Area Drainage Master Study

LITTLE DEER VALLEY

Conceptual Drainage Plan

Volume 1, Report

Prepared for:
CITY OF PHOENIX, ARIZONA
Engineering Department
Floodplain Management Section

Index Number ST-886358
Job Number 881111-11022

Collar, Williams and White Engineering
Water Resources Division
2702 North 44th Street, Suite 100A
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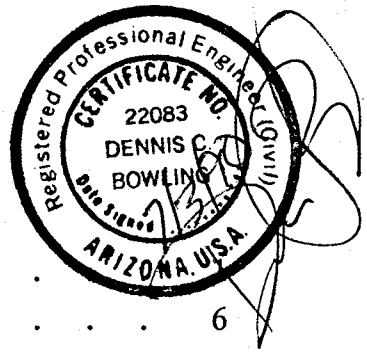

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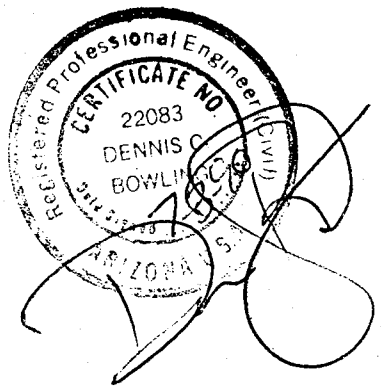

LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
EXECUTIVE SUMMARY

Presently, the Little Deer Valley Watershed consists of few residential developments with the vast majority of the area undeveloped and lying within the jurisdiction of the Arizona State Land Department. Future land use plans indicate the watershed will become fully developed with low, medium and high density residential, commercial developments, parks and open space. This conceptual drainage analysis provides a plan for future drainage improvements throughout the watershed including, but not limited to the following:

- Open Channels: The majority of drainage improvements within this plan consist of open channel reaches, usually parallel to major street alignments. The study analyzes two different alternatives for each suggested channel reach. These are unlined channels and concrete lined channels. Drainage and recreation corridors have been analyzed as unlined channels and have been located in areas which would serve a recreation theme best. These corridors link up major recreation destination points. Areas with open washes have also been analyzed with these two alternatives.

- Culvert crossings: Culverts crossing major roadways have been analyzed using the 100-year design storm.

- Underground Storm Drain Systems: 100-year storm drain systems have been analyzed where open channel reaches may be impractical due to available space.

- Retention: The analysis of retention is an issue which should be further studied. The possibilities for retention within the Little Deer Valley watershed are minimal and locations may not serve useful retention purposes.

- No-Action Areas: These are areas which require a site specific evaluation for local drainage relief or areas that should be left in their natural state to preserve the desert environment.

Study Objectives

The objectives of this study were to identify potential flooding and drainage problem areas in the Little Deer Valley watershed north of Adobe Dam, and to develop a conceptual flood control and drainage plan to mitigate these problem areas. The study includes two

plans. The conceptual drainage plan proposes a drainage conveyance network capable of conveying the 100-year peak discharge. The storm drain plan proposes storm drain systems along major street alignments capable of conveying the 2-year peak discharge. These 2-year facilities discharge runoff into the larger 100-year facilities. To achieve these objectives five hydrologic computer models were developed using the U.S. Army Corps of Engineers' HEC-1 Flood Hydrograph Package as follows:

- Case I: Existing watershed condition for the 100-year storm of 24-hour duration.
- Case II: Proposed watershed development condition for the 100-year storm of 24-hour duration.
- Case III: Existing watershed condition with the implemetation of the 100-year conceptual drainage plan.
- Case IV: Existing watershed condition with the implementation of the 2-year storm drain plan.
- Case V: Existing water condition with the implementation of both the 100-year conceptual drainage plan and the 2-year storm drain plan.

Hydrologic Modeling

Case I: The Case I model was developed to identify existing and potential flooding problem areas within the Little Deer Valley watershed. Problem areas are located north of Happy Valley Road between 35th Avenue and 67th Avenue, north of Pinnacle Peak Road between 59th Avenue and 39th Avenue, east of 67th Avenue between Jomax Road and Mariposa Grande Street and parallel to 51st Avenue between Happy Valley Road and Pinnacle Peak Road. The major factors contributing to these drainage problems consist of existing inadequate facilities and non-existent road crossings.

Case II: The Case II model was developed to determine peak flows for a fully developed watershed and to determine the extent to which retention would need to be implemented.

Case III: The Case III model was developed to determine the extent to which a conceptual drainage plan would mitigate the existing drainage inadequacies within the Little Deer Valley watershed. The proposed conceptual drainage plan consists of open channels, major culverts, major storm drain systems and no-action areas. For the locations of these major

100-year facilities, see Plates 1 and 2 along with the tables beginning on page 29 of the report.

Case IV: The Case IV model was developed to provide 2-year storm protection for major streets in the study area. The flows for the Case IV model were calculated using a discharge per acre calculation from the 2-year HEC-1 model. The proposed storm drain system was designed to outlet into the major 100-year facilities. For location and size of the proposed storm drains, see Plates 3 and 4.

Case V: The Case V model represents the selected conceptual drainage and storm drain plan for the Little Deer Valley watershed. The entire conceptual and storm drain plan is shown on Plates 5 and 6.

Public Concerns

In a public meeting held on April 24, 1990, the 100-year conceptual plan and 2-year storm drain plan were revealed to the general public. A questionnaire concerning the channel alternatives was distributed to the audience and responses were returned. The public expressed the desire for unlined open channels, no-action areas and drainage/recreation corridors. They didn't like concrete channels and were indifferent concerning the 100-year underground storm drain facilities.

The public's primary concern of the public was Skunk Creek. Happy Valley and Pinnacle Peak Road currently flood frequently at the Skunk Creek crossing. These floods close major transportation routes for the residents of the area and are hazardous. The public expressed that improvements to Skunk Creek should be a priority.

Conclusions

The Conceptual Drainage and Storm Drain Plan for the Little Deer Valley provides required drainage and flood control improvements for the 100-year and 2-year storm events. Areas with proposed densities of less than five residences per acre were identified as no-action areas. Flood control for these areas should consist of non structural measures. These measures must establish safe finished floor elevations, create erosion setbacks and floodproof existing structures. These management techniques are preferred for they maintain the existing, natural drainage patterns and preserve the desert environment.

Preliminary costs and right-of-way acquisition requirements were developed for each of the channel options. Costs include construction, engineering and administration.

A summary of costs is shown on the next page.

LITTLE DEER VALLEY
CONCEPTUAL DRAINAGE PLAN

Summary of Costs per Basin

Basin	Total Basin Facility Cost with Unlined Channel Improvements	Required Area for Right-of-way (AC)	Total Basin Facility Cost with Concrete Channel Improvements	Required Area for Right-of-way (AC)
1	$655,300	3.8	$482,600	2.5
2	$1,002,200	7.9	$1,053,400	4.2
3	$1,086,000	9.6	$1,291,000	5.4
4	$2,062,800	27.9	$2,320,700	14.2
5	$8,742,900	61.3	$7,473,200	2.8
6	$1,551,000	24.3	$1,345,600	3.3
7	$190,100	1.13	$194,300	0.67
8	$287,200	2.6	$334,600	1.7

INTRODUCTION

This report describes the Conceptual Drainage Plan for facilities in the Little Deer Valley watershed, within the City of Phoenix, Maricopa County, Arizona *(see Figure 1)*. The report identifies the following: the data base used in the analysis; the hydrologic criteria used for analysis and design of the drainage infrastructure for the contributing watersheds; the effects of developments within the watershed on flood peaks, and the proposed drainage network used to convey the predicted flood peaks within the watershed.

The Conceptual Drainage Plan is developed to evaluate existing drainage facilities. The plan also provides preliminary design information on the drainage conveyance network of proposed improvements within the Little Deer Valley watershed.

This Conceptual Drainage Plan is engineered following the guidelines and regulations set forth by the City of Phoenix and the Maricopa County Flood Control District. It is intended to provide a guideline for the design of storm drainage improvements in the area.

The plan addresses flood control improvements at locations with contributing watershed areas of 0.1 square miles or greater. Drainage collection systems, including interceptor ditches, minor culverts, inlets and underground storm drain systems, will be constructed as the watershed develops. Capacities of existing systems and sizing of proposed improvements needed to convey the design flows are based upon our field investigation and topography provided by the City of Phoenix. Final design of any storm drain or open channel system should be performed by a qualified engineer.

Location

The boundaries of the Little Deer Valley watershed are as follows:

Beginning at the southwest corner of Section 7, T4N, R2E as shown on the Hedgepeth Hills, USGS Quadrangle. Thence north along the alignment of 67th Avenue to the boundary of the Deadman Wash watershed in Section 19, T5N, R2E. Thence easterly to a hill in the NW4, S20, T5N, R2E, thence southeasterly along the same watershed boundary to Skunk Creek. Thence southerly along Skunk Creek to Adobe Dam, thence westerly along Adobe Dam to Hedgepeth Hills. Thence northwesterly along the Hedgepeth Hills watershed

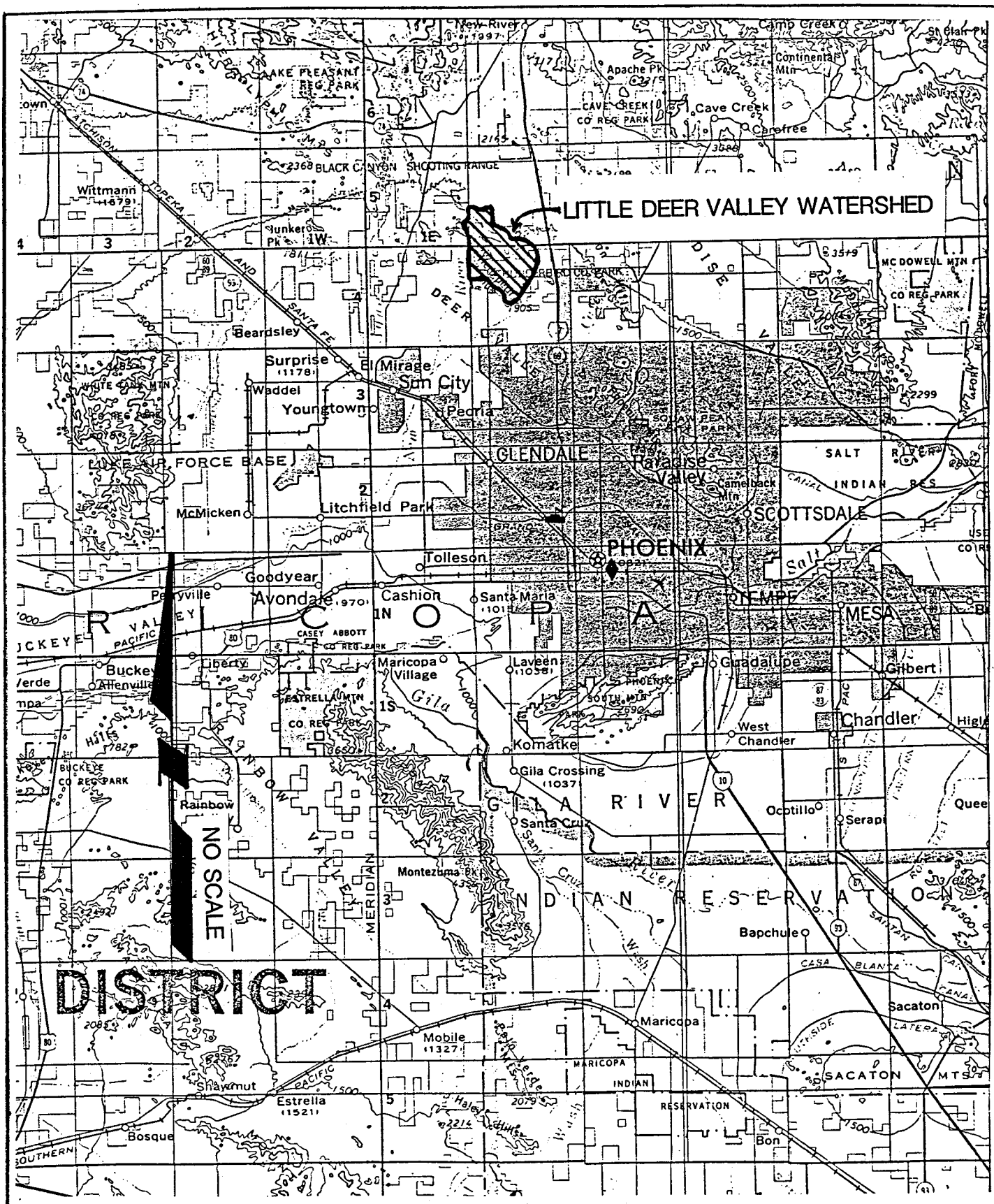

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FIGURE 1

VICINITY MAP

boundary to the alignment of Pinnacle Peak Road, thence westerly to the point of beginning *(see Figure 2)*.

Basin Description

The study area is approximately 13 square miles in size and consists of eight separate drainage basins. These basins will form the basis for the study and will be referenced with a basin number specific to their respective discharge point *(see Figure 3)*.

The following basins discharge west of 67th Street into the City of Peoria:

- Basin 1 has an area of about 1.4 square miles and is located north of the Central Arizona Project (C.A.P.) aqueduct, east of 67th Avenue and west of the Biscuit Flats region. Basin 1 discharges runoff to the northwestern boundary of the Little Deer Valley watershed, north of the C.A.P.

- Basin 2 has an area of about 2.5 square miles. Its northern portion lies between the C.A.P. and the Little Deer Valley watershed boundary, west of the proposed 51st Avenue extension and east of the planned Northwest Outer Loop. The remaining 1.3 square miles continues southwest to its outlet point at 67th Avenue, approximately 1/2 mile north of Happy Valley Road.

- Basin 3 has an area of about 1.0 square mile. It is located east of 67th Avenue and is bisected by the western portion of Happy Valley Road. This basin discharges runoff over 67th Avenue, approximately 1,000 feet north of Mariposa Grande Street.

The following basin discharges runoff south into the Thunderbird Recreation Area in the City of Glendale:

- Basin 4 has an area of about 2.3 square miles and is bisected by Happy Valley Road. This basin is located west of 51st Avenue, approximately one mile east of 67th Avenue, south of the C.A.P. and north of Pinnacle Peak Road. The portion of Basin 4 which now lies north of the C.A.P. was diverted to Basin 2 when construction of the C.A.P. was completed. Basin 4 discharges runoff into the Thunderbird Recreation area.

