



POTENTIAL ALTERNATIVE  
SUBMITTAL

VOLUME PA



Entellus



**POTENTIAL ALTERNATIVE  
SUBMITTAL**

**VOLUME PA**

**Contract FCD 99-44**

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## VOLUME DESIGNATION

VOLUME ID	Volume Name	Number
DC	Data Collection	1
HY	Hydrology	2
PA	Potential Alternatives	3
AA	Alternative Analysis (Level II)	4
RA	Recommended Alternatives (Level III)	5
ZA	Zone A Floodplain Delineation	6
DS	Detailed (Section 15)	7
AL	Arrowhead Lakes Hydrology	8
AR	Administrative Report (Correspondence)	9

Note: Volume ID will be used for Section, Plate, Figure, and Table identifiers.

# Glendale/Peoria Area Drainage Master Plan Update

FCD 99-44

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# Glendale/Peoria Area Drainage Master Plan Update

FCD No. 99-44

## POTENTIAL ALTERNATIVE SUBMITTAL

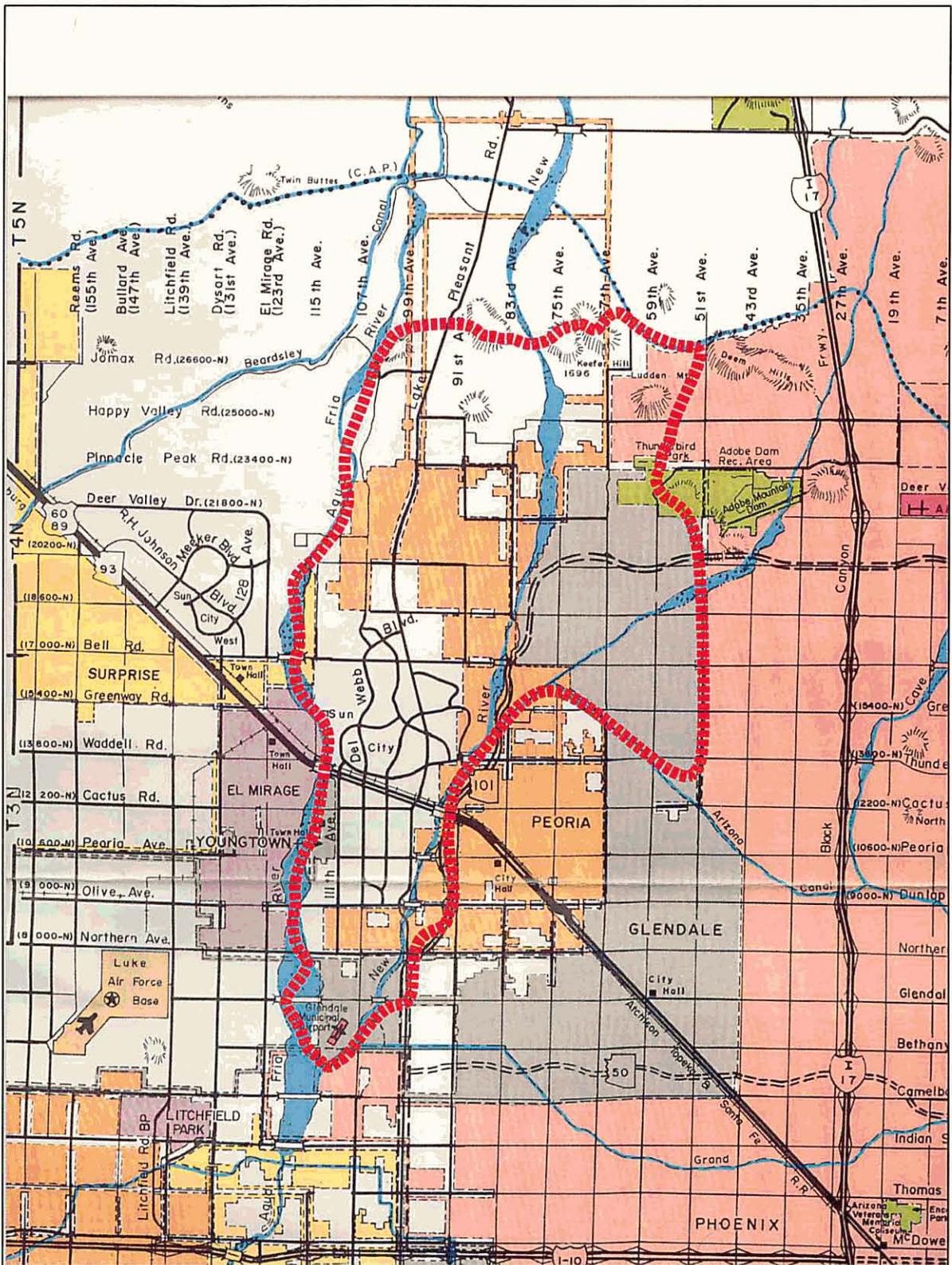
### SECTION PA-1: INTRODUCTION

The information and analysis presented in this potential alternatives submittal is part of the scope of work performed by Entellus, Inc. for the Flood Control District of Maricopa County (District) under FCD Contract Number 99-44. The purpose of this report is to present and summarize the results of the Level I analysis task for this project. In addition, it documents the decision process used to arrive at the recommended potential alternatives to be taken to the Level II analysis of this stage project.

The project under this contract consists of an Area Drainage Master Plan (ADMP) update for the Glendale/Peoria area. This area includes portions of the cities of Glendale, Peoria, Youngtown, Phoenix and unincorporated portions of Maricopa County. The study area is located between 51<sup>st</sup> Avenue and the Agua Fria River and between Dynamite Boulevard and Bethany Home Road in northern Maricopa County as shown in **Figure PA-1**.

The purpose of this overall study is to update a portion of the existing *Glendale/Peoria ADMP* study completed in May 1987 by quantifying the extent of flooding problems and developing alternative solutions. The major objectives of the study are to qualify selected drainage problems and to develop a plan to control runoff and prevent flood damage.

The Level I analysis leading to the development of this potential alternative submittal included a three-step process. This process included (1) alternatives formulation, (2) brainstorming and screening of alternatives, and (3) development of regional alternative solutions. A detailed description of these three steps leading to the development of Potential Alternatives Solutions is included in Sections 2, 3, and 4 respectively.



**LEGEND**

■■■■■■■■■■ - PROJECT AREA BOUNDARY



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GLENDALE/PEORIA ADMP UPDATE  
 FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  
 FCD PROJECT NO. 99-44

VICINITY MAP  
 FIGURE PA-1

AN ASSOCIATION OF THE  
**PENTACORE**  
**ARIZONA**  
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## SECTION PA-2: ALTERNATIVE FORMULATION

The alternatives formulation included an initial stage of research, which identified focus areas where historic drainage problems have been identified by the District or client agencies. The historic drainage problem “focus areas” were combined with data collected on existing facilities and environmental, social and cultural resources in the study area. In addition, the alternatives formulation included the development of a hydrologic model, identification of screening parameters and identification of initial “seed” alternative solutions for each focus area.

### 2.1 Focus Areas

As part of the original scope development for this ADMP update, ten historic drainage problem or “focus areas” were identified. These areas are shown on **Figure PA-2**. As part of the study process, the focus areas were investigated in the field and the scope of the problem was verified through discussions with the participating agencies, the public, and staff from the District. An eleventh focus area was identified during the data collection process in the area of 87<sup>th</sup> Avenue and Williams, which is approximately one-half mile north of Deer Valley Road.

### 2.2 Existing Conditions

#### 2.2.1 General Conditions

The Area is traversed or bounded by several major natural channels mainly: the Agua Fria River, the New River and Skunk Creek. Additionally, several man-made flow control structures and channels are encountered in the Area including the New River Dam, the ACDC, the West Brook Village detention basins and several other channels and detentions basins.

The study area consists of several regions in different stages of development. North of Pinnacle Peak Road, the area is mainly underdeveloped and

# LEGEND

Focus Area



Study Area Boundary

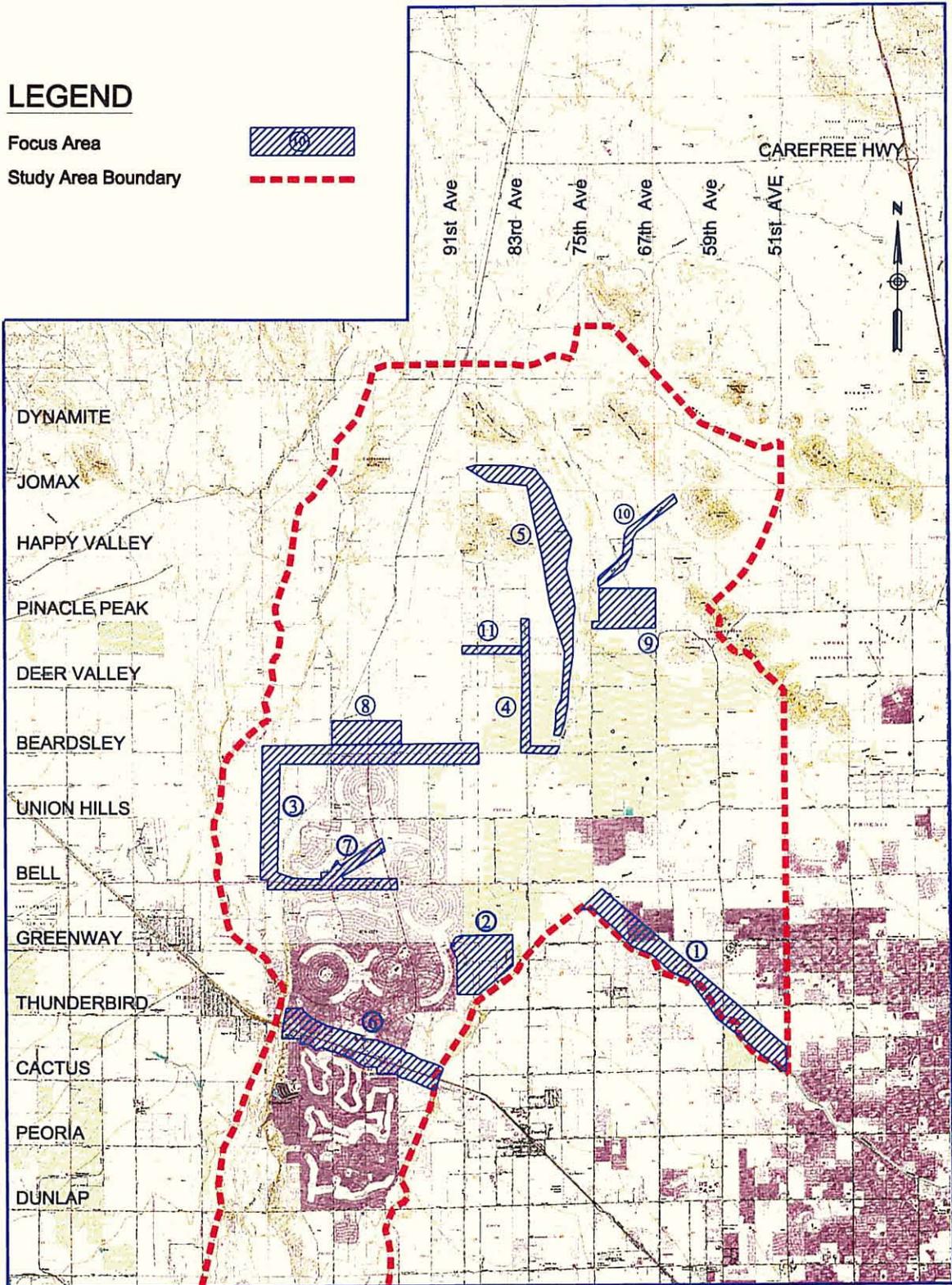


FIGURE PA-2 FOCUS AREA MAP



characterized by steep hills draining into flat valleys. This area contains several washes that have not been significantly affected by development. However, several developments are currently under construction or in the planning stage. Most likely, the entire area will be completely developed within the next ten years.

Between Pinnacle Peak and Beardsley Road the area is heavily developed and all the natural drainage paths have been significantly altered. The drainage systems in this area are mostly man-made and have been constructed by individual developers. However, there are non-continuous channel and inconsistencies in the systems. Between Beardsley Road and Northern Avenue the area is almost fully developed and included in the Master Planned communities of Sun City, Youngtown and portions of Glendale and Peoria. For the most part, the drainage infrastructure for this area is already in place. However, the increasing development upstream may increase runoff to the area and overwhelm the systems.

South of Northern Avenue the area is mostly industrial or underdeveloped. This area is located between the Agua Fria River and the New River and the entire area is a mile or less from a river outfall and flooding problems are rare.

### 2.2.2 Existing Facilities

As part of the alternatives evaluation, a tremendous amount of data was collected in order to identify and characterize the existing drainage facilities in the project study area. These facilities, identified primarily from previous drainage reports and studies, were documented and entered into the project database, and used to develop an existing facilities exhibit. The reader of this report is referred to the Data Collection Report, which includes the project database and Existing facilities exhibit.

