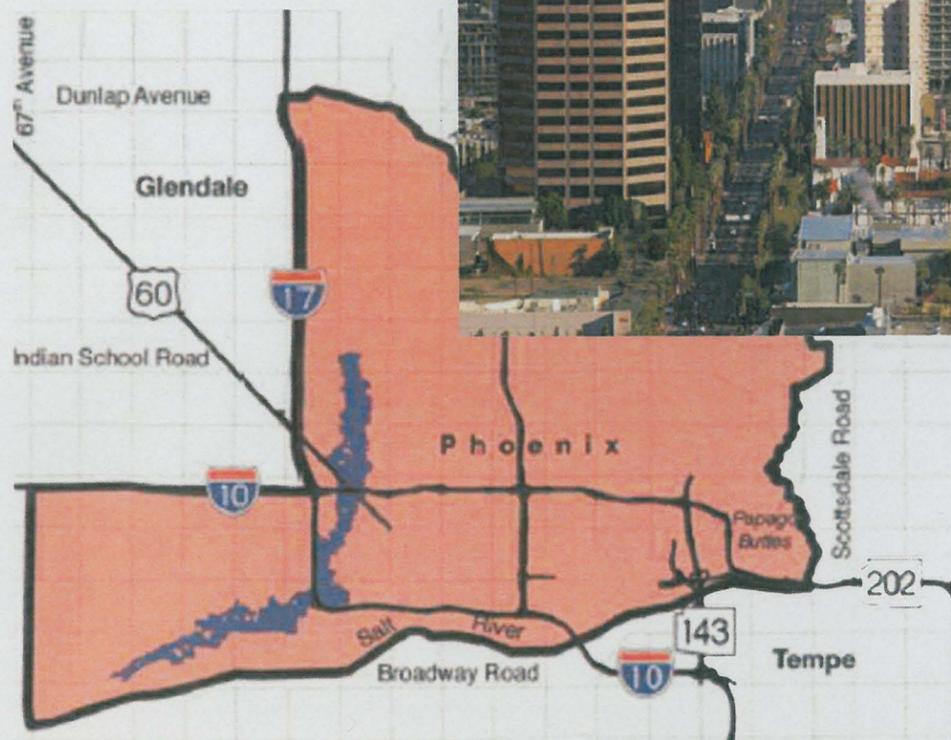
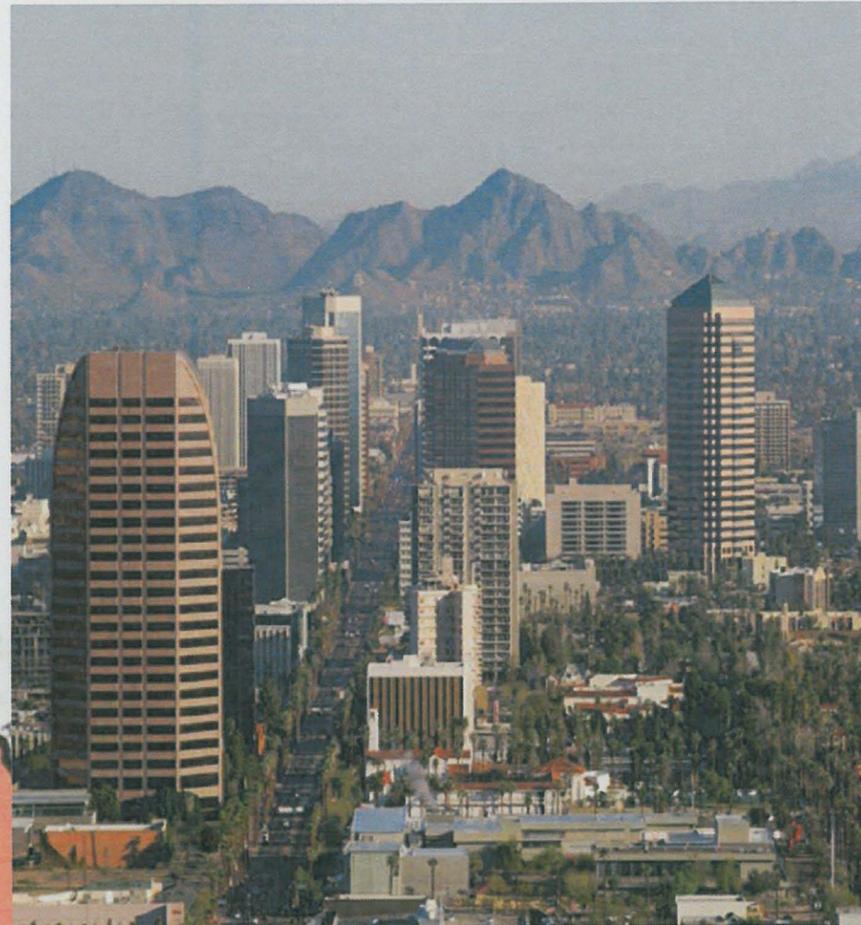




Metro Phoenix ADMP

FCD Contract 2004 C040



Potential Alternatives Report (Level I Analysis)

Prepared by:



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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of the Metro Phoenix Area Drainage Master Plan (ADMP) is to identify and quantify flood hazards within the central Phoenix area and develop a recommended plan for mitigation of the identified flooding problems.

1.2 Purpose of this Report

The purpose of this report is to document and summarize the potential flood control solutions for the Metro Phoenix ADMP. This is a summary of the Level I Analysis, which is the first step in the process of developing flood control alternatives. This initial step involved a preliminary analysis of a wide array of plausible flood control measures in order to determine the most promising alternatives that will be carried forward into the next phase of the study. The next phase, or the Level II Analysis, will involve a more detailed analysis of the shortlist of flood control alternatives.

1.3 Study Area

The study area for the Metro Phoenix ADMP is shown in Figure 1. The area is bounded by the Arizona Canal Diversion Channel (ACDC) on the north, I-17 on the west, the Salt River on the south, and the ridgeline in the Papago Buttes on the east. Between 44th Street and 60th Street, the study area extends north of the Arizona Canal up to the ridgeline in Camelback Mountain. The total study area encompasses approximately 90 square miles. The study also includes a portion of the Durango ADMP study area, west of I-17, which encompasses the Cave Creek floodplain and its corresponding watershed (cross-hatched area on Figure 1). The reason for including the Durango area in the Metro Phoenix ADMP is for the re-study of the Cave Creek floodplain; no new flood mitigation plans will be developed for the Durango watershed, as this effort was previously accomplished as part of the Durango ADMP.

1.4 Flood Hazard Areas (refer to Figure 2)

The following paragraphs describe the eight flood hazard areas that were identified in the first phase of the Metro Phoenix ADMP, which was carried out between May 2005 and October 2006 and consisted of data collection, analysis of existing conditions, and identification of flood hazard areas. The work included 1) review of flooding complaints, 2) conducting public meetings, 3) consulting with affected agencies, 4) reviewing existing flood studies and drainage reports, 5) preparing an inventory of existing and planned drainage infrastructure, 6) developing a comprehensive rainfall-runoff model of the study area, and 7) preparing a re-delineation of the Cave Creek floodplain. The data obtained from this first phase of the work was used to define the following flood hazards:

Old Cave Creek Floodplain: As evidenced by numerous drainage complaints, the low-lying areas within the old Cave Creek floodplain are still susceptible to flooding. This area is approximately 10 square miles in size, located between the ACDC to the north, the Grand Canal to the south, I-17 to the west, and 7th Street to the east. Prior to construction of the ACDC, flood flows from Cave Creek would inundate this area, hence the name old Cave Creek Floodplain. But even though the ACDC captures and diverts the upstream flows in Cave Creek, eliminating the floodplain designation, the area still experiences flooding problems. These problems are primarily due to the topographic shape of the area, which is a very wide and shallow conveyance corridor without a defined channel. The rest of the Metro Phoenix study area is more characteristic of a sloping plain where runoff, that exceeds the conveyance capacity of the streets, flows overland as shallow sheet flow. In contrast, the topography of the old Cave Creek floodplain tends to concentrate runoff. Consequently, during times of heavy rainfall, runoff can exceed the capacity of the 2-year storm drain system and accumulate to significant depths, causing flood damage to those properties located in low-lying areas.

Cave Creek Floodplain: The Cave Creek floodplain area from the Grand Canal downstream to I-10 is approximately 6 square miles in size, which incorporates the designated floodplain as well as areas outside of the floodplain. The defined floodplain lies roughly between 19th Avenue to the west and 15th Avenue to the east, encompassing over 2000 homes and businesses. However, the Metro ADMP hydrologic model indicates that the risk of flooding in adjacent conveyance corridors, outside of the designated floodplain limits, is essentially the same as the flood risk within the

floodplain. That is, the 100-year peak discharge that is conveyed within the floodplain between 19th Avenue and 15th Avenue is roughly equivalent to the peak discharge in the other adjacent half mile wide conveyance corridors; including I-17 to 19th Ave., 15th Ave. to 7th Ave., and 7th Ave. to Central Ave. As is the case with the old Cave Creek floodplain area upstream of the Grand Canal, the flooding problems downstream of the Grand Canal are primarily due to the topographic shape of the area which is a very wide, shallow conveyance corridor stretching from I-17 to Central Avenue. Runoff tends to concentrate within this area and, during times of heavy rainfall, runoff can exceed the capacity of the 2-year storm drain system and accumulate to significant depths, causing flood damage to those properties located in low-lying areas.

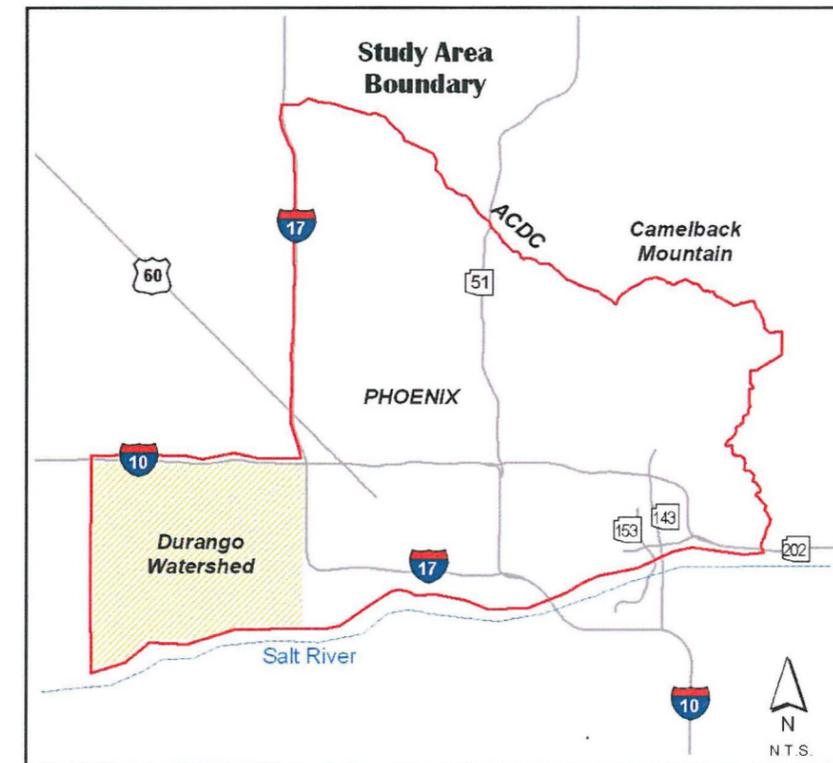


Figure 1: Study Area Map

Grand Canal Floodplain: The banks of the Grand Canal are elevated about 1 to 3 feet above the surrounding ground, resulting in a shallow floodplain along its upstream side. Approximately 530 homes, plus a number of businesses and apartment buildings, are located within the Grand Canal floodplain between I-17 and 22nd Street. Some areas within the floodplain experience flooding on a much more frequent basis than others, such as the neighborhood located between 3rd Street and 12th Street. This area has been flooded twice within the past year, whereas other areas behind the Canal haven't flooded for decades. Nonetheless, the entire area that lies below the elevation of the Canal bank is susceptible to flooding. Moreover, the flooding can be caused by storms much smaller than the 100-year event because the problem is a result of the elevated Canal embankment. That is, once the capacity of the 2-year storm drain system becomes overtaxed, excess runoff ponds behind the Canal and causes flooding of homes and businesses.

Downtown Area: For purposes of this study, the Downtown Area is defined as the 7.8 square mile region bounded by 19th Ave. on the west, I-10 on the north and east, and I-17 on the south. I-10 is a drainage divide for the Downtown Area; capturing upstream runoff and conveying it to the Salt River, but the local watershed still generates relatively high rates of runoff due to the level of development and lack of pervious areas. Surface flows run east to west

through the Downtown area, with the highest concentrations of runoff occurring along Fillmore Street, the Union Pacific Railroad, Buckeye Road, and I-17. The hydrologic model predicts that these concentrations of runoff range from 100cfs to over 1200cfs for the 100-year flood, indicating a significant flood hazard. The flooding problems are exacerbated by the fact that many of the storm water catch basins are dysfunctional drywells that leave standing water after the storms have passed. In addition, even though 2-year storm drains exist on half-mile intervals, many of the inlets in the Downtown area seem inadequate to capture the runoff from a 2-year storm.

Durango Curve Area: At Durango Street, the 90 degree curve in the I-17 Freeway is on an elevated embankment which impounds floodwaters to a depth of about 3 feet, according to the effective floodplain map and verified with the Metro Phoenix hydrologic model. The flooded area is about 1/2 square mile in size and includes about 670 homes and businesses along the east side of I-17, from the Freeway curve upstream to the Union Pacific Railroad. The contributing watershed to the Durango Curve area extends all the way up to the ACDC. Storm water runoff from the watershed, that exceeds the existing storm drain system, concentrates along the north side of the Union Pacific Railroad and is diverted into I-17, filling the depressed part of the highway north of the curve. Since the existing storm drain system is designed to convey the 2-year flood, storms exceeding the 2-year event can cause this problem of floodwater spilling into I-17. Once the storage volume of I-17 is exceeded, floodwaters spill over the east side of I-17, flooding the area in the northeast quadrant of the curve. The west bank of the depressed freeway is higher than the east bank, which results in the spill to the east. This flooding problem not only impacts homes and businesses, but can also flood I-17, making the Freeway impassable on a fairly frequent basis.

Arizona Country Club Swale: This swale is downstream of the Arizona Country Club, located between the Papago Buttes on the south and the elevated Arizona Canal on the north. The swale runs east to west through the Arizona Country Club and continues west, in an alignment north of Thomas Road, until it reaches the Old Cross Cut Canal at 48th Street. The swale tends to lose its definition downstream of 52nd Street, transforming from a swale that contains floodwater into a spread out surface flow. There is record of several flooding complaints from homeowners who live along the low-lying part of the swale.

Arcadia Area: The Arcadia area has long been a flooding concern for both the City of Phoenix and the Flood Control District. Storm water runoff from Camelback Mountain causes flooding problems for the homeowners whose property lies adjacent to the flow corridors. These flow corridors are the north-south aligned streets that convey the mountain runoff from Camelback Mountain's slopes down to the Arizona Canal. Another issue is the elevated embankment of the Arizona Canal. Much like the Grand Canal described previously, the Canal embankment impounds floodwaters resulting in a designated floodplain along the upstream side of the Canal. These flooding issues have resulted in numerous flooding complaints, prompting the inclusion of Arcadia into the list of flood hazard areas.

Area north of Sky Harbor Airport: This area is located between the Loop 202 Highway on the north and the Union Pacific Railroad on the south, from the I-10 Freeway upstream to the SR 143 Highway. The drainage area is approximately four square miles in size and the general fall of the land is from northeast to southwest. The Railroad forms a drainage divide along the north boundary of Sky Harbor Airport. North of the Railroad, a wide swale is formed along the Washington Street alignment where the grade is due west. This swale accumulates surface flow that exceeds the capacity of the existing 2-year storm drain system. According to the Metro Phoenix hydrologic model, the 100-year surface flow along Washington Street exceeds 1000cfs.

1.5 Potential Alternatives

A brainstorming session was held on June 1, 2006 to solicit ideas from the Metro ADMP stakeholders and to develop a list of potential alternatives for each identified flood hazard area. The stakeholders who attended included representatives from the Arizona Department of Transportation, the Salt River Project, Maricopa County Parks Department, and a number of departments within the City of Phoenix government, including Aviation, Development Services, Planning, and Street Transportation. Numerous flood control ideas were discussed at the brainstorming session, but the group as a whole was most supportive of the following five alternatives:

- Floodwater Storage at Encanto Golf Course – This idea is to reconstruct Encanto Golf Course in a manner that allows storage of floodwater, makes it more interesting from a player's standpoint, and enhances the aesthetic appeal of the course, thereby reducing or eliminating the Cave Creek floodplain.
- Floodwater Storage at the Durango Curve – It was thought that providing floodwater storage at the Durango Curve would eliminate the Cave Creek floodplain, preclude flooding of the I-17 Freeway, provide an opportunity for sports fields, and provide an outfall for new upstream storm drains within the Cave Creek floodplain.
- Linear Park along the Grand Canal – This alternative would remove homes from the Grand Canal floodplain, create an open space that compliments the existing trail system, and would provide opportunities for floodwater storage which would reduce downstream flood flows.
- 18th Avenue Storm Drain – A new storm drain in 18th Avenue, from the Grand Canal downstream to Encanto Golf Course, was seen as a good idea for collecting floodwater at the Grand Canal and conveying it to the new, reconstructed gold course.
- Downtown Storm Drains – This idea is to upgrade the Downtown area storm drains to a 10-year level of protection.

These five alternatives, plus thirty-five other potential alternatives, are further described in Sections 2 through 9 of this report. A summary of the evaluation of these initial flood control ideas is presented in Section 10, along with a recommendation for those alternatives to be carried forward to the next step in the study process which is the Level II Analysis; a more detailed investigation of the flood control alternatives.

1.5 Scenery Resources/Multi-Use Opportunities

As part of the first phase of the work on this project, conducted between May 2005 and October 2006, considerable information was gathered relative to the existing and future landscape character as well as the existing and planned recreational facilities (refer to the Metro Phoenix ADMP Data Collection Report, dated October 2006). Subsequent to the Data Collection Report, significant progress has been made on a Scenery Resource & Recreation Multi-Use Assessment being prepared as part of this project (refer to the Draft of the Metro Phoenix ADMP Scenery Resource & Recreation Multi-Use Assessment). The information from these efforts has aided in the selection of potential flood control alternatives and has defined the landscape themes that are compatible within different parts of the study area. This data has also been a very valuable tool in the effort to evaluate the potential alternatives. As can be seen in the Alternative Evaluation Matrix (Section 10 of this report), a number of the evaluation criteria are largely based on aesthetics and multi-use opportunities, including: maintenance costs, construction costs, urban wildlife habitat, aesthetics, community acceptance, multi-use opportunities, and agency acceptance.

1.6 Environmental Impacts

An environmental overview is being conducted as part of this study that includes a cultural resources assessment and a hazardous materials overview. In order to effectively evaluate the potential alternatives identified in this Level I Analysis, our team prepared a table of known historic districts and prehistoric sites. This information was utilized to aid in the evaluation of the potential alternatives. Specifically, a number of evaluation criteria (refer to the Alternative Evaluation Matrix located in Section 10 of this report) are associated with this environmental overview, including: construction costs, permitting, cultural impacts, and hazardous material impacts.

2.0 OLD CAVE CREEK FLOODPLAIN (ACDC to Grand Canal)

The old Cave Creek floodplain area is approximately 10 square miles in size, located between the Arizona Canal Diversion Channel (ACDC) and the Grand Canal. Even though the ACDC captures the upstream runoff, the remnant floodplain area downstream of the ACDC still experiences flooding problems. These problems are primarily due to the topographic shape of the area which is a very wide, shallow channel. The rest of the study area is more characteristic of a sloping plain where runoff, that exceeds the conveyance capacity of the streets, flows overland as shallow sheet flow. In contrast, the topography of the old Cave Creek floodplain tends to concentrate runoff. Consequently, during times of heavy rainfall, runoff can exceed the capacity of the 2-year storm drain system and accumulate to significant depths, causing flood damage to those properties located in low-lying areas.

2.1 No Action

The no action alternative will result in continued flooding problems in the old Cave Creek floodplain area. These problems include house flooding and disruption to vehicular traffic due to flooded streets. Some of the specific flood problems identified with this study include:

- Frequent flooding to low lying houses along Central Avenue (Central Avenue doesn't have a storm drain north of Bethany Home Road)
- Flooding of homes in the area north of Glendale Avenue and east of 15th Avenue (this area is lower than the crowns of 15th Avenue and Glendale Avenue)
- Flooding of properties along the downstream side of Bethany Home Road (Bethany is essentially level in an east-west direction which results in downstream flooding once the storm drain capacity is exceeded)
- 23rd Avenue Storm Drain terminates at Northern Avenue resulting in flooding along Northern Avenue
- Flooding of properties along the downstream side of Butler Avenue (as is the case with Bethany Home, Butler is essentially level in an east-west direction. The flat slope creates very little conveyance capacity in the street which results in flooding of the downstream properties once the street capacity is exceeded. This is a common problem throughout the old Cave Creek floodplain area.)

Cost = \$0

2.2 10-year Storm Drain System without Storage (See Exhibit 2.A)

This potential solution is to increase the capacity of the existing 2-year storm drain system to a 10-year design for the area between I-17 and Central Avenue. It includes new storm drains in 21st Avenue, 15th Avenue, 3rd Avenue, and Central Avenue. Floods greater than the 10-year event would be conveyed in the streets, providing a level of protection that exceeds the 10-year flood. The following individual alternative elements make up this solution:

- Alternative 01 – 21st Avenue Storm Drain, Northern Ave. to Grand Canal (10-year design)
- Alternative 02 – Central Avenue Storm Drain, Arizona Canal to Bethany Home Rd. (2-year design)

- Alternative 03 – 3rd Avenue Storm Drain, Bethany Home Rd. to Grand Canal (10-year design)
- Alternative 04 – 15th Avenue Storm Drain, Butler Dr. to Grand Canal (10-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
1	New Storm Drain in 21st Avenue (10-year)	\$ 30,264,200.00
2	New Storm Drain Extension in Central Avenue (2-year)	\$ 6,847,100.00
3	New Storm Drain in 3rd Avenue (10-year)	\$ 5,759,700.00
4	New Parallel Storm Drain in 15th Avenue (Supplement 10-year)	\$ 34,671,500.00
TOTAL		\$ 77,542,500.00

2.3 10-year Storm Drain System with Storage (See Exhibit 2.B)

This potential solution would increase the capacity of the existing 2-year storm drain system to a 10-year design for the area between I-17 and Central Avenue. It includes new storm drains in 21st Avenue, 15th Avenue, 3rd Avenue, and Central Avenue, as well as a new 10-year storage basin within Palo Verde Golf Course at 15th Avenue and Maryland. Floods greater than the 10-year event would be conveyed in the streets, providing a level of protection that exceeds the 10-year flood. This alternative includes the following individual alternative elements:

- Alternative 01 – 21st Avenue Storm Drain, Northern Ave. to Grand Canal (10-year design)
- Alternative 02 – Central Avenue Storm Drain, Arizona Canal to Bethany Home Rd. (2-year design)
- Alternative 03 – 3rd Avenue Storm Drain, Bethany Home Rd. to Grand Canal (10-year design)
- Alternative 05 – 15th Avenue Storm Drain, Butler Drive to Maryland Ave., with Storage at Palo Verde Golf Course and new storm drain laterals downstream of Palo Verde G.C.(10-year design)

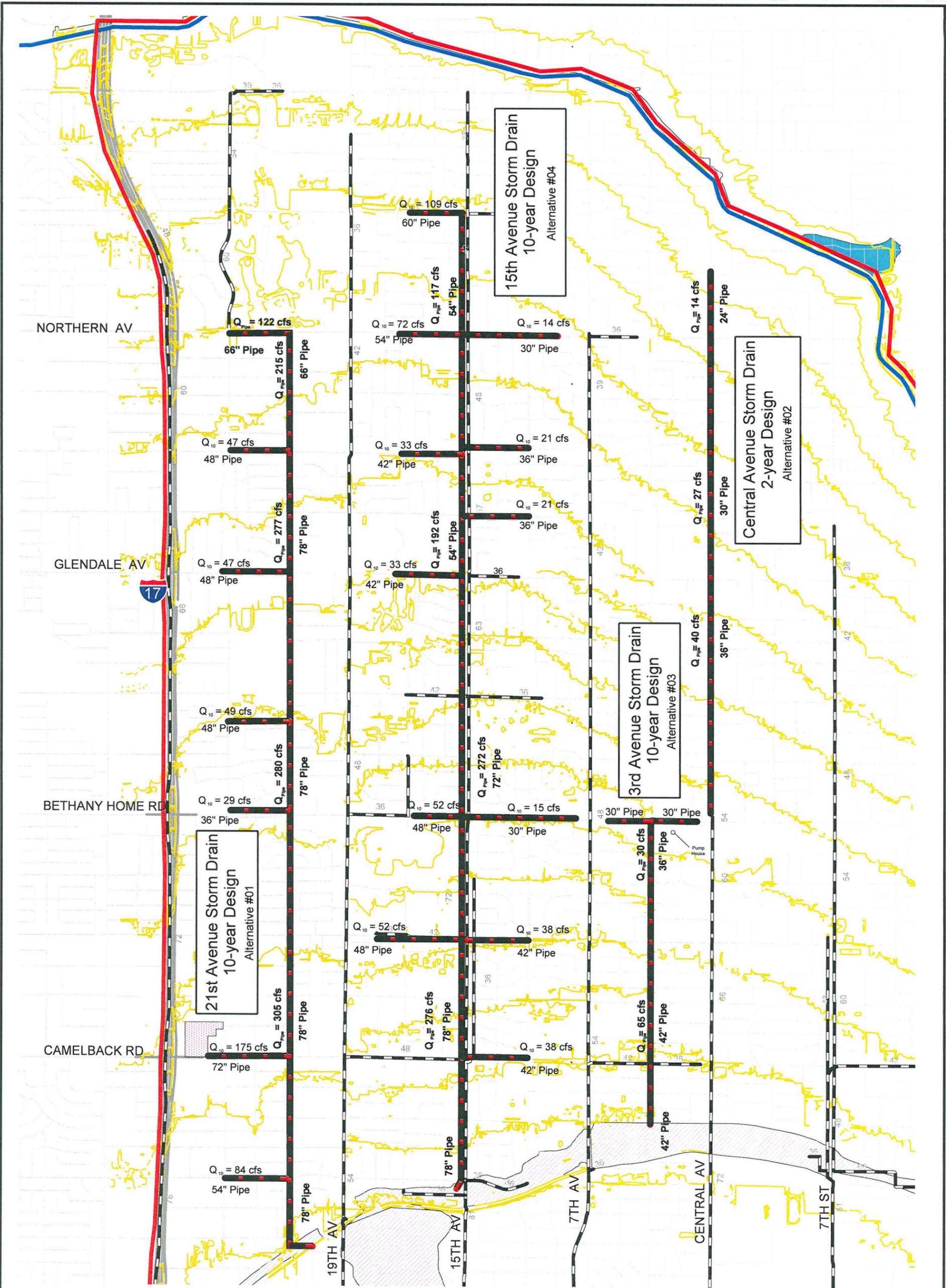
Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
1	New Storm Drain in 21st Avenue (10-year)	\$ 30,264,200.00
2	New Storm Drain Extension in Central Avenue (2-year)	\$ 6,847,100.00
3	New Storm Drain in 3rd Avenue (10-year)	\$ 5,759,700.00
5	15th Avenue Storm Drain and Storage in Palo Verde Golf Course	\$ 35,593,600.00
TOTAL		\$ 78,464,600.00