The following basins discharge runoff south to the Adobe Dam Recreational Area / Maricopa County Flood Control Reservoir:

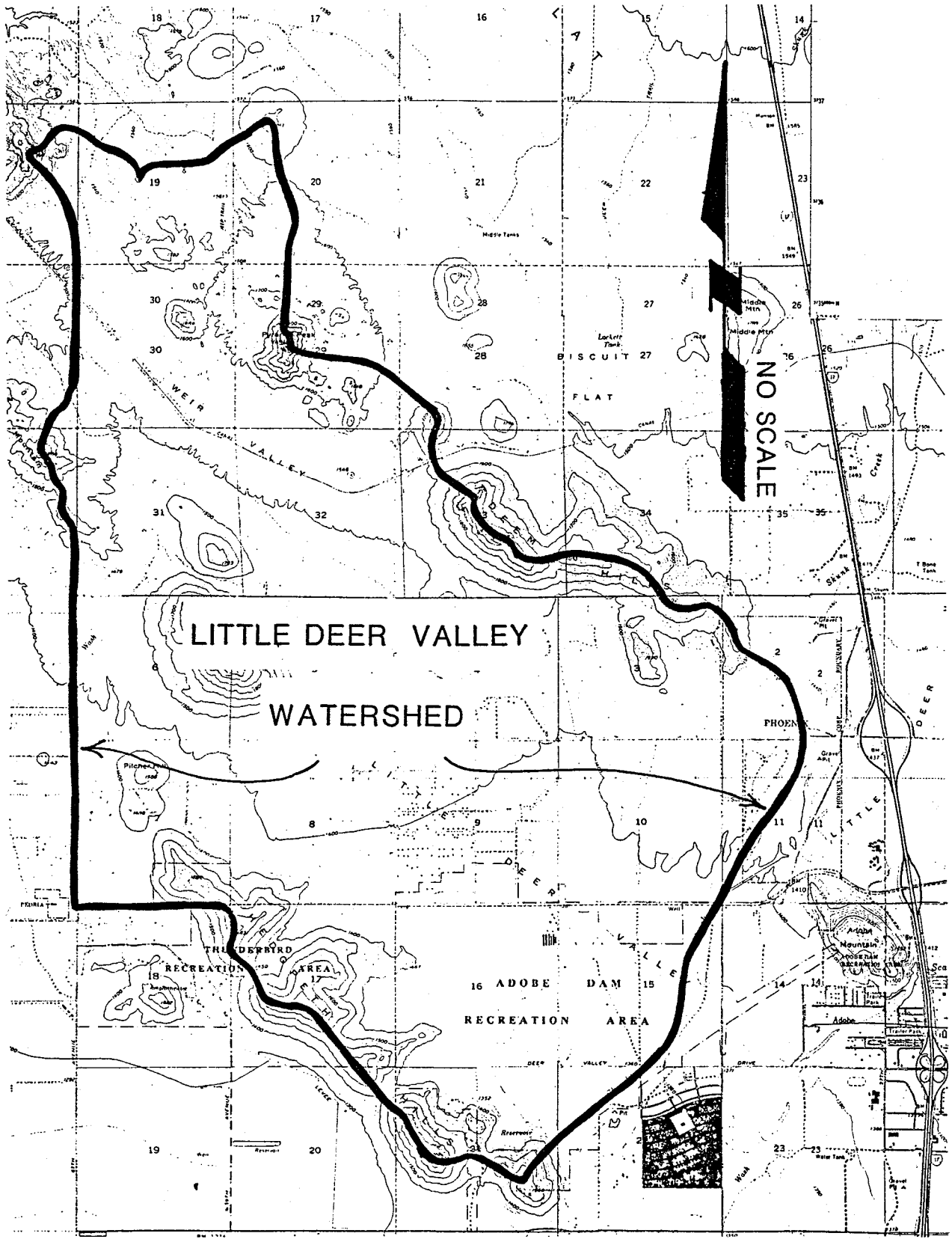

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FIGURE 2

PROJECT LOCATION

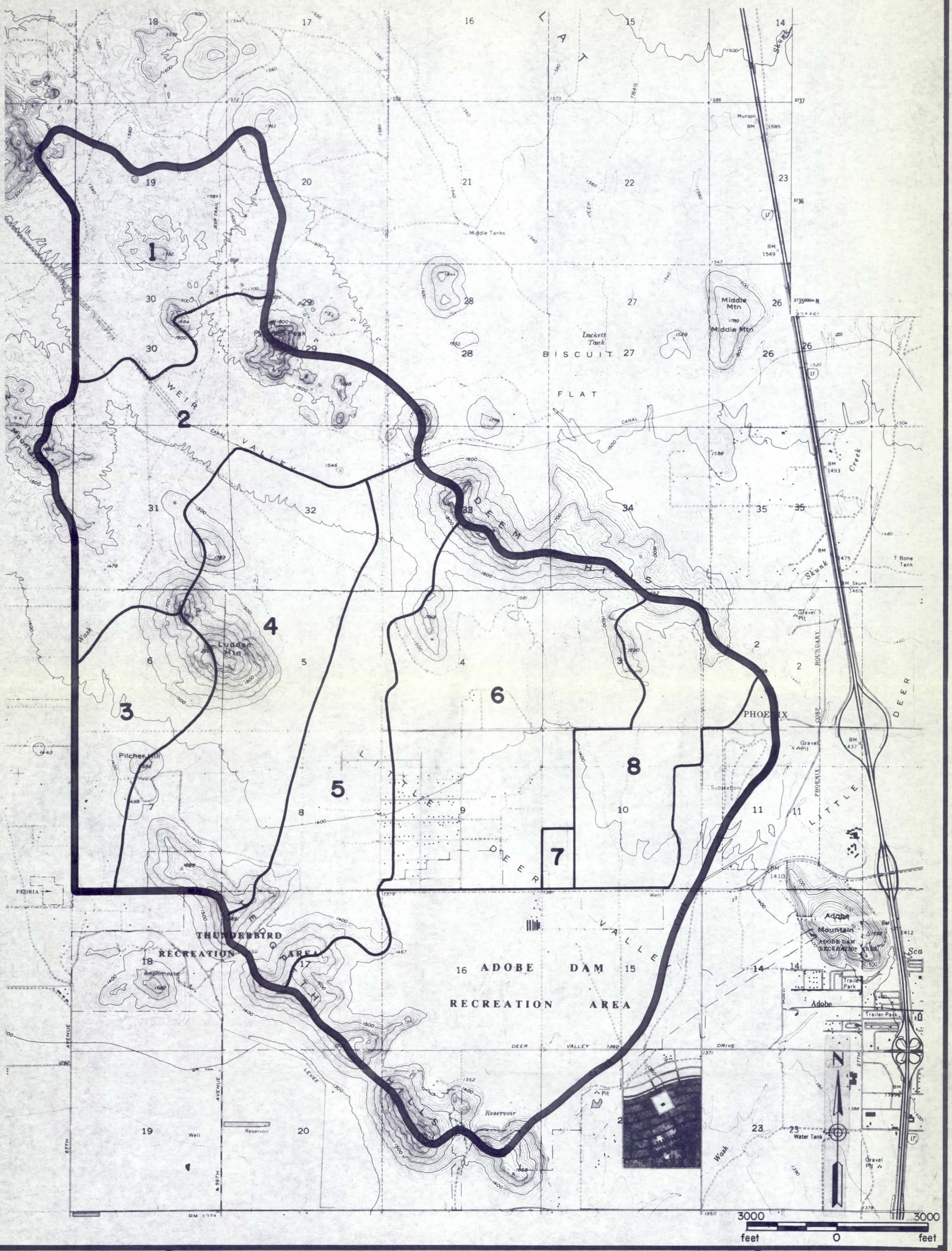

FIGURE 3

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY DRAINAGE BASIN LOCATION

SCALE: 1" = 3000'

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LEGEND:

- LITTLE DEER VALLEY WATERSHED BOUNDARY
- BASIN BOUNDARY
- 4 DRAINAGE BASIN NUMBER

DATE: APRIL, 1990

- Basin 5 has an area of about 2.0 square miles and is located in the center of the Little Deer Valley watershed. This basin runs parallel to 51st Avenue, lies south of the C.A.P. and north of the Adobe Dam Recreational Area. This basin discharges runoff into the Adobe Dam Recreation Area at the intersection of Pinnacle Peak Road and 51st Avenue.

- Basin 6 has an area of about 2.6 square miles and is bisected by Happy Valley Road. The northern portion is south of the Little Deer Valley watershed boundary, east of 51st Avenue and west of 39th Avenue. The southern portion lies east of 51st Avenue, west of 41st Avenue and north of Pinnacle Peak Road. Basin 6 discharges runoff into the Adobe Dam Recreation Area at the intersection of Pinnacle Peak Road and 47th Avenue.

- Basin 7 has an area of about 0.1 square miles and is located west of 39th Avenue, east of 47th Avenue, north of Pinnacle Peak Road and south of Alameda Road. Basin 7 discharges runoff into the Adobe Dam Recreation Area, west of the Oasis Water Park, at the intersection of Pinnacle Peak Road and 43rd Avenue.

- Basin 8 has an area of about 1.1 square miles and is located at the southeastern end of the Little Deer Valley watershed. This basin discharges runoff into the Adobe Dam Recreation Area at the intersection of Pinnacle Peak Road and 39th Avenue.

Scope of Work

This study addresses the following major topics related to the drainage infrastructure:

1. Calculate the 2-year and 100-year design discharges for the watershed under existing and proposed land use conditions.

2. Evaluate the adequacy of existing drainage facilities to safely convey the 100-year design flow.

3. Describe the drainage improvements recommended in the watershed study area to correct existing system inadequacies and provide an adequate backbone drainage system for future development. This backbone system will consist of major 100-year facilities with a 2-year storm drain plan along major streets.

4. Provide preliminary construction costs for recommended improvements.

CONCEPTUAL DRAINAGE PLAN DATA BASE

Topographic information for development of the Little Deer Valley Conceptual Drainage Plan was derived from the current County of Maricopa 1000 scale Orthophoto Topographic Survey maps for the area. These maps were supplemented by USGS Quadrangle maps and a detailed field investigation.

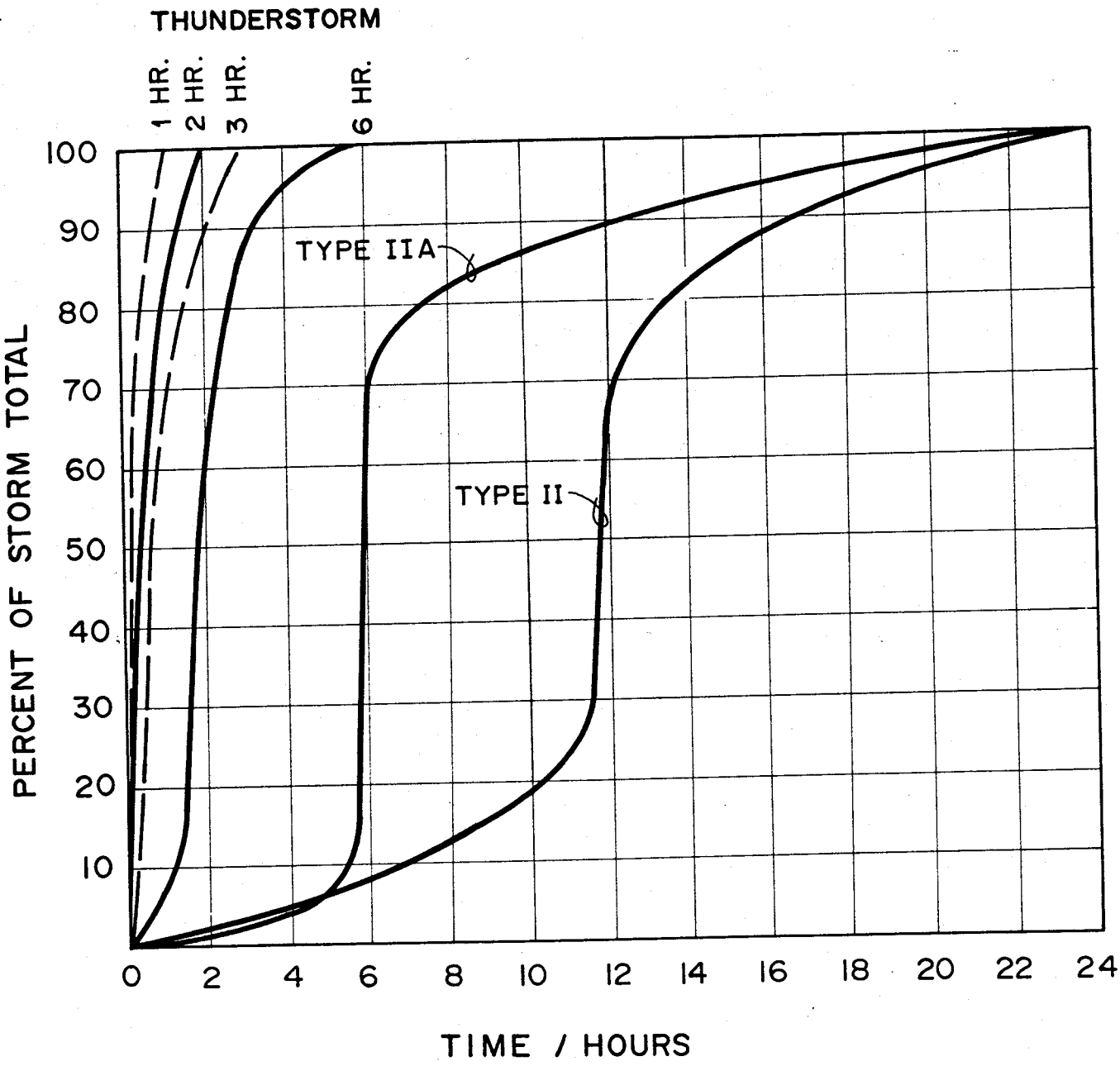
Existing drainage facilities in the watershed area were identified using as-built storm drain plans obtained from the City of Phoenix and engineering consultants. Existing facility sizes and discharge points were verified by field reconnaissance. Existing flow characteristics and problem areas were also noted by field investigation.