### 2.2.3 Environmental Issues

All the environmental factors addressed as part of the environmental overview were carefully considered during the Level I analysis. A complete and detailed environmental overview was prepared including a review of the natural, physical and cultural environment, land use and transportation environment, visual resources, planning influences and multi-use opportunities.

A review of the existing land use shows several significant factors that were considered in the development and formulation of alternatives. The study area predominately north of Pinnacle Peak Road is relatively vacant and undeveloped where as south of Pinnacle Peak Road the vast majority of the study area has been developed into residential and commercial development. There is also a significant amount of park and open space located in the eastern portion of the study area and within the Master Planned communities of Sun City and Youngtown. These urbanized areas tend to be less conducive to having the development of natural multi-use channels as part of the drainage solution.

The transportation, land use, and links and nodes exhibit prepared as part of the environmental analysis showed many potential planned multi-use pathways as well as proposed freeways or major arterials. Some of the more significant multi-use trails and pathways include: Pinnacle Peak Road from 67<sup>th</sup> Avenue to Agua Fria, the Loop 303 alignment along Happy Valley Road, Deer Valley Road improvements, and Lake Pleasant Road (See **Plate PA-1**).

The visual conditions analysis (shown on **Plate PA-2**) found similar results to the review of existing development. The visual analysis identified the area north of Deer Valley Road as having a high to moderate level of intactness. Intactness was defined as the area having a visual character that was consistent with an intact or natural and undeveloped appearance. These findings, coupled with the undeveloped nature of the portions of the project

north of Deer Valley Road, indicate that drainage solution elements constructed north of Deer Valley Road have a high potential of being natural drainage solutions with multi-use or recreational opportunity. This was further emphasized by the determination that the existing landscape character in the northern portions of the project was identified as desert scrub.

One area of additional consideration was the identification of several cultural resources north of Beardsley Road and along the Agua Fria and New River alignments. Some of these cultural resources are shown on **Plate PA-3**. Avoiding these resources was considered when developing alternatives.

## **2.3 Hydrologic Analysis**

A detailed hydrologic model was prepared as part of the study, which was initially started using the Kaminski Hubbard model prepared in 1987 as part of the original part of the ADMP. Reference was also made to the hydrologic model prepared for the Sun City area by Flood Control District. Both these models were completely redone and updated to the Flood Control District's latest design and analysis criteria as part of this study. A complete and detailed report for the hydrology prepared as part of this study is being completed at the time of the preparation of this report.

### **2.3.1 Study Area Hydrologic Boundaries**

As part of the development of the new hydrologic model for this project study area, a detailed review of as-built information, field data, mapping, and field investigation was made in order to determine new sub-regional watershed limits. It was important to determine these sub-regional watershed limits to establish the hydrologic connectivity of individual alternative solutions. By determining these watershed boundaries, the study team was able to ascertain if an upstream alternative solution may have a beneficial affect on drainage problems that were occurring downstream.

**Plate PA-4** shows the hydrologic boundaries determined as part of this study. These ten regional watershed boundaries would naturally be independent of each other unless channels or conduits were constructed that would divert flows from one watershed to another. There are four natural north to south drainage paths coming through the project area including, the Agua Fria River on the west, New River in the center, Skunk Creek to the east in the southeast portion of the watershed is the ACDC. The fact that there are ten individual watershed boundaries that have four north to south natural drainage ways or outlets, gives support to the concept that individual solutions for each of the focus areas may in fact work as an overall drainage solution for the project study area

### 2.3.2 Summary of Key Flows

A specific list of preliminary peak flows at key locations was developed to facilitate the evaluation of drainage problems in focus areas. **Table PA-1** below shows a summary of key flows for the rainfall runoff from the one hundred year 6-hour storm event.

TABLE PA-1

GLENDALE/PEORIA ADMP UPDATE

Channel Capacity Data for the 100-Year 6-Hour Storm

Routing ID	Hec-1 Peak Flow (old)	Hec-1 Peak Flow (NEW)	Drainage Report capacity	Calculated Capacity	Recalculated Capacity	Drainage
	[cfs]	[cfs]	[cfs]	[cfs]	[cfs]	
RS10F	389	376		572		Channel along Grand west of 99 <sup>th</sup>
RS10C	4654	2991		1132	2911.3	Channel along Grand East of 99 <sup>th</sup>
RS10G	3041	2647		587	2701.3	Channel along 99 <sup>th</sup> between Bell and Grand
RS30D	416	173		415		Channel along 99 <sup>th</sup> North of Del Webb
RS30BW	567	556		555		Channel along Dell Webb West of 99 <sup>th</sup>
RN11	1185	975		693	1461.6	Channel along 91 <sup>st</sup> to Greenway
CN09*	1400	413		632	884.2	Channel along Greenway East of 91 <sup>st</sup>
RA09C	1152	808		418	1118.3	Channel along Beardsley West of 99 <sup>th</sup>
RN21DS	977	1138	972	1000		Channel along 83 <sup>rd</sup> South of Deer Valley
RN21E	1006	1148	973	1000		Channel along 83 <sup>rd</sup> North of Beardsley
RN21I	277	945	520	684	735.7	Along 83 <sup>rd</sup> South of Pinnacle Peak
				728		Along 83 <sup>rd</sup> South of Pinnacle Peak
						Terramar Subdivision

## 2.4 Screening Parameters

As part of the preparation of the brainstorming meeting the design team prepared a list of criteria to be used when considering the screening of the potential alternatives. The following criteria were developed:

### Traditional Criteria

1. Implementation Cost – Construction Cost, Right-of-Way Cost
2. O & M cost – Initial and long term efforts and maintenance costs willing to be accepted by an organization capable of providing the maintenance needed
3. Safety – Safety in design elements. Need for Flood warning system
4. Impact on traffic during and after construction
5. Politically consistent with ordinances and promises
6. Sound Design – Design is based on tested and economical engineering practices

### Sustainability Criteria

7. Aesthetics – Will the improvements blend in and even enhance the visual character of the area?
8. Environmental considerations – Visual, biological, cultural, ecological
9. Multi-Use opportunity – Is this going to be a useable amenity?
10. Neighborhood Acceptance – Does the neighborhood want this solution?
11. Others -

### SECTION PA-3: BRAINSTORMING AND SCREENING OF ALTERNATIVES

A brainstorming session was held with representatives from the District, the client organizations, and the design team. The following attendees were present:

Dan Sherwood	City of Glendale	Burton Charron	City of Peoria
Scott Friend	City of Peoria	Marilyn DeRosa	FCDMC
Geza Kmetty	FCDMC	Dennis Holcombe	FCDMC
Theresa Hoff	FCDMC	Amir Motamedi	FCDMC
Mike Bonar	Entellus	Sam Kao	Entellus
Hernan Aristizabal	Entellus	Patrick Wolf	Entellus
Scott Ogden	Pentacore	Keith Kesti	Pentacore
Wayne Colebank	Logan Simpson Design	Laurie Miller	LTM
Ashley Kowallis	Logan Simpson Design		

The brainstorming meeting process included a presentation on the results of the hydrological model, a detailed review of the results of the environmental overview, and the presentation of potential solutions or “seed” solutions for each focus area, and the development of new alternative solutions. A copy of the draft agenda for the brainstorming meeting, including the initial screen parameters, is included as **APPENDIX B**. The brainstorming process included an open discussion for each focus area where attendees could present the advantages or disadvantages of each alternative. More appropriately, all attendees voted and ranked each alternative in order of preference. Based upon the ranking, and subsequent discussion for ratification, the brainstorming group concurred on the alternatives to be carried forward to the Level II analysis. A detailed summary of the process used for selection of alternatives to be carried forward to the Level II analysis for each focus area follows.

#### 3.1 Area 1- North side of the Arizona Canal Diversion Channel (ACDC)

This problem area was split into five different areas (See **Plate PA-5**). Each area has its own unique set of alternative solutions.

3.1.1 Area 1-1 - 59<sup>th</sup> Avenue and ACDC

The problem in Area 1-1 (See **Plate PA-5**) is that runoff exceeding the 10-year event is beyond the capacity of the trunk line storm drain systems. Excessive ponding occurs at the sag at 59<sup>th</sup> Avenue approximately 500 feet north of the ACDC. Runoff flows overland through a nursery on the west side of the street. This area is highly developed, and the solution to this problem will have to be linear or nonstructural. The existing utilities in the area could be in conflict with any storm sewer design. The goal of the selected alternative is to alleviate the flooding impact to the nursery and to ACDC recreational facilities that lie in the path of the overland flow.

<b>Alternative AS1 (PA1-1):</b> Up size the storm drain in this area to handle additional flows.	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Invisible/Out-of-site solution.</li> </ul>	<ul style="list-style-type: none"> <li>• Utility conflicts.</li> <li>• High Cost.</li> </ul>

<b>Alternative AS2 (PA1-1):</b> Buy the nursery property and make it into a parking lot for Thunderbird Paseo Park.	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• A possible 100-year solution.</li> <li>• Offers a kinder/gentler opportunity.</li> </ul>	<ul style="list-style-type: none"> <li>• High Cost.</li> <li>• Still have to build the facility.</li> <li>• Require additional modifications to the adjacent facilities.</li> </ul>

<b>Alternative AS3 (PA1-1):</b> Buy a drainage easement thru the nursery and construct a drainage path.	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Lower cost than AS2.</li> </ul>	<ul style="list-style-type: none"> <li>• Less control on flow capacity.</li> <li>• Build facility to handle flooding - additional cost.</li> <li>• Require additional modifications to the adjacent facilities.</li> </ul>

**Alternative AS4 (PA1-1):** Re-grade Eugie Avenue to carry flow south thru an easement in the parking lot.

**ADVANTAGES**

- Does not affect adjacent facilities.

**DISADVANTAGES**

- High Cost.
- Property acquisition.
- Right-of-Way acquisition.
- Road closures during construction.

**Results of Ranking - Area 1-1**

	AS1	AS2	AS3	AS4
First		3	5	2
Second		6	4	
Third	4			6
Fourth	6	1	1	2

It was decided by the brainstorming group to bring Alternatives AS2, AS3, and AS4 to the Level II analysis for Problem Area 1-1.

3.1.2 Area 1-2 – 61<sup>st</sup> Avenue and Hearn Road

The problem in Area 1-2 is that two small catch basins and a small diameter pipe drain the area. Ponding is anticipated for most events and excessive ponding could result from larger magnitude flows. Flows exceeding the capacity of the sump will spill overland back to Hearn Road and then ACDC. The area is fully developed with no solution except linear or nonstructural. There could be utility conflicts in the area. The goal of the selected alternative is to alleviate potential flooding impact to the homes adjacent to the sump.

<b>Alternative AS1(PA1-2): Upsize the catch basin and storm drain to handle flows.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Low cost.</li> <li>• Less entities to deal with.</li> </ul>	<ul style="list-style-type: none"> <li>• Low benefit/cost ratio.</li> </ul>

<b>Alternative AS2 (PA1-2): Buy the property downstream and provide an overland outfall to ACDC.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• A possible 100-year solution.</li> </ul>	<ul style="list-style-type: none"> <li>• High Cost.</li> </ul>

<b>Alternative AS3 (PA1-2): Purchase a 20-foot easement between homes to provide an overland outfall to the ACDC.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Ease of maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>• High cost.</li> <li>• Zoning problems.</li> <li>• Difficult to implement.</li> </ul>

<b>Alternative AS4 (PA 1-2): Re-grade street to remove sump and take flow north and back into ACDC.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Moderate cost.</li> <li>• Will solve 10 &amp; 100-year rainfall events.</li> </ul>	<ul style="list-style-type: none"> <li>• May impact utilities.</li> <li>• Driveway access becomes steeper.</li> </ul>

Results of Ranking - Area 1-2				
	AS1	AS2	AS3	AS4
First	1		4	5
Second	4	1	2	2
Third	2	1	3	2
Fourth	1		6	1

It was decided by the brainstorming group to bring Alternatives AS3 and AS 4 to the Level II analysis.

### 3.1.3 Area 1-3 – 63<sup>rd</sup> Avenue and Coral Gables Drive

The problem with Area 1-3 is that flows exceeding the 10-year event exceed the capacity of the storm drain system and excessive ponding occurs at the sag located at 63<sup>rd</sup> Avenue and Coral Gables Drive. The excess flow spills southeasterly within 63<sup>rd</sup> Avenue, or southwesterly through the recreational fields of Pioneer Elementary. This area is also highly developed and an alternative solution will be linear or nonstructural. In consideration of Pioneer Elementary, a detention basin, or excessive overland flows would not be desirable if they took away too much play area. The goal of the selected alternative is to alleviate flooding in this area and reduce the ponding.

Alternative 1 is to replace the storm drain with a larger storm drain system that will minimize the flooding. Alternative 2 is to construct an overland flow channel with a collection system that will remove the ponding flow from the street. It was decided by the brainstorming group to combine the two alternatives and to take the new alternative to the Level II analysis.

### 3.1.4 Area 1-4 – Cul-de-Sac at Maui Lane and the ACDC

The problem with Area 1-4 is that the capacity of the scupper and the sag at the cul-de-sac spill over the curb directly to the ACDC. The spillway is being eroded by runoff flowing parallel to it. The area is fully developed with no solutions except linear. The goal of the selected alternative is to minimize the erosion along the spillway.