2.4 Floodproofing (See Exhibit 2.C)

This potential solution is to raise the floor elevations of the homes within the old Cave Creek floodplain that experience repetitive flooding. The number of homes that would receive floodproofing was estimated from the reported flood complaints documented in the Data Collection Report. Although this solution would protect low-lying homes from flooding, it would not prevent the disruption caused by street flooding nor would it prevent property flooding. This solution includes the following individual alternative elements:

- Alternative 06 – Floodproofing

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
6	Floodproofing (43 homes)	\$ 9,030,000.00
TOTAL		\$ 9,030,000.00



Metro Phoenix ADMP
Old Cave Creek Floodplain
Solution 2.2: 10-year Storm Drain System Without Storage

- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins
- Future Detention Basins (Planned with 24th Ave. and Camelback Rd. DCR)
- Proposed Retention Basins

- Pipe Dimensions (inches)**
- Existing Storm Drain
- Proposed Storm Drain (Metro ADMP)
- FEMA Flood Hazard Boundaries**
- Floodplain
- Floodway

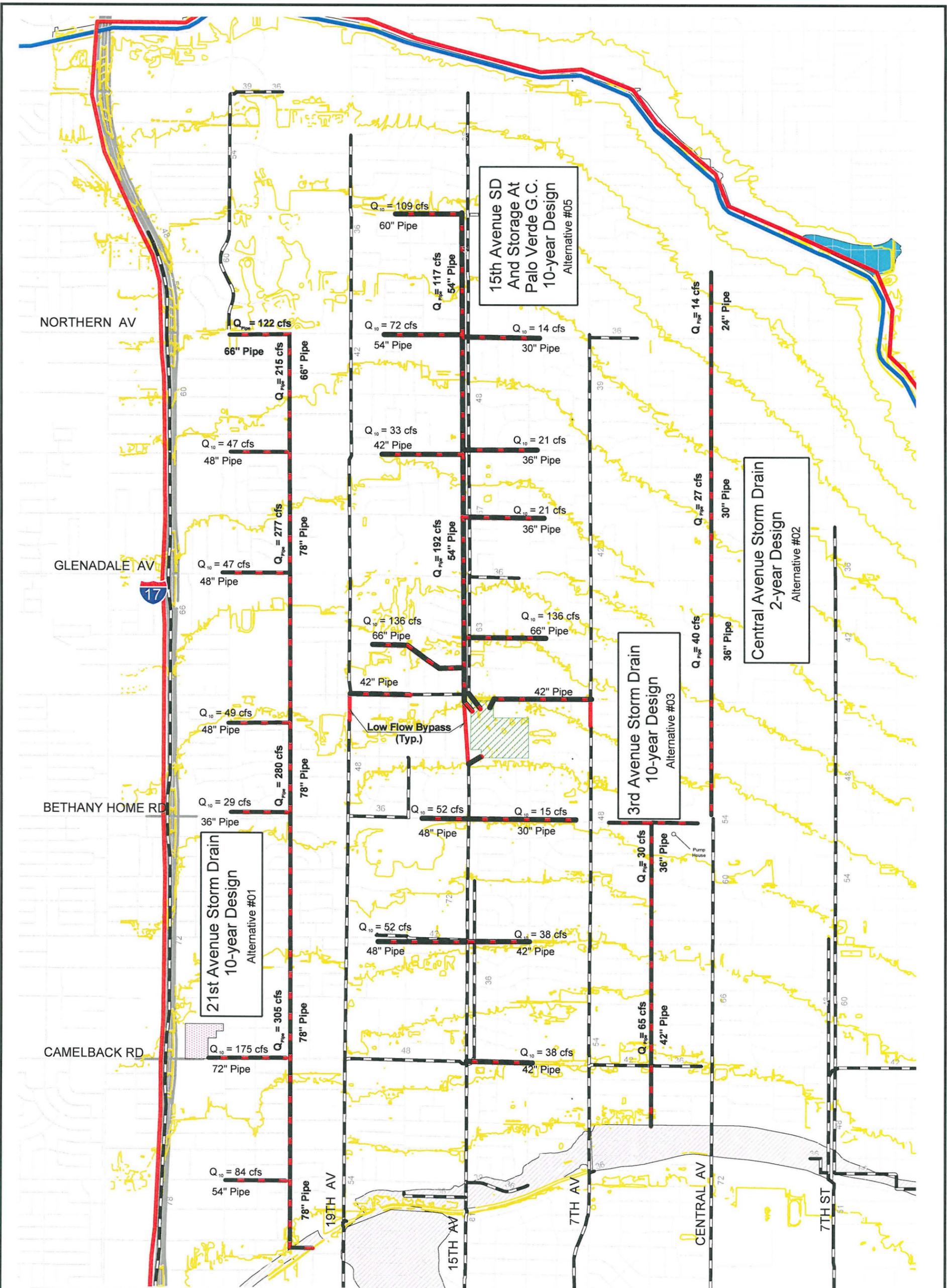
Exhibit 2.A
Alternatives #01-04



Scale: 1" = 2,000'
 C.I. = 10'



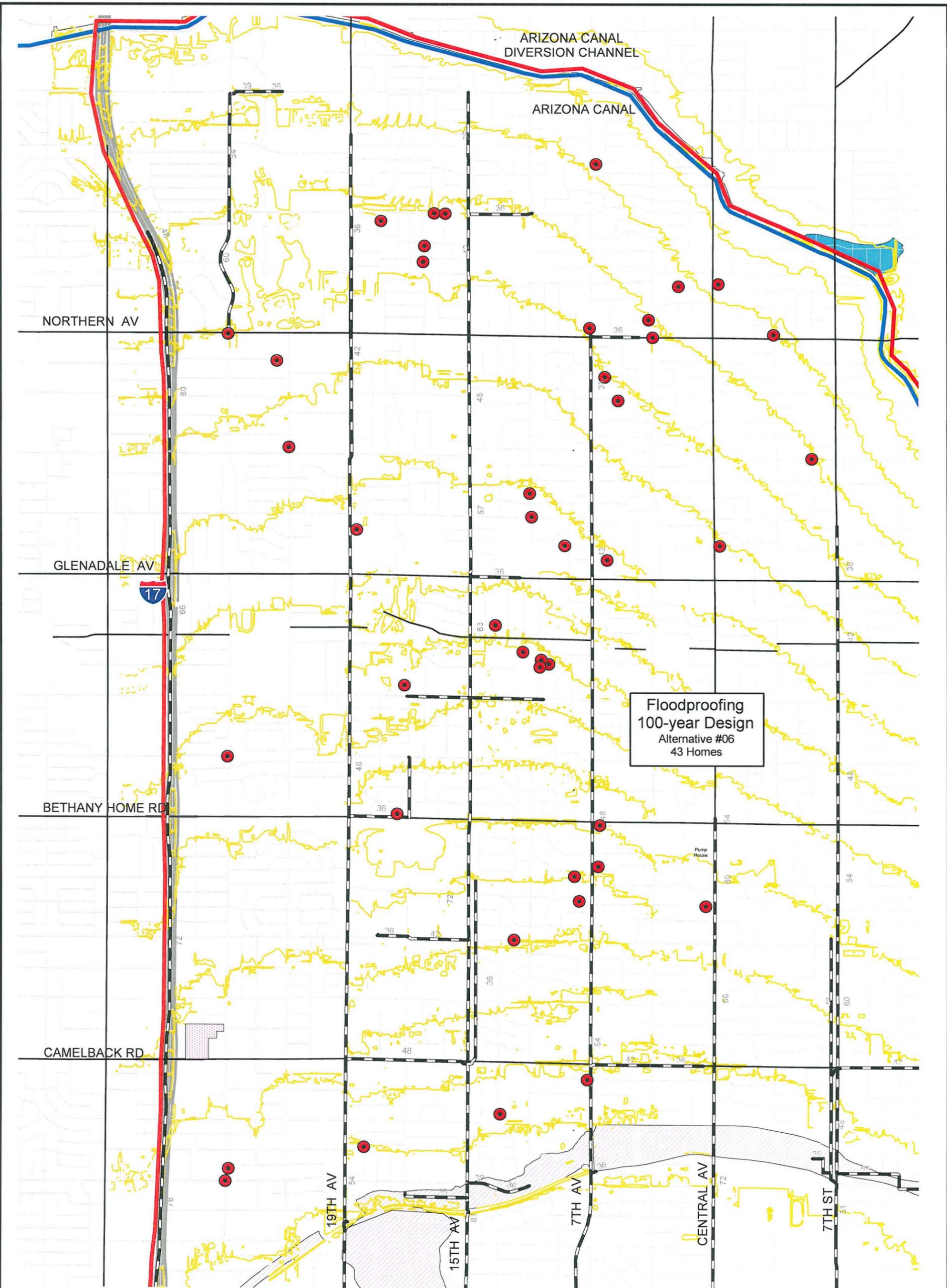
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Metro Phoenix ADMP
Old Cave Creek Floodplain
Solution 2.3: 10-year Storm Drain System With Storage

Exhibit 2.B
Alternatives #01-03, & 05

<ul style="list-style-type: none"> Study Area Boundary Major Streets Interstate / Highway Local Roads Railroad 	<ul style="list-style-type: none"> Drainage Tunnel Open Channel Arizona Canal Diversion Channel Retention Basins Future Detention Basins (Planned with 24th Ave. and Camelack Rd. DCR) Proposed Retention Basins 	<ul style="list-style-type: none"> Pipe Dimensions (inches) Existing Storm Drain Proposed Storm Drain (Metro ADMP) FEMA Flood Hazard Boundaries Floodplain Floodway 	 N Scale: 1" = 2,000' C.I. = 10'	 Engineering and Environmental Consultants, Inc. 3003 N. Central Ave Suite 600 Phoenix, Arizona 85012
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Metro Phoenix ADMP
Old Cave Creek Floodplain
Solution 2.4: Floodproofing Homes

Exhibit 2.C
Alternative #06

- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins
- Future Detention Basins (Planned with 24th Ave. and Camelack Rd. DCR)
- Proposed Retention Basins

- Pipe Dimensions (inches)**
- Existing Storm Drain
- Location of Homes That Experience Flooding
- FEMA Flood Hazard Boundaries**
- Floodplain
- Floodway

N
 Scale: 1" = 2,000'
 C.I. = 10'



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3.0 CAVE CREEK FLOODPLAIN (Grand Canal to I-10)

The Cave Creek floodplain area from the Grand Canal downstream to I-10 is approximately 6 square miles in size, which includes a significant amount of land area outside of the designated floodplain. The defined floodplain lies roughly between 19th Avenue and 15th Avenue, encompassing over 2000 homes and businesses. However, the Metro ADMP hydrologic model indicates that the risk of flooding outside of the floodplain limits is essentially the same as the flood risk within the floodplain. That is, the 100-year peak discharge that is conveyed within the floodplain between 19th Avenue and 15th Avenue is equivalent to the peak discharge in the other half mile wide conveyance corridors; including I-17 to 19th Ave., 15th Ave. to 7th Ave., and 7th Ave. to Central Ave. As is the case with the old Cave Creek floodplain area upstream of the Grand Canal, the flooding problems are primarily due to the topographic shape of the area which is a very wide, shallow channel. The rest of the Metro Phoenix study area is more characteristic of a sloping plain where runoff, that exceeds the conveyance capacity of the streets, flows overland as shallow sheet flow. In contrast, the topography of the Cave Creek floodplain area tends to concentrate runoff. Consequently, during times of heavy rainfall, runoff can exceed the capacity of the 2-year storm drain system and accumulate to significant depths, causing flood damage to those properties located in low-lying areas.

3.1 No Action

The no action alternative will result in no change to the existing floodplain boundaries which encompass thousands of properties, requiring owners to purchase flood insurance. In addition, shallow flooding in the area results in house flooding and causes disruption to vehicular traffic due to flooded streets. Some of the specific flood problems identified with this study include:

- Over 2000 homes and businesses located within the designated floodplain, requiring property owners to purchase flood insurance.
- Flooding of properties along the downstream side of Osborn Road (Osborn Road is very flat in the east west direction. The flat slope creates very little conveyance capacity in the street which results in flooding of the downstream properties once the street capacity is exceeded. This is a common problem throughout the Cave Creek floodplain area.)

Cost = \$0

3.2 10-year Storm Drain System without Storage (See Exhibit 3.A)

This potential solution is to increase the capacity of the existing 2-year storm drain system to a 10-year design for the area between I-17 and Central Avenue. It includes new storm drains in 19th Avenue, 15th Avenue, McDowell Road, and 3rd Avenue. Floods greater than the 10-year event would be conveyed in the streets, providing a level of protection that exceeds the 10-year flood. The following individual alternative elements make up this solution:

- Alternative 07 – 3rd Avenue Storm Drain, Grand Canal to I-10 (10-year design)
- Alternative 08 – McDowell Road Storm Drain, 19th Ave. to 9th Ave. (10-year design)
- Alternative 09 – 19th Avenue Storm Drain, Grand Canal to McDowell Rd. (10-year design)
- Alternative 10 – 15th Avenue Storm Drain, Grand Canal to McDowell Rd. (10-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
7	New Storm Drain in 3rd Avenue (10-year)	\$ 15,691,400.00
8	New Storm Drain in McDowell Road (10-year)	\$ 10,303,500.00
9	New Parallel Storm in 19th Avenue (10-year)	\$ 24,378,900.00
10	New Storm Drain in 15th Avenue (10-year)	\$ 32,326,600.00
TOTAL		\$ 82,700,400.00

3.3 10-year Storm Drain System with Storage at Encanto GC (See Exhibit 3.B)

This potential solution would increase the capacity of the existing 2-year storm drain system to a 10-year design for the area between I-17 and Central Avenue. It includes new storm drains in 18th Avenue, 15th Avenue, Thomas Road, and 3rd Avenue, as well as a new 10-year, 400 ac-ft storage basin within Encanto Golf Course at 15th Avenue and Thomas. Floods greater than the 10-year event would be conveyed in the streets, providing a level of protection that exceeds the 10-year flood. This solution includes the following individual alternative elements:

- Alternative 11 – Storage at Encanto Golf Course (10-year design)
- Alternative 12 – 18th Avenue Storm Drain, Grand Canal to Thomas Rd. (10-year design)
- Alternative 13 – Thomas Road Storm Drain, 24th Ave. to 18th Ave. (10-year design)
- Alternative 14 – 15th Avenue Storm Drain, Grand Canal to Thomas Rd. (10-year design)
- Alternative 15 – 3rd Avenue Storm Drain, Grand Canal to Thomas Rd. (10-year design)

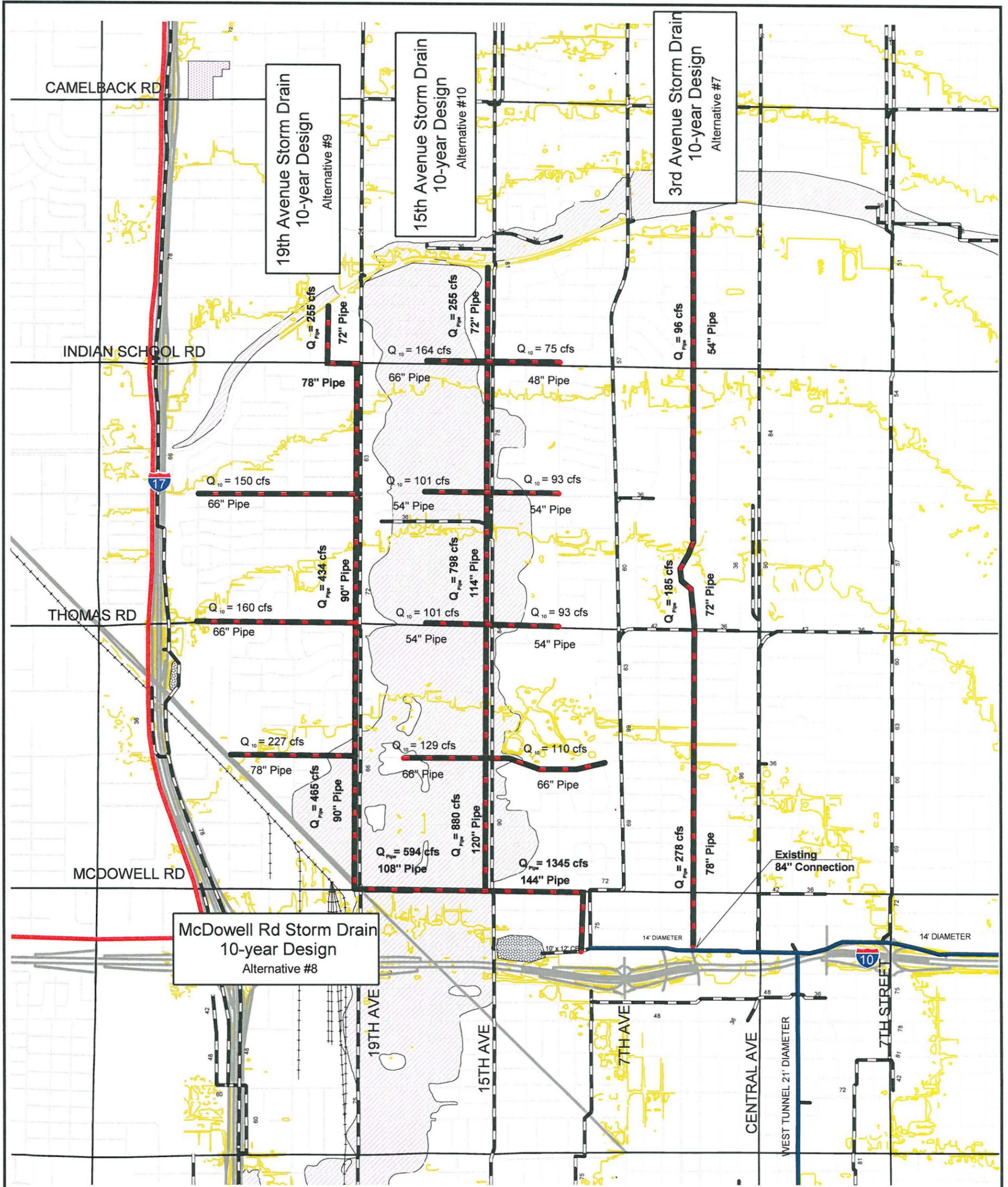
Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
11	Storage in Encanto Municipal Golf Course	\$ 22,545,900.00
12	New Storm Drain in 18th Avenue (10-year)	\$ 13,535,400.00
13	New Storm Drain in Thomas Road (10-year)	\$ 3,835,000.00
14	New Parallel Storm Drain in 15th Avenue (10-year)	\$ 18,821,600.00
15	New Storm Drain in 3rd Avenue (10-year)	\$ 11,538,700.00
TOTAL		\$ 70,276,600.00

3.4 10-year Storm Drain System with Storage at Fairgrounds (See Exhibit 3.C)

This potential solution would increase the capacity of the existing 2-year storm drain system to a 10-year design for the area between I-17 and Central Avenue. It includes new storm drains in 19th Avenue, 15th Avenue, 3rd Avenue, and Grand Avenue, as well as a new 10-year, 240 ac-ft storage basin within the Fairground property at 19th Avenue and McDowell. Floods greater than the 10-year event would be conveyed in the streets, providing a level of protection that exceeds the 10-year flood. This solution includes the following individual alternative elements:

- Alternative 07 – 3rd Avenue Storm Drain, Grand Canal to I-10 (10-year design)
- Alternative 16 – Storage at Fairgrounds (10-year design)
- Alternative 17 – 15th Avenue Storm Drain, Grand Canal to Encanto Blvd. (10-year design)
- Alternative 18 – 19th Avenue Storm Drain, Grand Canal to Encanto Blvd. (10-year design)
- Alternative 19 – Encanto Boulevard Storm Drain, 23rd Ave. to 19th Ave. (10-year design)
- Alternative 20 – Grand Avenue Storm Drain, 23rd Ave. to 19th Ave. (10-year Design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
16	Storage at Veterans Memorial Coliseum/Arizona State Fairgrounds	\$ 64,258,700.00
17	New Parallel Storm Drain in 15th Avenue (10-year)	\$ 35,455,000.00
18	New Storm Drain in 19th Avenue (10-year)	\$ 11,196,800.00
19	New Storm Drain in Encanto Boulevard (10-year)	\$ 3,098,400.00
20	New Storm Drain in Grand Avenue (10-year)	\$ 3,098,400.00
TOTAL		\$ 117,107,300.00



Metro Phoenix ADMP
Cave Creek Floodplain (Grand Canal to I-10)
Solution 3.2: 10-year Storm Drain System Without Storage

Exhibit 3.A
Alternative #7-10

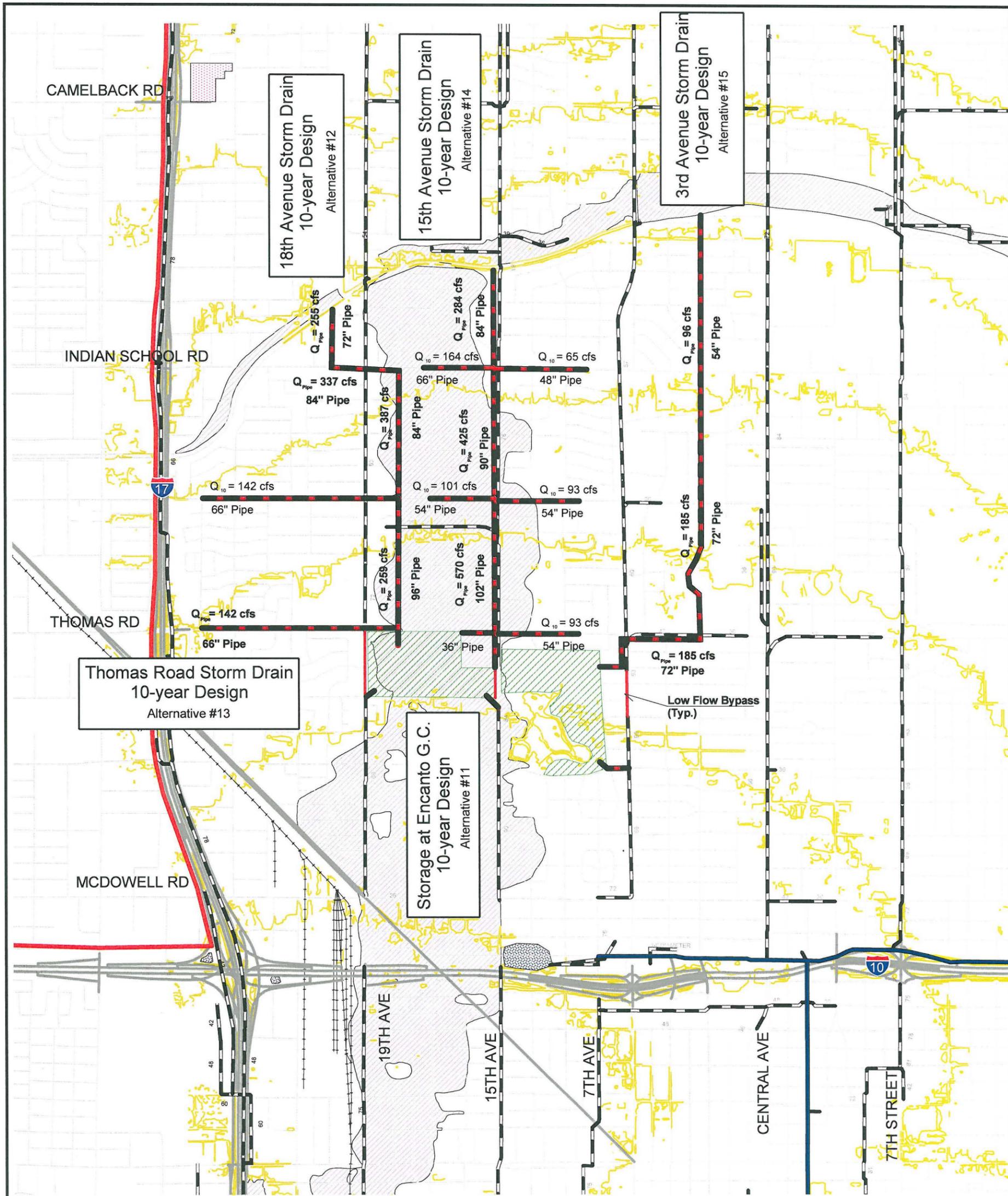
- | | | | |
|----------------------|---------------------------|--------------------------------------|------------------------------|
| Study Area Boundary | Drainage Tunnel | Existing Storm Drain | FEMA Flood Hazard Boundaries |
| Major Streets | Open Channel | Future Storm Drain (COP 5-year Plan) | Floodplain |
| Interstate / Highway | Retention Basins | Proposed Storm Drain (Metro ADMP) | Floodway |
| Local Roads | Proposed Retention Basins | | |
| Railroad | | | |



Scale: 1" = 2,000'
 C.I. = 10'



