

CAVE CREEK DRAINAGE MASTER PLAN

Alternatives Formulation Report

FINAL

Prepared for:

2/13/08

DATE



Flood Control District of Maricopa County

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1.0 INTRODUCTION

This report documents the process and procedures utilized to select the preferred alternative. The preferred alternative is presented in the final *Cave Creek Drainage Master Plan (DMP)*. Several tasks were completed prior to this task to provide the data to make informed recommendations. These included identifying existing drainage conditions within the Town of Cave Creek (Town) (including a structure inventory and interviews with the public, stakeholders, and agencies), preparing hydrologic and hydraulic analyses for washes within the project area, developing potential alternative solutions based on the drainage problems identified, and the solutions acceptable to the Flood Control District of Maricopa County (District) and the public. Finally, potential solutions were applied to specific locations within the project area. Also applied were general solutions that are relevant throughout the project boundary and to future development.

2.0 DESCRIPTION OF PROJECT AREA

The project boundary encompasses the entire Town plus portions of Maricopa County unincorporated land. The Town is located in portions of Township 5 North, Ranges 3 and 4 East; Township 6 North, Ranges 3 and 4 East; and is east of the Gila and Salt River Meridian within the county of Maricopa. The Town is bounded by Maricopa County unincorporated land, Tonto National Forest, town of Carefree, and the cities of Phoenix and Scottsdale. The study limits are shown in *Figure 1*, on Page 3.

3.0 DATA COLLECTION SUMMARY

Information was obtained from a variety of sources, including (but not limited to) the District, Maricopa County Department of Transportation (MCDOT), Town, FEMA, public comment, and field observations. Data was obtained in the form of as-built plans, GIS data, studies, reports, pictures, and interviews. The tables included in *Appendix A* of the *Data Collection Report* contain a summary of the information obtained.

3.1 Current Conditions

Several major drainage conveyances are located within the Town. Many are mapped as floodplains and/or floodways by FEMA, as shown on the Flood Insurance Rate Maps (FIRM) for the study area. The Town's drainage scheme generally consists of culverts or at-grade crossings as the means of crossing roadways and washes. The project team inventoried all the culverts greater than 24 inches in the study area, both public and private.

3.2 Areas of Potential Flooding and Problem Areas

Areas of potential flooding were determined from published maps, studies, field reconnaissance, and interviews with residents. In general, flooding can be expected in any of the mapped floodplains throughout the Town, with additional areas of localized flooding.

Additionally, significant washes not currently mapped as floodplains were determined. These are contained in the Technical Memorandum dated August 4, 2006 titled *Cave Creek DMP Major Wash Identification* by JE Fuller/Hydrology and Geomorphology, Inc. These drainage pathways are expected to convey water during significant runoff events.

