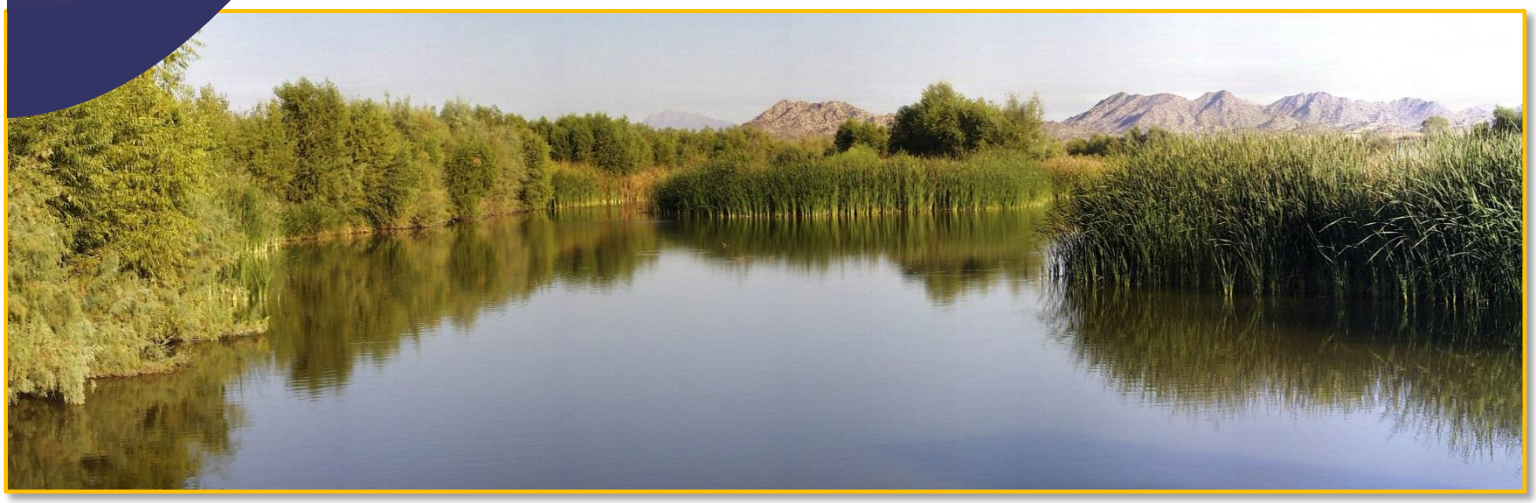
Flood Control District of Maricopa County



2015 Floodplain Management Plan for Unincorporated Maricopa County

Expires 9-30-18

LTM Engineering, Inc.
4727 E. Bell Road
Suite 45-310
Phoenix, Arizona 85032

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2015 Floodplain Management Plan for Unincorporated Maricopa County

Adopted on November 18, 2015

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Executive Summary

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's Community Rating System for unincorporated Maricopa County. As part of the program, the District is required to update its Floodplain Management Plan (FMP). Development of the FMP was based on input from a committee representing the District, Maricopa County Planning & Development Department, various stakeholders, and the public. The committee consisted of three staff members from Maricopa County, ten stakeholders, and one resident.

The 2015 update will serve as a road map for addressing flooding issues in unincorporated Maricopa County over the next five years. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood-related hazards within the county. The purpose of this FMP is to identify flood hazards in the community, set goals, and recommend a program of activities to address the county's vulnerability to flooding.

Assessment of Community Hazards *(Sections 2 and 3)*

The assessment of the hazards and problems were reviewed by the FMP Committee in order to analyze and identify the sources, extent, and causes of flooding and to address the impacts of flooding caused by these hazards.

The hazard assessment involved reviewing and summarizing data from existing flood studies, historical records, and the knowledge and experiences of District staff and the FMP Committee members. The assessment of the problems included evaluating the impacts of flooding on people, property, infrastructure, the local economy, and natural floodplain functions.

Some of the identified hazards in unincorporated areas include flash flooding; recreational, development, and transportation activity within floodplains; downstream inundation from embankment failures; single-lot development with no coordinated drainage system; interruptions to and channelization of natural flow paths; lateral (side-to-side) migration and erosion of washes; sediment-laden floodwaters; loss of habitat; and worsening of flood conditions caused by drought, subsidence, earth fissures, and wildfires.

Goals *(Section 4)*

Six goals were identified for floodplain management in unincorporated Maricopa County:

1. Continue/Expand Public Outreach

Public education of flood hazards is essential to protecting lives and property. The District's existing program is very beneficial and should be expanded and directed to specific audiences of residents, managers of local, state, and federal agencies, and elected officials.

2. Improve Quality of Life

Implementing sound floodplain management practices will improve public safety and property protection and will help residents receive the full benefits of living in Maricopa County. Economic benefits of lower flood risk include reduced residential and commercial flood losses and reduced disruption of transportation and commerce due to flooding.

3. Strengthen Role as Regional Leader

The District provides floodplain regulation and management for the unincorporated portions of Maricopa County and for 14 of the 24 municipalities. The District also provides technical training and expertise, educational materials, design manuals, and flood warning services. The District's continued leadership role should further integrate with other regional planning efforts, and the District should actively seek public and private partnerships to maximize the value of infrastructure and support long-term sustainability.

4. Develop Lists of Resources

Severe flooding during the 2014 monsoon season created challenges in meeting the public's requests for flood-fighting resources and post-flood site visits. The District could improve its response to public information requests by developing pre-programmed web pages and field-ready response kits.

5. Enforce/Enhance Regulatory Standards

The District is committed to enforcing floodplain regulations and identifying flood hazards. This commitment could be enhanced to incorporate emerging flood control technologies, improve technical analysis tools, and support alternate solutions such as floodproofing or acquisition of floodprone properties.

Action Plan *(Section 5)*

An action plan was developed to accomplish the 2015 goals. Specific activities were identified within the categories of flood prevention, property protection, natural resource protection, emergency services, structural flood control projects, and public information. The FMP Committee identified two areas that should be given the highest priority. The first is to explore additional funding for the District's Capital Improvement Program (CIP) because the need for flood control projects far exceeds the current available funding. The second category is public education. Given the transient nature of the county's population and infrequency of storms, there is a great need for continual, effective education on flood risks, personal safety, and the benefits of flood insurance.

Implementation *(Section 6)*

Funding for implementation of the action plan will be provided annually as resources permit under the District's operating and CIP budgets. The District divisions with responsibility for implementing the action plan will provide annual progress reports for review by the FMP Committee and the District's Board of Directors.

1. Introduction

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System (CRS) for unincorporated Maricopa County. As part of the program, the District is updating its Floodplain Management Plan (FMP). The 2015 update will serve as a road map for addressing flooding issues in unincorporated Maricopa County over the next five years. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood-related hazards within the county.

1.1 Purpose and Need

The purpose of this FMP is to identify flood hazards in the community, set goals, and recommend a program of activities to address the county's vulnerability to flooding. The District developed the previous FMP in 2009, titled *Comprehensive Floodplain Management Plan and Program Report* (2009 Plan). An update to the 2009 Plan is required as part of the District's participation in the NFIP and is a prerequisite of a CRS Class 4 community.

This 2015 update incorporates information collected from recent District studies and projects and changes in watershed conditions, population, and community expectations. It is intended to be used in guiding future development and is compatible with the comprehensive planning documents of the County, cities, and other agencies. The FMP includes background data to help District leadership, in partnership with other agencies, prioritize funding for future studies and projects.

1.2 Geographic and Jurisdictional Scope

As shown on **Map 1** of **Appendix A**, the geographic and jurisdictional scope of the 2015 FMP includes all unincorporated areas of Maricopa County. The District has regulatory authority for floodplain management in unincorporated Maricopa County. Additionally, the District currently performs floodplain management services for 14 incorporated municipalities that have not assumed the powers and duties of floodplain management for their jurisdiction. For purposes of the CRS administered under the NFIP, only the areas in unincorporated Maricopa County are considered in the insurance credits awarded for this FMP and other floodplain management activities.

1.3 Acknowledgements

Mark Frago, AICP, CFM, District Project Manager, headed the effort and was supported by Sharon McGuire and Tim Murphy, PE, CFM. Laurie T. Miller, PE, LTM Engineering, Inc., prepared the 2015 FMP on behalf of the District under Contract FCD 2010C041.

1.4 Plan Organization and Development

District staff from the following departments provided information and input during the development of the 2015 FMP:

Department	Representative
1. Floodplain Management & Services Division	Kelli Sertich, AICP, CFM Mike Smith, CFM
2. Planning Branch	Doug Williams, AICP Afshin Ahouraiyan, PE
3. Hydrology/Hydraulics Branch	Cathy Regester, PE, CFM Jeff Shelton, PE
4. Planning & Project Management Division	Don Rerick, PE
5. Engineering Division	Scott Vogel, PE
6. Flood Warning Branch	Steve Waters
7. Operations & Maintenance Division	Charlie Klenner Bill Leal
8. Mitigation Planning & Technical Programs Branch	Tim Murphy, PE, CFM Mark Frago, AICP, CFM Sharon McGuire
9. Maricopa County Planning & Development Department	Stacey Lapp, PE, CFM Carol Hu
10. Public Information Office	Aisha Alexander
11. Office of Enterprise Technology/GIS	Tennille Blair

1.5 FMP Committee

As identified in **Table 1**, a committee was formed of representatives from the District, Maricopa County Planning & Development Department, various stakeholders, and the public. The committee consisted of three members from Maricopa County, ten stakeholders, and one resident.

Table 1: 2015 Floodplain Management Plan Committee

Affiliation	Member
Arizona Department of Emergency & Military Affairs	Sue Wood *State Mitigation Planner*
Arizona Department of Water Resources	Maureen Towne, CFM *Risk Map Coordinator*
Arizona Forward	Doug Plasencia, PE, CFM *Vice-President*

Affiliation	Member
Arizona Rock Products Association	Steve Trussell *Executive Director*
Audubon Arizona	Tice Supplee *Interim Executive Director*
Central Arizona Project	Patrick Kernan, PE *Civil Engineer*
City of Phoenix	Kristina Jensen, EIT, CFM *Civil Engineer II*
City of Scottsdale	Ashley Couch, PE, CFM *Stormwater Manager*
Flood Control District of Maricopa County	*Mark Frago, AICP, CFM *Mitigation Planning Analyst*
Grand Canyon Chapter, Sierra Club	Jennifer Martin *AZ Water Sentinels Program Coordinator*
Maricopa Association of Governments	Jason Howard *GIS Program Manger*
Maricopa County Planning & Development Department	*Stacey Lapp, PE, CFM *Senior Civil Engineer* *Carol Hu *Planner*
Maricopa County resident	Eric Pfister *Insurance Agent*

* Maricopa County Staff

The FMP Committee met five times to address each of the following needs:

1. Assess the hazard
2. Assess the problem
3. Set goals
4. Review possible activities
5. Draft an action plan

The discussion and outcomes of each meeting are presented in subsequent sections of this FMP. Meeting agendas, attendance sheets, and summaries are included in **Appendix B**.

1.6 Public Involvement

All FMP Committee meetings were advertised on the District's website and were open to the public. In addition, two public meetings were held during the development of the FMP. The first, held early in the planning process on April 21, 2015, was an open-house format and included information on the plan's development process and progress-to-date. A

second public meeting was held on August 25, 2015, to present the draft FMP and obtain input from the public.

Additional public information activities included:

1. Development of the FMP was featured on the home screen of the District's website with a link to information on the purpose and planning process, the FMP Committee meeting dates, and discussion topics. The page also included a link for residents to request additional information or submit flooding concerns for consideration in the plan development.
2. A questionnaire was distributed to residents at the first public meeting to obtain input on flooding concerns that should be included in developing the plan.
3. A separate questionnaire was distributed to stakeholders (representatives of public or private interests) to collect information on floodprone locations, flooding concerns, and input on issues to address while developing the plan.
4. Letters describing the FMP update with invitations to attend each of the two public meetings were sent to federal, state, and local agencies and drainage districts in and surrounding Maricopa County.
5. An additional public meeting was held on October 27, 2015, to present the draft plan. A letter invitation was sent to representatives of federal, state, and local agencies and drainage districts to review the draft FMP and to discuss how it impacts their operations.
6. District staff presented the draft plan at a public meeting of the Maricopa County Flood Control Advisory Board (FCAB) on September 23, 2015. The presentation included information on the planning process, hazard identification, plan goals, and the action plan for the next five years. The FCAB voted to recommend adoption of the plan to the Maricopa County Board of Directors.

Documentation of these public outreach activities and summaries of input from the public and stakeholder questionnaires are provided in **Appendix C**.

1.7 Coordination with Other Agencies

Representatives from the following agencies were contacted for input to the 2015 FMP:

Federal

- Bureau of Land Management (BLM)
- Bureau of Reclamation (BOR)
- Central Arizona Project (CAP)
- Environmental Protection Agency (EPA)
- Federal Emergency Management Agency (FEMA)
- National Weather Service (NWS)

- Natural Resources Conservation Service (NRCS)
- U.S. Army Corp of Engineers (USACE)
- U.S. Fish & Wildlife Service (USFWS)
- U.S. Forest Service (USFS)

State

- Arizona Department of Emergency and Military Affairs (ADEMA)
- Arizona Department of Environmental Quality (ADEQ)
- Arizona Department of Transportation (ADOT)
- Arizona Department of Water Resources (ADWR)
- Arizona State Land Department (ASLD)

Maricopa County

- Maricopa Association of Governments (MAG)
- Maricopa County Department of Emergency Management (MCDEM)
- Maricopa County Department of Environmental Services (MCDES)
- Maricopa County Department of Transportation (MCDOT)
- Maricopa County Parks and Recreation Department (MCPRD)
- Maricopa County Planning & Development Department (MCPDD)

Surrounding Counties

- Gila County
- La Paz County
- Pima County
- Pinal County
- Yavapai County
- Yuma County

Municipal

- Apache Junction
- Avondale
- Buckeye
- Carefree
- Cave Creek
- Chandler
- El Mirage
- Fountain Hills
- Gila Bend
- Gilbert
- Glendale
- Goodyear
- Guadalupe
- Litchfield Park
- Mesa
- Paradise Valley
- Peoria
- Phoenix
- Queen Creek
- Scottsdale
- Surprise
- Tempe
- Tolleson
- Wickenburg
- Youngtown

Other

- Aguila Irrigation District
- Arizona Rock Products Association
- Audubon Society
- Buckeye Water Conservation & Drainage District
- Chandler Heights Citrus Irrigation District
- Fort McDowell Yavapai Indian Nation
- Gila River Indian Community
- Harquahala Valley Irrigation and Drainage District
- Harquahala Valley Power District
- Home Builders Association of Central Arizona
- Maricopa County Municipal Water Conservation District
- McMicken Irrigation District
- Ocotillo Irrigation District
- Paloma Irrigation & Drainage District
- Queen Creek Irrigation District
- Red Cross
- Roosevelt Irrigation District
- Roosevelt Water Conservation District
- Salt River Pima-Maricopa Indian Community
- Salt River Project (SRP)
- San Tan Irrigation District
- Sierra Club
- The Nature Conservancy
- Tohono O'odham Nation
- Tonopah Irrigation District
- Woolsey Flood Protection District

1.8 Review of Other Planning Studies

Since the previous plan was completed, the District has continued developing and updating Area Drainage Master Studies (ADMS) and Area Drainage Master Plans (ADMP) throughout the county. The following District studies and plans were reviewed:

- Buckeye ADMP (Dibble, 2009)
- Upper New River/Skunk Creek Flood Response Plan (FCDMC, 2009)
- Wickenburg Flood Response Plan Update (LTM, 2009)
- Wittmann ADMP Update (Entellus, 2009)
- Rainbow Valley ADMS (URS, 2011)
- Bullard Wash Flood Response Plan Update (FCDMC, 2012)
- Gillespie ADMS (Stantec, 2013)

- Peoria Flood Response Plan (FCDMC, 2013)
- San Tan West ADMS (KHA, 2013)
- Wickenburg ADMS/P (Hoskin-Ryan, 2013)
- East Mesa ADMP Update (Entellus, 2014)
- Aguila/Upper Centennial Wash Flood Response Plan Update (FCDMC, 2015)

In addition to the District studies and plans, the following documents were reviewed:

- Maricopa County Department of Emergency Management's (MCDEM) 2009 Multi-Jurisdictional Hazard Mitigation Plan (JEF, 2009)
- Pinnacle Peak South ADMS, developed through a partnership of the City of Scottsdale and the District (TYLIN, 2013)
- Agua Fria River Hydrology Revision Feasibility Study (JEF, 2014)
- MCDEM draft 2015 Multi-Jurisdictional Hazard Mitigation Plan (JEF, 2015)
- Aggregate Protection Guidance (Haley & Aldrich, 2015)

1.8.1 Goals Identified in Planning Studies

Goals identified in the various ADMP/S documents include:

- Identify and mitigate flooding and erosion hazards in order to protect the built environment
- Identify potential flood hazards associated with existing structures within the planning area
- Identify stream reaches that have experienced long-term degradation, aggradation, or lateral migration
- Develop recommendations that would provide an adequate regional drainage system that maximizes the use of existing infrastructure
- Encourage design and planning efforts that mitigate potential disruptions to the predevelopment function of a watershed
- Minimize disturbances to natural watercourses in order to preserve the natural and beneficial floodplain function
- Leverage multi-use opportunities of watercourses to achieve both flood control objectives and the passive/active recreation desires of the surrounding community
- Design flood control facilities to enhance and complement the beauty of the natural desert landscapes and character of local communities within the planning area

1.9 Disaster Damage Reports

Following heavy statewide storms January 19-21, 2010, a disaster declaration was made by the state, which included Maricopa County. Damages in the county were estimated to exceed $2.5 million. A presidential disaster was declared for other Arizona counties, but it did not include Maricopa County (ADEMA, 2015, and NCDC, 2014).


Wickenburg home flooded in August 2014

A presidential disaster was declared for Maricopa County following a severe storm on September 8, 2014. Damages were estimated to be $16.3 million in Maricopa County (Slutsky, 2015).

1.9.1 Identified Flood Control Needs

Following a series of intense storms during August and September 2014, the District collected information on flood control needs in unincorporated Maricopa County (**Table 2**).

Table 2: Flood Control Needs Identified for Unincorporated Maricopa County

Project*	Description	ADMS/P Element
Carver Hills Basin and Storm Drain	Construct detention basin & storm drain	Laveen
Bonita Area Drainage Channel	Construct channel and basin	Wittmann
Circle City Drainage Improvements	Construct channel(s)	Wittmann
Iona Wash/Lone Mountain Road Area Drainage Improvements	Construct channel(s)	Wittmann
FRS No.1 Subarea - Fan 36	Construct channels and basins	Sun Valley
Small Projects Assistance Program	Specific locations needs further analysis	N/A

*Data was prepared by District staff following intense storms in August-September 2014.

Additionally, in November 2014, the District contacted 34 agencies in Maricopa County and requested feedback on flood control needs and associated priorities of high, medium, or low. The information was summarized in the appendix of the District's Comprehensive Report & Program 2015 (2015 Report) (FCDMC, 2015). Seventeen agencies responded; projects they identified as high priority are summarized in **Table 3**. Projects that had been identified previously as part of an ADMS/P are noted.

Table 3: Flood Control Needs Identified and Deemed High Priority by Municipalities in Maricopa County

Municipality	Project*	Description	ADMS/P Element
Chandler	Downtown Chandler Storm Drain Improvements	10-year storm drains & catch basins	Stormwater Master Plan Update
El Mirage	Dysart Road Culvert between Thunderbird & Cactus	Remove existing 2-48" RCP, replace with box culvert	L303/White Tanks
Glendale	Camelback Road Storm Drain - 51st Ave. to 58th Ave.	Install 72" storm drain	Glendale Stormwater Master Plan
	83rd Ave. Storm Drain - Bethany Home to Camelback	Install 60" storm drain	Glendale Stormwater Master Plan
	83rd Ave. & Georgia Ave. Drainage Improvements	Basin reconstruction, storm drain & catch basins	N/A
	47th Ave. & State Ave. Drainage Improvements	Storm drain & inlets	
	Murphy Park/City Hall Drainage Improvements	Outlet pipe & drywell	N/A
	Rose Land Park & 49th Ave. Drainage Improvements	Curb cuts & grading	N/A
Mesa	Oak Street Detention Basin and Storm Drain	Detention basin, storm drain & catch basins	Spook Hill
	Pecos Road Channel	Channel	East Mesa ADMP Update
	Broadway Rd Storm Drain: Center to Mesa Dr.	Storm drain & catch basins	N/A
	Center Street Storm Drain: Southern to US 60	Storm drain to tie into Heritage Park Basin	N/A
	Lewis Road Storm Drain: Baseline to US 60	Storm drain & catch basins	N/A
	Southern Avenue Area Drainage Improvements	Storm drain & catch basins	N/A
	Hawes Road Channel - Range Rider Trail to Oak Street	Channel & outfall to Oak Street system	N/A
	Winterhaven Storm Drain Connection	Relief line from existing storm drain	N/A
	Skyline: Power and McKellips	Retention basin	N/A
	Countryside Park Line Connection	36" storm drain with siphon	N/A
	90th and Brown Rd. Drainage Improvements	Channel	N/A
	Hawes Road Channel - Pecos to Germann	Channel	N/A
	90th St. and Butternut Ave. Drainage Improvements	Storm drain & catch basins	N/A

Municipality	Project*	Description	ADMS/P Element
Mesa (cont.)	2nd Avenue and Solomon Drainage Improvements	Relieve flows from Main; outfall to basin at junior high. Over 80 homes flooded in this area	N/A
	Emerald Acres Drainage Improvements	Increase retention capacity. Over 100 homes flooded	N/A
	Pecos Road Drainage	Verify H&H and original solutions	N/A
	Baseline - Signal Butte and State Land	Runoff from State Trust Land cause road closures even in small events	N/A
Paradise Valley	Hummingbird Lane & Quartz Mountain Road	Drainage Improvements	N/A
	Scottsdale Rd. & Indian Bend Rd. Drainage Improvements	Joint project with City of Scottsdale	N/A
	Middle Indian Bend Wash ADMS	Study	N/A
	Storm Water Master Plan	Study	N/A
Peoria	T4N, R1E, S12 Drainage Study	Study hazards in an imminent development situation	N/A
Phoenix	Durango Regional Conveyance Channel - Phase II (83rd Ave. to 107th Ave.)	Channel	Durango
	27th Ave. & South Mtn Rd. Detention Basin	Detention basin	S. Mountain
	27th Ave. & Dobbins Rd. Detention Basin	Detention basin	S. Mountain
	South Phoenix/Laveen Drainage Improvements	Storm drains, catch basins, and detention basins	S. Mtn/Laveen
	Circle K Park Basin 5 & Storm Drain	Storm drains, catch basins, and detention basins	Hohokam
	14th/15th Street Storm Drain	Storm drains & catch basins	N/A
	Ardmore Road Basin 1 & Storm Drain	Detention basin, storm drains, & catch basins	N/A
	South Mtn. Ave. and 17th Way Storm Drain	Storm drains & catch basins	N/A
	20th Avenue and Turney Basin	Detention basin	N/A
	Skunk Creek Levee at I-17	Levee	N/A
	Skunk Creek Channel at Pinnacle Peak Road	Channel	N/A
	Arcadia Drive Drainage Improvements Phase III	Storm drain & catch basins, Arcadia Dr. to 44th St.	N/A
	I-17/Jefferson Street Storm Drain	Storm drain & catch basins	Metro
Queen Creek	San Tan Interceptor Channel/Farmers Dike	Levee, channel, and basin	San Tan West
	Goldmine Ranch Subdivision Drainage Improvements	Collector channels & basin	San Tan West
	Riggs Road (Grapefruit to Hawes) Drainage Improvements	Channels, storm drain, and basin	San Tan West

Municipality	Project*	Description	ADMS/P Element
Queen Creek (cont.)	Newell Barney Junior High School Drainage Improvements	Storm drain & basin	San Tan West
	Cloud Road Area Improvements	Basin & outlet channel	San Tan West
	Power Road Channel - Cloud Rd. to Chandler Heights	Channel	San Tan West
	Queen Creek Channel Extension & Detention Basin	Channel & basin	East Mesa ADMP Update
Salt River Project	Stormwater Improvement Features along SRP Canal	Overchutes, interceptor channels/storm drains, basins	N/A
Scottsdale	Granite Reef Wash Improvements	Storm drain, catch basins, and detention basins	Scottsdale Stormwater Master Plan
	Reata Pass Wash Flood Control Project	Channel & basins	Pinnacle Peak South
	Rawhide Wash Flood Control Project	Channel & basins	Pinnacle Peak West
	Crossroads East Phase I Drainage Improvements	Various infrastructure	N/A
	Crossroads East Phase II Drainage Improvements	Various infrastructure	N/A
	Pinnacle Peak West ADMS	Hazard identification	N/A
Surprise	115th Ave./Union Hills Dr. Drainage Improvements	Channel, storm drains, catch basins, detention basins	N/A
	Reems Road Channel - Waddell Rd. to Cactus Rd.	Channel	N/A
	Peoria Ave. & Litchfield Rd. Drainage Improvements	Channel rehabilitation	N/A
	Martin Acres Drainage Improvements	Channel & culverts	N/A
	Jerry Street & Rimrock Rd. Drainage Improvements	Detention basin	N/A
Tempe	Loma Vista Corridor Drainage Improvements	Storm drain, catch basins, and detention basin	Design Concept Report
	Tempe Area Drainage Master Study	Hazard identification	N/A
	Lower Indian Bend Wash Area Drainage Master Study	Hazard identification	N/A
Wickenburg	Hassayampa Elementary School Drainage Improvements	Alternatives analysis	N/A
	Powder House Wash Improvements	Alternatives analysis	N/A
Youngtown	Connecticut Avenue Storm Drain	Storm drain & catch basins	N/A

* Needs data was provided by local agencies following intense storms in August-September 2014.

1.10 Overview of 2009 Floodplain Management Plan

Preparation of the 2009 Plan coincided with the District's 50-year anniversary and the plan was combined with its comprehensive plan. The identified goals and progress to date on the action items are described below.

1.10.1 2009 Strategic Goals

The goals established in the 2009 Plan are to:

1. Strengthen role as regional leader
2. Streamline multi-objective watershed approach to flood mitigation
3. Increase collaboration and partnerships
4. Preserve and restore the natural resources and functions of floodplains and riparian areas
5. Continue commitment to process improvement

1.10.2 Assessment of Progress: 2009 – 2014

A summary of action items, responsibilities, and progress are summarized in **Table 4**.

Table 4: Progress of Action Plan Items from the 2009 Comprehensive Floodplain Management Plan and Program Report

ACTION	RESPONSIBLE GROUP	STATUS
Preventive		
Enforce existing floodplain regulations to minimize and prevent flood-related damage in unincorporated county and the 12 communities for which the District performs floodplain management duties.	Regulation, Floodplain Management Services Division	Ongoing
Complete 22 ADMS/ADMPs	Identification, Planning Branch	14, covering 1,723 square miles
Complete 530 miles of delineations	Identification, Floodplain Delineations Branch	735 miles completed (most are in unincorporated areas) - 242 mi. new - 493 mi. revised
Coordinate with jurisdictions to adopt and enforce the recommendations of area drainage master plans, watercourse master plans and other studies.	Identification, Planning Branch	Ongoing
Develop a standardized model of assessing flooding risk and vulnerability at a watershed and sub-watershed level. This method will be	Identification, Planning Branch	Ongoing development as an integral part of ADMS/Ps and WCMPs

ACTION	RESPONSIBLE GROUP	STATUS
used to develop structural and non-structural flooding solutions as part of the ADMP and WCMP planning processes.	*Please refer to the previous page.*	
Develop model guidelines for land use planning and site development within floodplains that protect public safety and preserve the natural functions of floodplains.	Identification: Planning Branch; Regulation: Floodplain Management Services Division	Ongoing; developed as part of ADMS/Ps and floodplain regulations
Property Protection		
Acquire eight properties through the Floodprone Properties Acquisition Program.	Remediation	None to date
Improve the unincorporated Maricopa County's rating in the NFIP-CRS program from Class 5 to Class 4.	All	Achieved in 2012
Implement flood warning systems to ensure safe crossings of rivers and washes.	Identification, Remediation: in cooperation with Maricopa County Dept. of Transportation	33 gages installed; 6 new or updated FRPs; began upgrade to new data transmission standards.
Natural Resource Protection		
Accommodate wildlife corridors and habitat, when feasible, during planning and construction of flood control solutions.	Identification: Remediation in cooperation with AZ Game & Fish Department and other entities	Ongoing; has been considered as part of ADMS/Ps and WCMPs
Create an exploratory committee that is tasked with investigating tools for preserving floodplains for conveyance and other beneficial uses; and defining the District's role in river management and restoration efforts.	Identification, Planning Branch serves as lead for establishing committee. Participation required from all divisions.	Not completed
Develop a sensitive-lands management plan for District-owned floodplain property.	Real Estate in cooperation with environmental planning	Not completed
Develop a habitat mitigation banking program to assist with regulatory compliance related to construction of flood control projects.	Identification and Remediation	Not completed
Emergency Services		
Update and support Emergency Action Plans for the 22 dams maintained by the District.	Remediation, Structures Branch	Updated 6 EAPs for dams; prepared 3 new levee EAPs; developed Dam Safety Flood Response Manual

ACTION	RESPONSIBLE GROUP	STATUS
Provide reliable weather, water level and stream flow information to other jurisdictions and the community.	Outreach, Engineering Division	Ongoing – has online forecasts, rain, stream, weather, & pool data; mobile apps; online FRPs; participates in AFWS
Conduct and participate in annual multi-hazard emergency drills.	All	Ongoing; exercises held each May with MCDEM & others
Perform a county-wide vulnerability assessment that simulates the impacts of a major storm event. Use this tool to update flood response plans, emergency action plans and to prioritize future District work.	Identification and Remediation, including Engineering Division	A countywide assessment has not been done, but assessments have been completed for major structures
Structural Projects		
Construct or rehabilitate 57 structures, providing flood protection for over 755 square miles.	Remediation, Project Management, Construction Management branches	29 completed CIP projects at $222.4 million
Ensure that all Priority 1 Work Orders (work required to assure safety or for a structure to function as designed) are completed within 14 days.	Remediation, Operations and Maintenance Branch	Ongoing; goal has been reached
Public Information		
Visit 12 schools in unincorporated county to discuss how to keep safe during flood events.	Outreach, Public Involvement Branch	Completed, ongoing
Produce 24 media messages regarding flood hazards, flooded wash crossings and other public safety issues.	Outreach, Public Involvement Branch	Ongoing
Maintain a library that contains all past studies and reports and is accessible on-line from the District's web page (www.fcd.maricopa.gov).	Outreach, Engineering Branch	Completed and available online in Fall 2014; ongoing addition of new products
Offer technical assistance to 12 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information, and to municipalities that do their own floodplain management at their request.	All	Ongoing; provides floodplain management services for 14 communities and technical assistance if requested for all communities

As indicated in the table, the District has completed or exceeded most of the activities identified in the 2009 Plan.

The FMP Committee reviewed the information, and several goals and activities were brought forward for consideration in the 2015 update. The goals and development of an action plan for the 2015 FMP are presented in Sections 4 and 5, respectively.

1.11 Evaluation of Current Floodplain Management Activities

As described below, a number of existing planning and floodplain management activities were reviewed to evaluate their effectiveness in lowering flood hazard risks in unincorporated Maricopa County.

1.11.1 Current Regulatory Activities

1.11.1.1 Land Use Plans

Maricopa County developed its first comprehensive plan in October 1997. The *Maricopa County 2020 Eye to the Future Comprehensive Plan* was revised in August 2002 and is currently under revision. According to the 2002 document, countywide land use issues were identified as follows:

- Protect the desert environment, including scenic views, native vegetation, and open space
- Maintain a visual sensitivity for the natural environment in new construction
- Establish stronger maintenance standards within existing subdivisions
- Develop additional recreational amenities
- Maintain opportunities for rural life-styles
- Buffer high-density residential land uses in rural areas
- Locate commercial development proximate to roadways, with appropriate landscaping and height restrictions
- Encourage master-planned communities as an appropriate pattern of development in unincorporated areas of the county

In addition to the comprehensive plan, area land use plans were developed for unincorporated county lands. These plans are more specific to the local areas they cover in relation to community characteristics, topography, and special conditions:

- East Mesa Area Plan
- Estrella Area Plan
- Goldfield Area Plan
- Laveen Area Plan
- Mobile Area Land Use Plan
- New River Area Plan
- Old U.S. Highway 80 Area Plan
- Queen Creek Area Plan
- Rainbow Valley Area Plan
- Rio Verde Foothills Area Plan
- State Route 85 Corridor Area Plan
- Tonopah/Arlington Area Plan
- White Tanks Grand Avenue Area Plan

The area-specific plans offer development guidance by providing an inventory and analysis on natural resources (physical characteristics, hydrology, vegetation, wildlife, and archeology), social and economic characteristics (population composition and projections and economic data), and land use (development patterns and zoning). It also identifies goals, policies, (natural resources, socioeconomic development, and land use), and resident issues.

The *Maricopa County 2020 Eye to the Future Development Master Plan Guidelines* includes an Open Space land use category that denotes areas best suited for permanent open space preservation. It includes uses such as scenic areas, mountain preserves, and washes. Development is not allowed in this category (Maricopa County, 2002).

1.11.1.2 Building Code

Maricopa County Local Additions & Addenda was adopted October 2014 and names the 2012 International Building Codes (IBC) as the official building codes for new and existing construction. The amendments do not impact drainage or other flood-related hazards. The IBC is widely accepted as appropriate requirements for new and remodeling construction activities.

1.11.1.3 Zoning Ordinance

The *Zoning Ordinance for the Unincorporated Area of Maricopa County* was implemented in May 1969 and was most recently updated in June 2015. Section 1205, Drainage Provisions, states:

> "The purpose of this section is to promote and protect the health, peace, safety, comfort, convenience and general welfare of the citizens of Maricopa County by regulating grading and drainage of all land within the unincorporated area of Maricopa County, Arizona and to minimize the possible loss of life and property through careful regulation of development, to protect watershed, natural waterways, and to minimize soil erosion, to ensure that all new development is free from adverse drainage conditions."

Section 1205 of the development regulations covers administrative duties, permits, the process for requesting waivers, and drainage submittal requirements for proposed development. It requires compliance with the Maricopa County Drainage Design Manual, including volumes for hydrology, hydraulics, and erosion control. It also requires compliance with the Maricopa County Drainage Policies and Standards Manual. These documents are comprehensive and provide excellent guidelines for analysis and design for new development.

1.11.1.4 Floodplain Regulations

Maricopa County adopted floodplain regulations in February 1974 and last updated them in June 2014. The regulations require compliance with the Maricopa County

Drainage Design Manual, including volumes for hydrology, hydraulics, and erosion control. Items of note that exceed minimum standards for floodplain management include:

- Section 305, Watercourse Master Plans, authorizes the District to submit plans for river or drainage systems that provide for uniform development standards. It also requires that the plans consider ground water recharge techniques.
- Section 306, Publication of Flood Hazard Boundaries, includes erosion control zones, watercourse master plans, moveable bed watercourses, and alluvial fan zones.
- Article 6, Development Standards, requires that the finished floor elevation of structures be at least one foot above the Base Flood Elevation (BFE), which is the water surface elevation of the 100-year flood. This requirement is one foot higher than that required by the NFIP.
- Section 601, General Development Standards, requires that "in order to control erosion and preserve the natural and beneficial functions of the floodplain, removal of vegetation shall be the minimum necessary for the development".
- Zone AE Floodplain: The finished floor of structures must be elevated two feet above the BFE if no floodway has been established. Otherwise, the requirement is one foot above the floodway elevation or one foot above the BFE, whichever is higher.
- Zone A Floodplain: The finished floor must be elevated two feet above the BFE.
- Zone A Shallow Flooding: The finished floor of structures must be elevated two feet above the community-determined BFE.
- Zone AH Ponding: The finished floor elevation must be at least one foot above the BFE. Any volume displacement must be compensated within the same ponding area, and lateral flow must be preserved.
- Zone AO Ponding: The finished floor elevation must be at least one foot above the flood depth. Any volume displacement must be compensated within the same ponding area, and lateral flow must be preserved.
- Zone AO Shallow Flooding: The finished floor elevation must be at least one foot above the flood depth.
- Zone AO Alluvial Fan: The finished floor elevation must be at least one foot above the flood depth.
- Zone A Alluvial Fan High Hazard Area Administrative Floodway: Only major engineering measures per the Piedmont Manual (Hjalmarson, 1997) may be used to mitigate the flood hazard.
- Zone A Alluvial Fan Uncertain Flow Distribution Area Administrative Floodway: Only major engineering measures per the Piedmont Manual may be used to mitigate the flood hazard.
- Zone A Approximate Alluvial Fan Administrative Floodway: Only major engineering measures per the Piedmont Manual may be used to mitigate the flood hazard.
- Zone A Alluvial Fan: Only major engineering measures per the Piedmont Manual may be used to mitigate the flood hazard.

1.11.1.5 Drainage Regulations

The *Drainage Regulations for Maricopa County* was most recently updated in November 2011. It is noted that Section 603, Design Parameters, requires that all subdivisions retain the 100-year, 2-hour storm volume onsite. This requirement results in a significant net decrease in discharge from development. The regulations further require that the retention volume be drained within 36 hours in order to prevent nuisance standing water and vector growth.

1.11.1.6 Subdivision Regulations

The *Maricopa County Subdivision Regulations* were adopted in November 1965 and were most recently updated in March 2011. The regulations apply to subdivisions in the unincorporated areas of the county. The regulations require that all development be in accordance with Maricopa County's floodplain and drainage regulations. As with the zoning ordinance and floodplain regulations, the subdivision regulations require compliance with the Maricopa County Drainage Design Manual, including volumes for hydrology, hydraulics, and erosion control.

1.11.1.7 Stormwater Management Regulations

The *Maricopa County Stormwater Quality Management and Discharge Control Regulation* was adopted in May 2009 and meets the requirements of the Clean Water Act as a Small Municipal Separate Storm Sewer System operator (MS4). The regulation serves to reduce the discharge of pollutants into the wash and river drainage systems in unincorporated Maricopa County. It requires that the first half-inch of rainfall be prevented from entering the drainage system in order to avoid contamination by substances such as oil, antifreeze, pool chemicals, and many other pollutants. Stormwater pollution prevention is to be addressed through the use of Best Management Practices (BMPs) to the greatest extent practicable.

1.11.1.8 Impacts of Regulations

The current floodplain regulations for existing development are considered to have a positive impact on people, property, and natural floodplain functions. As a whole, the regulations diminish flood hazard risks through uniform practices that allow the wash and river systems to move flood waters through and away from the county and to support wildlife habits and other beneficial functions such as open space and recreation. Future conditions are expected to improve because of the requirement to retain the 100-year, 2-hour storm volume onsite. Hydrology studies consistently report a significant reduction in peak flow rates and runoff volumes of future conditions (full build-out) compared to existing conditions. Additionally, zoning restrictions and open-space requirements help mitigate the effects of development on the natural floodplain functions.

As noted previously, Maricopa County's floodplain regulations for finished floor elevations require one additional foot above that required by the NFIP. The more stringent requirement further reduces the flood risk.

The current regulations also address other flood-related special hazards such as alluvial fans, lateral (side-to-side) movement of stream beds, and land subsidence/earth fissures as follows:

- The floodplain regulations allow the District to identify and provide requirements for erosion control, moveable bed watercourses, and alluvial fan zones.
- The Watercourse Master Plan requirement to consider ground water recharge techniques is an important component of ensuring a long-term water supply that will also help to mitigate land subsidence. Land subsidence in this region is caused by significant withdrawal of ground water which, in turn, can cause earth fissures to develop. Ground water recharge lessens our dependence on ground water and helps build a sustainable community.

The current regulations meet or exceed the requirements of the NFIP and the Clean Water Act and encourage the realization of full beneficial use of the floodplains in Maricopa County. Ideally, regulations carefully weigh the rights of property owners, public safety, economic interests, recreation, and environmental stewardship to achieve a balanced, resilient community. Although the regulations may need adjustment from time to time, no gaps were identified in the review.

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2. Assessment of Flood Hazards

The FMP Committee performed a two-step process in assessing flood hazards in unincorporated Maricopa County. The first step was to ascertain the types of flood hazards present throughout Maricopa County, and the second step identified the approximate locations of those hazards.

2.1 Description of Known Flood Hazards

The following hazards are present in unincorporated Maricopa County:

Step 1
Initial Assessment of Flood Hazards

Special Flood Hazard Areas (SFHA): FEMA defines an SFHA as the area where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies to structures backed by federally-insured mortgages. Existing delineated floodplains in the county are shown on Map **2a**. The figure also includes pending floodplains, which have been accepted by FEMA but are not yet shown on flood insurance rate maps (FIRMs). Floodplain regulations apply to pending floodplains in the same way as existing floodplains shown on the FIRMs.

Dams: Dams and flood retarding structures (FRS) provide valuable flood control benefits for residential and commercial property, transportation infrastructure, critical facilities, and farming operations. The structures typically provide additional incidental protection that is significantly greater than for the 100-year flood. Dams require a rigorous program of inspection and maintenance to ensure that they will continue to provide the intended flood protection.

Embankment overtopping: Major surface water transport systems such as the CAP Canal and local irrigation district canals typically are protected by earthen berms along the upstream side. These berms collect upstream runoff and create local ponding. Additionally, downstream hazards exist if ponded stormwater breaches the berms.

Levees: The District operates 24 levees on 9 watercourses. The levees provide 100-year protection and were designed to be at least three feet higher than the expected water surface elevation (freeboard). Similar to dams, levees require regular inspection and maintenance to ensure that they will continue to provide the intended flood protection.

Single-lot development with no coordinated drainage system: Lots that are owned by individual landowners are often improved at different times and result in a patchwork drainage system. Frequently, the drainage is interrupted and the flow path is shifted from pre-development conditions.

Recreation hazards along floodplains: Much of the county's extensive trails system is within or adjacent to floodplains. Human presence during periods of runoff poses a threat to personal safety. All-terrain vehicle (ATV) activity is prevalent in river corridors and can exacerbate erosion and lateral migration. ATV use has also been noted on the sides of earthen dams; such activity exacerbates erosion and can compromise the integrity of the structures.

Repetitive losses: The location of farmlands in floodplains, lack of drainage infrastructure, and irrigation berms' susceptibility to failure results in repetitive flooding and associated damage to crops and structures. Six repetitive loss areas have been identified in the unincorporated county (**Map 2a)**.

Flash flooding: Maricopa County is subject to quick-forming thunderstorms and intense rainfall. The regional climate, steep terrain, and sparse vegetation make the county susceptible to flash flooding with short reaction times.

High runoff potential of soils: The runoff potential of a watershed is partly determined by the types of soil present. Rocky outcrops have a very low capacity to absorb rainfall, while sandy soil has a very high capacity.

Flooding of transportation corridors: Much of the freeway infrastructure in the urban areas is depressed, i.e., below the elevation of adjacent land. During heavy rains, the freeway drainage system can be overwhelmed and roadway flooding ensues.

At-grade road crossings: Normally-dry washes commonly cross over roadway surfaces (dip crossings). During flash flooding, the washes fill quickly and flood the road crossing; this condition is an ongoing serious threat to public safety.

Sheet flow channelized by development: Sheet flow is broad, shallow runoff with little or no defined flood path. Any disruption to the natural flow tends to concentrate the runoff and create channels where none had previously existed.

Split flows: Braided washes convey floodwaters in two or more directions around in-channel islands. The flow distribution among the different paths can vary from storm to storm and make it difficult to determine the true flood risk to adjacent property.

Alluvial fans: Alluvial fans are cone-shaped deposits that form when runoff exits mountainous terrain and is slowed by milder slopes of the valley plains. Runoff continues downward, but the depth of water, location, and drainage path on an alluvial fan are uncertain (**Map 2a**).

Lateral migration and erosion: Lateral migration is the side-to-side movement of the main channel within a watercourse over time. Lateral erosion is the widening of a wash from floodwaters that eat away at the channel sides. Lateral migration and

erosion of washes can endanger adjacent structures, roads, or other infrastructure.

Sediment-laden floodwaters: Fast-moving floodwaters over sparsely-vegetated land have a high capacity for carrying loose soil and rocks. The material can cause clogs in storm drainage systems and result in high clean-up costs.

Loss of habitat: As the urban areas expand, valuable flora and fauna habitats shrink. Consequently, the full benefits of natural floodplains are reduced.

Flooding exacerbated by agricultural interruptions to natural drainage patterns: Farming has historically occurred along the floodplains of the Gila, Salt, and Verde Rivers and on similar terrain such as along the Queen Creek floodplain (**Map 2b**).

Subsidence and earth fissures: Land subsidence is the lowering of the ground surface caused by pumping groundwater extensively from the underlying aquifer. Land subsidence can cause long, narrow cracks in the ground called earth fissures. Often, the location of fissures is at the edges of mountainous areas where the land subsidence is not as severe as the adjacent alluvial valley plain. During floods, fissures can open up and create new paths for floodwaters. Subsidence can reduce the capacity of channels by reducing their downward slope. Also, increased fissure activity caused by subsidence may damage drainage structures and other infrastructure.

Wildfires: Wildfires can cause dramatic increases in runoff from a watershed as a result of removal of vegetation, increased erosion potential, and reduced infiltration of the charred ground. In addition, storm runoff from a burn area brings with it considerable vegetation, soil, and other debris. With the increase in runoff and debris flow, the impact of flooding to areas downstream of a burn area can be severe for several years.

Drought: Extended periods of drought can increase the risk of wildfire and compromise the health and habitats of wildlife. Drought conditions may also cause an increase on ground water pumping, which aggravates subsidence conditions. In turn, increased subsidence can reduce the capacity of channels by reducing slope. Additionally, increased fissure activity caused by subsidence may damage drainage structures and other infrastructure.

Step 2:

Identify Locations of Flood Hazards

The hazards described above were evaluated for all land in the unincorporated county. Maricopa County covers 9,226 square miles and is drained by the Gila River and five principal tributaries. Eight watersheds contribute to these major river systems:

- Agua Fria River
- Cave Creek south of the Arizona Canal and Salt River

- Centennial Wash
- Gila River and Queen Creek system
- Hassayampa River
- Lower Gila River
- Verde River
- Waterman Wash

Each watershed has unique characteristics that determine the flooding risk and influence activities that the District can employ to mitigate risk. The information in the following subsections includes physical descriptions and features for each watershed that were documented in the 2009 Plan (FCDMC, 2009). Summary tables are provided of hazards that were identified by the FMP Committee and by supplemental research.

2.2 Agua Fria Watershed Hazards

The Agua Fria watershed is located in and beyond north-central Maricopa County and covers 2,329 square miles (**Map 3**). About half of the watershed is unincorporated. The Arizona Canal Diversion Channel (ACDC), completed in 1993, marks the southern boundary of the watershed. Several dams and FRSs provide protection in the Agua Fria watershed: White Tanks FRS No. 3 and Adobe, Cave Buttes, Cave Creek, Dreamy Draw, McMicken, New River, and New Waddell dams. White Tanks FRS No. 3 was rehabilitated in 2011 to address safety deficiencies. All or portions of Avondale, Carefree, Cave Creek, El Mirage, Glendale, Goodyear, Litchfield Park, New River, Peoria, Phoenix, and Youngtown are within the watershed. Major transportation features include I-17, US 60 (Grand Avenue), SR 101, SR 303, and SR 74.

Major rivers and washes include reaches of Cave Creek, Skunk Creek, the New River, and the Agua Fria River. The Agua Fria River is ephemeral downstream of Lake Pleasant and New Waddell Dam. It is the main watercourse for conveying flows during flood events from the New River down to the Gila River. Cave Creek and Skunk Creek are highly prone to flash flooding. The 100-year flow depths of Cave Creek at wash crossings of major roads in the town of Cave Creek range from 2.5 to 8.5 feet and velocities from 4.5 to 10.5 feet per second (fps). Corresponding lead time is estimated to be 30 minutes based on rain and stream gage thresholds, but earlier notifications are made based on NWS storm watches and warnings (LTM, 2007). The 100-year flow depths on Skunk Creek are estimated to be above five feet with corresponding velocities of 4.5-5 fps (JEF, 2009). The areas draining to the Agua Fria and New rivers are larger and lead time is longer. As expected, flow depths are greater than that for the smaller watercourses.


Gila River near the Agua Fria River

Valuable wildlife habitat exists in the watershed, particularly along the Agua Fria River just below Lake Pleasant and at its confluence with the Gila River.

