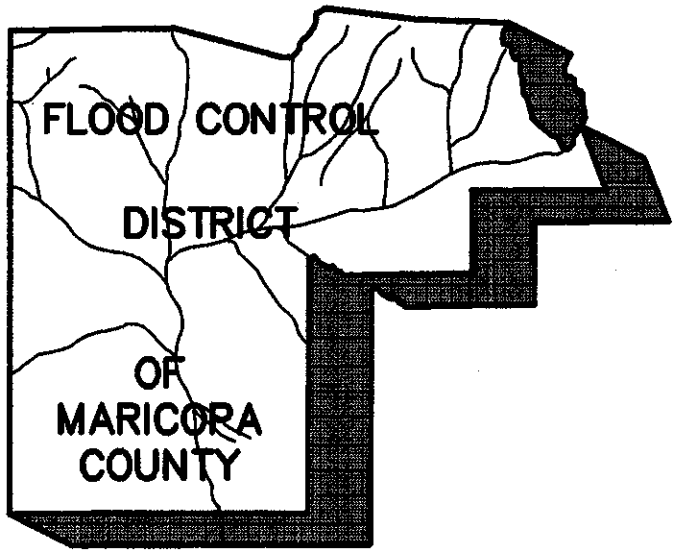
10TH STREET WASH TO CAVE CREEK WATERSHED

VOLUME 1.6

ARIZONA CANAL DIVERSION CHANNEL AREA DRAINAGE MASTER STUDY

ACDC/ADMS PHASE 1



HYDROLOGY REPORT

NOVEMBER 1994

KAMINSKI HUBBARD engineering, inc.

SURVEYING * CIVIL * HYDROLOGY

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

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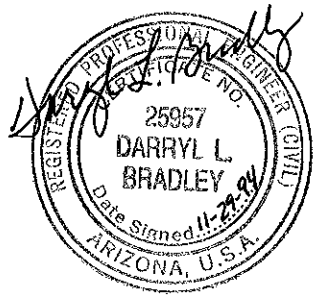

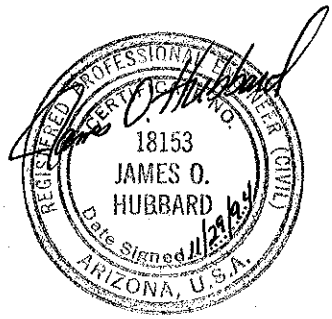

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10TH STREET WASH TO CAVE CREEK WATERSHED HYDROLOGY REPORT

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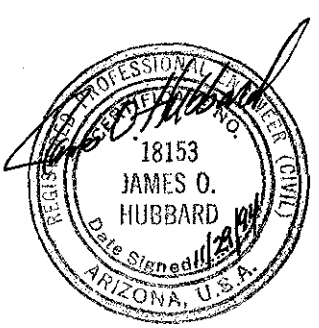

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1.0 SYNOPSIS

Kaminski-Hubbard Engineering, Inc. (KHE) was retained by the Flood Control District of Maricopa County (FCDMC) to prepare a comprehensive hydrologic analysis of the watershed contributing to the Arizona Canal Diversion Channel (ACDC) from 10th Street Wash to Cave Creek for existing and future conditions. This study area, as indicated in Figure 1, is one of several subwatersheds analyzed as a part of the ACDC Area Drainage Master Study (ADMS). This watershed drains the southern portion of the Phoenix Mountains, namely Shaw Butte and North Mountain, from the Cave Creek boundary on the west to the 10th Street Wash boundary on the east.

The study area has a total watershed area contributing to the ACDC of approximately 4.88 square miles. Within the watershed, six sub-basin area groupings were defined to address the precipitation depth/areal reduction issue for side inflow to the ACDC. The size of area groupings ranged between 0.19 square miles to 1.30 square miles.

There are two existing detention basins within the watershed that reduce the amount of runoff from the Phoenix Mountains reaching the ACDC. The watershed also contains an extensive network of storm drain systems that collect and convey storm runoff to the ACDC. However, there are two trunk lines that divert runoff out of the watershed along its western boundary to Cave Creek.

This report presents the hydrologic analysis of the 10th Street Wash to Cave Creek Watershed for both existing and future conditions upstream of the ACDC. Table 1 summarizes the controlling peak discharges for existing conditions at specific locations along the ACDC. Table 2 presents the controlling peak discharges for future conditions.

TABLE 1

Controlling Peak Discharge (Existing Conditions)

Location	Drainage Area (Sq. Mi.)	2-Yr. (cfs)	10-Yr. (cfs)	100-Yr. (cfs)
7th Street	0.79	81	319	619
Central Avenue	0.96	316	1,235	2,402
7th Avenue	0.46	136	506	961
15th Avenue	1.17	146	544	1,018
19th Avenue	1.30	90	873	1,935
21st Avenue	0.19	55	168	309

TABLE 2

Controlling Peak Discharge (Future Conditions)

Location	Drainage Area (Sq. Mi.)	2-Yr. (cfs)	10-Yr. (cfs)	100-Yr. (cfs)
7th Street	0.79	87	327	628
Central Avenue	0.96	332	1,261	2,435
7th Avenue	0.46	164	550	1,009
15th Avenue	1.17	166	566	1,056
19th Avenue	1.30	111	937	2,031
21st Avenue	0.19	61	169	310

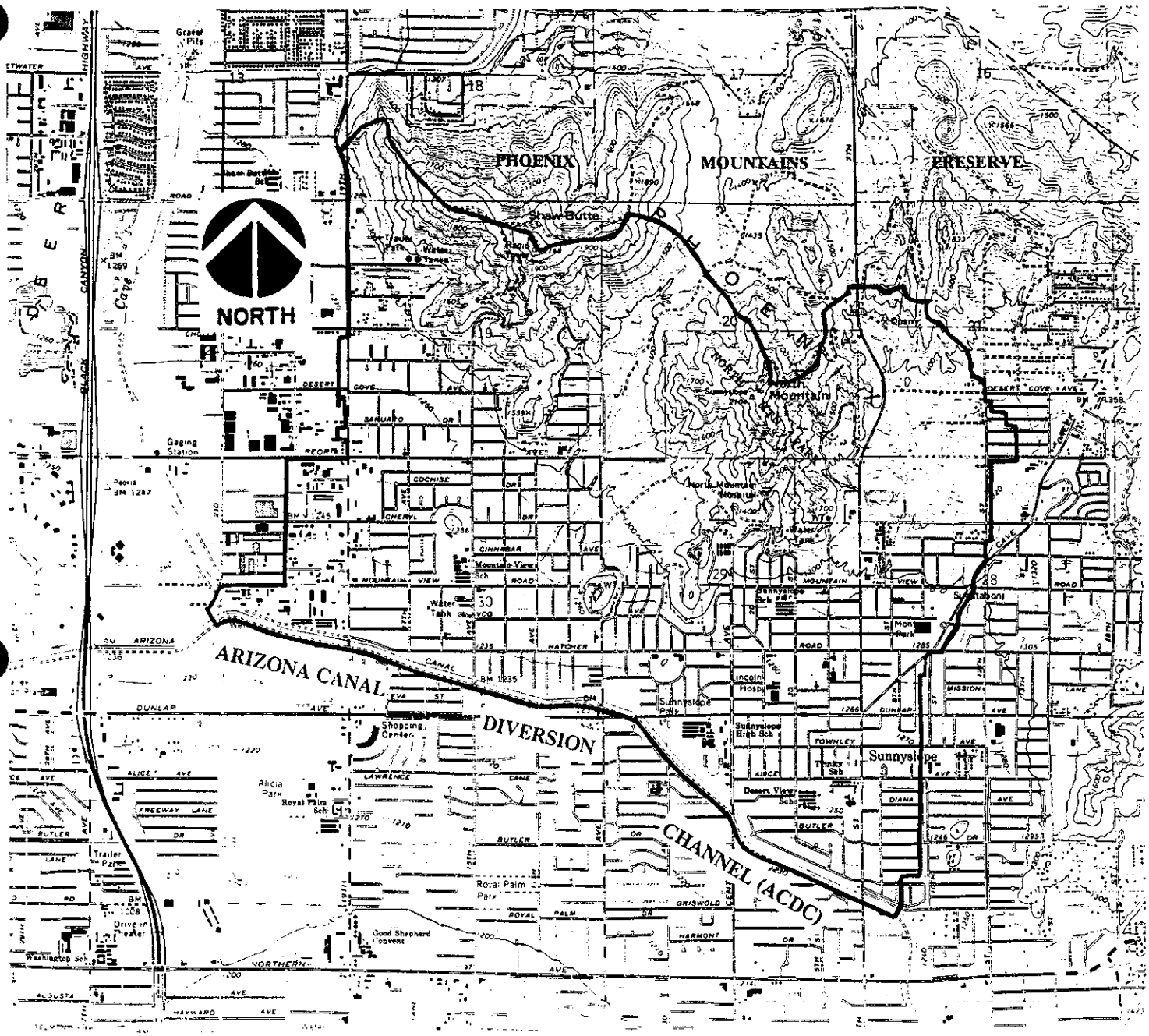

FIGURE 1 - VICINITY MAP

2.0 INTRODUCTION

A hydrologic analysis of the 10th Street Wash to Cave Creek watershed for both existing and future conditions was developed 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. The majority of flows contributing to the ACDC originate from the Phoenix Mountains and Sunnyslope area. The watershed is bounded by the Cave Creek boundary to the west and the 10th Street Wash boundary to the east.

The watershed contains two existing detention basins that significantly affect the amount of runoff reaching the ACDC. The watershed also contains a network of storm drain systems that either divert flows from one sub-basin into another sub-basin or completely out of the watershed. Previous hydrologic investigations of the watershed were reviewed for historical, as well as, hydrological information which could be used in our analysis.

This report presents the existing and future hydrologic analysis for the watershed contributing to the ACDC from 10th Street Wash to Cave Creek. The hydrology was developed using the FCDMC's new design criteria and included reservoir routing of existing detention basins.

3.0 STUDY PARAMETERS

3.1 Study Area

The watershed contributing storm runoff to the ACDC from 10th Street Wash to Cave Creek contains approximately 4.88 square miles. The watershed is bounded by the Phoenix Mountains to the north, the 10th Street Wash boundary to the east, the ACDC to the south, and the Cave Creek boundary to the west. The watershed is characterized by moderate to steep mountains to the north and a high degree of the development at the mountain base.

The watershed was divided into six sub-basin area groupings having concentration points at the ACDC. The contributing areas at each concentration point range between 0.19 square miles to 1.30 square miles. The three most easterly sub-basin area groupings are located in what is referred to as the Sunnyslope drainage area. This area has an extensive storm drain network that influenced the overall hydrologic makeup and sub-basin delineation.

The sub-basin area group west of the Sunnyslope drainage area contained the two existing detention basins that controlled the flow leaving the Phoenix Mountains. The next westerly basin contained the storm drain pipes which diverted flows out of the watershed to Cave Creek.

3.2 Mapping

The available mapping utilized in this study are as follows:

1. **FCDMC Mapping:** The watershed was flown as a 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 between November 1990 and February 1991. These maps were used to establish the sub-basin drainage delineation, flow patterns, and storage volume calculations for detention facilities. The aerial maps were also utilized to provide land use information for existing conditions.

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. **Construction Plans:** Construction plans for drainage structures associated with Cholla Street, Peoria Avenue, Mountain View Road, Hatcher Road, Dunlap Avenue, Cave Creek Road, 7th Street, Central Avenue, 7th Avenue, 15th Avenue, 19th Avenue, and 23rd Avenue were used for routing and sub-basin delineation purposes. Construction plans for the Shaw Butte Flood Detention Dams were utilized for reservoir routing purposes. Construction plans for the ACDC were used to determine sub-area grouping concentration points.

6. **General Plan for Phoenix:** This general plan was used to determine the extent of future development. Areas of future parks, open-spaces, and traffic corridors were considered during the future hydrologic analysis.

7. **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-hour 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 Clark Unit Hydrograph method will be utilized;

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

7. The Maricopa County Unit Hydrograph Procedure 1 (MCUHP1) computer program, as provided by the FCDMC, will be used to compute times of concentration and storage coefficients for the Clark Unit Hydrograph Method.

8. Rainfall distributions and depth-area relations for the 6-hour storm duration will be based on NOAA HYDRO-40 (Ref. 13) and COE (Ref. 7) data, as presented in the FCDMC's Drainage Design Manual (Ref. 6). This data is included in the MCUHP1 program to develop areal reduction for the watershed.

9. 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. 13). This data is included in the MCUHP1 program.

10. Existing and future flow rates are to be determined.

11. Transmission losses will be estimated based on existing field data or literature. Existing field data or literature was not available to estimate infiltration losses. Due to this study's detailed determination for the watershed roughness coefficient (Kb), the exclusion of transmission losses has little impact on the flow peaks and volumes.

4.0 HYDROLOGY

4.1 General

The existing and future hydrology for the 10th Street Wash to Cave Creek watershed was analyzed for the 2-, 10-, and 100-year frequency storms. The 6- and 24-hour storm durations were evaluated for all three storms. The 10th Street Wash to Cave Creek watershed was modeled using the COE HEC-1 computer program. The May, 1991, version of HEC-1 was used for this study. The Clark Unit Graph, the Green-Ampt Loss Rate, and the Muskingum-Cunge Routing options were used in the HEC-1 computer model. The HEC-1 modeling also included allowances for routing hydrographs through detention basins using the Modified Puls Method. This section describes the assumptions and methodologies used to develop the HEC-1 computer model for existing and future conditions within the 10th Street Wash to Cave Creek watershed.

4.2 Previous Hydrologic Investigations

Previous hydrologic investigations of the watershed were reviewed for historical, as well as, hydrologic information that could be used as part of our analysis for both existing and future conditions. Particular attention was given to hydrologic modeling techniques, sub-basin delineation, storm frequency and duration, reach routing methods, location of concentration points, treatment of detention basin areas, and location of future drainage structures. A brief summary of previous investigations performed within the 10th Street Wash to Cave Creek watershed are presented below.

Sunnyslope Master Drainage Plan (Ref. 3)

In 1981, a Master Drainage Plan for the Sunnyslope Area was performed by the City of Phoenix Engineering Department. The study area was bounded by the 10th Street Wash boundary, the ACDC, 7th Avenue, and the ridge line of North Mountain. This area drains approximately 2.2 square miles of mountainous and urbanized areas.

This study utilized the Soil Conservation Service (SCS) TR-20 computer model to predict the magnitude of runoff from the study area. The major design assumption is that the ACDC was built and all storm drains in the study area will drain into the ACDC for the 2-year storm frequency. No onsite retention was assumed on residential lots and mountainous areas were assigned a curve number of 98. The peak discharge results were used to design a storm drain system for the study area.

Storm Drain Design for Cholla Street, 19th Avenue to Cave Creek Wash (Ref. 16)

In 1981, a storm drain design for Cholla Street from 19th Avenue to Cave Creek Wash was developed by Wadsworth, Jensen & Associates for the City of Phoenix. The study area was bounded by Cactus Road, 19th Avenue, Cholla Street, and Cave Creek Wash. The pipe size and grade was established for the Cholla Street storm sewer trunk line by using flows furnished by the City of Phoenix. At Cholla Street and 23rd Avenue, the 2-year design flow was 210 CFS. The City of Phoenix Storm Drain Design manual was used for design purposes.

Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum No. 2, Hydrology Part 2 (Ref. 8)

In 1982, a hydrologic investigation was performed by the COE for flood control projects in the Phoenix area. The COE procedure of watershed modelling is to determine the Standard Project Flood (SPF) that would result from the most severe combination of meteorologic and hydrologic conditions that are considered reasonable for the area. The lesser storm frequency events are calculated as a percentage of the SPF. As an example, the 100-year peak discharge is 45 percent of the SPF.

The 10th Street Wash to Cave Creek Watershed was analyzed as one sub-basin having an area of approximately 5.22 square miles. The basin Mannings roughness n-value was 0.040 with an impervious cover of 50 percent for fully developed conditions. The COE used the Phoenix Valley S-Graph to generate the basin hydrograph.

4.3 Parameter Estimation

4.3.1 Drainage Area Boundaries

The initial delineation of sub-basins for the 10th Street Wash to Cave Creek watershed was developed using information presented in the Sunnyslope Master Drainage Plan (Ref. 3). Next, this initial delineation was evaluated using the new 1 inch to 400 feet topographic and aerial maps flown as a part of this study. Particular attention was given to the areas contributing to detention basins. The initial delineation was also supplemented by construction drawings of major storm drain facilities in the study area.

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 during time of concentration calculations for each sub-basin. The field investigations also included the determination of onsite retention locations and non-contributing areas within the watershed. The non-contributing areas were evaluated for each storm frequency. A parcel area labeled as non-contributing for a two-year storm may be contributing for a 10- and 100-year storm analysis.

The sub-basins were delineated so that concentration points were provided at major street intersections and impoundment areas. Concentration points were also located such that comparisons could be made with other hydrologic investigations. The major concentration points along the ACDC were chosen at intersections with major collector streets based on sub-basin area groupings. The sub-basin delineations are presented in Plate 1.

The drainage delineation for future conditions was the same as existing conditions. The watershed is almost fully developed with the remaining vacant areas located within the Phoenix Mountain Preserve. There are no plans in the future to construct any new detention basins for the Phoenix Mountains. Therefore, the drainage delineation presented in Plate 1 would also be applicable for future conditions.

4.3.2 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 MCUHP1 program. The SCS Type II distribution was used for the 24-hour storm. The rainfall distributions are presented in Tables 7 & 8 in Section I of the Appendix.

Precipitation Data

The point precipitation values were obtained using the NOAA Atlas isopluvial maps for Maricopa County, Arizona. The point precipitation values are presented in Table 5 in Section I of the Appendix.

Areal Reduction Factors

The point precipitation values used for the various sub-basin area groupings were adjusted to account for the reduction in precipitation depth over a spatial 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 MCUHP1 program. The 24-hour storm reduction factors were obtained from the NOAA Technical Memorandum NWS HYDRO-40 (Ref. 13). These factors are presented in Table 6 in Section I of the Appendix.

4.3.3 Physical Parameters

Loss Rate Estimation

The Green-Ampt loss rate method in HEC-1 was used to estimate rainfall losses for both existing and future conditions. 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 volumetric 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 Survey (Ref. 10) 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. The soil units within each sub-basin are shown on Plate 3 for both existing and future conditions. 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 in Drainage Design Manual (Ref. 6).

The computed Green-Ampt parameters 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. The various land uses categories within each sub-basin are shown on Plate 2 for existing conditions and Plate 5 for future conditions. 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 Survey (Ref. 10). 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 and are presented in Table 9 in Section I of the Appendix.

The total "percent impervious" value for each sub-basin was computed as a summation of the above two "percent impervious" values. This computation was also incorporated into the Green-Ampt Loss Parameter spreadsheet. The average Green-Ampt parameters for existing and future conditions are presented in Tables 10 and 11, respectively, in Section II of the Appendix.

Time Of Concentration

The Clark Unit Hydrograph method requires the estimation of the time of concentration, T_c. The following empirical equation was used to compute the time of concentration as a function of watershed characteristics (Ref. 6):

$$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$$

where:

T_c = time of concentration, in hours.

L = length of the flow path for T_c, in miles.

K_b = representative watershed resistance coefficient.

S = watercourse slope, in feet/mile.

i = the average rainfall excess intensity, during the time T_c, in inches/hour.

The length of the flow path for T_c and its corresponding slope within each sub-basin were determined using 1 inch to 400 feet topographic maps. Street flow patterns observed from the field investigations were also used to determine the flow path for T_c considerations. The MCUHP1 program, as provided by the FCDMC, was used to calculate the time of concentration, T_c, and storage coefficient, R, for each sub-basin.

The watershed resistance coefficients, K_b, necessary to determine T_c was estimated using the following equation (Ref. 6):

$$K_b = m \log A + b$$

where:

K_b = watershed resistance coefficient.

A = drainage area, in acres.

m&b = parameters dependent on land use and vegetation cover.

The watershed resistance coefficient, K_b, for each sub-basin was weighted to account for varying roughness conditions associated with mixed land use classifications. The land use classifications within each sub-basin were categorized into roughness types using the descriptions presented in Table 5.1 (Ref. 6). All vacant areas were placed under the category of moderately high roughness (Type C). Low and very low density residential areas were labelled as having moderately low roughness (Type B). Medium density and multi-family residential areas were placed under the category of minimal roughness (Type A).

The time of concentration flow paths for existing and future conditions are presented in Plate 4. The hydrologic sub-basin characteristics for existing conditions are presented in Tables 12, 13 and 14 in Section III of the Appendix. The characteristics for future conditions are presented in Tables 16, 17 and 18 in Section III of the Appendix.

4.3.4 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 for existing and future conditions are presented in Plate 4. 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 resistance coefficient, not including transmission losses has little impact on the flow peaks and volumes.

Reservoir Routing

The Modified Puls method was used for reservoir routing through a detention basin. There are two detention basins, which are impounded behind the Shaw Butte Flood Detention Dams, that control the amount of runoff from the Phoenix Mountains. Both detention basins are drained by 27-inch diameter concrete pipes having 13-inch by 12-inch orifice inlets. The easterly basin is impounded by the East Park Dam, which has a 50 foot emergency spillway. The westerly basin is impounded by the West Park Dam, which has a 115 foot emergency spillway. Storage volumes were determined using 1 inch to 400 feet topographic maps.

The detention storage calculations for the above basins are presented in Section IV of the Appendix. Section IV also contains the pipe and weir flow parameters used for the reservoir routing option.

4.4 Special Considerations

4.4.1 Flow Splits

Flow splits are a major problem to consider when evaluating storm runoff at major street intersections. The intersection of Dunlap Avenue, Cave Creek Road, and 7th Street was analyzed as a possible flow split location. The Cave Creek Road to Dunlap Avenue crown runs westerly through the 7th Street intersection. However, 7th Street from the north has its crown intersecting the westerly crown along Cave Creek Road such that the northeast quadrant of the intersection is in a sump condition. When this intersection is flooded, flows will predominantly break out westerly along Dunlap Avenue. However, surface flows in addition to pipe flow will break out south and continue along 7th Street to the ACDC. Therefore, it was necessary to estimate how much flow will continue west along Dunlap Avenue.

The flow split was analyzed by treating the intersecting roadway crowns as overflow weir sections. Pipe flows were also considered when generating a rating curve to determine the conveyance capacity of each breakout direction. The flow split calculations are presented in Section V of the Appendix.

4.4.2 Storm Drain Pipes

There are five (5) locations where flow was diverted out of the watershed or diverted from one sub-basin into another using storm drains. These locations are as follows:

1. The 7th Street Storm Drain at Mountain View Road;
2. The 7th Street Storm Drain at Dunlap Avenue;
3. The Cave Creek Road Storm Drain at 7th Street;
4. The 19th Avenue Storm Drain at Cholla Street; and
5. The 19th Avenue Storm Drain at Peoria Avenue.

At Location 1, the 7th Street Storm Drain collects and conveys the 2-year peak discharge from Sub-Basin No. 150 south into Sub-Basin No. 151 along 7th Street to Hatcher Road, then west into Sub-Basin No. 153 along Hatcher Road to Central Avenue and south along Central Avenue to Dunlap Avenue. Flows in excess of the design capacity at Location 1 does not flow south along 7th Street, but westerly through residential streets to the intersection of Central Avenue and Dunlap Avenue.

The pipe at Location 2 collects and conveys the 2-year design flows contributing from an area east of 7th Street between Hatcher Road and Cave Creek Road. This location was involved in a flow split which was discussed previously for the Dunlap Avenue, Cave Creek Road, and 7th Street intersection. This 18-inch diameter pipe was found to convey approximately 9 cfs west along Dunlap Avenue (Ref. 3). This outflow was included in the split flow calculations for breakout flows heading west along Dunlap Avenue.

The pipe at Location 3 collects the 2-year design flows contributing to Cave Creek Road and conveys the flows south along 7th Street to the ACDC. This location was involved in a flow split which was discussed previously for this intersection. This 24-inch diameter pipe was found to convey approximately 27 cfs south along 7th Street (Ref. 3). This flow was included in the split flow calculations for breakout flows heading south along 7th Street.

The 19th Avenue Storm Drain at Location 4 collects the 2-year storm runoff east of 19th Avenue between the Phoenix Mountains and Cholla Street. This 78-inch diameter pipe was found to divert approximately 210 cfs westerly along Cholla Street to Cave Creek (Ref. 16). Flows in excess of the design capacity continue to flow south along 19th Avenue to Peoria Avenue.

At Location 5, the 19th Avenue Storm Drain diverts the contributing runoff out of the watershed along Peoria Avenue. This 78-inch diameter pipe was found to convey approximately 180 cfs to Cave Creek. Flows in excess of this capacity continue to flow southward along 19th Avenue to the ACDC.

For Locations 4 and 5, flows were diverted out of the watershed and into the Cave Creek watershed. Instead of modelling each divert option separately, they were combined into one divert card to address flows diverted from Sub-Basin No. 160. Flows in excess of the combined divert capacity continued to flow south along 19th Avenue to the ACDC.

