FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HYDROLOGY REPORT

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for

Floodplain Delineation Study

of

Upper Centennial Wash, Grass Wash and Aguila Farm Channel

URS
CONSULTANTS
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REVISED

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Hydrology Report

for

Floodplain Delineation Study

of

Upper Centennial Wash, Grass Wash and Aguila Farm Channel

Contract No. FCD 88-54

April 1990

Prepared by:

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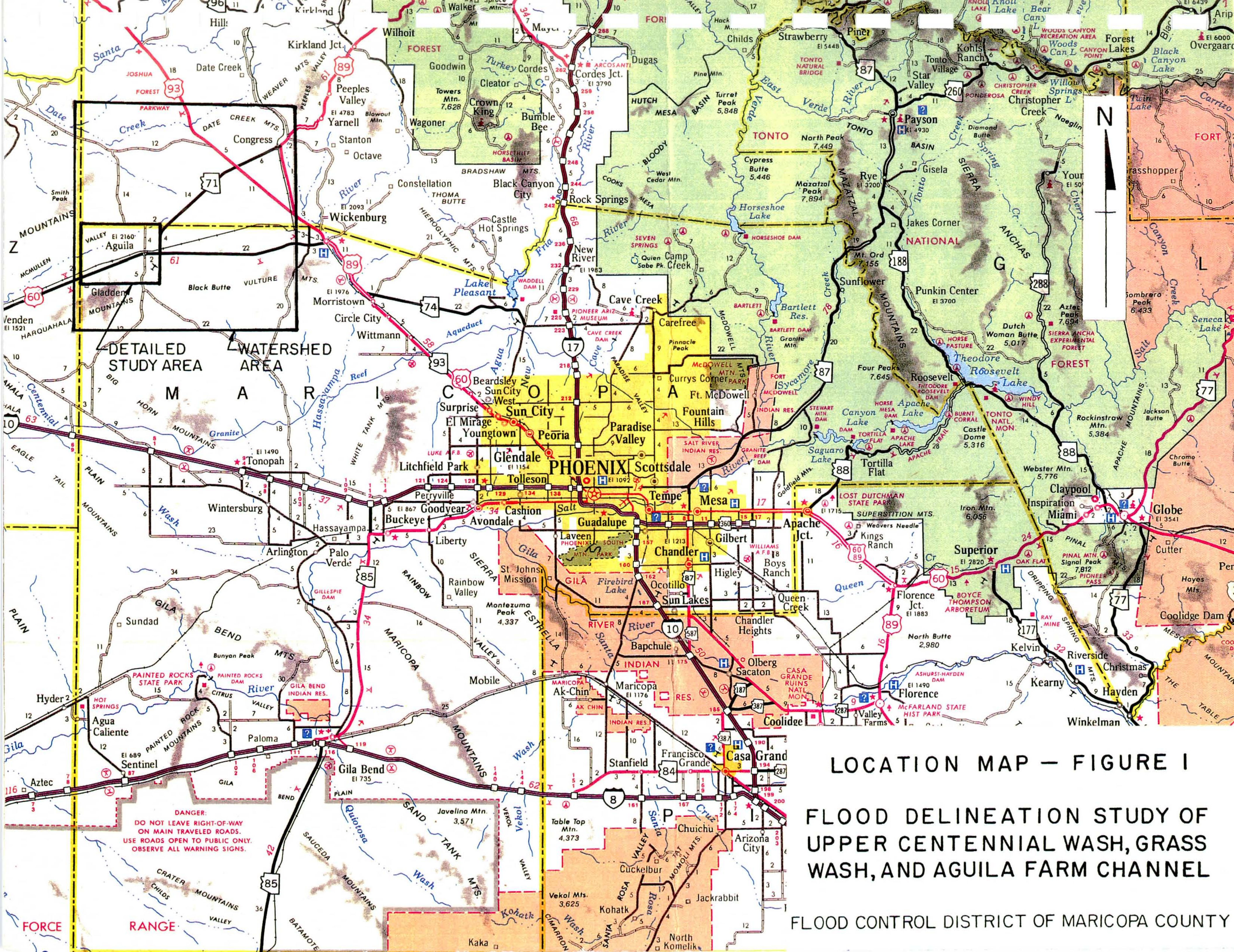
I. INTRODUCTION

URS Consultants was contracted by the Flood Control District of Maricopa County (the District) to perform detailed hydrologic and hydraulic analyses and floodplain mapping for the Upper Centennial Wash, Grass Wash and Aguila Farm Channel. The study was conducted in accordance with the Federal Emergency Management Agency's (FEMA), "Flood Insurance Study Guidelines and Specifications for Study Contractors, September 1985" (Reference 7). The study area is located surrounding the unincorporated community of Aguila, Arizona in the extreme northwest corner of Maricopa County (Figures 1 and 2). Aguila, Arizona is located approximately 25 miles west of Wickenburg, Arizona along U.S. Highway 60/70 and is centered within Township 7 North, Range 9 West, Gila and Salt River Base and Meridian.

The purpose of this report is to estimate 10-, 50-, and 100-year return frequency peak discharges at appropriate locations along the study reaches identified above. A detailed study previously had been performed (1978) by FEMA along portions of the Aguila Farm Channel and Grass Wash which estimated 10-, 50, and 100-year return frequency peak discharges (References 5 and 6). Similar peak discharges have not been estimated for the portion of Upper Centennial Wash encompassed by this study. Upper Centennial Wash was previously mapped using approximate methods. Therefore, the Aguila Farm Channel and Grass Wash study reaches are re-study areas, while the Upper Centennial Wash is a new detailed study reach.

The peak discharges estimated by this study will be used in determining water surface elevations and associated profiles, floodplain and floodway boundaries, and flood hazard zones within the study area. Floodplain and floodway boundaries and flood hazard zones will be determined using the appropriate 100-year peak discharge.



LOCATION MAP — FIGURE 1

FLOOD DELINEATION STUDY OF UPPER CENTENNIAL WASH, GRASS WASH, AND AGUILA FARM CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

II. WATERSHED DESCRIPTION

The watershed and associated subbasins are located within the extreme northwest corner of Maricopa County, Arizona. The northern boundary of the watershed consists of the Harcuvar and Date Creek Mountains. The eastern boundary is defined by a natural topographic watershed division between the Sols Wash and Upper Centennial Wash watersheds. The southern boundary of the watershed is formed by the Vulture and Harquahala Mountains. Runoff from the Aguila Farm Channel and Grass Wash join with the Upper Centennial Wash drainage system at the unincorporated town of Aguila. Runoff within the Upper Centennial Wash drains in a southwesterly direction where it exits Maricopa County and enters La Paz County. Runoff within the Centennial Wash drainage system eventually turns southeasterly and re-enters Maricopa County where it is referred to as Lower Centennial Wash (previously studied, see Reference 3).

The slope of the natural terrain varies widely. The steeper foothills and mountain slopes range from approximately 5 to 60 percent. Less steep areas within the study range from 0.2 to 5 percent. It should be noted that the slope of the three major drainage channels being studied range from 0.2 to 0.3 percent (Appendix F).

Four major soil texture classes were identified from the numerous soil types present within the watershed. The four are: Sandy Loam, Sandy Clay Loam, Clay Loam, and Clay. The most common is Sandy Loam. The least common is Clay (Appendix G and References 16 and 17).

The watershed has several man-made physical features which should be noted.

U.S. Highways 60/70 and 93 and State Route 71 traverse the watershed. Field reconnaissance observed that these highways are primarily constructed at-grade (or minimal fill) with low-flow culverts located at drainage concentration points. A major highway bridge crossing is located at Grass Wash and will be hydraulically modeled using HEC-2. This study assumed that the roadways do not significantly impede or alter the natural direction of flow.

The Atchinson Topeka and Santa Fe Railroad (AT & SF) transects the study area in a southwesterly direction. The rail bed is elevated fill approximately 4 to 6 feet above natural grade and acts as a barrier to runoff draining in a northerly direction. There are 33 drainage structures within the study area which allow runoff to pass through the railroad bed (Figure 2). The largest of these structures is a 300 foot long trestle crossing Grass Wash which will be hydraulically modeled using HEC-2. The remaining 32 structures were individually rated for their conveyence capacity using the procedure described in HDS-5 (Appendix I and Reference 19). Several assumptions were made in order to estimate culvert capacity. They were:

1. Each culvert has the ability to flow full so that HW/D = 1.
2. Each culvert is under inlet control.
3. Sedimentation which may be present at culverts will flush during significant flow events or will be removed by ongoing AT & SF maintenance activities.

It was determined that where one or multiple culverts are present within a subbasin, their combined capacity exceeds the estimated 100-year peak discharge for the subbasin (Appendix I). Therefore, the railroad drainage structures are adequately sized to allow runoff to pass through the rail bed. Where there are no drainage structures, runoff flows parallel to the rail bed in a southwesterly direction.

There are numerous man-made structures consisting of training dikes, spreader dikes, stock tanks, etc., located throughout the watershed. These structures do not meet the FEMA criteria as identified in Chapter 2-7.e. of Reference 7 and, therefore, were not considered in this study. These structures generally consist of unprotected fill, some compacted and some not, are poorly maintained, and have no erosion protection. Historically, these structures have failed during significant flow events (Reference 1). The Sols Wash Tank, located at the terminus of Subbasin 100, was assumed to fail and 50 percent of the flow would drain in Sols Wash and 50 percent of the flow would drain into the study area. This assumption was based on review of the topographic base map and aerial observation of the drainage patterns downstream of the structure, both indicate that flow splits to the east and west downstream of the structure in numerous channels. It was determined by further analyses (0% to 100% diversion) that flows from Subbasin 100 do not significantly affect downstream peak discharges within the detailed study area.

III. METHODOLOGY

URS Consultants estimated the flood hydrology and peak discharges for Upper Centennial Wash, Grass Wash and Aguila Farm Channel. A memo from the District specifying modeling methodology is included for review in Appendix D. A summary of the methodology and assumptions are presented below.

Computer Modeling

The Army Corps of Engineer's hydrologic computer model, "HEC-1 - Flood Hydrograph Package", was used to estimate peak discharges at several critical runoff concentration points within the study area (Reference 13). This program develops a runoff hydrograph for individual subbasins through the input of numerical representations of the basin's physical/hydrologic characteristics. The individual hydrographs are then routed and/or combined in a sequence similar to the way runoff occurs within the physical watershed. Hydrographs and peak discharges can be requested for output at specified runoff concentration points. A schematic representation of the modeling logic is illustrated in Figure 3.

Field Reconnaissance

URS Consultants has performed three field reconnaissance trips to the study area. The first trip was a general reconnaissance trip with District staff. This trip included aerial reconnaissance of the entire watershed combined with ground reconnaissance to observe the watershed's physical and hydrologic characteristics first hand. Two more detailed reconnaissance trips were made by URS staff to measure, record, and photograph the watershed's physical and hydrologic characteristics applied in the HEC-1 modeling.

Watershed Areas

United States Geological Survey topographic quadrangle maps were used to develop a mylar base map having a scale of 1:62,500 (Figure 2 and Reference 20). Individual watershed subbasins were delineated on this base map for area determination. The subbasin boundaries were defined using: 1) the topography as shown on the USGS base map; 2) aerial photos contained in the SCS soil survey documents (References 16 and 17); and, 3) through field reconnaissance.

Rainfall Depth

The depth of rainfall has been obtained from the information and procedures in the National Oceanic and Atmospheric Administration (NOAA) Atlas 2, "Precipitation-Frequency Atlas of the Western United States, Volume VIII - Arizona, " (Reference 18). The 24-hour, 10-, 50-, and 100-year frequency rainfall depths for the project area are 2.50, 3.55 and 4.05 inches, respectively (Appendix E).

Rain Distribution

The temporal rainfall distribution being used is the Type II, 24-hour duration storm developed by the Soil Conservation Service. The cumulative distribution table being used is included in Appendix E.

Area Reduction of Rainfall Depth

The spatial distribution pattern of rainfall in Arizona is not always uniform. Rainfall depths given in NOAA Atlas 2 are point values. It is necessary to adjust these point rainfall depths by a given ratio based on the watershed area being considered. Depth/area ratios were developed by District staff using NWS HYDRO 40 and supplied to URS. A copy of the depth/area values being used in this study are included in Appendix E.

Unit Hydrograph

The SCS Dimensionless Unit Hydrograph procedure was used in this study. This synthetic hydrograph represents the runoff hydrograph due to 1 inch (a unit) of rainfall excess applied uniformly over a watershed. The unit hydrograph ordinates are then adjusted based on the amount of rainfall excess. HEC-1 input from this method requires the estimation of the watershed's lag time in hours which is derived from the time of concentration.

Time of Concentration and Lag Time

Time of concentration (T_c) is the time it takes a molecule of water to travel from the hydraulically most distant point in a watershed to the outlet or
concentration point. The Kirpich Equation was used to estimate subbasin T_c values. T_c was estimated by the equation below:

$$T_c = L^{1.15}/7700\ H^{0.38}$$

where:

T_c = Time of concentration (hours)

L = Hydraulic length (feet)

H = Elevation difference (feet)

Lag time (L) is time between the center of mass of rainfall excess and the peak of the runoff hydrograph. Lag time is often empirically related to the Time of Concentration (T_c) of a watershed as shown below:

$$L = 0.6\ T_c$$

where:

L = Lag time (hours)

T_c = Time of Concentration (hours)

This relationship was developed by the SCS (References 13 and 15) and was used to compute lag time in this study. Computation sheets for T_c and L are included in Appendix F.

Watershed Losses

Rainfall excess is the equivalent uniform depth of runoff that occurs during a storm event. Rainfall excess equals the total rainfall depth minus losses due to interception, infiltration, surface depression storage, etc. Watershed losses for this study were modeled using the Green and Ampt procedure described in Reference 8. The Green and Ampt procedure in HEC-1 uses five parameters (surface retention loss, hydraulic conductivity, wetting front capillary suction, soil moisture deficit, and percent impervious area) which are based on soil texture classification and land-use to compute the expected losses. Loss parameters for the Green and Ampt procedure were determined using detailed SCS soil maps to identify the soil types present within the watershed (References 16 and 17). Soil types were then grouped by their respective texture classifications. Weighted Green and Ampt parameters were computed for each subbasin based on the percent of individual soil textures present. Figure 5 illustrates the major soil texture groups within the study area. Four land-uses, Commercial/Residential, Mountain, Range, and Agriculture, were quantified within each subbasin for use in the Green and Ampt procedure. Computation sheets for the Green and Ampt parameters are included in Appendix G.

Channel Losses

Channel losses via bed infiltration can contribute to the attenuation of peak discharge as flood waters travel downstream. Some infiltration occurs in most natural channels, however, alluvial (sandy or gravelly) bed channels are known to be areas of significant groundwater recharge because of their relatively high infiltration rates.

Channel losses were not estimated in this study for the following reasons:

1. Reliable infiltration data is very site specific and not available for this area.
2. Non-uniformity of the soil types/textures throughout the floodplain.
3. Broad, sheet flow type floodplain with low flow channels instead of a uniform prismatic channel section with clearly definable bed. A channel is not present in many areas.

Flood Routing

Channel routing of flood flows was accomplished using the Muskingum Method (Reference 13). Flood routing is an important consideration in large, undeveloped watersheds where overbank storage, distributary flow, and lengthy travel time can attenuate flood peaks. As previously mentioned, many of the flow paths are broad sheet flow areas with several braided low flow channels throughout. Flood Control District staff related that observed flow velocities in this terrain typically range from 3 to 5 feet per second within Maricopa County. URS staff estimated that flow velocities could range from 2 to 8 feet per second using Manning's Equation for normal depth. U.S.G.S. topographic maps were used to estimate slope and approximate cross section geometry for the flow plains. In addition, a study conducted in a watershed having similiar hydrologic and topographic characteristics concluded that flow velocities generally range from 3 to 7 feet per second (Reference 21).

Based on the information above and engineering judgement, URS selected 4 feet per second as an average routing velocity to be used in the Muskingum method. The routing travel time was estimated using an average flow velocity of 4 feet per second for the distance traveled between concentration points. The number of time steps for each routing reach was estimated using a 10 minute computation interval. A weighing factor (X) of 0.2 was used in each routing procedure (Reference 9). Tabulation of routing data can be found in Appendix H.

IV. RESULTS

A summary of the resultant peak discharges estimated by this study which are proposed for FEMA adoption are presented in Table 1. Complete HEC-1 summary outputs for the 10-, 50-, and 100-year return frequency storm events are provided for review in Appendicies A, B, and C, respectively. Table 1 compares URS estimates with the previously estimated values adopted by FEMA (Appendix J and Reference 6).

URS acquired a graphical relationship of peak discharge per square mile verses drainage area in square miles plotted by the Arizona Department of Water Resources from previously adopted FEMA studies which determined 100-year peak discharges in Maricopa County, Arizona (Reference 1). URS peak discharge per square mile were derived from the 100-year return frequency model (Appendix C) were plotted against the existing FEMA data as illustrated in Figure 4. Table 2 provides a summary of the URS data plotted on Figure 4. Figure 4 indicates that the 100-year peak discharges estimated by URS are within the range of peak discharge values previously adopted by FEMA.

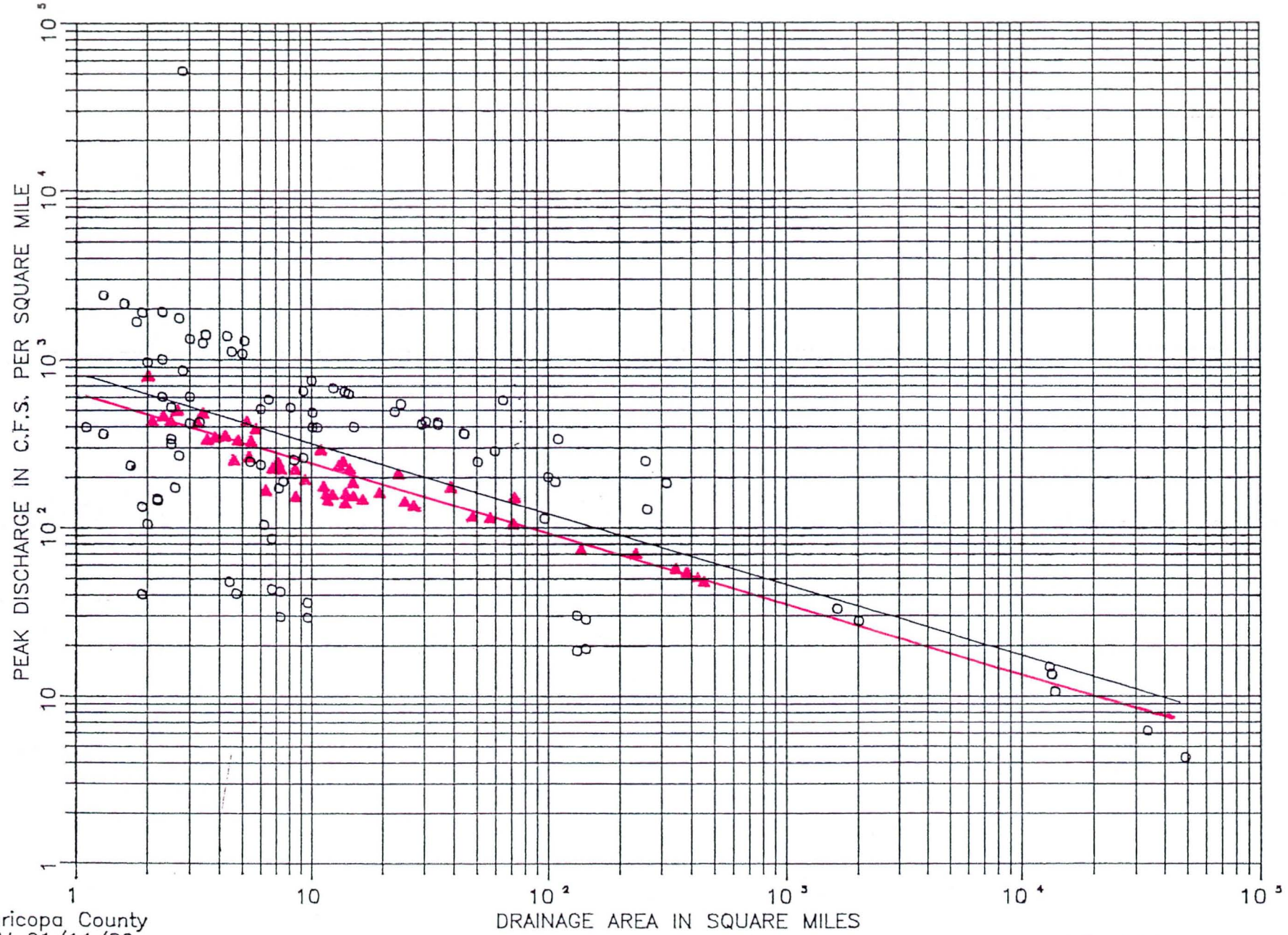
Calibration of the HEC-1 model's peak discharge/return frequency relationship to known gauged discharges was not possible due to the fact that no discharge gauges are present within the three major tributaries being studied.

FEMA has recently adopted a hydrologic analysis conducted for a floodplain delineation study performed on the lower portion of Centennial Wash prepared by Cella Barr Associates (Reference 3). This study estimated the 100-year peak discharge for Upper Centennial Wash at the Maricopa/La Paz County line to be 19,500 cfs (384 square miles) compared with the URS estimate of 21,700 cfs (452 square miles). The difference in watershed area is primarily due to URS determining that a portion of a 58 square mile area, Subbasin 100, has the potential to drain into the study area. Even though the URS study went into much greater detail subdividing the watershed, the 100-year peak discharges derived in both studies are very similar.

There is some difference in the existing FEMA peak discharges and the discharges estimated by this study, especially for the Grass Wash watershed. URS was not able to obtain a copy of the original hydrology which established the adopted FEMA values. The current FEMA Flood Insurance Study (Reference 6) states that the original hydrology was performed using the SCS TR-20 flood hydrology program and was conducted in 1978. The differences between the two studies are likely due to the following obvious dissimilarities:

1. The URS study is by COE HEC-1 while the previous study used SCS TR-20.
2. The URS study is using the Green and Ampt method for estimating watershed losses while the previous study probably used the SCS curve number method.
3. The Grass Wash watershed is estimated at 70.6 square miles by URS while the previous study estimated the watershed at 83.0 square miles. (The Grass Wash peak discharges have the most significant differences).

In conclusion, this study is presented to supercede the previous study's peak discharge data (where applicable) and to establish new estimated peak discharge values at the locations identified in Table 1.



Maricopa County
JRM 01/11/89
Power Function PK/SQM = 828.9 DA ** −0.42
URS Data PK/SQM = 609.7 DA** -0.41
R2 = 0.89

FIGURE 4
Comparison of 100-yr Discharges
Source: Arizona Department of Water Resources

Table 1

Summary of Discharges

Flooding Source and Location	Drainage Area (Sq.Mi.)	Peak Discharge (Cubic Feet per Second) 10-yr	50-yr	100-yr
Grass Wash				
At U.S. Highways 60/70	**70.6** (83.0)	**3,340** (6,380)	**8,660** (11,400)	**11,100** (14,400)
At N.W. corner of Sec. 25, T7N, R9W	**39.9** N/A	**2,430** N/A	**5,950** N/A	**7,500** N/A
At S.E. corner of Sec.25, T7N, R9W	**23.9** N/A	**1,720** N/A	**3,900** N/A	**4,870** N/A
Aguila Farm Channel				
At Eagle Eye Ave	**239.6** (216.0)	**3,620** (5,450)	**12,700** (12,000)	**16,900** (16,000)
Below Grass Wash	**314.4** N/A	**4,130** N/A	**14,500** N/A	**19,300** N/A
Upper Centennial Wash				
At Maricopa/La Paz County Boundary	**451.5** N/A	**4,880** N/A	**16,400** N/A	**21,700** N/A
At S.W. corner of Sec.4, T7N, R9W	**41.1** N/A	**1,900** N/A	**5,410** N/A	**6,960** N/A

Bold - URS Study
(Regular) - Previous FEMA Study
N/A - Not estimated in Previous Study

Table 2

100-year Peak Discharge per Square Mile
Summary Table

Subbasin I.D.	100-year Peak Discharge (cfs)	Area Sq.Mi	100-year Peak Discharge per Square Mile
1	1701	3.48	489
2A	2267	5.21	435
2B	1645	6.98	236
3	1205	3.63	332
4	1180	4.59	257
5A	1591	2.01	792
5B	1681	5.44	309
6	1454	8.57	170
7A	1231	2.25	547
7B	1649	4.95	333
8	923	2.13	433
9	1449	5.34	271
10	1168	6.34	184
11	1352	3.12	433
12	1046	2.59	404
13	1349	3.92	344
100	6549	58.27	112
101	1868	9.37	199
102	1544	5.25	294
103	2322	13.66	170
104	3993	28.20	142
105	3525	19.80	178
106	2247	5.75	391
107	3206	10.92	294

Table 2 (continued)

100-year Peak Discharge per Square Mile Summary Table

Subbansin I.D.	100-year Peak Discharge (cfs)	Area Sq.Mi	100-year Peak Discharge per Square Mile
108	1331	2.68	497
109	5682	49.05	116
110	2979	18.84	158
111	1073	2.41	445
112	2674	15.40	174
200	1486	4.24	350
201	3505	14.68	239
202	2288	14.98	153
203	2026	11.41	178
204	2158	12.76	169
205	3825	25.65	149
206	1966	8.83	223
207	1592	7.49	213
208	2143	12.62	170
209	1871	11.82	158
210	2701	16.93	160
A	3547	15.67	226
B	4873	23.88	204
C	7495	39.90	188
D	1668	7.19	232
E	3616	14.67	246
F	11060	70.55	157

Table 2 (continued)

100-year Peak Discharge per Square Mile Summary Table

Subbasin I.D.	100-year Peak Discharge (cfs)	Area Sq.Mi.	100-year Peak Discharge per Square Mile
H	3202	16.66	192
I	11061	151.20	73
J	7221	70.29	103
K	16866	239.57	70
L	20345	355.43	57
M	21136	393.84	54
N	21364	422.77	51
O	21730	451.53	48

