63**	**21.04**
Business Interruption						
	Income	0.00	0.02	0.00	0.01	0.03
	Relocation	0.02	0.00	0.00	0.00	0.02
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.03	0.06
	Subtotal	**0.02**	**0.05**	**0.00**	**0.04**	**0.11**
ALL	**Total**	**11.96**	**5.67**	**1.84**	**1.68**	**21.15**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	New River and Deadman Wash
Return Period:	100
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	132
Short Term Shelter (# People)	184

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	6.51
Total Property (Capital Stock) Losses ($ Millions)	14.92
Business Interruptions (Income) Losses ($ Millions)	0.30

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	Skunk Creek
Return Period:	100
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	258
Short Term Shelter (# People)	261

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	14.62
Total Property (Capital Stock) Losses ($ Millions)	25.30
Business Interruptions (Income) Losses ($ Millions)	0.13

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: New River and Deadman Wash

Print Date: Thursday, September 10, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	268,322	78.4%
Commercial	54,178	15.8%
Industrial	8,550	2.5%
Agricultural	1,613	0.5%
Religion	3,272	1.0%
Government	3,187	0.9%
Education	3,058	0.9%
Total	**342,180**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	New River and Deadman Wash
Return Period Analyzed:	100
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 31 buildings will be at least moderately damaged. This is over 35% of the total number of buildings in the study case. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	6.45	17	54.84	5	16.13	5	16.13	2	6.45
Total	**0**		**2**		**17**		**5**		**5**		**2**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	100.00
Masonry	0	0.00	0	0.00	7	87.50	0	0.00	1	12.50	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	9.52	10	47.62	5	23.81	4	19.05	0	0.00

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	1	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,444 tons of debris will be generated. Of the total amount, Finishes comprises 51% of the total, Structure comprises 22% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 58 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 132 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 184 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 15.22 million dollars, which represents 4.45 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 14.92 million dollars. 2% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.80% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.92	1.39	0.22	0.51	6.04
	Content	2.58	3.38	0.47	2.21	8.65
	Inventory	0.00	0.07	0.11	0.05	0.23
	Subtotal	**6.51**	**4.85**	**0.79**	**2.77**	**14.92**
Business Interruption						
	Income	0.00	0.03	0.00	0.02	0.05
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.21	0.23
	Subtotal	**0.01**	**0.06**	**0.00**	**0.23**	**0.30**
ALL	**Total**	**6.51**	**4.90**	**0.79**	**3.01**	**15.22**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

Building Stock Exposure by Building Type

September 17, 2009 *All values are in thousands of dollars*

	Wood	Steel	Concrete	Masonry	Manuf. Housing	Total
Arizona						
Maricopa	1,010,913	96,640	53,759	697,994	31,254	1,890,560
Total	**1,010,913**	**96,640**	**53,759**	**697,994**	**31,254**	**1,890,560**
Study Region Total	**1,010,913**	**96,640**	**53,759**	**697,994**	**31,254**	**1,890,560**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Stock Exposure by General Occupancy

September 17, 2009

All values are in thousands of dollars

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Arizona								
Maricopa	1,599,311	226,104	33,045	10,127	10,647	4,522	6,814	1,890,570
Total	**1,599,311**	**226,104**	**33,045**	**10,127**	**10,647**	**4,522**	**6,814**	**1,890,570**
Study Region Total	**1,599,311**	**226,104**	**33,045**	**10,127**	**10,647**	**4,522**	**6,814**	**1,890,570**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Transportation System Dollar Exposure

September 17, 2009

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Arizona								
Maricopa								
Segments	532,192.83	0.00	0.00	0.00	0.00	0.00	29,526.00	561,718.83
Bridges	301,968.12	119.70	0.00	0.00	0.00	0.00	0.00	302,087.82
Tunnels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facilities	0.00	0.00	0.00	0.00	0.00	0.00	5,177.50	5,177.50
Total	**834,160.95**	**119.70**	**0.00**	**0.00**	**0.00**	**0.00**	**34,703.50**	**868,984.15**
Total	**834,160.95**	**119.70**	**0.00**	**0.00**	**0.00**	**0.00**	**34,703.50**	**868,984.15**
Study Region Total	**834,160.95**	**119.70**	**0.00**	**0.00**	**0.00**	**0.00**	**34,703.50**	**868,984.15**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Utility System Dollar Exposure

September 18, 2009

All values are in thousands of dollars.

	otable Water	Waste Water	Oil Systems	Natural Gas	Electric Powei	Communicatior	Total
Arizona							
Maricopa							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Study Region Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Vehicle Dollar Exposure (Day)

September 17, 2009

All values are in dollars.