4.4.3 Onsite Retention

The City of Phoenix requires that all new developments retain the 100-year 2-hour duration storm volume which falls onsite. Field investigations within the watershed found that a majority of lots had no onsite retention or minimal retention at best. A few commercial and industrial sites constructed in the last few years had complied with the 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-year or 100-year volumes. Therefore, the retention volume for the parcels in question 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 onsite volume computations were automatically labeled as non-contributing for a 2-year storm. 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.

5.0 RESULTS AND CONCLUSIONS

The HEC-1 computer model was used to compute the 2-, 10-, and 100-year peak discharges for existing and future conditions within the 10th Street Wash to Cave Creek watershed. The 6-hour and 24-hour events were evaluated using the Clark Unit Hydrograph method for each storm frequency. The hydrologic analysis for both existing and future conditions was developed through the consolidation of previous hydrologic investigations and verifying or updating that information with new topographic mapping and our own field investigations.

The existing peak discharge results for the 10th Street Wash to Cave Creek watershed are summarized in Table 3. The future peak discharge results of this study are presented in Table 4. Evaluation of the results indicate that larger peak discharges occur from a 6-hour duration storm for all three (3) recurrence intervals.

The total watershed area contributing to the ACDC from 10th Street Wash to Cave Creek is approximately 4.9 square miles. However, this study was interested only in side inflows to the ACDC and not the combining and routing of flows within the ACDC. Therefore, sub-basin area groupings were developed to determine the contributing areas at six inflow locations along the ACDC. These sub-basin area groupings were also used for precipitation depth/areal reduction purposes.

Two detention basins within the watershed were found to have sufficient capacity to detain the 100-year storm runoff. These detention basins provide flood protection against storm runoff from the Phoenix Mountains for residential and commercial areas. Low level outflows from these basins were routed downstream and did not significantly contribute to the downstream peak discharges.

Two storm drain pipe systems, one along Cholla Street and the other along Peoria Avenue, divert storm runoff westerly from 19th Avenue into the Cave Creek watershed. The total diversion of the two storm drains is approximately 390 CFS with the excess continuing to flow southerly along 19th Avenue to the ACDC.

TABLE 3

Existing Peak Discharges
At ACDC (CFS)

Location	HEC-I.D.	2-Year		10-Year		100-Year		100-Year 24-Hour Time To Peak (Hrs.)
		6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.	
7th Street	152DC	81	54	319	177	619	418	12.13
Central Avenue	154DC	316	183	1,235	846	2,402	1,771	12.13
7th Avenue	156DC	136	73	506	280	961	584	12.07
15th Avenue	159DC	146	99	544	368	1,018	771	12.07
19th Avenue	161DC	90	64	873	493	1,935	1,449	12.13
21st Avenue	162DC	55	35	168	102	309	209	12.20

TABLE 4

Future Peak Discharges
At ACDC (CFS)

Location	HEC-I.D.	2-Year		10-Year		100-Year		100-Year 24-Hour Time To Peak (Hrs.)
		6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.	
7th Street	152DC	87	57	327	183	628	425	12.13
Central Avenue	154DC	332	189	1,261	863	2,435	1,811	12.13
7th Avenue	156DC	164	90	550	301	1,009	615	12.07
15th Avenue	159DC	166	112	566	375	1,056	795	12.07
19th Avenue	161DC	111	80	937	513	2,031	1,502	12.13
21st Avenue	162DC	61	38	169	103	310	210	12.20

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APPENDIX

SECTION I	Rainfall and Physical Hydrologic Parameters
SECTION II	Green-Ampt & Land Use Parameters
SECTION III	Hydrologic Sub-Basin Characteristics
SECTION IV	Hydrograph Routing Parameters
SECTION V	Divert & Onsite Retention Parameters
SECTION VI	HEC-1 Hydrology Results, 100-Year 24-Hour Storm (Existing Conditions)
SECTION VII	HEC-1 Hydrology Results, 100-Year 24-Hour Storm (Future Conditions)
SECTION VIII	Plates 1-5
SECTION IX	HEC-1 Data Files On Computer Diskette

SECTION I

Rainfall & Physical Hydrologic Parameters

TABLE 5

Point Precipitation Values For 10th Street Wash To Cave Creek Study Area (Inches)

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

Source: NOAA Atlas Isopluvial Maps For Arizona

TABLE 6

Areal Precipitation Reduction Data

Watershed Area (Sq. Mi.)	Storm Duration (Hours)	
	6[1]	24[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
40	0.87	0.89

[1] Drainage Design Manual For Maricopa County, (Ref. 6)

[2] NOAA Technical Memorandum NWS HYDRO-40, (Ref. 13)

TABLE 7

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	0.00	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 8

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

Storm Time (Hours)	Precipiation 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)	Precipiation 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

TABLE 9

Percent Impervious Estimates For Zoning/Land Use Classifications

Zoning Unit	Zoning Description	Land Use Description	Land Use Unit	Percent Impervious
S-1	Ranch or Farm Res.	Very Low Density Residential	V.L.D.R. or VLO RES	15
S-2	Ranch or Farm Commercial			
RE-43	Single Family, 1 acre min.			
RE-35	Single Family, 35000 S.F. min.	Low Density Residential	L.D.R. or LO RES	25
RE-24	Single Family, 24000 S.F. min.			
RI-18	Single Family, 18000 S.F. min.			
RI-14	Single Family, 14000 S.F. min.			
RI-10	Single Family, 10000 S.F. min.	Medium Density Residential	M.D.R. or MED RES	45
RI-8	Single Family, 8000 S.F. min.			
RI-6	Single Family, 6000 S.F. min.			
R-0	Residential Office			
R-2	Multi-Family, 4000 S.F. per unit	Multiple Density Residential	M.F.R. or MF RES	65
R-3	Multi-Family, 3000 S.F. per unit			
R-3A	Multi-Family			
R-4	Multi-Family, 1500 S.F. per unit			
R-4A	Multi-Family, 1000 S.F. per unit			
R-5	Multi-Family, 1000 S.F. per unit			
CP/BP	Business Park			
R-H	Resort District			
C-1	Neighborhood Commercial	Commercial	COMM or COMM.	90
C-2	Intermediate Commercial			
C-3	General Commercial			
C-O	Commercial Office/Restricted Comm.			
H-R	High Rise District			
CP/GCP	General Commerce Park			
IND PARK	Industrial Park	Industrial	IND or INDUST.	75
A-1	Light Industrial			
A-2	Heavy Industrial			
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

SECTION II

Green-Ampt & Land Use Parameters

Green-Ampt Parameters
(Existing Condition)

TABLE 10

Average Green Ampt Parameters
Existing Conditions

Sub-Basin I.D.	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)
150	0.129	0.313	3.81	0.279	44.17
151	0.118	0.276	3.50	0.288	54.96
152	0.102	0.254	4.30	0.460	59.70
153	0.106	0.262	3.50	0.287	64.90
154	0.100	0.254	4.24	0.447	56.66
156	0.117	0.285	3.66	0.324	53.28
157	0.150	0.350	4.03	0.408	34.09
158	0.150	0.360	3.81	0.280	23.86
159	0.120	0.294	5.36	0.224	44.29
160	0.126	0.301	3.66	0.325	50.82
161	0.103	0.256	4.12	0.265	61.73
162	0.100	0.257	3.66	0.309	78.49

LOSS PARAMETERS FOR SUBBASIN: 150

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.134	46.32	0.4	-0.184	65.00	30.11
TrB	0.125	43.17	0.13	-0.382	0.00	0.00
CO	0.029	9.87	0.29	-0.053	20.00	1.97
CrB	0.002	0.65	0.4	-0.003	0.00	0.00
TOTAL =	0.289 SQ.MI.		XKSAT =	0.24	%ROCK=	32.08

DTHETA

Dry =	0.36
Normal =	0.25
Wet =	0

PSIF

=	3.81

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.167	VACANT	57.66	DRY	25.00	0.00	0.00	0.15	0.086
0.063	M.F.R.	21.93	NORMAL	25.00	65.00	0.04	0.10	0.022
0.049	M.D.R.	17.11	NORMAL	25.00	45.00	0.02	0.10	0.017
0.010	COMM	3.30	NORMAL	20.00	90.00	0.01	0.10	0.003
0.289	=TOTAL AREA	OK	AVERAGE =	24.84	TOTAL =	0.07	AVG. =	0.129
					% =	24.92		

PERCENT OF SUBBASIN

DRY =	57.66 %
NORMAL =	42.34 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.313

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.279

IMPERVIOUS AREA:

URBAN @	100 %	effective =	24.92
ROCK OUTCROP @	60 %	effective =	19.25
	% EFFECTIVE IMP. =		44.17

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
150	0.289	1.120	0.065	304.00	0.129	0.313	3.81	0.279	44.17

LOSS PARAMETERS FOR SUBBASIN: 151

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.231	38.18	0.13	-0.338	0.00	0.00
RS	0.088	14.47	0.4	-0.058	65.00	9.40
18	0.084	13.80	0.33	-0.066	15.00	2.07
AdA	0.082	13.47	0.4	-0.054	0.00	0.00
CrB	0.068	11.28	0.4	-0.045	0.00	0.00
RaA	0.047	7.81	0.39	-0.032	0.00	0.00
CO	0.006	1.00	0.29	-0.005	20.00	0.20
TOTAL =	0.606 SQ.MI.		XKSAT =	0.25	%ROCK=	11.67

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF = 3.5

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.145	VACANT	23.99	DRY	25.00	0.00	0.00	0.15	0.036
0.014	UTIL.	2.38	DRY	0.00	0.00	0.00	0.35	0.008
0.252	M.F.R.	41.57	NORMAL	25.00	65.00	0.16	0.10	0.042
0.107	M.D.R.	17.61	NORMAL	25.00	45.00	0.05	0.10	0.018
0.088	COMM	14.45	NORMAL	20.00	90.00	0.08	0.10	0.014
0.606	=TOTAL AREA	OK	AVERAGE =	23.68	TOTAL =	0.29	AVG. =	0.118
					% =	47.95		

PERCENT OF SUBBASIN DRY = 26.37 %
NORMAL = 73.63 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.276

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.288

IMPERVIOUS AREA:
URBAN @ 100 % effective = 47.95
ROCK OUTCROP @ 60 % effective = 7.00
% EFFECTIVE IMP. = 54.96

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
151	0.606	2.130	0.039	199.00	0.118	0.276	3.50	0.288	54.96

LOSS PARAMETERS FOR SUBBASIN: 152

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AdA	0.183	100.00	0.4	-0.398	0.00	0.00
TOTAL =	0.183 SQ.MI.		XKSAT =	0.40	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.35	=	4.3
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.
0.007	VACANT	3.70	DRY	25.00	0.00	0.00	0.15	0.006
0.038	M.F.R.	20.51	NORMAL	25.00	65.00	0.02	0.10	0.021
0.089	M.D.R.	48.53	NORMAL	25.00	45.00	0.04	0.10	0.049
0.050	COMM	27.26	NORMAL	20.00	90.00	0.04	0.10	0.027
0.183	=TOTAL AREA	OK	AVERAGE =	23.64	TOTAL =	0.11	AVG. =	0.102
					% =	59.70		

PERCENT OF SUBBASIN DRY = 3.70 %
NORMAL = 96.30 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.254

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.460

IMPERVIOUS AREA:
URBAN @ 100 % effective = 59.70
ROCK OUTCROP @ 60 % effective = 0.00
% EFFECTIVE IMP. = 59.70

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
152	0.183	0.890	0.030	39.00	0.102	0.254	4.30	0.460	59.70

LOSS PARAMETERS FOR SUBBASIN: 153

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.159	41.13	0.13	-0.364	0.00	0.00
RaA	0.097	25.28	0.39	-0.103	0.00	0.00
AdA	0.049	12.76	0.4	-0.051	0.00	0.00
RS	0.044	11.49	0.4	-0.046	65.00	7.47
CO	0.023	5.89	0.29	-0.032	20.00	1.18
CrB	0.013	3.45	0.4	-0.014	0.00	0.00
TOTAL =	0.386 SQ.MI.		XKSAT =	0.25	%ROCK=	8.65

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF = 3.5

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.047	VACANT	12.18	DRY	25.00	0.00	0.00	0.15	0.018
0.120	M.F.R.	31.21	NORMAL	25.00	65.00	0.08	0.10	0.031
0.099	M.D.R.	25.60	NORMAL	25.00	45.00	0.04	0.10	0.026
0.120	COMM	31.01	NORMAL	20.00	90.00	0.11	0.10	0.031
0.386	=TOTAL AREA	OK	AVERAGE =	23.45	TOTAL =	0.23	AVG. =	0.106
					% =	59.71		

PERCENT OF SUBBASIN

DRY =	12.18 %
NORMAL =	87.82 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.262

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.287

IMPERVIOUS AREA:

URBAN @	100 %	effective =	59.71
ROCK OUTCROP @	60 %	effective =	5.19
	% EFFECTIVE IMP. =		64.90

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
153	0.386	1.240	0.033	279.00	0.106	0.262	3.50	0.287	64.90

LOSS PARAMETERS FOR SUBBASIN: 154

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AdA	0.183	64.99	0.4	-0.259	0.00	0.00
RaA	0.081	28.69	0.39	-0.117	0.00	0.00
GgA	0.018	6.32	0.25	-0.038	0.00	0.00
TOTAL =	0.282 SQ.MI.		XKSAT =	0.39	%ROCK=	0.00

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF = 4.24

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.012	ACDC	4.13	DRY	10.00	90.00	0.01	0.10	0.004
0.209	M.D.R.	74.10	NORMAL	25.00	45.00	0.09	0.10	0.074
0.061	COMM	21.77	NORMAL	20.00	90.00	0.06	0.10	0.022
0.282	=TOTAL AREA	OK	AVERAGE =	23.29	TOTAL =	0.16	AVG. =	0.100
					% =	56.66		

PERCENT OF SUBBASIN

DRY =	4.13 %
NORMAL =	95.87 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.254

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.447

IMPERVIOUS AREA:

URBAN @	100 %	effective =	56.66
ROCK OUTCROP @	60 %	effective =	0.00
	% EFFECTIVE IMP. =		56.66

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
154	0.282	0.810	0.026	33.00	0.100	0.254	4.24	0.447	56.66

LOSS PARAMETERS FOR SUBBASIN: 156

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.174	37.80	0.4	-0.150	65.00	24.57
TrB	0.104	22.57	0.13	-0.200	0.00	0.00
LcA	0.069	14.93	0.25	-0.090	0.00	0.00
RaA	0.061	13.34	0.39	-0.055	0.00	0.00
CO	0.017	3.61	0.29	-0.019	20.00	0.72
GgA	0.016	3.42	0.25	-0.021	0.00	0.00
CrB	0.010	2.13	0.4	-0.008	0.00	0.00
Es	0.009	1.91	0.25	-0.011	0.00	0.00
AdA	0.001	0.31	0.4	-0.001	0.00	0.00
TOTAL =	0.461 SQ.MI.		XKSAT =	0.28	%ROCK=	25.29

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF

= 3.66

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.159	VACANT	34.57	DRY	25.00	0.00	0.00	0.15	0.052
0.045	M.F.R.	9.76	NORMAL	25.00	65.00	0.03	0.10	0.010
0.185	M.D.R.	40.27	NORMAL	25.00	45.00	0.08	0.10	0.040
0.007	IND	1.46	NORMAL	20.00	75.00	0.01	0.10	0.001
0.064	COMM	13.95	NORMAL	20.00	90.00	0.06	0.10	0.014
0.461	=TOTAL AREA	OK	AVERAGE =	24.23	TOTAL =	0.18	AVG. =	0.117
					% =	38.11		

PERCENT OF SUBBASIN

DRY =	34.57 %
NORMAL =	65.43 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.285

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.324

IMPERVIOUS AREA:

URBAN @	100 %	effective =	38.11
ROCK OUTCROP @	60 %	effective =	15.17
	% EFFECTIVE IMP. =		53.28

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
156	0.461	1.830	0.047	298.00	0.117	0.285	3.66	0.324	53.28

LOSS PARAMETERS FOR SUBBASIN: 157

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.072	87.40	0.4	-0.348	65.00	56.81
TrB	0.010	12.60	0.13	-0.112	0.00	0.00
TOTAL =	0.083 SQ.MI.		XKSAT =	0.35	%ROCK=	56.81

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF

=	4.03

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.083	VACANT	100.00	DRY	25.00	0.00	0.00	0.15	0.150
0.083	=TOTAL AREA	OK	AVERAGE =	25.00	TOTAL =	0.00	AVG. =	0.150
					% =	0.00		

PERCENT OF SUBBASIN

DRY =	100.00 %
NORMAL =	0.00 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.350

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.408

IMPERVIOUS AREA:

URBAN @	100 %	effective =	0.00
ROCK OUTCROP @	60 %	effective =	34.09
	% EFFECTIVE IMP. =		34.09

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
157	0.083	0.540	0.107	320.00	0.150	0.350	4.03	0.408	34.09

LOSS PARAMETERS FOR SUBBASIN: 158

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.326	60.41	0.4	-0.240	65.00	39.27
EbD	0.137	25.34	0.1	-0.253	0.00	0.00
TrB	0.063	11.73	0.13	-0.104	0.00	0.00
CO	0.014	2.52	0.29	-0.014	20.00	0.50
TOTAL =	0.540 SQ.MI.		XKSAT =	0.24	%ROCK=	39.77

DTHETA

Dry =	0.36
Normal =	0.25
Wet =	0

PSIF = 3.81

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.540	VACANT	100.00	DRY	25.00	0.00	0.00	0.15	0.150
0.540	=TOTAL AREA	OK	AVERAGE =	25.00	TOTAL =	0.00	AVG. =	0.150
					% =	0.00		

PERCENT OF SUBBASIN

DRY =	100.00 %
NORMAL =	0.00 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.360

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.280

IMPERVIOUS AREA:

URBAN @	100	% effective =	0.00
ROCK OUTCROP @	60	% effective =	23.86
		% EFFECTIVE IMP. =	23.86

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
158	0.540	1.290	0.087	314.00	0.150	0.360	3.81	0.280	23.86

LOSS PARAMETERS FOR SUBBASIN: 159

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.316	57.53	0.13	-0.510	0.00	0.00
LcA	0.076	13.86	0.25	-0.083	0.00	0.00
CrB	0.046	8.40	0.4	-0.033	0.00	0.00
RS	0.045	8.18	0.4	-0.033	65.00	5.32
Es	0.043	7.73	0.25	-0.047	0.00	0.00
Ge	0.019	3.50	0.26	-0.020	0.00	0.00
CO	0.004	0.80	0.29	-0.004	20.00	0.16
TOTAL =	0.550 SQ.MI.		XKSAT =	0.19	%ROCK=	5.48

DTHETA		PSIF	
Dry =	0.38	=	5.36
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.
0.184	VACANT	33.55	DRY	25.00	0.00	0.00	0.15	0.050
0.193	M.F.R.	35.05	NORMAL	25.00	65.00	0.13	0.10	0.035
0.071	M.D.R.	12.91	NORMAL	25.00	45.00	0.03	0.10	0.013
0.046	IND	8.35	NORMAL	20.00	75.00	0.03	0.10	0.008
0.038	COMM	6.83	NORMAL	20.00	90.00	0.03	0.10	0.007
0.018	PARK	3.31	NORMAL	90.00	0.00	0.00	0.20	0.007
0.550	=TOTAL AREA	OK	AVERAGE =	26.39	TOTAL =	0.23	AVG. =	0.120
					% =	41.00		

PERCENT OF SUBBASIN
DRY = 33.55 %
NORMAL = 66.45 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.294

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.224

IMPERVIOUS AREA:
URBAN @ 100 % effective = 41.00
ROCK OUTCROP @ 60 % effective = 3.29
% EFFECTIVE IMP. = 44.29

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
159	0.550	1.620	0.045	274.00	0.120	0.294	5.36	0.224	44.29

LOSS PARAMETERS FOR SUBBASIN: 160

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.394	45.59	0.4	-0.181	65.00	29.63
TrB	0.198	22.88	0.13	-0.203	0.00	0.00
LcA	0.108	12.43	0.25	-0.075	0.00	0.00
AdA	0.051	5.91	0.4	-0.024	0.00	0.00
CO	0.049	5.70	0.29	-0.031	20.00	1.14
PsB	0.042	4.81	0.26	-0.028	0.00	0.00
Cp	0.021	2.38	0.4	-0.009	0.00	0.00
PeA	0.003	0.29	0.37	-0.001	0.00	0.00
TOTAL =	0.865 SQ.MI.		XKSAT =	0.28	%ROCK=	30.77

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF

= 3.66

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.445	VACANT	51.47	DRY	25.00	0.00	0.00	0.15	0.077
0.327	M.F.R.	37.74	NORMAL	25.00	65.00	0.21	0.10	0.038
0.031	M.D.R.	3.59	NORMAL	25.00	45.00	0.01	0.10	0.004
0.016	IND	1.80	NORMAL	20.00	75.00	0.01	0.10	0.002
0.047	COMM	5.40	NORMAL	20.00	90.00	0.04	0.10	0.005
0.865	=TOTAL AREA	OK	AVERAGE =	24.64	TOTAL =	0.28	AVG. =	0.126
					% =	32.36		

PERCENT OF SUBBASIN

DRY =	51.47 %
NORMAL =	48.53 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.301

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.325

IMPERVIOUS AREA:

URBAN @	100	% effective =	32.36
ROCK OUTCROP @	60	% effective =	18.46
		% EFFECTIVE IMP. =	50.82

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
160	0.865	1.440	0.053	314.00	0.126	0.301	3.66	0.325	50.82

LOSS PARAMETERS FOR SUBBASIN: 161

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LcA	0.286	65.25	0.25	-0.393	0.00	0.00
TrB	0.068	15.39	0.13	-0.136	0.00	0.00
Es	0.059	13.55	0.25	-0.082	0.00	0.00
RS	0.015	3.52	0.4	-0.014	65.00	2.28
CO	0.006	1.34	0.29	-0.007	20.00	0.27
AdA	0.004	0.95	0.4	-0.004	0.00	0.00
TOTAL =	0.439 SQ.MI.		XKSAT =	0.23	%ROCK=	2.55

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.
0.024	VACANT	5.58	DRY	25.00	0.00	0.00	0.15	0.008
0.163	M.F.R.	37.08	NORMAL	25.00	65.00	0.11	0.10	0.037
0.151	M.D.R.	34.47	NORMAL	25.00	45.00	0.07	0.10	0.034
0.100	COMM	22.87	NORMAL	20.00	90.00	0.09	0.10	0.023
0.439	=TOTAL AREA	OK	AVERAGE =	23.86	TOTAL =	0.26	AVG. =	0.103
					% =	60.20		

PERCENT OF SUBBASIN

DRY =	5.58 %
NORMAL =	94.42 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.256

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.265

IMPERVIOUS AREA:

URBAN @	100 %	effective =	60.20
ROCK OUTCROP @	60 %	effective =	1.53
	% EFFECTIVE IMP. =		61.73

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
161	0.439	1.420	0.028	41.00	0.103	0.256	4.12	0.265	61.73

LOSS PARAMETERS FOR SUBBASIN: 162

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LcA	0.117	60.24	0.25	-0.363	0.00	0.00
Mp	0.018	9.21	0.25	-0.055	0.00	0.00
Ge	0.015	7.91	0.26	-0.046	0.00	0.00
Cp	0.011	5.53	0.4	-0.022	0.00	0.00
Br	0.009	4.60	1.05	0.001	0.00	0.00
GgA	0.009	4.58	0.25	-0.028	0.00	0.00
RbA	0.009	4.48	0.26	-0.026	0.00	0.00
Tc	0.004	2.01	0.4	-0.008	0.00	0.00
Vh	0.001	0.74	0.27	-0.004	0.00	0.00
TD	0.001	0.70	1.2	0.001	0.00	0.00
TOTAL =	0.194 SQ.MI.		XKSAT =	0.28	%ROCK=	0.00

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF

= 3.66

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.001	VACANT	0.63	DRY	25.00	0.00	0.00	0.15	0.001
0.011	ACDC	5.90	DRY	10.00	90.00	0.01	0.10	0.006
0.142	IND	72.97	NORMAL	20.00	75.00	0.11	0.10	0.073
0.040	COMM	20.50	NORMAL	20.00	90.00	0.04	0.10	0.020
0.194	=TOTAL AREA	OK	AVERAGE =	19.44	TOTAL =	0.15	AVG. =	0.100
					% =	78.49		

PERCENT OF SUBBASIN

DRY =	6.53 %
NORMAL =	93.47 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.257

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.309

IMPERVIOUS AREA:

URBAN @	100 %	effective =	78.49
ROCK OUTCROP @	60 %	effective =	0.00
% EFFECTIVE IMP. =			78.49

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
162	0.194	1.160	0.027	19.00	0.100	0.257	3.66	0.309	78.49

Green-Ampt Parameters
(Future Condition)