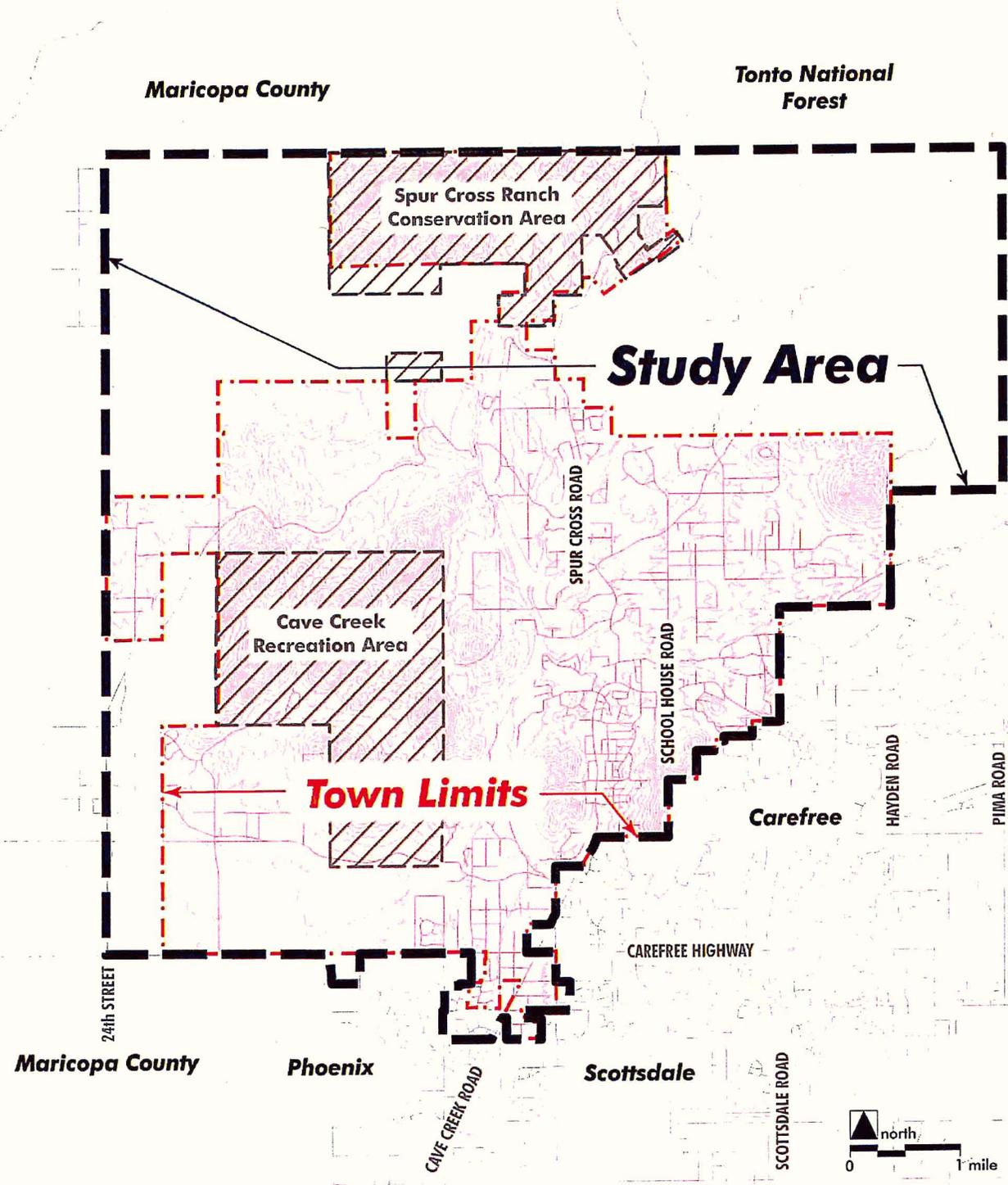


Figure 1: Study area boundary

3.3 Historical Research Results

Research was performed at the local library archives, newspaper databases, District databases, and flood gage records. Additionally, historical aerial photographs were obtained and reviewed.

3.4 Public Comment

Historical information from the public was obtained during an open house held July 26, 2006, and from one-on-one conversations and interviews.

Flooding problems and issues discussed centered on what happens when washes that are normally dry flow to capacity. Some flooding situations were discussed that are outside the scope of the DMP, and generally involve local flooding cause by the indiscriminate actions of adjacent property owners. When washes become flooded due to severe runoff events, the following situations have been observed to occur:

- When normally dry washes are flooded, vehicles can't cross, resulting in one of the following situations;
 - People attempt to cross the flooded wash and get stuck (or worse swept away).
 - People are not able to get home and have to wait for the wash to recede.
 - People have to go out of their way and take a different route home.
 - People can't get out of their homes and are essentially stranded.
- The flooded washes erode laterally, causing movement and degradation of the banks of the wash, which endanger structures placed adjacent to the bank.
- Homes or outbuildings that have been built in wash or low-lying areas perceived to be always dry become flooded, generally because the risk of building in or near a dry wash was not recognized by the builder.
- Flood water exceeds the capacity of the wash. Overtopping of the banks occurs and excess floodwaters sheet across the adjacent areas, causing water damage to homes and personal property.