The Phoenix Sonoran Preserve in north Phoenix encompasses more than 5,000 acres of pristine desert land. The land in the preserve is unique, characterized by lush and diverse plant and animal life.

The central and southern portions of the Agua Fria watershed are comparatively flat. The northern part and southwest corner contain several mountain ranges with slopes greater than 10%. The watershed has significant natural vegetation in the north and western areas. The river channel is carved into hard rock north of the CAP Canal to Lake Pleasant. However, during flood events, the river channel south of the crossing of the CAP Canal siphon has a tendency to shift from side to side (lateral migration) and erode its banks. Hazards identified in the watershed are presented in **Table 5**.

Table 5: Hazards Affecting the Agua Fria Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	White Tanks FRS No. 3 and Adobe, Cave Buttes, Cave Creek, Dreamy Draw, McMicken, New River and New Waddell dams provide downstream flood protection for large metropolitan areas and farmlands, Luke AFB, and major transportation corridors (I-17, US 60, SR 101, SR L303). White Tanks FRS No. 3 was rehabilitated in 2011 to address safety deficiencies.
Embankment overtopping	The CAP Canal traverses the watershed; the Beardsley Canal is located in the southwest portion.
Levee failure	None in unincorporated county. In the urban areas, levees exist on Scatter Wash and Skunk Creek and the New, Agua Fria, and Salt rivers.
Single-lot development	Single-lot development is predominant in unincorporated areas, especially Wittmann, New River, and Desert Hills.
Undelineated floodplains	Large areas of undeveloped land in the northern portion lack delineated floodplains.
In-channel activities	Hiking/biking trails, camping, ATV use, low water crossings, bridges, aggregate mining.
Repetitive losses	One unincorporated location east of Luke AFB.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	About 32% of the watershed has high runoff potential.
Sheet and split flows	Significant sheet flow conditions and braided washes.
Alluvial fans	Alluvial fans present in the Hieroglyphic Mountains.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the rivers and washes.
Fissures	Confirmed and unconfirmed fissures have been identified by the

Hazard	Description
	Arizona Geological Survey (AZGS) near SR 303 between Indian School Road and Peoria Avenue and in the vicinity of Luke Air Force Base. Note that a fissure was detected at the south end of McMicken Dam and was remediated in 2005.
Wildfires	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a medium to high hazard rating in the northern portion of the watershed.

2.3 Cave Creek/Salt Watershed Hazards

The Cave Creek/Salt watershed covers 506 square miles and drains to the Salt River between the Verde and Agua Fria rivers. It includes Indian Bend Wash and a portion of the Cave Creek watershed south of the ACDC (**Map 4**). It is traversed by the CAP, Arizona, and Crosscut canals. All or portions of Avondale, Glendale, Paradise Valley, Phoenix, and Scottsdale are located within the watershed. Major transportation facilities include Sky Harbor International Airport and portions of I-17, I-10, SR 51, SR 101, and Grand Avenue.

Much of the watershed has been developed or is part of lands governed by the Salt River Pima-Maricopa Indian Community. Mountain preserves in the McDowell, Phoenix, and Papago mountains restrict new development; large tracts of developable areas are primarily located north of the CAP Canal. Alluvial fans in the northern portion of the watershed are associated with large regulatory floodplains.

The repetitive loss area of Holly Acres is located at the confluence of the Salt, Agua Fria, and Gila rivers in the southwestern corner of the Cave Creek/Salt watershed. In 2012, the U.S. Army Corps of Engineers, in conjunction with the City of Phoenix and the District, completed the Tres Rios North Levee, which offers protection from the 1%-chance flood. The District has submitted a Letter of Map Revision (LOMR) to FEMA.

Hazards identified in the watershed are presented in **Table 6**.

Table 6: Hazards Affecting the Cave Creek/Salt Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	None in unincorporated county.
Embankment overtopping	The CAP and Grand canals traverse the watershed.
Levee failure	None in unincorporated county; levees along the Salt River and along Indian Bend Wash.
Single-lot development	Some pockets exist in unincorporated county, but much of the watershed is incorporated and development has been reviewed and approved through the regulatory process for subdivisions.
Undelineated floodplains	Large areas of undeveloped land in the northern portion lack

Hazard	Description
	delineated floodplains.
In-channel activities	Hiking/biking trails, camping, ATV use, low water crossings, and bridges. Active aggregate mining along the Salt River. Tempe Town Lake within the Salt River has high recreational activity.
Repetitive losses	One unincorporated repetitive loss area, Holly Acres.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	About 75% of the watershed has moderately low runoff potential.
Sheet and split flows	Significant sheet flow conditions and braided washes in the northern portions, particularly in the alluvial fan areas.
Alluvial fans	North of the CAP Canal in Phoenix, Scottsdale, and unincorporated county.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the rivers and washes.
Fissures	None in unincorporated county. A fissure was confirmed by the Arizona Geological Survey (AZGS) in Scottsdale near Frank Lloyd Wright Blvd/Cactus Rd, and an unconfirmed fissure was identified in Phoenix near 40th St./Cholla St.
Wildfires	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a low hazard rating for the I-10 corridor in south Phoenix and medium hazard for most of the remainder. Wash corridors and alluvial fan areas with dense vegetation are shown to have high hazard potential.

2.4 Centennial Watershed Hazards

The Centennial watershed covers 1,924 square miles in northwest Maricopa County and parts of Yavapai and La Paz counties (**Map 5**) Major transportation features include I-10 and US 60. Grass Wash, which traverses the agricultural community of Aguila in the far northwest corner of the county, is a significant tributary to Centennial Wash. Velocities for the 100-year flood event in Grass Wash are estimated to be 2.5-3 fps with expected lead times ranging from less than 30 minutes to nearly 4 hours (FCDMC, 2015). Much of the watershed is in its natural state and includes the Harquahala Mountains and Signal Mountain wilderness areas. Development in the watershed is primarily agricultural and single-lot residential. Hazards identified in the watershed are presented in **Table 7**.

Table 7: Hazards Affecting the Centennial Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	Harquahala and Saddleback FRSs are located on the north and south sides of I-10, respectively, near the Salome Road crossing.
Embankment overtopping	The CAP Canal and I-10 traverse the watershed. Numerous irrigation berms are located in the agricultural areas.
Levee failure	Centennial Levee is south of I-10 near the Salome Road crossing.
Single-lot development	Existing development is predominantly single-lot and is located in and around farming operations.
Undelineated floodplains	Some vacant lands with future development potential in the Aguila area lack delineated floodplains.
In-channel activities	Hiking/biking trails, camping, ATV use, and low water crossings.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	46% of the watershed has moderately low runoff potential.
Sheet and split flows	Sheet flow conditions and braided washes in the alluvial fan areas and valley plains.
Alluvial fans	An area was identified on the west border of the county in the vicinity of Eagle Eye Road.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the rivers and washes.
Fissures	The AZGS mapped two active fissures south of I-10: one across Aguila Rd near the Maricopa/La Paz County border and another west of Harquahala Valley Rd. Two fissures were also documented in the Wintersburg area.
Wildfires	For the mapped (urban) portion of the watershed, the draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a medium hazard rating for portions of the Harquahala Valley and the Harquahala Mountains Wilderness intermixed with isolated high-hazard areas. Wash corridors with dense vegetation north and south of I-10 in the southwest and south-central portions are shown as medium hazard potential.

2.5 Gila/Queen Creek Watershed Hazards

The Gila/Queen Creek watershed covers 1,307 square miles in southeast Maricopa County and part of Pinal County (**Map 6**). The Gila River Indian Reservation covers the southwest portion of the watershed. Most of the remaining land includes heavily-developed portions of Chandler, Gilbert, Mesa, Phoenix, and Tempe, as well as a mix of urban/rural/agricultural development in Queen Creek. The unincorporated area of the county consists mostly of small county islands. South Mountain Park, Phoenix-Mesa Gateway Airport, and portions of I-10, US 60, SR 101, and SR 202 are within the watershed.

Queen Creek, Sonoqui Wash, and the East Maricopa Floodway (EMF) are significant watercourses that drain to the Salt River, which is the north boundary of the watershed. Hazards identified in the watershed are presented in **Table 8**.

Table 8: Hazards Affecting the Gila/Queen Creek Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	Buckhorn-Mesa Structures & floodways: Spook Hill FRS and Floodway are in Mesa and protect several unincorporated county islands as well as portions of Mesa. Signal Butte FRS is in unincorporated county; Apache Junction FRS is in Pinal County and protects several unincorporated islands in Maricopa County. PVR FRSs: Powerline, Vineyard Road, and Rittenhouse FRSs are in Pinal County and protect several unincorporated county islands and portions of Mesa, Queen Creek, and Gilbert. Guadalupe FRS is located in Tempe and protects a small county island and portions of Phoenix, Tempe, and Guadalupe.
Embankment overtopping	The CAP, Western, Highline, Consolidated, Eastern, Tempe, and South canals traverse the watershed. Smaller irrigation canals are present in the agricultural areas of Queen Creek.
Levee failure	The Pass Mountain Diversion Channel Levee is located in unincorporated county as part of the Signal Butte FRS. Levees are also present on the east and west banks of the East Maricopa Floodway in Mesa.
Single-lot development	The Mountain/Erie county island on the east county border is single-lot. Single-lot development is present throughout the developable areas of the watershed.
Undelineated floodplains	Most of the watershed is developed and there is little opportunity to delineate new floodplains.
In-channel activities	Hiking/biking trails, camping, ATV use, low water crossings, and bridges. Aggregate mining along the Salt River.
Repetitive losses	One unincorporated location in the Laveen area.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	78% of the watershed has moderately low runoff potential.
Sheet and split flows	Sheet flow conditions and braided channels are limited to undeveloped land and low-density development. Queen Creek and Sonoqui Wash are braided in the unimproved reaches.
Alluvial fans	None have been identified.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the unimproved reaches of watercourses.

Hazard	Description
Fissures	Significant fissure activity was confirmed by the AZGS in the Empire Blvd (Hunt Hwy) corridor. Numerous confirmed and unconfirmed fissures reported by AZGS near US 60/Meridian Rd and in Pinal County between US 60 and Guadalupe Rd. A fissure was detected at the downstream toe of Powerline FRS in Pinal Co. and remediated in 2014.
Wildfires	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a medium hazard rating in portions of the watershed and high in the Gila River corridor. The remainder of the watershed has no hazard rating.

2.6 Hassayampa Watershed Hazards

The Hassayampa watershed covers 1,063 square miles in northwest Maricopa and part of Yavapai counties (**Map 7**). I-10, US 60, and Sun Valley Parkway are the major transportation routes. The watershed includes Buckeye and Wickenburg, and most development is concentrated in these locations. However, more than half of the county land in the watershed is either privately owned or is State Trust Land. Smaller tributaries are very prone to flash flooding. In the town of Wickenburg, typical flood depths range from 2.5 to 8.5 feet and velocities from 4.5 to 10.5 feet per second (fps). Typical corresponding lead time is estimated to be 0-30 minutes based on rain and stream gage thresholds, but earlier notifications are made based on NWS storm watches and warnings. In this area, lead times for flooding on the Hassayampa River are somewhat longer at 75-90 minutes (LTM, 2009).

Jackrabbit Wash drains to the Hassayampa River north of I-10 and is a significant tributary to the river system. Hazards identified in the watershed are presented in **Table 9**.

Table 9: Hazards Affecting the Hassayampa Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	The Buckeye Structures (Buckeye FRS Nos. 1, 2, and 3 and floodways) are located at the south end of the watershed north of I-10. The Wickenburg Structures (Sunset and Sunnycove FRSs and Casandro Wash Dam) provide protection for the town and surrounding areas.
Embankment overtopping	The CAP Canal traverses the midsection and the Roosevelt Irrigation and Buckeye canals cross the southern tip of the watershed.
Single-lot development	Predominant residential type in unincorporated areas.
Undelineated floodplains	Large areas of undeveloped land in the northern portion lack delineated floodplains.
In-channel activities	Hiking/biking trails, camping, ATV use, low water crossings, and bridges.

Hazard	Description
Repetitive losses	One unincorporated location along the Hassayampa River south of Wickenburg.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	About 32% of the watershed has high runoff potential.
Sheet and split flows	Significant sheet flow conditions and braided washes.
Alluvial fans	On the west side of the White Tank Mountains.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the river and tributary washes.
Wildfires	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a medium to high hazard rating in the mapped (urban) portion of the watershed.

2.7 Lower Gila Watershed Hazards

The Lower Gila watershed covers 1,522 square miles in southwest Maricopa County (**Map 8**). Major features include the Gila River, Painted Rock Dam, I-8, and MC 85. Very little development has occurred south of I-8, and most of the land is occupied by the Barry M. Goldwater Air Force Range. North of I-8, development is limited to agriculture. Velocity of flow in the portion of the Gila River within the watershed is typically low as a result of relatively flat bed slopes and an abundance of vegetation such as tamarisk trees and reeds. Hazards identified in the watershed are presented in **Table 10**.

Table 10: Hazards Affecting the Lower Gila Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	The U.S. Army Corps of Engineers' Painted Rock Dam is in the northeast portion of the watershed.
Embankment overtopping	Irrigation canals support farming operations in the watershed.
Single-lot development	Very few, isolated structures that support farming operations.
Undelineated floodplains	A number of washes are delineated as Zone A (approximate). Natural washes on much of the remaining developed/developable land have been eliminated by farm fields.
In-channel activities	Agricultural fields.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	About half of the watershed has high runoff potential.
Sheet and split flows	Significant sheet flow conditions and braided washes.
Alluvial fans	None have been identified.

Hazard	Description
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the river and tributary washes.
Wildfires	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a high hazard rating in the Gila River corridor.

2.8 Verde Watershed Hazards

The Verde watershed covers 3,216 square miles in northeast Maricopa County, although much of the area lies within Gila County (**Map 9**). Fountain Hills, Rio Verde, and portions of Mesa are within the watershed. Major features include the Salt and Verde rivers, Sycamore Creek, SR 87, SR 88, and a small segment of SR 202. Much of the watershed is within the Tonto National Forest; developable/developed areas are limited to the southwest portion. Hazards identified in the watershed are presented in **Table 11**.

Table 11: Hazards Affecting the Verde Watershed in Unincorporated Maricopa County

Hazard	Description
Dams	Bartlett and Horseshoe dams are on the Verde River. Salt River dams include Roosevelt at the eastern tip of the county, Horse Mesa, Mormon Flat, and Stewart Mountain. The Buckhorn-Mesa Structures & floodways form the Verde and Gila/Queen Creek watershed boundary.
Single-lot development	The community of Rio Verde is a mix of subdivisions and single-lot development.
Undelineated floodplains	A number of floodplains are delineated in the Rio Verde Area. Additional delineated floodplains are expected to be approved by FEMA by November 2015. The natural flow exhibits shallow, distributary characteristics and floodplains are difficult to delineate.
In-channel activities	High recreation use in the lakes created by the dams on both rivers.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	The watershed has a mix of moderately low, moderately high, and high runoff potential.
Sheet and split flows	Significant sheet flow conditions and braided washes.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the rivers and tributary washes.
Wildfires	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a high hazard rating in the northern and eastern portions of the watershed and moderate for most of the remaining portion.

2.9 Waterman Watershed Hazards

The Waterman watershed covers 2,472 square miles in southern Maricopa County and a portion of Pinal County (**Map 10**). The Gila River is the most prominent drainage feature; it flows west through Goodyear and Buckeye and adjacent to Gila Bend. Velocity of flow in the portion of the Gila River within the watershed is typically low as a result of relatively flat bed slopes and an abundance of vegetation such as tamarisk trees and reeds. Major transportation routes include I-8, I-10, and SR 85. Waterman Wash is a large tributary that flows northwest through Goodyear and joins the Gila River near Buckeye. The Sonoran Desert National Monument covers much of the watershed, and development in the remainder of unincorporated county is primarily agricultural with some single-lot residential. The Solana Generating Station, a large solar power facility, is located north of I-8 in the far west portion of the watershed. Hazards identified in the Waterman watershed are presented in **Table 12**.

Table 12: Hazards Affecting the Waterman Watershed in Unincorporated Maricopa County

Hazard	Description
Embankment overtopping	Numerous irrigation berms are located in the agricultural areas near Gila Bend.
Single-lot development	Single-lot development is predominant in Mobile and on the south side of the Gila River near Goodyear.
Undelineated floodplains	Some vacant lands with future development potential in the Waterman Wash corridor and south of Gila Bend lack delineated floodplains.
In-channel activities	Agricultural fields.
Flash flooding	Entire watershed is susceptible.
High runoff potential of some soils	65% of the watershed has moderately low runoff potential; 24% has high potential.
Sheet and split flows	Sheet flow conditions and braided washes in the alluvial fan areas and valley plains.
Lateral migration and erosion of natural streams	Significant lateral migration and erosion in the river and washes. Waterman Wash and vicinity have highly-erosive soils.
Fissures	The AZGS identified an unconfirmed fissure near 78th Ave. north of SR 238 near the community of Mobile.
Wildfires	For the mapped portion of the watershed, the draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a high hazard rating for several reaches of the Gila River and Estrella Mountains. The Luke Wash corridor and Gila River floodplain are shown as medium hazard potential.

2.10 Other Hazards

Several other natural and man-made hazards were evaluated to ascertain the likelihood and severity of impacts throughout the entire county. The information was taken from the draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan (JEF, 2015). According to the plan, hazards related to floodplain management and identified for mitigation strategies for unincorporated Maricopa County include:

- Dam Discharge Inundation
- Fissures
- Flooding
- Levee failure
- Subsidence
- Wildfire
- Severe wind
- Drought
- Tornadoes and earthquakes

Most of these hazards were identified for each watershed in Sections 2.2 – 2.9. The remaining hazards affect the entire county similarly and are discussed below.

2.10.1 Severe Wind

Severe wind often accompanies thunderstorm activity. It can exacerbate flooding conditions by increasing debris flow that blocks natural and constructed drainage systems. Also, the movement of man-made debris through the drainage system could introduce contaminates and degrade the integrity of wildlife habitat.

Severe wind also commonly causes low-visibility dust storms, which can create hazardous driving conditions and increases airborne particulate matter.

2.10.2 Drought

The U.S. Drought Monitor recently estimated drought conditions in Maricopa County to be predominantly moderate. The southern portion of the Centennial watershed and the Lower Gila watershed north of I-8 were estimated to be abnormally dry.

As previously noted drought can increase the risk of wildfire and compromise the health and habitats of wildlife in the floodplains. Drought conditions cause a decrease in vegetation and may cause increases in ground water pumping, which aggravates subsidence conditions. In turn, increased subsidence can reduce the capacity of channels by reducing slope. Additionally, increased fissure activity caused by subsidence may damage drainage structures and other infrastructure.

2.10.3 Tornadoes and Earthquakes

Tornadoes and earthquakes were also evaluated; however, the occurrence of tornadoes has been historically rare and isolated. Infrequent, mild earthquakes have been recorded in other parts of Arizona, but none have occurred in Maricopa County and none have resulted in any structural damage. Therefore, they are not considered to be a significant threat to the community.

2.11 Less-Frequent Flood Hazards

Maricopa County has enjoyed significant flood protection for many years from a number of dams and levees. These structures provide valuable flood protection to urban populations, farmlands, the transportation infrastructure, Luke Air Force Base, and many critical facilities. The District operates 22 dams and FRSs in and around Maricopa County (**Table 13**) and 24 levees on nine watercourses (**Table 14**). The estimated downstream inundation areas of dams and FRSs are shown on **Map 11**, and inundation areas for levees are shown on **Map 12**.

Table 13: Inventory of Flood Control District Dams and FRSs

Structure		Date Constructed	O&M Responsibility	Federal Sponsor
1	Adobe Dam	1982	FCDMC	USACE
2	Apache Junction FRS & Floodway	1988	FCDMC	NRCS
3	Buckeye FRS No. 1 & Floodway	1974	FCDMC	NRCS
4	Buckeye FRS No. 2 & Floodway	1975	FCDMC	NRCS
5	Buckeye FRS No. 3 & Floodway	1975	FCDMC	NRCS
6	Casandro Wash Dam & Outlet	1996	FCDMC	N/A
7	Cave Buttes Dam & Dikes	1980	FCDMC	USACE
8	Dreamy Draw Dam	1974	FCDMC	USACE
9	Guadalupe FRS	1975	FCDMC	NRCS
10	Harquahala FRS & Floodway	1983	FCDMC	NRCS
11	McMicken Dam	1956	FCDMC	USACE
12	New River Dam	1985	FCDMC	USACE
13	Powerline FRS & Floodway	1967	FCDMC	NRCS

Structure		Date Constructed	O&M Responsibility	Federal Sponsor
14	Rittenhouse FRS	1969	FCDMC	NRCS
15	Saddleback FRS & Diversion Channel	1982	FCDMC	NRCS
16	Signal Butte FRS & Floodway	1987	FCDMC	NRCS
17	Spook Hill FRS & Floodway	1979	FCDMC	NRCS
18	Sunnycove FRS	1976	FCDMC	NRCS
19	Sunset FRS	1976	FCDMC	NRCS
20	Vineyard Road FRS	1968	FCDMC	NRCS
21	White Tanks FRS No. 3	1954	FCDMC	NRCS
22	White Tanks FRS No. 4	1953	FCDMC	NRCS

Table 14: Inventory of Flood Control District Levees

Structure		Constructed by	Date Completed
1	Agua Fria River #3 CBRLN	FCDMC	1998
2	Agua Fria River #8	FCDMC	1988
3	Agua Fria River #11 CBRLS	FCDMC	1998
4	Agua Fria River #16	USACE	1989
5	Agua Fria River #18	FCDMC & USACE	1989
6	Centennial Wash Levee	NRCS	1985
7	East Maricopa Floodway	NRCS	1985
8	East Maricopa Floodway	NRCS	1987
9	Indian Bend Wash IBW1	USACE	1986
10	Indian Bend Wash IBW2	USACE	1979
11	Indian Bend Wash IBW3	USACE	1986
12	Indian Bend Wash IBW4	USACE	1979
13	Indian Bend Wash IBW5	USACE	1979
14	Indian Bend Wash IBW6	USACE	1979
15	New River #30 NR1	USACE	1989
16	New River #30 NR2	USACE	1989
17	Pass Mountain Diversion	NRCS	1984
18	Salt River #33 North Levee	ADOT	1989
19	Salt River #33 South Levee	ADOT	1989
20	Skunk Creek SK1	USACE	1983
21	Skunk Creek SK2	USACE	1983
22	Scatter Wash North Levee	ADOT	1991
23	Scatter Wash South Levee	ADOT	1991
24	Tres Rios North Levee	USACE	2012

These flood control structures are normally dry and operate only in severe flood events. The District runs a rigorous operations & maintenance program and has a robust real-time 24/7 monitoring system. The likelihood of failure is extremely low. However, if stormwater is released through an emergency spillway or a failure occurs at any of these structures, large areas would potentially be inundated.


New River Levee and multi-use trail

The District has developed emergency action plans for all 22 dams and FRSs to monitor the structures and identify notification and response procedures in the event of a discharge to downstream areas. Additionally, emergency action plans are in place for three of the levee systems and the District intends to develop plans for the remaining levees. Finally, the District has developed a Dam Safety Flood Response Manual that includes detailed procedures for monitoring conditions as they develop and taking measures to stop or minimize any damage that may be occurring to the structure (LTM, 2011).

2.12 Impacts of Potential Future-Condition Changes to Floodplains

The District recognizes that the community's floodplain health is a valuable asset that needs to be maintained into the future. The ability to manage the complex natural and man-made drainage systems is essential to providing sustainable flood control, wildlife habitat, and recreational enjoyment. Potential impacts of future conditions affecting floodplains are described below.

2.12.1 Changes in Demographics

Maricopa County's employment centers are concentrated in the metropolitan Phoenix area. No major employment centers are located in unincorporated Maricopa County. As shown on **Map 13**, the higher population densities are strongly correlated geographically with the employment centers (MAG 2013).

Population projections show an increase in total population from just over four million in 2014 to more than six million in 2035. Density estimates for 2010 and 2030 are presented on **Map 14** and **Map 15,** respectively (MAG, 2013). Overall, the projected population patterns are stable, with expansion of existing development outward from Phoenix. New growth areas are anticipated in the Waterman watershed.

A significant portion of projected growth areas has shallow, poorly-defined washes that are sensitive to changes in flow characteristics. Impacts to the floodplains in these areas are expected to be significant, so drainage plans for new development should be coordinated to the greatest extent possible.

2.12.2 Future Development in the Watershed

As development continues in the watersheds, drainage patterns tend to become more concentrated. Fortunately, current subdivision regulations include a requirement to retain runoff from the 100-year, 2-hour storm event. Additionally, any development is required to accommodate offsite runoff; the location, flow rate, and velocity of stormwater leaving a property must be preserved under pre-development conditions. Therefore, impacts of future development are expected to be largely mitigated.

2.12.3 Climate Change

Executive Order 13677 was issued by President Obama on September 23, 2014. The order, *Climate-Resilient International Development*, requires that climate change be considered in federally-funded risk management activities. Long-term changes in climate conditions could impact the variability, frequency, and severity of floods over time and alter the ability of watercourses to perform drainage functions. Another consideration is that climate change could compromise flora and fauna habitats. Additionally, the impact would extend to aggravating conditions such as wildfires, drought, and severe wind. Existing drainage facilities could be overtaxed, which would effectively reduce the level of flood protection. A mitigating factor is that freeboard is built into the design of retention/detention and conveyance facilities. Freeboard may serve to buffer any future increases in storm severity.

2.13 Past Flood Events: 2009-2014

Several significant flood events have occurred since publication of the previous FMP:

January 19-21, 2010: A powerful winter storm system brought heavy precipitation and caused $4 million in damage. Much of the region received one to five inches of total rainfall over three days, with up to ten inches recorded by District gages in the mountains on the northeastern edge of Maricopa County. A state of emergency was declared by the state, which included Maricopa County. Damages in the county were estimated to exceed $2.5 million (ADEMA, 2015, and NCDC, 2014).

July 31, 2012: An intense, slow-moving severe thunderstorm produced heavy rainfall in and around the Anthem community in north-central Maricopa County. District rain gages and independent weather observers recorded rainfall between 1.38 and 5.01 inches in a 90-minute period. Storm water damaged several homes in Anthem, with up to three feet of flood water inside some of the structures.

August 12, 2014: A cluster of thunderstorms caused flooded roads, damage to farmlands, and flooded residences and businesses. Based on rainfall captured by District gages, storm return periods were estimated to be in the 500-900 year range for the 2-hour storm duration.

August 19, 2014: Tropically-enhanced rainfall across northern Maricopa County caused very high discharges on New River, Skunk Creek, and Cave Creek. Rainfall estimates indicated up to 500-year storm return periods. Several home and businesses were damaged. Floodwaters broke over the west bank of Skunk Creek and inundated portions of Interstate 17.

September 8, 2014: Tropical moisture from Hurricane Norbert began to fall as rain in the early morning, and by morning rush hour many Valley cities were crippled. In a six-hour period, some areas of the Southeast Valley received over five inches of rain, a 1,000-year return period. Homes in Mesa were flooded by an over-taxed system of flood basins on the north side of US 60 and I-10 was closed for several hours due to flooding. A presidential disaster was declared following severe flooding on September 8, 2014. Disaster damage reports from the storm were evaluated; according to ADEMA, the September flooding caused an estimated 16.3 in Maricopa County (Slutsky, 2014).

September 27, 2014: This final major storm of Monsoon 2014 affected East Valley cities and northeast unincorporated county with up to 50-year rainfall return periods.

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3. Assessment of Flooding Problems

The hazards identified in the previous section were evaluated to determine what problems, if any, they create within each watershed. Although a hazard may exist, if there is no human activity, no problem is created by the hazard. Summary tables of problems caused by the flood hazards identified in Section 2 are presented in the following subsections.

3.1 Agua Fria Watershed Flooding Problems

Table 15: Identified Flooding Problems of the Agua Fria Watershed

	Issue	Impact
Dams	**Life, safety, health, evacuation**	Hiking trails & other recreation along McMicken, Adobe, Cave Buttes, & New River dams. After major events, damage (seen & unseen) should be evaluated and addressed ASAP. Consider redundant systems where needed.
	Public health hazards caused by flooding	Popping manhole lids at some locations. Water and sewer lines in the Adobe Dam reservoir pool could exacerbate emergency conditions.
	Critical facilities	Dams protect numerous hospitals, rescue centers, police/fire stations, airports, Luke AFB.
	Transportation	No downstream ingress/egress if dams discharge or fail; need one lane free from flooding.
	Flood insurance claims	May decrease due to increased flood protection.
	Economic	Support economy by providing flood protection. High negative impact to businesses/employment centers during a dam emergency spillway discharge or dam failure, but likelihood of occurrence is very low.
	Natural floodplain functions	Provides open space. Dams cut off water to downstream reaches of washes but provide habitat in the upstream reservoir pool.
Embankment Overtopping	**Life, safety, health, evacuation**	Identify evacuation areas or centers. Skunk Creek & CAP Canal and Beardsley Canal are upstream of large population centers.
	Public health hazards caused by flooding	Canal breaches cause flooding downstream.
	Critical facilities	Rescue centers, hospitals. Consider the use of audible alerts (sirens).
	Transportation	One dry lane needed for access/egress.
	Flood insurance claims	Risk for structures upstream & downstream of canals.
	Economic	Damage to Zone X structures (moderate to low flood risk).
	Natural floodplain functions	Recreation in impoundment areas. Canals modify natural floodplains, both beneficially and detrimentally.
Single-lot development	**Life, safety, health, evacuation**	Wittmann, New River, and Desert Hills are affected. Need positive drainage. Streams may be filled in on some lots. Emergency access needed.
	Public health hazards caused by flooding	Flooded streets. Animal waste conveyed downstream in rural/large-lot properties.
	Critical facilities	No significant impact.

	Issue	Impact
	Transportation	Road closures, access issues, high maintenance for road clearing. Limited regulation of floodplains in watershed.
	Flood insurance claims	Uncoordinated drainage system could increase number of claims.
	Economic	Flooded residences.
	Natural floodplain functions	Uncoordinated drainage systems tend to negatively interrupt natural flow patterns and behavior.
Undelineated floodplains	**Life, safety, health, evacuation**	Approximate A Zone delineations should be restudied with the understanding that adjacent land will be developed.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness.
	Flood insurance claims	Many residents are unaware of flooding risk.
	Economic	Unexpected flooding interrupts commerce and results in property damage.
	Natural floodplain functions	Would be adversely affected by unregulated development.
In-channel activities	**Life, safety, health, evacuation**	Human activity such as trails, camping, ATV use, low water crossings, bridges. Unpermitted/non-conforming agricultural or mining use. Consider dedicated storage capacity in mining operations.
	Public health hazards caused by flooding	In-channel activity can result in injury or death during a flash flood.
	Critical facilities	N/A
	Transportation	Numerous at-grade road crossings prevent access/egress and increase risk to personal safety.
	Flood insurance claims	N/A
	Economic	Aggregate mining equipment and/or recreational facilities could be damaged by floods.
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.
Repetitive losses	**Life, safety, health, evacuation**	Need to publish evacuation routes with at least one driving lane open for access/egress in the repetitive loss area near Luke AFB.
	Public health hazards caused by flooding	Increases potential exposure to post-flood hazards such as mold growth.
	Critical facilities	Rescue centers needed more often.
	Transportation	Access/egress repeatedly flooded.
	Flood insurance claims	Comparatively more claims made.
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	No significant impact.
Flash flooding	**Life, safety, health, evacuation**	Areas in the New River community were flooded in the 2014 storms. Improve communications listing areas impacted. Show evacuation routes and safe distances from areas impacted. Sun City/Sun City Grand may need special mobilization plans for evacuation. Communication messages should be consistent during floods.
	Public health hazards caused by flooding	Improve communications listing areas impacted. Animal waste conveyed downstream in rural/large-lot properties.
	Critical facilities	New River Elementary School is adjacent to the New River floodplain.

	Issue	Impact
	Transportation	Major transportation corridors may be impassible. Depressed roadways or at-grade road crossings are flooded. Dove Valley Rd @ Carefree Highway was damaged in 2014 storms & prevented access.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Losses to major employment centers if ingress/egress is compromised.
	Natural floodplain functions	Recreational activity is at risk. Consider user check in/out system at trailheads where flash flood potential is high.
High runoff potential of some soils	**Life, safety, health, evacuation**	Mountainous areas in Peoria and Deer Valley have high runoff potential. Construct grade breaks to slow down velocity of the runoff.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Short basin response times in & around mountains increase risk at road crossings.
	Flood insurance claims	May increase.
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Level of risk to life and property is uncertain.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	Roads interrupt the drainage patterns and concentrate flows.
	Flood insurance claims	Would increase due to greater uncertainty of risk.
	Economic	Population growth has channelized sheet flow and increased flood risk.
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.
Alluvial fans	**Life, safety, health, evacuation**	Alluvial fans present in the Hieroglyphic Mountains. Perceived risk may be lower than actual, so preparedness is diminished.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways.
	Flood insurance claims	Many residents are unaware of flooding risk and do not have flood insurance.
	Economic	Unexpected flooding interrupts commerce and results in property damage.
	Natural floodplain functions	Fans provide important wildlife habitat.
Lateral erosion of natural streams	**Life, safety, health, evacuation**	The Agua Fria River migrates laterally except where it is channelized.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.

	Issue	Impact
	Economic	High costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourse.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Fissures	**Life, safety, health, evacuation**	Fissures near SR 303 between Indian School Rd. and Peoria Ave. and in the vicinity of Luke AFB. High localized risk if fissure opens up and creates a new watercourse. Coordination with AZGS is needed.
	Public health hazards caused by flooding	Hazardous materials could be transported if a fissure opens up and creates a new watercourse. Example: trucks transporting hazardous material on SR 303 are at risk if a fissure causes road damage during a storm.
	Critical facilities	SR 303 and Luke AFB are impacted.
	Transportation	Could result in lengthy access/egress issues if damage occurs to SR 303 or surrounding roads.
	Flood insurance claims	Could increase if new areas are exposed to flooding.
	Economic	Longer-term access/egress interruptions if SR 303 is damaged.
	Natural floodplain functions	Could dramatically alter the location and behavior of drainage and reduce flora and fauna habitats.
Wildfires	**Life, safety, health, evacuation**	Transfer of sediment downstream after a wildfire. Cave Creek Complex Fire resulted in sediment transfer and increases in flash flood potential.
	Public health hazards caused by flooding	Post-fire debris flow increases risk to public health.
	Critical facilities	Downstream flood risk to increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.2 Cave Creek/Salt Watershed Flooding Problems

Table 16: Identified Flooding Problems of the Cave Creek/Salt Watershed

	Issue	Impact
Overtopping of embankments	**Life, safety, health, evacuation**	The CAP and Grand canals traverse the watershed. Need to Identify evacuation areas or centers.
	Public health hazards caused by flooding	Canal breaches cause flooding downstream in unpredictable locations.
	Critical facilities	Rescue centers, hospitals may be inundated.
	Transportation	Downstream roads may be inundated. One dry lane needed.
	Flood insurance claims	Risk to structures upstream & downstream of canals is increased.
	Economic	Damage to Zone X structures, O&M plans.
	Natural floodplain functions	Recreation in impoundment areas. Canals modify natural floodplains, both beneficially and detrimentally.

	Issue	Impact
Single-lot development	**Life, safety, health, evacuation**	Flooding is usually unpredictable. Most affected properties are not in an identified floodplain. Pre-FIRM development is typically slab-on-grade and very susceptible to flooding. Exacerbated by roads and more recent developments.
	Public health hazards caused by flooding	Flooded streets. Lots are typically large, and many keep horses. Animal waste conveyed downstream in rural/large-lot properties.
	Critical facilities	No significant impact.
	Transportation	Road closures, access issues, high maintenance for road clearing. Limited regulation of floodplains in watershed.
	Flood insurance claims	Uncoordinated drainage system could increase number of claims.
	Economic	Flooded residences.
	Natural floodplain functions	Uncoordinated drainage systems tend to negatively interrupt natural flow patterns and behavior.
Undelineated floodplains	**Life, safety, health, evacuation**	Approximate A Zone delineations should be restudied with the understanding that adjacent land will be developed.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness. Ingress/egress is restricted and post- flood maintenance is needed.
	Flood insurance claims	Many residents are unaware of flooding risk.
	Economic	Unexpected flooding interrupts commerce and results in property damage. Increased post-flood maintenance costs.
	Natural floodplain functions	Would be adversely affected by unregulated development. More critical to minor and medium-sized washes.
In-channel activities	**Life, safety, health, evacuation**	Human activity such as trails, camping, ATV use, low water crossings, bridges. Unpermitted/non-conforming agricultural or mining use. Consider dedicated storage capacity in mining operations.
	Public health hazards caused by flooding	In-channel activity can result in injury or death during a flash flood.
	Critical facilities	N/A
	Transportation	Numerous at-grade road crossings prevent access/egress and increase risk to personal safety.
	Flood insurance claims	N/A
	Economic	Aggregate mining equipment in the Salt River and/or recreational facilities could be damaged by floods.
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.
Repetitive losses	**Life, safety, health, evacuation; public health hazards caused by flooding; critical facilities; transportation; flood insurance claims; economic; natural floodplain function**	Holly Acres is located in unincorporated county. Recent completion of Tres Rios North Levee in Phoenix will reduce risk to neighborhood and is expected to remove the repetitive loss designation.

	Issue	Impact
Flash flooding	**Life, safety, health, evacuation**	Entire watershed is susceptible to flooding. Need effective, consistent communication during floods. Evacuation routes may be interrupted, dictating shelter-in-place.
	Public health hazards caused by flooding	Sanitary sewers may be affected. Animal waste conveyed downstream in rural/large-lot properties. Need to improve communications listing areas impacted.
	Critical facilities	Public transportation and power infrastructures are in unincorporated county. Need to show evacuation routes and safe distances from areas impacted.
	Transportation	Directly affected – most deaths during flooding are transportation-related.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Losses to major employment centers if ingress/egress is compromised.
	Natural floodplain functions	Upper Cave Creek to Carefree Highway is an important bird habitat.
High runoff potential of some soils	**Life, safety, health, evacuation**	Runoff typically includes greater transport of sediment.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Short basin response times in & around mountains increase risk at road crossings.
	Flood insurance claims	May increase.
	Economic	Comparatively more frequent property damages. Could be costly. Losses to major employment centers if ingress/egress is compromised.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Level of risk to life and property is uncertain.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	Roads interrupt the drainage patterns and concentrate flows.
	Flood insurance claims	Would increase due to greater uncertainty of risk.
	Economic	Population growth has channelized sheet flow and increased flood risk.
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.
Alluvial fans	**Life, safety, health, evacuation**	Alluvial fans present in the White Tank and Hieroglyphic Mountains. Perceived risk may be lower than actual, so preparedness is diminished.
	Public health hazards caused by flooding	Alluvial fans present north of the CAP Canal in Phoenix and Scottsdale, but none in unincorporated county.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	N/A

Lateral erosion of natural streams	**Life, safety, health, evacuation**	Significant lateral migration and erosion in the rivers and washes can increase risk to adjacent properties.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.
	Economic	High costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourse.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Fissures	**Life, safety, health, evacuation**	Fissures near SR 303 between Indian School Rd. and Peoria Ave. and in the vicinity of Luke AFB. High localized risk if fissure opens up and creates a new watercourse. Coordination with AZGS is needed.
	Public health hazards caused by flooding	None in unincorporated county. A fissure was confirmed by the Arizona Geological Survey (AZGS) in Scottsdale near Frank Lloyd Wright Blvd/Cactus Rd, and an unconfirmed fissure was identified in Phoenix near 40th St./Cholla St.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	N/A
Wildfires	**Life, safety, health, evacuation**	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a low hazard rating for the I-10 corridor in south Phoenix and medium hazard for most of the remainder. Wash corridors and alluvial fan areas with dense vegetation are shown to have high hazard potential. Transfer of sediment downstream and increased flash flood potential after a wildfire.
	Public health hazards caused by flooding	Post-fire debris flow increases risk to public health.
	Critical facilities	Downstream risk to access/egress problems increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.3 Centennial Watershed Flooding Problems

Table 17: Identified Flooding Problems of the Centennial Watershed

	Issue	Impact
Dams	**Life, safety, health, evacuation**	Harquahala and Saddleback FRSs are located on the north and south sides of I-10, respectively, near the Salome Road crossing. Limited activity downstream of the structures.
	Public health hazards caused by flooding	N/A
	Critical facilities	The CAP is downstream of the Harquahala FRS.
	Transportation	The Harquahala FRS provides valuable flood protection for I-10, but the freeway would be inundated by a dam failure.
	Flood insurance claims	No impact.
	Economic	I-10 is an important route for the region and commerce would be affected if it closed due to failure of the Harquahala FRS.
	Natural floodplain functions	Dams cut off water to downstream reaches of washes but provide habitat in the upstream reservoir pool.
Overtopping of embankments	**Life, safety, health, evacuation**	The CAP Canal and I-10 traverse the watershed, as well as numerous irrigation canals. Except for I-10 itself, there is very little activity upstream or downstream of embankments.
	Public health hazards caused by flooding	No impact.
	Critical facilities	No impact.
	Transportation	No impact.
	Flood insurance claims	No impact.
	Economic	No impact.
	Natural floodplain functions	Canals modify natural floodplains, both beneficially and detrimentally.
Levee failures	**Life, safety, health, evacuation**	The Centennial Levee is located south of I-10. However, there is very little human activity downstream.
	Public health hazards caused by flooding	No impact.
	Critical facilities	No impact.
	Transportation	No impact.
	Flood insurance claims	No impact.
	Economic	A levee failure may disrupt irrigation delivery and farming activity downstream.
	Natural floodplain functions	No impact.
Single-lot development	**Life, safety, health, evacuation**	Flooding is usually unpredictable. Pre-FIRM development is typically slab-on-grade and very susceptible to flooding.
	Public health hazards caused by flooding	Development is limited to the community of Aguila. Flooded streets are a frequent problem.
	Critical facilities	No significant impact.
	Transportation	Access/egress problems on local streets in Aguila.
	Flood insurance claims	Uncoordinated drainage system could increase number of claims.

	Issue	Impact
	Economic	Flooded residences and post flood road maintenance costs.
	Natural floodplain functions	Uncoordinated drainage systems tend to negatively interrupt natural flow patterns and behavior.
Undelineated floodplains	**Life, safety, health, evacuation**	Approximate A Zone delineations should be restudied with the understanding that adjacent land will be developed.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness. Ingress/egress is restricted and post- flood maintenance is needed.
	Flood insurance claims	Residents are unaware of flooding risk.
	Economic	Unexpected flooding causes property damage and interrupts farming operations. Increased post-flood maintenance costs.
	Natural floodplain functions	Would be adversely affected by unregulated development. More critical to minor and medium-sized washes.
In-channel activities	**Life, safety, health, evacuation**	Human activity such as hiking in the Harquahala Mountains and Signal Mountain wilderness areas. Hikers could be stranded during floods.
	Public health hazards caused by flooding	In-channel activity can result in injury or death during a flash flood.
	Critical facilities	N/A
	Transportation	Numerous at-grade road crossings prevent access/egress and increase risk to personal safety.
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.
Flash flooding	**Life, safety, health, evacuation**	Entire watershed is susceptible to flooding. Need effective, consistent communication during floods. Evacuation routes may be interrupted, dictating shelter-in-place.
	Public health hazards caused by flooding	Sanitary sewers may be affected. Animal waste conveyed.
	Critical facilities	The Harquahala Fire District's fire station and the Aguila Elementary School are within the floodplain. Public transportation and power infrastructures are in unincorporated county. Need to show evacuation routes and safe distances from areas impacted.
	Transportation	Directly affected – most deaths during flooding are transportation-related. Access to nuclear generating station may be impacted.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Losses to major employment centers if ingress/egress is compromised.

	Issue	Impact
	Natural floodplain functions	Upper Cave Creek to Carefree Highway is an important bird habitat.
High runoff potential of some soils	**Life, safety, health, evacuation**	Runoff typically includes greater transport of sediment.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Short basin response times in & around mountains increase risk at road crossings.
	Flood insurance claims	May increase.
	Economic	Comparatively more frequent property damages. Could be costly. Losses to major employment centers if ingress/egress is compromised.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Level of risk to life and property is uncertain.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	Roads interrupt the drainage patterns and concentrate flows.
	Flood insurance claims	Would increase due to greater uncertainty of risk.
	Economic	Population growth has channelized sheet flow and increased flood risk.
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.
Alluvial fans	**Life, safety, health, evacuation**	Alluvial fan along the west county border in the vicinity of Eagle Eye Road. However, there is very little human activity in the area.
	Public health hazards caused by flooding	No significant impact.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	N/A
Lateral erosion of natural streams	**Life, safety, health, evacuation**	Significant lateral migration and erosion in the rivers and washes can increase risk to adjacent properties.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.
	Economic	High costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourse.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Fissures	**Life, safety, health, evacuation**	Fissures were confirmed by the AZGS near Wintersburg at the nuclear generating plant.
	Public health hazards caused by flooding	Fissures could negatively impact the plant.

	Issue	Impact
	Critical facilities	Nuclear generating plant could be impacted.
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	Financial, electrical power, and employment impacts if the nuclear plant is out of service.
	Natural floodplain functions	N/A
Wildfires	**Life, safety, health, evacuation**	The draft 2015 Maricopa County Multi-Jurisdictional Hazard Mitigation Plan shows a low hazard rating for the I-10 corridor in south Phoenix and medium hazard for most of the remainder. Wash corridors and alluvial fan areas with dense vegetation are shown to have high hazard potential. Transfer of sediment downstream and increased flash flood potential after a wildfire.
	Public health hazards caused by flooding	Post-fire debris flow increases risk to public health.
	Critical facilities	Downstream risk to access/egress problems increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.4 Gila/Queen Creek Watershed Flooding Problems

Table 18: Identified Flooding Problems of the Gila/Queen Creek Watershed

	Issue	Impact
Dams	**Life, safety, health, evacuation**	Spook Hill, Signal Butte, Apache Junction, Powerline, Vineyard Road, and Rittenhouse protect several unincorporated county islands as well as several East Valley cities. Guadalupe FRS protects a small county island and portions of Phoenix, Tempe, and Guadalupe. The structures reduce exposure to flooding; however, in the unlikely event of a dam failure, large metropolitan areas would require evacuation.
	Public health hazards caused by flooding	Large discharges could lead to hazardous materials spills and animal waste.
	Critical facilities	Dams protect numerous hospitals, rescue centers, police/fire stations, Phoenix-Mesa Gateway Airport and extensive transportation and utility infrastructures.
	Transportation	Lower impact to county islands, but access/egress and utilities may be interrupted.
	Flood insurance claims	May decrease due to increased flood protection.
	Economic	Support economy by providing flood protection. High negative impact to businesses/employment centers during a dam emergency spillway discharge or dam failure, but the likelihood of occurrence is very low.

	Issue	Impact
	Natural floodplain functions	The dams cut off water to downstream reaches of washes but provide habitat in the upstream reservoir pool.
Overtopping of embankments	**Life, safety, health, evacuation**	The CAP, Western, Highline, Consolidated, Eastern, Tempe, and South canals traverse the watershed and downstream areas would be impacted by a breach. Smaller irrigation canals are present in the agricultural areas of Queen Creek and have a comparatively reduced impact but higher probability of occurrence.
	Public health hazards caused by flooding	Canal breaches cause flooding downstream.
	Critical facilities	Could interrupt irrigation operations.
	Transportation	One dry lane needed.
	Flood insurance claims	Risk for structures upstream & downstream of canals.
	Economic	Could damage Zone X structures. If irrigation supply is significantly interrupted, agricultural operations would be damaged.
	Natural floodplain functions	Recreation in impoundment areas. Canals modify natural floodplains, both beneficially and detrimentally.
Levee failures	**Life, safety, health, evacuation**	Development downstream of the Pass Mountain Diversion Channel Levee would be impacted. Same as embankment overtopping issues.
	Public health hazards caused by flooding	Flooding of the downstream neighborhood could promote mold growth.
	Critical facilities	Access/egress issues would impact emergency response to the downstream community.
	Transportation	Local streets downstream would have access/egress issues.
	Flood insurance claims	May increase downstream of the levee.
	Economic	Property damage to residences.
	Natural floodplain functions	N/A
Single-lot development	**Life, safety, health, evacuation**	The Mountain/Erie development is frequently flooded due to interruption of the shallow drainage paths by improved roadways. Single lot development on the downstream side of the Pass Mountain Diversion Channel Levee would be significantly impacted by a breach because the meandering drainage paths would be overwhelmed.
	Public health hazards caused by flooding	Flooded streets. Animal waste conveyed downstream in rural/large-lot properties.
	Critical facilities	No significant impact.
	Transportation	Road closures, access issues, high maintenance for road clearing.
	Flood insurance claims	Uncoordinated drainage system could increase number of claims.
	Economic	Flooded residences.
	Natural floodplain functions	Uncoordinated drainage systems tend to negatively interrupt natural flow patterns and behavior.
Undelineated floodplains	**Life, safety, health, evacuation**	Approximate A Zone delineations should be restudied with the understanding that adjacent land will be developed.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness.