TABLE 11

Average Green Ampt Parameters
Future Conditions

Sub-Basin I.D.	IA(in)	DTHETA	PSIF(in)	XKSAT (in/hr)	RTIMP (%)
150	0.129	0.313	3.81	0.279	44.17
151	0.117	0.275	3.50	0.288	55.80
152	0.100	0.250	4.30	0.458	62.93
153	0.105	0.260	3.50	0.287	65.98
154	0.100	0.250	4.19	0.433	57.96
156	0.113	0.277	3.66	0.323	58.28
157	0.150	0.350	4.03	0.408	34.09
158	0.147	0.354	3.81	0.280	26.47
159	0.117	0.286	5.36	0.224	48.16
160	0.121	0.292	3.66	0.325	57.38
161	0.101	0.252	4.12	0.264	64.41
162	0.100	0.257	3.66	0.307	79.71

LOSS PARAMETERS FOR SUBBASIN: 150 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.134	46.32	0.4	-0.184	65.00	30.11
TrB	0.125	43.17	0.13	-0.382	0.00	0.00
CO	0.029	9.87	0.29	-0.053	20.00	1.97
CrB	0.002	0.65	0.4	-0.003	0.00	0.00
TOTAL =	0.289 SQ.MI.		XKSAT =	0.24	%ROCK=	32.08

DTHETA

Dry =	0.36
Normal =	0.25
Wet =	0

PSIF

= 3.81

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.167	VACANT	57.66	DRY	25.00	0.00	0.00	0.15	0.086
0.063	M.F.R.	21.93	NORMAL	25.00	65.00	0.04	0.10	0.022
0.049	M.D.R.	17.11	NORMAL	25.00	45.00	0.02	0.10	0.017
0.010	COMM	3.30	NORMAL	20.00	90.00	0.01	0.10	0.003
0.289	=TOTAL AREA	OK	AVERAGE =	24.84	TOTAL =	0.07	AVG. =	0.129
					% =	24.92		

PERCENT OF SUBBASIN

DRY =	57.66 %
NORMAL =	42.34 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.313

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.279

IMPERVIOUS AREA:

URBAN @	100	% effective =	24.92
ROCK OUTCROP @	60	% effective =	19.25
		% EFFECTIVE IMP. =	44.17

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
150F	0.289	1.120	0.065	304.00	0.129	0.313	3.81	0.279	44.17

LOSS PARAMETERS FOR SUBBASIN: 151 (FUTURE)

Soil Survey Used AGUILA & CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.231	38.18	0.13	-0.338	0.00	0.00
RS	0.088	14.47	0.4	-0.058	65.00	9.40
18	0.084	13.80	0.33	-0.066	15.00	2.07
AdA	0.082	13.47	0.4	-0.054	0.00	0.00
CrB	0.068	11.28	0.4	-0.045	0.00	0.00
RaA	0.047	7.81	0.39	-0.032	0.00	0.00
CO	0.006	1.00	0.29	-0.005	20.00	0.20
TOTAL =	0.606 SQ.MI.		XKSAT =	0.25	%ROCK=	11.67

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF

=	3.5

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.138	VACANT	22.76	DRY	25.00	0.00	0.00	0.15	0.034
0.014	UTIL.	2.38	DRY	0.00	0.00	0.00	0.35	0.008
0.257	M.F.R.	42.49	NORMAL	25.00	65.00	0.17	0.10	0.042
0.107	M.D.R.	17.69	NORMAL	25.00	45.00	0.05	0.10	0.018
0.089	COMM	14.68	NORMAL	20.00	90.00	0.08	0.10	0.015
0.606	=TOTAL AREA	OK	AVERAGE =	23.67	TOTAL =	0.30	AVG. =	0.117
					% =	48.79		

PERCENT OF SUBBASIN

DRY =	25.14 %
NORMAL =	74.86 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.275

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.288

IMPERVIOUS AREA:

URBAN @	100 %	effective =	48.79
ROCK OUTCROP @	60 %	effective =	7.00
	% EFFECTIVE IMP. =		55.80

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
151F	0.606	2.130	0.038	199.00	0.117	0.275	3.50	0.288	55.80

LOSS PARAMETERS FOR SUBBASIN: 152 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AdA	0.183	100.00	0.4	-0.398	0.00	0.00
TOTAL =	0.183 SQ.MI.		XKSAT =	0.40	%ROCK=	0.00

DTHETA		PSIF
Dry =	0.35	= 4.3
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.
0.044	M.F.R.	24.09	NORMAL	25.00	65.00	0.03	0.10	0.024
0.087	M.D.R.	47.24	NORMAL	25.00	45.00	0.04	0.10	0.047
0.049	COMM	26.54	NORMAL	20.00	90.00	0.04	0.10	0.027
0.004	DRNWAY	2.13	NORMAL	0.00	100.00	0.00	0.10	0.002
0.183	=TOTAL AREA	OK	AVERAGE =	23.14	TOTAL =	0.12	AVG. =	0.100
					% =	62.93		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.458

IMPERVIOUS AREA:
URBAN @ 100 % effective = 62.93
ROCK OUTCROP @ 60 % effective = 0.00
% EFFECTIVE IMP. = 62.93

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
152F	0.183	0.890	0.027	39.00	0.100	0.250	4.30	0.458	62.93

LOSS PARAMETERS FOR SUBBASIN: 153 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.159	41.13	0.13	-0.364	0.00	0.00
RaA	0.097	25.28	0.39	-0.103	0.00	0.00
AdA	0.049	12.76	0.4	-0.051	0.00	0.00
RS	0.044	11.49	0.4	-0.046	65.00	7.47
CO	0.023	5.89	0.29	-0.032	20.00	1.18
CrB	0.013	3.45	0.4	-0.014	0.00	0.00
TOTAL =	0.386 SQ.MI.		XKSAT =	0.25	%ROCK=	8.65

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF

= 3.5

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.040	VACANT	10.33	DRY	25.00	0.00	0.00	0.15	0.015
0.119	M.F.R.	30.90	NORMAL	25.00	65.00	0.08	0.10	0.031
0.104	M.D.R.	27.08	NORMAL	25.00	45.00	0.05	0.10	0.027
0.122	COMM	31.69	NORMAL	20.00	90.00	0.11	0.10	0.032
0.386	=TOTAL AREA	OK	AVERAGE =	23.42	TOTAL =	0.23	AVG. =	0.105
					% =	60.79		

PERCENT OF SUBBASIN

DRY =	10.33 %
NORMAL =	89.67 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.260

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.287

IMPERVIOUS AREA:

URBAN @	100 %	effective =	60.79
ROCK OUTCROP @	60 %	effective =	5.19
	% EFFECTIVE IMP. =		65.98

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
153F	0.386	1.240	0.032	279.00	0.105	0.260	3.50	0.287	65.98

LOSS PARAMETERS FOR SUBBASIN: 154 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AdA	0.183	63.30	0.4	-0.252	0.00	0.00
RaA	0.087	30.16	0.39	-0.123	0.00	0.00
GgA	0.019	6.54	0.25	-0.039	0.00	0.00
TOTAL =	0.290 SQ.MI.		XKSAT =	0.38	%ROCK=	0.00

DTHETA

Dry = 0.35
Normal = 0.25
Wet = 0

PSIF

= 4.19

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.209	M.D.R.	72.17	NORMAL	25.00	45.00	0.09	0.10	0.072
0.068	COMM	23.53	NORMAL	20.00	90.00	0.06	0.10	0.024
0.012	DRNWAY	4.31	NORMAL	0.00	100.00	0.01	0.10	0.004
0.290	=TOTAL AREA	OK	AVERAGE =	22.75	TOTAL =	0.17	AVG. =	0.100
					% =	57.96		

PERCENT OF SUBBASIN
DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.433

IMPERVIOUS AREA:
URBAN @ 100 % effective = 57.96
ROCK OUTCROP @ 60 % effective = 0.00
% EFFECTIVE IMP. = 57.96

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
154F	0.290	0.810	0.026	33.00	0.100	0.250	4.19	0.433	57.96

LOSS PARAMETERS FOR SUBBASIN: 156 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.174	37.80	0.4	-0.150	65.00	24.57
TrB	0.104	22.57	0.13	-0.200	0.00	0.00
LcA	0.069	14.93	0.25	-0.090	0.00	0.00
RaA	0.061	13.34	0.39	-0.055	0.00	0.00
CO	0.017	3.61	0.29	-0.019	20.00	0.72
GgA	0.016	3.42	0.25	-0.021	0.00	0.00
CrB	0.010	2.13	0.4	-0.008	0.00	0.00
Es	0.009	1.91	0.25	-0.011	0.00	0.00
AdA	0.001	0.31	0.4	-0.001	0.00	0.00
TOTAL =	0.461 SQ.MI.		XKSAT =	0.28	%ROCK=	25.29

DTHETA		PSIF	
Dry =	0.35	=	3.66
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.
0.124	VACANT	26.87	DRY	25.00	0.00	0.00	0.15	0.040
0.068	M.F.R.	14.87	NORMAL	25.00	65.00	0.04	0.10	0.015
0.194	M.D.R.	42.11	NORMAL	25.00	45.00	0.09	0.10	0.042
0.006	IND	1.23	NORMAL	20.00	75.00	0.00	0.10	0.001
0.062	COMM	13.54	NORMAL	20.00	90.00	0.06	0.10	0.014
0.006	DRNWAY	1.38	NORMAL	0.00	100.00	0.01	0.10	0.001
0.461	=TOTAL AREA	OK	AVERAGE =	23.92	TOTAL =	0.20	AVG. =	0.113
					% =	43.11		

PERCENT OF SUBBASIN DRY = 26.87 %
NORMAL = 73.13 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.277

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.323

IMPERVIOUS AREA:

URBAN @	100 %	effective =	43.11
ROCK OUTCROP @	60 %	effective =	15.17
	% EFFECTIVE IMP. =		58.28

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
156F	0.461	1.830	0.042	298.00	0.113	0.277	3.66	0.323	58.28

LOSS PARAMETERS FOR SUBBASIN: 157 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.072	87.40	0.4	-0.348	65.00	56.81
TrB	0.010	12.60	0.13	-0.112	0.00	0.00
TOTAL =	0.083 SQ.MI.		XKSAT =	0.35	%ROCK=	56.81

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF = 4.03

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.083	VACANT	100.00	DRY	25.00	0.00	0.00	0.15	0.150
0.083	=TOTAL AREA	OK	AVERAGE =	25.00	TOTAL =	0.00	AVG. =	0.150
					% =	0.00		

PERCENT OF SUBBASIN

DRY =	100.00 %
NORMAL =	0.00 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.350

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.408

IMPERVIOUS AREA:

URBAN @	100 %	effective =	0.00
ROCK OUTCROP @	60 %	effective =	34.09
	% EFFECTIVE IMP. =		34.09

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
157F	0.083	0.540	0.107	320.00	0.150	0.350	4.03	0.408	34.09

LOSS PARAMETERS FOR SUBBASIN: 158 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.326	60.41	0.4	-0.240	65.00	39.27
EbD	0.137	25.34	0.1	-0.253	0.00	0.00
TrB	0.063	11.73	0.13	-0.104	0.00	0.00
CO	0.014	2.52	0.29	-0.014	20.00	0.50
TOTAL =	0.540 SQ.MI.		XKSAT =	0.24	%ROCK=	39.77

DTHETA

Dry =	0.36
Normal =	0.25
Wet =	0

PSIF

=	3.81

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.508	VACANT	94.21	DRY	25.00	0.00	0.00	0.15	0.141
0.031	M.D.R.	5.79	NORMAL	25.00	45.00	0.01	0.10	0.006
0.540	=TOTAL AREA	OK	AVERAGE =	25.00	TOTAL =	0.01	AVG. =	0.147
					% =	2.61		

PERCENT OF SUBBASIN

DRY =	94.21 %
NORMAL =	5.79 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.354

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.280

IMPERVIOUS AREA:

URBAN @	100 %	effective =	2.61
ROCK OUTCROP @	60 %	effective =	23.86
	% EFFECTIVE IMP. =		26.47

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
158F	0.540	1.290	0.083	314.00	0.147	0.354	3.81	0.280	26.47

LOSS PARAMETERS FOR SUBBASIN: 159 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TrB	0.316	57.53	0.13	-0.510	0.00	0.00
LcA	0.076	13.86	0.25	-0.083	0.00	0.00
CrB	0.046	8.40	0.4	-0.033	0.00	0.00
RS	0.045	8.18	0.4	-0.033	65.00	5.32
Es	0.043	7.73	0.25	-0.047	0.00	0.00
Ge	0.019	3.50	0.26	-0.020	0.00	0.00
CO	0.004	0.80	0.29	-0.004	20.00	0.16
TOTAL =	0.550 SQ.MI.		XKSAT =	0.19	%ROCK=	5.48

DTHETA

Dry =	0.38
Normal =	0.25
Wet =	0

PSIF = 5.36

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.153	VACANT	27.84	DRY	25.00	0.00	0.00	0.15	0.042
0.211	M.F.R.	38.32	NORMAL	25.00	65.00	0.14	0.10	0.038
0.081	M.D.R.	14.68	NORMAL	25.00	45.00	0.04	0.10	0.015
0.038	IND	6.97	NORMAL	20.00	75.00	0.03	0.10	0.007
0.041	COMM	7.47	NORMAL	20.00	90.00	0.04	0.10	0.007
0.008	DRNWAY	1.41	NORMAL	0.00	100.00	0.01	0.10	0.001
0.018	PARK	3.31	NORMAL	90.00	0.00	0.00	0.20	0.007
0.550	=TOTAL AREA	OK	AVERAGE =	26.07	TOTAL =	0.25	AVG. =	0.117
					% =	44.88		

PERCENT OF SUBBASIN

DRY =	27.84 %
NORMAL =	72.16 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.286

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.224

IMPERVIOUS AREA:

URBAN @	100 %	effective =	44.88
ROCK OUTCROP @	60 %	effective =	3.29
		% EFFECTIVE IMP. =	48.16

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
159F	0.550	1.620	0.041	274.00	0.117	0.286	5.36	0.224	48.16

LOSS PARAMETERS FOR SUBBASIN: 160 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
RS	0.394	45.59	0.4	-0.181	65.00	29.63
TrB	0.198	22.88	0.13	-0.203	0.00	0.00
LcA	0.108	12.43	0.25	-0.075	0.00	0.00
AdA	0.051	5.91	0.4	-0.024	0.00	0.00
CO	0.049	5.70	0.29	-0.031	20.00	1.14
PsB	0.042	4.81	0.26	-0.028	0.00	0.00
Cp	0.021	2.38	0.4	-0.009	0.00	0.00
PeA	0.003	0.29	0.37	-0.001	0.00	0.00
TOTAL =	0.865 SQ.MI.		XKSAT =	0.28	%ROCK=	30.77

DTHETA

Dry =	0.35
Normal =	0.25
Wet =	0

PSIF = 3.66

LAND USE

AREA SQ.MI.	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea SQ.MI.	IA in.	Wgtd.IA in.
0.361	VACANT	41.68	DRY	25.00	0.00	0.00	0.15	0.063
0.364	M.F.R.	42.03	NORMAL	25.00	65.00	0.24	0.10	0.042
0.054	M.D.R.	6.20	NORMAL	25.00	45.00	0.02	0.10	0.006
0.016	IND	1.86	NORMAL	20.00	75.00	0.01	0.10	0.002
0.071	COMM	8.24	NORMAL	20.00	90.00	0.06	0.10	0.008
0.865	=TOTAL AREA	OK	AVERAGE =	24.50	TOTAL =	0.34	AVG. =	0.121
					% =	38.92		

PERCENT OF SUBBASIN

DRY =	41.68 %
NORMAL =	58.32 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.292

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.325

IMPERVIOUS AREA:

URBAN @	100 %	effective =	38.92
ROCK OUTCROP @	60 %	effective =	18.46
	% EFFECTIVE IMP. =		57.38

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
160F	0.865	1.440	0.047	314.00	0.121	0.292	3.66	0.325	57.38

LOSS PARAMETERS FOR SUBBASIN: 161 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LcA	0.286	65.25	0.25	-0.393	0.00	0.00
TrB	0.068	15.39	0.13	-0.136	0.00	0.00
Es	0.059	13.55	0.25	-0.082	0.00	0.00
RS	0.015	3.52	0.4	-0.014	65.00	2.28
CO	0.006	1.34	0.29	-0.007	20.00	0.27
AdA	0.004	0.95	0.4	-0.004	0.00	0.00
TOTAL =	0.439 SQ.MI.		XKSAT =	0.23	%ROCK=	2.55

DTHETA		PSIF	
Dry =	0.36	=	4.12
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.
0.009	VACANT	1.94	DRY	25.00	0.00	0.00	0.15	0.003
0.163	M.F.R.	37.21	NORMAL	25.00	65.00	0.11	0.10	0.037
0.159	M.D.R.	36.19	NORMAL	25.00	45.00	0.07	0.10	0.036
0.099	COMM	22.58	NORMAL	20.00	90.00	0.09	0.10	0.023
0.009	DRNWAY	2.08	NORMAL	0.00	100.00	0.01	0.10	0.002
0.439	=TOTAL AREA	OK	AVERAGE =	23.35	TOTAL =	0.28	AVG. =	0.101
					% =	62.87		

PERCENT OF SUBBASIN

DRY =	1.94	%
NORMAL =	98.06	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.252

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.264

IMPERVIOUS AREA:

URBAN @	100	% effective =	62.87
ROCK OUTCROP @	60	% effective =	1.53
		% EFFECTIVE IMP. =	64.41

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
161F	0.439	1.420	0.026	41.00	0.101	0.252	4.12	0.264	64.41

LOSS PARAMETERS FOR SUBBASIN: 162 (FUTURE)

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA SQ.MI.	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LcA	0.117	60.24	0.25	-0.363	0.00	0.00
Mp	0.018	9.21	0.25	-0.055	0.00	0.00
Ge	0.015	7.91	0.26	-0.046	0.00	0.00
Cp	0.011	5.53	0.4	-0.022	0.00	0.00
Br	0.009	4.60	1.05	0.001	0.00	0.00
GgA	0.009	4.58	0.25	-0.028	0.00	0.00
RbA	0.009	4.48	0.26	-0.026	0.00	0.00
Tc	0.004	2.01	0.4	-0.008	0.00	0.00
Vh	0.001	0.74	0.27	-0.004	0.00	0.00
TD	0.001	0.70	1.2	0.001	0.00	0.00
TOTAL =	0.194 SQ.MI.		XKSAT =	0.28	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.35	=	3.66
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.
0.013	DRNWAY	6.53	DRY	0.00	100.00	0.01	0.10	0.007
0.142	IND	72.97	NORMAL	20.00	75.00	0.11	0.10	0.073
0.040	COMM	20.50	NORMAL	20.00	90.00	0.04	0.10	0.020
0.194	=TOTAL AREA	OK	AVERAGE =	18.69	TOTAL =	0.15	AVG. =	0.100
					% =	79.71		

PERCENT OF SUBBASIN

DRY =	6.53 %
NORMAL =	93.47 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.257

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.307

IMPERVIOUS AREA:

URBAN @	100 %	effective =	79.71
ROCK OUTCROP @	60 %	effective =	0.00
	% EFFECTIVE IMP. =		79.71

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	AREA sq.mi.	LENGTH miles	Kb	SLOPE ft/mile	IA inches	DTHETA	PSIF	XKSAT	RTIMP %
162F	0.194	1.160	0.027	19.00	0.100	0.257	3.66	0.307	79.71

SECTION III

Hydrologic Sub-Basin Characteristics

Hydrologic Sub-Basin Characteristics
(Existing Condition)

TABLE 12

Existing Hydrologic Sub-Basin Characteristics
2-Year Storm

Sub-Basin I.D.	Area (Sq. Mile)	Flow Path Length (Miles)	Adjusted Slope (Ft./Mile)	Kb	6-Hr. Time of Concentration (Hours)	24-Hr. Time of Concentration (Hours)
150	0.239	1.12	304	0.065	0.500	0.521
151	0.450	2.13	199	0.039	0.613	0.637
152	0.116	0.89	39	0.030	0.571	0.592
153	0.233	1.24	279	0.033	0.313	0.354
154	0.135	0.81	33	0.026	0.525	0.542
156	0.337	1.83	298	0.047	0.538	0.563
157	0.083	0.54	320	0.107	0.500	0.496
158	0.540	1.29	314	0.087	0.808	0.854
159	0.410	1.62	274	0.045	0.517	0.533
160	0.697	1.44	314	0.053	0.521	0.517
161	0.282	1.42	41	0.028	0.696	0.729
162	0.155	1.16	19	0.027	0.771	0.813

TABLE 13

Existing Hydrologic Sub-Basin Characteristics
10-Year Storm

Sub-Basin I.D.	Area (Sq. Mile)	Flow Path Length (Miles)	Adjusted Slope (Ft./Mile)	Kb	6-Hr. Time of Concentration (Hours)	24-Hr. Time of Concentration (Hours)
150	0.289	1.12	304	0.065	0.346	0.404
151	0.606	2.13	199	0.039	0.446	0.479
152	0.183	0.89	39	0.030	0.408	0.458
153	0.386	1.24	279	0.033	0.237	0.296
154	0.282	0.81	33	0.026	0.371	0.429
156	0.461	1.83	298	0.047	0.383	0.433
157	0.083	0.54	320	0.107	0.313	0.387
158	0.540	1.29	314	0.087	0.504	0.542
159	0.550	1.62	274	0.045	0.363	0.412
160	0.865	1.44	314	0.053	0.379	0.408
161	0.439	1.42	41	0.028	0.500	0.542
162	0.194	1.16	19	0.027	0.568	0.629

TABLE 14

Existing Hydrologic Sub-Basin Characteristics
100-Year Storm

Sub-Basin I.D.	Area (Sq. Mile)	Flow Path Length (Miles)	Adjusted Slope (Ft./Mile)	Kb	6-Hr. Time of Concentration (Hours)	24-Hr. Time of Concentration (Hours)
150	0.289	1.12	304	0.065	0.271	0.329
151	0.606	2.13	199	0.039	0.354	0.392
152	0.183	0.89	39	0.030	0.317	0.371
153	0.386	1.24	279	0.033	0.200	0.246
154	0.282	0.81	33	0.026	0.292	0.346
156	0.461	1.83	298	0.047	0.300	0.354
157	0.083	0.54	320	0.107	0.242	0.300
158	0.540	1.29	314	0.087	0.371	0.417
159	0.550	1.62	274	0.045	0.283	0.338
160	0.865	1.44	314	0.053	0.300	0.333
161	0.439	1.42	41	0.028	0.396	0.438
162	0.194	1.16	19	0.027	0.454	0.488

TABLE 15

Summary Of Sub-Basin Peak Discharges (CFS)
(Existing Conditions)

Sub-Basin I.D.	2-Year		10-Year		100-Year	
	6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.
150	85	53	285	182	534	391
151	164	100	584	366	1,098	749
152	41	25	182	106	347	224
153	135	87	527	330	875	615
154	47	31	293	186	540	394
156	136	73	506	280	961	584
157	19	13	67	39	138	99
158	112	60	406	269	868	658
159	140	92	533	357	1,002	757
160	286	195	907	631	1,637	1,292
161	90	64	379	270	693	553
162	55	35	168	102	309	209

Existing Conditions

SubBasin No.	Type D Max. Roughness %	Type C Mod. High Roughness %	Type B Mod. Low Roughness %	Type A Min. Roughness %	Weighted m %	Weighted b %	Area Acres	Kb
150	0.0%	57.6%	0.0%	42.3%	-0.01704	0.10332	184.96	0.0647
151	0.0%	24.0%	2.4%	73.6%	-0.01093	0.06736	387.84	0.0391
152	0.0%	3.7%	0.0%	96.3%	-0.00694	0.04407	117.12	0.0297
153	0.0%	12.2%	0.0%	87.8%	-0.00854	0.05342	247.04	0.0330
154	0.0%	0.0%	0.0%	100.0%	-0.00625	0.04000	180.48	0.0259
155	0.0%	0.0%	23.6%	76.4%	-0.00802	0.04944	37.12	0.0369
156	0.0%	34.6%	0.0%	65.4%	-0.01274	0.07806	295.04	0.0466
157	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15000	53.12	0.1069
158	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15000	345.60	0.0865
159	0.0%	33.6%	0.0%	66.4%	-0.01255	0.07696	352.00	0.0450
160	0.0%	51.5%	0.0%	48.5%	-0.01591	0.09665	553.60	0.0530
161	0.0%	5.6%	0.0%	94.4%	-0.00730	0.04616	280.96	0.0283
162	0.0%	0.6%	0.0%	99.4%	-0.00636	0.04066	124.16	0.0273

Hydrologic Sub-Basin Characteristics
(Future Condition)

