Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40

FINAL

VOLUME IV

Level III

Area Drainage Master Plan Update Report

APPENDICES B-G

Prepared for:

Flood Control District of Maricopa County

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Prepared by:

URS

APPENDIX B

FUTURE CONDITION HYDROLOGY REPORT

FUTURE CONDITION
HYDROLOGY
Loop 303 Corridor/White Tanks
Area Drainage Master Plan Update
Contract FCD 99-40

Prepared for
Flood Control District of Maricopa
County

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1.0 INTRODUCTION

The purpose of this report is to document the methodology and criteria followed to develop the future condition hydrology model used with the Level III portion of the ADMP Update analysis. The purpose of the future condition hydrology model was to provide a check to ensure adequate freeboard present within the proposed facilities upon ultimate build out of the project watershed area.

The ADMP Update project area is located west of the Agua Fria River and is bounded on the north by the McMicken Dam and US 60, on the west by the White Tanks Mountains, on the east by the Agua Fria River and on the south by the Salt/Gila rivers. For a more detailed description of the project and location, see the Data Collection Report, May 2003 and/or Figure 1.1 in the Level III Draft Area Drainage Master Plan Update Report.

For a detailed description of any changes in modeling assumptions, methodology or the project area that have occurred since the original WLB ADMS, refer to the Existing Condition Hydrology, dated November 2002. Figure 2.6 in the Existing Condition Hydrology, dated November 2002 shows the project area sub basin map. This map is identical for the future condition model with the exception that discharge rates shown on Figure 2.6 correspond with the existing condition hydrology model. However, the concentration point, divert and sub basins labels are identical and can be used in conjunction with the future condition output summary to determine particular discharge rates at locations of interest.

1.1 MODEL DEVELOPMENT SUMMARY

The following section will summarize the methodology used to develop the future condition hydrology model(s) prepared for the ADMP Update project. The first of the models prepared was based on the existing condition hydrology model. Using the existing condition hydrology model as a template, sub basins were modified to include a weighted percent impervious factor consistent with the future 'planned' land use as well as a volume diversion to simulate the enforcement of jurisdictional future onsite retention requirements.

The second of the future condition models developed was used to simulate the effect of the proposed ADMP facilities on the watershed area under ultimate build out conditions. This was necessary to ensure that the facilities proposed by the preferred/selected alternative would provide adequate freeboard upon the future development of the ADMP Update project area.

1.1.1 Future Condition Hydrology Development summary

Land Use

The FCDMC used a partially updated 1995 MAG land use map to generate the RTIMP variable. The RTIMP variable represents the percent impervious factor associated with the sub basins present within the Loop 303 ADMP Update project area under future conditions. RTIMP is assigned a value that is dependent upon land use and area cover. Using the relative percentages of particular future land uses anticipated in a given sub basin and the associated RTIMP value for each, a weighted RTIMP factor was computed. The MAG land use map is a working document, which is in the process of being updated by the various cities present within the ADMP Update project area. This map represents the best available/current land plan data associated with each of the jurisdictional agencies present within the watershed as of April 2001.

The following procedure was used to determine the input data used in the HEC-1 model to represent future development within each of the watershed sub basins:

- Identify all sub basins whose future land use is the same as the current use. By overlaying the sub basin map with the color aerial photograph, this task was relatively simple. The Figure located in Appendix B is one example of such an overlay used to make this type of comparison. The Figure was plotted on a transparency and overlaid onto the aerial photograph. Table 1.1 located in Appendix A shows a complete listing of the sub basins and their associated future land use.

    - For example land designated as agriculture or State Lands that remained unchanged on future zoning/land use plans was hatched and noted. The hydrologic input parameters for these areas were not changed in the future condition model.

- Proposed values for the percent impervious (%IMP) factor related to land uses by FCDMC were listed on a table and faxed to URS on May 1, 2001. A copy of this table has been included in Appendix B of this report. URS made recommendations for modifying these values and faxed them back to FCDMC for concurrence. A copy of the URS recommended changes is included in Appendix B.

- Sub basins in which future land use was identified as different from existing were noted in Table 1.1. The land use categories identified by the modified 1995 MAG future land use plan were weighted in each sub basin by the FCDMC GIS department electronically and provided to URS.

Future Retention Volume

To model the volume of retention to divert from a particular sub basin in the future condition model, the requirements enforced by the agency within whose jurisdiction the sub basin lies were used. These requirements range from the 100-year, 1-hour storm (no longer be applicable in this watershed), the 100-year, 2-hour storm and the 100-year, 6-hour storm.

To model these events quickly and efficiently, URS modified the JD and PC cards in the HEC-1 model. Although the hydrograph (UI) records should be regenerated and changed on every sub basin, this was beyond the scope and not considered essential for an adequate approximation of the total runoff volume expected.

The isopluvial curves found in the FCDMC hydrology manual were used to determine the total rainfall for the given storm events (JD card). The aerial reduction factors shown in the FCDMC manual were then applied and entered on the remaining JD cards.

Due to the size of the study area, the intersecting isopluvials were averaged over the site to estimate the total rainfall depth.

Basins that were distinguished as fully developed in the existing condition hydrology model were assumed to remain 100% developed in the future and carried the same retention values that were used for the existing condition. Sub basins that were developed in the future beyond the existing development percentage were evaluated further to estimate the magnitude of the sub basin retention.

Future development was assumed to provide the minimum jurisdictional retention reduced by 20% (or 80% effective). If the existing development had retention, then the total future development percentage was assumed to provide the jurisdictional minimum retention. If the existing development did not have retention, then only the land developed in the future (the total future percentage minus the existing percentage) was assumed to provide the minimum jurisdictional retention. These calculated values are shown in the "Future Development Providing Retention" column shown on *Table 1.1*.

The proposed method for determining the future onsite retention volume required to be provided by development was done according to the following steps:

- URS overlaid the sub basin map from the existing condition model with the color aerial photo of the project site. A hatch pattern was used to designate existing sub basins that were fully developed and providing retention. These sub basins were noted on a table. No change was made to these sub basins in the future condition model.

- Using another overlay, the existing, fully developed sub basins *not* providing retention were noted on the table. No change was made to these sub basins in the future condition model.

- Using another overlay, existing condition sub basins that were partially developed and *not* providing retention were noted on the table. The percent of the existing developed area (not providing retention) relative to the total sub basin area was estimated by inspection from the overlay of the aerial photo with the sub basin map. The additional retention volume diverted due to future conditions was based only on that portion of the sub basin that would develop in the future and provide onsite retention.

  As an example, if Sub Basin '1' is 10 ac and 6 ac are existing & developed without retention, then the total future retention volume diverted would be computed by:

$$V_{DIVERT} = ((10ac - 6ac)/10ac)*0.8*V_{HEC\text{-}1}$$

Where the coefficient 0.8 reflects the assumption that a basin has an 80% efficiency of retention capacity.

- Determine the retention volume requirements for sub basins within specific Towns, Cities or other jurisdictional areas within the project limits. This was done through documented phone conversations with the appropriate city personnel. *Table 1.2* located in Appendix A shows the retention requirements for the cities within the project area.

- Each sub basin was visually inspected for its location with respect to city boundaries using the Phoenix Mapping Service's 2001 edition Phoenix Metropolitan Street Atlas. In most cases, the sub basins were solely located within a single jurisdiction; however, a few crossed as many as 4 different jurisdictions (this occurred when Luke Air Force Base was considered an individual jurisdictional entity). Table 1.3 Located in Appendix A shows the percentages of each sub basin present within each city.

- Basins located completely within the City of Goodyear were included under the 100-year, 6-hour retention requirement. Basins outside the City of Goodyear boundaries fell under the 100-year, 2-hour retention requirement. In sub basins having 75% or greater area falling within the City of Goodyear, the 6-hour retention requirement was used for that basin. If the percentages of sub basin area within the City of Goodyear were less than 75% the 2-hour retention requirement was used. This was conservative since the runoff from sub basins providing onsite retention for the 100-year, 2-hour storm would be higher than on those providing retention for the 100-year, 6-hour storm.

- A hydrologic HEC-1 model was created and run for each of the storm events required for retention by the jurisdictional entities located within the project area. The volume of runoff estimated within the sub basins for each model was tabulated for later use in determining the actual onsite retention diversion used in the future condition 100-year, 24-hour storm event ADMP Update model. For all of the jurisdictional entities present within the watershed area, there were only two different criteria enforced for onsite storm water runoff retention:

  - 100-year, 2-hour storm

  - 100-year, 6-hour storm

  The HEC-1 hydrologic models developed to estimate the runoff volume associated with each of the storm event criteria listed above used estimated percent impervious data based on the future planned development discussed above. These models predict the total amount of volume generated by the required storm events within each of the watershed sub basins for future, developed conditions. The total volume generated within each sub basin was used as a basis for determining the appropriate volume diversion associated with the future development within each individual sub basin for the final future condition HEC-1 model (100-year, 24-hour storm).

- As mentioned above, the isopluvial maps found within the Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology, were used to determine the necessary rainfall depths to be used for computing runoff volume for the storm events listed above. In addition, the depth area reduction factors were computed. Table 1.4 located in Appendix A shows the precipitation estimates and depth area reduction factors used with the 100-year 2-hour and

100-year 6-hour HEC-1 models. Copies of the isopluvial maps are located in Appendix C.

- A table was developed showing the sub basin identification and the runoff volume generated within it (using the future condition RTIMP) corresponding with the appropriate storm duration. Table 1.5a and 1.5b located in Appendix A show the results for the 100-year, 6-hour and 100-year, 2-hour storms respectively.

For the detailed computations regarding the estimated magnitude of the future onsite retention diversion used for the individual sub basins in the future condition ADMP Update model, see Tables 1.1 – 1.5

2.0 ANALYSIS ISSUES AND EXPLANATION

Three conditions were checked and used to eliminate sub basins where the future land use would not be changed from existing and therefore would not require updating in the model. Since the FCDMC used its GIS software to generate RTIMP for all sub basins, URS used the following criteria to eliminate sub basins where the RTIMP variable would remain the same in the future.

All of these sub basins were eliminated from the list of sub basin vs. future RTIMP provided URS by FCDMC. Then, all remaining sub basin were modified in the HEC-1 future condition model to reflect the future condition RTIMP variable on the LG card.

Condition #1 – All sub basins that were 100% developed in the existing condition model were identified and crossed off of the list of sub basins requiring new (future) RTIMP values.

Condition #2 – All sub basins where the RTIMP value calculated with the FCDMC future land use maps and GIS software was less than the value used with the existing condition model were checked. In almost every case, this value was higher due to rock outcropping accounted for by WLB but not incorporated into the FCDMC land use category. For consistency, the original RTIMP value was used.

If a sub basin where the RTIMP decreased was in a developing area of the watershed, the existing (higher) RTIMP value was used unless the current land use was changing to a future land use with a legitimately lower RTIMP.

Condition #3 – All sub basins where the future land use remained the same (i.e., agriculture existing to agriculture future) were identified as 'no change' sub basins and crossed off the list of sub basins requiring modification.

The list of sub basins vs. weighted RTIMP provided URS by the FCDMC on Thursday, May 3rd showed some basins where RTIMP went down from the existing. Table 2.1 located in Appendix A shows a listing of sub basins, area, land use, associated RTIMP values and a weighted RTIMP value.

In cases where the future weighted RTIMP value (as computed by the FCDMC GIS department) was less than the existing, URS inspected the future land use vs. the present land use. If this analysis indicated a genuine reduction in RTIMP, the lower RTIMP provided by FCDMC was used. If the future land use did not change or otherwise indicate a need to reduce the RTIMP, the RTIMP from the existing condition hydrology model was maintained. Below is a list of these sub basins and the decision made regarding each. The RTIMP values associated with each sub basin listed are described as URS/WLB% to FCD/Future% where 'URS/WLB%' indicates the existing RTIMP value used in the existing condition model and the 'FCD/Future%' indicates the future RTIMP value provided by FCDMC:

- Sub Basin #1: 10% to 0%
    - White Tank Mountain area, 10% reflects rock outcrop therefore, RTIMP remains at 10%
- Sub Basin #8: same as above
- Sub Basin #9: same as above
- Sub Basin #33: same as above
- Sub Basin #34: same as above
- Sub Basin #35: 10% to 1.9% - White Tank FRS #4 watershed – Land use is changing from open space to some rural, 10% due to rock outcrop, leave at 10%
- Sub Basin #37: 9% to 1% - Land use is changing from open space to open space and rural – 9% due to rock outcrop, leave at 9%
- Sub Basin #40: 11% to 9% - Land use changing from open space to open space/rural/low density residential – 11% due to rock outcrop, leave at 11%.
- Sub Basin #111: 25% to 15.2% - Existing Arizona Traditions residential development is 100% developed – therefore, future land use will not change – use 25%.
- Sub Basin #114: 26% to 16% - Existing Sun City Grand 100% developed, therefore, future land use will not change, use 26%.
- Sub Basin #115: 27% to 17% - same as Sub Basin #114.
- Sub Basin #116: 28% to 15% - Existing Kingswood Parke sub division 100% developed, therefore, future land use will not change, use 28%.
- Sub Basin #118: 80% to 76.1% - Existing Home Depot, Wal-Mart and other commercial land use 100% developed therefore, future land use will not change, use 80%.

- Sub Basin #158: 25% to 21.5% - Existing land use is residential (aerial photo) vs. future described as mixed with mostly residential. Use the 25% for consistency with the existing model.

- Sub Basin #245: 18% to 5% - Existing land use included some residential and some open space (aerial photo), future land use described as rural densities. For consistency with the existing condition model, use 18%.

- Sub Basin 2711: 20% to 19.7% - Existing land use is Litchfield Park – future won't change, use 20%.

- Sub Basin 111A: 18% to 15.2% - Existing Arizona Traditions & open space 100% developed therefore, future is same, use 18%.

- Sub Basin 113A: 30% to 25.4% - Existing Bell West Ranch (aerial shows beginning of site grading, therefore the 30% assumes this development existing), future land use won't change, therefore use 30%.

- Sub Basin 138A: 30% to 17.7% - Existing Roseview sub division 100% developed, therefore, future won't change use 30%.

- Sub Basin 22A: 6% to 5.2% - Existing White Tank Mountain area, future land used described as rural, open space and industrial, use 6% for consistency with existing model.

- Sub Basin 243A: 30% to 15.2% - Existing open space and residential (aerial photo), future land use described as large & small lot residential. Therefore, use 30% for consistency with existing model.

- Sub Basin 243B: 18% to 14.4% - same as 243A.

- Sub Basin 255A: 12% to 9.5% - existing Litchfield Park therefore, future land use won't change, use 12%.

- Sub Basin 279A: 90% to 80% - Commercial/prison therefore, future land use won't change use 90%

- Sub Basin 279B: 90% to 80% - same as 279A

- Sub Basin 279C: Same as 279A-B

- Sub Basin 289A: 27% to 23.3% - existing land use is rural/residential. Future land use is Palm Valley/Pebble Creek – the existing RTIMP assumes that this development is built therefore, use 27%.

- Sub Basin 377B: 4% to 0% - existing MC 85 roadway, agriculture and open space. Future land use is open space. Since MC 85 exists, use 4%.

- Sub Basin Sub6: 20% to 11% - Existing Litchfield Park. Future land use will not change therefore use 20%.

From the above analysis, all of the RTIMP's that decreased using the FCDMC future land use (GIS calculation) will be maintained at the original (higher) value used with the existing condition model.

The following RTIMP variables provided to URS by FCDMC future land-use/GIS database indicate 0% IMP. This was verified by checking the aerial and the future land use categories.

- Sub Basin #182: 0% to 0% - future land use will still be agriculture
- Sub Basin #193: 0% to 0% - future land use is agriculture and rural densities
- Sub Basin #210: 0% to 0% - future land use is agriculture
- Sub Basin #211: same as #210
- Sub Basin #221: same as #211
- Sub Basin #369: open space, future is same
- Sub Basin #377: open space, future is same
- Sub Basin #379: same as above
- Sub Basin #380: same as above
- Sub Basin #381: same as above
- Sub Basin #386: same
- Sub Basin #387: same

- Sub basin #194A: existing agriculture, future is same
- Sub Basin #194B: same as 194A
- Sub Basin #221A: existing agriculture, future is same
- Sub Basin #377A-B: existing open space, future same
- Sub Basin #381A-B: same
- Sub Basin #383A: same

Explanation of Table 1.3

Table 1.3 discussed in section 1 above, contains some information that requires additional explanation. The column headings listed below are explained in more detail. Columns with headings that are self-explanatory are not addressed below.

100% Developed NO retention – This data represents the sub basins that were considered to be 100% developed at the time of the preparation of the existing condition (EEC/URS) HEC-1 model. These developed areas did not provide onsite retention and were identified when preparing the future condition HEC-1 so that they would not be given retention diversions in the future model. These Sub Basins should not change in the future condition model.

100% Developed with retention – This data represents the sub basins that were considered to be 100% developed at the time of the preparation of the existing condition (EEC/URS) HEC-1 model. These developed areas provided onsite retention and diverts were identified when preparing the existing condition HEC-1. These Sub Basins will not change in the future condition model. The retention diverts will remain the same.

Partial Development NO retention – This data represents the amount or percentage of the total sub basin area that was developed at the time of the preparation of the existing condition (EEC/URS) HEC-1 model. The percentages of developed area were based on inspection of an overlay of the sub basin boundary map with the color aerial photo (dated 2/2000).

In the future condition model, these sub basins were given retention diverts based upon the generation of storm water volume using the total sub basin area. Since a portion of this area exists as development without retention, the future volume to be retained is reduced by the percentage of existing development and providing retention.

For the condition of partial development that provides retention in the existing condition, the retention diversion shown in the existing condition (EEC/URS) HEC-1 file was replaced with the total volume calculated by the future condition HEC-1 using the appropriate retention requirement. This is based on the fact that the retained volume provided by the existing development plus the future development retention would equal the total future retention volume required for the sub basin.

During the preparation of the future condition model, several sub basins were evaluated and compared against the aerial photograph. During this analysis, three issues arose that impacted the RTIMP variable used in the existing condition model. These have been listed below:

- ***Sub Basin 173A*** – The RTIMP variable for the existing condition is listed at 0 however; this sub basin is clearly built out per the aerial photograph. URS has used the RTIMP calculated for the future condition by the FCDMC GIS/Land use as the existing condition and updated the existing condition HEC-1. This sub basin discharges to the Agua Fria River, therefore there were no significant impacts to downstream areas.
- ***Sub Basin 271C*** – The RTIMP variable for the existing condition is listed at 0 however; this sub basin is clearly built out per the aerial photograph. URS has used the RTIMP calculated for the future condition by the FCDMC GIS/Land use as the existing condition and updated the existing condition HEC-1. There were no significant impacts to downstream areas.

Other issues include the LAFB and Goodyear airports. Although these are considered existing and 100% developed, there is a chance that more buildings could be added to each site. The higher RTIMP values from the FCDMC future land use seem to indicate this possibility, therefore, the higher future values were used in the future condition HEC-1 model.

APPENDIX

A

Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout <u>No</u> Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
1	1.819		0.013	0%	0%	~~0%~~
10	2.051	Small Lot Residential (2-5)	22.390	22%	0%	22%
						~~0%~~
100A	0.154	Retirement Community	0.213	98%	0%	98%
101	0.149	Open Space	0.668	99%	0%	99%
102A	0.597	Open Space	1.049	99%	0%	99%
104	0.140	Open Space	6.887	93%	0%	93%
105	0.186		0.001	96%	0%	96%
106	0.801		0.004	99%	0%	99%
11	1.617	Rural	0.525	1%	0%	1%
~~111~~	~~0.250~~	~~Open Space~~	~~1.758~~	~~98%~~	~~0%~~	~~98%~~
111A	0.580	Open Space	1.425	99%	0%	99%
~~112~~	~~0.637~~	~~Medium/High Density Residential~~	~~96.847~~	~~100%~~	~~0%~~	~~100%~~
113A	0.501	Low Density Residential (3-5 Dus	83.936	100%	0%	100%
~~114~~	~~2.236~~	~~Retirement Community~~	~~2.053~~	~~100%~~	~~0%~~	~~100%~~
~~115~~	~~2.333~~	~~Retirement Community~~	~~3.817~~	~~100%~~	~~0%~~	~~100%~~
					0%	~~0%~~
116	0.728	Low Density Residential (3-5 Dus	100.000	100%	0%	100%
117	0.924	Retirement Community	7.612	100%	0%	100%
118	0.151	Retirement Community	5.993	100%	0%	100%
119	0.804	Open Space	0.170	100%	0%	100%
					0%	~~0%~~
119A	0.460	Medium/High Density Residential	100.000	100%	0%	100%
12	1.412	Small Lot Residential (2-5)	26.362	26%	0%	26%
120	0.526	Medium/High Density Residential	99.718	100%	0%	100%
					0%	~~0%~~
121	0.496	Medium/High Density Residential	0.654	100%	0%	100%
121A	0.511	Medium/High Density Residential	77.934	100%	0%	100%
122A	0.504	Medium/High Density Residential	95.919	100%	0%	100%
122B	0.396	Medium/High Density Residential	97.715	100%	0%	100%
					0%	~~0%~~
123	0.434	Low Density Residential (3-5 Dus	100.000	100%	0%	100%
124	0.561	Surprise Center	0.026	100%	0%	100%
125	1.014	Surprise Center	98.447	100%	0%	100%
126	0.936	Neighborhood Retail Center	0.131	100%	0%	100%
~~127~~	~~0.205~~	~~Neighborhood Retail Center~~	~~2.122~~	~~100%~~	~~0%~~	~~100%~~
128	0.403	Medium/High Density Residential	2.710	100%	0%	100%
~~129~~	~~0.408~~	~~Rural Residential (0-1 Du;s/Ac)~~	~~96.196~~	~~100%~~	~~0%~~	~~100%~~
13	1.361	Unknown	0.801	66%	0%	66%
130	0.979	Medium/High Density Residential	1.622	100%	0%	100%
131	0.488	Medium/High Density Residential	49.647	100%	0%	100%
131A	0.503	Medium/High Density Residential	50.719	100%	0%	100%
					0%	~~0%~~
132	0.393	Low Density Residential (3-5 Dus	100.000	100%	0%	100%
					0%	~~0%~~
133	0.500	Low Density Residential (3-5 Dus	100.000	100%	0%	100%
					0%	~~0%~~
134	0.499	Low Density Residential (3-5 Dus	100.000	100%	0%	100%
135	0.490	Surprise Center	0.003	100%	0%	100%
136	0.415	Surprise Center	0.014	100%	0%	100%
137	0.602	Surprise Center	4.138	100%	0%	100%
138	0.485	Medium/High Density Residential	2.071	100%	0%	100%
~~138A~~	~~0.509~~	~~Small Lot Residential~~	~~0.852~~	~~100%~~	~~0%~~	~~100%~~
139	0.475	Small Lot Residential	24.115	100%	0%	100%
14	1.471	Rural	0.277	2%	0%	2%
140	0.172	Small Lot Residential	0.303	100%	10%	90%
141	0.467	Rural Residential (0-1 Du;s/Ac)	0.005	99%	0%	99%
					0%	~~0%~~
141A	0.132	Rural Residential (0-1 Du;s/Ac)	1.859	100%	0%	100%
142	0.502	Suburban Residential (1-3 Dus/Ac	0.004	100%	0%	100%
143	0.501	Suburban Residential (1-3 Dus/Ac	96.658	100%	0%	100%
144	0.498	Medium/High Density Residential	0.544	100%	0%	100%
145	0.503	Medium/High Density Residential	0.007	100%	0%	100%
145A	0.503	Medium/High Density Residential	3.291	100%	0%	100%
146	0.895	Low Density Residential (3-5 Dus	0.002	100%	0%	100%
147	0.502	Low Density Residential (3-5 Dus	1.142	100%	0%	100%

1. As a % of total sub basin area.
Note!: Sub Basin lines w/ a strike-through are basins that **Do Not** provide future retention.

Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout No Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
148	0.495	Suburban Residential (1-3 Dus/Ac	0.099	100%	0%	100%
149	0.511	Suburban Residential (1-3 Dus/Ac	0.056	100%	0%	100%
15	1.277	Unknown	0.088	32%	0%	32%
					0%	~~0%~~
150	0.267	Suburban Residential (1-3 Dus/Ac	100.000	100%	0%	100%
					0%	~~0%~~
151	0.245	Suburban Residential (1-3 Dus/Ac	0.022	100%	0%	100%
152	0.371	Employment	0.095	100%	0%	100%
153	0.185	Low Density Residential (3-5 Dus	10.706	100%	0%	100%
154	0.180	Small Lot Residential	2.031	100%	0%	100%
155	0.251	Small Lot Residential	3.784	100%	0%	100%
156	0.293	Small Lot Residential	38.700	100%	50%	50%
~~156A~~	~~0.293~~	~~Small Lot Residential~~	~~82.034~~	~~100%~~	~~0%~~	~~100%~~
157	0.913	Small Lot Residential	81.908	100%	0%	100%
158	0.982	Water	0.014	96%	0%	96%
159	0.610	Rural Residential (0-1 Du;s/Ac)	11.130	100%	0%	100%
16	1.178	Small Lot Residential (2-5)	0.825	100%	0%	100%
160	0.358	Rural Residential (0-1 Du;s/Ac)	0.000	100%	0%	100%
161	0.503	Suburban Residential (1-3 Dus/Ac	2.187	100%	0%	100%
162	0.297	Suburban Residential (1-3 Dus/Ac	0.047	100%	0%	100%
163	0.698	Suburban Residential (1-3 Dus/Ac	4.385	100%	0%	100%
164	0.500	Suburban Residential (1-3 Dus/Ac	0.051	100%	0%	100%
164A	0.491	Mixed Use Gateway	1.610	100%	0%	100%
165	0.903	Suburban Residential (1-3 Dus/Ac	0.169	100%	0%	100%
166	0.980	Suburban Residential (1-3 Dus/Ac	0.000	100%	0%	100%
167	0.995	Suburban Residential (1-3 Dus/Ac	0.001	100%	0%	100%
168	0.485	Public Facilities	0.081	100%	0%	100%
169	0.495	Rural	3.836	100%	0%	100%
17	1.047	Small Lot Residential (2-5)	91.531	100%	0%	100%
					0%	~~0%~~
170	0.326	Rural	100.000	100%	90%	10%
171	0.649	Small Lot Residential	3.236	100%	30%	70%
172	0.114	Small Lot Residential	6.197	100%	25%	75%
~~173~~	~~0.263~~	~~Small Lot Residential~~	~~2.889~~	~~49%~~	~~49%~~	~~0%~~
~~173A~~	~~0.201~~		~~0.004~~	~~63%~~	~~0%~~	~~63%~~
173B	0.186	Water	0.099	81%	0%	81%
174	0.411	Unknown	0.725	99%	0%	99%
175	0.261	Unknown	0.508	99%	0%	99%
175A	0.465	Unknown	0.781	99%	0%	99%
176	0.679	Small Lot Residential (2-5)	37.722	100%	0%	100%
176A	0.597	Rural Residential (0-1 Du;s/Ac)	0.082	100%	5%	95%
177	0.501	Rural Residential (0-1 Du;s/Ac)	0.023	4%	0%	4%
177A	0.498	Unknown	0.004	97%	0%	97%
178	0.452	Rural Residential (0-1 Du;s/Ac)	1.236	3%	0%	3%
179	0.469	Rural Residential (0-1 Du;s/Ac)	0.001	2%	0%	2%
18	0.757		0.019	76%	0%	76%
180	0.999	Low Density Residential (3-5 Dus	0.414	3%	0%	3%
181	0.356	Employment	0.410	1%	0%	1%
181A	0.409	Suburban Residential (1-3 Dus/Ac	0.025	8%	0%	8%
					0%	~~0%~~
182	0.251	Agriculture	100.000	100%	0%	100%
183	0.220	Employment	0.269	6%	0%	6%
184	0.770	Rural	0.005	66%	0%	66%
185	0.671	Small Lot Residential	3.715	100%	0%	100%
186	0.320	Small Lot Residential	53.037	100%	0%	100%
187	0.268		0.002	89%	0%	89%
					0%	~~0%~~
188	0.165	Small Lot Residential (2-5)	100.000	100%	0%	100%
189	0.526	Unknown	0.006	100%	0%	100%
19	0.773	Rural	83.619	84%	0%	84%
190	0.874	Unknown	0.016	100%	0%	100%
191	0.991	Rural Densities (0-1)	1.680	100%	0%	100%
192	0.516	Unknown	0.043	0%	0%	0%
192A	0.494	Unknown	0.171	100%	0%	100%
					0%	~~0%~~
~~193~~	~~0.929~~	~~Agriculture~~	~~100.000~~	~~0%~~	~~0%~~	~~0%~~

1. *As a % of total sub basin area.*

Note!: Sub Basin lines w/ a strike-through are basins that Do Not provide future retention.

Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout <u>No</u> Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
					~~0%~~	~~0%~~
~~194A~~	~~0.257~~	~~Agriculture~~	~~100.000~~	~~0%~~	~~0%~~	~~0%~~
~~194B~~	~~0.254~~	~~Agriculture~~	~~0.228~~	~~0%~~	~~0%~~	~~0%~~
194C	0.490	Industrial	1.078	1%	0%	1%
195	0.530	Transportation	0.278	2%	0%	2%
196	0.554	Transportation	1.872	8%	8%	0%
197	0.987	Mixed Use	2.588	27%	0%	27%
198	0.903	Small Lot Residential	8.228	100%	0%	100%
199	0.097	Small Lot Residential	31.568	99%	0%	99%
2	1.870		0.002	5%	0%	5%
20	1.040	Rural	5.135	50%	0%	50%
200	0.223	Open Space	2.795	97%	0%	97%
~~201~~	~~0.306~~	~~Transportation~~	~~0.403~~	~~100%~~	~~100%~~	~~0%~~
202	0.500	Mixed Use Center	2.302	74%	0%	74%
203	0.214	Mixed Use Center	93.500	100%	0%	100%
204	0.236	Small Lot Residential	1.745	100%	0%	100%
					0%	~~0%~~
205	0.064	Mixed Use Center	100.000	100%	0%	100%
206	0.094	Rural	4.344	100%	0%	100%
207	1.001	Unknown	0.619	99%	100%	~~0%~~
207A	0.465	Small Lot Residential (2-5)	0.586	100%	0%	100%
208	1.009	Unknown	0.000	100%	100%	~~0%~~
209	0.506	Unknown	0.016	2%	0%	2%
209A	0.496	Unknown	0.635	99%	0%	99%
21	0.666	Rural	98.037	99%	0%	99%
					0%	~~0%~~
210	0.440	Agriculture	100.000	0%	0%	~~0%~~
					0%	~~0%~~
211	0.518	Agriculture	100.000	0%	0%	~~0%~~
212	0.531	**Airport**	2.423	2%	0%	2%
~~213~~	~~0.346~~	~~Industrial~~	~~1.161~~	~~99%~~	~~0%~~	~~99%~~
214	0.164	Small Lot Residential (2-5)	97.313	100%	0%	100%
215	0.309	Small Lot Residential (2-5)	99.633	100%	0%	100%
					0%	~~0%~~
215A	0.381	Small Lot Residential (2-5)	100.000	100%	0%	100%
~~216~~	~~0.482~~	~~Rural~~	~~5.358~~	~~100%~~	~~0%~~	~~100%~~
217	0.517	Unknown	0.180	100%	70%	30%
218	0.994	Rural Densities (0-1)	87.306	99%	0%	99%
219	0.497	Unknown	0.014	100%	0%	100%
22	0.579	Rural	94.812	100%	0%	100%
220	0.503	Unknown	0.014	98%	0%	98%
221	0.478	Agriculture	0.357	0%	0%	~~0%~~
221A	0.323	Agriculture	7.492	0%	0%	~~0%~~
~~222~~	~~1.112~~	~~Industrial~~	~~0.029~~	~~96%~~	~~100%~~	~~0%~~
~~223~~	~~1.357~~	~~Rural Densities (0-1)~~	~~0.136~~	~~100%~~	~~100%~~	~~0%~~
224	0.563	Small Lot Residential	0.828	99%	12%	87%
225	0.430	Unknown	0.012	100%	30%	70%
225A	0.368	Small Lot Residential (2-5)	39.494	100%	0%	100%
226	1.156	Unknown	0.010	100%	80%	20%
227	0.233	Small Lot Residential	1.587	100%	12%	88%
228	0.254	Small Lot Residential	0.554	100%	0%	100%
228A	0.060	Water	0.456	100%	10%	90%
229	0.478	Small Lot Residential	0.260	100%	6%	94%
22A	0.513	Rural	99.592	100%	0%	100%
						~~0%~~
23	0.154	Rural	100.000	100%	0%	100%
230	0.037	Small Lot Residential (2-5)	62.825	100%	0%	100%
230A	0.173	Unknown	0.065	100%	30%	70%
						~~0%~~
231	0.322	Rural Densities (0-1)	100.000	100%	0%	100%
232	0.938	Small Lot Residential (2-5)	99.350	100%	0%	100%
233	0.473	Small Lot Residential (2-5)	98.909	100%	0%	100%
234	0.487	Small Lot Residential (2-5)	0.215	100%	0%	100%
235	0.515	Unknown	0.000	100%	0%	100%
236	0.986	Unknown	0.015	100%	0%	100%
237	0.500	Mixed Use Center	84.446	84%	0%	84%

***1.** As a % of total sub basin area.*

***Note!**: Sub Basin lines w/ a strike-through are basins that **Do Not** provide future retention.*

Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout No Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
238	0.491	Unknown	0.047	41%	0%	41%
239	0.467	Industrial	3.768	4%	0%	4%
					0%	~~0%~~
24	0.115	Rural	100.000	100%	0%	100%
240	0.388	**Airport**	1.461	1%	0%	1%
241	1.552	Unknown	0.000	56%	10%	46%
242	0.826	Unknown	2.325	91%	0%	91%
242A	0.101	Unknown	0.227	75%	0%	75%
242B	0.330	Unknown	0.006	96%	0%	96%
243	0.159	Unknown	3.405	97%	0%	97%
243A	0.189	Unknown	1.781	98%	0%	98%
243B	0.107	Unknown	3.324	96%	60%	36%
244	0.265	Small Lot Residential (2-5)	90.942	100%	0%	100%
244A	0.322	Unknown	1.902	98%	0%	98%
						~~0%~~
245	0.265	Rural Densities (0-1)	100.000	100%	0%	100%
						~~0%~~
245A	0.104	Rural Densities (0-1)	100.000	100%	0%	100%
246	0.655	Water	0.009	100%	2%	98%
247	0.502	Water	0.003	100%	0%	100%
248	1.014	Rural Densities (0-1)	0.011	99%	0%	99%
249	1.001	Rural Densities (0-1)	0.458	100%	0%	100%
25	0.462	Rural	99.195	100%	0%	100%
250	0.505	Transportation	0.079	98%	0%	98%
250A	0.513	Transportation	0.008	94%	0%	94%
251	0.495	Rural	0.551	93%	0%	93%
252	0.519	Rural	0.565	89%	0%	89%
253	1.037	Unknown	0.001	85%	0%	85%
253A	0.340	Small Lot Residential	8.313	60%	10%	50%
254	0.296	Unknown	0.091	57%	0%	57%
~~254A~~	~~0.182~~	~~Small Lot Residential~~	~~3.674~~	~~89%~~	~~0%~~	~~89%~~
254B	0.132	Small Lot Residential	63.791	99%	0%	99%
~~255A~~	~~0.588~~	~~Unknown~~	~~2.054~~	~~61%~~	~~0%~~	~~61%~~
256	0.450	Unknown	0.013	100%	0%	100%
257	0.281	Unknown	0.001	100%	0%	100%
258	0.326	Small Lot Residential (2-5)	17.766	100%	0%	100%
258A	0.111	Water	0.109	100%	0%	100%
259	0.175	Water	0.003	100%	0%	100%
26	1.141	Rural	83.150	83%	0%	83%
260	0.459	Water	0.003	100%	60%	40%
261	0.418	Water	0.001	90%	0%	90%
262	1.004	Employment	1.656	3%	0%	3%
263	0.494	Employment	7.395	100%	0%	100%
264	0.481	Public Facilities	0.266	100%	0%	100%
265	0.251	Transportation	14.146	100%	0%	100%
265A	0.836	Transportation	5.092	79%	20%	59%
~~266~~	~~0.792~~	~~Open Space~~	~~1.776~~	~~70%~~	~~0%~~	~~70%~~
~~267~~	~~1.170~~	~~Open Space~~	~~0.111~~	~~74%~~	~~0%~~	~~74%~~
~~268~~	~~0.278~~	~~Public Facilities~~	~~0.888~~	~~89%~~	~~0%~~	~~89%~~
~~269~~	~~0.266~~	~~Public Facilities~~	~~5.849~~	~~94%~~	~~0%~~	~~94%~~
~~269B~~	~~0.265~~	~~Small Lot Residential~~	~~0.102~~	~~100%~~	~~0%~~	~~100%~~
27	1.030	Rural	0.035	100%	0%	100%
~~270~~	~~0.247~~	~~Small Lot Residential~~	~~25.025~~	~~91%~~	~~0%~~	~~91%~~
~~2711~~	~~0.115~~	~~Small Lot Residential~~	~~70.283~~	~~91%~~	~~0%~~	~~91%~~
2712	0.337	Water	0.022	92%	10%	82%
						~~0%~~
271A	0.263	Water	1:338	99%	0%	99%
~~271C~~	~~0.236~~	~~Water~~	~~10.407~~	~~89%~~	~~0%~~	~~89%~~
272	0.137	Water	5.690	83%	0%	83%
273	0.566	Unknown	0.496	99%	5%	94%
274	0.654	Unknown	0.001	96%	0%	96%
275	0.074	Transportation	0.001	76%	0%	76%
276	0.280	Transportation	0.072	23%	0%	23%
277	0.879	Transportation	3.302	44%	10%	34%
278	0.991	Transportation	0.136	100%	25%	75%
279	0.053	Transportation	26.998	100%	0%	100%

1. As a % of total sub basin area.
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Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout No Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
~~279A~~	~~0.076~~	~~Transportation~~	~~35.920~~	~~100%~~	~~0%~~	~~100%~~
~~279B~~	~~0.028~~	~~Transportation~~	~~18.196~~	~~100%~~	~~0%~~	~~100%~~
~~279C~~	~~0.037~~	~~Transportation~~	~~48.389~~	~~100%~~	~~0%~~	~~100%~~
279D	0.021	Transportation	26.370	100%	0%	100%
28	0.897	Small Lot Residential (2-5)	96.315	100%	0%	100%
280	0.629	Transportation	5.501	83%	0%	83%
280A	0.059	Transportation	25.133	78%	0%	78%
281	0.838	Transportation	0.152	78%	20%	58%
282	0.130	Transportation	0.230	79%	0%	79%
283	0.134	Open Space	1.676	94%	0%	94%
284	0.355	Public Facilities	1.530	94%	0%	94%
285	0.045	Transportation	32.938	100%	0%	100%
285A	0.068	Transportation	27.676	96%	0%	96%
285B	0.063	Transportation	37.330	100%	0%	100%
286	0.762	Open Space	0.236	85%	0%	85%
287	0.259	Transportation	23.950	80%	0%	80%
287A	0.314	Transportation	12.144	76%	0%	76%
287B	0.111	Transportation	13.610	70%	0%	70%
287C	0.220	Transportation	13.163	66%	0%	66%
287D	0.222	Transportation	0.463	71%	0%	71%
287E	0.173		0.001	93%	0%	93%
288	0.225	Open Space	1.492	99%	0%	99%
288A	0.073	Open Space	0.045	100%	0%	100%
288B	1.104	Small Lot Residential	0.051	65%	0%	65%
~~289~~	~~0.426~~	~~Small Lot Residential~~	~~0.266~~	~~67%~~	~~0%~~	~~67%~~
289A	0.211	Water	1.443	99%	20%	79%
~~289B~~	~~0.312~~	~~Public Facilities~~	~~10.854~~	~~68%~~	~~0%~~	~~68%~~
289C	0.283	Water	0.023	85%	0%	85%
~~289D~~	~~0.248~~	~~Public Facilities~~	~~3.608~~	~~83%~~	~~0%~~	~~83%~~
29	0.212	Small Lot Residential (2-5)	95.948	100%	0%	100%
290	0.528	Water	1.712	61%	0%	61%
291	0.898		0.004	100%	0%	100%
292	0.906	Unknown	0.020	100%	50%	50%
293	0.727	Transportation	0.114	94%	13%	81%
293A	0.079	Open Space	29.803	70%	0%	70%
294	0.255	Transportation	2.940	92%	0%	92%
294A	0.201	Transportation	1.964	86%	0%	86%
295	0.283	Transportation	4.229	88%	0%	88%
295A	0.093	Transportation	4.082	91%	5%	86%
296	0.322	Transportation	1.446	86%	0%	86%
296A	0.409	Transportation	0.341	85%	0%	85%
297	0.383	Transportation	0.005	93%	0%	93%
297A	0.239	Transportation	2.706	95%	0%	95%
298	0.780	Transportation	0.036	90%	0%	90%
299	0.388	Transportation	1.498	87%	0%	87%
3	0.741	Water	0.019	74%	0%	74%
30	0.275	Small Lot Residential (2-5)	91.028	100%	0%	100%
300	0.396	Transportation	4.920	100%	15%	85%
301	0.280	Transportation	0.220	100%	70%	30%
302	0.125	Water	0.163	97%	10%	87%
303	0.906		0.044	96%	0%	96%
303A	0.377	Transportation	3.963	100%	0%	100%
304	1.063	Small Lot Residential (2-5)	0.143	100%	0%	100%
305	0.917	Water	0.000	84%	0%	84%
306	0.508	Water	5.857	68%	0%	68%
					0%	~~0%~~
307	0.220	Small Lot Residential (2-5)	100.000	100%	0%	100%
308	0.286	Small Lot Residential (2-5)	91.088	100%	0%	100%
309	1.053	Open Space	0.022	95%	0%	95%
31	0.737	Unknown	0.440	99%	0%	99%
310	0.176	Open Space	5.642	92%	0%	92%
311	0.757	Transportation	3.132	88%	0%	88%
311A	0.314	Transportation	0.067	85%	0%	85%
312	0.658	Public Facilities	2.031	88%	0%	88%
~~313~~	~~0.417~~	~~Public Facilities~~	~~2.418~~	~~85%~~	~~85%~~	~~0%~~
314	0.429	Open Space	4.967	95%	0%	95%

***1.** As a % of total sub basin area.*
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Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout No Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
315	0.478	Open Space	2.648	96%	0%	96%
316	0.832	Open Space	0.087	91%	0%	91%
317	0.562	Open Space	3.113	97%	0%	97%
318	0.611	Small Lot Residential	0.009	93%	75%	18%
319	0.521	Small Lot Residential	0.622	98%	85%	13%
32	1.300		0.008	34%	0%	34%
320	0.564	Transportation	0.159	91%	35%	56%
321	0.607		0.026	99%	0%	99%
322	0.343		0.008	89%	0%	89%
					0%	~~0%~~
323	0.151	Small Lot Residential (2-5)	100.000	100%	0%	100%
324	0.339	Small Lot Residential (2-5)	97.470	100%	0%	100%
325	0.469	Small Lot Residential (2-5)	81.986	100%	30%	70%
325A	0.610	Small Lot Residential (2-5)	54.321	100%	0%	100%
326	0.544	Small Lot Residential (2-5)	99.999	100%	0%	100%
327	0.468	Small Lot Residential (2-5)	0.097	100%	0%	100%
328	0.780	Open Space	4.716	93%	0%	93%
329	0.595	Open Space	2.874	95%	30%	65%
33	0.609		0.001	0%	0%	0%
330	0.620	Transportation	0.021	89%	0%	89%
331	0.735	Transportation	1.227	89%	15%	74%
332	0.623	Public Facilities	2.138	96%	10%	86%
333	0.484	Public Facilities	1.105	91%	0%	91%
334	0.639	Open Space	3.251	97%	0%	97%
335	0.273	Open Space	6.557	93%	0%	93%
335A	0.063	Open Space	24.568	75%	0%	75%
336	1.358	Transportation	0.075	97%	60%	37%
336A	0.362	Unknown	0.191	99%	15%	84%
337	0.475	Transportation	0.039	99%	50%	49%
338	0.221		0.059	100%	0%	100%
338A	0.682	Unknown	0.004	100%	30%	70%
339	0.960		0.020	100%	0%	100%
34	0.334		0.094	0%	0%	~~0%~~
					0%	~~0%~~
340	0.460	Large Lot Residential (1-2)	100.000	100%	0%	100%
					0%	~~0%~~
341	0.776	Large Lot Residential (1-2)	100.000	100%	0%	100%
342	0.355	Small Lot Residential (2-5)	39.012	100%	0%	100%
342A	0.368	Small Lot Residential (2-5)	99.410	100%	0%	100%
343	0.493	Small Lot Residential (2-5)	94.916	100%	0%	100%
344	0.576	Open Space	0.086	92%	0%	92%
345	0.433	Medium Density	0.005	100%	0%	100%
346	0.522	Medium Density	0.628	100%	0%	100%
346A	0.148	Transportation	0.010	74%	0%	74%
346B	0.289	Medium Density	17.493	100%	0%	100%
346C	0.121	Transportation	0.106	91%	0%	91%
347	1.055	Transportation	2.334	95%	0%	95%
348	0.323	Transportation	4.055	89%	0%	89%
348A	0.216	Open Space	11.110	89%	50%	39%
348B	0.662	Transportation	0.014	95%	0%	95%
349	0.860		0.023	99%	0%	99%
35	0.444	Rural	38.312	38%	0%	38%
350	0.187		0.016	8%	0%	8%
351	0.720	Rural Densities (0-1)	91.524	100%	0%	100%
352	0.180	Small Lot Residential (2-5)	0.129	99%	0%	99%
352A	0.141	Rural Densities (0-1)	32.530	96%	0%	96%
353	0.226	Small Lot Residential (2-5)	1.593	100%	0%	100%
354	0.300	Small Lot Residential (2-5)	99.998	100%	0%	100%
355	0.109	Small Lot Residential (2-5)	19.547	98%	0%	98%
355A	0.039	Water	3.694	95%	0%	95%
356	0.346	Small Lot Residential (2-5)	46.525	96%	0%	96%
357	0.145	Employment	0.090	100%	0%	100%
358	0.190	Open Space	10.074	86%	0%	86%
359	0.112	Employment	0.036	100%	0%	100%
36	0.220	Rural	85.875	86%	0%	86%
360	0.269	Transportation	0.000	96%	0%	96%

1. As a % of total sub basin area.

Note!: Sub Basin lines w/ a strike-through are basins that **Do Not** provide future retention.

Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout <u>No</u> Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
361	0.268	Transportation	0.818	65%	0%	65%
362	0.446		0.017	88%	0%	88%
363	0.596		0.012	92%	0%	92%
364	0.461		0.056	81%	0%	81%
364A	0.113	Transportation	8.376	100%	0%	100%
364B	0.213		0.050	68%	0%	68%
365	0.355	Employment	1.087	100%	0%	100%
366	0.461	Industrial	2.317	100%	0%	100%
367	0.111	Mixed Use Center	0.442	100%	0%	100%
368	0.823		0.028	37%	0%	37%
369	0.116		0.115	0%	0%	~~0%~~
37	0.883		0.085	18%	0%	18%
370	0.085		0.005	23%	0%	23%
371	0.892		0.018	80%	0%	80%
372	1.577	Water	0.038	76%	0%	76%
373	0.381	Water	0.014	100%	0%	100%
374	0.742	Small Lot Residential	73.579	100%	0%	100%
375	0.389	Open Space	0.020	99%	0%	99%
376	0.418		0.021	97%	0%	97%
377	0.085	Open Space	12.444	0%	0%	~~0%~~
377A	0.180		0.105	0%	0%	~~0%~~
377B	0.146		0.071	0%	0%	~~0%~~
378	0.740		0.044	5%	0%	5%
379	0.417		0.030	0%	0%	~~0%~~
38	0.724		0.009	97%	0%	97%
380	0.180		0.120	0%	0%	~~0%~~
381	0.217	Water	5.628	0%	0%	~~0%~~
					0%	~~0%~~
381A	0.086	Recreational Open Space	100.000	0%	0%	~~0%~~
381B	0.042		0.391	0%	0%	~~0%~~
382	0.697	Water	5.799	31%	0%	31%
383	0.152		0.156	0%	0%	~~0%~~
383A	0.136		0.069	0%	0%	~~0%~~
384	0.279	Water	5.717	90%	0%	90%
385	0.364	Water	0.002	94%	0%	94%
386	0.332		0.049	0%	0%	~~0%~~
387	0.205		0.076	0%	0%	~~0%~~
39	0.748	Unknown	0.160	100%	0%	100%
3A	0.247		0.002	7%	0%	7%
4	0.227		0.128	86%	0%	86%
40	0.487		0.038	100%	0%	100%
41	0.538		0.004	100%	0%	100%
41-1	0.111		0.018	100%	0%	100%
41-2	0.099		0.010	100%	0%	100%
41A	0.026		0.012	93%	0%	93%
41A1	0.019		0.229	14%	0%	14%
41A2	0.026	Transportation	9.217	15%	0%	15%
41A3	0.028	Transportation	5.893	59%	0%	59%
42	1.214	Unknown	0.964	99%	0%	99%
43	0.013	Transportation	4.229	100%	0%	100%
43-1	0.040	Transportation	4.362	100%	0%	100%
43-2	0.023	Transportation	4.019	100%	0%	100%
43-3	0.068	Transportation	4.375	100%	0%	100%
43-4	0.025	Transportation	7.779	100%	0%	100%
43-5	0.015	Transportation	11.192	100%	0%	100%
43-6	0.015	Transportation	10.608	100%	0%	100%
43-7	0.018	Transportation	9.020	100%	0%	100%
43-8	0.014	Transportation	6.902	100%	0%	100%
44	0.752	Unknown	0.000	81%	0%	81%
45	0.399	Unknown	0.291	96%	0%	96%
45-1	0.071	Transportation	3.460	100%	0%	100%
46	0.872	Unknown	0.039	99%	0%	99%
46-1	0.139	Unknown	0.245	100%	0%	100%
5	0.578		0.060	1%	0%	1%
6	0.468	Rural	2.896	3%	0%	3%
7	0.310	Rural	47.188	48%	0%	48%

1. As a % of total sub basin area.

Note!: Sub Basin lines w/ a strike-through are basins that **Do Not** provide future retention.

Table 1.1

Subbasin number	Subbasin area in sq.mi	LANDUSE	% Landuse Cover in Sub Basin	[1]% Future Development in Sub Basin	Existing Partial Buildout <u>No</u> Retention	Future Developmen Providing Retention - Mult. V_{HEC-1} by this factor
					0%	~~0%~~
8	0.803	Recreational Open Space	100.000	0%	0%	~~0%~~
9	1.394	Rural	0.000	0%	0%	0%
RETAIN	0.946		0.040	68%	0%	68%
~~sub6~~	~~0.109~~	~~Unknown~~	~~5.997~~	~~70%~~	~~0%~~	~~70%~~
~~sub7~~	~~0.264~~	~~Small Lot Residential~~	~~4.617~~	~~37%~~	~~0%~~	~~37%~~
WT#3	0.451	Small Lot Residential (2-5)	35.430	100%	0%	100%
WT#4	0.245	Transportation	6.247	98%	0%	98%

1. As a % of total sub basin area.

Note!: Sub Basin lines w/ a strike-through are basins that **Do Not** provide future retention.

Table 1.2

City	Storm Event (year/hour)
Surprise	100/2
Avondale	100/2
Litchfield Park	100/2
Goodyear	100/6
El Mirage	100/2
Buckeye	100/2
County	100/2

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention: Sub Basin	Partial Development NO retention: [7]%Developed
1	1	0%	no	0		off map	2											
1	2	0%	no	0	County	parts of	2											
1	3	0%	no	0	County	100	2											
1	4	0%	no	90		off map	2											
1	5	0%	no	1		off map	2											
1	6	0%	no	2		off map	2											
1	7	0%	no	60		off map	2											
1	8	0%	no	0		off map	2											
1	9	0%	no	0		off map	2											
1	10	0%	no	10	County	parts of	2											
1	11	0%	no	0	County	parts of	2											
1	12	0%	no	5	County	parts of	2											
1	13	0%	no	0	County	100	2											
1	14	0%	no	1		off map	2											
1	15	0%	no	30	County	parts of	2											
1	16	0%	no	100	Buckeye	parts of	2											
1	17	0%	no	0	Buckeye	parts of	2	County	parts of									
23	18	0%	no	80		off map	2											
23	19	0%	no	85		off map	2											
23	20	0%	no	50		off map	2											
23	21	0%	no	95		off map	2											
23	22	0%	no	100		off map	2											
23	23	0%	no	100	Buckeye	parts of	2											
23	24	0%	no	100	Buckeye	100	2											
23	25	0%	no	100	Buckeye	parts of	2	County	parts of									
23	26	0%	no	80		off map	2											
23	27	0%	no	100	Buckeye	parts of	2											
24	28	0%	no	15	Buckeye	50	2	County	50									
24	29	0%	no	100	Buckeye	100	2											
24	30	0%	no	100	Buckeye	100	2											
24	31	0%	no	95	County	100	2											
23	32	0%	no	30		off map	2											
23	33	0%	no	0		off map	2											
23	34	0%	no	0		off map	2											
23	35	0%	no	50		off map	2											
23	36	0%	no	80		off map	2											
23	37	0%	no	20		off map	2											
23	38	0%	no	95		off map	2											
23	39	0%	no	100	Buckeye	parts of	2											
23	40	0%	no	75		off map	2											
23	41	0%	no	0		off map	2											
23	42	0%	no	100	Buckeye	parts of	2	County	parts of									
23	43	0%	no	0	Buckeye	100	2											
24	44	0%	no	0	Buckeye	50	2	County	50									
24	45	0%	no	10	County	97	2	Buckeye	3									
24	46	0%	no	30	County	97	2	Buckeye	3									
2A	101	0%	no	100	Surprise	100	2											
2B	104	0%	no	100	Surprise	100	2											
2A	105	0%	no	100	Surprise	100	2											
2A	106	0%	yes	100	Surprise	100	2											
2B	111	100%	yes	100	Surprise	100	2							Sub Basin 111		Sub 111		
2A	112	100%	yes	100	Surprise	100	2							Sub Basin 112		Sub 112		
2A	114	100%	yes	100	Surprise	100	2							Sub Basin 114		Sub 114		
2A	115	100%	yes	100	Surprise	100	2							Sub Basin 115		Sub 115		
2C	116	90%	yes	100	Surprise	100	2											
2C	117	65%	yes	100	Surprise	100	2											
2C	118	15%	yes	100	Surprise	100	2											
2B	119	0%	no	100	Surprise	100	2											
2B	120	0%	no	100	Surprise	100	2											
2B	121	0%	no	100	Surprise	100	2											
2C	123	0%	no	100	Surprise	100	2											
2C	124	0%	no	100	Surprise	100	2											
2C	125	0%	no	100	Surprise	100	2											

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention	
																	Sub Basin	[7]%Developed
2C	126	75%	yes	100	Surprise	100	2											
2D	127	100%	no	100	Surprise	100	2							Sub Basin 127	Sub Basin 127			
2B	128	0%	no	100	County	100	2											
2B	129	100%	no	100	County	100	2							Sub Basin 129	Sub Basin 129			
2B	130	0%	no	80	County	100	2											
2B	131	0%	no	0	County	100	2											
2B	132	0%	no	100	Surprise	100	2											
2B	133	40%	yes	100	Surprise	100	2											
2B	134	0%	no	100	Surprise	100	2											
2B	135	50%	yes	100	Surprise	100	2											
2B	136	0%	no	100	Surprise	100	2											
2B	137	0%	no	100	Surprise	80	2	County	20									
2D	138	0%	no	0	Surprise	100	2											
2D	139	50%	yes	0	El Mirage	100	2											
2D	140	10%	no	0	El Mirage	100	2										Sub 140	10%
2G	141	0%	no	0	County	100	2											
2G	142	0%	no	0	County	100	2											
2G	143	0%	no	0	County	100	2											
2G	144	0%	no	0	County	100	2											
2G	145	0%	no	0	County	100	2											
2G	146	0%	no	0	County	100	2											
2H	147	0%	no	0	County	100	2											
2H	148	0%	no	50	Surprise	50	2	County	50									
2I	149	0%	no	0	County	100	2											
2I	150	0%	no	0	County	100	2											
2I	151	0%	no	0	County	100	2											
2I	152	0%	no	0	County	100	2											
2D	153	0%	no	0	County	100	2											
2D	154	0%	no	0	County	100	2											
2I	155	0%	no	0	Surprise	100	2											
2D	156	50%	no	0	El Mirage	100	2										Sub 156	50%
2D	157	50%	yes	0	El Mirage	100	2											
2E	158	75%	yes	0	El Mirage	100	2											
2G	159	0%	no	0	Surprise	50	2	County	50									
2G	160	0%	no	0	County	100	2											
2G	161	0%	no	0	Surprise	50	2	County	50									
2G	162	0%	no	0	County	100	2											
2G	163	0%	no	0	County	100	2											
2G	164	0%	no	0	County	100	2											
2G	165	0%	no	0	County	100	2											
2H	166	0%	no	100	Surprise	100	2											
2I	167	0%	no	100	Surprise	100	2											
2I	168	0%	no	50	Surprise	100	2											
2I	169	0%	no	0	Surprise	100	2											
2J	170	90%	no	0	El Mirage	100	2										Sub 170	90%
2F	171	30%	no	0	El Mirage	100	2										Sub 171	30%
2D	172	25%	no	0	El Mirage	100	2										Sub 172	25%
2E	173	100%	no	0	El Mirage	100	2							Sub Basin 173	Sub Basin 173			
2K	174	0%	no	90	County	100	2											
2K	175	0%	no	95	County	100	2											
2K	176	0%	no	50	County	100	2											
2G	177	0%	no	0	County	100	2											
2G	178	0%	no	0	County	100	2											
2G	179	0%	no	0	County	100	2											
2H	180	0%	no	0	County	100	2											
2H	181	0%	no	0	County	100	2											
2I	182	0%	no	0	County	100	2											
2I	183	0%	no	0	County	100	2											
2I	184	0%	no	0	El Mirage	60	2	County	40									
2J	185	0%	no	0	El Mirage	100	2											
2F	186	0%	no	0	El Mirage	100	2											
2F	187	0%	no	0	El Mirage	100	2											
3	188	0%	no	0	County	100	2											

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention	
																	Sub Basin	[7]%Developed
2K	189	0%	no	0	County	100	2											
2K	190	0%	no	0	County	100	2											
2K	191	0%	no	100	County	100	2											
2K	192	0%	no	0	County	100	2											
2K	193	0%	no	0	County	100	2											
2K	195	0%	no	0	County	100	2											
2K	196	100%	no	0	County	90	2	LukeAFB	10					Sub Basin 196	Sub Basin 196			
2J	197	0%	no	0	County	75	2	El Mirage	25									
2J	198	20%	yes	0	El Mirage	100	2											
2F	199	0%	no	0	El Mirage	100	2											
2F	200	0%	no	0	El Mirage	100	2											
3	201	100%	no	100	LukeAFB	100	2							Sub Basin 201	Sub Basin 201			
2K	202	0%	no	0	County	100	2											
2J	203	40%	yes	0	County	100	2											
2K	204	0%	no	0	County	100	2											
2K	205	0%	no	0	County	100	2											
2K	206	0%	no	0	County	100	2											
3	207	100%	no	100	County	100	2							Sub Basin 207	Sub Basin 207			
3	208	100%	no	0	County	100	2							Sub Basin 208	Sub Basin 208			
3	209	0%	no	0	County	100	2											
3	210	0%	no	0	County	100	2											
3	211	0%	no	0	County	100	2											
3	212	0%	no	0	County	100	2											
3	213	100%	no	100	LukeAFB	100	2							Sub Basin 213	Sub Basin 213			
3	214	0%	no	0	County	100	2											
3	215	0%	no	0	County	100	2											
3	216	100%	no	100	County	100	2							Sub Basin 216	Sub Basin 216			
3	217	70%	no	100	County	100	2										Sub 217	70%
3	218	0%	no	15	County	100	2											
3	219	0%	no	0	County	100	2											
3	220	0%	no	0	County	100	2											
3	221	0%	no	0	County	100	2											
3	222	100%	no	100	LukeAFB	100	2							Sub Basin 222	Sub Basin 222			
3	223	100%	no	100	LukeAFB	100	2							Sub Basin 223	Sub Basin 223			
3	224	12%	no	0	County	80	2	LukeAFB	20								Sub 224	12%
12	225	30%	no	0	County	100	2										Sub 225	30%
3	226	80%	no	0	LukeAFB	70	2	County	30								Sub 226	80%
12	227	12%	no	0	County	100	2										Sub 227	12%
12	228	0%	no	0	County	100	2											
12	229	6%	no	0	County	100	2										Sub 229	6%
12	230	0%	no	0	County	100	2											
12	231	0%	no	0	County	100	2											
9	232	0%	no	0	County	100	2											
3	233	0%	no	0	County	100	2											
3	234	0%	no	0	County	100	2											
3	235	0%	no	0	County	100	2											
3	236	0%	no	0	County	100	2											
3	237	0%	no	0	County	100	2											
3	238	0%	no	0	County	100	2											
3	239	0%	no	0	County	100	2											
3	240	0%	no	0	County	100	2											
3	241	10%	no	0	County	50	6	Goodyear	25	Litchfield Park	20	LukeAFB	5				Sub 241	10%
12	242	0%	no	0	County	90	2	Litchfield Park	10									
12	243	0%	no	90	County	100	2											
12	244	0%	no	100	County	100	2											
12	245	20%	yes	0	County	100	2											
9	246	2%	no	0	Buckeye	67	2	County	33								Sub 246	2%
4	247	0%	no	30	Buckeye	100	2											
4	248	0%	no	0	Goodyear	100	6											
4	249	0%	no	0	Goodyear	100	6											
4	250	0%	no	100	Goodyear	100	6											
4	251	0%	no	100	Goodyear	100	6											
4	252	0%	no	100	Goodyear	100	6											

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention: Sub Basin	Partial Development NO retention: [7]%Developed
4	253	0%	no	100	Goodyear	90	6	Litchfield Park	10									
14	254	90%	yes	100	Litchfield Park	100	2											
14	256	25%	yes	20	County	100	2											
14	257	0%	no	0	County	100	2											
12	258	0%	no	0	Avondale	50	2	County	50									
13	259	0%	no	0	Avondale	50	2	County	50									
9	260	60%	no	0	County	100	2										Sub 260	60%
9	261	0%	no	0	County	100	2											
9	262	0%	no	0	Goodyear	100	6											
9	263	0%	no	100	Goodyear	100	6											
9	264	0%	no	100	Goodyear	100	6											
8	265	0%	no	100	Goodyear	100	6											
5	266	100%	yes	100	Goodyear	100	6							Sub Basin 266		Sub 266		
4	267	100%	yes	100	Goodyear	100	6							Sub Basin 267		Sub 267		
14	268	100%	yes	100	Goodyear	100	6							Sub Basin 268		Sub 268		
14	269	100%	yes	100	Goodyear	100	6							Sub Basin 269		Sub 269		
14	270	100%	no	100	Litchfield Park	100	2							Sub Basin 270	Sub Basin 270			
13	272	0%	no	0	Avondale	100	2											
9	273	5%	no	0	County	100	2										Sub 273	5%
9	274	0%	no	0	County	99	2	Buckeye	1									
9	275	0%	no	0	Goodyear	50	2	County	50									
9	276	0%	no	0	Goodyear	90	6	County	10									
9	277	10%	no	50	Goodyear	100	6										Sub 277	10%
9	278	25%	no	80	Goodyear	STATE PRISON	6										Sub 278	25%
9	279	0%	no	0	Goodyear	100	6											
9	280	0%	no	100	Goodyear	100	6											
8	281	20%	no	100	Goodyear	100	6										Sub 281	20%
8	282	0%	no	100	Goodyear	100	6											
5	283	0%	no	100	Goodyear	100	6											
5	284	0%	no	100	Goodyear	100	6											
5	285	0%	no	100	Goodyear	100	6											
4	286	0%	no	100	Goodyear	100	6											
5	287	0%	no	0	Goodyear	100	6											
4	288	0%	no	100	Goodyear	100	6											
14	289	100%	no	100	Goodyear	100	6							Sub Basin 289	Sub Basin 289			
13	290	80%	yes	40	Avondale	100	2											
13	291	90%	yes	70	Avondale	100	2											
17	292	50%	no	0	County	67	2	Buckeye	33								Sub 292	50%
17	293	13%	no	0	County	99	6	Goodyear	1								Sub 293	13%
17	294	0%	no	0	Goodyear	100	6											
10	295	40%	yes	0	Goodyear	100	6											
9	296	60%	yes	100	Goodyear	100	6											
11	297	0%	no	75	Goodyear	100	6											
5	298	5%	yes	10	Goodyear	100	6											
6	299	5%	yes	0	Goodyear	100	6											
6	300	15%	no	0	Goodyear	100	6										Sub 300	15%
6	301	70%	no	0	Goodyear	100	6										Sub 301	70%
15	302	10%	no	0	Avondale	100	2										Sub 302	10%
26	303	0%	no	0	Buckeye	75	2	County	25									
25	304	0%	no	0	Buckeye	100	2											
21	305	0%	no	100	Buckeye	100	2											
18	306	0%	no	0	Buckeye	100	2											
18	307	0%	no	0	County	100	2											
18	308	0%	no	0	County	100	2											
17	309	0%	no	0	County	90	6	Goodyear	10									
19	310	0%	no	95	Goodyear	90	6	County	10									
10	311	0%	no	70	Goodyear	100	6											
9	312	0%	no	100	Goodyear	100	6											
11	313	85%	yes	100	Goodyear	100	6											
7	314	40%	yes	50	Goodyear	100	6											
5	315	0%	no	50	Goodyear	100	6											
5	316	0%	no	40	Goodyear	100	6											
6	317	0%	no	0	Goodyear	100	6											

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention	
																	Sub Basin	[7]%Developed
6	318	75%	no	0	Goodyear	90	6	Avondale	10								Sub 318	75%
6	319	85%	no	0	Avondale	100	2										Sub 319	85%
15	320	35%	no	0	Avondale	100	2										Sub 320	35%
26	321	0%	no	0	Buckeye	50	2	County	50									
26	322	0%	no	0	County	100	2											
25	323	0%	no	0	County	100	2											
25	324	0%	no	0	County	100	2											
21	325	30%	no	25	County	100	2										Sub 325	30%
18	326	0%	no	0	County	100	2											
18	327	0%	no	0	County	100	2											
17	328	0%	no	0	County	100	2											
19	329	30%	no	0	County	100	2										Sub 329	30%
10	330	50%	yes	70	Goodyear	80	6	County	20									
9	331	20%	no	100	Goodyear	90	6	County	10								Sub 331	20%
11	332	10%	no	100	Goodyear	80	6	County	20								Sub 332	10%
7	333	40%	yes	100	Goodyear	100	6											
5	334	0%	no	100	Goodyear	100	6											
5	335	0%	no	80	Goodyear	100	6											
6	336	60%	no	95	Goodyear	100	6										Sub 336	60%
6	337	50%	no	0	Avondale	50	6	Goodyear	30	County	20						Sub 337	50%
15	338	0%	no	0	Avondale	100	2											
26	339	0%	no	0	County	100	2											
25	340	0%	no	0	County	100	2											
21	341	0%	no	0	County	100	2											
21	342	50%	no	0	County	100	2										Sub 342	50%
18	343	0%	no	0	County	100	2											
17	344	0%	no	60	Goodyear	75	6	County	25									
19	345	0%	no	50	Goodyear	95	6	County	5									
19	346	0%	no	25	Goodyear	70	2	County	30									
11	347	0%	no	50	Goodyear	60	2	County	40									
7	348	0%	no	40	Goodyear	100	6											
26	349	0%	no	0	County	100	2											
26	350	0%	no	0	County	75	2	Buckeye	25									
25	351	0%	no	0	County	85	2	Buckeye	15									
21	352	0%	no	0	County	100	2											
21	353	5%	no	0	Buckeye	50	2	County	50								Sub 353	5%
18	354	0%	no	0	County	100	2											
18	355	0%	no	0	County	100	2											
18	356	0%	no	0	County	100	2											
19	357	0%	no	0	County	100	2											
19	358	0%	no	0	Goodyear	50	2	County	50									
19	359	0%	no	0	County	100	2											
19	360	0%	no	0	County	90	6	Goodyear	10									
16	361	0%	no	0	Goodyear	100	6											
11	362	0%	no	0	Goodyear	100	6											
7	363	0%	no	0	Goodyear	100	6											
6	364	0%	no	0	Goodyear	100	6											
6	365	0%	no	0	Goodyear	100	6											
15	366	0%	no	0	Goodyear	100	6											
15	367	0%	no	0	Avondale	100	2											
15	368	0%	no	0	Goodyear	100	6											
15	369	0%	no	0	County	60	6	Goodyear	40									
15	370	0%	no	0	Avondale	50	2	County	50									
26	371	0%	no	0	County	100	2											
25	372	0%	no	5	County	95	2	Buckeye	5									
20	373	0%	no	0	County	95	2	Buckeye	5									
20	374	0%	no	0	County	100	2											
20	375	0%	no	0	County	100	2											
20	376	0%	no	0	County	100	2											
16	377	0%	no	50	County	100	2											
11	378	0%	no	0	Goodyear	100	6											
26	379	0%	no	0	County	100	2											
16	380	0%	no	0	County	100	2											

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention	
																	Sub Basin	[7] %Developed
16	381	0%	no	0	County	100	2											
25	382	0%	no	0	County	100	2											
16	383	0%	no	0	County	100	2											
22	384	0%	no	10	County	100	2											
22	385	0%	no	0	County	100	2											
16	386	0%	no	0	County	100	2											
16	387	0%	no	0	County	100	2											
14	2711	100%	no	100	Litchfield Park	100	2							Sub Basin 2711	Sub Basin 2711			
14	2712	10%	no	100	Avondale	90	6	Goodyear	10								Sub 2712	10%
2A	100A	0%	no	100	Surprise	100	2											
2A	102A	0%	yes	100	Surprise	100	2											
2B	111A	60%	yes	100	Surprise	100	2											
2A	113A	20%	yes	100	Surprise	100	2											
2B	119A	0%	no	100	Surprise	100	2											
2B	121A	0%	no	100	Surprise	100	2											
2A	122A	60%	yes	100	Surprise	100	2											
2A	122B	60%	yes	100	Surprise	100	2											
2B	131A	0%	no	0	County	100	2											
2D	138A	100%	yes	0	Surprise	100	2							138A		138A		
2G	141A	0%	no	0	County	100	2											
2G	145A	0%	no	0	County	100	2											
2E	156A	100%	no	0	El Mirage	100	2							156A	156A			
2G	164A	0%	no	0	County	100	2											
2F	173A	100%	no	0	El Mirage	100	2							173A	173A			
2E	173B	0%	no	0	El Mirage	100	2											
2K	175A	0%	no	20	County	100	2											
2G	176A	5%	no	0	County	100	2										176A	5%
2G	177A	0%	no	0	County	100	2											
2I	181A	0%	no	0	County	100	2											
2K	192A	25%	yes	0	County	100	2											
2K	194A	0%	no	0	County	100	2											
2K	194B	100%	yes	0	County	100	2							194B		194B		
2K	194C	0%	no	0	County	100	2											
3	207A	0%	no	0	County	100	2											
3	209A	0%	no	0	County	100	2											
3	215A	0%	no	0	County	100	2											
3	221A	0%	no	0	County	100	2											
12	225A	0%	no	0	County	100	2											
2K	228A	10%	no	0	LukeAFB	75	2	County	25								228A	10%
23	22A	0%	no	100	Buckeye	parts of	2	County	parts of									
12	230A	30%	no	0	County	100	2										230A	30%
12	242A	0%	no	0	Litchfield Park	100	2											
12	242B	0%	no	0	County	100	2											
12	243A	90%	yes	2	County	100	2											
12	243B	60%	no	0	County	100	2										243B	60%
12	244A	40%	yes	25	County	100	2											
12	245A	0%	no	0	County	100	2											
4	250A	0%	no	100	Goodyear	100	6											
4	253A	10%	no	100	Litchfield Park	100	2										253A	10%
14	254A	100%	no	100	Litchfield Park	100	2							254A	254A			
14	254B	0%	no	100	Litchfield Park	100	2											
14	255A	100%	no	100	Litchfield Park	100	2							255A	255A			
13	258A	0%	no	0	Avondale	100	2											
8	265A	20%	no	100	Goodyear	100	6										265A	20%
14	269B	100%	yes	100	Goodyear	50	2	Litchfield Park	50					269B		269B		
14	271A	5%	yes	100	Avondale	100	2											
13	271C	100%	no	50	Avondale	100	2							271C	271C			
9	279A	100%	yes	0	Goodyear	100	6							279A		279A		
9	279B	100%	no	0	Goodyear	100	6							279B	279B			
9	279C	100%	no	0	Goodyear	100	6							279C	279C			
9	279D	0%	no	0	Goodyear	100	6											
9	280A	0%	no	100	Goodyear	100	6											
5	285A	0%	no	100	Goodyear	100	6											

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention: Sub Basin	Partial Development NO retention: [7]%Developed
5	285B	0%	no	100	Goodyear	100	6											
14	287A	30%	yes	80	Goodyear	100	6											
14	287B	70%	yes	60	Goodyear	100	6											
14	287C	60%	yes	100	Goodyear	100	6											
14	287D	0%	yes	100	Goodyear	100	6											
14	287E	60%	yes	70	Avondale	100	2											
14	288A	0%	yes	100	Goodyear	100	6											
14	288B	40%	yes	100	Goodyear	100	6											
14	289A	20%	no	100	Avondale	100	2										289A	20%
14	289B	100%	no	100	Goodyear	100	6							289B	289B			
14	289C	0%	no	100	Avondale	60	6	Goodyear	40									
14	289D	100%	no	100	Goodyear	100	6							289D	289D			
17	293A	0%	no	0	County	100	2											
10	294A	0%	no	0	Goodyear	100	6											
9	295A	5%	no	100	Goodyear	100	6										295A	5%
9	296A	60%	yes	100	Goodyear	100	6											
5	297A	0%	no	0	Goodyear	100	6											
25	303A	0%	no	0	Buckeye	75	2	County	25									
9	311A	0%	no	100	Goodyear	100	6											
21	325A	40%	no	20	County	99	2	Buckeye	1								325A	40%
5	335A	0%	no	0	Goodyear	100	6											
6	336A	15%	no	0	Goodyear	90	6	Avondale	10								336A	15%
15	338A	30%	no	0	Avondale	100	2										338A	30%
18	342A	0%	no	0	County	100	2											
11	346A	0%	no	0	Goodyear	100	6											
19	346B	0%	no	0	Goodyear	100	6											
19	346C	0%	no	0	Goodyear	100	6											
7	348A	50%	no	75	Goodyear	100	6										348A	50%
7	348B	0%	no	90	Goodyear	100	6											
25	352A	0%	no	0	County	100	2											
20	355A	0%	no	0	County	100	2											
6	364A	0%	no	0	Goodyear	100	6											
7	364B	0%	no	0	Goodyear	100	6											
16	377A	0%	no	0	County	100	2											
16	377B	0%	no	0	County	100	2											
26	381A	0%	no	0	County	100	2											
16	381B	0%	no	0	County	100	2											
16	383A	0%	no	0	County	100	2											
1	3A	0%	no	0	County	100	2											
23	41 A-1	0%	no	0	Buckeye	100	2											
23	41 A-2	0%	no	0	Buckeye	100	2											
23	41 A-3	0%	no	0	Buckeye	100	2											
23	41-1	0%	no	0	Buckeye	50	2	County	50									
23	41-2	0%	no	0	County	75	2	Buckeye	25									
23	41A	0%	no	0	Buckeye	50	2	County	50									
23	43-1	0%	no	0	Buckeye	50	2	County	50									
23	43-2	0%	no	0	Buckeye	50	2	County	50									
23	43-3	0%	no	0	Buckeye	100	2											
23	43-4	0%	no	0	Buckeye	100	2											
23	43-5	0%	no	0	Buckeye	100	2											
23	43-6	0%	no	0	Buckeye	100	2											
23	43-7	0%	no	0	Buckeye	100	2											
23	43-8	0%	no	0	Buckeye	100	2											
24	45-1	0%	no	0	County	97	2	Buckeye	3									
24	46-1	0%	no	0	County	97	2	Buckeye	3									
14	Sub 6	100%	no	100	Litchfield Park	100	2							Sub 6	Sub 6			
14	Sub 7	100%	no	100	Litchfield Park	100	2							Sub 7	Sub 7			
1	WT#3	0%	no	0	County	parts of	2											
24	WT#4	0%	no	0	Buckeye	100	2											

1. Existing percent developed obtained from visually inspecting areal photos.
   Planned percent developed obtained from FCD.
2. "Planned development" from platted development shown on URS CAD DWG.
3. "Future Development" from FCDMC GIS Data Base

Table 1.3

Super Basin	Sub Basin	[1]Existing Buildout	[4]Existing Retention?	[2]Planned Development*	[5]City / Municipality	Percent of Sub Basin in City 1	Retention Requirement[10] (in hours)	City 2	Percent of Sub Basin in City 2	City 3	Percent of Sub Basin in City 3	City 4	Percent of Sub Basin in City 4	[6]100% Existing Development	[8]100% Developed NO retention	[8]100% Developed with retention	Partial Development NO retention	
																	Sub Basin	[7] %Developed

4. "Existing Retention" from URS Sub Basin Map 'triangles'.
5. Agency Regulating Retention Requirement.
6. Cross these off of RTIMP list from FCDMC
7. **Reduce** retention volume divert by this amount.
8. No additional retention diverted in future condition HEC-1
9. Partial development with retention will be completely replaced based upon new calculations for future HEC-1 model.
10. Retention requirements not known for Luke AFB property (assumed 100-year/2-hour). For a conservativly high runoff estimate, sub basins with 75% or more area in Goodyear used Goodyear retention requirements (100-yr/6-hr), all other basins used the 100-yr/2-hr retention requirement.