	Issue	Impact
	Flood insurance claims	Many residents are unaware of risk and may not carry flood insurance.
	Economic	Unexpected flooding interrupts commerce and results in property damage.
	Natural floodplain functions	Would be adversely affected by unregulated development in the floodplain.
In-channel activities	**Life, safety, health, evacuation**	Human activity such as trails, ATV use, low water crossings, bridges. Remote hiking areas such as Usery Mountain Park are risky during flash flooding.
	Public health hazards caused by flooding	In-channel activity can result in injury or death during a flash flood.
	Critical facilities	N/A
	Transportation	At-grade road crossings prevent access/egress and increase risk to personal safety.
	Flood insurance claims	N/A
	Economic	Increased O&M on at-grade road crossings.
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.
Repetitive losses	**Life, safety, health, evacuation**	Need to publish evacuation routes with at least one driving lane open for access/egress in the loss area near Luke AFB.
	Public health hazards caused by flooding	One unincorporated location in the Laveen area. Causes damage to properties and increases potential exposure to post-flood hazards such as mold growth.
	Critical facilities	Rescue centers needed more often.
	Transportation	Access/egress repeatedly flooded.
	Flood insurance claims	Comparatively more claims made.
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	No significant impact.
Flash flooding	**Life, safety, health, evacuation**	The Laveen community was flooded in 2014 storms, as well as the Emerald Park neighborhood in Mesa and many other locations. Need to improve communications listing areas impacted. Show evacuation routes and safe distances from areas impacted. Sun City/Sun City Grand may need special mobilization plans for evacuation. Communication messages should be consistent during floods.
	Public health hazards caused by flooding	Improve communications listing areas impacted. Animal waste conveyed downstream in rural/large-lot properties.
	Critical facilities	Show evacuation routes and safe distances from areas impacted.
	Transportation	Major transportation corridors were impassible during the 2014 monsoon storms. Depressed roadways or at-grade road crossings are also flooded.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Losses to major employment centers if ingress/egress is compromised.

	Issue	Impact
	Natural floodplain functions	Recreational activity is at risk. Consider user check in/out system at trailheads where flash flood potential is high.
High runoff potential of some soils	**Life, safety, health, evacuation**	Increases flash flood risk. 75% of the watershed has moderately low runoff potential, particularly in the agricultural areas.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Short basin response times in & around mountains increase risk at road crossings.
	Flood insurance claims	May increase.
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Level of risk to life and property is uncertain. Queen Creek and Sonoqui Wash are braided in the unimproved reaches. Runoff from Pinal County to the west into Maricopa County has these characteristics. The unimproved reaches of Queen Creek and Sonoqui Wash are braided.
	Public health hazards caused by flooding	Risk to property is uncertain, so residents may be unaware of the dangers of changes to the watercourses.
	Critical facilities	N/A
	Transportation	Roads interrupt the drainage patterns and concentrate flows.
	Flood insurance claims	Would increase due to greater uncertainty of risk.
	Economic	Population growth has channelized sheet flow and increased flood risk.
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.
Lateral erosion of natural streams	**Life, safety, health, evacuation**	Significant lateral migration and erosion in the unimproved reaches of watercourses.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.
	Economic	Increased costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourse.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Fissures	**Life, safety, health, evacuation**	Significant fissure activity along the Hunt Highway corridor, US 60/ Meridian Rd and in Pinal County between US 60 and Guadalupe Rd. Serious safety issues if fissures open up and/or widen.
	Public health hazards caused by flooding	Hazardous materials could be transported if a fissure opens up and creates a new watercourse. Example: trucks transporting hazardous material on the Hunt Highway or US 60 are at risk if a fissure causes road damage during a storm.
	Critical facilities	US 60, Hunt Highway.
	Transportation	Could result in lengthy access/egress issues if damage occurs to US 60, Hunt Highway, or surrounding roads.

	Issue	Impact
	Flood insurance claims	Could increase if new areas are exposed to flooding.
	Economic	Longer-term access/egress interruptions if SR 303 is damaged.
	Natural floodplain functions	Could dramatically alter the location and behavior of drainage and reduce flora and fauna habitats.
Wildfires	**Life, safety, health, evacuation**	Transfer of sediment downstream after a wildfire.
	Public health hazards caused by flooding	Post-fire debris flow increases risk to public health.
	Critical facilities	Downstream risk to access/egress problems increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.5 Hassayampa Watershed Flooding Problems

Table 19: Identified Flooding Problems of the Hassayampa Watershed

	Issue	Impact
Dams	**Life, safety, health, evacuation**	The Buckeye Structures (Buckeye FRS Nos. 1, 2, and 3 and floodways) are located at the south end of the watershed north of I-10. The structures provide valuable flood protection to I-10, agricultural operations, and parts of Buckeye. The Wickenburg Structures (Sunset and Sunnycove FRSs and Casandro Wash Dam) provide protection for the town and surrounding areas.
	Public health hazards caused by flooding	Although very unlikely, significant residential developments downstream of the dams may be inundated in a dam failure.
	Critical facilities	I-10, Roosevelt and Buckeye irrigation canals, and the railroad are in the downstream inundation areas of the Buckeye Structures. US 60 and police/fire/municipal complex are downstream of the Wickenburg Structures.
	Transportation	The structures provide valuable flood protection for I-10 and US 60 and the railroad, but they would be inundated in the unlikely event of a dam failure.
	Flood insurance claims	May decrease downstream due to increased flood protection.
	Economic	I-10, US 60, and the railroad are important commerce routes for the region and would be highly affected if it damaged due to a dam failure. US 60/SR 93 is a heavily-traveled route to Las Vegas.
	Natural floodplain functions	Dams cut off water to downstream reaches of washes but provide habitat in the upstream reservoir pool.
Overtopping of embankments	**Life, safety, health, evacuation**	The CAP, Roosevelt, and Buckeye canals and I-10 traverse the watershed, as well as numerous smaller local irrigation canals. A breach may cause safety issues downstream.
	Public health hazards caused by flooding	None identified.

	Issue	Impact
	Critical facilities	I-10, the CAP Canal, and utility infrastructures.
	Transportation	SR 303 may be affected by a breach of the CAP Canal.
	Flood insurance claims	May increase if downstream flooding occurs.
	Economic	Damage to Zone X structures, higher post-flood maintenance costs.
	Natural floodplain functions	Canals modify natural floodplains, both beneficially and detrimentally.
Single-lot development	**Life, safety, health, evacuation**	Minimal single-lot development. Flooding is usually unpredictable.
	Public health hazards caused by flooding	Flooded local streets in unincorporated county.
	Critical facilities	No significant impact.
	Transportation	Access/egress problems on local streets.
	Flood insurance claims	Uncoordinated drainage system could increase number of claims.
	Economic	Flooded residences and post-flood road maintenance costs.
	Natural floodplain functions	Uncoordinated drainage systems tend to negatively interrupt natural flow patterns and behavior.
Undelineated floodplains	**Life, safety, health, evacuation**	Large areas of undeveloped land in the northern portion lack delineated floodplains.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness. Ingress/egress is restricted and post- flood maintenance is needed.
	Flood insurance claims	Residents are unaware of flooding risk and may not carry a policy.
	Economic	Unexpected flooding causes property damage and interrupts farming operations. Increased post-flood maintenance costs.
	Natural floodplain functions	Would be adversely affected by unregulated development along the floodplain. Effect is more critical to minor and medium-sized washes.
In-channel activities	**Life, safety, health, evacuation**	Human activity such as hiking in the White Tank Mountains and long the Hassayampa River. Hikers could be stranded during floods. ATV use is also prevalent in the river corridor.
	Public health hazards caused by flooding	In-channel activity can result in injury or death during a flash flood.
	Critical facilities	I-10 and the railroad cross the Hassayampa River.
	Transportation	At-grade road crossings prevent access/egress and increase risk to personal safety.
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.
Repetitive losses	**Life, safety, health, evacuation**	One unincorporated location along the Hassayampa River south of Wickenburg.
	Public health hazards caused by flooding	Causes damage to properties and increases potential exposure to post-flood hazards such as mold growth.
	Critical facilities	N/A
	Transportation	Access/egress repeatedly flooded.
	Flood insurance claims	Comparatively more claims made.

	Issue	Impact
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	No significant impact.
Flash flooding	**Life, safety, health, evacuation**	Entire watershed is susceptible to flooding. Need effective, consistent communication during floods. Evacuation routes may be interrupted, dictating shelter-in-place.
	Public health hazards caused by flooding	Sanitary sewers may be affected. Animal waste conveyed.
	Critical facilities	Public transportation and power infrastructures are in unincorporated county. Need to show evacuation routes and safe distances from areas impacted.
	Transportation	Directly affected – most deaths during flooding are transportation-related.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Agricultural losses may increase.
	Natural floodplain functions	The Hassayampa River Corridor is an important bird habitat.
High runoff potential of some soils	**Life, safety, health, evacuation**	About 32% of the watershed has high runoff potential. Runoff typically includes greater transport of sediment.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Increases flash flood risk.
	Flood insurance claims	May increase.
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Significant sheet flow conditions and braided washes, but development in unincorporated county is low. Level of risk to life and property is uncertain.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	Roads interrupt the drainage patterns and concentrate flows.
	Flood insurance claims	Would increase due to greater uncertainty of risk.
	Economic	Population growth has channelized sheet flow and increased flood risk.
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.
Alluvial fans	**Life, safety, health, evacuation**	Fan activity on the west side of the White Tank Mountains. Perceived risk may be lower than actual, so preparedness is diminished.
	Public health hazards caused by flooding	Festival Ranch is a master-planned subdivision on the northwest side of the White Tank Mountains.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	May increase.

	Issue	Impact
	Economic	May result in greater losses to property.
	Natural floodplain functions	Alluvial fans provide important wildlife habitat.
Lateral erosion of natural streams	**Life, safety, health, evacuation**	Significant lateral migration and erosion in the Hassayampa River and tributary washes can increase risk to adjacent properties.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.
	Economic	High costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourse.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Wildfires	**Life, safety, health, evacuation**	The hazard rating is medium to high in the mapped portion of the watershed.
	Public health hazards caused by flooding	Transfer of sediment downstream and increased flash flood potential after a wildfire. Post-fire debris flow increases risk to public health.
	Critical facilities	Downstream risk to access/egress problems increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.6 Lower Gila Watershed Flooding Problems

Table 20: Identified Flooding Problems of the Lower Gila Watershed

	Issue	Impact
Dams	**Life, safety, health, evacuation**	The U.S. Army Corps of Engineers' Painted Rock Dam is in the northeast portion of the watershed.
	Public health hazards caused by flooding	Minimal human activity downstream.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	Agricultural operations would be impacted.
	Natural floodplain functions	Tamarisk deters growth of native plant species. Dams cut off water to downstream reaches of washes.
Overtopping of embankments	**Life, safety, health, evacuation**	N/A
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A

	Issue	Impact
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Irrigation canals modify natural floodplains, both beneficially and detrimentally.
Single-lot development	**Life, safety, health, evacuation**	Evacuation routes are less reliable.
	Public health hazards caused by flooding	Very few, isolated structures that support farming operations.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	N/A
Undelineated floodplains	**Life, safety, health, evacuation**	A number of washes are delineated as Zone A (approximate). Natural washes on much of the remaining developed/ developable land have been significantly altered or eliminated by farm fields.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	N/A
In-channel activities	**Life, safety, health, evacuation**	Channelization in the vicinity of Gillespie Dam. Invasive tamarisk (salt cedar) along canals & other waterways impede conveyance of floodwaters.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted. Invasive tamarisk.
Flash flooding	**Life, safety, health, evacuation**	Entire watershed is susceptible to flooding, but lack of human activity poses low risk.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	Agricultural operations may sustain losses to crops.

	Issue	Impact
	Natural floodplain functions	Not impacted.
High runoff potential of some soils	**Life, safety, health, evacuation**	About half of the watershed has high runoff potential. High water table near the Gila River results in increased runoff potential.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	May exacerbate agricultural losses.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Flatter land slopes and farming operations result in ill-defined flow patterns that mask flood risk. Significant sheet flow conditions and braided washes outside the agricultural areas.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	N/A
Lateral erosion of natural streams	**Life, safety, health, evacuation**	N/A
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Lateral migration is important to natural floodplain function.
Wildfires	**Life, safety, health, evacuation**	High hazard in the Gila River corridor.
	Public health hazards caused by flooding	Post-fire debris flow increases risk to public health.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	May cause loss of crops and livestock.
	Natural floodplain functions	Wildfires may be a natural process, but tamarisk and man-made debris transported during storms can be detrimental to natural floodplain.

3.7 Verde Watershed Flooding Problems

Table 21: Identified Flooding Problems of the Verde Watershed

	Issue	Impact
Dams	**Life, safety, health, evacuation**	Bartlett and Horseshoe dams are on the Verde River. Salt River dams include Roosevelt at the eastern tip of the county, Horse Mesa, Mormon Flat, and Stewart Mountain dams.
	Public health hazards caused by flooding	Although very unlikely, significant damage could occur downstream of a dam failure. Outreach and education is needed regarding water quality on the Salt and Verde systems since they are a vital source for potable water in Maricopa County.
	Critical facilities	SR 87, 188, and 288 are downstream of Bartlett Dam.
	Transportation	SR 87, 188, and 288 provide access to Payson and the lakes on the Salt River. The highways may be inundated in the unlikely event of a dam failure.
	Flood Insurance Claims	N/A
	Economic	A dam failure would have a major impact on the metropolitan Phoenix area. If the highways were damaged by a failure at Bartlett Dam, access to Payson would be cut off, and alternative routes are much longer. Recreational enterprises would be financially impacted if access to the Salt River river/lake system.
	Natural floodplain functions	Dams cut off water to downstream reaches of washes but provide habitat in the upstream reservoir pool.
Single-lot development	**Life, safety, health, evacuation**	The community of Rio Verde is predominantly single-lot development and is susceptible to shallow sheet flow and shifting drainage patterns.
	Public health hazards caused by flooding	Flooded local streets limit access/egress.
	Critical facilities	No significant impact.
	Transportation	Rio Verde is adjacent to The Tonto National Forest and McDowell Mountain Regional Park, which limits access/egress. Within the community, local streets may be flooded also.
	Flood insurance claims	Uncoordinated drainage system could increase number of claims.
	Economic	Flooded residences. Many of the streets are unimproved and are susceptible to flood damage.
	Natural floodplain functions	Uncoordinated drainage systems tend to negatively interrupt natural flow patterns and behavior.
Undelineated floodplains	**Life, safety, health, evacuation**	A number of washes are delineated in the Rio Verde Area. The natural flow exhibits shallow, distributary characteristics and the level of risk is difficult to determine.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness. Ingress/egress is restricted and post- flood maintenance is needed.
	Flood insurance claims	Residents are unaware of flooding risk and may not carry a policy.
	Economic	Unexpected flooding causes property damage and interrupts farming operations. Increased post-flood maintenance costs.

	Issue	Impact
	Natural floodplain functions	Would be adversely affected by unregulated development. More critical to minor and medium-sized washes.
In-channel activities	**Life, safety, health, evacuation**	High recreation use in the lakes created by the dams on both rivers.
	Public health hazards caused by flooding	In-channel activity can result in injury or death during a flash flood.
	Critical facilities	N/A
	Transportation	At-grade road crossings prevent access/egress and increase risk to personal safety.
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.
Flash flooding	**Life, safety, health, evacuation**	Entire watershed is susceptible to flooding. Need to provide outreach to Rio Verde residents on flood risk. Evacuation routes may be interrupted, dictating shelter-in-place.
	Public health hazards caused by flooding	Sanitary sewers may be affected, and animal waste may be conveyed.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Directly affected – most deaths during flooding are transportation-related.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Increased structural damage and road maintenance costs.
	Natural floodplain functions	Important bird area; nesting habitat for bald eagles.
High runoff potential of some soils	**Life, safety, health, evacuation**	The watershed has a mix of moderately low, moderately high, and high runoff potential.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Increases flash flood risk.
	Flood insurance claims	May increase.
	Economic	Comparatively more frequent property damages.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Significant sheet flow conditions and braided washes. Level of risk to life and property is uncertain.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	Roads interrupt the drainage patterns and concentrate flows.
	Flood insurance claims	Would increase due to greater uncertainty of risk.
	Economic	Population growth has channelized sheet flow and increased flood risk.
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.

	Issue	Impact
Lateral erosion of natural streams	**Life, safety, health, evacuation**	Significant lateral migration and erosion in the rivers and washes.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.
	Economic	High costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourses.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Wildfires	**Life, safety, health, evacuation**	The hazard rating is high in the northern and eastern portions of the watershed and moderate for most of the remaining portion. A considerable portion of the watershed is in the Tonto National Forest.
	Public health hazards caused by flooding	Transfer of sediment downstream and increased flash flood potential after a wildfire. Post-fire debris flow increases risk to public health. Wildfires can lead to water quality issues in the reservoir systems.
	Critical facilities	Downstream risk to access/egress problems increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.8 Waterman Watershed Flooding Problems

Table 22: Identified Flooding Problems of the Waterman Watershed

	Issue	Impact
Overtopping of embankments	**Life, safety, health, evacuation**	Numerous irrigation berms are located in the agricultural areas near Gila Bend.
	Public health hazards caused by flooding	Minimal human activity downstream of the irrigation berms.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Irrigation canals modify natural floodplains, both beneficially and detrimentally.
Single-lot development	**Life, safety, health, evacuation**	Evacuation routes are less reliable.
	Public health hazards caused by flooding	Single-lot development is predominant in Mobile and on the south side of the Gila River near Goodyear.
	Critical facilities	N/A

	Issue	Impact
	Transportation	N/A
	Flood insurance claims	Likely to increase.
	Economic	Structural damage can occur to residences.
	Natural floodplain functions	Adversely affected by changes in flow patterns.
Undelineated floodplains	**Life, safety, health, evacuation**	A number of washes are delineated as Zone A (approximate). Natural washes on much of the remaining developed/ developable land have been significantly altered or eliminated by farm fields.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Unidentified level of risk diminishes flood awareness and preparedness. Ingress/egress is restricted and post-flood maintenance is needed.
	Flood insurance claims	Residents are unaware of flooding risk.
	Economic	Unexpected flooding causes property damage and interrupts farming operations. Increased post-flood maintenance costs.
	Natural floodplain functions	Would be adversely affected by unregulated development. More critical to minor and medium-sized washes.
In-channel activities	**Life, safety, health, evacuation**	Channelization in the vicinity of Gillespie Dam. Invasive tamarisk (salt cedar) along canals & other waterways impede conveyance of floodwaters.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	N/A
	Economic	N/A
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted. Invasive tamarisk is detrimental to native plants.
Flash flooding	**Life, safety, health, evacuation**	Entire watershed is susceptible to flooding, but lack of human activity poses low risk.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	Directly affected – most deaths during flooding are transportation-related. Ray Rd. north of Narrimore was flooding in January 2010.
	Flood insurance claims	Increases likelihood of claims.
	Economic	Agricultural operations may sustain losses to crops.
	Natural floodplain functions	Not impacted.

	Issue	Impact
High runoff potential of some soils	**Life, safety, health, evacuation**	About half of the watershed has high runoff potential. High water table near the Gila River results in increased runoff potential.
	Public health hazards caused by flooding	Increases flash flood risk.
	Critical facilities	Exacerbates access problems.
	Transportation	Short basin response times in & around mountains increase risk at road crossings.
	Flood insurance claims	May increase.
	Economic	May exacerbate agricultural losses.
	Natural floodplain functions	N/A
Sheet and split flows across the valley plains	**Life, safety, health, evacuation**	Flatter land slopes and farming operations result in ill-defined flow patterns that mask flood risk. Significant sheet flow conditions and braided washes outside the agricultural areas. Waterman Wash is highly erosive.
	Public health hazards caused by flooding	Increased due to uncertain flow paths.
	Critical facilities	N/A
	Transportation	N/A
	Flood insurance claims	Increased due to uncertain flow paths.
	Economic	Increased due to uncertain flow paths.
	Natural floodplain functions	N/A
Lateral erosion of natural streams	**Life, safety, health, evacuation**	Significant lateral migration and erosion in the rivers and washes.
	Public health hazards caused by flooding	Unidentified level of risk diminishes flood awareness and preparedness, resulting in flooded roadways, residences, and businesses.
	Critical facilities	Unidentified level of risk diminishes flood awareness and preparedness.
	Transportation	Bridge abutments may be undermined.
	Flood insurance claims	Claims may increase as changes in the location of the watercourse affect additional properties.
	Economic	High costs to repair roads, bridges. Additional property damage may occur adjacent to the watercourse.
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.
Fissures	**Life, safety, health, evacuation**	Unconfirmed fissure near 78th Ave. north of SR 238.
	Public health hazards caused by flooding	N/A
	Critical facilities	N/A
	Transportation	SR 238 could be impacted.
	Flood insurance claims	Could increase if new areas are exposed to flooding.
	Economic	Longer-term access/egress interruptions if SR 303 is damaged.
	Natural floodplain functions	Could dramatically alter the location and behavior of drainage and reduce flora and fauna habitats.

	Issue	Impact
Wildfires	**Life, safety, health, evacuation**	High hazard in the Gila River corridor.
	Public health hazards caused by flooding	Post-fire debris flow increases risk to public health.
	Critical facilities	Downstream risk to access/egress problems increases for several years after a wildfire.
	Transportation	Access/egress problems increases for several years after a wildfire.
	Flood insurance claims	Could increase in areas downstream of a burn area.
	Economic	Higher post-flood maintenance costs for several years after a wildfire.
	Natural floodplain functions	Wildfires may be a natural process, but man-made debris transported during storms can be detrimental to natural floodplain.

3.9 Flood Damage to Structures: 2009 – 2014

Since 2009, two presidential disaster declarations have been made for Maricopa County. Property damage from the 2010 and 2014 declarations was estimated to be $11.4 million and $18 million, respectively.


Wickenburg flooding, August 2014

During the same time period, Maricopa County experienced 49 significant flooding events totaling $25.9 million. The total federal and Maricopa County damages between 2009 and 2014 is estimated to be $55.3 million.

From 2009 through 2014, The District performed maintenance and repair of its structures as follows:

Year	Number of Structures	Cost
2009	6	$ 49,490
2010	51	$ 547,715
2011	13	$ 24,947
2012	13	$ 21,463
2013	12	$ 40,578
2014	52	$ 796,790
	147	**$ 1,480,983**

Note that the maintenance and repair costs in 2010 and 2014 are much higher than in other years; this corresponds with the flood disasters that occurred in those years.

3.10 Flood Insurance Claims: 2009 – 2014

The District recently commissioned an assessment of the proportion of households and businesses that have purchased federal flood insurance in unincorporated Maricopa County. The study evaluated prior claims and vulnerabilities, identified factors that affect purchasing decisions, and explored opportunities to improve flood insurance coverage (Dewberry, 2014). It was reported that 791 of a total 1,212 insurable structures were located within an SFHA. Of the 791 structures, 596 carried a policy on the structure (75%) and 177 on contents (22%). A portion of the study report is included as **Appendix D**.

As of March 2015, there were 2,619 flood insurance policies in effect for unincorporated Maricopa County, an increase of 345 policies since January 2009. Between February 2009 and April 2014, 63 flood insurance claims were filed; of those, 39 had been closed. The total amount of claims paid during this time is $1,562,000.

The Monsoon 2014 storms caused extensive damage; between June 2014 and April 2015, 50 flood insurance claims were made, and 30 have since been closed. The total amount of flood insurance claims paid during this recent time period is $1,270,000.

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4. Floodplain Management Goals

The FMP Committee reviewed the goals established in the 2009 Plan and considered new ones based on discussions of flood hazards and problems described in the previous sections. Goals for the next five years are described herein.

4.1 Continue/Expand Public Outreach

Public education of flood hazards is an essential part of protecting lives and property. The District's existing program is very beneficial and should be expanded to include electronic, audio/visual, and printed media. The messages should be specific to the target audience and should include residents; managers of local, state, and federal agencies; and elected officials.

4.2 Protect Natural Resources

Floodplains serve to capture and convey runoff through and away from the county during storms. Storm drainage is one of many important benefits provided by floodplains; others valued by the community include:

- Aggregate resources needed for local development
- Cultural resources
- Recreational opportunities
- Vegetation habitat
- Visual aesthetics
- Water conservation opportunities
- Wildlife habitat and migration corridors

The District's current efforts to support the natural and beneficial functions of floodplains should include water conservation and ground water recharge where feasible. The diverse and unique benefits offered by natural floodplains should be maximized in flood control planning.

4.3 Improve Quality of Life

Implementing sound floodplain management practices will improve public safety and protection of property and will help residents to experience the full benefits of living in Maricopa County. Economic benefits of lower flood risk include the reduction of residential and commercial flood losses and disruption of transportation and commerce due to flooding.

4.4 Strengthen Role as Regional Leader

The District provides floodplain regulation and management for the unincorporated portions of Maricopa County. It also serves this function for 14 of the 24 municipalities. The District also provides technical training and expertise, educational materials, design manuals, and flood warning services. The District's continued leadership role should further integrate with other regional planning efforts and the District should actively seek public and private partnerships to maximize the value of infrastructure and support long-term sustainability.

4.5 Develop Lists of Resources

Severe flooding during the 2014 monsoon season created challenges in meeting the public's requests for flood-fighting resources and post-flood site visits. The District could improve its response to public information requests by developing pre-programmed web pages and field-ready response kits.

4.6 Enforce/Enhance Regulatory Standards

The District is committed to enforcing floodplain regulations and identifying flood hazards. This commitment could be enhanced to incorporate emerging flood control technologies, improve technical analysis tools, and support alternate solutions such as floodproofing or acquisition of floodprone properties.

5. Five-Year Action Plan

The FMP Committee selected a number of activities in the 2009 Plan and developed additional items to be considered in developing the 2015 Plan. As categorized in the *CRS Coordinator's Manual*, activities may include preventative, property protection, natural resource protection, emergency services, structural projects, and public information. Activities considered under these categories and their merits are described in **Appendix E**.

The activities selected as viable were then brought forward to create the five-year action plan. As shown in **Table 23**, the viable activities were placed in the six categories prescribed by the CRS Program.

The FMP Committee considered the value to the community of each action item in setting priorities. Community benefits and comparative costs to implement were used to establish the value of each action item. Actions that offer high benefits and are relatively inexpensive to implement received a high priority rating. Lesser benefit with relatively high implementation cost received either a medium or low rating.

Top Priorities

- Increase CIP program funding
- Educate the public on flood risk

The FMP Committee then considered the action plan items as a whole and identified two areas that should be given the highest priority. The first is to explore additional funding for the District's CIP Program. It was recognized that the need for flood control projects far exceeds the current available funding. The second category is public education. Given the transient nature of the county's population and infrequency of storms, there is a great need for continual, effective education on flood risks, personal safety, and the benefits of flood insurance.

Funding for implementation of the action plan will be provided annually as resources permit under the District's operating and CIP budgets. Some exceptions are noted in the activity descriptions where soliciting outside funding is planned.

Table 23: 2015 Floodplain Management Action Plan

	ACTION	GOAL						RESPONSIBLE	TIMEFRAME	PRIORITY
		Continue/expand public outreach	Protect natural resources	Improve quality of life	Strengthen role as regional leader	Improve preparedness	Implement/enhance regulatory standards			
		1	2	3	4	5	6			
	Preventative									
1	Enforce current floodplain regulations						X	FCDMC – FMS Division/ Maricopa County Planning & Development	Ongoing	High
2	Offer technical assistance to 14 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information and at the request of municipalities that perform their own floodplain management				X		X	FCDMC – FMS Division	Ongoing	High
3	Improve flood risk information by evaluating the merits of converting approximate (Zone A) floodplain delineations to detailed studies based on need and benefit to existing and new development: - Redelineate existing Zone A floodplains identified in approximate studies - Delineate floodplains downstream of embankments that were recently declared by FEMA as Zone A - Revise regulatory floodplain remnants whose level of risk has been altered by surrounding development			X	X		X	FCDMC – Engineering Division	FY 2015-2020	High

		Continue/expand public outreach	Protect natural resources	Improve quality of life	Strengthen role as regional leader	Improve preparedness	Implement/enhance regulatory standards			
		1	2	3	4	5	6			
	ACTION	**GOAL**						**RESPONSIBLE**	**TIMEFRAME**	**PRIORITY**
4	Encourage the Maricopa County Planning & Development Department to continue to propose/discuss "good ideas" at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the risk of flooding)	X		X			X	Maricopa County Planning & Development	Ongoing	Medium
5	Create a nontechnical booklet with photos and illustrations of examples of good vs. poor floodplain management practices and a fact sheet with resources on floodproofing for distribution by inspectors and staff	X		X		X	X	FCDMC – FMS Division	2017	Low
6	Provide annual funding for the Floodprone Properties Assistance Program (FPAP) and floodproofing activities			X		X	X	FCDMC – PPM Division	Annually for FY 2016-2020	High
7	Continue preparing and updating Area Drainage Master Studies/Plans (ADMS/Ps) and pursue implementation with local jurisdictions	X			X			FCDMC – PPM Division	Ongoing	High
8	Evaluate and implement improvements to methodologies, where feasible, to better identify flood hazards				X			FCDMC – Engineering Division	Ongoing	Low
9	Develop a benchmark of risks to evaluate current conditions and quantify how risk changes over time and the associated demand for services	X			X			FCDMC – PPM Division	FY 2017-2018	Medium
10	Continue participation in the Community Rating System, which provides residents with discounts on flood insurance premiums	X		X	X	X		FCDMC – FMS Division	Ongoing	High

		Continue/expand public outreach	Protect natural resources	Improve quality of life	Strengthen role as regional leader	Improve preparedness	Implement/enhance regulatory standards			
		1	2	3	4	5	6			
	ACTION	**GOAL**						**RESPONSIBLE**	**TIMEFRAME**	**PRIORITY**
11	Collaborate with other agencies and master-planned developments to meet floodplain management goals and integrate with other plans (e.g., transportation, planning, land-use zoning)			X	X			FCDMC – PPM Division	Ongoing	Medium
	Property Protection									
12	Implement flood warning systems to prevent unsafe crossings of washes and flooded streets			X	X	X		FCDMC – Engineering Division & MCDOT	Ongoing	High
13	Continue inspection and maintenance of District structures			X	X	X		FCDMC - Operations & Maintenance Division	Ongoing	High
	Natural Resource Protection									
14	Recognize natural resource benefits (use of water and aggregate; outdoor activity) within the ADMS/P program		X	X	X			FCDMC – PPM Division	Ongoing	High
15	Support multi-use/multi-benefit approaches to floodplain management		X	X	X			FCDMC – PPM Division	Ongoing	High
16	Incorporate low-flow storm water conservation and explore partnerships for best use of water		X	X	X			FCDMC – PPM Division	2017 and Ongoing	High
17	Identify and accommodate wildlife corridors, habitat, and recreational opportunities as part of the ADMS/P program and during the planning and construction of flood control projects		X	X	X			FCDMC – PPM Division	Ongoing	High

		Continue/expand public outreach	Protect natural resources	Improve quality of life	Strengthen role as regional leader	Improve preparedness	Implement/enhance regulatory standards			
		1	2	3	4	5	6			
	ACTION	**GOAL**						**RESPONSIBLE**	**TIMEFRAME**	**PRIORITY**
18	Evaluate floodplains and District-owned lands for ground water recharge potential and explore public/private partnerships to support ground water recharge		X	X	X			FCDMC – PPM Division	2017	High
19	Promote restoration of natural habitat by replacing invasive species with native species where feasible		X	X	X			FCDMC – PPM Division	Ongoing	High
	Emergency Services									
20	Prepare a ready-to-use Flood Response Kit for District staff - Include brochures, how to find information and resources, post-flood field documentation form	X				X		FCDMC – FMS Division	FY 2015-2016	High
21	Construct a web page with information that can be uploaded during flood events	X				X		FCDMC – FMS Division	FY 2015-2016	High
22	Stockpile material at 11 structures for emergency repairs					X		FCDMC - Operations & Maintenance Division	FY 2015-2020 @ 2-3/yr	Medium
23	Continue to update and support Emergency Action Plans for District dams and levees				X	X	X	FCDMC – Engineering Division	Ongoing	High
24	Continue annual flood emergency drills				X	X	X	FCDMC – Engineering Division	Ongoing	High
25	Continue to provide reliable weather data, water level and stream flow data to other jurisdictions and the community	X		X	X	X		FCDMC – Engineering Division	Ongoing	High
26	Identify the need for new Flood Response Plans and develop new or update existing plans as needed				X	X	X	FCDMC – Engineering Division	Ongoing	High

	ACTION	Continue/expand public outreach (1)	Protect natural resources (2)	Improve quality of life (3)	Strengthen role as regional leader (4)	Improve preparedness (5)	Implement/enhance regulatory standards (6)	RESPONSIBLE	TIMEFRAME	PRIORITY
	Structural Projects									
27	Adjust criteria for Small Projects Assistance Program (SPAP), which provides funding for drainage infrastructure, to allow projects for areas that have a demonstrated flood risk but have not previously experienced structural flooding			X	X		X	FCDMC – PPM Division	FY 2015-2016	High
28	Develop a process to act as an advocate for unincorporated areas that lack funding partnerships			X				FCDMC – Executive Division (Ombudsman)	2016	Medium
29	Explore avenues to expand the CIP budget for infrastructure to meet the demands of identified flood risks			X	X			FCDMC – Executive Division	Ongoing	High
30	Partner with sand and gravel operations to implement mutually beneficial activities in the river corridors		X	X	X			FCDMC – PPM Division	FY 2015-2020	High
31	Incorporate ongoing Best Management Practices (BMPs) and emerging Low Impact Development (LID) technologies in design projects		X	X	X		X	FCDMC – PPM Division	FY 2015-2020	Medium

	ACTION	GOAL						RESPONSIBLE	TIMEFRAME	PRIORITY
		Continue/expand public outreach (1)	Protect natural resources (2)	Improve quality of life (3)	Strengthen role as regional leader (4)	Improve preparedness (5)	Implement/enhance regulatory standards (6)			
	Public Information									
32	Develop a marketing plan to promote sound floodplain management practices and personal responsibility - Include multiple communication venues - Convey a "greater good" message on responsible floodplain management approaches - Convey the message that flood hazards are present, regardless of the FEMA FIRM zone classification - Include benchmark information of flood risks in education efforts from surveys and public outreach - Recognize the potential economic benefits from reduced flood losses and disruptions to commerce - Visit schools in unincorporated county to discuss flood safety and awareness	X		X	X	X		FCDMC – Executive Division (PIO) / FMS Division	FY 2016-2017	High
33	Educate the public & officials on floodplain management needs and benefits	X			X			FCDMC – Executive Division	Ongoing	High
34	Develop multi-hazard educational material on the effects of long and short term changes to the watersheds	X	X					FCDMC – Executive Division (PIO) / FMS & Engineering Divisions	2017	Medium
35	Develop a strategy to publicize the benefits of past floodplain management practices, flood control efforts, and the potential economic benefits from reduced flood losses and disruption to commerce	X			X			FCDMC – FMS Division	2018	Medium
36	Develop educational material and guidelines for fencing to promote lot-to-lot drainage functions	X					X	Maricopa County Planning & Development	2016	High

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6. Adoption and Implementation

6.1 Adoption of the 2015 Floodplain Management Plan

The draft FMP was made available for review and comments at three public open houses held at the District and posted on the District's web site. The link to the plan was emailed to approximately 100 stakeholders for review. The FMP fully complied with the public notification process, timelines for review, and all requirements set forth for adoption. Upon incorporating comments into the draft plan, the final FMP was adopted by the Board of Directors under Resolution FCD2016R001 on November 18, 2015. The resolution is provided on the following page.

6.2 Recommendations for Monitoring/Revising the 5-Year Plan

Implementation of the FMP is central to meeting the District's goals of protecting lives and property and realizing the full benefits of floodplains. The following steps are recommended:

1. The District's Floodplain Management and Services Division appoints a staff member to gather status reports at least annually from the divisions listed in the action plan as responsible for performing the tasks.

2. After the status reports are gathered, the FMP manager prepares a summary for review by the FMP Committee.

3. The FMP Committee reviews the progress and may recommend changes to the FMP, if deemed necessary.

4. The District's FMP manager prepares and submits a report to the Maricopa County Board of Directors on the status of implementation, as well as any recommended changes to the FMP. This report will be published on the District's web site and released to the media.

5. If changes are made to the FMP as a result of recommendations by the FMP Committee, an updated plan is submitted to the Maricopa County Board of Directors to be considered for adoption.

6. If adopted, the District posts the updated plan on its website and issues a news release to local media.

OFFICIAL RECORDS OF
MARICOPA COUNTY RECORDER
HELEN PURCELL
ELECTRONIC RECORDING
20150838151 11/24/2015 11:06
RESFCD2016R001-2-1-1--N

When Recorded Return to:
Contracts Branch
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

RESOLUTION FCD 2016R001

FLOODPLAIN MANAGEMENT PLAN 2015

Agenda Item: C-69-16-012-6-00

WHEREAS, the Chief Engineer and General Manager of the Flood Control District of Maricopa County (District) is required under Arizona Revised Statutes (ARS) §48-3616 to prepare or have prepared a report for a comprehensive program of flood hazard mitigation describing existing flood control facilities and identifying work proposed to eliminate or minimize flood control problems within Maricopa County; and,

WHEREAS, the Board of Directors of the District on October 7, 2009 adopted Resolution FCD 2010R010 (C-69-10-015-6-00) for the "2009 Comprehensive Floodplain Management Plan and Program" (Plan 2009), which the Floodplain Management Plan was part of; and,

WHEREAS, the District administers the National Flood Insurance Program's Community Rating System and is required to update its Floodplain Management Plan every five years; and,

WHEREAS, the development of the this Floodplain Management Plan 2015 (Plan) was based on committee input of various stakeholders, the public and the county; and,

WHEREAS, the Plan serves as a five-year guideline to addresses flooding issues, public education, loss reduction measures, floodplain beneficial functions and flood related hazards; and,

WHEREAS, the Plan has been made available to the public, other jurisdictions and agencies for their review and comment; and,

WHEREAS, the Board of Directors of the District has held a public hearing as required under ARS §48-3616; and,

WHEREAS, the Flood Control Advisory Board of the District endorsed the Plan on September, 23 2015, recommending to the Board of Directors of the District that the Plan be adopted.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the District approve and adopt the "Floodplain Management Plan 2015"; and,

BE IT FURTHER RESOLVED that the Chief Engineer and General Manager of the District is authorized and directed to forward the adopted Plan to local communities and other interested agencies and entities.

Dated this 18th day of November, 2015

Chairman, Board of Directors

ATTEST:

DEPUTY Clerk of the Board

Enclosure

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7. List of Acronyms and Terms

Acronym	Description
ADEMA	Arizona Department of Emergency and Military Affairs
2009 Plan	Flood Control District of Maricopa County Comprehensive Floodplain Management Plan and Program Report
2015 Report	Flood Control District of Maricopa County Comprehensive Report & Program 2015
ACDC	Arizona Canal Diversion Channel
ADEQ	Arizona Department of Environmental Quality
ADMP	Area Drainage Master Plan
ADMS	Area Drainage Master Study
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
ASLD	Arizona State Land Department
ATV	All-terrain vehicle
BFE	Base Flood Elevation
BLM	Bureau of Land Management
BMP	Best Management Practices
CAP	Central Arizona Project
CBRL N/S	Camelback Ranch Levee North/South
CIP	Capital Improvement Program
CIPPP	Capital Improvement Program Prioritization Procedure
CRS	Community Rating System
CTP	Cooperating Technical Partner
District	Flood Control District of Maricopa County
EAP	Emergency Action Plan
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
FCAB	Flood Control Advisory Board
FCDMC	Flood Control District of Maricopa County
FDS	Floodplain Delineation Study
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMP	Floodplain Management Plan
FMS	Floodplain Management & Services
FPAP	Floodprone Properties Assistance Program
FPS	Feet per second
FRP	Flood Response Plan

Acronym	Description
FRS	Flood Retarding Structure
IBC	International Building Code
MAG	Maricopa Association of Governments
MCDEM	Maricopa County Department of Emergency Management
MCDES	Maricopa County Department of Environmental Services
MCDOT	Maricopa County Department of Transportation
MCPDD	Maricopa County Planning & Development Department
MCPRD	Maricopa County Parks and Recreation Department
MS4	Municipal Separate Storm Sewer System
NCDC	National Climatic Data Center
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
O&M	Operation and Maintenance
PIO	Public Information Officer
Plan	Comprehensive Report & Program 2015
PPM	Planning and Project Management
PVR FRSs	Powerline, Vineyard Road, and Rittenhouse Flood Retarding Structures
RWCD	Roosevelt Water Conservation District
SFHA	Special Flood Hazard Area
SPAP	Small Projects Assistance Program
SRP	Salt River Project
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service
Zone A	An area with an approximate delineation of a Floodplain. Floodway boundaries and Base Flood Elevations have not been determined.
Zone AE	An area with a detailed delineation of a Floodplain and in which Base Flood Elevations have been determined.
Zone AH	An area with Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations have been determined.
Zone AO	An area with Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average flood depths have been determined. For areas of Alluvial Fan flooding, velocities may have also been determined.
Zone D	Areas in which flood hazards are undetermined, but possible.
Zone X	Areas determined to be outside the 1% annual chance floodplain but within the 0.2% annual chance floodplain.