Alternative 1 is to armor the areas adjacent to the spillway and mitigate the erosion. Alternative 2 is to do the same as Alternative 1, and to increase the size of the scupper. The brainstorming committee decided to take Alternative 2 to the Level II analysis.

3.1.5 Area 1-5 – Greenway and 70<sup>th</sup> Avenue.

The problem with Area 1-5 is that flows are concentrated at the intersection. The existing catch basins are undersized and seem to be filled with sediment. The flow at this location exceeds the capacity of the catch basins and flows overland to the ACDC. There is a large storm drain in the area, but it is apparently insufficient. The area is highly developed leaving little opportunity for solutions except linear and nonstructural. Utility conflicts will be likely with any storm drain design. The City of Glendale is planning on improving 67<sup>th</sup> Avenue from Union Hills Drive to the ACDC, which should reduce the runoff reaching Greenway Road and 70<sup>th</sup> Avenue. The goal of the selected alternative is to alleviate the flooding of the mobile homes adjacent to the sumped area. The City of Glendale is planning to improve Greenway Road from 67<sup>th</sup> Avenue to 71<sup>st</sup> Avenue.

<b>Alternative AS1 (PA 1-5): Depress the existing curb to allow better runoff conveyance to the ACDC.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Low cost.</li> <li>• Easily coordinated with existing design.</li> <li>• Does not restrict Multi-use opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• Potential traffic hazard.</li> <li>• Safety must be incorporated.</li> </ul>

<b>Alternative AS2 (PA 1-5): Remove and replace catch basins and add a parallel pipe for the excess flow.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Provide street drainage.</li> <li>• Reduce maintenance.</li> <li>• Incorporates “other” flows.</li> <li>• Easily incorporated into design.</li> </ul>	<ul style="list-style-type: none"> <li>• Some maintenance required.</li> <li>• Higher cost.</li> <li>• Potential utility conflicts.</li> </ul>

**Alternative AS3 (PA 1-5):** Construct full curb and gutter improvements on 67<sup>th</sup> Ave. to reduce flows.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>Easily incorporated into design.</li> <li>Could utilize frontage road.</li> </ul>	<ul style="list-style-type: none"> <li>Shifts 100-year flows (problems) to other areas.</li> <li>Difficulty to cross Greenway Rd.</li> </ul>

**Alternative AS4 (PA 1-5) -** Perform design analysis on 100-year flows and how they may be handled by the street design projects by incorporating AS1, AS2, and AS3 into AS4.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>Existing Right-of-Way available.</li> <li>Low cost.</li> <li>Increased level of protection.</li> </ul>	<ul style="list-style-type: none"> <li>Will not obtain 100-year protection.</li> <li>High expectation by the public.</li> <li>Will impact new subdivision.</li> </ul>

Results of Ranking - Area 1-5				
	AS1	AS2	AS3	AS4
First	1	1		8
Second	7	1		
Third		5	3	
Fourth		1	5	2

The brainstorming committee decided to take Alternative 4 to the Level II analysis.

### 3.2 Area 2- 91<sup>st</sup> Avenue and Greenway Road Alignment Channel

The problem in Area 2 is that the capacity of the channel along the Greenway Road alignment is less than that of the channel upstream (See **Plate PA-6**). Any upstream solution for focus area 11 could affect this area. It was determined by the committee that the hydrology of the existing HEC-1 model would be compared against the

hydraulic capacity of the system after incorporation of the Desert Amethyst basin into the HEC-1 model. If the capacity of the Greenway Road alignment channel is a problem, two alternatives will be taken to the Level II analysis. The first alternative will be to improve the Greenway Road alignment channel and making it more aesthetically pleasing. The second alternative will be a combination of the first alternative with the addition of detention basins near the 91<sup>st</sup> and Greenway intersection. There was no vote taken on the alternative by the brainstorming committee. It was decided to wait until after the beneficial effects from alternatives in focus Area 11 were determined to see if there was still a need to pursue improvements to the Greenway Channel.

### 3.3 Area 3 – Beardsley Road Channel

The problem in Area 3 (see **Plate PA-7**) is that the Beardsley Road channel does not have enough capacity or needs maintenance and repair in order to carry the contributing flows to or near the Agua Fria River. The entrance into a golf course at 115<sup>th</sup> Avenue constricts the flow, and the excess flow overtops the banks of the channel and flows south down 115<sup>th</sup> Avenue. The treatment facilities west of 111<sup>th</sup> Avenue need to be protected from channel overflows. The channel at Rose Garden Lane makes a ninety-degree turn south onto 111<sup>th</sup> Avenue. The goal of the selected alternative is to carry the flows to the Agua Fria River with no overflow or ponding and to reduce maintenance costs.

<b>Alternative A (PA 3): Channel along Deer Valley Road from Lake Pleasant Road to Agua Fria River.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Good Multi-use opportunities.</li> <li>• Protects the wastewater treatment plants.</li> <li>• May Solve regional flooding problems.</li> <li>• Can be implemented with future planned roadway project.</li> <li>• Addresses citizen's complaints.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not address the maintenance issue on the Beardsley Road channel.</li> <li>• Potential cultural resource impacts.</li> </ul>

**Alternative B & C (PA 3):** Improve channel along north side of Beardsley Road to carry excess flows. Improve outlet into golf course.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>• May allow reduced maintenance of Beardsley Channel.</li> <li>• Directly addresses the citizen's comments.</li> </ul>	<ul style="list-style-type: none"> <li>• Higher flows into Coyote Lakes development.</li> <li>• Will not address the overland flows.</li> <li>• There may be a Right-of-Way constraint.</li> <li>• Less Multi-use opportunity.</li> </ul>

**Alternative D (PA 3):** Combination Detention/Multi-use facility north of Beardsley Road and west of 111<sup>th</sup> Avenue.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>• NPDES compliance.</li> <li>• Multi-use Opportunity.</li> <li>• Buffer to residential neighborhood.</li> </ul>	<ul style="list-style-type: none"> <li>• Minor benefits due to proximity of the Agua Fria River.</li> <li>• Siltation/Maintenance problem.</li> <li>• Does not address public concerns.</li> <li>• Very high cost.</li> </ul>

**Alternative E (PA 3):** Channel along Rose Garden Lane alignment west from Lake Pleasant Road to the Agua Fria River

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>• Protects the wastewater treatment plants.</li> <li>• Addresses the citizens concerns.</li> <li>• Eliminates the need for 111<sup>th</sup> Avenue Channel from Rosewood to Beardsley.</li> <li>• Possible Multi-use opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• Potential cultural resource problem.</li> </ul>

RESULTS OF RANKING - PROBLEM AREA 3				
	A	B+C	D	E
First	7	1		3
Second	2	7		2
Third	2	2	1	4
Fourth			6	

The Alternatives that will be studied in the Level II analysis will be Alternative A, B&C, and E. A smaller channel in Alternative E will also be examined with Alternatives A and B&C. It was decided that the original Alternative C would have to be performed in combination with all the other alternatives.

### **3.4 Area 4 – 83<sup>rd</sup> Avenue to the New River north of Beardsley Road.**

The problem in Area 4 (see **Plate PA-8**) is that development has routed flow along 83<sup>rd</sup> Avenue and created a default regional drainage corridor. The channel created along 83<sup>rd</sup> Avenue was created in pieces and is discontinuous. The design requirements stipulate that the existing channel in conjunction with the roadway carries the 100 year flow. The alternative solution to this problem area is to carry flow to the New River without excessive flooding and to maintain accessibility to 83<sup>rd</sup> Avenue.

A detailed hydraulic analysis will be performed on the 83<sup>rd</sup> Avenue channel. If the existing 83<sup>rd</sup> Avenue channel is undersized, three alternatives will be taken to the Level II analysis. The first alternative would be to increase the size of the 83<sup>rd</sup> Avenue channel and culverts. The second alternative is a detention basin located one mile north of Pinnacle Peak Road and 83<sup>rd</sup> Avenue, or a detention basin located at Deer Valley Road and 83<sup>rd</sup> Avenue. The third alternative is to straighten the bends in the channel.

### **3.5 Area 5 – Rock Springs Creek**

The problem in Area 5 (see **Plate PA-9**) is that water runs down Rock Springs Creek and floods homes that are near or encroaching into the creek floodplain. Rock Springs Creek has been impinged and ends at a Sand and Gravel Pit north of its original outfall into New River. A consideration of the alternatives is that the homes were built in the creek floodplain limits. Another consideration is that the water surface at New River would have to be checked against the water surface of any outfall channel. Stantec is currently delineating AE zones along Rock Springs Creek. The goal of the

selected alternative is to prevent flooding and damage to existing structures from Rock Springs Creek, and to provide a suitable outlet into New River.

<b>Alternative A (PA 5): A relief channel along Pinnacle Peak Road or Patrick Lane east to the New River.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Provides an outlet to the New River</li> <li>• Diverts flows to the New River.</li> <li>• Low cost</li> <li>• Prevents flows from reaching the borrow pits.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not address issues of residents in upstream floodplain.</li> <li>• Diversion from Rock Springs Creek may have negative Environmental impacts.</li> <li>• Doesn't reduce peak flows.</li> <li>• The cost/benefit ratio is very high.</li> </ul>

<b>Alternative B (PA 5): A relief channel along Happy Valley Road east to the New River.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Provides an outlet to the New River</li> <li>• Diverts flows to the New River.</li> <li>• Protects existing homes in the floodplain.</li> <li>• Prevents flows from reaching the borrow pits.</li> </ul>	<ul style="list-style-type: none"> <li>• Higher Cost than Alternative A.</li> <li>• More negative Environmental impacts than Alternative A.</li> <li>• Problems with Hydrology/Hydraulics.</li> <li>• The cost/benefit ratio is very high.</li> </ul>

<b>Alternative C (PA 5): Improvements to Rock Springs Creek in combination with trail and/or other recreational facilities.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Natural solution.</li> <li>• Greater public acceptance.</li> <li>• Adhere to the District's mandates.</li> <li>• Less Environmental impacts than Alternative A &amp; B.</li> </ul>	<ul style="list-style-type: none"> <li>• Higher Cost than Alternative A &amp; B.</li> <li>• Existing homes may not be protected.</li> </ul>

<b>Alternative D (PA 5): Detention Basin located near Happy Valley Road</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Multi-use opportunities.</li> <li>• Reduces the peak flows.</li> <li>• Reduces the current floodplain.</li> </ul>	<ul style="list-style-type: none"> <li>• High land cost.</li> <li>• The detention basin would still need an outlet to the New River.</li> <li>• Potential visual impacts.</li> <li>• Sedimentation Problems.</li> <li>• State land. (Impossible to acquire)</li> </ul>

**Alternative E (PA 5):** Use the AE zone delineated by Stantec to enforce constructions outside AE limits.

**ADVANTAGES**

- No 404 permits required.
- Low cost.
- Pro-active.

**DISADVANTAGES**

- Does not solve current problem.
- Potential litigation.
- No outlet to New River.
- Long-term implementation.

**RESULTS OF RANKING - PROBLEM AREA 5**

	A	B	C	D	E
First	2		7	1	4
Second	1	1	4	2	5
Third	5	3		4	
Fourth	2	5		3	
Fifth	3	2		2	3

The Alternatives that will be studied in the Level II analysis will be C with A, E, and D. The C with A alternative was combined so that Alternative now becomes Improving Rock Springs Creek with an outlet into the New River at Pinnacle Peak Road or Patrick Lane

**3.6 Area 6 – Channel along north side of Grand Avenue**

The problem in Area 6 (see **Plate PA-10**) is that Grand Avenue is a major drainage-way for a large area of Sun City. It was also determined that any additional channel widening along Bell Road would be difficult due to existing development and Right-of-Way constraints. The analysis will include capacity of not only the channel, but also the entire roadway section in the Right-of-Way.

The preliminary hydrology results indicate that the flows are two to three times the capacity of the channel along Grand Avenue east of 99<sup>th</sup> Avenue. In addition, the channel has steep shotcrete slopes that are in need of repair.

After a discussion by the brainstorming group, it was decided that a detailed hydraulic analysis would be performed on the Grand Avenue channel. After the hydraulic analysis is complete, two alternatives will be taken to the Level II analysis. The first alternative will be an open channel, and the second alternative will be a closed box or conduit. No retention or detention basins will be evaluated.

### **3.7 Area 7 – Drainage along 99<sup>th</sup> Ave and Bell Rd to the Agua Fria River**

The problem in Area 7 is that 99<sup>th</sup> Avenue is a major drainage way for the north area of Sun City. Sun City was designed prior to most of the current retention policies or hydrologic master planning, resulting in a somewhat inconsistent drainage system. This drainage channels system makes numerous transitions and sharp turns, which greatly decrease the conveyance capacity.

After a discussion by the brainstorming group, it was decided that the detailed Hydraulic analysis must be performed on 99<sup>th</sup> Avenue prior to identification of any solutions. There have been no flooding complaints by the residents of Sun City for 99<sup>th</sup> Avenue.