Table 1.4

JD Card Calculations

Storm Event	Isopluvial	# Crosses	Estimated Rainfall	Area	Depth-Area Reduction
100-yr/6-hr	3	2		10	3.06
	3.2	2		50	2.83
	3.3	4		100	2.74
	3.4	3	3.25	200	2.66
100-yr/2-hr	2.6	2		10	2.56
	2.7	4		50	2.37
	2.8	2		100	2.29
	2.9	1	2.72	200	2.22

Table 1.5a

6-hour Retention									
Sub Basin	[1]Existing Buildout	[4]Existing Retention?	Future Development Providing Retention	Sub Basins to Edit	100-year, 6-hour HEC-1 Volume ac-ft	Effective Volume to Add (ac-ft)	*0.8 = efficiency factor* Volume Retained for Future Case	***Exceptions***	***Comments***
241	10%	no	46	241	**153**	70.38	56.304		
248	0%	no	99	248	92	91.08	**72.864**		
249	0%	no	100	249	120	120	96		
250	0%	no	98	250	74	72.52	58.016		
251	0%	no	93	251	72	66.96	53.568		
252	0%	no	89	252	65	57.85	46.28		
253	0%	no	85	253	128	108.8	87.04		
262	0%	no	3	262	92	2.76	2.208		
263	0%	no	100	263	76	76	60.8		
264	0%	no	100	264	76	76	**60.8**		
265	0%	no	100	265	**38**	38	30.4		
266	100%	yes	0	--		--	--		
267	100%	yes	0	--		--	--		
268	100%	yes	0	--		--	--		
269	100%	yes	0	--		--	--		
276	0%	no	23	276	28	6.44	**5.152**		
277	10%	no	34	277	**93**	31.62	25.296		
278	25%	no	75	278	136	102	81.6		
279	0%	no	100	279	8	8	6.4		
280	0%	no	83	280	78	64.74	51.792		
281	20%	no	58	281	96	55.68	44.544		
282	0%	no	79	282	17	13.43	**10.744**		
283	0%	no	94	283	**18**	16.92	13.536		
284	0%	no	94	284	44	41.36	33.088		
285	0%	no	100	285	6	6	4.8		
286	0%	no	85	286	94	79.9	63.92		
287	0%	no	80	287	31	24.8	19.84		
288	0%	no	99	288	31	30.69	24.552		
289	100%	no	0	--		--	--		
294	0%	no	92	294	19	17.48	13.984		
295	40%	yes	88	295	35	30.8	24.64		
296	60%	yes	86	296	40	34.4	~~27.52~~	36.8	value in existing model higher than that estimated for future - existing number used since it's based on actual retention estimations for final subdivion construction
297	0%	no	93	297	46	42.78	**34.224**		
298	5%	yes	90	298	107	96.3	77.04		
299	5%	yes	87	299	57	49.59	39.672		
300	15%	no	85	300	**60**	51	40.8		
301	70%	no	30	301	37	11.1	**8.88**		
310	0%	no	92	310	23	21.16	16.928		
311	0%	no	88	311	91	80.08	64.064		
312	0%	no	88	312	**81**	71.28	57.024		
313	100%	yes	0	--	45	--	--		
314	40%	yes	95	314	52	49.4	39.52		
315	0%	no	96	315	**64**	61.44	49.152		
316	0%	no	91	316	120	109.2	**87.36**		
317	0%	no	97	317	86	83.42	66.736		
318	75%	no	18	318	**79**	14.22	11.376		
330	50%	yes	89	330	64	56.96	45.568		
331	15%	no	74	331	87	64.38	51.504		
332	10%	no	86	332	61	52.46	41.968		
333	40%	yes	91	333	70	63.7	50.96		
334	0%	no	97	334	85	82.45	65.96		
335	0%	no	93	335	**66**	61.38	49.104		
336	60%	no	37	336	201	74.37	**59.496**		
344	0%	no	92	344	73	67.16	53.728		
345	0%	no	100	345	51	51	40.8		
348	0%	no	89	348	**47**	41.83	33.464		
361	0%	no	65	361	26	16.9	13.52		
362	0%	no	88	362	51	44.88	35.904		
363	0%	no	92	363	93	85.56	68.448		
364	0%	no	81	364	**71**	57.51	46.008		

Table 1.5a

6-hour Retention									
Sub Basin	[1]Existing Buildout	[4]Existing Retention?	Future Development Providing Retention	Sub Basins to Edit	100-year, 6-hour HEC-1 Volume ac-ft	Effective Volume to Add (ac-ft)	*0.8 = efficiency factor* Volume Retained for Future Case	*Exceptions*	*Comments*
365	0%	no	100	365	58	58	**46.4**		
366	0%	no	100	366	66	66	52.8		
368	0%	no	37	368	99	36.63	29.304		
378	0%	no	5	378	**85**	4.25	3.4		
250A	0%	no	94	250A	76	71.44	57.152		
265A	20%	no	59	265A	106	62.54	**50.032**		
279A	100%	yes	0	--		--	--		
279B	100%	no	0	--		--	--		
279C	100%	no	0	--		--	--		
279D	0%	no	100	279D	**3**	3	2.4		
280A	0%	no	78	280A	9	7.02	5.616		
285A	0%	no	96	285A	9	8.64	6.912		
285B	0%	no	100	285B	9	9	**7.2**		
287A	100%	yes	76	--	46	--	--	*100% Developed as Detention Structure	
287B	100%	yes	70	--	13	--	--	*100% Developed as Detention Structure	
287C	100%	yes	66	--	32	--	--	*100% Developed as Detention Structure	
287D	100%	yes	71	--	33	--	--	*100% Developed as Detention Structure	
288A	0%	yes	100	288A	**11**	11	8.8		
288B	40%	yes	65	288B	100	65	52		
289B	100%	no	0	--		--	--		
289D	100%	no	0	--		--	--		
294A	0%	no	86	294A	30	25.8	**20.64**		
295A	5%	no	86	295A	7	6.02	4.816		
296A	60%	yes	85	296A	41	34.85	27.88		
297A	0%	no	95	297A	**37**	35.15	28.12		
311A	0%	no	85	311A	41	34.85	27.88		
335A	0%	no	75	335A	10	7.5	6		
336A	15%	no	84	336A	52	43.68	34.944		
346A	0%	no	74	346A	20	14.8	11.84		
346B	0%	no	100	346B	37	37	**29.6**		
346C	0%	no	91	346C	**18**	16.38	13.104		
348A	0%	no	39	348A	28	10.92	8.736		
348B	0%	no	95	348B	110	104.5	83.6		
364A	0%	no	100	364A	16	16	12.8		
364B	0%	no	68	364B	**32**	21.76	17.408		

Table 2.1

URS Basin ID	[1]%IMP	$RTIMP_{weighted}$	Comments	Future Undeveloped	Existing 100% Developed
1	10	~~0.0~~	Use 10% (URS)	1	
2	12	~~0.2~~	Use 12% (URS)		
3	0	13.7			
4	9	~~4.3~~	Use 9% (URS)		
5	9	~~0.0~~	Use 9% (URS)		
6	10	~~0.1~~	Use 10% (URS)		
7	10	~~2.4~~	Use 10% (URS)		
8	10	~~0.0~~	Use 10% (URS)	8	
9	10	~~0.0~~	Use 10% (URS)	9	
10	4	4.9			
11	7	~~0.0~~	Use 7% (URS)		
12	3	5.8			
13	0	14.4			
14	9	~~0.1~~	Use 9% (URS)		
15	7	~~2.7~~	Use 7% (URS)		
16	11	~~5.1~~	Use 11% (URS)	-	
17	0	21.8			
18	10	~~3.8~~	Use 10% (URS)		
19	9	~~4.2~~	Use 9% (URS)		
20	8	~~3.9~~	Use 8% (URS)		
21	7	~~5.2~~	Use 7% (URS)		
22	8	~~7.6~~	Use 8% (URS)		
23	26	~~5.0~~	Use 26% (URS)		
24	0	5.0			
25	0	5.4			
26	3	4.2			
27	21	~~5.5~~	Use 21% (URS)		
28	0	21.6			
29	0	21.3			
30	32	~~21.2~~	Use 32% (URS)		
31	0	13.9			
32	10	~~1.7~~	Use 10% (URS)		
33	10	~~0.0~~	Use 10% (URS)	33	
34	10	~~0.0~~	Use 10% (URS)	34	
35	10	~~1.9~~	Use 10% (URS)		
36	1	4.3			
37	9	~~0.9~~	Use 9% (URS)		
38	4	4.8			
39	0	6.3			
40	11	~~9.0~~	Use 11% (URS)		
41	0	45.9			
42	0	25.8			
43	0	64.1			
44	0	49.6			
45	0	30.7			
46	0	26.9			
101	0	14.9			
104	0	14.0			
105	0	14.5			
106	0	14.8			
111	25	~~15.2~~	Use 25% (URS)		111
112	21	~~36.4~~			112
114	26	~~16.1~~	Use 26% (URS)		114
115	27	~~17.1~~	Use 27% (URS)		115
116	28	~~15.0~~	Use 28% (URS)		
117	26	27.6			
118	80	~~76.1~~	Use 80% (URS)		
119	0	36.9			
120	0	37.1			
121	0	31.2			
123	0	15.0			
124	0	15.0			
125	0	30.2			
126	25	48.3			
127	20	~~43.6~~			127
128	0	15.6			
129	4	~~5.4~~			129
130	0	15.3			
131	0	56.6			
132	0	15.0			
133	8	15.0			
134	0	15.0			
135	15	15.0			
136	0	15.0			
137	0	31.7			
138	0	15.5			
139	26	63.1			
140	0	78.6			
141	0	5.0			
142	0	5.4			
143	0	15.0			
144	0	15.5			
145	0	35.9			
146	0	15.0			
147	0	15.0			
148	0	15.0			
149	0	31.8			
150	0	15.0			
151	0	40.8			
152	0	80.0			
153	0	73.0			
154	0	78.0			
155	0	76.9			
156	8	54.8			

Table 2.1

URS					
Basin ID	[1]%IMP	*RTIMP* $_{weighted}$	Comments	Future Undeveloped	Existing 100% Developed
157	12	22.7			
158	25	~~21.5~~	Use 25% (URS)		
159	0	5.0			
160	0	5.0			
161	0	5.2			
162	0	12.6			
163	0	10.3			
164	0	56.5			
165	0	10.2			
166	0	28.6			
167	0	58.3			
168	0	73.1			
169	0	76.7			
170	5	5.0			
171	0	28.4			
172	0	62.2			
173	0	8.4			
174	0	20.7			
175	0	21.8			
176	0	17.5			
177	0	1.2			
178	0	0.2			
179	0	0.1			
180	0	2.2			
181	0	0.6			
182	0	~~0.0~~		182	
183	0	5.1			
184	0	38.6			
185	0	72.7			
186	0	41.3			
187	0	48.3			
188	0	22.0			
189	0	20.0			
190	0	15.3			
191	0	14.7			
192	0	~~0.0~~			
193	0	~~0.0~~		193	
195	0	1.4			
196	2	5.1			
197	0	15.8			
198	12	54.5			
199	0	48.6			
200	0	53.5			
201	0	79.3	LAFB		
202	0	44.6			
203	0	59.9			
204	0	57.8			
205	0	60.0			
206	0	57.4			
207	0	~~14.6~~	100% dev but 0% imp - Clearwater Farms		207
208	0	~~5.2~~	100% dev but 0% imp - Clearwater Farms		208
209	0	0.7			
210	0	~~0.0~~		210	
211	0	~~0.0~~		211	
212	0	1.9			
213	0	79.2	LAFB		
214	0	21.5			
215	0	21.9			
216	0	~~14.5~~	100% dev but 0% imp - Clearwater Farms		216
217	0	14.6	same dev as 207,08,16		
218	0	11.5	same dev as 207,08,16		
219	0	60.0			
220	0	58.8			
221	0	~~0.0~~		221	
222	15	74.6	LAFB		
223	72	79.6	LAFB		
224	0	60.3			
225	4	18.7			
226	17	28.5			
227	3	28.0			
228	0	59.7			
229	2	5.0			
230	0	15.7			
231	0	5.0			
232	0	21.9			
233	0	21.8			
234	0	14.4			
235	0	14.5			
236	0	29.0			
237	0	50.7			
238	0	24.8			
239	0	2.4			
240	0	1.2			
241	0	30.5			
242	0	16.2			
243	0	19.9			
244	0	20.8			
245	18	~~5.0~~	Use 18% (URS)		
246	0	16.8			
247	0	14.7			
248	0	5.0			

Table 2.1

URS					
Basin ID	[1]%IMP	$RTIMP_{weighted}$	Comments	Future Undeveloped	Existing 100% Developed
249	0	36.2			
250	0	77.7			
251	0	66.5			
252	0	46.4			
253	0	35.0			
254	8	9.9			
256	3	22.1			
257	0	21.7			
258	0	8.6			
259	0	30.9			
260	4	5.0			
261	0	4.5			
262	0	2.5			
263	0	80.0			
264	0	80.0			
265	0	80.0			
266	14	~~22.3~~			266
267	14	~~25.7~~			267
268	30	~~37.4~~			268
269	30	~~37.9~~			269
270	18	~~35.4~~			270
272	0	39.6			
273	2	35.2			
274	0	32.4			
275	0	60.9			
276	0	16.9			
277	2	27.1			
278	2	67.6			
279	0	80.0			
280	0	42.4			
281	1	27.1			
282	0	63.4			
283	0	43.1			
284	0	46.1			
285	0	80.0			
286	7	52.2			
287	0	50.5			
288	0	59.0			
289	27	30.4			
290	11	21.1			
291	20	46.7			
292	6	39.5			
293	2	28.0			
294	0	35.4			
295	5	37.8			
296	8	32.3			
297	0	28.4			
298	16	52.7			
299	14	70.0			
300	0	78.5			
301	10	47.9			
302	4	36.4			
303	0	69.9			
304	0	58.2			
305	0	23.2			
306	0	44.9			
307	0	22.0			
308	0	21.7			
309	0	23.5			
310	0	34.5			
311	0	35.1			
312	0	28.4			
313	20	28.7			
314	7	49.0			
315	0	51.4			
316	0	68.2			
317	0	77.2			
318	12	52.9			
319	14	30.0			
320	14.5	40.7			
321	0	14.5			
322	0	13.7			
323	0	22.0			
324	0	21.8			
325	0	20.7			
326	0	22.0			
327	0	21.8			
328	0	25.3			
329	3	25.9			
330	9	30.6			
331	2	29.3			
332	2	26.2			
333	12	45.7			
334	0	75.2			
335	0	74.8			
336	13	77.9			
337	23.5	63.3			
338	0	55.0			
339	0	26.2			
340	0	15.0			
341	0	15.0			
342	0	17.9			
343	0	21.9			
344	0	28.3			

Table 2.1

URS				Future	Existing
Basin ID	[1]%IMP	$RTIMP_{weighted}$	Comments	Undeveloped	100% Developed
345	0	30.9			
346	0	32.1			
347	2	51.2			
348	0	57.2			
349	0	54.6			
350	0	2.9			
351	0	9.5			
352	0	5.0			
353	0	27.2			
354	0	22.0			
355	0	22.6			
356	0	49.6			
357	0	80.0			
358	0	66.1			
359	0	80.0			
360	0	72.3			
361	0	20.5			
362	0	28.5			
363	0	72.7			
364	0	64.8			
365	0	80.0			
366	0	79.2			
367	0	55.0			
368	0	29.5			
369	0	~~0.0~~		369	
370	0	12.5			
371	0	16.3			
372	0	17.7			
373	0	22.2			
374	0	31.4			
375	0	21.8			
376	0	21.4			
377	0	0.0		377	
378	0	4.0			
379	0	~~0.0~~		379	
380	0	~~0.0~~		380	
381	0	~~0.0~~		381	
382	0	1.6			
383	0	~~0.0~~		383	
384	2	50.1			
385	0	39.8			
386	0	~~0.0~~		386	
387	0	~~0.0~~		387	
2711	20	~~19.7~~	Use 20% (URS)		2711
2712	2	59.8			
100A	0	58.9			
102A	0	15.2			
111A	18	~~15.2~~	Use 18% (URS)		
113A	30	~~25.4~~	Use 30% (URS)		
119A	0	37.0			
121A	0	45.4			
122A	35	36.1			
122B	35	36.5			
131A	0	58.1			
138A	30	~~17.7~~	Use 30% (URS)		138A
141A	0	5.0			
145A	0	37.0			
156A	20	~~26.7~~			156A
164A	0	59.5			
173A	0	9.4	*change for existing case*		173A
173B	0	12.2			
175A	0	20.7			
176A	0	14.3			
177A	0	6.0			
181A	0	6.2			
192A	5	~~5.0~~	No change		
194A	0	~~0.0~~		194A	
194B	0	~~0.0~~		194B	194B
194C	0	0.6			
207A	0	21.9			
209A	0	5.1			
215A	0	22.0			
221A	0	~~0.0~~		221A	
225A	0	38.3			
228A	0	58.6			
22A	6	~~5.2~~	Use 6% (URS)		
230A	0	6.4			
242A	0	21.9			
242B	0	14.4			
243A	30	~~15.2~~	Use 30% (URS)		
243B	18	~~14.4~~	Use 18% (URS)		
244A	9	15.1			
245A	0	5.0			
250A	0	73.7			
253A	0	10.3			
254A	20	~~48.1~~			254A
254B	0	20.7			
255A	12	~~9.5~~	Use 12% (URS)		255A
258A	0	5.6			
265A	2	33.5			
269B	15	~~46.0~~			269B
271A	13	71.1			
271C	0	34.5	*change for existing case*		271C
279A	90	~~80.0~~	Use 90% (URS)		

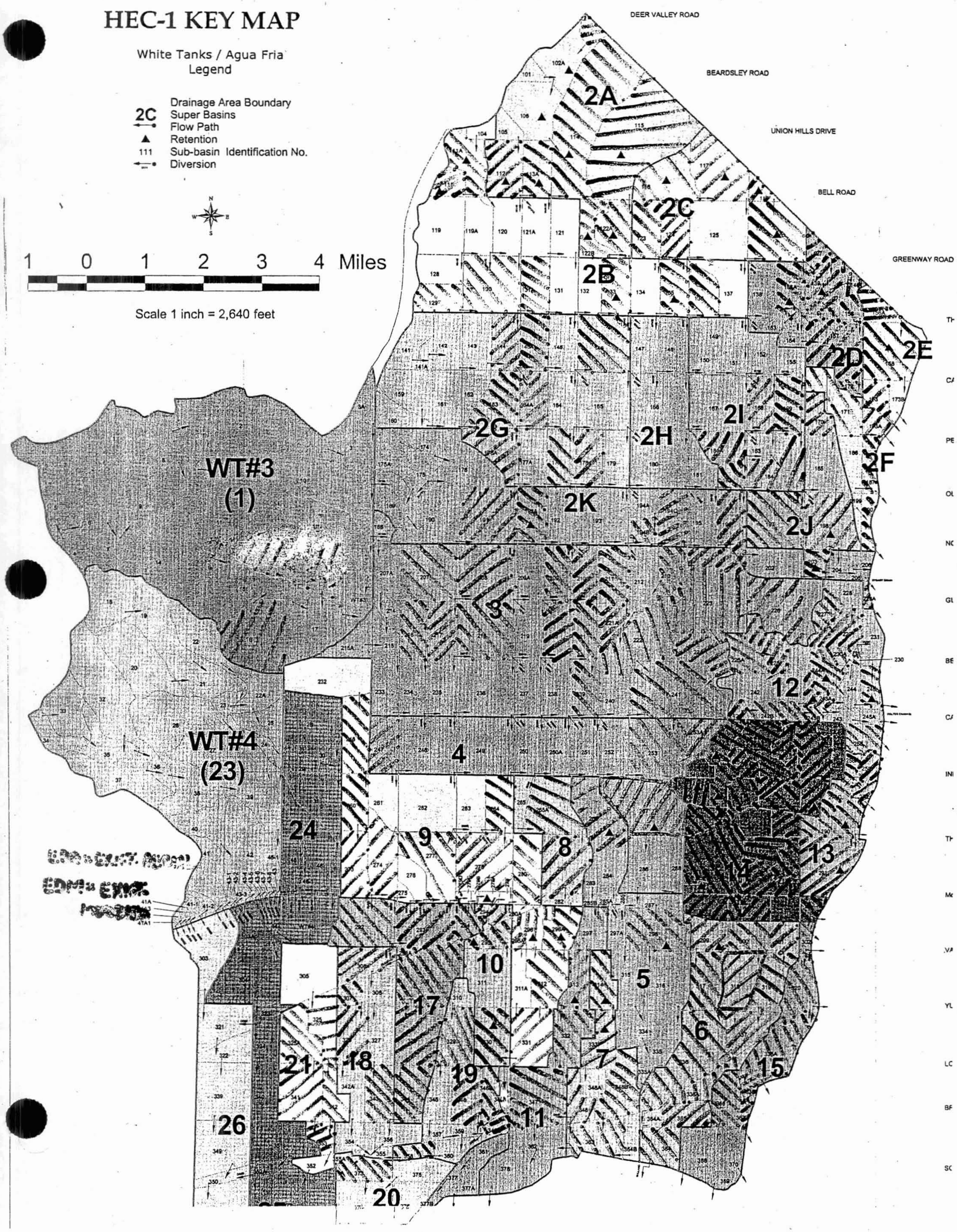
Table 2.1

URS				Future	Existing
Basin ID	[1]%IMP	*RTIMP* $_{weighted}$	Comments	Undeveloped	100% Developed
279B	90	~~80.0~~	Use 90% (URS)		
279C	90	~~80.0~~	Use 90% (URS)		
279D	0	**80.0**			
280A	0	**61.5**			
285A	0	**77.0**			
285B	0	**79.9**			
287A	16	**61.0**			
287B	54	**55.7**			
287C	48	**53.2**			
287D	0	**56.7**			
287E	59	**74.0**			
288A	0	**80.0**			
288B	14	**32.4**			
289A	27	~~23.3~~	Use 27% (URS)		
289B	15	~~25.7~~			**289B**
289C	1	**13.6**			
289D	26	~~30.6~~			**289D**
293A	0	**21.1**			
294A	0	**42.8**			
295A	3	**39.5**			
296A	6	**31.2**			
297A	0	**54.5**			
303A	0.1	**69.1**			
311A	0	**39.3**			
325A	0	**18.8**			
335A	0	**60.4**			
336A	3	**77.8**			
338A	10	**35.7**			
342A	0	**22.0**			
346A	0	**41.9**			
346B	0	**55.9**			
346C	0	**72.5**			
348A	0	**38.4**			
348B	0	**67.8**			
352A	0	**4.8**			
355A	0	**20.6**			
364A	0	**79.6**			
364B	0	**54.4**			
377A	0	~~0.0~~		**377A**	
377B	4	~~0.0~~	Use 4% (URS)	**377B**	
381A	0	~~0.0~~		**381A**	
381B	0	~~0.0~~		**381B**	
383A	0	~~0.0~~		**383A**	
3A	0	**0.4**			
41-1	0	**75.5**			
41-2	0	**66.4**			
41A	0	**74.7**			
41A1	0	**10.8**			
41A2	0	**12.2**			
41A3	0	**46.9**			
43-1	0	**56.3**			
43-2	0	**56.0**			
43-3	0	**56.2**			
43-4	0	**69.3**			
43-5	0	**72.0**			
43-6	0	**71.8**			
43-7	0	**71.0**			
43-8	0	**69.5**			
45-1	0	**61.0**			
46-1	0	**47.0**			
SUB6	20	~~11.0~~	Use 20% (URS)		**SUB6**
SUB7	3	~~6.8~~			**SUB7**
WT3	0	**22.0**			
WT4	0	**49.1**			

APPENDIX

B

HEC-1 KEY MAP


White Tanks / Agua Fria
Legend
Drainage Area Boundary
2C Super Basins
Flow Path
Retention
111 Sub-basin Identification No.
Diversion
1 0 1 2 3 4 Miles
Scale 1 inch = 2,640 feet
DEER VALLEY ROAD
BEARDSLEY ROAD
UNION HILLS DRIVE
BELL ROAD
GREENWAY ROAD
2A
2B
2C
2D
2E
2F
2G
2H
2I
2J
2K
WT#3
(1)
WT#4
(23)
3
4
5
6
7
8
9
10
11
12
13
14
15
17
18
19
20
21
24
26

A, VLD LD MD MFR I C
0 5 15 30 45 55 80

Land Use Types for Proposed Land Use in Loop303/White Tanks ADMP

	Land Use Type	RTIMP		
1	(Blank)	0	✓	
2	Agriculture	55 80	80	C - 80
3	Airport	80	✓	
4	Business Park	80	✓	
5	City Center	80	✓	
6	Commercial	80	✓	
7	Community Retail Center	80	✓	
8	Dedicated Open Space	0	✓	
9	Dedicated or Non-developable Ope	0	✓	
10	Educational	45	✓	
11	Employment	80	✓	
12	High Density	45	✓	
13	High Density Residential	45	✓	
14	Hotel, Motel or Resort	80	✓	
15	Industrial	55	✓	
16	Institutional	80		(45+80)/2 = 62.5
17	Large Lot Residential	45	✓	
18	Large Lot Residential (1-2)	15	✓	
19	Low Density Residential (3-5 Dus	15	✓	
20	Medium Density	45 30	✓	
21	Medium Density Residential	45 30	✓	
22	Medium High Density	37	✓	
23	Medium Low Density	22	✓	
24	Medium/High Density Residential	37	✓	
25	Mixed Use	80 80		45+80/2
26	Mixed Use Center	80 60	(45+80)/2	(45+55+80)/3
27	Mixed Use Gateway	80 60	(45+55+80)/3	
28	Neighborhood Retail Center	80	✓	
29	Open Space	0	✓	
30	Proposed Open Space	0	✓	
31	Public Facilities PRISON 15-20%	80 75 80	✓	55+80 = 67.5
32	Public Facility MAINTENENCE YARDS	80 67.5 80	✓	55+80 = 67.5
33	Recreational Open Space	0	✓	
34	Retirement Community	15	✓	
35	Rural	5	✓	
36	Rural Densities (0-1)	5	✓	
37	Rural Residential (0-1 Du;s/Ac)	5	✓	
38	Small Lot Residential	30 15	15	
39	Small Lot Residential (2-5)	30 22.0	22.0	
40	Suburban Residential (1-3 Dus/Ac	15	15	OK
41	Surprise Center	30	✓	
42	Transportation	80	✓	
43	Unknown	0	✓	
44	Water	0	✓	

Con 80
Ind 55

From: Sam Hanna
FCDMC

URS

Job LOOP 303 ADMP | Project No. | Page ___ of ___
Description | Computed by RJS | Sheet ___ of ___ | Date 5/1/01
LAND USE VS. RTIMP | Checked by | Date

Reference

FAX SHEET TO GET FEEDBACK FOR:
"LAND USE TYPES FOR PROPOSED LAND USE IN LOOP 303/WHITE TANKS ADMP":

1.) FOLLOWING LAND USES MODIFIED BY URS AND (RTIMP)

FAXED TO FCDMC FOR CONCURRENCE.

#3 → AIRPORT RTIMP = 55 → URS CHANGED TO 80%
HIGH % IMP. W/ TARMAC AND RUNWAYS
MAKES AIRPORT SIMILAR TO COMMERCIAL

#16 → INSTITUTIONAL RTIMP = 80 → URS CHANGED TO 55+80/2 = ~~67.5~~ 80 PER AMR
CROSS BETWEEN INDUSTRIAL/COMMERCIAL
EX: HOSPITAL, LIBRARY, ETC.---

#17 → LARGE LOT RESIDENTIAL RTIMP = 15, URS CHANGED TO 5
THIS APPEARS TO BE LOT ≥ 1 AC SINCE #18 IS
1-2 DU/AC. ∴ IT IS ANALAGOUS TO VERY
LOW DENSITY RESIDENTIAL (T 4.2a)

#25 → MIXED USE RTIMP = 80, URS CHGED TO 45+80/2 = ~~85~~ 80 PER AMR
VIEWED AS MIX OF MULTI-FAMILY RESIDENTIAL AND
COMMERCIAL (T 4.2a)

#26 → MIXED USE CENTER RTIMP 80, URS CHGED TO 45+80/2 = 85
SAME REASON AS #25 ✓

#27 → MIXED USE GATEWAY RTIMP = 80, URS CHG TO 60
SAME AS #26 & #27, HOWEVER SOME INDUSTRIAL
INCLUDED ∴ 55+45+80/3 = 60

#31 → PUBLIC FACILITIES RTIMP = 80, URS CHG TO 67.5
SEEN AS AVE. OF INDUSTRIAL & COMMERCIAL (T4.2a)
55+80/2 = ~~67.5~~ PER AMR, 80

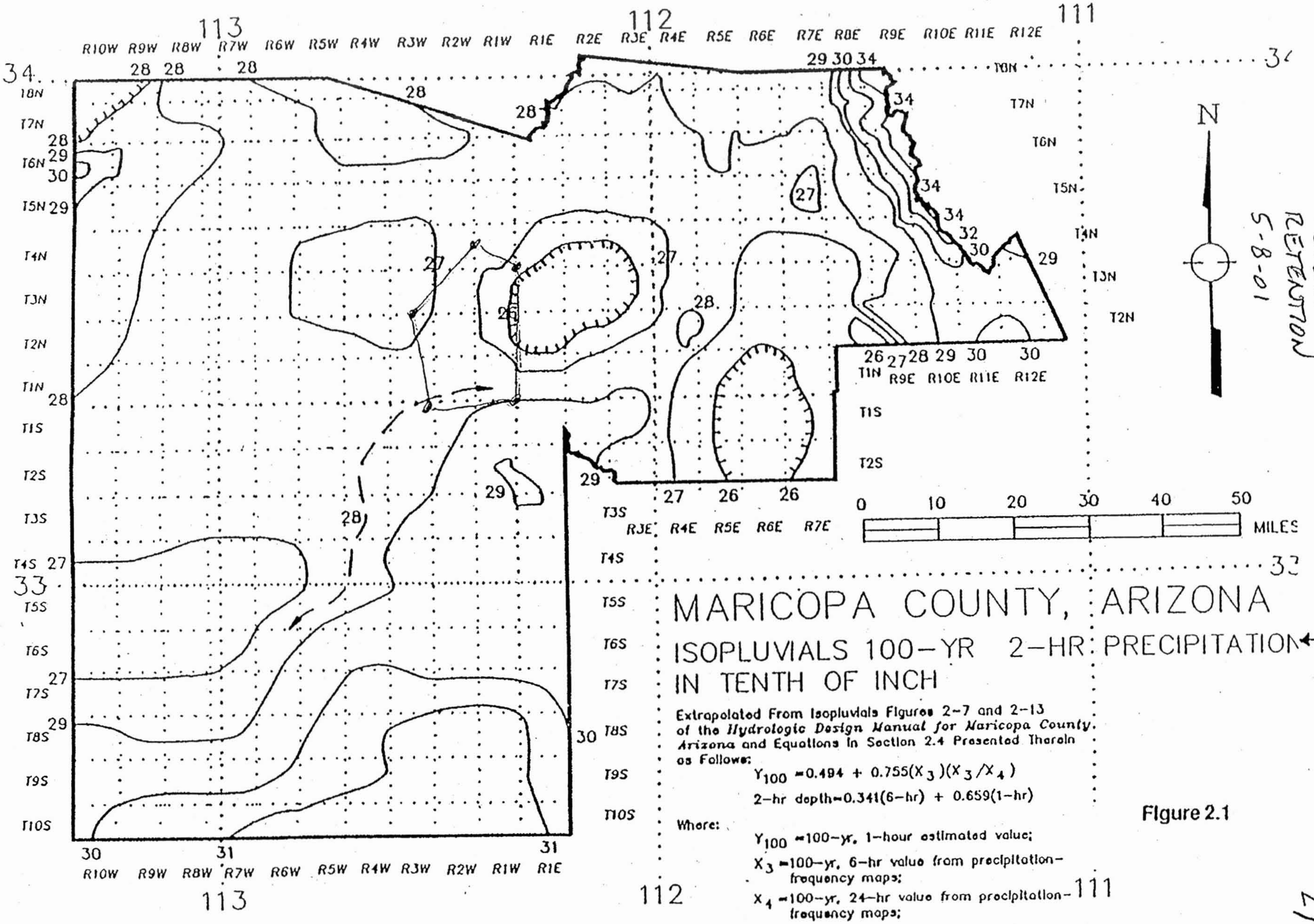
#32 → SAME AS #31

#39 → SMALL LOT RESIDENTIAL RTIMP = 30; URS CHG TO 22.5
2-5 DU/AC → BETWEEN LOW DENSITY & MEDIUM ∴ 30+15/2 = 22.5

#40 → SUBURBAN RESIDENTIAL (1-3 DU/AC) RTIMP = 15, ~~CHG TO~~ OK

APPENDIX

C



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 2-HR PRECIPITATION IN TENTH OF INCH

Extrapolated From Isopluvials Figures 2-7 and 2-13 of the *Hydrologic Design Manual for Maricopa County, Arizona* and Equations In Section 2.4 Presented Therein as Follows:

$$Y_{100} = 0.494 + 0.755(X_3)(X_3/X_4)$$

$$\text{2-hr depth} = 0.341(\text{6-hr}) + 0.659(\text{1-hr})$$

Where:

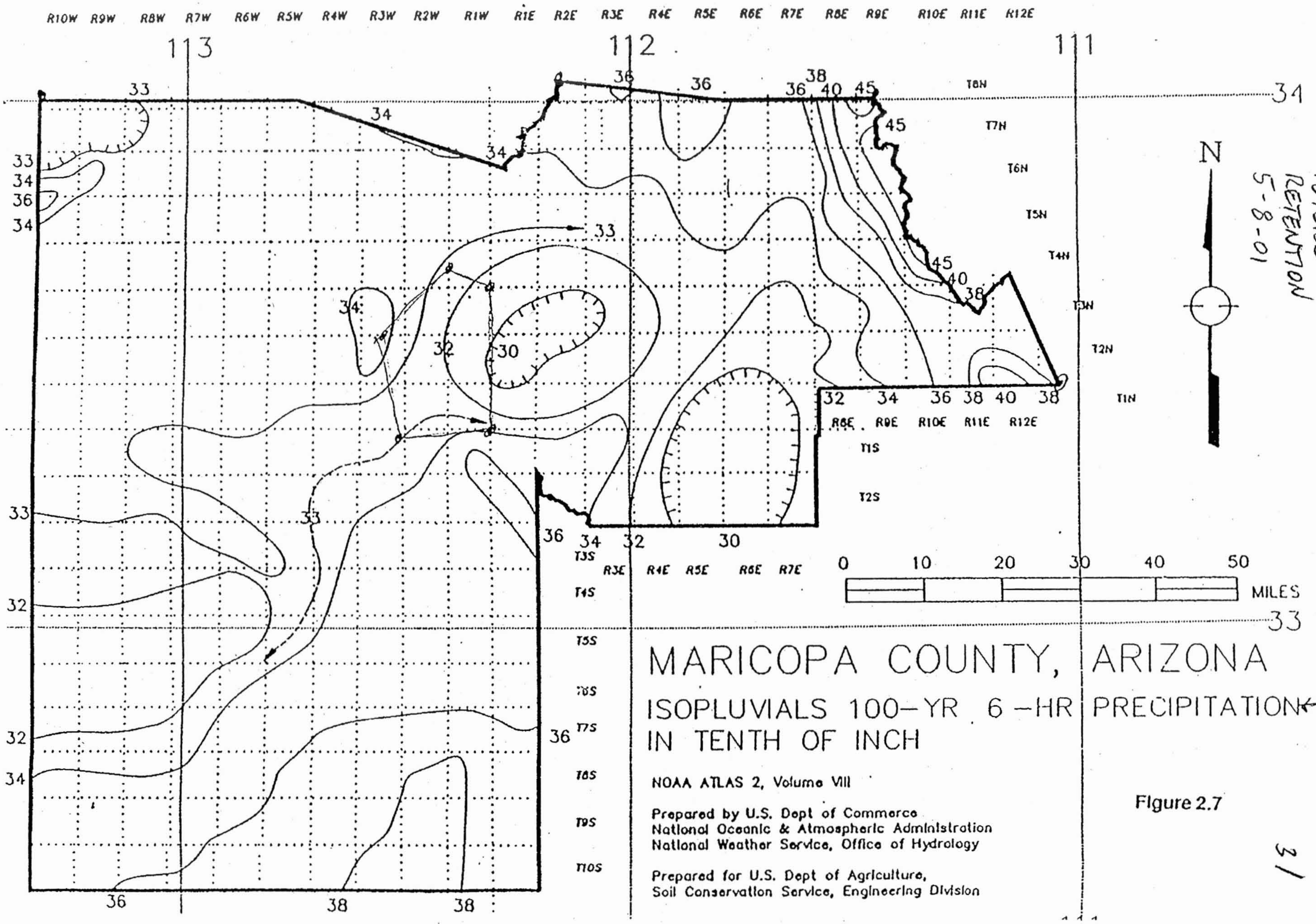
Y_{100} = 100-yr, 1-hour estimated value;

X_3 = 100-yr, 6-hr value from precipitation-frequency maps;

X_4 = 100-yr, 24-hr value from precipitation-frequency maps;

6-hr = Isopluvial values from figure 2.7;

Figure 2.1



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 6-HR PRECIPITATION←
IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.7

APPENDIX C

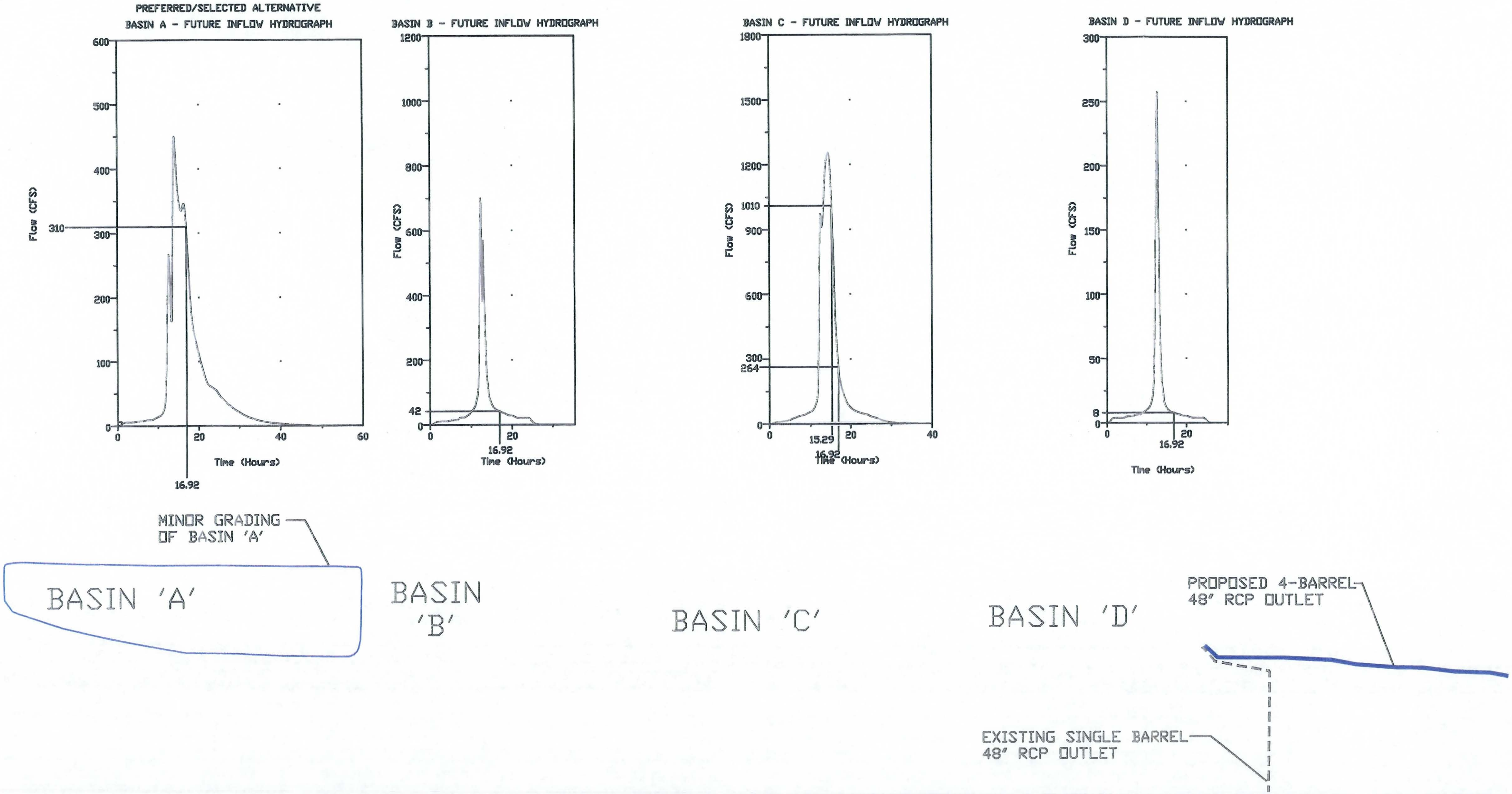
ADOT BASIN ANALYSIS

LEVEL III ANALYSIS OF THE ADOT BASINS

The following procedure was developed and followed for the analysis of the existing ADOT basins:

- The four existing ADOT basins were labeled "A" through "D" beginning with the far west basin located just east of Bullard Avenue.
- The approximate capacity of each of the four existing basins is as follows:
  - Basin A = 265.2 AF, Basin B = 109.0 AF, Basin C = 324.5 AF, and Basin D = 334.7 AF.
- It was assumed that the first 109 AF of the total estimated inflow of 127 AF to Basin B would stay in Basin B. There would be little to no transfer to either Basin A on the west or Basin C on the east until the peak stage in Basin B occurred.
  - The inflow hydrograph to Basin B was used to determine the time, t_B, at which the basin was completely filled (time t_B, at which the inflow volume was equal to 109 AF).
- Using the hydrographs for the inflow at Basin A, Basin C, and Basin D, the total volume of inflow to each basin was determined at time, t_B.
  - The WSELs within Basin A, Basin C, and Basin D at time, t_B, were determined by interpolating the total inflow volume obtained from the hydrograph on the stage storage rating curve for each basin.
  - From the above interpolation, the adjacent WSEL in Basin A was estimated at 982.5 feet, in Basin C at 988.0 feet, and in Basin D at 974.6 feet. The WSEL in Basin B at time, t_B, was 986.0 feet.
    - Since Basin C is over capacity at time, t_B, the time at which Basin C was at capacity (time, t_C) was determined and the corresponding peak flow rate was estimated from the hydrograph. At time, Tc, the WSEL within Basin C is approximately 986.0 feet.
  - The peak inflow to Basin A and Basin D was also determined from their respective inflow hydrographs at time, t_B.
- Using the relative WSELs at time, t_B, the direction of flow between the basins was estimated as the following:
  - There would be a transfer of volume from Basin B to Basin A in the amount of approximately 18 AF and at a maximum flow rate of approximately 42 cubic feet per second (cfs).
  - Beginning at approximately time, t_C (occurring 1 hour prior to t_B), there would be a transfer of volume from Basin C to Basin D in the amount of approximately 135.5 AF and at a maximum flow rate of approximately 1,010 cfs.
    - Although there may be some transfer of flow from Basin C to Basin B as well, it is assumed that this amount of transfer is very small since the relative head elevation between Basin C and Basin D is on the order of 11.4 feet compared with 1 to 2 feet maximum between Basin C and Basin B. The main impact of the transfer of volume to Basin B from Basin C at time, t_C would be to fill Basin B prior to time, t_B but after time, t_C. Since there is only a 1-hour difference between these times, this is not significant.
  - Very little, if any, transfer of volume would take place between Basins B and C.
- Based on the above transfer data and assumptions, the approximate conveyance capacity of each of the interconnecting basin pipes was checked to ensure adequate performance during the equalization of the basins. A pipe was determined as adequate if it had the ability to convey the inflow rate in cfs estimated at time, t_B, (or t_C), given the tailwater conditions in the adjacent basin without exceeding the maximum elevation of 986. All of the connector pipes appeared adequate for equalization.
- The total volume provided by the ADOT basins is approximately 1,030.0 AF and the total inflow volume was approximately *862 AF*. Therefore, the maximum peak stage will not exceed 984.5 feet once the basins have equalized. This is determined by interpolation on the composite stage-storage curve for the basins. Due to the limitations of the HEC-1 model described above, the peak stage data reported by HEC-1 may not be accurate.

Figure CI shows the ADOT Basins and the associated inflow hydrographs for the future condition storm with projects in place. *Table CI* contains a summary of the inflow volume to each of the ADOT Basins for all of the HEC-1 models.



MARICOPA COUNTY N.T.S.

URS

Flood Control District of Maricopa County

PROPOSED ADOT BASIN IMPROVEMENTS

AUGUST, 2004

Figure C.1

Table C.1
ADOT Basin Inflow
Volume Summary

ADOT Basins Inflow Volume Summary																	
	Basin A					Basin B					Basin C			Basin D			[2]TOTAL
HEC-1 Model	RADOT (ac-ft)	287A (ac-ft)	R288A (ac-ft)	Total (ac-ft)	[1]Provided (ac-ft)	1I287B (ac-ft)	R288B (ac-ft)	287B (ac-ft)	Total (ac-ft)	[1]Provided (ac-ft)	1I287C (ac-ft)	Total (ac-ft)	[1]Provided (ac-ft)	287D (ac-ft)	Total (ac-ft)	[1]Provided (ac-ft)	A-D (ac-ft)
Existing, no projects	n/a	29	2	31	265	n/a	88	14	102	109	388	388	325	19	19	335	540
Future, no projects	n/a	51	4	55	265	n/a	113	14	127	109	460	460	325	35	35	335	677
Existing, with projects	201	29	2	232	265	n/a	88	14	102	109	388	388	325	19	19	335	741
Future, with projects	185	51	4	240	265	126	n/a	n/a	126	109	460	460	325	35	35	335	861

Composite *Volume Provided by the ADOT Basins:*

Elevation (ft)	Volume (ac-ft)
970.5	0
974.0	20
976.0	80
978.0	197
980.0	370
982.0	578
986.0	1,029
988.0	1,282
990.0	1,714

1. Indicates the total volume provided by the individual basin at the maximum WSEL of 986 ft. If ponding exceeds 986 ft, the topography indicates that basins A, B and C may overtop.
2. This is the total inflow volume to the 'composite' of all four basins (A through D) given the scenario described in the column 1.

URS

Memorandum

Date: March 27, 2002

To: Greg Jones, Flood Control District of Maricopa County (FCDMC)

From: Elliot Silverston
Rob Scrivo

Subject: **ADOT Basin Watershed Area**

URS has completed a review and analysis of the existing ADOT Basins and contributing watershed area located on the north side of I-10 between Bullard Avenue and Dysart Road. This Memorandum is an update to our earlier Memorandum submitted to FCDMC on October 29, 2001. This revised evaluation contains six additional scenarios related to runoff from the watershed to the existing ADOT Basins. These additional conditions were analyzed using the HEC-1 model as requested by the FCDMC at the October 31, 2001 meeting.

The six additional analyses and results are described under Tasks 3 and 4 below.

Purpose
The purpose of the analysis was to determine the volume of discharge resulting from the 100-year, 24-hour storm event intercepted by the existing ADOT Basins. In addition, the relative percentages of runoff contributing from area stakeholders upstream are summarized for comparison purposes. This information will be useful to the FCDMC in determining a quantifiable benefit in terms of flood control offered to the above entities through the use of the existing ADOT Basins as detention for the post-developed storm water volume generated within each jurisdictional boundary upstream. The stakeholders identified with the ADOT basin watershed area are listed below:

- The City of Goodyear
- The City of Litchfield Park
- The City of Avondale
- Maricopa County
- Estrella Community College
- Palm Valley Master Planned Development

Analysis
The analysis consisted of four major tasks. These tasks included a field trip, preparation of work maps, modification of the draft existing condition hydrology model prepared for the Loop 303 ADMP Update, modification of the Level III preliminary draft preferred alternative model and the preparation of various HEC-1 models for other conditions of interest.

Task 1
The first task consisted of a comprehensive field review to assess the extent to which development has occurred since the submittal of the Draft Existing Condition Hydrology model as well as to

verify modeled retention areas within the watershed. The watershed was video taped and several pictures were taken to document the findings of the field visit. The information was summarized in tables and put into the project file.

Information from the field visit was used to summarize the most recent changes in the watershed and incorporate those into a revised version of the Draft Existing Condition Hydrology model. This information is presented in Table 1.1a.

Only two modeled retention basins from the Draft Existing Condition Hydrology model were not field verified. The first is modeled in sub basin 288A and was not yet constructed. This basin is described in some detail in the "Drainage Report for Palm Valley Phase II Mass grading", dated December 23, 1998 by the WLB Group. This basin was removed from the draft existing condition model. The second basin is located within sub area 254. This area is gated and no access is permitted to the public. This development appeared fully built-out however, and the retention was assumed to be in place.

In some cases, on-lot retention in recently developed strip malls and other commercial properties was noted, however, this amount of volume was considered inconsequential compared with the total contributing watershed area and was not included in the model.

Task 2

The next task was to prepare a work-map from which the contributing areas and the percent contribution of each city/jurisdictions and the Palm Valley Master Planned Community boundary were estimated. The map is shown on Figure 1.1. The map shows stakeholder boundaries and sub basins. Using this map, the relative percentage of contributing watershed area associated with the stakeholders was determined and quantified.

Task 3

The next step in the analysis was to develop the following 10 hydrologic models:

- Undeveloped Model -This model was created by simply modifying the percent impervious (RTIMP) variable in the draft existing condition model to reflect an undeveloped condition. In addition, all existing retention/detention diverts were disabled.
- Existing Model – This model was a result of modifications made to the draft existing condition model based upon the data in Table 1.1a resulting from the field visit described in Task 1.
- Fully Developed No Retention – This model was created using the data provided URS from the FCDMC GIS Data base during the Level II portion of the Loop 303 ADMP Update project. This information consists of a tabulation of all sub basins within the ADMP Update project area and the associated full build-out or completely developed RTIMP variable. In this model, there were no diverts for retention of detention.
- Fully Developed with Retention – This model was created by adding retention diversions to the fully developed no retention model. The magnitude of these diverts was determined by running the 100-year, 6-hour storm for sub basins located within the City of Goodyear and the 100-year, 2-hour storm for all remaining sub basins. Sub Basins whose boundaries cross multiple jurisdictions were evaluated by computing a composite retention volume based upon the percentage of area found each jurisdiction. See Table 1.1b. All computed retention

volumes were multiplied by an 80% efficiency factor (as requested by FCDMC) to account for lost volume due to inadequate construction, siltation, etc…

- No ADMP, Future Retention Requirements met – This model was created by modifying the existing condition hydrology model for future conditions with onsite retention in currently undeveloped sub basins within the ADOT Basins contributing watershed.
- No ADMP, Future Retention Based on Pre-Post Analysis - This model was created by modifying the existing condition hydrology model for future conditions. Onsite retention in currently undeveloped sub basins within the ADOT Basins contributing watershed is provided. In lieu of normal on-site retention requirements, enough retention is provided so that post developed peak discharge is attenuated to be less than or equal to the existing peak discharge.
- The ADMP is in place and Future Retention Requirements are met – This model was created by modifying the Level III preliminary draft preferred condition hydrology model for future conditions within the ADOT Basins watershed. Onsite retention in currently undeveloped sub basins within the ADOT Basins contributing watershed is modeled for the ultimate build-out scenario.
- The ADMP is in place and Future Retention Based on Pre-Post Analysis is provided - This model was created by modifying the Level III preliminary draft preferred condition hydrology model for future conditions within the ADOT Basins watershed. Onsite retention in currently undeveloped sub basins within the ADOT Basins contributing watershed is provided. In lieu of normal on-site retention requirements however, only the amount of retention required for a pre-post peak attenuation is modeled.
- The ADMP is in place and there is no future retention modeled for the ultimate build out of the ADOT Basin watershed.
- There is no ADMP in place and there is no future retention modeled for the ultimate build out of the ADOT Basin watershed.

Task 4

This task involved the preparation of summary tables showing the results of the ten hydrologic models described above. Table 1.2a shows a break down of all four ADOT Basins labeled A – D from west to east and the amount of volume flowing to each. Both the total volume as well as the percentage of volume from the individual cities/jurisdictions and Palm Valley is shown. Table 1.2b shows a break down of all four ADOT Basins labeled A – D from west to east and the approximate stage corresponding with the condition modeled within the contributing watershed.

Table(s) 1.3 – 1.7 show the ADOT Basins as a composite and then individually for all ten hydrologic models analyzed as well as analysis results from other studies/reports. The information contained on these tables includes peak inflow/outflow data, peak stage/storage data and maximum ponding and storage information.

Figure 1.2 illustrates total expected inflow volume based on the results of the modeled conditions described above relative to the existing volume provided by the ADOT Basins. Important relationships between the inflow volumes have been highlighted. These relationships show comparisons of interest between various modeled watershed conditions. Table 1.8 contains a tabulated summary of the key comparisons shown on Figure 1.2.

Results

It is important to note that the volume of inflow indicated on Table 1.2a is lower than the peak storage information shown on Table(s) 1.3 – 1.7. This is a result of the way in which the HEC-1 model is routing flow from the western most basin ('A') to the eastern most basin ('D'). Since the basins are connected by pipes/culverts and the flow moves from one to the next in the model, peak storage volume data given by the HEC-1 output summary at Basin D for example would include both runoff directly flowing into basin D and also, runoff routed from Basin C to the west. For this reason, the total inflow volumes shown on Table 1.2a were obtained by simply summing the volume generated on individual sub basins contributing to the total inflow upstream.

In addition, it should be noted that the total inflow volume would typically be higher than the peak storage volume since it represents the entire volume under the inflow hydrograph for the entire storm duration rather than only that volume present in the basin corresponding to the hydrograph peak discharge. This is always true for a basin with only a single inflow point.

The results of the analysis showed that for any given storm event the majority of runoff contributing to the volume at the ADOT Basins comes from the City of Goodyear followed by Litchfield Park and then Avondale. The Palm Valley development contributes approximately 60% of the total volume conveyed downstream to the ADOT Basins (Note: Palm Valley is located in several jurisdictions – Figure 1.1). By comparison, the City of Goodyear contributes approximately 46% of the total inflow volume versus approximately 37% and 14% for the cities of Litchfield Park and Avondale respectively.

The results of the above analysis have been charted and are presented on figure 1.2. From a review of the analysis results and figure 1.2, it is clear that under existing conditions, the outer ADOT Basins 'A' (far west) and 'D' (far east) have far more volume than that which is directly flowing in from the adjacent watershed. However, the results also indicate that the existing inner ADOT Basins 'B' and 'C' accept the highest rates of inflow and may not have adequate volume under certain conditions modeled. This indicates that the excess inflow volume to the inner basins would require transfer to the outer basins whose geometry provide more volume than that which directly flows in from the adjacent land. This would be a direct function of the adequacy or in-adequacy of the existing connection pipes/culverts.

Taken as a composite facility, the existing ADOT Basins appear to have adequate capacity to store the runoff generated by the offsite drainage area as well as diverted discharges from the Bullard Wash, however, the FCDMC minimum freeboard requirement may not be met.

Table 1.8 summarizes key comparisons made between the 10 modeled inflow conditions illustrated on Figure 1.2. According to these comparisons, the difference between the existing condition inflow volume and the undeveloped inflow volume (165 ac-ft) represents the current benefit to upstream development. This apparent benefit is due to the lack of existing onsite retention provided by the majority of existing upstream development. Typically, development must reserve land for the construction of onsite retention basins to attenuate post-developed peak discharges resulting from the 100-year storm event. In this case, most of the upstream development has not constructed onsite retention basins but has instead directed storm water runoff downstream to the existing ADOT Basins.

If planned future development on currently undeveloped sub basins upstream of the existing ADOT Basins is allowed to directly discharge post developed storm water downstream without providing onsite retention, the total benefit would be equal to the land that would be required to store approximately 415 ac-ft. Based on Table 1.2a, the approximate relative benefits to each of the stakeholders in the watershed in terms of volume are as follows:

- The City of Goodyear – 192 ac-ft
- The City of Litchfield Park – 156 ac-ft
- The City of Avondale – 59 ac-ft
- Maricopa County – 5 ac-ft
- Estrella Community College – 3 ac-ft
- Palm Valley Master Planned Community – 264 ac-ft

In reviewing the results in Figure 1.2 and Table 1.2a, key comparisons can be made to the use of retention in the existing contributing watershed to the ADOT Basins. The impacts of the ADMP in diverting runoff to the ADOT Basins can also be evaluated. These scenarios are used for comparison purposes.

1. Assuming there is no ADMP in place, the impact of waiving retention criteria in the contributing watershed to date is approximately 165 ac-ft, which is approximately 25% of the present contributing runoff volume to the basins. Based on Table 1.2a, the approximate relative benefits to each of the stakeholders in the watershed in terms of volume are as follows:
    - The City of Goodyear – 76 ac-ft
    - The City of Litchfield Park – 62 ac-ft
    - The City of Avondale – 23 ac-ft
    - Maricopa County – 2 ac-ft
    - Estrella Community College – 2 ac-ft
    - Palm Valley Master Planned Community – 105 ac-ft
2. If the ADMP is not implemented and development occurred as planned in the ADOT Basins watershed, the increased volume of runoff to the ADOT Basins by waiving retention entirely is approximately 139 ac-ft. Based on Table 1.2a, the approximate relative benefits to each of the stakeholders in the watershed in terms of volume are as follows:
    - The City of Goodyear – 64 ac-ft
    - The City of Litchfield Park – 52 ac-ft
    - The City of Avondale – 20 ac-ft
    - Maricopa County – 2 ac-ft
    - Estrella Community College – 1 ac-ft
    - Palm Valley Master Planned Community – 89 ac-ft
3. If the ADMP is implemented and development occurs as planned in the entire watershed (existing hydrology), the increase in runoff volume to the ADOT Basins is again 139 ac-ft. However, the ADMP project diverts an additional runoff volume of approximately 156 ac-ft to the ADOT Basins. Again, based on Table 1.2a, the approximate relative benefits to each of the stakeholders in the watershed in terms of volume are as follows:
    - The City of Goodyear – 64 ac-ft

- The City of Litchfield Park – 50 ac-ft
- The City of Avondale – 20 ac-ft
- Maricopa County – 156 ac-ft
- Estrella Community College – 1 ac-ft
- Palm Valley Master Planned Community – 898 ac-ft

Note that when the ADMP is in place the FCDMC now contributes 55% of the total increase in inflow at the ADOT Basins while area stakeholders combined contribute 45% of the total increase in runoff volume. The 45% would then be split between the stakeholders according to the percentages shown on Table 1.2a.

The data provided herein can be used to determine the impacts of each stakeholder including FCDMC on the ADOT Basins. The proportional benefit to each stakeholder may be used to facilitate partnering in the future improvement(s) to the basins.

cc:

Attachment

Table 1.1a

Hydrologic Modeling Parameters

Sub Area	Modeled Parameters													
	Retention Triangle (Y/N)	Development [18]RTIMP (WLB)	Development RTIMP (Draft Exist) (URS)	[5]Ultimate RTIMP (FCDMC-GIS)	[1]Modeled As Dev or (FD,UD,PD)	Color Aerial Visible Development (FD,UD,PD)	[6]Estimated Percentage of Development in Draft Exist. Condition Model	Field Check Development As a % of Full Build-out (approx. %)	Field Verified Existing Condition of Sub Basin (FD,UD,PD)	Revised Existing Cond. RTIMP	[7]Field Check Verified Retention (Y/N)	[8]Future Retention Proposed in Sub-Area (Y/N)	Palm Valley Phase
288A	Y	0%	0%	80.0%	UD	UD	0%	0%	UD	0.0%	[13]N	Y	II
287A	N	0%	16%	61.0%	PD	PD	26%	26%	PD	16%	N/A	N/A	N/A
254	Y	0%	8%	9.9%	PD	PD	81%	92%	PD	9.1%	[10]Y	N	NS
254B	N	0%	0%	20.7%	UD	UD	0%	0%	UD	0.0%	N/A	[14]N	NS
269	Y	0%	30%	37.9%	PD	PD	79%	100%	FD	37.9%	[15]Y	[14]N	NS
269B	Y	0%	15%	46.0%	PD	PD	33%	74%	PD	34.0%	[15]Y	[14]N	NS
268	Y	0%	30%	37.4%	PD	PD	80%	100%	FD	37.4%	[12]Y	[14]N	NS
[2]288B	Y	0%	14%	32.4%	PD	PD	43%	43%	PD	13.9%	Y	[14]N	II
287B	N	0%	54%	55.7%	PD	PD	97%	100%	FD	55.7%	[9]N/A	N/A	N/A
2711	N	0%	20%	20.0%	FD	FD	100%	100%	FD	20.0%	N/A	[20]N	NS
254A	N	20%	20%	48.1%	FD	FD	Used URS RTIMP	100%	FD	20.0%	N/A	[20]N	N/A
257	N	0%	0%	21.7%	UD	UD	0%	0%	UD	0.0%	N/A	Unknown	N/A
256	Y	0%	3%	22.1%	PD	PD	14%	27%	PD	6.0%	Y	[21]Y	N/A
SUB6	N	12%	20%	11.0%	FD	FD	Used URS RTIMP	100%	FD	20.0%	N/A	[20]N	N/A
SUB7	N	12%	3%	5.8%	FD	FD	Used URS RTIMP	100%	FD	3.0%	N/A	[20]N	N/A
271A	Y	0%	13%	71.1%	PD	PD	18%	65%	PD	46.2%	Y	[14]N	NS
255A	N	12%	12%	9.5%	FD	FD	Used URS RTIMP	100%	FD	12.0%	N/A	[20]N	N/A
2712	N	0%	2%	59.8%	PD	PD	3%	3%	PD	2%	N/A	[14]N	I
270	N	18%	30%	35.4%	PD	PD	85%	100%	FD	35.4%	N/A	[20]N	N/A
289C	N	0%	1%	13.6%	PD	PD	7%	7%	PD	1.0%	N/A	[14]N	I
289A	N	0%	27%	27.0%	FD	[19]PD	100%	100%	FD	27.0%	N/A	[14]N	I
[3]289B	N	0%	15%	25.7%	FD	FD	Used URS RTIMP	90%	PD	15.0%	N/A	[14]N	I
[illegible]	N	0%	26%	26.0%	FD	FD	100%	100%	FD	26.0%	N/A	[14]N	I
[illegible]	N	0%	27%	30.4%	PD	PD	89%	96%	PD	29.2%	[9]N/A	[14]N	I
287C	N	0%	48%	53.0%	PD	PD	91%	91%	PD	48%	N/A	N/A	N/A
287D	N	0%	0%	56.7%	UD	UD	0%	0%	UD	0.0%	N/A	N/A	N/A

FD = Fully Developed
PD = Partly Developed
UD = Un-Developed

1. If the percent impervious is 0%, then undeveloped.
2. Represents off-line retention as described in "Drainage Report for Palm Valley Phase 2 Mass Grading", dated 12/23/1998.
3. EEC/URS modeled as a lower RTIMP at full build-out than later calculated by the FCDMC GIS data base for preparation of Future Condition Hydrology model. Did not change to the higher value since the value used in the Existing Condition model had already been approved by the FCDMC.
4. RTIMP fully developed was less than the full build-out RTIMP used in the Existing Condition model, therefore, the RTIMP from the Existing Condition model was used for consistency.
5. Data source from the FCDMC GIS Data Base. Based on the percentage of the total sub basin area that will be developed in the ultimate built-out condition.
6. This is the percentage of the sub area that was built out at the time the Draft Existing Condition Hydrology model was prepared.
7. N = field trip could not verify the modled retention, Y = field trip verified modeled retention.
8. As described by applicable drainage report, this would be new or additional retention, beyond what currently exists.
9. Some on-lot retention observed, not included in model.
10. Could not access portion of sub area 254 due to gate, assume no change from draft and that retention exists.
11. "100%" indicates this area is completely built-out according to future land-use plan. Note that this does not necessarily mean the entire sub area is covered with development for the 100% or "full build-out" condition.
12. This retention was verified and documented on page 12 by the "Palm Valley Concept Drainage Plan for the Roosevelt Canal Watershed", dated 12/17/96.
13. Retention as described on pages 9 and 12 of the "Drainage Report for Palm Valley Phase 2 Mass Grading", dated 12/23/1998 - not yet constructed however, modeled in the Draft Existing Condtion Hydrology Model. This divert will be turned off for the existing condition in this analysis since it was not yet constructed.
14. Per the "Developed Conditions Watershed Boundary Map" (11"x17") map, in the "Master Drainage Study for Palm Valley", dated March 8 1998, excess runoff from this area will drain directly to the ADOT basins.
15. Retention provided per the "Palm Valley Master Drainage Study", by the WLB Group, dated 1/8/98 - see sub basins '**S34**', '**S34A**' and '**S12**'.
16[illegible]he "Developed Conditions Watershed Boundary Map" (11"x17") map, in the "Master Drainage Study for Palm Valley", dated March 8 1998, this area generally drains to the RID Overchute.
1[illegible] indicates that there was no phase specified for this sub basin in any documentation available to URS.
18. Some differences due to sub basin boundary changes in the ADMP Update.
19. Although area appears partly developed on aerial, it may be fully developed according to future land use.
20. Sub basin is fully developed without retention.
21. Retention construction noted during field trip.

Table 1.1b

Onsite Retention Requirements for ADOT Basin Watershed Sub Basins

Retention Requirement Sub Basin	ADOT Basin Study % Area Within Jurisdiction 100-yr, 2-hr Avondale	100-yr, 6-hr Goodyear	100-yr, 2-hr Litchfield Park	100-yr, 2-hr Maricopa County	100-yr, 2-hr Estrella CC	100-yr, 2-hr Volume (ac-ft)	100-yr, 6-hr Volume (ac-ft)	[1]Modeled Design Storm	Required Onsite Retention (ac-ft)	Volume of Diverted Flow Currently Used to Model Existing Onsite Retention (ac-ft)	Required to Provide Future Retention?	% Future Development to be Retained	(80% Eff.) (ac-ft)	Part 1A&2A RET. DIV. in HEC-1 as % of Future Developed Area (ac-ft)	Part 1B&2B RET. DIV. in HEC-2 as % of Future (ac-ft)
[6,8]254			100%			11.8	21.8	100-yr, 2-hr	11.8	29.6	N	0.0%	9.4	**29.6**	4.80
[5]256			95%	5%		36.9	50.8	100-yr, 2-hr	36.9	5.0	Y	73.0%	29.5	**26.5**	20.50
[5]257			100%			31.9	42.5	100-yr, 2-hr	31.9	0.0	Y	100.0%	25.5	**25.5**	18.40
268		100%				19.2	27.4	100-yr, 6-hr	27.4	N/A	N/A	N/A	21.9	N/A	N/A
269		100%				18.1	25.9	100-yr, 6-hr	25.9	N/A	N/A	N/A	20.7	N/A	N/A
270			90%	10%		23.5	33.4	100-yr, 2-hr	23.5	N/A	N/A	N/A	18.8	N/A	N/A
[6]289		100%				20.7	29.6	100-yr, 6-hr	29.6	0.0	N	0.0%	23.7	0.0	N/A
2711			100%			6.8	10.7	100-yr, 2-hr	6.8	N/A	N/A	N/A	5.4	N/A	N/A
[5]2712	90%	6%		4%		45.2	59.4	***Composite***	46.1	0.0	Y	89.0%	36.9	**32.8**	36.65
254A			100%			11.3	23.8	100-yr, 2-hr	11.3	N/A	N/A	N/A	9.0	N/A	N/A
[6]254B			100%			8.1	12.7	100-yr, 2-hr	8.1	0.0	N	0.0%	6.5	0.0	N/A
255A			100%			38.1	59.3	100-yr, 2-hr	38.1	N/A	N/A	N/A	30.5	N/A	N/A
[5]269B		55%	37%	7%		21.5	30.3	***Composite***	26.4	12.4	Y	24.0%	21.1	**17.5**	16.60
[5]271A	100%					27.2	34.5	100-yr, 2-hr	27.2	11.1	Y	33.5%	21.7	**18.4**	20.00
[5]287A		100%				35.3	45.9	ADOT Basin	45.9	0.0	Y	74.0%	36.7	**N/A**	N/A
287B		100%				9.4	12.6	ADOT Basin	12.6	N/A	N/A	N/A	10.1	N/A	N/A
[6]287C		100%				24.6	31.7	ADOT Basin	31.7	0.0	N	0.0%	25.3	0.0	N/A
[5]287D		100%				26.1	33.0	ADOT Basin	33.0	0.0	Y	100.0%	26.4	**N/A**	N/A
[5]288A		100%				8.9	11.0	100-yr, 6-hr	11.0	0.0	Y	100.0%	8.8	**8.8**	6.50
[5,7]288B		100%				68.3	99.8	100-yr, 6-hr	99.8	[7]N/A	Y	26.0%	79.8	**20.8**	47.10
289A	67%				33%	13.8	20.9	100-yr, 2-hr	13.8	N/A	N/A	N/A	11.0	N/A	N/A
[6]289B		100%				21.4	31.4	100-yr, 6-hr	31.4	0.0	N	0.0%	25.1	0.0	N/A
[5]289C	87%	14%				16.6	27.1	***Composite***	18.1	0.0	Y	76.5%	14.5	**11.1**	10.80
289D		100%				17.2	26.1	100-yr, 6-hr	26.1	N/A	N/A	N/A	20.9	N/A	N/A
SUB6			100%			8.2	11.8	100-yr, 2-hr	8.2	N/A	N/A	N/A	6.6	N/A	N/A
SUB7			100%			14.4	23.1	100-yr, 2-hr	14.4	N/A	N/A	N/A	11.5	N/A	N/A

1. N/A indicates that the sub area exists as 100% developed with no retention, therefore, no future retention divert is waranted. However, for the purposes of this study retention will be used to evaluate the "benefit" to a development of not having to provide on-site retention.
2. Data taken frome the Loop 303 ADMP Update workbook, "sub basin data.xls". Since the scope for this study allows for more accurate determination of jurisdictional boudaries as well as percentages of sub basins within different jurisdictions, the data from this study supercedes that from the ADMP Update. The ADMP data was included for information only.
3. Differences in percentages of a sub basin found in multiple jurisdictions between the ADMP Update and this study are a result of more detailed scope and data used to produce this information.
4. The ADMP Update used the following criteria to model future onsite retention: If 75% or more of a sub basin was within the city of Goodyear, the 100-year, 6-hour storm event was used, otherwise the 100-year, 2-hour storm event was used (results in higher downstream runoff and hence is more conservative). Per the higher level of detail required by this study, the retention will be weighted by the percentages of the sub basin found within and outside of the City of Goodyear.
5. Sub basin is going to develop in the future and will be required to provide the required on-site retention.
6. Sub basin is going to develop in the future but is part of existing phases of the Palm Valley development and will not provide future retention.
7. Off-line retention exists in the golf course portion of this sub basin. It is modeled by HEC-1. The proposed future retention will be based on on the balance of area currently un-developed and will be shown in the HEC-1 model as a divert.
8. Total divert in existing condition is 29.6 ac-ft. This includes approximately 4.8 ac-ft for existing development and 24.8 ac-ft for ponding behind the airline canal.

Table 1.2a

Contributing Jurisdictions/Development to ADOT Basin Inflow

Total ADOT Basin Contributing Watershed Area: ***7.39 sm***

			City/Jurisdictional Agency																				
	Total Contributing		Goodyear			Litchfield Park			Avondale			Maricopa County			Estrella Community College			Palm Valley			[2]Total Inflow	Actual Available
Basin ID	Area (sm)	Modeled Condition	*% Total*	*Peak Discharge (cfs)*	*Volume (ac-ft)*	*% Total*	*Peak Discharge (cfs)*	*Volume (ac-ft)*	*% Total*	*Peak Discharge (cfs)*	*Volume (ac-ft)*	*% Total*	*Peak Discharge (cfs)*	*Volume (ac-ft)*	*% Total*	*Peak Discharge (cfs)*	*Volume (ac-ft)*	*% Total*	*Peak Discharge (cfs)*	*Volume (ac-ft)*	Volume (ac-ft)	Storage (ac-ft)
A	0.41																					
		Completely Undeveloped	100.0%	277	26	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	184	17	26	265.2
		Existing Conditions	100.0%	295	34	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	196	23	34	
		Fully Developed - No Onsite Retention	100.0%	361	64	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	240	42	64	
		Fully Developed - Onsite Retention All Sub Basins	100.0%	297	55	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	198	37	55	
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	100.0%	297	55	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	198	37	55	
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	100.0%	297	57	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	198	38	57	
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	100.0%	723	211	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	481	140	211	
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	100.0%	733	213	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	488	142	213	
		Part 3A: No ADMP, Dev. W/O Future Retention	100.0%	361	64	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	240	42	64	
		Part 3B: W/ADMP, Dev. W/O Future Retention	100.0%	733	220	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	66.6%	488	146	220	
B	2.18																					
		Completely Undeveloped	75.7%	890	93	23.5%	276	29	0.0%	0	0	0.8%	9	1	0.0%	0	0	96.0%	1128	118	123	109.0
		Existing Conditions	75.7%	520	143	23.5%	162	44	0.0%	0	0	0.8%	6	2	0.0%	0	0	96.0%	659	181	188	
		Fully Developed - No Onsite Retention	75.7%	1007	174	23.5%	313	54	0.0%	0	0	0.8%	11	2	0.0%	0	0	96.0%	1276	220	229	
		Fully Developed - Onsite Retention All Sub Basins	75.7%	280	58	23.5%	87	18	0.0%	0	0	0.8%	3	1	0.0%	0	0	96.0%	355	73	77	
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	75.7%	532	141	23.5%	165	44	0.0%	0	0	0.8%	6	1	0.0%	0	0	96.0%	675	179	186	
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	75.7%	436	122	23.5%	135	38	0.0%	0	0	0.8%	5	1	0.0%	0	0	96.0%	553	154	161	
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	75.7%	532	141	23.5%	165	44	0.0%	0	0	0.8%	6	1	0.0%	0	0	96.0%	675	179	186	
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	75.7%	436	122	23.5%	135	38	0.0%	0	0	0.8%	5	1	0.0%	0	0	96.0%	553	154	161	
		Part 3A: No ADMP, Dev. W/O Future Retention	75.7%	535	158	23.5%	166	49	0.0%	0	0	0.8%	6	2	0.0%	0	0	96.0%	678	200	208	
		Part 3B: W/ADMP, Dev. W/O Future Retention	75.7%	535	158	23.5%	166	49	0.0%	0	0	0.8%	6	2	0.0%	0	0	96.0%	678	200	208	
C	4.57																					
		Completely Undeveloped	24.7%	331	76	49.4%	662	152	22.8%	305	70	1.6%	21	5	1.6%	22	5	47.1%	630	145	308	324.5
		Existing Conditions	24.7%	350	99	49.4%	699	197	22.8%	322	91	1.6%	22	6	1.6%	23	6	47.1%	666	188	400	
		Fully Developed - No Onsite Retention	24.7%	436	121	49.4%	872	242	22.8%	402	111	1.6%	28	8	1.6%	28	8	47.1%	831	230	489	
		Fully Developed - Onsite Retention All Sub Basins	24.7%	132	49	49.4%	265	98	22.8%	122	45	1.6%	8	3	1.6%	9	3	47.1%	252	93	199	
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	24.7%	322	93	49.4%	644	185	22.8%	297	85	1.6%	21	6	1.6%	21	6	47.1%	614	176	375	
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	24.7%	314	95	49.4%	627	189	22.8%	289	87	1.6%	20	6	1.6%	20	6	47.1%	597	180	383	
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	24.7%	322	93	49.4%	644	185	22.8%	297	85	1.6%	21	6	1.6%	21	6	47.1%	614	176	375	
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	24.7%	314	95	49.4%	627	189	22.8%	289	87	1.6%	20	6	1.6%	20	6	47.1%	597	180	383	
		Part 3A: No ADMP, Dev. W/O Future Retention	24.7%	379	117	49.4%	758	234	22.8%	349	108	1.6%	24	7	1.6%	25	8	47.1%	723	223	473	
		Part 3B: W/ADMP, Dev. W/O Future Retention	24.7%	379	117	49.4%	758	234	22.8%	349	108	1.6%	24	7	1.6%	25	8	47.1%	723	223	473	
D	[illegible].23																					
		Completely Undeveloped	100.0%	460	19	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	238	10	19	334.7
		Existing Conditions	100.0%	460	19	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	238	10	19	
		Fully Developed - No Onsite Retention	100.0%	482	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	249	18	35	
		Fully Developed - Onsite Retention All Sub Basins	100.0%	284	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	147	18	35	
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	100.0%	472	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	244	18	35	
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	100.0%	472	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	244	18	35	
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	100.0%	472	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	244	18	35	
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	100.0%	472	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	244	18	35	
		Part 3A: No ADMP, Dev. W/O Future Retention	100.0%	477	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	247	18	35	
		Part 3B: W/ADMP, Dev. W/O Future Retention	100.0%	477	35	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	51.7%	247	18	35	

	Composite	Percentage of Contributing Area at ADOT Basins					
	[1]Total	46.3%	37.5%	14.1%	1.2%	1.0%	63.7%
Modeled Condition	Inflow Volume (ac-ft)	[3]Goodyear (ac-ft)	[3]Litchfield Park (ac-ft)	[3]Avondale (ac-ft)	[3]Maricopa County (ac-ft)	[3]Estrella College (ac-ft)	[3]Palm Valley (ac-ft)
Completely Undeveloped	476	220	178	67	6	5	303
Existing Conditions	641	297	240	90	8	6	408
Fully Developed - No Onsite Retention	818	378	307	115	10	8	521
Fully Developed - Onsite Retention All Sub Basins	365	169	137	51	4	4	233
Part 1A:No diverts from ADMP, Future Onsite Retention Provided	651	301	244	92	8	7	415
Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	636	294	239	90	8	6	405
Part 2A:Diverts from ADMP, Future Onsite Retention Provided	807	374	303	114	10	8	514
Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	792	367	297	112	10	8	505
Part 3A: No ADMP, Dev. W/O Future Retention	780	361	292	110	9	8	497
Part 3B: W/ADMP, Dev. W/O Future Retention	936	433	351	132	11	9	597

1. Note: The 'Total Volume' reported here is indicative of the sum of the volumes generated on the individual sub basins upstream that contribute directly to the ADOT Basins. Peak storage values on Table 1.3 were obtained by summing the peak storage value reported at each ADOT Basin (A-D) in the HEC-1 output file. Since the basins are interconnected and modeled routing the discharges from one to the next (A-D), these volumes in effect double-count storm water. For example, the peak storage in Basin D would have portions of the volume that originally discharged into the upstream bains A - C as well as volume from the adjacent/upstream sub basin areas.
2. Note: The sum of the volumes will be higher than the total if Palm Valley is included. This is because portions of Palm Valley lie within multiple cities. If it is excluded, the summation will equal the total volume.
3. Note: Portion of the total volume that drains to the ADOT Basins from respective city, jurisdiction or development. This value is based on the percentage of total contributing area shown above.