V. REFERENCES

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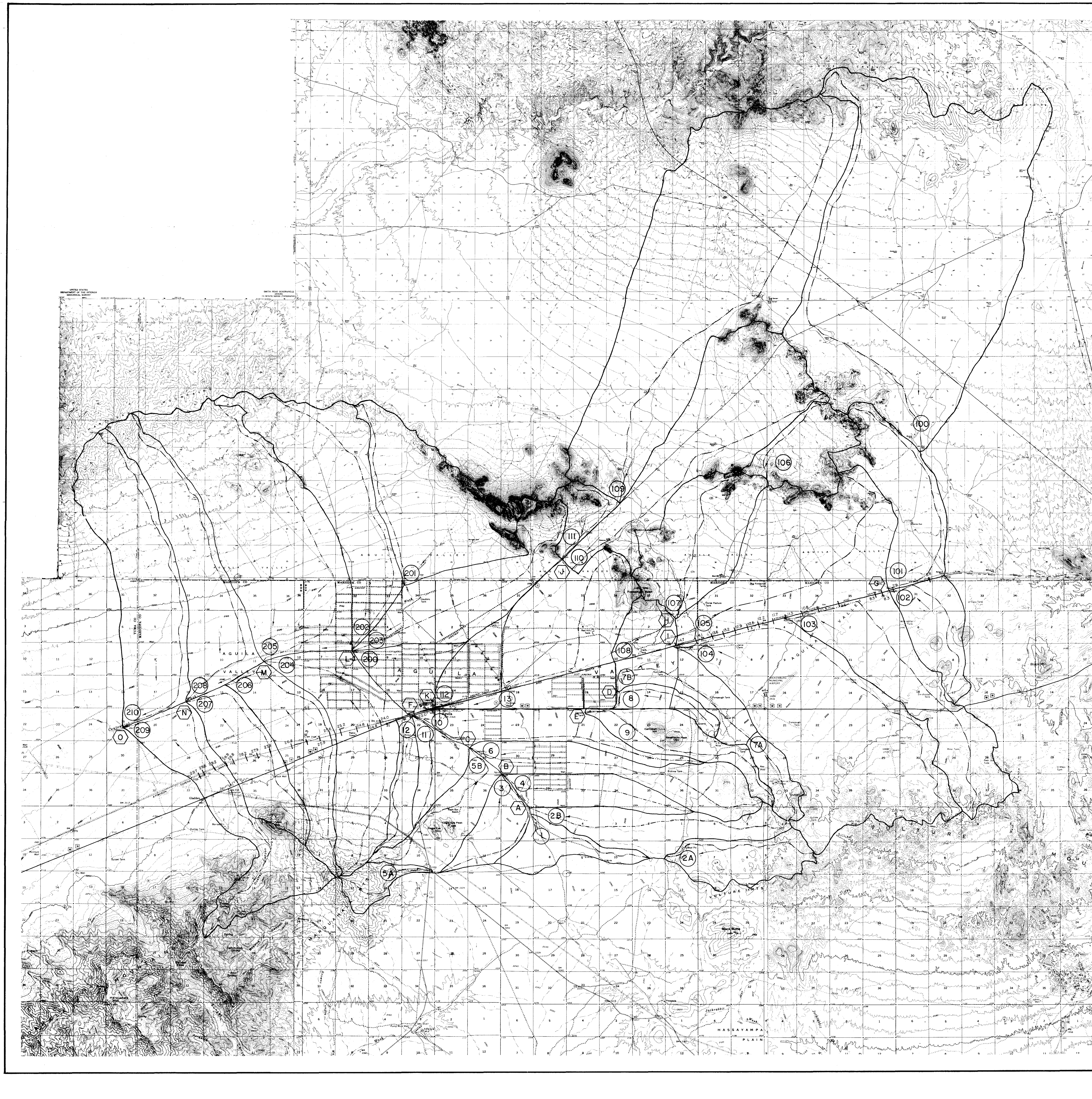


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF UPPER CENTENNIAL WASH, GRASS WASH AND AGUILA FARM CHANNEL

LEGEND

SUBBASIN BOUNDARY

(100) SUBBASIN IDENTIFICATION

(G) HYDROGRAPH COMBINATION POINT

FLOW DIRECTION

11.3 AT & SF RR DRAINAGE STRUCTURE

Tc FLOW PATH

DISCHARGE SUMMARY

Subbasin I.D.	Area Sq. Mi.	Estimated Peak Discharge (cfs) 10-year	50-year	100-year
1	3.48	675	1373	1701
2A	5.21	782	1805	2267
2B	6.98	621	1326	1645
A	15.67	1227	2829	3547
3	3.63	479	969	1205
4	4.59	437	946	1180
B	23.88	1716	3901	4873
5A	2.01	561	1269	1591
5B	5.44	585	1342	1681
6	8.57	521	1165	1454
C	39.90	2428	5948	7495
7A	2.25	450	989	1231
7B	4.95	498	1293	1649
8	2.13	300	731	923
9	5.34	481	1150	1449
E	14.67	1080	2836	3616
10	6.34	481	934	1168
11	3.12	495	1087	1352
12	2.59	365	835	1046
13	3.92	586	1106	1349
F	70.55	3337	8660	11060
100	58.27	1585	5014	6549
101	9.37	651	1491	1868
102	5.25	545	1234	1544
G	72.89	871	2768	3618
103	13.66	772	1845	2322
104	28.20	1199	3141	3993
105	19.80	1192	2814	3525
106	5.75	714	1769	2247
107	10.92	992	2520	3206
H	16.66	943	2508	3202
I	151.20	2751	8509	11061
108	2.68	457	1061	1331
109	49.05	1402	4362	5682
110	18.84	838	2323	2979
111	2.41	354	850	1073
J	70.29	1676	5500	7221
112	15.40	929	2141	2674
K	239.57	3615	12731	16866
200	4.24	561	1179	1486
201	14.68	1049	2749	3505
202	14.98	663	1788	2288
203	11.41	725	1624	2026
L	355.43	4398	15332	20345
204	12.76	695	1709	2158
205	25.65	1068	2983	3825
M	393.84	4718	15945	21136
206	8.83	624	1551	1966
207	7.49	473	1246	1592
208	12.62	629	1676	2143
N	422.77	4799	16133	21364
209	11.82	571	1468	1871
210	16.93	775	2110	2701
O	451.53	4881	16438	21730

WATERSHED SUBBASIN BOUNDARY MAP

N

SCALE 1:62,500

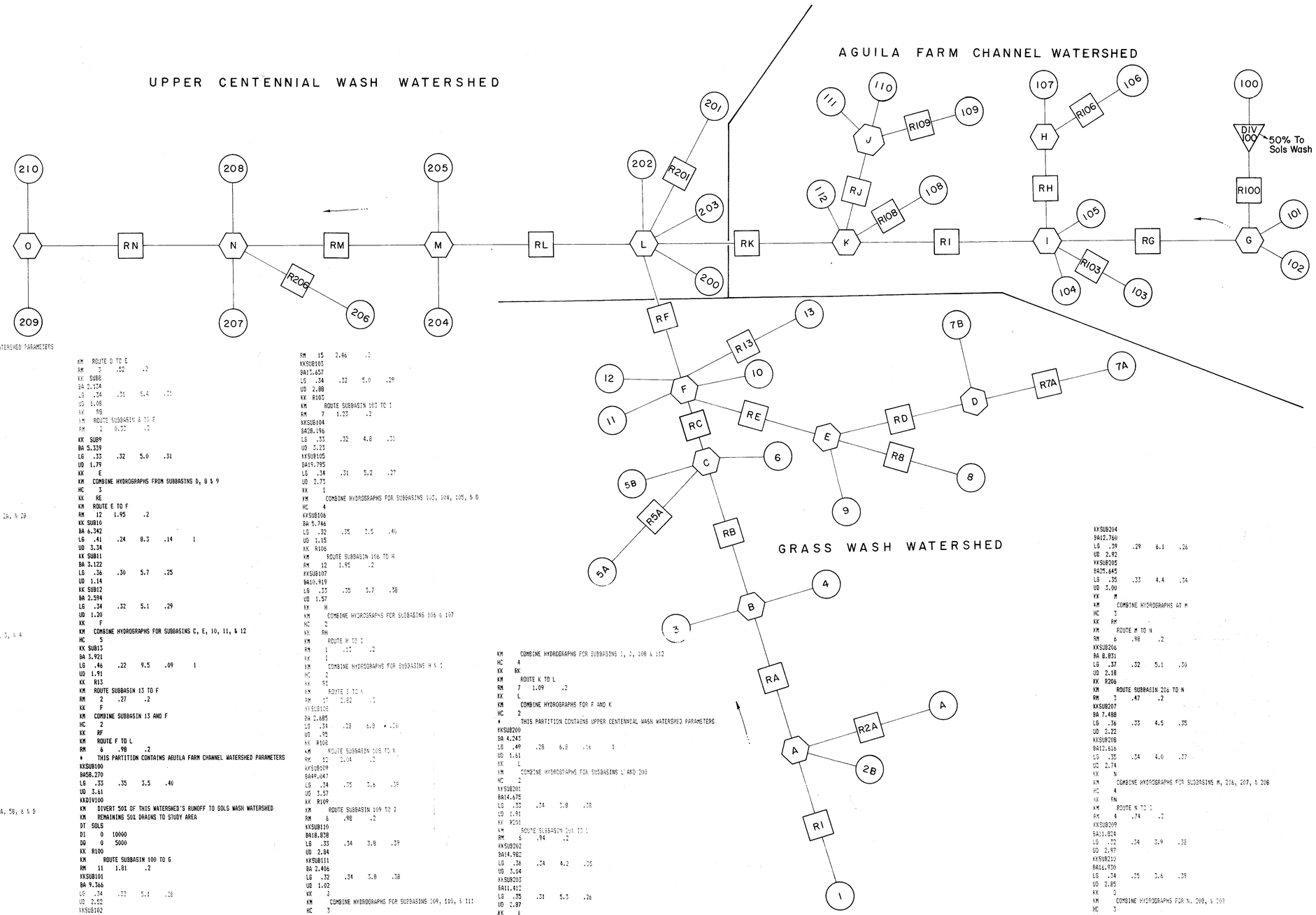
FIGURE 2

PREPARED BY: URS CONSULTANTS, INC.
432 North 44th Street, Suite 163
Phoenix, Arizona 85008

	BY	DATE	
DESIGN	S.S.S	11/8/89	SUBMITTED BY: DATE 3/27/90
DESIGN CHK.	G.V.S.	11/15/89	RECOMMENDED BY: DATE
PLANS	S.S.S.	11/8/89	APPROVED BY: DATE
PLANS CHK.	G.V.S.	11/15/89	CHIEF ENGINEER AND GENERAL MANAGER

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF UPPER CENTENNIAL WASH, GRASS WASH AND AGUILA FARM CHANNEL



LEGEND

- (100) SUBBASIN HYDROGRAPH
- (H) COMBINE HYDROGRAPHS
- [R2] ROUTE HYDROGRAPH
- (DIV 100) DIVERT HYDROGRAPH
- ← FLOW DIRECTION

```
*   THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS
KK  SUB1
BA 2.476
LG  .34    .27    7.2    .20
UD  1.05
KK   R1
KM   ROUTE SUBBASIN 1 TO A
RM    1    .67     .2
KK SUB2A
BA 5.211
LG  .28    .33    4.8    .22
UD  1.07
KK   R2A
KM   ROUTE SUBBASIN 2A TO A
RM   10   1.63     .2
KK SUB2B
BA 6.983
LG  .31    .30    6.1    .24
UD  2.20
KK    A
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
HC    3
KK   RA
KM   ROUTE A TO B
RM    3    .49     .2
KK  SUB3
BA 3.027
LG  .35    .29    6.4    .22
UD  1.47
KK  SUB4
BA 4.585
LG  .40    .29    6.4    .21
UD  2.07
KK    B
KM   COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
HC    3
KK   RB
KM   ROUTE B TO C
RM    3   0.47     .2
KK SUB5A
BA 2.012
LG  .26    .35    7.5    .40
UD  .49
KK   R5A
KM   ROUTE SUBBASIN 5A TO C
RM    9   1.52     .2
KK SUB5B
BA 5.437
LG  .34    .32    5.2    .28
UD  1.60
KK  SUB6
BA 8.572
LG  .38    .27    7.2    .22
UD  3.08
KK    C
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & 9
HC    4
KK   RC
KM   ROUTE C TO F
RM    4   0.72     .2
KK SUB7A
BA 2.247
LG  .30    .32    5.1    .29
UD  .85
KK   R7A
KM   ROUTE SUBBASIN 7A TO D
RM   12   1.97     .2
KK SUB7B
BA 4.947
LG  .35    .32    5.1    .22
UD  1.39
KK    D
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
HC    2
KK   RD
```

```
KM   ROUTE D TO E
RM    2    .52     .2
KK  SUB8
BA 2.124
LG  .34    .31    5.4    .21
UD  1.08
KK   R8
KM   ROUTE SUBBASIN 8 TO E
RM    2   0.37     .2
KK  SUB9
BA 5.339
LG  .33    .32    5.0    .31
UD  1.79
KK    E
KM   COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
HC    3
KK   RE
KM   ROUTE E TO F
RM   12   1.95     .2
KK SUB10
BA 6.342
LG  .41    .24    8.3    .14     1
UD  3.34
KK SUB11
BA 3.122
LG  .36    .30    5.7    .25
UD  1.14
KK SUB12
BA 2.594
LG  .34    .32    5.1    .29
UD  1.20
KK    F
KM   COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
HC    5
KK SUB13
BA 3.921
LG  .46    .22    9.5    .09     1
UD  1.91
KK   R13
KM   ROUTE SUBBASIN 13 TO F
RM    2    .27     .2
KK    F
KM   COMBINE SUBBASIN 13 AND F
HC    2
KK   RF
KM   ROUTE F TO L
RM    6    .98     .2
*    THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS
KKSUB100
BA58.270
LG  .33    .35    3.5    .40
UD  3.61
KKDIV100
KM   DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
KM   REMAINING 50% DRAINS TO STUDY AREA
DT  SOLS
DI    0   10000
DQ    0    5000
KK  R100
KM   ROUTE SUBBASIN 100 TO G
RM   11   1.81     .2
KKSUB101
BA 9.366
LG  .34    .32    5.1    .28
UD  2.52
KKSUB102
BA 5.249
LG  .34    .32    5.1    .28
UD  1.69
KK    G
KM COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
HC    3
KK   RG
KM   ROUTE G TO I
```

```
RM   15   2.46     .2
KKSUB103
BA13.657
LG  .34    .32    5.0    .29
UD  2.88
KK  R103
KM   ROUTE SUBBASIN 103 TO I
RM    7   1.23     .2
KKSUB104
BA28.196
LG  .33    .32    4.8    .31
UD  3.23
KKSUB105
BA19.795
LG  .34    .31    5.2    .27
UD  2.73
KK    I
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
HC    4
KKSUB106
BA 5.746
LG  .32    .25    3.5    .40
UD  1.15
KK  R106
KM   ROUTE SUBBASIN 106 TO H
RM   12   1.95     .2
KKSUB107
BA10.919
LG  .33    .35    3.7    .38
UD  1.57
KK    H
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
HC    2
KK   RH
KM   ROUTE H TO I
RM    1    .17     .2
KK    I
KM   COMBINE HYDROGRAPHS FOR SUBBASINE H & I
HC    2
KK   RI
KM   ROUTE I TO K
RM   17   2.82     .2
KKSUB108
BA 2.885
LG  .34    .28    6.8    .18
UD  .95
KK  R108
KM   ROUTE SUBBASIN 108 TO K
RM   12   2.04     .2
KKSUB109
BA49.047
LG  .34    .35    3.6    .35
UD  3.57
KK  R109
KM   ROUTE SUBBASIN 109 TO J
RM    6    .98     .2
KKSUB110
BA18.838
LG  .33    .34    3.8    .39
UD  2.84
KKSUB111
BA 2.406
LG  .32    .34    3.8    .38
UD  1.02
KK    J
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
HC    3
KK   RJ
KM   ROUTE J TO K
RM   13   2.13     .2
KKSUB112
BA15.399
LG  .37    .28    6.6    .27
UD  2.90
KK    K
```

```
KM   COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
HC    4
KK   RK
KM   ROUTE K TO L
RM    7   1.09     .2
KK    L
KM   COMBINE HYDROGRAPHS FOR F AND K
HC    2
*    THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS
KKSUB200
BA 4.243
LG  .49    .28    6.8    .16     1
UD  1.61
KK    L
KM   COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
HC    2
KKSUB201
BA14.675
LG  .33    .24    7.8    .38
UD  1.91
KK  R201
KM   ROUTE SUBBASIN 201 TO L
RM    5    .94     .2
KKSUB202
BA14.982
LG  .36    .24    4.2    .25
UD  3.04
KKSUB203
BA11.412
LG  .35    .31    5.3    .26
UD  2.87
KK    L
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
HC    3
KK    L
KM   COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
HC    2
KK   RL
KM   ROUTE L TO M
RM    6    .99     .2
```

```
KKSUB204
BA12.760
LG  .39    .29    6.1    .26
UD  2.92
KKSUB205
BA25.645
LG  .35    .33    4.4    .34
UD  3.00
KK    M
KM   COMBINE HYDROGRAPHS AT M
HC    3
KK   RM
KM   ROUTE M TO N
RM    6    .98     .2
KKSUB206
BA 8.831
LG  .37    .32    5.1    .30
UD  2.18
KK  R206
KM   ROUTE SUBBASIN 206 TO N
RM    3    .47     .2
KKSUB207
BA 7.498
LG  .36    .33    4.5    .35
UD  2.22
KKSUB208
BA12.616
LG  .35    .34    4.0    .37
UD  2.74
KK    N
KM   COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
HC    4
KK   RN
KM   ROUTE N TO O
RM    4    .74     .2
KKSUB209
BA21.824
LG  .32    .34    3.9    .38
UD  2.97
KKSUB210
BA16.930
LG  .34    .35    3.6    .39
UD  2.85
KK    O
KM   COMBINE HYDROGRAPHS FOR N, 209, & 210
HC    3
II
```

HEC-I COMPUTER MODELING SCHEMATIC

FIGURE 3

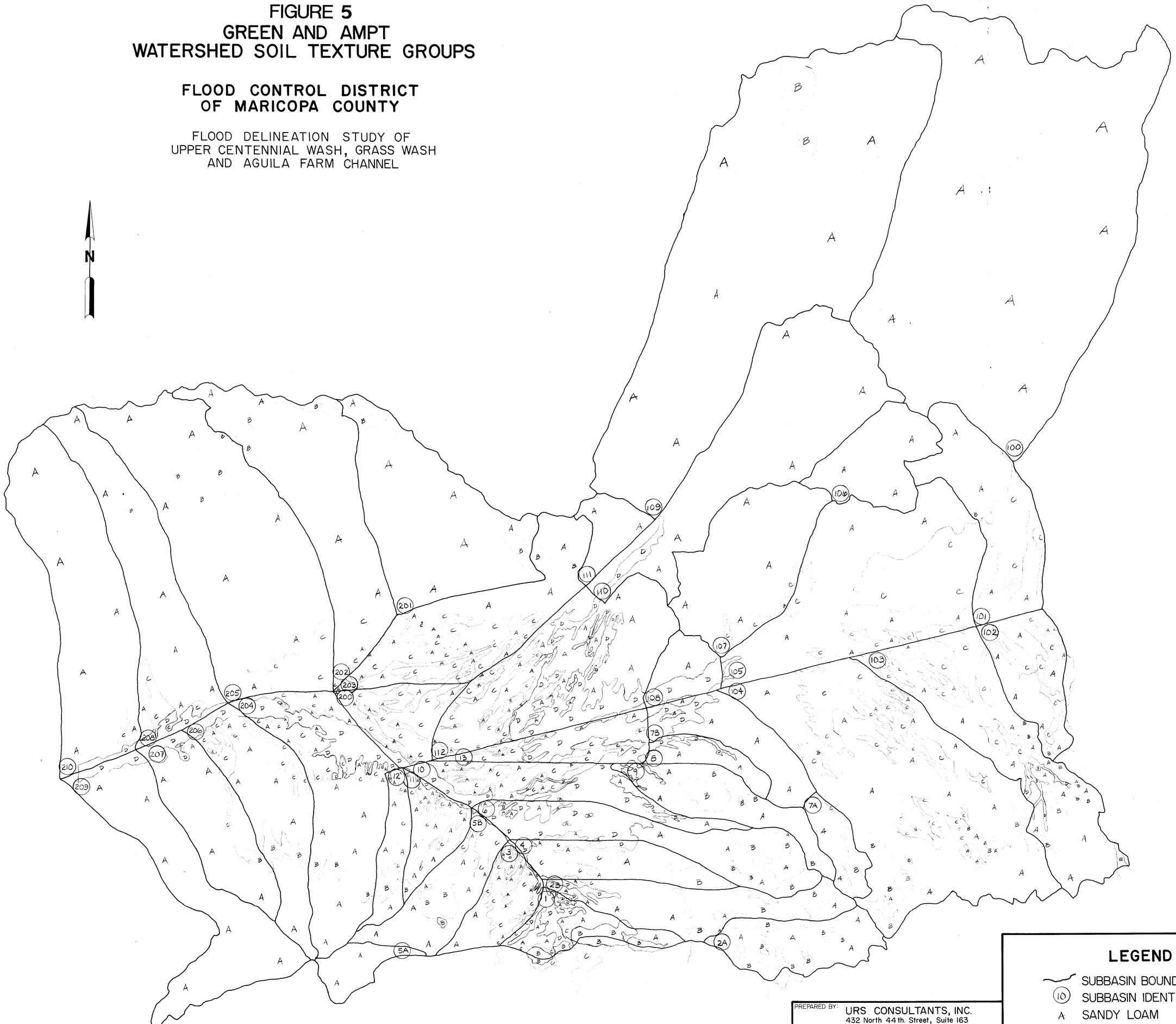
PREPARED BY: URS CONSULTANTS, INC.
432 North 44th Street, Suite 163
Phoenix, Arizona 85008

	BY	DATE		DATE
DESIGN	S.S.S.	11/8/89	SUBMITTED BY:	3/27/90
DESIGN CHK.	G.V.S.	11/15/89	RECOMMENDED BY:	DATE
PLANS	R.W.H.	11/8/89	APPROVED BY:	DATE
PLANS CHK.	S.S.S.	11/9/89	CHIEF ENGINEER AND GENERAL MANAGER	

FIGURE 5
GREEN AND AMPT
WATERSHED SOIL TEXTURE GROUPS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF
UPPER CENTENNIAL WASH, GRASS WASH
AND AGUILA FARM CHANNEL



PREPARED BY:	URS CONSULTANTS, INC. 432 North 44th. Street, Suite 163 Phoenix, Arizona 85008			
DESIGN	BY K.P.C.	DATE 3/90	SUBMITTED BY: Scot Schlund, P.E.	DATE 4/17/90
DESIGN CHK.	S.S.S.	4/90	RECOMMENDED BY:	DATE
PLANS			APPROVED BY:	DATE
PLANS CHK.			CHIEF ENGINEER AND GENERAL MANAGER	

LEGEND

- SUBBASIN BOUNDARY
- (10) SUBBASIN IDENTIFICATION
- A SANDY LOAM
- B SANDY CLAY LOAM
- C CLAY LOAM
- D CLAY

APPENDICES

APPENDIX A

10 Year Peak Discharges

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

  1           ID     GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
  2           ID     FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  3           ID     10 YEAR, 24 HOUR TYPE II STORM
  4           ID     GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH
  5           ID
  6           ID     URS CONSULTANTS FILE: FCD.10    MARCH 1990
  7           ID
  8           IT      10 02AUG89    1200     145
  9           IO       5       0
 10           IN      30 02AUG89    1200
 11           JD    2.50      .1
 12           PC       0    .005    .011    .016    .022    .028    .035    .041    .048    .056
 13           PC    .063    .071    .080    .089    .098    .108    .120    .133    .147    .163
 14           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 15           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 16           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 17           JD    2.38      10
 18           JD    2.30      20
 19           JD    2.25      30
 20           JD    2.15      70
 21           JD    2.13     100
 22           JD    2.08     150
 23           JD    2.00     300
 24           JD    2.00     400
              *    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS

 25           KK    SUB1
 26           BA   3.476
 27           LG     .34     .27     7.2     .20
 28           UD    1.05

 29           KK      R1
 30           KM     ROUTE SUBBASIN 1 TO A
 31           RM       1     .07      .2

 32           KK   SUB2A
 33           BA   5.211
 34           LG     .28     .33     4.8     .32
 35           UD    1.07

 36           KK     R2A
 37           KM     ROUTE SUBBASIN 2A TO A
 38           RM      10    1.63      .2

 39           KK   SUB2B
 40           BA   6.983
 41           LG     .31     .30     6.1     .24
 42           UD    2.20

 43           KK       A
 44           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
 45           HC       3
```

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

  46          KK      RA
  47          KM     ROUTE A TO B
  48          RM      3     .49      .2

  49          KK    SUB3
  50          BA   3.627
  51          LG     .35     .29     6.4     .20
  52          UD    1.63

  53          KK    SUB4
  54          BA   4.585
  55          LG     .40     .29     6.4     .21
  56          UD    2.07

  57          KK      B
  58          KM     COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
  59          HC      3

  60          KK      RB
  61          KM     ROUTE B TO C
  62          RM      3    0.47      .2

  63          KK   SUB5A
  64          BA   2.013
  65          LG     .26     .35     3.5     .40
  66          UD     .49

  67          KK     R5A
  68          KM     ROUTE SUBBASIN 5A TO C
  69          RM      9    1.52      .2

  70          KK   SUB5B
  71          BA   5.437
  72          LG     .34     .32     5.2     .28
  73          UD    1.60

  74          KK    SUB6
  75          BA   8.572
  76          LG     .38     .27     7.2     .22
  77          UD    3.08

  78          KK      C
  79          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
  80          HC      4

  81          KK      RC
  82          KM     ROUTE C TO F
  83          RM      4    0.72      .2
```

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

  84          KK   SUB7A
  85          BA   2.247
  86          LG     .30     .32     5.1     .29
  87          UD     .85

  88          KK     R7A
  89          KM     ROUTE SUBBBASIN 7A TO D
  90          RM      12    1.97      .2

  91          KK   SUB7B
  92          BA   4.947
  93          LG     .35     .32     5.1     .33
  94          UD    1.39

  95          KK       D
  96          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
  97          HC       2

  98          KK      RD
  99          KM     ROUTE D TO E
 100          RM       3     .52      .2

 101          KK    SUB8
 102          BA   2.134
 103          LG     .34     .31     5.4     .31
 104          UD    1.08

 105          KK      R8
 106          KM     ROUTE SUBBASIN 8 TO E
 107          RM       2    0.33      .2

 108          KK    SUB9
 109          BA   5.339
 110          LG     .33     .32     5.0     .31
 111          UD    1.79

 112          KK       E
 113          KM     COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
 114          HC       3

 115          KK      RE
 116          KM     ROUTE E TO F
 117          RM      12    1.95      .2

 118          KK   SUB10
 119          BA   6.342
 120          LG     .41     .24     8.3     .14       1
 121          UD    3.34
```

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

 122          KK   SUB11
 123          BA   3.122
 124          LG    .36     .30     5.7     .25
 125          UD   1.14

 126          KK   SUB12
 127          BA   2.594
 128          LG    .34     .32     5.1     .29
 129          UD   1.20

 130          KK      F
 131          KM    COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
 132          HC      5

 133          KK   SUB13
 134          BA   3.921
 135          LG    .46     .22     9.5     .09      1
 136          UD   1.91

 137          KK    R13
 138          KM    ROUTE SUBBASIN 13 TO F
 139          RM      2     .27      .2

 140          KK      F
 141          KM    COMBINE SUBBASIN 13 AND F
 142          HC      2

 143          KK     RF
 144          KM     ROUTE F TO L
 145          RM      6     .98      .2
              *    THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS

 146          KK  SUB100
 147          BA  58.270
 148          LG    .33     .35     3.5     .40
 149          UD   3.61

 150          KK  DIV100
 151          KM     DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
 152          KM     REMAINING 50% DRAINS TO STUDY AREA
 153          DT   SOLS
 154          DI      0   10000
 155          DQ      0    5000

 156          KK   R100
 157          KM       ROUTE SUBBASIN 100 TO G
 158          RM     11    1.81      .2

 159          KK  SUB101
 160          BA   9.366
 161          LG    .34     .32     5.1     .28
 162          UD   2.52
```