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Metro Phoenix ADMP
Cave Creek Floodplain (Grand Canal to I-10)
Solution 3.3: 10-year Storm Drain System
With Storage at Encanto Golf Course

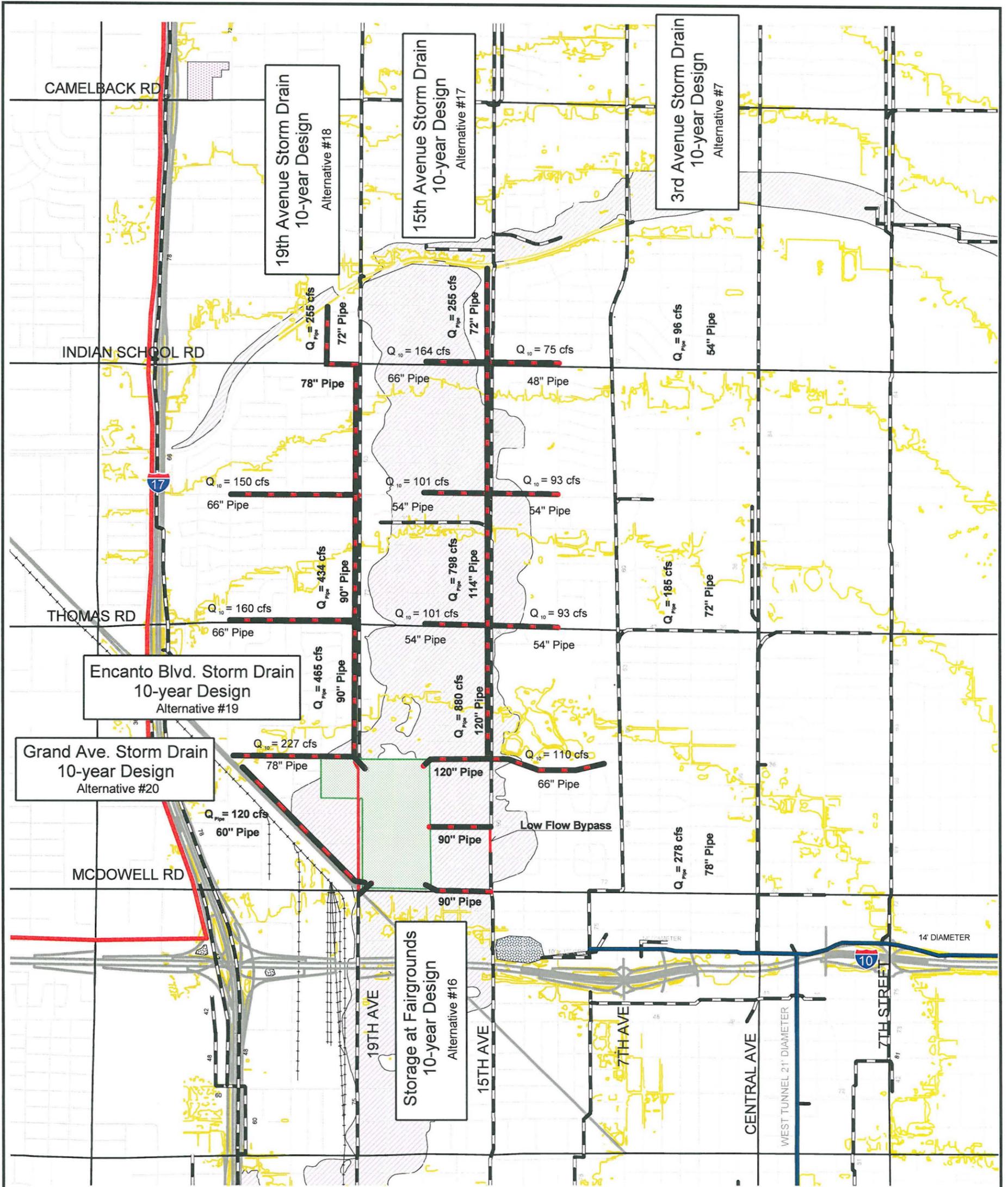
Exhibit 3.B
Alternative #11-15

- | | | | |
|----------------------|---------------------------|---------------------------------------|------------------------------|
| Study Area Boundary | Drainage Tunnel | Existing Storm Drain | FEMA Flood Hazard Boundaries |
| Major Streets | Open Channel | Future Storm Drain (COP 5-year Plan) | Floodplain |
| Interstate / Highway | Retention Basins | Proposed Storm Drain (Metro ADMP) | Floodway |
| Local Roads | Proposed Retention Basins | Proposed Low Flow Bypass (Metro ADMP) | |
| Railroad | | | |

N
 Scale: 1" = 2,000'
 C.I. = 10'



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Metro Phoenix ADMP

**Cave Creek Floodplain (Grand Canal to I-10)
Solution 3.4: 10-year Storm Drain System
With Storage at Fairgrounds**

**Exhibit 3.C
Alternative #07, 16-20**



- | | | | |
|----------------------|---------------------------|--------------------------------------|------------------------------|
| Study Area Boundary | Drainage Tunnel | Pipe Dimensions (inches) | FEMA Flood Hazard Boundaries |
| Major Streets | Open Channel | Existing Storm Drain | Floodplain |
| Interstate / Highway | Retention Basins | Future Storm Drain (COP 5-year Plan) | Floodway |
| Local Roads | Proposed Retention Basins | Proposed Storm Drain (Metro ADMP) | |
| Railroad | | | |



Scale: 1" = 2,000'
C.I. = 10'



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4.0 GRAND CANAL FLOODPLAIN (I-17 to 24th Street)

The banks of the Grand Canal are elevated about 1 to 3 feet above the surrounding ground, resulting in a shallow floodplain along its upstream side. 530 homes are located within the floodplain along with a number of businesses and apartment buildings. Some areas within the floodplain experience flooding on a much more frequent basis than others, such as the neighborhood located between 3rd Street and 12th Street. This area has been flooded twice within the past year, whereas other areas behind the Canal haven't flooded for decades. Nonetheless, the entire area that lies below the elevation of the Canal bank is susceptible to flooding. Moreover, the flooding can be caused by storms much smaller than the 100-year event because the problem is a result of the elevated Canal embankment. That is, once the capacity of the 2-year storm drain system becomes overtaxed, excess runoff backs up behind the Canal and causes flooding of homes and businesses.

4.1 No Action

The no action alternative will not eliminate the existing floodplain nor will it alleviate the frequent flooding problems experienced by some of the neighborhoods located along the Canal. However, if the 10-year storm drain system is installed upstream of the Canal (refer to solutions described in Section 1.0), the frequency of flooding will be substantially reduced. Some of the specific flood problems identified with this study include:

- Over 500 homes and businesses are located within the designated floodplain, requiring property owners to purchase flood insurance.
- The neighborhood between 3rd Street and 12th Street has flooded repeatedly over the past several years.

Cost = \$0

4.2 Buyout Homes and Resell Lots in Floodplain (See Exhibit 4.A)

This potential solution is to buyout the single-family homes that are located within the floodplain and re-sell the lots. The buyers would construct new homes that would be elevated above the Canal bank. This solution would protect the homes from flooding, but the businesses would still be susceptible to flooding. However, if the upstream 10-year storm drain system is installed, their chance of flooding would be greatly reduced. This solution includes the following individual alternative element.

- Alternative 21 – Buyout Homes and Re-sell Lots (100-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
21	Buyout Homes and Resell Lots in Floodplain (531 homes)	\$ 104,410,600.00
TOTAL		\$ 104,410,600.00

4.3 Buyout Homes and Create Linear Park with Storage Basins (See Exhibit 4.B)

This potential solution is to buyout the existing single-family homes that are located within the floodplain, demolish the homes and turn the property into floodwater storage basins. The combined area is about 155 acres which could provide approximately 700 acre-feet of storage. This is a substantial volume which, when combined with the existing storm drain system, could probably store enough runoff to contain the 10-year flood. And, since the homes would be removed from the floodplain, floods greater than the 10-year flood would simply spill over the Canal without causing upstream flooding. Some businesses would still be susceptible to flooding, but the 10-year storage system would greatly reduce the chance of flooding. The basins would be developed into parks/open space and connected by a trail system running along the Canal, creating a 4.5 mile long linear park along the Canal. This solution includes the following individual alternative element.

- Alternative 22 – Storage Basins and Linear Park (100-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
22	Buyout Homes and Create Linear Park in Floodplain	\$ 210,228,300.00
TOTAL		\$ 210,228,300.00

4.4 100-year Collection System in Canal North Neighborhood (See Exhibit 4.C)

This potential solution is a 100-year storm drain system to protect the neighborhood that lies between 3rd Street and 12th Street. It includes a new 102" storm drain in 7th Street from the Canal to the I-10 tunnel system. This solution includes the following individual alternative element.

- Alternative 23 – 100-year Storm Drain, Grand Canal to I-10 (100-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
23	100-year Collection System in Canal North Neighborhood	\$ 20,674,000.00
TOTAL		\$ 20,674,000.00

Metro Phoenix ADMP
Grand Canal
Solution 4.2: Storage Basins
And Linear Park

Exhibit 4.A
Alternative #21

-  Study Area Boundary
-  Major Streets
-  Interstate
-  Freeways
-  Local Roads
-  Railroad
-  Index Contours
-  Arizona Canal
-  Diversion Channel
-  Existing Storm Drain
-  Proposed Storm Drain (Metro ADMP)
-  Proposed Retention Basin
-  FEMA Flood Hazard Boundaries
-  Floodplain
-  Floodway



Scale: 1" = 2,000'
 C.I. = 10'



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Storage Basins
And Linear Park
 Alternative #21
 531 Homes

Group 4
 116 Homes

Group 5
 35 Homes

Group 6
 78 Homes

Group 7
 27 Homes

Group 8
 27 Homes

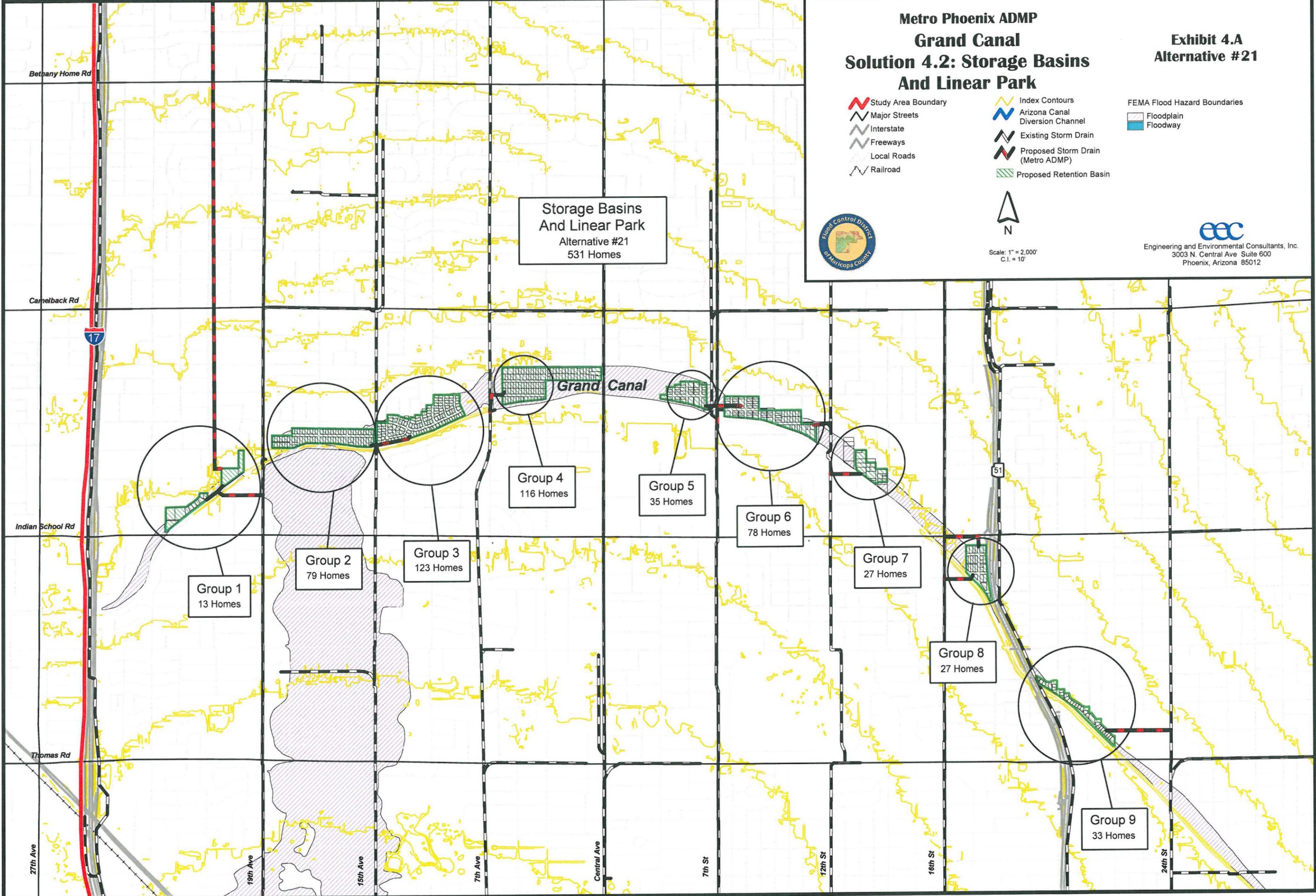
Group 9
 33 Homes

Group 1
 13 Homes

Group 2
 79 Homes

Group 3
 123 Homes

Grand Canal



Metro Phoenix ADMP
Grand Canal
Solution 4.3: Buy-Out Homes

Exhibit 4.B
Alternative #22

-  Study Area Boundary
-  Major Streets
-  Interstate
-  Freeways
-  Local Roads
-  Railroad
-  Index Contours
-  Arizona Canal Diversion Channel
-  Existing Storm Drain
-  Proposed Storm Drain (Metro ADMP)

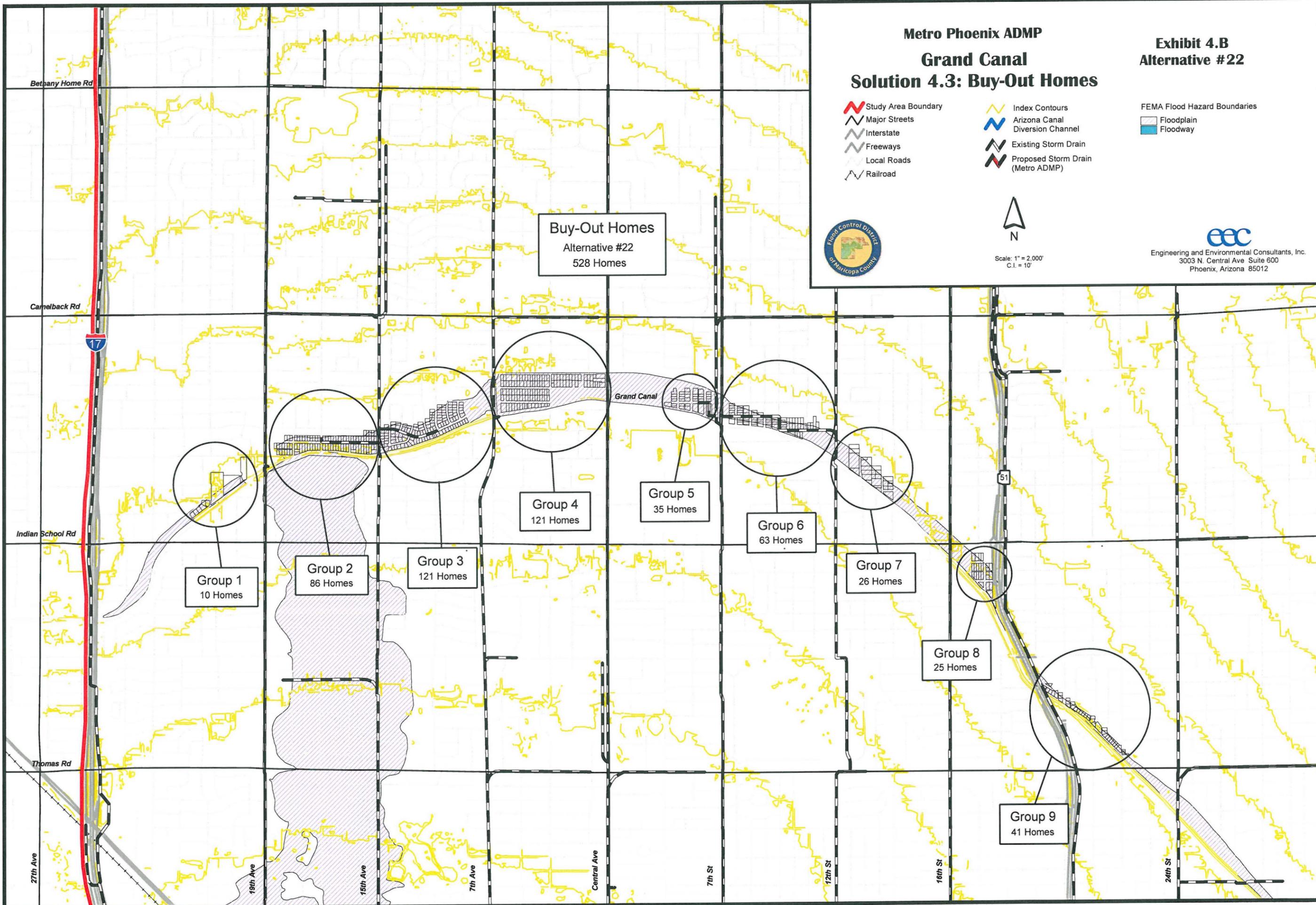
- FEMA Flood Hazard Boundaries
-  Floodplain
 -  Floodway



Scale: 1" = 2,000'
 C.I. = 10'



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**Metro Phoenix ADMP
Grand Canal
Solution 4.4:
100-year Storm Drain**

**Exhibit 4.C
Alternative #23**

- | | | | |
|---------------------|-----------------------------------|---------------|------------------------------|
| Study Area Boundary | Index Contours | Arizona Canal | FEMA Flood Hazard Boundaries |
| Major Streets | Diversion Channel | Floodplain | Floodway |
| Interstate | Existing Storm Drain | | |
| Freeways | Proposed Storm Drain (Metro ADMP) | | |
| Local Roads | Proposed Retention Basin | | |
| Railroad | | | |

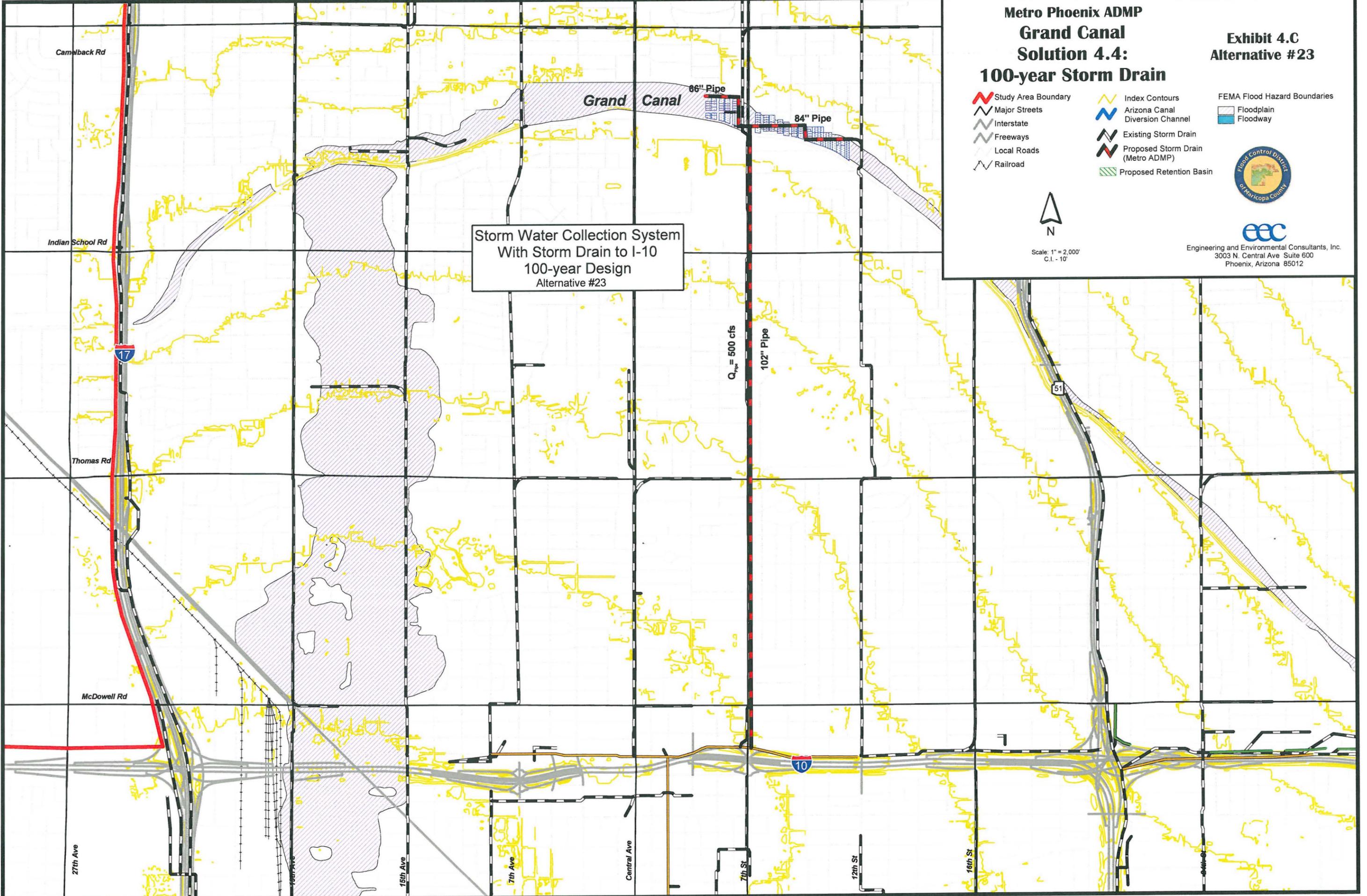


Scale: 1" = 2,000'
C.I. - 10'



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**Storm Water Collection System
With Storm Drain to I-10
100-year Design
Alternative #23**



5.0 DOWNTOWN AREA

For purposes of this study, the Downtown Area is defined as the 7.8 square mile region bounded by 19th Ave. on the west, I-10 on the north and east, and I-17 on the south. I-10 is a drainage divide for the Downtown Area; capturing upstream runoff and conveying it to the Salt River, but the local watershed still generates relatively high rates of runoff due to the level of development and lack of pervious areas. Surface flows run east to west through the Downtown area, with the highest concentrations of runoff occurring along Fillmore Street, the Union Pacific Railroad, Buckeye Road, and I-17. The hydrologic model predicts that these concentrations of runoff range from 100cfs to over 1200cfs for the 100-year flood, indicating a significant flood hazard. The flooding problems are exasperated by the fact that many of the storm water catch basins are dysfunctional drywells that leave standing water after the storms have passed. In addition, even though 2-year storm drains exist on half-mile intervals, many of the inlets in the Downtown area seem inadequate to capture the runoff from a 2-year storm.

5.1 No Action

The no action alternative will result in no change to the existing flooding problems in the Downtown area which encompasses the offices of State, County and City government, as well as ASU's Downtown Campus, numerous high-rise commercial office buildings, the Baseball stadium, and the Basketball arena. The no action alternative leaves this center of government and commerce susceptible to building flooding and traffic disruption. Some specific flooding issues include:

- Stantec Consulting estimated that as many as 139 buildings would be inundated by the 100-year flood along the Light Rail route between McDowell Road and 27th Street (taken from Light Rail Transit Project, Drainage Report, dated Jan. 2005),
- There are numerous locations where water stands for long period of times because the catch basins are dysfunctional drywells,
- The storm of August 2005 resulted in traffic disruption and flooded buildings.