Existing developed land use for the Little Deer Valley watershed was obtained from field investigation and from the 2000 scale aerial photo of the watershed. Current land use in the study area includes low density single-family residential developments and undeveloped land. Future land use plans in the study area include low and medium density single-family residential, multifamily residential, schools, parks, public and commercial developments. The future land use was taken from the City of Phoenix General Plan, dated October 1985, and the Stetson Hills Master Plan, dated December 1986.

Soil in the study area is predominately Hydrologic Soil Groups "B" and "D" but also includes some "C" soils as outlined in the USGS Soil Survey for Maricopa County, Arizona. Vegetation on undeveloped areas consists primarily of desert brush with approximately 15 percent coverage.

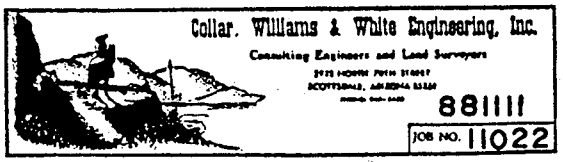
Rainfall information for use in this study was obtained from the Soil Conservation Service (SCS) Type IIA rainfall distribution. The 2-year and 100-year frequency storms of 24-hour duration were used with 30-minute intervals *(see Figures 4 and 5)*.

Note: Figure 4 was taken from the American Society of Agricultural Engineers' paper number 73-209. It was written by Donald E. Woodward in June, 1973. Figure 5 was taken from a TR-20 Manual used by the Arizona Department of Water Resources in the 1970s. These two charts have been found to compare favorably.



(REF. ASAE 1973)

FIGURE 4
SCS TYPE IIA
RAINFALL DISTRIBUTIONS



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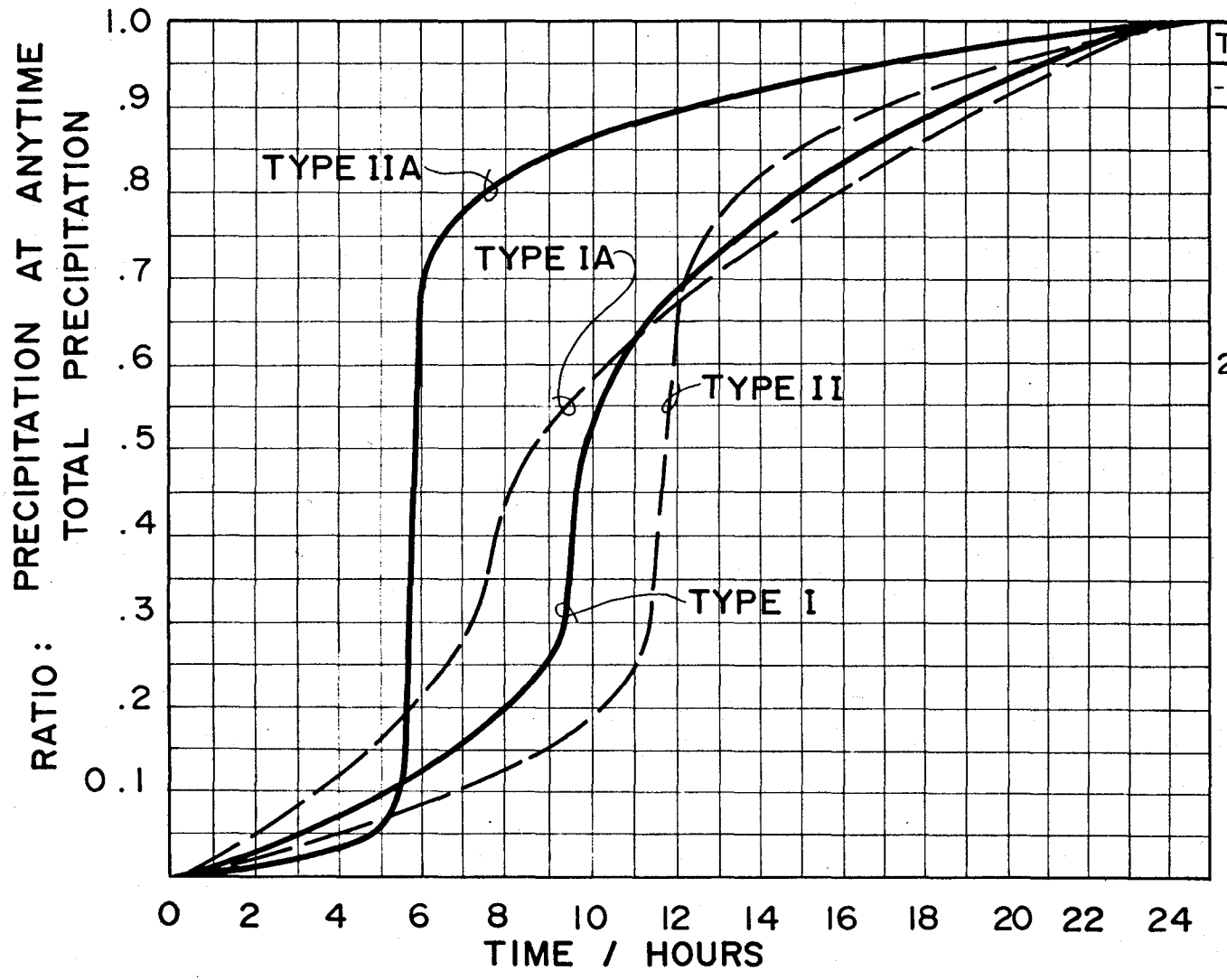
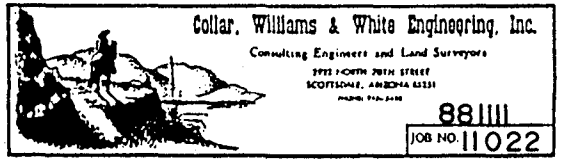


PERCENT OF RAINFALL BY DURATION

TIME -HRS-	TYPE IA %	TYPE I %	TYPE II %	TYPE IIA %
0.5	11.5	21.2	37.8	59.1
1.0	16.9	28.0	45.0	65.0
2.0	24.9	37.0	53.5	71.4
6.0	46.1	57.3	70.4	83.0
12.0	68.0	75.7	83.7	91.0
24.0	100.0	100.0	100.0	100.0

(REF. TR-20, 1970)

FIGURE 5
RAINFALL DISTRIBUTIONS
FROM TR-20 (1970)



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HEC-1 ANALYSIS: Little Deer Valley

The U.S. Army Corps of Engineers' HEC-1 Flood Hydrograph Package was used for the hydrologic analysis of the Little Deer Valley watershed. For this study three different hydrologic cases were analyzed. These are as follows:

1. Existing conditions hydrology
2. Proposed land use conditions hydrology
3. Existing conditions hydrology with proposed drainage improvements

The hydrologic analysis involved calculating and comparing the anticipated surface runoff from the project site for the existing condition and the proposed after development condition. Facilities were sized using the existing conditions hydrology and runoff was routed through the proposed drainage improvements in Case 3.

The results of our HEC-1 analysis for these three cases can be found in Appendices A, B and C.

The HEC-1 program allows the engineer to simulate both natural and improved watersheds. Program input parameters include sub-basin area, lag time, precipitation, cumulative rainfall distribution and infiltration rate. These input parameters were determined from the City of Phoenix Drainage Manual, soil and vegetative maps, topographic maps and observations made during a field investigation of the site. Rainfall rates and distributions were developed following the SCS Type IIA rainfall distribution *(see Figures 4 and 5)*. Rainfall runoff characteristics for the 2-year and 100-year, 24-hour storms were simulated in the course of the analysis. The SCS synthetic unit hydrograph with curvilinear transformation was used to develop runoff hydrographs for the watershed. This unit hydrograph is dimensionless and a function of the watershed area and lag time. Lag time for the watershed was calculated using the equation outlined in the U.S. Department of Agriculture's National Engineering Handbook, Section 4 (NEH- 4) circular, March, 1985.

Infiltration losses were estimated using SCS curve numbers for the watershed. Estimated curve numbers are a function of the vegetative cover and soil type. Estimates of vegetative cover were made from vegetative cover maps and field inspection. Soil types were obtained

from the SCS soil maps for the County of Maricopa. Original curve numbers obtained from the City of Phoenix Drainage Manual were adjusted accordingly for the 24-hour storm duration. Curve numbers were adjusted for storm duration using Table 1 from the Water Resources Associates', "General Drainage Plan for North Scottsdale, Arizona," 1988. This table is a function of soil group, storm duration and curve number. Curve number reduces as the storm duration increases.

TABLE 1

Summary of SCS Curve Numbers as a Function of Storm Duration and Hydrologic Soil Group

Hydrologic Soil Group	Curve Number By Storm Duration (hours)					
	1	2	3	6	12	24
A	74	71	69	66	63	60
B	83	81	80	78	76	74
C	89	87	86	85	83	82
D	92	91	90	88	87	86

The HEC-1 drainage basin map is shown in Figure 6. Peak flow rates based on these hydrologic characteristics for the 2-year and 100-year storms of 24-hour duration for existing conditions are shown in Figure 7.

Data used for the calculation of HEC-1 input parameters including lag time, curve numbers, percent impervious and rainfall distribution can be found in Appendix D and E of this report.

Hydrologic Results

The results of the hydrologic analysis are shown in Table 2 and on Figure 7. These results vary widely when compared to previous reports completed for areas within Little Deer Valley. The reasons for the wide variations are do to the hydrologic criteria used from one study to the other. Some of these are: storm duration, methods for calculating lag time and time of concentration and the calculation of the runoff curve number. The studies that have been compared are listed in the Reference section on page 62 of this report.

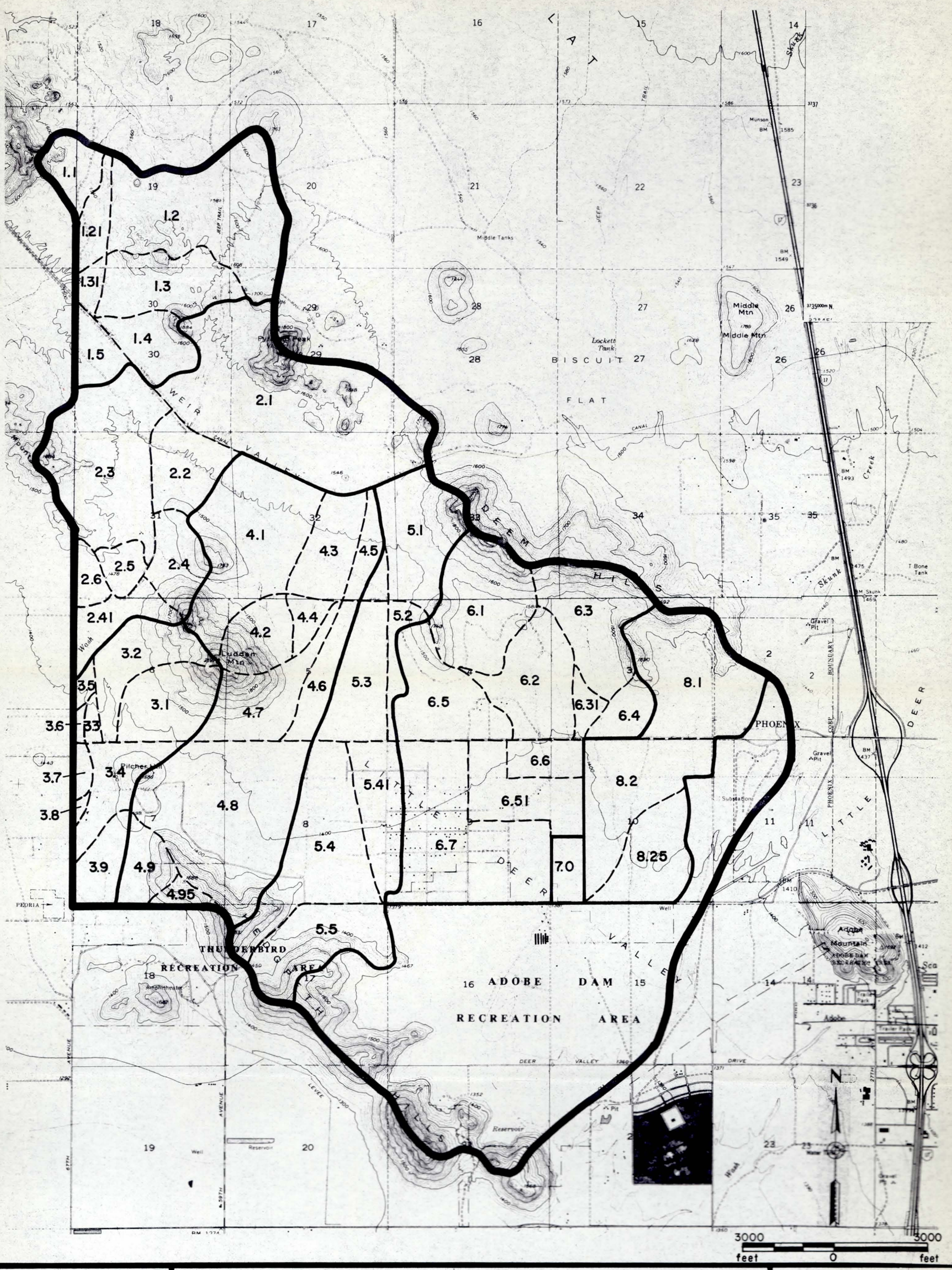

FIGURE 6

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY HEC-1 DRAINAGE BASIN MAP

SCALE: 1" = 3000'

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LEGEND:

- LITTLE DEER VALLEY WATERSHED BOUNDARY
- BASIN BOUNDARY
- SUB BASIN BOUNDARY
- 1._ BASIN
- 1.2 SUB BASIN OF BASIN 1

DATE: APRIL, 1990

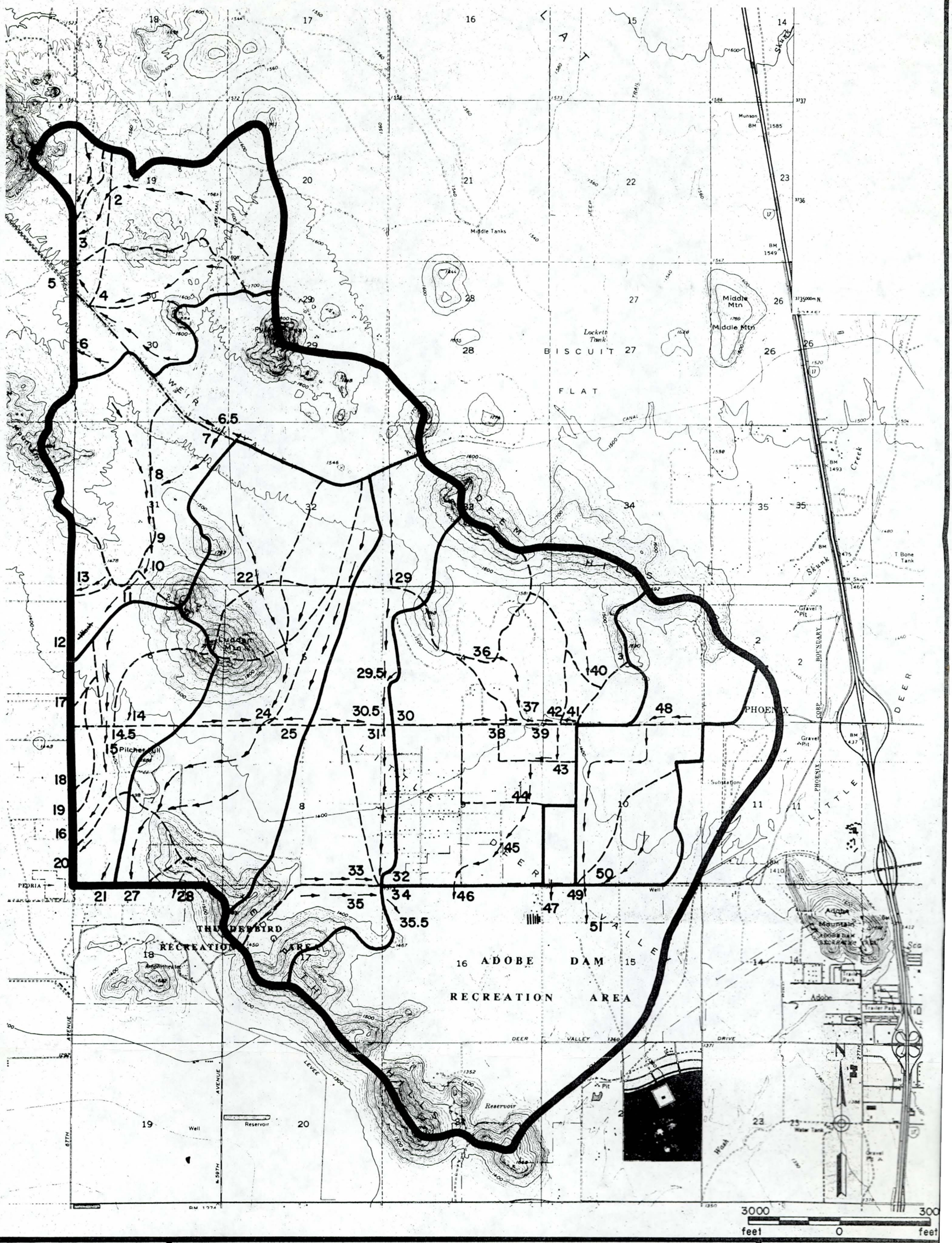

FIGURE 7

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY HEC-1 CONCENTRATION POINTS

SCALE: 1" = 3000'

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LEGEND:

- LITTLE DEER VALLEY WATERSHED BOUNDARY
- BASIN BOUNDARY
- SUB BASIN BOUNDARY
- 26 CONCENTRATION POINTS
- FLOW PATH

DATE: APRIL, 1990

TABLE 2
Peak Discharges and Concentration Points

Basin	Sub Basin	Concentration Point	Existing 2-Year Discharge (cfs)	Existing 100-Year Discharge (cfs)
1	1.1	1	13	85
	1.2	2	58	443
	1.2-1.21	3	62	482
	1.3-1.4	4	47	401
	1.3-1.31	5	58	524
	1.5	6	19	138
2	2.1	6.5	103	847
	2.1	7	23	40
	2.1-2.2	8	36	199
	2.1-2.3	9	88	582
	2.1-2.4	10	92	621
	2.1-2.5	11	94	630
	2.1-2.41	12	94	650
	2.6	13	96	183
3	3.1	14	70	489
	3.2	14.5	38	321
	3.1-3.3	15	101	750
	3.1-3.4	16	96	827
	3.5	17	1	33
	3.6-3.7	18	2	47
	3.8	19	1	13
	3.9	20	2	66
	3.95	31	1	29
4	4.1	22	46	412
	4.1-4.4	23	58	575
	4.1-4.4, 4.7	24	59	709
	4.5-4.6	25	3	66
	4.1-4.8	26	80	934
	4.1-4.9	27	81	925
	4.95	28	17	93

TABLE 2
Peak Discharges and Concentration Points (continued)

Basin	Sub Basin	Concentration Point	Existing 2-Year Discharge (cfs)	Existing 100-Year Discharge (cfs)
5	5.1	29	39	357
	5.2	29.5	13	93
	5.1-5.2	30	40	400
	5.3	30.5	7	109
	5.1-5.3	31	43	440
	5.1-5.41	32	68	575
	5.4	33	89	593
	5.1-5.4	34	155	1180
	5.5	35	26	282
	5.1-5.5	35.5	173	1456
6	6.1	36	45	449
	6.1-6.2	37	50	470
	6.5	38	10	158
	6.1-6.2, 6.5	39	43	579
	6.3	40	34	313
	6.3-6.4	41	38	395
	6.1-6.5	42	81	960
	6.1-6.6	43	83	988
	6.1-6.6	44	106	1137
	6.1-6.7	45	96	1137
	6.1-6.7	46	109	1340
7	7.1	47	30	190
8	8.1	48	26	275
	8.2	49	47	430
	8.25	50	109	470
	8.1-8.25	51	154	860

Adequacy of Existing Storm Drain Facilities

Existing drainage facilities were evaluated to determine their adequacy for 100-year peak design flows. The capacity of the facilities was based upon approximate methods and engineering judgment. Existing culvert capacities were based upon inlet control unless specific downstream control was known. Available headwater was determined by site investigations.

Existing drainage facilities for each basin are outlined below:

- Basin 1: There are no existing drainage improvements within Basin 1. Currently discharge flows via natural washes to outlet points within the City of Peoria.

- Basin 2: Existing drainage facilities within Basin 2 consist of natural washes and three culverts. The northern portion of Basin 2 is located north of the C.A.P. and runoff is controlled by a 42-inch reinforced concrete pipe (RCP) over the C.A.P. The next facility consists of a dual 42-inch spiral rib steel pipe (CSP) located under Jomax Road, just north of the rock quarry. The final facility is a dual 24-inch RCP culvert under Jomax Road approximately 1,500 feet east of 67th Avenue. Currently runoff from Basin 2 flows over 67th Avenue. For this hydrologic analysis, it was assumed that the rock quarry did not affect discharges.

- Basin 3: No major storm facilities currently exist within Basin 3; however, there are two 18-inch RCP culverts and one 24-inch RCP culvert which cross Happy Valley Road just east of 67th Avenue. A field investigation revealed these pipes were silted. Runoff flows via natural washes over 67th Avenue north of Mariposa Grande Street.

- Basin 4: Currently no major facilities exist within Basin 4. Runoff is conveyed through natural washes. A 24-inch RCP culvert is located south of Happy Valley Road and conveys discharges from the new development east of 55th Avenue to outlet points within Basin 4.

- Basin 5: Existing storm facilities within Basin 5 are located south of Happy Valley Road. These facilities are minor and consist of a drainage ditch parallel to 51st Avenue with 18-inch RCP culverts as road crossings. Two 24-inch RCP culverts convey some of the

runoff under Pinnacle Peak Road to Adobe Dam. The remaining discharge flows over 51st Avenue and into Basin 6.

- Basin 6: Existing facilities north of Happy Valley Road consist of a v-ditch, a dual 18-inch and one 18-inch RCP culvert parallel to Happy Valley Road, just east of 51st Avenue. This system outlets along side Happy Valley Road. A trapezoidal channel with a base width of 45-feet, a depth of 5-feet and side slopes of 4:1 and 7:1 is located north of Happy Valley Road. A 5-foot berm runs on the south side of the channel to protect Happy Valley Road from flooding. Four 5-foot by 10-foot reinforced concrete box culverts (RCBs) convey the flows from the northern portion of Basin 6 under Happy Valley Road and into the Upland Hills development.

  Runoff then flows through a trapezoidal channel lined with gunite. The channel has a base width of 28-feet, a depth of 6-feet and 1:1 side slopes. Five 5-foot by 10-foot RCBs are located at the downstream end of the channel. A retention basin is located downstream and retains flows from the Upland Hills Development. Runoff then flows overland to a trapezoidal channel within the Pinnacle Peak Crossing subdivision. This channel varies in width from 50-feet at the entrance to 80-feet at the exit. Runoff flows into a retention basin before reaching a 30-inch by 36-inch corrugated metal pipe arch (CMPA) culvert under Pinnacle Peak Road. Runoff then flows into the Adobe Dam Receational Area.

- Basin 7: Existing drainage facilities within Basin 7 consist of a 24-inch RCP culvert under Pinnacle Peak Road. A drainage ditch is located parallel to 43rd Avenue and conveys the flows past the Oasis Water Park in the Adobe Dam Recreational Area. A 30-inch by 36-inch CMPA is located under each access road to the water park.

- Basin 8: Currently no facilities exist within the portion of Basin 8 north of Happy Valley Road. South of Happy Valley Road new development has taken place and drainage improvements are vast. These improvements consist of a series of trapezoidal channels, retention basins and culverts.

Some of the existing road culverts constructed with the major roadways were found to be inadequate for the 100-year design storm. These road crossings are as follows:

- Basin 2: The dual 42-inch CSP system under Jomax Road.
- Basin 3: The 24-inch RCP system under Happy Valley Road east of 67th Avenue.

- Basin 5: The two 24-inch RCP systems under Pinnacle Peak Road at 51st Avenue.
- Basin 6: The 30-inch by 36-inch CMPA under Pinnacle Road at 47th Avenue.
- Basin 7: The 24-inch RCP under Pinnacle Peak Road at 41st Avenue.

Skunk Creek flows through Little Deer Valley east of Basin 8 and west of Interstate 17. No road crossings exist at either Happy Valley Road or Pinnacle Peak Road. During this rainy season, severe flooding occurs at these two locations and transportation in and out of Little Deer Valley becomes difficult.

Due to the high discharge within Skunk Creek and the lack of improvements, severe erosion has occurred downstream of Pinnacle Peak Road. Although this study does not address this issue, it is recommended that a detail study of this area become a priority.

RECOMMENDED DRAINAGE INFRASTRUCTURE IMPROVEMENTS

Introduction

The recommended drainage improvements for the Little Deer Valley watershed area are intended to provide a guideline for design of the storm drainage infrastructure within the area. The analysis addresses improvements at locations with contributing areas of 0.1 square miles or greater. Drainage collection systems including interceptor ditches, minor culverts, inlets and underground storm drain systems will be constructed as the watershed develops.

Design of these facilities are based upon approximate methods and engineering judgment. Final design of any storm drain or open channel should be performed by a qualified engineer.

The existing and recommended drainage facilities for the 100-year conceptual plan are shown in Table 3, beginning on page 36 of this report. The location of the drainage facilities referenced in the tables are shown on Plates 1 and 2. The recommended facilities for the 2-year storm drain plan are located on Plates 3 and 4. Both 2-year and 100-year facilities are shown on Plates 5 and 6.

Design Criteria

The existing 2-year and 100-year frequency storms of 24-hour duration were used as the basis for design of the recommended improvements in the watershed. Hydrologic methodology is discussed in the "Hydrologic Methodology and Criteria" section of this report.

Reinforced concrete pipe (RCP) is assumed for closed conduit design. For road crossings, either RCP or reinforced concrete box culverts (RCBs) are used. Reinforced concrete pipe sizes from 24-inch to 96-inch diameter in increments of 6-inches are used in the study. A Manning's roughness coefficient ('n' value) of 0.012 is used for RCP storm drain design.

Box culvert sizing is based on a minimum 3-foot height for ease of maintenance. Height sizing is based on 1-foot vertical increments and width sizing is based on 2-foot horizontal increments. A Manning's roughness coefficient of 0.014 is used for design. Because of the

relatively flat land, the headwater was assumed to be consistent throughout the study area. Available headwater was determined in the field by analyzing existing culverts. Culverts which needed substantially more headwater were accommodated with earthen berms to contain the 100-year storm event.

No-action areas were deemed appropriate in low-density residential areas where the existing natural flow paths would convey storm runoff. No-action areas are also located along major washes to assume preservation of the desert environment.

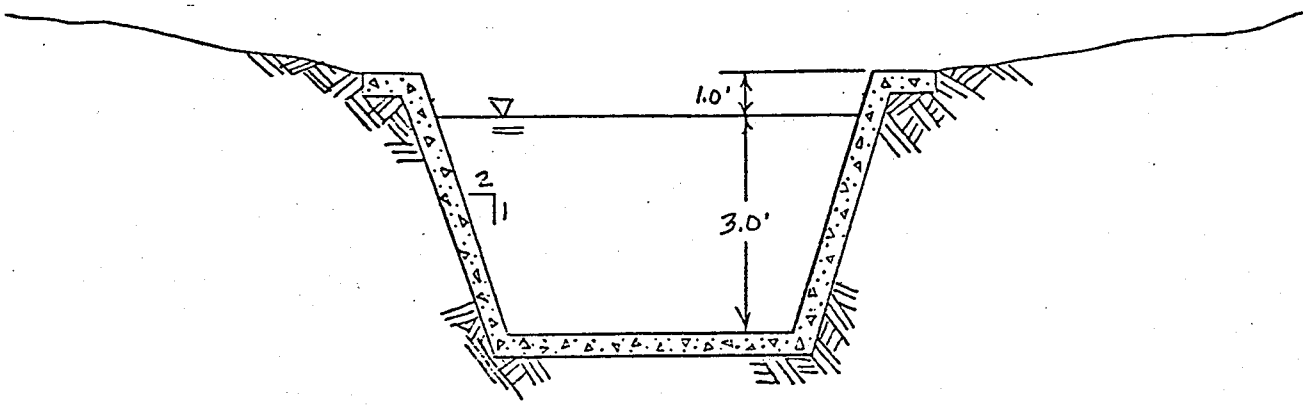
Floodplain management is used for natural washes and open channel reaches of the drainage system where practical. Natural channels should be used anywhere that an existing natural channel and adjacent floodplain can be expected to contain the 100-year flood. Concrete lined channels are used in areas where unlined channels are impractical, due to available space.

