SECTION 5: RISK ASSESSMENT

§201.6(c)(2): *[The plan shall include…] (2) A* ***risk assessment*** *that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include:*

(i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

(ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of:

(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;

(B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate;

(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

(iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

One of the key elements to the hazard mitigation planning process is the risk assessment. In performing a risk assessment, a community determines "what" can occur, "when" (how often) it is likely to occur, and "how bad" the effects could be[32]. According to DMA 2000, the primary components of a risk assessment that answer these questions are generally categorized into the following measures:

- ☑ **Hazard Identification and Screening**
- ☑ **Hazard Profiling**
- ☑ **Assessing Vulnerability to Hazards**

The risk assessment for Maricopa County and participating jurisdictions was performed using a county-wide, multi-jurisdictional perspective, with much of the information gathering and development being accomplished by the MJPT. This integrated approach was employed because many hazard events are likely to affect numerous jurisdictions within a consolidated urban area like Maricopa County, and are rarely relegated to a single jurisdictional boundary. The vulnerability analysis was performed in a way such that the results reflect vulnerability at an individual jurisdictional level, and at a countywide level.

5.1 Hazard Identification and Screening

Hazard identification is the process of answering the question; "*What hazards can and do occur in my community or jurisdiction?*" For this update, the list of hazards identified in the 2004 Plan were reviewed by the MJPT with the goal of refining the list to reflect the natural hazards that pose the greatest risk to the jurisdictions represented by this MJHMP. The planning team also chose to focus on natural hazards, with the exception of dam and levee failure, which were considered to be closely tied to natural events and therefore kept. The MJPT also compared and contrasted the 2004 Plan list to the comprehensive hazard list summarized in the 2007 State Plan[33] to ensure compatibility with the State Plan. Table 5-1 summarizes the 2004 Plan and 2007 State Plan hazard lists.

[32] National Fire Protection Association, 2000, *Standard on Disaster/Emergency Management and Business Continuity Programs*, NFPA 1600.

[33] ADEM, 2007, *State of Arizona Multi-Hazard Mitigation Plan*

Table 5-1: Summary of Initial Hazard Identification Lists

2004 Plan Hazard List	2007 State Plan Hazard List
• Dam Failure • Disease • Drought • Earthquake • Extreme Heat • Flood • Hail • Hazardous Material (HAZMAT) Event • Lightning • Severe Winds • Subsidence • Thunderstorm • Tornado • Tropical Cyclone • Wildfire	• Dam Failure • Drought • Earthquake • Fissure • Flooding/Flash Flooding • Hazardous Materials Incidents • Landslides/Mudslides • Monsoon • Subsidence • Thunderstorms/High Winds • Tornadoes/Dust Devils • Tropical Storms/Hurricane • Wildfires • Winter Storms

The review included an initial screening process to evaluate each of the listed hazards based on the following considerations:

- Experiential knowledge on behalf of the MJPT with regard to the relative risk associated with the hazard
- Documented historic context for damages and losses associated with past events (especially events that have occurred during the last plan cycle)
- The ability/desire of MJPT to develop effective mitigation for the hazard under current DMA 2000 criteria
- Compatibility with the state hazard mitigation plan hazards
- Duplication of effects attributed to each hazard

One tool used in the initial screening process was the historic hazard database referenced in 2004 Plan. With this update, the 2004 Plan database was reviewed and revised to separately summarize declared disaster events versus non-declared events. Declared event sources included Maricopa County Department of Emergency Management (MCDEM), Arizona Division of Emergency Management (ADEM), Federal Emergency Management Agency (FEMA), and United States Department of Agriculture (USDA). Non-declared sources included Arizona State Land Department (ASLD), National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center (NCDC), United States Geological Survey (USGS), and United States Forest Service (USFS). Both data sets were updated with additional hazard events that have occurred over the last plan cycle and were also modified to primarily represent the period of June 1955 to February 2009. Two tables are used in this update to summarize the historic hazard events. Table 5-2 summarizes the federal and state disaster declarations that included Maricopa County. Table 5-3 summarizes all non-declared hazard events that meet the following selection criteria:

- 1 or more fatalities
- 1 or more injuries
- Any dollar amount in property or crop damages
- Significant event, as expressed in historical records or according to defined criteria above

Table 5-2: State and Federally Declared Natural Hazard Events That Included Maricopa County – January 1966 to October 2008

Hazard	No. of Declarations	Recorded Losses		
		Fatalities	Injuries	Damage Costs ($)
Drought	12	0	0	$303,000,000
Dam Failure	0	0	0	$0
Earthquake	0	0	0	$0
Fissure	2	0	0	$2,500
Flooding / Flash Flooding	16	52	115	$594,150,000
Landslide / Mudslide	0	0	0	$0
Levee Failure	0	0	0	$0
Snow Storm	0	0	0	$0
Sleet / Freezing Rain	0	0	0	$0
Subsidence	2	0	0	$4,170,000
Thunderstorm / High Wind	4	0	0	$0
Tornado	0	0	0	$0
Tropical Storm / Hurricane	1	0	0	$375,000,000
Wildfire	18	0	0	$0
Notes: Damage Costs are reported as is and no attempt has been made to adjust costs to current dollar values				

Table 5-3: Maricopa County Historic Hazard Events – June 1955 to September 2008

Hazard	No. of Records	Recorded Losses		
		Fatalities	Injuries	Damage Costs ($)
Drought	0	0	0	$0
Dam Failure	1	0	0	$0
Earthquake	0	0	0	$0
Fissure	0	0	0	$0
Flooding / Flash Flooding	31	9	7	$101,610,500
Landslide / Mudslide	0	0	0	$0
Levee Failure	0	0	0	$0
Snow Storm	4	1	0	$115,000
Sleet / Freezing Rain	0	0	0	$0
Subsidence	0	0	0	$0
Thunderstorm / High Wind	193	6	144	$421,055,000
Tornado	44	0	57	$37,220,900
Tropical Storm / Hurricane	0	0	0	$0
Wildfire	4	0	0	$0
Notes: Damage Costs are reported as is and no attempt has been made to adjust costs to current dollar values				

Detailed historic hazard records are provided in Appendix D.

The culmination of the review and screening process by the MJPT resulted in a revised list of hazards that will be carried forward with this updated mitigation plan. The 2004 Plan hazards selected for removal are listed below and include a brief explanation of the reason for removal:

Disease – there are numerous agencies and programs at the local, state and federal levels to prevent, detect, and respond to disease. Examples include the Centers for Disease Control and Prevention, Arizona Department of Health Services, Maricopa County Department of Public Health, Organization Internationale des Epizooties, USDA Animal and Plant Health Inspection Service, USDA Plant Protection and Quarantine, and Arizona Department of Agriculture. The MJPT chose to focus resources and attention on other hazards and not duplicate existing efforts.

Earthquake – there are no damage causing historic seismic events recorded for Maricopa County, and the entire county is located within a relatively low seismic risk area. The MJPT felt that the perceived low risk did not warrant further consideration.

Hail – the MJPT acknowledges that historic hailstorms (usually associated with thunderstorm events) have caused some damage in the past. However, mitigating hail damage is extremely difficult, if not cost prohibitive, and the MJPT chose to not include the hazard as a line item.

Hazardous Material (HAZMAT) Event – HAZMAT events are usually addressed by Local Emergency Planning Committees (LEPC) and Community Emergency Response Teams (CERT). This hazard is also a human caused event and will not be addressed in this plan.

Lightning – lightning strikes are a regular part of the monsoon season and have resulted in damages, injury, and even fatalities. For wildfire, lighting strikes are often the source of ignition. The MJPT acknowledges that lightning is a very real hazard, however, mitigating against lightning caused damages and/or injury is extremely difficult and further profiling was not deemed as warranted.

Several of the hazards in the 2004 Plan list may be better described as storm events wherein the effects of the storm may pose exposure to multiple hazards. For instance, hazards associated with a ***Thunderstorms*** may include flooding, microburst winds, tornados, and/or hail in a single event. ***Tropical Cyclone*** is another storm event that may include damaging winds and heavy precipitation resulting in flooding. In both of these examples, the true resulting hazards are generally flooding and damaging or severe winds. Accordingly, the MJPT chose to consolidate or eliminate several of the 2004 Plan hazards as follows:

Thunderstorm – damaging elements associated with thunderstorms include very intense bursts of precipitation that may result in flash-floods, micro- and macro-burst winds, hail, lightning, and occasionally tornados. Accordingly, the hazard category of "thunderstorm" will be eliminated as the flooding and severe wind effects are addressed already.

Tropical Cyclone – the damaging elements associated with tropical cyclones are the heavy precipitation that results in flooding and sever winds. As with thunderstorm, these hazards are addressed elsewhere and this category is therefore redundant.

Tornado – damage producing tornadoes are rare in Arizona and are usually associated with thunderstorm events. Additionally, mitigation of damages due to the typical type of tornado that impacts Maricopa County would be similar to those proposed for other severe wind events such as micro-bursts. Accordingly, this hazard is being eliminated as a line item and will be incorporated into the ***Severe Wind*** category.

The MJPT has selected the following list of hazards for profiling and updating based on the above explanations and screening process. Revised and updated definitions for each hazard are provided in Section 5.3 and in Section 8.2:

- **Dam Inundation**
- **Drought**
- **Extreme Heat**
- **Fissure**
- **Flood**
- **Levee Failure**
- **Severe Wind**
- **Subsidence**
- **Wildfire**

5.2 Vulnerability Analysis Methodology

5.2.1 General

The following sections summarize the methodologies used to perform the vulnerability analysis portion of the risk assessment. For this update, the entire vulnerability analysis was either revised or updated to reflect the new hazard categories, the availability of new data, or differing loss estimation methodology. Specific changes are noted below and/or in Section 5.3

For the purposes of this vulnerability analysis, hazard profile maps were developed for Dam Inundation, Fissure, Flood, Levee Failure, Subsidence and Wildfire, to map the geographic variability of the probability and magnitude risk of the hazards as estimated by the planning team. Hazard profile categories of HIGH, LOW, and/or MEDIUM were used and were subjectively assigned based on the factors discussed in Probability and Magnitude sections below. Within the context of the county limits, the other hazards do not exhibit significant geographic variability and will not be categorized as such.

Unless otherwise specified in this Plan, the general cutoff date for new historic or hazard profile data is the end of February 2009.

5.2.2 Calculated Priority Risk Index (CPRI) Evaluation

The first step in the vulnerability analysis (VA) is to assess the perceived overall risk for each of the plan hazards using a tool developed by the State of Arizona called the Calculated Priority Risk Index[34] (CPRI). The CPRI value is obtained by assigning varying degrees of risk to four (4) categories for each hazard, and then calculating an index value based on a weighting scheme. Table 5-4 summarizes the CPRI risk categories and provides guidance regarding the assignment of values and weighting factors for each category. As an example, assume that the project team is assessing the hazard of flooding, and has decided that the following assignments best describe the flooding hazard for their community:

- Probability = Likely
- Magnitude/Severity = Critical
- Warning Time = 12 to 24 hours
- Duration = Less than 6 hours

The CPRI for the flooding hazard would then be:

CPRI = [(3*0.45) + (3*0.30) + (2*0.15) + (1*0.10)]

CPRI = 2.65

[34] ADEM, 2003, *Arizona Model Local Hazard Mitigation Plan*, prepared by JE Fuller/ Hydrology & Geomorphology, Inc.

Table 5-4: Summary of Calculated Priority Risk Index (CPRI) categories and risk levels

CPRI Category	Degree of Risk			Assigned Weighting Factor
	Level ID	Description	Index Value	
Probability	Unlikely	▪ Extremely rare with no documented history of occurrences or events. ▪ Annual probability of less than 0.001.	1	45%
	Possibly	▪ Rare occurrences with at least one documented or anecdotal historic event. ▪ Annual probability that is between 0.01 and 0.001.	2	
	Likely	▪ Occasional occurrences with at least two or more documented historic events. ▪ Annual probability that is between 0.1 and 0.01.	3	
	Highly Likely	▪ Frequent events with a well documented history of occurrence. ▪ Annual probability that is greater than 0.1.	4	
Magnitude/ Severity	Negligible	▪ Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses are treatable with first aid and there are no deaths. ▪ Negligible quality of life lost. ▪ Shut down of critical facilities for less than 24 hours.	1	30%
	Limited	▪ Slight property damages (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses do not result in permanent disability and there are no deaths. ▪ Moderate quality of life lost. ▪ Shut down of critical facilities for more than 1 day and less than 1 week.	2	
	Critical	▪ Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses result in permanent disability and at least one death. ▪ Shut down of critical facilities for more than 1 week and less than 1 month.	3	
	Catastrophic	▪ Severe property damages (greater than 50% of critical and non-critical facilities and infrastructure). ▪ Injuries or illnesses result in permanent disability and multiple deaths. ▪ Shut down of critical facilities for more than 1 month.	4	
Warning Time	Less than 6 hours	Self explanatory.	4	15%
	6 to 12 hours	Self explanatory.	3	
	12 to 24 hours	Self explanatory.	2	
	More than 24 hours	Self explanatory.	1	
Duration	Less than 6 hours	Self explanatory.	1	10%
	Less than 24 hours	Self explanatory.	2	
	Less than one week	Self explanatory.	3	
	More than one week	Self explanatory.	4	

5.2.3 Asset Inventory

With this update, a detailed asset inventory was performed to establish a more accurate baseline data-set for assessing the vulnerability of each jurisdiction's assets to the hazards identified in Section 5.1. This effort constitutes a significant change to the base asset data used in the 2004 Plan, and consequently to the entire vulnerability analysis. Details of this change are discussed later in this section.

The 2007 State Plan defines assets as:

Any natural or human-caused feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

The asset inventory is generally tabularized into ***critical*** and ***non-critical*** categories. ***Critical facilities and infrastructure*** are systems, structures and infrastructure within a community whose incapacity or destruction would:

- Have a debilitating impact on the defense or economic security of that community.
- Significantly hinder a community's ability to recover following a disaster.

Following the criteria set forth by the Critical Infrastructure Assurance Office (CIAO), the State of Arizona has adopted eight general categories[35] that define critical facilities and infrastructure:

1. **Telecommunications Infrastructure:** Telephone, data services, and Internet communications, which have become essential to continuity of business, industry, government, and military operations.
2. **Electrical Power Systems:** Generation stations and transmission and distribution networks that create and supply electricity to end-users.
3. **Gas and Oil Facilities:** Production and holding facilities for natural gas, crude and refined petroleum, and petroleum-derived fuels, as well as the refining and processing facilities for these fuels.
4. **Banking and Finance Institutions:** Banks, financial service companies, payment systems, investment companies, and securities/commodities exchanges.
5. **Transportation Networks:** Highways, railroads, ports and inland waterways, pipelines, and airports and airways that facilitate the efficient movement of goods and people.
6. **Water Supply Systems:** Sources of water; reservoirs and holding facilities; aqueducts and other transport systems; filtration, cleaning, and treatment systems; pipelines; cooling systems; and other delivery mechanisms that provide for domestic and industrial applications, including systems for dealing with water runoff, wastewater, and firefighting.
7. **Government Services:** Capabilities at the federal, state, and local levels of government required to meet the needs for essential services to the public.
8. **Emergency Services:** Medical, police, fire, and rescue systems.

Other assets such as public libraries, schools, museums, parks, recreational facilities, historic buildings or sites, churches, residential and/or commercial subdivisions, apartment complexes, and so forth, are classified as non-critical facilities and infrastructure, as they are not necessarily "critical" per the definition set forth in Executive Order 13010. They are, however, still considered by the MJPT to be important facilities and critical and non-critical should not be construed to equate to important and non-important. For each asset, attributes such name, description, physical address, geospatial position,

[35] Instituted via Executive Order 13010, which was signed by President Clinton in 1996.

and estimated replacement cost were identified to the greatest extent possible and entered into a GIS geodatabase.

The 2004 Plan used HAZUS[36] data to represent the critical and non-critical facilities for Maricopa County jurisdictions. During the review, the MJPT determined that many of the HAZUS facilities were not geospatially positioned correctly and felt that the dataset did not provide an adequate or accurate depiction of the participating jurisdiction's asset inventories. Accordingly, new asset inventory data was developed for each community using existing GIS data sets, on-line mapping utilities, and manual data acquisition by members of the local planning teams. Table 5-5 summarizes the facility counts by category for each of the participating jurisdictions in this plan.

5.2.4 Loss Estimations

In the original 2004 Plan, losses were estimated by either quantitative or qualitative methods. Quantitative methods included use of the HAZUS®-MH program or a statistical approach that was based on historic data. None of the original computational data was available for this update, nor were any of the statistical calculations. Accordingly, all loss estimates for this Plan update are new and were accomplished using the procedures discussed below.

Economic loss and human exposure estimates for each of the final hazards identified in Section 5.1 begins with an assessment of the potential exposure of critical and non-critical assets and human populations to those hazards. Estimates of exposure to critical and non-critical assets identified by each jurisdiction is accomplished by intersecting the asset inventory with the hazard profiles in Section 5.3 Human or population exposures are estimated by intersecting the same hazards with 2000 Census Data population statistics that have been re-organized into GIS compatible databases and distributed with HAZUS®-MH [37]. Additional exposure estimates for general residential, commercial, and industrial building stock not specifically identified with the asset inventory, are also accomplished using the HAZUS®-MH database, wherein the developers of the HAZUS®-MH database have made attempts to correlate building/structure counts to census block data.

It is duly noted that the HAZUS®-MH data population statistics may not exactly equate to the current population statistics provided in Section 4.2 due to changes in population, GIS positioning anomalies and the way HAZUS®-MH depicts certain census block data. It is also noted that the residential, commercial and industrial building stock estimates for each census block may severely under-predict the actual buildings present due to the substantial growth in the last decade and the general lack of data for some of the more rural communities within the county, and the disparity of the HAZUS®-MH estimates for these categories. However, without a detailed, site specific structure inventory of these types of buildings, the HAZUS®-MH database is still the best available and the results are representative of a general magnitude of population and residential, commercial and industrial facility exposures to the various hazards discussed. Combining the exposure results from the asset inventory and the HAZUS®-MH database provides a fairly comprehensive depiction of the overall exposure of building stock and the two datasets are considered complimentary and not redundant.

[36] U.S. Department of Homeland Security, Federal Emergency Management Agency, HAZUS®-MH.

[37] U.S. Department of Homeland Security, Federal Emergency Management Agency, HAZUS®-MH.

Table 5-5: Summary of Critical and Non-Critical Facility counts by category and jurisdiction

Participating Jurisdiction	Critical Facilities and Infrastructure								Non-Critical Facilities and Infrastructure				
	Telecommunications Infrastructure	Electrical Power Systems	Gas and Oil Facilities	Banking and Finance Institutions	Transportation Networks	Water Supply Systems	Government Services	Emergency Services	Education	Cultural	Business	Residential	Recreational
Avondale						39	2	1	8		8		3
Buckeye		10		3		36	10	7	10	1			
Carefree						1	4	1					
Cave Creek		1				32	4						2
Chandler	16	22			1	57	35	15	57	3		18	2
El Mirage					2	13	3	3	6		7		
Fountain Hills						1	3	2	6			1	2
Fort McDowell Yavapai Nation					1		3	2	1	2	8		1
Gila Bend						2	3	1	1				
Gilbert	18	3		52		14,317 (225)[a]	33	25	77	94	68	179	100
Glendale	3	19	1	42	51	52	41	87	183	108	162	360	96
Goodyear	14	1		14	7	27	10	8	11		1		
Guadalupe							2	1	2				1
Litchfield Park							1		2		1		1
Maricopa County		7			363	4	54	19					
Mesa		12	214		6	136	53	38	123	4		24	3
Paradise Valley	6	1				16	2	7	6	14	13	4	
Peoria					4	43	94	4	35	6		35	4
Phoenix		6	5		1	16	270	101	422	19		66	7
Queen Creek	17			8	10	21	3	6	12	9	11	11	9
Salt River Pima-Maricopa Indian Community	1	1	2		3		3	4	2	1	2		2
Salt River Project	SRP reported a total of 511 assets that are comprised of SRP main buildings/offices, substations, switchyards, receiving stations, and well sites. No further separation of asset categories was necessary.												
Scottsdale		1				1	17	6	54	15		18	2
Surprise		1			2	1	4	8	15	1		4	1
Tempe			1			3	22	5	71	1		6	2
Tolleson						2	2	2	4				
Wickenburg		1	1				2	2	5				
Youngtown							2		1			2	

a – Number of water supply facilities that are not a part of the underground pipe network

Economic losses to structures and facilities are estimated by multiplying the exposed facility replacement cost estimates by an assumed exposure to loss ratio for the hazard. The exposure to loss ratios used in this plan update are summarized by hazard in Section 5.3. It is important to note that the exposure to loss ratios are subjective and the estimates are solely intended to provide an understanding of relative risk from the hazards and potential losses. The reality is that uncertainties are inherent in any loss estimation methodology due to:

- Incomplete scientific knowledge concerning hazards and our ability to predict their effects on the built environment;
- Approximations and simplifications that are necessary for a comprehensive analysis; and,
- Lack of detailed data necessary to implement a viable statistical approach to loss estimations.

Several of the hazards profiled in this Plan update will not include quantitative exposure and loss estimates. The vulnerability of people and assets associated with some hazards are nearly impossible to evaluate given the uncertainty associated with where these hazards will occur as well as the relatively limited focus and extent of damage. Instead, a qualitative review of vulnerability will be discussed to provide insight to the nature of losses that are associated with the hazard. For subsequent updates of this Plan, the data needed to evaluate these unpredictable hazards may become refined such that comprehensive vulnerability statements and thorough loss estimates can be made.

5.2.5 Development Trend Analysis

The 2004 Plan development trend analysis will require updating to reflect growth and changes in Maricopa County over the last planning cycle. The updated analysis will focus on the potential risk associated with projected growth patterns and their intersection with the Plan identified hazards.

5.3 Hazard Risk Profiles

The following sections summarize the risk profiles for each of the Plan hazards identified in Section 5.1. For each hazard, the following elements are addressed to present the overall risk profile:

- **Description**
- **History**
- **Probability and Magnitude**
- **Vulnerability**
  - **CPRI Results**
  - **Loss Estimations**
  - **Development Trend Analysis**
- **Sources**
- **Profile Maps (if applicable)**

Much of the 2004 Plan data has been updated, incorporated and/or revised to reflect current data and MJPT changes, as well as an overall plan format change. County-wide profile maps are provided at the end of the section (if applicable) and jurisdiction specific maps are included in the Executive Plan Summary for that jurisdiction. Also, the maps are not included in the pagination count.

5.3.1 Dam Inundation

Description

There are two primary scenarios of downstream inundation risk associated with dams in Maricopa County: (1) Emergency Spillway Discharges, and (2) Dam Failure. In the 2004 Plan, only dam failure was addressed. For this update, the MJPT wanted to provide a distinction between the downstream inundation risk due to emergency spillway discharges versus a dam failure. Accordingly, vulnerability for each scenario will be assessed separately.

Dams within or impacting Maricopa County can generally be divided into two groups: (1) storage reservoirs designed to permanently impound water and possibly generate power, and (2) single purpose flood retarding structures (FRS) designed to attenuate or reduce flooding by impounding stormwater for relatively short durations of time during flood events. The majority of dams within, or upstream of, Maricopa County are FRS and are typically earthen structures equipped with emergency spillways. The purpose of an emergency spillway is to provide a designed and protected outlet to convey runoff volumes exceeding the dam's storage capacity during extreme or back-to-back storm events. Dam failures may be caused by a variety of reasons including: seismic events, extreme wave

action, leakage and piping, overtopping, material fatigue and spillway erosion. The risk associated with an emergency spillway discharge is different from a dam failure for several reasons:

- First, dams that are properly designed and maintained are considerably less likely to fail and assets located downstream of them are more likely to be impacted by an emergency spillway discharge than by a dam failure.
- Second, the emergency spillway is at a fixed location(s), and therefore, the downstream inundation limits can be more readily predicted as compared to a dam failure, which could occur anywhere along the structure.
- Lastly, the dynamics of the flood wave associated with an emergency spillway discharge are different than that of a dam failure. A dam failure is an uncontrolled release of water impounded behind a dam through a breach in the dam itself, and is usually catastrophically destructive. An emergency spillway discharge usually increases in magnitude gradually, and then decreases gradually as the structure drains.

History

Maricopa County has a limited history of dam failures and emergency spillway discharges that caused damaging inundation of downstream properties. The following are examples from the records available:

- In January-February 1993, a major statewide precipitation event caused major spillway releases from the Salt and Verde River system of dams, with a peak discharge of nearly 124,000 cfs from Granite Reef Dam. The unavoidable releases caused major flooding along the Salt and Gila River all the way to the county line, with over $38 million in public and private damages reported and the evacuation of over 200 families. The flooding also caused the failure of Gillespie Dam[38] and forced peak spillway discharges of 25,600 cfs at Painted Rock Dam in the southwestern part of the county (USACE, 1994).
- In September 1997, Tropical Storm Nora moved through the western portion of Maricopa County dumping record breaking precipitation along the way. The Narrows Dam located just north of Maricopa County on Centennial Wash, began filling in the early part of the storm with flows reaching a depth of over two feet in the emergency spillway before the dam itself failed by breach in two locations. The peak discharge estimated from the dam spillway was 2,610 cfs (FCDMC, 1997).

Probability and Magnitude

The probability and magnitude of emergency spillway and dam failure discharges vary greatly with each dam. Most of the dams located within Maricopa County function as flood retarding structures (FRS) with a normally dry impoundment area. These FRS are typically designed to store, at a minimum, runoff from the one percent probability storm (100-year) in the flood-pool below the crest of the emergency spillway. Many of the FRS have sufficient capacity to store the 0.2 percent probability storm (500-year) or greater, without emergency spillway operation. Depending on the dam hazard classification, the emergency spillways will usually have capacity to pass the entire Inflow Design Flood (IDF) without any overtopping of the dam itself. The IDF is based on the hazard classification of the dam and is usually the probable maximum flood (PMF) or some fraction thereof. Other dams impacting Maricopa County that impound water on a continuous basis (Salt and Verde River systems for example) are typically equipped with primary and secondary spillways that are closely monitored and operated to provide an optimized level of flood protection, freeboard and reservoir storage for power generation, irrigation, and drinking water supplies. Probabilities and magnitudes of spillway discharge from these systems are dependent on several variables such as available reservoir capacity, time of year, and magnitude of storm causing the spillway discharge.

[38] Gillespie Dam was an irrigation diversion structure that was not regulated as a jurisdictional dam by ADWR.

There are two sources of data that publish hazard ratings for dams impacting Maricopa County that are based on either an assessment of the consequence of failure and/or dam safety considerations. The hazard ratings are not tied to probability of occurrence. The first is the Arizona Department of Water Resources (ADWR) and the second is the National Inventory of Dams (NID).

ADWR has regulatory jurisdiction over the non-federal dams impacting the County and is responsible for regulating the safety of these dams, conducting field investigations, and participating in flood mitigation programs with the goal of minimizing the risk for loss of life and property to the citizens of Arizona. ADWR jurisdictional dams are inspected regularly according to downstream hazard potential classification. High hazard dams are inspected annually, significant hazard dams every three years, and low hazard dams every five years. Via these inspections, ADWR identifies safety deficiencies requiring correction and assigns each dam one of five safety ratings (listed in increasing severity): no deficiency, safety deficiency, unsafe non-emergency, unsafe non-emergency elevated risk, or unsafe emergency. Examples of safety deficiencies include: lack of an adequate emergency action plan, inability to safely pass the required IDF, embankment erosion, dam stability, etc. Further descriptions of each safety classification are summarized in Table 5-6.

Table 5-6: Summary of ADWR safety categories

ADWR Safety Rating	Definition
No Deficiency	No safety deficiencies found
Safety Deficiency	One or more conditions at the dam that impair or adversely affects the safe operation of the dam.
Unsafe Non-emergency	Safety deficiencies in a dam or spillway could result in failure of the dam with subsequent loss of human life or significant property damage. Failure is not considered imminent.
Unsafe Non-emergency Elevated Risk	Safety deficiencies in a dam or spillway could result in failure of the dam with subsequent loss of human life or significant property damage. Concern the dam could fail during a 100-yr or smaller flood.
Unsafe Emergency	The dam is in imminent risk of failure.

Source: ADWR, 2009.

The NID database contains information on approximately 77,000 dams in the 50 states and Puerto Rico, with approximately 30 characteristics reported for each dam, such as: name, owner, river, nearest community, length, height, average storage, max storage, hazard rating, Emergency Action Plan (EAP), latitude, and longitude. Dams within the NID database are classified by hazard potential that is based on an assessment of the consequences of failure. Table 5-7 summarizes those classifications and there criteria.

Table 5-7: Summary of NID downstream hazard classifications

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Note: The hazard potential classification is an assessment of the consequences of failure, but not an evaluation of the probability of failure.

Source: NID

The NID database includes dams that are either:

- High or Significant hazard potential class dams, or,
- Low hazard potential class dams that exceed 25 feet in height and 15 acre-feet storage, or,

- Low hazard potential class dams that exceed 50 acre-feet storage and 6 feet height.

There are 52 dams in the NID database that are located in Maricopa County, and 41 of those dams are under ADWR jurisdiction. There are also four more dams located in Pinal County that are owned and operated by the Flood Control District of Maricopa County and have a direct impact on Maricopa County communities. Table 5-8 provides a summary of the hazard and safety classifications by count for both the ADWR and NID databases. The location and hazard classifications for each dam are shown on Maps 1A, 1B, 1C and 2A, 2B, and 2C.

Table 5-8: Summary count of NID and ADWR hazard classification dams

Database Source	High	Significant	Low	Safety Deficiency	Unsafe (any sub-category)
NID	39	8	5	N/A	N/A
ADWR	36	5	4	7	3

NOTES:
- Two of the unsafe dams require rehabilitation or removal and one is designated as non-emergency, elevated risk.
- Four of the High hazard dams are located just east of Maricopa County in Pinal County.

Source: ADWR and NID, 2009

The magnitude of impacts due to emergency spillway flows and/or dam failure are usually depicted by mapping the estimated inundation limits based on an assessment of a combination of flow depth and velocity. These limits are typically a critical part of the emergency action plan. Of the 56 dams considered, 40 have emergency action plans.

The MJPT chose to assign profile categories separately for emergency spillway inundation and dam failure inundation, since the perceived probability and magnitude for each is distinctly different. For inundation resulting from emergency spillway flows, two classes of hazard risk are depicted as follows:

HIGH Hazard = Inundation limits due to full emergency spillway flow

LOW Hazard = All other areas outside the inundation limits

For inundation resulting from a dam failure, three classes of hazard are depicted as follows:

HIGH Hazard = Dam failure inundation limits downstream of any dam classified as "Unsafe" by ADWR.

MEDIUM Hazard = Dam failure inundation limits downstream of any dam classified as "Safety Deficient" by ADWR.

LOW Hazard = All other areas.

Extents of the emergency spillway and dam failure inundation hazard areas are shown on Maps 1A-C and 2A-C, respectively.

Vulnerability – CPRI Results

Dam inundation CPRI results for each community are summarized in Table 5-9.

Table 5-9: Summary of CPRI results by jurisdiction for dam inundation (emergency spillway flow and dam failure)

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Possibly	Limited	6 – 12 hours	< 24 hours	2.15
Buckeye	Unlikely	Critical	<6 hours	<6 hours	2.05
Carefree	Unlikely	Negligible	12-24 hours	<1 week	1.35
Cave Creek	Unlikely	Limited	>24 hours	<24 hours	1.40
Chandler	Unlikely	Limited	>24 hours	<24 hours	1.40
El Mirage	Possibly	Limited	<6 hours	<24 hours	2.30
Fountain Hills	Possibly	Limited	<6 hours	>1 week	2.50
Fort McDowell Yavapai Nation	Unlikely	Negligible	>24 hours	<24 hours	1.10
Gila Bend	Unlikely	Negligible	>24 hours	<6 hours	1.00
Gilbert	Unlikely	Critical	6-12 hours	<1 week	2.10
Glendale	Unlikely	Negligible	<6 hours	<6 hours	1.45
Goodyear	Unlikely	Critical	<6 hours	<24 hours	2.15
Guadalupe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Litchfield Park	Unlikely	Limited	<6 hours	<24 hours	1.85
Unincorporated Maricopa County	Possibly	Critical	<6 hours	>1 week	2.80
Mesa	Unlikely	Critical	<6 hours	>1 week	2.35
Paradise Valley	Unlikely	Catastrophic	>24 hours	<24 hours	2.00
Peoria	Possibly	Catastrophic	<6 hours	<6 hours	2.80
Phoenix	Unlikely	Critical	12-24 hours	<24 hours	1.85
Queen Creek	Unlikely	Catastrophic	12-24 hours	<24 hours	2.15
Salt River Pima-Maricopa Indian Community	Possibly	Catastrophic	<6 hours	>1 week	3.10
Salt River Project	Unlikely	Catastrophic	<6 hours	<1 week	2.55
Scottsdale	Possibly	Negligible	6-12 hours	<24 hours	1.85
Surprise	Unlikely	Catastrophic	6-12 hours	<6 hours	2.20
Tempe	Unlikely	Catastrophic	6-12 hours	>1 week	2.50
Tolleson	Unlikely	Negligible	>24 hours	<1 week	1.20
Wickenburg	Possibly	Catastrophic	<6 hours	<24 hours	2.90
Youngtown	Likely	Critical	6-12 hours	<24 hours	2.90
				County-wide average CPRI =	**2.04**

Vulnerability – Loss Estimations

The estimation of potential losses due to inundation from either an emergency spillway flow or a dam failure was accomplished by intersecting the human and facility assets with the inundation limits depicted on Maps 1A, 1B, and 1C. Since no common methodology is available for obtaining losses from the exposure values, estimates of the loss-to-exposure ratios were assumed based on the perceived potential for damage. Any storm event, or series of storm events of sufficient magnitude to cause an emergency spillway to operate or cause a dam failure scenario, would have potentially catastrophic consequences in the inundation area. Floodwaves from these type of events travel very fast and possess tremendous destructive energy. Accordingly, an average, event based loss-to-exposure ratio for the inundation areas with a high and medium hazard rating are estimated to be 0.25. Low rated areas are zero.

It should be noted that the MJPT recognizes that probability of an emergency spillway flow or dam failure occurring on multiple (or all) structures at the same time is essentially zero. Accordingly, the loss estimates presented below are intended to serve as a collective evaluation of the potential exposure and losses to high and medium hazard emergency spillway and dam failure inundation events.

Table 5-10 and 5-11 summarize estimations of losses to MJPT identified assets for emergency spillway and dam failure inundation hazards. Tables 5-12 through 5-39 summarize exposure and loss estimates to the HAZUS residential, commercial, and industrial building stock for the emergency spillway and dam failure inundation hazards, as well as Fissure, Flooding, Levee Failure, Subsidence and Wildfire. Table 5-12 summarizes the HAZUS based exposure and losses for the entirety of Maricopa County. Tables 5-13 through 5-39 summarize jurisdiction specific HAZUS data exposure

and loss estimates. Tables 5-40 and 5-41 summarize the estimated population exposed to emergency spillway and dam failure inundation hazards.

In summary, $489.4 million and $3.7 billion in asset related losses are estimated for emergency spillway and dam failure inundations, respectively, for all the participating jurisdictions in Maricopa County and all high and medium hazard categories. An additional $1.5 and $23.8 billion in losses to HAZUS defined residential, commercial, and industrial facilities is estimated for all participating Maricopa County jurisdictions. Regarding human vulnerability, a total population of 53,424 people, or 3.51% of the total 2000 Maricopa County population, is potentially exposed to an emergency spillway inundation event. A total population of 861,534 people, or 56.6% of the total 2000 Maricopa County population, is potentially exposed to a high or medium hazard dam failure inundation event. The potential for deaths and injuries are directly related to the warning time and type of event and are plausible. Given the magnitude of such an event(s), it is realistic to anticipate at least one death and several injuries. There is also a high probability of population displacement for most of the inhabitants within the inundation limits downstream of the dam(s).

Vulnerability – Development Trend Analysis

Most of the dams within Maricopa County serve as flood retarding structures (FRS) and typically sit empty for most of their design life. The flood protection afforded by these structures has encouraged development of lands immediately downstream of the structures. In some cases, the FRS are long linear structures that intercept runoff from multiple washes and have emergency spillways that are not always directed to a regional watercourse. All of the larger dams with some level of permanent reservoir storage direct emergency spillway flows to the regional watercourse they are constructed on. Emergency spillway flows from these structures typically coincide with FEMA regulated 100-year floodplains in the downstream watercourse, and are therefore not as potentially destructive as an emergency spillway flow from some of the FRS structures. A dam failure in any case, would be catastrophic.

The vulnerability analysis indicates that collectively, over half of the county population is situated within the potential downstream inundation limits of a dam failure. Prohibition of development within those limits is not feasible. Instead, public awareness measures such as notices on final plats and public education on dam safety are mitigation efforts employed by local county and city/town officials. Also, Emergency Action Plans (EAPs) that establish notification procedures and thresholds are also prepared for response to potential dam related disaster events.

Sources

Arizona Department of Water Resources, 2009, http://www.azwater.gov/AzDWR/SurfaceWater/DamSafety/default.htm

Arizona Division of Emergency Management, 2009, *State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT*.

Flood Control District of Maricopa County, 1997, *Storm Report, Tropical Storm Nora – September 1997*, prepared by S. D. Waters.

URS, 2004, *Maricopa County Hazard Mitigation Plan*

US Army Corps of Engineers, 1994, *Flood Damage Report, State of Arizona, Floods of 1993*.