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

 163          KK  SUB102
 164          BA   5.249
 165          LG    .34     .32     5.1     .28
 166          UD   1.69

 167          KK      G
 168          KM   COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
 169          HC      3

 170          KK     RG
 171          KM       ROUTE G TO I
 172          RM     15    2.46      .2

 173          KK  SUB103
 174          BA  13.657
 175          LG    .34     .32     5.0     .29
 176          UD   2.88

 177          KK   R103
 178          KM       ROUTE SUBBASIN 103 TO I
 179          RM      7    1.23      .2

 180          KK  SUB104
 181          BA  28.196
 182          LG    .33     .32     4.8     .31
 183          UD   3.23

 184          KK  SUB105
 185          BA  19.795
 186          LG    .34     .31     5.2     .27
 187          UD   2.73

 188          KK      I
 189          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
 190          HC      4

 191          KK  SUB106
 192          BA   5.746
 193          LG    .32     .35     3.5     .40
 194          UD   1.15

 195          KK   R106
 196          KM       ROUTE SUBBASIN 106 TO H
 197          RM     12    1.95      .2

 198          KK  SUB107
 199          BA  10.919
 200          LG    .33     .35     3.7     .38
 201          UD   1.57
```

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

 202          KK      H
 203          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
 204          HC      2

 205          KK     RH
 206          KM       ROUTE H TO I
 207          RM      1     .13      .2

 208          KK      I
 209          KM       COMBINE HYDROGRAPHS FOR SUBBASINS H & I
 210          HC      2

 211          KK     RI
 212          KM       ROUTE I TO K
 213          RM     17    2.82      .2

 214          KK  SUB108
 215          BA   2.685
 216          LG    .34     .28     6.8     .26
 217          UD    .95

 218          KK   R108
 219          KM       ROUTE SUBBASIN 108 TO K
 220          RM     12    2.04      .2

 221          KK  SUB109
 222          BA  49.047
 223          LG    .34     .35     3.6     .39
 224          UD   3.57

 225          KK   R109
 226          KM       ROUTE SUBBASIN 109 TO J
 227          RM      6     .98      .2

 228          KK  SUB110
 229          BA  18.838
 230          LG    .33     .34     3.8     .39
 231          UD   2.84

 232          KK  SUB111
 233          BA   2.406
 234          LG    .32     .34     3.8     .38
 235          UD   1.02

 236          KK      J
 237          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
 238          HC      3

 239          KK     RJ
 240          KM       ROUTE J TO K
 241          RM     13    2.13      .2
```

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

 242          KK  SUB112
 243          BA  15.399
 244          LG    .37     .28     6.6     .23
 245          UD   2.90

 246          KK      K
 247          KM       COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
 248          HC      4

 249          KK     RK
 250          KM       ROUTE K TO L
 251          RM      7   1.09      .2

 252          KK      L
 253          KM       COMBINE HYDROGRAPHS FOR F AND K
 254          HC      2
              *      THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS

 255          KK  SUB200
 256          BA   4.243
 257          LG    .49     .28     6.8     .16       1
 258          UD   1.61

 259          KK      L
 260          KM       COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
 261          HC      2

 262          KK  SUB201
 263          BA  14.675
 264          LG    .33     .34     3.8     .38
 265          UD   1.91

 266          KK   R201
 267          KM       ROUTE SUBBASIN 201 TO L
 268          RM      6     .94      .2

 269          KK  SUB202
 270          BA  14.982
 271          LG    .36     .34     4.2     .35
 272          UD   3.04

 273          KK  SUB203
 274          BA  11.412
 275          LG    .35     .31     5.3     .26
 276          UD   2.87

 277          KK      L
 278          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
 279          HC      3
```

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

 280          KK      L
 281          KM       COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
 282          HC      2

 283          KK     RL
 284          KM       ROUTE L TO M
 285          RM      6     .99      .2

 286          KK  SUB204
 287          BA  12.760
 288          LG    .39     .29     6.1     .26
 289          UD   2.92

 290          KK  SUB205
 291          BA  25.645
 292          LG    .35     .33     4.4     .34
 293          UD   3.00

 294          KK      M
 295          KM       COMBINE HYDROGRAPHS AT M
 296          HC      3

 297          KK     RM
 298          KM       ROUTE M TO N
 299          RM      6     .98      .2

 300          KK  SUB206
 301          BA   8.831
 302          LG    .37     .32     5.1     .30
 303          UD   2.18

 304          KK   R206
 305          KM       ROUTE SUBBASIN 206 TO N
 306          RM      3     .47      .2

 307          KK  SUB207
 308          BA   7.488
 309          LG    .36     .33     4.5     .35
 310          UD   2.22

 311          KK  SUB208
 312          BA  12.616
 313          LG    .35     .34     4.0     .37
 314          UD   2.74

 315          KK      N
 316          KM       COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
 317          HC      4
```

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

 318          KK      RN
 319          KM        ROUTE N TO O
 320          RM      .4     .74      .2

 321          KK  SUB209
 322          BA  11.824
 323          LG     .32     .34     3.9     .38
 324          UD    2.97

 325          KK  SUB210
 326          BA  16.930
 327          LG     .34     .35     3.6     .39
 328          UD    2.85

 329          KK       O
 330          KM        COMBINE HYDROGRAPHS FOR N, 208, & 209
 331          HC       3
 332          ZZ
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*************************************
*                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*    BY THE COE IN FEBRUARY 1981    *
*         REVISED 02 AUG 88         *
*                                   *
* RUN DATE  04/16/1990  TIME  14:17:22 *
*                                   *
*************************************
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*************************************
*                                   *
*    DODSON AND ASSOCIATES, INC.    *
*  HYDROLOGIST AND CIVIL ENGINEERS  *
*     7015 W TIDWELL SUITE 107      *
*       HOUSTON, TEXAS  77092       *
*          (713) 895-8322           *
*                                   *
*************************************
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GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
10 YEAR, 24 HOUR TYPE II STORM
GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH

URS CONSULTANTS FILE: FCD.10 MARCH 1990

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

   IT        HYDROGRAPH TIME DATA
                   NMIN         10  MINUTES IN COMPUTATION INTERVAL
                  IDATE     2AUG89  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        145  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     3AUG89  ENDING DATE
                 NDTIME       1200  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .17 HOURS
                 TOTAL TIME BASE   24.00 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

11 JD        INDEX STORM NO. 1
                  STRM       2.50  PRECIPITATION DEPTH
                  TRDA        .10  TRANSPOSITION DRAINAGE AREA

12 PI          PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
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            .00      .00      .00      .00

17 JD     INDEX STORM NO. 2
             STRM        2.38  PRECIPITATION DEPTH
             TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00

18 JD     INDEX STORM NO. 3
             STRM        2.30  PRECIPITATION DEPTH
             TRDA       20.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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            .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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            .00      .00      .00      .00

19 JD     INDEX STORM NO. 4
             STRM        2.25  PRECIPITATION DEPTH
             TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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20 JD INDEX STORM NO. 5

STRM 2.15 PRECIPITATION DEPTH
TRDA 70.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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21 JD INDEX STORM NO. 6

STRM 2.13 PRECIPITATION DEPTH
TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00						

22 JD INDEX STORM NO. 7

STRM 2.08 PRECIPITATION DEPTH
TRDA 150.00 TRANSPOSITION DRAINAGE AREA

[illegible] PATTERN

[illegible] .00 .00 .00

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.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
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23 JD INDEX STORM NO. 8

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STRM        2.00  PRECIPITATION DEPTH
TRDA      300.00  TRANSPOSITION DRAINAGE AREA
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0 PI PRECIPITATION PATTERN

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.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
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24 JD INDEX STORM NO. 9

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STRM        2.00  PRECIPITATION DEPTH
TRDA      400.00  TRANSPOSITION DRAINAGE AREA
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0 PI PRECIPITATION PATTERN

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.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
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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	SUB1	675.	12.83	175.	44.	44.	3.48		
ROUTED TO	R1	668.	12.83	175.	44.	44.	3.48		
HYDROGRAPH AT	SUB2A	782.	12.83	205.	51.	51.	5.21		
ROUTED TO	R2A	645.	14.50	205.	51.	51.	5.21		
HYDROGRAPH AT	SUB2B	621.	14.00	305.	79.	79.	6.98		
3 COMBINED AT	A	1227.	14.33	624.	160.	160.	15.67		
ROUTED TO	RA	1200.	14.83	623.	160.	160.	15.67		
HYDROGRAPH AT	SUB3	479.	13.33	183.	46.	46.	3.63		
HYDROGRAPH AT	SUB4	437.	13.83	204.	53.	53.	4.59		
3 COMBINED AT	B	1716.	13.83	907.	233.	233.	23.88		
ROUTED TO	RB	1696.	14.33	905.	233.	233.	23.88		
HYDROGRAPH AT	SUB5A	561.	12.33	79.	20.	20.	2.01		
ROUTED TO	R5A	357.	13.83	79.	20.	20.	2.01		
HYDROGRAPH AT	SUB5B	585.	13.33	219.	55.	55.	5.44		
HYDROGRAPH AT	SUB6	521.	14.83	327.	92.	92.	8.57		
4 COMBINED AT	C	2428.	14.17	1291.	339.	339.	39.90		
ROUTED TO	RC	2350.	14.83	1286.	338.	338.	39.90		
HYDROGRAPH AT	SUB7A	450.	12.67	97.	24.	24.	2.25		
ROUTED TO	R7A	332.	14.67	97.	24.	24.	2.25		
HYDROGRAPH AT	SUB7B	498.	13.17	164.	41.	41.	4.95		
2 COMBINED AT	D	503.	13.33	254.	64.	64.	7.19		
ROUTED TO	RD	494.	14.00	254.	64.	64.	7.19		
HYDROGRAPH AT	SUB8	300.	12.83	79.	20.	20.	2.13		
ROUTED TO	R8	286.	13.17	79.	20.	20.	2.13		
HYDROGRAPH AT	SUB9	481.	13.50	199.	51.	51.	5.34		
3 COMBINED AT	E	1080.	13.50	484.	122.	122.	14.67		

ROUTED TO	RE	978.	15.67	481.	122.	122.	14.67
HYDROGRAPH AT	SUB10	481.	15.17	319.	93.	93.	6.34
HYDROGRAPH AT	SUB11	495.	13.00	138.	35.	35.	3.12
HYDROGRAPH AT	SUB12	365.	13.00	106.	26.	26.	2.59
5 COMBINED AT	F	3090.	15.17	1856.	502.	502.	66.63
HYDROGRAPH AT	SUB13	586.	13.67	257.	66.	66.	3.92
ROUTED TO	R13	579.	14.00	257.	66.	66.	3.92
2 COMBINED AT	F	3337.	15.00	2032.	548.	548.	70.55
ROUTED TO	RF	3259.	16.00	2020.	547.	547.	70.55
HYDROGRAPH AT	SUB100	1585.	15.50	1096.	322.	322.	58.27
DIVERSION TO	SOLS	793.	15.50	548.	161.	161.	58.27
HYDROGRAPH AT	DIV100	793.	15.50	548.	161.	161.	58.27
ROUTED TO	R100	775.	17.33	543.	158.	158.	58.27
HYDROGRAPH AT	SUB101	651.	14.33	355.	95.	95.	9.37
HYDROGRAPH AT	SUB102	545.	13.50	214.	54.	54.	5.25
3 COMBINED AT	G	871.	16.67	773.	249.	249.	72.89
ROUTED TO	RG	857.	19.17	759.	238.	238.	72.89
HYDROGRAPH AT	SUB103	772.	14.67	463.	127.	127.	13.66
ROUTED TO	R103	751.	16.00	460.	127.	127.	13.66
HYDROGRAPH AT	SUB104	1199.	15.00	775.	220.	220.	28.20
HYDROGRAPH AT	SUB105	1192.	14.50	689.	187.	187.	19.80
4 COMBINED AT	I	2429.	15.67	1774.	579.	579.	134.53
HYDROGRAPH AT	SUB106	714.	13.00	200.	50.	50.	5.75
ROUTED TO	R106	585.	15.00	200.	50.	50.	5.75
HYDROGRAPH AT	SUB107	992.	13.33	365.	92.	92.	10.92
2 COMBINED AT	H	943.	13.50	510.	129.	129.	16.66
ROUTED TO	RH	941.	13.67	510.	129.	129.	16.66
2 COMBINED AT	I	2751.	15.33	1970.	636.	636.	151.20
ROUTED TO	RI	2633.	18.17	1937.	591.	591.	151.20
HYDROGRAPH AT	SUB108	457.	12.67	109.	27.	27.	2.68

ROUTED TO	R108	348.	14.83	109.	27.	27.	2.68
HYDROGRAPH AT	SUB109	1402.	15.33	963.	282.	282.	49.05
ROUTED TO	R109	1386.	16.33	958.	280.	280.	49.05
HYDROGRAPH AT	SUB110	838.	14.67	498.	137.	137.	18.84
HYDROGRAPH AT	SUB111	354.	12.83	89.	22.	22.	2.41
3 COMBINED AT	J	1676.	15.83	1204.	365.	365.	70.29
ROUTED TO	RJ	1624.	18.00	1192.	355.	355.	70.29
HYDROGRAPH AT	SUB112	929.	14.67	560.	154.	154.	15.40
4 COMBINED AT	K	3615.	18.00	2715.	877.	877.	239.57
ROUTED TO	RK	3569.	19.17	2704.	838.	838.	239.57
2 COMBINED AT	L	4118.	18.00	3586.	1185.	1185.	310.12
HYDROGRAPH AT	SUB200	561.	13.33	213.	55.	55.	4.24
2 COMBINED AT	L	4125.	18.00	3604.	1215.	1215.	314.37
HYDROGRAPH AT	SUB201	1049.	13.67	457.	117.	117.	14.68
ROUTED TO	R201	1006.	14.67	455.	117.	117.	14.68
HYDROGRAPH AT	SUB202	663.	14.83	412.	115.	115.	14.98
HYDROGRAPH AT	SUB203	725.	14.67	434.	119.	119.	11.41
3 COMBINED AT	L	1898.	14.67	1032.	279.	279.	41.07
2 COMBINED AT	L	4398.	17.33	4008.	1383.	1383.	355.43
ROUTED TO	RL	4392.	18.17	3990.	1336.	1336.	355.43
HYDROGRAPH AT	SUB204	695.	14.67	421.	116.	116.	12.76
HYDROGRAPH AT	SUB205	1068.	14.83	659.	183.	183.	25.65
3 COMBINED AT	M	4718.	17.00	4285.	1489.	1489.	393.84
ROUTED TO	RM	4697.	18.17	4268.	1425.	1425.	393.84
HYDROGRAPH AT	SUB206	624.	14.00	304.	79.	79.	8.83
ROUTED TO	R206	614.	14.50	303.	79.	79.	8.83
HYDROGRAPH AT	SUB207	473.	14.00	234.	61.	61.	7.49
HYDROGRAPH AT	SUB208	629.	14.50	364.	99.	99.	12.62
4 COMBINED AT	N	4799.	18.00	4362.	1528.	1528.	422.77
ROUTED TO	RN	4779.	18.83	4348.	1463.	1463.	422.77

HYDROGRAPH AT	SUB209	571.	14.83	350.	97.	97.	11.82
HYDROGRAPH AT	SUB210	775.	14.67	462.	127.	127.	16.93
3 COMBINED AT	0	4881.	18.67	4443.	1565.	1565.	451.53

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

APPENDIX B

50 Year Peak Discharges

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

  1           ID     GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
  2           ID     FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  3           ID     50 YEAR, 24 HOUR TYPE II STORM
  4           ID     GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH
  5           ID
  6           ID     URS CONSULTANTS FILE: FCD.50     NOVEMBER 1989
  7           ID
  8           IT      10 02AUG89    1200     145
  9           ID       5       0
 10           IN      30 02AUG89    1200
 11           JD    3.55      .1
 12           PC       0    .005    .011    .016    .022    .028    .035    .041    .048    .056
 13           PC    .063    .071    .080    .089    .098    .108    .120    .133    .147    .163
 14           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 15           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 16           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 17           JD    3.37      10
 18           JD    3.27      20
 19           JD    3.20      30
 20           JD    3.05      70
 21           JD    3.02     100
 22           JD    2.95     150
 23           JD    2.84     300
 24           JD    2.84     400
              *    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS

 25           KK    SUB1
 26           BA   3.476
 27           LG     .34     .27     7.2     .20
 28           UD    1.05

 29           KK      R1
 30           KM     ROUTE SUBBASIN 1 TO A
 31           RM       1     .07      .2

 32           KK   SUB2A
 33           BA   5.211
 34           LG     .28     .33     4.8     .32
 35           UD    1.07

 36           KK     R2A
 37           KM     ROUTE SUBBASIN 2A TO A
 38           RM      10    1.63      .2

 39           KK   SUB2B
 40           BA   6.983
 41           LG     .31     .30     6.1     .24
 42           UD    2.20

 43           KK       A
 44           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
 45           HC       3
```

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

  46          KK      RA
  47          KM     ROUTE A TO B
  48          RM       3     .49      .2

  49          KK    SUB3
  50          BA   3.627
  51          LG     .35     .29     6.4     .20
  52          UD    1.63

  53          KK    SUB4
  54          BA   4.585
  55          LG     .40     .29     6.4     .21
  56          UD    2.07

  57          KK       B
  58          KM     COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
  59          HC       3

  60          KK      RB
  61          KM     ROUTE B TO C
  62          RM       3    0.47      .2

  63          KK   SUB5A
  64          BA   2.013
  65          LG     .26     .35     3.5     .40
  66          UD     .49

  67          KK     R5A
  68          KM     ROUTE SUBBASIN 5A TO C
  69          RM       9    1.52      .2

  70          KK   SUB5B
  71          BA   5.437
  72          LG     .34     .32     5.2     .28
  73          UD    1.60

  74          KK    SUB6
  75          BA   8.572
  76          LG     .38     .27     7.2     .22
  77          UD    3.08

  78          KK       C
  79          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
  80          HC       4

  81          KK      RC
  82          KM     ROUTE C TO F
  83          RM       4    0.72      .2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  84          KK   SUB7A
  85          BA   2.247
  86          LG     .30     .32     5.1     .29
  87          UD     .85

  88          KK     R7A
  89          KM     ROUTE SUBBBASIN 7A TO D
  90          RM      12    1.97      .2

  91          KK   SUB7B
  92          BA   4.947
  93          LG     .35     .32     5.1     .33
  94          UD    1.39

  95          KK       D
  96          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
  97          HC       2

  98          KK      RD
  99          KM     ROUTE D TO E
 100          RM       3     .52      .2

 101          KK    SUB8
 102          BA   2.134
 103          LG     .34     .31     5.4     .31
 104          UD    1.08

 105          KK      R8
 106          KM     ROUTE SUBBASIN 8 TO E
 107          RM       2    0.33      .2

 108          KK    SUB9
 109          BA   5.339
 110          LG     .33     .32     5.0     .31
 111          UD    1.79

 112          KK       E
 113          KM     COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
 114          HC       3

 115          KK      RE
 116          KM     ROUTE E TO F
 117          RM      12    1.95      .2

 118          KK   SUB10
 119          BA   6.342
 120          LG     .41     .24     8.3     .14       1
 121          UD    3.34
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 122          KK   SUB11
 123          BA   3.122
 124          LG     .36     .30     5.7     .25
 125          UD    1.14

 126          KK   SUB12
 127          BA   2.594
 128          LG     .34     .32     5.1     .29
 129          UD    1.20

 130          KK       F
 131          KM     COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
 132          HC       5

 133          KK   SUB13
 134          BA   3.921
 135          LG     .46     .22     9.5     .09       1
 136          UD    1.91

 137          KK     R13
 138          KM     ROUTE SUBBASIN 13 TO F
 139          RM       2     .27      .2

 140          KK       F
 141          KM     COMBINE SUBBASIN 13 AND F
 142          HC       2

 143          KK      RF
 144          KM      ROUTE F TO L
 145          RM       6     .98      .2
              *     THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS

 146          KK  SUB100
 147          BA  58.270
 148          LG     .33     .35     3.5     .40
 149          UD    3.61

 150          KK  DIV100
 151          KM      DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
 152          KM      REMAINING 50% DRAINS TO STUDY AREA
 153          DT    SOLS
 154          DI       0   10000
 155          DQ       0    5000

 156          KK    R100
 157          KM        ROUTE SUBBASIN 100 TO G
 158          RM      11    1.81      .2

 159          KK  SUB101
 160          BA   9.366
 161          LG     .34     .32     5.1     .28
 162          UD    2.52
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 163          KK  SUB102
 164          BA   5.249
 165          LG     .34     .32     5.1     .28
 166          UD    1.69

 167          KK       G
 168          KM   COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
 169          HC       3

 170          KK      RG
 171          KM        ROUTE G TO I
 172          RM      15    2.46      .2

 173          KK  SUB103
 174          BA  13.657
 175          LG     .34     .32     5.0     .29
 176          UD    2.88

 177          KK    R103
 178          KM        ROUTE SUBBASIN 103 TO I
 179          RM       7    1.23      .2

 180          KK  SUB104
 181          BA  28.196
 182          LG     .33     .32     4.8     .31
 183          UD    3.23

 184          KK  SUB105
 185          BA  19.795
 186          LG     .34     .31     5.2     .27
 187          UD    2.73

 188          KK       I
 189          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
 190          HC       4

 191          KK  SUB106
 192          BA   5.746
 193          LG     .32     .35     3.5     .40
 194          UD    1.15

 195          KK    R106
 196          KM        ROUTE SUBBASIN 106 TO H
 197          RM      12    1.95      .2

 198          KK  SUB107
 199          BA  10.919
 200          LG     .33     .35     3.7     .38
 201          UD    1.57
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 202          KK      H
 203          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
 204          HC      2

 205          KK     RH
 206          KM       ROUTE H TO I
 207          RM      1     .13      .2

 208          KK      I
 209          KM       COMBINE HYDROGRAPHS FOR SUBBASINS H & I
 210          HC      2

 211          KK     RI
 212          KM       ROUTE I TO K
 213          RM     17    2.82      .2

 214          KK  SUB108
 215          BA   2.685
 216          LG    .34     .28     6.8     .26
 217          UD    .95

 218          KK   R108
 219          KM       ROUTE SUBBASIN 108 TO K
 220          RM     12    2.04      .2

 221          KK  SUB109
 222          BA  49.047
 223          LG    .34     .35     3.6     .39
 224          UD   3.57

 225          KK   R109
 226          KM       ROUTE SUBBASIN 109 TO J
 227          RM      6     .98      .2

 228          KK  SUB110
 229          BA  18.838
 230          LG    .33     .34     3.8     .39
 231          UD   2.84

 232          KK  SUB111
 233          BA   2.406
 234          LG    .32     .34     3.8     .38
 235          UD   1.02

 236          KK      J
 237          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
 238          HC      3

 239          KK     RJ
 240          KM       ROUTE J TO K
 241          RM     13    2.13      .2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 242          KK  SUB112
 243          BA  15.399
 244          LG    .37     .28     6.6     .23
 245          UD   2.90

 246          KK      K
 247          KM       COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
 248          HC      4

 249          KK     RK
 250          KM       ROUTE K TO L
 251          RM      7   1.09      .2

 252          KK      L
 253          KM       COMBINE HYDROGRAPHS FOR F AND K
 254          HC      2
              *      THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS

 255          KK  SUB200
 256          BA   4.243
 257          LG    .49     .28     6.8     .16       1
 258          UD   1.61

 259          KK      L
 260          KM       COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
 261          HC      2

 262          KK  SUB201
 263          BA  14.675
 264          LG    .33     .34     3.8     .38
 265          UD   1.91

 266          KK   R201
 267          KM       ROUTE SUBBASIN 201 TO L
 268          RM      6     .94      .2

 269          KK  SUB202
 270          BA  14.982
 271          LG    .36     .34     4.2     .35
 272          UD   3.04

 273          KK  SUB203
 274          BA  11.412
 275          LG    .35     .31     5.3     .26
 276          UD   2.87

 277          KK      L
 278          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
 279          HC      3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 280          KK      L
 281          KM       COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
 282          HC      2

 283          KK     RL
 284          KM       ROUTE L TO M
 285          RM      6    .99     .2

 286          KK  SUB204
 287          BA  12.760
 288          LG    .39    .29    6.1    .26
 289          UD   2.92

 290          KK  SUB205
 291          BA  25.645
 292          LG    .35    .33    4.4    .34
 293          UD   3.00

 294          KK      M
 295          KM       COMBINE HYDROGRAPHS AT M
 296          HC      3

 297          KK     RM
 298          KM       ROUTE M TO N
 299          RM      6    .98     .2

 300          KK  SUB206
 301          BA   8.831
 302          LG    .37    .32    5.1    .30
 303          UD   2.18

 304          KK   R206
 305          KM       ROUTE SUBBASIN 206 TO N
 306          RM      3    .47     .2

 307          KK  SUB207
 308          BA   7.488
 309          LG    .36    .33    4.5    .35
 310          UD   2.22

 311          KK  SUB208
 312          BA  12.616
 313          LG    .35    .34    4.0    .37
 314          UD   2.74

 315          KK      N
 316          KM       COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
 317          HC      4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 318          KK      RN
 319          KM        ROUTE N TO O
 320          RM       4     .74      .2

 321          KK  SUB209
 322          BA  11.824
 323          LG     .32     .34     3.9     .38
 324          UD    2.97

 325          KK  SUB210
 326          BA  16.930
 327          LG     .34     .35     3.6     .39
 328          UD    2.85

 329          KK       O
 330          KM        COMBINE HYDROGRAPHS FOR N, 208, & 209
 331          HC       3
 332          ZZ
```