For areas needing improved channels, two alternatives were reviewed, they are: unlined earth channels, and concrete-lined channels. Design criteria for flood control channels was provided by the MCFCD and is outlined below: 1) Unlined channels shall have a Manning's roughness coefficient of 0.05, a maximum velocity of 5.0 feet per second, a maximum depth of 2.5 feet, 0.5 feet of freeboard and 4:1 side slopes. Natural channels, which are narrowed to accommodate development, and graded channels will be designed to meet allowable velocity criteria. 2) Concrete lined channels shall have a roughness coefficient of 0.02, a maximum velocity of 8.5 feet per second, a maximum depth of 3.0 feet, 1.0 foot of freeboard and 2:1 side slopes. Recreation corridors shall be implemented at locations where major recreation areas could be linked together. These recreation/drainage corridors will have a 2-year channel with a 100-year floodplain with a minimum width of 200 feet. Unlined channels including recreation/drainage corridors will have a 30 inch RCP to convey nuisance flows. The channel alternatives are shown on Figure 8.

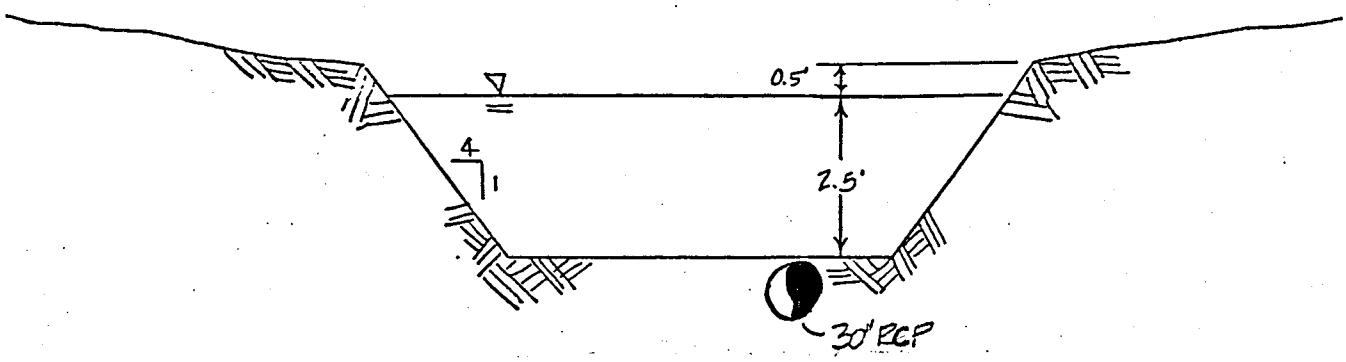
Proposed channel slopes are based on existing topographic maps. Existing channel slopes have been estimated in the field.

The finished floor of structures shall be built at a minimum of one foot above the 100-year water surface in the channel. All channels shall be in compliance with current floodplain criteria.

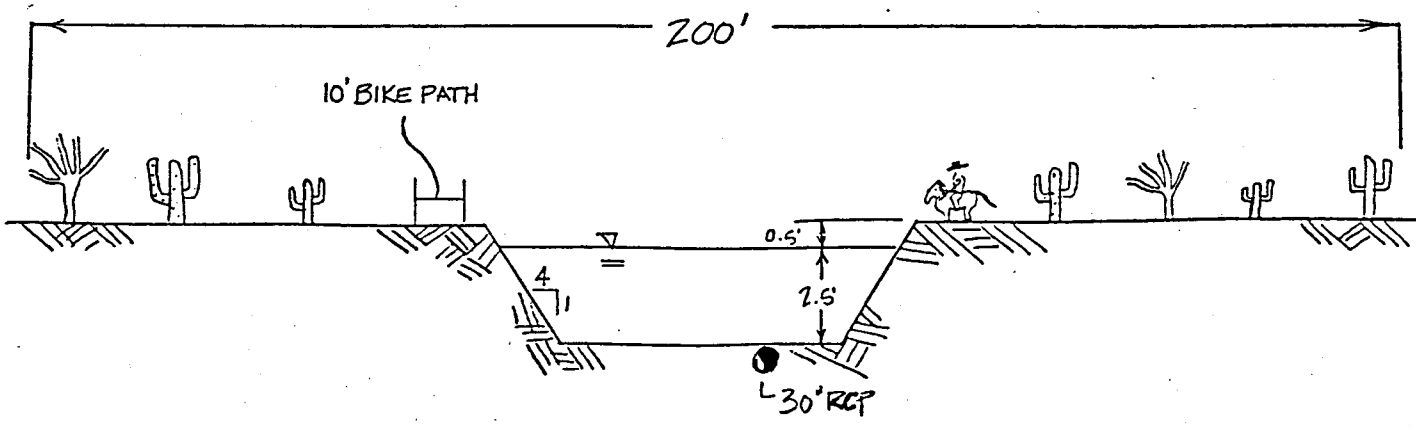
CONCRETE LINED



EARTH LINED



DRAINAGE AND RECREATION CORRIDOR



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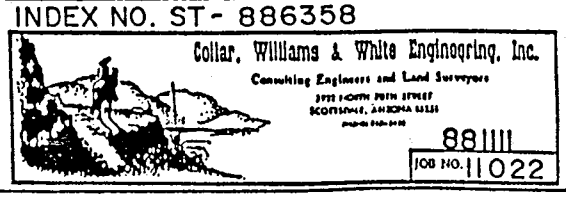

FIGURE 8

CHANNEL ALTERNATES

The following improvements are recommended to mitigate the existing drainage inadequacies in the various sub-basins. These recommendations are shown on Plates 1 and 2 and outlined below:

- Basin 1: Proposed improvements within Basin 1 will accommodate the proposed street alignment of 67th Avenue. These improvements will consist of improved channels and four, 3-foot by 10-foot RCBs. Basin 1 lies north of the C.A.P. and therefore no new retention facilities are necessary. Proposed development in Basin 1 is low density single-family residential and runoff may be conveyed through natural washes. These washes have been defined as no-action areas.

- Basin 2: Proposed improvements for Basin 2 will consist of three 36-inch RCPs under Jomax Road at the rock quarry. Channel improvements will accommodate the proposed road alignment of 67th Avenue near the rock quarry. Triple 4-foot by 10-foot RCBs are required for the crossing at 67th Avenue. If retention for this area is needed to further reduce peak discharges within Weir Wash, the existing rock quarry could be used for future retention. However, a substantial amount of runoff is already retained north of the C.A.P. and further retention may not be necessary.

- Basin 3: Proposed improvements for Basin 3 will consist of channel improvements north of Happy Valley Road with a 3-foot berm to contain the 100-year discharge. The existing culverts under Happy Valley Road will be replaced with dual 4-foot by 10-foot RCBs. Three 4-foot by 10-foot RCBs will be required for the crossing at 67th Avenue. The area south of Happy Valley Road is considered a no-action area and no drainage improvements have been implemented. There are no areas within Basin 3 appropriate for retention purposes although future developments may retain onsite.

- Basin 4: Proposed improvements for Basin 4 will accommodate a culvert crossing at Happy Valley Road. This culvert will consist of three 4-foot by 10-foot RCBs with channel improvements parallel to Happy Valley Road. A major channel will run north-south through the open space area reserved in the Stetson Hills Master Plan. The best location for retention within Basin 4 is north of Happy Valley Road at the proposed road crossing. Any area north of this crossing would not be reasonable for retention because the discharge would be minimal.

- Basin 5: Proposed improvements for the portion of Basin 5 north of Happy Valley Road consist of a recreation and drainage corridor parallel to 51st Avenue and channel improvements parallel to Happy Valley Road. Two 4-foot by 10-foot RCBs are located under Happy Valley Road. Possible retention facilities within Basin 5 are located north of Happy Valley Road at the proposed school and park site locations. However, retention at these locations will have a minimal impact on the overall basin discharge.

  Improvements south of Happy Valley Road will consist of two 100-year storm drains, one parallel to 51st Avenue and one parallel to Pinnacle Peak Road. Four 4-foot by 10-foot RCBs will convey the discharge from both storm drain systems under Pinnacle Peak Road at 51st Avenue. An improved channel is also located south of Pinnacle Peak Road.

- Basin 6: Drainage improvements for the portion of Basin 6 north of Happy Valley Road consist of a recreation and drainage corridor which conveys discharges around existing and proposed developments. This recreation and drainage corridor is located within a planned equestrian trail in the Stetson Hills Master Plan. The recreation corridor and drainage long with a storm drain system parallel to Happy Valley Road, convey discharges into the existing 45-foot trapezoidal channel parallel to Happy Valley Road.

  A dual 3-foot by 8-foot RCB culvert is required to accommodate the proposed street loop which accommodates 43rd and 39th Avenues.

  Improvements for the southern portion of Basin 6 will consist of an improved channel which will convey flows from the Upland Hills Development to the existing channel within the Pinnacle Peak Crossing Development. Five 4-foot by 10-foot RCBs are required to convey the discharge of Basin 6 under Pinnacle Peak Road. Before the discharge is conveyed into Adobe Dam Recreation Area, it is retained in a large basin north of Pinnacle Peak Road. Other existing retention basins are for on-site retention only.

- Basin 7: Drainage improvements for Basin 7 will consist of a dual 3-foot by 8-foot culvert under Pinnacle Peak Road. Retention facilities within Basin 7 will be onsite.

- Basin 8: Drainage improvements for the portion of Basin 8 north of Happy Valley Road will consist of an improved channel parallel to Happy Valley Road with dual 3-foot by 6-foot RCBs under Happy Valley Road. The existing facilities south of Happy Valley

Road are adequate and therefore no improvements are necessary. Retention basins are located throughout Basin 8 and no proposed basins are necessary.

This study does not include retention basin design. However, all future projects within the Little Deer Valley Watershed must provide retention in accordance with criteria presented by the City of Phoenix. These projects must not discharge more than pre-development flow rates, or an increased volume of runoff by changing the hydrograph for a sub-basin. If the developments discharge an increased volume of runoff, then they must recompute the model for the entire watershed demonstrating that the project would have no adverse impact on the drainage system.

Priority of Improvements

The recommended improvements as outlined in this plan have been given a priority rating in Table 3. The ratings vary from 1 as the highest priority to 3 as the lowest priority. Criteria for determining the ratings are:

1. Improvement is needed due to an endangerment to life or public health and safety.
2. Improvement is needed to mitigate potential damage to existing property or structures.
3. Improvements will be needed to protect future development.

The existing and recommended drainage facilities in the Little Deer Valley watershed are shown on Table 3. This table lists preliminary facility location, tributary drainage area, size length, capacity, 100-year design discharge and recommended improvements when needed. The location of the 100-year drainage facilities are shown on Plates 1 and 2. For areas with proposed channel improvements, both concrete lined and unlined systems were analyzed.

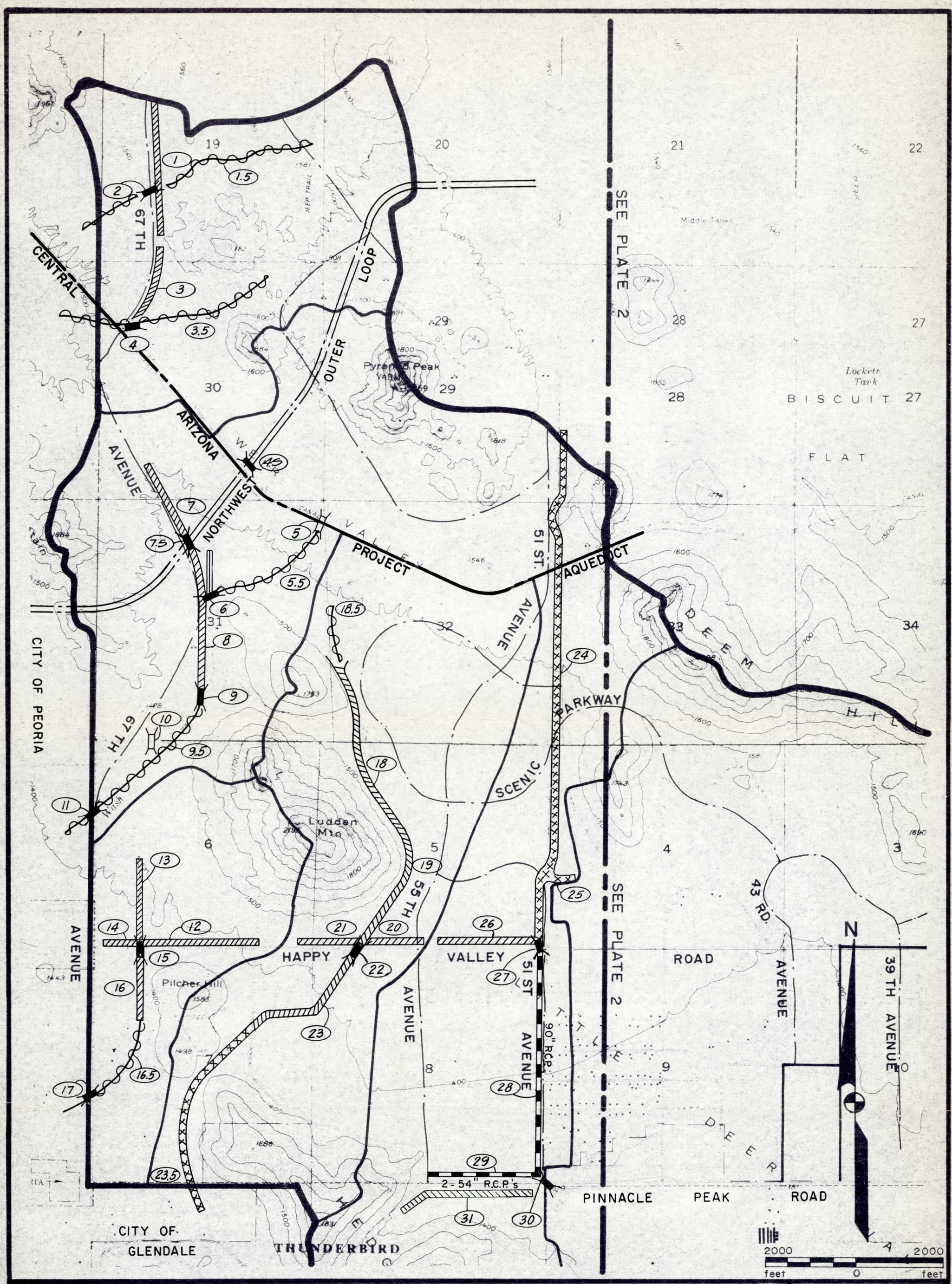

PLATE 1

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY

FACILITY INDEX FOR: DRAINAGE BASINS 1 THROUGH 5
CASE 3: 100 YEAR CONCEPTUAL DRAINAGE PLAN

SCALE: 1" = 2000'

