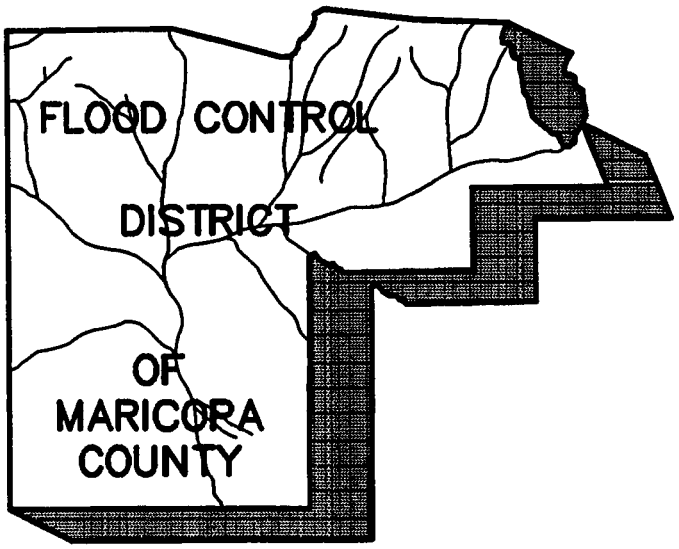
10TH STREET WASH WATERSHED

VOLUME 1.9

ARIZONA CANAL DIVERSION CHANNEL AREA DRAINAGE MASTER STUDY

ACDC/ADMS PHASE 1



HYDROLOGY REPORT

JUNE 1992

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10TH STREET WASH WATERSHED

Volume 1.9

Arizona Canal Diversion Channel
Area Drainage Master Study
ACDC/ADMS Phase I

HYDROLOGY REPORT

June 11, 1992

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10TH STREET WASH WATERSHED
HYDROLOGY REPORT

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1.0 SYNOPSIS

Kaminski-Hubbard Engineering, Inc. (KHE) was retained by the Flood Control District of Maricopa County (FCDMC) to prepare a comprehensive hydrologic analysis of the 10th Street Wash as part of the Arizona Canal Diversion Channel (ACDC) Area Drainage Master Study (ADMS), Phase I. The 10th Street Wash watershed is located in north central Phoenix on the eastern portion of an area commonly referred to a Sunnyslope (See Figure 1). This watershed has an approximate area of 2.8 square miles and is subject to relatively high rates of runoff because of the surrounding steep mountains.

Presently, the watershed is fully developed having 58 percent urbanized area with the remaining 42 percent predominantly located within the Phoenix Mountain Preserve. The watershed is comprised mostly of residential neighborhoods with commercial and industrial developments bordering Cave Creek Road. Residential neighborhoods are predominantly located along the 10th Street Wash channel, which flows southerly to Griswold Road, then proceeds westerly to the ACDC.

Currently, one major flood control structure is in place which collects runoff from a 0.52 square mile area and limits the 100-year flow through a 14-inch by 14-inch orifice plate covering a 30-inch principal spillway pipe. This structure, hereinafter called Detention Basin No. 3, was constructed in 1974 by the City of Phoenix. However, previous hydrologic studies by the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (COE) did not include the modelling of Detention Basin No. 3 (Ref. 4 & 10).

This report presents the hydrologic analysis developed for 10th Street Wash at its confluence with the ACDC. Table 1 summarizes the controlling peak discharges at specific locations along the 10th Street Wash Channel.

TABLE 1

Controlling Peak Discharge

Location	Drainage Area (Sq. Mi.)	6-Hr. 2-Yr. (CFS)	6-Hr. 10-Yr. (CFS)	24-Hr. 100-Yr. (CFS)
Detention Basin No. 3 Outflow	0.5	17	21	26
10th Street Wash Above Confluence w/Main Tributary	0.7	47	145	293
10th Street Wash Below Confluence w/Main Tributary	1.2	139	501	1014
Dunlap Avenue	1.8	246	948	1828
Alice Avenue	2.3	327	1280	2444
ACDC	2.8	390	1621	3069

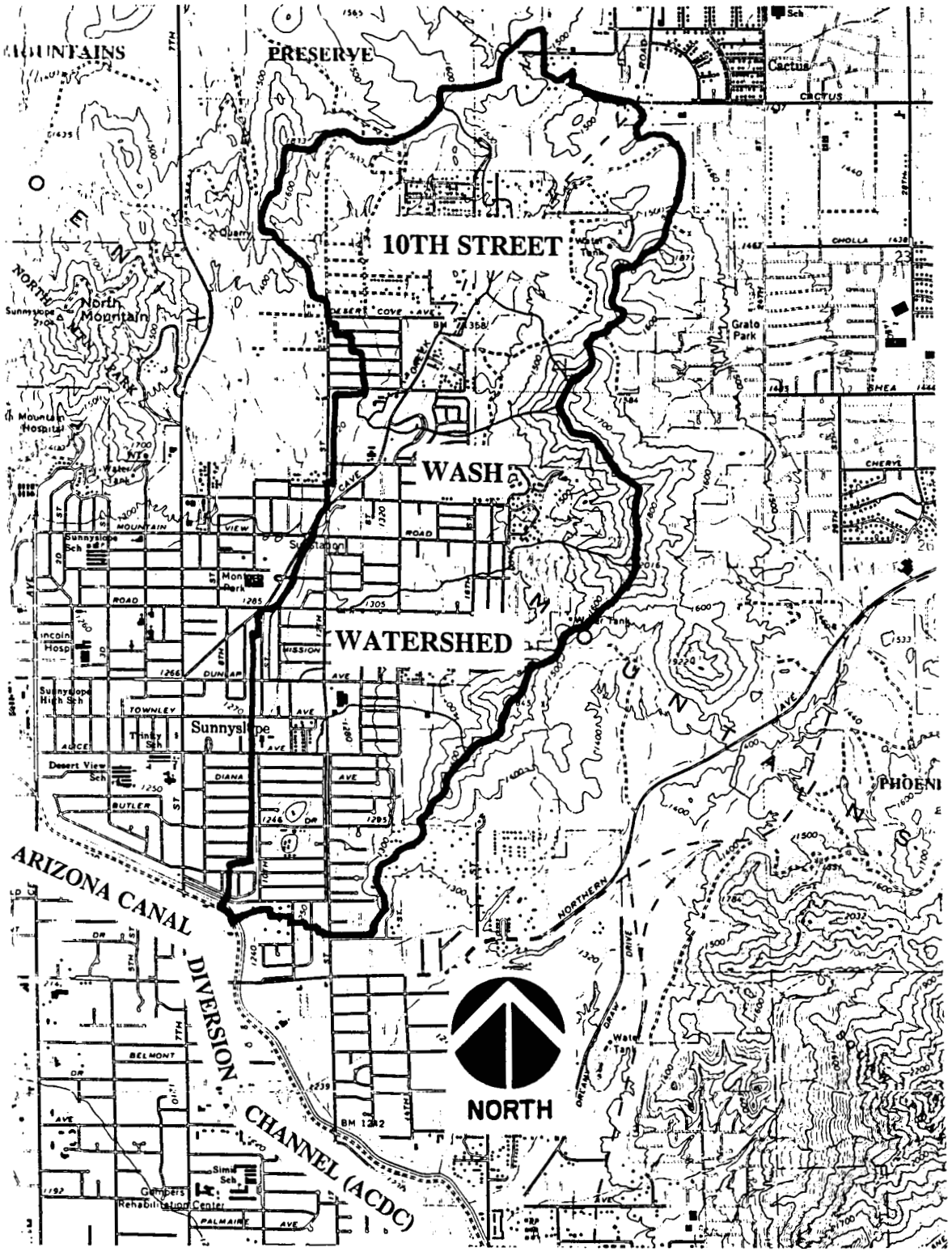

FIGURE 1 - VICINITY MAP

2.0 INTRODUCTION

A hydrologic analysis of the 10th Street Wash was prepared by Kaminski-Hubbard Engineering, Inc. (KHE) for the Flood Control District of Maricopa County (FCDMC) as part of the Arizona Canal Diversion Channel (ACDC) Area Drainage Master Study (ADMS), Phase I. Previous hydrologic investigations of the watershed were reviewed for historical, as well as, hydrological information which could be used in our analysis.

The purpose of this report is to present the revised hydrology for 10th Street Wash based on the FCDMC's new hydrologic design criteria, increased urbanization, and the modelling of Detention Basin No. 3. This report also presents the assumptions and methodology for the hydrologic analysis of 10th Street Wash.

3.0 STUDY PARAMETERS

3.1 Study Area

The 10th Street Wash watershed has an approximate drainage area of 2.8 square miles. The watershed is bounded to the west by the Sunnyslope Drainage Area (roughly 9th Street), to the north and east by the Phoenix Mountains, and to the south by Harmont Drive and Griswold Road. The watershed area is subject to relatively high rates of runoff due to the surrounding steep mountains and the high degree of development at the mountain base.

Presently, the watershed is fully developed with approximately 58 percent urbanized area. The remaining 42 percent is predominantly located within the Phoenix Mountain Preserve and probably will not be developed. The areas adjacent to the 10th Street Wash are comprised of commercial and industrial developments along the west bank and primarily residential developments along the east bank extending eastward to the base of the Phoenix Mountains.

The North Mountain Flood Detention Dam No. 3 is a significant drainage structure that control the contributing runoff from the northeastern portion of the watershed. The detention basin has a 14-inch by 14-inch orifice plate covering a 30-inch pipe for a low level outlet and a 100-foot wide emergency spillway. The outflow from Detention Basin No. 3 also coincides with the beginning of the 10th Street Wash.

The 10th Street Wash proceeds southwesterly from Detention Basin No. 3 along an alignment that parallels Cave Creek Road to Hatcher Road. The wash crosses under Cave Creek Road through 3 - 10'x3' CBC between Peoria Avenue and Cheryl Drive and through 2 - 15'x8' CBC at 12th Street. The wash crosses under Mountain View Road through 2 - 15'x8' CBC. The wash then proceeds southerly from Hatcher Road along an alignment that parallels 10th Street to Griswold Road. At Griswold Road, the wash makes an approximate 90 degree turn and proceeds westerly to the ACDC.

3.2 Mapping

The available mapping utilized in this study are as follows:

1. **FCDMC Mapping:** The 10th Street Wash watershed was flown as part of this study for the purpose of obtaining 1 inch = 400 foot contour and aerial mapping. The contour interval is 2 feet. These maps were flown in November, 1990. These maps were used to establish the sub-basin drainage delineations, flow patterns, and storage volume calculations for detention facilities. The aerial maps were also utilized to provide land use information.

2. **USGS Quadrangle Maps:** Sunnyslope, Arizona, 7.5 minute series. The horizontal scale is 1 inch = 2000 feet. The contour interval is 20 feet. These maps were photo revised in 1982.

3. **City of Phoenix Storm Drain Maps:** These maps are at a scale of 1 inch = 400 feet and provide a schematic location of storm drains and culverts in the area.

4. **City of Phoenix Zoning Maps:** These maps are at a scale of 1 inch = 400 feet and provide zoning designations and boundaries in the area.

5. **As-Built Plans:** As-built plans for drainage structures associated with Cave Creek Road and Detention Basin No. 3 were used for flow routing purposes.

6. **Field Reconnaissance:** Field investigations were undertaken to verify hydrologic information obtained from aerial and topographic mapping. Areas of new development or developments under construction and existing on-site retention areas were identified. All major drainage structures within the watershed were identified. The flow paths of all major mile and half-mile streets were identified. Some drainage patterns were documented for local streets.

3.3 Study Criteria

The following criteria and guidelines were set forth by the FCDMC prior to and during the drainage study:

1. Hydrology calculations will be completed for the 2-, 10-, and 100-year storms.

2. Storm durations of 6- and 24-hours will be evaluated for all three storms.

3. The U.S. Army Corps of Engineers (COE) HEC-1 computer program will be used for hydrograph computations.

4. Sub-basins will be limited to a maximum of five square miles in area;

5. The S-Graph Method will be utilized;

6. The Green-Ampt Loss Method will be utilized for estimation of precipitation losses.

7. The S-Graph basin lag equation as documented in the FCDMC's Drainage Design Manual (Ref. 6) will be utilized. The estimated mean Manning's "n" for all channels within a sub-basin will be determined using the U.S. Geological Survey Method (Ref. 16).

8. The Maricopa County Unit Hydrograph Procedure 2 (MCUHP2) computer program, as provided by the FCDMC, will be used to convert an S-Graph into a unit-graph and generate the necessary basin HEC-1 input file with the appropriate rainfall pattern distribution.

9. Rainfall distributions and depth-area relations for the 6-hour storm duration will be based on NOAA HYDRO-40 (Ref. 14) and COE (Ref. 9) data, as presented in the FCDMC's Drainage Design Manual (Ref. 6). This data is included in the MCUHP2 program to develop areal reduction for the watershed.

10. The SCS Type II rainfall distribution will be used for the 24-hour storm, with corresponding depth-area ratios based on NOAA HYDRO-40 (Ref. 14). This data is included in the MCUHP2 Program.

11. Stage-storage data for Detention Basin No. 3 was obtained from 1 inch to 400 feet topographic mapping. The reservoir storage routing method in HEC-1 will be used to determine a stage-discharge relationship.

12. Transmission losses will be estimated based on existing field data or literature. Existing field data or literature was not available to estimate infiltration losses. Based on the watershed topography and this study's detail for the watershed roughness coefficient (Manning's "n"), not including transmission losses has little impact on the flow peaks and volumes.

4.0 HYDROLOGY

4.1 General

The hydrology for the 10th Street Wash watershed was analyzed for the 2-, 10-, and 100- year storms. The 6- and 24-hour storm durations were evaluated for all three storms. The 10th Street Wash watershed was modeled using the COE HEC-1 computer program. The May 1991 version of HEC-1 was used for this study. The S-graph method was used to represent runoff characteristics for the watershed and converted to a Unit-graph using the FCDMC's MCUHP2 program for input into the HEC-1 computer model. The HEC-1 modeling also included allowances for Green-Ampt infiltration losses, Muskingum-Cunge channel routing, storage routing, and combining and diversion of sub-basin hydrographs. This section describes the assumptions and methodologies used to develop the HEC-1 computer model for the 10th Street Wash watershed.

4.2 Parameter Estimation

4.2.1 Drainage Area Boundaries

The watershed area was delineated into six sub-basins using 1 inch to 400 feet topographic and aerial mapping. Particular attention was given to existing drainage structures and their conveyance effects within the watershed. In-house drainage delineation was also supplemented by as-built drawings of major collector streets and drainage structures.

The initial delineation was then verified or revised based on field investigations. This field investigation included driving major mile and half-mile streets to distinguish flow patterns and possible flow split locations. These flow patterns were recorded and later referred to in determining lag times for each sub-basin. The field investigations also included the determination of on-site retention locations within the watershed. Observations were also made to determine non-contributing areas within the watershed that occur during the 2-year storm analysis.

The sub-basins were delineated such that concentration points were provided at major streets, detention basins, and stream confluences. The major concentration points are located at the North Mountain Detention Basin No. 3, at the confluence of 10th Street Wash and a unnamed main tributary wash located southwest of the Peoria Avenue - Cave Creek Road intersection, at Dunlap Avenue west of 12th Street, at Alice Avenue, and at the ACDC.

4.2.2 Rainfall Parameters

Rainfall Distributions

The rainfall distribution used for the 6-hour storm duration are as documented in the FCDMC's Drainage Design Manual (Ref. 6) and contained in the MCUHP2 Program. The SCS Type II distribution was used for the 24-hour storm. The rainfall distributions are presented in Tables 6 and 7 in Section I of the Appendix.

Precipitation Data

The point precipitation values used in this analysis were obtained from isopluvial maps for Maricopa County as published in the FCDMC's Drainage Design Manual (Ref. 6). The point precipitation values are presented in Table 4 in Section I of the Appendix.

Areal Reduction Factors

The point precipitation values used for this study were adjusted to account for the reduction in precipitation depth over a very large area. Reduction factors for the 6-hour duration storms were obtained from the FCDMC's Drainage Design Manual (Ref. 6). This information was also included in the FCDMC's MCUHP2 Program. The 24-hour storm reduction factors were obtained from the NOAA Technical Memorandum NWS HYDRO-40 (Ref. 14). These factors are presented in Table 5 in Section I of the Appendix.

4.2.3 Physical Parameters

Loss Rate Estimation

The Green-Ampt loss rate method in HEC-1 was used to estimate rainfall losses. This method involves a two phase process in simulating rainfall losses. The first phase involves no infiltration of rainfall until the accumulated rainfall equals the initial loss (IA). Recommended IA values are presented in Table 4.1 in the Drainage Design Manual (Ref. 6).

The second phase is the infiltration of rainfall into the soil immediately after IA is completely satisfied. The three Green-Ampt infiltration parameters as coded in HEC-1 are: hydraulic conductivity at natural saturation (XKSAT); wetting front capillary suction (PSIF); and volummetric soil moisture deficit at the start of rainfall (DTHETA).