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****************************************
*                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*     BY THE COE IN FEBRUARY 1981      *
*          REVISED 02 AUG 88           *
*                                      *
* RUN DATE  04/16/1990  TIME  14:01:23 *
*                                      *
****************************************
```

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****************************************
*                                      *
*    DODSON AND ASSOCIATES, INC.       *
*  HYDROLOGIST AND CIVIL ENGINEERS     *
*     7015 W TIDWELL SUITE 107         *
*       HOUSTON, TEXAS  77092          *
*          (713) 895-8322              *
*                                      *
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                    GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
                    FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
                    50 YEAR, 24 HOUR TYPE II STORM
                    GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH

                    URS CONSULTANTS FILE: FCD.50     NOVEMBER 1989


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

   IT        HYDROGRAPH TIME DATA
                   NMIN         10  MINUTES IN COMPUTATION INTERVAL
                  IDATE     2AUG89  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        145  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     3AUG89  ENDING DATE
                 NDTIME       1200  ENDING TIME
                  ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .17 HOURS
                  TOTAL TIME BASE   24.00 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

11 JD        INDEX STORM NO. 1
                  STRM       3.55  PRECIPITATION DEPTH
                  TRDA        .10  TRANSPOSITION DRAINAGE AREA

12 PI          PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
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.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00						

17 JD INDEX STORM NO. 2

STRM 3.37 PRECIPITATION DEPTH

TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

18 JD INDEX STORM NO. 3

STRM 3.27 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

19 JD INDEX STORM NO. 4

STRM 3.20 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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      .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
      .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
      .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
      .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
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      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00
20 JD        INDEX STORM NO. 5
             STRM        3.05  PRECIPITATION DEPTH
             TRDA       70.00  TRANSPOSITION DRAINAGE AREA

 0 PI         PRECIPITATION PATTERN
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
      .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
      .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
      .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00
21 JD        INDEX STORM NO. 6
             STRM        3.02  PRECIPITATION DEPTH
             TRDA      100.00  TRANSPOSITION DRAINAGE AREA

 0 PI         PRECIPITATION PATTERN
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
      .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
      .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
      .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00
22 JD        INDEX STORM NO. 7
             STRM        2.95  PRECIPITATION DEPTH
             TRDA      150.00  TRANSPOSITION DRAINAGE AREA
```

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.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00
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23 JD        INDEX STORM NO. 8
                STRM        2.84  PRECIPITATION DEPTH
                TRDA      300.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
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```
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00
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```
24 JD        INDEX STORM NO. 9
                STRM        2.84  PRECIPITATION DEPTH
                TRDA      400.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
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```
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00
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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	SUB1	1373.	12.83	356.	89.	89.	3.48		
ROUTED TO	R1	1364.	12.83	356.	89.	89.	3.48		
HYDROGRAPH AT	SUB2A	1805.	12.83	475.	119.	119.	5.21		
ROUTED TO	R2A	1490.	14.50	474.	119.	119.	5.21		
HYDROGRAPH AT	SUB2B	1326.	14.00	651.	170.	170.	6.98		
3 COMBINED AT	A	2829.	14.33	1409.	360.	360.	15.67		
ROUTED TO	RA	2763.	14.83	1405.	360.	360.	15.67		
HYDROGRAPH AT	SUB3	969.	13.33	370.	93.	93.	3.63		
HYDROGRAPH AT	SUB4	946.	13.83	441.	114.	114.	4.59		
3 COMBINED AT	B	3901.	14.00	2094.	538.	538.	23.88		
ROUTED TO	RB	3877.	14.50	2090.	538.	538.	23.88		
HYDROGRAPH AT	SUB5A	1269.	12.33	182.	46.	46.	2.01		
ROUTED TO	R5A	820.	13.83	182.	46.	46.	2.01		
HYDROGRAPH AT	SUB5B	1342.	13.33	502.	127.	127.	5.44		
HYDROGRAPH AT	SUB6	1165.	14.83	731.	205.	205.	8.57		
4 COMBINED AT	C	5948.	14.00	3199.	839.	839.	39.90		
ROUTED TO	RC	5756.	14.83	3186.	839.	839.	39.90		
HYDROGRAPH AT	SUB7A	989.	12.67	214.	54.	54.	2.25		
ROUTED TO	R7A	732.	14.67	214.	54.	54.	2.25		
HYDROGRAPH AT	SUB7B	1293.	13.17	428.	107.	107.	4.95		
2 COMBINED AT	D	1306.	13.17	633.	159.	159.	7.19		
ROUTED TO	RD	1273.	13.83	632.	159.	159.	7.19		
HYDROGRAPH AT	SUB8	731.	12.83	194.	48.	48.	2.13		
ROUTED TO	R8	698.	13.17	194.	48.	48.	2.13		
HYDROGRAPH AT	SUB9	1150.	13.50	476.	121.	121.	5.34		
				[illegible]	[illegible]	314.	14.67		

ROUTED TO	RE	2548.	15.67	1234.	314.	314.	14.67
HYDROGRAPH AT	SUB10	934.	15.17	619.	179.	179.	6.34
HYDROGRAPH AT	SUB11	1087.	12.83	304.	76.	76.	3.12
HYDROGRAPH AT	SUB12	835.	13.00	243.	61.	61.	2.59
5 COMBINED AT	F	8155.	15.17	4884.	1318.	1318.	66.63
HYDROGRAPH AT	SUB13	1106.	13.67	489.	126.	126.	3.92
ROUTED TO	R13	1094.	14.00	488.	126.	126.	3.92
2 COMBINED AT	F	8660.	15.00	5256.	1415.	1415.	70.55
ROUTED TO	RF	8466.	16.00	5225.	1413.	1413.	70.55
HYDROGRAPH AT	SUB100	5014.	15.33	3468.	1020.	1020.	58.27
DIVERSION TO	SDLS	2507.	15.33	1734.	510.	510.	58.27
HYDROGRAPH AT	DIV100	2507.	15.33	1734.	510.	510.	58.27
ROUTED TO	R100	2451.	17.17	1717.	500.	500.	58.27
HYDROGRAPH AT	SUB101	1491.	14.33	813.	217.	217.	9.37
HYDROGRAPH AT	SUB102	1234.	13.50	486.	123.	123.	5.25
3 COMBINED AT	G	2768.	16.83	2362.	766.	766.	72.89
ROUTED TO	RG	2712.	19.17	2324.	730.	730.	72.89
HYDROGRAPH AT	SUB103	1845.	14.67	1107.	305.	305.	13.66
ROUTED TO	R103	1796.	15.83	1099.	304.	304.	13.66
HYDROGRAPH AT	SUB104	3141.	15.00	2032.	577.	577.	28.20
HYDROGRAPH AT	SUB105	2814.	14.50	1626.	442.	442.	19.80
4 COMBINED AT	I	7222.	15.50	5376.	1787.	1787.	134.53
HYDROGRAPH AT	SUB106	1769.	12.83	499.	125.	125.	5.75
ROUTED TO	R106	1451.	15.00	498.	125.	125.	5.75
HYDROGRAPH AT	SUB107	2520.	13.33	927.	234.	234.	10.92
2 COMBINED AT	H	2508.	13.50	1359.	344.	344.	16.66
ROUTED TO	RH	2502.	13.67	1358.	344.	344.	16.66
2 COMBINED AT	I	8509.	15.33	6167.	2031.	2031.	151.20
ROUTED TO	RI	8153.	18.00	6068.	1879.	1879.	151.20
HYDROGRAPH AT	SUB108	1061.	12.67	252.	63.	63.	2.68

ROUTED TO	R108	805.	14.83	252.	63.	63.	2.68
HYDROGRAPH AT	SUB109	4362.	15.33	2997.	878.	878.	49.05
ROUTED TO	R109	4313.	16.33	2981.	871.	871.	49.05
HYDROGRAPH AT	SUB110	2323.	14.67	1381.	379.	379.	18.84
HYDROGRAPH AT	SUB111	850.	12.83	215.	54.	54.	2.41
3 COMBINED AT	J	5500.	15.83	3954.	1199.	1199.	70.29
ROUTED TO	RJ	5329.	18.00	3913.	1165.	1165.	70.29
HYDROGRAPH AT	SUB112	2141.	14.67	1290.	356.	356.	15.40
4 COMBINED AT	K	12731.	18.00	9581.	3102.	3102.	239.57
ROUTED TO	RK	12565.	19.00	9541.	2958.	2958.	239.57
2 COMBINED AT	L	14530.	18.17	12365.	4089.	4089.	310.12
HYDROGRAPH AT	SUB200	1179.	13.33	448.	114.	114.	4.24
2 COMBINED AT	L	14545.	18.17	12405.	4171.	4171.	314.37
HYDROGRAPH AT	SUB201	2749.	13.67	1199.	307.	307.	14.68
ROUTED TO	R201	2633.	14.67	1194.	307.	307.	14.68
HYDROGRAPH AT	SUB202	1788.	14.83	1113.	311.	311.	14.98
HYDROGRAPH AT	SUB203	1624.	14.67	973.	267.	267.	11.41
3 COMBINED AT	L	5410.	14.67	2933.	792.	792.	41.07
2 COMBINED AT	L	15332.	17.83	13776.	4801.	4801.	355.43
ROUTED TO	RL	15286.	18.83	13716.	4624.	4624.	355.43
HYDROGRAPH AT	SUB204	1709.	14.67	1035.	286.	286.	12.76
HYDROGRAPH AT	SUB205	2983.	14.83	1841.	512.	512.	25.65
3 COMBINED AT	M	15945.	18.33	14770.	5210.	5210.	393.84
ROUTED TO	RM	15919.	19.17	14714.	4976.	4976.	393.84
HYDROGRAPH AT	SUB206	1551.	14.00	756.	197.	197.	8.83
ROUTED TO	R206	1525.	14.50	755.	197.	197.	8.83
HYDROGRAPH AT	SUB207	1246.	14.00	616.	161.	161.	7.49
HYDROGRAPH AT	SUB208	1676.	14.50	971.	264.	264.	12.62
4 COMBINED AT	N	16133.	18.83	15080.	5402.	5402.	422.77

HYDROGRAPH AT	SUB209	1468.	14.67	900.	250.	250.	11.82
HYDROGRAPH AT	SUB210	2110.	14.67	1257.	345.	345.	16.93
3 COMBINED AT	0	16438.	19.00	15413.	5588.	5588.	451.53

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

APPENDIX C

100 Year Peak Discharges

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

  1           ID     GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
  2           ID     FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  3           ID     100 YEAR, 24 HOUR TYPE II STORM
  4           ID     GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH
  5           ID
  6           ID     URS CONSULTANTS FILE: FCD.100    NOVEMBER 1989
  7           ID
  8           IT      10 02AUG89    1200     145
  9           IO       5       0
 10           IN      30 02AUG89    1200
 11           JD    4.05      .1
 12           PC       0    .005    .011    .016    .022    .028    .035    .041    .048    .056
 13           PC    .063    .071    .080    .089    .098    .108    .120    .133    .147    .163
 14           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 15           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 16           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 17           JD    3.85      10
 18           JD    3.73      20
 19           JD    3.65      30
 20           JD    3.48      70
 21           JD    3.44     100
 22           JD    3.36     150
 23           JD    3.24     300
 24           JD    3.24     400
              *    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS

 25           KK    SUB1
 26           BA   3.476
 27           LG     .34     .27     7.2     .20
 28           UD    1.05

 29           KK      R1
 30           KM     ROUTE SUBBASIN 1 TO A
 31           RM       1     .07      .2

 32           KK   SUB2A
 33           BA   5.211
 34           LG     .28     .33     4.8     .32
 35           UD    1.07

 36           KK     R2A
 37           KM     ROUTE SUBBASIN 2A TO A
 38           RM      10    1.63      .2

 39           KK   SUB2B
 40           BA   6.983
 41           LG     .31     .30     6.1     .24
 42           UD    2.20

 43           KK       A
 44           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
 45           HC       3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  46          KK     RA
  47          KM    ROUTE A TO B
  48          RM      3     .49      .2

  49          KK   SUB3
  50          BA  3.627
  51          LG    .35     .29     6.4     .20
  52          UD   1.63

  53          KK   SUB4
  54          BA  4.585
  55          LG    .40     .29     6.4     .21
  56          UD   2.07

  57          KK      B
  58          KM    COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
  59          HC      3

  60          KK     RB
  61          KM    ROUTE B TO C
  62          RM      3    0.47      .2

  63          KK  SUB5A
  64          BA  2.013
  65          LG    .26     .35     3.5     .40
  66          UD    .49

  67          KK    R5A
  68          KM    ROUTE SUBBASIN 5A TO C
  69          RM      9    1.52      .2

  70          KK  SUB5B
  71          BA  5.437
  72          LG    .34     .32     5.2     .28
  73          UD   1.60

  74          KK   SUB6
  75          BA  8.572
  76          LG    .38     .27     7.2     .22
  77          UD   3.08

  78          KK      C
  79          KM    COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
  80          HC      4

  81          KK     RC
  82          KM    ROUTE C TO F
  83          RM      4    0.72      .2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  84          KK   SUB7A
  85          BA   2.247
  86          LG     .30     .32     5.1     .29
  87          UD     .85

  88          KK     R7A
  89          KM     ROUTE SUBBBASIN 7A TO D
  90          RM      12    1.97      .2

  91          KK   SUB7B
  92          BA   4.947
  93          LG     .35     .32     5.1     .33
  94          UD    1.39

  95          KK       D
  96          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
  97          HC       2

  98          KK      RD
  99          KM     ROUTE D TO E
 100          RM       3     .52      .2

 101          KK    SUB8
 102          BA   2.134
 103          LG     .34     .31     5.4     .31
 104          UD    1.08

 105          KK      R8
 106          KM     ROUTE SUBBASIN 8 TO E
 107          RM       2    0.33      .2

 108          KK    SUB9
 109          BA   5.339
 110          LG     .33     .32     5.0     .31
 111          UD    1.79

 112          KK       E
 113          KM     COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
 114          HC       3

 115          KK      RE
 116          KM     ROUTE E TO F
 117          RM      12    1.95      .2

 118          KK   SUB10
 119          BA   6.342
 120          LG     .41     .24     8.3     .14       1
 121          UD    3.34
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 122          KK   SUB11
 123          BA   3.122
 124          LG     .36     .30     5.7     .25
 125          UD    1.14

 126          KK   SUB12
 127          BA   2.594
 128          LG     .34     .32     5.1     .29
 129          UD    1.20

 130          KK       F
 131          KM     COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
 132          HC       5

 133          KK   SUB13
 134          BA   3.921
 135          LG     .46     .22     9.5     .09       1
 136          UD    1.91

 137          KK     R13
 138          KM     ROUTE SUBBASIN 13 TO F
 139          RM       2     .27      .2

 140          KK       F
 141          KM     COMBINE SUBBASIN 13 AND F
 142          HC       2

 143          KK      RF
 144          KM      ROUTE F TO L
 145          RM       6     .98      .2
              *     THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS

 146          KK  SUB100
 147          BA  58.270
 148          LG     .33     .35     3.5     .40
 149          UD    3.61

 150          KK  DIV100
 151          KM      DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
 152          KM      REMAINING 50% DRAINS TO STUDY AREA
 153          DT    SOLS
 154          DI       0   10000
 155          DQ       0    5000

 156          KK    R100
 157          KM        ROUTE SUBBASIN 100 TO G
 158          RM      11    1.81      .2

 159          KK  SUB101
 160          BA   9.366
 161          LG     .34     .32     5.1     .28
 162          UD    2.52
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 163          KK  SUB102
 164          BA   5.249
 165          LG    .34     .32     5.1     .28
 166          UD   1.69

 167          KK      G
 168          KM   COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
 169          HC      3

 170          KK     RG
 171          KM       ROUTE G TO I
 172          RM     15   2.46      .2

 173          KK  SUB103
 174          BA  13.657
 175          LG    .34     .32     5.0     .29
 176          UD   2.88

 177          KK   R103
 178          KM       ROUTE SUBBASIN 103 TO I
 179          RM      7   1.23      .2

 180          KK  SUB104
 181          BA  28.196
 182          LG    .33     .32     4.8     .31
 183          UD   3.23

 184          KK  SUB105
 185          BA  19.795
 186          LG    .34     .31     5.2     .27
 187          UD   2.73

 188          KK      I
 189          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
 190          HC      4

 191          KK  SUB106
 192          BA   5.746
 193          LG    .32     .35     3.5     .40
 194          UD   1.15

 195          KK   R106
 196          KM       ROUTE SUBBASIN 106 TO H
 197          RM     12   1.95      .2

 198          KK  SUB107
 199          BA  10.919
 200          LG    .33     .35     3.7     .38
 201          UD   1.57
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 202          KK      H
 203          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
 204          HC      2

 205          KK     RH
 206          KM       ROUTE H TO I
 207          RM      1     .13      .2

 208          KK      I
 209          KM       COMBINE HYDROGRAPHS FOR SUBBASINS H & I
 210          HC      2

 211          KK     RI
 212          KM       ROUTE I TO K
 213          RM     17    2.82      .2

 214          KK  SUB108
 215          BA   2.685
 216          LG    .34     .28     6.8     .26
 217          UD    .95

 218          KK   R108
 219          KM       ROUTE SUBBASIN 108 TO K
 220          RM     12    2.04      .2

 221          KK  SUB109
 222          BA  49.047
 223          LG    .34     .35     3.6     .39
 224          UD   3.57

 225          KK   R109
 226          KM       ROUTE SUBBASIN 109 TO J
 227          RM      6     .98      .2

 228          KK  SUB110
 229          BA  18.838
 230          LG    .33     .34     3.8     .39
 231          UD   2.84

 232          KK  SUB111
 233          BA   2.406
 234          LG    .32     .34     3.8     .38
 235          UD   1.02

 236          KK      J
 237          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
 238          HC      3

 239          KK     RJ
 240          KM       ROUTE J TO K
 241          RM     13    2.13      .2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 242          KK  SUB112
 243          BA  15.399
 244          LG    .37     .28     6.6     .23
 245          UD   2.90

 246          KK      K
 247          KM       COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
 248          HC      4

 249          KK     RK
 250          KM       ROUTE K TO L
 251          RM      7   1.09     .2

 252          KK      L
 253          KM       COMBINE HYDROGRAPHS FOR F AND K
 254          HC      2
              *      THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS

 255          KK  SUB200
 256          BA   4.243
 257          LG    .49     .28     6.8     .16      1
 258          UD   1.61

 259          KK      L
 260          KM       COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
 261          HC      2

 262          KK  SUB201
 263          BA  14.675
 264          LG    .33     .34     3.8     .38
 265          UD   1.91

 266          KK   R201
 267          KM       ROUTE SUBBASIN 201 TO L
 268          RM      6    .94     .2

 269          KK  SUB202
 270          BA  14.982
 271          LG    .36     .34     4.2     .35
 272          UD   3.04

 273          KK  SUB203
 274          BA  11.412
 275          LG    .35     .31     5.3     .26
 276          UD   2.87

 277          KK      L
 278          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
 279          HC      3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 280          KK      L
 281          KM       COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
 282          HC      2

 283          KK     RL
 284          KM       ROUTE L TO M
 285          RM      6     .99      .2

 286          KK  SUB204
 287          BA  12.760
 288          LG    .39     .29     6.1     .26
 289          UD   2.92

 290          KK  SUB205
 291          BA  25.645
 292          LG    .35     .33     4.4     .34
 293          UD   3.00

 294          KK      M
 295          KM       COMBINE HYDROGRAPHS AT M
 296          HC      3

 297          KK     RM
 298          KM       ROUTE M TO N
 299          RM      6     .98      .2

 300          KK  SUB206
 301          BA   8.831
 302          LG    .37     .32     5.1     .30
 303          UD   2.18

 304          KK   R206
 305          KM       ROUTE SUBBASIN 206 TO N
 306          RM      3     .47      .2

 307          KK  SUB207
 308          BA   7.488
 309          LG    .36     .33     4.5     .35
 310          UD   2.22

 311          KK  SUB208
 312          BA  12.616
 313          LG    .35     .34     4.0     .37
 314          UD   2.74

 315          KK      N
 316          KM       COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
 317          HC      4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 318          KK      RN
 319          KM        ROUTE N TO O
 320          RM       4     .74      .2

 321          KK  SUB209
 322          BA  11.824
 323          LG     .32     .34     3.9     .38
 324          UD    2.97

 325          KK  SUB210
 326          BA  16.930
 327          LG     .34     .35     3.6     .39
 328          UD    2.85