US Army Corps of Engineers, National Inventory of Dams, 2009, https://nid.usace.army.mil/

Profile Maps

Maps 1A, 1B, and 1C – Dam Spillway Flood Hazard Map

Maps 2A, 2B, and 2C – Potential Dam Failure Flood Hazard Map

Table 5-10: Summary asset inventory losses due to emergency spillway flooding

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
County-Wide Totals	**5,179**	**360**	**6.95%**	**100.00%**	**$1,993,560**	**$498,390**
Avondale	61	0	0.00%	0.00%	$0	$0
Buckeye	77	1	1.30%	0.28%	$0	$0
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	0	0.00%	0.00%	$0	$0
Chandler	226	0	0.00%	0.00%	$0	$0
El Mirage	34	22	64.71%	6.11%	$122,230	$30,558
Fountain Hills	15	0	0.00%	0.00%	$0	$0
Fort McDowell Yavapai Nation	18	0	0.00%	0.00%	$0	$0
Gila Bend	7	1	14.29%	0.28%	$9,000	$2,250
Gilbert	694	40	5.76%	11.11%	$611,000	$152,750
Glendale	1,205	77	6.39%	21.39%	$244,816	$61,204
Goodyear	93	0	0.00%	0.00%	$0	$0
Guadalupe	6	1	16.67%	0.28%	$800	$200
Litchfield Park	5	0	0.00%	0.00%	$0	$0
Unincorporated Maricopa County	447	17	3.80%	4.72%	$12,321	$3,080
Mesa	613	37	6.04%	10.28%	$90,824	$22,706
Paradise Valley	69	0	0.00%	0.00%	$0	$0
Peoria	225	33	14.67%	9.17%	$38,761	$9,690
Phoenix	913	8	0.88%	2.22%	$9,731	$2,433
Queen Creek	117	82	70.09%	22.78%	$156,502	$39,126
Salt River Pima-Maricopa Indian Community	21	21	100.00%	5.83%	$509,053	$127,263
Salt River Project [39]	511	8	1.57%	N/A	N/A	N/A
Scottsdale	114	1	0.88%	0.28%	$0	$0
Surprise	37	19	51.35%	5.28%	$188,521	$47,130
Tempe	111	0	0.00%	0.00%	$0	$0
Tolleson	10	0	0.00%	0.00%	$0	$0
Wickenburg	11	0	0.00%	0.00%	$0	$0
Youngtown	5	0	0.00%	0.00%	$0	$0

[39] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-11: Summary asset inventory losses due to dam failure flooding

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
HIGH						
County-Wide Totals	**5,179**	**573**	**11.06%**	**100.00%**	**$2,414,804**	**$603,701**
Avondale	61	0	0.00%	0.00%	$0	$0
Buckeye	77	0	0.00%	0.00%	$0	$0
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	0	0.00%	0.00%	$0	$0
Chandler	226	4	1.77%	0.70%	$5,870	$1,468
El Mirage	34	0	0.00%	0.00%	$0	$0
Fountain Hills	15	0	0.00%	0.00%	$0	$0
Fort McDowell Yavapai Nation	18	10	55.56%	1.75%	$22,630	$5,657
Gila Bend	7	2	28.57%	0.35%	$12,000	$3,000
Gilbert	694	501	72.19%	87.43%	$2,209,020	$552,255
Glendale	1,205	0	0.00%	0.00%	$0	$0
Goodyear	93	0	0.00%	0.00%	$0	$0
Guadalupe	6	0	0.00%	0.00%	$0	$0
Litchfield Park	5	0	0.00%	0.00%	$0	$0
Unincorporated Maricopa County	447	9	2.01%	1.57%	$49,618	$12,404
Mesa	613	40	6.53%	6.98%	$110,369	$27,592
Paradise Valley	69	0	0.00%	0.00%	$0	$0
Peoria	225	0	0.00%	0.00%	$0	$0
Phoenix	913	0	0.00%	0.00%	$0	$0
Queen Creek	117	6	5.13%	1.05%	$5,243	$1,311
Salt River Pima-Maricopa Indian Community	21	1	4.76%	0.17%	$54	$14
Salt River Project [40]	511	40	7.83%	N/A	N/A	N/A
Scottsdale	114	0	0.00%	0.00%	$0	$0
Surprise	37	0	0.00%	0.00%	$0	$0
Tempe	111	0	0.00%	0.00%	$0	$0
Tolleson	10	0	0.00%	0.00%	$0	$0
Wickenburg	11	0	0.00%	0.00%	$0	$0
Youngtown	5	0	0.00%	0.00%	$0	$0

[40] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-11: Summary asset inventory losses due to dam failure flooding

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
MEDIUM						
County-Wide Totals	**5,179**	**2390**	**46.15%**	**100.00%**	**$12,373,888**	**$3,093,472**
Avondale	61	61	100.00%	2.55%	$87,482	$21,871
Buckeye	77	27	35.06%	1.13%	$53,000	$13,250
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	0	0.00%	0.00%	$0	$0
Chandler	226	197	87.17%	8.24%	$844,840	$211,210
El Mirage	34	34	100.00%	1.42%	$267,640	$66,910
Fountain Hills	15	4	26.67%	0.17%	$185,500	$46,375
Fort McDowell Yavapai Nation	18	1	5.56%	0.04%	$4,000	$1,000
Gila Bend	7	1	14.29%	0.04%	$9,000	$2,250
Gilbert	694	82	11.82%	3.43%	$360,000	$90,000
Glendale	1,205	531	44.07%	22.22%	$1,886,808	$471,702
Goodyear	93	66	70.97%	2.76%	$90,198	$22,550
Guadalupe	6	2	33.33%	0.08%	$1,100	$275
Litchfield Park	5	1	20.00%	0.04%	$100,000	$25,000
Unincorporated Maricopa County	447	193	43.18%	8.08%	$876,772	$219,193
Mesa	613	155	25.29%	6.49%	$382,677	$95,669
Paradise Valley	69	13	18.84%	0.54%	$61,000	$15,250
Peoria	225	130	57.78%	5.44%	$115,275	$28,819
Phoenix	913	594	65.06%	24.85%	$4,867,484	$1,216,871
Queen Creek	117	92	78.63%	3.85%	$164,070	$41,017
Salt River Pima-Maricopa Indian Community	21	19	90.48%	0.79%	$508,986	$127,247
Salt River Project [41]	511	246	48.14%	N/A	N/A	N/A
Scottsdale	114	49	42.98%	2.05%	$55,000	$13,750
Surprise	37	28	75.68%	1.17%	$285,389	$71,347
Tempe	111	96	86.49%	4.02%	$1,157,300	$289,325
Tolleson	10	8	80.00%	0.33%	$0	$0
Wickenburg	11	1	9.09%	0.04%	$5,000	$1,250
Youngtown	5	5	100.00%	0.21%	$5,367	$1,342

[41] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-12: Summary of Maricopa County HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
Maricopa County HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
County-Wide Totals	**507,215**	**$126,956,339**	**26,647**	**$30,750,493**	**7,397**	**$7,187,748**	**$164,894,580**		
Flooding									
High	13,034	$3,505,566	779	$997,214	241	$266,873	$4,769,654	20%	$953,931
Medium	466,352	$115,034,095	24,305	$27,941,813	6,765	$6,683,366	$149,659,274	5%	$7,482,964
Dam Failure									
High	19,192	$5,243,823	1,138	$813,407	324	$263,799	$6,321,029	25%	$1,580,257
Medium	269,470	$65,736,310	14,407	$18,802,871	3,944	$4,422,934	$88,962,115	25%	$22,240,529
Wildfire									
High	251	$29,815	17	$15,313	3	$2,873	$48,002	20%	$9,600
Medium	107	$20,307	6	$4,137	2	$435	$24,879	5%	$1,244
Spillway									
High	24,111	$5,024,425	976	$906,036	294	$140,952	$6,071,413	25%	$1,517,853
Levee Failure									
High	4,106	$798,599	182	$158,800	67	$125,643	$1,083,042	20%	$216,608
Subsidence									
High	93,741	$21,903,194	3,935	$3,637,480	1,049	$598,084	$26,138,758	%	$0
Fissure									
High	474	$66,149	15	$7,634	6	$2,406	$76,189	%	$0

Maricopa County HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**94.51%**	**93.37%**	**94.14%**	**94.11%**	**94.73%**	**96.70%**
High	02.57%	02.76%	02.93%	03.24%	03.26%	03.71%
Medium	91.94%	90.61%	91.21%	90.87%	91.46%	92.98%
Dam Failure	**56.91%**	**55.91%**	**58.34%**	**63.79%**	**57.70%**	**65.20%**
High	03.78%	04.13%	04.27%	02.65%	04.38%	03.67%
Medium	53.13%	51.78%	54.07%	61.15%	53.32%	61.53%
Wildfire	**0.07%**	**0.04%**	**0.09%**	**0.06%**	**0.06%**	**0.05%**
High	0.05%	0.02%	0.06%	0.05%	0.03%	0.04%
Medium	0.02%	0.02%	0.02%	0.01%	0.03%	0.01%
Spillway	**04.75%**	**03.96%**	**03.66%**	**02.95%**	**03.97%**	**01.96%**
High	04.75%	03.96%	03.66%	02.95%	03.97%	01.96%
Levee Failure	**0.81%**	**0.63%**	**0.68%**	**0.52%**	**0.90%**	**01.75%**
High	0.81%	0.63%	0.68%	0.52%	0.90%	01.75%
Subsidence	**18.48%**	**17.25%**	**14.77%**	**11.83%**	**14.18%**	**08.32%**
High	18.48%	17.25%	14.77%	11.83%	14.18%	08.32%
Fissure	**0.09%**	**0.05%**	**0.06%**	**0.02%**	**0.09%**	**0.03%**
High	0.09%	0.05%	0.06%	0.02%	0.09%	0.03%

Table 5-13: Summary of AVONDALE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
AVONDALE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**4,580**	**$970,779**	**190**	**$112,339**	**42**	**$27,138**	**$1,110,256**		
Flooding									
High	9	$1,640	2	$2,569	1	$585	$4,794	20%	$959
Medium	4,572	$969,138	188	$109,770	42	$26,554	$1,105,462	5%	$55,273
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	4,577	$970,618	190	$112,338	42	$27,138	$1,110,094	25%	$277,524
Wildfire									
High	0	$31	0	$2	0	$0	$33	20%	$7
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	518	$115,603	18	$10,036	2	$552	$126,191	20%	$25,238
Subsidence									
High	1,133	$284,021	34	$22,976	6	$873	$307,870	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

AVONDALE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.19%	0.17%	01.18%	02.29%	01.43%	02.15%
Medium	99.81%	99.83%	98.82%	97.71%	98.57%	97.85%
Dam Failure	**99.93%**	**99.98%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	99.93%	99.98%	100.0%	100.0%	100.0%	100.0%
Wildfire	**0.0%**	**0.0%**	**0.01%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.01%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**11.32%**	**11.91%**	**09.52%**	**08.93%**	**05.07%**	**02.03%**
High	11.32%	11.91%	09.52%	08.93%	05.07%	02.03%
Subsidence	**24.74%**	**29.26%**	**17.76%**	**20.45%**	**14.21%**	**03.22%**
High	24.74%	29.26%	17.76%	20.45%	14.21%	03.22%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-14: Summary of BUCKEYE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
BUCKEYE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**1,609**	**$204,996**	**104**	**$63,794**	**27**	**$8,513**	**$277,303**		
Flooding									
High	67	$4,623	11	$5,741	2	$835	$11,199	20%	$2,240
Medium	1,542	$200,373	93	$57,991	24	$7,679	$266,042	5%	$13,302
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	1,502	$188,721	86	$55,896	22	$6,779	$251,397	25%	$62,849
Wildfire									
High	1	$44	2	$450	0	$0	$494	20%	$99
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	35	$4,984	2	$575	1	$282	$5,841	25%	$1,460
Levee Failure									
High	11	$1,443	1	$725	0	$77	$2,246	20%	$449
Subsidence									
High	116	$12,124	8	$3,285	2	$1,215	$16,625	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

BUCKEYE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**99.94%**	**99.90%**	**100.0%**	**100.0%**
High	04.14%	02.26%	10.42%	09.0%	08.93%	09.80%
Medium	95.86%	97.74%	89.51%	90.90%	91.07%	90.20%
Dam Failure	**93.36%**	**92.06%**	**82.91%**	**87.62%**	**81.70%**	**79.63%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	93.36%	92.06%	82.91%	87.62%	81.70%	79.63%
Wildfire	**0.06%**	**0.02%**	**01.93%**	**0.71%**	**0.0%**	**0.0%**
High	0.06%	0.02%	01.93%	0.71%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**02.15%**	**02.43%**	**01.95%**	**0.90%**	**02.94%**	**03.31%**
High	02.15%	02.43%	01.95%	0.90%	02.94%	03.31%
Levee Failure	**0.68%**	**0.70%**	**01.02%**	**01.14%**	**0.47%**	**0.91%**
High	0.68%	0.70%	01.02%	01.14%	0.47%	0.91%
Subsidence	**07.20%**	**05.91%**	**07.94%**	**05.15%**	**09.35%**	**14.27%**
High	07.20%	05.91%	07.94%	05.15%	09.35%	14.27%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-15: Summary of CAREFREE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
CAREFREE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**1,199**	**$364,026**	**48**	**$34,405**	**12**	**$4,672**	**$403,103**		
Flooding									
High	27	$7,646	1	$823	1	$197	$8,667	20%	$1,733
Medium	1,118	$333,498	46	$33,372	11	$4,439	$371,308	5%	$18,565
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	0	$0	0	$0	0	$0	$0	25%	$0
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$56	0	$11	0	$0	$67	20%	$13
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

CAREFREE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**95.50%**	**93.71%**	**98.80%**	**99.39%**	**97.27%**	**99.23%**
High	02.24%	02.10%	02.34%	02.39%	04.82%	04.22%
Medium	93.26%	91.61%	96.47%	97.0%	92.45%	95.01%
Dam Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.02%**	**0.02%**	**0.02%**	**0.03%**	**0.0%**	**0.0%**
High	0.02%	0.02%	0.02%	0.03%	0.0%	0.0%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-16: Summary of CAVE CREEK HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
CAVE CREEK (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**1,279**	**$235,535**	**84**	**$53,609**	**30**	**$12,638**	**$301,783**		
Flooding									
High	89	$17,519	6	$5,265	2	$881	$23,665	20%	$4,733
Medium	1,190	$218,016	78	$48,344	28	$11,757	$278,118	5%	$13,906
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	0	$0	0	$0	0	$0	$0	25%	$0
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	1	$55	$55	5%	$3
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$1	0	$0	0	$0	$1	20%	$0
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

CAVE CREEK (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	06.95%	07.44%	07.15%	09.82%	06.40%	06.97%
Medium	93.05%	92.56%	92.85%	90.18%	93.60%	93.03%
Dam Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**02.45%**	**0.44%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	02.45%	0.44%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-17: Summary of CHANDLER HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
CHANDLER (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**27,825**	**$7,617,113**	**1,393**	**$1,183,011**	**378**	**$341,750**	**$9,141,874**		
Flooding									
High	564	$121,106	14	$8,952	4	$6,706	$136,764	20%	$27,353
Medium	27,260	$7,496,006	1,380	$1,174,058	375	$335,045	$9,005,109	5%	$450,255
Dam Failure									
High	2,056	$582,224	61	$24,960	18	$6,642	$613,825	25%	$153,456
Medium	22,988	$6,328,712	1,156	$953,442	295	$207,184	$7,489,338	25%	$1,872,334
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	1	$213	0	$0	0	$0	$214	5%	$11
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	268	$42,820	20	$20,086	5	$5,419	$68,326	20%	$13,665
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

CHANDLER (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	02.03%	01.59%	01.0%	0.76%	01.01%	01.96%
Medium	97.97%	98.41%	99.0%	99.24%	98.99%	98.04%
Dam Failure	**90.01%**	**90.73%**	**87.30%**	**82.70%**	**82.60%**	**62.57%**
High	07.39%	07.64%	04.35%	02.11%	04.74%	01.94%
Medium	82.62%	83.09%	82.95%	80.59%	77.87%	60.62%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.96%**	**0.56%**	**01.45%**	**01.70%**	**01.26%**	**01.59%**
High	0.96%	0.56%	01.45%	01.70%	01.26%	01.59%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-18: Summary of EL MIRAGE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
EL MIRAGE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**1,612**	**$237,986**	**59**	**$40,473**	**25**	**$12,048**	**$290,507**		
Flooding									
High	109	$13,720	3	$2,530	2	$975	$17,224	20%	$3,445
Medium	1,504	$224,266	55	$37,943	23	$11,073	$273,282	5%	$13,664
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	1,612	$237,986	59	$40,473	25	$12,048	$290,507	25%	$72,627
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	1,505	$224,397	53	$36,925	22	$10,644	$271,966	25%	$67,991
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	1,612	$237,986	59	$40,473	25	$12,048	$290,507	%	$0
Fissure									
High	0	$7	0	$3	0	$0	$11	%	$0

EL MIRAGE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	06.73%	05.77%	05.94%	06.25%	07.60%	08.09%
Medium	93.27%	94.23%	94.06%	93.75%	92.40%	91.91%
Dam Failure	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**93.35%**	**94.29%**	**90.26%**	**91.23%**	**88.75%**	**88.35%**
High	93.35%	94.29%	90.26%	91.23%	88.75%	88.35%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fissure	**0.0%**	**0.0%**	**0.04%**	**0.01%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.04%	0.01%	0.0%	0.0%

Table 5-19: Summary of FOUNTAIN HILLS HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
FOUNTAIN HILLS (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**4,089**	**$1,010,039**	**206**	**$126,112**	**65**	**$18,417**	**$1,154,569**		
Flooding									
High	176	$45,287	8	$4,566	2	$725	$50,579	20%	$10,116
Medium	3,912	$964,477	198	$121,478	62	$17,687	$1,103,642	5%	$55,182
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	392	$98,446	14	$6,417	5	$1,656	$106,518	25%	$26,630
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	1	$154	0	$18	0	$6	$177	5%	$9
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

FOUNTAIN HILLS (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**99.98%**	**99.97%**	**99.98%**	**99.95%**	**99.98%**	**99.97%**
High	04.31%	04.48%	04.02%	03.62%	03.59%	03.94%
Medium	95.66%	95.49%	95.96%	96.33%	96.38%	96.03%
Dam Failure	**09.59%**	**09.75%**	**07.01%**	**05.09%**	**08.02%**	**08.99%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	09.59%	09.75%	07.01%	05.09%	08.02%	08.99%
Wildfire	**0.02%**	**0.02%**	**0.03%**	**0.01%**	**0.09%**	**0.03%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.02%	0.02%	0.03%	0.01%	0.09%	0.03%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-20: Summary of FORT MCDOWELL YAVAPAI NATION HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
FORT MCDOWELL YAVAPAI NATION (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**138**	**$30,971**	**5**	**$3,717**	**0**	**$167**	**$34,855**		
Flooding									
High	12	$2,816	1	$595	0	$31	$3,442	20%	$688
Medium	126	$28,153	4	$3,119	0	$137	$31,409	5%	$1,570
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	46	$8,914	1	$361	0	$1	$9,276	25%	$2,319
Wildfire									
High	6	$1,177	0	$0	0	$0	$1,177	20%	$235
Medium	2	$633	0	$83	0	$4	$720	5%	$36
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

FORT MCDOWELL YAVAPAI NATION (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**99.99%**	**99.87%**	**99.93%**	**99.94%**	**99.95%**
High	08.87%	09.09%	14.75%	16.01%	16.61%	18.30%
Medium	91.13%	90.90%	85.13%	83.91%	83.33%	81.66%
Dam Failure	**33.23%**	**28.78%**	**19.12%**	**09.72%**	**0.33%**	**0.41%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	33.23%	28.78%	19.12%	09.72%	0.33%	0.41%
Wildfire	**06.16%**	**05.84%**	**01.12%**	**02.24%**	**02.57%**	**02.33%**
High	04.39%	03.80%	0.0%	0.0%	0.0%	0.0%
Medium	01.78%	02.04%	01.12%	02.24%	02.57%	02.33%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-21: Summary of GILA BEND HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
GILA BEND (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**605**	**$49,862**	**10**	**$5,431**	**4**	**$1,468**	**$56,761**		
Flooding									
High	165	$12,603	2	$1,630	0	$41	$14,273	20%	$2,855
Medium	440	$37,244	8	$3,802	3	$1,427	$42,473	5%	$2,124
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	1	$46	0	$0	0	$0	$46	25%	$11
Wildfire									
High	1	$26	0	$0	0	$0	$26	20%	$5
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	31	$2,222	2	$726	1	$242	$3,190	20%	$638
Subsidence									
High	547	$40,977	8	$4,604	3	$1,220	$46,802	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

GILA BEND (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**99.89%**	**99.97%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	27.18%	25.27%	20.56%	30.01%	02.55%	02.79%
Medium	72.71%	74.69%	79.44%	69.99%	97.45%	97.21%
Dam Failure	**0.24%**	**0.09%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.24%	0.09%	0.0%	0.0%	0.0%	0.0%
Wildfire	**0.13%**	**0.05%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.13%	0.05%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**05.19%**	**04.46%**	**20.0%**	**13.37%**	**18.45%**	**16.50%**
High	05.19%	04.46%	20.0%	13.37%	18.45%	16.50%
Subsidence	**90.33%**	**82.18%**	**81.90%**	**84.77%**	**75.23%**	**83.14%**
High	90.33%	82.18%	81.90%	84.77%	75.23%	83.14%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-22: Summary of GILBERT HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
GILBERT (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**17,557**	**$4,870,721**	**1085**	**$786,313**	**300**	**$250,127**	**$5,907,161**		
Flooding									
High	482	$127,979	61	$58,092	18	$33,401	$219,473	20%	$43,895
Medium	17,075	$4,742,730	1,024	$728,220	282	$216,726	$5,687,675	5%	$284,384
Dam Failure									
High	14,160	$3,975,513	851	$625,502	227	$188,623	$4,789,638	25%	$1,197,410
Medium	197	$43,807	29	$15,754	11	$7,515	$67,075	25%	$16,769
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	97	$21,868	17	$7,423	5	$4,977	$34,268	25%	$8,567
Levee Failure									
High	106	$39,412	9	$8,674	2	$3,178	$51,264	20%	$10,253
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	3	$717	0	$27	0	$7	$751	%	$0

GILBERT (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	02.75%	02.63%	05.59%	07.39%	06.02%	13.35%
Medium	97.25%	97.37%	94.41%	92.61%	93.98%	86.65%
Dam Failure	**81.77%**	**82.52%**	**81.22%**	**81.55%**	**79.38%**	**78.42%**
High	80.65%	81.62%	78.50%	79.55%	75.61%	75.41%
Medium	01.12%	0.90%	02.72%	02.0%	03.77%	03.0%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.55%**	**0.45%**	**01.59%**	**0.94%**	**01.62%**	**01.99%**
High	0.55%	0.45%	01.59%	0.94%	01.62%	01.99%
Levee Failure	**0.60%**	**0.81%**	**0.81%**	**01.10%**	**0.74%**	**01.27%**
High	0.60%	0.81%	0.81%	01.10%	0.74%	01.27%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.02%**	**0.01%**	**0.01%**	**0.0%**	**0.01%**	**0.0%**
High	0.02%	0.01%	0.01%	0.0%	0.01%	0.0%

Table 5-23: Summary of GLENDALE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
GLENDALE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**32,571**	**$8,893,903**	**1,588**	**$1,324,304**	**467**	**$313,585**	**$10,531,793**		
Flooding									
High	467	$112,262	21	$26,128	7	$5,711	$144,102	20%	$28,820
Medium	32,098	$8,779,234	1,565	$1,297,913	460	$307,874	$10,385,022	5%	$519,251
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	13,392	$3,815,400	695	$672,751	174	$83,746	$4,571,897	25%	$1,142,974
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	1,488	$474,122	105	$176,727	25	$11,414	$662,262	25%	$165,566
Levee Failure									
High	4	$753	10	$13,776	7	$14,792	$29,321	20%	$5,864
Subsidence									
High	7,550	$2,076,542	349	$273,397	103	$56,386	$2,406,325	%	$0
Fissure									
High	0	$159	0	$16	0	$84	$259	%	$0

GLENDALE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**99.98%**	**99.97%**	**99.95%**	**99.98%**	**100.0%**	**100.0%**
High	01.44%	01.26%	01.34%	01.97%	01.41%	01.82%
Medium	98.55%	98.71%	98.61%	98.01%	98.59%	98.18%
Dam Failure	**41.12%**	**42.90%**	**43.78%**	**50.80%**	**37.31%**	**26.71%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	41.12%	42.90%	43.78%	50.80%	37.31%	26.71%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**04.57%**	**05.33%**	**06.62%**	**13.34%**	**05.26%**	**03.64%**
High	04.57%	05.33%	06.62%	13.34%	05.26%	03.64%
Levee Failure	**0.01%**	**0.01%**	**0.62%**	**01.04%**	**01.50%**	**04.72%**
High	0.01%	0.01%	0.62%	01.04%	01.50%	04.72%
Subsidence	**23.18%**	**23.35%**	**21.96%**	**20.64%**	**22.02%**	**17.98%**
High	23.18%	23.35%	21.96%	20.64%	22.02%	17.98%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.03%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.03%

Table 5-24: Summary of GOODYEAR HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
GOODYEAR (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**3,343**	**$826,747**	**219**	**$175,665**	**60**	**$68,724**	**$1,071,137**		
Flooding									
High	102	$28,918	8	$9,061	2	$3,411	$41,390	20%	$8,278
Medium	3,241	$797,804	212	$166,592	58	$65,313	$1,029,709	5%	$51,485
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	2,175	$531,259	151	$139,506	41	$55,972	$726,737	25%	$181,684
Wildfire									
High	0	$4	0	$2	0	$0	$6	20%	$1
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	5	$562	0	$148	0	$138	$849	25%	$212
Levee Failure									
High	15	$1,534	1	$732	1	$143	$2,409	20%	$482
Subsidence									
High	1,355	$341,599	103	$111,463	23	$13,161	$466,224	%	$0
Fissure									
High	0	$38	0	$2	0	$0	$40	%	$0

GOODYEAR (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**99.99%**	**100.0%**	**99.99%**	**99.99%**	**99.99%**	**100.0%**
High	03.05%	03.50%	03.45%	05.16%	02.96%	04.96%
Medium	96.94%	96.50%	96.55%	94.83%	97.03%	95.04%
Dam Failure	**65.06%**	**64.26%**	**69.07%**	**79.42%**	**67.43%**	**81.44%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	65.06%	64.26%	69.07%	79.42%	67.43%	81.44%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.15%**	**0.07%**	**0.19%**	**0.08%**	**0.44%**	**0.20%**
High	0.15%	0.07%	0.19%	0.08%	0.44%	0.20%
Levee Failure	**0.44%**	**0.19%**	**0.61%**	**0.42%**	**0.84%**	**0.21%**
High	0.44%	0.19%	0.61%	0.42%	0.84%	0.21%
Subsidence	**40.54%**	**41.32%**	**47.11%**	**63.45%**	**38.26%**	**19.15%**
High	40.54%	41.32%	47.11%	63.45%	38.26%	19.15%
Fissure	**0.01%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.01%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-25: Summary of GUADALUPE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
GUADALUPE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**655**	**$102,675**	**25**	**$18,215**	**1**	**$948**	**$121,838**		
Flooding									
High	43	$8,839	1	$806	0	$121	$9,767	20%	$1,953
Medium	613	$93,836	24	$17,408	1	$827	$112,071	5%	$5,604
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	105	$18,398	8	$5,827	0	$661	$24,887	25%	$6,222
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

GUADALUPE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	06.50%	08.61%	04.74%	04.43%	06.26%	12.76%
Medium	93.50%	91.39%	95.26%	95.57%	93.74%	87.24%
Dam Failure	**15.95%**	**17.92%**	**32.04%**	**31.99%**	**16.03%**	**69.74%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	15.95%	17.92%	32.04%	31.99%	16.03%	69.74%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-26: Summary of LITCHFIELD PARK HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
LITCHFIELD PARK (Maricopa County) HAZUS Summary	**Building Count**	**Potential Economic Impact**	**Building Count**	**Potential Economic Impact**	**Building Count**	**Potential Economic Impact**	**Total of All Economic Impact**	**Loss-to-Exposure**	**Total Estimated Loss (x$1000)**
Community-Wide Totals	**586**	**$196,331**	**44**	**$31,908**	**11**	**$3,426**	**$231,665**		
Flooding									
High	4	$1,665	0	$99	0	$1	$1,765	20%	$353
Medium	582	$194,666	44	$31,808	11	$3,425	$229,900	5%	$11,495
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	586	$196,331	44	$31,908	11	$3,426	$231,665	25%	$57,916
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	586	$196,331	44	$31,908	11	$3,426	$231,665	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

LITCHFIELD PARK (Maricopa County) HAZUS Summary	**% Building Count**	**% Potential Economic Impact**	**% Building Count**	**% Potential Economic Impact**	**% Building Count**	**% Potential Economic Impact**
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.68%	0.85%	0.47%	0.31%	0.02%	0.02%
Medium	99.32%	99.15%	99.53%	99.69%	99.98%	99.98%
Dam Failure	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-27: Summary of UNINCORPORATED MARICOPA COUNTY HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
UNINCORPORTATED MARICOPA COUNTY (Maricopa County) HAZUS	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**56,609**	**$10,562,895**	**1,817**	**$1,347,631**	**556**	**$286,840**	**$12,197,366**		
Flooding									
High	2,117	$359,716	96	$53,584	44	$20,366	$433,665	20%	$86,733
Medium	53,222	$10,039,063	1,686	$1,260,661	506	$264,750	$11,564,475	5%	$578,224
Dam Failure									
High	1,011	$267,178	106	$52,279	38	$28,866	$348,323	25%	$87,081
Medium	37,536	$6,636,998	894	$664,366	223	$124,537	$7,425,901	25%	$1,856,475
Wildfire									
High	85	$15,356	14	$14,845	3	$2,872	$33,073	20%	$6,615
Medium	90	$16,591	6	$3,926	1	$352	$20,870	5%	$1,043
Spillway									
High	6,101	$942,314	158	$119,690	38	$23,195	$1,085,200	25%	$271,300
Levee Failure									
High	856	$145,590	29	$18,044	12	$8,216	$171,849	20%	$34,370
Subsidence									
High	28,687	$4,932,033	658	$526,229	119	$65,832	$5,524,094	%	$0
Fissure									
High	100	$16,459	8	$3,615	5	$2,114	$22,188	%	$0

UNINCORPORTATED MARICOPA COUNTY (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**97.76%**	**98.45%**	**98.07%**	**97.52%**	**98.80%**	**99.40%**
High	03.74%	03.41%	05.26%	03.98%	07.87%	07.10%
Medium	94.02%	95.04%	92.81%	93.55%	90.93%	92.30%
Dam Failure	**68.09%**	**65.36%**	**55.06%**	**53.18%**	**46.92%**	**53.48%**
High	01.79%	02.53%	05.86%	03.88%	06.79%	10.06%
Medium	66.31%	62.83%	49.20%	49.30%	40.13%	43.42%
Wildfire	**0.31%**	**0.30%**	**01.13%**	**01.39%**	**0.67%**	**01.12%**
High	0.15%	0.15%	0.80%	01.10%	0.45%	01.0%
Medium	0.16%	0.16%	0.33%	0.29%	0.22%	0.12%
Spillway	**10.78%**	**08.92%**	**08.67%**	**08.88%**	**06.77%**	**08.09%**
High	10.78%	08.92%	08.67%	08.88%	06.77%	08.09%
Levee Failure	**01.51%**	**01.38%**	**01.58%**	**01.34%**	**02.24%**	**02.86%**
High	01.51%	01.38%	01.58%	01.34%	02.24%	02.86%
Subsidence	**50.68%**	**46.69%**	**36.22%**	**39.05%**	**21.33%**	**22.95%**
High	50.68%	46.69%	36.22%	39.05%	21.33%	22.95%
Fissure	**0.18%**	**0.16%**	**0.44%**	**0.27%**	**0.86%**	**0.74%**
High	0.18%	0.16%	0.44%	0.27%	0.86%	0.74%

Table 5-28: Summary of MESA HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
MESA (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**70,114**	**$14,672,734**	**2,939**	**$2,716,664**	**855**	**$536,271**	**$17,925,668**		
Flooding									
High	488	$83,382	34	$40,828	6	$4,035	$128,244	20%	$25,649
Medium	67,774	$14,100,820	2,822	$2,636,326	820	$521,179	$17,258,325	5%	$862,916
Dam Failure									
High	1,952	$416,075	118	$109,783	41	$39,316	$565,174	25%	$141,294
Medium	19,323	$3,818,458	715	$789,765	183	$106,105	$4,714,328	25%	$1,178,582
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	3,108	$487,388	148	$190,702	34	$17,213	$695,303	25%	$173,826
Levee Failure									
High	3	$556	5	$4,414	3	$13,774	$18,744	20%	$3,749
Subsidence									
High	4,411	$776,471	184	$97,619	52	$16,753	$890,843	%	$0
Fissure									
High	259	$27,030	3	$2,797	0	$9	$29,836	%	$0

MESA (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**97.36%**	**96.67%**	**97.18%**	**98.55%**	**96.57%**	**97.94%**
High	0.70%	0.57%	01.16%	01.50%	0.70%	0.75%
Medium	96.66%	96.10%	96.02%	97.04%	95.87%	97.19%
Dam Failure	**30.34%**	**28.86%**	**28.32%**	**33.11%**	**26.10%**	**27.12%**
High	02.78%	02.84%	04.01%	04.04%	04.75%	07.33%
Medium	27.56%	26.02%	24.32%	29.07%	21.35%	19.79%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**04.43%**	**03.32%**	**05.03%**	**07.02%**	**03.97%**	**03.21%**
High	04.43%	03.32%	05.03%	07.02%	03.97%	03.21%
Levee Failure	**0.0%**	**0.0%**	**0.16%**	**0.16%**	**0.40%**	**02.57%**
High	0.0%	0.0%	0.16%	0.16%	0.40%	02.57%
Subsidence	**06.29%**	**05.29%**	**06.25%**	**03.59%**	**06.14%**	**03.12%**
High	06.29%	05.29%	06.25%	03.59%	06.14%	03.12%
Fissure	**0.37%**	**0.18%**	**0.11%**	**0.10%**	**0.01%**	**0.0%**
High	0.37%	0.18%	0.11%	0.10%	0.01%	0.0%

Table 5-29: Summary of PARADISE VALLEY HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
PARADISE VALLEY (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**2,401**	**$1,017,857**	**159**	**$96,441**	**31**	**$13,349**	**$1,127,647**		
Flooding									
High	75	$32,664	4	$1,733	2	$503	$34,900	20%	$6,980
Medium	514	$222,395	34	$25,694	7	$3,054	$251,143	5%	$12,557
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	693	$303,196	45	$30,155	16	$9,847	$343,198	25%	$85,800
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	107	$46,915	11	$10,670	2	$383	$57,968	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

PARADISE VALLEY (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**24.56%**	**25.06%**	**23.90%**	**28.44%**	**28.24%**	**26.65%**
High	03.14%	03.21%	02.61%	01.80%	04.91%	03.77%
Medium	21.42%	21.85%	21.29%	26.64%	23.33%	22.88%
Dam Failure	**28.86%**	**29.79%**	**28.21%**	**31.27%**	**51.10%**	**73.77%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	28.86%	29.79%	28.21%	31.27%	51.10%	73.77%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**04.46%**	**04.61%**	**06.97%**	**11.06%**	**05.85%**	**02.87%**
High	04.46%	04.61%	06.97%	11.06%	05.85%	02.87%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-30: Summary of PEORIA (Maricopa County) HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
PEORIA (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**17,798**	**$4,438,043**	**769**	**$604,653**	**257**	**$115,377**	**$5,158,074**		
Flooding									
High	97	$24,281	6	$3,490	6	$3,575	$31,347	20%	$6,269
Medium	17,418	$4,343,796	753	$598,776	252	$111,814	$5,054,386	5%	$252,719
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	12,399	$3,052,813	526	$445,942	153	$56,932	$3,555,686	25%	$888,922
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	4,560	$1,134,538	206	$204,541	63	$20,280	$1,359,358	25%	$339,840
Levee Failure									
High	1,174	$190,464	33	$18,116	10	$2,793	$211,373	20%	$42,275
Subsidence									
High	15,542	$3,859,978	614	$525,202	186	$86,244	$4,471,424	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

PEORIA (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**98.41%**	**98.42%**	**98.80%**	**99.61%**	**100.02%**	**100.01%**
High	0.55%	0.55%	0.82%	0.58%	02.21%	03.10%
Medium	97.86%	97.88%	97.98%	99.03%	97.81%	96.91%
Dam Failure	**69.66%**	**68.79%**	**68.45%**	**73.75%**	**59.40%**	**49.34%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	69.66%	68.79%	68.45%	73.75%	59.40%	49.34%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**25.62%**	**25.56%**	**26.75%**	**33.83%**	**24.50%**	**17.58%**
High	25.62%	25.56%	26.75%	33.83%	24.50%	17.58%
Levee Failure	**06.60%**	**04.29%**	**04.30%**	**03.0%**	**03.74%**	**02.42%**
High	06.60%	04.29%	04.30%	03.0%	03.74%	02.42%
Subsidence	**87.32%**	**86.97%**	**79.80%**	**86.86%**	**72.24%**	**74.75%**
High	87.32%	86.97%	79.80%	86.86%	72.24%	74.75%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-31: Summary of PHOENIX HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
PHOENIX (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**188,432**	**$49,106,193**	**11,334**	**$15,336,943**	**2,975**	**$3,217,141**	**$67,660,277**		
Flooding									
High	4,275	$1,184,608	292	$332,441	90	$132,119	$1,649,168	20%	$329,834
Medium	177,208	$45,396,377	10,672	$14,713,954	2,787	$3,027,354	$63,137,685	5%	$3,156,884
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	102,056	$25,572,247	6,872	$10,446,375	1,858	$2,257,706	$38,276,328	25%	$9,569,082
Wildfire									
High	1	$178	0	$1	0	$0	$179	20%	$36
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	2,012	$576,117	96	$69,643	39	$25,564	$671,324	25%	$167,831
Levee Failure									
High	944	$218,464	43	$55,685	13	$11,271	$285,420	20%	$57,084
Subsidence									
High	18,688	$5,321,319	1,187	$1,020,088	323	$137,314	$6,478,721	%	$0
Fissure									
High	58	$14,562	3	$936	0	$108	$15,605	%	$0

PHOENIX (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**96.31%**	**94.86%**	**96.74%**	**98.11%**	**96.71%**	**98.21%**
High	02.27%	02.41%	02.58%	02.17%	03.03%	04.11%
Medium	94.04%	92.45%	94.16%	95.94%	93.68%	94.10%
Dam Failure	**54.16%**	**52.08%**	**60.63%**	**68.11%**	**62.44%**	**70.18%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	54.16%	52.08%	60.63%	68.11%	62.44%	70.18%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**01.07%**	**01.17%**	**0.85%**	**0.45%**	**01.30%**	**0.79%**
High	01.07%	01.17%	0.85%	0.45%	01.30%	0.79%
Levee Failure	**0.50%**	**0.44%**	**0.38%**	**0.36%**	**0.43%**	**0.35%**
High	0.50%	0.44%	0.38%	0.36%	0.43%	0.35%
Subsidence	**09.92%**	**10.84%**	**10.47%**	**06.65%**	**10.87%**	**04.27%**
High	09.92%	10.84%	10.47%	06.65%	10.87%	04.27%
Fissure	**0.03%**	**0.03%**	**0.02%**	**0.01%**	**0.01%**	**0.0%**
High	0.03%	0.03%	0.02%	0.01%	0.01%	0.0%

Table 5-32: Summary of QUEEN CREEK (Maricopa County) HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
QUEEN CREEK (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**897**	**$163,548**	**56**	**$23,825**	**27**	**$10,037**	**$197,411**		
Flooding									
High	75	$12,161	5	$1,623	5	$2,262	$16,046	20%	$3,209
Medium	774	$145,212	49	$21,668	20	$6,702	$173,581	5%	$8,679
Dam Failure									
High	13	$2,833	2	$882	1	$352	$4,067	25%	$1,017
Medium	693	$136,478	49	$20,220	25	$9,541	$166,239	25%	$41,560
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	3	$247	0	$6	0	$0	$253	5%	$13
Spillway									
High	706	$137,971	51	$21,101	25	$9,873	$168,946	25%	$42,236
Levee Failure									
High	9	$2,360	1	$447	1	$481	$3,288	20%	$658
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	49	$5,882	0	$95	1	$83	$6,060	%	$0

QUEEN CREEK (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**94.59%**	**96.22%**	**96.48%**	**97.76%**	**92.85%**	**89.31%**
High	08.35%	07.44%	08.36%	06.81%	19.29%	22.54%
Medium	86.24%	88.79%	88.12%	90.94%	73.57%	66.77%
Dam Failure	**78.78%**	**85.18%**	**92.27%**	**88.57%**	**93.20%**	**98.57%**
High	01.49%	01.73%	03.49%	03.70%	02.58%	03.51%
Medium	77.29%	83.45%	88.77%	84.87%	90.62%	95.06%
Wildfire	**0.29%**	**0.15%**	**0.05%**	**0.02%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.29%	0.15%	0.05%	0.02%	0.0%	0.0%
Spillway	**78.76%**	**84.36%**	**92.26%**	**88.57%**	**92.70%**	**98.36%**
High	78.76%	84.36%	92.26%	88.57%	92.70%	98.36%
Levee Failure	**01.02%**	**01.44%**	**0.98%**	**01.88%**	**02.63%**	**04.79%**
High	01.02%	01.44%	0.98%	01.88%	02.63%	04.79%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**05.44%**	**03.60%**	**0.88%**	**0.40%**	**03.90%**	**0.82%**
High	05.44%	03.60%	0.88%	0.40%	03.90%	0.82%

Table 5-33: Summary of SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY (Maricopa County) HAZUS	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**2,474**	**$375,496**	**108**	**$137,169**	**21**	**$56,720**	**$569,385**		
Flooding									
High	60	$15,249	1	$1,623	0	$1,609	$18,482	20%	$3,696
Medium	1,587	$164,091	78	$93,093	8	$10,344	$267,528	5%	$13,376
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	2,188	$343,699	92	$122,366	20	$56,372	$522,438	25%	$130,609
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**66.57%**	**47.76%**	**73.62%**	**69.05%**	**38.62%**	**21.07%**
High	02.43%	04.06%	01.18%	01.18%	01.55%	02.84%
Medium	64.14%	43.70%	72.44%	67.87%	37.07%	18.24%
Dam Failure	**88.45%**	**91.53%**	**85.34%**	**89.21%**	**95.89%**	**99.39%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	88.45%	91.53%	85.34%	89.21%	95.89%	99.39%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-34: Summary of SCOTTSDALE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
SCOTTSDALE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**37,830**	**$12,332,231**	**2,453**	**$3,369,182**	**616**	**$431,382**	**$16,132,795**		
Flooding									
High	3,041	$1,201,679	173	$339,543	39	$33,550	$1,574,772	20%	$314,954
Medium	20,067	$6,953,353	1,368	$1,696,669	358	$286,435	$8,936,457	5%	$446,823
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	19,639	$6,045,462	1,198	$1,615,333	324	$273,751	$7,934,546	25%	$1,983,636
Wildfire									
High	0	$81	0	$15	0	$1	$97	20%	$19
Medium	4	$1,871	0	$101	0	$17	$1,989	5%	$99
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	129	$29,459	7	$2,355	2	$514	$32,327	20%	$6,465
Subsidence									
High	6,157	$2,340,395	489	$870,339	139	$174,893	$3,385,628	%	$0
Fissure									
High	4	$1,165	0	$132	0	$0	$1,297	%	$0

SCOTTSDALE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**61.08%**	**66.13%**	**62.82%**	**60.44%**	**64.50%**	**74.18%**
High	08.04%	09.74%	07.04%	10.08%	06.33%	07.78%
Medium	53.04%	56.38%	55.78%	50.36%	58.17%	66.40%
Dam Failure	**51.91%**	**49.02%**	**48.82%**	**47.94%**	**52.69%**	**63.46%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	51.91%	49.02%	48.82%	47.94%	52.69%	63.46%
Wildfire	**0.01%**	**0.02%**	**0.01%**	**0.0%**	**0.02%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.01%	0.02%	0.01%	0.0%	0.02%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.34%**	**0.24%**	**0.28%**	**0.07%**	**0.29%**	**0.12%**
High	0.34%	0.24%	0.28%	0.07%	0.29%	0.12%
Subsidence	**16.27%**	**18.98%**	**19.94%**	**25.83%**	**22.55%**	**40.54%**
High	16.27%	18.98%	19.94%	25.83%	22.55%	40.54%
Fissure	**0.01%**	**0.01%**	**0.01%**	**0.0%**	**0.0%**	**0.0%**
High	0.01%	0.01%	0.01%	0.0%	0.0%	0.0%

Table 5-35: Summary of SURPRISE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
SURPRISE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**6,640**	**$1,320,656**	**173**	**$91,246**	**58**	**$28,956**	**$1,440,857**		
Flooding									
High	50	$4,545	1	$602	1	$770	$5,918	20%	$1,184
Medium	6,590	$1,316,111	172	$90,644	57	$28,185	$1,434,940	5%	$71,747
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	4,830	$972,197	120	$61,946	44	$23,569	$1,057,712	25%	$264,428
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$2	0	$0	$2	5%	$0
Spillway									
High	4,487	$1,019,651	140	$78,378	42	$17,223	$1,115,252	25%	$278,813
Levee Failure									
High	36	$7,541	0	$147	0	$57	$7,745	20%	$1,549
Subsidence									
High	6,381	$1,280,964	170	$89,464	52	$27,612	$1,398,040	%	$0
Fissure									
High	1	$122	0	$10	0	$2	$134	%	$0

SURPRISE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.75%	0.34%	0.51%	0.66%	02.17%	02.66%
Medium	99.25%	99.66%	99.49%	99.34%	97.83%	97.34%
Dam Failure	**72.74%**	**73.61%**	**69.22%**	**67.89%**	**74.98%**	**81.40%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	72.74%	73.61%	69.22%	67.89%	74.98%	81.40%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**67.58%**	**77.21%**	**80.89%**	**85.90%**	**72.59%**	**59.48%**
High	67.58%	77.21%	80.89%	85.90%	72.59%	59.48%
Levee Failure	**0.55%**	**0.57%**	**0.08%**	**0.16%**	**0.29%**	**0.20%**
High	0.55%	0.57%	0.08%	0.16%	0.29%	0.20%
Subsidence	**96.10%**	**96.99%**	**98.13%**	**98.05%**	**90.22%**	**95.36%**
High	96.10%	96.99%	98.13%	98.05%	90.22%	95.36%
Fissure	**0.01%**	**0.01%**	**0.02%**	**0.01%**	**0.02%**	**0.01%**
High	0.01%	0.01%	0.02%	0.01%	0.02%	0.01%