The Green-Ampt parameters were determined using a spreadsheet provided by the FCDMC, Watershed Management Branch. The XKSAT values were determined by the FCDMC for all map units contained in the SCS Soil Surveys (Ref. 11 & 12) using log averaging of major and minor soil XKSAT values. These map units along with their corresponding XKSAT and percent rock outcrop values are presented in lookup tables within the Green-Ampt Spreadsheet.

The area of each soil unit within each sub-basin was determined and used as input into the Green-Ampt Loss Parameter spreadsheet. These area calculations were determined using ARC INFO GIS. The spreadsheet subsequently computed average sub-basin XKSAT values using log averaging methods. Next, values for PSIF and each DTHETA condition (i.e. dry, normal, wet) were interpolated using the computed XKSAT. These tables were contained within the spreadsheet and were similar to Table 4.2 (Ref. 6).

The Green-Ampt parameters computed above were based strictly on soil characteristics and adjustments were necessary to account for vegetative cover and land use. These guidelines are presented in the FCDMC's Drainage Design Manual (Ref. 6) and are incorporated in the Green-Ampt Loss Parameter Spreadsheet. The area of each land use within each sub-basin was also determined and used as input into the spreadsheet. Again, these area calculations were performed using ARC INFO GIS.

The "percent impervious" for each sub-basin was computed as a function of both natural rock outcrop and land use. The percentage of impervious rock outcrop within each sub-basin was estimated from soil unit data provided in the SCS Soil Surveys (Ref. 11 & 12). A factor of 0.6 was used to convert the "percentage of rock outcrops" to the "percent impervious" for each sub-basin.

Next, the impervious areas associated with various land use categories were determined for each sub-basin. The City of Phoenix zoning designations were classified into land use categories based on aerial mapping are presented in Table 9 in Section II of the Appendix.

The total "percent impervious" value for each sub-basin was computed as a summation of the above two "percent impervious" values. The computation was also incorporated into the Green-Ampt Loss Parameter spreadsheet. The average Green-Ampt parameters for each sub-basin are presented in Table 8 in Section II of the Appendix.

Estimation Of Lag Time

The S-Graph Method requires the estimation of the basin lag parameter. The following empirical equation was used to compute basin lag as a function of watershed characteristics (Ref. 6 & 7):

$$Lag = 24K_n\left(\frac{LL_{ca}^{0.38}}{S^{0.5}}\right)$$

where

Lag	=	basin lag, in hours.
L	=	length of the longest watercourse, in miles.
L_{ca}	=	length along the watercourse to a point opposite the basin centroid, in miles.
S	=	watercourse slope, in feet/mile.
K_n	=	estimated mean Manning's roughness coefficient for all channels within a basin

The length of the longest watercourse within each sub-basin and its corresponding slope were determined using 1 inch to 400 feet topographic mapping and from street flow patterns observed from field investigations. The centroid of each sub-basin was determined using ARC INFO GIS and located along the watercourse to determine L_{ca}.

A major disadvantage of the Lag equation is that the roughness coefficient must be selected which is very subjective and introduces significant uncertainty into the lag prediction. Also, the roughness coefficient is not necessarily a constant for each sub-basin for all rainfall depths and requires some adjustment to account for the different storm frequencies. Therefore, Manning's roughness coefficients were estimated for each sub-basin using the guidelines established in Reference 16.

Five categories were developed to reflect the diversity in sub-basin runoff characteristics. These categories are mountain area, hillslope area, valley area, urbanized hillslope area, and urbanized valley area. Manning roughness coefficients were computed for the 2-, 10-, and 100-year storm frequency for each category and are presented in Section III of the Appendix. Based on land use information, a representative roughness coefficient was computed for each sub-basin using linear area averaging. The hydrologic sub-basin characteristics are presented in Tables 10, 11, and 12 in Section III of the Appendix.

4.2.4 Routing Parameters

Channel Routing

For this study, the Muskingum-Cunge method was used to route a hydrograph through a downstream sub-basin. Channel cross-section information, slopes, and Manning's roughness coefficients were estimated using topographic mapping and observations made during the field investigation. Channel routing flow paths are presented in Plate 4 and channel routing work sheets are presented in Section IV of the Appendix.

Existing field data or literature was not available to estimate infiltration losses. Based on the watershed topography and this study's detail for the watershed roughness coefficient (Manning's "n"), not including transmission losses has little impact on the flow peaks and volumes.

Reservoir Routing

The upstream watershed hydrograph contributing to Detention Basin No. 3 was routed using the Modified Puls method. New storage volume calculations for Detention Basin No. 3 were determined from 1 inch to 400 feet topographic mapping. Field surveys were made to determine pipe culvert sizes and inverts, including spot elevations for overflow spillway calculations. The volume calculations are presented in Section IV of the Appendix.

4.3 Special Considerations

Storm Drain Pipes

The only storm drain pipe systems within the watershed were found along Cave Creek Road. The storm drain pipes were predominantly less than 48-inches in diameter and did not divert flows out of the watershed area or from one-sub-basin to another. Therefore, all storm drains were ignored in the HEC-1 model.

On-Site Retention

The City of Phoenix requires that all new developments retain the 100-year 2-hour duration storm volume that falls on-site. Field investigations within the watershed found that a majority of lots had no on-site retention or minimal retention at best. A few commercial and industrial sites constructed in the last few years had complied with the on-site retention requirements. However, there was no detailed mapping available to accurately determine the retention volume for a given site, much less whether they were 10- or 100-year volumes. Therefore, as a conservative approach, the retention volume for the parcels in questions were assumed to retain the 10-year 2-hour storm volume. The total estimated retention volume for each sub-basin was subtracted from the bottom of the hydrograph by diverting the estimated volume. These computations are presented in Section V of the Appendix.

Particular attention was placed on determining the non-contributing areas associated with a 2-year storm. Those areas that required on-site volume computations were automatically labeled as non-contributing. Next, impervious area associated with land use were assumed to contribute 100% of their areas. The remaining pervious areas were assumed to be non-contributing. These computations are presented in Section V of the Appendix.

TABLE 2

SUMMARY OF SUB-BASIN PEAK DISCHARGES

Sub-Basin I.D.	2-Year		10-Year		100-Year	
	6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.
140	57	50	184	172	496	551
141	38	36	145	139	263	281
142	92	85	362	337	671	720
143	126	117	484	450	841	890
144	84	75	341	310	615	645
145	99	95	457	436	786	844

TABLE 3

COMPARISON OF 100-YEAR PEAK DISCHARGES FOR 10TH STREET WASH W/PREVIOUS STUDIES

Location	Existing Condition					
	COE-1982* (Ref. No. 10)		FEMA-1989* (Ref. No. 4)		KHE-1992	
	DA (SQ. MI.)	Q (CFS)	DA (SQ. MI.)	Q (CFS)	DA (SQ. MI.)	Q (CFS)
10th Street Wash Above Confluence w/ACDC	2.74	3900	2.69	4740	2.84	3069

* **Does not include modelling of Detention Basin No. 3**

5.0 RESULTS AND CONCLUSIONS

The HEC-1 computer model was used to compute the 2-, 10-, and 100-year peak discharges for the 10th Street Wash above its confluence with the ACDC. The existing condition model reflects a fully developed watershed and therefore negates the need for developing a future condition model. This hydrologic analysis has been a synthesis of new topographic mapping observations, completed drainage improvements and increased urbanization. The results of sub-basin peak discharges for the above storm frequencies are presented in Table 2 for both the 6-hour and 24-hour events.

The hydrologic analysis has computed a peak discharge of 390 CFS, 1621 CFS, and 3069 CFS for the 2-, 10-, and 100-year runoff event, respectively, at the 10th Street Wash and ACDC confluence. The total contributing drainage area for the 10th Street Wash watershed is 2.84 square miles. These computed flows vary from previous hydrologic studies and will be discussed below.

A hydrologic analysis of the 10th Street Wash watershed was prepared for the City of Phoenix in 1965 to determine the 10-, 25-, and 50-year peak discharges (Ref. 17). A 10-year peak discharge of 1785 CFS was developed from a 3.21 square mile drainage area. The drainage area is larger because a tributary wash having an approximate confluence at the Mountain View Road - Cave Creek Road intersection and extending northwesterly to the Phoenix Mountains was included as contributing to the 10th Street Wash. Due to the urbanization and street improvements to Cave Creek Road, this tributary wash was directed westward to 7th Street and out of the 10th Street Wash watershed.

A comparison of previous hydrology results with the results of this study are presented in Table 3. The study's use of more refined topographic mapping, the FCDMC's Drainage Design Manual (Ref. 6), and the modelling of Detention Basin No. 3 were all factors in arriving at lower peak discharges for the 10th Street Wash watershed. Detention Basin No. 3 was found to collect runoff from a 0.52 square mile area and limit the 100-year flow through a 14-inch by 14-inch orifice plate covering a 30-inch principal spillway pipe to 26 CFS.

6.0 REFERENCES

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APPENDIX

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SECTION I

Rainfall Hydrologic Parameters

TABLE 4

Point Precipitation Values For Tenth Street Wash Study Area (Inches)

Return Period (Years)	Storm Duration	
	6-Hr.	24-Hr.
2	1.20	1.40
10	2.00	2.30
100	3.00	3.80

Source: NOAA Atlas Isopluvial Maps For Arizona

TABLE 5

Areal Precipitation Reduction Data

Watershed Area (Sq. Mi.)	Storm Duration	
	6-Hr[1]	24-Hr[2]
0	1.00	1.00
1	0.99	---
3	---	0.98
5	0.96	---
10	0.94	0.96
20	0.91	0.92
30	0.89	0.90

[1] Drainage Design Manual For Maricopa County, (Ref. 6)
[2] NOAA Technical Memorandum NWS HYDRO-40, (Ref. 14)

TABLE 6

6-HOUR STORM RAINFALL DISTRIBUTIONS
(Furnished by FCDMC's Maricopa County Unit Hydrograph Procedure 2)
Cumulative Rainfall Table

Storm Time (Hours)	Watershed Area (Sq. Mi.)				
	≤ 0.5	2.8	16	90	500
0.00	0.000	0.000	0.000	0.000	0.000
0.25	0.008	0.009	0.015	0.021	0.024
0.50	0.016	0.016	0.020	0.035	0.043
0.75	0.025	0.025	0.030	0.051	0.059
1.00	0.033	0.034	0.048	0.071	0.078
1.25	0.041	0.042	0.063	0.087	0.098
1.50	0.050	0.051	0.076	0.105	0.119
1.75	0.058	0.059	0.090	0.125	0.141
2.00	0.066	0.067	0.105	0.143	0.162
2.25	0.074	0.076	0.119	0.160	0.186
2.50	0.087	0.087	0.135	0.179	0.212
2.75	0.099	0.100	0.152	0.201	0.239
3.00	0.118	0.120	0.175	0.232	0.271
3.25	0.138	0.163	0.222	0.281	0.321
3.50	0.216	0.252	0.304	0.364	0.408
3.75	0.377	0.451	0.472	0.500	0.515
4.00	0.834	0.694	0.670	0.658	0.627
4.25	0.911	0.837	0.796	0.773	0.735
4.50	0.931	0.900	0.868	0.841	0.814
4.75	0.950	0.938	0.912	0.888	0.864
5.00	0.962	0.950	0.946	0.927	0.907
5.25	0.972	0.963	0.960	0.945	0.930
5.50	0.983	0.975	0.973	0.964	0.954
5.75	0.991	0.988	0.987	0.982	0.977
6.00	1.000	1.000	1.000	1.000	1.000

TABLE 7

24-HOUR STORM RAINFALL DISTRIBUTION
(Standard SCS 24-Hour, Type II Distribution
Cumulative Rainfall Table)

Storm Time (Hours)	Precipitation Ratio
0.0	0.000
0.5	0.005
1.0	0.011
1.5	0.016
2.0	0.022
2.5	0.028
3.0	0.035
3.5	0.041
4.0	0.048
4.5	0.056
5.0	0.063
5.5	0.071
6.0	0.080
6.5	0.089
7.0	0.098
7.5	0.109
8.0	0.120
8.5	0.133
9.0	0.147
9.5	0.163
10.0	0.181
10.5	0.204
11.0	0.235
11.5	0.283
12.0	0.663

Storm Time (Hours)	Precipitation Ratio
12.5	0.735
13.0	0.772
13.5	0.799
14.0	0.820
14.5	0.838
15.0	0.854
15.5	0.868
16.0	0.880
16.5	0.891
17.0	0.902
17.5	0.912
18.0	0.921
18.5	0.929
19.0	0.937
19.5	0.945
20.0	0.952
20.5	0.959
21.0	0.965
21.5	0.972
22.0	0.978
22.5	0.984
23.0	0.989
23.5	0.995
24.0	1.000

SECTION II

Green-Ampt & Land Use Parameters

TABLE 8

AVERAGE GREEN-AMPT PARAMETERS BY SUB-BASIN

Sub-Basin	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)
140	0.145	0.339	4.25	0.488	20.44
141	0.126	0.303	3.61	0.313	38.57
142	0.127	0.309	4.12	0.267	34.03
143	0.115	0.279	4.12	0.269	49.66
144	0.118	0.280	3.61	0.320	43.17
145	0.105	0.265	5.67	0.210	44.60

TABLE 9

Percent Impervious Estimates For Zoning/Land Use Classifications

Zoning Unit	Zoning Description	Land Use Description	Land Use Unit	Percent Impervious
S-1 S-2 RE-43	Ranch or Farm Res. Ranch Or Farm Commercial Single Family, 1 acre min.	Very Low Density Residential	V.L.D.R. or VLO Res	15
RE-35 RE-24 R1-18 R1-14	Single Family, 35000 S.F. min. Single Family, 24000 S.F. min Single Family, 18000 S.F. min Single Family, 14000 S.F. min.	Low Density Residential	L.D.R. or LO RES	25
RI-10 RI-8 RI-6 R-0	Single Family, 10000 S.F. min. Single Family, 8000 S.F. min Single Family, 6000 S.F. min Residential Office	Medium Density Residential	M.D.R. or MED RES	45
R-2 R-3 R-3A R-4 R-4A R-5 CP/BP R-H	Multi-Family, 4000 S.F. per unit Multi-Family, 3000 S.F. per unit Multi Family Multi-Family, 1500 S.F. per unit Multi-Family, 1000 S.F. per unit Multi-Family, 1000 S.F. per unit Business Park Resort District	Multiple Family Residential	M.F.R. or. MF RES	65
C-1 C-2 C-3 C-O H-R CP/GCP	Neighborhood Commercial Intermediate Commercial General Commercial Commercial Office/Restricted Comm. High Rise District General Commerce Park	Commercial	COMM or COMM.	90
IND PARK A-1 A-2	Industrial Park Light Industrial Heavy Industrial	Industrial	IND or INDUST.	75
PAD	Planned Area Development	Variable	---	Variable
PSC	Planned Shopping Center	Planned Shopping Center	PSC or PLND.SHP	85
P-1	Parking (Open)	Parking	PARKING	Variable
P-2	Parking (Structure)	Parking	PARKING	85
MISCELLANEOUS CATEGORIES: Evaluated On A Case By Case Basis				
		Desert Cover	DESERT	0
		Undeveloped Parcel	VACANT or OPEN	0
		Golf Course	GC	0
		Park	PARK	0
		School	SCHOOL	Variable
		Airport	AIRPORT	Variable

LOSS PARAMETERS FOR SUBBASIN: 140

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
109	0.291	56.36	0.35	-0.257	35.00	19.73
68	0.168	32.56	0.63	-0.065	0.00	0.00
18	0.031	6.01	0.33	-0.029	15.00	0.90
21	0.018	3.53	0.38	-0.015	0.00	0.00
TrB	0.008	1.48	0.13	-0.013	0.00	0.00
RS	0.000	0.06	0.4	-0.000	65.00	0.04

TOTAL = 0.516 SQ.MI. XKSAT = 0.42 %ROCK= 20.67

DTHETA

Dry = 0.35
Normal = 0.25
Wet = 0

PSIF

= 4.25

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.459	DESERT	89.02	DRY	25.00	0.00	0.00	0.15	0.134
0.017	M.D.R.	3.29	NORMAL	25.00	45.00	0.01	0.10	0.003
0.007	M.F.R.	1.44	NORMAL	25.00	65.00	0.00	0.10	0.001
0.032	COMM	6.25	NORMAL	20.00	90.00	0.03	0.10	0.006
0.516	=TOTAL AREA	OK	AVERAGE =	24.69	TOTAL =	0.04	AVG. =	0.145
					% =	8.04		

PERCENT OF SUBBASIN DRY = 89.02 %
NORMAL = 10.98 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.339

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.488

IMPERVIOUS AREA: URBAN @ 100 % effective = 8.04
ROCK OUTCROP @ 60 % effective = 12.40

% EFFECTIVE IMP. = 20.44

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Lca miles	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
140	0.516	1.220	0.510	162.00	0.145	0.339	4.25	0.488	20.44