	Cars	Light Trucks	Heavy Trucks	Total
Arizona				
Maricopa	$25,413,966	$10,687,331	$19,783,488	$55,884,785
Total	**$25,413,966**	**$10,687,331**	**$19,783,488**	**$55,884,785**
Study Region Total	**$25,413,966**	**$10,687,331**	**$19,783,488**	**$55,884,785**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Vehicle Dollar Exposure (Night)

September 17, 2009 *All values are in dollars.*

	Cars	Light Trucks	Heavy Trucks	Total
Arizona				
Maricopa	$55,811,081	$23,470,225	$43,446,107	$122,727,413
Total	**$55,811,081**	**$23,470,225**	**$43,446,107**	**$122,727,413**
Study Region Total	**$55,811,081**	**$23,470,225**	**$43,446,107**	**$122,727,413**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage by Building Type

September 17, 2009 — *All values are in thousands of square feet*

	Average Damage (%) Within Each Damage Range						
	None	**1-10**	**11-20**	**21-30**	**31-40**	**41-50**	**Substantial**
Arizona							
Maricopa							
Concrete	0.0	5.0	12.0	3.0	2.0	1.0	1.0
ManufHousing	3.0	0.0	0.0	0.0	0.0	0.0	8.0
Masonry	22.0	3.0	13.0	24.0	7.0	8.0	0.0
Steel	0.0	3.0	8.0	2.0	1.0	1.0	0.0
Wood	30.0	2.0	16.0	30.0	12.0	11.0	2.0
Total	**55.0**	**13.0**	**49.0**	**59.0**	**22.0**	**21.0**	**11.0**
Total	**55.0**	**13.0**	**49.0**	**59.0**	**22.0**	**21.0**	**11.0**
Scenario Total	**55.0**	**13.0**	**49.0**	**59.0**	**22.0**	**21.0**	**11.0**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage By General Occupancy

September 17, 2009 — *All values are in thousands of square feet*

	Total Square Footage	Square Footage Distribution by Damage Percent Range						
		None	1-10	11-20	21-30	31-40	41-50	Substantial
Arizona								
Maricopa								
Agriculture	5.99	0.23	0.44	1.26	1.40	1.06	0.93	0.66
Commercial	53.24	2.81	2.30	21.48	11.56	7.74	5.56	1.81
Education	21.63	0.20	7.35	11.31	1.82	0.35	0.18	0.43
Government	7.33	1.27	4.74	1.33	0.00	0.00	0.00	0.00
Industrial	10.45	0.56	0.23	2.95	2.05	2.37	1.27	1.01
Religion	1.41	0.11	0.19	1.11	0.00	0.00	0.00	0.00
Residential	203.87	67.04	1.95	20.78	49.93	20.66	21.00	22.52
Total	**303.93**	**72.22**	**17.19**	**60.21**	**66.75**	**32.19**	**28.94**	**26.43**
Total	**303.93**	**72.22**	**17.19**	**60.21**	**66.75**	**32.19**	**28.94**	**26.43**
Scenario Total	**303.93**	**72.22**	**17.19**	**60.21**	**66.75**	**32.19**	**28.94**	**26.43**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage By General Occupancy Post-FIRM

September 17, 2009

All values are in thousands of square feet

	Total Square Footage	Square Footage Distribution by Damage Percent Range						
		None	1-10	11-20	21-30	31-40	41-50	Substantial
Total								
Total								
Scenario Total								

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage By General Occupancy Pre-FIRM

September 17, 2009

All values are in thousands of square feet

	Total Square Footage	Square Footage Distribution by Damage Percent Range						
		None	1-10	11-20	21-30	31-40	41-50	Substantial
Arizona								
Maricopa								
Agriculture	5.99	0.23	0.44	1.26	1.40	1.06	0.93	0.66
Commercial	53.24	2.81	2.30	21.48	11.56	7.74	5.56	1.81
Education	21.63	0.20	7.35	11.31	1.82	0.35	0.18	0.43
Government	7.33	1.27	4.74	1.33	0.00	0.00	0.00	0.00
Industrial	10.45	0.56	0.23	2.95	2.05	2.37	1.27	1.01
Religion	1.41	0.11	0.19	1.11	0.00	0.00	0.00	0.00
Residential	203.87	67.04	1.95	20.78	49.93	20.66	21.00	22.52
Total	**303.93**	**72.22**	**17.19**	**60.21**	**66.75**	**32.19**	**28.94**	**26.43**
Total	**303.93**	**72.22**	**17.19**	**60.21**	**66.75**	**32.19**	**28.94**	**26.43**
Scenario Total	**303.93**	**72.22**	**17.19**	**60.21**	**66.75**	**32.19**	**28.94**	**26.43**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage Count by General Building Type

September 17, 2009

	# of Buildings							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Arizona								
Maricopa								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	1	0	0	0	0	0	2	3
Masonry	5	0	0	7	0	1	0	13
Steel	0	0	0	0	0	0	0	0
Wood	18	0	2	10	5	4	0	39
Total	**24.00**	**0.00**	**2.00**	**17.00**	**5.00**	**5.00**	**2.00**	**55.00**
Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**
Scenario Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage Count by General Occupancy

September 17, 2009

	Count of Buildings (#) by Range of Damage (%)							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Arizona								
Maricopa								
Agriculture	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Residential	24	0	2	17	5	5	2	55
Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**
Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**
Scenario Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage Count by General Occupancy Post-FIRM