### **3.8 Area 8 – Lakes North of Beardsley Road between 91<sup>st</sup> and 107<sup>th</sup> Avenues.**

The problem in Area 8 (see **Plate PA-7**) is that runoff from inside Ventana Lakes development flows through the Ventana lakes' system into the Beardsley Road Channel. It is unclear how the lakes perform and what kind of storage can be expected given the existing operation procedures. The lakes may contain chemicals, which may be undesirable in the Beardsley Road channel and the Agua Fria River. The lakes on the south side of Beardsley Road have no true outlet.

A stage-storage-discharge analysis of the lakes system will be performed to see how the system performs during rainfall events. Any potential offsite impacts from the lakes discharging the chemicals into the Beardsley Road channel will be studied. If there is a problem with the capacity of the Beardsley Road channel, it will be addressed by the solution for problem area three.

### 3.9 Area 9 – Pinnacle Peak Road and 67<sup>th</sup> Avenue

The problem in Area 9 (see **Plate PA-11**) is that significant offsite flows enter into the existing subdivision at various locations. Ponding depths of one foot or more are expected for large magnitude storms. Any mitigation for this problem area will have to be done north of Pinnacle Peak Road because the area to the south is much more developed. The goal of the selected alternative is to minimize the amount of offsite flows entering the subdivision.

<b>Alternative AS1 (PA 9): A regional channel or storm drain along Pinnacle Peak Road to New River.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Least Impact on land development.</li> <li>• Compatible with present/future land uses.</li> <li>• Advances the trail opportunities for the City of Peoria's Major Trail Plan.</li> <li>• Possible Multi-use opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• Access problems on the north side of Pinnacle Peak.</li> <li>• Additional Right-of-Way size.</li> <li>• Not a natural channel.</li> </ul>

<b>Alternative AS2 (PA 9): An offline detention basin in combination with a smaller channel along Pinnacle Peak Road to reduce the peak flows.</b>	
<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
<ul style="list-style-type: none"> <li>• Park opportunities.</li> <li>• Active recreational opportunities.</li> <li>• Advances the trail opportunities for the City of Peoria's Major Trail Plan.</li> <li>• More partnering opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• Availability of the Phoenix property.</li> <li>• Additional Right-of-Way size.</li> <li>• Not a natural channel.</li> <li>• Higher cost.</li> </ul>

**Alternative AS3 (PA 9):** A natural channel through the property northwest of Pinnacle Peak and 67<sup>th</sup> Avenue in a southwesterly alignment.

**ADVANTAGES**

- Natural appearance.
- Additional connection to Thunderbird Park and Mountain Preserve.
- Same as AS1 and AS2.

**DISADVANTAGES**

- Property acquisition.
- Potential conflict with Thunderbird Park plans.

**Results of Ranking - Area 9**

	AS1	AS2	AS3
First	3	4	7
Second	4	7	2
Third	6	2	4

It was decided by the brainstorming group to bring all three alternatives to the Level II analysis

**3.10 Area 10 – Wier Wash**

The problem in Area 11 is that Wier Wash historically carried run-off to the southwest with an outfall to the New River. Recent development to the area has made the natural wash into a channel and filled-in certain portions of Wier Wash. These areas that have been filled in may not have capacity to convey runoff from rainfall from one hundred rainfall events. Based upon a review of mapping and a detailed field investigation, it was determined that Wier Wash has basically been eliminated and replaced by man-made channels. The original scope of work for this project has requested that Entellus, Inc. identify candidate segments of Weir Wash for Zone-A flood plain delineation. Since Weir Wash has been basically eliminated it was determined that Entellus, Inc., will instead evaluate the capacity of the new channels that have been constructed in the place of Wier Wash, and if the capacity is adequate no further study analysis will be done.

If the capacity of the new channel that has replaced Wier Wash is found to be inadequate for one hundred year rainfall events, then potential alternative solutions include the widening or paralleling of the new shotcrete lined channel or the possibility of constructing a detention basin will be evaluated. Based upon preliminary observations, it appears that the new shotcrete lined channel has adequate capacity to convey the runoff from one hundred year rainfall event.

### **3.11 Area 11 – 87<sup>th</sup> Avenue and Pinnacle Peak Road to Deer Valley Road**

The problem in Area 11 (see **Plate PA-12**) is that water ponds upstream from an old irrigation canal along the Williams Road alignment. During large storm events, water ponds until it is high enough to overflow the low spot and flow down 87<sup>th</sup> and 89<sup>th</sup> Avenues. Storm runoff flows due north south in this area. The flow line of the New River is approximately three to four feet lower than the ground at Deer Valley Road and 87<sup>th</sup> Avenue. However, the Agua Fria River is 80 feet lower at the same location. The goal of the selected alternative would be to eliminate ponding in the 87<sup>th</sup> Avenue and Williams Road area.

Alternative A was a relief channel along Pinnacle Peak Road to the 83<sup>rd</sup> Avenue Channel. Alternative B was a relief channel or conduit along Pinnacle Peak to the Agua Fria River. Alternative C was a relief channel or conduit from Pinnacle Peak Road south to Deer Valley Road. Alternative D was a detention basin near Williams Road and 83<sup>rd</sup> Avenue. Alternative E was a detention basin west of 91<sup>st</sup> Avenue in the State land area. Alternative F was to implement an ordinance to require development to maintain sheet flow. Alternative G was to require the developer of the state land west of 91<sup>st</sup> Avenue to provide a regional detention basin.

After a discussion, it was decided by the group to take Alternatives B, F, D, and E+G to the Level II analysis. Alternative E and G were combined because they are essentially the same concept. The combined alternative (E & G) will be taken to Level II analysis if the alternative is possible. There was no vote taken on the alternatives for this problem area.

## SECTION PA-4: DEVELOPMENT OF REGIONAL ALTERNATIVE SOLUTIONS

Subsequent to the brainstorming session, a coordination meeting was held at Entellus, Inc., as a final verification step in the completion of the Level One analysis. The purpose of this meeting was to insure that the collective benefit from each alternative would solve the drainage problems on a regional basis. A second purpose of this meeting was to insure that the existing constraints and opportunities identified as part of the environmental overview had been incorporated into the potential alternatives and that the environmental influences had been considered on a regional basis. In support of this meeting, overlays of the proposed alternative solutions for each focus area, of the original ADMP planned improvements, and the sub-regional watershed boundaries were prepared and compared with the existing facilities inventory and the exhibits that were a result of the environmental overview. As a result of this meeting, it was evident that the alternatives selected for the Level II analysis would result in a holistic and regional solution. It was also evident that the alternatives did address and appropriately incorporate the findings of both the existing facilities inventory and the environmental overview prepared as part of the data collection phase.

### 4.1 Review of Hydrologic influences

A more detailed breakdown of the sub-regional watersheds was prepared as part of the regional solution verification process. These hydrologic influence areas are shown on **Plate PA-13**. Of the ten different sub-regional watershed identified, only four watersheds can directly benefit the other if a lateral channel or storm drain were constructed. The Agua Fria area and the Sun City area can divert runoff from 91<sup>st</sup> Avenue area west of the Agua Fria. It is also possible that runoff could be diverted from the 91<sup>st</sup> Avenue area to the east and into New River through the Rock Springs Creek area. The other six sub-regional act relatively independently from each other with the exception of the Arrowhead Lakes area and the Skunk Creek area that are connected by drainage crossings at the Loop 202 Freeway. Although no significant drainage problems are known in the Arrowhead Lakes of Skunk Creek area, a study is being prepared to evaluate the flooding safety status in the Arrowhead Lakes chain.

As a result of the potential benefit of diverting flow to either the Agua Fria or New River out from the 91<sup>st</sup> Avenue area, potential drainage alternatives were suggested on Pinnacle Peak Road, Deer Valley Road, Rose Garden Lane and Beardsley Road. As can be seen on **Plate PA-13**, construction of any drainage improvements that would convey flow west to the Agua Fria would reduce runoff to the south. This would also reduce runoff in the 91<sup>st</sup> Avenue area and potentially alleviates flooding in the Greenway Channel in the vicinity of 91<sup>st</sup> Avenue and Greenway Road.

#### **4.2 Review of Environmental Factors**

As an additional verification measure to determine whether the alternative solutions had considered all the regional factors, the proposed alternative solutions were overlaid with the exhibits prepared as part of the environmental overview. The group concluded that the geographic location of the proposed alternative solutions and the type of solutions had addressed both the needs of the communities for identifying a regional drainage solution and had respected the cultural-visual and other environmental resources that are available in the undeveloped portion of this study area. **Plate PA-14** shows the layout of the proposed alternative solutions. Solutions include establishing Zone A floodplains over the existing natural washes in the far north undeveloped region of the study area. Additionally, the alternative proposed for Rock Springs Creek is to refine and preserve in greater detail the existing natural stream by establishing detailed floodplain delineation along Rock Springs Creek. The balance of the solutions north of Beardsley Road show alternatives constructed along roadway alignments which not only provide an opportunity for a multi-use corridor or trail (such as Pinnacle Peak Road), but also fit in well with planned major road way corridors in the region. The balance of these solutions include the incorporation of basins which not only provide multi-use opportunity but can be incorporated as part of development requirements or can be accomplished through development of regional basins. By focusing the majority of proposed improvements in the north portion watershed it provides the greatest potential to construct facilities that will allow for the natural desert environment to remain and will not have a negative visual

impact in the area. The proposed alternatives solution along Grand Avenue, if required, would provide an opportunity to improve the visual character of the area as well as create an opportunity to meet the planned use for a multi-use corridor.

#### **4.3 Comparison with 1987 Glendale/Peoria ADMP**

As a further verification of the completeness of the proposed alternatives as a regional solution, an overlay comparison of the proposed alternatives with the improvements proposed in the 1987 ADMP was prepared (see **Plate PA-15**). This overlay comparison showed that storm drain conduits proposed in 1987 are in a very similar location to the proposed channels and Zone A delineations that compromise the potential alternatives. In some cases, where storm drains were proposed in 1987, Zone A delineations and restoration of Rock Springs Creek Channel replaced the proposed storm drain improvements. The 1987 ADMP had proposed an east to west improvement along Pinnacle Peak Road. Improvements to Beardsley Road were also common proposed improvements. A significant amount of the improvements along 91<sup>st</sup> Avenue, which includes retention basins and channels, have already been completed. The alternative solution recommended in this report would eliminate the need for some of the channels or conduit north of Union Hills Drive. The proposed improvements near and adjacent to the ACDC are just a completion of the proposed storm drain conduits system or relief for ponding areas that were substantially completed based on the 1987 ADMP.

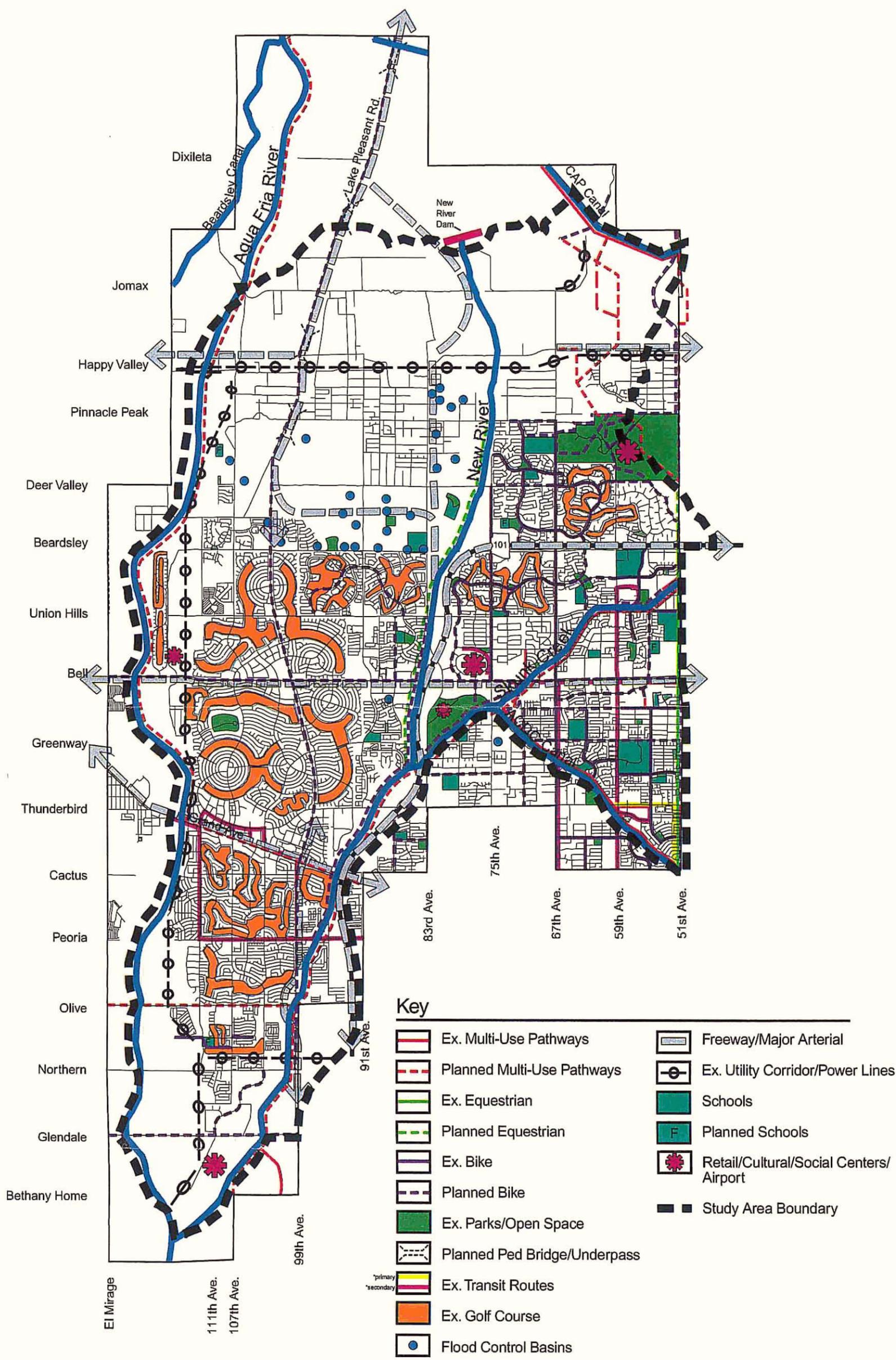
#### **4.4 Conclusion**

Based upon the alternatives formulation, brainstorming meeting, and subsequent regional verification meeting, the Entellus, Inc. Team recommends that the alternatives described in Section Three of this report be carried forward to the Level II analysis for this project.