Cost = \$0

5.2 10-year Storm Drain between I-10 and Union Pacific Railroad Tracks (See Exhibit 5.A)

This potential solution is to increase the level of protection provided by the storm drain system to a 10-year design, but it only covers the portion of the Downtown area that lies north of the Union Pacific Railroad Tracks. It was found that this northern portion of the downtown area, which represents about half of the total area, could be protected from the 10-year flood by simply supplementing the existing storm drains. That is, this solution does not require any new outfall pipes to the Salt River. It is based on the assumption, however, that the upstream flows in the 15th Avenue and 19th Avenue storm drains will be stored and/or diverted upstream of I-10, leaving the capacity of those pipes to collect runoff in the Downtown Area. This solution takes advantage of the Tunnel connections at Fillmore, Grant and Tonto Streets that were built by ADOT, at the City's request, during construction of the Tunnel. It also takes advantage of the excess capacity in the City's storm drains that was created when the construction of I-10 diverted upstream flows, this includes the storm drains in 16th Street, 3rd Street and 11th Avenue. The following individual alternative elements make up this solution:

- Alternative 24 – Add inlets to the 16th Street Storm Drain, I-10 to Railroad (10-year design)
- Alternative 25 - Fillmore Street (East) Storm Drain, 13th St. to West Tunnel (10-year design)
- Alternative 26 – 9th Street Storm Drain, Van Buren to Grant (10-year design)
- Alternative 27 – Fillmore Street (West) Storm Drain, Central Ave. to 9th Ave. (10-year design)
- Alternative 28 – 3rd Avenue Storm Drain, Van Buren St. to Tonto St. (10-year design)
- Alternative 29 - Add inlets to the 15th Ave. Storm Drain, I-10 to Railroad (10-year design)
- Alternative 30 - Add inlets to the 19th Ave. Storm Drain, I-10 to Railroad (10-year design)

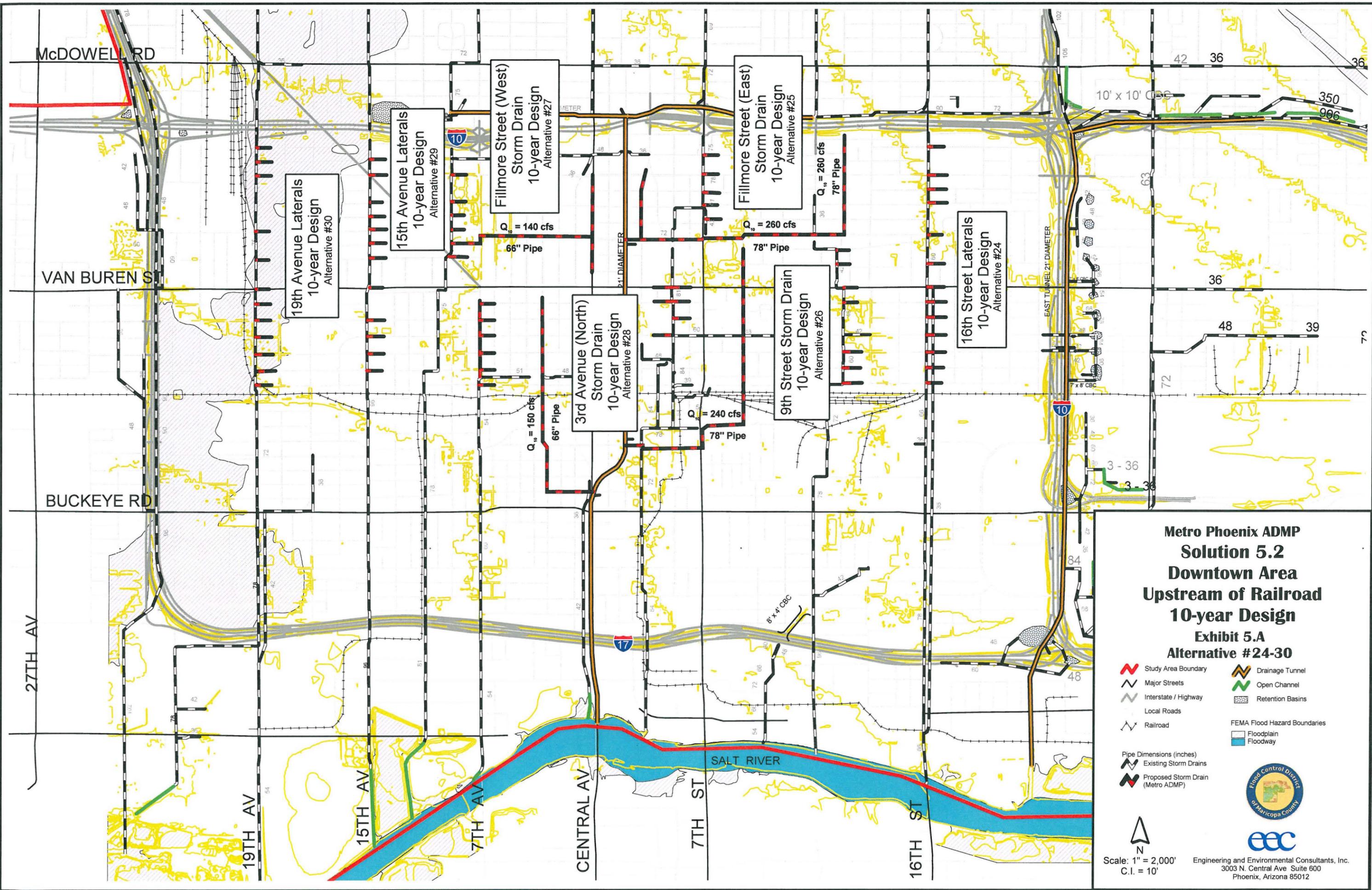
Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
24	Modifications to 16th Street Storm Drain	\$ 856,100.00
25	Fillmore Street (East) Storm Drain	\$ 9,585,300.00
26	9th Street Storm Drain	\$ 9,165,500.00
27	Fillmore Street (West) Storm Drain	\$ 6,007,900.00
28	3rd Avenue (North) Storm Drain	\$ 6,368,800.00
29	Modifications to 15th Avenue Storm Drain	\$ 790,300.00
30	Modifications to 19th Avenue Storm Drain	\$ 790,300.00
TOTAL		\$ 33,564,200.00

5.3 10-year Storm Drain between I-10 and I-17 (See Exhibit 5.B)

This potential solution is similar to solution 4.2 described above, except that it covers the entire Downtown Area. It includes all of the alternative elements of 4.2 plus two new storm drains that outfall to the Salt River; located in 7th Street and 7th Avenue. It also includes an additional storm drain connection to the West Tunnel; located on the upstream side of I-17. As is the case with solution 4.2, it is based on the assumption that the upstream flows in the 15th Avenue and 19th Avenue storm drains will be stored and/or diverted upstream of I-10, leaving the capacity of those pipes to collect runoff in the Downtown Area. The following individual alternative elements make up this solution:

- Alternative 24 – Add inlets to the 16th Street Storm Drain, I-10 to Railroad (10-year design)
- Alternative 25 - Fillmore Street (East) Storm Drain, 13th St. to West Tunnel (10-year design)
- Alternative 26 – 9th Street Storm Drain, Van Buren to Grant (10-year design)
- Alternative 27 – Fillmore Street (West) Storm Drain, Central Ave. to 9th Ave. (10-year design)
- Alternative 28 – 3rd Avenue Storm Drain, Van Buren St. to Tonto St. (10-year design)
- Alternative 29 - Add inlets to the 15th Ave. Storm Drain, I-10 to Railroad (10-year design)
- Alternative 30 - Add inlets to the 19th Ave. Storm Drain, I-10 to Railroad (10-year design)
- Alternative 31 – 7th Street Storm Drain, Sherman St. to Salt River (10-year design)
- Alternative 32 – 3rd Avenue (South) Storm Drain, Buckeye Rd. to I-17 (10-year design)
- Alternative 33 – 7th Avenue Storm Drain, Grant St. to Salt River (10-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
24	Modifications to 16th Street Storm Drain	\$ 856,100.00
25	Fillmore Street (East) Storm Drain	\$ 9,585,300.00
26	9th Street Storm Drain	\$ 9,165,500.00
27	Fillmore Street (West) Storm Drain	\$ 6,007,900.00
28	3rd Avenue (North) Storm Drain	\$ 6,368,800.00
29	Modifications to 15th Avenue Storm Drain	\$ 790,300.00
30	Modifications to 19th Avenue Storm Drain	\$ 790,300.00
31	7th Street Storm Drain	\$ 6,215,000.00
32	3rd avenue (South) Storm Drain	\$ 3,964,100.00
33	7th Avenue Storm Drain	\$ 7,468,800.00
TOTAL		\$ 51,212,100.00



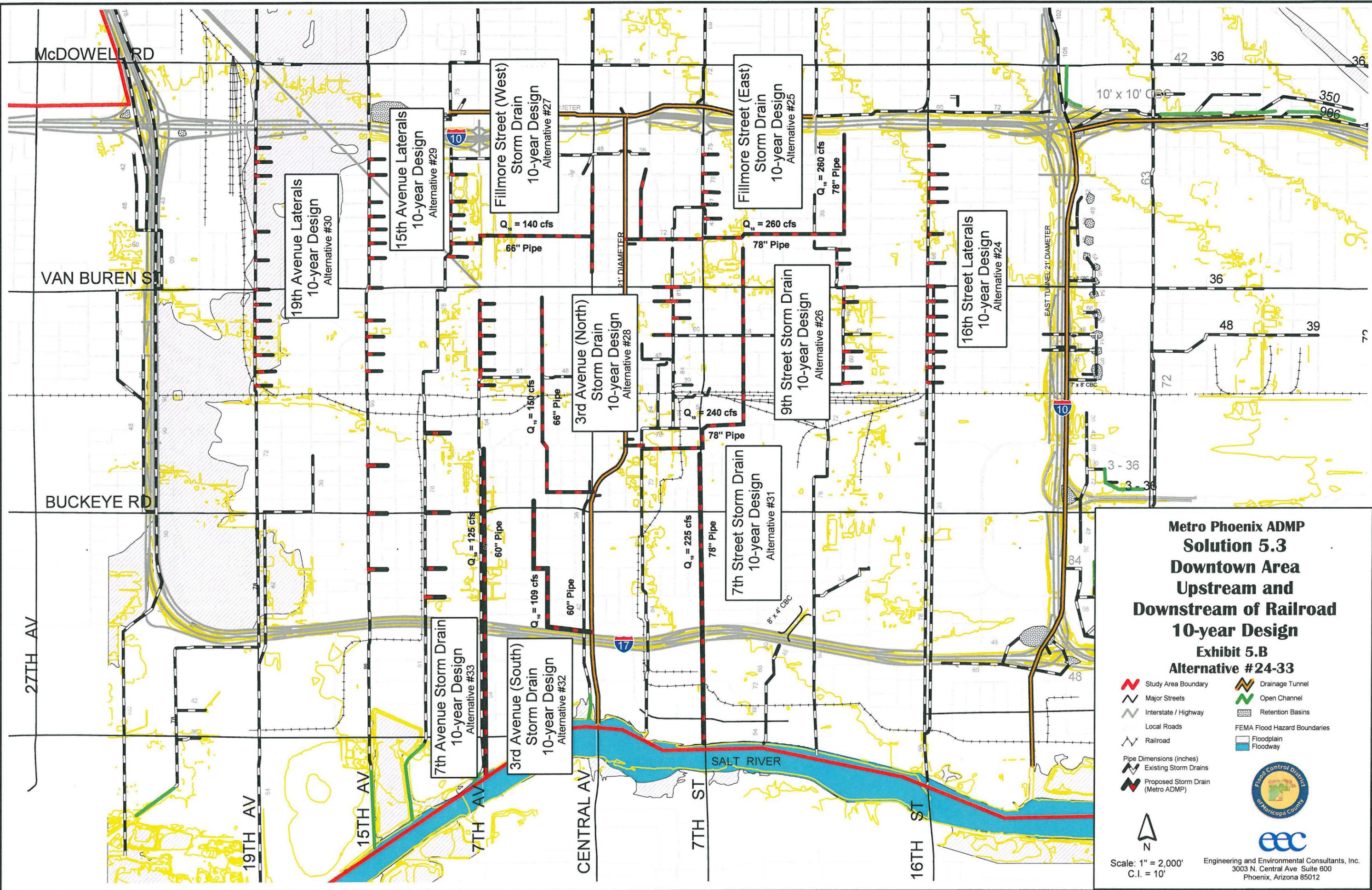
**Metro Phoenix ADMP
Solution 5.2
Downtown Area
Upstream of Railroad
10-year Design
Exhibit 5.A
Alternative #24-30**

- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Retention Basins
- FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

Pipe Dimensions (inches)
 Existing Storm Drains
 Proposed Storm Drain (Metro ADMP)

Scale: 1" = 2,000'
 C.I. = 10'

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**Metro Phoenix ADMP
Solution 5.3
Downtown Area
Upstream and
Downstream of Railroad
10-year Design
Exhibit 5.B
Alternative #24-33**

- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Pipe Dimensions (inches)
- Existing Storm Drains
- Proposed Storm Drain (Metro ADMP)
- Drainage Tunnel
- Open Channel
- Retention Basins
- FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

Scale: 1" = 2,000'
C.I. = 10'




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6.0 DURANGO CURVE AREA

At Durango Street, the 90 degree curve in the I-17 Freeway is on an elevated embankment which impounds floodwaters to a depth of about 3 feet, according to the effective floodplain map and verified with the Metro Phoenix hydrologic model. The flooded area is about 1/2 square mile in size and includes about 670 homes and businesses along the east side of I-17, from the Freeway curve upstream to the Union Pacific Railroad. The contributing watershed to the Durango Curve area extends all the way up to the ACDC. Storm water runoff from the watershed, that exceeds the existing storm drain system, concentrates along the north side of the Union Pacific Railroad and is diverted into I-17, filling the depressed part of the highway north of the curve. Since the existing storm drain system is designed to convey the 2-year flood, storms exceeding the 2-year event can cause this problem of floodwater spilling into I-17. Once the storage volume of I-17 is exceeded, floodwaters spill over the east side of I-17, flooding the area in the northeast quadrant of the curve. This occurs because the west bank of the depressed freeway is higher than the east bank, which results in the spill to the east. This flooding problem not only impacts homes and businesses, but can also flood I-17, making the Freeway impassable on a fairly frequent basis.

6.1 No Action

The no action alternative will result in no change to the existing floodplain boundaries which encompass hundreds of properties, requiring owners to purchase flood insurance. In addition, flooding in the area results in house flooding and causes disruption to vehicular traffic due to flooded streets. Some of the specific flood problems identified with this study include:

- The depressed section of I-17 becomes flooded and impassable on a fairly frequent basis.
- Over 670 homes and businesses located within the designated floodplain, requiring property owners to purchase flood insurance.
- Properties south of Buckeye Road and west of 19th Avenue are susceptible to flooding up to 3-ft in depth since they lie in the upstream floodpool of the Durango Curve Area.

Cost = \$0

6.2 100-year Collection System without Storage (See Exhibit 6.A)

This potential solution is for a new storm drain system that would intercept and convey stormwater from the Durango Curve area while preventing I-17 from flooding. This 100-year system is based on the assumption that new 10-year systems are located upstream within both the Cave Creek Floodplain area and the Downtown area. New storm drains would be located in the I-17 frontage road and in Durango Street. The combined inflow will discharge into a new outlet pipe that follows Durango Street west to 27th Avenue and then 27th Avenue south to the Salt River. The following individual alternative elements make up this solution:

- Alternative 36 – 100-year Collection System without Storage

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
36	New Conveyance System from Durango Curve to Salt River	\$ 103,335,100.00
TOTAL		\$ 103,335,100.00

6.3 100-year Collection System with Single Storage Basin (See Exhibit 6.B)

This potential solution is for a new storm drain system to intercept and convey stormwater runoff and discharge that runoff into a new storage basin located in the Durango Curve area. The basin and storm drains are sized for the 100-year event assuming that there is a new 10-year system in place upstream. New storm drains would be located in the I-17 frontage road, Pima Street, and in Durango Street. A metered outflow of 400 cfs will be conveyed in a new storm drain, from the storage basin, west in Durango Street to 27th Avenue and then south in 27th Avenue to the Salt River. The following individual alternative elements make up this solution:

- Alternative 34 – 100-year Design with Storage Basin

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
34	New Storage Basin at Durango Curve with Conveyance to Salt River	\$ 76,874,700.00
TOTAL		\$ 76,874,700.00

6.4 100-year Collection System with Multiple Storage Basins (See Exhibit 6.C)

This potential solution is for a new storm drain system to intercept and convey stormwater runoff and discharge that runoff into two new storage basins located in the Durango Curve area. The basins and storm drains are sized for the 100-year event assuming that there is a new 10-year system in place upstream. The first storage basin would be located within the existing floodplain north of the Union Pacific Railroad and adjacent to I-17. This basin would collect the 100-year flood and meter out 200 cfs to a new storm drain in the I-17 frontage road that would convey the runoff to the 2nd storage basin located in the Durango Curve area. Additional new storm drains would be located in Pima Street and in Durango Street. A metered outflow of 400 cfs would be conveyed, from the 2nd storage basin, within a new storm drain west in Durango Street to 27th Avenue and then south in 27th Avenue to the Salt River. The following individual alternative elements make up this solution:

- Alternative 35 – 100-year Collection System with Multiple Storage Basins

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
35	Multiple Storage Basins with Conveyance to Salt River	\$ 100,497,700.00
TOTAL		\$ 100,497,700.00

Collection System with
Conveyance to Salt River
100-year Design
Alternative #36

BUCKEYE RD

27TH AVE

DURANGO ST

WSE₁₀₀ = 1038.2

102

78

36

19TH AV

54

15TH AV

$Q_{Pipe} = 490$ cfs
10' x 6' CBC

$Q_{Pipe} = 980$ cfs
12' x 8' CBC

$Q_{Pipe} = 1470$ cfs
12' x 10' CBC

$Q_{Pipe} = 490$ cfs
10' x 6' CBC

$Q_{Pipe} = 1960$ cfs
2 - 12' x 8' CBC's

$Q_{Pipe} = 100$ cfs
54" Pipe

$Q_{Pipe} = 2060$ cfs
2 - 12' x 8' CBC's

$Q_{Pipe} = 95$ cfs
54" Pipe

$Q_{Pipe} = 2155$ cfs
2 - 12' x 8' CBC's

$Q_{Pipe} = 260$ cfs
78" Pipe

$Q_{Pipe} = 520$ cfs
10' x 6' CBC

$Q_{Pipe} = 65$ cfs
8 - 48" Pipe

$Q_{Pipe} = 2831$ cfs
2 - 12' x 10' CBC's

$Q_{Pipe} = 715$ cfs
10' x 8' CBC

$Q_{Pipe} = 570$ cfs
10' x 6' CBC

$Q_{Pipe} = 260$ cfs
78" Pipe

$Q_{Pipe} = 80$ cfs
54" Pipe

- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad

- Drainage Tunnel
- Open Channel
- Retention Basins
- Proposed Retention Basins

- Pipe Dimensions (inches)**
- Existing Storm Drains
- Proposed Storm Drain (Metro ADMP)

- FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

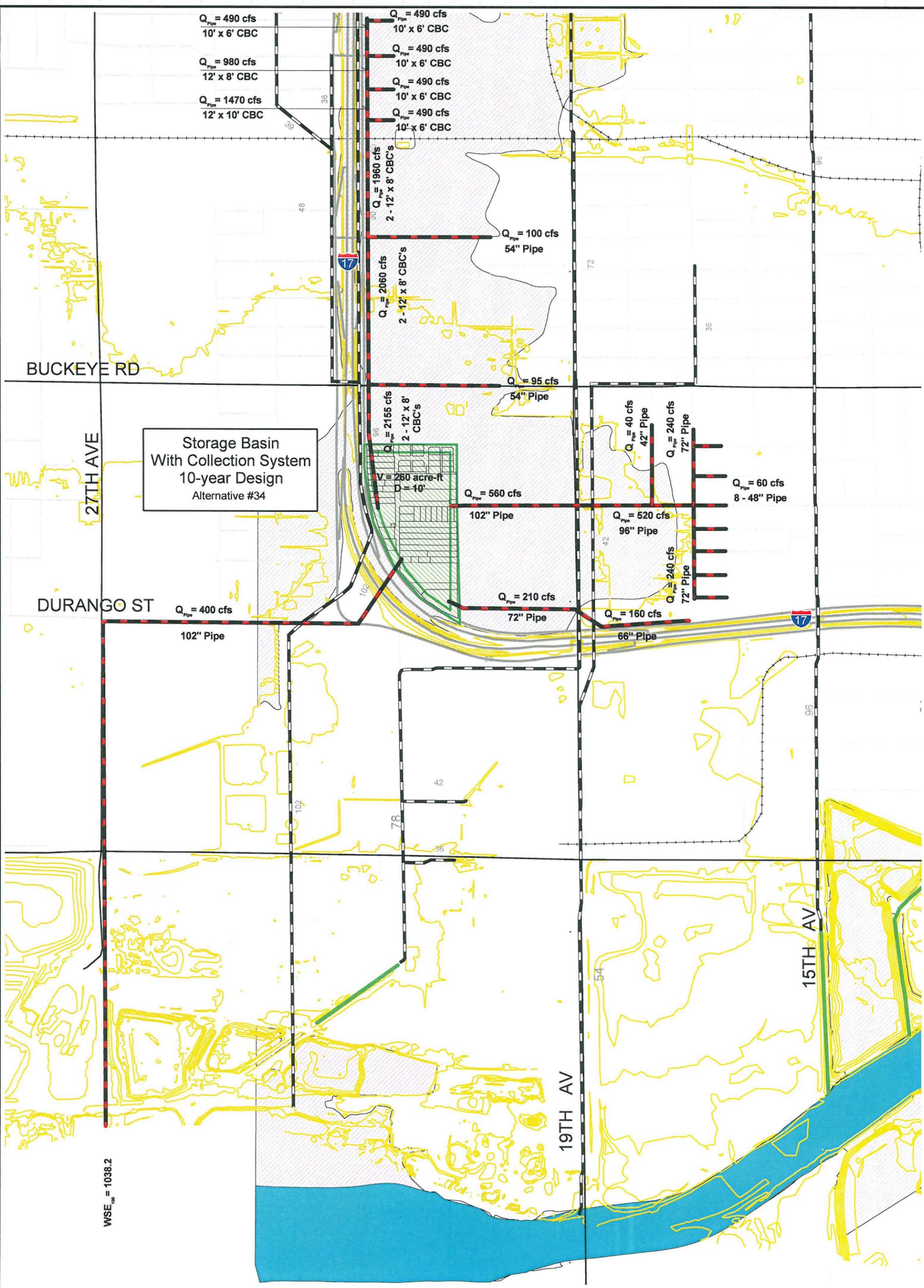
Solution 6.2: 100-year Collection System w/out Storage

**Exhibit 6.A
Alternative #36**

Scale: 1" = 1,000'
C.I. = 10'



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Storage Basin
With Collection System
10-year Design
Alternative #34

**Metro Phoenix ADMP
Durango Curve
Solution 6.3: 10-year Design With Storage Basin**

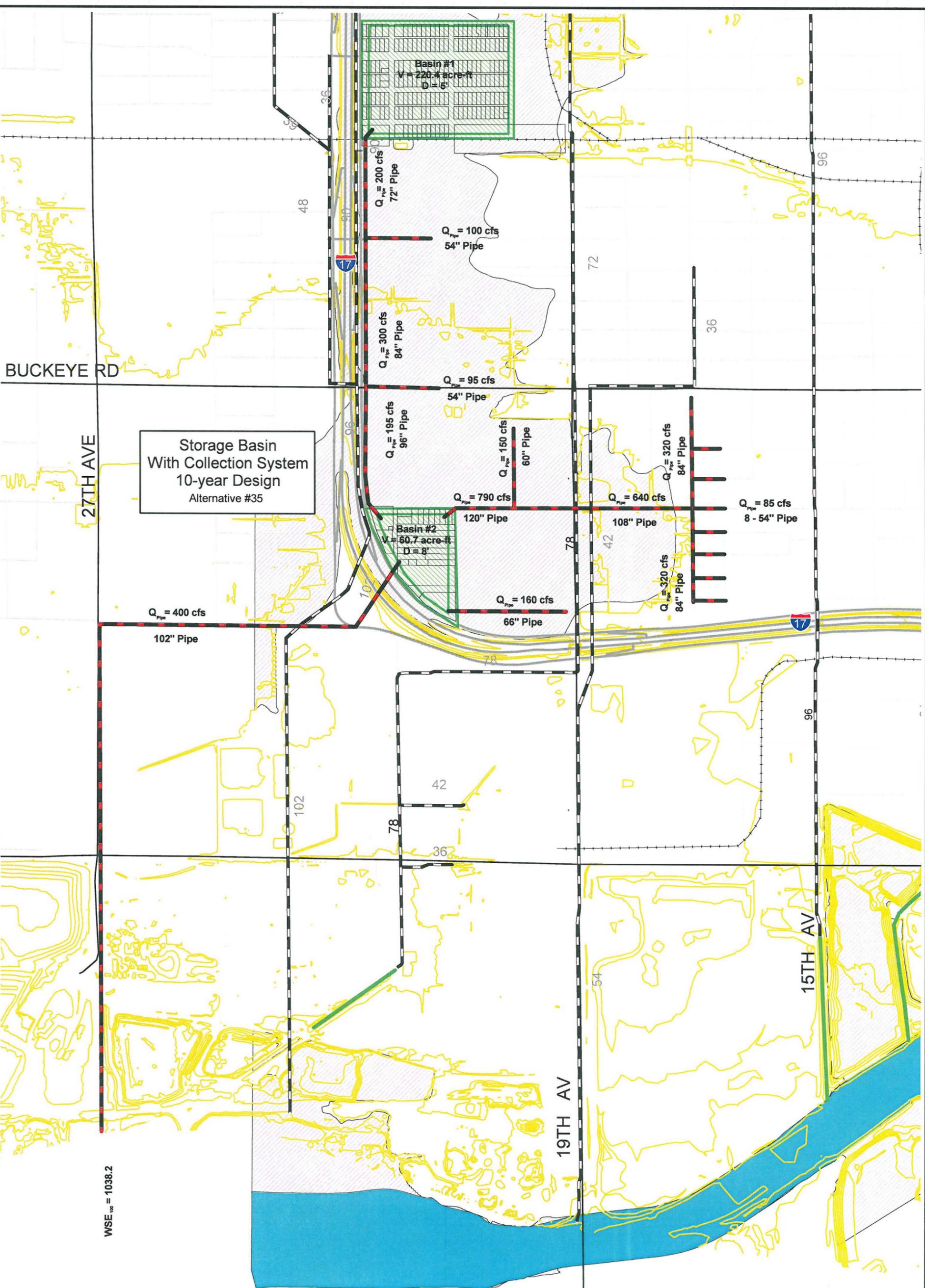
**Exhibit 6.B
Alternative #34**

- | | | | |
|----------------------|---------------------------|-----------------------------------|------------------------------|
| Study Area Boundary | Drainage Tunnel | Pipe Dimensions (inches) | FEMA Flood Hazard Boundaries |
| Major Streets | Open Channel | Existing Storm Drains | Floodplain |
| Interstate / Highway | Retention Basins | Proposed Storm Drain (Metro ADMP) | Floodway |
| Local Roads | Proposed Retention Basins | | |
| Railroad | | | |

N
Scale: 1" = 1,000'
C.I. = 10'



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Storage Basin
With Collection System
10-year Design
Alternative #35

Basin #1
V = 220.4 acre-ft
D = 6'

Basin #2
V = 60.7 acre-ft
D = 8'

**Metro Phoenix ADMP
Durango Curve
Solution 6.4: 10-year Design With Storage Basin**

**Exhibit 6.C
Alternative #35**

- | | | | |
|----------------------|---------------------------|-----------------------------------|------------------------------|
| Study Area Boundary | Drainage Tunnel | Pipe Dimensions (inches) | FEMA Flood Hazard Boundaries |
| Major Streets | Open Channel | Existing Storm Drains | Floodplain |
| Interstate / Highway | Retention Basins | Proposed Storm Drain (Metro ADMP) | Floodway |
| Local Roads | Proposed Retention Basins | | |
| Railroad | | | |

N
Scale: 1" = 1,000'
C.I. = 10'



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7.0 ARIZONA COUNTRY CLUB SWALE

The swale is downstream of the Arizona Country Club, located between the Papago Buttes on the south and the elevated Arizona Canal on the north. The swale runs east to west through the Arizona Country Club and continues west, in an alignment north of Thomas Road, until it reaches 48th Street and the Old Cross Cut Canal. It tends to lose its definition downstream of 52nd Street, transforming from a swale that contains floodwater into a spread out surface flow.