September 17, 2009

	Count of Buildings (#) by Range of Damage (%)							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Total								
Total								
Scenario Total								

<u>Special Notice Regarding Building Count:</u>

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Building Damage Count by General Occupancy Pre-FIRM

September 17, 2009

	Count of Buildings (#) by Range of Damage (%)							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Arizona								
Maricopa								
Agriculture	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Residential	24	0	2	17	5	5	2	55
Study Region Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**
Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**
Scenario Total	**24**	**0**	**2**	**17**	**5**	**5**	**2**	**55**

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Emergency Operation Center Damage and Functionality

September 17, 2009 *Dollar values are in thousands.*

	Count of EOCs	Total Building Damage ($)	Total Content Damage ($)	Non-Functional EOCs	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Fire Station Facilities Damage and Functionality

September 17, 2009 *Dollar values are in thousands.*

	Count of Fire Stations	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Fire Stations	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Care Facilities (Hospital) Damage and Functionality

September 17, 2009

Dollar values are in thousands.

	Total # of Beds	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Hospitals	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Police Station Facilities Damage and Functionality

September 17, 2009 *Dollar values are in thousands.*

	Count of Police Stations	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Police Stations	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

School Damage and Functionality

September 17, 2009 — *Dollar values are in thousands.*

	Count of Schools	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Schools	Average Restoration Time
Arizona					
Maricopa					
Grade Schools (Primary and High Schools	1	149.08	465.80	0	900
Total	**1**	**149.08**	**465.80**	**0**	**900**
Total	**1**	**149.08**	**465.80**	**0**	**900**
Scenario Total	**1**	**149.08**	**465.80**	**0**	**900**

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Highway Bridge Damage and Functionality

September 17, 2009 *Dollar values are in thousands.*

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Light Rail Bridge Damage and Functionality

September 17, 2009

Dollar values are in thousands.

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Potable Water System Facility Damage

September 17, 2009 *Dollar values are in thousands.*

	# of Facilities	Average Damage (%)	Total Loss ($)	Non-Functional Facilities
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Railroad Bridge Damage and Functionality

September 17, 2009 *Dollar values are in thousands.*

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Waste Water Facility Damage

September 17, 2009

Dollar values are in thousands.

	# of Facilities	verage Damage (%)	Total Loss ($)	Non-Functional Facilities
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Debris Summary Report

September 17, 2009

All values are in tons.

	Finishes	Structures	Foundations	Total
Arizona				
Maricopa	731	314	399	1,444
Total	**731**	**314**	**399**	**1,444**
Scenario Total	**731**	**314**	**399**	**1,444**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Annualized Losses for Buildings

September 17, 2009 — *All values are in thousands of dollars*

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Arizona									
Maricopa	6,040	8,646	234	1.8	12	47	234	3	15,216
Total	**6,040**	**8,646**	**234**	**1.8**	**12**	**47**	**234**	**3**	**15,216**
Scenario Total	6,040	8,646	234	1.8	12	47	234	3	15,216

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Depreciated Direct Economic Losses for Buildings

September 17, 2009 *All values are in thousands of dollars*

	Capital Stock Losses		
	Cost Building Damage	Cost Contents Damage	Total Loss
Arizona			
Maricopa	4,512	6,501	11,013
Total	**4,512**	**6,501**	**11,013**
Scenario Total	**4,512**	**6,501**	**11,013**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Loss For Agriculture Products

September 17, 2009

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Total
Total					
Total					
Scenario Total					

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Losses for Buildings

September 17, 2009 *All values are in thousands of dollars*

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Arizona									
Maricopa	6,040	8,646	234	1.8	12	47	234	3	15,216
Total	**6,040**	**8,646**	**234**	**1.8**	**12**	**47**	**234**	**3**	**15,216**
Scenario Total	**6,040**	**8,646**	**234**	**1.8**	**12**	**47**	**234**	**3**	**15,216**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Loss For Transportation

September 17, 2009

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Arizona								
Maricopa								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Scenario Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Losses for Utilities

September 17, 2009

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Arizona							
Maricopa							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Scenario Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Losses For Vehicles (Day)

September 17, 2009 *All values are in dollars.*

	Cars	Light Trucks	Heavy Trucks	Total Loss
Arizona				
Maricopa	$169,593	$54,201	$42,374	$266,168
Total	**$169,593**	**$54,201**	**$42,374**	**$266,168**
Scenario Total	**$169,593**	**$54,201**	**$42,374**	**$266,168**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Direct Economic Losses For Vehicles (Night)

September 17, 2009 *All values are in dollars.*

	Car	Light Truck	Heavy Truck	Total Loss
Arizona				
Maricopa	$371,396	$116,636	$84,572	$572,604
Total	**$371,396**	**$116,636**	**$84,572**	**$572,604**
Scenario Total	**$371,396**	**$116,636**	**84,572**	**$572,604**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Income and Employment Impact (with outside aid)

September 17, 2009

Income impact in millions of dollars
Employment impact in number of employees
Positive values denote a gain, negative values denote a loss