TABLE 16

Future Hydrologic Sub-Basin Characteristics
2-Year Storm

Sub-Basin I.D.	Area (Sq. Mile)	Flow Path Length (Miles)	Adjusted Slope (Ft./Mile)	Kb	6-Hr. Time of Concentration (Hours)	24-Hr. Time of Concentration (Hours)
150	0.239	1.12	304	0.065	0.500	0.521
151	0.448	2.13	199	0.038	0.613	0.621
152	0.115	0.89	39	0.027	0.517	0.533
153	0.231	1.24	279	0.032	0.304	0.350
154	0.142	0.81	33	0.026	0.517	0.533
156	0.324	1.83	298	0.047	0.488	0.500
157	0.083	0.54	320	0.107	0.500	0.496
158	0.523	1.29	314	0.083	0.762	0.800
159	0.388	1.62	274	0.041	0.479	0.492
160	0.640	1.44	314	0.047	0.475	0.467
161	0.285	1.42	41	0.026	0.654	0.679
162	0.155	1.16	19	0.027	0.767	0.808

TABLE 17

Future Hydrologic Sub-Basin Characteristics
10-Year Storm

Sub-Basin I.D.	Area (Sq. Mile)	Flow Path Length (Miles)	Adjusted Slope (Ft./Mile)	Kb	6-Hr. Time of Concentration (Hours)	24-Hr. Time of Concentration (Hours)
150	0.289	1.12	304	0.065	0.346	0.404
151	0.606	2.13	199	0.038	0.438	0.471
152	0.183	0.89	39	0.027	0.375	0.429
153	0.386	1.24	279	0.032	0.233	0.292
154	0.290	0.81	33	0.026	0.371	0.425
156	0.461	1.83	298	0.042	0.350	0.404
157	0.083	0.54	320	0.107	0.313	0.387
158	0.540	1.29	314	0.083	0.483	0.517
159	0.535	1.62	274	0.041	0.338	0.392
160	0.824	1.44	314	0.047	0.342	0.375
161	0.439	1.42	41	0.026	0.471	0.508
162	0.194	1.16	19	0.027	0.571	0.625

TABLE 18

Future Hydrologic Sub-Basin Characteristics
100-Year Storm

Sub-Basin I.D.	Area (Sq. Mile)	Flow Path Length (Miles)	Adjusted Slope (Ft./Mile)	Kh	6-Hr. Time of Concentration (Hours)	24-Hr. Time of Concentration (Hours)
150	0.289	1.12	304	0.065	0.271	0.329
151	0.606	2.13	199	0.038	0.346	0.387
152	0.183	0.89	39	0.027	0.296	0.350
153	0.386	1.24	279	0.032	0.196	0.242
154	0.290	0.81	33	0.026	0.287	0.346
156	0.461	1.83	298	0.042	0.279	0.333
157	0.083	0.54	320	0.107	0.242	0.300
158	0.540	1.29	314	0.083	0.358	0.404
159	0.550	1.62	274	0.041	0.267	0.321
160	0.865	1.44	314	0.047	0.275	0.308
161	0.439	1.42	41	0.026	0.375	0.421
162	0.194	1.16	19	0.027	0.454	0.488

TABLE 19

Summary Of Sub-Basin Peak Discharges (CFS)
(Future Conditions)

Sub-Basin I.D.	2-Year		10-Year		100-Year	
	6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.
150	90	56	285	182	534	391
151	181	111	595	372	1,117	753
152	52	31	196	113	365	236
153	153	97	533	333	881	620
154	63	41	308	197	565	411
156	164	90	550	301	1,009	615
157	19	13	67	39	138	99
158	121	67	427	283	895	674
159	159	105	555	364	1,041	780
160	313	220	943	653	1,734	1,334
161	111	80	398	286	716	566
162	61	38	169	103	310	210

SECTION IV

Hydrograph Routing Parameters

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 6-3-92	Job No. 0146
	Checked by	Date	Sheet No.
	For HEC-I I.D. 157RR		

STAGE - STORAGE - DISCHARGE PARAMETERS FOR EAST PARK DETENTION BASIN

Stage (Ft.)	Planimeter Reading (in^2)	Average Reading (in^2)	Area (Ac.)	Volume (Ac.-Ft.)	Storage Volume (Ac.-Ft.)
1347.5	0	0	0		0
				0.15	
1350	0.04 0.07 0.10	0.033	0.122		0.15
				1.22	
1355	0.10 0.20 0.30	0.100	0.367		1.37
				2.85	
1360	0.22 0.42 0.63	0.210	0.771		4.22
				5.72	
1365	0.42 0.82 1.24	0.413	1.518		9.94
				9.58	
1370	0.62 1.26 1.89	0.630	2.314		19.52
				7.51	
1373	0.73 1.47 2.20	0.733	2.694		27.03

Low-Level Outlet

Diameter, D = 27" RCP with 13" x 12" orifice.

$A = \frac{13" \times 12"}{144} = 1.083\ ft^2$

Center Line Elev. = 1348.0
Coef. of Discharge = 0.6
Exponent of Head = 0.5

Emergency Spillway

Crest Elev. = 1368.0
Spillway Width = 50'
Weir Coef. = 2.7
Exponent of Head = 1.5

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 6-3-92	Job No. 0146
	Checked by	Date	Sheet No.
	For HEC-1 I.D. 158RR		

STAGE - STORAGE - DISCHARGE PARAMETERS FOR WEST PARK DETENTION BASIN

Stage (Ft.)	Planimeter Reading (in^2)	Average Reading (in^2)	Area (Ac.)	Volume (Ac.-Ft.)	Storage Volume (Ac.-Ft.)
1313.3			0		0
				0.33	
1316	0.07 0.14 0.20	0.067	0.245		0.33
				3.92	
1320	0.47 0.92 1.40	0.467	1.714		4.25
				9.77	
1324	0.86 1.72 2.59	0.863	3.171		14.02
				16.65	
1328	1.41 2.81 4.21	1.403	5.155		30.67
				25.37	
1332	2.05 4.10 6.15	2.050	7.530		56.04
				36.61	
1336	2.94 5.86 8.80	2.933	10.774		92.65
				49.32	
1340	3.79 7.55 11.34	3.780	13.884		141.97

Low-Level Outlet

Diameter, D = 27" RCP with 13" x 12" Orifice.

$A = \frac{13" \times 12"}{144} = 1.083 ft^2$

Centerline Elev. = 1313.8

Coef. of Discharge = 0.6

Exponent of Head = 0.5

Emergency Spillway

Crest Elev. = 1335.7

Spillway Width = 115'

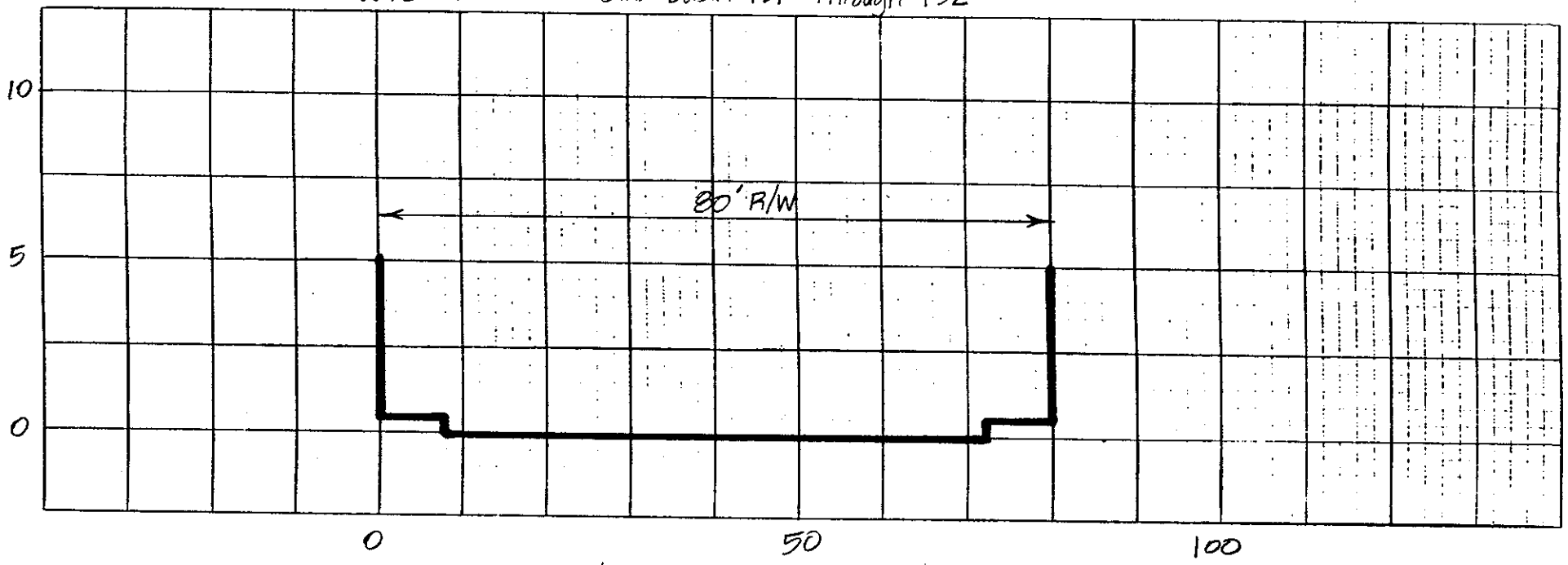
Weir Coef. = 2.7

Exponent of Head = 1.5

COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RM151A

Route Flow From Sub-Basin 151 Through 152



7th Street - South of Dunlap Avenue

RD				30/3770				
RC	0.030	0.020	0.030	3770	0.0080			
RX	0	0	8	8	72	72	80	80
RY	5	0.5	0.5	0	0	0.5	0.5	5

CALCULATED BY: DLB 6/4/92

COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RM150B

Hatcher Road - Between 2nd street & 4th street

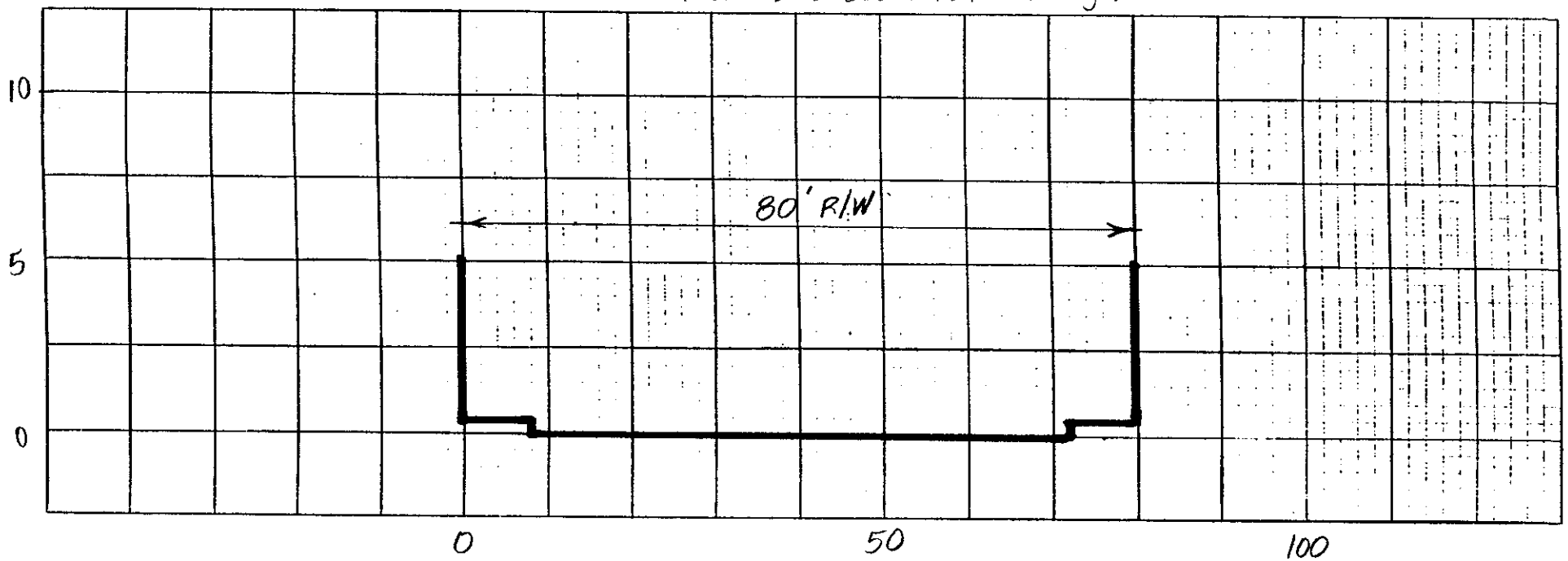
RD								
RC	0.030	0.020	0.030	4973	0.0086			
RX	0	0	10	10	50	50	60	60
RY	5	0.5	0.5	0	0	0.5	0.5	5

CALCULATED BY: DLB 6/4/92

COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RM151B

Route Diverted Flow From Sub-Basin 151 Through 153



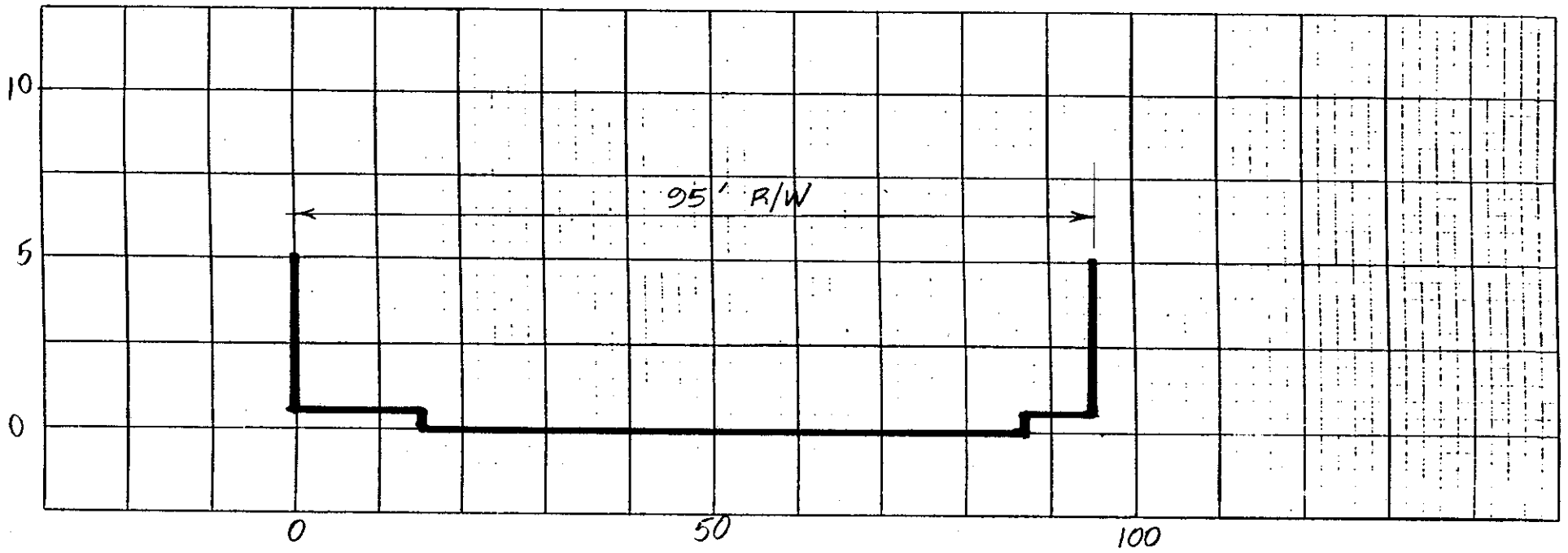
Dunlap Avenue - West of 7th street

RD				22/2650				
RC	0.030	0.020	0.030	2650	0.0083			
RX	0	0	8	8	72	72	80	80
RY	5	0.5	0.5	0	0	0.5	0.5	5

CALCULATED BY: DLB 6/4/92

COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RM153



Central Avenue - South of Dunlap Avenue

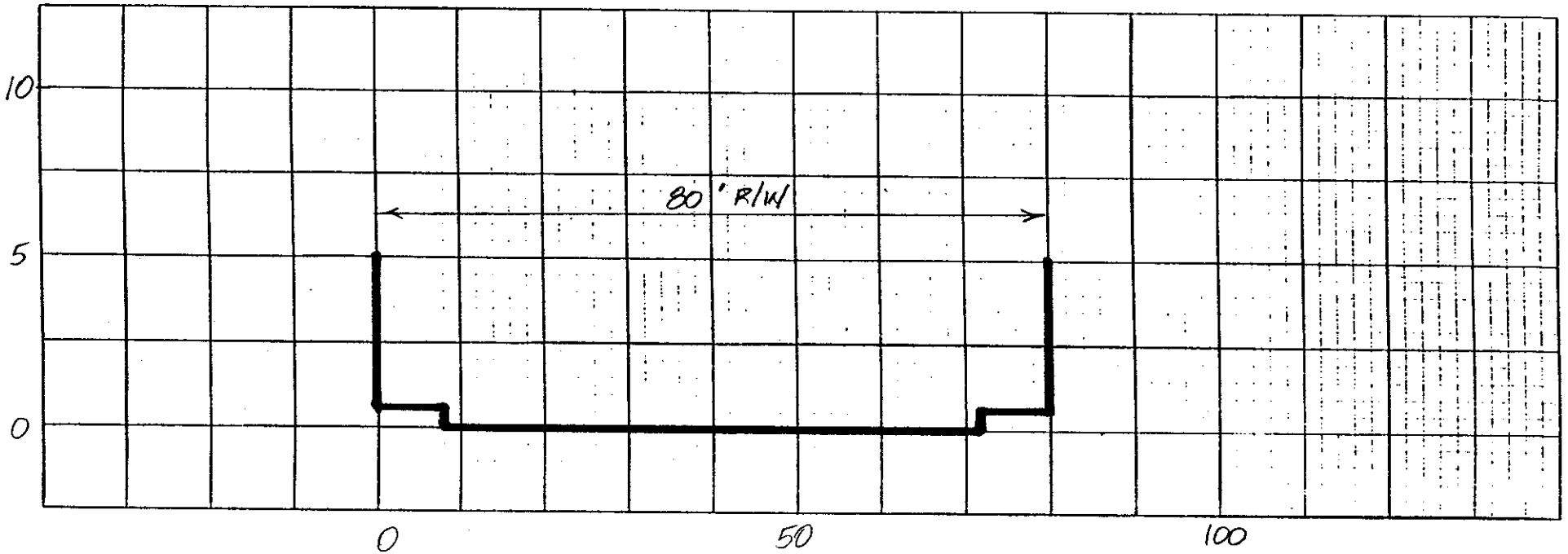
8/1835

RD								
RC	0.030	0.020	0.030	1835	0.0044			
RX	0	0	15	15	87	87	95	95
RY	5	0.5	0.5	0	0	0.5	0.5	5

CALCULATED BY: DLB 6/4/92

COMPUTATION SHEET

ROUTE IDENTIFICATION NUMBER RM160



19th Avenue - South of Peoria Avenue

26/3675

RD								
RC	0.030	0.020	0.030	3675	0.0071			
RX	0	0	8	8	72	72	80	80
RY	5	0.5	0.5	0	0	0.5	0.5	5

CALCULATED BY: DLB 6/4/92

SECTION V

Divert & Onsite Retention Parameters

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 4-26-93	Job No. 0146
	Checked by	Date	Sheet No.
	For FLOW SPLIT CALCULATIONS		

7TH STREET / CAVE CREEK ROAD INTERSECTION

WEIR FLOW DETERMINATION

$Q = C L H^{1.5}$ Use $C = 3.0$

Q_A = Westerly Flows Along Dunlap Ave.

Q_B = Southerly Flows Along 7th St.

(1) WS Elev. = 1266.53

$Q_A = (3.0)\left(\frac{0.24}{2}\right)^{1.5}(174) \cong 22$ CFS

$Q_B = (3.0)\left(\frac{0.24}{2}\right)^{1.5}(39) \cong 5$ CFS

$Q_{TOTAL} = 27$ CFS (Assume All Goes West)

(2) WS Elev. = 1266.95

$Q_A = (3.0)\left[(23)\left(\frac{0.25}{2}\right)^{1.5} + (68)\left(\frac{0.25+0.42}{2}\right)^{1.5} + (174)\left(\frac{0.42+0.66}{2}\right)^{1.5}\right]$

$= 250$ CFS

$Q_B = (3.0)(108)\left(\frac{0.66}{2}\right)^{1.5} = 62$ CFS

$Q_{TOTAL} = 250 + 62 = 312$ CFS

(3) WS Elev. = 1267.29

$Q_A = (3.0)\left[(55)\left(\frac{0.59}{2}\right)^{1.5} + (68)\left(\frac{0.59+0.76}{2}\right)^{1.5} + (174)\left(\frac{0.76+1.00}{2}\right)^{1.5}\right]$

$= 571$ CFS

$Q_B = (3.0)\left[(108)\left(\frac{1.00+0.34}{2}\right)^{1.5} + (132)\left(\frac{0.34}{2}\right)^{1.5}\right]$

$= 205$ CFS

$Q_{TOTAL} = 571 + 205 = 776$ CFS

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 4-28-93	Job No. 0146
	Checked by	Date	Sheet No.
	For FLOW SPLIT CALCULATIONS 7TH STREET / CAVE CREEK ROAD INTERSECTION		

(4) WS Elev. = 1267.40

$$Q_A = (3.0)\left[(65)\left(\frac{0.70}{2}\right)^{1.5} + (68)\left(\frac{0.70+0.87}{2}\right)^{1.5} + (174)\left(\frac{0.87+1.11}{2}\right)^{1.5}\right]$$

$$= 697 \text{ CFS}$$

$$Q_B = (3.0)\left[(108)\left(\frac{1.11+0.45}{2}\right)^{1.5} + (132)\left(\frac{0.45+0.11}{2}\right)^{1.5} + (26)\left(\frac{0.11}{2}\right)^{1.5}\right]$$

$$= 283 \text{ CFS}$$

$$Q_{TOTAL} = 697 + 283 = 980 \text{ CFS}$$

(5) WS Elev. = 1268.00

$$Q_A = (3.0)\left[(50)\left(\frac{0.60}{2}\right)^{1.5} + (65)\left(\frac{0.60+1.30}{2}\right)^{1.5} + (68)\left(\frac{1.30+1.47}{2}\right)^{1.5} + (174)\left(\frac{1.47+1.71}{2}\right)^{1.5}\right]$$

$$Q_A = 1584 \text{ CFS}$$

$$Q_B = (3.0)\left[(108)\left(\frac{1.71+1.05}{2}\right)^{1.5} + (132)\left(\frac{1.05+0.71}{2}\right)^{1.5} + (110)\left(\frac{0.71}{2}\right)^{1.5}\right]$$

$$Q_B = 922 \text{ CFS}$$

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 4-27-93	Job No. 0146
	Checked by	Date	Sheet No.
	For FLOW SPLIT CALCULATIONS		

7TH STREET / CAVE CREEK ROAD INTERSECTION

STORM DRAIN FLOW DETERMINATION

The following peak discharge values were determined using the TR-20 computer program. This information was obtained from the report, "Sunnyslope Master Drainage Plan, Proj. No. ST-80354" by the City of Phoenix Engineering Department. The following flows were determined using a 2-year storm.

24" RCP flowing South in 7th St. = 27 CFS

18" RCP flowing West in Dunlap Ave. = 9 CFS

SPLIT FLOW DETERMINATION

Flow West in Dunlap Ave

9 = 9 CFS
9 + 27 = 36 CFS
9 + 250 = 259 CFS
9 + 571 = 580 CFS
9 + 697 = 706 CFS
9 + 1584 = 1593 CFS

Flow South in 7th St.

27 CFS
27 CFS
27 + 62 = 89 CFS
27 + 205 = 232 CFS
27 + 283 = 310 CFS
27 + 922 = 949 CFS

Total Flow	Flow West in Dunlap Ave.
0	0
36	9
63	36
348	259
812	580
1016	706
2542	1593

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	Checked by	Date	Sheet No.
	For		

Storm Drain Pipe Diverts

(1) Cholla Street - Cave Creek to 19th Avenue

Source: Storm Drain Design for Cholla Street, 19th Avenue to Cave Creek Wash, C.O.P. Job No. ST-79256.00, November 1981, by Wadsworth, Jensen & Assoc.

Main Line Pipe Sizing - 19th Ave. (West) to 23rd Ave.

$Q_{2yr} = 210$ CFS

(2) Peoria Avenue - Cave Creek to 19th Avenue

Source: Construction Plans for Peoria Ave - Cave Creek to 19th Ave by Dibble & Assoc.