LOSS PARAMETERS FOR SUBBASIN: 141

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.072	38.62	0.13	-0.342	0.00	0.00
68	0.042	22.61	0.63	-0.045	0.00	0.00
18	0.039	20.65	0.33	-0.099	15.00	3.10
109	0.034	18.12	0.35	-0.083	35.00	6.34

TOTAL = 0.187 SQ.MI. XKSAT = 0.27 %ROCK= 9.44

DTHETA

Dry = 0.35
Normal = 0.25
Wet = 0

PSIF

= 3.61

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.099	DESERT	52.96	DRY	25.00	0.00	0.00	0.15	0.079
0.006	M.D.R.	3.16	NORMAL	25.00	45.00	0.00	0.10	0.003
0.060	M.F.R.	32.04	NORMAL	25.00	65.00	0.04	0.10	0.032
0.022	COMM	11.84	NORMAL	20.00	90.00	0.02	0.10	0.012
0.187	=TOTAL AREA	OK	AVERAGE =	24.41	TOTAL = % =	0.06 32.90	AVG. =	0.126

PERCENT OF SUBBASIN
DRY = 52.96 %
NORMAL = 47.04 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.303

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.313

IMPERVIOUS AREA:
URBAN @ 100 % effective = 32.90
ROCK OUTCROP @ 60 % effective = 5.66
% EFFECTIVE IMP. = 38.57

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Lca miles	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
141	0.187	0.830	0.570	315.00	0.126	0.303	3.61	0.313	38.57

LOSS PARAMETERS FOR SUBBASIN: 142

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
18	0.225	43.95	0.33	-0.212	15.00	6.59
TrB	0.214	41.87	0.13	-0.371	0.00	0.00
RS	0.037	7.23	0.4	-0.029	65.00	4.70
109	0.022	4.24	0.35	-0.019	35.00	1.48
CO	0.010	1.96	0.29	-0.011	20.00	0.39
68	0.004	0.75	0.63	-0.002	0.00	0.00

TOTAL = 0.512 SQ.MI. XKSAT = 0.23 %ROCK= 13.17

DTHETA

Dry = 0.36
Normal = 0.25
Wet = 0

PSIF

= 4.12

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.275	DESERT	53.73	DRY	25.00	0.00	0.00	0.15	0.081
0.165	M.D.R.	32.29	NORMAL	25.00	45.00	0.07	0.10	0.032
0.020	M.F.R.	3.92	NORMAL	25.00	65.00	0.01	0.10	0.004
0.052	COMM	10.06	NORMAL	20.00	90.00	0.05	0.10	0.010
0.512	=TOTAL AREA	OK	AVERAGE =	24.50	TOTAL =	0.13	AVG. =	0.127
					% =	26.13		

PERCENT OF SUBBASIN DRY = 53.73 %
NORMAL = 46.27 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.309

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.267

IMPERVIOUS AREA: URBAN @ 100 % effective = 26.13
ROCK OUTCROP @ 60 % effective = 7.90
% EFFECTIVE IMP. = 34.03

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Lca miles	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
142	0.512	1.160	0.750	257.00	0.127	0.309	4.12	0.267	34.03

‡0‡‡0

LOSS PARAMETERS FOR SUBBASIN: 143

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.283	46.81	0.13	-0.415	0.00	0.00
109	0.149	24.69	0.35	-0.113	35.00	8.64
AdA	0.072	11.86	0.4	-0.047	0.00	0.00
18	0.050	8.22	0.33	-0.040	15.00	1.23
68	0.046	7.55	0.63	-0.015	0.00	0.00
CO	0.004	0.65	0.29	-0.003	20.00	0.13
CrB	0.001	0.22	0.4	-0.001	0.00	0.00

TOTAL = 0.604 SQ.MI. XKSAT = 0.23 %ROCK= 10.00

DTHETA

Dry = 0.36
Normal = 0.25
Wet = 0

PSIF

= 4.12

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.158	DESERT	26.23	DRY	25.00	0.00	0.00	0.15	0.039
0.158	M.D.R.	26.19	NORMAL	25.00	45.00	0.07	0.10	0.026
0.234	M.F.R.	38.77	NORMAL	25.00	65.00	0.15	0.10	0.039
0.045	COMM	7.41	NORMAL	20.00	90.00	0.04	0.10	0.007
0.008	PARK	1.40	NORMAL	90.00	0.00	0.00	0.20	0.003

0.604 =TOTAL AREA OK AVERAGE = 25.54 TOTAL = 0.26 AVG. = 0.115
% = 43.66

PERCENT OF SUBBASIN DRY = 26.23 %
NORMAL = 73.77 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.279

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.269

IMPERVIOUS AREA: URBAN @ 100 % effective = 43.66
ROCK OUTCROP @ 60 % effective = 6.00
% EFFECTIVE IMP. = 49.66

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Lca miles	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
143	0.604	1.640	0.880	273.00	0.115	0.279	4.12	0.269	49.66

LOSS PARAMETERS FOR SUBBASIN: 144

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.147	31.04	0.13	-0.275	0.00	0.00
109	0.116	24.50	0.35	-0.112	35.00	8.57
18	0.079	16.65	0.33	-0.080	15.00	2.50
AdA	0.074	15.57	0.4	-0.062	0.00	0.00
RS	0.034	7.22	0.4	-0.029	65.00	4.69
68	0.024	5.02	0.63	-0.010	0.00	0.00

TOTAL = 0.475 SQ.MI. XKSAT = 0.27 %ROCK= 15.77

DTHETA		PSIF	
Dry =	0.35	=	3.61
Normal =	0.25		
Wet =	0		

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.141	DESERT	29.70	DRY	25.00	0.00	0.00	0.15	0.045
0.255	M.D.R.	53.75	NORMAL	25.00	45.00	0.11	0.10	0.054
0.048	M.F.R.	10.16	NORMAL	25.00	65.00	0.03	0.10	0.010
0.004	CHURCH	0.82	NORMAL	20.00	90.00	0.00	0.10	0.001
0.011	COMM	2.42	NORMAL	20.00	90.00	0.01	0.10	0.002
0.015	PARK	3.15	NORMAL	90.00	0.00	0.00	0.20	0.006
0.475	=TOTAL AREA	OK	AVERAGE =	26.89	TOTAL =	0.16	AVG. =	0.118
					% =	33.71		

PERCENT OF SUBBASIN DRY = 29.70 %
NORMAL = 70.30 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.280

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.320

IMPERVIOUS AREA: URBAN @ 100 % effective = 33.71
ROCK OUTCROP @ 60 % effective = 9.46
% EFFECTIVE IMP. = 43.17

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Lca miles	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
144	0.475	1.800	1.110	291.00	0.118	0.280	3.61	0.320	43.17

LOSS PARAMETERS FOR SUBBASIN: 145

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.381	69.45	0.13	-0.615	0.00	0.00
AdA	0.071	13.02	0.4	-0.052	0.00	0.00
18	0.042	7.75	0.33	-0.037	15.00	1.16
RS	0.033	5.96	0.4	-0.024	65.00	3.88
CO	0.021	3.82	0.29	-0.021	20.00	0.76

TOTAL = 0.548 SQ.MI. XKSAT = 0.18 %ROCK= 5.80

DTHETA		PSIF	
Dry =	0.39	=	5.67
Normal =	0.25		
Wet =	0		

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.059	DESERT	10.71	DRY	25.00	0.00	0.00	0.15	0.016
0.466	M.D.R.	84.95	NORMAL	25.00	45.00	0.21	0.10	0.085
0.022	M.F.R.	4.07	NORMAL	25.00	65.00	0.01	0.10	0.004
0.001	CHURCH	0.27	NORMAL	20.00	90.00	0.00	0.10	0.000
0.548	=TOTAL AREA	OK	AVERAGE =	24.99	TOTAL =	0.23	AVG. =	0.105
					% =	41.12		

PERCENT OF SUBBASIN DRY = 10.71 %
NORMAL = 89.29 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.265

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.210

IMPERVIOUS AREA: URBAN @ 100 % effective = 41.12
ROCK OUTCROP @ 60 % effective = 3.48
% EFFECTIVE IMP. = 44.60

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Lca miles	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
145	0.548	1.370	0.860	242.00	0.105	0.265	5.67	0.210	44.60

SECTION III

Hydrologic Sub-Basin Characteristics

TABLE 10

HYDROLOGIC SUB-BASIN CHARACTERISTICS
2-YEAR STORM

Sub-Basin	Area (Sq. Mile)	Length (Miles)	Lca (Miles)	Slope (Ft./Mile)	Kn	Lag (Hours)
140	0.478	1.22	0.51	162	0.064	0.488
141	0.132	0.83	0.57	315	0.052	0.315
142	1.367	1.16	0.75	257	0.053	0.420
143	0.364	1.64	0.88	273	0.044	0.418
144	0.292	1.80	1.11	291	0.045	0.478
145	0.284	1.37	0.86	242	0.039	0.351

TABLE 11

HYDROLOGIC SUB-BASIN CHARACTERISTICS
10-YEAR STORM

Sub-Basin	Area (Sq. Mi.)	Length (Miles)	Lca (Miles)	Slope (Ft./Mile)	Kn	Lag (Hours)
140	0.516	1.22	0.51	162	0.060	0.457
141	0.187	0.83	0.57	315	0.048	0.291
142	1.512	1.16	0.75	257	0.049	0.389
143	0.604	1.64	0.88	273	0.040	0.380
144	0.475	1.80	1.11	291	0.041	0.436
145	0.548	1.37	0.86	242	0.035	0.315

TABLE 12

HYDROLOGIC SUB-BASIN CHARACTERISTICS
100-YEAR STORM

Sub-Basin	Area (Sq. Mile)	Length (Miles)	Lca (Miles)	Slope (Ft./Mile)	Kn	Lag (Hours)
140	0.516	1.22	0.51	162	0.050	0.381
141	0.187	0.83	0.57	315	0.042	0.254
142	1.512	1.16	0.75	257	0.042	0.333
143	0.604	1.64	0.88	273	0.035	0.333
144	0.475	1.80	1.11	291	0.036	0.382
145	0.548	1.37	0.86	242	0.032	0.288

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	Checked by	Date	Sheet No. 1
	For		

Estimated Manning's Roughness Coefficients

1. Mountain Area

(a) 100-Year Storm

n_b = 0.030 (Coarse Sand)
n_1 = 0.008 (Moderate)
n_2 = — —
n_3 = 0.015 (Medium)
n = 0.053

(b) 10-Year Storm

n_b = 0.030
n_1 = 0.008
n_2 = — —
n_3 = 0.025
n = 0.063

(c) 2-Year Storm

n_b = 0.030
n_1 = 0.008
n_2 = — —
n_3 = 0.030
n = 0.068

2. Hillslope Area

(a) 100-Year Storm

n_b = 0.030 (Coarse Sand)
n_1 = 0.005 (Minor)
n_2 = — —
n_3 = 0.010 (Medium)
n = 0.045

(b) 10-Year Storm

n_b = 0.030
n_1 = 0.005
n_2 = — —
n_3 = 0.018
n = 0.053

(c) 2-Year Storm

n_b = 0.030
n_1 = 0.005
n_2 = — —
n_3 = 0.025
n = 0.060

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	Checked by	Date	Sheet No. 2
	For		

Estimated Manning's Roughness Coefficients (Cont'd.)

3. Valley Area

(a) 100-Year storm

n_b = 0.025 (Sand & Gravel)
n_1 = 0.005 (Moderate)
n_2 = --
n_3 = 0.008 (Small)
n = 0.038

(b) 10-Year storm

n_b = 0.025
n_1 = 0.005
n_2 = --
n_3 = 0.015 (Medium)
n = 0.045

(c) 2-Year storm

n_b = 0.025
n_1 = 0.005
n_2 = --
n_3 = 0.025
n = 0.055

4. Urbanized Hillslope Area — Flow is 40% Hillslope & 60% streets

(a) 100-Year storm

Hillslope	Street
n_b = 0.030	n_b = 0.018
n_1 = 0.005	n_1 = --
n_2 = --	n_2 = --
n_3 = 0.010	n_3 = --
n = 0.045	n = 0.018

$$n = (0.40)(0.045) + (0.60)(0.018) = 0.029$$

(b) 10-Year Storm

Hillslope	Street
n_b = 0.030	n_b = 0.018
n_1 = 0.005	n_1 = -
n_2 = --	n_2 = -
n_3 = 0.018	n_3 = -
n = 0.053	n = 0.018

$$n = (0.40)(0.053) + (0.60)(0.018) = 0.032$$

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 4-9-92	Job No. 0146
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	For		

Estimated Mannings Roughness Coefficient (Cont'd)

4. (c) 2-Year Storm

Mountain	Street
$n_b = 0.030$	$n_b = 0.018$
$n_1 = 0.005$	$n_1 = -$
$n_2 = --$	$n_2 = -$
$n_3 = 0.025$	$n_3 = -$
$n = 0.060$	$n = 0.018$

$n = (0.40)(0.060) + (0.60)(0.018) = 0.035$

5. Urbanized Valley Area — Assume 85% street Flow and 15% Outside of Roadway Prism.

(a) 100-Year Storm

Street	Outside street
$n_b = 0.018$	$n_b = 0.025$
$n_1 = -$	$n_1 = 0.003$
$n_2 = -$	$n_2 = 0.004$
$n_3 = -$	$n_3 = -$
$n = 0.018$	$n = 0.032$

$n = (0.85)(0.018) + (0.15)(0.032) = 0.020$

(b) 10-Year Storm

$n = 0.025$

(c) 2-Year Storm

$n = 0.025$

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 4-9-92	Job No. 0146
	Checked by	Date	Sheet No. 1
	For Mean Mannings "n" - 10th Street Wash		

2-YEAR STORM

10TH4.WK3

Sub-Basin 140

$$K_n = (0.890)(0.068) + (0.110)(0.035) = 0.064$$

Sub-Basin 141

$$K_n = (0.530)(0.068) + (0.470)(0.035) = 0.052$$

Sub-Basin 142

$$K_n = (0.537)(0.068) + (0.463)(0.035) = 0.053$$

Sub-Basin 143

$$K_n = (0.262)(0.068) + (0.738)(0.035) = 0.044$$

Sub-Basin 144

$$K_n = (0.297)(0.068) + (0.703)(0.035) = 0.045$$

Sub-Basin 145

$$K_n = (0.107)(0.068) + (0.893)(0.035) = 0.039$$

10-YEAR STORM

10TH3.WK3

Sub-Basin 140

$$K_n = (0.890)(0.063) + (0.110)(0.032) = 0.060$$

Sub-Basin 141

$$K_n = (0.530)(0.063) + (0.470)(0.032) = 0.048$$

Sub-Basin 142

$$K_n = (0.537)(0.063) + (0.463)(0.032) = 0.049$$

Sub-Basin 143

$$K_n = (0.262)(0.063) + (0.738)(0.032) = 0.040$$

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 4-10-92	Job No. 0146
	Checked by	Date	Sheet No. 2
	For Mean Manning's "n" – 10th Street Wash		

10-YEAR STORM (Cont'd)

Sub-Basin 144

$$K_n = (0.297)(0.063) + (0.703)(0.032) = 0.041$$

Sub-Basin 145

$$K_n = (0.107)(0.063) + (0.893)(0.032) = 0.035$$

100-YEAR STORM

10THZ.WK3

Sub-Basin 140

$$K_n = (0.890)(0.053) + (0.110)(0.029) = 0.050$$

Sub-Basin 141

$$K_n = (0.530)(0.053) + (0.470)(0.029) = 0.042$$

Sub-Basin 142

$$K_n = (0.537)(0.053) + (0.463)(0.029) = 0.042$$

Sub-Basin 143

$$K_n = (0.262)(0.053) + (0.738)(0.029) = 0.035$$

Sub-Basin 144

$$K_n = (0.297)(0.053) + (0.703)(0.029) = 0.036$$

Sub-Basin 145

$$K_n = (0.107)(0.053) + (0.893)(0.029) = 0.032$$

LAG TIME CALCULATIONS FOR: TENTH STREET WASH
STORM FREQUENCY - 2 YEAR

SUBBASIN	S-GRAPH SELECTED	24	Kn	L (miles)	Lca (miles)	S (ft/mile)	S^1/2	LAG (hours)	LAG (min.)
140	PV	24	0.064	1.22	0.51	162	12.73	0.488	29.27
141	PV	24	0.052	0.83	0.57	315	17.75	0.315	18.89
142	PV	24	0.053	1.16	0.75	257	16.03	0.420	25.22
143	PV	24	0.044	1.64	0.88	273	16.52	0.418	25.09
144	PV	24	0.045	1.8	1.11	291	17.06	0.478	28.69
145	PV	24	0.039	1.37	0.86	242	15.56	0.351	21.07