Table 5-36: Summary of TEMPE HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
TEMPE (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**22,824**	**$6,813,557**	**1,594**	**$2,913,669**	**505**	**$1,150,565**	**$10,877,790**		
Flooding									
High	91	$28,062	14	$78,933	3	$5,113	$112,108	20%	$22,422
Medium	22,732	$6,785,368	1,580	$2,834,692	502	$1,145,448	$10,765,509	5%	$538,275
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	20,585	$6,101,113	1,378	$2,492,010	441	$985,241	$9,578,365	25%	$2,394,591
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$905	0	$1,373	$2,278	20%	$456
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

TEMPE (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.40%	0.41%	0.88%	02.71%	0.64%	0.44%
Medium	99.60%	99.59%	99.12%	97.29%	99.36%	99.56%
Dam Failure	**90.19%**	**89.54%**	**86.47%**	**85.53%**	**87.35%**	**85.63%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	90.19%	89.54%	86.47%	85.53%	87.35%	85.63%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.03%**	**0.03%**	**0.06%**	**0.12%**
High	0.0%	0.0%	0.03%	0.03%	0.06%	0.12%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-37: Summary of TOLLESON HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
TOLLESON (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**937**	**$175,940**	**66**	**$72,942**	**47**	**$234,671**	**$483,553**		
Flooding									
High	40	$8,394	3	$6,995	4	$8,084	$23,473	20%	$4,695
Medium	896	$167,546	63	$65,947	44	$226,587	$460,081	5%	$23,004
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	517	$99,576	30	$41,053	19	$82,178	$222,807	25%	$55,702
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	4	$3,888	8	$62,760	$66,647	20%	$13,329
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

TOLLESON (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	04.30%	04.77%	04.76%	09.59%	07.61%	03.44%
Medium	95.70%	95.23%	95.24%	90.41%	92.39%	96.56%
Dam Failure	**55.20%**	**56.60%**	**44.77%**	**56.28%**	**41.03%**	**35.02%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	55.20%	56.60%	44.77%	56.28%	41.03%	35.02%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**05.60%**	**05.33%**	**17.08%**	**26.74%**
High	0.0%	0.0%	05.60%	05.33%	17.08%	26.74%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-38: Summary of WICKENBURG HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
WICKENBURG (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**1,316**	**$172,575**	**83**	**$52,790**	**15**	**$12,713**	**$238,077**		
Flooding									
High	310	$44,201	11	$8,961	1	$1,267	$54,429	20%	$10,886
Medium	1,006	$128,374	72	$43,829	14	$11,446	$183,648	5%	$9,182
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	272	$35,563	19	$10,784	2	$934	$47,280	25%	$11,820
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	6	$512	0	$183	0	$149	$845	25%	$211
Levee Failure									
High	2	$320	0	$32	0	$4	$357	20%	$71
Subsidence									
High	0	$0	0	$0	0	$0	$0	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

WICKENBURG (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	23.55%	25.61%	13.46%	16.97%	08.02%	09.97%
Medium	76.45%	74.39%	86.54%	83.03%	91.98%	90.03%
Dam Failure	**20.68%**	**20.61%**	**22.89%**	**20.43%**	**12.33%**	**07.35%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	20.68%	20.61%	22.89%	20.43%	12.33%	07.35%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.49%**	**0.30%**	**0.31%**	**0.35%**	**01.80%**	**01.17%**
High	0.49%	0.30%	0.31%	0.35%	01.80%	01.17%
Levee Failure	**0.15%**	**0.19%**	**0.08%**	**0.06%**	**0.14%**	**0.03%**
High	0.15%	0.19%	0.08%	0.06%	0.14%	0.03%
Subsidence	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-39: Summary of YOUNGTOWN HAZUS Building Exposure by hazard

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		SUMMARY		
YOUNGTOWN (Maricopa County) HAZUS Summary	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Building Count	Potential Economic Impact	Total of All Economic Impact	Loss-to-Exposure	Total Estimated Loss (x$1000)
Community-Wide Totals	**871**	**$155,538**	**18**	**$9,761**	**3**	**$725**	**$166,023**		
Flooding									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	871	$155,538	18	$9,761	3	$725	$166,023	5%	$8,301
Dam Failure									
High	0	$0	0	$0	0	$0	$0	25%	$0
Medium	871	$155,538	18	$9,761	3	$725	$166,023	25%	$41,506
Wildfire									
High	0	$0	0	$0	0	$0	$0	20%	$0
Medium	0	$0	0	$0	0	$0	$0	5%	$0
Spillway									
High	0	$0	0	$0	0	$0	$0	25%	$0
Levee Failure									
High	0	$0	0	$0	0	$0	$0	20%	$0
Subsidence									
High	871	$155,538	18	$9,761	3	$725	$166,023	%	$0
Fissure									
High	0	$0	0	$0	0	$0	$0	%	$0

YOUNGTOWN (Maricopa County) HAZUS Summary	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact	% Building Count	% Potential Economic Impact
Flooding	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Dam Failure	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Wildfire	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Spillway	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Levee Failure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsidence	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
High	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fissure	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
High	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5-40: Summary of population sectors exposed to emergency spillway inundation

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
County-Wide Totals	**1,522,083**	**53,424**	**3.51%**	**180,521**	**11,271**	**6.24%**	**100,684**	**2,832**	**2.81%**
Avondale	15,613	0	0.00%	855	0	0.00%	764	0	0.00%
Buckeye	3,906	71	1.81%	342	5	1.35%	344	2	0.49%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	0	0.00%	5,156	0	0.00%	3,029	0	0.00%
El Mirage	3,400	3,365	98.96%	213	211	99.05%	194	193	99.73%
Fountain Hills	8,759	0	0.00%	1,750	0	0.00%	387	0	0.00%
Fort McDowell Yavapai Nation	309	0	0.00%	17	0	0.00%	10	0	0.00%
Gila Bend	1,010	0	0.00%	81	0	0.00%	117	0	0.00%
Gila River Indian Community	1,091	0	0.00%	48	0	0.00%	140	0	0.00%
Gilbert	54,901	163	0.30%	1,834	7	0.39%	883	4	0.41%
Glendale	118,654	5,258	4.43%	9,169	159	1.73%	8,282	109	1.31%
Goodyear	10,967	14	0.12%	921	0	0.02%	309	0	0.03%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	0	0.00%	291	0	0.00%	39	0	0.00%
Unincorporated Maricopa County	104,385	9,853	9.44%	43,659	4,418	10.12%	9,288	1,077	11.59%
Mesa	189,697	5,951	3.14%	25,867	1,462	5.65%	12,410	426	3.43%
Paradise Valley	5,769	0	0.00%	868	0	0.00%	68	0	0.00%
Peoria	49,884	11,470	22.99%	6,555	2,506	38.22%	1,921	400	20.85%
Phoenix	657,658	6,002	0.91%	54,037	311	0.58%	47,321	108	0.23%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	2,320	81.97%	145	113	77.56%	114	87	76.23%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	0	0.00%	15,440	0	0.00%	5,177	0	0.00%
Surprise	13,387	8,948	66.84%	3,460	2,078	60.05%	757	426	56.20%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	9	0.45%	547	3	0.51%	288	1	0.47%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

Table 5-41: Summary of population sectors exposed to dam failure

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
HIGH									
County-Wide Totals	**1,522,083**	**57,873**	**3.80%**	**180,521**	**2,310**	**1.28%**	**100,684**	**1,023**	**1.02%**
Avondale	15,613	0	0.00%	855	0	0.00%	764	0	0.00%
Buckeye	3,906	0	0.00%	342	0	0.00%	344	0	0.00%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	5,980	6.92%	5,156	270	5.23%	3,029	134	4.44%
El Mirage	3,400	0	0.00%	213	0	0.00%	194	0	0.00%
Fountain Hills	8,759	0	0.00%	1,750	0	0.00%	387	0	0.00%
Fort McDowell Yavapai Nation	309	0	0.00%	17	0	0.00%	10	0	0.00%
Gila Bend	1,010	0	0.00%	81	0	0.00%	117	0	0.00%
Gila River Indian Community	1,091	0	0.00%	48	0	0.00%	140	0	0.00%
Gilbert	54,901	44,383	80.84%	1,834	1,429	77.91%	883	723	81.83%
Glendale	118,654	0	0.00%	9,169	0	0.00%	8,282	0	0.00%
Goodyear	10,967	0	0.00%	921	0	0.00%	309	0	0.00%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	0	0.00%	291	0	0.00%	39	0	0.00%
Unincorporated Maricopa County	104,385	2,985	2.86%	43,659	139	0.32%	9,288	24	0.25%
Mesa	189,697	4,484	2.36%	25,867	470	1.82%	12,410	142	1.14%
Paradise Valley	5,769	0	0.00%	868	0	0.00%	68	0	0.00%
Peoria	49,884	0	0.00%	6,555	0	0.00%	1,921	0	0.00%
Phoenix	657,658	0	0.00%	54,037	0	0.00%	47,321	0	0.00%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	41	1.45%	145	2	1.52%	114	1	0.83%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	0	0.00%	15,440	0	0.00%	5,177	0	0.00%
Surprise	13,387	0	0.00%	3,460	0	0.00%	757	0	0.00%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	0	0.00%	547	0	0.00%	288	0	0.00%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

Table 5-41: Summary of population sectors exposed to dam failure

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
MEDIUM									
County-Wide Totals	**1,522,083**	**803,661**	**52.80%**	**180,521**	**106,770**	**59.15%**	**100,684**	**58,035**	**57.64%**
Avondale	15,613	15,609	99.97%	855	855	100.00%	764	764	100.00%
Buckeye	3,906	3,670	93.95%	342	328	95.93%	344	336	97.45%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	73,872	85.48%	5,156	4,135	80.18%	3,029	2,650	87.50%
El Mirage	3,400	3,400	100.00%	213	213	100.00%	194	194	100.00%
Fountain Hills	8,759	898	10.25%	1,750	172	9.86%	387	44	11.43%
Fort McDowell Yavapai Nation	309	103	33.14%	17	0	2.58%	10	1	10.46%
Gila Bend	1,010	1	0.06%	81	0	0.00%	117	0	0.00%
Gila River Indian Community	1,091	777	71.21%	48	34	71.16%	140	100	71.59%
Gilbert	54,901	433	0.79%	1,834	20	1.08%	883	10	1.08%
Glendale	118,654	47,363	39.92%	9,169	3,665	39.97%	8,282	2,824	34.10%
Goodyear	10,967	5,774	52.65%	921	707	76.81%	309	201	65.08%
Guadalupe	2,558	393	15.38%	125	18	14.51%	194	31	15.87%
Litchfield Park	1,350	1,350	100.00%	291	291	100.00%	39	39	100.00%
Unincorporated Maricopa County	104,385	64,515	61.80%	43,659	34,308	78.58%	9,288	7,402	79.69%
Mesa	189,697	48,515	25.58%	25,867	7,474	28.90%	12,410	3,431	27.64%
Paradise Valley	5,769	1,923	33.34%	868	188	21.63%	68	15	21.57%
Peoria	49,884	33,516	67.19%	6,555	5,334	81.37%	1,921	1,328	69.16%
Phoenix	657,658	356,803	54.25%	54,037	29,870	55.28%	47,321	27,300	57.69%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	2,287	80.81%	145	110	75.78%	114	85	74.88%
Salt River Pima-Maricopa Indian Community	6,306	5,370	85.16%	1,086	973	89.65%	842	739	87.74%
Scottsdale	92,034	49,862	54.18%	15,440	8,711	56.42%	5,177	2,899	55.99%
Surprise	13,387	10,228	76.40%	3,460	2,463	71.18%	757	578	76.34%
Tempe	80,802	73,172	90.56%	6,138	5,729	93.33%	7,051	6,521	92.49%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	1,700	55.11%	316	176	55.84%	202	112	55.46%
Wickenburg	2,093	453	21.64%	547	106	19.40%	288	59	20.50%
Youngtown	1,675	1,675	100.00%	887	887	100.00%	373	373	100.00%

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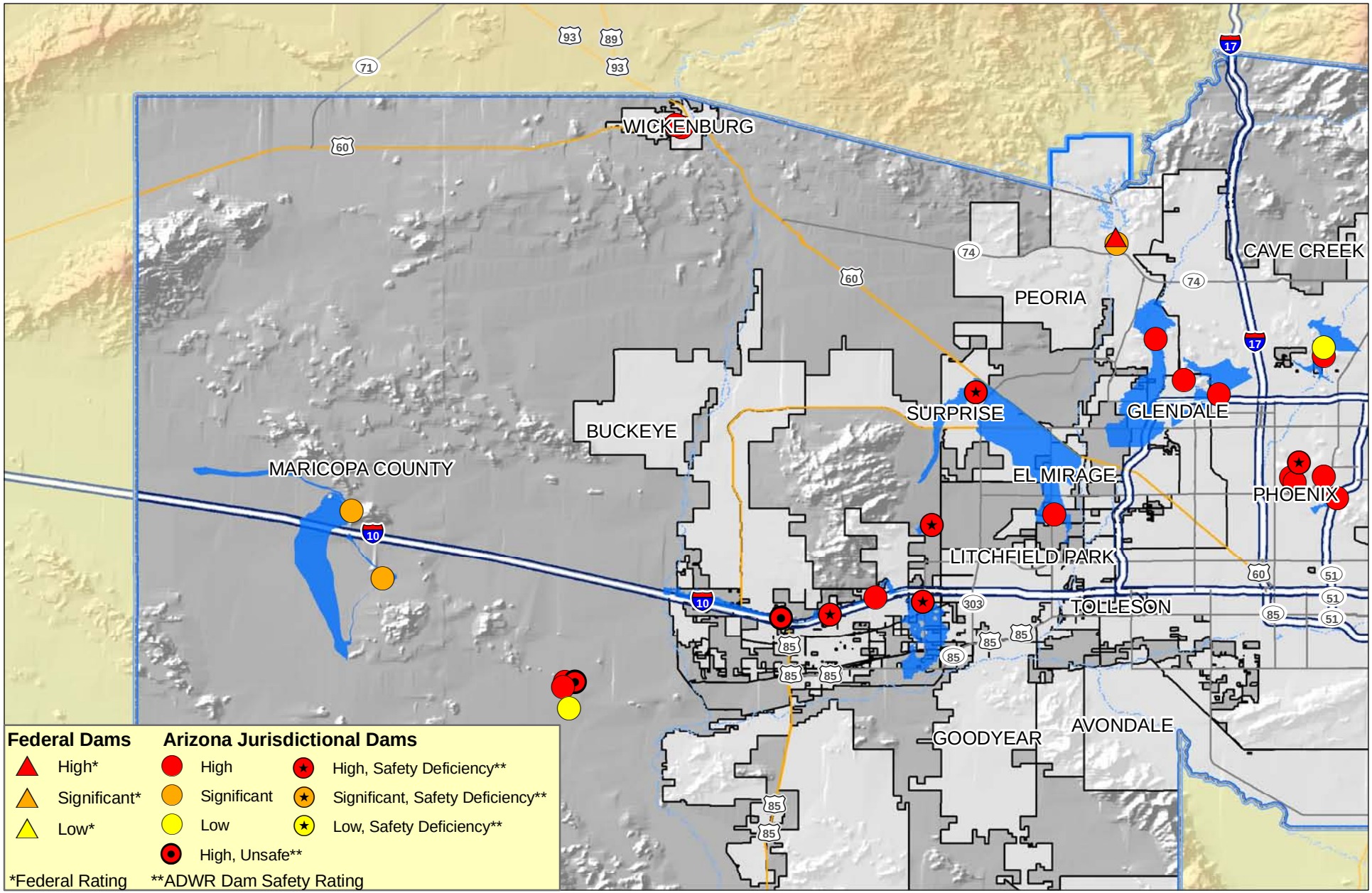


Legend

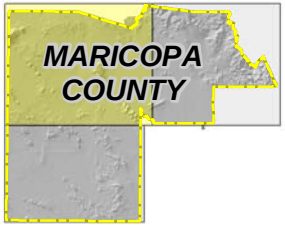
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Dam Spillway Flood Hazard Rating

- High

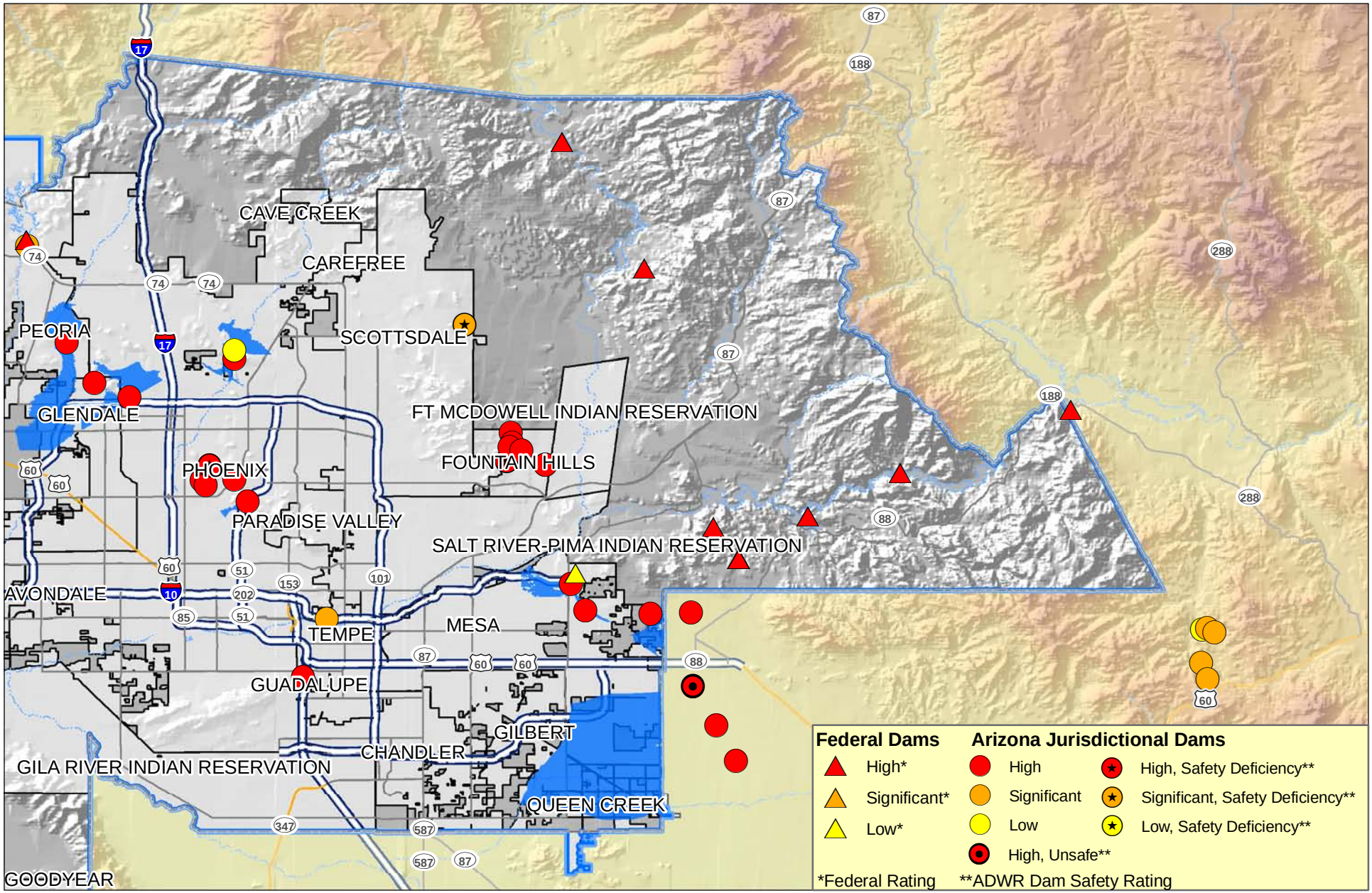
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #1A
Maricopa County Dam Spillway Flood Hazard Map as of May 2009



Legend

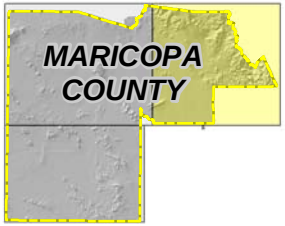
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Dam Spillway Flood Hazard Rating

- High

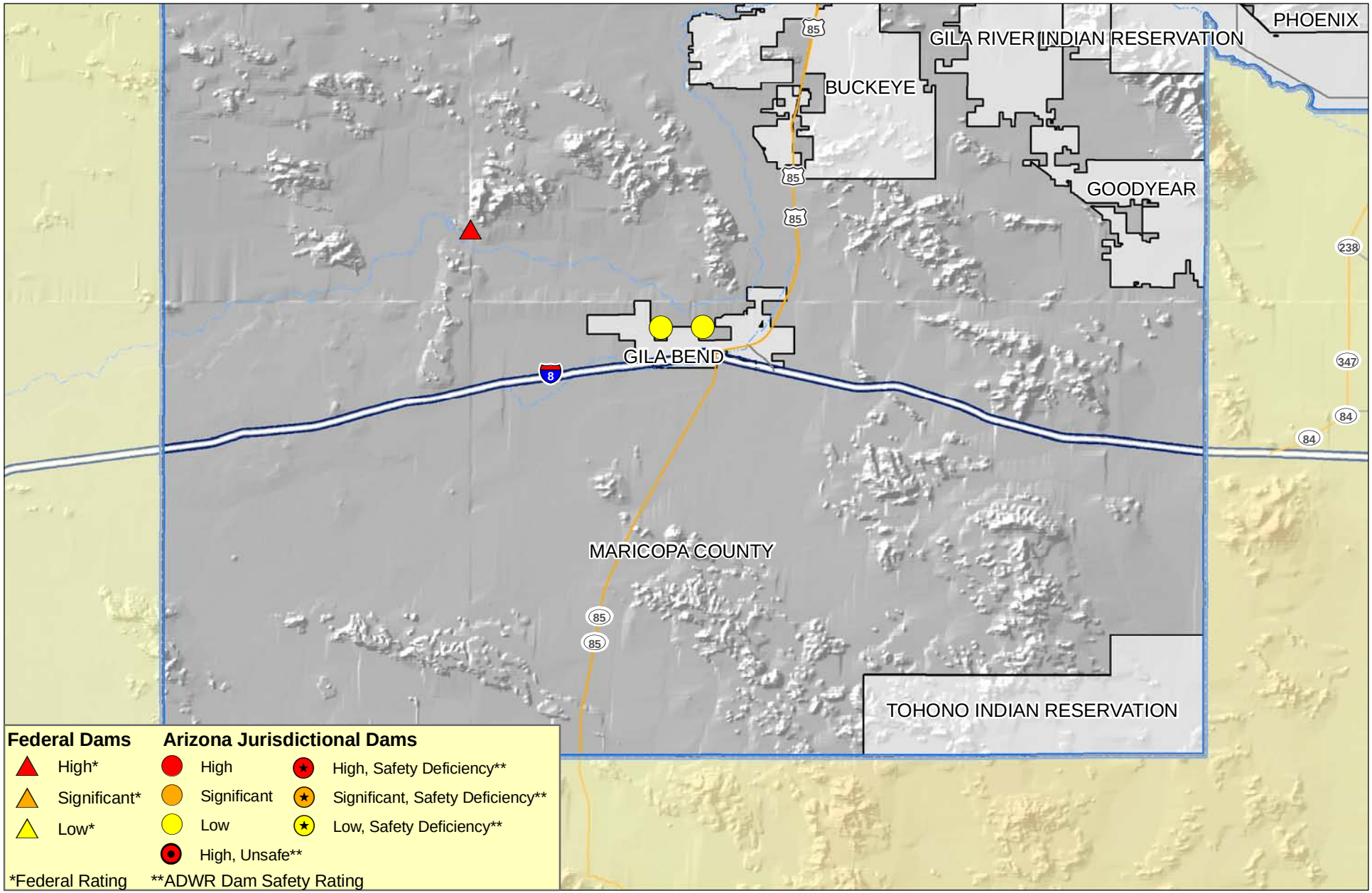
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #1B
Maricopa County
Dam Spillway
Flood Hazard Map
as of May 2009



Legend

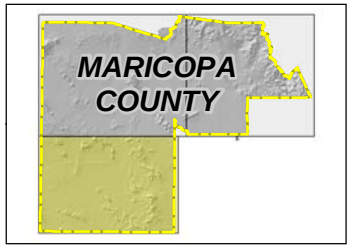
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Dam Spillway Flood Hazard Rating

- High

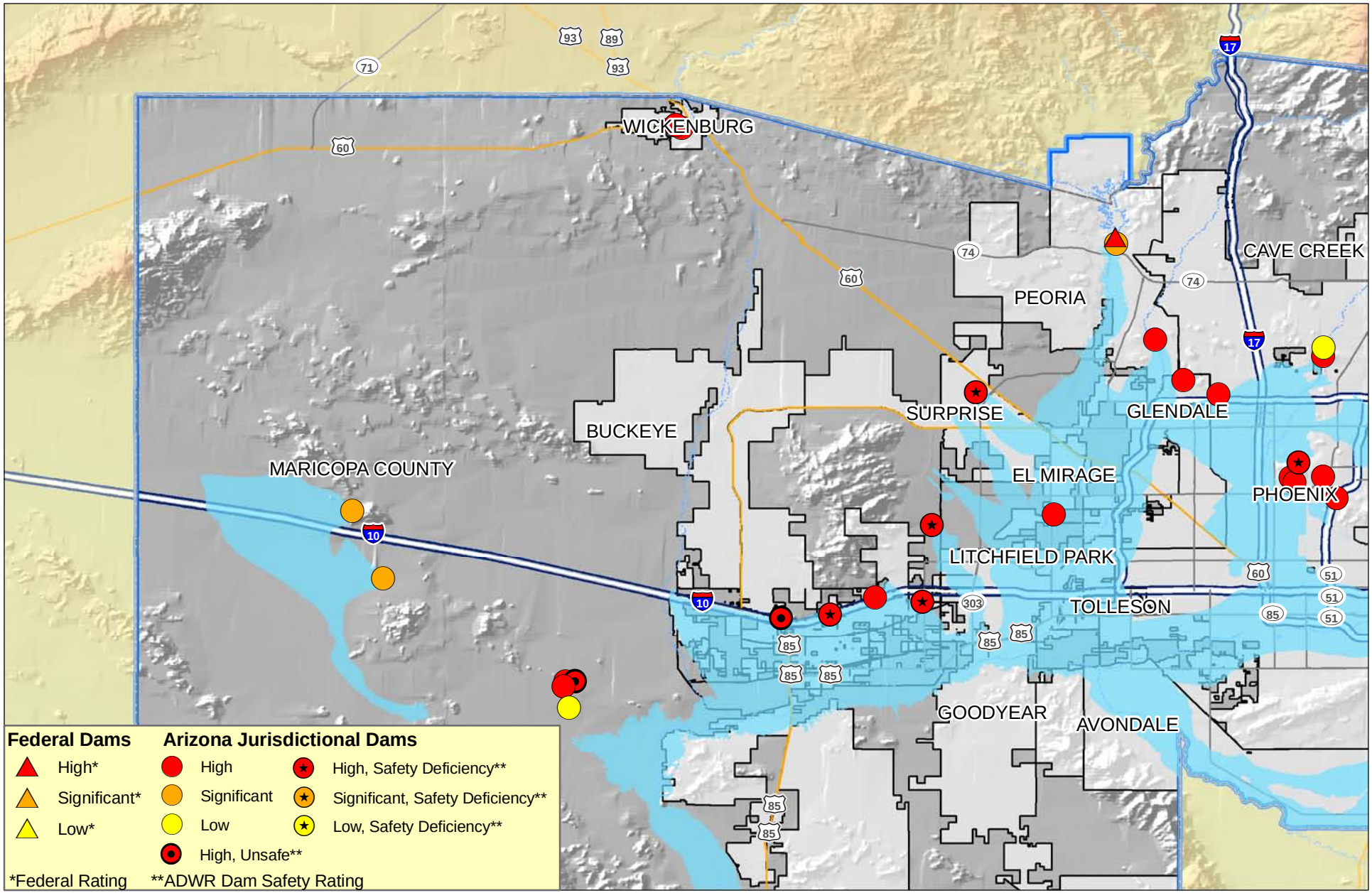
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #1C
Maricopa County Dam Spillway Flood Hazard Map as of May 2009



Legend

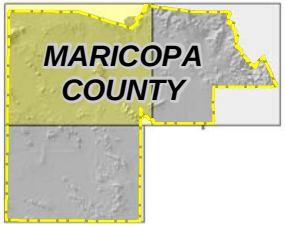
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Potential Dam Failure Flood Hazard Rating

- High
- Medium

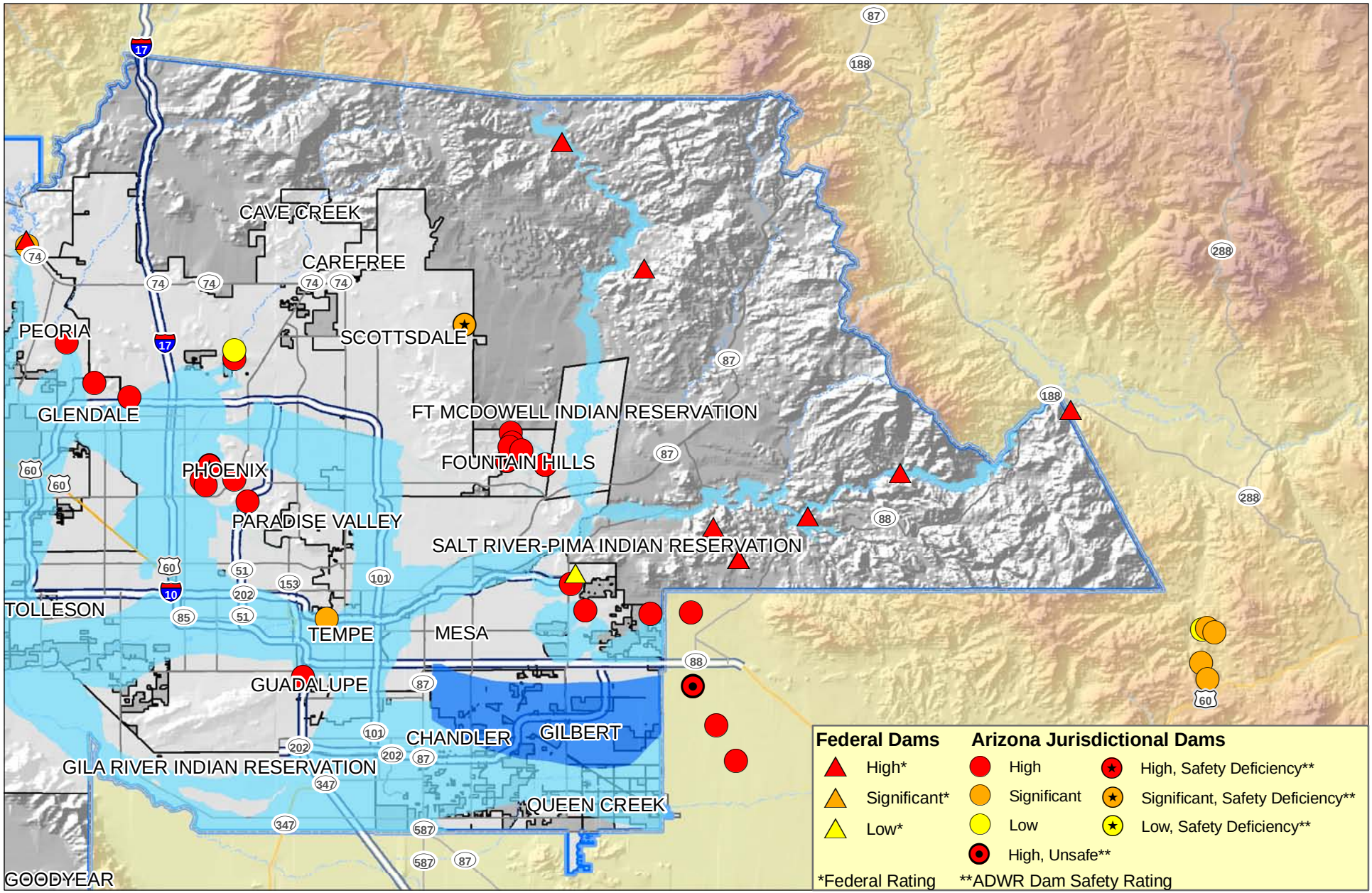
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #2A
Maricopa County Potential Dam Failure Flood Hazard Map as of May 2009



Legend

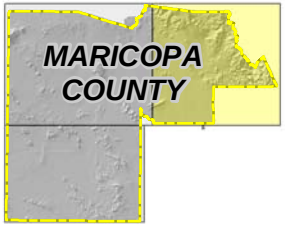
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Potential Dam Failure Flood Hazard Rating

- High
- Medium

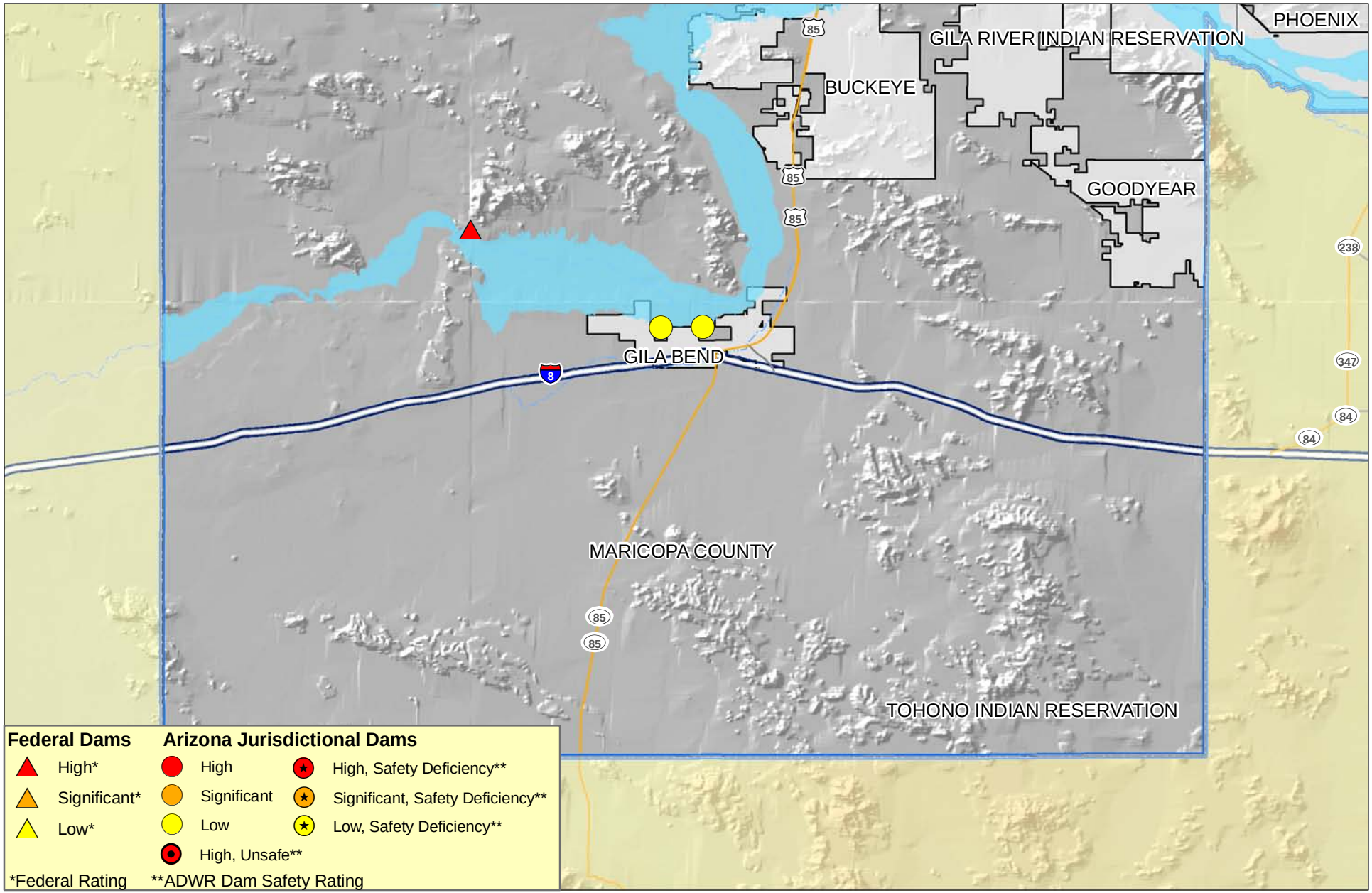
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #2B
Maricopa County Potential Dam Failure Flood Hazard Map as of May 2009



Legend

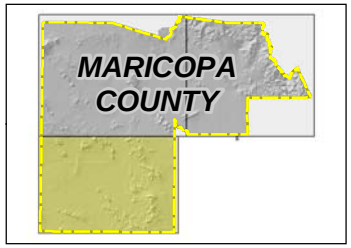
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Potential Dam Failure Flood Hazard Rating

- High
- Medium

0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #2C
Maricopa County Potential Dam Failure Flood Hazard Map as of May 2009

5.3.2 Drought

Description

Drought is a normal part of virtually every climate on the planet, including areas of high and low rainfall. It is different from normal aridity, which is a permanent characteristic of the climate in areas of low rainfall. Drought is the result of a natural decline in the expected precipitation over an extended period of time, typically one or more seasons in length. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity (FEMA, 1997).

Drought is a complex natural hazard which is reflected in the following four definitions commonly used to describe it:

- Meteorological – drought is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Hydrological – drought is related to the effects of precipitation shortfalls on streamflows and reservoir, lake, and groundwater levels.
- Agricultural – drought is defined principally in terms of naturally occurring soil moisture deficiencies relative to water demands of plant life, usually arid crops.
- Socioeconomic – drought associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of weather-related supply shortfall. It may also be called a water management drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent as well as regional water supply demands by humans and vegetation. Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments.

Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation and lingering effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion of its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments.

Droughts may cause a shortage of water for human and industrial consumption, hydroelectric power, recreation, and navigation. Water quality may also decline and the number and severity of wildfires may increase. Severe droughts may result in the loss of agricultural crops and forest products, undernourished wildlife and livestock, lower land values, and higher unemployment.

History

Arizona has experienced 17 droughts declared as drought disasters/emergencies and 93 drought events (droughts affecting multiple years are recorded as a distinct event for each year affected). Figures 5-1 and 5-2 depict the most recent precipitation data from NCDC regarding average statewide precipitation variances from normal. Between 1849 and 1905, the most prolonged period of drought conditions in 300 years occurred in Arizona (NOAA, 2003). Another prolonged drought occurred during the period of 1941 to 1965, during which time there were no spill releases into the Salt River (ADEM, 2001). The period from 1979-1983 appears to have been anomalously wet, while the rest of the historical records shows that dry conditions are most likely the normal condition for Arizona. Between 1998 and 2007, there have been more months with below normal precipitation than months with above normal precipitation.

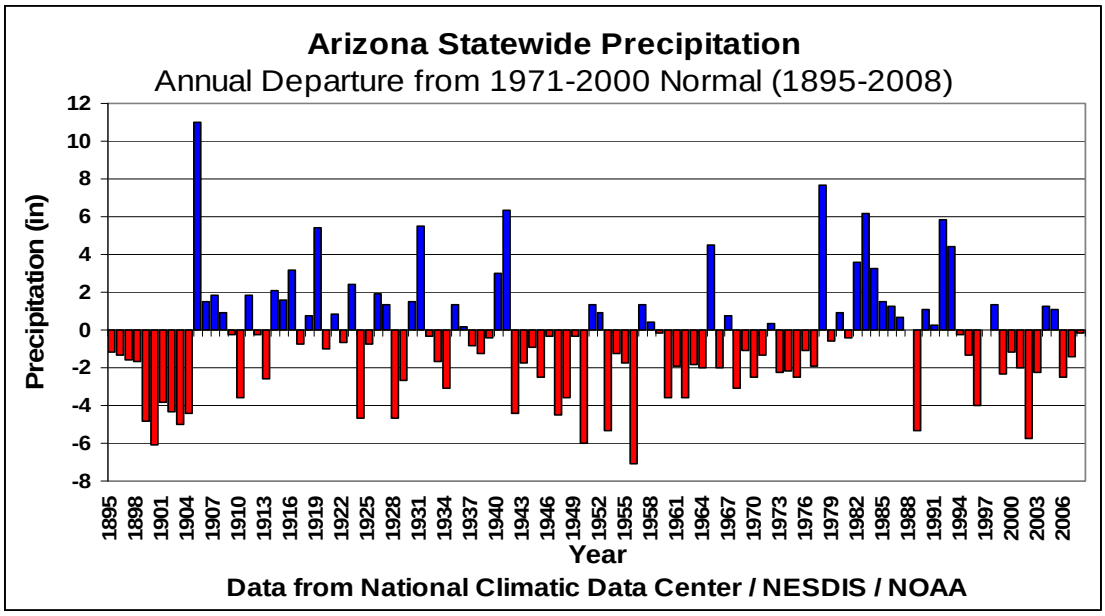


Figure 5-1: Average statewide precipitation variances from a normal based on 1971-2000 period

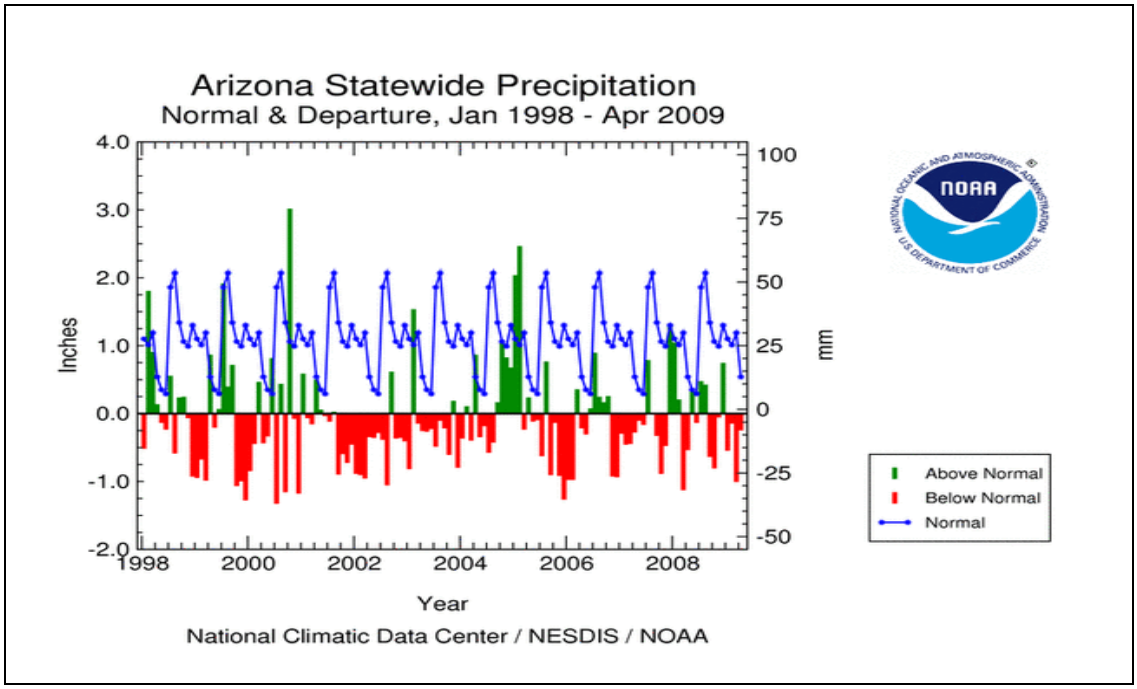


Figure 5-2: Average statewide precipitation variances from a normal based on 1998-2009 period

Maricopa County is currently in what appears to be the possible end of a drought cycle that began in 1995. Drought conditions gradually worsened until 2003, with a brief period of relief occurring during the period of winter 2004 to spring 2005. Each year after has resulted in less than normal precipitation. Other noteworthy dates include 1951 and 1991, which are the only two times in the Salt River Project's 100-year history that it has rationed water.