A complete range of potential solutions to these described typical flooding situations was evaluated with the public at a meeting, also known as the Alternatives Formulation and Preliminary Analysis meeting, on October 12, 2006. This meeting was conducted as a public workshop, and resulted in the recommendation of preliminary alternatives or combinations of alternatives to be studied later. At the conclusion of the brainstorming portion of the workshop, five presentations were made which represented the working efforts of the five community/agency/consultant teams. A number of the same concepts were expressed by all the teams, including which of the potential alternatives maintained the aesthetics of the Town. Some teams arrived at unique concepts. Additionally, some of the flood management tools presented by the consultant team were not adopted by any of the community teams.

3.5 Planning Elements

The study area is generally developed with large lot single family residences, with the exception of the downtown area which contains commercial and higher-density residential development. Additionally, several parks and preserves are located within the study area: Black Mountain Summit Recreation Area, Cave Creek Recreation Area, and Spur Cross Ranch Conservation Area.

4.0 LAND

4.1 Parcel Ownership

Parcel ownership within the study area is generally by either private landowners, part of a park or conservation area, or State of Arizona Trust Lands. For detailed maps on land ownership for the project area refer to *Appendix D* of the *Hydrology Report*.

5.0 MAJOR UTILITIES AND UTILITIES CONFLICTS

In general, utilities present within the right-of-way may include water, sewer, gas, fiber optic, storm drain, telephone, and cable. Water service in the Town is provided by Global Water Company with occasional well sites and storage tanks within the town.

6.0 POTENTIAL ALTERNATIVES

The following issues summarize the most prevalent flooding concerns noted by residents and the Town, and are fully covered in the *Potential Alternatives Report*:

- Erosion
- Access
- Wash obstructions
- Floodway encroachments
- Sedimentation
- Damaged storm drains

6.1 Solutions

Possible solutions to the various flooding problems identified were discussed and evaluated. While certain preferences were expressed by various individuals as to the appropriateness of the solutions to specific locations, it was agreed that the identified possible solutions can be categorized as follows:

6.1.1 Constructed

- All-weather crossings
- Culverts
- Low water crossings (with grade control)

-
- o Bank protection
 - o Channelization
 - o Basins

6.1.2 Non-constructed

- o Early flood warning
- o Education
- o Conservation easements
- o Erosion hazard setbacks
- o Floodplain delineations
- o Flood prone Properties Acquisition Program

Any numbers of combinations of these various solutions were used to assemble comprehensive alternatives that address the flooding concerns of the Town and are acceptable from an aesthetic point of view to maintain the character, rural feel and western characteristics.

6.2 Proposed Recommendations

Rather than one or more distinct alternatives, this project focused on possible solutions for specific locations throughout the study area identified as having existing flooding, erosion, or other related problems. The types of recommendations include:

- o All-weather crossings on School House Road
- o All-weather crossings on Spur Cross Road
- o Improved culverts on Cave Creek Road
- o Remove walls and other man made obstructions from washes
- o Monitor/educate homeowners whose houses or other occupied accessory buildings are within a mapped erosion hazard setback
- o Inform homeowners that live in a floodplain that if they have experienced repeated flooding of their homes they have the option to relocate, through the Districts Floodprone Properties Acquisition Program (FPAP)
- o Educate the general public on driving during storm events
- o Enforcement of federal, state, and local laws
- o Floodplain Delineations

A priority rating was assigned to each alignment of all-weather crossings as a result of the Alternatives Formulation and Preliminary Analysis meeting. This rating establishes the order of proposed construction for the all-weather crossings in the Town of Cave Creek. Each alignment was evaluated based on the potential for future land use development, traffic projections, planned traffic intersection improvements, quantity of existing residential home sites and alignment connectivity for alternative access.

6.2.1 All-weather Crossings

All-weather crossings could be low profile, with rustic detailing and stone or dark colored concrete supports and would pass a 100-year storm event without overtopping the road.

Crossings could provide for trail and equestrian access over or around the feature rather than through.

6.2.2 Improved Culverts

Culverts could be reconstructed to accommodate the existing flows. They could be designed in conjunction with upstream facilities to minimize the sediment that now currently continues to fill the pipes. Like the all-weather crossings, the culverts headwalls could be designed with stone, dark colored or stained concrete and rustic detailing.

6.2.3 Remove Obstructions From Washes

There are currently several locations where obstructions have been placed in or across washes on private property. These obstructions may cause possible flooding on adjacent properties.