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Ponding Elevation Summary

Basin ID	Total Contributing Area (sm)	Modeled Condition	[2]Max. Ponding Elevation (ft)	[4]Ponding Elevation at Peak Inflow (ft)
A	0.41 (Ex. Vol: 265.2 ac-ft)	*Completely Undeveloped*	986	978.7
		Existing Conditions	986	978.9
		Fully Developed - No Onsite Retention	986	979.6
		Fully Developed - Onsite Retention All Sub Basins	986	979.3
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	986	979.3
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	986	979.4
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	986	983.3
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	986	983.3
		Part 3A: No ADMP, Dev. W/O Future Retention	986	979.6
		Part 3B: W/ADMP, Dev. W/O Future Retention	986	983.5
B	2.18 (Ex. Vol: 109.0 ac-ft)	*Completely Undeveloped*	986	982.9
		Existing Conditions	986	982.0
		Fully Developed - No Onsite Retention	986	985.1
		Fully Developed - Onsite Retention All Sub Basins	986	980.5
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	986	981.9
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	986	981.7
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	986	981.9
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	986	981.7
		Part 3A: No ADMP, Dev. W/O Future Retention	986	982.4
		Part 3B: W/ADMP, Dev. W/O Future Retention	986	982.4
C	4.57 (Ex. Vol: 324.5 ac-ft)	*Completely Undeveloped*	986	982.7
		Existing Conditions	986	983.9
		Fully Developed - No Onsite Retention	986	987.3
		Fully Developed - Onsite Retention All Sub Basins	986	978.6
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	986	982.9
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	986	982.8
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	986	982.9
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	986	982.9
		Part 3A: No ADMP, Dev. W/O Future Retention	986	986.0
		Part 3B: W/ADMP, Dev. W/O Future Retention	986	985.7
D	0.23 (Ex. Vol: 334.7 ac-ft)	*Completely Undeveloped*	986	984.9
		Existing Conditions	986	987.6
		Fully Developed - No Onsite Retention	986	992.9
		Fully Developed - Onsite Retention All Sub Basins	986	981.0
		Part 1A:No diverts from ADMP, Future Onsite Retention Provided	986	987.5
		Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	986	987.7
		Part 2A:Diverts from ADMP, Future Onsite Retention Provided	986	988.1
		Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	986	988.2
		Part 3A: No ADMP, Dev. W/O Future Retention	986	990.9
		Part 3B: W/ADMP, Dev. W/O Future Retention	986	991.5

(Ex. Vol: 1033.3 ac-ft)

COMPOSITE BASIN		
Modeled Condition	**Max. Ponding Elevation (ft)**	**[1]Ponding Elevation at Peak Inflow (ft)**
Completely Undeveloped	986	982.4
Existing Conditions	986	983.6
Fully Developed - No Onsite Retention	986	986.9
Fully Developed - Onsite Retention All Sub Basins	986	979.8
Part 1A:No diverts from ADMP, Future Onsite Retention Provided	986	983.4
Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	986	983.4
Part 2A:Diverts from ADMP, Future Onsite Retention Provided	986	984.6
Part 2B: Diverts from ADMP, Post developed Q's </equal to existing	986	984.6
Part 3A: No ADMP, Dev. W/O Future Retention	986	985.6
Part 3B: W/ADMP, Dev. W/O Future Retention	986	986.6

1. Represents a weighted average using the peak elevations shown above within individual basins and weighting them according to total volume provided. This is only an approximation and is not the result of an actual model.
2. WSEL's exceding 986' may no longer be contained within the basins and may begin to pond on upstream adjacent land.
3. At the time of peak inflow discharge, this is the HEC-1 maximum ponding WSEL. This indicates breakout if it exceeds the maximum WSEL of 986'.

Table 3

Composite ADOT Basin Capacity

Design Storm (Yr-Duration)	Q_{in} Peak (cfs)	Q_{out} Peak (cfs)	Peak[1,10] Stage (ft)	Max.[2] Ponding Elevation (ft)	Peak Storage (ac-ft)	Max. Storage (ac-ft)	Modeled Condition	Data Source (Design Report)
100-24	3252	73	978.7 - 984.9	986	605.6	1033.3	Completely Undeveloped	ADOT Basin Analysis, URS, 10/01
100-24	2857	80	978.9 - 987.7	986	726.2	1033.3	[11]Existing Condition	ADOT Basin Analysis, URS, 10/01
100-24	3938	92	979.6 - 992.9	986	1074.1	1033.3	Completely Developed with NO Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	1487	63	978.6 - 981.0	986	353.8	1033.3	Completely Developed with Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	2776	79	979.3 - 987.5	986	696.9	1033.3	Part 1A:No diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	2614	79	979.4 - 987.7	986	699.9	1033.3	Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-24	3202	81	981.9 - 988.1	986	846.5	1033.3	Part 2A:Diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	3050	81	981.7 - 988.2	986	847.8	1033.3	Part 2B:Diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-25	3080	87	979.6 - 990.9	986	913.2	1033.3	Part 3A: No ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/03
100-26	3452	88	982.4 - 991.5	986	1062.2	1033.3	Part 3B: W/ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/04
50-24	965[3]	58[4]	982.1	983.4	810[5]	1020	Existing Condition	Offsite Drainage Design Report, I-IG-10-2(37)C, Ehrenberg-Phoenix, Highway, Bullard-Dysart Road, Dibble and Associates, January, 1976.
100-24	1,861	67	979.3 - 982.8	Varies[8,9]	514.2	1541.6	Existing Condition	White Tanks/Agua Fria Area Drainage Master Study, Part A: Flood Study Technical Data Notebook, By: The WLB Group, Inc., October 1992
100-24	2,100[6]/3,600[7]	62[6]/67[7]	981[6]/982.5[7]	988	510[6]/650[7]	1350.0	Existing/Developed	Palm Valley Phase I, Golf Course LOMR, RID Canal Overchute to ADOT Detention Basins, by The WLB Group, 2/298.
100-24	4,303	99	979.7	984	416.0	725.0	Existing Condition	I-10/Litchfield Road Basins, Final Hydrology Study, by Parsons Brinckerhoff, 7/23/99.
100-24	2,797	77	978.8 - 986.8	986	700.6	1125.7	Existing Condition	URS Draft Existing Condition Hydrology, 6/29/01.

1. May not include freeboard.
2. Overflow elevation. Freeboard is equal to peak stage minus max. ponding elevation.
3. Sum of discharges 1-3 from Hydrologic Design Data Sheets, SCS Method, 50-year, 24-hour event.
4. From stage-storage-discharge curve for Alternate 3, 48" pipe.
5 From stage-storage-discharge curve for Alternate 3, 48" pipe.
6. Existing discharge.
7. Post development discharge.
8. See Flood Study Technical Data Notebook for the White Tanks/Agua Fria ADMS, Appendix I, Vol. 10 of 15 by WLB, dated 5/28/92.
9. Max. ponding elevations are: Basin A = 988.8'; Basin B = 987.3'; Basin C = 988.6'; Basin D = 990.5'.
10. WLB and URS values represent the range from lowest to highest WSEL computed within the 4 basins - these models look at each basin individually.
11. Note:The Peak Storage for the "ADOT Basin Analysis" Existing Condition is larger than that shown for the Draft Existing Hydrology. This is due to increased RTIMP variables verified by recent field trips.

Tab

Capacity/Inflow to ADOT Basin 'A'

Design Storm (Yr-Duration)	Q_{in} Peak (cfs)	Q_{out} Peak (cfs)	Peak[1] Stage (ft)	Max.[2] Ponding Elevation (ft)	Peak Storage (ac-ft)	Max. Storage (ac-ft)	Modeled Condition	Data Source (Design Report)
100-24	277	23	978.7	986	23.9	265.17	Completely Undeveloped	ADOT Basin Analysis, URS, 10/01
100-24	295	28	978.9	986	27.9	265.17	[9]Existing Condition	ADOT Basin Analysis, URS, 10/01
100-24	361	46	979.6	986	44.9	265.17	Completely Developed with NO Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	297	38	979.3	986	37.9	265.17	Completely Developed with Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	297	36	979.3	986	37.9	265.17	Part 1A:No diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	297	38	979.4	986	39.9	265.17	Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-24	723	55	983.3	986	167.0	265.17	Part 2A:Diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	733	55	983.3	986	169.0	265.17	Part 2B:Diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-25	0	44	979.6	986	44.9	265.17	Part 3A: No ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/03
100-26	0	55	983.5	986	174.1	265.17	Part 3B: W/ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/04
50-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	Offsite Drainage Design Report, I-IG-10-2(37)C, Ehrenberg-Phoenix, Highway, Bullard-Dysart Road, Dibble and Associates, January, 1976.
100-24	618	55	981.18	988.8	106.5	423.01	Existing Condition	WLB[8]
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing/Developed	PV
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	PB
100-24	245	23	978.75	986	25.9	265.17	Existing Condition	URS Draft Existing Condition Hydrology, 6/29/01.

1. Does not include freeboard.
2. Overflow elevation. Freeboard is equal to peak stage minus max. ponding elevation.
3. Sum of discharges 1-3 from Hydrologic Design Data Sheets, SCS Method, 50-year, 24-hour event.
4. From stage-storage-discharge curve for Alternate 3, 48" pipe.
5 From stage-storage-discharge curve for Alternate 3, 48" pipe.
6. Existing discharge.
7. Post development discharge.
8. See Flood Study Technical Data Notebook for the White Tanks/Agua Fria ADMS, Appendix I, Vol. 10 of 15 by WLB, dated 5/28/92.
9. Note:The Peak Storage for the "ADOT Basin Analysis" Existing Condition is larger than that shown for the Draft Existing Hydrology. This is due to increased RTIMP variables verified by recent field trips.

Ta

Capacity/Inflow
to
ADOT Basin 'B'

Design Storm (Yr-Duration)	Q_{in} Peak (cfs)	Q_{out} Peak (cfs)	Peak[1] Stage (ft)	Max.[2] Ponding Elevation (ft)	Peak Storage (ac-ft)	Max. Storage (ac-ft)	Modeled Condition	Data Source (Design Report)
100-24	1176	357	982.9	986.0	68.86	108.98	Completely Undeveloped	ADOT Basin Analysis, URS, 10/01
100-24	687	270	982.0	986.0	57	108.98	[9]Existing Condition	ADOT Basin Analysis, URS, 10/01
100-24	1330	581	985.1	986.0	97.58	108.98	Completely Developed with NO Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	370	114	980.5	986.0	39.58	108.98	Completely Developed with Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	703	247	981.9	986.0	55.7	108.98	Part 1A:No diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	576	231	981.7	986.0	53.7	108.98	Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-24	703	247	981.9	986.0	55.7	108.98	Part 2A:Diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	576	231	981.7	986.0	53.7	108.98	Part 2B:Diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-25	576	301	982.4	986.0	62	108.98	Part 3A: No ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/03
100-26	576	301	982.4	986.0	62	108.98	Part 3B: W/ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/04
50-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	Offsite Drainage Design Report, I-IG-10-2(37)C, Ehrenberg-Phoenix, Highway, Bullard-Dysart Road, Dibble and Associates, January, 1976.
100-24	212	65	980.06	987.3	39	132.52	Existing Condition	WLB[8]
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing/Developed	PV
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	PB
100-24	692	252	981.9	986	56	108.98	Existing Condition	URS Draft Existing Condition Hydrology, 6/29/01.

1. Does not include freeboard.
2. Overflow elevation. Freeboard is equal to peak stage minus max. ponding elevation.
3. Sum of discharges 1-3 from Hydrologic Design Data Sheets, SCS Method, 50-year, 24-hour event.
4. From stage-storage-discharge curve for Alternate 3, 48" pipe.
5 From stage-storage-discharge curve for Alternate 3, 48" pipe.
6. Existing discharge.
7. Post development discharge.
8. See Flood Study Technical Data Notebook for the White Tanks/Agua Fria ADMS, Appendix I, Vol. 10 of 15 by WLB, dated 5/28/92.
9. Note:The Peak Storage for the "ADOT Basin Analysis" Existing Condition is larger than that shown for the Draft Existing Hydrology. This is due to increased RTIMP variables verified by recent field trips.

Ta

Capacity/Inflow
to
ADOT Basin 'C'

Design Storm (Yr-Duration)	Q_{in} Peak (cfs)	Q_{out} Peak (cfs)	Peak[1] Stage (ft)	Max.[2] Ponding Elevation (ft)	Peak Storage (ac-ft)	Max. Storage (ac-ft)	Modeled Condition	Data Source (Design Report)
100-24	1339	460	982.7	986	211.7	324.54	Completely Undeveloped	ADOT Basin Analysis, URS, 10/01
100-24	1415	460	983.9	986	254.9	324.54	[9]Existing Condition	ADOT Basin Analysis, URS, 10/01
100-24	1765	460	987.3	986	373.6	324.54	Completely Developed with NO Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	536	297	978.6	986	87.5	324.54	Completely Developed with Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	1304	460	982.9	986	219.7	324.54	Part 1A:No diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	1269	460	982.8	986	218.2	324.54	Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-24	1304	460	982.9	986	220.4	324.54	Part 2A:Diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	1269	460	982.9	986	218.2	324.54	Part 2B:Diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-25	1269	460	986.0	986	313.7	324.54	Part 3A: No ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/03
100-26	1269	460	985.7	986	314.7	324.54	Part 3B: W/ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/04
50-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	Offsite Drainage Design Report, I-IG-10-2(37)C, Ehrenberg-Phoenix, Highway, Bullard-Dysart Road, Dibble and Associates, January, 1976.
100-24	649	376	979.28	988.6	122.6	453.25	Existing Condition	WLB[8]
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing/Developed	PV
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	PB
100-24	1400	460	983.43	986	237.7	324.54	Existing Condition	URS Draft Existing Condition Hydrology, 6/29/01.

1. Does not include freeboard.
2. Overflow elevation. Freeboard is equal to peak stage minus max. ponding elevation.
3. Sum of discharges 1-3 from Hydrologic Design Data Sheets, SCS Method, 50-year, 24-hour event.
4. From stage-storage-discharge curve for Alternate 3, 48" pipe.
5 From stage-storage-discharge curve for Alternate 3, 48" pipe.
6. Existing discharge.
7. Post development discharge.
8. See Flood Study Technical Data Notebook for the White Tanks/Agua Fria ADMS, Appendix I, Vol. 10 of 15 by WLB, dated 5/28/92.
9. Note:The Peak Storage for the "ADOT Basin Analysis" Existing Condition is larger than that shown for the Draft Existing Hydrology. This is due to increased RTIMP variables verified by recent field trips.

Ta'

Capacity/Inflow to ADOT Basin 'D'

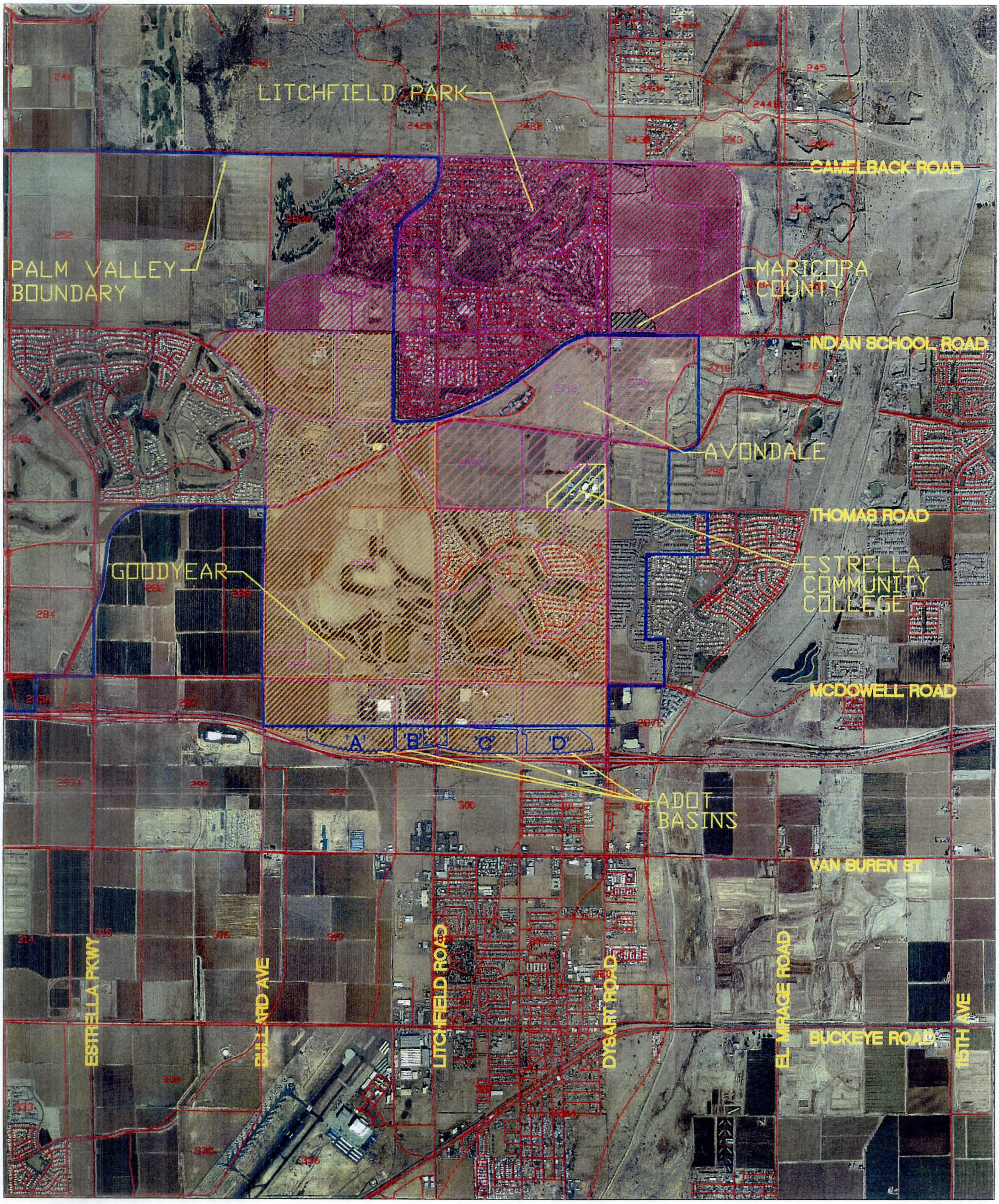
Design Storm (Yr-Duration)	Q_{in} Peak (cfs)	Q_{out} Peak (cfs)	Peak[1] Stage (ft)	Max.[2] Ponding Elevation (ft)	Peak Storage (ac-ft)	Max. Storage (ac-ft)	Modeled Condition	Data Source (Design Report)
100-24	460	73	984.9	986	301.2	334.65	Completely Undeveloped	ADOT Basin Analysis, URS, 10/01
100-24	460	80	987.6	986	386.4	334.65	[9]Existing Condition	ADOT Basin Analysis, URS, 10/01
100-24	482	92	992.9	986	558.1	334.65	Completely Developed with NO Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	284	63	981.0	986	188.8	334.65	Completely Developed with Onsite Retention on All Sub Basins	ADOT Basin Analysis, URS, 10/01
100-24	472	79	987.5	986	383.6	334.65	Part 1A:No diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	472	79	987.7	986	388.1	334.65	Part 1B:No diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
100-24	472	81	988.1	986	403.4	334.65	Part 2A:Diverts from ADMP, Future Onsite Retention Provided	ADOT Basin Analysis, URS, 2/02
100-24	472	81	988.2	986	406.9	334.65	Part 2B:Diverts from ADMP, Post developed Q's </equal to existing	ADOT Basin Analysis, URS, 2/02
not include fre	472	87	990.9	986	492.6	334.65	Part 3A: No ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/03
equal to peak	472	88	991.5	986	511.4	334.65	Part 3B: W/ADMP, Dev. W/O Future Retention	ADOT Basin Analysis, URS, 2/04
50-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	Offsite Drainage Design Report, I-IG-10-2(37)C, Ehrenberg-Phoenix, Highway, Bullard-Dysart Road, Dibble and Associates, January, 1976.
100-24	382	67	982.8	990.5	246.1	532.82	Existing Condition	WLB[8]
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing/Developed	PV
100-24	n/a	n/a	n/a	n/a	n/a	n/a	Existing Condition	PB
100-24	460	77	986.8	986	381	334.65	Existing Condition	URS Draft Existing Condition Hydrology, 6/29/01.

1. Does not include freeboard.
2. Overflow elevation. Freeboard is equal to peak stage minus max. ponding elevation.
3. Sum of discharges 1-3 from Hydrologic Design Data Sheets, SCS Method, 50-year, 24-hour event.
4. From stage-storage-discharge curve for Alternate 3, 48" pipe.
5 From stage-storage-discharge curve for Alternate 3, 48" pipe.
6. Existing discharge.
7. Post development discharge.
8. See Flood Study Technical Data Notebook for the White Tanks/Agua Fria ADMS, Appendix I, Vol. 10 of 15 by WLB, dated 5/28/92.
9. Note:The Peak Storage for the "ADOT Basin Analysis" Existing Condition is larger than that shown for the Draft Existing Hydrology. This is due to increased RTIMP variables verified by recent field trips.

Table 1.8

Modeled Condition Comparison	Total Inflow Volume (ac-ft)	Δ (delta) (ac-ft)	Comments
Part 1A:No diverts from ADMP, Future Onsite Retention Provided	651	*156*	Increased inflow volume at ADOT Basins due to the ADMP
Part 2A:Diverts from ADMP, Future Onsite Retention Provided	807		
Part 3A: No ADMP, Dev. W/O Future Retention	780	*156*	Diversion to ADOT Basin with ADMP
Part 3B: W/ADMP, Dev. W/O Future Retention	936		
Fully Developed - Onsite Retention All Sub Basins	365	*276*	Decreased volume due to enforcement of retention requirements to date
Existing Conditions	641		
Completely Undeveloped	476	*165*	Benefit to date to development - volume increase from adjacent properties and sub basins to ADOT Basins
Existing Conditions	641		
Part 3A: No ADMP, Dev. W/O Future Retention	780	*139*	Increase in volume associated with the future condition assuming no future retention and no ADMP
Existing Conditions	641		
Part 3A: No ADMP, Dev. W/O Future Retention	780	*415*	Approximate total increase in volume due to non-enforcement of retention requirements at ultimate build-out
Fully Developed - Onsite Retention All Sub Basins	365		
Part 3B: W/ADMP, Dev. W/O Future Retention	936	*295*	Total additional ADMP volume from today
Existing Conditions	641		
Part 3B: W/ADMP, Dev. W/O Future Retention	936	*94*	Minimum excess volume of ADOT Basin - ADMP diversion to basins, no on-site retention in watershed for future development
Existing Volume Provided	1030		

1. Maximum ponding elevation before overtopping is 986'.



LEGEND:

- AVONDALE
- GOODYEAR
- LITCHFIELD PARK
- MARICOPA COUNTY
- ESTRELLA COMMUNITY COLLEGE
- PALM VALLEY

N

MARICOPA COUNTY
N.T.S.

CONTRIBUTING WATERSHED TO ADOT BASINS

February 2002

ADOT Basins/Contributing Watershed Analysis

FIGURE 1.1

Flood Control District of Maricopa County

URS

Composite ADOT Basin Total Inflow Volume

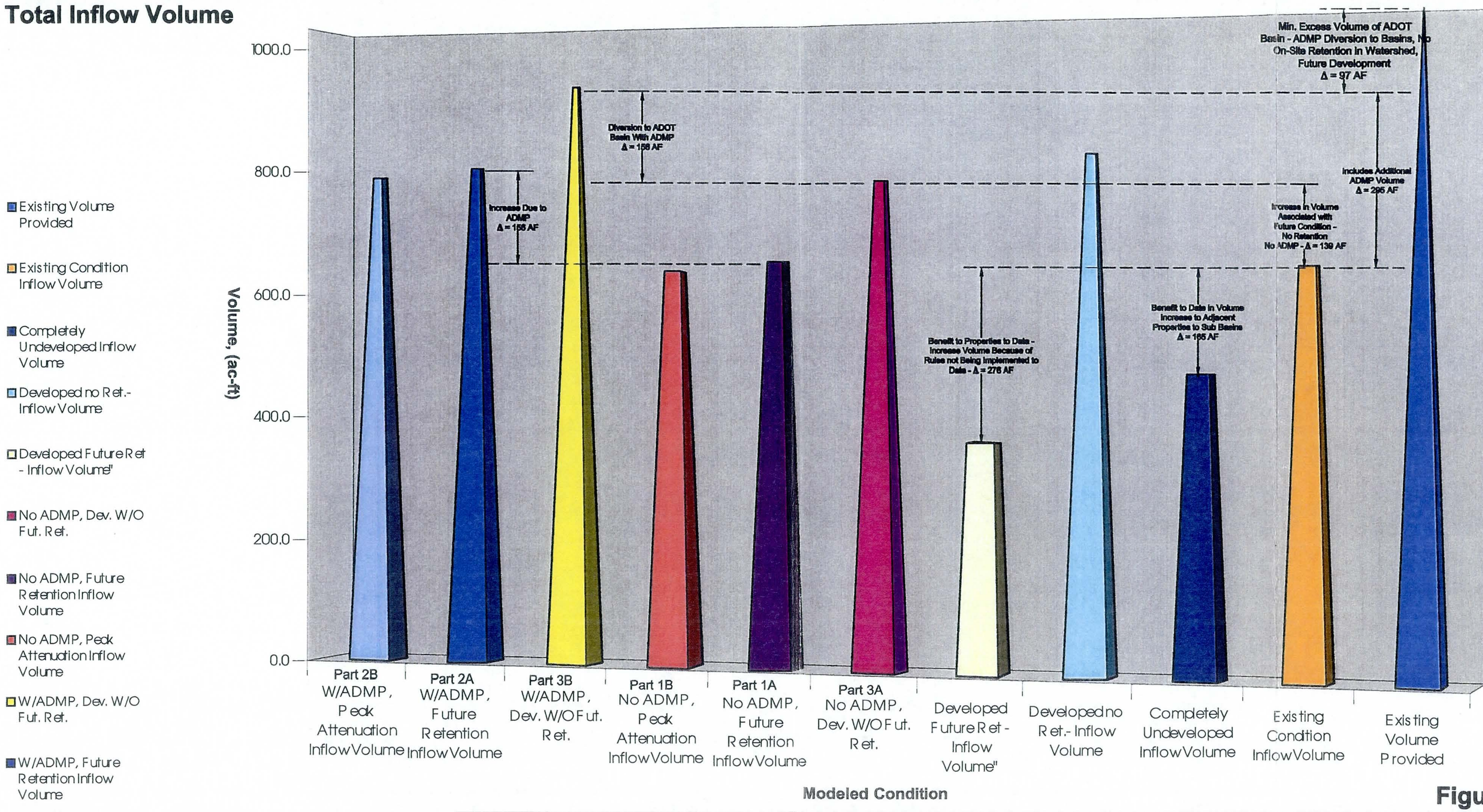


Figure 1.2

	Composite
Existing Volume Provided	1033.3
Existing Condition Inflow Volume	641
Completely Undeveloped Inflow Volume	476
Developed no Ret.- Inflow Volume	818
Developed Future Ret - Inflow Volume"	365
No ADMP, Dev. W/O Fut. Ret.	780
No ADMP, Future Retention Inflow Volume	651
No ADMP, Peak Attenuation Inflow Volume	636
W/ADMP, Dev. W/O Fut. Ret.	936
W/ADMP, Future Retention Inflow Volume	807
W/ADMP, Peak Attenuation Inflow Volume	792

APPENDIX D

NAOS/RETENTION WAIVER ANALYSIS AND RESULTS

Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40

NAOS, FIRST FLUSH & RETENTION WAIVER ANALYSIS

Prepared for:

Flood Control District of Maricopa County

June 2002

Prepared by:

URS

Table of Contents

NAOS, FIRST FLUSH & RETENTION WAIVER ANALYSIS RESULTS

1.0 Introduction

The Flood Control District of Maricopa County (FCDMC) has requested that URS consider the physical and economic impacts to the project if onsite retention criteria for future development is waived and developers were to contribute funds to increasing the capacity of the backbone flood control project proposed by the Loop 303 ADMP Update. The analysis is to be conducted within a typical sub-basin located within a typical watershed contributing to a proposed segment of the backbone flood control project. The analysis will assume both first flush and landscape/open space requirements are still the responsibility of the developer.

The analysis will be helpful in evaluating the potential for land savings to the developer due to waived onsite retention requirements. In addition, the analysis will estimate the size/cost for a modified flood control channel and/or basin based on waiving onsite retention requirements to upstream developers and compare that with an estimate of the size/cost for a flood control channel and/or basin based on enforcement of onsite retention requirements.

The information gained from the results of the above analysis will be used to determine the feasibility of the FCDMC gaining project partners from the development community by relaxing or waiving onsite retention requirements for development within the ADMP Update project area.

2.0 Analysis

The analysis consisted of following tasks, which are generally described by the scope of work. These tasks are summarized below:

- Data Collection – All available information regarding natural area open space (NAOS) and onsite retention requirements specific to the relevant cities within the L303 ADMP Update project area (Surprise, El Mirage, Goodyear, Buckeye, Avondale, Litchfield Park as well as Unincorporated Maricopa County) was collected. Most of this information was found within sub division and zoning ordinances, however, some of it was gained verbally when individual documents did not specifically address topics. Table 2.1 shows the results of this task.
- Selection of a 'Typical' Watershed - Two initial locations within the approximately 220 square mile L303 ADMP Update watershed area were identified as 'typical' by URS. One of these areas was then selected for detailed study. The two initial areas identified were characterized by contributing watersheds of at least 4 square miles and had a difference in peak flow rates of at least 25% between existing and future hydrologic conditions. Further, the areas selected were close to 100% developed in the future condition. Table 2.2 on the following page contains the list of concentration points along the proposed FCDMC flood control system under the L303 ADMP Update project. At each concentration point, the peak discharge for

Table 2.1

Check Onsite Retention, First Flush and NAOS Requirements for Development

City	NAOS	Min. Open Space	Secondary Req.	Onsite Retention Req.	ID #1 (!RM4) Dev. Area A_{dev}	ID #2 (!LP2) Dev. Area A_{dev}	ID #1 (!RM4) [1]First Flush Volume (ac-ft)	ID #1 (!RM4) [2]First Flush Footprint (ac)	ID #2 (!LP2) [1]First Flush Volume (ac-ft)	ID #2 (!LP2) [2]First Flush Footprint (ac)	ID #1 (!RM4) NAOS Footprint A_{NAOS}	ID #2 (!LP2) NAOS Footprint A_{NAOS}
Avondale	5%	5000 square ft.	2 acres/100 homes	100/2 year/hr.	****	****	****	****	****	****	****	****
Buckeye	**	N/A	N/A	100/2 year/hr.	****	****	****	****	****	****	****	****
El Mirage	7%	N/A	N/A	100/2 year/hr.	****	****	****	****	****	****	****	****
Goodyear	*	N/A	N/A	100/6 year/hr.	****	****	****	****	****	****	****	****
Litchfield Park	Varies	N/A	N/A	100/2 year/hr.	****	****	****	****	****	****	****	****
Surprise	*7%*	*N/A*	*N/A*	*100/2 year/hr.*	*5568 AC*	*8192 AC*	*232*	***79***	*341*	***116***	***370 AC***	***545 AC***
Maricopa	***	***	***	100/2 year/hr.	****	****	****	****	****	****	****	****

"Typical" adjacent road area: 5% of sub basin area

*Avg. Lot Size	NAOS
5,000-7,000 sq. ft.	15%
7,001-10,001 sq. ft.	12%
10,001-15,001 sq. ft.	10%
15,001+ sq. ft.	no minimum

** Area	NAOS
Residential	15%
Commercial	10%
Industrial	5%

*** No definitive information was found regarding required open spaces in developments. The following documents were consulted, "Article I for the Unincorporated Area of Maricopa County, Arizona", "Eye to the Future 2020 Update Opon Space - Draft", "Report to the Planning and Zoning Commision". These documents were obtained from the Planning and Developments Web Site for Maricopa County.

**** Not applicable to this city or jurisdiction. These calculations were only performed for the two 'Typical Watersheds', ID#1 and ID#2 respectively which lie within the City of Surprise.

1. Must retain V = CPA, where C = 1, P = 0.5 in, A = Total Area.
2. Assume 3' depth, 1' free board and 4:1 side slopes for first flush basin.

Table 2.2

Loop 303 ADMP Update

Existing and Future Discharge Comparison

Level III Preferred Alternative

Concentration Pt.	Existing (cfs)	Future (cfs)	Comments
!ADOTD	694	370	Due to future onsite retention on the 46.4 sm area, discharge was reduced by 47%
!BC1	313	314	Upstream area (0.3 sm) will remain relatively undeveloped in the future
!BC2	2830	2866	Upstream area (4.9) will remain relatively undeveloped in the future
!BC3	6489	6216	Due to future onsite retention on the 10.9 sm area, discharge was reduced by 4%
!BC4	6735	6363	Due to future onsite retention on the 12.3 sm area, discharge was reduced by 6%
!BC5	6671	6314	Due to future onsite retention on the 12.7 sm area, discharge was reduced by 5%
!BD1N	2103	2296	Sub basin 201 and 223 may develop further in the future without providing onsite retention - (45% of total contributing watershed area) - LAFB.
!BD1S	3530	2674	Due to future onsite retention on the 44.6 sm area, discharge was reduced by 24%
!BD2N	2979	3109	Sub basin 201 and 223 may develop further in the future without providing onsite retention - (4% of total contributing watershed area) - LAFB.
!BD2S	3553	2689	Due to future onsite retention on the 46.4 sm area, discharge was reduced by 24%
!BD3N	3284	2961	Due to future onsite retention on the 42.5 sm area, discharge was reduced by 10%
!BD3S	2166	1789	Due to future onsite retention on the 47.2 sm area, discharge was reduced by 17%
!BD4N	3226	2812	Due to future onsite retention on the 43.7 sm area, discharge was reduced by 13%
!BD4S	2393	2027	Due to future onsite retention on the 48.0 sm area, discharge was reduced by 15%
!BD5S	2407	2288	Due to future onsite retention on the 49.4 sm area, discharge was reduced by 5%
!BD6S	2412	2308	Due to future onsite retention on the 49.8 sm area, discharge was reduced by 4%
!CM1	485	307	Due to future onsite retention on the 30.1 sm area, discharge was reduced by 37%
!CM2	775	594	Due to future onsite retention on the 31.5 sm area, discharge was reduced by 23%
!CM3	920	729	Due to future onsite retention on the 31.9 sm area, discharge was reduced by 21%
!CM4	1096	1318	future development may not include onsite retention for sub basins 211, 221A, 222, and 213 (LAFB)
!JR1	953	916	Due to future onsite retention on the 0.9 sm area, discharge was reduced by 4%
!JR2	884	758	Due to future onsite retention on the 1.8 sm area, discharge was reduced by 14%
!JR3	981	626	Due to future onsite retention on the 2.3 sm area, discharge was reduced by 36%
!JR4	1302	672	Due to future onsite retention on the 3.0 sm area, discharge was reduced by 48%
!JR5	1736	915	Due to future onsite retention on the 7.7 sm area, discharge was reduced by 47%

Table 2.2

Loop 303 ADMP Update

Existing and Future Discharge Comparison

Level III Preferred Alternative

Concentration Pt.	Existing (cfs)	Future (cfs)	Comments
!LE1	683	815	Sub basin 139 exists with less retention than required for existing development, also, sub basin 140 exists with no retention and 8% RTIMP
!LE2	808	1007	Sub basin 139 exists with less retention than required for existing development, also, sub basin 140 exists with no retention and 8% RTIMP
!LE3	*1386*	*1384*	Sub basin 139 exists with less retention than required for existing development, also, sub basin 140 exists with no retention and 8% RTIMP - effect this far downstream is minimized by more contributing area providing future onsite retention in model
!LE4	1356	1387	sub basin 172, some existing development without onsite retention
!LE5	855	839	Due to future onsite retention on the 2.1 sm area, discharge was reduced by 2%
!LP1	1297	742	Due to future onsite retention on the 8.7 sm area, discharge was reduced by 43%
!LP10	673	280	Due to future onsite retention on the 5.0 sm area, discharge was reduced by 58%
!LP11	948	563	Due to future onsite retention on the 6.0 sm area, discharge was reduced by 41%
!LP12	1566	787	Due to future onsite retention on the 10.5 sm area, discharge was reduced by 50%
!LP13	695	386	Due to future onsite retention on the 11.1 sm area, discharge was reduced by 44%
!LP14	695	413	Due to future onsite retention on the 11.8 sm area, discharge was reduced by 41%
!LP15	844	469	Due to future onsite retention on the 17.3 sm area, discharge was reduced by 44%
!LP16	871	467	Due to future onsite retention on the 17.5 sm area, discharge was reduced by 46%
!LP17	598	422	Due to future onsite retention on the 18.3 sm area, discharge was reduced by 29%
!LP2	2430	1163	Due to future onsite retention on the 11.2 sm area, discharge was reduced by 52%
!LP3	2235	795	Due to future onsite retention on the 14.2 sm area, discharge was reduced by 64%
!LP4	2607	941	Due to future onsite retention on the 15.3 sm area, discharge was reduced by 64%
!LP5	2600	922	Due to future onsite retention on the 15.8 sm area, discharge was reduced by 65%
!LP6	437	350	Due to future onsite retention on the 23.6 sm area, discharge was reduced by 20%
!LP7	776	586	Due to future onsite retention on the 25.6 sm area, discharge was reduced by 24%
!LP8	1366	952	Due to future onsite retention on the 28.6 sm area, discharge was reduced by 30%
!LP9	625	252	Due to future onsite retention on the 3.0 sm area, discharge was reduced by 60%
!NR1	256	233	Due to future onsite retention on the 0.2 sm area, discharge was reduced by 9%

Table 2.2

Loop 303 ADMP Update

Existing and Future Discharge Comparison

Level III Preferred Alternative

Concentration Pt.	Existing (cfs)	Future (cfs)	Comments
!NR2	1313	701	Due to future onsite retention on the 2.12 sm area, discharge was reduced by 47%
!NR3	2281	1184	Due to future onsite retention on the 5.3 sm area, discharge was reduced by 48%
!NR4	2382	1209	Due to future onsite retention on the 5.8 sm area, discharge was reduced by 49%
!NR5	908	272	Due to future onsite retention on the 21.6 sm area, discharge was reduced by 70%
!NR6	906	457	Due to future onsite retention on the 22.5 sm area, discharge was reduced by 50%
!RI1	338	201	Due to future onsite retention on the 0.3 sm area, discharge was reduced by 41%
!RI2	473	173	Due to future onsite retention on the 0.4 sm area, discharge was reduced by 63%
!RI3	1451	1146	Due to future onsite retention on the 8.1 sm area, discharge was reduced by 21%
!RI4	1462	1076	Due to future onsite retention on the 8.2 sm area, discharge was reduced by 26%
!RI5	1741	1137	Due to future onsite retention on the 9.3 sm area, discharge was reduced by 35%
!RI6	1947	1220	Due to future onsite retention on the 10.3 sm area, discharge was reduced by 37%
!RM1	874	870	some existing upstream development provides existing onsite retention
!RM2	1008	951	Due to future onsite retention on the 10.0 sm area, discharge was reduced by 6%
!RM3	1397	934	Due to future onsite retention on the 11.4 sm area, discharge was reduced by 33%
!RM4	1690	881	Due to future onsite retention on the 15.7 sm area, discharge was reduced by 48%
!RM5	870	649	Due to future onsite retention on the 18.2 sm area, discharge was reduced by 25%
!RM6	1010	772	Due to future onsite retention on the 30.4 sm area, discharge was reduced by 24%
!RR1	425	256	Due to future onsite retention on the 6.1 sm area, discharge was reduced by 40%
!RR2	491	229	Due to future onsite retention on the 21.9 sm area, discharge was reduced by 53%
!RR3	782	316	Due to future onsite retention on the 8.6 sm area, discharge was reduced by 60%
!RR4	929	496	Due to future onsite retention on the 11.1 sm area, discharge was reduced by 47%
!RR5	1016	479	Due to future onsite retention on the 25.8 sm area, discharge was reduced by 53%
!RR6	1778	854	Due to future onsite retention on the 11.7 sm area, discharge was reduced by 52%
!RR7	1814	867	Due to future onsite retention on the 13.0 sm area, discharge was reduced by 52%
!RR8	1526	936	Due to future onsite retention on the 21.4 sm area, discharge was reduced by 39%
!TC1	1407	1247	Due to future onsite retention on the 2.9 sm area, discharge was reduced by 11%

Table 2.2

Loop 303 ADMP Update

Existing and Future Discharge Comparison

Level III Preferred Alternative

Concentration Pt.	Existing (cfs)	Future (cfs)	Comments
!TC2	2069	1457	Due to future onsite retention on the 13.3 sm area, discharge was reduced by 30%
!TC3	1932	1331	Due to future onsite retention on the 13.7 sm area, discharge was reduced by 31%
!TC4	1944	1337	Due to future onsite retention on the 14.2 sm area, discharge was reduced by 31%
!TC5	1945	1342	Due to future onsite retention on the 14.9 sm area, discharge was reduced by 31%
!TC6	1953	1343	Due to future onsite retention on the 15.1 sm area, discharge was reduced by 31%
!TC7	2569	1691	Due to future onsite retention on the 29.8 sm area, discharge was reduced by 34%
!TC8	2793	1730	Due to future onsite retention on the 30.5 sm area, discharge was reduced by 38%
!TC9	2793	1706	Due to future onsite retention on the 30.7 sm area, discharge was reduced by 39%

both the existing and future condition hydrology models are shown. This information was used in the completion of this task (see Figure 2.1 in the appendix).

- Preparation of a hand drawn schematics – These schematics were drawn to illustrate the location and contributing area associated with the two 'typical' watersheds selected in the preceding task (see Figure(s) 2.2A and 2.2B in the appendix). The selected areas drain to concentration points 'LP2' and 'RM4' respectively.
- Selection of a 'Typical' Watershed – URS met with the FCDMC for concurrence with the initial identification of two 'typical' watersheds. FCDMC agreed with the initial choices for the 'typical' watersheds made by URS. At the meeting URS and FCDMC agreed to proceed with the analysis using the area draining to 'LP2' as the 'typical' watershed.
- Selection of an individual sub basin - Within this identified 'typical' watershed area, Sub Basin 119 was selected for the detailed analysis. The sub basin was selected based on the following characteristics:
    - This sub basin is not influenced by offsite drainage.
    - This sub basin is currently undeveloped but will be approximately 100% developed in the future.
    - The sub basin is located approximately 1.5 miles from the proposed FCDMC Loop 303 channel and approximately 3.5 miles from the proposed FCDMC Cactus detention basin. These distances are long enough to show the potential costs to the developer in conveying their discharges to the FCDMC channel while close enough to have a real impact to the FCDMC facilities.
- Determination of First Flush and NAOS – These requirements were determined for Sub Basin 119 based on its location within the City of Surprise and the applicable requirements (see Table 2.3). The required NAOS for a development is based on taking 7% of the gross development area. Per the City of Surprise Municipal Code Title 16 Subdivision manual. This includes all interior roadways associated with the developed area per conversations with city staff, (LaTonya Finch, Project Expeditor). Additionally, NAOS can be used for onsite retention areas per the City of Surprise Preliminary Plat Process Guide, page 2 of 5 item #4. The use of NAOS with onsite retention was verified with City of Surprise staff, (LaTonya Fincha, Project Expeditor). Requirements for first flush were estimated using a ½ inch of runoff over the entire area as a basis for a volume estimate. The first flush basin was assumed to be 3 feet deep with 4:1 side slopes and a foot of freeboard. The basin was allowed to be coincident with NAOS as well as the onsite retention requirements.
- Development of Two Hydrologic Models – Two hydrologic models were prepared as part of the analysis.
    - The first model assumes that Sub Basin 119 is fully developed and provides onsite retention per the City of Surprise requirements. The model is referred to as 'developed with retention' (DWR). The onsite retention requirement was based on 100% of the total volume estimated to runoff the developed Sub Basin 119. This runoff volume was estimated using HEC-1 to model a 100-year, 2-hour storm event. The model was run assuming an increased impervious condition due to development within Sub Basin 119. A volume divert was then included for Sub Basin 119 with the 100-year, 24-hour HEC-1 model and run. A footprint

Table 2.3

NAOS vs. First Flush and On-Site Retention Requirements for Development

Sub Basin 119

Basin Perimeter Access/Landscaping
10 ft *Landscape/access easement on 3 sides
15 ft *Vehicle access on 1 side

City	NAOS	Min. Open Space	Secondary Req.	Onsite Retention Req.	Sub Basin 119 [1]First Flush Volume (ac-ft)	Sub Basin 119 [2]First Flush Footprint (ac)	Sub Basin 119 Dev. Area A_{dev}	Sub Basin 119 NAOS Footprint A_{NAOS}	Sub Basin 119 Onsite Retention (ac-ft)	Sub Basin 119 Retention Footprint (ac)	Sub Basin Access Easement (ac)	Total Footprint Sub Basin 119 (ac)
Surprise	*7%*	*N/A*	*N/A*	*100/2 year/hr.*	*23*	***8***	*550 AC*	***37 AC***	*82*	***28.3***	***1.4***	***29.7***
						(598 sf)		(1263 sf)		(1110 sf)		

"Typical" adjacent road area: 5% of sub basin area

Total Land Required to Handle First Flush and Retention: 30 AC (1140' by 1135')

*Avg. Lot Size	NAOS
5,000-7,000 sq. ft.	15%
7,001-10,001 sq. ft.	12%
10,001-15,001 sq. ft.	10%
15,001+ sq. ft.	no minimum

** Area	NAOS
Residential	15%
Commercial	10%
Industrial	5%

1. Must retain V = CPA, where C = 1, P = 0.5 in, A = Total Area.
2. Assume 3' depth, 1' FB and 4:1 side slopes for first flush basin.

area for the onsite retention basin was based on the City of Surprise requirements of 4:1 side slopes, 3-foot ponding depth, 1 foot of freeboard and the retention of 100% of the 100-year, 2-hour runoff volume for the development (see Table 2.3). Using the discharges resulting from this model, the proposed FCDMC channel & basin along Loop 303 from Greenway Road to Cactus was sized. Note that the footprint area for the onsite retention basin required by the developer for sub basin 119 was based on 100% of the runoff volume generated by the 100-year, 2-hour storm while the volume calculated for storage in the proposed regional basin located at Cactus and Loop 303 was based on 80% efficiency of the onsite retention provided within sub basin 119 by development.

  - The second model assumes that Sub Basin 119 is fully developed and has been given a waiver for onsite retention requirements. This model is referred to as 'developed with no retention' (DNR). The resultant discharges were used to size a channel along Greenway from Sub Basin 119 east to the Loop 303 channel & basin from Greenway to Cactus. The Loop 303 channel & basin from Greenway Road south to the proposed basin at Cactus were re-sized based on the increased flow due to the waived onsite retention on Sub Basin 119 – other than the first flush.

3.0 Results

The results of the analysis were used to generate a cost estimate for the following:

- Sub Basin 119 Developed with Onsite Retention (DWR)
  - The cost to FCDMC associated with the construction of the proposed channel along Loop 303 from Greenway Road south to Cactus Road
  - The cost to FCDMC associated with the proposed detention basin at Loop 303 and Cactus Road
- Sub Basin 119 Developed with No Onsite Retention (DNR)
  - The cost to the developer for the channel along Greenway Road to convey discharge from Sub Basin 119 east to the Loop 303 channel & basin system
  - The cost to FCDMC associated with the construction of the proposed channel along Loop 303 from Greenway Road south to Cactus Road
  - The cost to FCDMC associated with the proposed detention basin at Loop 303 and Cactus Road

The quantities were calculated using the following set of simplifying assumptions:

- Channel excavation was based on an average end area method where the area of the channel section (including required freeboard) was assumed to be in cut – no fill.
- Basin excavation was based on the total volume provided including freeboard. The entire basin was assumed to be in cut – no fill.
- The landscape costs estimated under the pre-value engineering (VE) Level III Preferred Alternative were extremely high. As a result, only hydro-seed quantities have been included within this estimate. Any landscape added beyond this base

treatment is considered non-essential to the basic function of the facility and not necessarily a required cost.

- Culvert quantities were based on the 72" RCP used with the Level III portion of the Loop 303 ADMP Update project. The Dodson Hydrocalc Hydraulics program for estimating culvert capacity was used with the design discharges to determine the appropriate number of culvert barrels required at each major roadway crossing. The Dodson program is based on the FHWA nomographs.
  - The number of barrels required at each crossing was used to determine the quantity of steel and concrete required in the inlet and outlet headwalls at each structure. These quantities were computed using the ADOT B-Standards.
- Drop structure quantities for grouted rip-rap were based on the average jump length and height computed for all of the drop structures evaluated for the preferred alternative analyzed during the pre-VE Loop 303 ADMP Update project.
- The right of way estimates were based on the computed channel top widths and reach lengths as well as the basin footprint area required at Cactus Road. The estimates include area for future access/maintenance roads adjacent to the proposed facilities.
- The hydro seed quantity was assumed equal to the right of way quantity computed above.
- Fill quantity was assumed to be negligible.

The unit costs used for the preferred alternative analysis under the Level III portion of the Loop 303 AMDP Update project were used with this analysis for consistency. Table 3.1 shows a summary of the total estimated cost required to construct the channel along Greenway and the Loop 303 channel & basin to Cactus Road for the DNR scenario. Table 3.2 shows the estimated cost to the developer to construct a channel along Greenway Road to convey storm water runoff from Sub Basin 119 to the proposed Loop 303 channel & basin system for the DNR scenario. Table 3.3 shows the estimated cost to the FCDMC to construct the portion of the proposed Loop 303 ADMP Update channel & basin from Greenway Road to Cactus Road for the DNR scenario. Finally, Table 3.4 shows the estimated cost to the FCDMC to construct the portion of the proposed Loop 303 ADMP Update channel & basin from Greenway Road to Cactus Road for the DWR scenario. A cost for the channel along Greenway Road for the DWR scenario was not estimated. It was assumed that the system to convey runoff greater than the regional retention is a sunk cost to the developer.

None of the cost estimates includes a contingency since the costs are relative and for comparison purposes only.

In addition to the cost estimate, the analysis showed that the developer of Sub Basin 119 would save approximately 1 acre of land as a result of waived onsite retention requirements (see Table 3.5). This number is fairly low since the NAOS area can be used for onsite retention and is approximately equal to the area required for onsite retention.

The increased cost of construction for the portion of the proposed Loop 303 channel & basin from Greenway Road to Cactus Road is approximately $1 Million. Therefore a factor calculated

Table

Loop 303 ADMP Update Proposed Channel Quantities

Sub Basin 119 Developed Without Retention Onsite

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
Greenway Channel and Loop 303 Channel	Channel Excavation	C.Y.	$3.25	224,890	$730,893
	Detention Basin Excavation	C.Y.	$5.00	585,640	$2,928,200
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	7	$910
	ROW	ACRE	$40,000.00	107	$4,290,543
	Hydroseed & Topsoil	ACRE	$2,500.00	107	$268,159
	9 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$447,610.10	2	$895,220
	14 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$693,057.60	1	$693,058
	19 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$938,505.10	1	$938,505
	8 Barrel 110' Long, 72" DIAM. RCP Culvert	EA.	$342,520.60	1	$342,521
				Σ =	**$11,088,008**

Table 3

Loop 303 ADMP Update Proposed Channel Quantities

Sub Basin 119 Developed Without Retention Onsite

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
Greenway Channel		Channel Excavation	C.Y.	$3.25	79,386	$258,006
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	4	$520
		ROW	ACRE	$40,000.00	32	$1,297,602
		Hydroseed & Topsoil	ACRE	$2,500.00	32	$81,100
	9	Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$447,610.10	2	$895,220
	14	Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$693,057.60	0	$0
	19	Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$938,505.10	0	$0
	8	Barrel 110' Long, 72" DIAM. RCP Culvert	EA.	$342,520.60	1	$342,521
					$\Sigma =$	**$2,874,969**

1. Represents an average cost from the Level III Pre-VE alternative analysis.

Table [illegible]

Loop 303 ADMP Update Proposed Channel Quantities

Sub Basin 119 Developed Without Retention Onsite

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
L303 Channel	Channel Excavation	C.Y.	$3.25	145,504	$472,887
	Detention Basin Excavation	C.Y.	$5.00	585,640	$2,928,200
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	3	$390
	ROW	ACRE	$40,000.00	75	$2,992,941
	Hydroseed & Topsoil	ACRE	$2,500.00	75	$187,059
	9 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$447,610.10	0	$0
	14 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$693,057.60	1	$693,058
	19 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$938,505.10	1	$938,505
	8 Barrel 110' Long, 72" DIAM. RCP Culvert	EA.	$342,520.60	0	$0
				$\Sigma =$	**$8,213,040**

1. Represents an average cost from the Level III Pre-VE alternative analysis.

Table [illegible]

Loop 303 ADMP Update Proposed Channel Quantities

Sub Basin 119 Developed With Retention

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
L303 Channel	Channel Excavation	C.Y.	$3.25	115,811	$376,385
	Detention Basin Excavation	C.Y.	$5.00	492,067	$2,460,333
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	3	$390
	ROW	ACRE	$40,000.00	68	$2,723,358
	Hydroseed & Topsoil	ACRE	$2,500.00	68	$170,210
	13 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$643,968.10	1	$643,968
	26 Barrel 130' Long, 72" DIAM. RCP Culvert	EA.	$1,282,131.60	1	$1,282,132
				$\Sigma =$	**$7,656,776**

1. Represents an average cost from the Level III Pre-VE alternative analysis.

NAOS-Cost-DWR-062402.xls
7/1/2002

Table

Change in Available Area for Home Construction for Sub Basin 119

[1]Scenario	First Flush (AC)	NAOS (AC)	Onsite Retention (AC)	[2]Total Footprint (AC)	[3]Δ (AC)
DNR	8.2	36.6	0.0	36.6	
DWR	8.2	36.6	29.7	36.6	0.0

1. Scenario 'DNR' is for developed Sub Basin 119 with no onsite retention.Scenraio 'DWR' is for the developed Sub Basin 119 with onsite retention.
2. This is the total area that the developer must set aside for retention, first flush and NAOS.
3. This is the amount of additional land that the developer may use for home building due to the waiver of onsite retention requirements.

as the incremental cost for flood control per acre of increased developable land is approximately $1 Million per acre.

4.0 Conclusions

The example sub division (sub basin 119) land savings were zero since the Natural Area Open Space would be designed to accommodate the area of volume requirement for post development retention. Therefore, there are no real land savings to the developer and hence no real benefit in terms of land savings due to waived retention requirements.

This conclusion is contingent upon circumstances in which a development may be required to use portions of the developable area for NAOS requirements for other than storm water/flood control. For example, non-storm water NAOS areas may be restricted at specific locations within the development based on slopes, native vegetation, and safety throughout the development. In this case, some or all of these locations may not be applicable for retention. This could occur when either the strip areas cannot accommodate required basin geometry and/or when the areas are located upstream rather than at the downstream portion of the development. Under these assumptions, the developer may only be able to provide some of their onsite retention requirement as coincident with NAOS requirements. No such regulations were noted within the documentation provided to URS from the City of Surprise or during phone conversations with the City of Surprise staff (LaTonya Finch, Project Expeditor).

Even if an assumption were made that up to 20% of the total retention requirement (about 5.96 acres) could not physically be met within the designated NAOS areas, the benefit to the developer for waived onsite retention requirements would likely be inadequate when weighed against the approximately $2.9 Million construction cost to build a conveyance channel from Sub Basin 119 to the Loop 303 channel & basin system. It is important to remember that although the City of Surprise does not seem to impose the restrictions on NAOS areas mentioned above that would make a portion of it infeasible as coincident with onsite retention requirements, other jurisdictions may. The way in which NAOS is designated varies greatly from jurisdiction to jurisdiction and may even be subjective based on the location of the development within the jurisdiction itself. The above analysis is a very simplistic one and may or may not yield the same result within another jurisdiction.

The benefit to the FCDMC can only be realized if funds contributed by the developer were to exceed the additional cost to the FCDMC for the required increase in size to the proposed flood control facilities. The additional cost to the FCDMC for waiving onsite retention requirements is approximately $560,000 for enlarged channels and basins. This means that the total increase in the overall cost for the project due to waiving onsite retention requirements on sub basin 119 is about 7.3%. FCDMC will be required to get at least this amount plus some additional funds from the developer(s) to make such and arrangement feasible.

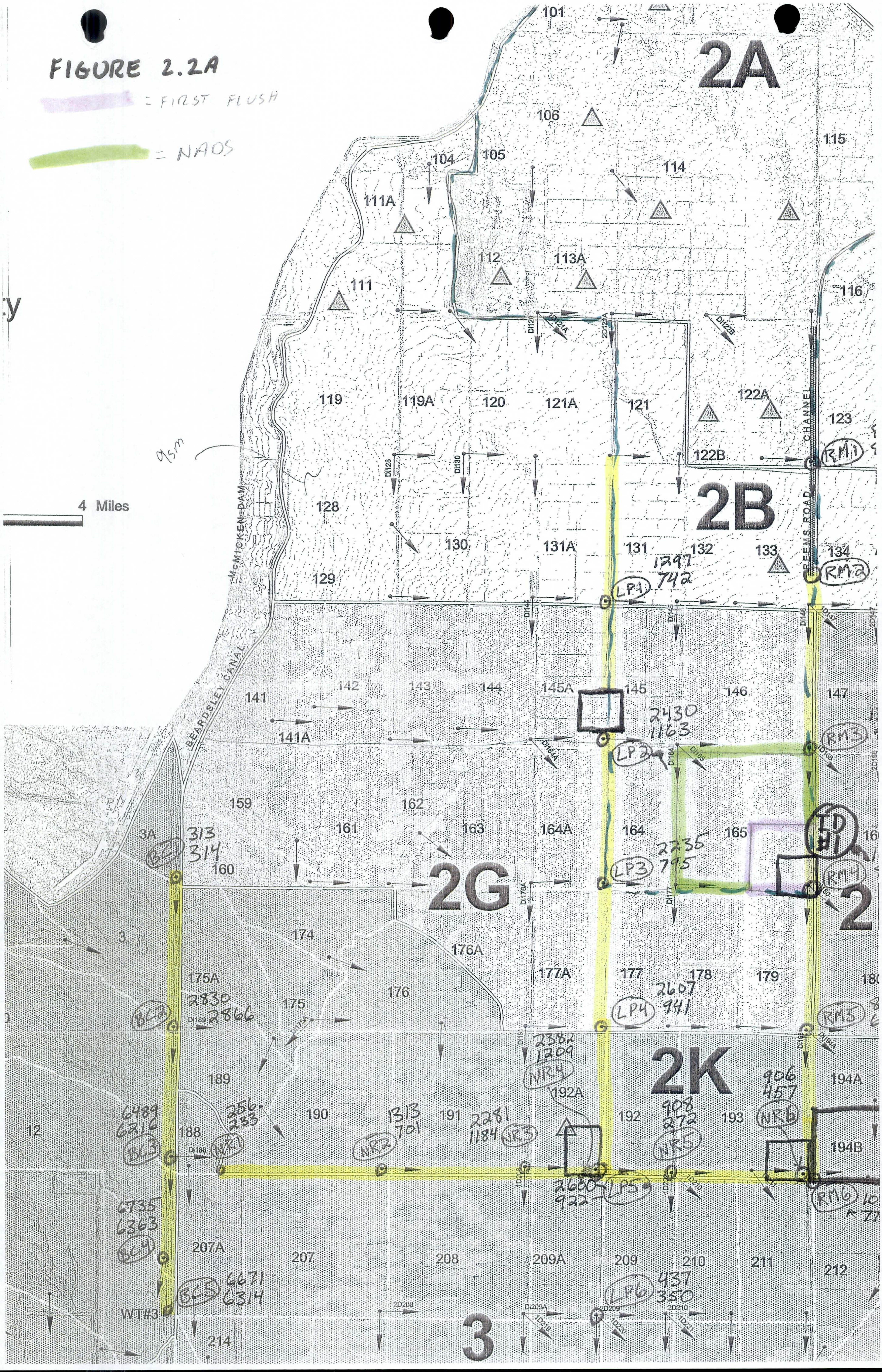
Due to the relatively high cost to the developer of constructing a conveyance channel from sub basin 119 to the proposed Loop 303 ADMP Update channel, and the very likely fact that there would be little or no increase in developable land due to waived onsite retention requirements, developer participation is not likely.

APPENDIX

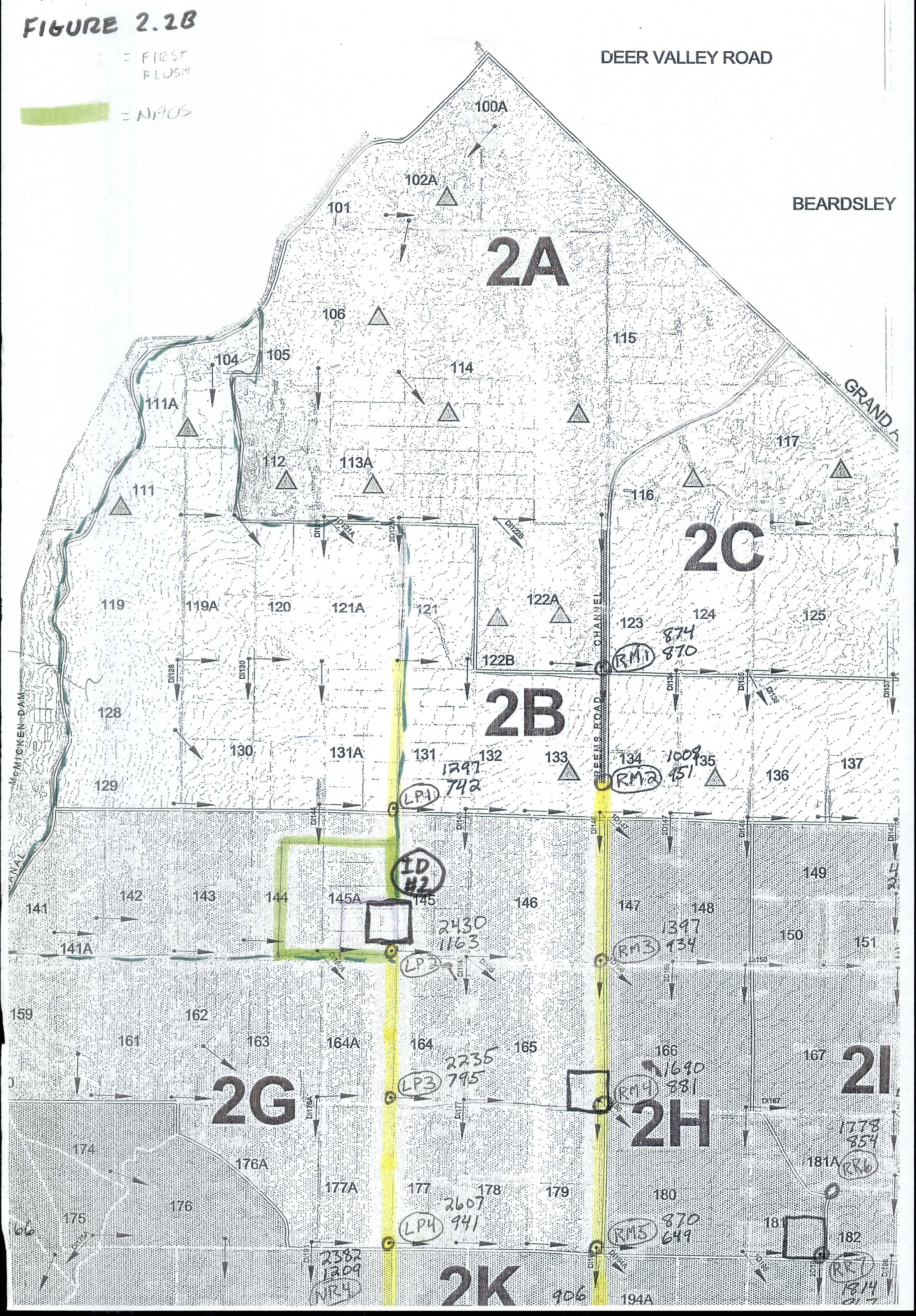
FIGURE 2.2A

= FIRST FLUSH

= NAOS



EXISTING CONDITION



APPENDIX E

COMPOSITE CHANNEL ANALYSIS

Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40

COMPOSITE CHANNEL ANALYSIS

Prepared for:

Flood Control District of Maricopa County

September 2002

Prepared by:

URS

Table of Contents

COMPOSITE CHANNEL ANALYSIS RESULTS

1.0 Introduction

As a result of a Value Engineering (VE) conducted in February of 2002 for the Loop 303 Corridor/White Tanks Area Drainage Master Plan Update, an alternative flood control option was recommended for further consideration. The VE team recommended that a composite channel consisting of an underground box structure and a surface channel be considered along the SR303 L. Such a channel could have the dual benefit of reducing the surface channel top width and right of way while conveying more runoff volume south. This would result in smaller detention basins along the SR303 L and might allow the basin proposed at Northern and Reems to be reduced in size.

If the proposed surface channel and detention basins could be significantly reduced in size, there is a potential for significant cost savings to the recommended preferred alternative. At the request of the Flood Control District of Maricopa County (FCDMC) URS has completed an analysis of the alternative as well as two others. As part of the analysis, URS considered the physical and economic impacts to the project of implementing the composite channel alternative recommended by the VE team. See Figure 1.1 for a plan view of the proposed composite channel alignment within the Loop 303 ADMP Update Project area.

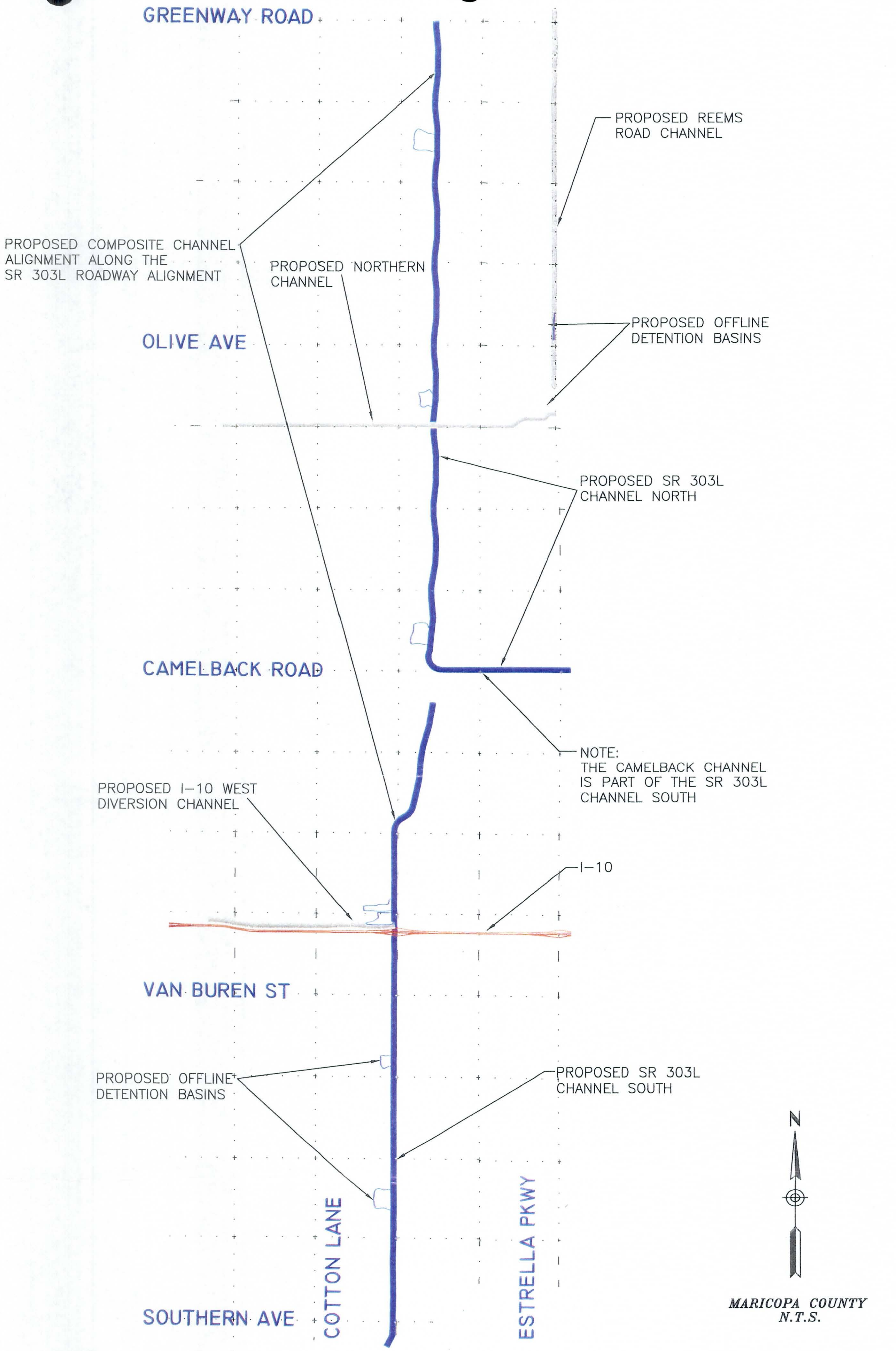
2.0 Analysis

Although the VE team recommended an underground box be used to convey flow, there was some ambiguity with regard to the actual box size. Although the box was recommended to convey the 50-year discharge for the segment of the SR303 L channel north of and including Camelback Road, the recommendation for the segment south of Camelback Road was less specific and referred to the box as a 'low flow' structure. Given this lack of specificity, URS evaluated both a 50-year box and a 'constant capacity' box (1,500 cfs). The 1,500 cfs box would constitute a relatively low-flow structure while the 50-year box was a much higher flow alternative. Finally, at the request of the FCDMC, a 'low flow' concrete channel was also analyzed as an alternative to the 'low flow' (1,500 cfs) box. See Figure 2.1 for the typical composite channel cross-sections.

The analysis consisted of several steps which are summarized in the following section.

2.1 Hydrology

In order to size the box structure for the 50-year storm event, a new hydrology model had to be created to approximate the 50-year storm event. Using the 100-year, 24-hour preferred alternative hydrology model as a starting point, the rainfall depth associated with the 50-year storm event in the project area was determined and entered into the HEC-1 model. Since the box structure would be designed to intercept and convey the discharge generated by the 50-year storm event, the off-line detention basins associated with the 100-year storm event would not operate until the 50-year storm event was exceeded. Therefore, the off line basins were



COMPOSITE CHANNEL ALIGNMENT—VALUE ENGINEERING

COMPOSITE CHANNEL ANALYSIS

September 2002

Flood Control District of Maricopa County

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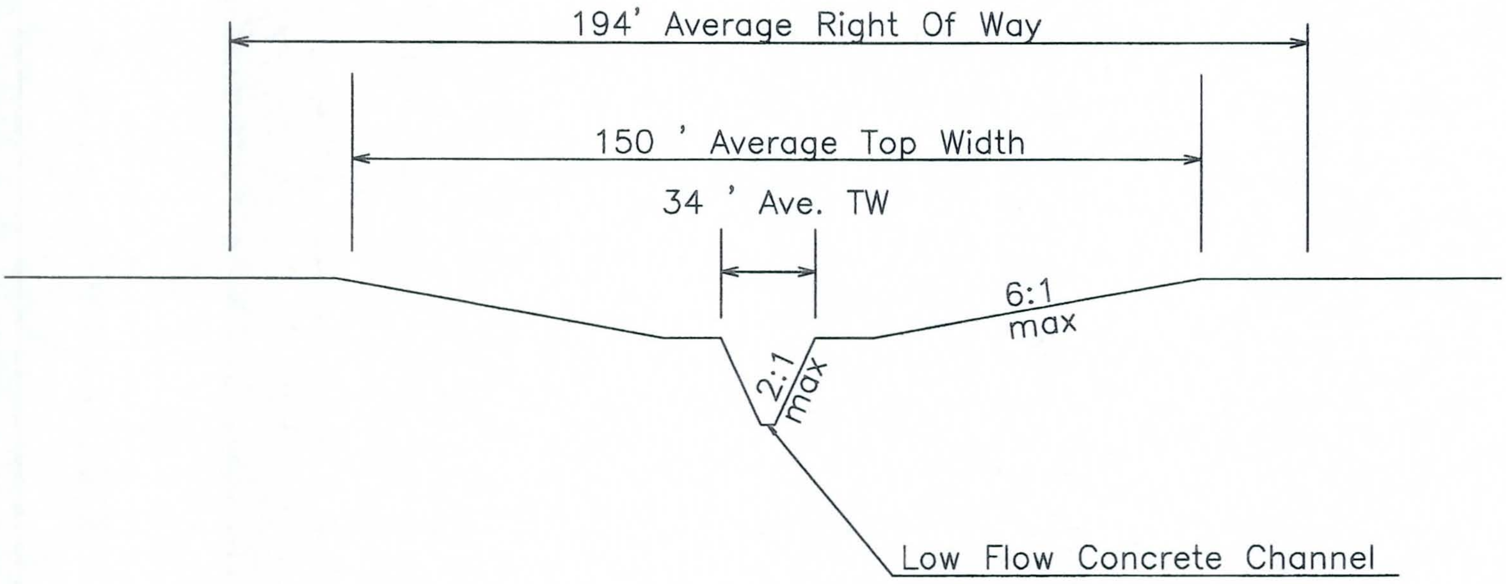
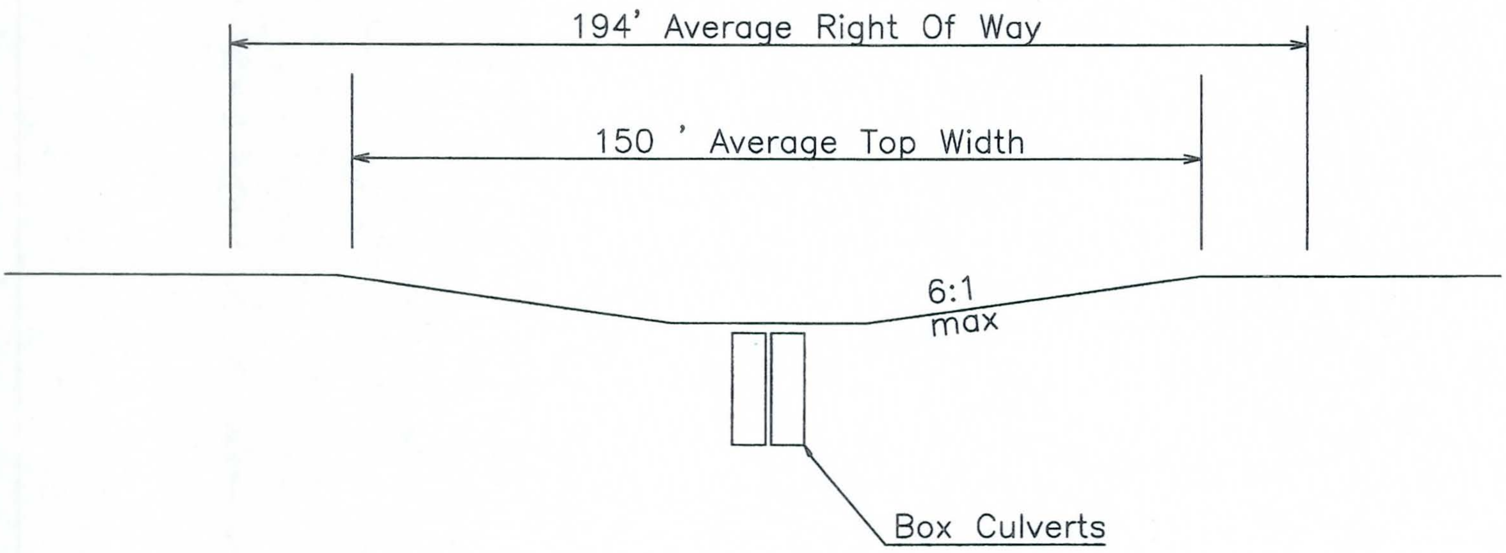
FIGURE 1.1

Loop 303 Corridor/White Tanks ADMP Update

COMPOSITE CHANNEL WITH 1,500 CFS LOW CONCRETE CHANNEL AND 100-YEAR SURFACE CHANNEL



COMPOSITE CHANNEL WITH 1,500 CFS LOW FLOW BOX AND 100-YEAR SURFACE CHANNEL



TYPICAL CROSS SECTIONS - VALUE ENGINEERING
COMPOSITE CHANNEL ANALYSIS

September 2002

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FIGURE 2.1

Flood Control District of Maricopa County

Loop 303 Corridor/White Tanks ADMP Update temporarily disabled in the model and the resultant discharges were used to size the box structure. As a simplification to the modeling process, no storage routing was considered or modeled along the box culvert which eliminated the need to optimize/iterate the discharges by continually running the model, generating discharges, sizing the box and updated model routes to reflect the most recent run. This was beyond the scope of the analysis.