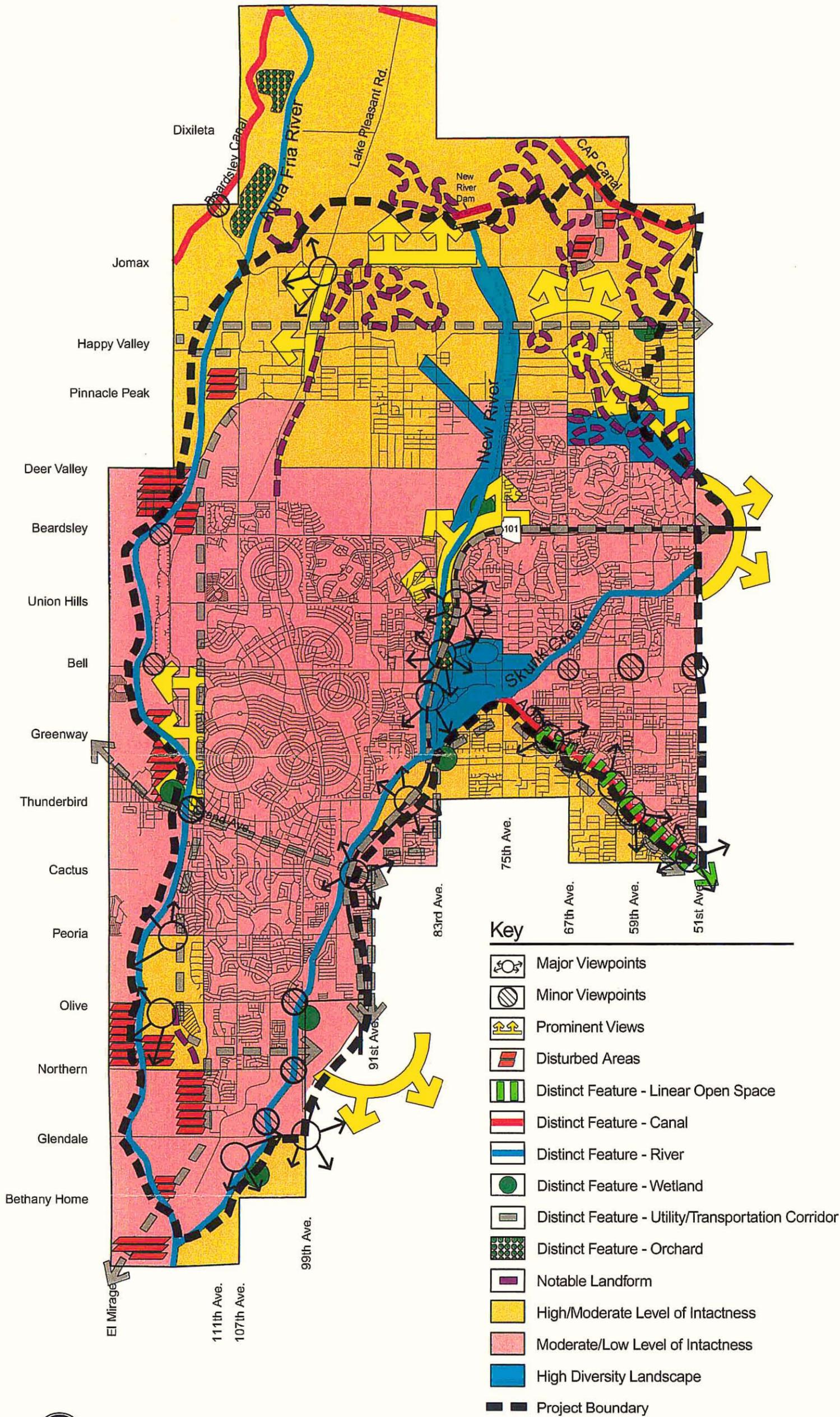
## SECTION PA-5: NEXT LEVEL OF ANALYSIS

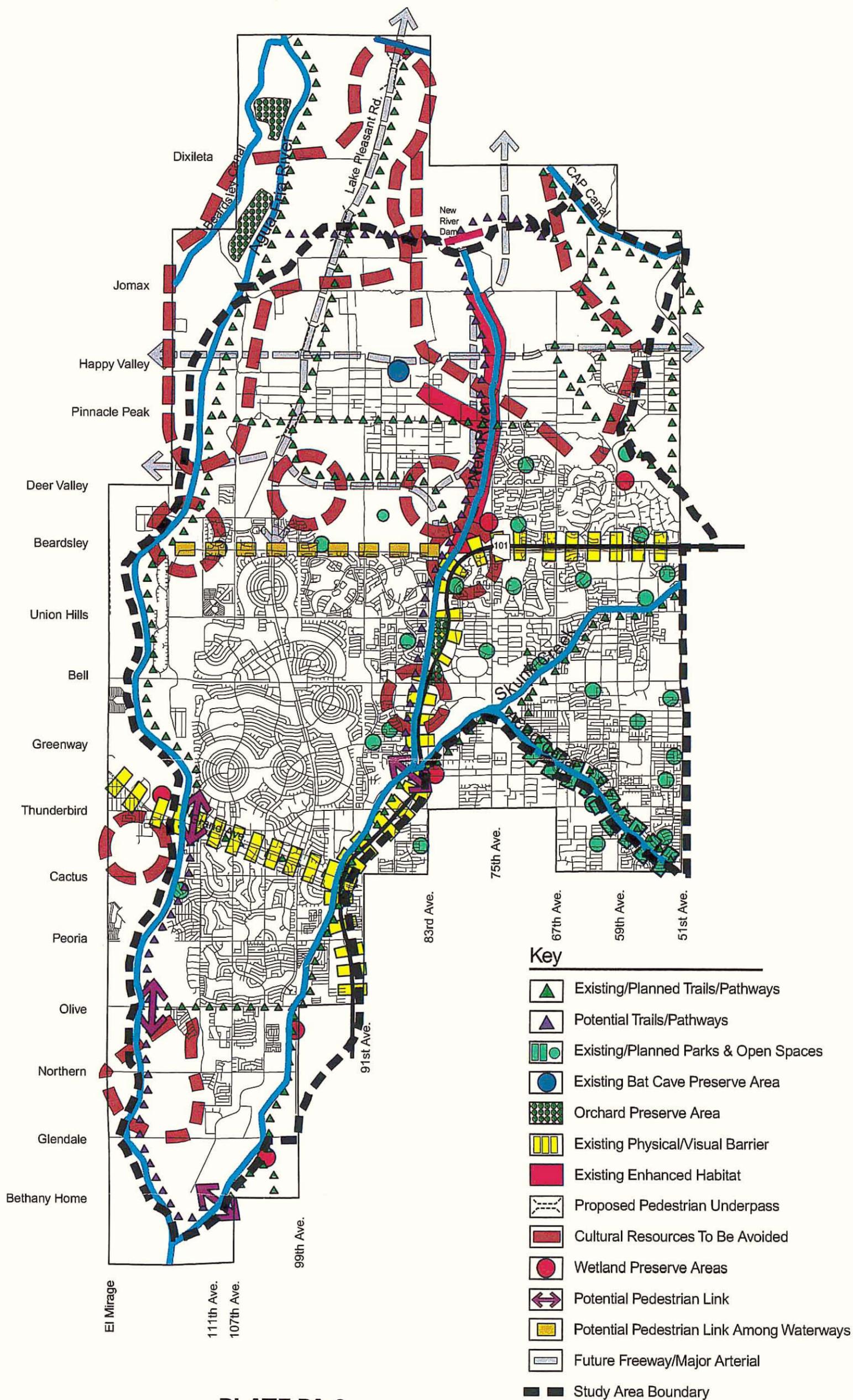
The regional alternative solutions approved as a result of the Level I analysis will be evaluated as part of Level II analysis to determine the engineering feasibility, consistency with environments restrains and opportunities, an approximate right-of-way and construction costs. Conceptual designs will be developed to the degree that is necessary to determine typical sizes, dimensions, right-of-way requirements and slopes based upon the peak flows from the project hydrology. The hydrology model will be modified in accordance with the proposed alternatives affects on peak runoff and retention and detention storage volumes. A series of public meetings will be held to receive input from public about the alternatives being evaluated as part of this study. The evaluation criteria presented in this report will be refined and used by the design committee to evaluate the alternative.