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Appendix A

Maps

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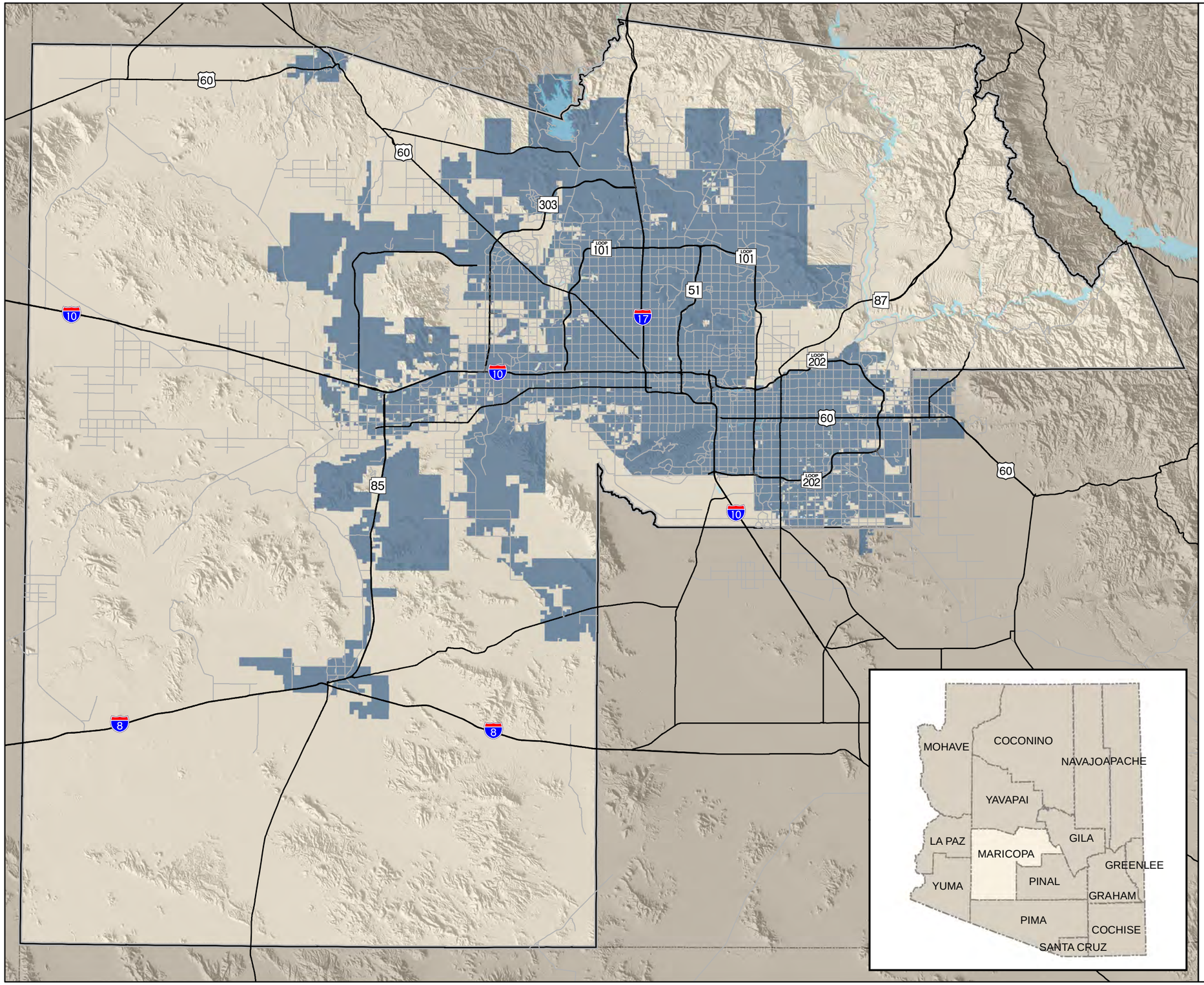
Location Map

Map 1



Maricopa County/Unincorporated Area

City/Incorporated Area

Other County

0 2.5 5 10 Miles

N

Data Source: Flood Control District of Maricopa County

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Regulatory Floodplains, Alluvial Fans and Repetitive Loss Areas

Map 2a

Upper Hassayampa

East of Luke AFB

North Gila

West MC 85

Holly Acres

Laveen

- Repetitive Loss Area
- FEMA Floodway
- FEMA Flooplain
- Alluvial Fan
- Pending Floodway
- Pending Floodplain
- City/Incorporated Area
- Maricopa County/Unincorporated Area
- Other County

0 2.5 5 10 Miles

N

Data Source: Flood Control District of Maricopa County

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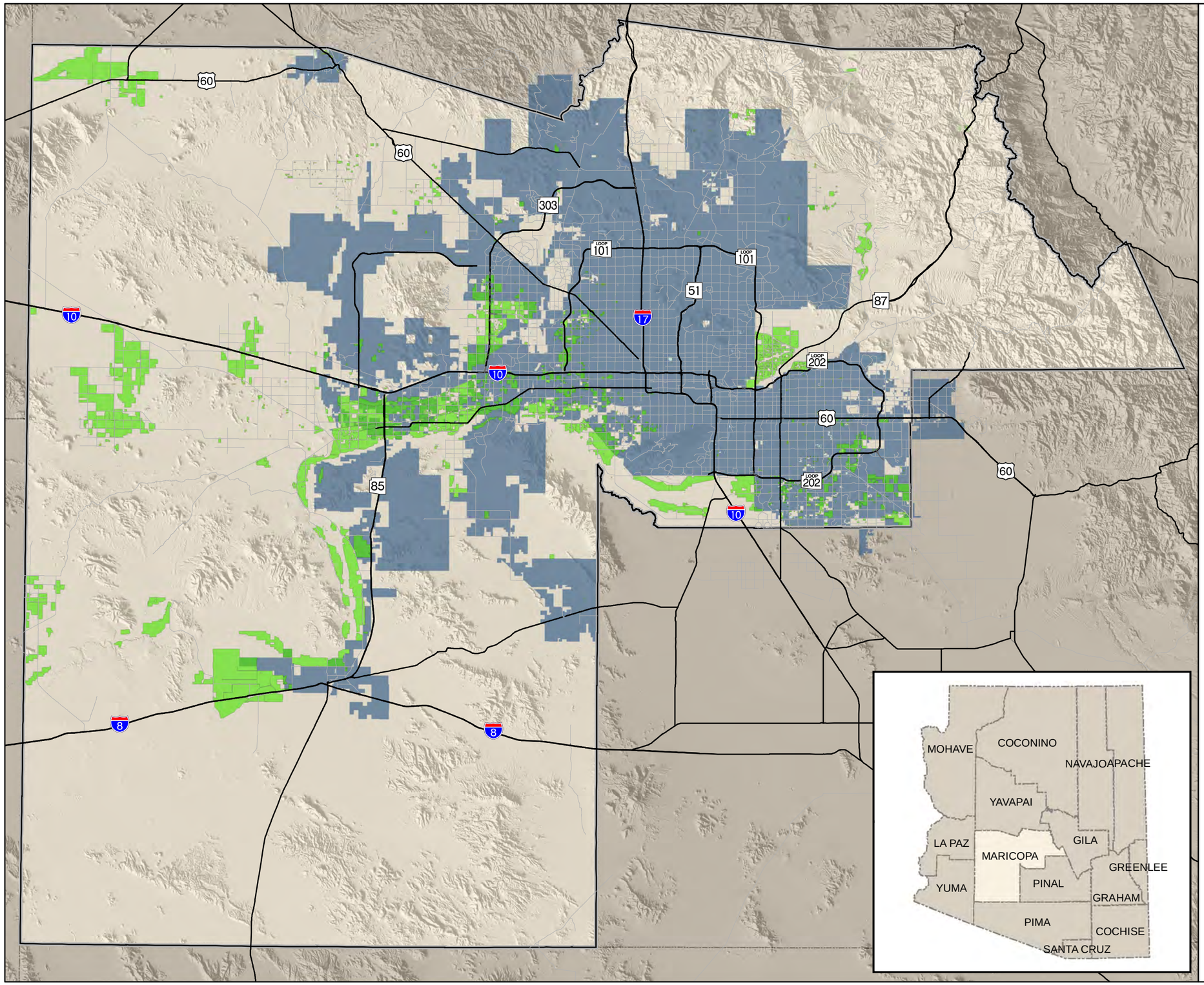
Agricultural Land

Map 2b



Agriculture Land Use

City/Incorporated Area

Maricopa County

Other County

0 2.5 5 10 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

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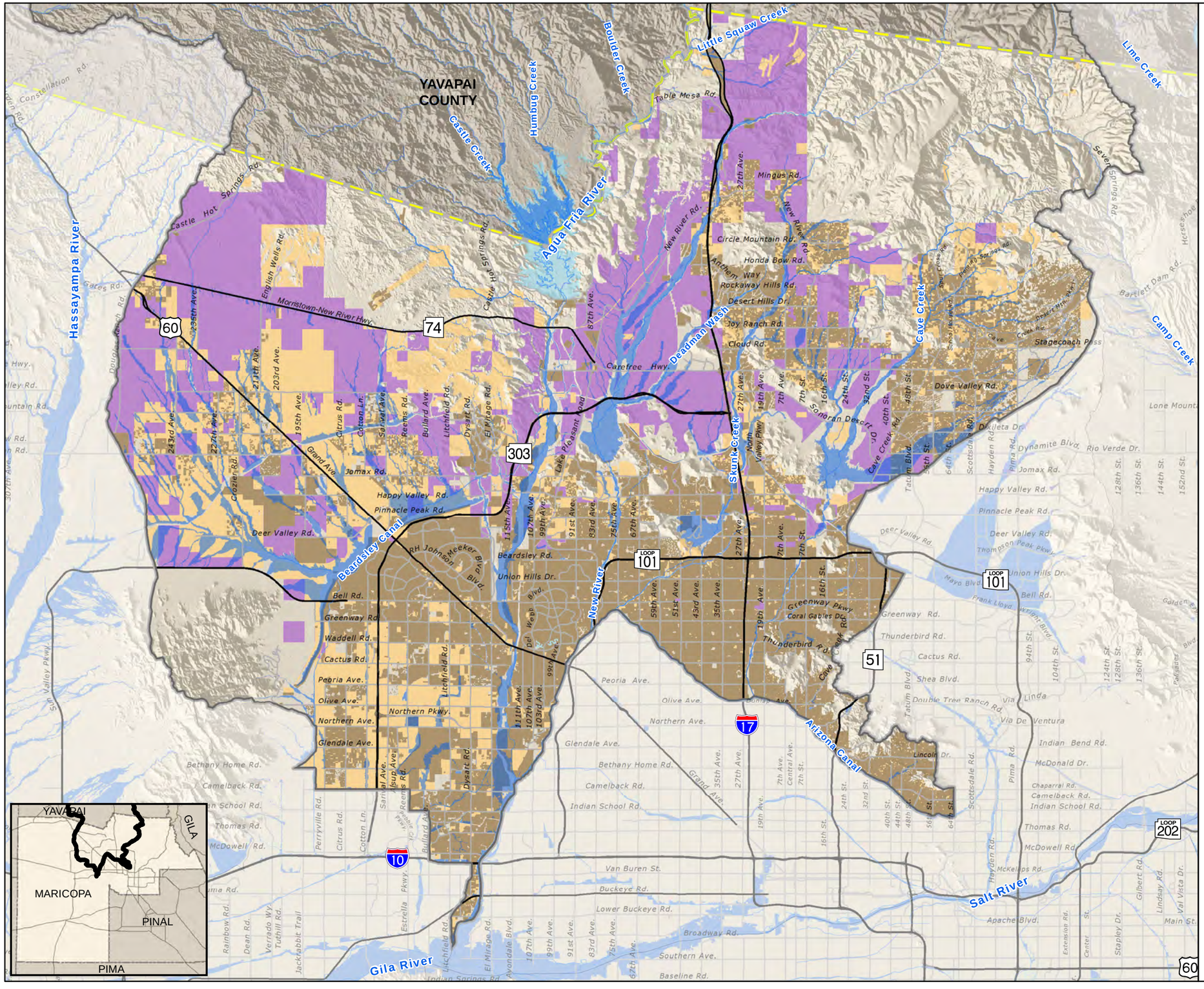

Agua Fria Watershed

Map 3

Agua Fria Watershed
2329 sq. miles

Developable Private Land
187 sq. miles

Developable State Trust Land
230 sq. miles

Existing Development (2014)
328 sq. miles

FEMA 100-Yr Floodplain

Maricopa County

Other County

0 1.25 2.5 5 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

Flood Control District of Maricopa County

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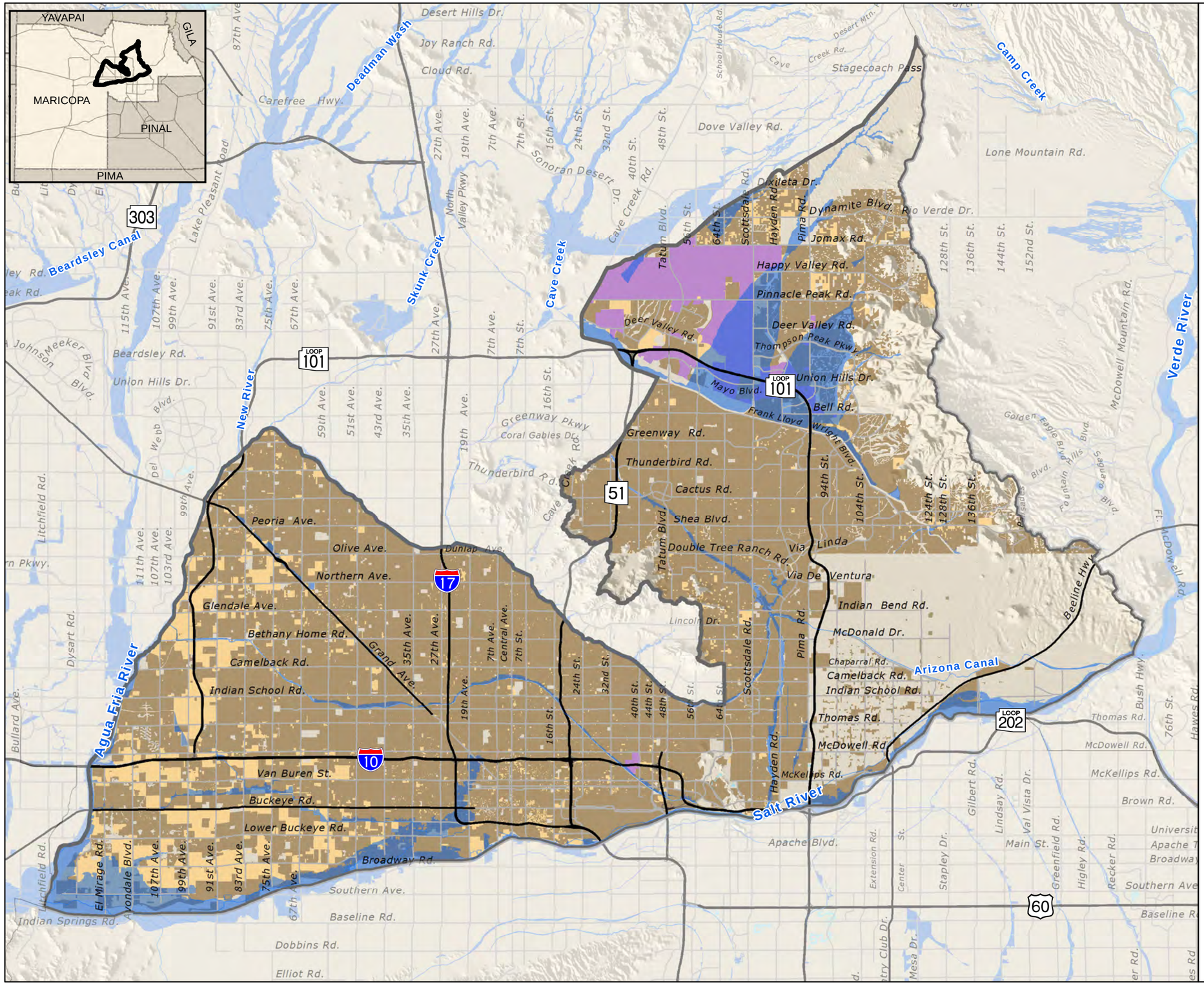

Cave Creek/Salt Watershed

Map 4

Cave Creek/Salt Watershed
506 sq. miles

Developable Private Land
42 sq. miles

Developable State Trust Land
18 sq. miles

Existing Development (2014)
317 sq. miles

FEMA 100-Yr Floodplain

Maricopa County

Other County

0 1 2 4 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

Flood Control District of Maricopa County

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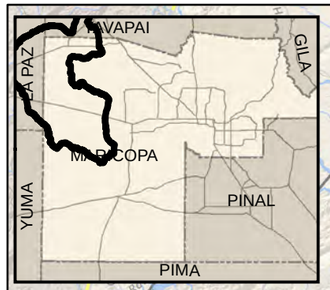

Centennial Watershed

Map 5

Centennial Watershed
1924 sq. miles

Developable Private Land
266 sq. miles

Developable State Trust Land
178 sq. miles

Existing Development (2014)
37 sq. miles

FEMA 100-Yr Floodplain

Maricopa County

Other County

0 1.5 3 6 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

Flood Control District of Maricopa County

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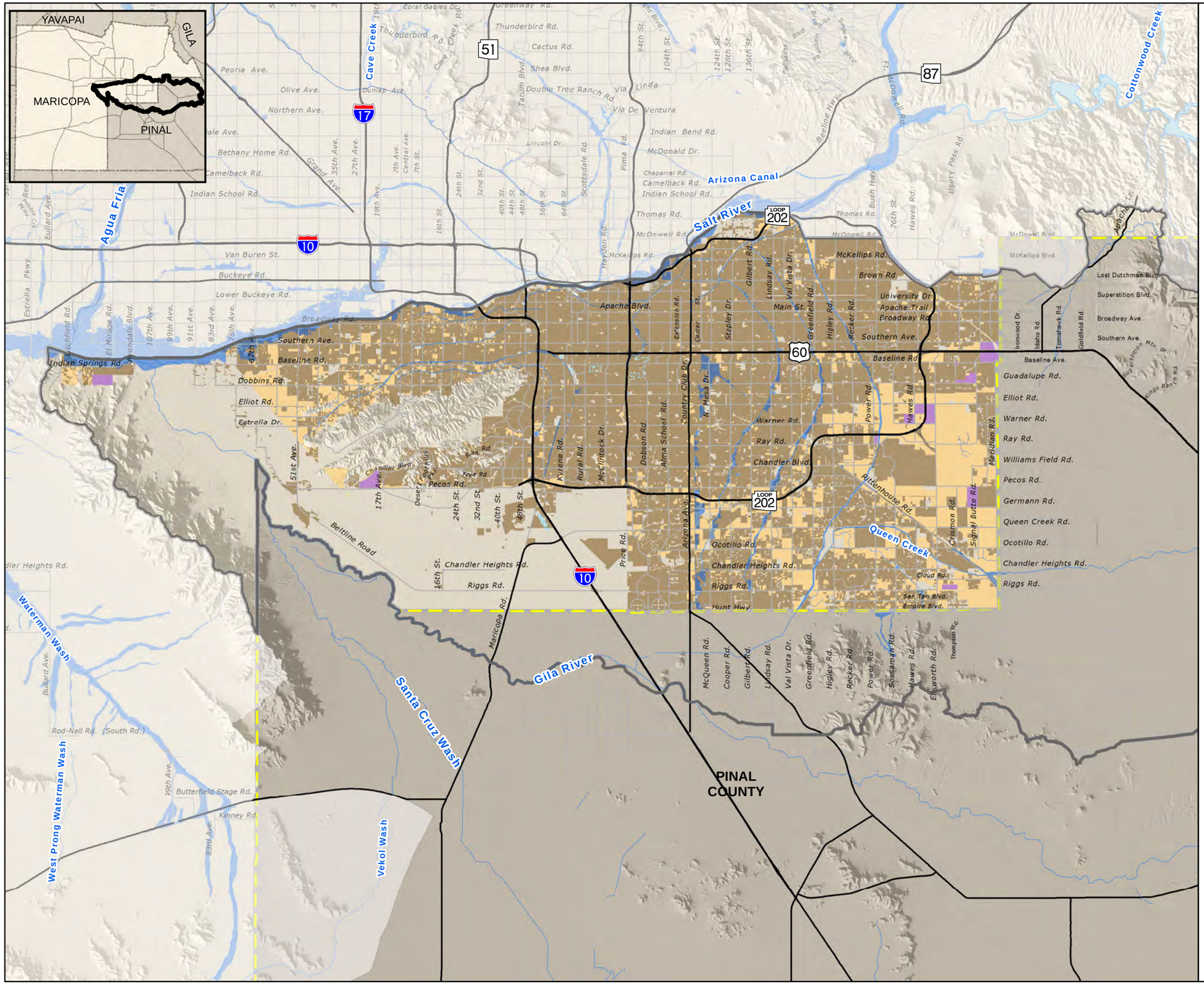


Gila/Queen Creek Watershed

Map 6

Gila/Queen Creek Watershed

1307 sq. miles

Developable Private Land

79 sq. miles

Developable State Trust Land

3.8 sq. miles

Existing Development (2014)

335 sq. miles

FEMA 100-Yr Floodplain

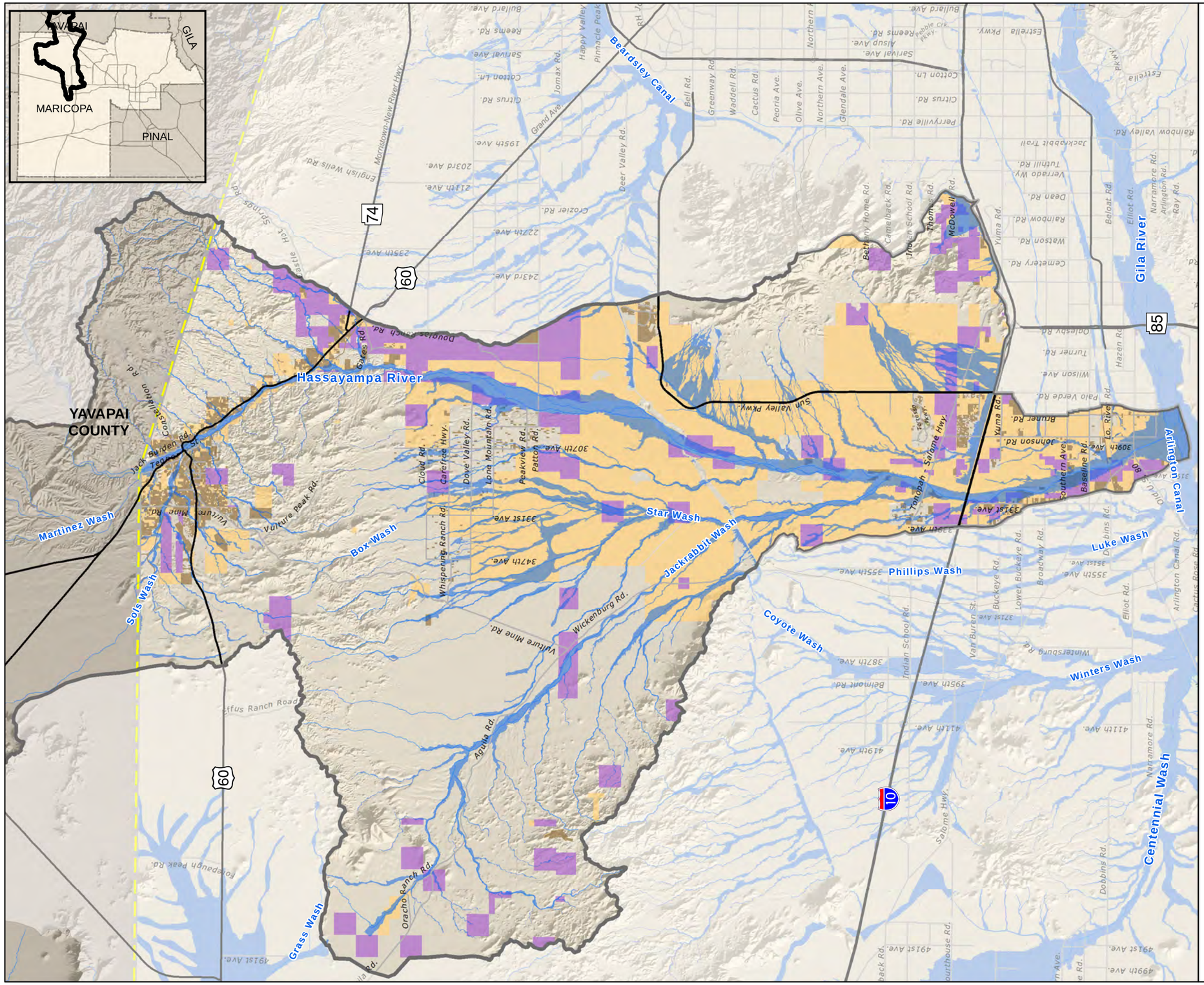
Maricopa County

Other County

0 1.5 3 6 Miles

N

Data Source: Flood Control District of Maricopa County, MAG



Hassayampa Watershed

Map 7

Hassayampa Watershed
1063 sq. miles

Developable Private Land
230 sq. miles

Developable State Trust Land
74 sq. miles

Existing Development (2014)
28 sq. miles

FEMA 100-Yr Floodplain

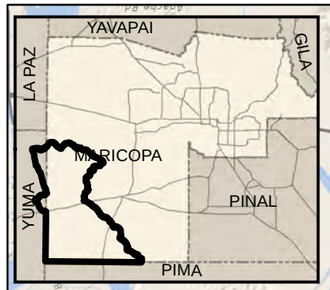
Maricopa County

Other County

0 1.5 3 6 Miles

N

Data Source: Flood Control District of Maricopa County, MAG



Lower Gila Watershed

Map 8

Lower Gila Watershed

1522 sq. miles

Developable Private Land

45 sq. miles

Developable State Trust Land

77 sq. miles

Existing Development (2014)

7 sq. miles

FEMA 100-Yr Floodplain

Maricopa County

Other County

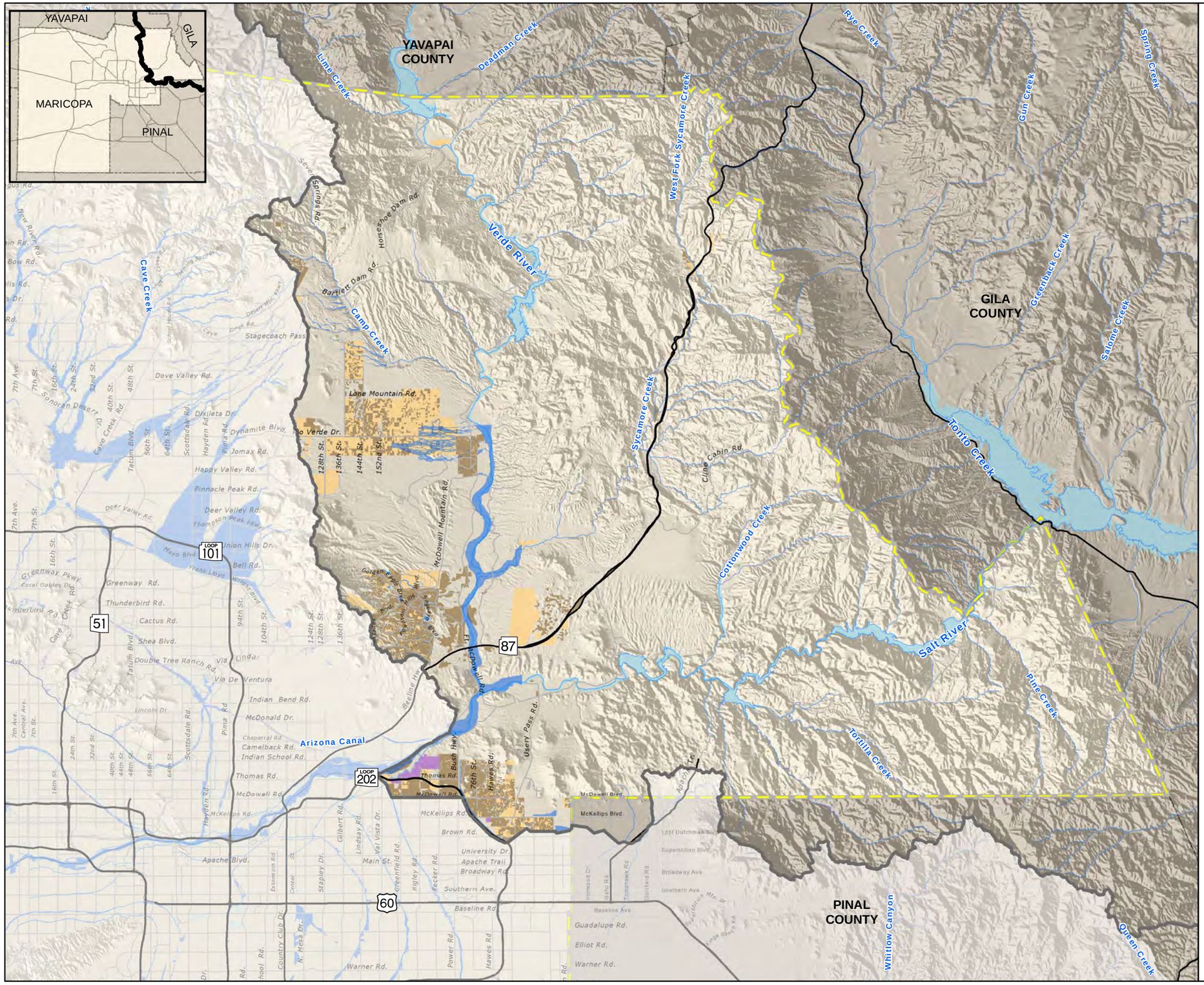
0 1.5 3 6 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

PIMA COUNTY

YUMA COUNTY



Verde Watershed

Map 9

Verde Watershed
3216 sq. miles

Developable Private Land
27 sq. miles

Developable State Trust Land
1.3 sq. miles

Existing Development (2014)
41 sq. miles

FEMA 100-Yr Floodplain

Maricopa County

Other County

0 1.5 3 6 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

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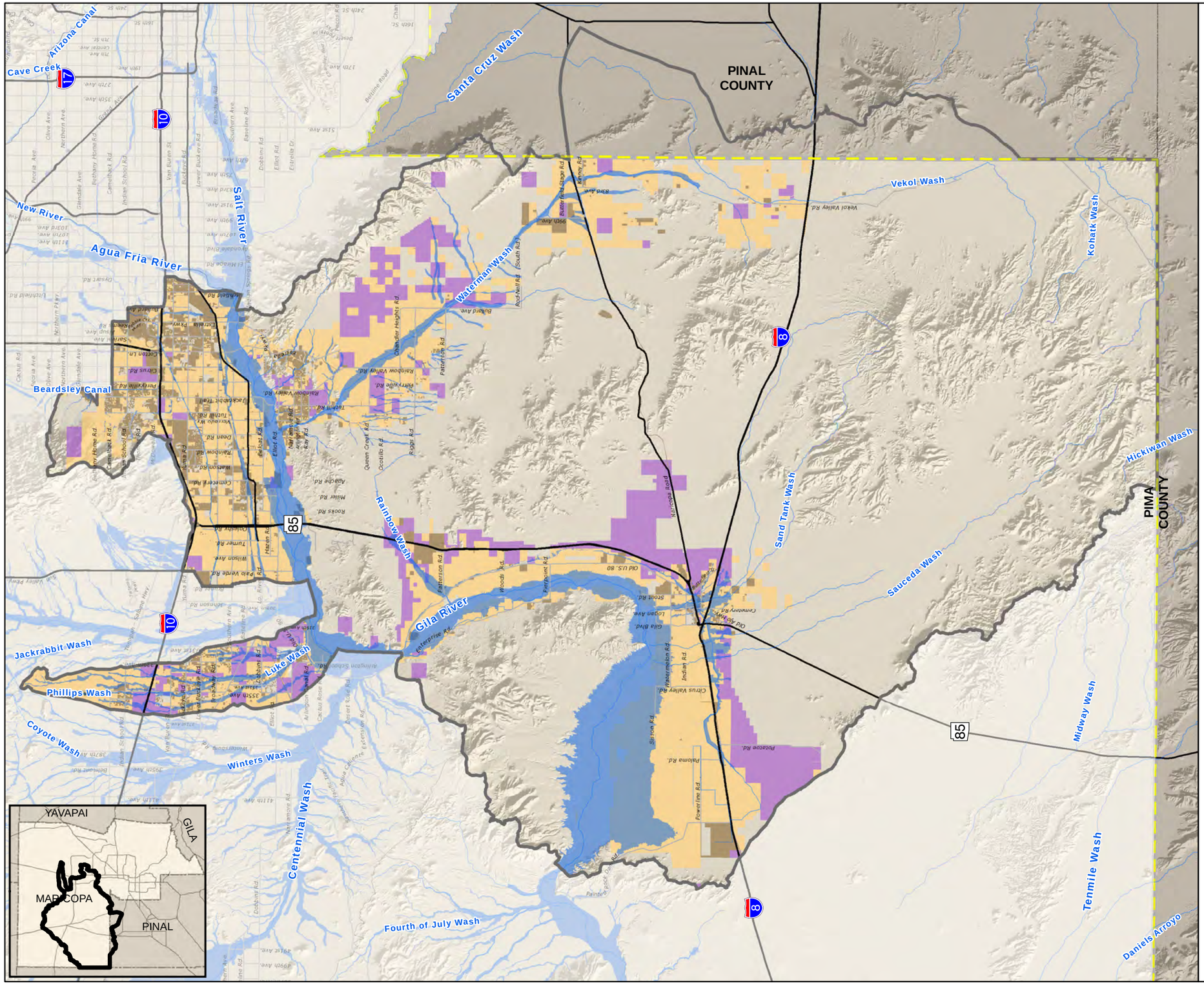
Waterman Watershed

Map 10



Waterman Watershed

2472 sq. miles

Developable Private Land

406 sq. miles

Developable State Trust Land

132 sq. miles

Existing Development (2014)

89 sq. miles

FEMA 100-Yr Floodplain

Maricopa County

Other County

0 2 4 8 Miles

N

Data Source: Flood Control District of Maricopa County, MAG

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Dams and Inundation Areas

Map 11

1. Adobe Dam
2. Apache Junction FRS
3. Buckeye FRS #1
4. Buckeye FRS #2
5. Buckeye FRS #3
6. Casandro Wash Dam
7. Cave Buttes Dam
8. Dreamy Draw Dam
9. Guadalupe FRS
10. Harquahala FRS
11. McMicken Dam
12. New River Dam
13. Powerline FRS
14. Rittenhouse FRS
15. Saddleback FRS
16. Signal Butte FRS
17. Spook Hill FRS
18. Sunnycove Dam
19. Sunset Dam
20. Vineyard Road FRS
21. White Tanks FRS #3
22. White Tanks FRS #4

Dam

Inundation Area

City/Incorporated Area

Maricopa County/Unincorporated Area

Other County

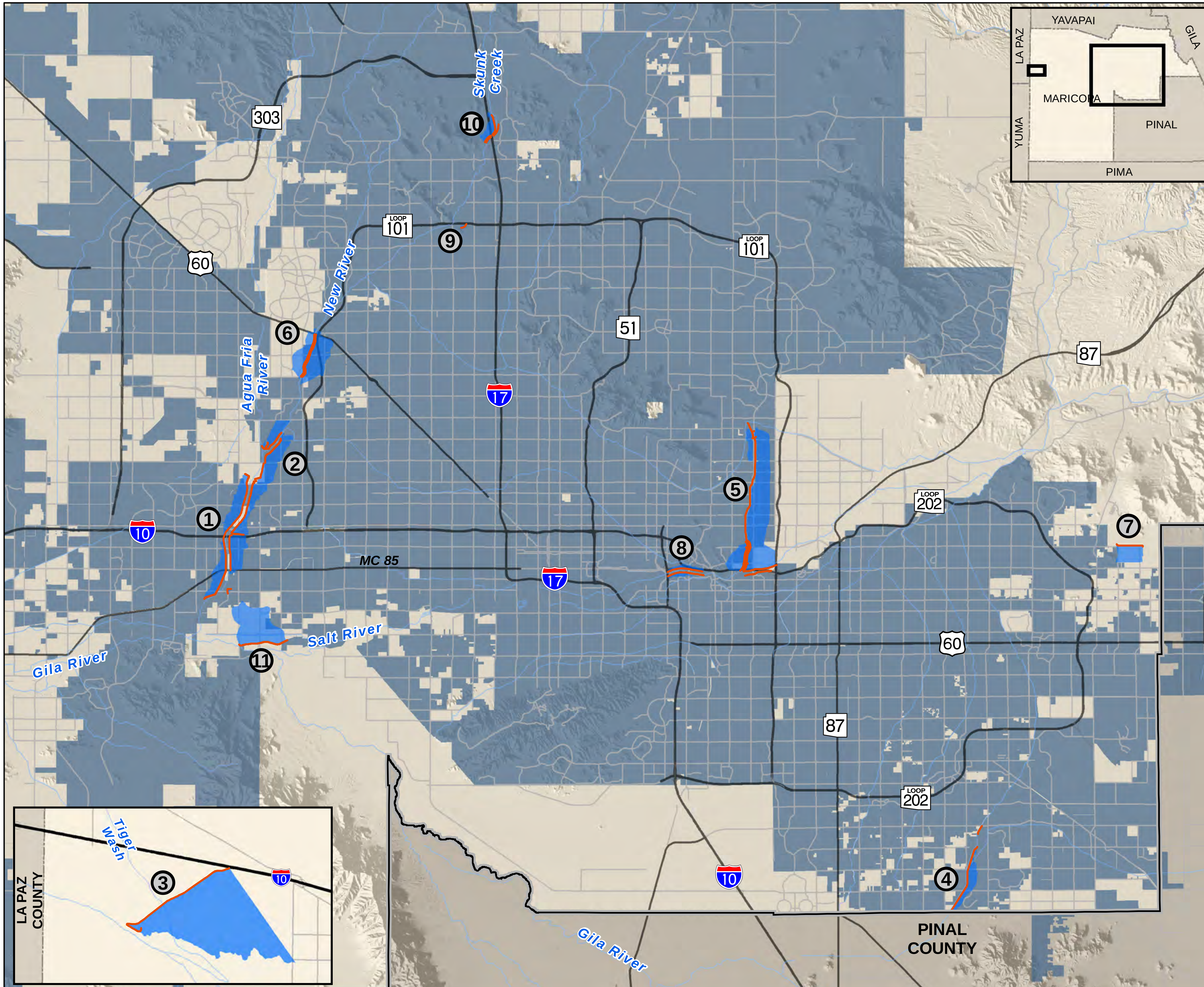
0 2.5 5 10 Miles

N

Data Source: Flood Control District of Maricopa County

District Levees and Inundation Areas

Map 12



1. Agua Fria River Levees
2. Camelback Ranch Levees
3. Centennial Wash Levee
4. East Maricopa Floodway
5. Indian Bend Wash
6. New River Channelization
7. Pass Mountain Diversion
8. Salt River Channel Levees
9. Scatter Wash Channel
10. Skunk Creek Levees
11. Tres Rios North Levee

Levee
Inundation Area
City/Incorporated Area
Maricopa County/Unincorporated Area
Other County

0 1.25 2.5 5 Miles

N

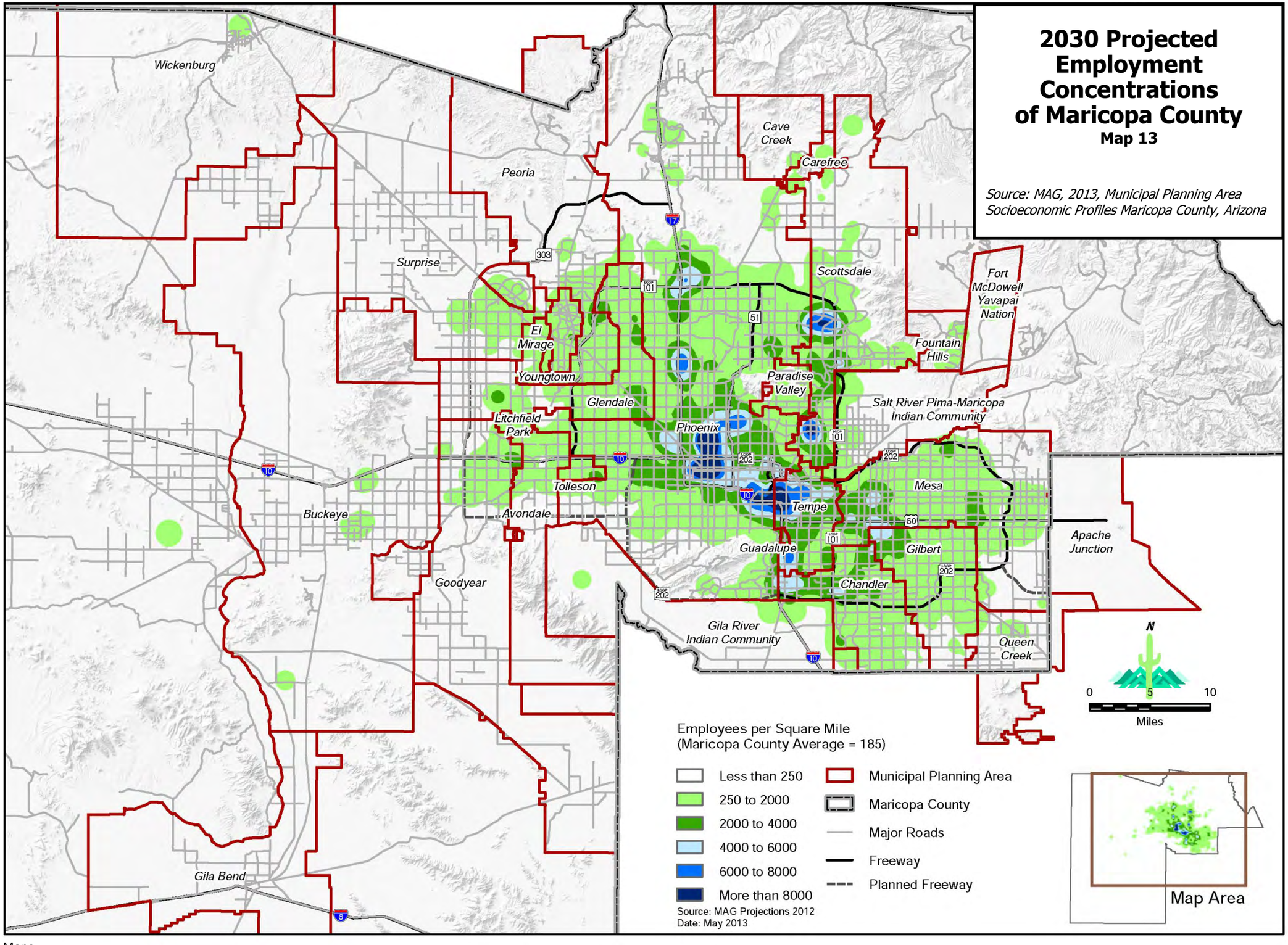
Data Source: Flood Control District of Maricopa County, U.S. Army Corps of Engineers

Flood Control District of Maricopa County

2030 Projected Employment Concentrations of Maricopa County

Map 13

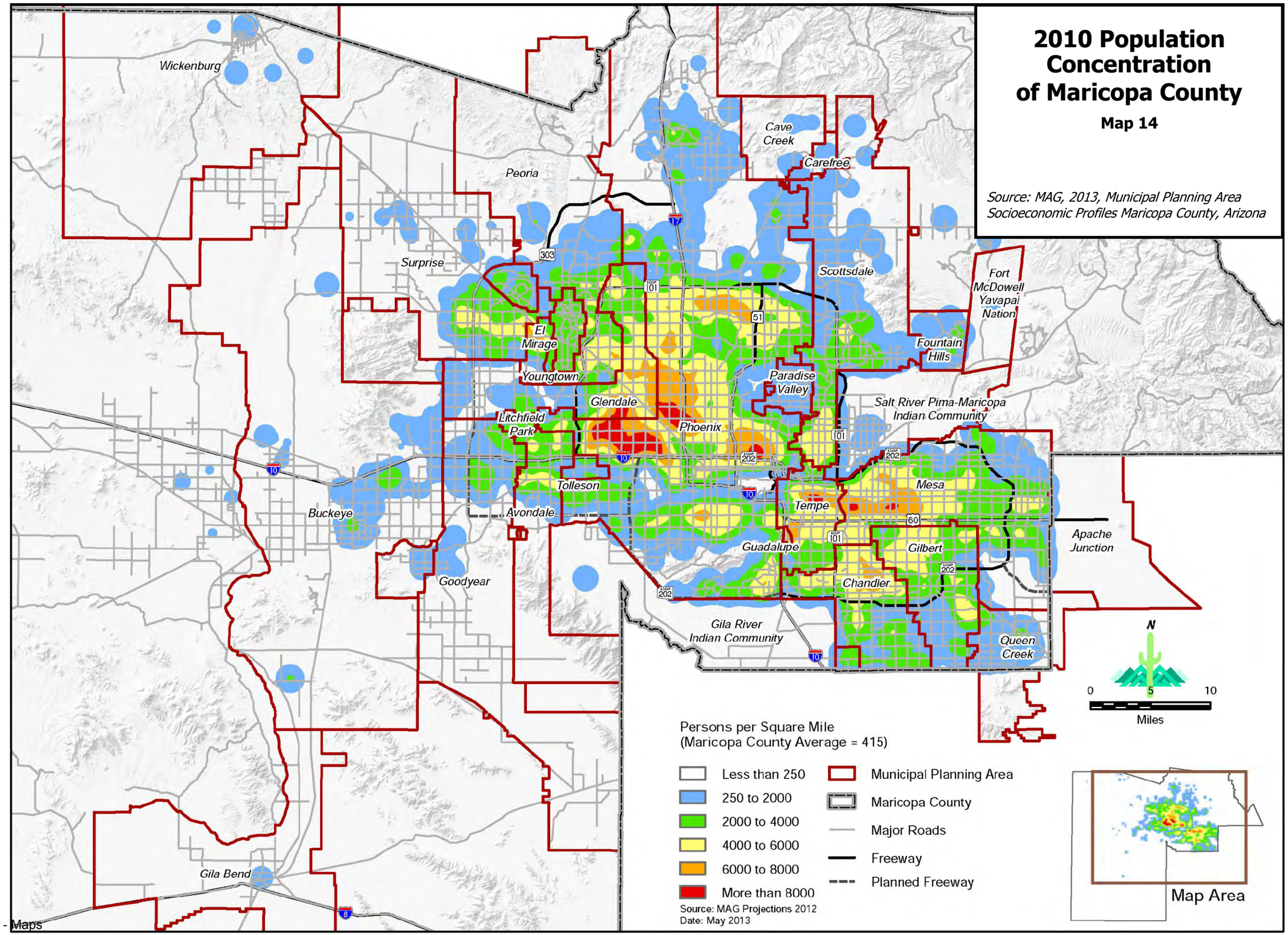
Source: MAG, 2013, Municipal Planning Area Socioeconomic Profiles Maricopa County, Arizona



2010 Population Concentration of Maricopa County

Map 14

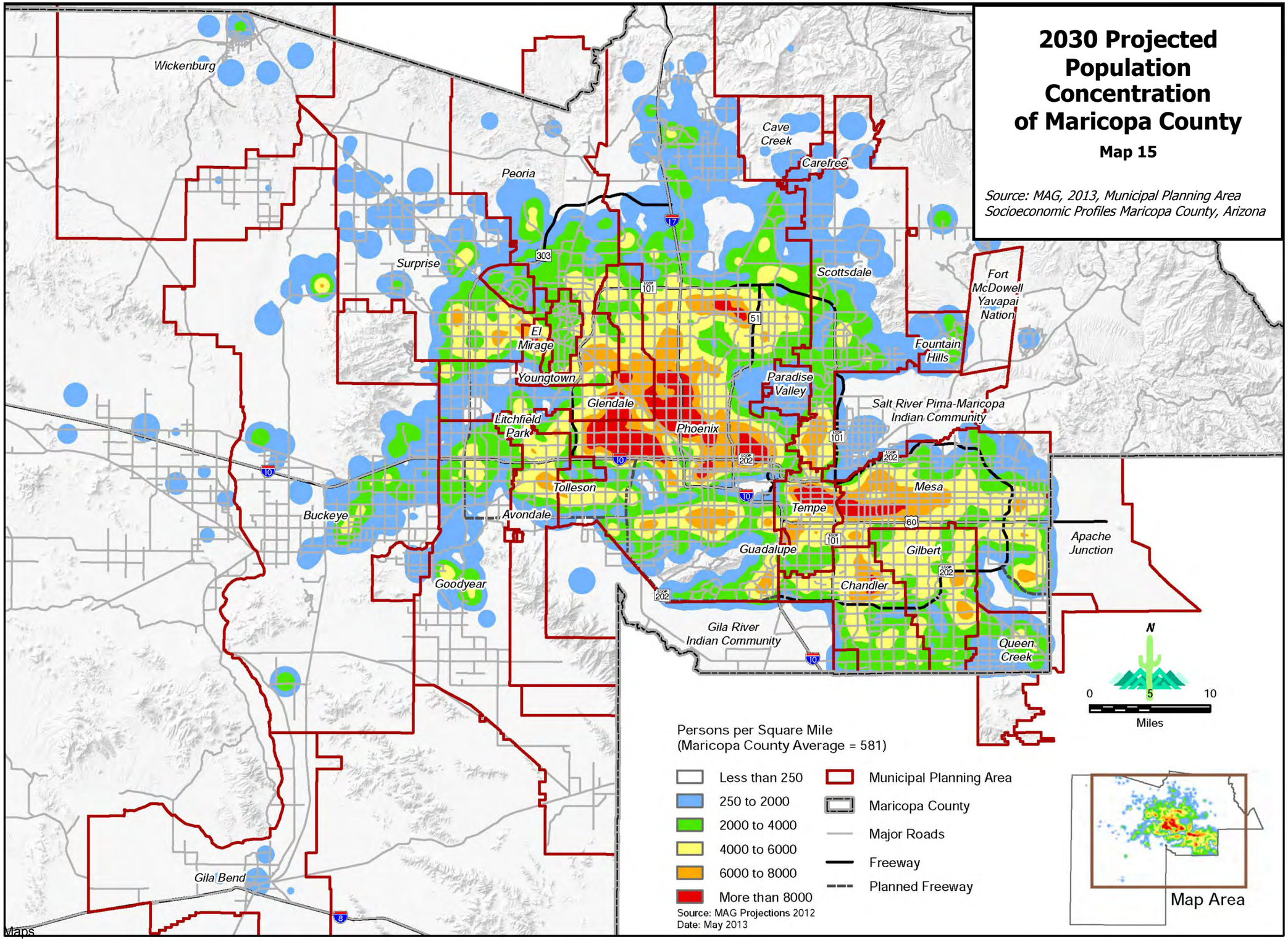
Source: MAG, 2013, Municipal Planning Area Socioeconomic Profiles Maricopa County, Arizona

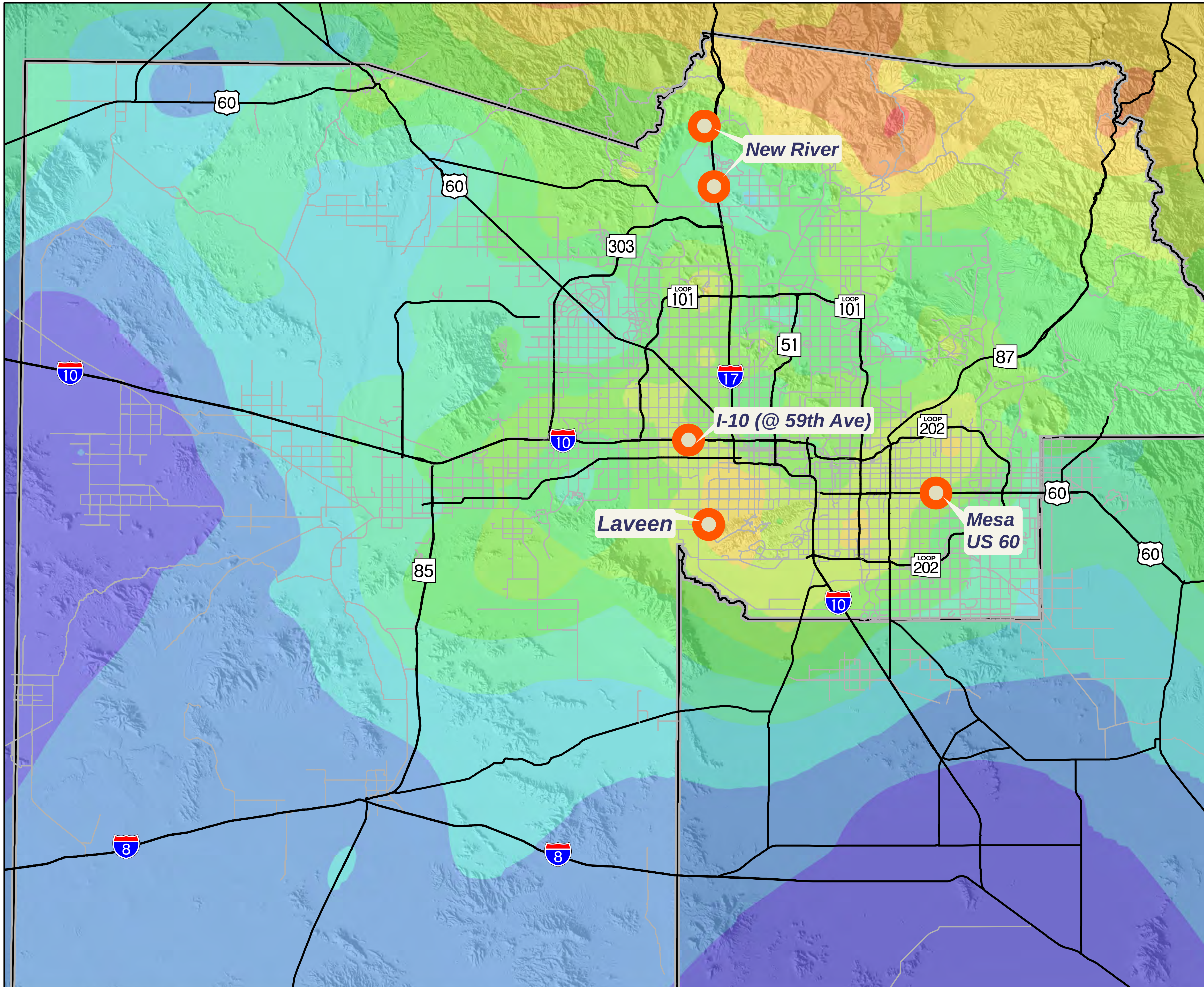


2030 Projected Population Concentration of Maricopa County

Map 15

Source: MAG, 2013, Municipal Planning Area Socioeconomic Profiles Maricopa County, Arizona





Reported Flooding Problems and Rainfall Estimates for August/September 2014

Map 16

Total Rainfall-Aug/Sept 2014 (inches)

- 1-2.45
- 1.45-3.64
- 3.64-4.68
- 4.68-5.67
- 5.67-6.5
- 6.5-7.2
- 7.2-7.9
- 7.9-8.68
- 8.68-9.97
- 9.97-13.7
- Reported Flooding Problems

0 2.5 5 10 Miles

N

Data Source: Flood Control District of Maricopa County

Flood Control District of Maricopa County

Appendix B

Floodplain Management Plan Committee Meetings

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FMP Committee Meeting #1 – Identify Hazards

Agenda
Sign-in Sheets
Meeting Summary

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MEETING AGENDA

Floodplain Management Plan 2015 Update

Wednesday, March 4, 9:00 – 11:30 a.m.