7.1 No Action

The no action alternative will result in no change to the existing conditions which effects the properties that are located along the flowline of the swale. The area is not within an existing floodplain and therefore, owners are not required to carry flood insurance. Flooding in the area typically results where the flow path is blocked by rows of homes built perpendicular to the swale. The flooding also results in a disruption to vehicular traffic due to flooded streets. Some of the specific flood problems identified with this study include:

- Residential flooding along the thalweg of the swale.
- Residential and street flooding where flow is blocked by structures and fences

Cost= \$0

7.2 10-year Storm Drain (Thomas Road) (See Exhibit 7.A)

This potential solution is for a new system that would intercept and convey stormwater within a new storm drain located in Thomas Road. This 10-year system would begin just east of 60th Street so as to intercept flow as it crosses Thomas Road from the south. A new storm drain lateral would be located in 56th Street beginning at the low point of the swale and continuing, to the south, to Thomas Road. The following individual alternative elements make up this solution:

- Alternative 37 – Thomas Road Storm Drain, 62nd St. to Old Cross Cut Canal (10-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
37	New Storm Drain in Thomas Road (10-year)	\$ 10,282,300.00
TOTAL		\$ 10,282,300.00

Metro Phoenix ADMP
Solution 7.2: Thomas Road Storm Drain
10-year Design

Exhibit 7.A
Alternatives #37

-  Study Area Boundary
-  Major Streets
-  Interstate / Highway
-  Local Roads
-  Railroad
-  Drainage Tunnel
-  Open Channel
-  Arizona Canal Diversion Channel
-  Retention Basins
-  Proposed Retention Basins
-  FEMA Flood Hazard Boundaries
-  Floodplain
-  Floodway
-  Existing Storm Drain
-  Future Storm Drain (C.O.P. 5-year Plan)
-  Proposed Storm Drain (Metro ADMP)

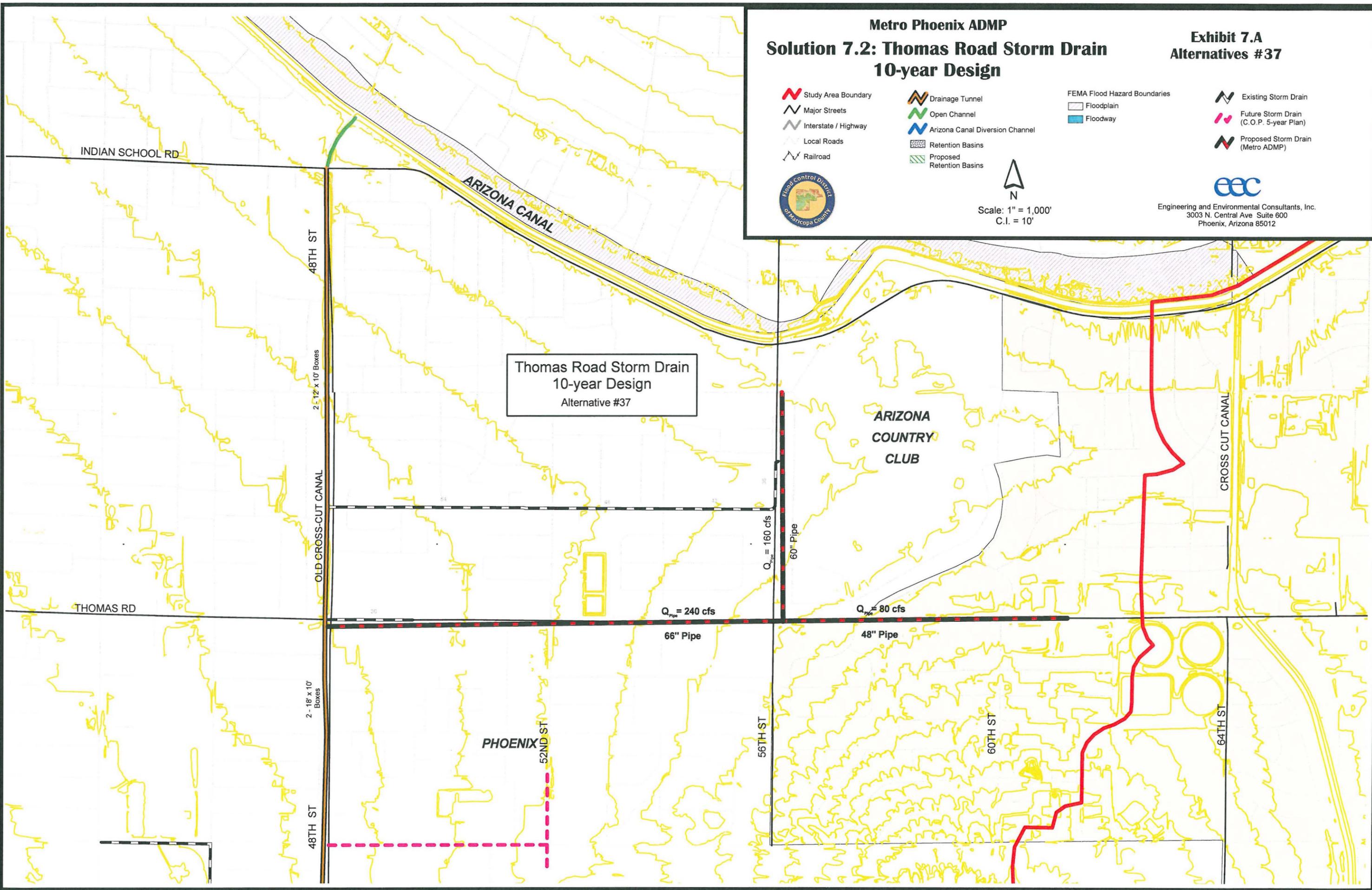


Scale: 1" = 1,000'
 C.I. = 10'



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Thomas Road Storm Drain
 10-year Design
 Alternative #37



8.0 ARCADIA AREA

The Arcadia area has long been a flooding concern for both the County and the City of Phoenix. Stormwater runoff, from Camelback Mountain, causes both a flooding problem for residences located adjacent to the flow corridors but also creates flood pools on the upstream side of the Arizona Canal. The area has been studied by Huitt-Zollars resulting in a *Final Recommendations Report-March 1997*. The study proposed five alternatives to eliminate the flooding problems. Although no single recommendation was made in the report, it is believed that Alternatives 2 and 3 are the most practical based upon constraints identified within the report and the 10-year level of protection provided by the two alternatives.

8.1 No Action

The no action alternative will result in no change to the existing conditions. Some of the specific flooding problems identified with this area are:

- Flooding of residential properties located within the flow corridors between Camelback Mountain and the Arizona Canal.
- Flood hazard to the properties that are located within the existing FEMA floodplain on the upstream side of the Arizona Canal. These properties are subject to serious, repetitive and frequent flood losses due to the lack of an adequate stormwater collection system.

Cost = \$0

8.2 10-year Storm Drain System (See Exhibit 8.A)

This potential solution is described as Alternative 2 in the report by Huitt-Zollars (*Final Recommendations Report-March 1997*) and consists of several components including the following:

- 40th Street Storm Drain, beginning at Camelback Road and 41st Street, west in Camelback Road to the Arizona Canal, northwest along the canal to 40th Street, north in 40th Street to Colter Street, west to the Cudia City Wash Sedimentation Basin and discharges to the ACDC.
- Arcadia Drive Storm Drain from Camelback Road to the Arizona Canal including a new undercrossing of the Canal and connection to the existing downstream conveyance channel (Old Cross Cut Canal).
- Camelback Road Storm Drain from ¼ mile east of 56th Street to Arcadia Drive.
- Camelback Road Storm Drain from Dromedary Road to Arcadia Drive.
- Lafayette Boulevard Storm Drain, beginning at Colter Street and 44th Street, south in 44th Street to Camelback Road, south and then east in Lafayette Boulevard to Arcadia Drive.
- 64th Street Storm Drain, beginning at Jokake Road and Camelback Road, east in Camelback Road to 64th Street and then south in 64th Street to Lafayette Boulevard where it connects to an existing storm drain.

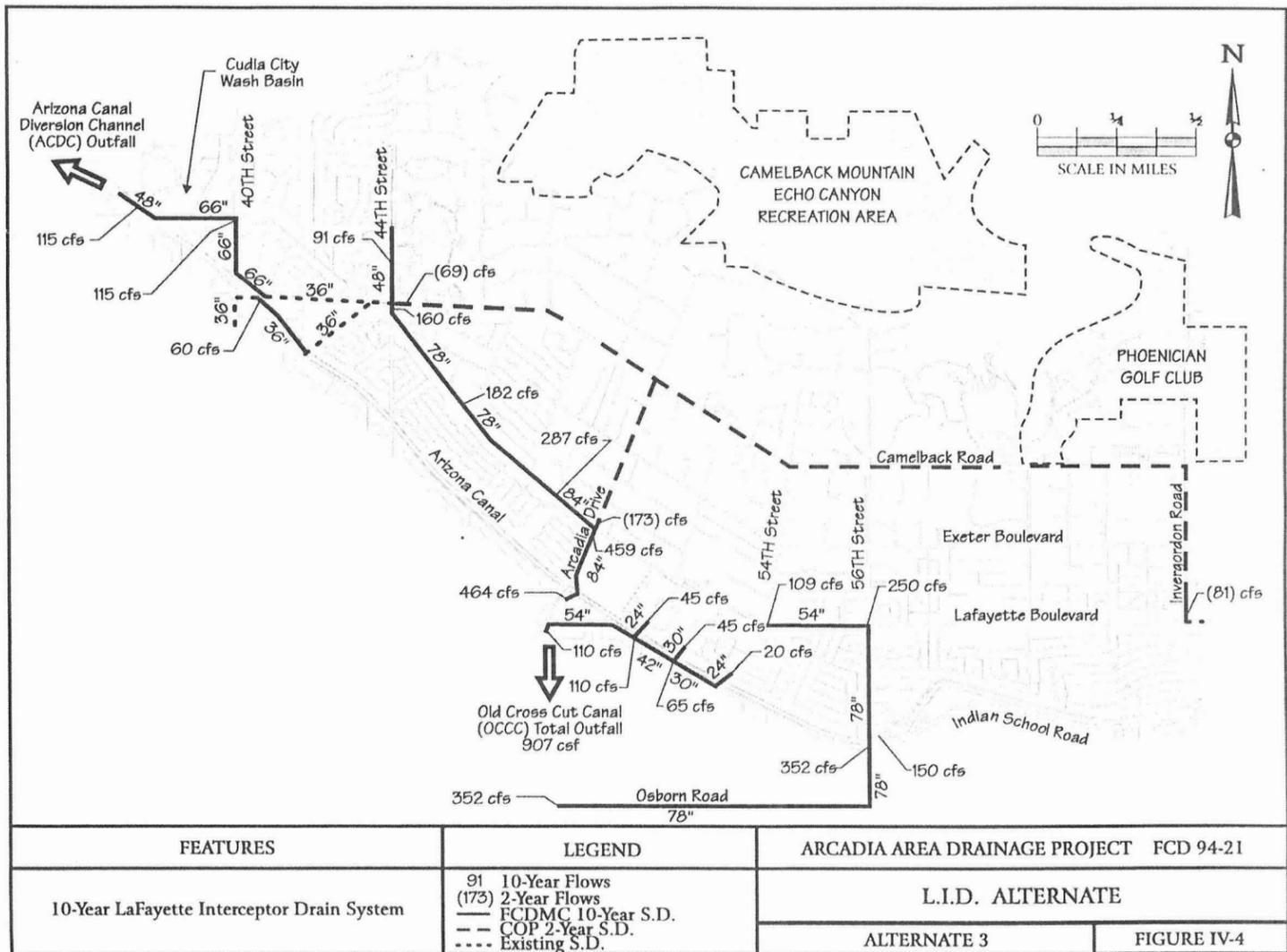
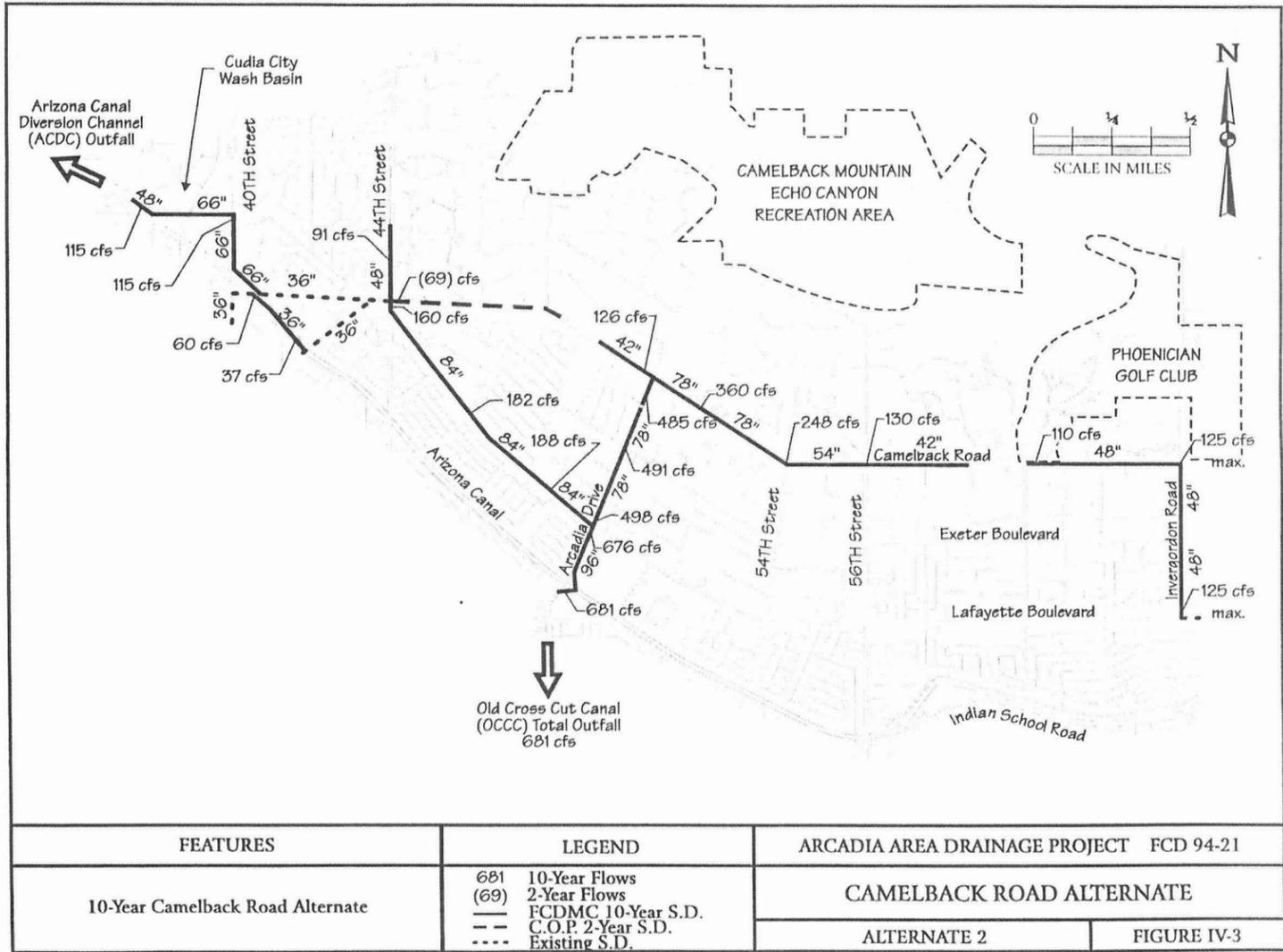
Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
38	10-year Camelback Road Collection System (Huitt Zoellers Alternate 2)	\$ 25,110,700.00
TOTAL		\$ 25,110,700.00

8.3 10-year Storm Drain System (See Exhibit 8.B)

This potential solution is described as Alternative 3 in the report by Huitt-Zollars (*Final Recommendations Report-March 1997*) and consists of several components including the following:

- 40th Street Storm Drain, beginning at Camelback Road and 41st Street, west in Camelback Road to the Arizona Canal, northwest along the canal to 40th Street, north in 40th Street to Colter Street, west to the Cudia City Wash Sedimentation Basin and discharges to the ACDC.
- Arcadia Drive Storm Drain from Lafayette Boulevard to the Arizona Canal including a new undercrossing of the Canal and connection to the existing downstream conveyance channel (Old Cross Cut Canal).
- Lafayette Boulevard Storm Drain, beginning at Colter Street and 44th Street, south in 44th Street to Camelback Road, south and then east in Lafayette Boulevard to Arcadia Drive.
- Indian School Road Storm Drain from 52nd Street to the Old Cross Cut Canal at 48th Street.
- Osborn Road Storm Drain, beginning at 54th Street and Lafayette Boulevard, east in Lafayette Boulevard to 56th Street, south in 56th Street under the Arizona Canal to Osborn Road, east in Osborn Road to the Old Cross Cut Canal at 48th Street..

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
39	10-year Lafayette Interceptor System (Huitt Zoellers Alternate 3)	\$ 25,969,900.00
TOTAL		\$ 25,969,900.00



9.0 AREA NORTH OF SKY HARBOR AIRPORT

This area is bounded between the Loop 202 Highway on the north, the railroad located parallel and adjacent to the north end of the Sky Harbor Airport on the south, I-10 Freeway on the west, and the SR 143 Highway on the east. The drainage area is approximately four square miles where the general fall of the land is from northeast to southwest. North of the airport, a wide swale is formed in the Washington Street alignment where the grade is due west. The railroad embankment, located on the north side of the airport, is several feet higher than the existing ground which increases the likelihood of flooding along Washington Street. Washington Street is susceptible to flooding for events that exceed the capacity of the existing 2-year storm drain. Washington Street is also the alignment for Segment-5 of Valley Metro’s light rail project.

In addition to onsite runoff, there are 2-year storm drains in 24th Street, 32nd Street and 40th Street that pass through the area and convey runoff from north of the loop 202 Highway, across the airport, and discharge to the Salt River.

9.1 No Action

The no action alternative will result in no change to the existing conditions. Some of the specific flooding problems identified within this area are:

- Potential flooding of residential and commercial properties located, within the swale, along Washington Street.
- Potential flood hazard to the new light rail corridor in Washington Street.
- Missed opportunity to improve drainage conditions at Sky Harbor Airport.

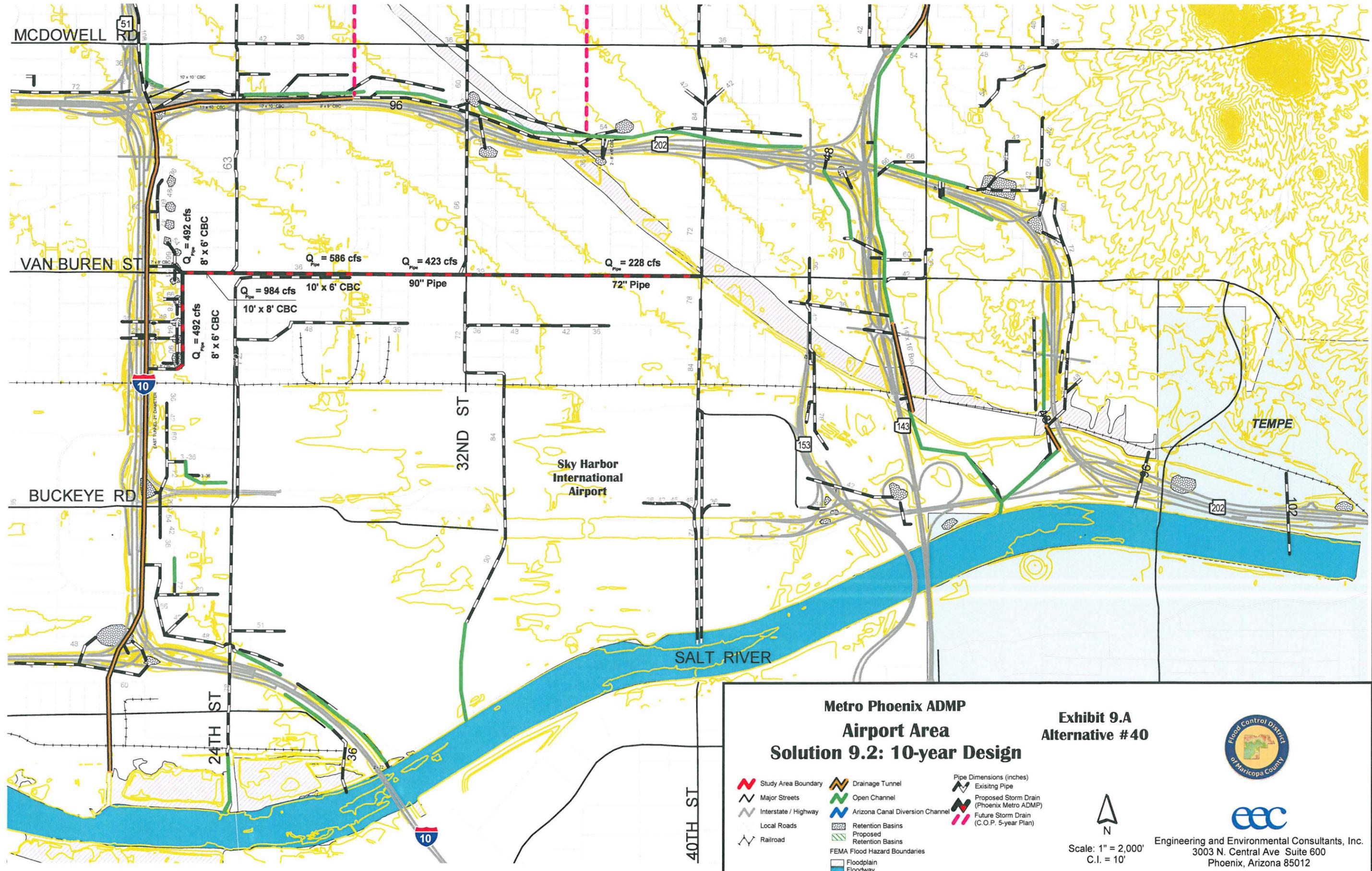
Cost = \$0

9.2 10-year Storm Drain System (See Exhibit 9.A)

This potential solution includes cutting off the north-south flows from the existing 2-year storm drains in 24th Street, 32nd Street and 40th Street and convey this flow plus the local 10-year discharge in a new storm drain located in Van Buren Street. The three existing storm drains that are truncated at Van Buren Street provide a significant benefit for the Airport. The City’s Aviation Department is currently investigating alternatives to improve drainage on the Airport property and they have expressed a desire to utilize these existing storm drains. Truncating the existing storm drains at Van Buren Street leaves them with considerable excess capacity through the Airport. The new 10-year storm drain in Van Buren Street would ultimately discharge into ADOT’s east tunnel located under I-10.

- Alternative 40 – Van Buren Street Storm Drain, 40th St. to I-10 (10-year design)

Alternative	Description (See Section 9 for Individual Alternative Itemized Cost)	Amount
40	10-year Storm Drain in Van Buren Street	\$ 23,562,600.00
TOTAL		\$ 23,562,600.00



**Metro Phoenix ADMP
Airport Area
Solution 9.2: 10-year Design**

**Exhibit 9.A
Alternative #40**

- | | | | | | |
|--|----------------------|--|---------------------------------|--|--|
| | Study Area Boundary | | Drainage Tunnel | | Pipe Dimensions (inches)
Existing Pipe |
| | Major Streets | | Open Channel | | Proposed Storm Drain
(Phoenix Metro ADMP) |
| | Interstate / Highway | | Arizona Canal Diversion Channel | | Future Storm Drain
(C.O.P. 5-year Plan) |
| | Local Roads | | Retention Basins | | |
| | Railroad | | Proposed Retention Basins | | |
| | | | FEMA Flood Hazard Boundaries | | |
| | | | Floodplain | | |
| | | | Floodway | | |

Scale: 1" = 2,000'
C.I. = 10'



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10.0 ALTERNATIVES EVALUATION/CONCLUSIONS

A meeting was held at the Flood Control District on December 13, 2006 to evaluate the potential solutions described in Sections 2 through 9 of this report. This evaluation meeting was attended by the study team as well as other representatives from the City of Phoenix and the Flood Control District. An evaluation matrix was completed during the meeting which documents the discussion regarding the advantages and disadvantages of each of the alternatives. The evaluation matrix can be found at the end of this section.

10.1 Summary of the Evaluation of Alternatives

The following is a brief summary regarding the decision to carry potential solutions forward to the Level II phase of the alternatives analysis.

Old Cave Creek Floodplain (ACDC to Grand Canal)

- 2.1 No Action
- 2.2 10-year Storm Drain System without Storage
- 2.3 10-year Storm Drain System with Storage
- 2.4 Floodproofing

It was decided that all three of these potential solutions would be carried forward to Level II. At this point, there was no reason to eliminate any of the solutions, including both of the storm drain solutions, despite the fact that they are much more expensive than floodproofing. The Floodproofing alternative is the least expensive but it does not address the street flooding issue nor does it help alleviate the downstream flooding problems.

Cave Creek Floodplain (Grand Canal to I-10)

- 3.1 No Action
- 3.2 10-year Storm Drain System without Storage
- 3.3 10-year Storm Drain System with Storage at Encanto Golf Course
- 3.4 10-year Storm Drain System with Storage at Fairgrounds

It was decided that the 10-year storm drain with storage at Encanto Golf Course would be carried forward. The primary advantage of this solution is that there is no land acquisition cost associated with the Golf Course storage, in addition it could have a positive impact on the golf course making it more interesting from a player's standpoint, and enhancing its aesthetic appeal. The group decided to eliminate the 10-year storm drain without storage because it discharges at too high of a rate into ADOT's I-10 tunnel system. The group also decided to eliminate the 10-year storm drain system with storage at the Fairgrounds because of the high cost and the uncertainty of acquiring the Fairgrounds property. It was also decided that Floodproofing would be added and carried forward as a potential solution for this area in the Level II analysis.