LAG TIME CALCULATIONS FOR: TENTH STREET WASH
STORM FREQUENCY - 10 YEAR

SUBBASIN	S-GRAPH SELECTED	24	Kn	L (miles)	Lca (miles)	S (ft/mile)	S^1/2	LAG (hours)	LAG (min.)
140	PV	24	0.06	1.22	0.51	162	12.73	0.457	27.44
141	PV	24	0.048	0.83	0.57	315	17.75	0.291	17.43
142	PV	24	0.049	1.16	0.75	257	16.03	0.389	23.32
143	PV	24	0.04	1.64	0.88	273	16.52	0.380	22.81
144	PV	24	0.041	1.8	1.11	291	17.06	0.436	26.14
145	PV	24	0.035	1.37	0.86	242	15.56	0.315	18.90

LAG TIME CALCULATIONS FOR: TENTH STREET WASH
STORM FREQUENCY - 100 YEAR

SUBBASIN	S-GRAPH SELECTED	24	Kn	L (miles)	Lca (miles)	S (ft/mile)	S^1/2	LAG (hours)	LAG (min.)
140	PV	24	0.05	1.22	0.51	162	12.73	0.381	22.87
141	PV	24	0.042	0.83	0.57	315	17.75	0.254	15.26
142	PV	24	0.042	1.16	0.75	257	16.03	0.333	19.99
143	PV	24	0.035	1.64	0.88	273	16.52	0.333	19.96
144	PV	24	0.036	1.8	1.11	291	17.06	0.382	22.95
145	PV	24	0.032	1.37	0.86	242	15.56	0.288	17.28

SECTION IV

Hydrograph Routing Parameters

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 1-16-92	Job No. 0146
	Checked by	Date	Sheet No.
	For HEC-1 I.D. 140RR		

STAGE - STORAGE VALUES FOR NORTH MOUNTAIN DETENTION BASIN NO. 3

Stage (Ft.)	Planimeter Reading (in^2)	Average Reading (in^2)	Area (Ac.)	Volume (Ac-Ft.)	Storage Volume (Ac-Ft.)
1355.9	0	0	0		0
				0.06	
1358	0.02 0.035 0.05	0.017	0.06		0.06
				1.46	
1362	0.19 0.365 0.545	0.182	0.67		1.52
				4.80	
1366	0.48 0.94 1.41	0.47	1.73		6.32
				11.10	
1370	1.05 2.09 3.12	1.04	3.82		17.42
				18.04	
1374	1.42 2.82 4.25	1.417	5.20		35.46
				24.88	
1378	1.98 3.97 5.91	1.97	7.24		60.34
				35.30	
1382	2.84 5.66 8.50	2.833	10.41		95.64

LOW LEVEL OUTLET

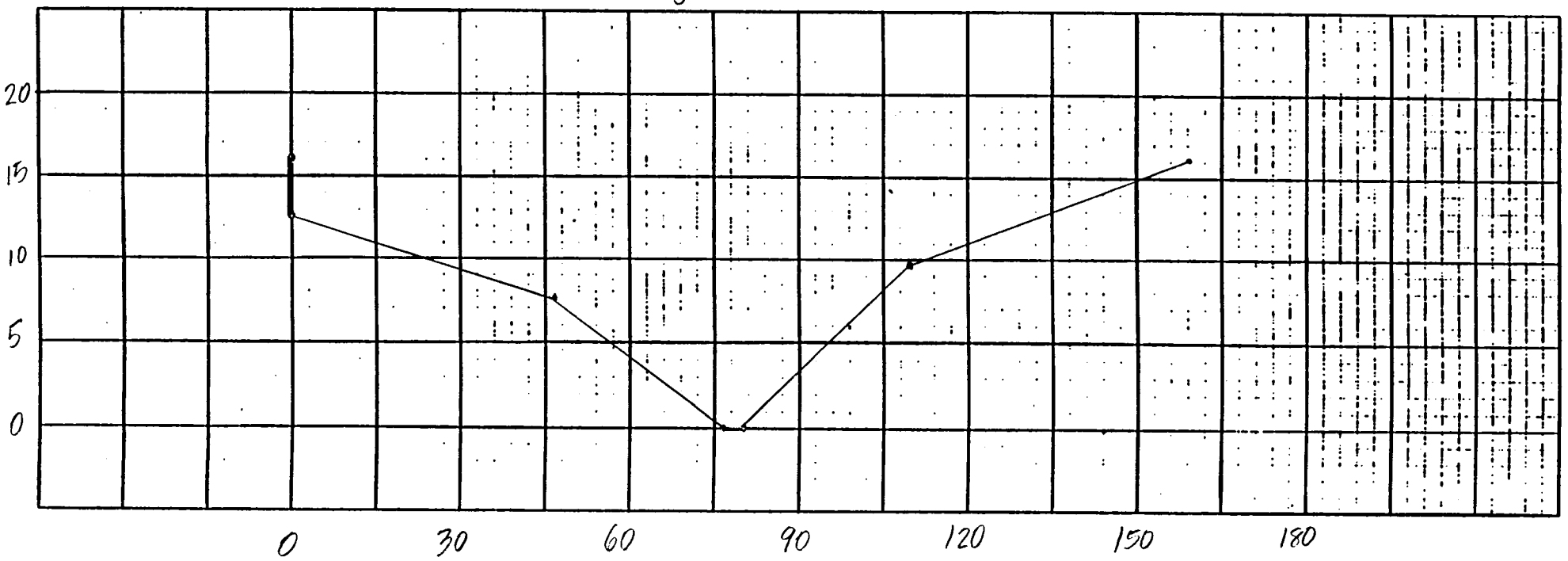
Diameter = 30" Conc. Pipe with 14" x 14" Orifice Opening
Area = 1.36 ft^2
Outlet Elevation = 1356.48
Coef. of Discharge = 0.6
Exponent of Head = 0.5

SPILLWAY

Crest Elevation = 1380.00
Length = 100 ft.
Weir Coefficient = 3.0
Exponent of Head = 1.5

ROUTE IDENTIFICATION NUMBER RM140

Route 140RR through 141

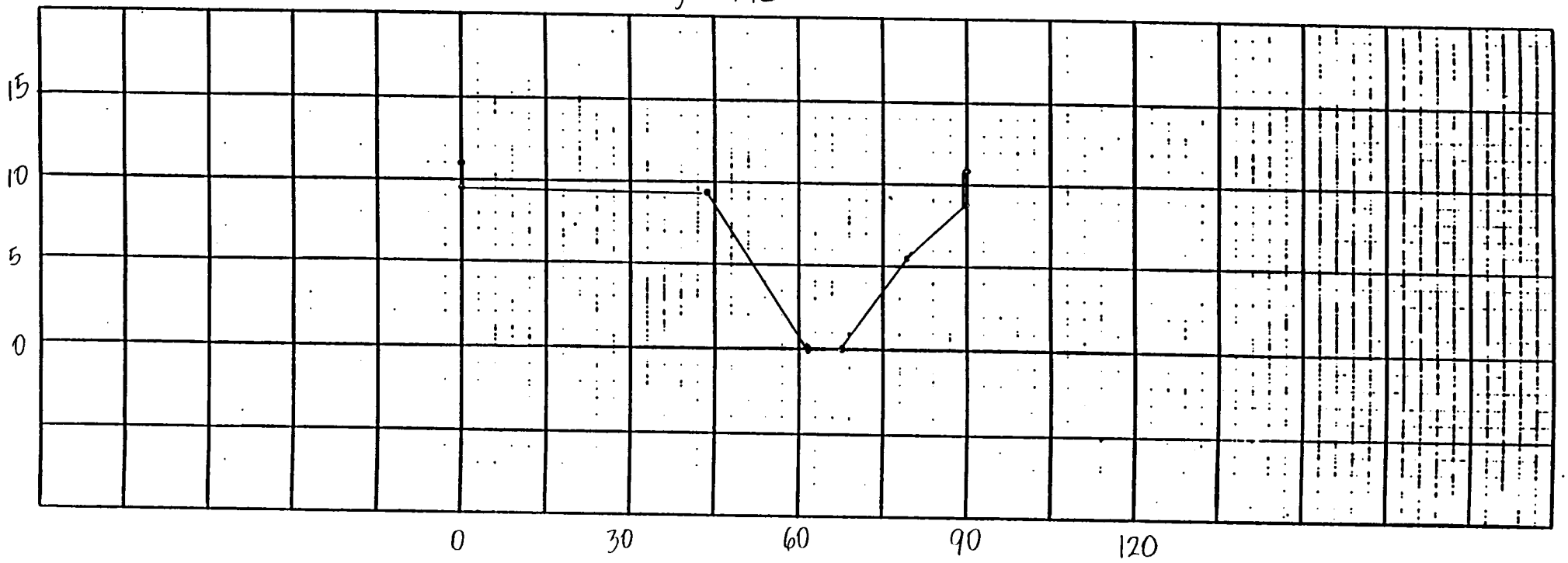


RSD								
RC	0.045	0.045	0.045	3600	0.0108			
RX	0	0	46.5	76.4	79.9	110.2	160.2	160.2
RY	16	12.6	7.3	0	0	9.9	15.9	16

CALCULATED BY: DLB 5/4/92

ROUTE IDENTIFICATION NUMBER RM 142

Route HC 142 through 143

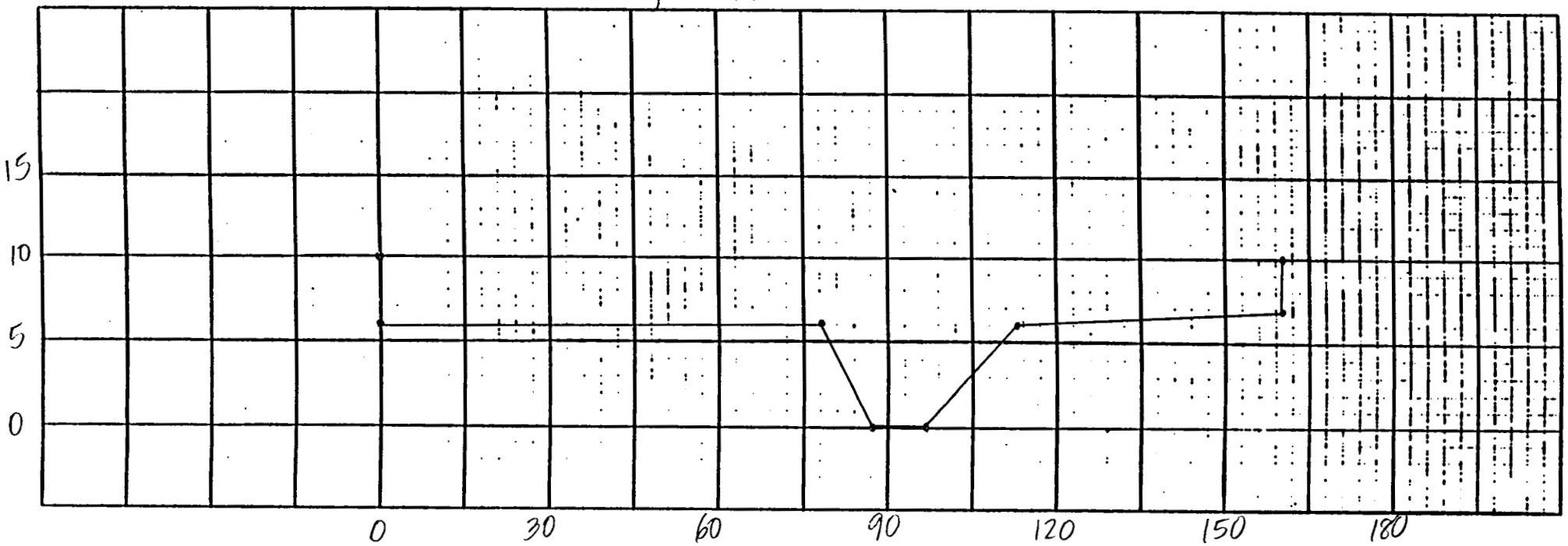


RSD								
RC	0.050	0.045	0.050	5140	0.0086			
RX	0	0	43.8	61.3	67.4	78.3	89.8	89.8
RY	10.8	9.4	9.4	0	0	5.4	8.8	10.8

CALCULATED BY: DLB 5/4/92

ROUTE IDENTIFICATION NUMBER RM143

Route HC143 through 144

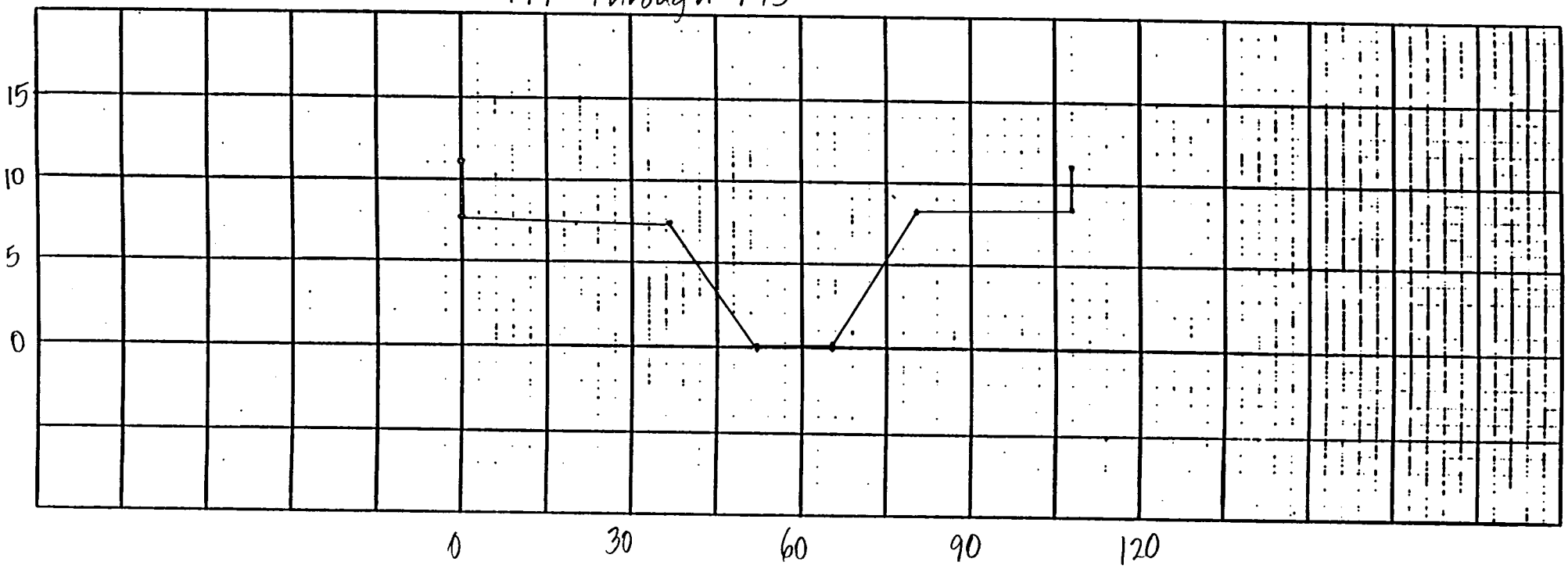


RSD								
RC	0.040	0.035	0.030	1400	0.0100			
RX	0	0	77.8	88.3	96.6	112.8	161.3	161.3
RY	10	6.2	6.2	0	0	6.3	6.9	10

CALCULATED BY: DLB 5/4/92

ROUTE IDENTIFICATION NUMBER RM 144

Route HC144 through 145



RSD								
RC	0.035	0.035	0.030	3000	0.0073			
RX	0	0	36.6	52	64.9	79.8	107.8	107.8
RY	11	7.7	7.4	0	0	8.3	8.5	11

CALCULATED BY: DLB 5/4/92

SECTION V

Divert & Onsite Retention Parameters

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 3-24-92	Job No. 0146
	Checked by	Date	Sheet No.
	For		

ONSITE RETENTION FOR 10TH STREET WASH WATERSHED

Assume retention volume on parcels in question to be based on 10-year 2-hour storm.

Determine the 10-year 2-hour intensity from page 32 of the City of Phoenix "Storm Drain Design Manual", September 1985:

$i = 0.80$ in/hr.

Determine peak discharge using $Q = CIA$ (Rational Method)

Storage Volume $= 7200\,Q\ (ft^3) = \frac{7200}{43560}\,Q$ (Ac-Ft.)

Sub-Basin	Land Use	C	Area (Ac.)	Peak Q (cfs)	Volume (Ac-Ft.)	Total Volume (Ac-Ft)
140	MF RES	0.65	4.70	2.44	0.40	
	COMM	0.90	13.59	9.78	1.62	
						2.02
141	MF RES	0.65	12.75	6.63	1.10	
	COMM	0.90	10.71	7.71	1.27	
						2.37
142	MF RES	0.65	6.80	3.54	0.58	
	COMM	0.90	25.25	18.18	3.00	
						3.58
143	MF RES	0.65	40.51	21.07	3.48	
	COMM	0.90	18.77	13.51	2.23	
						5.71
144	MF RES	0.65	13.70	7.12	1.18	
	COMM	0.90	7.38	5.31	0.88	
						2.06
145	NO ONSITE RETENTION CALCULATIONS					

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 3-24-92	Job No 0146
	Checked by	Date	Sheet No.
	For		

CONTRIBUTING AREA FOR 10TH STREET WASH - 2 YEAR STORM

The following assumptions were made:

(1) Undeveloped areas and desert areas contribute 100 %.
(2) 100% of Land Use Impervious Areas contribute with remaining pervious areas as non contributing with the exception of those areas in which storage volumes were computed. Areas with storage volume calculations are assumed as non-contributing.