1. Introduction

- Around-the-room introductions
- Overview of the National Flood Insurance Program (NFIP)
  - Flood Insurance
  - Floodplain management goals
  - Community Rating System (CRS)
- Purpose of the Floodplain Management Plan (FMP)
- Goals of the FMP
- Overview of Featured District Programs
  - Studies & Plans, Floodplain Management, and Flood Detection/Response

2. Hazards Identified in the 2009 Plan

3. Where We are Now – Status of 2009 Plan Goals & Action Plan

- Prevention
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information

4. Where We Want to Be – 2015 Plan

- Update/identify hazards in Maricopa County
- Understand the problems associated with the hazards
- Set goals
- Evaluate potential actions to meet goals
- Prepare a five-year action plan
- Implement the plan
- Monitor progress

5. Next Steps

- Collect and incorporate hazard and mitigation data from communities
- Ongoing coordination with FMP Committee
- Public/Stakeholder Involvement
- Responsibilities of participants
  - Committee members
  - District representatives

6. Other

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting #1:	Access the Hazard	**Meeting Date:**	Wednesday – March 4, 2015
Facilitator:	Laurie Miller - LTM Engineering, Inc.	**Place/Room:**	DreamyDraw/SunnyCove/CaveButtes

Name	Title	Organization	Phone
Maureen Towne	Risk MAP coordinator	ADWR	(602) 771-8662
Stacey Lapp	Sr Civil Eng.	P&D	602. 506-4717
Carol Hu	Planner	P & D	602-506-850
ERIC Pfister	Insurance Agent	Farmers	6024127422
Jason Howard	GIS Program Mgr	MAG	602.254.6300
Ashley Couch	Stormwater Manager	City of Scottsdale	480-312-4317
Steve Waters	Flood Warning Mgr.	FCDMC	6-8694
Jim Trussell	~~Executive~~ Director	ARIZONA Rock Products Assn	602 989-3854
Jeff Shelton	Sr. Civil Eng	FCDMC	602-506-4486
Susan Woods	State Mitigation Planner	DEMA	602-464-6518
Tice Supplee	Interim Executive Director	Audubon Arizona	602-380-3722
HASAN MUSHTAQ	FLOODPLAIN MANAGER	CITY OF PHOENIX	602 262 4026

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Name	Title	Organization	Phone
Dova Plasencia	Vice President	Michael Baker Representing Arizona Farmers	602 798 7552
Tim Murphy	Mitigation Manager	FCDMC	602 506 4605
Laurie Miller	President	LTM Engineering, Inc.	602-485-5880
Shawn McGuire	Program Coordinator	FCDMC	602-506-8378
Mark Fooge AICP	Project Manager	FCDMC	602-506-0750

MEETING SUMMARY

	Floodplain Management Plan Update FCD 2014C041, Work Assignment #5	**Date:**	March 4, 2015
Subject:	FMP Committee Meeting #1	**Time:**	9:00 a.m.
	Hazard Assessment	**Place:**	FCDMC

The following is a summary of the first of five Floodplain Management Plan Committee (FMP Committee) meetings to update the Flood Control District of Maricopa County's (District) 2009 FMP. Attendance sheets and the agenda are attached.

1. Introduction

Tim Murphy, Mitigation Manager for the District, provided an overview of the National Flood Insurance Program (NFIP) as a means to reduce impacts of flooding on people and property through floodplain management. The program also offers subsidized flood insurance to participating communities. Flood insurance discounts to policy holders are based on the extent of the community's efforts in managing its floodplains. Unincorporated Maricopa County is currently a Class 4 community, which translates to a flood insurance discount of 30% for residences within a Special Flood Hazard Area. The classes range from 10 (no discount) to 1 (highest discount, 45%), and are based on a rating system with points awarded for floodplain management activities. The system is called the Community Rating System (CRS), and development of an FMP is one activity that can achieve points. The District's most recent FMP in 2009 was developed internally. The 2015 update will expand its value to the community and allow the county to earn additional CRS points.

District staff provided overviews of three programs:

Planning: Doug Williams, Planning Branch Manager, provided an overview of the District's planning activities. Regional planning is accomplished through Area Drainage Master Studies (ADMSs), Area Drainage Master Plans (ADMPs), and Watercourse Master Plans (WCMPs). The studies are performed to identify projects for consideration under the Capital Improvement Program (CIP). The studies and plans strive to advance multi-use opportunities and recognize more fully the beneficial functions of floodplains. There is a strong focus on developing nonstructural options; structural approaches are viewed as a "last resort". The branch's dual purpose goals are to 1) assess urban flooding and 2) get ahead of development by identifying flood hazards in areas forecasted to develop and plan accordingly.

Floodplain Delineation: Jeff Shelton, Engineering Division, described the District's processes in delineating floodplains. The program has shifted in recent years as the number of unstudied floodplains in unincorporated Maricopa County has diminished. The focus is now on restudies

due to changed drainage conditions, better topographic mapping, upgrading an approximate study to a detailed study with water surface elevations, etc. Letters of Map Revision (LOMRs) are submitted when structural changes have altered the hydrologic or hydraulic characteristics of a stream. Conditional Letters of Map Revision (CLOMRs) are issued for planned construction that would alter the hydrologic or hydraulic characteristics of a stream.

Costs for floodplain delineation studies can vary widely, depending on whether existing mapping can be used, if hydrologic modeling has been developed previously, and on the complexity of the drainage system. The District's CIP budget has been $40M to $70M in the past, but is projected to be $5M next year and $2M the following year.

Flood Warning: Steve Waters, Flood Warning Branch Manager, described the District's flood warning activities. The District operates and monitors a network of more than 350 ALERT gage sites including rainfall and stream gages and full weather stations. ALERT stands for Automated Local Evaluation in Real Time and is a standardized data collection platform. During the next two years, the District will be converting its system to ALERT2, a new platform that includes GIS applications and allows data to be transmitted faster, more reliably, and with less interference from other systems.

The primary function of the system is to monitor weather and flooding conditions and provide support to emergency managers, first responders, and operations and maintenance personnel. The Flood Warning Branch has developed a number of local flood response plans based on floodplain information and using the ALERT system to trigger pre-planned actions during a flood event. However, the system has important secondary functions such as research, transportation, education, water resource management, and forensics. It was noted that, although floodplain management has traditionally focused on 100-year flood frequencies, monitoring storms with higher and lower statistical frequencies is also important to public safety.

2. Hazards Identified in the 2009 FMP

The hazards identified in the 2009 FMP were reviewed as a start in developing a list for the 2015 update:

- Structural
  - Dam safety deficiencies
  - Overtopping of the CAP and other canals
  - Noncertified levees
- Regulatory
  - Single lot development – no coordinated drainage system
  - Undelineated floodplains
  - In-channel activities
  - Repetitive losses
- Natural Hazards
  - Flash flooding
  - High runoff potential of some soils
  - Sheet and split flows across the valley plains
  - Alluvial fans
  - Lateral erosion of natural streams

- Human-Caused Hazards
  - Changed flow characteristics due to urbanization
  - Changed flow paths due to farming

It was noted that the items listed may be included in the 2015 FMP if they are still relevant. However, additional hazards may be identified that were not considered in the 2009 FMP. For example, hazards such wildfires, subsidence, or others could become part of the new plan.

Meeting attendees were asked to share experiences during the August 19 and September 8, 2014, floods as an exercise in identifying flood hazards. The discussion included:

- Backyard weep holes in the exterior block wall were plugged before the storms and the resulting ponding nearly caused flooding of the house. Once the openings were cleared, the water receded with no further problems.
- A roof with known leaks was repaired several months before the storms (self-mitigation). The repairs held up and no flooding occurred.
- A friend had received a variance to build a house between two washes, with the stipulation that the lowest floor be raised. Both washes ran full during the flood and destroyed the landscaping, but the house was not damaged.
- Several reported that the flooding of I-10 and other routes prevented access to work.
- One participant reported that, although the September 8 storm was record-breaking and parts of the freeway system were under water, he was still able to travel on surface streets that morning to Sky Harbor Airport for a flight.

The group agreed that with drainage infrastructure in place, the region as a whole benefitted greatly.

The District prepares reports for significant storms in Maricopa County. The reports are listed by water year, which begins October 1 and ends September 30. Links to the recent storms in Water Year 2014:

Storm Report for 8/12/2014:
http://alert.fcd.maricopa.gov/alert/WY14/StormRpt_08122014_R1.pdf

Storm Report for 8/19/2014:
http://alert.fcd.maricopa.gov/alert/WY14/StormRpt_08192014.pdf

Storm Report for 9/8/2014:
http://alert.fcd.maricopa.gov/alert/WY14/StormRpt_09082014_R1.pdf

Storm Report for 9/27/2014
http://alert.fcd.maricopa.gov/alert/WY14/StormRpt_09272014.pdf

3. Where We are Now – Status of 2009 Plan Goals & Action Plan

A summary of action items from the 2009 FMP was reviewed as a reference point for developing, assessing, and selecting activities for the 2015 FMP. The list is incomplete and will be revisited in future meetings. The handout is attached.

4. Where We Want to Be – 2015 Plan

The following steps will be followed in developing the 2015 FMP:

- Update/identify list of hazards in Maricopa County
- Understand the problems associated with the hazards
- Set goals for the District to work toward
- Evaluate potential actions to meet goals
- Prepare a five-year action plan

Once the plan is complete, the District will present it to the Maricopa County Board of Supervisors. If accepted, the plan will be followed over the next five years. It was noted that the plan is not a regulatory document; it is a guide for the District to follow in striving to meet the plan's identified goals.

Once the 2015 FMP is implemented, the District would like to continue meeting with the FMP Committee or a similarly-structured group on an annual basis to monitor the progress of implementation.

5. Next Steps

The next meeting will be held at the District from 9:00 to 11:30 a.m. on March 11, 2015. At that meeting, the FMP Committee will continue identifying hazards and assessing problems caused by those hazards. The date for Meeting #4, April 15, will need to be changed; the District has been scheduled for its annual review with FEMA's CRS Coordinator on April 14-15. Proposed alternate dates will be provided for consideration by the members.

The District will invite the public to participate through an open house in late April and will post FMP Committee meeting information and progress on its website. Note that the public and any other stakeholders are welcome to attend any of the FMP Committee meetings.

6. Other

The following questions and comments were discussed:

1. *Q: Will climate change be included in the development of the FMP?*
   A: Yes, as well as other natural hazards. The information developed for the 2015 Maricopa County Hazard Mitigation Plan will be incorporated. It was noted that President Obama issued an Executive Order addressing the inclusion of climate change in disaster preparedness activities. Federal agencies will implement the order through their rules.

2. *Q: Did the downturn in housing in 2009 help or hurt District funding?*
   A: It helped in terms of the ability to build projects because construction costs dropped significantly. However, the ability of local cost-sharing partners to participate also dropped. Therefore, fewer projects were able to be constructed. The downturn has had a greater impact to the District in recent years as the assessed tax base lags changes in home values.

3. Sand & gravel operators were able to provide sand for sandbagging operations and could be used as a flood-fighting resource in the future.

4. Sand & gravel pits along the Agua Fria River have provided incidental storage during floods. The industry is evaluating the benefits of upstream capture to operations in lower reaches of the river and if nearby development would also benefit from it.

5. A number of areas have been identified by the Audubon Society as important habitat; GIS layers are available on bird habitats and wildlife corridors. The District is interested in obtaining them for this effort and other District planning studies.

6. Binders with maps and background information were provided; attendees are asked to bring their binder to each meeting for discussion and additions.

The preceding summary was prepared by Laurie Miller.

c: Attendees

Attachments
- Sign-in Sheets
- Meeting Agenda
- Partial List of 2009 FMP Action Items

Flood Control District of Maricopa County

Status of 2009 Floodplain Management Plan Action Items

March 4, 2015

ACTION	RESPONSIBLE	STATUS
Preventive		
Enforce existing floodplain regulations	Regulation, Floodplain Management Services Division	Ongoing
Complete 22 ADMS/ADMPs	Identification, Planning Branch	14, covering 1,723 square miles
Complete 530 miles of delineations	Identification, Floodplain Delineations Branch	735 miles completed (most are in unincorporated areas) - 242 mi. New - 493 mi. Revised
Coordinate with jurisdictions to adopt and enforce the recommendations of area drainage master plans, watercourse master plans and other studies.	Identification, Planning Branch	Ongoing
Develop a standardized model of assessing flooding risk and vulnerability at a watershed and sub-watershed level. This method will be used to develop structural and non-structural flooding solutions as part of the ADMP and WCMP planning processes.	Identification, Planning Branch	Ongoing; integral part of ADMS/Ps and WCMPs
Develop model guidelines for land use planning and site development within floodplains that protect public safety and preserve the natural functions of floodplains.	Identification: Planning Branch; Regulation: Floodplain Management Services Division	Ongoing; developed as part of ADMS/Ps and floodplain regulations
Property Protection		
Acquire eight properties through the Floodprone Properties Acquisition Program.	Remediation	None to date
Improve the unincorporated Maricopa County's rating in the NFIP-CRS program from Class 5 to Class 4.	All	Achieved in 2012
Implement flood warning systems to ensure safe crossings of rivers and washes.	Identification, Remediation: in cooperation with Maricopa County Dept. of Transportation	33 gages installed; 6 new or updated FRPs; began upgrade to new data transmission standards.
Natural Resource Protection		
Accommodate wildlife corridors and habitat, when feasible, during planning and construction of flood control solutions.	Identification: Remediation in cooperation with AZ Game & Fish Department and other entities	Ongoing; part of ADMS/Ps and WCMPs
Create an exploratory committee that is tasked with investigating tools for preserving floodplains for conveyance and other beneficial uses; and defining the District's r ole in river management and restoration efforts.	Identification, Planning Branch serves as lead for establishing committee. Participation required from all divisions.	Healthy Rivers Initiative developed 2013-2014

ACTION	RESPONSIBLE	STATUS
Develop a sensitive-lands management plan for District-owned floodplain property.	Real Estate in cooperation with environmental planning staff.	Not completed
Develop a habitat mitigation banking program to assist with regulatory compliance related to construction of flood control projects.	Identification and Remediation	
Emergency Services		
Update and support Emergency Action Plans for the 22 dams maintained by the District.	Remediation, Structures Branch	Updated EAPs for dams; prepared three new levee EAPs; developed Dam Safety Flood Response Manual
Provide reliable weather, water level and stream flow information to other jurisdictions and the community.	Outreach, Engineering Division	Ongoing – has online forecasts, rain, stream, weather, & pool data; mobile apps; online FRPs; participates in AFWS
Conduct and participate in annual multi-hazard emergency drills.	All	Ongoing; exercises held each May with MCDEM & others
Perform a county-wide vulnerability assessment that simulates the impacts of a major storm event. Use this tool to update flood response plans, emergency action plans and to prioritize future District work.	Identification and Remediation, including Engineering Division	None countywide; have completed for major structures
Structural Projects		
Construct or rehabilitate 57 structures, providing flood protection for over 755 square miles.	Remediation, Project Management, Construction Management branches	29 completed CIP projects @ $222.4M
Ensure that all Priority 1 Work Orders (work required to assure safety or for a structure to function as designed) are completed within 14 days.	Remediation, Operations and Maintenance Branch	Ongoing
Public Information		
Visit 12 schools in unincorporated county to discuss how to keep safe during flood events.	Outreach, Public Involvement Branch	
Produce 24 media messages regarding flood hazards, flooded wash crossings and other public safety issues.	Outreach, Public Involvement Branch	
Maintain a library that contains all past studies and reports and is accessible on-line from the District's web page (www.fcd.maricopa.gov).	Outreach, Engineering Branch	Completed; ongoing addition of new products
Offer technical assistance to 12 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information, and to municipalities that do their own floodplain management at their request.	All	Yes; provides floodplain management services for 14 communities

FMP Committee Meeting #2 – Identify Problems

Agenda
Sign-in Sheets
Meeting Summary

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MEETING AGENDA
Floodplain Management Plan 2015 Update
Wednesday, March 11, 9:00 – 11:30 a.m.

1. Introduction

- Around-the-room introductions
- District perspectives of 2014 flooding
  - Planning, Floodplain Management & Services, and O&M
- FMP watersheds

2. Hazard Identification

- Structural
- Regulatory
- Natural
- Human-Caused
- (Additional)

3. Impacts of Hazards During Major Storms

- Life, safety, health, evacuation
- Public health hazards caused by flooding
- Critical facilities – description of specific impact on these facilities
- Transportation
- Flood insurance claims
- Economic
- Natural floodplain functions

4. Impacts of Hazards During Lesser Flood Events

- Localized flooding of roads
- Local inconvenience

5. Next Steps

- Continued collection of hazard and mitigation data from communities
- Ongoing coordination with FMP Committee
- Meeting #3 – Set Goals
- Select date for Meeting #4 - Review Possible Activities
- Public meeting on April 21

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting #2:	Access the Problem	**Meeting Date:**	Wednesday – March 11, 2015
Facilitator:	Laurie Miller - LTM Engineering, Inc.	**Place/Room:**	DreamyDraw/SunnyCove/CaveButtes

Name	Title	Organization	Phone
GREG TOTH	SENIOR HYDROLOGIST	SCOTTSDALE	480-312-7055
Jason Howard	GIS Program Mgr.	MAG	602.254.6300
ERIC FOSTER	Agent/Owner	Farmers Ins. Foster Agency	6022127422
MICHAEL SMITH	INSPECTION SUPERVISOR,	FLOOD CONTROL DISTRICT of MARICOPA Co	602-506-0538
Bill LEAL	Work Control Center Supervisor	FCDMC	602.506.4723
Manny Patel	W.R. Engineer	ASLD	602 364 1596
Carol Hu	Planner	MC Planning & Development	602-506-8506
Doug Plasencia	Vice President	Michael Baker International	602 798-7552
Patrick Kiernan	Civil Engineer	CAP	623 8692494
Tice Supplee	Dir Bird Conservation	Audubon Arizona	602-380-3722
Sloan McGuire	Program Coordinator	FCDMC	602 506-8378
Stacy Lager	Sr Civil Engineer	MC. Planning & Development	602 506-4717

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Name	Title	Organization	Phone
Susan Wood	State Hazard Mitigation Planner	DEPT OF EMERGENCY & MILITARY AFFAIRS	602 464-6518
Jennifer Martin	Sierra Club ← →	AZ Water Sentinels Program Coordinator	(602) 423-6157
Kristina Jensen	Civil Engineer II	City of Phoenix	602 261-8417
Maureen Towne	RiskMAP coordinator	ADWR	602 771-8662
Tim Murphy	FCDMC	Mitigation Branch Manager	602 506-4605
Mark Fraga	~~F~~ Mitigation Planning Analyst	FCDMC	602-506-0750
Stan Tusler	Executive Director	~~AKPA~~	602 989 3854
Laurie Miller	President	LTM Engineering, Inc.	602-485-5880

MEETING SUMMARY

	Floodplain Management Plan Update FCD 2014C041, Work Assignment #5	**Date:**	March 11, 2015
Subject:	FMP Committee Meeting #2	**Time:**	9:00 a.m.
	Assessment of Problems Caused by Hazards	**Place:**	FCDMC

The following is a summary of the second of five Floodplain Management Plan Committee (FMP Committee) meetings to update the Flood Control District of Maricopa County's (District) 2009 FMP. Attendance sheets and the agenda are attached.

1. Introduction

District staff provided an overview of its Operation & Maintenance program and staff observations after major events in August and September 2014:

Monsoon 2014: Impacts to Structures: Bill Leal, Operations & Maintenance Division, provided information on storm severity, damages, subsequent repairs, and future mitigation plans. The District operates and maintains about 80 structures, including dams, levees, channels, detention basins, and drains. Monsoon events included:

1. August 12: South Mountain Communities
2. August 19: North-central Maricopa County
3. September 8: Urban Phoenix
4. September 27: Southeast Valley

During the September 8 storm, 47 structures were impacted, although all functioned as designed. The most common post-storm activity was to clear the structures of sediment and debris that is normally caught during flooding. Several dams and detention basins required significant sediment removal. A number of channels and drains had to be cleaned also, and several sustained structural damage to the banks. The estimate of damages to District structures is $4.8 million; examples of damage include:

- Bank failure of 48th Street Drain and erosion and bank failure of the East Maricopa Floodway and Rittenhouse Road Drain
- Extensive debris at New River Dam
- Nine feet of sediment deposited along the Spook Hill Floodway
- Extensive sediment and debris in Cudia City Wash Detention Basin

A State of Emergency was declared by Governor Brewer, and subsequently a Federal Disaster was declared by President Obama. The District has applied for funding from the FEMA Public

Assistance Program: 1) 404 Hazard Mitigation Grant Program, 2) 406 Hazard Mitigation Program, and 3) Debris Removal Pilot Program. Additionally, the US Army Corps of Engineers funds a Rehabilitation & Inspection Program, which may be used to repair Corps-sponsored structures.

Monsoon 2014: Planning Branch Comparisons: Afshin Ahouraiyan reported on Planning Branch activities during the monsoon season. The Planning Branch conducts regional studies to identify drainage concerns, prepare computer models of rainfall and runoff, and recommend alternatives to address the issues. During and after the 2014 storms, staff visited a number of sites as a reference point to evaluate whether the planning models are accurately capturing problem areas. At some flooded locations, projects had been identified but had not been constructed due to lack of funding and/or the absence of support from the local community. The Laveen area is being re-studied as an update to the 2002 Area Drainage Master Plan.

Monsoon 2014: Regulatory Observations: Mike Smith, Floodplain Compliance Branch Manager, inspected locations of damaged houses after the summer storms. In many cases, the structures were constructed before floodplain ordinances were adopted and do not comply with current regulations. In other cases, a residence was permitted but additional homes were constructed on the properly without a permit and were found to be within the 100-year floodplain. Other problems included unpermitted block walls that lacked weep holes and exacerbated flood conditions. A portion of the Beardsley Canal was damaged, and downstream Zone X (low to moderate flood risk) areas were flooded. Dove Valley Road east of Interstate 17 was washed out and had to be closed to traffic.

A question was asked regarding RV use on properties. Mike noted that Temporary units such as RVs may park for up to 180 days. However, they must be road-worthy, i.e., ready for quick removal.

2. Hazard Identification

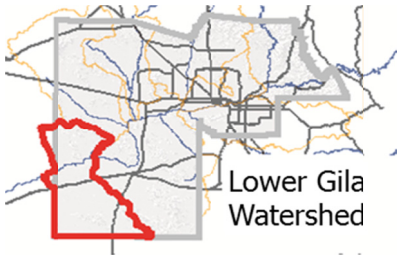
Several additional hazards were added to those identified in the 2009 FMP and the list was reviewed:

- Dams
- Overtopping of the CAP and other canals
- Levee failures
- Single lot development
- Undelineated floodplains
- In-channel activities
- Repetitive losses
- Flash flooding
- High runoff potential of some soils
- Sheet and split flows across the valley plains
- Alluvial fans
- Lateral erosion of natural streams
- Fissures
- Wildfires
- Sever wind
- Drought
- Climate change

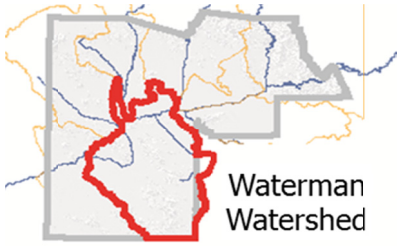
3. Impacts of Hazards During Major Storms

The FMP Committee attendees were split into four groups, and each group was asked to identify problems associated with the hazards by watershed. The watersheds were taken from the 2009 FMP, and each group received one urban and one rural watershed as follows:

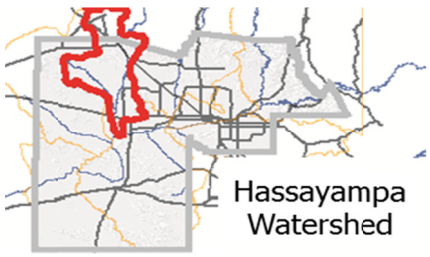
Group 1: Agua Fria and Lower Gila



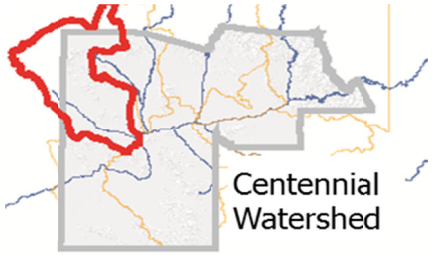
Group 2: Cave Creek/Salt and Waterman



Group 3: Gila/Queen Creek and Hassayampa



Group 4: Verde and Centennial



Worksheets were collected and the results summarized (attached). It is noted that the Hassayampa Watershed was not evaluated.

4. Impacts of Hazards During Lesser Events

Attendees were also asked to evaluate their watersheds with respect to problems during lower-frequency storms.

5. Next Steps

The next meeting will be held at the District from 9:00 to 11:30 a.m. on March 26, 2015. At that meeting, the FMP Committee will complete the assessment of problems caused by the identified hazards and establish goals for the FMP.

The date for Meeting #4, April 15, will be moved to either April 17 or May 12, depending on group availability.

The District will invite the public to participate through an open house April 21, 2015, between 10:30 AM and 1:00 PM. The public and any other stakeholders are also welcome to attend any of the FMP Committee meetings.

The preceding summary was prepared by Laurie Miller. Attendees are asked to advise Laurie within one week of dissemination via e-mail of any discrepancies and/or omissions.

c: Attendees

Attachments
- Sign-in Sheets
- Meeting Agenda
- Summary of Identified Hazards and Problems

Hazard		Impacts							
		Agua Fria	**Cave Creek/ Salt**	**Centennial**	**Gila/Queen Creek**	**Hassayampa**	**Lower Gila**	**Verde**	**Waterman**
Dams	**Life, safety, health, evacuation**	Hiking trails & other recreation along McMicken, Adobe, Cave Buttes, & New River dams. After major events, damage (seen & unseen) should be assessed and addressed ASAP. Consider redundant systems where needed.		EAPs on the Harquahala FRSs.	Spook Hill, & other FRSs (Signal Butte, Apache Junction, Powerline, Vineyard Road, Rittenhouse) offer flood protection for the eastern part of watershed. FRSs are 40+ yrs old & require major rehabilitation. Sediment loads behind Guadalupe FRS on end of So. Mtns – if failed would flood areas so. of US 60.		Gillespie Dam and Painted Rock Dam are in the watershed.	EAPs on all of the dams (Salt – 4; Verde – 2).	
	Public health hazards caused by flooding	Popping manhole lids; no ingress/egress.		Outreach and education regarding water quality and drinking water.				Outreach and education regarding water quality and drinking water.	
	Critical facilities	Hospitals, rescue centers, police/fire stations, airports.							
	Transportation	No ingress/egress; need one lane free from flooding. Dove Valley Rd @ Carefree Hwy was damaged in 2014 storms & prevented access.							
	Flood insurance claims	Flood damage adjusters or inspections		Lower due to flooding prevented by the FRSs.					
	Economic				Tempe Town Lake				
	Natural floodplain functions	Open space					Tamarisk deters growth of native plant species.		
Overtopping of CAP & Other Canals	**Life, safety, health, evacuation**	Identify evacuation areas or centers. Skunk Creek & CAP Canal and Beardsley Canal – are they designed for flood control?	Introduces pollutants and sediment; treatment plant issues.	CAP canal crosses the watershed, as well as numerous irrigation ditches. Can cause unexpected flooding in unpredictable locations.	CAP overtopping has been addressed by flood control structures. Many canals & railroads block sheet flow. Upstream side of canals are potential flood areas.		Channelization in the vicinity of Gillespie Dam. Invasive tamarisk (salt cedar) along canals & other waterways impede conveyance of floodwaters.		
	Public health hazards caused by flooding	Canal breaches cause flooding downstream							
	Critical facilities	Rescue centers, hospitals, audible alert	Treatment plant operations are affected.						
	Transportation	One dry lane	Canals modify natural floodplains, both beneficially and detrimentally.	Flooded roads	Irrigation canals in Laveen, Chandler, & Queen Creek.				
	Flood insurance claims	Risk for structures upstream & downstream of canals		Yes					
	Economic	Damage to Zone X structures, O&M plans		Yes					
	Natural floodplain functions	Recreation impoundment areas			Canals modify natural floodplains, both beneficially and detrimentally.				

Hazard		Impacts							
		Agua Fria	**Cave Creek/ Salt**	**Centennial**	**Gila/Queen Creek**	**Hassayampa**	**Lower Gila**	**Verde**	**Waterman**
Levee failures	**Life, safety, health, evacuation**	Same as canal overtopping issues. Levees that are damaged but didn't fail should be repaired	Results in flooding of areas not designed with elevation safeguards.	Can cause unexpected flooding.					
	Public health hazards caused by flooding	Canal breaches cause flooding downstream	Yes						
	Critical facilities	Rescue centers, hospitals, audible alert	Affected somewhat - in areas flooded by levee failure.						
	Transportation	One dry lane	Affected.		Loop 202 & So. Mtn. freeways – potential design components.				
	Flood insurance claims	Risk for structures upstream & downstream of canals	Limited, because dwellings protected by levees wouldn't be required to carry flood insurance.						
	Economic	Damage to Zone X structures, O&M plans	Multi-use parks affected.						
	Natural floodplain functions	Recreation impoundment areas			Salt River, Rio Salado Oeste, Tres Rios, El Rio.				
Single-lot development	**Life, safety, health, evacuation**	Need positive drainage. Streams may be filled in. Emergency access needed	Time – flooding is usually unpredictable. Most affected properties are not in an identified floodplain.	Braided washes; alluvial flooding.	Mostly in Laveen and eastern Queen Creek – tends to be adjacent to challenging sheet flow issues.		Evacuation routes are less reliable.	Braided washes; alluvial flooding.	Limited resources
	Public health hazards caused by flooding	Flooded streets		Access is cut off during flooding.				Access is cut off during flooding.	Mud
	Critical facilities								May be more affected because of limited facilities.
	Transportation		Road closures, access issues, high maintenance for road clearing. Limited regulation of floodplains in watershed.	Numerous dirt roads, at-grade crossings of streams; access problems.				Numerous dirt roads, at-grade crossings of streams; access problems.	Interior road system generally designed to minimum standards.
	Flood insurance claims								Limited resources
	Economic		High impact.						Greater
	Natural floodplain functions		More critical to minor and medium-sized washes.	Lots of undeveloped land				Lots of undeveloped land.	Maintain existing
floodplains	**Life, safety, health, evacuation**	Approximate A Zone delineations should be restudied with the understanding that adjacent land will be developed		Unmapped areas have high potential for development.	Flood flows from South Mountain are undelineated. Laveen area flood channel.		Sheet flow characteristics make it difficult to recognize flood risk.	Unmapped areas have high potential for development.	Limited resources
	Public health hazards caused by flooding				Lack of hazard identification to the public around South Mountain.				Mud

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Undelineated	Critical facilities								May be more affected because of limited facilities.
	Transportation		Road closures, access issues, high maintenance for road clearing.						Interior road system generally designed to minimum standards.
	Flood insurance claims			Many residents are unaware of flooding risk.				Many residents are unaware of flooding risk.	Limited resources
	Economic		High impact.						Greater
	Natural floodplain functions		More critical to minor and medium-sized washes.						Maintain existing
In-channel activities	Life, safety, health, evacuation	Human activity such as trails, camping, ATV use, low water crossings, bridges. Unpermitted/non-conforming agricultural or mining use. Consider dedicated storage capacity in mining operations.	Driving on at-grade road crossings can cause injury or death.		Sand & gravel mining; Tres Rios.		Mining can alter flow characteristics.	Recreation	Structures usually under-designed
	Public health hazards caused by flooding			Water quality				Water quality	
	Critical facilities	Channel maintenance needed.							
	Transportation	Need access to channels for maintenance.	Closures of at-grade road crossings.	Roads that cross channels				Roads that cross channels	Affected
	Flood insurance claims								Limited for rural areas.
	Economic								Limited for rural areas. Farming operations possibly more impacted.
	Natural floodplain functions		Yes	Keep channels clear.				Keep channels clear	
Repetitive losses	Life, safety, health, evacuation	Publish evacuation routes with one lane reasonable site of flooding. Filling pits.		Yes, to affected property owners.	Most likely in the single-lot development pockets.		Loss of land value due to redelineation of floodplains	Yes, to affected property owners	
	Public health hazards caused by flooding								
	Critical facilities	Rescue centers							
	Transportation								
	Flood insurance claims			High potential due to past flooding events.				High potential due to past flooding events	
	Economic			Financial impacts on farming operations.					
	Natural floodplain functions								

Hazard		Impacts							
		Agua Fria	**Cave Creek/ Salt**	**Centennial**	**Gila/Queen Creek**	**Hassayampa**	**Lower Gila**	**Verde**	**Waterman**
Flash flooding	**Life, safety, health, evacuation**	Areas in the New River community were flooded in 2014 storms. Improve communications listing areas impacted. Show evacuation routes and safe distances from areas impacted. Sun City/Sun City Grand may need special mobilization plans for evacuation. Consider user check in/out system at trailheads where flash flood potential is high. Communication messages should be consistent during floods.	Great concern for life, safety, and health. Evacuations may not be possible due to flooded roads.	Ingress and egress are affected.	Entire watershed susceptible. Street flooding; clogged storm drains. Highest risks in single-lot and undeveloped areas. Sheet flow on farm fields.		Present in the watershed.	Access and egress are affected.	Impacted
	Public health hazards caused by flooding	Improve communications listing are	Mold, sewers impacted	Same as other hazards.				Same as other hazards.	
	Critical facilities	Show evacuation routes and safe distances from areas impacted.							
	Transportation		Directly affected – most deaths during flooding are transportation-related.	Problems with access and rescue operations – flooded roads.				Problems with access and rescue operations – flooded roads.	
	Flood insurance claims			Very likely.				Very likely	
	Economic		Could be costly.	Damaged roads, residential property damage. Financial impacts on farming operations.				Damaged roads, residential property damage.	
	Natural floodplain functions		Yes	Alluvial fan flooding, changes to braided channel systems.				Alluvial fan flooding, changes to braided channel systems.	
High runoff potential of some soils	**Life, safety, health, evacuation**	Mountainous areas in Peoria and Deer Valley have high runoff potential. Construct grade breaks to slow down velocity of the runoff.			Areas around South Mountain are susceptible.		High water table near the Gila River results in increased runoff potential.		
	Public health hazards caused by flooding							Horse properties - pollution	
	Critical facilities								
	Transportation			Closed roads due to high sediment loads.				Closed roads due to high sediment loads.	
	Flood insurance claims								
	Economic								
	Natural floodplain functions			Yes				Yes	

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Sheet and split flows across the valley plains	Life, safety, health, evacuation			Yes	East Valley is very flat & prior agriculture has obliterated historical channels.		Flatter land slopes and farming operations result in ill-defined flow patterns that mask flood risk.	Yes	
	Public health hazards caused by flooding			Access is cut off.				Access is cut off	
	Critical facilities				Solved in past with detention basins in master-planned communities.				
	Transportation			Yes, some roads will be affected.	Inadequate drainage outlets where water management is part of freeway design.			Yes, some roads will be affected.	
	Flood insurance claims								
	Economic						Population growth has channelized sheet flow and increased flood risk.		
	Natural floodplain functions			Yes				Yes	
Alluvial fans	Life, safety, health, evacuation	Alluvial fans present in the White Tank Mountains.		Residents affected by debris flows.	Southeast side of South Mountain believed to be relatively stable.			Residents affected by debris flows.	
	Public health hazards caused by flooding			Residents affected by debris flows.				Residents affected by debris flows.	
	Critical facilities								
	Transportation			Affects road crossings, bridges.				Affects road crossings, bridges.	
	Flood insurance claims			Residents may be unaware of flooding risks.				Residents may be unaware of flooding risks.	
	Economic								
	Natural floodplain functions								
Lateral erosion of natural streams	Life, safety, health, evacuation	The Agua Fria River migrates laterally except where it is channelized.		Houses can fall into a wash and shift its course.				Houses can fall into a wash and shift its course.	
	Public health hazards caused by flooding			Houses can fall into a wash and shift its course.				Houses can fall into a wash and shift its course.	
	Critical facilities								
	Transportation			Can affect roads and crossings.				Can affect roads and crossings.	
	Flood insurance claims								
	Economic			Costs to repair roads, bridges.					
	Natural floodplain functions			Lateral erosion is important to natural floodplain function.				Lateral erosion is important to natural floodplain function.	

Hazard		Impacts							
		Agua Fria	**Cave Creek/ Salt**	**Centennial**	**Gila/Queen Creek**	**Hassayampa**	**Lower Gila**	**Verde**	**Waterman**
Fissures	**Life, safety, health, evacuation**	Fissure zone remediated at the south end of McMicken Dam. Coordination with AZGS is needed.			Natural fissures in the East Valley.		Coordinate with USGS/AZGS.		
	Public health hazards caused by flooding								
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions								
Wildfires	**Life, safety, health, evacuation**	Transfer of sediment downstream after a wildfire. Cave Creek Complex Fire resulted in sediment transfer and increases in flash flood potential.			South Mountain – invasive plants (buffalo grass) increases risk.			Lots of forest lands in the watershed; potential is high.	
	Public health hazards caused by flooding							Wildfires will/can lead to water quality issues	
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions							Degrades the natural floodplain functions in the short-term.	
Severe Wind	**Life, safety, health, evacuation**	Dust storms cause driving hazards. Debris from high winds can plug drainageways.		Can topple trees, which can affect flow in natural drainages.				Can topple trees, which can affect flow in natural drainages.	
	Public health hazards caused by flooding								
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions								
Drought	**Life, safety, health, evacuation**				South Mountain – invasive plants (buffalo grass) are more drought-resistant.			Decreases vegetation; increases chance of wildfire	
	Public health hazards caused by flooding			Decreases vegetation; increases chance of wildfire	Causes complacency of the public about flooding.				
	Critical facilities								
	Transportation			Roads affected by more debris.				Roads affected by more debris.	

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
	Flood insurance claims			Lower risk.				Lower risk	
	Economic			Yes, due to less surface water.				Yes, due to less surface water.	
	Natural floodplain functions			Adversely affected by decreased vegetation and increased debris.				Adversely affected by decreased vegetation and increased debris.	
Climate Change	Life, safety, health, evacuation	Executive order issued requiring that climate change be considered in risk management activities.			Uncertainty of how historical standards will perform.				
Climate Change	Public health hazards caused by flooding								
Climate Change	Critical facilities								
Climate Change	Transportation								
Climate Change	Flood insurance claims								
Climate Change	Economic								
Climate Change	Natural floodplain functions								
Other - So. Mtn. Freeway/Loop	Life, safety, health, evacuation				In-channel vegetation				
Other - So. Mtn. Freeway/Loop	Public health hazards caused by flooding								
Other - So. Mtn. Freeway/Loop	Critical facilities								
Other - So. Mtn. Freeway/Loop	Transportation								
Other - So. Mtn. Freeway/Loop	Flood insurance claims								
Other - So. Mtn. Freeway/Loop	Economic								
Other - So. Mtn. Freeway/Loop	Natural floodplain functions				If properly managed, natural floodplains may be a hazard mitigation strategy.				
Other - On-lot Drainage Systems	Life, safety, health, evacuation				Home maintenance of drainage system.				
Other - On-lot Drainage Systems	Public health hazards caused by flooding				Overwhelmed sanitary sewer systems.				
Other - On-lot Drainage Systems	Critical facilities								
Other - On-lot Drainage Systems	Transportation								
Other - On-lot Drainage Systems	Flood insurance claims								
Other - On-lot Drainage Systems	Economic								
Other - On-lot Drainage Systems	Natural floodplain functions								

FMP Committee Meeting #3 – Set Goals

Agenda
Sign-in Sheets
Meeting Summary

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MEETING #3 AGENDA – SET GOALS
Floodplain Management Plan 2015 Update
Thursday, March 26, 9:00 – 11:30 a.m.

1. Introduction

- Around-the-room introductions
- Discussion of identified hazards/problems by watershed
  - Results of Meeting #2 working groups
  - Additional issues identified by FCDMC team
  - Opportunities for additional Committee input on issues
- Summary of significant hazards

2. 2009 FMP Goals

- Strengthen Role as Regional Leader
- Streamline the multi-objective watershed approach to flood mitigation
- Increase collaboration and partnering to expand flood mitigation efforts
- Preserve and restore the natural resources and functions of floodplains & riparian areas
- Continued commitment to process improvement

3. Discussion of Potential 2015 FMP Goals

4. Next Steps

- Ongoing coordination with FMP Committee
- Public meeting on April 21
- FCDMC team to develop possible FMP activities
- Meeting #4 – Review Possible Activities
  - Date is Thursday, April 30
- Reminder: Meeting #5, Draft Plan, will be held May 12

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting #3:	Set Goals	**Meeting Date:**	Thursday – March 26, 2015
Facilitator:	Laurie Miller - LTM Engineering, Inc.	**Place/Room:**	Adobe/Harq/New River

Name	Title	Organization	Phone
Jason Howard	GIS Program Manager	MAG	602.254.6300
Eric Pfister	Owner	Farmers Agency	6024127422
Stacey Lage	Civil Engr	Maricopa Co Planning & Development	602-506-4717
Ashley Couch	Stormwater Manager	City of Scottsdale	480-312-4317
Susan Wood	State Mitigation Planner	DEMA	602 464-6518
Carol He	Planner	MC Planning & Development	602-506-8170
Patricia Herman	Civil Engineer	CAP	623-869-2494
Steve Trussell	Executive Director	Arizona Rock Products Assn	6029893854 #5
Maureen Towne	Risk MAP coordinator	ADWR	602-771-8662
Doug Plasencia	Vice President	Baker - Representing AZ Forward	602 798-7552
Tice Supplee	Dir. Bird Conservation	Audubon Arizona	602.380.3722
Kristina Jensen	Civil Engineer II	City of Phoenix	602-261-8417

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Name	Title	Organization	Phone
Laurie Miller	President	LTM Engineering, Inc.	602-485-5880
Mark Frago AICP	Project Manager	FCDMC	6-0750
Katina Castillo	Floodplain Rep.	FCDMC	67839
Sharon McGuire	~~FCD~~ Program Coordinator	FCDMC	68378

MEETING SUMMARY

	Floodplain Management Plan Update FCD 2014C041, Work Assignment #5	**Date:**	March 26, 2015
Subject:	FMP Committee Meeting #3	**Time:**	9:00 a.m.
	Set FMP Goals	**Place:**	FCDMC

The following is a summary of the third of five Floodplain Management Plan Committee (FMP Committee) meetings to update the Flood Control District of Maricopa County's (District) 2009 FMP. The agenda and attendance sheets are attached.

1. Introductions

The flood hazards and associated problems identified in the previous FMP meetings were augmented by information collected from District staff and the project team. A spreadsheet was distributed that contains the original information (*shown in black text*) and the additions (*shown in green text*). The augmented spreadsheet is attached, as well as a summary of problems by watershed and a grouping of hazards by presence/type of development.

Several issues specific to urban development were discussed:

- Alluvial fans should be added to the list of hazards/problems.
- A number of floodplains have conveyance issues, either from natural vegetation growth or artificially enhanced growth as a result of increased availability of water. New water sources may be caused by obstructions, diversions, and/or lack of maintenance in and along watercourses.
- A template should be created for habitat preservation in undeveloped areas.
- Public safety and natural environment must be balanced.

The FMP Committee was asked to review the spreadsheet as a work-in-progress and is welcome to provide additional input. Comments should be submitted by April 15th so that they can be incorporated before the public open house on April 21st.

2. 2009 FMP Goals

The District's goals set previously in the 2009 FMP were revisited as a reference point:

- Strengthen role as regional leader
- Streamline the multi-objective watershed approach to flood mitigation

- Increase collaboration and partnering to expand flood mitigation efforts
- Preserve and restore the natural resources and functions of floodplains & riparian areas
- Continued commitment to process improvement

3. Potential 2015 FMP Goals

The following ideas were discussed in developing goals for the 2015 FMP:

- Continue/expand public outreach
  - Educate the public and elected officials on the need for floodplain mitigation. Flood hazards are real but are sporadic, so support dwindles over time after a flood.
  - Develop a marketing plan that offers reasons to support floodplain management and includes multiple communication venues with frequent messages.
  - Include multi-hazard education on the effects of long-term (changing flows) and short-term (post-wildfire) changes to the watersheds.
  - Promote a "standards work" strategy to recognize benefits of past floodplain management and flood control efforts.
  - Convey a "greater good" message on responsible floodplain management approaches.
  - Convey the message that flood hazards are present, regardless of the FIRM classification
  - Ongoing education/guidelines for fencing to promote intended on-lot drainage functions.
- Improve quality of life
  - Economic benefits
  - Reduce public suffering
  - Natural resources (use of water and minerals; outdoor activity)
- Intergovernmental outreach
  - Collaborate with other agencies to coordinate planning efforts and needs
  - Integrate floodplain management goals with other plans (transportation, planning, land-use zoning)
- Develop standard lists of resources available before, during, & after flood events
- Regulatory goals
  - Preserve floodplains on single-lot developments as open space
  - Encourage the Maricopa County Planning & Development Department to continue to propose/discuss "good ideas" at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the future risk of flooding).
- Re-evaluate the CIP selection process

4. Next Steps

- The District is holding an open house for the public on April 21, 2015, between 10:30 AM and 1:00 PM. The public, FMP Committee, and any other stakeholders are welcome to attend. Members of the FMP Committee will be sent an invitation by email.
- Future FMP Committee meetings:
  - Meeting #4, Review Possible Activities, will be held at the District from 9:00 to 11:30 a.m. on April 30, 2015. The initial list of potential activities for the 2015 FMP will be prepared by the District's project team and will be sent by email before the meeting.
  - Meeting #5, Draft an Action Plan, is scheduled for May 12.

The preceding summary was prepared by Laurie Miller. Attendees are asked to advise Laurie within one week of dissemination via e-mail of any discrepancies and/or omissions.

c: Attendees

Attachments
- Sign-in sheets
- Meeting agenda
- Work-in-progress summary of identified hazards and problems
- Overview of identified hazards/problems by watershed
- Groupings of hazards and problems by presence/type of development

CRS Activity 510: Floodplain Management Plan 2015 - Identify Hazards Associated Problems

Hazard		Impacts							
		Agua Fria	**Cave Creek/ Salt**	**Centennial**	**Gila/Queen Creek**	**Hassayampa**	**Lower Gila**	**Verde**	**Waterman**
Dams	**Life, safety, health, evacuation**	Hiking trails & other recreation along McMicken, Adobe, Cave Buttes, & New River dams. After major events, damage (seen & unseen) should be assessed and addressed ASAP. Consider redundant systems where needed.		EAPs on the Harquahala FRSs.	Spook Hill, & other FRSs (Signal Butte, Apache Junction, Powerline, Vineyard Road, Rittenhouse) offer flood protection for the eastern part of watershed. FRSs are 40+ yrs old & require major rehabilitation. Sediment loads behind Guadalupe FRS on end of So. Mtns – if failed would flood areas so. of US 60.		Gillespie Dam and Painted Rock Dam are in the watershed.	EAPs on all of the dams (Salt – 4; Verde – 2).	
	Public health hazards caused by flooding	Popping manhole lids; no ingress/egress.	Water and sewer lines in the Adobe Dam reservoir pool; could exacerbate emergency conditions.	Outreach and education regarding water quality and drinking water.	Sewer line in the Spook Hill FRS reservoir pool; could exacerbate emergency conditions.			Outreach and education regarding water quality and drinking water.	
	Critical facilities	Dams protect hospitals, rescue centers, police/fire stations, airports.	Dams protect hospitals, rescue centers, police/fire stations, airports.		Dams protect hospitals, rescue centers, police/fire stations, airports.				
	Transportation	No ingress/egress; need one lane free from flooding. Dove Valley Rd @ Carefree Hwy was damaged in 2014 storms & prevented access.							
	Flood insurance claims	Flood damage adjusters or inspections		Lower due to flooding prevented by FRSs.					
	Economic				Tempe Town Lake is impacted when the Salt River floods.				
	Natural floodplain functions	Open space Dams cut off water to downstream reaches of washes.	Dams cut off water to downstream reaches of washes.		Dams cut off water to downstream reaches of washes.		Tamarisk deters growth of native plant species. Dams cut off water to downstream reaches of washes.	Dams cut off water to downstream reaches of washes.	
Overtopping of CAP & Other Canals	**Life, safety, health, evacuation**	Identify evacuation areas or centers. Skunk Creek & CAP Canal and Beardsley Canal – are they designed for flood control?	Introduces pollutants and sediment; treatment plant issues.	CAP canal crosses the watershed, as well as numerous irrigation ditches. Can cause unexpected flooding in unpredictable locations.	CAP overtopping has been addressed by flood control structures. Many canals & railroads block sheet flow. Upstream side of canals are potential flood areas.		Channelization in the vicinity of Gillespie Dam. Invasive tamarisk (salt cedar) along canals & other waterways impede conveyance of floodwaters.		Sedimentation & erosion issues ID'ed in Gillespie ADMS on upstream side of Gila Bend Canal & ADOT Channel; clogged culverts across GB Canal. Overtopping of GB Canal & ADOT Channel.
	Public health hazards caused by flooding	Canal breaches cause flooding downstream							
	Critical facilities	Rescue centers, hospitals, audible alert	Treatment plant operations are affected.						
	Transportation	One dry lane	Canals modify natural floodplains, both beneficially and detrimentally.	Flooded roads	Irrigation canals in Laveen, Chandler, & Queen Creek.				
	Flood insurance claims	Risk for structures upstream & downstream of canals		Yes					
	Economic	Damage to Zone X structures, O&M plans		Yes					
	Natural floodplain functions	Recreation in impoundment areas. Canals modify natural floodplains, both beneficially and detrimentally.	Canals modify natural floodplains, both beneficially and detrimentally.	Irrigation canals modify natural floodplains, both beneficially and detrimentally.	Queen Creek has a number of unengineered irrigation berms that interrupt flow and can breach at unpredictable locations.		Canals modify natural floodplains, both beneficially and detrimentally.		Canals around Gila Bend and Buckeye modify natural floodplains, both beneficially and detrimentally.