	Agriculture	Mining	Construction	Manufacturing	Transportation	Trade	Finance	Services	Government	iscellaneous	Total

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Income and Employment Impact (without outside aid)

September 17, 2009

Income impact in millions of dollars
Employment impact in number of employees
Positive values denote a gain, negative values denote a loss

	Agriculture	Mining	Construction	Manufacturing	Transportation	Trade	Finance	Services	Government	iscellaneous	Total

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

Shelter Summary Report

September 17, 2009

	# of Displaced People	# of People Needing Short Term Shelter
Arizona		
Maricopa	396	184
Total	**396**	**184**
Scenario Total	**396**	**184**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: New River and Deadman Wash
Return Period: 100

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: Skunk Creek

Print Date: Tuesday, September 15, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	429,004	84.5%
Commercial	56,293	11.1%
Industrial	12,274	2.4%
Agricultural	4,531	0.9%
Religion	3,549	0.7%
Government	663	0.1%
Education	1,678	0.3%
Total	**507,992**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	Skunk Creek
Return Period Analyzed:	100
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 56 buildings will be at least moderately damaged. This is over 31% of the total number of buildings in the study case. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	3.57	37	66.07	5	8.93	12	21.43	0	0.00
Total	**0**		**2**		**37**		**5**		**12**		**0**	

Table 4: Expected Building Damage by Building Type

	1-10		11-20		21-30		31-40		41-50		Substantially	
Building Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	9	75.00	1	8.33	2	16.67	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	4.55	28	63.64	4	9.09	10	22.73	0	0.00

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,547 tons of debris will be generated. Of the total amount, Finishes comprises 65% of the total, Structure comprises 15% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 62 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 258 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 261 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 25.43 million dollars, which represents 5.98 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 25.30 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 57.58% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	9.07	1.90	0.75	0.36	12.08
	Content	5.55	4.50	1.17	1.49	12.70
	Inventory	0.00	0.17	0.22	0.13	0.52
	Subtotal	**14.62**	**6.56**	**2.14**	**1.98**	**25.30**
Business Interruption						
	Income	0.00	0.03	0.00	0.01	0.04
	Relocation	0.02	0.00	0.00	0.00	0.03
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.04	0.06
	Subtotal	**0.02**	**0.06**	**0.00**	**0.05**	**0.13**
ALL	**Total**	**14.64**	**6.62**	**2.14**	**2.03**	**25.43**

Appendix A: County Listing for the Region

Arizona
- Maricopa

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

Building Stock Exposure by Building Type

September 18, 2009 *All values are in thousands of dollars*

	Wood	Steel	Concrete	Masonry	Manuf. Housing	Total
Arizona						
Maricopa	1,010,913	96,640	53,759	697,994	31,254	1,890,560
Total	**1,010,913**	**96,640**	**53,759**	**697,994**	**31,254**	**1,890,560**
Study Region Total	**1,010,913**	**96,640**	**53,759**	**697,994**	**31,254**	**1,890,560**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Stock Exposure by General Occupancy

September 18, 2009 *All values are in thousands of dollars*

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Arizona								
Maricopa	1,599,311	226,104	33,045	10,127	10,647	4,522	6,814	1,890,570
Total	**1,599,311**	**226,104**	**33,045**	**10,127**	**10,647**	**4,522**	**6,814**	**1,890,570**
Study Region Total	**1,599,311**	**226,104**	**33,045**	**10,127**	**10,647**	**4,522**	**6,814**	**1,890,570**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Transportation System Dollar Exposure

September 18, 2009

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Arizona								
Maricopa								
Segments	532,192.83	0.00	0.00	0.00	0.00	0.00	29,526.00	561,718.83
Bridges	301,968.12	119.70	0.00	0.00	0.00	0.00	0.00	302,087.82
Tunnels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facilities	0.00	0.00	0.00	0.00	0.00	0.00	5,177.50	5,177.50
Total	**834,160.95**	**119.70**	**0.00**	**0.00**	**0.00**	**0.00**	**34,703.50**	**868,984.15**
Total	**834,160.95**	**119.70**	**0.00**	**0.00**	**0.00**	**0.00**	**34,703.50**	**868,984.15**
Study Region Total	**834,160.95**	**119.70**	**0.00**	**0.00**	**0.00**	**0.00**	**34,703.50**	**868,984.15**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Utility System Dollar Exposure

September 18, 2009

All values are in thousands of dollars.

	otable Water	Waste Water	Oil Systems	Natural Gas	Electric Powei	Communicatior	Total
Arizona							
Maricopa							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Study Region Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Vehicle Dollar Exposure (Day)

September 18, 2009

All values are in dollars.