APPENDIX A. PLATES

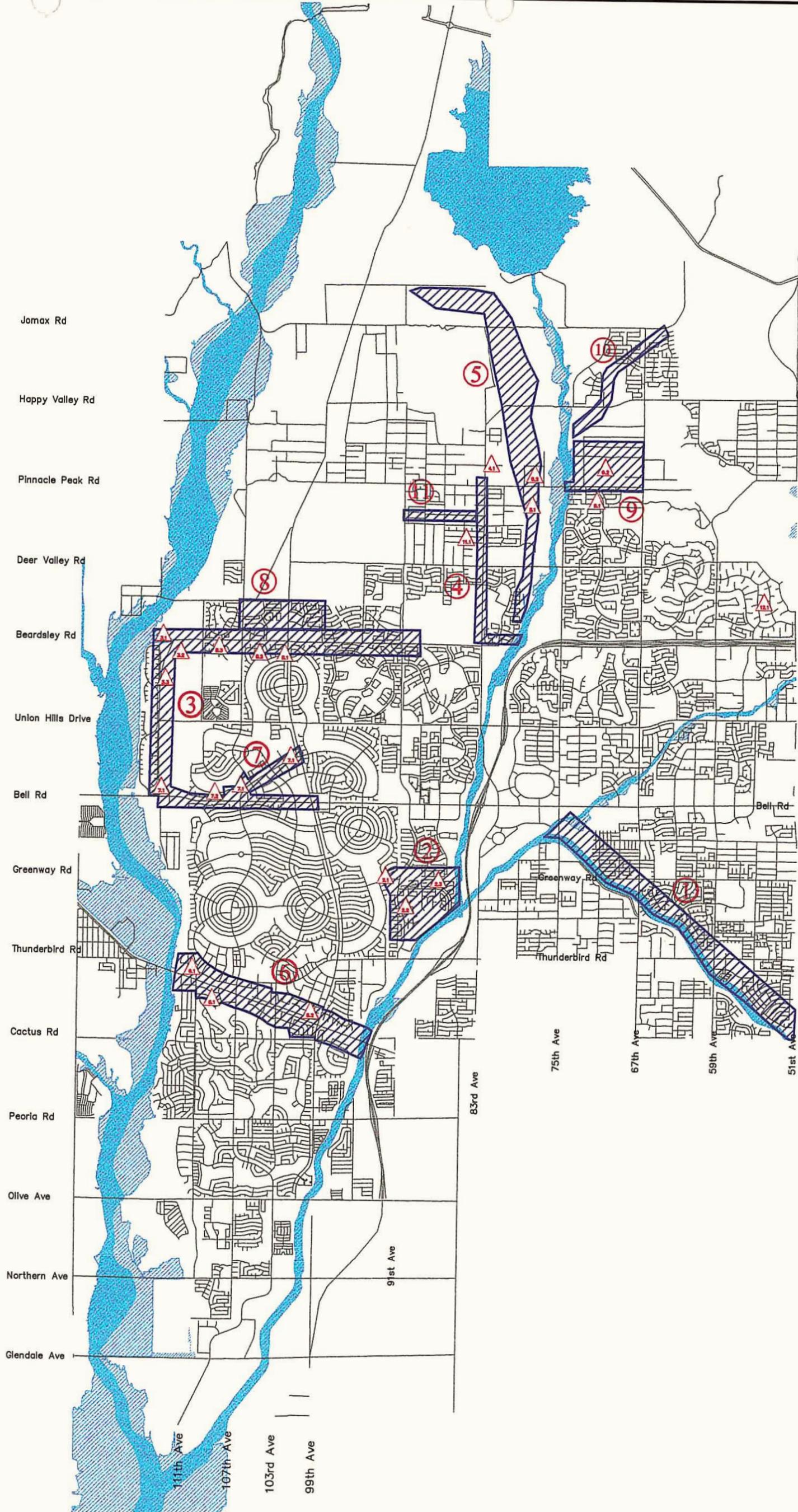


### PLATE PA-1 TRANSPORTATION, LAND USE, LINKS & NODES





**PLATE PA-3  
PLANNING INFLUENCES AND MULTI-USE OPPORTUNITIES**



## PLATE PA-4 HYDROLOGIC BOUNDARIES

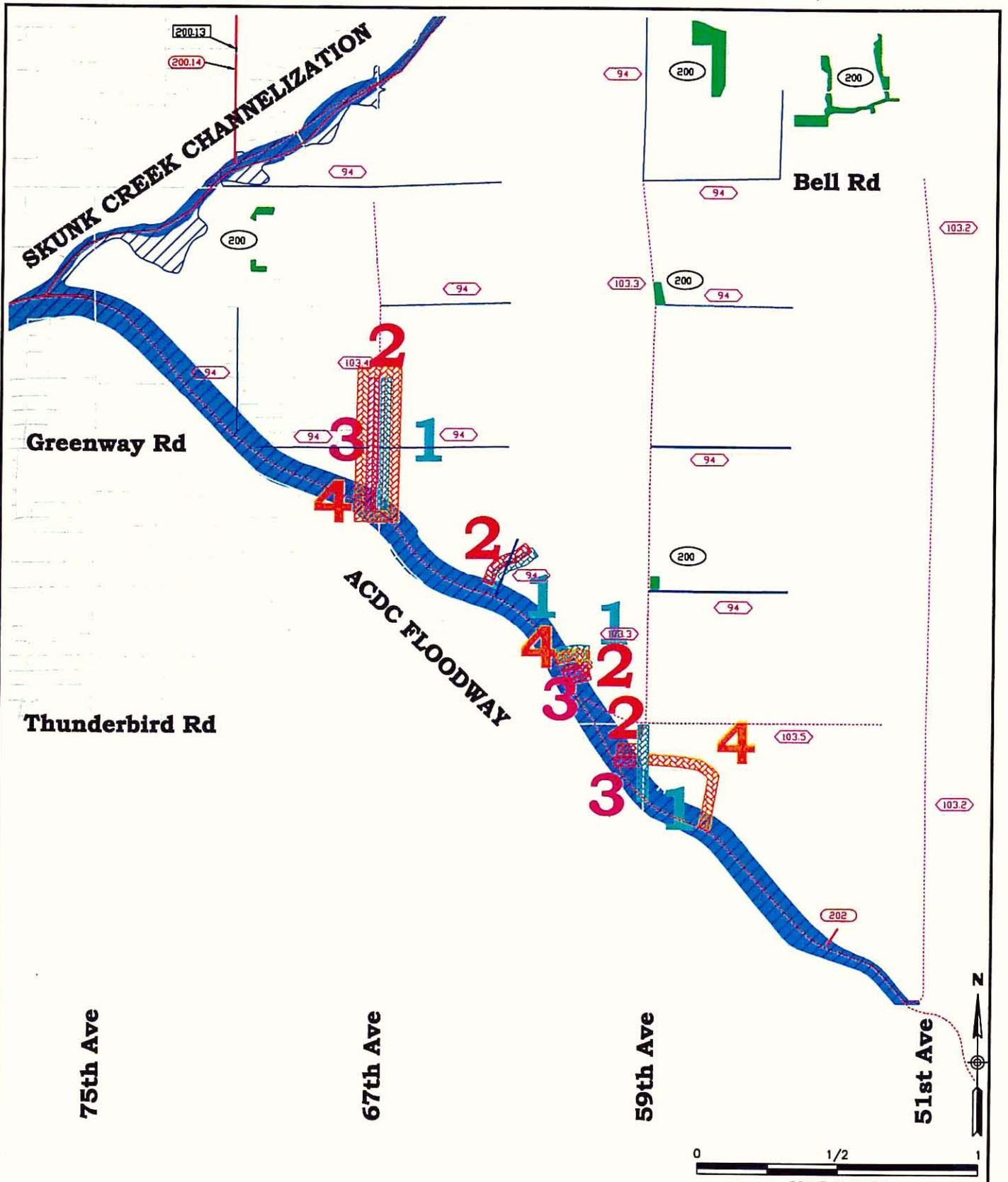
**Glendale Peoria**  
Area Drainage Master Plan



*LTM Engineering, Inc.*  
3323 East Thunderbird Road Suite 74-171  
Phoenix, Arizona 85032