 329          KK       O
 330          KM        COMBINE HYDROGRAPHS FOR N, 208, & 209
 331          HC       3
 332          ZZ
```

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****************************************
*                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*     BY THE COE IN FEBRUARY 1981      *
*          REVISED 02 AUG 88           *
*                                      *
* RUN DATE  04/16/1990  TIME  13:46:38 *
*                                      *
****************************************
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****************************************
*                                      *
*    DODSON AND ASSOCIATES, INC.       *
*  HYDROLOGIST AND CIVIL ENGINEERS     *
*     7015 W TIDWELL SUITE 107         *
*       HOUSTON, TEXAS  77092          *
*          (713) 895-8322              *
*                                      *
****************************************
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GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
100 YEAR, 24 HOUR TYPE II STORM
GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH

URS CONSULTANTS FILE: FCD.100 NOVEMBER 1989

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

   IT        HYDROGRAPH TIME DATA
                   NMIN         10  MINUTES IN COMPUTATION INTERVAL
                  IDATE     2AUG89  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        145  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     3AUG89  ENDING DATE
                 NDTIME       1200  ENDING TIME
                  ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .17 HOURS
                  TOTAL TIME BASE   24.00 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

11 JD        INDEX STORM NO. 1
                  STRM       4.05  PRECIPITATION DEPTH
                  TRDA        .10  TRANSPOSITION DRAINAGE AREA

12 PI          PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
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.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

17 JD INDEX STORM NO. 2

STRM 3.85 PRECIPITATION DEPTH

TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

18 JD INDEX STORM NO. 3

STRM 3.73 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00						

19 JD INDEX STORM NO. 4

STRM 3.65 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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            .00      .00      .00      .00
20 JD     INDEX STORM NO. 5
             STRM        3.48  PRECIPITATION DEPTH
             TRDA       70.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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            .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
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            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00
21 JD     INDEX STORM NO. 6
             STRM        3.44  PRECIPITATION DEPTH
             TRDA      100.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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            .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
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            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00
22 JD     INDEX STORM NO. 7
             STRM        3.36  PRECIPITATION DEPTH
             TRDA      150.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
          .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
          .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
          .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
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          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00

23 JD     INDEX STORM NO. 8
            STRM        3.24  PRECIPITATION DEPTH
            TRDA      300.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
          .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
          .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
          .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
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          .00      .00      .00      .00

24 JD     INDEX STORM NO. 9
            STRM        3.24  PRECIPITATION DEPTH
            TRDA      400.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
          .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
          .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
          .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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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	SUB1	1701.	12.83	444.	111.	111.	3.48		
ROUTED TO	R1	1687.	12.83	444.	111.	111.	3.48		
HYDROGRAPH AT	SUB2A	2267.	12.83	597.	149.	149.	5.21		
ROUTED TO	R2A	1872.	14.50	596.	149.	149.	5.21		
HYDROGRAPH AT	SUB2B	1645.	14.00	807.	210.	210.	6.98		
3 COMBINED AT	A	3547.	14.33	1760.	450.	450.	15.67		
ROUTED TO	RA	3464.	14.83	1756.	450.	450.	15.67		
HYDROGRAPH AT	SUB3	1205.	13.33	462.	117.	117.	3.63		
HYDROGRAPH AT	SUB4	1180.	13.83	551.	142.	142.	4.59		
3 COMBINED AT	B	4873.	14.00	2618.	672.	672.	23.88		
ROUTED TO	RB	4844.	14.50	2614.	672.	672.	23.88		
HYDROGRAPH AT	SUB5A	1591.	12.33	229.	57.	57.	2.01		
ROUTED TO	R5A	1030.	13.83	229.	57.	57.	2.01		
HYDROGRAPH AT	SUB5B	1681.	13.33	629.	159.	159.	5.44		
HYDROGRAPH AT	SUB6	1454.	14.83	912.	256.	256.	8.57		
4 COMBINED AT	C	7495.	14.00	4037.	1059.	1059.	39.90		
ROUTED TO	RC	7252.	14.83	4021.	1059.	1059.	39.90		
HYDROGRAPH AT	SUB7A	1231.	12.67	267.	67.	67.	2.25		
ROUTED TO	R7A	912.	14.67	267.	67.	67.	2.25		
HYDROGRAPH AT	SUB7B	1649.	13.17	546.	137.	137.	4.95		
2 COMBINED AT	D	1668.	13.17	803.	201.	201.	7.19		
ROUTED TO	RD	1624.	13.83	802.	201.	201.	7.19		
HYDROGRAPH AT	SUB8	923.	12.83	245.	61.	61.	2.13		
ROUTED TO	R8	882.	13.17	245.	61.	61.	2.13		
HYDROGRAPH AT	SUB9	1449.	13.50	600.	152.	152.	5.34		
3 COMBINED AT	E	3616.	13.50	1579.	399.	399.	14.67		

ROUTED TO	RE	3246.	15.67	1569.	399.	399.	14.67
HYDROGRAPH AT	SUB10	1168.	15.17	774.	224.	224.	6.34
HYDROGRAPH AT	SUB11	1352.	12.83	378.	94.	94.	3.12
HYDROGRAPH AT	SUB12	1046.	13.00	305.	76.	76.	2.59
5 COMBINED AT	F	10427.	15.17	6241.	1685.	1685.	66.63
HYDROGRAPH AT	SUB13	1349.	13.67	599.	154.	154.	3.92
ROUTED TO	R13	1336.	14.00	598.	154.	154.	3.92
2 COMBINED AT	F	11060.	15.00	6708.	1806.	1806.	70.55
ROUTED TO	RF	10812.	16.00	6668.	1803.	1803.	70.55
HYDROGRAPH AT	SUB100	6549.	15.33	4530.	1332.	1332.	58.27
DIVERSION TO	SOLS	3275.	15.33	2265.	666.	666.	58.27
HYDROGRAPH AT	DIV100	3275.	15.33	2265.	666.	666.	58.27
ROUTED TO	R100	3202.	17.17	2243.	653.	653.	58.27
HYDROGRAPH AT	SUB101	1868.	14.33	1019.	272.	272.	9.37
HYDROGRAPH AT	SUB102	1544.	13.50	608.	154.	154.	5.25
3 COMBINED AT	G	3618.	16.83	3072.	997.	997.	72.89
ROUTED TO	RG	3543.	19.17	3023.	950.	950.	72.89
HYDROGRAPH AT	SUB103	2322.	14.67	1393.	383.	383.	13.66
ROUTED TO	R103	2261.	15.83	1383.	382.	382.	13.66
HYDROGRAPH AT	SUB104	3993.	15.00	2583.	734.	734.	28.20
HYDROGRAPH AT	SUB105	3525.	14.50	2037.	553.	553.	19.80
4 COMBINED AT	I	9334.	15.50	6966.	2322.	2322.	134.53
HYDROGRAPH AT	SUB106	2247.	12.83	633.	158.	158.	5.75
ROUTED TO	R106	1841.	15.00	632.	158.	158.	5.75
HYDROGRAPH AT	SUB107	3206.	13.33	1180.	298.	298.	10.92
2 COMBINED AT	H	3202.	13.50	1735.	439.	439.	16.66
ROUTED TO	RH	3194.	13.67	1734.	439.	439.	16.66
2 COMBINED AT	I	11061.	15.17	8026.	2649.	2649.	151.20
ROUTED TO	RI	10597.	18.00	7897.	2450.	2450.	151.20
HYDROGRAPH AT	SUB108	1331.	12.67	316.	79.	79.	2.68

ROUTED TO	R108	1009.	14.83	316.	79.	79.	2.68
HYDROGRAPH AT	SUB109	5682.	15.33	3905.	1144.	1144.	49.05
ROUTED TO	R109	5618.	16.33	3884.	1135.	1135.	49.05
HYDROGRAPH AT	SUB110	2979.	14.67	1771.	486.	486.	18.84
HYDROGRAPH AT	SUB111	1073.	12.83	272.	68.	68.	2.41
3 COMBINED AT	J	7221.	15.83	5192.	1574.	1574.	70.29
ROUTED TO	RJ	6997.	18.00	5138.	1530.	1530.	70.29
HYDROGRAPH AT	SUB112	2674.	14.67	1612.	444.	444.	15.40
4 COMBINED AT	K	16866.	18.00	12697.	4111.	4111.	239.57
ROUTED TO	RK	16649.	19.00	12643.	3919.	3919.	239.57
2 COMBINED AT	L	19295.	18.17	16376.	5415.	5415.	310.12
HYDROGRAPH AT	SUB200	1486.	13.33	568.	145.	145.	4.24
2 COMBINED AT	L	19313.	18.17	16428.	5520.	5520.	314.37
HYDROGRAPH AT	SUB201	3505.	13.67	1529.	391.	391.	14.68
ROUTED TO	R201	3357.	14.67	1522.	391.	391.	14.68
HYDROGRAPH AT	SUB202	2288.	14.83	1424.	398.	398.	14.98
HYDROGRAPH AT	SUB203	2026.	14.67	1213.	334.	334.	11.41
3 COMBINED AT	L	6963.	14.67	3774.	1019.	1019.	41.07
2 COMBINED AT	L	20345.	17.83	18239.	6362.	6362.	355.43
ROUTED TO	RL	20283.	18.83	18161.	6125.	6125.	355.43
HYDROGRAPH AT	SUB204	2158.	14.67	1307.	361.	361.	12.76
HYDROGRAPH AT	SUB205	3825.	14.83	2360.	657.	657.	25.65
3 COMBINED AT	M	21136.	18.33	19561.	6912.	6912.	393.84
ROUTED TO	RM	21101.	19.33	19487.	6599.	6599.	393.84
HYDROGRAPH AT	SUB206	1966.	14.00	959.	249.	249.	8.83
ROUTED TO	R206	1932.	14.33	956.	249.	249.	8.83
HYDROGRAPH AT	SUB207	1592.	14.00	787.	205.	205.	7.49
HYDROGRAPH AT	SUB208	2143.	14.50	1242.	338.	338.	12.62
4 COMBINED AT	N	21364.	19.00	19980.	7176.	7176.	422.77
ROUTED TO	RN	21350.	19.67	19923.	6865.	6865.	422.77

HYDROGRAPH AT	SUB209	1871.	14.67	1146.	318.	318.	11.82
HYDROGRAPH AT	SUB210	2701.	14.67	1610.	442.	442.	16.93
3 COMBINED AT	0	21730.	19.00	20430.	7433.	7433.	451.53

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

APPENDIX D

District Memo

Centennial Wash Flood Insurance Study - Hydrology

Preferred Hydrologic Methods for the Centennial Wash hydrology:

Rainfall :	100 year, 24 hour storm. SCS type II distribution.
Areal Reduction :	NOAA HYDRO-40 (FCD will provide a copy of the report).
Loss Rate :	Green and Ampt as described in the Hydrology Manual (Tables of parameters to be provided) if the version of HEC-1 dated Dec. 5, 1988 is used.
or	Initial and uniform loss rate (tables of parameters to be provided).
Unit Hydrograph :	SCS dimensionless.
Channel Routing :	Normal depth routing where good channel data is available.
	Muskingum for all other routing.

Submittals for review by the Watershed Management Branch of the Hydrology Division will include the following upon completion:

1. Preliminary plans and maps.

2. Sample calculations to determine basin parameters for approval prior to the parameter determination for all the subbasins.

3. All calculations to determine basin parameters.

4. HEC-1 model along with the parameters used to prepare the HEC-1 coding. A running model on floppy disk and a schematic drawing of the basins shall accompany the HEC-1 model. The following symbols shall be used to prepare the schematic drawing along with the terminology to be used in the model:

LEGEND

○	Subarea calculation (SUB)
⬡	Combined hydrograph (CO)
□	Route hydrograph (R, or RO)
▽	Divert hydrograph (D, or DIV)

5. Preliminary and final report and product.

Note: The FCD requests prior notice to when the products will be submitted for review to allow scheduling by reviewer. All efforts will be made to return comments within one week after submittal.

APPENDIX E

Precipitation Data

UPPER CENTENNIAL /
GRASS WASH

49520.32