6.2.4 Erosion Hazard Setbacks

Based on the erosion hazard setback zones that were mapped by JE Fuller, there are homeowners whose residences are located within the erosion hazard zone. The proposal is to inform them of the risks and provide information on how to monitor the condition of the wash banks on their property. In the future, occupied buildings would not be permitted and built within the setback lines, unless erosion protection measures are constructed.

6.2.5 Floodprone Properties Acquisition Program (FPAP)

Based on the proposed floodplains mapped by HDR and the effective floodplains prepared by others, there are homeowners that have homes within the delineated floodplains that could be subject to flooding. The proposal is to inform these homeowners about the FPAP program and inform them that they have the option to be voluntarily relocated.

6.2.6 Education

Develop an education program for the public that informs them of the possible dangers that can occur during storm events and ways in which they can protect their homes and their families.

6.2.7 Enforcement

Establish a program for agencies to enforce the existing and proposed development regulations.

7.0 ALTERNATIVE EVALUATION

Evaluation of the proposed alternatives was based on how well each of the alternatives would meet the goals of the DMP. Several criteria were proposed to use to evaluate the alternatives. The rating system is termed a "consumer reports" style of ranking, where symbols are used to relay positive and negative values rather than a number score. Due to the unique nature of the proposed alternatives, this system was desired to indicate relative differences, as alternatives range from constructed solutions to information dissemination.

7.1 Ranking Criteria

Ranking criteria were developed in a collaborative fashion with members of the project team. The purpose of the criteria was to evaluate the bearing each solution might have on the problem in relation to the other proposed solutions. The following criteria were used:

- Safety
- Number of people impacted
- Environmental impact
- Relative cost
- Multi-use capabilities
- Degree of improvement
- Context-sensitive aesthetics
- Public acceptance
- Agency acceptance

Five different symbols were available for each criterion. The symbols generally used the color red fill to indicate a positive impact, no fill for a neutral or non-impact, and black fill to indicate a negative impact. The index to each symbol and value follows.

CAVE CREEK DMP ALTERNATIVES EVALUATION
INDEX TO SYMBOLS

<p>Safety</p> <ul style="list-style-type: none">  Greatly Improves Safety  Slightly Improves Safety  Neutral/Not Applicable/No Impact  Slightly Worsens Safety  Greatly Worsens Safety 	<p>Cost (Relative)</p> <ul style="list-style-type: none">  Relatively inexpensive  Slightly inexpensive  Neutral/Not Applicable/No Impact  Slightly expensive  Very Expensive 	<p>Context Sensitive Aesthetics</p> <ul style="list-style-type: none">  Very Context Sensitive, fits in perfectly  Context sensitive  Neutral/Not Applicable/No Impact  Slightly context sensitive  Out of context, looks bad
<p># People Impacted</p> <ul style="list-style-type: none">  Helps Many People  Helps Some People  Neutral/Not Applicable/No Impact  Helps Individual/one property only  Negatively impacts people 	<p>Multi-Use Capabilities</p> <ul style="list-style-type: none">  Great opportunity for multi-use  Opportunity, doesn't hinder multi-use  Neutral/Not Applicable/No Impact  May hinder multi-use  Prohibits Multi-Use 	<p>Public Acceptance</p> <ul style="list-style-type: none">  Public will love it  Public will like it  Neutral/Not Applicable/No Impact  Public will tolerate it  Public will hate it
<p>Environmental Impact</p> <ul style="list-style-type: none">  Improves Environment  Slightly Improves Environment  Neutral/Not Applicable/No Impact  Slightly Worsens Impact  Negative impact to environment 	<p>Degree of Improvement</p> <ul style="list-style-type: none">  Greatly improves issue  Improves issue  Neutral/Not Applicable/No Impact  Slight improvement  Doesn't improve at all 	<p>Agency Acceptance</p> <ul style="list-style-type: none">  Agency will love it  Acceptable to Agency  Neutral/Not Applicable/No Impact  Barely acceptable  Agency will hate it

Members of the project team created an initial ranking and concept for the potential solutions to each problem. A spreadsheet was created to summarize the effort, which includes each identified issue, possible solutions, evaluation criteria, proposed solution (both initial and team recommendations), and the party responsible for initiating the solution. *Appendix A* contains the complete spreadsheet documentation of the effort.