The next step was to modify the 100-year hydrologic model to reflect the operation of the 50-year box. Flow diverts in the amount equal to the 50-year peaks (estimated above) were inserted at the concentration points along the proposed channel alignment to simulate the amount of discharge conveyed by the box at each location. Since any flow in excess of the 50-year discharge at any given location must by conveyed by a surface channel and attenuated by detention basins, the next step was to begin at the upstream end of the channel and size each proposed offsite basin one at a time. Since the combined outflow from an offline basin is used as the basis for determining the discharge downstream in combination with runoff from additional contributing area, the channel reach downstream of a proposed basin location cannot be sized until the basin upstream has been sized.

As each successive basin was sized, the model was run. The resulting discharges were then used as a basis for sizing the next downstream channel reach. The same approach was used for the 1,500 cfs capacity box alternative with the exception being the diverts to the box at the concentration points in the 100-year hydrology model were based on a total box capacity of 1,500 cfs at any given location.

In order to properly model the cumulative nature of flow from upstream to downstream, the diverts to a box at concentration point #1 were retrieved and combined with all of the additional overland flow at the next downstream concentration point #2. Once all of the flow has been combined, a divert is then entered to simulate a divert back to the box. This procedure provides an approximate "accounting" of the storm water runoff as it is conveyed from upstream to downstream. For example, in the case of the 1,500 cfs capacity box alternative, of the total flow at upstream concentration point #1, 1,500 cfs was diverted to the proposed box. Then, at the next downstream concentration point #2, the 1,500 cfs divert was retrieved and added to the additional area which contributes to concentration point #2. Now, another divert is placed in the model to put 1,500 cfs back into the proposed box culvert.

2.2 Hydraulic Grade Line Calculations

In order to estimate the size of the box culvert structure a simple hydraulic grade line analysis was conducted. Starting at the downstream end, the hydraulic grade line associated with the box was estimated by adding entrance and exit losses (computed as a function of the velocity head) to friction loss estimates through each reach. All head losses were added to the hydraulic grade line from the preceding reach. A starting water surface elevation was estimated at the downstream end as equal to the free water surface elevation into which the proposed box daylights.

Using this approach, the barrel capacity for a given box size was estimated for each reach and then divided into the design discharge to determine the total number of barrels required. One set of calculations was checked using the Haestad Methods StormCad software. The hydraulic grade line calculations did not account for losses at potential access manholes or inlet structures.

The hydraulic grade line was held to the top of box. No ponding was allowed in the surface channel for the 50-year discharge. See Table(s) 2.1 and 2.2 for the detailed hydraulic grade line calculations.

2.3 Channel Sizing

All channel sizing was done using the Manning equation to estimate normal depth. No backwater or step methods were used with this analysis.

Surface channel sizing was done based on the balance of discharge remaining after diversions to the box culvert and off line basins respectively. The channel profile was held as close to the profile used in the preferred alternative as possible due to issues involving relative depths between channels and off-line basins as well as with day lighting issues downstream. Although the profiles were modified slightly to allow adequate day lighting of the proposed box structure at the downstream locations, it was generally held to the preferred alternative profile elevations. The bottom width was then adjusted to accommodate the design discharge at each concentration point along the channel alignment. The following parameters were used in sizing the channel:

- 6:1 side slopes
- Velocity of 6 f/s or less
- Manning roughness of 0.03 indicating a durable grass channel lining

For the low flow concrete channel alternative (1,500 cfs capacity) the following channel parameters were used:

- 2:1 side slopes
- Velocity of 12 f/s or less
- Manning roughness of 0.02

No freeboard was assumed for the channel sizes since the existing condition hydrology model was used for estimating the discharges. This is consistent with the methods used in sizing the preferred alternative and associated channel sizes evaluated by the VE team. Under the preferred alternative, the channels and basins were sized with zero freeboard and then checked with the future condition hydrology model to ensure proper freeboard once the surrounding watersheds are developed and have implemented onsite retention as required by the individual cities in the project area.

3.0 Results

The results of the analysis are briefly described in the following section.

50-YR Box With Surface Channel – The discharge values estimated by the 50-year HEC-1 model were approximately 80% of the 100-year values. The result was a relatively large box culvert structure that required from 1 – 12' x 10' RCB at the upper most reach of the channel to 7 – 12' x 10' RCB's at the downstream end. This resulted in a decrease in bottom width of

Table 2.1
50-year Box Culvert

HGL Calculation sheet - (English Units) - Mainline

Elev. Drop from inlet MH to outlet MH: 0 ft
Depth at DS confluence: 10 ft

	Design Discharge (cfs)	Length of pipe L (ft)	Slope S (ft/ft)	D/S Inv Elev. of pipe I.E. (ft)	U/S Inv Elev. of pipe I.E. (ft)	Box or Pipe? (B/P)	box span (ft)		box rise (ft)	Area A (ft2)	[1]Single Box Capacity (cfs)	From Fig. Hydraulic Radius R (ft)	Velocity V (ft/s)	Velocity Head $V^2/2g$ (ft)	Friction Slope S_f (ft/ft)	Minor Losses: Frict. Loss h_f (ft)	(Kb) Bend Loss h_b (ft)	Junct. Loss h_j (ft)	Trans Loss h_t (ft)	(Ke) Ent. Loss h_e (ft)	(Kmh) MH Loss h_{mh} (ft)	***HGL Elev. (ft)***	EGL Elev. (ft)	***Grate Elev. (ft)***	HGL vs. Grate Elev. (ft)	Top of Pipe	Flow Condition	Required No. Barrels
																						1049.50						
!CM4	5,297	3547.00	0.0022	1039.50	1047.30	B	12	x	10	120.00	1192.67	2.73	9.94	1.53	0.00198	7.04				0.767		***1057.30***	1058.84	***1057.30***	(0.00)	1057.30	Full Flow	5
!CM3	5,264	2702.40	0.0008	1047.30	1049.47	B	12	x	10	120.00	758.77	2.73	6.32	0.62	0.00080	2.17						***1059.47***	1060.09	***1059.47***	(0.01)	1059.47	Full Flow	7
!CM2	5,146	2566.80	0.0016	1049.47	1053.57	B	12	x	10	120.00	1070.17	2.73	8.92	1.23	0.00160	4.10						***1063.57***	1064.81	***1063.57***	(0.00)	1063.57	Full Flow	5
!CM1	4,912	2601.60	0.0045	1053.57	1065.28	B	12	x	10	120.00	1796.45	2.73	14.97	3.48	0.00450	11.71						***1075.28***	1078.76	***1075.28***	(0.00)	1075.28	Full Flow	3
!LP8	4,798	5518.00	0.0030	1065.28	1082.05	B	12	x	10	120.00	1476.42	2.73	12.30	2.35	0.00304	16.78						***1092.06***	1094.41	***1092.05***	(0.01)	1092.05	Full Flow	4
!LP7	4,487	5339.30	0.0046	1082.05	1106.35	B	12	x	10	120.00	1806.42	2.73	15.05	3.52	0.00455	24.30						***1116.36***	1119.88	***1116.35***	(0.01)	1116.35	Full Flow	3
!LP6	4,151	5343.00	0.0029	1106.35	1121.74	B	12	x	10	120.00	1437.09	2.73	11.98	2.23	0.00288	15.39						***1131.75***	1133.98	***1131.74***	(0.01)	1131.74	Full Flow	3
!LP5	3,934	3700.00	0.0063	1121.74	1144.90	B	12	x	10	120.00	2118.49	2.73	17.65	4.84	0.00626	23.16						***1154.91***	1159.75	***1154.90***	(0.01)	1154.90	Full Flow	2
!LP4	3,844	5292.40	0.0037	1144.90	1164.48	B	12	x	10	120.00	1628.68	2.73	13.57	2.86	0.00370	19.58						***1174.49***	1177.35	***1174.48***	(0.01)	1174.48	Full Flow	3
!LP3	3,468	5250.00	0.0046	1164.48	1188.68	B	12	x	10	120.00	1817.96	2.73	15.15	3.56	0.00461	24.20						***1198.69***	1202.25	***1198.68***	(0.01)	1198.68	Full Flow	2
!LP2	2,164	5293.00	0.0046	1188.68	1212.77	B	12	x	10	120.00	1806.44	2.73	15.05	3.52	0.00455	24.09						***1222.78***	1226.30	***1222.77***	(0.01)	1222.77	Full Flow	2
!LP1	1,114	5236.00	0.0023	1212.77	1224.76	B	12	x	10	120.00	1236.52	2.73	10.30	1.65	0.00213	11.17				0.824		***1234.77***	1236.42	***1234.76***	(0.01)	1234.76	Full Flow	1
																						909.00						
!LP16	2,314	6015.00	0.0050	899.00	929.08	B	12	x	10	120.00	1835.49	2.73	15.30	3.63	0.00470	28.26				1.816		***939.08***	942.71	***939.08***	(0.01)	939.08	Full Flow	2
!LP15	2,276	5298.00	0.0050	929.08	955.57	B	12	x	10	120.00	1893.40	2.73	15.78	3.87	0.00500	26.49						***965.57***	969.44	***965.57***	(0.01)	965.57	Full Flow	2
!LP14	1,934	5319.00	0.0048	955.57	981.10	B	12	x	10	120.00	1855.10	2.73	15.46	3.71	0.00480	25.53						***991.10***	994.81	***991.10***	(0.00)	991.10	Full Flow	2
!LP13	1,690	4047.00	0.0061	981.10	1005.78	B	12	x	10	120.00	2091.20	2.73	17.43	4.72	0.00610	24.68						***1015.78***	1020.50	***1015.78***	(0.00)	1015.78	Full Flow	1
!LP12	840	1178.00	0.0033	1005.78	1009.67	B	12	x	10	120.00	1538.70	2.73	12.82	2.55	0.00330	3.89						***1019.67***	1022.23	***1019.67***	(0.00)	1019.67	Full Flow	1
!LP11	840	5322.00	0.0047	1009.67	1034.68	B	12	x	10	120.00	1835.60	2.73	15.30	3.63	0.00470	25.01						***1044.68***	1048.32	***1044.68***	(0.00)	1044.68	Full Flow	1
!LP10	526	5791.00	0.0030	1034.68	1052.06	B	12	x	10	120.00	1466.91	2.73	12.22	2.32	0.00300	17.38						***1062.06***	1064.38	***1062.06***	(0.01)	1062.06	Full Flow	1
!LP9	465	3387.00	0.0017	1052.06	1057.81	B	12	x	10	120.00	1045.50	2.73	8.71	1.18	0.00152	5.16				0.589		***1067.82***	1069.00	***1067.81***	(0.00)	1067.81	Full Flow	1
																											Average:	3

gravity (g) 32.2 ft/s^2
Manning's coefficient (n) 0.013 RCB 0.011 PVC
Bend loss coefficient (K_b) 0.162 (Eq. pg. 129 - "Modern Sewer Design")
Entrance loss coefficient (K_e 0.5 (pg 10.35)
Manhole loss coefficient (K_{mh}) 0.05 (Fig. 10.15)

1. The number of barrels was estimated by dividing the total discharge by the single barrel capacity. These sizes have not been optimized since that was beyond the scope of this analysis. Optimization could result in as much as a 20% reduction in the $$/LF. Note that in the report, when the total cost estimate for the entire underground box was cut in half, the cost was still prohibitively expensive. Only the low flow concrete channel was approximately comparible to the preferred alternative but even that was more
2. The exclamation point (!) preceding the concentration point label is used by a spreadsheet macro used to sort raw HEC-1 output data.

Table 2.2
1,500 cfs Box Culvert

HGL Calculation sheet - (English Units) - Mainline

Elev. Drop from inlet MH to outlet MH: 0 ft
Depth at DS confluence: 10 ft

	Design Using the Largest 100-YEAR Discharge (cfs)	CONSTANT Discharge (cfs)	Length of pipe L (ft)	Slope S (ft/ft)	D/S Inv Elev. of pipe I.E. (ft)	U/S Inv Elev. of pipe I.E. (ft)	Box or Pipe? (B/P)	box span x box rise (ft)	Area A (ft2)	[1]Single Box Capacity (cfs)	From Fig. Hydraulic Radius R (ft)	Velocity V (ft/s)	Velocity Head $V^2/2g$ (ft)	Friction Slope S_f (ft/ft)	Frict. Loss h_f (ft)	Minor Losses: (Kb) Bend Loss h_b (ft)	Minor Losses: Junct. Loss h_j (ft)	Minor Losses: Trans Loss h_t (ft)	Minor Losses: (Ke) Ent. Loss h_e (ft)	Minor Losses: (Kmh) MH Loss h_{mh} (ft)	***HGL Elev. (ft)***	EGL Elev. (ft)	***Grate Elev. (ft)***	HGL vs. Grate Elev. (ft)	Top of Pipe	Flow Condition	Required No. Barrels
																					1049.50						
!CM4	6,343	1,500	3547.00	0.0022	1039.50	1047.30	B	12 x 10	120.00	1192.67	2.73	9.94	1.53	0.00198	7.04				0.767		***1057.30***	1058.84	***1057.30***	(0.00)	1057.30	Full Flow	2
!CM3	6,314	1,500	2702.40	0.0008	1047.30	1049.47	B	12 x 10	120.00	758.77	2.73	6.32	0.62	0.00080	2.17						***1059.47***	1060.09	***1059.47***	(0.01)	1059.47	Full Flow	2
!CM2	6,161	1,500	2566.80	0.0016	1049.47	1053.57	B	12 x 10	120.00	1070.17	2.73	8.92	1.23	0.00160	4.10						***1063.57***	1064.81	***1063.57***	(0.00)	1063.57	Full Flow	2
!CM1	5,885	1,500	2601.60	0.0045	1053.57	1065.28	B	12 x 10	120.00	1796.45	2.73	14.97	3.48	0.00450	11.71						***1075.28***	1078.76	***1075.28***	(0.00)	1075.28	Full Flow	1
!LP8	5,744	1,500	5518.00	0.0030	1065.28	1082.05	B	12 x 10	120.00	1476.42	2.73	12.30	2.35	0.00304	16.78						***1092.06***	1094.41	***1092.05***	(0.01)	1092.05	Full Flow	2
!LP7	5,409	1,500	5339.30	0.0046	1082.05	1106.35	B	12 x 10	120.00	1806.42	2.73	15.05	3.52	0.00455	24.30						***1116.36***	1119.88	***1116.35***	(0.01)	1116.35	Full Flow	1
!LP6	4,996	1,500	5343.00	0.0029	1106.35	1121.74	B	12 x 10	120.00	1437.09	2.73	11.98	2.23	0.00288	15.39						***1131.75***	1133.98	***1131.74***	(0.01)	1131.74	Full Flow	2
!LP5	4,723	1,500	3700.00	0.0063	1121.74	1144.90	B	12 x 10	120.00	2118.49	2.73	17.65	4.84	0.00626	23.16						***1154.91***	1159.75	***1154.90***	(0.01)	1154.90	Full Flow	1
!LP4	4,616	1,500	5292.40	0.0037	1144.90	1164.48	B	12 x 10	120.00	1628.68	2.73	13.57	2.86	0.00370	19.58						***1174.49***	1177.35	***1174.48***	(0.01)	1174.48	Full Flow	1
!LP3	4,172	1,500	5250.00	0.0046	1164.48	1188.68	B	12 x 10	120.00	1817.96	2.73	15.15	3.56	0.00461	24.20						***1198.69***	1202.25	***1198.68***	(0.01)	1198.68	Full Flow	1
!LP2	2,561	1,500	5293.00	0.0046	1188.68	1212.77	B	12 x 10	120.00	1806.07	2.73	15.05	3.52	0.00455	24.08						***1222.77***	1226.29	***1222.77***	(0.00)	1222.77	Full Flow	1
!LP1	1,297	1,297	5236.00	0.0023	1212.77	1224.76	B	12 x 10	120.00	1236.51	2.73	10.30	1.65	0.00213	11.17				0.824		***1234.76***	1236.41	***1234.76***	(0.00)	1234.76	Full Flow	2
																					909.00						
!LP16	2,925	1,500	6015.00	0.0050	899.00	929.08	B	12 x 10	120.00	1835.49	2.73	15.30	3.63	0.00470	28.26				1.816		***939.08***	942.71	***939.08***	(0.00)	939.08	Full Flow	1
!LP15	2,873	1,500	5298.00	0.0050	929.08	955.57	B	12 x 10	120.00	1896.97	2.73	15.81	3.88	0.00502	26.59						***965.67***	969.55	***965.57***	(0.10)	965.57	Full Flow	1
!LP14	2,447	1,500	5319.00	0.0048	955.57	981.10	B	12 x 10	120.00	1851.47	2.73	15.43	3.70	0.00478	25.43						***991.10***	994.80	***991.10***	(0.00)	991.10	Full Flow	1
!LP13	2,127	1,500	4047.00	0.0061	981.10	1005.78	B	12 x 10	120.00	2091.20	2.73	17.43	4.72	0.00610	24.68						***1015.78***	1020.50	***1015.78***	(0.00)	1015.78	Full Flow	1
!LP10	1,166	1,166	1178.00	0.0033	1005.78	1009.67	B	12 x 10	120.00	1538.75	2.73	12.82	2.55	0.00330	3.89						***1019.67***	1022.23	***1019.67***	(0.00)	1019.67	Full Flow	1
!LP11	999	999	5322.00	0.0047	1009.67	1034.68	B	10 x 8	80.00	1024.00	2.22	12.80	2.54	0.00432	23.01						***1042.68***	1045.23	***1042.68***	(0.00)	1042.68	Full Flow	1
!LP10	627	627	5791.00	0.0030	1034.68	1052.06	B	10 x 8	80.00	853.13	2.22	10.66	1.77	0.00300	17.38						***1060.06***	1061.83	***1060.06***	(0.01)	1060.06	Full Flow	1
!LP9	558	558	3387.00	0.0017	1052.06	1057.81	B	10 x 8	80.00	615.47	2.22	7.69	0.92	0.00156	5.29				0.460		***1065.81***	1066.73	***1065.81***	(0.00)	1065.81	Full Flow	1
																										Average:	2

gravity (g 32.2 ft/s^2
Manning's coefficient (n; 0.013 RCB 0.011 PVC
Bend loss coefficient (K_b; 0.162 (Eq. pg. 129 - "Modern Sewer Design")
Entrance loss coefficient (K_e 0.5 (pg 10.35)
Manhole loss coefficient (K_{mh} 0.05 (Fig. 10.15)

1. The number of barrels was estimated by dividing the total discharge by the single barrel capacity. These sizes have not been optimized since that was beyond the scope of this analysis. Optimization could result in as much as a 20% reduction in the $$/LF. Note that in the report, when the total cost estimate for the entire underground box was cut in half, the cost was still prohibitively expensive. Only the low flow concrete channel was approximately comparible to the preferred alternative but even that was more expensive.
2. The exclamation point (!) preceding the concentration point label is used by a spreadsheet macro used to sort raw HEC-1 output data.

approximately 60% within the surface channel and an overall decrease in channel top width of approximately 20%. Since the most of the channel top width is a function of the relatively flat channel side slopes multiplied by the channel depth based on the proposed profile, the large reduction in bottom width does not translate to an overall large decrease in channel footprint and hence required right of way.

The large capacity box was able to convey a significant volume of discharge downstream. The adjacent off line basins designed to operate during storm events in excess of the 50-year storm event (all discharge from the 50-year storm event and less would be diverted to the box) were much smaller than those required under the pre VE preferred alternative. In addition, the detention basin proposed at Buckeye Road along SR303 L was no longer required. However, the volume of discharge conveyed by the box culvert and previously attenuated by the upstream off line detention basins results in a much larger basin at the proposed basin site located downstream along the SR303 L channel just north of MC85. This is where the proposed box below the south portion of the SR303 L channel daylights and combines with the discharge in the surface channel above. Due to topography flattening and even becoming somewhat adverse through this right overbank area of the Gila/Salt river(s), the box cannot easily be daylighted within the river itself.

Similarly, the north portion of the SR303 L channel daylights at the confluence of the Camelback Road and Bullard Wash channels. The Camelback Road channel is actually a part of the SR303 L channel north of I-10. Again, due to the large amount of volume conveyed within the underground box that was previously attenuated by upstream detention basins, a new basin is required at this location to limit the discharge downstream within the Bullard Wash. The maximum discharge allowed within Bullard Wash is somewhat limited downstream due to existing development with channelization based on a specific discharge. Even if the flow were allowed to continue downstream within Bullard Wash, a much larger basin would be required to handle the increase in volume at the metering location just upstream of I-10. The existing Bullard Wash channel south of I-10 recently completed by the FCDMC has a maximum capacity based on 3,200 cfs. Further, the reach of the Bullard Wash from I-10 downstream to the upstream end of the recently completed channel is currently under design based on this maximum discharge. See Table 3.1 and 3.4 for detailed channel and basin design summaries corresponding with the 50-year box alternative.

1,500-YR Box With Surface Channel – In the case of the 1,500 cfs capacity box, the over-all effectiveness of the structure in terms of reducing the size of the surface channel was somewhat limited. The reason for this is due to the fact that as you progress downstream from concentration point to concentration point the 100-year discharges range from approximately 1,295 cfs at LP1 to 6,343 cfs at CM4 downstream. These are the total cumulative discharges predicted along the proposed SR303 L channel neglecting the effects of detention/attenuation of peak discharges.

If the box has a maximum capacity of 1,500 cfs at any given location along the channel and there are 12 concentration points along the channel, it would only take approximately 3 miles, (the distance between each concentration point is roughly 1 mile), to maximize the box capacity of 1,500 cfs assuming 500 cfs were conveyed via grate opening inlets into the box. The alternative would be to allow equal inflow increments to the box over all 12 concentration points or

Table 3.1
Loop 303 ADMP Update
Proposed Channel Summary

50-Year Box

Channel Name	[1]concentration Point	Qexist	[3]Approximate Qcap (cfs)	DS Invert (ft)	WSEL (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Natural slope (ft/ft)	Design slope (ft/ft)	(Q/A) V ft/s	Inculding Operation & Maintenance Rd. Tw (ft)	Tw (ft)	No. Req'd Vertical Drops	Approx. Spacing Bet. Drops
L303 North Channel															
	!LP1	97	100	1228.6	1230.7	2.1	5	(6:1)	0.0023	*0.0028*	2.9	90	90	0	
US Cactus Basin	!LP2	338	338	1204.0	1207.6	3.6	5	(6:1)	0.0046	*0.0023*	3.7	108	108	3	
	!LP3	497	497	1179.8	1183.8	4.0	5	(6:1)	0.0046	*0.0030*	4.5	113	113	2	
	!LP4	580	580	1161.4	1165.7	4.3	5	(6:1)	0.0037	*0.0026*	4.4	117	117	1	
US Northern Basin	!LP5	617	617	1130.9	1135.3	4.4	5	(6:1)	0.0063	*0.0027*	4.6	118	118	5	
	!LP6	498	498	1109.5	1113.4	3.9	5	(6:1)	0.0029	*0.0032*	4.6	112	112	1	
	!LP7	366	366	1088.2	1091.5	3.3	5	(6:1)	0.0046	*0.0039*	4.5	105	105	0	
US Camelback Basin	!LP8	636	636	1061.5	1065.8	4.3	5	(6:1)	0.0030	*0.0031*	4.8	117	117	3	
Camelback Channel	!CM1	289	289	1054.2	1057.6	3.4	5	(6:1)	0.0045	*0.0020*	3.4	106	106	1	
	!CM2	340	340	1048.9	1052.6	3.7	5	(6:1)	0.0016	*0.0020*	3.5	109	109	0	
	!CM3	359	359	1043.3	1047.1	3.8	5	(6:1)	0.0008	*0.0020*	3.5	111	111	0	
	!CM4	391	391	1035.9	1039.8	3.9	5	(6:1)	0.0022	*0.0020*	3.6	112	112	0	
L303 Channel South															
	!LP9	558	558	1052.5	1056.7	4.2	5	(6:1)	0.0017	*0.0027*	4.4	115	115	0	
	!LP10	101	543	1037.6	1041.8	4.2	5	(6:1)	0.0030	*0.0026*	4.3	115	115	0	
	!LP11	159	726	1013.3	1017.5	4.2	5	(6:1)	0.0047	*0.0046*	5.8	115	115	0	
US I-10 Basin	!LP12	326	647	1009.0	1013.2	4.2	5	(6:1)	0.0033	*0.0036*	5.1	115	115	0	
	!LP13	0	512	984.2	988.2	4.0	5	(6:1)	0.0061	*0.0032*	4.6	113	113	3	size based on DILP13, the balance goes to box.
US Buckeye/Yuma Basin - (not required)	!LP14	0	402	958.7	962.3	3.6	5	(6:1)	0.0048	*0.0033*	4.4	108	108	2	Flow from sub 311, the balance goes to box
	!LP15	1	450	933.0	936.7	3.7	5	(6:1)	0.0050	*0.0034*	4.5	109	109	2	Represents the flow from CP331 & 2ILP13 combined with the flow for sub basin 330.
US MC85 Basin	!LP16	2,158	101	902.0	902.9	0.9	50	(6:1)	0.0050	*0.0025*	2.1	121	121	4	Flow-by from !LP15 plus flow from sub basin 346A, the balance goes into box
	!LP17	1,217	1,217	882.9	886.8	3.9	35	(6:1)	0.0040	*0.0030*	5.4	142	142	0	
Northern Channel															
	!NR1	256	256	1220.4	0.0	2.7	5	(6:1)	N/A	*0.0050*	4.6	108	108	0	
	!NR2	1,313	1,313	1183.6	1187.7	4.1	30	(6:1)	0.0056	*0.0039*	6.1	139	139	3	
	!NR3	2,281	2,281	1151.6	1156.7	5.1	45	(6:1)	0.0074	*0.0027*	6.0	166	166	5	
US L303 Basin	!NR4	2,347	2,347	1131.2	1136.1	4.9	50	(6:1)	0.0061	*0.0027*	6.0	169	169	4	
	!NR5	1,350	1,733	1122.0	1127.2	5.2	35	(6:1)	0.0033	*0.0020*	5.1	157	157	1	
US Reems Basin	!NR6	1,424	1,756	1096.7	1101.4	4.7	35	(6:1)	0.0049	*0.0031*	6.0	151	151	3	
Reems Channel															
	[2]!RM1	874	497	1223.7	1228.2	4.5	7	(3:1)	0.0037	*0.0037*	5.6	101	101	0	
	!RM2	1,008	1,382	1210.3	1216.4	6.1	12	(4:1)	0.0032	*0.0032*	6.5	133	133	0	
	!RM3	1,397	1,397	1167.8	1172.0	4.2	30	(6:1)	0.0062	*0.0039*	6.2	143	143	4	
	!RM4	1,690	1,690	1142.9	1147.7	4.8	30	(6:1)	0.0047	*0.0033*	6.1	148	148	2	
US olive basin	!RM5	2,103	2,103	1119.4	1124.6	5.2	35	(6:1)	0.0045	*0.0029*	6.2	157	157	2	
US Northern Basin	!RM6	1,044	1,044	1097.5	1102.7	5.2	5	(6:1)	0.0041	*0.0034*	5.6	128	128	1	

1. The exclamation point (!) preceding the concentration point is used to flag a spreadsheet macro that sorts the raw output data from the HEC-1 file.
2. This reach of the Reems Channel exists (Mountain Vista) and is under capacity.
3. Channel capacity in terms of normal depth, no backwater computations were performed.

Table 3.4
Loop 303 ADMP Udate
Composite Channel Analysis
Proposed Basin Comparison Summary

Existing Hydrology

Aesthetic Landscape Tract around Basin Perimeter: 30'

Channel/ Location ID	Preferred (VE) no box		50-year Box		1,500cfs Box		Preferred (no box) Max. Vol. Provided (ac-ft)	50-year (Box) Max. Vol. Provided (ac-ft)	1,500 cfs (Box) Max. Vol. Provided (ac-ft)	Low Adj. NG Ground Elev. (Approx.) (ft)	on/off line	Preferred Approximate Basin Footprint (no Aesthetics) (ac)	50-year box Approximate Basin Footprint (no Aesthetics) (ac)	1,500 cfs Approximate Basin Footprint (no Aesthetics) (ac)	Preferred Approximate Basin Footprint (W/Aesthetics) (ac)	50-year box Approximate Basin Footprint (W/Aesthetics) (ac)	1,500 cfs Approximate Basin Footprint (W/Aesthetics) (ac)	Preferred Approximate Daylight Footprint (W/Aesthetics) (ac)	50-year box Approximate Daylight Footprint (W/Aesthetics) (ac)	1,500 cfs Approximate Daylight Footprint (W/Aesthetics) (ac)	Prop. Bot. Elev. (ft)	Prop. Top Elev. (ft)
	Qin (cfs)	Qout (cfs)	Qin (cfs)	Qout (cfs)	Qin (cfs)	Qout (cfs)																
L303 Channel																						
SRLP2 (Cactus Road)	1500	78	226	35	671	128	376	7	48	1211.9	off-line	33.0	1.4	7.9	36.4	2.2	9.6	39.3	1.7	9.3	1,205.0	1,212.0
SRNRLP (Northern)	4389	1282	1934	1054	2526	951	816	98	220	1140.0	off-line	60.9	10.2	21.4	65.5	12.1	24.1	84.5	14.1	29.5	1,128.0	1,140.0
SRRMNR (Northern&Reems)	1494	988	1424	729	1040	802	314	195	165	1109.9	off-line	40.0	25.3	21.6	43.7	28.3	24.4	50.0	31.6	27.0	1,095.0	1,103.5
SRLP8 (Camelback)	1133	178	426	90	1003	294	317	18	156	1071.7	off-line	19.5	2.4	14.7	22.1	3.4	16.9	26.1	3.2	19.6	1,058.0	1,071.0
SRBD2N (BULLARD)	3059	3059	7197	3059	4330	3059	N/A	673	457	1046.0	off-line	N/A	45.3	31.7	N/A	49.2	35.0	N/A	60.3	42.7	1,028.7	1,046.0
SRLP12 (I-10)	987	180	855	132	998	237	341	*160	*147	1014.1	off-line	27.0	13.6	12.6	30.0	15.8	14.7	34.3	17.1	15.9	999.0	1,014.0
SRLP14 (Yuma/Buckeye)	576	326	0	0	0	0	175	N/A	N/A	964.2	N/A	20.0	N/A	N/A	22.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SRLP16 (MC85)	630	339	1295	416	1046	419	225	370	297	908.0	off-line	30.6	49.4	40.0	33.9	53.5	43.7	51.3	82.5	66.8	902.0	910.0

* The total 50-year discharge at this concentration point along the proposed channel is less than 1,500 cfs.

approximately 125 cfs of inflow per reach from upstream to downstream. This would require a much smaller box structure upstream and would gradually increase in size until it reached a maximum required for the full 1,500 cfs (the modeled situation more closely resembles the first assumption, ie, the box is at capacity from !LP1 on). In either case, the amount of surface flow left to be conveyed to offline basins as well as through the channel reach itself would still be very large. See Table 3.2 and 3.4 for detailed channel and basin design summaries corresponding with the 1,500 cfs box alternative.

1,500 cfs/Low Flow Concrete Channel – For this option, the low flow surface channel was sized based on a maximum capacity of 1,500 cfs. This was done as a means of estimating the cost associated with a low flow concrete channel versus the cost of the 1,500 cfs box. Although the cost associated with the low flow concrete channel were lower than those associated with the box, it was still significantly higher than building the preferred alternative channel section. The reality of such a channel would be that the capacity of the channel would have to either vary as it progressed downstream to a maximum of 1,500 cfs at the most downstream point or it would have to carry a lower frequency storm event upstream than downstream if the channel were sized for a maximum flow rate of 1,500 cfs. See Table 3.3 and 3.4 for detailed channel and basin design summaries corresponding with the 1,500 cfs low flow concrete channel alternative.

4.0 Quantities/Cost Estimate

4.1 Assumptions

The quantities were calculated using the following set of simplifying assumptions:

- Channel excavation was based on an average end area method. Proposed profiles were run along channel alignments and earthwork quantities were generated with the AutoDesk Land Development Desktop (LDD).
- Basin excavation was based on the total volume provided plus estimated daylight locations based on actual topography at proposed basin locations. The entire basin was assumed to be in cut – no fill.
- The landscape costs estimated under the pre-value engineering (VE) Level III Preferred Alternative were also applied here for consistency. This allows a more realistic comparison between the pre-value engineering preferred alternative and the composite channel alternative.
- Culvert quantities were based on the cheaper of a 72" RCP or a 10' x 6' RCB for consistency with the Level III analysis. The Dodson Hydrocalc Hydraulics program was used to estimate culvert capacity at various culvert slopes assuming outlet control. Evaluation of the results showed very little difference in barrel capacities for the given conditions. Therefore, an average inlet capacity was used to simplify and speed up the analysis at every location.
    - o Using this approach the number of barrels required at each crossing was quickly determined by dividing the total design discharge by the inlet capacity computed per the method described above. The quantity of steel and concrete required in the inlet and outlet headwalls at each structure was based on the total number of

Table 3.2
Loop 303 ADMP Update
Proposed Channel Summary

Existing Hydrology

Channel Name	[1]concentration Point	Qchannel	[3]Approximate Qcap (cfs)	DS Invert (ft)	WSEL (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Natural slope (ft/ft)	Design slope (ft/ft)	(Q/A) V ft/s	Inculding Operation & Maintenance Rd. Tw (ft)	Tw (ft)	No. Req'd Vertical Drops	Approx. Spacing Bet. Drops
L303 North Channel															
	!LP1	1,211	1,211	1228.6	1232.8	4.2	30	(6:1)	0.0023	*0.0028*	5.3	140	140	0	
US Cactus Basin	!LP2	1,002	1,002	1204.0	1208.0	4.0	30	(6:1)	0.0046	*0.0023*	4.7	138	138	3	
	!LP3	1,747	1,747	1179.8	1184.5	4.7	35	(6:1)	0.0046	*0.0030*	5.9	151	151	2	
	!LP4	2,074	2,074	1161.4	1166.1	4.7	50	(6:1)	0.0037	*0.0026*	5.7	166	166	1	
US Northern Basin	!LP5	2,084	2,084	1130.9	1135.6	4.7	50	(6:1)	0.0063	*0.0027*	5.8	166	166	5	
	!LP6	1,109	1,109	1109.5	1113.4	3.9	30	(6:1)	0.0029	*0.0032*	5.4	137	137	1	
	!LP7	1,181	1,181	1088.2	1092.1	3.9	30	(6:1)	0.0046	*0.0039*	5.9	137	137	0	
US Camelback Basin	!LP8	1,857	1,857	1061.5	1066.3	4.8	35	(6:1)	0.0030	*0.0031*	6.1	153	153	3	
Camelback Channel	!CM1	905	1,055	1054.2	1058.5	4.3	30	(6:1)	0.0045	*0.0020*	4.5	142	142	1	
	!CM2	1,227	1,343	1048.9	1053.5	4.6	35	(6:1)	0.0016	*0.0020*	4.7	150	150	0	
	!CM3	1,235	1,339	1043.3	1047.9	4.6	35	(6:1)	0.0008	*0.0020*	4.7	150	150	0	
	!CM4	1,580	1,778	1035.9	1041.2	5.3	35	(6:1)	0.0022	*0.0020*	5.1	159	159	0	
L303 Channel South															
	!LP9	558	558	1052.5	1056.7	4.2	5	(6:1)	0.0017	*0.0027*	4.4	115	115	0	size for overland flow at CP9, then divert all into box
	!LP10	16	114	1037.6	1039.8	2.2	5	(6:1)	0.0030	*0.0026*	2.9	91	91	0	Size for flow from sub 265 and D250, balance to box
	!LP11	19	468	1013.3	1016.8	3.5	5	(6:1)	0.0047	*0.0046*	5.2	107	107	0	size for flow from 278 and DCP265, balance in box.
US I-10 Basin	!LP12	45	1,078	1009.0	1012.7	3.7	30	(6:1)	0.0033	*0.0036*	5.6	134	134	0	size for overland flow as represented by 2I278, the rest in box.
	!LP13	9	388	984.2	987.4	3.2	10	(6:1)	0.0061	*0.0032*	4.3	108	108	3	size for overland flow from DILP13, rest in box.
US Yuma Basin	!LP14	41	402	958.7	961.9	3.2	10	(6:1)	0.0048	*0.0033*	4.4	108	108	2	size for overland flow from sub basin 311, rest in box
	!LP15	521	910	933.0	937.3	4.3	15	(6:1)	0.0050	*0.0034*	5.4	127	127	2	size for overland flow from sub basin 330, 2ILP13 and CP331, rest in box.
US MC85 Basin	!LP16	2,091	102	902.0	903.6	1.6	15	(6:1)	0.0050	*0.0025*	2.7	94	94	4	size for overland flow from sub basin 346A, rest in box.
	!LP17	1,379	1,379	882.9	888.5	5.6	10	(6:1)	0.0040	*0.0030*	5.8	137	137	0	
Northern Channel															
	!NR1	256	256	1220.4	0.0	2.7	5	(6:1)	N/A	*0.0050*	4.6	108	108	0	
	!NR2	1,313	1,313	1183.6	1187.7	4.1	30	(6:1)	0.0056	*0.0039*	6.1	139	139	3	
	!NR3	2,281	2,281	1151.6	1156.7	5.1	45	(6:1)	0.0074	*0.0027*	6.0	166	166	5	
US L303 Basin	!NR4	2,347	2,347	1131.2	1136.1	4.9	50	(6:1)	0.0061	*0.0027*	6.0	169	169	4	
	!NR5	1,025	1,733	1122.0	1127.2	5.2	35	(6:1)	0.0033	*0.0020*	5.1	157	157	1	
US Reems Basin	!NR6	1,040	1,756	1096.7	1101.4	4.7	35	(6:1)	0.0049	*0.0031*	6.0	151	151	3	
Reems Channel															
	[2]!RM1	874	497	1223.7	1228.2	4.5	7	(3:1)	0.0037	*0.0037*	5.6	101	101	0	
	!RM2	1,008	1,382	1210.3	1216.4	6.1	12	(4:1)	0.0032	*0.0032*	6.5	133	133	0	
	!RM3	1,397	1,397	1167.8	1172.0	4.2	30	(6:1)	0.0062	*0.0039*	6.2	143	143	4	
	!RM4	1,690	1,690	1142.9	1147.7	4.8	30	(6:1)	0.0047	*0.0033*	6.1	148	148	2	
US olive basin	!RM5	2,103	2,103	1119.4	1124.6	5.2	35	(6:1)	0.0045	*0.0029*	6.2	157	157	2	
US Northern Basin	!RM6	1,044	1,044	1097.5	1102.7	5.2	5	(6:1)	0.0041	*0.0034*	5.6	128	128	1	

1. The exclamation point (!) preceding the concentration point is used to flag a spreadsheet macro that sorts the raw output data from the HEC-1 file.
2. This reach of the Reems Channel exists (Mountain Vista) and is under capacity.
3. Channel capacity in terms of normal depth, no backwater computations were performed.

Table 3.3
Loop 303 ADMP Update
Proposed Low Flow Concrete Channel Summary

Existing Hydrology

Channel Name	[1]concentration Point	Qexist	[2]Approximate Qcap (cfs)	DS Invert (ft)	WSEL (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Natural slope (ft/ft)	Design slope (ft/ft)	(Q/A) V ft/s	Inculding Operation & Maintenance Rd. Tw (ft)	(WSEL) Tw (ft)	No. Req'd Vertical Drops
L303 North Channel														
	!LP1	1,297	1,297	1225.7	1232.9	7.2	5	(2:1)	0.0023	*0.0028*	9.4	94	34	0
US Cactus Basin	!LP2	1,500	1,500	1201.1	1209.1	8.0	5	(2:1)	0.0046	*0.0023*	9.1	97	37	3
	!LP3	1,500	1,714	1176.8	1184.8	8.0	5	(2:1)	0.0046	*0.0030*	10.4	97	37	2
	!LP4	1,500	1,607	1158.4	1166.4	8.0	5	(2:1)	0.0037	*0.0026*	9.8	97	37	1
US Northern Basin	!LP5	1,500	1,637	1128.0	1136.0	8.0	5	(2:1)	0.0063	*0.0027*	9.9	97	37	5
	!LP6	1,500	1,759	1106.5	1114.5	8.0	5	(2:1)	0.0029	*0.0032*	10.7	97	37	1
	!LP7	1,500	1,944	1085.2	1093.2	8.0	5	(2:1)	0.0046	*0.0039*	11.8	97	37	0
US Camelback Basin	!LP8	1,500	1,742	1058.6	1066.6	8.0	5	(2:1)	0.0030	*0.0031*	10.6	97	37	3
Camelback Channel	!CM1	1,500	1,500	1051.2	1059.4	8.2	5	(2:1)	0.0045	*0.0020*	8.6	98	38	1
	!CM2	1,500	1,500	1045.9	1054.1	8.2	5	(2:1)	0.0016	*0.0020*	8.6	98	38	0
	!CM3	1,500	1,500	1040.3	1048.5	8.2	5	(2:1)	0.0008	*0.0020*	8.6	98	38	0
	!CM4	1,500	1,500	1033.0	1041.2	8.2	5	(2:1)	0.0022	*0.0020*	8.6	98	38	0
L303 Channel South														
	!LP9	558	558	1051.7	1056.7	5.0	5	(2:1)	0.0017	*0.0027*	7.5	85	25	0
	!LP10	627	627	1036.8	1042.1	5.3	5	(2:1)	0.0030	*0.0026*	7.6	86	26	0
	!LP11	999	999	1012.5	1018.3	5.8	5	(2:1)	0.0047	*0.0046*	10.6	88	28	0
US I-10 Basin	!LP12	1,166	1,166	1008.2	1014.7	6.5	5	(2:1)	0.0033	*0.0036*	10.1	91	31	0
	!LP13	1,500	1,500	983.4	990.8	7.4	5	(2:1)	0.0061	*0.0032*	10.3	95	35	3
US Yuma Basin	!LP14	1,500	1,529	957.9	965.3	7.4	5	(2:1)	0.0048	*0.0033*	10.5	95	35	2
	!LP15	1,500	1,541	932.2	939.6	7.4	5	(2:1)	0.0050	*0.0034*	10.5	95	35	2
US MC85 Basin	!LP16	1,500	1,500	901.2	909.0	7.8	5	(2:1)	0.0050	*0.0025*	9.4	96	36	4
	!LP17	2,925	2,925	882.1	887.5	5.4	40	(2:1)	0.0040	*0.0030*	10.7	122	62	0

1. The exclamation point (!) preceding the concentration point is used to flag a spreadsheet macro that sorts the raw output data from the HEC-1 file.
2. Channel capacity in terms of normal depth, no backwater computations were performed.

barrels required to convey the design discharge. These quantities were computed using the ADOT B-Standards.

- Drop structure quantities for grouted riprap were based on the average jump length and height computed for all of the drop structures required along the channel profile.
- The right of way estimates were based on the proposed channel footprint in plan view based on computed daylight lines using LDD. The estimates include area for future access/maintenance roads adjacent to the proposed facilities. This footprint area was then added to the footprint area estimated for each basin location along the proposed channel. One additional basin was required at the confluence of the Camelback Road (part of the SR303 L south channel) channel with the Bullard Wash channel. This is a result of the underground box daylighting at this location. The volume of discharge in the box is then combined with the surface flow in the channel. This is higher than the preferred alternative and requires additional detention due to conveyance limitations downstream on existing portions of Bullard Wash/channel where development has already improved the wash corridor.
- The hydro-seed quantity was assumed equal to the right of way quantity computed above.

The unit costs used for the preferred alternative analysis under the Level III portion of the Loop 303 AMDP Update project were used with this analysis for consistency. Table(s) 4.1, 4.2 and 4.3 summarize the total estimated cost required to construct each of the three alternatives evaluated with this analysis. Table 4.4 shows the cost estimate associated with the pre-VE preferred alternative. Finally, Table 4.5 shows a total cost summary of all four of the alternatives.

4.2 *Explanation of Cost Estimate and Results*

There are several reasons why the actual costs for the composite channel option were not as low as the VE team had assumed. Those reasons are listed below with a brief description following.

Proposed Box Daylighting Point – The VE team assumed that the proposed box structures could be daylighted at the ultimate outfall rather than at some point upstream. Since this assumption proved impractical, one additional (very large) detention basin was required at the downstream end of the SR303 L channel north. In the case of this analysis the basin was located at the confluence of the Camelback Channel (part of the SR303 L north channel) and the Bullard Wash. Since the proposed underground box structure is conveying a significant volume of runoff that was previously detained and metered out by proposed offline detention basins upstream under the preferred alternative, this volume must now be accounted for at some point downstream. Due to topographic and economic constraints, the box underneath the SR303 L north channel must be daylighted well before the ultimate outfall point of either the ADOT/FCDMC basins or the Salt/Gila river(s).

At the actual daylight location proposed above, the additional volume within the box (previously detained upstream under the preferred alternative) now combines with that in the surface channel and must be detained. Since Bullard Wash already has capacity issues, it is best to use a detention basin at this location rather than allow the flow to continue downstream. Conveyance of the increased discharge/volume downstream would require a much larger cross section and

Tab[illegible] 1
Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 50-YR Box

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
Beardsley Canal	Channel Excavation	C.Y.	$3.25	1137174	$3,695,816
	Channel Fill	C.Y.	$3.25	33602	$109,206
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	5476	$711,935
	ROW	ACRE	$40,000.00	134	$5,364,032
	Hydroseed & Topsoil	ACRE	$2,500.00	134	$335,252
	Landscaping & Aesthetic Treatment	SF	$1.35	5841431	$7,885,932
	15 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
	34 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,020,347.60	1	$1,020,348
	35 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,050,187.10	1	$1,050,187
				Σ =	$20,626,105
Jackrabbit Channel	Channel Excavation	C.Y.	$3.25	1606202	$5,220,156
	Channel Fill	C.Y.	$3.25	39655	$128,880
	Detention Basin Excavation	C.Y.	$5.00	175900	$879,500
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	1127	$146,503
	ROW	ACRE	$40,000.00	107	$4,293,057
	Hydroseed & Topsoil	ACRE	$2,500.00	107	$268,316
	Landscaping & Aesthetic Treatment	SF	$1.60	4211352	$6,738,163
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
				Σ =	$18,229,100
L303 North Channel/ Camelback Channel	Channel Excavation	C.Y.	$3.25	1,463,535	$4,756,487
	Channel Fill	C.Y.	$3.25	12,321	$40,043
	50-year box inlet grates	EA.		198	$0
	Access Manhole	EA.		12	$0
	Detention Basin Excavation	C.Y.	$5.00	2,794,814	$13,974,072
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	4,862	$632,056
	ROW	ACRE	$40,000.00	280	$11,201,349
	Hydroseed & Topsoil	ACRE	$2,500.00	280	$700,084
	[1]Landscaping & Aesthetic Treatment	SF	$1.54	12,198,269	$18,810,623
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$35,644.10	1	$35,644
	1 Barrel 150' Long, 10' x 6' Box Culvert	EA.	$75,960.49	1	$75,960
	1 Barrel 75' Long, 10' x 6' Box Culvert	EA.	$42,830.84	5	$214,154
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	3	$285,969
	4 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$125,162.60	1	$125,163
	5 Barrel 12' X 10' BOX/Channel	LF	$3,724.30	3,547	$13,210,099
	7 Barrel 12' X 10' BOX/Channel	LF	$5,210.96	2,702	$14,082,101
	5 Barrel 12' X 10' BOX/Channel	LF	$3,724.30	2,567	$9,559,538
	3 Barrel 12' X 10' BOX/Channel	LF	$2,237.64	2,602	$5,821,452
	4 Barrel 12' X 10' BOX/Channel	LF	$2,980.97	5,518	$16,449,006
	3 Barrel 12' X 10' BOX/Channel	LF	$2,237.64	5,339	$11,947,447
	3 Barrel 12' X 10' BOX/Channel	LF	$2,237.64	5,343	$11,955,726
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	3,700	$5,528,959
	3 Barrel 12' X 10' BOX/Channel	LF	$2,237.64	5,292	$11,842,501
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,250	$7,845,145
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,293	$7,909,401
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,236	$3,932,151
				Σ =	$170,935,132
L303 Channel South	Channel Excavation	C.Y.	$3.25	479,142	$1,557,210
	Channel Fill	C.Y.	$3.25	65,118	$211,633
	50-year box inlet grates	EA.		248	$0
	Access Manhole	EA.		9	$0
	Detention Basin Excavation	C.Y.	$5.00	3,132,222	$15,661,108
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	1,497	$194,580
	ROW	ACRE	$40,000.00	231	$9,221,360
	Hydroseed & Topsoil	ACRE	$2,500.00	231	$576,335
	[1]Landscaping & Aesthetic Treatment	SF	$1.38	10,042,061	$13,837,874
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$35,644.10	2	$71,288
	1 Barrel 75' Long, 10' x 6' Box Culvert	EA.	$42,830.84	1	$42,831
	3 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	4	$381,292
	4 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$125,162.60	1	$125,163
	4 Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$440,162.60	1	$440,163
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	6,015	$8,988,295
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,298	$7,916,872
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,319	$7,948,253
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	4,047	$3,039,232

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

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Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 50-YR Box

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	1,178	$884,659
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,322	$3,996,736
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,791	$4,348,947
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	3,387	$2,543,582
				Σ =	$82,202,094
Northern Channel	Channel Excavation	C.Y.	$3.25	1312755	$4,266,455
	Channel Fill	C.Y.	$3.25	33987	$110,457
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	ROW	ACRE	$40,000.00	129	$5,167,264
	Hydroseed & Topsoil	ACRE	$2,500.00	129	$322,954
	[1]Landscaping & Aesthetic Treatment	SF	$1.55	5627151	$8,722,084
	2 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$65,483.60	1	$65,484
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	12 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13 Barrel 150' Long, 72" DIAM. RCP Culvert	EA.	$734,968.10	1	$734,968
				Σ =	$20,123,228
Reems Channel	Channel Excavation	C.Y.	$3.25	556650	$1,809,111
	Channel Fill	C.Y.	$3.25	40867	$132,818
	Detention Basin Excavation	C.Y.	$5.00	1185194	$5,925,969
	ROW	ACRE	$40,000.00	146	$5,844,320
	Hydroseed & Topsoil	ACRE	$2,500.00	146	$365,270
	[1]Landscaping & Aesthetic Treatment	SF	$1.52	3773632	$5,743,797
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	2	$310,004
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	8 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
				Σ =	$20,835,011
El Mirage Channel/ AT&SF Railroad Channel	Channel Excavation	C.Y.	$3.25	1173435	$3,813,664
	Channel Fill	C.Y.	$3.25	126041	$409,635
	Detention Basin Excavation	C.Y.	$5.00	583671	$2,918,355
	ROW	ACRE	$40,000.00	201	$8,027,702
	Hydroseed & Topsoil	ACRE	$2,500.00	201	$501,731
	[1]Landscaping & Aesthetic Treatment	SF	$1.60	7116719	$11,386,750
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
	11 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
				Σ =	$28,340,119
Lower El Mirage Channel	Channel Excavation	C.Y.	$3.25	147095	$478,058
	Channel Fill	C.Y.	$3.25	0	$0
	Detention Basin Excavation	C.Y.	$5.00	205370	$1,026,850
	ROW	ACRE	$40,000.00	39	$1,552,376
	Hydroseed & Topsoil	ACRE	$2,500.00	39	$97,023
	[1]Landscaping & Aesthetic Treatment	SF	$1.60	955406	$1,528,650
	7 Barrel 98' Long, 8'x6' Box Culverts	EA.	$271,031.10	1	$271,031
				Σ =	$4,953,988
Bullard Channel	Channel Excavation	C.Y.	$3.25	1954041	$6,350,633
	Channel Fill	C.Y.	$3.25	21347	$69,379
	Detention Basin Excavation	C.Y.	$5.00	150922	$754,610
	ROW	ACRE	$40,000.00	234	$9,354,696
	Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,669
	[1]Landscaping & Aesthetic Treatment	SF	$1.59	9651566	$15,370,147
	12 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$393,718.10	2	$787,436
	16 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$483,236.60	1	$483,237
	17 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$513,076.10	1	$513,076
	18 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$542,915.60	1	$542,916
	19 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$572,755.10	1	$572,755
	19 Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$2,069,005.10	1	$2,069,005
				Σ =	$37,816,437
RID Channel	Channel Excavation	C.Y.	$3.25	1624291	$5,278,947
	Channel Fill	C.Y.	$3.25	44629	$145,043
	Detention Basin Excavation	C.Y.	$5.00	593474	$2,967,370
	ROW	ACRE	$40,000.00	147	$5,881,662

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

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Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 50-YR Box

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
		Hydroseed & Topsoil	ACRE	$2,500.00	147	$367,604
		[1]Landscaping & Aesthetic Treatment	SF	$1.60	5141945	$8,227,112
	3	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	1	$95,323
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	2	$489,041
	9	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
					Σ =	$24,030,663
Tuthill Channel		Channel Excavation	C.Y.	$3.25	1454895	$4,728,409
		Channel Fill	C.Y.	$3.25	333963	$1,085,381
		Detention Basin Excavation	C.Y.	$5.00	681640	$3,408,200
		ROW	ACRE	$40,000.00	234	$9,353,979
		Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,624
		[1]Landscaping & Aesthetic Treatment	SF	$1.55	8898906	$13,800,450
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	3	$912,599
	11	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
	14	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$423,557.60	1	$423,558
	15	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
					Σ =	$35,329,156
I-10 Channel		Channel Excavation	C.Y.	$3.25	75709	$246,054
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	14	$576,000
		Hydroseed & Topsoil	ACRE	$2,500.00	14	$36,000
		[1]Landscaping & Aesthetic Treatment	SF	$1.60	627264	$1,003,622
					Σ =	$1,861,677
El Mirage East 1/2 Channel		Channel Excavation	C.Y.	$3.25	6430	$20,899
		Channel Fill	C.Y.	$3.25	22750	$73,936
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	15	$613,382
		Hydroseed & Topsoil	ACRE	$2,500.00	15	$38,336
		[1]Landscaping & Aesthetic Treatment	SF	$1.60	667973	$1,068,757
					Σ =	$1,815,310
					Sub Total =	*$467,098,017*
					30% Contingency =	*$140,129,405*
					Total =	***$607,227,422***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

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Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 1500cfs Box

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
Beardsley Canal	Channel Excavation	C.Y.	$3.25	1137174	$3,695,816
	Channel Fill	C.Y.	$3.25	33602	$109,206
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	5476	$711,935
	ROW	ACRE	$40,000.00	134	$5,364,032
	Hydroseed & Topsoil	ACRE	$2,500.00	134	$335,252
	[1]Landscaping & Aesthetic Treatment	SF	$1.35	5841431	$7,885,932
	15 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
	34 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,020,347.60	1	$1,020,348
	35 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,050,187.10	1	$1,050,187
				Σ =	$20,626,105
Jackrabbit Channel	Channel Excavation	C.Y.	$3.25	1606202	$5,220,156
	Channel Fill	C.Y.	$3.25	39655	$128,880
	Detention Basin Excavation	C.Y.	$5.00	175900	$879,500
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	1127	$146,503
	ROW	ACRE	$40,000.00	107	$4,293,057
	Hydroseed & Topsoil	ACRE	$2,500.00	107	$268,316
	[1]Landscaping & Aesthetic Treatment	SF	$1.60	4211352	$6,738,163
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
				Σ =	$18,229,100
L303 North Channel/ Camelback Channel	Channel Excavation	C.Y.	$3.25	1,855,374	$6,029,967
	Channel Fill	C.Y.	$3.25	30,690	$99,742
	1500-year box inlet grates	EA.		878	$0
	Access Manhole	EA.		12	$0
	Detention Basin Excavation	C.Y.	$5.00	2,973,736	$14,868,678
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	2,868	$372,881
	ROW	ACRE	$40,000.00	342	$13,677,754
	Hydroseed & Topsoil	ACRE	$2,500.00	342	$854,860
	[1]Landscaping & Aesthetic Treatment	SF	$1.54	14,895,074	$22,969,295
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$35,644.10	1	$35,644
	6 Barrel 150' Long, 72" DIAM. RCP Culvert	EA.	$342,341.60	1	$342,342
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	3	$554,525
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	3	$644,043
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	11 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	2	$668,078
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	3,547	$5,300,329
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	2,702	$4,038,232
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	2,567	$3,835,604
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	2,602	$1,953,760
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,518	$8,245,621
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,339	$4,009,728
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,343	$7,984,116
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	3,700	$2,778,640
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,292	$3,974,507
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,250	$3,942,665
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,293	$3,974,957
	2 Barrel 12' X 10' BOX/Channel	LF	$1,494.31	5,236	$7,824,225
				Σ =	$119,254,553
L303 Channel South	Channel Excavation	C.Y.	$3.25	500,275	$1,625,893
	Channel Fill	C.Y.	$3.25	62,258	$202,339
	1500-year box inlet grates	EA.		247	$0
	Access Manhole	EA.		9	$0
	Detention Basin Excavation	C.Y.	$5.00	2,561,668	$12,808,342
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	876	$113,831
	ROW	ACRE	$40,000.00	215	$8,587,040
	Hydroseed & Topsoil	ACRE	$2,500.00	215	$536,690
	[1]Landscaping & Aesthetic Treatment	SF	$1.38	9,351,287	$12,885,993
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$35,644.10	3	$106,932
	1 Barrel 75' Long, 10' x 6' Box Culvert	EA.	$42,830.84	2	$85,662
	3 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	2	$190,646
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	6 Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$657,341.60	1	$657,342
	8 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	6,015	$4,517,168
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,298	$3,978,712
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	5,319	$3,994,483

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Table 2
Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 1500cfs Box

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	4,047	$3,039,232
	1 Barrel 12' X 10' BOX/Channel	LF	$750.98	1,178	$884,659
	1 Barrel 10' X 8' BOX/Channel	LF	$502.08	5,322	$2,672,051
	1 Barrel 10' X 8' BOX/Channel	LF	$502.08	5,791	$2,907,525
	1 Barrel 10' X 8' BOX/Channel	LF	$502.08	3,387	$1,700,533
				Σ =	$61,894,597
Northern Channel	Channel Excavation	C.Y.	$3.25	1312755	$4,266,455
	Channel Fill	C.Y.	$3.25	33987	$110,457
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	ROW	ACRE	$40,000.00	129	$5,167,264
	Hydroseed & Topsoil	ACRE	$2,500.00	129	$322,954
	[1]Landscaping & Aesthetic Treatment	SF	$1.55	5627151	$8,722,084
	2 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$65,483.60	1	$65,484
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	12 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13 Barrel 150' Long, 72" DIAM. RCP Culvert	EA.	$734,968.10	1	$734,968
				Σ =	$20,123,228
Reems Channel	Channel Excavation	C.Y.	$3.25	556650	$1,809,111
	Channel Fill	C.Y.	$3.25	40867	$132,818
	Detention Basin Excavation	C.Y.	$5.00	1081974	$5,409,868
	ROW	ACRE	$40,000.00	141	$5,659,320
	Hydroseed & Topsoil	ACRE	$2,500.00	141	$353,707
	[1]Landscaping & Aesthetic Treatment	SF	$1.52	3773632	$5,743,797
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	2	$310,004
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	8 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
				Σ =	$20,122,348
El Mirage Channel/ AT&SF Railroad Channel	Channel Excavation	C.Y.	$3.25	1173435	$3,813,664
	Channel Fill	C.Y.	$3.25	126041	$409,635
	Detention Basin Excavation	C.Y.	$5.00	583671	$2,918,355
	ROW	ACRE	$40,000.00	201	$8,027,702
	Hydroseed & Topsoil	ACRE	$2,500.00	201	$501,731
	[1]Landscaping & Aesthetic Treatment	SF	$1.60	7116719	$11,386,750
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
	11 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
				Σ =	$28,340,119
Lower El Mirage Channel	Channel Excavation	C.Y.	$3.25	147095	$478,058
	Channel Fill	C.Y.	$3.25	0	$0
	Detention Basin Excavation	C.Y.	$5.00	205370	$1,026,850
	ROW	ACRE	$40,000.00	39	$1,552,376
	Hydroseed & Topsoil	ACRE	$2,500.00	39	$97,023
	[1]Landscaping & Aesthetic Treatment	SF	$1.60	955406	$1,528,650
	7 Barrel 98' Long, 8'x6' Box Culverts	EA.	$271,031.10	1	$271,031
				Σ =	$4,953,988
Bullard Channel	Channel Excavation	C.Y.	$3.25	1954041	$6,350,633
	Channel Fill	C.Y.	$3.25	21347	$69,379
	Detention Basin Excavation	C.Y.	$5.00	150922	$754,610
	ROW	ACRE	$40,000.00	234	$9,354,696
	Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,669
	[1]Landscaping & Aesthetic Treatment	SF	$1.59	9651566	$15,370,147
	12 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$393,718.10	2	$787,436
	16 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$483,236.60	1	$483,237
	17 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$513,076.10	1	$513,076
	18 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$542,915.60	1	$542,916
	19 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$572,755.10	1	$572,755
	19 Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$2,069,005.10	1	$2,069,005
				Σ =	$37,816,437
RID Channel	Channel Excavation	C.Y.	$3.25	1624291	$5,278,947
	Channel Fill	C.Y.	$3.25	44629	$145,043
	Detention Basin Excavation	C.Y.	$5.00	593474	$2,967,370

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tab. .2

Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 1500cfs Box

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
		ROW	ACRE	$40,000.00	147	$5,881,662
		Hydroseed & Topsoil	ACRE	$2,500.00	147	$367,604
		[1]Landscaping & Aesthetic Treatment	SF	$1.60	5141945	$8,227,112
	3	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	1	$95,323
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	2	$489,041
	9	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
					Σ =	$24,030,663
Tuthill Channel		Channel Excavation	C.Y.	$3.25	1454895	$4,728,409
		Channel Fill	C.Y.	$3.25	333963	$1,085,381
		Detention Basin Excavation	C.Y.	$5.00	681640	$3,408,200
		ROW	ACRE	$40,000.00	234	$9,353,979
		Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,624
		[1]Landscaping & Aesthetic Treatment	SF	$1.55	8898906	$13,800,450
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	3	$912,599
	11	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
	14	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$423,557.60	1	$423,558
	15	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
					Σ =	$35,329,156
I-10 Channel		Channel Excavation	C.Y.	$3.25	75709	$246,054
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	14	$576,000
		Hydroseed & Topsoil	ACRE	$2,500.00	14	$36,000
		[1]Landscaping & Aesthetic Treatment	SF	$1.60	627264	$1,003,622
					Σ =	$1,861,677
El Mirage East 1/2 Channel		Channel Excavation	C.Y.	$3.25	6430	$20,899
		Channel Fill	C.Y.	$3.25	22750	$73,936
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	15	$613,382
		Hydroseed & Topsoil	ACRE	$2,500.00	15	$38,336
		[1]Landscaping & Aesthetic Treatment	SF	$1.60	667973	$1,068,757
					Σ =	$1,815,310
					Sub Total =	*$394,397,279*
					30% Contingency =	*$118,319,184*
					Total =	***$512,716,462***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tab. .3
Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 1500cfs Low Flow Channel

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
Beardsley Canal	Channel Excavation	C.Y.	$3.25	1137174	$3,695,816
	Channel Fill	C.Y.	$3.25	33602	$109,206
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	5476	$711,935
	ROW	ACRE	$40,000.00	134	$5,364,032
	Hydroseed & Topsoil	ACRE	$2,500.00	134	$335,252
	Landscaping & Aesthetic Treatment	SF	$1.35	5841431	$7,885,932
	15 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
	34 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,020,347.60	1	$1,020,348
	35 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,050,187.10	1	$1,050,187
				Σ =	$20,626,105
Jackrabbit Channel	Channel Excavation	C.Y.	$3.25	1606202	$5,220,156
	Channel Fill	C.Y.	$3.25	39655	$128,880
	Detention Basin Excavation	C.Y.	$5.00	175900	$879,500
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	1127	$146,503
	ROW	ACRE	$40,000.00	107	$4,293,057
	Hydroseed & Topsoil	ACRE	$2,500.00	107	$268,316
	Landscaping & Aesthetic Treatment	SF	$1.60	4211352	$6,738,163
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
				Σ =	$18,229,100
L303 North Channel/ Camelback Channel	Channel Excavation	C.Y.	$3.25	1,855,374	$6,029,967
	Channel Fill	C.Y.	$3.25	30,690	$99,742
	Detention Basin Excavation	C.Y.	$5.00	2,973,736	$14,868,678
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	2,868	$372,881
	ROW	ACRE	$40,000.00	342	$13,677,754
	Hydroseed & Topsoil	ACRE	$2,500.00	296	$740,375
	[1]Landscaping & Aesthetic Treatment	SF	$1.54	12,900,286	$19,893,185
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$35,644.10	1	$35,644
	6 Barrel 150' Long, 72" DIAM. RCP Culvert	EA.	$342,341.60	1	$342,342
	6 Barrel 75' Long, 10' x 6' Box Culvert	EA.	$184,841.60	3	$554,525
	7 Barrel 75' Long, 10' x 6' Box Culvert	EA.	$214,681.10	3	$644,043
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	11 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	2	$668,078
	Low Flow Concrete Channel	LF	$540.17	54,126	$29,237,297
				Σ =	$87,438,871
L303 Channel South	Channel Excavation	C.Y.	$3.25	500,275	$1,625,893
	Channel Fill	C.Y.	$3.25	62,258	$202,339
	1500-year box inlet grates	EA.		247	$0
	Access Manhole	EA.		9	$0
	Detention Basin Excavation	C.Y.	$5.00	2,561,668	$12,808,342
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	876	$113,831
	ROW	ACRE	$40,000.00	215	$8,587,040
	Hydroseed & Topsoil	ACRE	$2,500.00	179	$448,489
	[1]Landscaping & Aesthetic Treatment	SF	$1.38	7,814,476	$10,768,280
	1 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$35,644.10	3	$106,932
	1 Barrel 75' Long, 10' x 6' Box Culvert	EA.	$42,830.84	2	$85,662
	3 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	2	$190,646
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	6 Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$657,341.60	1	$657,342
	8 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	Low Flow Concrete Channel	LF	$503.83	42,667	$21,496,725
				Σ =	$57,491,045
Northern Channel	Channel Excavation	C.Y.	$3.25	1312755	$4,266,455
	Channel Fill	C.Y.	$3.25	33987	$110,457
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	ROW	ACRE	$40,000.00	129	$5,167,264
	Hydroseed & Topsoil	ACRE	$2,500.00	129	$322,954
	Landscaping & Aesthetic Treatment	SF	$1.55	5627151	$8,722,084
	2 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$65,483.60	1	$65,484
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	12 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13 Barrel 150' Long, 72" DIAM. RCP Culvert	EA.	$734,968.10	1	$734,968

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tab[illegible] 3
Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 1500cfs Low Flow Channel

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
				Σ =	$20,123,228
Reems Channel	Channel Excavation	C.Y.	$3.25	556650	$1,809,111
	Channel Fill	C.Y.	$3.25	40867	$132,818
	Detention Basin Excavation	C.Y.	$5.00	1081974	$5,409,868
	ROW	ACRE	$40,000.00	141	$5,659,320
	Hydroseed & Topsoil	ACRE	$2,500.00	141	$353,707
	[1]Landscaping & Aesthetic Treatment	SF	$1.52	3773632	$5,743,797
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	2	$310,004
	6 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	8 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
				Σ =	$20,122,348
El Mirage Channel/ AT&SF Railroad Channel	Channel Excavation	C.Y.	$3.25	1173435	$3,813,664
	Channel Fill	C.Y.	$3.25	126041	$409,635
	Detention Basin Excavation	C.Y.	$5.00	583671	$2,918,355
	ROW	ACRE	$40,000.00	201	$8,027,702
	Hydroseed & Topsoil	ACRE	$2,500.00	201	$501,731
	Landscaping & Aesthetic Treatment	SF	$1.60	7116719	$11,386,750
	5 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
	11 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
				Σ =	$28,340,119
Lower El Mirage Channel	Channel Excavation	C.Y.	$3.25	147095	$478,058
	Channel Fill	C.Y.	$3.25	0	$0
	Detention Basin Excavation	C.Y.	$5.00	205370	$1,026,850
	ROW	ACRE	$40,000.00	39	$1,552,376
	Hydroseed & Topsoil	ACRE	$2,500.00	39	$97,023
	Landscaping & Aesthetic Treatment	SF	$1.60	955406	$1,528,650
	7 Barrel 98' Long, 8'x6' Box Culverts	EA.	$271,031.10	1	$271,031
				Σ =	$4,953,988
Bullard Channel	Channel Excavation	C.Y.	$3.25	1954041	$6,350,633
	Channel Fill	C.Y.	$3.25	21347	$69,379
	Detention Basin Excavation	C.Y.	$5.00	150922	$754,610
	ROW	ACRE	$40,000.00	234	$9,354,696
	Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,669
	[1]Landscaping & Aesthetic Treatment	SF	$1.59	9651566	$15,370,147
	12 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$393,718.10	2	$787,436
	16 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$483,236.60	1	$483,237
	17 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$513,076.10	1	$513,076
	18 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$542,915.60	1	$542,916
	19 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$572,755.10	1	$572,755
	19 Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$2,069,005.10	1	$2,069,005
				Σ =	$37,816,437
RID Channel	Channel Excavation	C.Y.	$3.25	1624291	$5,278,947
	Channel Fill	C.Y.	$3.25	44629	$145,043
	Detention Basin Excavation	C.Y.	$5.00	593474	$2,967,370
	ROW	ACRE	$40,000.00	147	$5,881,662
	Hydroseed & Topsoil	ACRE	$2,500.00	147	$367,604
	Landscaping & Aesthetic Treatment	SF	$1.60	5141945	$8,227,112
	3 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	1	$95,323
	8 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	2	$489,041
	9 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10 Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
				Σ =	$24,030,663
Tuthill Channel	Channel Excavation	C.Y.	$3.25	1454895	$4,728,409
	Channel Fill	C.Y.	$3.25	333963	$1,085,381
	Detention Basin Excavation	C.Y.	$5.00	681640	$3,408,200
	ROW	ACRE	$40,000.00	234	$9,353,979
	Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,624

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tab... 3

Loop 303 ADMP Update Proposed Channel Quantities
Composite Channel With 1500cfs Low Flow Channel

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
		Landscaping & Aesthetic Treatment[1]	SF	$1.55	8898906	$13,800,450
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	3	$912,599
	11	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
	14	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$423,557.60	1	$423,558
	15	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
					Σ =	$35,329,156
I-10 Channel		Channel Excavation	C.Y.	$3.25	75709	$246,054
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	14	$576,000
		Hydroseed & Topsoil	ACRE	$2,500.00	14	$36,000
		Landscaping & Aesthetic Treatment	SF	$1.60	627264	$1,003,622
					Σ =	$1,861,677
El Mirage East 1/2 Channel		Channel Excavation	C.Y.	$3.25	6430	$20,899
		Channel Fill	C.Y.	$3.25	22750	$73,936
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	15	$613,382
		Hydroseed & Topsoil	ACRE	$2,500.00	15	$38,336
		Landscaping & Aesthetic Treatment	SF	$1.60	667973	$1,068,757
					Σ =	$1,815,310
					Sub Total =	*$358,178,045*
					30% Contingency =	*$107,453,413*
					Total =	***$465,631,458***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tab. 4
Loop 303 ADMP Update Proposed Channel Quantities

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
Beardsley Canal		Channel Excavation	C.Y.	$3.25	1137174	$3,695,816
		Channel Fill	C.Y.	$3.25	33602	$109,206
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	5476	$711,935
		ROW	ACRE	$40,000.00	134	$5,364,032
		Hydroseed & Topsoil	ACRE	$2,500.00	134	$335,252
		Landscaping & Aesthetic Treatment	SF	$1.35	5841431	$7,885,932
	15	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
	34	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,020,347.60	1	$1,020,348
	35	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$1,050,187.10	1	$1,050,187
					Σ =	$20,626,105
Jackrabbit Channel		Channel Excavation	C.Y.	$3.25	1606202	$5,220,156
		Channel Fill	C.Y.	$3.25	39655	$128,880
		Detention Basin Excavation	C.Y.	$5.00	175900	$879,500
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	1127	$146,503
		ROW	ACRE	$40,000.00	107	$4,293,057
		Hydroseed & Topsoil	ACRE	$2,500.00	107	$268,316
		Landscaping & Aesthetic Treatment	SF	$1.60	4211352	$6,738,163
	5	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	6	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	7	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
					Σ =	$18,229,100
L303 North Channel/ Camelback Channel		Channel Excavation	C.Y.	$3.25	2,046,591	$6,651,421
		Channel Fill	C.Y.	$3.25	75499	$245,373
		Detention Basin Excavation	C.Y.	$5.00	4938213	$24,691,065
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	1896	$246,535
		ROW	ACRE	$40,000.00	425	$17,002,013
		Hydroseed & Topsoil	ACRE	$2,500.00	425	$1,062,626
		Landscaping & Aesthetic Treatment	SF	$1.54	11,984,953	$18,481,675
	3	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	2	$190,646
	3	Barrel 150' Long, 72" DIAM. RCP Culver	EA.	$174,073.10	1	$174,073
	4	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$125,162.60	1	$125,163
	5	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	2	$310,004
	7	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	12	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$393,718.10	1	$393,718
	14	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$423,557.60	2	$847,115
					Σ =	$70,999,988
L303 Channel South		Channel Excavation	C.Y.	$3.25	1333407	$4,333,572
		Channel Fill	C.Y.	$3.25	159475	$518,294
		Detention Basin Excavation	C.Y.	$5.00	2944160	$14,720,800
		ROW	ACRE	$40,000.00	305	$12,191,809
		Hydroseed & Topsoil	ACRE	$2,500.00	305	$761,988
		Landscaping & Aesthetic Treatment	SF	$1.38	8455858	$11,652,100
	3	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	3	$285,969
	4	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$125,162.60	2	$250,325
	5	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	4	$620,008
	7	Barrel 300' Long, 72" DIAM. RCP Culvert	EA.	$765,931.10	1	$765,931
					Σ =	$46,100,797
Northern Channel		Channel Excavation	C.Y.	$3.25	1312755	$4,266,455
		Channel Fill	C.Y.	$3.25	33987	$110,457
		Detention Basin Excavation	C.Y.	$5.00	0	$0
		ROW	ACRE	$40,000.00	129	$5,167,264
		Hydroseed & Topsoil	ACRE	$2,500.00	129	$322,954
		Landscaping & Aesthetic Treatment	SF	$1.55	5627151	$8,722,084
	2	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$65,483.60	1	$65,484
	5	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	12	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13	Barrel 150' Long, 72" DIAM. RCP Culvert	EA.	$734,968.10	1	$734,968
					Σ =	$20,123,228
Reems Channel		Channel Excavation	C.Y.	$3.25	556650	$1,809,111
		Channel Fill	C.Y.	$3.25	40867	$132,818
		Detention Basin Excavation	C.Y.	$5.00	1594647	$7,973,235

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tab. .4

Loop 303 ADMP Update Proposed Channel Quantities

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
		ROW	ACRE	$40,000.00	164	$6,578,261
		Hydroseed & Topsoil	ACRE	$2,500.00	164	$411,141
		Landscaping & Aesthetic Treatment	SF	$1.52	3773632	$5,743,797
	5	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	2	$310,004
	6	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$184,841.60	1	$184,842
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	9	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
					Σ =	$23,662,090
El Mirage Channel/ AT&SF Railroad Channel		Channel Excavation	C.Y.	$3.25	1173435	$3,813,664
		Channel Fill	C.Y.	$3.25	126041	$409,635
		Detention Basin Excavation	C.Y.	$5.00	583671	$2,918,355
		ROW	ACRE	$40,000.00	201	$8,027,702
		Hydroseed & Topsoil	ACRE	$2,500.00	201	$501,731
		Landscaping & Aesthetic Treatment	SF	$1.60	7116719	$11,386,750
	5	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$155,002.10	1	$155,002
	7	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$214,681.10	1	$214,681
	9	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
	11	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
					Σ =	$28,340,119
Lower El Mirage Channel		Channel Excavation	C.Y.	$3.25	147095	$478,058
		Channel Fill	C.Y.	$3.25	0	$0
		Detention Basin Excavation	C.Y.	$5.00	205370	$1,026,850
		ROW	ACRE	$40,000.00	39	$1,552,376
		Hydroseed & Topsoil	ACRE	$2,500.00	39	$97,023
		Landscaping & Aesthetic Treatment	SF	$1.60	955406	$1,528,650
	7	Barrel 98' Long, 8'x6' Box Culverts	EA.	$271,031.10	1	$271,031
					Σ =	$4,953,988
Bullard Channel		Channel Excavation	C.Y.	$3.25	1954041	$6,350,633
		Channel Fill	C.Y.	$3.25	21347	$69,379
		Detention Basin Excavation	C.Y.	$5.00	150922	$754,610
		ROW	ACRE	$40,000.00	234	$9,354,696
		Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,669
		Landscaping & Aesthetic Treatment	SF	$1.59	9651566	$15,370,147
	12	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$363,878.60	1	$363,879
	13	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$393,718.10	2	$787,436
	16	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$483,236.60	1	$483,237
	17	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$513,076.10	1	$513,076
	18	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$542,915.60	1	$542,916
	19	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$572,755.10	1	$572,755
	19	Barrel 300' Long, 72" DIAM. RCP Culver	EA.	$2,069,005.10	1	$2,069,005
					Σ =	$37,816,437
RID Channel		Channel Excavation	C.Y.	$3.25	1624291	$5,278,947
		Channel Fill	C.Y.	$3.25	44629	$145,043
		Detention Basin Excavation	C.Y.	$5.00	593474	$2,967,370
		ROW	ACRE	$40,000.00	147	$5,881,662
		Hydroseed & Topsoil	ACRE	$2,500.00	147	$367,604
		Landscaping & Aesthetic Treatment	SF	$1.60	5141945	$8,227,112
	3	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$95,323.10	1	$95,323
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	2	$489,041
	9	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$274,360.10	1	$274,360
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	1	$304,200
					Σ =	$24,030,663
Tuthill Channel		Channel Excavation	C.Y.	$3.25	1454895	$4,728,409
		Channel Fill	C.Y.	$3.25	333963	$1,085,381
		Detention Basin Excavation	C.Y.	$5.00	681640	$3,408,200
		ROW	ACRE	$40,000.00	234	$9,353,979
		Hydroseed & Topsoil	ACRE	$2,500.00	234	$584,624
		[1]Landscaping & Aesthetic Treatment	SF	$1.55	8898906	$13,800,450
	8	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$244,520.60	1	$244,521
	10	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$304,199.60	3	$912,599
	11	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$334,039.10	1	$334,039
	14	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$423,557.60	1	$423,558
	15	Barrel 75' Long, 72" DIAM. RCP Culvert	EA.	$453,397.10	1	$453,397
					Σ =	$35,329,156

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Tabl 4

Loop 303 ADMP Update Proposed Channel Quantities

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
I-10 Channel	Channel Excavation	C.Y.	$3.25	75709	$246,054
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	ROW	ACRE	$40,000.00	14	$576,000
	Hydroseed & Topsoil	ACRE	$2,500.00	14	$36,000
	Landscaping & Aesthetic Treatment	SF	$1.60	627264	$1,003,622
				Σ =	$1,861,677
El Mirage East 1/2 Channel	Channel Excavation	C.Y.	$3.25	6430	$20,899
	Channel Fill	C.Y.	$3.25	22750	$73,936
	Detention Basin Excavation	C.Y.	$5.00	0	$0
	ROW	ACRE	$40,000.00	15	$613,382
	Hydroseed & Topsoil	ACRE	$2,500.00	15	$38,336
	Landscaping & Aesthetic Treatment	SF	$1.60	667973	$1,068,757
				Σ =	$1,815,310
				Sub Total =	*$333,888,655*
				30% Contingency =	*$100,166,597*
				Total =	***$434,055,252***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Table 4.5
Cost Comparison
Preferred Alternative vs. Value Engineering Recommendations

Proposed Alterantive	*Description*	[2] *Surface Channel Cost Estimate*	[3] *Culverts Cost Estimate*	[4] *Detention Basin Cost Estimate*	*Total Right of Way Cost Estimate*	[5] *Box Channel Cost Estimate*	[6] *Low Flow Channel Cost Estimate*	[7] *Landscape Cost Estimate*	*Total Cost Estimate*
Preferred Alternative									
SR303 L Channel Cost North	Total cost estimate to build proposed SR 303 L channel adjacent to Camelback and North along Loop 303	$8,205,956	$2,619,279	$24,691,065	$17,002,013	N/A	N/A	$18,481,675	$70,999,988
SR303 L Channel Cost South	Total cost estimate to build proposed SR 303 L channel adjacent to the proposed Loop 303 south of Camelback	$5,613,854	$1,922,234	$14,720,800	$12,191,809	N/A	N/A	$11,652,100	$46,100,797
Total Cost		*$13,819,810*	*$4,541,513*	*$39,411,865*	*$29,193,822*	*N/A*	*N/A*	*$30,133,775*	**$117,100,785**
[1] *50-Year Composite Box Alternative*									
SR303 L Channel Cost North	Total cost estimate to build proposed SR 303 L channel adjacent to Camelback and North along Loop 303	$6,128,670	$736,891	$13,974,072	$11,201,349	$120,083,527	N/A	$18,810,623	$170,935,132
SR303 L Channel Cost South	Total cost estimate to build proposed SR 303 L channel adjacent to the proposed Loop 303 south of Camelback	$2,539,758	$1,275,418	$15,661,108	$9,221,360	$39,666,576	N/A	$13,837,874	$82,202,094
Total Cost		*$8,668,429*	*$2,012,308*	*$29,635,180*	*$20,422,709*	*$159,750,103*	*N/A*	*$32,648,497*	**$253,137,226**
[1] *1,500 cfs Composite Box Alternative*									
SR303 L Channel Cost North	Total cost estimate to build proposed SR 303 L channel adjacent to Camelback and North along Loop 303	$7,357,450	$2,518,992	$14,868,678	$13,677,754	$57,862,384	N/A	$22,969,295	$119,254,553
SR303 L Channel Cost South	Total cost estimate to build proposed SR 303 L channel adjacent to the proposed Loop 303 south of Camelback	$2,478,754	$1,440,104	$12,808,342	$8,587,040	$23,694,364	N/A	$12,885,993	$61,894,597
Total Cost		*$9,836,204*	*$3,959,097*	*$27,677,020*	*$22,264,794*	*$81,556,748*	*N/A*	*$35,855,288*	**$181,149,150**
Low Flow (1,500 cfs) Box Alterantive									
SR303 L Channel Cost North	Total cost estimate to build proposed SR 303 L channel adjacent to Camelback and North along Loop 303	$7,242,965	$2,518,992	$14,868,678	$13,677,754	N/A	$29,237,297	$19,893,185	$87,438,871
SR303 L Channel Cost South	Total cost estimate to build proposed SR 303 L channel adjacent to the proposed Loop 303 south of Camelback	$2,390,553	$1,440,104	$12,808,342	$8,587,040	N/A	$21,496,725	$10,768,280	$57,491,045
Total Cost		*$9,633,518*	*$3,959,097*	*$27,677,020*	*$22,264,794*	*N/A*	*$50,734,022*	*$30,661,466*	**$144,929,916**

1. Cost does not include the cost of maintenance ramps/manholes, inlet grate/structures to box or potential increased utility conflicts due to increased structure depth from preferred alternative.
2. Includes earthwork, drop structures, hydroseed, etc...
3. Includes concrete, steel, headwalls, etc...
4. Includes earthwork, etc...
5. Includes earthwork, concrete, steel, etc...
6. Inlcudes earthwork, concrete, steel, etc...
7. Using $/sf from preferred alternative for consistency/comparison.

increased structure sizes all the way to the ultimate outfall. Even if the flow were conveyed directly to the ADOT/FCDMC basins north of I-10, those facilities would require significant improvement to accommodate the added volume.