Sub Basin 140

$$\text{Contributing Area} = 0.516 - \underset{\text{MF RES}}{\overset{\text{SV}}{0.007}} - \underset{\text{COMM}}{\overset{\text{SV}}{0.021}} - (0.10)\underset{\text{COMM}}{(0.011)} - (0.55)(0.017)$$
$$= 0.478 \text{ sq. mi.}$$

Sub-Basin 141

$$\text{Contributing Area} = 0.187 - \underset{\text{MF RES}}{\overset{\text{SV}}{0.020}} - \underset{\text{MF RES}}{(0.35)(0.040)} - \underset{\text{COMM}}{\overset{\text{SV}}{0.017}} - \underset{\text{COMM}}{(0.10)(0.005)} - (0.55)(0.006)$$
$$= 0.132 \text{ sq. mi.}$$

Sub-Basin 142

$$\text{Contributing Area} = 0.512 - \underset{\text{MF RES}}{\overset{\text{SV}}{0.011}} - \underset{\text{MF RES}}{(0.35)(0.009)} - \underset{\text{COMM}}{\overset{\text{SV}}{0.039}} - \underset{\text{COMM}}{(0.10)(0.012)} - (0.55)(0.165)$$
$$= 0.367 \text{ sq. mi.}$$

Sub-Basin 143

$$\text{Contributing Area} = 0.604 - \underset{\text{MF RES}}{\overset{\text{SV}}{0.063}} - \underset{\text{MF RES}}{(0.35)(0.171)} - \underset{\text{COMM}}{\overset{\text{SV}}{0.029}} - \underset{\text{COMM}}{(0.10)(0.015)} - (0.55)(0.158)$$
$$= 0.364 \text{ Sq. Mi.}$$

Sub-Basin 144

$$\text{Contributing Area} = 0.475 - \underset{\text{MF RES}}{\overset{\text{SV}}{0.021}} - \underset{\text{MF RES}}{(0.35)(0.027)} - \underset{\text{COMM}}{\overset{\text{SV}}{0.012}} - (0.55)(0.255) - (0.10)(0.004)$$
$$= 0.292 \text{ Sq. Mi.}$$

Sub-Basin 145

$$\text{Contributing Area} = 0.548 - (0.35)(0.022) - (0.55)(0.466) - (0.10)(0.0015)$$
$$= 0.284 \text{ Sq. Mi.}$$

SECTION VI

HEC-1 Hydrology Results

100-Year 24-Hour Storm

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  01/03/94  TIME  11:32:11   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   ACDC AREA DRAINAGE MASTER STUDY
  2           ID   10TH STREET WASH WATERSHED
  3           ID   FILENAME:  TEN324.DAT     KHE JOB NO. 0146
  4           ID   100-YEAR 24-HOUR DURATION STORM
              *
              *  Based on FCDMC comments dated March 17,1992 we adjusted the Mannings "n"
              *  coefficient to reflect weighted averaging in lieu of log averaging.
              *  We also changed the S-graph from Phoenix Mountain to Phoenix Valley.
              *
              *DIAGRAM
  5           IT       4                    500
  6           IO       3

  7           KK    140S
  8           KM   RUNOFF GENERATED ON SUB-BASIN 140
  9           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 10           KM    L= 1.22 mi.  Lca= 0.51 mi.  S= 162 ft/mi.  Kn= .050  LAG= 22.87 min.
 11           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 12           BA    .516
 13           IN      30
 14           KM   RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 15           KM   AN AREAL REDUCTION COEFFICIENT OF .980 WAS USED
 16           PB    3.72
 17           KM   THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II RAINFALL
 18           PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 19           PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 20           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 21           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 22           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 23           LG    .145    .339    4.25    .488   20.44
 24           UI     76.    207.    377.    486.    666.    923.    690.    529.    397.    254.
 25           UI    131.     99.     65.     23.     23.     23.     23.      0.      0.      0.
 26           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 27           KK   DT140
 28           KM   THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.0 AC-FT FROM SUB-BASIN 140
 29           KM                                              (Hydrograph identified as OR140)
 30           KM                                            2) Balance of runoff continues on.
 31           KM                                              (Hydrograph identified as DT140)
 32           DT   OR140     2.0
 33           DI       0   10000
 34           DQ       0   10000

 35           KK   140RR
 36           KM   ROUTE FLOW THROUGH NORTH MOUNTAIN DETENTION NO.3
 37           RS       1    ELEV    55.9
 38           SV       0     .06    1.52    6.32   17.42   35.46   60.34   95.64
 39           SE    55.9      58      62      66      70      74      78      82
 40           SL   56.48    1.36      .6      .5
 41           SS   80.00     100     3.0     1.5
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  42          KK   RM140
  43          KM   MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM DETENTION BASIN THROUGH SUB-BASIN 141
  44          KM            1) Reach Length = 3600 ft.
  45          RD
  46          RC    .045    .045    .045    3600   .0108
  47          RX       0       0    46.5    76.4    79.9   110.2   160.2   160.2
  48          RY      16    12.6     7.3       0       0     9.9    15.9      16

  49          KK    141S
  50          KM   RUNOFF GENERATED ON SUB-BASIN 141
  51          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  52          KM    L= 0.83 mi.  Lca= 0.57 mi.  S= 315 ft/mi.  Kn= .042  LAG= 15.26 min.
  53          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  54          BA    .187
  55          LG    .126    .303    3.61    .313   38.57
  56          UI     53.    186.    283.    468.    354.    233.    117.     59.     28.     13.
  57          UI     13.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  58          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

  59          KK   DT141
  60          KM   THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.4 AC-FT FROM SUB-BASIN 141
  61          KM                                              (Hydrograph identified as OR141)
  62          KM                                            2) Balance of runoff continues on.
  63          KM                                              (Hydrograph identified as DT141)
  64          DT   OR141     2.4
  65          DI       0   10000
  66          DQ       0   10000

  67          KK   HC141
  68          KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 141 WITH ROUTED FLOW FROM DETENTION
  69          HC       2

  70          KK    142S
  71          KM   RUNOFF GENERATED ON SUB-BASIN 142
  72          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  73          KM    L= 1.16 mi.  Lca= 0.75 mi.  S= 257 ft/mi.  Kn= .042  LAG= 19.99 min.
  74          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  75          BA    .512
  76          LG    .127    .309    4.12    .267   34.03
  77          UI     86.    291.    470.    634.   1000.    835.    612.    442.    240.    145.
  78          UI     88.     37.     26.     26.      0.      0.      0.      0.      0.      0.
  79          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

  80          KK   DT142
  81          KM   THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 3.6 AC-FT FROM SUB-BASIN 142
  82          KM                                              (Hydrograph identified as OR142)
  83          KM                                            2) Balance of runoff continues on.
  84          KM                                              (Hydrograph identified as DT142)
  85          DT   OR142     3.6
  86          DI       0   10000
  87          DQ       0   10000
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 88           KK   HC142
 89           KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 142 WITH 141
 90           HC       2

 91           KK   RM142
 92           KM   MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASINS 141/142 THROUGH 143
 93           KM            1) Reach Length = 5140 ft.
 94           RD
 95           RC    .050    .045    .050    5140   .0086
 96           RX       0       0    43.8    61.3    67.4    78.3    89.8    89.8
 97           RY    10.8     9.4     9.4       0       0     5.4     8.8    10.8

 98           KK    143S
 99           KM   RUNOFF GENERATED ON SUB-BASIN 143
100           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
101           KM    L= 1.64 mi.  Lca= 0.88  S= 273 ft/mi.  Kn= .035  LAG= 19.96 min.
102           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
103           BA    .604
104           LG    .115    .279    4.12    .269   49.66
105           UI    102.    344.    556.    750.   1183.    984.    721.    519.    281.    171.
106           UI    103.     42.     31.     31.      0.      0.      0.      0.      0.      0.
107           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

108           KK   DT143
109           KM   THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 5.7 AC-FT FROM SUB-BASIN 143
110           KM                                              (Hydrograph identified as OR143)
111           KM                                            2) Balance of runoff continues on.
112           KM                                              (Hydrograph identified as DT143)
113           DT   OR143     5.7
114           DI       0   10000
115           DQ       0   10000

116           KK   HC143
117           KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 143 WITH ROUTED FLOW FROM 141/142
118           HC       2

119           KK   RM143
120           KM   MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASIN 143 THROUGH 144
121           KM            1) Reach Length = 1400 ft.
122           RD
123           RC    .040    .035    .030    1400   .0100
124           RX       0       0    77.8    88.3    96.6   112.8   161.3   161.3
125           RY      10     6.2     6.2       0       0     6.3     6.9      10

126           KK    144S
127           KM   RUNOFF GENERATED ON SUB-BASIN 144
128           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
129           KM    L= 1.80 mi.  Lca= 1.11 mi.  S= 291 ft/mi.  Kn= .036  LAG= 22.95 min.
130           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
131           BA    .475
132           LG    .118    .280    3.61     .32   43.17
133           UI     70.    189.    345.    445.    605.    850.    637.    489.    368.    239.
134           UI    121.     93.     61.     21.     21.     21.     21.      0.      0.      0.
135           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 136          KK   DT144
 137          KM   THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.1 AC-FT FROM SUB-BASIN 144
 138          KM                                             (Hydrograph identified as OR144)
 139          KM                                           2) Balance of runoff continues on.
 140          KM                                             (Hydrograph identified as DT144)
 141          DT   OR144     2.1
 142          DI       0   10000
 143          DQ       0   10000

 144          KK   HC144
 145          KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 144 WITH ROUTED FLOW FROM 143
 146          HC       2

 147          KK   RM144
 148          KM   MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASIN 144 THROUGH 145
 149          KM           1) Reach Length = 3000 ft.
 150          RD
 151          RC    .035    .035    .030    3000   .0073
 152          RX       0       0    36.6      52    64.9    79.8   107.8   107.8
 153          RY      11     7.7     7.4       0       0     8.3     8.5      11

 154          KK    145S
 155          KM   RUNOFF GENERATED ON SUB-BASIN 145
 156          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 157          KM    L= 1.37 mi.  Lca= 0.86 mi.  S= 242 ft/mi.  Kn= .032  LAG= 17.28 min.
 158          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 159          BA    .548
 160          LG    .105    .265    5.67    .210   44.60
 161          UI    108.    437.    654.   1010.   1170.    790.    540.    264.    153.     82.
 162          UI     33.     33.      0.      0.      0.      0.      0.      0.      0.      0.
 163          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 164          KK   HC145
 165          KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 145 WITH ROUTED FLOW FROM 144
 166          KM   ALSO DETERMINES 10TH STREET WASH DISCHARGE INTO ACDC
 167          HC       2
 168          ZZ
```

```
                SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

[illegible]    (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  7         140S
               .
               .
 32            .-------->   OR140
 27        DT140
               V
               V
 35        140RR
               V
               V
 42        RM140
               .
               .
 49            .        141S
               .           .
               .           .
 64            .           .-------->   OR141
 59            .       DT141
               .           .
               .           .
 67        HC141............
               .
               .
[illegible]    .        142S
               .           .
               .           .
 85            .           .-------->   OR142
 80            .       DT142
               .           .
               .           .
 88        HC142............
               V
               V
 91        RM142
               .
               .
 98            .        143S
               .           .
               .           .
113            .           .-------->   OR143
108            .       DT143
               .           .
               .           .
116        HC143............
               V
               V
119        RM143
               .
               .
[illegible]    .        144S
               .           .
               .           .
141            .           .-------->   OR144
```

```
136          .       DT144
             .          .
             .          .
144       HC144............
             V
             V
147       RM144
             .
             .
154          .       145S
             .          .
             .          .
164       HC145............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  01/03/94  TIME  11:32:11   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
                    ACDC AREA DRAINAGE MASTER STUDY
                    10TH STREET WASH WATERSHED
                    FILENAME:  TEN324.DAT     KHE JOB NO. 0146
                    100-YEAR 24-HOUR DURATION STORM

  6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          3  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          4  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        500  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       0916  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.07 HOURS
                     TOTAL TIME BASE   33.27 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
  7 KK    *     140S   *
          *            *
          **************
                    RUNOFF GENERATED ON SUB-BASIN 140
                     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
                     L= 1.22 mi.  Lca= 0.51 mi.  S= 162 ft/mi.  Kn= .050  LAG= 22.87 min.
                     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
                    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
```

AN AREAL REDUCTION COEFFICIENT OF .980 WAS USED
THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II RAINFALL

13 IN TIME DATA FOR INPUT TIME SERIES

JXMIN		30	TIME INTERVAL IN MINUTES
JXDATE	1	0	STARTING DATE
JXTIME		0	STARTING TIME

SUBBASIN RUNOFF DATA

12 BA SUBBASIN CHARACTERISTICS

TAREA	0.52	SUBBASIN AREA

PRECIPITATION DATA

17 PB

STORM	3.72	BASIN TOTAL PRECIPITATION

17 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

LG GREEN AND AMPT LOSS RATE

STRTL	0.14	STARTING LOSS
DTH	0.34	MOISTURE DEFICIT
PSIF	4.25	WETTING FRONT SUCTION
XKSAT	0.49	HYDRAULIC CONDUCTIVITY

```
                    RTIMP       20.44  PERCENT IMPERVIOUS AREA

23 UI          INPUT UNITGRAPH,  17 ORDINATES,  VOLUME = 1.00
                    76.0     207.0     377.0     486.0     666.0     923.0     690.0     529.0     397.0     254.0
                   131.0      99.0      65.0      23.0      23.0      23.0      23.0
                                                                  ***

   ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     140S

   TOTAL RAINFALL =    3.72, TOTAL LOSS =    2.29, TOTAL EXCESS =    1.43

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                  6-HR       24-HR       72-HR     33.27-HR
   551.      12.13        (CFS)      67.         20.         14.         14.
                        (INCHES)    1.210       1.432       1.433       1.433
                         (AC-FT)     33.         39.         39.         39.

                     CUMULATIVE AREA =    0.52 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
   KK     *     DT140  *
          *            *
          **************
                      THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.0 AC-FT FROM SUB-BASIN 140
                                                                 (Hydrograph identified as OR140)
                                                               2) Balance of runoff continues on.
                                                                 (Hydrograph identified as DT140)

   DT          DIVERSION
                     ISTAD       OR140  DIVERSION HYDROGRAPH IDENTIFICATION
                    DSTRMX        2.00  MAXIMUM VOLUME TO BE DIVERTED

   DI             INFLOW        0.00  10000.00

   DQ      DIVERTED FLOW        0.00  10000.00
                                                                  ***

   ***            ***            ***            ***            ***

                     DIVERSION HYDROGRAPH    OR140

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                  6-HR       24-HR       72-HR     33.27-HR
     5.       7.20         (CFS)       4.          1.          1.          1.
                        (INCHES)    0.065       0.073       0.073       0.073
                         (AC-FT)      2.          2.          2.          2.

                     CUMULATIVE AREA =    0.52 SQ MI
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*** *** *** *** ***

HYDROGRAPH AT STATION DT140

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
551.	12.13	(CFS)	67.	19.	14.	14.
		(INCHES)	1.210	1.360	1.360	1.360
		(AC-FT)	33.	37.	37.	37.