	Cars	Light Trucks	Heavy Trucks	Total
Arizona				
Maricopa	$25,413,966	$10,687,331	$19,783,488	$55,884,785
Total	**$25,413,966**	**$10,687,331**	**$19,783,488**	**$55,884,785**
Study Region Total	**$25,413,966**	**$10,687,331**	**$19,783,488**	**$55,884,785**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Vehicle Dollar Exposure (Night)

September 18, 2009 *All values are in dollars.*

	Cars	Light Trucks	Heavy Trucks	Total
Arizona				
Maricopa	$55,811,081	$23,470,225	$43,446,107	$122,727,413
Total	**$55,811,081**	**$23,470,225**	**$43,446,107**	**$122,727,413**
Study Region Total	**$55,811,081**	**$23,470,225**	**$43,446,107**	**$122,727,413**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage by Building Type

September 18, 2009

All values are in thousands of square feet

	Average Damage (%) Within Each Damage Range						
	None	1-10	11-20	21-30	31-40	41-50	Substantial
Arizona							
Maricopa							
Concrete	1.0	6.0	12.0	5.0	5.0	3.0	1.0
ManufHousing	4.0	0.0	0.0	0.0	0.0	0.0	2.0
Masonry	66.0	4.0	17.0	48.0	12.0	18.0	2.0
Steel	1.0	4.0	7.0	1.0	1.0	1.0	0.0
Wood	112.0	5.0	28.0	70.0	23.0	28.0	3.0
Total	**184.0**	**19.0**	**64.0**	**124.0**	**41.0**	**50.0**	**8.0**
Total	**184.0**	**19.0**	**64.0**	**124.0**	**41.0**	**50.0**	**8.0**
Scenario Total	**184.0**	**19.0**	**64.0**	**124.0**	**41.0**	**50.0**	**8.0**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage By General Occupancy

September 18, 2009

All values are in thousands of square feet

	Total Square Footage	Square Footage Distribution by Damage Percent Range						
		None	1-10	11-20	21-30	31-40	41-50	Substantial
Arizona								
Maricopa								
Agriculture	22.61	3.85	5.73	9.04	2.05	0.79	0.46	0.68
Commercial	87.25	5.45	8.64	33.41	16.47	13.02	7.24	3.03
Education	7.62	0.47	4.29	2.25	0.60	0.01	0.00	0.00
Government	0.40	0.04	0.15	0.21	0.00	0.00	0.00	0.00
Industrial	32.12	2.69	0.64	3.53	5.48	7.65	5.80	6.34
Religion	4.45	0.30	0.61	3.44	0.07	0.00	0.01	0.02
Residential	473.36	186.86	4.01	41.02	118.34	42.70	52.19	28.25
Total	**627.81**	**199.67**	**24.06**	**92.88**	**143.01**	**64.17**	**65.70**	**38.33**
Total	**627.81**	**199.67**	**24.06**	**92.88**	**143.01**	**64.17**	**65.70**	**38.33**
Scenario Total	**627.81**	**199.67**	**24.06**	**92.88**	**143.01**	**64.17**	**65.70**	**38.33**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage By General Occupancy Post-FIRM

September 18, 2009

All values are in thousands of square feet

	Total Square Footage	Square Footage Distribution by Damage Percent Range						
		None	1-10	11-20	21-30	31-40	41-50	Substantial
Total								
Total								
Scenario Total								

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage By General Occupancy Pre-FIRM

September 18, 2009 *All values are in thousands of square feet*

	Total Square Footage	Square Footage Distribution by Damage Percent Range						
		None	1-10	11-20	21-30	31-40	41-50	Substantial
Arizona								
Maricopa								
Agriculture	22.61	3.85	5.73	9.04	2.05	0.79	0.46	0.68
Commercial	87.25	5.45	8.64	33.41	16.47	13.02	7.24	3.03
Education	7.62	0.47	4.29	2.25	0.60	0.01	0.00	0.00
Government	0.40	0.04	0.15	0.21	0.00	0.00	0.00	0.00
Industrial	32.12	2.69	0.64	3.53	5.48	7.65	5.80	6.34
Religion	4.45	0.30	0.61	3.44	0.07	0.00	0.01	0.02
Residential	473.36	186.86	4.01	41.02	118.34	42.70	52.19	28.25
Total	**627.81**	**199.67**	**24.06**	**92.88**	**143.01**	**64.17**	**65.70**	**38.33**
Total	**627.81**	**199.67**	**24.06**	**92.88**	**143.01**	**64.17**	**65.70**	**38.33**
Scenario Total	**627.81**	**199.67**	**24.06**	**92.88**	**143.01**	**64.17**	**65.70**	**38.33**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage Count by General Building Type

September 18, 2009

	# of Buildings							
	None	**1-10**	**11-20**	**21-30**	**31-40**	**41-50**	**Substantial**	**Total**
Arizona								
Maricopa								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0
Masonry	23	0	0	9	1	2	0	35
Steel	0	0	0	0	0	0	0	0
Wood	45	0	2	28	4	10	0	89
Total	**68.00**	**0.00**	**2.00**	**37.00**	**5.00**	**12.00**	**0.00**	**124.00**
Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**
Scenario Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage Count by General Occupancy