Pipe diameter, $d = 78$ in. $\quad n = 0.012$

$S = 0.0010$ ft/ft

$$K = \frac{1.486}{n} \times R^{2/3} \times A$$

For Pipe Running Full, $K = 5679$

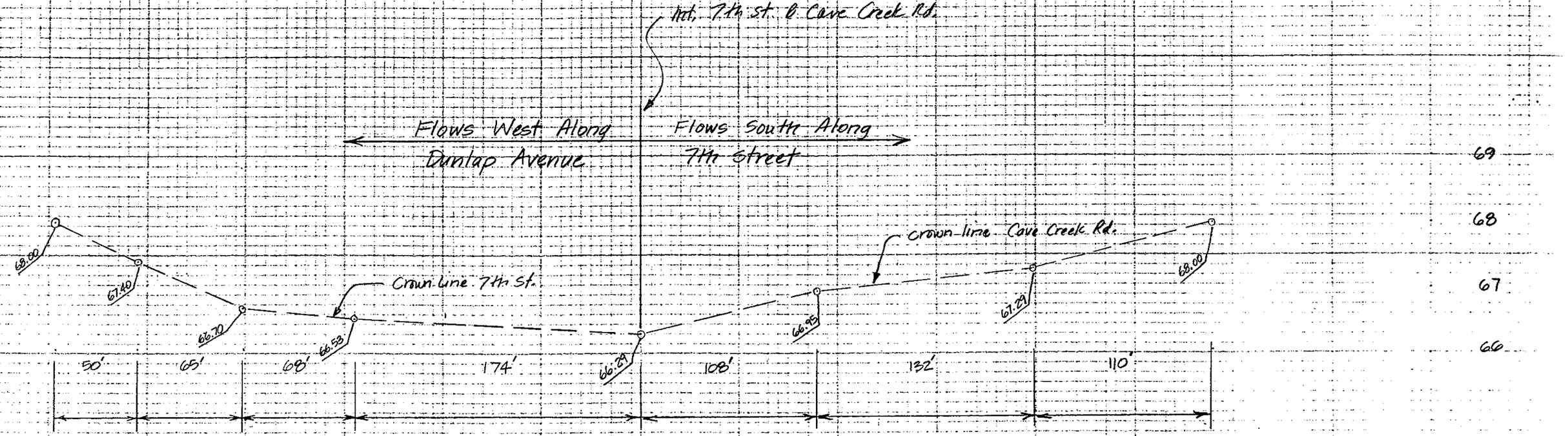
$$\therefore Q = K\sqrt{S} = 5679\sqrt{0.0010}$$

$$= 180 \text{ CFS}$$

(3) 7th Street - South of Mountain View Road

Source: Sunnyslope Master Drainage Plan, Project No. ST-80354.00, October 23, 1981, by City of Phoenix Engineering Department.

42" RCP flowing South, $Q_{24hr.} = 129$ CFS



Horiz. 1" = 60'
Vert. 1" = 1.5'

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	Checked by	Date	Sheet No.
	For ONSITE RETENTION CALCULATIONS		

Precipitation Calculations

From Figs. 2.2, 2.7, 2.8 & 2.13

$X_1 = 1.20$ in. $X_2 = 1.40$ in. $X_3 = 3.10$ in. $X_4 = 3.80$ in.

$$Y_2 = -0.011 + 0.942(X_1)(X_1/X_2)$$
$$= -0.011 + 0.942(1.20)(1.20/1.40)$$
$$Y_2 = 0.96 \text{ in.}$$

$$Y_{100} = 0.494 + 0.755(X_3)(X_3/X_4)$$
$$= 0.494 + 0.755(3.10)(3.10/3.80)$$
$$Y_{100} = 2.40 \text{ in.}$$

2-Year, 2-Hour Depth $= 0.341(1.20) + 0.659(0.96)$
$= 1.04$ in.

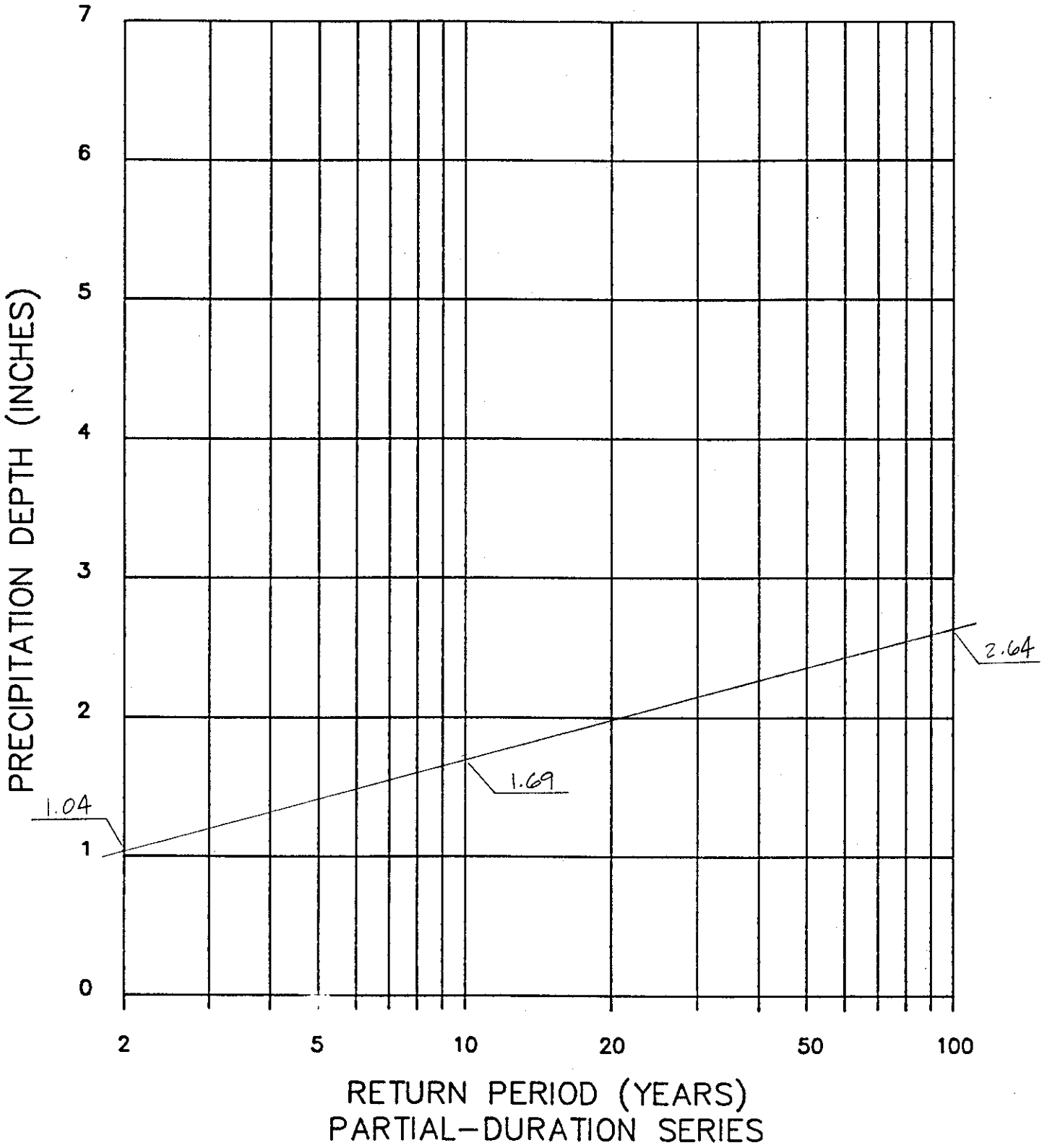
100-Year, 2-Hour Depth $= 0.341(3.10) + 0.659(2.40)$
$= 2.64$ in.

Plot Rainfall depths on Precip. Depth vs. Return Period Graph.

Therefore, **10-Year 2-Hour Depth = 1.69 in.**

Retention Volume, $V = C\left(\frac{P}{12}\right)A = \left(\frac{1.69}{12}\right)CA$
$= 0.141\,CA$ [Acre-Ft.]

For 100-Year 2-Hour Depth,
Volume $= \left(\frac{2.64}{12}\right)CA = 0.22\,CA$



Precipitation Depth versus Return Period for Partial-Duration Series

EXISTING CONDITIONS

Vol. (Ac.-Ft.) = 0.141 CA

4-27-93

Sub-Basin	Planimetered Area (in^2) ①	②	③	Avg.	Area (Ac.)	Land Use	C	Vol. (Ac-Ft.)
150								
152	290' x	140'			0.93	COMM	0.80	0.10
	110' x	300'			0.76	MF RES	0.55	0.06
							Σ =	0.16
							To Small - Neglect	
153	(320' x	500') -	$\frac{1}{2}$(180)(200)		3.26	COMM	0.80	
①	(515' x	285') -	(155')(145')		2.85	COMM	0.80	
③	400' x	275'			2.53	"	"	
⑤	(360' x	255') -	(230')(140')		1.37	"	"	
④	585' x	775'			10.41	"	"	
⑤	280' x	200'			1.29	COMM	0.80	
⑥	(340' x	200') -	(130')(130')		1.17	"	"	
⑦	600' x	135'			1.86	"	"	
⑧	130' x	255'			0.76	"	"	
⑨	(205' x	190') -	(135' x 55') + $\frac{1}{2}$(205')(60')		0.86	COMM	0.80	
				Σ =	26.36			2.97

EXISTING CONDITIONS

Vol. (Ac-Ft) = 0.141 CA

4-27-93

Sub-Basin	Planimetered Area (in^2) ①	②	③	Avg.	Area (Ac.)	Land Use	C	Vol. (Ac-Ft.)
154 ①	150' x	110'			0.38	COMM	0.80	0.04
②	150' x	270'			0.93	COMM	0.80	0.10
③	(260' x	135') − (	115' x 55')		0.66	COMM	0.80	0.07
④	(835)(285)	−(65)(95)	+(290)(90) −½(90)(90)		4.63	MF RES	0.60	0.39
⑤	(180)(285)				1.18	COMM	0.80	0.13
⑥	(615' x	620') − (	115' x 305')		7.95	MED RES	0.50	0.56
							Σ =	1.29
156	(155' x	220') − (	50' x 30')		0.75	COMM	0.80	
	(130' x	135')			0.40	COMM	0.80	
					1.15			0.13
							To Small - Neglect	
159	(295' x	485') +	(145' x 130')		3.72	COMM	0.80	0.42
							To Small - Neglect	
160 ①	(155)(280)	+(150)(225)	+(285)(195)		3.05	COMM	0.80	0.34
②	(415)(100)	+(200)(200)			1.87	COMM	0.80	0.21
③	(575)(220+270(½))		+(320+160)(305)		6.59	MF RES	0.60	0.56
④	(195)(310)	+(320)(305)	+(175)(310)		4.87	MF RES	0.60	0.41
⑤	(465)(305)	+(445)(280)			6.12	MF RES	0.60	0.52
⑥	(150)(165) +	(215)(90) +	(310)(250)		2.79	MF RES	0.60	0.24
							Σ =	2.28

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 6-2-93	Job No. 146
	Checked by	Date	Sheet No. 1
	For CONTRIBUTING AREA CALCS.		

10TH STREET WASH TO CAVE CREEK

2-YEAR CONTRIBUTING AREA - EXISTING CONDITIONS

1. Undeveloped (vacant) Areas Contribute 100%. Very Low Density and Low Density Residential Areas Contribute 100%.
2. Based on Land Use Classification, All Impervious Areas Contribute 100%. The Remaining Pervious Areas Were Treated As Non-Contributing.
3. Land Use Areas Having Onsite Retention Calculations Are Non-Contributing.
4. Parks and Golf Courses Are Non-contributing.

Sub-Basin 150 Area = $0.289 - (0.35)(0.063) - (0.55)(0.049) - (0.10)(0.010)$
$= 0.239 \text{ mi.}^2$

Sub-Basin 151 Area = $0.606 - (0.35)(0.252) - (0.55)(0.107) - (0.10)(0.088)$
$= 0.450 \text{ mi.}^2$

Sub-Basin 152 Area = $0.183 - (0.35)(0.038) - (0.55)(0.089) - (0.10)(0.050)$
$= 0.116 \text{ mi.}^2$

Sub-Basin 153 Area = $0.386 - (0.35)(0.120) - (0.55)(0.099 - 0.016)_{\text{(SCHOOL)}} - 0.016 - 0.041 - (0.10)(0.120 - 0.041)$
$= 0.233 \text{ mi.}^2$

Sub-Basin 154 Area = $0.282 - 0.020 - (0.55)(0.209 - 0.020 - 0.028)_{\text{(SCHOOL)}} - 0.028 - 0.005 - (0.10)(0.061 - 0.005)$
$= 0.135 \text{ mi.}^2$

Sub-Basin 156 Area = $0.461 - (0.35)(0.045) - (0.55)(0.185) - (0.10)(0.064)$
$= 0.337 \text{ mi.}^2$

Sub-Basin 157 Area = 0.083 mi.^2

Sub-Basin 158 Area = 0.540 mi.^2

Sub-Basin 159 Area = $0.550 - (0.35)(0.193) - (0.55)(0.071) - (0.25)(0.046) - (0.10)(0.038) - 0.018$
$= 0.410 \text{ mi.}^2$

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 6-2-93	Job No. 146
	Checked by	Date	Sheet No. 2
	For CONTRIBUTING AREA CALCS.		

2-YEAR CONTRIBUTING AREA (CONT'D)

Sub-Basin 160 Area = $0.865 - 0.032 - (0.35)(0.327-0.032) - (0.55)(0.031) - (0.25)(0.016) - 0.008 - (0.10)(0.047-0.008)$
= 0.697 mi.^{2}

Sub-Basin 161 Area = $0.439 - (0.35)(0.163) - (0.55)(0.151-0.015) - 0.015$ (SCHOOL) $- (0.10)(0.100)$
= 0.282 mi.^{2}

Sub-Basin 162 Area = $0.194 - (0.25)(0.142) - (0.10)(0.040)$
= 0.155 mi.^{2}

10TH STREET WASH TO CAVE CREEK
ONSITE RETENTION CALCS.
(FUTURE CONDITION)

Sub-Basin	Planimetered Area (in^2) ①	②	③	Avg.	Area (Ac.)	Land Use	C	Vol. (Ac-Ft.)	
153					26.36	COMM	0.80	2.97	*
154					3.15	COMM	0.80	0.35	*
					4.63	MF RES	0.60	0.39	*
					7.95	MED RES	0.50	0.56	*
							Σ =	1.29	
159					2.36	COMM	0.80	0.27	*
					1.78	MF RES	0.60	0.15	*
					9.51	MF RES	0.60	1.26	
							Σ =	1.68	
160					4.92	COMM	0.80	0.55	*
					20.37	MF RES	0.60	1.72	*
					8.04	COMM	0.80	1.42	
					17.94	MF RES	0.60	2.37	
							Σ =	6.06	

* Based on 10-Year 2-Hour Storm Frequency

KAMINSKI HUBBARD engineering inc. • Surveying • Civil • Hydrology	Made by DLB	Date 10-6-93	Job No. 146
	Checked by	Date	Sheet No. 1
	For Contributing Area Calculations		

10TH STREET WASH TO CAVE CREEK

2-YEAR CONTRIBUTING AREA - FUTURE CONDITIONS

Refer to Existing Conditions for Contributing Area Determinations.

Sub-Basin 150 Area = $0.289 - (0.35)(0.063) - (0.55)(0.049) - (0.10)(0.010)$
$= 0.239\ mi^2$

Sub-Basin 151 Area = $0.606 - (0.35)(0.257) - (0.55)(0.107) - (0.10)(0.089)$
$= 0.448\ mi^2$

Sub-Basin 152 Area = $0.183 - (0.35)(0.044) - (0.55)(0.087) - (0.10)(0.049)$
$= 0.115\ mi^2$

Sub-Basin 153 Area = $0.386 - (0.35)(0.119) - (0.55)(0.104 - 0.016) - 0.016$
$- 0.041 - (0.10)(0.122 - 0.041)$
$= 0.231\ mi^2$

Sub-Basin 154 Area = $0.290 - 0.020 - (0.55)(0.209 - 0.020 - 0.028) - 0.028$
$- 0.005 - (0.10)(0.068 - 0.005)$
$= 0.142\ mi^2$

Sub-Basin 156 Area = $0.461 - (0.35)(0.068) - (0.55)(0.194) - (0.10)(0.068)$
$= 0.324\ mi^2$

Sub-Basin 157 Area = $0.083\ mi^2$

Sub-Basin 158 Area = $0.540 - (0.55)(0.031)$
$= 0.523\ mi^2$

Sub-Basin 159 Area = $0.550 - 0.018 - (0.35)(0.211 - 0.018) - (0.55)(0.081)$
$- (0.25)(0.038) - (0.10)(0.041) - 0.018$
$= 0.388\ mi^2$

Sub-Basin 160 Area = $0.865 - 0.060 - (0.35)(0.364 - 0.060) - (0.55)(0.054)$
$- (0.25)(0.016) - 0.020 - (0.10)(0.071 - 0.020)$
$= 0.640\ mi^2$

Sub-Basin 161 Area = $0.439 - (0.35)(0.163) - (0.55)(0.159) - (0.10)(0.099)$
$= 0.285\ mi^2$

Sub-Basin 162 Area = $0.194 - (0.25)(0.142) - (0.10)(0.040)$
$= 0.155\ mi^2$

SECTION VI

HEC-1 Hydrology Results, 100-Year 24-Hour Storm (Existing Conditions)

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  03/14/94  TIME  15:02:21   *
*                                       *
*****************************************
```

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

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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

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

  1       ID      ACDC AREA DRAINAGE MASTER STUDY
  2       ID      FILENAME:  SUN324.DAT       KHE JOB NO. 0146
  3       ID      WATERSHED CONTRIBUTING TO THE ACDC
  4       ID      10TH STREET WASH TO CAVE CREEK
  5       ID      100-YEAR 24-HOUR DURATION STORM FOR EXISTING CONDITIONS
          *                                                       *
          *                CREATED:  JUNE 3, 1993                 *
          *                REVISED:  SEPTEMBER 16, 1993           *
          *                                                       *
          *DIAGRAM
  6       IT      4 10OCT92    1200     800
  7       IO      5

  8       KK    151S
  9       KM    RUNOFF GENERATED ON SUB-BASIN 151
 10       KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 11       KM    L= 2.13 mi.  S= 199 ft/mi.  Adj. S= 199 ft/mi.  Kb= .039
 12       KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 13       BA    .606
 14       IN      30
 15       KM   ************7TH STREET SUBBASINS, PRECIP. BASED UPON DA = 0.789 SQ.MI.
 16       KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 17       KM    AN AREAL REDUCTION COEFFICIENT OF .995 WAS USED
 18       PB   3.781
 19       PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 20       PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 21       PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 22       PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 23       PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 24       LG    .118    .276   3.500    .288  54.960
 25       UC    .392    .318
 26       UA       0       5      16      30      65      77      84      90      94      97
 27       UA     100

 28       KK   151RE
 29       KM    DIVERT FLOW WEST ALONG DUNLAP AVENUE IN STREET AND 18" PIPE
 30       KM    (Hydrograph identified as 153D1) (9 cfs in 18")
 31       KM    REMAINDER FLOWS SOUTH ALONG 7TH ST. IN STREET AND 24" PIPE.
 32       KM    (Hydrograph identified as 151RE) (27 cfs in PIPE)
 33       DT   153D1
 34       DI       0      36      63     348     812    1016    2542
 35       DQ       0       9      36     259     580     706    1593

 36       KK  RM151A
 37       KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 151 THROUGH 152
 38       KM             1) Reach Length = 3770 ft.
 39       RD
 40       RC    .030    .020    .030    3770   .0080
 41       RX       0       0       8       8      72      72      80      80
 42       RY       5     0.5     0.5       0       0     0.5     0.5       5
```

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

  43      KK   152S
  44      KM   RUNOFF GENERATED ON SUB-BASIN 152
  45      KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  46      KM   L= 0.89 mi.  S= 39 ft/mi.  Adj. S= 39 ft/mi.  Kb= .030
  47      KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  48      BA   .183
  49      LG   .102    .254   4.300    .460  59.700
  50      UC   .371    .295
  51      UA     0       5      16      30      65      77      84      90      94      97
  52      UA   100

  53      KK  HC152
  54      KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 152 WITH ROUTED FLOW FROM 151
  55      HC     2

  56      KK  152RE
  57      KM   DIVERT FLOW FROM SUB-BASIN 152 INTO THE ACDC
  58      DT  152DC
  59      DI     0   10000
  60      DQ     0   10000
  61      KM   ***********CENTRAL AVENUE SUBBASINS, PRECIP. BASED UPON DA = 0.957 SQ.MI.

  62      KK   150S
  63      KM   RUNOFF GENERATED ON SUB-BASIN 150
  64      KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  65      KM   L= 1.12 mi.  S= 493 ft/mi.  Adj. S= 304 ft/mi.  Kb= .065
  66      KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  67      BA   .289
  68      KM   RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  69      KM   AN AREAL REDUCTION COEFFICIENT OF .993 WAS USED
  70      PB  3.773
  71      LG   .129    .313   3.810    .279  44.170
  72      UC   .329    .239
  73      UA     0       5      16      30      65      77      84      90      94      97
  74      UA   100

  75      KK  RM150
  76      KM   MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 150 THROUGH 153
  77      KM            1) Reach Length = 4973 ft.
  78      RD
  79      RC   .030    .020    .030    4973   .0086
  80      RX     0       0      10      10      50      50      60      60
  81      RY     5     0.5     0.5       0       0     0.5     0.5       5

  82      KK   R151
  83      KM   RETRIEVE DIVERTED HYDROGRAPH FROM SUB-BASIN 151
  84      DR  153D1

  85      KK  RM151B
  86      KM   MUSKINGUM-CUNGE ROUTE DIVERTED FLOW FROM SUB-BASIN 151 THROUGH 153
  87      KM            1) Reach Length = 2650 ft.
  88      RD
  89      RC   .030    .020    .030    2650   .0083
  90      RX     0       0       8       8      72      72      80      80
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  91      RY      5      .5      .5       0       0      .5      .5       5

  92      KK    153S
  93      KM    RUNOFF GENERATED ON SUB-BASIN 153
  94      KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  95      KM    L= 1.24 mi.  S= 344 ft/mi.  Adj. S= 279 ft/mi.  Kb= .033
  96      KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  97      BA    .386
  98      LG    .106    .262   3.500    .287  64.900
  99      UC    .246    .159
 100      UA      0       5      16      30      65      77      84      90      94      97
 101      UA    100

 102      KK   DT153
 103      KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 3.0 AC-FT FROM SUB-BASIN 153
 104      KM                                               (Hydrograph identified as OR153)
 105      KM                                             2) Balance of runoff continues on.
 106      KM                                               (Hydrograph identified as DT153)
 107      DT   OR153     3.0
 108      DI       0   10000
 109      DQ       0   10000

 110      KK   HC153
 111      KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 153 WITH ROUTED FLOW FROM 150 AND 151
 112      HC       3

 113      KK   RM153
 114      KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 153 THROUGH 154
 115      KM             1) Reach Length = 1835 ft.
 116      RD
 117      RC    .030    .020    .030    1835   .0044
 118      RX       0       0      15      15      87      87      95      95
 119      RY       5      .5      .5       0       0      .5      .5       5

 120      KK    154S
 121      KM    RUNOFF GENERATED ON SUB-BASIN 154
 122      KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 123      KM    L= 0.81 mi.  S= 33 ft/mi.  Adj. S= 33 ft/mi.  Kb= .026
 124      KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 125      BA    .282
 126      LG    .100    .254   4.240    .447  56.660
 127      UC    .346    .198
 128      UA      0       5      16      30      65      77      84      90      94      97
 129      UA    100

 130      KK   DT154
 131      KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 1.3 AC-FT FROM SUB-BASIN 154
 132      KM                                               (Hydrograph identified as OR154)
 133      KM                                             2) Balance of runoff continues on.
 134      KM                                               (Hydrograph identified as DT154)
 135      DT   OR154     1.3
 136      DI       0   10000
 137      DQ       0   10000
```

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

  138     KK  HC154A
  139     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 154 WITH ROUTED FLOW FROM 153
  140     HC       2

  141     KK   154RE
  142     KM    DIVERT FLOW FROM SUB-BASIN 154 INTO THE ACDC
  143     DT   154DC
  144     DI       0   10000
  145     DQ       0   10000

  146     KK  HC154B
  147     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 154 WITH REMAINING FLOW FROM 151
  148     HC       2
  149     KM    **********7TH AVENUE SUBBASIN, PRECIP. BASED UPON DA = 0.461 SQ.MI.

  150     KK    156S
  151     KM    RUNOFF GENERATED ON SUB-BASIN 156
  152     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  153     KM    L= 1.83 mi.  S= 453 ft/mi.  Adj. S= 298 ft/mi.  Kb= .047
  154     KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  155     BA    .461
  156     KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  157     KM    AN AREAL REDUCTION COEFFICIENT OF .997 WAS USED
  158     PB   3.788
  159     LG    .117    .285   3.660    .324  53.280
  160     UC    .354    .295
  161     UA       0       5      16      30      65      77      84      90      94      97
  162     UA     100

  163     KK   156RE
  164     KM    DIVERT FLOW FROM SUB-BASIN 156 INTO THE ACDC
  165     DT   156DC
  166     DI       0   10000
  167     DQ       0   10000

  168     KK   HC156
  169     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 156 WITH REMAINING FLOW FROM 154
  170     HC       2
  171     KM    **************15TH AVENUE SUBBASINS, PRECIP. BASED UPON DA = 1.173 SQ.MI.

  172     KK    157S
  173     KM    RUNOFF GENERATED ON SUB-BASIN 157
  174     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  175     KM    L= 0.54 mi.  S= 1397 ft/mi.  Adj. S= 320 ft/mi.  Kb= .107
  176     KM    CLARK UNIT HYDROGRAPH FOR NATURAL WATERSHEDS WAS USED FOR THIS BASIN
  177     BA    .083
  178     KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  179     KM    AN AREAL REDUCTION COEFFICIENT OF .992 WAS USED
  180     PB   3.769
  181     LG    .150    .350   4.030    .408  34.090
  182     UC    .300    .245
  183     UA       0       3       5       8      12      20      43      75      90      96
  184     UA     100
```