Grand Canal Floodplain (I-17 to 24th Street)

- 4.1 No Action
- 4.2 Buyout Homes and Resell Lots in Floodplain
- 4.3 Buyout Homes and Create Linear Park with Storage Basins
- 4.4 100-year Collection System in Canal North Neighborhood

It was decided that each neighborhood along the Canal will be looked at in more detail, using the half mile streets as boundaries. For each section, all three types of action (buy-out and resell lots, floodproofing, and buyout and create storage) will be analyzed. The 100-year storm water collection system was eliminated from further study. This alternative has many disadvantages that would have been very hard to overcome,

including high price, difficulty to construct, and the difficulty in attaining rights to discharge to the ADOT I-10 tunnel system.

Downtown Area

- 5.1 No Action
- 5.2 10-year Storm Drain System (between I-10 and Railroad Tracks)
- 5.3 10-year Storm Drain System (between I-10 and I-17)

These two potential storm drain solutions have been combined into a single solution with two phases. The storm drains north of the Railroad tracks will be Phase I and the storm drains south of the tracks will be Phase II. As part of Level II Analysis, the capacities will be analyzed in more detail and the connections to ADOT Tunnels will be coordinated with ADOT.

Durango Curve Area

- 6.1 No Action
- 6.2 100-year Collection System without Storage
- 6.3 100-year Collection System with Single Storage Basin
- 6.4 100-year Collection System with Multiple Storage Basins

All three of these solutions will be carried forward to the Level II analysis. Even though the multiple storage basin option is more expensive, it has a high value in terms of its multi-use opportunities so it was kept as a potential solution. The storm drain option is also expensive but it was kept because the land acquisition associated with the storage basin solutions could be difficult.

Arizona Country Club Swale

- 7.1 No Action
- 7.2 10-year Storm Drain System

There was only one alternative, the Thomas Road storm drain, which will be carried forward to the next level of analysis.

Arcadia Area

- 8.2 No Action
- 8.3 10-year Camelback Road Collection System (Huitt-Zollars Alternate 2)
- 8.4 10-year Lafayette Interceptor System (Huitt-Zollars Alternate 3)

These potential solutions were presented to the Arcadia residents in the 1990's and were met with significant opposition. Therefore, the City and the Flood Control District terminated further development of a flood control plan for Arcadia. It was decided that the project team would meet with local community leaders to see if there is any interest in pursuing either of these alternatives, or some other solution. After those meetings take place, a decision will be made as to whether the Arcadia alternatives will be carried forward.

Area North of Airport

- 9.1 No Action
- 9.2 10-year Storm Drain System (includes diverting storm drain flows upstream of Airport)

There was only one alternative, the Van Buren Street storm drain, which will be carried forward to the next level of analysis. It should be understood, however, that this alternative carries with it a potential fatal flaw. The problem is that the proposed storm drain includes capturing upstream storm drain flows and diverting them to ADOT's east tunnel. This will have to be approved by ADOT.

10.2 Table of Selected Alternatives

The following table summarizes the potential solutions that will be carried forward to the Level II Analysis:

Potential Solution	Alternative	Description
1A	1	New SD in 21st Ave (10-Yr, Grand Canal to Northern Avenue)
	2	New SD Ext. in Central Ave (2-Yr, Bethany Home Rd. to Arizona Canal)
	3	New SD in 3rd Ave. (10-Yr, Grand Canal to Bethany Home Rd)
	4	New Parallel SD in 15th Ave. (10-Yr, Grand Canal to Butler Drive)
1B	1	New SD in 21st Ave (10-Yr, Grand Canal to Northern Avenue)
	2	New SD Ext. in Central Ave (2-Yr, Bethany Home Rd. to Arizona Canal)
	3	New SD in 3rd Ave. (10-Yr, Grand Canal to Bethany Home Rd)
	5	Storage in Palo Verde Golf Course (10-Yr)
1C	6	Floodproofing
2B	11	Storage in Encanto Municipal Golf Course (10-Yr)
	12	New Storm Drain in 18th Avenue (10-year, Encanto G.C. to Grand Canal)
	13	New Storm Drain in Thomas Road (10-year, 24th Ave. to 18th Ave)
	14	New Parallel Storm Drain in 15th Avenue (10-year, Encanto G.C. to Grand Canal)
	15	New Storm Drain in 3rd Avenue (10-year, I-10 to Grand Canal))
2C		Floodproofing
3A	21	Buyout, Demolish and Resale Lots within the Floodplain
3B	22	Linear Parks and Storage in Floodplain along the Grand Canal
3C		Floodproofing
4B		Phase I
	24	Modifications to 16th Street Storm Drain
	25	Fillmore Street (East) Storm Drain
	26	9th Street Storm Drain
	27	Fillmore Street (West) Storm Drain
	28	3rd Avenue (North) Storm Drain
	29	Modifications to 15th Avenue Storm Drain
	30	Modifications to 19th Avenue Storm Drain
		Phase II
	31	7 th Street Storm Drain
	32	3 rd Avenue (South) Storm Drain
33	7th Avenue Storm Drain	
5A	36	New 100-Year Conveyance System from Durango Curve to Salt River
5B	34	New 100-Yr Storage Basin at Durango Curve with Conveyance to Salt River
5C	35	Multiple 100-Yr Storage Basins with Conveyance to Salt River
6A	37	New 10-year Storm Drain in Thomas Road, Old Cross Cut Canal to 62nd St.
7A	38	10-year Camelback Road Collection System (Huitt-Zollars Alternate 2)
7B	39	10-year Lafayette Interceptor System (Huitt-Zollars Alternate 3)
8A	40	10-year Storm Drain in Van Buren Street, I-10 to 40th Street

Alternative Evaluation Matrix
(Level 1)

Alternative Group No.	Description	Economic				Environmental					Social					Feasibility			
		Implementation Costs	Maintenance Costs	Construction Costs	Design Life	Permitting	Aesthetics	Urban Wildlife Habitat	Cultural Impacts	Hazmat Impacts	Community Acceptance	Perceived Benefit	Multi-Use Opportunities	Land Acquisition	Owner Relocation	Access During Flooding	Constructability	Agency Acceptance	Circulation/Disruption During Construction
1A (Alts 1-4)	New SD in 21st Ave (10-Yr, OCCFP) New SD Ext. in Central Ave (2-Yr, OCCFP) New SD in 3rd Ave. (10-Yr, OCCFP) New Parallel SD in 15th Ave. (Supplement 10-Yr, OCCFP)	High (-)	Low (+)	High (-)	High (+)	None	N/A	N/A	None (+)	None (+)	SD in neighborhc (-)	Flood Protection (+)	None (-)	None (+)	N/A (+)	Difficult (-)	Medium (+)	Poor (-)	FCD COP
Total Cost = \$77 million		Advantage	Low Maintenance Cost, High Design Life		Advantage No Known Cultural Impacts					Advantage Provide 10-yr protection, No land Acq. Or owner Reloc., Provide access					Advantage Agency Acceptance				
		Disadvantage	High Cost		Disadvantage Murphy Bridal path, considered historic					Disadvantage Low public acceptance for Central, 3rd Ave, & 21st Ave.					Disadvantage 15th Ave. Constructability, Disruption during construction				
1B (Alts 1-3, 5)	New SD in 21st Ave (10-Yr, OCCFP) New SD Ext. in Central Ave (2-Yr, OCCFP) New SD in 3rd Ave. (10-Yr, OCCFP) Storage in Palo Verde Golf Course (10-Yr, OCCFP)		Low (+)	High (-)	High (+)	N/A	(+)	Improvement (+)	N/A	N/A	Challenge (-)	(+)	(+)	N/A (+)	N/A (+)		Low (-)	Poor (-)	FCD COP Parks
Total Cost = \$78 million		Advantage	Low Maintenance, High design life		Advantage Improve Urban wildlife, Better aesthetics					Advantage All above advantage, Higher Multi-use					Advantage				
		Disadvantage	High Cost		Disadvantage Murphy Bridal path, considered historic					Disadvantage Low public acceptance for Central, 3rd, and 21st					Disadvantage Constructability low if Palo Verde sold, Low agency accept.				
1C (Alt 6)	Floodproofing	Long Term	None (+)	Low (+)		No Known Impact	Potential (-)	No Known Impact	No Known Impact	No Known Impact	(-)		N/A	(-)	(-)		High (+)	(-)	FCD COP (+)
Total Cost = \$9 Million (43 homes)		Advantage	Least expensive, no maintenance cost		Advantage					Advantage Moderate community acceptance					Advantage				
		Disadvantage			Disadvantage Could have negative aesthetics					Disadvantage No multi-use, does not solve street flooding, solves only house flooding					Disadvantage Could have negative impact downstream				
2A (Alts 7-10)	New SD in 3rd Ave. (10-Yr, GCFP) New SD in McDowell Road (10-year, GCFP) New Parallel Storm Drain in 19th Avenue (Supplement 10-year, GCFP) New Parallel Storm Drain in 15th Avenue (Supplement 10-year, GCFP)		Low (+)	High (-)		No Known Impact	No Known Impact	No Known Impact	No Known Impact	No Known Impact	Mixed (+) (-)	(+) (-)	N/A	None (+)	N/A	(-)	ADOT (-)	Poor (-)	FCD COP
Total Cost = \$83 million		Advantage	Low Maintenance, High Design Life		Advantage No Impact, No Benefit					Advantage No land acquisition, Community acceptance, Remove FP					Advantage				
		Disadvantage	High Cost		Disadvantage Cultural Impacts, Low aesthetics					Disadvantage No Multi-use					Disadvantage ADOT connection, Difficult to construct				
2B (Alts 11-15)	Storage in Encanto Municipal Golf Course New Storm Drain in 18th Avenue (10-year, GCFP) New Storm Drain in Thomas Road (10-year, GCFP) New Parallel Storm Drain in 15th Avenue (Supplement 10-year, GCFP) New Storm Drain in 3rd Avenue (10-year, GCFP)	Low (-)	Medium (+) (-)	High (-)	High (+)	(-)	Moderate	(+)	High (-)		(-)	High (+)	Enhanced (+)	Low (+)	N/A	(+)			(+)
Total Cost = \$70 million		Advantage	Low Cost, Low Maintenance, High Design Life		Advantage Moderate Aesthetic, Wildlife					Advantage No owner relocation or land acquisition, perceived benefit, Multi-use opportunity					Advantage Phased construction, Financial Partners				
		Disadvantage			Disadvantage High Cultural Impacts					Disadvantage					Disadvantage Disruption to golf course				
2C (Alts 7, 16-20)	New SD in 3rd Ave. (10-Yr, GCFP) Storage at Veterans Memorial Coliseum/Arizona State Fairgrounds New Parallel Storm Drain in 15th Avenue (Supplement 10-year, GCFP) New Storm Drain in 19th Avenue (10-year, GCFP) New Storm Drain in Encanto Boulevard (10-year, GCFP) New Storm Drain in Grand Avenue (10-year, GCFP)	High (-)	Moderate (+) (-)	High (-)	High (+)		(+)	(+)	Moderate (+) (-)	High (-)	(+) (-)	(+) (-)	(+)	(-)	N/A		Low (-)		
Total Cost = \$117 million		Advantage	High Design Life		Advantage High Aesthetic					Advantage Multi-use Opportunities, high and low community acceptance					Advantage				
		Disadvantage	High Cost, moderate maintenance		Disadvantage Cultural impacts, Hazardous materials					Disadvantage Land Acquisition, High Cost					Disadvantage Agency Acceptance, Constructability, Disruption during construction				
3A (Alt 21)	Buyout, Demolish and Resale Lots within the Floodplain	High (-)	Low (+)	N/A	High (+)	(-)	(-)	Trees (-)		(-)	Mixed Rx (+) (-)		Potential (+) (-)	(-)	(-)	N/A	Low (-)	(-)	
Total Cost = \$104 million		Advantage	Low Maintenance Cost, High Design Life		Advantage Lead, Asbestos, Historic, Aesthetics					Advantage Potential Multi-Use					Advantage				
		Disadvantage	High Implementation cost		Disadvantage					Disadvantage Owner relocation, Land Acquisition, Community acceptance, no multi-use					Disadvantage Low Agency Acceptance, Disruption				
										Disadvantage No multi-use, no other problems resolved					Disadvantage Disruption during construction				
3B (Alt 22)	Linear Parks and Storage in Floodplain along the Grand Canal	High	Parks (+)	(-)	High (+)	(-)	High (+)	(+)	Historic (-) (-)	(-)	Mixed (+) (-)	(+) (-)	(+) (+)	(-)	(-)	N/A	(+)	Moderate	(-)
Total Cost = \$210 million		Advantage	Costs divided between agencies		Advantage High Aesthetics, Wildlife					Advantage High Multi-Use, Perceived Benefit					Advantage Constructability				
		Disadvantage	High Cost		Disadvantage Hazardous Material, Historic, Permitting					Disadvantage Land Acquisition, owner relocation					Disadvantage Could be negative for financial partners				
3C (Alt 23)	Stormwater Collection System		Moderate		High (+)			No Known Impact			(-)	Moderate (+)	(-)	(+)	None (+)		Very Difficult (-) (-)	ADOT (-) (-)	High (-)
Total Cost = \$21 million		Advantage	Moderate Cost, High Design Life		Advantage Aesthetics could be enhanced					Advantage Perceived Benefit					Advantage Constructability, Agency Acceptance, ADOT Tunnels				
		Disadvantage			Disadvantage					Disadvantage Acceptance (during construction)					Disadvantage				
4B (Alts 24-33)	Phase I - Total Cost = \$34 million Modifications to 16th Street Storm Drain Fillmore Street (East) Storm Drain 9th Street Storm Drain Fillmore Street (West) Storm Drain 3rd Avenue (North) Storm Drain Modifications to 15th Avenue Storm Drain Modifications to 19th Avenue Storm Drain Phase II - Total Cost = 17 million 7th Street Storm Drain 3rd Avenue (South) Storm Drain 7th Avenue Storm Drain																		
		Advantage			Advantage					Advantage					Advantage				
		Disadvantage			Disadvantage					Disadvantage					Disadvantage				

Alternative Evaluation Matrix
(Level 1)

Alternative Group No.	Description	Economic			Environmental				Social					Feasibility						
		Implementation Costs	Maintenance Costs	Construction Costs	Design Life	Permitting	Aesthetics	Urban Wildlife Habitat	Cultural Impacts	Hazmat Impacts	Community Acceptance	Perceived Benefit	Multi-Use Opportunities	Land Acquisition	Owner Relocation	Access During Flooding	Constructability	Agency Acceptance	Circulation/Disruption During Construction	Financial Partners
5A (Alt 36)	New Conveyance System from Durango Curve to Salt River		Low (+)	High (-)	High (+)	Low (+)	Low (-)	Low (-)				Low (-)					Moderate	High	Moderate	
Total Cost = \$103 million		Advantage	High Design Life, Low Maintenance		Advantage	Wildlife Habitat			Advantage	Perceived benefit, low land acquisition, no owner relocation					Advantage	Moderate Agency Acceptance, Potential Financial Partners				
		Disadvantage	High Cost		Disadvantage	Cultural Impacts, Low Aesthetics			Disadvantage	No multi-use					Disadvantage	Constructability				
5B (Alt 34)	New Storage Basin at Durango Curve with Conveyance to Salt River			Low (+)	High (+)		High (+)	High	Moderate (-)	Mixed (+) (-)		Moderate (+)	High (-)	High (-)			Moderate			
Total Cost = \$77 million		Advantage	High Design Life, Lower Cost		Advantage	Aesthetics, could provide more area for wildlife			Advantage	Multi-Use, Community Benefit					Advantage	Moderate Agency Acceptance, Financial Partners				
		Disadvantage			Disadvantage	Discharges to Rio Salado Area			Disadvantage	Land Acquisition, Owner Relocation					Disadvantage	Constructability				
5C (Alt 35)	Multiple Storage Basins with Conveyance to Salt River			High (-)	High (+)		High	Moderate				High (+)	High (-)	High (-)			Moderate			
Total Cost = \$100 million		Advantage	High Design Life		Advantage	Aesthetics			Advantage	High Multi-use					Advantage	Moderate Agency Acceptance, Potential Financial Partners				
		Disadvantage	High Cost		Disadvantage	Hazardous Material, Discharges to Rio Salado Area			Disadvantage	Land Acquisition, Owner Relocation					Disadvantage	Constructability				
6A (Alt 37)	New Storm Drain in Thomas Road (10-year, Arcadia)		Low (+)	High (-)	High (+)		No Known Impact													
Total Cost = \$10 million		Advantage			Advantage				Advantage						Advantage					
		Disadvantage			Disadvantage				Disadvantage						Disadvantage					
7A (Alt 38)	10-year Camelback Road Collection System (Huitt-Zollars Alternate 2)		Low (+)	Low (+)	High (+)		No Known Impact			Low (-)	Mixed (+) (-)	None (-)	None (+)	N/A					In neighborhoods (-)	
Total Cost = \$25 million		Advantage			Advantage				Advantage						Advantage	(+) (-)				
		Disadvantage			Disadvantage				Disadvantage						Disadvantage					
7B (Alt 39)	10-year Lafayette Interceptor System (Huitt-Zollars Alternate 3)		Low (+)	Low (+)	High (+)		No Known Impact			Low (-)	Mixed (+) (-)	None (-)	None (+)	N/A					In neighborhoods (-)	
Total Cost = \$26 million		Advantage			Advantage				Advantage						Advantage	(+) (-)				
		Disadvantage			Disadvantage				Disadvantage						Disadvantage					
8A (Alt 40)	10-year Storm Drain in Van Buren Street		Low (+)	High (-)	High (+)		No known Impact			Mixed (+) (-)		None (-)	None (+)	N/A						FCD COP Aviation
Total Cost = \$24 million		Advantage			Advantage				Advantage						Advantage	ADOT (-) (-)				
		Disadvantage			Disadvantage				Disadvantage						Disadvantage	(-)				

APPENDIX 1

ALTERNATIVE 1

Alternative 1 – New Storm Drain in 21st Avenue (10-year, OCCFP)

This alternative is for a new 10-year storm drain that connects to the existing storm drain which terminates at the intersection of 23rd and Northern Avenues. The new main line storm drain continues to the east to 21st Avenue and then south, in 21st Avenue, from Northern Avenue to the Grand Canal. New laterals are located approximately every half- mile and extend to the west to 23rd Avenue (¼ mile). This system includes enough connector pipes and inlets to capture the 10-year runoff between I-17 and 19th Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	66" SD in Northern Ave, 23rd Ave to 21st Ave	LF	\$819.44	1330	\$ 1,089,858.92
2	66" SD in 21st Ave., Northern to Glendale	LF	\$819.44	5280	\$ 4,326,657.98
3	78" SD in 21st Ave, Glendale to Bethany Home	LF	\$937.95	5280	\$ 4,952,388.67
4	78" SD in 21st Ave, Bethany Home to Camelback	LF	\$937.95	5280	\$ 4,952,388.67
5	78" SD in 21st Ave, Camelback to Grand Canal	LF	\$937.95	4440	\$ 4,164,508.66
6	48" SD Lateral in Orangewood Rd., 23rd Dr. to 21st Ave	LF	\$637.14	1300	\$ 828,278.88
7	48" SD Lateral in Glendale Ave., 23rd Dr to 21st Ave	LF	\$637.14	1460	\$ 930,220.90
8	48" SD Lateral in Citrus Way, 23rd Dr. to 21st Ave	LF	\$637.14	1330	\$ 847,393.01
9	36" SD Lateral in Bethany Home Rd., 23rd Dr to 21st Ave	LF	\$506.89	1330	\$ 674,167.96
10	72" SD Lateral in Camelback Rd., 23rd Dr. to 21st Ave	LF	\$878.70	1760	\$ 1,546,507.78
11	54" SD Lateral in Campbell Ave., 23rd Dr to 21st Ave	LF	\$698.29	1300	\$ 907,781.16
Sub Total					\$ 25,220,152.58
Contingencies (20%)					\$ 5,044,030.52
TOTAL					\$ 30,264,200.00

ALTERNATIVE 2

Alternative 2 – New Storm Drain Extension in Central Avenue (2-year, OCCFP)

This alternative is for a new 2-year storm drain in Central Avenue that begins just north of Butler Drive and continues south, in Central Avenue, to Bethany Home Road where it ties into an existing 54-inch storm drain. This system includes enough connector pipes and inlets to capture the 2-year runoff between Central Avenue and 7th Street.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	24" SD in Central Ave, Butler to Northern	LF	\$448.81	1470	\$ 659,755.40
2	30" SD in Central Ave, Northern to Glendale	LF	\$448.81	5280	\$ 2,369,733.70
3	36" SD in Central Ave, Glendale to Bethany Home	LF	\$506.89	5280	\$ 2,676,396.10
					\$ -
Sub Total					\$ 5,705,885.20
Contingencies (20%)					\$ 1,141,177.04
TOTAL					\$ 6,847,100.00

ALTERNATIVE 3

Alternative 3 – New Storm Drain in 3rd Avenue (10-year, OCCFP)

This alternative is for a new 10-year storm drain in 3rd Avenue that begins at Bethany Home Road and continues to the south, in 3rd Avenue, to the Grand Canal. This system includes enough connector pipes and inlets to capture the 10-year runoff from the east plus the 10-year runoff in Bethany Home Road between 7th Avenue and Central Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	36" SD in 3rd Ave, Bethany Home to Camelback	LF	\$506.89	5280	\$ 2,676,396.10
2	42" SD in 3rd Ave, Camelback to Grand Canal	LF	\$578.17	2120	\$ 1,225,727.18
3	30" SD Lateral in Bethany Home Rd., 2nd Ave. to 3rd Ave.	LF	\$448.81	1000	\$ 448,813.20
4	30" SD Lateral in Bethany Home Rd., 5th Ave. to 3rd Ave.	LF	\$448.81	1000	\$ 448,813.20
					\$ -
Sub Total					\$ 4,799,749.68
Contingencies (20%)					\$ 959,949.94
TOTAL					\$ 5,759,700.00

ALTERNATIVE 4

Alternative 4 – New Parallel Storm Drain in 15th Avenue (Supplement 10-year, OCCFP)

This alternative is for a new parallel storm drain in 15th Avenue that supplements the existing storm drain system by increasing the overall capacity to the equivalent of a 10-year system. This storm drain begins at Butler Drive and continues south, in 15th Avenue, to the Grand Canal. New ¼ mile long storm drain laterals are located at Butler Drive (west), Northern Avenue (east and west), Vista Avenue (east), Orangewood Avenue (west), Myrtle Avenue (east and west), Glendale Avenue (west), Bethany Home Road (east and west), Missouri Avenue (east and west), and Camelback Road (east). This system includes enough connector pipes and inlets to capture the 10-year runoff between 17th Avenue and 7th Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	54" SD in 15th Ave, Butler to Northern	LF	\$698.29	2640	\$ 1,843,494.05
2	54" SD in 15th Ave, Northern to Glendale	LF	\$698.29	5280	\$ 3,686,988.10
3	72" SD in 15th Ave, Glendale to Bethany Home	LF	\$878.70	5280	\$ 4,639,523.33
4	78" SD in 15th Ave, Bethany Home to Camelback	LF	\$937.95	5280	\$ 4,952,388.67
5	78" SD in 15th Ave, Camelback to Grand Canal	LF	\$937.95	3300	\$ 3,095,242.92
6	60" SD Lateral in Butler, 17th Ave to 15th Ave	LF	\$759.41	1170	\$ 888,508.76
7	54" SD Lateral in Northern, 17th Ave to 15th Ave	LF	\$698.29	1530	\$ 1,068,388.60
8	30" SD Lateral in Northern, 9th Ave to 15th Ave	LF	\$448.81	1950	\$ 875,185.74
9	42" SD Lateral in Orangewood Rd., 17th Ave to 15th Ave	LF	\$578.17	1470	\$ 849,914.60
10	36" SD Lateral in Vista Ave., 11th Ave to 15th Ave	LF	\$506.89	1300	\$ 658,961.16
11	36" SD Lateral in Myrtle Ave., 11th Ave to 15th Ave	LF	\$506.89	1300	\$ 658,961.16
12	42" SD Lateral in Glendale Ave., 17th Ave to 15th Ave	LF	\$578.17	1600	\$ 925,077.12
13	48" SD Lateral in Bethany Home, 17th Ave to 15th Ave	LF	\$637.14	1200	\$ 764,565.12
14	30" SD Lateral in Bethany Home, 8th Ave to 15th Ave	LF	\$448.81	2500	\$ 1,122,033.00
15	48" SD Lateral in Missouri Ave., 18th Ave to 15th Ave	LF	\$637.14	1990	\$ 1,267,903.82
16	42" SD Lateral in Missouri Ave., 11th Ave to 15th Ave	LF	\$578.17	1320	\$ 763,188.62
17	42" SD Lateral in Camelback Ave., 11th Ave to 15th Ave	LF	\$578.17	1440	\$ 832,569.41
Sub Total					\$ 28,892,894
Contingencies (20%)					\$ 5,778,578.84
TOTAL					\$ 34,671,500

ALTERNATIVE 5

Alternative 5 – 15th Avenue Storm Drain with Storage in Palo Verde Golf Course (10-year, OCCFP)

This alternative is for a new 10-year detention basin to be constructed within the existing Palo Verde Golf Course. The golf course would be reconstructed to provide the 10-year, 24-hour required storage of about 125 acre-feet. It would also have an outfall to the existing 15th Avenue storm drain at the southwest corner of the site. This alternative replaces the 15th Avenue Storm Drain described in Alternative 4. It includes a new storm drain in 15th Avenue upstream of the Golf Course. But, downstream of the Golf Course, it is assumed that the existing 15th Avenue storm drain can convey the 10-year flood; since it's upstream contribution is cut off. This system includes enough connector pipes and inlets to capture the 10-year runoff between 17th Avenue and 7th Avenue.