Compared to some areas of the State, Maricopa County and its surrounding communities are less affected by drought due to the availability of supplies from the Central Arizona Project (CAP), the Salt River Project (SRP), significant investments in recharge systems, and ground water sources (Jacobs and Morehouse, June 11-13, 2003).

Probability and Magnitude

There are no commonly accepted return period or non-exceedance probability for defining the risk from drought (such as the 100-year or 1 percent annual chance of flood). The magnitude of drought is usually measured in time and the severity of the hydrologic deficit. There are several resources available to evaluate drought status and even project very near future expected conditions.

The National Integrated Drought Information System (NIDIS) Act of 2006 (Public Law 109-430) prescribes an interagency approach for drought monitoring, forecasting, and early warning (NIDIS, 2007). The NIDIS maintains the U.S. Drought Portal[42] which is a centralized, web-based access point to several drought related resources including the U.S. Drought Monitor (USDM) and the U.S. Seasonal Drought Outlook (USSDO). The USDM, shown in Figure 5-3, is a weekly map depicting the current status of drought and is developed and maintained by the National Drought Mitigation Center. The USSDO , shown in Figure 5-4, is a six month projection of potential drought conditions developed by the National Weather Service's Climate Prediction Center. The primary indicators for these maps for the Western U.S. are the Palmer Hydrologic Drought Index and the 60-month Palmer Z-index.. The Palmer Drought Severity Index (PSDI) is a commonly used index that measures the severity of drought for agriculture and water resource management. It is calculated from observed temperature and precipitation values and estimates soil moisture. However, the Palmer Index is not considered to be consistent enough to characterize the risk of drought on a nationwide basis (FEMA, 1997) and neither of the Palmer indices are well suited to the dry, mountainous western United States.

In 2003, Governor Janet Napolitano created the Arizona Drought Task Force (ADTF), led by ADWR, which developed a statewide drought plan. The plan includes criteria for determining both short and long-term drought status for each of the 15 major watersheds in the state using assessments that are based on precipitation and stream flow. The plan also provides the framework for an interagency group which reports to the governor on drought status, in addition to local drought impact groups in each county and the State Drought Monitoring Technical Committee. Twice a year this interagency group reports to the governor on the drought status and the potential need for drought declarations. The counties use the monthly drought status reports to implement drought actions within their drought plans. The State Drought Monitoring Technical Committee uses the Standardized Precipitation Index (SPI) for the short-term drought status and a combination of the SPI and streamflow for the long-term drought status. Figures 5-5 and 5-6, present the most current short and long term maps available as of the writing of this plan.

Each of the four maps show general agreement and indicate that portions of Maricopa County currently remain in a drought condition with abnormally dry conditions and no expected improvement or worsening over the next six months.

[42] NIDIS U.S. Drought Portal website is located at: http://www.drought.gov/portal/server.pt/community/drought.gov/202

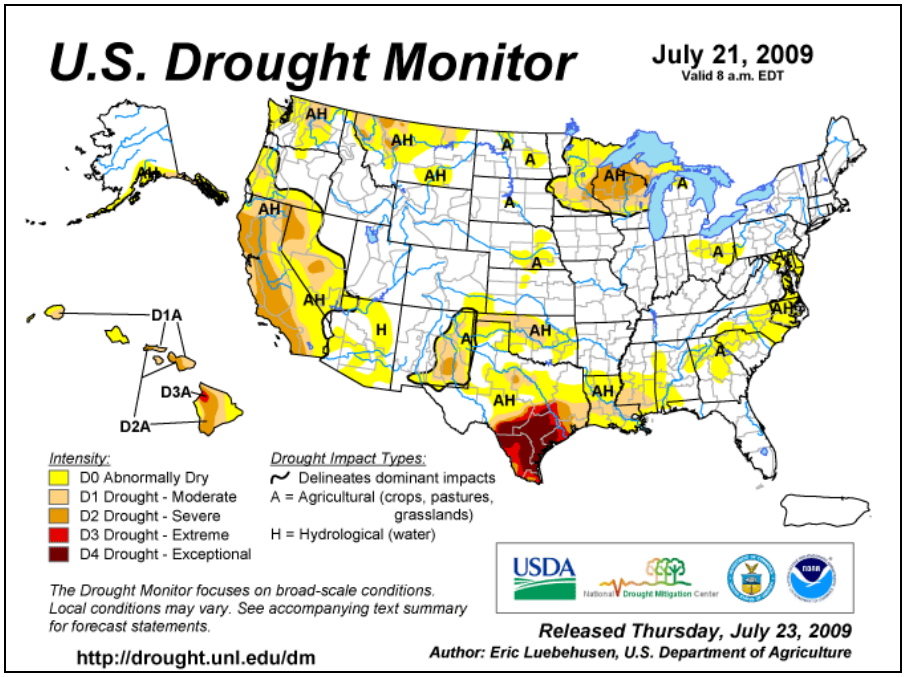


Figure 5-3: U.S. Drought Monitor Map for July 21, 2009

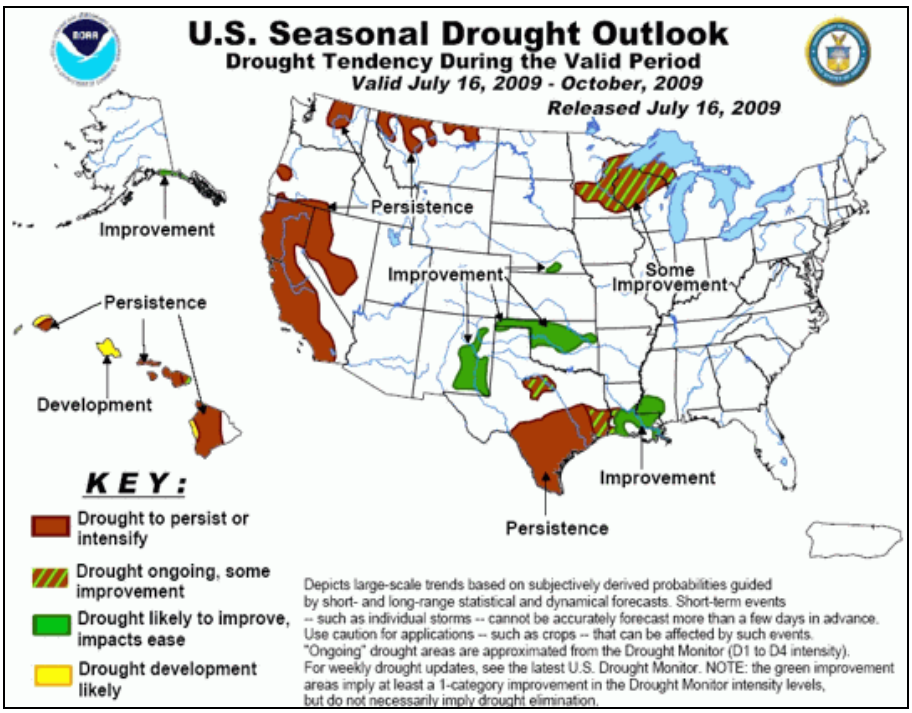


Figure 5-4: U.S. Seasonal Drought Outlook, July to October 2009

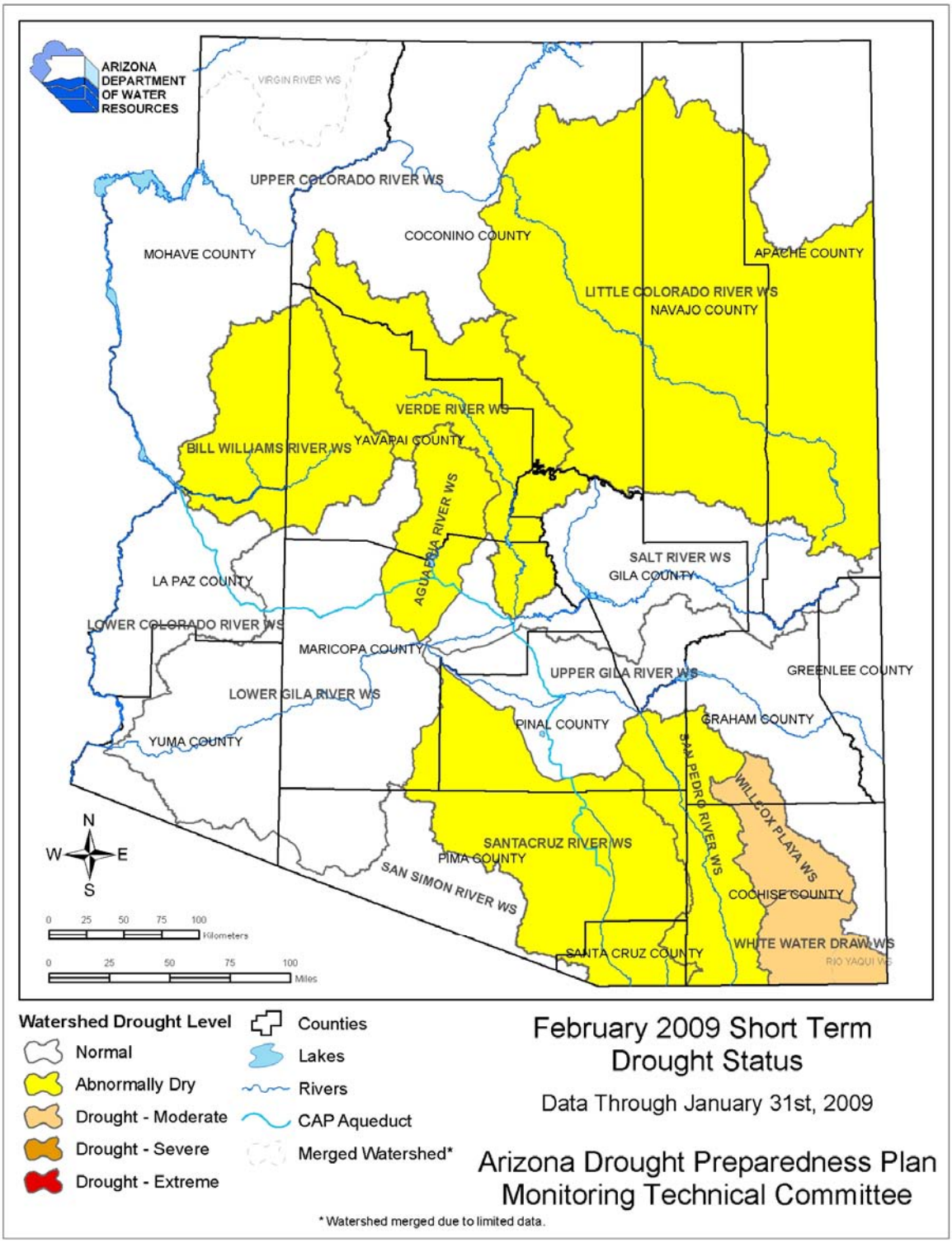


Figure 5-5: Arizona short term drought status map for February 2009

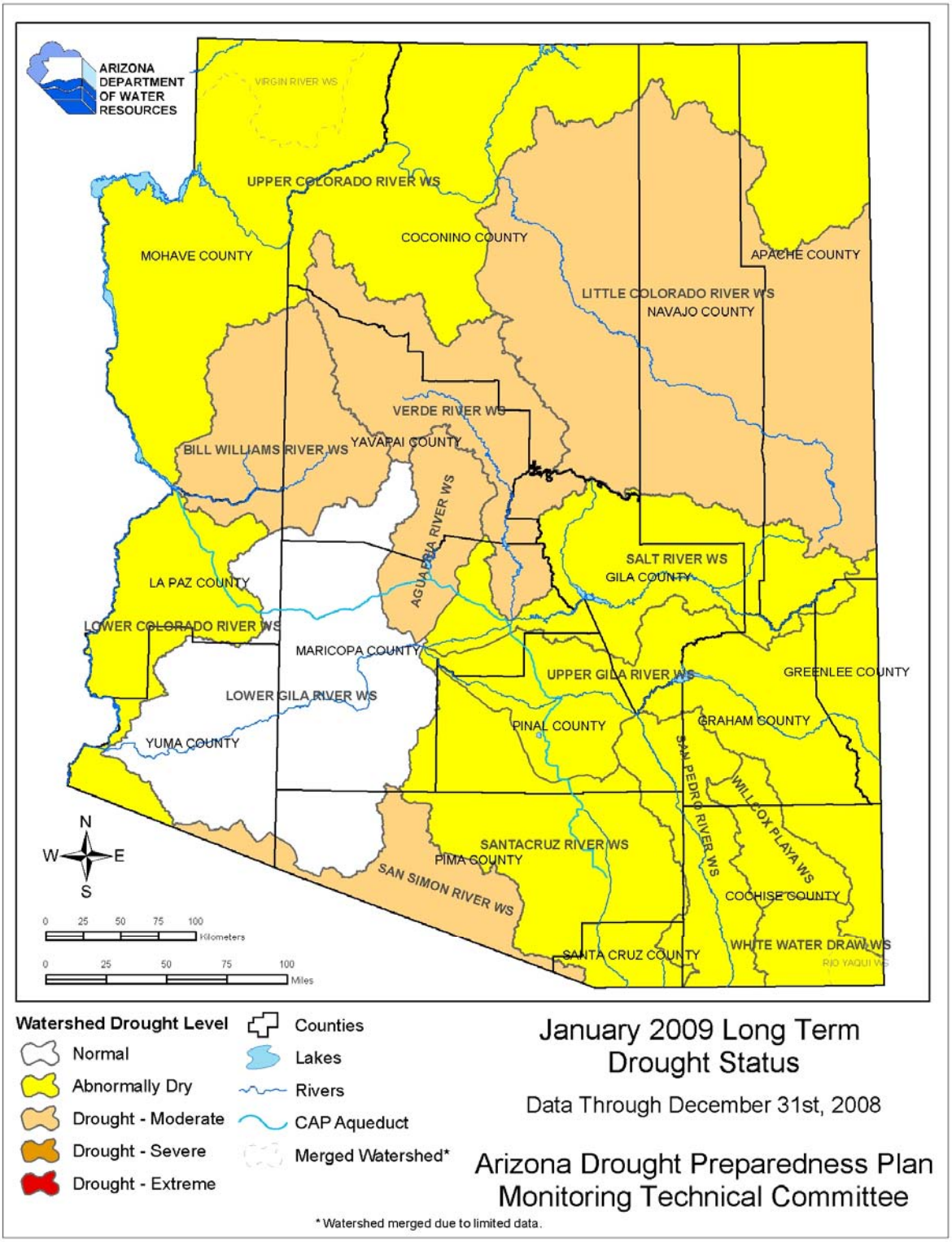


Figure 5-6: Arizona long term drought status map for January 2009

When attempting to evaluate the probability and magnitude of drought in Maricopa County, it is helpful to remember that potable water in Maricopa County is derived from both surface water and groundwater. Surface water to Maricopa County users comes from two sources, the Colorado River, (through the Central Arizona Project (CAP) Canal), and in-state rivers (including streams and lakes). This surface water is a major renewable resource for the county, but can vary dramatically between years, seasons, and locations due to the state's desert climate. In order to lessen the impact of such variations, water storage reservoirs and delivery systems have been constructed throughout the county, the largest of which are located on the Salt River, Verde River, Gila River, and Agua Fria River.

The other major source of water for Maricopa County is groundwater. This water has been pumped out of large subsurface natural reservoirs known as aquifers. While a significant supply of water remains stored in the aquifers, groundwater has historically been pumped out much more rapidly than it can be replenished through natural recharge, and has lead to a condition known as overdraft. In 1980, Arizona implemented the Groundwater Management Code in order to promote conservation and long-range planning of water resources, including reducing reliance on groundwater supplies. Active Management Areas (AMAs) were formed based on groundwater basin areas and Maricopa County is mostly covered under the Phoenix AMA.

Reclaimed water, or effluent, is the only increasing source of water in the county, although it constitutes only a small amount of the overall water used. As the regional population grows; however, increasing amounts of reclaimed water will be available for agricultural, golf course, and landscape irrigation, as well as industrial cooling, and maintenance of wildlife areas.

Vulnerability – CPRI Results

Drought CPRI results for each community are summarized in Table 5-42 below.

Table 5-42: Summary of CPRI results by jurisdiction for drought

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Likely	Limited	>24 hours	>1 week	2.50
Buckeye	Likely	Limited	>24 hours	>1 week	2.50
Carefree	Highly Likely	Limited	12-24 hours	>1 week	2.95
Cave Creek	Highly Likely	Limited	>24 hours	<24 hours	2.75
Chandler	Highly Likely	Limited	>24 hours	>1 week	2.95
El Mirage	Highly Likely	Critical	>24 hours	>1 week	3.25
Fountain Hills	Likely	Limited	>24 hours	>1 week	2.50
Fort McDowell Yavapai Nation	Possibly	Limited	>24 hours	>1 week	2.05
Gila Bend	Unlikely	Negligible	<6 hours	>1 week	1.75
Gilbert	Likely	Limited	>24 hours	>1 week	2.50
Glendale	Likely	Negligible	>24 hours	>1 week	2.20
Goodyear	Highly Likely	Limited	>24 hours	>1 week	2.95
Guadalupe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Litchfield Park	Possibly	Negligible	>24 hours	>1 week	1.75
Unincorporated Maricopa County	Highly Likely	Negligible	>24 hours	>1 week	2.65
Mesa	Likely	Limited	>24 hours	>1 week	2.50
Paradise Valley	Likely	Limited	>24 hours	<1 week	2.40
Peoria	Highly Likely	Critical	>24 hours	>1 week	3.25
Phoenix	Highly Likely	Critical	>24 hours	>1 week	3.25
Queen Creek	Possibly	Limited	>24 hours	>1 week	2.05
Salt River Pima-Maricopa Indian Community	Likely	Limited	>24 hours	>1 week	2.50
Salt River Project	Highly Likely	Limited	>24 hours	>1 week	2.95
Scottsdale	Possibly	Negligible	>24 hours	>1 week	1.75
Surprise	Possibly	Limited	>24 hours	>1 week	2.05
Tempe	Highly Likely	Limited	>24 hours	>1 week	2.95
Tolleson	Possibly	Critical	>24 hours	>1 week	2.35
Wickenburg	Highly Likely	Critical	>24 hours	>1 week	3.25
Youngtown	Likely	Critical	>24 hours	>1 week	2.80
				County-wide average CPRI =	**2.53**

Vulnerability – Loss Estimations

No standardized methodology exists for estimating losses due to drought and drought does not generally have a direct impact on critical and non-critical facilities and building stock. A direct correlation to loss of human life due to drought is improbable for Maricopa County. Instead, drought vulnerability is primarily measured by its potential impact to certain sectors of the County economy and natural resources include the following:

- Crop and livestock agriculture
- Municipal and industrial water supply
- Recreation/tourism
- Wildlife and wildlife habitat

Sustained drought conditions will also have secondary impacts to other hazards such as fissures, flooding, subsidence and wildfire. Extended drought may weaken and dry the grasses, shrubs, and trees of wildfire areas, making them more susceptible to ignition. Drought also tends to reduce the vegetative cover in watersheds, and hence decrease the interception of rainfall and increase the flooding hazard. Subsidence and fissure conditions are aggravated when lean surface water supplies force the pumping of more groundwater to supply the demand without the benefit of recharge from normal rainfall.

From 1995 to 2006, Maricopa County farmers and ranchers received over $11.4 million in disaster related assistance funding from the U.S Department of Agriculture (USDA) for crop and livestock damages. Over $8.7 million of those funds were received from 1999 to 2003, which corresponds to the most severe period of the current drought cycle. According to the USDA, 35 to 55 percent of the disaster assistance money (USDA, 2004), in the last 10 years (1994-2004) can be attributed to drought related losses. Accordingly, at least $5-6 million of these losses are likely drought related and $4-5 million occurred in the span of 4 years. It is therefore realistic to expect at least $1-2 million in agriculture related drought losses in a given year of severe drought conditions. Other direct costs such as increased pumping costs due to lowering of groundwater levels and costs to expand water infrastructure to compensate for reduced yields or to develop alternative water sources, are a significant factor but very difficult estimate due to a lack of documentation. There are also the intangible costs associated with lost tourism revenues, and impacts to wildlife habitat and animals. Typically, these impacts are translated into the general economy in the form of higher food and agricultural goods prices and increase utility costs.

Vulnerability – Development Trends

Population growth in Maricopa County will also require additional water to meet the thirsty demands of potable, landscape, and industrial uses. All new residential, commercial, and/or industrial developments within the County that are comprised of 6 or more parcels and at least one parcel less than 36 acres in size, are required to demonstrate an Assured and Adequate Water Supply, as administered by ADWR. All water service providers operating within the Phoenix AMA are required to comply with this requirement. The ADTF is also working cooperatively with water providers within the State to develop System Water Plans that are comprised of three components:

- *Water Supply Plan* – describes the service area, transmission facilities, monthly system production data, historic demand for the past five years, and projected demands for the next five, 10 and 20 years.
- *Drought Preparedness Plan* – includes drought and emergency response strategies, a plan of action to respond to water shortage conditions, and provisions to educate and inform the public.
- *Water Conservation Plan* – addresses measures to control lost and unaccounted for water, considers water rate structures that encourage efficient use of water, and plans for public information and education programs on water conservation.

Sources

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Profile Maps

No profile maps are provided.

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5.3.3 Extreme Heat

Description

Extreme Heat is the combination of very high temperatures and exceptionally humid conditions that exceed regionally based indices for perceived risk. The major human risks associated with extreme heat are as follows:

- *Heat Cramps:* May occur in people unaccustomed to exercising in the heat and generally ceases to be a problem after acclimatization.
- *Heat Syncope:* This refers to sudden loss of consciousness and is typically associated with people exercising who are not acclimated to warm temperatures. Causes little or no harm to the individual.
- *Heat Exhaustion:* While much less serious than heatstroke, heat exhaustion victims may complain of dizziness, weakness, or fatigue. Body temperatures may be normal or slightly to moderately elevated. The prognosis is usually good with fluid treatment.
- *Heatstroke:* Considered a medical emergency, heatstroke is often fatal. It occurs when the body's responses to heat stress are insufficient to prevent a substantial rise in the body's core temperature. While no standard diagnosis exists, a medical heatstroke condition is usually diagnosed when the body's temperature exceeds 105°F due to environmental temperatures. Rapid cooling is necessary to prevent death, with an average fatality rate of 15 percent even with treatment.

In addition to affecting people, extreme heat places significant stress on plants and animals leading to reduced agricultural yields and increased mortality rates.

History

For the period of 1992 to 2008, there were 537 deaths attributed to excessive natural heat in Maricopa County, with 80 and 85 of those deaths occurring in 2005 and 2006, respectively (Mrela, C.K., 2004 and MCDPH, 2009). The overwhelming majority of those deaths occurred during the hot summer months of June, July and August. Figure 5-7 is an excerpt from the Maricopa County Department of Public Health (MCDPH) report showing the distribution of deaths for 2008.

Probability/Magnitude

There are no recurrence or non-exceedance probabilities developed for extreme heat events in Maricopa County. The National Weather Service (NWS) Warning and Forecast Office (WFO) in Phoenix, with the technical support of the University of Maryland, designed a science-based, customized, extreme heat derivation technique developed specifically for the Phoenix metropolitan region. During Arizona's hottest months, the NWS WFO in Phoenix issues three types of heat-related messages, which are based on four factors – temperature, humidity, amount of cloudiness, and the expected duration of these conditions. The combination of factors that will trigger one of these heat-related messages varies according to the time of year. For example, a combination of factors that would result in an excessive heat warning in early May might not result in one in mid-July. The three NWS WFO products are:

a. *Heat Advisory* – issued when the temperature is forecast to be unusually hot but not life-threatening.

b. *Excessive Heat Watch* – issued when conditions are likely to result in a life-threatening heat emergency within the next 24 to 48 hours.

c. *Excessive Heat Warning* – issued when a life-threatening heat emergency exists or is imminent.

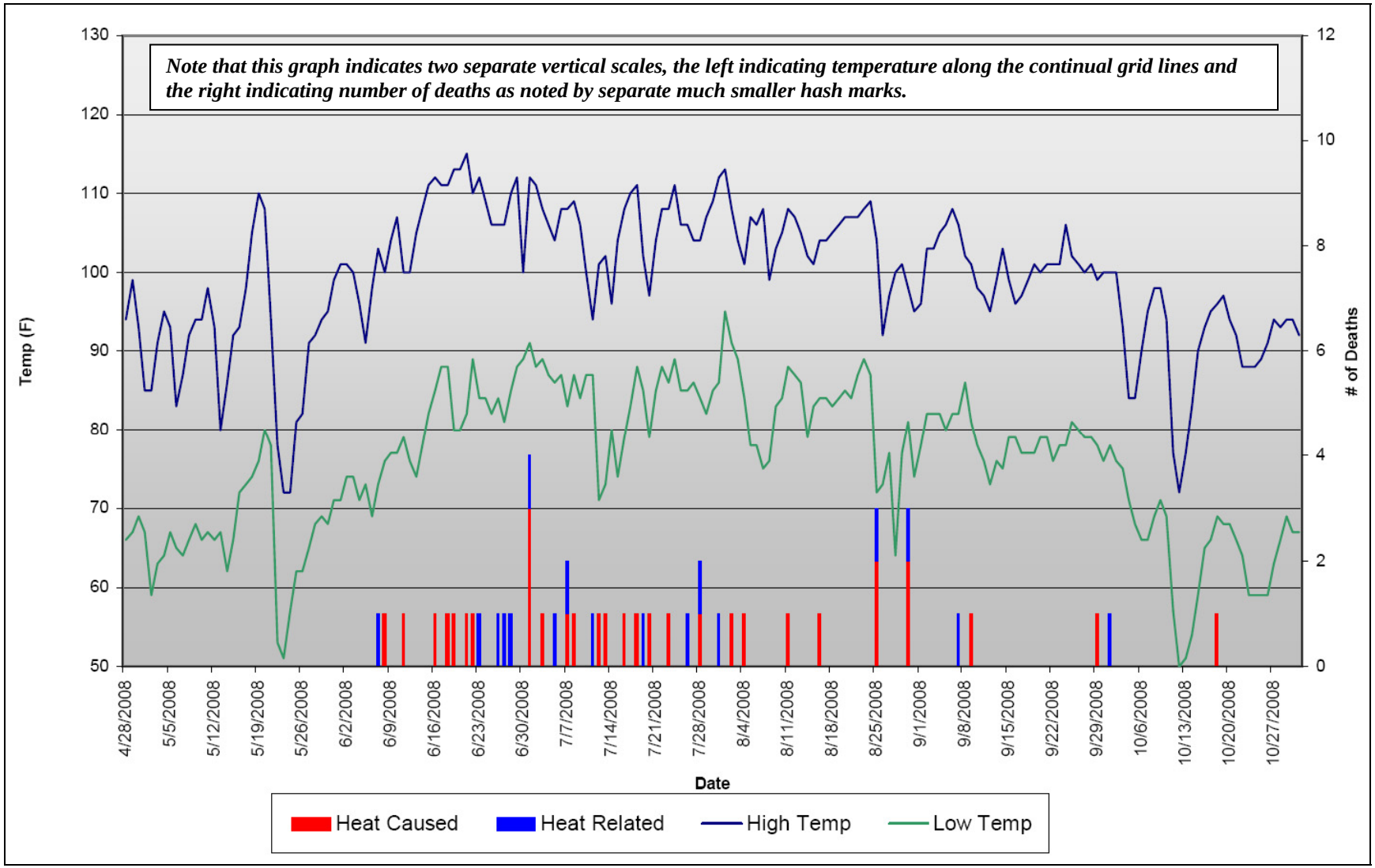


Figure 5-7: 2008 heat caused/related deaths by temperature and date

These products are intended to raise the public's awareness to prevent heat illnesses from occurring. When the NWS WFO Phoenix issues one of its heat products, it should serve as a signal that on that day outdoor activities are not "business as usual.". If significantly hot weather is forecast, the NWS WFO Phoenix will issue an Excessive Heat Watch generally two to three days in advance. An Excessive Heat Watch is a way to give the public and emergency officials a "heads up" that extreme temperatures are expected. If significantly hot temperatures remain in the forecast for today or tomorrow, the Excessive Heat Watch will be upgraded to an Excessive Heat Warning, indicating that extreme heat has either arrived or is expected shortly (NWS-WFO Phoenix, 2009). Figure 5-8 shows a table of maximum and minimum excessive heat threshold values determined for the Phoenix metropolitan area and published by the NWS WFO Phoenix office.

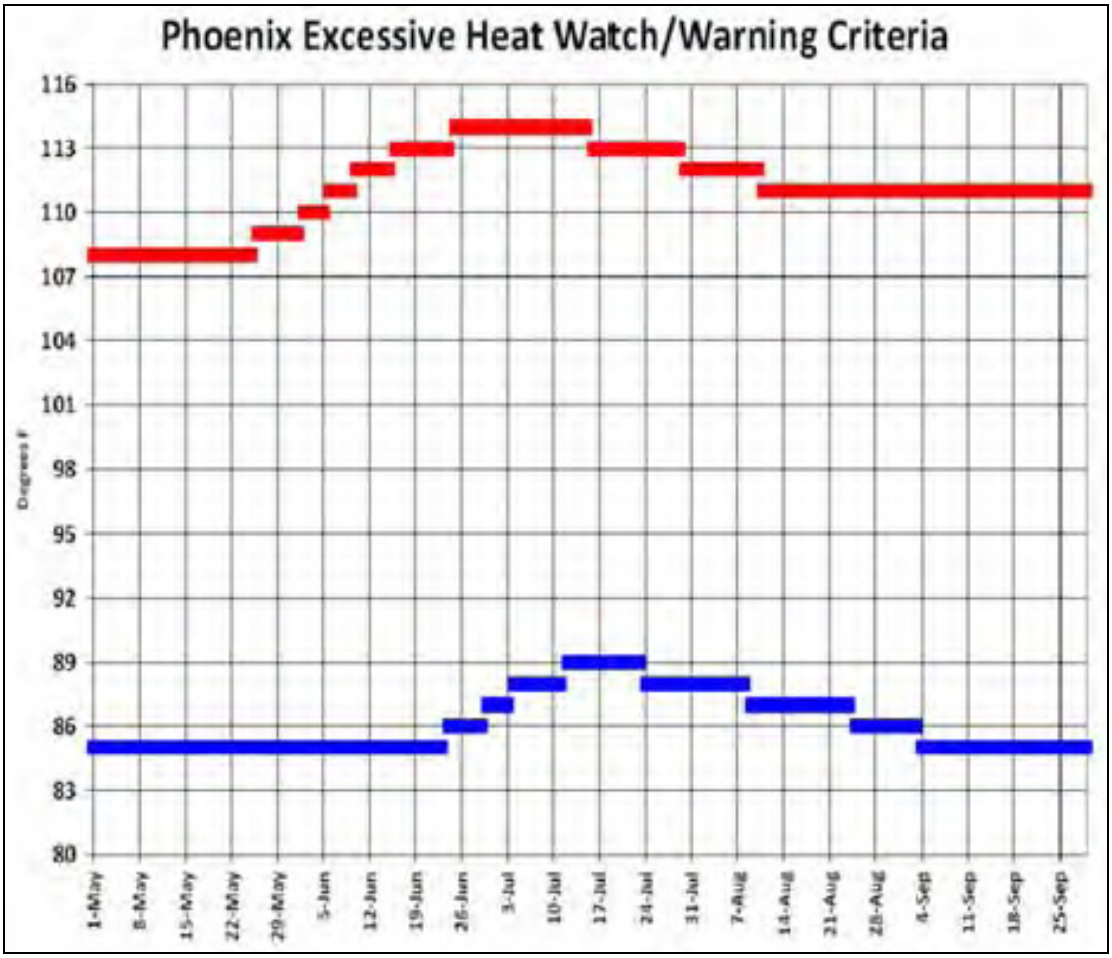


Figure 5-8: Phoenix excessive heat watch/warning criteria

Another indicator of the degree of danger associated with extreme heat is the Heat Index (HI) or the "Apparent Temperature". According the NWS, the HI is an accurate measure of how hot it really feels when the Relative Humidity (RH) is added to the actual air temperature. Figure 5-9 is a quick reference published by the NWS that shows the HI based on current temperature and relative humidity, and levels of danger for HI values.

Heat Index

Temperature (°F) \ Relative Humidity (%)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
80	77	78	78	79	79	79	80	80	80	81	81	82	82	83	84	84	85	86	86	87
81	78	79	79	79	79	80	80	81	81	82	82	83	84	85	86	86	87	88	90	91
82	79	79	80	80	80	80	81	81	82	83	84	84	85	86	88	89	90	91	93	95
83	79	80	80	81	81	81	82	82	83	84	85	86	87	88	90	91	93	95	97	99
84	80	81	81	81	82	82	83	83	84	85	86	88	89	90	92	94	96	98	100	103
85	81	81	82	82	82	83	84	84	85	86	88	89	91	93	95	97	99	102	104	107
86	81	82	83	83	83	84	85	85	87	88	89	91	93	95	97	100	102	105	108	112
87	82	83	83	84	84	85	86	87	88	89	91	93	95	98	100	103	106	109	113	116
88	83	84	84	85	85	86	87	88	89	91	93	95	98	100	103	106	110	113	117	121
89	84	84	85	85	86	87	88	89	91	93	95	97	100	103	106	110	113	117	122	
90	84	85	86	86	87	88	89	91	92	95	97	100	103	106	109	113	117	122	127	
91	85	86	87	87	88	89	90	92	94	97	99	102	105	109	113	117	122	126	132	
92	86	87	88	88	89	90	92	94	96	99	101	105	108	112	116	121	126	131		
93	87	88	89	89	90	92	93	95	98	101	104	107	111	116	120	125	130	136		
94	87	89	90	90	91	93	95	97	100	103	106	110	114	119	124	129	135	141		
95	88	89	91	91	93	94	96	99	102	105	109	113	118	123	128	134	140			
96	89	90	92	93	94	96	98	101	104	108	112	116	121	126	132	138	145			
97	90	91	93	94	95	97	100	103	106	110	114	119	125	130	136	143	150			
98	91	92	94	95	97	99	102	105	109	113	117	123	128	134	141	148				
99	92	93	95	96	98	101	104	107	111	115	120	126	132	138	145	153				
100	93	94	96	97	100	102	106	109	114	118	124	129	136	143	150	158				
101	93	95	97	99	101	104	108	112	116	121	127	133	140	147	155					
102	94	96	98	100	103	106	110	114	119	124	130	137	144	152	160					
103	95	97	99	101	104	108	112	116	122	127	134	141	148	157	165					
104	96	98	100	103	106	110	114	119	124	131	137	145	153	161						
105	97	99	102	104	108	112	116	121	127	134	141	149	157	166						
106	98	100	103	106	109	114	119	124	130	137	145	153	162	172						
107	99	101	104	107	111	116	121	127	134	141	149	157	167							
108	100	102	105	109	113	118	123	130	137	144	153	162	172							
109	100	103	107	110	115	120	126	133	140	148	157	167	177							
110	101	104	108	112	117	122	129	136	143	152	161	171								
111	102	106	109	114	119	125	131	139	147	156	166	176								
112	104	107	111	115	121	127	134	142	150	160	170	181								
113	104	108	112	117	123	129	137	145	154	164	175									
114	105	109	113	119	125	132	140	148	158	168	179									
115	106	110	115	121	127	134	143	152	162	173	184									
116	107	111	116	122	129	137	146	155	166	177										
117	108	112	118	124	132	140	149	159	170	181										
118	108	113	119	126	134	142	152	162	174	186										
119	109	114	121	128	136	145	155	166	178											
120	110	116	122	130	138	148	158	170	182											
121	111	117	124	132	141	151	162	174	187											
122	111	118	125	134	143	154	165	178												
123	112	119	127	136	146	157	169	182												
124	113	120	129	138	148	160	172													
125	114	121	130	140	151	163	176													

Extreme Danger	Heat stroke likely.
Danger	Sunstroke, musde cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
Extreme Caution	Sunstroke, musde cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	Fatigue possible with prolonged exposure and/or physical activity.

Figure 5-9: NWS Heat Index chart

Vulnerability – CPRI Results

Extreme Heat CPRI results for each community are summarized in Table 5-43 below.

Table 5-43: Summary of CPRI results by jurisdiction for extreme heat

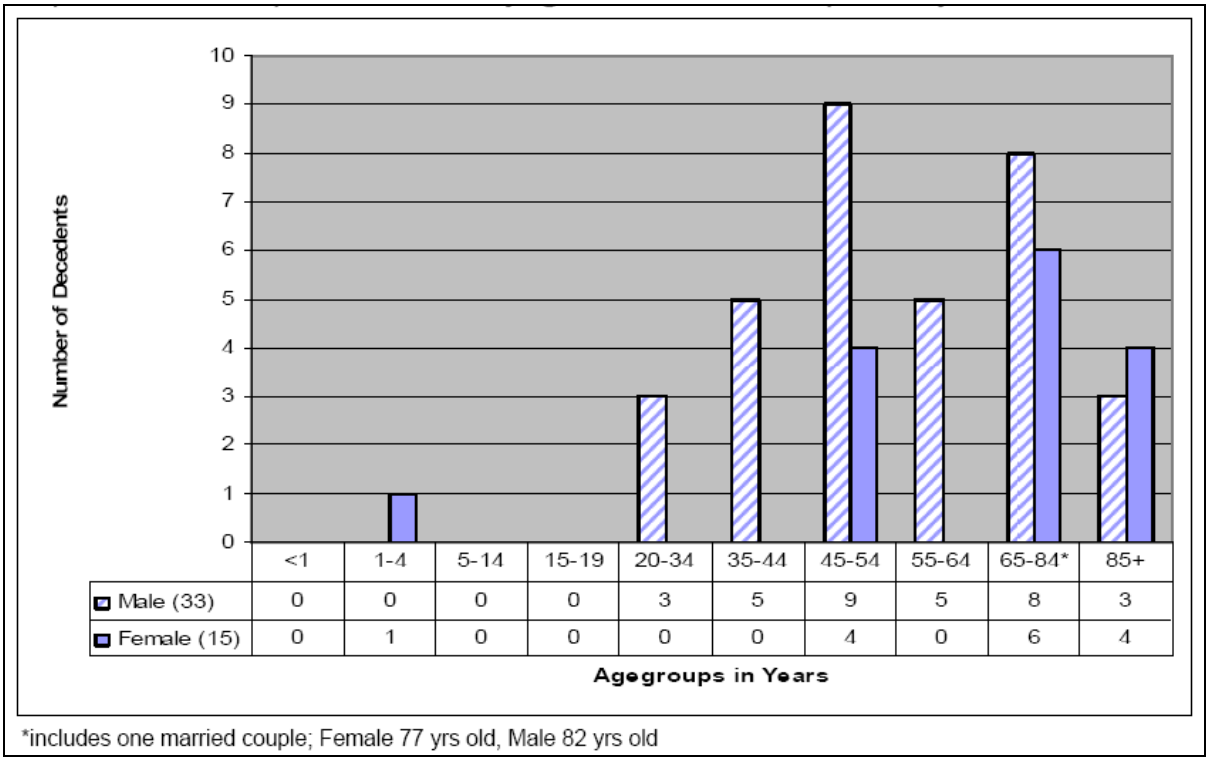
Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Likely	Critical	>24 hours	>1 week	2.80
Buckeye	Highly Likely	Limited	12-24 hours	>1 week	3.10
Carefree	Highly Likely	Critical	12-24 hours	<6 hours	3.30
Cave Creek	Highly Likely	Limited	12-24 hours	<24 hours	2.90
Chandler	Highly Likely	Critical	>24 hours	<1 week	3.15
El Mirage	Highly Likely	Critical	>24 hours	>1 week	3.25
Fountain Hills	Likely	Limited	12-24 hours	<1 week	2.55
Fort McDowell Yavapai Nation	Likely	Limited	>24 hours	>1 week	2.50
Gila Bend	Possibly	Limited	<6 hours	>1 week	2.50
Gilbert	Highly Likely	Limited	12-24 hours	<1 week	3.00
Glendale	Highly Likely	Critical	12-24 hours	>1 week	3.40
Goodyear	Highly Likely	Limited	>24 hours	<1 week	2.85
Guadalupe	Possibly	Negligible	<6 hours	<24 hours	2.30
Litchfield Park	Highly Likely	Limited	12-24 hours	>1 week	3.10
Unincorporated Maricopa County	Highly Likely	Critical	12-24 hours	<1 week	3.30
Mesa	Likely	Critical	>24 hours	<1 week	2.70
Paradise Valley	Highly Likely	Critical	>24 hours	<1 week	3.15
Peoria	Highly Likely	Critical	>24 hours	>1 week	3.25
Phoenix	Likely	Negligible	<6 hours	<6 hours	2.35
Queen Creek	Likely	Limited	12-24 hours	<1 week	2.55
Salt River Pima-Maricopa Indian Community	Highly Likely	Limited	>24 hours	>1 week	2.95
Salt River Project	Highly Likely	Limited	>24 hours	<1 week	2.85
Scottsdale	Likely	Limited	12-24 hours	<6 hours	2.35
Surprise	Likely	Critical	12-24 hours	<24 hours	2.75
Tempe	Highly Likely	Limited	>24 hours	>1 week	2.95
Tolleson	Likely	Critical	>24 hours	<1 week	2.70
Wickenburg	Highly Likely	Critical	12-24 hours	<1 week	3.30
Youngtown	Highly Likely	Critical	12-24 hours	<1 week	3.30
				County-wide average CPRI =	**2.90**

Vulnerability – Loss Estimations

Losses due to extreme heat primarily occur in the form of death and illness. According to the MCDPH 2009 report, heat death statistics for Maricopa County for the year of 2006, 2007, and 2008 are summarized as follows:

Cases	2006	%	2007	%	2008	%	TOTAL
Total Reported	103	100	129	100	95	100	327
Confirmed	85	83	50	39	48	50.5	183
Ruled Out	18	17	79	61	47	49.5	144
Pending	0	0	0	0	0	0	0

Preliminary epidemiological studies by MCDPH bring to light a number of interesting potential variables at play in heat-caused and heat-related deaths. One noteworthy trend is how the deaths for 2008 track with high overnight temperatures as illustrated in Figure 5-7. Another variable indicating increased vulnerability, is the number of deaths as they relate to age and gender, as shown in Figure 5-10.