CUMULATIVE AREA = 0.52 SQ MI

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              **************
              *            *
35 KK         *     140RR  *
              *            *
              **************
```

ROUTE FLOW THROUGH NORTH MOUNTAIN DETENTION NO.3

HYDROGRAPH ROUTING DATA

37 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	ELEV	TYPE OF INITIAL CONDITION
RSVRIC	55.90	INITIAL CONDITION
X	0.00	WORKING R AND D COEFFICIENT

38 SV	STORAGE	0.0	0.1	1.5	6.3	17.4	35.5	60.3	95.6
39 SE	ELEVATION	55.90	58.00	62.00	66.00	70.00	74.00	78.00	82.00

40 SL LOW-LEVEL OUTLET

ELEVL	56.48	ELEVATION AT CENTER OF OUTLET
CAREA	1.36	CROSS-SECTIONAL AREA
COQL	0.60	COEFFICIENT
EXPL	0.50	EXPONENT OF HEAD

41 SS SPILLWAY

CREL	80.00	SPILLWAY CREST ELEVATION
SPWID	100.00	SPILLWAY WIDTH
COQW	3.00	WEIR COEFFICIENT
EXPW	1.50	EXPONENT OF HEAD

***

COMPUTED OUTFLOW-ELEVATION DATA

OUTFLOW	0.00	0.00	5.46	6.19	7.15	8.46	10.36	13.36	18.80	31.74
ELEVATION	55.90	56.48	57.18	57.37	57.67	58.15	58.99	60.65	64.74	80.00
OUTFLOW	32.63	38.67	54.94	86.52	138.48	215.89	323.84	467.38	651.61	881.59
ELEVATION	80.02	80.08	80.18	80.32	80.50	80.72	80.98	81.28	81.62	82.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.02	0.04	0.04	0.05	0.06	0.12	0.42	1.03	1.52
OUTFLOW	0.00	0.00	5.46	6.19	7.15	8.07	8.46	10.36	13.36	15.38
ELEVATION	55.90	56.48	57.18	57.37	57.67	58.00	58.15	58.99	60.65	62.00
STORAGE	4.80	6.32	17.42	35.46	60.34	77.99	78.17	78.70	79.59	80.82
OUTFLOW	18.80	20.19	24.06	27.39	30.36	31.74	32.63	38.67	54.94	86.52
ELEVATION	64.74	66.00	70.00	74.00	78.00	80.00	80.02	80.08	80.18	80.32
STORAGE	82.41	84.35	86.65	89.29	92.29	95.64				
OUTFLOW	138.48	215.89	323.83	467.38	651.61	881.59				
ELEVATION	80.50	80.72	80.98	81.28	81.62	82.00				

*** *** *** *** ***

HYDROGRAPH AT STATION 140RR

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
26.	13.07	(CFS)	25.	19.	14.	14.
		(INCHES)	0.455	1.359	1.359	1.359
		(AC-FT)	13.	37.	37.	37.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	33.27-HR
27.	13.07	24.	11.	8.	8.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	33.27-HR
72.07	13.07	71.40	65.90	63.15	63.15

CUMULATIVE AREA = 0.52 SQ MI

*** ***

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          **************
          *            *
42 KK     *    RM140   *
          *            *
          **************
```

MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM DETENTION BASIN THROUGH SUB-BASIN 141
1) Reach Length = 3600 ft.

HYDROGRAPH ROUTING DATA

45 RD MUSKINGUM-CUNGE CHANNEL ROUTING

46 RC NORMAL DEPTH CHANNEL

ANL	0.045	LEFT OVERBANK N-VALUE
ANCH	0.045	MAIN CHANNEL N-VALUE
ANR	0.045	RIGHT OVERBANK N-VALUE
RLNTH	3600.	REACH LENGTH
SEL	0.0108	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL		------- +	--- RIGHT OVERBANK ---		
48 RY	ELEVATION	16.00	12.60	7.30	0.00	0.00	9.90	15.90	16.00
RX	DISTANCE	0.00	0.00	46.50	76.40	79.90	110.20	160.20	160.20

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.45	1.33	2.62	4.33	6.46	9.01	11.98	15.37	19.19
OUTFLOW	0.00	12.85	55.26	137.82	270.21	461.31	719.33	1052.03	1466.80	1994.95
ELEVATION	0.00	0.84	1.68	2.53	3.37	4.21	5.05	5.89	6.74	7.58
STORAGE	23.65	28.80	34.65	41.42	49.19	57.96	67.46	77.44	87.92	98.88
OUTFLOW	2672.82	3469.46	4426.92	5627.41	7015.97	8616.91	10510.34	12619.84	14945.32	17498.36
ELEVATION	8.42	9.26	10.11	10.95	11.79	12.63	13.47	14.32	15.16	16.00

COMPUTED MUSKINGUM-CUNGE PARAMETERS

COMPUTATION TIME STEP

ELEMENT	ALPHA	M	DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN			4.00	300.00	25.78	804.00	1.36	2.34

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN			4.00		25.78	804.00	1.36	

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3741E+02 EXCESS=0.0000E+00 OUTFLOW=0.3740E+02 BASIN STORAGE=0.6616E-03 PERCENT ERROR= 0.0

*** *** *** *** ***

HYDROGRAPH AT STATION RM140

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
26.	13.40	(CFS)	25.	19.	14.	14.
		(INCHES)	0.455	1.359	1.359	1.359
		(AC-FT)	13.	37.	37.	37.

CUMULATIVE AREA = 0.52 SQ MI

*** ***

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               ***************
               *             *
49 KK          *     141S    *
               *             *
               ***************
```

RUNOFF GENERATED ON SUB-BASIN 141
THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
L= 0.83 mi. Lca= 0.57 mi. S= 315 ft/mi. Kn= .042 LAG= 15.26 min.
PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN

SUBBASIN RUNOFF DATA

54 BA SUBBASIN CHARACTERISTICS

TAREA	0.19	SUBBASIN AREA

PRECIPITATION DATA

17 PB	STORM	3.72	BASIN TOTAL PRECIPITATION

17 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

55 LG GREEN AND AMPT LOSS RATE

STRTL	0.13	STARTING LOSS
DTH	0.30	MOISTURE DEFICIT
PSIF	3.61	WETTING FRONT SUCTION
XKSAT	0.31	HYDRAULIC CONDUCTIVITY
RTIMP	38.57	PERCENT IMPERVIOUS AREA

50 UI INPUT UNITGRAPH, 11 ORDINATES, VOLUME = 1.00

```
                53.0     186.0     283.0     468.0     354.0     233.0     117.0      59.0      28.0      13.0
                13.0

                                                          ***

   ***          ***          ***          ***          ***

                  HYDROGRAPH AT STATION     141S

   TOTAL RAINFALL =    3.72, TOTAL LOSS =    1.62, TOTAL EXCESS =    2.10

PEAK FLOW    TIME                          MAXIMUM AVERAGE FLOW
  (CFS)      (HR)                  6-HR       24-HR       72-HR     33.27-HR
   281.     12.00        (CFS)      34.         11.          8.          8.
                       (INCHES)    1.680       2.099       2.100       2.100
                        (AC-FT)     17.         21.         21.         21.

                  CUMULATIVE AREA =    0.19 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 59 KK    *     DT141  *
          *            *
          **************
                         THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.4 AC-FT FROM SUB-BASIN 141
                                                                    (Hydrograph identified as OR141)
                                                                  2) Balance of runoff continues on.
                                                                    (Hydrograph identified as DT141)

    DT          DIVERSION
                      ISTAD       OR141  DIVERSION HYDROGRAPH IDENTIFICATION
                     DSTRMX        2.40  MAXIMUM VOLUME TO BE DIVERTED

    DI             INFLOW        0.00  10000.00

    DQ      DIVERTED FLOW        0.00  10000.00

                                                          ***

    ***          ***          ***          ***          ***

                   DIVERSION HYDROGRAPH    OR141

PEAK FLOW    TIME                          MAXIMUM AVERAGE FLOW
  (CFS)      (HR)                  6-HR       24-HR       72-HR     33.27-HR
     6.      9.87        (CFS)       4.          1.          1.          1.
                       (INCHES)    0.178       0.241       0.241       0.241
                        (AC-FT)      2.          2.          2.          2.

                   CUMULATIVE AREA =    0.19 SQ MI

    ***          ***          ***          ***          ***
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HYDROGRAPH AT STATION DT141

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
281.	12.00	(CFS)	34.	9.	7.	7.
		(INCHES)	1.675	1.860	1.860	1.860
		(AC-FT)	17.	19.	19.	19.

CUMULATIVE AREA = 0.19 SQ MI

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*            *
*     HC141  *
*            *
**************
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67 KK

COMBINE HYDROGRAPHS FROM SUB-BASIN 141 WITH ROUTED FLOW FROM DETENTION

69 HC HYDROGRAPH COMBINATION

ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

*** *** *** *** ***

HYDROGRAPH AT STATION HC141

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
293.	12.07	(CFS)	56.	28.	20.	20.
		(INCHES)	0.734	1.492	1.492	1.492
		(AC-FT)	28.	56.	56.	56.

CUMULATIVE AREA = 0.70 SQ MI

*** ***

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**************
*            *
*     142S   *
*            *
**************
```

70 KK

RUNOFF GENERATED ON SUB-BASIN 142
THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
L= 1.16 mi. Lca= 0.75 mi. S= 257 ft/mi. Kn= .042 LAG= 19.99 min.
PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN

SUBBASIN RUNOFF DATA

75 BA SUBBASIN CHARACTERISTICS

TAREA 0.51 SUBBASIN AREA

PRECIPITATION DATA

17 PB STORM 3.72 BASIN TOTAL PRECIPITATION

17 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

76 LG GREEN AND AMPT LOSS RATE

STRTL	0.13	STARTING LOSS
DTH	0.31	MOISTURE DEFICIT
PSIF	4.12	WETTING FRONT SUCTION
XKSAT	0.27	HYDRAULIC CONDUCTIVITY
RTIMP	34.03	PERCENT IMPERVIOUS AREA

71 UI INPUT UNITGRAPH, 14 ORDINATES, VOLUME = 1.00

86.0	291.0	470.0	634.0	1000.0	835.0	612.0	442.0	240.0	145.0
88.0	37.0	26.0	26.0						

***

*** *** *** *** ***

HYDROGRAPH AT STATION 142S

TOTAL RAINFALL = 3.72, TOTAL LOSS = 1.71, TOTAL EXCESS = 2.01

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
720.	12.07	(CFS)	90.	27.	20.	20.
		(INCHES)	1.626	1.994	1.996	1.996
		(AC-FT)	44.	54.	54.	54.

CUMULATIVE AREA = 0.51 SQ MI

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              **************
              *            *
  80 KK       *    DT142   *
              *            *
              **************
```

THROW AWAY 10-YR 2-HR RETENTION VOLUME: 1) 3.6 AC-FT FROM SUB-BASIN 142
(Hydrograph identified as OR142)
2) Balance of runoff continues on.
(Hydrograph identified as DT142)

DT	DIVERSION		
	ISTAD	OR142	DIVERSION HYDROGRAPH IDENTIFICATION
	DSTRMX	3.60	MAXIMUM VOLUME TO BE DIVERTED
DI	INFLOW	0.00	10000.00
DQ	DIVERTED FLOW	0.00	10000.00

***

*** *** *** *** ***

DIVERSION HYDROGRAPH OR142

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
9.	7.60	(CFS)	6.	2.	1.	1.
		(INCHES)	0.114	0.132	0.132	0.132
		(AC-FT)	3.	4.	4.	4.

CUMULATIVE AREA = 0.51 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION DT142

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
720.	12.07	(CFS)	90.	26.	19.	19.
		(INCHES)	1.626	1.864	1.864	1.864
		(AC-FT)	44.	51.	51.	51.

CUMULATIVE AREA = 0.51 SQ MI

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          **************
          *            *
88 KK     *     HC142  *
          *            *
          **************
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COMBINE HYDROGRAPHS FROM SUB-BASIN 142 WITH 141

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90 HC          HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
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*** *** *** *** ***

HYDROGRAPH AT STATION HC142

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
1014.	12.07	(CFS)	143.	54.	39.	39.
		(INCHES)	1.094	1.648	1.649	1.649
		(AC-FT)	71.	107.	107.	107.

CUMULATIVE AREA = 1.21 SQ MI

*** ***

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          **************
          *            *
91 KK     *     RM142  *
          *            *
          **************
```

MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASINS 141/142 THROUGH 143

1) Reach Length = 5140 ft.

```
          HYDROGRAPH ROUTING DATA

94 RD        MUSKINGUM-CUNGE CHANNEL ROUTING

95 RC        NORMAL DEPTH CHANNEL
                  ANL       0.050  LEFT OVERBANK N-VALUE
                 ANCH       0.045  MAIN CHANNEL N-VALUE
                  ANR       0.050  RIGHT OVERBANK N-VALUE
                RLNTH       5140.  REACH LENGTH
                  SEL      0.0086  ENERGY SLOPE
                ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION
```

CROSS-SECTION DATA

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                    --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
97 RY       ELEVATION     10.80     9.40     9.40     0.00     0.00     5.40     8.80    10.80
```

96 RX DISTANCE 0.00 0.00 43.80 61.30 67.40 78.30 89.80 89.80

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.48	1.11	1.89	2.82	3.89	5.12	6.49	8.01	9.67
OUTFLOW	0.00	7.68	26.09	55.15	95.78	149.06	216.05	297.83	395.45	509.93
ELEVATION	0.00	0.57	1.14	1.71	2.27	2.84	3.41	3.98	4.55	5.12
STORAGE	11.49	13.51	15.72	18.14	20.75	23.57	26.56	31.00	37.02	43.04
OUTFLOW	650.49	818.44	1007.41	1218.94	1454.47	1715.29	2005.41	2355.87	2815.24	3342.27
ELEVATION	5.68	6.25	6.82	7.39	7.96	8.53	9.09	9.66	10.23	10.80

COMPUTED MUSKINGUM-CUNGE PARAMETERS

COMPUTATION TIME STEP

ELEMENT	ALPHA	M	DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN			4.00	1028.00	996.40	732.00	1.65	8.09

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN			4.00		996.40	732.00	1.65	

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1068E+03 EXCESS=0.0000E+00 OUTFLOW=0.1069E+03 BASIN STORAGE=0.7056E-03 PERCENT ERROR= 0.0

*** *** *** *** ***

HYDROGRAPH AT STATION RM142

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
996.	12.20	(CFS)	143.	54.	39.	39.
		(INCHES)	1.094	1.647	1.649	1.649
		(AC-FT)	71.	107.	107.	107.

CUMULATIVE AREA = 1.21 SQ MI

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**************
*            *
*     143S   *
*            *
**************
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98 KK

RUNOFF GENERATED ON SUB-BASIN 143
THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
L= 1.64 mi. Lca= 0.88 S= 273 ft/mi. Kn= .035 LAG= 19.96 min.
PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN

SUBBASIN RUNOFF DATA

103 BA SUBBASIN CHARACTERISTICS

TAREA 0.60 SUBBASIN AREA

PRECIPITATION DATA

17 PB STORM 3.72 BASIN TOTAL PRECIPITATION

17 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

104 LG GREEN AND AMPT LOSS RATE

STRTL	0.12	STARTING LOSS
DTH	0.28	MOISTURE DEFICIT
PSIF	4.12	WETTING FRONT SUCTION
XKSAT	0.27	HYDRAULIC CONDUCTIVITY
RTIMP	49.66	PERCENT IMPERVIOUS AREA

UI INPUT UNITGRAPH, 14 ORDINATES, VOLUME = 1.00

102.0	344.0	556.0	750.0	1183.0	984.0	721.0	519.0	281.0	171.0
103.0	42.0	31.0	31.0						

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   ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION     143S

  TOTAL RAINFALL =    3.72, TOTAL LOSS =    1.30, TOTAL EXCESS =    2.42

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                 6-HR       24-HR       72-HR     33.27-HR
   890.      12.07       (CFS)     122.         39.         28.         28.
                       (INCHES)   1.872        2.409       2.412       2.412
                        (AC-FT)    60.         78.         78.         78.

                    CUMULATIVE AREA =    0.60 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


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          *            *
 108 KK   *     DT143  *
          *            *
          **************
                         THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 5.7 AC-FT FROM SUB-BASIN 143
                                                                    (Hydrograph identified as OR143)
                                                                  2) Balance of runoff continues on.
                                                                    (Hydrograph identified as DT143)

   DT          DIVERSION
                     ISTAD       OR143  DIVERSION HYDROGRAPH IDENTIFICATION
                    DSTRMX        5.70  MAXIMUM VOLUME TO BE DIVERTED

   DI             INFLOW        0.00  10000.00

   DQ      DIVERTED FLOW        0.00  10000.00

                                                                  ***

   ***            ***            ***            ***            ***

                    DIVERSION HYDROGRAPH    OR143

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                 6-HR       24-HR       72-HR     33.27-HR
    13.        7.20       (CFS)      10.          3.          2.          2.
                       (INCHES)   0.158        0.177       0.177       0.177
                        (AC-FT)     5.          6.          6.          6.