Black text: progress as of 3-26-15
Green text: added by LTM Engineering based on research & input from District staff
Blue text: from individual FMP Committee members

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Levee failures	**Life, safety, health, evacuation**	Same as canal overtopping issues. Levees that are damaged but didn't fail should be repaired	Results in flooding of areas not designed with elevation safeguards.	Can cause unexpected flooding to downstream farms.			Channelized near Gila River confluence		
	Public health hazards caused by flooding	Canal breaches cause flooding downstream	Yes						
	Critical facilities	Rescue centers, hospitals, audible alert	Affected somewhat - in areas flooded by levee failure.						
	Transportation	One dry lane	Affected.		Loop 202 & So. Mtn. freeways – potential design components.				
	Flood insurance claims	Risk for structures upstream & downstream of canals	Limited, because dwellings protected by levees wouldn't be required to carry flood insurance.						
	Economic	Damage to Zone X structures, O&M plans.	Multi-use parks affected.						
	Natural floodplain functions	Recreation impoundment areas		Centennial Wash Levee modifies natural floodplains tributary to the wash.	Salt River, Rio Salado Oeste, Tres Rios, El Rio have riparian areas. Gila River, 89th Ave to Gillespie Dam, is important bird area; habitat for endangered Yuma Ridgeway's Rail.				
Single-lot development	**Life, safety, health, evacuation**	Need positive drainage. Streams may be filled in. Emergency access needed	Time – flooding is usually unpredictable. Most affected properties are not in an identified floodplain. Pre-FIRM development is typically slab-on-grade and very susceptible to flooding. Exacerbated by roads and more recent developments.	Braided washes; alluvial flooding.	Mostly in Laveen and eastern Queen Creek – tends to be adjacent to challenging sheet flow issues.	Very little development in unincorporated county.	Evacuation routes are less reliable.	Braided washes; alluvial flooding.	Limited resources
	Public health hazards caused by flooding	Flooded streets. Animal waste conveyed downstream in rural/large-lot properties.	Animal waste conveyed downstream in rural/large-lot properties.	Access is cut off during flooding.	Animal waste conveyed downstream in rural/large-lot properties.			Access is cut off during flooding.	Mud
	Critical facilities								May be more affected due to limited facilities.
	Transportation	Road closures, access issues, high maintenance for road clearing. Limited regulation of floodplains in watershed.	Road closures, access issues, high maintenance for road clearing. Limited regulation of floodplains in watershed.	Numerous dirt roads, at-grade crossings of streams; access problems.	Road closures, access issues, high maintenance for road clearing. Limited regulation of floodplains in watershed.			Numerous dirt roads, at-grade crossings of streams; access problems.	Interior road system generally designed to minimum standards.
	Flood insurance claims							May rise when new mapping is implemented.	Limited resources
	Economic	Flooded residences.	High impact.		Flooded residences.				Greater
	Natural floodplain functions		More critical to minor and medium-sized washes.	Lots of undeveloped land	Encroachment into the floodplain.	Important wildlife habitats and migration corridors are interrupted.	Important wildlife habitats and migration corridors are interrupted.	Lots of undeveloped land.	Maintain existing

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Blue text: from individual FMP Committee members

CRS Activity 510: Floodplain Management Plan 2015 - Identify Hazards Associated Problems

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Undelineated floodplains	Life, safety, health, evacuation	Approximate A Zone delineations should be restudied with the understanding that adjacent land will be developed		Unmapped areas have high potential for development.	Flood flows from South Mountain are undelineated. Laveen area flood channel.	Future development impacted.	Sheet flow characteristics make it difficult to recognize flood risk.	Unmapped areas have high potential for development.	Limited resources
	Public health hazards caused by flooding				Lack of hazard identification to the public around South Mountain.				Mud
	Critical facilities								May be more affected because due to facilities.
	Transportation		Road closures, access issues, high maintenance for road clearing.						Interior road system generally designed to minimum standards.
	Flood insurance claims	Many residents are unaware of flooding risk.	Many residents are unaware of flooding risk.	Many residents are unaware of flooding risk.	Many residents are unaware of flooding risk.			Many residents are unaware of flooding risk.	Limited resources
	Economic		High impact.						Greater
	Natural floodplain functions		More critical to minor and medium-sized washes.		Include projects like El Rio in future designs.	Alluvial fans on the w. side of the White Tank Mtns. Oppor-tunity to retain/ maintain existing floodplain functions.		Maintain natural floodplain.	Maintain existing
In-channel activities	Life, safety, health, evacuation	Human activity such as trails, camping, ATV use, low water crossings, bridges. Unpermitted/non-conforming agricultural or mining use. Consider dedicated storage capacity in mining operations.	Driving on at-grade road crossings can cause injury or death.		Sand & gravel mining; Tres Rios. Water quality could be diminished if Tres Rios water management systems fail.		Mining can alter flow characteristics.	Recreation	Structures usually under-designed
	Public health hazards caused by flooding			Water quality				Water quality	
	Critical facilities	Channel maintenance needed.							
	Transportation	Need access to channels for maintenance.	Closures of at-grade road crossings.	Roads that cross channels				Roads that cross channels	Affected
	Flood insurance claims								Limited for rural areas.
	Economic								Limited for rural areas. Farming operations possibly more impacted.
	Natural floodplain functions	Important wildlife habitats and migration corridors may be negatively impacted.	Yes	Keep channels clear. Important wildlife habitats and migration corridors may be negatively impacted.	Important wildlife habitats and migration corridors may be negatively impacted. Invasive tamarisk.	Important wildlife habitats & migration corridors may be negatively impacted. Invasive tamarisk.	Important wildlife habitats and migration corridors may be negatively impacted. Invasive tamarisk.	Keep channels clear	Important wildlife habitats and migration corridors may be negatively impacted.
Repetitive losses	Life, safety, health, evacuation	Publish evacuation routes with one lane reasonable site of flooding. Filling pits.		Yes, to affected property owners.	Most likely in the single-lot development pockets.		Loss of land value due to redelineation of floodplains	Yes, to affected property owners	
	Public health hazards caused by flooding								
	Critical facilities	Rescue centers							
	Transportation								
	Flood insurance claims	Comparatively more claims made.	Comparatively more claims made.	High potential due to past flooding events.	Comparatively more claims made.			High potential due to past flooding events	
	Economic	Comparatively more frequent property damages.	Comparatively more frequent property damages.	Financial impacts on farming operations.	Comparatively more frequent property damages.				
	Natural flood-plain functions								

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Green text: added by LTM Engineering based on research & input from District staff
Blue text: from individual FMP Committee members

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Flash flooding	**Life, safety, health, evacuation**	Areas in the New River community were flooded in 2014 storms. Improve communications listing areas impacted. Show evacuation routes and safe distances from areas impacted. Sun City/Sun City Grand may need special mobilization plans for evacuation. Communication messages should be consistent during floods.	Great concern for life, safety, and health. Evacuations may not be possible due to flooded roads.	Ingress and egress are affected.	Entire watershed susceptible. Street flooding; clogged storm drains. Highest risks in single-lot and undeveloped areas. Sheet flow on farm fields.		Present in the watershed.	Access and egress are affected.	Impacted. Ponding in the Mobile area along SR 238 and crossings of Waterman Wash.
	Public health hazards caused by flooding	Improve communications listing areas impacted. Animal waste conveyed downstream in rural/large-lot properties.	Mold, sewers impacted. Animal waste conveyed downstream in rural/large-lot properties.	Same as other hazards. Agriculture runoff.	Animal waste conveyed downstream in rural/large-lot properties. Wastewater treatment wetlands.	Animal waste conveyed downstream in horse properties.	Runoff from farming operations impact water quality of the Gila River.	Same as other hazards.	
	Critical facilities	Show evacuation routes and safe distances from areas impacted.			Phx-Gateway Airport; freeways; major transportation corridors; hospitals; police/fire.				
	Transportation	Major transportation corridors may be impassible. Depressed roadways or at-grade road crossings are flooded.	Directly affected – most deaths during flooding are transportation-related.	Problems with access and rescue operations – flooded roads.	Major transportation corridors may be impassible. Depressed roadways or at-grade road crossings are flooded.	Tonopah Salome Highway crossing.		Problems with access and rescue operations – flooded roads.	SR 238 is flooded often at multiple locations; access to landfills and residences is blocked.
	Flood insurance claims			Very likely.				Very likely	
	Economic	Losses to major employment centers if ingress/egress is compromised.	Could be costly. Losses to major employment centers if ingress/egress is compromised.	Damaged roads, residential property damage. Financial impact on farming ops.	Losses to major employment centers if ingress/egress is compromised.			Damaged roads, residential property damage.	Damages to farming operations.
	Natural floodplain functions	Consider user check in/out system at trailheads where flash flood potential is high.	Upper Cave Creek to Carefree Hwy is important bird area.	Alluvial fan flooding, changes to braided channel systems. Farming has obliterated natural drainageways; runoff has no positive drainage paths.	Farming has obliterated natural drainageways; runoff has no define path to reach outfalls.	Northern portion currently has an intact floodplain.		Alluvial fan flooding, changes to braided channel systems. Important bird area; nesting bald eagles.	Farming has obliterated natural drainageways; runoff has no positive drainage paths.
High runoff potential of some soils	**Life, safety, health, evacuation**	Mountainous areas in Peoria and Deer Valley have high runoff potential. Construct grade breaks to slow down velocity of the runoff.	Typically includes high sediment transport.		Areas around South Mountain are susceptible. Typically includes high sediment transport.		High water table near the Gila River results in increased runoff potential.		
	Public health hazards caused by flooding							Horse properties - pollution	
	Critical facilities								
	Transportation	Short basin response times in & around mountains increase risk at road crossings.	Short basin response times in & around mountains increase risk at road crossings.	Closed roads due to high sediment loads.	Short basin response times in & around mountains increase risk at road crossings.			Closed roads due to high sediment loads.	
	Flood insurance claims								
	Economic								
	Natural floodplain functions			Yes				Yes	

Black text: progress as of 3-26-15
Green text: added by LTM Engineering based on research & input from District staff
Blue text: from individual FMP Committee members

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Sheet and split flows across the valley plains	Life, safety, health, evacuation			Yes	East Valley is very flat & prior agriculture has obliterated historical channels.		Flatter land slopes and farming operations result in ill-defined flow patterns that mask flood risk.	Yes	
	Public health hazards caused by flooding			Access is cut off.				Access is cut off	
	Critical facilities				Solved in past with detention basins in master-planned communities.				
	Transportation	Roads interrupt the drainage patterns and concentrate flows.	Roads interrupt the drainage patterns and concentrate flows.	Yes, some roads will be affected.	Inadequate drainage outlets where water management is part of freeway design. Roads interrupt the drainage patterns and concentrate flows.			Yes, some roads will be affected.	
	Flood insurance claims								
	Economic	Population growth has channelized sheet flow and increased flood risk.	Population growth has channelized sheet flow and increased flood risk.		Population growth has channelized sheet flow and increased flood risk.		Population growth has channelized sheet flow and increased flood risk.		
	Natural floodplain functions	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.		Yes. Natural drainage patterns obliterated in agricultural areas.	Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.			Yes. Very sensitive to development & road crossings. Flow becomes concentrated and downstream system may not accommodate it.	Natural drainage patterns obliterated in agricultural areas.
Alluvial fans	Life, safety, health, evacuation	Alluvial fans present in the White Tank Mountains.	Downstream development at greater risk due to shifting flow patterns.	Residents affected by debris flows.	Southeast side of South Mountain believed to be relatively stable.			Residents affected by debris flows.	Alluvial fans have been identified in the Rainbow Valley area.
	Public health hazards caused by flooding			Residents affected by debris flows.				Residents affected by debris flows.	
	Critical facilities								
	Transportation	Road crossings susceptible to clogging from sediment.		Affects road crossings, bridges.	Road crossings susceptible to clogging from sediment.	Affects road crossings, bridges.		Affects road crossings, bridges.	
	Flood insurance claims			Residents may be unaware of flooding risks.		Residents may be unaware of flooding risks.		Residents may be unaware of flooding risks.	
	Economic								
	Natural floodplain functions	Fans are important wildlife habitat.	Fans are important wildlife habitat.	Fans are important wildlife habitat.	Fans are important wildlife habitat.	Alluvial fan flooding currently intact. Provides important wildlife habitat.	Fans are important wildlife habitat.	Fans are important wildlife habitat.	Fans are important wildlife habitat.

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Green text: added by LTM Engineering based on research & input from District staff
Blue text: from individual FMP Committee members

CRS Activity 510: Floodplain Management Plan 2015 - Identify Hazards Associated Problems

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Lateral erosion of natural streams	Life, safety, health, evacuation	The Agua Fria River migrates laterally except where it is channelized.	Shifting flow patterns can increase risk to development	Houses can fall into a wash and shift its course.	Shifting flow patterns can increase risk to development	Power lines in flood-plain may be at risk.	Lateral migration.	Houses can fall into a wash and shift its course.	Extensive erosion issues ID'ed in Gillespie ADMS in washes from Maricopa Mtns & Buckeye Hills.
	Public health hazards caused by flooding			Houses can fall into a wash and shift its course.				Houses can fall into a wash and shift its course.	
	Critical facilities								
	Transportation	Bridge abutments may be undermined.	Bridge abutments may be undermined.	Can affect roads and crossings.	Bridge abutments may be undermined.			Can affect roads and crossings.	
	Flood insurance claims								
	Economic	Costs to repair roads, bridges.	Costs to repair roads, bridges.	Costs to repair roads, bridges.	Costs to repair roads, bridges.				
	Natural floodplain functions	Lateral erosion is important to natural floodplain function.	Lateral erosion is important to natural floodplain function.	Lateral erosion is important to natural floodplain function.	Lateral erosion is important to natural floodplain function.	Lateral erosion is important to natural floodplain function.	Lateral erosion is important to natural floodplain function.	Lateral erosion is important to natural floodplain function.	
Fissures	Life, safety, health, evacuation	Fissure zone remediated at the south end of McMicken Dam. Coordination with AZGS is needed.			Natural fissures in the East Valley. Fissure zone remediated at the north end of Powerline FRS. Additional ID'ed in south Gilbert/Queen Creek.		Coordinate with USGS/AZGS.		
	Public health hazards caused by flooding								
	Critical facilities								
	Transportation				Roads may be damaged/destroyed.				
	Flood insurance claims								
	Economic								
	Natural floodplain functions								
Wildfires	Life, safety, health, evacuation	Transfer of sediment downstream after a wildfire. Cave Creek Complex Fire resulted in sediment transfer and increases in flash flood potential.			South Mountain – invasive plants (buffelgrass) increases risk.			Lots of forest lands in the watershed; potential is high.	
	Public health hazards caused by flooding							Wildfires will/can lead to water quality issues	
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions		Degrades the natural floodplain functions in the short-term.					Degrades the natural floodplain functions in the short-term.	
Severe Wind	Life, safety, health, evacuation	Dust storms cause driving hazards. Debris from high winds can plug drainageways.	Dust storms cause driving hazards. Debris from high winds can plug drainageways.	Can topple trees, which can affect flow in natural drainages.	Dust storms cause driving hazards. Debris from high winds can plug drainageways.			Can topple trees, which can affect flow in natural drainages.	
	Public health hazards caused by flooding								
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions								

Black text: progress as of 3-26-15
Green text: added by LTM Engineering based on research & input from District staff
Blue text: from individual FMP Committee members

Hazard		Impacts							
		Agua Fria	Cave Creek/ Salt	Centennial	Gila/Queen Creek	Hassayampa	Lower Gila	Verde	Waterman
Drought	Life, safety, health, evacuation				South Mountain – invasive plants (buffelgrass) are more drought-resistant.			Decreases vegetation; increases wildfire risk.	
	Public health hazards caused by flooding			Decreases vegetation; increases wildfire risk	Causes complacency of the public about flooding.				
	Critical facilities								
	Transportation			Roads affected by more debris.				Roads affected by more debris.	
	Flood insurance claims			Lower risk.				Lower risk	
	Economic			Yes, due to less surface water.				Yes, due to less surface water.	
	Natural floodplain functions	Adversely affected by decreased vegetation and increased debris.	Adversely affected by decreased vegetation and increased debris.	Adversely affected by decreased vegetation and increased debris.	Adversely affected by decreased vegetation and increased debris.			Adversely affected by decreased vegetation and increased debris.	
Climate Change	Life, safety, health, evacuation	Executive order issued requiring that climate change be considered in risk management activities. Uncertainty of how historical design standards will perform.	Uncertainty of how historical standards will perform.		Uncertainty of how historical standards will perform.				
	Public health hazards caused by flooding								
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions								
Other: So. Mtn. Freeway/L202	Life, safety, health, evacuation				In-channel vegetation				
	Public health hazards caused by flooding								
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions				If properly managed, natural floodplains may be a hazard mitigation strategy.				
Other: On-lot Drainage Systems	Life, safety, health, evacuation				Home maintenance of drainage system.				
	Public health hazards caused by flooding				Overwhelmed sanitary sewer systems.				
	Critical facilities								
	Transportation								
	Flood insurance claims								
	Economic								
	Natural floodplain functions								

Black text: progress as of 3-26-15
Green text: added by LTM Engineering based on research & input from District staff
Blue text: from individual FMP Committee members

Agua Fria River

- Canal overtopping
- Susceptible to flash flooding
- Major transportation corridors flooded
- At-grade road crossings
- Sheet flow channelized by development
- Lateral erosion
- Sediment-laden floodwaters
- Single-lot development
- Trails
- Habitat
- ATV use

Cave Creek / Salt River

- Canal overtopping
- Susceptible to flash flooding
- Major transportation corridors flooded
- At-grade road crossings
- Sheet flow channelized by development
- Lateral erosion
- Sediment-laden floodwaters
- Single-lot development
- Repetitive loss areas
- Treatment plant operations
- Wildfires increase flood risk
- Trails
- Habitat

Centennial Wash

- At-grade road crossings
- Sheet flow channelized by agriculture
- Flash flooding exacerbated by agricultural interruptions to natural drainage patterns
- Lateral erosion
- Sediment-laden floodwaters
- Repetitive losses in active farming areas
- Habitat

Gila River / Queen Creek

- Canal overtopping
- Susceptible to flash flooding
- Major transportation corridors flooded
- At-grade road crossings
- Flash flooding exacerbated by agricultural interruptions to natural drainage patterns
- Sheet flow channelized by development and agriculture
- Lateral erosion
- Sediment-laden floodwaters Single-lot development
- Repetitive losses in active farming areas
- Habitat
- ATV use

Hassayampa River

- Lateral erosion
- Sediment-laden floodwaters
- Habitat
- ATV use

Lower Gila River

- Lateral erosion
- Sediment-laden floodwaters
- Canal overtopping
- Habitat

Verde River

- At-grade road crossings
- Sheet flow channelized by development
- Lateral erosion
- Sediment-laden floodwaters
- Single-lot development
- Wildfires increase flood risk
- Habitat

Waterman Wash

- Canal overtopping
- Flash flooding exacerbated by agricultural interruptions to natural drainage patterns
- At-grade road crossings with minimal or no access during flooding
- Sheet flow channelized by agriculture
- Lateral erosion
- Sediment-laden floodwaters
- Habitat

Floodplain Management Plan 2015 Update
Overview of Problems Caused by Flood Hazards
March 26, 2015

Urban Watersheds

- Canal overtopping
- Susceptible to flash flooding
- Major transportation corridors flooded
- At-grade road crossings
- Sheet flow channelized by development
- Lateral erosion
- Sediment-laden floodwaters
- Single-lot development
- Trails
- ATV use in river corridors and around/on dams
- Habitat

Agricultural Areas

- Canal overtopping
- Susceptible to flash flooding
- At-grade road crossings
- Flooding exacerbated by agricultural interruptions to natural drainage patterns
- Sheet flow channelized by development
- Single-lot development
- Repetitive losses in active farming areas
- Habitat

Undeveloped/Rural Areas

- At-grade road crossings with minimal or no access during flooding
- Lateral erosion
- Sediment-laden floodwaters
- Single-lot development
- Flooding exacerbated by interruptions to natural drainage patterns
- Habitat

FMP Committee Meeting #4 – Review Potential Activities

Agenda
Sign-in Sheets
Meeting Summary

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MEETING #4 AGENDA – REVIEW POSSIBLE ACTIVITIES
Floodplain Management Plan 2015 Update
Thursday, April 30, 9:00 – 11:30 a.m.

1. Introduction

- Around-the-room introductions
- Overview of April 21 open house
- Review identified potential goals

2. Discussion of Potential 2015 FMP Activities

- Preventative
- Property protection
- Natural resource protection
- Emergency services
- Structural projects
- Public information

3. Applicable 2009 FMP Activities

4. Next Steps

- Ongoing coordination with FMP Committee
- Meeting #5 – draft an action plan
  - Date is Tuesday, May 12th

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting #4:	Review of Possible Activities	**Meeting Date:**	Thursday – April 30, 2015
Facilitator:	Laurie Miller - LTM Engineering, Inc.	**Place/Room:**	Adobe/Harq/New River

Name	Title	Organization	Phone
Jessica Howard	GIS Prog Mgr.	MAG	602-254-6300
Jennifer Martin	AZ Water Sentinels Coordinator	Sierra Club	602 423 6107
ERIC FOSTER	Agency Owner	Farmers Ins.	602 912 7422
Patrick Kiernan	Civil Engineer	CAP	623-869-2494
Susan Woodall	Mitigation Planner	DEMA	602 464-6518
Maureen Towne	Risk MAP	ADWR	602 771-8662
Steve Trussell	Association Flunkie	ARPA	602 989-3854
Tice Supplee	Dir. Bird Conservation	Audubon Arizona	602-380-3722
Ashley Couch	Stormwater Manager	City of Scottsdale	480-312-4317
Stacey Capp	Sr. Civil Eng.	Maricopa Co P&D	602-506-4717
Kristina Jensen	Civil Engineer II	COP	602-261-8417
Carol HL	Planner	MC P&D	602-506-8150

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Name	Title	Organization	Phone
Doug Placencia	Vice President	Michael Baker representing Arizona Farm Bureau	602 798 7552
Sharon McGinnis	Program Coordinator	FCD	602-278-3150
Laurie Miller	President	LTM Engineering	602-485-5880
Mark Fraco	Mitigation Planning Analyst	FCD	602-506-0750

MEETING SUMMARY

	Floodplain Management Plan Update FCD 2014C041, Work Assignment #5	**Date:**	April 30, 2015
Subject:	FMP Committee Meeting #4	**Time:**	9:00 a.m.
	Action Plan Activities	**Place:**	FCDMC

The following is a summary of the fourth of five Floodplain Management Plan Committee (FMP Committee) meetings to update the Flood Control District of Maricopa County's (District) 2009 FMP. Attendance sheets and the agenda are attached.

1. Introduction

An open house was held on April 21, 2015, and 15 people attended. Two questionnaires were distributed, one for residents and the other for representatives of public and private entities. Additionally, several completed questionnaires were received electronically after the open house. Information gathered included types and locations of flooding, access problems during storms, and the importance of multi-use opportunities and habitat preservation within floodplains.

Based on input from the previous committee meeting and on individual meetings with District division managers, goals and pertinent activities were summarized for review (attached).

It was noted that natural resource preservation, a 2009 goal, had been included as activities in the Goal #2, Improve Quality of Life. The committee agreed that it should be brought forward as a separate goal in the 2015 FMP.

Goal # 5, Regulatory, should be changed to Regulatory Standards.

2. Potential 2015 FMP Activities

- Under the goal of natural resource protection, additional activities include:
  - Evaluate floodplains and District-owned lands for water conservation and recharge potential
  - Explore public/private partnerships for water conservation and recharge
  - Post-mining operations of aggregate operators may allow opportunities to partner in transitioning the river corridors to activities that improve quality of life
  - Planning & Development should encourage multi-use drainage corridors in new developments
  - Incorporate low-flow storm water conservation and evaluate partnerships for multi-use activities and to realize the highest and best use of water resources

- Zone A redelineations under the regulatory standards goal should be clarified to include the following specific categories:
  - Zone A floodplains identified in approximate studies
  - Floodplains recently declared by FEMA as Zone A
  - Regulatory floodplain remnants whose level of risk has been altered by surrounding development
- An additional activity under regulatory standards goal would be to evaluate the need for improvement in facilitating developers through the permitting process
- Additional activities under the goal to re-evaluate the CIP selection process:
  - Explore avenues to expand the CIP budget
  - Modify the Small Project Assistance Program (SPAP) to include projects that have identified a significant flood risk but flooding has not yet occurred. The current program only considers projects where flooding has already occurred.
  - Identify an advocate for projects in unincorporated Maricopa County, which would not have a funding partner
- Public education activities:
  - Messages should include information on how to take action
  - Messages should be personal (e.g., illustrate messages with photographs/videos of the 2014 monsoon storms) to enhance understanding of flood risks and consequences
  - Messages must be audience-specific
  - A significant portion (25% nationally) of flood insurance claims occur outside the regulatory floodplain, i.e., Zone X. A map should be created that shows location and number of claims in Zone X versus within the regulatory floodplain.
- An activity should be added to set a benchmark of risk and include the information in public education materials. The benchmark could be used to quantify the demand for services, and in the future it could document how risk changes over time due to factors such as population growth, climate change, etc.
- Support and funding should continue for the District's Floodprone Properties Acquisition Program

3. Applicable 2009 Activities

Activities by category from the 2009 FMP were reviewed for applicability in the 2015 Plan. The following were carried forward for consideration:

Preventative

- Enforce existing floodplain regulations
- Coordinate with jurisdictions to adopt and enforce the recommendations of area drainage master plans, watercourse master plans and other studies

Natural resource protection

- Accommodate wildlife corridors and habitat, when feasible, during planning and construction of flood control solutions

- Develop a habitat mitigation banking program to assist with regulatory compliance related to construction of flood control projects

Emergency services

- Provide reliable weather, water level and stream flow data to other jurisdictions and the community
- Conduct and participate in annual multi-hazard emergency drills

Public information

- Offer technical assistance to 14 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information, and to municipalities that do their own floodplain management at their request

Additionally, Tice Supplee and Ashley Couch provided written input on bringing the 2009 activities forward. The items included a-c, e-f, i-q, and s-w (see attached handout for item descriptions).

4. Next Steps

The final FMP Committee Meeting #5, Draft an Action Plan, is scheduled for May 12.

The preceding summary was prepared by Laurie Miller. Attendees are asked to advise Laurie within one week of dissemination via e-mail of any discrepancies and/or omissions.

c: Attendees

Attachments

- Meeting agenda
- Potential 2015 FMP goals
- 2009 FMP action plan items
- Sign-in sheets

POTENTIAL 2015 FLOODPLAIN MANAGEMENT GOALS

1. **Continue/expand public outreach**
   - Develop a marketing plan that offers reasons to support floodplain management
     - Include multiple communication venues with frequent messages
     - Educate the public and elected officials on the need for floodplain management
     - Include multi-hazard education on the effects of long-term (e.g., changing flows) and short-term (e.g., post-wildfire) changes to the watersheds
     - Promote a "standards work" strategy to recognize benefits of past floodplain management and flood control efforts
     - Convey a "greater good" message on responsible floodplain management approaches
     - Convey the message that flood hazards are present, regardless of the FIRM classification
     - Ongoing education/guidelines for fencing to promote intended on-lot drainage functions

2. **Improve quality of life**
   - Recognize potential economic benefits from reduced flood losses and disruptions due to flooding
   - Recognize natural resource benefits (use of water and minerals; outdoor activity)
     - Support multi-use approaches to floodplain management
     - Develop water conservation efforts

3. **Expand intergovernmental outreach**
   - Collaborate with other agencies to coordinate planning efforts and needs
   - Integrate floodplain management goals with other plans (e.g., transportation, planning, land-use zoning)

4. **Develop standard lists of resources available before, during, & after flood events**
   - Prepare a ready-to-use Flood Response Kit
     - Include brochures, how to find information and resources, post-flood field documentation form
     - Construct a web page with information that can be uploaded during flood events

5. **Regulatory**
   - Improve flood risk information by evaluating the merits of converting approximate (Zone A) floodplain delineations to detailed studies based on benefit to existing and new development
   - Encourage the Maricopa County Planning & Development Department to continue to propose/discuss "good ideas" at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the future risk of flooding)
     - Create a hand-out with photos and illustrations of examples of poor vs. good floodplain management practices

6. **Re-evaluate the Capital Improvement Program selection process**
   - Adjust CIP process for funding of drainage infrastructure

2009 FMP Goals

✓Strengthen role as regional leader
✓Streamline the multi-objective watershed approach to flood mitigation
✓Increase collaboration and partnering to expand flood mitigation efforts
✓Preserve and restore the natural resources and functions of floodplains and riparian areas
✓Continued commitment to process improvement

2009 FMP ACTION PLAN ITEMS

Preventative

a. Enforce existing floodplain regulations
b. Complete 22 ADMS/ADMPs
c. Complete 530 miles of delineations
d. Coordinate with jurisdictions to adopt and enforce the recommendations of area drainage master plans, watercourse master plans and other studies
e. Develop a standardized model of assessing flooding risk and vulnerability at a watershed and sub-watershed level. This method will be used to develop structural and non-structural flooding solutions as part of the ADMP and WCMP planning processes.
f. Develop model guidelines for land use planning and site development within floodplains that protect public safety and preserve the natural functions of floodplains

Property protection

g. Acquire eight properties through the Floodprone Properties Acquisition Program.
h. Improve the unincorporated Maricopa County's rating in the NFIP-CRS program from Class 5 to Class 4
i. Implement flood warning systems to ensure safe crossings of rivers and washes

Natural resource protection

j. Accommodate wildlife corridors and habitat, when feasible, during planning and construction of flood control solutions
k. Create an exploratory committee that is tasked with investigating tools for preserving floodplains for conveyance and other beneficial uses; and defining the District's r ole in river management and restoration efforts
l. Develop a sensitive-lands management plan for District-owned floodplain property
m. Develop a habitat mitigation banking program to assist with regulatory compliance related to construction of flood control projects

Emergency services

n. Update and support Emergency Action Plans for the 22 dams maintained by the District
o. Provide reliable weather, water level and stream flow data to other jurisdictions and the community
p. Conduct and participate in annual multi-hazard emergency drills
q. Perform a county-wide vulnerability assessment that simulates the impacts of a major storm event. Use this tool to update flood response plans, EAPs, and to prioritize future District work.

Structural projects

r. Construct or rehabilitate 57 structures, providing flood protection for over 755 square miles
s. Ensure that all Priority 1 Work Orders (work required to assure safety or for a structure to function as designed) are completed within 14 days

Public information

t. Visit 12 schools in unincorporated county to discuss how to keep safe during flood events
u. Produce 24 media messages on flood hazards, flooded wash crossings and other public safety issues
v. Maintain a library of all past studies and reports and is accessible online from the District's web page
w. Offer technical assistance to 12 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information, and to municipalities that do their own floodplain management at their request

FMP Committee Meeting #5 – Draft an Action Plan

Agenda
Sign-in Sheet
Meeting Summary

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MEETING #5 AGENDA – DRAFT ACTION PLAN
Floodplain Management Plan 2015 Update
Tuesday, May 12, 9:00 – 11:30 a.m.

1. Introduction

- Around-the-room introductions
- Meeting #5 goals
  - Review and recommend action items
  - Prioritize action items

2. Recommend Action Items by Category

- Preventative
- Property protection
- Natural resource protection
- Emergency services
- Structural projects
- Public information

3. Prioritize Recommended Action Items

4. Next Steps

- Identify implementation responsibility
- Set completion schedule
- Identity funding source(s)
- Draft FMP
- Committee and public review of draft FMP

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting #5:	Draft Action Plan	**Meeting Date:**	Tueday – May 12, 2015
Facilitator:	Laurie Miller - LTM Engineering, Inc.	**Place/Room:**	Adobe/Harq/New River

Name	Title	Organization	Phone
Matt Heckard	Emg Svcs Prog Coord	AZDEMA	6024646308
Jason Howard	GIS Program Manager	MAG	602-254-6300
Ashley Couch	Stormwater Manager	City of Scottsdale	480-312-4317
Laurie Miller	LTM Engineering President		602-485-5880
Patrick Kiernan	Civil Engineer	CAP	623-869-2494
Stacey Lapp	Sr Civil Eng	Maricopa Co P&D	602-506-4717
Doug Pleserics	Vice President	Baker representing Valley Forward	602 798 7552
Tice Supplee	Interim Director Audubon Arizona	Audubon	602-380-3722
Shaun McGlenn	Program Coordinator	FCD	602-506-9378
Steve Trussell	Executive Director	ARPA	602-999-3854
Mark Fraco	Project Manager	FCD	602-506-0750
Kristina Jensen (by teleconference)	Civil Engineer II	City of Phoenix	602-261-8417

MEETING SUMMARY

	Floodplain Management Plan Update FCD 2014C041, Work Assignment #5	**Date:**	May 12, 2015
Subject:	FMP Committee Meeting #5	**Time:**	9:00 a.m.
	Draft Action Plan	**Place:**	FCDMC

The following is a summary of the fifth of five Floodplain Management Plan Committee (FMP Committee) meetings to update the Flood Control District of Maricopa County's (District) 2009 FMP. The attendance sheet, agenda, and handouts are included in Attachment A.

1. Introduction

During the previous FMP Committee meeting, action plan activities were considered. Based on the discussion and on additional input from District staff, a matrix of potential activities was prepared that lists the items and associated goals. The purpose of Meeting #5 is to review the activities, select items for further consideration, and set priorities.

2. Recommend Action Items by Category

The procedures prescribed by the National Flood Insurance Plan (NFIP) include developing action items in the following categories:

- Preventative
- Property protection
- Natural resource protection
- Emergency services
- Structural projects
- Public information

Issues discussed are summarized below. See the Action Plan Matrix in Attachment A for the full text of action items.

g. Evaluate need to improve facilitation of the permitting process
   - Clarify the roles of P&D and District staffs.

h. Encourage "good ideas" discussions with permit applicants
   - P&D recently conducted a Kaizen exercise to identify improvements to the permitting process. The results should be evaluated and included if applicable.

k. Update ADMS/Ps

- Some areas of the county have not been studied; include new studies where needed to the action item.

l. Develop standardized model of assessing risk
   - Delete. It was determined that the effort would not be achievable given the size of the county and complexity/diversity of drainage characteristics.

m. Develop model guidelines for land use planning & site development
   - Delete. It was noted that P&D already performs this function.

<unnumbered> Ensure that all Priority I Work Orders are completed within 14 days
   - Delete. This action item from the 2009 FMP has been accomplished.

ff. Continue providing storm data to other jurisdictions & the community
   - Evaluate the need and feasibility of linking rain data with flooded roadway locations.

vv. Maintain a library of past studies & reports
   - Delete. This action item from the 2009 FMP has been accomplished.

zz. Collaborate with other agencies to coordinate planning efforts
   - Add master planned developments and combine with (aaa) Integrate floodplain management goals with other plans and; move new item to the "Preventative" category.

3. Prioritize Recommended Action Items

The FMP Committee agreed that the highest priorities for the 2015 FMP should be public education and CIP funding for needed flood control facilities.

Individual action items were qualitatively considered according to their relative benefit (high, moderate, low) in carrying out the Districts mission of protecting lives and property and statutory mandates. Relative costs (high, moderate, low) to implement each action item were considered concurrently in order to gauge the potential value to unincorporated Maricopa County. Items for which relative costs are unknown were left undesignated.

The Action Plan Matrix discussed during the meeting (Attachment A) was revised per the recommended changes herein and is included as Attachment B. The revised matrix includes the FMP Committee's input on relative benefits, costs, and associated value of each item.

4. Next Steps

The draft FMP is expected to be ready for review in mid-July.

The preceding summary was prepared by Laurie Miller. Attendees are asked to advise Laurie within one week of dissemination via e-mail of any discrepancies and/or omissions.

c: Attendees

Attachment A
- Meeting agenda
- Action Plan Matrix
- Sign-in sheet

Attachment B
- Revised Action Plan Matrix, including assignment of relative value, per meeting discussion

Flood Control District of Maricopa County
2015 Floodplain Management Plan
Action Plan Matrix
May 12, 2015

	ACTION ITEM	GOALS 1. Continue/expand public outreach	2. Protect natural resources	3. Improve quality of life	4. Expand intergovernmental outreach	5. Develop lists of resources	6. Regulatory standards	7. Strengthen role as regional leader
	Preventative							
a.	Enforce existing floodplain regulations						X	
b.	Offer technical assistance to 14 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information, and to municipalities that do their own floodplain management at their request				X		X	X
c.	Improve flood risk information by evaluating the merits of converting approximate (Zone A) floodplain delineations to detailed studies based on benefit to existing and new development						X	X
d.	Redelineate Zone A floodplains identified in approximate studies						X	X
e.	Delineate floodplains recently declared by FEMA as Zone A						X	X
f.	Revise regulatory floodplain remnants whose level of risk has been altered by surrounding development						X	X
g.	Evaluate the need for improvement in facilitating developers through the permitting process						X	X
h.	Encourage the Maricopa County Planning & Development Department to continue to propose/discuss “good ideas” at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the future risk of flooding)						X	
i.	Create a booklet with photos and illustrations of examples of poor vs. good floodplain management practices	X					X	
j.	*****Realize the Floodprone Properties Assistance Program			X			X	
k.	*****Continue updating Area Drainage Master Studies/Plans (ADMS/Ps) and pursue implementation with local jurisdictions	X			X			X
l.	*****Develop a standardized model of assessing flooding risk and vulnerability at a watershed and sub-watershed level. This method will be used to develop structural and non-structural flooding solutions as part of the ADMP and WCMP planning processes.		X	X				X
m.	*****Develop model guidelines for land use planning and site development within floodplains that protect public safety and preserve the natural functions of floodplains		X	X				X

Flood Control District of Maricopa County
2015 Floodplain Management Plan
Action Plan Matrix
May 12, 2015

		GOALS						
	ACTION ITEM	**1. Continue/expand public outreach**	**2. Protect natural resources**	**3. Improve quality of life**	**4. Expand intergovernmental outreach**	**5. Develop lists of resources**	**6. Regulatory standards**	**7. Strengthen role as regional leader**
	Property protection							
n.	*****Provide funding for floodproofing activities			X			X	
o.	*****Develop fact sheet that includes links to resources for floodproofing for distribution by inspectors and P&D staff			X				
p.	*****Implement flood warning systems to ensure safe crossings of rivers and washes			X				
	Natural Resource protection							
q.	Recognize natural resource benefits (use of water and minerals; outdoor activity)		X					
r.	Support multi-use approaches to floodplain management		X	X				
s.	Develop water conservation efforts		X	X				X
t.	Incorporate low-flow storm water conservation and explore partnerships for multi-use opportunities and best use of water		X	X				X
u.	Accommodate wildlife corridors and habitat, when feasible, during planning and construction of flood control solutions		X	X				
v	Evaluate floodplains and District-owned lands for water conservation and ground water recharge potential		X	X				X
w	Explore private/public partnerships for water conservation and ground water recharge efforts		X	X	X			X
x	*****Facilitate natural habitat by replacing invasive species with native species where feasible		X	X				
y	*****Accommodate wildlife corridors and habitat, when feasible, during planning and construction of flood control solutions		X	X				
z	*****Create an exploratory committee that is tasked with investigating tools for preserving floodplains for conveyance and other beneficial uses; and defining the District's role in river management and restoration efforts		X					X
aa.	*****Develop a habitat mitigation banking program to assist with regulatory compliance related to construction of flood control projects		X				X	

Flood Control District of Maricopa County
2015 Floodplain Management Plan
Action Plan Matrix
May 12, 2015

		GOALS						
	ACTION ITEM	**1. Continue/expand public outreach**	**2. Protect natural resources**	**3. Improve quality of life**	**4. Expand intergovernmental outreach**	**5. Develop lists of resources**	**6. Regulatory standards**	**7. Strengthen role as regional leader**
	Emergency services							
bb.	Prepare a ready-to-use Flood Response Kit	X				X		
cc.	Include brochures, how to find information and resources, post-flood field documentation form	X				X		
dd.	Construct a web page with information that can be uploaded during flood events	X				X		
ee.	*****Continue to update and support Emergency Action Plans for District dams and levees						X	
ff.	*****Continue to provide reliable weather, water level and stream flow data to other jurisdictions and the community			X				X
gg.	*****Continue annual multi-hazard emergency drills						X	X
	Structural projects							
hh.	Adjust criteria for Special Projects Assistance Program (SPAP) for funding of drainage infrastructure to include projects for demonstrated flood risk for areas that have not previously experienced flooding			X	X		X	
ii.	Develop process to act as advocate for unincorporated areas that lack funding partnerships			X				
jj.	Explore avenues to expand the CIP budget for infrastructure to meet the demands of identified flood risks			X				X
kk.	*****Partner with sand & gravel operators to implement mutually beneficial activities in the river corridors		X	X	X			
ll.	*****Incorporate ongoing Best Management Practices (BMPs) and emerging Low Impact Development (LID) technologies in design projects		X	X			X	X
	*****Ensure that all Priority 1 Work Orders (work required to assure safety or for a structure to function as designed) are completed within 14 days			X				

Flood Control District of Maricopa County
2015 Floodplain Management Plan
Action Plan Matrix
May 12, 2015

		GOALS						
	ACTION ITEM	**1. Continue/expand public outreach**	**2. Protect natural resources**	**3. Improve quality of life**	**4. Expand intergovernmental outreach**	**5. Develop lists of resources**	**6. Regulatory standards**	**7. Strengthen role as regional leader**
	Public Information							
mm	Develop marketing plan	X						
nn	Multiple communication venues	X						
oo	Educate public & officials on floodplain mgmt needs	X						X
pp	Include "benchmark" information of risk in education efforts	X						
qq	Include multi-hazard education on the effects of long-term (e.g., changing flows) and short-term (e.g., post-wildfire) changes to the watersheds	X						
rr	Promote a "standards work" strategy to recognize benefits of past floodplain management and flood control efforts	X						X
ss	Convey a "greater good" message on responsible floodplain management approaches	X						
tt	Convey the message that flood hazards are present, regardless of the FIRM classification	X						
uu	Ongoing education/guidelines for fencing to promote intended on-lot drainage functions	X						
vv	*****Maintain a library of all past studies and reports and is accessible online from the District's web page	X						
	Other							
ww	Recognize potential economic benefits from reduced flood losses and disruptions due to flooding			X				X
xx	Encourage multi-use drainage corridors in new developments		X	X				
yy	Develop a "benchmark" of risks to evaluate current conditions and quantify how risk changes overtime the associated demand for services	X						X
zz	Collaborate with other agencies to coordinate planning efforts and needs				X			X
aaa	Integrate floodplain management goals with other plans (e.g., transportation, planning, land-use zoning)				X			X
bbb	*****Evaluate and implement improvements to methodologies where feasible to better identify flood hazards							X

Flood Control District of Maricopa County
Draft 2015 Floodplain Management Plan
Action Plan Matrix
Updated June 4, 2015

		GOALS								
	ACTION ITEM	**1. Continue/expand public outreach**	**2. Protect natural resources**	**3. Improve quality of life**	**4. Strengthen role as regional leader**	**5. Develop lists of resources**	**6. Implement & enhance regulatory stds.**	Relative Benefit (H, M, L)	Relative Cost (H, M, L)	**Value (H, M, L)**
	Preventative									
a	Enforce existing floodplain regulations						X			H
b	Offer technical assistance to 14 of the 24 municipalities in Maricopa County as their Floodplain Management Agency, to residents seeking information, and to municipalities that do their own floodplain management at their request				X		X			H
c	Improve flood risk information by evaluating the merits of converting approximate (Zone A) floodplain delineations to detailed studies based on need and benefit to existing and new development: - Redelineate Zone A floodplains identified in approximate studies - Delineate floodplains recently declared by FEMA as Zone A - Revise regulatory floodplain remnants whose level of risk has been altered by surrounding development			X	X		X	H		
d	Encourage the Maricopa County Planning & Development Department to continue to propose/discuss "good ideas" at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the future risk of flooding)						X	H	L	H
e	Create a nontechnical booklet with photos and illustrations of examples of poor vs. good floodplain management practices	X					X	H		
f	Provide annual funding for the Floodprone Properties Assistance Program			X			X	M		
g	Continue preparing new and updating existing Area Drainage Master Studies/Plans (ADMS/Ps) and pursue implementation with local jurisdictions	X			X			H		
h	Collaborate with other agencies and master-planned developments to meet floodplain management goals and integrate with other plans (e.g., transportation, planning, land-use zoning)				X			H		
i	Evaluate and implement improvements to methodologies where feasible to better identify flood hazards				X			H		
	Property Protection									
j	Provide funding for floodproofing activities under the Floodplain Properties Assistance Program			X			X	M		
k	Develop a nontechnical fact sheet that includes links to resources for floodproofing for distribution by District and P&D staffs	X		X					L	M

Flood Control District of Maricopa County
Draft 2015 Floodplain Management Plan
Action Plan Matrix
Updated June 4, 2015

		GOALS									
	ACTION ITEM	**1. Continue/expand public outreach**	**2. Protect natural resources**	**3. Improve quality of life**	**4. Strengthen role as regional leader**	**5. Develop lists of resources**	**6. Implement & enhance regulatory stds.**	Relative Benefit (H, M, L)	Relative Cost (H, M, L)	**Value (H, M, L)**
l	Implement flood warning systems to prevent unsafe crossings of rivers and washes			X	X			H		
	Natural Resource Protection									
m	Recognize natural resource benefits (use of water, aggregate; outdoor activity)		X	X				H		
n	Support multi-use/multi-benefit approaches to floodplain management		X	X				H	L	H
o	Develop water conservation efforts		X	X	X			H		
p	Incorporate low-flow storm water conservation and explore partnerships for multi-use opportunities and best use of water		X	X	X			H		
q	Identify and accommodate wildlife corridors, habitat, and recreational opportunities, when feasible, within the ADMS/P program and in the design of flood control solutions		X	X	X			H		
r	Evaluate floodplains and District-owned lands for water conservation and ground water recharge potential		X	X	X			H	L	H
s	Explore private/public partnerships for ground water recharge efforts		X	X	X			H	L	H
t	Facilitate natural habitat by replacing invasive species with native species where feasible		X	X	X			H		
	Emergency Services									
u	Prepare a ready-to-use Flood Response Kit for District staff - Include brochures, how to find information and resources, post-flood field documentation form	X				X		H	L	H
v	Construct a web page with information that can be uploaded during flood events	X				X		H	L	H
w	Continue to update and support Emergency Action Plans for District dams and levees						X			H
x	Update existing and prepare new Flood Response Plans as needed to enhance public safety									H
y	Continue to provide reliable weather, water level and stream flow data to other jurisdictions and the community	X		X	X					H
z	Continue annual flood emergency drills				X		X			H
	Structural Projects									
aa	Adjust criteria for Small Projects Assistance Program (SPAP) for funding of drainage infrastructure to include projects for demonstrated flood risk for areas that have not previously experienced structural flooding			X	X		X	H	L	H