ADDENDUM to "HYDROLOGIC DESIGN FOR HIGHWAY DRAINAGE IN ARIZONA" April 1975

Steps to be used to determine precipitation values for various durations and return periods.

STEP 1. From the precipitation maps in the manual "Hydrologic Design for Highway Drainage in Arizona", determine the precipitation values for the 6 and 24 hour duration storms for return periods of 2, 5, 10, 25, 50 and 100 years. Tabulate these values in Table 1 in the column headed 'Map Values'

TABLE 1

Return Period (Years)	Precipitation Values (inches)			
	6 hour duration		24 hour duration	
	Map Value	Corrected Value	Map Value	Corrected Value
2	1.3	1.30	1.5	1.50
5	1.8	1.80	2.1	2.10
10	2.1	2.15	2.5	2.50
25	2.6	2.55	3.2	3.10
50	3.0	3.00	3.6	3.55
100	3.3	3.35	4.0	4.05

NOTE: There is a possibility of making an error while reading the maps because, (1) a site is not easy to locate precisely on a series of 12 maps, (2) there may be some slight registration differences in printing, and (3) precise interpolation between isolines is difficult. In order to minimize any errors in reading the maps, these values should be plotted on the diagram "Precipitation Depth versus Return Period" Fig. 1.

Project No. 49520.32 Station _____

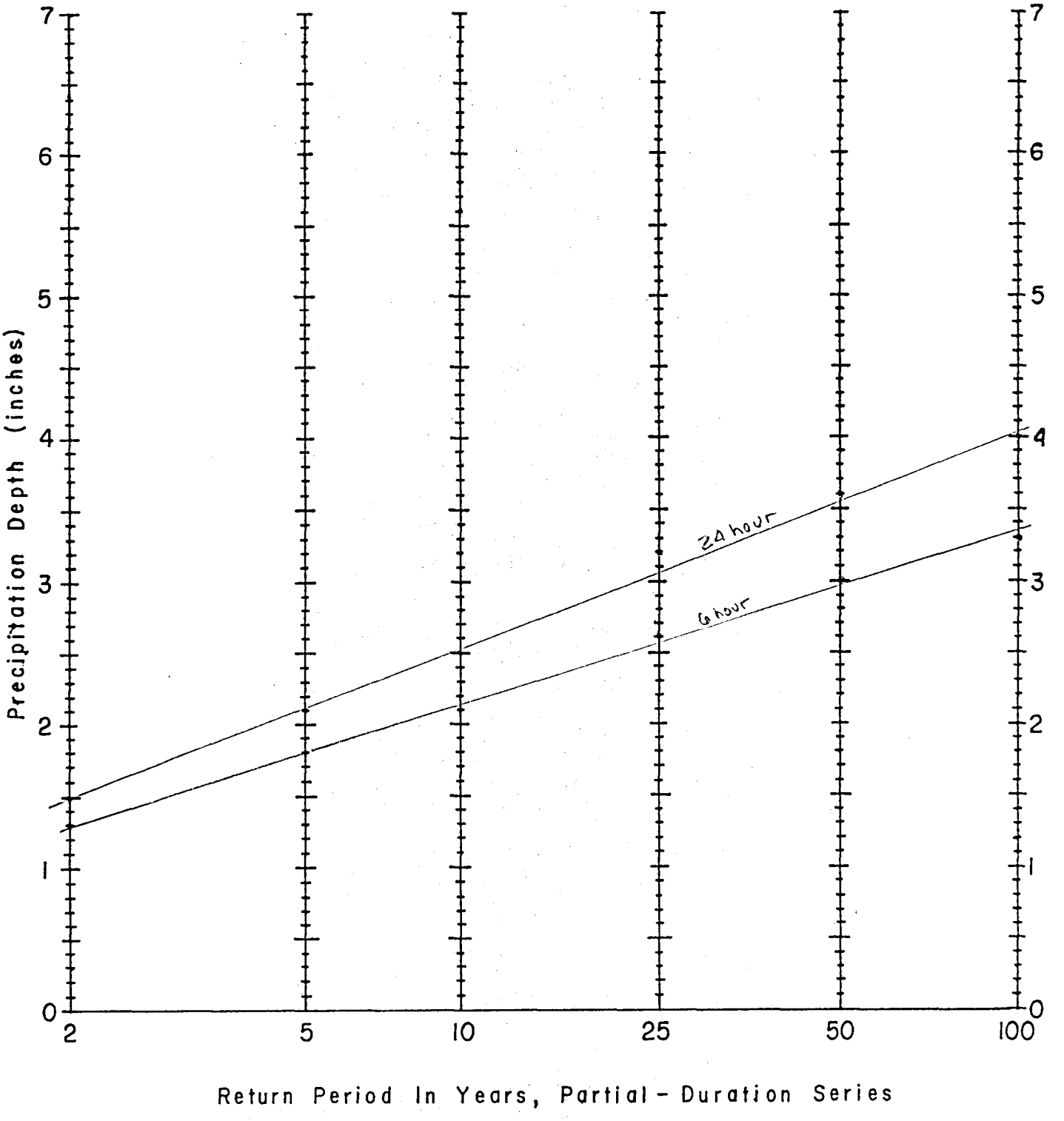


Figure 1 Precipitation Depth Versus Return Period for Partial-Duration Series

FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO.	SUBJECT: AREAL REDUCTION	☒ FILE ☐ DESTROY

TO: DJP FROM: VAR JRL DATE: 4/11/89

A question had come up regarding which areal reduction curve should be used. NOAA in their Technical Memorandum NWS HYDRO-40 entitled "Depth-Area Ratios in the Semi-Arid Southwest United States" has utilized the data from the Walnut Gulch Experimental watershed to develop the curves to be used for the Southwest region of the United States. The memo does not provide a regression equation for the curves, but only a graph. Because of the shape and the scale for the curves, it is difficult to achieve accurate values for the smaller watersheds. Therefore, Tom Hieb and I conducted independent determinations of the values for less than 100 square miles for a uniform set of ratios for a storm with a duration of 24 hours.

The ratios should be used for any watershed greater than 10 square miles. The following are the values to be used for a storm with a duration of 24 hours.

Square Mile	Ratio	Sq mi	Ratio
10	.95		
20	.92		
30	.90	150	.83
40	.89	200	.82
50	.88	250	.81
60	.87	300	.80
70	.86	350	.80
80	.86	400	.80
90	.85	450	.79
100	.85	500	.78

I have not looked at values for other durations, it there is a need to have these values, then we should determine a set of uniform ratios for that specific duration that can be used.

Aerially Reduced Rainfall Values

Area in Square Miles	Reduction Ratio	Precipitation Depth in Inches 10-yr	50-yr	100-yr
Point Rainfall	1.00	2.50	3.55	4.05
10	0.95	2.38	3.37	3.85
20	0.92	2.30	3.27	3.73
30	0.90	2.25	3.20	3.65
70	0.86	2.15	3.05	3.48
100	0.85	2.13	3.02	3.44
150	0.83	2.08	2.95	3.36
300	0.80	2.00	2.84	3.24
400	0.80	2.00	2.84	3.24

TABLE P-5

Coordinates of the SCS Type II Rainfall Distribution
(General Storm)

Time hrs	Ratio of Rainfall to Total Rainfall	Time hrs	Ratio of Rainfall to Total Rainfall
0	0.0	12.0	.663
.5	.005	12.5	.735
1.0	.011	13.0	.772
1.5	.016	13.5	.799
2.0	.022	14.0	.820
2.5	.028	14.5	.838
3.0	.035	15.0	.854
3.5	.041	15.5	.868
4.0	.048	16.0	.880
4.5	.056	16.5	.891
5.0	.063	17.0	.902
5.5	.071	17.5	.912
6.0	.080	18.0	.921
6.5	.089	18.5	.929
7.0	.098	19.0	.937
7.5	.108	19.5	.945
8.0	.120	20.0	.952
8.5	.133	20.5	.959
9.0	.147	21.0	.965
9.5	.163	21.5	.972
10.0	.181	22.0	.978
10.5	.204	22.5	.984
11.0	.235	23.0	.989
11.5	.283	23.5	.995
		24.0	1.000

APPENDIX F

Tc and L Data

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
1	2400	2200	200	22395	.0089	3.6	1.74	1.05
				22395		3.6	1.74	

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
2 A	2835	2600	235	4427	.053		.25	
	2600	2360	240	21353	.011		1.54	
				25780		4.0	1.79	1.07

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.	
2B	2930	2640	290	729.17	.398		0.03	0.01	
	2640	2600	40	312.50	.128		0.02	0.01	
	2600	2560	40	1666.67	.024		0.16	0.10	
	2560	2480	80	5338.54	.015		0.48	0.29	
	2480	2200	280	39895.81	.007		2.98	1.79	KPC
				47942.69		3.6	3.67	2.20	KPC

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

12332

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
3	2360	2220	140	14583	.0096		1.22	
	2220	2186	34	10937	.0031		1.50	
				25520		2.6	2.72	1.63

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
4	2480	2400	80	625.00	.128		0.04	0.02
	2400	2320	80	6875.00	.012		0.64	0.38
	2320	2240	80	10677.08	.008		1.05	0.63
	2240	2190	50	13958.32	.004		1.72	1.03
				32135		2.6	3.45	2.07

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

17420

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
5A	4489	2600	1889	10417	.18		.31	
	2600	2390	210	7812	.027		.51	
				18229		6.2	.82	.49

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

2752

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
5B	3200	2600	600	3906	.15		.15	
	2600	2280	320	11979	.027		.71	
	2280	2200	80	7812	.010		.74	
	2200	2175	25	7292	.003		1.06	
				30989		3.2	2.66	1.60

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$*L = 0.6\ Tc$

9576

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
6	2912	2600	312	833.33	.374		0.03	0.02
	2600	2480	120	3385.41	.035		0.24	0.14
	2480	2320	160	13854.16	.012		1.09	0.66
	2320	2240	80	12031.24	.007		1.21	0.73
	2240	2200	40	8020.83	.005		0.99	0.59
	2200	2174	26	10937.50	.002		1.66	1.00
				49062		2.7	5.13	3.08

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

1616.2

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
7A	2930	2600	330	1562	.21		.07	
	2600	2480	120	9635	.012		.80	
	2480	2435	45	4948	.0091		.54	
				16145		3.2	1.41	.85

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

6076

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
7B	2435	2255	180	27604	KPC .0065	3.3	2.31	1.39

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

7316

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
8	2450	2400	50	781	.064		.06	
	2400	2250	150	20312	.0074		1.74	
				21093		3.3	1.80	1.08

6480

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
9	2620	2600	20	781	.026		.09	
	2600	2400	200	13020	.015		.94	
	2400	2235	165	23177	.0071		1.95	
				36978		3.4	2.98	1.79

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

10/26

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
10	2380	2240	140	18750	.0075		1.63	
	2240	2180	60	16667	.0036		1.96	
	2180	2155	25	12500	.0020		1.97	
				47917		2.4	5.56	3.34

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

20016

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
11	2360	2200	160	11458	.014		.88	
	2200	2155	45	8594	.0052		1.02	
				20052		2.9	1.90	1.14

6240

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
12	3000	2400	600	4427	.14		.18	
	2400	2240	160	9375	.017		.70	
	2240	2155	85	11458	.0074		1.12	
				25260		3.5	2.00	1.20

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

7200

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
13	2260	2163	97	29687	.0033	2.6	3.18	1.91

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

11418

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
100	4214	3800	414	.22 1,146.	.361		.04	
	3800	3720	80	.45 2,396.	.033		.19	
	3720	3680	40	.24 1,250.	.032		.12	
	3680	3520	160	.555 2,891.	.055		.18	
	3520	3240	280	1.825 9505.	.030		.57	
	3240	2800	440	4.79 24,948.	.018		1.46	
	2800	2720	80	1.64 8,542.	.009		.82	
	2720	2580	140	5.48 28,542.	.005		2.64	
				79,220		3.66	6.07	3.61

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

16416

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.	
101	3420	3100	320	.115 599	.534		.023		
	3100	3000	100	.09 469	.213		.027		
	3000	2900	100	.21 1094.	.091		.070		
	2900	2800	100	.375 1953.	.051		.137		
	2800	2600	200	1.7 8,854	.023		.600		
	2600	2520	80	2.7 10885.	.007		1.078		KPC
	2520	2460	60	2.275 11,849.	.005		1.326		
	2460	2440	20	1.18 6,146.	.003		.946		
				41849.		2.8	4.207	2.524	KPC

*Tc = $L^{1.15}$ / 7700 $H^{0.38}$

*L = 0.6 Tc

16474

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
102	2930	2640	290	.26 1354	.214		.060	
	2640	2600	40	.14 729	.055		.062	
	2600	2480	120	.325 15,755	.008		1.414	
	2480	2440	40	.92 10,000.	.004		1.273	
				27838		2.8	2.809	1.685

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

10112

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
103	2840	2800	40	.26 1,354.	.030		.128	
	2800	2680	120	1.725 8,984.	.013		.741	
	2680	2440	240	5.9 30,729.	.008		2.343	
	2440	2385	55	2.57 13,437	.004		1.584	
				54504		3.2	4.796	2.878

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

1726

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
104	3054	2840	214	.15 781	.274		.036	
	2840	2800	40	.12 625	.064		.052	
	2800	2600	200	3.5 18,750	.011		1.423	
	2600	2400	200	4.755 24,609	.008		1.945	
	2400	2300	100	3.73 19,427	.005		1.928	
				64192		3.3	5.384	3.23

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

19372

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
105	3181	2800	381	.19 990	.385		.038	
	2800	2700	100	.09 469	.213		.027	KPC
	2700	2600	100	.37 1,979	.051		.139	
	2600	2540	60	1.27 6,615	.009		.678	
	2540	2400	140	2.74 14,375	.010		1.200	
	2400	2295	105	4.7 24,479	.004		2.469	
				48907		3.0	4.551	2.731 KPC

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
106	3320	3000	320	.16 833	.384		.033	
	3000	2900	100	.14 729	.137		.044	
	2900	2800	100	.075 391	.256		.022	
	2800	2700	100	.53 2,760	.036		.204	
	2700	2560	140	1.4 7,292	.019		.550	
	2560	2540	20	.42 2,187	.009		.288	
	2540	2535	5	.63 3,281	.002		.779	
				17973		2.5	1.92	1.152

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
107	3165	2600	565	.25 1302	.434		.045	
	2600	2540	60	.125 651	.092		.047	
	2540	2480	60	.525 2,734	.022		.246	
	2480	2420	60	.64 3,333	.018		.308	
	2420	2305	115	3.975 20,703	.006		1.967	
				28723		3.1	2.613	1.568

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

9409

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
108	2560	2400	160	.11 573	.279		.028	
	2400	2360	40	.13 677	.060		.058	
	2360	2300	60	.7 3,646	.017		.342	
	2300	2260	40	1.74 9,167	.004		1.152	
				14063		2.5	1.58	0.948

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

5688

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
109	4240	3800	440	.17 885	.497		.031	
	3800	3600	200	.155 807	.248		.038	
	3600	3480	120	.18 937	.128		.055	
	3480	3240	240	.79 4,115	.058		.232	
	3240	3000	240	1.84 9,583	.025		.613	
	3000	2840	160	1.775 9,245	.017		.687	
	2840	2740	100	1.45 7,552	.013		.651	
	2740	2420	320	7.875 41,016	.009		2.927	
	2420	2390	30	1.05 5,469	.006		.709	
				79609		3.7	5.943	3.566

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

21395

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
110								
	3300	3000	300	.115 599	.501		.023	KPC
	3000	2900	100	.1 521	.192		.030	KPC
	2900	2780	120	.3 1,562	.077		.099	
	2780	2580	200	1.45 7,552	.027		.500	
	2580	2480	100	2.06 10,729	.009		.974	
	2480	2380	100	3.105 16,484	.006		1.596	