                    CUMULATIVE AREA =    0.60 SQ MI

   ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION    DT143

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                 6-HR       24-HR       72-HR     33.27-HR
```

890.	12.07	(CFS)	122.	36.	26.	26.
		(INCHES)	1.872	2.235	2.235	2.235
		(AC-FT)	60.	72.	72.	72.

CUMULATIVE AREA = 0.60 SQ MI

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*            *
*     HC143  *
*            *
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116 KK

COMBINE HYDROGRAPHS FROM SUB-BASIN 143 WITH ROUTED FLOW FROM 141/142

118 HC HYDROGRAPH COMBINATION

ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

*** *** *** *** ***

HYDROGRAPH AT STATION HC143

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
1828.	12.13	(CFS)	263.	90.	65.	65.
		(INCHES)	1.343	1.836	1.844	1.844
		(AC-FT)	130.	178.	179.	179.

CUMULATIVE AREA = 1.82 SQ MI

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*            *
*     RM143  *
*            *
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119 KK

MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASIN 143 THROUGH 144

1) Reach Length = 1400 ft.

HYDROGRAPH ROUTING DATA

122 RD MUSKINGUM-CUNGE CHANNEL ROUTING

3 RC NORMAL DEPTH CHANNEL

ANL	0.040	LEFT OVERBANK N-VALUE
ANCH	0.035	MAIN CHANNEL N-VALUE
ANR	0.030	RIGHT OVERBANK N-VALUE
RLNTH	1400.	REACH LENGTH
SEL	0.0100	ENERGY SLOPE

ELMAX 0.0 MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL		------- +	--- RIGHT OVERBANK ---		
RY	ELEVATION	10.00	6.20	6.20	0.00	0.00	6.30	6.90	10.00
124 RX	DISTANCE	0.00	0.00	77.80	88.30	96.60	112.80	161.30	161.30

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.16	0.36	0.59	0.87	1.18	1.53	1.91	2.34	2.80
OUTFLOW	0.00	12.58	41.94	87.02	148.56	227.67	325.56	443.47	582.63	744.26
ELEVATION	0.00	0.53	1.05	1.58	2.11	2.63	3.16	3.68	4.21	4.74
STORAGE	3.30	3.84	4.71	7.00	9.72	12.45	15.18	17.91	20.64	23.36
OUTFLOW	929.56	1139.70	1390.17	1866.93	2579.43	3481.11	4542.46	5746.71	7081.82	8538.41
ELEVATION	5.26	5.79	6.32	6.84	7.37	7.89	8.42	8.95	9.47	10.00

COMPUTED MUSKINGUM-CUNGE PARAMETERS

COMPUTATION TIME STEP

ELEMENT	ALPHA	M	DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN			1.97	700.00	1822.06	731.83	1.84	11.83

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN			4.00		1821.47	732.00	1.84	

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1789E+03 EXCESS=0.0000E+00 OUTFLOW=0.1789E+03 BASIN STORAGE=0.1456E-03 PERCENT ERROR= 0.0

*** *** *** *** ***

HYDROGRAPH AT STATION RM143

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
1821.	12.20	(CFS)	263.	90.	65.	65.
		(INCHES)	1.344	1.837	1.845	1.845
		(AC-FT)	130.	178.	179.	179.

CUMULATIVE AREA = 1.82 SQ MI

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          **************
          *            *
126 KK    *     144S   *
          *            *
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****

RUNOFF GENERATED ON SUB-BASIN 144
THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
L= 1.80 mi. Lca= 1.11 mi. S= 291 ft/mi. Kn= .036 LAG= 22.95 min.
PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN

SUBBASIN RUNOFF DATA

131 BA SUBBASIN CHARACTERISTICS

TAREA	0.47	SUBBASIN AREA

PRECIPITATION DATA

17 PB STORM	3.72	BASIN TOTAL PRECIPITATION

17 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

132 LG GREEN AND AMPT LOSS RATE

STRTL	0.12	STARTING LOSS
DTH	0.28	MOISTURE DEFICIT
PSIF	3.61	WETTING FRONT SUCTION
XKSAT	0.32	HYDRAULIC CONDUCTIVITY
RTIMP	43.17	PERCENT IMPERVIOUS AREA

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127 UI          INPUT UNITGRAPH,  17 ORDINATES,  VOLUME = 1.00
                    70.0     189.0     345.0     445.0     605.0     850.0     637.0     489.0     368.0     239.0
                   121.0      93.0      61.0      21.0      21.0      21.0      21.0

                                                          ***

   ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     144S

   TOTAL RAINFALL =    3.72, TOTAL LOSS =    1.49, TOTAL EXCESS =    2.23

PEAK FLOW    TIME                          MAXIMUM AVERAGE FLOW
  (CFS)      (HR)                  6-HR       24-HR       72-HR     33.27-HR
   645.      12.13       (CFS)      90.         28.         21.         21.
                       (INCHES)    1.756       2.225       2.228       2.228
                        (AC-FT)     44.         56.         56.         56.

                     CUMULATIVE AREA =    0.47 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
136 KK    *     DT144  *
          *            *
          **************
                      THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.1 AC-FT FROM SUB-BASIN 144
                                                                 (Hydrograph identified as OR144)
                                                               2) Balance of runoff continues on.
                                                                 (Hydrograph identified as DT144)

   DT          DIVERSION
                    ISTAD       OR144  DIVERSION HYDROGRAPH IDENTIFICATION
                   DSTRMX        2.10  MAXIMUM VOLUME TO BE DIVERTED

   DI            INFLOW        0.00  10000.00

   DQ      DIVERTED FLOW       0.00  10000.00

                                                          ***

   ***            ***            ***            ***            ***

                     DIVERSION HYDROGRAPH    OR144

PEAK FLOW    TIME                          MAXIMUM AVERAGE FLOW
  (CFS)      (HR)                  6-HR       24-HR       72-HR     33.27-HR
     8.      4.53        (CFS)       4.          1.          1.          1.
                       (INCHES)    0.083       0.083       0.083       0.083
                        (AC-FT)     2.          2.          2.          2.

                     CUMULATIVE AREA =    0.47 SQ MI

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HYDROGRAPH AT STATION DT144

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
645.	12.13	(CFS)	90.	27.	20.	20.
		(INCHES)	1.756	2.145	2.145	2.145
		(AC-FT)	44.	54.	54.	54.

CUMULATIVE AREA = 0.47 SQ MI

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              **************
              *            *
144 KK        *     HC144  *
              *            *
              **************
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COMBINE HYDROGRAPHS FROM SUB-BASIN 144 WITH ROUTED FLOW FROM 143

146 HC HYDROGRAPH COMBINATION

ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

*** *** *** *** ***

HYDROGRAPH AT STATION HC144

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
2444.	12.20	(CFS)	352.	116.	85.	85.
		(INCHES)	1.427	1.885	1.907	1.907
		(AC-FT)	175.	231.	233.	233.

CUMULATIVE AREA = 2.29 SQ MI

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              **************
              *            *
147 KK        *     RM144  *
              *            *
              **************
```

MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASIN 144 THROUGH 145
1) Reach Length = 3000 ft.

HYDROGRAPH ROUTING DATA

150 RD MUSKINGUM-CUNGE CHANNEL ROUTING

151 RC NORMAL DEPTH CHANNEL

ANL	0.035	LEFT OVERBANK N-VALUE
ANCH	0.035	MAIN CHANNEL N-VALUE
ANR	0.030	RIGHT OVERBANK N-VALUE
RLNTH	3000.	REACH LENGTH
SEL	0.0073	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---			+ ------ MAIN CHANNEL -------		+ --- RIGHT OVERBANK ---		
153 RY	ELEVATION	11.00	7.70	7.40	0.00	0.00	8.30	8.50	11.00
152 RX	DISTANCE	0.00	0.00	36.60	52.00	64.90	79.80	107.80	107.80

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.56	1.21	1.95	2.77	3.69	4.70	5.79	6.98	8.25
OUTFLOW	0.00	19.25	62.79	127.35	212.72	319.47	448.41	600.52	776.80	978.32
ELEVATION	0.00	0.58	1.16	1.74	2.32	2.89	3.47	4.05	4.63	5.21
STORAGE	9.62	11.07	12.61	14.31	17.33	21.06	25.36	29.66	33.96	38.25
OUTFLOW	1206.13	1461.28	1744.84	2066.92	2497.32	3063.19	3780.80	4608.87	5532.46	6541.96
ELEVATION	5.79	6.37	6.95	7.53	8.11	8.68	9.26	9.84	10.42	11.00

COMPUTED MUSKINGUM-CUNGE PARAMETERS

ELEMENT	ALPHA	M	COMPUTATION TIME STEP DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN			4.00	1500.00	2436.31	736.00	1.91	11.54

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN			4.00		2436.31	736.00	1.91	

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2333E+03 EXCESS=0.0000E+00 OUTFLOW=0.2333E+03 BASIN STORAGE=0.5826E-03 PERCENT ERROR= 0.0

*** *** *** *** ***

HYDROGRAPH AT STATION RM144

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.27-HR
2436.	12.27	(CFS)	352.	116.	85.	85.
		(INCHES)	1.427	1.885	1.907	1.907
		(AC-FT)	175.	231.	233.	233.

CUMULATIVE AREA = 2.29 SQ MI

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***************
*             *
KK   *     145S  *
*             *
***************
```

RUNOFF GENERATED ON SUB-BASIN 145
THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
L= 1.37 mi. Lca= 0.86 mi. S= 242 ft/mi. Kn= .032 LAG= 17.28 min.
PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN

SUBBASIN RUNOFF DATA

159 BA SUBBASIN CHARACTERISTICS
TAREA 0.55 SUBBASIN AREA

PRECIPITATION DATA

17 PB STORM 3.72 BASIN TOTAL PRECIPITATION

17 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

160 LG GREEN AND AMPT LOSS RATE
STRTL 0.10 STARTING LOSS

```
                DTH        0.26  MOISTURE DEFICIT
               PSIF        5.67  WETTING FRONT SUCTION
              XKSAT        0.21  HYDRAULIC CONDUCTIVITY
              RTIMP       44.60  PERCENT IMPERVIOUS AREA

155 UI        INPUT UNITGRAPH,  12 ORDINATES,  VOLUME = 0.99
                108.0     437.0     654.0    1010.0    1170.0     790.0     540.0     264.0     153.0      82.0
                 33.0      33.0

                                                          ***

   ***            ***            ***            ***            ***

                  HYDROGRAPH AT STATION     145S

  TOTAL RAINFALL =    3.72, TOTAL LOSS =    1.40, TOTAL EXCESS =    2.32

PEAK FLOW    TIME                          MAXIMUM AVERAGE FLOW
  (CFS)      (HR)                 6-HR       24-HR       72-HR     33.27-HR
   844.     12.07       (CFS)     108.         34.         25.         25.
                      (INCHES)   1.824       2.306       2.308       2.308
                       (AC-FT)    53.         67.         67.         67.

                  CUMULATIVE AREA =    0.55 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
164 KK    *     HC145  *
          *            *
          **************
                  COMBINE HYDROGRAPHS FROM SUB-BASIN 145 WITH ROUTED FLOW FROM 144
                  ALSO DETERMINES 10TH STREET WASH DISCHARGE INTO ACDC

167 HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

   ***            ***            ***            ***            ***

                  HYDROGRAPH AT STATION    HC145

PEAK FLOW    TIME                          MAXIMUM AVERAGE FLOW
  (CFS)      (HR)                 6-HR       24-HR       72-HR     33.27-HR
  3069.     12.20       (CFS)     459.        148.        109.        109.
                      (INCHES)   1.501       1.939       1.984       1.984
                       (AC-FT)   227.        294.        301.        301.

                  CUMULATIVE AREA =    2.84 SQ MI
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	140S	551.	12.13	67.	20.	14.	0.52		
DIVERSION TO	OR140	5.	12.13	4.	1.	1.	0.52		
HYDROGRAPH AT	DT140	551.	12.13	67.	19.	14.	0.52		
ROUTED TO	140RR	26.	13.07	25.	19.	14.	0.52	72.07	13.07
ROUTED TO	RM140	26.	13.40	25.	19.	14.	0.52		
HYDROGRAPH AT	141S	281.	12.00	34.	11.	8.	0.19		
DIVERSION TO	OR141	6.	12.00	4.	1.	1.	0.19		
HYDROGRAPH AT	DT141	281.	12.00	34.	9.	7.	0.19		
2 COMBINED AT	HC141	293.	12.07	56.	28.	20.	0.70		
HYDROGRAPH AT	142S	720.	12.07	90.	27.	20.	0.51		
DIVERSION TO	OR142	9.	12.07	6.	2.	1.	0.51		
HYDROGRAPH AT	DT142	720.	12.07	90.	26.	19.	0.51		
2 COMBINED AT	HC142	1014.	12.07	143.	54.	39.	1.21		
ROUTED TO	RM142	996.	12.20	143.	54.	39.	1.21		
HYDROGRAPH AT	143S	890.	12.07	122.	39.	28.	0.60		
DIVERSION TO	OR143	13.	12.07	10.	3.	2.	0.60		
HYDROGRAPH AT	DT143	890.	12.07	122.	36.	26.	0.60		
2 COMBINED AT	HC143	1828.	12.13	263.	90.	65.	1.82		
ROUTED TO	RM143	1821.	12.20	263.	90.	65.	1.82		
HYDROGRAPH AT	144S	645.	12.13	90.	28.	21.	0.47		
DIVERSION TO	OR144	8.	12.13	4.	1.	1.	0.47		
HYDROGRAPH AT	DT144	645.	12.13	90.	27.	20.	0.47		
2 COMBINED AT	HC144	2444.	12.20	352.	116.	85.	2.29		
ROUTED TO	RM144	2436.	12.27	352.	116.	85.	2.29		
HYDROGRAPH AT	145S	844.	12.07	108.	34.	25.	0.55		
2 COMBINED AT	HC145	3069.	12.20	459.	148.	109.	2.84		

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
RM140	MANE	4.00	25.78	804.00	1.36	4.00	25.78	804.00	1.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3741E+02 EXCESS=0.0000E+00 OUTFLOW=0.3740E+02 BASIN STORAGE=0.6616E-03 PERCENT ERROR= 0.0

RM142	MANE	4.00	996.40	732.00	1.65	4.00	996.40	732.00	1.65

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1068E+03 EXCESS=0.0000E+00 OUTFLOW=0.1069E+03 BASIN STORAGE=0.7056E-03 PERCENT ERROR= 0.0

RM143	MANE	1.97	1822.06	731.83	1.84	4.00	1821.47	732.00	1.84

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1789E+03 EXCESS=0.0000E+00 OUTFLOW=0.1789E+03 BASIN STORAGE=0.1456E-03 PERCENT ERROR= 0.0

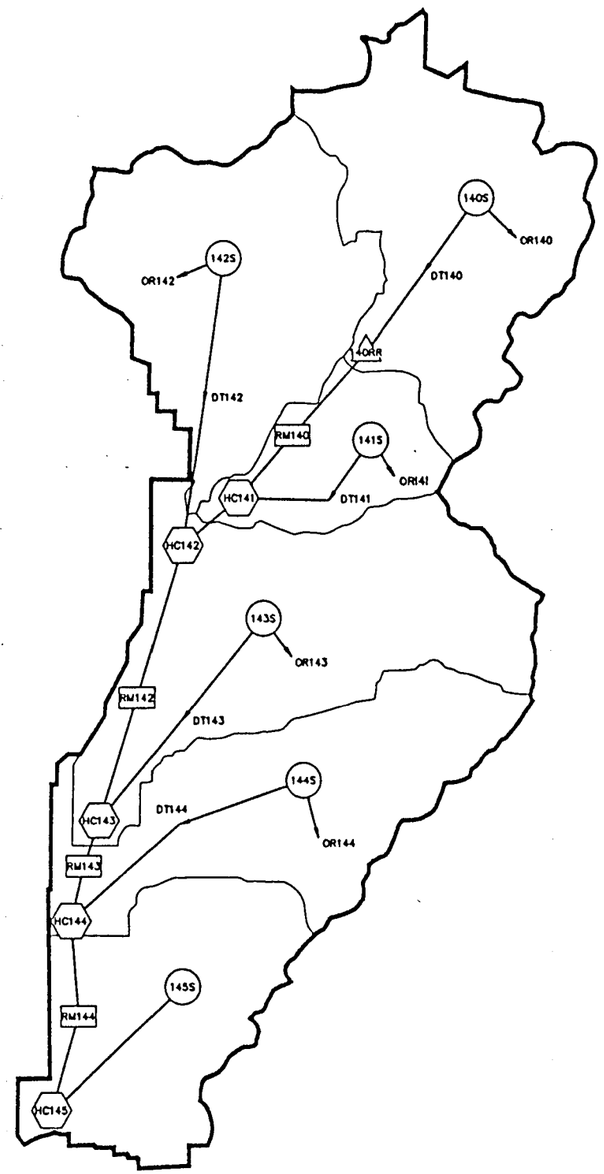
RM144	MANE	4.00	2436.31	736.00	1.91	4.00	2436.31	736.00	1.91

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2333E+03 EXCESS=0.0000E+00 OUTFLOW=0.2333E+03 BASIN STORAGE=0.5826E-03 PERCENT ERROR= 0.0

*** NORMAL END OF HEC-1 ***

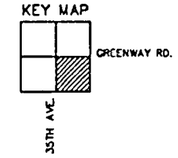
SECTION VII

PLATES



T.3N., R.3E.

KEY MAP



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	14	13	18	17	16	15	14	13	18	17	THUNDERBIRD RD.
PEORIA AVE.	23	24	19	20	21	22	23	24	19	20	CACTUS RD.
DUNLAP AVE.	26	25	30	29	28	27	26	25	30	29	SHEA BLVD.
	35	36	31	32	33	34	35	36	31	32	DOUBLE TREE RANCH RD.
GLENDALE AVE.	2	1	6	5	4	3	2	1	6	5	NORTHERN AVE.
BETHANY HOME RD.	11	12	7	8	9	10	11	12	7	8	INDIAN BEND RD.
CAMELBACK RD.	14	13	18	17	16	15	14	13	18	17	MC DONALD DR.
	35TH AVE.	27TH AVE.	19TH AVE.	7TH AVE.	7TH ST.	16TH ST.	24TH ST.	32ND ST.	40TH ST.	48TH ST.	56TH ST. CHAPARRAL RD.