7.2 Alternative Development Workshop

Once the initial spreadsheet was created, a 4-hour team workshop was held on June 12, 2007. The workshop was attended by members of the District, Town, and the consultant team. The purpose of the workshop was to discuss each identified problem and potential solution in order to gain consensus from the team on the proposed solution. The team's comments were recorded in the spreadsheet in the "team suggestion" column, which is included in Appendix A. Due to the unique nature of the Town, solutions ranged from constructed improvements to education programs.

During examination of access routes, it was determined that approximately the same access to the north could be gained by either improving major wash crossings on School House Road or Spur Cross Road, or a combination of the two. School House Road to the south of Ocotillo Wash was identified as the main access road to properties to the north, as Spur Cross Road traverses through residential neighborhoods, with a narrower right-of-way and many jogs and curves. Additionally, access to School House Road from Cave Creek Road is from a four-way stop intersection, unlike Spur Cross Road which is uncontrolled. Therefore, the members of the workshop recommended a combination of improvements on both roads as the first priority, with improvements to both roads recommended over time. This results in all-weather access improvements as a first priority on School House Road to the south of Ocotillo Wash and on Spur Cross Road to the north of Ocotillo Wash, with connection between the two roads via Fleming Springs Road.

The following solutions were presented at the conclusion of the workshop for further evaluation by the consultant team. The *Drainage Master Plan* document outlines the specific elements of each recommended solution.

ALTERNATIVE DEVELOPMENT WORKSHOP RESULTS PROPOSED SOLUTIONS

- All-weather crossings at strategic locations to provide access for the majority of the Town during runoff events
- Removal of walls and obstructions
- Recommendation for enforcement at specific areas (walls, fill, etc.)
- Realign 24th Street (a carry over project from the *Adobe Dam/Desert Hills DMP*)
- Identify possible properties eligible for Flood Prone Properties Acquisition Program
- Floodplain Mapping
- Flood Response Plan
- Erosion Hazard Setbacks
- Erosion Monitoring Program (ID specific lots for monitoring)

-
- Drainage Guidelines
 - Education Program
 - Flood Warning signs, gauges for at-grade crossings – recommendation for typical warning at crossings

8.0 REFERENCES/FIGURES

Adobe Dam/Desert Hills ADMP, FCD #2002C001, FCDMC, various dates from 2003 through 2005.

Carefree Drainage Master Plan, FCD #2004C025, FCDMC, 2003

Carefree Drainage Master Plan Update, FCD #2004C025 Work Assignment #2, FCDMC, August 2005.

Cave Creek Above Carefree Highway Floodplain Delineation Study, FCDMC 95-28, July 1997.

Cave Creek/Carefree Flood Delineation Study, FCD #88-53, March 1990.

Flood Control District of Maricopa County, "Drainage Design Manual for Maricopa County, Arizona," Volume I, Hydrology, January 1, 1995.

Flood Control District of Maricopa County, "Drainage Design Manual for Maricopa County, Arizona," Volume II, Hydraulics, January 28, 1996.

Floodplain Delineation Study of Andora Hills and Galloway Washes, FCD #99-14, January 2000.

Flood Delineation Study of Cline Creek, FCD #89-15, April 1990.

Flood Delineation Study of Ocotillo Wash, June 2007.

Flood Delineation Study of Cave Creek Wash Tributaries, August 2007.

Flood Delineation Study of Willow Springs Wash Tributaries, August 2007.

Flood Delineation Study of Galloway Wash Tributaries, August 2007.

Maricopa Association of Governments, "Uniform Standard Details for Public Works Construction", 1998 (Includes Revisions through 2001).

North Scottsdale Floodplain Delineation Study, FCD #2003C008, FCDMC, April 2005.

North Scottsdale Floodplain Delineation Study, FCD #2003C008, FCDMC, April 2005.

Rodger Creek Floodplain Delineation Study, FCD #89-15, April 1990.

9.0 APPENDIX A

Alternative Evaluation Matrices