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

  185     KK   157RR
  186     KM    ROUTE FLOW THROUGH EAST PARK DETENTION BASIN
  187     RS       1    ELEV  1347.5
  188     SV       0     .15    1.37    4.22    9.94   19.52   27.03
  189     SE  1347.5    1350    1355    1360    1365    1370    1373
  190     SL    1348   1.083      .6      .5
  191     SS    1368      50     2.7     1.5

  192     KK   RM157
  193     KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 157 THROUGH 159
  194     KM            1) Reach Length = 7131 ft.
  195     RD    7131   .0160    .040           TRAP       5       2

  196     KK    158S
  197     KM    RUNOFF GENERATED ON SUB-BASIN 158
  198     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  199     KM    L= 1.29 mi.  S= 606 ft/mi.  Adj. S= 314 ft/mi.  Kb= .087
  200     KM    CLARK UNIT HYDROGRAPH FOR NATURAL WATERSHEDS WAS USED FOR THIS BASIN
  201     BA    .540
  202     LG    .150    .360   3.810    .280  23.860
  203     UC    .417    .244
  204     UA       0       3       5       8      12      20      43      75      90      96
  205     UA     100

  206     KK   158RR
  207     KM    ROUTE FLOW THROUGH WEST PARK DETENTION BASIN
  208     RS       1    ELEV  1313.3
  209     SV       0     .33    4.25   14.02   30.67   56.04   92.65  141.97
  210     SE  1313.3    1316    1320    1324    1328    1332    1336    1340
  211     SL  1313.8   1.083      .6      .5
  212     SS  1335.7     115     2.7     1.5

  213     KK   RM158
  214     KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 158 THROUGH 159
  215     KM            1) Reach Length = 6871 ft.
  216     RD    6871   .0119    .040           TRAP       6       2

  217     KK    159S
  218     KM    RUNOFF GENERATED ON SUB-BASIN 159
  219     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  220     KM    L= 1.62 mi.  S= 325 ft/mi.  Adj. S= 274 ft/mi.  Kb= .045
  221     KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  222     BA    .550
  223     LG    .120    .294   5.360    .224  44.290
  224     UC    .338    .229
  225     UA       0       5      16      30      65      77      84      90      94      97
  226     UA     100

  227     KK  HC159A
  228     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 159 WITH ROUTED FLOW FROM 157 AND 158
  229     HC       3
```

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

  230     KK   159RE
  231     KM    DIVERT FLOW FROM SUB-BASIN 159 INTO THE ACDC
  232     DT   159DC
  233     DI       0   10000
  234     DQ       0   10000

  235     KK  HC159B
  236     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 159 WITH REMAINING FLOW FROM 156
  237     HC       2
  238     KM    ************19TH AVENUE SUBBASINS, PRECIP. BASED UPON DA = 1.304 SQ.MI.

  239     KK    160S
  240     KM    RUNOFF GENERATED ON SUB-BASIN 160
  241     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  242     KM    L= 1.44 mi.  S= 600 ft/mi.  Adj. S= 314 ft/mi.  Kb= .053
  243     KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  244     BA    .865
  245     KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  246     KM    AN AREAL REDUCTION COEFFICIENT OF .991 WAS USED
  247     PB   3.766
  248     LG    .126    .301   3.660    .325  50.820
  249     UC    .333    .159
  250     UA       0       5      16      30      65      77      84      90      94      97
  251     UA     100

  252     KK   DT160
  253     KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 2.3 AC-FT FROM SUB-BASIN 160
  254     KM                                               (Hydrograph identified as OR160)
  255     KM                                             2) Balance of runoff continues on.
  256     KM                                               (Hydrograph identified as DT160)
  257     DT   OR160     2.3
  258     DI       0   10000
  259     DQ       0   10000

  260     KK   160RE
  261     KM    DIVERT FLOW WEST INTO SUB-BASIN 265 THROUGH 78" STORM DRAIN ALONG CHOLLA
  262     KM    STREET (210 CFS) AND 78" STORM DRAIN ALONG PEORIA AVENUE (180 CFS).
  263     KM    TOTAL DIVERSION = 210 + 180 = 390 CFS
  264     KM    REMAINDER FLOWS SOUTH ALONG 19TH AVENUE TO THE ACDC.
  265     KM    SOURCE:  (1) Storm Drain Design for Cholla St., 19th Ave. to Cave Creek
  266     KM                 Wash, November, 1981, by Wadsworth, Jensen & Assoc.
  267     DT    265D
  268     DI       0     390    1000    2000
  269     DQ       0     390     390     390

  270     KK   RM160
  271     KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 160 THROUGH 161
  272     KM              1) Reach Length = 3675 ft.
  273     RD
  274     RC    .030    .020    .030    3675   .0071
  275     RX       0       0       8       8      72      72      80      80
  276     RY       5      .5      .5       0       0      .5      .5       5
```

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

277       KK   161S
278       KM   RUNOFF GENERATED ON SUB-BASIN 161
279       KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
280       KM   L= 1.42 mi.  S= 41 ft/mi.  Adj. S= 41 ft/mi.  Kb= .028
281       KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
282       BA   .439
283       LG   .103    .256   4.120    .265  61.730
284       UC   .438    .313
285       UA     0       5      16      30      65      77      84      90      94      97
286       UA   100

287       KK  HC161A
288       KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 161 WITH ROUTED FLOW FROM 160
289       HC     2

290       KK   161RE
291       KM   DIVERT FLOW FROM SUB-BASIN 161 INTO THE ACDC
292       DT   161DC
293       DI     0   10000
294       DQ     0   10000

295       KK  HC161B
296       KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 161 WITH REMAINING FLOW FROM 159
297       HC     2
298       KM   *************21ST AVENUE SUBBASIN, PRECIP. BASED UPON DA = 0.194 SQ.MI.

299       KK   162S
300       KM   RUNOFF GENERATED ON SUB-BASIN 162
301       KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
302       KM   L= 1.16 mi.  S= 19 ft/mi.  Adj. S= 19 ft/mi.  Kb= .027
303       KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
304       BA   .194
305       KM   RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
306       KM   AN AREAL REDUCTION COEFFICIENT OF .999 WAS USED
307       PB  3.796
308       LG   .100    .257   3.660    .309  78.490
309       UC   .488    .478
310       UA     0       5      16      30      65      77      84      90      94      97
311       UA   100

312       KK   162RE
313       KM   DIVERT FLOW FROM SUB-BASIN 162 INTO THE ACDC
314       DT   162DC
315       DI     0   10000
316       DQ     0   10000

317       KK   HC162
318       KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 162 WITH REMAINING FLOW FROM 161
319       HC     2
```

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

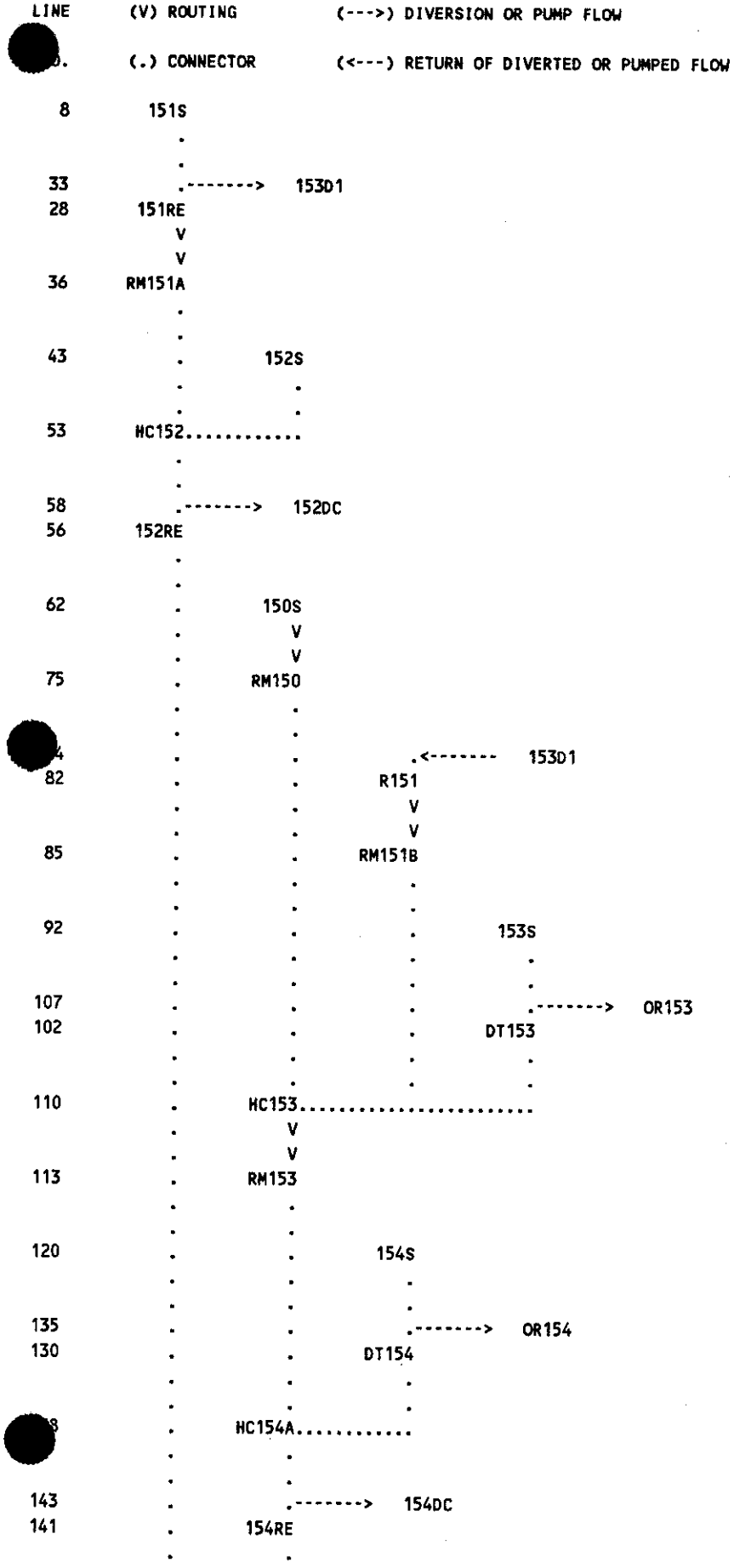
 320      KK    R160
 321      KM    RETRIEVE DIVERTED HYDROGRAPH FROM SUB-BASIN 160 AT 19TH AVENUE AND CHOLLA
 322      KM    STREET AND PEORIA AVENUE.  THIS HYDROGRAPH WILL BE STORED IN FILENAME:
 323      KM    CCW324.DSS FOR RETRIEVAL AT A PART OF THE WATERSHED CONTRIBUTING TO
 324      KM    CAVE CREEK.
 325      DR    265D
 326      ZW    A=CHOLLA STREET  B=R160  C=FLOW  F=SUNNYSLOPE
 327      ZZ
```

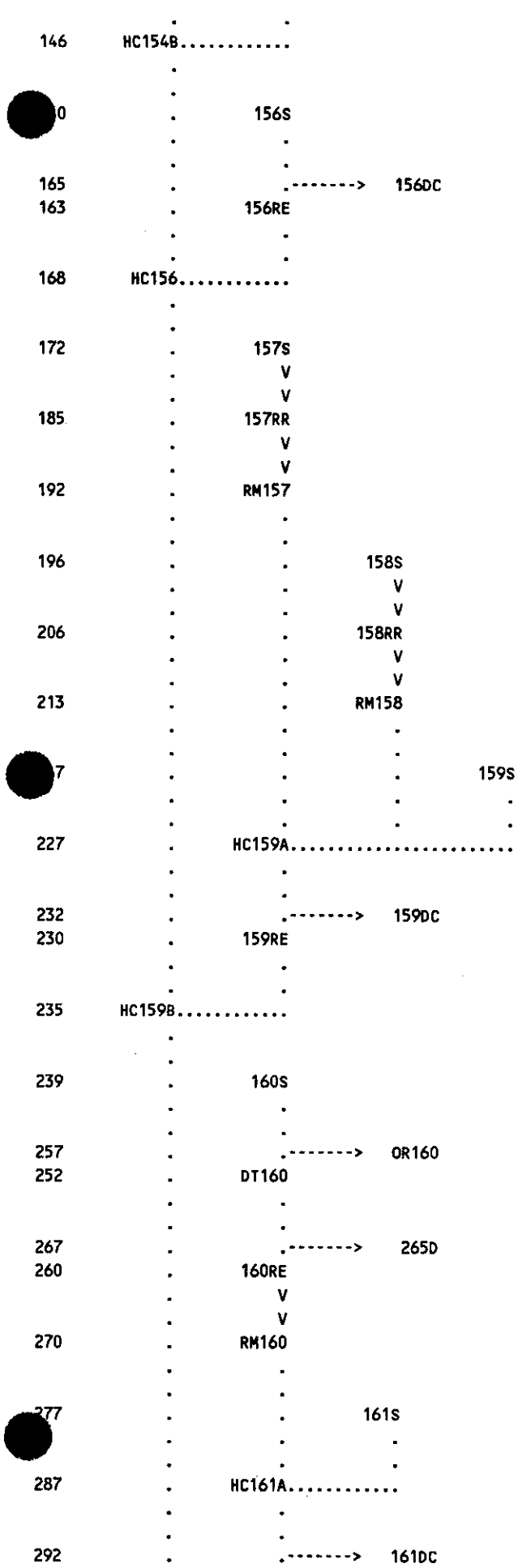
SCHEMATIC DIAGRAM OF STREAM NETWORK

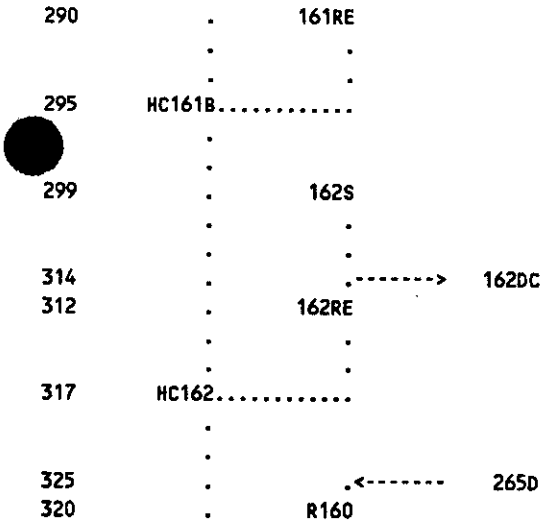
INPUT LINE

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

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




146 HC154B.....
156S
165 .-------> 156DC
163 156RE
168 HC156.....
172 157S
V
V
185 157RR
V
V
192 RM157
196 158S
V
V
206 158RR
V
V
213 RM158
159S
227 HC159A.....
232 .-------> 159DC
230 159RE
235 HC159B.....
239 160S
257 .-------> OR160
252 DT160
267 .-------> 265D
260 160RE
V
V
270 RM160
161S
287 HC161A.....
292 .-------> 161DC



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/14/94  TIME  15:02:21   *
*                                       *
*****************************************
```

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

ACDC AREA DRAINAGE MASTER STUDY
FILENAME: SUN324.DAT KHE JOB NO. 0146
WATERSHED CONTRIBUTING TO THE ACDC
10TH STREET WASH TO CAVE CREEK
100-YEAR 24-HOUR DURATION STORM FOR EXISTING CONDITIONS

```
  7 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN          4  MINUTES IN COMPUTATION INTERVAL
                     IDATE     10OCT92  STARTING DATE
                     ITIME       1200  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    12OCT92  ENDING DATE
                     NDTIME       1716  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.07 HOURS
                    TOTAL TIME BASE   53.27 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
  -----DSS---ZOPEN:  Existing File Opened,  File: CCW324.DSS
                     Unit:  71;  DSS Version: 6-FT
-----DSS---ZWRITE Unit  71; Vers.    1:  /CHOLLA STREET/R160/FLOW/10OCT1992/4MIN/SUNNYSLOPE/
-----DSS---ZWRITE Unit  71; Vers.    1:  /CHOLLA STREET/R160/FLOW/11OCT1992/4MIN/SUNNYSLOPE/
-----DSS---ZWRITE Unit  71; Vers.    1:  /CHOLLA STREET/R160/FLOW/12OCT1992/4MIN/SUNNYSLOPE/
```

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	151S	749.	12.13	130.	42.	19.	0.61		
DIVERSION TO	153D1	536.	12.13	84.	23.	11.	0.61		
HYDROGRAPH AT	151RE	213.	12.13	46.	19.	9.	0.61		
ROUTED TO	RM151A	217.	12.27	46.	19.	9.	0.61		
HYDROGRAPH AT	152S	224.	12.07	39.	13.	6.	0.18		
2 COMBINED AT	HC152	418.	12.13	85.	32.	14.	0.79		
DIVERSION TO	152DC	418.	0.07	85.	32.	14.	0.79		
HYDROGRAPH AT	152RE	0.	0.07	0.	0.	0.	0.79		
HYDROGRAPH AT	150S	391.	12.07	56.	18.	8.	0.29		
ROUTED TO	RM150	381.	12.27	56.	18.	8.	0.29		
HYDROGRAPH AT	R151	536.	12.13	84.	23.	11.	0.00		
ROUTED TO	RM151B	537.	12.20	84.	23.	11.	0.00		
HYDROGRAPH AT	153S	615.	12.00	89.	30.	13.	0.39		
DIVERSION TO	OR153	10.	12.00	6.	2.	1.	0.39		
HYDROGRAPH AT	DT153	615.	12.00	89.	28.	13.	0.39		
3 COMBINED AT	HC153	1423.	12.13	229.	69.	31.	0.68		
ROUTED TO	RM153	1401.	12.13	229.	69.	31.	0.68		
HYDROGRAPH AT	154S	394.	12.07	59.	19.	9.	0.28		
DIVERSION TO	OR154	5.	12.07	3.	1.	0.	0.28		
HYDROGRAPH AT	DT154	394.	12.07	59.	19.	8.	0.28		
2 COMBINED AT	HC154A	1771.	12.13	287.	88.	40.	0.96		
DIVERSION TO	154DC	1771.	0.07	287.	88.	40.	0.96		
HYDROGRAPH AT	154RE	0.	0.07	0.	0.	0.	0.96		
2 COMBINED AT	HC154B	0.	0.07	0.	0.	0.	1.75		
HYDROGRAPH AT	156S	584.	12.07	96.	31.	14.	0.46		
DIVERSION TO	156DC	584.	0.07	96.	31.	14.	0.46		
HYDROGRAPH AT	156RE	0.	0.07	0.	0.	0.	0.46		
2 COMBINED AT	HC156	0.	0.07	0.	0.	0.	2.21		
HYDROGRAPH AT	157S	99.	12.13	14.	4.	2.	0.08		

ROUTED TO	157RR	18.	12.73	13.	4.	2.	0.08	1359.54	12.73
ROUTED TO	RM157	18.	13.27	13.	4.	2.	0.08		
HYDROGRAPH AT	158S	658.	12.20	85.	25.	11.	0.54		
ROUTED TO	158RR	20.	13.47	20.	18.	11.	0.54	1328.89	13.53
ROUTED TO	RM158	20.	14.00	20.	18.	11.	0.54		
HYDROGRAPH AT	159S	757.	12.07	108.	34.	15.	0.55		
3 COMBINED AT	HC159A	771.	12.07	135.	52.	29.	1.17		
DIVERSION TO	159DC	771.	0.07	135.	52.	29.	1.17		
HYDROGRAPH AT	159RE	0.	0.07	0.	0.	0.	1.17		
2 COMBINED AT	HC159B	0.	0.07	0.	0.	0.	3.38		
HYDROGRAPH AT	160S	1292.	12.07	175.	57.	26.	0.87		
DIVERSION TO	OR160	13.	12.07	5.	1.	1.	0.87		
HYDROGRAPH AT	DT160	1292.	12.07	175.	56.	25.	0.87		
DIVERSION TO	265D	390.	12.07	110.	39.	18.	0.87		
HYDROGRAPH AT	160RE	902.	12.07	66.	16.	7.	0.87		
ROUTED TO	RM160	896.	12.13	67.	17.	8.	0.87		
HYDROGRAPH AT	161S	553.	12.13	99.	33.	15.	0.44		
2 COMBINED AT	HC161A	1449.	12.13	166.	49.	22.	1.30		
DIVERSION TO	161DC	1449.	0.07	166.	49.	22.	1.30		
HYDROGRAPH AT	161RE	0.	0.07	0.	0.	0.	1.30		
2 COMBINED AT	HC161B	0.	0.07	0.	0.	0.	4.68		
HYDROGRAPH AT	162S	209.	12.20	49.	17.	8.	0.19		
DIVERSION TO	162DC	209.	0.07	49.	17.	8.	0.19		
HYDROGRAPH AT	162RE	0.	0.07	0.	0.	0.	0.19		
2 COMBINED AT	HC162	0.	0.07	0.	0.	0.	4.88		
HYDROGRAPH AT	R160	390.	11.67	110.	39.	18.	0.00		

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
RM151A	MANE	4.00	216.77	736.00	1.16	4.00	216.77	736.00	1.16

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3750E+02 EXCESS=0.0000E+00 OUTFLOW=0.3755E+02 BASIN STORAGE=0.4124E-03 PERCENT ERROR= -0.1

RM150	MANE	4.00	380.74	736.00	2.30	4.00	380.74	736.00	2.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3534E+02 EXCESS=0.0000E+00 OUTFLOW=0.3543E+02 BASIN STORAGE=0.5807E-03 PERCENT ERROR= -0.3

RM151B	MANE	4.00	536.93	732.00	-1.00	4.00	536.93	732.00	-1.00
RM153	MANE	3.63	1412.02	728.91	3.83	4.00	1401.33	728.00	3.82

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1377E+03 EXCESS=0.0000E+00 OUTFLOW=0.1377E+03 BASIN STORAGE=0.2713E-03 PERCENT ERROR= 0.0

RM157	MANE	4.00	17.67	796.00	1.90	4.00	17.67	796.00	1.90

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8417E+01 EXCESS=0.0000E+00 OUTFLOW=0.8419E+01 BASIN STORAGE=0.4858E-02 PERCENT ERROR= -0.1

RM158	MANE	4.00	20.22	840.00	1.73	4.00	20.22	840.00	1.73

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4984E+02 EXCESS=0.0000E+00 OUTFLOW=0.4985E+02 BASIN STORAGE=0.6048E-02 PERCENT ERROR= 0.0

RM160	MANE	2.00	896.16	728.00	0.71	4.00	896.16	728.00	0.72

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3248E+02 EXCESS=0.0000E+00 OUTFLOW=0.3283E+02 BASIN STORAGE=0.3736E-03 PERCENT ERROR= -1.1

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

-----DSS---ZCLOSE Unit: 71, File: CCW324.DSS
Pointer Utilization: 0.27
Number of Records: 75
File Size: 167.6 Kbytes
Percent Inactive: 0.0

SECTION VII

HEC-1 Hydrology Results, 100-Year 24-Hour Storm (Future Conditions)

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  03/14/94  TIME  15:35:04   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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      FILENAME:  SUN324F.DAT        KHE JOB NO. 0146
  3       ID      WATERSHED CONTRIBUTING TO THE ACDC
  4       ID      10TH STREET WASH TO CAVE CREEK
  5       ID      100-YEAR 24-HOUR DURATION STORM FOR FUTURE CONDITIONS
          *                                                       *
          *                 CREATED:  OCTOBER 7, 1993             *
          *                                                       *
          *                                                       *
          *DIAGRAM
  6       IT      4 10OCT92    1200     800
  7       IO      5

  8       KK    151S
  9       KM    RUNOFF GENERATED ON SUB-BASIN 151
 10       KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 11       KM    L= 2.13 mi.  S= 199 ft/mi.  Adj. S= 199 ft/mi.  Kb= .038
 12       KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 13       BA    .606
 14       IN      30
 15       KM    ************7TH STREET SUBBASINS, PRECIP. BASED UPON DA = 0.789 SQ.MI.
 16       KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 17       KM    AN AREAL REDUCTION COEFFICIENT OF .995 WAS USED
 18       PB   3.781
 19       PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 20       PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 21       PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 22       PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 23       PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 24       LG    .117    .275   3.500    .288  55.800
 25       UC    .387    .315
 26       UA       0       5      16      30      65      77      84      90      94      97
 27       UA     100

 28       KK   151RE
 29       KM    DIVERT FLOW WEST ALONG DUNLAP AVENUE IN STREET AND 18" PIPE.
 30       KM    (Hydrograph identified as 153D2) (9 cfs in 18" PIPE)
 31       KM    REMAINDER FLOWS SOUTH ALONG 7TH ST. IN STREET AND 24" PIPE.
 32       KM    (Hydrograph identified as 151RE) (27 cfs in PIPE)
 33       DT   153D1
 34       DI       0      36      63     348     812    1016    2542
 35       DQ       0       9      36     259     580     706    1593

 36       KK  RM151A
 37       KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 151 THROUGH 152
 38       KM            1) Reach Length = 3770 ft.
 39       RD
 40       RC    .030    .020    .030    3770   .0080
 41       RX       0       0       8       8      72      72      80      80
 42       RY       5     0.5     0.5       0       0     0.5     0.5       5
```

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

  43      KK   152S
  44      KM   RUNOFF GENERATED ON SUB-BASIN 152
  45      KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  46      KM   L= 0.89 mi.  S= 39 ft/mi.  Adj. S= 39 ft/mi.  Kb= .027
  47      KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  48      BA   .183
  49      LG   .100    .250   4.300    .458  62.930
  50      UC   .350    .277
  51      UA     0       5      16      30      65      77      84      90      94      97
  52      UA   100

  53      KK  HC152
  54      KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 152 WITH ROUTED FLOW FROM 151
  55      HC     2

  56      KK  152RE
  57      KM   DIVERT FLOW FROM SUB-BASIN 152 INTO THE ACDC
  58      DT  152DC
  59      DI     0   10000
  60      DQ     0   10000
  61      KM   ************CENTRAL AVENUE SUBBASINS, PRECIP. BASED UPON DA = 0.957 SQ.MI.