September 18, 2009

	Count of Buildings (#) by Range of Damage (%)							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Arizona								
Maricopa								
Agriculture	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Residential	68	0	2	37	5	12	0	124
Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**
Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**
Scenario Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Building Damage Count by General Occupancy Post-FIRM

September 18, 2009

	Count of Buildings (#) by Range of Damage (%)							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Total								
Total								
Scenario Total								

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Building Damage Count by General Occupancy Pre-FIRM

September 18, 2009

	Count of Buildings (#) by Range of Damage (%)							
	None	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Arizona								
Maricopa								
Agriculture	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Residential	68	0	2	37	5	12	0	124
Study Region Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**
Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**
Scenario Total	**68**	**0**	**2**	**37**	**5**	**12**	**0**	**124**

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Emergency Operation Center Damage and Functionality

September 18, 2009 | *Dollar values are in thousands.*

	Count of EOCs	Total Building Damage ($)	Total Content Damage ($)	Non-Functional EOCs	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Fire Station Facilities Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	Count of Fire Stations	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Fire Stations	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Care Facilities (Hospital) Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	Total # of Beds	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Hospitals	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Police Station Facilities Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	Count of Police Stations	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Police Stations	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

School Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	Count of Schools	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Schools	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Highway Bridge Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Light Rail Bridge Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Potable Water System Facility Damage

September 18, 2009 *Dollar values are in thousands.*

	# of Facilities	Average Damage (%)	Total Loss ($)	Non-Functional Facilities
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Railroad Bridge Damage and Functionality

September 18, 2009 *Dollar values are in thousands.*

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Waste Water Facility Damage

September 18, 2009

Dollar values are in thousands.

	# of Facilities	.verage Damage (%)	Total Loss ($)	Non-Functional Facilities
Total				
Scenario Total				

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box ask you to replace the existing results.

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP

Scenario: Skunk Creek

Return Period: 100

Debris Summary Report

September 18, 2009

All values are in tons.

	Finishes	Structures	Foundations	Total
Arizona				
Maricopa	1,010	229	307	1,547
Total	**1,010**	**229**	**307**	**1,547**
Scenario Total	**1,010**	**229**	**307**	**1,547**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Annualized Losses for Buildings

September 18, 2009

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Arizona									
Maricopa	12,077	12,704	515	2.4	26	41	63	4	25,430
Total	**12,077**	**12,704**	**515**	**2.4**	**26**	**41**	**63**	**4**	**25,430**
Scenario Total	**12,077**	**12,704**	**515**	**2.4**	**26**	**41**	**63**	**4**	**25,430**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Depreciated Direct Economic Losses for Buildings

September 18, 2009 *All values are in thousands of dollars*

	Capital Stock Losses		
	Cost Building Damage	Cost Contents Damage	Total Loss
Arizona			
Maricopa	10,439	10,922	21,361
Total	**10,439**	**10,922**	**21,361**
Scenario Total	**10,439**	**10,922**	**21,361**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Loss For Agriculture Products

September 18, 2009

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Total
Total					
Total					
Scenario Total					

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Losses for Buildings

September 18, 2009

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Arizona									
Maricopa	12,077	12,704	515	2.4	26	41	63	4	25,430
Total	**12,077**	**12,704**	**515**	**2.4**	**26**	**41**	**63**	**4**	**25,430**
Scenario Total	**12,077**	**12,704**	**515**	**2.4**	**26**	**41**	**63**	**4**	**25,430**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Loss For Transportation

September 18, 2009

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Arizona								
Maricopa								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Scenario Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Losses for Utilities

September 18, 2009

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Arizona							
Maricopa							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Scenario Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Losses For Vehicles (Day)

September 18, 2009

All values are in dollars.

	Cars	Light Trucks	Heavy Trucks	Total Loss
Arizona				
Maricopa	$511,490	$146,279	$110,337	$768,106
Total	**$511,490**	**$146,279**	**$110,337**	**$768,106**
Scenario Total	**$511,490**	**$146,279**	**$110,337**	**$768,106**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Direct Economic Losses For Vehicles (Night)

September 18, 2009

All values are in dollars.

	Car	Light Truck	Heavy Truck	Total Loss
Arizona				
Maricopa	$960,368	$290,362	$213,105	$1,463,835
Total	**$960,368**	**$290,362**	**$213,105**	**$1,463,835**
Scenario Total	**$960,368**	**$290,362**	**213,105**	**$1,463,835**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Income and Employment Impact (with outside aid)

September 18, 2009

Income impact in millions of dollars
Employment impact in number of employees
Positive values denote a gain, negative values denote a loss

	Agriculture	Mining	Construction	Manufacturing	Transportation	Trade	Finance	Services	Government	iscellaneous	Total

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Income and Employment Impact (without outside aid)

September 18, 2009

Income impact in millions of dollars
Employment impact in number of employees
Positive values denote a gain, negative values denote a loss

Agriculture	Mining	Construction	Manufacturing	Transportation	Trade	Finance	Services	Government	iscellaneous	Total