Flood Control District of Maricopa County
Draft 2015 Floodplain Management Plan
Action Plan Matrix
Updated June 4, 2015

		GOALS								
	ACTION ITEM	**1. Continue/expand public outreach**	**2. Protect natural resources**	**3. Improve quality of life**	**4. Strengthen role as regional leader**	**5. Develop lists of resources**	**6. Implement & enhance regulatory stds.**	Relative Benefit (H, M, L)	Relative Cost (H, M, L)	**Value (H, M, L)**
bb	Develop process to act as advocate for unincorporated areas that lack funding partnerships			X				H		
cc	Explore avenues to expand the CIP budget for infrastructure to meet the demands of identified flood risks			X	X			H	H	H
dd	Partner with sand & gravel operators to implement mutually beneficial activities in the river corridors		X	X	X			H		
ee	Incorporate ongoing Best Management Practices (BMPs) and emerging Low Impact Development (LID) technologies in design projects		X	X	X		X	H		H
	Public Information									
ff	Develop marketing plan to promote sound floodplain management and personal responsibility							H		H
	- Include multiple communication venues	X								
	- Include "benchmark" information of risk in education efforts	X								
	- Include multi-hazard education on the effects of long-term (e.g., changing flows) and short-term (e.g., post-wildfire) changes to the watersheds	X								
	- Convey a "greater good" message on responsible floodplain management approaches	X								
	- Convey the message that flood hazards are present, regardless of the FIRM classification	X								
	- Recognize potential economic benefits from reduced flood losses and disruptions due to flooding	X		X	X					
gg	Educate public & officials on floodplain management needs	X			X			H		H
hh	Develop a strategy to recognize benefits of past floodplain management and flood control efforts	X			X			H		H
ii	Provide ongoing education/guidelines for fencing to promote intended lot-to-lot drainage functions	X						H		H
jj	Reinstate public survey process to enhance flood threat awareness and improve the effectiveness of outreach efforts							H		H
	Other									
kk	Develop a "benchmark" of risks to evaluate current conditions and quantify how risk changes over time the associated demand for services	X			X			H		

Appendix C

Public and Stakeholder Involvement

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FCDMC Web Site Screen Shots

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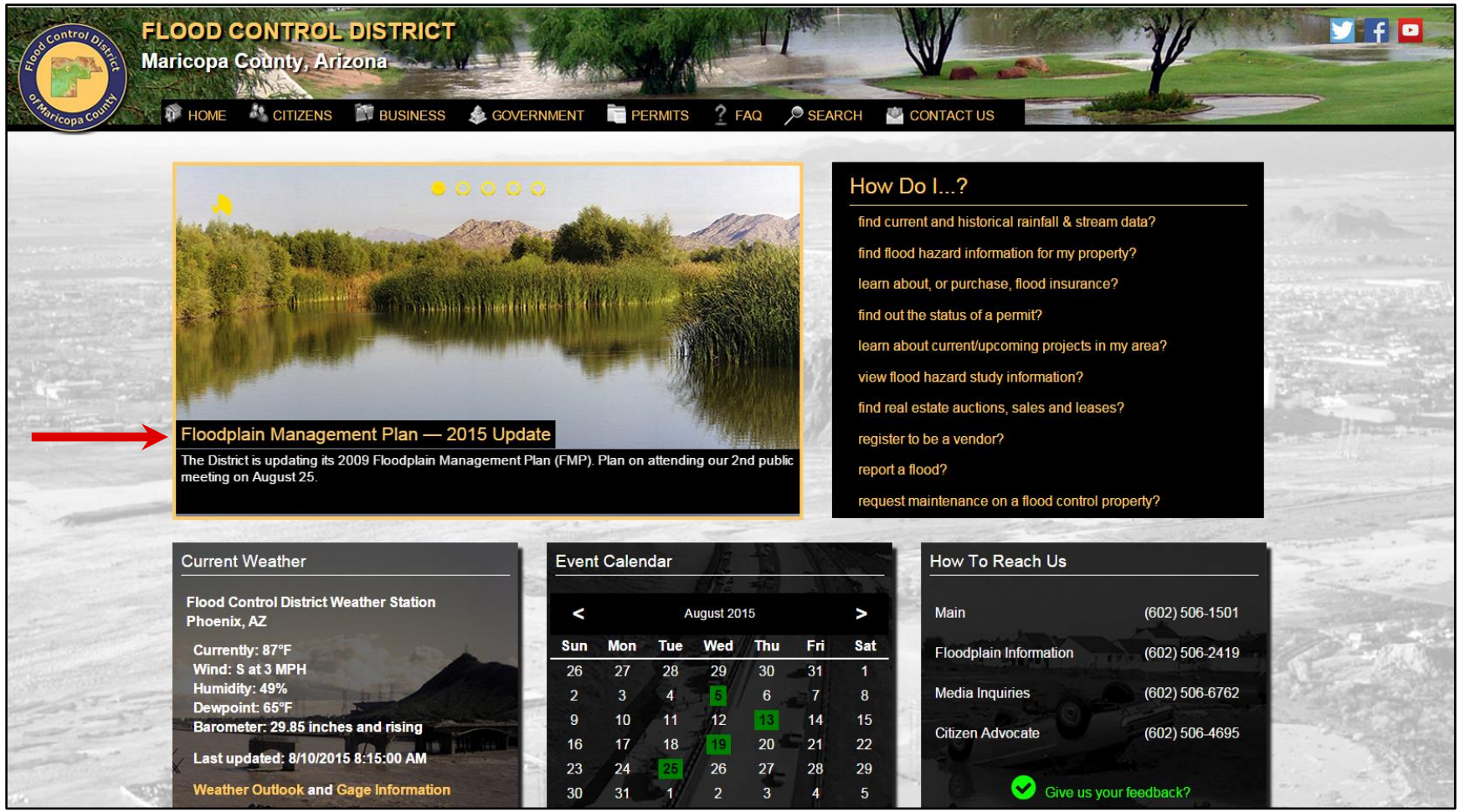
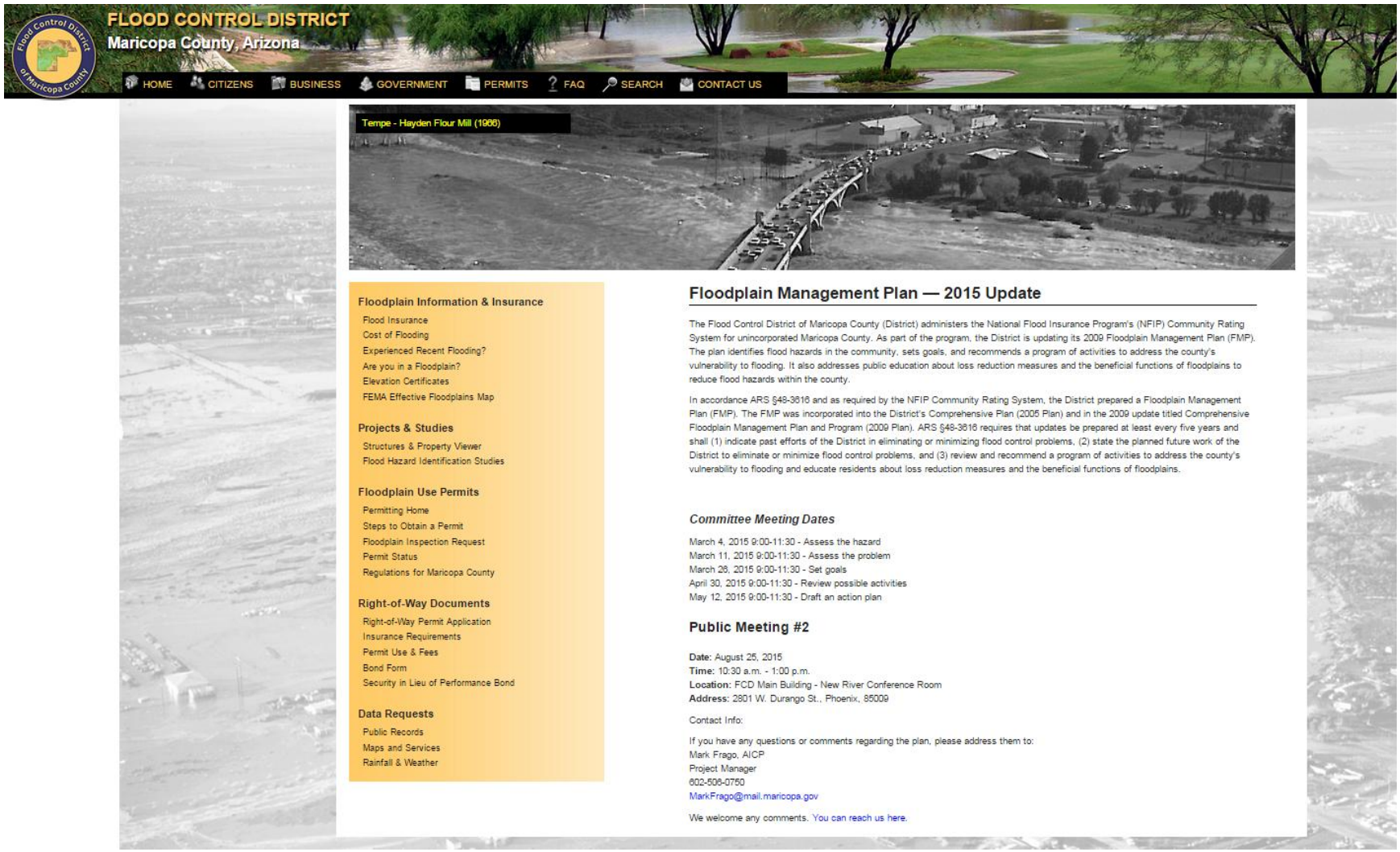
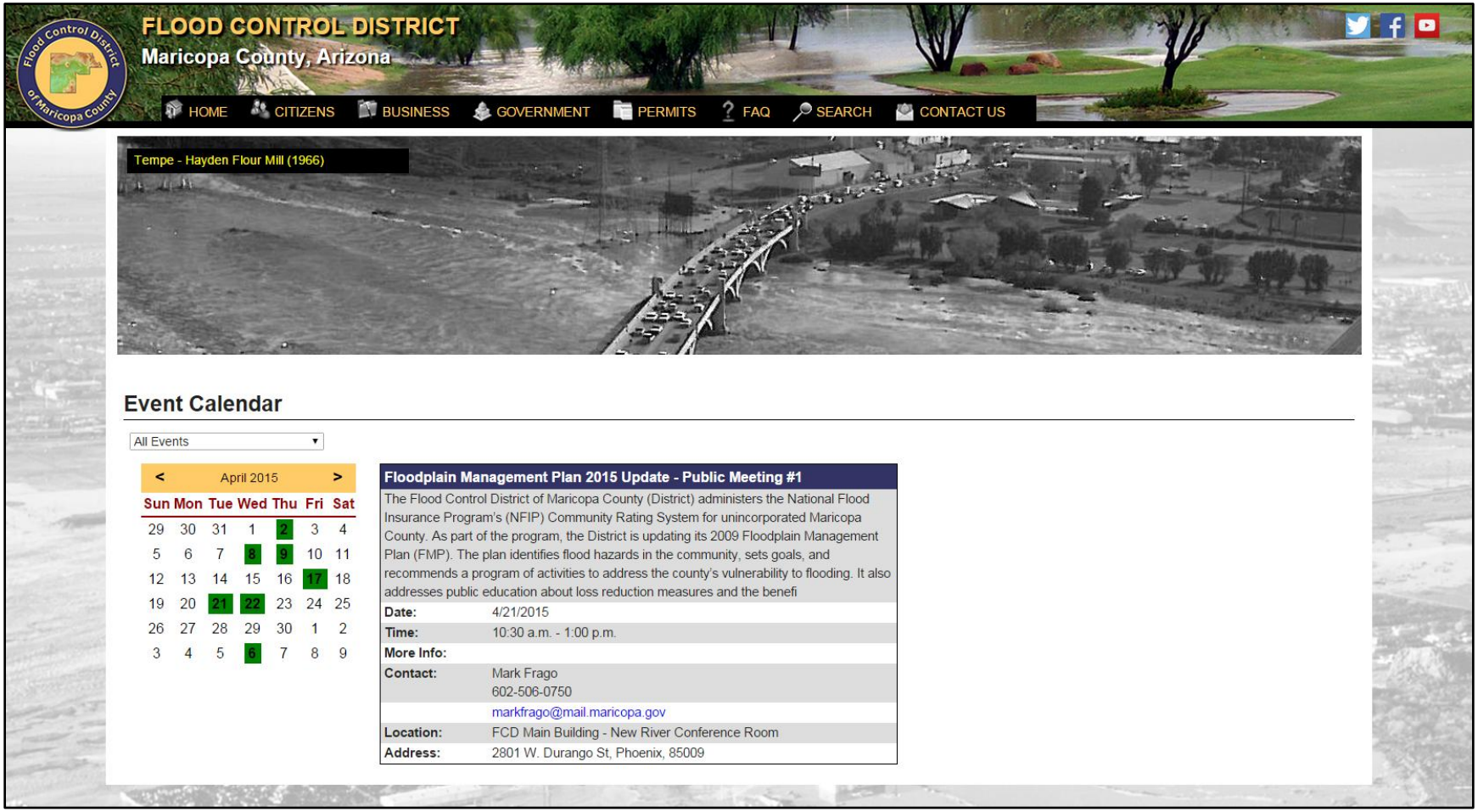
Screen Shot of Flood Control District of Maricopa County Web Site Home Page



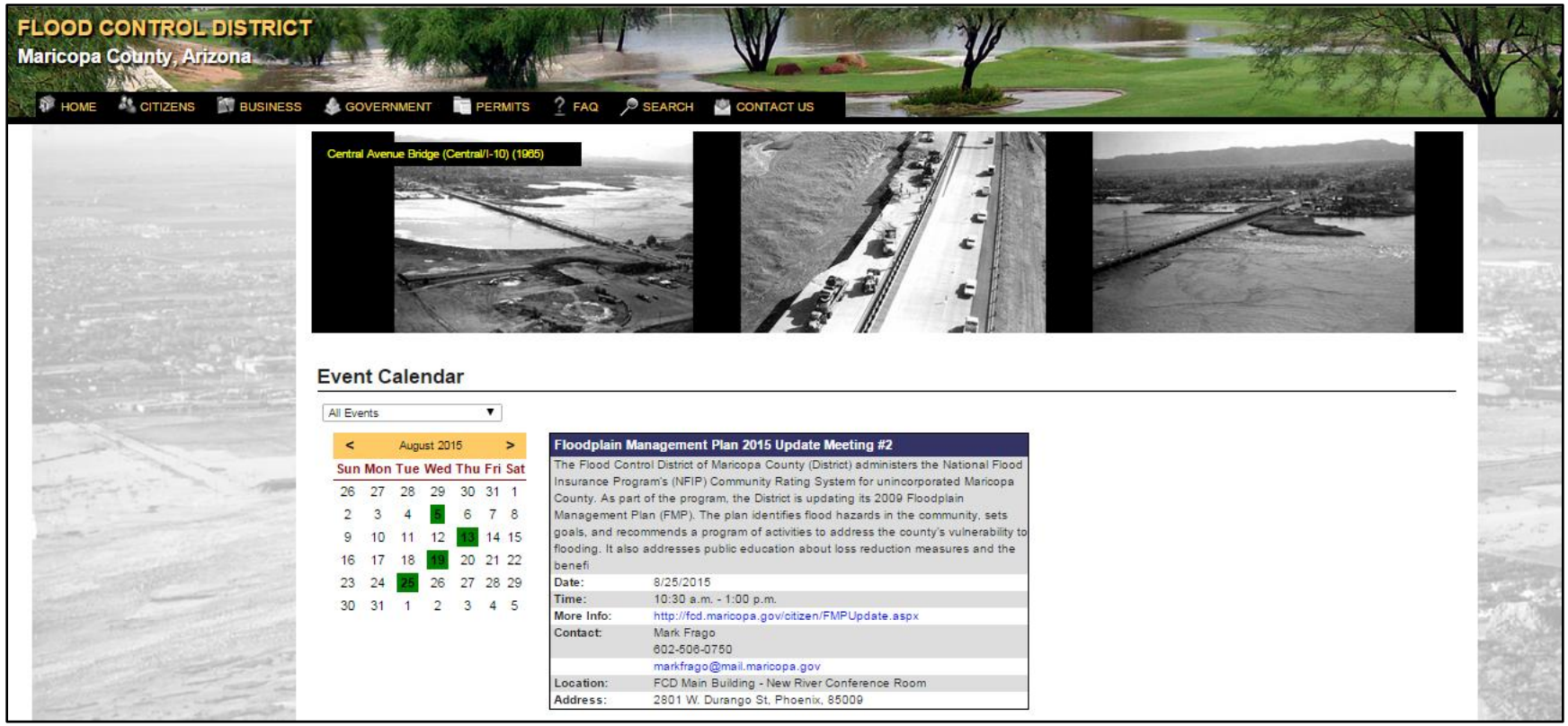
Screen Shot of Flood Control District of Maricopa County Web Page for the 2015 Floodplain Management Plan



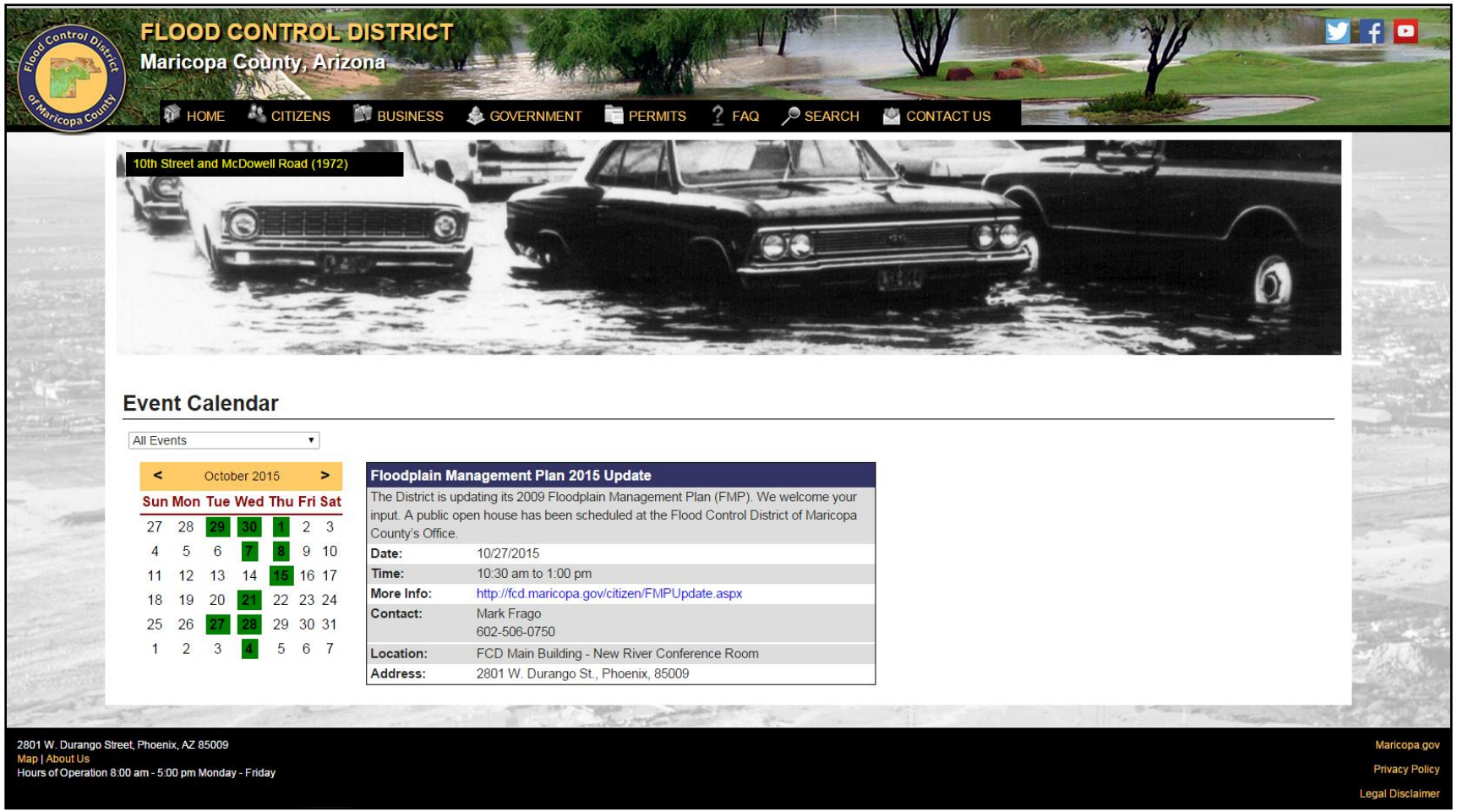
Screen Shot of Flood Control District of Maricopa County Web Site Public Meeting #1 Notice



Screen Shot of Flood Control District of Maricopa County Web Site Public Meeting #2 Notice



Screen Shot of Flood Control District of Maricopa County Web Site Public Meeting #3 Notice



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Public Meeting Notices

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AFFIDAVIT OF PUBLICATION
PUBLIC MEETING / COMMUNITY RATING

Reference/PO # PCN 014.00.00
01

Arizona Business Gazette
The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7315 FAX (602) 444-5901

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Manny Vargas, being first duly sworn, upon oath deposes and says: That he is the Legal Ad Rep of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published weekly at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates indicated.

3/19/2015
3/26/2015

Sworn to before me this
10TH day of
AUGUST 2015

BRIAN BILLINGS
Notary Public - Arizona
Maricopa County
My Commission Expires
July 25, 2018

Notary Public

Flood Control District of Maricopa County PUBLIC MEETING

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county.

We welcome your input. A public open house has been scheduled at the Flood Control District of Maricopa County's Office:

Floodplain Management Plan 2015 Update
Tuesday, April 21, 2015
10:30 AM to 1:00 PM
New River Conference Room
2801 W. Durango Street, Phoenix, AZ 85009

The 2015 FMP is a 5-year plan that will serve as a road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in any time during the open house to discuss:

- The plan's development process
- Progress-to-date of preparing the plan
- Any flooding issues you may have and/or concerns that should be included in developing the plan

For more information, please contact Mark Frago, 602-506-0750 or markfrago@mail.maricopa.gov

Para mas informacion sobre este proyecto, favor de llamar al (602) 506-1501.

Requests for a sign language interpreter, listening devices, or alternative format materials require 72 hours notice to (602) 506-1501 or AishaAlexander@mail.maricopa.gov.

www.fcd.maricopa.gov

AFFIDAVIT OF PUBLICATION
FLOODPLAIN MANAGEMENT

Reference/PO # PG15690040050
01

Arizona Business Gazette
The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7315 FAX (602) 444-5901

Flood Control District of Maricopa County

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its Multi Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also addresses public education about loss reduction measures and the financial benefits of floodplains to reduce flood hazards within the county. We welcome your input. A public open house has been scheduled at the Flood Control District of Maricopa county's office:

Floodplain Management Plan 2015 Update
Tuesday, October 27, 2015
10:30 AM to 1:30 PM
Near First Conference Room
2801 W. Durango Street, Phoenix, AZ 85009

The 2015 FMP is a 5-year plan that will serve as a road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in any time during the open house to discuss:

o The plan's development process
o Any flooding issues you may have and/or concerns that should be included in developing the plan
o DRAFT Floodplain Management Plan 2015 Update available for review

Published: September 24, October 8, 2015

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Manny Vargas, being first duly sworn, upon oath deposes and says: That he is the Legal Ad Rep of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published weekly at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates indicated.

9/24/2015
10/8/2015

Sworn to before me this
1ST day of
DECEMBER 2015

BRIAN BILLINGS
Notary Public - Arizona
Maricopa County
My Commission Expires
July 25, 2016

Notary Public

County: Maricopa
Printed In: Arizona Business Gazette (Phoenix)
Printed On: 2015/10/08

Flood Control District of Maricopa County The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county. We welcome your input. A public open house has been scheduled at the Flood Control District of Maricopa County's Office: Floodplain Management Plan 2015 Update Tuesday, October 27, 2015 10:30 AM to 1:00 PM New River Conference Room 2801 W. Durango Street, Phoenix, AZ 85009 The 2015 FMP is a 5-year plan that will serve as a road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in any time during the open house to discuss: o The plan's development process o Any flooding issues you may have and/or concerns that should be included in developing the plan o DRAFT Floodplain Management Plan 2015 Update available for review Published: September 24, October 8, 2015

Public Notice ID:

County: Maricopa
Printed In: Arizona Business Gazette (Phoenix)
Printed On: 2015/09/24

Flood Control District of Maricopa County Published in Arizona Business Gazette on Sept 24th and October 8th The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county. We welcome your input. A public open house has been scheduled at the Flood Control District of Maricopa County's Office: Floodplain Management Plan 2015 Update Tuesday, October 27, 2015 10:30 AM to 1:00 PM New River Conference Room 2801 W. Durango Street, Phoenix, AZ 85009 The 2015 FMP is a 5-year plan that will serve as a road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in any time during the open house to discuss: o The plan's development process o Any flooding issues you may have and/or concerns that should be included in developing the plan o DRAFT Floodplain Management Plan 2015 Update available for review Published: September 24, October 1, 2015

Public Notice ID:

Stakeholder Notices

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The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county.

You have been identified as an important participant in updating the plan, and we invite you to join the FMP Committee for the 2015 update. As a committee member, you will need to attend all meetings to provide a meaningful contribution by being aware of previous group discussions. The meetings will be held at the District offices, **2901 W. Durango Street, Phoenix, AZ, 85009**:

Date/Time			Purpose
Wednesday	March 4	9 a.m. – 11:30	Assess the hazard
Wednesday	March 11	9 a.m. – 11:30	Assess the problem
Thursday	March 26	9 a.m. – 11:30	Set goals
Wednesday	April 15	9 a.m. – 11:30	Review possible activities
Thursday	April 30	9 a.m. – 11:30	Draft an action plan

Please let Laurie Miller know who will attend from your organization by Friday, February 27th. You may reach her at 602-485-5880 or miller@LTMengineering.com.

If you would like additional information on the plan update, you may reach me at 602-506-0750 or MarkFrago@mail.maricopa.gov.

Sincerely,

Mark Frago, AICP, CFM
Project Manager

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also addresses public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county.

You have been identified as an important stakeholder in updating the plan, and we welcome your input. A public open house has been scheduled at the District's offices:

2015 Floodplain Management Plan Open House
Tuesday, April 21, 2015
10:30 a.m. to 1:00 p.m.
New River Conference Room
2801 W. Durango Street, Phoenix, AZ, 85009

The 2015 FMP is a 5-year plan that will serve as a road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in at any time during the open house to discuss:

- The plan's development process
- Progress-to-date on preparing the plan
- Any flooding issues your organization may have and/or concerns that should be included in developing the plan

Please let Laurie Miller know who will attend from your organization by Wednesday, April 15th. You may reach her at 602-485-5880 or miller@LTMengineering.com.

If you would like additional information on the project, you may reach me at 602-506-0750 or MarkFrago@mail.maricopa.gov.

Sincerely,

Mark Frago, AICP, CFM
Project Manager

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also includes public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county.

You are an important stakeholder in updating the plan, and we welcome your input. You may download the Draft 2015 FMP at:

http://www.fcd.maricopa.gov/downloads/2015-Floodplain-Mgmt-Plan-Draft.pdf

Your review comments are welcome and may be submitted to miller@LTMengineering.com or MarkFrago@mail.maricopa.gov by Thursday, September 10, 2015.

In addition, a public open house to discuss the draft plan will be held at the District's offices:

2015 Floodplain Management Plan Open House
Tuesday, August 25, 2015
10:30 a.m. to 1:00 p.m.
New River Conference Room
2801 W. Durango Street, Phoenix, AZ, 85009

The 2015 FMP is a 5-year road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in at any time during the open house to discuss elements of the draft plan, including:

- Identified flood hazards
- Plan goals
- Activities proposed to be conducted over the next five years
- Any issues your organization may have and/or concerns that should be included in the final plan

Please let Laurie Miller know who will attend from your organization by Wednesday, August 19th. You may reach her at 602-485-5880 or miller@LTMengineering.com.

If you would like additional information on the project, you may reach me at 602-506-0750 or MarkFrago@mail.maricopa.gov.

Sincerely,

Mark Frago, AICP, CFM
Project Manager

The Flood Control District of Maricopa County (District) administers the National Flood Insurance Program's (NFIP) Community Rating System for unincorporated Maricopa County. As part of the program, the District is updating its 2009 Floodplain Management Plan (FMP). The plan identifies flood hazards in the community, sets goals, and recommends a program of activities to address the county's vulnerability to flooding. It also includes public education about loss reduction measures and the beneficial functions of floodplains to reduce flood hazards within the county.

You are an important stakeholder in updating the plan, and we welcome your input. You may download the Draft 2015 FMP at:

http://www.fcd.maricopa.gov/downloads/2015-Floodplain-Mgmt-Plan-Draft.pdf

A public open house to discuss the draft plan will be held at the District's offices:

2015 Floodplain Management Plan Open House

Tuesday, October 27, 2015
10:30 a.m. to 1:00 p.m.
New River Conference Room
2801 W. Durango Street, Phoenix, AZ, 85009

The 2015 FMP is a 5-year road map for addressing flooding issues in unincorporated Maricopa County. You are welcome to stop in at any time during the open house to discuss elements of the draft plan, including:

- Identified flood hazards
- Plan goals
- Activities proposed to be conducted over the next five years
- Any issues your organization may have and/or concerns that should be included in the final plan

Please let Laurie Miller know who will attend from your organization by Wednesday, October 21st. You may reach her at 602-485-5880 or miller@LTMengineering.com.

If you would like additional information on the project, you may reach me at 602-506-0750 or MarkFrago@mail.maricopa.gov.

Sincerely,

Mark Frago, AICP, CFM
Project Manager

Public Meeting #1

Meeting Handout
Sign-In Sheets
Questionnaires and Responses

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Public Meeting #1

POTENTIAL 2015 FLOODPLAIN MANAGEMENT PLAN GOALS

The following ideas have been discussed in developing goals for the 2015 FMP:

1. **Continue/expand public outreach**
   - Educate the public and elected officials on the need for floodplain mitigation. Flood hazards are real but are sporadic, so support dwindles over time after a flood.
   - Develop a marketing plan that offers reasons to support floodplain management and includes multiple communication venues with frequent messages.
   - Include multi-hazard education on the effects of long-term (e.g., changing flows) and short-term (e.g., post-wildfire) changes to the watersheds.
   - Promote a "standards work" strategy to recognize benefits of past floodplain management and flood control efforts.
   - Convey a "greater good" message on responsible floodplain management approaches.
   - Convey the message that flood hazards are present, regardless of the FIRM classification.
   - Ongoing education/guidelines for fencing to promote intended on-lot drainage functions.

2. **Improve quality of life**
   - Increase economic benefits from reduced flood losses and disruptions due to flooding
   - Reduce public suffering
   - Recognize natural resource benefits (use of water and minerals; outdoor activity)

3. **Intergovernmental outreach**
   - Collaborate with other agencies to coordinate planning efforts and needs
   - Integrate floodplain management goals with other plans (e.g., transportation, planning, land-use zoning)

4. **Develop standard lists of resources available before, during, & after flood events**

5. **Regulatory goals**
   - Preserve floodplains on single-lot developments as open space
   - Encourage the Maricopa County Planning & Development Department to continue to propose/discuss "good ideas" at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the future risk of flooding).

6. **Re-evaluate the District's Capital Improvement Program (CIP) selection process for funding of drainage infrastructure.**

Please circle any goals that you would support. You are welcome to suggest new or modified goals on the back of the page.

Suggestions for new or modified goals:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting:	Public Meeting	**Meeting Date:**	Tuesday – April 21, 2015
Facilitator:	Flood Control District of Maricopa County	**Place/Room:**	New River Conference Room

Name	Title	Organization	Phone
Kristina Jensen	Civil Engineer II	City of Phoenix	602-261-8417
Doug C. Nelson	Attorney	Woolsey & Flood Protection District	602-395-1612
Buzz HATCH	General Manager	Queen Creek Irrigation District	480 987-3002
Mary Hoadley	Chair	Upper Agua Fria Watershed Partnership	480-206-828
Curtis Overall	Govt. Liaison American Red Cross	*CURTIS.OVERALL@REDCROSS.ORG American Red Cross	602 291 1081
John Regala	Quality Inspector	Pinal County FC	520 866-6281
Lynn Whitmer	District Engineer	Yavapai County Flood Control	928 771 3197
Maureen Towne	RISKMAP coord.	ADWR	602-771-8662
Jenn. Le Martin	Water Sentinels Program Coordinator	Sierra Club	602 423 6157
JON FRIES	PLANNING DIRECTOR	CITY OF GLENDALE	(623) 930.2585
Bob Eroh	Project Engineer	City of Buckeye	
Sharon McGuire	Program Coordinator	FCD	602 506-8378

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Name	Title	Organization	Phone
Michael Smith	Inspection Supervisor	FCDMC	(602) 506-0538
Frank Brown	Senior Civil Engineer	FCD of MC	602-506-4617
Cathy Reegester	Engineer	FCDMC	602-506-4001
James P. Shano	Public works Director	Town of Paradise Valley	480-348-3573
Jeremy Knapp	Engineering Services	Town of Paradise Valley	480-348-3622
Theresa Pinto	Project Manager	FCDMC	6025068127
Margarita Teneva	Civil eng. tech.	FCD MC	6-7366
Ashley Couch	Stormwater Manager	City of Scottsdale	480-312-4317
Laurie Miller	President	LTM Engineering, Inc.	602-485-5880
Mark Frago	Project Manager	FCDMC	602-506-0750
Pat Quinn	Proj. Manager	JE Fuller	480-222-5708

Flood Control District of Maricopa County
Floodplain Management Plan Update
Public Meeting – April 21, 2015

Stakeholder Questionnaire

1. What community do you represent?

   _____

2. Please describe past flooding problems in your community and the location(s) of the flooding:

   _____

   _____

   _____

3. How often are these areas flooded?

   ☐ Frequently (once or more per year)
   ☐ Occasionally (every few years)
   ☐ Rarely

4. Have members of your community had problems accessing their property during storms?

   ☐ **Yes** ☐ **No** *If yes, what areas were flooded?*

   _____

   _____

5. Drainage systems typically include open channels, washes, and detention basins. Does your community support the use of natural or constructed drainage facilities for recreation? ☐ **Yes** ☐ **No**

   If yes, please name and/or describe the locations of multi-use basins/channels/washes:

   _____

   _____

6. Do you consider recreation, wildlife habitat, or scenic value to be an important benefit of floodplains in your community?

   ☐ Very important ☐ Somewhat important ☐ Not important ☐ Don't know/no opinion

7. Your community is best described as (*mark all that apply*):

   ☐ Urban /city
   ☐ Agricultural
   ☐ Rural or undeveloped

Flooding is a natural hazard, and it comes in many forms, including those listed on the back of this page. Please mark the type of hazards that affect your community.

Stakeholder Questionnaire

8. Hazards that affect your community

- ☐ Canal overtopping
- ☐ Flash flooding
- ☐ Alluvial fan flood hazards
- ☐ Major streets/roads or freeways/highways flooded
- ☐ At-grade road crossings of washes
- ☐ Shallow, sheet flow becomes channelized by development
- ☐ Erosion
- ☐ Lateral migration of washes
- ☐ Sediment and/or debris-laden floodwaters
- ☐ Natural flow patterns interrupted by single-lot development
- ☐ River and wash corridors damaged by ATV use
- ☐ Natural habitat disturbed
- ☐ Flooding worsened by agricultural fields that have obliterated natural drainageways
- ☐ Repetitive losses in active farming areas

Other hazards (*Please describe*)

Other flooding concerns you may have:

Flood Control District of Maricopa County
Floodplain Management Plan 2015 Update
Public Open House
April 21, 2015

Table 1: Summary of Stakeholder Questionnaire Responses

Information Source	Past Flooding Problems	Frequency of Flooding	Property Access	Support for multi-use facilities	Importance of floodplains on recreation, habitat, scenic views	Type of Community	Hazard Types	Additional Hazards
City of Buckeye	Along the Lower Gila River and several smaller areas	Occasionally	Yes, several rural areas	Yes	Somewhat important	Urban, agricultural, and rural/undeveloped	Canal overtopping; flash floods; alluvial fans; major roads/hwys flooded; at-grade road crossings; sheet flow channelized by development; erosion, lateral migration; sediment/debris-laden floodwaters; natural flow interrupted by single-lot development; conveyance corridors damaged by ATVs.	
City of Phoenix	Flood-irrigated lots below street grade and no positive outfall; structures behind canal banks; no onsite retention of older subdivisions and no consideration for offsite flows	Occasionally	No	Yes: 27th & So. Mtn. avenues; 19th Ave & Dobbins Rd.	Very important	Urban	Canal overtopping; flash floods; at-grade road crossings; sediment/debris-laden floodwaters	Short time of concentration on or near hillside developments
Pinal County								PVR FRSs

Information Source	Past Flooding Problems	Frequency of Flooding	Property Access	Support for multi-use facilities	Importance of floodplains on recreation, habitat, scenic views	Type of Community	Hazard Types	Additional Hazards
Town of Paradise Valley	Localized flooding along washes where banks are overtopped	Occasionally	Yes, in rare occasions, with road closures at Tatum Blvd. south of Lincoln Dr. and at Invergordon & Indian Bend Wash.	Yes: Cudia City Wash at Phoenix Country Day School (40th St. & Sanford)	Very important	Urban	Flash floods; major roads/hwys flooded; at-grade road crossings; sheet flow channelized by development; erosion, lateral migration; natural flow interrupted by single-lot development	
Sierra Club Grand Canyon Chapter					Very important			
Woolsey Flood Protection District	Numerous	Frequent	Yes	Yes	Somewhat important	Agricultural	Canal overtopping; flash floods; alluvial fans, major roads/hwys flooded; at-grade road crossings; sheet flow channelized by development; erosion, lateral migration; sediment/debris-laden floodwaters; natural flow interrupted by single-lot development	

Additional Comments:

1. Pinal County: Stress good communication with Pinal County on any information on the PVR FRSs or any progress on surrounding areas.
2. Sierra Club: Primary interest is planning that minimizes hazards yet puts flood waters to their best & highest use, either by routing and treating for municipal use or by recharge basins or in-stream flow in existing waterways. Drainage infrastructure should maximize ecosystem value by using natural vegetation/green infrastructure and through placement & design. Vulnerable or fragile ecosystems that may be damaged by floods should be considered among hazards.
   Upper Agua Fria Watershed Partnership: We experience the upstream flow of the Agua Fria from the border of the Prescott AMA to the upper end of Lake Pleasant and are aware of the periodic large flows that can create downstream flooding issues in Yavapai and Maricopa counties, such as January 2010, Winter 2015.

Flood Control District of Maricopa County
Floodplain Management Plan Update
Public Meeting – April 21, 2015

Public Questionnaire

1. What are the major crossroads near your home?

   _____

2. Please describe past flooding problems in your area and the location(s) of the flooding:

   _____

   _____

   _____

3. How often is your neighborhood flooded?

   - ☐ Frequently (once or more per year)
   - ☐ Occasionally (every few years)
   - ☐ Rarely
   - ☐ Not aware of any past flooding problems

4. Have you had problems entering or leaving your property during storms? ☐ **Yes** ☐ **No**

   If yes, which streets were flooded?

   _____

   _____

5. Has your home or other buildings on your property been flooded? ☐ **Yes** ☐ **No**

   If yes, how many times and how severe was the damage?

   _____

   _____

6. Flood control solutions include open channels, washes, and detention basins. Do you use any existing channels, washes, or basins for recreation? ☐ **Yes** ☐ **No**

   If yes, please provide their names and locations:

   _____

   _____

7. Do you consider recreation, wildlife habitat, or scenic value to be an important benefit of floodplains?

   ☐ Very important ☐ Somewhat important ☐ Not important ☐ Don't know/no opinion

8. Your neighborhood is best described as:

   - ☐ Urban /city
   - ☐ Agricultural
   - ☐ Rural or undeveloped

Flooding is a natural hazard, and it comes in many forms, including those listed on the back of this page. Please mark the type of hazards that affect your community.

9. Hazards that affect you

- ☐ Canal overtopping
- ☐ Flash flooding
- ☐ Major streets/roads or freeways/highways flooded
- ☐ Local streets or roads flooded
- ☐ At-grade road crossings of washes (no culverts)
- ☐ Shallow, sheet flow becomes channelized by development
- ☐ Erosion
- ☐ Washes have moved from side to side (lateral migration)
- ☐ Floodwaters carry sediment and/or debris
- ☐ Natural flow patterns interrupted by single-lot development
- ☐ River and wash corridors damaged by ATV use
- ☐ Natural habitat disturbed
- ☐ Flooding worsened by agricultural fields that have cut off natural drainage
- ☐ Repetitive losses in active farming areas

Other hazards (*Please describe*)

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Other flooding concerns you may have:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Flood Control District of Maricopa County
Floodplain Management Plan 2015 Update
Public Open House
April 21, 2015

Table 2: Summary of Public Questionnaire Responses

Major Cross Streets	Past Flooding Problems	Frequency of Neighborhood Flooding	Property Access	Past History of Flooded Structures on Property	Support for multi-use facilities	Importance of floodplains on recreation, habitat, scenic views	Type of Community	Hazard Types	Additional Hazards
Litchfield & Indian School Rds		Not aware of past flooding problems	No	No	Yes	Somewhat important	Urban	Canal overtopping	
Cooper Rd & Chandler Blvd	Street flooding	Not aware of past flooding problems	Yes, Cooper Road	No	Yes: Tibshraeny Park/ detention basin	Very important	Urban	Major roads/hwys flooded; at-grade road crossings.	
24th St & E. Christy Dr., Phoenix	None since 1995	Rarely	No	No	Yes, natural washes for bird=watching around Maricopa Co. (e.g., Upper Agua Fria & Hassayampa rivers & their tributaries	Very important	Urban	Flash floods; natural flow interrupted by single-lot development; river/wash corridors damaged by ATV use; natural habitat disturbed.	Channelizing where not necessary increases likelihood of floods downstream. Flash flooding of the Upper Agua Fria River and New River in Maricopa County have affected persons I know from Black Canyon City and New River areas.

Additional Comments:

1. a. The Upper Agua Fria and tributaries, although mostly outside of Maricopa County, flow into Lake Pleasant. In Maricopa County, this river (and others in the watershed) has devastated areas in high water times in their rush downstream and toward that impoundment. I firmly believe public policies both up-river and down-stream, no matter political and agency boundaries, have to change enough to allow for

rebuilding of natural riparian areas. These areas slow the flow of water, letting some seep into the ground. This helps protect riverside habitat; human developments in “normal" high water times can become less vulnerable.

b. Preserving and increasing these natural stream side areas on upper reaches of rivers and slowing the rush to “channelize” watercourses, Arizona will, in future, have fewer of the flooding cycles that result in destruction of natural habitat, property and even persons as we have seen in rural Maricopa County.

c. Near my house(Northeast Phoenix), off-roading occurs occasionally which upsets the remaining natural washes. When it rains substantially, rain water speeds down East Christy Drive into the catch basin on 24th street. It is a waste of water and illustrates that channelizing and covering washes concrete and pavement simply increases the "flooding" waters downstream. No concerns at my house, but at venues away from Phoenix in M. Co. where I watch birds, rivers and tributaries that are left natural are wet long after water stops flowing. This encourages the growth of plants that create shade and humidity...these natural washes need to be preserved; where there are "channelized washes, even in town, like parts of Cave Creek Wash, these need to be put back as much as is practical, into natural washes which would slow down the water and help to relieve "normal” flooding (not the Big Ones perhaps) but the normal flooding rains. These rains are actually killing people in parts of Maricopa County (New River, for example in recent years) where water is NOT slowed down enough in the natural channels. We have to mitigate the mistakes of prior years like cutting down vegetation in riparian areas to increase H2O flow into reservoirs, etc.

Public Meeting #2

Sign-In Sheets

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Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting:	Public Meeting #2	**Meeting Date:**	Tuesday – August 25, 2015
Facilitator:	Flood Control District of Maricopa County	**Place/Room:**	New River Conference Room

Name	Title	Organization	Phone
Ken Conklin	Division Mgr.	MC Environmental Services Dept.	602 506-0002
Carl D'Acosta	Environmental Health Supervisor	" " "	602. 506.6944
Leigh Johnson	MCPRD ↔	Park Planner	
Nuning Lemka	Civil Engineer	City of Surprise	623-222-6148
Steve Scinto	Sr. Civil Engineer	City of Goodyear	623-882-7988
Keith Brown	Asst. City Engineer	City Goodyear	623-882-7956
Paul Lopez	Engineering	City of Avondale.	623-333-4219
DAVID JANOVER	CITY ENGINEER	CITY OF AVONDALE	623-333-4216
Kirsten Sorensen	Disaster Prog. Mngr. ~~Red Cross~~	Red Cross	928-713-5060
Maureen Towne	ADWR ↔	floodplain	602-771-8662
CHRIS DOVEL	TOWN ENGINEER	TOWN OF QUEEN CREEK	480-358-3067
Steve Boyle	Community Development Director	Town of Wickenburg	928-668-0512

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Name	Title	Organization	Phone
Kristina Jensen	Civil Engineer	City of Phoenix	602-261-8417
John Townsend	Division Manager	MC Environmental Services	602-506-0703
Laurie Miller	President	LTM Engineering	602-485-5880
Sharon McGuire	Program Coordinator	Flood Control District	602-278-3156
Michele Kogl	P+D Manager	Parks and Rec	928-501-9203
Jon Froke	Planning Director	City of Glendale	(623)930.2585
Kelli Sertich	Floodplain Mngt & Services Dev. Mngr	FCD	506-2202
Bill Wiley		FCD	
Mark Frago AICP	Project Manager	FCD	506-0750

Public Meeting #3

Sign-In Sheet

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Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

FLOODPLAIN MANAGEMENT PLAN 2015 UPDATE
SIGN-IN SHEET

Meeting:	Public Meeting #3	**Meeting Date:**	Tuesday – October 27, 2015
Facilitator:	Flood Control District of Maricopa County	**Place/Room:**	New River Conference Room

Name	Title	Organization	Phone
Kelli Sertich		Rainbow Valley Resident	
Margarita Teresa		SCOTTSDALE	
Laurie Miller		LTM Engineering	602-485-5880
Sharon McGuire		FCD	602-506-9378
Mark Frago		FCD	506 0750
STEVE HOSSACK		GLENDALE	658 -602-9673

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Appendix D

Assessment of Flood Insurance Coverage in Unincorporated Maricopa County

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Federal Flood Insurance Assessment
Community Rating System (CRS) Activity 370a
Maricopa County (Unincorporated Areas)

Introduction

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) recognizes floodplain management and outreach activities performed by communities that exceed the NFIP minimum standards. CRS, a voluntary program, recognizes these efforts by reducing the cost of flood insurance premiums by 5 to 45 percent for flood insurance policies in communities that participate in the CRS. The CRS recognizes 19 creditable activities organized under four categories: **Public Information**, **Mapping and Regulations**, **Flood Damage Reduction**, and **Warning and Response**. Communities can choose to undertake any or all of these activities. Based on the number of credit points received for each activity, a community is ranked in one of ten CRS *classes* with Class 1 requiring the most credit points and giving the largest premium reduction.

The CRS is widely seen as one of the more effective ways for communities to lessen the impact of flood insurance rate increases that are beginning to take effect for communities across the country because of the Flood Insurance Reform Act of 2012. Activity 370, 'Flood Insurance Promotion' is a new CRS activity within the Public Outreach activity series. As part of Activity 370, communities can receive credit for performing an assessment of flood insurance coverage within their community, and developing and implementing a coverage improvement plan based on that assessment. Detailed information about Activity 370 is provided in the 2013 CRS Coordinator's Manual.