DATE FLOWN: 11-15-1990

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH HYDROLOGY STUDY

LEGEND

- Major Drainage Basin Boundary
- Drainage Sub-Basin Boundary
- (A) Compute Runoff from Sub-Basin A
- (B) Compute Runoff from Sub-Basin B
- (C) Combine Hydrographs
- [D] Route Hydrograph
- (E) Route Hydrograph through Retention Basin E
- G/F Divide Hydrograph into F and G

DRAINAGE AREA MAP & HEC-1 SCHEMATIC

PLATE 1
JUNE 11, 1992

KAMINSKI HUBBARD engineering, inc.
SURVEYING • CIVIL • HYDROLOGY
4550 N. BLACK CANYON HWY., SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

N

SCALE

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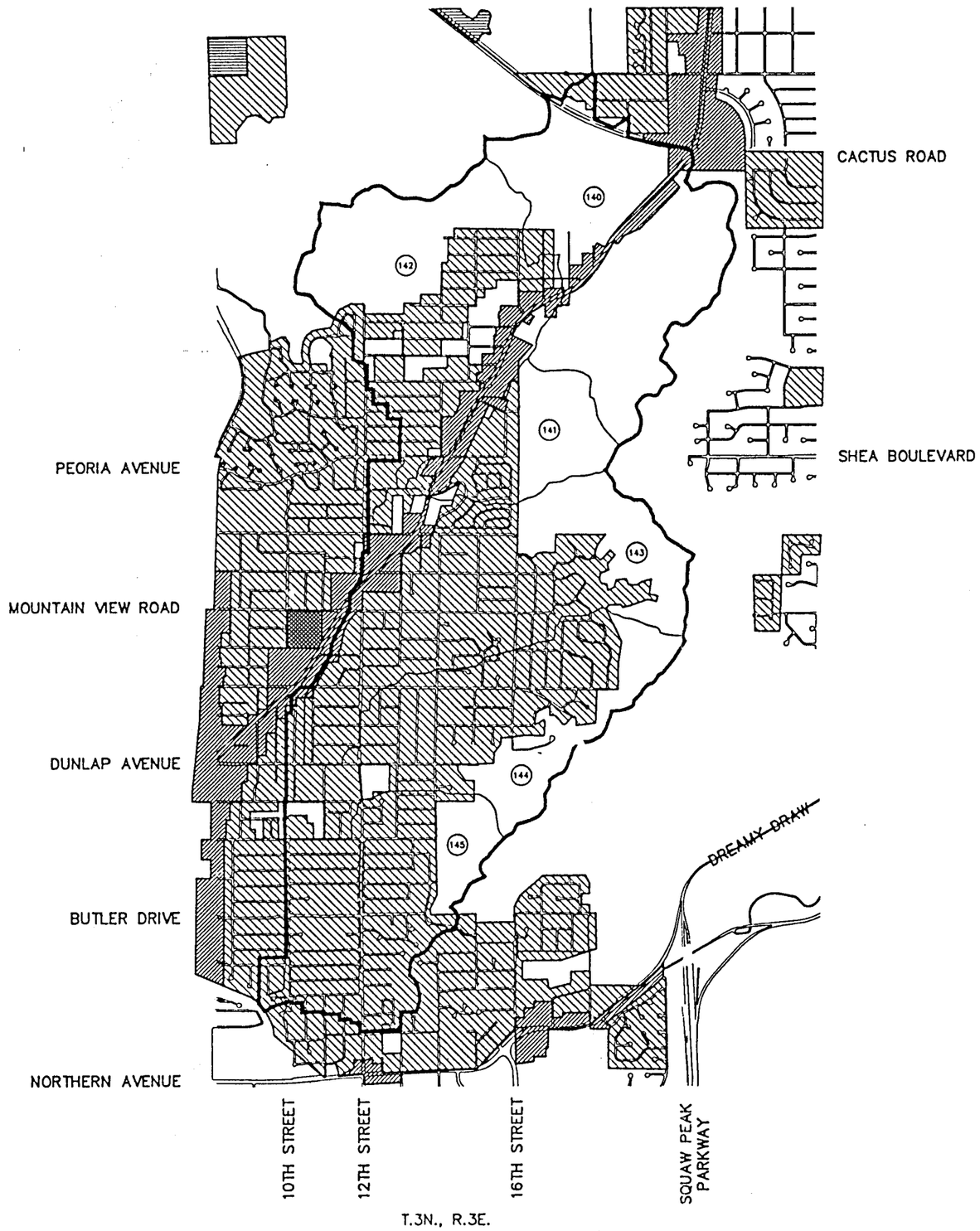
FEET



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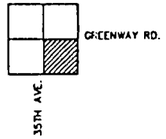

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											CACTUS RD.
PEORIA AVE.	23	24	19	20	21	22	23	24	19	20	SHEA BLVD.
DUNLAP AVE.	26	25	30	29	28	27	26	25	30	29	DOUBLE TREE RANCH RD.
	35	36	31	32	33	34	35	36	31	32	NORTHERN AVE.
GLENDALE AVE.	2	1	6	5	4	3	2	1	6	5	INDIAN BEND RD.
BETHANY HOME RD.	11	12	7	8	9	10	11	12	7	8	MC DONALD DR.
CAMELBACK RD.	14	13	18	17	16	15	14	13	18	17	CHAPARRAL RD.
	35TH AVE.	27TH AVE.	19TH AVE.	7TH ST.	16TH ST.	24TH ST.	32ND ST.	40TH ST.	48TH ST.	56TH ST.	

DATE FLOWN: 11-15-1990

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH HYDROLOGY STUDY

LEGEND

- Major Drainage Basin Boundary
- Drainage Sub-Basin Boundary
- Residential Land Use
- Commercial Land Use
- Golf Course
- Utility Land Use
- Vacant Land Use
- (140) Drainage Sub-Basin Number

LAND USE MAP

PLATE 2
JUNE 11, 1992

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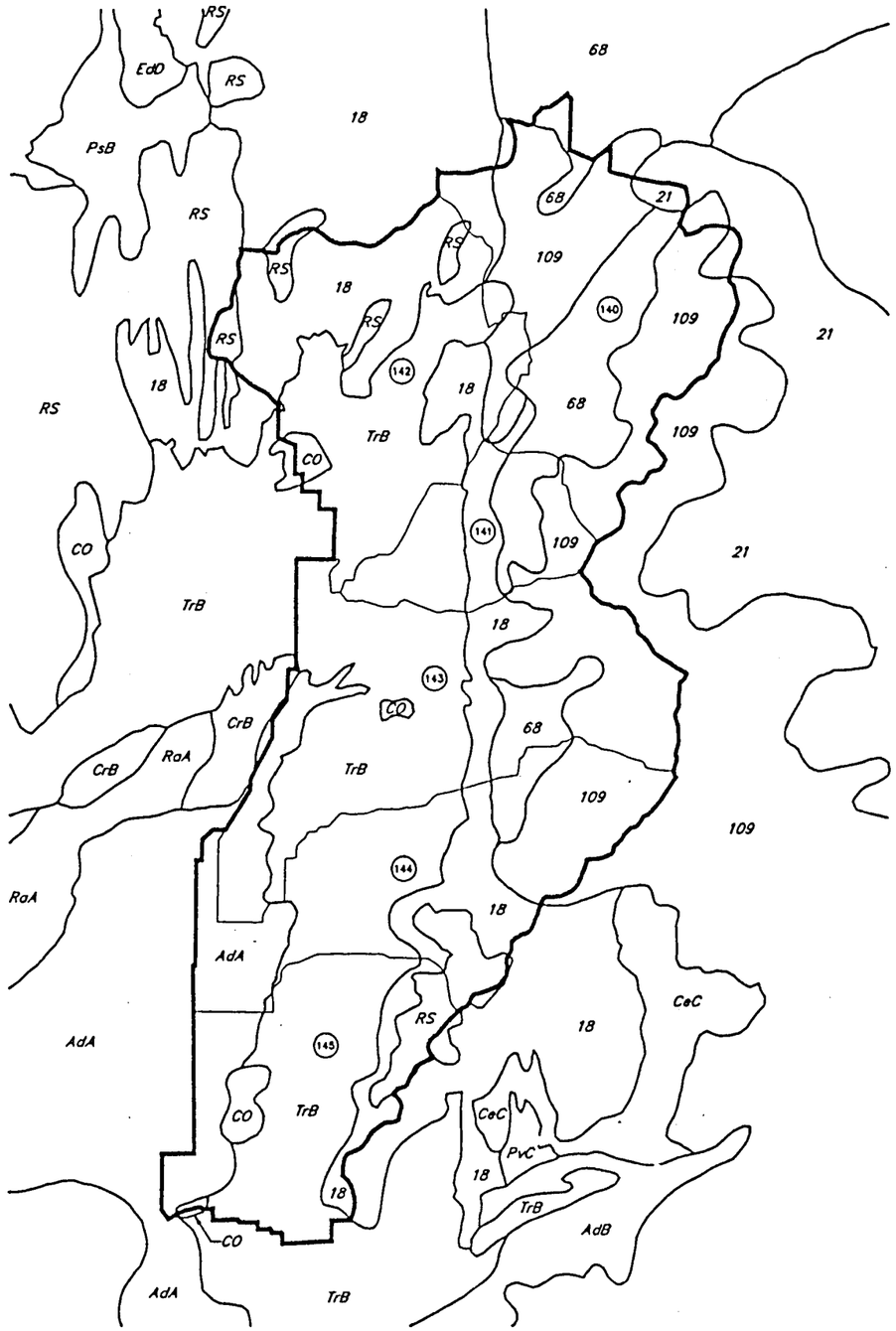

T.3N., R.3E.

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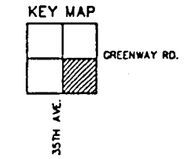

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	35TH AVE.	27TH AVE.	19TH AVE.	7TH AVE.	7TH ST.	16TH ST.	24TH ST.	32ND ST.	40TH ST.	48TH ST.	56TH ST.	
	11	12	7	8	9	10	11	12	7	8		GREENWAY RD.
	14	13	18	17	16	15	14	13	18	17		THUNDERBIRD RD.
PEORIA AVE.	23	24	19	20	21	22	23	24	19	20		CACTUS RD.
DUNLAP AVE.	26	25	30	29	28	27	26	25	30	29		SHEA BLVD.
	35	36	31	32	33	34	35	36	31	32		DOUBLE TREE RANCH RD.
GLENDALE AVE.	2	1	6	5	4	3	2	1	6	5		NORTHERN AVE.
BETHANY HOME RD.	11	12	7	8	9	10	11	12	7	8		INDIAN BEND RD.
CAMELBACK RD.	14	13	18	17	16	15	14	13	18	17		MC DONALD DR.
												CHAPARRAL RD.

DATE FLOWN: 11-15-1950

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1
10TH STREET WASH
HYDROLOGY STUDY

LEGEND

- Major Drainage Basin Boundary
- Drainage Sub-Basin Boundary
- (140) Drainage Sub-Basin Number
- CrB Soil Unit Boundary
- CO Soil Unit Identification
  Reference: USDA, Soil Conservation Service, Soil Survey of Maricopa County, Arizona Central Part
- 109 Soil Unit Identification
  Reference: USDA, Soil Conservation Service, Soil Survey of Aguila-Carefree Area Parts of Maricopa and Pinal Counties, Arizona

SOILS MAP

PLATE 3
JUNE 11, 1992

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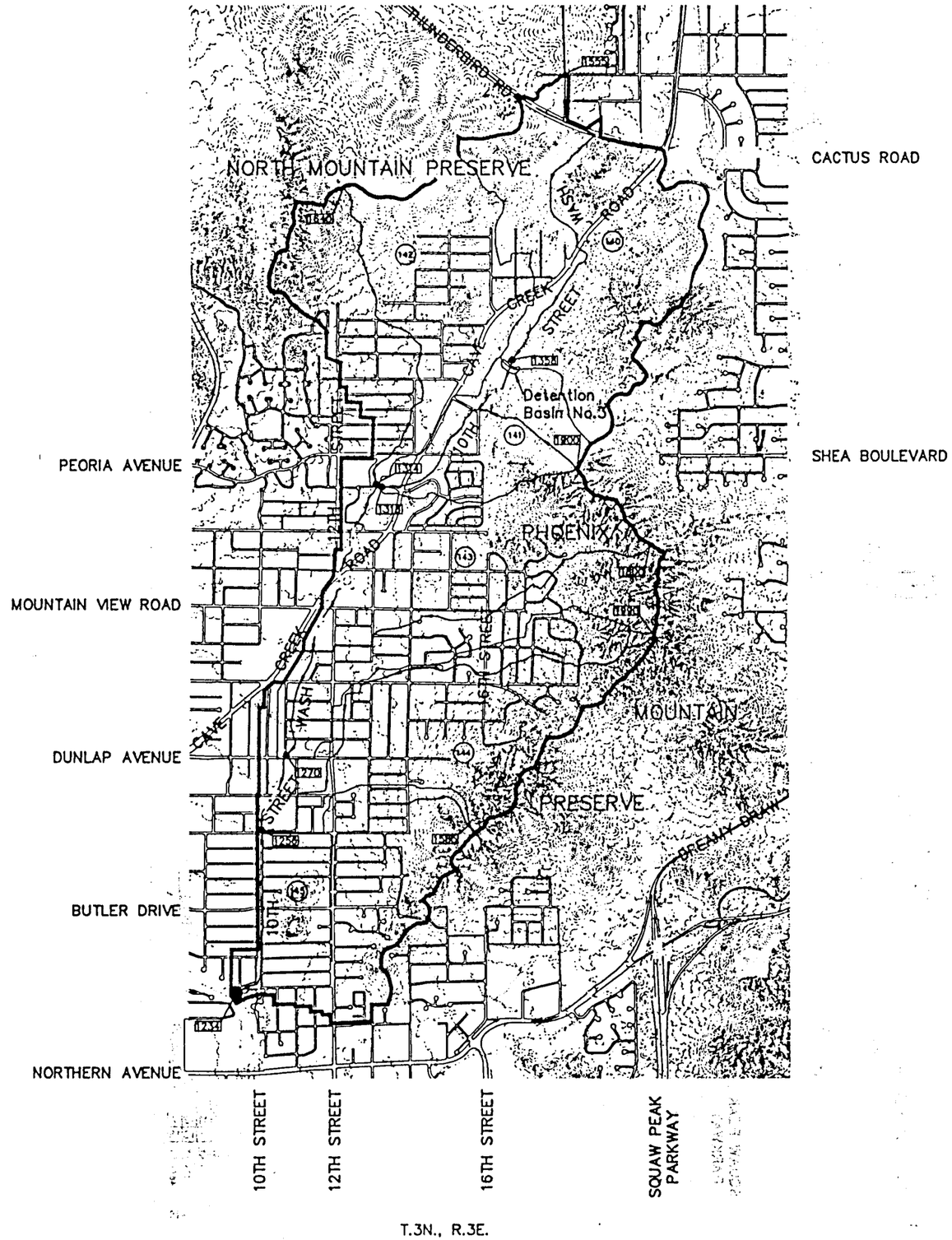

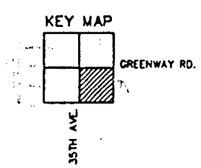

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		11	12	7	8	9	10	11	12	7	8	GREENWAY RD.
		4	13	18	17	16	15	14	13	18	17	THUNDERBIRD RD.
												CACTUS RD.
PEORIA AVE.	23	24	19	20	21	22	23	24	19	20		SHEA BLVD.
DUNLAP AVE.	26	25	30	29	28	27	26	25	30	29		DOUBLE TREE RANCH RD.
	35	36	31	32	33	34	35	36	31	32		NORTHERN AVE.
GLENDALE AVE.	2	1	6	5	4	3	2	1	6	5		INDIAN BEND RD.
BETHANY HOME RD.	11	12	7	8	9	10	11	12	7	8		MC DONALD DR.
CAMELBACK RD.	14	13	18	17	16	15	14	13	18	17		CHAPARRAL RD.
	35TH AVE.	27TH AVE.	19TH AVE.	7TH AVE.	7TH ST.	16TH ST.	24TH ST.	32ND ST.	40TH ST.	48TH ST.	56TH ST.	

DATE FLOWN: 11-15-1990

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH HYDROLOGY STUDY

LEGEND

- Major Drainage Basin Boundary
- Drainage Sub-Basin Boundary
- (140) Drainage Sub-Basin Number
- Major Drainage Basin Concentration Point
- Drainage Sub-Basin Concentration Point
- Routing Flow Path
- Length of Longest Watercourse
- 1514 Elevation Along Flow Path

FLOW ROUTING MAP

PLATE 4
JUNE 11, 1992

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4550 N. BLACK CANYON HWY., SUITE C
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N

SCALE
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FEET

CONTOUR INTERVAL 10 FEET

SECTION VIII

HEC-1 Data Files On Computer Diskette