INDEX NO. ST.- 886358

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Consulting Engineers and Land Surveyors
2702 N. 44TH ST. SUITE 100A
PHOENIX ARIZONA 85008
PHONE (602) 957-3350

881111

JOB NO. 11022

LEGEND:
- DIKE
- PROPOSED CHANNEL
- ROADWAY
- FACILITY NO.
- (38) NO-ACTION AREA
- RECREATION CORRIDOR
- EXISTING CULVERT
- EXISTING RETENTION BASIN
- WATERSHED BOUNDARY
- PROPOSED CULVERT
- BASIN BOUNDARY
- STORM DRAIN
- EXISTING CHANNEL

DATE: APRIL, 1990

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY

FACILITY INDEX FOR: DRAINAGE BASINS 6 THROUGH 8
CASE 3: 100 YEAR CONCEPTUAL DRAINAGE PLAN

PLATE 2

SCALE: 1" = 2000'

DATE: APRIL, 1990

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PHONE: (602) 957-3350

881111

JOB NO 11022

LEGEND:

- DIKE
- PROPOSED CHANNEL
- ROADWAY
- FACILITY NO. (38)
- NO-ACTION AREA
- RECREATION CORRIDOR
- EXISTING CULVERT
- EXISTING RETENTION BASIN
- WATERSHED BOUNDARY
- PROPOSED CULVERT
- BASIN BOUNDARY
- EXISTING CHANNEL
- STORM DRAIN

2000 feet 0 2000 feet

PLATE 3

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY

FACILITY INDEX FOR: DRAINAGE BASINS I THROUGH 5

CASE 4: 2 YEAR CONCEPTUAL STORM DRAIN PLAN

SCALE: 1" = 2000'

DATE: APRIL, 1990

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PHOENIX ARIZONA 85008
PHONE (602) 957-3350

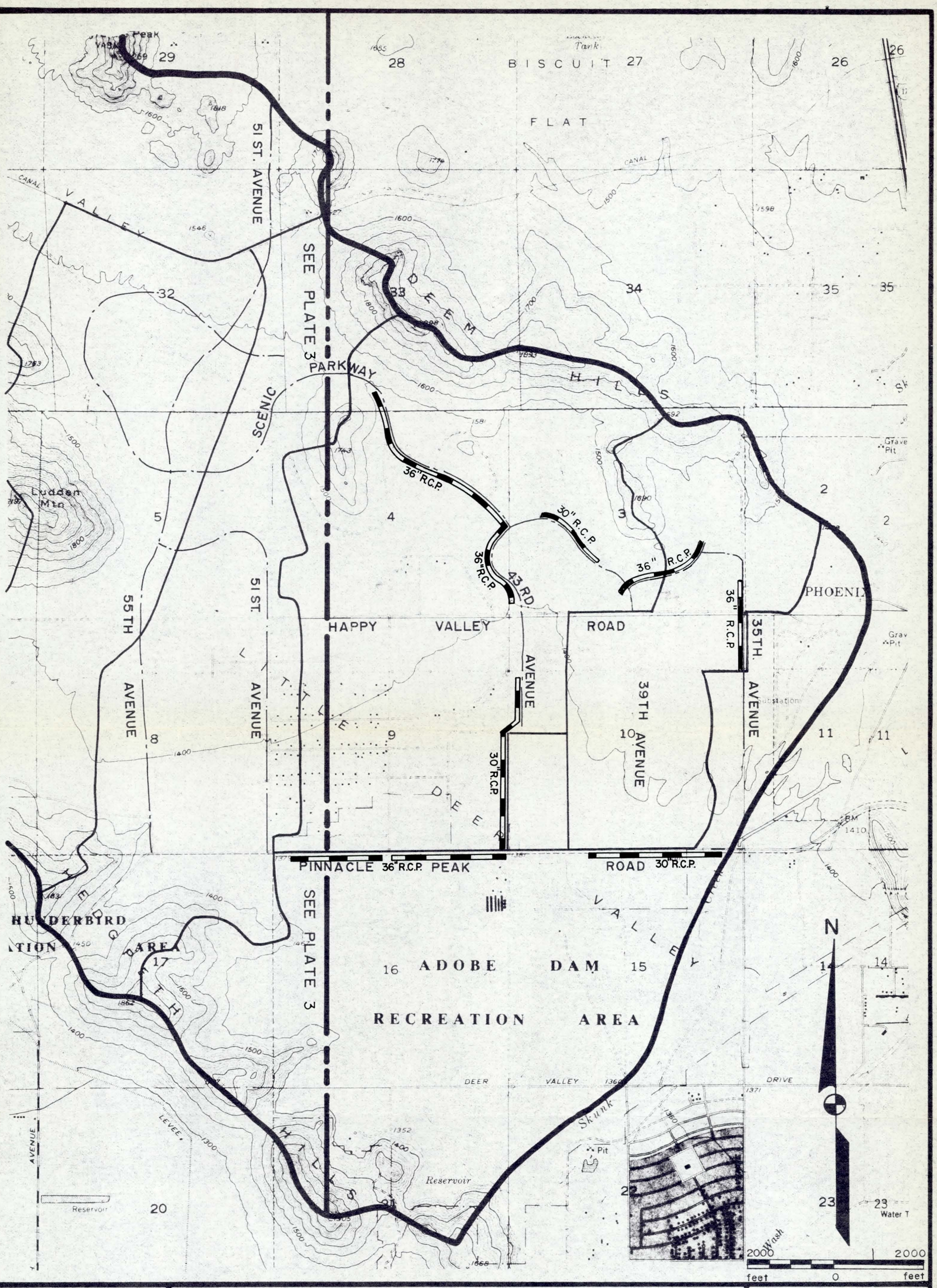
881111

JOB NO. 11022

LEGEND:

- STORM DRAIN
- ROADWAY
- BASIN BOUNDARY
- WATERSHED BOUNDARY
- PIPE DIMENSIONS 48"R.C.P.

2000 feet 0 2000 feet



4 PLATE

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY

FACILITY INDEX FOR: DRAINAGE BASINS 6 THROUGH 8

CASE 4: 2 YEAR CONCEPTUAL STORM DRAIN PLAN

SCALE: 1" = 2000'

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PHONE: (602) 957-3350

881111

JOB NO. 11022

LEGEND:

STORM DRAIN — ROADWAY

BASIN BOUNDARY — WATERSHED BOUNDARY

PIPE DIMENSIONS 48" R.C.P.

DATE: APRIL, 1990

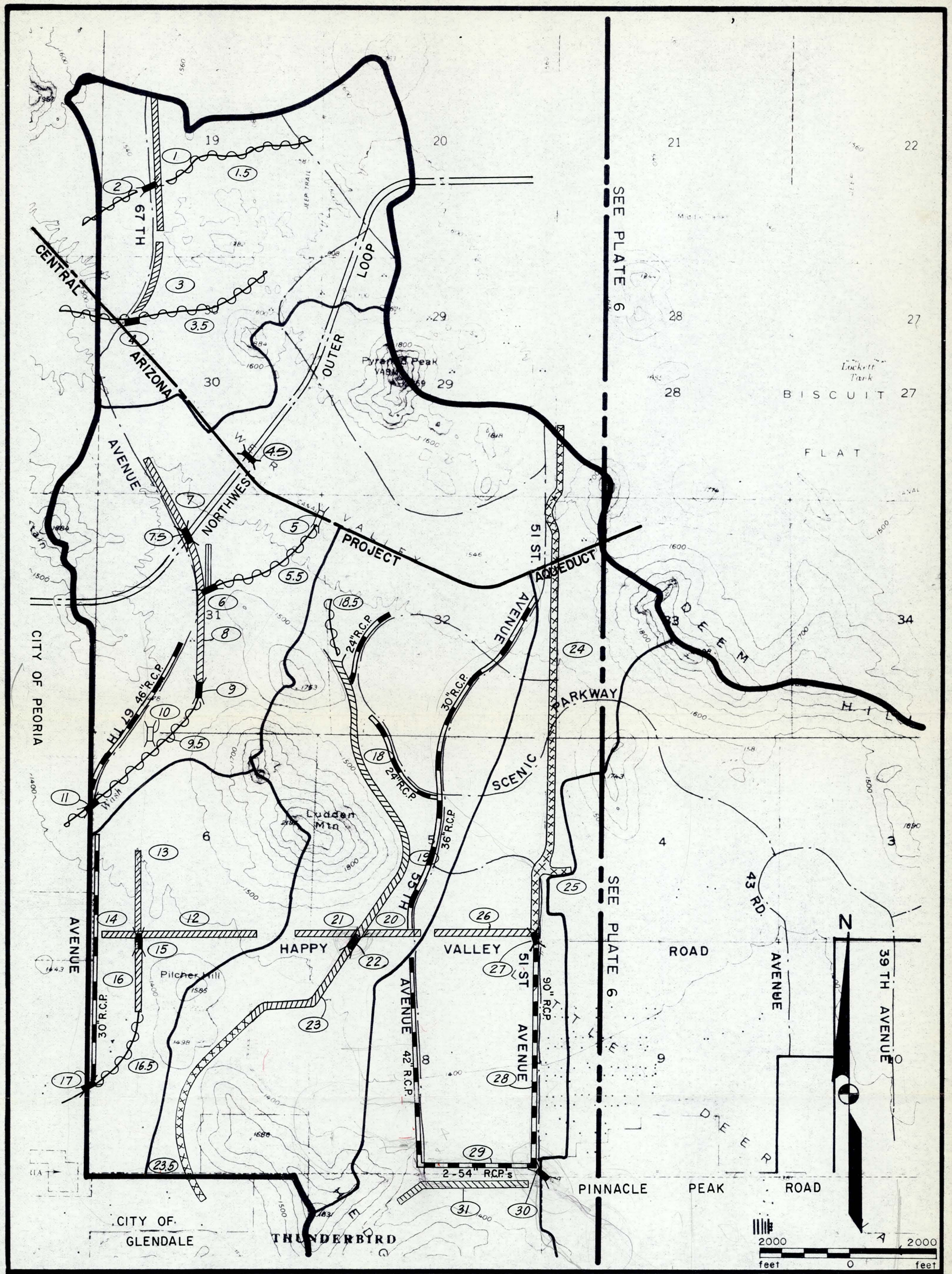

PLATE 5

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY

FACILITY INDEX FOR: DRAINAGE BASINS 1 THROUGH 5
CASE 5 · 100 YEAR CONCEPTUAL DRAINAGE PLAN
& 2 YEAR STORM DRAIN PLAN

SCALE: 1" = 2000'

INDEX NO. ST.- 886358

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881111

JOB NO. 11022

LEGEND:
- DIKE
- FACILITY NO.
- EXISTING CULVERT
- PROPOSED CULVERT
- EXISTING CHANNEL
- PROPOSED CHANNEL
- (38) NO-ACTION AREA
- EXISTING RETENTION BASIN
- BASIN BOUNDARY
- ROADWAY
- RECREATION CORRIDOR
- WATERSHED BOUNDARY
- STORM DRAIN

DATE: APRIL, 1990

GENERAL PLAN FOR DRAINAGE AND FLOOD CONTROL FOR THE LITTLE DEER VALLEY

FACILITY INDEX FOR: DRAINAGE BASINS 6 THROUGH 8

CASE 5: 100 YEAR CONCEPTUAL DRAINAGE PLAN & 2 YEAR STORM DRAIN PLAN

PLATE 6

SCALE: 1" = 2000'

DATE: APRIL, 1990

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JOB NO. 11022

LEGEND:

- DIKE
- PROPOSED CHANNEL
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- NO-ACTION AREA
- RECREATION CORRIDOR
- EXISTING CULVERT
- EXISTING RETENTION BASIN
- WATERSHED BOUNDARY
- PROPOSED CULVERT
- BASIN BOUNDARY
- EXISTING CHANNEL
- STORM DRAIN

2000 feet 0 2000 feet

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN

TABLE 3
EXISTING FACILITIES WITH PROPOSED IMPROVEMENTS

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Capacity (cfs) Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
1	1.2	1	Parallel to Proposed Alignment of 67th Ave, North of Cap	0.05	2000	None	----	30	----	Unlined Trap Channel b=1' d=2.5' tw=25' Concrete Channel b=0' s=0.5% d=3' tw=12'	16.0 126.9	3
1	1.2	1.3	Parallel to Proposed Alignment of 67th Ave, North of Cap	0.03	1000	None	----	20		Unlined Trap Channel b=0' d=2.5' tw=24' Concrete Channel b=0' d=2.5' tw=10'	7.4 52.3	3
1	1.2	1.5	Northernmost Portion of Little Deer Valley	0.7	4000	Natural Wash	440	440	----	No-Action Area Low-Density Residential	----	----
1	1.2	2	Proposed Crossing of Future Alignment of 67th Ave, North of Cap	0.7	100	None	----	440	----	2-3' High by 10' Wide RCBs	88.3	3
1	1.3	3	Parallel to Proposed Alignment of 67th Ave at Cap	0.05	2000	None	----	40	----	Unlined Trap Channel b=1' d=2.5' tw=21' Concrete Channel b=0' s=0.5% d=3' tw=12'	13.5 126.9	3
1	1.3	3.5	Center of Basin/ North of Cap	0.3	3500	Natural Wash	230	230	----	No-Action Area Low-Density Residential	----	----
1	1.3-1.4	4	Proposed Crossing of Future Alignment of 67th Ave	0.5	100	None	----	400	----	2-3' High by 10' Wide RCBs	88.3	3