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Shelter Summary Report

September 18, 2009

	# of Displaced People	# of People Needing Short Term Shelter
Arizona		
Maricopa	773	261
Total	**773**	**261**
Scenario Total	**773**	**261**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Upper New River and Skunk Creek FRP
Scenario: Skunk Creek
Return Period: 100

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	New River and Deadman Wash
Return Period:	200
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	146
Short Term Shelter (# People)	221

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	7.26
Total Property (Capital Stock) Losses ($ Millions)	16.22
Business Interruptions (Income) Losses ($ Millions)	0.38

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	Skunk Creek
Return Period:	200
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	280
Short Term Shelter (# People)	293

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	16.42
Total Property (Capital Stock) Losses ($ Millions)	28.38
Business Interruptions (Income) Losses ($ Millions)	0.15

Disclaimer:

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The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: New River and Deadman Wash

Print Date: Thursday, September 10, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	268,322	78.4%
Commercial	54,178	15.8%
Industrial	8,550	2.5%
Agricultural	1,613	0.5%
Religion	3,272	1.0%
Government	3,187	0.9%
Education	3,058	0.9%
Total	**342,180**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	New River and Deadman Wash
Return Period Analyzed:	200
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 31 buildings will be at least moderately damaged. This is over 35% of the total number of buildings in the study case. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	1	3.23	16	51.61	4	12.90	7	22.58	3	9.68
Total	**0**		**1**		**16**		**4**		**7**		**3**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	100.00
Masonry	0	0.00	0	0.00	6	85.71	0	0.00	1	14.29	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	1	4.76	10	47.62	4	19.05	6	28.57	0	0.00

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	1	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,552 tons of debris will be generated. Of the total amount, Finishes comprises 52% of the total, Structure comprises 21% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 62 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 146 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 221 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 16.60 million dollars, which represents 4.85 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 16.22 million dollars. 2% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 43.80% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	4.37	1.47	0.23	0.54	6.62
	Content	2.89	3.53	0.50	2.44	9.36
	Inventory	0.00	0.07	0.12	0.05	0.25
	Subtotal	**7.26**	**5.07**	**0.85**	**3.04**	**16.22**
Business Interruption						
	Income	0.00	0.03	0.00	0.02	0.05
	Relocation	0.01	0.01	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.29	0.32
	Subtotal	**0.01**	**0.06**	**0.00**	**0.31**	**0.38**
ALL	**Total**	**7.27**	**5.13**	**0.85**	**3.35**	**16.60**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

HAZUS-MH: Flood Event Report

Region Name:	Upper New River and Skunk Creek FRP
Flood Scenario:	Skunk Creek
Print Date:	Tuesday, September 15, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	429,004	84.5%
Commercial	56,293	11.1%
Industrial	12,274	2.4%
Agricultural	4,531	0.9%
Religion	3,549	0.7%
Government	663	0.1%
Education	1,678	0.3%
Total	**507,992**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	Skunk Creek
Return Period Analyzed:	200
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 67 buildings will be at least moderately damaged. This is over 34% of the total number of buildings in the study case. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	4	5.97	43	64.18	7	10.45	13	19.40	0	0.00
Total	**0**		**4**		**43**		**7**		**13**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	1	7.14	10	71.43	1	7.14	2	14.29	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	3	5.66	33	62.26	6	11.32	11	20.75	0	0.00

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,686 tons of debris will be generated. Of the total amount, Finishes comprises 66% of the total, Structure comprises 14% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 67 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 280 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 293 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 28.53 million dollars, which represents 6.71 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 28.38 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 57.64% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	10.24	2.17	0.84	0.42	13.67
	Content	6.18	4.98	1.32	1.68	14.15
	Inventory	0.00	0.17	0.25	0.14	0.56
	Subtotal	**16.42**	**7.32**	**2.41**	**2.24**	**28.38**
Business Interruption						
	Income	0.00	0.03	0.00	0.01	0.04
	Relocation	0.03	0.01	0.00	0.00	0.03
	Rental Income	0.00	0.00	0.00	0.00	0.01
	Wage	0.00	0.03	0.00	0.04	0.07
	Subtotal	**0.03**	**0.07**	**0.00**	**0.06**	**0.15**
ALL	**Total**	**16.44**	**7.39**	**2.41**	**2.29**	**28.53**

Appendix A: County Listing for the Region

Arizona
- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	New River and Deadman Wash
Return Period:	500
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	206
Short Term Shelter (# People)	396

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	11.38
Total Property (Capital Stock) Losses ($ Millions)	22.38
Business Interruptions (Income) Losses ($ Millions)	0.55

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

Quick Assessment Report

September 15, 2009

Study Region :	Upper New River and Skunk Creek FRP
Scenario :	Skunk Creek
Return Period:	500
Analysis Option:	0

Regional Statistics

Area (Square Miles)	1,266
Number of Census Blocks	977
Number of Buildings	
Residential	8,408
Total	9,163
Number of People in the Region (x 1000)	17
Building Exposure ($ Millions)	
Residential	1,599
Total	1,891