Item No.	Item Description	Unit	Price	Quantity	Amount
1	54" SD in 15th Avenue, Butler to Northern Ave	LF	\$698.29	2640	\$ 1,843,494.05
2	54" SD in 15th Avenue, Northern Ave to Glendale Ave	LF	\$698.29	5280	\$ 3,686,988.10
3	72" SD in 15th Avenue, Glendale Ave to Maryland	LF	\$878.70	2640	\$ 2,319,761.66
4	60" SD Lateral in Butler, 17th Ave to 15th Ave	LF	\$759.41	1170	\$ 888,508.76
5	54" SD Lateral in Northern, 17th Ave to 15th Ave	LF	\$698.29	1530	\$ 1,068,388.60
6	30" SD Lateral in Northern, 9th Ave to 15th Ave	LF	\$448.81	1950	\$ 875,185.74
7	42" SD Lateral in Orangewood, 17th Ave to 15th Ave	LF	\$578.17	1470	\$ 849,914.60
8	36" SD Lateral in Vista, 11th Ave to 15th Ave	LF	\$506.89	1300	\$ 658,961.16
9	36" SD Lateral in Myrtle, 11th Ave to 15th Ave	LF	\$506.89	1300	\$ 658,961.16
10	66" SD Lateral in Ocotillo, 11th Ave to 15th Ave	LF	\$819.44	1850	\$ 1,515,969.18
11	66" SD Lateral in McLellan, 17th Ave to 15th Ave	LF	\$819.44	2300	\$ 1,884,718.44
12	42" SD, Connect existing Pipes between 19th and 17th Avenue	LF	\$578.17	1400	\$ 809,442.48
13	42" SD, Connect existing 7th Avenue Storm Drain to Golf Course	LF	\$578.17	2200	\$ 1,271,981.04
14	48" SD Lateral in Bethany Home, 17th Ave to 15th Ave	LF	\$637.14	1200	\$ 764,565.12
15	30" SD Lateral in Bethany Home, 8th Ave to 15th Ave	LF	\$448.81	2500	\$ 1,122,033.00
16	48" SD Lateral in Missouri Ave., 18th Ave to 15th Ave	LF	\$637.14	1990	\$ 1,267,903.82
17	42" SD Lateral in Missouri Ave., 11th Ave to 15th Ave	LF	\$578.17	1320	\$ 763,188.62
18	42" SD Lateral in Camelback Rd., 11th Ave to 15th Ave	LF	\$578.17	1440	\$ 832,569.41
19	Excavation and Haul (18 mile round trip)	CY	\$13.00	280000	\$ 3,640,000.00
20	36" Pipe - Golf Course Equalization	LF	\$506.89	600	\$ 304,135.92
21	30" Pipe - Golf Course Equalization	LF	\$448.81	300	\$ 134,643.96
22	Reconstruct Golf Course (9 holes, 27 acres)	LS	\$2,500,000.00	1	\$ 2,500,000.00
Sub Total					\$ 29,661,314.83
Contingencies (20%)					\$ 5,932,262.97
TOTAL					\$ 35,593,600.00

ALTERNATIVE 6

Alternative 6 – Floodproofing

There are currently 43 homeowners that have complained of flooding in the Old Cave Creek Floodplain area. For some of the homes, simply raising the driveway and creating a berm along a side of the property may solve the flooding issue, but for purposes of this cursory analysis, it was assumed that all 43 homes would be elevated

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Floodproof Home - Raise Finish Floor Elevation	EA	\$150,000.00	43	\$ 6,450,000.00
2	Move Residents and Provide Temporary Housing	EA	\$25,000.00	43	\$ 1,075,000.00
Sub Total					\$ 7,525,000.00
Contingencies (20%)					\$ 1,505,000.00
TOTAL					\$ 9,030,000.00

ALTERNATIVE 7

Alternative 7 – New Storm Drain in 3rd Avenue (10-year, GCFP)

This alternative is for a new 10-year storm drain in 3rd Avenue that begins at the Grand Canal and continues to the south, in 3rd Avenue, to I-10 where it discharges into the I-10 tunnel system. This system includes enough connector pipes and inlets to capture the 10-year runoff along the 3rd Avenue corridor.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	54" SD in 3rd Ave., Grand Canal to Indian School Rd	LF	\$698.29	3200	\$ 2,234,538.24
2	72" SD in 3rd Ave., Indian School Rd to Thomas Rd	LF	\$878.70	5400	\$ 4,744,967.04
3	78" SD in 3rd Ave., Thomas Rd to I-10 Tunnel	LF	\$937.95	6500	\$ 6,096,690.60
					\$ -
Sub Total					\$ 13,076,195.88
Contingencies (20%)					\$ 2,615,239.18
TOTAL					\$ 15,691,400.00

ALTERNATIVE 8

Alternative 8 – New Storm Drain in McDowell Road (10-year, GCFP)

This alternative is for a new 10-year storm drain in McDowell Road that begins at 19th Avenue and continues to the east, in McDowell Road, to 9th Avenue and then south, in 9th Avenue, to I-10 where it discharges into the I-10 tunnel system. This system intercepts the flow from both the new and existing storm drains in 19th Avenue and 15th Avenue and diverts them to the I-10 Tunnel.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	108" SD in McDowell Rd., 19th Ave to 15th Ave	LF	\$1,260.61	2640	\$ 3,328,018.85
2	144" SD in McDowell Rd., 15th Ave to 9th Ave	LF	\$1,696.21	1900	\$ 3,222,805.08
3	144" SD in 9th Ave., McDowell Rd to I-10 Tunnel	LF	\$1,696.21	1200	\$ 2,035,455.84
					\$ -
Sub Total					\$ 8,586,279.77
Contingencies (20%)					\$ 1,717,255.95
TOTAL					\$ 10,303,500.00

ALTERNATIVE 9

Alternative 9 – New Parallel Storm Drain in 19th Avenue (Supplement 10-year, GCFP)

This alternative is for a new parallel storm drain in 19th Avenue that supplements the existing storm drain by increasing the overall capacity to the equivalent of a 10-year system. This storm drain begins at the Grand Canal and continues south, in 20th Avenue, to Indian School Road then east, in Indian School Road to 19th Avenue, then south, in 19th Avenue, to McDowell Road. At McDowell Road the storm drain ties into a new storm drain (Alternative 8) and ultimately discharges into the I-10 tunnel system. New ½ mile long storm drain laterals are located at Osborn Road (west), Thomas Road (west), and Encanto Boulevard (west). This system has enough capacity to collect the 10-year flow between I-17 and 19th Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	72" SD in 20th Ave, Grand Canal to Indian School Rd.	LF	\$878.70	1200	\$ 1,054,437.12
2	78" SD in Indian School Rd., 20th Ave to 19th Ave	LF	\$937.95	650	\$ 609,669.06
3	90" SD in 19th Ave, Indian School Rd to Thomas Rd	LF	\$1,056.45	5280	\$ 5,578,049.66
4	90" SD in 19th Ave, Thomas Rd to McDowell Rd	LF	\$1,056.45	5280	\$ 5,578,049.66
5	66" SD Lateral in Osborn Rd., 24th Ave to 19th Ave	LF	\$819.44	3200	\$ 2,622,216.96
6	66" SD Lateral in Thomas Rd., 24th Ave to 19th Ave	LF	\$819.44	3200	\$ 2,622,216.96
7	78" SD Lateral in Encanto Blvd., 23rd Ave to 19th Ave	LF	\$937.95	2400	\$ 2,251,085.76
					\$ -
	Sub Total				\$ 20,315,725.19
	Contingencies (20%)				\$ 4,063,145.04
	TOTAL				\$ 24,378,900.00

ALTERNATIVE 10

Alternative 10 – New Parallel Storm Drain in 15th Avenue (Supplement 10-year, GCFP)

This alternative is for a new parallel storm drain in 15th Avenue that supplements the existing storm drain by increasing the overall capacity to the equivalent of a 10-year system. This storm drain begins at the Grand Canal and continues south, in 15th Avenue, to McDowell Road. At McDowell Road the storm drain ties into a new storm drain (Alternative 8) and ultimately discharges into the I-10 tunnel system. New ¼ mile long storm drain laterals are located at Indian School Road (east and west), Osborn Road (east and west), Thomas Road (east and west), and Encanto Boulevard (east and west). This system includes enough capacity to collect and convey the 10-year flow between 19th Avenue and 7th Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	72" SD in 15th Ave, Grand Canal to Indian School Road	LF	\$878.70	2100	\$ 1,845,264.96
2	114" SD in 15th Ave, Indian School Road to Thomas Road	LF	\$1,333.21	5280	\$ 7,039,365.70
3	120" SD in 15th Ave, Thomas Road to McDowell Road	LF	\$1,405.81	5280	\$ 7,422,693.70
4	66" SD Lateral in Indian School Rd., 18th Ave to 15th Ave	LF	\$819.44	1800	\$ 1,474,997.04
5	48" SD Lateral in Indian School Rd., 11th Ave to 15th Ave	LF	\$637.14	1400	\$ 891,992.64
6	54" SD Lateral in Osborn Rd., 18th Ave to 15th Ave	LF	\$698.29	1800	\$ 1,256,927.76
7	54" SD Lateral in Osborn Rd., 11th Ave to 15th Ave	LF	\$698.29	1400	\$ 977,610.48
8	54" SD Lateral in Thomas Rd., 18th Ave to 15th Ave	LF	\$698.29	1800	\$ 1,256,927.76
9	54" SD Lateral in Thomas Rd., 8th Ave to 15th Ave	LF	\$698.29	2200	\$ 1,536,245.04
10	66" SD Lateral in Encanto Blvd., 17th Ave to 15th Ave	LF	\$819.44	1750	\$ 1,434,024.90
11	66" SD Lateral in Encanto Blvd., 8th Ave to 15th Ave	LF	\$819.44	2200	\$ 1,802,774.16
	Sub Total				\$ 26,938,824.13
	Contingencies (20%)				\$ 5,387,764.83
	TOTAL				\$ 32,326,600.00

ALTERNATIVE 11

Alternative 11 – Storage in Encanto Municipal Golf Course

This alternative is for a new 10-year detention basin to be constructed within the existing Encanto Municipal Golf Course. The golf course would be reconstructed to provide the required 10-year, 24-hour runoff volume of about 400 acre-feet. It would drain to the existing 7th Avenue, 15th Avenue and 19th Avenue storm drains at a combined rate of 100 cfs. This storage basin would provide the outfall for the new storm drains in Alternatives 12 through 15 as well as the existing storm drains in 7th, 15th, and 19th Avenues.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Reconstruct Golf Course	EA	\$6,000,000.00	1	\$ 6,000,000.00
2	Excavation and Haul (12 mile Round Trip)	CY	\$12.00	840,000.00	\$ 10,080,000.00
3	66" Connection to Existing 7th Ave SD	LF	\$819.00	500	\$ 409,500.00
4	84" Connection to Existing 15th Ave SD	LF	\$997.19	100	\$ 99,719.40
5	72" Connection to Existing 19th Ave SD	LF	\$878.70	100	\$ 87,869.76
6	66" Outlet SD to 7th Ave SD	LF	\$819.00	500	\$ 409,500.00
7	84" Outlet SD to 15th Ave SD	LF	\$997.19	100	\$ 99,719.40
8	66" Outlet SD to 19th Ave SD	LF	\$819.44	100	\$ 81,944.28
9	Interior Basin Drainage, 24" Pipe	LF	\$120.00	1000	\$ 120,000.00
10	Interior Basin Drainage, 42" Pipe	LF	\$240.00	400	\$ 96,000.00
11	Interior Basin Drainage, 48" Pipe	LF	\$280.00	1800	\$ 504,000.00
12	Interior Basin Drainage, 60" Pipe	LF	\$360.00	1000	\$ 360,000.00
13	Interior Basin Drainage, 72" Pipe	LF	\$440.00	1000	\$ 440,000.00
	Sub Total				\$ 18,788,252.84
	Contingencies (20%)				\$ 3,757,650.57
	TOTAL				\$ 22,545,900.00

ALTERNATIVE 12

Alternative 12 – New Storm Drain in 18th Avenue (10-year, GCFP)

This alternative is for a new storm drain in 18th Avenue that begins at the Grand Canal and continues south, in 20th Avenue, to Indian School Road then east, in Indian School Road to 18th Avenue, then south, in 18th Avenue, to Thomas Road where it discharges into the Encanto Municipal Golf Course/Detention Basin. This storm drain includes a new ½ mile lateral in Osborn Road (west). This system has enough capacity to collect and convey the 10-year flood between I-17 and 19th Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	72" SD in 20th Ave., Grand Canal to Indian School	LF	\$878.70	1300	\$ 1,142,306.88
2	84" SD in Indian School Rd., 20th Ave to 18th Ave	LF	\$997.19	1300	\$ 1,296,352.20
3	84" SD in 18th Ave., Indian School to Osborn	LF	\$997.19	2640	\$ 2,632,592.16
4	96" SD in 18th Ave., Osborn to Encanto Golf Course	LF	\$1,115.70	2700	\$ 3,012,399.72
5	66" SD Lateral In Osborn Rd., 24th Ave to 18th Ave	LF	\$819.44	3900	\$ 3,195,826.92
					\$ -
Sub Total					\$ 11,279,477.88
Contingencies (20%)					\$ 2,255,895.58
TOTAL					\$ 13,535,400.00

ALTERNATIVE 13

Alternative 13 – New Storm Drain in Thomas Road (10-year, GCFP)

This alternative is for a new 10-year storm drain in Thomas Road that begins at 24th Avenue and continues to the east, in Thomas Road, to 19th Avenue and into the new detention basin located in the Encanto Municipal Golf Course.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	66" SD in Thomas Rd., 24th Ave to Encanto Golf Course	LF	\$819.44	3900	\$ 3,195,826.92
					\$ -
Sub Total					\$ 3,195,826.92
Contingencies (20%)					\$ 639,165.38
TOTAL					\$ 3,835,000.00

ALTERNATIVE 14

Alternative 14 – New Parallel Storm Drain in 15th Avenue (Supplement 10-year, GCFP)

This alternative is for a new parallel storm drain in 15th Avenue that supplements the existing storm drain system by increasing the overall capacity to the equivalent of a 10-year system. This storm drain begins at the Grand Canal and continues south, in 15th Avenue, to Thomas Road. At Thomas Road the storm drain discharges into the Encanto Municipal Golf Course/Detention Basin (Alternative 11). New ¼ mile long storm drain laterals are located at Indian School Road (east and west), Osborn Road (east and west), Thomas Road (east and west).

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	84" SD in 15th Ave., Grand Canal to Indian School	LF	\$997.19	2200	\$ 2,193,826.80
2	90" SD in 15th Ave., Indian School to Osborn	LF	\$1,056.45	2640	\$ 2,789,024.83
3	102" SD in 15th Ave., Osborn to Encanto Golf Course	LF	\$1,188.16	3500	\$ 4,158,554.40
4	66" SD Lateral in Indian School Rd., 18th Ave to 15th Ave	LF	\$819.44	1800	\$ 1,474,997.04
5	48" SD Lateral in Indian School Rd., 11th Ave to 15th Ave	LF	\$637.14	1400	\$ 891,992.64
6	54" SD Lateral in Osborn Rd., 18th Ave to 15th Ave	LF	\$698.29	1800	\$ 1,256,927.76
7	54" SD Lateral in Osborn Rd., 11th Ave to 15th Ave	LF	\$698.29	1400	\$ 977,610.48
8	36" SD Lateral in Thomas Rd., 18th Ave to 15th Ave	LF	\$506.89	800	\$ 405,514.56
9	54" SD Lateral in Thomas Rd., 8th Ave to 15th Ave	LF	\$698.29	2200	\$ 1,536,245.04
Sub Total					\$ 15,684,693.55
Contingencies (20%)					\$ 3,136,938.71
TOTAL					\$ 18,821,600.00

ALTERNATIVE 15

Alternative 15 – New Storm Drain in 3rd Avenue (10-year, GCFP)

This alternative is for a new 10-year storm drain in 3rd Avenue that begins at the Grand Canal and continues to the south, in 3rd Avenue, to Thomas Road and then west, in Thomas Road, to 7th Avenue and then south, in 7th Avenue, to Cambridge Avenue and then west, in Cambridge Avenue, to where it discharges into the Encanto Municipal Golf Course.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	54" SD in 3rd Ave., Grand Canal to Indian School	LF	\$698.29	3200	\$ 2,234,538.24
2	72" SD in 3rd Ave., Indian School to Thomas	LF	\$878.70	5400	\$ 4,744,967.04
3	72" SD in Thomas Rd., 3rd Ave to Encanto Golf Course	LF	\$878.70	3000	\$ 2,636,092.80
Sub Total					\$ 9,615,598.08
Contingencies (20%)					\$ 1,923,119.62
TOTAL					\$ 11,538,700.00

ALTERNATIVE 16

Alternative 16 – Storage at Veterans Memorial Coliseum/Arizona State Fairgrounds

This alternative is for a new 10-year detention basin to be constructed within the existing Arizona State Fairgrounds. The fair grounds would be redesigned to provide the required storage with outfalls to the existing 19th Avenue storm drain without increasing the downstream discharge in the existing system. This storage basin is the outfall for the new storm drains in Alternatives 17 through 20 as well as the existing storm drains in 15th and 19th Avenues. The outfall for the new storage basin is the existing 19th Avenue storm drain.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Reconstruct 10-acre Parking Lot (West of 19th Avenue)	EA	\$1,200,000.00	1	\$ 1,200,000.00
2	Purchase Of Grounds (90 acres)	EA	\$32,000,000.00	1	\$ 32,000,000.00
3	Demolition (Coliseum and other Structures)	CF	\$0.36	10700000	\$ 3,852,000.00
4	66" Connection to Existing 19th Ave. SD	LF	\$819.44	100	\$ 81,944.28
5	90" Connection to Existing 15th Ave. SD	LF	\$1,056.45	1250	\$ 1,320,561.00
6	66" Outlet SD to 19th Ave SD	LF	\$819.44	100	\$ 81,944.28
7	Excavation and Haul (12 mile Roundtrip)	CY	\$12.00	800000	\$ 9,600,000.00
8	Park Amenities	LS	\$2,000,000.00	1	\$ 2,000,000.00
9	DG and Plants for Side Slopes	SF	\$1.25	650000	\$ 812,500.00
10	Turf for Basin (Provide Sports Fields)	SF	\$1.00	2600000	\$ 2,600,000.00
Sub Total					\$ 53,548,949.56
Contingencies (20%)					\$ 10,709,789.91
TOTAL					\$ 64,258,700.00

ALTERNATIVE 17

Alternative 17 – New Parallel Storm Drain in 15th Avenue (Supplement 10-year, GCFP)

This alternative is for a new parallel storm drain in 15th Avenue that supplements the existing storm drain system by increasing the overall capacity to the equivalent of a 10-year system. This storm drain begins at the Grand Canal and continues south, in 15th Avenue, to Palm Lane and then west, in Palm Lane to the new storage basin at the State Fairgrounds where the pipe discharges (Alternative 16). The existing storm drain in 15th Avenue will also be diverted west at either Palm Lane or at McDowell Road and will also discharge into the new storage basin. This system includes enough connector pipes and inlets to capture the mainline design flow.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	72" SD in 15th Ave., Grand Canal to Indian School	LF	\$878.70	2100	\$ 1,845,264.96
2	114" SD in 15th Ave., Indian School to Thomas	LF	\$1,333.21	5280	\$ 7,039,365.70
3	120" SD in 15th Ave., Thomas to Palm	LF	\$1,405.81	4000	\$ 5,623,252.80
4	120" SD in Palm, 15th Ave to 17th Ave	LF	\$1,405.81	1400	\$ 1,968,138.48
5	78" SD in Palm Lane., 15th Ave to Coliseum Storage Basin	LF	\$937.95	1200	\$ 1,125,542.88
6	66" SD Lateral in Indian School Rd., 18th Ave to 15th Ave	LF	\$819.44	1800	\$ 1,474,997.04
7	48" SD Lateral in Indian School Rd., 11th Ave to 15th Ave	LF	\$637.14	1400	\$ 891,992.64
8	54" SD Lateral in Osborn Rd., 18th Ave to 15th Ave	LF	\$698.29	1800	\$ 1,256,927.76
9	54" SD Lateral in Osborn Rd., 11th Ave to 15th Ave	LF	\$698.29	1400	\$ 977,610.48
10	54" SD Lateral in Thomas Rd., 18th Ave to 15th Ave	LF	\$698.29	1800	\$ 1,256,927.76
11	54" SD Lateral in Thomas Rd., 8th Ave to 15th Ave	LF	\$698.29	2200	\$ 1,536,245.04
12	66" SD Lateral in Encanto Blvd., 8th Ave to 15th Ave	LF	\$819.44	2200	\$ 1,802,774.16
13	90" SD McDowell Rd., 17th Ave to 15th Ave	LF	\$1,056.45	1300	\$ 1,373,383.44
14	90" SD McDowell Rd., 17th Ave to 15th Ave	LF	\$1,056.45	1300	\$ 1,373,383.44
Sub Total					\$ 29,545,806.58
Contingencies (20%)					\$ 5,909,161.32
TOTAL					\$ 35,455,000.00

ALTERNATIVE 18

Alternative 18 – New Storm Drain in 19th Avenue (10-year, GCFP)

This alternative is for a new storm drain in 19th Avenue that begins at the Grand Canal and continues south, in 20th Avenue, to Indian School Road then east, in Indian School Road to 19th Avenue, the south, in 19th Avenue, to Encanto Boulevard where it discharges into the new storage basin at the State Fairgrounds (Alternative 16). The existing storm drain in 19th Avenue will also discharge into the new storage basin at Encanto Boulevard. This system includes enough connector pipes and inlets to capture the mainline design flow.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	72" SD in 20th Ave., Grand Canal to Indian School	LF	\$878.70	1300	\$ 1,142,306.88
2	78" SD in Indian School Rd., 20th Ave to 19th Ave	LF	\$937.95	650	\$ 609,669.06
3	78" SD in 19th Ave., Indian School to Thomas	LF	\$937.95	5280	\$ 4,952,388.67
4	78" SD in 19th Ave., Thomas to Coliseum Storage Basin	LF	\$937.95	2800	\$ 2,626,266.72
					\$ -
Sub Total					\$ 9,330,631.33
Contingencies (20%)					\$ 1,866,126.27
TOTAL					\$ 11,196,800.00

ALTERNATIVE 19

Alternative 19 – New Storm Drain in Encanto Boulevard (10-year, GCFP)

This alternative is for a new storm drain in Encanto Boulevard from 23rd Avenue to the Arizona State Fairgrounds where the pipe will discharge into a new storage basin (Alternative 16). This system includes enough connector pipes and inlets to capture the mainline design flow.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	78" SD in Encanto Blvd., 23rd Ave to Coliseum Storage Basin	LF	\$937.95	2800	\$ 2,626,266.72
					\$ -
Sub Total					\$ 2,626,266.72
Contingencies (20%)					\$ 525,253.34
TOTAL					\$ 3,151,500.00

ALTERNATIVE 20

Alternative 20 – New Storm Drain in Grand Avenue (10-year, GCFP)

This alternative is for a new storm drain in Grand Avenue from 22nd Avenue to McDowell Road and then discharge into the new storage basin at the Arizona State Fairgrounds (Alternative 16). This system includes enough connector pipes and inlets to capture the mainline design flow.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	60" SD in Grand Ave., 23rd Ave to Coliseum Storage Basin	LF	\$759.41	3400	\$ 2,581,991.28
					\$ -
Sub Total					\$ 2,581,991.28
Contingencies (20%)					\$ 516,398.26
TOTAL					\$ 3,098,400.00

ALTERNATIVE 21

Alternative 21 – Buyout, Demolish and Resale Lots within the Floodplain

This alternative is a buyout program for the residential homes located within the floodplain on the upstream side of the Grand Canal. The homes would be bought and demolished with the cleared lots sold for redevelopment with homes whose finished floors would be above the flood pool elevation.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Buy Out Homes in Grand Canal Floodplain	EA	\$128,654,248.00	1	\$ 128,654,248.00
2	Demolition	EA	\$11,000.00	531	\$ 5,841,000.00
3	Resale of Land	EA	\$150,000.00	531	\$ (79,650,000.00)
4	Relocation, Admin., Broker Costs (25% of Purchase Price)	LS	\$32,163,562.00	1	\$ 32,163,562.00
Sub Total					\$ 87,008,810.00
Contingencies (20%)					\$ 17,401,762.00
TOTAL					\$ 104,410,600.00

ALTERNATIVE 22

Alternative 22 – Linear Parks and Storage in Floodplain along the Grand Canal

This alternative is to buy some of the property on the upstream side of the Grand Canal and to convert these properties into small parks connected by a trail system along the canal.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Buy out homes for Linear Park	EA	\$128,235,241.00	1	\$ 128,235,241.00
2	Construction of Parks/Open Space	AC	\$100,000.00	155	\$ 15,500,000.00
3	Demolition	EA	\$11,000.00	528	\$ 5,808,000.00
4	Relocation, Admin. Costs (20% of Purchase Price)	LS	\$25,647,048.20	1	\$ 25,647,048.20
Sub Total					\$ 175,190,289.20
Contingencies (20%)					\$ 35,038,057.84
TOTAL					\$ 210,228,300.00

ALTERNATIVE 23

Alternative 23 – Linear Park and Stormwater Collection System

This alternative is for the purchase of some residential homes located between 4th Street and 11th Street. The residences would be demolished and the land turned into two linear parks separated by 7th Street. Additionally, a 100-year storm drain system would be constructed in the new parks that would collect and convey storm water out to a new storm drain located in 7th Street. The new storm drain would siphon under the Grand Canal and continue south, in 7th Street, and ultimately connect into ADOT's I-10 west tunnel system.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	102" Storm Drain	LF	\$1,188.16	14500	\$ 17,228,296.80
					\$ -
Sub Total					\$ 17,228,296.80
Contingencies (20%)					\$ 3,445,659.36
TOTAL					\$ 20,674,000.00

ALTERNATIVE 24

Alternative 24 – Modifications to 16th Street Storm Drain (I-10 to the Railroad)

This alternative is to add storm drain lateral pipes and inlets to the 16th Street storm drain in order to take advantage of its extra capacity. The construction of I-10 diverted the upstream portion of the 16th SD into the tunnel system, which resulted in extra capacity in the downstream pipe. This alternative is to construct enough inlets to capture 160 cfs which is the approximate capacity of the pipe.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	M1, L=17' Inlets	EA	\$5,000.00	26	\$ 130,000.00
2	30" Storm Drain Laterals	LF	\$448.81	1300	\$ 583,457.16
					\$ -
Sub Total					\$ 713,457.16
Contingencies (20%)					\$ 142,691.43
TOTAL					\$ 856,100.00

ALTERNATIVE 25

Alternative 25 – Fillmore Street (East) Storm Drain (West Tunnel to 13th Street)