This same situation presents itself on the SR303 L south channel segment. Again, a large volume of flow within the box must combine with the surface channel flow at the daylight point. This daylight location is proposed at a detention basin located just north of MC 85 along the SR303 L south channel. At this location the box structure must daylight to allow positive conveyance from this location to the ultimate outfall at the Salt/Gila river(s). This is a result of the wide shallow flood plain in the right overbank area of the Salt/Gila river(s) which is typical of this location. The topography is somewhat bowl shaped from this point to the river and would result in the box structure profile intersecting the river alignment well below natural grade. As above, this situation results in a larger runoff volume at this location than would be encountered by the preferred alternative due to the reduction and in some cases the elimination of upstream offline basins formerly part of the preferred plan. Again, the result is a much larger detention basin facility at this location.

VE Under Estimated Actual Discharges – The discharges used for the VE team's estimate of the required box size appear to be based upon the discharges presented along the channel reaches in the preferred alternative. Although the VE team used these flow rates, they recommended an approximate 50-year design. Further the VE recommends a surface channel that will carry all flow in excess of the 50-year discharges.

Given the above assumptions, the 50-year discharges estimated at the concentration points along the proposed channel alignment are much higher than those used by the VE team to estimate the required box sizes. A comparison is shown below. The values used by the VE team are the 100-year, 24-hour discharges presented as a result of the implementation of the preferred alternative as of 2/15/02 and are labeled 'VE Q'. The values used for the 50-year storm box and the 1,500 cfs box in this analysis estimated from the HEC-1 model are labeled '50-year Box' and '1,500 Box' respectively.

VE Q – The VE Q values ranged from 800 cfs to 2,400 cfs on the SR303 L channel north and from 570 cfs to 1,350 cfs on the SR303 L south. They are the result of upstream offline detention/attenuation facilities and routing.

50-year Box – The 50-year box values were estimated using the 50-year rainfall data corresponding with the project area in the HEC-1 hydrologic model. These values ranged from 1,100 cfs to 5,300 cfs on the SR303 L channel north and from 465 cfs to 2,300 cfs on the SR303 L channel south. Per the VE recommendation, these values have not been routed through offline facilities. Only discharges in excess of the 50-year storm event will actually begin to pond within the proposed surface channel.

1,500 Box – The 1,500 cfs capacity box values were estimated using a constant discharge conveyed through the box of 1,500 cfs. This was diverted from the 100-year surface flow and the proposed surface channel and offline basins carried the remaining discharge.

At first glance, the VE team seemed to use a conservative approach by using the '100-year' discharges from the preferred alternative and then recommending the actual facility be constructed based on the 50-year storm discharges. The problem is that the 100-year values used by the VE team were derived from a model in which the discharges had first been routed to offline basins, attenuated and then routed downstream to the next concentration point along the channel. This means that the values used by the VE team represented flow rates that had been significantly reduced due to extensive routing and attenuation upstream.

The VE team recommended that the box structure be sized for about the 50-year storm event with all excess flow carried by the channel and attenuated by the offline basins. By this definition, no flow is attenuated until the surface channels begin to flow. This makes sense since diversion of lower flows to the offline basins would require very complicated and likely expensive structures to 'divert' flow from the underground box to the proposed offline basins.

In any event, the assumption that the box will carry all flow up to the 50-year storm event and then excess will be carried by the surface channel and attenuated in offline basins requires a model that predicts 50-year discharges without diversion to offline detention basins. These discharges are then the basis for the required box size. It should be remembered that the discharges assumed by the VE team were the discharges resulting from the benefits of extensive detention/attenuation due to the operation of the offline detention basins per the preferred alternative for the 100-year storm event. In other words, the actual un-attenuated discharges from the 50-year storm are much larger than the attenuated discharges resulting from the 100-year storm event. This results in andapples' to 'oranges' comparison between the two conditions. Ultimately, it means that the discharges used by the VE team to size the required box structure were very low and not consistent with the actual values obtained by running the appropriate hydrologic model.

Recognizing this fact, URS chose to do an additional analysis to estimate the impact of a box structure that had a specific capacity unrelated to storm event. This value was approximated based on an average of the discharges used to size the facility recommended by the VE team. Taking an average of those discharges, the value of 1,380 cfs was obtained. The actual value used was 1,500 cfs in an effort to get a larger amount of discharge out of the surface channel. Under this assumption however, the surface channel and offline basins are modeled by using diverts at concentration points along the proposed channel alignments that simulate a box carrying 1,500 cfs. Since the effect of the discharge is to accumulate as it progresses downstream, the overall effectiveness of a 1,500 cfs maximum capacity box on the surface channel is minimal. The 100-year discharges along the channel range from 1,297 cfs to 6,343 cfs along the SR303 L north segment and from 558 cfs to 3,290 cfs along the SR303 L south segment (before attenuation in offline basins). This means that after removing 1,500 cfs from the total, there is still up to 4,800 cfs and 1,800 cfs in the SR303 L channels north and south respectively at the downstream ends.

Unfortunately, the VE team sized the box for the discharge values tabulated at each concentration point along the proposed channel for the preferred alternative. This is inadequate however, due to the fact that it neglects the additional volume of discharge that was diverted from the channel to the various offline detention basins upstream of the given concentration points. The VE team could have used its method if there had not been diverts to offline basins between concentration points thereby decreasing the total volumes conveyed within the system from point to point. In fact, the VE team should not have used this approach since the team's recommendation called for an underground system that was to be sized prior to any diversion of volume to proposed offline basins.

As a result of discrepancies between the assumptions employed by the VE team and those actually used to model the situation with this in depth analysis, there is a significant underestimation of required box size, surface channel size and ultimately the cost of the composite channel alternative in general. See Table 4.6 for a detailed comparison of the composite channel assumptions made by the VE team to those actually required by this detailed analysis.

5.0 Conclusions/Recommendations

5.1 Alternative Channel Sizing

In reviewing the results of the analysis, it has become apparent that even a large capacity underground box structure has little impact to the overall required top width of the surface channel. The main reason for this can be tied to the proposed channel profiles.

The approximate channel profile set by the preferred alternative was a function not only of hydraulics but also of existing topography; crossing of existing canals; roadways; railroads and other similar structures. In addition to these things it was important to maintain a profile that would allow for a low flow drain pipe to bleed the adjacent offline detention facilities. These drains must be able to daylight in a reasonable amount of distance within the proposed channel bottom.

Given all of the above constraints on the channel profile, the vertical (profile) dimension was generally held per the preferred alternative. The bottom width was then varied to achieve the desired conveyance capacity. Since the 6:1 side slopes are essential in maintaining the desired multi-use character/function of the surface channel, the daylight lines for the channel banks are nearly the same regardless of the reduced bottom width. In other words, the channel bottom width accounts for approximately 5% (south channel) and 32% (north channel) of the total channel top width. This corroborates the findings reported in section 3 above. If the total bottom width of the channel were reduced by approximately 60% and the bottom width represented approximately 32% of the total top width, the resultant decrease in total channel top width would be approximately 20%.

Based on these facts, there is little benefit in terms of reduced surface channel footprint realized by using an underground box structure to convey the discharges. Only by significantly increasing the channel side slopes could there be any significant land savings on the surface channel. Unfortunately, by increasing the channel side slopes, the multi-use character of the facility would be seriously inhibited.

Table ...
VE Assumed Values
versus Actual Values
from Composite Channel Analysisl

Channel Location	*Value Engineering*			*50-Year Box*			*1,500 cfs Box*		
	No. & Size of Barrels	Average Price per LF $/LF	Average Surface Channel TW (ft)	No. & Size of Barrels	Average Price per LF $/LF	Average Surface Channel TW (ft)	No. & Size of Barrels	Average Price per LF $/LF	Average Surface Channel TW (ft)
SR303 L North Channel	1 to 2 - (8'x8', 10'x8', 10'x12')	$794	54	1 to 7 - 10'x12'	$2,300	162	1 to 2 - 10'x12'	$1,100	194
SR303 L South Channel	2 to 2 - (8'x8', 10'x8', 10'x12')	$806	24	1 to 2 - 10'x12'	$1,100	133	1 to 2 - (10'x8', 10'x12')	$775	135

5.2 Alternative Cost Estimate(s)

Based upon a comparison of the cost estimate prepared for the three alternatives discussed above to the preferred alternative, the substitution of any one of the three for the preferred would be prohibitively expensive.

From Table 4.5, it is obvious that the underground box option is prohibitively expensive from the cost of the box structure alone. This is clearly shown by the fact that the cost of the box would have to be less than the difference between the cost of the preferred alternative and the reduced channel/basin alternative due to conveyance in an underground box.

For the 50-year option, the maximum cost of the box would have to be 24 million or less to make this option feasible. The 50-year cost estimate for the box structure only was approximately 159.7 million. This is the cost for concrete, steel, earthwork, and structural backfill only. The cost does not include maintenance/access ramps, manholes or like structures. The cost does not include the required inlet structures that would be necessary to convey surface flow from the channel above to the underground box. Given that long stretches of channels, storm drain, culverts, etc... can typically be constructed for less than relatively shorter runs, (from a review of actual bids from other projects), even if the box structure could be built for 1/2 of the estimated cost (159.8/2 = 79.9 million) the total estimate would still be approximately 173.2 million (93.3 + 79.9 = 173.2 million) which is still 56.2 million more than the preferred alternative.

Similarly, for the 1,500 cfs box option, the minimum required cost savings would need to be approximately 17.4 million. Since the 1,500 cfs box cost estimate was approximately 81.6 million for the box structure alone, this option is still too expensive. Again, if the 1,500 cfs box were actually built for 1/2 of this cost, the structure would be approximately 40.8 million (81.6/2 = 40.8 million) and the total project would be approximately 140.3 million or approximately 23.3 million more costly than the preferred alternative.

Finally, the 1,500 cfs low flow concrete channel option appears to be the cheapest of the three alternatives to the preferred. For this option to be feasible however, the required savings must be approximately 22.8 million or less. Following the same logic from above, if the cost of the low flow channel structure itself were actually ½ of the estimate (50.7 million / 2 = 25.4 million), the total project cost would be approximately 119.6 million or approximately 2.5 million more expensive than the preferred alternative.

In conclusion, the total cost of the preferred alternative is still the least cost alternative. It is recommended that this alternative remain the preferred option.

APPENDIX F

CHANGE ORDER 12

Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40

MCDOT DCR Channel and Basin Evaluation/Comparison

Prepared for:

Flood Control District of Maricopa County

June 2004

Prepared by:

URS

Comment Responses for Change Order #12 – General Comments

1. **Figure 1.1 – Let's not show Town of Buckeye and leader arrow.** *Removed reference to Buckeye.*
2. **Page 3 – Snytax.** *Corrected.*
3. **Page 3 – This information is confusing.** *The quantity or cost estimated with the DCR and the range of values estimated for the three alternatives have been removed from the text in this location.*
4. **Table 2.1 – Need an exhibit to identify where these channel reaches are located.** *Figures 2.1 – 2.3 have been added to the submittal to show the channel reaches, basins, and control points for each alternative.*
5. **Table 2.2 – Need an exhibit to show where these basins are located.** *Please refer to Figures 2.1 – 2.3.*
6. **Table 3.1 – Where is CP113A? Exhibit please.** *Please refer to Figures 2.1 – 2.3.*
7. **Page 5 – Remove redundant sentence.** *OK.*
8. **Page 5 – Will need an IGA w/ Luke.** *We have added a note that the drainage from the post storm outlet pipe will require an Intergovernmental Agreement (IGA).*
9. **Page 6 – Remove "this was not specifically stated by the report but is…."** *Removed.*
10. **Page 7 – Is there a graphics to reference to?** *Added a reference to Figure 2.5 which shows the proposed channels and basin designs for alternatives 1-3.*
11. **Page 8 – Why?** *Added the statement "Since the excess runoff from sub-basin 106 would impact the SR 303L channel (even using the 50 year storm) when onsite retention is assumed 80% effective, it has been included in this analysis.*
12. **Page 9 – Need graphic with Control Points.** *Reference added Figures 2.1-2.3.*
13. **Figure 3.2 – Syntax.** *Made suggested changes.*
14. **Page 10 – State in the models being used whether or not it includes proposed FCD projects upstream facilities and effects thereof.** *Added additional description in Section 3.3 Alternatives Analysis.*
15. **Page 11 – Put in a table?** *The changes in inflow volume are now shown in Table 3.3.*
16. **Page 12 – Put in a table?** *The changes in inflow volume are now shown in Table 3.4.*
17. **Page 13 – Put in a table?** *The changes in inflow volume are now shown in Table 3.5.*
18. **Table 3.3 – Where are these located?** *Figures 2.5 – 27 show the proposed alternatives and associated concentration points.*
19. **Table 3.4 – Location of Basin ID?** *Figures 2.5 – 2.7 show the proposed alternatives and the proposed basin locations.*
20. **Table 3.4 – Can these be reduced if off-line? Please comment in text and stipulate what other "facilities" would be required if changed to off-line.** *Yes, however, off-line would require weir structures and would result in lower excavation quantity. Since the 303L will require large amounts of fill, on-line basins where used. A detailed note was added to the table.*

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SR 303L 50-year Channel Improvement

1.0 Introduction and Purpose

At the request of the Flood Control District of Maricopa County (FCDMC), URS has completed an evaluation of the drainage channels proposed as part of the SR 303L DCR from the Gila River north to Bell Road. URS evaluated the drainage facilities proposed with each DCR for a less frequent (100-year) design storm. Three alternatives were developed as part of this study and are listed below:

- Alternative 1 – The off site drainage channel proposed by the MCDOT DCR is to be increased in conveyance capacity to the 100-year, 24-hour design storm event. The proposed retention basin facilities will not be changed.
- Alternative 2 – The off site drainage channel proposed by the MCDOT DCR is not to be changed. The proposed retention basin facilities will be increased in volume to accommodate the runoff volume generated during a 100-year, 24-hour storm event.
- Alternative 3 – A combination of increased channel conveyance capacity and retention basin volume will be analyzed to provide the level of flood protection required by the FCDMC as described in the Loop 303 ADMP Update project.

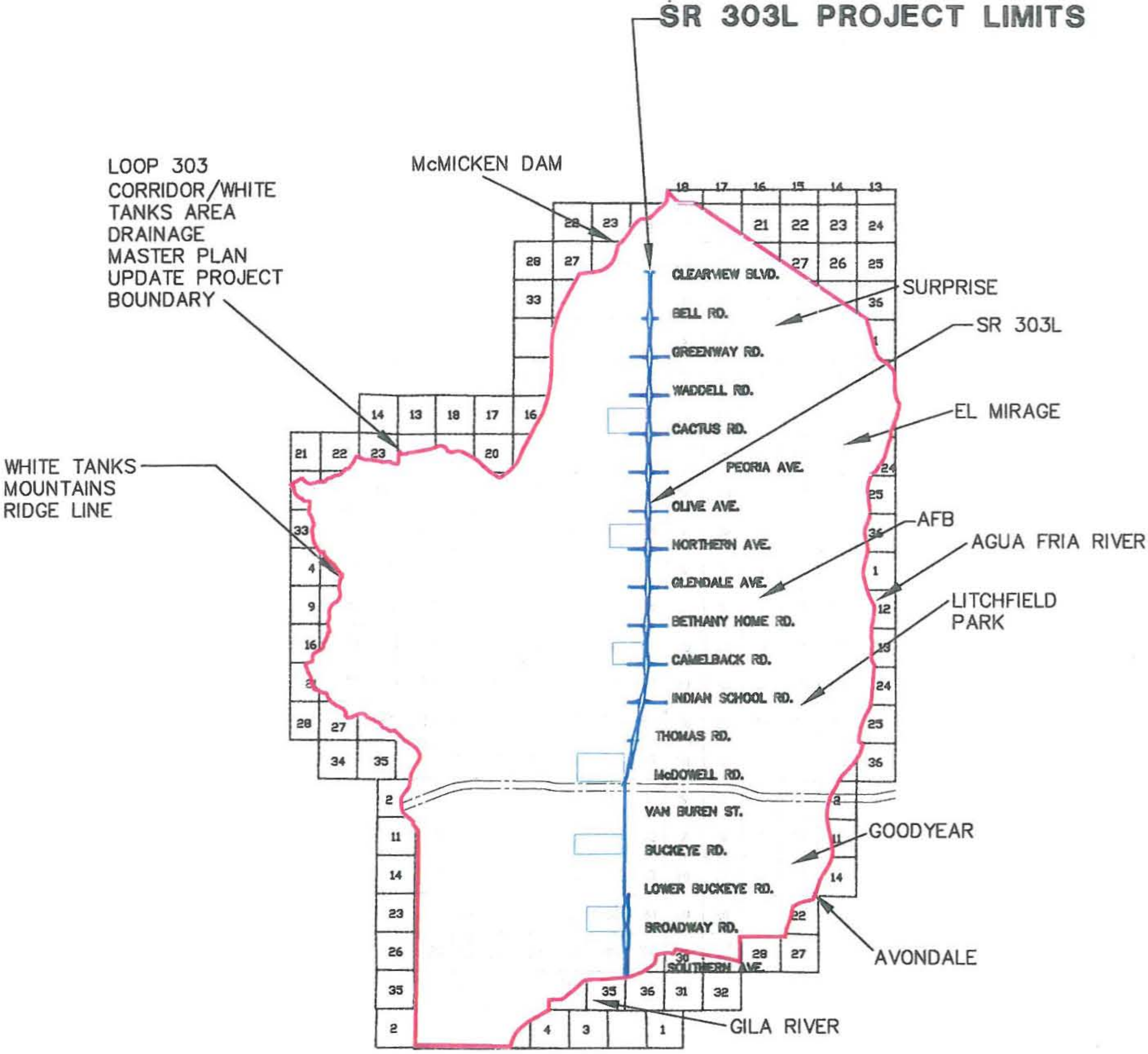
See Figure 1.1 for the project location map.

One objective of this study is to account for significant differences in the cost estimate prepared for the SR 303L portion of the Preferred Alternative (prepared for the Loop 303 ADMP Update Project prior to the Value Engineering - conducted in February, 2002), and the MCDOT DCR proposed 50-year channel. Table 1.1 shows a quantity/cost comparison of the major cost items.

URS was also asked to perform a quantity/cost analysis of the preferred alternative presented in the MCDOT DCR using the methodology and criteria specified in the Loop 303 ADMP Update. This would allow a direct comparison of costs between the MCDOT DCR (50-year system) and the three alternatives listed above (100-year system). See Meeting Minutes "Loop 303 Corridor/White Tanks ADMP Update, SR 303L Alternatives – C.O. #12", dated February 20, 2003, in Appendix A.

The SR 303L DCR was completed in two parts. The first segment from the Gila River north to Indian School Road was addressed in the design concept report entitled, "Initial Design Concept Report, State Route Loop 303 (SR 303L), MC 85 to Indian School Road", by HDR Engineering, Inc, dated September 2002. This portion will be referred to as the 'south segment'. The second segment from Indian School Road to Clearview Boulevard was addressed in the design concept report entitled, "Initial Design Concept Report, SR 303L Indian School Road to Clearview Boulevard", by URS, dated April 24, 2002. This portion will be referred to as the 'north segment'.

The first portion of this study involved a detailed review of the assumptions, design calculations, quantities and cost estimates associated with both the north and south DCR channel segments



VICINITY MAP
N.T.S.

URS

FIGURE 1.1
JUNE 2004

Table 1.1

MCDOT DCR vs. Preferred Alternative

Summary of Major Cost Factors:

Item	*MCDOT DCR - 16.6 M* quantity	cost $$ K=Thousand M=Million	Explaination	*Preferred Alternative, VE - 71 M* quantity	cost $$ K=Thousand M=Million	Explaination	difference Δ
Storm	50-year	n/a	ADOT design criteria	100-year	n/a	ADOT design criteria	n/a
Channel R/W	0.97AC	$42.3 K	channel in R/W, no daylighting	[4]157.5 AC	6.30 M	channel not in R/W, dayligh W/DTM	+6.26 M
Basin R/W	88.6 AC	3.90 M	no daylighting	150 AC	6.00 M	daylighting, DTM used	+2.10 M
[2]Channel and Basin Treatment/LA	*	**4.21 M	concrete channel, grass lined basins	275 AC	18.48 M	aesthetic & multi-use facility	+14.27 M
[1]Channel Excavation	371,000 cy	$650 K	no daylighting, area based on constructed depth and side slopes	2 M cy	6.65 M	topography, outfall, cross section	+6.00 M
Culverts	EA	2.00 M	very simple $/foot estimate	EA	2.60 M	detailed estimate based on ADOT 'B-standards'	+0.60 M
Basin Excavation	2.1 M cy	3.20 M	no daylighting, simplified method	4.9 M cy	24.69 M	daylighting, DTM used	+21.49 M
Low-flow storm drain	4.6 miles	2.68 M	48" to 72" pipe	1.5 miles	0 M	***	-2.68 M

Preferred Alternative: Per the Loop 303 ADMP Update - Value Engineering +48.04 M

* Channel is concrete, no quantity was asigned for proposed grass lined basins.
** Cost of concrete lining only.
*** Low flow drain cost was assumed part of the contingency.
**** North channel only, does not include contingencies.
1. Factors contributing to cost difference:
   A - VE unit cost is $1.5 higher per CY.
   B - channel limits and outfall different, VE outfall at Bullard is flatter while the channel is deeper Wash therefore, the terrain from SR 303L to outfall. This creates substantially more cut due to daylighting requirements.
   C - DCR quantities don't consider topography/daylighting
2. No allowance for grass lined basin made in estimate.
3. Culvert lengths used with ADMP Update were much shorter than those used with the DCR, however, the DCR does not account for reinforceing steel, inlet/outlet aprons, headwalls, increased cost for additoinal barrels of the structure based on added structural steel and concrete.
4. Under the assumption used with the L303 ADMP Update, all right of way is outside of the ADOT SR 303L roadway and therefore, 275 AC are required. the value shown here assumes that the SR 303L right of way may be used without encroaching on the required clear zone for the roadway.

completed for MCDOT. The purpose of the second portion of the study was to re-sized the off site drainage improvements designed for the DCR to meet the requirements specified by the FCDMC as described in the scope of work for the Loop 303 Corridor/White Tanks Area Drainage Master Plan Update project.

The design storm used for the off site improvements (proposed with the north segment of the DCR) was based on a 50-year, 24-hour design storm frequency. The off site improvements for the south segment were not directly addressed by the DCR. The DCR simply stated that the off site drainage improvements for that portion of the SR 303L would be managed by the FCDMC ADMP Update project.

1.1 Summary of Results

Since the DCR did not provide a quantity/cost estimate for the south segment portion of the SR 303L, all of the quantity/cost comparisons contained within this report are based on the north segment DCR only.

The results of this study show that the quantities and cost estimate prepared for the MCDOT SR 303L DCR were not at the same level of detail as those generated for the Loop 303 ADMP Update project. This was due to a more limited scope of work of a DCR level report. As a result, several simplifying assumptions were used to complete the DCR estimate, which in some cases results in significantly lower quantities than those determined with the Loop 303 ADMP Update project. In addition the MCDOT DCR used different unit costs to assign dollar amounts to estimated quantities versus those used with the Loop 303 ADMP Update project.

URS performed a detailed quantity/cost estimate for the preferred alternative 2B (presented by the MCDOT DCR) using the methodology and criteria consistent with that used to generate the estimates for alternatives 1-3 above. This allows a direct comparison of the alternatives analyzed relative to the preferred alternative presented by the MCDOT DCR. These costs will be referred to as the MCDOT DCR Normalized costs.

The cost estimates for the MCDOT DCR preferred alternative (labeled 2B in the report) as well as for the north segment of the SR 303L channel for the three alternatives evaluated by this study are listed below:

MCDOT DCR – $16,000,000
MCDOT DCR Normalized - $48,160,000 (Δ = +$31,560,000)
Alternative 1 – $46,690,000 (Δ = +$30,090,000)
Alternative 2 – $50,390,000 (Δ = +$33,790,000)
Alternative 3– $48,700,000 (Δ = +$32,100,000)

The cost estimate associated with Alternative 1 above is somewhat misleading when compared with the MCDOT DCR normalized cost estimate. Under Alternative 1, the scope of work for change order #12 directed URS *not* to alter the basins proposed with the MCDOT DCR. Rather, those basin sizes/geometrics proposed by the MCDOT DCR were held constant while the channel was improved to convey the runoff generated by the 100-year storm event. By contrast, the purpose of the MCDOT DCR normalized cost estimate was to give both a directly comparable and realistic cost estimate. Therefore, before preparing the MCDOT DCR normalized estimate, URS resolved some modeling issues (discussed in detail below) and reran the 50-year HEC-1 model. The results were significantly higher estimates for the 50-year runoff volume at the proposed Cactus basin and slightly lower 50-year runoff volume estimates at the Northern Avenue and Camelback Road basins respectively. The net effect of these changes was an increase in total basin footprint and earthworks associated with the MCDOT DCR normalized quantity/cost estimate.

The above earthwork/quantity issue does not arise in Alternative 2. The reason is that the discharges not in the MCDOT DCR do not result in significant change to the peaks within the channels due to hydrograph combination and timing. Also, with Alternative 2, the channel quantities were based on zero freeboard for the existing hydrologic condition model per the ADMP Update criteria. The MCDOT DCR design allows for approximately 1 to 2 feet of freeboard along the proposed channel.

As a result of the above, the MCDOT DCR normalized alternative estimated basin costs were approximately $4,400,000 higher than those shown for alternative 1.

The methods used to estimate the quantities and costs associated with the Loop 303 ADMP Update project were used to determine the estimates presented herein regarding Alternatives 1 through 3. The major factors affecting the cost differences between the alternatives and the MCDOT DCR are briefly listed below.

- Design storm frequency
- Channel R/W
- Basin R/W
- Channel and basin lining/treatment/landscape
- Channel excavation
- Culverts
- Basin Excavation

Some of the major reasons for the large differences in the cost associated with the listed quantities above are as follows:

- Design storm frequency – per the scope of work for this study, the design storm was the 100-year event, therefore peak discharges and volumes of runoff increase.
- Channel R/W – The MCDOT DCR did not estimate a channel footprint based on daylighting as the alternatives do. Also, the increased channel cross section associated with the alternatives was due to the less frequent design storm.
- Basin R/W – As above, the basin footprints estimated in the MCDOT DCR do not account for daylighting or an access road around the perimeter. For alternatives 1 through 3, basin footprints were determined based on daylighting using a DTM and a basin template that includes an access road along the perimeter.
- Channel and basin lining/treatment/landscape – The MCDOT DCR does not account for the cost of hydro seeding in the proposed grass lined basins. Also, the DCR does not

explicitly account for reinforcing of the 6" and 8" proposed concrete channel lining. The alternatives assume an 8" thick concrete lining with reinforcement.

- Channel excavation - The MCDOT DCR did not estimate a channel cross section based on daylighting as the alternatives do. The increased channel cross section associated with the alternatives was due to the less frequent design storm.
- Culverts – The MCDOT DCR allows ponding of water within the channel at culvert inlets that exceeds the computed water surface elevations within the channel. This results in fewer required barrels to convey a given discharge. The DCR does not account for the potential backwater impacts on the channel design. The alternatives limit the headwater at culvert inlets to the computed water depth within the proposed channel. Also, the MCDOT DCR does not explicitly account for inlet/outlet aprons, headwalls or reinforcing steel as the alternatives do.
- Basin excavation - The MCDOT DCR did not estimate basin excavation based on daylighting with a DTM as the alternatives do. The MCDOT DCR did not account for the proposed 15-foot wide perimeter access roads along the basins.

In addition to the major items listed here, differences in unit costs between the MCDOT DCR and the alternatives also contributed to the difference in cost. These differences are described in detail in sections four and six of this report. Tables 1.2 – 1.5 summarize the items listed above. Figures 1.2 – 1.5 show a typical cross-section for each of the alternatives as well as the MCDOT DCR.

2.0 Data Collection

In order to complete the first portion of this study, URS initiated a data collection phase to collect the data used to prepare the DCR's submitted to MCDOT for both the north and south channel segments of the SR 303L. This information included the DCR's as well as accompanying computations, worksheets, quantities, costs and any other significant supporting data. If a hydrologic model was produced as part of the DCR, that information was also reviewed for this analysis.

Using all of the information gathered as part of the Data Collection phase of this study, URS summarized the design flows, channel geometry, basin geometry and other significant characteristics of the MCDOT off site drainage design. Table 2.1 is a summary and comparison of the proposed drainage channel characteristics. Table 2.2 is a summary and comparison of the proposed basin characteristics associated with the SR 303L for the following studies:

- The SR 303L DCR for the north segment drainage channel from Indian School Road to Clearview Boulevard (channel limits are from Indian School Road to Bell Road.
- The SR 303L DCR for the south segment drainage channel from Indian School Road to the Gila River.
- The proposed channel along the SR 303L from the Gila River to Greenway Road as presented by the Loop 303 Corridor/White Tanks Area Drainage Master Plan Update.

Figures 2.1 – 2.3 show the proposed alternatives and associated concentration points.

Table 1.2

MCDOT DCR vs. Alternative 1

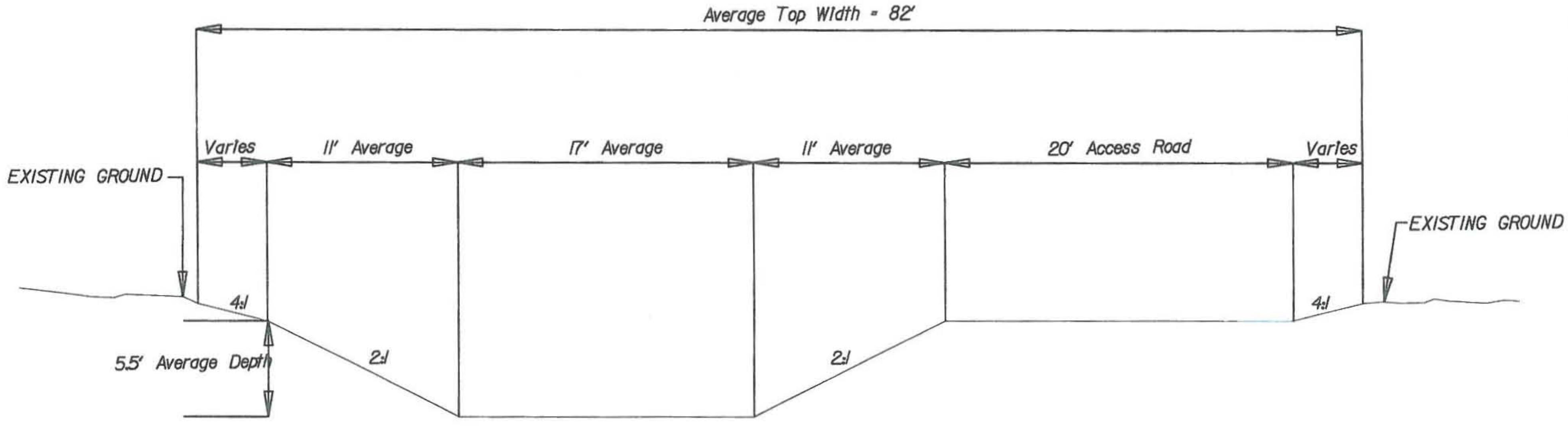
Summary of Major Cost Factors:

Item	*quantity*	*MCDOT DCR - 16.6 M* *cost $$* K=Thousand M=Million	*Explaination*	*quantity*	*****Alternative 1 - Improve Channel Only - 46.69 M* *cost $$* K=Thousand M=Million	*Explaination*	*difference* Δ
Storm	50-year	n/a	ADOT design criteria	100-year	n/a	ADOT design criteria	n/a
Channel R/W	0.97AC	$42.3 K	channel in R/W, no daylighting	41.1 AC	1.64 M	use available SR 303L R/W, daylight with DTM	+1.60 M
[3]Basin R/W	88.6 AC	3.90 M	no daylighting	105.1 AC	4.20 M	daylighting, DTM used	+0.30 M
[2]Channel and Basin Treatment/LA	*	4.21 M	concrete channel, grass lined basins	98.2 AC	15.23 M	includes concrete lining and hydroseed in basins	+11.02 M
[1]Channel Excavation	371,000 cy	$650 K	no daylighting, area based on constructed depth and side slopes	444,000 cy	1.44 M	daylighting, DTM used	+0.79 M
[3]Culverts	EA	2.00 M	very simple $/foot estimate	EA	6.27 M	estimate using ADOT 'B-standards' lengths modified per DCR	+4.27 M
[3]Basin Excavation	2.1 M cy	3.20 M	no daylighting, simplified method	2.39 M cy	11.97 M	daylighting, DTM used	+8.77 M
Low-flow storm drain	4.6 miles	2.68 M	48" to 72" pipe	5.0 miles	5.76 M	48" to 78" pipe	+3.08 M

Alternative 1: Improve 50-year DCR basins for the 100-year storm, do nothing to channel   +29.83 M

* Channel is concrete, no quantity was asigned for proposed grass lined basins.
** Cost of concrete lining only.
*** Low flow drain cost was assumed part of the contingency. .
**** North channel only, does not include contingencies.

1. Factors contributing to cost difference:
   - ***A*** - Alternative unit cost is $1.5 higher per CY.
   - ***B*** - channel is larger due to 100-yr capacity
   - ***C*** - DCR quantities don't consider topography/daylighting
2. No allowance for grass lined basin made in estimate.
3. Note: The basin quantities are based on the MCDOT DCR and the quantities contained within. These quantities did not account for a 15' access road which was presented as part of the MCDOT basin concept. The quantities did not account for the increase in volume due to the HEC-1 model modification that includes discharges from sub basin 106 as well as the combination of the hydrograph for the operation R120. Since Alternative 1 does not make any change to the original basins, these quantities were generated from the MCDOT design.



TYPICAL SECTION

Alternative 1
(Looking Downstream)
N.T.S.

URS

FIGURE 1.2
JUNE 2004

Table 1.3

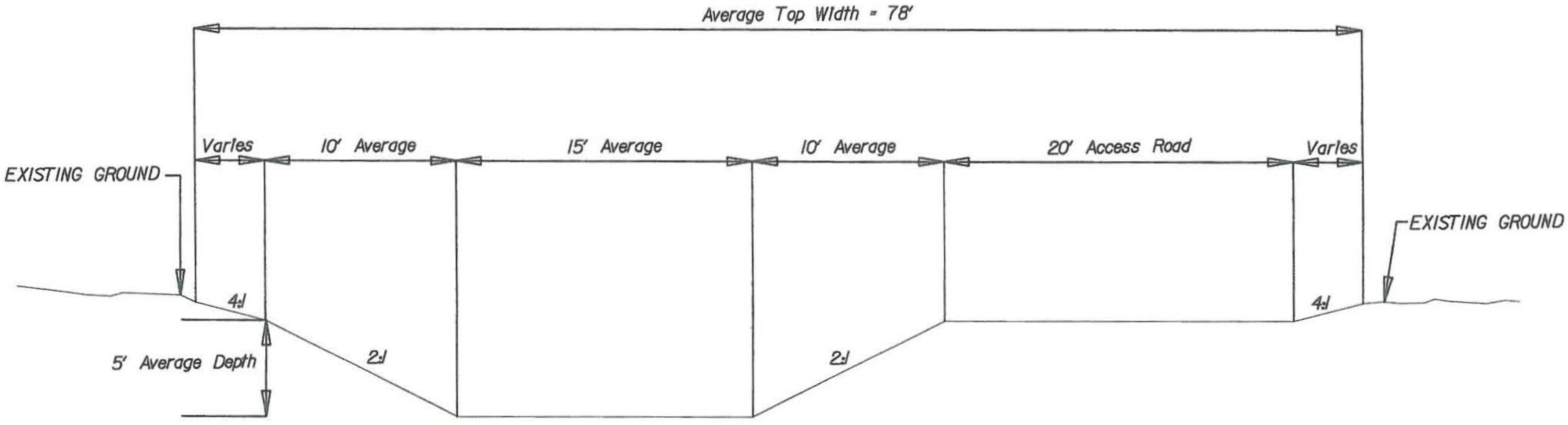
MCDOT DCR vs. Alternative 2

Item	MCDOT DCR - 16.6 M quantity	cost $$ K=Thousand M=Million	Explaination	****Alternative 2 - Improve Basins Only - 50.39 M quantity	cost $$ K=Thousand M=Million	Explaination	difference Δ
Storm	50-year	n/a	ADOT design criteria	100-year	n/a	ADOT design criteria	n/a
[3,5]Channel R/W	0.97AC	$42.3 K	channel in R/W, no daylighting	36 AC	1.44 M	use available SR 303L R/W, daylight with DTM	+1.40 M
Basin R/W	88.6 AC	3.90 M	no daylighting	128.1 AC	5.12 M	daylighting, DTM used	+1.22 M
[2]Channel and Basin Treatment/LA	*	4.21 M	concrete channel, grass lined basins	122 AC	14.96 M	includes concrete lining and hydroseed in basins	+10.75 M
[1,5]Channel Excavation	371,000 cy	$650 K	no daylighting, area based on constructed depth and side slopes	482 K cy	1.57 M	daylighting, DTM used	+0.92 M
Culverts	EA	2.00 M	very simple $/foot estimate	EA	5.65 M	estimate using ADOT 'B-standards' - lengths modified per DCR	+3.65 M
Basin Excavation	2.1 M cy	3.20 M	no daylighting, simplified method	3.1 M cy	15.70 M	daylighting, DTM used	+12.50 M
Low-flow storm drain	4.6 miles	2.68 M	48" to 72" pipe	5.0 miles	5.85 M	48" to 78" pipe	+3.17 M

Alternative 2: Improve 50-year DCR channel for the 100-year storm, do nothing to basins +33.61 M

* Channel is concrete, no quantity was asigned for proposed grass lined basins.
** Cost of concrete lining only.
*** Low flow drain cost was assumed part of the contingency.
**** North channel only, does not include contingencies.

1. Factors contributing to cost difference:
   - ***A*** - Alternative unit cost is $1.5 higher per CY.
   - ***B*** - channel is larger due to 100-yr capacity
   - ***C*** - DCR quantities don't consider topography/daylighting
2. No allowance for grass lined basin made in estimate.
3. Accounts for increased top width due to 100-year spread of water surface.
4. Used 10'x6' RCB instead of the 5'x6', 6'x4', 6'x6' and 6'x8' sizes used in the DCR.
5. The channel template used the ADMP criteria which include a 20' access road versus the 15' access road used with the DCR.



TYPICAL SECTION

Alternative 2
(Looking Downstream)
N.T.S.

Flood Control District of Maricopa County

URS

FIGURE 1.3
JUNE 2004

Table 1.4

MCDOT DCR vs. Alternative 3

Summary of Major Cost Factors:

Item	MCDOT DCR - 16.6 M			****Alternative 3 - Combined 1&2 - 48.70 M			
	quantity	*cost $$* K=Thousand M=Million	*Explaination*	*quantity*	*cost $$* K=Thousand M=Million	*Explaination*	*difference* Δ
Storm	50-year	n/a	ADOT design criteria	100-year	n/a	ADOT design criteria	n/a
Channel R/W	0.97AC	$42.3 K	channel in R/W, no daylighting	48.3 AC	1.93 M	use available SR 303L R/W, daylight with DTM	+1.89 M
Basin R/W	88.6 AC	3.90 M	no daylighting	123.9 AC	4.96 M	daylighting, DTM used	+1.06 M
[2]Channel and Basin Treatment/LA	*	4.21 M	concrete channel, grass lined basins	119 AC	14.56 M	includes concrete lining and hydroseed in basins	+10.35 M
[1]Channel Excavation	371,000 cy	$650 K	no daylighting, area based on constructed depth and side slopes	442 K cy	1.44 M	daylighting, DTM used	+0.79 M
Culverts	EA	2.00 M	very simple $/foot estimate	EA	5.46 M	estimate using ADOT 'B-standards' - lengths modified per DCR	+3.46 M
Basin Excavation	2.1 M cy	3.20 M	no daylighting, simplified method	2.77 M cy	13.83 M	daylighting, DTM used	+10.63 M
Low-flow storm drain	4.6 miles	2.68 M	48" to 72" pipe	5.0 miles	6.36 M	48" to 78" pipe	+3.68 M

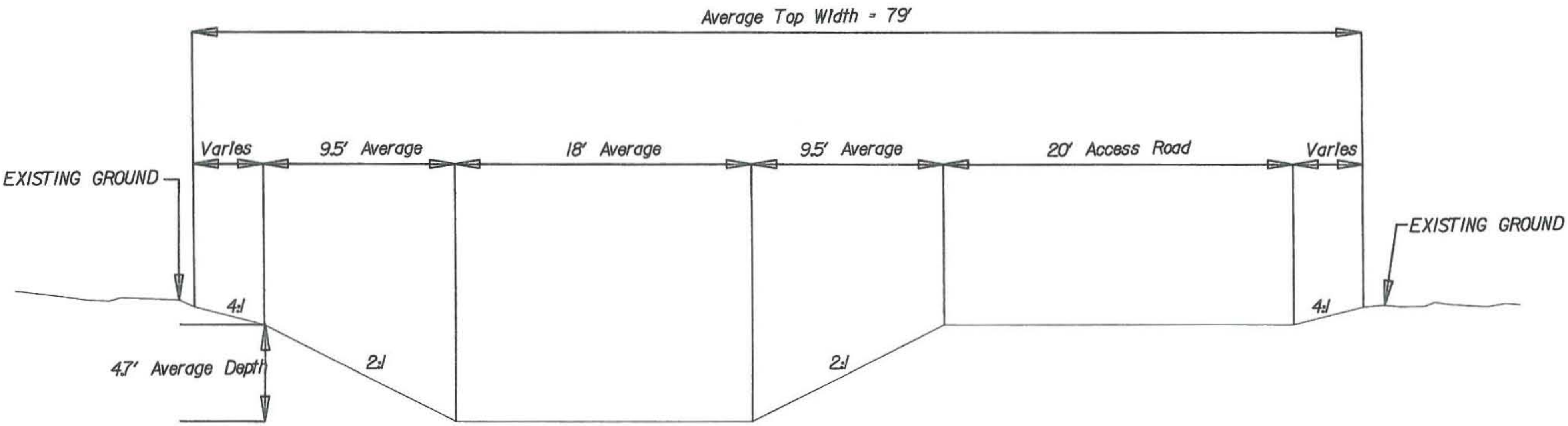
Alternative 3: Improve 50-year DCR channel and basins for the 100-year storm +31.86 M

* Channel is concrete, no quantity was asigned for proposed grass lined basins.
** Cost of concrete lining only.
*** Low flow drain cost was assumed part of the contingency.
**** North channel only, does not include contingencies.

1. Factors contributing to cost difference:

   A - Alternative unit cost is $1.5 higher per CY.
   B - channel is larger due to 100-yr capacity
   C - DCR quantities don't consider topography/daylighting

2. No allowance for grass lined basin made in estimate.



TYPICAL SECTION

Alternative 3
(Looking Downstream)
N.T.S.

URS

FIGURE 1.4
JUNE 2004

Table 1.5

MCDOT DCR vs. 'Normalized' Quantity Cost Estimate of MCDOT DCR

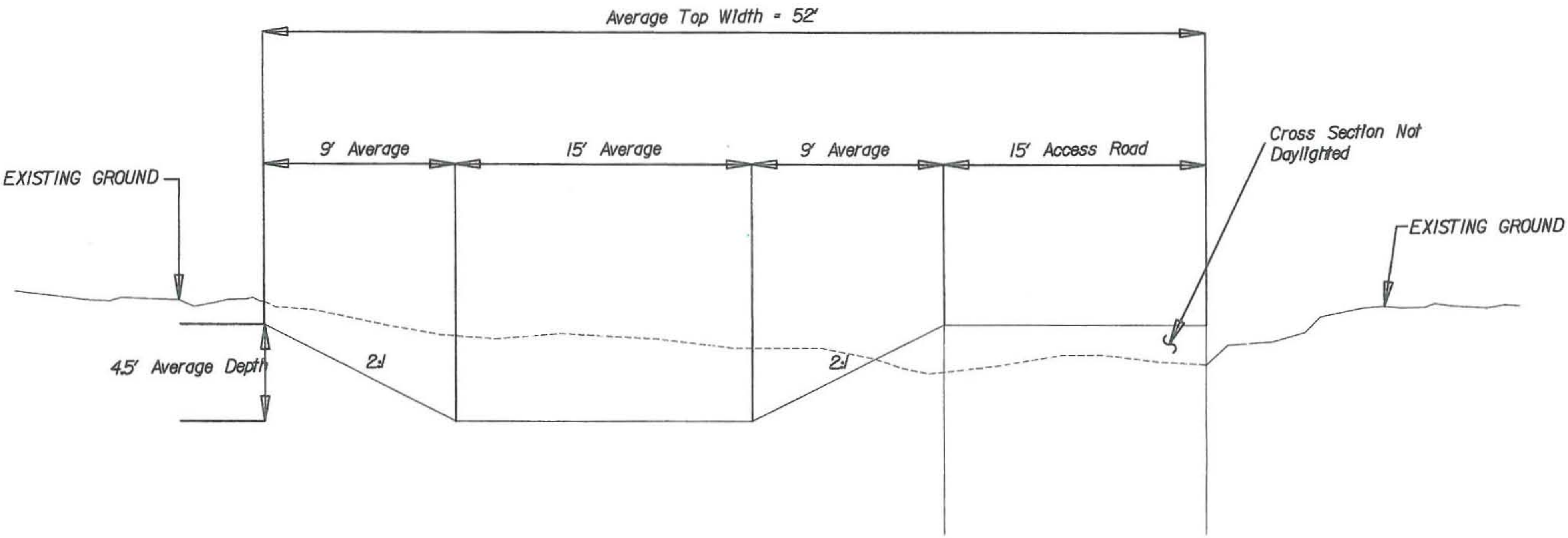
Summary of Major Cost Factors:

Item	*MCDOT DCR - 16.6 M* quantity	cost $$ (K=Thousand, M=Million)	Explaination	****MCDOT DCR, Normalized - 48.16 M* quantity	cost $$ (K=Thousand, M=Million)	Explaination	difference Δ
Storm	50-year	n/a	ADOT design criteria	50-year	n/a	ADOT design criteria	n/a
Channel R/W	0.97AC	$42.3 K	channel in R/W, no daylighting	3 AC	120.4 K	channel not in R/W, dayligh W/DTM	+0.08 M
[4]Basin R/W	88.6 AC	3.90 M	no daylighting	113.7 AC	4.55 M	daylighting, DTM used	+0.65 M
[2]Channel and Basin Treatment/LA	*	**4.21 M	concrete channel, grass lined basins	107 AC	14.51 M	aesthetic & multi-use facility	+10.30 M
[1]Channel Excavation	371,000 cy	$650 K	no daylighting, area based on constructed depth and side slopes	468,988 cy	6.65 M	topography, outfall, cross section	+0.87 M
[3]Culverts	EA	2.00 M	very simple $/foot estimate	EA	5.93 M	detailed estimate based on ADOT 'B-standards'	+3.93 M
[4]Basin Excavation	2.1 M cy	3.20 M	no daylighting, simplified method	3.2 M cy	16.00 M	daylighting, DTM used	+12.80 M
Low-flow storm drain	4.6 miles	2.68 M	48" to 72" pipe	4.6 miles	5.45 M	42" to 72" pipe	2.77 M

Preferred Alternative: Per the Loop 303 ADMP Update - Value Engineering +31.40 M

* Channel is concrete, no quantity was asigned for proposed grass lined basins.
** Cost of concrete lining only.
*** North channel only, does not include contingencies.

1. Factors contributing to cost difference:
   A - VE unit cost is $1.5 higher per CY.
   B - MCDOT DCR quantities don't consider topography/daylighting
2. No allowance for grass lined basin made in estimate.
3. Culvert cost in the MCDOT DCR do not account for increased reinforceing steel, inlet/outlet aprons, headwalls, or increased cost for additoinal barrels of the structure based on added structural steel and concrete.
4. Note: These basin quantities are based on the MCDOT DCR design modified to account for a 15' access road which was presented as part of the MCDOT basin concept but wasn't included in the MCDOT DCR quantities. These quantities also account for the increase in volume due to the HEC-1 model modification that includes discharges from sub basin 106 as well as the combination of the hydrograph for the operation R120. Since Alternative 1 does not make any change to the original(MCDOT DCR) basins, the quantites shown here are larger than those shown with Alternative 1.



TYPICAL SECTION

MCDOT DCR - North Segment
(Looking Downstream)
N.T.S.

FIGURE 1.5

JUNE 2004

Table 2.1

Summary and Comparison of Proposed Channel Characteristics

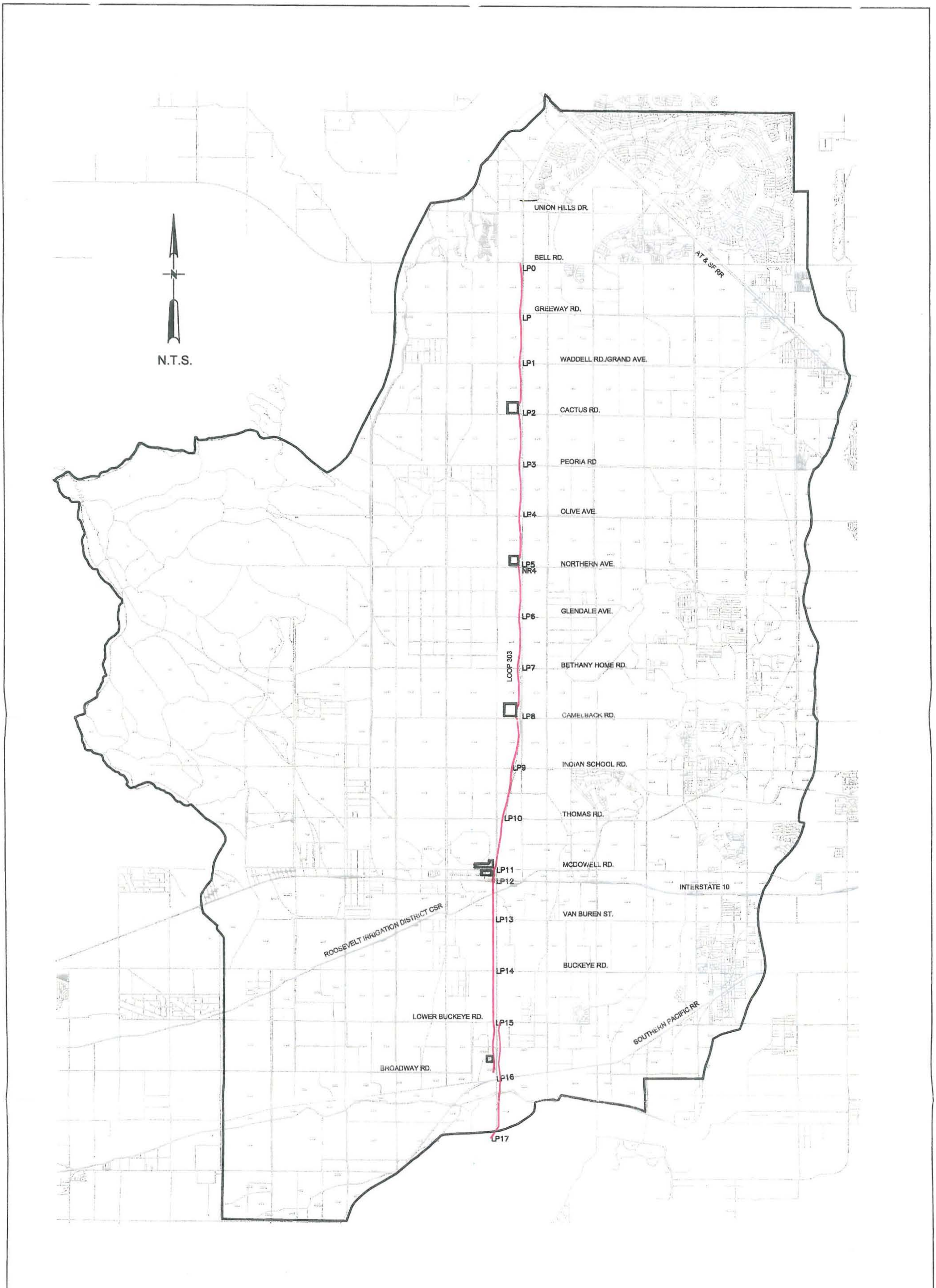
Channel Reach ID			Channel Reach Length (ft)			Channel Construction Material			Channel Design Flow (cfs)			Channel Flow Depth (ft)			Channel Construction Depth (ft)			Channel Bottom Width (ft)		
[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR
R113A	n/a	N/A	5160	n/a	N/A	concrete	earthen	N/A				3.3	n/a	N/A	4.5	n/a	N/A	10	n/a	N/A
CP121A	n/a								998	1,306	N/A									
R131AC	n/a	N/A	4980	5,236	N/A	concrete	earthen	N/A				3.9	3.8	N/A	5.0	3.8	N/A	10	45	N/A
CP131A	LP1								2,077	2,453	N/A									
R145AC	RLP1	N/A	4120	5,293	N/A	concrete	earthen	N/A				5.1	4.8	N/A	6.0	4.8	N/A	15	65	N/A
CP145A	LP2								1,419	2,276	N/A									
Retention	RLP2	N/A	4990	5,250	N/A	concrete	earthen	N/A				4.0	4.6	N/A	5.0	4.6	N/A	15	55	N/A
CP164A	LP3								1,843	2,651	N/A									
R164AC	RLP3	N/A	5010	5,292	N/A	concrete	earthen	N/A				5.0	5.1	N/A	6.0	5.1	N/A	15	55	N/A
CP177A	LP4								1,912	2,605	N/A									
R192AC	RLP4	N/A	4360	3,700	N/A	concrete	earthen	N/A				4.5	5.0	N/A	5.5	5.0	N/A	15	55	N/A
CP192A	LP5								1,357	450	N/A									
Retention	RLP5	N/A	5070	6,961	N/A	concrete	earthen	N/A				3.9	3.1	N/A	5.0	3.1	N/A	15	15	N/A
CP209A	LP6								1,468	776	N/A									
R209A	RLP6	N/A	4770	5,339	N/A	concrete	earthen	N/A				4.3	3.7	N/A	5.5	3.7	N/A	15	15	N/A
CP219	LP7								2,113	1,385	N/A									
R219	RLP7	N/A	3990	5,518	N/A	concrete	earthen	N/A				5.3	5.2	N/A	6.5	5.2	N/A	15	15	N/A
CP237	LP8								466	566	N/A									
Retention	RLP8	N/A	4920	2,602	N/A	concrete	earthen	N/A				3.7	4.3	N/A	5.0	4.3	N/A	5	5	N/A
CP250	LP9								N/A	619	no detail									
N/A	RLP9	N/A	2320	3,387	N/A	concrete	earthen	N/A				3.7	4.5	N/A	5.0	4.5	N/A	5	5	N/A
N/A	LP10								N/A	874	no detail									
N/A	RLP10	no detail	N/A	5,791	no detail	concrete	earthen	no detail				N/A	4.6	4' to 5'	N/A	4.6	min. 4' to 5'	N/A	5.0	8' average
N/A	LP11								N/A	1,332	no detail									
N/A	RLP11	no detail	N/A	5,322	no detail	concrete	earthen	no detail				N/A	4.7	4' to 5'	N/A	4.7	min. 4' to 5'	N/A	20.0	8' average
N/A	LP12								N/A	549	no detail									
N/A	RLP12	no detail	N/A	1,178	no detail	concrete	earthen	no detail				N/A	3.9	4' to 5'	N/A	3.9	min. 4' to 5'	N/A	5.0	8' average
N/A	LP13								N/A	652	no detail									
N/A	RLP13	no detail	N/A	4,047	no detail	concrete	earthen	no detail				N/A	4.1	4' to 5'	N/A	4.1	min. 4' to 5'	N/A	5.0	8' average
N/A	LP14								N/A	811	no detail									
N/A	RLP14	no detail	N/A	5,319	no detail	concrete	earthen	no detail				N/A	3.8	4' to 5'	N/A	3.8	min. 4' to 5'	N/A	15.0	8' average
N/A	LP15								N/A	829	no detail									
N/A	RLP15	no detail	N/A	5,298	no detail	concrete	earthen	no detail				N/A	4.1	4' to 5'	N/A	4.1	min. 4' to 5'	N/A	20.0	8' average
N/A	LP16								N/A	N/A	no detail									
	RLP16	N/A	N/A	6,015	no detail	concrete	earthen	no detail				N/A	4.1							

1. This represents the DCR channel concept developed by URS for MCDOT up-sized from the 50-year storm event to the 100-year storm event.
2. Does not include daylighting of the channel.
3. No specific detail or backup computations was included with the HDR study. Such detail was beyond the scope of their study.
4. Does not include a landscape easement tract.

Table 2.1

Summary and Comparison of Proposed Channel Characteristics

Channel Reach ID			Channel Side Slope (X:1)			Channel Slope (ft/ft)			Channel n - value			Operation and Maitnenance Road Width (ft)			Total Channel Top Width (includes access road) (ft)			Channel Velocity (f/s)			Channel Drop Structures #		
[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR
R113A	n/a	N/A	2:1	6:1	N/A	0.0049		N/A	0.013	0.03	N/A	15'	16' one side	N/A	43	n/a	N/A	13.6	n/a	N/A	none	n/a	N/A
CP121A	n/a																						
R131AC	n/a	N/A	2:1	6:1	N/A	0.0044	0.0028	N/A	0.013	0.03	N/A	15'	16' one side	N/A	45	167	N/A	14.2	5.2	N/A	none	0	N/A
CP131A	LP1																						
R145AC	RLP1	N/A	2:1	6:1	N/A	0.0039	0.0023	N/A	0.013	0.03	N/A	15'	16' one side	N/A	54	199	N/A	16.1	5.6	N/A	none	3	N/A
CP145A	LP2																						
Retention	RLP2	N/A	2:1	6:1	N/A	0.0047	0.0030	N/A	0.013	0.03	N/A	15'	16' one side	N/A	50	186	N/A	15.5	6.1	N/A	none	2	N/A
CP164A	LP3																						
R164AC	RLP3	N/A	2:1	6:1	N/A	0.0034	0.0026	N/A	0.013	0.03	N/A	15'	16' one side	N/A	54	192	N/A	14.9	6.1	N/A	none	1	N/A
CP177A	LP4																						
R192AC	RLP4	N/A	2:1	6:1	N/A	0.0056	0.0027	N/A	0.013	0.03	N/A	15'	16' one side	N/A	52	191	N/A	18.0	6.2	N/A	none	3	N/A
CP192A	LP5																						
Retention	RLP5	N/A	2:1	6:1	N/A	0.0048	0.0032	N/A	0.013	0.03	N/A	15'	16' one side	N/A	53	128	N/A	15.4	4.4	N/A	none	0	N/A
CP209A	LP6																						
R209A	RLP6	N/A	2:1	6:1	N/A	0.0038	0.0045	N/A	0.013	0.03	N/A	15'	16' one side	N/A	52	135	N/A	14.5	5.7	N/A	none	0	N/A
CP219	LP7																						
R219	RLP7	N/A	2:1	6:1	N/A	0.0036	0.0031	N/A	0.013	0.03	N/A	15'	16' one side	N/A	56	153	N/A	15.8	5.8	N/A	none	3	N/A
CP237	LP8																						
Retention	RLP8	N/A	2:1	6:1	N/A	0.0029	0.0020	N/A	0.013	0.03	N/A	15'	16' one side	N/A	40	133	N/A	10.2	3.8	N/A	none	0	N/A
CP250	LP9																						
N/A	RLP9	N/A	2:1	6:1	N/A	0.0029	0.0026	no detail	0.013	0.03	no detail	15'	16' one side	no detail	40	135	N/A		4.5	N/A	none	1	N/A
N/A	LP10																						
N/A	RLP10	no detail			3:1	n/a	0.0046	no detail	n/a	0.03	no detail	N/A	16' one side	no detail	N/A	136	no detail	N/A	6.0	no detail	N/A	0	no detail
N/A	LP11		N/A	6:1																			
N/A	RLP11	no detail			3:1	n/a	0.0036	no detail	n/a	0.03	no detail	N/A	16' one side	no detail	N/A	152	no detail	N/A	6.1	no detail	N/A	0	no detail
N/A	LP12																						
N/A	RLP12	no detail	N/A	6:1	3:1	n/a	0.0040	no detail	n/a	0.03	no detail	N/A	16' one side	no detail	N/A	128	no detail	N/A	5.1	no detail	N/A	2	no detail
N/A	LP13																						
N/A	RLP13	no detail	N/A	6:1	3:1	n/a	0.0044	no detail	n/a	0.03	no detail	N/A	16' one side	no detail	N/A	130	no detail	N/A	5.5	no detail	N/A	0	no detail
N/A	LP14																						
N/A	RLP14	no detail	N/A	6:1	3:1	n/a	0.0046	no detail	n/a	0.03	no detail	N/A	16' one side	no detail	N/A	137	no detail	N/A	5.9	no detail	N/A	2	no detail
N/A	LP15																						
N/A	RLP15	no detail	N/A	6:1	3:1	n/a	0.0025	no detail	n/a	0.03	no detail	N/A	16' one side	no detail	N/A	145	no detail	N/A	4.7	no detail	N/A	1	no detail
N/A	LP16																						
	RLP16	N/A																					



ALTERNATIVE #1 PROPOSED CHANNEL *June 2004*

Loop 303 Corridor/White Tanks ADMP Update

FIGURE 2.1

URS

Table

Summary and Comparison of Proposed Basin Characteristics

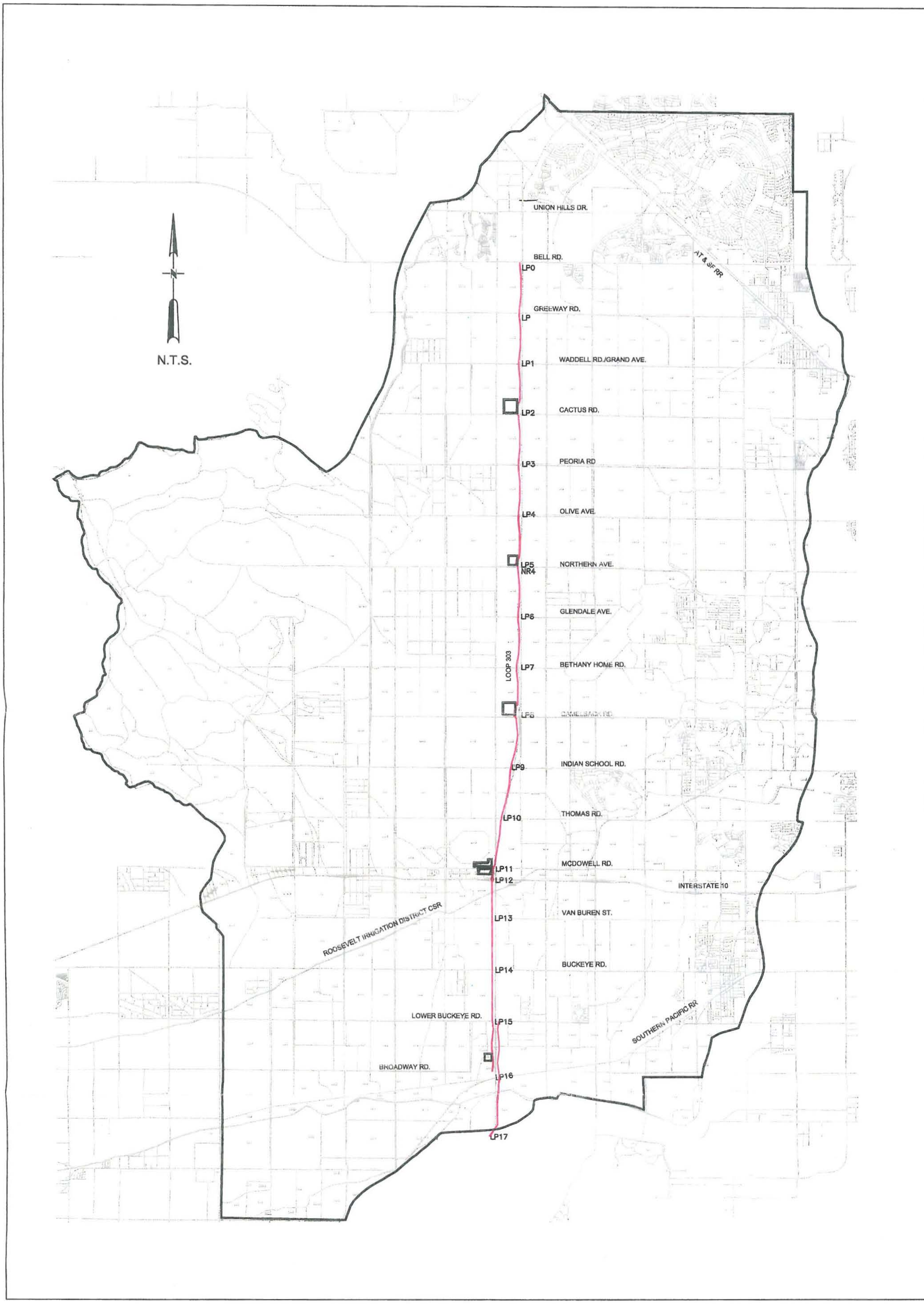
Basin ID			Basin Volume Provided (ac-ft)			Basin Depth (ft)			Basin Bottom Elevation (ft)		
[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR	[2,4]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR
DLP2	SRLP2	n/a	360	382	no detail	15	13	n/a	1196.9	1202.0	n/a
DLP5	SRNRLP	n/a	236	838	no detail	15	15	n/a	1125.0	1117.0	n/a
DLP8	SRLP8	n/a	504	323	no detail	15	22	n/a	1060.5	1050.0	n/a
n/a	SRLP12	no detail	no detail	320	no detail	no detail	15	no detail	n/a	999.0	no detail
n/a	SRLP16	no detail	no detail	230	no detail	no detail	8	no detail	n/a	902.0	no detail

1. This represents the DCR channe&basin concept developed by URS for MCDOT up-sized from the 50-year storm event to the 100-year storm event.
2. Does not include daylighting of the basin.
3. No specific detail or backup computations was included with the HDR study. Such detail was beyond the scope of their study.
4. Basin elevations were not given in the URS/DCR, but derived from known natural ground elevations at the proposed locations and using the proposed basin depths.