  62      KK   150S
  63      KM   RUNOFF GENERATED ON SUB-BASIN 150
  64      KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  65      KM   L= 1.12 mi.  S= 493 ft/mi.  Adj. S= 304 ft/mi.  Kb= .065
  66      KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  67      BA   .289
  68      KM   RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  69      KM   AN AREAL REDUCTION COEFFICIENT OF .993 WAS USED
  70      PB  3.773
  71      LG   .129    .313   3.810    .279  44.170
  72      UC   .329    .239
  73      UA     0       5      16      30      65      77      84      90      94      97
  74      UA   100

  75      KK  RM150
  76      KM   MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 150 THROUGH 153
  77      KM            1) Reach Length = 4973 ft.
  78      RD
  79      RC   .030    .020    .030    4973   .0086
  80      RX     0       0      10      10      50      50      60      60
  81      RY     5     0.5     0.5       0       0     0.5     0.5       5

  82      KK   R151
  83      KM   RETRIEVE DIVERTED HYDROGRAPH FROM SUB-BASIN 151
  84      DR  153D1

  85      KK  RM151B
  86      KM   MUSKINGUM-CUNGE ROUTE DIVERTED FLOW FROM SUB-BASIN 151 THROUGH 153
  87      KM            1) Reach Length = 2650 ft.
  88      RD
  89      RC   .030    .020    .030    2650   .0083
  90      RX     0       0       8       8      72      72      80      80
```

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

  91      RY      5      .5      .5       0       0      .5      .5       5

  92      KK    153S
  93      KM    RUNOFF GENERATED ON SUB-BASIN 153
  94      KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  95      KM    L= 1.24 mi.  S= 344 ft/mi.  Adj. S= 279 ft/mi.  Kb= .032
  96      KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  97      BA    .386
  98      LG    .105    .260   3.500    .287  65.980
  99      UC    .242    .156
 100      UA      0       5      16      30      65      77      84      90      94      97
 101      UA    100

 102      KK   DT153
 103      KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 3.0 AC-FT FROM SUB-BASIN 153
 104      KM                                               (Hydrograph identified as OR153)
 105      KM                                             2) Balance of runoff continues on.
 106      KM                                               (Hydrograph identified as DT153)
 107      DT   OR153     3.0
 108      D1       0   10000
 109      DQ       0   10000

 110      KK   HC153
 111      KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 153 WITH ROUTED FLOW FROM 150 AND 151
 112      HC       3

 113      KK   RM153
 114      KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 153 THROUGH 154
 115      KM              1) Reach Length = 1835 ft.
 116      RD
 117      RC   .030    .020    .030    1835   .0044
 118      RX      0       0      15      15      87      87      95      95
 119      RY      5      .5      .5       0       0      .5      .5       5

 120      KK    154S
 121      KM    RUNOFF GENERATED ON SUB-BASIN 154
 122      KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 123      KM    L= 0.81 mi.  S= 33 ft/mi.  Adj. S= 33 ft/mi.  Kb= .026
 124      KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 125      BA    .290
 126      LG    .100    .250   4.190    .433  57.960
 127      UC    .346    .195
 128      UA      0       5      16      30      65      77      84      90      94      97
 129      UA    100

 130      KK   DT154
 131      KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 1.3 AC-FT FROM SUB-BASIN 154
 132      KM                                               (Hydrograph identified as OR154)
 133      KM                                             2) Balance of runoff continues on.
 134      KM                                               (Hydrograph identified as DT154)
 135      DT   OR154     1.3
 136      DI       0   10000
 137      DQ       0   10000
```

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

  138     KK  HC154A
  139     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 154 WITH ROUTED FLOW FROM 153
  140     HC       2

  141     KK   154RE
  142     KM    DIVERT FLOW FROM SUB-BASIN 154 INTO THE ACDC
  143     DT   154DC
  144     DI       0   10000
  145     DQ       0   10000

  146     KK  HC154B
  147     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 154 WITH REMAINING FLOW FROM 151
  148     HC       2
  149     KM    **********7TH AVENUE SUBBASIN, PRECIP. BASED UPON DA = 0.461 SQ.MI.

  150     KK    156S
  151     KM    RUNOFF GENERATED ON SUB-BASIN 156
  152     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  153     KM    L= 1.83 mi.  S= 453 ft/mi.  Adj. S= 298 ft/mi.  Kb= .042
  154     KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  155     BA    .461
  156     KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  157     KM    AN AREAL REDUCTION COEFFICIENT OF .997 WAS USED
  158     PB   3.788
  159     LG    .113    .277   3.660    .323  58.280
  160     UC    .333    .276
  161     UA       0       5      16      30      65      77      84      90      94      97
  162     UA     100

  163     KK   156RE
  164     KM    DIVERT FLOW FROM SUB-BASIN 156 INTO THE ACDC
  165     DT   156DC
  166     DI       0   10000
  167     DQ       0   10000

  168     KK   HC156
  169     KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 156 WITH REMAINING FLOW FROM 154
  170     HC       2
  171     KM    *************15TH AVENUE SUBBASINS, PRECIP. BASED UPON DA = 1.173 SQ.MI.

  172     KK    157S
  173     KM    RUNOFF GENERATED ON SUB-BASIN 157
  174     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  175     KM    L= 0.54 mi.  S= 1397 ft/mi.  Adj. S= 320 ft/mi.  Kb= .107
  176     KM    CLARK UNIT HYDROGRAPH FOR NATURAL WATERSHEDS WAS USED FOR THIS BASIN
  177     BA    .083
  178     KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  179     KM    AN AREAL REDUCTION COEFFICIENT OF .992 WAS USED
  180     PB   3.769
  181     LG    .150    .350   4.030    .408  34.090
  182     UC    .300    .245
  183     UA       0       3       5       8      12      20      43      75      90      96
  184     UA     100
```

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

  185     KK   157RR
  186     KM    ROUTE FLOW THROUGH EAST PARK DETENTION BASIN
  187     RS       1    ELEV  1347.5
  188     SV       0     .15    1.37    4.22    9.94   19.52   27.03
  189     SE  1347.5    1350    1355    1360    1365    1370    1373
  190     SL    1348   1.083      .6      .5
  191     SS    1368      50     2.7     1.5

  192     KK   RM157
  193     KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 157 THROUGH 159
  194     KM             1) Reach Length = 7131 ft.
  195     RD    7131   .0160    .040            TRAP       5       2

  196     KK    158S
  197     KM    RUNOFF GENERATED ON SUB-BASIN 158
  198     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  199     KM    L= 1.29 mi.  S= 606 ft/mi.  Adj. S= 314 ft/mi.  Kb= .083
  200     KM    CLARK UNIT HYDROGRAPH FOR NATURAL WATERSHEDS WAS USED FOR THIS BASIN
  201     BA    .540
  202     LG    .147    .354   3.810    .280  26.470
  203     UC    .404    .236
  204     UA       0       3       5       8      12      20      43      75      90      96
  205     UA     100

  206     KK   158RR
  207     KM    ROUTE FLOW THROUGH WEST PARK DETENTION BASIN
  208     RS       1    ELEV  1313.3
  209     SV       0     .33    4.25   14.02   30.67   56.04   92.65  141.97
  210     SE  1313.3    1316    1320    1324    1328    1332    1336    1340
  211     SL  1313.8   1.083      .6      .5
  212     SS  1335.7     115     2.7     1.5

  213     KK   RM158
  214     KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 158 THROUGH 159
  215     KM             1) Reach Length = 6871 ft.
  216     RD    6871   .0119    .040            TRAP       6       2

  217     KK    159S
  218     KM    RUNOFF GENERATED ON SUB-BASIN 159
  219     KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  220     KM    L= 1.62 mi.  S= 325 ft/mi.  Adj. S= 274 ft/mi.  Kb= .041
  221     KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
  222     BA    .550
  223     LG    .117    .286   5.360    .224  48.160
  224     UC    .321    .217
  225     UA       0       5      16      30      65      77      84      90      94      97
  226     UA     100

  227     KK   DT159
  228     KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 1.7 AC-FT FROM SUB-BASIN 159
  229     KM    (INCLUDES 100-YR 2-HR FUTURE VOLUME)       (Hydrograph identified as OR159)
  230     KM                                             2) Balance of runoff continues on.
  231     KM                                               (Hydrograph identified as DT159)
  232     DT   OR159     1.7
```

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

 233      DI       0   10000
 234      DQ       0   10000

 235      KK  HC159A
 236      KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 159 WITH ROUTED FLOW FROM 157 AND 158
 237      HC       3

 238      KK   159RE
 239      KM    DIVERT FLOW FROM SUB-BASIN 159 INTO THE ACDC
 240      DT   159DC
 241      DI       0   10000
 242      DQ       0   10000

 243      KK  HC159B
 244      KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 159 WITH REMAINING FLOW FROM 156
 245      HC       2
 246      KM    ************19TH AVENUE SUBBASINS, PRECIP. BASED UPON DA = 1.304 SQ.MI.

 247      KK    160S
 248      KM    RUNOFF GENERATED ON SUB-BASIN 160
 249      KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 250      KM    L= 1.44 mi.  S= 600 ft/mi.  Adj. S= 314 ft/mi.  Kb= .047
 251      KM    CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 252      BA    .865
 253      KM    RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 254      KM    AN AREAL REDUCTION COEFFICIENT OF .991 WAS USED
 255      PB   3.766
 256      LG    .121    .292   3.660    .325  57.380
 257      UC    .308    .146
 258      UA       0       5      16      30      65      77      84      90      94      97
 259      UA     100

 260      KK   DT160
 261      KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 6.1 AC-FT FROM SUB-BASIN 160
 262      KM    (INCLUDES 100-YR 2-HR FUTURE VOLUME)       (Hydrograph identified as OR160)
 263      KM                                             2) Balance of runoff continues on.
 264      KM                                               (Hydrograph identified as DT160)
 265      DT   OR160     6.1
 266      DI       0   10000
 267      DQ       0   10000

 268      KK   160RE
 269      KM    DIVERT FLOW WEST INTO SUB-BASIN 265 THROUGH 78" STORM DRAIN ALONG CHOLLA
 270      KM    STREET (210 CFS) AND 78" STORM DRAIN ALONG PEORIA AVENUE (180 CFS).
 271      KM    TOTAL DIVERSION = 210 + 180 = 390 CFS
 272      KM    REMAINDER FLOWS SOUTH ALONG 19TH AVENUE TO THE ACDC.
 273      KM    SOURCE:  (1) Storm Drain Design for Cholla St., 19th Ave. to Cave Creek
 274      KM                 Wash, November, 1981, by Wadsworth, Jensen & Assoc.
 275      DT    265D
 276      DI       0     390    1000    2000
 277      DQ       0     390     390     390
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```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 278      KK  RM160
 279      KM   MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 160 THROUGH 161
 280      KM            1) Reach Length = 3675 ft.
 281      RD
 282      RC  .030   .020   .030   3675  .0071
 283      RX    0      0      8      8     72     72     80     80
 284      RY    5     .5     .5      0      0     .5     .5      5

 285      KK   161S
 286      KM   RUNOFF GENERATED ON SUB-BASIN 161
 287      KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 288      KM   L= 1.42 mi.  S= 41 ft/mi.  Adj. S= 41 ft/mi.  Kb= .026
 289      KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 290      BA   .439
 291      LG   .101   .252  4.120   .264 64.410
 292      UC   .421   .300
 293      UA     0      5     16     30     65     77     84     90     94     97
 294      UA   100

 295      KK  HC161A
 296      KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 161 WITH ROUTED FLOW FROM 160
 297      HC     2

 298      KK   161RE
 299      KM   DIVERT FLOW FROM SUB-BASIN 161 INTO THE ACDC
 300      DT   161DC
 301      DI     0   10000
 302      DQ     0   10000

 303      KK  HC161B
 304      KM   COMBINE HYDROGRAPHS FROM SUB-BASIN 161 WITH REMAINING FLOW FROM 159
 305      HC     2
 306      KM   **************21ST AVENUE SUBBASIN, PRECIP. BASED UPON DA = 0.194 SQ.MI.

 307      KK   162S
 308      KM   RUNOFF GENERATED ON SUB-BASIN 162
 309      KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 310      KM   L= 1.16 mi.  S= 19 ft/mi.  Adj. S= 19 ft/mi.  Kb= .027
 311      KM   CLARK UNIT HYDROGRAPH FOR URBAN WATERSHEDS WAS USED FOR THIS BASIN
 312      BA   .194
 313      KM   RAINFALL DEPTH OF 3.80 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 314      KM   AN AREAL REDUCTION COEFFICIENT OF .999 WAS USED
 315      PB  3.796
 316      LG   .100   .257  3.660   .307 79.710
 317      UC   .488   .478
 318      UA     0      5     16     30     65     77     84     90     94     97
 319      UA   100

 320      KK   162RE
 321      KM   DIVERT FLOW FROM SUB-BASIN 162 INTO THE ACDC
 322      DT   162DC
 323      DI     0   10000
 324      DQ     0   10000
```

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

 325      KK   HC162
 326      KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 162 WITH REMAINING FLOW FROM 161
 327      HC       2

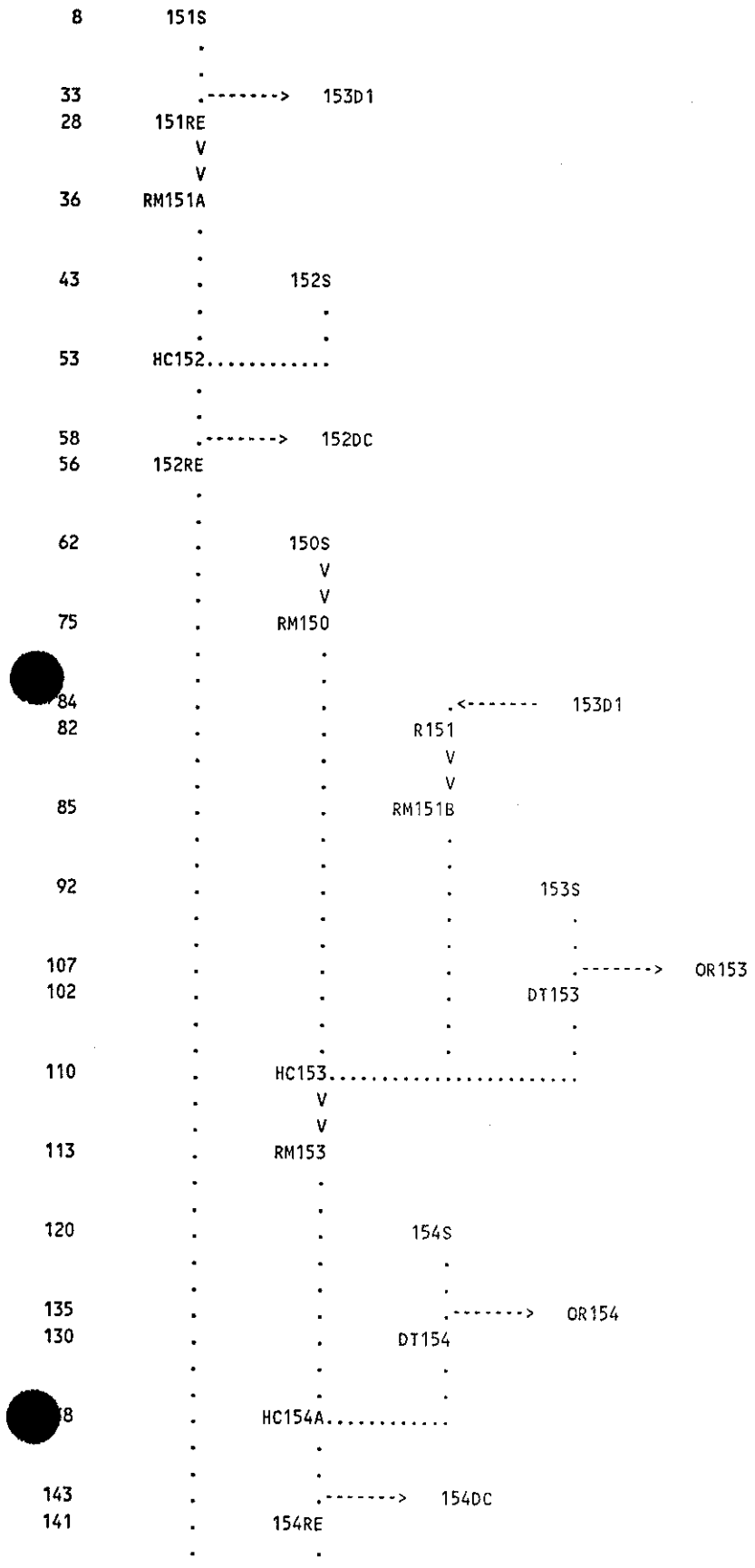
 328      KK    R160
 329      KM    RETRIEVE DIVERTED HYDROGRAPH FROM SUB-BASIN 160 AT 19TH AVENUE AND CHOLLA
 330      KM    STREET AND PEORIA AVENUE.  THIS HYDROGRAPH WILL BE STORED IN FILENAME:
 331      KM    CC324F.DSS FOR RETRIEVAL AT A PART OF THE WATERSHED CONTRIBUTING TO
 332      KM    CAVE CREEK.
 333      DR    265D
 334      ZW    A=CHOLLA STREET  B=R160  C=FLOW  F=SUNNYSLOPE
 335      ZZ
```

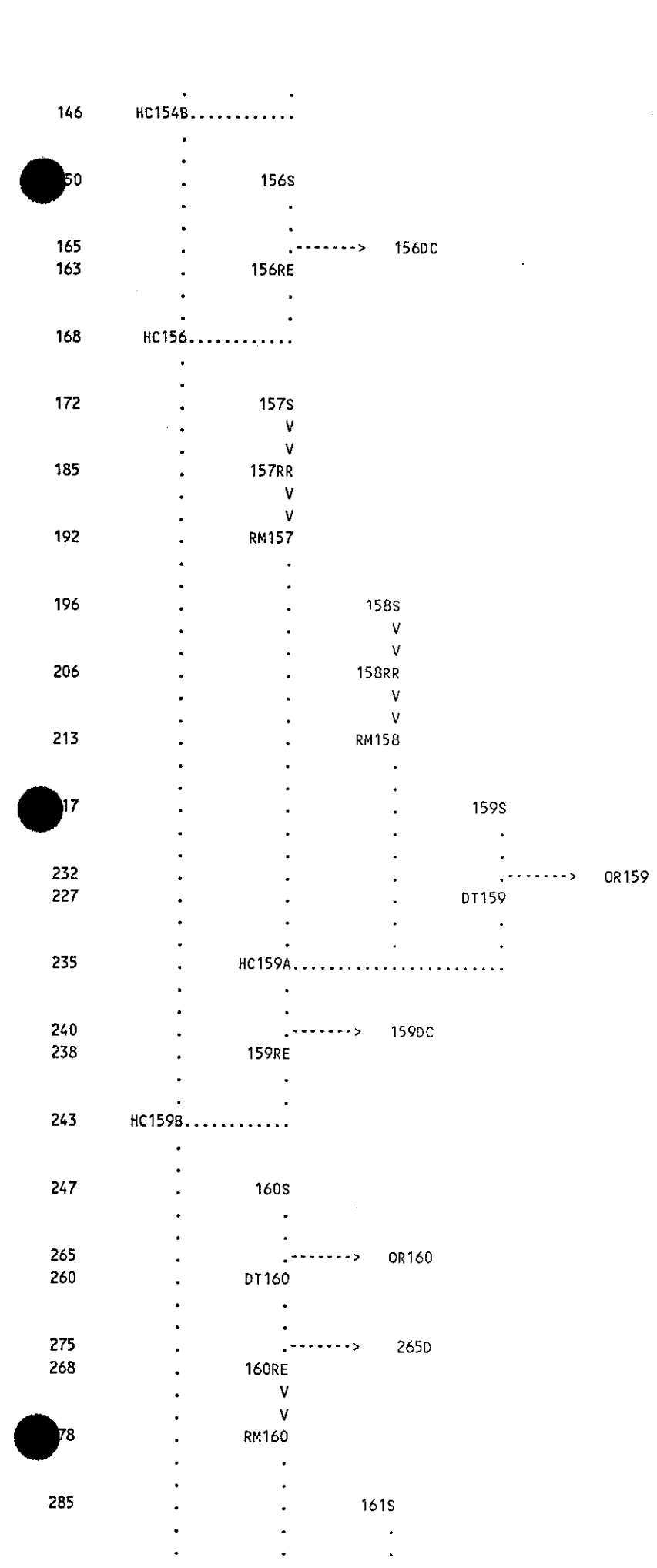
SCHEMATIC DIAGRAM OF STREAM NETWORK

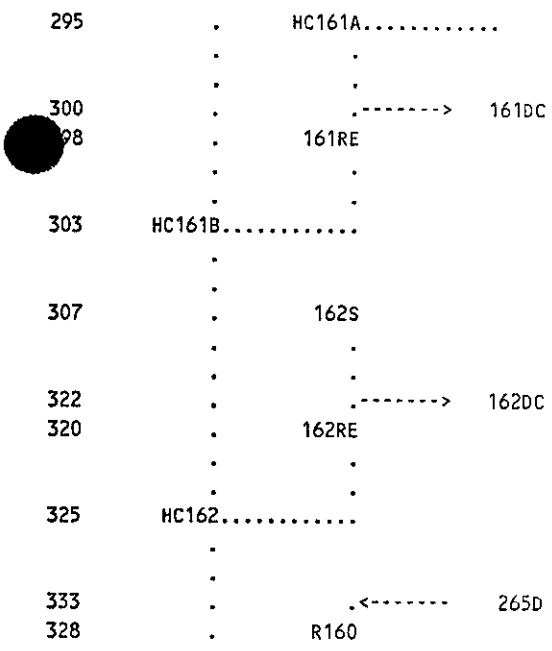
INPUT LINE NO.