This alternative is to construct a new storm drain in Fillmore Street from 2nd Street to 13th Street, discharging to the west tunnel. It includes laterals in 3rd Street, 7th Street, and 13th Street. The 7th Street lateral is an existing storm drain which will require new lateral pipes and inlets to take advantage of excess capacity. Like the 16th Street SD, the 7th Street SD was truncated at I-10 during construction of the Freeway. The combined system has sufficient capacity to collect and convey the 10-year flood from the area north of Fillmore Street, between 2nd Street and 16th Street.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	78" SD in 13th St, I-10 to Fillmore	LF	\$937.95	2360	\$ 2,213,567.66
2	78" SD in Fillmore, 13th St to West Tunnel	LF	\$937.95	5220	\$ 4,896,111.53
3	M1, L=17 Inlets	EA	\$5,000.00	32	\$ 160,000.00
4	30" Storm Drain Laterals	LF	\$448.81	1600	\$ 718,101.12
					\$ -
	Sub Total				\$ 7,987,780.31
	Contingencies (20%)				\$ 1,597,556.06
	TOTAL				\$ 9,585,300.00

ALTERNATIVE 26

Alternative 26 – 9th Street Storm Drain (Van Buren to the Railroad)

This alternative includes a new storm drain in 9th Street that discharges to the I-10 tunnel at Grant Street. It also includes adding new inlets to the existing storm drain in 12th Street. The combined system has enough capacity to convey the 10-year flood from the area east of 9th Street, between the Railroad and Fillmore Street.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	78" SD in 9th Street, Taylor to Lincoln	LF	\$937.95	4120	\$ 3,864,363.89
2	78" SD in Lincoln, 9th Street to West Tunnel	LF	\$937.95	2970	\$ 2,785,718.63
3	M1, L=17 Inlets	EA	\$5,000.00	36	\$ 180,000.00
4	30" Storm Drain Laterals	LF	\$448.81	1800	\$ 807,863.76
					\$ -
	Sub Total				\$ 7,637,946.28
	Contingencies (20%)				\$ 1,527,589.26
	TOTAL				\$ 9,165,500.00

ALTERNATIVE 27

Alternative 27 – Fillmore Street (East) Storm Drain (West Tunnel to 13th Street)

This alternative is to construct a new storm drain in Fillmore Street from 9th Avenue to Central Avenue, discharging to the existing 9th Avenue storm drain. It includes laterals in Central Avenue as well as new lateral pipes and inlets on the 9th Avenue storm drain. Like the 16th Street SD, the 9th Avenue SD was truncated at I-10 during construction of the Freeway, leaving the extra capacity available for the Fillmore storm drain connection. The combined system has sufficient capacity to collect and convey most of the 10-year flood from the area north of Van Buren Street, between 9th Avenue and 2nd Street.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	66" SD in Fillmore Rd., Central Avenue to 9th Avenue	LF	\$819.44	3510	\$ 2,876,244.23
2	48" SD in Central Ave, Roosevelt to Polk	LF	\$637.14	2310	\$ 1,471,787.86
3	M1, L=17 Inlets	EA	\$5,000.00	24	\$ 120,000.00
4	30" Storm Drain Laterals	LF	\$448.81	1200	\$ 538,575.84
					\$ -
	Sub Total				\$ 5,006,607.92
	Contingencies (20%)				\$ 1,001,321.58
	TOTAL				\$ 6,007,900.00

ALTERNATIVE 28

Alternative 28 – 3rd Avenue Storm Drain (Van Buren to Tonto Street)

This alternative is to construct a new storm drain in 3rd Avenue from Van Buren down to Tonto, discharging to ADOT’s West Tunnel at Tonto Street. This alternative also includes new laterals and inlets on the 5th Street Storm Drain which will be truncated by the Fillmore Street storm drain described in Alternative number 25. The combined system has enough capacity to convey the 10-year flood from the area upstream of the Railroad, between 3rd Avenue and 9th Street.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	66" SD in 3rd Avenue, Van Buren to Tonto/West Tunnel	LF	\$819.44	5740	\$ 4,703,601.67
2	M1, L=17 Inlets	EA	\$5,000.00	22	\$ 110,000.00
3	30" Storm Drain Laterals	LF	\$448.81	1100	\$ 493,694.52
					\$ -
	Sub Total				\$ 5,307,296.19
	Contingencies (20%)				\$ 1,061,459.24
	TOTAL				\$ 6,368,800.00

ALTERNATIVE 29

Alternative 29 – Modifications to 15th Avenue Storm Drain

This alternative is based on the assumption that the flow in the existing 15th Avenue storm drain will be diverted upstream of I-10, either into the I-10 tunnel or into a storage basin, which will leave the capacity of the storm drain to be used to collect and convey flow from the Downtown Area. The cost associated with this alternative is to add storm drain lateral pipes and inlets to the 15th Avenue storm drain in order to take advantage of its extra capacity. This alternative is to construct enough inlets to capture 240 cfs which is the approximate capacity of the pipe.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	M1, L=17' Inlets	EA	\$5,000.00	24	\$ 120,000.00
2	30" Storm Drain Laterals	LF	\$448.81	1200	\$ 538,575.84
					\$ -
	Sub Total				\$ 658,575.84
	Contingencies (20%)				\$ 131,715.17
	TOTAL				\$ 790,300.00

ALTERNATIVE 30

Alternative 30 – Modifications to 19th Avenue Storm Drain

This alternative is based on the assumption that the flow in the existing 19th Avenue storm drain will be diverted upstream of I-10, either into the I-10 tunnel or into a storage basin, which will leave the capacity of the storm drain to be used to collect and convey flow from the Downtown Area. The cost associated with this alternative is to add storm drain lateral pipes and inlets to the 19th Avenue storm drain in order to take advantage of its extra capacity. This alternative is to construct enough inlets to capture 140 cfs which is the approximate capacity of the pipe.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	M1, L=17' Inlets	EA	\$5,000.00	24	\$ 120,000.00
2	30" Storm Drain Laterals	LF	\$448.81	1200	\$ 538,575.84
					\$ -
	Sub Total				\$ 658,575.84
	Contingencies (20%)				\$ 131,715.17
	TOTAL				\$ 790,300.00

ALTERNATIVE 31

Alternative 31 – 7th Street Storm Drain (Salt River to Sherman Street)

This alternative is for a new storm drain in 7th Street. The storm drain alignment is in 7th Street from Sherman Street to the Salt River. It is designed to convey the 10-year flood from the area between I-17 and the Railroad, east of 7th Street.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	60" SD in Thomas Rd., Shermann Street to Salt River	LF	\$759.41	6820	\$ 5,179,170.74
					\$ -
	Sub Total				\$ 5,179,170.74
	Contingencies (20%)				\$ 1,035,834.15
	TOTAL				\$ 6,215,000.00

ALTERNATIVE 32

Alternative 32 – 3rd Avenue (South) Storm Drain (Buckeye Road to I-17)

This alternative is for a new storm drain in 3rd Avenue. The storm drain will outlet to the West Tunnel at I-17. It is designed to convey the 10-year flood from the area between I-17 and Buckeye Road, east of 3rd Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	60" SD in 3rd Avenue, Buckeye Road to West Tunnel at I-17	LF	\$759.41	4350	\$ 3,303,430.02
				0	\$ -
Sub Total					\$ 3,303,430.02
Contingencies (20%)					\$ 660,686.00
TOTAL					\$ 3,964,100.00

ALTERNATIVE 33

Alternative 33 – 7th Avenue Storm Drain

The alternative is a new storm drain in 7th Avenue that would run from Grant Street to the Salt River. It also includes new lateral pipes and inlets on the existing 11th Avenue and 15th Avenue storm drains in order to utilize their excess capacity. The combined system is designed to convey the 10-year flood from the area between I-17 and Railroad, east of 15th Avenue.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	60" SD in 7th Avenue, Grant Street to Salt River	LF	\$759.41	7690	\$ 5,839,856.75
2	M1, L=17 Inlets	EA	\$5,000.00	14	\$ 70,000.00
3	30" Storm Drain Laterals	LF	\$448.81	700	\$ 314,169.24
Sub Total					\$ 6,224,025.99
Contingencies (20%)					\$ 1,244,805.20
TOTAL					\$ 7,468,800.00

ALTERNATIVE 34

Alternative 34 – New Storage Basin at Durango Curve with Conveyance to Salt River

This solution is for a new storm drain system to intercept and convey stormwater runoff and discharge that runoff into a new storage basin located in the Durango Curve area. The basin and storm drains are sized for the 100-year event assuming that there is a new 10-year system in place upstream. New storm drains would be located in the I-17 frontage road, Pima Street, and in Durango Street. A metered outflow of 400 cfs will be conveyed in a new storm drain, from the storage basin, west in Durango Street to 27th Avenue and then south in 27th Avenue to the Salt River.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Purchase Land for Storage Basin (61 parcels)	LS	\$10,109,243.00	1	\$ 10,109,243.00
2	Relocation, Admin. Costs (20% of Purchase Price)	LS	\$2,021,848.60	1	\$ 2,021,848.60
3	Demolish and Remove Debris (1 structure/parcel)	EA	\$20,000.00	61	\$ 1,220,000.00
4	Drainage Excavation and Haul	CY	\$9.50	550000	\$ 5,225,000.00
5	Turf and Park Amenities	SF	\$3.00	1600000	\$ 4,800,000.00
6	SD Line 1a, Jefferson to Madison, 10' x 6' CBC	LF	\$1,740.25	300	\$ 522,074.52
7	SD Line 1b, Madison to Jackson, 12' x 8' CBC	LF	\$2,410.08	400	\$ 964,032.96
8	SD Line 1c, Jackson to Harrison, 12' x 10' CBC	LF	\$2,621.88	350	\$ 917,656.74
9	SD Line 1d, Harrison to Lincoln St, 2 - 12' x 8' CBCs	LF	\$3,396.98	1300	\$ 4,416,074.52
10	SD Line 1e, Lincoln St to Buckeye Rd, 2 - 12' x 8' CBCs	LF	\$3,396.98	1650	\$ 5,605,017.66
11	SD Line 1f, Buckeye Rd to Basin, 2 - 12' x 8' CBCs	LF	\$3,396.98	800	\$ 2,717,584.32
12	SD Line 1 Laterals, Jefferson - Harrison, 10' x 6' CBC	LF	\$1,740.25	2000	\$ 3,480,496.80
13	SD Line 1 Lateral, Lincoln St., 54" Pipe	LF	\$698.29	1500	\$ 1,047,439.80
14	SD Line 1 Lateral, Buckeye Rd., 54" Pipe	LF	\$698.29	1500	\$ 1,047,439.80
15	SD Line 3a, Pima Street, Basin to 19th Ave, 102" Pipe	LF	\$1,188.16	1500	\$ 1,782,237.60
16	SD Line 3a, Pima Street, 19th Ave to 17th Ave, 96" Pipe	LF	\$1,115.70	1200	\$ 1,338,844.32
17	SD Line 3 Lateral, 18th Ave, 42" Pipe	LF	\$578.17	1000	\$ 578,173.20
18	SD Line 3 Lateral, 17th Ave, 72" Pipe	LF	\$878.70	1700	\$ 1,493,785.92
19	SD Line 3 Lateral, 8 Laterals, 48" Pipes	LF	\$637.14	2000	\$ 1,274,275.20
20	SD Line 5a, Durango St, 19th Ave to Basin, 72" Pipe	LF	\$878.70	1400	\$ 1,230,176.64
21	SD Line 5b, Durango St, 17th Ave to 19th Ave, 66" Pipe	LF	\$819.44	1200	\$ 983,331.36
22	SD Line 6, Basin to Salt River, 102" Pipe	LF	\$1,188.16	9500	\$ 11,287,504.80
Sub Total					\$ 64,062,237.76
Contingencies (20%)					\$ 12,812,447.55
TOTAL					\$ 76,874,700.00

ALTERNATIVE 35

Alternative 35 – Multiple Storage Basins at Durango Curve with Conveyance to Salt River

This solution is for a new storm drain system to intercept and convey stormwater runoff and discharge that runoff into two new storage basins located in the Durango Curve area. The basins and storm drains are sized for the 100-year event assuming that there is a new 10-year system in place upstream. The first storage basin would be located within the existing floodplain north of the railroad and adjacent to I-17. This basin would collect the 100-year flood and meter out 200 cfs to a new storm drain in the I-17 frontage road that would convey the runoff to the 2nd storage basin located in the Durango Curve area. Additional new storm drains would be located in Pima Street and in Durango Street. A metered outflow of 400 cfs will be conveyed, from the 2nd storage basin, within a new storm drain west in Durango Street to 27th Avenue and then south in 27th Avenue to the Salt River.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	Purchase Land for Basin #1	LS	\$24,710,388.00	1	\$ 24,710,388.00
2	Relocation, Admin. Costs (20% of Purchase Price)	LS	\$4,942,077.60	1	\$ 4,942,077.60
3	Demolish Existing Structures and Remove Debris	EA	\$20,000.00	213	\$ 4,260,000.00
4	Drainage Excavation and Haul for Basin #1	CY	\$9.50	480,000	\$ 4,560,000.00
5	Turf and Park Amenities for Basin #1	SF	\$3.00	2,160,000	\$ 6,480,000.00
6	Purchase Land for Basin #2	LS	\$4,544,281.00	1	\$ 4,544,281.00
7	Relocation, Admin. Costs (20% of Purchase Price)	LS	\$908,856.20	1	\$ 908,856.20
8	Demolish Existing Structures and Remove Debris	EA	\$20,000.00	27.0	\$ 540,000.00
9	Drainage Excavation and Haul for Basin #2	CY	\$9.50	120,000	\$ 1,140,000.00
10	Turf and Park Amenities for Basin #2	SF	\$3.00	590,000	\$ 1,770,000.00
11	SD Line 1a, Basin 1 to Lincoln St., 72" Pipe	LF	\$878.70	1,250	\$ 1,098,372.00
12	SD Line 1b, Lincoln St. to Buckeye Rd., 84" Pipe	LF	\$997.19	1,650	\$ 1,645,370.10
13	SD Line 1c, Buckeye Rd to Basin 2, 96" Pipe	LF	\$1,115.70	2,000	\$ 2,231,407.20
14	SD Line 1 Lateral, Lincoln St, 54" Pipe	LF	\$819.44	3,100	\$ 2,540,272.68
15	SD Line 1 Lateral, Buckeye Rd, 54" Pipe	LF	\$506.89	3,000	\$ 1,520,679.60
16	SD Line 3a, Pima St - 21st Ave to Basin, 120" Pipe	LF	\$1,405.81	750	\$ 1,054,359.90
17	SD Line 3b, Pima St - 17th Ave to 21st Ave, 108" Pipe	LF	\$1,260.61	1,950	\$ 2,458,195.74
18	SD Line 3 Lateral, 21st Ave, 60" Pipe	LF	\$759.41	900	\$ 683,468.28
19	SD Line 3 Lateral, 17th Ave (North), 84" Pipe	LF	\$997.19	1,200	\$ 1,196,632.80
20	SD Line 3 Lateral, 17th Ave (South), 84" Pipe	LF	\$997.19	1,000	\$ 997,194.00
21	SD Line 3 Lateral, 7 laterals, 54" Pipe	LF	\$698.29	2,100	\$ 1,466,415.72
22	SD Line 5, Durango St, 66" Pipe	LF	\$819.44	1,250	\$ 1,024,303.50
23	SD Line 6, Basin 2 to Salt River, 102" Pipe	LF	\$1,260.61	9,500	\$ 11,975,825.40
Sub Total					\$ 83,748,099.72
Contingencies (20%)					\$ 16,749,619.94
TOTAL					\$ 100,497,700.00

ALTERNATIVE 36

Alternative 36 – New Conveyance System from Durango Curve to Salt River

This solution is for a new storm drain system that would intercept and convey stormwater from the Durango Curve area while preventing I-17 from flooding. This 100-year system assumes that new 10-year systems are located upstream in both the Cave Creek floodplain area and the Downtown area. New storm drains would be located in the I-17 frontage road and in Durango Street. The combined inflow will discharge into a new outlet pipe that follows Durango Street west to 27th Avenue and then 27th Avenue south to the Salt River.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	SD Line 1a, Jefferson to Madison, 10' x 6' CBC	LF	\$1,740.25	300	\$ 522,074.52
2	SD Line 1b, Madison to Jackson, 12' x 8' CBC	LF	\$2,410.08	400	\$ 964,032.96
3	SD Line 1c, Jackson to Harrison, 12' x 10' CBC	LF	\$2,621.88	350	\$ 917,656.74
4	SD Line 1d, Harrison to Lincoln, 2 - 12' x 8' CBCs	LF	\$3,396.98	1300	\$ 4,416,074.52
5	SD Line 1e, Lincoln to Buckeye, 2 - 12' x 8' CBCs	LF	\$3,396.98	1650	\$ 5,605,017.66
6	SD Line 1f, Buckeye to 22nd Ave, 2 - 12' x 8' CBCs	LF	\$3,396.98	2200	\$ 7,473,356.88
7	SD Line 1 Laterals, Jefferson - Harrison, 10' x 6' CBC	LF	\$1,740.25	4000	\$ 6,960,993.60
8	SD Line 1 Lateral, Lincoln St, 54" Pipe	LF	\$698.29	2100	\$ 1,466,415.72
9	SD Line 1 Lateral, Buckeye Rd, 54" Pipe	LF	\$698.29	2100	\$ 1,466,415.72
10	SD Line 4, 19th Ave to Durango Curve, 10' x 8' CBC	LF	\$3,162.28	2200	\$ 6,957,025.68
11	SD Line 4 Lateral, Cocopah to Durango, 10' x 6' CBC	LF	\$1,740.25	800	\$ 1,392,198.72
12	SD Line 4 Lateral, Pima to Cocopah, 10' x 6' CBC	LF	\$1,740.25	400	\$ 696,099.36
13	SD Line 4 Lateral, Pima, 17th to 19th, 10' x 6' CBC	LF	\$1,740.25	1300	\$ 2,262,322.92
14	SD Line 4 Lateral, 17th North, Buckeye to Pima, 78" Pipe	LF	\$937.95	1250	\$ 1,172,440.50
15	SD Line 4 Lateral, 17th South, Durango to Pima, 78" Pipe	LF	\$937.95	1100	\$ 1,031,747.64
16	SD Line 4 Laterals, 7-48" Pipes	LF	\$637.14	1400	\$ 891,992.64
17	SD Line 4 Lateral, I17 Frontage, 17th to 19th, 54" Pipe	LF	\$698.29	1300	\$ 907,781.16
18	SD Line 5, Durango Curve to Salt River, 2 - 12' x 10' CBCs	LF	\$4,473.51	9100	\$ 40,708,908.24
19	Special Structure at Durango Curve	EA	\$300,000.00	1	\$ 300,000.00
					\$ -
	Sub Total				\$ 86,112,555.18
	Contingencies (20%)				\$ 17,222,511.04
	TOTAL				\$ 103,335,100.00

ALTERNATIVE 37

Alternative 37 – New Storm Drain in Thomas Road (10-year, Arcadia)

This alternative is for a new storm drain in Thomas Road from 61st Street to 48th Street that would discharge into the existing Old Cross Cut Canal. A lateral in 56th Street would begin at the Arizona Country Club Golf Course outfall and continue south, in 56th Street, to connect to the mainline in Thomas Road. This system includes enough connector pipes and inlets to capture the 10-year flow.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	48" SD in Thomas Rd., 61st St. to 56th St.	LF	\$637.14	3380	\$ 2,153,525.09
2	66" SD in Thomas Rd., 56th St. to 48th St.	LF	\$819.44	5280	\$ 4,326,657.98
3	60" SD in 56th St., Osborn Rd. to Thomas Rd.	LF	\$759.41	2750	\$ 2,088,375.30
	Sub Total				\$ 8,568,558.37
	Contingencies (20%)				\$ 1,713,711.67
	TOTAL				\$ 10,282,300.00

ALTERNATIVE 38

Alternative 38 – 10-year Camelback Road Collection System (Huitt-Zollars Alternate II)

This alternative is taken from the Arcadia Area Drainage Project (March 1997).

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	48" Pipe, CCWSB East to 40th Street	LF	\$637.14	1160	\$ 739,079.62
2	66" Pipe, CCWSB East to 40th Street	LF	\$819.44	670	\$ 549,026.68
3	66" Pipe, 40th Street South to Canal	LF	\$819.44	1025	\$ 839,928.87
4	66" Pipe, Canal - 40th Street to Camelback	LF	\$819.44	561	\$ 459,707.41
5	66" Pipe, Camelback - Canal East to Existing Pipe	LF	\$819.44	295	\$ 241,735.63
6	36" Pipe, Camelback - Castille Condos to Existing Pipe	LF	\$506.89	1300	\$ 658,961.16
7	78" Pipe, Arcadia - OCCC to Camelback	LF	\$937.95	2659	\$ 2,494,015.43
8	96" Pipe, Arcadia - OCCC to Camelback	LF	\$1,115.70	1366	\$ 1,524,051.12
9	78" Pipe, Camelback - Arcadia to 56th Street East to End	LF	\$937.95	1897	\$ 1,779,295.70
10	72" Pipe, Camelback - Arcadia to 56th Street East to End	LF	\$878.70	796	\$ 699,443.29
11	54" Pipe, Camelback - Arcadia to 56th Street East to End	LF	\$698.29	1323	\$ 923,841.90
12	36" Pipe, Camelback - Arcadia to 56th Street East to End	LF	\$506.89	1725	\$ 874,390.77
13	42" Pipe, Camelback - Arcadia West to End	LF	\$578.17	692	\$ 400,095.85
14	78" Pipe, Lafayette - 44th Street to Arcadia	LF	\$937.95	5013	\$ 4,701,955.38
15	48" Pipe, 44th Street - Lafayette North to End	LF	\$637.14	1157	\$ 737,168.20
16	48" Pipe, Invergordon - Lafayette to Camelback	LF	\$637.14	2552	\$ 1,625,975.16
17	48" Pipe, Camelback - Invergordon West to the End	LF	\$637.14	2632	\$ 1,676,946.16
Sub Total					\$ 20,925,618.33
Contingencies (20%)					\$ 4,185,123.67
TOTAL					\$ 25,110,700.00

ALTERNATIVE 39

Alternative 39 – 10-year Lafayette Interceptor System (Huitt-Zollars Alternate III)

This alternative is taken from the Arcadia Area Drainage Project (March 1997).

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	48" Pipe, CCSWB East to 40th Street	LF	\$637.14	1160	\$ 739,079.62
2	66" Pipe, CCWSB East to 40th Street	LF	\$819.44	670	\$ 549,026.68
3	66" Pipe, 40th Street South to Canal	LF	\$819.44	1025	\$ 839,928.87
4	66" Pipe, Canal - 40th Street to Camelback	LF	\$819.44	561	\$ 459,707.41
5	66" Pipe, Camelback - Canal East to Existing Pipe	LF	\$819.44	295	\$ 241,735.63
6	36" Pipe, Camelback - Castille Condo to Existing Pipe	LF	\$506.89	1300	\$ 658,961.16
7	84" Pipe, Arcadia - Canal to Lafayette	LF	\$997.19	1365	\$ 1,361,169.81
8	84" Pipe Siphon	EA	\$200,000.00	1	\$ 200,000.00
9	84" Pipe, Lafayette - Arcadia to 44th Street	LF	\$997.19	1320	\$ 1,316,296.08
10	78" Pipe, Lafayette - Arcadia to 44th Street	LF	\$937.95	3963	\$ 3,717,105.36
11	48" Pipe, 44th Street - Lafayette North to End	LF	\$637.14	1157	\$ 737,168.20
12	54" Pipe, Indian School Road - OCCC East to End	LF	\$698.29	1320	\$ 921,747.02
13	42" Pipe, Indian School Road - OCCC East to End	LF	\$578.17	772	\$ 446,349.71
14	30" Pipe, Indian School Road - OCCC East to End	LF	\$448.81	1299	\$ 583,008.35
15	24" Pipe, Indian School Road - OCCC East to End	LF	\$448.81	650	\$ 291,728.58
16	78" Pipe, Osborn Road - OCCC to 56th Street	LF	\$937.95	5277	\$ 4,949,574.81
17	78" Pipe, 56th Street - Osborn Road to Lafayette	LF	\$937.95	2596	\$ 2,434,924.43
18	48" Pipe, 56th Street - Osborn Road to Lafayette	LF	\$637.14	80	\$ 50,971.01
19	54" Pipe, Lafayette - 56th Street West to End	LF	\$698.29	1637	\$ 1,143,105.97
Sub Total					\$ 21,641,588.70
Contingencies (20%)					\$ 4,328,317.74
TOTAL					\$ 25,969,900.00

ALTERNATIVE 40

Alternative 40 – 10-year Storm Drain in Van Buren Street

This solution includes cutting off the north-south flows from the existing 2-year storm drains in 24th Street, 32nd Street and 40th Street and convey this flow plus the local 10-year discharge in a new storm drain located in Van Buren Street. The now empty existing storm drains would then become available for additional stormwater conveyance at the airport. The new 10-year storm drain in Van Buren Street would ultimately discharge into ADOT’s east tunnel under I-10.

Item No.	Item Description	Unit	Unit Price	Quantity	Amount
1	SD Line 1a, Van Buren connection to East Tunnel, 8'x6' CBC	LF	\$1,502.91	750	\$ 1,127,184.30
2	SD Line 1b, Jackson St. connection to East Tunnel, 8'x6' CBC	LF	\$1,502.91	2800	\$ 4,208,154.72
3	SD Line 1c, Van Buren, 22nd St to 24th St, 10'x8' CBC	LF	\$1,897.79	1200	\$ 2,277,348.48
4	SD Line 1b, Van Buren, 28th St to 24th St, 10'x6' CBC	LF	\$1,740.25	2640	\$ 4,594,255.78
5	SD Line 1c, Van Buren, 32nd St to 28th St, 90" Pipe	LF	\$1,056.45	2640	\$ 2,789,024.83
6	SD Line 1d, Van Buren, 40th St to 32nd St, 72" Pipe	LF	\$878.70	5280	\$ 4,639,523.33
Sub Total					\$ 19,635,491.44
Contingencies (20%)					\$ 3,927,098.29
TOTAL					\$ 23,562,600.00