Table [illegible]

Summary and Comparison of Proposed Basin Characteristics

Basin ID			Basin Top Elevation (ft)			Basin Side Slopes (X:1)			Basin Off or On Line? (ft)		
[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[3]HDR DCR	[2,4]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100 yr	[3]HDR DCR
DLP2	SRLP2	n/a	1215.0	1215.0	n/a	6:1	6:1	n/a	on line	off line	n/a
DLP5	SRNRLP	n/a	1132.0	1132.0	n/a	6:1	6:1	n/a	on line	on line	n/a
DLP8	SRLP8	n/a	1072.0	1072.0	n/a	6:1	6:1	n/a	on line	off line	n/a
n/a	SRLP12	no detail	n/a	1014.0	no detail	n/a	6:1	no detail	n/a	off line	no detail
n/a	SRLP16	no detail	n/a	910.0	no detail	n/a	6:1	no detail	n/a	off line	no detail



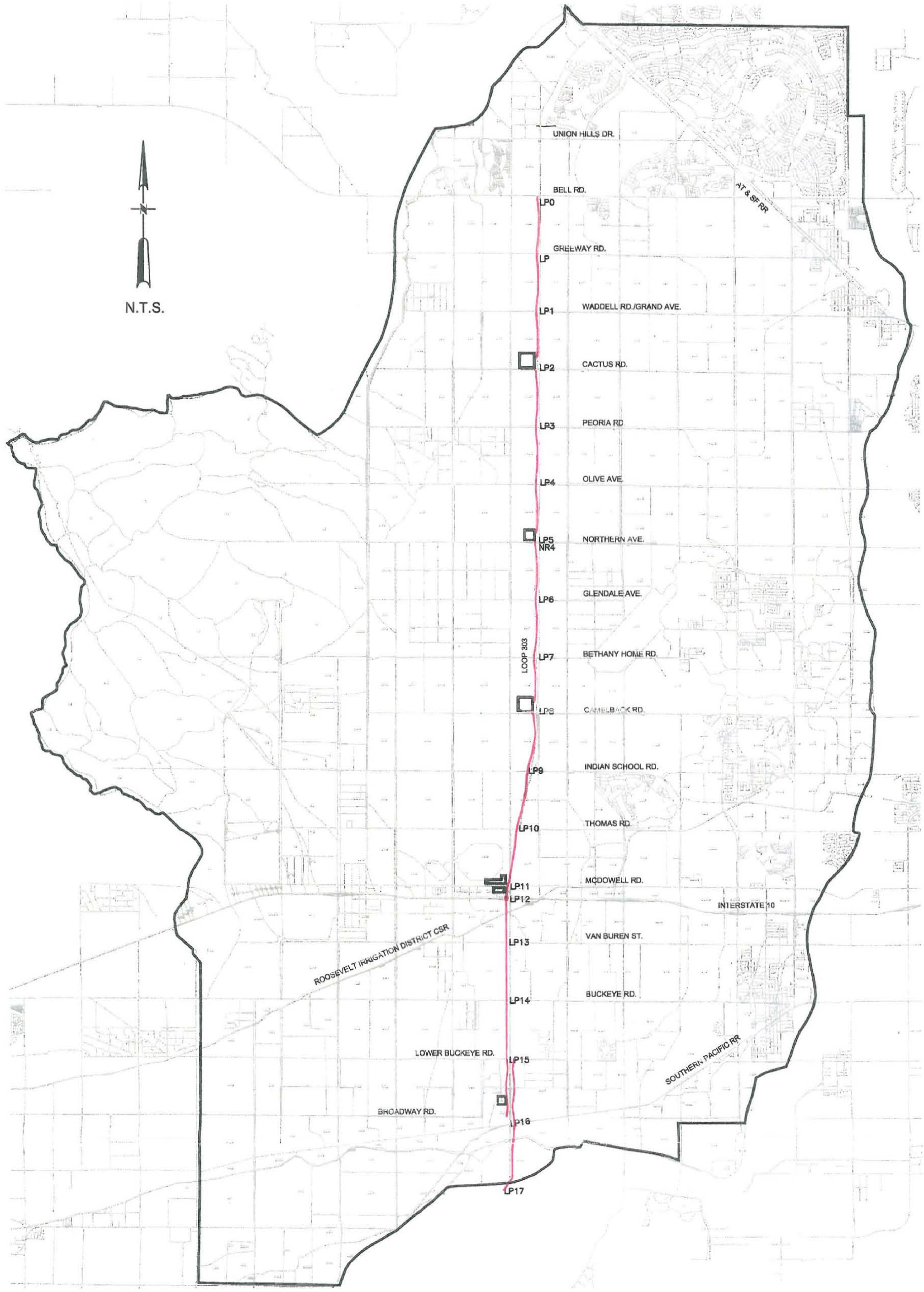
ALTERNATIVE #2 PROPOSED CHANNEL

June 2004

Loop 303 Corridor/White Tanks ADMP Update

FIGURE 2.2

URS



ALTERNATIVE #3 PROPOSED CHANNEL

June 2004

Loop 303 Corridor/White Tanks ADMP Update

FIGURE 2.3

URS

2.1 SR 303L – North Segment DCR

The DCR associated with the north segment of the SR 303L roadway (prepared by URS) was obtained as part of the data collection effort for this study. After careful review of the document and its supporting calculations, the following conclusions were drawn regarding the general concept of the proposed off site drainage facilities associated with that study:

- The North Segment DCR was prepared for MCDOT using ADOT drainage design criteria specified in the ADOT *Concrete Channel Design Guidance Manual.* ADOT standards were used in conjunction with generally accepted design procedures since the ultimate roadway would be owned and operated by ADOT .
- Retention (not detention) basins were used. Post storm bleed pipes were assumed to be gated and closed during the storm event. After the storm event the gates would be opened to allow the basins to drain within 36 hours. These proposed basins are in-line facilities that capture and impound the entire inflow generated as a result of the 50-year, 24-hour storm event.
- The design event for the North Segment DCR was the 50-year, 24-hour storm.
- The North Segment DCR assumes that the proposed channel along the west side of the SR 303L roadway detailed in the FCDMC Loop 303 Corridor/White Tanks ADMP Update would not be in place or constructed at the time of the SR 303L improvements.
- The preferred alternative recommended by the North Segment DCR shows retention basins placed at the northwest corners of Cactus, Northern, Camelback and the SR 303L roadway respectively. All three basins retain 100% of the incoming runoff volume generated during the design storm event.
- The post storm outlet pipe from the proposed retention basin at Cactus Road drains south until it daylights within the proposed 50-year open channel along the SR 303L.
- The post storm outlet pipe from the proposed retention basin at Northern Avenue drains east until it daylights within the existing Falcon Dunes golf course/retention basin at Reems Road and Northern Avenue. This will require an Intergovernmental Agreement (IGA) with Luke Airforce Base.
- The post storm outlet pipe from the proposed retention basin at Camelback Road drains east until it daylights within the existing Bullard Wash approximately 2.5 miles east between Reems Road and Bullard Avenue.
- The North Segment DCR proposes channel improvements from Indian School Road north to Bell Road. The URS DCR roadway limits are from Indian School Road north to Clearview Boulevard.
- The design flow rates were calculated by inputting the 50-year, 24-hour design storm into the Loop 303 ADMP Update existing condition hydrologic model.

2.2 SR 303L – South Segment DCR

The DCR associated with the south segment of the SR 303L roadway (prepared by HDR) was obtained by URS as part of the data collection effort for this study. After careful review of the document and its supporting calculations, the following conclusions were drawn regarding the general concept of the proposed off site drainage facilities associated with that study:

- The South Segment DCR does not specifically address the proposed off site drainage improvements. Rather, the South Segment DCR generally describes the facility proposed with the ultimate condition for the SR 303L. According to the South Segment DCR, the system would include a 100-year channel contained within a 75-foot drainage corridor that was secured for the project by the City of Goodyear on the west side of SR 303L. This would place the off site drainage facility completely outside of the SR 303L roadway right of way.
- The South Segment DCR does not describe whether or not a 75-foot drainage corridor exists on the east side of the SR 303L roadway from Lower Buckeye south to the Gila River where the off site drainage concept shows the flood control channel.
- The HDR DCR indicates the 75-foot drainage corridor extends for the DCR project limits. However, the City of Goodyear general land plan shows no indication of such corridor north of I-10. The South Segment DCR project limits extend north of I-10 to Indian School Road.
- The South Segment DCR states that the off-site channel is preliminarily designed as a 'smooth lined' channel. The South Segment DCR does not specify actual construction material. For the purposes of this study, the construction material was assumed to be concrete.
- The South Segment DCR shows a channel on the west side of the SR 303L roadway from Indian School Road south to Broadway Road. There is also a proposed channel (parallel to the one on the west side of SR 303L) shown on the east side of the SR 303L beginning at approximately the discharge point of the proposed conveyance channel through the Canyon Trails master plan development near Lower Buckeye Road. This eastern channel continues south from near Lower Buckeye Road to the Gila River.
- At Broadway Road, the west channel along the SR 303L crosses beneath the SR 303L and combines with the eastern channel from Broadway to the Gila River.
- The South Segment DCR proposes two basins. The first is to be located at the northwest corner of I-10 and SR 303L. The second is proposed at the northwest corner of Broadway Road and SR 303L. The South Segment DCR refers to these basins as 'regional retention or detention area (peak skimming)' facilities. No other information was given regarding the basins.
- The South Segment DCR cost estimate only addresses on site drainage improvements (10-year storm event) in the quantities and cost estimate. Although the general approach to the off site system is briefly described, there are no costs attributed to the SR 303L project. The assumption seems to be that the total cost of the off site improvements is independent of the SR 303L project.
- The South Segment DCR roadway improvements extend from Indian School Road south to the Gila River.

As a result of the lack of clarity with regard to the extent and limits of the 75-foot dedicated off site drainage corridor, URS has assumed that this corridor is only available on a single side of the SR 303L alignment. Therefore, for the portion of SR 303L where there is a channel on both the east and west sides of the roadway, it is assumed that right of way is available only on the west side. For the portion of the SR 303L where the channels combined on the east side, the 75 foot corridor is assumed to exist on the east side. Figure 2.4 shows the HDR proposed drainage improvements. Figure 2.5 summarizes the proposed channels and basin designs for alternatives 1 – 3 and the MCDOT DCR.

3.0 Conceptual Design Modifications

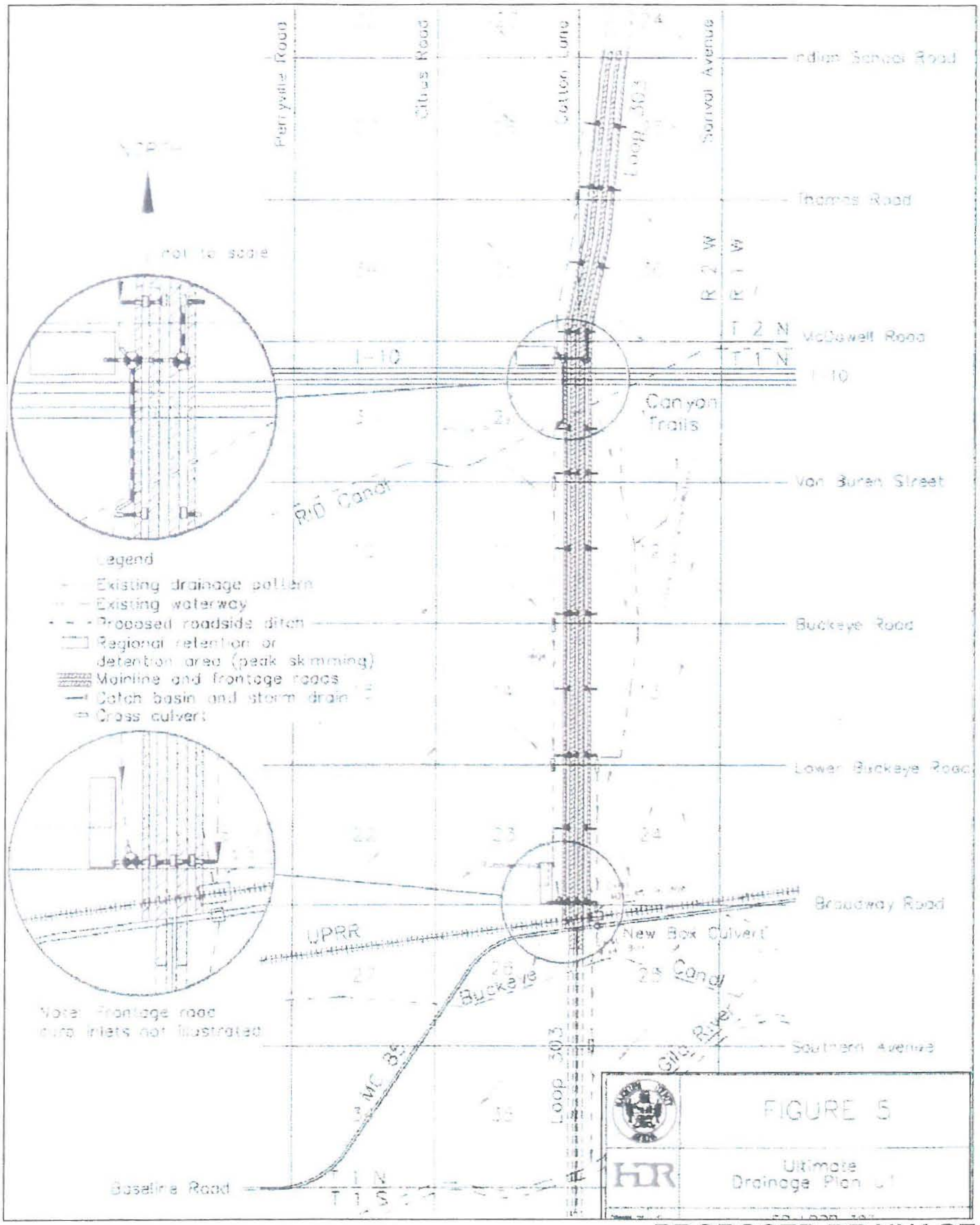
Using the conceptual off site drainage design for the MCDOT SR 303L roadway, URS performed the necessary calculations required to further improve the MCDOT SR 303L drainage system. The improved system was designed to safely convey the storm water runoff generated during the 100-year, 24-hour storm event. URS upgraded the system to comply with the FCDMC criteria of zero freeboard for the existing condition hydrology and 1-foot minimum freeboard for the future condition hydrology.

3.1 Modeling Issues

URS used the information collected, summarized and reviewed from the data collection portion of this study to determine a method for completing the required design modifications. During the detailed review of the design concepts presented by the SR 303L DCR, URS determined that there was a modeling issue resulting from the change in design storm from the 50-year, 24-hour to the 100-year, 24-hour storm event.

The North Segment DCR for the SR 303L was designed using the ADOT drainage design criteria, or the 50-year storm event. Upon a detailed review of the HEC-1 connectivity diagram produced for the DCR, URS discovered that approximately 199 cfs of excess runoff was generated by the 50-year storm event within sub basin 106. Sub basin 106 is adjacent to and upstream of the SR 303L on the west. This runoff was not accounted for in the North Segment DCR off site drainage design due to the following reasons:

- This excess runoff is generated on a developed sub basin where the development has provided on-site retention for the runoff generated during the 100-year storm event.
- The design storm for the SR 303L off site drainage system was specified by ADOT as the 50-year, 24-hour storm event.
- The existing development (adjacent to the SR 303L roadway) north of Union Hills Drive is fenced along its perimeter via a block wall precluding entry of any excess runoff from the sub basin to the SR 303L off site drainage channel.
- Given the fact of the onsite retention was designed for a more stringent design storm than the SR 303L drainage channel from a peak flow perspective, and the effect of the adjacent block wall, the North Segment DCR assumed that this discharge would not impact the SR 303L drainage channel at Union Hills Drive (CP 106). Hence, the SR 303L off site drainage channel begins at Bell Road rather than Union Hills Drive and does not include the inflow from sub basin 106 in the model. Since the excess runoff from sub basin 106 would impact the SR 303L channel (even using the 50-yr storm) when onsite retention is assumed 80% effective, it has been included in this analysis.



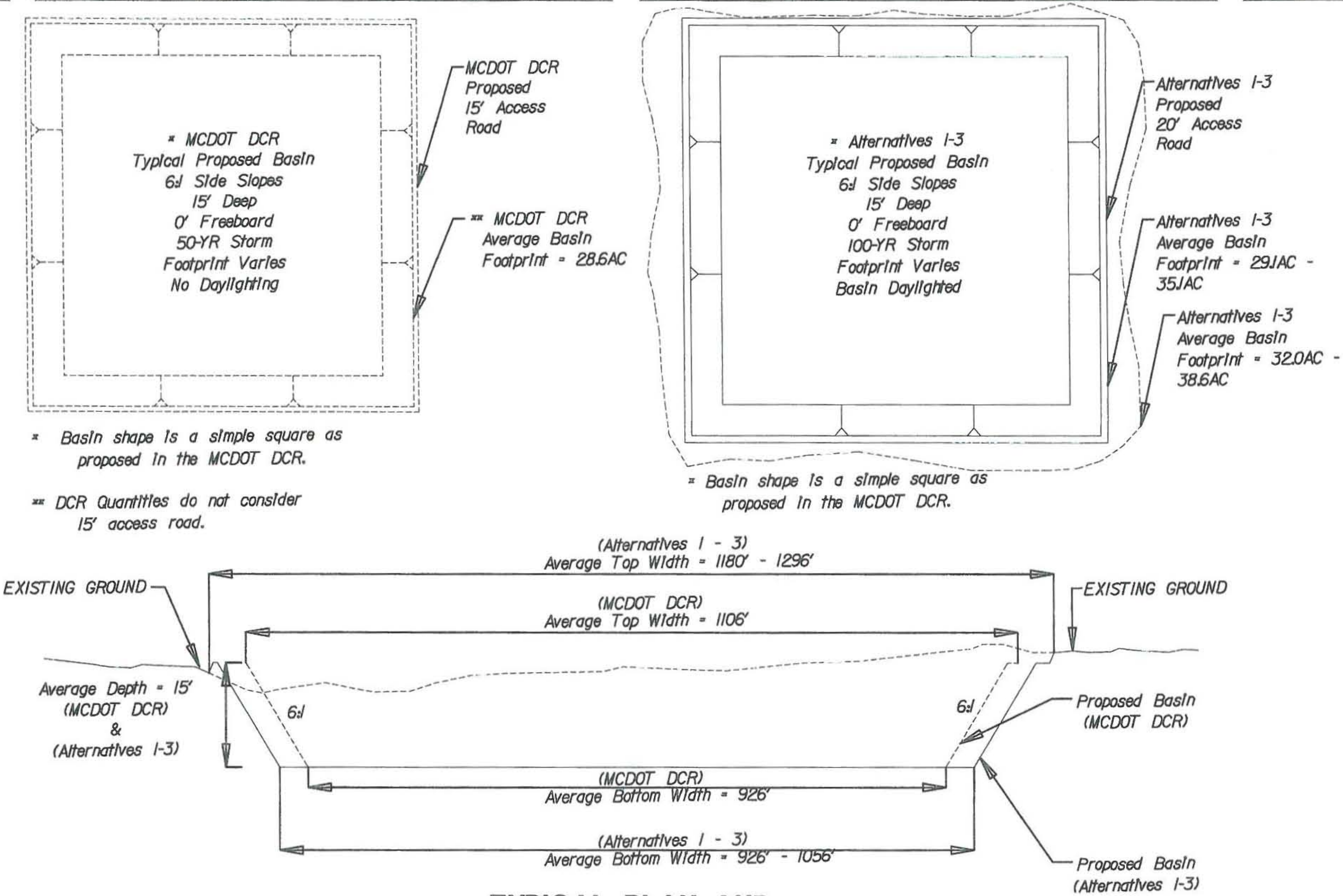
Source: Initial Design Concept Report State Route 303
HDR Engineering, September 2002

PROPOSED DRAINAGE IMPROVEMENTS

URS

Figure 2.4

June 2004



TYPICAL PLAN AND SECTION MCDOT DCR AND ALTERNATIVES 1-3 N.T.S.

URS

FIGURE 2.5
June 2004

Given the above information, the HEC-1 connectivity was updated to include the discharge produced from sub basin 106 in the total concentrated flow at the upstream end of the proposed SR 303L off site drainage channel at Bell Road. This decision was made based on the following:

- The excess runoff generated within sub basin 106 is actually higher than one would expect due to the use of the FCDMC ADMP Update hydrology model that assumes all onsite retention provided by developments within the watershed will only be 80% effective. The excess runoff is further increased when modeling the 100-year, 24-hour storm event (Q_{excess} 50-year = 199 cfs, Q_{excess} 100-year = 409 cfs).
- According to the ADMP Update watershed map, the excess volume produced within sub basin 106 will likely enter the SR 303L off site drainage system at Bell Road and must be accounted for when designing the retention basins.
- Any excess runoff produced on sub basin 106 would be conveyed south through the existing development, across Union Hills Drive and south to Bell Road. At Bell Road, the runoff would be conveyed east to the SR 303L. Therefore, this discharge should be included in the total concentrated flow used to design the 100-year off site drainage channel.

Finally, in the review of the 50-year hydrology model used with the SR 303L off site drainage design, URS discovered that the HEC-1 routing routine 'R120' was not being added to the total discharge at CP 130. Since CP 130 is upstream of the SR 303L off site drainage channel, this flow should be included. The magnitude of the discharge associated with R120 is approximately 670 cfs. However, the timing of the peak is 'off set' from the peak at CP130 by about 25 minutes. This difference in timing results in a combined peak at CP130 that is much lower than what would be expected if the peak timing of the inflow hydrographs were coincident. URS will coordinate to carry this change over to the DCR hydrology models for consistency.

3.2 Baseline HEC-1 Model

The first step in evaluating the three alternatives described above was to create a 'baseline' model from which to work. To this end, URS used the existing hydrology model developed for the proposed/preferred alternative as developed for the ADMP Update project as a starting point. This model was then modified for the 50-year storm event using the rainfall data included in the SR 303L 50-year hydrology model prepared for the DCR.

URS further modified the model to include the following changes per the 50-year model used with the SR 303L DCR:

- Channel routing data used in the 50-year SR 303L DCR was incorporated into the ADMP Update model.
- Excess runoff from Sub Basin 106 was included in total inflow to the proposed SR 303L channel at Bell Road.
- Discharge associated with the R120 operation was included with the hydrograph combination at CP130 upstream of the SR 303L channel at Thunderbird Road.

- The Northern Avenue channel proposed as part of the Loop 303 Corridor/White Tanks ADMP Update project was not part of the SR 303L HEC-1 model. By direction of MCDOT the North Segment DCR design was to estimate off site channel design discharges assuming that the proposed FCDMC ADMP update improvements were not yet constructed. Therefore, the baseline HEC-1 model developed for this study does not include the Northern Avenue channel. If this channel is constructed at a future date, it could be constructed to convey the majority of the discharges east of SR 303L to the proposed detention basin adjacent to the existing Falcon Dunes golf course basin at Reems Road and Northern Avenue. The South Segment DCR does not develop a detailed analysis with discharges for an off site drainage channel. Therefore, URS assumed a consistent methodology in the south segment of the SR 303L channel and assumed that the I-10 channel proposed as part of the ADMP Update is not yet constructed at the time of the SR 303L construction.
- URS inserted the basin diversions included in the SR 303L HEC-1 model to simulate the proposed retention facilities at Cactus Road, Northern Avenue and Camelback Road.

After making the appropriate changes to the 50-year baseline HEC-1 model, URS compared the results of the baseline model run with the DCR. Table(s) 3.1 and 3.2 shows a comparison of peak discharge and volume estimated by the 50-year DCR HEC-1 model with those estimated by the baseline HEC-1 model prepared for this study.

Finally, URS used the baseline HEC-1 model to estimate inflow volumes at the proposed detention/retention basin sites in the South Segment DCR. The South Segment DCR only proposed basins at I-10 and Broadway Road. Therefore, the basin proposed at Yuma Road in the ADMP Update was removed. The model was then run and used to estimate total inflow volume at the proposed basin locations for the south segment SR 303L. Once determined, these volumes were input to the baseline HEC-1 model to simulate retention basins at these locations. URS used retention basins since the South Segment DCR did not specify the use of retention over detention. Retention basins were consistent with the methodology used in the North Segment DCR.

The South Segment DCR proposed a channel on the east side of SR 303L parallel to the channel on the west side from approximately Lower Buckeye Road to approximately Broadway Road. At Broadway Road, the west side channel crosses SR 303L via a storm drain outlet from the proposed retention basin at the northwest corner of Broadway Road and SR 303L. The flow from the west side channel combines with the flow in the east side channel and is conveyed south to the outlet at the Gila River.

Finally, channel routing parameters were based on the general information given by the South Segment DCR and entered into the baseline HEC-1 model. Values that were not specified such as the manning roughness coefficient were estimated based on the description of a 'smooth lined' channel. Since a type of concrete was not specified, the n-value was estimated as an average for smooth finish types.

Table ? ?

50-year Discharge Compar[illegible] of the SR 303L DCR with the 50-year ADMP Baseline Model

ID		DISCAHRGES			TIME OF PEAK		
DCR	ADMP	50-year DCR Model	50-year Baseline existing Model	Difference Δ	50-year DCR Model	50-year Baseline Model	Difference Δ
[1]CP113A	!LP0	664	670	6	12.25	12.25	0
[1]R113A	RLP0	593	588	-5	12.42	12.42	0
[1]CP121A	!LP	756	756	0	12.42	12.42	0
[1]R131AC	RLPUS	707	707	0	12.5	12.5	0
[1]CP131A	!LP1	998	1235	237	13.17	13.25	0.08
[1]R145AC	RLP1	995	1232	237	13.25	13.33	0.08
[1]CP145A	!LP2	2077	2314	237	13.33	13.33	0
R164AC	RLP2	0	0	-----	0	22.67	-----
CP164A	!LP3	1419	1419	0	13.17	13.17	0
164AC	RLP3	1401	1401	0	13.25	13.25	0
CP177A	!LP4	1843	1843	0	13.25	13.25	0
R192AC	RLP4	1838	1838	0	13.33	13.33	0
*CP192A	2NRLP	1912	1984	72	13.33	13.42	0.09
N/A	RLP5	1838	0	-----	13.33	0	-----
CP209A	!LP6	1357	1355	-2	13.75	13.75	0
R209A	RLP6	1354	1352	-2	13.83	13.83	0
CP219	!LP7	1468	1467	-1	13.75	13.75	0
R219	RLP7	1457	1460	3	13.92	13.83	-0.09
CP237	!LP8	2113	2098	-15	13.92	13.92	0
R237	RLP8	no value	0	-----	0	0	-----
CP250	!LP9	466	466	0	13.58	13.58	0

1. The ADMP Baseline file accounts for 199 cfs (50-yr) and 409 cfs (100-yr) discharge from sub basin(s) 100A, 102A, 101, and 106 - at CP106. The DCR does not. This was due to the fact that sub basin 106 is a developed basin providing on-site retention for the 100-yr storm. sub basin actually produces more runoff than it retains in the both the 50-yr or 100-yr events. This may be due to the 80% effeciency factor assumed for all on-site retention throughout the L303 ADMP project area or the difference in modeled storm duration (24-hr) relative to the retention criteria (2-hr).

* Northern channel is not modeled by the DCR. Therefor, it is removed here for consistency with the conditions modeled by the DCR. This results in the existing diversion (1D208) being 'turned on' in the ADMP baseline.

Table 3.2
50-year Volume Comparison of the SR 303L DCR with the 50-year ADMP Baseline Model

ID		VOLUME (AC-FT)			TIME OF PEAK		
DCR	ADMP	DCR Model	Baseline Model	Difference Δ	DCR Model	Baseline Model	Difference Δ
[1]CP145A	!LP2	360	488	128	13.33	13.33	0
CP192A	2NRLP	236	227	-9	13.33	13.33	0
CP237	!LP8	504	476	-28	13.92	13.92	0

1. The ADMP Baseline file accounts for 199 cfs (50-yr) and 409 cfs (100-yr) discharge from sub basin(s) 100A, 102A, 101, and 106 - at CP106. The DCR does not. This was due to the fact that sub basin 106 is a developed basin providing on-site retention for the 100-yr storm. sub basin actually produces more runoff than it retains in the both the 50-yr or 100-yr events. This may be due to the 80% effeciency factor assumed for all on-site retention throughout the L303 ADMP project area or the difference in modeled storm duration (24-hr) relative to the retention criteria (2-hr).

3.3 Alternatives Analysis

Once the baseline model was complete, the alternatives analysis used it as a starting point from which to create the 100-year, 24-hour storm event. The first step in this process was to import the 100-year, 24-hour rainfall data into the HEC-1 model. Next, the three alternatives were modeled. The three alternatives that were to be analyzed were as follows:

- Alternative 1 – The off site drainage channel proposed by the MCDOT DCR will be increased in conveyance capacity to the 100-year, 24-hour design storm event. The proposed retention basin facilities will not be changed.
- Alternative 2 – The off site drainage channel proposed by the MCDOT DCR will not be changed. The proposed retention basin facilities will be increased in volume to accommodate the runoff volume generated during a 100-year, 24-hour storm event.
- Alternative 3 – A combination of increased channel conveyance capacity and retention basin volume will be analyzed to provide the level of flood protection required by the FCDMC as described in the Loop 303 ADMP Update project.

For all three alternatives, the west to east channel along northern from approximately Beardsley Canal to SR 303L and along I-10 from approximately ½ mile west of Jackrabbit Road to SR 303L were not included. Although these channels are part of the loop 303 ADMP update, they are not part of the DCR off-site drainage. Since this analysis is upgrading the concept presented in the DCR from a 50-year to a 100-year design, these channels are not included. The impacts of not including these channels are listed below:

Northern Avenue

- Smaller basin at Northern Avenue and SR 303L
- Slightly larger channel reaches from Northern Avenue to Camelback Road since upstream flows are not intercepted at Northern Avenue.

I-10

- Smaller basin at I-10 and SR 303L
- No change to downstream channel reaches since flow crossing I-10 is conveyed from north to south (parallel) to SR 303L. (Flow along Northern Avenue is conveyed diagonally to the southeast and thus impacts SR 303L downstream of Northern Avenue.)

3.3.1 Alternative 1

The modeling of Alternative 1 was accomplished by the process listed below:

- The 100-year, 24-hour rainfall data was inserted into the baseline HEC-1 model in place of the 50-year, 24-hour rainfall data.
- Diversions cards were modified at each proposed retention basin site that allowed all flow to be diverted out of the system up to a ceiling volume amount equal to the total 50-year volume determined by the SR 303L DCR's. This simulates the retention basins and allows for excess discharge to continue downstream within the channels.
- The HEC-1 model was run and the outflow data were imported into the channel-sizing workbook.

- Each channel reach was sized for the increased discharge according to the following criteria:
  - o Velocity was held at 15 f/s or less – some drop structures were required
  - o Constructed channel depths defined by the SR 303L DCR's were held and bottom width was increased.
  - o There was no freeboard designed into the channel.
- The appropriate routing data were exported to HEC-1 and the model was run.
- The resulting discharges were imported back into the channel sizing worksheet and the channel sizes were modified appropriately.
- The channel routing parameters from the above step were inserted into the future condition hydrology HEC-1 model and run.
- These discharges were evaluated to ensure that the proposed channel would meet FCDMC freeboard requirements in the future hydrologic condition.

Using the results of the analysis for Alternative 1, several comparisons of Alternative 1 with the North Segment DCR were made. The results of these comparisons are listed below:

- The total discharge within the channel increased an average of approximately 35%.
- Flow depths within the channel increased an average of approximately 15%.
- The channel bottom width increased an average of approximately 29%
- The channel top width increased an average of approximately 17%

The following information summarizes the increase in inflow volume at each proposed retention basin. Negative values indicate that the total inflow to a given basin was lower for the future condition (full build-out of watershed) 100-year, 24-hour model than that computed by the existing condition 50-year, 24-hour model:

	Inflow Volume % Change (Existing model)	Inflow Volume % Change (Future condition model)
Cactus Road	66%	4%
Northern Avenue	112%	-38%
Camelback Road	54%	-17%
I-10 Retention Basin	84%	-30%
UPRR/MC 85 Retention Basin	403%	-4%

Table 3.3. Alternative 1 Inflow Volume Changes

3.3.2 Alternative 2

The process listed below accomplished the modeling of Alternative 2:

- The 100-year, 24-hour rainfall data was inserted into the baseline HEC-1 model in place of the 50-year, 24-hour rainfall data.

- Diversions cards were modified at each proposed retention basin site that allowed all flow and associated volume to be diverted out of the system.
- The HEC-1 model was run and the outflow data were imported into the channel sizing worksheet. Although no modifications were made to the channel sizing, the results of the larger discharges due to the increased storm event were analyzed.

Using the results of the analysis for Alternative 2, several comparisons of Alternative 2 with the North Segment DCR were made. The results of these comparisons are listed below:

- The total discharge within the channel increased an average of approximately 24%
- Flow depths within the channel increased an average of approximately 8%.

The channel depths did over-top the 50-year channel design at two locations. At all other locations along the proposed channel, flow depths were less than or equal to the proposed constructed depth of the 50-year design.

The following information summarizes the increase in inflow volume at each proposed retention basin. Negative values indicate that the total inflow to a given basin was lower for the future condition (full build-out of watershed) 100-year, 24-hour model than that computed by the existing condition 50-year, 24-hour model:

	Inflow Volume % Change (Existing model)	Inflow Volume % Change (Future condition model)
Cactus Road	56%	-2%
Northern Avenue	-68%	84%
Camelback Road	67%	29%
I-10 Retention Basin	47%	-15%
UPRR/MC 85 Retention Basin	-58%	80%

Table 3.4. Alternative 2 Inflow Volume Changes

3.3.3 Alternative 3

The process listed below was used in the modeling of Alternative 3:

- The 100-year, 24-hour rainfall data was inserted into the baseline HEC-1 model in place of the 50-year, 24-hour rainfall data.
- The HEC-1 model was run and the outflow data were imported into the channel-sizing workbook.
- Working from upstream to downstream, the channel reaches were sized and then the proposed basins were sized. Basins were modeled as detention basins in order to allow some outflow during the design storm.
- The channel reaches were sized according to the following criteria:

- o Velocity was held at 15 f/s or less – some drop structures were required
  - o Constructed channel depths defined by the SR 303L DCR's were held and bottom width was increased.
  - o There was no freeboard designed into the channel.
- Channel reaches and proposed detention basins were sized in an attempt at combining the approaches used in Alternatives 1 and 2.
- The appropriate routing data were exported to HEC-1 and the model was run.
- The resulting discharges were imported back into the channel sizing worksheet and the channel and basin sizes were modified appropriately.
- The channel and detention basin routing parameters from the above step were inserted into the future condition hydrology HEC-1 model and run.
- The discharges and volumes were evaluated to ensure that the proposed channel and basins would meet FCDMC freeboard requirements in the future hydrologic condition.

Using the results of the analysis for Alternative 3, several comparisons of Alternative 3 with the North Segment DCR were made. The results of these comparisons are listed below:

- The total discharge within the channel increased an average of approximately 23%.
- Flow depths within the channel increased an average of approximately 12%.
- The channel bottom width increased an average of approximately 14%
- The channel top width increased an average of approximately 11%

The following information summarizes the increase in inflow volume at each proposed retention basin. Negative values indicate that the total inflow to a given basin was lower for the future condition (full build-out of watershed) 100-year, 24-hour model than that computed by the existing condition 50-year, 24-hour model:

	Inflow Volume % Change (Existing model)	Inflow Volume % Change (Future condition model)	Freeboard (Ft)
Cactus Road	47%	-7%	5
Northern Avenue	-69%	-84%	6.6
Camelback Road	70%	9%	4.9
I-10 Retention Basin	16%	23%	5
UPRR/MC 85 Retention Basin	-57%	-73%	3.3

Table 3.5. Alternative 3 Inflow Volume Changes

Table 3.6 shows a comparison of the proposed drainage channel characteristics. Table 3.7 shows a summary and comparison of the proposed basin characteristics associated with the SR 303L for the three alternatives.

From a review of the information obtained as part of the above analysis, the following information was noted:

Table 3.6

Summary and Comparison of Proposed Channel Characteristics

Channel Reach ID and Concentration Point			Channel Reach Length (ft)			Channel Construction Material						Channel Design Flow (cfs)			Channel Flow Depth (ft)		
[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[3]HDR DCR	[2]URS DCR 50-yr	[2]URS ADMP 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr
RLP0	RLP0	RLP0	5,234	5,234	5,234	concrete	concrete	concrete	N/A						3.2	3.7	3.5
LP	LP	LP								998	1,306	1,619	1,640	1,614			
RLP	RLP	RLP	5,237	5,237	5,237	concrete	concrete	concrete	N/A						4.6	5.0	5.0
LP1	LP1	LP1								2,077	2,453	2,874	2,906	2,901			
RLP1	RLP1	RLP1	4,261	3,967	4,007	concrete	concrete	concrete	N/A						5.9	6.1	6.0
LP2	LP2	LP2								1,419	2,276	1,765	1,765	1,765			
RLP2	RLP2	RLP2	5,292	5,292	5,292	concrete	concrete	concrete	N/A						5.0	4.5	4.4
LP3	LP3	LP3								1,843	2,651	2,229	2,258	2,229			
RLP3	RLP3	RLP3	5,291	5,291	5,291	concrete	concrete	concrete	N/A						5.7	5.5	5.3
LP4	LP4	LP4								1,912	2,605	2,260	2,288	2,250			
RLP4	RLP4	RLP4	4,500	4,446	4,459	concrete	concrete	concrete	N/A						5.5	4.9	5.4
LP5	LP5	LP5								1,357	450	1,788	1,500	1,504			
RLP5	RLP5	RLP5	5,347	5,347	5,347	concrete	concrete	concrete	N/A						4.9	4.1	4.4
LP6	LP6	LP6								1,468	776	2,232	1,659	1,657			
RLP6	RLP6	RLP6	5,336	5,336	5,336	concrete	concrete	concrete	N/A						5.4	4.6	4.7
LP7	LP7	LP7								2,113	1,385	2,384	2,390	2,388			
RLP7	RLP7	RLP7	4,059	4,019	4,005	concrete	concrete	concrete	N/A						4.3	4.6	6.0
LP8	LP8	LP8								466	566	1,492	559	559			
RLP8	RLP8	RLP8	5,481	5,481	5,481	concrete	concrete	concrete	N/A						4.7	4.0	4.0
LP9	LP9	LP9								N/A	619	1,462	624	621			
RLP9	RLP9	RLP9	5,366	5,366	5,366	concrete	concrete	concrete	N/A						4.5	3.5	3.4
LP10	LP10	LP10								N/A	874	1,462	965	953			
RLP10	RLP10	RLP10	5,407	5,407	5,407	concrete	concrete	concrete	no detail						4.3	4.6	4.5
LP11	LP11	LP11								N/A	1,332	2,066	1,237	1,234			
RLP11	RLP11	RLP11	33	181	58	concrete	concrete	concrete	no detail						4.3	4.1	4.1
LP12	LP12	LP12								N/A	549	1,642	428	428			
RLP12	RLP12	RLP12	4,049	4,049	4,049	concrete	concrete	concrete	no detail						4.4	3.0	3.0
LP13	LP13	LP13								N/A	652	1,642	508	508			
RLP13	RLP13	RLP13	5,320	5,320	5,320	concrete	concrete	concrete	no detail						4.5	3.2	3.2
LP14	LP14	LP14								N/A	811	1,642	810	810			
RLP14	RLP14	RLP14	5,261	5,261	5,261	concrete	concrete	concrete	no detail						4.4	4.0	4.0
LP15	LP15	LP15								N/A	829	1,642	810	810			
RLP15	RLP15	RLP15	4,681	4,614	4,604	concrete	concrete	concrete	no detail						4.5	3.7	4.1
LP16	LP16	LP16								N/A	N/A	426	426	426			
-----	-----	-----	N/A	N/A	N/A	concrete	concrete	concrete	no detail								

1. Figures 2.5 - 2.7 show the proposed alternatives and associated concentration points.

Table 3.6

Summary and Comparison of Proposed Channel Characteristics

Channel Reach ID and Concentration Point			Channel Construction Depth (ft)			Channel Bottom Width (ft)			Channel Side Slope (X:1)			Channel Slope (ft/ft)		
[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr
RLP0	RLP0	RLP0	4.4	5.1	5.1	15	10	10	2:1	2:1	2:1	0.0049	0.0049	0.0049
LP	LP	LP												
RLP	RLP	RLP	4.4	5.1	5.5	15	10	12	2:1	2:1	2:1	0.0036	0.0044	0.0036
LP1	LP1	LP1												
RLP1	RLP1	RLP1	4.8	5.8	6.1	22	15	20	2:1	2:1	2:1	0.0024	0.0039	0.0026
LP2	LP2	LP2												
RLP2	RLP2	RLP2	5.9	6.2	4.5	14	15	18	2:1	2:1	2:1	0.0035	0.0047	0.0037
LP3	LP3	LP3												
RLP3	RLP3	RLP3	5.0	4.5	5.3	15	15	18	2:1	2:1	2:1	0.0030	0.0034	0.0030
LP4	LP4	LP4												
RLP4	RLP4	RLP4	5.7	5.6	5.4	17	15	18	2:1	2:1	2:1	0.0029	0.0056	0.0029
LP5	LP5	LP5												
RLP5	RLP5	RLP5	5.5	4.9	4.4	15	15	15	2:1	2:1	2:1	0.0034	0.0048	0.0037
LP6	LP6	LP6												
RLP6	RLP6	RLP6	4.9	4.3	4.9	17	15	15	2:1	2:1	2:1	0.0030	0.0038	0.0033
LP7	LP7	LP7												
RLP7	RLP7	RLP7	5.4	4.7	6.0	15	15	15	2:1	2:1	2:1	0.0029	0.0043	0.0028
LP8	LP8	LP8												
RLP8	RLP8	RLP8	6.0	5.7	4.1	13	5	5	2:1	2:1	2:1	0.0035	0.0029	0.0029
LP9	LP9	LP9												
RLP9	RLP9	RLP9	4.7	4.1	3.5	16	8	8	3:1	3:1	3:1	0.0042	0.0052	0.0052
LP10	LP10	LP10												
RLP10	RLP10	RLP10	4.3	5.0	5.0	20	8	8	3:1	3:1	3:1	0.0037	0.0037	0.0037
LP11	LP11	LP11												
RLP11	RLP11	RLP11	4.4	4.3	4.3	20	8	8	3:1	3:1	3:1	0.0069	0.0099	0.0099
LP12	LP12	LP12												
RLP12	RLP12	RLP12	4.5	3.1	3.2	16	8	8	3:1	3:1	3:1	0.0057	0.0046	0.0046
LP13	LP13	LP13												
RLP13	RLP13	RLP13	4.5	3.2	3.2	17	8	8	3:1	3:1	3:1	0.0048	0.0048	0.0048
LP14	LP14	LP14												
RLP14	RLP14	RLP14	4.5	4	4.0	18	8	8	3:1	3:1	3:1	0.0048	0.0048	0.0048
LP15	LP15	LP15												
RLP15	RLP15	RLP15	4.5	3.7	4.1	20	8	8	3:1	3:1	3:1	0.0039	0.0068	0.0043
LP16	LP16	LP16												
-----	-----	-----												

1. Figures 2.5 - 2.7 show the proposed alternative and associated concentration points.

Table 3.6

Summary and Comparison of Proposed Channel Characteristics

Channel Reach ID and Concentration Point			Channel n - value			Operation and Maitnenance Road Width (ft)			Total Channel Top Width (includes access road) (ft)			Channel Velocity (f/s)			Channel Drop Structures #		
[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr	[1]Alternative 1 100-yr	[1]Alternative 2 100-yr	[1]Alternative 3 100-yr
RLP0	RLP0	RLP0	0.013	0.013	0.013	20' west side	20' west side	20' west side	52.7	50.5	50.5	14.1	14.3	14.1	0	0	0
LP	LP	LP															
RLP	RLP	RLP	0.013	0.013	0.013	20' west side	20' west side	20' west side	54.4	53.1	54.0	14.6	16.2	14.8	2	0	1
LP1	LP1	LP1															
RLP1	RLP1	RLP1	0.013	0.013	0.013	20' west side	20' west side	20' west side	65.6	59.8	64.4	14.4	17.7	14.9	2	0	2
LP2	LP2	LP2															
RLP2	RLP2	RLP2	0.013	0.013	0.013	20' west side	20' west side	20' west side	54.0	53.0	56.0	14.9	16.5	15.0	2	0	1
LP3	LP3	LP3															
RLP3	RLP3	RLP3	0.013	0.013	0.013	20' west side	20' west side	20' west side	57.8	57.4	59.2	14.9	15.7	14.8	1	0	1
LP4	LP4	LP4															
RLP4	RLP4	RLP4	0.013	0.013	0.013	20' west side	20' west side	20' west side	59.0	54.6	59.6	14.7	18.9	14.6	4	0	5
LP5	LP5	LP5															
RLP5	RLP5	RLP5	0.013	0.013	0.013	20' west side	20' west side	20' west side	54.6	52.1	52.7	14.8	15.9	14.5	0	0	0
LP6	LP6	LP6															
RLP6	RLP6	RLP6	0.013	0.013	0.013	20' west side	20' west side	20' west side	58.6	54.0	54.7	14.9	15.0	14.3	3	0	2
LP7	LP7	LP7															
RLP7	RLP7	RLP7	0.013	0.013	0.013	20' west side	20' west side	20' west side	59.0	57.7	59.0	15.0	17.4	14.8	2	0	2
LP8	LP8	LP8															
RLP8	RLP8	RLP8	0.013	0.013	0.013	20' west side	20' west side	20' west side	51.8	41.4	41.4	14.3	10.7	10.7	0	0	1
LP9	LP9	LP9															
RLP9	RLP9	RLP9	0.018	0.018	0.018	20' west side	20' west side	20' west side	63.0	49.0	49.0	11.0	9.9	9.8	0	0	0
LP10	LP10	LP10															
RLP10	RLP10	RLP10	0.018	0.018	0.018	20' west side	20' west side	20' west side	65.8	58.1	58.1	10.4	9.7	9.7	0	0	0
LP11	LP11	LP11															
RLP11	RLP11	RLP11	0.018	0.018	0.018	20' west side	20' west side	20' wešt side	66.4	54.0	54.0	14.4	14.9	14.9	1	1	1
LP12	LP12	LP12															
RLP12	RLP12	RLP12	0.018	0.018	0.018	20' west side	20' west side	20' west side	63.0	46.6	47.2	12.7	8.5	8.5	0	0	0
LP13	LP13	LP13															
RLP13	RLP13	RLP13	0.018	0.018	0.018	20' west side	20' west side	20' west side	64.0	47.2	47.2	12.0	9.1	9.1	0	0	0
LP14	LP14	LP14															
RLP14	RLP14	RLP14	0.018	0.018	0.018	20' west side	20' west side	20' west side	65.0	52.0	52.0	11.9	10.2	10.2	0	0	0
LP15	LP15	LP15															
RLP15	RLP15	RLP15	0.018	0.018	0.018	20' west side	20' west side	20' west side	67.0	50.2	52.6	11.0	11.6	9.8	0	0	0
LP16	LP16	LP16															
-----	-----	-----															

1. Figures 2.5 - 2.7 show the proposed alternative and associated concentration points.

Table 3.7

Summary and Comparison of Proposed Basin Characteristics

Proposed Basin ID			Volume Provided (ac-ft)			Basin Depth (ft)			Basin Bottom Elevation (ft)			Basin Top Elevation (ft)			Basin Side Slopes (X:1)			Basin Off or On Line (ft)		
Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr	Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr	Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr	Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr	Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr	Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr	Alternative 1 100-yr	Alternative 2 100-yr	Alternative 3 100-yr
LP2ART	LP2ART	SRLP2	360	596	560	15	15	15	1197	1197	1197	1212.0	1212.0	1212.0	6:1	6:1	6:1	on line	on line	on line
DILP5	DILP5	SRLP5	236	268	260	15	15	15	1126	1126	1126	1141.0	1141.0	1141.0	6:1	6:1	6:1	on line	on line	on line
LP8ART	LP8ART	SRLP8	504	538	550	15	15	15	1059	1059	1059	1074.0	1074.0	1074.0	6:1	6:1	6:1	on line	on line	on line
LP12RT	LP12RT	SRLP12	388	471	370	15	15	15	998	998	998	1013.0	1013.0	1013.0	6:1	6:1	6:1	on line	on line	on line
LP16RT	LP16RT	SRLP16	78	97	100	10	10	10	902	902	902	912.0	912.0	912.0	6:1	6:1	6:1	on line	on line	on line

NOTE:
The above basins are designated as 'on line'. Although the basin footprints could be reduced by making them 'off line', this would result in larger volumes of flow moving downstream. Therefore, basins further downstream would receive larger amounts of volume and would have to therefore provide more attenuation to maintain channel peaks. The savings in area downstream may be lost due to the added volume from upstream. Depending on the situation, the downstream channel reaches might increase as well. This would result of the peak timing for combining hydrographs ocurred in a mannor that the resultant discharge was larger than before. Finally, offline basins require some type of inflow and outflow structure (such as a weir).

1. This represents the DCR channe&basin concept developed by URS for MCDOT up-sized from the 50-year storm event to the 100-year storm event.
2. Does not include daylighting of the basin.
3. No specific detail or backup computations was included with the HDR study. Such detail was beyond the scope of their study.
4. Basin elevations were not given in the URS/DCR, but derived from known natural ground elevations at the proposed locations and using the proposed basin depths.
5. Figures 2.5 - 2.7 show the proposed alternatives and the proposed basin locations.

- For Alternative 1, the inflow volume at proposed basin for the North and South Segment DCR's was exceeded by an average of approximately 280 acre-feet.
- For Alternative 2, there were 8 channel reaches where the maximum allowable channel velocities recommended in the FCDMC hydraulic design manual were exceeded (V > 15 f/s).
- For Alternative 2, there were 2 channel reaches where the proposed constructed channel depth for the North Segment DCR was exceeded.
- Alternative 3 used a combination of Alternatives 1 and 2 to eliminate channel overtopping and to eliminate surcharging of proposed retention basins.

Once the facilities were sized for the 3 alternatives, they were super-imposed on the digital terrain model (DTM) created for the project area in Land Development Desktop.

The proposed alternative channels were not horizontally 'tied down' using field survey monuments since that type of precision was beyond the scope of this study. However, they were oriented by lining up the east bank channel daylight line for each alternative with the east channel bank line of the proposed off site channel facility for the North Segment DCR.

Since the North Segment DCR did not daylight the proposed off site channel using the DTM, the east channel bank is shown on the plans as a straight line. Per the scope of work for this study, the proposed alternative channels were daylighted with the DTM. The east daylight line was then superimposed on the east channel bank line as defined by the North Segment DCR. The purpose for this method of placement was to facilitate an approximate comparison of the 100-year channel alternatives relative to the 50-year North Segment DCR off site channel design. The comparison was to be specific to the proposed channel footprint and orientation with respect to the clear recovery zone required by ADOT for the SR 303L roadway design. The comparison would also be useful in determining the amount of additional right of way required (if any) due to the larger alternative channel footprints.

Since there was no detail shown for the off site channel proposed with the South Segment DCR, the alternative channels were placed within a 75 foot corridor outside of the SR 303L right of way.

4.0 Quantity and Cost Analysis

Based on the Alternatives Analysis discussed above, URS has developed quantities for each of the 3 alternative channel designs. In addition to the three alternatives, quantities and costs were developed for the 50-year MCDOT DCR design as well. This was done using the methodology and criteria followed by the Loop 303 ADMP Update and the three alternatives. This results in a 'normalized' cost estimate for the MCDOT DCR that is directly comparable with the estimates prepared for the three alternatives.

As a result of the data collection and summary task of this analysis several factors emerged which explained the difference in the quantity/cost estimates prepared for the North Segment DCR and the Loop 303 ADMP Update preferred alternative. These are briefly explained below:

- The Loop 303 ADMP Update used a greater level of protection design storm (100-year, 24-hour versus the 50-year 24-hour)
- The ADMP Update 'North Loop 303 Channel' (analogous to the North Segment DCR channel) had different project limits. The ADMP Update North Loop 303 Channel extends from Greenway Road to Bullard Wash. The North Segment DCR channel extends from Bell Road to Indian School Road.
- The philosophy of the Loop 303 ADMP Update channel was to use a large shallow multi-use type facility to accomplish flood control. The philosophy of the North Segment DCR was to use a relatively narrow concrete channel to protect the SR 303L roadway.
- Due to the difference in design philosophy, the Loop 303 ADMP Update channel has a much larger footprint. The channel also has more stringent limits to the maximum allowable velocity and therefore, uses drop structures to limit it.
- The multi-use/aesthetic nature of the Loop 303 ADMP Update channel requires the use of elaborate landscaping and treatments compared with the simple concrete finish associated with the North Segment DCR.
- Due to uncertainties associated with the final preferred cross section for the SR 303L roadway, the Loop 303 ADMP Update assumed that all right of way required for the channel would be additional to that already secured for the roadway. If the assumption is made that the Loop 303 ADMP Update channel can use any and all right of way available from the SR 303L roadway, the total required right of way is decreased by approximately 42.7% from approximately 275 acres to 157.5 acres.
- The methods for determining earthworks are more detailed for the Loop 303 ADMP Update analysis than those used with the North Segment DCR. The North Segment DCR used the average area end method to determine channel excavation without regard for topography. For the alternatives analysis, a proposed channel profile was developed and superimposed onto the digital terrain model (DTM) developed for the project. Using channel cross-section templates, the Land Development Desktop software (LDD) was used to estimate cut and fill quantities. The North Segment DCR used a simplified approach to determining the excavation quantity required for the proposed retention facilities. The North Segment DCR simply used the volume of inflow during the 50-year storm event as the basin excavation quantity. The alternatives analysis superimposed the proposed basin design onto the DTM and used LDD to determine the cut and fill quantities.
- There were different assumptions used to size proposed culvert crossings along the North Segment DCR channel versus those used for the Loop 303 ADMP Update analysis. The main difference being that the Loop 303 ADMP Update analysis assumed that the maximum allowable headwater at each proposed culvert inlet couldn't exceed the depth of flow within the channel. For the North Segment DCR, the maximum allowable headwater was allowed to be greater than the flow depth within the channel and hence, fewer culvert barrels were required to convey the discharge. The North Segment DCR does not account for the effects of this excessive headwater on the proposed water surface elevation within the channel. There would likely be a significant impact to the channel capacity due to backwater, which could require a larger channel section.
- The proposed channel footprint for the North Segment DCR was based on the top width of the channel times the channel length. The top width was a function of channel side slopes, a 15-foot access road and total proposed depth of the channel. For the alternative

analysis, the proposed channel footprint was based on daylight lines determined by superimposing the proposed channel onto the DTM. These daylight lines typically result in a much wider channel footprint and are generated by attaching cross section templates to the proposed vertical profile. The templates included a 20-foot access road on the west side of the proposed channel per the criteria used with the L303 ADMP Update.

- The proposed basin footprints for the North Segment DCR were estimated by assuming a square shaped basin at 15-feet of depth and 6:1 side slopes with zero freeboard. No provision was made for the daylighting of the basin. The alternatives analysis superimposed the basin design onto the DTM and determined the daylight lines. In addition, a 20-foot access road was accounted for per the L303 ADMP Update criteria. The North Segment DCR did not account for any access road in its footprint estimate.

Similarly, during the course of completing this task, several factors affecting the quantities and hence the cost of the alternatives relative to the North Segment DCR off site drainage improvements were discovered. These factors result in a significant difference between the cost estimates for the North Segment DCR off site drainage improvements and the alternatives analysis. Several of these factors are listed and briefly explained below:

- The alternatives analysis starts with higher discharges and volume inflow estimates for the 50-year baseline model. This is due to modeling issues/differences between the alternatives analysis and the SR 303L North Segment DCR. See discussion in sections 3.1 and 3.2 for detail.
- Due to an increased storm event for the basis of design from the 50-year, 24-hour storm to the 100-year 24-hour storm, proposed alternatives are generally larger than those detailed in the SR 303L DCR. See discussion in section 3.3.1 through 3.3.3 above for details.
- There were different assumptions used to size proposed culvert crossings along the North Segment DCR channel versus those used for the alternatives analysis. The main difference being that the alternatives analysis assumes that the maximum allowable headwater at each proposed culvert inlet can't exceed the depth of flow within the channel. For the North Segment DCR, the maximum allowable headwater was allowed to be greater than the flow depth within the channel and hence, fewer culvert barrels were required to convey the discharge. The North Segment DCR does not account for the effects of this excessive headwater on the upstream hydraulic conveyance capacity of the channel. There would likely be a significant impact to the channel capacity due to backwater, which could require a larger channel section.
- The method for determining earthworks was much more detailed for the alternative analysis than those used with the North Segment DCR. The North Segment DCR used the average area end method to determine channel excavation without regard for topography. The alternatives analysis used a proposed channel profile superimposed onto a DTM developed for the project. The proposed channel sections were drawn as templates and attached to the proposed profile. The Land Development Desktop software (LDD) was used to estimate cut and fill quantities. Similarly, the North Segment DCR used a simplified approach to determining the excavation quantity required for the proposed retention facilities. The North Segment DCR simply used the volume of inflow during the 50-year storm event as the basin excavation quantity. The alternatives analysis

superimposed the proposed basin design onto the DTM and used LDD to determine the cut and fill quantities.

- The proposed channel footprint for the North Segment DCR was based on the top width of the channel times the channel length. The top width was a function of channel side slopes, a 15-foot access road and total proposed depth of the channel. For the alternative analysis, the proposed channel footprint was based on daylight lines determined by superimposing the proposed channel onto the DTM. These daylight lines typically result in a much wider channel footprint and are generated by attaching cross section templates to the proposed vertical profile. The templates included a 20-foot access road on the west side of the proposed channel.
- The proposed basin footprints for the North Segment DCR were estimated by assuming a square shaped basin at 15-feet of depth and 6:1 side slopes with zero freeboard. No provision was made for the daylighting of the basin. The alternatives analysis superimposed the basin design onto the DTM and determined the daylight lines. In addition, a 20-foot access road was accounted for. The North Segment DCR did not account for any access road in its footprint estimate.

Detailed comparisons similar to those described above with the South Segment DCR are not possible since that study does not consider the quantities and/or costs associated with the off site drainage improvements. Rather, the study only gives average estimates of the channel and basin dimensions without any detailed computations. Table 4.1 shows a detailed comparison of quantities estimated with the North Segment DCR relative to those estimated for the alternative analysis. Table 4.1 also shows the quantities computed for the North Segment DCR using the methodology and criteria laid out for the L303 ADMP Update. This information has been labeled on Table 4.1 as the 'Normalized' DCR.

5.0 Channel Safety and Access Considerations

The issues of safety and access were considered regarding the improved design of the proposed 100-year SR 303L flood control facility. Implementing proper cost effective safety measures for this type of facility is extremely important in order to mitigate issues related to life, traffic and property. Since this proposed facility will be constructed adjacent to a high-speed roadway, the issue of safety in regard to traffic becomes very important. Safety with regard to the life and health will not be as critical since the proposed facility will not offer multi-use components and will likely have restricted access. The following section will discuss the safety issues as they are described by both FCDMC and MCDOT/ADOT. The topics discussed will include public access; escape ramps, clear recovery zones, barriers and an evaluation of safety requirements in general.

5.1 FCDMC General Safety Requirements

The FCDMC hydraulic manual discusses safety requirements in terms of multi-use/aesthetic facilities as well as limited access facilities.

Table 4.1
Quantities Summary of Directly
Comparable Items for
North DCR Channel

Quantities Summary of Directly Comparible Items

CHANNEL NAME	ITEM DESCRIPTION	UNIT	Quantities DCR	Normalized DCR	Alternative 1	Alternative 2	Alternative 3	Comments
SR 303L - North	Channel Excavation	C.Y.	371,000	468,988	443,614	481,701	448,056	
	Channel Fill	C.Y.	0	13,830	46,102	24,918	43,813	
	Concrete Channel Lining	[3]S.Y./L.F.	201,080SY/49,690LF	234,130SY/52,302LF	52,420	55,738	52,071	DCR uses 6" and 8" lining, Alternatives use 8"
	Retention Basin Net Excavation	C.Y.	2,100,000	[4]3,206,183	2,393,119	3,139,998	2,765,343	
	Drop Structures - Grouted Rip-Rap	C.Y.	0	0	80	0	72	
	Channel ROW	ACRE	0.97	[5]3.00	41	36	48	
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	89	[6]105.9/113.7	105	128	124	ADMP values include daylight lines
	Hydroseed & Topsoil	ACRE	n/a	107	98	122	119	Alternatives assume hydroseed in basins only, ADMP assumes hydroseed in channels as well
	Landscaping & Aesthetic Treatment	SF	n/a	n/a	0	0	0	
	Rip Rap Energy Dissipater	EA.	3	3	3	3	3	
	Bell Road Culvert	EA.	2-barrel 5x6 RCB - 190'	9-barrel 5x6 RCB - 190'	4-barrel 10x6 RCB - 190'	3-barrel 10x6 RCB - 190'	3-barrel 10x6 RCB - 190'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Greenway Road Culvert	EA.	2-barrel 6x6 RCB - 230'	9-barrel 6x6 RCB - 230'	5-barrel 10x6 RCB - 230'	4-barrel 10x6 RCB - 230'	3-barrel 10x6 RCB - 230'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Waddell Road Culvert	EA.	2-barrel 6x8 RCB - 330'	9-barrel 6x8 RCB - 330'	7-barrel 10x6 RCB - 330'	6-barrel 10x6 RCB - 330'	6-barrel 10x6 RCB - 330'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Cactus Road Culvert	EA.	n/a	n/a	n/a	n/a	n/a	no culvert at this location for DCR
	Peoria Avenue Culvert	EA.	3-barrel 6x8 RCB - 330'	11-barrel 6x8 RCB - 330'	7-barrel 10x6 RCB - 330'	8-barrel 10x6 RCB - 330'	8-barrel 10x6 RCB - 330'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Olive Avenue Culvert	EA.	4-barrel 6x8 RCB - 320'	12-barrel 6x8 RCB - 320'	8-barrel 10x6 RCB - 320'	9-barrel 10x6 RCB - 320'	8-barrel 10x6 RCB - 320'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Northern Avenue Culvert	EA.	n/a					no culvert at this location for DCR
	Glendale Road Culvert	EA.	3-barrel 6x8 RCB - 310'	11-barrel 6x8 RCB - 310'	7-barrel 10x6 RCB - 310'	7-barrel 10x6 RCB - 310'	7-barrel 10x6 RCB - 310'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Bethany Home Road Culvert	EA.	3-barrel 6x8 RCB - 320'	12-barrel 6x8 RCB - 320'	8-barrel 10x6 RCB - 330'	7-barrel 10x6 RCB - 330'	7-barrel 10x6 RCB - 330'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.
	Camelback Road Culvert	EA.	n/a					no culvert at this location for DCR
	Indian School Road Culvert	EA.	2-barrel 5x6 RCB - 450'	6-barrel 5x6 RCB - 450'	6-barrel 10x6 RCB - 420'	3-barrel 10x6 RCB - 420'	3-barrel 10x6 RCB - 420'	DCR culverts sized using HW>dchannel without checking backwater; ADMP uses HW = dchannel.

1. Alternative culvert lengths were based on the DCR Ultimate plans.
2. The MCDOT DCR preferred alternative 2B was 'normalized' for direct comparison with the CO#12 alternatives. The DCR was quantified based on the methods and criteria used with the L303 ADMP Update and alternatives 1-3.
3. MCDOT DCR used a unit of SY, the ADMP Update and CO#12 alternatives used L.F.
4. MCDOT DCR did not daylight or include access road. The normailzed cost accounts for both of these things.
5. MCDOT DCR did not daylight. The normailzed cost did.
6. MCDOT DCR did not daylight. The normailzed cost did. Also, the normalized cost shows daylight only (DO) and rectangular area (RA) bounding the basin, DO/RA above.

For multi-use facilities, it is very important to communicate potential hazards to the public. To this end, the FCDMC recommends the use of signage with illustrative graphics that explain the primary flood control purpose of the facility. The signage should also inform the public of potential dangers present such as flooding, high velocity flows, etc... and explain that the primary purpose of the facility is flood control. In addition to signage, potential danger can be communicated to the public by using advanced warning of flooding such as alarms that may be triggered by the detection of flow upstream.

The FCDMC divides potential flood devices into two categories. The first include those devices that limit access (fencing, guardrail, warning signs, safety barriers, etc...). The second includes those devices that permit escape (safety nets, cables, safety racks, stepped walls, ladders, etc...). It should be noted that devices that permit escape, generally tend to impede flow as well.

The FCDMC recommends that dry weather safety also be addressed. This includes potential traffic hazards such as, improper guardrail placement and unprotected drops. This could also include vertical drops within the channels that attract the public for unsafe recreation. Since the manual does not use specifics in regard to these types of safety measures, more detail is given in the ADOT and MCDOT Roadway Design Guidelines.

In alternatives 1 and 3, some drop structures were used to control maximum channel velocity. The flow velocity in the channel for all three alternatives is generally between 10 and 19 f/s, however, it is limited to a maximum of 15 f/s for alternatives where drop structures are used. According to the new FCDMC draft hydraulic manual, any hydraulic structure that incorporates drop structures should limit the height of such structures to a maximum of 2.5 feet.

To simplify the analysis, the proposed drop structure height ranged from 2 to 4 feet. The height of the drops was determined by a quick initial optimization of the channel profile using a combination of proposed channel slope, the existing ground slope and upstream/downstream target elevations. The target elevations were generally based on the following factors:

- Existing structure elevation (either upstream or downstream) that is being 'tied into'
- A maximum or minimum elevation required to allow clearance over or under an existing structure
- Cut and fill considerations based on the existing topography
- Minimum channel depths required to maintain flow depth and freeboard requirements relative to existing grades along the proposed channel profile

Based on the FCDMC safety requirements, all of the channel design alternatives may require some modification. The proposed channel in all three alternatives is a concrete lined channel with side slopes of 2:1 from Indian School Road north and 3:1 from Indian School Road south. The channel is sub-critical with depths greater than three feet and has relatively high velocities during the design storm. Due to the relatively steep channel side slopes of 2:1, and high flow velocities, the FCDMC safety recommendations call for either limited access to the channel or escape ladders with signage in the channel indicating escape routes. Although it would be more economical to provide escape ladders and signage, it would probably be safer to preclude any public access at all through the use of fencing. Such fencing may not be desired, however, due to aesthetic considerations. In any case, the cost of fencing along the entire channel length of 18.5 miles on both sides (37 miles) would be a significant (approximately 1.5 Million). Table 5.1 shows a summary of the alternatives and the recommended FCDMC channel safety and access requirements.

In regard to proposed retention basins, the FCDMC recommends that factors such as inflow velocities at basin inlets be minimized to reduce the risk of harm to anyone near the inlet during a storm event. This study did not consider the reduction of inflow velocities, however, they should be considered upon final design. For an in line basin, limiting the channel velocity at the inlet would likely be accomplished through a combination of flattening the channel, use of grade control/drop structure(s) with a stilling basin and/or channel widening. For off line basins, this is not as difficult since the inflow velocity could be controlled using a side weir from the channel in combination with a stilling basin/energy dissipator.

The FCDMC recommends that railings or fencing be provided along the top of structural walls. Again, this was not considered for this analysis. Such fencing and railing would be a very minor cost in comparison with the overall project costs.

The FCDMC also recommends that the side slopes in proposed retention/detention facilities be kept as flat as possible (4:1 or flatter) to allow persons caught to easily escape. Since all three alternatives propose the use of grass lined basins with 6:1 side slopes, this should not be an issue.

Another FCDMC safety requirement for retention/detention basins involves the use of trash racks or access barriers on outlet pipes. These structures will effectively reduce the potential for someone to be trapped in the outlet pipe. In addition, there should be well signed exit routes that are easy to negotiate when wet. This should not be a problem since the proposed retention basins will have 6:1 side slopes and should be easy to exit from any direction. It is important that signs be posted at outlets alerting the public that powerful currents could develop near the outlet that could drag a person under-water regardless of the presence of a trash-rack. The use of trash racks should be considered during final design and will create some head loss due to the restriction of the outflow. Computations of the trash rack head loss and its effect on peak stage within the basin should be evaluated. If trash rack head loss is significant, the basin may be enlarged or deepened to compensate. Table 5.2 shows a summary of the alternatives and the recommended FCDMC basin safety and access requirements.

5.2 ADOT/MCDOT Safety and Access Requirements

Based on conversations with the URS SR 303L DCR project team, the SR 303L DCR scope of work dictated the use of ADOT design criteria. The reason for this was based on ownership of the roadway. Since ADOT actually owns the road the ultimate design should be based on ADOT standards. However, design requirements for the interim condition may be more flexible and may possibly incorporate MCDOT standards. For the purpose of this study, the assumption will be for the ultimate SR 303L roadway design and therefore, the ADOT guidelines are used.

Table 5.1
FCDMC Channel Safety and Access

Alternative ID	Channel Description: Depth (ft)	Velocity (f/s)	Side Slopes (X:1)	Material Description	Multi-Use Y/N	Headwalls and/or Wingwalls Y/N	Drop Structures Y/N	Flow Classification	FCDMC Safety Recommendations: [1]escape ladders or equal	[3]Cost Estimate	minimize height of drops @ 2.5'	[4]Cost Estimate	[2]fencing along channel Y/N	[5]Cost Estimate
Alternative 1	4.5 to 6	13 to 15	2:1	concrete	N	Y	Y	sub critical	N/A	N/A	N	N/A	N	$1,502,546
Alternative 2	4 to 6	10.5 to 19	2:1	concrete	N	Y	N	sub critical	N/A	N/A	N	N/A	N	$1,502,546
Alternative 3	4 to 6	10.5 TO 14.9	2:1	concrete	N	Y	Y	sub critical	N/A	N/A	N	N/A	N	$1,502,546

N = Alternative does not implement the recommendation
Y = Alternative implements the recommendation

1. Beyond the scope of a planning project. This safety feature would be implemented upon final design and will not be significant relative to over all project costs.
2. Not included in the cost estimate, however, may be required due to the steep side slopes, concrete channel, etc...
3. Cost anticipated to be very low relative to overal construction cost.
4. Cost is a trade-off. Replacement of a few large drops with several small drops will not significantly increase cost.
5. This value represents an average for all three alternatives.

Table 5.2
FCDMC Basin Safety and Access

Basin Description						FCDMC Safety Recommendations													
Alternative ID	Depth (ft)	Side Slopes (X:1)	Material Description	Multi-Use Y/N	Headwalls and/or Wingwalls Y/N	[1]escape ramps or equal	[1]Cost Estimate	[1]minimize inflow velocity	[1]Cost Estimate	fencing along basin Y/N	[3]Cost Estimate	[1]use of railings on structures Y/N	Cost Estimate	adequate bottom conditions Y/N	[2]Cost Estimate	[1]use of trash-racks on outlets Y/N	[1]Cost Estimate
Alternative 1	10 to 15	6:1	grass lined	N	Y	N	N/A	N	N/A	N	$226,962	N/A	N/A	Y	N/A	N/A	N/A
Alternative 2	11 to 15	6:1	grass lined	N	Y	N	N/A	N	N/A	N	$226,962	N/A	N/A	Y	N/A	N/A	N/A
Alternative 3	12 to 15	6:1	grass lined	N	Y	N	N/A	N	N/A	N	$226,962	N/A	N/A	Y	N/A	N/A	N/A

N = Alternative does not implement the recommendation
Y = Alternative implements the recommendation

1. Beyond the scope of a planning project. This safety feature would be implemented upon final design and will not be significant relative to over all project costs.
2. Inherent to selected construction material.
3. This value represents an average for all three alternatives.

According Chapter 600 in the ADOT Roadway Design Guidelines, the following safety requirements are stated in regard to open channel conveyances for storm drainage adjacent to a highway:

- Channels adjacent to a roadway without barrier protection should have side slopes not steeper than 4:1 and a rounded bottom at least 4 feet wide
- Velocities may not exceed 29.5 f/s
- Channel side slopes should not exceed 2:1

Regarding access, the ADOT guidelines stated the following:

- A 20 foot access strip would be desired adjacent and gently sloping toward the channel on both sides
- At a minimum, a 12 foot wide strip should be provided on at least one side of the channel for access
- 10 foot wide maintenance access ramps should be incorporated into the channel design to provide access into the channel upstream and downstream of hydraulic structures
- Access ramps should be approximately 100 feet away from channel transitions and should be placed in the high side of the channel

In regard to the design of basins, the guidelines stated the following:

- All basins should drain completely within 36 hours
- The basin should be placed at a 20 foot setback from adjacent property or section lines
- Basin side slopes should not exceed 3:1
- The maximum basin depth should not exceed 25 feet
- The need for fencing around proposed basins should be evaluated on a case by case basis

The ADOT Roadway Design Guidelines detail the use of barriers such as guardrails, safety-shape barriers, etc… in section 300-19. According to Table 303.2A, the required clear zone adjacent to the SR 303L would be approximately 30 feet minimum. If the cost of providing this recovery area is too high due to inadequate or cost prohibitive right of way, the clear zone may be encroached upon. If there is encroachment into the clear zone, some form of barrier such as guardrail must be used for safety.

ADOT typically prefers the use clear recover zones to that of barriers due to safety issues regarding the barrier itself and the dangers it poses to motorists relative to the encroaching facility. Further, barriers are not typically aesthetically pleasing and would not necessarily fit in with the overall project goals for the area. Finally, barriers do have an associated cost that can be significant and should be weighed against the cost of additional right of way.

For the purpose of this study a quick cost estimate was done to determine the cost of encroachment on the clear zone by the channel versus the increase in project cost for additional right of way. The analysis was done for the north portion of the channel from Indian School Road north to Bell Road. The HDR/DCR for the portion south from Indian School Road to the Gila River did not include detail sufficient for the comparison.

The results of the comparison showed that the URS/DCR provides an average clear zone of approximately 35.4 feet. The average distance that the proposed 100-year channel would exceed the existing right of way line was estimated to be approximately 32 feet. The difference of approximately 3.5 feet should be adequate to allow for the use of guardrail. When using guardrail, consideration must be given to its impact deflection properties and therefore, there must be some amount of clearance between the guardrail and the encroaching facility into the clear zone. If the assumption were made that the 3.5' clearance is adequate with regard to guardrail impact deflection, the cost savings in terms of right of way would be approximately 1.6 Million dollars. Since the cost of a guardrail would be approximately $700,000, the use of guardrail would be more economical. However, if the assumption is made that 3.5 feet is inadequate regarding the impact deflection properties of the guardrail, then an alternative concrete type barrier must be considered. Based on the use of a concrete barrier, the cost of the barrier would increase to 2.1 Million dollars. In this case, the cost of additional right of way is more economical.

The above analysis does not attempt to assess the 'cost' to motorist safety based on the placement of the barrier/guardrail itself. Upon final design, all such considerations should be weighed one against the other in order to make the best over all choice.

The MCDOT Roadway Design Manual states in section 4-21 that, "Drainage design will be in accordance with the current Flood Control District of Maricopa County Drainage Design Manual (Volumes I, II, and III)". Further, the manual does not directly address access or safety regarding flood control channels. Rather, these subjects are addressed in context of roadway design only.

The manual does discus clear zone safety requirements in section 5.25 but gives similar guidance as the ADOT manual. From Figure 5.30 on page 5-57 of the manual, the required clear zone recovery for the SR 303L is approximately 30 feet. Section 5.3 of the manual also addresses the issue of barrier use in cases where there is a roadside feature that encroaches on the required clear zone. In these instances, the manual directs the designer to perform a cost-benefit type analysis similar to that discussed above. The analysis would include the following:

- Remove the roadside feature so that shielding is unnecessary
- Install the barrier
- Do nothing

As shown above, the SR 303L project involves the issue of whether to place the proposed channel in the clear recovery zone to avoid large right of way takes required for the increased storm event (50-year to 100-year).

The MCDOT manual indicates that the 'do nothing' alternative is only feasible on roadways with very low traffic volumes or design speeds. In essence, the MCDOT safety requirements and access guidelines are a combination of the FCDMC and ADOT requirements in so far as they pertain to those items reviewed by this analysis per the scope of work. Therefore, the discussion will be limited to FCDMC and ADOT requirements only in the following sections. Table(s) 5.3 and 5.4 summarize the ADOT safety and access requirements.

5.3 Cost Impacts of Implementing ADOT and FCDMC Safety and Access Requirements

Based on some simple computations, the total cost of implementing the major safety items discussed above is itemized below:

- Fencing along the channel on both sides to restrict public access - $1,500,000 *additional*
- Fencing along the perimeter of all proposed retention facilities - $227,000 *additional*
- Providing access ramps upstream and downstream of major hydraulic structures - $208,000 *additional*

Sub Total = $1,940,000

- Use of a guardrail instead of purchasing additional right of way if permitted based on impact deflection - $947,500 *saved on northern reach. Assuming the same rate of saving on the southern reach, at total savings of $1,700,000 is estimated ($947,500/10.56miles = $89,725/mile @ total project length of 10.56mi + 7.97mi =18.53miles. Therefore, $89,725/mile * 18.53 miles = $1, 700,00)*

Total Additional Project Costs = ($1,940,000 - $1,700,000 = $240,000)

- Use of a concrete barrier if guardrail impact deflection exceeds 3.5 feet allowed - $489,000 *additional on northern reach. Assuming the same rate of increased cost on the southern reach, or an additional $369,000 is estimated*

Total Additional Project Costs = ($1,950,000 + $489,000 + $369,000 = $2,800,000)

The costs associated with the portion of the SR 303L south of Indian School Road were estimated based on those determined for the north segment from Indian School Road to Bell. This was necessary since the HDR/DCR did not provide sufficient detail for the analysis to have any meaning on the south segment.

The total cost of the above safety improvements is significant, however, relative to the average total cost of all three alternatives ($78,500,000 dollars using ADMP costs or $41,700,000 dollars using the DCR costs – not including contingencies), it is not a huge percentage of the total cost estimate (approximately 3.5% and 6.7% respectively). Tables 5.1 through 5.4 include estimates of costs associated with the implementation of major safety and access issues not currently addressed by the alternatives.