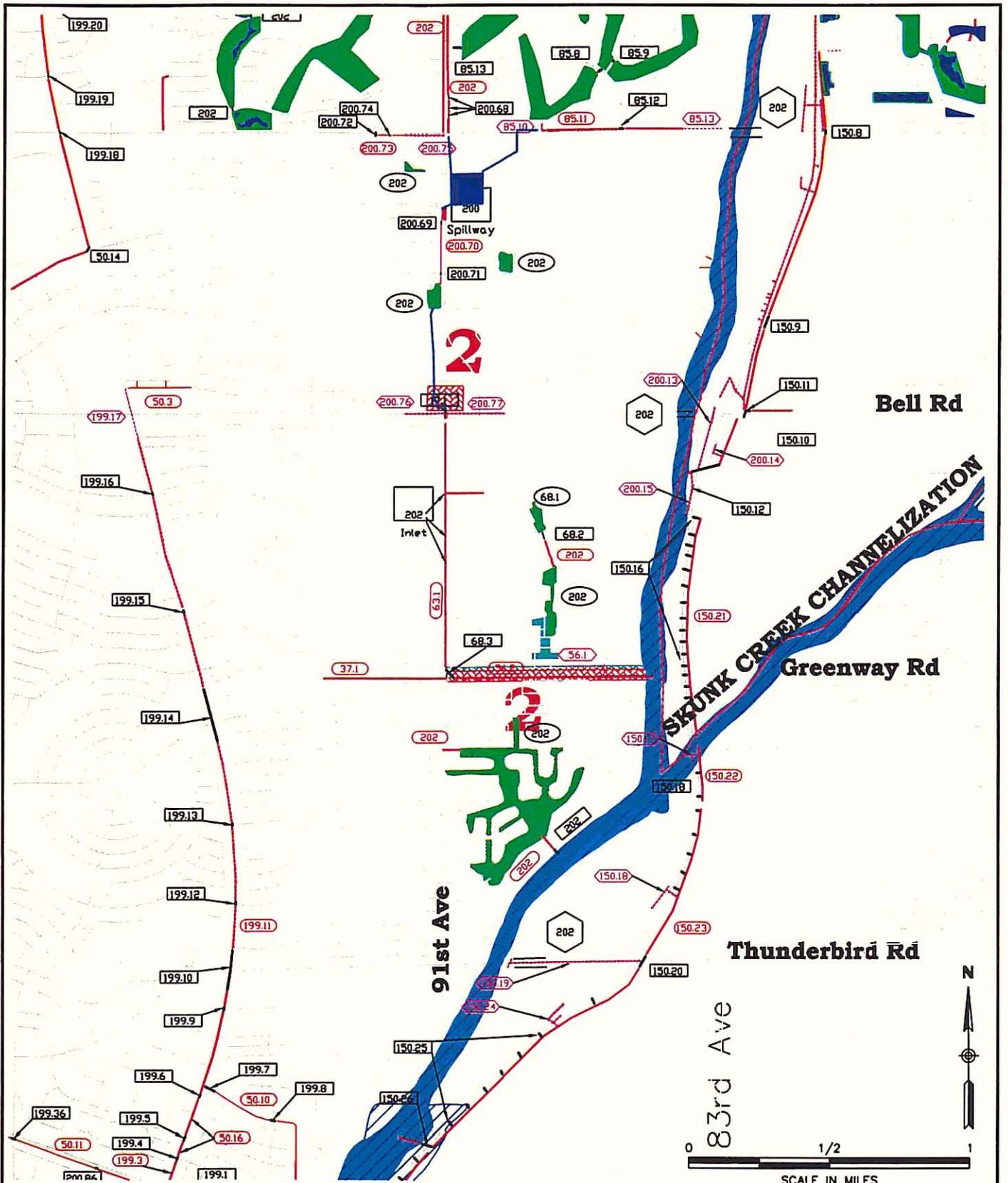
LOGAN SIMPSON  
DESIGN INC



Glendale  Peoria  
Area Drainage Master Plan

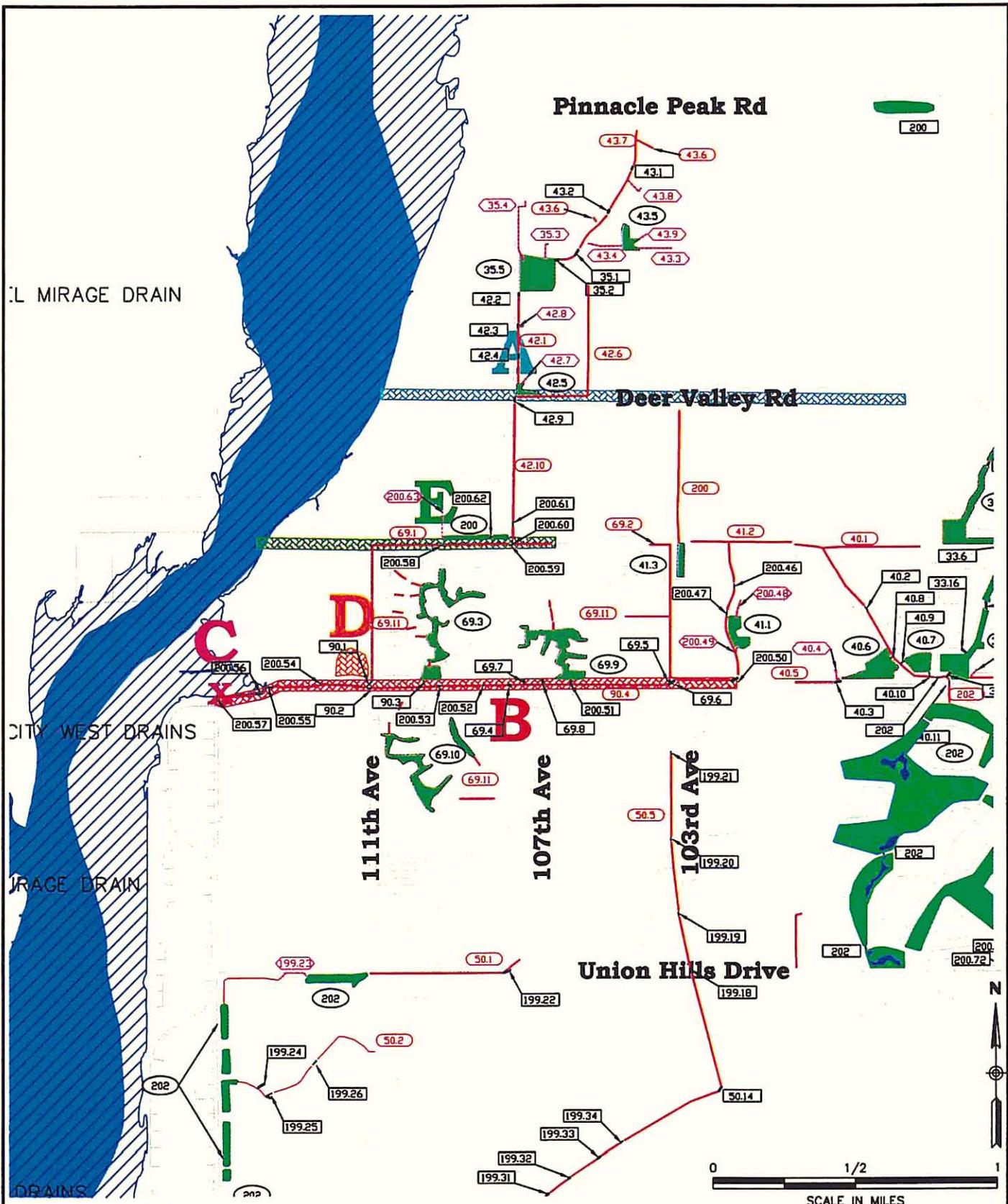
**PLATE PA-5 FOCUS AREA 1 - ACDC**





**Glendale Peoria**  
Area Drainage Master Plan



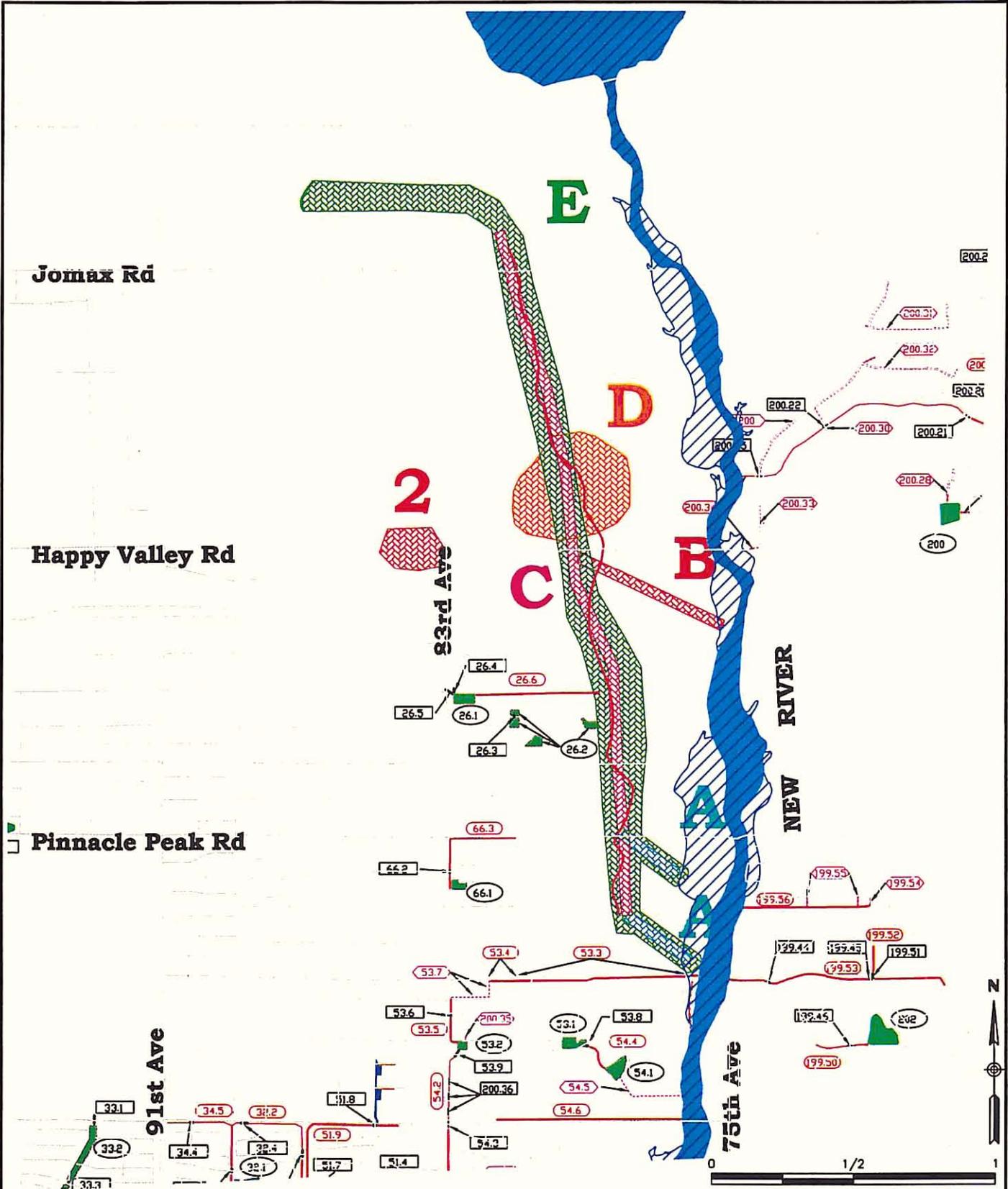


**Glendale Peoria PLATE PA-7 FOCUS AREAS 3 & 8 - BEARDSLEY CHANNEL**

Area Drainage Master Plan

GLENDALE CITY OF PEORIA Pinal County Flood Control District Entellus PENTACORE ARIZONA LOGAN SIMPSON DESIGN INC.

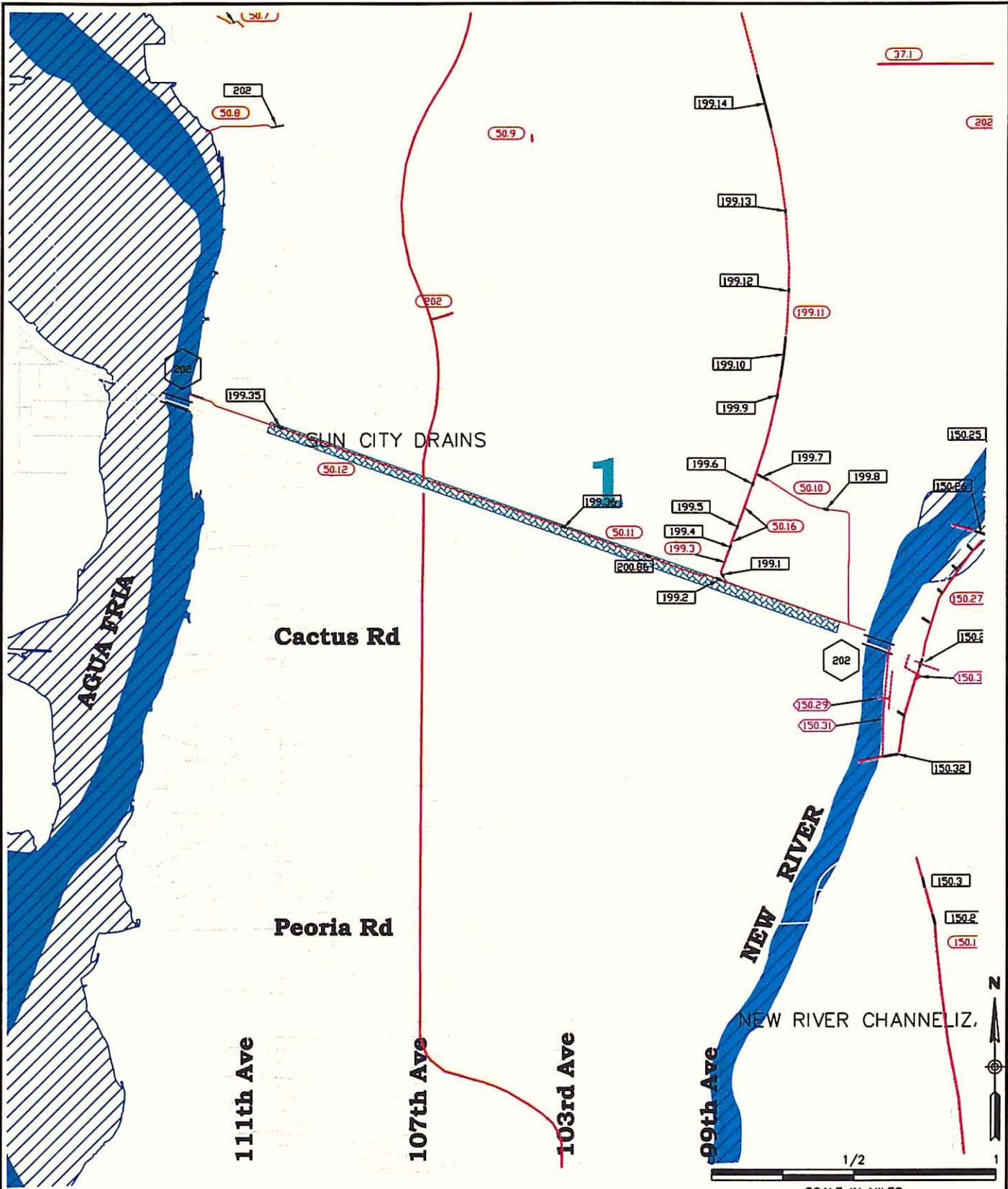




**PLATE PA-9 FOCUS AREA 5 - ROCK SPRINGS CREEK**

**Glendale**  **Peoria**  
Area Drainage Master Plan





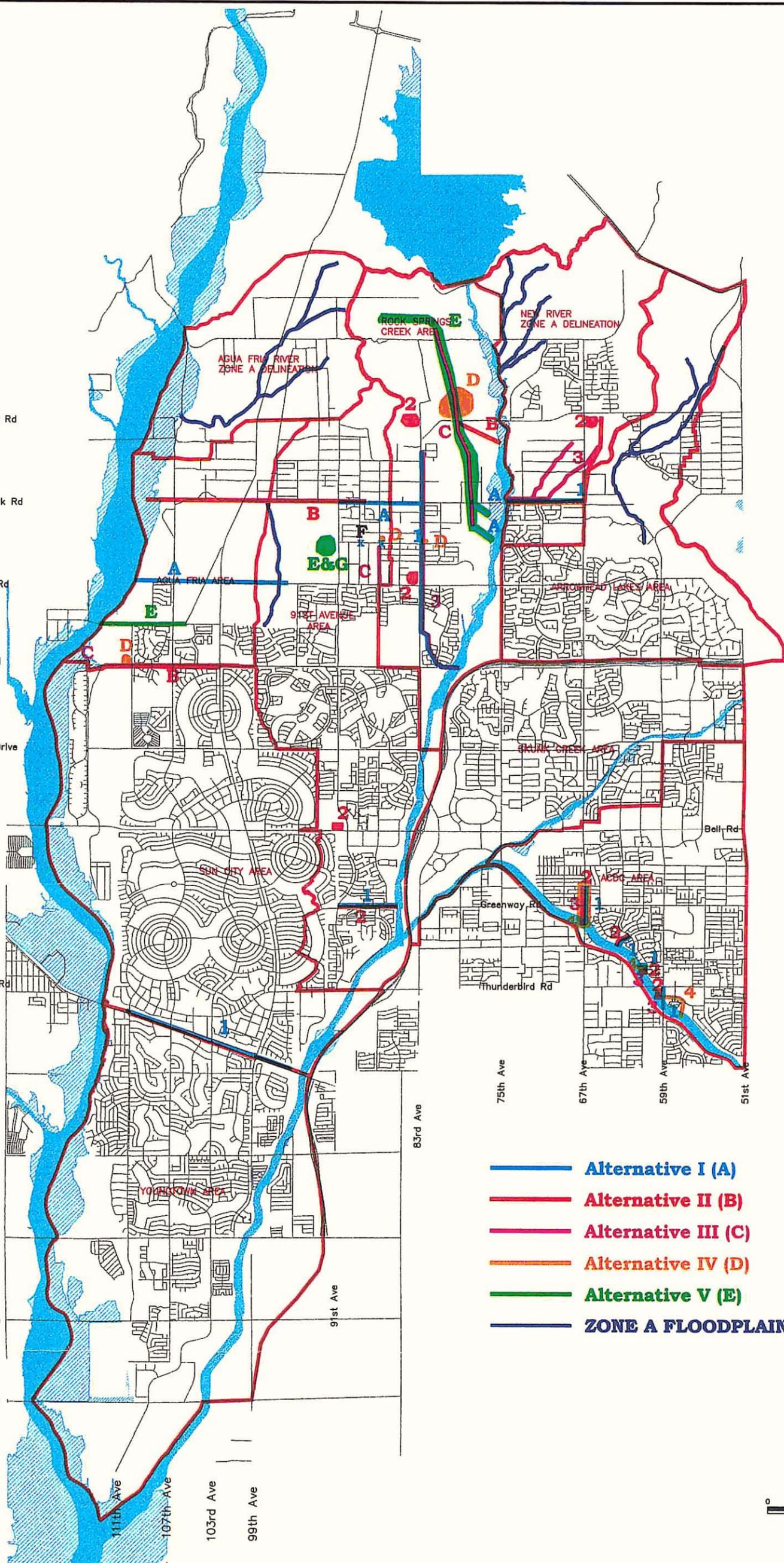
**PLATE PA-10 FOCUS AREA 6 - GRAND AVENUE**



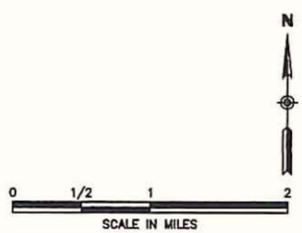




Jomax Rd  
 Happy Valley Rd  
 Pinnacle Peak Rd  
 Deer Valley Rd  
 Beardsley Rd  
 Union Hills Drive  
 Bell Rd  
 Greenway Rd  
 Thunderbird Rd  
 Cactus Rd  
 Peoria Rd  
 Olive Ave  
 Northern Ave  
 Glendale Ave



- Alternative I (A)
- Alternative II (B)
- Alternative III (C)
- Alternative IV (D)
- Alternative V (E)
- ZONE A FLOODPLAIN DELINEATION