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
2	2.1	4.5	North of Cap, West of Northwest Outer Loop	0.13	200	None	----	90	----	2-24" RCPs	31.3	3
2	2.1	5	Chute Over Cap Aqueduct	1.2	200	42" RCP	40	40	None	Adequate	----	----
2	2.2	5.5	South of Cap Chute	1.4	3000	Natural Wash	200	200	----	No-Action Area Low-Density Residential	----	----
2	2.2	6	Culvert Under Jomax Rd West of Quarry	1.4	100	2-42" CSP	180	200	Overtopping of Jomax Rd	3-36" RCPs	31.2	2
2	2.3	7	Parallel to Proposed Alignment of 67th Ave, West of Water Treatment Plant	0.4	3500	Natural Wash	----	130	----	Unlined Trap Channel b=10' d=3' tw=34' Concrete Channel b=1' s=0.45% d=4' tw=17'	56.5 294.2	3
2	2.3	7.5	Culvert Under North-west Outer Loop at Treatment Plant	0.4	150	Natural Wash	----	130	----	2-36" RCPs	31.2	3
2	2.3	8	Parallel to Proposed Alignment of 67th Ave, East of Rock Quarry	2.0	2000	----	----	580	----	Unlined Trap Channel b=60' d=3' tw=84' Concrete Channel b=17' s=0.45% d=4' tw=33'	84.5 539.9	3
2	2.3	9	Jomax Rd South of Quarry	2.0	100	None	----	580	----	3-4'x10' RCBs	140.8	3
2	2.4	9.5	Parallel to Proposed Alignment of 67th Ave, South of Quarry	2.3	1500	Weir Wash	----	630	----	No-Action Area Major Wash Desert Preserve	----	----
2	2.5	10	Jomax Rd, East of 67th Ave	0.06	80	2-24" RCPs	----	130	None	Adequate	----	----
2	2.1-2.5	11	67th Ave 1/2 Mile North of Happy Valley Rd	2.4	80	Dip Section	----	700	Flooding of 67th Ave	3-4' High By 10' Wide RCBs	140.8	1

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Capacity (cfs) Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
3	3.1	12	Parallel to Happy Valley Rd, East of 67th Ave Southwest of Luden Mt.	0.3	1500	None	----	490	Flooding of Happy Valley Rd	Unlined Trap Channel b = 48' d = 3' tw = 72' with 3' Berm Concrete Channel b = 13' s = 0.5 d = 4' tw = 29'	101.2 270.0	1
3	3.2	13	North of Happy Valley Rd, East of 67th Ave	0.3	2000	Natural	----	320	Flooding of Happy Valley Rd	Unlined Trap Channel b = 30' d = 3' tw = 54' Concrete Channel b = 7' d = 4' tw = 23'	61.6 248.3	1
3	3.2,3.6	14	Parallel to Happy Valley Rd, East of 67th Ave	0.1	80	1-18" RCP	----	70	Flooding of Happy Valley Rd	Unlined Trap Channel b = 1' d = 3' tw = 25' Concrete Channel b = 0' d = 3.5' tw = 14'	0.8 6.0	1
3	3.2	15	Happy Valley Rd East of 67th Ave	0.3	100	1-24" RCP	----	880	Flooding of Happy Valley Rd	3-4' High by 10' Wide RCBs	176.2	1
3	3.4	16	South of Happy Valley Rd, East of 67th Ave	0.8	1500	Natural Wash	----	880	----	Unlined Trap Channel b = 60' d = 3' tw = 84' s = 1% Concrete Channel b = 28' s = 0.4% d = 4' tw = 44'	63.4 355.7	3
3	3.4	16.5	Southwest of Pitcher Hills, East of 67th Ave	0.8	2000	Natural Wash	----	880	----	No-Action Area Low-Density Residential	----	----
3	3.4	17	67th Ave 1000' North of Mariposa Grande St	0.8	100	Dip Section	----	930	Flooding of 67th Ave	4-4' High by 10' Wide RCBs	234.8	3
4	4.1	18	One Mile North of Happy Valley Rd Between 67th and 51st Avenues	0.6	2500	Natural Wash	----	410	----	Unlined Trap Channel b = 37' d = 3' tw = 61' Concrete Channel b = 10' s = 0.5% d = 4' tw = 26	71.9 351.0	3
4	4.1	18.5	South of Cap, West of Stetson Hills Development	0.2	1500	Natural Wash	----	140	----	No-Action Area Low-Density Residential	----	----

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
4	4.1-4.7	19	1/2 Mile North of Happy Valley Rd Between 67th and 51st Avenues	1.0	3500	Natural Wash	----	580	----	Unlined Trap Channel b=60' d=3' tw=84' Concrete Channel b=17' s=0.4% d=4' tw=33'	147.8 605.9	3
4	4.1-4.7	20	Parallel to Happy Happy Valley Rd Between 67th and 51st Avenues	0.2	2000	None	----	100	Flooding of Happy Valley Rd	Unlined Trap Channel b=5' d=3' tw=29' Concrete Channel b=0' s=0.5% d=4' tw=16'	25.0 173.3	1
4	4.7	21	Parallel to Happy Valley Rd, South of Luden Mt.	0.07	1100	None	----	45	Flooding of Happy Valley Rd	Unlined Trap Channel b=0' d=3' tw=24' Concrete Channel b=0' s=0.5% d=4' tw=16'	9.8 95.3	1
4	4.1-4.7	22	Crossing at Happy Valley Rd Between 67th and 55th Avenues	1.3	100	None	----	710	Flooding of Happy Valley Rd	3-4' High by 10' Wide RCBs	176.2	1
4	4.1-4.7	23	South of Happy Valley Rd Between 67th and 55th Avenues	1.5	4500	Natural Wash	----	820	----	Unlined Trap Channel b=85' d=3' tw=105' Concrete Channel b=23' s=0.5% d=4' tw=39'	250.8 919.0	3
4	4.1-4.9	23.5	Southeast of Pilcher Hill	2.1	3300	Natural Wash	----	930	----	Rec Corridor Unlined Trap Channel b=90' d=3' tw=114'	----	3
5	5.1	24	North of Happy Valley Rd Parallel to 51st Ave, South of Biscut Flats	0.4	11500	None	----	350	Flooding of Proposed Development	Rec Corridor Unlined Trap Channel b=33' d=3' tw-57'	101.2	3
5	5.2	25	1500' North of Happy Valley Rd, East of 51st Ave	0.1	800	Masonry Wall	----	93	Currently Water Ponds Behind Wall	Rec Corridor Unlined Trap Channel b=4' d=3' tw=28'	3.1	2

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
5	5.3	26	Parallel to Happy Valley Rd, West of 51st Ave	0.3	1600	Dip Section	----	110	Flooding of Happy Valley Rd	Unlined Trap Channel b=4' d=3' tw=28' Concrete Channel d=8' tw=16' s=0.67%	18.9 138.4	1
5	5.1-5.3	27	Intersection of Happy Valley Rd and 51st Ave	0.8	100	None	----	440	Flooding of Happy Valley Rd	2-4' High by 10' Wide RCBs	117.6	1
5	5.1-5.41	28	South of Happy Valley Rd Parallel to 51st Ave	0.9	5300	V-Ditch	50	580	Flooding of 51st Ave and Surrounding Area	90" RCP or 2-72" RCPs	2015.5 2795.9	2
5	5.4	29	Parallel to Pinnacle Peak Rd, East of 55th Ave and West of 51st Ave	0.9	2500	V-Ditch	60	690	Flooding of Pinnacle Peak Rd	96" RCP or 2-54" RCPs	1088.3 864.3	1
5	5.1-5.41	30	Intersection of 51st Ave and Pinnacle Peak Rd	0.9	100	1-24" RCP	26	580	Flooding of Surrounding Area	4-4' High by 10' Wide RCBs	234.8	1
5	5.4	30	Intersection of 51st Ave and Pinnacle Peak Rd	0.9	100	1-24" RCP	26	690	Flooding of Surrounding Area			
5	5.5	31	South of Pinnacle Peak Rd, West of 51st Ave	0.3	2500	V-Ditch	30	280	Flooding of Pinnacle Peak Rd	Unlined Trap Channel b=25' d=3' tw=49' Concrete Channel b=6' s=0.5% d=4' tw=22'	54.3 218.4	1
6	6.1	32	North of Happy Valley Rd Along Existing Ranch House	0.5	1500	None	----	450	----	Rec Corridor Unlined Trap Channel b=42' d=3' tw=66'	19.8	2
6	6.2	33	North of Happy Valley Rd	0.5	2300	None	----	450	----	Rec Corridor Unlined Trap Channel b=42' d=3' tw=66'	30.4	3

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
6	6.5	34	Parallel to Happy Valley Rd, East of 49th Ave	0.6	2000	V-Ditch	10	160	Flooding of Happy Valley Rd	2-48" RCPs	374.5	1
6	6.1-6.5	35	Parallel to Happy Valley Rd, North of Upland Hills Development	1.1	1000	Unlined Trap Channel b=45' d=5' tw=100'	480	480	None	Adequate	----	----
6	6.3	36	North of Proposed 43rd Ave Loop to 39th Ave	0.4	1000	Natural Wash	----	310	----	Unlined Trap Channel b=28' d=3' tw=52' Concrete Channel b=7' d=4' tw=23' s=0.5%	29.3 124.4	3
6	6.3	36.5	North of Proposed 43rd Ave Loop to 39th Ave	0.4	2000	Natural Wash	310	310	----	No-Action Area Low-Density Residential	----	----
6	6.3	37	Crossing Under Proposed 43rd Ave Loop to 39th Ave	0.4	100	None	----	310	----	2-3' High by 8' Wide RCBs	70.5	3
6	6.3	38	Parallel to Happy Valley Rd, West of 39th Ave	0.1	700	None	----	100	Flooding of Happy Valley Rd	Unlined Trap Channel b=5' d=3' tw=29' Concrete Channel b=0' d=4' tw=16' s=0.5%	8.7 60.7	1
6	6.2-6.4	39	Parallel to Happy Valley Rd, North of Upland Hills Development	0.6	3000	Unlined Trap Channel b=45' d=5' tw=100'	400	400	None	Adequate	----	----
6	6.1-6.5	40	Under Happy Valley Rd at Upland Hills	1.7	100	4-5' High by 10' Wide RCBs	960	960	None	Adequate	----	----
6	6.1-6.6	41	Through Upland Hills Development	1.9	1000	Concrete Lined Trap Channel b=28' d=6' tw=40'	990	990	None	Adquate	----	----
6	6.1-6.6	42	South of Upland Hills Development	1.9	500	5-5' High by 10' Wide RCBs	990	990	None	Adequate	----	----

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Capacity (cfs) Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
6	6.1-6.6	43	South of Upland Hills Development	1.9		Existing Retention Basin	990	990	None	Adequate	----	----
6	6.1-6.51	44	Between Upland Hills and Pinnacle Peak Plains Subdivision	2.0	1400	None	----	1140	Flooding of Surrounding Area	Unlined Trap Channel b = 100' d = 3' tw = 124' s = 0.067% Concrete Channel b = 40' d = 4' tw = 56' s = 0.0035'	92.0 422.1	3
6	6.1-6.51	45	Through Pinnacle Peak Plains Subdivision	2.3	1500	None	1140	1140	None	Adequate	----	----
6	6.1-6.51	46	Through Pinnacle Peak Plains Subdivision	2.6		Retention Basin	----	----	None	Adequate	----	----
6	6.1-6.7	47	Crossing at Intersection of Pinnacle Peak Rd and 47th Ave	2.6	100	1-30" x 36" CMP Arch	----	1340	Flooding of Surrounding Area	5-4' High by 10' Wide RCBs	293.4	1
7	7.1	48	Crossing at 43rd Ave and Pinnacle Peak Rd	0.1	100	1-24" RCP	----	190	Flooding of Surrounding Area	1-4' x 6' RCB	35.2	1
7	7.1	48.4	South of Pinnacle Peak and West of Water Park	0.1	1000	V-Ditch	----	190	Flooding of Surrounding Area	Unlined Trap Channel b = 15' d = 3' tw = 39' Concrete Channel b = 3' d = 4' tw = 19' s = 0.57%	19.8 112.4	2 2
7	7.1	48.6	South of Pinnacle Peak and West of Water Park	0.1	50	1-30" x 36" CMP Arch	----	190	Flooding of Surrounding Area	3-36" RCPs	46.7	2
8	8.1	49	North of Happy Valley Rd, West of 35th Ave	0.5	2000	V-Ditch	----	275	Flooding of Happy Valley Rd	Unlined Trap Channel b = 22' d = 3' tw = 46' Concrete Channel b = 11' d = 4' tw = 27' s = 0.2%	68.1 292.2	1
8	8.1	49.5	North Of Happy Valley Rd, East of 35th Ave	0.5	1500	Natural Wash	280	280	----	No-Action Area Open Space	----	----

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Capacity (cfs) Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
8	8.1	50	North of Happy Valley Rd, East of 35th Ave	0.5	80	Dip Section	280	280	Flooding of Happy Valley Rd	2-3' High by 6' Wide RCBs	42.4	1
8	8.1	51	South of Happy Valley Rd, East of 35th Ave	0.5	1500	Unlined Trap Channel b = 11' d-3.5' tw = 35.5'	280	280	None	Adequate	----	----
8	8.1	52	South of Happy Valley Rd, East Parallel to 35th Ave	0.5	80	Unlined Trap Channel b = 13.5' d = 4' tw-46.5'	280	280	None	Adequate	----	----
8	8.1	55	Culvert Crossing 39th Ave	0.6	80	3-3.5' x 6' CMP Arches	300	300	None	Adequate	----	----
8	8.1	54	Culvert Crossing 39th Ave			Retention Basin	----	----	None	Adequate	----	----
8	8.1	55	Culvert Within Retention Basin West of 39th Ave	0.6	50	3-36" RCPs	300	300	None	Adequate	----	----
8	8.1	56				Retention Basin	----	----	None	Adequate	----	----
8	8.1-8.2	57	East of Upland Hills	0.7	100	5-36" x 42" CMP Arches	340	340	None	Adequate	----	----
8	8.1-8.2	58	Channel Between 39th and 43rd Avenues	0.9	1000	Unlined Trap Channel b-14' d = 10' tw = 44'	340	340	None	Adequate	----	----
8	8.1-8.2	59	Channel Between 39th and 43rd Avenues	0.9	200	Unlined Trap Channel b = 12' d = 5' tw = 42'	340	340	None	Adequate	----	----
8	8.1-8.2	60	Crossing Under Alameda, West of 39th Ave	0.9	80	2-4' x 6' RCBs	340	340	None	Adequate	----	----