	<1	1-4	5-14	15-19	20-34	35-44	45-54	55-64	65-84*	85+
Male (33)	0	0	0	0	3	5	9	5	8	3
Female (15)	0	1	0	0	0	0	4	0	6	4

Figure 5-10: Heat caused/related deaths by age and gender for Maricopa County in 2008

There are currently no statistical analyses for projecting heat related deaths in Maricopa County, however, MCDPH continues to track data and monitor the above mentioned trends and other factors to determine if a statistical significance exists. Past history would indicated that multiple deaths due to extreme heat are highly likely

Vulnerability – Development Trends

In a metropolitan area, paved surfaces typically absorb and retain the heat of the day and then slowly release that heat back into the atmosphere through the night. When large areas are paved, the metropolitan area will develop an "urban heat island" effect, wherein temperatures in the center of the metropolitan area become much warmer than those on the outskirts of the valley due to the storage of heat during the day.

The metropolitan area of Maricopa County has grown dramatically in size over the last two decades, transforming a significant portion of the once natural desert and/or agricultural farm lands, into concrete and asphalt paved streets, roofs, driveways, sidewalks, parking lots, and other hardscapes. The result has been an intensification of the urban heat island effect and a steady increase in the nighttime low temperature. The impacts of this expansion include increased cooling costs and greater demand on power resources. According to the Arizona Republic, the Salt River Project estimates that for every degree increase in temperature, the utility's 610,000 residential customers pay $3.2 million to $3.8 million extra per month in cooling costs, or about $5 to $7 per customer per month (Az Republic, 1998).

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Profile Maps

No profile maps are provided.

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5.3.4 Fissure

Description

Earth fissures are linear cracks, seams, or separations in the ground that extend from the groundwater table and are caused by tensional forces related to differential land subsidence. In many cases, fissures form as a direct result of subsidence caused by groundwater depletion. The surface expression of fissures ranges from less than a yard to several miles long and from less than an inch to tens of feet wide. The longest fissure is in Pinal County, near Picacho, and is over 10 miles long. Earth fissures occur at the edges of basins, usually parallel to mountain fronts, or above local bedrock highs in the subsurface, and typically cut across natural drainage patterns. Fissures can alter flood patterns, break buried pipes and lines, cause infrastructure to collapse, provide a direct conduit to the groundwater table for contaminants, and even pose a life safety hazard for both humans and animals.

History

In Arizona, fissures were first noted near Picacho in 1927. The number of fissures has increased dramatically since the 1950s because of groundwater depletion, first because of agriculture, and later, because of exponential population growth. The risk posed by fissures is also increasing as the population expands into the outlying basin edges and mountain fronts. Several fissure case histories for the Maricopa County area are summarized below.

- San Tan Mountains, Maricopa and Pinal Counties
  - Foothills—undermining at least one home, and crossing several roads; dogs trapped in flash flood flowing through the fissure in 2007
  - Y-crack—crosses the Hunt Highway and San Tan Boulevard east of Sossaman Road; present at least by 1969; catastrophically re-opened from 195th Street and Happy Road to San Tan in 2005 and again in 2007, damaging roads, corrals, fences, driveways, stranding and trapping vehicles, and killing a horse
- Apache Junction/East Mesa, Maricopa County
  - Baseline and Meridian—fissure crosses diagonally under the intersection, fissure zone over one mile long
  - Ironwood and Guadalupe—industrial facilities built on top of several fissures in the area; fissures stop immediately east of subdivision; fissures crossing powerlines
- Mesa, Maricopa County
  - Loop 202 (Red Mountain Freeway)—fissure present at least since 1970s; attempted mitigation during construction cost $200,000
  - Sossamon Road and University Drive—fissure runs diagonally through a subdivision along the entrance; fissure known in 1973 and subsequently backfilled
- Wintersburg, Maricopa County
  - Fissure runs perpendicular to power transmission lines near Palo Verde Nuclear Generating Station; made one road impassable
- Scottsdale, Maricopa County
  - CAP Canal—fissure paralleling the canal opened within a few feet of the lining on the east side in 2003
  - 40th St and Cholla—discovered in 1980s
- Flood retarding structures, Maricopa and Pinal Counties
  - McMicken Dam, White Tank Mountains—dam had to be removed and replaced; cost several million dollars

- Powerline FRS, Apache Junction—fissure just discovered within 1200 feet of the FRS; Flood Control District examining mitigation options

Probability/Magnitude

There are no methods of quantifiably predicting the probability and magnitude of earth fissures. The locations of potential fissures or extension of existing fissures may be predictable in specific areas if enough information about the subsurface material properties and groundwater levels are available. It is a fair assurance that continued groundwater depletion will result in more fissures. The magnitude of existing and new fissures is dependent upon several variables including the depth to groundwater, type and depth of surficial material present, amount and rate of groundwater depletion, groundwater basin depth, depth to bedrock, volume and rate of runoff due to precipitation entering the fissure, and human intervention.

The Arizona Geological Survey has mapped known and suspected fissure lineaments for certain areas of the County, with the latest update of GIS data having a version date of June 22, 2009. In order to estimate the areas of immediate risk, the MJPT chose to use create polygons that represent a 500-foot buffer along the mapped fissures and assign a HIGH hazard risk to areas within the buffered zone. These areas are indicated on Maps 3A, 3B, and 3C.

Vulnerability – CPRI Results

Fissure CPRI results for each community are summarized in Table 5-44 below.

Table 5-44: Summary of CPRI results by jurisdiction for fissure hazard

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Possibly	Negligible	<6 hours	>1 week	2.20
Buckeye	Unlikely	Negligible	>24 hours	<24 hours	1.10
Carefree	Unlikely	Negligible	>24 hours	<6 hours	1.00
Cave Creek	Unlikely	Negligible	>24 hours	<6 hours	1.00
Chandler	Unlikely	Negligible	>24 hours	<6 hours	1.00
El Mirage	Unlikely	Negligible	>24 hours	<24 hours	1.10
Fountain Hills	Possibly	Limited	<6 hours	>1 week	2.50
Fort McDowell Yavapai Nation	Unlikely	Negligible	6-12 hours	<24 hours	1.40
Gila Bend	Unlikely	Negligible	>24 hours	<6 hours	1.00
Gilbert	Likely	Negligible	>24 hours	>1 week	2.20
Glendale	Likely	Negligible	12-24 hours	>1 week	2.35
Goodyear	Unlikely	Negligible	<6 hours	<6 hours	1.45
Guadalupe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Litchfield Park	Unlikely	Negligible	<6 hours	<6 hours	1.45
Unincorporated Maricopa County	Likely	Limited	<6 hours	>1 week	2.95
Mesa	Highly Likely	Negligible	<6 hours	>1 week	3.10
Paradise Valley	Unlikely	Negligible	<6 hours	<1 week	1.65
Peoria	Possibly	Limited	<6 hours	>1 week	2.50
Phoenix	Unlikely	Negligible	<6 hours	<6 hours	1.45
Queen Creek	Possibly	Negligible	<6 hours	<6 hours	1.90
Salt River Pima-Maricopa Indian Community	Likely	Limited	>24 hours	>1 week	2.50
Salt River Project	Possibly	Negligible	>24 hours	>1 week	1.75
Scottsdale	Possibly	Negligible	<6 hours	<6 hours	1.90
Surprise	Possibly	Limited	<6 hours	<6 hours	2.20
Tempe	Possibly	Limited	>24 hours	>1 week	2.05
Tolleson	Unlikely	Negligible	>24 hours	>1 week	1.30
Wickenburg	Likely	Limited	>24 hours	>1 week	2.50
Youngtown	Unlikely	Limited	>24 hours	>1 week	1.60
				County-wide average CPRI =	**1.81**

Vulnerability – Loss Estimations

The Arizona Land Subsidence Group (ALSG) prepared a white paper in 2007 (ASLG, 2007) that summarizes fissure risk and various case studies. The following table is an excerpt from that report listing various types of damages that either have or could occur as a result of fissures:

Table 1. Hazards Directly Associated with Earth Fissures	
• Cracked or collapsing roads	• Severed or deformed railroad track
• Broken pipes & utility lines	• Damaged well casing or wellhead
• Damaged or breached canals	• Disrupted drainage
• Cracked foundation/separated walls	• Contaminated groundwater aquifer
• Loss of agricultural land	• Sudden discharge of ponded water
• Livestock & wildlife injury or death	• Human injury or death

(After Pewe, 1990; Bell & Price, 1993; and Slaff, 1993)

Historic losses in Maricopa County due to fissures are mostly minor losses associated with damaged utilities, fences and dirt/gravel roads and driveways. The exception was the death of a horse in the Town of Queen Creek's Planning Area when a fissure opened up and engulfed the animal during a July 2007 storm. It is therefore very difficult to estimate economic losses due to a lack of an established methodology. Potential exposure of human and facility assets to high hazard fissure zones will be estimated instead, and no estimation of economic losses will be made. Table 5-45 summarizes the MJPT defined critical and non-critical facilities potentially exposed to a high hazard fissure zone. Table 5-46 summarizes population sectors exposed to the high hazard fissure zones. HAZUS residential, commercial and industrial exposures to high hazard fissure zones are summarized in Tables 5-12 through 5-39.

In summary, $27.4 million in critical and non-critical MJPT identified assets are exposed to high hazard fissure zones County-wide. An additional $76.2 million of HAZUS defined residential, commercial, and industrial facilities for all participating jurisdictions are exposed to a high hazard fissure zone. Regarding human vulnerability, a total population of 834 people, or 0.05% of the total 2000 Maricopa County population, is potentially exposed to a high hazard fissure zone. The potential for death and/or injury is possible, although no occurrences have been documented to-date. Short and long-term displacement are also likely should structures become damaged.

Vulnerability – Development Trends

Earth fissures have been part of the landscape of southern and south central Arizona for at least the past seventy years (ALSG, 2007). As the communities of Maricopa County grow, it is inevitable that expansion into agricultural and undeveloped desert lands will occur, bringing the urban interface into more and more intersection with the geologic hazards related to fissures. The AZGS and State are working to provided better reporting and disclosure of fissure hazards, and county and local officials are becoming more aware of the dangers of not addressing the them with development.

Sources

Arizona Division of Emergency Management, 2009, State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT.

Arizona Geological Survey, 2009, Webpage entitled: Arizona's Earth Fissure Center, http://www.azgs.az.gov/EFC.shtml

Arizona Land Subsidence Group, 2007. Land subsidence and earth fissures in Arizona: Research and informational needs for effective risk management, white paper, Tempe, AZ, . http://www.azgs.az.gov/Earth%20Fissures/CR-07-C.pdf

URS, 2004, Maricopa County Hazard Mitigation Plan

Profile Maps

Map 3A, 3B, and 3C – Earth Fissure Hazard Map(s)

Table 5-45: Summary of asset inventory exposure to high hazard fissure zones

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
County-Wide Totals	**5,179**	**9**	**0.17%**	**100.00%**	**$27,436**	**$0**
Avondale	61	0	0.00%	0.00%	$0	None Estimated
Buckeye	77	0	0.00%	0.00%	$0	None Estimated
Carefree	6	0	0.00%	0.00%	$0	None Estimated
Cave Creek	39	0	0.00%	0.00%	$0	None Estimated
Chandler	226	0	0.00%	0.00%	$0	None Estimated
El Mirage	34	0	0.00%	0.00%	$0	None Estimated
Fountain Hills	15	0	0.00%	0.00%	$0	None Estimated
Fort McDowell Yavapai Nation	18	0	0.00%	0.00%	$0	None Estimated
Gila Bend	7	0	0.00%	0.00%	$0	None Estimated
Gilbert	694	1	0.14%	11.11%	$11,000	None Estimated
Glendale	1,205	3	0.25%	33.33%	$11,771	None Estimated
Goodyear	93	0	0.00%	0.00%	$0	None Estimated
Guadalupe	6	0	0.00%	0.00%	$0	None Estimated
Litchfield Park	5	0	0.00%	0.00%	$0	None Estimated
Unincorporated Maricopa County	447	3	0.67%	33.33%	$465	None Estimated
Mesa	613	1	0.16%	11.11%	$200	None Estimated
Paradise Valley	69	0	0.00%	0.00%	$0	None Estimated
Peoria	225	0	0.00%	0.00%	$0	None Estimated
Phoenix	913	0	0.00%	0.00%	$0	None Estimated
Queen Creek	117	1	0.85%	11.11%	$4,000	None Estimated
Salt River Pima-Maricopa Indian Community	21	0	0.00%	0.00%	$0	None Estimated
Salt River Project [43]	511	0	0.00%	N/A	N/A	N/A
Scottsdale	114	0	0.00%	0.00%	$0	None Estimated
Surprise	37	0	0.00%	0.00%	$0	None Estimated
Tempe	111	0	0.00%	0.00%	$0	None Estimated
Tolleson	10	0	0.00%	0.00%	$0	None Estimated
Wickenburg	11	0	0.00%	0.00%	$0	None Estimated
Youngtown	5	0	0.00%	0.00%	$0	None Estimated

[43] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-46: Summary of population sectors exposed to high hazard fissure zones

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
County-Wide Totals	**1,522,083**	**834**	**0.05%**	**180,521**	**177**	**0.10%**	**100,684**	**55**	**0.05%**
Avondale	15,613	0	0.00%	855	0	0.00%	764	0	0.00%
Buckeye	3,906	0	0.00%	342	0	0.00%	344	0	0.00%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	0	0.00%	5,156	0	0.00%	3,029	0	0.00%
El Mirage	3,400	0	0.01%	213	0	0.02%	194	0	0.00%
Fountain Hills	8,759	0	0.00%	1,750	0	0.00%	387	0	0.00%
Fort McDowell Yavapai Nation	309	0	0.00%	17	0	0.00%	10	0	0.00%
Gila Bend	1,010	0	0.00%	81	0	0.00%	117	0	0.00%
Gila River Indian Community	1,091	0	0.00%	48	0	0.00%	140	0	0.00%
Gilbert	54,901	11	0.02%	1,834	1	0.04%	883	0	0.01%
Glendale	118,654	2	0.00%	9,169	0	0.00%	8,282	0	0.00%
Goodyear	10,967	1	0.01%	921	0	0.00%	309	0	0.05%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	0	0.00%	291	0	0.00%	39	0	0.00%
Unincorporated Maricopa County	104,385	260	0.25%	43,659	31	0.07%	9,288	12	0.13%
Mesa	189,697	293	0.15%	25,867	120	0.46%	12,410	33	0.26%
Paradise Valley	5,769	0	0.00%	868	0	0.00%	68	0	0.00%
Peoria	49,884	0	0.00%	6,555	0	0.00%	1,921	0	0.00%
Phoenix	657,658	123	0.02%	54,037	14	0.03%	47,321	3	0.01%
Pinal County	6	0	1.74%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	127	4.48%	145	9	6.36%	114	6	5.22%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	14	0.02%	15,440	1	0.01%	5,177	1	0.02%
Surprise	13,387	3	0.02%	3,460	0	0.00%	757	0	0.00%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	0	0.00%	547	0	0.00%	288	0	0.00%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

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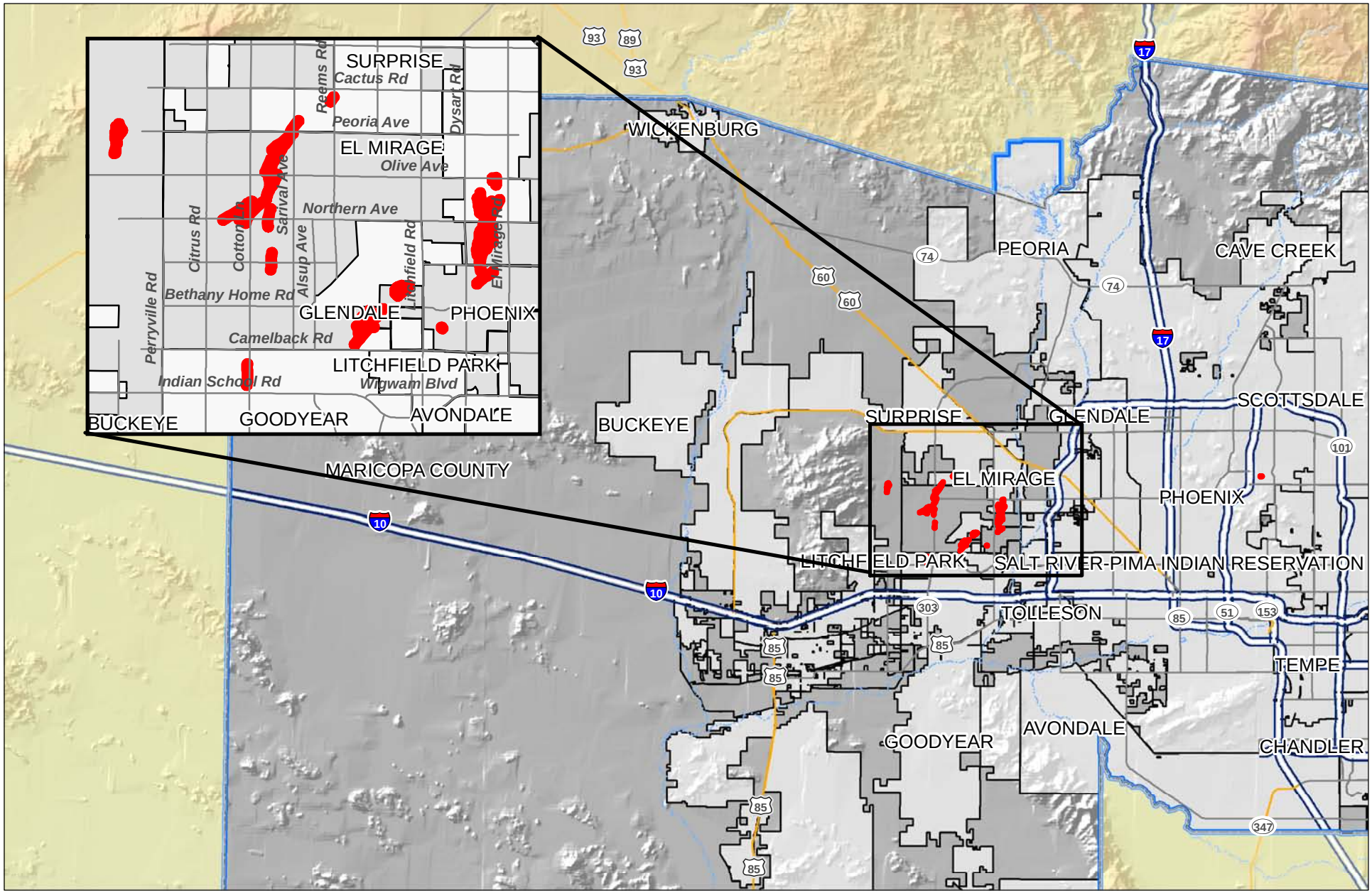


Legend

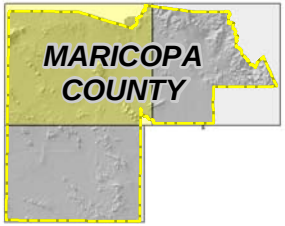
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Earth Fissure Hazard Rating

- High

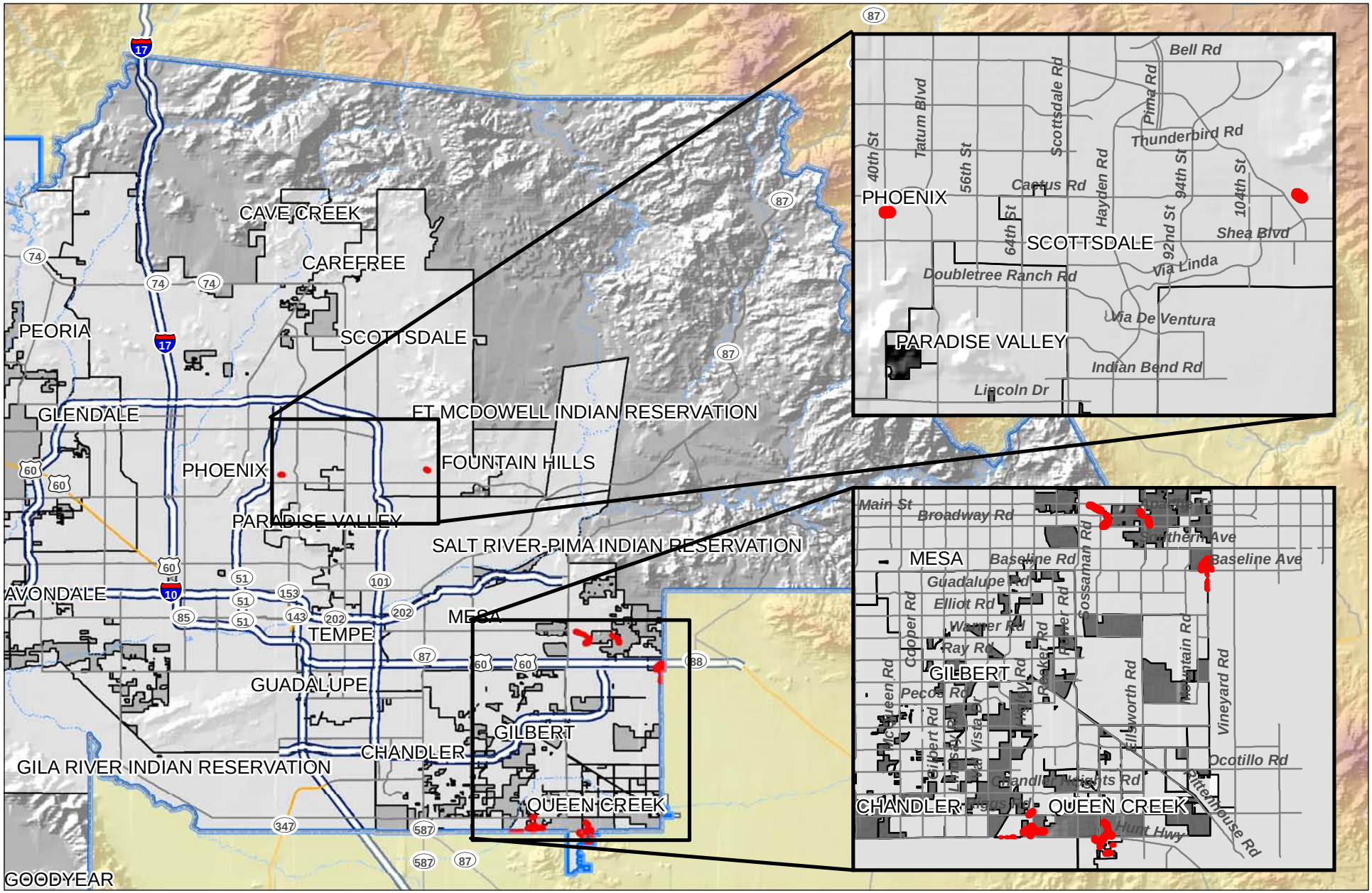
0 40 80 160
Miles

Source: JE Fuller 2009; ALRIS 2006; FCDMC 2009, AZGS 2008



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #3A
Maricopa County Earth Fissure Hazard Map as of May 2009



Legend

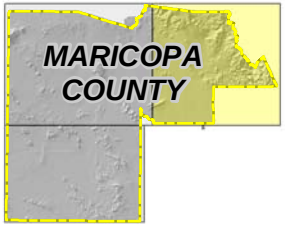
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Earth Fissure Hazard Rating

- High

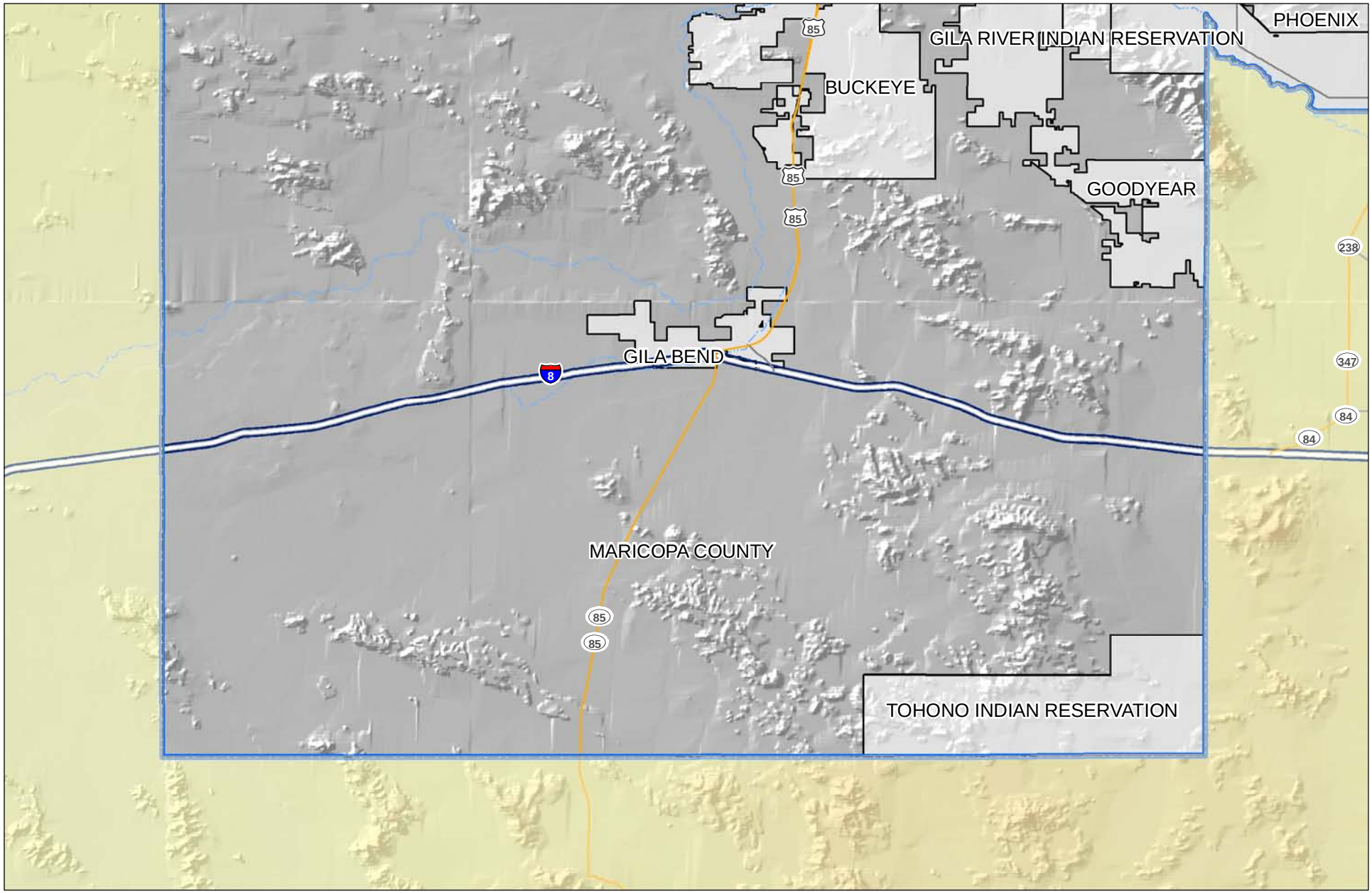
0 40 80 160
Miles

Source: JE Fuller 2009; ALRIS 2006; FCDMC 2009, AZGS 2008



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #3B
Maricopa County Earth Fissure Hazard Map as of May 2009



Legend

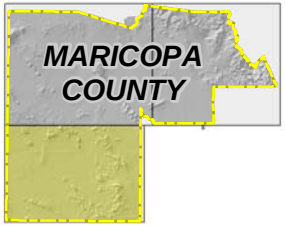
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Earth Fissure Hazard Rating

- High

0 40 80 160
Miles

Source: JE Fuller 2009; ALRIS 2006; FCDMC 2009, AZGS 2008



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #3C
Maricopa County
Earth Fissure
Hazard Map
as of May 2009

5.3.5 Flood / Flash Flood

Description

For the purpose of this Plan, the hazard of flooding addressed in the is section will pertain to floods that result from precipitation/runoff related events. Other flooding due to dam and levee failures are addressed separately. The three seasonal atmospheric events that tend to trigger floods in Maricopa County are:

- *Tropical Storm Remnants*: Some of the worst flooding tends to occur when the remnants of a hurricane that has been downgraded to a tropical storm or tropical depression enter the State. These events occur infrequently and mostly in the early autumn, and usually bring heavy and intense precipitation over large regions causing severe flooding.
- *Winter Rains*: Winter brings the threat of low intensity; but long duration rains covering large areas that cause extensive flooding and erosion, particularly when combined with snowmelt.
- *Summer Monsoons*: A third atmospheric condition that brings flooding to Arizona is the annual summer monsoon. In mid to late summer the monsoon winds bring humid subtropical air into the State. Solar heating triggers afternoon and evening thunderstorms that can produce extremely intense, short duration bursts of rainfall. The thunderstorm rains are mostly translated into runoff and in some instances, the accumulation of runoff occurs very quickly resulting in a rapidly moving flood wave referred to as a flash flood. Flash floods tend to be very localized and cause significant flooding of local watercourses.

Damaging floods in the County can be primarily categorized as either riverine, sheet flow, or local area flows. Riverine flooding occurs along established watercourses when the bankfull capacity of a wash is exceeded by storm runoff and the overbank areas become inundated. There are also areas within the County where the watercourse is broad and generally shallow with ill-defined low flow paths and broad sheet flooding. Local area flooding is often the result of poorly designed or planned development wherein natural flowpaths are altered, blocked or obliterated, and localized ponding and conveyance problems result. Erosion is also often associated with damages due to flooding.

History

Flooding is clearly a major hazard in Maricopa County as shown in Tables 5-2 and 5-3. Maricopa County has been part of 16 presidential disaster declarations for flooding and there have been at least 31 other reported flooding incidents that met the thresholds outlined in Section 5.1. The following incidents represent examples of major flooding that has impacted the County:

- In March 1978, a general winter storm centered over the mountains north and east of Phoenix, 35 miles north at Rock Springs. Extrapolation of intensity-probability data for one measurement of 5.73 inches of precipitation in a 24 hour period equates to a 400 yr. storm. The main source of flooding was due to Verde River with runoff volume exceeding reservoir storage capacity above Bartlett Dam. Flooding also occurred along irrigation canals on north side of the Phoenix metro area, and along tributaries of the Gila River and Queen Creek. There was one death-countywide and $37 million in total damages (USACE, 1978). Presidential Disaster Declaration 550-DR.
- In December 1978, a second major storm for the year hit hard with total precipitation that ranged from less than 1 inch in the northeastern and far southwestern portions of Arizona to nearly 10 inches in the Mazatzal Mountains northeast of Phoenix. A large area of the central mountains received over 5 inches. The main stems of the Gila, Salt, Verde, Agua Fria, Bill Williams, and Little Colorado Rivers, as well as a number of major tributaries, experienced especially large discharges. There were 4 deaths, $16.3 million-public and $5 million-agriculture losses estimated for Maricopa County (USACE, 1979). Presidential Disaster Declaration 570-DR.

- In February 1980, severe flooding in central Arizona set record discharges (later broken in 1993) in the Phoenix metro area on the Salt, Verde, Agua Fria and Gila Rivers, as well as on Oak Creek in north central Arizona. The Phoenix metro area was nearly cut in half with only two bridges remaining open over the Salt River. It took hours for people to move between Phoenix and the East Valley using either the Mill Avenue or Central Avenue bridges. Even the Interstate 10 bridge was closed for fear that it had been damaged. Precipitation during this period at Crown King in the Bradshaw Mountains was 16.63 inches. Three people died statewide and damages were estimated at $63,700,000 for Phoenix Metro Area (USACE, 1980). Presidential Disaster Declaration 614-DR.

- In January and February 1993, flooding damage occurred from winter storms associated with the El Nino phenomenon. These storms flooded watersheds throughout Arizona by dumping excessive rainfall amounts that saturated soils and increased runoff. Warm temperature snowmelt exacerbated the situation over large areas. Erosion caused tremendous damage and some communities along normally dry washes were devastated. Stream flow velocities and runoff volumes exceeded historic highs. Many flood prevention channels and retention reservoirs were filled to capacity and so water was diverted to the emergency spillways or the reservoirs were breached, causing extensive damage in some cases (e.g., Painted Rock Reservoir spillway). The new Mill Avenue Bridge and a large landfill in Mesa were washed away by the raging Salt River. The Gillespie Dam west of Phoenix was damaged as high water spread throughout low-lying areas. Many roads were closed and motorists were stranded by flooded dips and washes. Phoenix alone sustained at least $4.2 million in damages from this prolonged period of heavy rains. County-wide, $38 million in property and agricultural losses were estimated (USACE, 1993). Presidential Disaster Declaration 977-DR.

- In 1997, flooding from the remnants of Hurricane Nora resulted in the breaching of Narrows Dam. The calculated 24-hour, 100-year rainfall amount in NW Maricopa County was exceeded at six ALERT measuring sites led to flash flooding in portions of NW Maricopa County. Two earthen dams gave way in Aguila and caused widespread flooding. One dike was located seven miles east of Aguila and the second in the center of the Martori Farms complex. Half of the cotton crop was lost at Martori Farms, as well as 300 to 500 acres of melons. Up to five feet of water filled Aqguila. About 40 people were evacuated from the hardest hit area of the town. Water flowing down the Sols Wash was so high that the Sols Wash Bridge in Wickenburg was closed for more than two hours. There was some flooding below Sols Wash in the streets around Coffinger Park. Several houses in the area were also flooded. Highway 71 west of Wickenburg and Highway 95 north were closed due to high water from the storm.

- In October 2000, a large low pressure area dumped four to six inches of rain over parts of eastern LaPaz and western Maricopa County. This caused flash flooding in the upper part of the Centennial Wash between the Harcuvar and Harquahala mountain ranges. The heavy runoff flowed into the town of Wenden where water ran over the highway 60 bridge. At its peak the wash was about 3/8ths of a mile wide and 12 feet deep. The resulting high water surged through the town of Wenden, with at least 400 residents evacuated. There was extensive damage to the town and for many miles downstream. The reported flow was in excess of 20,000 cfs. When the flood hit Wenden, it inundated some mobile homes, causing them to lift off their foundations and float down the wash. An estimated 125 mobile homes were affected. One migrant worker was killed when flood waters swept through the town during the early morning hours. Additional heavy rainfall hit this area several days later and complicated relief efforts for many of the homeless. A spotter in Wickenburg reported that route 93 was closed north of Wickenburg due to high water. Sols wash was out of its banks and flooded Coffinger Park as well as nearby homes. The Vulture Mine road was closed and motorists had to be rescued. Flood water produced considerable damage to melon and cotton crops in northwest Maricopa County. The roads around Aguila were closed for several hours. A total of $10.2 million in structure and crop damages was estimated (NCDC, 2008). Presidential Disaster Declaration 1347-DR.

- In late July – early August, 2005, one of the heaviest rainfall events of the 2005 season struck the greater Phoenix metropolitan. Almost 3 inches of rain fell at many locations in the metro, causing

roofs to collapse and streets to flood quickly. Up to 120 residents at the Crystal Creek Apartments in Phoenix were evacuated after 83 apartment units were damaged by flood waters. Additional roof damage was reported at the Scottsdale Community College, and Osco Drug store in Mesa, and a Frys grocery store in Tempe. In the Wickenburg area, very heavy rainfall caused flooding of low spots and washes. The peak flow in Hartman Wash was reported as 1,200 cfs. Major damage occurred at Bear Cat Manufacturing where a large robotic welding building was destroyed by the flood. Losses were estimated at over $4 million (NCDC, 2009).

- In July 2007, very heavy rainfall accompanied thunderstorms over much of Maricopa County. Strong and gusty winds were also reported with some of the more intense storms. The storm closed roads in north Scottsdale and at least 6 water rescues were reported. Several automatic gauges reported between 1.5 and 2.0 inch per hour rainfall rates. Floodwaters caused $2 million in damages at Desert Sun Elementary School in North Scottsdale.

Numerous other flood related incidents are summarized in the historic hazard database provided in Appendix D.

Probability and Magnitude

For the purposes of this Plan, the probability and magnitude of flood hazard for Maricopa County jurisdictions are based on the 1 percent probability floodplains delineated on FEMA Flood Insurance Rate Maps (FIRMs), plus any provisional floodplain delineations used for in-house purposes by participating jurisdictions. FEMA and participating agencies and departments of Maricopa County jurisdictions have recently completed a map modification program to update the FIRMs for the County into a digital FIRM (DFIRM) format. Those maps became effective in 2005 and are the basis for flood hazard depictions in this Plan. Floodplain limits and GIS base files were provided by the FCDMC.

Two designations of flood hazard are used, with HIGH hazard areas being any “A” zone and MEDIUM flood hazard being either all “Shaded X” zones. All “A” zones (e.g. – A, A1-99, AE, AH, AO, etc.) represent areas with a one percent (1%) probability of being flooded at a depth of one-foot or greater in any given year. All “Shaded X” zones represent areas with a 0.2 percent (0.2%) probability of being flooded at a depth of one-foot or greater in any given year. These two storms are often referred to as the 100-year and 500-year storm, respectively.

Maps 4A, 4B, and 4C present the high flood hazard areas for Maricopa County. When viewing the maps, the following should be note:

- Neither the Fort McDowell Yavapai Nation or the Salt River Pima-Maricopa Indian Community participate in the National Flood Insurance Program (NFIP). Consequently, neither Tribe has FEMA mapped floodplains for their reservation boundaries except for Sycamore Creek and the Verde and Salt Rivers. The Local Planning Team for each Tribe met and discussed identifying supplemental delineations of on reservation floodplains, and the results are indicated on the hazard profile maps.
- With the 2005 DFIRM update, a decision was made county-wide to map most of the non Zone A areas as Shaded Zone X without the benefit of supporting hydrologic and hydraulic analysis. Obvious mountain and steep hillslope areas were excluded. For the sake of map clarity, only the high flood hazard areas are shown.

Vulnerability – CPRI Results

Flooding CPRI results for each community are summarized in Table 5-47 below.