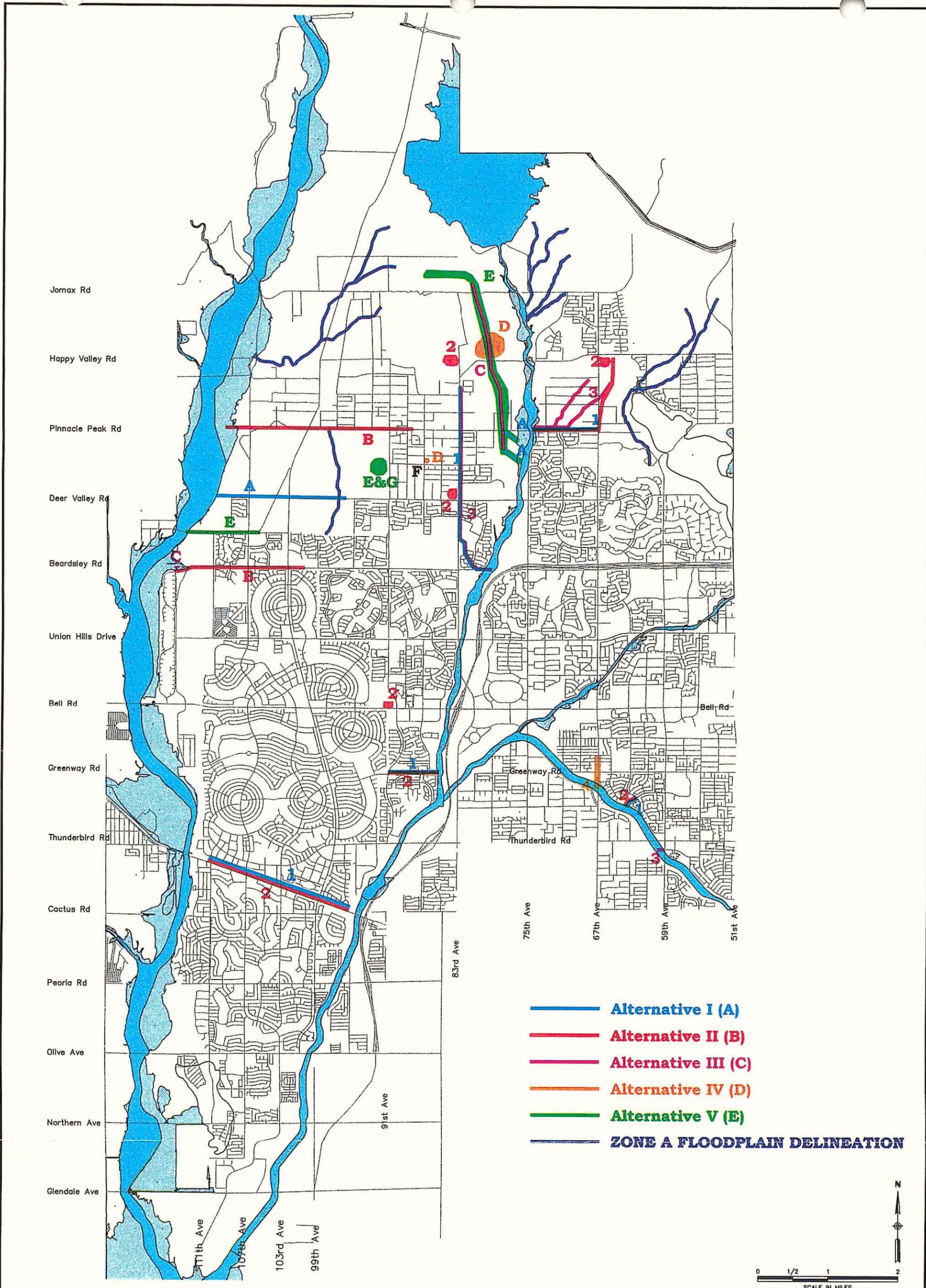
**PLATE PA-13 - HYDROLOGIC INFLUENCE AREAS**

**Glendale Peoria**  
 Area Drainage Master Plan



LTM Engineering, Inc.  
 3023 East Thunderbird Road, Suite 20-121  
 Phoenix, Arizona 85032





**PLATE PA-14 SCREENED ALTERNATIVE SOLUTIONS**

**Glendale Peoria**  
Area Drainage Master Plan

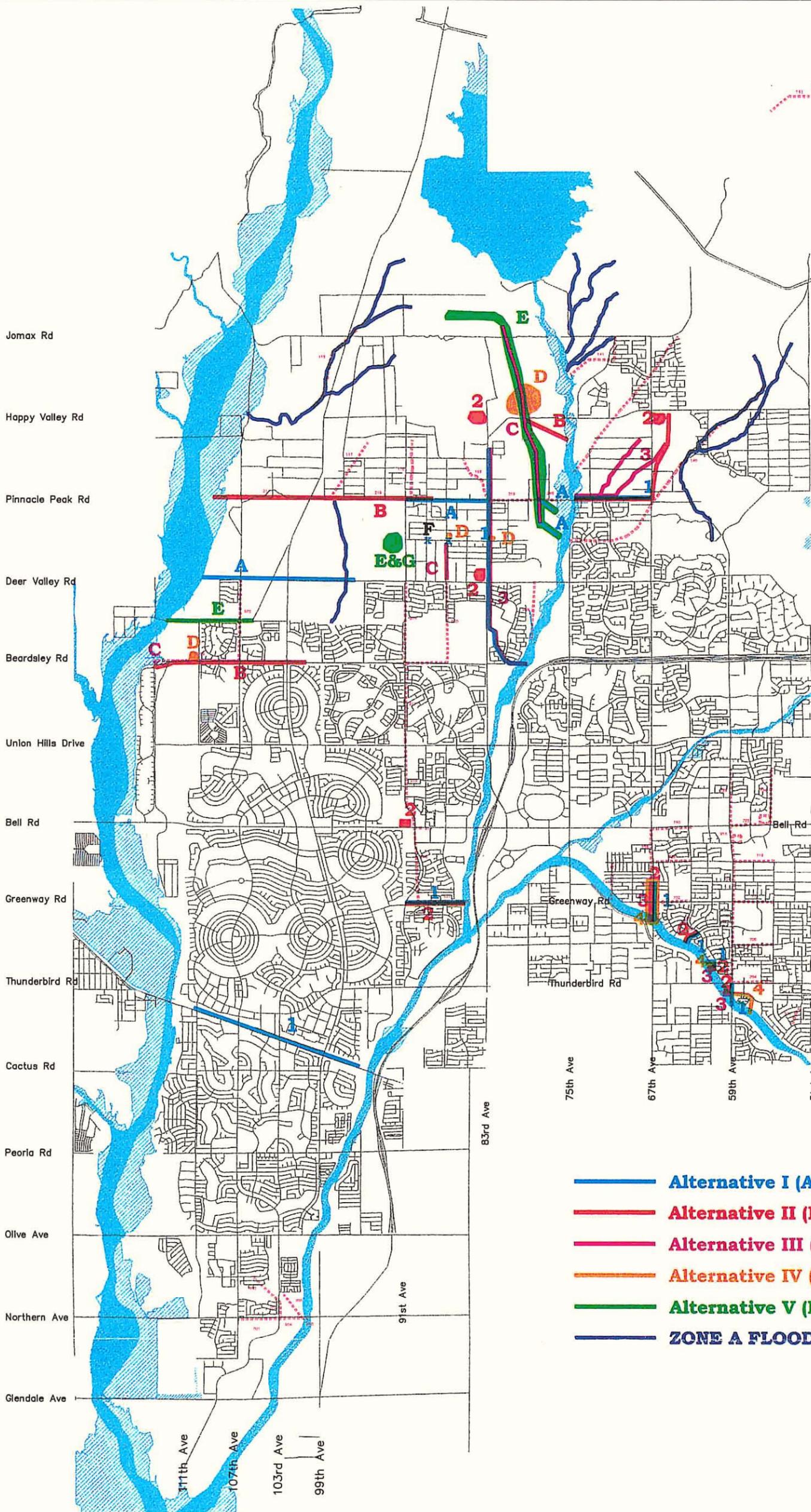


**LTM Engineering, Inc.**  
3525 East Thunderbird Road, Suite 26-121  
Phoenix, Arizona 85032

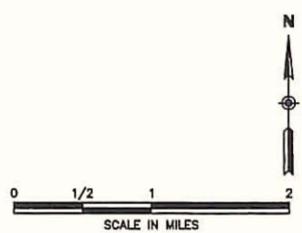


**LEGEND**

**Planned Improvements from 1987 ADMP**



- **Alternative I (A)**
- **Alternative II (B)**
- **Alternative III (C)**
- **Alternative IV (D)**
- **Alternative V (E)**
- **ZONE A FLOODPLAIN DELINEATION**



**PLATE PA-15 IMPROVEMENTS PROPOSED BY 1987 ADMP**

**Glendale Peoria**  
Area Drainage Master Plan



**LTM Engineering, Inc.**  
3023 East Thunderbird Road, Suite 26-121  
Peoria, Arizona 85032



**LOGAN SIMPSON DESIGN INC.**

**APPENDIX B. BRAINSTORMING MEETING AGENDA**



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TO M. DeRosa, FCDMC

FROM: M. Bonar, Entellus

JOB NO: 310.017

DATE: February 1, 2000

JOB: Glendale/Peoria ADMP Update

## MEMORANDUM

Re: Outline for Brainstorming meeting on March 15, 2000

As requested at our coordination meeting on January 20<sup>th</sup>, we have developed a Draft agenda and Evaluation Criteria for our Brainstorming meeting on March 17, 2000. We have also prepared a draft list of improvement types and the initial constraints that can be considered. They are based on our original scope of work and on subsequent conversations with team members.

### DRAFT AGENDA FOR BRAINSTORMING

- I. Introductions, Roles, and Responsibilities
- II. Distribution of existing constraints map
- III. Report on Environmental, Visual and Multi-Use Opportunity Assessment
- IV. Report on Results of Hydrologic Model
- V. Description of Problem areas
  - Original Scope areas, areas from data collection, Areas from Public Meetings
- VI. Review of Public Information meetings
- VII. Brainstorming for alternatives
  - Preface brainstorming: POTENTIAL MEASURES FOR FLOOD MITIGATION, CONSTRAINTS
  - ACDC watershed
  - New River Watershed
  - Sun City Watershed
  - AguaFria Watershed
- VIII. Review of evaluation criteria and weighting
- IX. Conclusion of meeting

A more detailed description of the potential measures for Flood Mitigation that can be stated at the beginning of the brainstorming session is listed below.

### POTENTIAL MEASURES FOR FLOOD MITIGATION

Structural solutions for Flood mitigation can be categorized as utilizing one or a combination of the following measures:

1. Increase of conveyance capacities by means of channel improvements:
  - Greenbelt
  - Concrete lined channels
  - Concrete channel with vertical walls
  - Covered channels (concrete boxes)
2. Reduction of downstream peak flow by detention basins:

- Parks
- Concrete lined basins
- 3. Diversion of storm runoff with diversion structures:
  - Greenbelt
  - Concrete lined channels
  - Concrete channel with vertical walls
  - Covered channels (concrete boxes)
  - Large diameter storm drains
- 4. Confinement of flow with levees or floodwalls

Non-Structural Solutions for Flood mitigation include:

- 5. Adopting ordinances by local City regulating development requirements and limitations
- 6. Adopting FEMA regulations limiting development
- 7. Adopting ordinances (i.e. hillside ordinances) that vary dependent upon divergent geologic, vegetative, and topographic conditions in the study area.

### **CONSTRAINTS**

- 1. Inadequate space to construct -Right-of-way limitation, lack of available land, existing developments.
- 2. Topographic constraints - Slopes are too flat.
- 3. Environmental concerns - Visual, biological, cultural,
- 4. Political Constraints - multi-jurisdictional issues, NIMBY, political connections
- 5. Maintenance Concerns - Who will maintain ? How hard is it to make the solutions self-sustaining?

### **EVALUATION CRITERIA**

#### Traditional Criteria

- 1. Implementation cost - Construction Cost, Right-of Way Cost
- 2. O & M cost - Initial and long term efforts and maintenance costs willing to be accepted by an organization capable of providing the maintenance needed.
- 3. Safety - Safety in design elements. Need for Flood warning system
- 4. Impact on traffic during and after Construction.
- 5. Politically consistent with ordinances and promises.
- 6. Sound Design - Design is based on tested and economical engineering practices

#### Sustainability Criteria

- 7. Aesthetics - Will the improvements blend in and even enhance the visual character of the area ?
- 8. Environmental considerations - Visual, biological, cultural, ecological.
- 9. Multi-Use opportunity - Is this going to be a useable amenity ?
- 10. Neighborhood Acceptance - does the neighborhood want this solution ?
- 11. Others -

A weighting of the final criteria will need to be developed by Entellus based upon input from the study participants. It will be used for the Level II analysis.

After the brainstorming meeting, the alternatives will be categorized, pared down by discarding some alternatives that are not viable, evaluated and the final alternatives recommended to the District for further evaluation. This may be handled by a one day session with representatives from the District, Peoria, Glendale, and possibly other study participants.

After the final selection of alternatives to be evaluated is approved by the District, Entellus will prepare a written description and sketch of the alternatives and make the Potential Alternative submittal. There will be a minimum of two alternatives per problem area (which is currently  $2 \times 10 = 20$  total). Entellus will have already completed the evaluation criteria but it will be summarized and included with the Potential Alternatives Submittal. After the alternatives for further evaluation are selected, the Level II analysis can begin.

Please review this draft information and provide us with your comments. It is intended to spur the thought process for evaluation and to clear up our specific tasks during and after the brainstorming meeting.