Table 5.3
ADOT/MCDOT Channel Safety and Access

Channel Description									ADOT Safety Recommendations							
Alternative ID	Depth (ft)	Velocity (f/s)	Side Slopes (X:1)	Material Description	Multi-Use Y/N	Headwalls and/or Wingwalls Y/N	Drop Structures Y/N	Flow Classification	[1]Channel Side Slopes > 4:1	[2]Channel Side Slopes > 2:1	4-foot Minimum Bottom Width	[2]fencing along channel Y/N	Velocities 29.5 f/s or Less	[3]inimum 12 foot Access Road	[4]10 foot wide access ramps	[5]Cost Estimate
Alternative 1	4.5 to 6	13 to 15	2:1	concrete	N	Y	Y	sub critical	Y	N	Y	N	Y	Y	N	$208,393
Alternative 2	4 to 6	10.5 to 19	2:1	concrete	N	Y	N	sub critical	Y	N	Y	N	Y	Y	N	$208,393
Alternative 3	4 to 6	10.5 TO 14.9	2:1	concrete	N	Y	Y	sub critical	Y	N	Y	N	Y	Y	N	$208,393

N = Alternative does not implement the recommendation
Y = Alternative implements the recommendation

1. Must be greater than 4:1 when channel is adjacent to a roadway without barrier protection.
2. Must not exceed 2:1.
3. The alternatives provide for a 20 foot access road.
4. This type of ramp is required on the high side of the channel upstream and downstream of major transisitions and hydraulic structures. Each alternative would require a minimum of 22 ramps to provide access upstream and downstream of every major culvert crossing.
5. This value represents an average for all three alternatives.

Table 5.4
ADOT/MCDOT Basin Safety and Access

	Basin Description					FCDMC Safety Recommendations												
												If Clear Zone Provided			If Clear Zone Encroached			
Alternative ID	Depth (ft)	Side Slopes (X:1)	Material Description	Multi-Use Y/N	Headwalls and/or Wingwalls Y/N	36 hour basin drain time	[1]Cost Estimate	20 foot [2]minimum property setback	25 foot maximum basin depth	[3]basin fencing provided	average fencing [1,5]Cost Estimate	minimum 30' clear zone	[6]right of way requirement	[6]right of way cost estimate	minimum 30' clear zone	[5]right of way requirement	[5]guard rail barrier cost estimate	[5]concrete barrier cost estimate
Alternative 1	10 to 15	6:1	grass lined	N	Y	Y	N/A	N	Y	N	$226,962	Y	41 ac	$1,645,516	N	0 ac	$698,013	$2,134,801
Alternative 2	11 to 15	6:1	grass lined	N	Y	Y	N/A	N	Y	N	$226,962	Y	36 ac	$1,439,656	N	0 ac	$698,013	$2,134,801
Alternative 3	12 to 15	6:1	grass lined	N	Y	Y	N/A	N	Y	N	$226,962	Y	48 ac	$1,933,835	N	0 ac	$698,013	$2,134,801

N = Alternative does not implement the recommendation
Y = Alternative implements the recommendation

1. Beyond the scope of a planning project. This safety feature would be implemented upon final design and will not be significant relative to over all project costs.
2. Beyond the scope of a planning project. This would be implemented upon final design and will not be significant relative to over all project costs.
3. Fencing requirements around basins are evaluated on a case by case basis.
4. Right of way estimate is based on an average requirement of all three alternatives. Right of way cost estimate is based on $40,000/acre.
5. NOTE: Only the north portion of channel was considered since the HDR/DCR did not have detailed information on clear zone provisions. For simplicity values are based on weighted averages. Actual values may vary slightly.
6. NOTE: Only the north portion of channel was considered since the HDR/DCR did not have detailed information on clear zone provisions.

6.0 Cost Estimates and Comparisons

The final task of this study was to complete a cost estimate for the proposed alternatives and compare that estimate with the North Segment DCR. Since there are very significant differences in the unit costs and the methods used to derive quantities associated with the alternatives analysis versus those used with the North Segment DCR, two cost estimates were prepared for each of the three alternatives. The first estimate was prepared using unit costs consistent with those used with the Loop 303 ADMP Update project. The second estimate was prepared using unit costs consistent with those used with the North Segment DCR.

The key differences to the unit costs used for like items are listed below:

Costs - North Segment DCR:

- The unit costs for the proposed culvert headwalls are based on a lump sum that does not change with additional barrels. These costs do not account for inlet/outlet aprons.
- The culvert concrete unit costs do not increase based on number of barrels, there is a price per LF that does not change with multiple barrels.
- The price per foot of the proposed low-flow post storm basin drainpipes are significantly lower than those used with the ADMP Update. There is no source sited for these costs.
- The cost of right of way was assumed to be $43,560/acre.
- The cost estimate for the concrete channel is given in $/SY for 6-inch and 8-inch concrete. There is no detail given regarding reinforcement, over excavation, structural backfill, etc...
- The unit cost for retention basin excavation was $1.50/CY
- The unit cost for channel cut and fill was $1.75/CY
- There were no allowances for contingencies or engineering design fees.

Alternatives 1 - 3:

- The quantities for the proposed culvert headwalls are based on the ADOT 'B Standards'. These unit costs increase with additional culvert barrels. They also include inlet and outlet apron quantities.
- The culvert concrete and steel quantities are based on the ADOT 'B Standards' and increase with increased number of barrels. Therefore, the unit costs for these quantities changes.
- The price per foot of the proposed low-flow post storm basin drain pipes are based on the ADOT construction costs and adjusted for inflation.
- The cost of right of way was assumed to be $40,000/acre.
- The cost estimate for the concrete channel is estimated based on 8-inch concrete. The cost per foot for the channel is derived based on required reinforcement, over excavation, structural backfill, etc...
- The unit cost for retention basin excavation was $5.0/CY
- The unit cost for channel cut and fill was $3.25/CY

- The estimate assumes that there are engineering fees of approximately 10% of the construction budget and there is a 30% contingency attached to the construction budget.

Tables 6.1 through 6.3 summarize the detailed cost estimate for each of the three alternatives using the Loop 303 ADMP Update unit costs and using the North Segment DCR unit costs.

For a better comparison of the alternative costs with those associated with the MCDOT DCR alternative, URS used the MCDOT DCR design to generate a quantity/cost estimate consistent with the methods used for the alternatives.

Although there are two costs associated with each of the alternatives listed above, the smaller of the two based on the MCDOT DCR unit costs, there are still significant differences in the methods of generating quantities. The MCDOT DCR uses a more general and simplified approach to quantity generation where the alternatives analysis use much more detailed methods consistent with those developed under the Loop 303 ADMP Update. Therefore, the only way to obtain a direct comparison of the alternatives to the MCDOT DCR, was to 'normalize' the MCDOT DCR quantity/cost estimate as discussed in previous sections of this memorandum.

URS used the methodology to generate quantities for the alternatives and applied those to the MCDOT DCR. Once quantities were generated for the MCDOT DCR using the more detailed methodology, the unit costs used with the Loop 303 ADMP Update and alternatives were applied to the MCDOT DCR quantities. The result was a total project cost estimate that was directly comparable with the alternatives evaluated under this study. Table 6.4 shows the cost estimate associated with the MCDOT DCR 'normalized' alternative. Table 6.5 shows a summary of the results of the cost estimate.

SR 303L Channel Alternative 1 - ADMP UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North & South	Channel Excavation	C.Y.	$3.25	916,044	$2,977,144
	Channel Fill	C.Y.	$3.25	85,467	$277,767
	Concrete&Steel	L.F.	$293.48	92,716	$27,210,854
	Retention Basin Net Excavation	C.Y.	$5.00	3,676,067	$18,380,335
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	85	$10,999
	Channel ROW	ACRE	$40,000.00	72	$2,878,074
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	164.3	$6,570,183
	Hydroseed & Topsoil	ACRE	$2,500.00	152	$380,565
	Utility Relocation	EA.	$0.00	2	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5	$25,000
	27" Low Flow Drain Pipe	L.F.	$72.00	1,364	$98,182
	48" Low Flow Drain Pipe	L.F.	$126.00	8,758	$1,103,508
	54" Low Flow Drain Pipe	L.F.	$155.00	7,212	$1,117,860
	78" Low Flow Drain Pipe	L.F.	$313.00	12,120	$3,793,560
	Culverts	L.S.	$16,522,944.62	1	$16,522,945
				Σ =	$81,346,975
				Sub Total =	*$81,346,975*
				Engineering (10% Construction) =	*$8,134,698*
				30% Contingency =	*$24,404,093*
				Total =	***$113,885,765***

SR 303L Channel Alternative 1 - DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North & South	Channel Excavation	C.Y.	$1.75	916,044	$1,603,077
	Channel Fill	C.Y.	$1.75	85,467	$149,567
	Concrete&Steel	L.F.	$105.73	92,716	$9,802,534
	Retention Basin Net Excavation	C.Y.	$1.50	3,676,067	$5,514,101
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	85	$12,691
	Channel ROW	ACRE	$43,560.00	72	$3,134,223
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*164.3*	$7,154,929
	Hydroseed & Topsoil	ACRE	$2,500.00	*152.2*	$380,565
	Utility Relocation	EA.	$0.00	2	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5	$25,000
	27" Low Flow Drain Pipe	L.F.	$40.00	1,364	$54,545
	48" Low Flow Drain Pipe	L.F.	$70.00	8,758	$613,060
	54" Low Flow Drain Pipe	L.F.	$86.11	7,212	$621,033
	78" Low Flow Drain Pipe	L.F.	$173.89	12,120	$2,107,533
	Culverts	L.S.	$15,399,788.51	1	$15,399,789
				Σ =	$46,572,647
				Sub Total =	*$46,572,647*
				Engineering (10% Construction) =	*$4,657,265*
				30% Contingency =	*$13,971,794*
				Total =	***$65,201,706***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 1 - ADMP UNIT COSTS

NEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North	Channel Excavation	C.Y.	$3.25	443,614	$1,441,744
	Channel Fill	C.Y.	$3.25	46,102	$149,830
	Concrete&Steel	L.F.	$285.89	52,420	$14,986,572
	Retention Basin Net Excavation	C.Y.	$5.00	2,394,395	$11,971,975
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	80	$10,381
	Channel ROW	ACRE	$40,000.00	41	$1,645,516
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	105.1	$4,202,896
	Hydroseed & Topsoil	ACRE	$2,500.00	98	$245,547
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
	48" Low Flow Drain Pipe	L.F.	$126.00	8,758	$1,103,508
	54" Low Flow Drain Pipe	L.F.	$155.00	5,560	$861,800
	78" Low Flow Drain Pipe	L.F.	$313.00	12,120	$3,793,560
	8 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$998,418.96	1	$998,419
	8 Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$968,950.50	1	$968,950
	7 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$878,508.57	2	$1,757,017
	7 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$826,698.17	1	$826,698
	6 Barrel 420' Long, 10' X 6' RCB Culvert	EA.	$959,675.59	1	$959,676
	5 Barrel 230' Long, 10' X 6' RCB Culvert	EA.	$450,901.08	1	$450,901
	4 Barrel 190' Long, 10' X 6' RCB Culvert	EA.	$304,448.45	1	$304,448
				Σ =	$46,694,439
				Sub Total =	*$46,694,439*
				Engineering (10% Construction) =	*$4,669,444*
				30% Contingency =	*$14,008,332*
				Total =	***$65,372,215***

SR 303L Channel Alternative 1 - DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North	Channel Excavation	C.Y.	$1.75	443,614	$776,324
	Channel Fill	C.Y.	$1.75	46,102	$80,678
	Concrete&Steel	L.F.	$98.22	52,420	$5,148,719
	Retention Basin Net Excavation	C.Y.	$1.50	2,394,395	$3,591,593
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	80	$11,978
	Channel ROW	ACRE	$43,560.00	41	$1,791,967
	1 Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*105.1*	$4,576,954
	Hydroseed & Topsoil	ACRE	$2,500.00	*98.2*	$245,547
	Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
	48" Low Flow Drain Pipe	L.F.	$70.00	8,758	$613,060
	54" Low Flow Drain Pipe	L.F.	$86.11	5,560	$478,772
	78" Low Flow Drain Pipe	L.F.	$173.89	12,120	$2,107,547
	8 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$972,459.42	1	$972,459
	8 Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$942,990.96	1	$942,991
	7 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$854,871.65	2	$1,709,743
	7 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$803,061.25	1	$803,061
	6 Barrel 420' Long, 10' X 6' RCB Culvert	EA.	$938,361.29	1	$938,361
	5 Barrel 230' Long, 10' X 6' RCB Culvert	EA.	$431,909.40	1	$431,909
	4 Barrel 190' Long, 10' X 6' RCB Culvert	EA.	$287,779.39	1	$287,779
				Σ =	$25,524,442
				Sub Total =	*$25,524,442*
				Engineering (10% Construction) =	*$2,552,444*
				30% Contingency =	*$7,657,333*
				Total =	***$35,734,218***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 1 - ADMP UNIT COSTS

NNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest		Channel Excavation	C.Y.	$3.25	434,326	$1,411,560
		Channel Fill	C.Y.	$3.25	3,162	$10,276
		Concrete&Steel	L.F.	$347.42	27,736	$9,635,943
		Retention Basin Net Excavation	C.Y.	$5.00	1,281,672	$6,408,360
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	5	$618
		Channel ROW	ACRE	$40,000.00	21	$823,858
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	59.2	$2,367,287
		Hydroseed & Topsoil	ACRE	$2,500.00	54	$135,019
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
		27" Low Flow Drain Pipe	L.F.	$72.00	1,364	$98,182
		54" Low Flow Drain Pipe	L.F.	$155.00	1,652	$256,060
	8	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$1,352,040.57	1	$1,352,041
	7	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$826,698.17	4	$3,306,793
	7	Barrel 70' Long, 10' X 6' RCB Culvert	EA.	$826,698.17	1	$826,698
	6	Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$736,256.24	1	$736,256
	6	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$713,914.30	3	$2,141,743
					Σ =	$29,520,692
					Sub Total =	*$29,520,692*
					Engineering (10% Construction) =	*$2,952,069*
					30% Contingency =	*$8,856,208*
					Total =	***$41,328,969***

SR 303L Channel Alternative 1 - DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest		Channel Excavation	C.Y.	$1.75	434,326	$760,071
		Channel Fill	C.Y.	$1.75	3,162	$5,533
		Concrete&Steel	L.F.	$119.24	27,736	$3,307,259
		Retention Basin Net Excavation	C.Y.	$1.50	1,281,672	$1,922,508
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	5	$713
		Channel ROW	ACRE	$43,560.00	21	$897,181
	1	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*59.2*	$2,577,975
		Hydroseed & Topsoil	ACRE	$2,500.00	*54.0*	$135,019
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
		27" Low Flow Drain Pipe	L.F.	$40.00	1,364	$54,545
		54" Low Flow Drain Pipe	L.F.	$86.11	1,652	$142,254
	8	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$1,326,081.03	1	$1,326,081
	7	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$803,061.25	4	$3,212,245
	7	Barrel 70' Long, 10' X 6' RCB Culvert	EA.	$181,336.41	1	$181,336
	6	Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$714,941.94	1	$714,942
	6	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$692,600.00	3	$2,077,800
					Σ =	$17,325,462
					Sub Total =	*$17,325,462*
					Engineering (10% Construction) =	*$1,732,546*
					30% Contingency =	*$5,197,639*
					Total =	***$24,255,646***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 1

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$3.25	38,104	$123,839
		Channel Fill	C.Y.	$3.25	36,203	$117,661
		Concrete&Steel	L.F.	$206.07	12,561	$2,588,339
		Retention Basin Net Excavation	C.Y.	$5.00	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
		Channel ROW	ACRE	$40,000.00	10	$408,701
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	0	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	0	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	12	Barrel 80' Long, 10' X 6' RCB Culvert	EA.	$385,022.27	1	$385,022
	9	Barrel 220' Long, 72" DIAM. RCP Culvert	EA.	$754,980.29	1	$754,980
	3	Barrel 310' Long, 72" DIAM. RCP Culvert	EA.	$376,650.81	2	$753,302
					S =	$5,131,844
					Sub Total =	*$5,131,844*
					Engineering (10% Construction) =	*$513,184*
					30% Contingency =	*$1,539,553*
					Total =	*$7,184,582*

SR 303L Channel Alternative 1 - DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$1.75	38,104	$66,683
		Channel Fill	C.Y.	$1.75	36,203	$63,356
		Concrete&Steel	L.F.	$107.21	12,561	$1,346,556
		Retention Basin Net Excavation	C.Y.	$1.50	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
		Channel ROW	ACRE	$43,560.00	10	$445,075
	1	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*0.0*	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	*0.0*	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	12	Barrel 80' Long, 10' X 6' RCB Culvert	EA.	$349,772.25	1	$349,772
	9	Barrel 220' Long, 72" DIAM. RCP Culvert	EA.	$726,698.13	1	$726,698
	3	Barrel 310' Long, 72" DIAM. RCP Culvert	EA.	$362,304.37	2	$724,609
					Σ =	$3,722,749
					Sub Total =	*$3,722,749*
					Engineering (10% Construction) =	*$372,275*
					30% Contingency =	*$1,116,825*
					Total =	*$5,211,848*

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 2 - ADMP UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$3.25	759,884	$2,469,624
	Channel Fill	C.Y.	$3.25	85,613	$278,244
	Concrete&Steel	L.F.	$243.58	97,822	$23,827,919
	Retention Basin Net Excavation	C.Y.	$5.00	4,726,753	$23,633,765
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	3	$408
	Channel ROW	ACRE	$40,000.00	65	$2,589,684
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	191.6	$7,663,113
	Hydroseed & Topsoil	ACRE	$2,500.00	184	$460,447
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5	$25,000
	30" Low Flow Drain Pipe	L.F.	$82.00	2,500	$205,000
	48" Low Flow Drain Pipe	L.F.	$126.00	8,758	$1,103,508
	66" Low Flow Drain Pipe	L.F.	$260.00	5,560	$1,445,600
	78" Low Flow Drain Pipe	L.F.	$313.00	12,120	$3,793,560
	Culverts	L.S.	$11,665,228.29	1	$11,665,228
				Σ =	$79,161,099
				Sub Total =	*$79,161,099*
				Engineering (10% Construction) =	*$7,916,110*
				30% Contingency =	*$23,748,330*
				Total =	***$110,825,539***

SR 303L Channel Alternative 2 - DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$1.75	759,884	$1,329,797
	Channel Fill	C.Y.	$1.75	85,613	$149,824
	Concrete&Steel	L.F.	$42.91	97,822	$4,197,904
	Retention Basin Net Excavation	C.Y.	$1.50	4,726,753	$7,090,130
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	3	$470
	Channel ROW	ACRE	$43,560.00	65	$2,820,166
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*191.6*	$8,345,130
	Hydroseed & Topsoil	ACRE	$2,500.00	184.2	$460,447
	Landscaping & Aesthetic Treatment	SF	$1.65	0.0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5.0	$25,000
	30" Low Flow Drain Pipe	L.F.	$45.56	2,500.0	$113,889
	48" Low Flow Drain Pipe	L.F.	$70.00	8,758.0	$613,060
	66" Low Flow Drain Pipe	L.F.	$144.44	5,560.0	$803,111
	78" Low Flow Drain Pipe	L.F.	$173.89	12,120.0	$2,107,533
	Culverts	L.S.	$11,265,992.29	1.0	$11,265,992
				Σ =	$39,322,453
				Sub Total =	*$39,322,453*
				Engineering (10% Construction) =	*$3,932,245*
				30% Contingency =	*$11,796,736*
				Total =	***$55,051,434***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 2 - ADMP UNIT COSTS

NNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North		Channel Excavation	C.Y.	$3.25	481,701	$1,565,527
		Channel Fill	C.Y.	$3.25	24,918	$80,983
		Concrete&Steel	L.F.	$262.98	55,738	$14,657,898
		Retention Basin Net Excavation	C.Y.	$5.00	3,139,998	$15,699,990
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
		Channel ROW	ACRE	$40,000.00	36	$1,439,656
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	128.1	$5,123,619
		Hydroseed & Topsoil	ACRE	$2,500.00	122	$304,228
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
		48" Low Flow Drain Pipe	L.F.	$70.00	8,758	$613,060
		66" Low Flow Drain Pipe	L.F.	$260.00	5,560	$1,445,600
		78" Low Flow Drain Pipe	L.F.	$313.00	12,120	$3,793,560
	9	Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$1,085,297.63	1	$1,085,298
	8	Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$998,418.96	1	$998,419
	7	Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$878,508.57	1	$878,509
	7	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$826,698.17	1	$826,698
	6	Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$758,598.17	1	$758,598
	4	Barrel 230' Long, 10' X 6' RCB Culvert	EA.	$365,033.59	1	$365,034
	3	Barrel 420' Long, 10' X 6' RCB Culvert	EA.	$505,210.43	1	$505,210
	3	Barrel 190' Long, 10' X 6' RCB Culvert	EA.	$236,403.96	1	$236,404
					Σ =	$50,393,290
					Sub Total =	*$50,393,290*
					Engineering (10% Construction) =	*$5,039,329*
					30% Contingency =	*$15,117,987*
					Total =	***$70,550,606***

SR 303L Channel Alternative 2 - DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South		Channel Excavation	C.Y.	$1.75	481,701	$842,976
		Channel Fill	C.Y.	$1.75	24,918	$43,606
		Concrete&Steel	L.F.	$36.53	55,738	$2,036,076
		Retention Basin Net Excavation	C.Y.	$1.50	3,139,998	$4,709,997
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
		Channel ROW	ACRE	$43,560.00	36	$1,567,785
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*128.1*	$5,579,621
		Hydroseed & Topsoil	ACRE	$2,500.00	*121.7*	$304,228
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
		48" Low Flow Drain Pipe	L.F.	$70.00	8,758	$613,060
		66" Low Flow Drain Pipe	L.F.	$144.44	5,560	$803,086
		78" Low Flow Drain Pipe	L.F.	$173.89	12,120	$2,107,547
	9	Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$1,057,015.47	1	$1,057,015
	8	Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$972,459.42	1	$972,459
	7	Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$854,871.65	1	$854,872
	7	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$803,061.25	1	$803,061
	6	Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$737,283.87	1	$737,284
	4	Barrel 230' Long, 10' X 6' RCB Culvert	EA.	$348,364.53	1	$348,365
	3	Barrel 420' Long, 10' X 6' RCB Culvert	EA.	$490,863.99	1	$490,864
	3	Barrel 190' Long, 10' X 6' RCB Culvert	EA.	$222,057.52	1	$222,058
					Σ =	$24,108,960
					Sub Total =	*$24,108,960*
					Engineering (10% Construction) =	*$2,410,896*
					30% Contingency =	*$7,232,688*
					Total =	***$33,752,544***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 2 - ADMP UNIT COSTS

ANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest		Channel Excavation	C.Y.	$3.25	254,388	$826,760
		Channel Fill	C.Y.	$3.25	6,437	$20,921
		Concrete&Steel	L.F.	$251.77	29,523	$7,433,084
		Retention Basin Net Excavation	C.Y.	$5.00	1,586,755	$7,933,775
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	3	$408
		Channel ROW	ACRE	$40,000.00	18	$700,283
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	70.1	$2,805,800
		Hydroseed & Topsoil	ACRE	$2,500.00	62	$156,218
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
		30" Low Flow Drain Pipe	L.F.	$82.00	2,500	$205,000
		66" Low Flow Drain Pipe	L.F.	$260.00	2,228	$579,280
	5	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$864,031.81	1	$864,032
	4	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$486,203.85	6	$2,917,223
	4	Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$501,350.14	1	$501,350
	3	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$376,650.81	1	$376,651
	3	Barrel 70' Long, 10' X 6' RCB Culvert	EA.	$96,157.10	1	$96,157
					Σ =	$25,426,942
					Sub Total =	*$25,426,942*
					Engineering (10% Construction) =	*$2,542,694*
					30% Contingency =	*$7,628,083*
					Total =	***$35,597,719***

SR 303L Channel Alternative 2 - DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest		Channel Excavation	C.Y.	$1.75	254,388	$445,178
		Channel Fill	C.Y.	$1.75	6,437	$11,265
		Concrete&Steel	L.F.	$46.73	29,523	$1,379,694
		Retention Basin Net Excavation	C.Y.	$1.50	1,586,755	$2,380,133
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	3	$470
		Channel ROW	ACRE	$43,560.00	18	$762,608
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*70.1*	$3,055,517
		Hydroseed & Topsoil	ACRE	$2,500.00	*62.5*	$156,218
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
		30" Low Flow Drain Pipe	L.F.	$45.56	2,500	$113,900
		66" Low Flow Drain Pipe	L.F.	$144.44	2,228	$321,812
	5	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$845,040.13	1	$845,040
	4	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$469,534.79	6	$2,817,209
	4	Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$484,681.08	1	$484,681
	3	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$362,304.37	1	$362,304
	3	Barrel 70' Long, 10' X 6' RCB Culvert	EA.	$81,810.66	1	$81,811
					Σ =	$13,227,840
					Sub Total =	*$13,227,840*
					Engineering (10% Construction) =	*$1,322,784*
					30% Contingency =	*$3,968,352*
					Total =	***$18,518,976***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 2 - ADMP UNIT COSTS

NNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$3.25	23,796	$77,337
		Channel Fill	C.Y.	$3.25	54,259	$176,340
		Concrete&Steel	L.F.	$145.12	12,561	$1,822,801
		Retention Basin Net Excavation	C.Y.	$5.00	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
		Channel ROW	ACRE	$40,000.00	11	$449,746
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	0.0	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	0	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	7	Barrel 80' Long, 10' X 6' RCB Culvert	EA.	$230,878.53	1	$230,879
	3	Barrel310' Long, 72" DIAM. RCP Culvert	EA.	$376,650.81	2	$753,302
	3	Barrel 220' Long, 72" DIAM. RCP Culvert	EA.	$271,465.67	1	$271,466
					Σ =	$3,781,869
					Sub Total =	*$3,781,869*
					Engineering (10% Construction) =	*$378,187*
					30% Contingency =	*$1,134,561*
					Total =	***$5,294,617***

SR 303L Channel Alternative 2 - DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$1.75	23,796	$41,643
		Channel Fill	C.Y.	$1.75	54,259	$94,952
		Concrete&Steel	L.F.	$60.90	12,561	$764,988
		Retention Basin Net Excavation	C.Y.	$1.50	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
		Channel ROW	ACRE	$43,560.00	11	$489,773
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*0.0*	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	*0.0*	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	7	Barrel 80' Long, 10' X 6' RCB Culvert	EA.	$207,241.61	1	$207,242
	3	Barrel310' Long, 72" DIAM. RCP Culvert	EA.	$362,304.37	2	$724,609
	3	Barrel 220' Long, 72" DIAM. RCP Culvert	EA.	$257,119.23	1	$257,119
					Σ =	$2,580,326
					Sub Total =	*$2,580,326*
					Engineering (10% Construction) =	*$258,033*
					30% Contingency =	*$774,098*
					Total =	***$3,612,457***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 3

INEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$3.25	734,766	$2,387,989
	Channel Fill	C.Y.	$3.25	105,805	$343,867
	Concrete&Steel	L.F.	$250.45	92,315	$23,120,272
	Retention Basin Net Excavation	C.Y.	$5.00	4,120,218	$20,601,090
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	75	$9,772
	Channel ROW	ACRE	$40,000.00	68	$2,712,681
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	174.9	$6,995,682
	Hydroseed & Topsoil	ACRE	$2,500.00	174	$434,328
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5	$25,000
	30" Low Flow Drain Pipe	L.F.	$82.00	2,500	$205,000
	48" Low Flow Drain Pipe	L.F.	$126.00	8,758	$1,103,508
	54" Low Flow Drain Pipe	L.F.	$155.00	2,228	$345,340
	66" Low Flow Drain Pipe	L.F.	$264.00	5,560	$1,467,840
	78" Low Flow Drain Pipe	L.F.	$313.00	12,120	$3,793,560
	Culverts	L.S.	$11,545,422.11	1	$11,545,422
				Σ =	$75,091,350
				Sub Total =	*$75,091,350*
				Engineering (10% Construction) =	*$7,509,135*
				30% Contingency =	*$22,527,405*
				Total =	***$105,127,890***

SR 303L Channel Alternative 3 - DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$1.75	734,766	$1,285,840
	Channel Fill	C.Y.	$1.75	105,805	$185,159
	Concrete&Steel	L.F.	$91.29	92,315	$8,427,124
	Retention Basin Net Excavation	C.Y.	$1.50	4,120,218	$6,180,327
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	75	$11,275
	Channel ROW	ACRE	$43,560.00	68	$2,954,109
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*174.9*	$7,618,297
	Hydroseed & Topsoil	ACRE	$2,500.00	*173.7*	$434,328
	Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5	$25,000
	30" Low Flow Drain Pipe	L.F.	$45.56	2,500	$113,889
	48" Low Flow Drain Pipe	L.F.	$70.00	8,758	$613,060
	54" Low Flow Drain Pipe	L.F.	$86.11	2,228	$191,856
	66" Low Flow Drain Pipe	L.F.	$146.67	5,560	$815,467
	78" Low Flow Drain Pipe	L.F.	$173.89	12,120	$2,107,533
	Culverts	L.S.	$8,217,337.09	1	$8,217,337
				Σ =	$39,180,602
				Sub Total =	*$39,180,602*
				Engineering (10% Construction) =	*$3,918,060*
				30% Contingency =	*$11,754,181*
				Total =	***$54,852,843***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 3

NEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North	Channel Excavation	C.Y.	$3.25	442,220	$1,437,217
	Channel Fill	C.Y.	$3.25	43,685	$141,976
	Concrete&Steel	L.F.	$273.90	52,071	$14,262,300
	Retention Basin Net Excavation	C.Y.	$5.00	2,765,343	$13,826,715
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	72	$9,365
	Channel ROW	ACRE	$40,000.00	48	$1,933,835
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	123.9	$4,955,682
	Hydroseed & Topsoil	ACRE	$2,500.00	119	$297,790
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
	48" Low Flow Drain Pipe	L.F.	$126.00	8,758	$1,103,508
	66" Low Flow Drain Pipe	L.F.	$264.00	5,560	$1,467,840
	78" Low Flow Drain Pipe	L.F.	$313.00	12,120	$3,793,560
	8 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$998,418.96	1	$998,419
	8 Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$968,950.50	1	$968,950
	7 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$878,508.57	1	$878,509
	7 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$826,698.17	1	$826,698
	6 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$758,598.17	1	$758,598
	3 Barrel 420' Long, 10' X 6' RCB Culvert	EA.	$505,210.43	1	$505,210
	3 Barrel 230' Long, 10' X 6' RCB Culvert	EA.	$283,152.91	1	$283,153
	3 Barrel 190' Long, 10' X 6' RCB Culvert	EA.	$236,403.96	1	$236,404
				Σ =	$48,700,728
				Sub Total =	*$48,700,728*
				Engineering (10% Construction) =	*$4,870,073*
				30% Contingency =	*$14,610,218*
				Total =	***$68,181,020***

SR 303L Channel Alternative 3 - DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North	Channel Excavation	C.Y.	$1.75	442,220	$773,886
	Channel Fill	C.Y.	$1.75	43,685	$76,448
	Concrete&Steel	L.F.	$94.12	52,071	$4,901,071
	Retention Basin Net Excavation	C.Y.	$1.50	2,765,343	$4,148,015
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	72	$10,806
	Channel ROW	ACRE	$43,560.00	48	$2,105,946
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*123.9*	$5,396,737
	Hydroseed & Topsoil	ACRE	$2,500.00	*119.1*	$297,790
	Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
	48" Low Flow Drain Pipe	L.F.	$70.00	8,758	$613,060
	66" Low Flow Drain Pipe	L.F.	$146.67	5,560	$815,485
	78" Low Flow Drain Pipe	L.F.	$173.89	12,120	$2,107,547
	8 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$709,394.57	1	$709,395
	8 Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$833,115.58	1	$833,116
	7 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$634,884.06	1	$634,884
	7 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$597,484.06	1	$597,484
	6 Barrel 330' Long, 10' X 6' RCB Culvert	EA.	$560,373.55	1	$560,374
	3 Barrel 420' Long, 10' X 6' RCB Culvert	EA.	$378,786.78	1	$378,787
	3 Barrel 230' Long, 10' X 6' RCB Culvert	EA.	$211,586.78	1	$211,587
	3 Barrel 190' Long, 10' X 6' RCB Culvert	EA.	$222,057.52	1	$222,058
				Σ =	$25,409,474
				Sub Total =	*$25,409,474*
				Engineering (10% Construction) =	*$2,540,947*
				30% Contingency =	*$7,622,842*
				Total =	***$35,573,263***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 3

ANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest	Channel Excavation	C.Y.	$3.25	272,256	$884,832
	Channel Fill	C.Y.	$3.25	11,216	$36,453
	Concrete&Steel	L.F.	$253.27	27,683	$7,011,350
	Retention Basin Net Excavation	C.Y.	$5.00	1,354,875	$6,774,375
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	3	$407
	Channel ROW	ACRE	$40,000.00	6	$226,839
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	61.4	$2,454,260
	Hydroseed & Topsoil	ACRE	$2,500.00	0.0	$0
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
	30" Low Flow Drain Pipe	L.F.	$82.00	2,500	$205,000
	54" Low Flow Drain Pipe	L.F.	$155.00	2,228	$345,340
	5 Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$864,031.81	1	$864,032
	4 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$486,203.85	6	$2,917,223
	4 Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$501,350.14	1	$501,350
	3 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$376,650.81	1	$376,651
	3 Barrel 70' Long, 10' X 6' RCB Culvert	EA.	$96,157.10	1	$96,157
				$\Sigma =$	$22,704,269
				Sub Total =	*$22,704,269*
				Engineering (10% Construction) =	*$2,270,427*
				30% Contingency =	*$6,811,281*
				Total =	***$31,785,976***

SR 303L Channel Alternative 3 - DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest	Channel Excavation	C.Y.	$1.75	272,256	$476,448
	Channel Fill	C.Y.	$1.75	11,216	$19,628
	Concrete&Steel	L.F.	$87.72	27,683	$2,428,245
	Retention Basin Net Excavation	C.Y.	$1.50	1,354,875	$2,032,313
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	3	$470
	Channel ROW	ACRE	$43,560.00	6	$247,028
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*61.4*	$2,672,689
	Hydroseed & Topsoil	ACRE	$2,500.00	*0.0*	$0
	Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
	30" Low Flow Drain Pipe	L.F.	$45.56	2,500	$113,900
	54" Low Flow Drain Pipe	L.F.	$86.11	2,228	$191,853
	5 Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$607,007.79	1	$607,008
	4 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$317,042.03	6	$1,902,252
	4 Barrel 320' Long, 10' X 6' RCB Culvert	EA.	$363,097.28	1	$363,097
	3 Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$281,986.78	1	$281,987
	3 Barrel 70' Long, 10' X 6' RCB Culvert	EA.	$70,786.78	1	$70,787
				$\Sigma =$	$11,417,704
				Sub Total =	*$11,417,704*
				Engineering (10% Construction) =	*$1,141,770*
				30% Contingency =	*$3,425,311*
				Total =	***$15,984,786***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel Alternative 3

ANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$3.25	20,289	$65,940
		Channel Fill	C.Y.	$3.25	50,904	$165,439
		Concrete&Steel	L.F.	$147.02	12,561	$1,846,622
		Retention Basin Net Excavation	C.Y.	$5.00	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
		Channel ROW	ACRE	$40,000.00	14	$552,007
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	0.0	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	0.0	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	7	Barrel 80' Long, 10' X 6' RCB Culvert	EA.	$230,878.53	1	$230,879
	4	Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$349,887.30	1	$349,887
	3	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$376,650.81	2	$753,302
					Σ =	$3,964,075
					Sub Total =	*$3,964,075*
					Engineering (10% Construction) =	*$396,408*
					30% Contingency =	*$1,189,223*
					Total =	***$5,549,705***

SR 303L Channel Alternative 3 - DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$1.75	20,289	$35,506
		Channel Fill	C.Y.	$1.75	50,904	$89,082
		Concrete&Steel	L.F.	$87.40	12,561	$1,097,808
		Retention Basin Net Excavation	C.Y.	$1.50	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
		Channel ROW	ACRE	$43,560.00	14	$601,136
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	0.0	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	0.0	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	0.0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	7	Barrel 80' Long, 10' X 6' RCB Culvert	EA.	$147,873.55	1	$147,874
	4	Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$202,786.78	1	$202,787
	3	Barrel 310' Long, 10' X 6' RCB Culvert	EA.	$246,931.52	2	$493,863
					Σ =	$2,668,056
					Sub Total =	*$2,668,056*
					Engineering (10% Construction) =	*$266,806*
					30% Contingency =	*$800,417*
					Total =	***$3,735,278***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel MCDOT DCR - Normalized UNIT COSTS Per ADMP Update

NNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$3.25	715,438	$2,325,175
	Channel Fill	C.Y.	$3.25	77,469	$251,774
	Concrete&Steel	L.F.	$266.49	94,386	$25,152,480
	Retention Basin Net Excavation	C.Y.	$5.00	4,469,753	$22,348,766
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
	Channel ROW	ACRE	$40,000.00	18	$707,447
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	169.9	$6,796,039
	Hydroseed & Topsoil	ACRE	$2,500.00	157	$392,182
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5	$25,000
	27" Low Flow Drain Pipe	L.F.	$72.00	2,500	$180,000
	42" Low Flow Drain Pipe	L.F.	$122.07	7,128	$870,115
	60" Low Flow Drain Pipe	L.F.	$218.00	7,508	$1,636,744
	72" Low Flow Drain Pipe	L.F.	$288.50	11,880	$3,427,380
	Culverts	L.S.	$10,224,754.23	1	$10,224,754
				Σ =	$74,337,857
				Sub Total =	*$74,337,857*
				Engineering (10% Construction) =	*$7,433,786*
				30% Contingency =	*$22,301,357*
				Total =	***$104,073,000***

SR 303L Channel MCDOT DCR Normalized Quantities With DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$1.75	715,438	$1,252,017
	Channel Fill	C.Y.	$1.75	77,469	$135,570
	Concrete&Steel	L.F.	$93.64	94,386	$8,838,680
	Retention Basin Net Excavation	C.Y.	$1.50	4,469,753	$6,704,630
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
	Channel ROW	ACRE	$43,560.00	18	$770,410
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*169.9*	$7,400,887
	Hydroseed & Topsoil	ACRE	$2,500.00	156.9	$392,182
	Landscaping & Aesthetic Treatment	SF	$1.65	0.0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	5.0	$25,000
	27" Low Flow Drain Pipe	L.F.	$37.60	2,500.0	$94,003
	42" Low Flow Drain Pipe	L.F.	$63.75	7,128.0	$454,410
	60" Low Flow Drain Pipe	L.F.	$90.00	7,508.0	$675,720
	72" Low Flow Drain Pipe	L.F.	$110.00	11,880.0	$1,306,800
	Culverts	L.S.	$9,784,441.18	1.0	$9,784,441
				Σ =	$37,834,751
				Sub Total =	*$37,834,751*
				Engineering (10% Construction) =	*$3,783,475*
				30% Contingency =	*$11,350,425*
				Total =	***$52,968,652***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel MCDOT DCR - Normalized UNIT COSTS Per ADMP Update

.NNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$3.25	468,988	$1,524,210
	Channel Fill	C.Y.	$3.25	13,830	$44,949
	Concrete&Steel	L.F.	$272.25	52,302	$14,239,215
	Retention Basin Net Excavation	C.Y.	$5.00	3,206,183	$16,030,915
	Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
	Channel ROW	ACRE	$40,000.00	3	$120,430
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	113.7	$4,548,056
	Hydroseed & Topsoil	ACRE	$2,500.00	107	$266,261
	Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
	42" Low Flow Drain Pipe	L.F.	$122.07	7,128	$870,115
	60" Low Flow Drain Pipe	L.F.	$218.00	5,280	$1,151,040
	72" Low Flow Drain Pipe	L.F.	$288.50	11,880	$3,427,380
	12 Barrel 320' Long, 6' X 8' RCB Culvert	EA.	$982,213.80	2	$1,964,428
	11 Barrel 330' Long, 6' X 8' RCB Culvert	EA.	$931,802.03	1	$931,802
	11 Barrel 310' Long, 6' X 8' RCB Culvert	EA.	$877,018.46	1	$877,018
	9 Barrel 330' Long, 6' X 8' RCB Culvert	EA.	$771,425.08	1	$771,425
	9 Barrel 230' Long, 6' X 6' RCB Culvert	EA.	$493,305.77	1	$493,306
	9 Barrel 190' Long, 5' X 6' RCB Culvert	EA.	$342,870.28	1	$342,870
	6 Barrel 450' Long, 5' X 6' RCB Culvert	EA.	$544,688.86	1	$544,689
				Σ =	$48,163,109
				Sub Total =	*$48,163,109*
				Engineering (10% Construction) =	*$4,816,311*
				30% Contingency =	*$14,448,933*
				Total =	***$67,428,353***

SR 303L Channel MCDOT DCR Normalized Quantities With DCR UNIT COSTS

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - North&South	Channel Excavation	C.Y.	$1.75	468,988	$820,728
	Channel Fill	C.Y.	$1.75	13,830	$24,203
	Concrete&Steel	L.F.	$93.56	52,302	$4,893,376
	Retention Basin Net Excavation	C.Y.	$1.50	3,206,183	$4,809,275
	Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
	Channel ROW	ACRE	$43,560.00	3	$131,148
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*113.7*	$4,952,833
	Hydroseed & Topsoil	ACRE	$2,500.00	*106.5*	$266,261
	Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
	Rip Rap Energy Dissipater	EA.	$5,000.00	3	$15,000
	42" Low Flow Drain Pipe	L.F.	$63.75	7,128	$454,410
	60" Low Flow Drain Pipe	L.F.	$90.00	5,280	$475,200
	72" Low Flow Drain Pipe	L.F.	$110.00	11,880	$1,306,800
	12 Barrel 320' Long, 6' X 8' RCB Culvert	EA.	$953,600.00	2	$1,907,200
	11 Barrel 330' Long, 6' X 8' RCB Culvert	EA.	$904,200.00	1	$904,200
	11 Barrel 310' Long, 6' X 8' RCB Culvert	EA.	$849,400.00	1	$849,400
	9 Barrel 330' Long, 6' X 8' RCB Culvert	EA.	$745,800.00	1	$745,800
	9 Barrel 230' Long, 6' X 6' RCB Culvert	EA.	$296,117.61	1	$296,118
	9 Barrel 190' Long, 5' X 6' RCB Culvert	EA.	$297,674.87	1	$297,675
	6 Barrel 450' Long, 5' X 6' RCB Culvert	EA.	$484,832.53	1	$484,833
				Σ =	$23,634,459
				Sub Total =	*$23,634,459*
				Engineering (10% Construction) =	*$2,363,446*
				30% Contingency =	*$7,090,338*
				Total =	***$33,088,243***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel MCDOT DCR - Normalized UNIT COSTS Per ADMP Update

ᴬNNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest		Channel Excavation	C.Y.	$3.25	225,279	$732,157
		Channel Fill	C.Y.	$3.25	6,329	$20,571
		Concrete&Steel	L.F.	$309.89	29,523	$9,148,826
		Retention Basin Net Excavation	C.Y.	$5.00	1,263,570	$6,317,851
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
		Channel ROW	ACRE	$40,000.00	10	$404,147
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	56.2	$2,247,983
		Hydroseed & Topsoil	ACRE	$2,500.00	50	$125,922
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
		27" Low Flow Drain Pipe	L.F.	$72.00	2,500	$180,000
		60" Low Flow Drain Pipe	L.F.	$218.00	2,228	$485,704
	9	Barrel 450' Long, 6' X 6' RCB Culvert	EA.	$579,360.53	1	$579,361
	7	Barrel 310' Long, 6' X 6' RCB Culvert	EA.	$323,167.88	1	$323,168
	8	Barrel 320' Long, 5' X 6' RCB Culvert	EA.	$449,154.70	1	$449,155
	8	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$435,118.62	1	$435,119
	8	Barrel 70' Long, 5' X 6' RCB Culvert	EA.	$98,252.59	1	$98,253
	7	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$384,557.18	2	$769,114
	6	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$333,995.75	3	$1,001,987
					Σ =	$23,329,316
					Sub Total =	*$23,329,316*
					Engineering (10% Construction) =	*$2,332,932*
					30% Contingency =	*$6,998,795*
					Total =	***$32,661,043***

SR 303L Channel MCDOT DCR Normalized Quantities With DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southwest		Channel Excavation	C.Y.	$1.75	225,279	$394,238
		Channel Fill	C.Y.	$1.75	6,329	$11,076
		Concrete&Steel	L.F.	$96.62	29,523	$2,852,669
		Retention Basin Net Excavation	C.Y.	$1.50	1,263,570	$1,895,355
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
		Channel ROW	ACRE	$43,560.00	10	$440,117
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*56.2*	$2,448,054
		Hydroseed & Topsoil	ACRE	$2,500.00	*50.4*	$125,922
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	2	$10,000
		27" Low Flow Drain Pipe	L.F.	$42.50	2,500	$106,250
		60" Low Flow Drain Pipe	L.F.	$90.00	2,228	$200,520
	9	Barrel 450' Long, 6' X 6' RCB Culvert	EA.	$579,360.53	1	$579,361
	7	Barrel 310' Long, 6' X 6' RCB Culvert	EA.	$323,167.88	1	$323,168
	8	Barrel 320' Long, 5' X 6' RCB Culvert	EA.	$449,154.70	1	$449,155
	8	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$435,118.62	1	$435,119
	8	Barrel 70' Long, 5' X 6' RCB Culvert	EA.	$98,252.59	1	$98,253
	7	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$384,557.18	2	$769,114
	6	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$333,995.75	3	$1,001,987
					Σ =	$12,140,357
					Sub Total =	*$12,140,357*
					Engineering (10% Construction) =	*$1,214,036*
					30% Contingency =	*$3,642,107*
					Total =	***$16,996,499***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

SR 303L Channel MCDOT DCR - Normalized UNIT COSTS Per ADMP Update

ANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$3.25	21,172	$68,808
		Channel Fill	C.Y.	$3.25	57,309	$186,254
		Concrete&Steel	L.F.	$146.14	12,561	$1,835,605
		Retention Basin Net Excavation	C.Y.	$5.00	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$130.00	0	$0
		Channel ROW	ACRE	$40,000.00	5	$182,870
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	0.0	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	0	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	0	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	11	Barrel 80' Long, 6' X 6' RCB Culvert	EA.	$122,596.69	1	$122,597
	6	Barrel 220' Long, 5' X 6' RCB Culvert	EA.	$237,029.24	1	$237,029
	5	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$283,434.31	1	$283,434
					Σ =	$2,916,598
					Sub Total =	*$2,916,598*
					Engineering (10% Construction) =	*$291,660*
					30% Contingency =	*$874,979*
					Total =	***$4,083,237***

SR 303L Channel MCDOT DCR Normalized Quantities With DCR UNIT COSTS

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L - southeast		Channel Excavation	C.Y.	$1.75	21,172	$37,051
		Channel Fill	C.Y.	$1.75	57,309	$100,291
		Concrete&Steel	L.F.	$87.38	12,561	$1,097,522
		Retention Basin Net Excavation	C.Y.	$1.50	0	$0
		Drop Structures - Grouted Rip-Rap	C.Y.	$150.00	0	$0
		Channel ROW	ACRE	$43,560.00	5	$199,145
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$43,560.00	*0.0*	$0
		Hydroseed & Topsoil	ACRE	$2,500.00	*0.0*	$0
		Landscaping & Aesthetic Treatment	SF	$1.65	*0.0*	$0
		Rip Rap Energy Dissipater	EA.	$5,000.00	0	$0
	11	Barrel 80' Long, 6' X 6' RCB Culvert	EA.	$122,596.69	1	$122,597
	6	Barrel 220' Long, 5' X 6' RCB Culvert	EA.	$237,029.24	1	$237,029
	5	Barrel 310' Long, 5' X 6' RCB Culvert	EA.	$283,434.31	1	$283,434
					Σ =	$2,077,069
					Sub Total =	*$2,077,069*
					Engineering (10% Construction) =	*$207,707*
					30% Contingency =	*$623,121*
					Total =	***$2,907,896***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Table 6.5

	North of I-10 Only		Entire SR 303L Channel	
Study/Alternative	Using MCDOT DCR Unit Costs	Using FCDMC Unit Costs	Using FCDMC Unit Costs	Comments
MCDOT DCR[1]	$16,618,000	see 'Normalized'		
MCDOT DCR Normalized[1]	$23,634,459	$48,163,109	$74,337,000	Page 1, Table 6.4
FCDMC[1]				
Alternative 1	$25,524,442	$46,694,439	$81,346,000	Page 1, Table 6.1
Alternative 2	$24,108,960	$50,393,290	$79,161,000	Page 1, Table 6.2
Alternative 3	$25,409,474	$48,700,728	$75,091,000	Page 1, Table 6.3

1. These costs do not include engineering fees, or contingency items.
These costs are for the North Segment SR 303L only. For cost information on the South Segment SR 303L, refer to tables 6.1 - 6.4.

REFERENCES

SR 303L, Indian School Road to Clearview Boulevard Initial Drainage Report, by URS in Association with Entranco Inc., Project Engineering Consultants Inc. and BRW, dated April 16, 2002.

SR 303L Indian School Road to Clearview Boulevard Initial Design Concept Report Volume I and II, by URS in Association with Entranco Inc., Project Engineering Consultants Inc. and BRW, dated April 24, 2002.

Design Concept Report, State Route Loop 303 (SR 303L), MC 85 to Indian School Road, by HDR Engineering Inc. in Association with The City of Goodyear, dated September 2002.

Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics, November 1991.

Draft Drainage Design Manual for Maricopa County, Arizona, Hydraulics, Dated November 2002.

Arizona Department of Transportation, Roadway Engineering Group, Roadway Design Guidelines, Dated May 1996.

Roadway Design Manual, Adopted November 3, 1993, Maricopa County Department of Transportation.

Appendix

February 20, 2003
23441586(E100001526.00)

Loop 303 Corridor/White Tanks ADMP Update
SR 303 L Alternatives – C.O. # 12
February 20, 2003

Location: Flood Control District of Maricopa County
Time: 1:30 p.m. to 3:00 p.m. (ACDC Conference Room)
Attendees: Russ Miracle (FCDMC), Greg Jones (FCDMC), Bill Hahn (MCDOT), Nasir Raza (URS representing MCDOT), Rob Scrivo (URS), and Elliot Silverston (URS)

MEETING MINUTES

I. Introduction

URS began the meeting by stating the purpose for the meeting and describing the scope of work associated with the analysis in Change Order #12. URS was contracted to evaluate three alternatives and compare the associated quantities/costs with those developed for the SR 303L MCDOT DCR. All three alternatives were variations of the SR 303L DCR basin/channel configuration and were developed to improve the SR 303L facilities to provide flood protection for the 50-year to the 100-year storm event.

II. Alternatives

URS gave a detailed explanation of the design criteria and assumptions that were used in preparing the MCDOT DCR. URS explained the process used to develop the three alternatives to the MCDOT DCR 50-year flood control concept. The MCDOT DCR concept was improved from a 50-year system to a 100-year system using the Flood Control District's criteria developed for the Loop 303 ADMP Update.

URS gave a quick summary of the three alternatives evaluated for this change order task. Alternative 1 involved the improvement of the MCDOT DCR 50-year channel concept to a 100-year system. No changes were made to the MCDOT DCR 50-year basin concept. Alternative 2 involved the improvement of the MCDOT DCR 50-year basin concept to a 100-year system. No changes were made to the MCDOT DCR 50-year channel design. Finally, Alternative 3 involved a combination of improvement to the both the MCDOT DCR channel and basin design from a 50-year system to a 100-year system.

Once the three alternatives were evaluated, a detailed comparison was made between the MCDOT DCR and the three (100-year) alternatives. The comparison focused on the methods used to generate quantities and unit costs for the MCDOT DCR versus those used with the alternatives analysis. The comparison also described key assumptions used with the MCDOT DCR versus the alternatives analysis and the impact they had on the final cost estimate. From the analysis, a few major cost impacting factors were identified as contributing to the large cost differential between the MCDOT DCR and the FCDMC alternatives analysis. These factors are listed below:

- Design Storm
- Channel R/W
- Basin R/W
- Channel and Basin Treatment/LA
- Channel Excavation
- Culverts
- Basin Excavation
- Low-Flow Storm Drain

The alternatives were evaluated from a safety and access standpoint. URS determined that although the costs associated with safety and access are significant they are minor in comparison with the overall project cost estimate. Further, it is ADOT's desire to keep the clear zone free of any encroachment, however, if the channel were placed within this area to save right of way, there would be a trade-off in cost due to the cost of a guardrail/barrier. There would also be a safety trade-off in that guardrail/barrier presents a potential hazard to the driver.

III. Action Items

URS has been instructed by FCDMC to revise the unit costs and methods used with the MCDOT DCR to those used with the Loop 303 ADMP Update. This will allow a direct comparison between the MCDOT DCR design and costs and the ADMP Update preferred alternative as well as those alternatives analyzed for this change order.

Since the level of analysis used to generate the MCDOT DCR cost estimate was not as detailed as that used with the Loop 303 ADMP Update, the MCDOT DCR costs will be revised to reflect the additional analysis. The additional analysis of the MCDOT DCR conceptual design is due to the following reasons:

- The MCDOT DCR used maximum allowable headwater that exceeded the estimated normal depth of flow within the channel. Since the ADMP Update limits the headwater to the channel flow depth, *all of the proposed MCDOT DCR culverts will require re-sizing.*
- *The MCDOT DCR* does not account for some channel discharge at the north end of the project that is conveyed to the channel. This *will require URS to adjust the HEC-1 connectivity diagram to model the additional inflow (199cfs in the 50-year, 409cfs in the 100-year storm events).*
- In order to bring the level of detail of quantity generation up to that of the ADMP, URS will have to create horizontal and vertical alignments in Land Development Desktop (LDD). URS will also be required to *create a vertical profile and cross section templates* which will have to be attached

to the alignments and used to *generate earthworks* from the digital terrain model (DTM).

- The *cost of the culverts* will be estimated based on the methodology used in the ADMP. *ADOT 'B' standards are used* to determine the quantities of *concrete* and *steel* present within the proposed culvert barrels, *headwalls and inlet/outlet aprons.*
- In order to *account for* the *access road and basin daylighting*, the proposed basins will be drawn in ACAD and *LDD* will be *used* to *generate earthworks* quantities.
- The *quantity* estimated *for hydro seed* within proposed retention basins will be included in the estimate.
- All *unit costs* associated with the MCDOT DCR will be *adjusted to match* those used with the *ADMP Update*. In the case where the quantifying units differ (ie, SY versus LF for concrete channel lining costs), the MCDOT DCR will be revised using the ADMP Update method. Also, since the MCDOT DCR proposes a combination of 6" and 8" concrete lining, there *lining will be changed to 8"* throughout *for* a *direct comparison* with the ADMP Update.

FCDMC also *asked URS to re-evaluate* the total *right of way required* for the value engineering *(VE) preferred alternative* for the Loop 303 ADMP Update. URS will *assume* that *portions of the channel* can be *within the available SR 303L right of way* outside of the clear recovery zone. The amount of channel area that falls outside of the SR 303L right of way will be quantified and included in the cost estimate.

Finally, in regard to the ADMP Update, *FCDMC has asked URS to divert all the flow from the proposed basin at Northern Avenue or the proposed basin at Camelback Road to the east.* Therefore there will be zero off-site discharge south along SR303 L at the Northern Avenue and Camelback Road intersections coming from the upstream system.

APPENDIX G

CHANGE ORDER 13 - 14

SR 303L Proposed Basin Relocation Analysis

1.0 Introduction and Purpose

At the request of the Flood Control District of Maricopa County (FCDMC), URS has completed an evaluation of the impacts of modifying the Level III Preferred Alternative flood control system proposed along the State Route 303L (SR 303L). Modification to the plan includes relocating the proposed detention basins at the northwest corners of Cactus Road and SR 303L and Northern Avenue and SR 303L to the designated crash zones for Luke Air Force Base (LAFB). The basin at Camelback Road and SR 303L has already been relocated to the crash zone area.

The variations on the Level III Preferred Alternative are referred to in this letter report as Alternative 1, Alternative 2, and Alternative 3 respectively.

The purpose of the basin relocations is to limit the extent of adjacent area development and subsequent encroachment into the LAFB crash zones. A brief description of the alternatives is presented below.

Alternative 1

The detention volume provided by the proposed (Preferred Alternative) basins was added to the proposed basin at Camelback Road. The proposed basins at Cactus Road and Northern Avenue (Preferred Alternative) were eliminated. The increased inflow volume at Camelback Road was then split into several basins and placed within the designated crash zones for LAFB. The total composite volume provided by this new set of basins is essentially the same as it was under the Preferred Alternative; however, the runoff from the upper watershed area must now be conveyed further in a channel with no discharge peak attenuation.

Alternative 2

A large portion of the detention volume provided by the proposed Cactus Road and Northern Avenue basins (Preferred Alternative) was added to the proposed basin at Camelback Road. This larger volume was then split into two basins. The first (larger) basin was placed within the crash zone designated "clear zone" for LAFB. The second (smaller) basin was left at the southwest corner of SR 303L and Camelback Road within the designated LAFB crash zone, "APZ-2".

For this alternative, the proposed footprint area for the basin located within the LAFB "clear zone" is at the southeastern corner of Bethany Home Road and Sarival Avenue. A concrete channel from SR 303L east to this proposed basin site is required. Further, a small detention basin has been added at the southwestern corner of SR 303L and Bethany Home Road to facilitate the 90-degree turn required to convey the SR 303L channel discharge to the crash zone basins. This alternative requires a larger channel footprint to convey the additional storm water downstream from the proposed Cactus Road and Northern Avenue detention basins. In addition, the smaller basins proposed at Cactus Road and Northern Avenue are offline rather than online as in the Preferred Alternative.

Alternative 3
A large portion of the detention volume provided by the proposed Cactus Road and Northern Avenue basins (Preferred Alternative) was added to the proposed basin at Camelback Road. This larger volume was then split into multiple basins and placed within the LAFB crash zone areas. The proposed basin configuration and location within the LAFB crash zones for this alternative is identical to that used with Alternative 1. The difference is that the Preferred Alternative proposed online basins located at Cactus Road and Northern Avenue have been changed to offline basins and retain less volume (in Alternative 1 these basins were eliminated).

Like Alternatives 1 and 2, the larger volume of discharge conveyed south to the LAFB crash zones requires a larger channel footprint area. Since the proposed Preferred Alternative basins at Cactus Road and Northern Avenue are not eliminated as in Alternative 1, the channel footprint area required to convey the larger amount of discharge is not as great as it is in Alternative 1. Also, unlike Alternative 2, there is no need for the proposed Bethany Home Road channel since the placement of the basins within the LAFB crash zones is identical to Alternative 1.

The project location is shown on Figure 1.1.

The steps associated with the completion of this study are listed below:

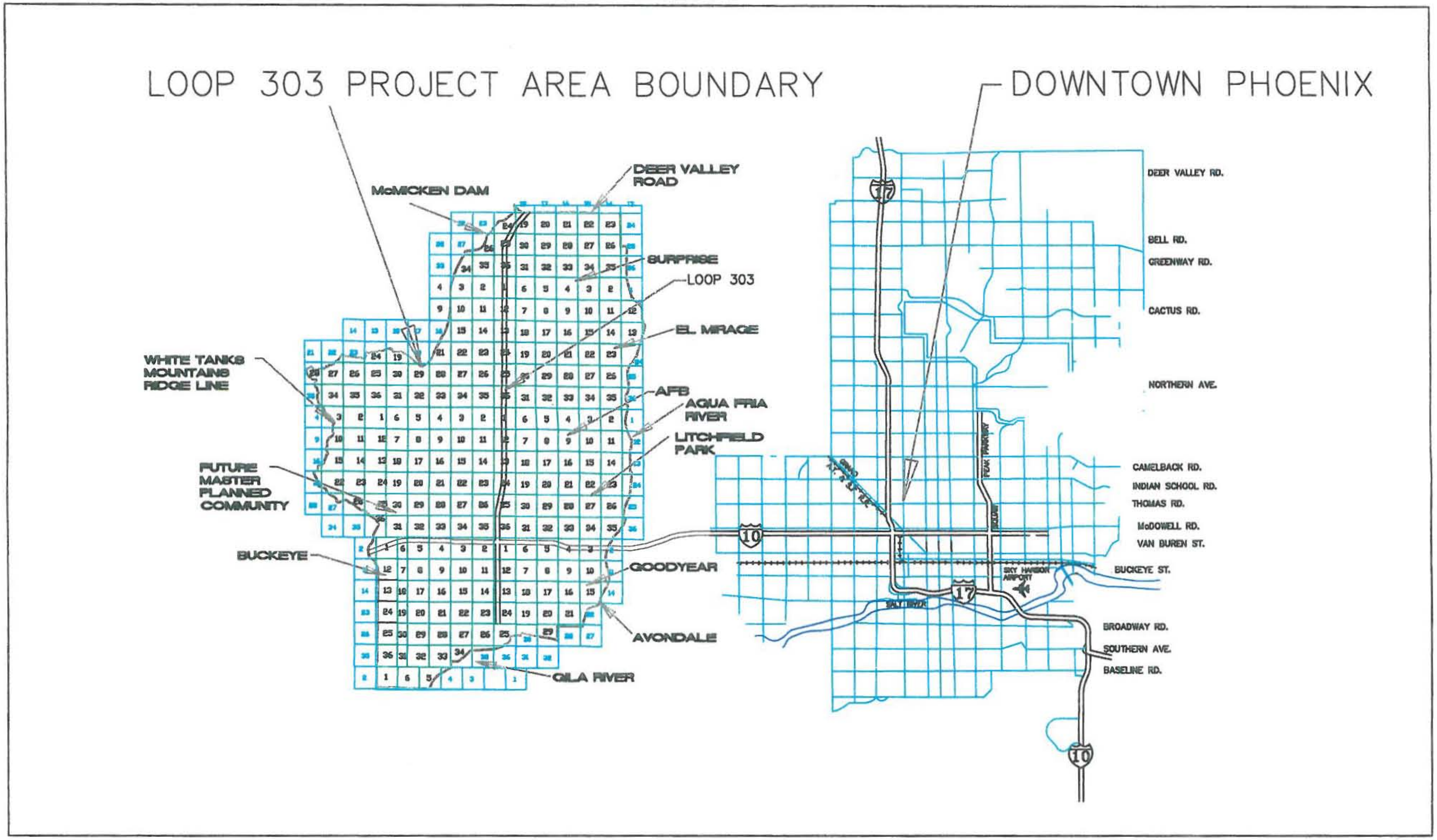
- Develop a working HEC-1 hydrologic model for Alternatives 1, 2 and 3.
- Size the channel reaches based on the updated discharges obtained from the model.
- Size the Cactus Road Basin and the Northern Avenue Basin – Alternatives 2 and 3 only.
- Size the basin located at the southwestern corner of SR 303L and Bethany Home Road – Alternative 2 only.
- Size the channel along Bethany Home Road to the LAFB crash zone basin – Alternative 2 only.
- Size the composite basin(s) near Camelback Road (placed within the LAFB crash zones) to attenuate the discharge hydrographs and limit peak outflow to amounts consistent with those obtained with the level III Preferred Alternative.
- Generate construction quantities for all three alternatives.
- Prepare a cost comparison between each alternative and the Level III Preferred Alternative.

2.0 Summary of Results

The cost of the Preferred Alternative SR 303L flood control system is approximately $95,370,821. The approximate increased cost of modifying the Preferred Plan along SR 303L for each of the three alternatives described above is as follows.

Alternative 1 – The cost of Alternative 1 is an additional $13,743,155. The additional cost is attributable to the increased size of the concrete channel along SR 303L from Camelback Road

P:\FCDMC\E152600\SUBMITTALS\RE-SUBMIT\DATA COLLECTION&VA - EXIST. HYDROLOGY\4-15-03\FIGURES\FIGURE 1.1.DWG



VICINITY MAP

URS

Flood Control District of Maricopa County

DRAFT

MAY, 2003
Figure 1.1

to Cactus Road (7.1 miles). The composite basin footprint is approximately 211 acres in the LAFB crash zones APZ1 and APZ2. The over-all Level III Preferred Alternative is shown on Figure 2.1. The over-all Alternative 1 is shown on Figure 2.2A. The basin relocation within the LAFB crash zones associated with Alternative 1 is shown on Figure 2.3A.

Alternative 2 – Alternative 2 will cost an additional $13,931,428 for the option of locating the proposed basin at the southwestern corner of Bethany Home Road and SR 303L within the 65db noise contour. Since this requires the placement of the basin farther west than would be required to locate it within the 70db contour, the cost of this option is slightly higher. An additional $13,706,532 is estimated for the option of locating the proposed basin at the southwestern corner of Bethany Home Road and SR 303L within the 70db noise contour.

The overall additional cost of Alternative 2 over the Preferred Alternative is attributable to the increased size of the concrete channel along SR 303L from Camelback Road to Cactus Road (7.1 miles); increased cost of building a new concrete channel along Bethany Home Road, and increased cost of building an additional basin at the southwestern corner of Bethany Home Road and SR 303L. The composite basin footprint is approximately 151 acres in the LAFB crash zones APZ1 and APZ2. Alternative 2 is shown on Figure 2.2Bi and 2.2Bii. The basin relocation within the LAFB crash zones associated with Alternative 2 is shown on Figure 2.3Bi and 2.3Bii.

Alternative 3 – Alternative 3 will cost an additional $8,269,082. The additional cost is attributable to the increased size of the concrete channel along SR 303L from Camelback Road to Cactus Road (7.1 miles). The inclusion of the offline basins at Cactus Road and Northern Avenue help to mitigate the channel cost increase. Therefore, the cost increase for Alternative 3 is not as great as in Alternative 1. The composite basin footprint is approximately 167 acres in the LAFB crash zones APZ1 and APZ2. The Level III Preferred Alternative is shown on Figure 2.1. Alternative 3 is shown on Figure 2.2C. The basin relocation within the LAFB crash zones associated with Alternative 3 is shown on Figure 2.3C.

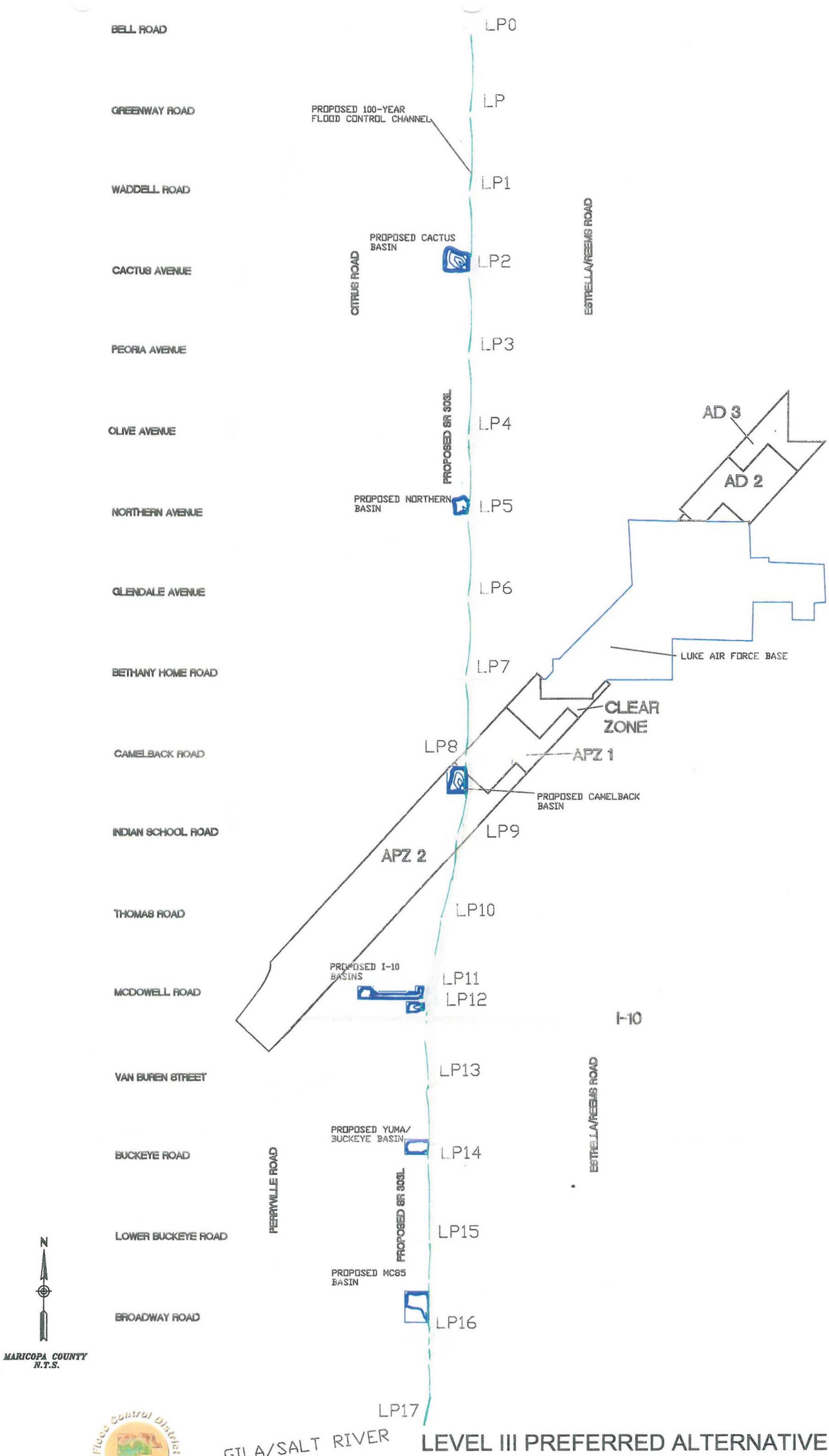
3.0 Analysis Summary and Assumptions

In order to complete the analysis the HEC-1 hydrologic model used for the Loop 303 ADMP Update project was modified to simulate the partial and total relocation of the Cactus Road and Northern Avenue basins south to Camelback Road for each of the three alternatives.

The following summarizes the modifications made to the HEC-1 model for each of the alternatives.

Alternative 1

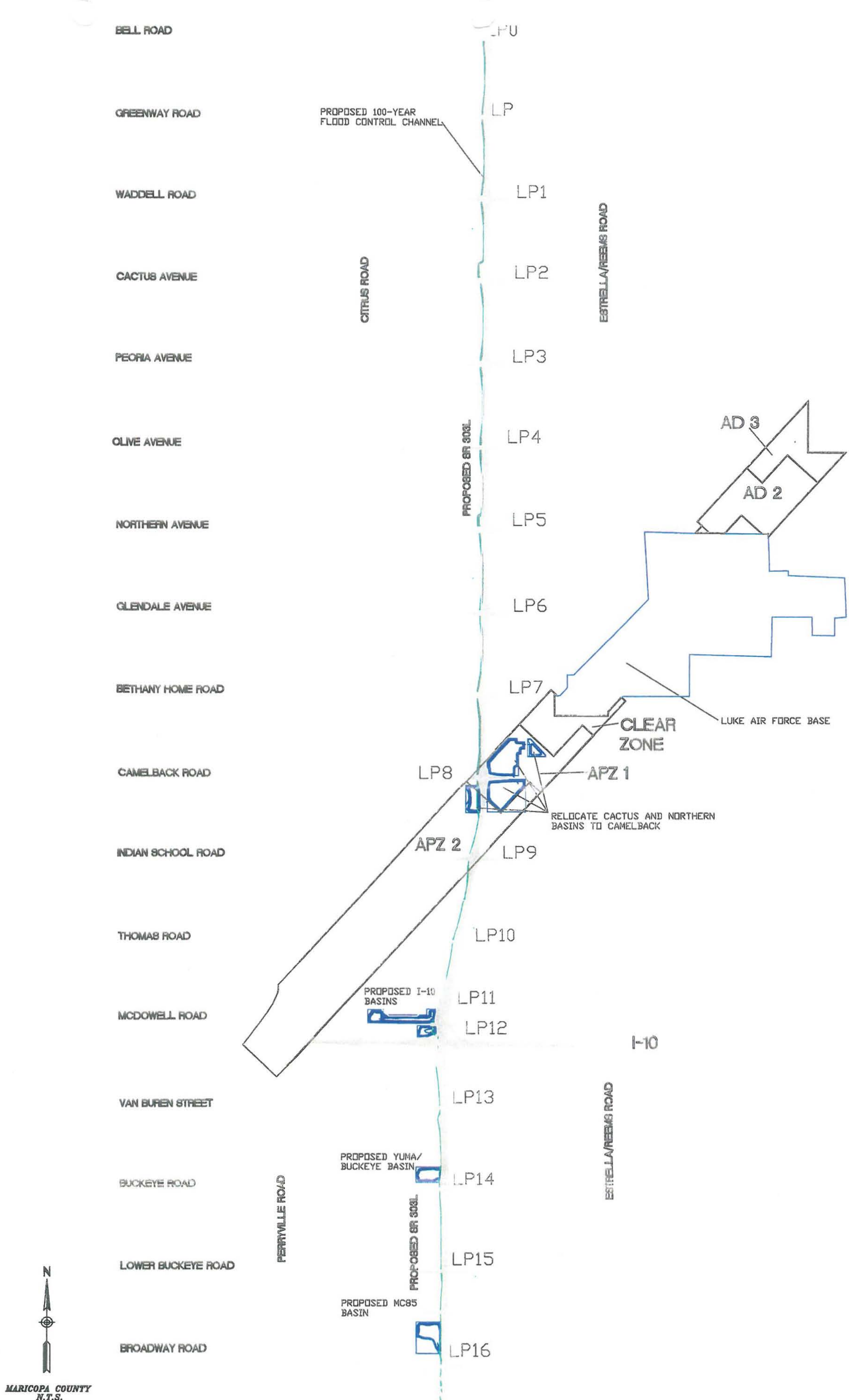
- Removed the storage routing data associated with the proposed Cactus Road and Northern Avenue basins.
- Ran HEC-1 and updated the discharges along the channel reach.
- Resized channel reaches based on the increased discharges.