Performing Activity 370 will have additional benefits for a community beyond CRS. Not only is it a way to obtain credit under CRS activities undertaken to improve overall flood insurance coverage within the community, it opens the opportunity to increase risk awareness and promote

Key Terms and Definitions

Flood Insurance Rate Map (FIRM)—*Official NFIP map of a community on which both Special Flood Hazard Areas and risk premium zones applicable to the community are shown.*

Floodway—*The stream channel and that portion of the adjacent floodplain which must remain open to permit passage of the base flood.*

Mandatory Purchase Requirement—*In communities participating in the NFIP, flood insurance is a prerequisite for receiving money from a Federal agency or a federally supported financial program for properties located in the SFHA.*

Special Flood Hazard Area (SFHA)—*The land area covered by the floodwaters of the 1% annual chance flood. It is the area where the mandatory purchase of flood insurance applies and includes the following zones relevant to this study: A, AO, AE, and AH.*

Insurable Structure—*Under the NFIP, a structure with 2 or more outside rigid walls and a fully secured roof affixed to a permanent site; a manufactured home affixed to a permanent foundation; or a travel trailer without wheels affixed to a permanent foundation and regulated under a community's floodplain management ordinance.*

mitigation measures to improve community resilience during outreach campaigns.

Objective of this Study

The NFIP's primary purpose is to insure those at risk against flood losses. This study is designed to (1) assess the proportion of households and businesses that have purchased federal flood insurance (the market penetration rate) in the community; (2) identify prior claims and vulnerabilities; (3) examine potential factors that affect the market penetration rate; and (4) identify some of the opportunities for improving the level of flood insurance coverage in identified target areas.

This assessment fulfils requirements of CRS Activity 370a (Flood Insurance Coverage Assessment) through the performance of the following:

- Identification of target areas with significant flood hazards and development present within the community;
- Mapping of flood insurance coverage within these identified target areas;
- Determination of the level of flood insurance coverage (including both structural and contents coverage) within each target area, including the comparison of coverage statistics with the number of buildings exposed to the hazard and potential losses from the 1% annual chance flood.;
- Development of this report summarizing the findings of the assessment.

Approach

In conducting this CRS Activity 370a assessment, the following data sets were used:

- The Federal Emergency Management Agency's (FEMA's) digital Flood Insurance Rate Map (FIRM) data;
- Current flood insurance policy and claims information available from FEMA;

Key Terms and Definitions, cont'd

Regular Program—*The final phase of a community's participation in the NFIP. In this phase, a FIRM is in effect and full limits of coverage are available.*

Pre-FIRM building—*A building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial FIRM.*

Post-FIRM building—*A building for which construction or substantial improvement occurred after December 31, 1974, or on or after the effective date of an initial FIRM, whichever is later.*

Repetitive Loss Structure—*An insured structure for which two or more claims of more than $1,000 have been paid by the NFIP within any 10-year period since 1978. (e.g., two claims during the periods 1978–1987, 1979–1988, etc.)*

Zone AE—*SFHA where Base Flood Elevations are provided.*

Zone —*SFHA where no Base Flood Elevations are provided.*

Zone AH—*Shallow flooding SFHA. Base Flood Elevations in relation to a an elevation referenced to a vertical datum are provided.*

Zone AO—*SFHA with sheet flow, ponding, or shallow flooding. Base flood depths (feet above grade) are provided.*

- The most recent imagery available for Maricopa County;
- U.S. Census Block boundaries;
- Local tax assessment data.

These data were used to examine the seven communities in Maricopa County that were participating in CRS as of October 2013. Within each community, market penetration, claims, and vulnerabilities were examined on an overall basis as well as within designated target areas where significant flood hazards and/or multiple claims were found. Each target area is comprised of multiple census blocks. Census blocks were chosen as the basis of the boundary areas to ensure a standardized geographic unit for all of the analysis performed as part of this project. If a part of the census block was chosen for inclusion in the assessment due to its partial inclusion in the Special Flood Hazard Area (SFHA) or the existence of claims, the entire geographic area of the census block was included. As such, the target area boundaries do not follow SFHA boundaries or specific clusters of claims, but instead follow census block boundaries that include the area chosen for analysis.

Further information on the data and methodology used to support this flood insurance coverage assessment can be found in Appendix A of this report.

Organization of this Report

The sections that follow summarize the key findings of this report including an overall community level assessment of Maricopa County's flood insurance coverage, claims data, and potential loss estimation of structures in the SFHA. The additional sections that follow include similar assessments but instead focus on each target area identified within the community. The final section includes conclusions and some recommended approaches for increasing flood insurance coverage in the community and identified target areas.

Community Overview

Maricopa County Unincorporated Areas (CID 040037) joined the Regular Phase of the NFIP on July 2, 1979. It entered the CRS program on October 1, 1991, and currently has a class rating of 4. There are approximately 192,890 insurable structures in the community, with 4,842 of these structures located in the SFHA as shown on the FIRM for Maricopa County dated October 16, 2013. As of April 2013, there were 1,231 flood insurance policies with coverage for the building and 403 policies with content coverage in force within the SFHA in the community. The average value of coverage per policy in the County is $239,829 and $73,656 for structural and content coverage respectively within the SFHA.

As of April 2013, 262 claims were paid for structural damage and 192 claims were paid for contents within the community. Of those claims, the average value of claims paid was $11,198 and $3,013 for structural damage and contents respectively. The total value of claims paid was $2,933,953 and $848,801 for structural damage and contents respectively. As of April 2013, there were 63 repetitive loss properties located in the community. There are no severe repetitive loss properties located within the community. Information about general flood insurance coverage for Maricopa County is provided in Table 1.

Table 1 – General Flood Insurance Coverage

	# of Insurable Structures	# of Structures within SFHA	# of Structural Policies within SFHA	# of Contents Policies within SFHA	# of Rep Loss Properties
Maricopa County Unincorporated Areas (CID 040037)	192,890	4,842	1,231	403	63

A full summary table of community statistics is provided in Appendix B of this report.

Target Areas

Three target areas within Maricopa County have been identified on which to focus this CRS Activity 370a flood insurance coverage assessment. Each target area is comprised of multiple census blocks. Census block boundaries were chosen as the basis for the target areas to ensure a standardized geographic unit for all of the analysis performed as part of this project. Target area boundaries were delineated taking into account the location of:

- Current SFHA boundaries shown on the FIRM;
- Current flood insurance policy information;
- Repetitive loss property locations;
- Historical claims information;
- The most recent imagery available for Maricopa County.

Figure 1 indicates the location of each target area within the unincorporated areas of Maricopa County.

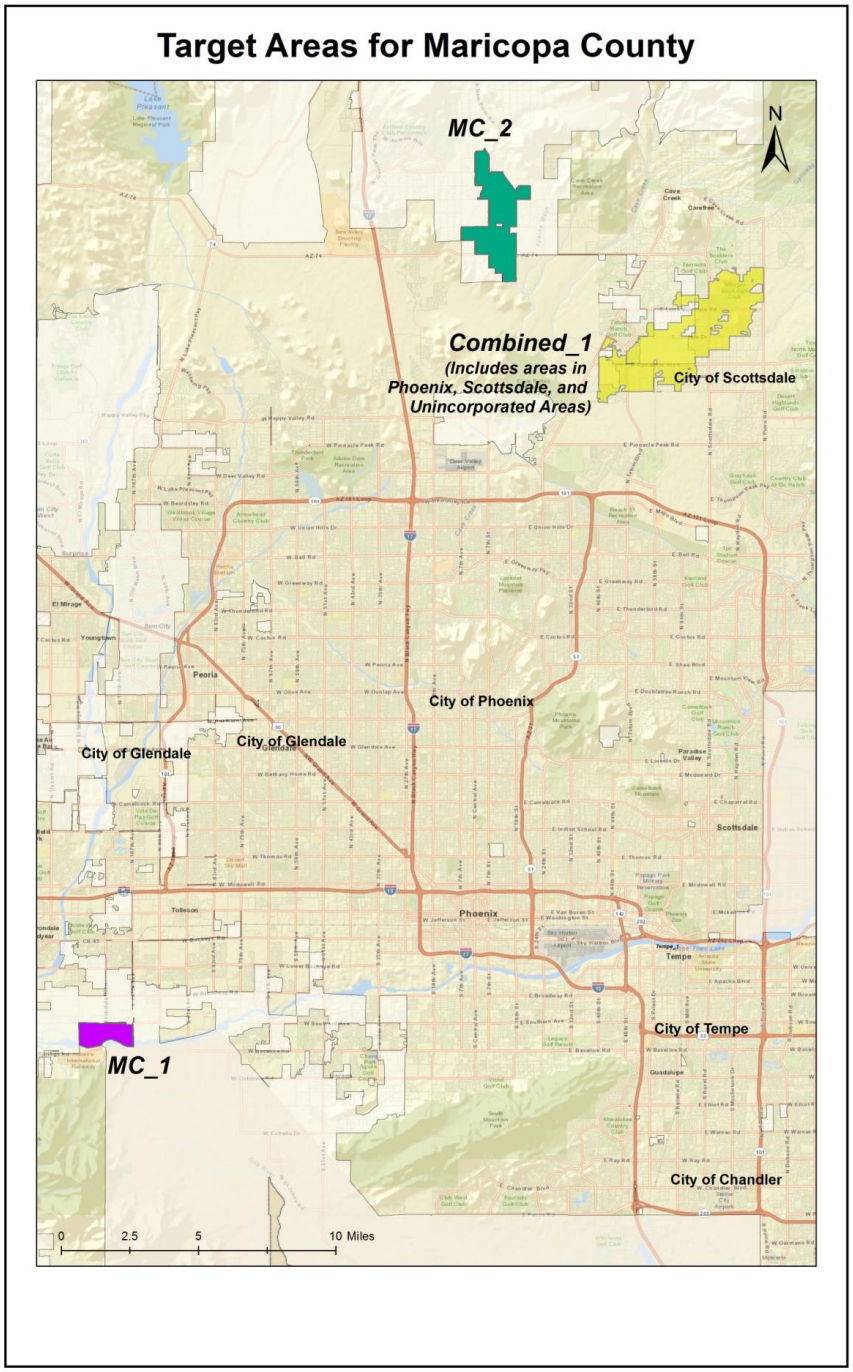

Figure 1: Target Areas within Maricopa County (Unincorporated Areas)

Each target area is mapped and described in detail in the sections that follow.

Target Area: MC_1

The *MC_1* target area is in the southwestern area of Maricopa County and is approximately 1.5 square miles in size. It is bounded by West Southern Avenue and Saint Johns Canal to the north, South 107th

Avenue to the east, Gila River and Salt River to the south, and South 123rd Avenue and South El Mirage Road to the west. The primary flooding source for this target area is the Gila River. The corresponding SFHA for the area is Zone AE. A portion of the area is also located in the regulatory floodway. This area includes pockets of residential properties surrounded by agricultural and vacant land.

A map summarizing data for the MC_1 target area is shown as Figure 2.

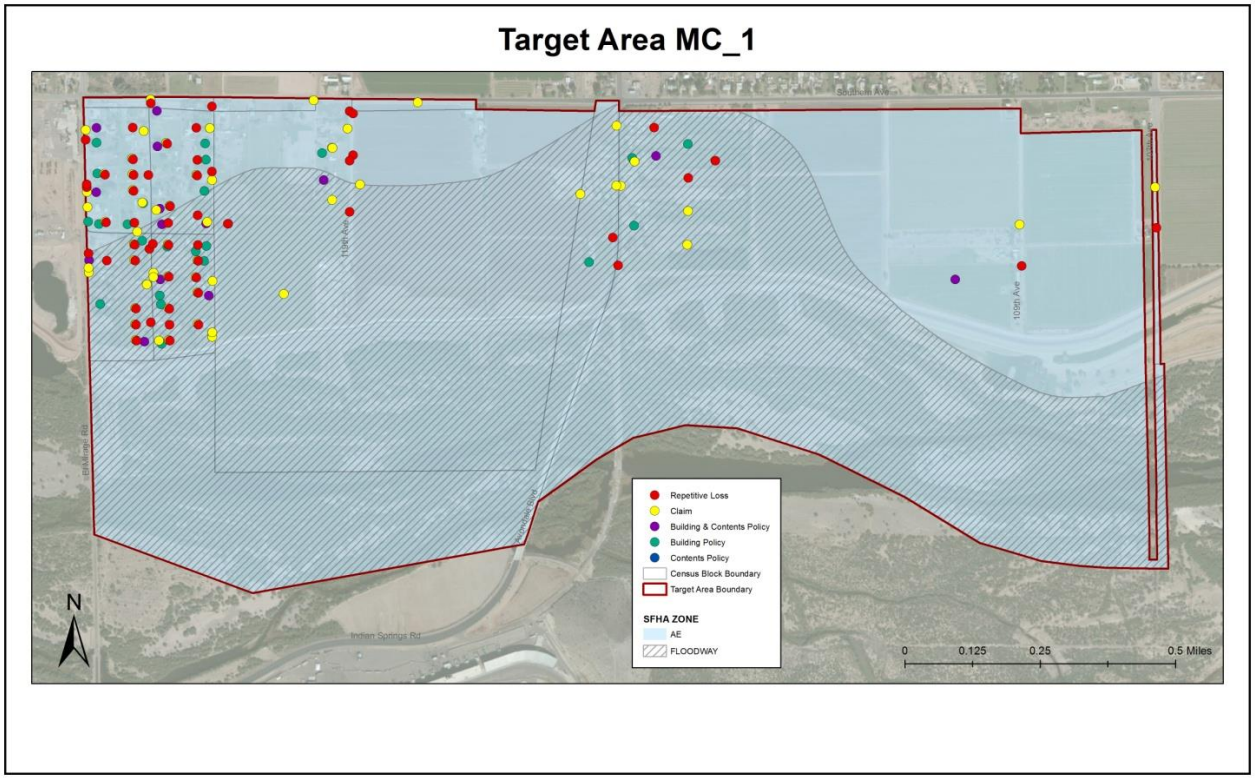

Figure 2: MC_1 Target Area

Flood Insurance Coverage and the SFHA

There are approximately 86 insurable structures located in this target area, and all of those 86 structures are located in the SFHA. Of these structures, there are 37 with structural flood insurance coverage and 14 with contents flood insurance coverage, representing a coverage rate of 43% and 16% for structural and contents policies respectively. These policies are predominantly for single family residential properties.

Table 2 – Flood Insurance Coverage Summary

			Structural Coverage		Content Coverage	
Target Area	**# of Insurable Structures**	**# of Structures within SFHA**	**# of Policies within SFHA**	**% of Buildings in SFHA with Coverage**	**# of Policies within SFHA**	**% of Buildings in SFHA with Coverage**
MC_1	86	86	37	43%	14	16%

Table 3 shows the breakdown of policies for Pre- and Post-FIRM structures within the target area as a whole.

Table 3 – Pre-FIRM versus Post-FIRM Policies

		Pre-FIRM		Post-FIRM	
Target Area	**Total # of Policies**	**# of Policies**	**% of Total Policies**	**# of Policies**	**% of Total Policies**
MC_1	33	31	94%	2	6%

Claims

As of April 2013, 119 claims were paid for structural damage and 112 claims were paid for contents within the target area. Of those claims, the average value of claims paid was $10,570 and $1,313 for structural damage and contents respectively. There are 55 repetitive loss properties located in the target area.

Potential Losses

The average amount of coverage per policy in the target area within the SFHA is $167,138 and $23,607 for structural and contents coverage respectively.

Homeowners can cover their structure for up to $250,000 and its contents for $100,000, and business owners can insure their structure and contents for $500,000 each under the NFIP. Insufficient flood insurance coverage can leave the property owner and community vulnerable. Many people only have coverage equal to the remaining balance of their mortgage, which may not be sufficient to cover the amount of damage that could result from a 1% annual chance flood. Table 4 shows the potential loss for buildings located in the SFHA in comparison with flood insurance coverage.

Table 4 – Estimated Potential Losses

Target Area	# of structures in SFHA	# of structural policies in the SFHA	Average Coverage in SFHA	Total Structural Coverage in the SFHA	Average Estimated Potential Losses in SFHA	Total Estimated Potential Losses in SFHA
MC_1	86	37	$167,138	$6,184,100	$62,000	$5,375,000

A complete data summary is also provided in Appendix C of this report.

Target Area: MC_2

The *MC_2* target area is in the northern area of Maricopa County and is approximately 5.3 square miles in size. It is bounded by North Central Avenue and North 7th Street to the north; portions of North 16th Street and 20th Street to the east; East Dove Valley Road to the south; and portions of West Cloud Road, North 7th Avenue, East Galvin Street, and Carefree Highway to the west. The primary flooding source for this target area is Desert Lake Wash. The corresponding SFHAs for the area are Zones A and AE. A

portion of the area is located in the regulatory floodway. Areas of moderate flood hazard, shaded Zone X, are shown on the FIRM throughout the target area. Zone X represents the flood that has a 0.2 percent annual chance of occurrence in any given year. By definition, it is not defined as the SFHA, and as such the structures included within areas of shaded Zone X do not carry a mandatory purchase requirement. This is a primarily residential area. A map summarizing data for the MC_2 target area is shown as Figure 3.

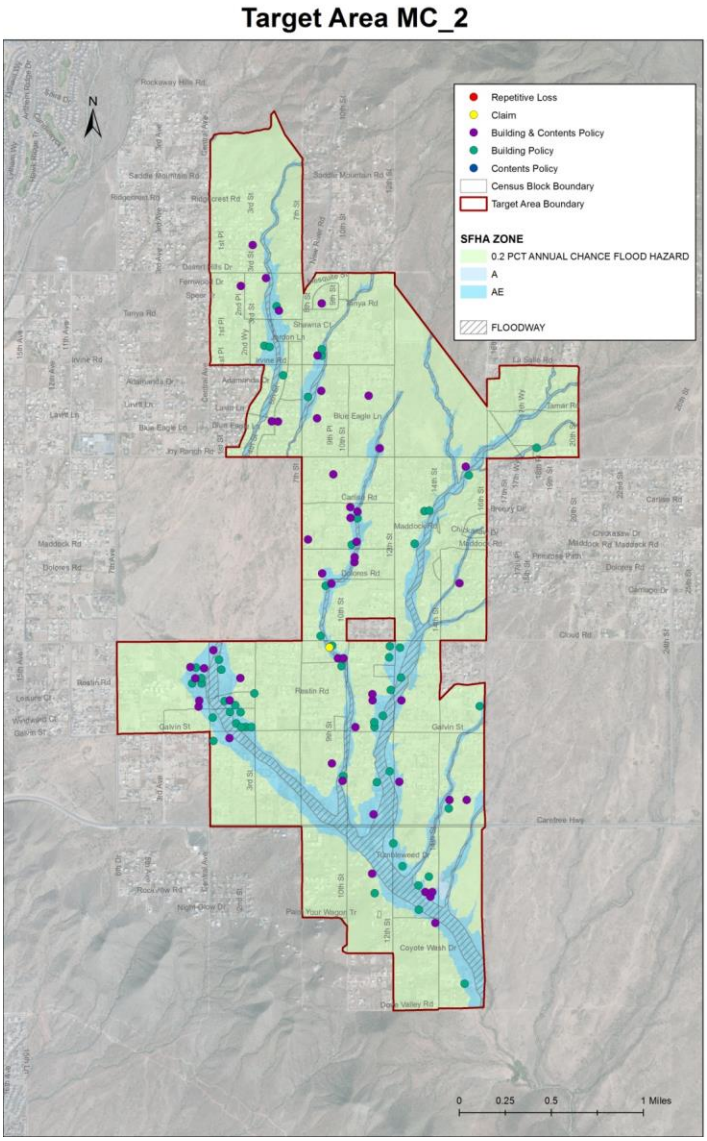

Figure 3: MC_2 Target Area

Flood Insurance Coverage and the SFHA

There are approximately 1,493 insurable structures located in this target area, with 113 of those structures located in the SFHA. Of those structures in the SFHA, there are 69 with structural flood insurance coverage and 27 with contents flood insurance coverage, representing a coverage rate of 61% and 24%

for structural and contents policies respectively. Almost all of these policies are for single family residential structures.

Table 5 – Flood Insurance Coverage Summary

			Structural Coverage		Content Coverage	
Target Area	**# of Insurable Structures**	**# of Structures within SFHA**	**# of Policies within SFHA**	**% of Buildings in SFHA with Coverage**	**# of Policies within SFHA**	**% of Buildings in SFHA with Coverage**
MC_2	1,493	113	69	61%	27	24%

Table 6 shows the breakdown of policies for Pre- and Post-FIRM structures within the target area as a whole.

Table 6 – Pre-FIRM versus Post-FIRM Policies

		Pre-FIRM		Post-FIRM	
Target Area	**Total # of Policies**	**# of Policies**	**% of Total Policies**	**# of Policies**	**% of Total Policies**
MC_2	103	3	3%	100	97%

Claims

As of April 2013, 1 claim has been paid within the target area for structural damage in the amount of $19,443. There are zero repetitive loss properties located in the target area.

Potential Losses

The average amount of coverage per policy in the target area within the SFHA is $219,464 and $49,711 for structural and contents coverage respectively.

Table 7 shows the potential loss for buildings located in the SFHA in comparison with flood insurance coverage.

Table 7 – Estimated Potential Losses

Target Area	**# of structures in SFHA**	**# of structural policies in the SFHA**	**Average Coverage in SFHA**	**Total Structural Coverage in the SFHA**	**Average Estimated Potential Losses in SFHA**	**Total Estimated Potential Losses in SFHA**
MC_2	113	69	$219,464	$15,143,000	$158,000	$17,821,000

A complete data summary is also provided in Appendix C of this report.

Target Area: Combined_1 (Maricopa County)

The *Combined_1* target area includes portions of Phoenix, Scottsdale and the unincorporated areas of the County. Specifically, it is located in northeast Phoenix, northwest Scottsdale and portions of the unincorporated areas of the County in the vicinity, to the east of 40th Street, to the north of Jomax Road, to the west of Pima Road, and to the south of Westland Drive. The portion of this target area within the unincorporated areas of the county is approximately 3.4 square miles in size. The flooding in this area is primarily due to the effects of alluvial fans. The corresponding SFHA for the area is Zones A, AO, and AE. This is a mainly residential area.

A map summarizing data for the *Combined_1* target area is shown as Figure 4.

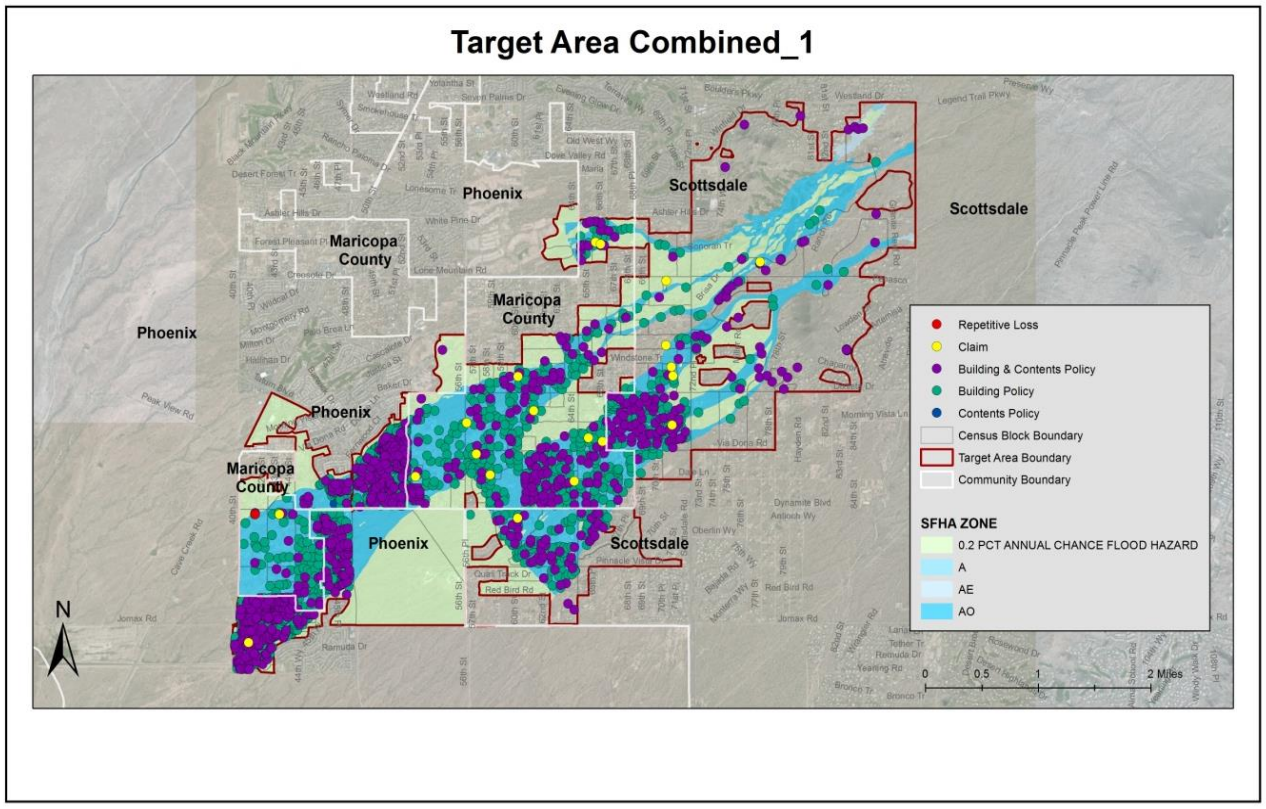

Figure 4: Combined_1 Target Area Including Phoenix, Scottsdale and Maricopa County (Unincorporated Areas)

Flood Insurance Coverage and the SFHA

Within the portion of *Combined_1* within the County, there are approximately 1,212 insurable structures located in this target area, with 791 of those structures located in the SFHA. Of those structures in the SFHA, there are 596 with structural flood insurance coverage and 177 with contents flood insurance coverage, representing a coverage rate of 75% and 22% for structural and contents policies respectively.

Table 8 – Flood Insurance Coverage Summary

			Structural Coverage		Content Coverage	
Target Area	**# of Insurable Structures**	**# of Structures within SFHA**	**# of Policies within SFHA**	**% of Buildings in SFHA with Coverage**	**# of Policies within SFHA**	**% of Buildings in SFHA with Coverage**
Combined_1 (County)	1,212	791	596	75%	177	22%

Table 9 shows the breakdown of policies for Pre- and Post-FIRM structures within the target area as a whole.

Table 9 – Pre-FIRM versus Post-FIRM Policies

		Pre-FIRM		Post-FIRM	
Target Area	**Total # of Policies**	**# of Policies**	**% of Total Policies**	**# of Policies**	**% of Total Policies**
Combined_1 (County)	623	63	10%	560	90%

Claims

As of April 2013, 15 claims were paid for structural damage and 1 claim was paid for contents within the target area. Of those claims, the average value of claims paid was $21,914 and $692 for structural damage and contents respectively. There is 1 repetitive loss property located in the target area.

Potential Losses

The average amount of coverage per policy in the target area within the SFHA is $238,167 and $70,879 for structural and contents coverage respectively.

Table 10 shows the potential loss for buildings located in the SFHA in comparison with flood insurance coverage.

Table 10 – Estimated Potential Losses

Target Area	**# of structures in SFHA**	**# of structural policies in the SFHA**	**Average Coverage in SFHA**	**Total Structural Coverage in the SFHA**	**Average Estimated Potential Losses in SFHA**	**Total Estimated Potential Losses in SFHA**
Combined_1 (County)	791	596	$238,167	$141,947,500	$235,000	$185,812,000

A complete data summary is also provided in Appendix C of this report.

Conclusions and Recommendations

The results of the analysis for Maricopa County Unincorporated County (CID 040037) show that of the 4,842 structures in the SFHA, there are 1,231 with structural flood insurance coverage and 403 with contents flood insurance coverage, representing a coverage rate of 25% and 8% for structural and contents policies respectively.

The failure to carry flood insurance is presumed to be either due to non-compliance with mandatory purchase requirements or owners in the target areas who do not have a federally backed mortgage on their property, and are opting to not purchase flood insurance on their property despite being located in a high risk flood zone. Given the available data, it is not possible to determine which situation applies more broadly.

Flood insurance coverage varied considerably across the target areas examined. The structural coverage rates in target area *MC_2* and *Combined_1* were considerably higher (61-75% percent) than in target area *MC_1* (approximately 43%). A large portion of target area *MC_1* is located in the floodway. The area includes 55 repetitive loss properties. As of April 2013, 119 claims were paid for structural damage and 112 claims were paid for contents within the target area.

While the data to fully evaluate the reasons for the lack of flood insurance coverage was not collected as part of this study, a number of patterns were observed. First, the coverage rate was higher in target areas *MC_2* and *Combined_1* where 90% or more of the buildings are post-FIRM buildings. Second, the coverage rate was greater in target areas with a greater number of buildings located in the SFHA (*Combined_1*). These findings are consistent with the findings of the study completed by the American Institute for Research for FEMA on flood insurance market penetration rates. That study found that the number of single family homes in a community's SFHA has a significant impact on the market penetration in the community. That study revealed a market penetration of 16 percent in communities with 500 or fewer homes in the SFHA, 56 percent in communities with 501 to 5,000 homes in the SFHA, and 66 percent in communities with more than 5,000 homes in the SFHA. The low market penetration rate in communities with relatively few homes in the SFHA is consistent with hypotheses that insurers market flood insurance less aggressively in such communities and that there are fewer agents in these communities familiar with the program writing policies. In addition, the results suggest that the mandatory purchase requirement is less vigorously enforced in communities with few structures in the SFHA. Further, such patterns might be the result of lower awareness of flood risk in communities with a lower percentage of homes in the SFHA (RAND Corporation, 2006).

On a whole, total structural flood insurance coverage in the SFHA was found to A low number of flood insurance policies in a community is not the only challenge communities face. Insufficient flood insurance coverage can leave both property owners and communities vulnerable. While homeowners can cover their structure for up to $250,000 and its contents for $100,000, and business owners can insure their structure and contents for $500,000 each under the NFIP, many under insure. Many people only have coverage equal to the remaining balance of their mortgage, which may not be sufficient to cover the amount of damage that could result from a 1% annual chance flood.

BW-12 could serve as a significant catalyst for change in market penetration. On the one hand, the potential elimination of subsidies and higher flood insurance rates could serve as a disincentive for those owners who do not have a federally backed mortgage on their property, and are opting to not purchase flood insurance on their property despite being located in a high risk flood zone. On the other hand, it could help improve market penetration going forward because BW-12 imposes new higher penalties on lenders who do not enforce mandatory purchase requirements for Federally-backed loans. These penalties increase from $350 to $2,000 under BW-12 which will likely serve as a strong incentive for lenders to ensure compliance.

The County has undertaken several outreach initiatives that have resulted in high flood insurance coverage in a number of areas. Other improvements might also be possible through increased focus on CRS Activities 320 and 330 and a focused campaign to help educate lenders, realtors, and insurers about mandatory purchase requirements and arming them with a suite of local tools that will help them better understand and communicate flood risk and share mitigation best practices. Other promising community engagement strategies that enlist community advocates and heighten risk awareness are outlined in *Developing a Program for Public Information* through FEMA's CRS Resource Center.

Appendix A: Summary of Data Sets and Sources

Target Area Boundary Delineation

Target areas determined for this CRS Activity 370a flood insurance coverage assessment are comprised of multiple census block boundaries. Census block boundaries were chosen as the basis for the target areas to ensure a standardized geographic unit for all of the analysis performed as part of this project. As such, the target area boundaries do not follow SFHA boundaries or specific clusters of claims, but instead follow census block boundaries that include the area chosen for analysis.

The census block boundaries used as the limits of the target areas were chosen by taking into account the location of the following:

- Current SFHA boundaries shown on the FIRM;
- Current flood insurance policy information;
- Historical claims information, including repetitive loss properties;
- The most recent imagery available for Maricopa County.

Datasets

The following datasets are described in greater detail below, with regards to usage for this flood insurance coverage assessment.

- **Maricopa County Tax Assessor/Parcel Data**

This dataset, provided in geospatial format by the Flood Control District of Maricopa County, was used to identify insurable structures within the community. Insurable structures were determined by identifying parcels for which attributes in the tax assessor database (fields 'PropertyUseShortDescription' and 'PropertyUseLongDescription') indicated the presence of a structure.

Structures impacted by the SFHA were determined by identifying structures for which 75% of the parcel was located within the SFHA.

Estimated potential losses for buildings in the SFHA were determined by using the improved full cash value (field name: ImprovementFullCashValue) of insurable structures within the SFHA as the replacement cost.

- **Flood Hazard Data**

The flood hazard boundaries used for this assessment were taken from the FIRM database for Maricopa County dated October 16, 2013.

- **FEMA Insurance Policy and Claims Data**

Flood insurance policy coverage (type of coverage, number of policies, $ amounts), flood insurance claims, repetitive losses, Pre-FIRM/Post-FIRM status, primary/non-primary residence status, number of PRPs were provided by FEMA to the Flood Control District of Maricopa County for use in this

assessment. The data was provided in April 2013. This information was joined to the insurable structure dataset referenced above in order to spatially reference the information.

For communities with repetitive loss properties, the list of those properties provided by FEMA was geocoded for this assessment using the Microsoft Bing geocoder. In some cases, no match was found. The assessment performed reflects only the properties for which a match was found. The property addresses which were not locatable will be provided to FEMA in accordance with CRS Activity 370 requirements to report possible data errors identified during the assessment process.

Appendix B: Maricopa County Community Data Summary

General Statistics	
Total number of insurable structures	192,890
Total number of insurable structures in the SFHA	4,842
Claims	
Total number of claims	303
Total number of paid claims (Structural)	262
Average Claim Paid $ (Structural)	11,198
Total number of paid claims (Contents)	192
Average Claim Paid $ (Contents)	3,013
Total Value of Claims Paid $ (Structural)	2,933,953
Total Value of Claims Paid $ (Contents)	848,801
Total number of Repetitive Loss Properties	63
Policy Information	
Total number of structural flood insurance policies (within the SFHA)	1,231
Average structural coverage per building ($) (within the SFHA)	239,829
Total number of contents flood insurance policies (within the SFHA)	403
Average contents coverage per building ($) (within the SFHA)	73,656
Total number of PRPs	674
Policy-Based Statistics	
Total number of Pre FIRM structures (policy holders only)	352
Total number of Post FIRM structures (policy holders only)	1,666
Total number of primary residences (policy holders only)	1,732
Total number of non-primary residences (policy holders only)	286
Estimated Losses	
Average Estimated Building Losses in SFHA ($)	132,000

Appendix C: Target Area Data Summary

A full summary of statistics relevant to this flood insurance coverage assessment for each target area identified for Maricopa County is provided in the tables below.

MC_1

General Statistics	
Total number of insurable structures	86
Total number of insurable structures in the SFHA	86
SFHA-Based Statistics	
Total number of structural policies in SFHA	37
Average structural coverage per building ($) in SFHA	167,138
Total number of contents policies in SFHA	14
Average contents coverage per building ($) in SFHA	23,607
Claims	
Total number of claims	145
Total number of paid claims (Structural)	119
Average Claim Paid $ (Structural)	10,570
Total number of paid claims (Contents)	112
Average Claim Paid $ (Contents)	1,313
Total Value of Claims Paid $ (Structural)	1,257,833
Total Value of Claims Paid $ (Contents)	147,026
Total number of Repetitive Loss Properties	55
Policy Information (for Entire Target Area)	
Total number of structural flood insurance policies	37
Average structural coverage per building ($)	167,138
Total number of contents flood insurance policies	14
Average contents coverage per building ($)	23,607
Total number of PRPs	0
Policy-Based Statistics	
Total number of Pre FIRM structures (policy holders only)	31
Total number of Post FIRM structures (policy holders only)	2
Total number of primary residences (policy holders only)	30
Total number of non-primary residences (policy holders only)	3
Estimated Losses	
Average Estimated Building Losses in SFHA ($)	62,000

MC_2

General Statistics	
Total number of insurable structures	1,493
Total number of insurable structures in the SFHA	113
SFHA-Based Statistics	
Total number of structural policies in SFHA	69
Average structural coverage per building ($) in SFHA	219,464
Total number of contents policies in SFHA	27
Average contents coverage per building ($) in SFHA	49,711

Claims	
Total number of claims	1
Total number of paid claims (Structural)	1
Average Claim Paid $ (Structural)	19,443
Total number of paid claims (Contents)	0
Average Claim Paid $ (Contents)	0
Total Value of Claims Paid $ (Structural)	19,443
Total Value of Claims Paid $ (Contents)	0
Total number of Repetitive Loss Properties	0
Policy Information (for Entire Target Area)	
Total number of structural flood insurance policies	105
Average structural coverage per building ($)	216,566
Total number of contents flood insurance policies	50
Average contents coverage per building ($)	63,038
Total number of PRPs	17
Policy-Based Statistics	
Total number of Pre FIRM structures (policy holders only)	3
Total number of Post FIRM structures (policy holders only)	100
Total number of primary residences (policy holders only)	94
Total number of non-primary residences (policy holders only)	9
Estimated Losses	
Average Estimated Building Losses in SFHA ($)	158,000

Combined_1 (Maricopa County – Unincorporated Areas)

General Statistics	
Total number of insurable structures	1,212
Total number of insurable structures in the SFHA	791
SFHA-Based Statistics	
Total number of structural policies in SFHA	596
Average structural coverage per building ($) in SFHA	238,167
Total number of contents policies in SFHA	177
Average contents coverage per building ($) in SFHA	70,879
Claims	
Total number of claims	15
Total number of paid claims (Structural)	15
Average Claim Paid (Structural) ($)	21,914.00
Total number of paid claims (Contents)	1
Average Claim Paid (Contents) ($)	692.00
Total Value of Claims Paid $ (Structural)	328,710
Total Value of Claims Paid $ (Contents)	692
Total number of Repetitive Loss Properties	1

Policy Information (for Entire Target Area)	
Total number of structural flood insurance policies	627
Average structural coverage per building ($)	237,900
Total number of contents flood insurance policies	192
Average contents coverage per building ($)	71,900
Total number of PRPs	8
Policy-Based Statistics	
Total number of Pre FIRM structures (policy holders only)	63
Total number of Post FIRM structures (policy holders only)	560
Total number of primary residences (policy holders only)	557
Total number of non-primary residences (policy holders only)	66
Estimated Losses	
Average Estimated Building Losses in SFHA ($)	$235,000

Appendix E

Potential Floodplain Management Plan Activities

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Table E-1: Potential Floodplain Management Plan Activities

	Potential Activity	Merits/Committee Comments	Determination
	Preventative		
a.	Enforce current floodplain regulations	Floodplain regulations are an essential component of uniform, effective floodplain management and flood risk reduction.	Carry forward
b.	Offer technical assistance to municipalities and residents, if requested	Currently, the District is the Floodplain Management Agency for 14 of the 24 municipalities and is a strong technical resource for residents as well as other agencies.	Carry forward
c.	Improve flood risk information by converting approximate (Zone A) floodplain delineations	Selection of watercourses should be based on need and benefit to existing and new development. Efforts should include floodplains downstream of embankments that were recently declared by FEMA as Zone A and on regulatory floodplain remnants whose level of risk has been altered by surrounding development.	Carry forward
d.	Encourage the Maricopa County Planning & Development Department to continue to propose/discuss "good ideas" at pre-application meetings for all proposed development (i.e., mitigation measures and approaches to reduce the risk of flooding)	Discussions help educate applicants on ways to reduce future flood risk.	Carry forward
e.	Create a nontechnical booklet with photos and illustrations of examples of good vs. poor floodplain management practices and a fact sheet with resources on floodproofing for distribution by inspectors and staff	The information will help residents understand the impact of future onsite improvements on drainage and may reduce future flood risk.	Carry forward
f.	Provide annual funding for the Floodprone Properties Assistance Program (FPAP) and floodproofing activities	Participation in the voluntary program may reduce repetitive losses.	Carry forward
g.	Continue preparing and updating Area Drainage Master Studies/Plans (ADMS/Ps) and pursue implementation with local jurisdictions	The ADMS/P projects identify flood and related hazards, quantify risk, and recommend nonstructural and/or structural solutions. The projects provide valuable drainage planning tools on a regional basis.	Carry forward

	Potential Activity	Merits/Committee Comments	Determination
h.	Evaluate and implement improvements to methodologies, where feasible, to better identify flood hazards	Improved technical tools will assist in identifying and quantifying flood risk.	Carry forward
i.	Develop a benchmark of risks to evaluate current conditions and quantify how risk changes over time and the associated demand for services	The information obtained will accommodate future conditions such as new development and climate change and will help decision-makers stay informed as public need changes.	Carry forward
j.	Continue participation in the Community Rating System	Participation in the CRS Program provides residents substantial discounts on flood insurance premiums.	Carry forward
k.	Collaborate with other agencies and master-planned developments to meet floodplain management goals and integrate with other plans (e.g., transportation, planning, land-use zoning)	Coordinated drainage systems improve safety and provide residents with better value.	Carry forward
l.	Develop model guidelines for land use planning and site development within floodplains that protect public safety and preserve the natural functions of floodplains	This is being accomplished in items (d) and (e) above.	Do not carry forward
	Property Protection		
m.	Implement flood warning systems to prevent unsafe crossings of washes and flooded streets	Flood warning on roadways would aid in reducing one of the most common dangers to life and personal property.	Carry forward
n.	Continue inspection and maintenance of District structures	Regular inspection and maintenance is vital to ensuring that the structures will function as designed. Additionally, a failure of poorly-maintained structures may cause or exacerbate downstream flooding at unexpected locations.	Carry forward
	Natural Resource Protection		
o.	Recognize natural resource benefits (use of water and aggregate; outdoor activity) within the ADMS/P program	Recognition of the full benefits of floodplains will provide a greater value to residents.	Carry forward
p.	Support multi-use/multi-benefit approaches to floodplain management	Multi-purpose facilities increase community amenities and provide a greater value to residents.	Carry forward
q.	Incorporate low-flow storm water conservation and explore partnerships for best use of water	Water conservation in the desert is essential to building a resilient community.	Carry forward

	Potential Activity	Merits/Committee Comments	Determination
r.	Identify and accommodate wildlife corridors, habitat, and recreational opportunities as part of the ADMS/P program and during the planning and construction of flood control projects	Support of wildlife habitat is important to the ecological health of the environment and increases community amenities.	Carry forward
s.	Evaluate floodplains and District-owned lands for ground water recharge potential and explore public/private partnerships to support ground water recharge	Water is a vital commodity in the desert and long-term availability must be protected. It was noted that recharge activity must accommodate vector control requirements of the Maricopa County Environmental Health Code.	Carry forward
t.	Promote restoration of natural habitat by replacing invasive species with native species where feasible	Restoration of native plants is important to the ecological health of the environment and increases community amenities.	Carry forward
u.	Planning & Development should encourage multi-use drainage corridors in new developments	This is being accomplished in item (p) above.	Do not carry forward
v.	Develop a habitat mitigation banking program to assist with regulatory compliance related to construction of flood control projects	In some cases habitat mitigation is mandated by federal law. The District currently reviews requirements on a project-by-project basis.	Do not carry forward
w.	Create an exploratory committee that is tasked with investigating tools for preserving floodplains for conveyance and other beneficial uses; and defining the District's role in river management and restoration efforts	The District is currently performing these tasks as part of the ADMS/P project process. Creation of a committee for further augmentation of the ADMS/P process will be considered for these efforts.	Do not carry forward
x.	Develop a sensitive-lands management plan for District-owned floodplain property	Future projects will be taking it into consideration.	Do not carry forward
	Emergency Services		
y.	Prepare a ready-to-use Flood Response Kit for District staff on how to find information and resources and include a post-flood field documentation form	During and after severe flooding in the 2014 monsoon season, District staff field-verified reports of flooding and spoke with many residents. A field kit will assist in providing residents with useful information and aid in documenting flood conditions.	Carry forward

	Potential Activity	Merits/Committee Comments	Determination
z.	Construct a web page with information that can be uploaded during flood events	During and after severe flooding in the 2014 monsoon season, District staff was overwhelmed by calls from residents asking for information. A ready-to-launch web page would provide the public with valuable information on flood-fighting resources so that the staff is more available to evaluate flood threat and respond to reports of flooding.	Carry forward
aa.	Stockpile material at 11 structures for emergency repairs	Due to the large size of the county, it can be difficult and time-consuming to haul material to remote structures. Onsite materials storage will shorten response time considerably in the event that a structure is damaged.	Carry forward
bb.	Continue to update and support Emergency Action Plans for District dams and levees	The District is required by state law to prepare EAPs for its dams. Emergency action planning is crucial to notifying parties downstream of potential discharges. Similarly, levees pose a risk to downstream properties that would benefit from an EAP in the event of a breach or overtopping.	Carry forward
cc.	Continue annual flood emergency drills	Flood emergency drills are important to the success of response during an actual emergency and are required for jurisdictional dams.	Carry forward
dd.	Continue to provide reliable weather data, water level and stream flow data to other jurisdictions and the community	The District's flood warning services provide invaluable information on weather events to other agencies and the public. The data also benefits drainage studies, wildfire response, post-burn flooding, and encourages water conservation through evapotranspiration studies and applications.	Carry forward
ee.	Identify the need for new Flood Response Plans and develop new or update existing plans as needed	The District has developed several FRPs that provide significant benefits to residents and businesses by reducing risk to life and property.	Carry forward
ff.	Perform a county-wide vulnerability assessment that simulates the impacts of a major storm event. Use this tool to update flood response plans, EAPs, and to prioritize future District work	The District is considering a GIS program that will further enhance storm information and response processes. The District is currently performing this task as part of is ADMS/P projects and EAPs for its dam and levee structures.	Do not carry forward

	Potential Activity	Merits/Committee Comments	Determination
	Structural Projects		
gg.	Adjust criteria for Small Projects Assistance Program (SPAP), which provides funding for drainage infrastructure, to allow projects for areas that have a demonstrated flood risk but have not previously experienced structural flooding	Currently, only projects that would protect areas that have experienced structural damage from flooding are eligible for funding assistance. Expansion of the criteria would allow prevention of flood damage rather than mediation.	Carry forward
hh.	Develop a process to act as an advocate for unincorporated areas that lack funding partnerships	Currently, CIP projects that have funding partners receive better scoring than those funded entirely by the District. Advocating for unincorporated areas allows more equitable consideration.	Carry forward
ii.	Explore avenues to expand the CIP budget for infrastructure to meet the demands of identified flood risks	Data collected after the 2014 monsoon season showed a tremendous need for flood control projects. However, the District's funding has been sharply reduced. Additional funding is needed to achieve reductions in flood risk and associated flood damages.	Carry forward
jj.	Partner with sand and gravel operations to implement mutually beneficial activities in the river corridors	Aggregate extraction is a necessary process to support new construction. Conducting mutually beneficial activities presents a win-win scenario that supports the local economy while accomplishing the goal of achieving the full benefits of floodplains.	Carry forward
kk.	Incorporate ongoing Best Management Practices (BMPs) and emerging Low Impact Development (LID) technologies in design projects	BMPs and LID technologies support flood risk reduction and provide additional benefits such as improved water quality and water conservation.	Carry forward
	Public Information		
ll.	Develop a marketing plan to promote sound floodplain management practices and personal responsibility - Include multiple communication venues - Convey a "greater good" message on responsible floodplain management - Convey the message that flood hazards are present, regardless of the FEMA FIRM zone classification	Public education is considered to be an essential element of flood risk reduction. The transient nature of Maricopa County's population dictates that the message of flood risk must be repeated often and across multiple media.	Carry forward

	Potential Activity	Merits/Committee Comments	Determination
	- Include benchmark information of flood risks in education efforts from surveys and public outreach - Recognize the potential economic benefits from reduced flood losses and disruptions to commerce - Visit schools in unincorporated county to discuss flood safety and awareness	Please refer to (ll.) on previous page.	
mm.	Educate the public & officials on floodplain management needs and benefits	The infrequent nature of flooding in the desert fosters an "out-of-sight, out-of-mind" condition in which the memory of past floods is quite short. It is imperative that the benefits and needs be publicized to foster long-term support of sound floodplain management practices.	Carry forward
nn.	Develop multi-hazard educational material on the effects of long and short term changes to the watersheds	It is important to understand the impact of changes to the watersheds over time in order to provide sustainable plans that have relevance both now and in the future.	Carry forward
oo.	Develop a strategy to publicize the benefits of past floodplain management practices, flood control efforts, and the potential economic benefits from reduced flood losses and disruption to commerce	The relatively long time between floods diminishes the perceived need for flood risk reduction. As a result, funding support for drainage needs is typically low and the public may not recognize the value that previous expenditures continue to provide.	Carry forward
pp.	Develop educational material and guidelines for fencing to promote lot-to-lot drainage functions	Single-lot development has no coordinated drainage system among properties, and unpermitted fences can exacerbate interruptions to drainage.	Carry forward
qq.	Visit schools in unincorporated county to discuss how to keep safe during flood events	This is being accomplished in item (ll) above.	N/A
rr.	A significant portion (25% nationally) of flood insurance claims occur outside the regulatory floodplain, i.e., Zone X. A map should be created that shows location and number of claims in Zone X versus within the regulatory floodplain	This is being accomplished in item (ll) above.	N/A