Table 5-47: Summary of CPRI results by jurisdiction for flooding hazard

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Likely	Limited	12-24 hours	<24 hours	2.45
Buckeye	Possibly	Critical	<6 hours	<24 hours	2.60
Carefree	Highly Likely	Limited	12-24 hours	<24 hours	2.90
Cave Creek	Highly Likely	Limited	6-12 hours	<6 hours	2.95
Chandler	Likely	Negligible	>24 hours	<24 hours	2.00
El Mirage	Highly Likely	Critical	12-24 hours	<24 hours	3.20
Fountain Hills	Possibly	Critical	6-12 hours	<1 week	2.55
Fort McDowell Yavapai Nation	Possibly	Limited	6-12 hours	<24 hours	2.15
Gila Bend	Possibly	Limited	<6 hours	<24 hours	2.30
Gilbert	Highly Likely	Limited	<6 hours	<24 hours	3.20
Glendale	Likely	Limited	12-24 hours	>1 week	2.65
Goodyear	Highly Likely	Limited	6-12 hours	<24 hours	3.05
Guadalupe	Possibly	Limited	<6 hours	<6 hours	2.20
Litchfield Park	Likely	Limited	12-24 hours	<24 hours	2.45
Unincorporated Maricopa County	Highly Likely	Critical	<6 hours	<24 hours	3.50
Mesa	Highly Likely	Limited	6-12 hours	<1 week	3.15
Paradise Valley	Possibly	Critical	12-24 hours	<24 hours	2.30
Peoria	Highly Likely	Critical	<6 hours	<24 hours	3.50
Phoenix	Likely	Limited	12-24 hours	<24 hours	2.45
Queen Creek	Highly Likely	Limited	6-12 hours	<24 hours	3.05
Salt River Pima-Maricopa Indian Community	Highly Likely	Critical	<6 hours	<1 week	3.60
Salt River Project	Highly Likely	Limited	6-12 hours	<6 hours	2.95
Scottsdale	Likely	Limited	<6 hours	<6 hours	2.65
Surprise	Highly Likely	Limited	<6 hours	<6 hours	3.10
Tempe	Highly Likely	Critical	6-12 hours	<1 week	3.45
Tolleson	Likely	Limited	12-24 hours	<24 hours	2.45
Wickenburg	Highly Likely	Catastrophic	<6 hours	<24 hours	3.80
Youngtown	Highly Likely	Catastrophic	<6 hours	<24 hours	3.80
				County-wide average CPRI =	**2.87**

Vulnerability – Loss Estimations

The estimation of potential exposure to high and medium flood hazards was accomplished by intersecting the human and facility assets with the flood hazard limits depicted on Maps 4A, 4B, and 4C. Loss estimates to all facilities located within the high and medium flood hazard areas were made based on the loss estimation tables published by FEMA (FEMA, 2001). Most of the assets located within high hazard flood areas will be subject to three feet or less of flooding. Using the FEMA tables, it is assumed that all structural assets located within the high hazard areas will have a loss-to-exposure ratio of 0.20 (or 20%). A loss to exposure ratio of 0.05 (5%) is assumed for assets located in the medium hazard areas. Table 5-48 summarizes the MJPT identified critical and non-critical facilities potentially exposed to high and medium flood hazards, and the corresponding estimates of losses. Table 5-49 summarizes population sectors exposed to the high and medium flood hazards. HAZUS residential, commercial and industrial exposures and loss estimates to high and medium flood hazards are summarized in Tables 5-12 through 5-39.

Table 5-48: Summary of asset inventory exposure to high and medium hazard flooding and corresponding loss estimates

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
HIGH						
County-Wide Totals	**5,179**	**230**	**4.44%**	**100.00%**	**$778,617**	**$155,723**
Avondale	61	5	8.20%	2.17%	$2,044	$409
Buckeye	77	5	6.49%	2.17%	$17,000	$3,400
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	3	7.69%	1.30%	$1,000	$200
Chandler	226	9	3.98%	3.91%	$17,400	$3,480
El Mirage	34	1	2.94%	0.43%	$27,500	$5,500
Fountain Hills	15	0	0.00%	0.00%	$0	$0
Fort McDowell Yavapai Nation	18	2	11.11%	0.87%	$10,000	$2,000
Gila Bend	7	0	0.00%	0.00%	$0	$0
Gilbert	694	21	3.03%	9.13%	$26,000	$5,200
Glendale	1,205	30	2.49%	13.04%	$51,680	$10,336
Goodyear	93	5	5.38%	2.17%	$13,150	$2,630
Guadalupe	6	2	33.33%	0.87%	$2,100	$420
Litchfield Park	5	0	0.00%	0.00%	$0	$0
Unincorporated Maricopa County	447	111	24.83%	48.26%	$508,981	$101,796
Mesa	613	2	0.33%	0.87%	$1,200	$240
Paradise Valley	69	0	0.00%	0.00%	$0	$0
Peoria	225	4	1.78%	1.74%	$4,800	$960
Phoenix	913	14	1.53%	6.09%	$74,221	$14,844
Queen Creek	117	8	6.84%	3.48%	$21,540	$4,308
Salt River Pima-Maricopa Indian Community	21	0	0.00%	0.00%	$0	$0
Salt River Project [44]	511	36	7.04%	N/A	N/A	N/A
Scottsdale	114	8	7.02%	3.48%	$0	$0
Surprise	37	0	0.00%	0.00%	$0	$0
Tempe	111	0	0.00%	0.00%	$0	$0
Tolleson	10	0	0.00%	0.00%	$0	$0
Wickenburg	11	0	0.00%	0.00%	$0	$0
Youngtown	5	0	0.00%	0.00%	$0	$0

[44] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-48: Summary of asset inventory exposure to high and medium hazard flooding and corresponding loss estimates

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
MEDIUM						
County-Wide Totals	**5,179**	**4,745**	**91.62%**	**100.00%**	**$23,671,878**	**$1,183,594**
Avondale	61	56	91.80%	1.18%	$85,438	$4,272
Buckeye	77	68	88.31%	1.43%	$145,500	$7,275
Carefree	6	6	100.00%	0.13%	$9,000	$450
Cave Creek	39	34	87.18%	0.72%	$58,745	$2,937
Chandler	226	217	96.02%	4.57%	$923,216	$46,161
El Mirage	34	32	94.12%	0.67%	$220,140	$11,007
Fountain Hills	15	15	100.00%	0.32%	$411,000	$20,550
Fort McDowell Yavapai Nation	18	16	88.89%	0.34%	$222,630	$11,131
Gila Bend	7	7	100.00%	0.15%	$36,000	$1,800
Gilbert	694	673	96.97%	14.18%	$3,311,369	$165,568
Glendale	1,205	1,169	97.01%	24.64%	$4,029,507	$201,475
Goodyear	93	88	94.62%	1.85%	$147,848	$7,392
Guadalupe	6	4	66.67%	0.08%	$2,700	$135
Litchfield Park	5	5	100.00%	0.11%	$118,900	$5,945
Unincorporated Maricopa County	447	325	72.71%	6.85%	$1,628,007	$81,400
Mesa	613	562	91.68%	11.84%	$2,003,698	$100,185
Paradise Valley	69	26	37.68%	0.55%	$61,000	$3,050
Peoria	225	201	89.33%	4.24%	$278,918	$13,946
Phoenix	913	888	97.26%	18.71%	$7,539,077	$376,954
Queen Creek	117	101	86.32%	2.13%	$154,798	$7,740
Salt River Pima-Maricopa Indian Community	21	21	100.00%	0.44%	$509,053	$25,453
Salt River Project [45]	511	438	85.71%	N/A	N/A	N/A
Scottsdale	114	57	50.00%	1.20%	$5,000	$250
Surprise	37	37	100.00%	0.78%	$362,429	$18,121
Tempe	111	111	100.00%	2.34%	$1,373,300	$68,665
Tolleson	10	10	100.00%	0.21%	$0	$0
Wickenburg	11	11	100.00%	0.23%	$29,239	$1,462
Youngtown	5	5	100.00%	0.11%	$5,367	$268

[45] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-49: Summary of population sectors exposed to high and medium hazard flooding

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
HIGH									
County-Wide Totals	**1,522,083**	**36,084**	**2.37%**	**180,521**	**3,681**	**2.04%**	**100,684**	**2,261**	**2.25%**
Avondale	15,613	22	0.14%	855	2	0.18%	764	1	0.12%
Buckeye	3,906	84	2.16%	342	6	1.62%	344	4	1.30%
Carefree	1,375	36	2.62%	455	12	2.63%	57	1	2.30%
Cave Creek	2,002	137	6.82%	246	16	6.64%	95	5	5.54%
Chandler	86,421	2,171	2.51%	5,156	82	1.59%	3,029	123	4.05%
El Mirage	3,400	32	0.94%	213	1	0.65%	194	1	0.41%
Fountain Hills	8,759	369	4.21%	1,750	76	4.32%	387	18	4.59%
Fort McDowell Yavapai Nation	309	25	7.97%	17	3	14.79%	10	1	5.48%
Gila Bend	1,010	246	24.34%	81	21	25.60%	117	28	23.99%
Gila River Indian Community	1,091	0	0.00%	48	0	0.00%	140	0	0.00%
Gilbert	54,901	1,608	2.93%	1,834	44	2.40%	883	33	3.68%
Glendale	118,654	1,644	1.39%	9,169	163	1.78%	8,282	160	1.94%
Goodyear	10,967	618	5.64%	921	33	3.63%	309	18	5.82%
Guadalupe	2,558	150	5.86%	125	4	3.09%	194	11	5.87%
Litchfield Park	1,350	6	0.45%	291	2	0.53%	39	0	0.48%
Unincorporated Maricopa County	104,385	4,678	4.48%	43,659	702	1.61%	9,288	274	2.95%
Mesa	189,697	1,026	0.54%	25,867	168	0.65%	12,410	84	0.67%
Paradise Valley	5,769	188	3.26%	868	19	2.23%	68	1	1.65%
Peoria	49,884	297	0.60%	6,555	29	0.44%	1,921	5	0.29%
Phoenix	657,658	13,873	2.11%	54,037	1,060	1.96%	47,321	990	2.09%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	224	7.93%	145	20	13.84%	114	9	7.74%
Salt River Pima-Maricopa Indian Community	6,306	213	3.38%	1,086	40	3.66%	842	25	2.94%
Scottsdale	92,034	7,421	8.06%	15,440	1,023	6.63%	5,177	369	7.12%
Surprise	13,387	113	0.85%	3,460	23	0.66%	757	8	1.09%
Tempe	80,802	306	0.38%	6,138	18	0.29%	7,051	15	0.21%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	182	5.91%	316	20	6.39%	202	13	6.39%
Wickenburg	2,093	412	19.70%	547	95	17.39%	288	64	22.27%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

Table 5-49: Summary of population sectors exposed to high and medium hazard flooding

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
MEDIUM									
County-Wide Totals	**1,522,083**	**1,412,257**	**92.78%**	**180,521**	**164,793**	**91.29%**	**100,684**	**93,125**	**92.49%**
Avondale	15,613	15,591	99.86%	855	854	99.82%	764	763	99.88%
Buckeye	3,906	3,822	97.84%	342	337	98.38%	344	340	98.70%
Carefree	1,375	1,226	89.18%	455	418	91.91%	57	51	90.20%
Cave Creek	2,002	1,865	93.18%	246	229	93.36%	95	90	94.46%
Chandler	86,421	84,249	97.49%	5,156	5,074	98.41%	3,029	2,906	95.95%
El Mirage	3,400	3,368	99.06%	213	212	99.35%	194	193	99.59%
Fountain Hills	8,759	8,389	95.77%	1,750	1,674	95.66%	387	370	95.39%
Fort McDowell Yavapai Nation	309	285	92.02%	17	15	85.16%	10	10	94.50%
Gila Bend	1,010	764	75.61%	81	60	74.40%	117	89	76.01%
Gila River Indian Community	1,091	1,060	97.17%	48	48	100.00%	140	140	100.00%
Gilbert	54,901	53,293	97.07%	1,834	1,790	97.60%	883	850	96.31%
Glendale	118,654	116,995	98.60%	9,169	9,004	98.21%	8,282	8,122	98.06%
Goodyear	10,967	10,348	94.36%	921	887	96.37%	309	291	94.17%
Guadalupe	2,558	2,408	94.14%	125	121	96.91%	194	183	94.13%
Litchfield Park	1,350	1,344	99.55%	291	289	99.47%	39	39	99.52%
Unincorporated Maricopa County	104,385	97,716	93.61%	43,659	42,507	97.36%	9,288	8,804	94.79%
Mesa	189,697	182,878	96.41%	25,867	25,231	97.54%	12,410	12,118	97.64%
Paradise Valley	5,769	1,362	23.62%	868	139	15.98%	68	13	19.40%
Peoria	49,884	48,854	97.94%	6,555	6,500	99.16%	1,921	1,898	98.81%
Phoenix	657,658	619,867	94.25%	54,037	50,324	93.13%	47,321	44,528	94.10%
Pinal County	6	6	100.00%	0	0	100.00%	0	0	100.00%
Queen Creek	2,831	2,452	86.62%	145	112	77.24%	114	97	85.24%
Salt River Pima-Maricopa Indian Community	6,306	3,820	60.58%	1,086	503	46.31%	842	457	54.28%
Scottsdale	92,034	50,114	54.45%	15,440	7,259	47.01%	5,177	2,176	42.04%
Surprise	13,387	13,273	99.15%	3,460	3,437	99.34%	757	749	98.91%
Tempe	80,802	80,494	99.62%	6,138	6,121	99.71%	7,051	7,036	99.79%
Tohono O'odham Nation	156	156	100.00%	11	11	100.00%	26	26	100.00%
Tolleson	3,085	2,903	94.09%	316	296	93.61%	202	189	93.61%
Wickenburg	2,093	1,681	80.30%	547	452	82.61%	288	224	77.73%
Youngtown	1,675	1,675	100.00%	887	887	100.00%	373	373	100.00%

In summary, $155.7 million and $1.2 billion in asset related losses are estimated for high and medium flood hazards, for all the participating jurisdictions in Maricopa County. An additional $0.9 and $7.5 billion in high and medium flood losses to HAZUS defined residential, commercial, and industrial facilities is estimated for all participating Maricopa County jurisdictions. Regarding human vulnerability, a total population of 36,084 people, or 2.37% of the total 2000 Maricopa County population, is potentially exposed to a high hazard flood event. A total population of 1,412,257 people, or 92.8% of the total 2000 Maricopa County population, is potentially exposed to a medium hazard flood event. Based on the historic record, multiple deaths and injuries are plausible and a substantial portion of the exposed population is subject to displacement depending on the event magnitude.

It is duly noted that the loss and exposure numbers presented above represent a comprehensive evaluation of the County as a whole. It is unlikely that a storm event would occur that would flood all of the delineated high and medium flood hazard areas at the same time. Accordingly, actual event based losses and exposure are likely to be only a fraction of those summarized above.

Vulnerability – Repetitive Loss Properties

Repetitive Loss (RL) properties are those NFIP-insured properties that since 1978, have experience multiple flood losses. FEMA tracks RL properties and in particular to identify Severe RL (SRL) properties. RL properties demonstrate a track record of flooding repeated flooding for a certain location and are one element of the vulnerability analysis. RL properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund. FEMA records dated October 31, 2007 (provided by ADWR) indicate that there are 164 identified RL properties in Maricopa County, with a total of over $4.4 million in associated building and contents value payments. Table 5-50 summarizes the RL property characteristics by jurisdiction.

Table 5-50: Summary of RL property statistics for Maricopa County jurisdictions

Jurisdiction	No. of Properties	No. of Properties Mitigated	Total Payments
Avondale	1	0	$9,865
Buckeye	7	0	$182,818
Glendale	3	3	$74,392
Goodyear	1	0	$210,035
Unincorporated Maricopa County	37	7	$1,261,865
Mesa	3	1	$113,498
Paradise Valley	2	0	$31,795
Peoria	2	0	$43,849
Phoenix	59	43	$1,316,725
Scottsdale	5	5	$54,198
Tempe	2	2	$110,570
Tolleson	39	0	$93,2095
Wickenburg	3	0	$75,682

Vulnerability – Development Trends

For most Maricopa County jurisdictions, adequate planning and regulatory tools are in place to regulate future development. The FCDMC is very proactive in delineating floodplains ahead of development in the less populated areas of the County, and works cooperatively with all incorporated jurisdictions to update and refine existing floodplain mapping as needed.

Sources

Arizona Division of Emergency Management, 2009, State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT.

FEMA, 2001, Understanding Your Risks; Identifying Hazards and Estimating Losses, FEMA Document No. 386-2.

URS, 2004, Maricopa County Hazard Mitigation Plan.

U.S. Army Corps of Engineers, Los Angeles District, 1978, Flood Damage Report, 28 February-6 March 1978 on the storm and floods in Maricopa County, Arizona, FCDMC Library #802.024.

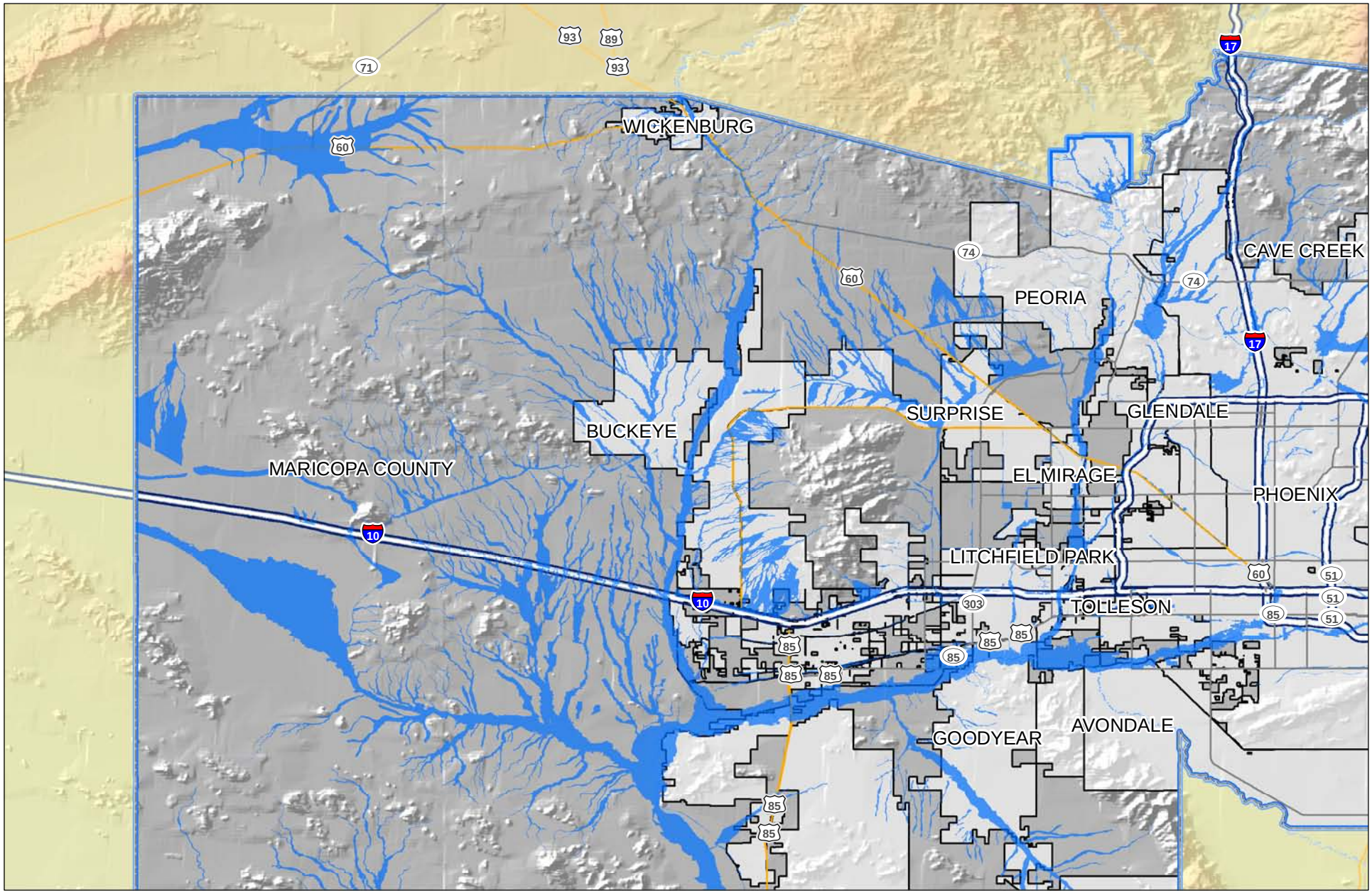
U.S. Army Corps of Engineers, Los Angeles District, 1979, Flood Damage Report, Phoenix Metropolitan Area, December 1978 Flood, FCDMC Library #802.027.

U.S. Army Corps of Engineers, Los Angeles District, 1980, Phoenix Flood Damage Survey, FCDMC Library #802.029.

U.S. Army Corps of Engineers, Los Angeles District, 1994, Flood Damage Report, State of Arizona, Floods of 1993.

Profile Maps

Maps 4A, 4B, and 4C – Flood Hazard Map



Legend

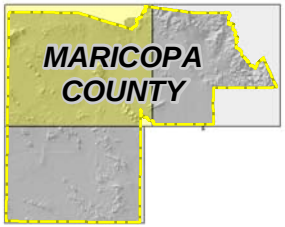
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Flood Hazard Rating

- High

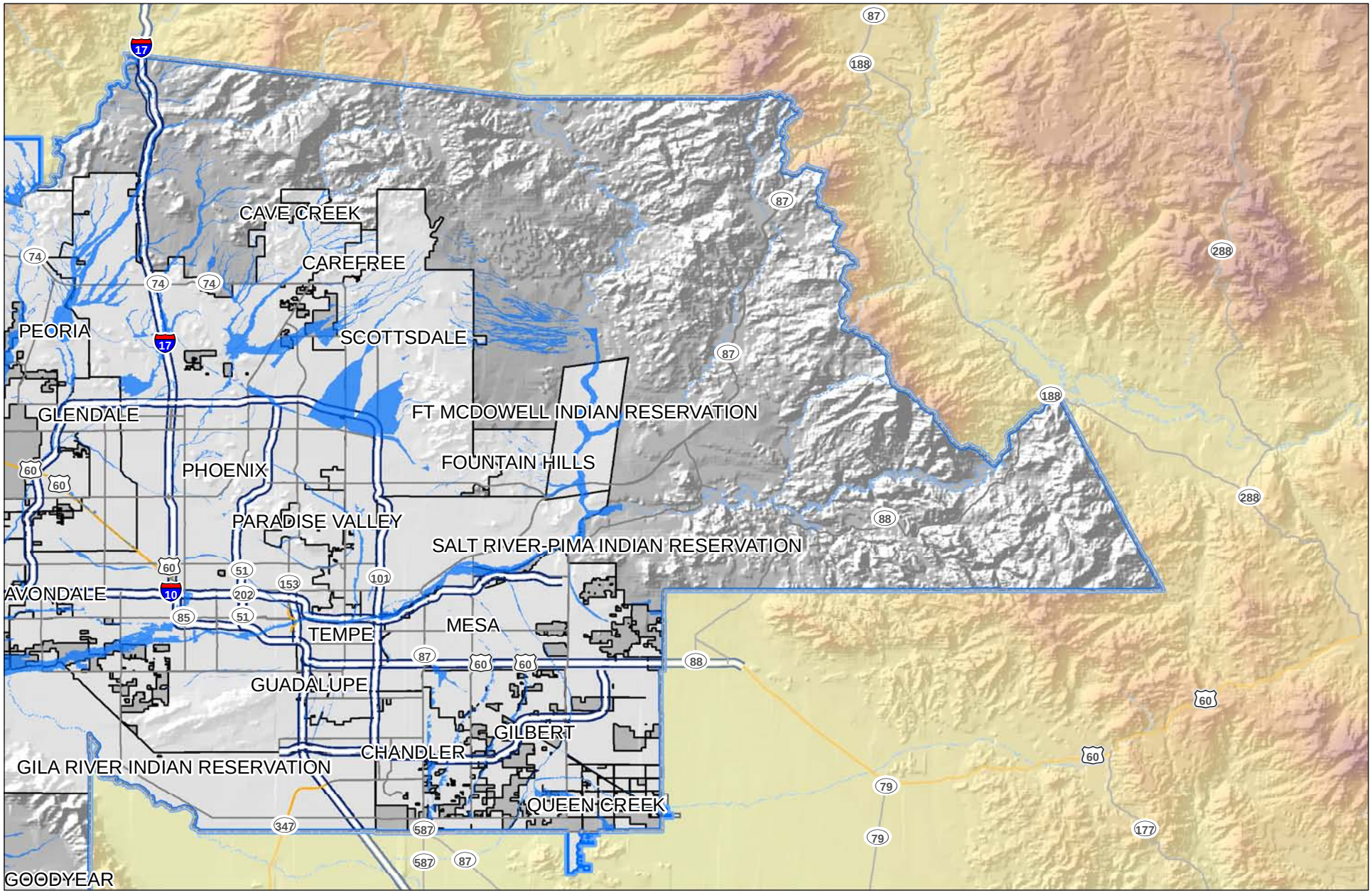
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #4A
Maricopa County
Flood Hazard Map
as of May 2009



Legend

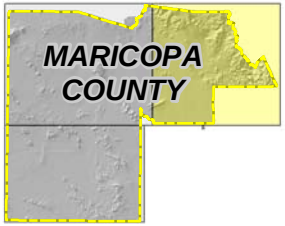
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Flood Hazard Rating

- High

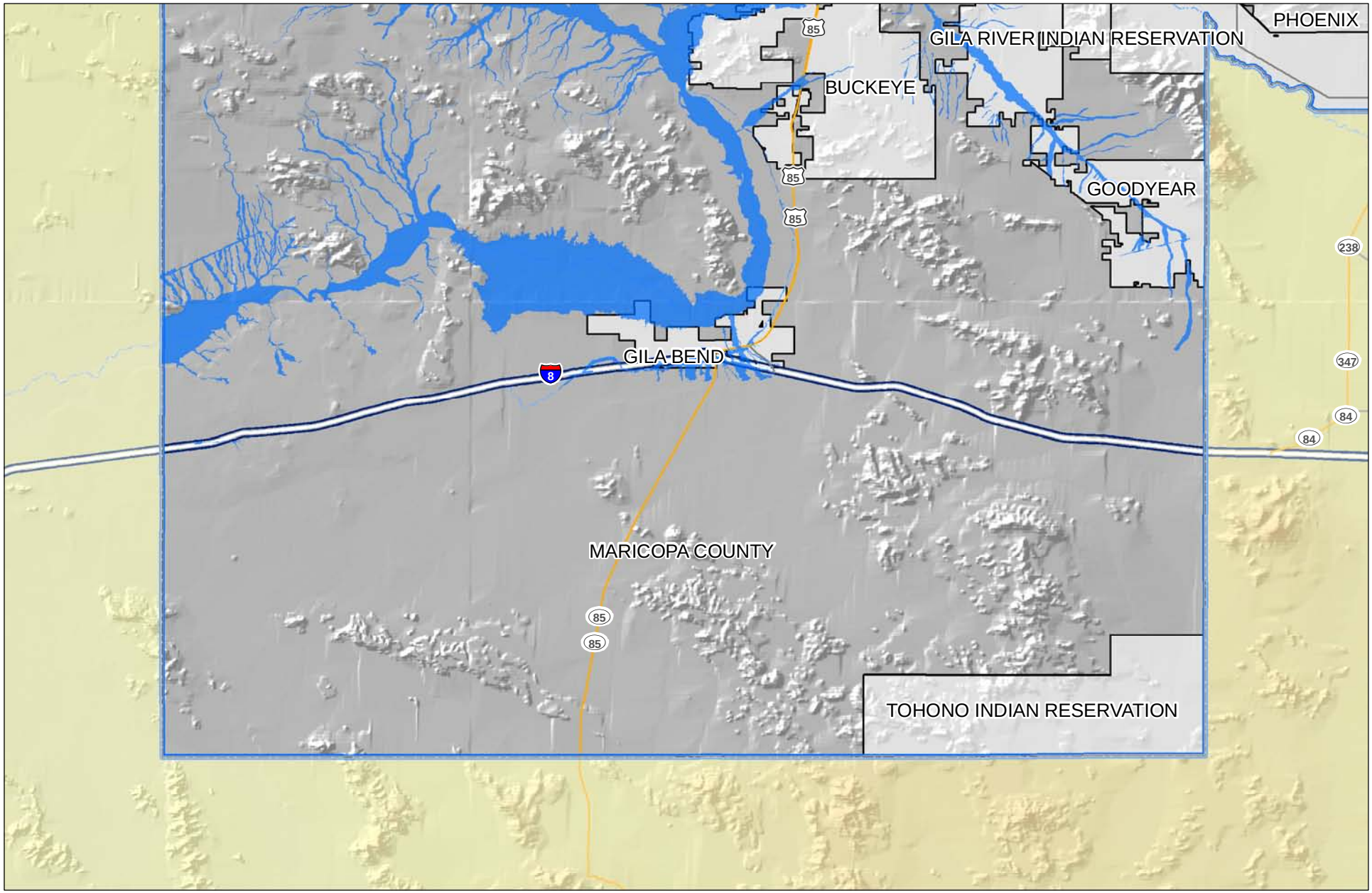
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #4B
Maricopa County
Flood Hazard Map
as of May 2009



Legend

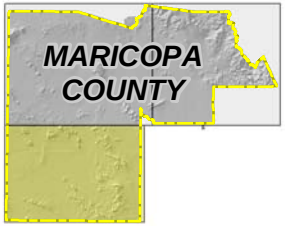
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Flood Hazard Rating

- High

0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #4C
Maricopa County
Flood Hazard Map
as of May 2009

5.3.6 Levee Failure

Description

FEMA defines levees as man-made structures, usually earthen embankments, that are designed and constructed in accordance with sound engineering practices to contain, control or divert the flow of water so as to provide protection from temporary flooding (FEMA, 2009). National flood policy now recognizes the term "levee" to mean only those structures which were designed and constructed according to sound engineering practices, have up to date inspection records and current maintenance plans, and have been certified as to their technical soundness by a professional engineer. FEMA has classified all other structures that impound, divert, and/or otherwise impede the flow of runoff as "non-levee embankments". In Maricopa County, these might be comprised of features such as roadway and railway embankments, canals, irrigation ditches and drains, and agricultural dikes.

Currently there is no State or Federal Levee Safety Program and no official levee inventory. It is anticipated that FEMA will institute a National Levee Safety Program in the near future. Many levees and non-levee embankments cut across drainage features, impounding water on their upstream side as a result of storm events. FEMA urges communities to recognize that all areas downstream of levees and embankments are at some risk of flooding. There are no guarantees that a levee or embankment will not fail or breach if a large quantity of water collects upstream.

Mechanisms for levee failure are similar to those for dam failure. Failure by overtopping could occur due to an inadequate design capacity, sediment deposition and vegetation growth in the channel, subsidence, and/or a runoff that exceeds the design recurrence interval of the levee. Failure by piping could be due to embankment cracking, fissures, animal boroughs, embankment settling, or vegetal root penetrations.

History

Levees (certified or not) have been used in Maricopa County for over a hundred years to protect communities and agricultural assets, as well as to facilitate the delivery and removal of irrigation water. These levees range from simple earthen embankments pushed up by small equipment to large cement stabilized aggregate embankments lining both sides of a river. The structural integrity of levees with regard to flood protection and policy has been discussed at a national level since the early 1980s but was elevated to a high priority after the collapse and breach of New Orleans' levees after Hurricane Katrina in 2005.

There are no documented failures of certified levees within Maricopa County, nor are there any documented records of non-levee embankment failures.

Probability and Magnitude

There are no established probability or magnitude criteria regarding levee failure due to variability in levee design and maintenance. For flood protection credit under the NFIP, FEMA has established certain design criteria that are based on the 1 percent (100-year) storm event. Federally constructed levees are usually designed for larger, more infrequent events that equate to 250 to 500 year events. All of the FEMA certified levees within Maricopa County are designed to safely convey the 100-year event, with a factor of safety provided by a minimum additional freeboard of 3 feet.

In the latest DFIRM data for Maricopa County, FEMA has re-established new flood hazard zones downstream of non-levee embankments and a shaded Zone X for all others. For this Plan cycle, The MJPT chose to map the new hazard areas downstream of non-levee embankments as a HIGH hazard. All other areas are defined as LOW.

Vulnerability – CPRI Results

Levee Failure CPRI results for each community are summarized in Table 5-47 below.

Table 5-51: Summary of CPRI results by jurisdiction for levee failure

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Possibly	Negligible	<6 hours	<24 hours	2.00
Buckeye	Unlikely	Negligible	<6 hours	<6 hours	1.45
Carefree	Unlikely	Negligible	>24 hours	<6 hours	1.00
Cave Creek	Unlikely	Negligible	<6 hours	<6 hours	1.45
Chandler	Unlikely	Negligible	>24 hours	<6 hours	1.00
El Mirage	Unlikely	Negligible	>24 hours	<6 hours	1.00
Fountain Hills	Unlikely	Negligible	<6 hours	<24 hours	1.55
Fort McDowell Yavapai Nation	Unlikely	Negligible	<6 hours	<24 hours	1.55
Gila Bend	Unlikely	Negligible	<6 hours	<24 hours	1.55
Gilbert	Possibly	Limited	<6 hours	<1 week	2.40
Glendale	Unlikely	Negligible	<6 hours	<24 hours	1.55
Goodyear	Unlikely	Negligible	<6 hours	<6 hours	1.45
Guadalupe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Litchfield Park	Unlikely	Negligible	<6 hours	<6 hours	1.45
Unincorporated Maricopa County	Likely	Limited	<6 hours	<1 week	2.85
Mesa	Unlikely	Limited	<6 hours	<1 week	1.95
Paradise Valley	Possibly	Limited	<6 hours	<24 hours	2.30
Peoria	Possibly	Limited	<6 hours	<24 hours	2.15
Phoenix	Unlikely	Critical	6-12 hours	<6 hours	2.00
Queen Creek	Possibly	Negligible	<6 hours	<24 hours	1.85
Salt River Pima-Maricopa Indian Community	Possibly	Critical	<6 hours	<24 hours	2.60
Salt River Project	Unlikely	Negligible	6-12 hours	<24 hours	1.40
Scottsdale	Unlikely	Negligible	<6 hours	<6 hours	1.45
Surprise	Unlikely	Negligible	<6 hours	<24 hours	1.55
Tempe	Possibly	Limited	<6 hours	<1 week	2.40
Tolleson	Unlikely	Negligible	>24 hours	<1 week	1.20
Wickenburg	Possibly	Limited	<6 hours	<6 hours	2.20
Youngtown	Unlikely	Critical	<6 hours	<6 hours	2.45
				County-wide average CPRI =	**1.79**

Vulnerability – Loss Estimations

The estimation of potential exposure to high hazard levee failure areas was accomplished by intersecting the human and facility assets with the levee failure hazard limits depicted on Maps 5A, 5B, and 5C. Loss estimates to all facilities located within the high hazard levee failure areas were made based on a loss-to-exposure ratio of 0.20 (or 20%), assuming that flood damages would be similar to those expected for 100-year flood. Table 5-52 summarizes the MJPT identified critical and non-critical facilities potentially exposed to high hazard levee failure areas, and the corresponding estimates of losses. Table 5-53 summarizes population sectors exposed to the high hazard levee failure areas. HAZUS residential, commercial and industrial exposures and loss estimates to high hazard levee failure areas are summarized in Tables 5-12 through 5-39.

In summary, $23.0 million in asset related losses are estimated for high hazard levee failures, for all the participating jurisdictions in Maricopa County. An additional $217 million in high hazard levee failure losses to HAZUS defined residential, commercial, and industrial facilities is estimated for all participating Maricopa County jurisdictions. Regarding human vulnerability, a total population of 10,562 people, or 0.69% of the total 2000 Maricopa County population, is potentially exposed to a high hazard levee failure event. Should a levee structure fail suddenly, it is plausible that death and injury might occur. It can also be expected that a substantial portion of the exposed population is subject to displacement depending on the event magnitude.

Table 5-52: Summary of asset inventory exposure to high hazard levee failure areas and corresponding loss estimates

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
County-Wide Totals	**5,179**	**58**	**1.12%**	**100.00%**	**$115,097**	**$23,019**
Avondale	61	12	19.67%	20.69%	$6,095	$1,219
Buckeye	77	1	1.30%	1.72%	$0	$0
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	0	0.00%	0.00%	$0	$0
Chandler	226	13	5.75%	22.41%	$7,017	$1,403
El Mirage	34	0	0.00%	0.00%	$0	$0
Fountain Hills	15	0	0.00%	0.00%	$0	$0
Fort McDowell Yavapai Nation	18	0	0.00%	0.00%	$0	$0
Gila Bend	7	0	0.00%	0.00%	$0	$0
Gilbert	694	3	0.43%	5.17%	$2,500	$500
Glendale	1,205	1	0.08%	1.72%	$0	$0
Goodyear	93	1	1.08%	1.72%	$1,500	$300
Guadalupe	6	0	0.00%	0.00%	$0	$0
Litchfield Park	5	0	0.00%	0.00%	$0	$0
Unincorporated Maricopa County	447	9	2.01%	15.52%	$46,666	$9,333
Mesa	613	2	0.33%	3.45%	$6,179	$1,236
Paradise Valley	69	0	0.00%	0.00%	$0	$0
Peoria	225	4	1.78%	6.90%	$551	$110
Phoenix	913	7	0.77%	12.07%	$35,138	$7,028
Queen Creek	117	4	3.42%	6.90%	$9,450	$1,890
Salt River Pima-Maricopa Indian Community	21	0	0.00%	0.00%	$0	$0
Salt River Project [46]	511	4	0.78%	N/A	N/A	N/A
Scottsdale	114	1	0.88%	1.72%	$0	$0
Surprise	37	0	0.00%	0.00%	$0	$0
Tempe	111	0	0.00%	0.00%	$0	$0
Tolleson	10	0	0.00%	0.00%	$0	$0
Wickenburg	11	0	0.00%	0.00%	$0	$0
Youngtown	5	0	0.00%	0.00%	$0	$0

[46] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-53: Summary of population sectors exposed to high hazard levee failure areas

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
County-Wide Totals	**1,522,083**	**10,562**	**0.69%**	**180,521**	**1,615**	**0.89%**	**100,684**	**728**	**0.72%**
Avondale	15,613	1,630	10.44%	855	60	7.03%	764	34	4.43%
Buckeye	3,906	19	0.48%	342	1	0.34%	344	1	0.18%
Carefree	1,375	0	0.02%	455	0	0.02%	57	0	0.03%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	992	1.15%	5,156	58	1.12%	3,029	112	3.68%
El Mirage	3,400	0	0.00%	213	0	0.00%	194	0	0.00%
Fountain Hills	8,759	0	0.00%	1,750	0	0.00%	387	0	0.00%
Fort McDowell Yavapai Nation	309	0	0.00%	17	0	0.00%	10	0	0.00%
Gila Bend	1,010	30	2.93%	81	2	2.48%	117	3	2.16%
Gila River Indian Community	1,091	0	0.00%	48	0	0.00%	140	0	0.00%
Gilbert	54,901	294	0.54%	1,834	16	0.86%	883	7	0.85%
Glendale	118,654	9	0.01%	9,169	0	0.00%	8,282	1	0.01%
Goodyear	10,967	37	0.34%	921	2	0.19%	309	2	0.57%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	0	0.00%	291	0	0.00%	39	0	0.00%
Unincorporated Maricopa County	104,385	1,685	1.61%	43,659	736	1.68%	9,288	199	2.14%
Mesa	189,697	4	0.00%	25,867	0	0.00%	12,410	0	0.00%
Paradise Valley	5,769	0	0.00%	868	0	0.00%	68	0	0.00%
Peoria	49,884	2,898	5.81%	6,555	539	8.22%	1,921	273	14.19%
Phoenix	657,658	2,565	0.39%	54,037	119	0.22%	47,321	73	0.15%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	19	0.67%	145	0	0.09%	114	0	0.14%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	314	0.34%	15,440	57	0.37%	5,177	22	0.42%
Surprise	13,387	63	0.47%	3,460	24	0.71%	757	3	0.36%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	3	0.16%	547	1	0.11%	288	0	0.15%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

It is duly noted that the loss and exposure numbers presented above represent a comprehensive evaluation of the County as a whole. It is unlikely that a storm event would occur that would fail all of the levees at the same time. Accordingly, actual event based losses and exposure are likely to be only a fraction of those summarized above.

Vulnerability – Development Trend Analysis

With the new focus on residual downstream risk for the land-side of levees and a general refocusing of national levee regulation and policy, it is likely that new and old developments in these areas will need to be revisited to determine if additional measures are necessary for adequate flood protection. Many structures located downstream of non-levee embankments are being re-mapped into Special Flood Hazard Zones. New developments should be evaluated to determine if sufficient protection is proposed to mitigate damages should the upstream structure fail.

Sources

Arizona Division of Emergency Management, 2009, State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT.

FEMA, 2001, Understanding Your Risks; Identifying Hazards and Estimating Losses, FEMA Document No. 386-2.

FEMA, 2009, Web page at URL: http://www.fema.gov/plan/prevent/fhm/lv_intro.shtm#3

URS, 2004, Maricopa County Hazard Mitigation Plan.