LEVEL III PREFERRED ALTERNATIVE MAP

URS

JULY, 2003
Figure 2.1



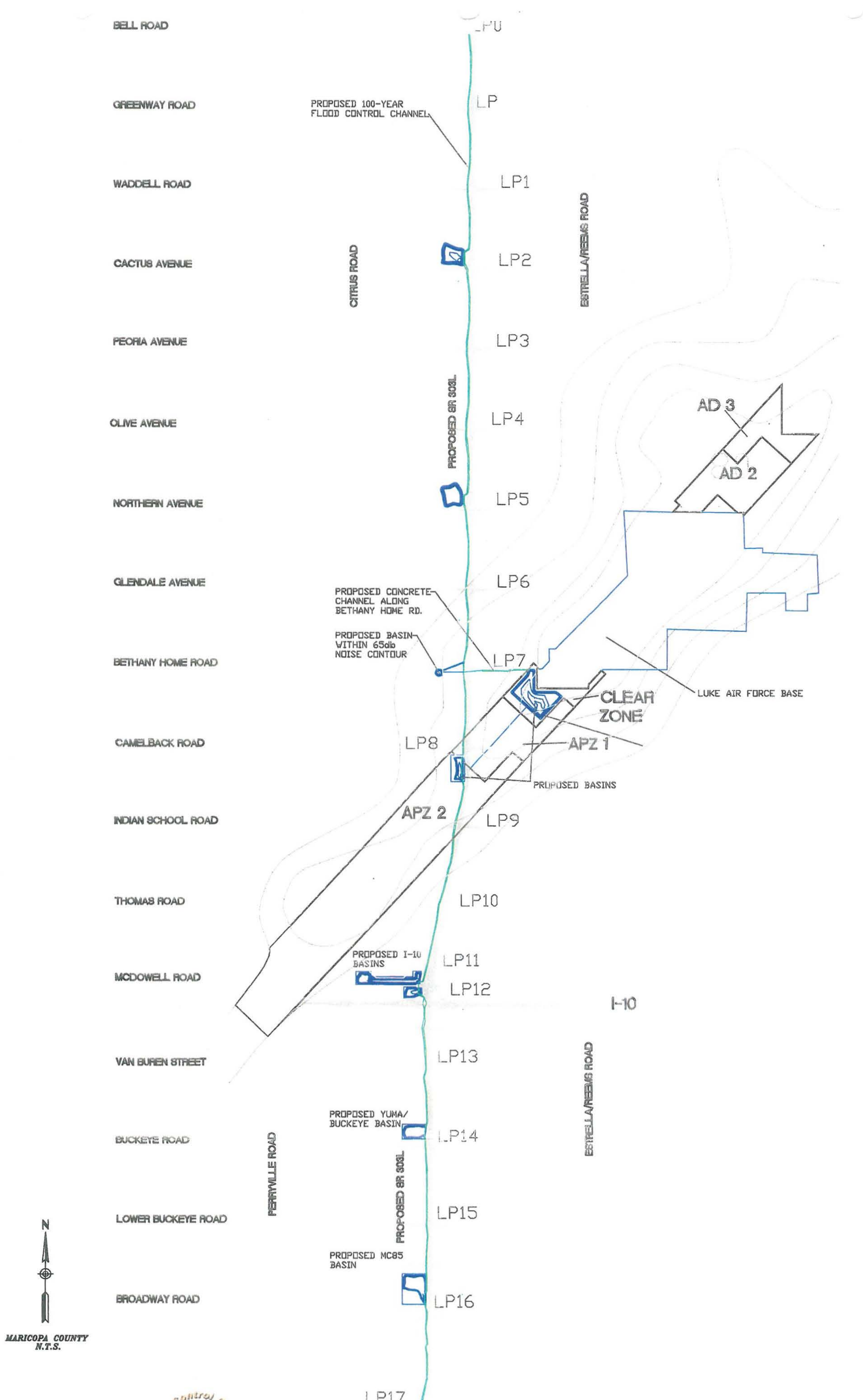
Flood Control District of Maricopa County

URS

ALTERNATIVE 1 MAP

JUNE, 2003

Figure 2.2A

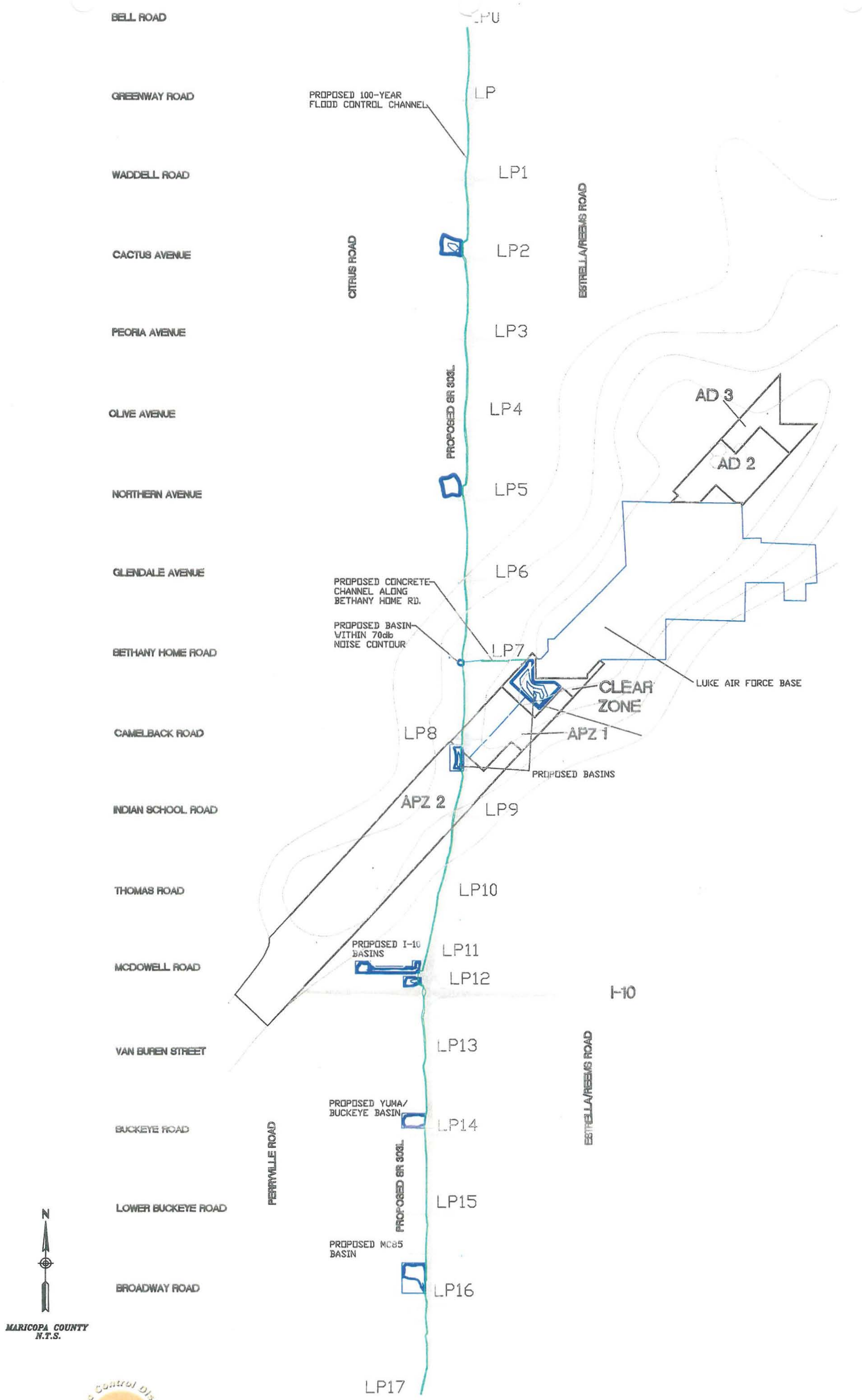


Flood Control District of Maricopa County

URS

ALTERNATIVE 2i MAP

JULY, 2003
Figure 2.2Bi



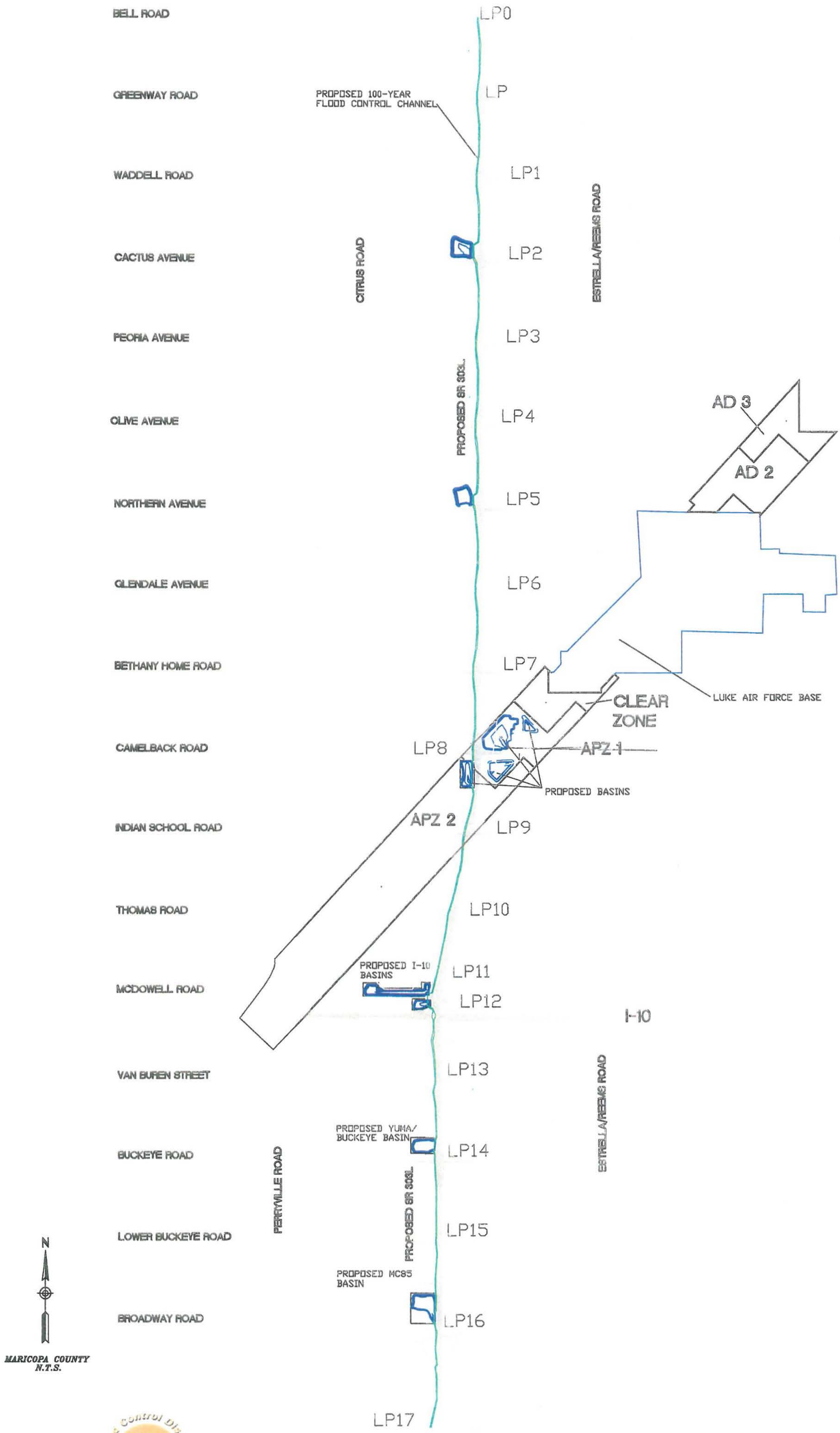
Flood Control District of Maricopa County

URS

ALTERNATIVE 2ii MAP

JULY, 2003

Figure 2.2Bii



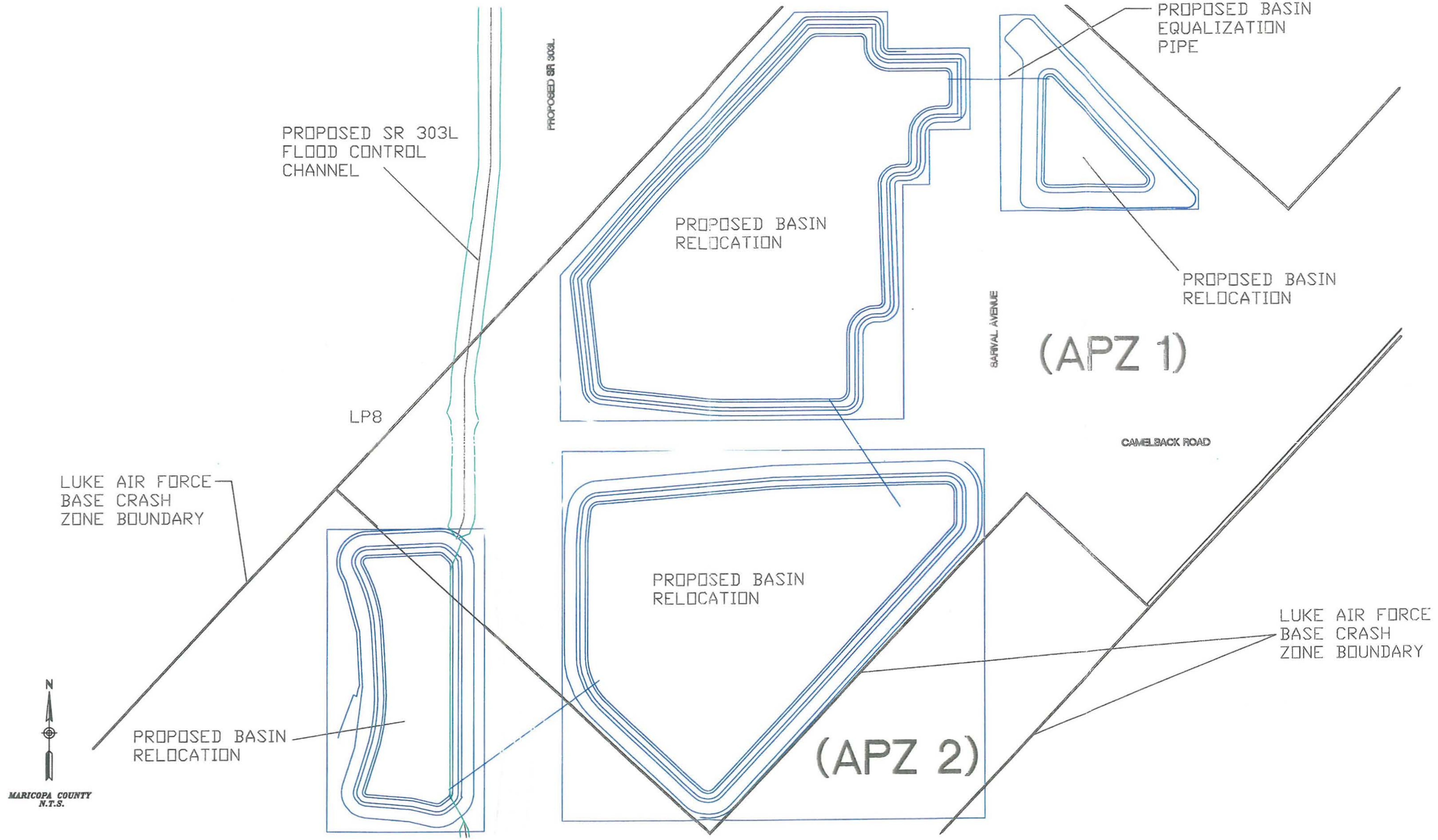
Flood Control District of Maricopa County

URS

ALTERNATIVE 3 MAP

JULY, 2003

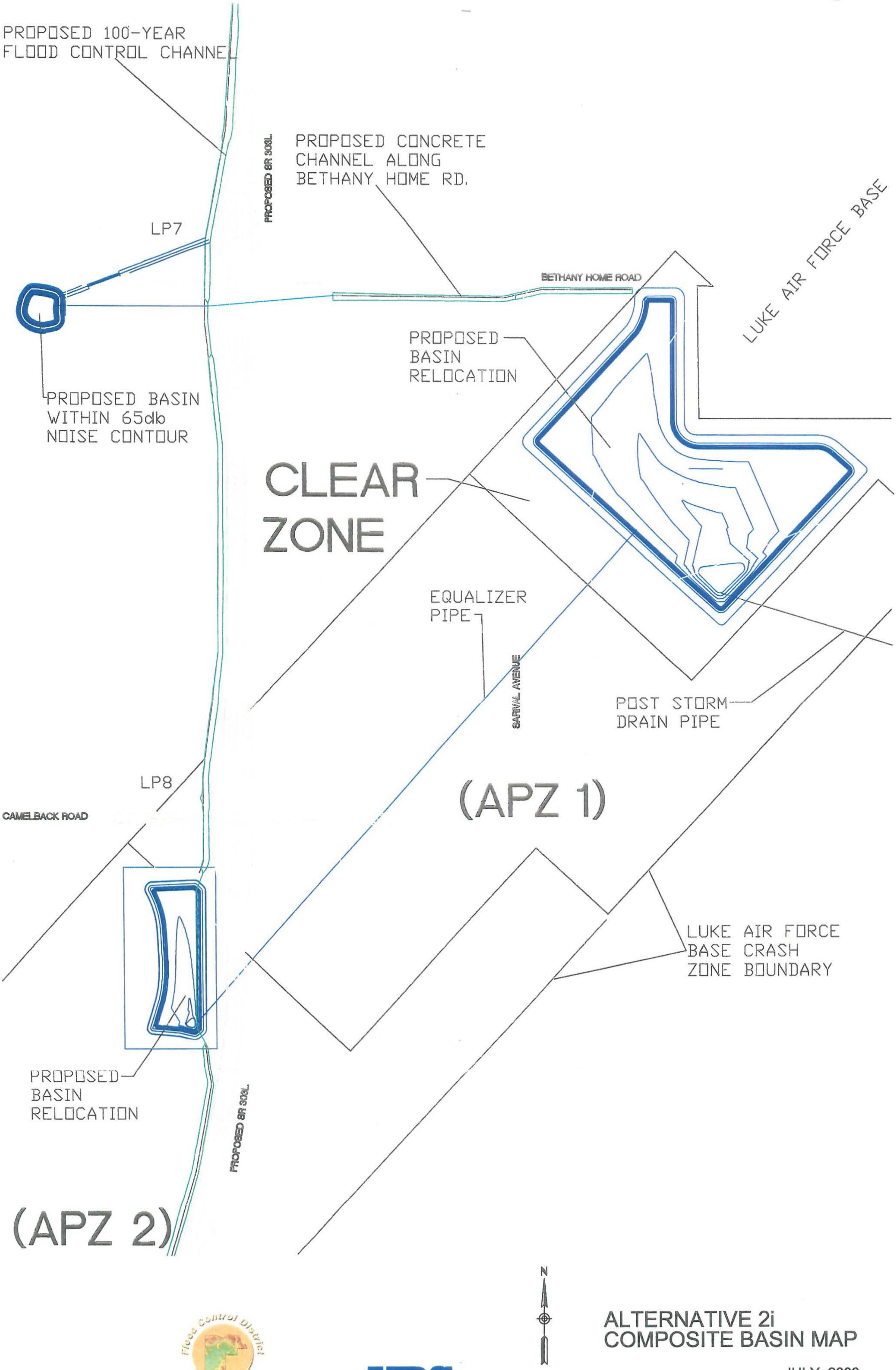
Figure 2.2C



URS

ALTERNATIVE 1 COMPOSITE BASIN MAP

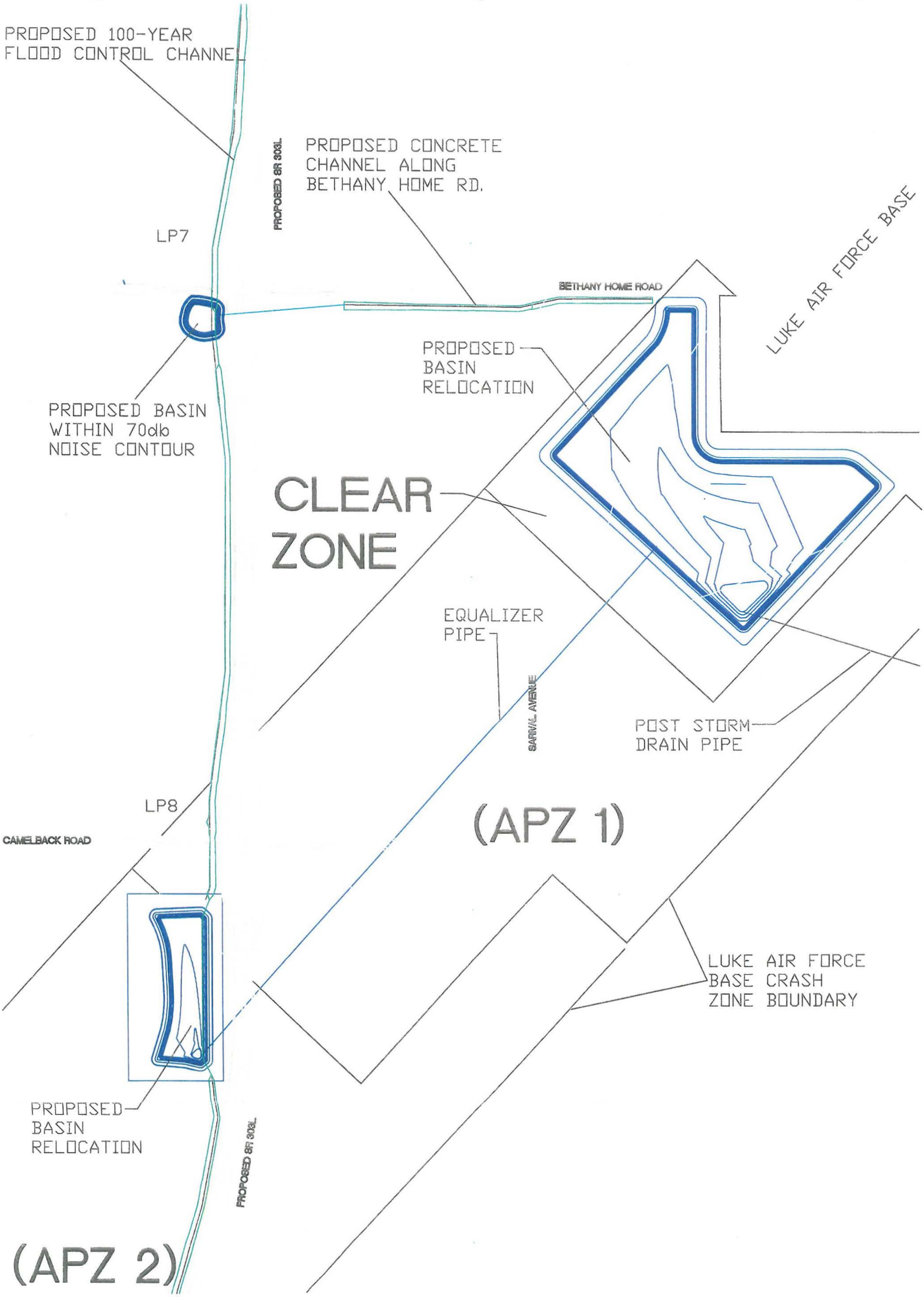
JULY, 2003
Figure 2.3A



URS

ALTERNATIVE 2i
COMPOSITE BASIN MAP

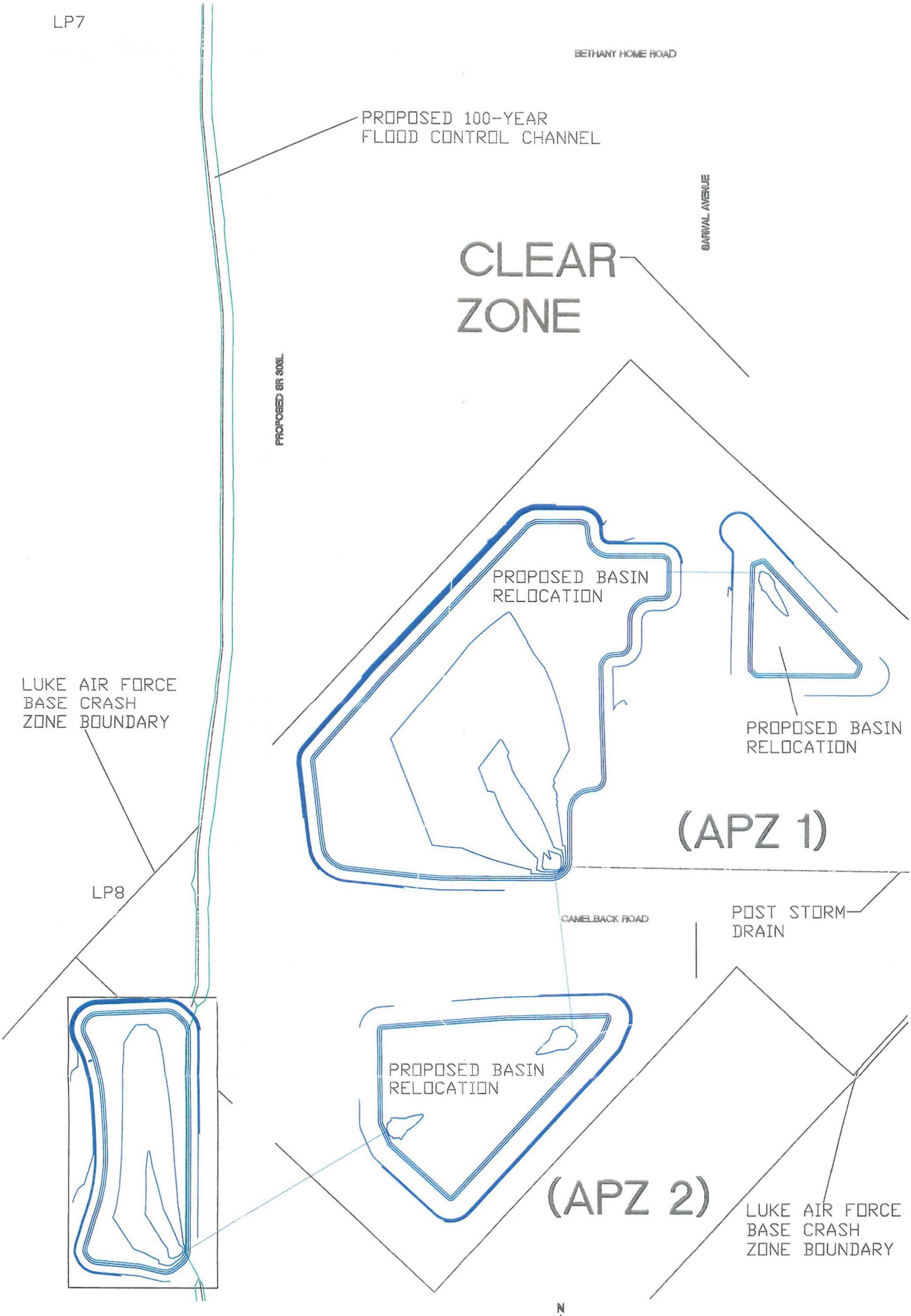
JULY, 2003
Figure 2.3Bi



MARICOPA COUNTY
N.T.S.

ALTERNATIVE 2ii
COMPOSITE BASIN MAP

JULY, 2003
Figure 2.3Bii



ALTERNATIVE 3
COMPOSITE BASIN MAP

Flood Control District of Maricopa County

URS

JULY, 2003
Figure 2.3C

- Updated the channel routing data in HEC-1 to model the changes in cross section due to the removal of the Cactus Road and Northern Avenue basins and the new channel reaches simulated on the routing data.
- Resized the proposed Camelback basin to detain the increased volume at that location from the Cactus Road and Northern Avenue basins while maintaining discharges south in SR 303L to values similar to those used in the Level III Preferred Alternative.

Alternative 2

- Replaced the storage routing data associated with the proposed Cactus Road and Northern Avenue basins to model the basins as offline basins.
- Ran HEC-1 and updated the discharges along the channel reaches.
- Resized channel reaches based on the increased discharges.
- Updated the channel routing data in HEC-1 to model the changes in cross section due to the modification and reduction of the Cactus Road and Northern Avenue basins and the new channel reaches simulated on the routing data.
- Added storage routing data to model the proposed basin located at the southwestern corner of the SR 303L and Bethany Home Road.
- Added channel routing and combination data to model the proposed concrete channel along Bethany Home Road.
- Resized the proposed Camelback basin to detain the increased volume at that location from the Cactus Road and Northern Avenue basins while maintaining discharges south in SR 303L to values similar to those used in the level III Preferred Alternative.

Alternative 3

- Replaced the storage routing data associated with the proposed Cactus Road and Northern Avenue basins to model the basins as offline basins.
- Ran HEC-1 and updated the discharges along the channel reach.
- Resized channel reaches based on the increased discharges.
- Updated the channel routing data in HEC-1 to model the changes in cross section due to the modification and reduction of the Cactus Road and Northern Avenue basins and the new channel reaches simulated on the routing data.
- Resized the proposed Camelback basin to detain the increased volume at that location from the Cactus Road and Northern Avenue basins while maintaining discharges south in SR 303L to values similar to those used in the level III Preferred Alternative.

For each alternative studied, relocating all or a portion of the proposed Cactus Road and Northern Avenue basins caused the discharges within the SR 303L channel to increase significantly from approximately Cactus Road south to Camelback Road. Table 3.1A-3.1C and Table 3.2 present detailed summaries of the geometric parameters associated with each of the proposed alternative channels. Table 3.3A-3.3D presents a comparison of the channel geometrics associated with the Level III Preferred Alternative versus each alternative. Figure 2.1 shows the overall Level III Preferred Alternative, Figure 2.2A-2.2C the proposed alternatives, and Figure 2.3A-2.3C a close up of the basin relocations associated with each alternative within the LAFB crash zones.

Table 3.1A
Channel Impact Summary
Alternative A1

Channel Name	Concentration Point	Change in Q_{design}: Q_{L3} (cfs)	Change in Q_{design}: Q_{A1}	Change in Q_{design}: % change	Change in Design Depth: D_{L3} (ft)	Change in Design Depth: D_{A1} (ft)	Change in Design Depth: % change	[3]Change in Flow Depth: d_{L3} (ft)	[3]Change in Flow Depth: d_{A1} (ft)	[3]Change in Flow Depth: % change	*Channel Geometry* Change in Bottom Width: BW_{L3} (ft)	*Channel Geometry* Change in Bottom Width: BW_{A1} (ft)	*Channel Geometry* Change in Bottom Width: % change	*Channel Geometry* Change in Total Top-width: TW_{L3} (ft)	*Channel Geometry* Change in Total Top-width: TW_{mod} (ft)	*Channel Geometry* Change in Total Top-width: % change
SR303L URS DCR - Channel																
Bell Road	!LP0	772	772	0%	5.5	5.5	0%	3.4	3.4	0%	10.0	10.0	0%	52	52	0%
Greenway Road	!LP	854	854	0%	5.5	5.5	0%	3.5	3.5	0%	10.0	10.0	0%	52	52	0%
Waddell Road	!LP1	1,612	1,612	0%	5.9	5.9	0%	5.1	5.1	0%	12.0	12.0	0%	56	56	0%
Cactus Avenue	!LP2	2,898	2,898	0%	6.1	6.1	0%	6.0	6.0	0%	20.0	20.0	0%	64	64	0%
Peoria Avenue	!LP3	1,765	4,460	153%	5.1	5.2	0%	4.9	5.1	3%	18.0	50.0	178%	59	91	55%
Olive Avenue	!LP4	2,227	4,988	124%	5.4	5.2	-4%	5.4	5.1	-6%	18.0	55.0	206%	60	96	60%
Northern Avenue	!LP5	2,242	4,953	121%	5.4	5.1	-5%	5.4	5.1	-5%	18.0	55.0	206%	60	96	60%
Glendale Avenue	!LP6	705	7,327	939%	4.7	6.0	28%	3.5	6.0	73%	10.0	70.0	600%	49	114	134%
Bethany Home Road	!LP7	1,040	7,368	608%	4.9	5.7	17%	3.7	5.7	52%	15.0	75.0	400%	54	118	116%
Camelback Road	!LP8	1,455	7,644	425%	5.5	5.7	3%	4.5	5.7	26%	20.0	80.0	300%	62	123	98%
Indian School Road	!LP9	558	558	0%	4.3	4.3	0%	4.2	4.2	0%	5.0	5.0	0%	42	42	0%
Thomas Road	!LP10	622	622	0%	3.9	3.9	0%	3.7	3.7	0%	5.0	5.0	0%	41	41	0%
McDowell Road	!LP11	961	961	0%	6.1	6.1	0%	5.0	5.0	0%	5.0	5.0	0%	49	49	0%
I-10	!LP12	1,315	1,315	0%	5.0	5.0	0%	3.3	3.3	0%	0.0	0.0	0%	40	40	0%
Van Buren Street	!LP13	666	666	0%	4.1	4.1	0%	3.5	3.5	0%	8.0	8.0	0%	45	45	0%
Buckeye Road	!LP14	664	664	0%	4.1	4.1	0%	3.4	3.4	0%	8.0	8.0	0%	44	44	0%
Lower Buckeye Road	!LP15	676	676	0%	4.1	4.1	0%	3.4	3.4	0%	8.0	8.0	0%	44	44	0%
MC 85	!LP16	746	746	0%	3.5	3.5	0%	3.5	3.5	0%	8.0	8.0	0%	42	42	0%

1. Changed values are relative to the Level III Preferred Alternative value. Therefore, positive values denote increases while negative values indicate decreases.
2. Q_{L3} = Level III Preferred, Q_{A1} = Alternative 1
3. Depth of flow within the channel is approximately the same for all reaches.

Table 3.1B
Channel Impact Summary
Alternative 2

Channel Geometry

Channel Name	Concentration Point	Change in Q_{design}			Change in Design Depth			[3]Change in Flow Depth			Change in Bottom Width			Change in Total Top-width		
		Q_{L3} (cfs)	Q_{A2}	% change	D_{L3} (ft)	D_{A2} (ft)	% change	d_{L3} (ft)	d_{A2} (ft)	% change	BW_{L3} (ft)	BW_{A2} (ft)	% change	TW_{L3} (ft)	TW_{A2} (ft)	% change
SR303L URS DCR - Channel																
Bell Road	!LP0	772	772	0%	5.5	5.5	0%	3.4	3.4	0%	10.0	10.0	0%	52	52	0%
Greenway Road	!LP	854	854	0%	5.5	5.5	0%	3.5	3.5	0%	10.0	10.0	0%	52	52	0%
Waddell Road	!LP1	1,612	1,612	0%	5.9	5.9	0%	5.1	5.1	0%	12.0	12.0	0%	56	56	0%
Cactus Avenue	!LP2	2,898	2,898	0%	6.1	6.1	0%	6.0	6.0	0%	20.0	20.0	0%	64	64	0%
Peoria Avenue	!LP3	1,765	1,907	8%	5.1	5.2	0%	4.9	5.0	2%	18.0	19.0	6%	59	60	2%
Olive Avenue	!LP4	2,227	2,373	7%	5.4	5.2	-4%	5.4	5.1	-6%	18.0	24.0	33%	60	65	8%
Northern Avenue	!LP5	2,242	2,403	7%	5.4	5.1	-5%	5.4	5.1	-5%	18.0	24.0	33%	60	65	8%
Glendale Avenue	!LP6	705	1,101	56%	4.7	6.0	28%	3.5	5.9	72%	10.0	5.0	-50%	49	49	1%
Bethany Home Road	!LP7	1,040	1,258	21%	4.9	5.9	21%	3.7	5.8	56%	15.0	7.0	-53%	54	51	-7%
Camelback Road	!LP8	1,455	835	-43%	5.5	5.7	3%	4.5	5.7	26%	20.0	3.0	-85%	62	46	-26%
Indian School Road	!LP9	558	558	0%	4.3	4.3	0%	4.2	4.2	0%	5.0	5.0	0%	42	42	0%
Thomas Road	!LP10	622	622	0%	3.9	3.9	0%	3.7	3.7	0%	5.0	5.0	0%	41	41	0%
McDowell Road	!LP11	961	961	0%	6.1	6.1	0%	5.0	5.0	0%	5.0	5.0	0%	49	49	0%
I-10	!LP12	1,315	1,315	0%	5.0	5.0	0%	3.3	3.4	2%	0.0	0.0	0%	40	40	0%
Van Buren Street	!LP13	666	666	0%	4.1	4.1	0%	3.5	3.5	0%	8.0	8.0	0%	45	45	0%
Buckeye Road	!LP14	664	664	0%	4.1	4.1	0%	3.4	3.4	0%	8.0	8.0	0%	44	44	0%
Lower Buckeye Road	!LP15	676	676	0%	4.1	4.1	0%	3.4	3.4	0%	8.0	8.0	0%	44	44	0%
MC 85	!LP16	746	746	0%	3.5	3.5	0%	3.5	3.5	0%	8.0	8.0	0%	42	42	0%

1. Changed values are relative to the Level III Preferred Alternative value. Therefore, positive values denote increases while negative values indicate decreases.
2. Q_{L3} = Level III Preferred, Q_{A2} = Alternative 2
3. Depth of flow within the channel is approximately the same for all reaches.

Table 3.1C
Channel Impact Summary
Alternative A3

														Channel Geometry		
		Change in Q_{design}			Change in Design Depth			[3]Change in Flow Depth			Change in Bottom Width			Change in Total Top-width		
Channel Name	Concentration Point	Q_{L3} (cfs)	Q_{A1}	% change	D_{L3} (ft)	D_{A1} (ft)	% change	d_{L3} (ft)	d_{A1} (ft)	% change	BW_{L3} (ft)	BW_{A1} (ft)	% change	TW_{L3} (ft)	TW_{mod} (ft)	% change
SR303L URS DCR - Channel																
Bell Road	!LP0	772	772	0%	5.5	5.5	0%	3.4	3.4	0%	10.0	10.0	0%	52	52	0%
Greenway Road	!LP	854	854	0%	5.5	5.5	0%	3.5	3.5	0%	10.0	10.0	0%	52	52	0%
Waddell Road	!LP1	1,612	1,612	0%	5.9	5.9	0%	5.1	5.1	0%	12.0	12.0	0%	56	56	0%
Cactus Avenue	!LP2	2,898	2,898	0%	6.1	6.1	0%	6.0	6.0	0%	20.0	20.0	0%	64	64	0%
Peoria Avenue	!LP3	1,765	2,083	18%	5.1	5.2	0%	4.9	5.1	2%	18.0	21.0	17%	59	62	5%
Olive Avenue	!LP4	2,227	2,554	15%	5.4	5.2	-4%	5.4	5.1	-6%	18.0	26.0	44%	60	67	12%
Northern Avenue	!LP5	2,242	2,582	15%	5.4	5.1	-5%	5.4	5.1	-5%	18.0	26.0	44%	60	67	12%
Glendale Avenue	!LP6	705	2,117	200%	4.7	6.1	30%	3.5	6.0	73%	10.0	16.0	60%	49	60	24%
Bethany Home Road	!LP7	1,040	2,262	118%	4.9	5.8	19%	3.7	5.7	53%	15.0	19.0	27%	54	62	14%
Camelback Road	!LP8	1,455	2,831	95%	5.5	5.8	5%	4.5	5.7	28%	20.0	26.0	30%	62	69	11%
Indian School Road	!LP9	558	558	0%	4.3	4.3	0%	4.2	4.2	0%	5.0	5.0	0%	42	42	0%
Thomas Road	!LP10	622	622	0%	3.9	3.9	0%	3.7	3.7	0%	5.0	5.0	0%	41	41	0%
McDowell Road	!LP11	961	961	0%	6.1	6.1	0%	5.0	5.0	0%	5.0	5.0	0%	49	49	0%
I-10	!LP12	1,315	1,315	0%	5.0	5.0	0%	3.3	3.3	0%	0.0	0.0	0%	40	40	0%
Van Buren Street	!LP13	666	666	0%	4.1	4.1	0%	3.5	3.5	0%	8.0	8.0	0%	45	45	0%
Buckeye Road	!LP14	664	664	0%	4.1	4.1	0%	3.4	3.4	0%	8.0	8.0	0%	44	44	0%
Lower Buckeye Road	!LP15	676	676	0%	4.1	4.1	0%	3.4	3.4	0%	8.0	8.0	0%	44	44	0%
MC 85	!LP16	746	746	0%	3.5	3.5	0%	3.5	3.5	0%	8.0	8.0	0%	42	42	0%

1. Changed values are relative to the Level III Preferred Alternative value. Therefore, positive values denote increases while negative values indicate decreases.
2. Q_{L3} = Level III Preferred, QA3 = Alternative 3
3. Depth of flow within the channel is approximately the same for all reaches.

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Table 3.2
Level III Preferred Alternative
Proposed Channel Summary

Channel Name	Concentration Point	[1]Approximate Q_{des} (cfs)	Channel Design Depth (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Top Width Including Operation and Maintenance Rd. and Landscape Tw (ft)	Number of Required Vertical Drops
SR303L URS DCR - Channel								
Bell Road	!LP0	772	5.5	3.4	10	(2:1)	52	0
Greenway Road	!LP	854	5.5	3.5	10	(2:1)	52	0
Waddell Road	!LP1	1,612	5.9	5.1	12	(2:1)	56	1
Cactus Avenue	!LP2	2,898	6.1	6.0	20	(2:1)	64	2
Peoria Avenue	!LP3	1,765	5.1	4.9	18	(2:1)	59	1
Olive Avenue	!LP4	2,227	5.4	5.4	18	(2:1)	60	1
Northern Avenue	!LP5	2,242	5.4	5.4	18	(2:1)	60	5
Glendale Avenue	!LP6	705	4.7	3.5	10	(2:1)	49	0
Bethany Home Road	!LP7	1,040	4.9	3.7	15	(2:1)	54	2
Camelback Road	!LP8	1,455	5.5	4.5	20	(2:1)	62	3
Indian School Road	!LP9	558	4.3	4.2	5	(2:1)	42	0
Thomas Road	!LP10	622	3.9	3.7	5	(2:1)	41	0
McDowell Road	!LP11	961	6.1	5.0	5	(2:1)	49	0
I-10	!LP12	1,315	5.0	3.3	0	(2:1)	40	0
Van Buren Street	!LP13	666	4.1	3.5	8	(2:1)	45	2
Buckeye Road	!LP14	666	4.1	3.4	8	(2:1)	44	0
Lower Buckeye Road	!LP15	676	4.1	3.4	8	(2:1)	44	0
MC 85	!LP16	746	3.5	3.5	8	(2:1)	42	1
Gila/Salt River	!LP17	449	4.4	4.1	5	(2:1)	43	1

1. By normal depth computation only - no backwater analysis performed at this time.

Table 3.3A
Alternative 1
Proposed Channel Summary

Channel Name	Concentration Point	[1]Approximate Qcap (cfs)	Channel Design Depth (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Top Width Including Operation and Maintenance Rd. and Landscape Tw (ft)	Number of Required Vertical Drops
SR303L URS DCR - Channel								
Bell Road	!LP0	772	5.5	3.4	10	(2:1)	52	0
Greenway Road	!LP	854	5.5	3.5	10	(2:1)	52	0
Waddell Road	!LP1	1,612	5.9	5.1	12	(2:1)	56	1
Cactus Avenue	!LP2	2,898	6.1	6.0	20	(2:1)	64	2
Peoria Avenue	!LP3	4,460	5.2	5.1	50	(2:1)	91	1
Olive Avenue	!LP4	4,988	5.2	5.1	55	(2:1)	96	1
Northern Avenue	!LP5	4,953	5.1	5.1	55	(2:1)	96	5
Glendale Avenue	!LP6	7,327	6.0	6.0	70	(2:1)	114	2
Bethany Home Road	!LP7	7,368	5.7	5.7	75	(2:1)	118	2
Camelback Road	!LP8	7,644	5.7	5.7	80	(2:1)	123	3
Indian School Road	!LP9	558	4.3	4.2	5	(2:1)	42	0
Thomas Road	!LP10	622	3.9	3.7	5	(2:1)	41	0
McDowell Road	!LP11	961	6.1	5.0	5	(2:1)	49	0
I-10	!LP12	1,315	5.0	3.3	0	(2:1)	40	0
Van Buren Street	!LP13	666	4.1	3.5	8	(2:1)	45	2
Buckeye Road	!LP14	664	4.1	3.4	8	(2:1)	44	0
Lower Buckeye Road	!LP15	676	4.1	3.4	8	(2:1)	44	0
MC 85	!LP16	746	3.5	3.5	8	(2:1)	42	1
Gila/Salt River	!LP17	414	4.4	4.1	5	(2:1)	44	1

1. By normal depth computation only - no backwater analysis performed at this time.

Table 3.3B
Alternative 2
Proposed Channel Summary

Channel Bethany Home Road Channel	Concentration Point	[1]Approximate Qcap (cfs)	Channel Design Depth (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Top Width Including Operation and Maintenance Rd. and Landscape Tw (ft)	Number of Required Vertical Drops
SR303L URS DCR - Channel								
Bell Road	!LP0	772	5.5	3.4	10	(2:1)	52	0
Greenway Road	!LP	854	5.5	3.5	10	(2:1)	52	0
Waddell Road	!LP1	1,612	5.9	5.1	12	(2:1)	56	0
Cactus Avenue	!LP2	2,898	6.1	6.0	20	(2:1)	64	2
Peoria Avenue	!LP3	1,907	5.2	5.0	19	(2:1)	60	0
Olive Avenue	!LP4	2,373	5.2	5.1	24	(2:1)	65	0
Northern Avenue	!LP5	2,403	5.1	5.1	24	(2:1)	65	5
Glendale Avenue	!LP6	1,101	6.0	5.9	5	(2:1)	49	0
Bethany Home Road	!LP7	1,258	5.9	5.8	7	(2:1)	51	0
Camelback Road	!LP8	835	5.7	5.7	3	(2:1)	46	0
Indian School Road	!LP9	558	4.3	4.2	5	(2:1)	42	0
Thomas Road	!LP10	622	3.9	3.7	5	(2:1)	41	0
McDowell Road	!LP11	961	6.1	5.0	5	(2:1)	49	0
I-10	!LP12	1,315	5.0	3.4	0	(2:1)	40	0
Van Buren Street	!LP13	666	4.1	3.5	8	(2:1)	45	0
Buckeye Road	!LP14	664	4.1	3.4	8	(2:1)	44	0
Lower Buckeye Road	!LP15	676	4.1	3.4	8	(2:1)	44	0
MC 85	!LP16	746	3.5	3.5	8	(2:1)	42	0
Gila/Salt River	!LP17	414	4.7	4.0	5	(2:1)	44	0

1. By normal depth computation only - no backwater analysis performed at this time.

Table 3.3C
Alternative 2
Proposed Bethany Home Road
Channel Summary

Channel Bethany Home Road Channel	Concentration Point	[1]Approximate Qcap (cfs)	Channel Design Depth (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Top Width Including Operation and Maintenance Rd. and Landscape Tw (ft)	Number of Required Vertical Drops
Bethany Home Road Channel	!BH1	1,193	6.4	6.1	5	(2:1)	50	0
	!BH2	1,449	7.3	6.7	5	(2:1)	54	0

1. By normal depth computation only - no backwater analysis performed at this time.

Table 3.3D
Alternative 3
Proposed Channel Summary

Channel Name	Concentration Point	[1]Approximate Qcap (cfs)	Channel Design Depth (ft)	Channel Flow Depth (ft)	Bottom Width (ft)	Side Slope (H:V)	Top Width Including Operation and Maintenance Rd. and Landscape Tw (ft)	Number of Required Vertical Drops
SR303L URS DCR - Channel								
Bell Road	!LP0	772	5.5	3.4	10	(2:1)	52	0
Greenway Road	!LP	854	5.5	3.5	10	(2:1)	52	0
Waddell Road	!LP1	1,612	5.9	5.1	12	(2:1)	56	0
Cactus Avenue	!LP2	2,898	6.1	6.0	20	(2:1)	64	2
Peoria Avenue	!LP3	2,083	5.2	5.1	21	(2:1)	62	0
Olive Avenue	!LP4	2,554	5.2	5.1	26	(2:1)	67	0
Northern Avenue	!LP5	2,582	5.1	5.1	26	(2:1)	67	5
Glendale Avenue	!LP6	2,117	6.1	6.0	16	(2:1)	60	0
Bethany Home Road	!LP7	2,262	5.8	5.7	19	(2:1)	62	0
Camelback Road	!LP8	2,831	5.8	5.7	26	(2:1)	69	0
Indian School Road	!LP9	558	4.3	4.2	5	(2:1)	42	0
Thomas Road	!LP10	622	3.9	3.7	5	(2:1)	41	0
McDowell Road	!LP11	961	6.1	5.0	5	(2:1)	49	0
I-10	!LP12	1,315	5.0	3.3	0	(2:1)	40	0
Van Buren Street	!LP13	666	4.1	3.5	8	(2:1)	45	0
Buckeye Road	!LP14	664	4.1	3.4	8	(2:1)	44	0
Lower Buckeye Road	!LP15	676	4.1	3.4	8	(2:1)	44	0
MC 85	!LP16	746	3.5	3.5	8	(2:1)	42	0
Gila/Salt River	!LP17	414	4.7	4.0	5	(2:1)	44	0

1. By normal depth computation only - no backwater analysis performed at this time.

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The key criteria used to size the channel reaches based on the increased discharges were consistent with those used in the Loop 303 ADMP Update. These criteria are as follows:

- 2:1 channel side slopes.
- Maximum channel velocity of 15 f/s for concrete.
- Manning roughness coefficient of 0.013 for concrete.
- Zero freeboard for existing condition and the FCDMC minimum required freeboard provided for future condition.

The invert profile for the proposed SR 303L channel was not significantly altered for any of the alternatives since many of the elevations were set based on downstream conditions or on existing land features. Instead, the channel was widened to convey the increased discharges.

A concrete channel is recommended for conveying flow along SR 303L for all three of the alternatives. The velocities in the channel are 15 f/s or less (supercritical flow). To maintain the supercritical flow regime at the roadway and crossings, single span bridges are recommended. This reduces the potential for a hydraulic jump to occur in the system that could cause overtopping of the channel.

The key assumptions that were made as part of the analysis are as follows:

- The channel along Northern Avenue west of SR 303L is included as part of the Loop 303 ADMP Update project.
- The channel along I-10 west of SR 303L is included as part of the Loop 303 ADMP Update project.
- Utility relocation costs will not significantly change from one alternative to the other and are not included in this analysis.
- Pedestrian crossing costs will not significantly change from one alternative to the other and are not included in this analysis.
- Operation and maintenance costs will not significantly change from one alternative to the other and are not included in this analysis.
- Basin equalizer pipe costs will not significantly change from one alternative to the other and are not included in this analysis.

4.0 Quantity and Cost Analysis

The results of the cost estimates for the Level III Preferred Alternative (SR 303L only) as well as Alternative(s) 1-3 are listed below:

Level III Preferred – \$95,370,821
Alternative 1 - \$109,113,976 (Δ = +\$13,743,155)
Alternative 2i – \$109,512,555 (Δ = +\$14,141,734)
Alternative 2ii – \$109,321,852 (Δ = +\$13,916,837)

Alternative 3 – \$103,644,439 (Δ = +\$8,269,082)

The above costs do not include any engineering or contingency costs. They were developed using quantity and cost criteria associated with the Loop 303 ADMP Update.

The cost differential between the Level III Preferred Alternative and each of the Preferred Alternatives (1, 2 and 3) are listed in Table 4.1A – 4.1C.

Some of the major reasons for the differences in the quantities and costs shown in Table(s) 4.1A-4.1C are as follows:

- The required channel right-of-way is significantly larger in each alternative since all or a significant portion of the discharges previously detained at Cactus Road and Northern Avenue is now conveyed south to Camelback Road. The result is a wider channel section than that proposed under the Level III Preferred Alternative.
- Basin excavation – with the exception of Alternative 2, this quantity was generally lower for each of the proposed alternatives. Since Alternative 2 proposes an additional basin located in the vicinity of the southwestern corner of SR 303L and Bethany Home Road to facilitate the turning of the main channel flow 90 degrees from SR 303L south to Bethany Home Road east, the basin excavation requirement was higher than any of the other alternatives. The reason behind the lower quantity associated with Alternatives 1 and 3 is based on the amount of volume required for detention at Camelback Road. This is determined based on routing the inflow hydrograph through the basin so that the outflow is no greater than the outflow obtained under the Level III Preferred Alternative. Using this criterion to size the basin, the result was a lower peak volume than the sum of the basins proposed with the Level III Preferred Alternative (Cactus, Northern and Camelback). The difference can be attributed to differences in basin shape, hydrograph routing from Cactus Road to Camelback Road, and hydrograph peak timing. Another difference is that the Cactus Road and Northern Avenue proposed basins used culvert outlet pipes to both meter discharges from the basins as well as convey them under the roads and south within the SR 303L channel. Since there are no immediate downstream streets to cross, the outflow from the relocated composite basin(s) within the LAFB crash zones is discharged using a surface weir spillway rather than a culvert. Therefore, the stage-storage-discharge rating curve for the proposed alternative basins is very different from the individual relationships modeled for the Level III Preferred Alternative. Finally, the basins used at Cactus Road and Northern Avenue for Alternatives 2 and 3 are offline rather than online as with the Level III Preferred Alternative.
- Since the channel discharges are higher due to the larger required conveyances for all three alternatives than the Level III Preferred Alternative, the concrete channel lining quantity is higher for all three. This is particularly true with Alternative 2 where an additional concrete channel has been proposed to convey flow from SR 303L along Bethany Home Road to the LAFB crash zone area.
- There are two additional bridges required for all three of the proposed alternatives for the following reasons:
  - ➢ ***Alternative 1:*** the previously proposed basins at Cactus Road and Northern Avenue are relocated to Camelback Road. In the Preferred Plan, culverts were used to meter

Table 4.1A
Level III Preferred Alternative vs.
Alternative 1
Cost Comparison

SR 303L Channel Alternatives

CHANNEL NAME	ITEM DESCRIPTION	UNIT	*Change in* QUANTITY L3 Quantity	A1 Quantity	Unit Cost $	*Change in* Cost $	*Percent Change* In Cost %
SR 303L	Channel Excavation	C.Y.	623,846	942,732	$3.25	1,036,380	51%
	Channel Fill	C.Y.	46,763	59,988	$3.25	42,983	28%
	Concrete&Steel	L.F.	82,022	84,132	$270.75	10,871,704	49%
	Retention Basin Net Excavation	C.Y.	7,224,706	5,920,217	$5.00	-6,522,445	-18%
	Drop Structures - additional concrete	C.Y.	3,421	4,807	$250.00	346,508	41%
	Channel ROW	ACRE	50	103	$40,000.00	2,129,511	107%
	Basin ROW - daylight only	ACRE	319	313	$40,000.00	-259,813	-2%
	Hydroseed & Topsoil	ACRE	347	396	$2,500.00	122,792	14%
	Rip Rap Energy Dissipater	EA.	6	4	$5,000.00	-10,000	-33%
	66" Low Flow Drain Pipe	L.F.	13,936	26,442	$264.00	3,301,584	90%
	72" Low Flow Drain Pipe	L.F.	10,768	5,355	$288.50	-1,561,651	-50%
	Single span bridge	EA.	22	24	[3]$550,000	4,555,500	45%
	culverts	EA.	6	4	[3]$250,000	-309,898	-22%
					Σ =	$13,743,155	14.4%

Sub Total = *$13,743,155*
Engineering (10% Construction) = *$1,374,315*
30% Contingency = *$4,122,946*

Total = ***$19,240,417***

1. C[illegible]ges in quantities and costs are relative to the Level III preferred alternative - positive values indicate an increase while negative values indicate a decrease.
2. L3 = level III preferred alternative, A1 = Alternative 1
3. This cost varies per location; therefore, an average value is included here.

Table 4.1Bi
Level III Preferred Alternative vs.
Alternative 2i
Cost Comparison

SR 303L Channel Alternatives

CHANNEL NAME	ITEM DESCRIPTION	UNIT	*Change in* QUANTITY L3 Quantity	A2i Quantity	Unit Cost $	*Change in* Cost $	*Percent Change* In Cost %
SR 303L	Channel Excavation	C.Y.	623,846	626,500	$3.25	8,624	0.4%
	Channel Fill	C.Y.	46,763	63,122	$3.25	53,167	35.0%
	[4]Concrete&Steel	L.F.	82,022	87,269	$268.62	1,234,747	5.6%
	[4]Retention Basin Net Excavation	C.Y.	7,224,706	7,977,675	$5.00	3,764,845	10.4%
	Drop Structures - additional concrete	C.Y.	3,421	4,319	$250.00	224,467	26.2%
	[4]Channel ROW	ACRE	50	77	$40,000.00	1,093,164	54.7%
	[4]Basin ROW - daylight only	ACRE	319	275	$40,000.00	-1,783,181	-14.0%
	Basin ROW - daylight only - within LAFB Crash Zone	ACRE	0	151	$30,000.00	4,520,129	n/a
	[4]Hydroseed & Topsoil	ACRE	347	427	$2,500.00	201,891	23.3%
	Rip Rap Energy Dissipater	EA.	6	7	$5,000.00	5,000	16.7%
	30" Low Flow Drain Pipe	L.F.	0	2,618	$82.00	214,676	n/a
	60" Low Flow Drain Pipe	L.F.	0	12,273	$218.00	2,675,514	n/a
	66" Low Flow Drain Pipe	L.F.	13,936	7,002	$264.00	-1,830,576	-49.8%
	72" Low Flow Drain Pipe	L.F.	10,768	9,547	$288.50	-352,259	-11.3%
	Single span bridge	EA.	22	24	[3]$550,000	3,271,020	32.21%
	culverts	EA.	6	7	[3]$320,000	840,506	60.02%
					$\Sigma =$	$14,141,734	14.8%

Sub Total = *$14,141,734*
Engineering (10% Construction) = *$1,414,173*
30% Contingency = *$4,242,520*

Total = ***$19,798,427***

. Changes in quantities and costs are relative to the level III preferred alternative - positive values indicate an increase while negative values indicate a decrease.
. L3 = Level III preferred alternative, A2i = Alternative 2 with the option of placing the Bethany Home Road Basin within the 65db contour.
. This cost varies per location; therefore, an average value is included here
. This cost includes the quantity for the Bethany Home Road Channel and/or basin.

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Table 4.1Bii
Level III Preferred Alternative vs.
Alternative 2ii
Cost Comparison

SR 303L Channel Alternatives

CHANNEL NAME	ITEM DESCRIPTION	UNIT	*Change in* QUANTITY L3 Quantity	A2ii Quantity	Unit Cost $	*Change in* Cost $	*Percent Change* In Cost %
SR 303L	Channel Excavation	C.Y.	623,846	624,930	$3.25	3,522	0.2%
	Channel Fill	C.Y.	46,763	61,960	$3.25	15,197	10.0%
	[4]Concrete&Steel	L.F.	82,022	86,744	$268.62	1,093,786	4.9%
	[4]Retention Basin Net Excavation	C.Y.	7,224,706	7,977,675	$5.00	3,764,845	10.4%
	Drop Structures - additional concrete	C.Y.	3,421	4,319	$250.00	224,467	26.2%
	[4]Channel ROW	ACRE	50	77	$40,000.00	1,093,164	54.7%
	[4]Basin ROW - daylight only	ACRE	319	274	$40,000.00	-1,821,513	-14.3%
	Basin ROW - daylight only - within LAFB Crash Zone	ACRE	0	151	$30,000.00	4,520,129	n/a
	[4]Hydroseed & Topsoil	ACRE	347	426	$2,500.00	199,360	23.0%
	Rip Rap Energy Dissipater	EA.	6	7	$5,000.00	5,000	16.7%
	30" Low Flow Drain Pipe	L.F.	0	2,618	$82.00	214,676	n/a
	60" Low Flow Drain Pipe	L.F.	0	12,273	$218.00	2,675,514	n/a
	66" Low Flow Drain Pipe	L.F.	13,936	7,002	$264.00	-1,830,576	-49.8%
	72" Low Flow Drain Pipe	L.F.	10,768	9,547	$288.50	-352,259	-11.3%
	Single span bridge	EA.	22	24	[3]$550,000	3,271,020	32.21%
	culverts	EA.	6	7	[3]$320,000	840,506	60.02%
					$\Sigma =$	$13,916,837	14.6%

Sub Total = $13,916,837
Engineering (10% Construction) = $1,391,684
30% Contingency = $4,175,051

Total = $19,483,572

1. Changes in quantities and costs are relative to the Level III preferred alternative - positive values indicate an increase while negative values indicate a decrease.
2. L3 = level III preferred alternative, A2ii = Alternative 2 with the option of placing the Bethany Home Road Basin within the 70db contour.
3. This cost varies per location; therefore, an average value is included here.
4. This cost includes the quantity for the Bethany Home Road Channel and/or basin.

Table 4.1C
Level III Preferred Alternative vs.
Alternative 3
Cost Comparison

SR 303L Channel Alternatives

CHANNEL NAME	ITEM DESCRIPTION	UNIT	*Change in* QUANTITY L3 Quantity	A3 Quantity	Unit Cost $	*Change in* Cost $	*Percent Change* In Cost %
SR 303L	Channel Excavation	C.Y.	623,846	664,063	$3.25	130,705	6.4%
	Channel Fill	C.Y.	46,763	61,885	$3.25	49,148	32.3%
	Concrete&Steel	L.F.	82,022	84,132	$268.62	2,227,459	10.0%
	Retention Basin Net Excavation	C.Y.	7,224,706	6,997,140	$5.00	-1,137,830	-3.1%
	Drop Structures - additional concrete	C.Y.	3,421	4,018	$250.00	149,191	17.4%
	Channel ROW	ACRE	50	78	$40,000.00	1,108,533	55.4%
	Basin ROW - daylight only	ACRE	319	253	$40,000.00	-2,632,020	-20.6%
	Basin ROW - daylight only - within LAFB Crash Zone	ACRE	0	167	$30,000.00	5,011,082	n/a
	Hydroseed & Topsoil	ACRE	347	422	$2,500.00	189,522	21.9%
	Rip Rap Energy Dissipater	EA.	6	6	$5,000.00	0	0.0%
	36" Low Flow Drain Pipe	L.F.	0	2,618	$82.00	214,676	n/a
	48" Low Flow Drain Pipe	L.F.	0	6,934	$126.00	873,684	
	60" Low Flow Drain Pipe	L.F.	0	5,339	$218.00	1,163,902	n/a
	66" Low Flow Drain Pipe	L.F.	13,936	7,002	$264.00	-1,830,576	-49.8%
	72" Low Flow Drain Pipe	L.F.	10,768	8,623	$288.50	-618,833	-19.9%
	Single span bridge	EA.	22	24	[3]$564,510	3,391,980	33.40%
	culverts	EA.	6	6	[3]$229,815	-21,542	-1.54%
					Σ =	$8,269,082	8.7%

Sub Total = $8,269,082
Engineering (10% Construction) = $826,908
30% Contingency = $2,480,724

Total = $11,576,714

1. Changes in quantities and costs are relative to the Level III preferred alternative - positive values indicate an increase while negative values indicate a decrease.
2. L3 = level III preferred alternative, A3 = Alternative 3
3. This cost varies per location; therefore, an average value is included here.

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flow from the proposed basins under the existing Cactus Road and Northern Avenue alignments. Channel hydraulics dictate the use of bridges for the channel when there are no online basins proposed at roadway crossings.

  - ➤ *Alternative 2 and 3:* Since both of these alternatives use offline basins at both Cactus Road and Northern Avenue, bridges are still assumed to be required for the by-pass portion of the SR 303L channel. Detailed backwater analysis should be performed at these locations to determine the necessity of bridges since the magnitude of discharge conveyed by the by-pass channels would be much smaller than that conveyed by the main channel without basins (as with Alternative 1). However, such an analysis is beyond the scope of this study.

- The required basin right-of-way is similar or slightly higher for each of the alternatives than in the Level III Preferred Alternative. This is a result of holding the proposed basin depth at the LAFB crash zones to 8 feet (Alternative 1) and 6.5 feet (Alternative(s) 2 and 3) in an effort to maximize the amount of land coverage around LAFB.
- In Alternative 2, the proposed Bethany Home Road Channel and the location of the proposed crash zone basins results in the interception of additional storm water runoff. In the Level III Preferred Alternative as well as Alternatives 1 and 3, that runoff is conveyed to the proposed Camelback Road Channel east and then to the proposed Bullard Wash Channel south.

Table 4.2 shows the detailed quantity and cost data associated the Level III Preferred Alternative. Tables 4.3A – 4.3C show the detailed quantity and cost data associated with each of the proposed Alternatives (1-3).

In summary, although the proposed alternatives generally result in a lowering of the required basin excavation, the overall cost for relocating the part or all of the Cactus Road and Northern Avenue basin(s) is significantly higher than the Level III Preferred Alternative. In other words, any reduction in basin construction costs due to the conveyance of additional runoff volume to the proposed composite Camelback/LAFB crash zone basins is insignificant when compared with the increase in channel costs required to convey the additional peak discharges.

The reasons for the overall increase in cost for each alternative are listed below:

Alternative 1

- Discharge increases ranged from 120% to 940%, which affected approximately 7 miles of the 17-mile SR 303L flood control channel.
- As a result of the above increases in discharge, the channel bottom widths increased from 180% to 600%.
- As a result of the increases in discharge and bottom width, the overall channel top widths increased from 55% to 134%.

Alternative 2

- Discharge increases ranged from 7% to 56%, which affected approximately 5.1 miles (Cactus Road to Bethany Home Road) of the 17-mile SR 303L flood control channel.

Table 4.2
Level III Preferred Alternative
Proposed Channel Quantities

SR 303L Channel Preferred Alternative

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L		Channel Excavation	C.Y.	$3.25	623,846	$2,027,500
		Channel Fill	C.Y.	$3.25	46,763	$151,979
		Concrete&Steel	L.F.	$270.75	82,022	$22,207,327
		Retention Basin Net Excavation	C.Y.	$5.00	7,224,706	$36,123,530
		Drop Structures - additional concrete	C.Y.	$250.00	3,421	$855,207
		Channel ROW	ACRE	$40,000.00	50.0	$1,999,448
		Basin ROW - daylight only	ACRE	$40,000.00	319.2	$12,766,976
		Hydroseed & Topsoil	ACRE	$2,500.00	346.6	$866,489
		Rip Rap Energy Dissipater	EA.	$5,000.00	6	$30,000
		66" Low Flow Drain Pipe	L.F.	$264.00	13,936	$3,679,104
		72" Low Flow Drain Pipe	L.F.	$288.50	10,768	$3,106,568
	22	Single span bridge	EA.	$10,156,260.00	1	$10,156,260
	1	Barrel 387' Long, 48" RCP Culvert	EA.	$73,440.15	1	$73,440
	2	Barrel 100' Long, 10' X 4' RCB Culvert	EA.	$83,216.44	1	$83,216
	4	Barrel 190' Long, 10' X 4' RCB Culvert	EA.	$280,339.25	1	$280,339
	1	Barrel 513' Long, 10' X 6' RCB Culvert	EA.	$236,458.16	1	$236,458
	2	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$377,092.25	1	$377,092
	4	Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$349,887.30	1	$349,887
					Σ =	$95,370,821
					Sub Total =	*$95,370,821*
					Engineering (10% Construction) =	*$9,537,082*
					30% Contingency =	*$28,611,246*
					Total =	***$133,519,150***

Table 4.3A
Alternative A1
Proposed Channel Quantities

SR 303L Channel LAFB Alternative 1

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	
SR 303L		Channel Excavation	C.Y.	$3.25	942,732	$3,063,880	
		Channel Fill	C.Y.	$3.25	59,988	$194,962	
		Concrete&Steel	L.F.	$393.18	84,132	$33,079,031	
		Retention Basin Net Excavation	C.Y.	$5.00	5,920,217	$29,601,085	
		Drop Structures - Additional Concrete	C.Y.	$250.00	4,807	$1,201,715	
		Channel ROW	ACRE	$40,000.00	103.2	$4,128,958	
		Basin ROW - daylight only	ACRE	$40,000.00	312.7	$12,507,164	
		Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	n/a	$0	
		Hydroseed & Topsoil	ACRE	$2,500.00	395.7	$989,281	
		Rip Rap Energy Dissipater	EA.	$5,000.00	4	$20,000	
		66" Low Flow Drain Pipe	L.F.	$264.00	26,442	$6,980,688	
		72" Low Flow Drain Pipe	L.F.	$288.50	5,355	$1,544,918	
	24	Single span bridge	EA.	$14,711,760.00	1	$14,711,760	
	2	Barrel 100' Long, 10' X 4' RCB Culvert	EA.	$83,216.44	1	$83,216	
	4	Barrel 190' Long, 10' X 4' RCB Culvert	EA.	$280,339.25	1	$280,339	
	2	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$377,092.25	1	$377,092	
	4	Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$349,887.30	1	$349,887	
					Σ =	$109,113,976	14.4%

Sub Total =	*$109,113,976*
Engineering (10% Construction) =	*$10,911,398*
30% Contingency =	*$32,734,193*
Total =	***$152,759,566***

1. Unit cost varies with channel reach, this represents a weighted unit cost for the entire channel.

Table 4.3Bi
Alternative A2
Proposed Channel Quantities

SR 303L Channel LAFB Alternative 2i - Bethany Home Road Basin within 65db contour

CHANNEL NAME		ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	
SR 303L		Channel Excavation	C.Y.	$3.25	626,500	$2,036,124	
		Channel Fill	C.Y.	$3.25	63,122	$205,146	
		Concrete&Steel - SR 303L	L.F.	$268.50	84,367	$22,652,076	
		Concrete&Steel - Bethany Home	L.F.	$272.22	2,902	$789,998	
		Retention Basin Net Excavation	C.Y.	$5.00	7,977,675	$39,888,375	
		Drop Structures - Additional Concrete	C.Y.	$250.00	4,319	$1,079,673	
		Channel ROW - SR 303L	ACRE	$40,000.00	73.3	$2,933,869	
		Channel ROW - Bethany Home	ACRE	$40,000.00	4.0	$158,743	
		Basin ROW - daylight only	ACRE	$40,000.00	274.6	$10,983,795	
		Basin ROW - daylight only - within LAFB Crash Zone	ACRE	$30,000.00	150.7	$4,520,129	
		Hydroseed & Topsoil	ACRE	$2,500.00	427.4	$1,068,380	
		Rip Rap Energy Dissipater	EA.	$5,000.00	7	$35,000	
		30" Low Flow Drain Pipe	L.F.	$82.00	2,618	$214,676	
		60" Low Flow Drain Pipe	L.F.	$218.00	12,273	$2,675,514	
		66" Low Flow Drain Pipe	L.F.	$264.00	7,002	$1,848,528	
		72" Low Flow Drain Pipe	L.F.	$288.50	9,547	$2,754,310	
	24	Single span bridge	EA.	$13,427,280.00	1	$13,427,280	
	1	Barrel 255' Long, 60" RCP Culvert	EA.	$63,020.10	1	$63,020	
	3	Barrel 333' Long, 48" RCP Culvert	EA.	$185,144.10	1	$185,144	
	2	Barrel 1193' Long, 10' X 4' RCB Culvert	EA.	$902,239.80	1	$902,240	
	2	Barrel 100' Long, 10' X 4' RCB Culvert	EA.	$83,216.44	1	$83,216	
	4	Barrel 190' Long, 10' X 4' RCB Culvert	EA.	$280,339.25	1	$280,339	
	2	Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$377,092.25	1	$377,092	
	4	Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$349,887.30	1	$349,887	
					Σ =	$109,512,555	*14.83%*

Sub Total =	*$109,512,555*
Engineering (10% Construction) =	*$10,951,255*
30% Contingency =	*$32,853,766*
Total =	***$153,317,577***

1.The subscript 'i' denotes that this is for the option of locating the Behtany Home Road Basin within the 65db contour.

Table 4.3Bii
Alternative 2
Proposed Channel Quantities

SR 303L Channel LAFB Alternative 2ii - Bethany Home Road Basin within 70db contour

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L	Channel Excavation	C.Y.	$3.25	624,930	$2,031,021
	Channel Fill	C.Y.	$3.25	61,960	$201,370
	Concrete&Steel - SR 303L	L.F.	$268.50	83,842	$22,511,116
	Concrete&Steel - Bethany Home	L.F.	$272.22	2,902	$789,998
	Retention Basin Net Excavation	C.Y.	$5.00	7,977,675	$39,888,375
	Drop Structures - Additional Concrete	C.Y.	$250.00	4,319	$1,079,673
	Channel ROW - SR 303L	ACRE	$40,000.00	73.3	$2,933,869
	Channel ROW - Bethany Home	ACRE	$40,000.00	4.0	$158,743
	Basin ROW - daylight only	ACRE	$40,000.00	273.6	$10,945,463
	Basin ROW - daylight only - within LAFB Crash Zone	ACRE	$30,000.00	150.7	$4,520,129
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	n/a	$0
	Hydroseed & Topsoil	ACRE	$2,500.00	426.3	$1,065,849
	Rip Rap Energy Dissipater	EA.	$5,000.00	7	$35,000
	30" Low Flow Drain Pipe	L.F.	$82.00	2,618	$214,676
	60" Low Flow Drain Pipe	L.F.	$218.00	12,273	$2,675,514
	66" Low Flow Drain Pipe	L.F.	$264.00	7,002	$1,848,528
	72" Low Flow Drain Pipe	L.F.	$288.50	9,547	$2,754,310
	24 Single span bridge	EA.	$13,427,280.00	1	$13,427,280
	1 Barrel 255' Long, 60" RCP Culvert	EA.	$63,020.10	1	$63,020
	3 Barrel 333' Long, 48" RCP Culvert	EA.	$185,144.10	1	$185,144
	2 Barrel 1193' Long, 10' X 4' RCB Culvert	EA.	$902,239.80	1	$902,240
	2 Barrel 100' Long, 10' X 4' RCB Culvert	EA.	$83,216.44	1	$83,216
	4 Barrel 190' Long, 10' X 4' RCB Culvert	EA.	$280,339.25	1	$280,339
	2 Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$377,092.25	1	$377,092
	4 Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$349,887.30	1	$349,887
				Σ =	$109,321,852 *14.63%*

Sub Total =	*$109,321,852*
Engineering (10% Construction) =	*$10,932,185*
30% Contingency =	*$32,796,556*
Total =	***$153,050,593***

1.The subscript 'ii' denotes the option of placing the Bethany Home Road Basin within the 70db contour.

Table 4.3C
Alternative A3
Proposed Channel Quantities

SR 303L Channel LAFB Alternative 3

CHANNEL NAME	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
SR 303L	Channel Excavation	C.Y.	$3.25	664,063	$2,158,205
	Channel Fill	C.Y.	$3.25	61,885	$201,128
	Concrete&Steel	L.F.	$290.44	84,132	$24,434,786
	Retention Basin Net Excavation	C.Y.	$5.00	6,997,140	$34,985,700
	Drop Structures - Additional Concrete	C.Y.	$250.00	3,826	$956,469
	Channel ROW	ACRE	$40,000.00	77.7	$3,107,980
	Basin ROW - daylight only	ACRE	$40,000.00	253.4	$10,134,956
	Basin ROW - daylight only - within LAFB Crash Zone	ACRE	$30,000.00	167.0	$5,011,082
	Basin ROW - rectangular parcel bounding daylight lines	ACRE	$40,000.00	n/a	$0
	Hydroseed & Topsoil	ACRE	$2,500.00	422.4	$1,056,011
	Rip Rap Energy Dissipater	EA.	$5,000.00	6	$30,000
	36" Low Flow Drain Pipe	L.F.	$102.04	2,618	$267,141
	48" Low Flow Drain Pipe	L.F.	$126.00	6,934	$873,684
	60" Low Flow Drain Pipe	L.F.	$218.00	5,339	$1,163,902
	66" Low Flow Drain Pipe	L.F.	$264.00	7,002	$1,848,528
	72" Low Flow Drain Pipe	L.F.	$288.50	8,623	$2,487,736
	24 Single span bridge	EA.	$13,548,240.00	1	$13,548,240
	1 Barrel 255' Long, 72" RCP Culvert	EA.	$92,366.60	1	$92,367
	2 Barrel 333' Long, 66" RCP Culvert	EA.	$195,990.20	1	$195,990
	2 Barrel 100' Long, 10' X 4' RCB Culvert	EA.	$83,216.44	1	$83,216
	4 Barrel 190' Long, 10' X 4' RCB Culvert	EA.	$280,339.25	1	$280,339
	2 Barrel 450' Long, 10' X 6' RCB Culvert	EA.	$377,092.25	1	$377,092
	4 Barrel 220' Long, 10' X 6' RCB Culvert	EA.	$349,887.30	1	$349,887
				Σ =	$103,644,439 *8.68%*
				Sub Total =	*$103,644,439*
				Engineering (10% Construction) =	*$10,364,444*
				30% Contingency =	*$31,093,332*
				Total =	***$145,102,215***

- As a result of the above increases in discharge, the channel bottom widths increased from 6% to 33% through the same channel reaches.
- Due to the conveyance of all the discharge present within the SR 303L channel east at Bethany Home Road, the SR 303L channel bottom width in reaches downstream of Bethany Home Road and upstream of Camelback Road were reduced by a range of 50% to 83% relative to the Level III Preferred Alternative. However, since a new concrete channel is required along Bethany Home Road, the cost of the alternative was higher.
- As a result of the increases in discharge and bottom width, the overall channel top widths increased from 55% to 120% from Cactus Road to Bethany Home Road.
- Due to the conveyance of all the discharge present within the SR 303L channel east at Bethany Home Road, the SR 303L channel top width in reaches downstream of Bethany Home Road and upstream of Camelback Road were reduced by a range of 7% to 26% relative to the Level III Preferred Alternative. However, since a new concrete channel is required along Bethany Home Road, the cost of the alternative was higher.

Alternative 3

- Discharge increases ranged from 15% to 200%, which affected approximately 7 miles of the 17-mile SR 303L flood control channel.
- As a result of the above increases in discharge, the channel bottom widths increased from 17% to 60%.
- As a result of the increases in discharge and bottom width, the overall channel top widths increased from 5% to 24%.

The actual proposed profile along the channel did not change significantly for any of the alternatives studied. Further, flow depths within the channel were held at or near the Level III Preferred Alternative values. This was done in an effort to minimize impacts to the channel profile since daylighting of the profile is very difficult downstream. Other considerations, such as crossing existing canals, railroads, etc., make changes to the channel profile undesirable. Further, since increased flow depths along the channel will cause more excavation, as well as require larger footprints to daylight, the effort is made to minimize these impacts.

In some locations, changes to the channel profile are required due to the large increase in discharge through specific reaches. In such locations, channel velocities exceeded the maximum of 15 feet per second and, therefore, additional drop structures are required to limit channel slopes through these reaches.

The overall cost increase can be attributed to the large increase in channel excavation, additional concrete and steel required for the channel lining, additional required channel right-of-way and, the added cost of bridges at Cactus Road and Northern Avenue.

Finally, some of the costs that will accompany the final submittal of the Loop 303 ADMP Update project are omitted from this analysis, as they are not assumed to represent a significant "relative" factor to this analysis. Such costs are those which do not change significantly between the alternatives analyzed and hence do not provide any useful information for the overall analysis. These costs are listed below:

- Pedestrian crossings at roadways along the SR 303L channel alignment.
- Utility relocation costs along the SR 303L channel alignment.
- Operation and maintenance costs.

5.0 Conclusion

In conclusion, the cost of the relocation of the proposed Cactus Road and Northern Avenue basins is significantly higher from the present Level III Preferred Plan. The estimated increase in ascending order of dollars is Alternative 3 ($8,269,032), Alternative 1 ($13,245,155), and Alternative 2 ($13,931,428). Approximately 150 to 211 acres of area is utilized for flood control purposes in the crash zone for these alternatives. The final determination of the feasibility of such relocation should carefully consider the quantifiable dollar impact to the overall project and the future use of the crash zone as a safety feature for LAFB.

Finally, it is important to note that by locating basins within the LAFB crash zones, some drainage areas contributing to the discharges within the proposed Camelback Channel under the Level III Preferred Alternative are now intercepted upstream. As a result, the peak flow rate and actual volume of discharge conveyed by both the proposed Camelback Channel and the proposed Bullard Wash Channel have decreased. Therefore, there will be a quantifiable construction cost savings associated with the alternatives presented above within certain reaches of the proposed Camelback Channel and the proposed basin located north of I-10 along the proposed Bullard Wash Channel. The evaluation and computation of this costs savings were beyond the scope of this assignment and, therefore, are not presented here.