Scenario Results

Shelter Requirements

Displaced Population (# Households)	355
Short Term Shelter (# People)	424

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	27.04
Total Property (Capital Stock) Losses ($ Millions)	41.98
Business Interruptions (Income) Losses ($ Millions)	0.19

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: New River and Deadman Wash

Print Date: Thursday, September 10, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	268,322	78.4%
Commercial	54,178	15.8%
Industrial	8,550	2.5%
Agricultural	1,613	0.5%
Religion	3,272	1.0%
Government	3,187	0.9%
Education	3,058	0.9%
Total	**342,180**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	New River and Deadman Wash
Return Period Analyzed:	500
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 61 buildings will be at least moderately damaged. This is over 30% of the total number of buildings in the study case. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	2	3.28	22	36.07	12	19.67	18	29.51	7	11.48
Total	**0**		**2**		**22**		**12**		**18**		**7**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	5	100.00
Masonry	0	0.00	0	0.00	8	47.06	3	17.65	6	35.29	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	2	5.13	14	35.90	9	23.08	12	30.77	2	5.13

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	1	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	1	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2,720 tons of debris will be generated. Of the total amount, Finishes comprises 43% of the total, Structure comprises 28% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 109 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 206 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 396 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 22.94 million dollars, which represents 6.70 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 22.38 million dollars. 2% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 49.68% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	6.77	1.95	0.27	0.79	9.78
	Content	4.61	4.09	0.54	3.12	12.36
	Inventory	0.00	0.08	0.11	0.06	0.25
	Subtotal	**11.38**	**6.11**	**0.92**	**3.98**	**22.38**
Business Interruption						
	Income	0.00	0.03	0.00	0.02	0.06
	Relocation	0.01	0.00	0.00	0.00	0.02
	Rental Income	0.00	0.00	0.00	0.00	0.01
	Wage	0.00	0.03	0.00	0.45	0.47
	Subtotal	**0.02**	**0.07**	**0.00**	**0.47**	**0.55**
ALL	**Total**	**11.40**	**6.18**	**0.92**	**4.45**	**22.94**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**

HAZUS-MH: Flood Event Report

Region Name: Upper New River and Skunk Creek FRP

Flood Scenario: Skunk Creek

Print Date: Tuesday, September 15, 2009

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Arizona

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,266 square miles and contains 977 census blocks. There are over 6 thousand households in the region and has a total population of 17,221 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,163 buildings in the region with a total building replacement value (excluding contents) of 1,891 million dollars (2006 dollars). Approximately 91.76% of the buildings (and 84.59% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 9,163 buildings in the region which have an aggregate total replacement value of 1,891 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,599,311	84.6%
Commercial	226,104	12.0%
Industrial	33,045	1.7%
Agricultural	10,127	0.5%
Religion	10,647	0.6%
Government	4,522	0.2%
Education	6,814	0.4%
Total	**1,890,570**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	429,004	84.5%
Commercial	56,293	11.1%
Industrial	12,274	2.4%
Agricultural	4,531	0.9%
Religion	3,549	0.7%
Government	663	0.1%
Education	1,678	0.3%
Total	**507,992**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 6 fire stations, no police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Upper New River and Skunk Creek FRP
Scenario Name:	Skunk Creek
Return Period Analyzed:	500
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 124 buildings will be at least moderately damaged. This is over 34% of the total number of buildings in the study case. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	6	4.84	59	47.58	14	11.29	40	32.26	5	4.03
Total	**0**		**6**		**59**		**14**		**40**		**5**	

Table 4: Expected Building Damage by Building Type

	1-10		11-20		21-30		31-40		41-50		Substantially	
Building Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	1	3.33	17	56.67	1	3.33	9	30.00	2	6.67
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	5	5.38	42	45.16	13	13.98	31	33.33	2	2.15

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	3	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 3,614 tons of debris will be generated. Of the total amount, Finishes comprises 48% of the total, Structure comprises 25% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 145 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 355 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 424 people (out of a total population of 17,221) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 42.16 million dollars, which represents 9.92 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 41.98 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 64.22% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	16.80	2.69	1.11	0.55	21.16
	Content	10.23	6.06	1.76	2.03	20.08
	Inventory	0.00	0.21	0.34	0.19	0.73
	Subtotal	**27.04**	**8.97**	**3.20**	**2.77**	**41.98**
Business Interruption						
	Income	0.00	0.04	0.00	0.01	0.05
	Relocation	0.04	0.01	0.00	0.00	0.04
	Rental Income	0.00	0.00	0.00	0.00	0.01
	Wage	0.00	0.03	0.00	0.05	0.09
	Subtotal	**0.04**	**0.08**	**0.00**	**0.07**	**0.19**
ALL	**Total**	**27.08**	**9.04**	**3.20**	**2.84**	**42.16**

Appendix A: County Listing for the Region

Arizona

- Maricopa

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Arizona				
Maricopa	17,221	1,599,311	291,259	1,890,570
Total	**17,221**	**1,599,311**	**291,259**	**1,890,570**
Total Study Region	**17,221**	**1,599,311**	**291,259**	**1,890,570**