Profile Maps

Maps 5A, 5B, and 5C – Potential Levee Failure Flood Hazard Map(s)

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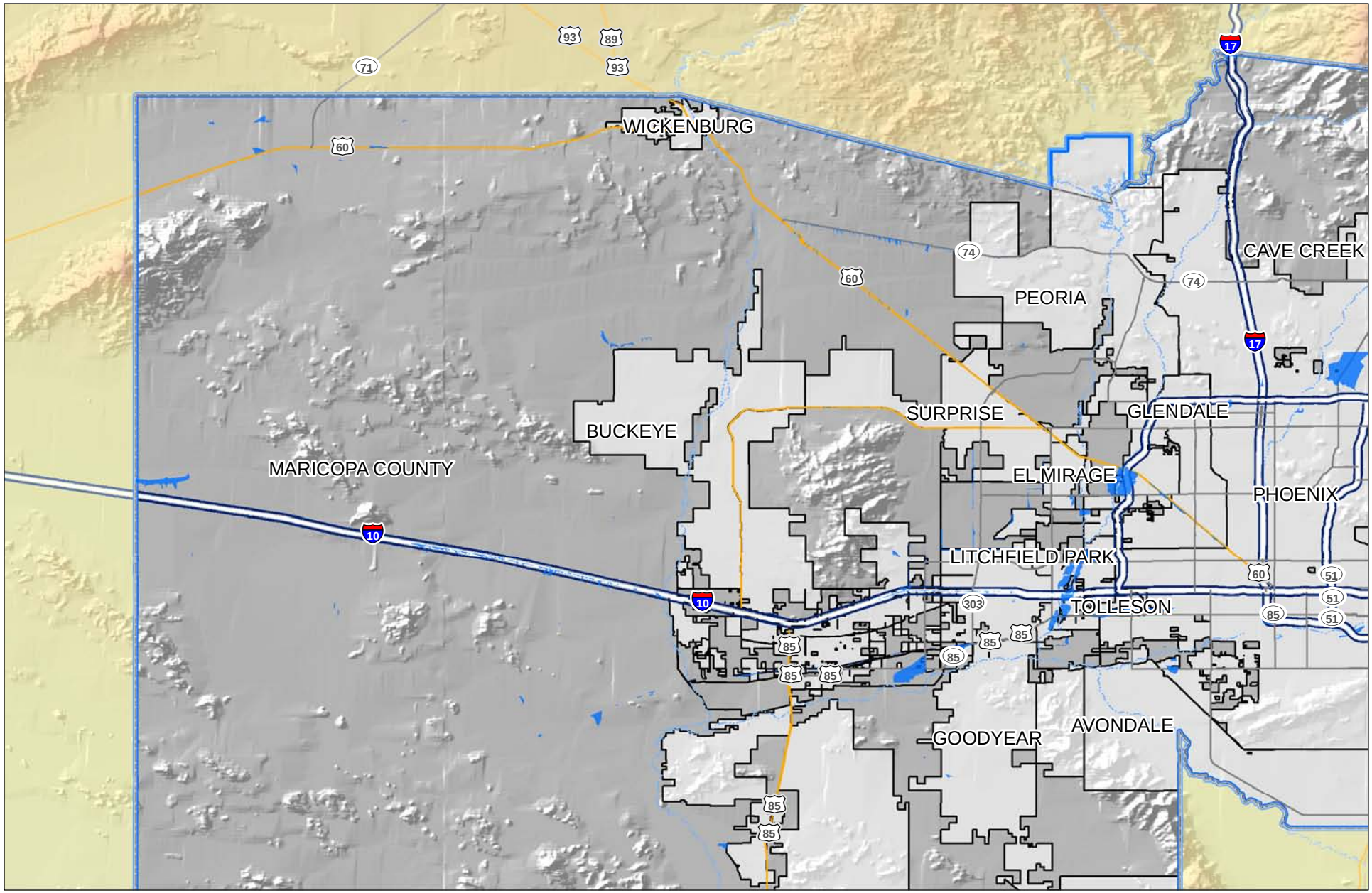


Legend

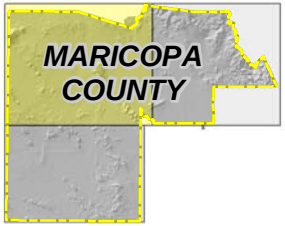
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Potential Levee Failure Flood Hazard Rating

- High

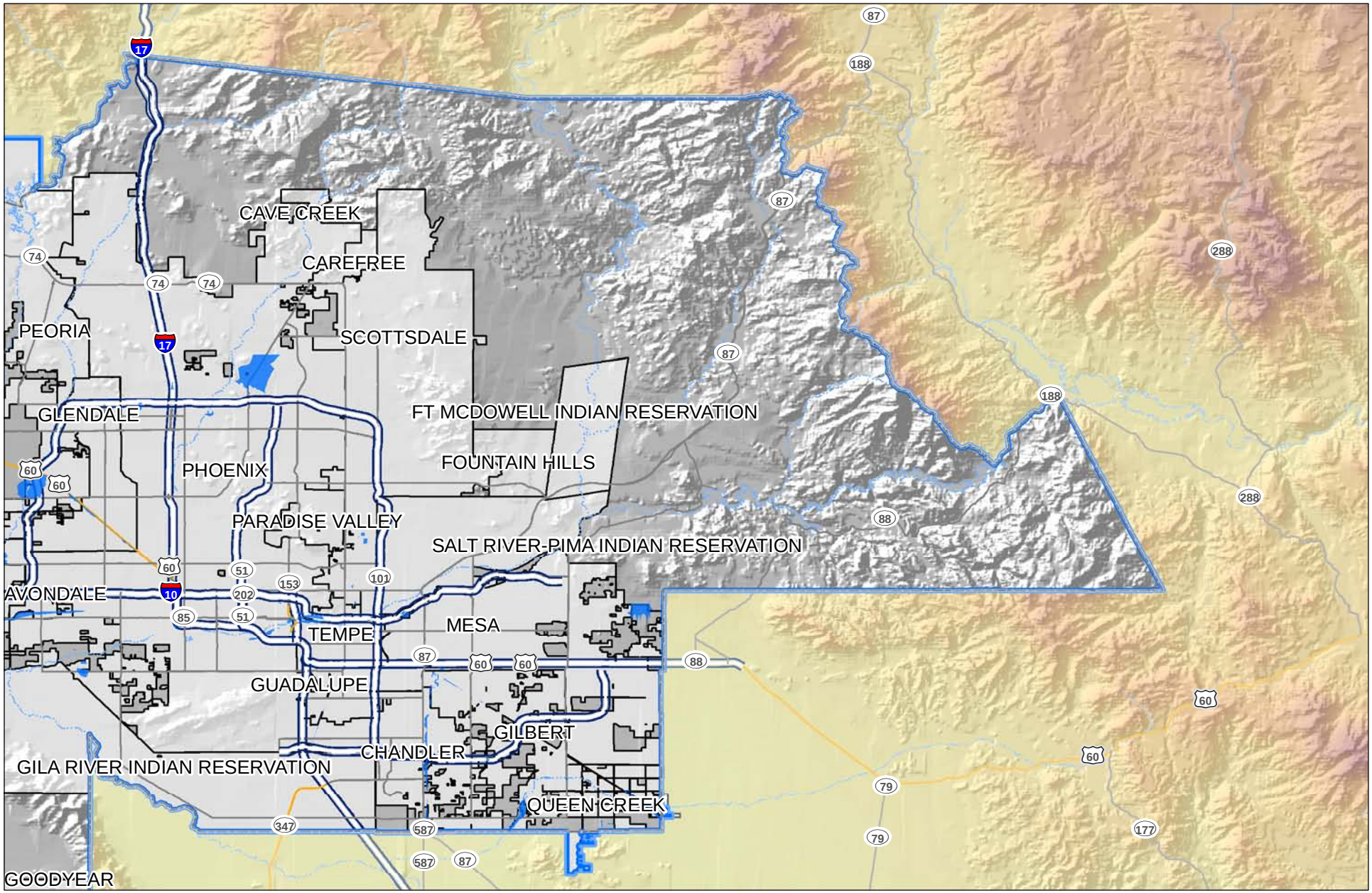
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #5A
Maricopa County Potential Levee Failure Flood Hazard Map as of May 2009



Legend

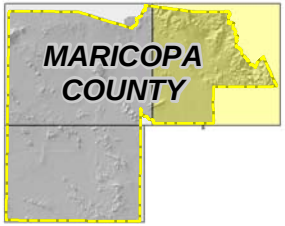
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Potential Levee Failure Flood Hazard Rating

- High

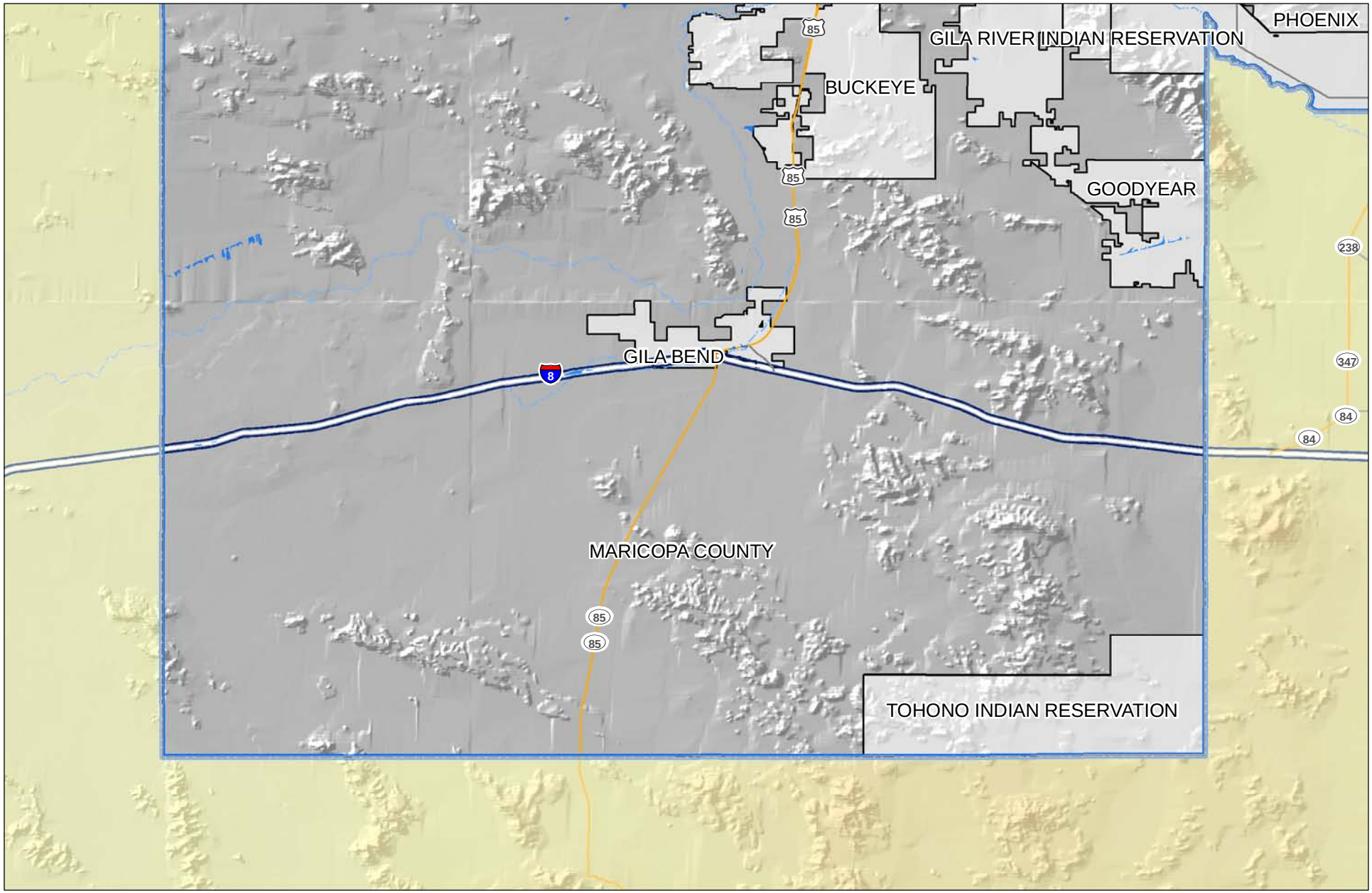
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #5B
Maricopa County
Potential Levee Failure
Flood Hazard Map
as of May 2009



Legend

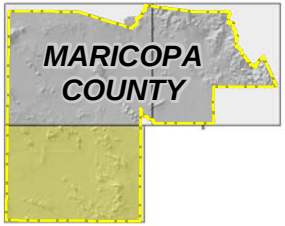
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Potential Levee Failure Flood Hazard Rating

- High

0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #5C
Maricopa County
Potential Levee Failure
Flood Hazard Map
as of May 2009

5.3.7 Severe Wind

Description

The hazard of Severe Wind encompasses all climatic events that produce damaging winds. For Maricopa County, Severe Winds usually result from either extreme pressure gradients that usually occur in the spring and early summer months, or from thunderstorms. Thunderstorms can occur year-round and are usually associated with cold fronts in the winter, monsoon activity in the summer, and tropical storms in the late summer or early fall.

Three types of damaging wind related features typically accompany a thunderstorm; 1) downbursts, 2) straight line winds, and infrequently, 3) tornadoes.

Downbursts are columns of air moving rapidly downward through a thunderstorm. When the air reaches the ground, it spreads out in all directions, creating horizontal wind gusts of 80 mph or higher. Downburst winds have been measured as high as 140 mph. Some of the air curls back upward with the potential to generate a new thunderstorm cell. Downbursts are called macrobursts when the diameter is greater than 2.5 miles, and microbursts when the diameter is 2.5 miles or less. They can be either dry or wet downbursts, where the wet downburst contains precipitation that continues all the way down to the ground, while the precipitation in a dry downburst evaporates on the way to the ground, decreasing the air temperature and increasing the air speed. In a microburst the wind speeds are highest near the location where the downdraft reached the surface, and are reduced as they move outward due to the friction of objects at the surface. Typical damage from downbursts includes uprooted trees, downed power lines, mobile homes knocked off their foundations, block walls and fences blown down, and porches and awnings blown off homes.

Straight line winds are developed similar to downbursts, but are usually sustained for greater periods as a thunderstorms reaches the mature stage, traveling parallel to the ground surface at speeds of 75 mph or higher. These winds are frequently responsible for generating dust storms and sand storms, reducing visibility and creating hazardous driving conditions.

A tornado is a rapidly rotating funnel (or vortex) of air that extends toward the ground from a cumulonimbus cloud. Most funnel clouds do not touch the ground, but when the lower tip of the funnel cloud touches the earth, it becomes a tornado and can cause extensive damage. For Maricopa County, tornadoes are the least common severe wind to accompany a thunderstorm.

History

According to Tables 5-2 and 5-3, Maricopa County has been included in 4 state and/or federal disaster declarations involving thunderstorms. There are also and additional 193 thunderstorm/high wind events and 44 tornadoes with a combined loss of approximately $460 million to structures and agriculture, 6 deaths, and over 200 injuries. The following are examples of documented past events:

- In January 1993, a category F2 tornado moved through Scottsdale damaging 18 homes, 4 with major damage, and damaging many trees and signs. The most damage occurred when the tornado moved east from 59th and Clinton to 72nd and Cholla. Controllers from the nearby Scottsdale Airport watched this tornado move through this, north Scottsdale residential area. Damages were estimated to exceed $5 million (NCDC, 2009).
- In August 1993, strong winds from nearby thunderstorms exceeded 50 mph in many areas of the Valley. Homes and businesses sustained damage, trees were uprooted and power lines were downed. Arizona Public Service reported 10,000 customers without power. An 8-year-old boy in Avondale was severely injured just after 1800 MST when a window burst and glass cut his jugular vein. The roof of a convenience store was blown off, as well as some damage to a church and an elementary school. A 1-mile section of a 69,000-volt power line near Perryville was knocked down. High winds blew tree limbs onto power poles and took shingles off several homes. Damages were estimated to exceed $5 million (NCDC, 2009).

- In September 1994, micro burst struck a school building at the Littleton Elementary School in the community of Cashion, two miles SW of Tolleson. The roof was torn from about eight classrooms with one teacher and eight children being injured. A National Weather Service Storm Survey Team estimated winds of 100 mph. A teacher reported the ground covered with hail, some golf ball-size. A weather spotter at 75th Avenue and Camelback Road reported 1.25 hail. A mile long stretch of power poles were downed near 107th Avenue and Interstate 10. Damage to the school was estimated in excess of $500,000 and stormwide estimates exceeded $5 million (NCDC, 2009).
- In September 1996, a massive thunderstorm move through western half of the Phoenix Metropolitan Area, with nearly every West Valley community reporting some damage. The hardest hit areas were in northwest Phoenix, Glendale, and Peoria. Other towns that sustained damage were Sun City, Surprise, El Mirage, Tolleson, Avondale, Goodyear, and Buckeye. Approximately 400 power poles were knocked down throughout these towns, 100 owned by SRP and 300 owned by APS. There were from 70,000 to 75,000 homeowner claims for about $100 million in damage (NCDC, 2009).
- In August 2001, a large thunderstorm complex developed over northwest Maricopa County and moved to the south and southwest. The thunderstorm induced gust front, at times over 60 miles long, west to east, caused widespread electric power outages in the Gila Bend area south to Ajo in west Pima County. In the immediate Gila Bend area, thirty-eight 230kv poles downed, and thirty-nine 69kv poles were downed. A substation was damaged as well as telephone lines. The reported wind gust of 66 knots was recorded at the Gila Bend municipal airport at 0245. As the gust front moved further to the south and southwest, a total of 140 power poles were blown over as reported by the Arizona Public Service. Electric power services were disrupted up to 5 days. State PCA No. 22001 (ADEM, 2009).
- In July 2006, several cities throughout the central portion of Maricopa County had major wind damage as a series of thunderstorms and microbursts moved across the area. According to SRP, an estimated 65 power poles were blown down, in parts of Scottsdale, Tempe and Mesa. At one point, about 20,000 customers were without power. APS reported about 8,000 customers were without power. At Phoenix Sky Harbor Airport, the official peak wind gust was 59 mph. However, winds at Williams Gateway Airport gusted to 86 mph and flipped a small twin-engine plane atop another aircraft. In Mesa, 35 schools reported damages due to the storm. Stormwide losses were estimated to exceed $150 million.
- In August 2008, Several waves of severe thunderstorms moved westward across the central and eastern portions of Maricopa County with wind gusts estimated to exceed .85 mph. In Tempe, an 18 year-old man was injured by a falling tree. Winds on the ASU campus were measured at 69 mph and severely damaged the indoor football practice facility. at 16th St and Thomas. Widespread damage occurred to homes, businesses and windows were knocked out in at least one Phoenix high-rise. Numerous power poles were downed, and many trees uprooted. Some damage also occurred at the Arizona State Capitol in Phoenix. Trees were uprooted at 48th street and McDowell and nearby homes were damaged. Microburst winds hit Chandler airport and flipped at least two planes. Over $26 million in losses were reported Valley-wide (NCDC, 2009).

Probability and Magnitude

For thunderstorms, the probability of a severe thunderstorm occurring with high velocity winds increases as the average duration and number of thunderstorm events increases. According to NCDC, 288 separate thunderstorm event damage reports have been filed for Maricopa County over the past 30 years (NCDC, 2009), yielding an average of 10 damaging or potentially damaging thunderstorm events per year. Reported damages for the same period were approximately $420 million, or $14 million per year.

The NWS issues a severe thunderstorm watch when conditions are favorable for the development of severe thunderstorms. The local NWS office considers a thunderstorm severe if it produces hail at least 3/4-inch in diameter, wind of 58 mph or higher, or tornadoes. When a watch is

issued for a region, residents are encouraged to continue normal activities but should remain alert for signs of approaching storms, and continue to listen for weather forecasts and statements from the local NWS office. When a severe thunderstorm has been detected by weather radar or one has been reported by trained storm spotters, the local NWS office will issue a severe thunderstorm warning. A severe thunderstorm warning is an urgent message to the affected counties that a severe thunderstorm is imminent. The warning time provided by a severe thunderstorm watch may be on the order of hours, while a severe thunderstorm warning typically provides an hour or less warning time. All of the 288 storms that are documented over the last 30 years would qualify as a severe thunderstorm.

The probability of tornadoes occurring is much less frequent than thunderstorms. For the same 30-year period, the NCDC reports only 24 tornadoes, which averages to less than one tornado per year. Reported damages associated with those tornadoes add up to $6.4 million or less than $270,000 per event.

Tornado damage severity is measured by the Fujita Tornado Scale, which assigns a numerical value of 0 to 5 based on wind speeds, as shown in Table 5-54, with the letter F preceding the number (e.g., FO, F1, F2). Most tornadoes last less than 30 minutes, but some last for over an hour. The path of a tornado can range from a few hundred feet to miles. The width of a tornado may range from tens of yards to more than a quarter of a mile.

Table 5-54: Fujita Tornado Scale

Category	Wind Speed	Description of Damage
F0	40-72 mph	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.
F1	73-112 mph	Moderate damage. The lower limit is the beginning of hurricane speed. Roof surfaces peeled off; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
F2	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	158-206 mph	Severe damage. Roofs and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
F4	207-260 mph	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	261-318 mph	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100-yards; trees debarked.

Source: FEMA, 1997.

Of the 24 recorded tornadoes, 15 were category F0, 8 were category F1, and 1 was category F2. According the NCDC, there has been only one F3 tornado recorded in the history of Maricopa County, and that was August 4, 1957.

Vulnerability – CPRI Results

Severe Wind CPRI results for each community are summarized in Table 5-55 below.

Table 5-55: Summary of CPRI results by jurisdiction for severe wind

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Likely	Limited	<6 hours	<6 hours	2.65
Buckeye	Highly Likely	Critical	<6 hours	<6 hours	3.40
Carefree	Highly Likely	Limited	12-24 hours	<1 week	3.00
Cave Creek	Highly Likely	Limited	12-24 hours	<6 hours	2.80
Chandler	Highly Likely	Negligible	6-12 hours	<6 hours	2.65
El Mirage	Highly Likely	Critical	>24 hours	<1 week	3.15
Fountain Hills	Likely	Critical	6-12 hours	<1 week	3.00
Fort McDowell Yavapai Nation	Highly Likely	Limited	12-24 hours	<6 hours	2.80
Gila Bend	Possibly	Limited	<6 hours	<24 hours	2.30
Gilbert	Highly Likely	Limited	<6 hours	<24 hours	3.20
Glendale	Highly Likely	Limited	<6 hours	<6 hours	3.10

Table 5-55: Summary of CPRI results by jurisdiction for severe wind

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Goodyear	Highly Likely	Negligible	12-24 hours	<24 hours	2.60
Guadalupe	Possibly	Limited	<6 hours	<24 hours	2.30
Litchfield Park	Highly Likely	Limited	<6 hours	<24 hours	3.20
Unincorporated Maricopa County	Highly Likely	Critical	<6 hours	<6 hours	3.40
Mesa	Highly Likely	Limited	<6 hours	<1 week	3.30
Paradise Valley	Highly Likely	Limited	6-12 hours	<24 hours	3.05
Peoria	Highly Likely	Critical	<6 hours	<24 hours	3.50
Phoenix	Likely	Limited	<6 hours	<6 hours	2.65
Queen Creek	Likely	Limited	<6 hours	<6 hours	2.65
Salt River Pima-Maricopa Indian Community	Highly Likely	Critical	6-12 hours	<1 week	3.45
Salt River Project	Highly Likely	Critical	<6 hours	<6 hours	3.40
Scottsdale	Likely	Limited	12-24 hours	<6 hours	2.35
Surprise	Highly Likely	Limited	<6 hours	<6 hours	3.10
Tempe	Highly Likely	Critical	<6 hours	<24 hours	3.50
Tolleson	Likely	Limited	12-24 hours	<24 hours	2.45
Wickenburg	Highly Likely	Critical	<6 hours	<6 hours	3.40
Youngtown	Highly Likely	Critical	<6 hours	<24 hours	3.50
				County-wide average CPRI =	**2.99**

Vulnerability – Loss Estimations

Exposure to severe wind events is generally the same across the County, although communities situated close to the mountains like Carefree, Cave Creek, and Fountain Hills , may not be as susceptible to tornadoes as other communities within the County. Based on the historic record over the last 30 years, it is feasible to expect average annual losses of $15 million (county-wide) It is difficult to estimate losses for individual jurisdictions within the County due to the lack of discrete data.

Vulnerability – Development Trend Analysis

Future development will expand the exposure of life and property to the damaging effects of severe wind events. Enforcement and/or implementation of modern building codes to regulate new developments is probably the best way to mitigate against losses.

Sources

Arizona Division of Emergency Management, 2009, State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT.

Federal Emergency Management Agency,1997, Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy.

FEMA, 2001, Understanding Your Risks; Identifying Hazards and Estimating Losses, FEMA Document No. 386-2.

URS, 2004, Maricopa County Hazard Mitigation Plan.

U.S. Dept of Commerce, National Climatic Data Center, 2009, Storm Events Database, accessed via the following URL: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Profile Maps

No profile maps provided.

5.3.8 Subsidence

Description

Subsidence occurs when the original land surface elevation drops due to changes in the subsurface. Causes of subsidence include, but are not limited to, removal of fluids (water, oil, gas, etc.), mine collapse, and hydrocompaction. Of these causes, hydrocompaction and mine collapse tend to be localized events, while fluid removal may occur either locally or regionally. The main cause for subsidence in Maricopa County is excessive groundwater withdrawal, wherein the volume of water withdrawn exceeds the natural recharge. Once an area has subsided, it is likely the ground elevation will not rise again due to consolidation of the soils, even if the pumped groundwater is replaced.

Subsidence causes regional drainage patterns to change. Impacts include unexpected flooding, storm drain backwater, reversal of channel drainage patterns, and damages to infrastructure both in the subsurface (water and electric lines, well casings, etc.) and surface (roads, canals, drainages, surveyed benchmarks, etc.). Subsidence also causes fissures, which are discussed in Section 5.3.4.

Land-use areas that are predominantly agricultural tend to experience the most intense subsidence due to groundwater based irrigation practices. Subsidence is not, however, restricted to only rural areas since exponential population growth also places great demands on groundwater.

History

Active subsidence has been occurring in certain areas of Maricopa County for over 60 years and is primarily due to groundwater overdraft. By 1980 ground-water levels had declined at least 100 feet county-wide and between 300 and 500 feet in some areas (Carpenter, 1999). These groundwater declines have resulted in areas of significant subsidence, as summarized in the following examples:

- Luke Air Force Base – by 1992, ground-water level declines of more than 300 feet generated land subsidence of as much as 18 feet about 20 miles west of Phoenix on and near Luke Air Force Base (Carpenter, 1999).
- Queen Creek – by 1977, an area of almost 230 square miles had subsided more than 3 feet(Carpenter, 1999).
- Harquahala Plain – subsidence of about 0.6 feet occurred in response to about 300 feet of water-level decline(Carpenter, 1999).
- East Mesa/Apache Junction – a total of 5.2 feet of subsidence was measured along the CAP near the Superstition Freeway, for the period of 1971 to 2001 (AMEC, 2006).
- Paradise Valley – between 1965 and 1982, over 5 feet subsidence occurred (Carpenter, 1999).
- Scottsdale/CAP – canal subsided about 1 foot since construction (Carpenter, 1999).

The following are two examples of documented damages that are directly attributable to subsidence:

- Dysart Drain Flow Reversal – Subsidence near Luke Air Force Base led to flow reversal in a portion of the Dysart Drain, which is an engineered flood conveyance channel. In 1992, surface runoff from four inches of precipitation caused the sluggish Dysart Drain to spill over flooding the base runways, damaging more than 100 homes, and forcing the base to close for 3 days. Total damage was on the order of $3 million (ALSG, 2007).
- Central Arizona Project Canal Repair – sections of the CAP canal in Scottsdale traverse an area that has subsided up to 1.5 feet over a 20-year period, threatening the canal's maximum flow capacity. In response, CAP raised the canal lining 3 feet over a one-mile segment of affected area at a cost of $350,000. A second and much larger subsidence area was later identified near the Scottsdale Airpark. Plans for raising the canal lining will cost an estimated $820,000. Recently, a third subsidence area has been identified east of the Scottsdale Airpark in the Scottsdale West World area which will likely require further repair (ALSG, 2007).

Land subsidence has been detected over the years using surveying techniques such as differential leveling and high accuracy Global Positioning System (GPS) surveying. In the early 1990's, scientists began to use a satellite based technology called Synthetic Aperture Radar (SAR) and interferometric processing (InSAR) to detect land surface elevation changes. InSAR has been developed into a highly reliable land subsidence monitoring technique that has been utilized by ADWR since 2002. ADWR has identified numerous subsidence features around the State and continues to monitor the extent and rates of these features on an annual basis (ADWR, 2009). In Maricopa County, ADWR monitors 7 geographical areas using InSAR and is developing data for an eighth.

Probability and Magnitude

There are no statistical probability estimates for subsidence. The magnitudes of severity depend on geography, with estimates summarized in the previous section above. The MJPT reviewed and chose to use the zones currently being monitored by ADWR to depict the subsidence hazard for the County. Areas defined by ADWR as active subsidence areas were mapped as HIGH hazard zones and all other areas were assigned a LOW hazard. The high hazard subsidence zones are presented on Maps 6A, 6B, and 6C.

Vulnerability – CPRI Results

Subsidence CPRI results for each community are summarized in Table 5-56 below.

Table 5-56: Summary of CPRI results by jurisdiction for subsidence

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Possibly	Limited	<6 hours	<6 hours	2.50
Buckeye	Unlikely	Negligible	>24 hours	<6 hours	1.00
Carefree	Unlikely	Negligible	>24 hours	<6 hours	1.00
Cave Creek	Unlikely	Negligible	>24 hours	<6 hours	1.0
Chandler	Unlikely	Negligible	>24 hours	<6 hours	1.00
El Mirage	Possibly	Limited	>24 hours	<6 hours	1.75
Fountain Hills	Possibly	Limited	<6 hours	>1 week	2.50
Fort McDowell Yavapai Nation	Unlikely	Negligible	>24 hours	>1 week	1.30
Gila Bend	Unlikely	Negligible	>24 hours	<6 hours	1.00
Gilbert	Highly Likely	Limited	>24 hours	<1 week	2.85
Glendale	Possibly	Limited	>24 hours	>1 week	2.05
Goodyear	Unlikely	Negligible	<6 hours	<6 hours	1.45
Guadalupe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Litchfield Park	Unlikely	Negligible	<6 hours	<6 hours	1.45
Unincorporated Maricopa County	Highly Likely	Limited	>24 hours	>1 week	2.95
Mesa	Highly Likely	Limited	< 6 hours	>1 week	2.95
Paradise Valley	Unlikely	Negligible	<6 hours	<1 week	1.65
Peoria	Unlikely	Limited	<6 hours	<6 hours	1.75
Phoenix	Unlikely	Negligible	<6 hours	>6 hours	1.45
Queen Creek	Possibly	Negligible	<6 hours	<6 hours	1.90
Salt River Pima-Maricopa Indian Community	Possibly	Critical	<6 hours	>1 week	2.80
Salt River Project	Unlikely	Negligible	>24 hours	>1 week	1.30
Scottsdale	Unlikely	Negligible	<6 hours	<6 hours	1.45
Surprise	Possibly	Limited	>24 hours	>1 week	2.05
Tempe	Possibly	Limited	<6 hours	>1 week	2.50
Tolleson	Unlikely	Negligible	>24 hours	<1 week	1.20
Wickenburg	Highly Likely	Limited	>24 hours	>1 week	2.95
Youngtown	Highly Likely	Negligible	<6 hours	>1 week	2.65
				County-wide average CPRI =	**1.85**

Vulnerability – Loss Estimations

The estimation of potential exposure to high hazard subsidence areas was accomplished by intersecting the human and facility assets with the subsidence high hazard limits depicted on Maps 6A, 6B, and 6C. No losses are estimated for facilities located within the high hazard subsidence areas due to lack of appropriate loss-to-exposure data. Table 5-57 summarizes the MJPT identified critical and non-critical facilities potentially exposed to high hazard subsidence areas. Table 5-58 summarizes

population sectors exposed to the high hazard subsidence areas. HAZUS residential, commercial and industrial exposures to high hazard subsidence areas are summarized in Tables 5-12 through 5-39.

In summary, 839 MJPT identified critical and non-critical facilities with a total replacement cost of $2.72 billion, for all the participating jurisdictions in Maricopa County, are exposed to high hazard subsidence areas. An additional $26.14 billion in HAZUS defined residential, commercial, and industrial facilities is exposed to high hazard subsidence areas. for all participating Maricopa County jurisdictions. Regarding human vulnerability, a total population of 227,120 people, or 14.92% of the total 2000 Maricopa County population, is potentially exposed to a high hazard subsidence area. It is unlikely that death and injury might be the direct result of subsidence, however, secondary impacts such as fissures and flooding due to slope reversal, may.

Vulnerability – Development Trend Analysis

As ADWR continues its mapping and tracking programs, more data will become available for use in regulating future development. Public awareness of the hazard is one a key element to any effective mitigation measure, as well as the need to slow the depletion of groundwater sources. New regional drainage features and structures should always refer to the maps in this plan to determine the need for special design considerations that address subsidence.

Sources

AMEC Earth & Environmental, Inc., 2006, Earth Fissure Risk Zone Investigation Report, Powerline and Vineyard Flood Retarding Structures, Pinal County, AZ, prepared for FCDMC under Contract FCD 2004C503, Work Assignments 1&2.

Arizona Department of Water Resources, 2009, land subsidence website at: http://www.azwater.gov/DWR/Content/Find_by_Program/Hydrology/land-subsidence-in-arizona.htm

Arizona Division of Emergency Management, 2009, State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT.

Arizona Land Subsidence Group, 2007. Land subsidence and earth fissures in Arizona: Research and informational needs for effective risk management, white paper, Tempe, AZ, . http://www.azgs.az.gov/Earth%20Fissures/CR-07-C.pdf

Carpenter, M.C., 1999, Land subsidence in the United States, South-Central Arizona: Earth fissures and subsidence complicate development of desert water resources, [Galloway, D., Jones, D.R., and Ingebritson, S.E., editors], USGS Circular 1182.

FEMA, 2001, Understanding Your Risks; Identifying Hazards and Estimating Losses, FEMA Document No. 386-2.

URS, 2004, Maricopa County Hazard Mitigation Plan.

Profile Maps

Maps 6A, 6B, and 6C – Subsidence Hazard Map(s)

Table 5-57: Summary of asset inventory exposure to high hazard subsidence areas

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
County-Wide Totals	**5,179**	**839**	**16.20%**	**100.00%**	**$2,720,988**	**None Estimated**
Avondale	61	15	24.59%	1.79%	$16,561	None Estimated
Buckeye	77	6	7.79%	0.72%	$12,000	None Estimated
Carefree	6	0	0.00%	0.00%	$0	None Estimated
Cave Creek	39	0	0.00%	0.00%	$0	None Estimated
Chandler	226	0	0.00%	0.00%	$0	None Estimated
El Mirage	34	33	97.06%	3.93%	$240,140	None Estimated
Fountain Hills	15	0	0.00%	0.00%	$0	None Estimated
Fort McDowell Yavapai Nation	18	7	38.89%	0.83%	$206,000	None Estimated
Gila Bend	7	0	0.00%	0.00%	$0	None Estimated
Gilbert	694	5	0.72%	0.60%	$25,000	None Estimated
Glendale	1,205	328	27.22%	39.09%	$992,635	None Estimated
Goodyear	93	27	29.03%	3.22%	$43,136	None Estimated
Guadalupe	6	1	16.67%	0.12%	$1,300	None Estimated
Litchfield Park	5	2	40.00%	0.24%	$102,100	None Estimated
Unincorporated Maricopa County	447	105	23.49%	12.51%	$216,789	None Estimated
Mesa	613	26	4.24%	3.10%	$101,080	None Estimated
Paradise Valley	69	0	0.00%	0.00%	$0	None Estimated
Peoria	225	153	68.00%	18.24%	$139,141	None Estimated
Phoenix	913	63	6.90%	7.51%	$256,410	None Estimated
Queen Creek	117	7	5.98%	0.83%	$900	None Estimated
Salt River Pima-Maricopa Indian Community	21	0	0.00%	0.00%	$0	None Estimated
Salt River Project [47]	511	39	7.63%	N/A	N/A	N/A
Scottsdale	114	19	16.67%	2.26%	$0	None Estimated
Surprise	37	37	100.00%	4.41%	$362,429	None Estimated
Tempe	111	0	0.00%	0.00%	$0	None Estimated
Tolleson	10	0	0.00%	0.00%	$0	None Estimated
Wickenburg	11	0	0.00%	0.00%	$0	None Estimated
Youngtown	5	5	100.00%	0.60%	$5,367	None Estimated

[47] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-58: Summary of population sectors exposed to high hazard subsidence areas

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
County-Wide Totals	**1,522,083**	**227,120**	**14.92%**	**180,521**	**49,249**	**27.28%**	**100,684**	**13,690**	**13.60%**
Avondale	15,613	3,373	21.60%	855	79	9.23%	764	12	1.60%
Buckeye	3,906	242	6.20%	342	10	2.84%	344	8	2.20%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	0	0.00%	5,156	0	0.00%	3,029	0	0.00%
El Mirage	3,400	3,400	100.00%	213	213	100.00%	194	194	100.00%
Fountain Hills	8,759	0	0.00%	1,750	0	0.00%	387	0	0.00%
Fort McDowell Yavapai Nation	309	0	0.00%	17	0	0.00%	10	0	0.00%
Gila Bend	1,010	859	85.02%	81	67	82.34%	117	98	84.23%
Gila River Indian Community	1,091	0	0.00%	48	0	0.00%	140	0	0.00%
Gilbert	54,901	0	0.00%	1,834	0	0.00%	883	0	0.00%
Glendale	118,654	27,192	22.92%	9,169	2,163	23.59%	8,282	1,687	20.37%
Goodyear	10,967	2,864	26.12%	921	545	59.22%	309	87	28.14%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	1,350	100.00%	291	291	100.00%	39	39	100.00%
Unincorporated Maricopa County	104,385	47,913	45.90%	43,659	26,945	61.72%	9,288	5,606	60.36%
Mesa	189,697	8,535	4.50%	25,867	1,420	5.49%	12,410	369	2.98%
Paradise Valley	5,769	334	5.79%	868	30	3.45%	68	4	6.15%
Peoria	49,884	44,101	88.41%	6,555	5,990	91.37%	1,921	1,836	95.58%
Phoenix	657,658	55,084	8.38%	54,037	5,479	10.14%	47,321	1,889	3.99%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	0	0.00%	145	0	0.00%	114	0	0.00%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	17,373	18.88%	15,440	1,862	12.06%	5,177	763	14.74%
Surprise	13,387	12,826	95.81%	3,460	3,268	94.44%	757	724	95.57%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	0	0.00%	547	0	0.00%	288	0	0.00%
Youngtown	1,675	1,675	100.00%	887	887	100.00%	373	373	100.00%

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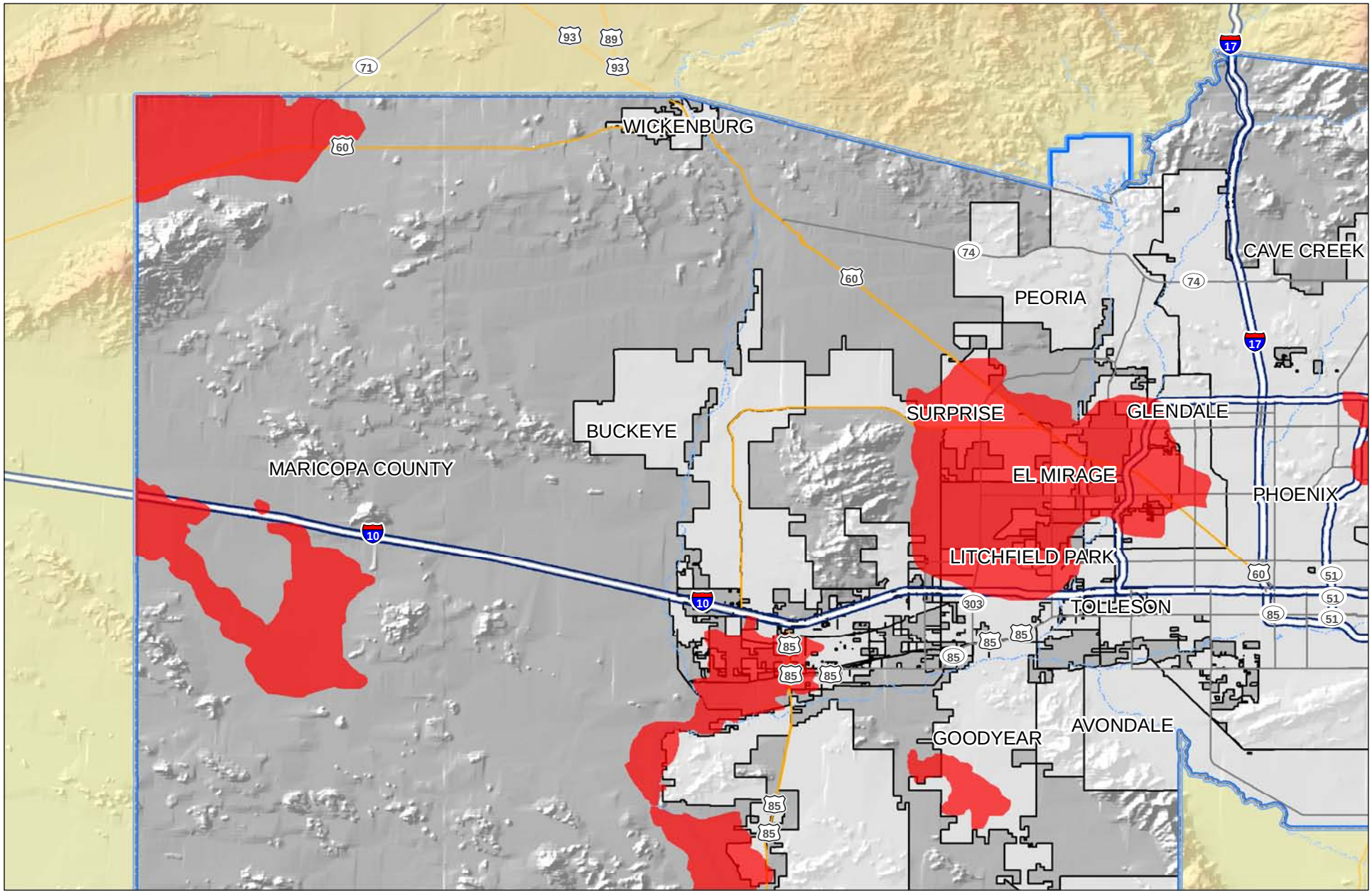


Legend

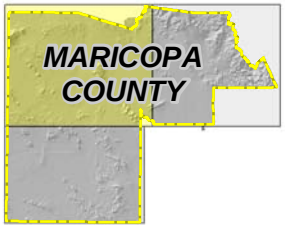
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Subsidence Hazard Rating