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

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




146
HC154B
150
156S
165
156DC
163
156RE
168
HC156
172
157S
185
157RR
192
RM157
196
158S
206
158RR
213
RM158
217
159S
232
OR159
227
DT159
235
HC159A
240
159DC
238
159RE
243
HC159B
247
160S
265
OR160
260
DT160
275
265D
268
160RE
278
RM160
285
161S



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*            MAY   1991                 *
*         VERSION 4.0.1E                *
*                                       *
*  RUN DATE  03/14/94  TIME  15:35:04   *
*                                       *
*****************************************
```

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

ACDC AREA DRAINAGE MASTER STUDY
FILENAME: SUN324F.DAT KHE JOB NO. 0146
WATERSHED CONTRIBUTING TO THE ACDC
10TH STREET WASH TO CAVE CREEK
100-YEAR 24-HOUR DURATION STORM FOR FUTURE CONDITIONS

7 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN	4	MINUTES IN COMPUTATION INTERVAL
IDATE	10OCT92	STARTING DATE
ITIME	1200	STARTING TIME
NQ	800	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	12OCT92	ENDING DATE
NDTIME	1716	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL 0.07 HOURS
TOTAL TIME BASE 53.27 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

-----DSS---ZOPEN: Existing File Opened, File: CC324F.DSS
Unit: 71; DSS Version: 6-FT
-----DSS---ZWRITE Unit 71; Vers. 1: /CHOLLA STREET/R160/FLOW/10OCT1992/4MIN/SUNNYSLOPE/
-----DSS---ZWRITE Unit 71; Vers. 1: /CHOLLA STREET/R160/FLOW/11OCT1992/4MIN/SUNNYSLOPE/
-----DSS---ZWRITE Unit 71; Vers. 1: /CHOLLA STREET/R160/FLOW/12OCT1992/4MIN/SUNNYSLOPE/

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	151S	753.	12.13	131.	43.	19.	0.61		
DIVERSION TO	153D1	539.	12.13	84.	24.	11.	0.61		
HYDROGRAPH AT	151RE	214.	12.13	46.	19.	9.	0.61		
ROUTED TO	RM151A	219.	12.27	46.	19.	9.	0.61		
HYDROGRAPH AT	152S	236.	12.07	40.	13.	6.	0.18		
2 COMBINED AT	HC152	425.	12.13	86.	32.	15.	0.79		
DIVERSION TO	152DC	425.	0.07	86.	32.	15.	0.79		
HYDROGRAPH AT	152RE	0.	0.07	0.	0.	0.	0.79		
HYDROGRAPH AT	150S	391.	12.07	56.	18.	8.	0.29		
ROUTED TO	RM150	381.	12.27	56.	18.	8.	0.29		
HYDROGRAPH AT	R151	539.	12.13	84.	24.	11.	0.00		
ROUTED TO	RM151B	540.	12.20	85.	24.	11.	0.00		
HYDROGRAPH AT	153S	620.	12.00	89.	30.	13.	0.39		
DIVERSION TO	OR153	10.	12.00	6.	2.	1.	0.39		
HYDROGRAPH AT	DT153	620.	12.00	89.	28.	13.	0.39		
3 COMBINED AT	HC153	1427.	12.13	230.	70.	31.	0.68		
ROUTED TO	RM153	1427.	12.13	231.	70.	32.	0.68		
HYDROGRAPH AT	154S	411.	12.07	61.	20.	9.	0.29		
DIVERSION TO	OR154	6.	12.07	3.	1.	0.	0.29		
HYDROGRAPH AT	DT154	411.	12.07	61.	20.	9.	0.29		
2 COMBINED AT	HC154A	1811.	12.13	292.	90.	40.	0.97		
DIVERSION TO	154DC	1811.	0.07	292.	90.	40.	0.97		
HYDROGRAPH AT	154RE	0.	0.07	0.	0.	0.	0.97		
2 COMBINED AT	HC154B	0.	0.07	0.	0.	0.	1.75		
HYDROGRAPH AT	156S	615.	12.07	100.	33.	15.	0.46		
DIVERSION TO	156DC	615.	0.07	100.	33.	15.	0.46		
HYDROGRAPH AT	156RE	0.	0.07	0.	0.	0.	0.46		
2 COMBINED AT	HC156	0.	0.07	0.	0.	0.	2.22		
HYDROGRAPH AT	157S	99.	12.13	14.	4.	2.	0.08		

ROUTED TO	157RR	18.	12.73	13.	4.	2.	0.08	1359.54	12.73
ROUTED TO	RM157	18.	13.27	13.	4.	2.	0.08		
HYDROGRAPH AT	158S	674.	12.20	88.	26.	12.	0.54		
ROUTED TO	158RR	20.	13.53	20.	18.	12.	0.54	1329.05	13.67
ROUTED TO	RM158	20.	14.13	20.	18.	12.	0.54		
HYDROGRAPH AT	159S	780.	12.07	112.	36.	16.	0.55		
DIVERSION TO	OR159	9.	12.07	3.	1.	0.	0.55		
HYDROGRAPH AT	DT159	780.	12.07	112.	35.	16.	0.55		
3 COMBINED AT	HC159A	795.	12.07	139.	54.	29.	1.17		
DIVERSION TO	159DC	795.	0.07	139.	54.	29.	1.17		
HYDROGRAPH AT	159RE	0.	0.07	0.	0.	0.	1.17		
2 COMBINED AT	HC159B	0.	0.07	0.	0.	0.	3.39		
HYDROGRAPH AT	160S	1334.	12.07	185.	61.	27.	0.87		
DIVERSION TO	OR160	19.	12.07	12.	3.	1.	0.87		
HYDROGRAPH AT	DT160	1334.	12.07	185.	58.	26.	0.87		
DIVERSION TO	265D	390.	12.07	115.	40.	18.	0.87		
HYDROGRAPH AT	160RE	944.	12.07	70.	17.	8.	0.87		
ROUTED TO	RM160	936.	12.13	70.	18.	8.	0.87		
HYDROGRAPH AT	161S	566.	12.13	101.	33.	15.	0.44		
2 COMBINED AT	HC161A	1502.	12.13	171.	51.	23.	1.30		
DIVERSION TO	161DC	1502.	0.07	171.	51.	23.	1.30		
HYDROGRAPH AT	161RE	0.	0.07	0.	0.	0.	1.30		
2 COMBINED AT	HC161B	0.	0.07	0.	0.	0.	4.69		
HYDROGRAPH AT	162S	210.	12.20	49.	17.	8.	0.19		
DIVERSION TO	162DC	210.	0.07	49.	17.	8.	0.19		
HYDROGRAPH AT	162RE	0.	0.07	0.	0.	0.	0.19		
2 COMBINED AT	HC162	0.	0.07	0.	0.	0.	4.89		
HYDROGRAPH AT	R160	390.	11.67	115.	40.	18.	0.00		

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

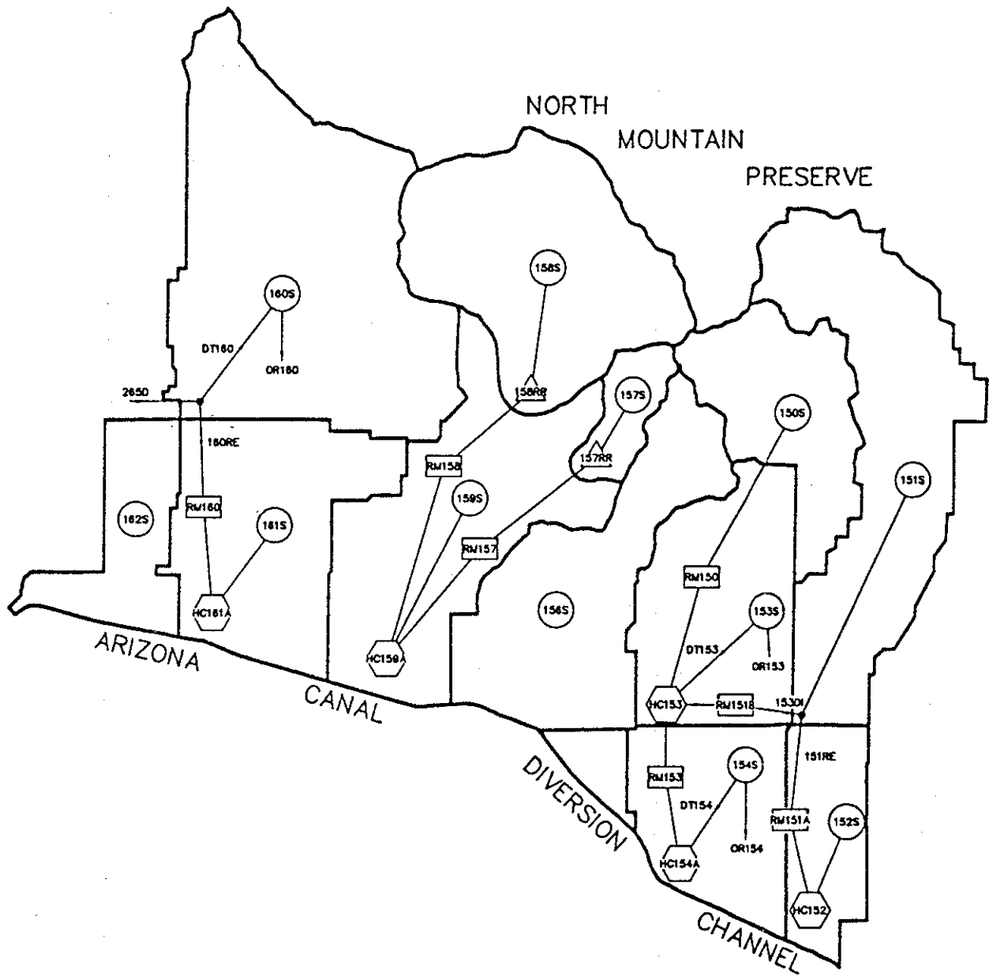
ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
RM151A	MANE	4.00	218.65	736.00	1.17	4.00	218.65	736.00	1.17
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3787E+02 EXCESS=0.0000E+00 OUTFLOW=0.3793E+02 BASIN STORAGE=0.4013E-03 PERCENT ERROR= -0.1									
RM150	MANE	4.00	380.74	736.00	2.30	4.00	380.74	736.00	2.30
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3534E+02 EXCESS=0.0000E+00 OUTFLOW=0.3543E+02 BASIN STORAGE=0.5807E-03 PERCENT ERROR= -0.3									
RM151B	MANE	4.00	540.19	732.00	-1.00	4.00	540.19	732.00	-1.00
RM153	MANE	3.62	1427.22	727.94	3.85	4.00	1426.81	728.00	3.86
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1387E+03 EXCESS=0.0000E+00 OUTFLOW=0.1387E+03 BASIN STORAGE=0.2188E-03 PERCENT ERROR= 0.0									
RM157	MANE	4.00	17.67	796.00	1.90	4.00	17.67	796.00	1.90
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8417E+01 EXCESS=0.0000E+00 OUTFLOW=0.8419E+01 BASIN STORAGE=0.4858E-02 PERCENT ERROR= -0.1									
RM158	MANE	4.00	20.32	848.00	1.80	4.00	20.32	848.00	1.80
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5190E+02 EXCESS=0.0000E+00 OUTFLOW=0.5191E+02 BASIN STORAGE=0.5053E-02 PERCENT ERROR= 0.0									
RM160	MANE	1.80	943.95	727.20	0.76	4.00	936.26	728.00	0.76
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3468E+02 EXCESS=0.0000E+00 OUTFLOW=0.3499E+02 BASIN STORAGE=0.6295E-03 PERCENT ERROR= -0.9									

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

-----DSS---ZCLOSE Unit: 71, File: CC324F.DSS
Pointer Utilization: 0.25
Number of Records: 27
File Size: 63.7 Kbytes
Percent Inactive: 0.0

SECTION VIII
Plates 1-5

T.3N., R.2E. | T.3N., R.3E.



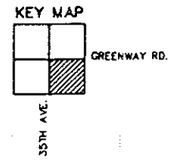
T.3N., R.2E.

T.2N., R.2E.

T.2N., R.2E. | T.2N., R.3E.

T.3N., R.3E.

KEY MAP



INDEX

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

DATE FLOWN: 11-15-1990, 1-18-1991, 2-12-1991 & 2-15-1991

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH TO CAVE CREEK WASH HYDROLOGY STUDY

LEGEND

- Drainage 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

EXISTING & FUTURE CONDITIONS

PLATE 1

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

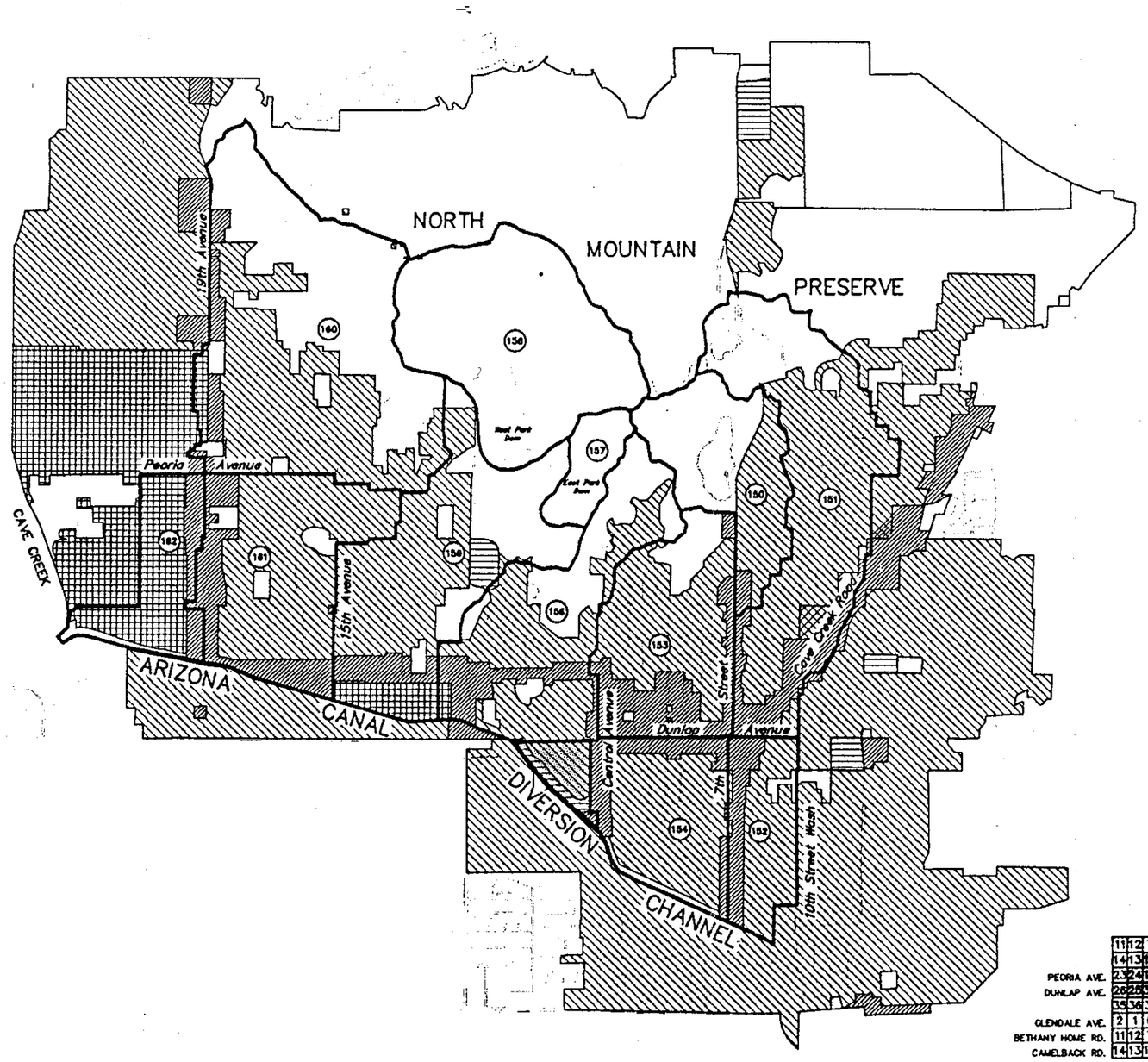
N

SCALE

1200 600 0 1200 2400

FEET

T.3N., R.2E. | T.3N., R.3E.

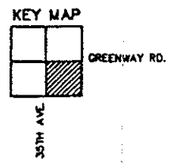


T.3N., R.2E.

T.2N., R.2E.

T.3N., R.3E.

KEY MAP



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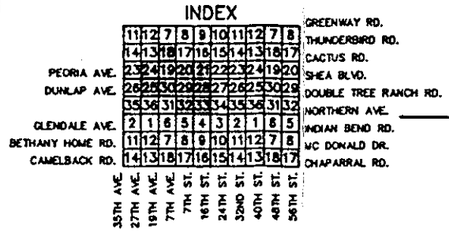


DATE FLOWN: 11-15-1990, 1-18-1991, 2-12-1991 & 2-15-1991

T.2N., R.2E. | T.2N., R.3E.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH TO CAVE CREEK WASH HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- Residential Land Use
- Commercial Land Use
- Golf Course/Park
- Utility Land Use
- Industrial Land Use
- Significant Onsite Retention Area
- Vacant Land Use
- (150) Drainage Sub-Basin Number

LAND USE MAP
EXISTING CONDITIONS

PLATE 2

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

N

SCALE
1200 600 0 1200 2400
FEET

T.3N., R.2E. | T.3N., R.3E.

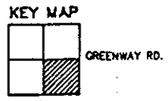
T.3N., R.3E.

T.3N., R.2E.

T.2N., R.2E.

T.2N., 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, 1-18-1991, 2-12-1991 & 2-15-1991

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH TO CAVE CREEK WASH HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- (150) 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
EXISTING & FUTURE CONDITIONS

PLATE 3

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

N

SCALE
1200 600 0 1200 2400

T.3N., R.2E. | T.3N., R.3E.

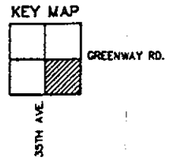
T.3N., R.2E.

T.2N., R.2E.

T.2N., R.2E. | T.2N., R.3E.

T.3N., R.3E.

KEY MAP



INDEX

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

DATE FLOWN: 11-15-1990 & 8-23-1991

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH TO CAVE CREEK WASH HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- (150) Drainage Sub-Basin Number
- Major Drainage Basin Concentration Point
- Drainage Sub-Basin Concentration Point
- Flow Diversion Point
- Routing Flow Path
- Length of Longest Watercourse
- [1314] Elevation Along Flow Path

FLOW ROUTING MAP
EXISTING & FUTURE CONDITIONS

PLATE 4

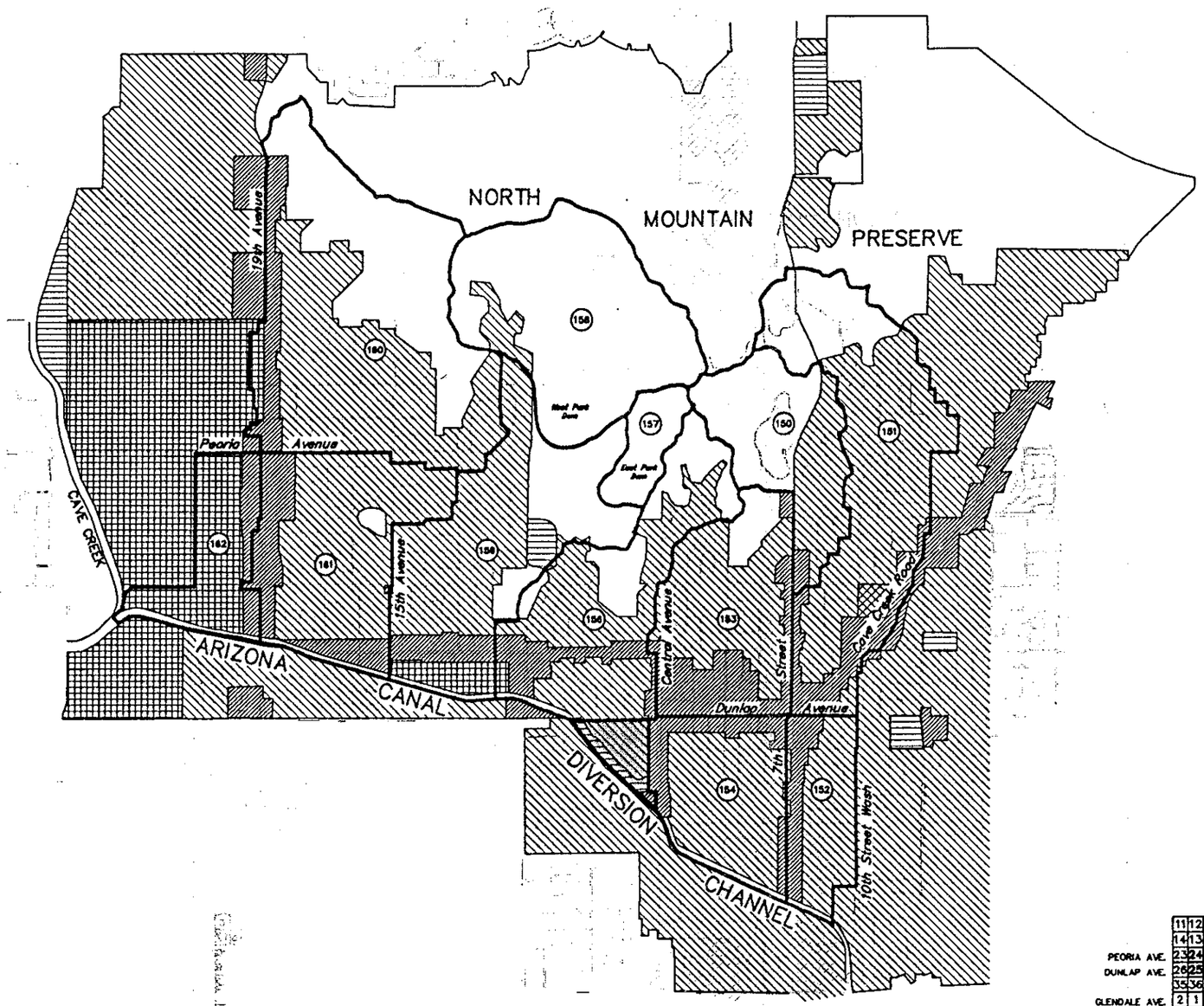
KAMINSKI HUBBARD engineering,inc.
SURVEYING • CIVIL • HYDROLOGY
4550 N. BLACK CANYON HWY.,SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

N

SCALE
1200 600 0 1200 2400
FEET

CONTOUR INTERVAL 10 FEET

T.3N., R.2E. | T.3N., R.3E.



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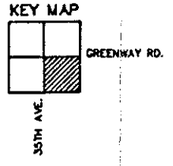

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	23	24	19	20	21	22	23	24	19	20	CACTUS RD.
PEORIA AVE.											SHEA BLVD.
DUNLAP AVE.	26	25	30	29	28	27	26	25	30	29	DOUBLE TREE RANCH RD.
	35	36	31	32	33	34	35	36	31	32	NORTHERN AVE.
GLENDALE AVE.	2	1	6	5	4	3	2	1	6	5	INDIAN BEND RD.
BETHANY HOME RD.	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, 1-18-1991, 2-12-1991 & 2-15-1991

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 10TH STREET WASH TO CAVE CREEK WASH HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- Residential Land Use
- Commercial Land Use
- Golf Course/Park
- Utility Land Use
- Industrial Land Use
- Significant Onsite Retention Area
- Vacant Land Use
- (150) Drainage Sub-Basin Number

LAND USE MAP
FUTURE CONDITIONS

PLATE 5

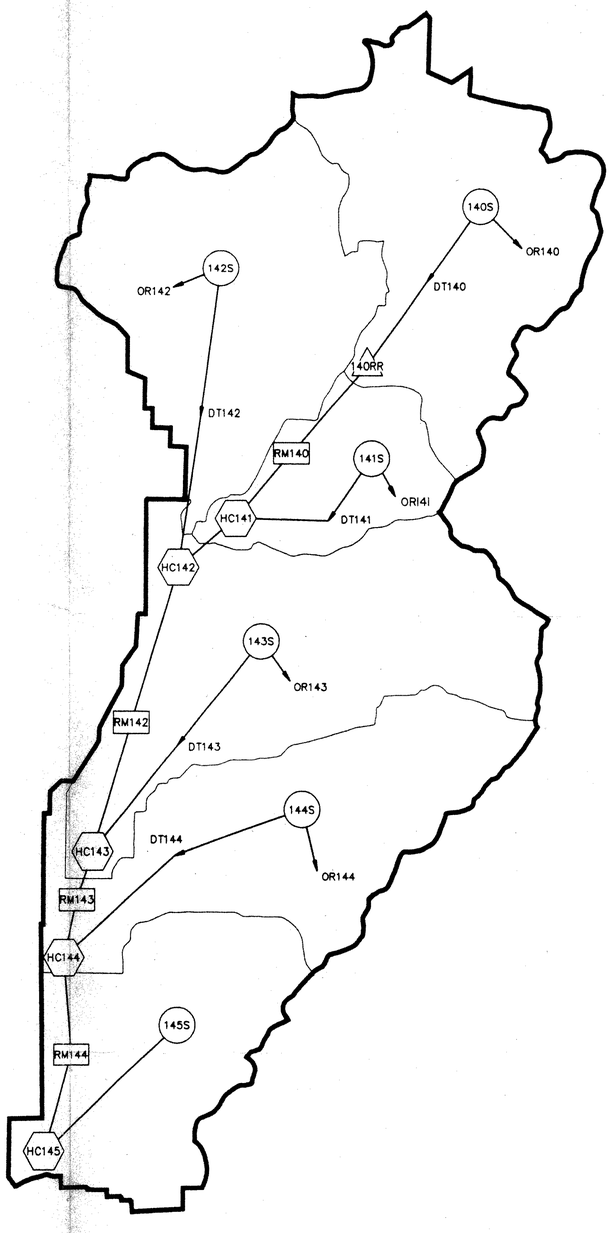
KAMINSKI HUBBARD engineering,inc.
SURVEYING • CIVIL • HYDROLOGY
4550 N. BLACK CANYON HWY.,SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

N

SCALE
1200 600 0 1200 2400
FEET

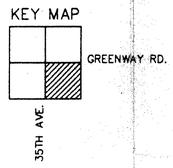
SECTION IX

HEC-1 Data Files on Computer Diskette



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.
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	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
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- 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