	2380	2320	60	2.55 13,281	.005		1.512	
				50728		3.0	4.734	2.840

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

18765

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
111								
	3092	2700	392	.18 937	.418		.035	
	2700	2600	100	.175 911	.110		.057	
	2600	2500	100	.41 2,135	.047		.152	
	2500	2380	120	1.12 5,833	.021		.451	
	2380	2320	60	1.775 9,245	.007		.997	
				19061		3.1	1.692	1.015

*Tc = $L^{1.15}$ / 7700 $H^{0.38}$

*L = 0.6 Tc

6091

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
112	2725	2600	125	260.42	.480		0.01	0.01
	2600	2500	100	364.58	.274		0.02	0.01
	2500	2420	80	1250.01	.064		0.09	0.05
	2420	2330	90	6041.66	.015		0.52	0.31
	2330	2240	90	15781.24	.006		1.58	0.95
	2240	2160	80	23541.65	.003		2.62	1.57
				47240		2.7	4.84	2.90

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
200	2200	2180	20	3333.33	.006		0.47	0.28
	2180	2140	40	8749.99	.005		1.09	0.65
	2140	2120	20	7161.45	.003		1.13	0.68
				19245		2.0	2.69	1.61

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
201	2721	2500	221	1458.33	.152		0.07	0.04
	2500	2400	100	4322.91	.023		0.34	0.21
	—	—						
	2400	2300	100	7395.83	.014		0.64	0.38
	2300	2220	80	8177.08	.010		0.78	0.47
	2220	2180	40	5781.25	.007		0.68	0.41
	2180	2160	20	4635.41	.004		0.68	0.41
				31771		2.8	3.19	1.91

11484

*Tc = $L^{1.15}$ / 7700 $H^{0.38}$

*L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.	
202	3320	3280	40	.09 468.75	.085		0.04	0.02	
	3280	3000	280	.11 572.92	.489		0.02	0.01	
	3000	2800	200	.19 989.58	.202		0.05	0.03	
	2800	2640	160	.34 1770.83	.090		0.10	0.06	
	2640	2500	140	.71 3697.91	.038		0.25	0.15	
	2500	2400	100	1.03 5364.58	.019		0.44	0.26	
	2400	2200	200	3.89 20260.40	.010		1.56	0.93	KPC
	2200	2160	40	1.35 7057.29	.006		0.85	0.51	
	2160	2120	40	2.53 13177.07	.003		1.75	1.05	
				53359.33		2.9	5.06	3.04	KPC

*Tc = $L^{1.15}$ / 7700 $H^{0.38}$

**L = 0.6 Tc

16524

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
203	3083	2800	283	468.75	.604		0.02	0.01
	2800	2700	100	260.42	.384		0.01	0.01
	2700	2600	100	390.62	.256		0.02	0.01
	2600	2500	100	651.04	.154		0.04	0.02
	2500	2380	120	2916.66	.041		0.20	0.12
	2380	2320	60	4479.16	.013		0.43	0.26
	2320	2240	80	11249.99	.007		1.12	0.67
	2240	2140	100	18749.99	.005		1.85	1.11
	2140	2120	20	6927.08	.003		1.09	0.65
				46094		2.7	4.78	2.87

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

17208

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
204	4489	3000	1489	3854.16	.386		0.11	0.06
	3000	2800	200	1041.67	.192		0.05	0.03
	2800	2600	200	1510.42	.132		0.08	0.05
	2600	2400	200	2968.75	.067		0.17	0.10
	2400	2280	120	6093.75	.020		0.47	0.28
	2280	2200	80	6458.33	.012		0.59	0.35
	2200	2140	60	8645.83	.007		0.92	0.55
	2140	2090	50	19218.74	.003		2.48	1.49
				49792		2.8	4.87	2.92

17532

*Tc = $L^{1.15}$ / 7700 $H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
205	3825	3680	145	677.08	.214		0.04	0.02
	3680	3000	680	2343.75	.290		0.08	0.05
	3000	2800	200	1406.25	.142		0.07	0.04
	2800	2600	200	4218.75	.047		0.26	0.15
	2600	2400	200	7656.25	.026		0.51	0.30
	2400	2300	100	6458.33	.016		0.54	0.33
	2300	2180	120	9847.74	.012		0.82	0.53
	2180	2120	60	10052.08	.006		1.10	0.66
	2120	2090	30	10989.58	.003		1.58	0.95
				53650		3.0	5.00	3.00

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*$L = 0.6\ Tc$

18000

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
206	4489	3200	1289	2318	.56		.06	
	3200	2600	600	3932	.15		.16	
	2600	2400	200	3437	.06		.20	
	2400	2200	200	10130	.02		(.009) .70	
	2200	2076	124	26302	(.0047)		2.52	
				46119		3.5	3.64	2.18

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

13108

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
207	3652	3000	652	1120	.58		.04	
	3000	2600	400	1406	.28		.06	
	2600	2360	240	2240	.11		.12	
	2360	2200	160	8333	.02		.61	
	2200	2080	120	15885	(.007) .01		1.43	
	2080	2065	15	8073	(.001)		1.44	
				37057		2.8	3.70	2.22

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

*L = 0.6 Tc

13320

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
208	4922	4000	922	1979	.47		.06	
	4000	3000	1000	6510	.15		.23	
	3000	2400	600	11979	.05		.56	
	2400	2200	200	13958	.01		1.01	
	2200	2100	100	10729	(.009) .01		.97	
	2100	2065	35	12500	(.003)		1.73	
				57655		3.5	4.56	2.74

16416

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
209	4919	4200	719	3255	.22		.12	
	4200	3000	1200	5208	.23		.17	
	3000	2800	200	911	.22		.04	
	2800	2400	400	9323	.04		.49	
	2400	2200	200	13021	.02		.94	
	2200	2060	140	14844	(.009) .01		1.25	
	2060	2040	20	11458	(.002)		1.94	
				58020		3.3	4.95	2.97

17820

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
210	5242	3200	2042	5755	.35		.15	
	3200	2600	600	6458	.09		.28	
	2600	2400	200	5000	.04		.31	
	2400	2200	200	14427	.01		1.05	
	2200	2060	140	16667	(.008) .01		1.42	
	2060	2040	20	9375	(.002)		1.54	
				57682		3.4	4.75	2.85

17100

*Tc = L $^{1.15}$ /7700 H$^{0.38}$

*L = 0.6 Tc

APPENDIX G

Green and Ampt Data

Soil Type/Texture Summary

Sandy Loam - SL

5,8,7,16,17,33,35,36,38,42,43,54,62,63,64,65,66,82,83,84,85,86,87,88,89,91,94,95,105,110,120,121,122,AoC,Sa,ArA,WgC,WhC,Mt,TwC,CgC,CvB,CuC,HmE,C1D,CnC,Go,CoD,CrF,CsC,ApB,AmC,CmD,Vm,Ba,Rr,CwD,BmF,BoF,WhC,Lc,La,LkD

Sandy Clay Loam - SCL

73,97,28,GsE,Le,GrB,Lh,Rs,LnC,Rm

Clay Loam - CL

24,25,26,27,LZ

Loam - L

None

Clay - C

67

TABLE 1

Surface retention loss for various land surfaces in Maricopa County

Land-use and/or Surface Cover	Surface Retention Loss IA inches
(1)	(2)
Natural	
Desert and rangeland, flat slope	.35
Hillslopes, Sonoran desert	.15
Mountain, with vegetated surface	.25
Developed (Residential and Commercial)	
Lawn and turf	.20
Desert landscape	.10
Pavement	.05
Agricultural	
Tilled fields and irrigated pasture	.50

Table 4.2
Green and Ampt Loss Rate Parameter Values for Bare Ground

Soil Texture Classification (1)	XKSAT Inches/hour (2)	PSIF Inches (3)	DTHETA[1]		
			Dry (4)	Normal (5)	Saturated (6)
sand	4.6	1.9	0.35	0.30	0
loamy sand	1.2	2.4	0.35	0.30	0
sandy loam	0.40	3.5	0.35	0.25	0
loam	0.25	4.3	0.35	0.25	0
silty loam	0.15	6.6	0.40	0.25	0
silt	0.10	7.5	0.35	0.15	0
sandy clay loam	0.06	8.6	0.25	0.15	0
clay loam	0.04	8.2	0.25	0.15	0
silty clay loam	0.04	10.8	0.30	0.15	0
sandy clay	0.02	9.4	0.20	0.10	0
silty clay	0.02	11.5	0.20	0.10	0
clay	0.01	12.4	0.15	0.05	0

[1] Selection of DTHETA:

Dry = Nonirrigated lands, such as desert and rangeland;
Normal = Irrigated lawn, turf, and permanent pasture;
Saturated = Irrigated agricultural land.

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
1	3.476		SL	44%		.35	3.5	.40	0
			SCL	24%		.25	8.6	.06	0
			CL	09%		.25	8.2	.04	0
			L						
			C	23%		.15	12.4	.01	0
	0.363		Mountain	10%	.25				
			Range	90%	.35				
			Ag.						
					.34	.27	7.2	.20	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
2A	5.211		SL	75%		.35	3.5	.40	0
			SCL	25%		.25	8.6	.06	0
			CL						
			L						
			C						
	3.711		mountain	71%	.25				
			range	29%	.35				
			Ag.	0%					
					.28	.33	4.8	.32	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
2B	6.983		SL	54 %		.35	3.5	.40	
			SCL	39 %		.25	8.6	.06	
			CL	01 %		.25	8.2	.04	
			L						
			C	06%		.15	12.4	.01	
	520.89		Mountain	12%	.25				
			Range	88%	.35				
			Ag						
					.31	.30	6.1	.24	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
3	3.627		SL	45%		.35	3.5	.40	0
			SCL						
			CL	48%		.25	8.7	.04	0
			L						
			C	07%		.15	12.4	.01	0
			Range	100%	.35				
			Ag.	0 %					
					.35	.29	6.4	.20	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
4	4.585		SL	46%		.35	3.5	.40	
			SCL	14%		.25	8.6	.06	
			CL	33%		.25	8.7	.04	
			L						
			C	07%		.15	12.4	.01	
			Mountain	0%					
			Range	64%	.35				
			Ag	36%	.50				
					.40	.29	6.4	.21	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
5A	2.013		SL	100%		.35	3.5	.40	0
			SCL						
			CL						
			L						
			C						
	.24		Range	12%	.35				
			Mountain	88%	.25				
			Ag.	0%					
					.26	.35	3.5	.40	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
5B	5.437		SL	66%		.35	3.5	.40	0
			SCL	17%		.25	8.6	.06	0
			CL	16%		.25	8.2	.04	0
			L						
			C	01%		.15	12.4	.01	0
			Range	67%	.35				
		1.297	Mountain	24%	.25				
			Ag.	9%	.50				
					.34	.32	5.2	.28	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
6	8.572		SL	51%		.35	3.5	.40	
			SCL	15%		.25	8.6	.06	
			CL	02%		.25	8.2	.04	
			L						
			C	32%		.15	12.4	.01	
	492.28		Mountain	9%	.25				
			Range	62%	.35				
			Ag	29%	.50				
					.38	.27	7.2	.22	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
7A	2.247		SL	68%		.35	3.5	.40	0
			SCL	31%		.25	8.6	.06	0
			CL	01%		.25	8.2	.04	0
			L						
			C						
			range	46%	.35				
	1.222		mountain	54%	.25				
			Ag.	0%					
					.30	.32	5.1	.29	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
7B	4.947		SL	82%		.35	3.5	.40	0
			SCL	01%		.25	8.6	.06	0
			CL						
			L						
			C	17%		.15	12.4	.01	0
			range	100%	.35				
			Ag.	0%					
					.35	.32	5.1	.33	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
8	2.134		SL	76%		.35	3.5	.40	0
			SCL	06%		.25	8.6	.06	0
			CL						
			L						
			C	18%		.15	12.4	.01	0
	.120		mountain	6%	.25				
			range	94%	.35				
			Ag.	0%					
					.34	.31	5.4	.31	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
9	5.339		SL	74%		.35	3.5	.40	0
			SCL	21%		.25	8.6	.06	0
			CL						
			L						
			C	05%		.15	12.4	.01	0
	1.084		mountain	20%	.25				
			Range	80%	.35				
					.33	.37	5.0	.31	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
10	6.342		SL	31%		.35	3.5	.40	0
			SCL						
			CL	32%		.25	8.2	.04	0
			L						
			C	37%		.15	12.4	.01	0
	.120		Res/Comm	1%	.10				
			Range	56%	.35				
			Ag.	43%	.50				
					.41	.24	8.3	.14	1%

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
11	3.122		SL	59%		.35	3.5	.40	0
			SCL	2%		.25	8.6	.06	0
			CL	33%		.25	8.2	.04	0
			L						
			C	6%		.15	12.4	.01	0
			Range	93%	.35				
			Ag.	7%	.50				
					.36	.30	5.7	.25	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
12	2.594		SL	69%		.35	3.5	.40	0
			SCL	14%		.25	8.6	.06	0
			CL	16%		.25	8.2	.04	0
			L						
			C	01%		.15	12.4	.01	0
			Range	90%	.35				
	.256		Mountain	10%	.25				
			Ag.	0%					
					.34	.32	5.1	.29	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
13	3.921		SL	19%		.35	3.5	.40	0
			SCL						
			CL	29%		.25	8.2	.04	0
			L						
			C	52%		.15	12.4	.01	0
	.091		Res/comm	1%	.10				
			Range	21%	.35				
	3.061		Ag	78%	.50				
					.46	.22	9.5	.09	1%

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
100	58.270		SL	100%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C						
	9.592		Mountain	17%	.25				
			Range	83%	.35				
			Ag.	0%					
					.33	.35	3.5	.40	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
101	9.366		SL	66%		.35	3.5	.40	
			SCL	01%		.25	8.6	.06	
			CL	33%		.25	8.2	.04	
			L						
			C						
	1.342		Mountain	14%	.25				
			Range	86%	.35				
			Ag.	0%					
					.34	.32	5.1	.28	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
102	5.249		SL	66%		.35	3.5	.40	
			SCL	04%		.25	8.6	.06	
			CL	30%		.25	8.2	.04	
			L						
			C						
	.528		Mountain	10%	.25				
			Range	90%	.35				
			Ag.	0%					
					.34	.32	5.1	.28	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