- High

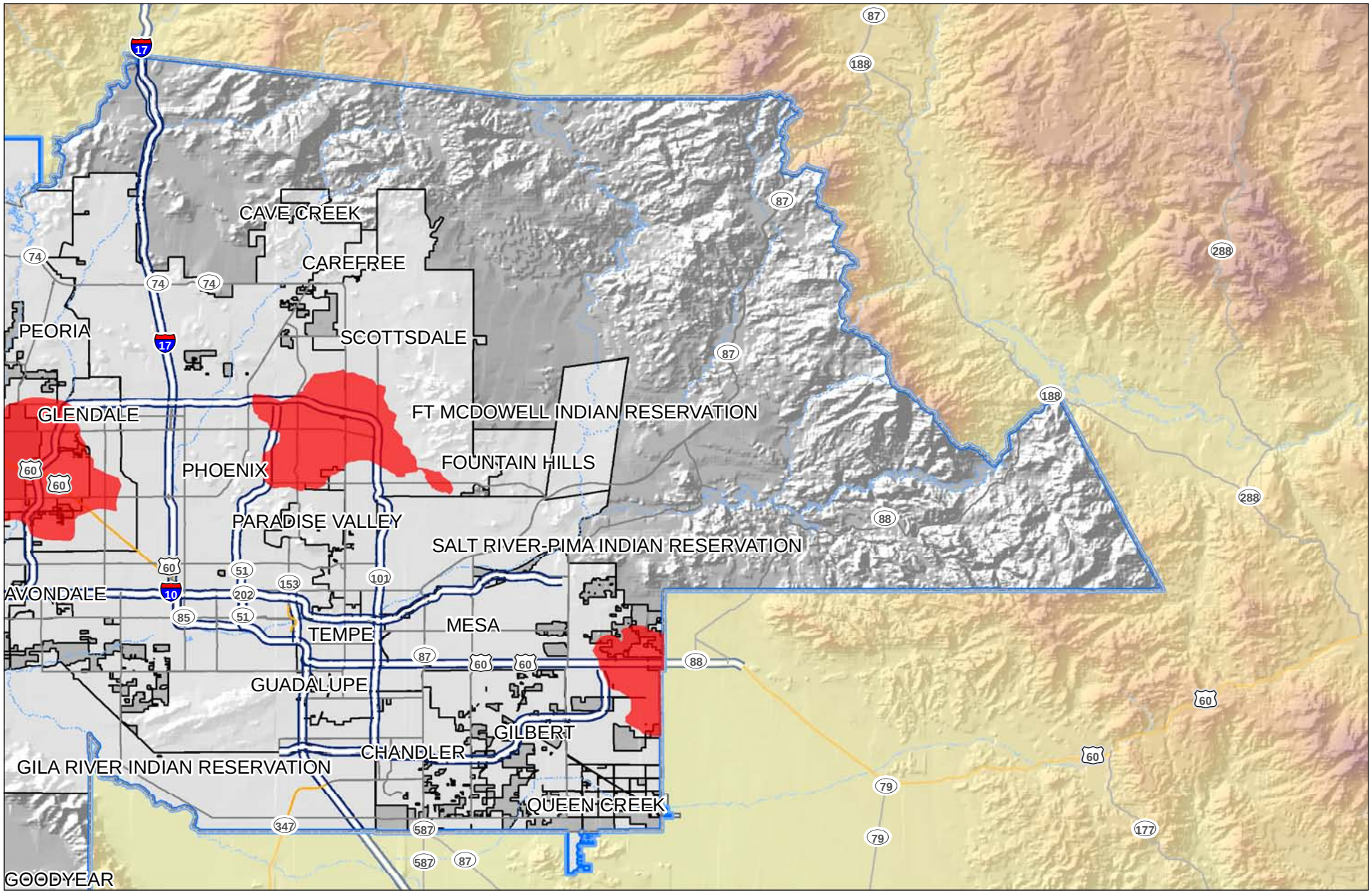
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; ADWR 2008



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #6A
Maricopa County Subsidence Hazard Map as of May 2009



Legend

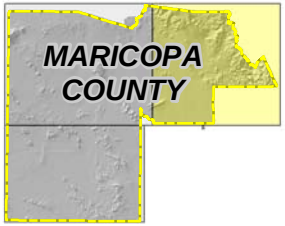
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Subsidence Hazard Rating

- High

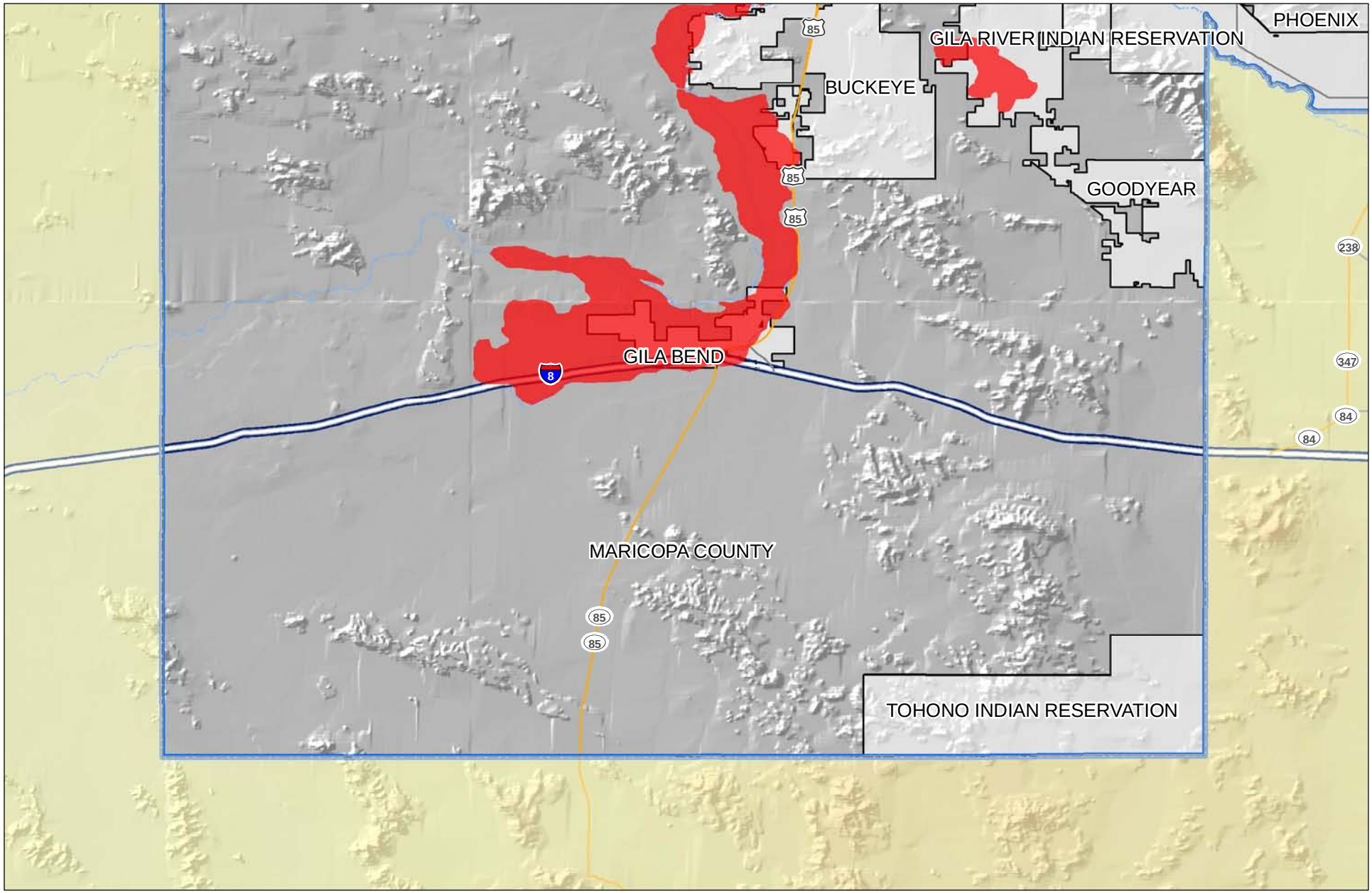
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; ADWR 2008



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #6B
Maricopa County Subsidence Hazard Map as of May 2009



Legend

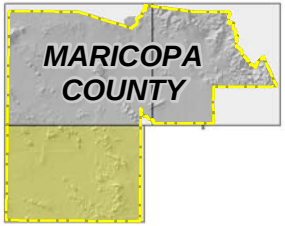
- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Subsidence Hazard Rating

- High

0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; ADWR 2008



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #6C
Maricopa County Subsidence Hazard Map
as of May 2009

5.3.9 Wildfire

Description

A wildfire is an uncontrolled fire spreading through wildland vegetative fuels and/or urban interface areas where fuels may include structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be human-caused through acts such as arson or campfires, or can be caused by natural events such as lightning. If not promptly controlled, wildfires may grow into an emergency or disaster. Even small fires can threaten lives, resources, and destroy improved properties.

The indirect effects of wildfires can also be catastrophic. In addition to stripping the land of vegetation and destroying forest resources and personal property, large, intense fires can harm the soil, waterways and the land itself. Soil exposed to intense heat may temporarily lose its capability to absorb moisture and support life. Exposed soils in denuded watersheds erode quickly and are easily transported to rivers and streams thereby enhancing flood potential, harming aquatic life and degrading water quality. Lands stripped of vegetation are also subject to increased landslide hazards.

History

The Sonoran desert vegetation typically found in Maricopa County is less dense than other areas of the state. That fact, combined with relative density of urban area, makes wildfire risk within the County relatively low when compared to the more densely forested areas of the state. There is still wildfire risk to Maricopa County as demonstrated by the following past historic events:

- In March 2004, The Citris Fire located west of Gila Bend burned over 5,700 acres along the Gila River included State, Private and Federal lands.
- In June 2005, lightning touched off the Cave Creek Complex Fire in the northern part of Maricopa County about 5 miles northeast of Carefree. The fire had threatened 440 homes in the Tonto Hills and Camp Creek areas, as well as major power lines serving Phoenix. There were damages reported to 11 residences and 3 out-buildings in Camp Creek (USFS, 2009).
- In June 2008, lightning touched off the Ethan Brush Fire in the heavily vegetated Gila River bed south of Laveen. Approximately 50 residents of 18 homes were evacuated overnight and allowed to return the their undamaged homes the next day. The fire ultimately consumed about 7,000 acres (Az Republic, 2008).
- In August 2008, the Robins Butte fire burned about 500 acres of the Gila River bottom located four miles west of State Route 85, south of Palo Verde Road, and near Buckeye (Az Republic, 2008).

Probability and Magnitude

The probability and magnitude of wildfire incidents for Maricopa County are influenced by numerous factors including vegetation densities, previous burn history, hydrologic conditions, climatic conditions such as temperature, humidity, and wind, ignition source (human or natural), topographic aspect and slope, and remoteness of area.

Wildfire hazard areas have been identified by the State of Arizona as a part of the 2003/04 Arizona Wildland Urban Interface Assessment (AWUIA) project (Fisher, 2004). The increasing growth of Arizona's rural populations, urban sprawl, and increasing wildland fuel loads ads to create a mix of situations that is known as the wildland urban interface (WUI). The purpose of the AWUIA was to attempt to conduct an analysis on a statewide basis using a common spatial model, for validation of those communities listed in the federal register as WUI, and further identify possible other communities at risk. The AWUIA approach used four main data layers:

- TOPO – aspect and slope derived from 30 meter Digital Elevation Model data from USGS.
- RISK – historical fire density using point data from fire record years 1986–1996 from all wildland agencies.

- HAZARD – fuels, natural fire regimes and condition class.
- HOUSE – houses and/or structures

A value rating of 1-15 was used for all layers.

Two separate results were developed. The first coverage used an applied weighting scheme that combined each of the four data layers to develop a ranking model for identifying WUI communities at greatest risk. The second coverage, referred to as the "Land Hazard", also applied a weighting scheme that combined only the TOPO, RISK, and HAZARD layers, as follows:

LAND HAZARD = (HAZARD*70%)+(RISK*20%)+(TOPO*10%)

Weighing percentages were determined through discussion with the Arizona Interagency Coordinating Group. The "Land Hazard" layer produced from this model is based on a 250-meter raster grid (some data originated at 1,000-meter). The resultant raster values range from 1-15 and were classified into three groups to depict wildfire hazard without the influence of structures: HIGH (values of 10-15), MEDIUM (values of 7-9), and LOW (values of 1-6).

Additional modifications were made to the map to accurately reflect the wildfire hazard posed by the dense the vegetation found along the Gila River and floodplain, as well as other waterways with extraordinarily high density vegetation. Recent aerial photography was used to modify the coverages as needed. The resulting wildfire hazard areas are presented on Maps 7A, 7B, and 7C will be used quantitatively for the vulnerability assessment. The AWUIA also identified the following 5 WUI communities as at risk in Maricopa County:

- St. Johns – Moderate risk
- Buckeye Valley – Moderate risk
- Gila Bend – Moderate risk
- New River – Moderate risk
- Sunflower – Low risk

Vulnerability – CPRI Results

Wildfire CPRI results for each community are summarized in Table 5-59 below.

Table 5-59: Summary of CPRI results by jurisdiction for wildfire

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Avondale	Likely	Limited	<6 hours	<1 week	2.85
Buckeye	Likely	Limited	<6 hours	<24 hours	2.75
Carefree	Highly Likely	Critical	6-12 hours	>1 week	3.55
Cave Creek	Likely	Critical	<6 hours	<1 week	3.15
Chandler	Possibly	Negligible	<6 hours	<6 hours	1.90
El Mirage	Possibly	Limited	6-12 hours	<6 hours	2.05
Fountain Hills	Likely	Critical	<6 hours	<1 week	3.15
Fort McDowell Yavapai Nation	Possibly	Limited	<6 hours	<1 week	2.40
Gila Bend	Unlikely	Negligible	<6 hours	<6 hours	1.45
Gilbert	Unlikely	Negligible	<6 hours	<6 hours	1.45
Glendale	Possibly	Negligible	<6 hours	<24 hours	1.80
Goodyear	Likely	Negligible	<6 hours	<24 hours	2.45
Guadalupe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Litchfield Park	Possibly	Limited	<6 hours	<24 hours	3.20
Unincorporated Maricopa County	Highly Likely	Critical	<6 hours	>1 week	3.70
Mesa	Unlikely	Negligible	<6 hours	<6 hours	1.45
Paradise Valley	Possibly	Critical	>24 hours	<1 week	2.25
Peoria	Likely	Critical	<6 hours	<6 hours	2.95
Phoenix	Unlikely	Negligible	<6 hours	<6 hours	1.45
Queen Creek	Possibly	Limited	<6 hours	>1 week	2.50
Salt River Pima-Maricopa Indian Community	Likely	Critical	<6 hours	<1 week	3.25
Salt River Project	Likely	Critical	<6 hours	<1 week	3.15

Table 5-59: Summary of CPRI results by jurisdiction for wildfire

Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Scottsdale	Likely	Limited	<6 hours	<24 hours	2.75
Surprise	Possibly	Limited	<6 hours	<24 hours	2.30
Tempe	Unlikely	Negligible	<6 hours	<6 hours	1.45
Tolleson	Unlikely	Negligible	>24 hours	<6 hours	1.00
Wickenburg	Highly Likely	Critical	<6 hours	<1 week	3.60
Youngtown	Possibly	Critical	<6 hours	<1 week	2.70
				County-wide average CPRI =	**2.43**

Vulnerability – Loss Estimations

The estimation of potential exposure to high and medium wildfire hazards was accomplished by intersecting the human and facility assets with the wildfire hazard limits depicted on Maps 7A, 7B, and 7C. Loss to exposure ratios of 0.20 (20%) and 0.05 (5%) were assumed to estimate losses for all facilities located within the high and medium wildfire hazard areas, respectively. Table 5-60 summarizes the MJPT identified critical and non-critical facilities potentially exposed to high and medium wildfire hazards, and the corresponding estimates of losses. Table 5-61 summarizes population sectors exposed to the high and medium wildfire hazards. HAZUS residential, commercial and industrial exposures and loss estimates to high and medium flood hazards are summarized in Tables 5-12 through 5-39.

In summary, $3.8 million and $10,000 in asset related losses are estimated for high and medium wildfire hazards, for all the participating jurisdictions in Maricopa County. An additional $9.6 and $1.2 million in high and medium hazard wildfire losses to HAZUS defined residential, commercial, and industrial facilities, is estimated for all participating Maricopa County jurisdictions. Regarding human vulnerability, a total population of 571 and 222 people, or 0.04% and 0.01% of the total 2000 Maricopa County population, is potentially exposed to a high and medium hazard wildfire event, respectively. Typically, deaths and injuries not related to firefighting activities are rare. However, it is feasible to assume that at least one death and/or injury may be plausible. There is also a high probability of population displacement during a wildfire event, and especially in the urban wildland interface areas.

It is duly noted that the loss and exposure numbers presented above represent a comprehensive evaluation of the County as a whole. It is unlikely that a storm event would occur that would flood all of the delineated high and medium flood hazard areas at the same time. Accordingly, actual event based losses and exposure are likely to be only a fraction of those summarized above.

Vulnerability – Development Trend Analysis

By its very definition, the WUI represents the fringe of urban development at it intersects with the natural environment. As communities push further out, more WUI is created. The County is currently working on developing a Community Wildfire Protection Plan in cooperation with other jurisdictions throughout the County. This document will ultimately establish a baseline for effective mitigation against wildfire damages in the WUI of Maricopa County.

Table 5-60: Summary of asset inventory exposure to high and medium wildfire hazard and corresponding loss estimates

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
HIGH						
County-Wide Totals	**5,179**	**6**	**0.12%**	**100.00%**	**$19,207**	**$3,841**
Avondale	61	0	0.00%	0.00%	$0	$0
Buckeye	77	0	0.00%	0.00%	$0	$0
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	0	0.00%	0.00%	$0	$0
Chandler	226	0	0.00%	0.00%	$0	$0
El Mirage	34	0	0.00%	0.00%	$0	$0
Fountain Hills	15	0	0.00%	0.00%	$0	$0
Fort McDowell Yavapai Nation	18	0	0.00%	0.00%	$0	$0
Gila Bend	7	0	0.00%	0.00%	$0	$0
Gilbert	694	0	0.00%	0.00%	$0	$0
Glendale	1,205	0	0.00%	0.00%	$0	$0
Goodyear	93	2	2.15%	33.33%	$1,750	$350
Guadalupe	6	0	0.00%	0.00%	$0	$0
Litchfield Park	5	0	0.00%	0.00%	$0	$0
Unincorporated Maricopa County	447	2	0.45%	33.33%	$14,457	$2,891
Mesa	613	2	0.33%	33.33%	$3,000	$600
Paradise Valley	69	0	0.00%	0.00%	$0	$0
Peoria	225	0	0.00%	0.00%	$0	$0
Phoenix	913	0	0.00%	0.00%	$0	$0
Queen Creek	117	0	0.00%	0.00%	$0	$0
Salt River Pima-Maricopa Indian Community	21	0	0.00%	0.00%	$0	$0
Salt River Project [48]	511	0	0.00%	N/A	N/A	N/A
Scottsdale	114	0	0.00%	0.00%	$0	$0
Surprise	37	0	0.00%	0.00%	$0	$0
Tempe	111	0	0.00%	0.00%	$0	$0
Tolleson	10	0	0.00%	0.00%	$0	$0
Wickenburg	11	0	0.00%	0.00%	$0	$0
Youngtown	5	0	0.00%	0.00%	$0	$0

[48] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-60: Summary of asset inventory exposure to high and medium wildfire hazard and corresponding loss estimates

Community	Total Facilities Reported by Community	Impacted Facilities	Percentage of Total Community Facilities Impacted	Percentage of Total County-wide Facilities Impacted	Estimated Replacement Cost (x $1000)	Estimated Structure Loss (x $1000)
MEDIUM						
County-Wide Totals	**5,179**	**2**	**0.04%**	**100.00%**	**$204**	**$10**
Avondale	61	0	0.00%	0.00%	$0	$0
Buckeye	77	0	0.00%	0.00%	$0	$0
Carefree	6	0	0.00%	0.00%	$0	$0
Cave Creek	39	0	0.00%	0.00%	$0	$0
Chandler	226	0	0.00%	0.00%	$0	$0
El Mirage	34	0	0.00%	0.00%	$0	$0
Fountain Hills	15	0	0.00%	0.00%	$0	$0
Fort McDowell Yavapai Nation	18	0	0.00%	0.00%	$0	$0
Gila Bend	7	0	0.00%	0.00%	$0	$0
Gilbert	694	0	0.00%	0.00%	$0	$0
Glendale	1,205	0	0.00%	0.00%	$0	$0
Goodyear	93	0	0.00%	0.00%	$0	$0
Guadalupe	6	0	0.00%	0.00%	$0	$0
Litchfield Park	5	0	0.00%	0.00%	$0	$0
Unincorporated Maricopa County	447	2	0.45%	100.00%	$204	$10
Mesa	613	0	0.00%	0.00%	$0	$0
Paradise Valley	69	0	0.00%	0.00%	$0	$0
Peoria	225	0	0.00%	0.00%	$0	$0
Phoenix	913	0	0.00%	0.00%	$0	$0
Queen Creek	117	0	0.00%	0.00%	$0	$0
Salt River Pima-Maricopa Indian Community	21	0	0.00%	0.00%	$0	$0
Salt River Project [49]	511	0	0.00%	N/A	N/A	N/A
Scottsdale	114	0	0.00%	0.00%	$0	$0
Surprise	37	0	0.00%	0.00%	$0	$0
Tempe	111	0	0.00%	0.00%	$0	$0
Tolleson	10	0	0.00%	0.00%	$0	$0
Wickenburg	11	0	0.00%	0.00%	$0	$0
Youngtown	5	0	0.00%	0.00%	$0	$0

[49] Facility count for Salt River Project is not included in overall County-Wide totals and all data was provided by SRP.

Table 5-61: Summary of population sectors exposed to high and medium wildfire hazard

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
HIGH									
County-Wide Totals	**1,522,083**	**571**	**0.04%**	**180,521**	**30**	**0.02%**	**100,684**	**63**	**0.06%**
Avondale	15,613	1	0.00%	855	0	0.01%	764	0	0.00%
Buckeye	3,906	1	0.04%	342	0	0.04%	344	0	0.07%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	0	0.00%	5,156	0	0.00%	3,029	0	0.00%
El Mirage	3,400	0	0.00%	213	0	0.00%	194	0	0.00%
Fountain Hills	8,759	0	0.00%	1,750	0	0.00%	387	0	0.00%
Fort McDowell Yavapai Nation	309	16	5.08%	17	0	0.00%	10	0	0.00%
Gila Bend	1,010	0	0.03%	81	0	0.00%	117	0	0.00%
Gila River Indian Community	1,091	428	39.23%	48	19	40.09%	140	53	38.07%
Gilbert	54,901	0	0.00%	1,834	0	0.00%	883	0	0.00%
Glendale	118,654	0	0.00%	9,169	0	0.00%	8,282	0	0.00%
Goodyear	10,967	0	0.00%	921	0	0.00%	309	0	0.00%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	0	0.00%	291	0	0.00%	39	0	0.00%
Unincorporated Maricopa County	104,385	123	0.12%	43,659	10	0.02%	9,288	9	0.10%
Mesa	189,697	0	0.00%	25,867	0	0.00%	12,410	0	0.00%
Paradise Valley	5,769	0	0.00%	868	0	0.00%	68	0	0.00%
Peoria	49,884	0	0.00%	6,555	0	0.00%	1,921	0	0.00%
Phoenix	657,658	2	0.00%	54,037	0	0.00%	47,321	0	0.00%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	0	0.00%	145	0	0.00%	114	0	0.00%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	0	0.00%	15,440	0	0.00%	5,177	0	0.00%
Surprise	13,387	0	0.00%	3,460	0	0.00%	757	0	0.00%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	0	0.00%	547	0	0.00%	288	0	0.00%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

Table 5-61: Summary of population sectors exposed to high and medium wildfire hazard

Community	Total Population	Population Exposed	Percent of Population Exposed	Total Population Over 65	Population Over 65 Exposed	Percent of Population Over 65 Exposed	Total Incomes Under $20K	Incomes Under $20K Exposed	Percent of Incomes Under $20K Exposed
MEDIUM									
County-Wide Totals	**1,522,083**	**222**	**0.01%**	**180,521**	**40**	**0.02%**	**100,684**	**23**	**0.02%**
Avondale	15,613	0	0.00%	855	0	0.00%	764	0	0.00%
Buckeye	3,906	0	0.00%	342	0	0.00%	344	0	0.00%
Carefree	1,375	0	0.00%	455	0	0.00%	57	0	0.00%
Cave Creek	2,002	0	0.00%	246	0	0.00%	95	0	0.00%
Chandler	86,421	4	0.00%	5,156	0	0.00%	3,029	0	0.01%
El Mirage	3,400	0	0.00%	213	0	0.00%	194	0	0.00%
Fountain Hills	8,759	1	0.01%	1,750	0	0.01%	387	0	0.00%
Fort McDowell Yavapai Nation	309	5	1.53%	17	1	4.54%	10	0	0.85%
Gila Bend	1,010	0	0.00%	81	0	0.00%	117	0	0.00%
Gila River Indian Community	1,091	26	2.42%	48	1	1.26%	140	3	2.02%
Gilbert	54,901	0	0.00%	1,834	0	0.00%	883	0	0.00%
Glendale	118,654	0	0.00%	9,169	0	0.00%	8,282	0	0.00%
Goodyear	10,967	0	0.00%	921	0	0.00%	309	0	0.00%
Guadalupe	2,558	0	0.00%	125	0	0.00%	194	0	0.00%
Litchfield Park	1,350	0	0.00%	291	0	0.00%	39	0	0.00%
Unincorporated Maricopa County	104,385	171	0.16%	43,659	36	0.08%	9,288	18	0.20%
Mesa	189,697	0	0.00%	25,867	0	0.00%	12,410	0	0.00%
Paradise Valley	5,769	0	0.00%	868	0	0.00%	68	0	0.00%
Peoria	49,884	0	0.00%	6,555	0	0.00%	1,921	0	0.00%
Phoenix	657,658	0	0.00%	54,037	0	0.00%	47,321	0	0.00%
Pinal County	6	0	0.00%	0	0	0.00%	0	0	0.00%
Queen Creek	2,831	8	0.29%	145	0	0.15%	114	1	1.06%
Salt River Pima-Maricopa Indian Community	6,306	0	0.00%	1,086	0	0.00%	842	0	0.00%
Scottsdale	92,034	8	0.01%	15,440	1	0.01%	5,177	0	0.00%
Surprise	13,387	0	0.00%	3,460	0	0.00%	757	0	0.00%
Tempe	80,802	0	0.00%	6,138	0	0.00%	7,051	0	0.00%
Tohono O'odham Nation	156	0	0.00%	11	0	0.00%	26	0	0.00%
Tolleson	3,085	0	0.00%	316	0	0.00%	202	0	0.00%
Wickenburg	2,093	0	0.00%	547	0	0.00%	288	0	0.00%
Youngtown	1,675	0	0.00%	887	0	0.00%	373	0	0.00%

Sources

Arizona Division of Emergency Management, 2009, State of Arizona Multi-Hazard Mitigation Plan, 2010 Update, DRAFT.

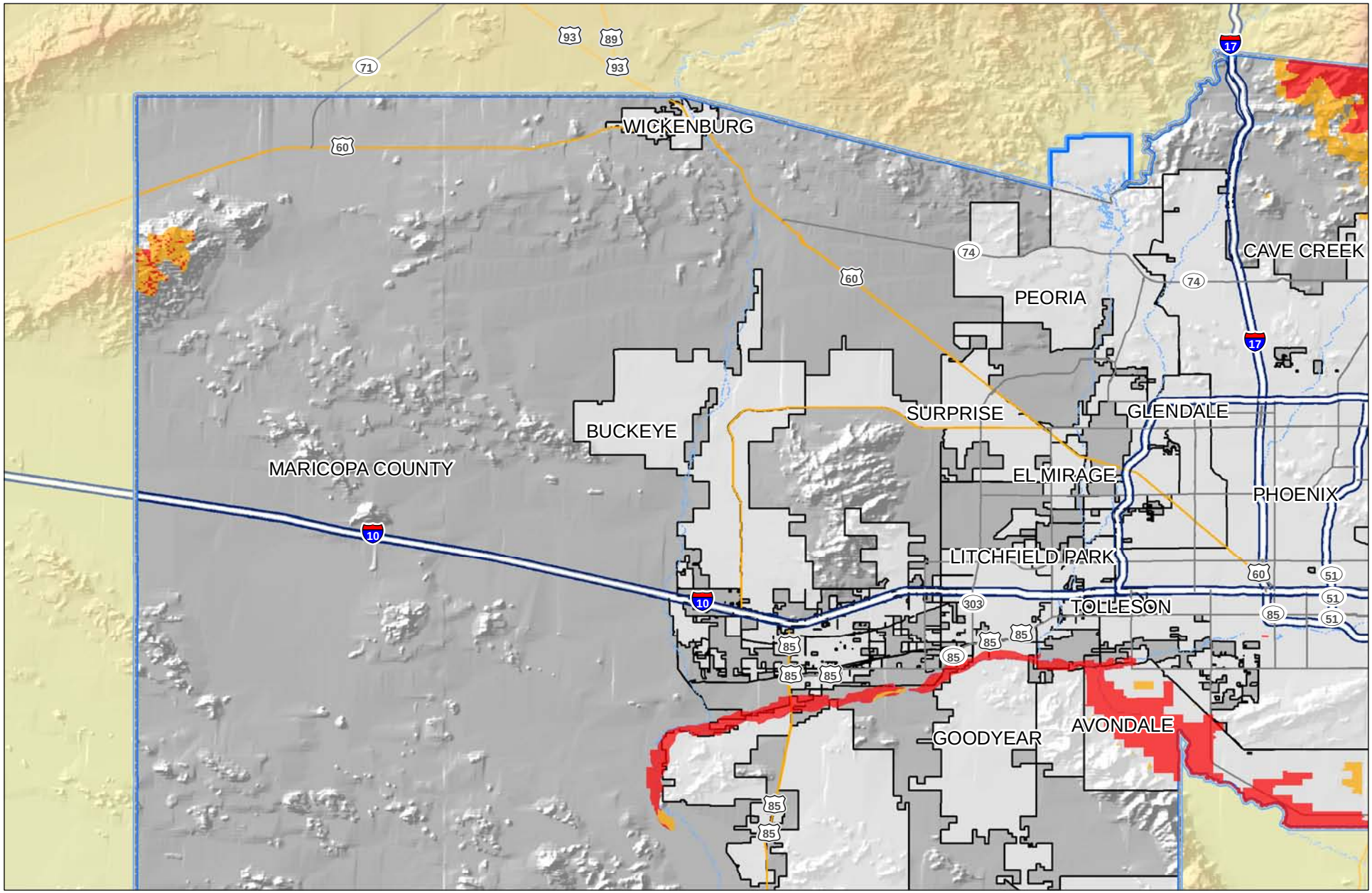
FEMA, 2001, Understanding Your Risks; Identifying Hazards and Estimating Losses, FEMA Document No. 386-2.

Fisher, M., 2004, Arizona Wildland Urban Interface Assessment, 2003, prepared for the Arizona Interagency Coordination Group. http://www.azsf.az.gov/UserFiles/PDF/Arizona%20Wildland%20Urban%20Interface%20Assessment%2005MAR04.pdf

URS, 2004, Maricopa County Hazard Mitigation Plan.

Profile Maps

Maps 7A, 7B, and 7C – Wildfire Hazard Map(s)



Legend

- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Wildfire Hazard Rating

- High
- Medium

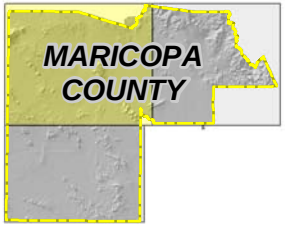
Note: The Arizona Wildland Urban Interface Assessment March 2004 uses four main data layer comprised of Risk, Topography and House/Structure Density to determine the wildfire hazard areas.

N

0 40 80 160

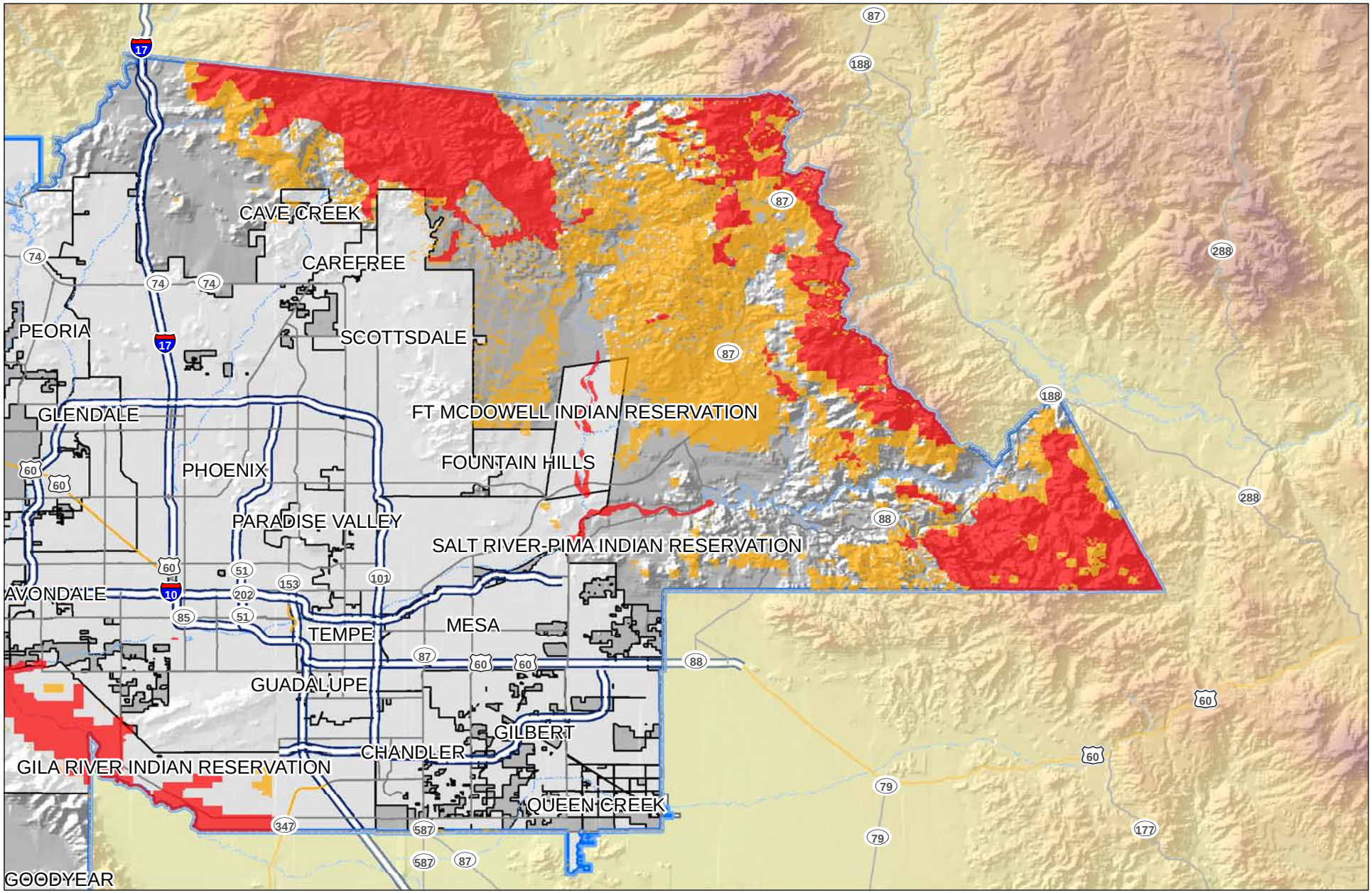
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009 Arizona Wildland Urban Interface Assessment, March 2004



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #7A
Maricopa County
Wildfire Hazard Map
as of May 2009



Legend

- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

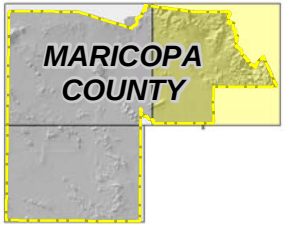
Wildfire Hazard Rating

- High
- Medium

Note: The Arizona Wildland Urban Interface Assessment March 2004 uses four main data layer comprised of Risk, Topography and House/Structure Density to determine the wildfire hazard areas.

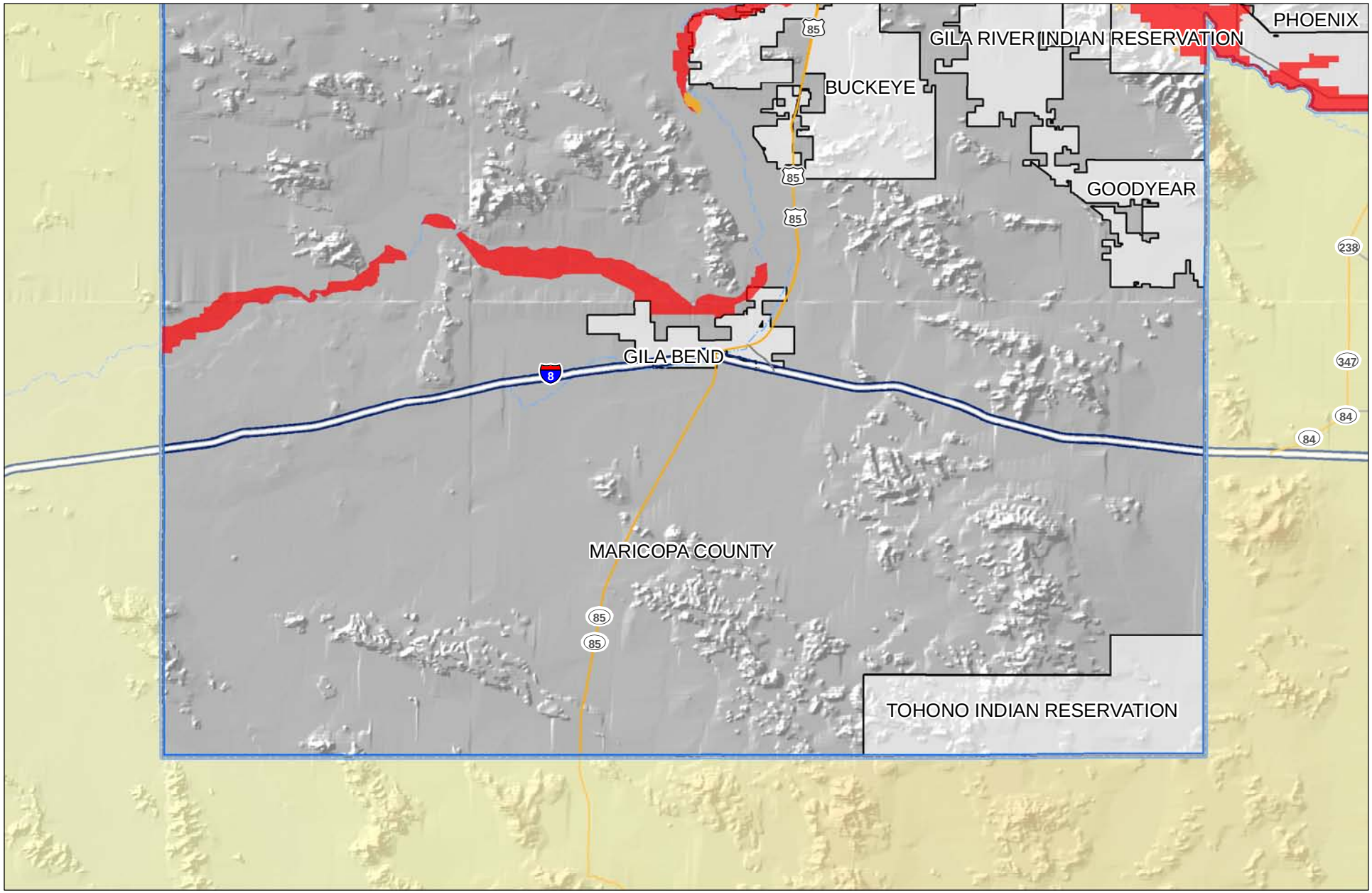
0 40 80 160
Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009 Arizona Wildland Urban Interface Assessment, March 2004



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #7B
Maricopa County
Wildfire Hazard Map
as of May 2009



Legend

- Maricopa County
- Mitigation Plan Extent
- Major Streams
- Canals Washes

Wildfire Hazard Rating

- High
- Medium

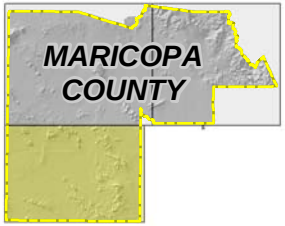
Note: The Arizona Wildland Urban Interface Assessment March 2004 uses four main data layer comprised of Risk, Topography and House/Structure Density to determine the wildfire hazard areas.

N

0 40 80 160

Miles

Source: JE Fuller 2009; FEMA 2008; ALRIS 2006; FCDMC 2009 Arizona Wildland Urban Interface Assessment, March 2004



Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

Map #7C
Maricopa County
Wildfire Hazard Map
as of May 2009

5.4 Risk Assessment Summary

The jurisdictional variability of risk associated with each hazard assessed in Section 5.3 is demonstrated by the various CPRI and loss estimation results. Accordingly, each jurisdiction has varying levels of need regarding the hazards to be mitigated, and may not consider all of the hazards as posing a great risk to their individual communities. Table 5-62 summarizes the hazards selected for mitigation by each jurisdiction and will be the basis for each jurisdictions mitigation strategy.

Table 5-62: Summary of hazards to be mitigated by each participating jurisdiction

Jurisdiction	Dam Inundation	Drought	Extreme Heat	Fissure	Flood	Levee Failure	Severe Wind	Subsidence	Wildfire
Avondale		x	x		x		x	x	x
Buckeye					x		x		x
Carefree		x			x				x
Cave Creek		x	x		x				x
Chandler		x	x		x		x		
El Mirage		x	x		x		x		
Fountain Hills		x	x		x		x		x
Fort McDowell Yavapai Nation		x	x		x		x		x
Gila Bend		x			x				
Gilbert			x		x		x		
Glendale					x		x		
Goodyear			x		x				
Guadalupe		x	x		x		x		
Litchfield Park			x		x		x		
Unincorporated Maricopa County	x			x	x	x	x		x
Mesa	x				x		x		
Paradise Valley		x	x		x		x	x	x
Peoria	x	x			x	x			x
Phoenix	x	x	x		x		x		
Queen Creek	x				x		x		x
Salt River Pima-Maricopa Indian Community					x				x
Salt River Project			x		x		x		x
Scottsdale					x				x
Surprise					x				x
Tempe		x	x		x				
Tolleson					x		x		
Wickenburg					x				
Youngtown					x		x		