Basin	Sub Basin	Facility Number	Location	Drainage Area (sq. mi.)	Length (feet)	Existing Facility	Capacity (cfs) Existing	Required 100-year	Associated Problems	Recommended Improvements	Improvement Cost (x $1000)	Priority
8	8.1-8.2	61	Channel South of Alameda	0.9	200	Unlined Trap Channel b = 12' d = 5' tw = 42'	430	430	None	Adequate	----	----
8	8.1-8.2	62	Parallel to 43rd Ave	0.9	2300	Unlined Trap Channel b = 9' d = 5.5' tw = 42'	430	430	None	Adequate	----	----
8	8.1-8.2	63	Crossing at Pinnacle Peak and 41st Ave	0.9	80	3-4.5' x 5.5' CMP Arches	430	430	None	Adequate	----	----
8	8.25	64	Parallel to 39th Ave	0.3	2300	Unlined Trap Channel b = 15' d = 18.2' tw = 39'	240	240	None	Adequate	----	----
8	8.25	65	Crossing 39th Ave North of Pinnacle Peak	0.3	80	3-48" x 54" CMP Arches	240	240	None	Adequate	----	----
8	8.25	66	Channel Between 39th and 41st Avenues Parallel to Pinnacle Peak	0.3	900	Unlined Trap Channel b = 18.2' d = 4.3' tw = 44'	470	470	None	Adequate	----	----
8	8.25	67	Culvert Crossing Pinnacle Peak	0.3	80	4-4' x 5' CMP Arches	470	470	None	Adequate	----	----
8	8.1-8.25	68	South of Pinnacle Peak Rd Within Adobedam Rec Park	1.2	1000	Unlined Trap Channel b = 19' d = 6' tw = 55'	870	870	None	Adequate	----	----

PRELIMINARY COST ESTIMATES

Introduction

The preliminary cost estimates used in this study were derived from the Arizona Department of Transportation's (ADOT) Construction Costs, 1985 (see Appendix F). Costs are broken out by basin in the Preliminary Cost Estimate Tables which begin on page XX. The costs are given as unit prices in terms of linear feet (LF) cubic yards (CY) and square yards (SY).

The preliminary cost estimates are based on anticipated construction costs including materials and installation. The estimates include 10 percent contingency for engineering of utilities and 20 percent contingency for engineering, administration and legal expenses.

Proposed underground facility improvements are assumed to be constructed within the right-of-way or easements. No additional cost is included for land easement acquisition in the preliminary cost estimates. Land needed for right-of-way easements along channels have been included in the cost estimates and values are listed as acreage. A right-of-way width of 10-feet was assumed.

It should be recognized that actual costs may vary from preliminary costs shown in this report. Possible reasons for variations include changes during final design, unforeseen field or soil conditions, variable costs of labor and materials, costs of traffic control, costs of street or curb and gutter cuts, costs of landscaping replacement and/or excess costs of utility relocation.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 4
Basin 1

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
1A	Unlined Trap Channel	2,410	CY	$5.00	$16,000
1A	Right-Of-Way	1.61	AC	----	----
1A	30" RCP	2,000	LF	$66.93	$176,700
1B	Excavation	1,335	CY	$5.00	$8,800
1B	Concrete Channel	2,981	SY	$30.00	$118,100
1B	Right-Of-Way	1.0	AC	----	----
1.3A	Unlined Trap Channel	1,112	CY	$5.00	$7,400
1.3A	Right-Of-Way	0.78	AC	----	----
1.3A	30" RCP	1,000	LF	$66.93	$88,400
1.3B	Excavation	463	CY	$5.00	$3,100
1.3B	Concrete Channel	1243	SY	$30.00	$49,200
1.3B	Right-Of-Way	0.46	AC	----	----
2	2-3'x10' RCBs	223	CY	$300.00	$88,300

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 4 (continued)
Basin 1

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
3A	Unlined Trap Channel	2,040	CY	$5.00	$13,500
3A	Right-Of-Way	1.42	AC	----	----
3A	30" RCP	2,000	LF	$66.93	$176,700
3B	Excavation	1,335	CY	$5.00	$8,800
3B	Concrete Channel	2,981	SY	$30.00	$118,100
3B	Right-Of-Way	1.0	AC	----	----
4	2-3'x10' RCBs	223	CY	$300.00	$88,300

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 5
Basin 2

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
4.5	2-24" RCPs	200	LF	$59.17	$31,300
6	3-36" RCPs	100	LF	$78.57	$31,200
7A	Unlined Trap Channel	8,560	CY	$5.00	$56,500
7A	Right-Of-Way	3.53	AC	----	----
7A	30" RCP	3,500	LF	$66,93	$309,200
7B	Excavation	4,670	CY	$5.00	$31,000
7B	Concrete Channel	7,350	SY	$30.00	$291,100
7B	Right-Of-Way	2.17	AC	----	----
7.5	2-36" RCPs	150	LF	$78.57	$31,200
8A	Unlined Trap Channel	16,000	CY	$4.00	$84,500
8A	30" RCP	2,000	LF	$66.93	$176,700
8A	Right-Of-Way	4.32	AC	----	----
8B	Excavation	7,410	CY	$5.00	$48,800

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 5 (continued)
Basin 2

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
8B	Concrete Channel	7,410	SY	$30.00	$307,200
8B	Right-Of-Way	7,755	AC	----	----
9	3-4'x10' RCBs	356	CY	$300.00	$140,800
11	3-4'x10' RCBs	356	CY	$300.00	$140,800

[1] Note: Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 6
Basin 3

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
12A	Unlined Trap Channel	10,000	CY	$5.00	$66,000
12A	Right-of-way	2.82	LF	----	----
12A	30" RCP	1,500	AC	$66.93	$132,500
12B	Excavation	4,670	CY	$5.00	$30,900
12B	Concrete Channel	5,150	SY	$30.00	$203,900
12B	Right-Of-Way	1.34	AC	----	----
12	3-foot Berm	2,670	CY	$10.00	$35,200
13A	Unlined Trap Channel	9,335	CY	$5.00	$61,600
13A	Right-Of-Way	2.94	AC	----	----
13A	30" RCP	2,000	LF	$66.93	$176,700
13B	Excavation	4,445	CY	$5.00	$29,300
13B	Concrete Channel	5,535	SY	$30.00	$219,000
13B	Right-Of-Way	1.52	AC	----	----

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 6 (continued)
Basin 3

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
14A	Unlined Trap Channel	116	CY	$5.00	$800
14A	Right-Of-Way	0.07	AC	----	----
14A	30" RCP	80	LF	$66.93	$7,100
14B	Excavation	73	CY	$5.00	$480
14B	Concrete Channel	140	SY	$30.00	$5,500
14B	Right-Of-Way	0.05	AC	----	----
15	3-4'x10' RCBs	445	CY	$300.00	$176,200
16A	Unlined Trap Channel	12,000	CY	$4.00	$63,400
16A	Right-Of-Way	3.81	AC	----	----
16A	30" RCP	1,500	LF	$66.93	$52,800
16B	Excavation	8,000	CY	$5.00	$302,900
16B	Concrete Channel	7,650	SY	$30.00	----
16B	Right-Of-Way	2.44	AC	----	$234,800

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 6 (continued)
Basin 3

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
17	4-4'x10' RCBs	593	CY	$300.00	$234,800

[1] Note: Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 7
Basin 4

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
18A	Unlined Trap Channel	13,610	CY	$4.00	$71,900
18A	Right-Of-Way	3.96	AC	----	----
18A	30" RCP	2,500	LF	$66.93	$220,900
18B	Excavation	6,670	CY	$5.00	$44,100
18B	Concrete Channel	7,750	SY	$30.00	$306,900
18B	Right-Of-Way	1.95	AC	----	----
19A	Unlined Trap Channel	28,000	CY	$4.00	$147,800
19A	Right-Of-Way	8.36	AC	----	----
19A	30" RCP	3,500	LF	$66.93	$309,200
19B	Excavation	12,970	CY	$4.00	$68,500
19B	Concrete Channel	13,570	SY	$30.00	$537,400
19B	Right-Of-Way	4.26	AC	----	----
20A	Unlined Trap Channel	3,780	CY	$5.00	$25,000

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 7 (continued)
Basin 4

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
20A	Right-Of-Way	1.79	AC	----	----
20A	30" RCP	2,000	LF	$66.93	$176,700
20B	Excavation	2,370	CY	$5.00	$15,000
20B	Concrete Channel	3,980	SY	$30.00	$157,600
20B	Right-Of-Way	1.19	AC	----	----
21A	Unlined Trap Channel	1,470	CY	$4.00	$9,800
21A	Right-Of-Way	0.86	AC	----	----
21A	30" RCP	1,100	LF	$5.00	$8,600
21B	Excavation	1,300	CY	$30.00	$86,700
21B	Concrete Channel	2,190	SY	----	----
21B	Right-Of-Way	0.65	AC	$300.00	$176,200
22	3-4'x10' RCBs	445	CY	$4.00	$250,800
23A	Unlined Trap Channel	47,500	CY	----	----

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 7 (continued)
Basin 4

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
23A	Right-Of-Way	12.95	AC	----	----
23A	30" RCP	4,500	LF	$66.93	$397,600
32B	Excavation	20,670	CY	$4.00	$109,200
23B	Concrete Channel	20,450	SY	$30.00	$809,800
23B	Right-Of-Way	6.13	AC	----	----

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 8
Basin 5

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
24	Rec Corridor	19,167	CY	$4.00	$101,200
24	Right-Of-Way	52.8	AC	----	----
24	30" RCP	11,500	LF	$66.93	$1,016,000
25	Rec Corridor	474	CY	$5.00	$3,100
25	Right-Of-Way	3.7	AC	----	----
25	30" RCP	800	LF	$66.93	$70,700
26A	Unlined Trap Channel	2,845	CY	$5.00	$18,900
26A	Right-of-way	1.40	AC	----	----
26A	30" RCP	1,600	LF	$66.93	$141,400
26B	Excavation	1,900	CY	$5.00	$12,500
26B	Concrete Channel	3,180	SY	$30.00	$125,900
26B	Right-Of-Way	0.96	AC	----	----
27	2-4'x10' RCBs	297	CY	$300.00	$117,600
28	1-90" RCP	5,300	LF	$288.09	$2,015,500

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 8 (continued)
Basin 5

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
28	2-72" RCPs	5,300	LF	$199.82	$2,795,900
29	1-96" RCP	2,500	LF	$329.80	$1,088,300
29	2-54" RCPs	2,500	LF	$130.95	$865,300
30	4-4'x10' RCBs	593	CY	$300.00	$234,800
31A	Unlined Trap Channel	10,280	CY	$4.00	$54,300
31A	Right-Of-Way	3.38	AC	----	----
31A	30" RCP	2,500	LF	$66.93	$220,900
31B	Excavation	5,190	CY	$5.00	$34,300
31B	Concrete Channel	4,650	SY	$30.00	$184,100
31B	Right-Of-Way	1.83	AC	----	----

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

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LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 9
Basin 6

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
32	Rec Corridor	3,000	CY	$5.00	$19,800
32	Right-Of-Way	6.9	AC	----	----
32	30" RCP	1,500	LF	$66.93	$132,500
33	Rec Corridor	4,600	CY	$5.00	$53,160
33	Right-Of-Way	10.6	AC	----	----
33	30" RCP	2,300	LF	$66.93	$203,200
34	2-48" RCPs	2,500	LF	$113.49	$374,500
36A	Unlined Trap Channel	4,445	CY	$5.00	$29,300
36A	Right-Of-Way	1.42	AC	----	----
36A	30" RCP	1,000	LF	$66.93	$88,400
36B	Excavation	2,225	CY	$5.00	$14,700
36B	Concrete Channel	2,770	SY	$30.00	$109,700
36B	Right-Of-Way	0.76	AC	----	----
37	2-3'x8' RCBs	178	CY	$300.00	$70,500

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 9 (continued)
Basin 6

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
38A	Unlined Trap channel	1,325	CY	$5.00	$8,700
38A	Right-Of-Way	0.79	AC	----	----
38A	30" RCP	700	LF	$66.93	$61,800
38A	Excavation	830	CY	$5.00	$5,500
38B	Concrete Channel	1,392	SY	$5.00	$55,200
38B	Right-Of-Way	0.58	AC	----	----
44A	Unlined Trap Channel	17,425	CY	$4.00	$92,000
44A	Right-Of-Way	4.63	AC	----	----
44A	30" RCP	1,400	LF	$66.93	$123,700
44B	Excavation	9,960	CY	$5.00	$65,700
44B	Concrete Channel	9,000	SY	$30.00	$356,400
44B	Right-Of-Way	1.93	AC	----	----
47	5-4'x10' RCBs	741	CY	$300.00	$293,400

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

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LITTLE DEER VALLEY CONCEPTUAL DRAINAGE PLAN
PRELIMINARY COST ESTIMATES

TABLE 10
Basin 7

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
48	1-4'x6' RCB	89	CY	$300.00	$35,200
48.4A	Unlined Trap Channel	3,000	CY	$5.00	$19,800
48.4A	Right-Of-Way	1.13	AC	----	----
48.4A	30" RCP	1,000	LF	$66.93	$88,400
48.4B	Excavation	3,100	CY	$5.00	$20,500
48.4B	Concrete Channel	2,320	SY	$30.00	$91,900
48.4B	Right-Of-Way	0.67	AC	----	----
48.6	9-36" RCPs	50	LF	$78.57	$46,700

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

CITY OF PHOENIX
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PRELIMINARY COST ESTIMATES

TABLE 11
Basin 8

Facility Number	Description	Estimated Quantity	Unit	Unit Cost	Facility[1] Cost
49A	Unlined Trap Channel	12,890	CY	$4.00	$68,100
49A	Right-Of-Way	2.57	AC	----	----
49A	30" RCP	2,000	LF	$66.93	$176,700
49B	Excavation	5,630	CY	$5.00	$37,200
49B	Concrete Channel	6,440	SY	$30.00	$255,000
49B	Right-Of-Way	1.70	AC	----	----
50	2-3'x6' RCBs	107	CY	$300.00	$42,400

[1] **Note:** Contingencies including both possible relocation of utilities (10%) and engineering, administration and legal expenses (20%) have been included in the cost of each facility.

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