103	13.657		SL	70%		.35	3.5	.40	
			SCL	06%		.25	8.6	.06	
			CL	22%		.25	8.2	.04	
			L						
			C	2%		.15	12.4	.01	
	1.764		Mountain	13%	.25				
			Range	87%	.35				
			Ag.	0%					
					.34	.32	5.0	.29	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
104	28.196		SL	74%		.35	3.5	.40	
			SCL	09%		.25	8.6	.06	
			CL	17%		.25	8.2	.04	
			L						
			C						
	6.048		Mountain	21%	.25				
			Range	79%	.35				
			Ag.	0%					
					.33	.32	4.8	.31	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
105	19.795		SL	65%		.35	3.5	.40	
			SCL	.01%		.25	8.6	.06	
			CL	33%		.25	8.7	.04	
			L						
			C	.01%		.15	12.4	.01	
	1.403		Mountain	7%	.25				
			Range	93%	.35				
			Ag.	0%					
					.34	.31	5.2	.27	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
106	5.746		SL	100%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C						
	1.870		mountain	33%	.25				
			range	67%	.35				
			Ag	0%					
					.32	.35	3.5	.40	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
107	10.919		SL	95%		.35	3.5	.40	
			SCL						
			CL	05%		.25	8.2	.04	
			L						
			C						
	1.705		Mountain	16%	.25				
			Range	84%	.35				
			Ag.	0%					
					.33	.35	3.7	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
108	2.685		SL	63%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C	37%		.15	12.4	.01	
	0.362		Mountain	14%	.25				
			Range	86%	.35				
			Ag.	0%					
					.34	.28	6.8	.26	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
09	49.047		SL	98 %		.35	3.5	.40	
			SCL	2%		.25	8.6	.06	
			CL						
			L						
			C						
	4.178		Mountain	9%	.25				
			Range	91%	.35				
			Ag.	0%					
					.34	.35	3.6	.39	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
110	18.838		SL	97%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C	03%		.15	12.4	.01	
	2.986		Mountain	16%	.25				
			Range	84%	.35				
			Ag.	0%					
					.33	.34	3.8	.39	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
111	2.406		SL	94 %		.35	3.5	.40	
			SCL	06 %		.25	8.6	.06	
			CL						
			L						
			C						
	.769		Mountain	32%	.25				
			Range	68%	.35				
			Ag.	0%					
					.32	.34	3.8	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
112	15.399		SL	54%		.35	3.5	.40	
			SCL						
			CL	24%		.25	8.2	.04	
			L						
			C	22%		.15	12.4	.01	
	559.85		Mountain	6%	.25				
			Range	76%	.35				
			Ag	18%	.50				
					.37	.28	6.6	.23	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
200	4.243		SL	34 %		.35	3.5	.40	
			SCL						
			CL	61%		.25	8.2	.04	
			L						
			C	05%		.15	12.4	.01	
			Res/Comm	1%	.10				
			Range	4%	.35				
			Ag.	95%	.50				
					.49	.28	6.8	.16	1

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
201	14.675		SL	94 %		.35	3.5	.40	
			SCL	06 %		.25	8.6	.06	
			CL						
			L						
			C						
	2258.70		Mountain	24%	.25				
			Range	76%	.35				
			Ag						
					.33	.34	3.8	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
202	14.982		SL	85%		.35	3.5	.40	
			SCL	04%		.25	8.6	.06	
			CL	11%		.25	8.2	.04	
			L						
			C						
	453.67		Mountain	5%	.25				
			Range	82%	.35				
			Ag	13%	.50				
					.36	.34	4.2	.35	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
203	11.412		SL	61%		.35	3.5	.40	
			SCL	02%		.25	8.6	.06	
			CL	37%		.25	8.2	.04	
			L						
			C						
	820.47		Mountain	11%	.25				
			Range	82%	.35				
			Ag	7%	.50				
					.35	.31	5.3	.26	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
204	12.760		SL	63%		.35	3.5	.40	
			SCL	03%		.25	8.6	.06	
			CL	14%		.25	8.2	.04	
			L						
			C	20%		.15	12.4	.01	
	1206.56		Mountain	15%	.25				
			Range	49%	.35				
			Ag	36%	.50				
					.39	.29	6.1	.26	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
205	25.645		SL	82 %		.35	3.5	.40	
			SCL	09 %		.25	8.6	.06	
			CL	09 %		.25	8.2	.04	
			L						
			C						
	2596.54		Mountain	16%	.25				
			Range	71%	.35				
			Ag	13 %	.50				
					.35	.33	4.4	.34	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
206	8.831		SL	72 %		.35	3.5	.40	
			SCL	06 %		.25	8.6	.06	
			CL	16 %		.25	8.2	.04	
			L						
			C	06 %		.15	12.4	.01	
	1.388		Mountain	16%	.25				
			Range	57%	.35				
			Ag.	27%	.50				
					.37	.32	5.1	.30	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
207	7.488		SL	86%		.35	3.5	.40	
			SCL	4%		.25	8.6	.06	
			CL	02%		.25	8.2	.04	
			L						
			C	08%		.15	12.4	.01	
	1.147		Mountain	15%	.25				
			Range	70%	.35				
			Ag.	15%	.50				
					.36	.33	4.5	.35	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
208	12.6116		SL	92%		.35	3.5	.40	
			SCL	<1%					
			CL	05%		.25	8.2	.04	
			L						
			C	03%		.15	12.4	.01	
	1.659		mountain	13	.25				
			Range	79%	.35				
			Ag.	08%	.50				
					.35	.34	4.0	.37	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
209	11.824		SL	96%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C	04%		.15	12.4	.01	
	5.641		mountain	48%	.25				
			Range	42%	.35				
			Ag	10%	.50				
					.32	.34	3.9	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
210	16.930		SL	98%		.35	3.5	.40	
			SCL						
			CL	01 %		.25	8.2	.04	
			L						
			C	01 %		.15	12.4	.01	
	2.670		Mountain	16%	.25				
			Range	81%	.35				
			Ag.	03 %	.50				
					.34	.35	3.6	.39	

APPENDIX H

Muskingum Routing Data

Muskingum Routing Summary Table

1) Assume Ave. Travel Velocity = 4.0 FPS

2) Muskingum K = $\frac{\text{Length (ft)}}{\text{4 fps x 3600 s/h}}$ = AMSKK

3) Time Steps = 10 min.

4) Steps = $\frac{\text{K (hr.) x 60 min/hr.}}{\text{10 min}}$ = integer NSTPS

5) X = .2 (constant)

ID	Length (ft)	NSTPS	AMSKK	X
R1	1042	1	.07	.2
R2A	23438	10	1.63	.2
RA	7031	3	.49	.2
RB	6771	3	.47	.2
R5A	21875	9	1.52	.2
RC	10417	4	.72	.2
R7A	28385	12	1.97	.2
RD	7552	3	.52	.2
R8	4687	2	.33	.2
RE	28125	12	1.95	.2
R13	3906	2	.27	.2
RF	14063	6	.98	.2
R100	26042	11	1.81	.2
RG	35417	15	2.46	.2
R103	17708	7	1.23	.2
R106	28125	12	1.95	.2

Muskingum Routing Summary Table (Continued)

ID	Length (ft)	NSTPS	AMSKK	X
RH	1823	1	.13	.2
RI	40625	17	2.82	.2
R108	29427	12	2.04	.2
R109	14062	6	.98	.2
RJ	30729	13	2.13	.2
RK	15625	7	1.09	.2
R201	13542	6	.94	.2
RL	14323	6	.99	.2
RM	14063	6	.98	.2
R206	6771	3	.47	.2
RN	10677	4	.74	.2

APPENDIX I

AT & SF Railroad Drainage Structures

9-13-89 ~~8/31/89~~

Page No.	Photo No.	I.D. No.	Qcap (cfs)
1	36	6.8	51
	35	7.9	511
2	34	8.3	861
	33	8.5	2,057
3	32	9.6	2,193
	31	10.3	1,426
4	30	10.8	557
	29	11.3	1,858
5	28	11.7	781
	27	12.2	1,421
6	26	12.5	1,080
	25	12.9	1,295
7	24	13.2	102
	23	13.6	1,509
8	22	14.1	1,607
	21	14.7	715
9	19	24.0	1,443
	18	24.4	1,330
10	17	24.8	1,272
	16	25.2	1,148
11	15	25.6	1,530
	14	25.9	1,125
12	13	26.3	2,544
	12	26.8	1,602
13	11	27.5	3,180
	10	27.9	608
14	9	28.2	2,584
	8	28.6	1,375
15	7	28.8	104
	6	29.2	717
16	5	29.6	2,600
	4	29.7	250

9/28/89 R.W.H.

Railroad culvert capacity vs. subbasin discharge check Sht. 1 of 2

Basin No. 102	Q cap.	Q basin	Q deficit
Clv. 6.8	51		
Clv. 7.9	511		
Total	562	1,544	982

Basin No. 103	Q cap.	Q basin	
Clv. 8.3	861		
Clv. 8.5	2,057		
Clv. 9.6	2,193		
Clv. 10.3	1,426		
Clv. 10.8	557		
Clv. 11.3	1,858		
Total	8,952	2,322	+ 982 = 3,304

Basin No. 104	Q cap.	Q basin
Clv. 11.7	781	
Clv. 12.2	1,421	
Clv. 12.5	1,080	
Clv. 12.9	1,295	
Clv. 13.2	102	
Clv. 13.6	1,509	
Clv. 14.1	1,607	
Clv. 14.7	715	
Total	8,510	3,993

9/28/89 R.M.H.

Basin No. 204	Q cap.	Q basin
Clv. 24.0	1,443	
Clv. 24.4	1,330	
Clv. 24.8	1,272	
Clv. 25.2	1,148	
Total	5,193	2,158

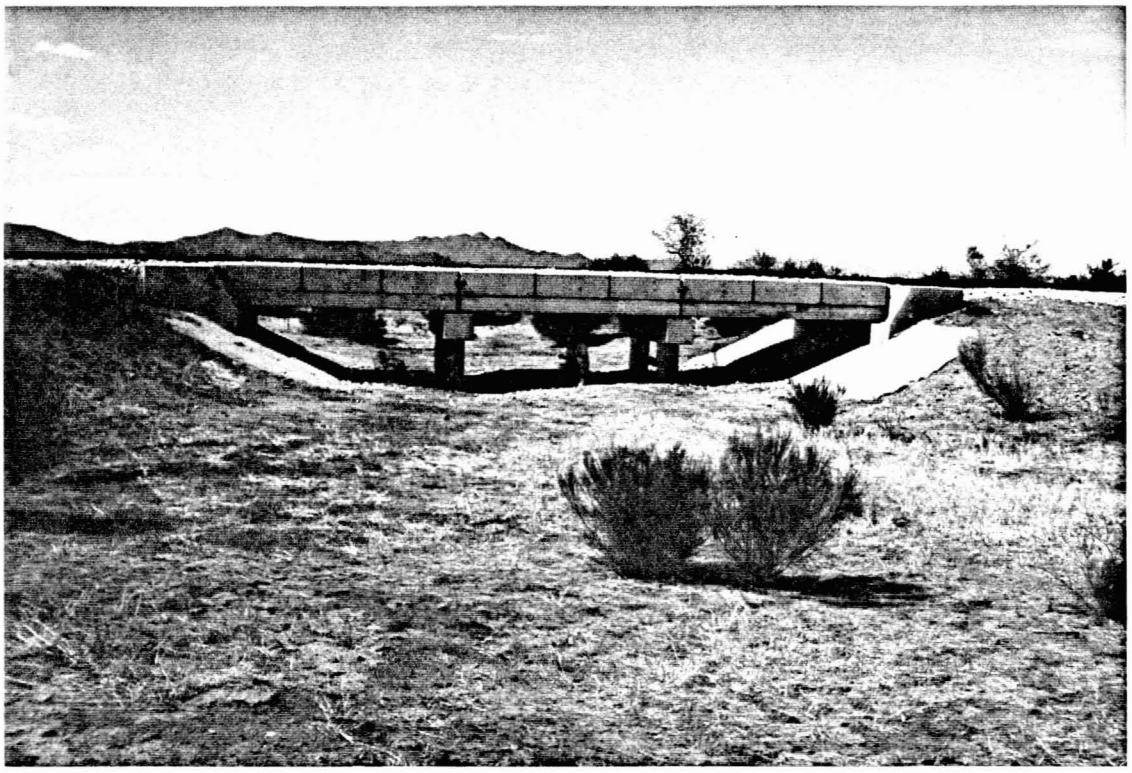
Basin No. 206	Q cap.	Q basin
Clv. 25.6	1,530	
Clv. 25.9	1,125	
Clv. 26.5	2,544	
Clv. 26.8	1,602	
Total	6,801	1,966

Basin No. 207	Q cap.	Q basin
Clv. 27.5	3,180	
Clv. 27.9	608	
Clv. 28.2	2,584	
Clv. 28.6	1,375	
Clv. 28.8	104	
Total	7,851	1,592

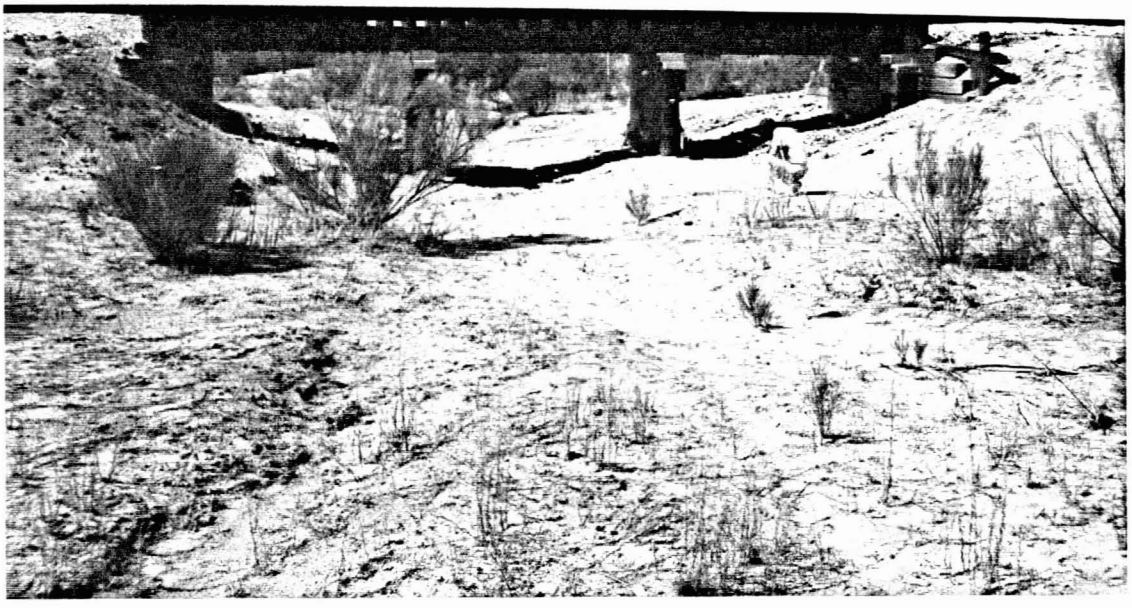
Basin No. 209	Q cap.	Q basin
Clv. 29.2	717	
Clv. 29.6	2,600	
Clv. 29.7	250	
Total	3,567	1,871

I.D. # 6.8

I.D # 7.9



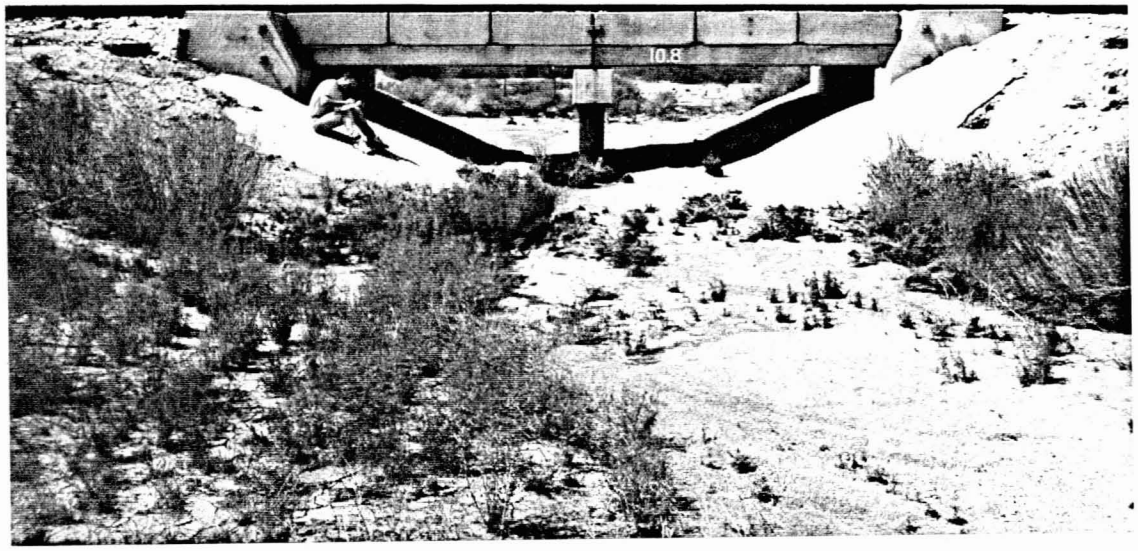
I.D. # 8.3



I.D # 8.5

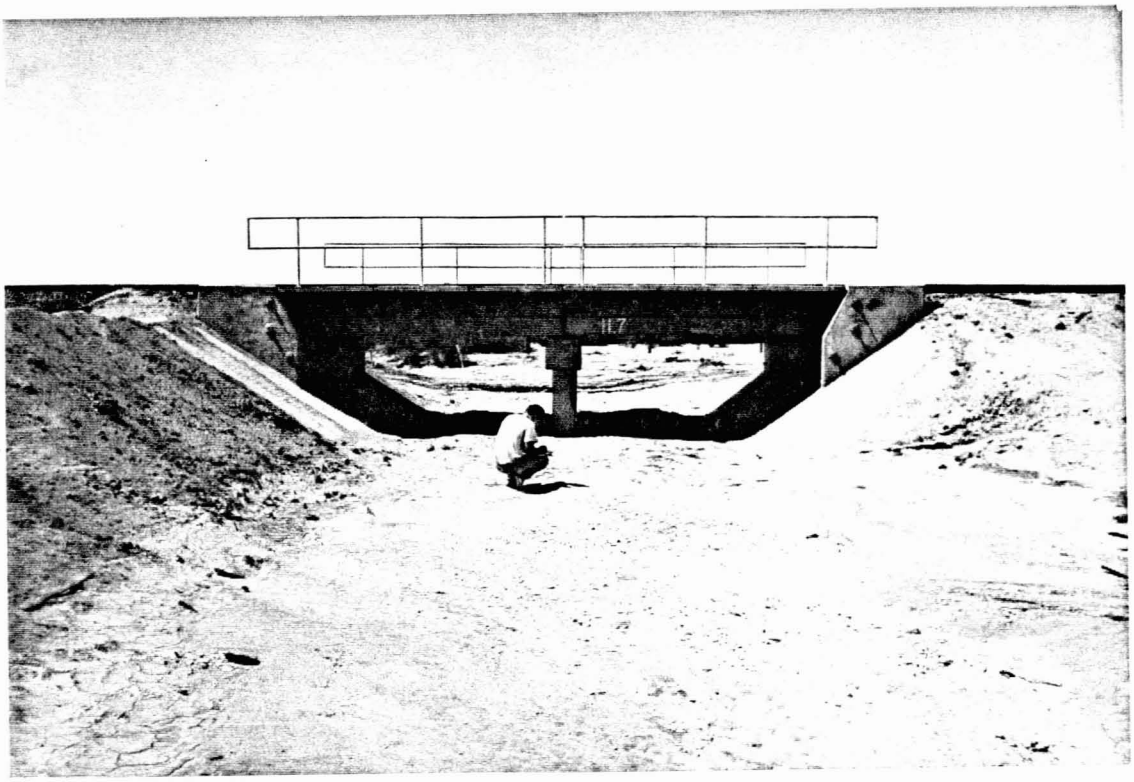
I.D. # 9.6

I.D. # 10.3



I.D.# 10.8

I.D.# 11.3



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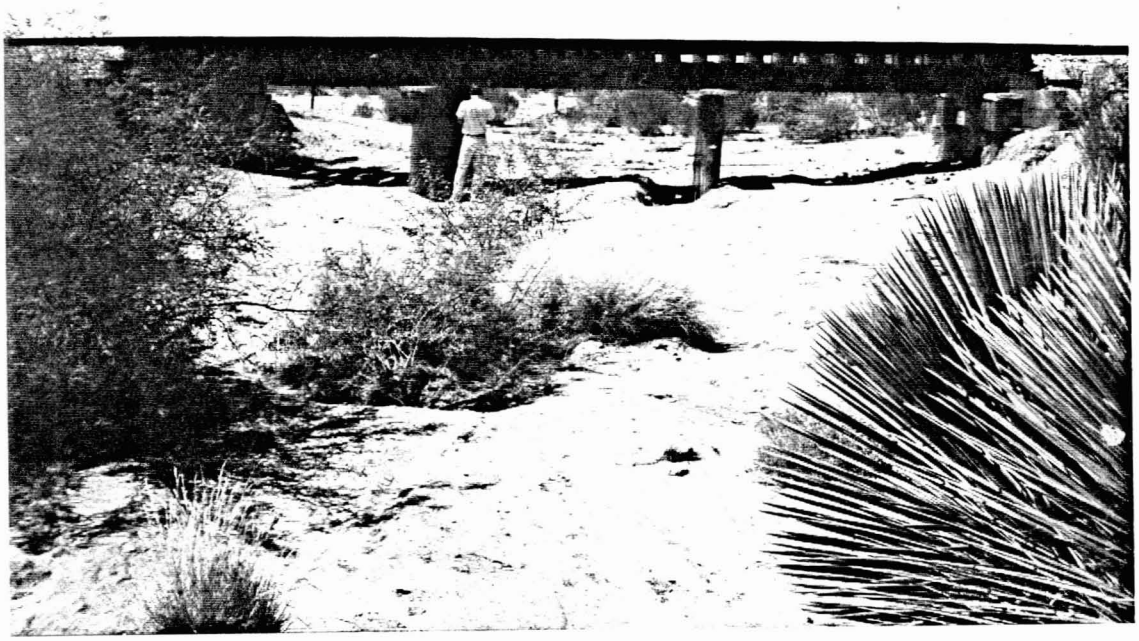

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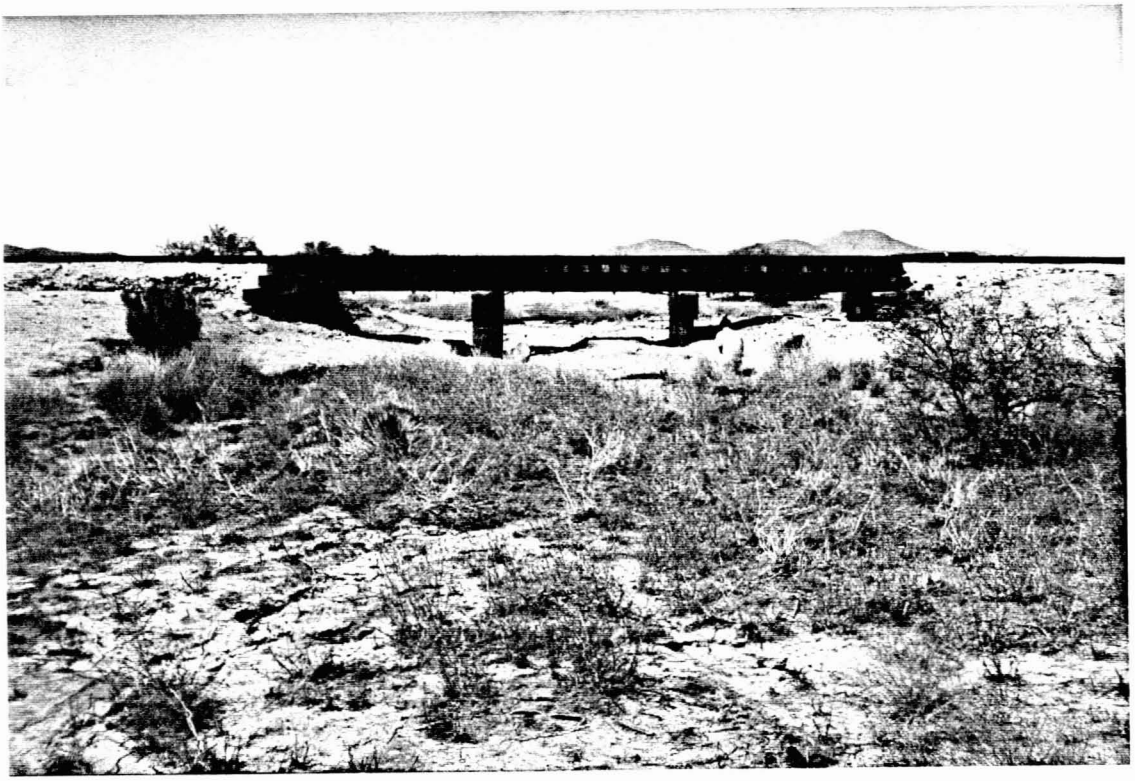

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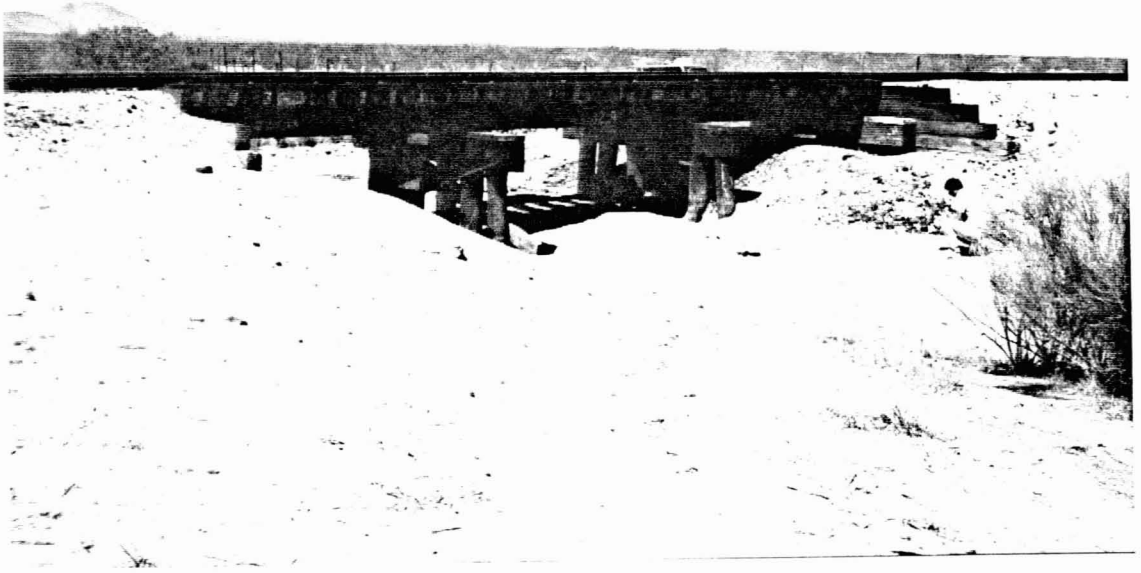

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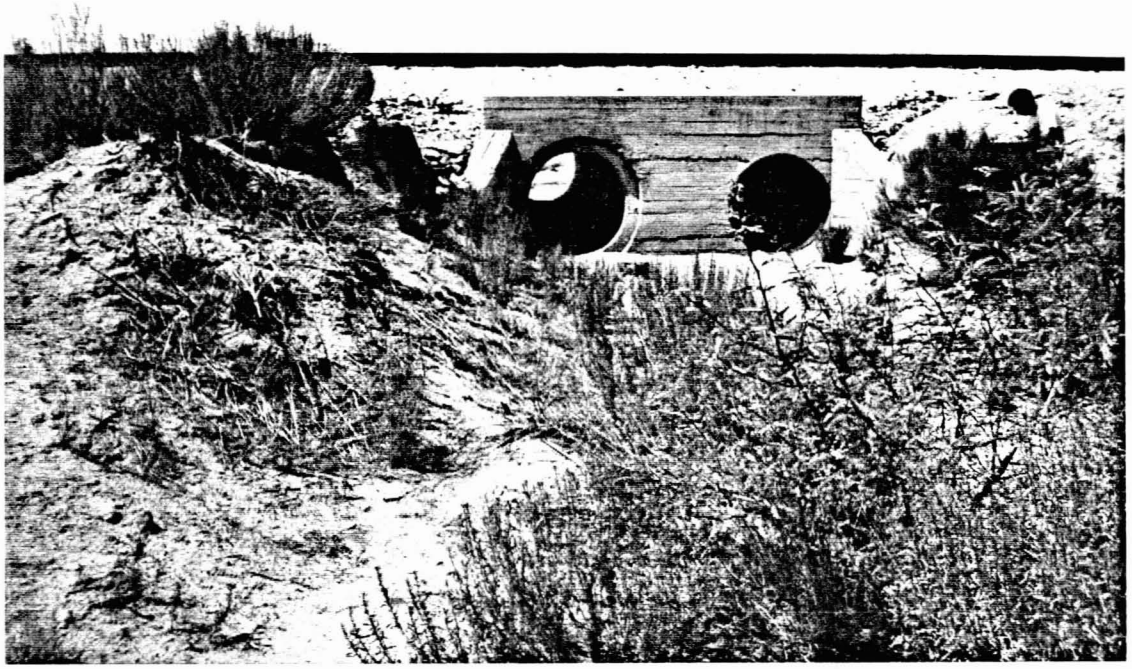

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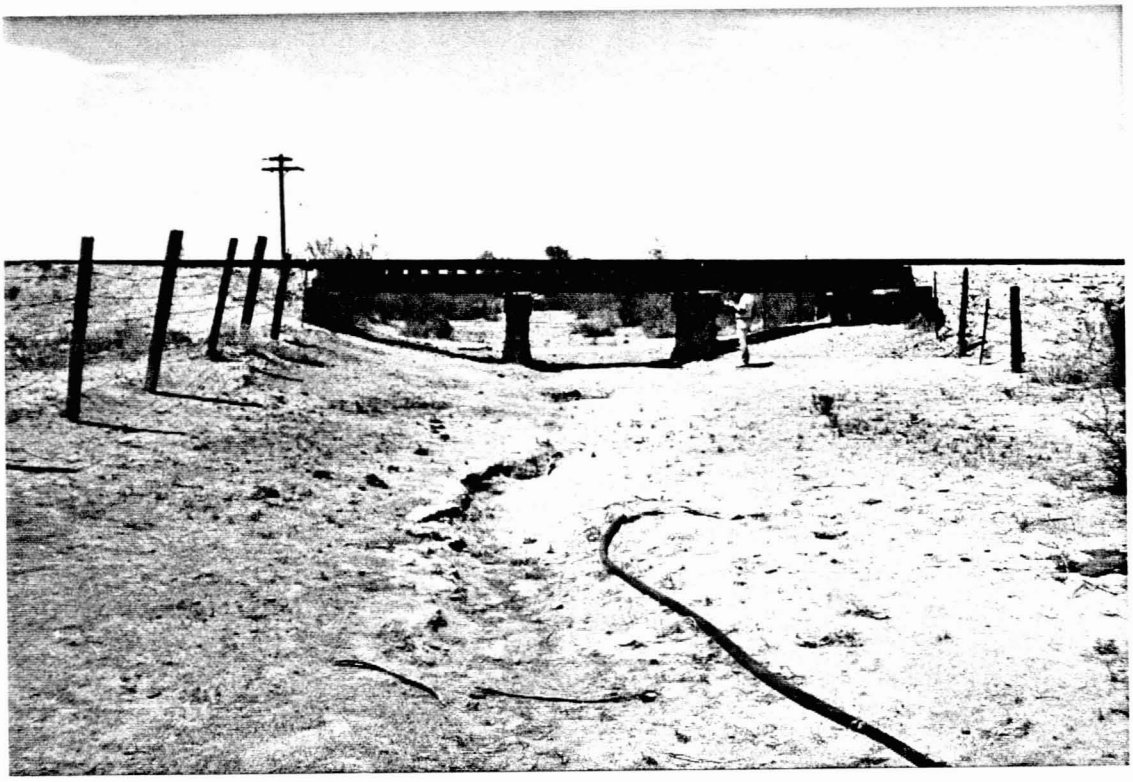

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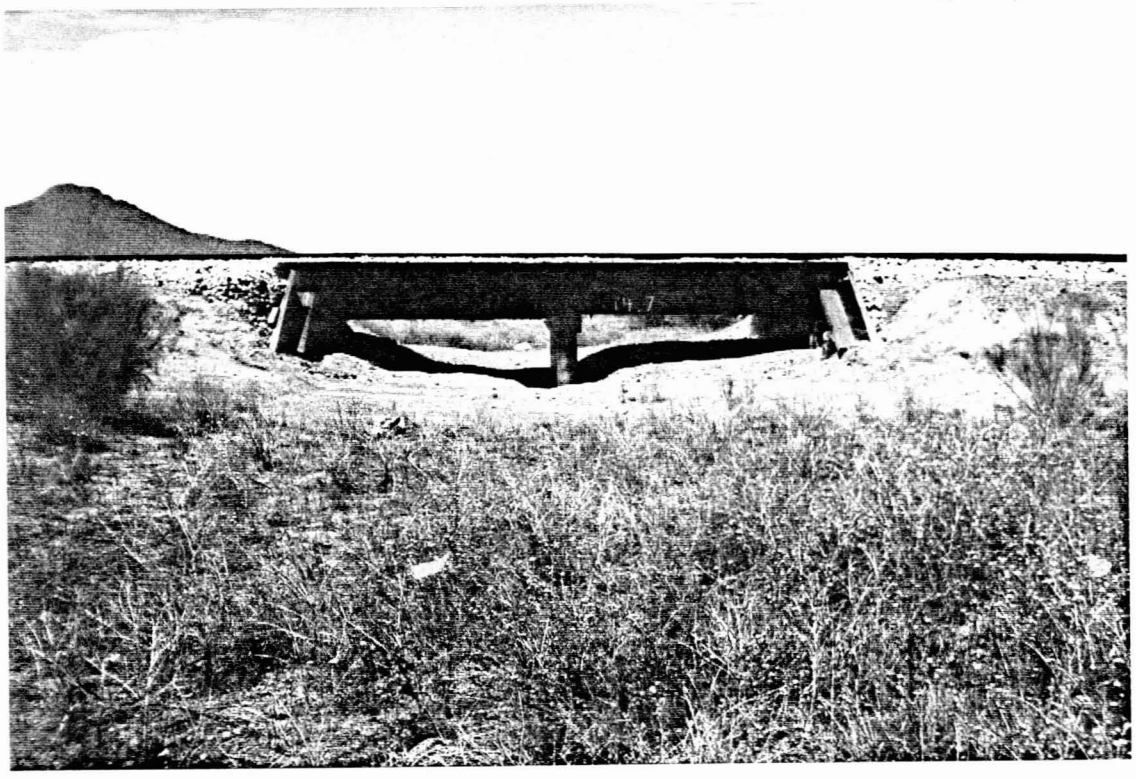

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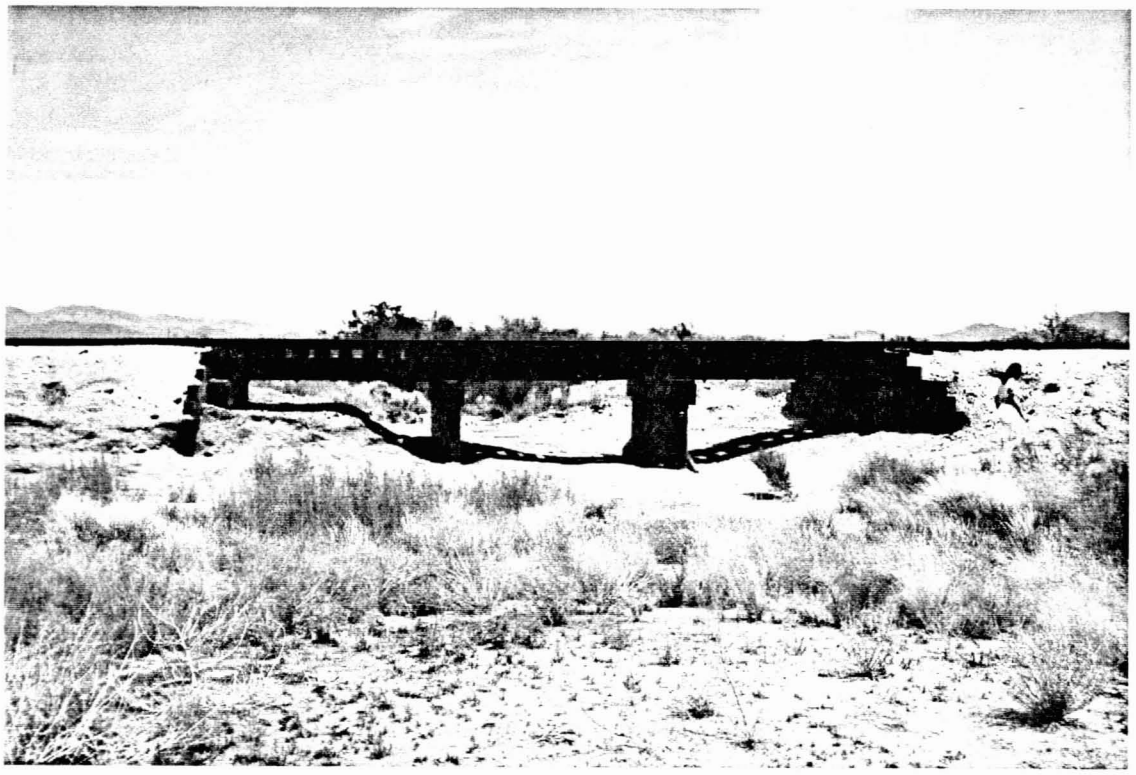

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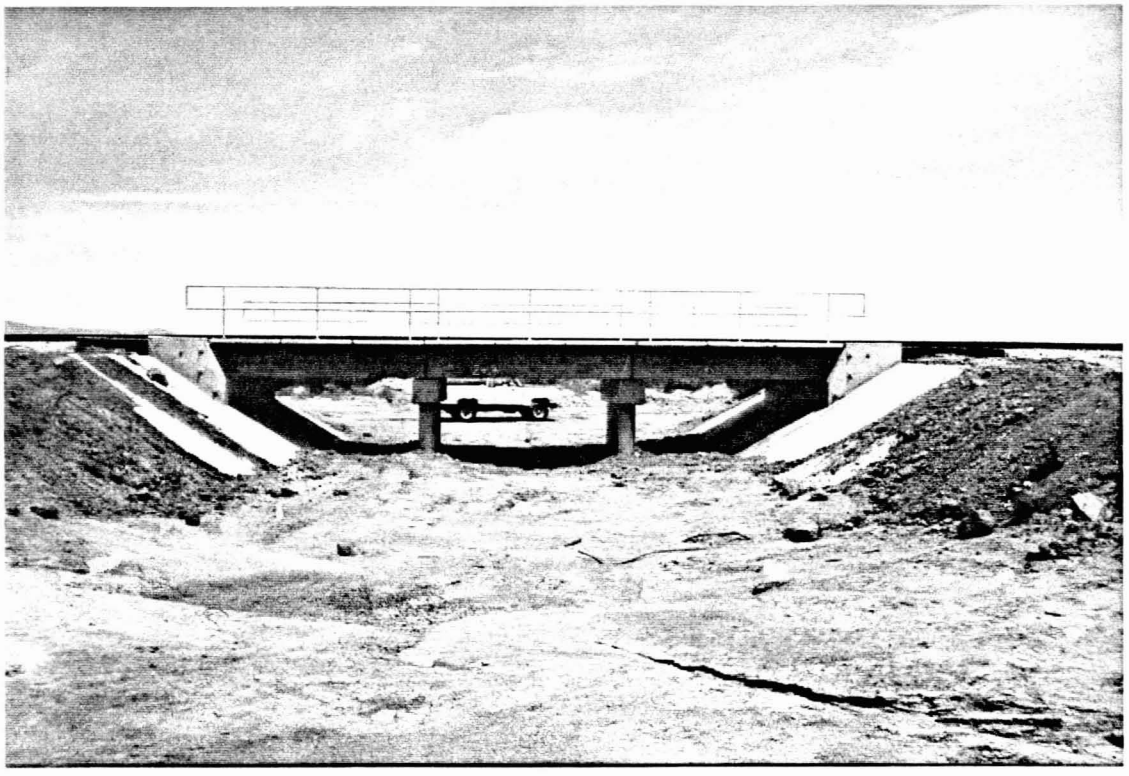

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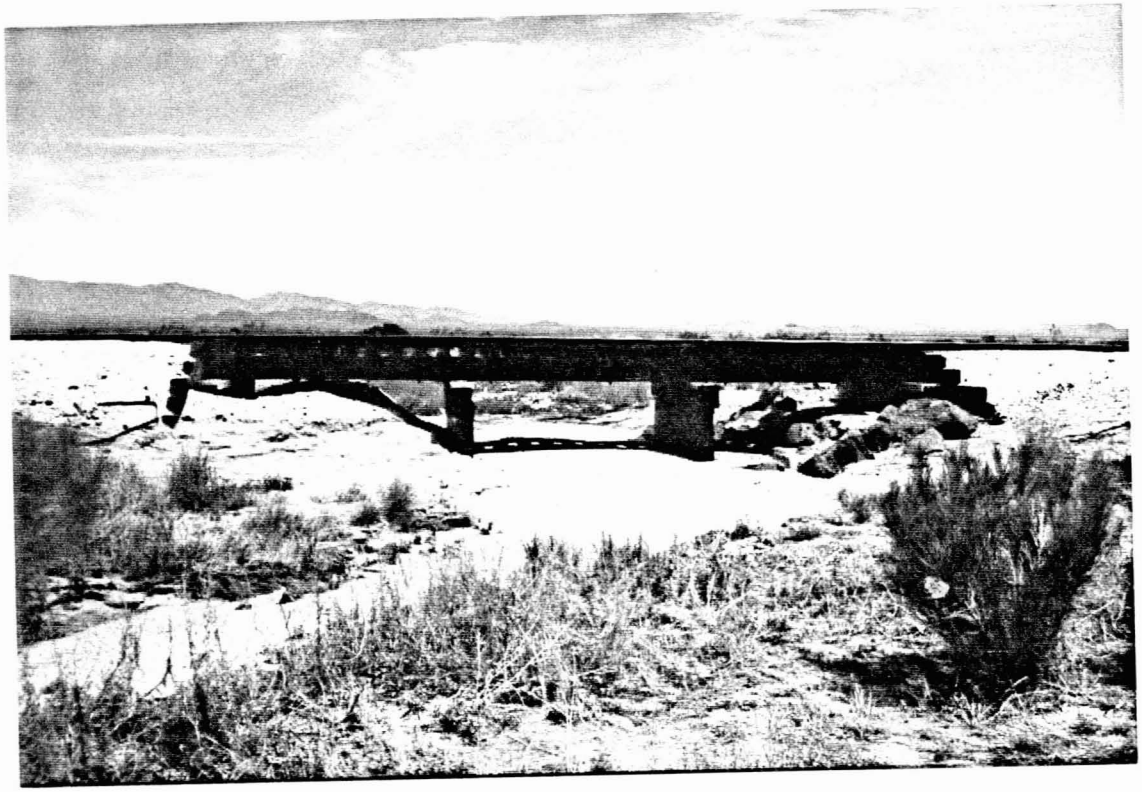

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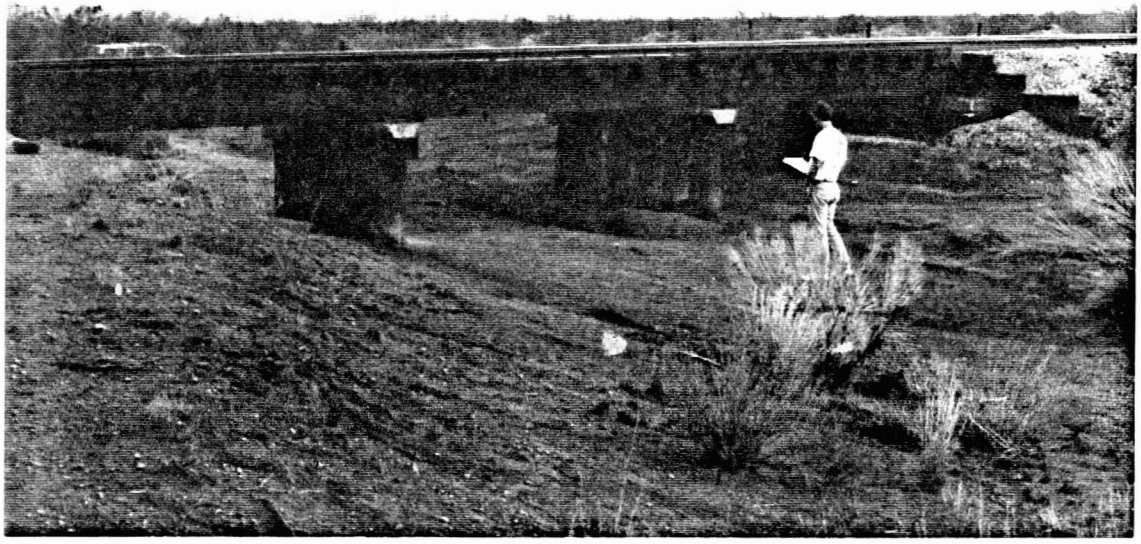

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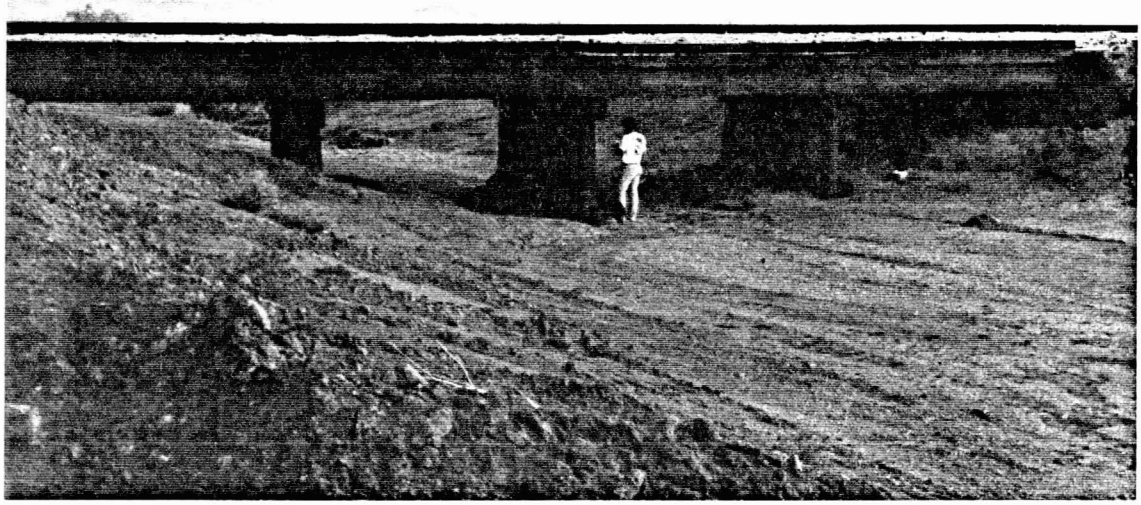

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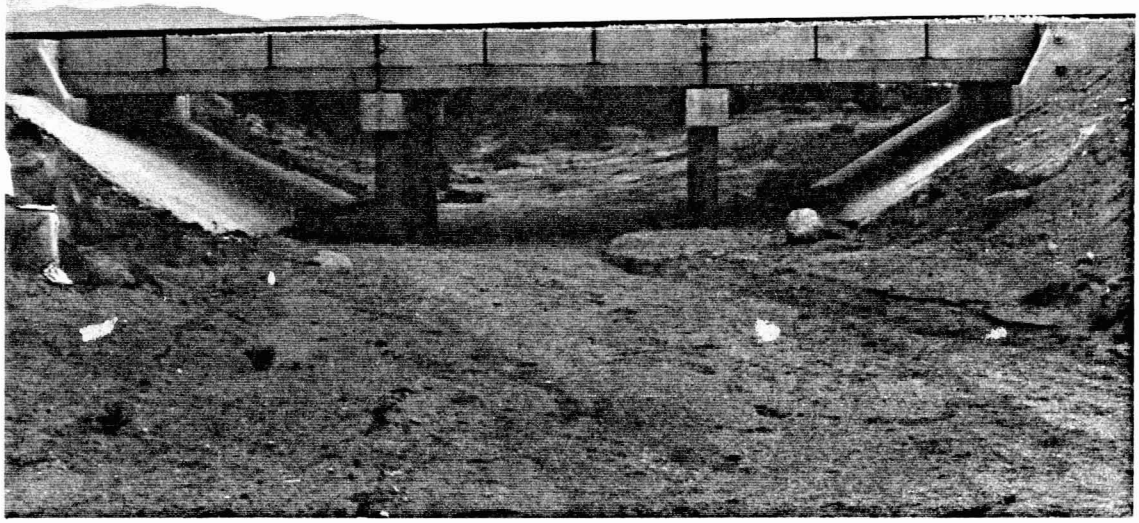

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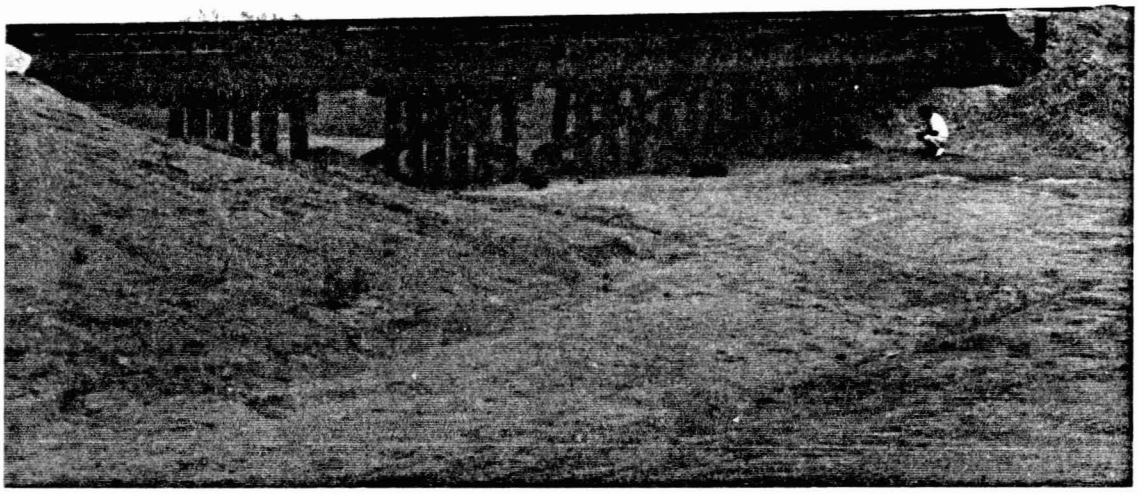

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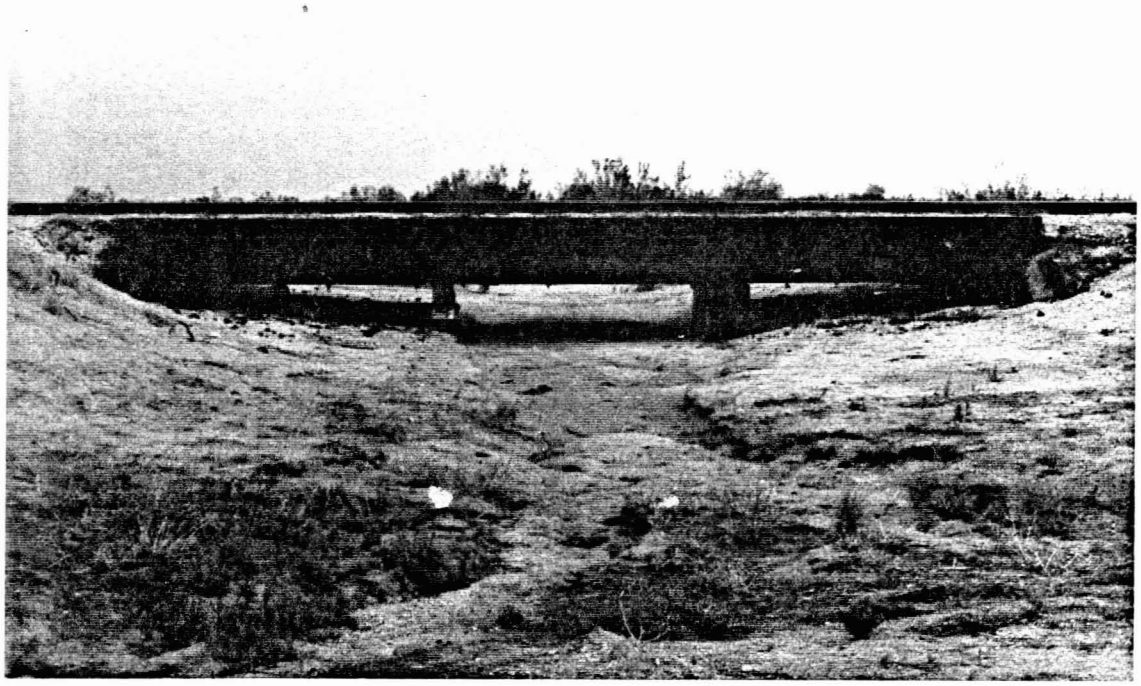

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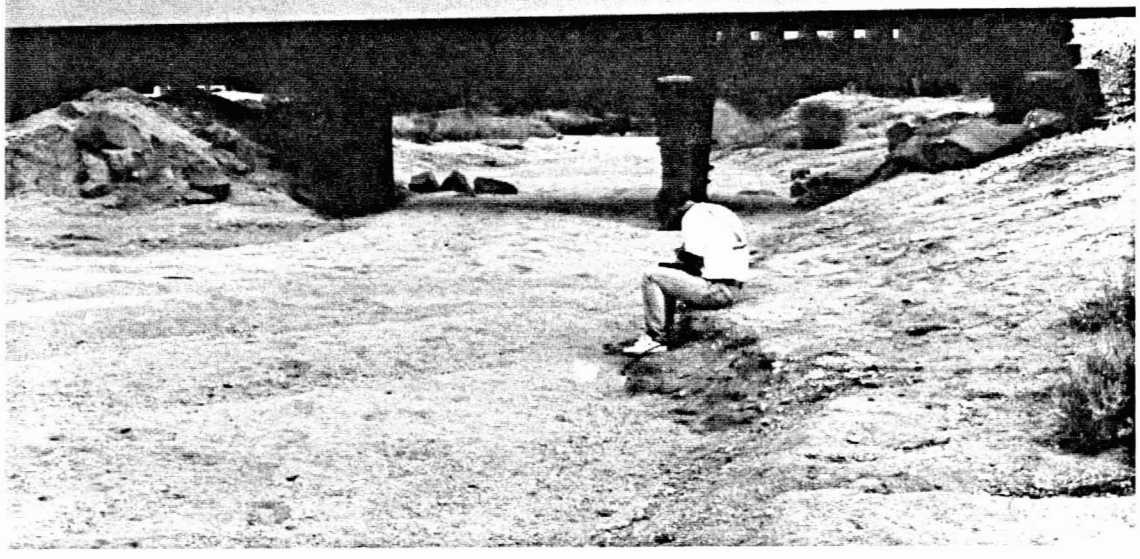

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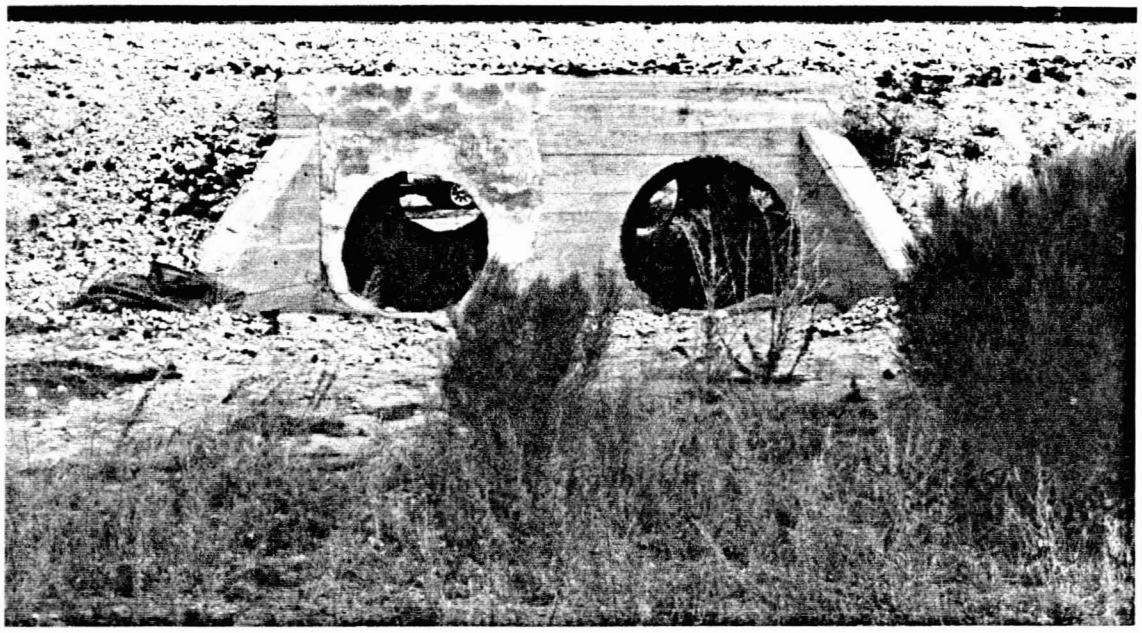

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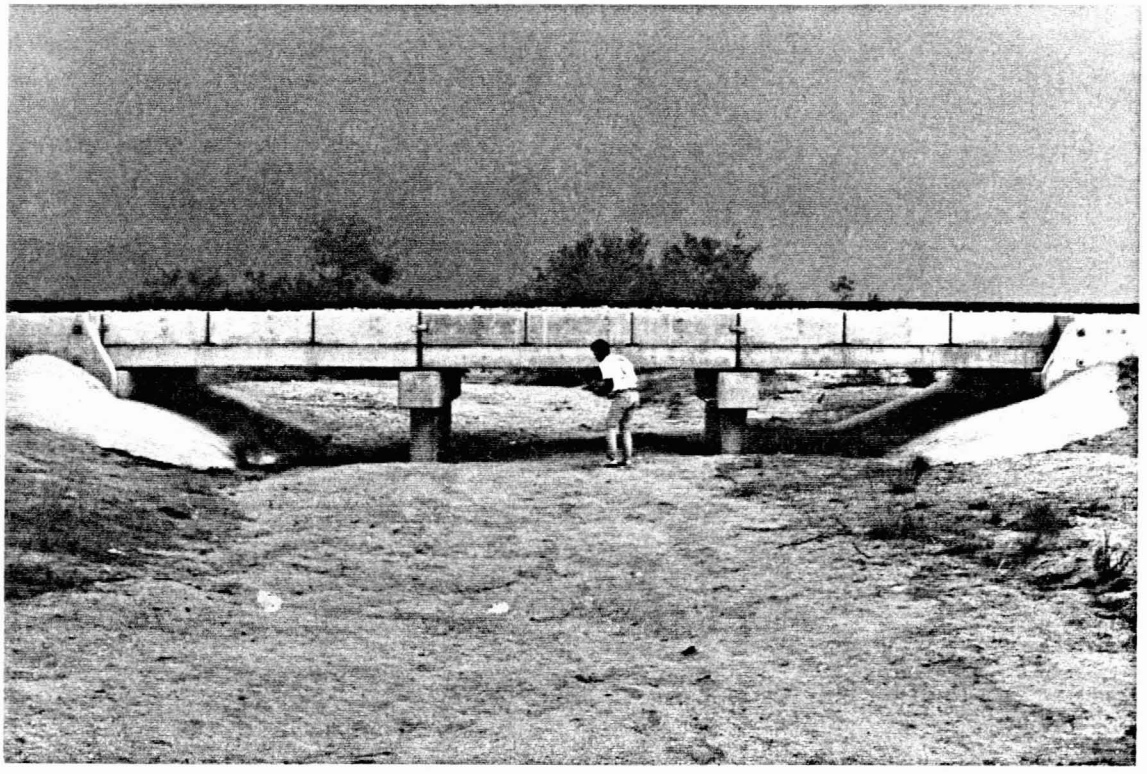

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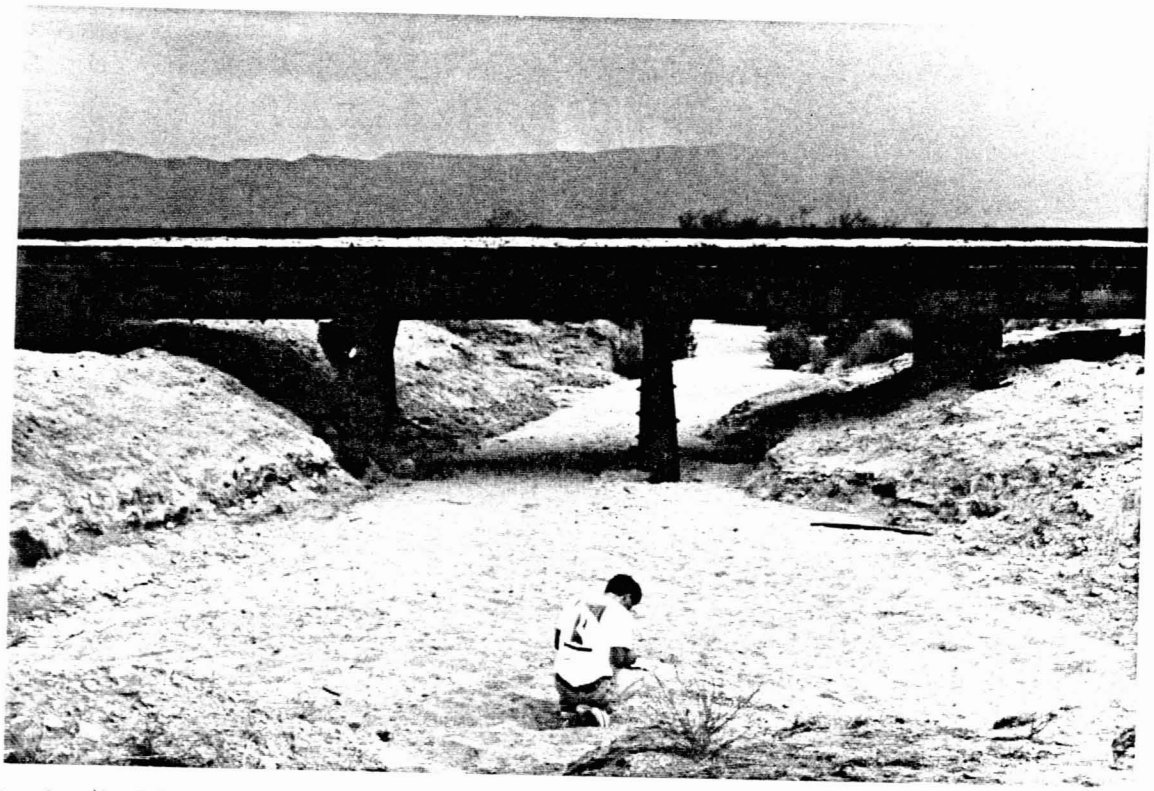

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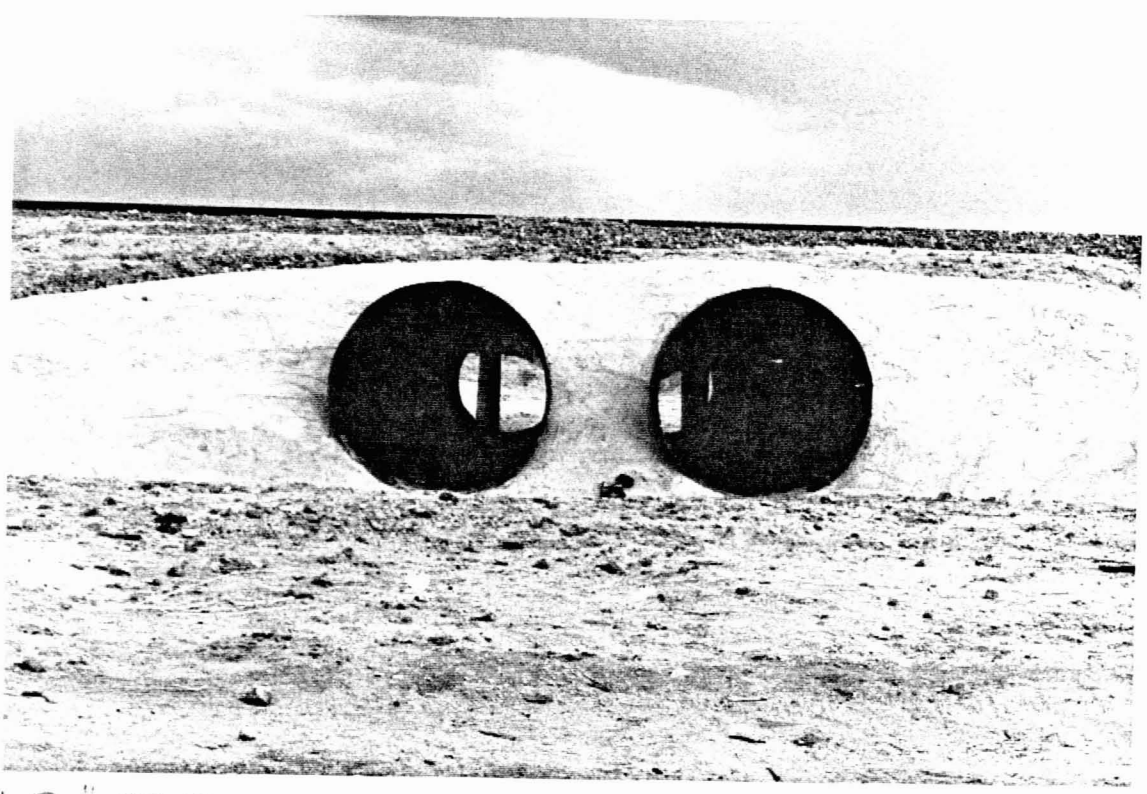

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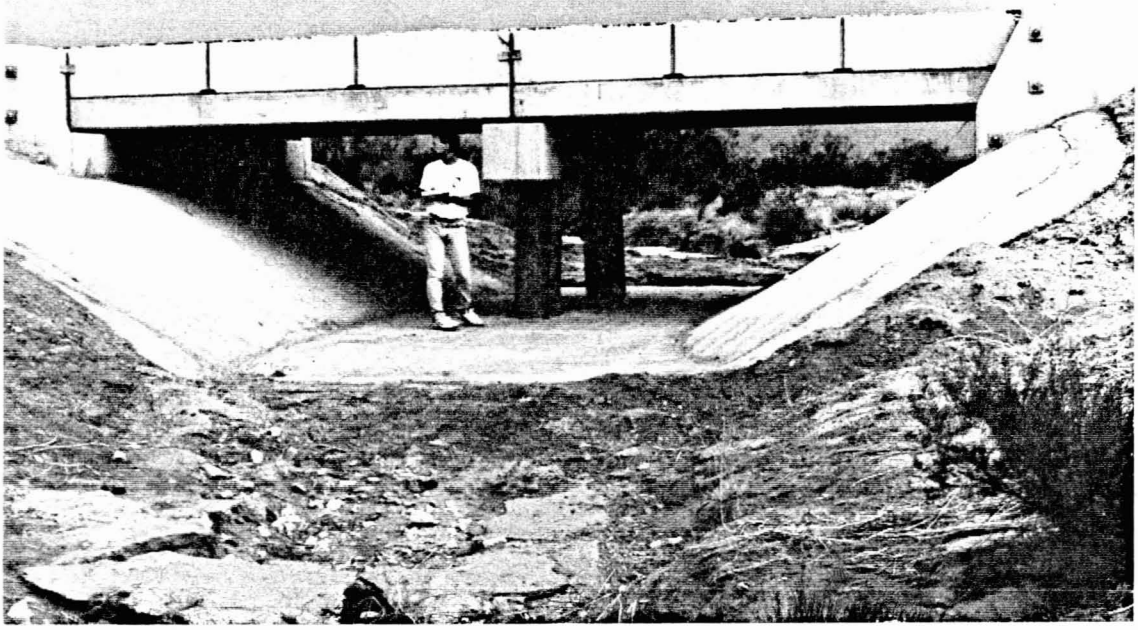

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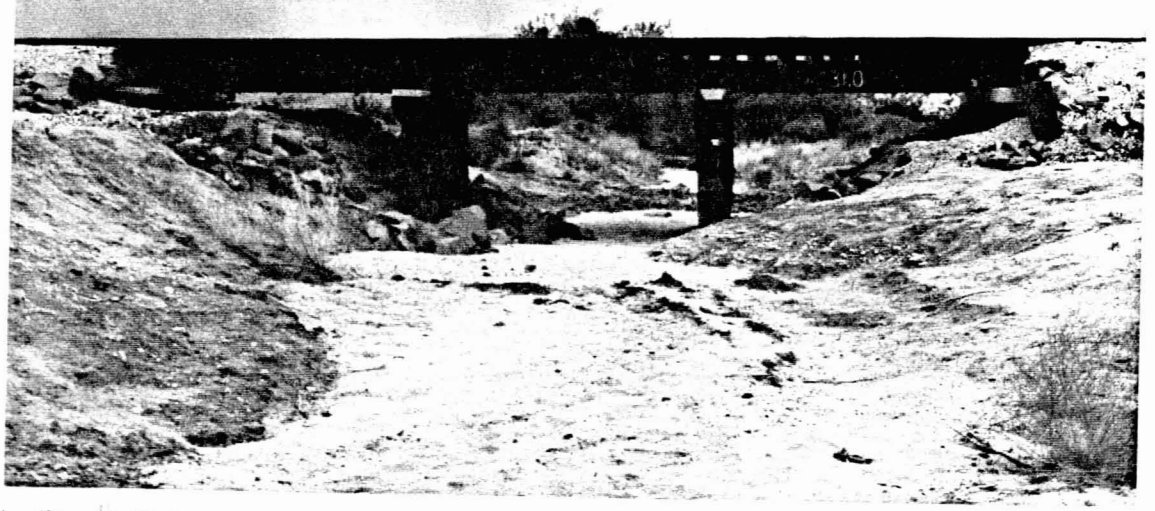
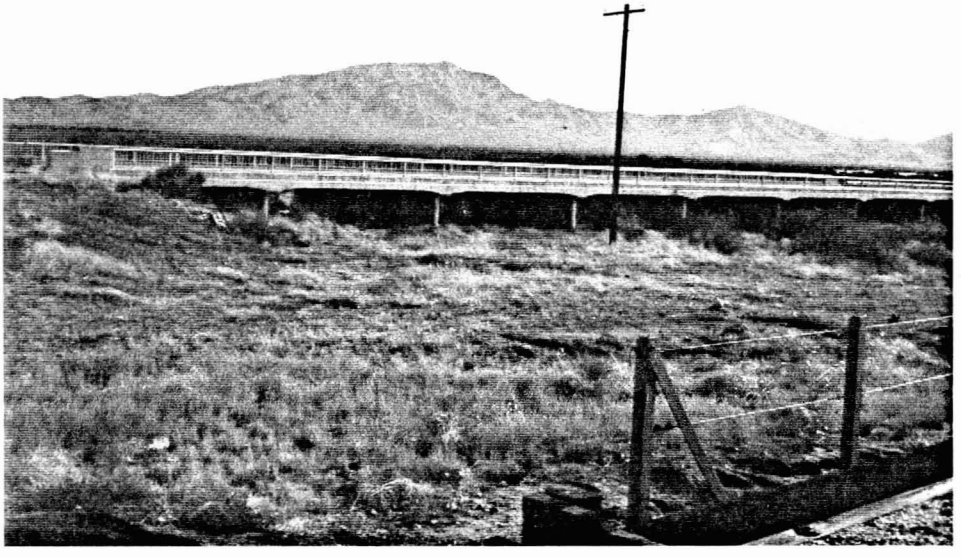


I.D. # 31.0

BRIDGES OVER GRASS WASH

I.D. # 23.0 AT&SF 300 ft. LONG TRESTLE OVER GRASS WASH. VIEW LOOKING DOWN-STREAM FROM U.S. HIGHWAY 60/70 BRIDGE (BELOW).



U.S. HIGHWAY 60/70 232 ft. LONG BRIDGE OVER GRASS WASH. VIEW LOOKING UPSTREAM FROM AT&SF TRESTLE (ABOVE).

APPENDIX J

FEMA Peak Discharges

Table 3. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Mockingbird Wash					
At U.S. Highways 60, 70, and 89	6.9	2,750	4,040	5,060	7,400
Little San Domingo Wash					
At U.S. Highways 60, 70, and 89	6.2	1,690	2,620	3,090	4,250
Wittmann Drainage					
At Atchison, Topeka & Santa Fe Railway	8.6	1,760	2,770	3,060	4,350
Aguila Farm Channel					
At Eagle Eye Avenue	216.0	5,450	12,000	16,000	--[1]
Grass Wash					
At U.S. Highways 60 and 70	83.0	6,380	11,600	14,400	--[1]
Lower El Mirage Wash					
At Cactus Road	1.9	90	200	250	--[1]
Lower El Mirage Wash Tributary					
At Mouth	1.3	53	110	150	--[1]
Sand Tank and Bender Washes					
At Gila Bend (Gillespie Canal)	261	28,200	33,000[2]	33,500[2]	34,500[2]
At Interstate Highway 8	257[3]	28,000	51,000	64,000	87,000

[1]Not Computed
[2]Decrease Due to Diversion at Interstate Highway 8
[3]An Equivalent of 128 Square Miles of Drainage Area Is Diverted to West at Interstate Highway 8